SIEMENS



Equipment Manual

SINAMICS

S120

Cabinet Modules, air-cooled

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SINAMICS

S120
Air-cooled Cabinet Modules

Equipment Manual

Preface

Fundamental safety instructions 1

System overview 2

Mechanical installation 3

Electrical installation 4

Cabinet Modules 5

Maintenance and servicing 6

Diagnostics 7

Options 8

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Legal information

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indicates that death or severe personal injury **may** result if proper precautions are not taken.

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indicates that minor personal injury can result if proper precautions are not taken.

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The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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Siemens AG
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Preface

SINAMICS documentation

The SINAMICS documentation is organized in the following categories:

- General documentation / catalogs
- Manufacturer/service documentation
- Electronic documentation

This documentation is part of the manufacturer/service documentation for SINAMICS. All of the documents are available individually.

Please contact your local Siemens office for further information about other available SINAMICS publications.

For the sake of simplicity, this documentation does not contain comprehensive detailed information about all types of the product and cannot cover every conceivable case of installation, operation, or maintenance.

The contents of this documentation are not part of an earlier or existing agreement, a promise, or a legal agreement, nor do they change this. The Purchase Agreement contains the complete and exclusive obligations of Siemens, including the warranty provisions. These contractual warranty provisions are neither extended nor curbed as a result of the statements made in this documentation.

Target group

This documentation is intended for machine manufacturers, commissioning engineers, and service personnel who use the SINAMICS drive system.

Objective

This manual describes the hardware components and design of the SINAMICS S120 Cabinet Modules. It provides information about installation, electrical connection, and cabinet design.

Technical support

If you have any questions, please contact our hotline:

Time zone Europe and Africa	
Phone	+49 911 895 7222
Fax	+49 911 895 7223
Internet	https://support.industry.siemens.com/sc/ww/en/sc/4868

Time zone Americas	
Phone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	techsupport.sea@siemens.com

Time zone Asia/Pacific	
Phone	+86 1064 757 575
Fax	+86 1064 747 474
E-mail	support.asia.automation@siemens.com

Note

Country-specific telephone numbers for technical support can be found on the Internet at the following address:

https://www.automation.siemens.com/aspa_app

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Further, you have access to the Technical Forum and other articles that our experts have drawn-up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

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Data matrix code data on the rating plate

The data matrix code on the rating plate contains the specific device data. This code can be read-in with any Smartphone and technical information for the appropriate device can be displayed via the "Industry Online Support" Mobile App.

Spare parts

Spare parts are available on the Internet at: Spare parts (https://support.industry.siemens.com/sc/de/en/sc/2110)

The spare parts available for the ordered drive can be found in the spare parts list. These are provided on the customer DVD.

Test certificates

Test certificates for functional safety functions ("Safety Integrated") can be found at:

https://support.industry.siemens.com/cs

An up-to-date list of currently certified components is also available on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact.

Internet addresses

Up-to-date information about our products can be found on the Internet at the following address:
http://www.siemens.com

Information about SINAMICS S120 Cabinet Modules can be found on the Internet at the following address:
http://www.siemens.com/sinamics-s120-cabinet-modules

EMC limit values for South Korea

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For sellers or other user, please keep in mind that this device in an A-grade electromagnetic wave device.
This device is intended to be used in areas other than home.

The EMC limit values to be observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of category C2 or the limit value class A, Group 1 according to EN 55011.
By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are complied with. Furthermore, additional measures such as the use of an additional radio interference suppression filter (EMC filter) may be required.
In addition, measures for proper plant design to meet EMC requirements are described in detail in this manual and the "SINAMICS Low Voltage Configuration Manual".

Certification

The following certifications can be found on the Internet at SINAMICS S120 Cabinet Modules certificates (https://support.industry.siemens.com/cs/de/en/ps/13233/cert):

- EC Declaration of Conformity with reference to the low voltage directive
- EC declaration of conformity with reference to the EMC directive:
- EC declaration of conformity with reference to the machinery directive (safety)
- Manufacturers declaration in reference to Safety Integrated

Standards that are not relevant



China Compulsory Certification

SINAMICS S120 Cabinet Modules do not fall in the area of validity of the China Compulsory Certification (CCC).

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Table of contents

Preface **3**

1 Fundamental safety instructions **17**

1.1 General safety instructions 17

1.2 Handling electrostatic sensitive devices (ESD) 22

1.3 Industrial security 23

1.4 Residual risks of power drive systems 24

2 System overview **25**

2.1 Overview 25

2.2 Field of application 27

2.3 Benefits 28

2.4 Line Modules 29
2.4.1 General information 29
2.4.2 Basic Line Modules 29
2.4.3 Smart Line Modules 30
2.4.4 Active Line Modules 31

2.5 Line Connection Modules 33
2.5.1 General information 33
2.5.2 Active Line Connection Modules-2 33

2.6 DC link components 34
2.6.1 Braking Modules as a Line Module or Motor Module option 34
2.6.2 Central Braking Modules 34

2.7 Motor Modules 34
2.7.1 Booksize Base Cabinets with Booksize Cabinet Kits 34
2.7.2 Chassis Cabinets 35
2.7.3 Chassis-2 Cabinets 35

2.8 Auxiliary Power Supply Modules 35

2.9 Overview of options 36

2.10 System structure 39

2.11 System data 40

2.12 Derating data 42
2.12.1 Derating data for booksize format 42
2.12.2 Derating data for chassis format 42
2.12.2.1 General 42
2.12.2.2 Derating measures 43
2.12.2.3 Current derating for Motor Modules depending on the pulse frequency 45
2.12.3 Derating data for devices in Chassis-2 format 47
2.12.3.1 General 47

2.12.3.2 Derating measures ... 48
2.12.3.3 Current derating for Motor Modules Chassis-2 depending on the pulse frequency ... 50

3 Mechanical installation ... 53

3.1 Important notes ... 53
3.2 Mechanical installation: Checklist ... 55
3.3 Installation ... 57
3.3.1 Important safety precautions ... 57
3.3.2 Preparatory steps ... 58
3.3.2.1 On-site requirements ... 58
3.3.2.2 Requirements on the levelness of the floor ... 60
3.3.2.3 Shipping and handling indicators ... 61
3.3.2.4 Unpacking the cabinets ... 63
3.3.2.5 Tools required ... 63
3.3.3 Lifting the cabinet units off the transport pallet and installing them ... 65
3.3.4 Disassembling the crane transport assembly ... 66
3.3.5 Connection to the foundation ... 68
3.3.6 Connection for side-by-side installation of cabinet units ... 69

4 Electrical installation ... 73

4.1 Safety information ... 73
4.2 Electrical installation: Checklist ... 74
4.3 EMC-compliant design ... 81
4.4 Connecting shielded three-phase cables ... 81
4.5 Connections ... 82
4.5.1 Cable lugs ... 82
4.5.2 Connection overview ... 84
4.5.3 PE busbar ... 85
4.5.3.1 General information ... 85
4.5.3.2 Connection for side-by-side installation of cabinet units ... 85
4.5.3.3 Connection according to the system-side grounding concept ... 87
4.5.3.4 Connecting external cables to the PE busbar ... 87
4.5.4 DC busbar ... 88
4.5.4.1 General information ... 88
4.5.4.2 Connection for side-by-side installation of cabinet units ... 88
4.5.4.3 Connecting cabinet units with different numbers of DC busbars ... 91
4.5.5 Auxiliary power supply system ... 92
4.5.5.1 General information ... 92
4.5.5.2 Connection overview ... 97
4.5.5.3 Connection for side-by-side installation of cabinet units ... 98
4.5.5.4 Connecting to the infeed ... 99
4.5.6 Connecting the motor cables ... 100
4.5.7 Line supply connections ... 106
4.5.8 Adjusting the fan voltage ... 106
4.5.9 Connecting Cabinet Modules to non-grounded line supplies (IT systems) ... 109
4.5.10 Signal connections ... 121
4.5.11 Other connections ... 121
4.5.12 Cable routing ... 121
4.5.12.1 General information ... 121

4.5.12.2 Cable routing for Line Connection Modules 122
4.5.12.3 Cable routing for Basic Line Modules 125
4.5.12.4 Cable routing for Smart Line Modules 129
4.5.12.5 Cable routing for Active Line Modules 133
4.5.12.6 Cable routing for Active Line Connection Modules-2 140
4.5.12.7 Cable routing for Booksize Base Cabinets and Booksize Cabinet Kit 145
4.5.12.8 Cable routing for Motor Modules in the chassis format 145
4.5.12.9 Cable routing for Motor Modules in the Chassis-2 format 152
4.5.12.10 Cable routing for Central Braking Modules 157
4.5.12.11 Cable routing for Auxiliary Power Supply Modules 159

5 Cabinet Modules 161

5.1 Line Connection Modules 161
5.1.1 Description 161
5.1.1.1 Fuse switch disconnector (input current ≤ 800 A) 165
5.1.1.2 Circuit breaker (input current > 800 A) 165
5.1.1.3 Terminal block -X40 external 230 V AC auxiliary infeed 168
5.1.2 Versions of Line Connection Modules 168
5.1.2.1 Version L42 for Active Line Modules 169
5.1.2.2 Version L43 for Basic Line Modules 170
5.1.2.3 Version L44 for Smart Line Modules 172
5.1.3 Options 173
5.1.4 Technical data 175

5.2 Basic Line Modules 179
5.2.1 Description 179
5.2.2 Interface description 184
5.2.2.1 General information 184
5.2.2.2 Control Interface Module 185
5.2.2.3 X41 EP terminal / temperature sensor connection 185
5.2.2.4 DRIVE-CLiQ interfaces X400, X401, X402 187
5.2.3 Options 188
5.2.4 Technical data 189

5.3 Smart Line Modules 193
5.3.1 Description 193
5.3.2 Interface description 199
5.3.2.1 General information 199
5.3.2.2 Control Interface Module 200
5.3.2.3 X41 EP terminal / temperature sensor connection 200
5.3.2.4 DRIVE-CLiQ interfaces X400, X401, X402 202
5.3.3 Options 203
5.3.4 Technical data 204

5.4 Active Line Modules including Active Interface Modules 208
5.4.1 Description 208
5.4.2 Interface description 216
5.4.2.1 General information 216
5.4.2.2 Control Interface Module 217
5.4.2.3 X41 EP terminal / temperature sensor connection 217
5.4.2.4 DRIVE-CLiQ interfaces X400, X401, X402 219
5.4.3 Options 220
5.4.4 Technical data 221

5.5 Active Line Connection Modules-2 ... 227
5.5.1 Description ... 227
5.5.1.1 Fuse switch disconnector (input current ≤ 800 A) ... 239
5.5.1.2 Circuit breaker (input current > 800 A) ... 240
5.5.1.3 Terminal block -X40 external 230 V AC auxiliary infeed ... 241
5.5.2 Interface description ... 242
5.5.2.1 General information ... 242
5.5.2.2 X41 EP terminal / temperature sensor connection ... 243
5.5.2.3 X42 terminal strip ... 245
5.5.2.4 X47 contactor feedback signal ... 245
5.5.2.5 X49 terminal block ... 246
5.5.2.6 DRIVE-CLiQ interfaces X400, X401, X402 ... 247
5.5.2.7 Test points for 1 mm test probes ... 247
5.5.3 Options ... 248
5.5.4 Technical data ... 250
5.5.4.1 Active Line Connection Modules-2, 3 AC 380 ... 480 V ... 250
5.5.4.2 Overload capability ... 253

5.6 Booksize format Motor Modules ... 255
5.6.1 Description ... 255
5.6.2 Interface description ... 259
5.6.2.1 General information ... 259
5.6.2.2 Customer terminal block X55.1 ... 260
5.6.2.3 X200, X201, X202 DRIVE-CLiQ interfaces ... 262
5.6.3 Options ... 262
5.6.4 Technical data ... 264
5.6.5 Overload capability ... 267

5.7 Chassis format Motor Modules ... 268
5.7.1 Description ... 268
5.7.2 X55 customer terminal strip ... 277
5.7.2.1 General information ... 277
5.7.2.2 X41 EP terminal / temperature sensor connection ... 278
5.7.2.3 X46 Brake control and monitoring ... 279
5.7.2.4 DRIVE-CLiQ interfaces X400, X401, X402 ... 280
5.7.3 Options ... 280
5.7.4 Technical data ... 282
5.7.5 Overload capability ... 291

5.8 Motor Modules - Chassis-2 format ... 293
5.8.1 Description ... 293
5.8.2 Interface description ... 303
5.8.2.1 General information ... 303
5.8.2.2 X51 connection, fan power supply ... 304
5.8.2.3 X9 terminal strip ... 305
5.8.2.4 X41 EP terminal / temperature sensor connection ... 305
5.8.2.5 X42 terminal strip ... 307
5.8.2.6 X46 Brake control and monitoring ... 308
5.8.2.7 X47 contactor feedback signal ... 309
5.8.2.8 X49 terminal block ... 309
5.8.2.9 DRIVE-CLiQ interfaces X400, X401, X402 ... 310
5.8.2.10 Test points for 1 mm test probes ... 310
5.8.3 Options ... 311
5.8.4 Technical data ... 312

5.8.5 Overload capability 315

5.9 Central Braking Modules 318
5.9.1 Description 318
5.9.2 Interfaces 323
5.9.3 Options 328
5.9.4 Technical data 329
5.9.5 Derating data 330
5.9.6 Braking resistor 331
5.9.6.1 Description 331
5.9.6.2 Safety information 331
5.9.6.3 Duty cycle 333
5.9.6.4 Interfaces on the braking resistor 333
5.9.6.5 Configuring the "Overtemperature" checkback 334
5.9.6.6 Technical data 334

5.10 Auxiliary Power Supply Modules 338
5.10.1 Description 338
5.10.2 Fuse switch disconnector (-Q1) 343
5.10.3 Transformer (-T2) for generating the auxiliary voltage 230 V AC 343
5.10.4 Auxiliary power supply system 345
5.10.5 Customer interfaces for supplying power to an additional auxiliary power supply system 345
5.10.6 Options 346
5.10.7 Technical data 347

6 Maintenance and servicing 349

6.1 Chapter content 349

6.2 Cleaning the cabinet 350

6.3 Servicing the cabinet 350

6.4 Replacing components 352
6.4.1 General information 352
6.4.2 Safety information 352
6.4.3 Messages after replacement of DRIVE-CLiQ components 353
6.4.4 Installation device for power blocks 354
6.4.5 Mounting aid for Active Line Modules Chassis-2 and Motor Modules Chassis-2 355
6.4.6 Replacing the filter mats 356
6.4.7 Replacing power units 358
6.4.8 Using crane lifting lugs to transport power blocks 360
6.4.9 Replacing the Motor Module, booksize format 365
6.4.10 Replacing the power block, chassis format 366
6.4.10.1 Replacing the power block, frame size FB 366
6.4.10.2 Replacing the power block, frame sizes GB and GD 369
6.4.10.3 Replacing the power block, frame size FX 372
6.4.10.4 Replacing the power block, frame size GX 375
6.4.10.5 Replacing the power block, frame size HX 378
6.4.10.6 Replacing the power block, frame size JX 384
6.4.11 Replacing Chassis-2 format devices 387
6.4.11.1 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+ 387
6.4.11.2 Replacing the Active Line Module Chassis-2, frame size FS4 391
6.4.11.3 Replacing the Motor Module Chassis-2, frame sizes FS2, FS2+ and FS4 395
6.4.12 Replacing the Control Interface Module 398

6.4.12.1 Replacing the Control Interface Module, frame size FB ... 398
6.4.12.2 Replacing the Control Interface Module, frame sizes GB and GD ... 400
6.4.12.3 Replacing the Control Interface Module, frame size FX ... 402
6.4.12.4 Replacing the Control Interface Module, frame size GX ... 404
6.4.12.5 Replacing the Control Interface Module, frame size HX ... 406
6.4.12.6 Replacing the Control Interface Module, frame size JX ... 408
6.4.12.7 Replacing the Control Interface Module, frame sizes FS2 and FS4 ... 410
6.4.13 Replacing the Control Unit ... 413
6.4.14 Replacing the fans ... 419
6.4.14.1 Replacing the fan, Booksize Cabinet Kit ... 419
6.4.14.2 Replacing the fan, frame sizes FB, GB and GD ... 423
6.4.14.3 Replacing the fan, sizes FX and GX ... 425
6.4.14.4 Replacing the fan, size HX ... 427
6.4.14.5 Replacing the fan, frame size JX ... 431
6.4.14.6 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4 ... 433
6.4.14.7 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4 ... 436
6.4.14.8 Replacing the fan, frame size FI ... 439
6.4.14.9 Replacing the fan, frame size GI ... 441
6.4.14.10 Replacing the fan, frame size HI ... 443
6.4.14.11 Replacing the fan, frame size JI ... 445
6.4.14.12 Replacing the fan in the Active Interface Module Chassis-2 ... 447
6.4.15 Replacing the fuses ... 449
6.4.15.1 Replacing the fuses for the auxiliary power supply ... 449
6.4.15.2 Replacing the fuses in the auxiliary power supply module ... 449
6.4.15.3 Replacing fuses (F71 to F73) ... 450
6.4.15.4 Replacing fuses in the fuse switch disconnector for Booksize Cabinet Kit ... 451
6.4.15.5 Replacing the DC fuses for chassis format ... 451
6.4.15.6 Replacing the DC fuses for the Chassis-2 format ... 455
6.4.15.7 Replacing cylindrical fuses ... 456
6.4.15.8 Replacement of LV HRC fuses with blade contacts ... 457
6.4.16 Replacing the DC interface (option L37) ... 459
6.4.17 Replacing the pre-charging resistors of the DC interface (option L37) ... 460
6.4.18 Replacing the backup battery for the cabinet operator panel ... 461
6.5 Forming the DC link capacitors ... 463
6.6 Environmental compatibility ... 466
7 Diagnostics ... 467
7.1 Chapter content ... 467
7.2 LEDs on the CU320-2 DP Control Unit ... 468
7.3 LEDs on the CU320-2 PN Control Unit ... 471
7.4 LEDs on the CBE20 Communication Board ... 473
7.5 LEDs on the Control Interface Module in the Basic Line Module ... 475
7.6 LEDs on the Control Interface Module in the Smart Line Module ... 476
7.7 LEDs on the Control Interface Module in the Active Line Module ... 477
7.8 LEDs on the Active Line Module, Chassis-2 format ... 478
7.9 LEDs on the Control Interface Module in the Motor Module, chassis format ... 479
7.10 LEDs on the Motor Module, Chassis-2 format ... 480

7.11 LEDs on the Motor Module in the booksize format 481
7.12 LEDs on the Central Braking Module 482
7.13 LEDs on the Voltage Sensing Module (VSM) in the Active Interface Module 482
7.14 LEDs on the SMC10 Sensor Module 483
7.15 LEDs on the SMC20 Sensor Module 483
7.16 LEDs on the SMC30 Sensor Module 484
7.17 LEDs on the TM54F Terminal Module 484
7.18 LEDs on the TM150 Terminal Module 486
7.19 LEDs on the SITOP power supply unit 486
8 Options 487
8.1 Safety information 487
8.2 D14, Preliminary copy of customer documentation 487
8.3 G20, CBC10 Communication Board 488
8.4 G33, CBE20 Communication Board 491
8.5 G51 to G54, temperature sensor module TM150 494
8.5.1 General information 494
8.5.2 Interfaces 495
8.5.3 Connection example 499
8.6 G56, contactor monitoring 501
8.7 G62, TB30 Terminal Board 502
8.8 K01 to K05, safety license for 1 to 5 axes 508
8.9 K08, AOP30 advanced operator panel 510
8.10 K46, Sensor Module Cabinet-Mounted SMC10 511
8.10.1 General information 511
8.10.2 Safety information 513
8.10.3 Interfaces 514
8.10.4 Connection example 517
8.11 K48, Sensor Module Cabinet-Mounted SMC20 518
8.11.1 General information 518
8.11.2 Safety information 519
8.11.3 Interfaces 520
8.11.4 Connection example 524
8.12 K50, Sensor Module Cabinet-Mounted SMC30 525
8.12.1 General information 525
8.12.2 Safety information 529
8.12.3 Interfaces 530
8.12.4 Connection example 534
8.13 K51, VSM10 Voltage Sensing Module Cabinet-Mounted 535
8.14 K52, Additional SMC30 Sensor Module 537
8.15 K70, fan power supply 538

8.16 K73, auxiliary power supply 24 V DC ... 538
8.17 K76, auxiliary voltage generating unit in the Line Connection Module ... 539
8.18 K82, terminal module for activating safety functions "Safe Torque Off" and "Safe Stop 1" ... 541
8.19 K87, Terminal Module TM54F ... 542
8.20 K88, Safe Brake Adapter SBA 230 V AC ... 544
8.21 K90, Control Unit CU320-2 DP ... 546
8.21.1 General information ... 546
8.21.2 Connection overview ... 547
8.21.3 Connection example ... 549
8.21.4 X55 customer terminal strip ... 551
8.21.4.1 Overview ... 551
8.21.4.2 X41 EP terminal / temperature sensor connection ... 554
8.21.4.3 X46 Brake control and monitoring ... 555
8.21.4.4 X122 digital inputs/outputs ... 556
8.21.4.5 X132 digital inputs/outputs ... 558
8.21.5 X100 - X103 DRIVE-CLiQ interface ... 559
8.21.6 X126 PROFIBUS ... 560
8.21.7 PROFIBUS address switch ... 561
8.21.8 X127 LAN (Ethernet) ... 562
8.21.9 X140 serial interface (RS232) ... 563
8.21.10 Measuring sockets T0, T1, T2 ... 564
8.21.11 Memory card ... 564
8.21.11.1 Using the memory card ... 565
8.21.11.2 Data functions ... 566
8.21.11.3 Saving the memory card parameter settings ... 567
8.21.11.4 Slot for the memory card ... 567
8.22 K94, Performance extension for CU320-2 ... 568
8.23 K95, Control Unit CU320-2 PN ... 569
8.23.1 General information ... 569
8.23.2 Connection overview ... 570
8.23.3 Connection example ... 572
8.23.4 X55 customer terminal strip ... 574
8.23.4.1 Overview ... 574
8.23.4.2 X41 EP terminal / temperature sensor connection ... 577
8.23.4.3 X46 Brake control and monitoring ... 578
8.23.4.4 X122 digital inputs/outputs ... 579
8.23.4.5 X132 digital inputs/outputs ... 581
8.23.5 X100 - X103 DRIVE-CLiQ interface ... 582
8.23.6 X127 LAN (Ethernet) ... 583
8.23.7 X140 serial interface (RS232) ... 584
8.23.8 X150 P1/P2 PROFINET connection ... 585
8.23.9 Measuring sockets T0, T1, T2 ... 586
8.23.10 Memory card ... 586
8.23.10.1 Using the memory card ... 587
8.23.10.2 Data functions ... 588
8.23.10.3 Saving the memory card parameter settings ... 589
8.23.10.4 Slot for the memory card ... 589

8.24 L00, use in the first environment according to EN 61800-3, Category C2 (TN/TT systems) 590
8.25 L07, dv/dt filter compact plus Voltage Peak Limiter 592
8.26 L08/L09, motor reactor/2 motor reactors in series 596
8.27 L10, dv/dt filter plus Voltage Peak Limiter 597
8.28 L13, main contactor for Line Connection Modules < 800 A 602
8.29 L20 - used in IT line systems 603
8.30 L21, surge suppression 603
8.31 L22, supplied as standard without line reactor 605
8.32 L25, circuit breaker in withdrawable unit design 605
8.33 L34, output-side circuit breaker 606
8.33.1 General information 606
8.33.2 Switching cycles for the output-side circuit breaker 609
8.33.3 Overview diagram of option L34 610
8.33.4 Parameter assignment 611
8.33.4.1 Parameterization with script 611
8.33.4.2 Parameterization with free function blocks 611
8.33.4.3 Parameterization with DCC (Drive Control Chart) 615
8.34 L37, DC interface incl. pre-charging input circuit for the relevant DC link capacitance 616
8.34.1 General information 616
8.34.2 DC interface incl. pre-charging for Booksize Cabinet Kits 616
8.34.2.1 Important safety precautions 616
8.34.2.2 DC interface, principle of operation 617
8.34.2.3 Commissioning the DC interface with option K90/K95 618
8.34.2.4 Commissioning the DC coupling without option K90/K95 618
8.34.3 DC interface incl. pre-charging for Motor Modules in the chassis format 619
8.34.3.1 Important safety precautions 620
8.34.3.2 Accessibility of the DC connection to the Motor Module 621
8.34.3.3 Measuring points for verifying isolation from supply 622
8.34.3.4 DC interface, principle of operation 623
8.34.3.5 Commissioning the DC interface with option K90/K95 624
8.34.3.6 Commissioning the DC coupling without option K90/K95 624
8.35 L40, line filter monitoring 625
8.36 L41, current transformer upstream of main switch 626
8.37 L42/L43/L44, Line Connection Module for Active/Basic/Smart Line Modules 629
8.38 L45, EMERGENCY OFF pushbutton installed in the cabinet door 629
8.39 L46/L47, grounding switch upstream/downstream of main switch 630
8.39.1 Grounding switch upstream of main breaker (option L46) 631
8.39.2 Grounding switch downstream of main breaker (option L47) 632
8.40 L50, cabinet lighting with service socket 633
8.41 L55, cabinet anti-condensation heating 634
8.42 L61/L62, L64/L65, braking units 636
8.42.1 General information 636

8.42.2 Interfaces ... 637
8.42.3 S1 - Threshold switch ... 638
8.42.4 Braking Module ... 640
8.42.5 Example connection of Braking Module ... 643
8.42.6 Braking resistors ... 643
8.42.7 Technical data ... 646
8.43 L87, insulation monitoring ... 647
8.44 M06, base 100 mm high, RAL 9005 ... 650
8.45 M07, cable-marshalling compartment 200 mm high, RAL 7035 ... 651
8.46 M21, degree of protection IP21 ... 653
8.46.1 General information ... 653
8.46.2 Mounting ... 654
8.47 M23/M43/M54, degree of protection IP23/IP43/IP54 ... 656
8.47.1 General information ... 656
8.47.2 Mounting ... 658
8.48 M26/M27, side panels mounted on right and left ... 663
8.49 M51, motor reactor terminal connection ... 664
8.50 M59, closed cabinet door, air inlet from below through floor opening ... 665
8.51 M60, additional shock protection ... 666
8.52 M70, EMC shield bus ... 667
8.52.1 General information ... 667
8.52.2 Connecting the cables to the EMC shield bus ... 667
8.53 M77, version without component support plates and without additional control components ... 668
8.54 M80 to M87, DC busbar system ... 669
8.55 M88, DC busbar system for line-side Cabinet Modules ... 671
8.56 M89, extended motor connection panel ... 671
8.57 M90, crane transport assembly (top-mounted) ... 674
8.58 N52, DC link fuses for Basic Line Modules ... 675
8.59 P10, measuring instrument for line values (installed in the cabinet doors) ... 676
8.60 P11, measuring instrument for line values with PROFIBUS connection (installed in the cabinet door) ... 677
8.61 Y11, factory assembly into transport units ... 678
Index ... 679

Fundamental safety instructions

1

1.1 General safety instructions



⚠WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or serious injury.

- Only work on electrical equipment if you are appropriately qualified.
- Always observe the country-specific safety rules for all work.

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check that every auxiliary circuit is de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness by following the above steps in the reverse order.



⚠WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.



⚠WARNING

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.



⚠WARNING

Electric shock due to unconnected cable shield

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- Connect cable shields and unused conductors of power cables (e.g. brake conductors) at least on one side to the grounded housing potential.



⚠WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.



⚠WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is in operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.



⚠WARNING

Electric shock due to residual charges in power components

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects, or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

⚠WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠WARNING

Active implant malfunctions due to electromagnetic fields

Converters generate electromagnetic fields (EMF) during operation. People with active implants in the immediate vicinity of this equipment are at particular risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants. The following clearances are usually adequate:
  - No clearance to closed control cabinets and shielded MOTION-CONNECT supply cables
  - Forearm length (approx. 35 cm clearance) to distributed drive systems and open control cabinets

⚠WARNING

Unexpected movement of machines caused by radio devices or mobile phones

When radio devices or mobile phones with a transmission power > 1 W are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- If you come closer than around 2 m to such components, switch off any radio devices or mobile phones.
- Use the "SIEMENS Industry Online Support App" only on equipment that has already been switched off.

⚠WARNING

Motor fire in the event of insulation overload

There is a greater load on the motor insulation as a result of a ground fault in an IT system. If the insulation fails, it is possible that death or severe injury can occur as a result of smoke and fire.

- Use a monitoring device that signals an insulation fault.
- Correct the fault as quickly as possible so the motor insulation is not stressed.

⚠WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased failures and shorter service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation check of the system/machine, disconnect the devices as all converters and motors have been subject to a high voltage test by the manufacturer, and therefore it is not necessary to perform an additional test within the system/machine.

⚠CAUTION

Injuries at places that are difficult to access

There is risk of injury when working at locations that are difficult to access. For example, sharp edges and splinters can cause injuries to the head and skin.

- Use suitable personal protective equipment, for example gloves.

⚠CAUTION

Hot component surfaces

Certain components (e.g. the heat sink and reactor) can become very hot during operation. These components can remain hot for a long time after operation. Contact can result in serious injury, such as skin burns.

- Do not touch hot components, even after you have switched off the device.

⚠WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have absolutely guaranteed that the functions relevant to safety are operating correctly.

Note

Important safety instructions for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety instructions in the Safety Integrated manuals.

1.2 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.



NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. using firewalls and/or network segmentation) are in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit:

Industrial Security (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they become available, and that only the latest product versions are used. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial Security (http://www.siemens.com/industrialsecurity).

Additional information is provided on the Internet:

Industrial security Configuration Manual
(https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the integrated industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by applying suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.
- Protect the drive against unauthorized changes by activating the "Know-how protection" converter function.

1.4 Residual risks of power drive systems

When assessing the machine or system-related risk in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or system installer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of the driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware and/or software errors in the sensors, control system, actuators and cables and connections
   - Response times of the controller and drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive pollution
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influence/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures - including open flames - as well as the emission of light, noise, particles, gases, etc. can occur inside and outside the components under fault conditions caused by, for example:
   - Component malfunctions
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influence/damage
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive pollution
   - External influence/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network.

For more information about residual risks of the components in a drive system, see the relevant sections in the technical user documentation.

System overview

2

2.1 Overview

SINAMICS S120 Cabinet Modules are the components of a modular cabinet unit system for multi-motor drives with a central supply infeed and a common DC link busbar, as typically found in paper-making machines, roller mills, test stands, or hoisting gear.

They contain built-in units from the SINAMICS S120 product series, thus making them an ideal supplement to the SINAMICS G150 and SINAMICS S150 series of cabinet units for single drives.

All drive components, from the supply infeed to the motor-side inverters, are configured in a clear, compact layout in the individual Cabinet Modules. They can be combined with great flexibility and can be optimally adapted to customer-specific requirements thanks to a comprehensive array of options.

The main components of the system are as follows:

- Line Connection Modules with line-side components such as contactors, fuses and circuit breakers, as well as line reactors for Basic Line Modules.
- Line Modules for the infeed in the following versions:
  - Basic Line Modules for two-quadrant operation
  - Smart Line Modules for four-quadrant operation
  - Active Line Modules for four-quadrant operation with negligible line harmonics
- Active Line Connection Modules-2 with line-side components such as contactors, fuses and circuit breakers and Active Interface Modules for four-quadrant operation with line harmonics that can be neglected
- Central Braking Modules for braking operation
- The following types of Motor Module:
  - Booksize Cabinet Kits
  - Chassis format
  - Chassis-2 format
- Control Units
- Auxiliary Power Supply Modules to supply the auxiliary power supply system

Standardized interfaces for both the power and the control connections facilitate configuration and installation. Communication between the Power Modules and the central Control Unit is established via the DRIVE-CLiQ system interface.

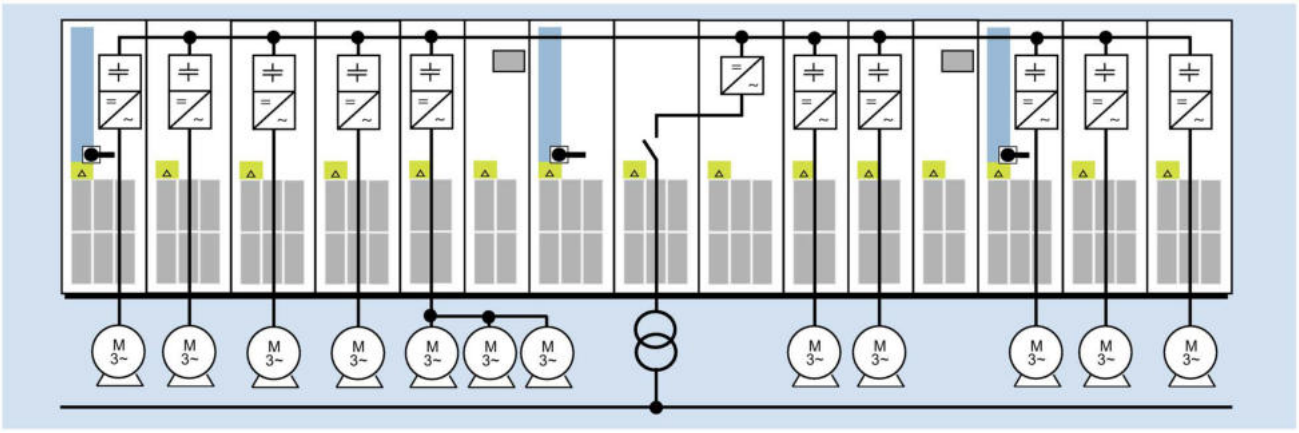


Figure 2-1 Example of a drive line-up with SINAMICS S120 Cabinet Modules for a multi-motor drive

The following table provides an overview of the voltage ranges and power ratings available for the SINAMICS S120 Cabinet Modules:

Table 2- 1 Overview of voltage ranges and power ratings of the SINAMICS S120 Cabinet Modules

	Supply voltage 3 ph. AC	Input current	DC-link voltage DC	DC-link current	Output current	Power
Line Connection Modules [1]	380 ... 480 V 500 ... 690 V	250 ... 3200 A 280 ... 3200 A				
Basic Line Modules [1]	380 ... 480 V 500 ... 690 V	365 ... 1630 A 260 ... 1580 A	510 … 650 V 675 … 930 V	420 … 1880 A 300 … 1880 A		200 ... 900 kW 250 ... 1500 kW
Smart Line Modules [1]	380 ... 480 V 500 ... 690 V	463 ... 1430 A 463 ... 1430 A	510 … 650 V 675 … 930 V	550 … 1700 A 550 … 1700 A		250 ... 800 kW 450 ... 1400 kW
Active Line Modules [1]	380 ... 480 V 500 ... 690 V	210 ... 1405 A 575 ... 1270 A	570 … 720 V 750 … 1035 V	235 … 1574 A 644 … 1422 A		132 ... 900 kW 630 ... 1400 kW
Active Line Connection Modules-2 [2]	380 ... 480 V	560 ... 985 A	570 ... 720 V	630 … 1100 A		355 ... 630 kW
Motor Modules Booksize	(380 ... 480 V)		510 ... 720 V	11 … 158 A	9 … 132 A	4.8 ... 71 kW
Motor Modules Chassis [1]	(380 ... 480 V) (500 ... 690 V)		510 ... 720 V 675 ... 1035 V	252 … 1686 A 102 … 1524 A	210 … 1405 A 85 … 1270 A	110 ... 800 kW 75 ... 1200 kW
Motor Modules Chassis-2 [2]	(380 ... 480 V)		510 ... 720 V	785 ...1440 A	655 ... 1200 A	315 ... 630 kW
Central Braking Modules [1]	(380 ... 480 V) (500 ... 600 V) (660 ... 690 V)		510 ... 720 V 675 ... 900 V 890 ... 1035 V			500 ... 1000 kW 550 ... 1100 kW 630 ... 1200 kW
Auxiliary Power Supply Module	380 ... 690 V	125 ... 250 A				

[1] The power range can be extended as required by connecting up to 4 identical modules in parallel.

[2] The power range can be extended as required by connecting up to 6 identical modules in parallel.

2.2 Field of application

The modular SINAMICS S120 Cabinet Modules drive system is used to coordinate multiple motors in a multi-axis drive system.

Typical examples include:

- Packaging machines
- Plastics processing machines
- Textile machines
- Presses, punches
- Printing and paper machines
- Machines used in the woodworking, glass and ceramics industries
- Hoisting gear
- Handling and assembly systems
- Machine tools
- Rolling mill drives
- Vehicle and gearbox test stands
- Test stand applications

High-power single drives (parallel connection) can also be implemented with Cabinet Modules.

2.3 Benefits

The outstanding system features of the SINAMICS S120 Cabinet Modules provide plant operators with the following advantages:

- Process optimization with minimal effort:
  - A standard PROFIBUS or PROFINET interface and various analog and digital interfaces allow them to be easily integrated into automation solutions.
  - Vector and servo control ensure that these drives fulfill the most exacting requirements regarding accuracy and dynamic response.
- High level of reliability and availability:
  - Individual modules and power components can be replaced quickly and easily, which ensures a higher level of plant availability.
- Energy savings during operation:
  - The motor-side inverters are coupled via the common DC link and allow energy to be exchanged between motors that are motoring and generating. This means that energy is saved, there is less load on the supply infeed and line harmonics are reduced.
  - The supply infeed is generally only dimensioned for the maximum motor power required / maximum motor current and not the sum of the energy requirements of the Motor Modules connected to the DC link. For example, for conveyor systems or engine test stands with Motor Modules that are simultaneously in the motoring and generating modes, this frequently results in smaller supply infeeds.
- Cost minimization during operation, maintenance, and service:
  - Simple commissioning thanks to the menu-driven "STARTER" commissioning tool.
  - Optional, menu-assisted AOP30 Advanced Operator Panel with plain text display and bar-type display.
  - All device modules are easily accessible, which makes them extremely service friendly.
- Space-saving design
- Environmentally-friendly operation:
  - The converters are exceptionally quiet and compact thanks to state-of-the-art IGBT power semiconductors and an innovative cooling concept.

2.4 Line Modules

2.4.1 General information

Power is fed to the drive line-up via Line Modules, which generate a DC voltage from the line voltage and, therefore, supply energy to the Motor Modules connected to the DC link. They are suitable for connection to systems grounded at the neutral point (TN, TT) and non-grounded (IT) systems.

The Line Modules are connected to the incoming supply via Line Connection Modules and are implemented in accordance with EN 61800-3 Category C3.

2.4.2 Basic Line Modules

Basic Line Modules are designed only for infeed operation, i.e. they are not capable of feeding regenerative energy back into the supply system.

If regenerative energy is produced, e.g. when braking drives, it must be converted to heat by means of a supplementary braking module and a braking resistor.

For infeeds with a Basic Line Module, a line reactor appropriate to the supply conditions must be installed. If the infeed is realized via a transformer with an appropriate rating in 6-pulse operation with a Basic Line Module or in 12-pulse operation with two Basic Line Modules, the line reactor is optional and can be omitted.

If two or more Basic Line Modules are operated in parallel on a common supply system in order to increase power, line reactors are also included in the associated Line Connection Module.

For a compact configuration, Line Connection Modules up to input currents of 3,200 A are available. Two Basic Line Modules can be operated in parallel on these Line Connection Modules. When Basic Line Modules are connected in parallel, for selective protection of the individual devices, line-side fuses are installed.

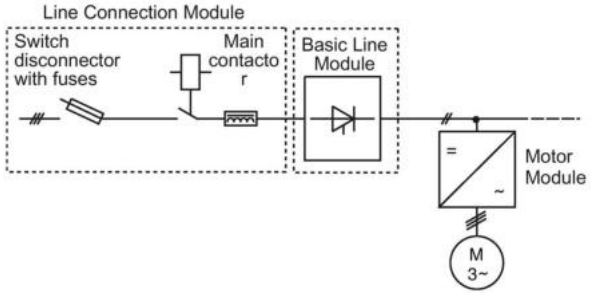


Figure 2-2 Line Connection Module with Basic Line Module ≤ 800 A

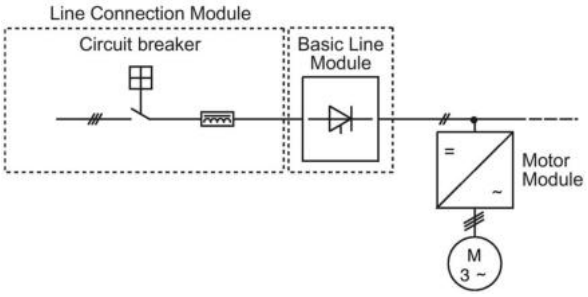


Figure 2-3 Line Connection Module with Basic Line Module > 800 A

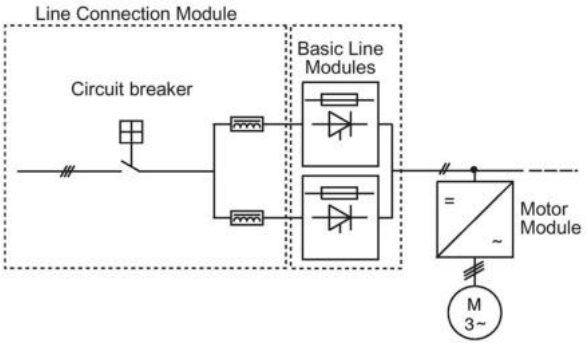


Figure 2-4 Line Connection Module with Basic Line Modules connected in parallel

2.4.3 Smart Line Modules

Smart Line Modules can supply energy to the DC link and feed back regenerative energy to the supply system. A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be recovered to the supply). When a Smart Line Module is used as the infeed, the appropriate line reactor is included in the device as standard.

For a compact configuration, Line Connection Modules up to input currents of 3,200 A are available. Two Smart Line Modules can be operated in parallel on these Line Connection Modules.

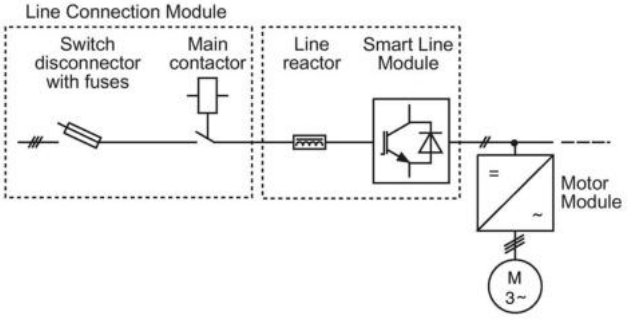


Figure 2-5 Line Connection Module with Smart Line Module ≤ 800 A

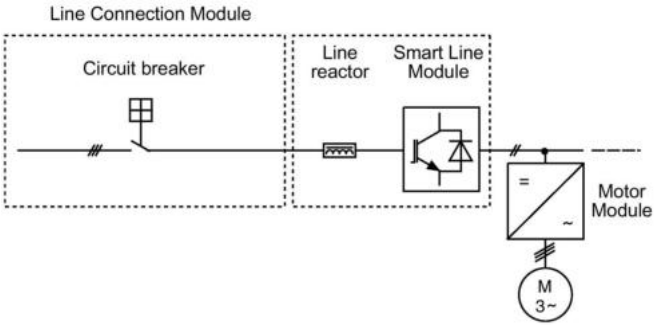


Figure 2-6 Line Connection Module with Smart Line Module > 800 A

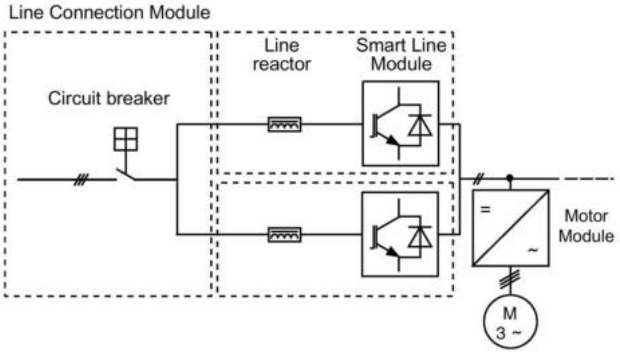


Figure 2-7 Line Connection Module with Smart Line Modules connected in parallel

2.4.4 Active Line Modules

Active Line Modules can supply energy to the DC link and return regenerative energy to the supply system. A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be fed back to the supply).

In contrast to Basic Line Modules and Smart Line Modules, Active Line Modules generate a regulated DC voltage, which remains constant despite fluctuations in the line voltage. However, in this case, the line voltage must remain within the permissible tolerance range. Active Line Modules draw an almost sinusoidal current from the line supply. Almost no harmonics occur. The total harmonic distortion factors of current THD(I) and voltage THD(U) at the rated current are typically in the range of 3 %. THD(I) is calculated according to IEEE 519 (2014) and THD(U) according to IEC 61000-2-4 (2002). The stringent limit values of IEEE 519 (2014) are typically complied with.

Active Line Modules are always used in conjunction with an Active Interface Module. Active Interface Modules include the required pre-charging input circuit for the Active Line Module, in addition to a Clean Power Filter.

These two components are considered to be an integral unit for SINAMICS S120 Cabinet Modules and are supplied together.

For a compact configuration, Line Connection Modules up to input currents of 3,200 A are available. Two Active Line Modules with their associated Active Interface Modules can be operated in parallel on these Line Connection Modules.

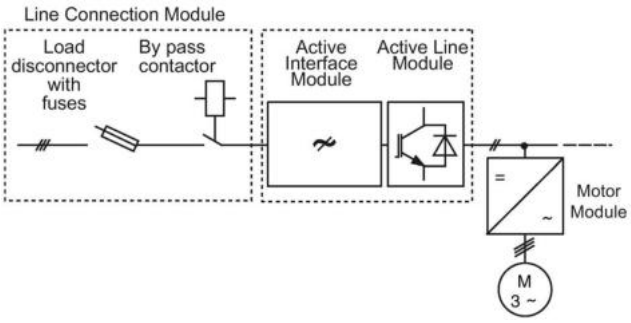


Figure 2-8 Line Connection Module with Active Interface Module and Active Line Module ≤ 800 A, example frame size HX + HI

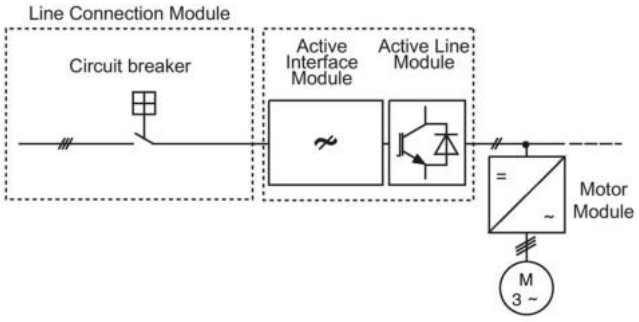


Figure 2-9 Line Connection Module with Active Interface Module and Active Line Module > 800 A

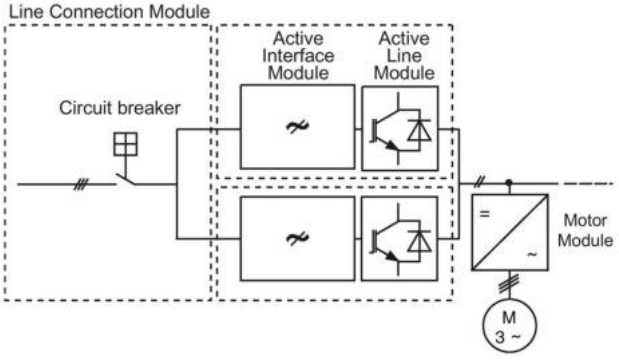


Figure 2-10 Line Connection Module with Active Interface Modules and Active Line Modules connected in parallel

2.5 Line Connection Modules

2.5.1 General information

Power is fed to the drive assembly via Line Connection Modules, which generate a DC voltage from the line voltage and, therefore, supply energy to the Motor Modules connected to the DC link. They are suitable for connection to systems grounded at the neutral point (TN, TT) and non-grounded (IT) systems.

The Line Connection Modules are connected to the line supply and are implemented as standard in accordance with EN 61800-3 Category C3.

2.5.2 Active Line Connection Modules-2

Active Line Connection Modules-2 comprise a Line Connection Module, an Active Interface Module-2 and an Active Line Module in the Chassis-2 format installed in a cabinet system.

Active Line Connection Modules-2 can supply energy to the DC link and return regenerative energy to the line supply (energy recovery). The use of an additional Motor Module as Braking Module is only required if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be fed back into the line supply).

Active Line Connection Modules-2 generate a regulated DC voltage that remains constant despite fluctuations in the line voltage. However, in this case, the line voltage must remain within the permissible tolerance range. Active Line Connection Modules-2 draw a virtually sinusoidal current from the supply system. Almost no harmonics occur. The total harmonic distortion factors of current THD(I) and voltage THD(U) at the rated current are typically in the range of 3 %. THD(I) is calculated according to IEEE 519 (2014) and THD(U) according to IEC 61000-2-4 (2002). The stringent limit values of IEEE 519 (2014) are typically complied with.

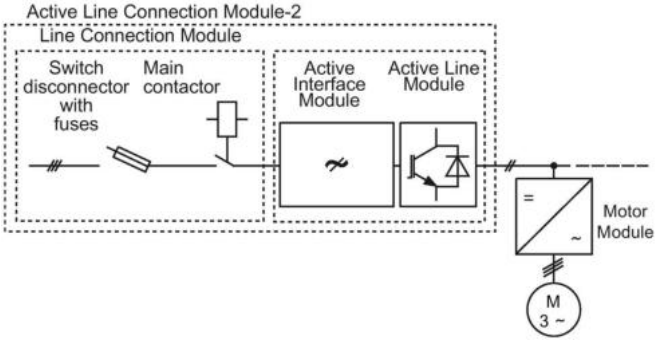


Figure 2-11 Active Line Connection Module-2 with Active Interface Module Chassis-2 and Active Line Module Chassis-2 ≤800 A

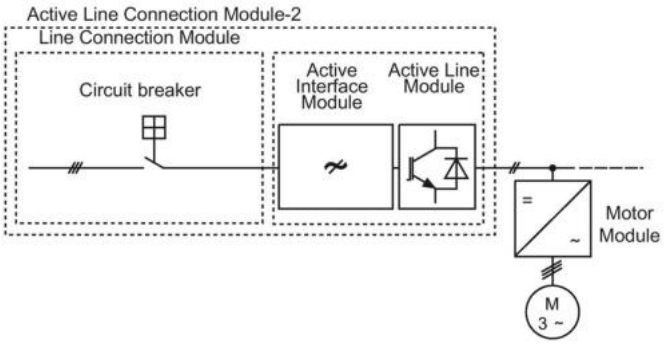


Figure 2-12 Active Line Connection Module-2 with Active Interface Module Chassis-2 and Active Line Module Chassis-2 ≤800 A

2.6 DC link components

Braking Modules are used so that the regenerative energy, which is produced when drives brake, can be converted into heat using braking resistors.

Using a Braking Module and braking resistance it is also possible to brake motors when the power fails.

2.6.1 Braking Modules as a Line Module or Motor Module option

For lower braking powers, Braking Modules are available with continuous braking powers up to 50 kW. These Braking Modules are available as option L61/L64 (25 kW) or L62/L65 (50 kW) for Basic Line Modules, Smart Line Modules, Active Line Modules or Motor Modules.

2.6.2 Central Braking Modules

For larger continuous braking powers, separate Central Braking Modules are available. These modules are implemented centrally in the drive line-up. To increase the braking power, up to four Central Braking Modules can be connected in parallel.

2.7 Motor Modules

There are three different types of Motor Modules available with the SINAMICS S120 Cabinet Modules drive system.

2.7.1 Booksize Base Cabinets with Booksize Cabinet Kits

Motor Modules at the low end of the power range from 4.8 kW to 71 kW are configured as Booksize Cabinet Kits installed in Booksize Base Cabinets.

2.7.2 Chassis Cabinets

Each Chassis Cabinet is fitted with one SINAMICS S120 Motor Module in the chassis format, and covers the power range from 75 kW up to 1200 kW.

Higher powers can be achieved by connecting the Motor Modules in parallel.

The Motor Modules can also be used as braking module (braking chopper) if a 3-phase braking resistor is connected instead of a motor.

For more detailed information on this topic, please refer to the SINAMICS Low Voltage Configuration Manual.

2.7.3 Chassis-2 Cabinets

Each Chassis-2 Cabinet is fitted with one SINAMICS S120 Motor Module in the Chassis-2 format, and covers the power range from 315 kW up to 630 kW.

Higher powers can be achieved by connecting the Motor Modules Chassis-2 in parallel.

For more detailed information on this topic, please refer to the SINAMICS Low Voltage Configuration Manual.

2.8 Auxiliary Power Supply Modules

Auxiliary Power Supply Modules supply power to the auxiliary power supply system of the SINAMICS S120 Cabinet Modules.

The fans of the SINAMICS S120 devices installed in the Cabinet Modules are some of the devices connected to this auxiliary power supply system. In addition, the auxiliary power supply system supplies the electronic modules with an external 24 VDC voltage. This is required when the DC link is not charged, for example, in order to maintain PROFIBUS communication.

2.9 Overview of options

Table 2- 2 Overview of options

Option code	Brief description of option
D00	Documentation in German
D02	Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format
D14	Draft of customer documentation
D56	Documentation in Russian
D58	Documentation in: English/French
D60	Documentation in: English/Spanish
D72	Documentation in Italian
D74	Documentation in: English/German
D76	Documentation in English
D77	Documentation in French
D78	Documentation in Spanish
D80	Documentation in: English/Italian
D84	Documentation in Chinese
D91	Documentation in: English/Chinese
D93	Documentation in: English/Portuguese (Brazil)
D94	Documentation in: English/Russian
F03	Visual acceptance
F71	Function test with no motor connected (with the customer present)
F72	Function test with no motor connected (without the customer present)
F74	Function test with test bay motor (without the customer present)
F75	Function test with test bay motor (with the customer present)
F76	Insulation test (without the customer present)
F77	Insulation test (with the customer present)
F97	Customer-specific acceptance inspections (on request)
G20	CBC10 Communication Board
G33	CBE20 Communication Board
G51	1 temperature sensor module TM150
G52	2 temperature sensor modules TM150
G53	3 temperature sensor modules TM150
G54	4 temperature sensor modules TM150
G56	Contactor monitoring
G62	Terminal Board TB30
K01	Safety license for 1 axis
K02	Safety license for 2 axes
K03	Safety license for 3 axes
K04	Safety license for 4 axes
K05	Safety license for 5 axes
K08	AOP30 Advanced Operator Panel installed in the cabinet door

Option code	Brief description of option
K46	Sensor Module Cabinet-Mounted SMC10
K48	Sensor Module Cabinet-Mounted SMC20
K50	Sensor Module Cabinet-Mounted SMC30
K51	Voltage Sensing Module for determining the motor speed and the phase angle
K52	Additional SMC30 Sensor Module
K70	Fan power supply
K73	Auxiliary power supply 24 VDC
K76	Auxiliary power generation in the Line Connection Module
K82	Terminal Module for controlling the "Safe Torque Off" and "Safe Stop 1" safety functions
K87	Terminal Module TM54F
K88	Safe Brake Adapter SBA 230 VAC
K90	Control Unit CU320-2 PROFIBUS
K94	Performance extension for CU320-2
K95	Control Unit CU320-2 PROFINET
L00	Use in the first environment according to EN 61800-3, Category C2 (TN/TT systems)
L07	dv/dt filter compact plus Voltage Peak Limiter
L08	Motor reactor
L09	2 motor reactors connected in series
L10	dv/dt filter plus Voltage Peak Limiter
L13	Main contactor
L20	Use in an IT line system
L21	Surge suppression
L22	Line reactor not included in scope of delivery
L25	Circuit breaker in withdrawable unit design
L34	Output-side circuit breaker
L37	DC interface including precharging input circuit of the associated DC link capacitance
L40	Line filter monitoring
L41	Current transformer upstream of main breaker
L42	Line Connection Module for Active Line Modules
L43	Line Connection Module for Basic Line Modules
L44	Line Connection Module for Smart Line Modules
L45	EMERGENCY OFF pushbutton installed in the cabinet door
L46	Grounding switch upstream of main breaker
L47	Grounding switch downstream of main breaker
L50	Cabinet lighting with service socket
L55	Cabinet anti-condensation heating
L61	25/125 kW braking unit for line voltages of 380 ... 480 V and 660 ... 690 V
L62	50/250 kW braking unit for line voltages of 380 ... 480 V and 660 ... 690 V
L64	25/125 kW braking unit for line voltages of 500 ... 600 V
L65	50/250 kW braking unit for line voltages of 500 ... 600 V
L87	Insulation monitoring
M06	Base 100 mm high, RAL 9005

Option code	Brief description of option
M07	Cable-marshaling compartment 200 mm high, RAL 7035
M21	IP21 degree of protection
M23	IP23 degree of protection
M26	Side panel (right)
M27	Side panel (left)
M43	IP43 degree of protection
M51	Motor reactor terminal connection
M54	IP54 degree of protection
M59	Closed cabinet door (air inlet from below through floor opening)
M60	Additional shock protection
M70	EMC shield bus
M77	Version without component support plates and without additional control components
M80	DC busbar system (Id = 1170 A, 1x 60 x 10 mm)
M81	DC busbar system (Id = 1500 A, 1x 80 x 10 mm)
M82	DC busbar system (Id = 1840 A, 1x 100 x 10 mm)
M83	DC busbar system (Id = 2150 A, 2x 60 x 10 mm)
M84	DC busbar system (Id = 2730 A, 2x 80 x 10 mm)
M85	DC busbar system (Id = 3320 A, 2x 100 x 10 mm)
M86	DC busbar system (Id = 3720 A, 3x 80 x 10 mm)
M87	DC busbar system (Id = 4480 A, 3x 100 x 10 mm)
M89	Extended motor connection panel
M90	Crane transport assembly (top-mounted)
N52	DC link fuses for Basic Line Module
P10	Measuring instrument for line values (installed in the cabinet door)
P11	Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door
T58	Rating plate data in English/French
T60	Rating plate data in English/Spanish
T80	Rating plate data in English/Italian
T83	Type plate data in English/Portuguese (Brazil)
T85	Rating plate data in English/Russian
T91	Rating plate data in English/Chinese
Y09	Special paint finish for cabinet
Y11	Factory assembly into transport units
Y31	One-line label for plant identification, 40 x 80 mm
Y32	Two-line label for plant identification, 40 x 180 mm
Y33	Four-line label for plant identification, 40 x 180 mm

2.10 System structure

Line Modules are coupled with the various Motor Modules using prefabricated DC busbar sets with different current load ratings.

All standard busbars, as well as electronics components, are protected against environmental influences. This is achieved through the use of nickel-plated copper bars and painted modules throughout.

An auxiliary power supply system spanning the individual Cabinet Modules supplies the required auxiliary voltages for the equipment fans and the 24 VDC loads.

Communication between the Control Unit, Line Module and Motor Module, and other active SINAMICS components takes place via DRIVE-CLiQ connections.

DRIVE-CLiQ is an internal serial interface of the drive that enables fast and easy configuration of the complete drive line-up with prefabricated cables in varying lengths.

As an option, Cabinet Modules can be delivered in preconfigured transport units with a total width of up to 2,400 mm each. This option is recommended in particular for Line Modules together with Line Connection Modules since, in this case, the Line Connection Module must be equipped with a pre-charging DC link or line reactors (depending on the type of Line Module), in addition to the electrical interface (mounted on a busbar). Transport units enable the various devices to be quickly and easily assembled on-site.

2.11 System data

General technical system data

General data			
Line voltages and power ranges	3 AC 380 ... 480 V, ±10% (-15% < 1 min), 4.8 ... 800 kW [1] 3 AC 500 ... 690 V, ±10% (-15% < 1 min), 55 ... 1200 kW [1]		
Line system configurations	Line supplies grounded at the neutral point (TN/TT systems) or non-grounded line supplies (IT systems)		
Line frequency	47 ... 63 Hz		
Output frequency	Vector control: 0 ... 550 Hz servo control: 0 ... 550 Hz U/f control: 0 ... 550 Hz (higher output frequencies on request)		
Line power factor fundamental factor	Basic Line Modules: > 0.96	Smart Line Modules: > 0.96	Active Line Modules: Can be adjusted (set in factory to cos φ =1)
Efficiency	> 99.0%	> 98.5%	> 97.5%
Control method	Servo control, vector control with and without sensor or V/f control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, programmable		
Skipped speed ranges	4, parameterizable		
Braking operation	With regenerative feedback or by additional Braking Modules and braking resistors		
Degree of protection	IP20, IP21, IP23, IP43 and IP54 (with options M26 and M27, side panels on the right and left respectively)		
Protection class	Protection class I acc. to EN 61800-5-1		
Overvoltage category	III to EN 61800-5-1		
Degree of pollution	2 according to EN 61800-5-1		
Cooling method	Forced air cooling AF acc. to EN 60146		
Shock protection	EN 50274 and DGUV regulation 3 when used for the intended purpose		
Cabinet system	Rittal TS 8, doors with double-bit key, tripartite base plates for cable inlet		
Paint finish	RAL 7035 (indoor requirements)		

[1] Output data in the basic version, performance enhancement possible with parallel connection.

Electromagnetic compatibility (EMC)	
Emitted interference • Standard • With line filter (option L00)	• Category C3 (second environment) according to EN 61800-3 • Category C2 (first [*)] and second environments) according to EN 61800-3 [*)] When used in the first environment, an appropriately trained and authorized technical person must set up the drive and commission it. NOTE: An appropriately trained and authorized technician is a person or organization with the required experience for setting up and/or for commissioning drive systems, including the associated EMC aspects.
Noise immunity	Use in the first and second environment according to EN 61800-3

Compliance with standards	
Standards	EN 50274, EN 60146-1, EN 60204-1, EN 60529, EN 61800-2, EN 61800-3, EN 61800-5-1
CE marking	- EMC Directive No. 2014/30/EU - Low-Voltage Directive No. 2014/35/EU - Machinery Directive No. 2006/42/EC for functional safety

Ambient conditions			
	During storage [2]	**During transport** [2]	**In operation** [2]
Ambient temperature	-25° C to +55° C	-25° C to +70° C from *-40 °C* for 24 hours	*0 °C* ... +40 °C to +50° C see derating data
Relative humidity (condensation not permissible) corresponds to class	*5 % ... 95 %* 1K4 acc. to EN 60721-3-1	5 % ... 95 % at 40 °C 2K3 acc. to EN 60 721-3-2	5 % ... *95 %* 3K3 acc. to EN 60721-3-3
Environmental class / harmful chemical substances	1C2 according to EN 60721-3-1	2C2 according to EN 60721-3-2	3C2 according to EN 60721-3-3
Organic/biological influences	1B1 according to EN 60721-3-1	2B1 according to EN 60721-3-2	3B1 according to EN 60721-3-3
Mechanically active substances	1S1 according to EN 60721-3-1	2S1 according to EN 60721-3-2	3S1 according to EN 60721-3-3
Installation altitude	• Motor Modules, Booksize Cabinet Kit format: up to 1000 m above sea level - no derating, > 1000 m - see characteristics/derating data • Cabinet Modules: up to 2000 m above sea level - no derating, > 2000 m - see characteristics/derating data		

[2] Deviations from the specified class are shown in *italics*.

Mechanical strength			
	During storage [2]	**During transport** [2]	**In operation** [2]
Vibrational load - Displacement - Acceleration - Corresponds to class	 1.5 mm at *5 Hz* ... 9 Hz 5 m/s² at > 9 ... 200 Hz 1M2 acc. to EN 60721-3-1	 3.1 mm at *5 Hz* ... 9 Hz 10 m/s² at > 9 ... 200 Hz 2M2 acc. to EN 60721-3-2	 0.075 mm at 10 ... 58 Hz 9.8 m/s² at >58 ... 200 Hz -
Shock load - Acceleration - Corresponds to class	 40 m/s² for 22 ms 1M2 acc. to EN 60721-3-1	 100 m/s² for 11 ms 2M2 acc. to EN 60721-3-2	 100 m/s² for 11 ms 3M4 acc. to EN 60721-3-3

[2] Deviations from the specified class are shown in *italics*.

Note

Weight of a cabinet unit

The relevant weight of a cabinet unit is specified on the test certificate supplied and on the rating plate. The specified weight corresponds to the actual expansion stage of the cabinet unit.

Note

Limiting overvoltages

On systems with a grounded phase conductor and a line voltage > 600 VAC, line-side components should be installed to limit overvoltages to overvoltage category II according to EN 61800-5-1.

2.12 Derating data

2.12.1 Derating data for booksize format

SINAMICS S120 Cabinet Modules with power units, booksize format, and the associated system components are dimensioned for an ambient temperature of 40 °C and installation altitudes up to 1000 m above sea level. If SINAMICS S120 Cabinet Modules with power units in the booksize format are operated at ambient temperatures higher than 40 °C and/or installation altitudes higher than 1000 m above sea level, then the corresponding derating factors must be taken into account as a function of the ambient temperature and/or the installation altitude. These derating factors are different to the derating factors for power units in the chassis format, and can be found in Catalog D 21.4, in Section "SINAMICS S120 drive system". They are valid for SINAMICS S120 Cabinet Modules with booksize format power units in degrees of protection IP20, IP21, IP23, IP43 and IP54.

2.12.2 Derating data for chassis format

2.12.2.1 General

SINAMICS S120 Cabinet Modules as well as the associated system components are dimensioned for an ambient temperature of 40° C and installation altitudes up to 2000 m above sea level.

S120 Cabinet Modules include Basic Line Modules, Smart Line Modules, Active Line Modules and Motor Modules with power units, chassis format including the associated system components, (e.g. line filter, chassis Braking Modules and motor filter), as well as Line Connection Modules and Auxiliary Power Supply Modules.

Exceptions are S120 Cabinet Modules with power units, Booksize format and the Central Braking Modules. This derating data can be taken from Chapter "Cabinet Modules" in subchapter "Derating data" of the particular S120 Cabinet Modules.

Permissible output current as a function of the ambient temperature

If SINAMICS S120 Cabinet Modules are operated at ambient temperatures higher than 40° C, then the output current must be reduced. Ambient temperatures higher than 50° C are not permissible. The following tables specify the permissible output current as a function of the ambient temperature for the various degrees of protection.

Table 2- 3 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 2000	100%	100%	100%	100%	100%	93.3%	86.7%

Table 2- 4 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 2000	100%	100%	100%	100%	93.3%	86.7%	80.0%

Installation altitudes greater than 2000 to 5000 m above sea level

If SINAMICS S120 Cabinet Modules are operated at installation altitudes greater than 2000 m above sea level, then it must be taken into account that with increasing installation altitude, the air pressure and therefore the density of the air decreases. The cooling effect as well as the insulating capability of the air decrease as a result of the lower air density.

Installation altitudes greater than 2000 to 5000 m can be achieved if the derating measures in the following chapter are applied.

2.12.2.2 Derating measures

Installation altitudes greater than 2000 to 5000 m can be achieved if the following derating measures are applied. These measures apply for the following drive configurations with SINAMICS S120 Cabinet Modules:

- Drives with Basic Line Modules at all voltage levels (3 AC 380 to 480 V and 3 AC 500 to 690 V).
- Drives with Smart Line Modules in all voltage levels (3 AC 380 to 480 V and 3 AC 500 to 690 V).
- Drives with Active Line Modules in the voltage level 3 AC 380 to 480 V (drives with Active Line Modules for 3 AC 500 to 690 V on request).
- Drives with Active Line Connection Modules-2 at voltage levels 3 AC 380 to 480 V.

Reducing the ambient temperature and the output current

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and, on the other, to lower heat loss in the Cabinet Module by reducing the output current, whereby ambient temperatures lower than 40° C may be offset to compensate. The following tables specify the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection. The specified values already take into account the permissible compensation between installation altitude and ambient temperature less than 40° C (air intake temperature where the air enters the Cabinet Module). The values apply under the precondition that the cooling air flow through the devices – as specified in the technical data – is guaranteed as a result of the cabinet installation.

Table 2- 5 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 2000	100%	100%	100%	100%	100%	93.3%	86.7%
... 2500	100%	100%	100%	100%	96.3%		
... 3000	100%	100%	100%	98.7%			
... 3500	100%	100%	100%				
... 4000	100%	100%	96.3%				
... 4500	100%	97.5%					
... 5000	98.2%						

Table 2- 6 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 2000	100%	100%	100%	100%	93.3%	86.7%	80.0%
... 2500	100%	100%	100%	96.3%	89.8%		
... 3000	100%	100%	98.7%	92.5%			
... 3500	100%	100%	94.7%				
... 4000	100%	96.3%	90.7%				
... 4500	97.5%	92.1%					
... 5000	93.0%						

Use of an isolating transformer to reduce transient overvoltages according to IEC 61800-5-1

As a consequence, overvoltage category III is reduced to overvoltage category II – which in turn reduces the demands placed on the insulating capability of air. An additional voltage derating (reduction of the input voltage) is not required if the following secondary conditions are maintained:

- The isolation transformer must be fed from a low-voltage supply or a medium-voltage supply and must not be directly supplied from a high-voltage supply.
- The isolation transformer may supply one or several Line Modules.
- The cables between the isolation transformer and the Line Module or Line Modules must be routed so that a direct lightning strike is completely ruled out, i.e. cables must not be routed outside.
- The following line supply types are permissible for drives equipped with Basic Line Modules and Smart Line Modules:
  - TN line supplies with grounded star point (no grounded phase conductor).
  - IT line supplies (operation with a short-circuit must be restricted to the absolutely shortest possible time).
- The following line supply types are permissible for drives equipped with Active Line Modules:
  - TN systems with grounded star point (no grounded outer conductor, no IT systems) for installation altitudes of greater than 2000 m.

2.12.2.3 Current derating for Motor Modules depending on the pulse frequency

When the pulse frequency is increased, the derating factor of the output current must be taken into account. This derating factor must be applied to the currents specified in the technical data for Motor Modules.

Table 2- 7 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Article No.	Type rating	Output current at 2 kHz	Derating factor at the pulse frequency				
6SL3720-...	[kW]	[A]	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 VDC							
1TE32-1AA3	110	210	95%	82%	74%	54%	50%
1TE32-6AA3	132	260	95%	83%	74%	54%	50%
1TE33-1AA3	160	310	97%	88%	78%	54%	50%
1TE33-8AA3	200	380	96%	87%	77%	54%	50%
1TE35-0AA3	250	490	94%	78%	71%	53%	50%

Table 2- 8 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Article No.	Type rating	Output current at 1.25 kHz	Derating factor at the pulse frequency					
6SL3720-...	[kW]	[A]	2 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 VDC								
1TE36-1AA3	315	605	83%	72%	64%	60%	40%	36%
1TE37-5AA3	400	745	83%	72%	64%	60%	40%	36%
1TE38-4AA3	450	840	87%	79%	64%	55%	40%	37%
1TE41-0AA3	560	985	92%	87%	70%	60%	50%	47%
1TE41-2AA3	710	1260	92%	87%	70%	60%	50%	47%
1TE41-4AA3	800	1405	97%	95%	74%	60%	50%	47%
Supply voltage 675 – 1035 VDC								
1TG28-5AA3	75	85	93%	89%	71%	60%	40%	--
1TG31-0AA3	90	100	92%	88%	71%	60%	40%	--
1TG31-2AA3	110	120	92%	88%	71%	60%	40%	--
1TG31-5AA3	132	150	90%	84%	66%	55%	35%	--
1TG31-8AA3	160	175	92%	87%	70%	60%	40%	--
1TG32-2AA3	200	215	92%	87%	70%	60%	40%	--
1TG32-6AA3	250	260	92%	88%	71%	60%	40%	--
1TG33-3AA3	315	330	89%	82%	65%	55%	40%	--
1TG34-1AA3	400	410	89%	82%	65%	55%	35%	--
1TG34-7AA3	450	465	92%	87%	67%	55%	35%	--
1TG35-8AA3	560	575	91%	85%	64%	50%	35%	--
1TG37-4AA3	710	735	87%	79%	64%	55%	35%	--
1TG38-1AA3	800	810	97%	95%	71%	55%	35%	--
1TG38-8AA3	900	910	92%	87%	67%	55%	33%	--
1TG41-0AA3	1000	1025	91%	86%	64%	50%	30%	--
1TG41-3AA3	1200	1270	87%	79%	55%	40%	25%	--

Note

Derating factors for pulse frequencies in the range between fixed values

For pulse frequencies in the range between the specified fixed values, the relevant derating factors can be determined by linear interpolation.

Maximum output frequencies achieved by increasing the pulse frequency

The adjustable pulse frequencies - and therefore the output frequencies that can be achieved with the factory-set current controller clock cycles - are listed below.

Table 2- 9 Maximum output frequencies achieved by increasing the pulse frequency

Current controller clock cycle T_I	Adjustable pulse frequencies f_p	Maximum achievable output frequency f_A		
		V/f operating mode	Vector operating mode	Servo mode
250 µs [1]	2 kHz 4 kHz 8 kHz	166 Hz 333 Hz 550 Hz [3]	166 Hz 333 Hz 480 Hz	333 Hz 550 Hz [3] 550 Hz [3]
400 µs [2]	1.25 kHz 2.50 kHz 5.00 kHz 7.50 kHz	104 Hz 208 Hz 416 Hz 550 Hz [3]	104 Hz 208 Hz 300 Hz 300 Hz	- - - -

[1] As factory setting, the following Motor Modules in the chassis format have a current controller clock cycle of 250 µs - and a pulse frequency of 2 kHz:
- 510 ... 720 V DC: ≤250 kW / 490 A

[2] As factory setting, the following Motor Modules in the chassis format have a current controller clock cycle of 400 µs - and a pulse frequency of 1.25 kHz:
- 510 ... 720 V DC: ≥315 kW / 605 A
- 675 ... 1035 V DC: All power ratings

[3] With the "High output frequencies" license, which can be ordered as option J01 on the CompactFlash card for SINAMICS S120, the maximum output frequency is increased up to 650 Hz.

Refer to the Low Voltage Configuration Manual for current controller clock cycles deviating from the factory setting.

2.12.3 Derating data for devices in Chassis-2 format

2.12.3.1 General

SINAMICS S120 Cabinet Modules-2 as well as the associated system components are dimensioned for an ambient temperature of 40 °C and installation altitudes up to 1000 m above sea level.

S120 Cabinet Modules-2 include Active Line Connection Modules-2 and Motor Modules with power units in the Chassis-2 format including the associated system components, (e.g. motor filter).

Permissible output current as a function of the ambient temperature

If SINAMICS S120 Cabinet Modules-2 are operated at ambient temperatures higher than 40 °C, then the output current must be reduced. Ambient temperatures higher than 50° C are not permissible. The following tables specify the permissible output current as a function of the ambient temperature for the various degrees of protection.

Table 2- 10 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of							
	15 °C	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 1000	100 %	100%	100%	100%	100%	100%	83%	69%

Table 2- 11 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of								
	10 °C	15 °C	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 1000	100 %	100%	100%	100%	100%	100 %	83%	69%	54%

Installation altitudes greater than 1000 to 5000 m above sea level

If SINAMICS S120 Cabinet Modules-2 are operated at installation altitudes greater than 1000 m above sea level, then it must be taken into account that with increasing installation altitude, the air pressure and therefore the density of the air decreases. The cooling effect as well as the insulating capability of the air decrease as a result of the lower air density.

Installation altitudes greater than 1000 up to 5000 m can be achieved if the derating measures in the subsequent chapter are applied.

2.12.3.2 Derating measures

Installation altitudes greater than 1000 up to 5000 m can be achieved if the following derating measures are applied. These measures apply for the following drive configurations with SINAMICS S120 Cabinet Modules-2:

- Drives with Active Line Connection Modules-2 at voltage levels 3 AC 380 to 480 V.
- Drives with Motor Modules Chassis-2 at voltage levels 3 AC 380 to 480 V.

Reducing the ambient temperature and the output current

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and, on the other, to lower heat loss in the Cabinet Module by reducing the output current, whereby ambient temperatures lower than 40° C may be offset to compensate. The following tables specify the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection. The specified values already take into account the permissible compensation between installation altitude and ambient temperature less than 40° C (air intake temperature where the air enters the Cabinet Module). The values apply under the precondition that the cooling air flow through the devices – as specified in the technical data – is guaranteed as a result of the cabinet installation.

Table 2- 12 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of							
	15 °C	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 1000	100 %	100 %	100 %	100 %	100 %	100 %	83%	69%
... 1500	100 %	100 %	100 %	100 %	100 %	98%	81%	67%
... 2000	100%	100%	100%	100%	100%	93%	78%	65%
... 2500	100%	100%	100%	100%	96%			
... 3000	100%	100%	100%	99%				
... 3500	100%	100%	100%					
... 4000	100%	100%	96%					
... 4500	100%	97%						
... 5000	98%							

Table 2- 13 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of								
	10 °C	15 °C	20° C	25° C	30° C	35° C	40° C	45° C	50° C
0 ... 1000	100 %	100 %	100 %	100 %	100 %	100 %	83%	69%	54%
... 1500	100 %	100 %	100 %	100 %	100 %	98%	81%	67%	52%
... 2000	100 %	100%	100%	100%	100%	93%	78%	65%	50 %
... 2500	100%	100%	100%	100 %	96%				
... 3000	100%	100%	100 %	99%					
... 3500	100%	100%	100 %						
... 4000	100%	100 %	96%						
... 4500	100 %	97%							
... 5000	98%								

Use of an isolating transformer to reduce transient overvoltages according to IEC 61800-5-1

As a consequence, overvoltage category III is reduced to overvoltage category II – which in turn reduces the demands placed on the insulating capability of air. An additional voltage derating (reduction of the input voltage) is not required if the following secondary conditions are maintained:

- The isolation transformer must be fed from a low-voltage supply or a medium-voltage supply and must not be directly supplied from a high-voltage supply.
- The isolation transformer may supply one or several Line Modules.
- The cables between the isolation transformer and the Line Module or Line Modules must be routed so that a direct lightning strike is completely ruled out, i.e. cables must not be routed outside.
- The following line supply types are permissible for drives equipped with Active Line Connection Modules-2:
  - TN systems with grounded star point (no grounded outer conductor, no IT systems) for installation altitudes of greater than 2000 m.

2.12.3.3 Current derating for Motor Modules Chassis-2 depending on the pulse frequency

When the pulse frequency is increased, the derating factor of the output current must be taken into account. This derating factor must be applied to the currents specified in the technical data for Motor Modules Chassis-2.

Table 2- 14 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2.5 kHz

Article No.	Type rating	Output current at 2.5 kHz	Derating factor at the pulse frequency			
6SL3721-...	[kW]	[A]	4 kHz	5 kHz	7.5 kHz	8 kHz
Connection voltage 510 ... 720 V DC (line voltage 3 AC 380 ... 480 V)						
1TE36-6BE0	315	655	78%	67%	48%	45%
1TE37-4BE0	355	740	78%	67%	48%	45%
1TE38-1BE0	400	810	78 %	67 %	48%	45 %
1TE38-8BE0	450	910	78 %	67 %	48%	45 %
1TE41-0BE0	500	975	78%	67%	48%	45%
1TE41-1BE0	560	1075	78%	67%	48%	45%
1TE41-2BE0	630	1200	78%	67%	48%	45%

Note

Derating factors for pulse frequencies in the range between fixed values

For pulse frequencies in the range between the specified fixed values, the relevant derating factors can be determined by linear interpolation.

Maximum output frequencies achieved by increasing the pulse frequency

The adjustable pulse frequencies - and therefore the output frequencies that can be achieved with the factory-set current controller clock cycles - are listed below.

Table 2- 15 Maximum output frequencies achieved by increasing the pulse frequency

Current controller clock cycle T_I	Adjustable pulse frequencies f_p	Maximum achievable output frequency f_A		
		V/f operating mode	Vector operating mode	Servo mode
400 µs [1]	2.50 kHz	208 Hz	208 Hz	-
	5.00 kHz	416 Hz	300 Hz	-
	7.50 kHz	550 Hz [2]	300 Hz	-

[1] As factory setting, the following Motor Modules Chassis-2 have a current controller clock cycle of 400 µs - and a pulse frequency of 2.5 kHz:
- 510 ... 720 V DC: All power ratings

[2] With the "High output frequencies" license, which can be ordered as option J01 on the CompactFlash card for SINAMICS S120, the maximum output frequency is increased up to 650 Hz.

Refer to the Low Voltage Configuration Manual for current controller clock cycles deviating from the factory setting.

Mechanical installation 3

3.1 Important notes

Transport

⚠WARNING

Incorrect transport of the device

The unit can tip over if you transport it incorrectly – or if you use transport equipment that is not permitted for the purpose. This can result in death, serious injury or material damage.

- Ensure that only trained personnel transport the device with approved transport equipment and lifting tools.
- Observe the center of gravity specifications. A label or stamp is attached to each transportation unit and precisely shows the center of gravity of the cabinet.
- Transport the unit only in the original marked upright position. Do not tilt the device or allow it to fall.
- The forks of the truck must protrude at the rear of the transport pallet. The floor panels of the transport units cannot be loaded or stressed.

⚠WARNING

Use of non-approved fork-lift trucks

If the forks are too short, this can cause the transport unit/cabinet to tip over resulting in death, serious injury or damage to the cabinet.

- The forks of the truck must protrude at the rear of the transport pallet. The floor panels of the transport units cannot be loaded or stressed.
- Only use fork-lift trucks approved for this purpose to transport the units.

Note

Notes regarding transportation

- The devices are packaged by the manufacturer in accordance with the climatic conditions and stress encountered during transit and in the recipient country.
- The notes on the packaging relating to transportation, storage, and proper handling must be observed.
- For transportation using forklifts, the devices must be set down on a wooden pallet.
- When the devices are unpacked, they can be transported using the optional transport eyebolts (option M90) or rails on the cabinet unit. The load must be distributed evenly. Heavy blows or impacts must be avoided during transit and when the devices are being set down, for example.
- Shock/tilt indicators are affixed to the packaging to detect unacceptable impact or tilting of the cabinet unit during transport (see Chapter Shipping and handling indicators (Page 61)).
- Permissible ambient temperatures:
  Air cooling: -25 to +70 °C, Class 2K3 acc. to IEC 60721-3-2
  Briefly up to -40 °C for max. 24 hours

Note

Notes regarding damage in transit

- Carry out a thorough visual inspection of the device before accepting the delivery from the transportation company. Pay special attention to transport damage that is not readily apparent but indicated by the tilt and shock indicators.
- Check that you have received all the items specified on the delivery note.
- Notify the shipping company immediately of any missing components or damage.
- If you identify any hidden defects or damage, contact the transportation company immediately and ask them to examine the device.
- If you fail to contact them immediately, you may lose your right to claim compensation for the defects and damage.
- If necessary, you can request the support of your local Siemens office.

Storage

The devices must be stored in clean, dry rooms. Temperatures between -25 and +55 °C (Class 1K4 acc. to EN 60721-3-1) are permissible. Temperature variations greater than 20 K per hour are not permitted.

If the enclosed drive is stored for a prolonged period once it has been unpacked, cover it or take other appropriate measures to ensure that it does not become dirty and that it is protected against environmental influences. If such measures are not taken, the warranty becomes invalid in the event of a claim for damages.

NOTICE
Material damage to the canopies caused by impermissible mechanical loading The separately delivered canopies may be damaged if they are subjected to mechanical loads before being installed on the cabinets. • Do not apply any mechanical loads to the canopies.

3.2 Mechanical installation: Checklist

Use the following checklist to guide you through the mechanical installation procedure for the cabinet/transport unit. Read the Chapter "Fundamental safety instructions" before you start working on the cabinet.

For installation instructions, see the following sections or refer to the documents listed in the table below.

Note

Checking the checklist

Check the boxes accordingly in the right-hand column if the option involved applies to the scope of delivery. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities have been completed.

Table 3- 1 Mechanical installation: Checklist

Item	Activity	Applicable?	Completed?
1	Check the transport indicators prior to installation. (→ See Chapter "Installation/preparation", Section "Transport indicators")	☐	☐
2	Check the cabinet center of gravity shown on the label provided.	☐	☐
3	The ambient conditions must be permissible. (→ See general technical data in Chapter "System overview", Section "System data")	☐	☐
4	The load-carrying capacity and properties of the ground must fulfill the requirements for installation of the Cabinet Modules. (→ See Chapter "Cabinet Modules" in the technical data for the relevant Cabinet Modules) (→ See Chapter "Mechanical installation", Section "Preparation")	☐	☐
5	The crane transport assembly (option M90) installed for delivery must be removed once the transport unit or individual cabinet units have been set down at the final installation location. (→ See Chapter "Installation", Section "Disassembling the crane transport assembly")	☐	☐
6	Before the cabinet units are finally installed, the wooden pallets supplied with the transport unit must be removed properly. (→ See Chapter "Installation", Section "Lifting from the transport pallet and installing the cabinet units")	☐	☐

Item	Activity	Applicable?	Completed?
7	The minimum ceiling height required (for unhindered air discharge) must be observed. The cooling air supply and discharge must not be obstructed and must provide an adequate quantity. (→ See Chapter "Installation", Section "Preparation")	☐	☐
8	The cabinet must be firmly attached to the fixing points provided. A proper connection must be established if the cabinet units are installed side-by-side. (→ See Chapter "Installation", Section "Connection for side-by-side installation of cabinet units")	☐	☐
9	The following optional components, which are supplied separately for transport reasons, must be assembled on the plant side. This applies to the following options: • IP21 degree of protection with canopy (option M21) • IP23/IP43/IP54 degree of protection with hood or filter elements (options M23, M43, M54) (→ See Chapter "Options", Section "M21, degree of protection IP21 " and "M23 / M43 / M54, degrees of protection IP23 / IP43 / IP54" under Installation.)	☐	☐
10	If it is possible to enter the area underneath the cabinet units, plant-side shock protection must be provided for this area.	☐	☐
11	The handle must be mounted for option L37 (DC interface including pre-charging input circuit). (→ See Chapter "Options", Section "DC interface including pre-charging input circuit of the associated DC-link capacitance")	☐	☐
12	With option M26, the installed cabinet equipment must be enclosed on the right, and with option M27, the installed cabinet equipment must be enclosed on the left! • Side panel installed on the right (option M26) • Side panel installed on the left (option M27) (→ See Chapter "Options", Section "M26 / M27, side panels mounted to the right or left".)	☐	☐
13	All shock protection measures (guards, plates) in and on the cabinet units must be installed before commissioning.	☐	☐
14	The clearance around an open control cabinet door (escape route) specified in the applicable accident prevention guidelines must be observed.	☐	☐

3.3 Installation

3.3.1 Important safety precautions

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.

Protection against the spread of fire

The device may be operated only in closed enclosures or in control cabinets with protective covers that are closed, and when all of the protective devices are used. The installation of the device in a metal control cabinet or the protection with another equivalent measure must prevent the spread of fire and emissions outside the control cabinet.

Protection against condensation or electrically conductive contamination

Protect the device, e.g. by installing it in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12. Further measures may be necessary for particularly critical operating conditions.

If condensation or conductive pollution can be excluded at the installation site, a lower degree of protection of the control cabinet is permitted.

3.3.2 Preparatory steps

3.3.2.1 On-site requirements

The Cabinet Modules are designed for installation in closed, electrical operating areas according to EN 61800-5-1. A closed electrical operating area is a room or area containing electrical equipment which can be accessed by trained personnel only. Access is controlled by a door or other form of barricade which can be opened only by means of a key or other tool. The room or area is also clearly signed with appropriate warning notices.

The installation location must be dry and dust-free. The air supplied must not contain any electrically conductive gas, vapors, or dust, which could impair operation. It may be necessary to filter the air supplied to the installation room. If the air contains dust, filter mats (option M54) can be installed in front of the ventilation grilles in the cabinet doors and also in front of the hoods, if necessary. Option M54 offers additional protection against water sprayed against the housing from any direction and corresponds to degree of protection IP54.

The permissible values for climatic ambient conditions must be taken into account.

Derating is required for ambient temperatures > 40° C (104° F) or installation altitudes > 1000 m (Booksize Cabinet Kit) or > 2000 m (Chassis) (→ see Chapter "System overview" under derating data).

The basic version of the cabinet units complies with the IP20 degree of protection in accordance with EN 60529.

Note

Requirements for IP20

Cabinet Modules do not fulfill the requirements for IP20 until they have been closed off by installing a side panel on the right (option M26) and a side panel on the left (option M27)!

The cabinet units are installed in accordance with the dimension drawings supplied. The clearance to be maintained between the top of the cabinet and the ceiling is shown in the diagram below. Additional dimensions must be taken into account for the M06 (cabinet base) and M07 (cable-marshaling compartment) options.

Note

Additional dimensions

Additional dimensions can be found in the relevant dimension drawings on the customer DVD supplied with the device.

Note

Interference to radio/wireless services due to high frequency (radio frequency) disturbances

The inverter can cause high frequency disturbances, which may make interference suppression measures necessary.

This device is not designed for unrestricted operation in the first environment (residential environment) and may not be used in the first environment without suitable interference suppression measures.

- Have qualified personnel install and commission the unit, applying appropriate radio interference suppression measures.

Required room height for Cabinet Modules

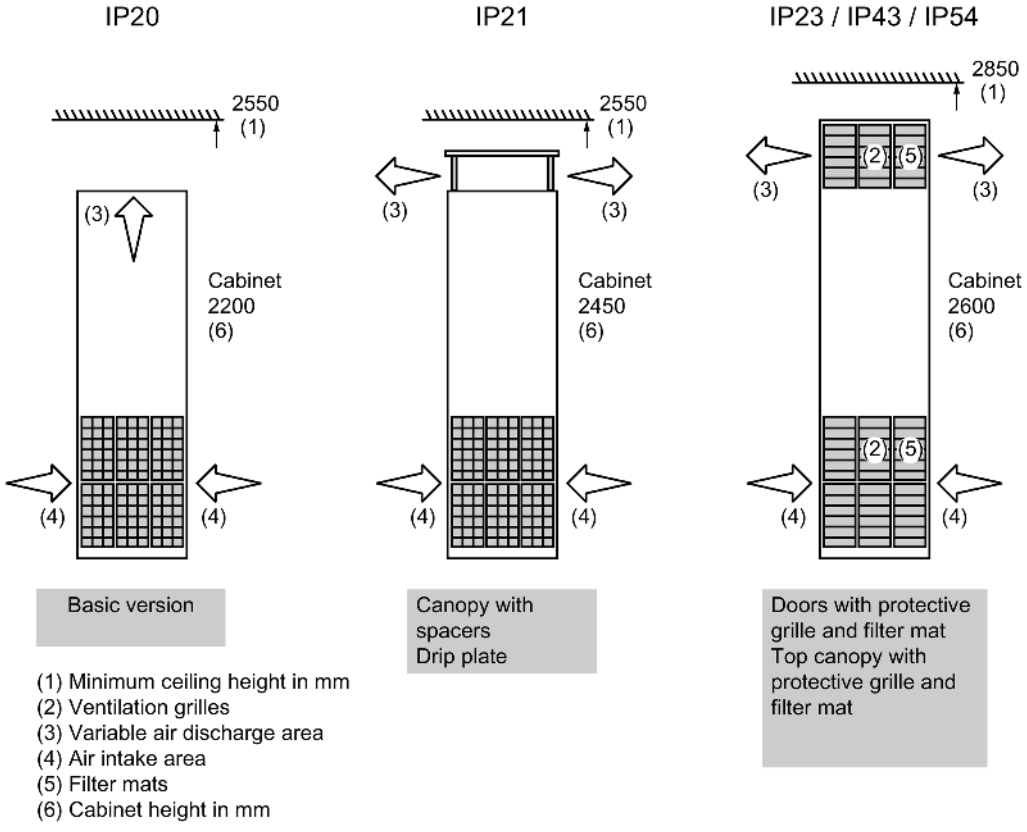


Figure 3-1 Required room height for Cabinet Modules with different degrees of protection (without Options M06 and M07)

The cooling air for the power unit is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors. The warmed air is discharged through the perforated top cover or the ventilation grilles in the hood (with options M23/M43/M54 for degrees of protection IP23/IP43/IP54). Cooling air can also be supplied from below through intermediate floors, air ducts, etc. Openings must be made in the split base plates to do this.

Required room height for Cabinet Modules Chassis-2

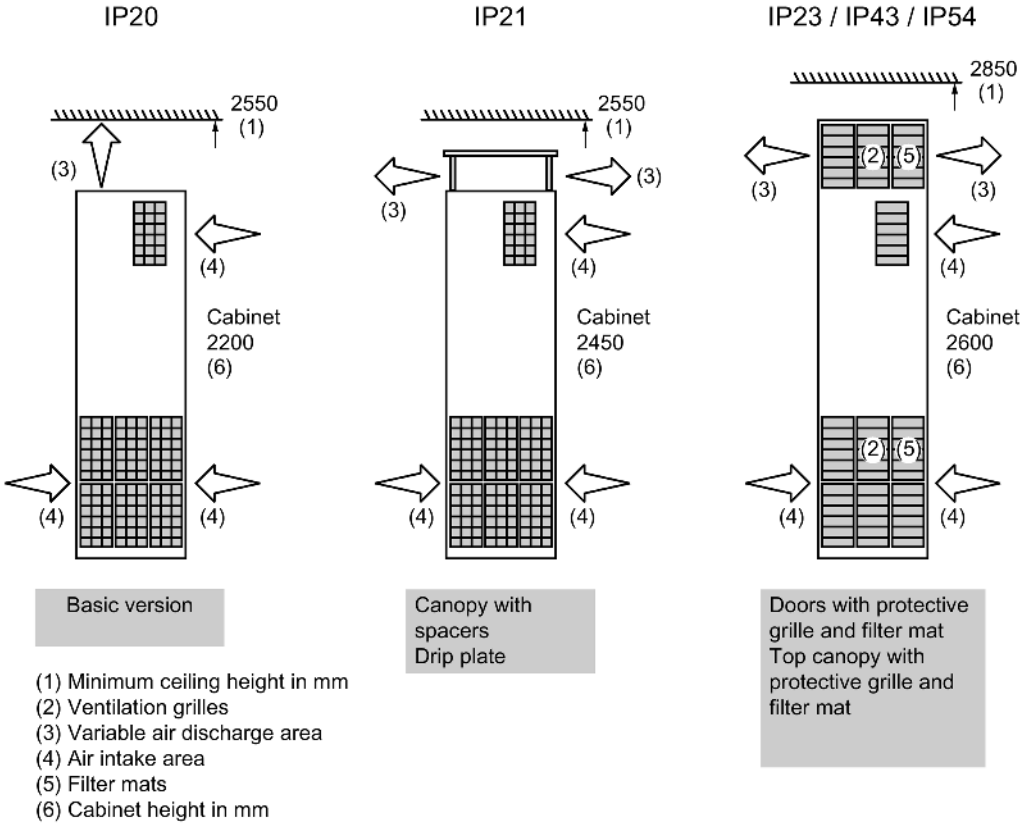


Figure 3-2 Required room height for Cabinet Modules Chassis-2 with different degrees of protection (without Options M06 and M07)

The cooling air for the power unit is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors and in the upper part of the cabinet. The hot air is discharged through the perforated top cover or the ventilation grilles in the hood (with options M23/M43/M54 for degrees of protection IP23/IP43/IP54).

3.3.2.2 Requirements on the levelness of the floor

The foundation at the installation location must be horizontal and level, to ensure proper functioning of the cabinet units.

- Care must be taken to ensure that the doors can be opened and closed, the locking systems work properly.
- Flat sections (such as doors, side panels and hoods) must be sealed correctly to ensure compliance with the specified degree of protection.
- When connecting cabinet units side-by-side, ensure that no air can enter through gaps.

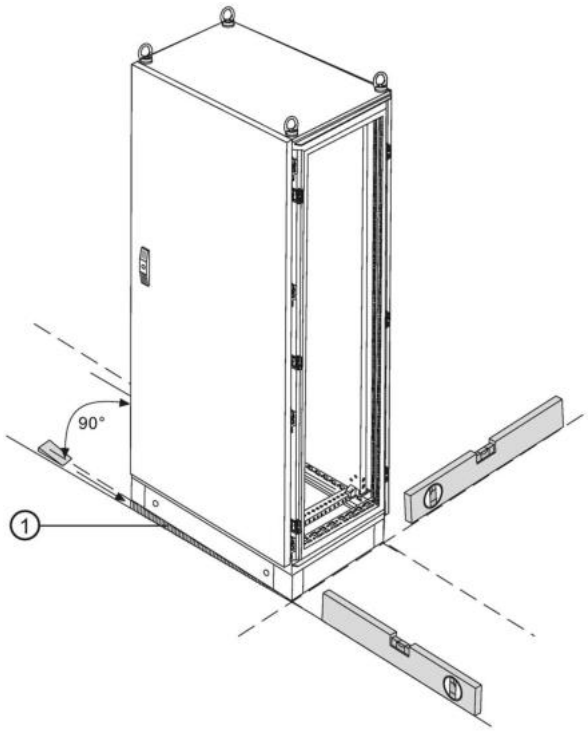


Figure 3-3 Requirements on the levelness of the floor

The following requirements must be met to ensure the full functionality of the cabinet units:

- The foundation must be level and horizontal.
- Irregularities must be leveled out.
- Gaps where air can enter, created when aligning (e.g.: ① in the diagram) must be closed and sealed.

3.3.2.3 Shipping and handling indicators

The cabinet units are equipped with tilt and shock indicators to monitor for damage during transit.



Figure 3-4 Tilt indicator



Figure 3-5 Shock indicator

Position of the shipping and handling indicators

The tilt indicators are affixed to the top of the cabinet unit inside the doors.

The shock indicators are affixed to the bottom of the cabinet unit inside the doors.

Checking the shipping and handling indicators prior to commissioning

It is essential to check the shipping and handling indicators prior to commissioning the converter.



Figure 3-6 Tilt indicator tripped

The tilt indicator provides immediate visible evidence of whether the cabinet units have been handled and stored upright. Blue-colored quartz sand begins to flow into the arrow-shaped indicator area. The tilt indicator has tripped when the blue color extends beyond the middle line of the arrowhead.



Figure 3-7 Shock indicator tripped

The shock indicator shows if an acceleration has exceeded 98.1 m/s² (10 x g) and indicates the direction of acceleration. The black color of the arrows indicates that an impermissible shock load has occurred in the direction of the arrow.

⚠WARNING

Damage to the device when shock or tilt indicators are tripped

If a shock or tilt indicator has tripped, safe operation of the device cannot be guaranteed.

This can result in death, serious injury or material damage.

- Terminate the commissioning if one of the shock or tilt indicators has tripped.
- Contact Technical Support immediately for clarification.

Removing the shipping and handling indicators prior to commissioning

NOTICE

Material damage caused by transport indicators remaining in the device during operation

If transport indicators remain in the device during operation, material damage can result from falling off or through temperature damage.

- Remove the transport indicators before commissioning the converter.

Ethyl alcohol can be used to remove any remains of adhesive after removing the transport indicators from the control cabinet.

3.3.2.4 Unpacking the cabinets

The packaging material must be discarded in accordance with the applicable country-specific guidelines and rules.

3.3.2.5 Tools required

To install the connections, you will need:

- Standard toolboxes with screwdrivers, screw wrenches, socket wrenches, etc.
- Torque wrenches from 1.5 Nm up to 100 Nm
- 400 mm extension for socket wrenches

Tightening torques for screw connections

The following tightening torques apply when tightening current-conducting connections (DC-link connections, motor connections, busbars, lugs) and other connections (ground connections, protective conductor connections, steel threaded connections).

Table 3- 2 Tightening torques for screw connections

Thread	Ground connections, protective conductor connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, lugs
M3	1.3 Nm	0.8 Nm
M4	3 Nm	1.8 Nm
M5	6 Nm	3 Nm
M6	10 Nm	6 Nm
M8	25 Nm	13 Nm
M10	50 Nm	25 Nm
M12	88 Nm	50 Nm
M16	215 Nm	115 Nm

NOTICE

Screw connections for protective covers

The threaded connections for the protective covers made of Makrolon may only be tightened with 2.5 Nm.

3.3.3 Lifting the cabinet units off the transport pallet and installing them

The applicable local guidelines regarding the transportation of the cabinet from the transport pallet to the installation location must be observed.

A crane transport assembly (option M90) can also be fitted on the top of the cabinet.

The fixing screws of the transport pallets can be removed without having to lift the cabinet unit. The positions of the fixing screws are indicated by red markings on the outside of the pallets.



Figure 3-8 Lifting from the transport pallet (left: without base; right: with base)

For cabinet units without base (in the figure on the left), the fixing screws of the transport pallets must be removed from the lower side of the pallet.
For cabinet units with base (in the figure on the right), the fixing screws of the transport pallet are accessible only after the cover is opened. They can then be loosened and removed directly from the front.

⚠WARNING

Failure to observe the weight and the center of gravity

The non-observance of restrictions concerning the weight and the center of gravity can cause death or severe injury during lifting and transport activities.

- The weight specified on the packaging and the designated center of gravity must always be taken into account when the cabinet is lifted and transported.
- This potential hazard must be taken into account particularly once you have unscrewed the cabinet units from the transport pallet.

Center of gravity of the cabinet

The diagram below shows the center of gravity of the cabinet (for all sizes), which must always be taken into account when lifting and installing the cabinet.

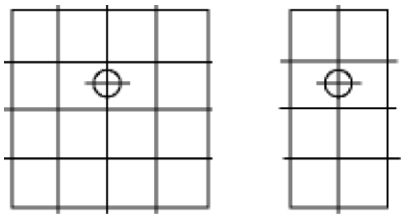


Figure 3-9 Center of gravity of the cabinet

Note

Center of gravity of the cabinet

A sticker with the precise position of the center of gravity of the cabinet is attached to all cabinets/transport units.

3.3.4 Disassembling the crane transport assembly

With option M90 (crane transport assembly), the Cabinet Modules are equipped with either transport eyebolts or mounting rails.

With option Y11 (assembly into transport units in the factory), the Cabinet Modules are always equipped with a mounting rail.



Figure 3-10 Option M90 / Y11, mounting rails

Removal

The transport eyebolts can be unscrewed and removed. Depending on the length of the cabinet or transport unit, the support rails can have a varying number of fastening screws. These must be unscrewed and removed before the rails can be removed.

⚠WARNING

Incorrect handling of the mounting rail

The improper handling of heavy carrying rails during disassembly can cause injuries or material damage.

- Ensure careful handling of the carrying rails during disassembly.
- Prevent screws from falling into the unit during disassembly and so causing damage during operation.

Original roof screws



Figure 3-11 Original roof screws accessory kit

After removing the crane transport aids, the transport eyebolts or the fixing screws of the mounting rail that have been removed must be replaced by the original roof screws from the accessories pack supplied in order to ensure compliance with the degree of protection and proper grounding of the cabinet.



Figure 3-12 Delivery state (left), original roof screws (right)

3.3.5 Connection to the foundation

Preparatory steps

- If possible, allow unimpeded access to the holes at the bottom of the cabinet units by removing the protective covers when carrying out installation work.

Connection to the foundation

Four holes for M12 screws are provided on each cabinet panel to secure the cabinet to the foundation. The fixing dimensions are specified on the associated dimension drawings.

Every cabinet panel must be attached to the ground using at least two opposing attachment points (one screw each in the front and rear part of the cabinet panel).
If this is not possible for reasons of accessibility, then the attachment points of the adjacent cabinet panels must be correspondingly raised.
Generally, as many attachment points as possible should be used.

Note

Additional information

Further dimensions can be found in the relevant dimension drawings on the customer DVD supplied with the device.

3.3.6 Connection for side-by-side installation of cabinet units

Description

An accessories kit is provided with each cabinet or transport unit for the connection of cabinet units in a side-by-side installation. The table below shows the content of this accessories kit for connecting the cabinet units.

Table 3- 3 Content of the accessories kit for connecting the cabinet units

Quantity	Material	Figure	Notes
1 x	Sealing strip		The sealing strip must be glued to the cabinets before connecting them.
3 x	Outer cabinet connectors including Mounting material		The cabinet connector is fitted and screwed on from the outside. Tightening torque: 9 Nm
3 x	Inner cabinet connectors including Mounting material		The cabinet connector is fastened with 4 screws. Tightening torque: 5 Nm

Assembly

1. Glue the sealing strip to the cabinet frames of the cabinets to be connected.
2. Push the cabinets together, they must come completely together both at the front and rear sides. The distance between the cabinets must be approximately 3 mm.
3. Attach the cabinet connectors to the outside and inside corresponding to the subsequent drawing.
4. If necessary, reattach the protective covers and doors. The ground connections must also be attached to the doors.

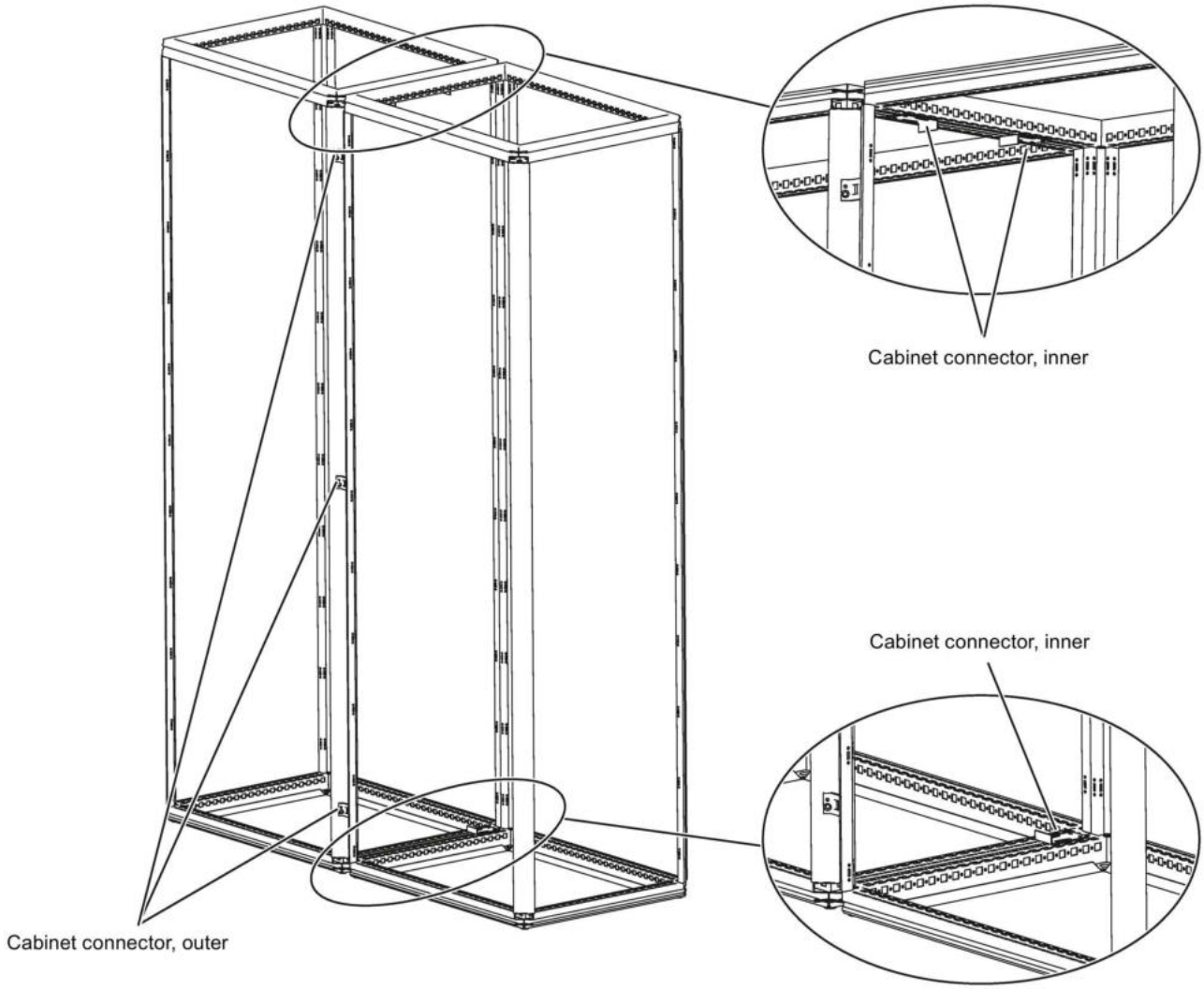


Figure 3-13 Positions of the cabinet connectors

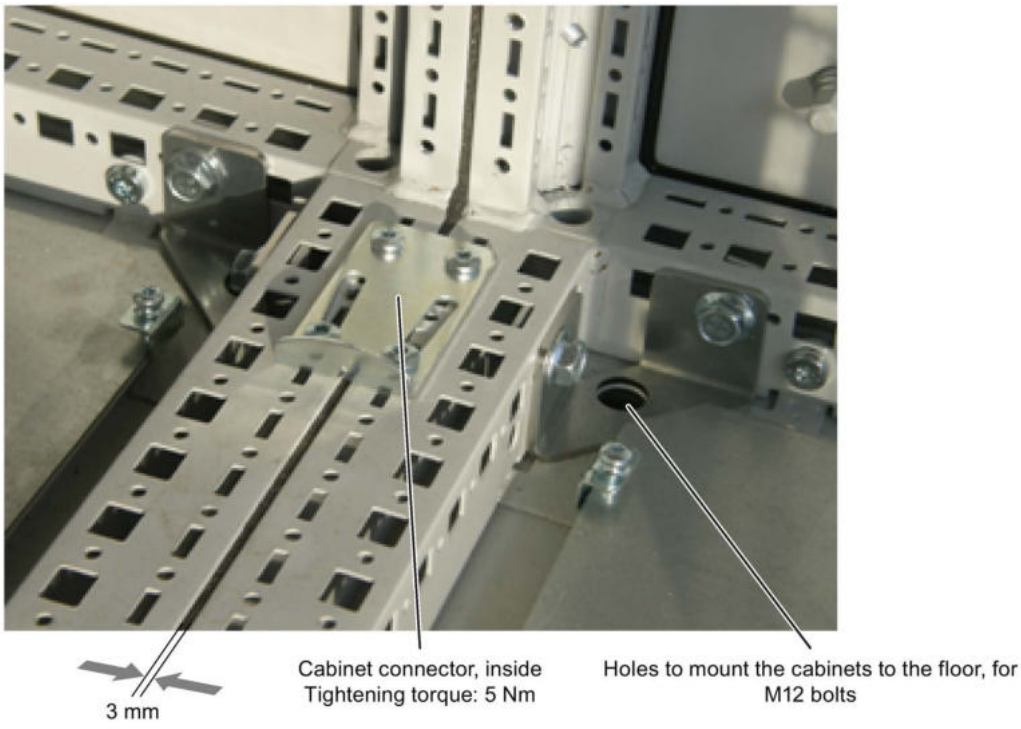


Figure 3-14 Inner cabinet connectors at the lower cabinet frame

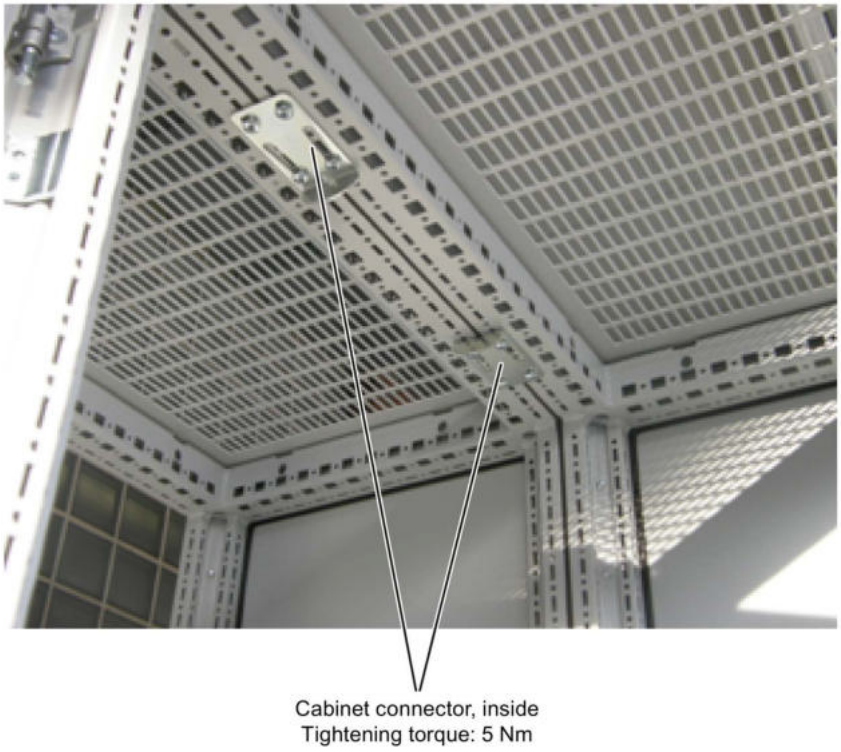


Figure 3-15 Inner cabinet connectors at the upper cabinet frame



Figure 3-16 Cabinet connector, outer

Note

Installing the canopy or hood at an early stage

It is recommended to attach the canopy or hood at an early stage to prevent foreign matter entering the cabinet units.

Note

Installing the side panels

For each row of cabinets installed, one side panel must be installed on the right (option M26) and one side panel on the left (option M27).

Electrical installation 4

4.1 Safety information

Required safety precautions before installation work is carried out

WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.



WARNING

Electric shock when using unsuitable fuses

If unsuitable fuses are used, an electric shock can cause severe injury or death.

- Use only fuses recommended in the technical data.
- Observe the necessary minimum short circuit current for the relevant fuse.



WARNING

Electric shock due to the residual charge of the DC link capacitors

Because of the DC-link capacitors, a hazardous voltage is still present for a period of time after the power supply has been switched off.

Coming into contact with live components can result in severe injury or death.

- Open the device only after the time specified on the warning label has elapsed.
- Before starting work, check the absence of voltage by measuring all poles/phases, also to ground.

NOTICE

Material damage resulting from switching on the device without forming the DC-link capacitors

After a storage time exceeding two years, switching on the device without forming the DC-link capacitors can damage it.

- Before switching on the device, it should be formed after a storage time exceeding two years, see Chapter "Maintenance and servicing".

Note

Touch protection

When the cabinet door is opened, cabinet units have touch protection in compliance with DGUV Regulation 3 according to EN 50274.

For versions that are equipped with option M60, additional protective covers are fitted. When the cabinet door is open, these provide increased protection against touching live components.

These protective covers may need to be removed during installation and connection procedures. Once work has been completed, the protective covers must be properly refitted.

Note

Different versions

The Cabinet Modules come in a range of different frame sizes, with each size differing from the others in several ways. The main differences are:

- The covers can have different dimensions, and they can be arranged and secured differently.
- The components can be arranged differently within the cabinet units.
- The components can be mounted differently within the cabinet units.

These variations result from the different requirements made of the components/equipment installed in the cabinet units. These differences are intentional and exist for "EMC optimization" reasons.

4.2 Electrical installation: Checklist

The checklist below guides you through the electrical installation procedure for the cabinet. Read the Chapter "Fundamental safety instructions" before you start working on the cabinet.

For wiring instructions, see the "Electrical installation" section or refer to the documents listed in the table below.

Note

Checking the checklist

Check the boxes accordingly in the right-hand column if the option involved applies to the scope of delivery. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities have been completed.

Table 4- 1 Electrical installation: Checklist

Item	Activity		Applicable?/Completed?	
General information				
1	For strain relief, the cables must be clamped on the cable propping bar (C-type mounting bar).		☐	☐
2	When EMC-shielded cables are used, screwed glands that connect the shield to ground with the greatest possible surface area must be provided on the motor terminal box. In the cabinet, the cable shields must be secured to the shield buses/plates with the fixing accessories provided to ensure proper EMC.		☐	☐
3	PE busbar	The PE busbar between the cabinet units or transport units must be linked. A connection with the ground for the entire system must also be established! (→ See following Section "PE busbar")	☐	☐
4	DC busbar	When several cabinet units or transport units are installed side-by-side, the DC busbars must be connected to each other by means of the jumpers provided. (→ See following Section "DC busbar")	☐	☐
5	Auxiliary power supply system	The Auxiliary Power Supply Modules must be interconnected between the cabinet units or transport units and supplied with the correct voltages. Make sure that the correct voltage is applied! (→ See following Section "Auxiliary power supply system")	☐	☐
6	For Cabinet Modules not used as a transport unit, connections on the plant side must be made according to the circuit diagram. The open connections that are correspondingly marked must be wired according to the circuit diagram.		☐	☐
Power connections				
7	A yellow warning label is attached to the basic interference suppression module at each connection clip. • The warning label must be removed from the connection clip (by pulling it off) if the connection clip is to remain in the unit (operation on a grounded line supply). • The warning label must be removed together with the connection clip if the unit is operated on a non-grounded line supply (IT system). (→ See following Section "Connecting the Cabinet Modules to non-grounded line supplies (IT system)")		☐	☐
8	The cables must be properly connected with the required torque to the terminals provided. The maximum permissible cable lengths between the Motor Module and the motor must be observed depending on the type of cable used. (→ see the following Section "Connecting the motor cables") (→ see Chapter "Cabinet Modules" in Section "Motor Modules Booksize format ") (→ see Chapter "Cabinet Modules" in Section "Motor Modules Chassis format") (→ see Chapter "Cabinet Modules" in Section "Motor Modules Chassis-2 format ")		☐	☐

Item	Activity	Applicable?	Completed?
9	When connecting the braking resistor, the maximum permissible cable lengths between the Braking Module (options L61/L62, L64/L65) and the associated braking resistor must be observed. The resistor is connected directly to terminal -X5. The thermal contact of the braking resistor must be wired and its signal evaluated by the controller. (→ See Chapter "Options", Section "L61/L62, L64/L65, braking units")	☐	☐
10	When connecting the braking resistor, the maximum permissible cable lengths between Central Braking Module and the associated braking resistor must be observed. The thermal contact of the braking resistor must be wired and its signal evaluated by the Control Unit or the controller. (→ See Chapter "Cabinet Modules" in Section "Central Braking Module")	☐	☐
11	With a parallel connection of Motor Modules Chassis format and connection to a motor with a single-winding system, it is essential either to observe the specified minimum cable lengths or to install a motor reactor (option L08). (→ see Chapter "Cabinet Modules" in Section "Motor Modules Chassis format") (→ see Chapter "Cabinet Modules" in Section "Motor Modules Chassis-2 format ")	☐	☐
12	The DC coupling – including the pre-charging circuit of the associated DC-link capacitance (Option L37) – must be connected properly and all the fuses must be checked to ensure that they are secure. The digital signal for pulse inhibit must be properly wired and parameterized. (→ See Chapter "Options" under "L37, "DC interface including pre-charging circuit of the associated DC-link capacitance" in Section "Commissioning the DC interface")	☐	☐
13	The cable shields must be properly applied.	☐	☐
14	Check the circuit breaker settings. (→ See Chapter "Cabinet Modules", Section "Line Connection Modules") (→ See Chapter "Cabinet Modules" in Section "Active Line Connection Modules-2")	☐	☐
15	The operating voltage must be correctly set for the 230 V AC fans in Line Connection Module, Basic Line Module, Smart Line Module, Active Line Module, Active Line Connection Module-2 and Motor Module Chassis format. Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps. (→ See Chapter "Electrical installation", Section "Adjusting the fan voltage")	☐	☐
16	The internal power supply must be correctly set in the Line Connection Module and the Auxiliary Power Supply Module. Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps. (→ See Chapter "Cabinet Modules", Section "Line Connection Modules") (→ See Chapter "Cabinet Modules" in Section "Active Line Connection Modules-2") (→ See Chapter "Cabinet Modules" in Section "Auxiliary Power Supply Module")	☐	☐
17	In the Auxiliary Power Supply Module, for a line supply voltage in the voltage range 3 AC 380 ... 480 V, the fuse must be adapted for the transformer. (→ See Chapter "Cabinet Modules", Section "Auxiliary Power Supply Module")	☐	☐

Item	Activity		Applicable?/Completed?	
18	The date of manufacture can be determined from the rating plates of the power components in the Cabinet Modules "Basic Line Module", "Smart Line Module", "Active Line Module", "Active Line Connection Module-2", "Motor Module Chassis format", "Motor Module Chassis-2 format" and "Booksize Cabinet Kit". If the period from the date of manufacture to initial commissioning or the downtime of the power components is shorter than two years, the DC-link capacitors do not have to be reformed. If the unit has not been operational for longer than two years, then the DC-link capacitors must be reformed as described in Chapter "Maintenance and service", Section "Reforming the DC-link capacitors".		☐	☐
Signal connections				
19	Cabinet operation by higher-level controller/control room. The control cables must be connected in accordance with the interface assignment and the shield applied! To prevent interference, the control cables must be laid separately from the power cables. Cabling and connections must always comply with the relevant EMC guidelines. (→ See Chapter "Electrical installation")		☐	☐
20	DRIVE-CLiQ cables	All DRIVE-CLiQ cables must be connected correctly. The permissible cable lengths should be carefully observed. (→ See "S120 Commissioning Manual, Rules for wiring with DRIVE-CLiQ") (→ See "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Cabinet Gland" and "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Coupling")	☐	☐
Options				
21	G20, CBC10 Communication Board	The supplied CBC10 is installed in the factory in the option slot of the Control Unit. (→ See Chapter "Options", Section "G20, CBC10 Communication Board")	☐	☐
22	G33, CBE20 Communication Board	The supplied CBE20 is installed in the factory in the option slot of the Control Unit. Remove the CBE20 in a no-current state and note down the MAC address. Install the CBE20 into the option slot again. (→ See Chapter "Options", Section "G33, CBE20 Communication Board")	☐	☐
23	G51 to G54, Temperature sensor module TM150	The Terminal Module TM150 can be connected to a maximum of 12 temperature sensors (PT100, PT1000, KTY84, PTC, bimetallic NC contact). (→ See Chapter "Options", Section "G51 to G54, temperature sensor module TM150 ")	☐	☐
24	G62, TB30 Terminal Board	Digital inputs, digital outputs, analog inputs and analog outputs can be connected to the TB30 Terminal Board (→ see Chapter "Options", Section "G62, TB30 Terminal Board")	☐	☐

Item	Activity		Applicable?/Completed?	
25	K01 to K05, Safety license for 1 to 5 axes	Activating the safety licenses. (→ See Chapter "Options", Section "K01 to K05, Safety license for 1 to 5 axes")	☐	☐
26	K46, SMC10 Sensor Module	The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle. The following encoders are supported by the SMC10 Sensor Module: • Resolver, 2-pin • Resolver, multi-pole (→ See Chapter "Options", in Section "K46, SMC10 Sensor Module Cabinet-Mounted")	☐	☐
27	K48, SMC20 Sensor Module	The SMC20 Sensor Module is used for detecting the actual motor speed and the path length. The following encoders are supported by the SMC20 Sensor Module: • Incremental sin/cos 1Vpp • EnDat absolute encoder • SSI encoder (→ See Chapter "Options", in Section "K48, SMC20 Sensor Module Cabinet-Mounted")	☐	☐
28	K50, SMC30 Sensor Module	The SMC30 Sensor Module is used for detecting the actual motor speed. The following encoders are supported by the SMC30 Sensor Module: • TTL encoder • HTL encoder • SSI encoder (→ See Chapter "Options", in Section "K50, SMC30 Sensor Module Cabinet-Mounted")	☐	☐
29	K51, VSM10 Voltage Sensing Module cabinet-mounted	The VSM10 Voltage Sensing Module is used to sense the voltage characteristic on the motor side, so that the following functions can be implemented: • Operation of a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function) • Fast flying restart of large induction motors: The time for the demagnetization of the motor is eliminated as a result of the voltage sensing. When operating a permanent-magnet synchronous motor without encoder, the "Flying restart" function must be activated with p1200. (→ See Chapter "Options", Section "K51, VSM10 Voltage Sensing Module cabinet-mounted")	☐	☐

Item	Activity		Applicable?/Completed?	
30	K52, Additional SMC30 Sensor Module	The additional SMC30 Sensor Module is used for safe actual value sensing when using the Safety Integrated Extended Functions. (→ See Chapter "Options", Section "K52, Additional SMC30 Sensor Module")	☐	☐
31	K70, Fan power supply	Voltages 230 V 1 AC and 24 V DC of the auxiliary power supply system must be supplied externally. (→ See Chapter "Options", Section "K70, fan power supply")	☐	☐
32	K76, auxiliary voltage generation in Line Connection Modules	In order to supply the auxiliary voltage supply system with the appropriate voltages, the phase must be connected to the corresponding transformer tap. Make sure that the correct voltage is applied! (→ See Chapter "Options", Section "K76, auxiliary voltage generating unit in the Line Connection Module")	☐	☐
33	K82, Terminal Module for activating safety functions "Safe Torque Off" and "Safe Stop 1"	Connect according to "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions". (→ See Chapter "Electrical installation", Section "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions") (→ See Chapter "Options", Section "K82, Terminal Module for activating safety functions "Safe Torque Off" and "Safe STOP 1"")	☐	☐
34	K87, Terminal Module TM54F	Establish the connection according to "Cable routing for the functions TM54F". (→ See Chapter "Electrical installation", Section "Cable routing for the Terminal Module TM54F") (→ See Chapter "Options", Section "K87, Terminal Module TM54F")	☐	☐
35	K88, Safe Brake Adapter SBA 230 V AC	To control the brake, a connection must be established between -X14 on the Safe Brake Adapter and the holding brake. (→ See Chapter "Options", Section "K88, Safe Brake Adapter SBA 230 V AC")	☐	☐
36	L13, main contactor	Connect the feedback signal contacts of the circuit breaker. (→ See Chapter "Options", Section "L13, main contactor")	☐	☐
37	L21, surge suppression	The monitoring of the surge arresters and the upstream fuses must be connected to terminal- X700. (→ See Chapter "Options", Section "L21, surge suppression")	☐	☐
38	L25, circuit breaker in withdrawable unit design	Connect the feedback signal contacts of the circuit breaker. (→ See Chapter "Options", Section "L25, circuit breaker in withdrawable unit design")	☐	☐
39	L34, output-side circuit breaker	Parameterize the control of the circuit breaker. (→ See Chapter "Options", Section "L34, output-side circuit breaker")	☐	☐

Item	Activity		Applicable?/Completed?	
40	L37, DC coupling, incl. pre-charging circuit of the associated DC link capacitance	Commission the DC coupling. (→ See Chapter "Options" in Section "L37, DC coupling - including the charging circuit of the associated DC link capacitance")	☐	☐
41	L40, line filter monitoring	Commission the line filter monitoring function. (→ See Chapter "Options", Section "L40, line filter monitoring")	☐	☐
42	L41, current transformer upstream of main switch	Connect the measuring connections of the current transformer. (→ See Chapter "Options", Section "L41, current transformer upstream of main switch")	☐	☐
43	L45, EMERGENCY OFF pushbutton in the cabinet door	Integrate the option into the EMERGENCY OFF circuit. (→ See Chapter "Options", Section "L45, EMERGENCY OFF pushbutton in the cabinet door")	☐	☐
44	L46, grounding switch upstream of circuit breaker	The interlock for the upstream, plant-side main breaker must be ensured. (→ See Chapter "Options", Section "L46/L47, grounding switch upstream/downstream of circuit breaker")	☐	☐
45	L47, grounding switch downstream of circuit breaker	The main breaker cannot be closed when the grounding switch is closed. (→ See Chapter "Options", Section "L46/L47, grounding switch upstream/downstream of circuit breaker")	☐	☐
46	L50, cabinet lighting with service socket	Provide the power supply. (→ See Chapter "Options", Section "L50, cabinet lighting with service socket")	☐	☐
47	L55, cabinet anti-condensation heating	Provide the power supply. (→ See Chapter "Options", Section "L55, cabinet anti-condensation heating")	☐	☐
48	L87, insulation monitoring	Integrate the option into the plant-side fault and alarm circuit. (→ See Chapter "Options", Section "L87, insulation monitoring")	☐	☐
49	P10, measuring instrument for line supply variables (installed in the cabinet doors)	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P10, measuring instrument for line supply variables installed in the cabinet doors")	☐	☐
50	P11, measuring instrument for line supply variables with PROFIBUS connection (installed in the cabinet door)	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P11, measuring instrument for line supply variables with PROFIBUS connection installed in the cabinet doors")	☐	☐

4.3 EMC-compliant design

For detailed configuration instructions regarding the EMC-compliant design of drives and control cabinet configuration, refer to the "SINAMICS Low Voltage Configuration Manual" provided on the customer DVD supplied with the unit.

4.4 Connecting shielded three-phase cables

A good shield connection is achieved by connecting the shields in the converter cabinet through a large surface area to the EMC shield rail using EMC shield clamps (PUK shield clamps). EMC shield clamps (PUK shield clamps) are provided in the accessories pack to connect to the shield rail.

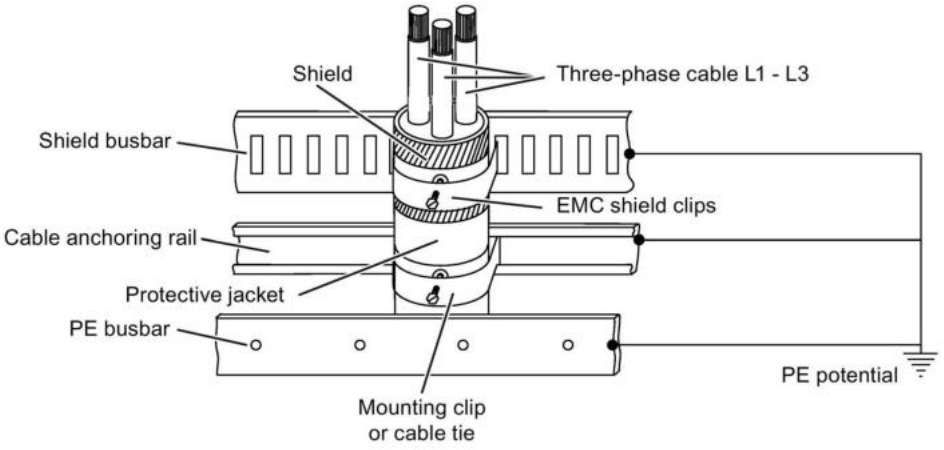


Figure 4-1 Connecting shields at the EMC shield rail using EMC shield clamps for the Chassis format

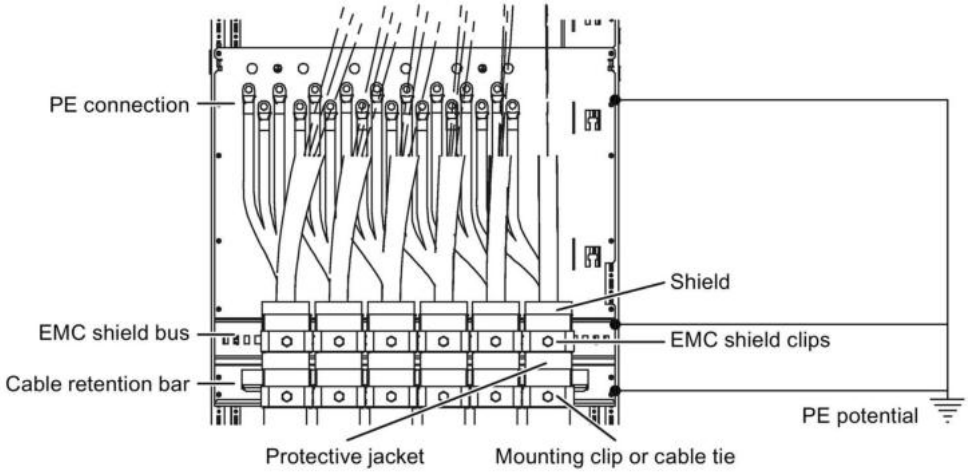


Figure 4-2 Connecting shields at the EMC shield rail using EMC shield clamps for the Chassis-2 format

Note

Detailed engineering information for connected shielded three-phase cables with concentrically arranged shields is provided in the "SINAMICS Low Voltage Configuration Manual" on the customer DVD supplied with the equipment.

4.5 Connections

4.5.1 Cable lugs

Cable lugs

The cable connections on the devices are designed for cable lugs according to DIN 46234 or DIN 46235.

When connecting alternative cable lugs, the maximum dimensions are listed in the following table.
These cable lugs are not to exceed these dimensions, as otherwise mechanical fastening and compliance with the voltage clearances is not guaranteed.

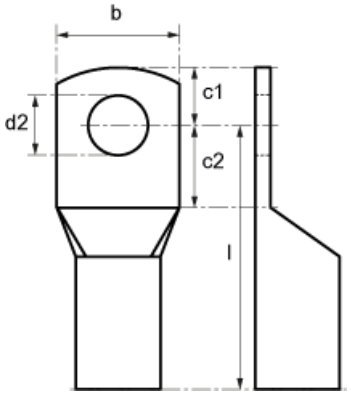


Figure 4-3 Dimensions of the cable lugs

Table 4- 2 Dimensions of the cable lugs

Screw / bolts	Connection cross-section [mm²]	d2 [mm]	b [mm]	l [mm]	c1 [mm]	c2 [mm]
M8	70	8.4	24	55	13	10
M10	185	10.5	37	82	15	12
M10	240	13	42	92	16	13
M12	95	13	28	65	16	13
M12	185	13	37	82	16	13
M12	240	13	42	92	16	13
M16	240	17	42	92	19	16

Attaching 2 cable lugs per phase

The cable lugs can be attached as shown in the following diagram if, at one connection per phase, 2 cable lugs can be connected.



Figure 4-4 2 cable lugs per connection

Cable lugs for Motor Modules Chassis-2 format

The motor connections at the Motor Modules Chassis-2 format are dimensioned for M12 cable lugs, as listed in the following table.
These cable lugs are not to exceed these dimensions, as mechanical fastening and adherence to the voltage clearances is otherwise not guaranteed.

Table 4- 3 Dimensions of the cable lugs

Screw / bolts	Connection cross-section [mm²]	d2 [mm]	b [mm]	l [mm]	c1 [mm]	c2 [mm]
M12	240	13	43	87	24	24

4.5.2 Connection overview

Connection overview

The following table shows the connections between the individual Cabinet Modules and their connections. When supplied as transport unit (Option Y11, transport units assembled in the factory), these connections only have to be established between the individual transport units as configured. The connections are established within transport units in the factory.

Note

System circuit diagram and layout plan

The table only shows the maximum possible number of connections to be established.

The individual connections that have to be established are defined in the system planning and configuring phases. See the system circuit diagram and layout plan.

Table 4- 4 Connection overview for Cabinet Modules

Cabinet Modules	Connection					
	PE busbar	DC busbars between the Cabinet Modules	Auxiliary power supply system	Line connection	Motor cables	Braking resistor
Line Connection Module	Yes	*	No	Yes	No	No
Basic Line Module	Yes	Yes	No	No	No	*
Smart Line Module	Yes	Yes	No	No	No	*
Active Line Module	Yes	Yes	No	No	No	*
Active Line Connection Module-2	Yes	Yes	Yes	Yes	No	No
Booksize Base Cabinet	Yes	Yes	Yes	No	No	No
Booksize Cabinet Kit	No	No	No	No	Yes	No
Motor Module Chassis format	Yes	Yes	Yes	No	Yes	*
Motor Module Chassis-2 format	Yes	Yes	Yes	No	Yes	No
Central Braking Module	Yes	Yes	Yes	No	No	Yes
Auxiliary Power Supply Module	Yes	*	Yes	Yes	No	No

* optional

4.5.3 PE busbar

4.5.3.1 General information

Availability

PE busbars are included in the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules Chassis format
- Motor Modules Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

Each Cabinet Module contains a PE busbar for grounding the components installed in the cabinet. For all cabinet units, the busbar is a 60 x 10 mm nickel-plated bar. It is located at the bottom of the cabinet and is secured on the left and right to the ground straps in the cabinet.

Note

Close the cabinet doors

When connecting the ground connections to the PE busbar, make sure that the cabinet doors will still close.

4.5.3.2 Connection for side-by-side installation of cabinet units

A connection jumper for the PE busbar is supplied with every cabinet.

Note

Connect only after the installation and the mechanical connection of the transport units

Installing the transport units as well as connecting the transport units with one another (see Chapter "Mechanical installation", Section "Connection for side-by-side installation of cabinet units"), must have been completed!

Preparatory steps

- Install and secure the cabinet units properly.
- Disconnect the cabinet units from the power supply.
- Allow unimpeded access to the PE busbar of the cabinet units (if necessary, remove the protective covers during installation work).

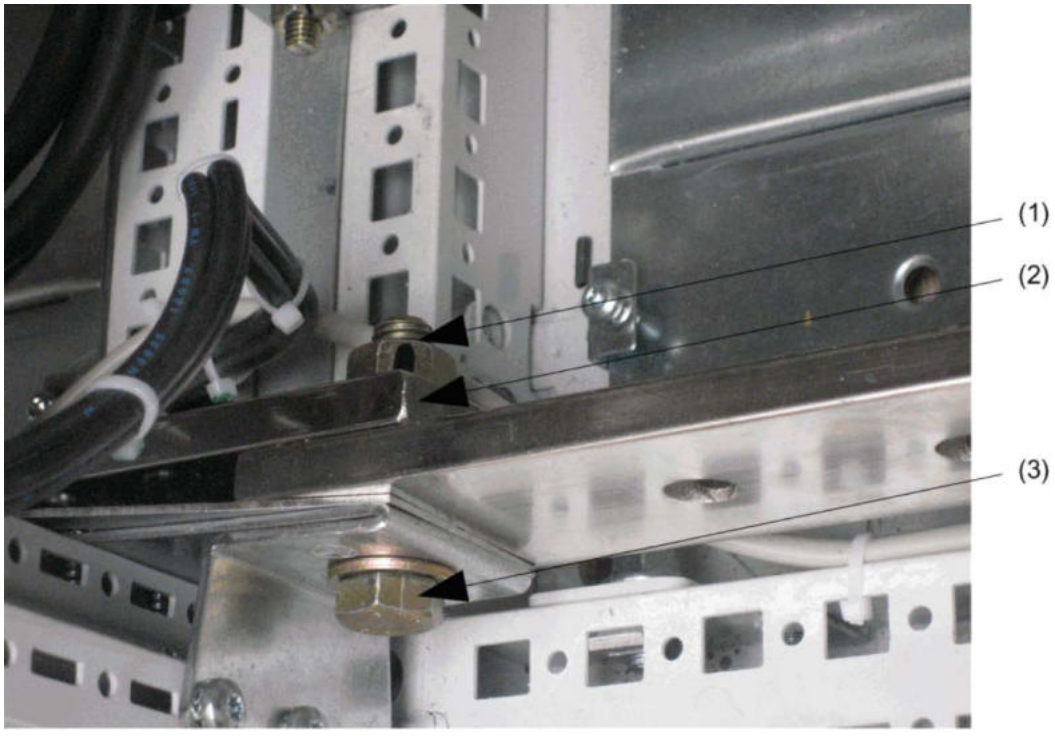


Figure 4-5 Connecting the PE busbar when cabinet units are installed side-by-side

Establishing the connection

1. Loosen the 1 x M12 nut (1) of the PE busbar at the 1st cabinet.
2. Remove the nut (1), washer and screw (3).
3. Loosen the 1 x M12 nut of the PE busbar on the 2nd cabinet.
4. Remove the nut, washer and screw.
5. Place the connection jumper (2) at the back on the PE busbar of the cabinet units to be connected.
6. Insert the screws in the ground straps of the PE busbar from the front.
7. Reattach the washers and nuts.
8. Tighten the nut (tightening torque: 50 Nm)

4.5.3.3 Connection according to the system-side grounding concept



⚠WARNING

Electric shock if there is no ground connection

If there is no connection to the central grounding of the complete plant, the cabinet unit may be at a dangerous voltage level in a fault situation. This means that when touched, this can result in death or severe injury

- Ground the device in compliance with the applicable regulations.

4.5.3.4 Connecting external cables to the PE busbar

Establishing the connection

1. Insert the screw from the front.
2. Attach the cable lug from the rear.
3. Attach the nut and, if necessary, the washers and tighten (tightening torque: 50 Nm).

Note

Close the cabinet doors

When external cables that are to be connected to the PE busbar have been laid, make sure that the cabinet doors close properly.

4.5.4 DC busbar

4.5.4.1 General information

Availability

The DC busbar is always integrated in the following S120 Cabinet Modules and must be ordered as option M80 to M87:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules Chassis format
- Motor Modules Chassis-2 format
- Central Braking Modules

Description

The DC busbar is used to connect Line Modules with Motor Modules; the connection is made using prefabricated busbar sets with different current-conducting capacities.

The DC busbar can be optionally included in the following Cabinet Modules:

- Line Connection Modules
- Auxiliary Power Supply Modules

4.5.4.2 Connection for side-by-side installation of cabinet units

Note
DC busbar

The procedure described below uses a DC busbar 1 x 60 x 10 mm (option M80) as an example, but applies to all other DC busbar versions as well.

For the other available versions, the number of jumpers on each busbar for connecting the DC busbar is as follows:

- 1 jumper for each DC busbar for 1 x nn x 10 busbars (options M80 to M82)
- 2 jumpers for a DC busbar comprising 2 x nn x 10 busbars (options M83 to M85)
- 3 jumpers for a DC busbar comprising 3 x nn x 10 busbars (options M86 and M87)

A connection jumper (① in the diagram below) on the right-hand side of the DC busbar in the cabinet connects the DC busbar across several Cabinet Modules. This connection jumper is already integrated in every DC busbar of the Cabinet Modules.

Preparatory steps

- Install and secure the cabinet units properly.
- Verify that the cabinet units to be connected have been isolated from the supply.
- Allow unimpeded access to the DC busbar (if necessary, remove the protective covers during installation work).

Note

Better accessibility from the top

In some cases, it is far simpler to connect the DC busbar from the top (with the hood or top cover removed) than from the front.

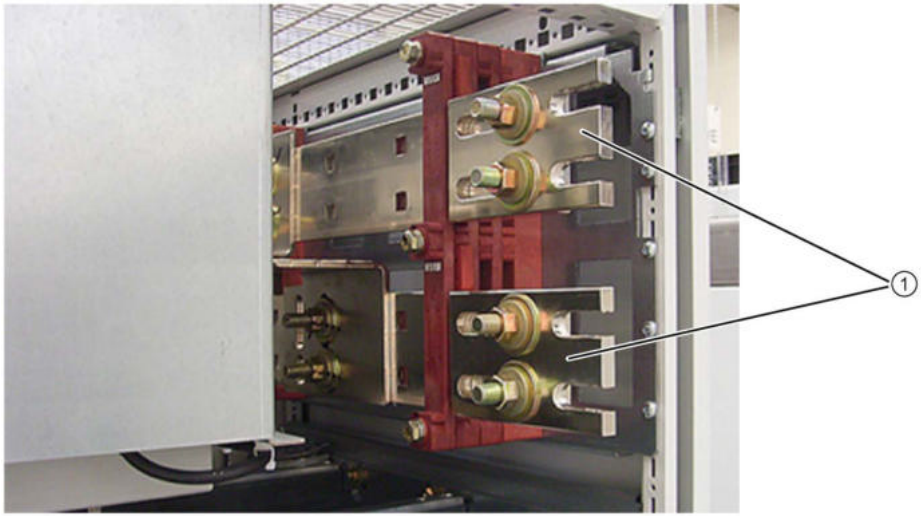


Figure 4-6 Delivery state of the DC busbar



Figure 4-7 Connecting the DC busbar when cabinet units are installed side-by-side

Establishing the connection

1. Loosen the 2 x M12 nuts on the upper DC busbar (DC P) on the right-hand side ① at the first cabinet.
2. Loosen the 2 x M12 nuts on the DC busbar on the left-hand side of the cabinet to be connected.
3. Withdraw jumper ① of the DC busbar from the first cabinet and insert into the DC busbar of the second cabinet up to its end stop ②.

NOTICE
Material damage due to incorrect connection of the jumpers for the DC busbar Incorrect connection of the jumpers for the DC busbar can heat up the busbars and therefore cause material damage. • Insert the jumper ① of the first cabinet into the cabinet to be connected until the washers ② rest fully on the jumper.

4. Re-tighten the nuts on the DC busbars in both cabinet units (torque: 50 Nm).
5. Repeat steps 1 to 4 for the lower DC busbar (DC N).

Note
Mounting specifications

The screws must only be loosened rather than removed because otherwise the nuts could fall into the device.

The torque (50 Nm) must be observed to avoid excessive heating of the terminal contacts during operation!

For the busbar systems, all jumpers of the DC busbar must always be connected!

For each cabinet row installed, you must mount one side panel on the right (option M26) and one on the left (option M27)!

Before mounting the side panels on an installed cabinet row, you must remove any jumpers present in the DC busbars of the cabinet on the right!

Note
DC busbars for the transport units

In the case of transport units with standard integrated DC busbars within the cabinet group, you only need to connect the ends of the busbars of the transport units.

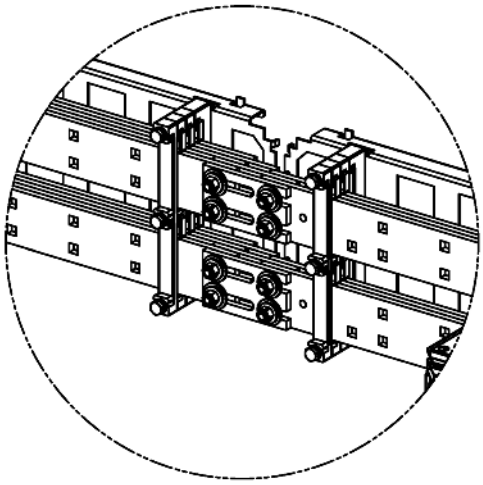
4.5.4.3 Connecting cabinet units with different numbers of DC busbars

When connecting cabinet units with different numbers of busbars, the DC busbars are connected as shown in the following diagrams.

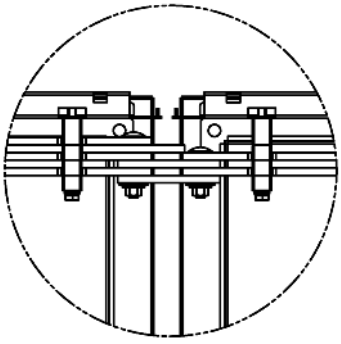
Transition from three busbars to two busbars

Of the three jumpers supplied to connect the DC busbars, only two jumpers have to be connected from the left-hand to the right-hand cabinet. The rear jumper remains in the position when the device is originally shipped, and is fixed using the screws of the left-hand DC busbars.

Oblique view of the connection location



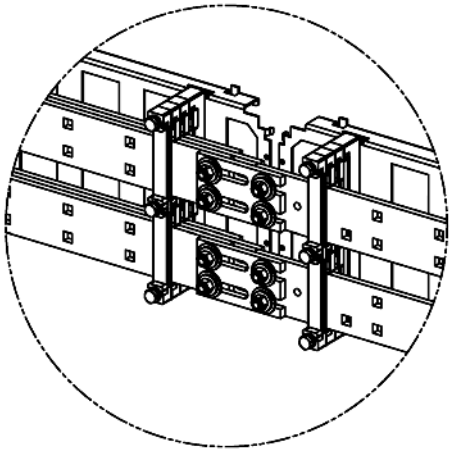
Top view of the connection location



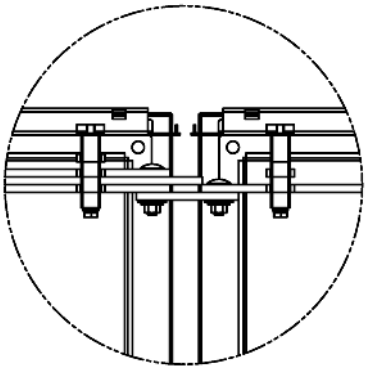
Transition from two busbars to one busbar

Of the two jumpers supplied to connect the DC busbars, only one jumper has to be connected from the left-hand to the right-hand cabinet. The rear jumper remains in the position when the device is originally shipped, and is fixed using the screws of the left-hand DC busbars.

Oblique view of the connection location



Top view of the connection location



4.5.5 Auxiliary power supply system

4.5.5.1 General information

Availability

To facilitate the auxiliary voltage supply to S120 Cabinet Modules, the individual modules are fitted with a special, standardized auxiliary voltage supply system. This system is delivered pre-installed. The cabling required from the Auxiliary Power Supply Module into the relevant Cabinet Module are factory-installed.

In the following S120 Cabinet Modules, two further voltage taps are available to the customer on the Auxiliary Power Supply Module for each voltage level:

- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules Chassis format
- Motor Modules Chassis-2 format
- Central Braking Modules

Description

The auxiliary power supply system installed in the Cabinet Module distributes the voltages provided by an auxiliary power supply.

Ideally, these voltages are generated by an Auxiliary Power Supply Module. Other ways to supply power is to use option K76 "Auxiliary voltage generating unit in the Line Connection Module" or to feed the auxiliary voltages to the auxiliary power supply system from an external source.

The maximum load capability of the auxiliary power supply system is 80 A. If the total power requirement of the cabinet line-up exceeds the maximum load capability, the auxiliary power supply system must be divided into segments and several infeed points selected.

The following diagram shows the mechanical design of the auxiliary power supply system. The standard assignment with the three auxiliary voltages is shown in the tables below.

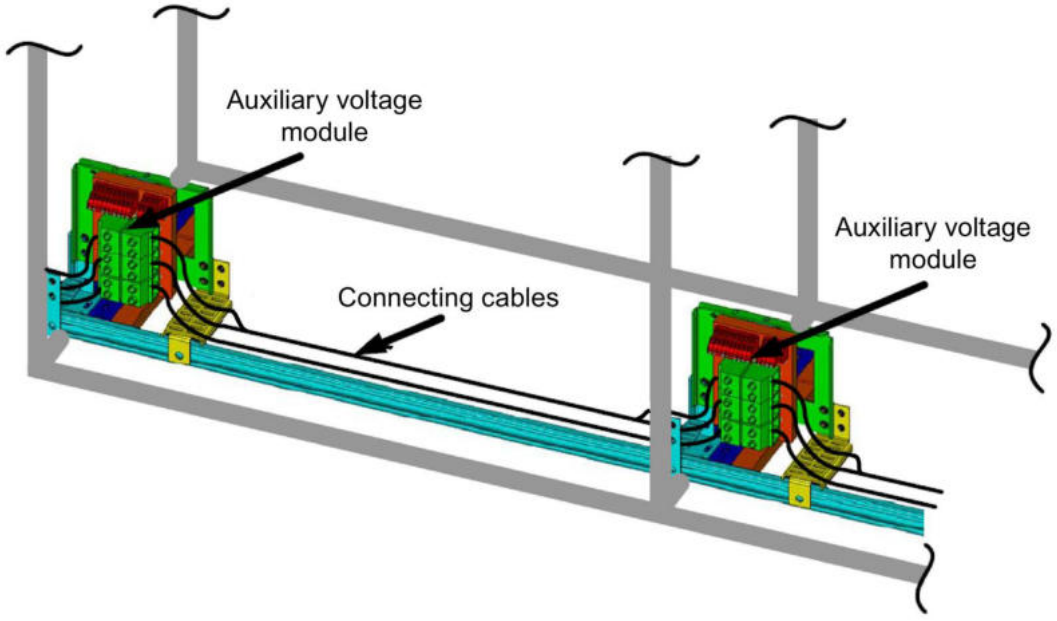


Figure 4-8 Auxiliary power supply system for voltage distribution

The auxiliary power supply system for an individual cabinet unit consists of an Auxiliary Power Supply Module and the connecting cables.

The Auxiliary Power Supply Module comprises two terminal blocks (-X100, -X101) and one fuse (-F24) for the 24 V DC supply. The Auxiliary Power Supply Module taps the necessary auxiliary voltages at terminal block -X100 and forwards auxiliary voltages to terminal block -X101 in the adjacent cabinet unit.

The connections are made using two special cables. One 4-phase cable for the power supply (1, 2) and for 230 V AC (3, 4), and an additional screened 2-phase cable for 24 V DC (1, 2).

The auxiliary power supply system is ready-to-operate as supplied. The cabling required from the terminal block into the relevant Cabinet Module are factory-installed. Only the connection to the adjacent Cabinet Module must be established on site by fastening the cables to the next terminal block. These connections are already established within transport units. Only the transport units need to be interconnected.

Auxiliary Power Supply Module

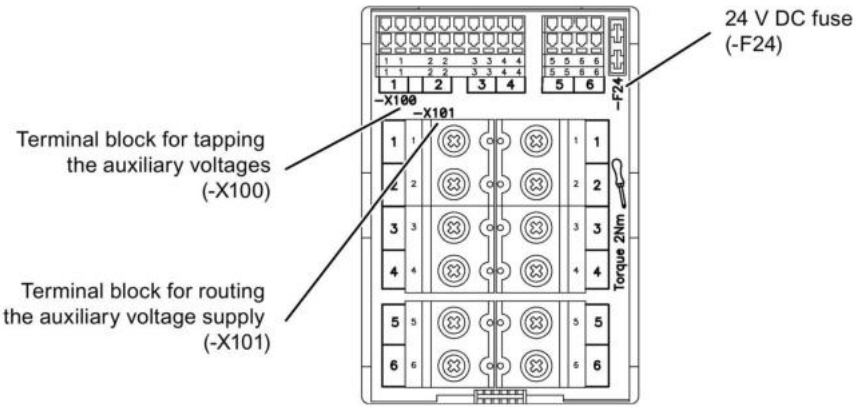
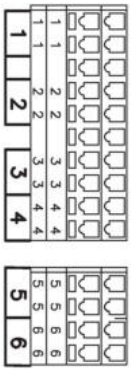


Figure 4-9 Auxiliary Power Supply Module with terminal blocks -X100, -X101 and 24 V DC fuse

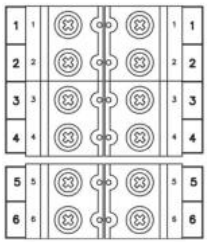
At least two terminals are always available to the customer at terminal block -X100 for tapping the auxiliary voltages.

Table 4- 5 X100, terminal block for tapping the auxiliary voltages

	Terminal	Designation	Voltage tap	Rated current
	1	L1	Line voltage (for fan supply via transformer): • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)	Max. 16 A [1]
	2	L2		
	3	L1	230 V 1 AC (max. 265 V AC)	Max. 16 A [1]
	4	N		
	5	P24	24 V DC for the electronics power supply (max. 30 VDC)	Max. 10 A [1]
	6	M		
The maximum load capability of the auxiliary power supply system is 80 A. Max. connectable cross-section: 2.5 mm^2				

[1] Max. total current of all tapping terminals available

Table 4- 6 X101, terminal block for routing the auxiliary voltage connecting cables

	Terminal	Designation	Assigned voltages	Rated current
	1	L1	Line voltage (for fan supply via transformer): • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)	Max. 80 A
	2	L2		
	3	L1	230 V 1 AC (max. 265 V AC)	Max. 80 A
	4	N		
	5	P24	24 V DC for the electronics power supply (max. 30 VDC)	Max. 80 A
	6	M		
The maximum load capability of the auxiliary power supply system is 80 A. Max. connectable cross-section: 35 mm^2 Tightening torque: 2 Nm				

Auxiliary Power Supply Module in the Line Connection Module

The Auxiliary Power Supply Module in the Line Connection Module consists of the -X100 terminal block for feeding in and routing the auxiliary voltages in both directions. No voltage taps are available to the customer.

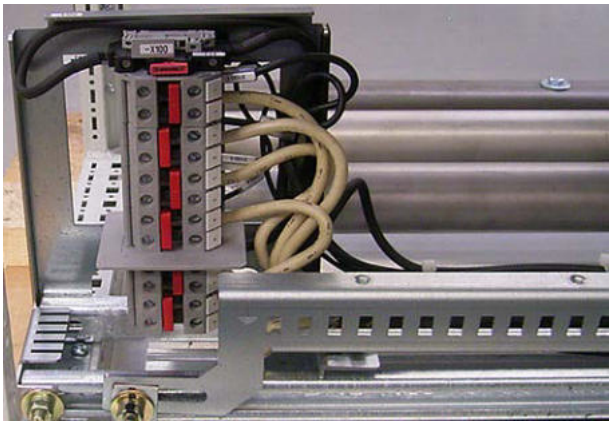
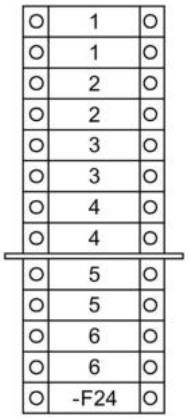


Figure 4-10 Auxiliary Power Supply Module in the Line Connection Module

Table 4- 7 X100, terminal block in the Line Connection Module for routing the auxiliary voltages

	Terminal	Voltage tap	Rated current
	1	Line voltage: • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)	Max. 80 A
	1		
	2		
	2		
	3	230 V 1 AC (max. 265 V AC)	Max. 80 A
	3		
	4		
	4		
	5	24 V DC for the electronics power supply (max. 30 VDC)	Max. 80 A
	5		
	6		
	6		
	-F24	24 V DC fuse	Max. 10 A
The maximum load capability of the auxiliary power supply system is 80 A. Max. connectable cross-section: 16 mm^2 Tightening torque: 2 Nm			

Note

External infeed

An external customer infeed to the auxiliary power supply system can be connected at terminal block -X100 of the Line Connection Module.

Fuse

A 10 A-fuse is incorporated in the Auxiliary Power Supply Modules to protect the 24 V DC auxiliary voltage. If a replacement part is required, this can be ordered, specifying Article number 6SL3760-0BG00-0AA0.
Fuse type: TAC ATO flat plug-in fuse according to DIN 72581-3, UL 248 Special Purpose Fuses, 10 A, 58 V, manufacturer: Littlefuse

Connecting cables

Table 4- 8 Voltage assignment for connecting cables

Cable	Phase	Assigned voltages
4-phase	1	Line voltage: • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)
	2	
	3	230 V 1 AC (max. 265 V AC)
	4	
2-phase	1	24 V DC for the electronics power supply (max. 30 V DC) The cable marked "1" must be connected to terminal 5 on the terminal block. The cable marked "2" must be connected to terminal 6 on the terminal block.
	2	



⚠WARNING

Dangerous voltage as a result of incorrect voltage assignment

Incorrect voltage assignment on the auxiliary power supply system can result in high voltages on unsuitable components and thus damage or destroy these components. Contact with these high voltages can result in death or serious injury.

- When establishing connections to the auxiliary power supply system, you must ensure that you do not interchange the power supplies.

4.5.5.2 Connection overview

The following connections must be established for the auxiliary power supply system:

- Connection of auxiliary power module when cabinet units are installed side-by-side
- Connecting to the infeed

Preparatory steps for all work carried out on the auxiliary power supply system

- Install and secure the cabinet units properly.
- Disconnect the cabinet units from the power supply.
- Disconnect the auxiliary power supply system from the power supply.
- Allow unimpeded access to the auxiliary power supply system of the cabinet units (if necessary, remove the protective covers during installation work)

4.5.5.3 Connection for side-by-side installation of cabinet units

Description

Prefabricated cables for connecting the Auxiliary Power Supply Modules are attached to the -X101 terminal block of the module in each cabinet. If the cabinets are delivered as single units, these must be routed to the next module and attached to the appropriate terminals of the -X101 terminal block. The procedure is described below.

Note

Connecting the Auxiliary Power Supply Modules for transport units.

These connections are already established within transport units. Only the transport units need to be interconnected.

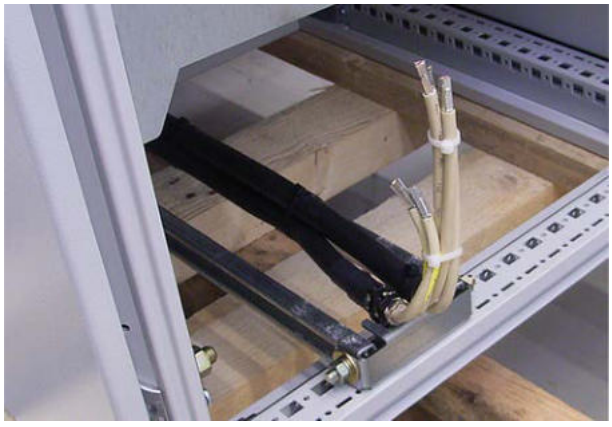


Figure 4-11 Connecting cables in the delivered state (e.g. transport units)

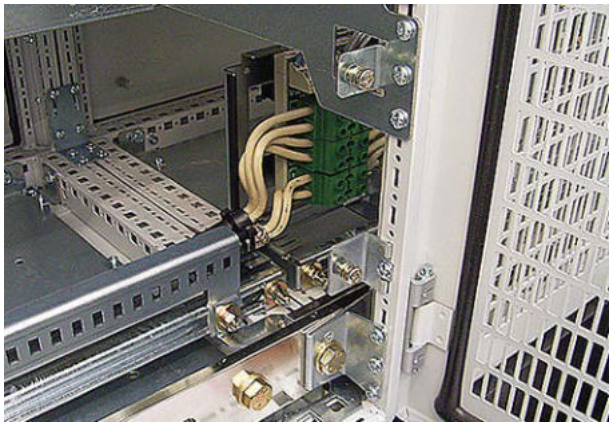


Figure 4-12 Connected connecting cables

Establishing the connection

Attach the cable to terminal block -X101 of the next module:

- 4-phase cable (1-2): for the line voltage to terminals 1 and 2
- 4-phase cable (3-4): for 230 VAC to terminals 3 and 4
- 2-phase cable (1-2): for 24 VDC to terminals 5 and 6

Note

Establishing the connection for Basic Line Modules

Basic Line Modules do not contain Auxiliary Power Supply Modules. The 24 VDC power supply is provided by connecting the 2-phase cable included in the Basic Line Module to the Auxiliary Power Supply Module of the adjacent cabinet unit.

4.5.5.4 Connecting to the infeed

Description

The voltages provided on the auxiliary power supply system must be produced by an auxiliary power supply (e.g. by an Auxiliary Power Supply Module or by Option K76 "Auxiliary voltage generating unit in the Line Connection Module").

If an Auxiliary Power Supply Module is not available to supply power to the auxiliary power supply system or if the Auxiliary Power Supply Module and the Cabinet Modules to be supplied are installed in different parts of the cabinet line-up, an auxiliary power module in the Line Connection Module can be used to feed power to the auxiliary power supply system. Further alternatives for feeding power are in the first or last auxiliary power module of the drive line-up. The maximum current-carrying capacity of the auxiliary power supply system is 80 A. In the case of the external power supply, this must be fuse protected on the line side.

4.5.6 Connecting the motor cables

Preparatory steps

- Install and secure the cabinet units properly.
- Disconnect the cabinet units from the power supply.
- Make sure that all the necessary safety measures have been taken at the installation location.



⚠WARNING

Electric shock when permanent magnet synchronous motors rotate

As soon as the motor rotates, a voltage is generated at the terminals, which when touched, can result in death or severe injury.

- Electrically disconnect the motor when working on the converter.
- If it is not possible to disconnect the connecting cables to the motor, secure the motor so that it cannot undesirably rotate, e.g. using a holding brake.

Motor Modules Booksize Cabinet Kit

Table 4- 9 Motor connection, Motor Modules

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 ... 720 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 3 AC 0 V to 0.717 x DC link voltage Terminals: 6 ... 95 mm^2 (→ see Technical data)

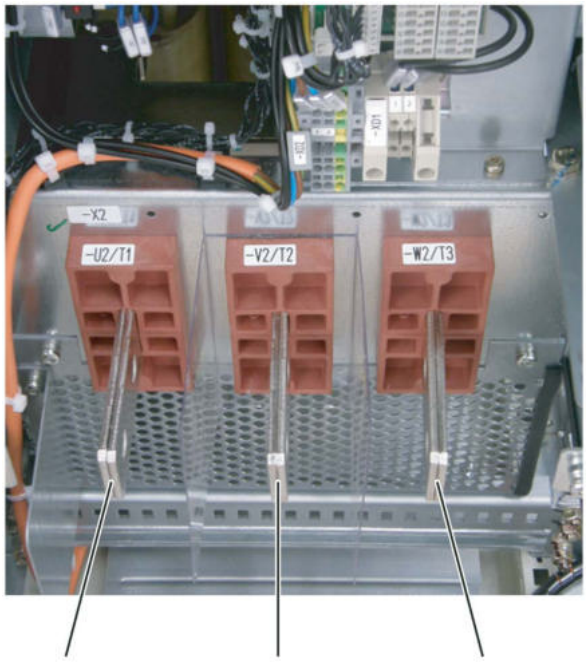
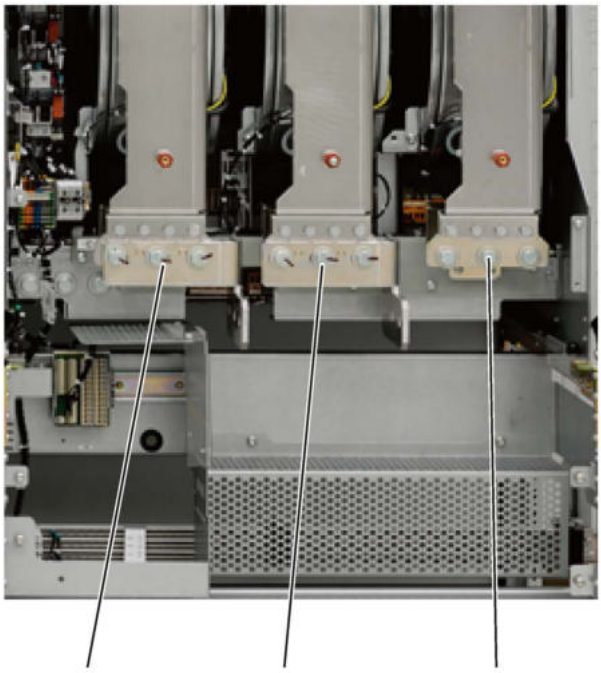
Motor Modules Chassis format

Table 4- 10 Motor connection, Motor Modules

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 ... 720 V DC 675 ... 1035 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 3 AC 0 V to 0.75 x DC link voltage [1] Connection: M12/50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [2]

[1] For pure space vector modulation, a factor of approximately 0.70 … 0.72 applies.
For edge modulation, a factor of approximately 0.74 … 0.75.

[2] Dimensions for connecting alternative cable lugs, see Chapter "Cable lugs", Section "Electrical installation".

Frame sizes FX and GX			Frame sizes HX and JX		
					
-U2/-T1	-V2/-T2	-W2/-T3	-U2/-T1	-V2/-T2	-W2/-T3

Connecting the motor cables

Note

Position of the connections

For the location of the connections, see the layout diagrams.

1. Open the cabinet and remove the covers in front of the connection panel for motor cables (terminals U2/T1, V2/T2, W2/T3; X2).
2. Move or remove the base plate below the connection panel through which the motor cables are fed.
3. Screw the protective earth (PE) onto the PE busbar at the specified points in the cabinet (50 Nm with M12).
4. Screw the motor cables onto the terminals.
   Make sure that the conductors have been connected in the correct sequence (U2/T1, V2/T2, W2/T3)!

NOTICE

Material damage due to loose power connections

Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line supply connection, motor connection, and DC link connections.
- Regularly check all power connections by retightening them with the prescribed tightening torque. This applies in particular after transport.

5. Secure the motor cables on the cable propping bar to avoid placing mechanical strain on the terminals.
6. When shielded motor cables are used, the shields must be secured to the EMC shield bus (option M70) in an EMC-compliant manner.

Note

PE connection of the motor

The PE connection on the motor must be guided back directly to the cabinet unit and connected there.

Motor Modules Chassis-2 format

The following figure shows a side view that better illustrates the plate for connecting the PE conductor, the EMC shield bus and the cable clamping bar.

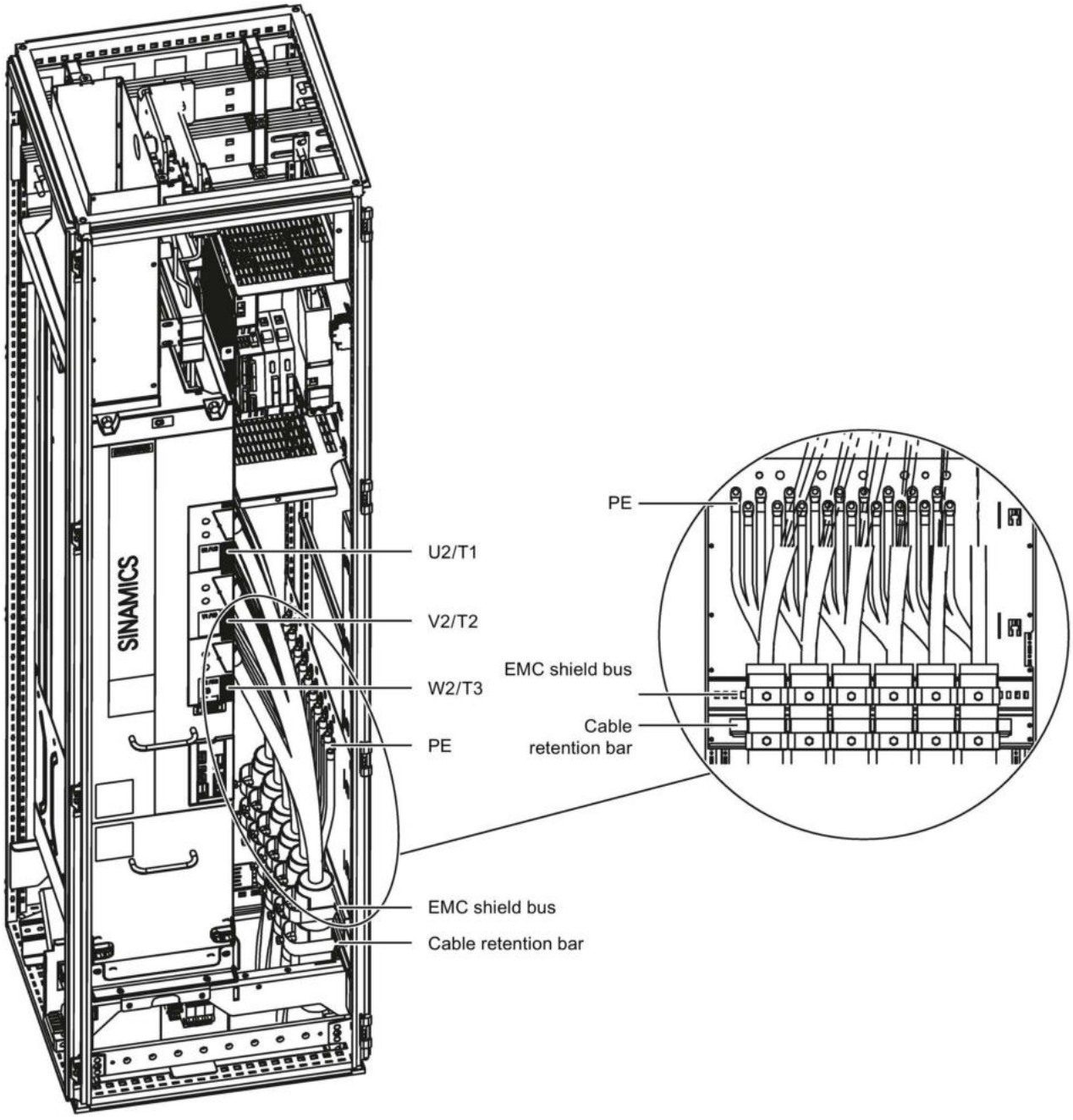


Figure 4-13 Connecting the motor cables, Motor Modules Chassis-2 format

Connecting the motor cables

Note

Position of the connections

For the location of the connections, see the layout diagrams.

1. Open the cabinet and remove the covers in front of the connection panel for motor cables (terminals U2/T1, V2/T2, W2/T3; X2).
2. Move or remove the base plate below the connection panel through which the motor cables are fed.
3. Install the cable corresponding to the description provided in Chapter "Cable routing for Motor Modules in the Chassis-2 format (Page 152)".

NOTICE

Material damage due to loose power connections

Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line supply connection, motor connection, and DC link connections.
- Regularly check all power connections by retightening them with the prescribed tightening torque. This applies in particular after transport.

⚠WARNING

Electric shock by using unsuitable screws

The plastic enclosure behind the motor connections can be damaged if screws longer than 40 mm are used. This represents danger to life, and equipment can be damaged.

- Only use the original M12x40 screws, including the spring washer, when connecting the motor cables.
- If you have to replace screws, then only use screws with the same length. Always use a spring washer.

Connection cross-sections

Refer to the "Technical data" for the Motor Modules, Chapter "Cabinet Modules" for the maximum connection cross-sections.

Direction of motor rotation

EN 60034-7 defines the two ends of an electric motor as follows:

- DE (Drive End): Usually the drive end of the motor
- NDE (Non-Drive End): Usually the non-drive end of the motor

An electric motor will rotate clockwise if the shaft is turning clockwise when looking at the DE side.

For electric motors with two shaft ends, the direction of rotation must be determined based on the shaft end specified as the drive end.

For clockwise rotation, the electric motor must be connected according to the following table.

Table 4- 11 Cabinet and motor connection terminals

Cabinet (motor connection terminals)	Motor (connection terminals)
U2/T1	U
V2/T2	V
W2/T3	W

In contrast to the connection for the clockwise phase sequence, two phases have to be reversed with a counter-clockwise phase sequence (looking at the drive shaft).

Note

Direction of motor rotation

If the motor was connected with an incorrect direction of phase rotation, it can be corrected without replacement of the phase sequence via p1821 (phase rotation direction reversal).

The correct phase sequence must be observed in both sub-cabinets when connecting cabinet units in parallel, since it is not possible to use converter functions to correct different phase sequences in the two sub-cabinets at a later stage.

For motors that can be star-connected or delta-connected, it must be ensured that the windings are interconnected consistent with the operating voltage indicated on the type plate or in the motor documentation. Make sure that the winding insulation of the connected motor has sufficient insulation strength to meet the requirements for converter operation.

4.5.7 Line supply connections

Line Connection Modules

The line supply is connected in the Line Connection Module at terminal -X1.

Table 4- 12 Line supply connection, Line Connection Modules

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3-phase AC power input	Voltage: 380 V 3 AC -10% to 480 V 3 AC +10% (-15% < 1 min) 500 V 3AC -10% to 690 V 3 AC +10% (-15% < 1 min) Connection thread: M12 / 50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [1)]

[1)] Dimensions for connecting alternative cable lugs, see Chapter "Cable lugs", Section "Electrical installation".

Active Line Connection Modules-2

The line supply is connected in the Active Line Connection Module-2 at terminal -X1.

Table 4- 13 Line connection, Active Line Connection Modules-2

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3-ph. AC power input	Voltage: 3 AC 380 V -10 % ... 3 AC 480 V +10 % (-15 % < 1 min) Connection thread: M12 / 50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [1)]

[1)] Dimensions for connecting alternative cable lugs, see Chapter "Cable lugs", Section "Electrical installation".

4.5.8 Adjusting the fan voltage

A transformer is incorporated in the Motor Module in the chassis format (-T1-T10) and/or Basic Line Module / Smart Line Module / Active Line Module (-T2-T10) for setting the correct operating voltage for the 230 VAC fans. The mounting positions of the transformers are indicated in the layout diagrams supplied.

The transformer is fitted with line-side taps so that it can be fine-tuned to the line voltage. When delivered, the taps are always set to the highest level. When connected to a lower line supply voltage, the appropriate transformer tap must be used. The neutral conductor is left on terminal "0" and the phase is clamped to the existing line voltage.

The fans are designed for 50/60 Hz operation.

Note

Positions of the setting terminals

The position of the setting terminals for the fan transformers is provided in Chapter "Cabinet Modules in the design descriptions of the appropriate modules.

Note

Two transformers for frame sizes HX and JX

In the case of Smart Line Modules, Active Line Modules, and Motor Modules with "HX" and "JX" frame sizes, two transformers are incorporated (-T10/-T11). The two line-side terminals on each of these devices must be adjusted together.

Note

No transformers in Active Line Modules Chassis-2 and Motor Modules Chassis-2

No transformers to adapt the fan voltage are installed in Active Line Modules Chassis-2 and Motor Modules Chassis-2.

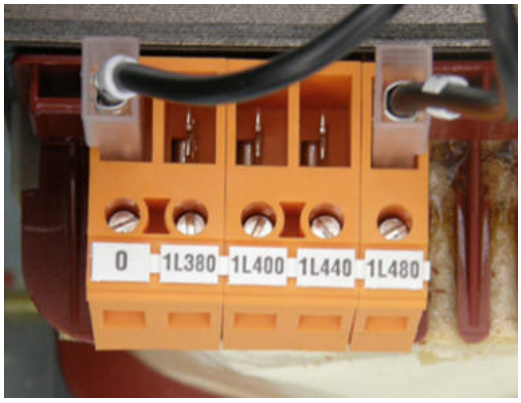


Figure 4-14 Connecting terminals for the fan transformers (380 to 480 V 2 AC)



Figure 4-15 Connecting terminals for the fan transformers (500 to 690 V 2 AC)

The line-voltage assignments for making the appropriate setting on the fan transformer are indicated in the following table.

⚠WARNING

Fire due to overheating resulting from insufficient equipment fan voltage

If the terminals are not reconnected to correspond with the actual line voltage, overheating and risks to personnel due to smoke and fire may result.
This can also cause the fan fuses to fail due to overload.

- Set the terminals in accordance with the actual line voltage.

Note

For the fan transformer (500 to 690 V 2 AC), a jumper is inserted between terminal "600 V" and "CON" terminal - ① in the diagram above). Terminal "CON" is for internal use.

The article numbers for fan fuses that have blown can be found in the spare parts list.

Table 4- 14 Line voltage assignment for the setting at the fan transformer (380 ... 480 V 2 AC)

Line voltage	Fan transformer tap (-T1/-T2 –T10, -T20)
380 V ± 10%	380 V
400 V ± 10%	400 V
440 V ± 10%	440 V
480 V ± 10%	480 V

Table 4- 15 Line voltage assignment for the setting at the fan transformer (500 ... 690 V 2 AC)

Line voltage	Fan transformer tap (-T1/-T2 -T10, -T20)
500 V ± 10%	500 V
525 V ± 10%	525 V
575 V ± 10%	575 V
600 V ± 10%	600 V
660 V ± 10%	660 V
690 V ± 10%	690 V

4.5.9 Connecting Cabinet Modules to non-grounded line supplies (IT systems)

If the Cabinet Modules are operated on a non-grounded line supply (IT system), the integrated basic interference suppression modules must be deactivated by unscrewing the connection clip in the following Cabinet Modules:

- Basic Line Modules
- Smart Line Modules (for frame sizes HX and JX, the connection clip is located behind the fan) - including the Voltage Sensing Module VSM10 included with it
- Active Line Modules (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10 included in it
- Active Line Connection Modules-2 (connection clip in the Active Interface Module-2) including the Voltage Sensing Module VSM10

NOTICE

Damage to the device through not removing the connection clip with a non-grounded line supply

Failure to remove the connection clip to the basic interference suppression module on a non-grounded line supply (IT system) can cause significant damage to the device.

- With a non-grounded line supply (IT system), remove the connection clip to the basic interference suppression module.

Note

Warning label on the connection clip

A yellow warning label is attached to each connection clip so that it is easier to find.

- The warning label must be removed from the connection clip (by pulling it off) if the connection clip is to remain in the unit (operation on a grounded line supply).
- The warning label must be removed together with the connection clip if the unit is operated on a non-grounded line supply (IT system).



Figure 4-16 Warning label on the connection clip

Basic Line Modules

If the device is operated on a non-grounded system (IT system), the connection clip to the basic interference suppression module must be removed.

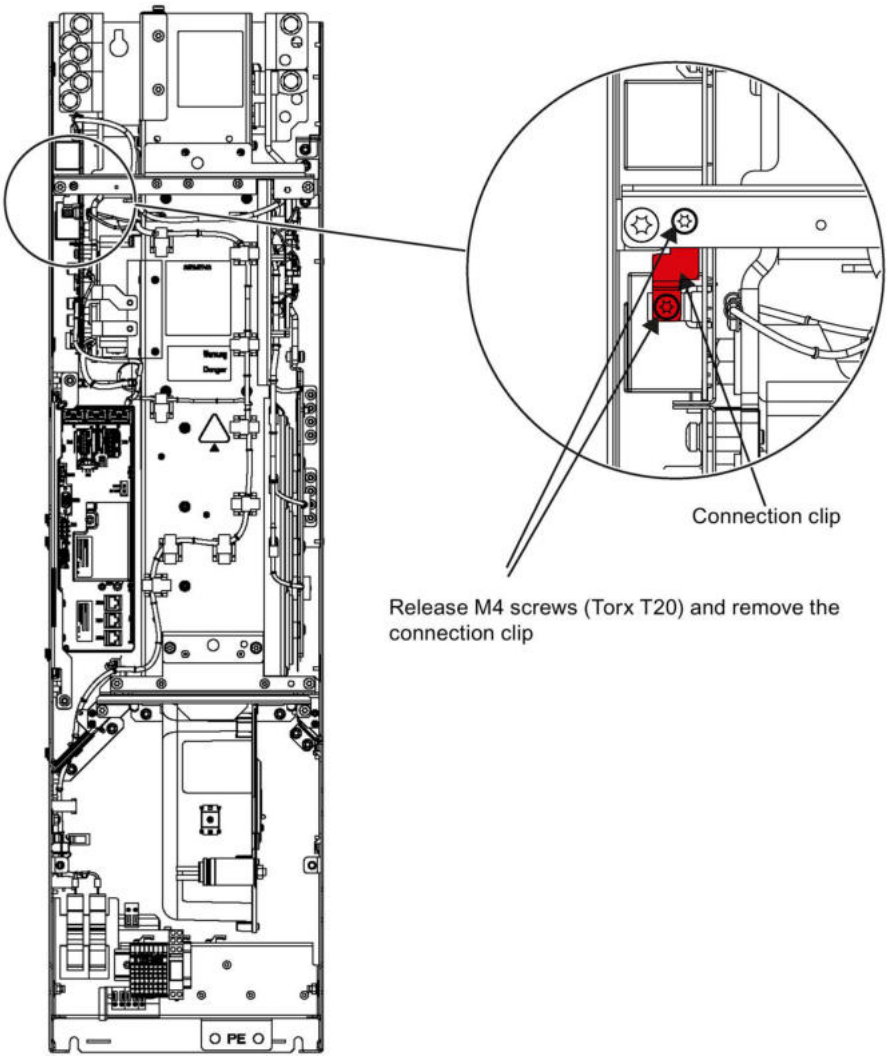


Figure 4-17 Removing the connection clip to the basic interference suppression module in the Basic Line Module, frame size FB

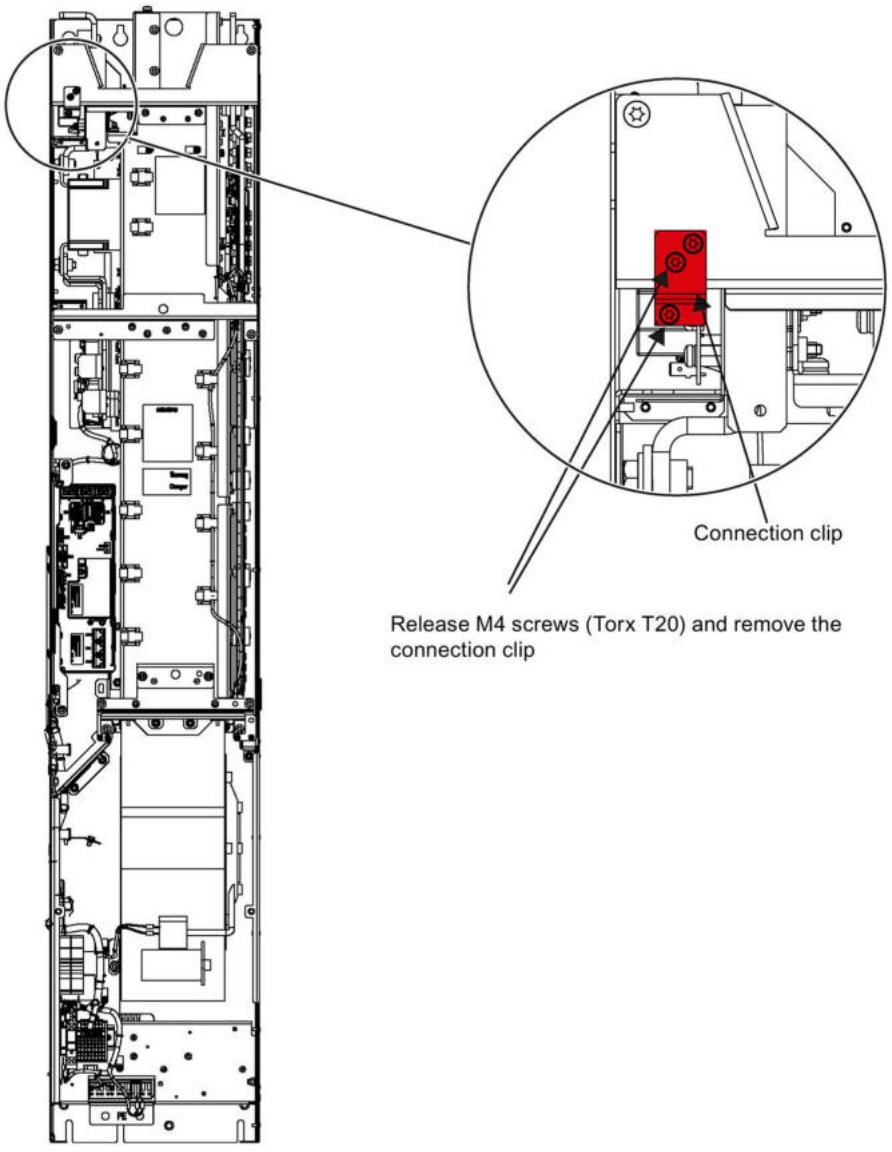


Figure 4-18 Removing the connection clip to the basic interference suppression module in the Basic Line Module, frame size GB

Smart Line Modules

If the device is operated on a non-grounded system (IT system), the connection clip to the basic interference suppression module must be removed.

With frame sizes HX and JX, you must remove the left-hand fan before removing the connection bar (see Chapter "Replacing components").

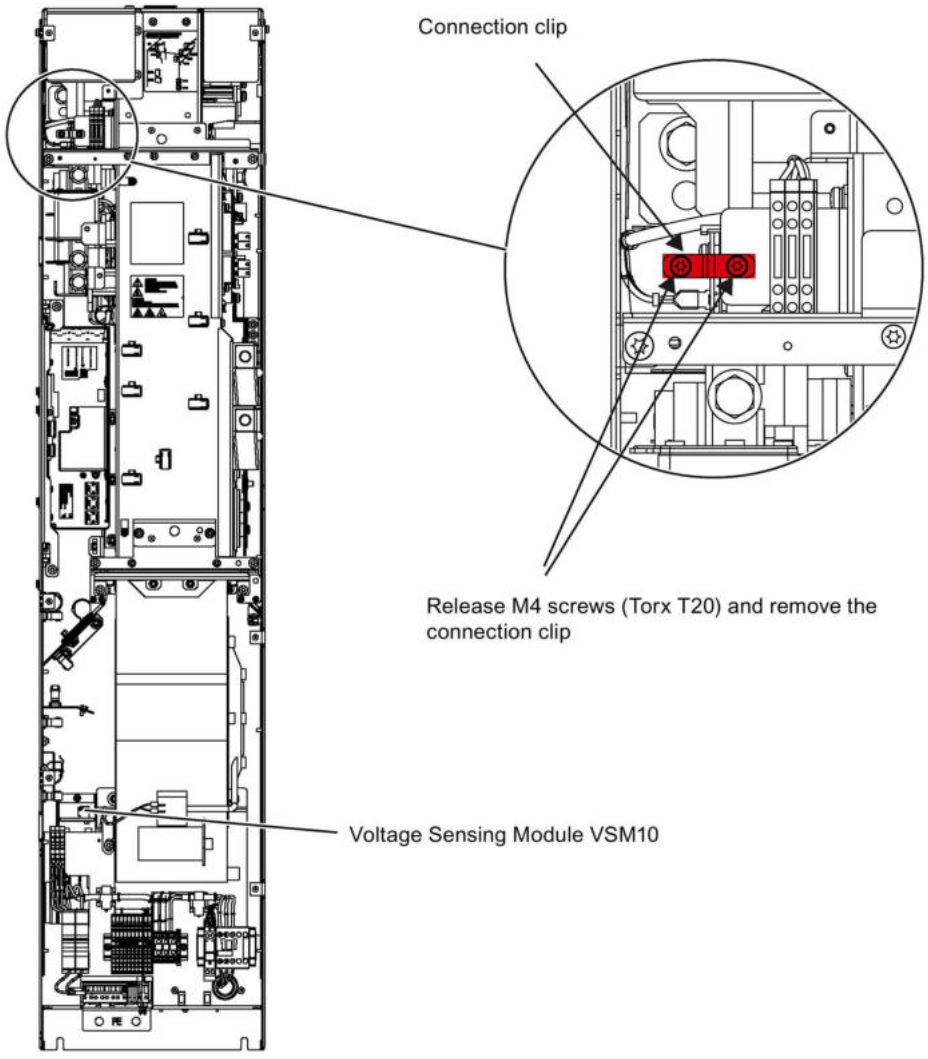


Figure 4-19 Removing the connection clip to the basic interference suppression module in the Smart Line Module for frame size GX

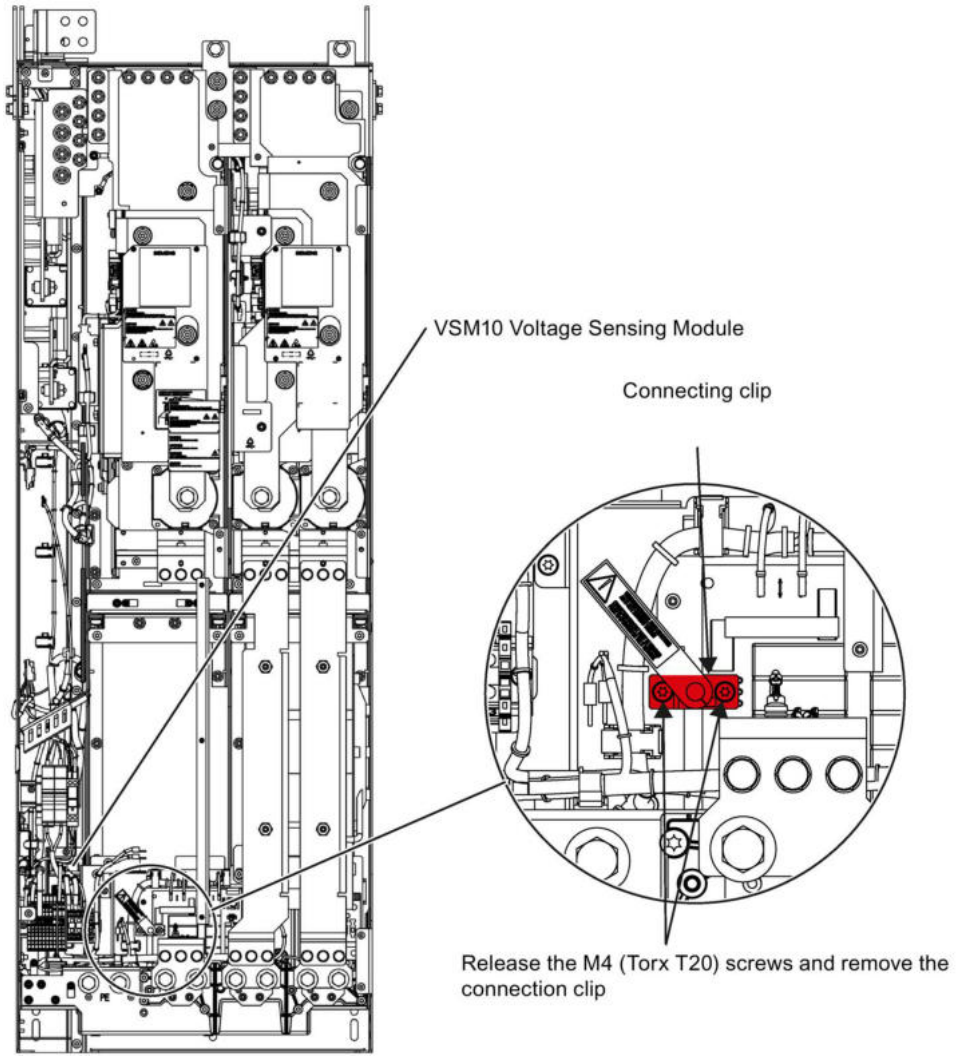


Figure 4-20 Removing the connection clip to the basic interference suppression module in the Smart Line Module for frame size HX

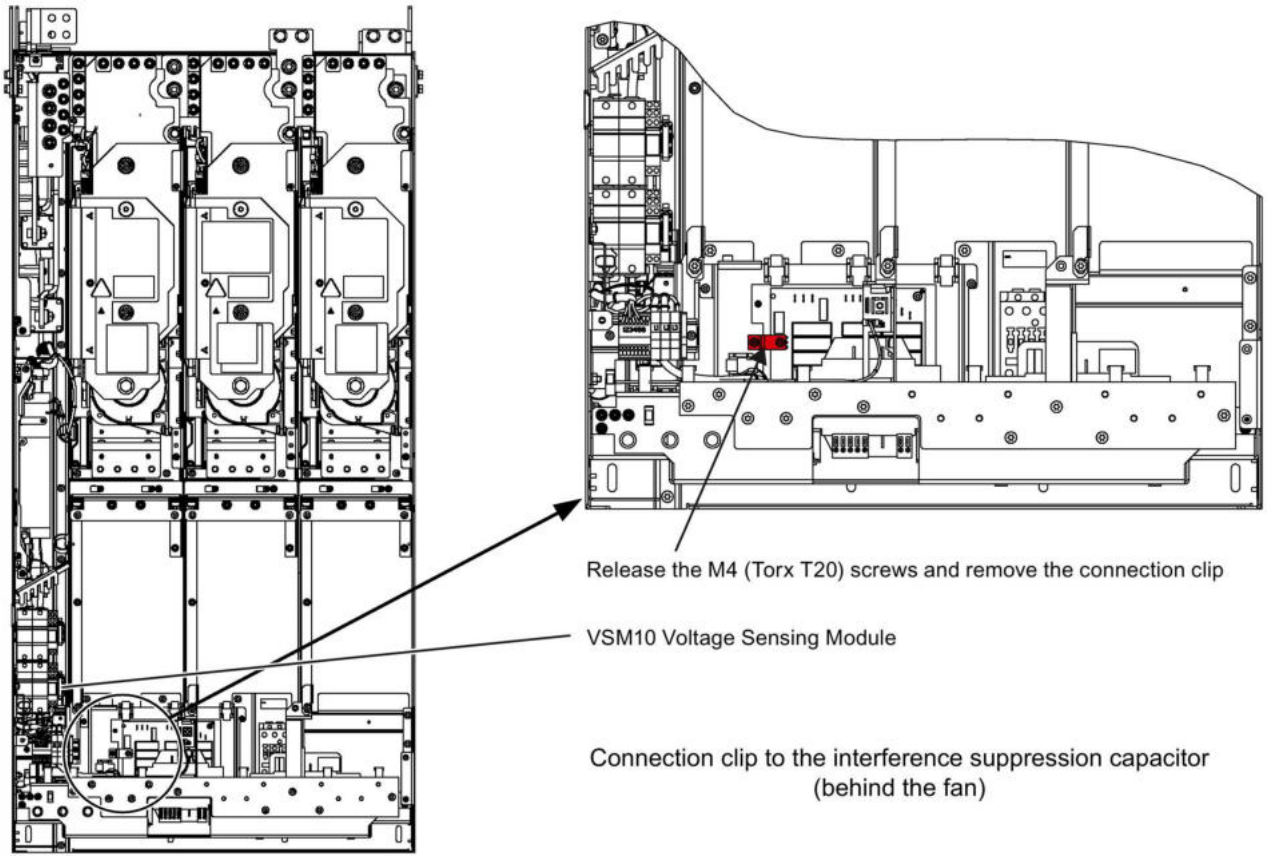


Figure 4-21 Removing the connection clip to the basic interference suppression module in the Smart Line Module for frame size JX

Active Line Modules

If the device is operated on a non-grounded system (IT system), the connection clip for the basic interference suppression module of the Active Interface Module (-A2) must be removed.

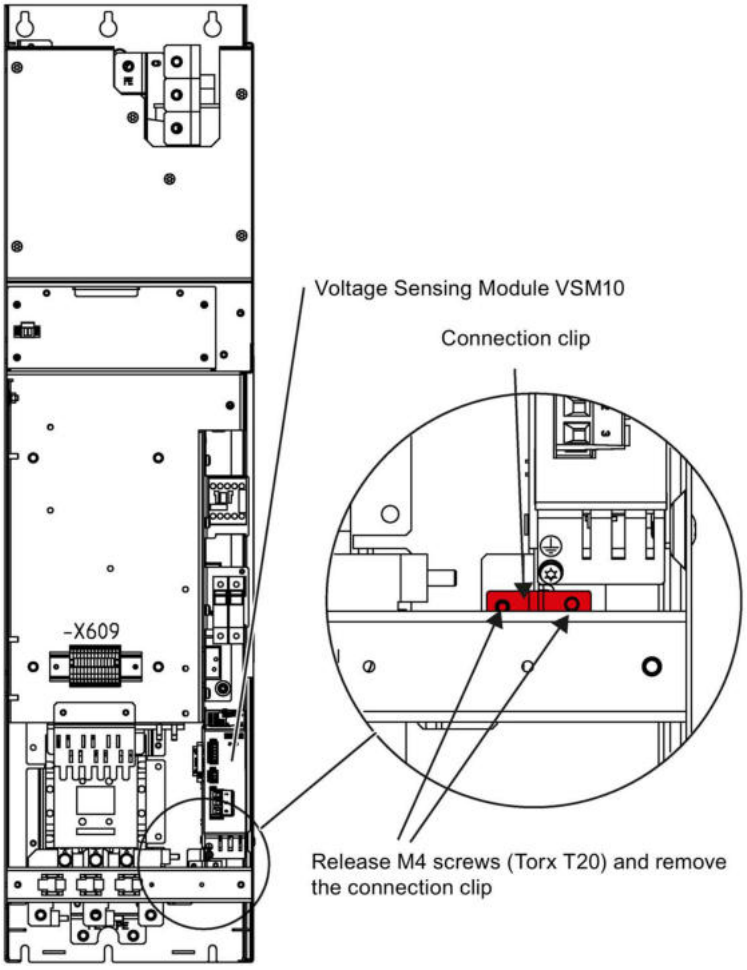


Figure 4-22 Removing the connection clip to the basic interference suppression module in the Active Interface Module, frame size FX

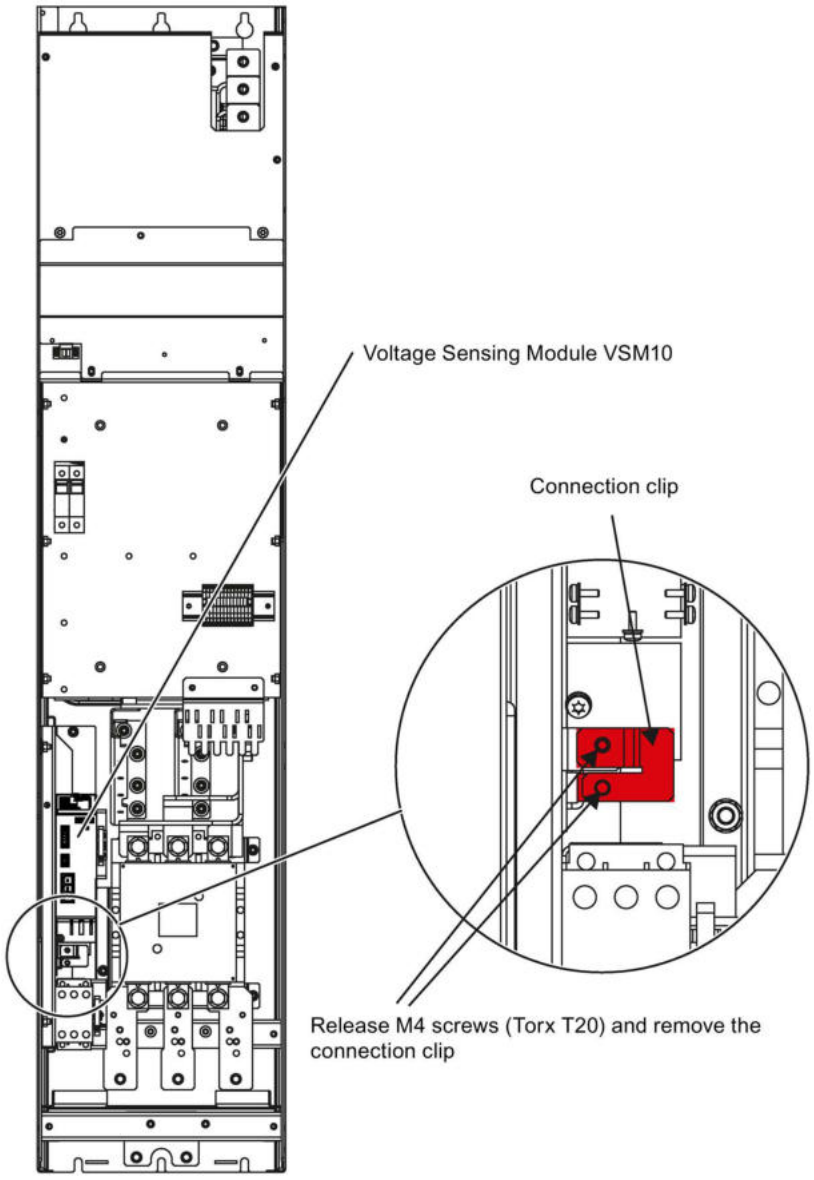


Figure 4-23 Removing the connection clip to the basic interference suppression module in the Active Interface Module, frame size GX

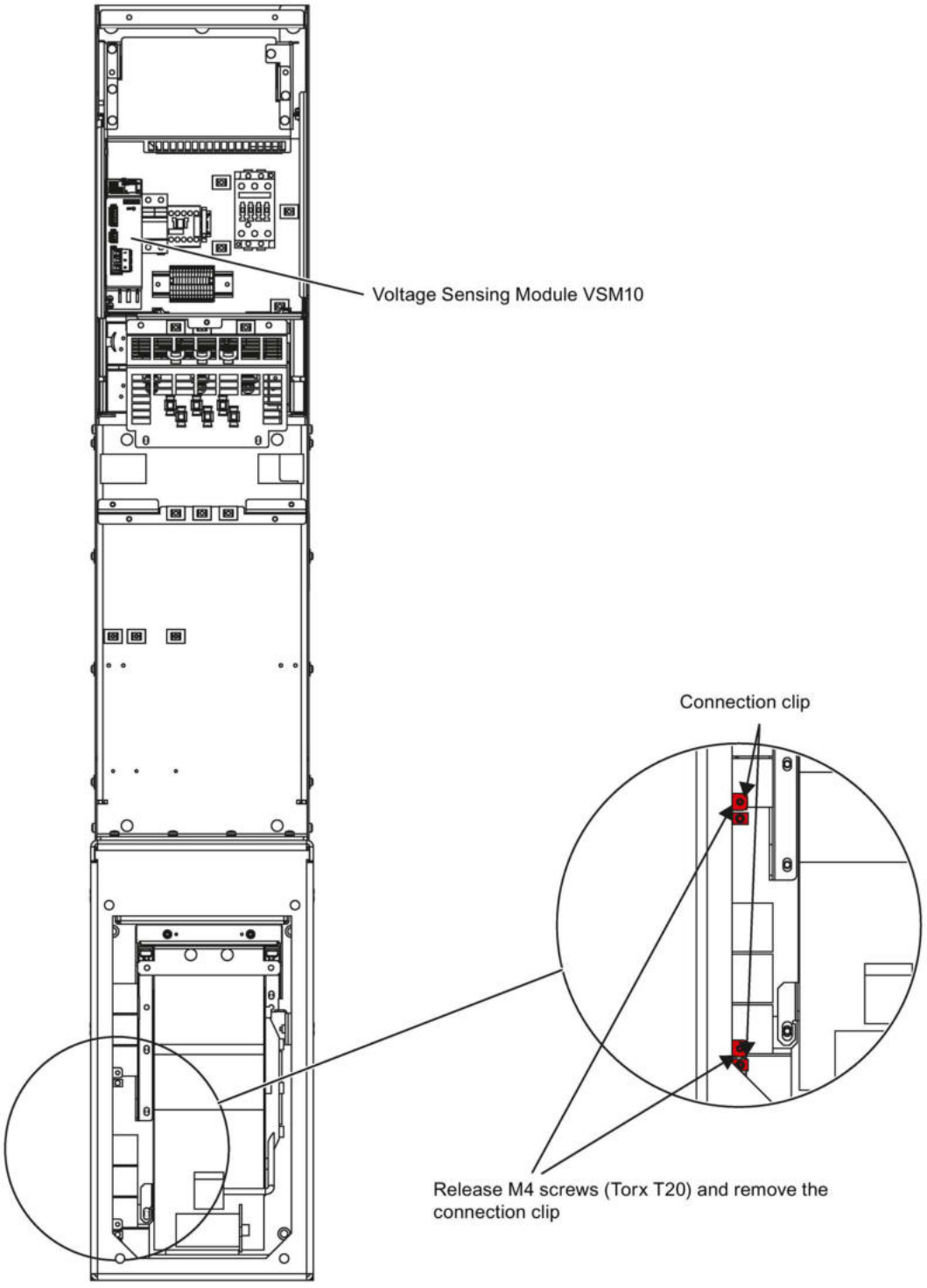


Figure 4-24 Removing the connection clip to the basic interference suppression module in the Active Interface Module, frame size HX

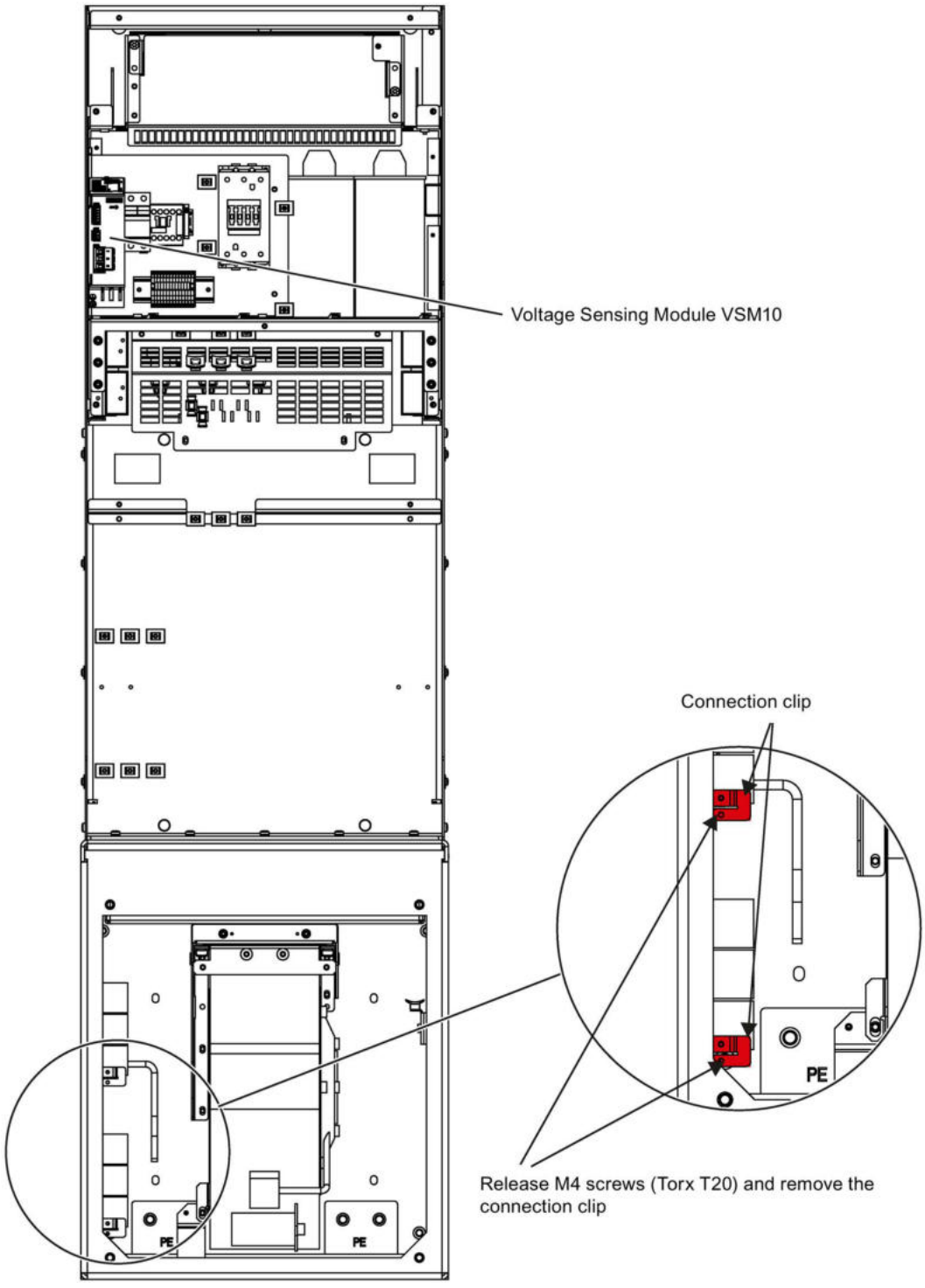


Figure 4-25 Removing the connection clip to the basic interference suppression module in the Active Interface Module, frame size JX

Active Line Connection Modules-2

When the unit is operated on an ungrounded system (IT system), the connection clip to the basic interference suppression module of the Active Interface Module Chassis-2 (-A2) must be removed.

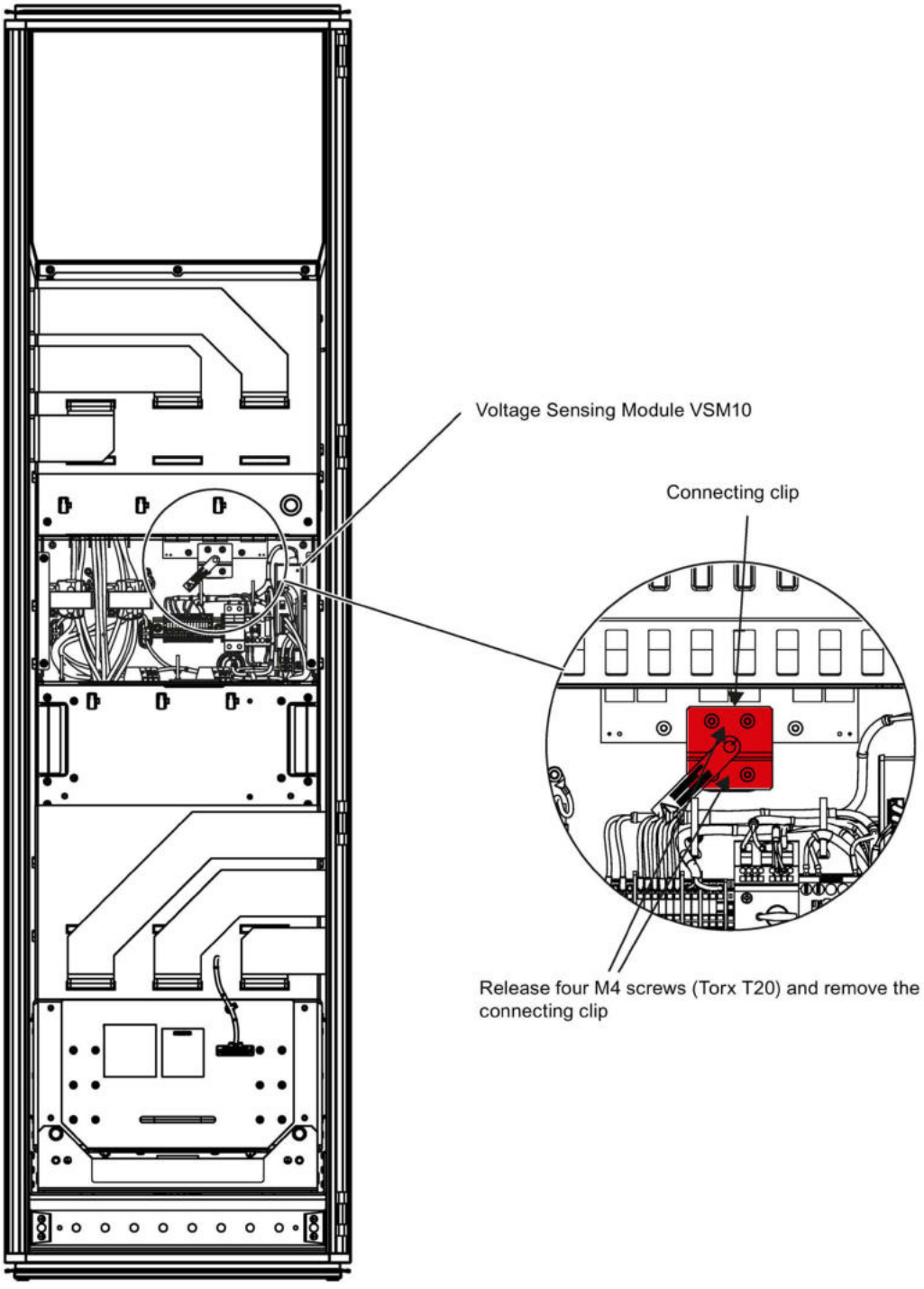


Figure 4-26 Removing the connection clip to the basic interference suppression module in the Active Interface Module in the Chassis-2 format

Removing the connector jumper in the Voltage Sensing Module VSM10

If a Smart Line Module, Active Line Module or an Active Line Connection Module-2 is operated on an ungrounded system (IT line system), at the Voltage Sensing Module (VSM 10), the connector jumper in terminal X530 on the lower side of the component must be removed.

The position of the Voltage Sensing Module must be obtained from the previous drawings.

Use two screwdrivers or a suitable tool in order to relieve the holding springs in the terminal and then withdraw the connector jumper.

	
Terminal X530 with connector jumper	Relieve the springs and withdraw the connector jumper

Note

Replacing a VSM10 Voltage Sensing Module

When replacing a VSM10 Voltage Sensing Module by one with a different article number, then inform yourself about the applicable boundary conditions.

Fan supply is connected at terminal strip X51 via an isolating transformer

When operating an Active Line Connection Module-2 and Motor Module Chassis-2 on an ungrounded line supply (IT line system), an isolating transformer must be connected for each fan supply upstream of the fan.

Generally, this is realized using option L20 "Use in IT line system".

4.5.10 Signal connections

Note

Pre-assignment and position of the customer terminal block

The factory setting and description of the customer terminal blocks are documented in the circuit diagrams.

The location of the customer terminal blocks of the individual Cabinet Modules is documented in the layout diagrams.

The interfaces or customer terminal blocks are documented for the respective Cabinet Modules.

DRIVE-CLiQ cables must be locally routed according to the customer-specific engineering specifications for the entire system.

4.5.11 Other connections

Depending on the range of options installed, further connections may have to be made.

For more information about the interfaces of available options, refer to the relevant sections in this manual.

4.5.12 Cable routing

4.5.12.1 General information

Basic rules for cable routing

The Cabinet Modules are delivered pre-wired.

The following basic rules must always be observed for all Cabinet Modules should any additional cabling and wiring or connection work be necessary.

- Observe EMC guidelines.
- Use existing routing for cable assemblies.
- Always use the shield plates provided (do not bypass them).
- Use existing cable propping bars as required.
- Attach the cable ties at suitable points on metal frames and cabinet frame profiles.
- Use a cabinet upright to route cables into adjacent cabinets.
- Refit any covers removed during cable routing before completing the work and commissioning!

Preparatory steps

Before starting any cabling or connection work in the Cabinet Modules, ensure that the following measures are performed:

- Disconnect the cabinet unit from the power supply.
- Allow unimpeded access to the necessary components in the Cabinet Module (if necessary, remove the covers).

Safety and EMC



⚠WARNING

Dangerous voltage when covers are missing

If covers are missing, live parts may be touched which can result in death or serious injury.

- Mount all covers again that you removed for the cable routing before commissioning the Cabinet Module.

Note

Internal cabinet wiring

When routing cables, utmost care must be taken not to change any existing internal cabinet wiring.

Note

EMC-compliant shielding

The shield plates must be re-mounted before the cabinet is commissioned to ensure EMC-compliant shielding.

The shields of the motor cables must be secured on the EMC shield bus (M70 option), and the PE cables must be secured on the PE busbar.

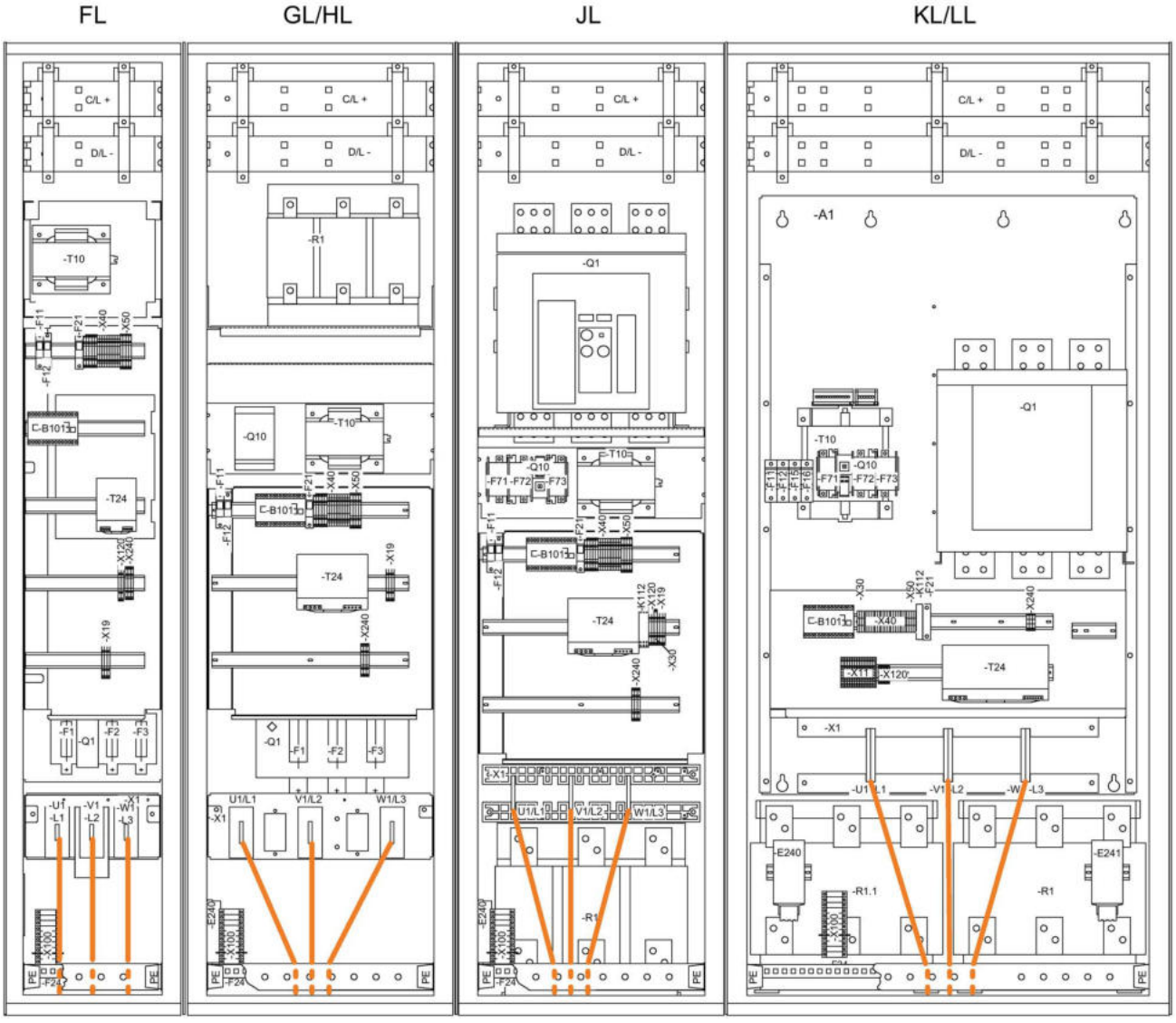
4.5.12.2 Cable routing for Line Connection Modules

For the Line Connection Modules, the customer must carry out the following cabling or connection work:

Table 4- 16 Checklist for cabling or connection work for Line Connection Modules

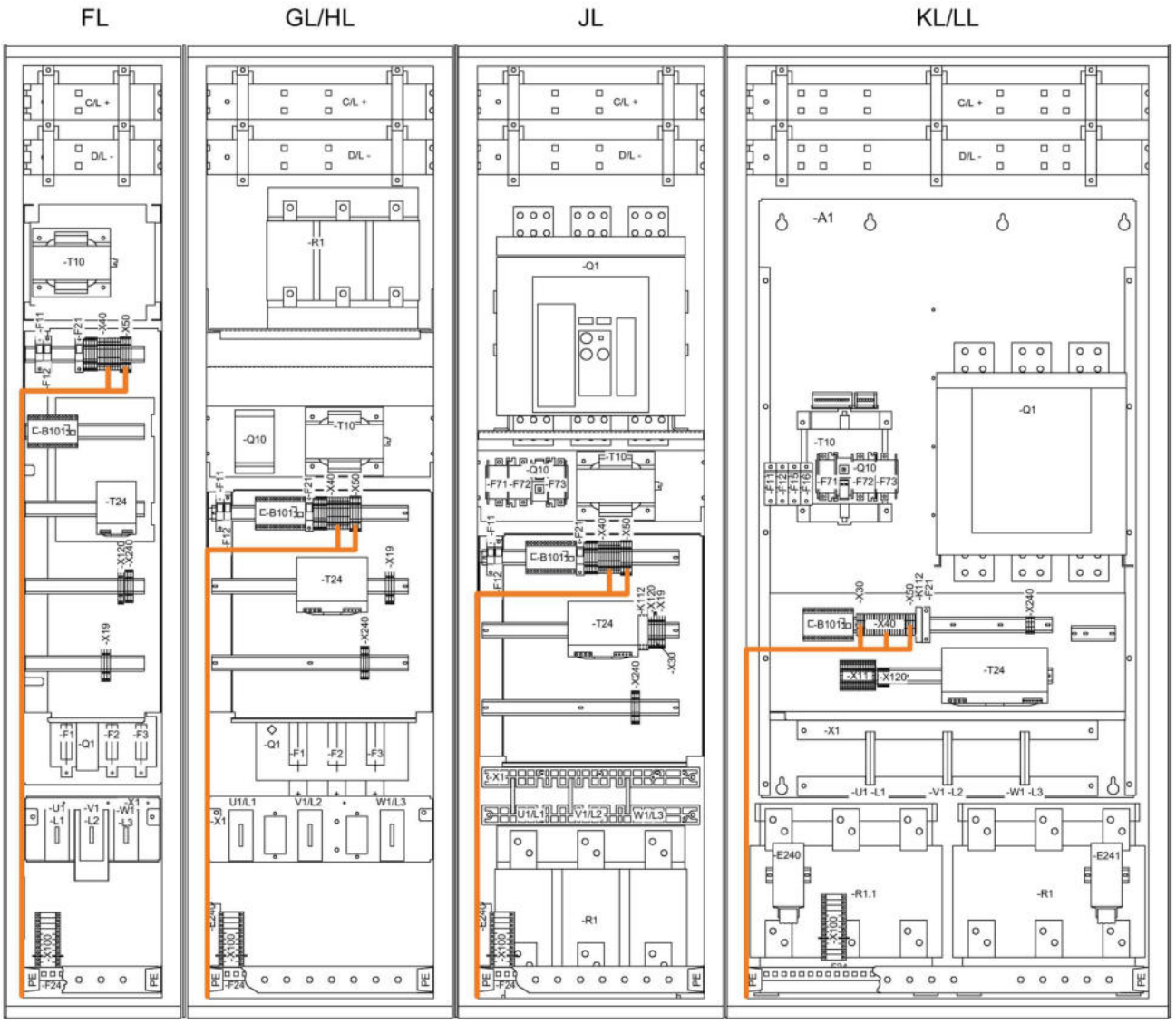
Cable routing	Completed?
Cable for the line supply connection (L1, L2, L3, PE)	
Signal cables	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for connecting to the supply infeed



1. Feed the infeed cable into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Feed the cable up through the cabinet to terminal block -X1.
4. Secure the cable at suitable points.
5. Connect the cable to the terminal block.

Signal cables



1. Feed the signal cables into the cabinet from the bottom left.
2. Feed the signal cables up through the cabinet to terminal blocks -X30, -X40, and -X50.
3. Fasten the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

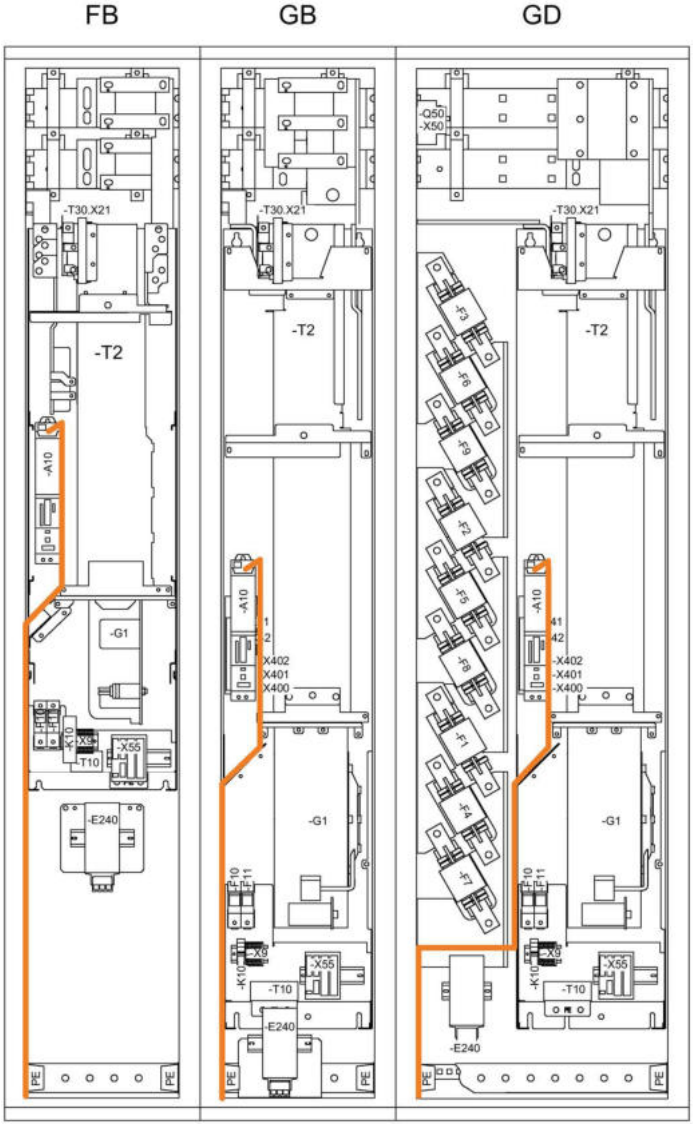
4.5.12.3 Cable routing for Basic Line Modules

For the Basic Line Modules, the customer must carry out the following cabling or connection work:

Table 4- 17 Checklist for cabling or connection work for Basic Line Modules

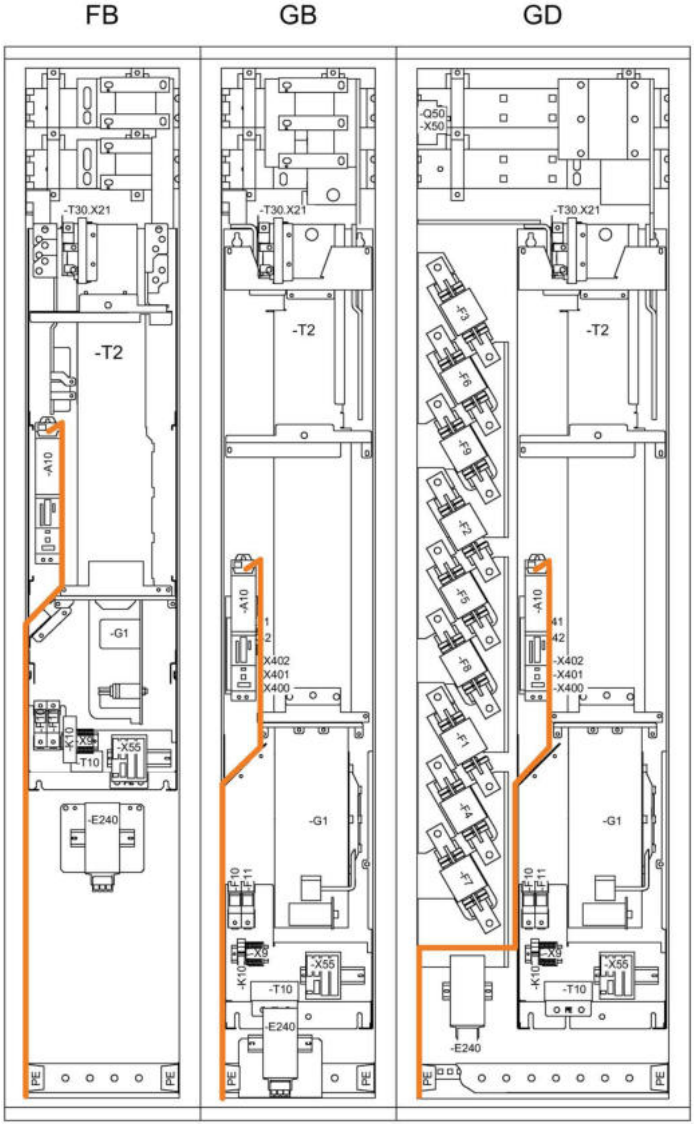
Cable routing	Completed?
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



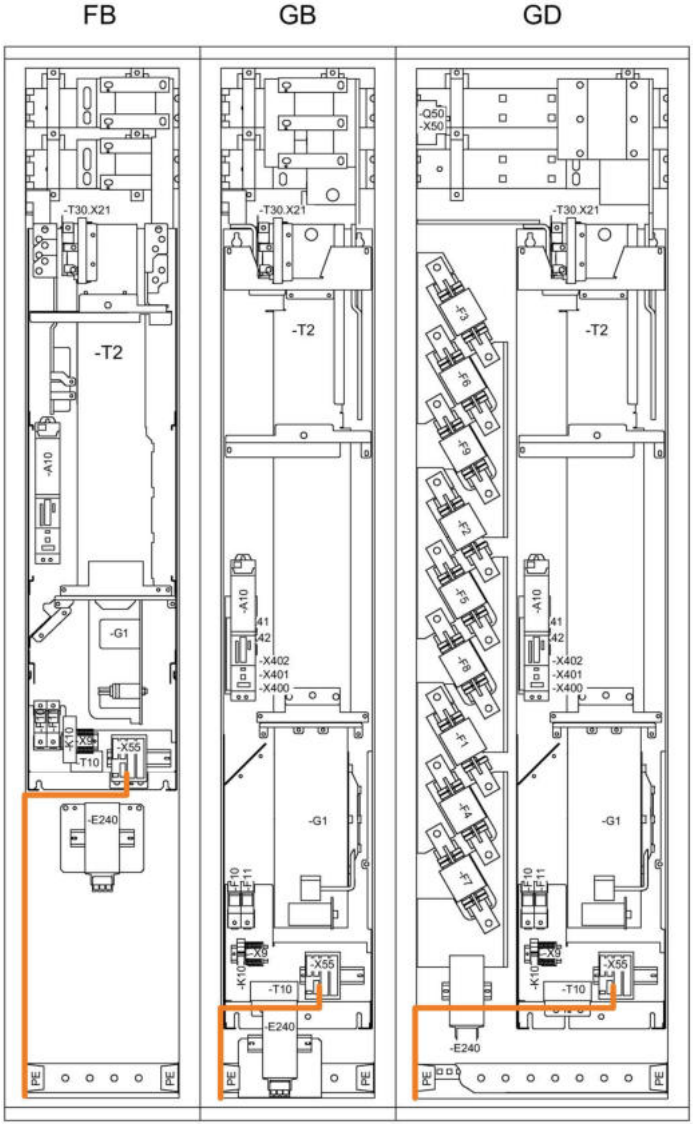
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit.
   (→See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables



1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.

Cable routing to the customer terminal block -X55



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cables to the customer terminal block -X55.

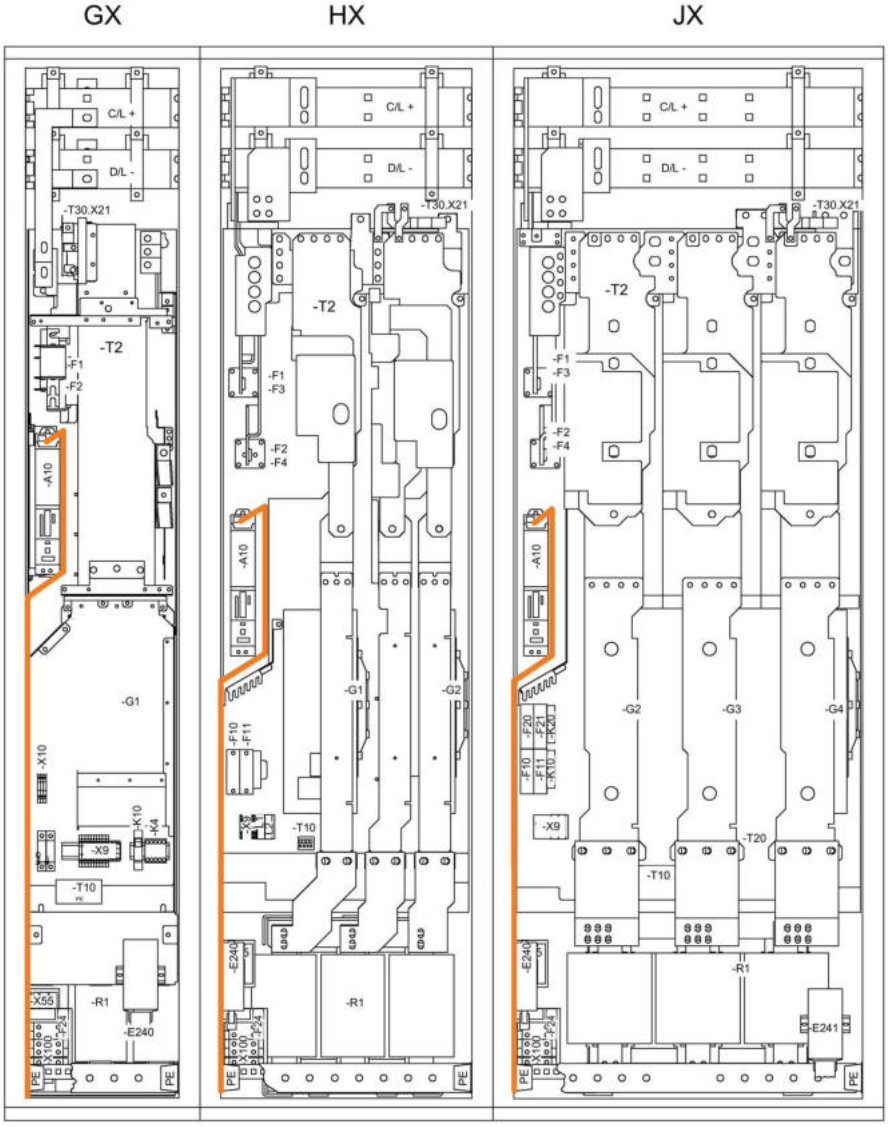
4.5.12.4 Cable routing for Smart Line Modules

For the Smart Line Modules, the customer must carry out the following cabling or connection work:

Table 4- 18 Checklist for cabling or connection work for Smart Line Modules

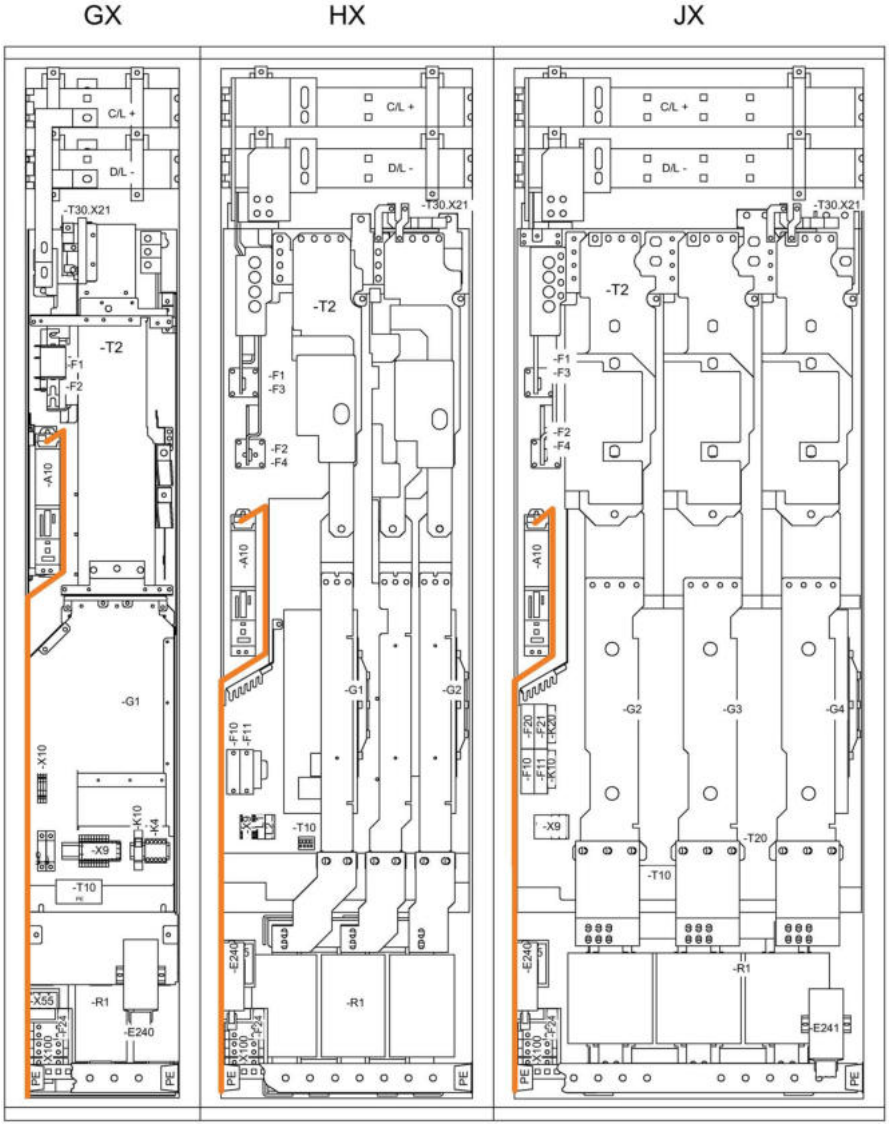
Cable routing	Completed?
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



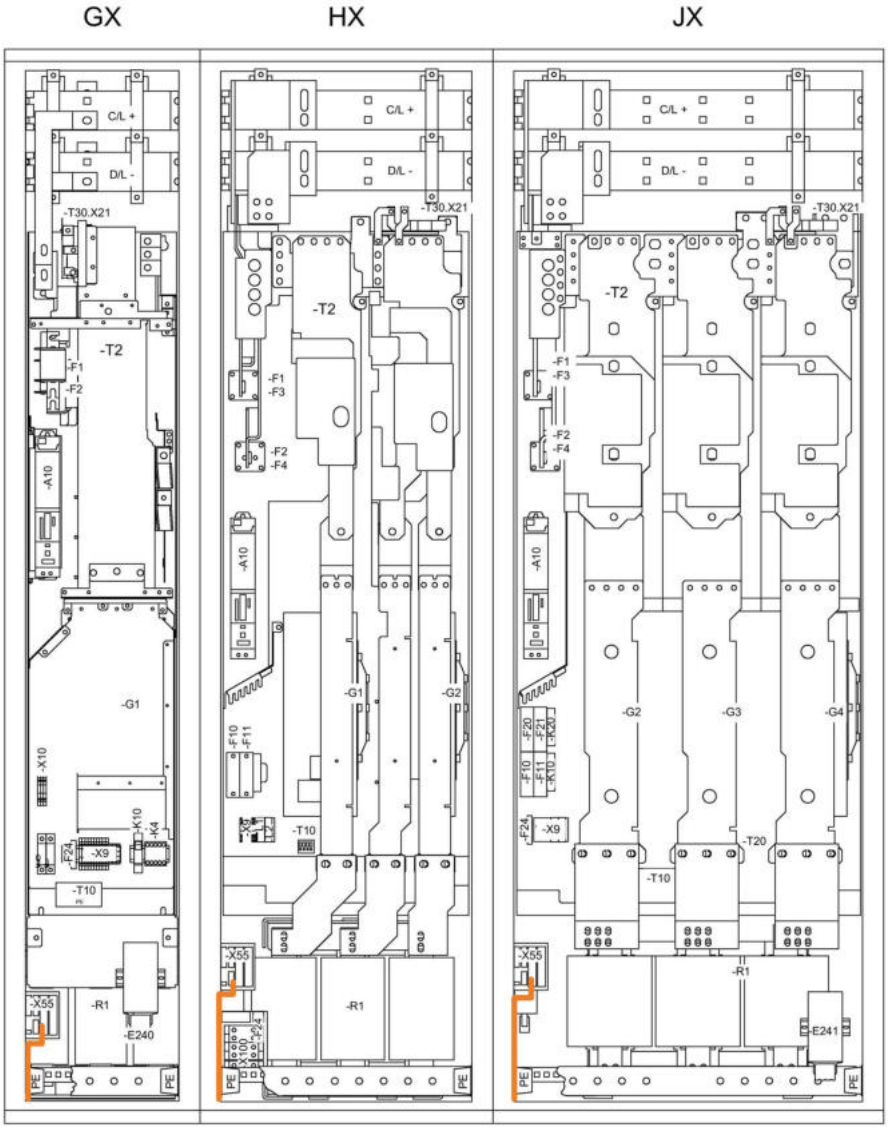
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit
   (→ See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables to the Control Unit



1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.

Cable routing to the customer terminal block -X55



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

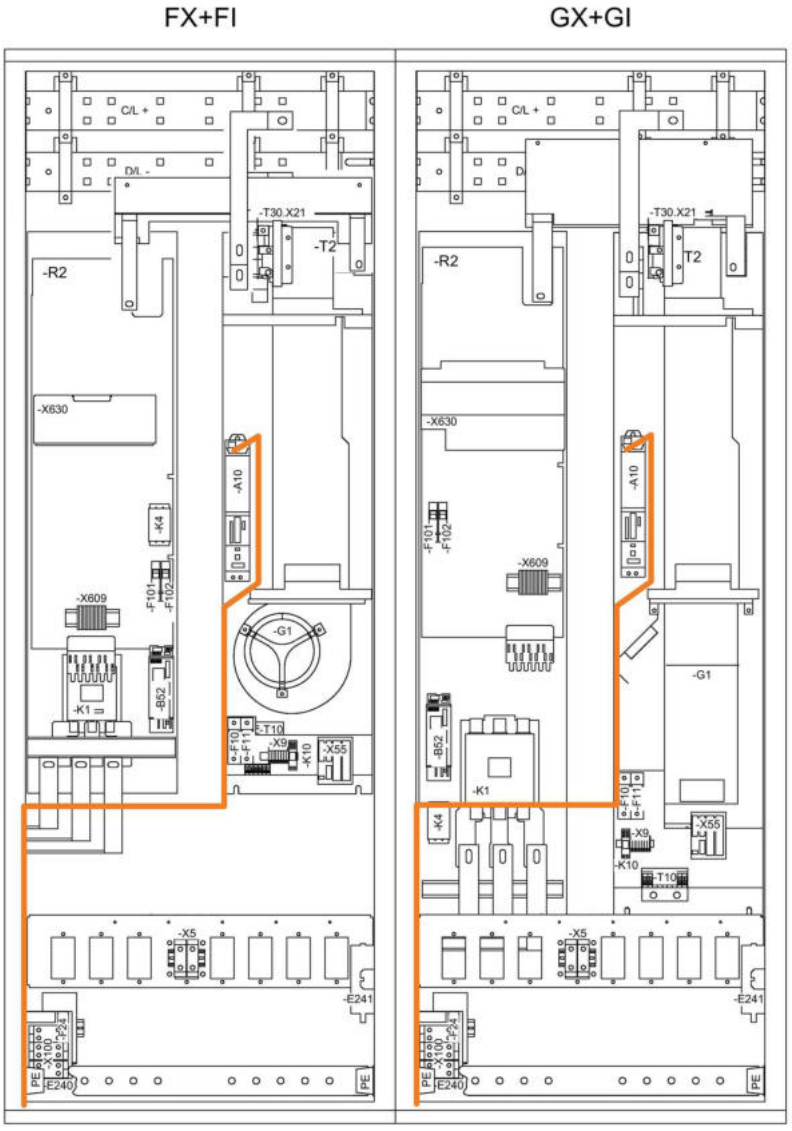
4.5.12.5 Cable routing for Active Line Modules

For the Active Line Modules, the customer must carry out the following cabling or connection work:

Table 4- 19 Checklist for cabling or connection work for Active Line Modules

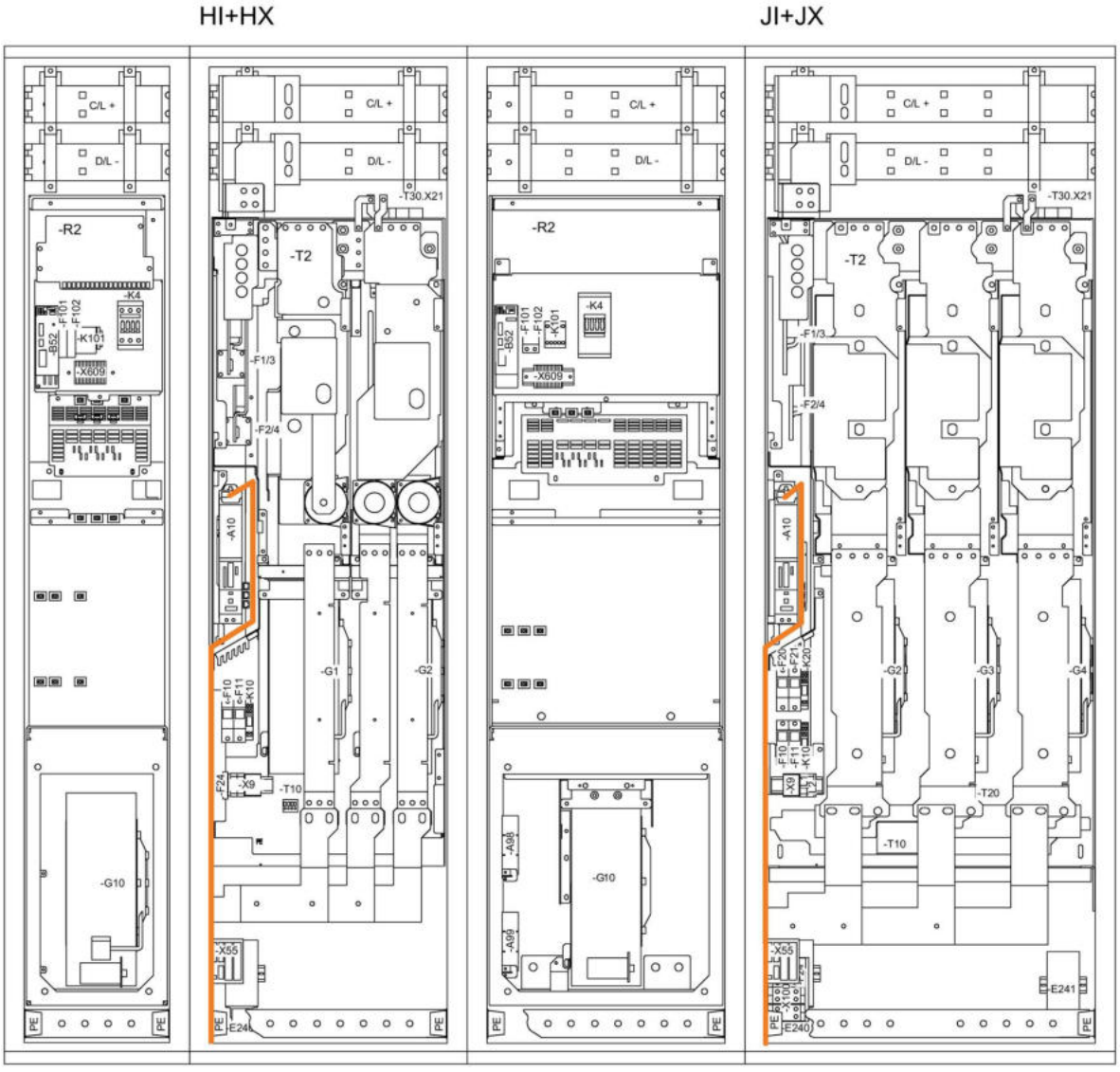
Cable routing	Completed?
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for PROFIBUS or PROFINET connection to the Control Unit, frame sizes FX+FI and GX+GI



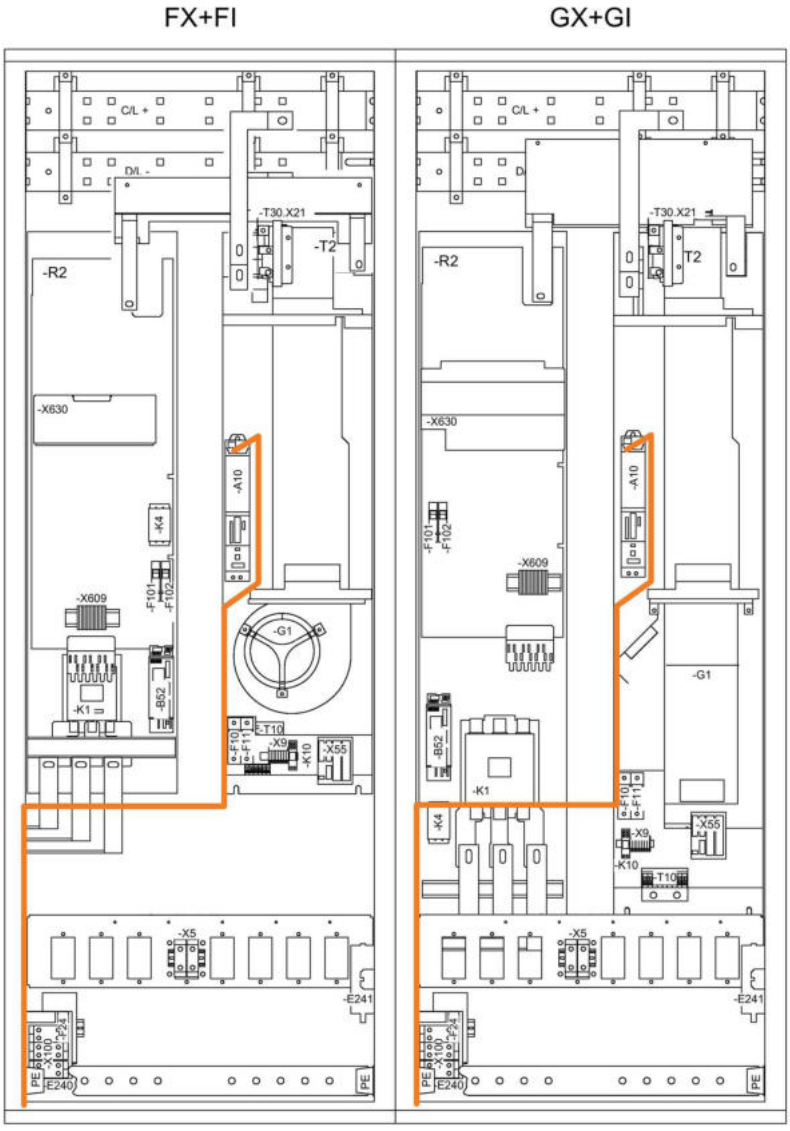
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit
   (→ See SINAMICS S120 Manual GH1 Control Units)

Cable routing for PROFIBUS or PROFINET connection to the Control Unit, frame sizes HX+HI and JX+JI



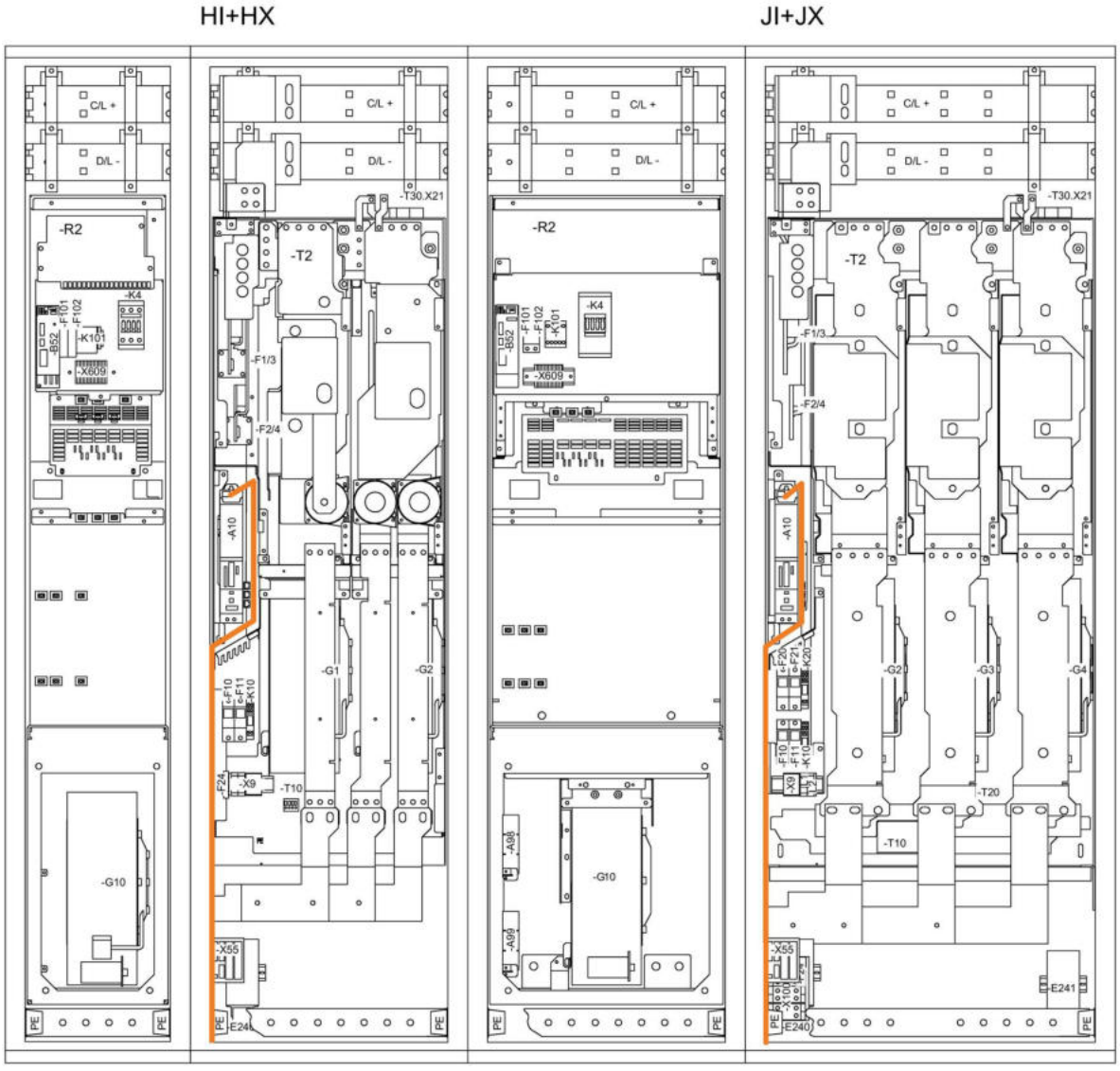
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit
   (→ See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables, frame sizes FX+FI and GX+GI



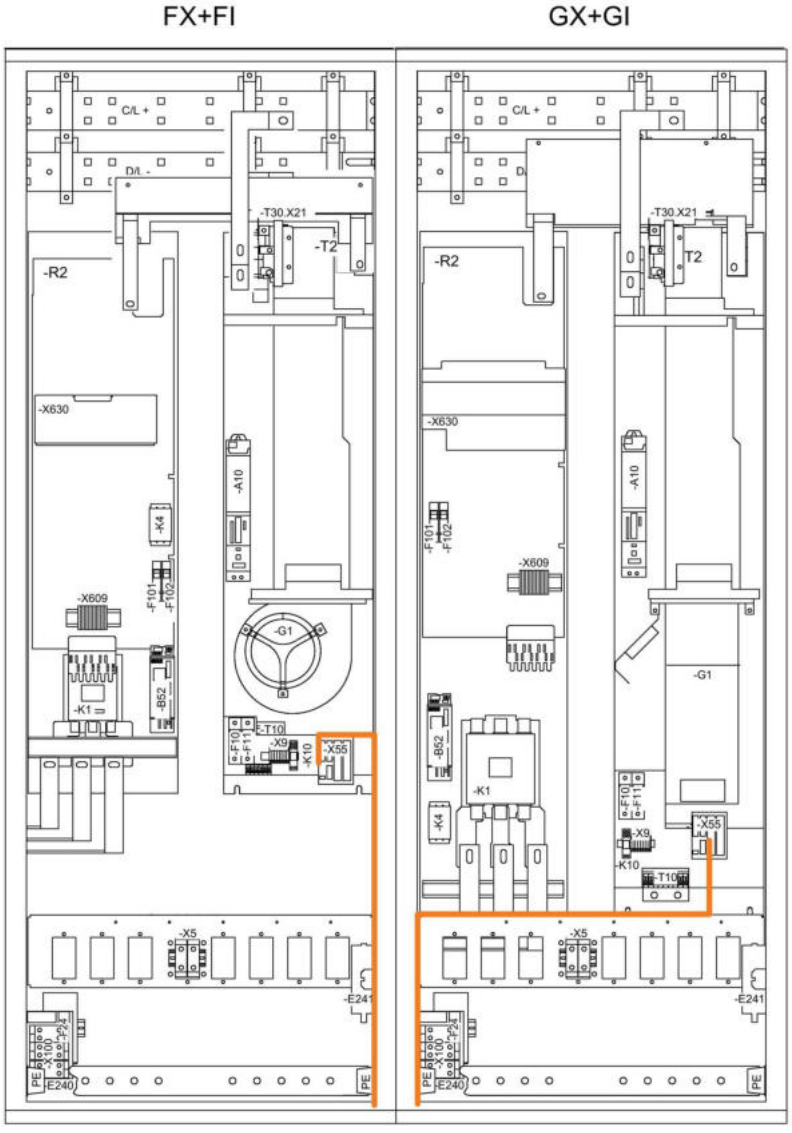
1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ or signal cable to the Control Unit.

Cable routing for DRIVE-CLiQ connections and signal cables, frame sizes HX+HI and JX+JI



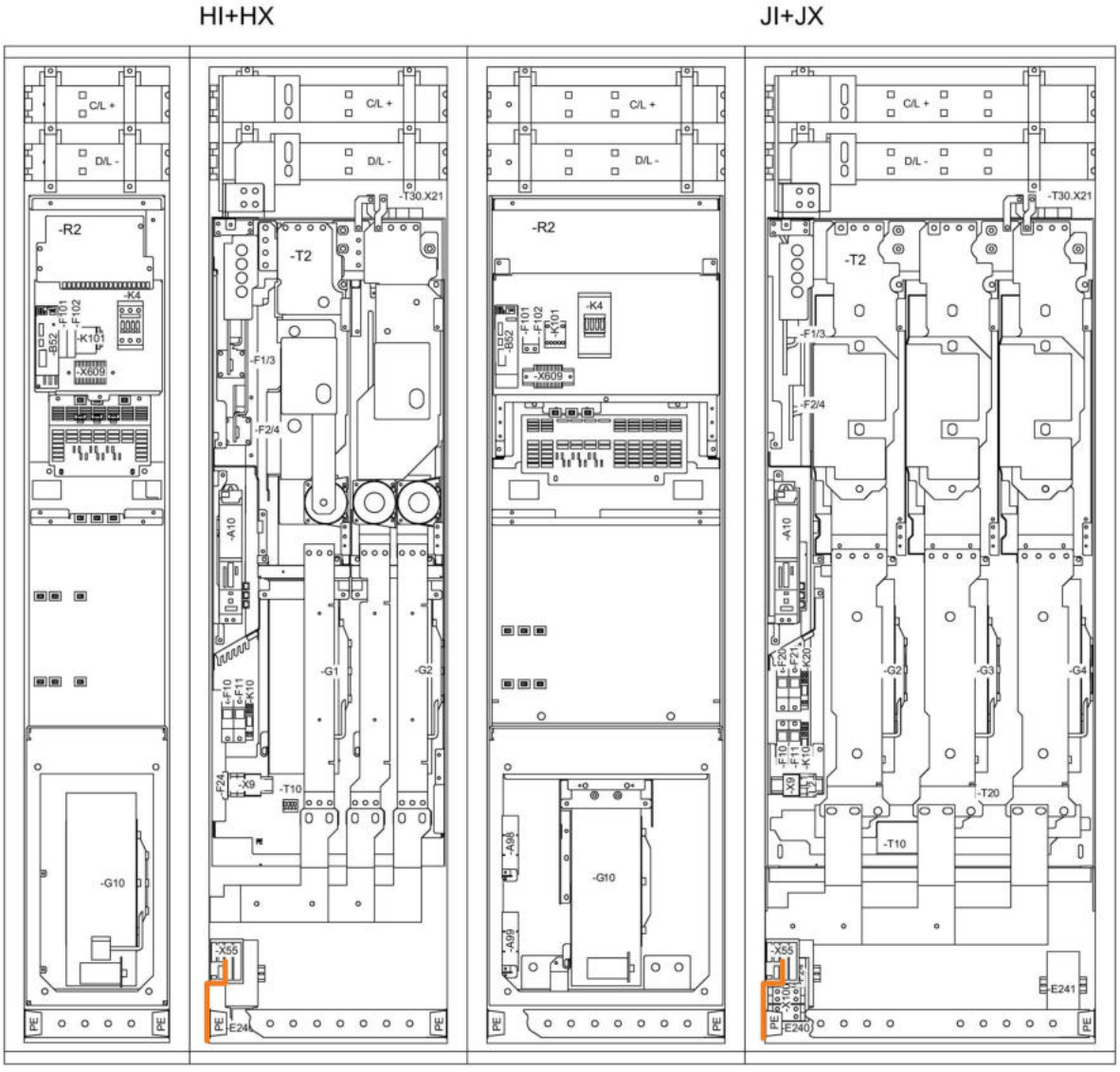
1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ or signal cable to the Control Unit.

Cable routing to customer terminal block -X55, frame sizes FX+FI and GX+GI



1. Feed the cable for the customer terminal block into the cabinet from the bottom right (frame size FX+FI) or bottom left (frame size GX+GI).
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

Cable routing for customer terminal block -X55, frame sizes HX+HI and JX+JI



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

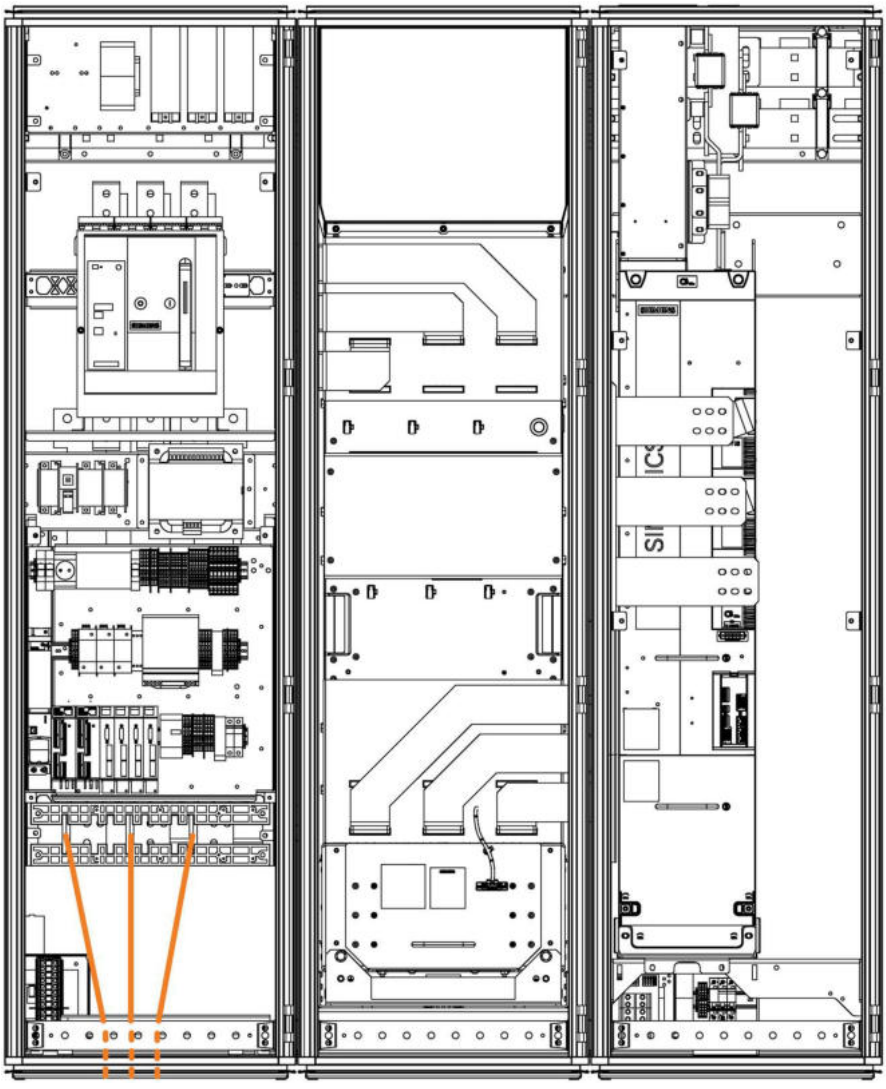
4.5.12.6 Cable routing for Active Line Connection Modules-2

For Active Line Connection Modules-2, customers must carry out the following cabling or connection work:

Table 4- 20 Checklist for cable routing and connection work for Active Line Connection Modules-2

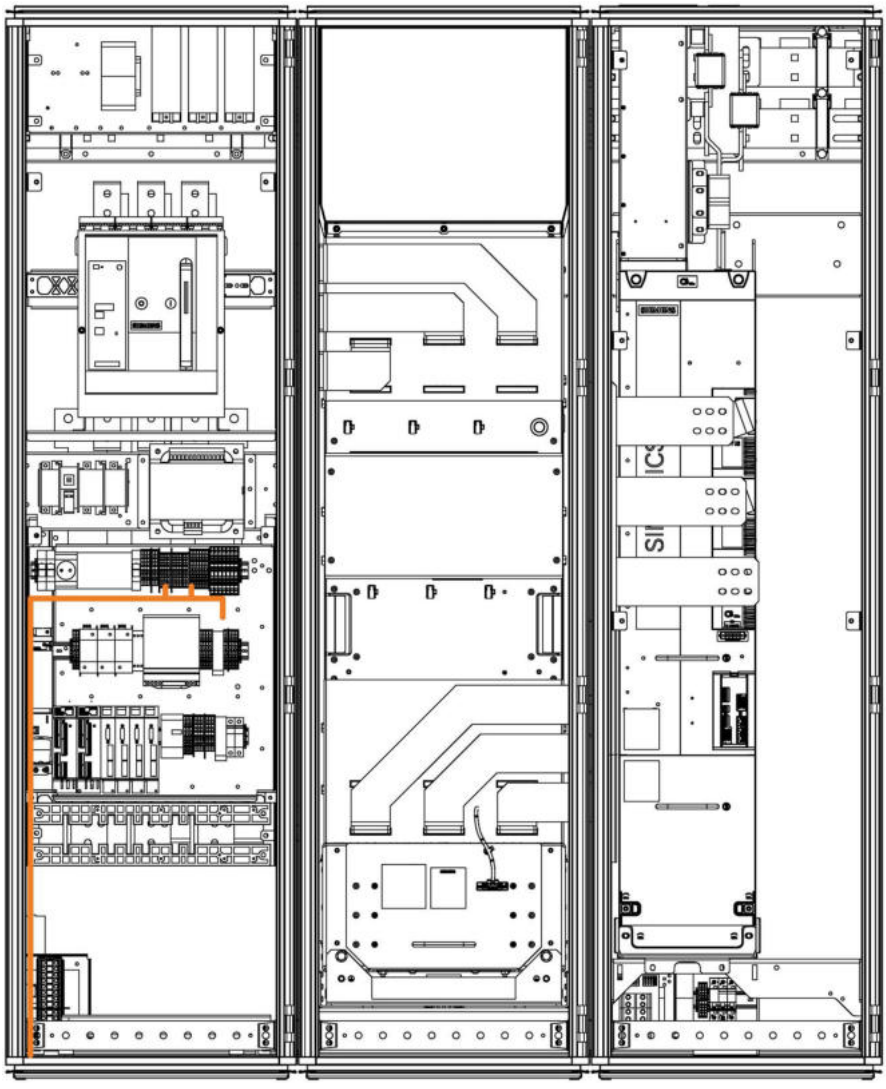
Cable routing	Completed?
Cable for the line supply (L1, L2, L3, PE)	
Signal cables to terminals -X30, -X40, -X50	
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for connecting to the supply infeed



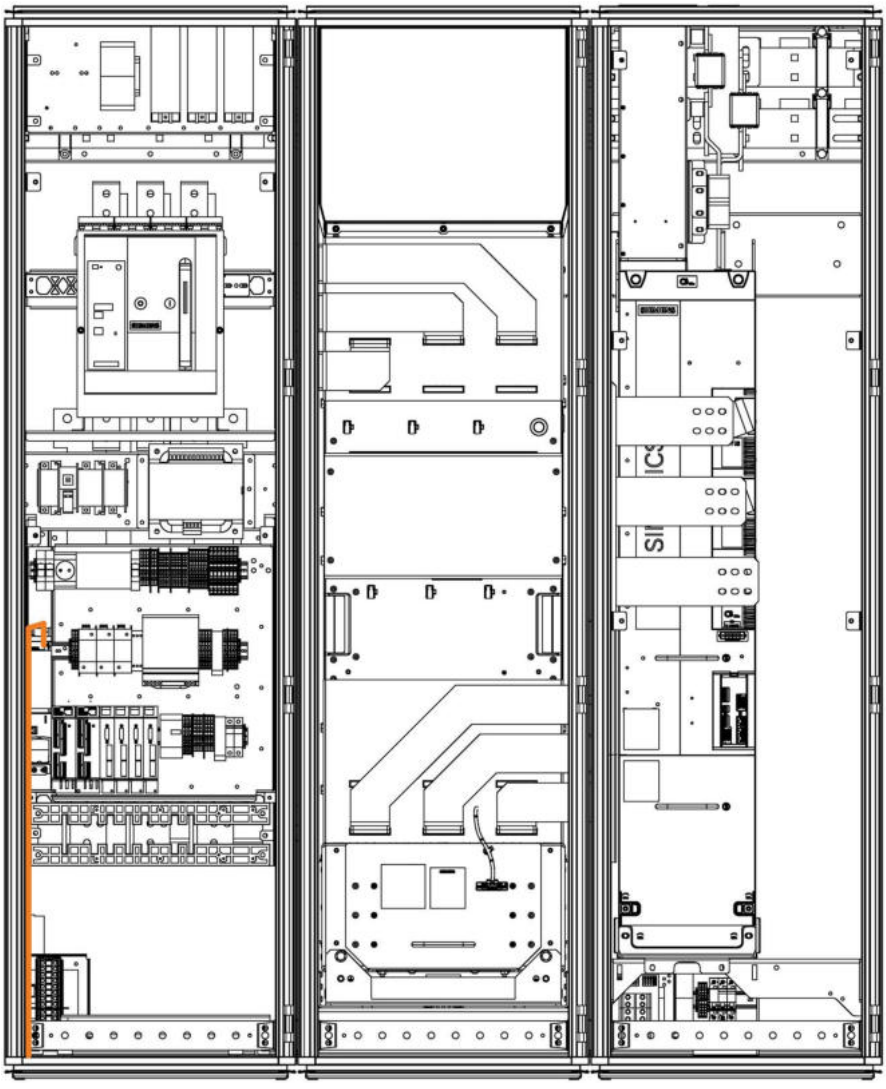
1. Route the cable for the infeed into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the line connections -X1 (-U1/-L1, -V1/-L2, -W1/-L3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

Routing signal cables



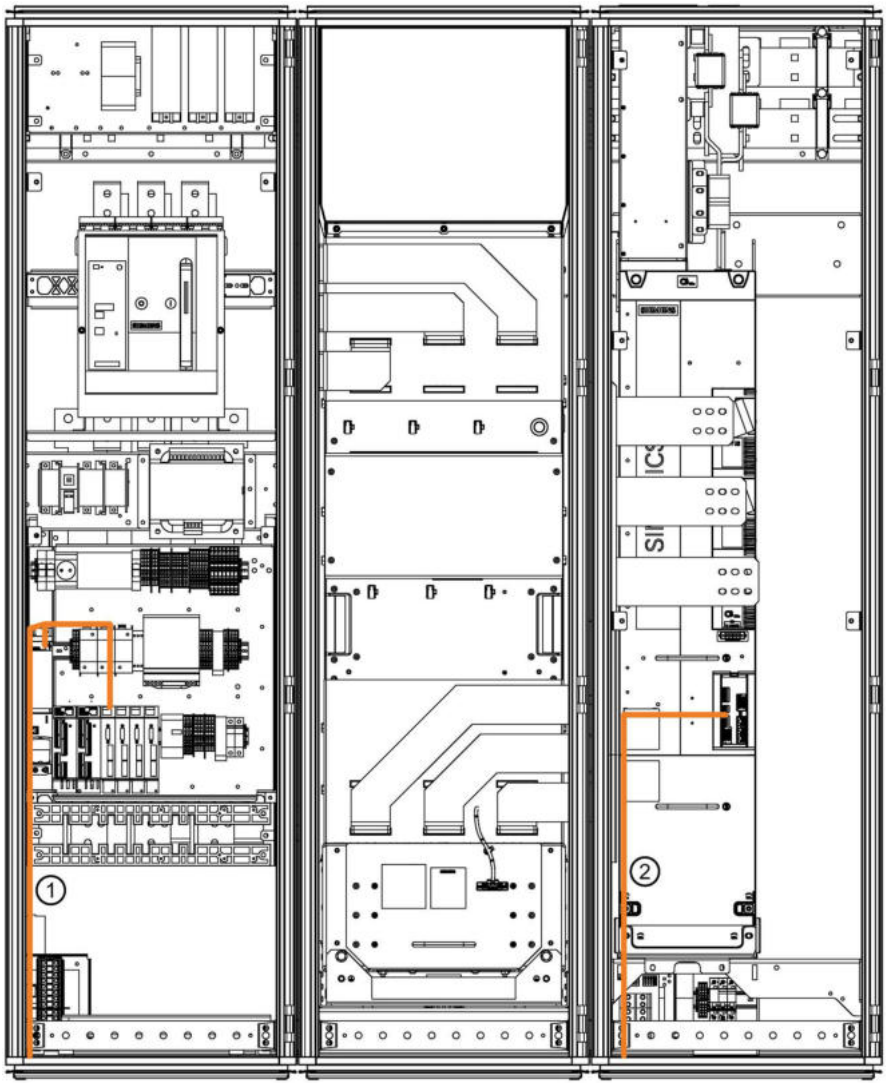
1. Route the signal cables into the cabinet from the bottom left.
2. Route the signal cables up through the cabinet to terminal blocks -X30, -X40 or-X50.
3. Attach the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit.
   (→ See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables



1. Route the DRIVE-CLiQ/signal cable to the Control Unit into the cabinet from the bottom left ①.
2. Use cable ties to secure the cable at suitable points.
3. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.
6. Route the DRIVE-CLiQ/signal cable to the Active Line Module from the bottom left into the cabinet ②.
7. Use cable ties to secure the cable at suitable points.
8. Route the cable further in the cabinet up to the height of the signal connections. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
9. Connect the DRIVE-CLiQ/signal cable at the appropriate interfaces.

4.5.12.7 Cable routing for Booksize Base Cabinets and Booksize Cabinet Kit

Note

Cable routing

The procedure is the same as that for the Cabinet Modules Motor Module in chassis format. (→ See Section "Cable routing for Motor Modules in chassis format")

Cable routing of motor cable

Note

Connecting the motor cables

The motor cables are easy to connect to terminals in the lower part of the customer connection area.

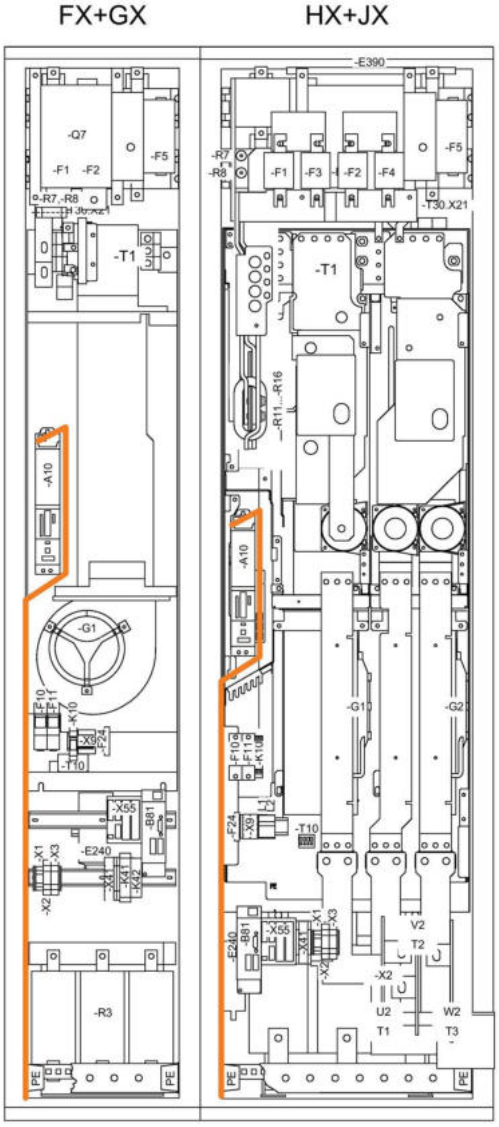
4.5.12.8 Cable routing for Motor Modules in the chassis format

For the Motor Modules in chassis format, the customer must carry out the following cabling or connection work:

Table 4- 21 Checklist for cabling or connection work for Motor Modules in the chassis format

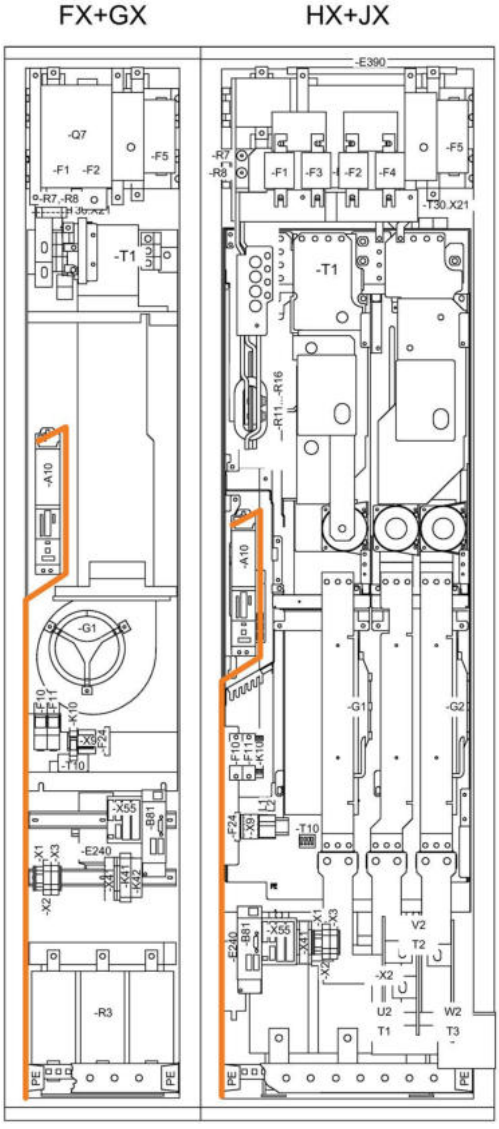
Cable routing	Completed?
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Option K82, terminal module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"	
Option K87, Terminal Module TM54F	
Option K88, Safe Brake Adapter SBA 230 VAC	
Signal cables to Sensor Module SMC10/20/30 (-B81/-B82/-B83)	
Cable connection between motor and Motor Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



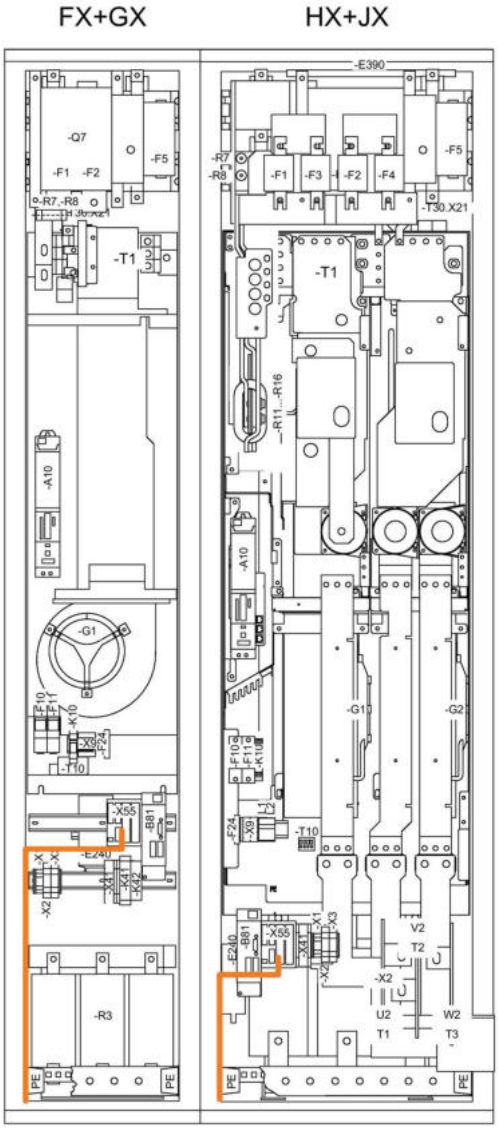
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit.
   (→See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables to the Control Unit



1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.

Cable routing of signal cables to the customer terminal block –X55



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

Cable routing for the "Safe Torque Off" and "Safe Stop 1" functions

Note
Cable routing

The procedure is the same as that for customer terminal block -X55.

Connect the cable to the terminals to control the functions.

(→ See Chapter "Options", Section "K82, terminal module for activating "Safe Torque Off" and "Safe Stop 1"")

Cable routing for the Terminal Module TM54F

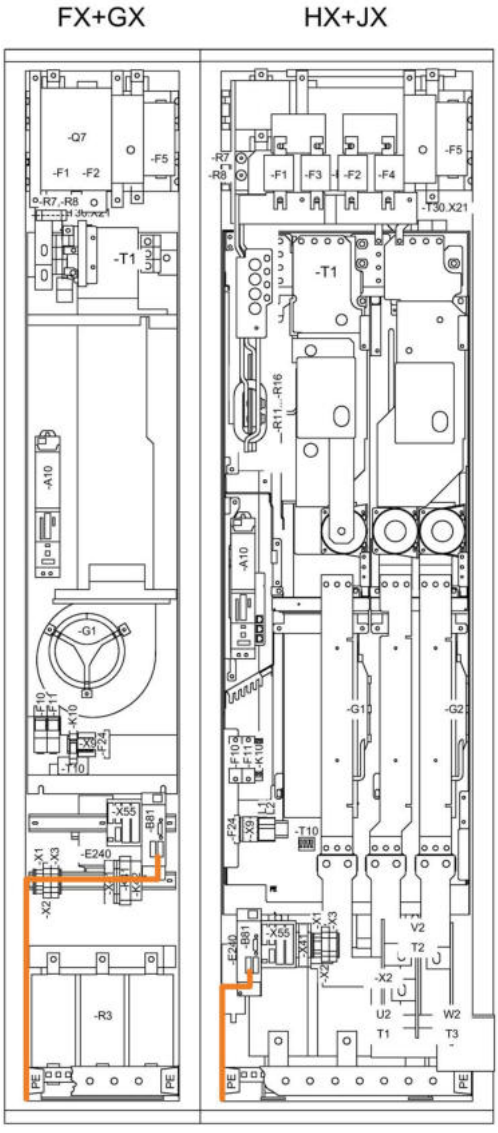
Note
Cable routing

The procedure is the same as that for customer terminal block -X55.

Connect the cable to the terminals to control the functions.

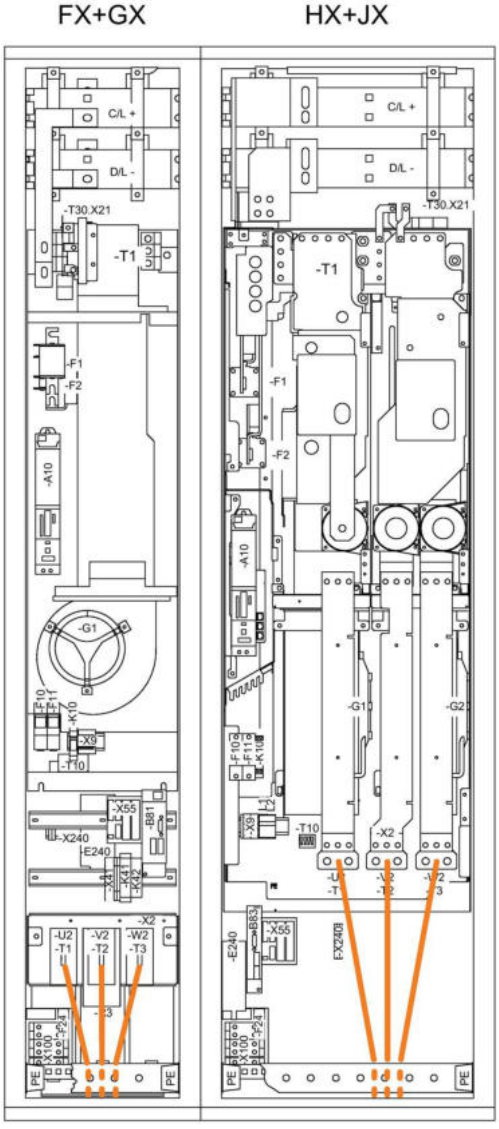
(→ See Chapter "Options", Section "K87, Terminal Module TM54F")

Cable routing for signal cables to SMC10/20/30 Sensor Module



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Guide the cable further up into the cabinet and, when it reaches the SMC10/20/30 Sensor Module (-B81/-B82/-B83), guide it to the right to the Sensor Module. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable at the encoder module SMC10/20/30 (-B81/-B82/-B83).
   (→ See Chapter "Options", K46, K48 and K50 (Sensor Module Cabinet-Mounted SMC10, 20 and 30))

Cable routing for motor connection



1. Feed the cable into the cabinet from below.
2. Feed the cable up through the cabinet to the motor connections -U2/-T1, -V2/-T2, -W2/-T3.
3. Fasten the cable at suitable points.
4. Connect the cable to the connections.

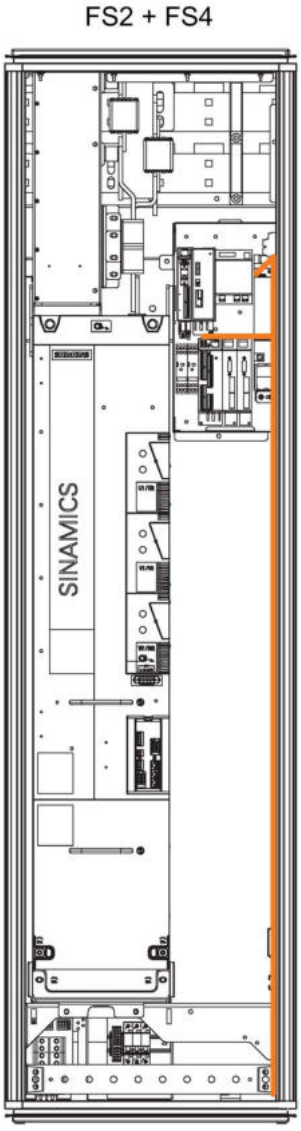
4.5.12.9 Cable routing for Motor Modules in the Chassis-2 format

For Motor Modules in the Chassis-2 format, the customer must carry out the following cabling or connection work:

Table 4- 22 Checklist for cabling or connection work for Motor Modules in the Chassis-2 format

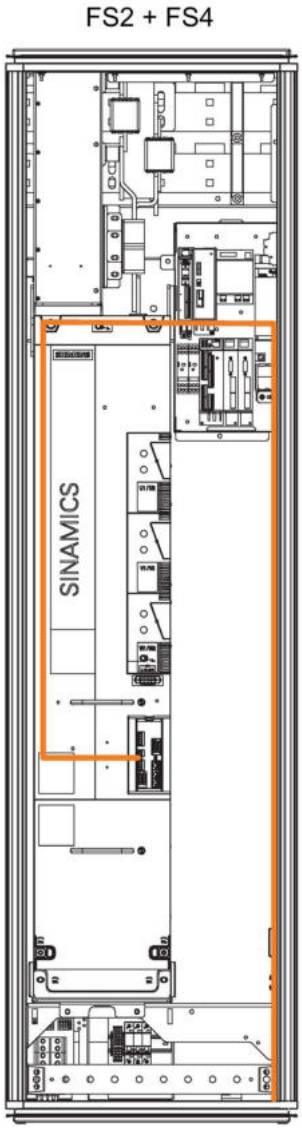
Cable routing	Completed?
PROFIBUS cable or PROFINET cable, DRIVE-CLiQ connections/signal cables to the Control Unit Signal cables to option modules	
Signal cables to the terminal strips on the Motor Module Chassis-2	
Cable connection between motor and Motor Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for PROFIBUS or PROFINET connection, signal cables to the Control Unit, signal cables to option modules



1. Introduce the signal cable from the bottom right in the cabinet, and route upwards in the cable duct.
2. At the height of the Control Unit or the option modules, route the cable out of the cable duct and route in parallel to the already installed standard cables in the cabinet.
3. Use cable ties to secure the cable at suitable points.
4. Connect the cable to the Control Unit or to the appropriate option modules.
   (→See SINAMICS S120 Manual Control Units and supplementary system components)

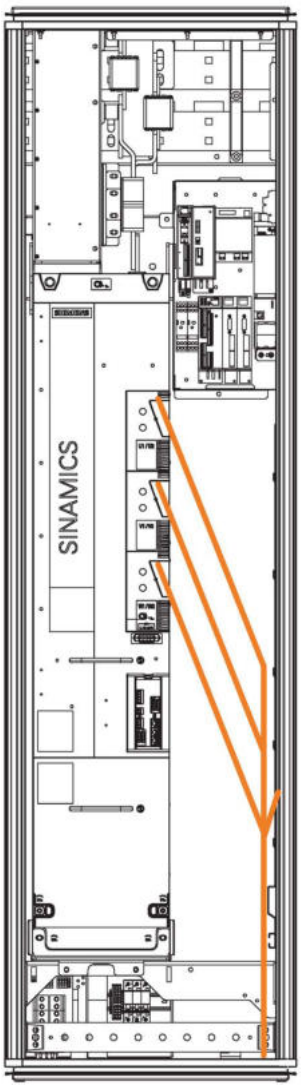
Cable routing for signal cables to the terminal strips on the Motor Module Chassis-2



1. Route the signal cable to the terminal strips from the bottom right in the cabinet, and route upwards in the cable duct.
2. At the height of the option modules, route the cable out of the cable duct to the left hand side of the Motor Modules Chassis-2, and then route downwards to the terminal strips.
3. Use cable ties to secure the cable at suitable points.
4. Connect the cable to the terminal strip.

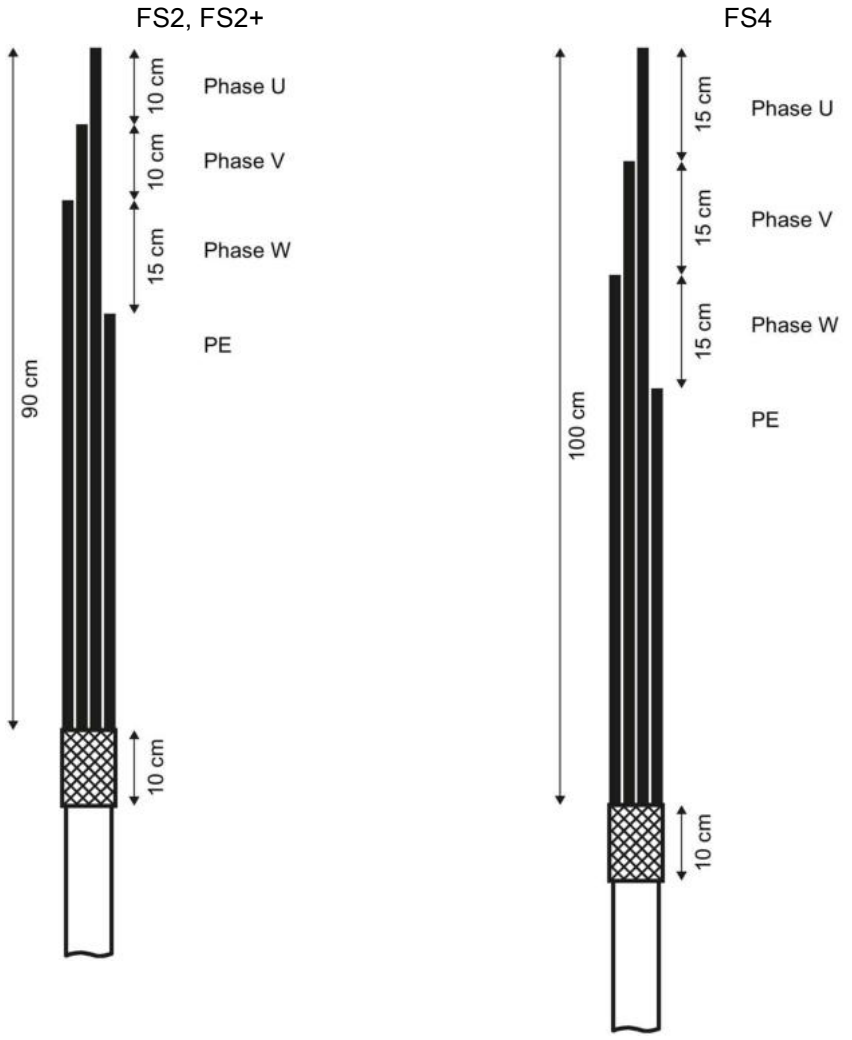
Cable routing for motor connection

FS2 + FS4



1. Prepare the motor cable by stripping the insulation and cutting to length as shown in the following diagram.
2. Route the motor cable into the cabinet from below.
3. Fasten the motor cable to the cable retaining bar, and were applicable to the shield bar.
4. Measure the final lengths of the motor cable in the cabinet, and appropriately adapt the individual phases.
5. Attach the cable lugs to the individual phases.
6. Connect the cable to the motor connections.
7. Connect the PE cables to the PE connection plate.

Table 4- 23 Dimensions for stripping insulation and cutting the motor cables to length

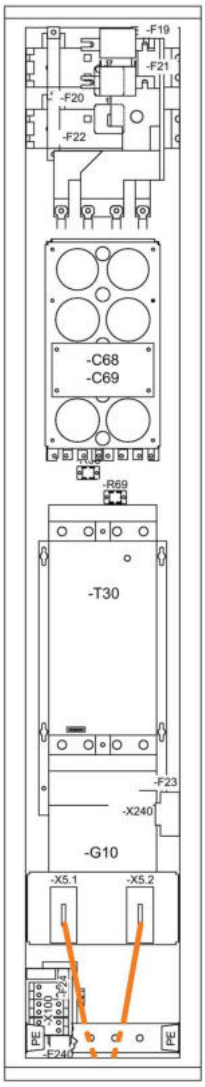


Note

Dimensions for stripping insulation and cutting the motor cables to length for option M89 "Extended motor connection power" are provided in Chapter "M89, extended motor connection panel (Page 671)".

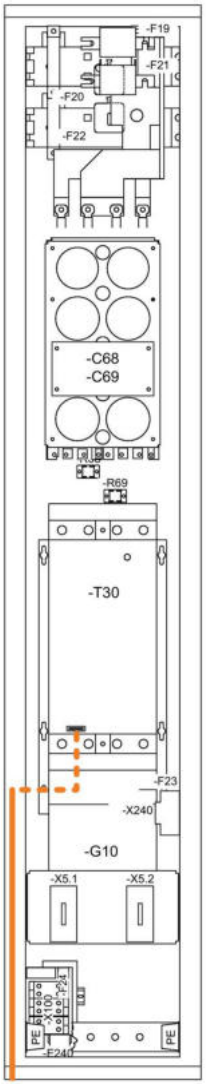
4.5.12.10 Cable routing for Central Braking Modules

Cable routing to the braking resistor



1. Feed the cable into the cabinet from below.
2. Feed the cable up and behind the PE busbar to the braking resistor terminals.
3. Connect the cable to terminals -X5.1 and -X5.2.

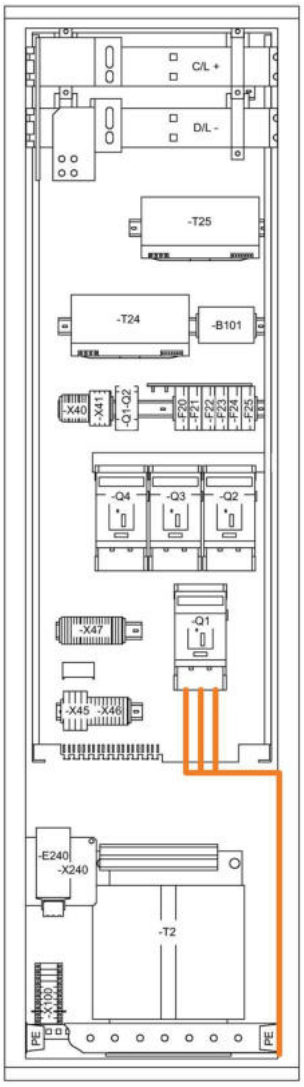
Cable routing to terminal block -X2



1. Feed the cable into the cabinet from the bottom left.
2. Guide the cable up and, when it reaches the level of terminal -X2, guide it to the right.
3. Continue to feed the cable upwards, securing it at suitable points using cable ties.
4. Connect the cable to terminals -X2.

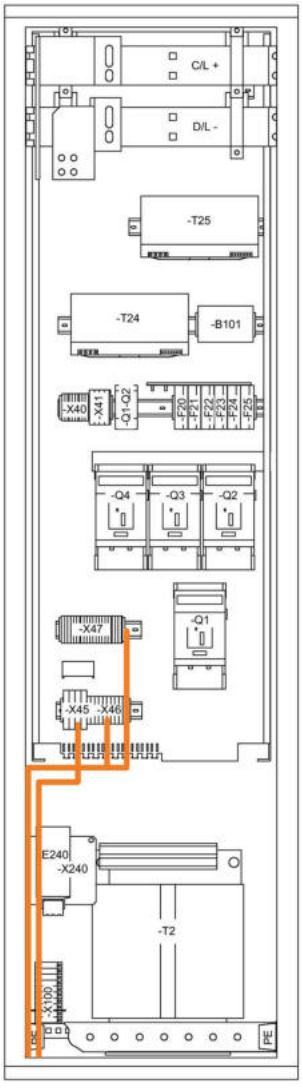
4.5.12.11 Cable routing for Auxiliary Power Supply Modules

Cable routing for connecting to the supply infeed



1. Feed the cable into the cabinet from the bottom right.
2. Guide the cable up and, when it reaches the level of the line connection, guide it to the left.
3. Secure the cable at suitable points.
4. Connect the cable to the line terminals.

Cable routing for signal cables to terminal blocks -X45, -X46, -X47



1. Feed the cable into the cabinet from the bottom left.
2. Guide the cable up and, when it reaches the terminal blocks, to the right.
3. Secure the cable at suitable points.
4. Connect the cable to terminals -X45, -X46, and -X47.

Cabinet Modules

5

5.1 Line Connection Modules

5.1.1 Description

Note

Additional information

Refer to the layout diagrams and circuit diagrams provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-1 Line Connection Module

Power is fed to the drive line-up via Line Modules, which generate a DC voltage from the line voltage and, therefore, supply energy to the Motor Modules connected to the DC link. They are suitable for connection to systems grounded at the neutral point (TN, TT) and non-grounded (IT) systems. The Line Modules are connected to the incoming supply via Line Connection Modules and are equipped with a radio interference suppression filter in accordance with EN 61800-3, Category C3 as a standard feature.

Line Connection Modules contain the line-side infeed with main breaker and fuse switch disconnector or circuit breaker and provide the connection between the plant power system and the Line Modules.

Line Connection Modules are available for the following voltages and currents:

Input voltage	Rated infeed / regenerative feedback current
3 AC 380 ... 480 V	250 ... 3200 A
3 AC 500 ... 690 V	280 ... 3200 A

Table 5- 1 X1 terminals for the supply infeed

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3-phase AC power input	Voltage: 380 V 3 AC –10% to 480 V 3 AC +10% (-15% < 1 min) 500 V 3AC –10% to 690 V 3 AC +10% (-15% < 1 min) Frequency: 47 ... 63 Hz

Depending on the input current, the following designs are used:

- ≤ 800 A: Main breaker with fuse switch disconnector
- > 800 A: Circuit breaker, type 3WL, with option L25 as draw-out circuit breaker

Configuration

Note

Additional information

The configuration examples of the individual Line Connection Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

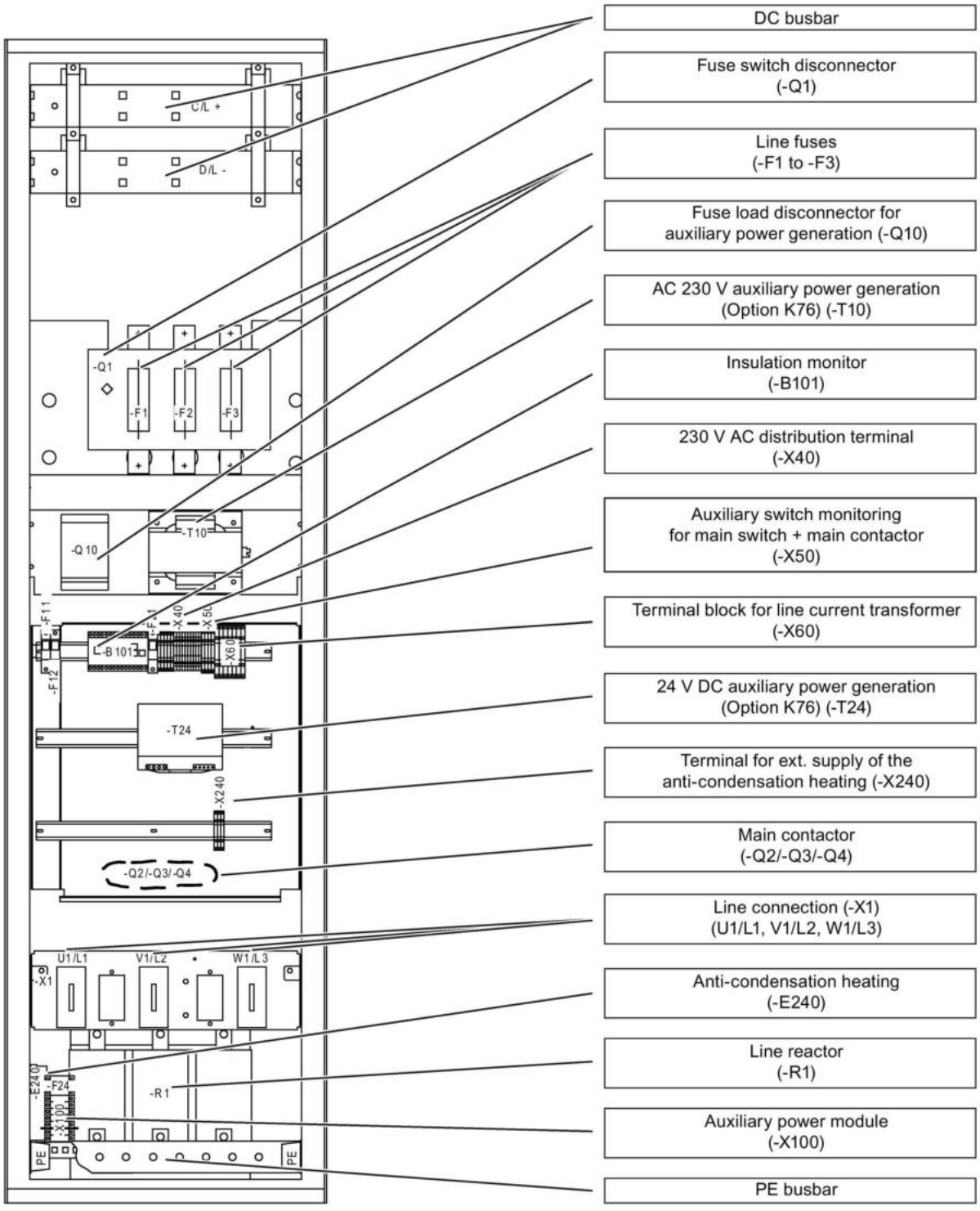


Figure 5-2 Configuration example for Line Connection Modules (frame size HL)

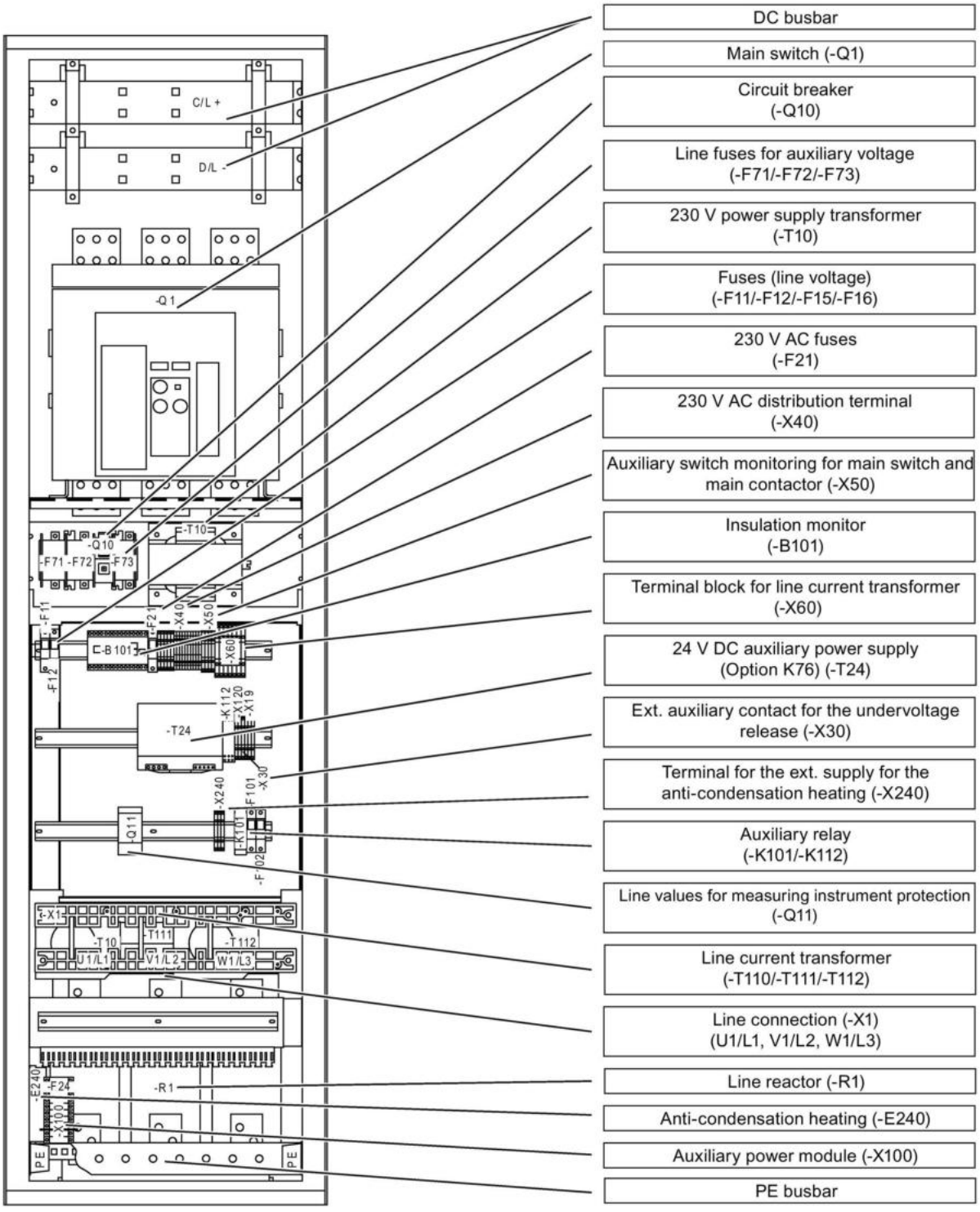


Figure 5-3 Configuration example for Line Connection Modules (frame size JL)

5.1.1.1 Fuse switch disconnector (input current ≤ 800 A)

Up to 800 A, a switch disconnector with integrated fuses and a main contactor are installed. The contactor is controlled internally.

NOTICE
Material damage caused by switching the line contactor under load Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor. • Always switch the line contactor at zero current.

X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Table 5- 2 Terminal block X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Terminal	Designation [1]	Technical data
1	NO	"Fuse switch disconnector" checkback contacts Max. load current: 3 A max. Switching voltage: 250 VAC
2	NC	
3	COM	
4	NO	"Main contactor" feedback signal contacts Max. load current: 10 A Max. Switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: normally-closed contact, NO: normally-open contact, COM: Center contact

5.1.1.2 Circuit breaker (input current > 800 A)

At currents greater than 800 A, the circuit breaker, which is located in the center of the cabinet, takes on the function of isolating the system from the supply and the overload and short-circuit protection. The circuit breaker is internally activated and has its own internal power supply.

As a consequence, the device is sufficiently protected using the factory setting.

The circuit breaker is set in the factory corresponding to the following table:

Table 5- 3 Factory setting of the circuit breaker for Line Connection Modules for Basic Line Modules

Article number Line Connection Module	Article number Basic Line Module	Input current Line Module	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (t_{sd})
6SL3700-0LE41-3AA3	6SL3730-1TE41-2AA3	1010 A	0.9	2	0
6SL3700-0LE41-6AA3	6SL3730-1TE41-5AA3	1265 A	0.8	2	0
6SL3700-0LE42-0AA3	6SL3730-1TE41-8AA3	1630 A	0.9	2	0
6SL3700-0LE42-0BA3	6SL3730-1TE41-2Bx3	2x 935 A	1.0	2	0
6SL3700-0LE42-5BA3	6SL3730-1TE41-5Bx3	2x 1170 A	1.0	2	0
6SL3700-0LE43-2BA3	6SL3730-1TE41-8Bx3	2x 1508 A	1.0	2	0
6SL3700-0LG41-0AA3	6SL3730-1TG41-1AA3	925 A	1.0	2	0
6SL3700-0LG41-3AA3	6SL3730-1TG41-4AA3	1180 A	1.0	2	0
6SL3700-0LG41-6AA3	6SL3730-1TG41-8AA3	1580 A	1.0	2	0
6SL3700-0LG42-0BA3	6SL3730-1TG41-1Bx3	2 x 855 A	0.9	2	0
6SL3700-0LG42-5BA3	6SL3730-1TG41-4Bx3	2 x 1092 A	0.9	2	0
6SL3700-0LG43-2BA3	6SL3730-1TG41-8Bx3	2 x 1462 A	1.0	2	0

Table 5- 4 Factory setting of the circuit breaker for Line Connection Modules for Smart Line Modules

Article number Line Connection Module	Article number Smart Line Module	Input current Line Module	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (t_{sd})
6SL3700-0LE41-0AA3	6SL3730-6TE41-1AA3	883 A	0.9	2	0
6SL3700-0LE41-3AA3	6SL3730-6TE41-3AA3	1093 A	0.9	2	0
6SL3700-0LE41-6AA3	6SL3730-6TE41-7AA3	1430 A	0.9	2	0
6SL3700-0LE42-0BA3	6SL3730-6TE41-1Bx3	2 x 817 A	0.9	2	0
6SL3700-0LE42-5BA3	6SL3730-6TE41-3Bx3	2 x 1011 A	0.9	2	0
6SL3700-0LE43-2BA3	6SL3730-6TE41-7Bx3	2 x 1323 A	0.9	2	0
6SL3700-0LG41-3AA3	6SL3730-6TG41-2AA3	1009 A	0.9	2	0
6SL3700-0LG41-6AA3	6SL3730-6TG41-7AA3	1430 A	0.9	2	0
6SL3700-0LG42-0BA3	6SL3730-6TG38-8Bx3	2 x 700 A	0.8	2	0
6SL3700-0LG42-0BA3	6SL3730-6TG41-2Bx3	2 x 934 A	1.0	2	0
6SL3700-0LG43-2BA3	6SL3730-6TG41-7Bx3	2 x 1323 A	0.9	2	0

Table 5- 5 Factory setting of the circuit breaker for Line Connection Modules for Active Line Modules

Article number Line Connection Module	Article number Active Line Module	Input current Line Module	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (t_{sd})
6SL3700-0LE41-0AA3	6SL3730-7TE38-4BA3	840 A	0.9	2	0
6SL3700-0LE41-3AA3	6SL3730-7TE41-0BA3	985 A	0.8	2	0
6SL3700-0LE41-6AA3	6SL3730-7TE41-4BA3	1405 A	0.9	2	0
6SL3700-0LE42-0BA3	6SL3730-7TE41-0Bx3	2 x 936 A	1.0	2	0
6SL3700-0LE43-2BA3	6SL3730-7TE41-4Bx3	2 x 1335 A	0.9	2	0
6SL3700-0LG41-3AA3	6SL3730-7TG41-0BA3	1025 A	0.9	2	0
6SL3700-0LG41-6AA3	6SL3730-7TG41-3BA3	1270 A	0.8	2	0
6SL3700-0LG42-0BA3	6SL3730-7TG37-4Bx3	2 x 698 A	0.7	2	0
6SL3700-0LG42-0BA3	6SL3730-7TG41-0Bx3	2 x 974 A	1.0	2	0
6SL3700-0LG42-5BA3	6SL3730-7TG41-3Bx3	2 x 1206 A	1.0	2	0

⚠WARNING

Incorrect circuit breaker setting

Incorrect settings can cause unwanted or delayed tripping of the circuit breaker and result in damage to the cabinet unit and can therefore result in death or severe injury.

- Check the settings described above, and if required, adapt the circuit breaker settings corresponding to the factory setting.

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker as well as the standard and additional options can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

X50 "circuit breaker" checkback contact

Table 5- 6 Terminal block X50 "Circuit-breaker" checkback contact

Terminal	Designation [1]	Technical data
1	NO	"Circuit breaker" checkback contacts
2	NC	Max. load current: 3 A
3	COM	Max. switching voltage: 250 VAC
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

X30 looping in an external EMERGENCY OFF

Terminal block -X30 provides you with the option of connecting an external EMERGENCY OFF (normally-closed contact) for switching off the circuit breaker.

Table 5- 7 Terminal block X30 "External EMERGENCY OFF" checkback contact

Terminal	Technical data
1	Factory-installed jumper between terminal 1 and terminal 2; this jumper must be removed if a normally-closed contact is looped in externally.
2	
Max. connectable cross-section: 2.5 mm²	

5.1.1.3 Terminal block -X40 external 230 V AC auxiliary infeed

Terminal block -X40 provides you with the option of connecting an external auxiliary infeed (such as an uninterruptible power supply) that is independent of the main infeed. The connection may be protected with up to a 16 A fuse.

Table 5- 8 Terminal block X40 external 230 VAC auxiliary infeed

Terminal	Designation	Technical data
1	L1	Factory-installed jumper to terminal 2; this jumper must be removed if an external infeed is used.
2	L1	Connection of external 230 VAC auxiliary infeed: L1
5	N	Factory-installed jumper to terminal 6; this jumper must be removed if an external infeed is used.
6	N	Connection of external 230 VAC auxiliary infeed: N
Max. connectable cross-section: 2.5 mm²		

5.1.2 Versions of Line Connection Modules

Different versions to suit specific input currents are available:

- Units ≤ 800 A are equipped with a main breaker with fuse switch disconnector
- Units > 800 A are equipped with a fixed-mounted circuit breaker (draw-out circuit breaker is available as option)

Line Connection Modules come in the following versions (specified by an option code) according to the type of the Line Module that is being fed:

- for Active Line Modules: Order code L42
- for Basic Line Modules: Order code L43
- for Smart Line Modules: Order code L44

5.1.2.1 Version L42 for Active Line Modules



Figure 5-4 Connection example: Line Connection Module ≤800 A for connection to Active Line Modules, option L42

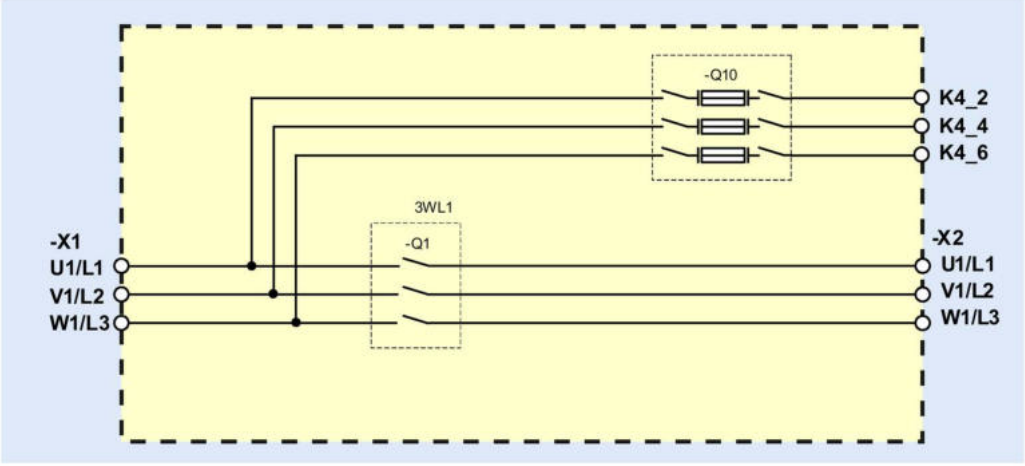


Figure 5-5 Connection example: Line Connection Module >800 A for connection to Active Line Modules, option L42

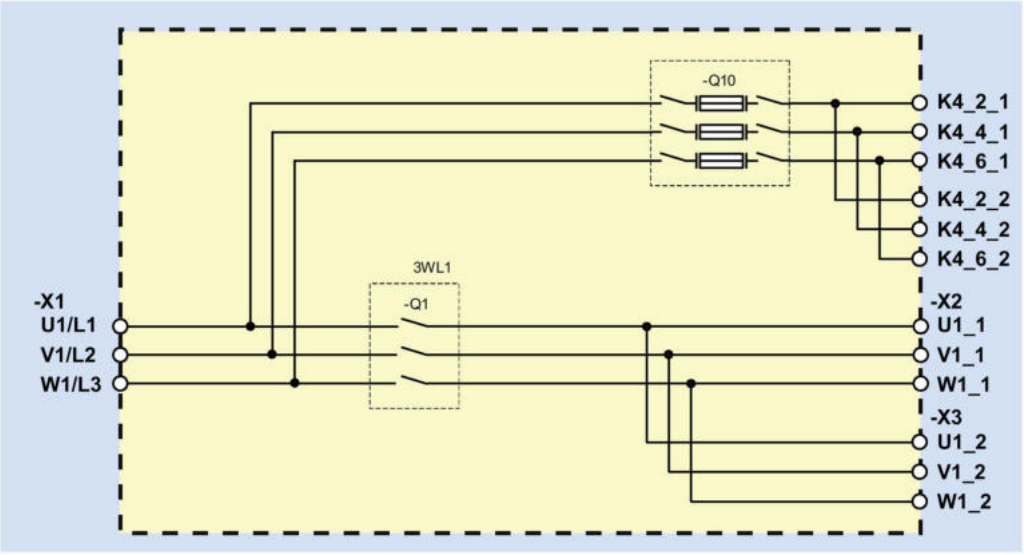


Figure 5-6 Connection example: Line Connection Module ≥2000 A for connection to Active Line Modules in parallel connection, option L42

5.1.2.2 Version L43 for Basic Line Modules

When Basic Line Modules are used, a line reactor is incorporated as a standard feature.

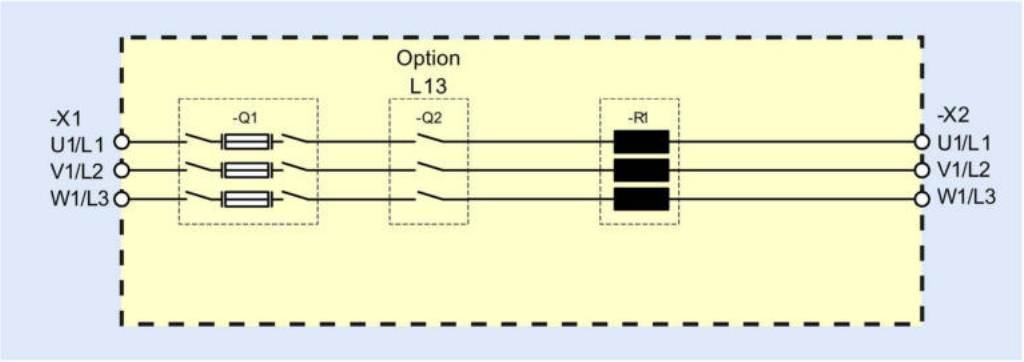


Figure 5-7 Connection example: Line Connection Module ≤ 800 A for connection to Basic Line Modules, options: L43, L13

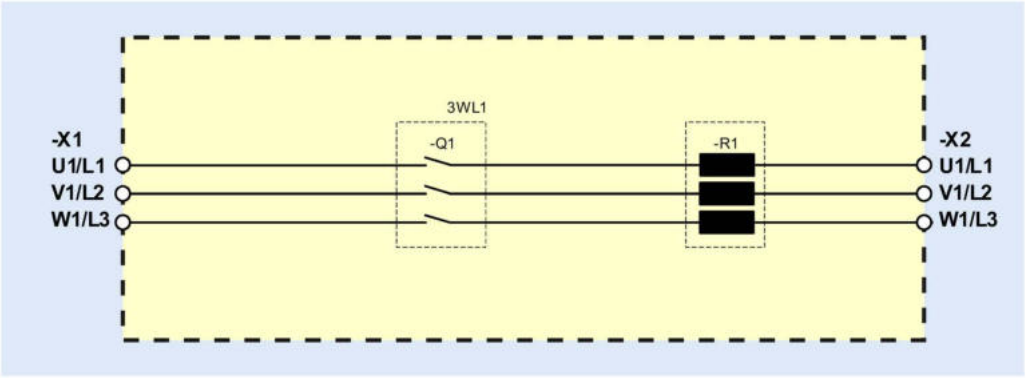


Figure 5-8 Connection example: Line Connection Module >800 A, <1800 A for connection to Basic Line Modules, option L43

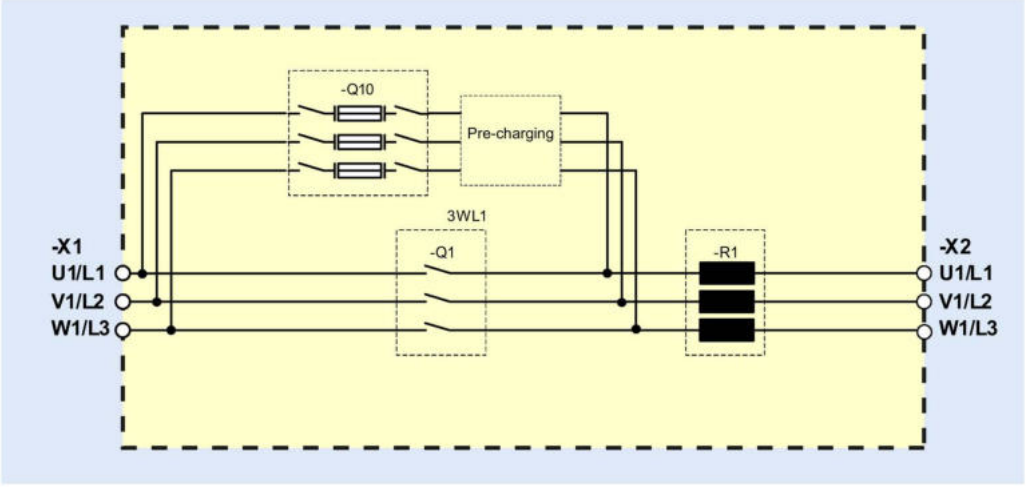


Figure 5-9 Connection example: Line Connection Module >1800 A, <2000 A for connection to Basic Line Modules, option L43

If Basic Line Modules that are fed via a common Line Connection Module are connected in parallel, line reactors are generally incorporated in the Line Connection Module.

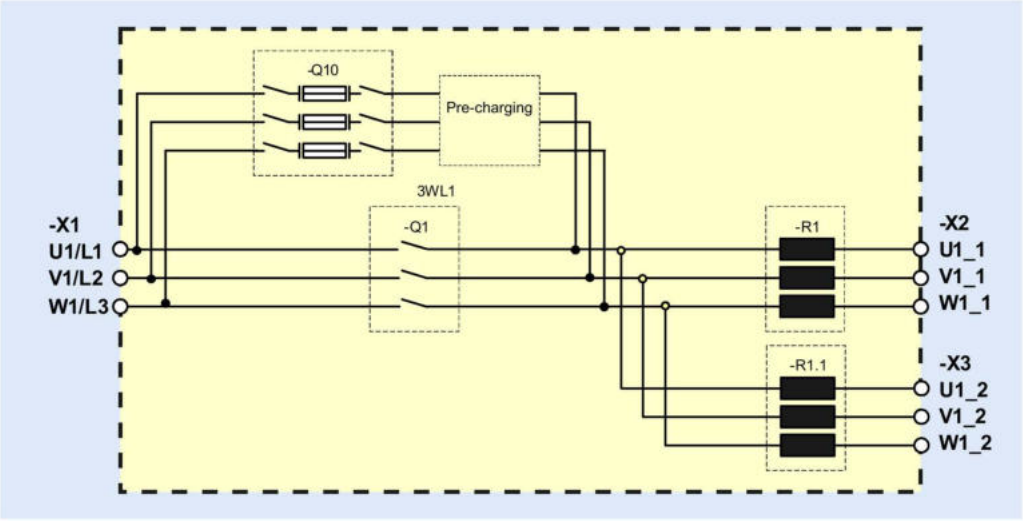


Figure 5-10 Connection example: Line Connection Module ≥2000 A for connection to Basic Line Modules in parallel connection, option L43

5.1.2.3 Version L44 for Smart Line Modules

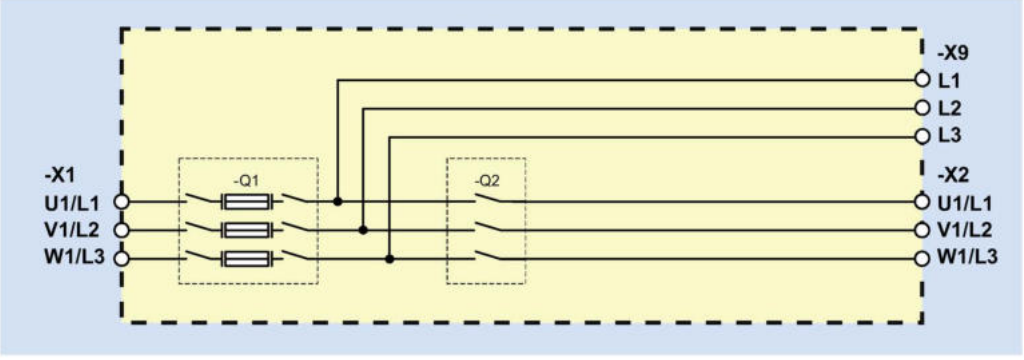


Figure 5-11 Connection example: Line Connection Module ≤800 A for connection to Smart Line Modules, option L44

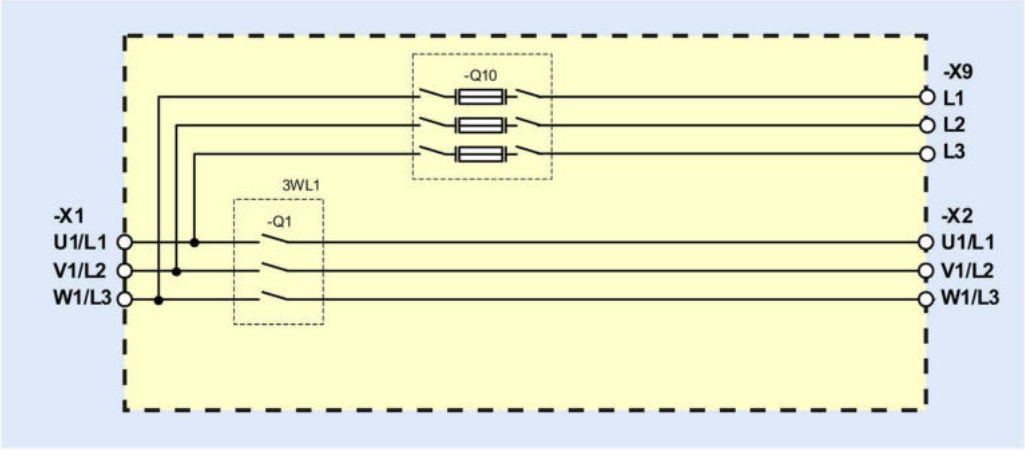


Figure 5-12 Connection example: Line Connection Module >800 A for connection to Smart Line Modules, option L44

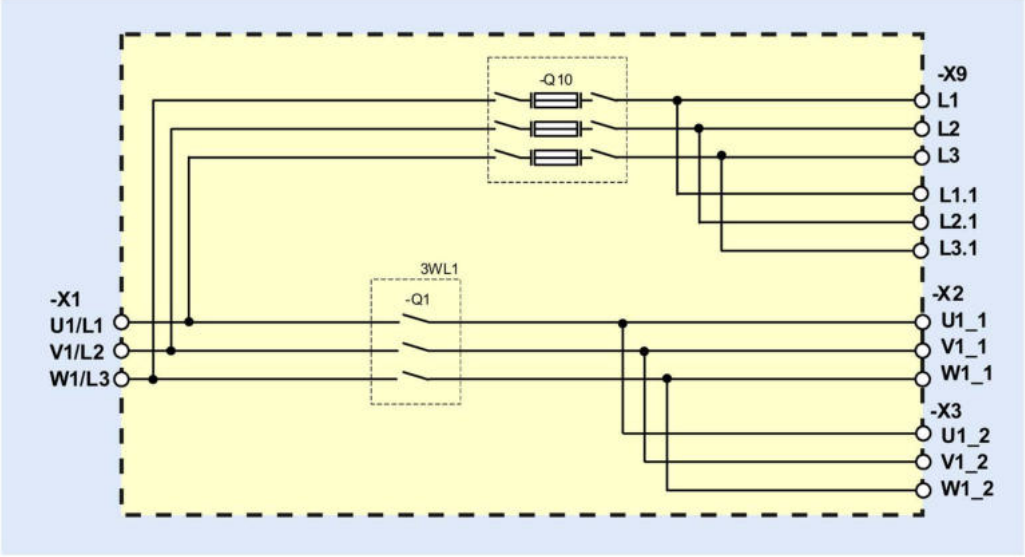


Figure 5-13 Connection example: Line Connection Module >1600 A for connection to Smart Line Modules in parallel connection, option L44

5.1.3 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
1 temperature sensor module TM150	G51
2 temperature sensor modules TM150	G52
3 temperature sensor modules TM150	G53
4 temperature sensor modules TM150	G54
Fan power supply	K70
Auxiliary power generation in the Line Connection Module	K76
Use in the first environment according to EN 61800-3, Category C2 (TN/TT systems)	L00
Main contactor (for Line Connection Modules ≤ 800 A)	L13
Surge suppression	L21
Line reactor not included in the scope of delivery (for Basic Line Modules)	L22
Draw-out circuit breaker (for Line Connection Modules > 800 A)	L25
Current transformer upstream of main breaker	L41
Line Connection Module for Active Line Modules	L42
Line Connection Module for Basic Line Modules	L43
Line Connection Module for Smart Line Modules	L44
EMERGENCY OFF pushbutton installed in the cabinet door	L45
Grounding switch upstream of circuit breaker	L46
Grounding switch downstream of circuit breaker	L47
Cabinet lighting with service socket	L50
Cabinet anti-condensation heating	L55
Insulation monitoring	L87
Measuring instrument for line values (installed in the cabinet door)	P10
Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door	P11

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
Additional shock protection	M60
EMC shield bus	M70
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.1.4 Technical data

Table 5- 9 Technical data for Line Connection Modules, 3 AC 380 ... 480 V, part I

Article No.	**6SL3700-**	**0LE32-5AA3**	**0LE34-0AA3**	**0LE36-3AA3**	**0LE38-0AA3**	**0LE41-0AA3**
Infeed/regenerative feedback current						
- Rated current $I_{N\,E}$	A	250	380	600	770	1000
Supply voltages						
- Line voltage	V_{ACrms}	3 AC 380 -10% ... 3 AC 480 +10% (-15% < 1 min)				
- Line frequency	Hz	47 ... 63 Hz				
230 VAC current consumption[1]						
- Inrush current	A	3.6	3.6	3.6	10.8	0.5
- Holding current	A	0.04	0.04	0.04	0.12	0.06
Power loss, max. [2]						
with 50 Hz 400 V						
- Option L42/L44	kW	0.115	0.19	0.31	0.39	0.18
- Option L43	kW	--	--	0.675	0.74	--
with 60 Hz 460 V						
- Option L42/L44	kW	0.115	0.19	0.31	0.39	0.18
- Option L43	kW	--	--	0.675	0.74	--
Fan						
- Current consumption 230 VAC	A	--	--	--	--	1.07
- Cooling air requirement [3]	m^3/s	--	--	--	--	0.36
- Sound pressure level L_{PA} (1 m) with 50/60 Hz	dB(A)	--	--	--	--	68/70
Line connection L1, L2, L3		2/M12	2/M12	2/M12	4/M12	10/M12
- Connection cross-section, max (IEC)	mm^2	2 x 150	2 x 150	4 x 240	8 x 240	8 x 240
PE/GND connection		PE busbar				
- Busbar cross-section	mm^2	600				
- Connection cross-section, max. (IEC)	mm^2	240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)						
- Width	mm	400	400	600	600	600
- Height [4]	mm	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600
Weight						
- Option L42, L44	kg	210	230	310	340	450
- Option L43	kg	--	--	360	420	--
Frame size		FL	FL	GL	HL	JL
Rated short-circuit current acc. to IEC	kA	50	50	50	50	100
Minimum short-circuit current [5]	kA	3	3	8	12	2

1) Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

2) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

3) For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

4) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5) Minimum current required for reliable tripping of the protective devices.

Table 5- 10 Technical data for Line Connection Modules, 3 AC 380 ... 480 V, part II

Article No.	**6SL3700-**	**0LE41-3AA3**	**0LE41-6AA3**	**0LE42-0AA3**	**0LE42-0BA3** [5]	**0LE42-5BA3** [5]	**0LE43-2BA3** [5]
Infeed/regenerative feedback current - Rated current $I_{N\,E}$	 A	 1250	 1600	 2000	 2000	 2500	 3200
Supply voltages - Line voltage - Line frequency	 V_{ACrms} Hz	3 AC 380 -10% ... 3 AC 480 +10% (-15% < 1 min) 47 ... 63 Hz					
230 VAC current consumption[1] - Inrush current - Holding current	 A A	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.04
Power loss, max. [2] **with 50 Hz 400 V** - Option L42/L44 - Option L43 **with 60 Hz 460 V** - Option L42/L44 - Option L43	 kW kW kW kW	 0.29 0.787 0.29 0.787	 0.41 1.186 0.41 1.186	 0.6 1.366 0.6 1.366	 0.6 1.594 0.6 1.594	 0.95 2.502 0.95 2.502	 0.95 2.482 0.95 2.482
Fan - Current consumption 230 VAC - Cooling air requirement [3] - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A m^3/s dB(A)	 1.07 0.36 68/70	 1.07 0.36 68/70	 2.14 0.72 70/72	 2.14 0.72 70/72	 2.14 0.72 70/72	 2.14 0.72 70/72
Line connection L1, L2, L3 - Conductor cross-section, max. (IEC)	mm^2	10/M12	10/M12	10/M12 + 4/M16	10/M12 + 4/M16	10/M12 + 4/M16	10/M12 + 4/M16
		8 x 240	10 x 240	10 x 240	10 x 240	10 x 240	10 x 300
PE/GND connection - Busbar cross-section - Connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [4] - Depth	 mm mm mm	 600 2200 600	 600 2200 600	 1000 2200 600	 1000 2200 600	 1000 2200 600	 1000 2200 600
Weight - Option L42, L44 - Option L43	 kg kg	 470 570	 490 650	 600 760	 620 820	 620 900	 720 1000
Frame size		JL	JL	KL	KL	KL	LL
Rated short-circuit current acc. to IEC	kA	100	100	100	100	100	100
Minimum short-circuit current [6]	kA	2.5	3.2	4	4	5	6.4

1) Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

2) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

3) For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

4) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5) Ready to connect to parallel Line Modules.

6) Minimum current required for reliable tripping of the protective devices.

Table 5- 11 Technical data for Line Connection Modules, 3 AC 500 ... 690 V, part I

Article No.	**6SL3700-**	**0LG32-8AA3**	**0LG34-0AA3**	**0LG36-3AA3**	**0LG38-0AA3**	**0LG41-0AA3**
Infeed/regenerative feedback current						
- Rated current $I_{N\,E}$	A	280	380	600	780	1000
Supply voltages						
- Line voltage	V_{ACrms}	3 AC 500 -10% ... 3 AC 690 +10% (-15% < 1 min)				
- Line frequency	Hz	47 ... 63 Hz				
230 VAC current consumption[1]						
- Inrush current	A	3.6	3.6	3.6	10.8	0.5
- Holding current	A	0.04	0.04	0.04	0.12	0.06
Power loss, max. [2]						
with 50 Hz 500/690 V						
- Option L42/L44	kW	0.125	0.19	0.31	0.39	0.18
- Option L43	kW	0.402	0.668	0.794	--	0.963
with 60 Hz 575 V						
- Option L42/L44	kW	0.125	0.19	0.31	0.39	0.18
- Option L43	kW	0.402	0.668	0.794	--	0.963
Fan						
- Current consumption 230 VAC	A	--	--	--	--	1.07
- Cooling air requirement [3]	m^3/s	--	--	--	--	0.36
- Sound pressure level L_{PA} (1 m) with 50/60 Hz	dB(A)	--	--	--	--	68/70
Line connection L1, L2, L3		2/M12	2/M12	2/M12	2/M12	10/M12
- Connection cross-section, max (IEC)	mm^2	2 x 150	2 x 150	4 x 240	8 x 240	8 x 240
PE/GND connection		PE busbar				
- Busbar cross-section	mm^2	600				
- Connection cross-section, max. (IEC)	mm^2	240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)						
- Width	mm	400	600	600	600	600
- Height [4]	mm	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600
Weight						
- Option L42, L44	kg	220	230	310	340	450
- Option L43	kg	260	310	400	--	650
Frame size		FL	FL	GL	HL	JL
Rated short-circuit current acc. to IEC	kA	50	50	50	50	85
Minimum short-circuit current [5]	kA	3	3.5	9	15	2

[1] Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

[2] The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

[3] For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

[4] The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

[5] Minimum current required for reliable tripping of the protective devices.

Table 5- 12 Technical data for Line Connection Modules, 3 AC 500 ... 690 V, part II

Article No.	**6SL3700-**	**0LG41-3AA3**	**0LG41-6AA3**	**0LG42-0BA3** [5]	**0LG42-5BA3** [5]	**0LG43-2BA3** [5]
Infeed/regenerative feedback current - Rated current I_{NE}	 A	 1250	 1600	 2000	 2500	 3200
Supply voltages - Line voltage - Line frequency	 V_{ACrms} Hz	3 AC 500 -10% ... 3 AC 690 +10% (-15% < 1 min) 47 ... 63 Hz				
230 VAC current consumption[1] - Inrush current - Holding current	 A A	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06
Power loss, max. [2] **with 50 Hz 500/690 V** - Option L42/L44 - Option L43 **with 60 Hz 575 V** - Option L42/L44 - Option L43	 kW kW kW kW	 0.29 1.073 0.29 1.073	 0.41 1.387 0.41 1.387	 0.6 2.166 0.6 2.166	 0.6 2.166 0.6 2.166	 0.95 2.894 0.95 2.894
Fan - Current consumption 230 VAC - Cooling air requirement [3] - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A m^3/s dB(A)	 1.07 0.36 68/70	 1.07 0.36 68/70	 2.14 0.72 70/72	 2.14 0.72 70/72	 2.14 0.72 70/72
Line connection L1, L2, L3 - Conductor cross-section, max. (IEC)	mm^2	10/M12 8 x 240	10/M12 8 x 240	10/M12 + 4/M16 10 x 240	10/M12 + 4/M16 10 x 240	10/M12 + 4/M16 10 x 240
PE/GND connection - Busbar cross-section - Connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [4] - Depth	 mm mm mm	 600 2200 600	 600 2200 600	 1000 2200 600	 1000 2200 600	 1000 2200 600
Weight - Option L42, L44 - Option L43	 kg kg	 470 670	 490 680	 600 980	 620 1000	 720 1080
Frame size		JL	JL	KL	KL	LL
Rated short-circuit current acc. to IEC	kA	85	85	85	85	85
Minimum short-circuit current [6]	kA	2.5	3.2	4	5	6.4

1) Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

2) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

3) For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

4) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5) Ready to connect to parallel Line Modules.

6) Minimum current required for reliable tripping of the protective devices.

5.2 Basic Line Modules

5.2.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-14 Basic Line Module

Basic Line Modules are compact line infeeds for two-quadrant operation, i.e. no regenerative feedback.

Under full load, the DC link voltage is higher than the rms value of the rated line voltage by a factor of 1.32, and under partial load by a factor of 1.35.

They are used in applications where energy does not have to be fed back into the line.

If regenerative conditions occur in the drive line-up, Braking Modules must be used because they convert the excess energy in braking resistors into heat.

Basic Line Modules are suitable for connection to supply systems grounded at the neutral point (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

Line voltage	Rated power
3 AC 380 ... 480 V	200 ... 900 kW
3 AC 500 ... 690 V	250 ... 1500 kW

The power rating can be increased by connecting Basic Line Modules in parallel.

Integration

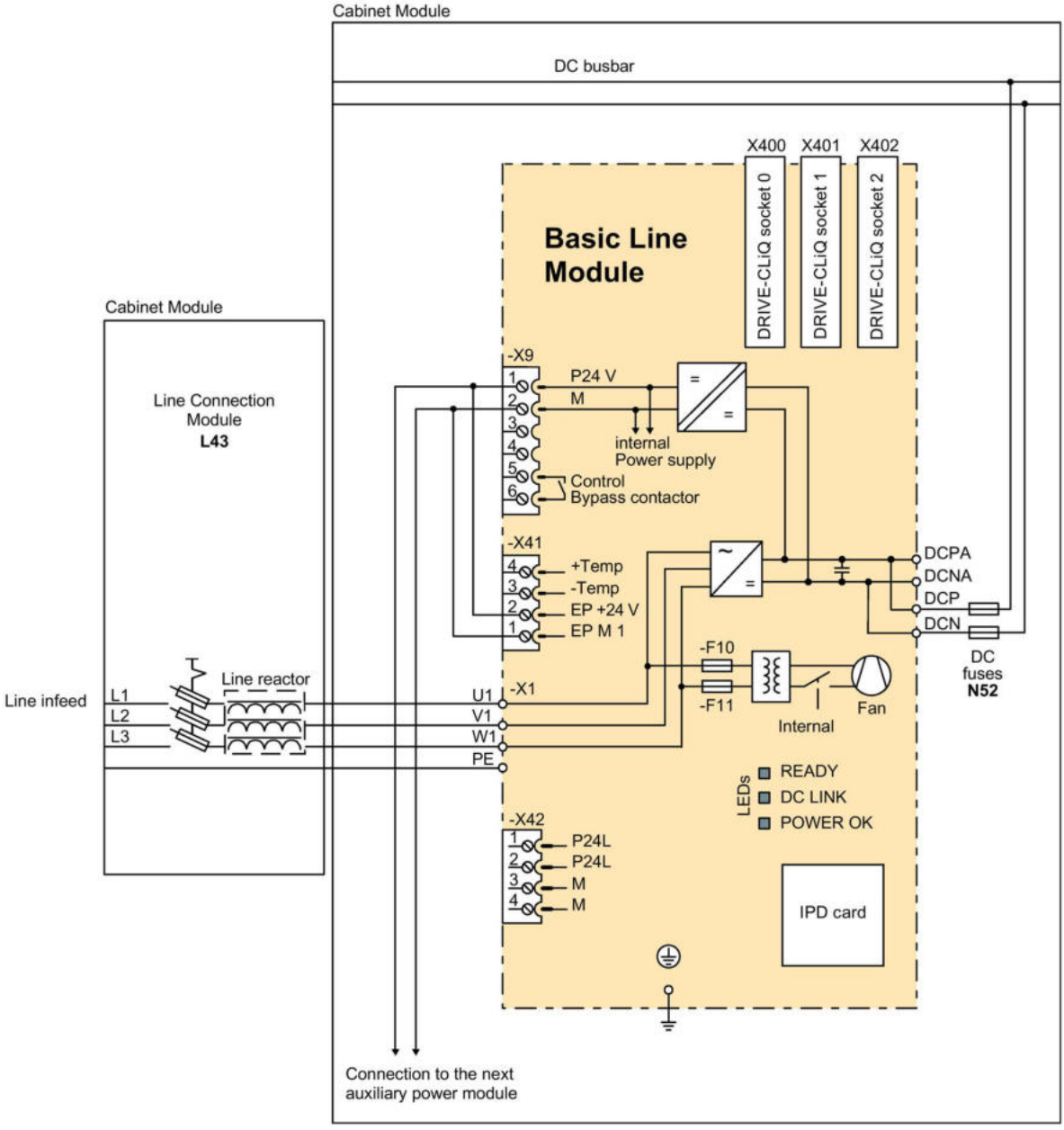


Figure 5-15 Connection example for Basic Line Modules (frame size FB and GB)

Note

X9 terminal assignment for the Basic Line Module (frame size GD)

For the Basic Line Modules, frame size GD, equipped with diode bridge

- The bypass contactor is controlled at terminals -X9:3 and -X9:4
- Precharging is controlled at terminals -X9:5 and -X9:6

Configuration

In Basic Line Modules of frame sizes FB and GB, a fully controlled thyristor bridge precharges the Basic Line Module and the connected DC link. The thyristors normally operate with a trigger delay angle of 0 °.

Basic Line Modules of type GD for 900 kW (400 V) or 1500 kW (690 V) feature a diode bridge. On these units, the DC link is precharged via a separate, line-side precharging device.

Note

Additional information

The configuration examples of the individual Basic Line Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

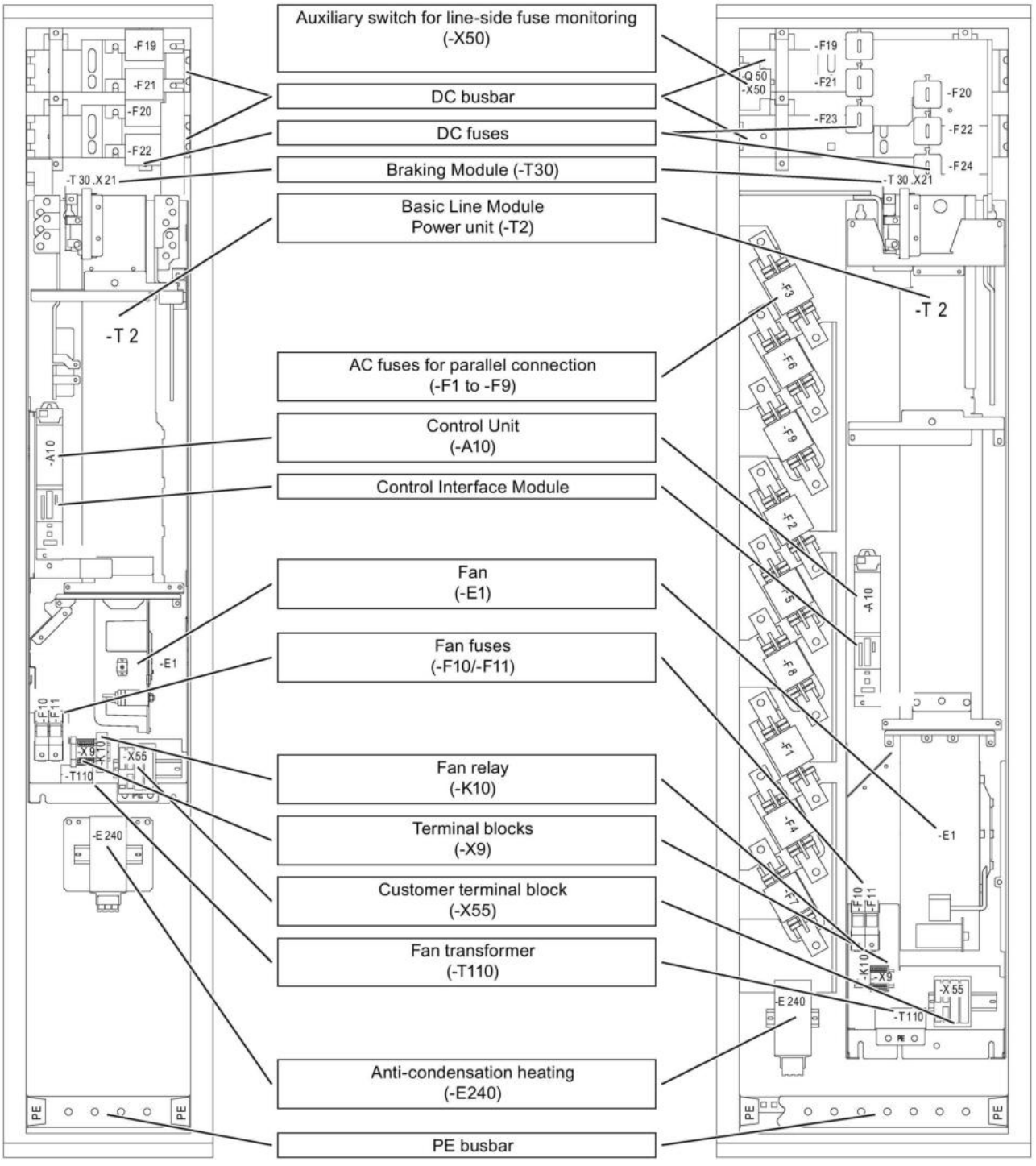


Figure 5-16 Configuration example for Basic Line Modules (frame size FB and GD)

Parallel connection of Basic Line Modules to increase power rating

A pair of Basic Line Modules is available for creating drive line-ups with more power. These modules can be operated on a common Line Connection Module and are arranged to the right and left of the Line Connection Module. The power connections on the Basic Line Module on the left of the Line Connection Module are a mirror image (Article number with "C" in the next to last position, example: 6SL3730-1Tx41-xBC3), which produces a very compact design for the line supply infeed.

The following rules must be observed when connecting Basic Line Modules in parallel:

- Up to four identical Basic Line Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- Special Line Connection Modules are available for connecting the modules in parallel.
- For multiple infeed units, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A derating factor of 7.5% must be taken into consideration, regardless of the number of modules connected in parallel.

When Basic Line Modules are connected in parallel, each having its own Line Connection Module, the main contactors or circuit breakers of the respective Line Connection Modules must switch on together and simultaneously.
The monitoring is realized via terminals -X50 of the particular Line Connection Module.

Note

Requirements placed on the line supply

In addition to the requirements of the three-winding transformer and the SINAMICS infeed, the line supply system must also meet certain standards with respect to the voltage harmonics present at the point of common coupling of the three-winding transformer. You can find more in-depth information about the requirements placed on the line supply in the "SINAMICS - Low Voltage Configuration Manual".

5.2.2 Interface description

5.2.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

5.2.2.2 Control Interface Module

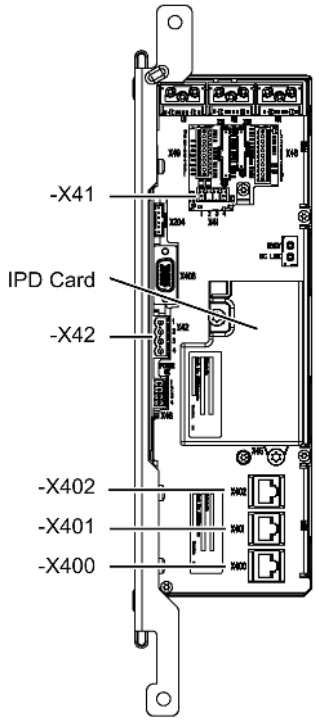
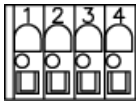


Figure 5-17 Control Interface Module

5.2.2.3 X41 EP terminal / temperature sensor connection

Table 5- 13 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: 1.5 mm^2			



⚠WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT1000 or PTC measuring sensor in the stator windings.

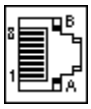
Note

Connection to terminals 1 and 2

24 VDC must be present at terminal 2 and ground at terminal 1 for operation. Pulse suppression is activated when removed.

5.2.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 14 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.2.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Contactor monitoring	G56
Terminal Board TB30	G62
AOP30 operator panel	K08
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
Cabinet anti-condensation heating	L55
25/125 kW braking unit	L61/L64
50/250 kW braking unit	L62/L65
DC fuses	N52

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
Additional shock protection	M60
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.2.4 Technical data

Table 5- 15 Technical data for Basic Line Modules, 3 AC 380 ... 480 V

Article No.	**6SL3730-**	**1TE34-2AA3**	**1TE35-3AA3**	**1TE38-2AA3**	**1TE41-2AA3**	**1TE41-5AA3**	**1TE41-8AA3**
For parallel connection							
- Attached to Line Connection Module on right side		--	--	--	...-2BA3	...-5BA3	...-8BA3
- Attached to Line Connection Module on left side		--	--	--	...-2BC3	...-5BC3	...-8BC3
Rated power							
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	200	250	400	560	710	900
- for $I_{H\,DC}$ (50 Hz 400 V)	kW	160	200	315	450	560	705
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	305	380	585	855	1070	1340
- for $I_{H\,DC}$ (60 Hz 460 V)	hp	275	310	475	695	870	1090
DC-link current							
- Rated current $I_{N\,DC}$	A	420	530	820	1200	1500	1880
- Base load current $I_{H\,DC}$ [1]	A	328	413	640	936	1170	1467
- Maximum current $I_{max\,DC}$	A	630	795	1230	1800	2250	2820
Infeed current							
- Rated current $I_{N\,E}$	A	365	460	710	1010	1265	1630
- Maximum current $I_{max\,E}$	A	547	690	1065	1515	1897	2380
Current consumption							
- Auxiliary supply 24 VDC	A	1.1					
- 400 VAC [2]	A	internal					
DC-link capacitance							
- Basic Line Module	µF	7200	9600	14600	23200	29000	34800
- Drive line-up, max.	µF	57600	76800	116800	185600	232000	139200
Power loss, max. [3]							
- at 50 Hz 400 V	kW	1.9	2.1	3.2	4.6	5.5	6.9
- at 60 Hz 460 V	kW	1.9	2.1	3.2	4.6	5.5	6.9
Cooling air requirement	m^3/s	0.17	0.17	0.17	0.36	0.36	0.36
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	66/68	66/68	66/68	71/73	71/73	71/73
PE/GND connection		PE busbar					
- Busbar cross-section	mm^2	600					
- Connection cross-section, max. (IEC)	mm^2	240					
Cable length, max. [4]							
- Shielded	m	2600	2600	2600	4000	4000	4000
- Unshielded	m	3900	3900	3900	6000	6000	7200
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)							
- Width	mm	400	400	400	400/600/600		
- Height [5]	mm	2200	2200	2200	2200		
- Depth	mm	600	600	600	600		
Weight (standard version)	kg	166	166	166	320/440/480		
Frame size		FB	FB	FB	GB	GB	GD

Article No.	6SL3730-	1TE34-2AA3	1TE35-3AA3	1TE38-2AA3	1TE41-2AA3	1TE41-5AA3	1TE41-8AA3
Rated short-circuit current acc. to IEC	kA	65	65	65	84	100	100
Minimum short-circuit current [6)] - with parallel connection	kA	4.4	5.2	10	2.5 4	3.2 5	4 6.4

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 400 VAC auxiliary supply is provided by the line input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request.

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

6) Minimum current required for reliable tripping of the protective devices.

Table 5- 16 Technical data for Basic Line Modules, 3 AC 500 ... 690 V

Article No.	**6SL3730-**	**1TG33-0AA3**	**1TG34-3AA3**	**1TG36-8AA3**	**1TG41-1AA3**	**1TG41-4AA3**	**1TG41-8AA3**
For parallel connection							
- Attached to Line Connection Module on right side		--	--	--	...-2BA3	...-4BA3	...-8BA3
- Attached to Line Connection Module on left side		--	--	--	...-2BC3	...-4BC3	...-8BC3
Rated power							
- for $I_{N\,DC}$ (50 Hz 690 V)	kW	250	355	560	900	1100	1500
- for $I_{H\,DC}$ (50 Hz 690 V)	kW	195	280	440	710	910	1220
- for $I_{N\,DC}$ (50 Hz 500 V)	kW	175	250	390	635	810	1085
- for $I_{N\,DC}$ (50 Hz 500 V)	kW	165	235	365	595	755	1015
- for $I_{N\,DC}$ (60 Hz 575 V)	hp	250	350	600	900	1250	1500
- for $I_{H\,DC}$ (60 Hz 575 V)	hp	200	300	450	800	1000	1250
DC-link current							
- Rated current $I_{N\,DC}$	A	300	430	680	1100	1400	1880
- Base load current $I_{H\,DC}$ [1]	A	234	335	530	858	1092	1467
- Maximum current $I_{max\,DC}$	A	450	645	1020	1650	2100	2820
Infeed current							
- Rated current $I_{N\,E}$	A	260	375	575	925	1180	1580
- Maximum current $I_{max\,E}$	A	390	563	863	1388	1770	2370
Current consumption							
- Auxiliary supply 24 VDC	A	1.1					
- 500/690 VAC [2]	A	internal					
DC-link capacitance							
- Basic Line Module	µF	3200	4800	7300	11600	15470	19500
- Drive line-up, max.	µF	25600	38400	58400	92800	123760	78000
Power loss, max. [3]							
- at 50 Hz 690 V	kW	1.5	2.1	3.0	5.4	5.8	7.3
- at 60 Hz 575 V	kW	1.5	2.1	3.0	5.4	5.8	7.3
Cooling air requirement	m^3/s	0.17	0.17	0.17	0.36	0.36	0.36
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	66/68	66/68	66/68	71/73	71/73	71/73
PE/GND connection							
- Busbar cross-section	mm^2	PE busbar					
- Connection cross-section, max. (IEC)	mm^2	600					
		240					
Cable length, max. [4]							
- Shielded	m	1500	1500	1500	2250	2250	2250
- Unshielded	m	2250	2250	2250	3375	3375	3375
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)							
- Width	mm	400	400	400	400/600/600		
- Height [5]	mm	2200	2200	2200	2200		
- Depth	mm	600	600	600	600		
Weight (standard version)	kg	166	166	166	320/440/480		
Frame size		FB	FB	FB	GB	GB	GD

Article No.	6SL3730-	1TG33-0AA3	1TG34-3AA3	1TG36-8AA3	1TG41-1AA3	1TG41-4AA3	1TG41-8AA3
Rated short-circuit current acc. to IEC	kA	65	65	65	65	100	100
Minimum short-circuit current [6] - with parallel connection	kA	3	4.4	8	2 4	2.5 5	3.2 6.4

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 500/690 VAC auxiliary supply is provided by the supply input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request.

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

6) Minimum current required for reliable tripping of the protective devices.

5.3 Smart Line Modules

5.3.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-18 Smart Line Module

Smart Line Modules are uncontrolled Active Line Modules. Like the Basic Line Module, they supply energy to the connected Motor Modules, but unlike the Basic Line Module, they can feed back regenerative energy. The infeed occurs over a diode jumper, while stable, line-commutated regenerative feedback takes place via IGBTs with 100% continuous energy regeneration.

Under full load, the DC link voltage is higher than the rms value of the rated line voltage by a factor of 1.30, and under partial load by a factor of 1.32.

Smart Line Modules are suitable for connection to supply systems grounded at the neutral point (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

Line voltage	Rated power
3 AC 380 … 480 V	250 ... 800 kW
3 AC 500 ... 690 V	450 ... 1400 kW

The power rating can be increased by connecting Smart Line Modules in parallel.

Integration

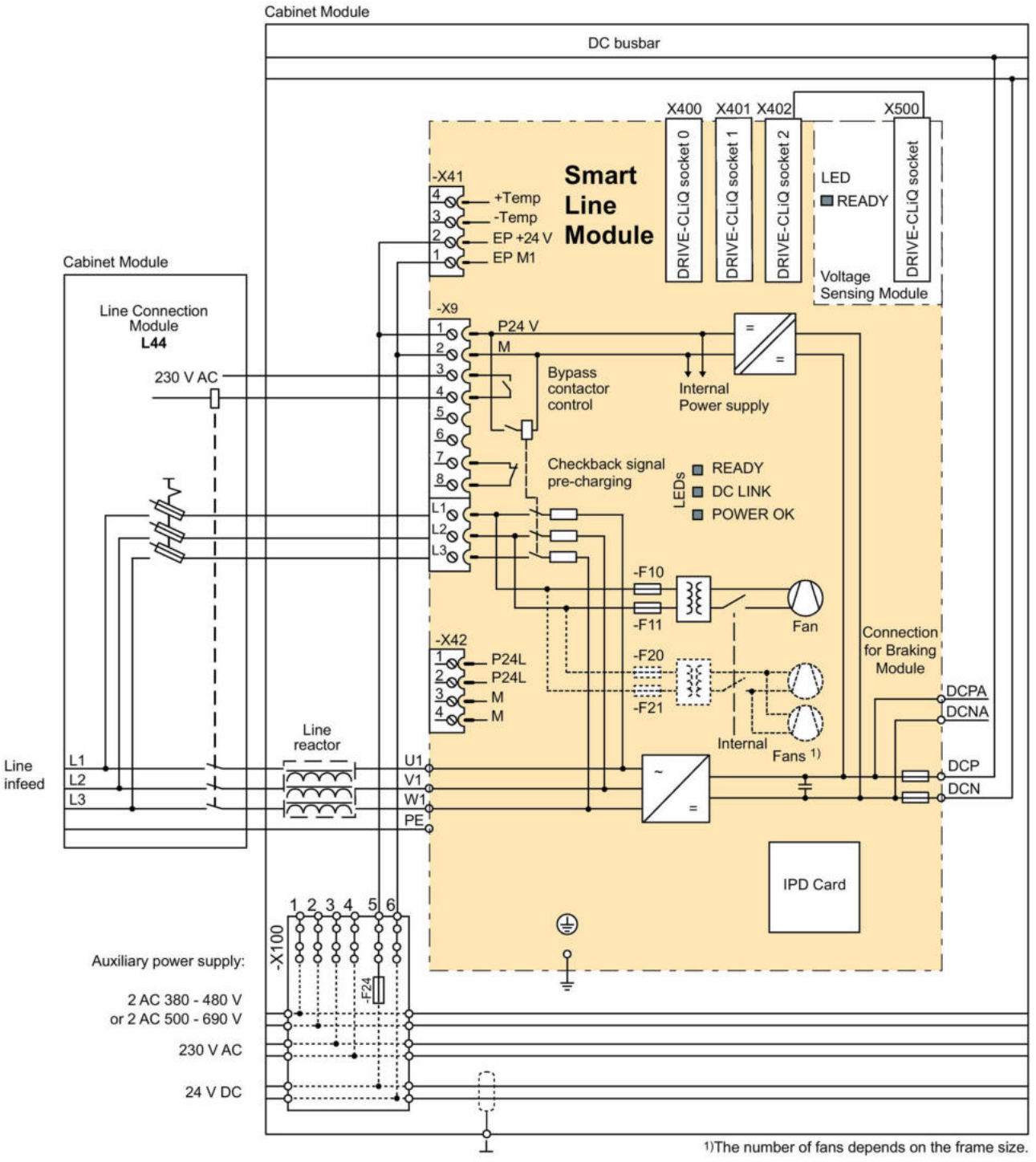


Figure 5-19 Connection example for Smart Line Modules

Configuration

IGBTs (fundamental frequency-switched) are used as power semiconductors of the Smart Line Modules. Because this reduces switching losses, high current utilization of the power units can be achieved.

The current flows in the direction of the infeed via the freewheeling diodes of the IGBTs. While a diode is conducting, the anti-parallel IGBT is also activated. If the DC link voltage increases due to regenerative operation of the drives, the IGBTs conduct electricity, thus feeding the energy back into the supply system.

Smart Line Modules do not require a line-side filter. A line reactor (4% u_k) is included in the standard package. The unit has a built-in precharging input circuit for the DC link capacitors. For this purpose, a main contactor or a motor-operated circuit breaker is included in the Line Connection Module on the line side.

It should be noted that the capacity of the precharging input circuit for charging the DC link capacitors depends on the unit being used. It is limited to no more than 4 to 7.8 times the value of the DC link capacitance installed in the device.

Note

Additional information

The configuration examples of the individual Smart Line Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

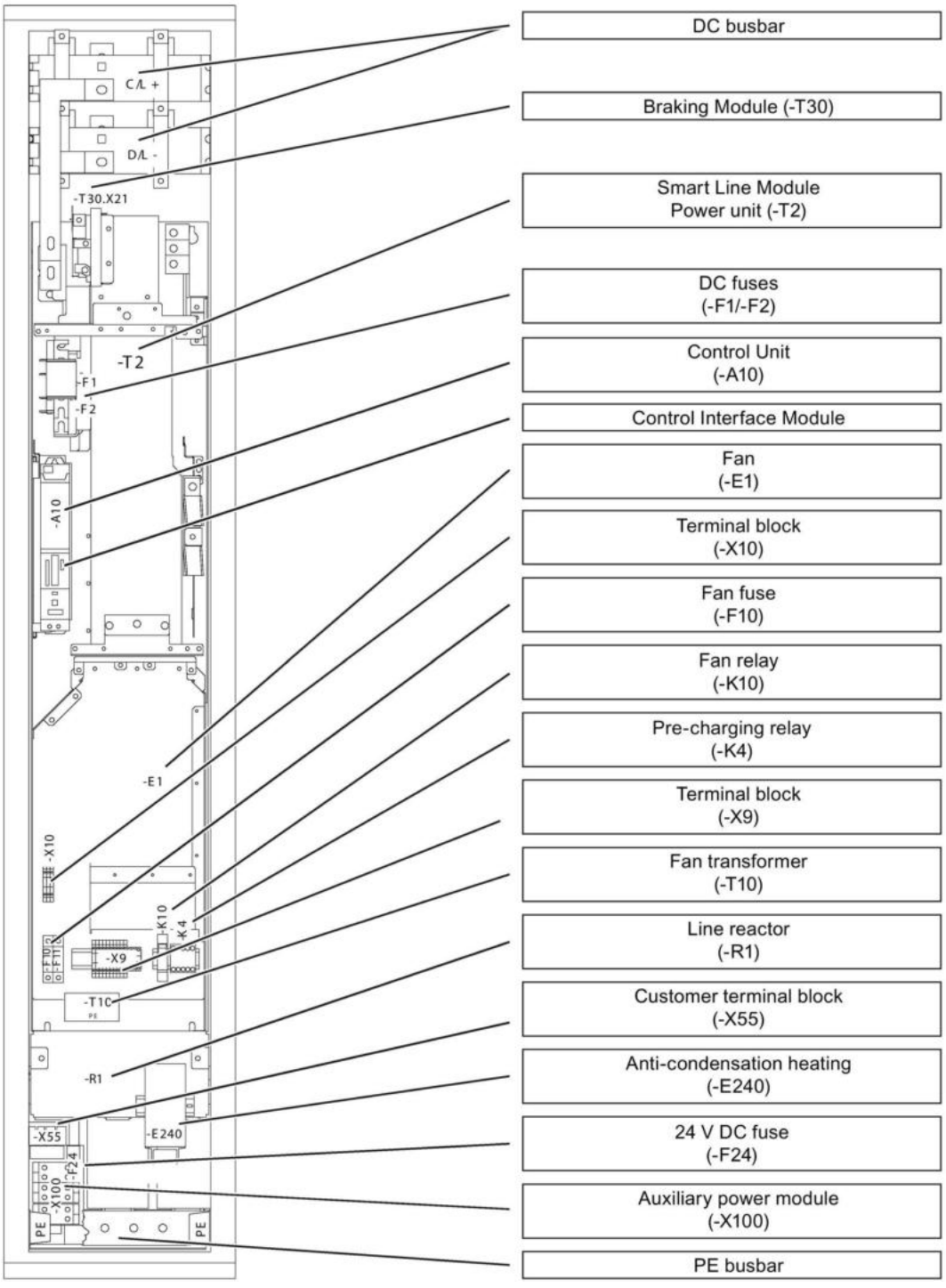


Figure 5-20 Configuration example for Smart Line Modules (frame size GX)

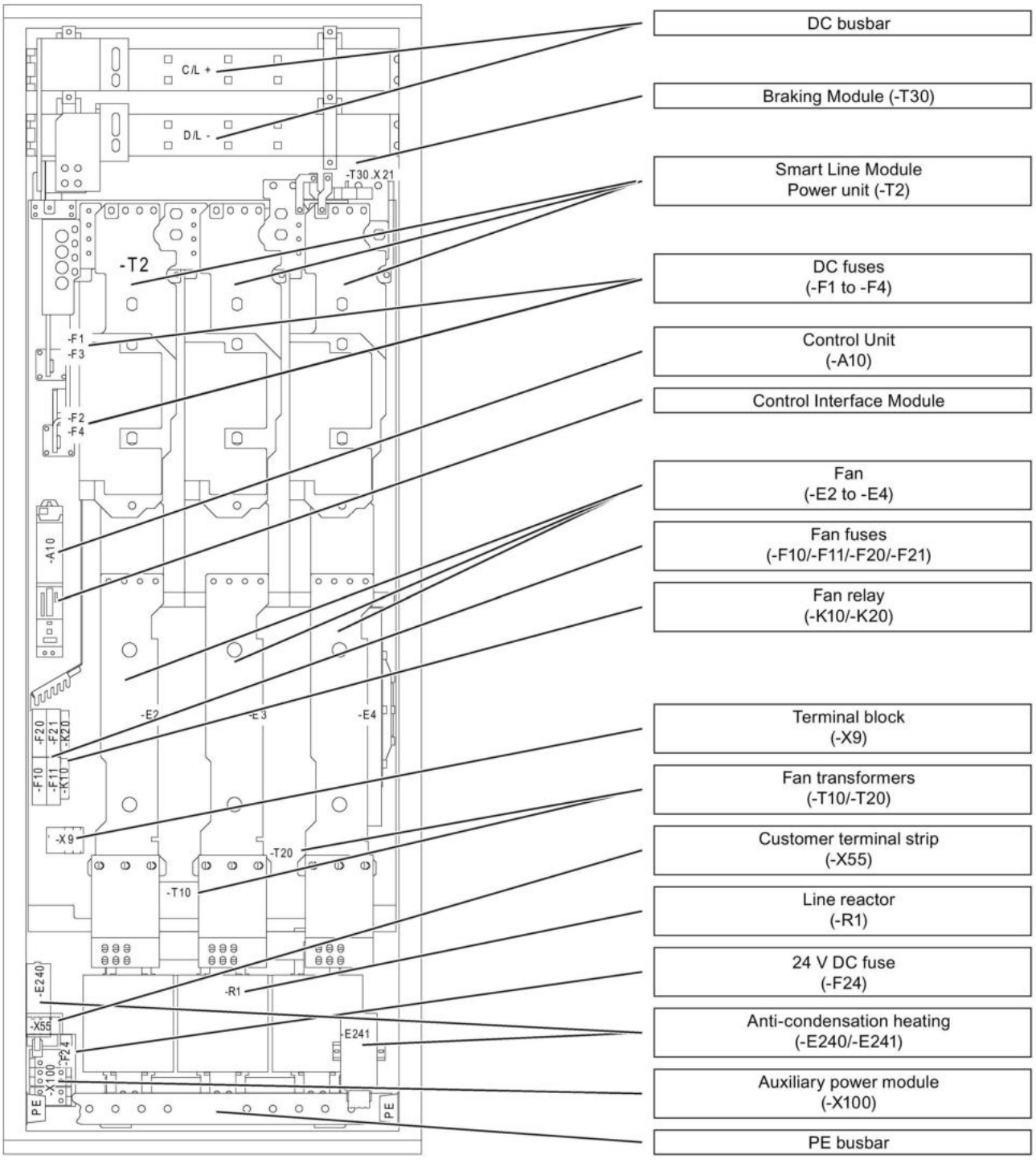


Figure 5-21 Configuration example for Smart Line Modules (frame size JX)

Parallel connection of Smart Line Modules to increase power rating

Up to four Smart Line Modules with the same power rating can be connected in parallel in order to increase power.

Smart Line Modules with "mirror-image" power connections enable the parallel connection of these modules in a compact configuration. Article numbers for devices that are arranged to the left of the Line Connection Module have a "C" in the next-to-last position, Example: 6SL3730-6TE41-1BC3.

The following rules must be observed when connecting Smart Line Modules in parallel:

- Up to four identical Smart Line Modules can be connected in parallel.
- The parallel connection must be implemented using a Control Unit.
- A 4% reactor is always required upstream of each Smart Line Module for the purpose of current balancing.
- Special Line Connection Modules are available for connecting the modules in parallel.
- For multiple infeed units, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A derating factor of 7.5% must be taken into consideration, regardless of the number of modules connected in parallel.

5.3.2 Interface description

5.3.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

5.3.2.2 Control Interface Module

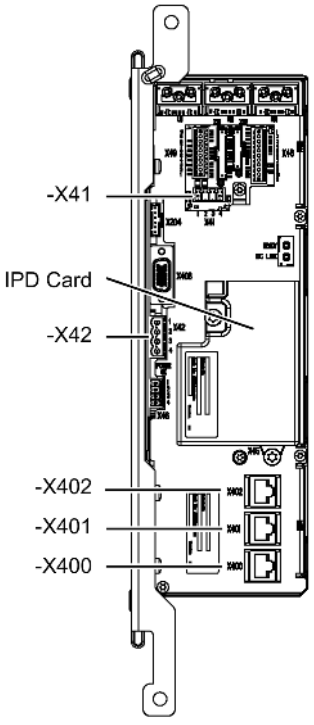
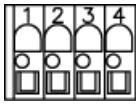


Figure 5-22 Control Interface Module

5.3.2.3 X41 EP terminal / temperature sensor connection

Table 5- 17 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: 1.5 mm²			



⚠WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT1000 or PTC measuring sensor in the stator windings.

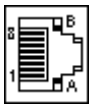
Note

Connection to terminals 1 and 2

24 VDC must be present at terminal 2 and ground at terminal 1 for operation. Pulse suppression is activated when removed.

5.3.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 18 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.3.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Contactor monitoring	G56
Terminal Board TB30	G62
AOP30 operator panel	K08
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
Line reactor not included in scope of delivery	L22
Cabinet anti-condensation heating	L55
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
Additional shock protection	M60
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.3.4 Technical data

Table 5- 19 Technical data for Smart Line Modules, 3 AC 380 ... 480 V

Article No.	**6SL3730-**	**6TE35-5AA3**	**6TE37-3AA3**	**6TE41-1AA3**	**6TE41-3AA3**	**6TE41-7AA3**
For parallel connection						
- Attached to Line Connection Module on right side		--	--	...-1BA3	...-3BA3	...-7BA3
- Attached to Line Connection Module on left side		--	--	...-1BC3	...-3BC3	...-7BC3
Rated power						
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	250	355	500	630	800
- for $I_{H\,DC}$ (50 Hz 400 V)	kW	235	315	450	555	730
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	395	545	770	970	1230
- for $I_{H\,DC}$ (60 Hz 460 V)	hp	360	485	695	860	1120
DC-link current						
- Rated current $I_{N\,DC}$	A	550	730	1050	1300	1700
- Base load current $I_{H\,DC}$ [1]	A	490	650	934	1157	1513
- Maximum current $I_{max\,DC}$	A	825	1095	1575	1950	2550
Input/regenerative feedback current						
- rated current $I_{N\,E}$	A	463	614	883	1093	1430
- maximum current $I_{max\,E}$	A	694	921	1324	1639	2145
Current consumption						
- Auxiliary supply 24 VDC	A	1.35	1.35	1.4	1.5	1.7
- 400 VAC [2]	A	1.8	1.8	3.6	5.4	5.4
DC-link capacitance						
- Smart Line Module	µF	8400	12000	16800	18900	28800
- Drive line-up, max.	µF	42000	60000	67200	75600	115200
Power loss, max. [3]						
- at 50 Hz 400 V	kW	3.7	4.7	7.1	11.0	11.5
- at 60 Hz 460 V	kW	3.7	4.7	7.1	11.0	11.5
Cooling air requirement	m^3/s	0.36	0.36	0.78	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	69/73	69/73	70/73	70/73	70/73
PE/GND connection		PE busbar				
- Busbar cross-section	mm^2	600				
- Connection cross-section, max. (IEC)	mm^2	240				
Cable length, max. [4]						
- Shielded	m	4000	4000	4800	4800	4800
- Unshielded	m	6000	6000	7200	7200	7200
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)						
- Width	mm	400	400	600	800	800
- Height [5]	mm	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600
Weight (standard version)	kg	270	270	490	775	775
Frame size		GX	GX	HX	JX	JX

Article No.	6SL3730-	6TE35-5AA3	6TE37-3AA3	6TE41-1AA3	6TE41-3AA3	6TE41-7AA3
Rated short-circuit current acc. to IEC	kA	65	65	84	84	100
Minimum short-circuit current [6]	kA	6.2	9.2	2	2.5	3.2

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 400 VAC auxiliary supply is provided by the line input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

6) Minimum current required for reliable tripping of the protective devices.

Table 5- 20 Technical data for Smart Line Modules, 3 AC 500 ... 690 V

Article No.	**6SL3730-**	**6TG35-5AA3**	**6TG38-8AA3**	**6TG41-2AA3**	**6TG41-7AA3**
For parallel connection					
- Attached to Line Connection Module on right side		--	...-8BA3	...-2BA3	...-7BA3
- Attached to Line Connection Module on left side		--	...-8BC3	...-2BC3	...-7BC3
Rated power					
- for $I_{N\,DC}$ (50 Hz 690 V)	kW	450	710	1000	1400
- for $I_{H\,DC}$ (50 Hz 690 V)	kW	405	665	885	1255
- for $I_{N\,DC}$ (50 Hz 500 V)	kW	320	525	705	995
- for $I_{H\,DC}$ (50 Hz 500 V)	kW	295	480	640	910
- for $I_{N\,DC}$ (60 Hz 575 V)	hp	500	790	1115	1465
- for $I_{H\,DC}$ (60 Hz 575 V)	hp	450	740	990	1400
DC-link current					
- Rated current $I_{N\,DC}$	A	550	900	1200	1700
- Base load current $I_{H\,DC}$ [1]	A	490	800	1068	1513
- Maximum current $I_{max\,DC}$	A	825	1350	1800	2550
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	463	757	1009	1430
- maximum current $I_{max\,E}$	A	694	1135	1513	2145
Current consumption					
- Auxiliary supply 24 VDC	A	1.35	1.4	1.5	1.7
- 500/690 VAC [2]	A	1.4/1.0	2.9/2.1	4.3/3.1	4.3/3.1
DC-link capacitance					
- Smart Line Module	µF	5600	7400	11100	14400
- Drive line-up, max.	µF	28000	29600	44400	57600
Power loss, max. [3]					
- at 50 Hz 690 V	kW	4.3	6.5	12	13.8
- at 60 Hz 575 V	kW	4.3	6.5	12	13.8
Cooling air requirement	m^3/s	0.36	0.78	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	69/73	70/73	70/73	70/73
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Cable length, max. [4]					
- Shielded	m	2250	2750	2750	2750
- Unshielded	m	3375	4125	4125	4125
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)					
- Width	mm	400	600	800	800
- Height [5]	mm	2200	2200	2200	2200
- Depth	mm	600	600	600	600
Weight (standard version)	kg	340	550	795	795
Frame size		GX	HX	JX	JX

Article No.	6SL3730-	6TG35- 5AA3	6TG38- 8AA3	6TG41- 2AA3	6TG41- 7AA3
Rated short-circuit current acc. to IEC	kA	65	84	100	100
Minimum short-circuit current [6]	kA	6.2	10.5	2.5	3.2

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 500/690 VAC auxiliary supply is provided by the supply input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

6) Minimum current required for reliable tripping of the protective devices.

5.4 Active Line Modules including Active Interface Modules

5.4.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-23 Active Line Modules including Active Interface Modules

Active Line Modules can supply motoring energy and return regenerative energy to the supply system.

Active Line Modules generate a regulated DC voltage that is kept consistent regardless of fluctuations in the line voltage (the line voltage must range within the permissible tolerances).

In the factory setting, the DC voltage is controlled to 1.5 times the rms value of the rated line voltage.

Active Line Modules draw a virtually sinusoidal current from the supply system and cause virtually no line harmonic distortions.

Active Line Modules are suitable for connection to supply systems grounded at the neutral point (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

Line voltage	Rated power
3 AC 380 … 480 V	132 ... 900 kW
3 AC 500 ... 690 V	630 ... 1400 kW

The power rating can be increased by connecting Active Line Modules in parallel.

Integration

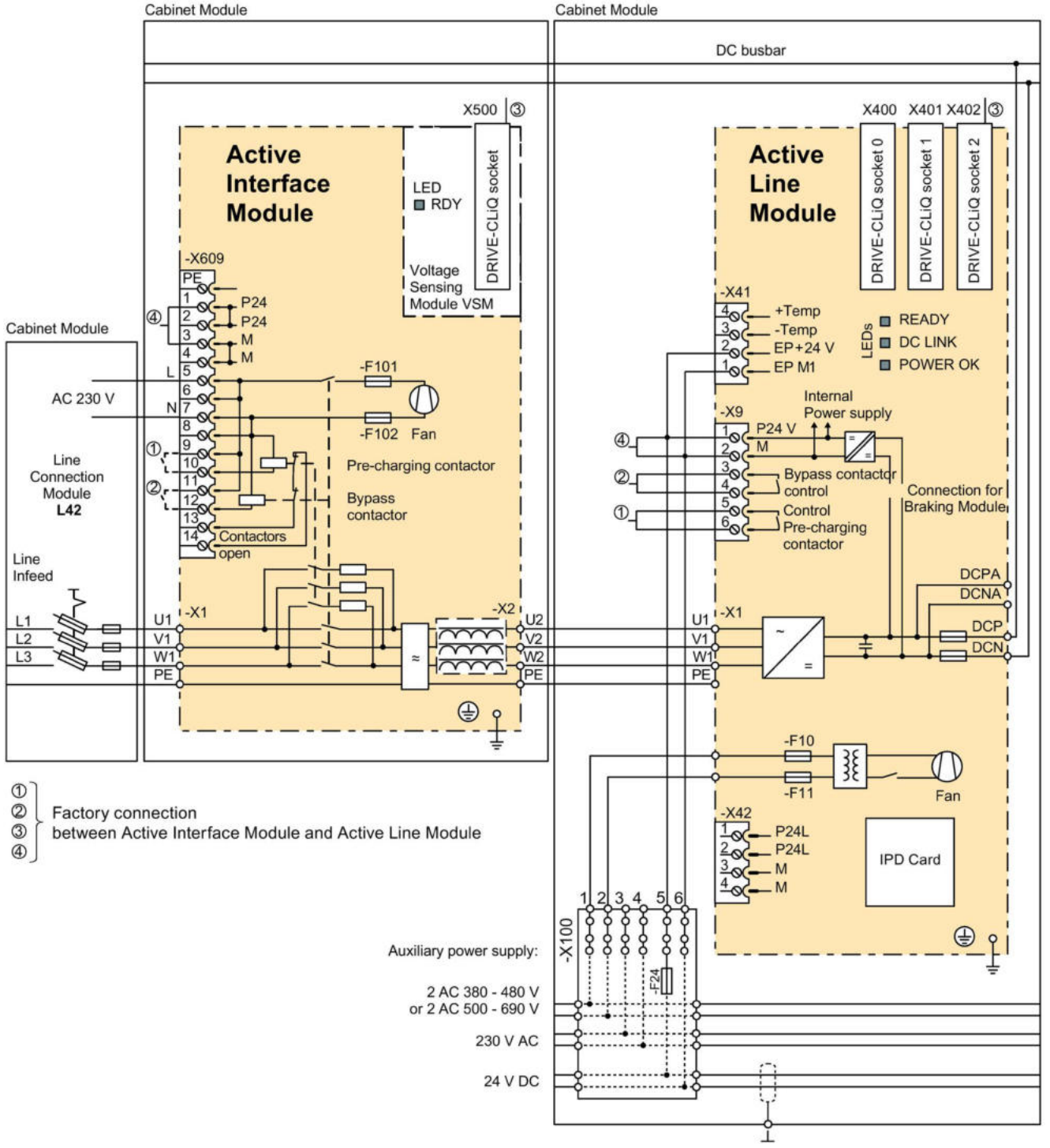


Figure 5-24 Connection example for Active Line Modules (frame size FI/FX and GI/GX)

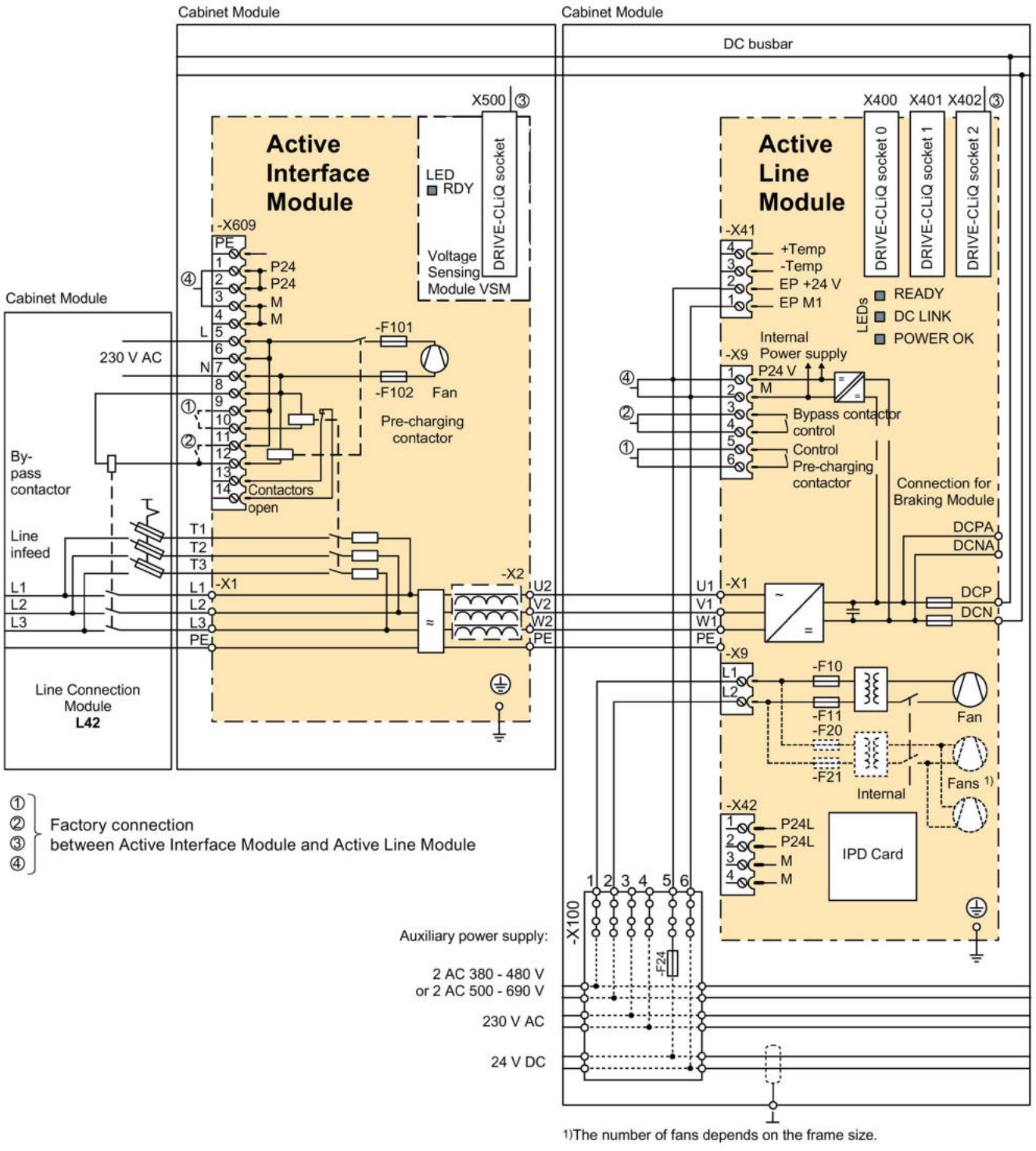


Figure 5-25 Connection example for Active Line Modules (frame size HI/HX and JI/JX)

Configuration

Active Line Modules are always operated together with an Active Interface Module, which contains the associated Clean Power Filter and precharging circuit. The included line filter enables compliance with the EMC requirements for the "second environment".

Note

Additional information

The configuration examples of the individual Active Line Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

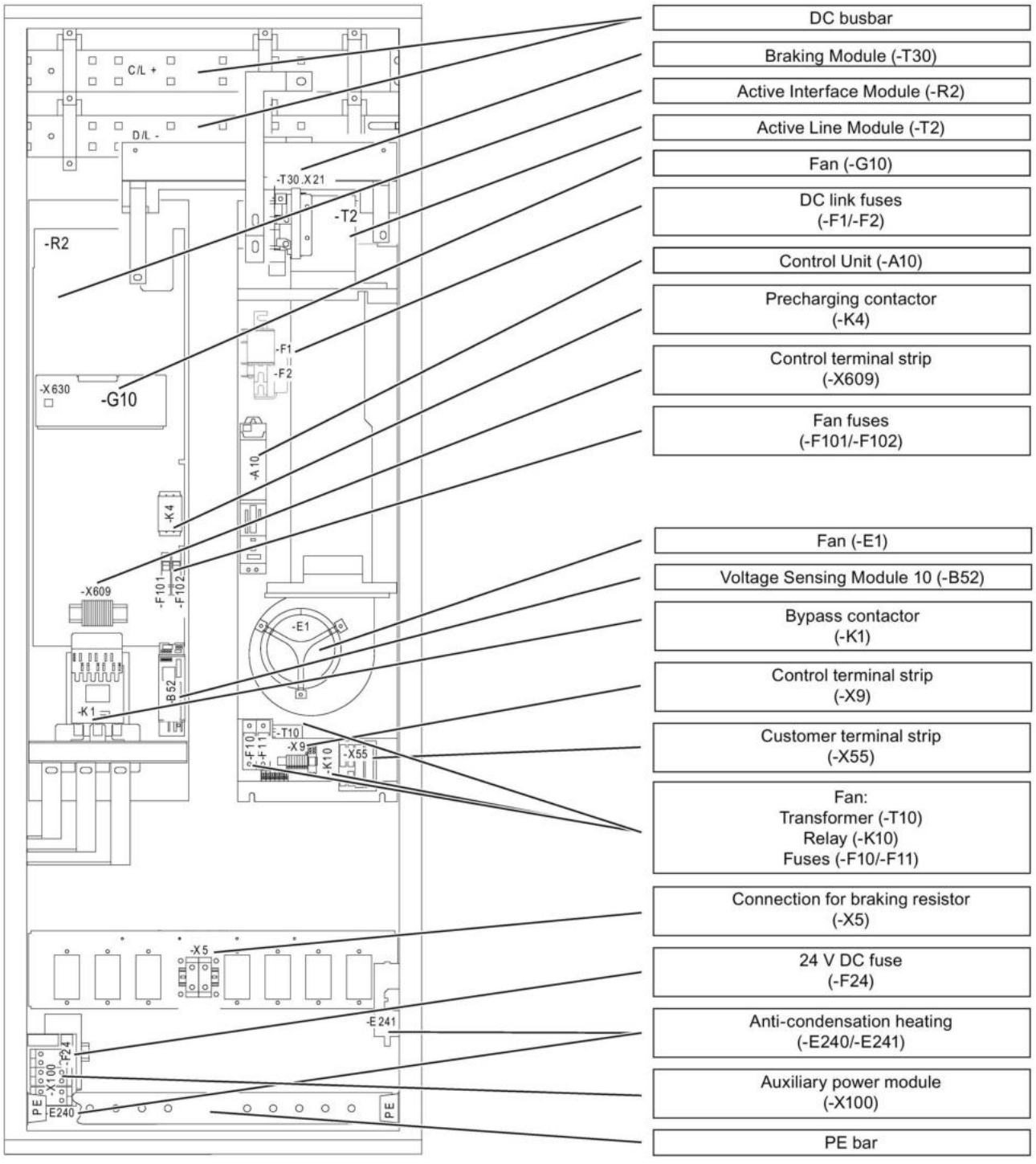


Figure 5-26 Configuration examples for Active Line Modules (frame size FX+FI)

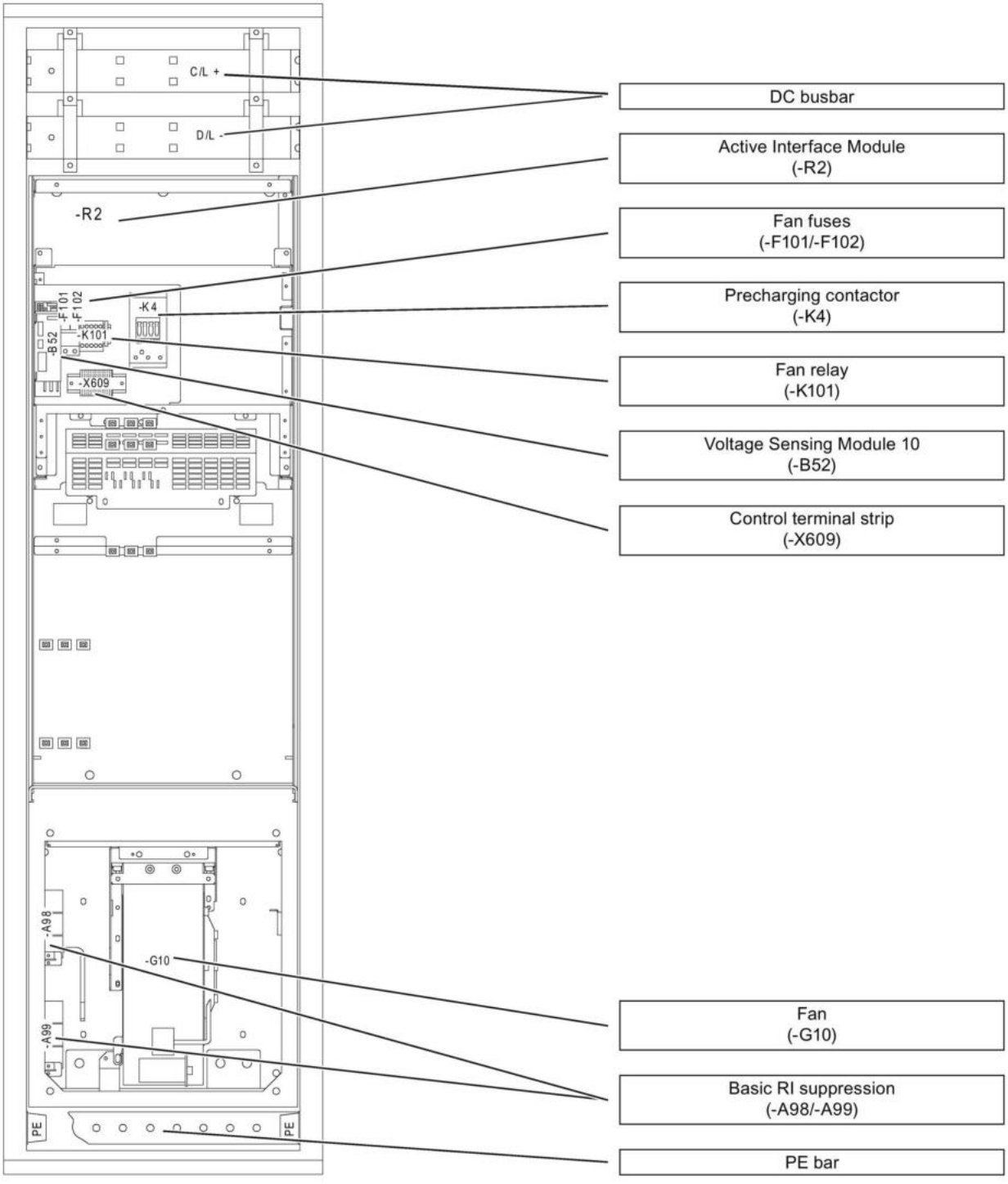


Figure 5-27 Configuration examples for Active Interface Modules (frame size JI)

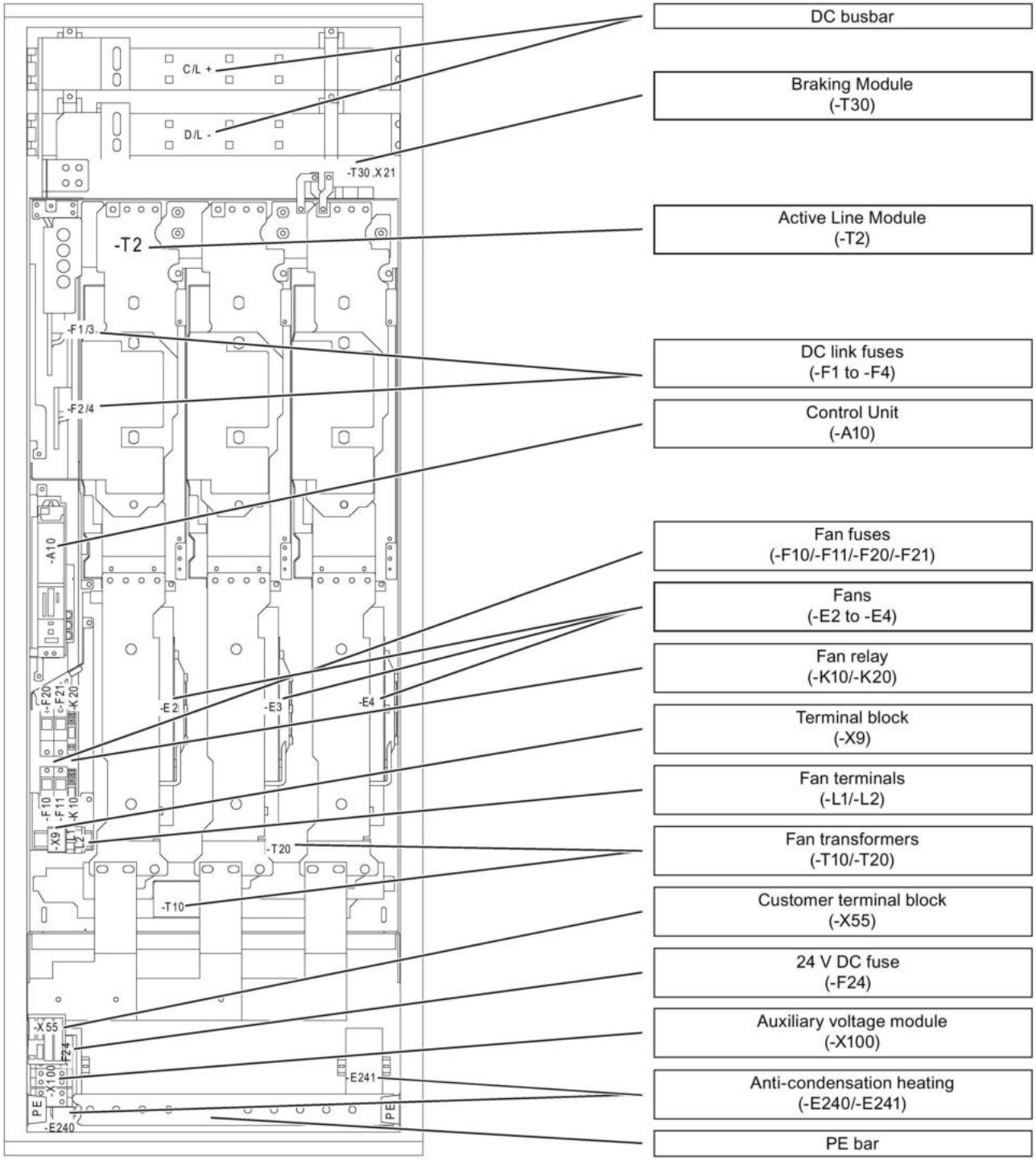


Figure 5-28 Configuration examples for Active Line Modules (frame size JX)

Parallel connection of Active Line Modules to increase power rating

Active Line Modules are available for creating drive line-ups with more power. These modules can be operated in parallel on a common Line Connection Module and are arranged to the right and left of the Line Connection Module. The power connections on the Active Line Module on the left of the Line Connection Module are a mirror image (Article No. with "C" in the next to last position, example: 6SL3730-7Tx41x-xBC3a), which produces a very compact design for the supply infeed.

The following rules must be observed when connecting Active Line Modules in parallel:

- Up to four identical Active Line Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- Special Line Connection Modules are available for connecting the modules in parallel.
- For multiple infeed units, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.

5.4.2 Interface description

5.4.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

5.4.2.2 Control Interface Module

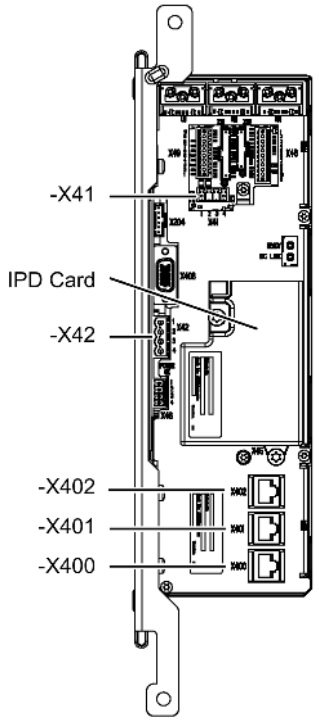
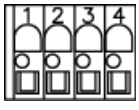


Figure 5-29 Control Interface Module

5.4.2.3 X41 EP terminal / temperature sensor connection

Table 5- 21 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: 1.5 mm^2			



⚠WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT1000 or PTC measuring sensor in the stator windings.

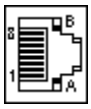
Note

Connection to terminals 1 and 2

24 VDC must be present at terminal 2 and ground at terminal 1 for operation. Pulse suppression is activated when removed.

5.4.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 22 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.4.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Contactor monitoring	G56
Terminal Board TB30	G62
AOP30 operator panel	K08
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
Line filter monitoring	L40
Cabinet anti-condensation heating	L55
25/125 kW braking unit	L61/L64
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
Additional shock protection	M60
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.4.4 Technical data

Table 5- 23 Technical data for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, part I

Article No.	**6SL3730-**	**7TE32-1BA3**	**7TE32-6BA3**	**7TE33-8BA3**	**7TE35-0BA3**
For parallel connection					
- Attached to Line Connection Module on left side		--	--	--	--
Rated power					
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	132	160	235	300
- for $I_{H\,DC}$ (50 Hz 400 V)	kW	115	145	210	270
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	200	250	400	500
- for $I_{H\,DC}$ (60 Hz 460 V)	hp	150	200	300	400
DC-link current					
- Rated current $I_{N\,DC}$	A	235	291	425	549
- Base load current $I_{H\,DC}$ [1]	A	209	259	378	489
- Maximum current $I_{max\,DC}$	A	352	436	637	823
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	210	260	380	490
- maximum current $I_{max\,E}$	A	315	390	570	735
Current demand					
- Auxiliary supply 24 V DC	A	1.27	1.27	1.52	1.52
- 400 V AC at 50/60 Hz [2]	A	0.63 / 0.95	1.13 / 1.7	1.8 / 2.7	1.8 / 2.7
- 230 V AC [2]	A	0.6	0.6	1.2	1.2
DC-link capacitance					
- Active Line Module	µF	4200	5200	7800	9600
- Drive line-up, max.	µF	41600	41600	76800	76800
Power loss, max. [3]					
- at 50 Hz 400 V	kW	4.3	4.9	6.9	8.7
- at 60 Hz 460 V	kW	4.4	5.1	7.2	9.0
Cooling air requirement	m^3/s	0.47	0.47	0.83	0.83
Sound pressure level L_{pA} (1 m) at 50/60 Hz [4]	dB(A)	74/76	75/77	76/78	76/78
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Cable length, max. [5]					
- Shielded	m	2700	2700	2700	2700
- Unshielded	m	4050	4050	4050	4050
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)					
- Width	mm	800	800	800	800
- Height [6]	mm	2200	2200	2200	2200
- Depth	mm	600	600	600	600
Weight (standard version)	kg	380	380	530	530
Frame size		FX + FI	FX + FI	GX + GI	GX + GI

Article No.	6SL3730-	7TE32-1BA3	7TE32-6BA3	7TE33-8BA3	7TE35-0BA3
Rated short-circuit current acc. to IEC	kA	65	65	65	65
Minimum short-circuit current [7]	kA	6.2	10.5	10.5	10.5

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 400 V AC and 230 V AC auxiliary supplies is provided by the line supply input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total sound pressure level of Active Interface Module and Active Line Module.

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.
The cable lengths are valid for use in IT line systems. When used in TN line systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN line systems, and when the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

6) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

7) Minimum current required for reliable tripping of the protective devices.

Table 5- 24 Technical data for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, part II

Article No.	**6SL3730-**	**7TE36-1BA3**	**7TE38-4BA3**	**7TE41-0BA3**	**7TE41-4BA3**
For parallel connection					
- Attached to Line Connection Module on left side		--	--	...-0BC3	...-4BC3
Rated power					
- for $I_{N\ DC}$ (50 Hz 400 V)	kW	380	500	630	900
- for $I_{H\ DC}$ (50 Hz 400 V)	kW	335	465	545	780
- for $I_{N\ DC}$ (60 Hz 460 V)	hp	600	700	900	1250
- for $I_{H\ DC}$ (60 Hz 460 V)	hp	500	700	800	1000
DC-link current					
- Rated current $I_{N\ DC}$	A	678	940	1103	1574
- Base load current $I_{H\ DC}$ [1]	A	603	837	982	1401
- Maximum current $I_{max\ DC}$	A	1017	1410	1654	2361
Input/regenerative feedback current					
- rated current $I_{N\ E}$	A	605	840	985	1405
- maximum current $I_{max\ E}$	A	907	1260	1260	2107
Current demand					
- Auxiliary supply 24 V DC	A	1.57	1.57	1.67	1.67
- 400 V AC at 50/60 Hz [2]	A	3.6 / 5.4	3.6 / 5.4	5.4 / 8.1	5.4 / 8.1
- 230 V AC [2]	A	4.6	4.6	4.9	4.9
DC-link capacitance					
- Active Line Module	µF	12600	16800	18900	28800
- Drive line-up, max.	µF	134400	134400	230400	230400
Power loss, max. [3]					
- at 50 Hz 400 V	kW	11.7	13.8	17.6	21.8
- at 60 Hz 460 V	kW	12.1	14.3	18.3	22.7
Cooling air requirement	m^3/s	1.18	1.18	1.48	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz [4]	dB(A)	78/80	78/80	78/80	78/80
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Cable length, max. [5]					
- Shielded	m	3900	3900	3900	3900
- Unshielded	m	5850	5850	5850	5850
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)					
- Width	mm	1000	1000	1400	1400
- Height [6]	mm	2200	2200	2200	2200
- Depth	mm	600	600	600	600
Weight (standard version)	kg	930	930	1360	1360
Frame size		HX + HI	HX + HI	JX + JI	JX + JI

Article No.	6SL3730-	7TE36-1BA3	7TE38-4BA3	7TE41-0BA3	7TE41-4BA3
Rated short-circuit current acc. to IEC	kA	65	84	84	100
Minimum short-circuit current [7]	kA	12	2	4	6.4

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 400 V AC and 230 V AC auxiliary supplies is provided by the line supply input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total sound pressure level of Active Interface Module and Active Line Module.

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.
The cable lengths are valid for use in IT line systems. When used in TN line systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN line systems, and when the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

6) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

7) Minimum current required for reliable tripping of the protective devices.

Table 5- 25 Technical data for Active Line Modules (including Active Interface Module), 3 AC 500 ... 690 V

Article No.	**6SL3730-**	**7TG35-8BA3**	**7TG37-4BA3**	**7TG41-0BA3**	**7TG41-3BA3**
For parallel connection					
- Attached to Line Connection Module on left side		--	...-4BC3	...-0BC3	...-3BC3
Rated power					
- for $I_{N\,DC}$ (50 Hz 690 V)	kW	630	800	1100	1400
- for $I_{H\,DC}$ (50 Hz 690 V)	kW	620	705	980	1215
- for $I_{N\,DC}$ (50 Hz 500 V)	kW	447	560	780	965
- for $I_{H\,DC}$ (50 Hz 500 V)	kW	450	510	710	880
- for $I_{N\,DC}$ (60 Hz 575 V)	hp	675	900	1250	1500
- for $I_{H\,DC}$ (60 Hz 575 V)	hp	506	600	1000	1250
DC-link current					
- Rated current $I_{N\,DC}$	A	644	823	1148	1422
- Base load current $I_{H\,DC}$ [1]	A	573	732	1022	1266
- Maximum current $I_{max\,DC}$	A	966	1234	1722	2133
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	575	735	1025	1270
- maximum current $I_{max\,E}$	A	862	1102	1537	1905
Current demand					
- Auxiliary supply 24 V DC	A	1.57	1.67	1.87	1.87
- 500 V AC at 50/60 Hz [2]	A	3 / 4.5	4.4 / 6.6	4.4 / 6.6	4.4 / 6.6
- 690 V AC at 50/60 Hz [2]	A	2.1 / 3.1	3.1 / 4.6	3.1 / 4.6	3.1 / 4.6
- 230 V AC [2]	A	4.6	4.9	4.9	4.9
DC-link capacitance					
- Active Line Module	µF	7400	11100	14400	19200
- Drive line-up, max.	µF	59200	153600	153600	153600
Power loss, max. [3]					
- at 50 Hz 500/690 V	kW	13.6	19.2	22.8	26.1
- at 60 Hz 575 V	kW	13.0	18.6	22.1	24.9
Cooling air requirement	m^3/s	1.18	1.48	1.48	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz [4]	dB(A)	78/80	78/80	78/80	78/80
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Cable length, max. [5]					
- Shielded	m	2250	2250	2250	2250
- Unshielded	m	3375	3375	3375	3375
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)					
- Width	mm	1000	1400	1400	1400
- Height [6]	mm	2200	2200	2200	2200
- Depth	mm	600	600	600	600
Weight (standard version)	kg	930	1360	1360	1360
Frame size		HX + HI	JX + JI	JX + JI	JX + JI

Article No.	6SL3730-	7TG35-8BA3	7TG37-4BA3	7TG41-0BA3	7TG41-3BA3
Rated short-circuit current acc. to IEC	kA	65	84	100	100
Minimum short-circuit current [7)] - For a parallel connection	kA	9	15 4	2.5 4	3.2 5

1) The base load current $I_{H\ DC}$ is based on a duty cycle of 150% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The power required for the 500/690 V AC auxiliary supply is provided by the supply input voltage.

3) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

4) Total sound pressure level of Active Interface Module and Active Line Module.

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.
The cable lengths are valid for use in IT line systems. When used in TN line systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN line systems, and when the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

6) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

7) Minimum current required for reliable tripping of the protective devices.

5.5 Active Line Connection Modules-2

5.5.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-30 Active Line Connection Module-2

Active Line Connection Modules-2 can inject energy into the DC voltage link and feed regenerative energy into the line supply.

Active Line Connection Modules-2 comprise a Line Connection Module, an Active Interface Module and an Active Line Module Chassis-2 format installed in a cabinet system.

The Active Line Connection Module-2 contains the line-side infeed via main breaker and circuit breaker and precharging, it establishes the connection between the line supply on the system side and the Active Line Module Chassis-2. It is equipped as standard with a radio interference suppression filter according to EN 61800-3 Category C3.

Active Line Connection Modules-2 generate a controlled DC voltage that is kept consistent regardless of fluctuations in the line voltage (the line voltage must lie within the permissible tolerances).

In the factory setting, the DC voltage is controlled to 1.5 times the rms value of the rated line voltage.

Active Line Connection Modules-2 draw a virtually sinusoidal current from the supply system and cause virtually no line harmonics.

Active Line Connection Modules-2 are suitable for connection to supply systems grounded at the neutral point (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

Line voltage	Rated power
3 AC 380 … 480 V	355 ... 630 kW

Note

Operating Active Line Connection Modules-2 on an IT line system

When operating Active Line Connection Modules-2 on an ungrounded line supply (IT line system), an isolating transformer must be connected for the fan supply upstream of the fan.

Generally, this is realized using option L20 "Use in IT line system".

Table 5- 26 X1 terminals for the line supply

Terminals	Technical specifications
U1/L1, V1/L2, W1/L3 3-ph. AC power input	Voltage: 380 V 3 AC -10% ... 480 V 3 AC +10% (-15% < 1 min) Frequency: 47 ... 63 Hz

Depending on the input current, the following versions are used:

- ≤ 800 A: Main breaker with fuse switch disconnector
- > 800 A: Circuit breaker, type 3WL, with option L25 as withdrawable circuit breaker

The power rating can be increased by connecting Active Line Connection Modules-2 in parallel.

NOTICE
Operation only with a firmware version from V5.2 HF4 and higher. The Active Line Module Chassis-2 can be damaged if operated with unsuitable firmware. • Only operate the Active Line Module Chassis-2 with a firmware version from V5.2 HF4 and higher.

Integration

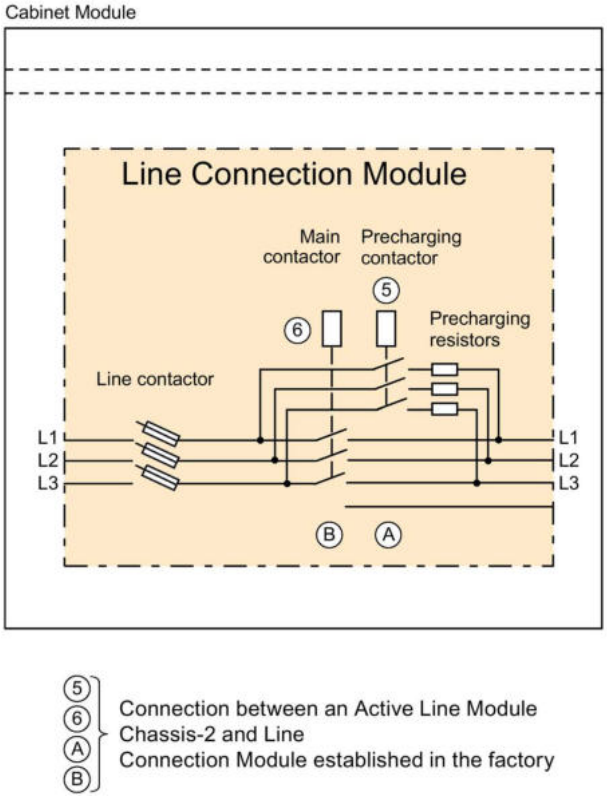


Figure 5-31 Connection example, Active Line Connection Module-2: Line Connection Module

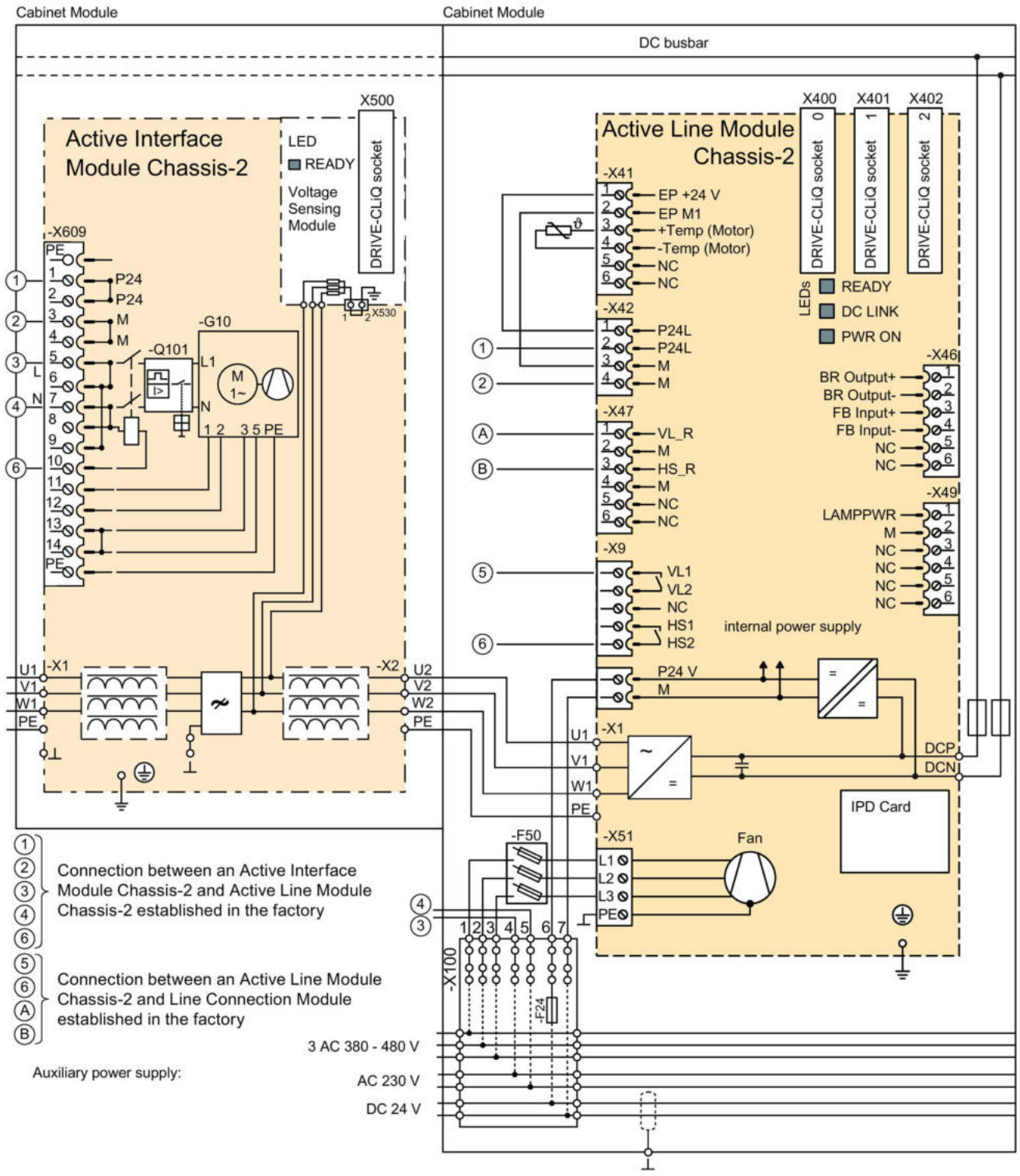


Figure 5-32 Connection example, Active Line Connection Module-2: Active Interface Module Chassis-2 and Active Line Module Chassis-2

Configuration

An Active Line Connection Module-2 always includes an Active Interface Module Chassis-2, which contains the associated Clean Power Filter. The included line filter enables compliance with the EMC requirements for the "second environment".

Active Line Connection Modules-2 are available for installing the Motor Modules to the right (Article number "...RE0") and for installing the Motor Modules to the left (Article number "...LE0"). The Line Connection Module with the line connection is installed directly next to the Active Interface Module.

Note

Additional information

The configuration examples of the individual Active Line Connection Modules-2 show the arrangement of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

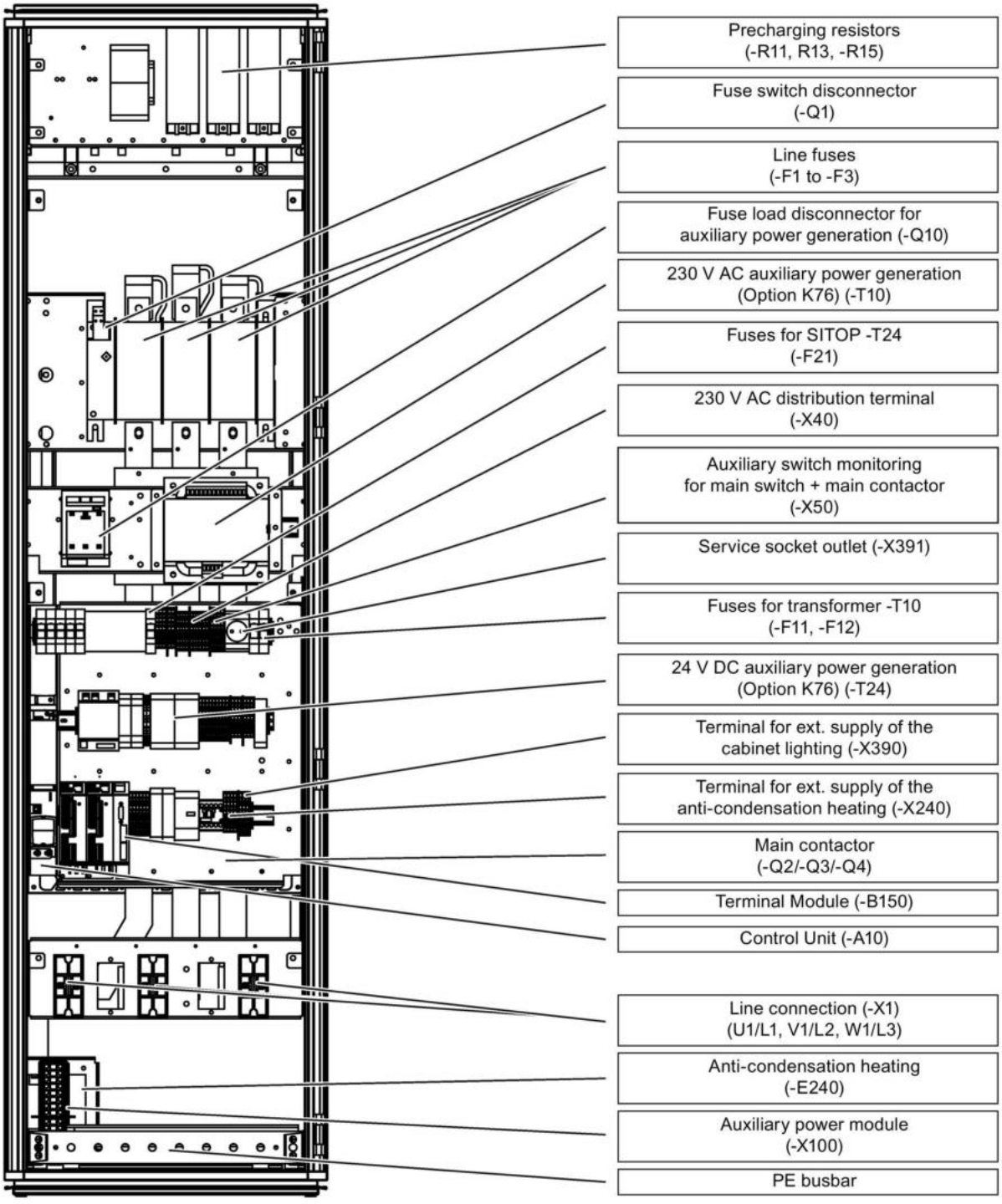


Figure 5-33 Configuration examples, Line Connection Modules (frame size HL)

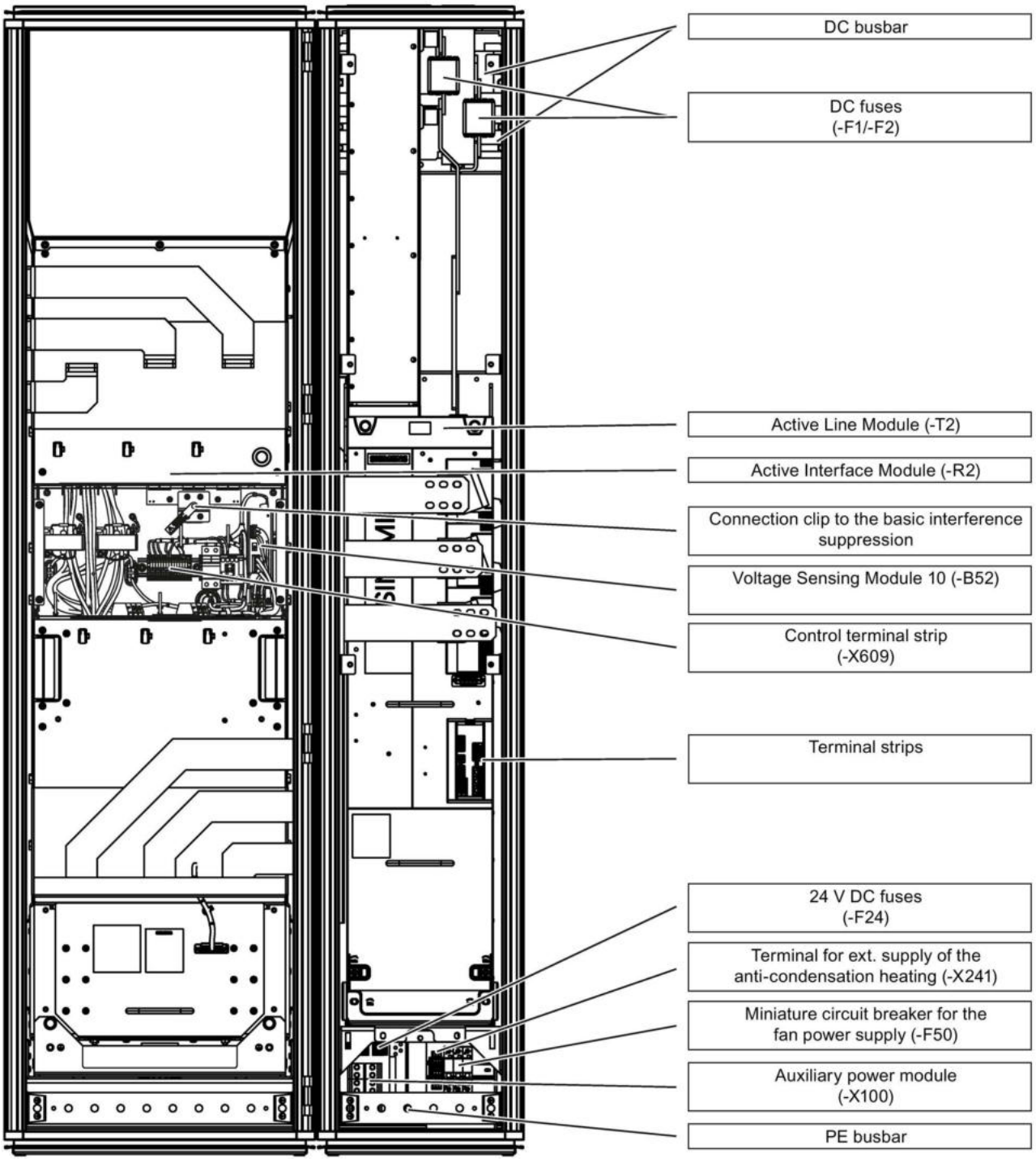


Figure 5-34 Configuration examples, Active Interface Module Chassis-2 (frame size FS2) and Active Line Module Chassis-2 (frame sizes FS2, FS2+) – for installing the Motor Modules to the right

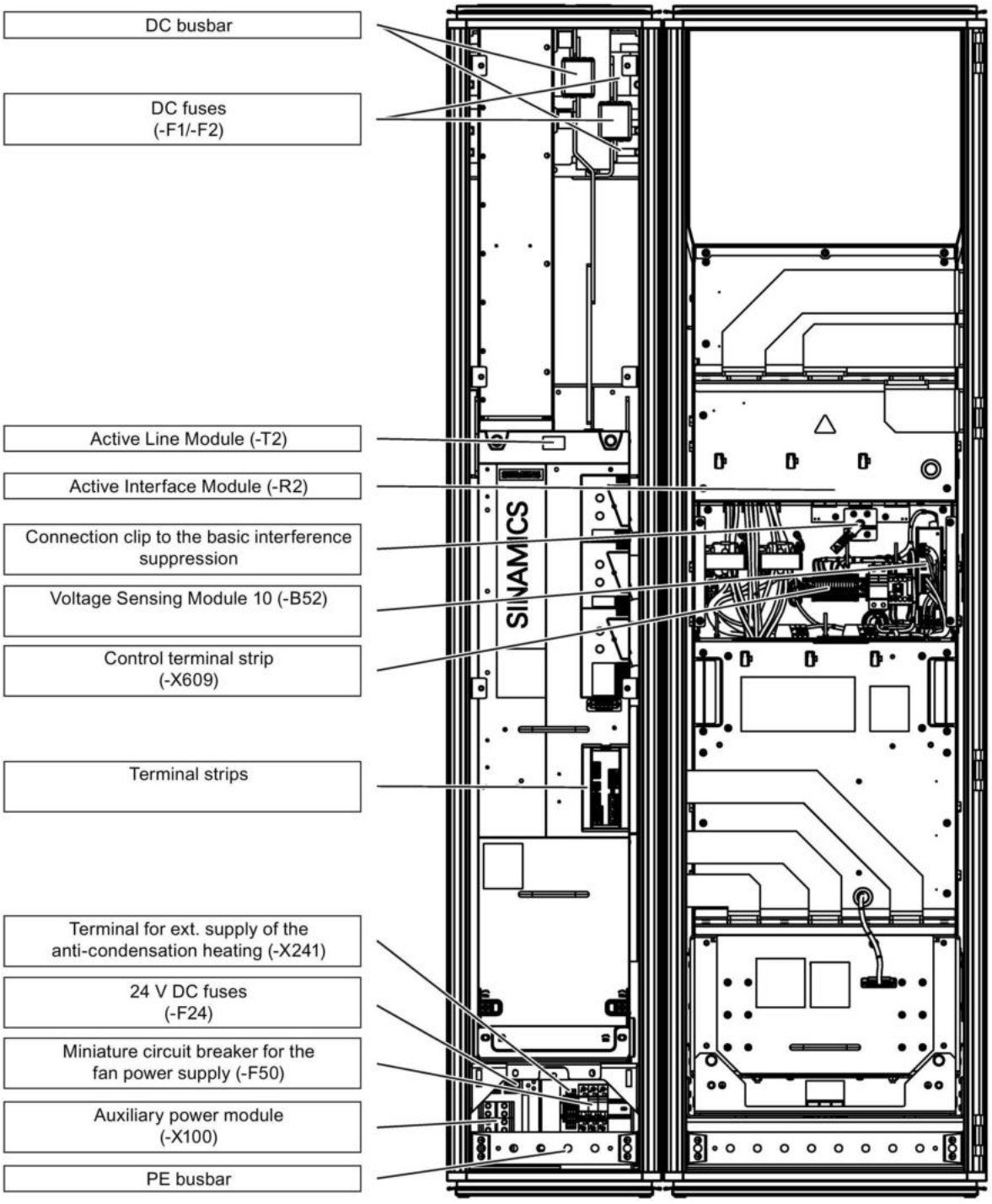


Figure 5-35 Configuration examples, Active Interface Module Chassis-2 (frame size FS2) and Active Line Module Chassis-2 (frame sizes FS2, FS2+) – for installing the Motor Modules to the left

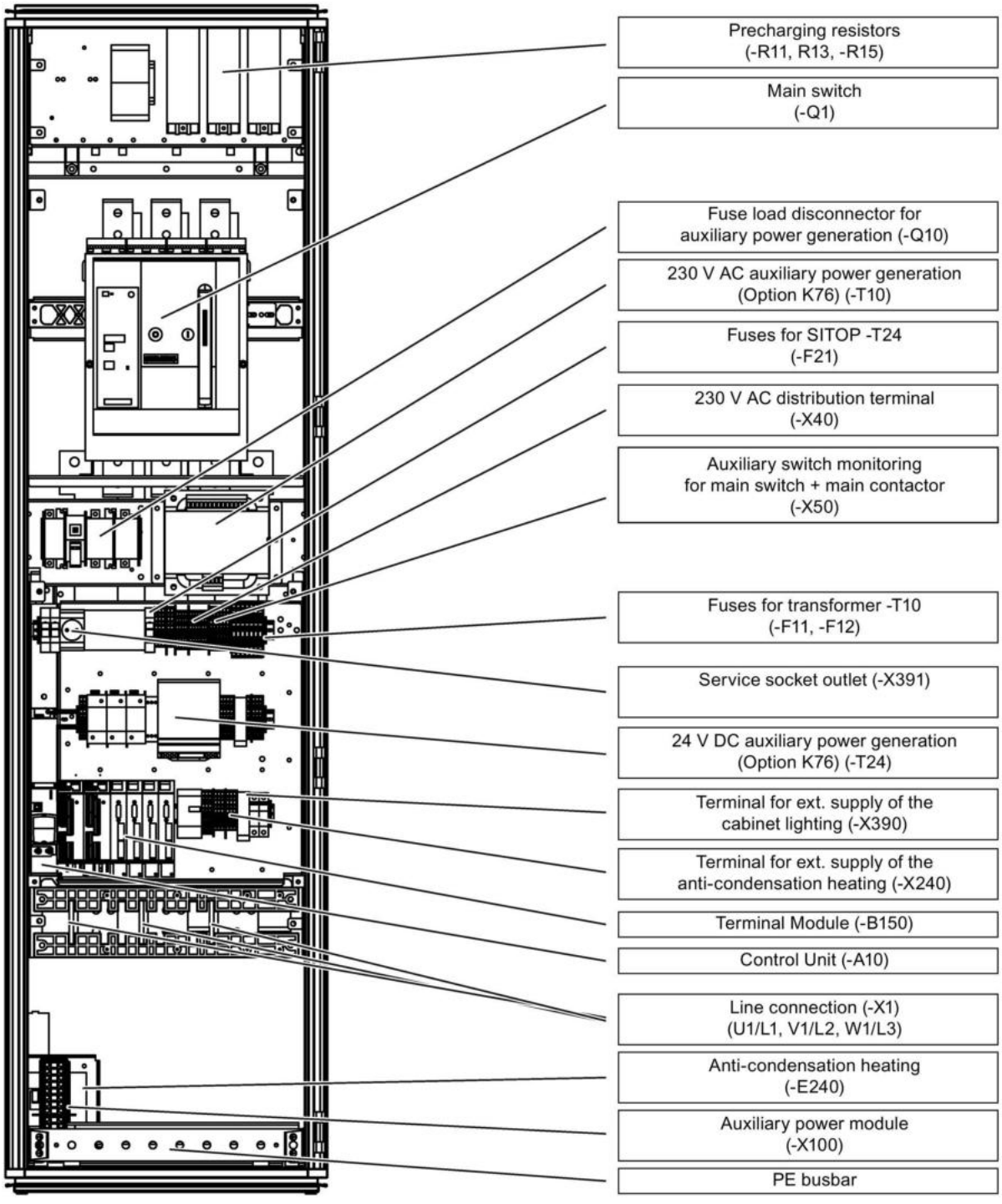


Figure 5-36 Line Connection Module design example (frame size JL)

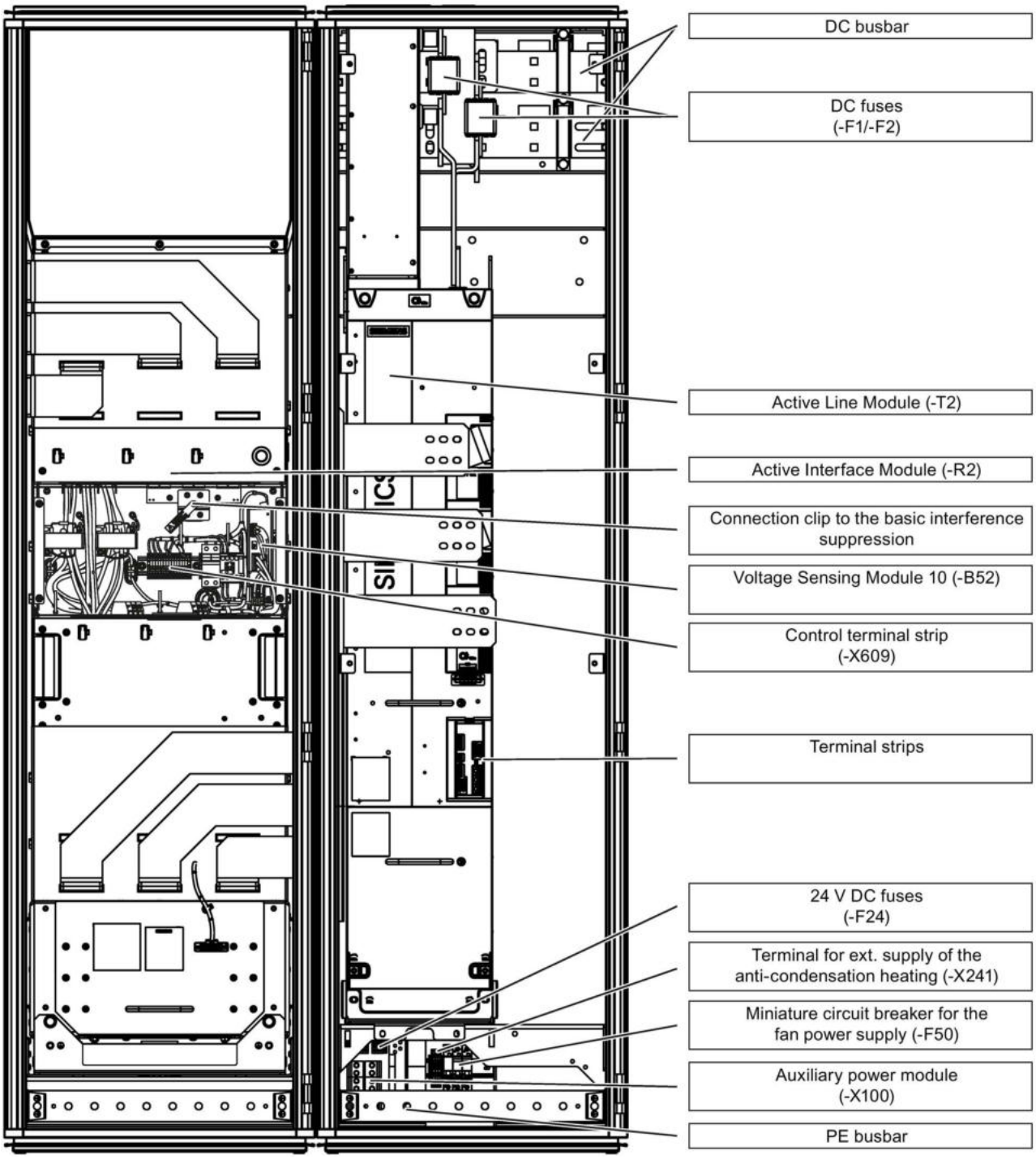


Figure 5-37 Design examples, Active Interface Module Chassis-2 (frame size FS4) and Active Line Module Chassis-2 (frame size FS4) – for installing the Motor Modules to the right

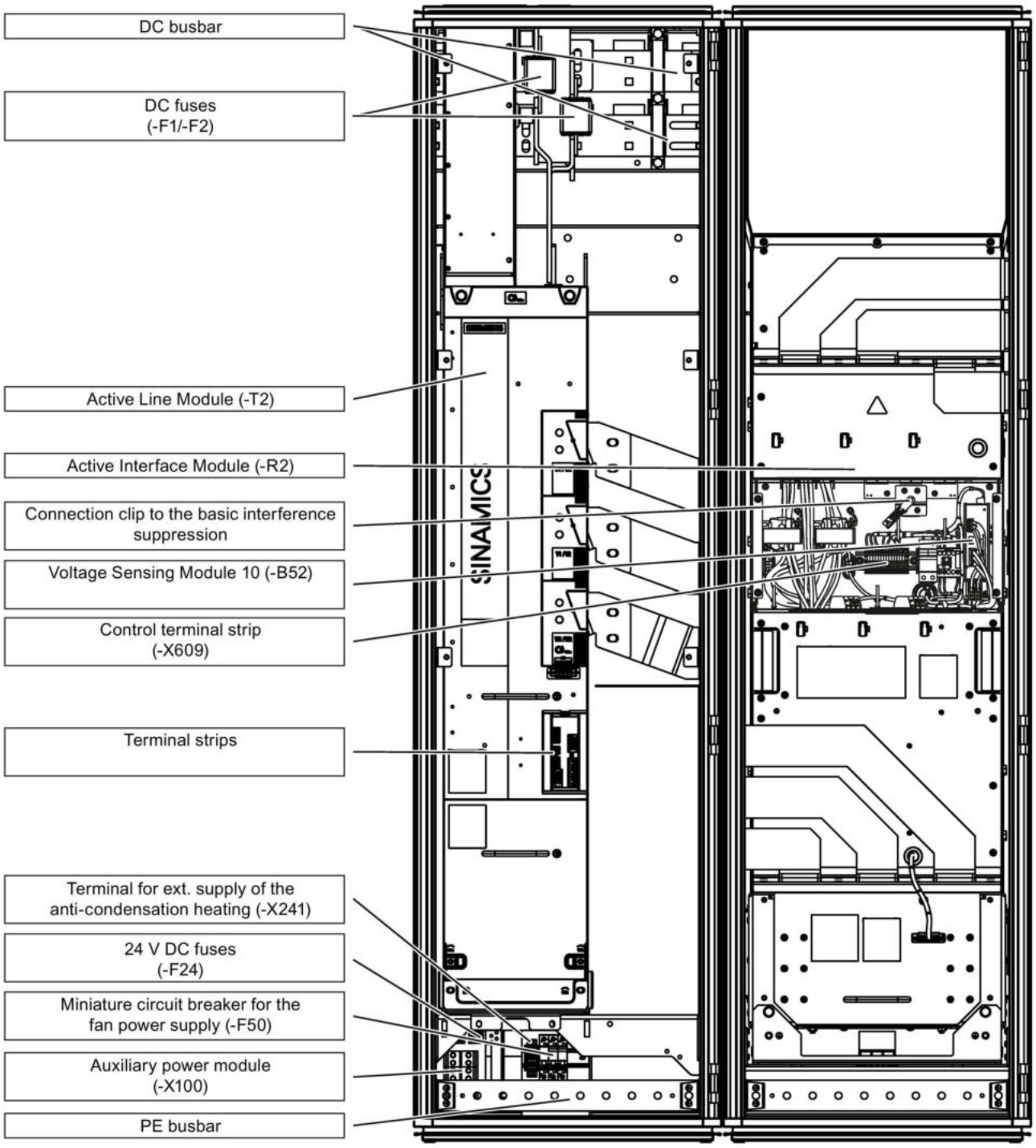


Figure 5-38 Design examples, Active Interface Module Chassis-2 (frame size FS4) and Active Line Module Chassis-2 (frame size FS4) – for installing the Motor Modules to the left

Connecting Active Line Connection Modules-2 in parallel to increase the power rating

The following rules must be observed when connecting Active Line Connection Modules-2 in parallel:

- Up to 6 identical Active Line Connection Modules-2 can be connected in parallel.
- Option M88 (DC busbar system for the line-side Cabinet Modules) must be installed so that the infeed can be realized at the common DC link.
- Parallel connection can only be implemented using one common Control Unit.
  For more than 4 power units, these must be distributed as symmetrically as possible between at least two DRIVE-CLiQ ports (e.g. 3x 2 Active Line Connection Modules-2 in series, or a minimum of 2x 3 Active Line Connection Modules-2 in series).
- The parallel connection must be supplied from a common infeed point (i.e. different supply systems are not permitted); see also SINAMICS Low Voltage Configuration Manual.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- The main contactors or circuit breakers of the respective Line Connection Modules must close together and simultaneously.
  The monitoring is realized via terminals -X50 of the particular Line Connection Module.

Using Active Line Connection Modules-2 in line supplies in conformance with Standard EN 61000-2-4, Class 2

When using Active Line Connection Modules-2 in line supplies in conformance with Standard EN 61000-2-4, Class 2, the following conditions must be carefully observed:

- Class 2 of EN 61000-2-4 is complied with for the step-up factor set in the factory (= 1.5) and an R_{SC} > 20 and a pulse frequency of 4 kHz.
- For a step-up factor ≥1.5, the pulse frequency of Active Line Modules Chassis-2 must be set to 8 kHz.
  When used in TN line systems and when the Active Line Modules Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

Note

In complying with the limit values according to standard EN 61000-2-4, Class 2 and Class 3, the evaluation of the conductor-conductor voltage in a frequency range of <9 kHz is assumed.

Operating Active Line Connection Modules-2 on weak line supplies

When using an Active Line Connection Module-2 on weak line supplies (R_{SC} < 20), the bandstop filter must be activated (parameter p5200.0 = 1), in order to suppress increased line harmonics.

Note

Activating the bandstop filter

Function module "Supplementary control" must be activated to activate the bandstop filter. For additional information, see "SINAMICS S120 Function Manual Drive Functions".

After activating the bandstop filter, no additional settings are required; it can be operated with the factory parameterization.

When using an Active Line Connection Module-2 on strong (stiff) line supplies (R_{SC} > 20), the bandstop filter should not be activated (parameter p5200.0 = 0), in order to avoid unfavorable overshoots. For more information, see Configuration Manual Low Voltage.

5.5.1.1 Fuse switch disconnector (input current ≤ 800 A)

Up to 800 A, a switch disconnector with integrated fuses and a main contactor are installed. The contactor is controlled internally.

NOTICE
Material damage caused by switching the line contactor under load Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor. • Always switch the line contactor at zero current.

X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Table 5- 27 Terminal block X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Terminal	Designation [1]	Technical data
1	NO	"Fuse switch disconnector" checkback contacts Max. load current: 3 A max. Switching voltage: 250 VAC
2	NC	
3	COM	
4	NO	"Main contactor" feedback signal contacts Max. load current: 10 A Max. Switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: normally-closed contact, NO: normally-open contact, COM: Center contact

5.5.1.2 Circuit breaker (input current > 800 A)

At currents greater than 800 A, the circuit breaker, which is located in the center of the cabinet, takes on the function of isolating the system from the supply and the overload and short-circuit protection. The circuit breaker is internally activated and has its own internal power supply.

As a consequence, the device is sufficiently protected using the factory setting.

The circuit breaker is set as follows in the factory:

Table 5- 28 Factory setting of the circuit breaker for the Active Line Connection Module-2

Article number Active Line Connection Module-2	Input current	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (t_{sd})
6SL3731-7TE38-4RE0 6SL3731-7TE38-4LE0	840 A	0.9	2	0
6SL3731-7TE38-8RE0 6SL3731-7TE38-8LE0	900 A	0.9	2	0
6SL3731-7TE41-0RE0 6SL3731-7TE41-0LE0	985 A	0.8	2	0

⚠WARNING

Incorrect circuit breaker setting

Incorrect settings can cause unwanted or delayed tripping of the circuit breaker and result in damage to the cabinet unit and can therefore result in death or severe injury.

- Check the settings described above, and if required, adapt the circuit breaker settings corresponding to the factory setting.

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker as well as the standard and additional options can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

X50 "circuit breaker" checkback contact

Table 5- 29 Terminal block X50 "Circuit-breaker" checkback contact

Terminal	Designation [1]	Technical data
1	NO	"Circuit breaker" checkback contacts
2	NC	Max. load current: 3 A
3	COM	Max. switching voltage: 250 VAC
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

X30 looping in an external EMERGENCY OFF

Terminal block -X30 provides you with the option of connecting an external EMERGENCY OFF (normally-closed contact) for switching off the circuit breaker.

Table 5- 30 Terminal block X30 "External EMERGENCY OFF" checkback contact

Terminal	Technical data
1	Factory-installed jumper between terminal 1 and terminal 2; this jumper must be removed if a normally-closed contact is looped in externally.
2	
Max. connectable cross-section: 2.5 mm²	

5.5.1.3 Terminal block -X40 external 230 V AC auxiliary infeed

Terminal block -X40 provides you with the option of connecting an external auxiliary infeed (such as an uninterruptible power supply) that is independent of the main infeed. The connection may be protected with up to a 16 A fuse.

Table 5- 31 Terminal block X40 external 230 VAC auxiliary infeed

Terminal	Designation	Technical data
1	L1	Factory-installed jumper to terminal 2; this jumper must be removed if an external infeed is used.
2	L1	Connection of external 230 VAC auxiliary infeed: L1
5	N	Factory-installed jumper to terminal 6; this jumper must be removed if an external infeed is used.
6	N	Connection of external 230 VAC auxiliary infeed: N
Max. connectable cross-section: 2.5 mm²		

5.5.2 Interface description

5.5.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

Overview of the terminal strips at the Active Line Connection Module-2

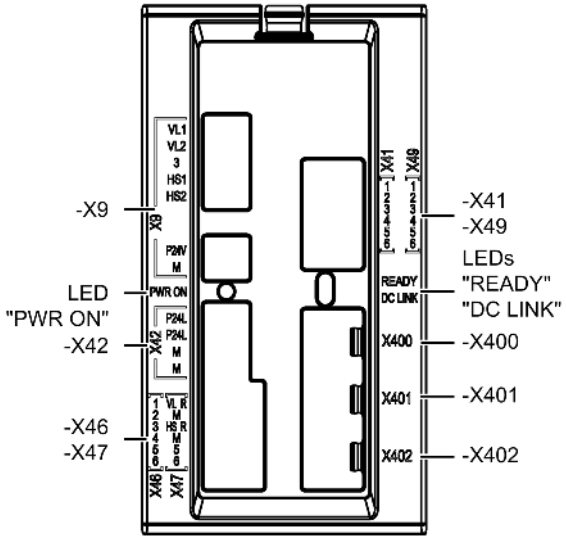


Figure 5-39 Terminal strips at the Active Line Connection Module-2

5.5.2.2 X41 EP terminal / temperature sensor connection

Table 5- 32 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP +24 V (enable pulses)	Supply voltage: 24 VDC (20.4 to 28.8 V) Current consumption: 10 mA
	2	EP M1 (enable pulses)	
	3	+Temp (motor)	Temperature sensor connection: KTY84-1C130 / PT100 / PT1000 / PTC
	4	-Temp (motor)	
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm^2 At terminals 1 and 2, the terminal strip has a yellow marking, it is coded at terminal 4; please use the corresponding connector from the accessory pack.			



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to the motor in the event of incorrectly connected KTY temperature sensor at terminals X41:3,4

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

NOTICE

Looping the circuit breaker into the EP terminal circuit for infeed units capable of energy recovery

If the upstream circuit breakers are not controlled from the SINAMICS drive group in the case of infeed units capable of energy recovery, then this can have a damaging reaction on the section that has been shut down when the circuit breaker is opened. As a consequence, under certain circumstances, the components connected in the line supply section involved could be damaged as a result of overvoltage.

- If, for infeed units capable of energy recovery, the upstream circuit breaker is not controlled from the SINAMICS drive group, then an auxiliary contact of the circuit breaker should be looped into the circuit associated with the EP terminals.

Note

The temperature sensor connection at terminals X41:3,4 can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

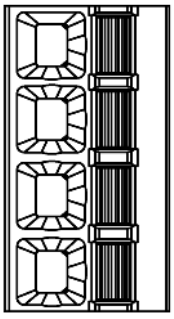
Note

Connection to terminals 1 and 2

For operation, 24 V DC must be connected to terminal 1 and ground to terminal 2. Pulse inhibit is activated when withdrawn.

5.5.2.3 X42 terminal strip

Table 5- 33 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

Connector	Terminal	Function	Technical specifications
	1	P24L	Power supply for Control Unit, Sensor Module and Terminal Module (18 ... 28.8 V) maximum load current: 3 A
	2		
	3	M	
	4		
Max. connectable cross-section: 2.5 mm²			

Note

Connection options for terminal strip X42

The terminal strip is not intended for free 24 VDC availability (for example for supplying further line-side components), as the voltage supply of the Control Interface Module could also be overloaded and operating capability could thus be compromised.

When required, additional system-side components can be connected via the central auxiliary power supply (X100).

5.5.2.4 X47 contactor feedback signal

Table 5- 34 Terminal strip X47, contactor feedback signal

Connector	Terminal	Signal name	Technical specifications
	1	VL_R	Precharging contactor feedback signal
	2	M	Supply voltage: 24 V DC Max. Load current: 10 mA
	3	HS_R	Main contactor feedback signal
	4	M	Supply voltage: 24 V DC Max. Load current: 10 mA
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm² The terminal strip is coded at terminal 3; please use the corresponding connector from the accessory pack.			

Monitoring the precharging and main contactor of the Active Line Connection Module-2 is activated in the factory setting.

Fault messages

- F30060 (A) status monitoring for the precharging contactor
- F30061 (A): Status monitoring for the main contactor

5.5.2.5 X49 terminal block

Table 5- 35 Terminal strip X49

Connector	Terminal	Function	Technical specifications
	1	LAMPPWR	Supply voltage: 24 V DC Max. Load current: 100 mA If a fault is active at the power unit, then a voltage is present at the terminals.
	2	M	
	3	NC	Reserved, do not use
	4	NC	Reserved, do not use
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm^2 The terminal strip is coded at terminal 6; please use the corresponding connector from the accessory pack.			

Note

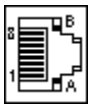
Function of the "LAMPPWR" signal

Terminal "LAMPPWR" can be used in large cabinet lineups to connect a signal lamp, which is then used to indicate which power unit has a problem. 24 V DC is output as soon as a fault becomes active in a power unit.

Note: For a firmware update, the output alternates between 0 V and 24 V.

5.5.2.6 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 36 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.5.2.7 Test points for 1 mm test probes

Test points for 1 mm test probes are provided at the sides of connectors X41, X46, X47 and X49, see ① in the following diagram.

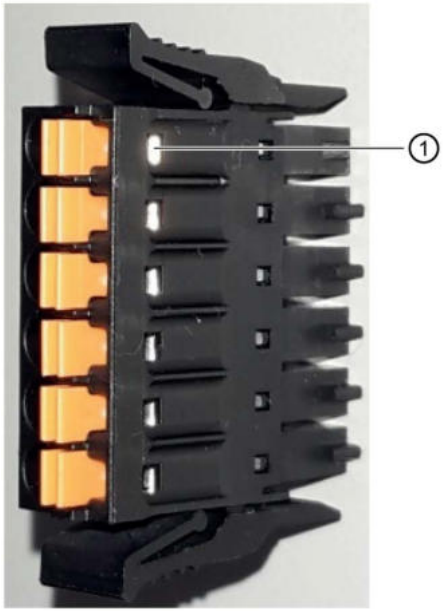


Figure 5-40 Test points for 1 mm test probes

5.5.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
1 temperature sensor module TM150	G51
2 temperature sensor modules TM150	G52
3 TM150 temperature sensor modules	G53
4 TM150 temperature sensor modules	G54
TM31 Terminal Module	G60
Additional TM31 Terminal Module	G61
TB30 Terminal Board	G62
AOP30 operator panel	K08
Auxiliary power generation in the Line Connection Module	K76
Control Unit CU320-2 DP (PROFIBUS)	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PN (PROFINET)	K95
Use in an IT line system	L20
Surge suppression	L21
Draw-out circuit breaker (for Line Connection Modules >800 A)	L25
Line filter monitoring	L40
Current transformer upstream of the main switch	L41
EMERGENCY OFF pushbutton installed in the cabinet door	L45
Cabinet lighting with service socket outlet	L50
Cabinet anti-condensation heating	L55
Insulation monitoring	L87
DC link fuses	N52
Measuring instrument for line values (installed in the cabinet door)	P10
Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door	P11

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
IP54 degree of protection	M54
DC busbar system	M80 ... M87
DC busbar system for line-side Cabinet Modules	M88
Crane transport assembly (top-mounted)	M90
Special cabinet paint finish	Y09
Factory assembly into transport units	Y11
One-line label for plant identification, 40 x 80 mm	Y31
Two-line label for plant identification, 40 x 180 mm	Y32
Four-line label for plant identification, 40 x 180 mm	Y33

Other options

Component	Option
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91

5.5.4 Technical data

5.5.4.1 Active Line Connection Modules-2, 3 AC 380 ... 480 V

Table 5- 37 Technical data for Active Line Connection Modules-2, 380 V ... 480 V 3 AC, Part 1

Article No. [1]	**6SL3731-**	**7TE35-6RE0 7TE35-6LE0**	**7TE36-4RE0 7TE36-4LE0**	**7TE37-5RE0 7TE37-5LE0**	**7TE38-4RE0 7TE38-4LE0**
Rated power					
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	355	400	450	500
- for $I_{L\,DC}$ (50 Hz 400 V)	kW	300	350	400	450
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	500	550	650	700
- for $I_{L\,DC}$ (60 Hz 460 V)	hp	400	500	550	650
DC link current					
- Rated current $I_{N\,DC}$	A	630	710	835	940
- Base load current $I_{H\,DC}$ [2]	A	571	649	760	854
- Maximum current $I_{max\,DC}$	A	857	974	1140	1281
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	560	635	745	840
- maximum current $I_{max\,E}$	A	773	878	1028	1155
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 380 -10 % ... 3 AC 480 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Pulse frequency [3]	kHz	4	4	4	4
Current consumption (230 V 1 AC)	A	4.1	4.1	4.1	4.1
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	1.5
DC link capacitance					
- Active Line Module	µF	16450	16450	18800	18800
- Drive line-up, max.	µF	250000	250000	250000	250000
Power loss, max. [4]					
- at 50 Hz 400 V	kW	12.14	12.65	16.38	17.32
- at 60 Hz 460 V	kW	12.14	12.65	16.38	17.32
Cooling air requirement	m^3/s	1.3	1.3	1.7	1.7
Sound pressure level L_{pA} (1 m) at 50/60 Hz [5]	dB(A)	75/75	75/75	75/75	75/75
Line connection L1, L2, L3		4M12	4/M12	10/M12	10/M12
- Connection cross-section, max. (IEC)	mm^2	8 x 240	8 x 240	8 x 240	8 x 240
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Cable length, max. [6]					
- shielded	m	3900	3900	3900	3900
- unshielded	m	5850	5850	5850	5850
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version)					
- Width	mm	1600	1600	1600	1600
- Height	mm	2200	2200	2200	2200
- Depth	mm	600	600	600	600

Article No. [1]	**6SL3731-**	**7TE35-6RE0 7TE35-6LE0**	**7TE36-4RE0 7TE36-4LE0**	**7TE37-5RE0 7TE37-5LE0**	**7TE38-4RE0 7TE38-4LE0**
Weight (standard version)	kg	989	994	1192	1192
Frame size - Line Connection Module - Active Interface Module - Active Line Module		 HL FS2 FS2	 HL FS2 FS2	 JL FS4 FS2+	 JL FS4 FS2+
Rated short-circuit current acc. to IEC	kA	50	50	100	100
Minimum short-circuit current [7]	kA	18	18	2	2

1) Article number "...RE0": Motor Modules installed to the right, "...LE0": Motor Modules installed to the left.

2) The base load current $I_{L\ DC}$ is based on a duty cycle of 115% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

3) Derating for higher pulse frequencies on request.

4) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

5) Total sound pressure level of Active Interface Module and Active Line Module.

6) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.
The cable lengths are valid for use in IT line systems. When used in TN line systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN line systems and when the Active Line Module Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

7) Minimum current required for reliable tripping of the protective devices provided.

Table 5- 38 Technical data for Active Line Connection Modules-2, 380 V ... 480 V 3 AC, Part 2

Article No. [1]	**6SL3731-**	**7TE38-8RE0 7TE38-8LE0**	**7TE41-0RE0 7TE41-0LE0**		
Rated power - for $I_{N\ DC}$ (50 Hz 400 V) - for $I_{L\ DC}$ (50 Hz 400 V) - for $I_{N\ DC}$ (60 Hz 460 V) - for $I_{L\ DC}$ (60 Hz 460 V)	 kW kW hp hp	 560 500 800 700	 630 560 900 800		
DC link current - Rated current $I_{N\ DC}$ - Base load current $I_{H\ DC}$ [2] - Maximum current $I_{max\ DC}$	 A A A	 1010 915 1373	 1100 1004 1506		
Input/regenerative feedback current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 900 1238	 985 1358		
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage	 V_{ACrms} Hz V_{DC} V_{DC}	 3 AC 380 -10 % ... 3 AC 480 +10 % (-15 % < 1 min) 47 ... 63 Hz 24 (20.4 ... 28.8) 1.5 x U_{line}			
Pulse frequency [3]	kHz	4	4		
Current consumption (230 V 1 AC)	A	4.1	4.1		
Current consumption of the electronics (24 V DC)	A	1.5	1.5		
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 25900 250000	 25900 250000		
Power loss, max. [4] - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 17.70 17.70	 18.55 18.55		
Cooling air requirement	m^3/s	1.7	1.7		
Sound pressure level L_{pA} (1 m) at 50/60 Hz [5]	dB(A)	75/75	75/75		
Line connection L1, L2, L3 - Connection cross-section, max. (IEC)	 mm^2	10/M12 8 x 240	10/M12 8 x 240		
PE/GND connection - Busbar cross-section - Connection cross-section, max. (IEC)	 mm^2 mm^2	 PE busbar 600 240			
Cable length, max. [6] - shielded - unshielded	 m m	 3900 5850	 3900 5850		
Degree of protection (standard version)		IP20	IP20		
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1800 2200 600	 1800 2200 600		
Weight (standard version)	kg	1264	1284		
Frame size - Line Connection Module - Active Interface Module - Active Line Module	 	 JL FS4 FS4	 JL FS4 FS4		

Article No. [1]	**6SL3731-**	**7TE38-8RE0 7TE38-8LE0**	**7TE41-0RE0 7TE41-0LE0**		
Rated short-circuit current acc. to IEC	kA	100	100		
Minimum short-circuit current [7]	kA	2	2.5		

1) Article number "...RE0": Motor Modules installed to the right, "...LE0": Motor Modules installed to the left.

2) The base load current $I_{L\ DC}$ is based on a duty cycle of 115% for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

3) Derating for higher pulse frequencies on request.

4) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total sound pressure level of Active Interface Module and Active Line Module.

6) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.
The cable lengths are valid for use in IT line systems. When used in TN line systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN line systems and when the Active Line Module Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

7) Minimum current required for reliable tripping of the protective devices provided.

5.5.4.2 Overload capability

The Active Line Connection Modules-2 have an overload reserve.

The criterion for overload is that the Active Line Connection Module-2 is operated as a maximum with its base load current before and after the overload occurs.

For the specified load cycles, it may be necessary to take into account derating factors (e.g. pulse frequency, ambient temperature).

For additional information on the overload capability, see the Low Voltage Configuration Manual and in the SINAMICS S 120 Function Manual Drive Functions.

Low overload

The base load current I_L is based on a load cycle of 115% for 60 s with a cycle duration of 300 s.

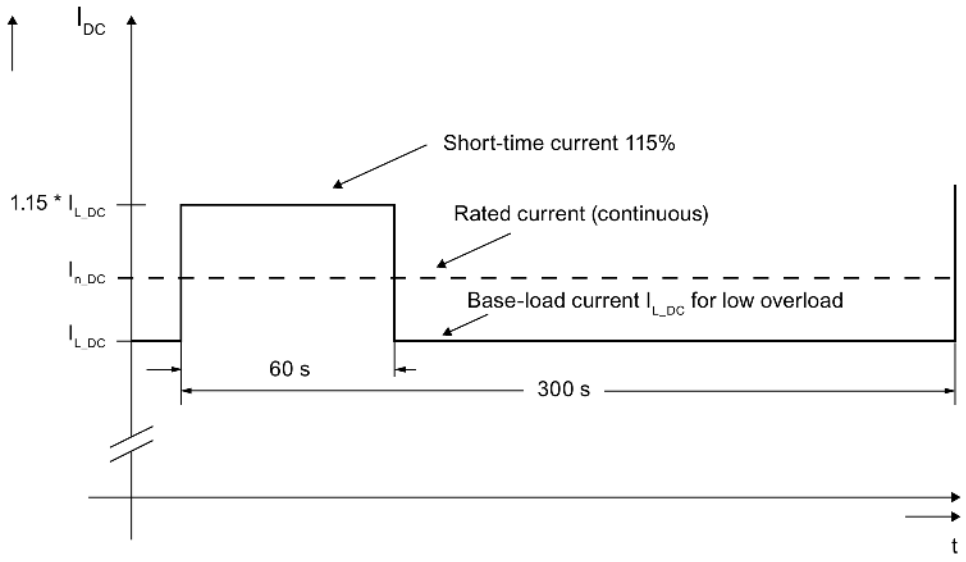


Figure 5-41 Low overload

Load cycle with maximum current

The load cycle with maximum current I_{max_DC} is based on a load cycle 150 % for 5 s with a cycle duration of 300 s.

The load cycle for I_{max_DC} is valid for a pulse frequency of 4 kHz.

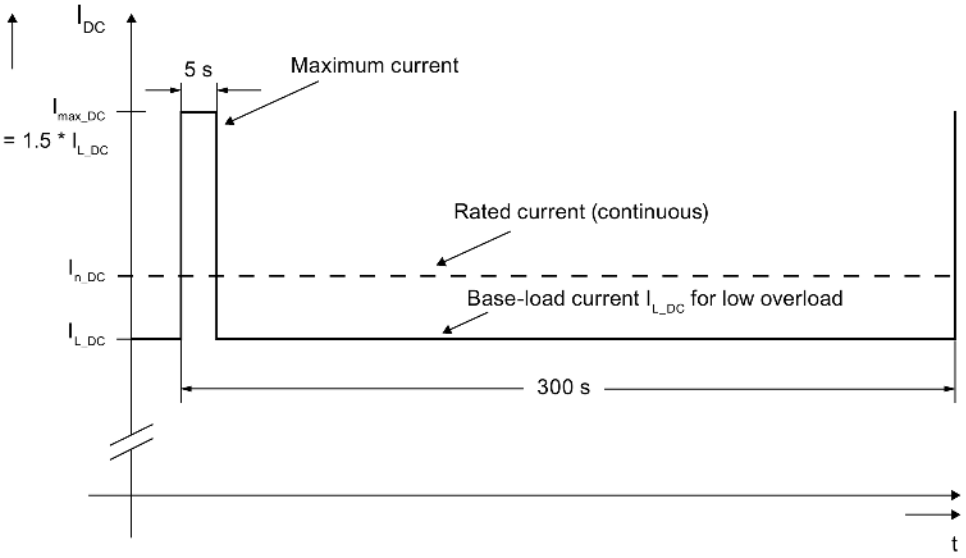


Figure 5-42 Load cycle with maximum current

5.6 Booksize format Motor Modules

5.6.1 Description

Note

Additional information

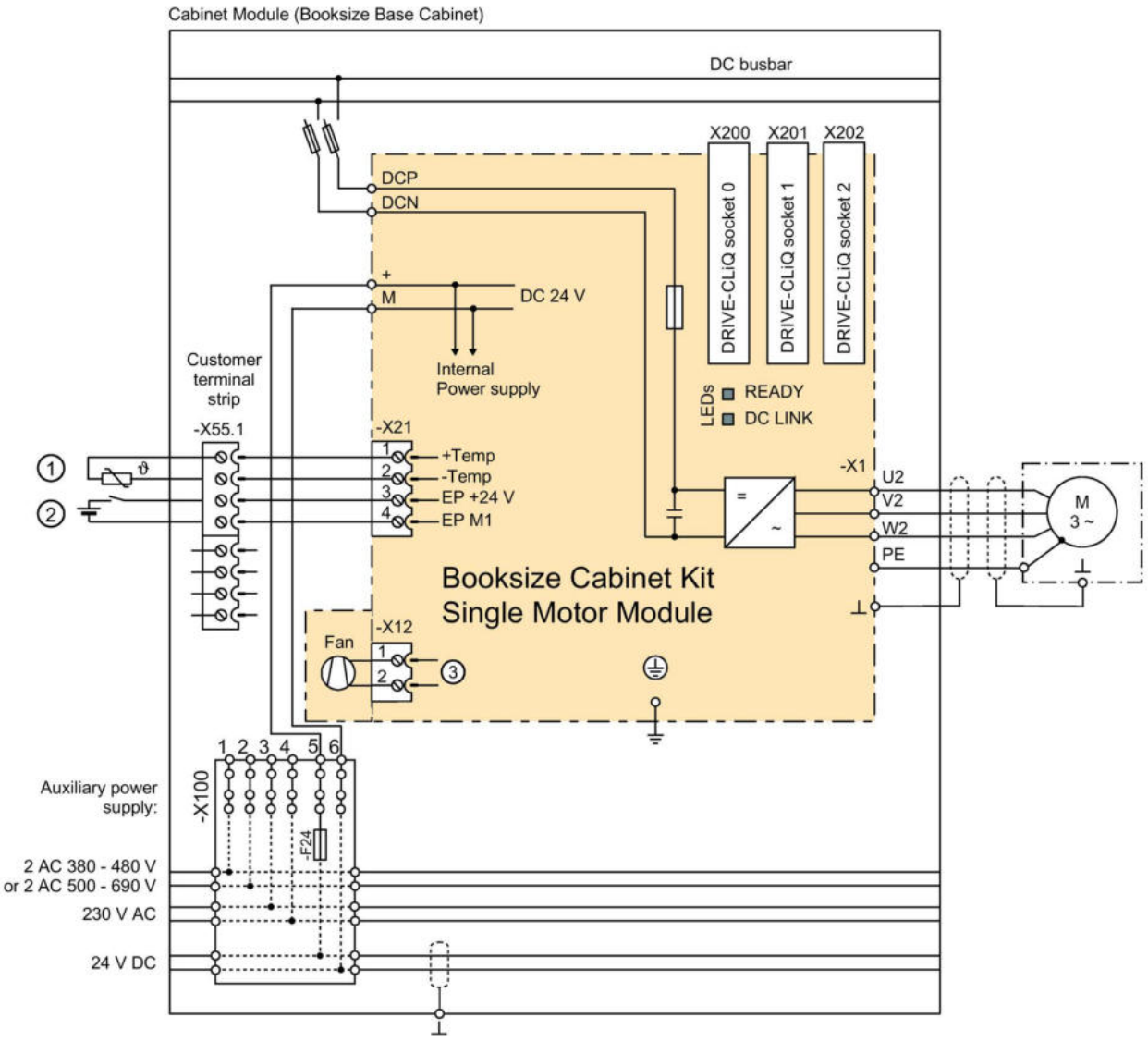
Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-43 Motor Modules in booksize format

Motor Modules are also available in a Booksize Cabinet Kit version for power ratings from 4.8 to 71 kW in voltage class 380 to 480 V (DC-link voltage 510 to 720 V).

Integration



① Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.
② Required for Safety Integrated
③ Withdrawable fan unit with a rated output current of 132 A

Figure 5-44 Connection example: Motor Module in Booksize Cabinet Kit format

Configuration

Motor Modules in booksize format are factory-installed as "Booksize Cabinet Kits" in Booksize Base Cabinets and delivered as a complete unit including cabinet-side connection components.

Several Booksize Cabinet Kits can be installed in one Booksize Base Cabinet, depending on the mounting width requirements, which in turn depend on the power. Each Motor Module is connected separately to the DC busbar of the Cabinet Modules via a separate fuse switch disconnector. The DC-link rail integrated in the devices is not used. As a 24 VDC supply buffered by the DC link is not possible for Booksize units, an auxiliary power supply is tapped to provide the 24 VDC required for the Booksize Cabinet Kit. The required 24 VDC supply must be provided by an external source via the auxiliary power supply.
With option K73, the 24 VDC supply is provided by a dedicated SITOP device.

Note

Additional information

The configuration examples of the individual Motor Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

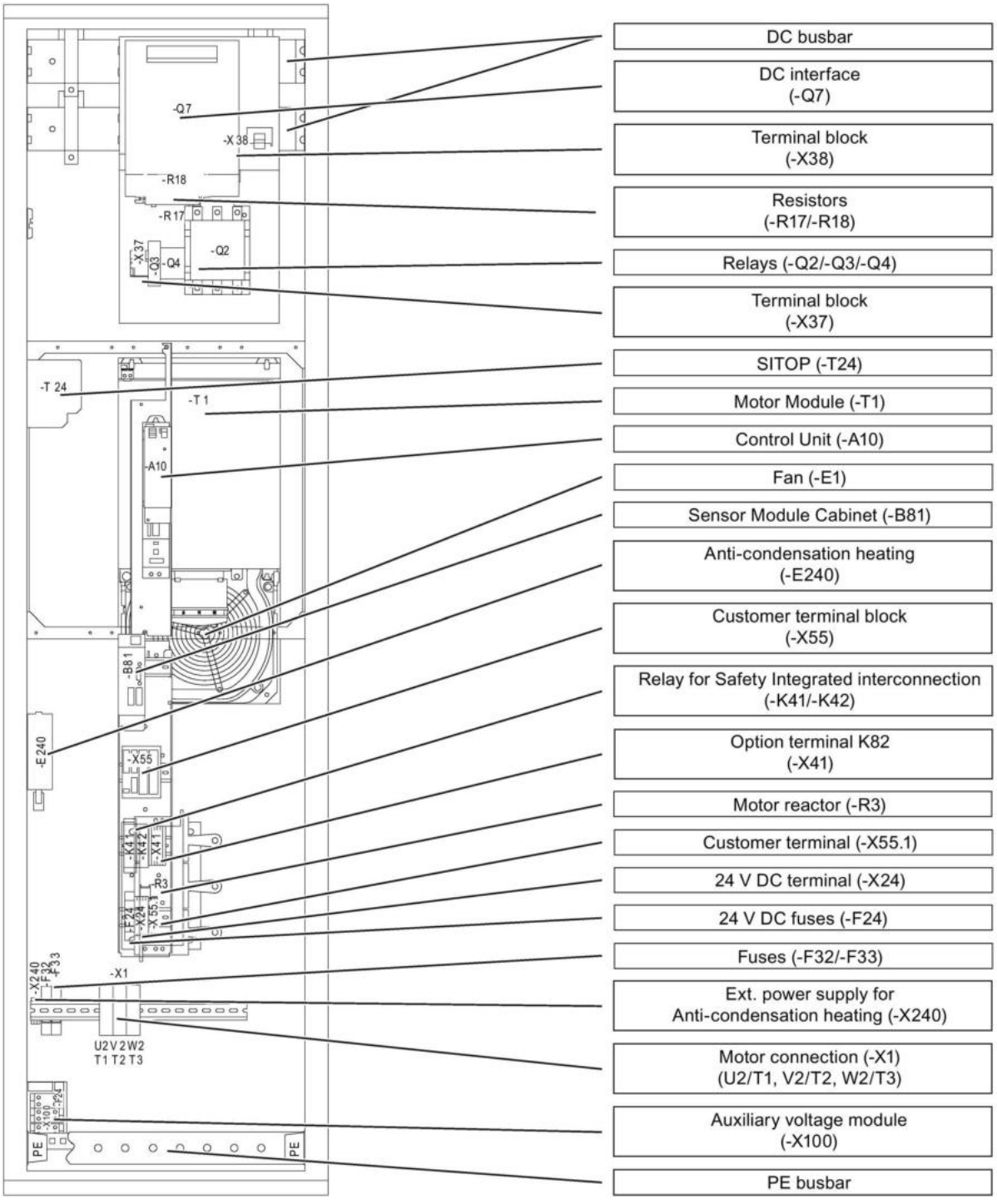


Figure 5-45 Configuration example for Motor Modules in Booksize Cabinet Kit format

Mounting grid arrangement in the cabinet

The area for connecting the Motor Modules in the cabinet is divided into three grid widths:

- 100 mm
- 200 mm
- 300 mm

The table below shows the grid width assigned to the various Motor Modules.

Table 5- 39 The assignment of the Motor Modules according to grid width

Grid width	Assignment of Motor Modules (see Section "Technical data")
100 mm	9 to 30 A Motor Modules
200 mm	45 to 85 A Motor Modules
300 mm	132 A Motor Module

Note

Available space in the Booksize base cabinets

The space available for the Motor Modules in the Booksize Base Cabinets is determined by taking the actual space and subtracting a clearance of 200 mm.

5.6.2 Interface description

5.6.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

5.6.2.2 Customer terminal block X55.1

Description

The customer terminal block (-X55.1) is mounted as standard in the cabinet for each Booksize Cabinet Kit. It provides the function-related inputs/outputs for temperature monitoring and for the "Safe Torque Off" and "Safe Stop 1" functions.

Note

Additional information

All other cabinet interfaces and connections are explained in the circuit and terminal diagrams on the customer DVD supplied.

X55.1 customer terminal block

Table 5- 40 Customer terminal block -X55.1

Terminal	Designation	Technical data
1	+ Temp	Temperature sensor connection KTY84-1C130 / PT1000 / PTC / bimetallic switch with NC contact
2	- Temp	
3	EP +24 V Enable Pulses	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
4	EP M1 Enable Pulses	Isolated input The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled.
Max. connectable cross-section: 2.5 mm^2		



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats. Overheating can cause damage to the motor.

- Connect the KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT1000 or PTC measuring sensor in the stator windings.

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

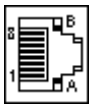
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated Functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

5.6.2.3 X200, X201, X202 DRIVE-CLiQ interfaces

Table 5- 41 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.6.3 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options for Booksize Base Cabinets

Component	Option
Auxiliary power supply 24 V DC	K73
Cabinet anti-condensation heating	L55

Mechanical options for Booksize Base Cabinets

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
EMC shield bus	M70
Version without component support plates and without additional control components	M77
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

Electrical options for Booksize Cabinet Kits

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Terminal Board TB30	G62
Safety license for 1... 5 axes	K01 ... K05
AOP30 operator panel	K08
SMC 10/20/30 Sensor Modules	K46, K48, K50
VSM10 Voltage Sensing Module Cabinet-Mounted	K51
Additional SMC30 Sensor Module	K52
Terminal Module for activating "Safe Torque Off" and "Safe STOP 1"	K82
Terminal Module TM54F	K87
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
Motor reactor	L08/L09
DC interface including pre-charging input circuit of the associated DC-link capacitance	L37
Motor reactor terminal connection	M51

5.6.4 Technical data

Table 5- 42 Technical data for Booksize Base Cabinet

Article No.	6SL3720-	1TX38-0AA3	1TX41-2AA3
Usable installation width	mm	600	1000
Weight (standard version)	kg	185	270
Dimensions (standard version, IP20) - Width - Height - Depth	 mm mm mm	 800 2200 600	 1200 2200 600

Table 5- 43 Technical data for Motor Modules in Booksize Cabinet Kit format, Single Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 VDC, part I

Article No.	6SL3720-	1TE21-0AB4	1TE21-8AB4	1TE23-0AB4	1TE24-5AB3
Type rating					
- for I_N (50 Hz 400 V) 1)	kW	4.8	9.7	16	24
- for I_H (50 Hz 400 V) 1)	kW	4.1	8.2	13.7	21
- for I_N (60 Hz 460 V) 2)	hp	5	10	20	30
- for I_H (60 Hz 460 V) 2)	hp	5	10	15	25
Output current					
- Rated current $I_{N\,A}$	A	9	18	30	45
- Base load current I_H 3)	A	7.7	15.3	25.5	38
- Maximum current $I_{max\,A}$	A	27	54	90	85
DC link current I_d 4)	A	11	22	36	54
Current consumption					
- 24 VDC, max.	A	0.75	0.75	0.8	1.2
DC link capacitance	µF	110	220	705	1175
Pulse frequency 5)					
- Rated frequency	kHz	4	4	4	4
- Pulse frequency, max. with current derating	kHz	16	16	16	16
Power loss, max. 6)					
- at 50 Hz 400 V	kW	0.08	0.165	0.29	0.43
- at 60 Hz 460 V	kW	0.08	0.165	0.29	0.43
Cooling air requirement	m^3/s	0.009	0.009	0.016	0.031
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<60	<60	<60	<65
Motor connection U2, V2, W2		Terminal			
- Conductor cross-section, max. (IEC)	mm^2	6	6	6	16
Cable length, max. 7)					
- Shielded	m	50	70	100	100
- Unshielded	m	75	100	150	150
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Degree of protection		IP20	IP20	IP20	IP20
Weight, approx.	kg	20	20	21.9	27
Wide Motor Module	mm	50	50	100	150
Installation width	mm	100	100	100	200
Rated short-circuit current acc. to IEC	kA	65	65	65	65

1) Rated power of a typ. 6-pole standard induction motor based on I_N or I_H at 3-ph. AC 50 Hz 400 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_N or I_H at 3-ph. AC 60 Hz 460 V.

3) The base load current I_H is based on a duty cycle of 150% for 60 s or 176% for 30 s with a duty cycle duration of 300 s.

4) For a DC link voltage of 600 VDC.

5) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

6) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

Table 5- 44 Technical data for Motor Modules in Booksize Cabinet Kit format, Single Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 VDC, part II

Article No.	6SL3720-	1TE26-0AB3	1TE28-5AB3	1TE31-3AB3	
Type rating					
- for I_N (50 Hz 400 V) [1]	kW	32	46	71	
- for I_H (50 Hz 400 V) [1]	kW	28	37	57	
- for I_N (60 Hz 460 V) [2]	hp	40	60	100	
- for I_H (60 Hz 460 V) [2]	hp	40	50	75	
Output current					
- Rated current $I_{N\,A}$	A	60	85	132	
- Base load current I_H [3]	A	52	65	105	
- Maximum current $I_{max\,A}$	A	113	141	210	
DC link current I_d [4]	A	72	102	158	
Current consumption					
- 24 VDC, max.	A	1.2	1.5	1.5	
DC link capacitance	µF	1410	1880	2820	
Pulse frequency [5]					
- Rated frequency	kHz	4	4	4	
- Pulse frequency, max. with current derating	kHz	16	16	16	
Power loss, max. [6]					
- at 50 Hz 400 V	kW	0.59	0.75	1.25	
- at 60 Hz 460 V	kW	0.59	0.75	1.25	
Cooling air requirement	m^3/s	0.031	0.044	0.144	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<65	<60	<73	
Motor connection U2, V2, W2		Terminal			
- Conductor cross-section, max. (IEC)	mm^2	16	35	70	
Cable length, max. [7]					
- Shielded	m	100	100	100	
- Unshielded	m	150	150	150	
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Connection cross-section, max. (IEC)	mm^2	240			
Degree of protection		IP20	IP20	IP20	
Weight, approx.	kg	27	33	41	
Wide Motor Module	mm	150	200	300	
Installation width	mm	200	200	300	
Rated short-circuit current acc. to IEC	kA	65	65	65	

[1] Rated power of a typ. 6-pole standard induction motor based on I_N or I_H at 3-ph. AC 50 Hz 400 V.

[2] Rated power of a typ. 6-pole standard induction motor based on I_N or I_H at 3-ph. AC 60 Hz 460 V.

[3] The base load current I_H is based on a duty cycle of 150% for 60 s or 176% for 30 s with a duty cycle duration of 300 s.

[4] For a DC link voltage of 600 VDC.

[5] For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

[6] The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

[7] Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

5.6.5 Overload capability

Duty cycle with 30 s and 60 s overload with a duty cycle duration of 300 s

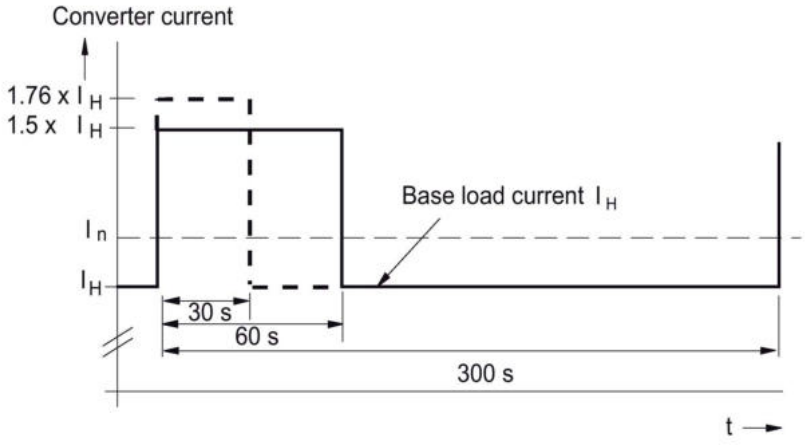


Figure 5-46 Duty cycle with 30 s and 60 s overload with a duty cycle duration of 300 s

5.7 Chassis format Motor Modules

5.7.1 Description

Note

Additional information

Refer to the layout diagrams and circuit diagrams provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.



Figure 5-47 Motor Module Chassis format

A Motor Module is a 3-phase inverter (IGBT technology) that supplies energy to the connected motor. Energy is supplied to the Motor Modules via the DC busbar.

Motor Modules Chassis format are available for the following voltages and power ratings:

Line voltage	DC link voltage	Type rating
3 AC 380 … 480 V	510 ... 720 VDC	110 ... 800 kW
3 AC 500 ... 690 V	675 ... 1035 VDC	75 ... 1200 kW

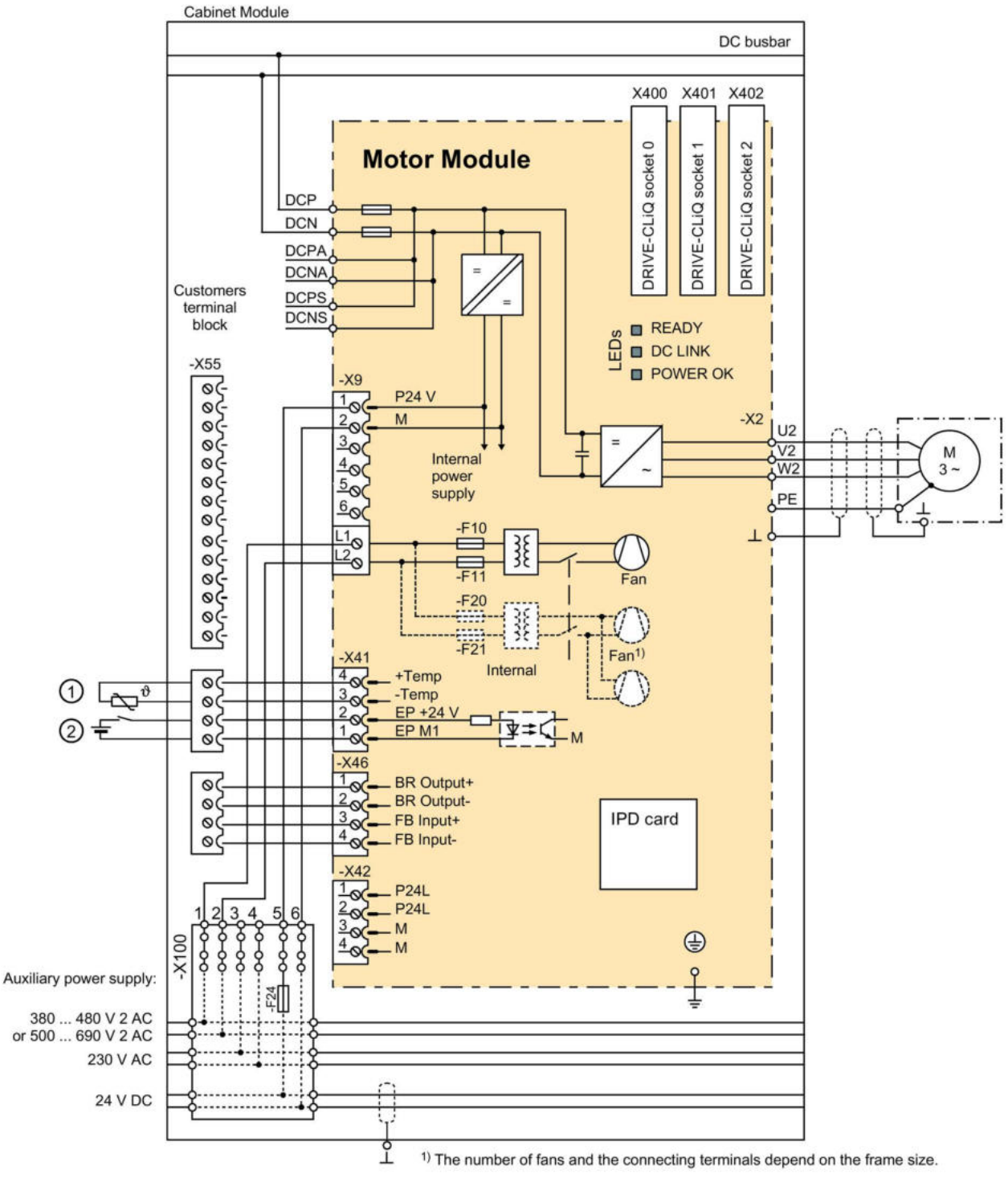
The available shaft output can be increased by connecting up to four Motor Modules in parallel. These modules are operated on one Control Unit and feed one motor.

Note

Parallel connection to a common Control Unit

Note that the Motor Modules connected in parallel are operated on a common Control Unit.

Integration



① Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.

② Required for Safety Integrated

Figure 5-48 Connection example for Motor Modules Chassis format

Configuration

Motor Modules contain the following components as standard:

- Retaining device for the DC busbar, including the interface to the DC connections of the Motor Module (the necessary DC busbar must be provided separately as option M80 to M87).
- Connection busbar, nickel-plated, for motor cables for Motor Modules with frame sizes FX and GX; for Motor Modules with frame sizes HX and JX, the motor cables are connected directly to the device.
- Cable propping bar for the electric power cables
- DRIVE-CLiQ interface (three DRIVE-CLiQ sockets), without Control Unit
- Customer interface -X55
- 6-pole auxiliary voltage supply, including auxiliary power module and cables for looping through to the next Cabinet Module.
- PE busbar (60 x 10 mm), including jumper for looping through to the next Cabinet Module.
- EMC-compliant design thanks to additional shielding measures and appropriate laying of cables.

Note

Additional information

The configuration examples of the individual Motor Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

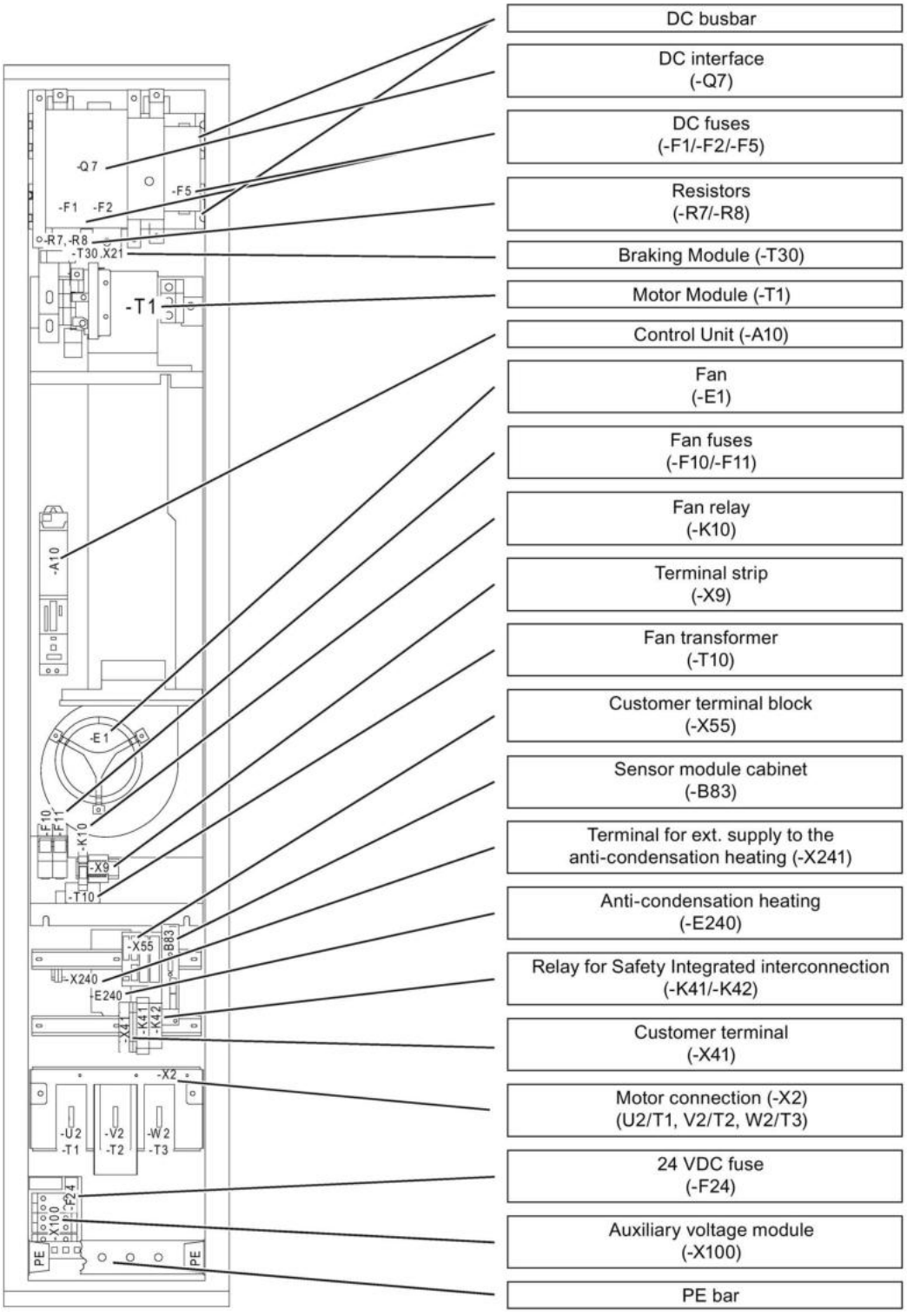


Figure 5-49 Configuration of Motor Modules Chassis format (frame size FX)

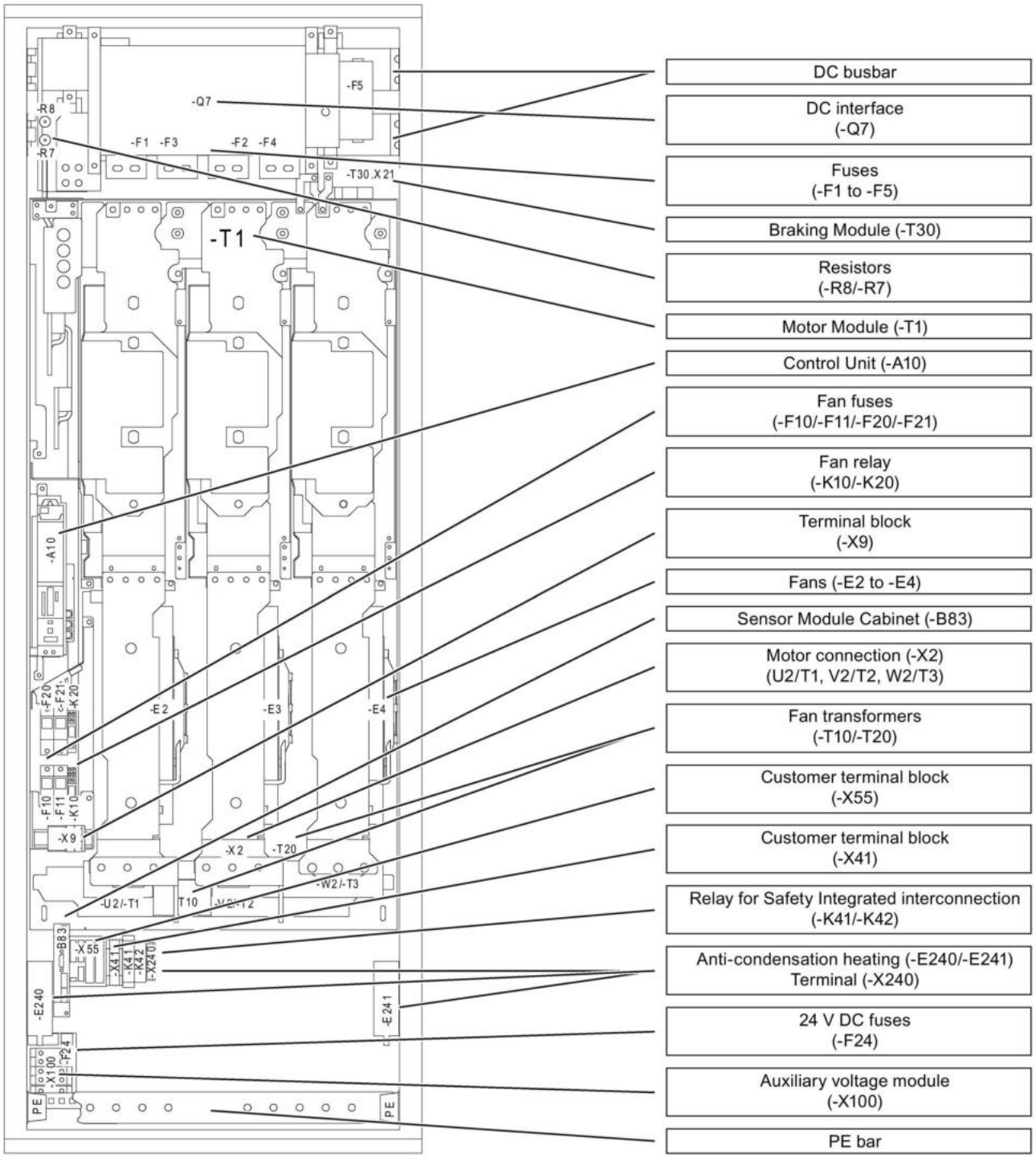


Figure 5-50 Configuration of Motor Modules Chassis format (frame size JX)

Parallel connection of Motor Modules to increase power rating

The following rules must be observed when connecting Motor Modules in parallel:

- Up to four identical Motor Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The motor supply cables must be the same length (symmetrical design).
- Power must be supplied to the Motor Modules from a common DC busbar.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- For motors with multi-winding systems, carefully observe the notes in the Low Voltage Configuration Manual
- For motors with a single-winding system, the length of the supply cables must be kept to a minimum. The cables lengths are listed in the following tables.

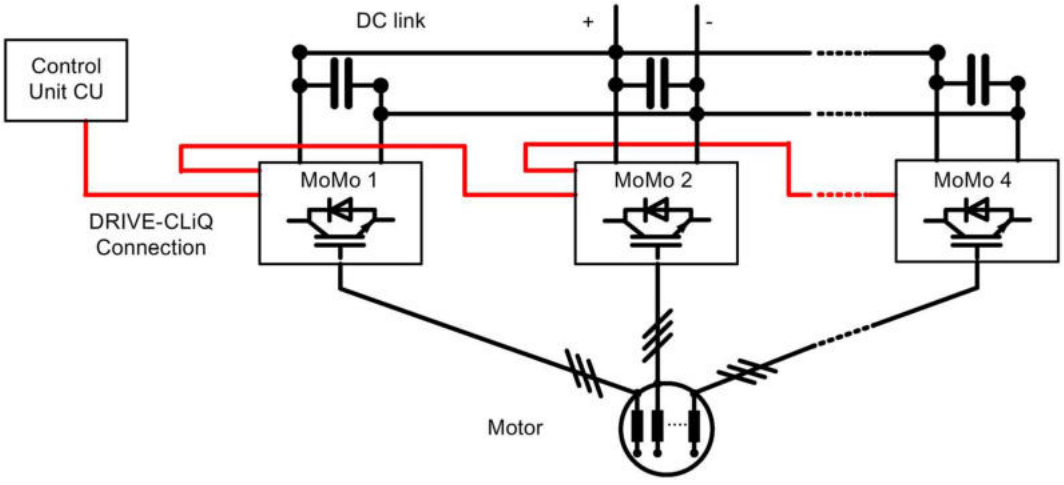


Figure 5-51 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules

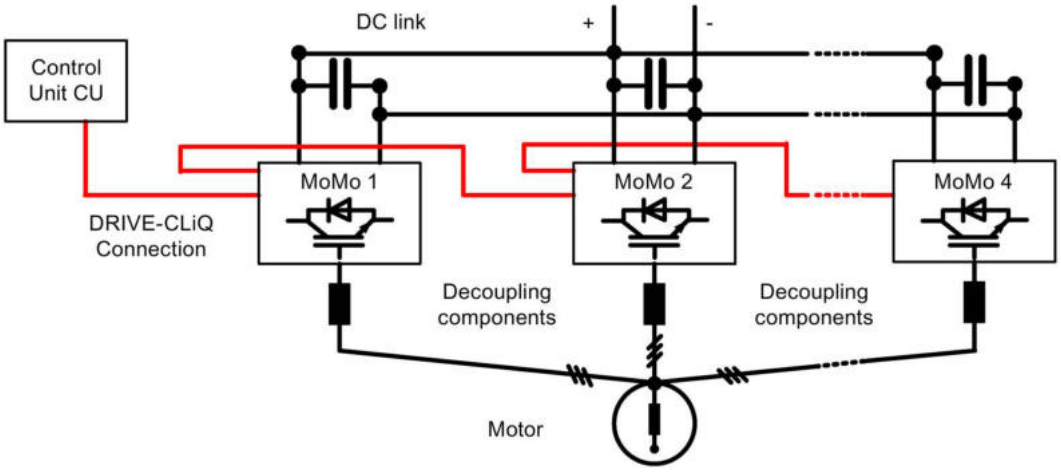


Figure 5-52 Motor with common winding system supplied by a parallel connection of S120 Motor Modules

Note

Mixed operation is not possible

It is only possible to connect power units in parallel if both of them have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

Minimum cable lengths for parallel connection and connection to a motor with a single-winding system

Note

Minimum cable lengths

The minimum cable lengths specified in the table below must be observed when two or more Motor Modules are connected in parallel and there is a connection to a motor with a single-winding system. The motor cables of Motor Modules connected in parallel may only be connected with one another at the motor terminal box.
A motor reactor (option L08, as is shown in the diagram above) must be used if the required cable length cannot be reached in the application.

Table 5- 45 Motor Modules, 510 ... 720 VDC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3720-1TE32-1AA3	FX	110	210	30
6SL3720-1TE32-6AA3	FX	132	260	27
6SL3720-1TE33-1AA3	GX	160	310	20
6SL3720-1TE33-8AA3	GX	200	380	17
6SL3720-1TE35-0AA3	GX	250	490	15
6SL3720-1TE36-1AA3	HX	315	605	13
6SL3720-1TE37-5AA3	HX	400	745	10
6SL3720-1TE38-4AA3	HX	450	840	9
6SL3720-1TE41-0AA3	JX	560	985	8
6SL3720-1TE41-2AA3	JX	710	1260	6
6SL3720-1TE41-4AA3	JX	800	1405	5

Table 5- 46 Motor Modules, 675 ...1035 VDC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3720-1TG28-5AA3	FX	75	85	100
6SL3720-1TG31-0AA3	FX	90	100	90
6SL3720-1TG31-2AA3	FX	110	120	80
6SL3720-1TG31-5AA3	FX	132	150	70
6SL3720-1TG31-8AA3	GX	160	175	60
6SL3720-1TG32-2AA3	GX	200	215	50
6SL3720-1TG32-6AA3	GX	250	260	40
6SL3720-1TG33-3AA3	GX	315	330	30
6SL3720-1TG34-1AA3	HX	400	410	25
6SL3720-1TG34-7AA3	HX	450	465	25
6SL3720-1TG35-8AA3	HX	560	575	20
6SL3720-1TG37-4AA3	JX	710	735	18
6SL3720-1TG38-1AA3	JX	800	810	15
6SL3720-1TG38-8AA3	JX	900	910	12
6SL3720-1TG41-0AA3	JX	1000	1025	10
6SL3720-1TG41-3AA3	JX	1200	1270	8

5.7.2 X55 customer terminal strip

5.7.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

Description

The customer interface -X55 is available in the cabinet irrespective of the CU320-2 Control Unit. Terminal blocks -X41 and -X46 are assigned by default.

With option K90/K95, terminal blocks -X122 and -X132 are also fully assigned (→ see "Options", section "K90, Control Unit CU320-2 DP" or section "K95, Control Unit CU320-2 PN")

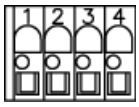
Note

Interfaces -X1, -X2, -X3 and -X4 are wired within the cabinet and are not available for customer connections!

If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be interchanged! Otherwise, the "Safe Torque Off" and "Safe Stop 1" safety functions will malfunction!

5.7.2.2 X41 EP terminal / temperature sensor connection

Table 5- 47 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 to 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled.
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic switch with NC contact
	4	+ Temp	
Max. connectable cross-section: 2.5 mm^2			



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE
Damage to motor in the event of incorrectly connected KTY temperature sensor If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor. • Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

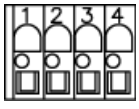
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated Functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

5.7.2.3 X46 Brake control and monitoring

Table 5- 48 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection Supply voltage: 24 V DC Max. load current: 200 mA
	2	BR output -	
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: 2.5 mm^2			

Note

The interface is intended for connection of the Safe Brake Adapter.

WARNING

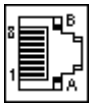
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables connected to terminal strip X46 can cause components to overheat with the associated risk of fire and smoke.

- Limit the length of the connecting cables to a maximum of 10 m.
- Do not route the connection cable outside the control cabinet or control cabinet group.

5.7.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 49 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.7.3 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Terminal Board TB30	G62
Safety license for 1 to 5 axes	K01 ... K05
AOP30 operator panel	K08
SMC 10/20/30 Sensor Modules	K46, K48, K50
VSM10 Voltage Sensing Module Cabinet-Mounted	K51
Additional SMC30 Sensor Module	K52
Terminal Module for activating "Safe Torque Off" and "Safe STOP 1"	K82
Terminal Module TM54F	K87
Safe Brake Adapter SBA 230 V AC	K88
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
dv/dt filter compact plus Voltage Peak Limiter	L07
Motor reactor	L08
dv/dt filter plus Voltage Peak Limiter	L10
Output-side circuit breaker (motorized)	L34
DC interface including pre-charging input circuit of the associated DC-link capacitance	L37
Cabinet anti-condensation heating	L55
25/125 kW braking unit	L61/L64
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
Additional shock protection	M60
EMC shield bus	M70
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.7.4 Technical data

Table 5- 50 Technical data for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC-link voltage 510 ... 720 VDC, part I

Article No.	6SL3720-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE33-8AA3	1TE35-0AA3	1TE36-1AA3
Type rating							
- for I_L (50 Hz 400 V) 1)	kW	110	132	160	200	250	315
- for I_H (50 Hz 400 V) 1)	kW	90	110	132	160	200	250
- for I_L (60 Hz 460 V) 2)	hp	150	200	250	300	400	500
- for I_H (60 Hz 460 V) 2)	hp	150	200	200	250	350	350
Output current							
- Rated current $I_{N\,A}$	A	210	260	310	380	490	605
- Base load current I_L 3)	A	205	250	302	370	477	590
- Base load current I_H 4)	A	178	233	277	340	438	460
- Maximum current $I_{max\,A}$	A	307	375	456	555	715	885
DC link current							
- rated current $I_{N\,DC}$ when fed via:							
- Basic-/Smart Line Module	A	252	312	372	456	588	726
- Active Line Module	A	227	281	335	411	529	653
- base load current $I_{L\,DC}$ 3) when fed via:							
- Basic-/Smart Line Module	A	245	304	362	444	573	707
- Active Line Module	A	221	273	326	400	515	636
- base load current $I_{H\,DC}$ 4) when fed via:							
- Basic-/Smart Line Module	A	224	277	331	405	523	646
- Active Line Module	A	202	250	298	365	470	581
Supply voltages							
- DC-link voltage	V_{DC}	510 ... 720					
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)					
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage					
Current consumption							
- Auxiliary supply 24 V DC	A	0.8	0.8	0.9	0.9	0.9	1.0
- 400 V AC	A	0.63	1.13	1.8	1.8	1.8	3.6
DC-link capacitance	µF	4200	5200	6300	7800	9600	12600
Pulse frequency							
- rated frequency	kHz	2	2	2	2	2	1.25
- pulse frequency, max.							
- without current derating	kHz	2	2	2	2	2	1.25
- with current derating	kHz	8	8	8	8	8	8
Power loss, max. 5)							
- at 50 Hz 400 V	kW	1.86	2.5	2.96	3.67	4.28	5.84
- at 60 Hz 460 V	kW	1.94	2.65	3.1	3.8	4.5	6.3
Cooling air requirement	m^3/s	0.17	0.23	0.36	0.36	0.36	0.78
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	67	69	69	69	69	72
Motor connection U2, V2, W2							
- Screws		2/M12	2/M12	2/M12	2/M12	2/M12	2/M12
- Connection cross-section, max. (IEC)	mm^2	2 x 185	2 x 185	2 x 240	2 x 240	2 x 240	4 x 240
Cable length, max. 6)							
- shielded	m	300	300	300	300	300	300
- unshielded	m	450	450	450	450	450	450

Article No.	**6SL3720-**	**1TE32-1AA3**	**1TE32-6AA3**	**1TE33-1AA3**	**1TE33-8AA3**	**1TE35-0AA3**	**1TE36-1AA3**
PE/GND connection - busbar cross-section - connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Degree of protection (standard model)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width [7] - Height [8] - depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	145	145	286	286	286	490
Frame size		FX	FX	GX	GX	GX	HX
Rated short-circuit current acc. to IEC	kA	65	65	65	65	65	65

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 400 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 460 V.

3) The base load current I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 51 Technical data for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC-link voltage 510 ... 720 VDC, part II

Article No.	6SL3720-	1TE37-5AA3	1TE38-4AA3	1TE41-0AA3	1TE41-2AA3	1TE41-4AA3
Type rating						
- for I_L (50 Hz 400 V) 1)	kW	400	450	560	710	800
- for I_H (50 Hz 400 V) 1)	kW	315	400	450	560	710
- for I_L (60 Hz 460 V) 2)	hp	600	700	800	1000	1150
- for I_H (60 Hz 460 V) 2)	hp	450	600	700	900	1000
Output current						
- Rated current $I_{N\,A}$	A	745	840	985	1260	1405
- Base load current I_L 3)	A	725	820	960	1230	1370
- Base load current I_H 4)	A	570	700	860	1127	1257
- Maximum current $I_{max\,A}$	A	1087	1230	1440	1845	2055
DC link current						
- rated current $I_{N\,DC}$ when fed via:						
- Basic-/Smart Line Module	A	894	1008	1182	1512	1686
- Active Line Module	A	805	907	1064	1361	1517
- base load current $I_{L\,DC}$ 3) when fed via:						
- Basic-/Smart Line Module	A	871	982	1152	1474	1643
- Active Line Module	A	784	884	1037	1326	1479
- base load current $I_{H\,DC}$ 4) when fed via:						
- Basic-/Smart Line Module	A	795	897	1051	1345	1500
- Active Line Module	A	716	807	946	1211	1350
Supply voltages						
- DC-link voltage	V_{DC}	510 ... 720				
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)				
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage				
Current consumption						
- Auxiliary supply 24 V DC	A	1.0	1.0	1.25	1.4	1.4
- 400 V AC	A	3.6	3.6	5.4	5.4	5.4
DC-link capacitance	µF	15600	16800	18900	26100	28800
Pulse frequency						
- rated frequency	kHz	1.25	1.25	1.25	1.25	1.25
- pulse frequency, max.						
- without current derating	kHz	1.25	1.25	1.25	1.25	1.25
- with current derating	kHz	8	8	8	8	8
Power loss, max. 5)						
- at 50 Hz 400 V	kW	6.68	7.15	9.5	11.1	12
- at 60 Hz 460 V	kW	7.3	7.8	10.2	12.0	13
Cooling air requirement	m^3/s	0.78	0.78	1.08	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	72	72	72	72	72
Motor connection U2, V2, W2						
- Screws		2/M12	2/M12	3/M12	3/M12	3/M12
- Connection cross-section, max. (IEC)	mm^2	4 x 240	4 x 240	6 x 240	6 x 240	6 x 240
Cable length, max. 6)						
- shielded	m	300	300	300	300	300
- unshielded	m	450	450	450	450	450
PE/GND connection		PE busbar				
- busbar cross-section	mm^2	600				
- connection cross-section, max. (IEC)	mm^2	240				

Article No.	**6SL3720-**	**1TE37-5AA3**	**1TE38-4AA3**	**1TE41-0AA3**	**1TE41-2AA3**	**1TE41-4AA3**
Degree of protection (standard model)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width[7)] - height[8)] - depth	 mm mm mm	 600 2200 600	 600 2200 600	 800 2200 600	 800 2200 600	 800 2200 600
Weight, approx. (standard version)	kg	490	490	700	700	700
Frame size		HX	HX	JX	JX	JX
Rated short-circuit current acc. to IEC	kA	65	84	84	100	100

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 400 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 460 V.

3) The base load current I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 52 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC-link voltage 675 ... 1035 VDC; part I

Article No.	6SL3720-	1TG28-5AA3	1TG31-0AA3	1TG31-2AA3	1TG31-5AA3	1TG31-8AA3	1TG32-2AA3
Type rating							
- for I_L (50 Hz 690 V) 1)	kW	75	90	110	132	160	200
- for I_H (50 Hz 690 V) 1)	kW	55	75	90	110	132	160
- for I_L (50 Hz 500 V) 1)	kW	55	55	75	90	110	132
- for I_H (50 Hz 500 V) 1)	kW	45	55	75	90	90	110
- for I_L (60 Hz 575 V) 2)	hp	75	75	100	150	150	200
- for I_H (60 Hz 575 V) 2)	hp	75	75	100	125	150	200
Output current							
- Rated current $I_{N\,A}$	A	85	100	120	150	175	215
- Base load current I_L 3)	A	80	95	115	142	170	208
- Base load current I_H 4)	A	76	89	107	134	157	192
- Maximum current $I_{max\,A}$	A	120	142	172	213	255	312
DC link current							
- rated current $I_{N\,DC}$ when fed via:							
- Basic-/Smart Line Module	A	102	120	144	180	210	258
- Active Line Module	A	92	108	130	162	189	232
- base load current $I_{L\,DC}$ 3) when fed via:							
- Basic-/Smart Line Module	A	99	117	140	175	204	251
- Active Line Module	A	89	105	126	157	184	226
- base load current $I_{H\,DC}$ 4) when fed via:							
- Basic-/Smart Line Module	A	90	106	128	160	186	229
- Active Line Module	A	81	96	115	144	168	206
Supply voltages							
- DC-link voltage	V_{DC}	675 ... 1035					
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)					
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage					
Current consumption							
- Auxiliary supply 24 VDC	A	0.8	0.8	0.8	0.8	0.9	0.9
- 500/690 VAC	A	0.7/0.4	0.7/0.4	0.7/0.4	0.7/0.4	1.5/1.0	1.5/1.0
DC-link capacitance	µF	1200	1200	1600	2800	2800	2800
Pulse frequency							
- rated frequency	kHz	1.25	1.25	1.25	1.25	1.25	1.25
- pulse frequency, max.							
- without current derating	kHz	1.25	1.25	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5	7.5	7.5
Power loss, max. 5)							
- at 50 Hz 690 V	kW	1.17	1.43	1.89	1.8	2.67	3.09
- at 60 Hz 575 V	kW	1.1	1.3	1.77	1.62	2.5	2.91
Cooling air requirement	m^3/s	0.17	0.17	0.17	0.17	0.36	0.36
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	67	67	67	67	69	69
Motor connection U2, V2, W2							
- Screws		2/M12	2/M12	2/M12	2/M12	2/M12	2/M12
- Connection cross-section, max. (IEC)	mm^2	2 x 185	2 x 185	2 x 185	2 x 185	2 x 240	2 x 240
Cable length, max. 6)							
- shielded	m	300	300	300	300	300	300
- unshielded	m	450	450	450	450	450	450

Article No.	**6SL3720-**	**1TG28-5AA3**	**1TG31-0AA3**	**1TG31-2AA3**	**1TG31-5AA3**	**1TG31-8AA3**	**1TG32-2AA3**
PE/GND connection - busbar cross-section - connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Degree of protection (standard model)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width[7)] - height[8)] - depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600
Weight, approx. (standard version)	kg	145	145	145	145	286	286
Frame size		FX	FX	FX	FX	GX	GX
Rated short-circuit current acc. to IEC	kA	65	65	65	65	65	65

1) Rated output of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 500 V or 690 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 575 V.

3) The base load current I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 53 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC-link voltage 675 ... 1035 VDC; part II

Article No.	6SL3720-	1TG32-6AA3	1TG33-3AA3	1TG34-1AA3	1TG34-7AA3	1TG35-8AA3
Type rating						
- for I_L (50 Hz 690 V) 1)	kW	250	315	400	450	560
- for I_H (50 Hz 690 V) 1)	kW	200	250	315	400	450
- for I_L (50 Hz 500 V) 1)	kW	160	200	250	315	400
- for I_H (50 Hz 500 V) 1)	kW	132	160	200	250	315
- for I_L (60 Hz 575 V) 2)	hp	250	300	400	450	600
- for I_H (60 Hz 575 V) 2)	hp	200	250	350	450	500
Output current						
- Rated current $I_{N\,A}$	A	260	330	410	465	575
- Base load current I_L 3)	A	250	320	400	452	560
- Base load current I_H 4)	A	233	280	367	416	514
- Maximum current $I_{max\,A}$	A	375	480	600	678	840
DC link current						
- rated current $I_{N\,DC}$ when fed via:						
- Basic-/Smart Line Module	A	312	396	492	558	690
- Active Line Module	A	281	356	443	502	621
- base load current $I_{L\,DC}$ 3) when fed via:						
- Basic-/Smart Line Module	A	304	386	479	544	672
- Active Line Module	A	273	347	431	489	605
- base load current $I_{H\,DC}$ 4) when fed via:						
- Basic-/Smart Line Module	A	277	352	437	496	614
- Active Line Module	A	250	316	394	446	552
Supply voltages						
- DC-link voltage	V_{DC}	675 ... 1035				
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)				
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage				
Current consumption						
- Auxiliary supply 24 VDC	A	0.9	0.9	1.0	1.0	1.0
- 500/690 VAC	A	1.5/1.0	1.5/1.0	3/2.1	3/2.1	3/2.1
DC-link capacitance	µF	3900	4200	7400	7400	7400
Pulse frequency						
- rated frequency	kHz	1.25	1.25	1.25	1.25	1.25
- pulse frequency, max.						
- without current derating	kHz	1.25	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5	7.5
Power loss, max. 5)						
- at 50 Hz 690 V	kW	3.62	4.34	6.13	6.8	10.3
- at 60 Hz 575 V	kW	3.38	3.98	5.71	6.32	9.7
Cooling air requirement	m^3/s	0.36	0.36	0.78	0.78	0.78
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	69/73	69/73	70/73	70/73	70/73
Motor connection U2, V2, W2						
- Screws		2/M12	2/M12	2/M12	2/M12	2/M12
- Connection cross-section, max. (IEC)	mm^2	2 x 240	2 x 240	4 x 240	4 x 240	4 x 240
Cable length, max. 6)						
- shielded	m	300	300	300	300	300
- unshielded	m	450	450	450	450	450

Article No.	**6SL3720-**	**1TG32-6AA3**	**1TG33-3AA3**	**1TG34-1AA3**	**1TG34-7AA3**	**1TG35-8AA3**
PE/GND connection - busbar cross-section - connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240				
Degree of protection (standard model)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width[7)] - height[8)] - depth	 mm mm mm	 400 2200 600	 400 2200 600	 600 2200 600	 600 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	286	286	490	490	490
Frame size		GX	GX	HX	HX	HX
Rated short-circuit current acc. to IEC	kA	65	65	65	84	84

1) Rated output of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 500 V or 690 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 575 V.

3) The base load current I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 54 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC-link voltage 675 ... 1035 VDC; part III

Article No.	6SL3720-	1TG37-4AA3	1TG38-1AA3	1TG38-8AA3	1TG41-0AA3	1TG41-3AA3
Type rating						
- for I_L (50 Hz 690 V) 1)	kW	710	800	900	1000	1200
- for I_H (50 Hz 690 V) 1)	kW	630	710	800	900	1000
- for I_L (50 Hz 500 V) 1)	kW	500	560	630	710	900
- for I_H (50 Hz 500 V) 1)	kW	450	500	560	630	800
- for I_L (60 Hz 575 V) 2)	hp	700	800	900	1000	1250
- for I_H (60 Hz 575 V) 2)	hp	700	700	800	900	1000
Output current						
- Rated current $I_{N\,A}$	A	735	810	910	1025	1270
- Base load current I_L 3)	A	710	790	880	1000	1230
- Base load current I_H 4)	A	657	724	814	917	1136
- Maximum current $I_{max\,A}$	A	1065	1185	1320	1500	1845
DC link current						
- rated current $I_{N\,DC}$ when fed via:						
- Basic-/Smart Line Module	A	882	972	1092	1230	1524
- Active Line Module	A	794	875	983	1107	1372
- base load current $I_{L\,DC}$ 3) when fed via:						
- Basic-/Smart Line Module	A	859	947	1064	1199	1485
- Active Line Module	A	774	853	958	1079	1337
- base load current $I_{H\,DC}$ 4) when fed via:						
- Basic-/Smart Line Module	A	784	865	971	1094	1356
- Active Line Module	A	706	778	874	985	1221
Supply voltages						
- DC-link voltage	V_{DC}	675 ... 1035				
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)				
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage				
Current consumption						
- Auxiliary supply 24 VDC	A	1.25	1.25	1.4	1.4	1.4
- 500/690 VAC	A	4.4/3.1	4.4/3.1	4.4/3.1	4.4/3.1	4.4/3.1
DC-link capacitance	µF	11100	11100	14400	14400	19200
Pulse frequency						
- rated frequency	kHz	1.25	1.25	1.25	1.25	1.25
- pulse frequency, max.						
- without current derating	kHz	1.25	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5	7.5
Power loss, max. 5)						
- at 50 Hz 690 V	kW	10.9	11.5	11.7	13.2	16.0
- at 60 Hz 575 V	kW	10	10.5	10.6	12.0	14.2
Cooling air requirement	m^3/s	1.08	1.08	1.08	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	71/73	71/73	71/73	71/73	71/73
Motor connection U2, V2, W2						
- Screws		3/M12	3/M12	3/M12	3/M12	3/M12
- Connection cross-section, max. (IEC)	mm^2	6 x 240	6 x 240	6 x 240	6 x 240	6 x 240
Cable length, max. 6)						
- shielded	m	300	300	300	300	300
- unshielded	m	450	450	450	450	450

Article No.	**6SL3720-**	**1TG37-4AA3**	**1TG38-1AA3**	**1TG38-8AA3**	**1TG41-0AA3**	**1TG41-3AA3**
PE/GND connection - busbar cross-section - connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240				
Degree of protection (standard model)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width[7)] - height[8)] - depth	 mm mm mm	 800 2200 600	 800 2200 600	 800 2200 600	 800 2200 600	 800 2200 600
Weight, approx. (standard version)	kg	700	700	700	700	700
Frame size		JX	JX	JX	JX	JX
Rated short-circuit current acc. to IEC	kA	100	100	100	100	100

1) Rated output of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 500 V or 690 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 575 V.

3) The base load current I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s with a duty cycle duration of 300 s.

4) The base load current I_H is based on a duty cycle of 150% for 60 s or 160% for 10 s with a duty cycle duration of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5.7.5 Overload capability

The Motor Modules Chassis format have an overload reserve (e.g. to handle breakaway torques).

In the case of drives with overload requirements, the appropriate base load current must, therefore, be used as a basis for the required load.

For overload, the following precondition applies: The drive is operated as a maximum with its base load current before and after the overload occurs (a duty cycle duration of 300 s is used as a basis here).

Another precondition is that the drive is operated with its factory-set pulse frequency at output frequencies >10 Hz.

For additional information on the overload capability, see the Low Voltage Configuration Manual and in the SINAMICS S 120 Function Manual Drive Functions.

Low overload

The base load current I_L is based on a duty cycle of 110% for 60 s or 150% for 10 s with a duty cycle of 300 s.

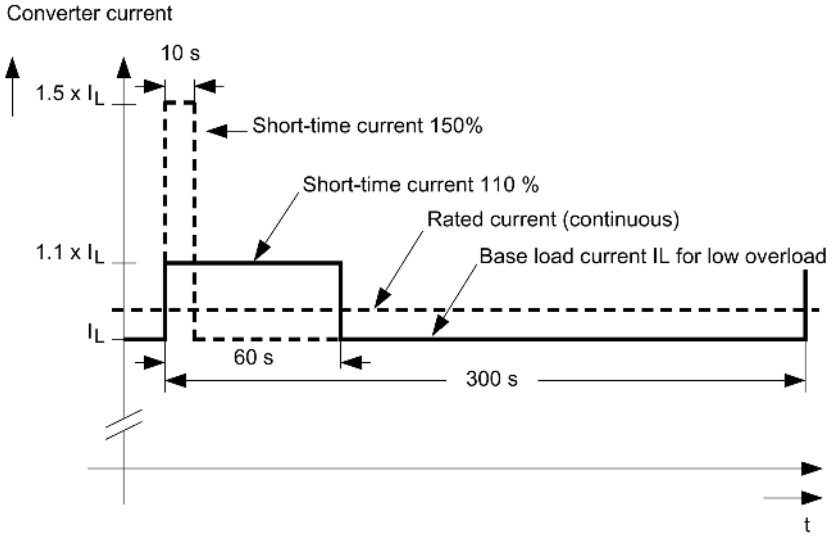


Figure 5-53 Low overload

High overload

The base load current I_H is based on a load cycle of 150% for 60 s or 160% for 10 s with a load cycle of 300 s.

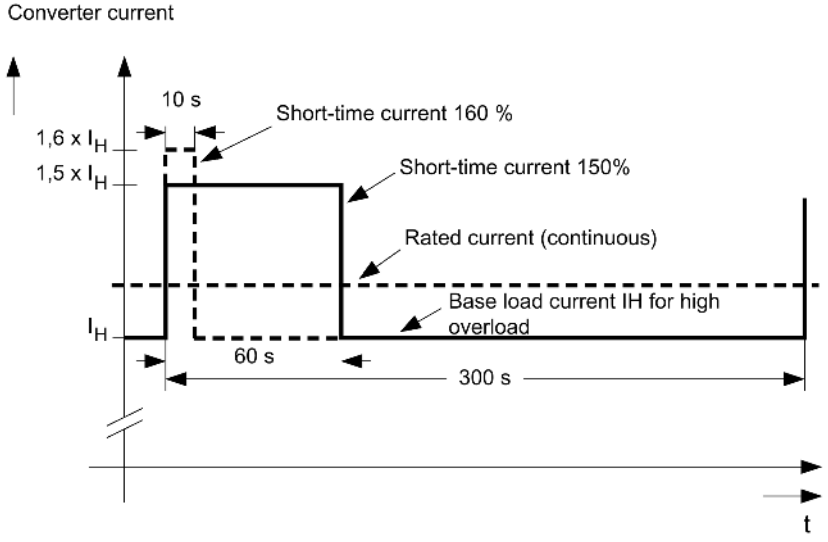


Figure 5-54 High overload

5.8 Motor Modules - Chassis-2 format

5.8.1 Description

Note

Additional information

Refer to the layout diagrams and circuit diagrams provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

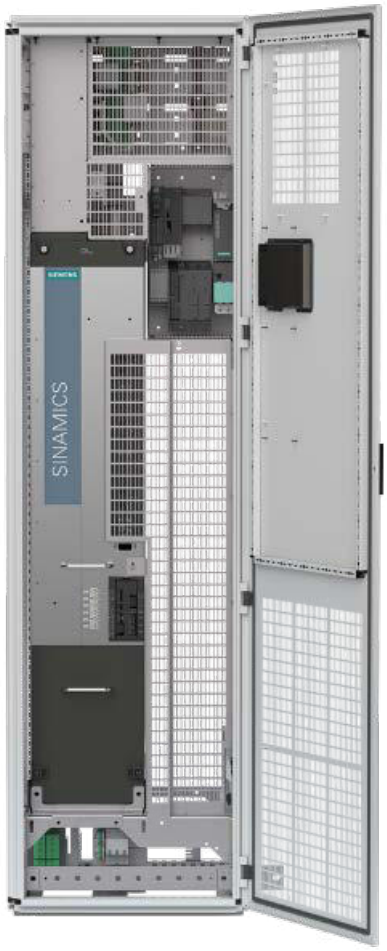


Figure 5-55 Motor Modules Chassis-2 format

A Motor Module is a 3-phase inverter (IGBT technology) that supplies energy to the connected motor. Energy is supplied to the Motor Modules via the DC busbar.

Motor Modules Chassis-2 format are available for the following voltages and power ratings:

Line voltage	DC link voltage	Type rating
3 AC 380 … 480 V	510 ... 720 VDC	315 ... 630 kW

The available shaft output can be increased by connecting up to 6 Motor Modules Chassis-2 in parallel. These modules are operated on one Control Unit and feed one motor.

Note

Parallel connection to a common Control Unit

Note that the Motor Modules connected in parallel are operated on a common Control Unit.

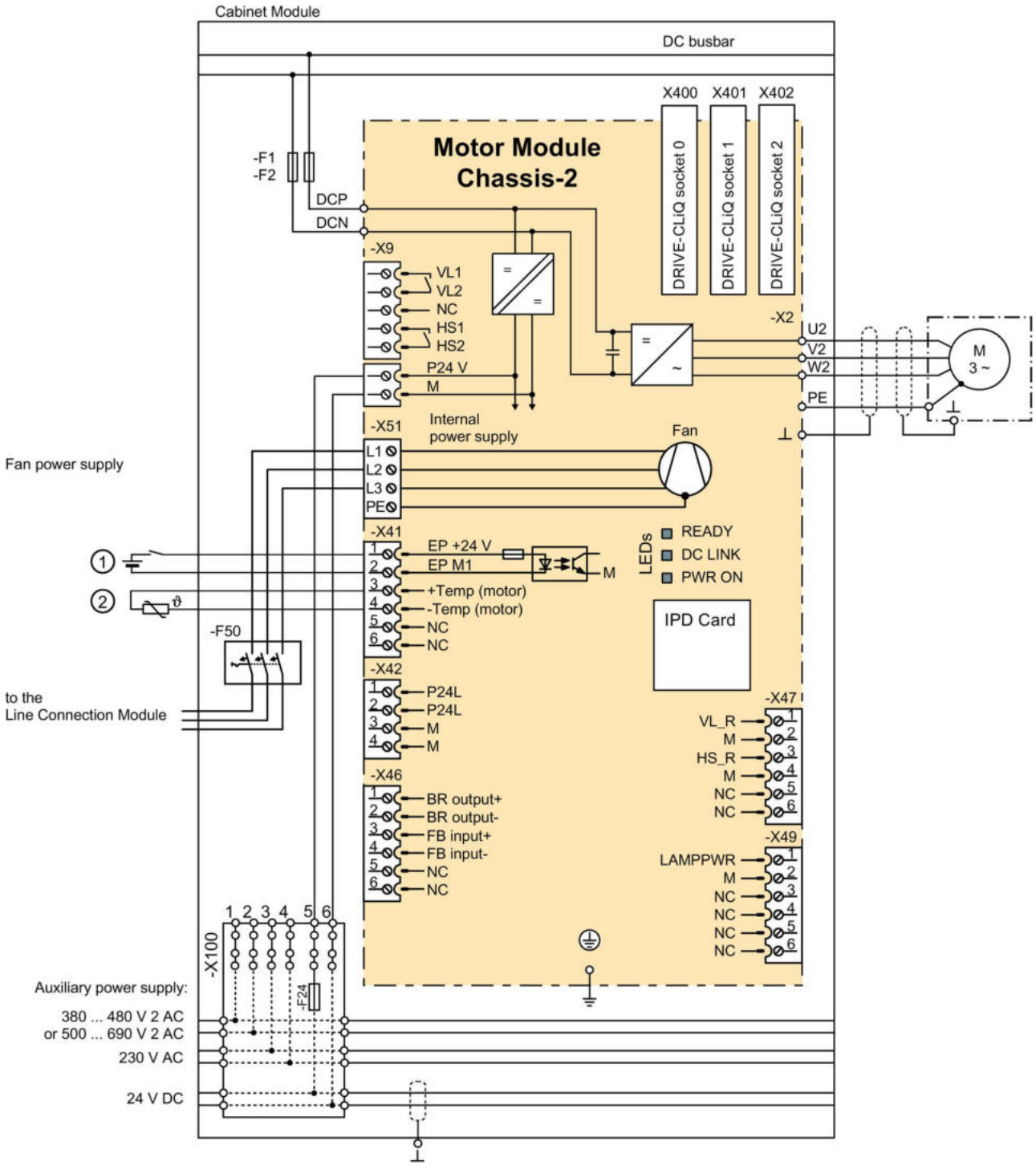
NOTICE

Operation only with a firmware version from V5.2 HF4 and higher.

The Motor Module Chassis-2 can be damaged if operated with unsuitable firmware.

- Only operate the Motor Module Chassis-2 with a firmware version from V5.2 HF4 and higher.

Integration



① Required for Safety Integrated

② Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.

Figure 5-56 Connection example: Motor Module Chassis-2 format

Configuration

Motor Modules contain the following components as standard:

- Retaining device for the DC busbar, including the interface to the DC connections of the Motor Module (the necessary DC busbar must be provided separately as option M80 to M87).
- Connection busbars, nickel-plated.
- DC fuses
- Cable propping bar for the electric power cables
- DRIVE-CLiQ interface (three DRIVE-CLiQ sockets), without Control Unit
- 6-pole auxiliary voltage supply, including auxiliary power module and cables for looping through to the next Cabinet Module.
- PE busbar (60 x 10 mm), including jumper for looping through to the next Cabinet Module.
- EMC-compliant design thanks to additional shielding measures and appropriate laying of cables.

Note

Additional information

The configuration examples of the individual Motor Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

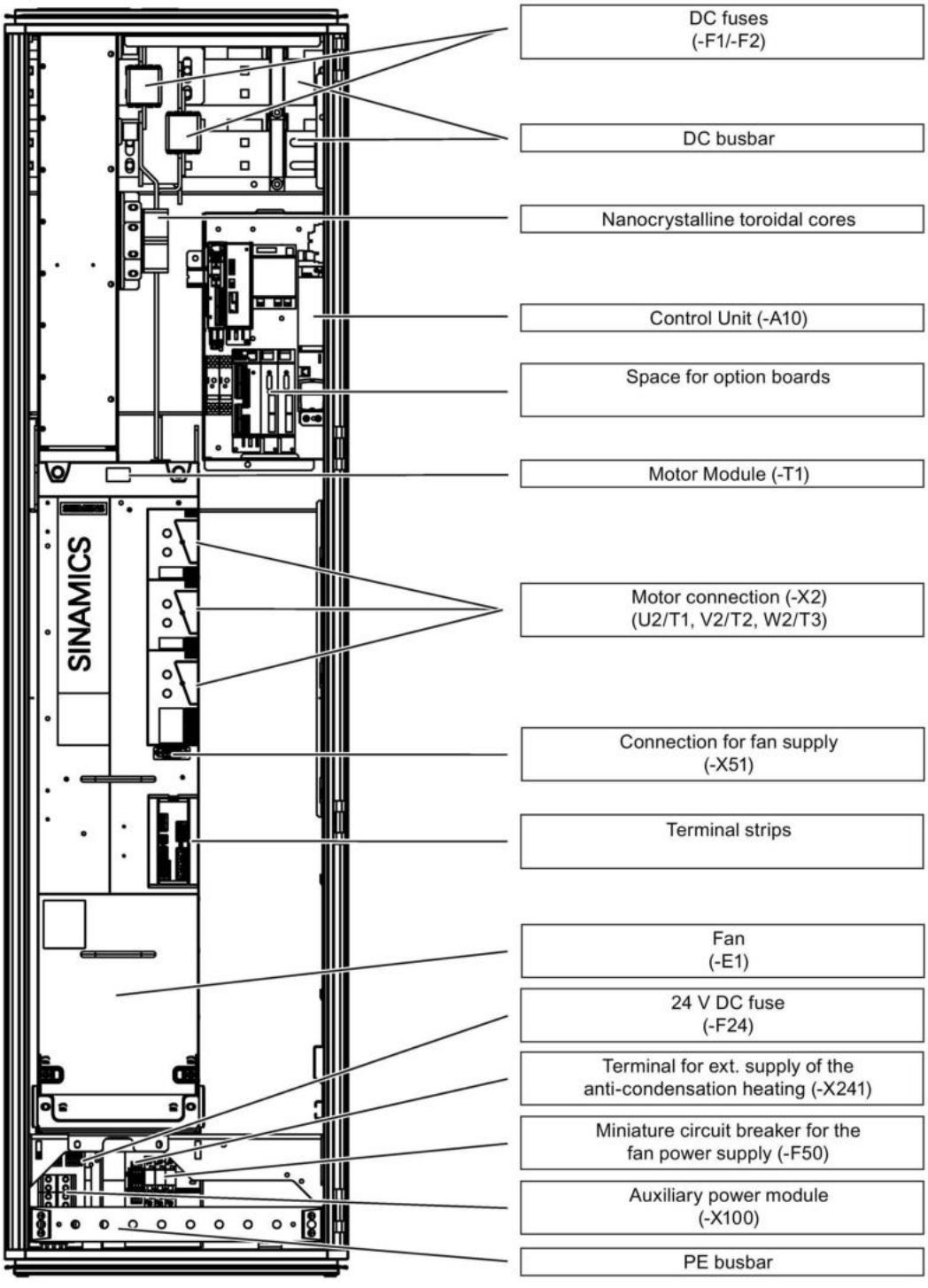


Figure 5-57 Configuration example for Motor Module Chassis-2 format (frame sizes FS2, FS2+)

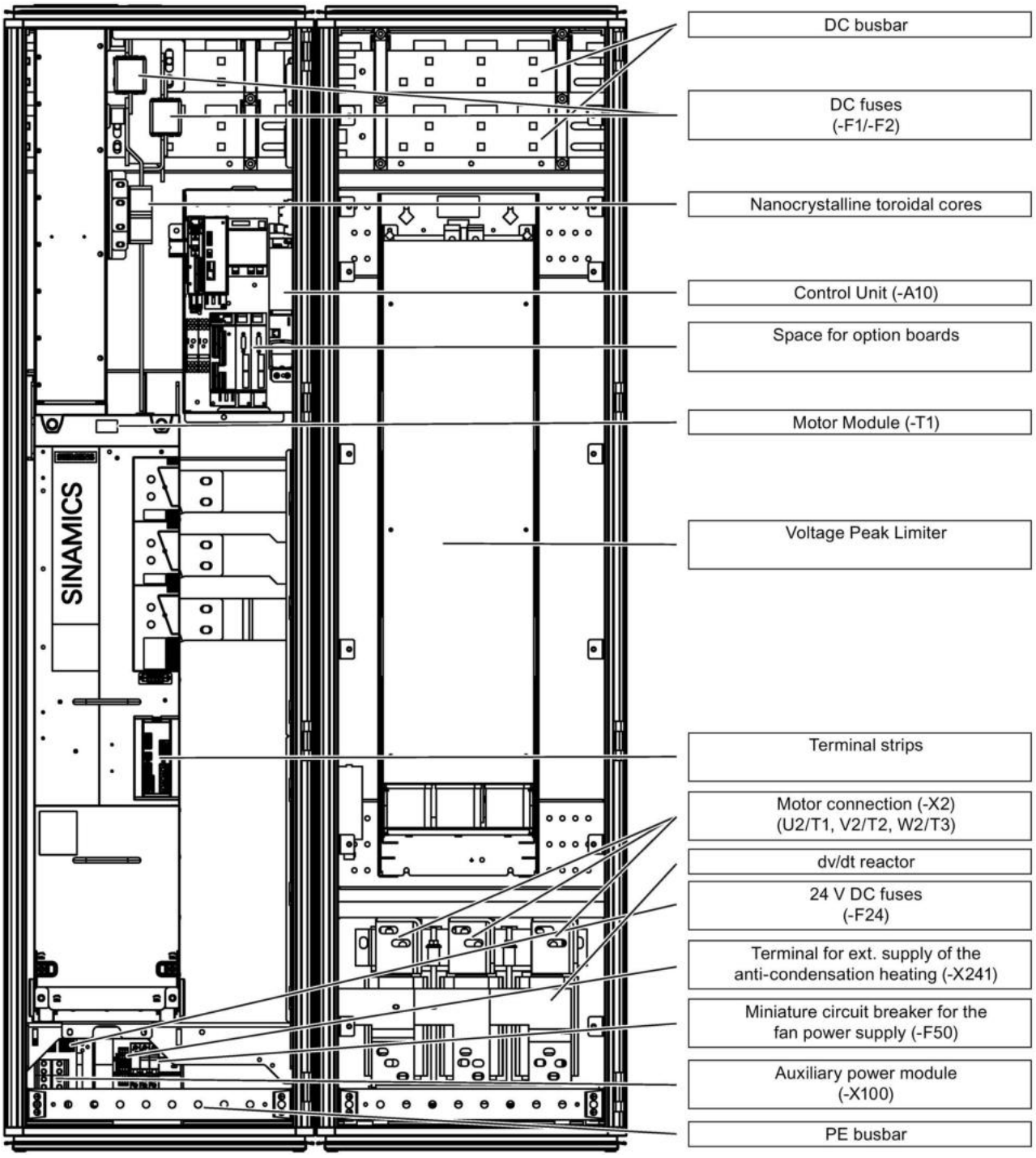


Figure 5-58 Configuration example for Motor Module Chassis-2 format (frame sizes FS2, FS2+) with Option L10

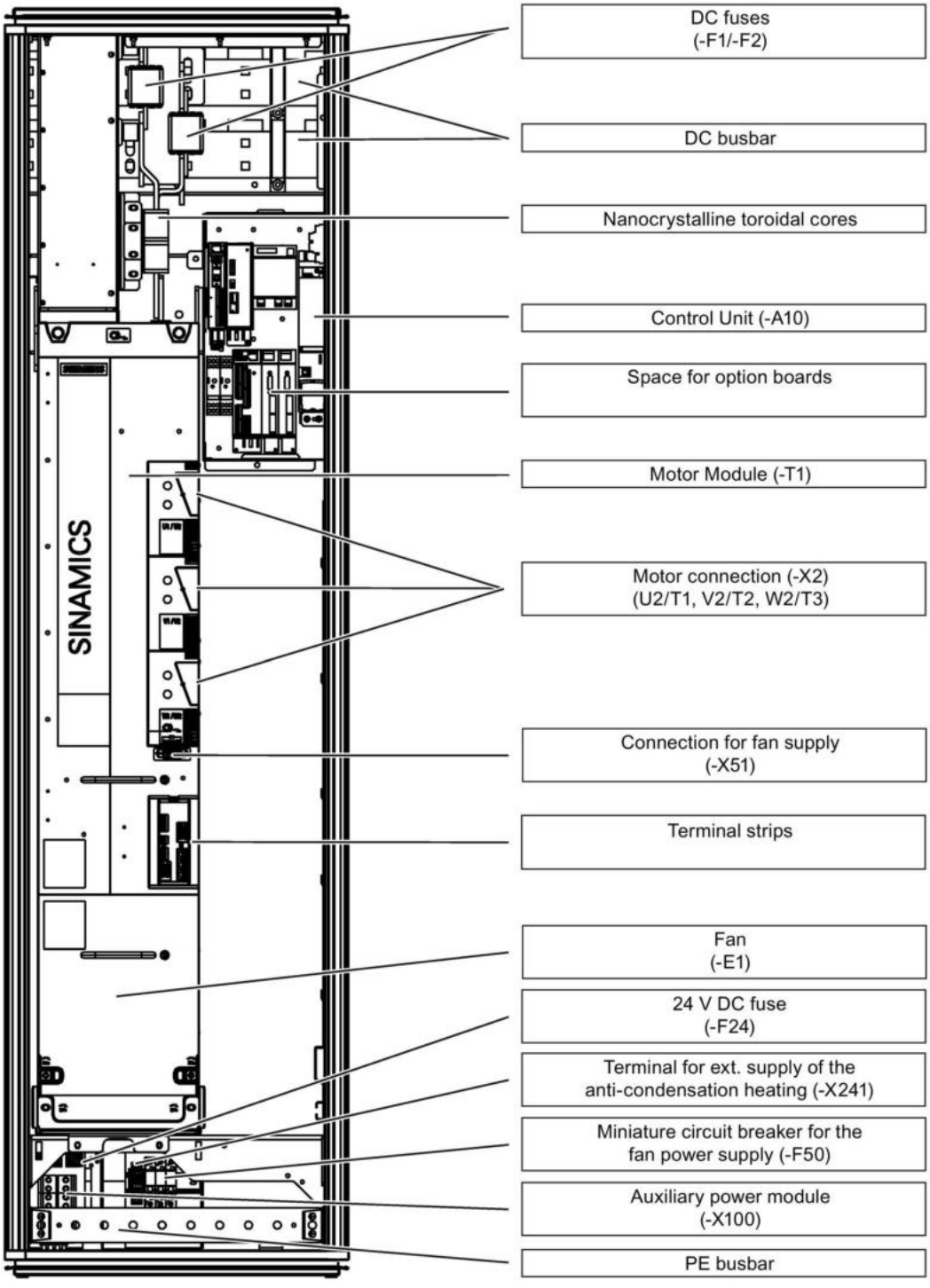


Figure 5-59 Configuration example for Motor Module Chassis-2 format (frame size FS4)

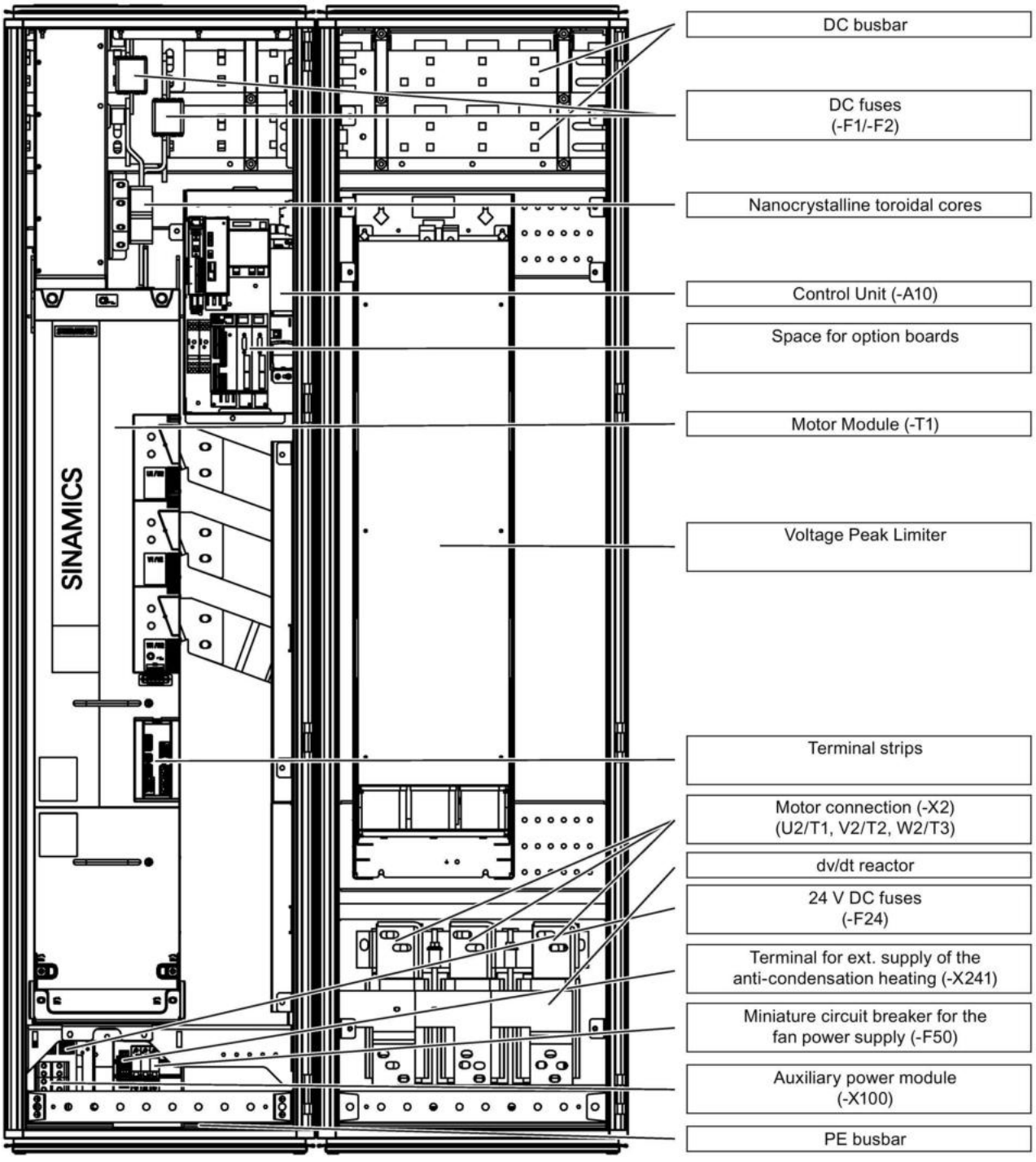


Figure 5-60 Configuration example for Motor Module Chassis-2 format (frame size FS4) with Option L10

Parallel connection of Motor Modules Chassis-2 to increase the power

The following rules must be observed when connecting Motor Modules Chassis-2 in parallel:

- Up to 6 identical Motor Modules Chassis-2 can be connected in parallel.
- Parallel connection can only be implemented using one common Control Unit.
  For more than 4 power units, these must be distributed as symmetrically as possible between at least two DRIVE-CLiQ ports (e.g. 3x 2 Motor Modules Chassis-2 in series, or a minimum of 2x 3 Motor Modules Chassis-2 in series).
- The motor supply cables must have the same length (symmetrical design).
- Power must be supplied to the Motor Modules from a common DC busbar.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- For motors with multi-winding systems, carefully observe the notes in the Low Voltage Configuration Manual
- For motors with a single-winding system, the length of the supply cables must be kept to a minimum. The cables lengths are listed in the following tables.

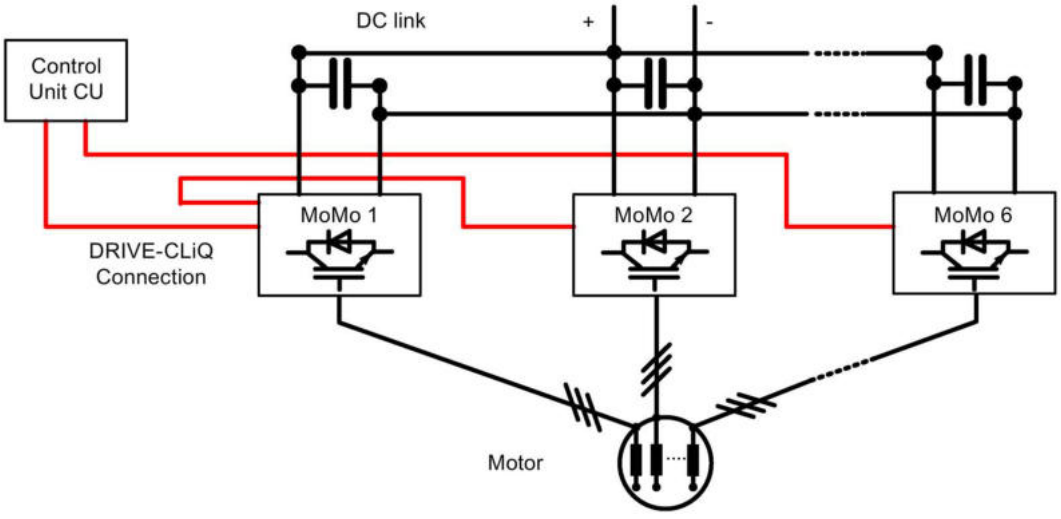


Figure 5-61 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules Chassis-2

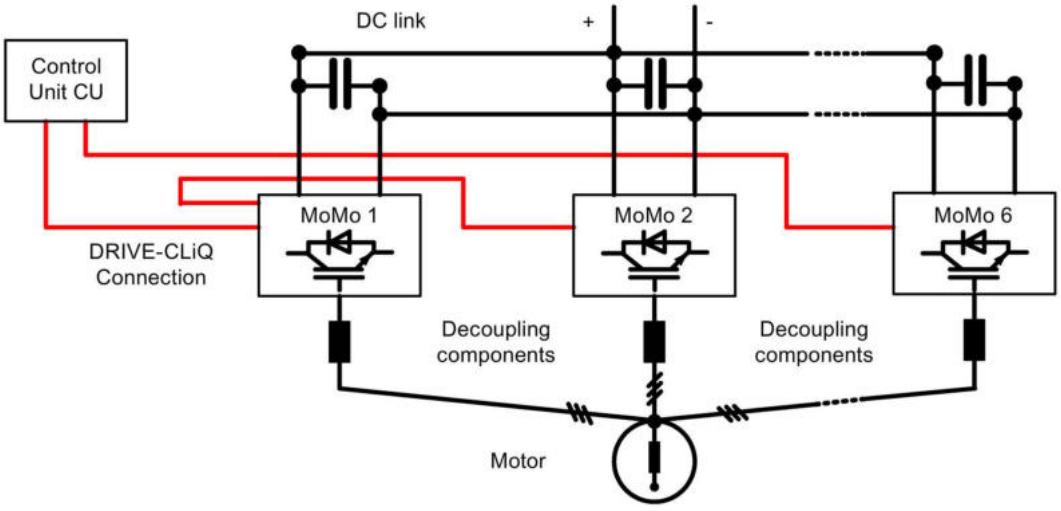


Figure 5-62 Motor with common winding system supplied by a parallel connection of S120 Motor Modules Chassis-2

Note

Mixed operation is not possible

It is only possible to connect power units in parallel if both of them have the same hardware version. Mixed operation with Motor Modules Chassis and Motor Modules Chassis-2 is not possible.

Minimum cable lengths for parallel connection and connection to a motor with a single-winding system

Note

Minimum cable lengths

The minimum cable lengths specified in the table below must be observed when two or more Motor Modules are connected in parallel and there is a connection to a motor with a single-winding system. The motor cables of Motor Modules connected in parallel may only be connected with one another at the motor terminal box.
A motor reactor (option L08, as is shown in the diagram above) must be used if the required cable length cannot be reached in the application.

Table 5- 55 Motor Modules Chassis-2, 510 ... 720 V DC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3721-1TE36-6BE0	FS2	315	655	13
6SL3721-1TE37-4BE0	FS2	355	740	12
6SL3721-1TE38-1BE0	FS2+	400	810	10
6SL3721-1TE38-8BE0	FS2+	450	910	9
6SL3721-1TE41-0BE0	FS4	500	975	8
6SL3721-1TE41-1BE0	FS4	560	1075	8
6SL3721-1TE41-2BE0	FS4	630	1200	8

5.8.2 Interface description

5.8.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit diagrams and terminal diagrams on the customer DVD supplied with the device.

Overview of the terminal strips on the Motor Module Chassis-2

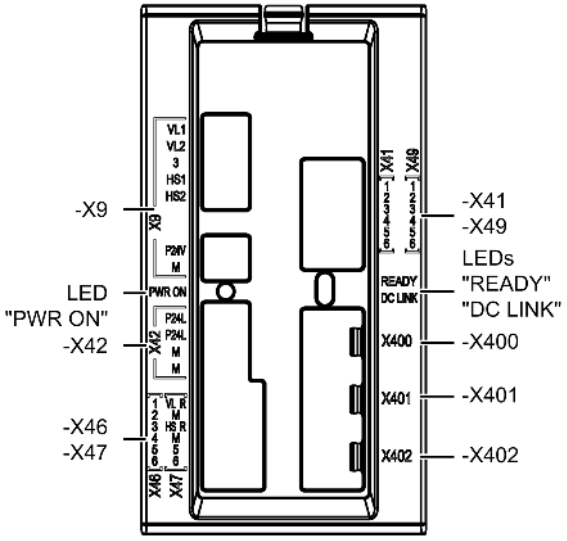
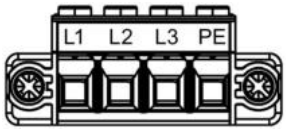


Figure 5-63 Terminal strips on the Motor Module Chassis-2

5.8.2.2 X51 connection, fan power supply

Table 5- 56 Terminal strip X51, fan power supply connection

Connector	Terminal	Function	Technical specifications
	L1	L1	Supply voltage: 3 AC 380 V … 480 V Frequency: 47 ... 63 Hz Max. load current: 1.8 A
	L2	L2	
	L3	L3	
	PE	PE	Connection is connected to the fan housing.
Max. connectable cross-section: 6.0 mm²			

The connection is established through a cable from a tap in the Line Connection Module, and is protected using a miniature circuit breaker (-F50)

When operating a Motor Module Chassis-2 on an ungrounded line supply (IT line system), an isolating transformer must be connected at terminal strip X51 upstream of the fan power supply.
Generally, this is realized using option L20 "Use in IT line system".

NOTICE

Device damage if an isolating transformer is not used for ungrounded line supplies

Significant device damage can occur if an isolating transformer is not used to supply the fan when connected to ungrounded line supplies (IT systems).

- Use an isolating transformer to supply the fan for ungrounded line supply systems (IT systems).

Note

In operation, the connector must always be correctly screwed into place.

Note

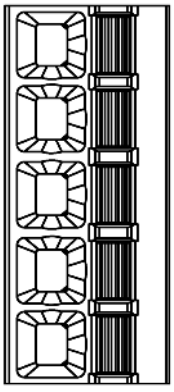
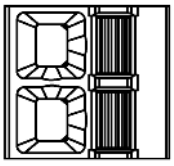
Connect the PE connection with the PE connection of the electrical cabinet.

Note

For installation altitudes exceeding 2000 m, an isolating transformer must be connected upstream of the fan power supply.

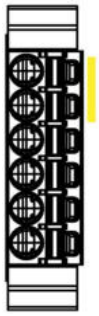
5.8.2.3 X9 terminal strip

Table 5- 57 Terminal strip X9

Connector	Terminal	Signal name	Technical specifications
	VL1	Pre-charge contactor control	240 V AC: 8 A max. 24 VDC: max. 1 A isolated relay contact
	VL2		
	NC	NC	Reserved, do not use
	HS1	Main contactor control	240 V AC: 8 A max. 24 VDC: max. 1 A isolated relay contact
	HS2		
	P24V	P24V	External 24 V DC supply Voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: max. 1.6 A
	M	M	
Max. connectable cross-section: 2.5 mm²			

5.8.2.4 X41 EP terminal / temperature sensor connection

Table 5- 58 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP +24 V (enable pulses)	Supply voltage: 24 VDC (20.4 to 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled.
	2	EP M1 (enable pulses)	
	3	+Temp (motor)	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic switch with NC contact
	4	-Temp (motor)	
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm² At terminals 1 and 2, the terminal strip has a yellow marking, it is coded at terminal 4; please use the corresponding connector from the accessory pack.			



⚠WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to the motor in the event of incorrectly connected KTY temperature sensor at terminals X41:3,4

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection at terminals X41:3,4 can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

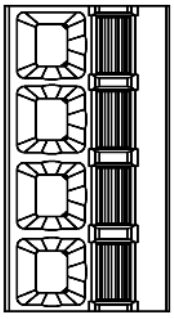
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated Functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

5.8.2.5 X42 terminal strip

Table 5- 59 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

Connector	Terminal	Function	Technical specifications
	1	P24L	Power supply for Control Unit, Sensor Module and Terminal Module (18 ... 28.8 V) maximum load current: 3 A
	2		
	3	M	
	4		
Max. connectable cross-section: 2.5 mm^2			

Note

Connection options for terminal strip X42

The terminal strip is not intended for free 24 VDC availability (for example for supplying further line-side components), as the voltage supply of the Control Interface Module could also be overloaded and operating capability could thus be compromised.

When required, additional system-side components can be connected via the central auxiliary power supply (X100).

5.8.2.6 X46 Brake control and monitoring

Table 5- 60 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm^2 The terminal strip is coded at terminal 1; please use the corresponding connector from the accessory pack.			

Note

The interface is intended for connection of the Safe Brake Adapter.

⚠WARNING

Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables connected to terminal strip X46 can cause components to overheat with the associated risk of fire and smoke.

- Limit the length of the connecting cables to a maximum of 10 m.
- Do not route the connection cable outside the control cabinet or control cabinet group.

5.8.2.7 X47 contactor feedback signal

Table 5- 61 Terminal strip X47, contactor feedback signal

Connector	Terminal	Signal name	Technical specifications
	1	VL_R	Precharging contactor feedback signal
	2	M	Supply voltage: 24 V DC Max. Load current: 10 mA
	3	HS_R	Main contactor feedback signal
	4	M	Supply voltage: 24 V DC Max. Load current: 10 mA
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm^2 The terminal strip is coded at terminal 3; please use the corresponding connector from the accessory pack.			

5.8.2.8 X49 terminal block

Table 5- 62 Terminal strip X49

Connector	Terminal	Function	Technical specifications
	1	LAMPPWR	Supply voltage: 24 V DC Max. Load current: 100 mA If a fault is active at the power unit, then a voltage is present at the terminals.
	2	M	
	3	NC	Reserved, do not use
	4	NC	Reserved, do not use
	5	NC	Reserved, do not use
	6	NC	Reserved, do not use
Max. connectable cross-section: 1.5 mm^2 The terminal strip is coded at terminal 6; please use the corresponding connector from the accessory pack.			

Note

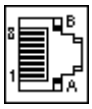
Function of the "LAMPPWR" signal

Terminal "LAMPPWR" can be used in large cabinet lineups to connect a signal lamp, which is then used to indicate which power unit has a problem. 24 V DC is output as soon as a fault becomes active in a power unit.

Note: For a firmware update, the output alternates between 0 V and 24 V.

5.8.2.9 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 63 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) Article number: 6SL3066-4CA00-0AA0			

5.8.2.10 Test points for 1 mm test probes

Test points for 1 mm test probes are provided at the sides of connectors X41, X46, X47 and X49, see ① in the following diagram.

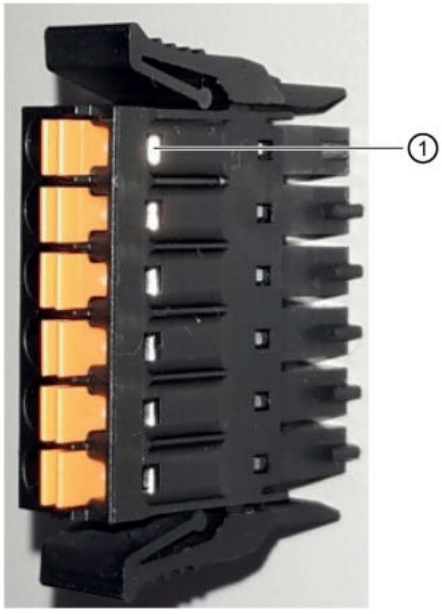


Figure 5-64 Test points for 1 mm test probes

5.8.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Terminal Board TB30	G62
Safety license for 1 to 5 axes	K01 ... K05
AOP30 operator panel	K08
SMC 10/20/30 Sensor Modules	K46, K48, K50
VSM10 Voltage Sensing Module Cabinet-Mounted	K51
Additional SMC30 Sensor Module	K52
Terminal Module for activating "Safe Torque Off" and "Safe STOP 1"	K82
Terminal Module TM54F	K87
Safe Brake Adapter SBA 230 V AC	K88
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
dv/dt filter compact plus Voltage Peak Limiter	L07
Motor reactor	L08
dv/dt filter plus Voltage Peak Limiter	L10
Use in an IT line system	L20
Output-side circuit breaker (motorized)	L34
Cabinet anti-condensation heating	L55

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Additional shock protection	M60
DC busbar system	M80 ... M87
Extended motor connection panel	M89
Crane transport assembly (top-mounted)	M90

5.8.4 Technical data

Table 5- 64 Technical data, Motor Modules Chassis-2 format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, Part 1

Article No.	6SL3721-	1TE36-6BE0	1TE37-4BE0	1TE38-1BE0	1TE38-8BE0
Type rating					
- for I_L (50 Hz 400 V) 1)	kW	315	355	400	450
- for I_H (50 Hz 400 V) 1)	kW	280	315	355	400
- for I_L (60 Hz 460 V) 2)	hp	500	600	650	700
- for I_H (60 Hz 460 V) 2)	hp	450	500	550	650
Output current					
- Rated current IN A	A	655	740	810	910
- Base load current I_L 3)	A	620	700	770	865
- Base load current I_H 4)	A	555	620	675	760
- Maximum current $I_{max\ A}$	A	917	1036	1134	1274
DC link current					
- Rated current $I_{N\ DC}$	A	785	890	975	1090
Supply voltages					
- DC-link voltage	V_{DC}	510 ... 720			
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption					
- Auxiliary supply 24 V DC	A	1.3	1.3	1.3	1.3
- 400 V AC	A	1.8	1.8	1.8	1.8
DC-link capacitance	µF	16450	16450	18800	18800
Pulse frequency					
- rated frequency	kHz	2.5	2.5	2.5	2.5
- pulse frequency, max.					
- without current derating	kHz	2.5	2.5	2.5	2.5
- with current derating	kHz	8	8	8	8
Power loss, max. 5)					
- at 50 Hz 400 V	kW	6.7	7.0	7.8	8.8
- at 60 Hz 460 V	kW	6.9	7.3	8.1	9.1
Cooling air requirement	m^3/s	0.64	0.64	0.64	0.64
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	53 ... 70	53 ... 70	53 ... 70	53 ... 70
Motor connection U2, V2, W2					
- Screws		4/M12	4/M12	4/M12	4/M12
- Connection cross-section, max. (IEC)	mm^2	4 x 240	4 x 240	4 x 240	4 x 240
Cable length, max. 6)					
- shielded	m	300	300	300	300
- unshielded	m	450	450	450	450
PE/GND connection		PE busbar			
- busbar cross-section	mm^2	600			
- connection cross-section, max. (IEC)	mm^2	240			
Degree of protection (standard model)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)					
- width 7)	mm	600	600	600	600
- height 8)	mm	2200	2200	2200	2200
- depth	mm	600	600	600	600
Weight, approx. (standard version)	kg	257	265	270	270

Article No.	6SL3721-	1TE36-6BE0	1TE37-4BE0	1TE38-1BE0	1TE38-8BE0
Frame size		FS2	FS2	FS2+	FS2+
Rated short-circuit current acc. to IEC	kA	100	100	100	100

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 400 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 460 V.

3) The base-load current I_L is based on a load cycle of 110% for 60 s with a load cycle of 300 s.

4) The base-load current I_H is based on a load cycle of 150% for 60 s with a load cycle of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules Chassis-2 are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L07 (dv/dt filter compact plus VPL), L08 (motor reactor), L10 (dv/dt filter plus VPL), L34 (circuit breaker at the output): → supplementary cabinet, 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 65 Technical data, Motor Modules Chassis-2 format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, Part 2

Article No.	**6SL3721-**	**1TE41-0BE0**	**1TE41-1BE0**	**1TE41-2BE0**	
Type rating					
- for I_L (50 Hz 400 V) 1)	kW	500	560	630	
- for I_H (50 Hz 400 V) 1)	kW	450	500	560	
- for I_L (60 Hz 460 V) 2)	hp	750	850	950	
- for I_H (60 Hz 460 V) 2)	hp	650	750	850	
Output current					
- Rated current $I_{N\,A}$	A	975	1075	1200	
- Base load current I_L 3)	A	910	1000	1145	
- Base load current I_H 4)	A	800	890	1000	
- Maximum current $I_{max\,A}$	A	1365	1505	1710	
DC link current					
- Rated current $I_{N\,DC}$	A	1170	1290	1440	
Supply voltages					
- DC-link voltage	V_{DC}	510 ... 720			
- Electronic power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption					
- Auxiliary supply 24 V DC	A	1.3	1.3	1.3	
- 400 V AC	A	1.8	1.8	1.8	
DC-link capacitance	µF	25900	25900	25900	
Pulse frequency					
- rated frequency	kHz	2.5	2.5	2.5	
- pulse frequency, max.					
- without current derating	kHz	2.5	2.5	2.5	
- with current derating	kHz	8	8	8	
Power loss, max. 5)					
- at 50 Hz 400 V	kW	9.2	9.8	11.0	
- at 60 Hz 460 V	kW	9.5	10.1	11.4	
Cooling air requirement	m^3/s	0.64	0.64	0.64	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	53 ... 70	53 ... 70	53 ... 70	
Motor connection U2, V2, W2					
- Screws		6/M12	6/M12	6/M12	
- Connection cross-section, max. (IEC)	mm^2	6 x 240	6 x 240	6 x 240	
Cable length, max. 6)					
- shielded	m	300	300	300	
- unshielded	m	450	450	450	
PE/GND connection		PE busbar			
- busbar cross-section	mm^2	600			
- connection cross-section, max. (IEC)	mm^2	240			
Degree of protection (standard model)		IP20	IP20	IP20	
Dimensions (standard version, IP20)					
- width 7)	mm	600	600	600	
- height 8)	mm	2200	2200	2200	
- depth	mm	600	600	600	
Weight, approx. (standard version)	kg	305	305	305	

Article No.	6SL3721-	1TE41-0BE0	1TE41-1BE0	1TE41-2BE0	
Frame size		FS4	FS4	FS4	
Rated short-circuit current acc. to IEC	kA	100	100	100	

1) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 50 Hz 400 V.

2) Rated power of a typ. 6-pole standard induction motor based on I_L or I_H at 3 AC 60 Hz 460 V.

3) The base-load current I_L is based on a load cycle of 110% for 60 s with a load cycle of 300 s.

4) The base-load current I_H is based on a load cycle of 150% for 60 s with a load cycle of 300 s.

5) The specified power loss represents the maximum value at 100% utilization. The value in normal operation is lower.

6) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Configuration Manual on the customer DVD supplied with the device.
When used in a TN line system with an infeed via Active Line Module and when the Motor Modules Chassis-2 are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L07 (dv/dt filter compact plus VPL), L08 (motor reactor), L10 (dv/dt filter plus VPL), L34 (circuit breaker at the output): → supplementary cabinet, 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5.8.5 Overload capability

The Motor Modules Chassis-2 format have an overload reserve (e.g. to handle breakaway torques).

In the case of drives with overload requirements, the appropriate base load current must, therefore, be used as a basis for the required load.

The overloads apply under the precondition that the drive is operated as a maximum with its base load current before and after the overload; this is based on a duty cycle of 300 s (low overload, high overload) - or 60 s (S6 duty cycle).

Another precondition is that the drive is operated with its factory-set pulse frequency at output frequencies >10 Hz.

For additional information on the overload capability, see the Low Voltage Configuration Manual and in the SINAMICS S 120 Function Manual Drive Functions.

Low overload

The base-load current I_L is based on a load cycle of 110% for 60 s with a load cycle of 300 s.

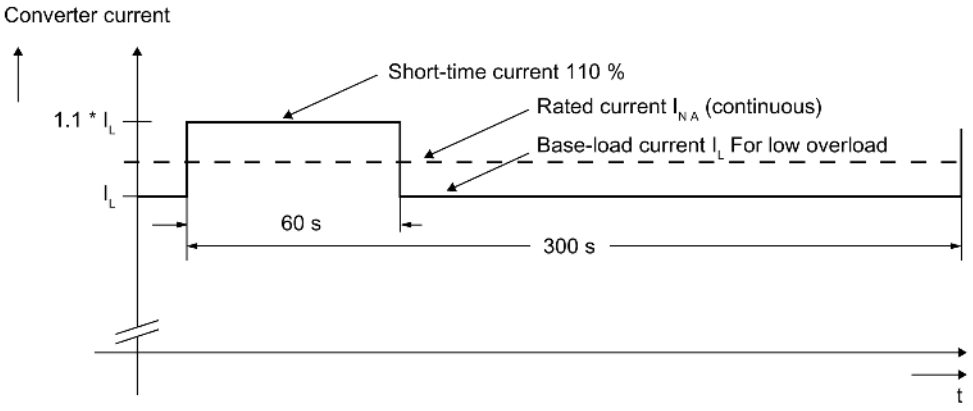


Figure 5-65 Low overload

High overload

The base-load current I_H is based on a load cycle of 150% for 60 s with a load cycle of 300 s.

The duty cycle for I_H is valid for a pulse frequency of 2 kHz. It is also valid for a pulse frequency of 2.5 kHz, if p0290 is set = 12 (automatic pulse frequency and output current reduction for a thermal power unit overload).

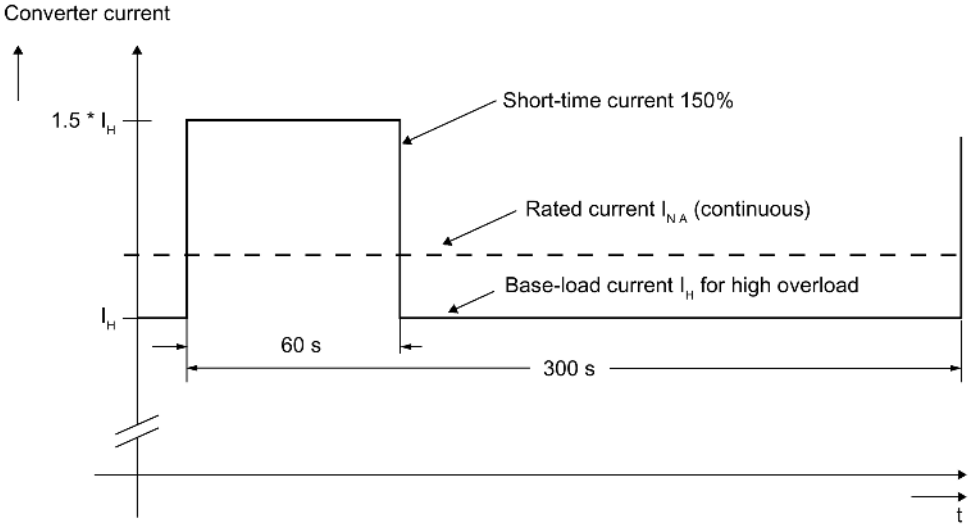


Figure 5-66 High overload

S6 duty cycle

The base-load current I_{S6} is based on a load cycle of 200% for 6 s with a load cycle of 60 s.

The load cycle for I_{S6} is valid for a pulse frequency of 2 kHz. It is also valid for a pulse frequency of 2.5 kHz, if p0290 is set = 12 (automatic pulse frequency and output current reduction for a thermal power unit overload).

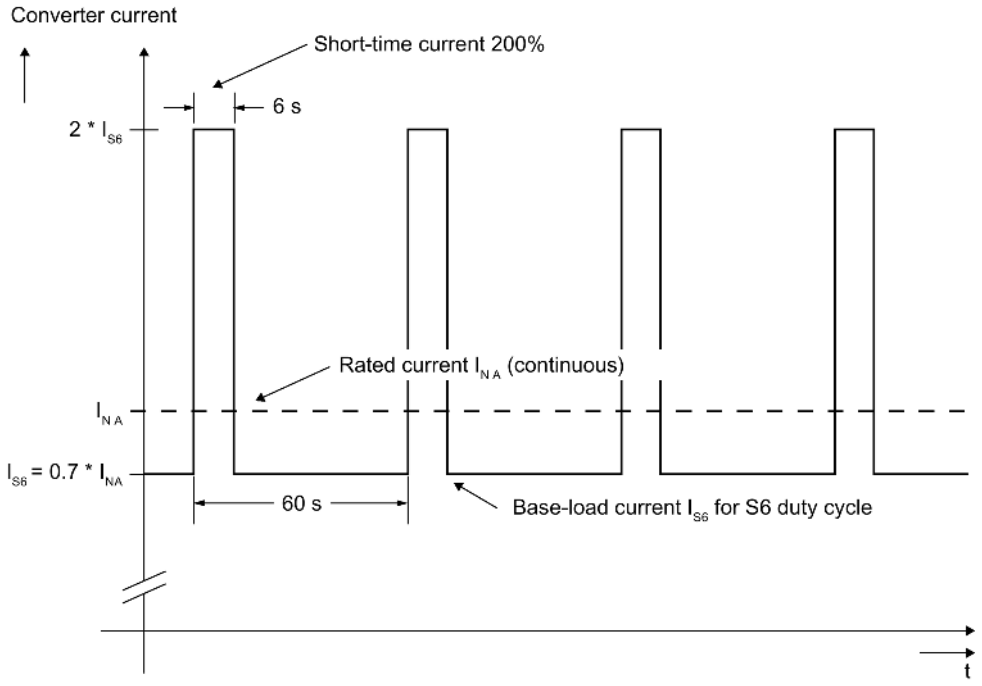


Figure 5-67 S6 duty cycle with initial load with a duty cycle duration of 60 s

5.9 Central Braking Modules

5.9.1 Description

Note

Additional information

Refer to the layout diagrams and circuit diagrams provided on the enclosed customer DVD for the arrangement of components and interfaces, and for wiring.



Figure 5-68 Central Braking Module

Central Braking Modules limit the DC-link voltage at a central location in the drive line-up when the motors are operated in regenerative mode and energy recovery to the supply system is not possible. If, in regenerative mode, the voltage of the DC busbar exceeds a limit value, an externally installed braking resistor is switched in, thus restricting the voltage from increasing further. The regenerative energy is converted to heat loss. The braking resistor is switched in by the Braking Module inside the Cabinet Module.

Central Braking Modules are an alternative to the optional Braking Modules (option L61/L62 or L64/L65) and are particularly suitable when high braking power is required in a drive line-up.

The capacitor module in the Central Braking Module is an extension of the DC link-capacitance for the safe functioning of the Braking Module.

The built-in fan means that Central Braking Modules are also suitable for high continuous power systems.

Braking resistors corresponding to the rated powers are available for the Central Braking Modules.
Braking resistors which are suitable for other applications are available on request.

Note

Dimensioning the braking resistor

The Braking Module incorporated into the Central Braking Module is able to support a higher braking power than standard braking resistors.

The braking resistor is only designed for occasional regenerative operation in accordance with the specified duty cycles.

If the braking resistor does not meet your particular requirements, an appropriate braking resistor must be requested on an order-specific basis.

Central Braking Modules are available for the following voltages and power ratings:

Line voltage	Rated power
3 AC 380 … 480 V	500/1000 kW
3 AC 500 … 600 V	550/1100 kW
3 AC 660 … 690 V	630/1200 kW

The braking power can be increased by connecting Central Braking Modules in parallel, refer to Point "Parallel connection of Central Braking Modules" at the end of this section.

Integration

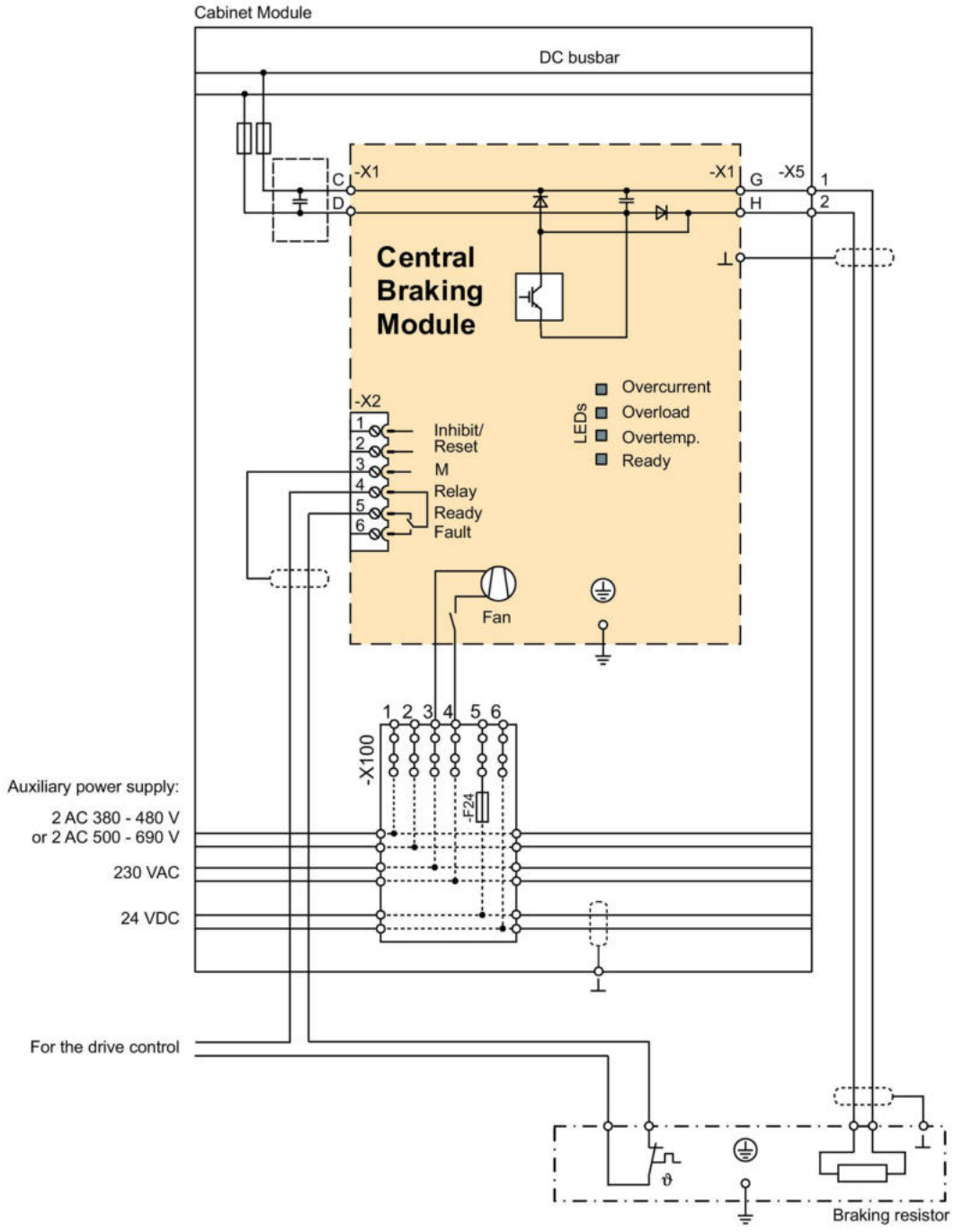


Figure 5-69 Connection example for Central Braking Modules

Configuration

Central Braking Modules are designed in a 400 mm wide Cabinet Module. The Central Braking Modules are connected to the overhead DC busbar with fuses.

The Central Braking Module comprises:

- Braking Module
- Capacitor Module
- 230 VAC connection with fuses
- Covers
- Braking resistor connection

Note

Additional information

The configuration example of the Central Braking Module illustrates the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

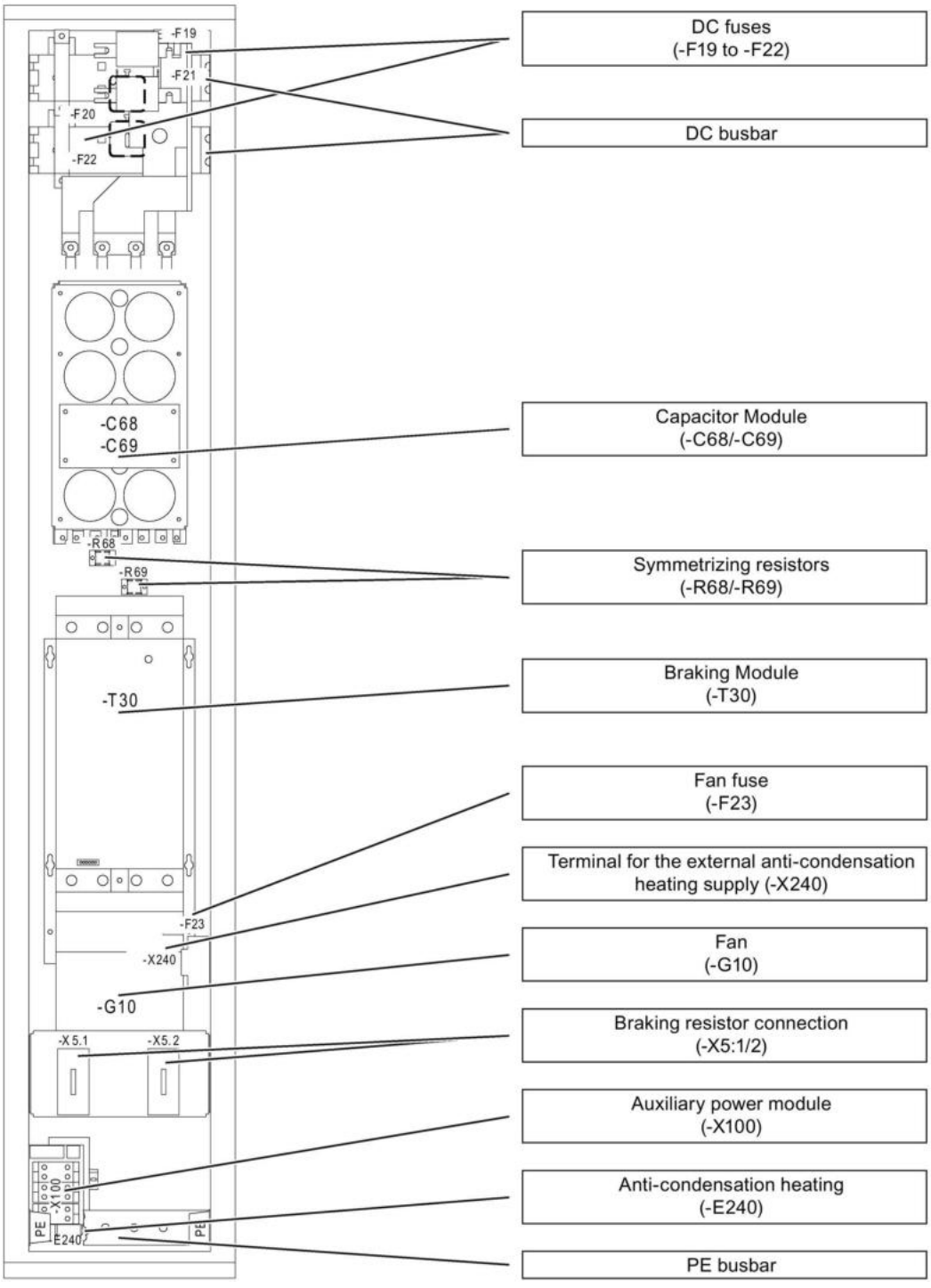


Figure 5-70 Configuration of Central Braking Modules

Parallel connection of Central Braking Modules

To increase the braking power, it is permissible for Central Braking Modules to be connected in parallel under the following conditions:

- Only Central Braking Modules of the same rating may be connected in parallel.
- A separate braking resistor must be connected to each Central Braking Module.
- Asymmetric load distribution (possibly tolerance-related) will result in a drop of 10% in terms of the total braking power provided by the Central Braking Modules that are connected in parallel.
- The maximum number of Central Braking Modules per DC busbar should be limited to four with regard to the power split. Higher numbers are in principle available on request after the boundary conditions have been checked on a case-for-case basis.

5.9.2 Interfaces

Description

The Central Braking Module has the following interfaces:

- Control terminals (Disable/Reset, Ready, Fault)
- Braking resistor connection
- Reset key
- Threshold switch
- Braking resistor monitoring
- Switch-on ratio of the braking resistor

Interface overview

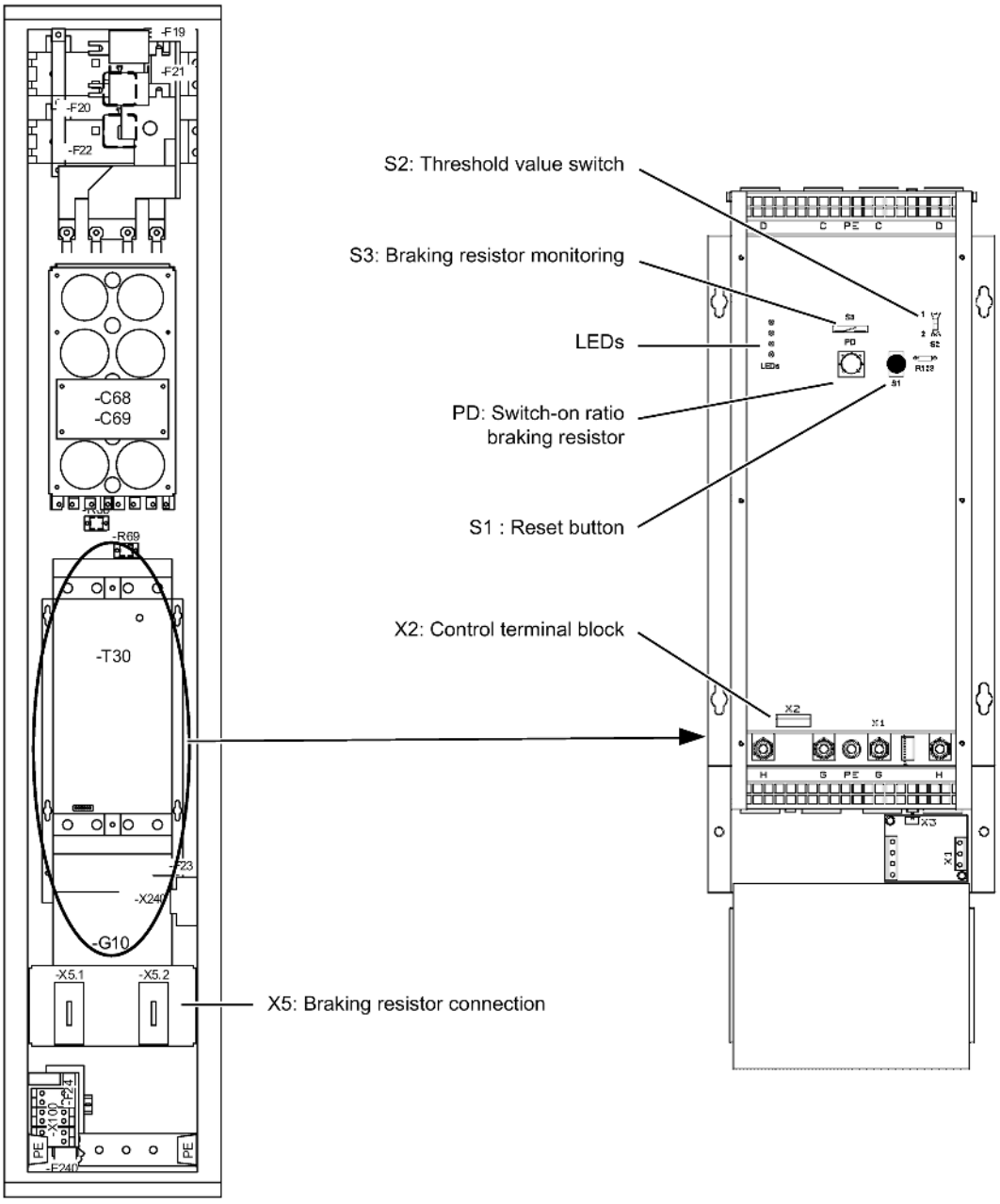
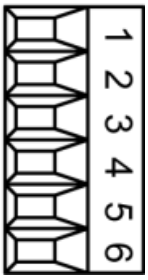


Figure 5-71 Interface overview for the Central Braking Module

X2 control terminals

Table 5- 66 Terminal strip X2 control terminals

	Terminal	Function	Meaning	Technical data
	1 2	DI 24V ground	0 = Normal operation 1 = Inhibit, reset	24 V AC/DC, input load approximately 10 mA (connection not required)
	3	Ground	Ground	
	4	DO.COM [1]	Center contact	Centralized fault indication for: No DC-link voltage, overtemperature, overload, short-circuit / ground fault. Switching capacity: 250 V, 2 A, 250 VA AC voltage
	5	DO.NO [1]	0 = Fault 1 = Ready	
	6	DO.NC [1]	0 = Ready 1 = Fault	
Max. connectable cross-section: 2.5 mm^2				

[1] NO: Normally-open contact, NC: Normally-closed contact, COM: Center contact

X5 braking resistor connection

Table 5- 67 Terminal strip X5 braking resistor

Terminal	Function
1	Braking resistor connection
2	Braking resistor connection

S1 reset key

Table 5- 68 Reset key S1

Function	Meaning
Reset key	0 = Normal operation 1 = Disable, reset

The key performs the same function as control terminal -X2:1/2.

S2 threshold switch

Table 5- 69 Threshold switch S2

Item	Function
1	Upper switching threshold (factory setting)
2	Lower switching threshold

The response threshold at which the Braking Module is activated and the resulting activated DC-link voltage for braking mode are specified in the following table.

NOTICE
Material damage due to switching the threshold switch when a DC-link voltage is present Switching the threshold switch when the Braking Module is switched on or when a DC-link voltage is present results in damage to the Braking Module. • Only operate the threshold switch at zero voltage and the DC-link capacitors are discharged.

Table 5- 70 Response thresholds of the Braking Module

Rated voltage	Response threshold	Switch position	Comments
380 ... 480 V	774 V	1	774 V is the default factory setting. With line voltages of between 380 V and 400 V, the response threshold can be set to 673 V to reduce the voltage stress on the motor and drive. This does, however, reduce the possible braking power with the square of the voltage (673/774)² = 0.75. The maximum possible braking power is, therefore, 75%.
	673 V	2	
500 ... 600 V	967 V	1	967 V is the default factory setting. With a line voltage of 500 V, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (841/967)² = 0.75. The maximum possible braking power is, therefore, 75%.
	841 V	2	
660 ... 690 V	1158 V	1	1158 V is the default factory setting. With a line voltage of 660 V, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (1070/1158)² = 0.85. The maximum possible braking power is, therefore, 85%.
	1070 V	2	

S3 braking resistor monitoring

Table 5- 71 Braking resistor monitoring S3

Function	Meaning
Braking resistor monitoring	0 (open) = Monitoring active 1 (closed) = Monitoring disabled

When monitoring is activated, the switch-on ratio (ratio between ON time and OFF time) set for the braking resistor on potentiometer "PD" is evaluated electronically.

If the set switch-on ratio is exceeded, the "MUL - Overload message" LED will be activated and at the same time the centralized fault indication will be triggered at terminal -X2:4/5,6. The fault message can be used by a higher-level controller to ensure timely shutdown, thereby preventing damage to the connected braking resistor.

Note

Monitoring the braking resistor

Monitoring is carried out solely on the basis of the switch-on ratio that has been set on potentiometer PD, which means that the actual temperature of the braking resistor is not monitored.

PD, switch-on ratio of the braking resistor

The braking resistor's switch-on ratio (ratio between ON time and OFF time) is set via potentiometer PD. The setting made is only evaluated when activated via the S3 switch. The adjustable values for the switch-on ratio at potentiometer PD correspond to the graphic below. A value of "40%" is used for the default factory setting.

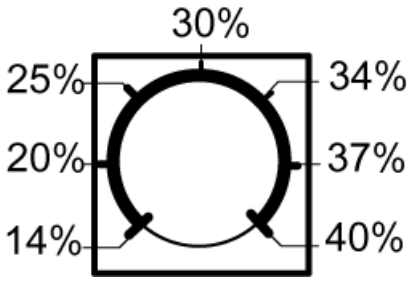


Figure 5-72 Setting of the switch-on ratio

Brake type	Explanation	PD setting
P_{15}	Power that is permissible for 15 s every 600 s	14% (min.)
P_{150}	Power that is permissible for 150 s every 600 s	23%
P_{270}	Power that is permissible for 270 s every 600 s	12%
P_{DB}	Continuous braking power	40% (max)

5.9.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
Cabinet anti-condensation heating	L55

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.9.4 Technical data

Table 5- 72 Technical data for Central Braking Modules

Article No.	**6SL3700-**	**1AE35-0AA3**	**1AE41-0AA3**	**1AF35-5AA3**	**1AF41-1AA3**	**1AH36-3AA3**	**1AH41-2AA3**
Line voltage	V	380 ... 480		500 ... 600		660 ... 690	
Supply voltage	V_{DC}	510 ... 720		675 ... 900		890 ... 1035	
Braking power P_{150}	kW	500	1000	550	1100	630	1200
Continuous braking power P_{DB}	kW	200	370	220	420	240	460
Braking power P_{15}	kW	730	1380	830	1580	920	1700
Braking power P_{270}	kW	300	580	340	650	380	720
Braking current for P_{150}	A	650	1200	580	1100	520	1000
Braking current for P_{DB}	A	260	480	230	430	210	400
Braking current for P_{15}	A	950	1800	870	1650	800	1500
Braking current for P_{270}	A	400	750	350	680	330	630
Power demand [1] 2 AC 230 V	A	0.4	0.4	0.4	0.4	0.4	0.4
Power loss, max. [2] at 50 Hz 400/500/690 V	kW	0.8	1.5	0.8	1.5	0.8	1.5
DC-link capacitance	µF	8160	9720	7640	8680	7640	8680
Connectable resistance							
- for braking power P_{150}							
S2:1	Ω	1.2	0.65	1.65	0.87	2.2	1.15
S2:2	Ω	1.0	0.56	1.45	0.77	2.05	1.05
- for braking power P_{DB}							
S2:1	Ω	3.0	1.6	4.2	2.25	5.5	2.9
S2:2	Ω	2.6	1.4	3.65	2.0	5.1	2.7
- for braking power P_{15}							
S2:1	Ω	0.8	0.43	1.1	0.58	1.45	0.8
S2:2	Ω	0.7	0.37	1.0	0.51	1.35	0.7
- for braking power P_{270}							
S2:1	Ω	1.9	1.0	2.7	1.58	3.5	1.8
S2:2	Ω	1.6	0.9	2.4	1.2	3.3	1.7
Cooling demand	m^3/s	0.14	0.14	0.14	0.14	0.14	0.14
Sound pressure level L_{PA} (1 m) at 50/60 Hz	dB(A)	55	55	55	55	55	55
Braking resistor connection		M12	M12	M12	M12	M12	M12
- Connection cross-section, max. (IEC)	mm^2	2 x 240	2 x 240	2 x 240	2 x 240	2 x 240	2 x 240
PE/GND connection		PE busbar					
- Busbar cross-section	mm^2	600					
- Connection cross-section, max. (IEC)	mm^2	240					
Degree of protection (standard version)	---	IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)							
- Width	mm	400	400	400	400	400	400
- Height [3]	mm	2200	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600	600
Weight, approx. (standard version)	kg	230	230	230	230	230	230

Article No.	6SL3700-	1AE35-0AA3	1AE41-0AA3	1AF35-5AA3	1AF41-1AA3	1AH36-3AA3	1AH41-2AA3
Frame size	mm	400	400	400	400	400	400
Rated short-circuit current acc. to IEC	kA	65	65	65	65	65	65

1) Power demand of fans.

2) The specified power loss equals the maximum value at 100% capacity utilization. The value in normal operation is lower.

3) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Duty cycle

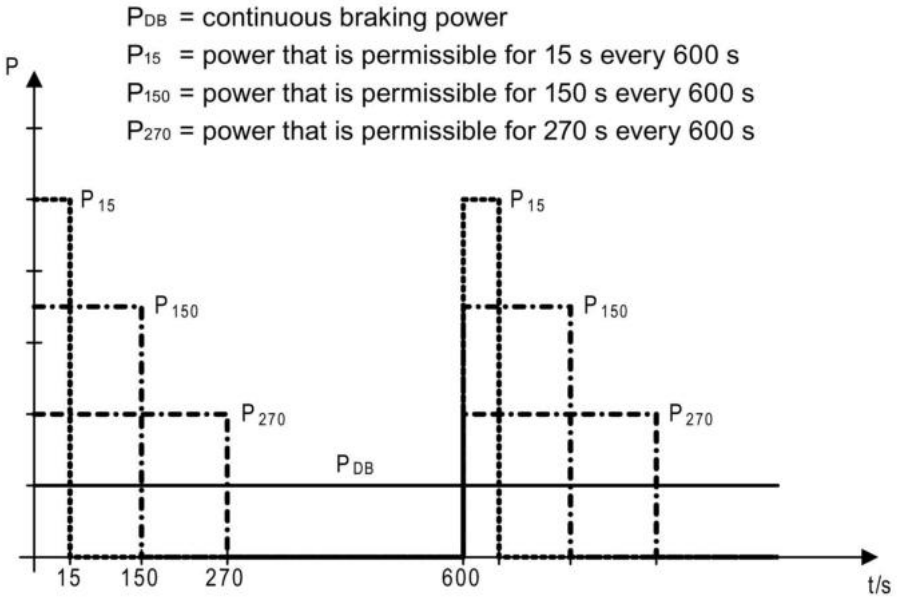


Figure 5-73 Duty cycle of the Central Braking Modules

5.9.5 Derating data

The Central Braking Modules have an integrated temperature monitoring function. A fan included as standard supports the power unit cooling. The fan is switched on and off by means of a temperature control, which prevents it from running unnecessarily. The permissible ambient temperature is from 0 °C to 40 °C. For temperatures between 40 °C and 50 °C, the power must be reduced according to the following formula:

- $P = [1 - 0.025 \times (T - 40\ °C)] \times P_n$

The installation altitude above sea level can be up to 2000 m. The power must be reduced for altitudes above 1000 m (derating). In this case, the derating is 1.5 % per 100 m.

5.9.6 Braking resistor

5.9.6.1 Description

The regenerative energy of the drive line-up is dissipated via the braking resistor. The braking resistor is connected to a Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This enables the resulting heat loss to be dissipated, thereby reducing the amount of air conditioning required.

A thermostat monitors the braking resistor for overheating and, if the limit value is exceeded, it is signaled via a floating contact. The tripping temperature is 120° C; this corresponds to a surface temperature on the resistor elements of approximately 400° C.

Only one braking resistor may be connected to a Central Braking Module.

The power of the braking resistors is matched to the rated braking power of the Central Braking Modules; however, operation is restricted to a reduced duty cycle of 15 seconds every 20 minutes.

⚠WARNING

Fire due to overheating as the thermostatic switch on the braking resistor is not connected

Missing wiring and evaluation of the thermostatic switch on the braking resistor can result in overheating of the braking resistor with fire and smoke

- Wire the contact of the thermostatic switch on the braking resistor for evaluation in the Control Unit or a higher-level controller, see Section "Commissioning the overtemperature checkback signal".

5.9.6.2 Safety information

⚠WARNING

Failure to observe fundamental safety instructions and residual risks

If the fundamental safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Adhere to the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠WARNING

Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long Braking Module connection cables can cause components to overheat with the associated risk of fire and smoke.

- The lengths of the Braking Module connection cables may not exceed 300 m.

⚠WARNING

Fire through overheating due to insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel as a result of fire and smoke. This can also result in increased failures and reduced service lives of braking resistors.

- It is essential that you maintain a ventilation clearance of 200 mm on all sides of the component with ventilation grilles.

⚠WARNING

Fire due to ground fault / short-circuit

Inadequate installation of the cables to the braking resistor can result in a ground fault/short-circuit and place persons at risk as a result of the associated smoke and fire.

- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- In addition, apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Route the cables in separate cable ducts or pipes.



⚠CAUTION

Burns resulting from high surface temperature of the braking resistor

The braking resistor can become very hot. You can get seriously burnt when touching the surface.

- Mount the braking resistors so that contact is not possible. If this is not possible, attach a clearly visible and understandable warning notice at hazardous positions.

NOTICE

Damage to braking resistor due to ingress of water

Water penetration may damage the braking resistor.

- For outdoor installations, a hood must be provided to protect it from precipitation in accordance with IP20 degree of protection.

Note

Braking resistor/fire alarm sensor interaction

If a braking resistor is placed underneath a fire alarm sensor, then the heat produced may trigger the fire alarm sensor.

5.9.6.3 Duty cycle

The following duty cycle applies only to the braking resistors that are described in this Chapter.

Duty cycle

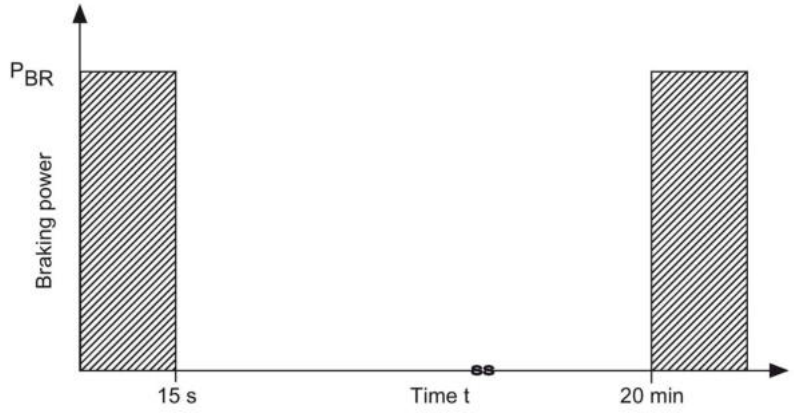


Figure 5-74 Duty cycle for braking resistor

Note

For other duty cycles, the braking resistors must be requested on an order-specific basis.

5.9.6.4 Interfaces on the braking resistor

Power connections on the braking resistor

Table 5- 73 Power connections on the braking resistor

Terminal	Function
1	Connection to the Central Braking Module: -X5
2	Connection to the Central Braking Module: -X5
PE	PE connection
Max. connectable cross-section: 2 x 240 mm^2	

Cables are always entered from below; a cable propping fixture must be provided by the customer.

X10 thermostatic switch checkback contact

Table 5- 74 Terminal strip X10 thermostatic switch checkback contact

Terminal	Function
1	Thermostatic switch checkback contact
2	Normally-closed contact, 250 VAC, max. 1 A
Max. connectable cross-section: 1.5 mm²	

5.9.6.5 Configuring the "Overtemperature" checkback

The checkback contact of the braking resistor thermostatic switch must be wired to a digital input so that the drive is shut down in the event of a malfunction.

- Assumption 1:
  The thermostatic switch feedback signal contact is wired to digital input 3 (DI3) of CU320-2 (-X122:4)
- Assumption 2:
  Once the thermostatic switch trips, "External Fault 3" (F7862) is triggered and the drive is shut down with OFF2.
- Setting required:
  (Drive) p2108 = (CU320-2) 0722.3

Control engineering measures must also be implemented to prevent the drive from starting up again before the braking resistor has had a chance to cool down properly.

5.9.6.6 Technical data

Table 5- 75 Technical data of the braking resistors

Article No.	6SL3000-	1BE35-0AA0	1BE41-0AA0	1BF35-5AA0	1BF41-1AA0	1BH36-3AA0	1BH41-2AA0
Line voltage	V	380 ... 480		500 ... 600		660 ... 690	
Supply voltage	V_{DC}	510 ... 720		675 ... 900		890 ... 1035	
Braking power P_{BR}[1)]	kW	500	1000	550	1100	630	1200
Continuous braking power P_{DB}	kW	23.8	58.65	34.8	62	42.5	75.6
Resistance value	Ω	0.95	0.49	1.35	0.69	1.8	0.95
I_{max}	A	766	1518	672	1343	643	1232
Degree of protection		IP21	IP21	IP21	IP21	IP21	IP21
Dimensions - Width - Height - Depth	 mm mm mm	 960 790 620	 960 1430 620	 960 1110 620	 960 1430 620	 960 1110 620	 960 1430 620
Fastening holes	mm	13	13	13	13	13	13
Weight	kg	82	170	110	180	124	196

1) Valid for specified duty cycle of 15 s (load) with a duty cycle duration of 20 min.

Table 5- 76 Assignments between braking resistors and dimension drawings below

Braking resistor	Dimension drawing, type
380 ... 480 V supply voltage	
6SL3000-1BE35-0AA0	Type 1
6SL3000-1BE41-0AA0	Type 3
500 ... 600 V supply voltage	
6SL3000-1BF35-5AA0	Type 2
6SL3000-1BF41-1AA0	Type 3
660 ... 690 V supply voltage	
6SL3000-1BH36-3AA0	Type 2
6SL3000-1BH41-2AA0	Type 3

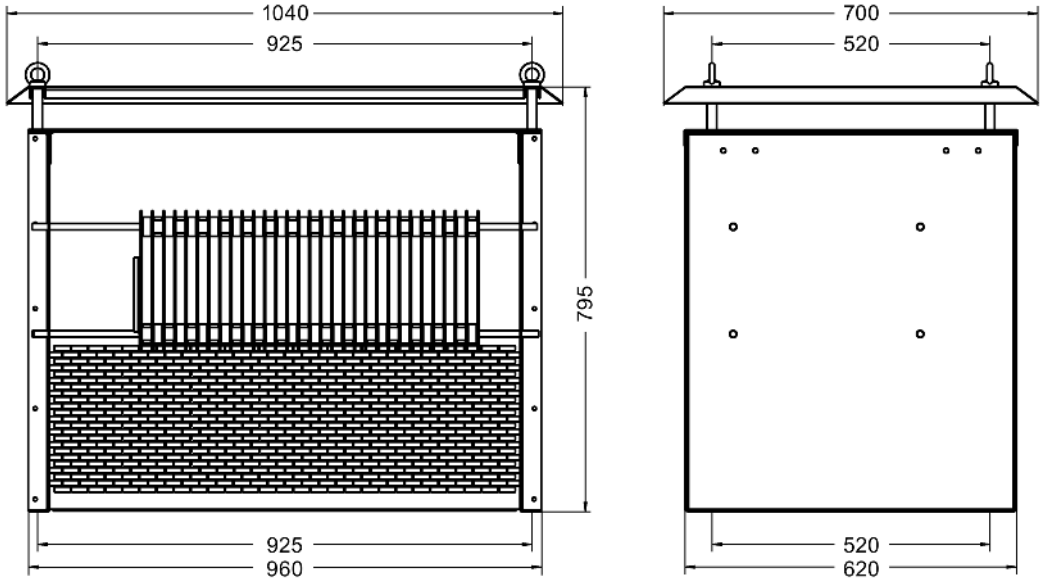


Figure 5-75 Dimension drawing type 1

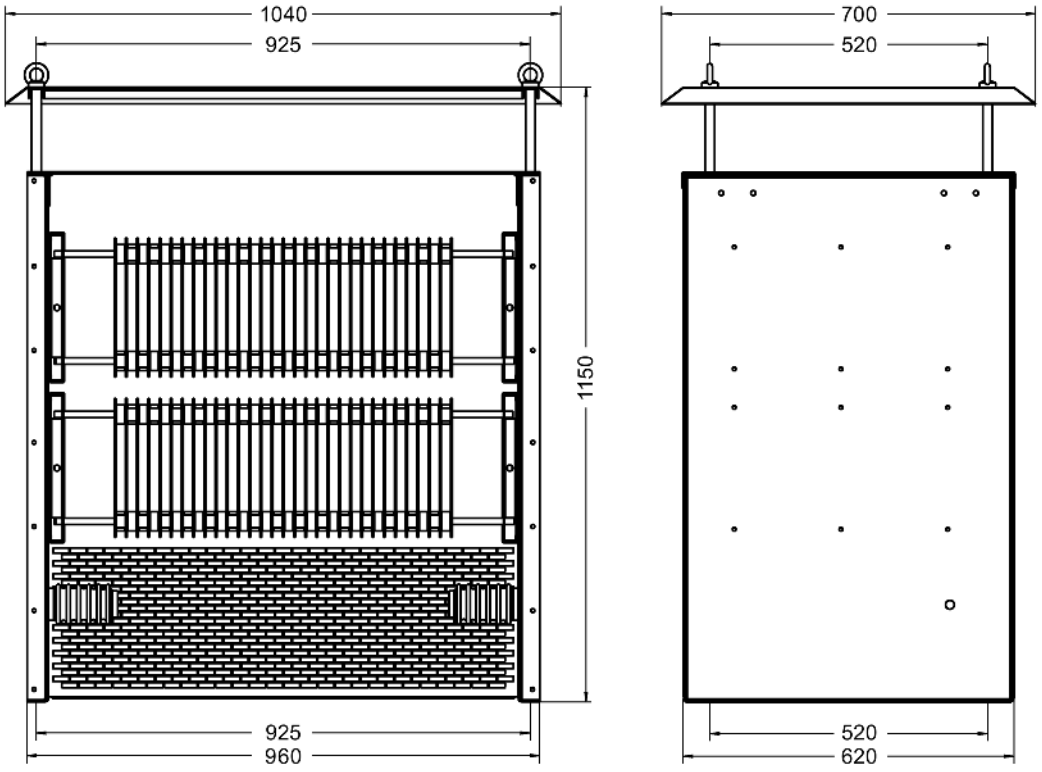


Figure 5-76 Dimension drawing type 2

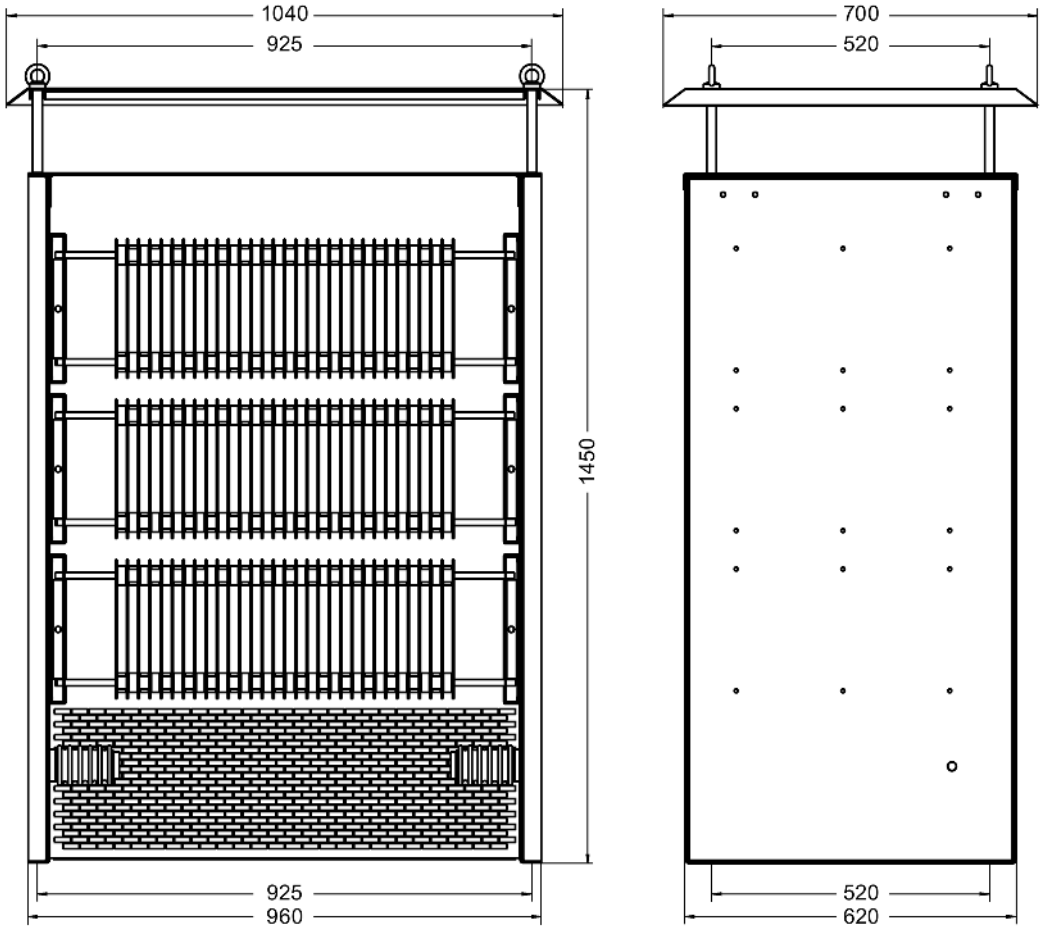


Figure 5-77 Dimension drawing type 3

5.10 Auxiliary Power Supply Modules

5.10.1 Description

Note

Additional information

Refer to the layout diagrams and circuit diagrams provided on the enclosed customer DVD for the arrangement of components and interfaces, and for wiring.



Figure 5-78 Auxiliary Power Supply Module

Auxiliary Power Supply Modules supply power to the auxiliary power supply system of the SINAMICS S120 Cabinet Modules as well as to other external loads. The fans of the SINAMICS S120 devices installed in the Cabinet Modules are some of the devices connected to this auxiliary power supply system. In addition, the auxiliary power supply system supplies the electronics modules with external 24 V DC. This voltage is required when the DC link is not charged, for example, to maintain PROFIBUS/PROFINET communication.

The 230 VAC supply can also be fed in externally via an uninterruptible power supply (UPS) and terminal -X46.

Note

Supply infeed

The same rated voltage must be fed into the supply infeed of the Auxiliary Power Supply Module as for the connected Cabinet Modules, as the voltage fed into the Auxiliary Power Supply Module supplies the entire system with auxiliary voltage via the auxiliary power supply system.

If a different voltage than that of the connected Cabinet Modules is fed in, there is a risk of an insufficient energy supply to the device fans or too high a voltage, which can cause damage to the system.

Integration

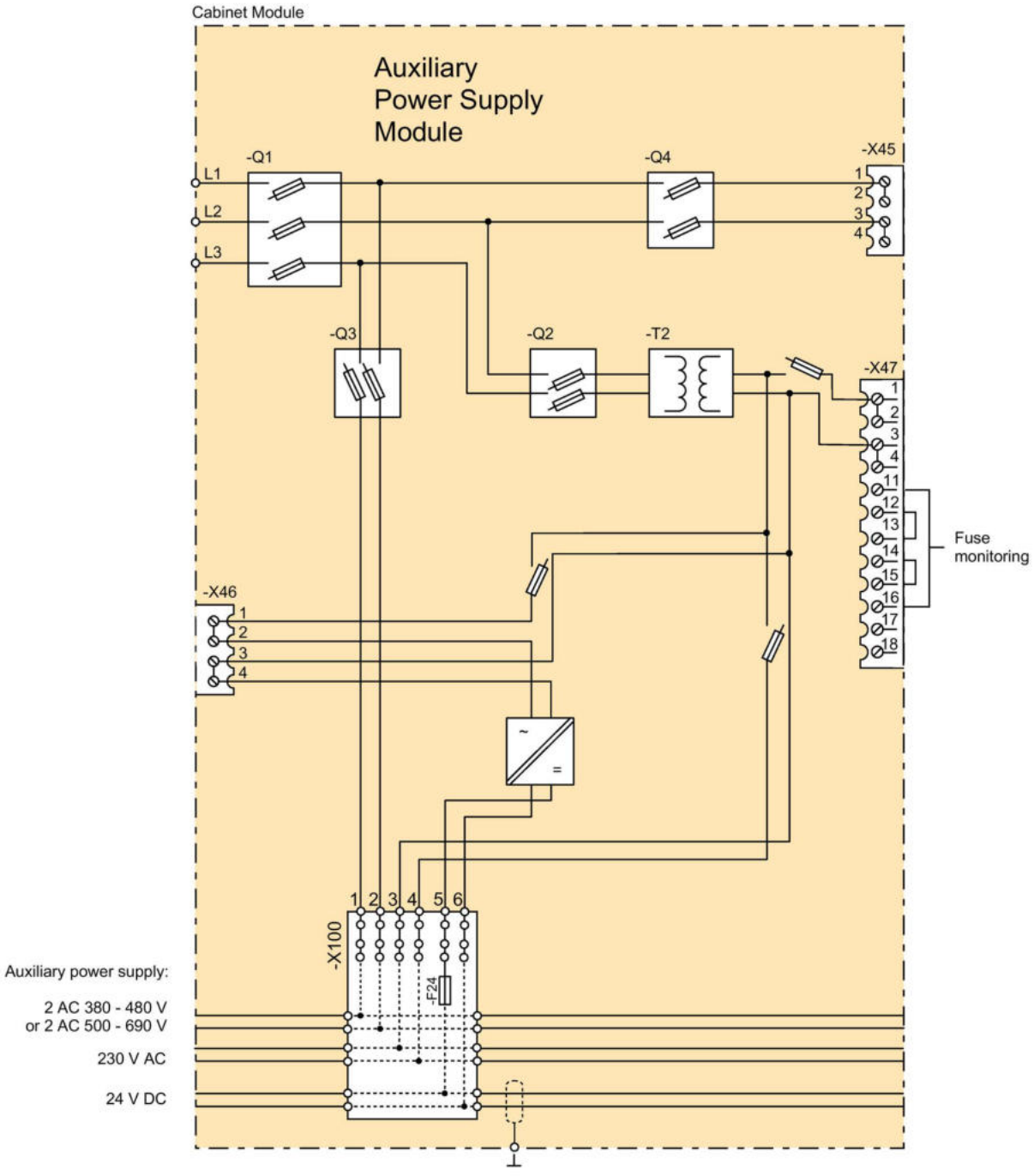


Figure 5-79 Connection example for Auxiliary Power Supply Modules

Configuration

The Auxiliary Power Supply Module is connected on the plant side to a voltage corresponding to the respective rated device voltage.

The standard version contains the following components:

- Fuse switch disconnector with fuse monitoring for external evaluation
- Supply of auxiliary power system with three auxiliary voltages:
  - 24 VDC for the electronics power supply
  - 230 V 1 AC to supply 230 VAC loads
  - 380 to 690 V 2 AC for supply of device fans (corresponding to the respective rated device voltage)
- Transformer with output voltage 230 V 1 AC
- SITOP power supply 24 VDC
- PE busbar, nickel-plated (60 x 10 mm), including jumper for looping through to the next Cabinet Module.

Note

Additional information

The configuration example of the Auxiliary Power Supply Module illustrates the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

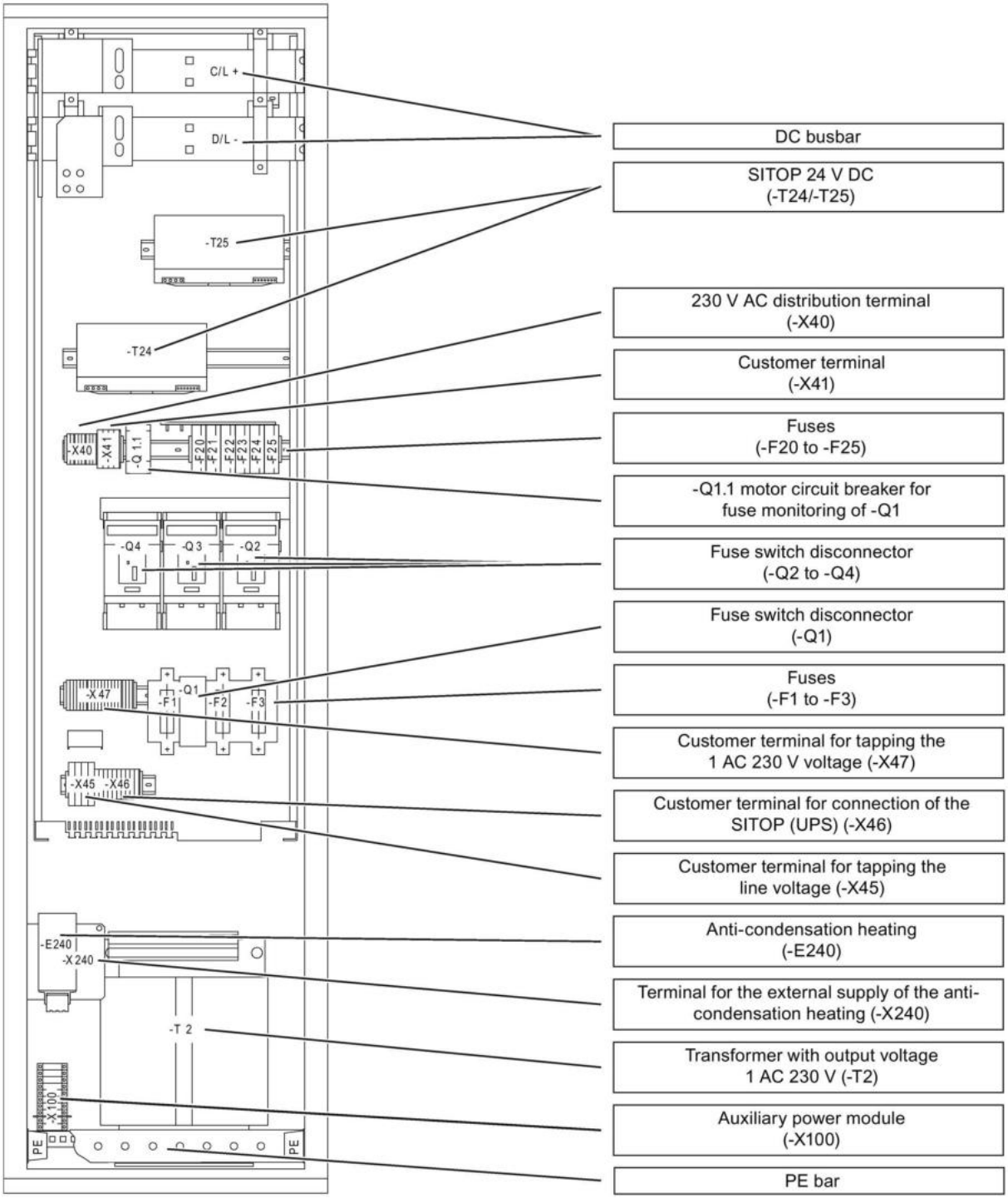


Figure 5-80 Configuration example for Auxiliary Power Supply Modules

5.10.2 Fuse switch disconnector (-Q1)

The infeed of the Auxiliary Power Supply Module occurs for the customer at the fuse switch disconnector (-Q1). The plant-side power demand indicated in the table "Technical data" varies according to the version of the Cabinet Module used.

5.10.3 Transformer (-T2) for generating the auxiliary voltage 230 V AC

A transformer is incorporated to generate the 230 VAC, 2-phase voltage. This voltage is made available in order to supply the auxiliary power system and the SITOP power supply.

When delivered, the taps are always set to the highest level. The line-side terminals of the transformer may need to be reconnected according to the existing line voltage.

The line voltage assignments for making the appropriate setting on the transformer for the internal power supply are indicated in the following table.

Note

Reconnecting the terminals according to the actual line voltage

The terminals must be reconnected to the actual line voltage so that the 230 VAC, 2-phase voltage required in the system is provided correctly.

Table 5- 77 Assignment of the available line voltage for generating the 230 VAC, 2-phase voltage

Tap	Taps of voltage adaptation transformer (T2) L_A – L_B
380 V	3 – 4
400 V	2 – 4
415 V	1 – 4
440 V	3 – 5
460 V	2 – 5
480 V	1 – 5
500 V	3 – 6
525 V	2 – 6
550 V	1 – 6
575 V	3 – 7
600 V	2 – 7
660 V	3 – 8
690 V	1 – 8

Fuse adaptation (-Q2) for transformer (-T2)

Two LV HRC fuses (-Q2:-F1/-F2) are installed upstream of the transformer (-T2) to protect it.

Fuses rated for a line infeed of between 500 ... 690 V are fitted in the factory. Customers must replace the fuses for supply voltages in the range from 380 ... 480 V. The required fuses are supplied as accessories with the Auxiliary Power Supply Module.

NOTICE

Replacing the fuses

If the customer fails to replace the fuses when the system is connected to a supply voltage in the 380 ... 480 V range, there is a risk of fuse overloading in the low voltage range (380 ... 480 V) so that the fuses will need to be replaced by new ones.

Note

Only replace the fuses using the fuse grip

A fuse grip must always be used to replace the fuses.

If necessary, the fuse grip can be ordered from Siemens.

Table 5- 78 Overview of fuses for the transformer (-T2) in the Auxiliary Power Supply Module

Auxiliary Power Supply Module Article No. 6SL3700-	0MX14-0AA3	0MX16-3AA3	0MX21-0AA3	0MX21-4AA3
LV HRC fuse for voltage range 3 AC 380 to 480 V				
Fuse protection in A	gG 20	gG 25	gG 35	gG 50
Fuse	3NA3807-6	3NA3810-6	3NA3814-6	3NA3820-6
LV HRC fuse for voltage range 3 AC 500 to 690 V (fitted at factory)				
Fuse protection in A	gG 16	gG 20	gG 32	gG 40
Fuse	3NA3805-6	3NA3807-6	3NA3812-6	3NA3817-6

5.10.4 Auxiliary power supply system

Description

The auxiliary power supply system is used to distribute the available voltages (line voltage for device fans, 230 VAC, 2-phase and 24 VDC). The table below shows an overview of the connected voltages and associated fuses for the auxiliary power supply system in the Auxiliary Power Supply Module. The 24 VDC voltage is provided directly from the SITOP power supply and is not protected separately by a fuse. The 24 VDC power supply itself is current-limited and short-circuit-proof at the output.

Note

The 24 VDC voltage is available only via the auxiliary power supply system.

The assignment of the auxiliary power module is described in Chapter "Electrical installation", Section "Connections / auxiliary power supply system".

Table 5- 79 Overview of the fuses for the auxiliary power supply system in the Auxiliary Power Supply Module

Article No. 6SL3700-	0MX14-0AA3	0MX16-3AA3	0MX21-0AA3	0MX21-4AA3
Fuse protection in A				
380 to 690 V 2 AC (depending on the rated device voltage)	63	80	100	100
230 V 1 AC	6	10	10	20
24 VDC	20	40	80	80

5.10.5 Customer interfaces for supplying power to an additional auxiliary power supply system

This chapter describes only those interfaces in the cabinet that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections. The table below provides an overview of the most important technical data of the customer terminals in the cabinet.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams on the customer DVD supplied.

Table 5- 80 Overview of customer terminals in the Auxiliary Power Supply Module

Cabinet Module **Article No. 6SL3700-**	**0MX14-0AA3**	**0MX16-3AA3**	**0MX21-0AA3**	**0MX21-4AA3**
Customer terminal -X45 for tapping the line voltage (380 to 480 V 3 AC or 500 to 690 V 3 AC)				
Fuse protection in A	50	63	80	80
Max. connection cross section in mm²	16	16	16	16
Customer terminal -X46 for connection of an uninterruptible power supply for SITOP [1]				
Fuse protection in A [2]	10	20	35	35
Max. connection cross section in mm²	6	6	6	6
Customer terminal -X47 for tapping the 230 V AC, 1-phase voltage				
Fuse protection in A	8	10	10	20
Max. connection cross section in mm²	2.5	2.5	2.5	2.5

1) When an uninterruptible power supply is connected, the jumpers between -X46:1/2 and -X46:5/6 must be removed.

2) The customer is responsible for providing external fuse protection for the uninterruptible power supply according to the specifications for the 24 V DC power supply used.

5.10.6 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	**Option**
Cabinet anti-condensation heating	L55

Mechanical options

Component	**Option**
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panel (right)	M26
Side panel (left)	M27
Closed cabinet door (air inlet from below through floor opening)	M59
EMC shield bus	M70
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.10.7 Technical data

Table 5- 81 Technical data for the Auxiliary Power Supply Modules

Article No.	6SL3700-	0MX14-0AA3	0MX16-3AA3	0MX21-0AA3	0MX21-4AA3
Supply voltage on the plant/system side 380 ... 690 V 3 AC	A	125	160	200	250
Line connection - Cable cross-section, max. (IEC)	mm^2	150	150	150	150
Current carrying capacity, max. - load feeder connection 380 ... 690 VAC - at the auxiliary power supply system - at customer terminal -X45 - load feeder connection 230 VAC - at the auxiliary power supply system - at customer terminal -X47 - load feeder connection 24 VDC - at the auxiliary power supply system	 A A A A A	 63 50 6 8 20	 80 63 10 10 40	 100 80 10 10 80	 100 80 20 20 80
Cable cross-section, max. - connection -X45 - connection -X47	 mm^2 mm^2	 16 2.5	 16 2.5	 16 2.5	 16 2.5
PE/GND connection - Busbar cross-section - Connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cooling air requirement		Natural convection			
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [1] - Depth	 mm mm mm	 600 2200 600	 600 2200 600	 600 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	170	180	210	240
Rated short-circuit current acc. to IEC	kA	80	80	80	80
Minimum short-circuit current [2]	kA	3.2	4	5	7

[1] The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP24 and IP54 degree of protection.

[2] Current required for reliable tripping of the protective devices.

Maintenance and servicing

6

6.1 Chapter content

This chapter provides information on the following:

- Maintenance and servicing procedures that have to be carried out on a regular basis to ensure the availability of the components
- Replacing device components when the unit is serviced
- Forming the DC-link capacitors

⚠WARNING

Not observing fundamental safety instructions and residual risks

The non-observance of the fundamental safety instructions and residual risks stated in Chapter 1 can result in accidents with severe injuries or death.

- Adhere to the fundamental safety instructions.
- When assessing the risk, take into account residual risks.



⚠DANGER

Electric shock due to the residual charge of the DC link capacitors

Because of the DC-link capacitors, a hazardous voltage is present for up to five minutes after the power supply has been switched off.

Contact with live parts can result in death or serious injury.

- Only open the device after five minutes have elapsed.
- Measure the voltage before starting work on the DCP and DCN DC-link terminals.

⚠DANGER

Electric shock from external supply voltages

When the external power supply or the external 230 V AC auxiliary supply is connected, dangerous voltages are still present in components even when the main circuit breaker is open.

Contact with live parts can result in death or serious injury.

- Switch off external supply voltages and external 230 V AC auxiliary supply before opening the device.

6.2 Cleaning the cabinet

The cabinet comprises mostly electronic components. Apart from the fan(s), therefore, it contains hardly any components that are subject to wear or that require maintenance or servicing. The purpose of maintenance is to preserve the specified condition of the cabinet. Dirt and contamination must be removed regularly and parts subject to wear replaced.

The following points must generally be observed.

Dust deposits

Dust deposits inside the cabinet must be removed at regular intervals (or at least once a year) by qualified personnel in line with the relevant safety regulations. The unit must be cleaned using a brush and vacuum cleaner, along with dry compressed air (max. 1 bar) for areas that cannot be easily reached.

Ventilation

The ventilation openings in the cabinet must never be obstructed. The fan must be checked to make sure that it is functioning correctly.

6.3 Servicing the cabinet

Servicing involves activities and procedures for maintaining and restoring the operating condition of the cabinet.

Required tools

The following tools are required for replacing components:

- Standard toolboxes with screwdrivers, screw wrenches, socket wrenches, etc.
- Torque wrenches from 1.5 Nm up to 100 Nm
- 400 mm extension for socket wrenches

Tightening torques for screw connections

The following tightening torques apply when tightening current-conducting connections (DC-link connections, motor connections, busbars, lugs) and other connections (ground connections, protective conductor connections, steel threaded connections).

Table 6- 1 Tightening torques for screw connections

Thread	Ground connections, protective conductor connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, lugs
M3	1.3 Nm	0.8 Nm
M4	3 Nm	1.8 Nm
M5	6 Nm	3 Nm
M6	10 Nm	6 Nm
M8	25 Nm	13 Nm
M10	50 Nm	25 Nm
M12	88 Nm	50 Nm
M16	215 Nm	115 Nm

Note

Screw connections for protective covers

The threaded connections for the protective covers made of Makrolon may only be tightened with 2.5 Nm.

Cable and screw terminals

Cable and screw terminals must be checked regularly to ensure that they are securely in position and, if necessary, retightened. Cabling must be checked for defects. Defective parts must be replaced immediately.

Note

Maintenance intervals

The actual intervals at which maintenance procedures are to be performed depend on the installation conditions (cabinet environment) and the operating conditions.

Siemens offers its customers support in the form of a service contract. For further details, contact your regional office or sales office.

6.4 Replacing components

6.4.1 General information

This chapter deals with replacing components that may need to be exchanged when the cabinet units require maintenance or service. Other components are not normally subject to wear and tear and are, therefore, not covered in this chapter.

Note

Additional information

The article numbers for spare/replacement parts are specified in the customer DVD in the list of spare/replacement parts.

6.4.2 Safety information

Required safety precautions to be taken before carrying out maintenance and servicing

⚠WARNING

Incorrect transport and installation of devices and components

Serious injury or even death and substantial material damage can occur if the devices are not transported or installed properly.

- Transport, mount, and remove the devices and components only if you are qualified to do so.
- Take into account that the devices and components are in some cases heavy and top-heavy; take the necessary precautionary measures.
  The weights of the individual power blocks are listed in the corresponding section.

6.4.3 Messages after replacement of DRIVE-CLiQ components

After DRIVE-CLiQ components are replaced (Control Interface Module, TM31, SMCxx) when service is required, generally no message is output after power-up, since an identical component is identified and accepted as component when the system boots.

The reason for this is that an identical component is detected and accepted as spare part when running-up. If, unexpectedly, a fault message of the "topology fault" category is displayed, then when replacing a component, one of the following faults/errors should have occurred:

- A Control Interface Module with different firmware data was installed.
- When connecting-up DRIVE-CLiQ cables, connections were interchanged.

Automatic firmware update

A firmware update for the replaced DRIVE-CLiQ component may run automatically after switching on the electronics.

- The following LEDs will flash slowly to indicate that an automatic firmware update is in progress: the "RDY" LED on the Control Unit (orange, 0.5 Hz) and an LED on the relevant DRIVE-CLiQ component (green/red, 0.5 Hz).

  Note

  Do not shut down the converter

  Do not shut down the converter during this process as the firmware update will otherwise have to be started again.

- Once the automatic firmware update is complete, the "RDY" LED on the Control Unit will flash quickly (orange, 2 Hz) along with an LED on the relevant DRIVE-CLiQ component (green/red, 2 Hz).
- To complete the automatic firmware update process, a POWER ON is required (switch the device off and back on again).

6.4.4 Installation device for power blocks

Installation device

The installation device is used for installing and removing the power blocks for the Basic Line Modules, Active Line Modules, Smart Line Modules, and Motor Modules in the Chassis format.

The mounting device cannot be used for Motor Modules in the Chassis-2 format.

It is used as an mounting aid, which is placed in front of and secured to the module. The telescopic guide support allows the withdrawable device to be adjusted according to the height at which the power blocks are installed. Once the mechanical and electrical connections have been removed, the power block can be removed from the module, Whereby the power block is guided and supported by the guide rails on the withdrawable devices.



Figure 6-1 Installation device

Article number of the installation device

The article number for the installation device is 6SL3766-1FA00-0AA0.

6.4.5 Mounting aid for Active Line Modules Chassis-2 and Motor Modules Chassis-2

Mounting aid

The mounting aid is used to install and remove the Active Line Modules Chassis-2 and Motor Modules Chassis-2.

The mounting aid is placed in front of the control cabinet and fastened to the upper side of the control cabinet. The rails can be adapted to the installation height of the power unit to facilitate horizontal installation and removal.

During installation, the crossbar of the mounting aid is attached to the crane lifting lugs provided on the power unit. This prevents the power unit from toppling over and rolling away.

The power unit is lifted and lowered using the integrated cable winch.

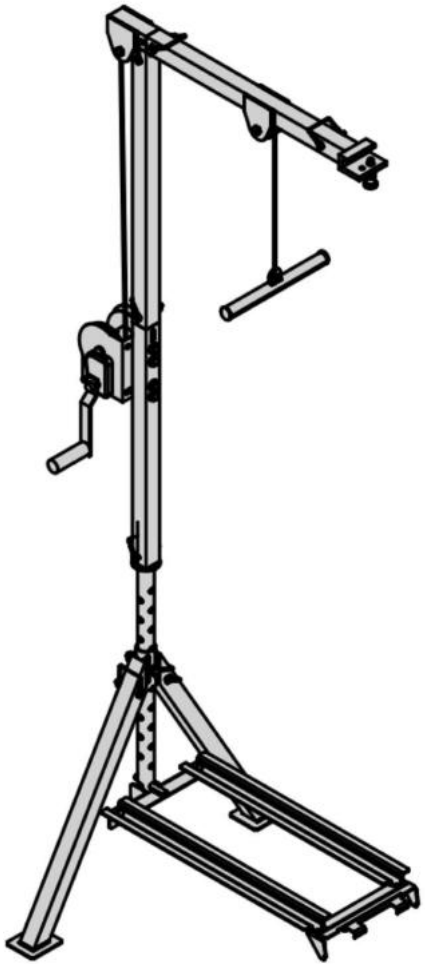


Figure 6-2 Mounting aid for Active Line Modules Chassis-2 and Motor Modules Chassis-2

Article number of the mounting aid

The article number of the mounting aid is 6SL3766-1CH02-0AA0.

6.4.6 Replacing the filter mats

Replacing the filter mats (for IP23/IP43/IP54)

The filter mats must be checked at regular intervals. If the mats are too dirty to allow the air supply to flow normally, they must be replaced.

Note

Replacing the filter mats

If you do not replace dirty filter mats, this can cause a premature thermal shutdown of the drive.

Ordering data are available in the spare parts lists.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access to the grille area of the doors.

Note

The cabinet must be disconnected from the power supply to prevent the fans from drawing in contaminated external air. If an external power supply for the fans is used, take the coasting-down period of the fan into account or switch off the power supply.

Removing/Installing filter mats from/in the cabinet doors (IP23/IP43/IP54)

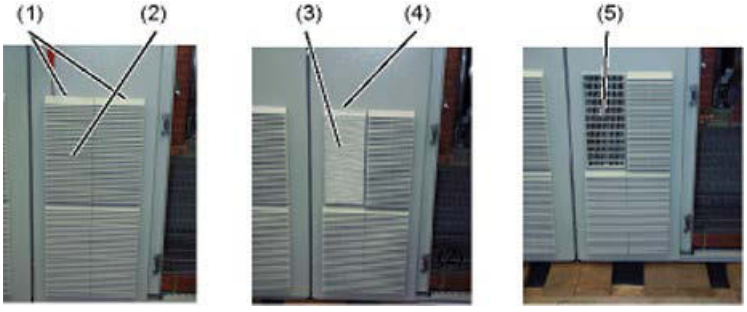


Figure 6-3 Removing/Installing filter mats (IP23/IP43/IP54)

1. Insert the screwdriver into the cut-out sections provided (1) and gently push the grille cover (2) down and forwards, then remove it.
2. Remove the filter mat (3).
3. Clean the ventilation grille (5).
4. Insert the new filter mat.
5. Replace the grille cover and gently snap it back into position in the cut-out sections.
6. Repeat the procedure for all filter mats that need to be replaced.

Note

Correct replacement of filter mats

Make sure that no dirt falls into the cabinet!

The filter mat with IP54 degree of protection must be placed in the correct position (arrow points towards the cabinet).
The filter mat must be placed on the upper guide edge (4).

If you do not do this, the specified degree of protection IP23/IP43/IP54 will not be achieved!

When disposing of old filter mats, observe the applicable legal requirements!

6.4.7 Replacing power units

The components required for connecting the DC busbars to the power unit are supplied as standard. If a component is replaced, you may have to restore these connections. The connection procedure is described in the following section.

Preparatory steps:

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access to the DC busbars
  (if necessary, remove the protective covers during installation work)

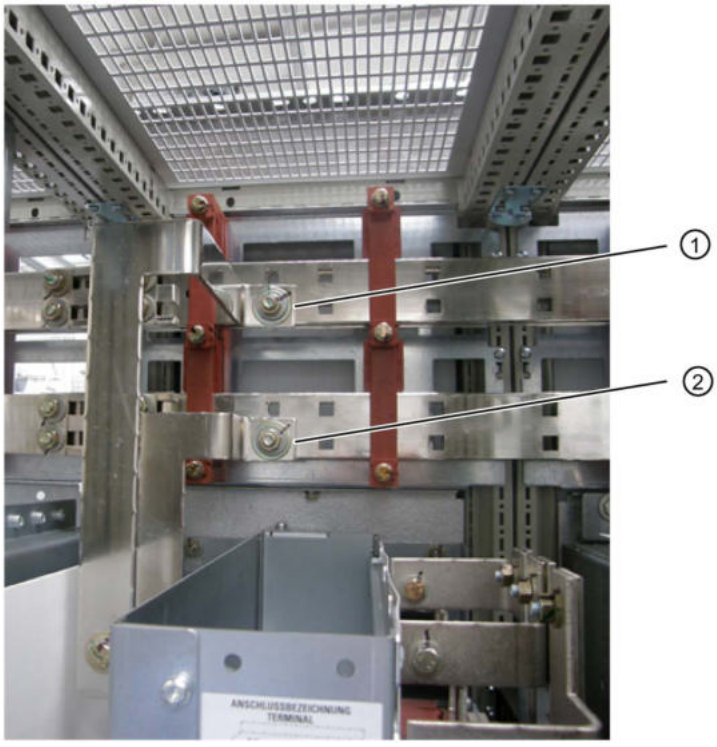


Figure 6-4 Connection to the DC busbar on the Basic Line Module, Smart Line Module, Active Line Module and Motor Module in the chassis format

Establishing the connection for booksize format

Note

Make sure that you do not drop any nuts, washers, or screws as this could cause damage.

1. Connect the "DC P" connection on the Motor Module to the upper DC busbar (DC P) (1 x M12 screw + nut + washer; torque: 50 Nm).
2. Connect the "DC N" connection on the Motor Module to the lower DC busbar (DC N) (1 x M12 screw + nut + washer; torque: 50 Nm).

Establishing the connection for chassis format

Note

Do not use cables

The use of cables instead of the factory-installed busbars is not permitted!

Note

Make sure that you do not drop any nuts, washers, or screws as this could cause damage.

1. Connect the "DC P" connection at the Basic Line Module, Smart Line Module, Active Line Module or Motor Module to the upper DC busbar (DC P) (1 x M12 screw + nut + washer; torque: 50 Nm).
2. Connect the "DC N" connection at the Basic Line Module, Smart Line Module, Active Line Module or Motor Module to the lower DC busbar (DC N) (1 x M12 screw + nut + washer; torque: 50 Nm).

6.4.8 Using crane lifting lugs to transport power blocks

Crane lifting lugs

The power blocks are fitted with crane lifting lugs for transportation on a lifting harness in the context of replacement.

The positions of the crane lifting lugs are illustrated by arrows in the figures below.

NOTICE
Damage to the device due to improper transport Improper transport can cause mechanical loads on the power block housing or the busbars, which result in damage to the device. • When transporting the power blocks, use a lifting harness with vertical ropes or chains. • Do not use the power block busbars to support or secure lifting harnesses.

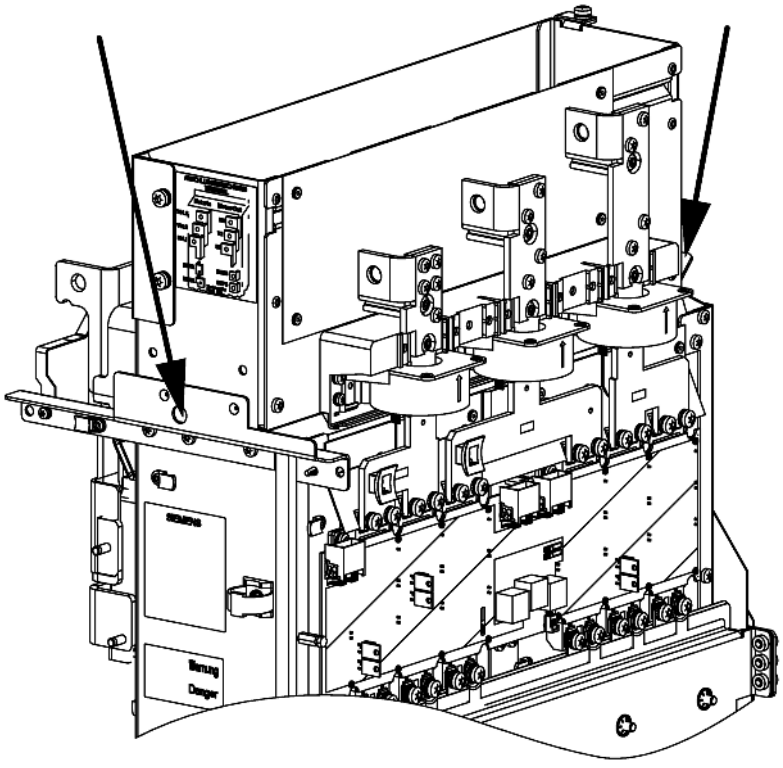


Figure 6-5 Crane lifting lugs on power block frame size FX, GX, FB

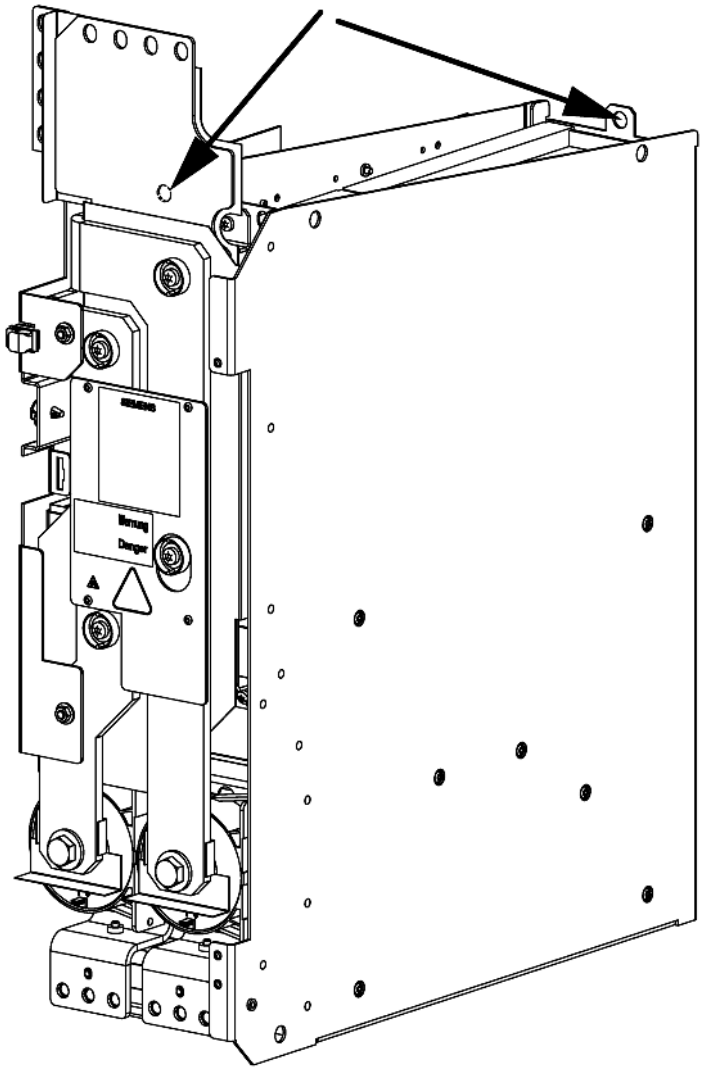


Figure 6-6 Crane lifting lugs on HX, JX power block

Note

Crane lifting lugs on HX, JX power block

On HX and JX power blocks, the front crane lifting lug is located behind the busbar.

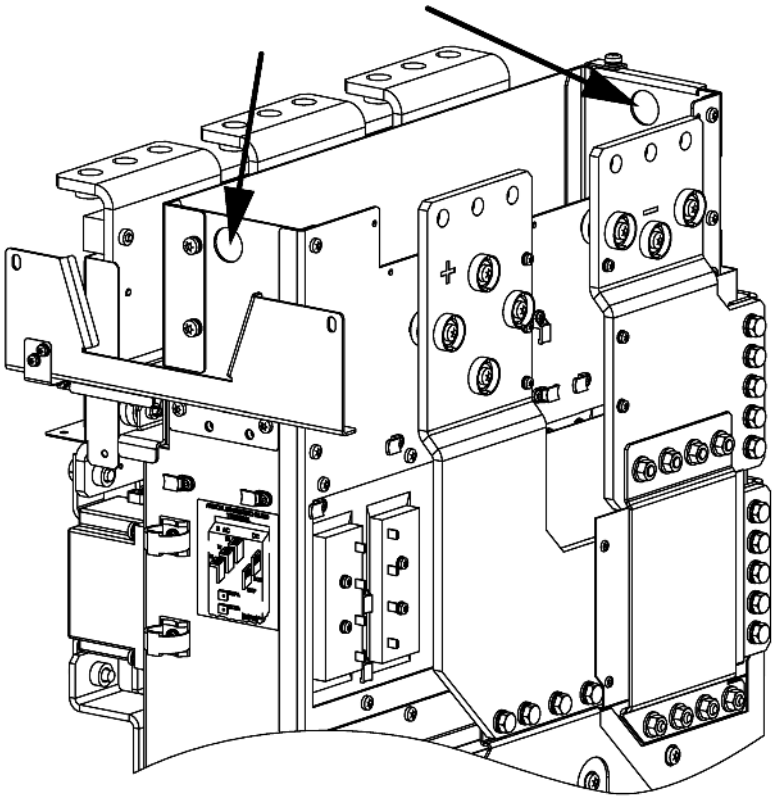


Figure 6-7 Crane lifting lugs on power block frame size GB, GD

Crane lifting lugs for Active Interface Modules Chassis-2

Active Interface Modules Chassis-2 are fitted with crane lifting lugs for transport using a lifting harness to facilitate replacement.

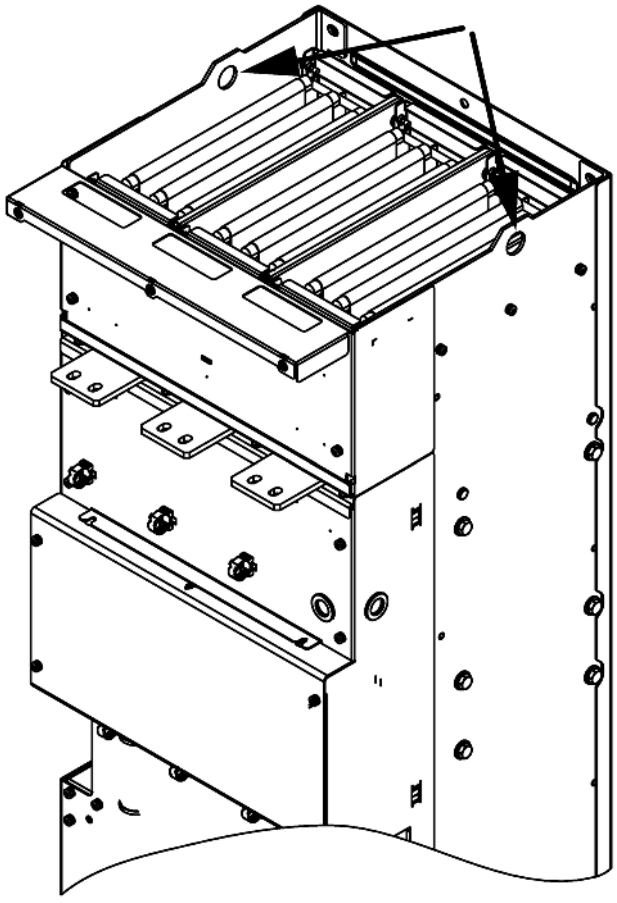


Figure 6-8 Crane lifting lugs for Active Interface Modules Chassis-2

Crane lifting lugs for Active Line Module and Motor Modules Chassis-2

Active Line Modules and Motor Modules Chassis-2 are fitted with crane lifting lugs for transport using a lifting harness to facilitate replacement.

The crane lifting lug on the side of the motor connections is used to secure the unit when it is turned and placed on its side, if this is required when the unit is being replaced.

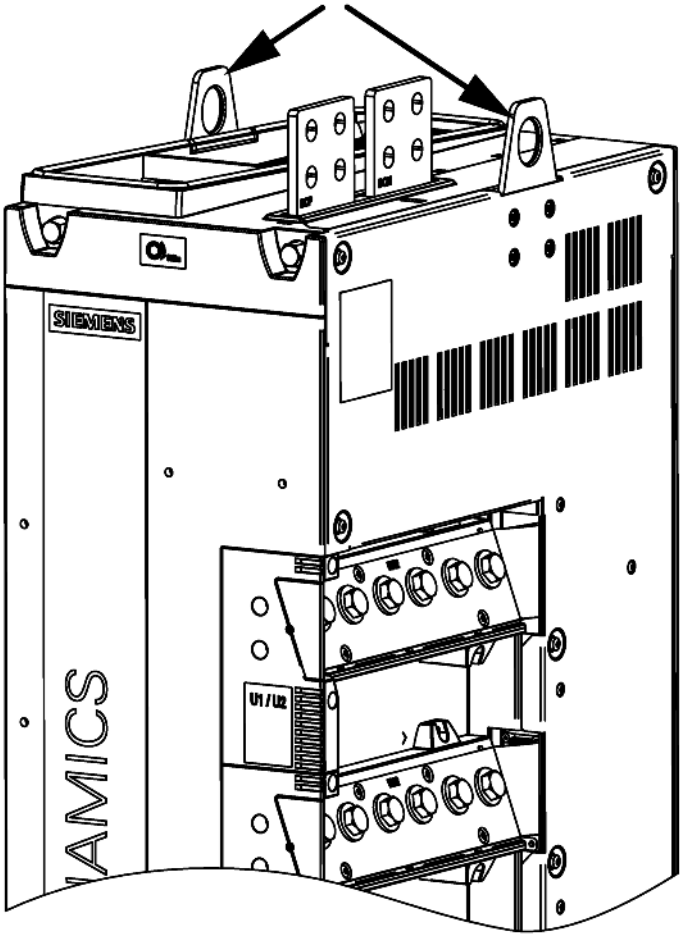


Figure 6-9 Crane lifting lugs for Active Line Module and Motor Module Chassis-2

6.4.9 Replacing the Motor Module, booksize format

Preparatory steps

- Remove the protective cover.
- Allow unimpeded access.

Removal

1. Disconnect the Control Unit and remove from the plate (if present).
2. Detach the cable from the plate and put to one side.
3. Remove the Control Unit plates.
4. Remove the DC-link rectifier adapter.
5. Remove and insulate the 24 VDC terminal adapter.
6. Remove the DRIVE-CLiQ cables.
7. Remove, short-circuit, and insulate the motor cable.
8. Unscrew the fastening screws of the Motor Module (two turns only).
9. Remove the Motor Module.

Installation

Installing is the same as removing, however in the reverse order.

6.4.10 Replacing the power block, chassis format

6.4.10.1 Replacing the power block, frame size FB

Replacing the power block

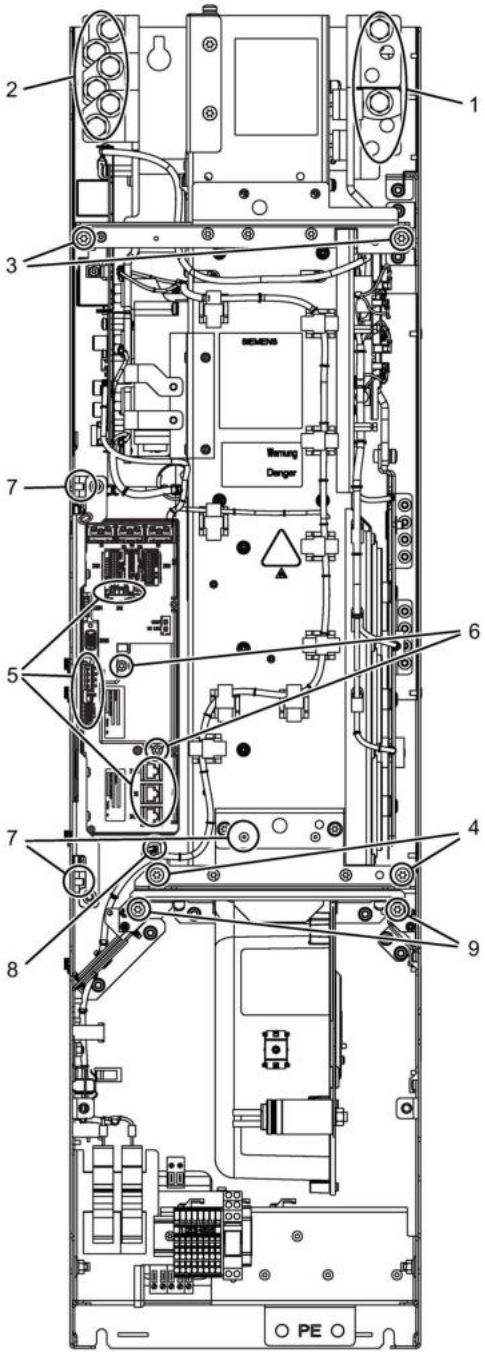


Figure 6-10 Replacing the power block, Basic Line Module, frame size FB

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Unscrew the connection to the DC link (4 screws).
2. Unscrew the connection to the line connection (6 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (1 screw and 2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.

Note

The power block weighs approx. 65 kg!

NOTICE
Damage to the device if signal cables are damaged when removing
Signal cables can be damaged when the power block is removed. This can cause the device to fail. • When removing the power block, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

Note

Connection clip for the basic interference suppression module

The connection clip for the basic interference suppression module is mounted on the spare power block together with a yellow warning label.

Please note the information in Chapter "Connecting Cabinet Modules to non-grounded line supplies (IT systems)".

6.4.10.2 Replacing the power block, frame sizes GB and GD

Replacing the power block

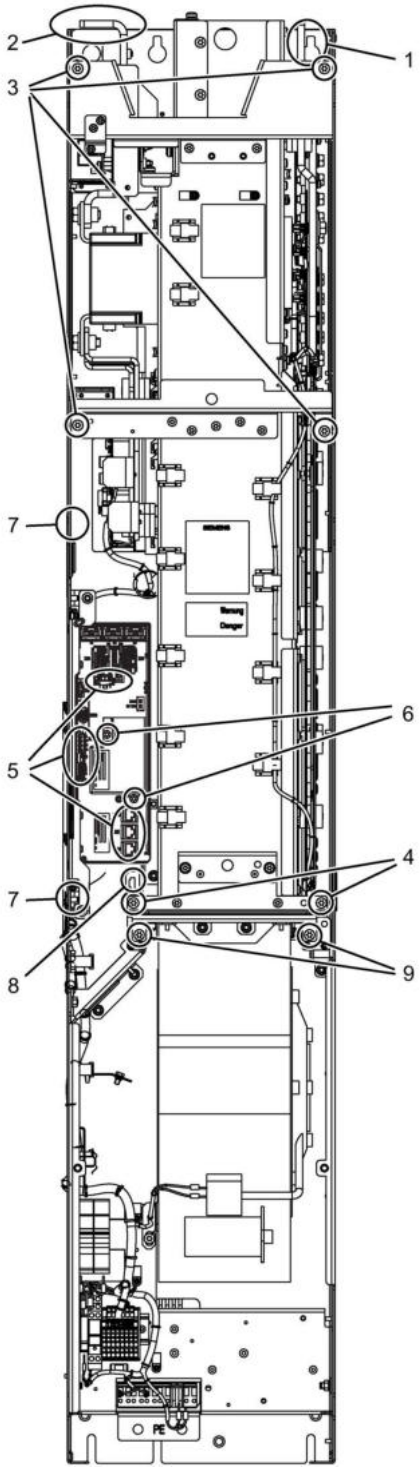


Figure 6-11 Replacing the power block, Basic Line Module, frame sizes GB and GD

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Unscrew the connection to the DC link (6 screws).
2. Unscrew the connection to the line connection (9 screws).
3. Remove the retaining screws at the top (4 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.

Note

The power block weighs approx. 135 kg!

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

Note

Connection clip for the basic interference suppression module

The connection clip for the basic interference suppression module is mounted on the spare power block together with a yellow warning label.

Please note the information in Chapter "Connecting Cabinet Modules to non-grounded line supplies (IT systems)".

6.4.10.3 Replacing the power block, frame size FX

Replacing the power block

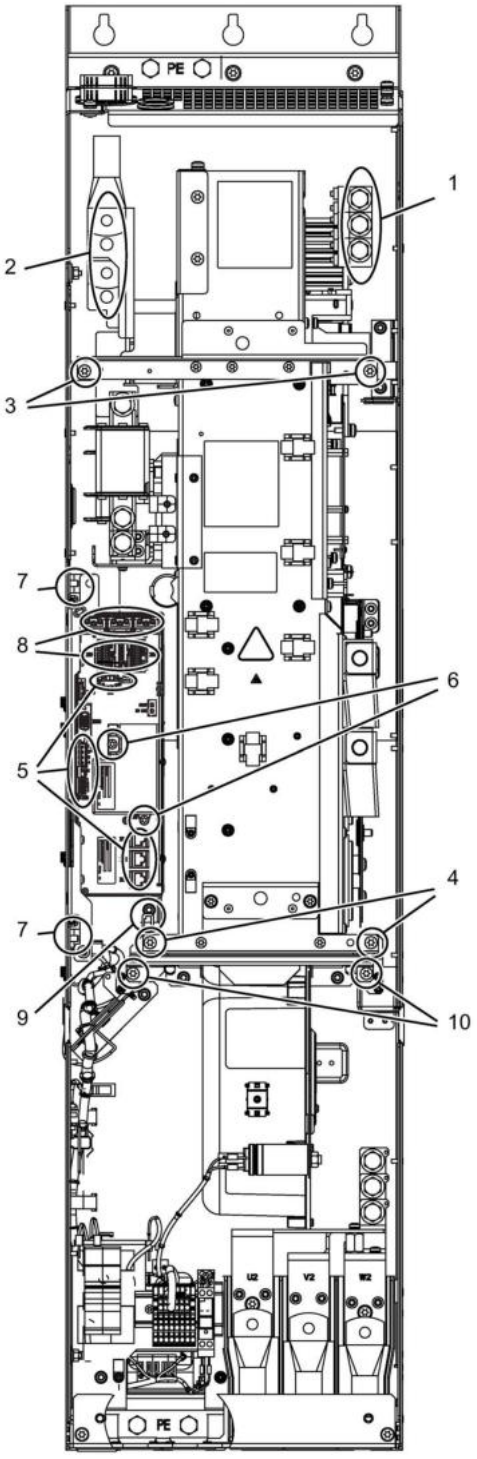


Figure 6-12 Replacing the power block, Active Line Module, and Motor Module, frame size FX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure.

1. Unscrew the connection to the line or to the motor (3 screws).
2. Unscrew the connection to the DC link (4 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs).
9. Disconnect the plug for the thermocouple.
10. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



⚠DANGER

Live parts and components

Death or serious injury can result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

Note

The power block weighs approx. 66 kg!

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 7).

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

6.4.10.4 Replacing the power block, frame size GX

Replacing the power block

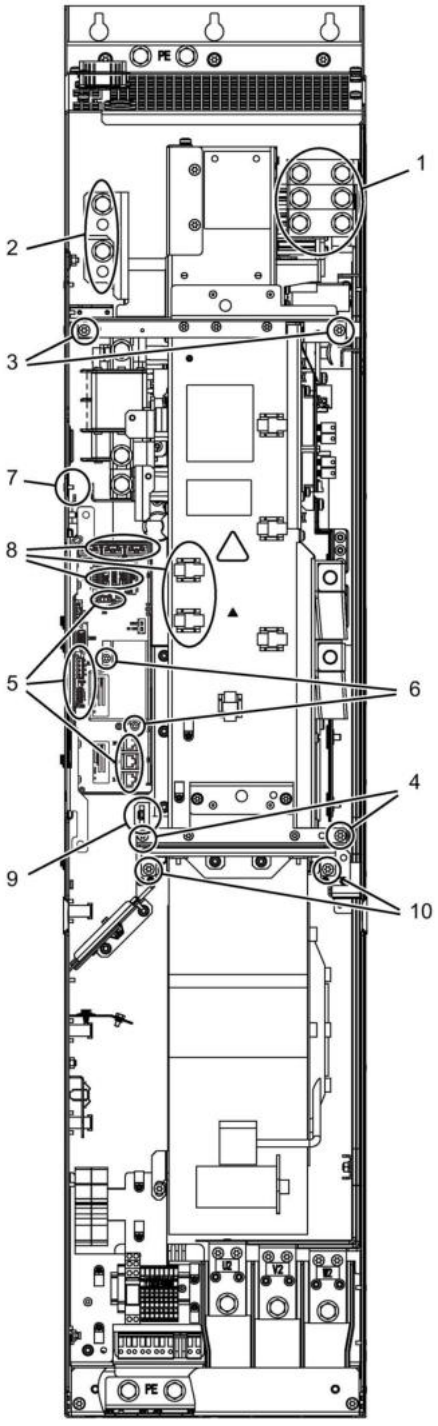


Figure 6-13 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size GX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure.

1. Unscrew the connection to the line or to the motor (3 screws).
2. Unscrew the connection to the DC link (4 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mount for the Control Interface Module (1 nut) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug connections for the fiber optic cables and signal cables (5 plugs) and release the cable connectors for the signal cables (2 connectors).
9. Disconnect the plug for the thermocouple.
10. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



⚠DANGER

Live parts and components

Death or serious injury will result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

Note

The power block weighs approx. 89 kg!

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 7).

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

Note

Connection clip for the basic interference suppression module on the Smart Line Module, frame size GX

The connection clip for the basic interference suppression module is mounted on the spare power block together with a yellow warning label.

Please note the information in Chapter "Connecting Cabinet Modules to non-grounded line supplies (IT systems)".

6.4.10.5 Replacing the power block, frame size HX

Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX – left power block

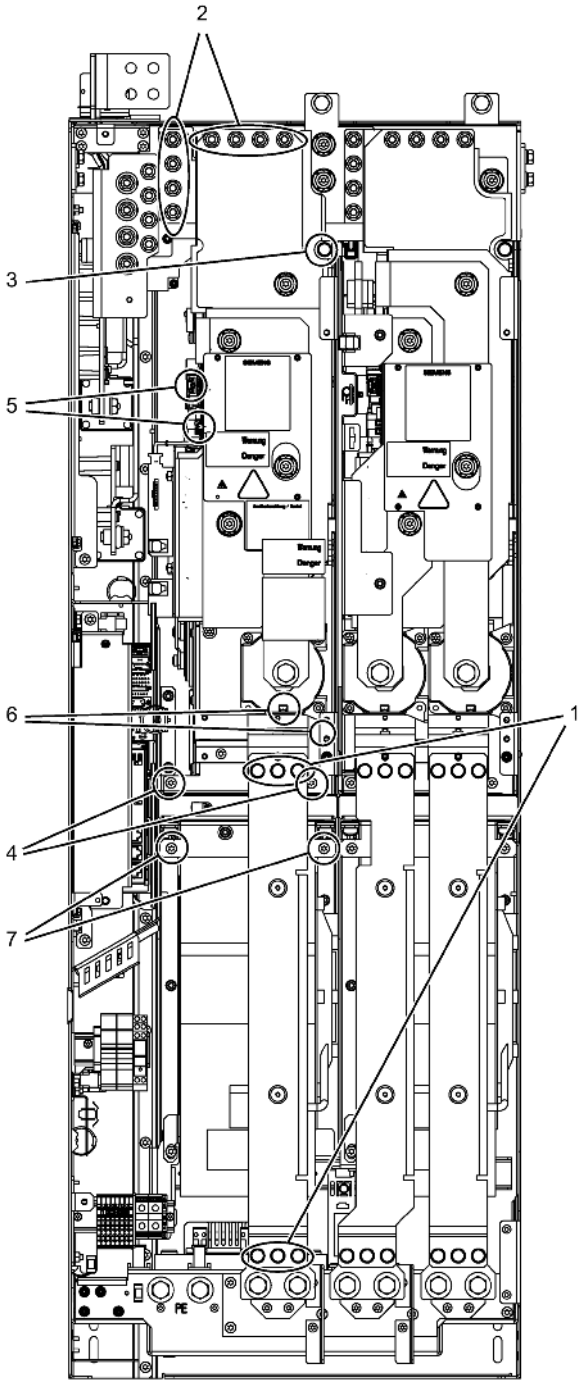


Figure 6-14 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX – left power block

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (6 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



⚠DANGER

Live parts and components

Death or serious injury will result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

Note

The power block weighs approx. 64 kg!

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 5).

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

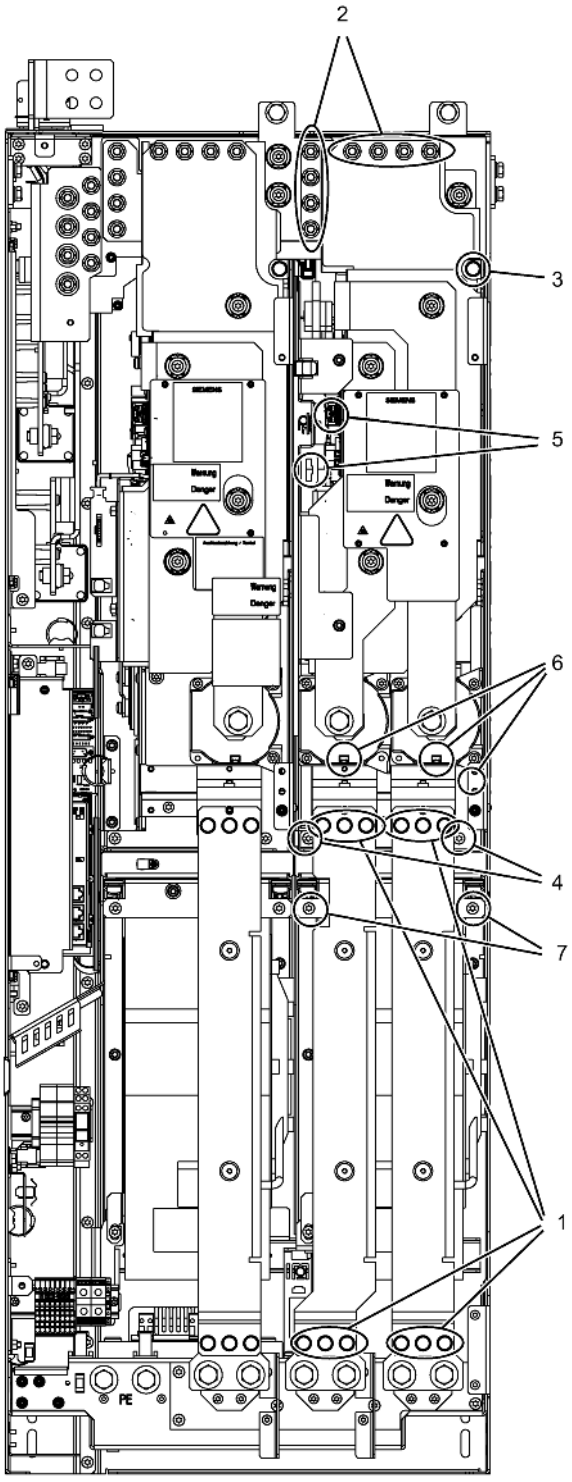


Figure 6-15 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbars (12 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs). The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly.
6. Remove the connection for the current transformer and associated PE connection (2 plugs).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



⚠DANGER

Live parts and components

Death or serious injury will result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

Note

The power block weighs approx. 86 kg!

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 5).

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

6.4.10.6 Replacing the power block, frame size JX

Replacing the power block

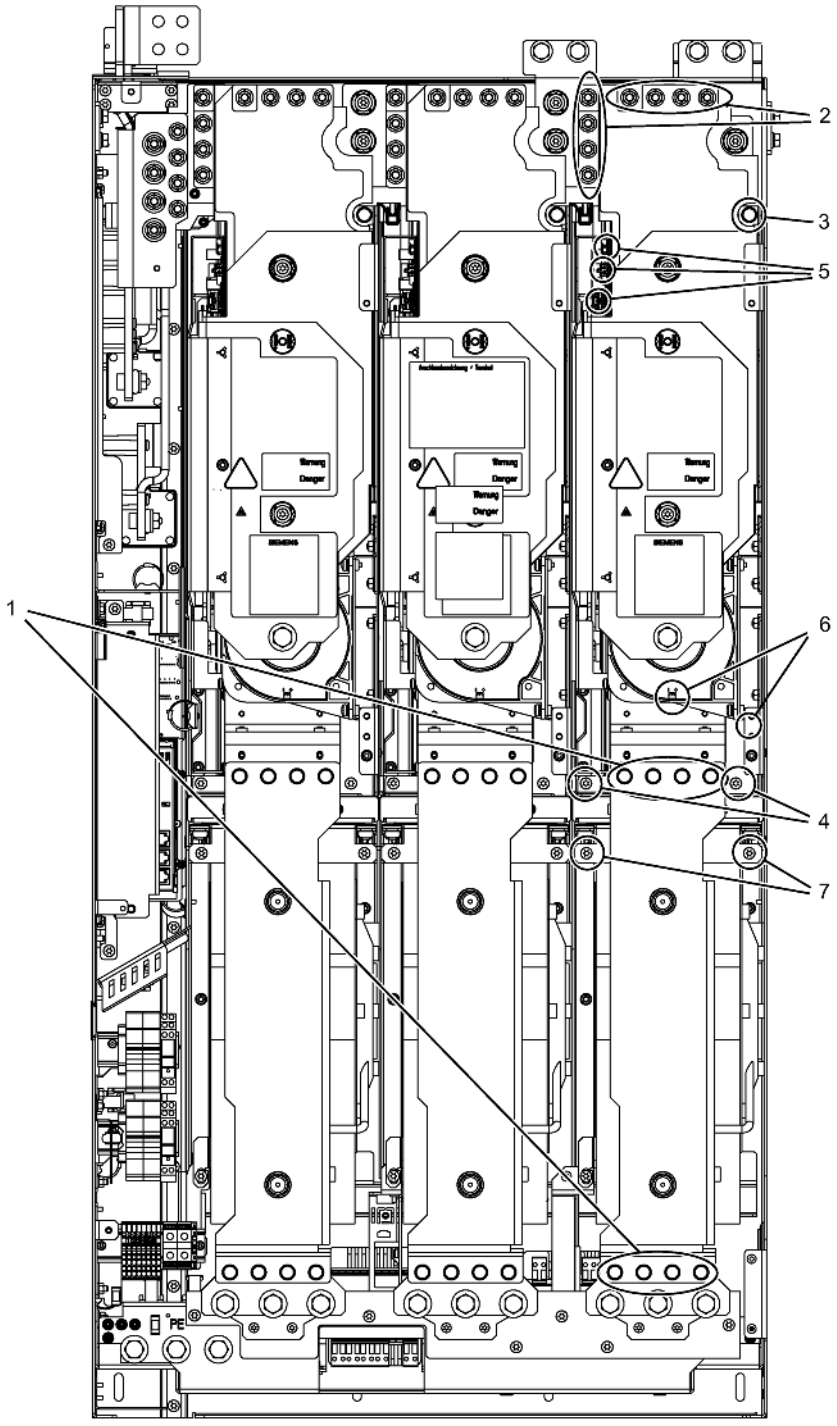


Figure 6-16 Replacing the power block, Active Line Module, Smart Line Module, and Motor Module, frame size JX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (8 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



⚠DANGER

Live parts and components

Death or serious injury can result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

Note

The power block weighs approx. 90 kg!

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

The procedure described here for replacing the power block refers to the module on the right. The other modules are handled in the same way.

6.4.11 Replacing Chassis-2 format devices

6.4.11.1 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+

Replacing the Active Line Module, frame sizes FS2 and FS2+

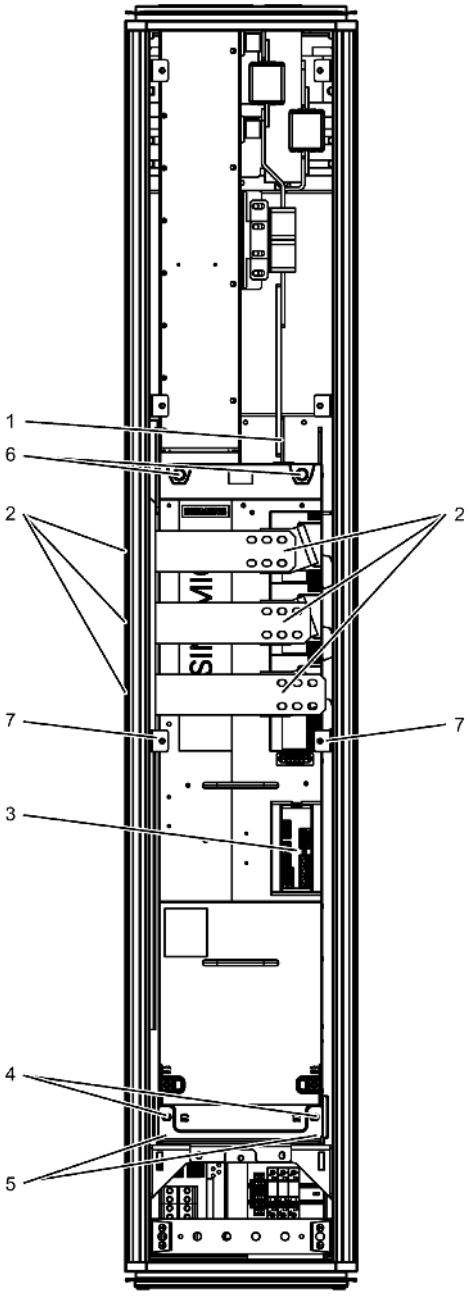


Figure 6-17 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+ when the Motor Modules are installed to the right

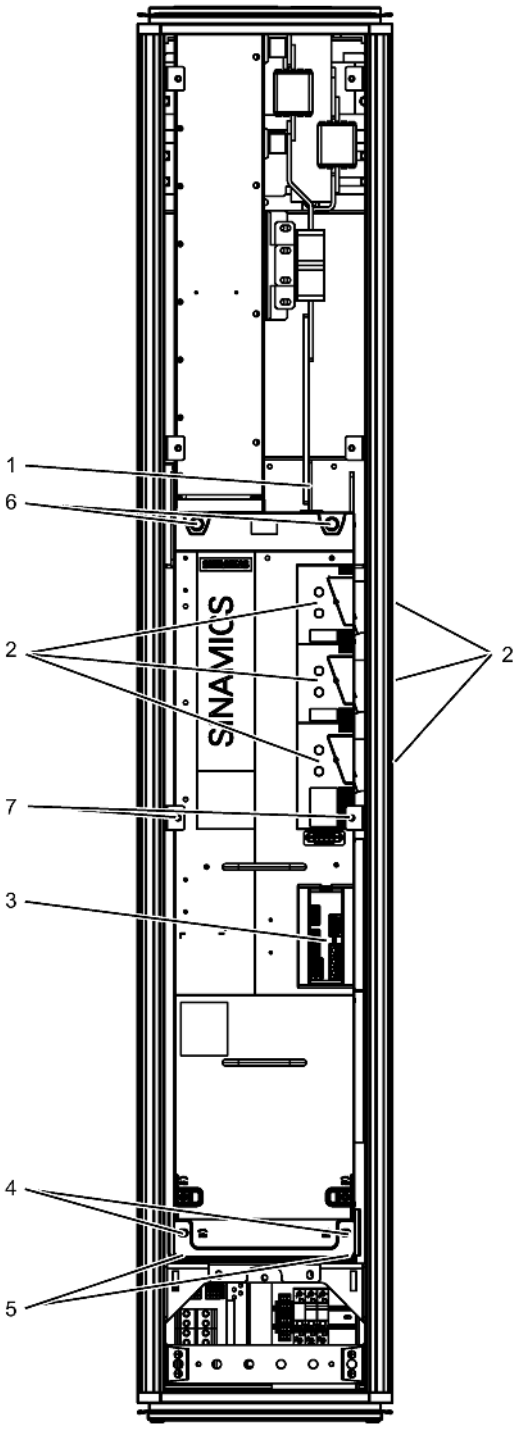


Figure 6-18 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+ when the Motor Modules are installed to the left

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Remove the protective cover in front of the Active Line Module and the Active Interface Module.
- Facilitate free access to the Active Line Module and the Active Interface Module.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Release the connection to the DC link.
2. Release the busbars to the power outputs at U1, V1, W1.
   - When installing the Motor Modules to the right:
     You can reach the screws on the left-hand side of the busbars from the Active Interface Module cabinet.
   - When the Motor Modules are installed to the left:
     Remove the screws at the connecting bars to the Active Interface Module.
     You can access the screws on the right-hand side of the connecting bars from the Active Interface Module cabinet.
3. Withdraw the signal cable connectors.
4. Remove the upper fastening screws of the mounting bracket (2 screws).
5. Remove the lower fastening screws of the mounting bracket (2 screws).
6. Remove the fastening screws (2 screws).
7. Remove the mounting bracket for the plastic cover.

The Active Line Module can then be withdrawn.

⚠CAUTION

When removing the device without using a suitable mounting aid, the device may be damaged or cause injury.

When removing the Active Line Module from the control cabinet without using a suitable mounting aid, the Active Line Module may be damaged or cause injury.

- When removing the Active Line Module from the control cabinet, use a suitable mounting aid such that the device can be horizontally drawn out of the control cabinet.
- We recommend using the mounting aid with Article number 6SL3766-1CH02-0AA0.

⚠CAUTION

Injury or damage to the device if it topples or rolls away.

During and after removing the Active Line Module from the control cabinet, the Active Line Module may topple over or roll away. This can result in injuries or damage to the device.

- Secure the Active Line Module so that it cannot topple over or roll away while being removed from the control cabinet.

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the Active Line Module is removed. This can cause the device to fail.

- When withdrawing the Active Line Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

6.4.11.2 Replacing the Active Line Module Chassis-2, frame size FS4

Replacing the Active Line Module, frame size FS4

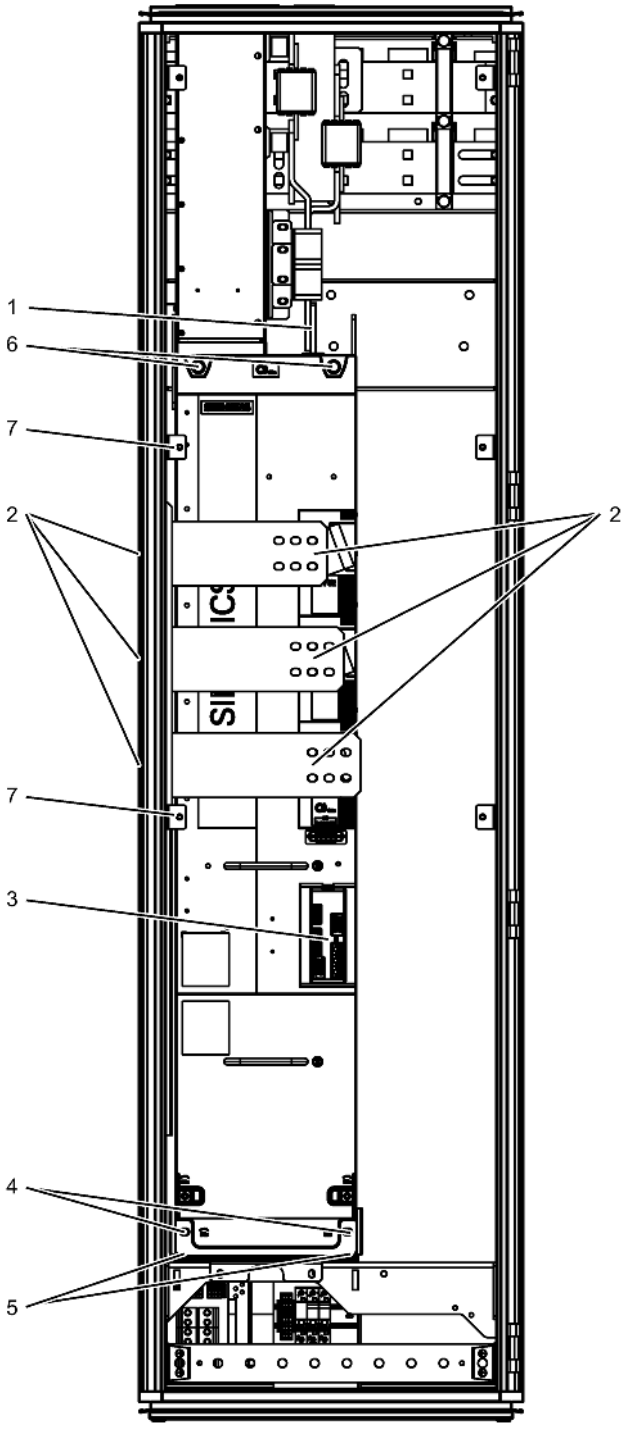


Figure 6-19 Replacing the Active Line Module Chassis-2, frame size FS4 when the Motor Modules are installed to the right

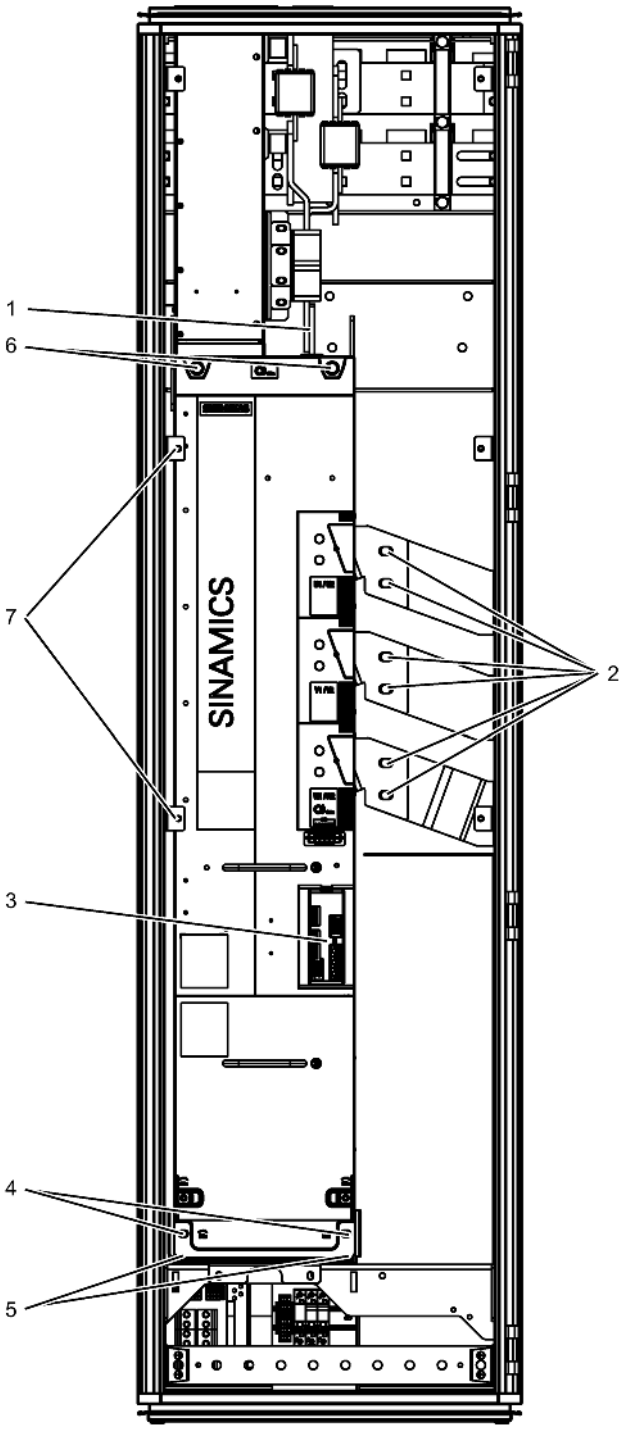


Figure 6-20 Replacing the Active Line Module Chassis-2, frame size FS4 when the Motor Modules are installed to the left

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Remove the protective cover in front of the Active Line Module and the Active Interface Module.
- Facilitate free access to the Active Line Module and the Active Interface Module.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Release the connection to the DC link.
2. Release the busbars to the power outputs at U1, V1, W1.
   - When installing the Motor Modules to the right:
     You can reach the screws on the left-hand side of the busbars from the Active Interface Module cabinet.
   - When the Motor Modules are installed to the left:
     Remove the screws at the connecting bars to the Active Interface Module.
3. Withdraw the signal cable connectors.
4. Remove the upper fastening screws of the mounting bracket (2 screws).
5. Remove the lower fastening screws of the mounting bracket (2 screws).
6. Remove the fastening screws (2 screws).
7. Remove the mounting bracket for the plastic cover.

The Active Line Module can then be withdrawn.

⚠CAUTION

When removing the device without using a suitable mounting aid, the device may be damaged or cause injury.

When removing the Active Line Module from the control cabinet without using a suitable mounting aid, the Active Line Module may be damaged or cause injury.

- When removing the Active Line Module from the control cabinet, use a suitable mounting aid such that the device can be horizontally drawn out of the control cabinet.
- We recommend using the mounting aid with Article number 6SL3766-1CH02-0AA0.

⚠CAUTION

Injury or damage to the device if it topples or rolls away.

During and after removing the Active Line Module from the control cabinet, the Active Line Module may topple over or roll away. This can result in injuries or damage to the device.

- Secure the Active Line Module so that it cannot topple over or roll away while being removed from the control cabinet.

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the Active Line Module is removed. This can cause the device to fail.

- When withdrawing the Active Line Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

6.4.11.3 Replacing the Motor Module Chassis-2, frame sizes FS2, FS2+ and FS4

Replacing the Motor Module

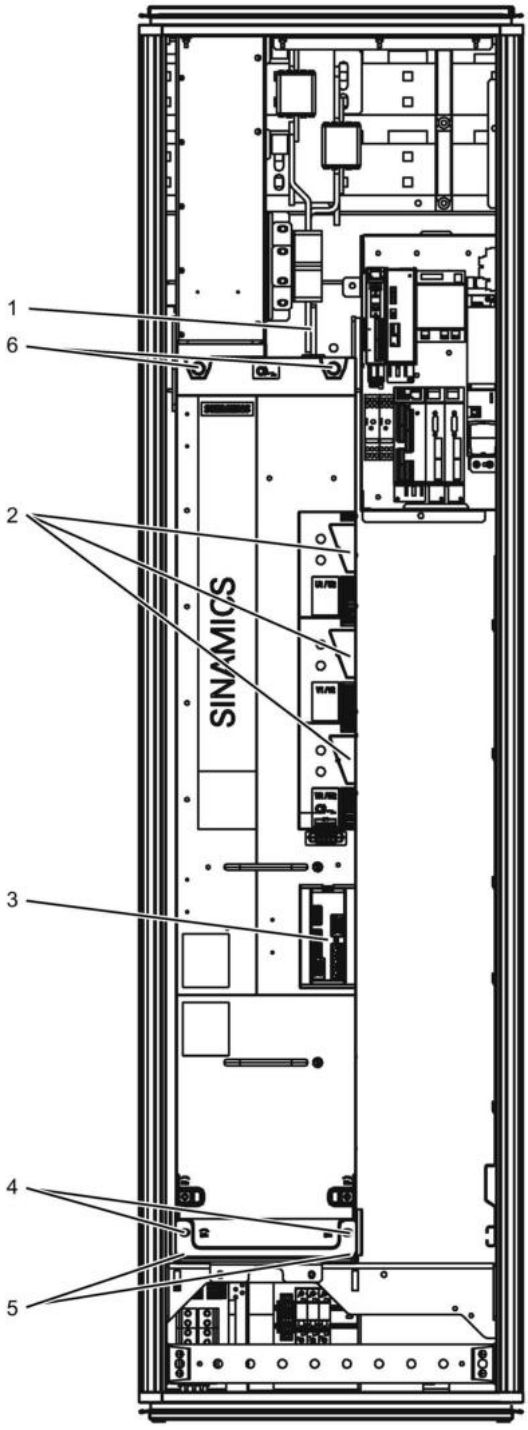


Figure 6-21 Replacing the Motor Module Chassis-2, frame sizes FS2, FS2+ and FS4

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the Motor Module.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Release the connection to the DC link.
2. Release the motor cables at U2, V2, W2.
3. Withdraw the signal cable connectors.
4. Remove the upper fastening screws of the mounting bracket (2 screws).
5. Remove the lower fastening screws of the mounting bracket (2 screws).
6. Remove the fastening screws (2 screws).

The Motor Module can then be withdrawn.

⚠CAUTION

When removing the device without using a suitable mounting aid, the device may be damaged or cause injury.

When removing the Motor Module from the control cabinet without using a suitable mounting aid, the Motor Module may be damaged or cause injury.

- When removing the Motor Module from the control cabinet, use a suitable mounting aid such that the device can be horizontally drawn out of the control cabinet.
- We recommend using the mounting aid with Article number 6SL3766-1CH02-0AA0.

⚠CAUTION

Injury or damage to the device if it topples or rolls away.

During and after removal of the Motor Module from the control cabinet, the Motor Module may topple over or roll away. This can result in injuries or damage to the device.

- Secure the Motor Module so that it cannot topple over or roll away while being removed from the control cabinet.

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become damaged when the Motor Module is removed. This can cause the device to fail.

- When withdrawing the Motor Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

6.4.12 Replacing the Control Interface Module

6.4.12.1 Replacing the Control Interface Module, frame size FB

Replacing the Control Interface Module

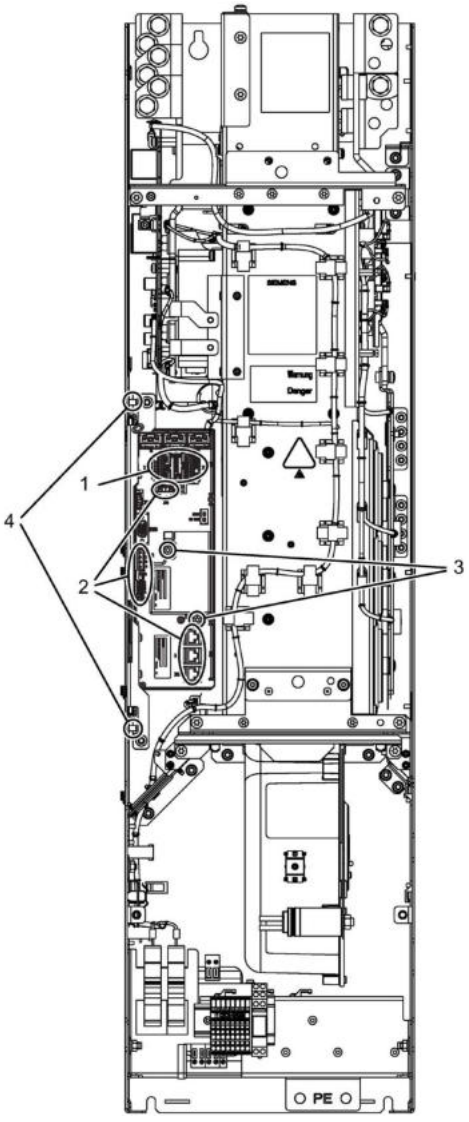


Figure 6-22 Replacing the Control Interface Module, frame size FB

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the front cover

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

NOTICE

Device damage as a result of damaged signal cables when removing

Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.

- When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

For installation, carry out the above steps in reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully establish the plug connections and then ensure that they are secure.

The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.12.2 Replacing the Control Interface Module, frame sizes GB and GD

Replacing the Control Interface Module

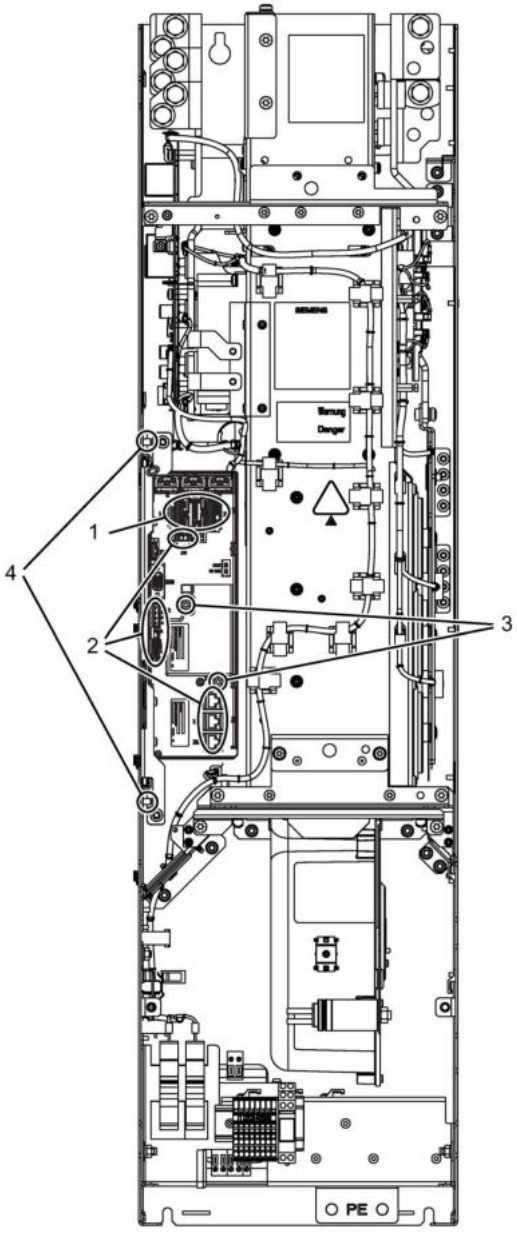


Figure 6-23 Replacing the Control Interface Module, frame sizes GB and GD

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the front cover

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

NOTICE

Device damage as a result of damaged signal cables when removing

Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.

- When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

For installation, carry out the above steps in reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully establish the plug connections and then ensure that they are secure.

The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.12.3 Replacing the Control Interface Module, frame size FX

Replacing the Control Interface Module

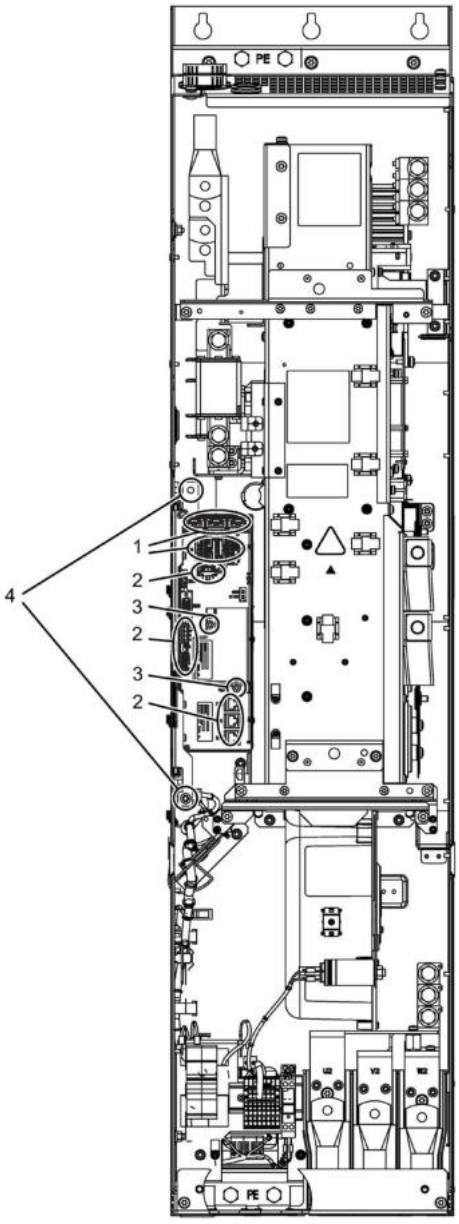


Figure 6-24 Replacing the Control Interface Module, frame size FX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the front cover.

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the Control Interface Module is removed. This can cause the device to fail.

- When removing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fixing screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.12.4 Replacing the Control Interface Module, frame size GX

Replacing the Control Interface Module

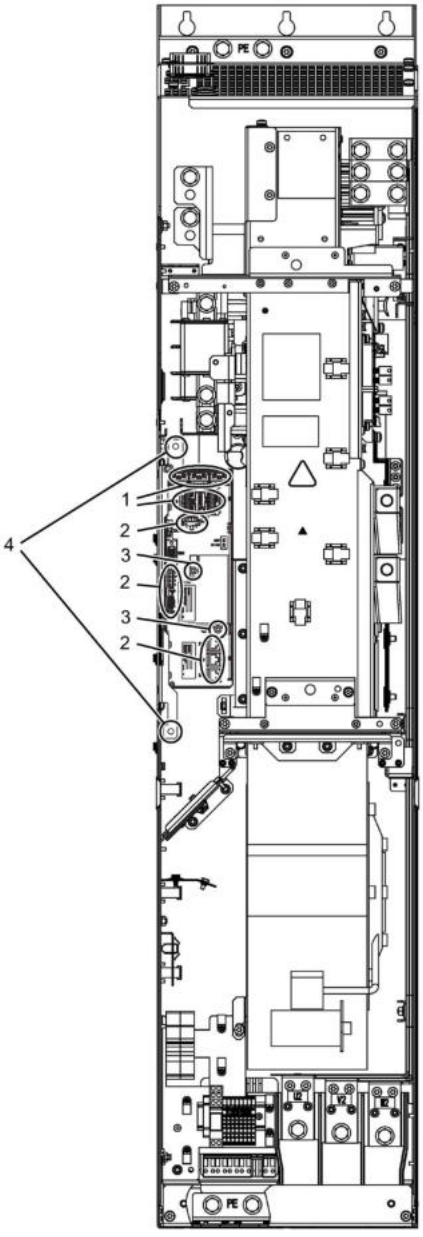


Figure 6-25 Replacing the Control Interface Module, frame size GX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the front cover.

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber optic cables and signal cables (5 plugs).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the Control Interface Module is removed. This can cause the device to fail.

- When removing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fixing screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.12.5 Replacing the Control Interface Module, frame size HX

Replacing the Control Interface Module

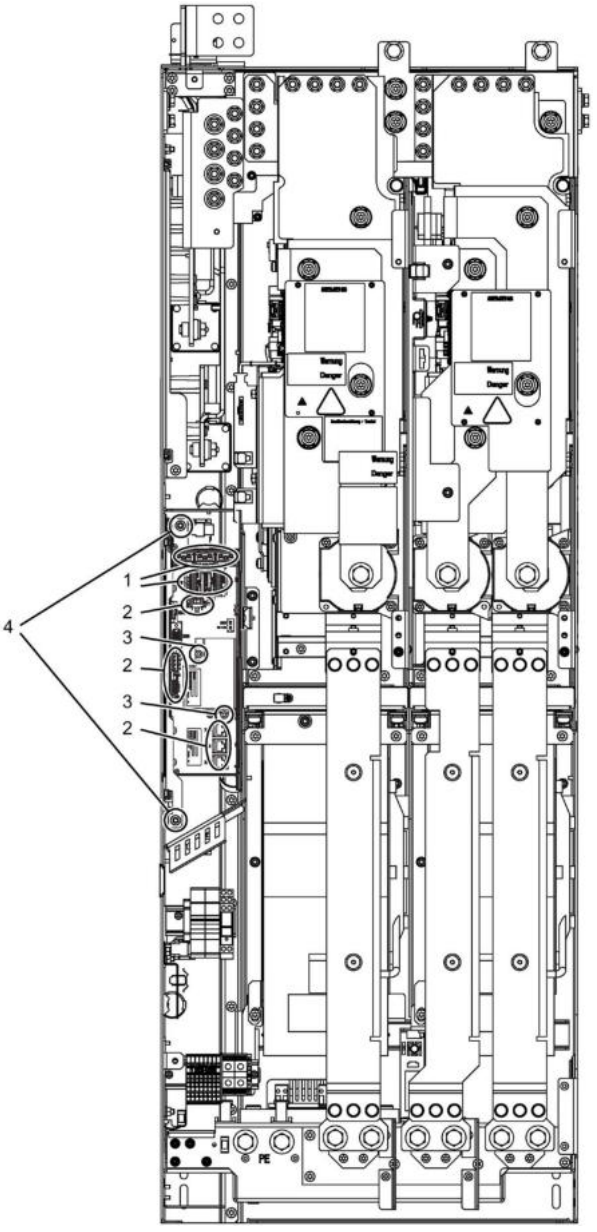


Figure 6-26 Replacing the Control Interface Module, frame size HX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the protective cover.

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the Control Interface Module is removed. This can cause the device to fail.

- When removing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fixing screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.12.6 Replacing the Control Interface Module, frame size JX

Replacing the Control Interface Module

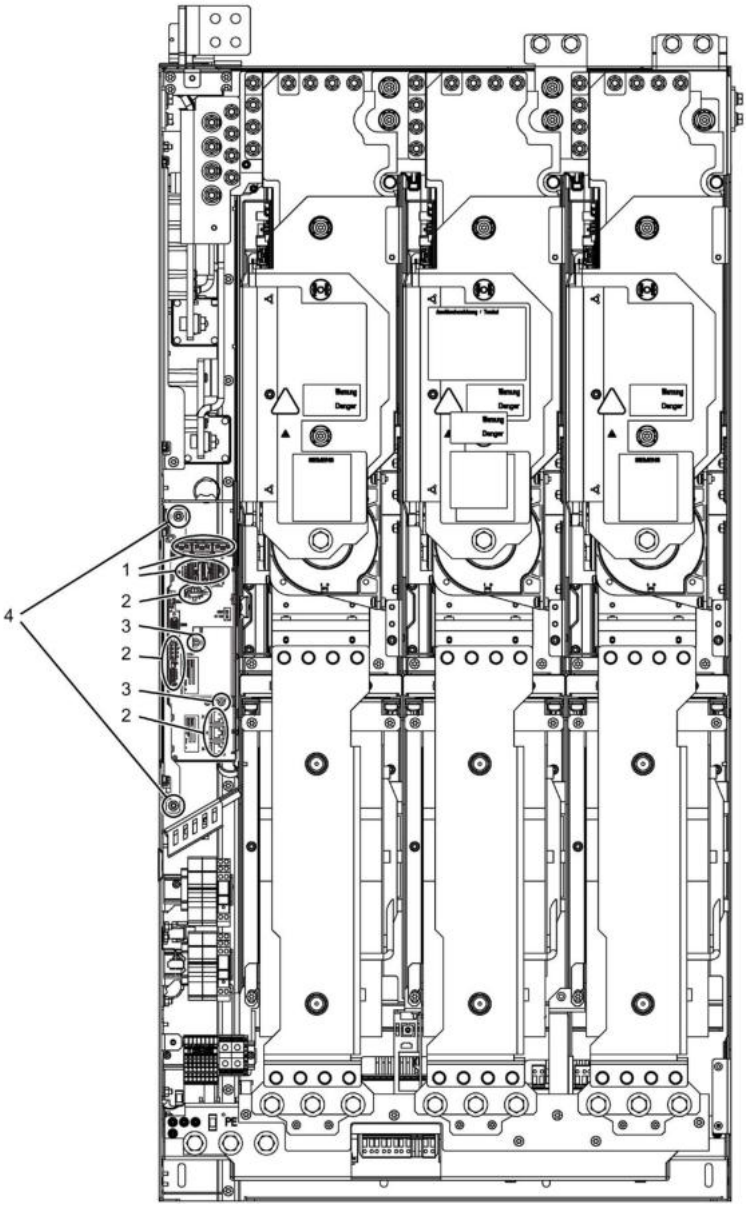


Figure 6-27 Replacing the Control Interface Module, frame size JX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the protective cover.

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can be damaged when the Control Interface Module is removed. This can cause the device to fail.

- When removing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fixing screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.12.7 Replacing the Control Interface Module, frame sizes FS2 and FS4

Replacing the Control Interface Module

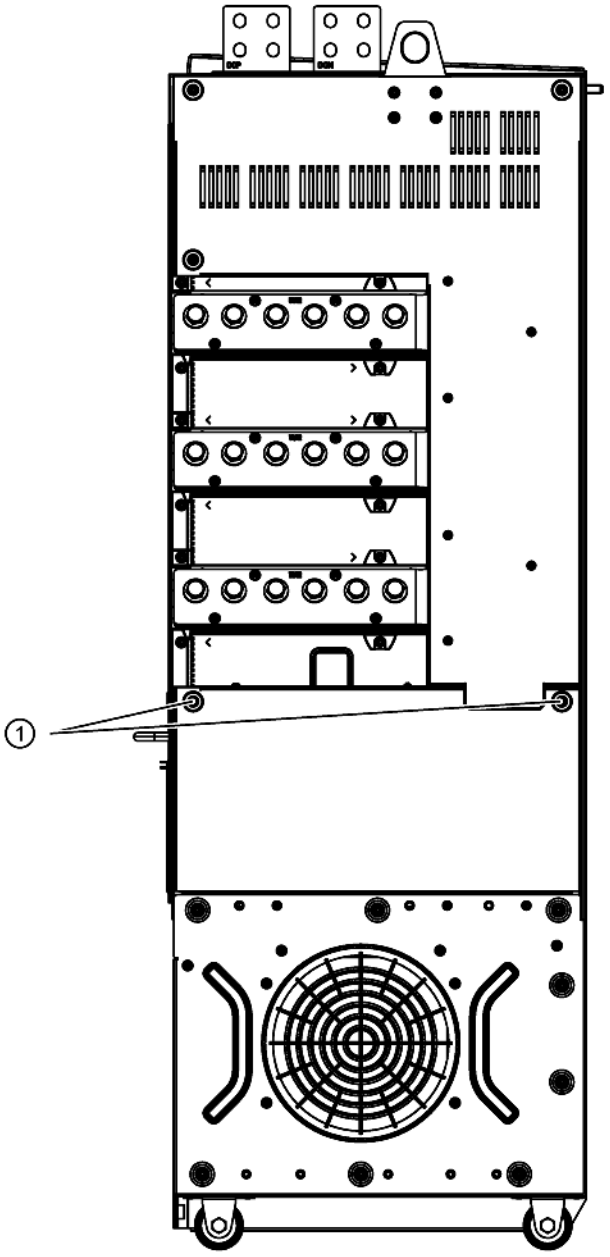


Figure 6-28 Replacing the Control Interface Module, frame sizes FS2 and FS4, Part 1

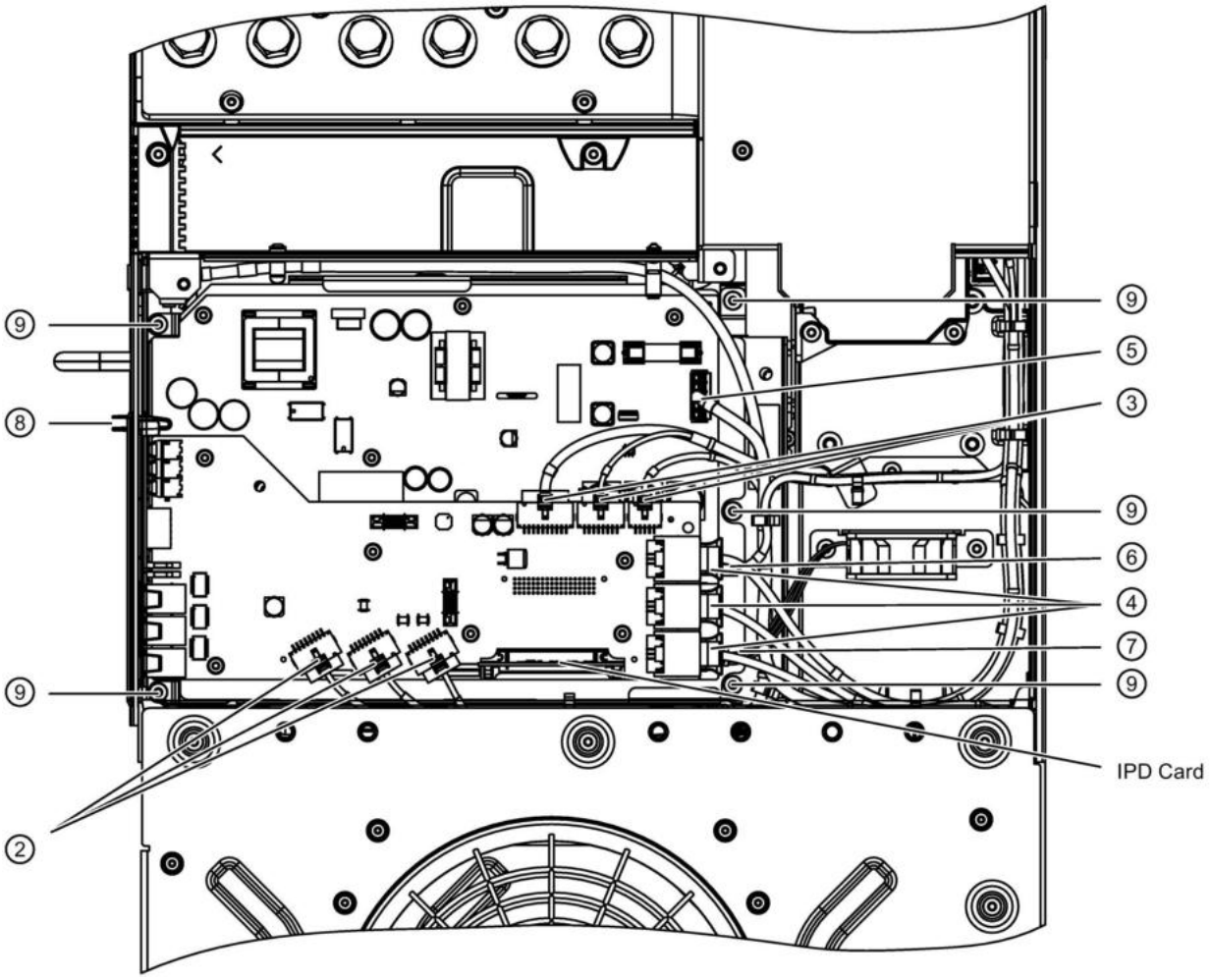


Figure 6-29 Replacing the Control Interface Module, frame sizes FS2 and FS4, Part 2

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the protective cover.
- Withdraw all plug connectors to the signal connections (–X9, –X41 ... –X49, –X400 ... –X402).
- Removing the device from the control cabinet is described in Chapter "Replacing Chassis-2 format devices (Page 387)".
- While removing the device from the control cabinet, it must be secured so that it can neither topple over nor roll away.

Removal steps

The removal step numbering corresponds to the numbers in the diagrams.

1. Open the service flap for the Control Interface Module (2 screws).
2. Withdraw the plug connectors of the current transformers X431 - X433 (3 plug connectors).
3. Withdraw the plug connectors for the temperature sensors X31, X32 (·2 plug connectors) and the fan control X50 (1 plug connector).
4. Withdraw the plug connectors of the fiber-optic cables U11, U21, U31 (3 plug connectors).
5. Withdraw the plug connector for the DC link voltage sensing X60 (1 connector).
6. Withdraw the plug connector of the 24 V DC control X271 (1 connector at the lower module).
7. Withdraw the plug connector of the internal fan X272 (1 connector at the lower module).
8. Press the latch of the cover for the signal connections and remove the cover.
9. Remove the fastening screws for the Control Interface Module (5 screws).

You can now remove the Control Interface Module.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Transferring the IPD card

When replacing the Control Interface Module with a replacement part, after removing the defective module, the IPD card must be transferred into the replacement part.

The IPD card contains the internal device data; it is not included with a replacement Control Interface Module.

Remove the IPD Card:
Open the locking mechanism and withdraw the IPD card from the Control Interface Module.

Insert the IPD card:
Insert the IPD card into the slot until the locking mechanism engages.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ⑨): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. To ensure correct assignment, the fiber-optic cables and the slots on the module are appropriately labeled (U11, U21, U31); the same is true for the plug connections for the current transformers (X431, X432, X433).

6.4.13 Replacing the Control Unit

Replacing the Control Unit in the Chassis format

The Control Unit is mounted on a slide-in unit that can be pulled out by removing a screw on the top left ① if the Control Unit needs to be replaced.

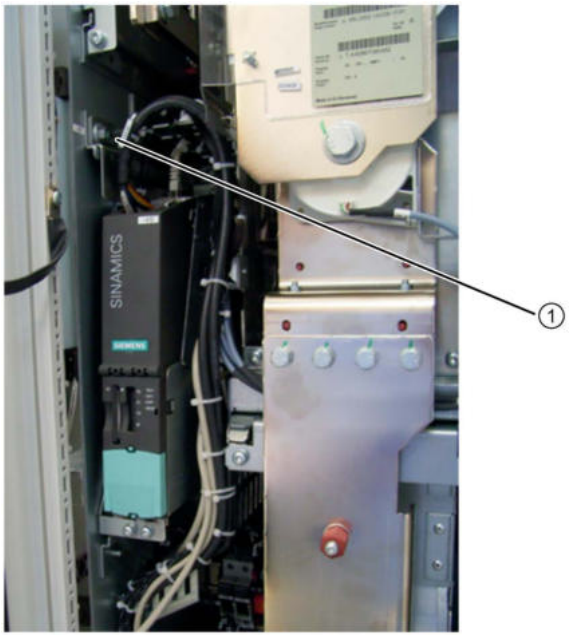


Figure 6-30 Replacing the Control Unit in the Chassis format

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

1. Release nut ①
2. Before pulling out the Control Unit on the slide-in unit completely, remove all cables connected to the Control Unit.
3. Pull out the Control Unit on the slide-in unit and install the new one.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the Control Unit is removed. This can cause the device to fail. • When removing the Control Unit, ensure that you do not damage any signal cables.

Note

When installing the new Control Unit, you must reconnect the cables to exactly the same positions.

Replacing the Control Unit for Active Line Connection Modules-2

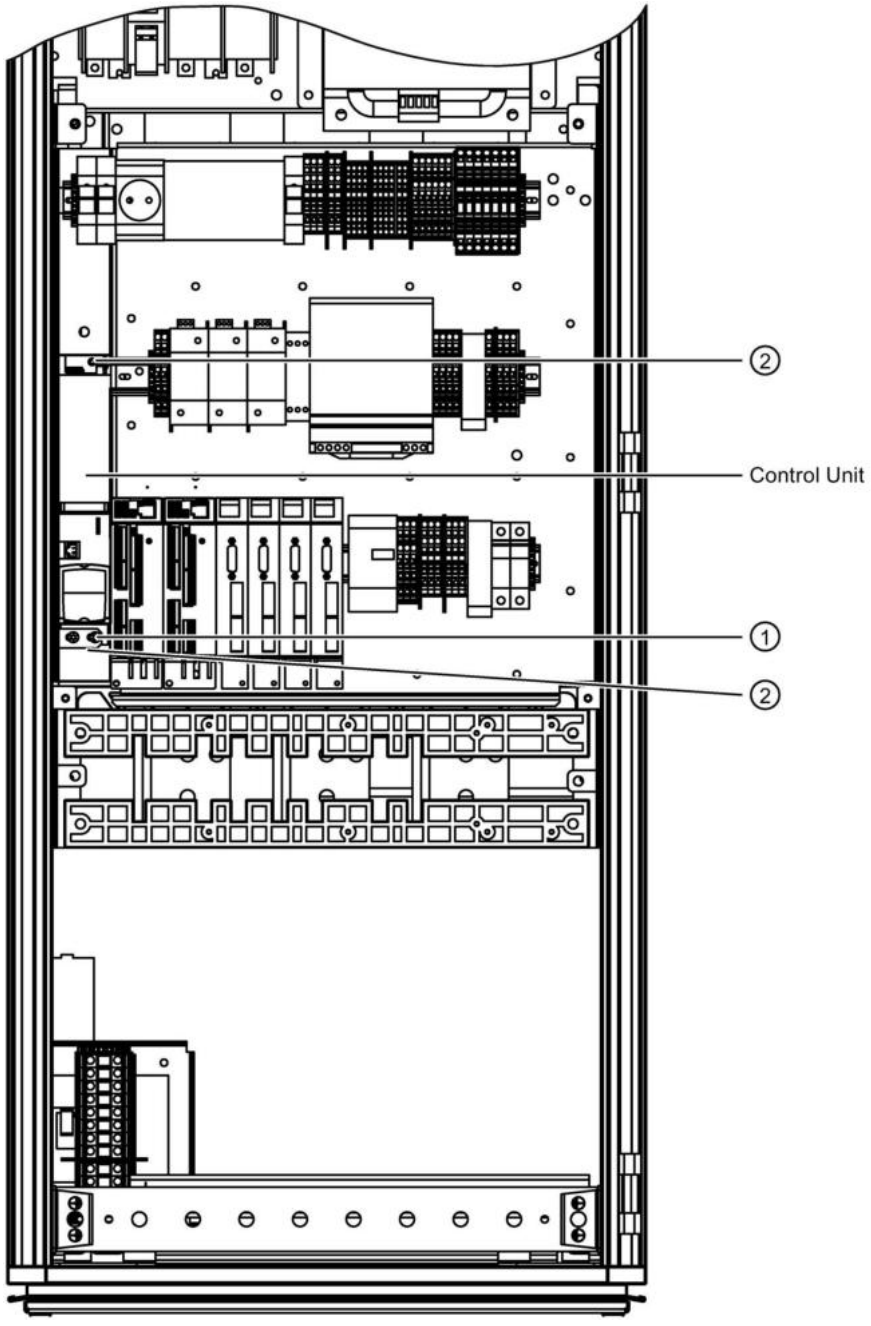


Figure 6-31 Replacing the Control Unit for Active Line Connection Modules-2

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

1. Release nut ①
2. Remove fastening screws ②.
3. Before withdrawing the Control Unit, remove all cables connected to the Control Unit
4. Remove and replace the Control Unit

NOTICE
Device damage as a result of damaged signal cables when removing Signal cables can be damaged when the Control Unit is removed. This can cause the device to fail. • When removing the Control Unit, ensure that you do not damage any signal cables.

Note

When installing the new Control Unit, you must reconnect the cables at precisely the same positions.

Replacing the Control Unit for Motor Modules in the Chassis-2 format

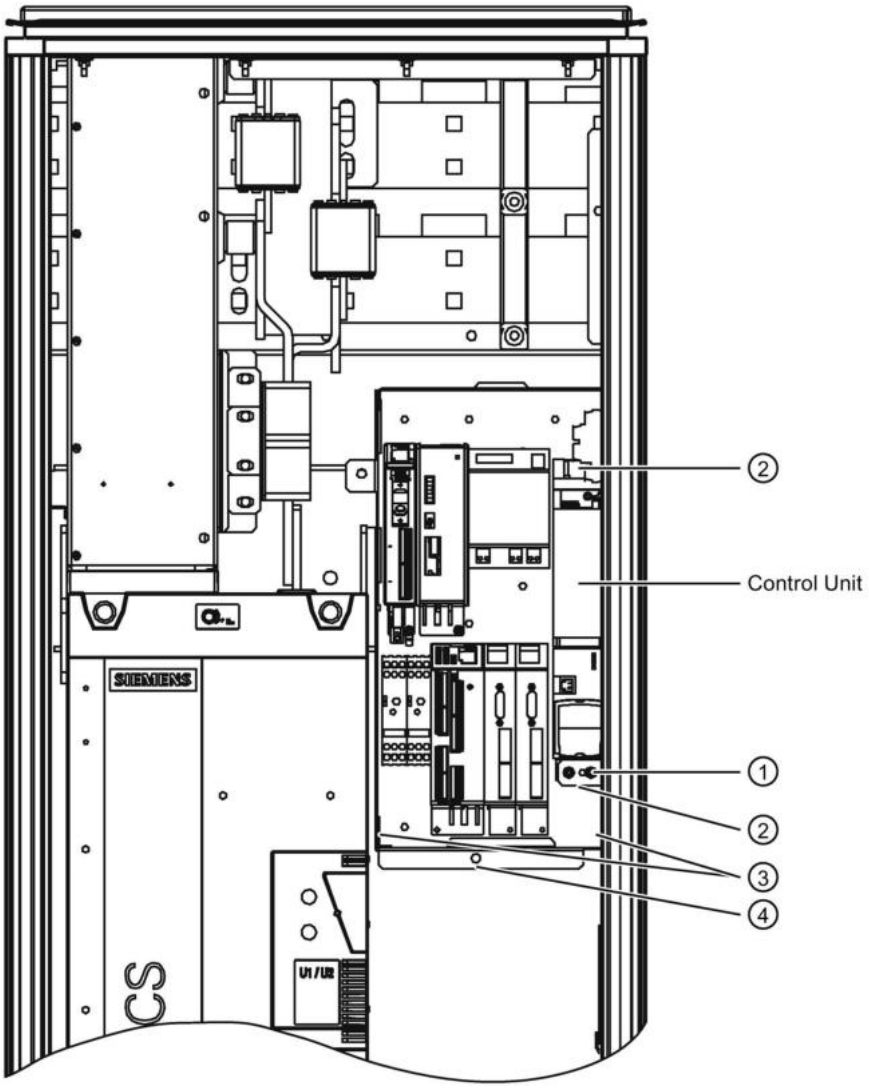


Figure 6-32 Replacing the Control Unit for Motor Modules in the Chassis-2 format

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover
- Allow unimpeded access

Removal steps

1. Release nut ①
2. Remove fastening screws ②.
3. Access to the lower fastening screw of the Control Unit can be simplified by releasing the two screws ③ and removing the sheet steel plate ④.
4. Before pulling out the Control Unit, remove all cables connected to the Control Unit
5. Remove and replace the Control Unit

NOTICE
Device damage as a result of damaged signal cables when removing Signal cables can be damaged when the Control Unit is removed. This can cause the device to fail. • When removing the Control Unit, ensure that you do not damage any signal cables.

Note

When installing the new Control Unit, you must reconnect the cables at exactly the same positions.

6.4.14 Replacing the fans

6.4.14.1 Replacing the fan, Booksize Cabinet Kit

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Fan replacement for Motor Modules with a width of 50 mm (9 A, 18 A)

Removing the existing fan module

		
Remove the shield connection clamp. Screwdriver: slotted, 0.8 x 5.5 mm	Release the catch of the motor connection plug and pull the plug out of the Motor Module.	Remove the shield connection plate from the Motor Module. Screwdriver: Torx 20
		
Detach the protective conductor from the Motor Module. Screwdriver: Torx 20	Pull the fan module forwards out of the Motor Module.	Motor Module with removed fan module

Installing a new fan module

1. Insert a new fan module into the Motor Module. The power supply for the fan is automatically established.
2. Connect the protective conductor to the Motor Module, tightening torque: 3 Nm.
3. Reattach the shield connection plate and tighten the fastening screws, tightening torque: 3 Nm.
4. Reinsert the motor connection plug.
5. Reattach the shield connection clamp and tighten the fastening screws, tightening torque: 0.8 Nm.

Fan replacement for Motor Modules with a width of 100 mm (30 A)

Fan replacement for Motor Modules with a width of 100 mm is the same as for Motor Modules with a width of 50 mm. Since the protective conductor is located not behind the connection plate but next to it, you can loosen it first and, after installation of the new fan module, screw it down as the last step.

Fan replacement for Motor Modules with a width of 150 ... 200 mm (45 ... 85 A)

Removing the fan

1. Disconnect the power supplies (24 V DC and 400 V AC)
   Wait 5 minutes while the DC link capacitors discharge.
2. Remove the Motor Module from the drive line-up.
3. Release the catches to open the fan cover.

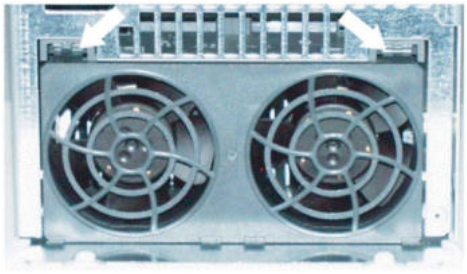


Figure 6-33 Position of the catches

4. Release and withdraw the connection plugs (1).
5. Release the catches (2) and remove the fan.

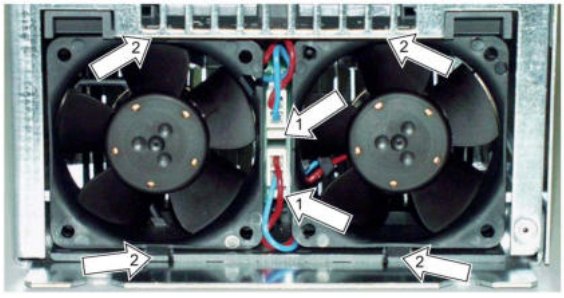


Figure 6-34 Position of the connection plugs (1) and catches (2)

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installing the fan

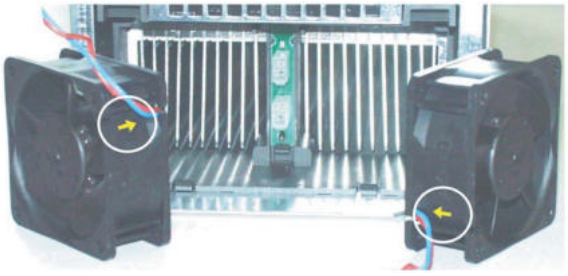


Figure 6-35 Fan installation, 150 ... 200 mm

1. Before installing the fan, note the direction of the airflow. The arrow on the fan must point toward the cooling ribs.
2. Push the fan into position until it is fully engaged. Take care not to crush the connecting cables.
3. Insert the connection plugs until they engage.
4. Attach the fan cover.

Fan replacement for Motor Modules with a width of 300 mm (132 A)

Removing the fan

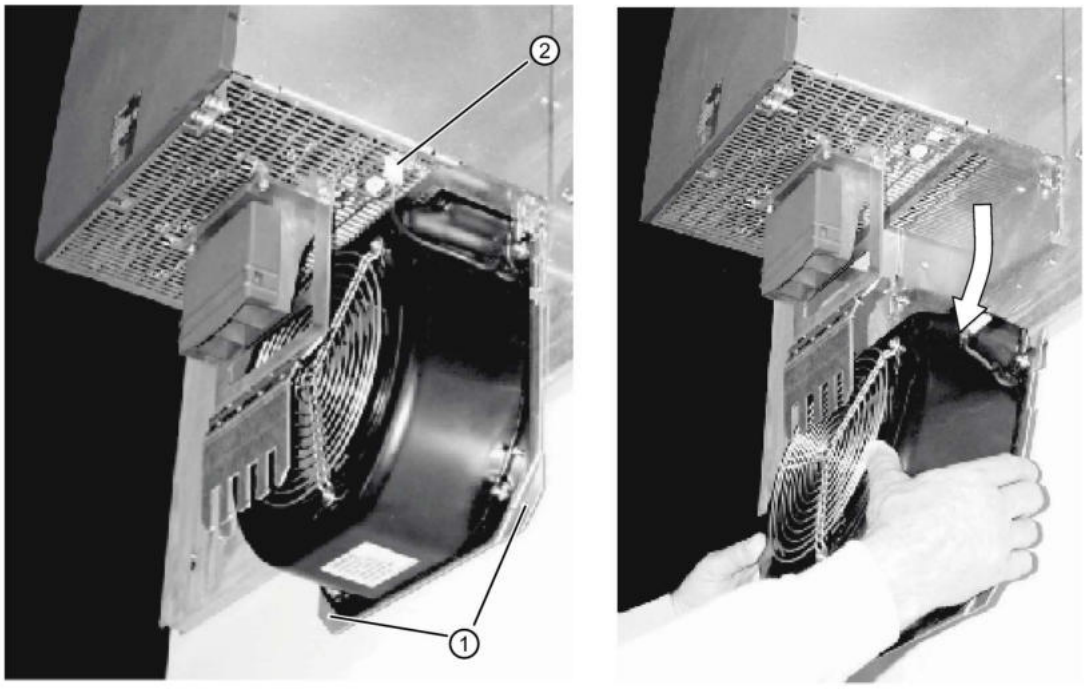


Figure 6-36 Fan removal, 300 mm

1. Loosen the M6 screws (1).
2. Disconnect the fan power supply (2).
3. You can now remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installing the fan

1. Insert the fan.
2. Secure the fan with the M6 screws, tightening torque: 6 Nm.
3. Connect the fan power supply (2).

6.4.14.2 Replacing the fan, frame sizes FB, GB and GD

Replacing the fan

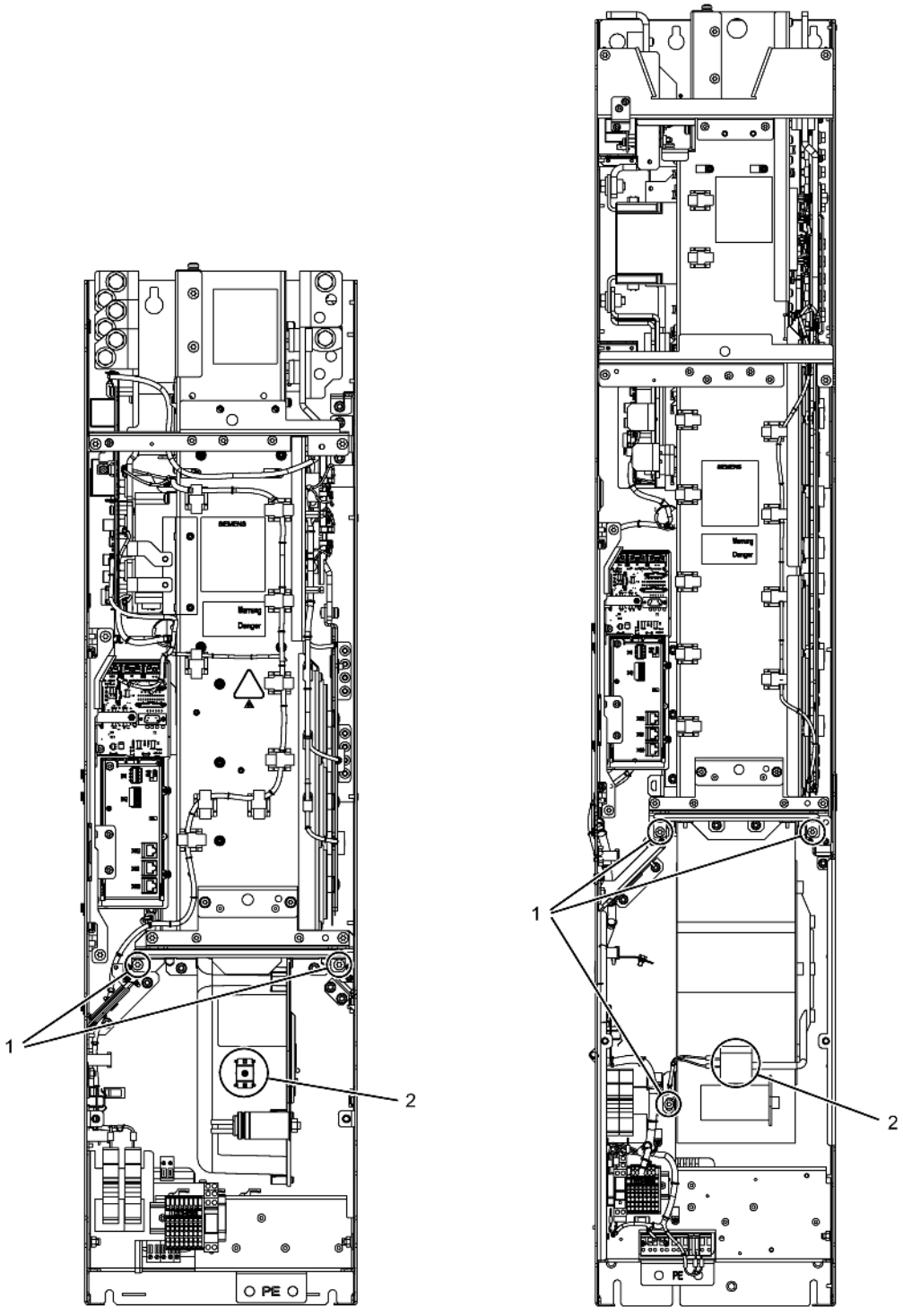


Figure 6-37 Replacing the fan, Basic Line Module, frame sizes FB, GB, and GD

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan
   (2 screws for frame size FB; 3 screws for frame sizes GB and GD).
2. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.3 Replacing the fan, sizes FX and GX

Replacing the fan

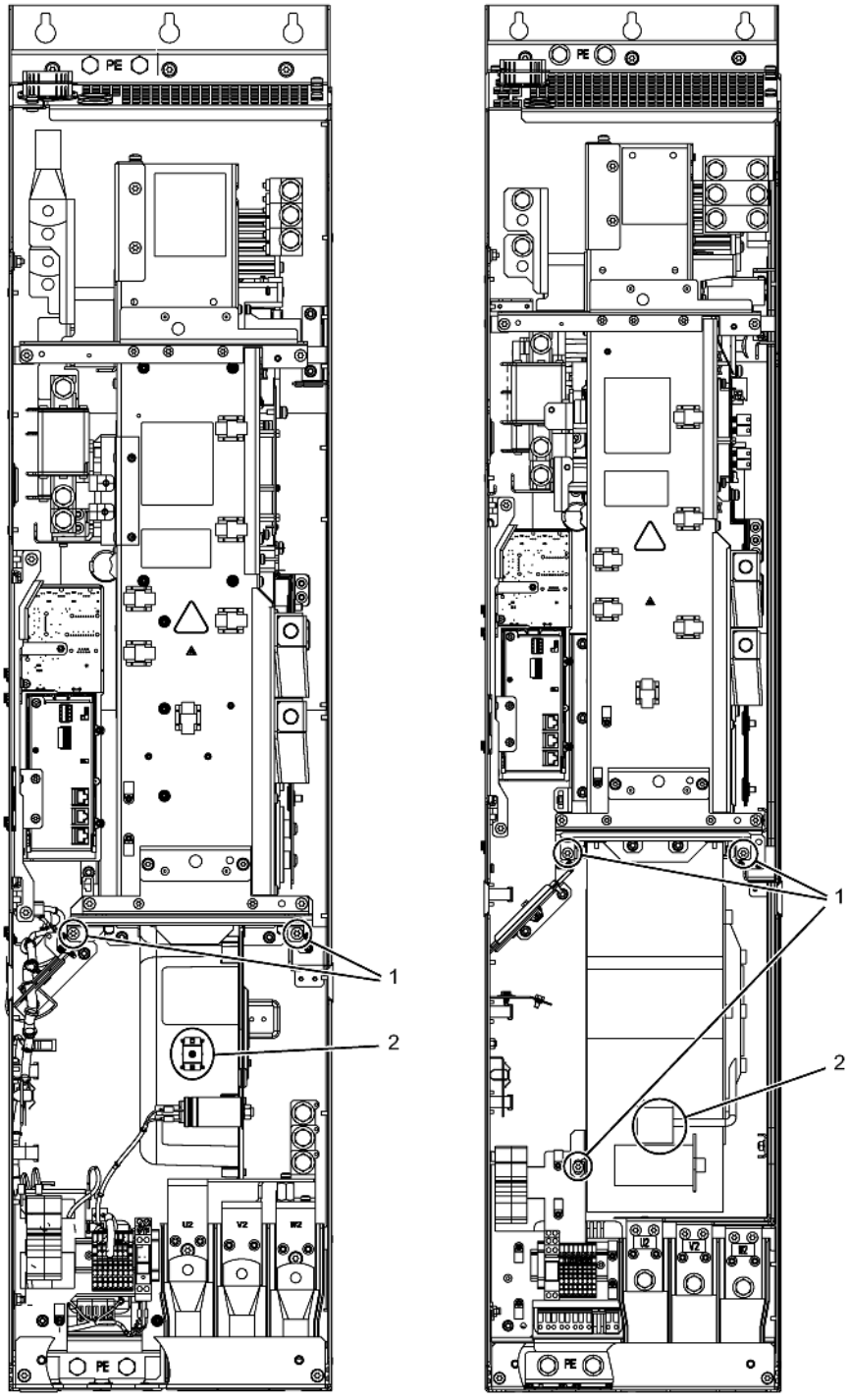


Figure 6-38 Replacing the fan, Smart Line Module, Active Line Module, and Motor Module, frame sizes FX and GX

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan
   (2 screws for frame size FX; 3 screws for frame size GX)
2. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.4 Replacing the fan, size HX

Replacing the fan, left power block

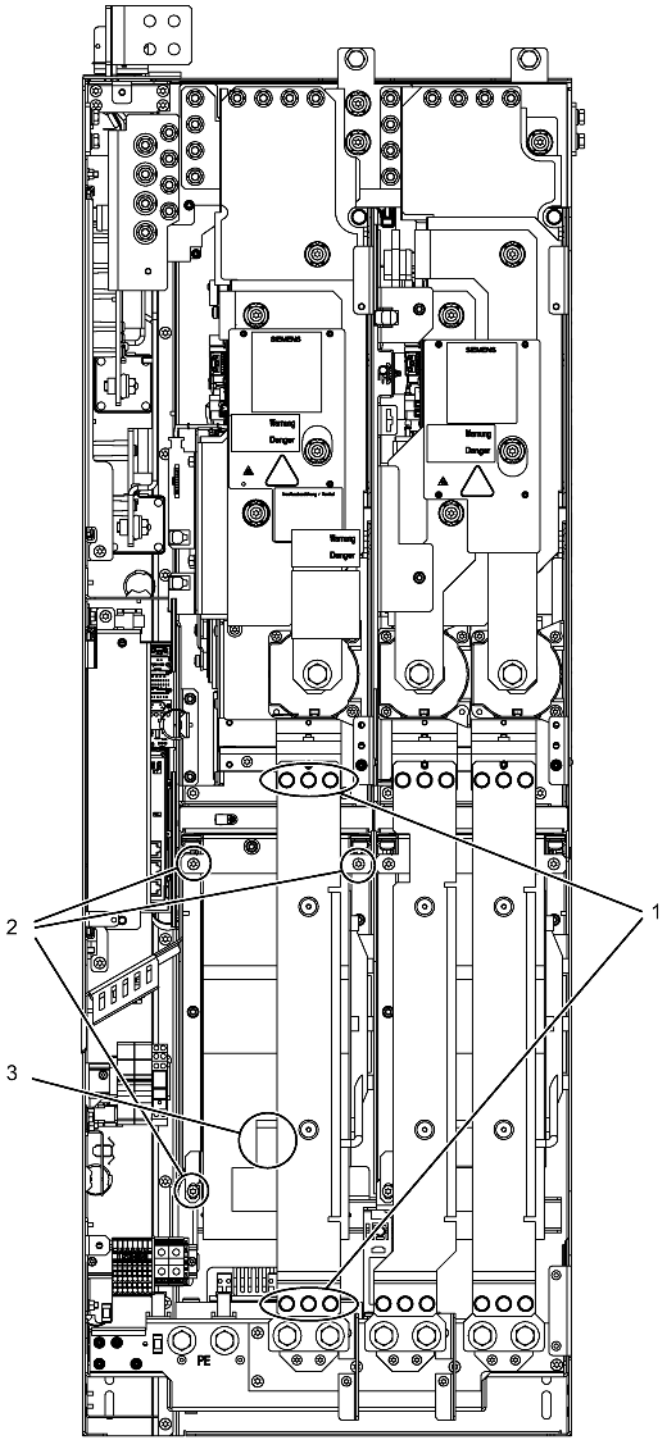


Figure 6-39 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - left power block

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (6 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Replacing the fan, right power block

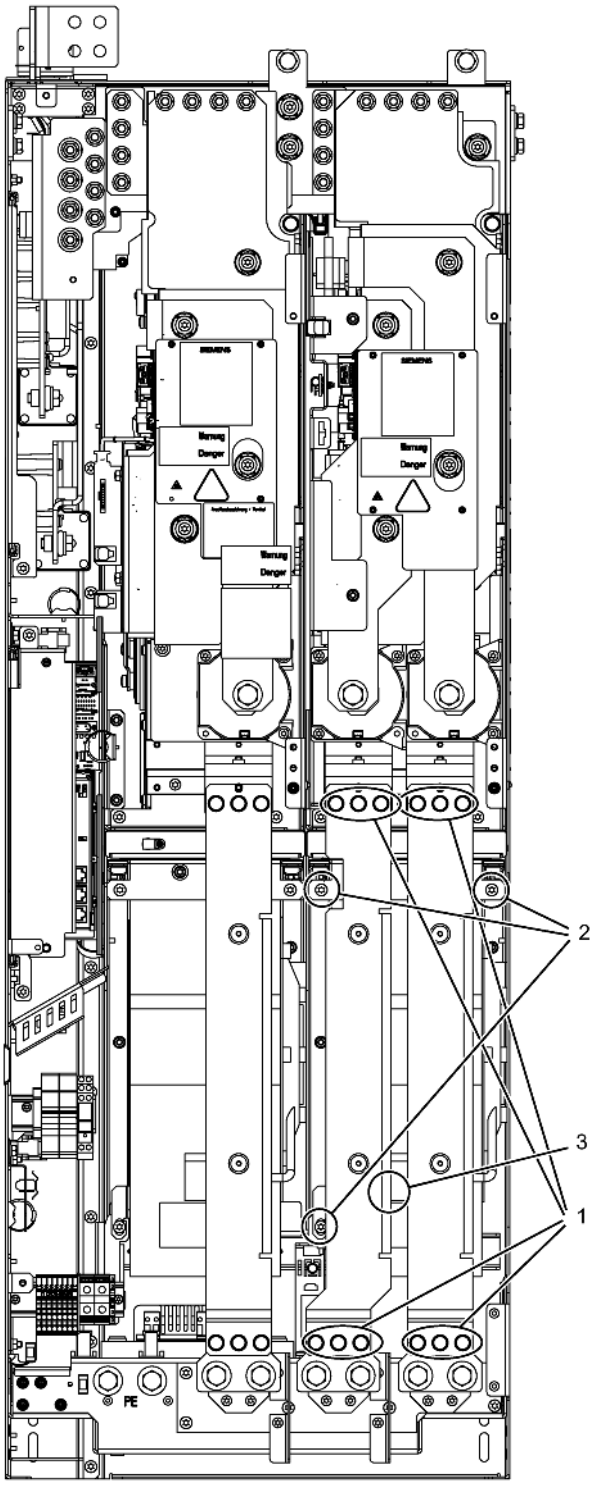


Figure 6-40 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - right power block

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbars (12 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.5 Replacing the fan, frame size JX

Replacing the fan

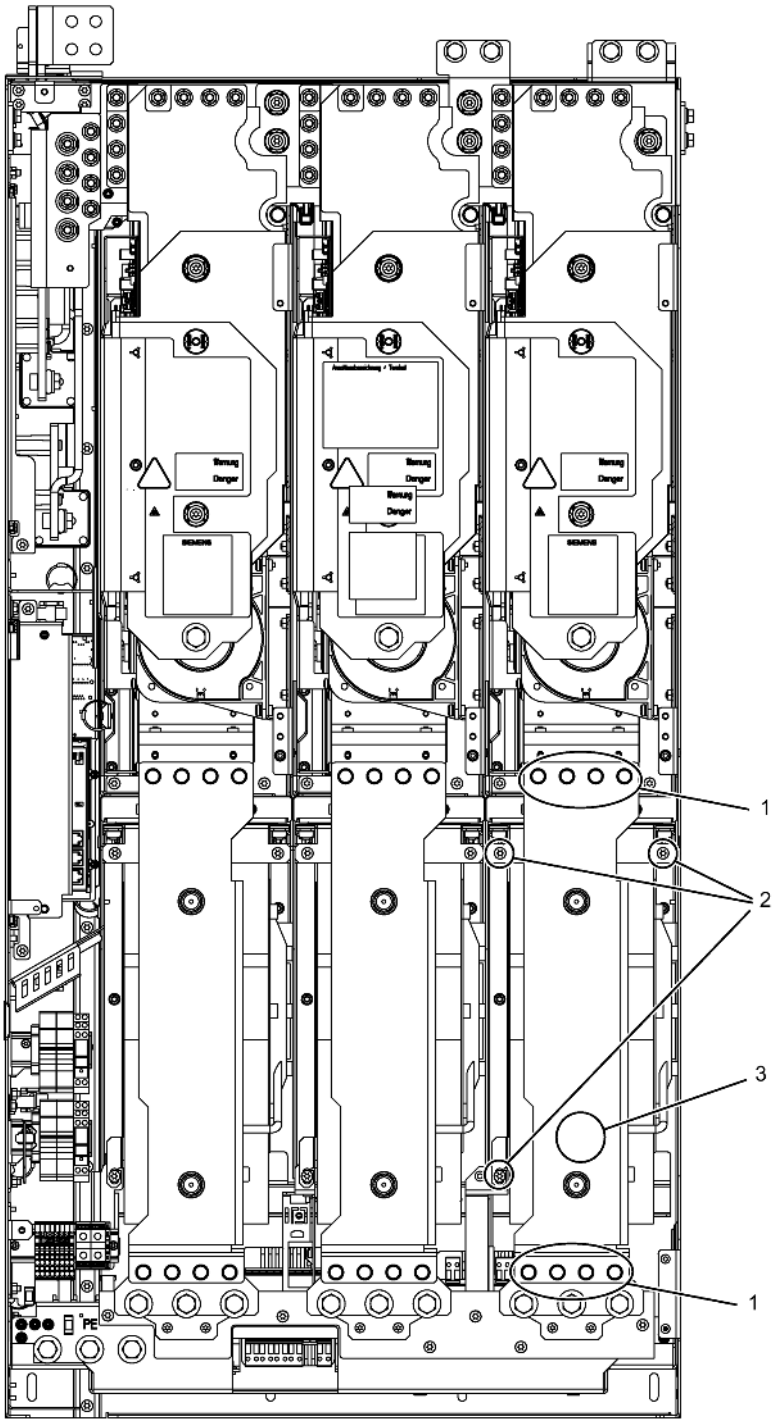


Figure 6-41 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size JX

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (8 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.6 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4

Replacing the fan

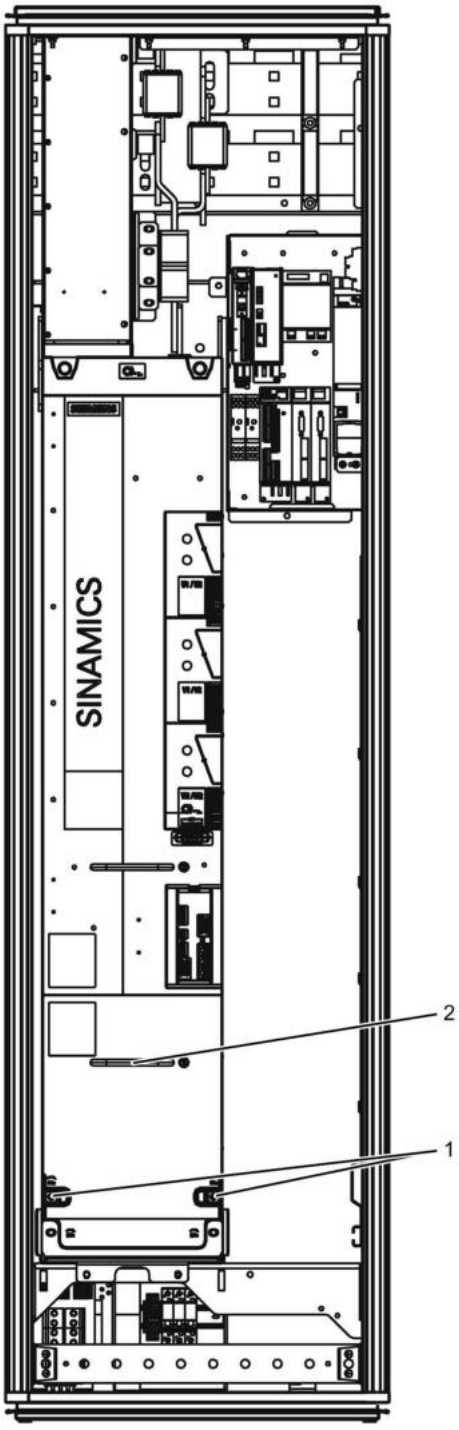


Figure 6-42 Replacing the fan, Active Line Modules and Motor Modules Chassis-2, frame sizes FS2, FS2+ and FS4

Description

The fan does not operate continuously, but only when required; it is monitored in operation.

The expected remaining operating time of the fan can be read-out from parameter p0277 "Heat sink fan wear counter" as a percentage of the service life.

500 hours before reaching the maximum operating duration, Alarm A30042 "Power unit: Fan has reached the maximum operating hours" indicated with alarm value "0" in r2124.

When reaching 99 % of the maximum operating duration, Alarm A30042 is output with alarm value "1" in r2124.

When reaching the maximum operating duration, Alarm A30042 is output with alarm value "2" in r2124.

If the fan no longer operates correctly, then this is signaled using Alarm A30048 "Power unit: Fan defective" with alarm value "0" is indicated in r2124.
If the fan does not correctly operate within 10 seconds after powering up after the pulses have been enabled, then fault F30058 "Power Unit: Heat sink fan defective" is displayed and shut down with OFF2.

The fan must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the numbers in the diagram.

1. Remove the fastening screws for the fan assembly (2 screws)
2. Completely remove the fan assembly from the device. The power supply automatically disengages when withdrawing.

NOTICE
Secure the fan assembly so that cannot topple over When withdrawing the fan assembly, the module housing or the plug connector can be damaged if the module is not secured to prevent it toppling over. • Carefully withdraw the fan assembly and secure it so that it cannot topple over.

Installation steps

NOTICE
Checking the new fan assembly contacts for any damage A damaged plug connection at the new fan assembly can damage the mating contacts when the module is inserted into the housing. • Before inserting it, check the plug connection at the new fan assembly for any damage.

Note

Sealing surface at the upper side of the new fan assembly

When mounting, ensure that the seal on the upper side of the new fan assembly is in a good condition.

Installing is the same as removing, however in the reverse order. The power supply automatically engages when inserting.

The tightening torque of the fixing screws for the fan assembly is 10 Nm.

6.4.14.7 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4

Replacing the electronic fan

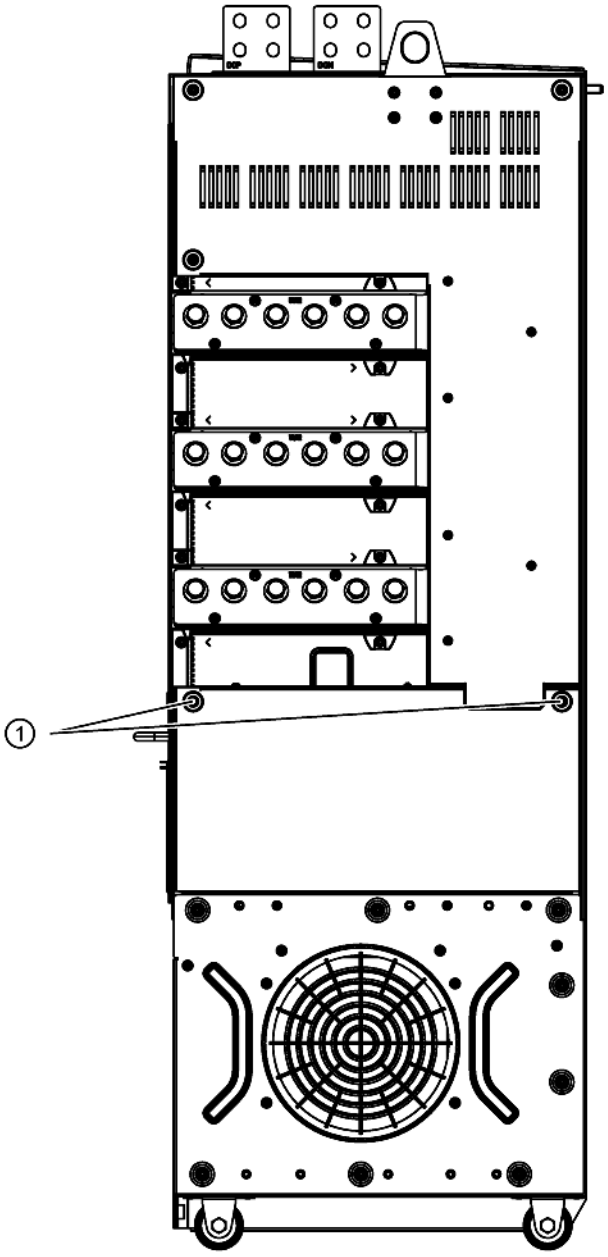


Figure 6-43 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4, Part 1

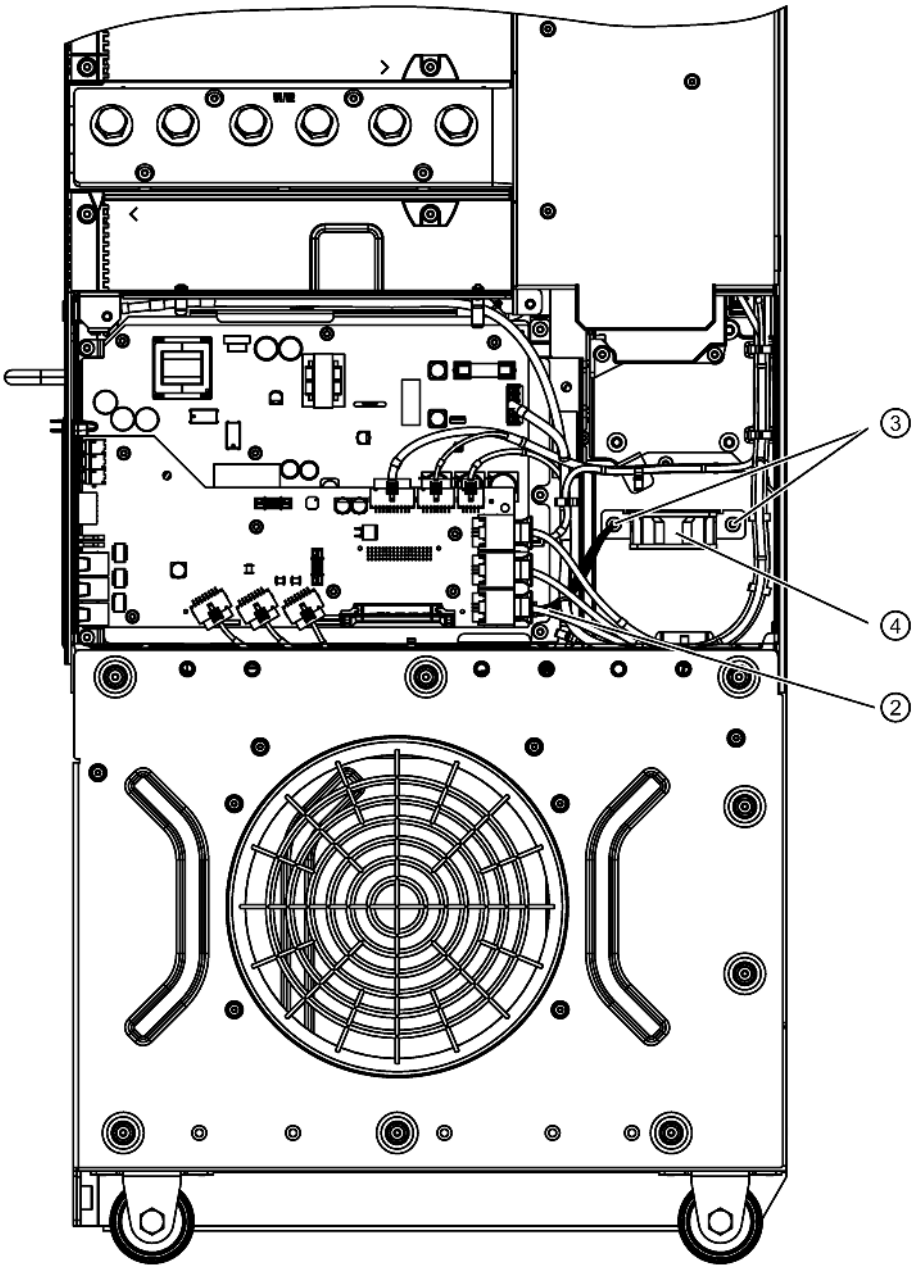


Figure 6-44 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4, Part 2

Description

The service life of the electronic fan is designed for the typical service life of the device itself - it doesn't operate continuously, but only when required. The electronic fan is monitored in operation.

If the fan no longer operates correctly, then this is signaled using Alarm A30048 "Power unit: Fan defective" with alarm value "1" in r2124.
If, with Alarm A30048 active, the measured air intake temperature indicated in r0037[3] violates an appropriate threshold, then fault F30059 "Power unit: Interior fan defective" is displayed, and the system is shut down with OFF2.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.
- Removing the device from the control cabinet is described in Chapter "Replacing Chassis-2 format devices (Page 387)".
- While removing the device from the control cabinet, it must be secured so that it can neither topple over nor roll away.

Removal steps

The removal step numbering corresponds to the numbers in the diagrams.

1. Open the service flap for the Control Interface Module (2 screws).
2. Withdraw the plug connector for the electronic fan the power supply.
3. Release the fastening screws for the electronic fan (2 screws).
4. Remove the electronic fan.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the electronic fan (M6 x 16, item ③): 6 Nm.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.8 Replacing the fan, frame size FI

Replacing the fan

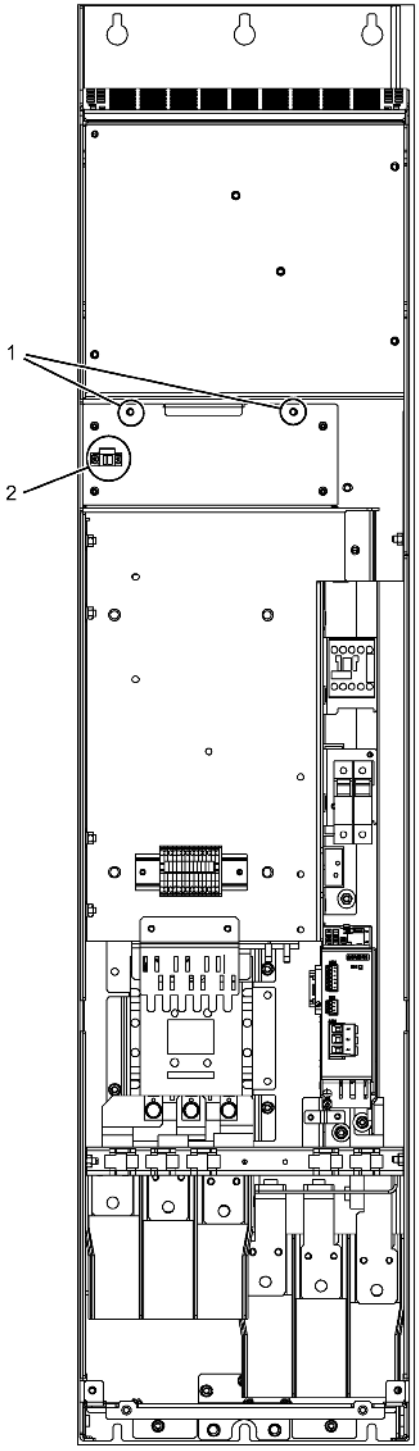


Figure 6-45 Replacing the fan, Active Interface Module, frame size FI

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (2 screws).
2. Unplug connector -X630.

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.9 Replacing the fan, frame size GI

Replacing the fan

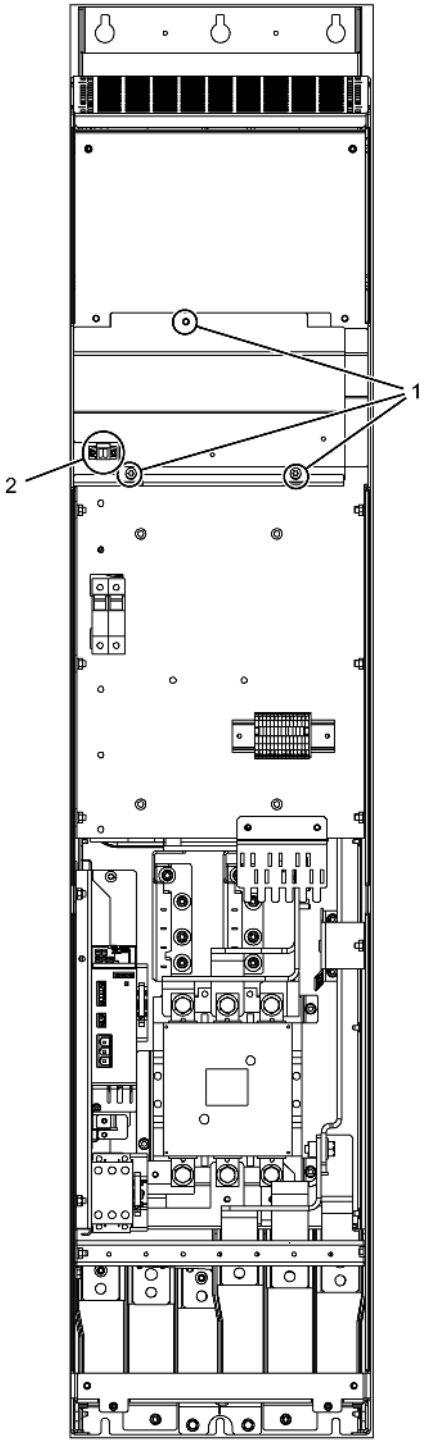


Figure 6-46 Replacing the fan, Active Interface Module, frame size GI

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (3 screws).
2. Unplug connector -X630.

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.10 Replacing the fan, frame size HI

Replacing the fan

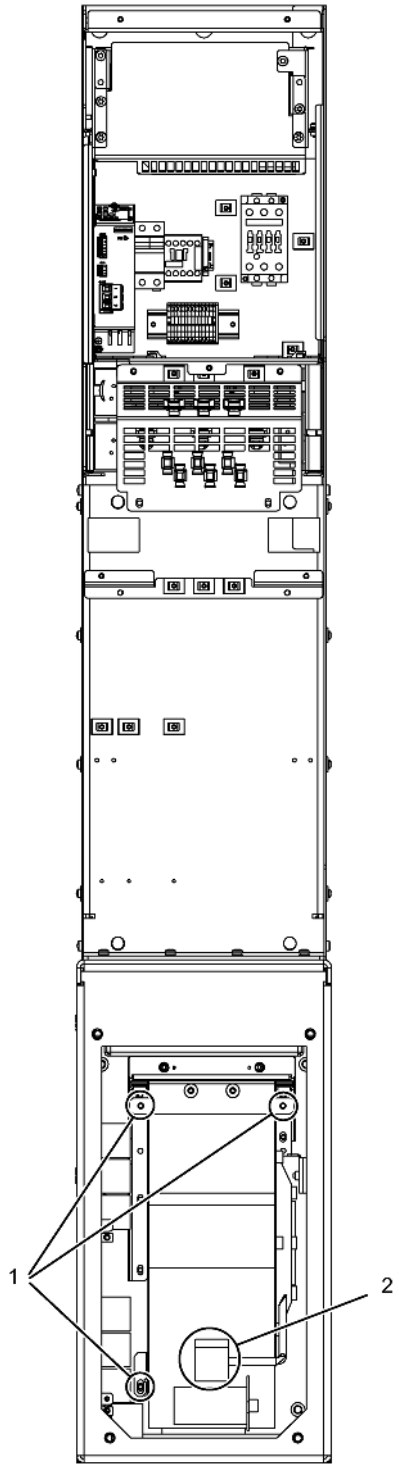


Figure 6-47 Replacing the fan, Active Interface Module, frame size HI

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cable (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.11 Replacing the fan, frame size JI

Replacing the fan

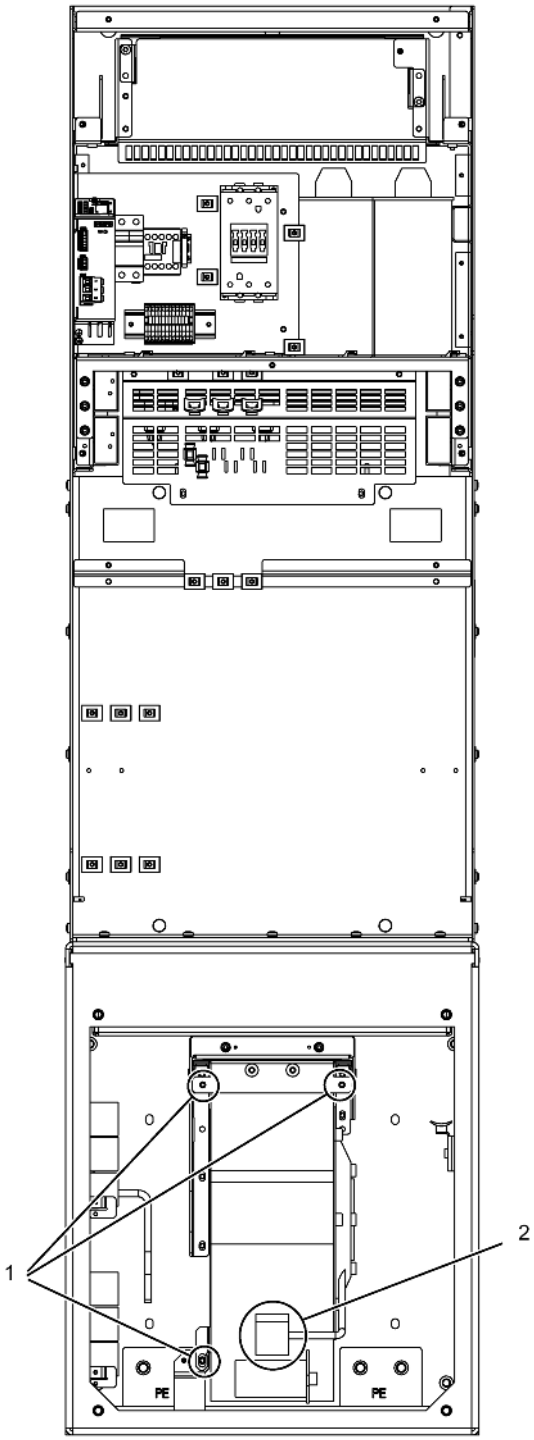


Figure 6-48 Replacing the fan, Active Interface Module, frame size JI

Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cable (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.14.12 Replacing the fan in the Active Interface Module Chassis-2

Replacing the fan

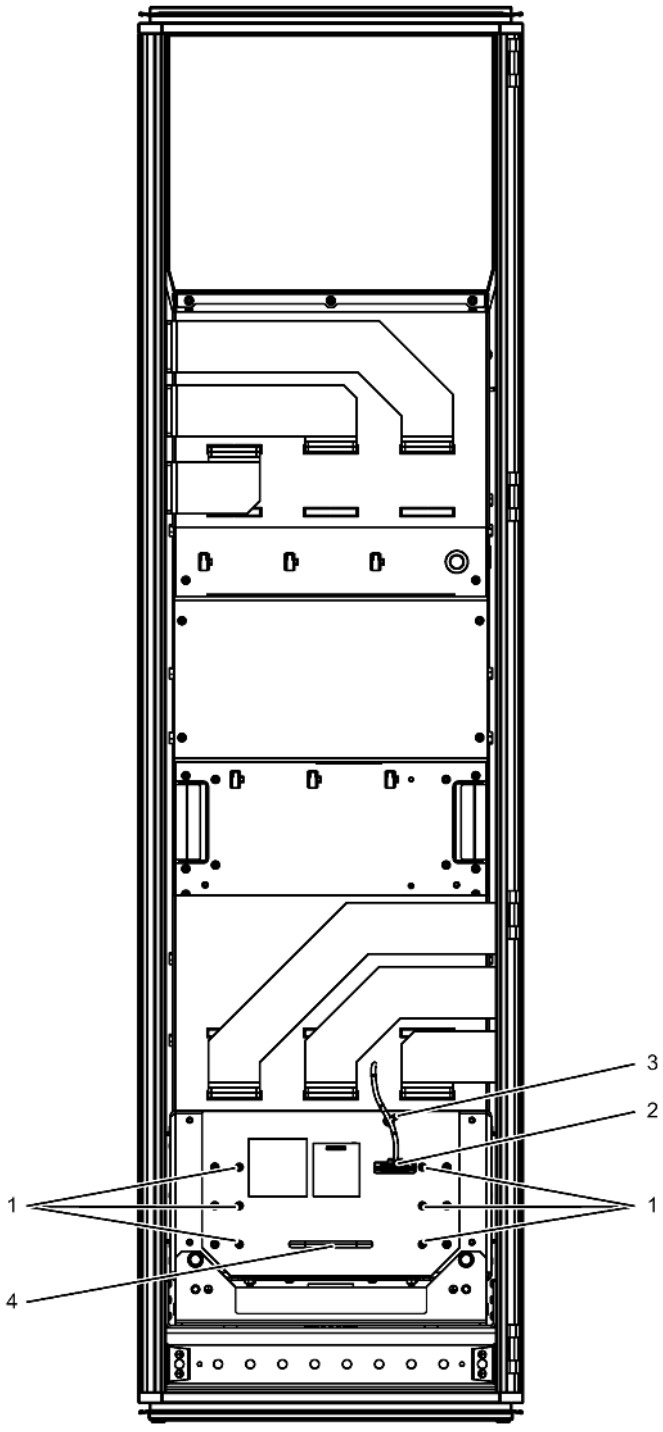


Figure 6-49 Replacing the fan, Active Interface Module Chassis-2

Description

The typical service life of the device fan is 40,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and may therefore deviate from this value.

The fan must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

The removal steps are numbered in accordance with the numbers in the diagram.

1. Remove the fastening screws for the fan assembly (6 screws).
2. Release the connector for the fan supply and remove it.
3. Release the cable from the cable holder.
4. Completely remove the fan assembly from the device.

Installation steps

Installing is the same as removing, however in the reverse order.

The tightening torque of the fixing screws for the fan assembly is 10 Nm.

The tightening torque for the holding screws of the fan power supply connector is 0.5 ... 0.6 Nm.

6.4.15 Replacing the fuses

Replacement fuses

Article numbers for replacing fuses that have blown are contained in the spare parts list.

6.4.15.1 Replacing the fuses for the auxiliary power supply

Replacement fuses

You can find the article numbers in the spare parts list for replacing auxiliary power supply fuses that have blown.

Note

The fuses for the auxiliary power supply are freely accessible and can be replaced once the fault cause has been eliminated.

6.4.15.2 Replacing the fuses in the auxiliary power supply module

Fuse in the auxiliary power supply module

A 10 A-fuse is incorporated in the auxiliary power supply modules to protect the 24 V DC auxiliary voltage. If a replacement part is required, this can be ordered, specifying Article number 6SL3760-0BG00-0AA0.

Fuse type: TAC ATO flat plug-in fuse according to DIN 72581-3, UL 248 Special Purpose Fuses, 10 A, 58 V, manufacturer: Littlefuse

Note

The fuses for the auxiliary power supply are freely accessible and can be replaced once the fault cause has been eliminated.

6.4.15.3 Replacing fuses (F71 to F73)

Fuses F71 to F73 are included in the Line Connection Modules and Active Line Connection Modules-2.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Have the fuse grip ready.

Removal and installation procedures

Note

For Line Connection Modules and Active Line Connection Modules-2 with a rated current of < 800 A, the fuses are freely accessible and can be replaced once the fault cause has been eliminated.

Note

For Line Connection Modules and Active Line Connection Modules-2 with a rated current of between 800 A to 1600 A, the removal procedures described below must be very carefully followed to replace the fuses.

1. Open the cabinet.
2. Take the top screws out of the support plate underneath the fuses. Loosen the bottom screws slightly. The support plate can then be pushed downwards.
3. Attach the fuse grip to the fuse.
4. Remove the defective fuse.
5. Press the yellow button on the fuse grip to release the defective fuse from it.
6. Attach the new fuse onto the grip.
7. Place the new fuse in the fuse holder in the cabinet.
8. Press the yellow button on the fuse grip to release the new fuse from it.
9. Attach the support plates underneath the fuses again.
10. Close the cabinet.

Note

If necessary, the fuse grip can be ordered from Siemens.

6.4.15.4 Replacing fuses in the fuse switch disconnector for Booksize Cabinet Kit

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Replacing

1. If option L37 is present, switch off the relevant DC interface in the door.
2. Open the door.
3. Open the fuse switch disconnector.
4. Remove the fuse link.
5. Replace the defective fuses.
6. Complete the procedure by carrying out the above actions in reverse order.

6.4.15.5 Replacing the DC fuses for chassis format

Replacing the DC fuses for Smart Line Module, Active Line Module, and Motor Module, frame sizes FX and GX

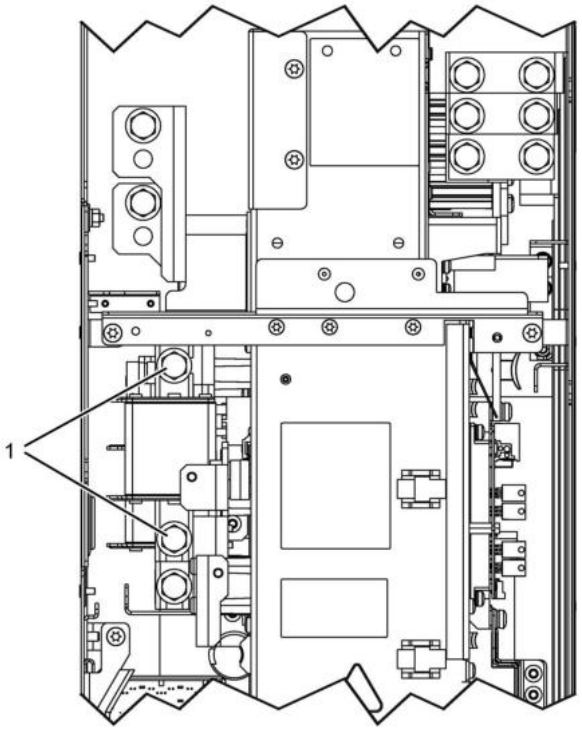


Figure 6-50 Replacing the DC fuses, frame sizes FX and GX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Replacing the front fuse

1. Unscrew and remove the screws and nuts (1) from the front DC fuse.
2. Remove the DC fuse.

Replacing the back fuse

1. Unscrew and remove the screws and nuts from the front DC fuse (1).
2. Remove the front DC fuse.
3. Unscrew and remove the screws and nuts from the rear DC fuse, which can now be accessed.
4. Remove the rear DC fuse.

NOTICE
Device failure after a DC fuse trips The neighboring DC fuses may also become damaged if a DC fuse trips. Failure to replace all fuses at the same time can cause the device to fail. • After a DC fuse trips, always replace all DC fuses at the same time. Always use fuses of the same type.

Note

Replacing a complete power unit

If you order a complete power unit as a replacement, make sure that DC fuses are always used. If the Option L37 (DC interface including precharging input circuit) is installed in your cabinet, the DC fuses of the replacement part must be replaced with the copper lugs of the existing power unit.

Replacing the DC fuses for Smart Line Module, Active Line Module, and Motor Module, frame sizes HX and JX

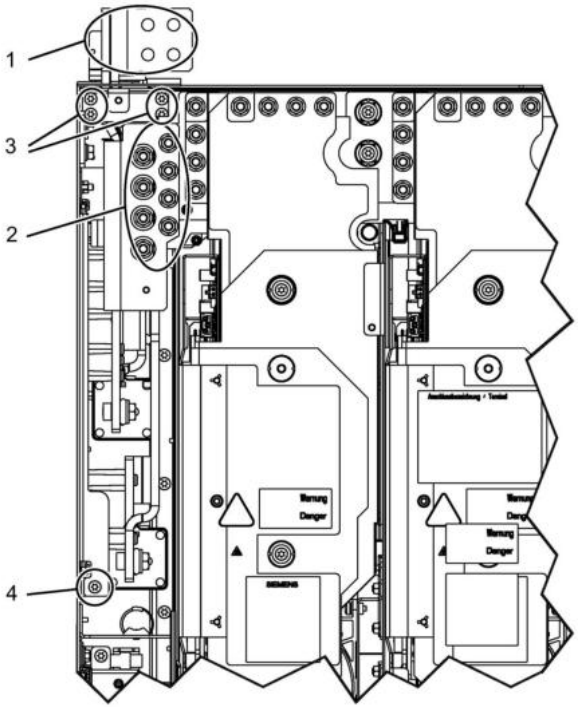


Figure 6-51 Replacing the DC fuses, frame sizes HX and JX

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

NOTICE
Device failure after a DC fuse trips The neighboring DC fuses may also become damaged if a DC fuse trips. Failure to replace all fuses at the same time can cause the device to fail. • After a DC fuse trips, always replace all DC fuses at the same time. Always use fuses of the same type.

Note

Replacing a complete power unit

If you order a complete power unit as a replacement, make sure that DC fuses are always used. If the option L37 (DC interface including precharging input circuit) is installed in your cabinet, the DC fuses of the replacement part must be replaced with the copper lugs of the existing power unit.

Removal steps

1. Release the DC connections at DCP and DCN (4 screws each).
2. Remove nuts (8 screws).
3. Remove the retaining screws for the connection plate of the housing (4 screws) and remove the connection plate.
4. Remove the retaining screws for the fuse insert (1 screw).

You can now remove the fuse insert.

NOTICE

Damage to the device if signal cables or plastic parts are damaged when removing

Signal cables or plastic parts can be damaged when the fuse insert is removed. This can cause the device to fail.

- When removing the fuse insert, ensure that you do not damage any signal cables or plastic parts.

You can then replace the DC fuses.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.15.6 Replacing the DC fuses for the Chassis-2 format

Replacing the DC fuses for the Motor Module, Chassis-2 format

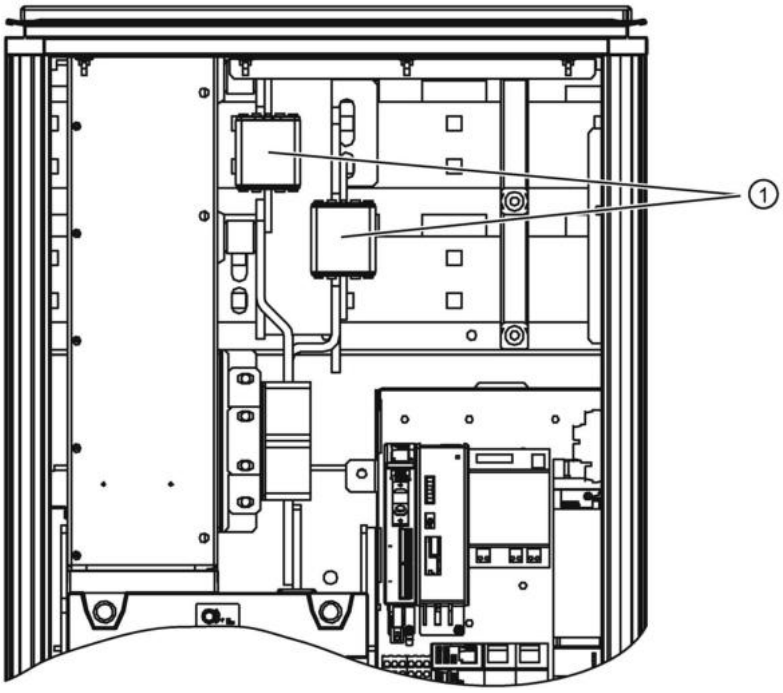


Figure 6-52 Replacing the DC fuses, Chassis-2 format

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removing the DC fuses

1. Release the screws and nuts at the DC fuses (①) and remove.
2. Remove the DC fuses.

NOTICE
Device failure after a DC fuse trips The neighboring DC fuses may also become damaged if a DC fuse trips. Failure to replace all fuses at the same time can cause the device to fail. • After a DC fuse trips, always replace all DC fuses at the same time. Always use fuses of the same type.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

6.4.15.7 Replacing cylindrical fuses

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Replacement steps

1. Open the cabinet.
2. Open the fuse holder (push the flap down/up).
3. Remove the defective fuse.
4. Insert the replacement fuse.
5. Close the fuse holder (push the flap up/down).
6. Close the cabinet.

6.4.15.8 Replacement of LV HRC fuses with blade contacts

Description

LV HRC fuses (LV HRC fuses) with blade contacts, also called blade fuses, are used, for example, in the main switches of the supply infeed.



Figure 6-53 LV HRC fuse with blade contacts

Preparatory steps

- Keep the safety equipment close at hand: LV HRC fuse puller with forearm protection for LV HRC fuse-links
- Observe the national safety regulations.



Figure 6-54 LV HRC fuse puller with forearm protection for LV HRC fuses

Note

If required, the LV HRC fuse grip can be ordered from Siemens using article number 3NX1.

Removal steps

The NH fuse is removed in the following steps:

1. Open the main switch.
2. Remove the front shock hazard protection cover of the cabinet in front of the fuses.



⚠WARNING

Electric shock due to removed cover above the power connections

When the lower cover (over the line connections) is removed, line voltage is present even when the main switch is switched off. Contact with the connections can result in death or serious injury.

- Do not remove the cover (shock protection) over the line connections.

3. Locate the LV HRC fuse puller with forearm protection for LV HRC fuse-links over the fuse.
4. Remove the defective fuse.

NOTICE

Device failure after a LV HRC fuse trips

The neighboring LV HRC fuses may also become damaged if a LV HRC fuse trips. Failure to replace all fuses at the same time can cause the device to fail.

- After an LV HRC fuse trips, always replace all LV HRC fuses at the same time. Always use fuses of the same type.

Installation steps

The NH fuse is installed in the following steps:

1. Insert the new fuse into the LV HRC fuse puller.
2. Insert the fuse into the fuse holder.
3. Press the release button on the LV HRC fuse puller to release the grip from the new fuse.
4. Attach the front touch protection cover.

The main switch can then be switched on.



⚠WARNING

Electric shock when using unsuitable fuses

If unsuitable fuses are used, an electric shock can cause severe injury or death.

- Use only fuses specified in the spare parts list.

6.4.16 Replacing the DC interface (option L37)

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access (Motor Module);
  (if no Control Unit is present, the plate can simply be unscrewed and turned to one side).

Removal

1. Switch off the relevant DC interface in the door.
2. Open the cabinet.
3. Open the fuse switch disconnector and remove the fuse link.
4. Remove the infeed cable to the Motor Module at the contactor.
5. Detach the motor plug or disconnect and insulate the motor cables.
6. Open the cover for the Motor Module.
7. Remove the 24 VDC connector and insulate the contact surfaces so that they cannot be touched.
8. Remove the cable (2 -T1) at the contactor.
9. Remove the screws on the DC rectifier adapter.
10. Remove the connector (-X37).
11. Remove the cable ties on the cable to the DC rectifier adapter.
12. Remove the lower screws (up to 3) on the support plate for the pre-charger.
13. Remove the upper screws (up to 3) on the support plate for the pre-charger.

Note

Secure the pre-charger

The pre-charger is only secured by the upper and lower screws, which means that it must be supported when you remove the final screws!

14. Carefully remove the support plate for the pre-charger and the DC rectifier adapter.

Installation

Installing is the same as removing, however in the reverse order.

Note
Use new cable ties

Use new cable ties to secure the cable to the DC rectifier adapter.

6.4.17 Replacing the pre-charging resistors of the DC interface (option L37)

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Removal

1. Remove the DC interface (see Section "Replacing the DC interface").
2. Remove the fastening screws for the pre-charging resistors.
3. Remove the resistors.

Installation

1. Insert the new resistors.
2. Tighten the fastening screws of the pre-charging resistors.
3. Re-install the DC interface.

6.4.18 Replacing the backup battery for the cabinet operator panel

Replacing the backup battery

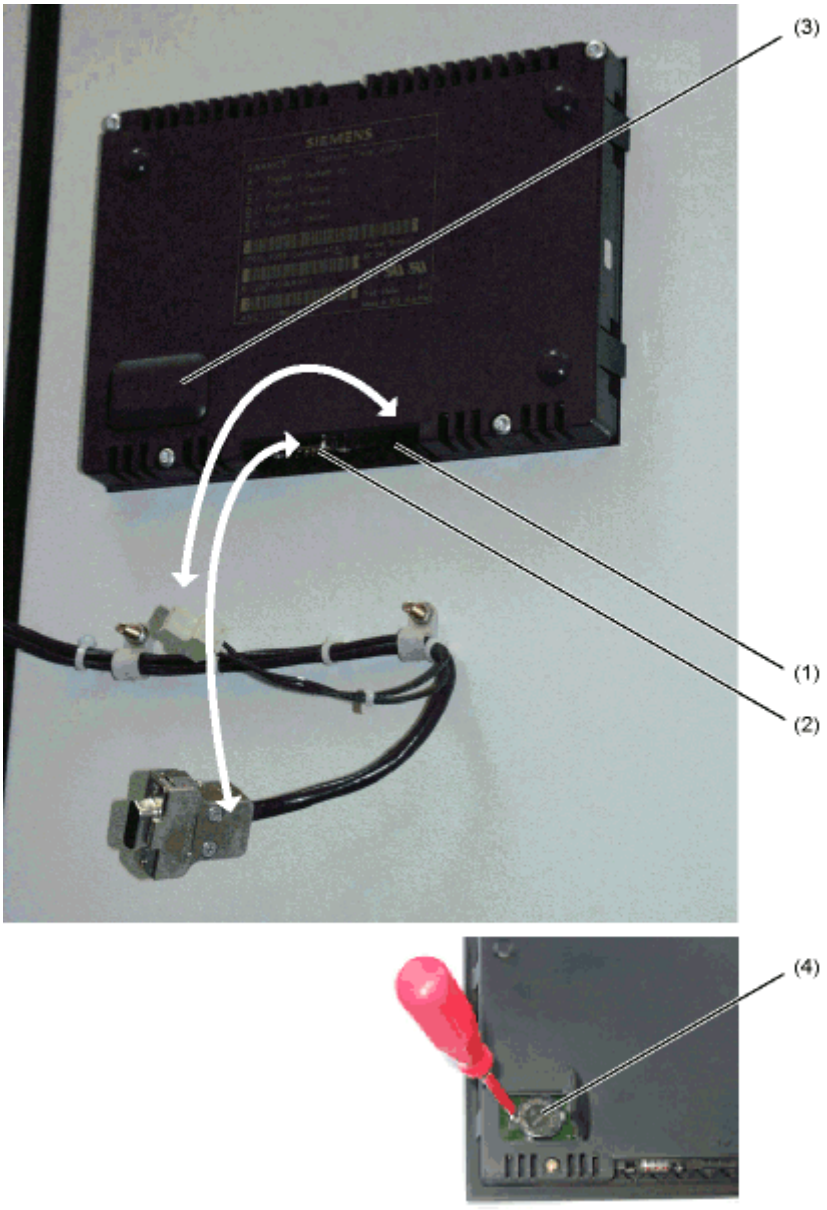


Figure 6-55 Replacing the backup battery

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Replacing

1. Disconnect the 24 VDC power-supply cable.
2. Disconnect the communication cable on the operator panel.
3. Open the cover of the battery compartment.
4. Remove the old battery.
5. Insert the new battery.
6. Complete the procedure by carrying out the above actions in reverse order.

Table 6- 2 Technical data for the backup battery

Type	CR2032 3 V lithium battery
Vendor	Maxell, Sony, Panasonic
Rated capacity	220 mAh
Maximum permissible charging current	10 mA (restricted to < 2 mA in operator panel)
Self-discharge at 20° C	1%/year
Service life (in backup mode)	> 1 year at 70° C > 1.5 years at 20° C

Note
Time for replacing the battery

The battery must be replaced within one minute to ensure that no AOP settings are lost.

Note
Battery disposal

The battery must be disposed of in accordance with the applicable country-specific guidelines and regulations.

6.5 Forming the DC link capacitors

Description

If the Basic Line Modules, Smart Line Modules, Active Line Modules, and Motor Modules have not been used for more than two years, the DC-link capacitors must be reformed. If this is not carried out, the units could be damaged after the DC-link voltage is applied under load.

If the cabinet is commissioned within two years of its date of manufacture, the DC-link capacitors do not need to be re-formed. The date of manufacture can be taken from the serial number on the rating plate.

Note

Storage period

It is important that the storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.

Rating plate

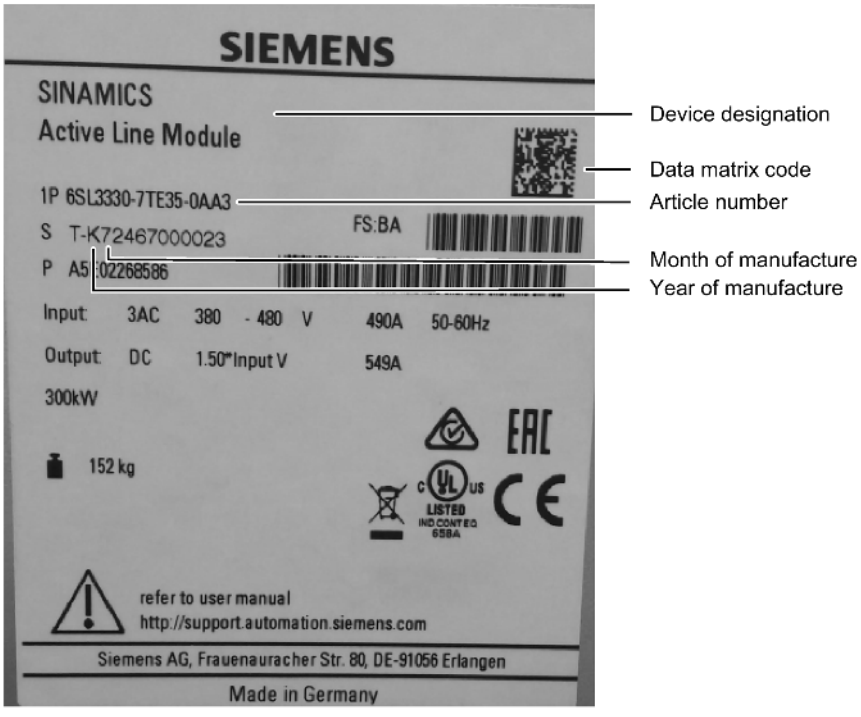


Figure 6-56 Rating plate using an Active Line Module as example

Date of manufacture

The date of manufacture can be determined as follows:

Table 6- 3 Production year and month

Character	Year of manufacture		Character	Month of manufacture
A	2010		1 to 9	January to September
B	2011		O	October
C	2012		N	November
D	2013		D	December
E	2014			
F	2015			
H	2016			
J	2017			
K	2018			
L	2019			
M	2020			
N	2021			
P	2022			
R	2023			

Procedure in the event of repair or replacement

A replacement Line Module or Motor Module or the corresponding replacement power block has to be re-formed after being in storage for a period of more than two years.

The DC link capacitors are formed by connecting the line voltage without any load connected for at least 30 minutes.
To do this, the DC link must be precharged (i.e. the Line Modules switched on), while the controller for the existing Motor Modules must not be enabled for the specified length of time.

Procedure for re-forming outside the drive line-up

Replacement power units which have to be held ready for immediate use in the event of repair or replacement can also be reformed individually and outside the drive line-up.

For this, the equipment must be connected to the forming circuits described in the following.

Components for the forming circuit (recommendation)

- 1 fuse switch 3-phase 400 V / 10 A or 690 V / 10 A
- 3 incandescent lamps 230 V / 100 W for a line voltage of 380 to 480 V 3 AC. Alternatively, use 3 resistors of 1 kΩ / 100 W each (e.g. GWK150J1001KLX000 from Vishay) instead of the incandescent lamps.

- 6 incandescent lamps 230 V / 100 W for a line voltage of 500 to 690 V 3 AC, where 2 incandescent lamps must be connected in series in each supply phase.
  Alternatively, use 3 resistors of 1 kΩ / 160 W each (e.g. GWK200J1001KLX000 from Vishay) instead of the incandescent lamps.
- Various small components, such as lamp sockets, cable 1.5 mm^2, etc.



WARNING

Electric shock when lamp sockets are installed so that they are not insulated

If two incandescent lamps connected in series are used, the insulation of the lamp sockets is not designed for a high voltage of 3 AC 500 to 690 V.

- For a line voltage of 3 AC 500 to 690 V, insulate the two lamp sockets connected in series and protect them from being touched.

Forming circuit for Line Modules

Note

Forming the Line Modules

Voltage must be supplied to Line Modules via a connected Motor Module and the associated DC link.

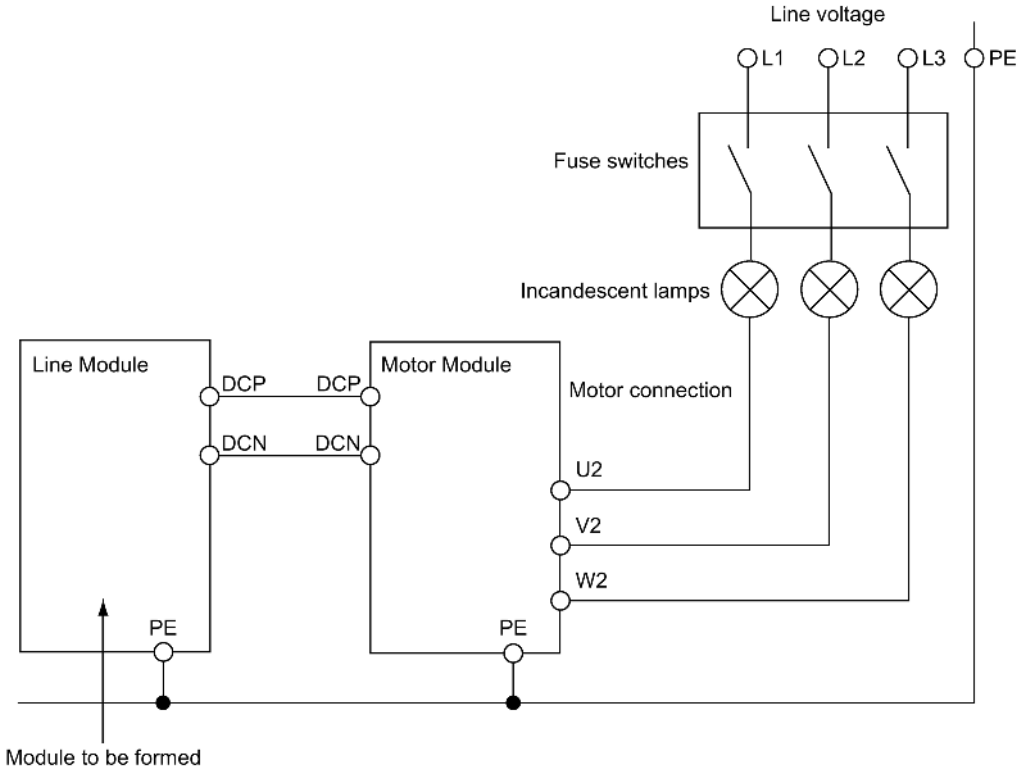


Figure 6-57 Forming circuit for Line Modules

Forming circuit for Motor Modules

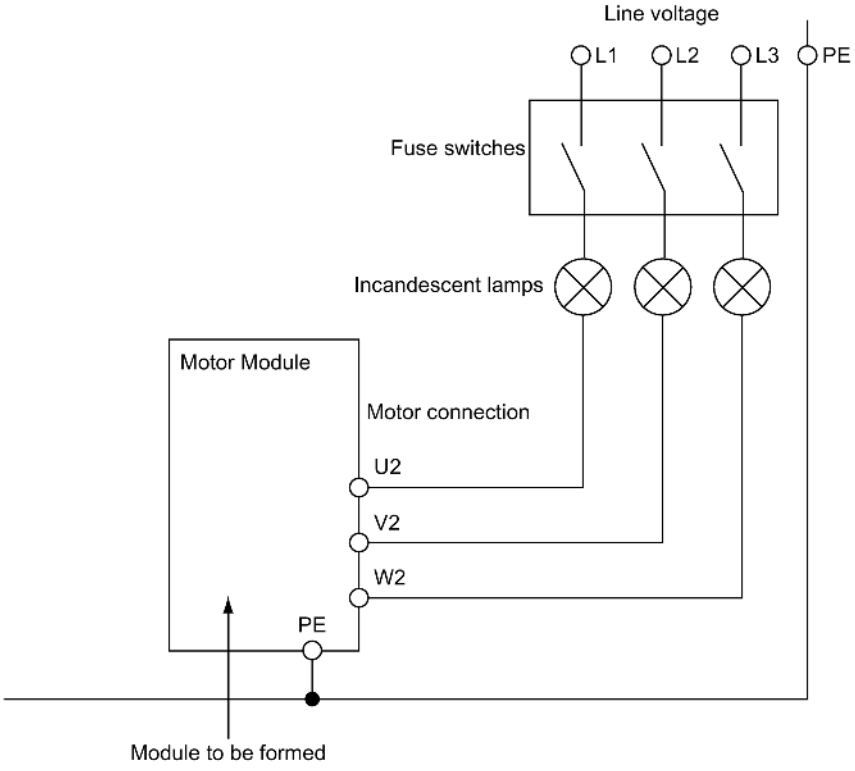


Figure 6-58 Forming circuit for Motor Modules

Procedure

- It is not permissible that the device being formed receives a power-on command (e.g. from the keyboard, BOP20 or terminal block).
- Connect the appropriate forming circuit.
- Forming has been completed if the DC link voltage no longer increases.

Maintaining the operational readiness of individual power blocks for servicing

It is recommended that during the planned downtimes, the power blocks positioned on the line side are replaced in order to guarantee the correct functioning of the power blocks during servicing.

6.6 Environmental compatibility



For environmentally friendly recycling and disposal of your old device, please contact a company certified for the disposal of old electrical and electronic devices and dispose of the device in accordance with the regulations in your country.

Diagnostics

7

7.1 Chapter content

This chapter provides an overview of the LEDs on the various cabinet unit components. Detailed descriptions of the components are provided either in this Manual or in the additional documentation on the customer DVD supplied with the device.

The overview of the LEDs provided here is intended for rapid diagnostic purposes.

7.2 LEDs on the CU320-2 DP Control Unit

Description of the LED states

The different states while booting are indicated by LEDs on the Control Unit.

- The duration of the individual states varies.
- If an error occurs, the booting procedure is terminated and the cause is indicated on the LEDs.
- Once the unit has successfully booted, all the LEDs are briefly switched off.
- Once the unit has booted, the LEDs are controlled via the loaded software.

Behavior of the LEDs during booting

Table 7- 1 Load software

LED			State	Comments
RDY	COM	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red flashing light 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red flashing light 2 Hz	Red flashing light 2 Hz	Off	File error	• Memory card not inserted or faulty • Software on memory card not present or corrupted
Red	Orange Flashing light	Off	FW loading	RDY LED lights up red, COM LED flashes orange without fixed frequency
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	–
Red flashing light 0.5 Hz	Red flashing light 0.5 Hz	Off	FW checked (CRC error)	• CRC error

Table 7- 2 Firmware

LED			State	Comments
RDY	COM	OPT		
Orange	Off	Off	Initializing	–
Alternating			Running	See the table below

Behavior of the LEDs after booting

Table 7- 3 Control Unit CU320-2 DP – Description of the LEDs after booting

LED	Color	State	Description, cause	Remedy
RDY (READY)	-	Off	The electronics power supply is missing or outside the permissible tolerance range.	Check power supply
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
		Flashing 0.5 Hz	Commissioning/reset	–
		Flashing light 2 Hz	Writing to the memory card	–
		Flashing light 0.5 s on, 3 s off	PROFIenergy energy-saving mode is active (in conjunction with option G33 - CBE20)	–
	Red	Flashing light 2 Hz	General errors	Check parameterization / configuration data
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready for operation. However, there are no software licenses.	Upgrade licenses
	Orange	Flashing 0.5 Hz	Updating the firmware of the connected DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update has been completed. Wait for POWER ON of the respective component.	Carry out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated. **Note**: Both options depend on the LED status when component recognition is activated via p0124[0] = 1.	–
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Comment:** PROFIdrive is ready for communication if the Control Unit is ready (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller.	–
	Red	Flashing light 0.5 Hz	PROFIBUS master is sending wrong parameterization/configuration data	Adapt configuration between master/controller and CU
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Correct the fault

LED	Color	State	Description, cause	Remedy
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
	Red	Continu-ous light	Depends on the option board used[1].	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
		Flashing light 2 Hz	At least one fault is present in this component. Option board not ready (e.g. after switching on).	Remedy and acknowledge fault
RDY and COM	Red	Flashing light 2 Hz	Bus fault - communication has been interrupted	Correct the fault
RDY and OPT	Orange	Flashing light 0.5 Hz	The firmware of the connected option board is being updated.	–

[1] Any individual response of the LED OPT is described for the respective Option Board.

7.3 LEDs on the CU320-2 PN Control Unit

Description of the LED states

The different states while booting are indicated by LEDs on the Control Unit.

- The duration of the individual states varies.
- If an error occurs, the booting procedure is terminated and the cause is indicated on the LEDs.
- Once the unit has successfully booted, all the LEDs are briefly switched off.
- Once the unit has booted, the LEDs are controlled via the loaded software.

Behavior of the LEDs during booting

Table 7- 4 Load software

LED			State	Comments
RDY	COM	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red flashing light 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red flashing light 2 Hz	Red flashing light 2 Hz	Off	File error	• Memory card not inserted or faulty • Software on memory card not present or corrupted
Red	Orange flashing light	Off	FW loading	RDY LED lights up red, COM LED flashes orange without fixed frequency
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	–
Red flashing light 0.5 Hz	Red flashing light 0.5 Hz	Off	FW checked (CRC error)	• CRC error

Table 7- 5 Firmware

LED			State	Comments
RDY	COM	OPT		
Orange	Off	Off	Initializing	–
Alternating			Running	See the table below

Behavior of the LEDs after booting

Table 7- 6 Control Unit CU320-2 PN – Description of the LEDs after booting

LED	Color	State	Description, cause	Remedy
RDY (READY)	–	Off	The electronics power supply is missing or outside the permissible tolerance range.	Check power supply
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
		Flashing light 0.5 Hz	Commissioning/reset	–
		Flashing light 2 Hz	Writing to the memory card	–
		Flashing light 0.5 s on, 3 s off	PROFIenergy energy saving mode is active	–
	Red	Flashing light 2 Hz	General errors	Check parameterization / configuration data
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready for operation. However, there are no software licenses.	Upgrade licenses
	Orange	Flashing light 0.5 Hz	Updating the firmware of the connected DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update has been completed. Wait for POWER ON of the respective component.	Carry out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated. **Remark**: Both options depend on the LED status when activating p0124[0] = 1.	–
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Remark:** PROFIdrive is ready for communication when the Control Unit is ready (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any set-points. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller. • "Shared Device" is selected and only one controller connected.	–
	Red	Flashing light 0.5 Hz	Bus error, incorrect parameter assignment/configuration	Adapt configuration between controller and devices

LED	Color	State	Description, cause	Remedy
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Correct the fault
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
	Red	Continuous light	Depends on the option board used[1].	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
		Flashing light 2 Hz	At least one fault is present in this component. Option board not ready (e.g. after switching on).	Remedy and acknowledge fault
RDY and COM	Red	Flashing light 2 Hz	Bus fault – communication has been interrupted	Correct the fault
RDY and OPT	Orange	Flashing light 0.5 Hz	The firmware of the connected option board is being updated.	–

[1] Any individual response of the LED OPT is described for the respective Option Board.

7.4 LEDs on the CBE20 Communication Board

Table 7- 7 Meaning of the LEDs at ports 1 to 4 of the X1400 interface

LED	Color	State	Description
Link port	–	Off	The electronics power supply is missing or outside the permissible tolerance range (link missing or defective).
	Green	Steady light	A different device is connected to port x and a physical connection exists.
Activity port	–	Off	The electronics power supply is missing or outside the permissible tolerance range (no activity).
	Yellow	Flashing light	Data is being received or sent at port x.

Table 7- 8 Meaning of the Sync and Fault LEDs on the CBE20

LED	Color	State	Description
Fault	–	Off	If the link port LED is green: The CBE20 is operating error-free, and data is being exchanged with the configured IO controller.
	Red	Flashing light	- The watchdog timer has elapsed. - Communication has been interrupted. - The IP address is incorrect. - Incorrect or missing configuration. - Incorrect parameter assignment. - Incorrect or missing device name. - IO controller not present/switched off but Ethernet connection present. - Other CBE20 errors.
		Steady light	CBE20 bus error - No physical connection to a subnet/switch. - Incorrect transmission rate. - Full-duplex transmission is not activated.
Sync	–	Off	If the link port LED is green: Control Unit task system is not synchronized with the IRT clock. An internal substitute clock is generated.
	Green	Flashing light	Control unit task system has synchronized with the IRT clock and data is being exchanged.
		Steady light	Task system and MC-PLL have synchronized with the IRT clock.

Table 7- 9 Meaning of the OPT LED on the Control Unit

LED	Color	State	Description, cause
OPT	–	OFF	Electronics power supply is missing or outside permissible tolerance range. The CBE20 is defective or not inserted.
	Green	Steady light	CBE20 is ready and cyclic communication is taking place.
		Flashing light 0.5 Hz	CBE20 is ready but cyclic communication is not running. Possible causes: - Communication is being established. -At least one fault is present.
	Red	Steady light	Cyclic communication via PROFINET has not yet been established. However, acyclic communication is possible. SINAMICS is waiting for a parameterization/configuration telegram.
		Flashing light 0.5 Hz	The firmware download to the CBE20 has failed. Possible causes: - The memory card of the Control Unit is faulty. - The CBE20 is out of order. The CBE20 cannot be used in this state.
		Flashing light 2 Hz	Communication between the Control Unit and the CBE20 is faulty. Possible causes: - The CBE20 was removed following power-up. - The CBE20 is defective.
	Orange	Flashing light 0.5 Hz	Firmware is being updated.

7.5 LEDs on the Control Interface Module in the Basic Line Module

Table 7- 10 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Basic Line Module

LED, state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	--- [1]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1] Irrespective of the status of the LED "DC LINK"

Table 7- 11 Meaning of the LED "POWER OK" on the Control Interface Module in the Basic Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC-link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.6 LEDs on the Control Interface Module in the Smart Line Module

Table 7- 12 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Smart Line Module

LED, state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	---[1)]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---[1)]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	---[1)]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	---[1)]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	---[1)]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1)] Irrespective of the status of the LED "DC LINK"

Table 7- 13 Meaning of the LED "POWER OK" on the Control Interface Module in the Smart Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC-link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.7 LEDs on the Control Interface Module in the Active Line Module

Table 7- 14 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Active Line Module

LED, state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	--- [1]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1] Irrespective of the status of the LED "DC LINK"

Table 7- 15 Meaning of the LED "POWER OK" on the Control Interface Module in the Active Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC-link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.8 LEDs on the Active Line Module, Chassis-2 format

Table 7- 16 Significance of the "READY" and "DC LINK" LEDs on the Active Line Module, Chassis-2 format

LED, state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	--- [1]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1] Irrespective of the status of the LED "DC LINK"

Table 7- 17 Significance of the "PWR ON" LED on the Active Line Module, Chassis-2 format

LED	Color	State	Description
POWER ON	Green	Off	DC link voltage or supply voltage at -X9 too low.
		On	The component is ready for operation.
	Red	Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.9 LEDs on the Control Interface Module in the Motor Module, chassis format

Table 7- 18 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Motor Module

LED, state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	--- [1]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1] Irrespective of the status of the LED "DC LINK"

Table 7- 19 Meaning of the LED "POWER OK" on the Control Interface Module in the Motor Module

LED	Color	State	Description
POWER OK	Green	Off	DC-link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.10 LEDs on the Motor Module, Chassis-2 format

Table 7- 20 Significance of the "READY" and "DC LINK" LEDs on the Motor Module, Chassis-2 format

LED, state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	--- [1]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1] Irrespective of the status of the LED "DC LINK"

Table 7- 21 Significance of the "PWR ON" LED on the Motor Module, Chassis-2 format

LED	Color	State	Description
POWER ON	Green	Off	DC link voltage or supply voltage at -X9 too low.
		On	The component is ready for operation.
	Red	Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.11 LEDs on the Motor Module in the booksize format

Table 7- 22 Meaning of the LEDs on the Motor Module in booksize format

LED, state		Description
Ready	DC LINK	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	---[1)]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---[1)]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	---[1)]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	---[1)]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	---[1)]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1)] Irrespective of the status of the LED "DC LINK"



WARNING

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.12 LEDs on the Central Braking Module

Table 7- 23 Meaning of the LEDs on the Braking Module in the Central Braking Module

LED	State	Description
ME - "Ready" message	OFF	U_{DC} missing Overtemperature Maximum control setting
	Steady light	Ready
MUI - "Overcurrent" message	OFF	Normal status
	Steady light	Short-circuit / ground fault
MUL - "Overload" message	OFF	Normal status
	Steady light	Overload: Set brake ON time exceeded
MUT - "Overtemperature" message	OFF	Normal status
	Steady light	Overtemperature

7.13 LEDs on the Voltage Sensing Module (VSM) in the Active Interface Module

Table 7- 24 Meaning of the LEDs on the Voltage Sensing Module in the Active Interface Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON.
	Green / orange or red / orange	2 Hz flashing light	Detection of the components via LED is activated (p0144). **Remark:** Both options depend on the LED status when module recognition is activated via p0144 = 1.

7.14 LEDs on the SMC10 Sensor Module

Table 7- 25 Meaning of the LEDs on the SMC10 Sensor Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON.
	Green/ orange or red/ or- ange	2 Hz flashing light	Detection of the components via LED is activated (p0144). **Remark:** Both options depend on the LED status when module recognition is activated via p0144 = 1.

7.15 LEDs on the SMC20 Sensor Module

Table 7- 26 Meaning of the LEDs on the SMC20 Sensor Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON.
	Green/ orange or red/ or- ange	2 Hz flashing light	Detection of the components via LED is activated (p0144). **Remark:** Both options depend on the LED status when module recognition is activated via p0144 = 1.

7.16 LEDs on the SMC30 Sensor Module

Table 7- 27 Meaning of the LEDs on the SMC30 Sensor Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON.
	Green / orange or red / orange	2 Hz flashing light	Detection of the components via LED is activated (p0144). **Remark:** Both options depend on the LED status when module recognition is activated via p0144 = 1.
OUT > 5V	-	Off	The electronics power supply is missing or outside the permissible tolerance range. Power supply ≤ 5 V.
	Orange	Steady light	The electronics power supply for the measuring system is available. Measuring system supply > 5 V **Notice:** You must ensure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics.

7.17 LEDs on the TM54F Terminal Module

Table 7- 28 Meaning of the LEDs on the Terminal Module TM54F

LED	Color	State	Description, cause
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation, cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.

LED	Color		State	Description, cause
	Green/red		Flashing light 0.5 Hz	Firmware is being downloaded.
			Flashing light 2 Hz	Firmware download has been completed. Wait for POWER ON.
	Green/orange or Red/Orange		Flashing light	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.
L1+, L2+,	–		On	The controllable sensor power supply is functioning fault-free.
	Red		Steady light	There is a fault in the controllable sensor power supply.
L3+	–		On	The sensor power supply is operating fault-free.
	Red		Steady light	The sensor power supply has a fault.
Fail-safe inputs / double inputs				
F_DI z (input x, (x+1)+, (x+1)-)	**LED**	**LED**		
	x	x+1		**NC contact/NC contact[1]: (z = 0 … 9, x = 0, 2, … 18)**
	–	Red	Steady light	Different signal states at input x and x+1
	–	–	–	No signal at input x and no signal at input x+1
				NC contact/NO contact[1]: (z = 0 … 9, x = 0, 2, … 18)
	–	Red	Steady light	Same signal states at input x and x+1
	–	–	–	No signal at input x and no signal at input x+1
	LED	**LED**		
	x	x+1		**NC contact/NC contact[1]: (z = 0 … 9, x = 0, 2, … 18)**
	Green	Green	Steady light	One signal at input x and one signal at input x+1
				NC contact/NO contact[1]: (z = 0 … 9, x = 0, 2, … 18)
	Green	Green	Steady light	One signal at input x and no signal at input x+1
Single digital inputs, not fail-safe				
DI x	–		Off	No signal at digital input x (x = 20 ... 23)
	Green		Steady light	Signal at digital input x
Fail-safe digital outputs with associated readback channel				
F_DO y (0+..3+, 0-..3-)	Green		Steady light	Output y (y = 0 … 3) has an active signal
Read back input DI 2y for output F_DO y (y = 0 ... 3) for test stop. The state of the LEDs depends on the type of external circuitry.				
DI 2y	–		Off	One of the two output lines y+ or y- or both lines of output y carry a signal
	Green		Steady light	Both output lines y+ and y- carry no signal

[1] Inputs x+1 (DI 1+, 3+, .. 19+) can be individually adjusted by a parameter (see List Manual)

7.18 LEDs on the TM150 Terminal Module

TM150 Terminal Module (-A151 to -A154)

Table 7- 29 Description of the LEDs on the TM150

LED	Color	State	Description
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is complete. Waiting for POWER ON.
	Green/ orange or Red/ orange	Flashing light 2 Hz	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.

7.19 LEDs on the SITOP power supply unit

Table 7- 30 Meaning of the LEDs on the SITOP power supply unit

LED	Meaning
Green	Output voltage > 20.5 V
Yellow	Overload, output voltage < 20.5 V ("constant current" mode)
Red	Latching shutdown ("Shutdown" mode)

Options

8

8.1 Safety information

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.

Note

Different types of Cabinet Modules

The Cabinet Modules come in a range of different frame sizes, with each size differing from the others in several ways. The main differences are:

- The covers can have different dimensions, and they can be arranged and secured differently.
- The components can be arranged differently within the cabinet units.
- The components can be mounted differently within the cabinet units.

These variations result from the different requirements made of the components/equipment installed in the cabinet units. These differences are intentional and exist for "EMC optimization" reasons.

8.2 D14, Preliminary copy of customer documentation

If documents such as circuit diagrams, terminal diagrams, arrangement diagrams and dimension drawings are required for the system engineering (integration of the plant in higher-level systems, interface clarification, installation, building planning, etc.), advance documentation can also be ordered when ordering the cabinet modules. These documents are then supplied electronically a few working days after the order has been entered. If the order includes options that fall outside the scope of standard delivery, these will not be covered by the documentation due to the obvious time constraints.

Documentation relating to the order is sent to the buyer by e-mail. The recipient's e-mail address must be specified with the order for this purpose. In the e-mail, the recipient is also provided with a link for downloading general advance documentation such as operating instructions, Manual and commissioning instructions.

8.3 G20, CBC10 Communication Board

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

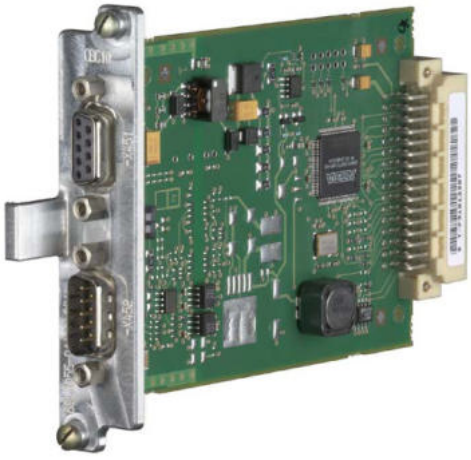


Figure 8-1 CAN CBC10 Communication Board

The CBC10 CANopen communication board (CAN Communication Board) is used to connect drives in the SINAMICS drive system to higher-level automation systems with a CAN bus.

The CANopen Option Board uses two 9-pin SUB D connectors for the connection to the CAN bus system.

The connectors can be used as inputs or outputs. Unused pins are plated through.

The following baud rates are also supported:
10, 20, 50, 125, 250, 500, 800 kBaud and 1 MBaud.

The module is installed in the factory in the option slot of the CU320-2 Control Unit.

NOTICE
Damage or malfunctions to the Option Board by inserting and withdrawing in operation Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction. • Only withdraw or insert Option Boards when the Control Unit is in a no voltage state.

Note

Additional information

Detailed and comprehensive instructions and information for the CBC10 Communication Board can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD provided.

Interface overview

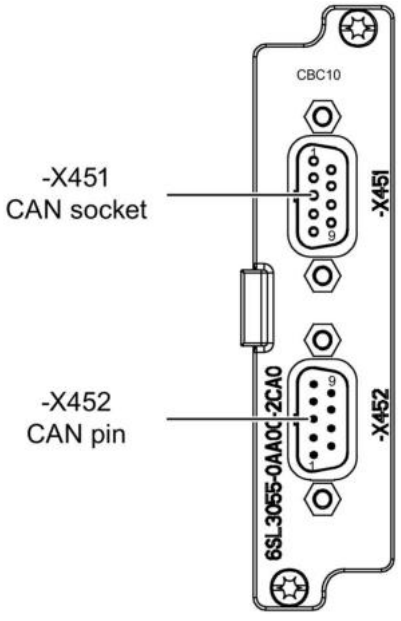
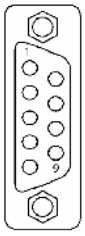


Figure 8-2 CAN CBC10 Communication Board, interface overview

X451 CAN bus interface

CAN bus interface -X451 features the following socket assignments:

Table 8- 1 CAN bus interface X451

Connector	Pin	Designation	Technical data
	1	Reserved	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved	
	9	Reserved	
Connector type: 9-pin Sub-D socket			

NOTICE

Destruction of the CAN interface due to the wrong connector

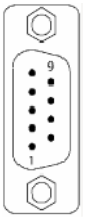
If PROFIBUS connectors are connected to CAN bus interfaces during operation, this may lead to the CAN interfaces being destroyed.

- Do not connect PROFIBUS connectors to CAN bus interfaces.

X452 CAN bus interface

CAN bus interface -X452 features the following socket assignments:

Table 8- 2 CAN BUS interface X452

Connector	Pin	Designation	Technical data
	1	Reserved	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved	
	9	Reserved	
Connector type: 9-pin SUB D connector (pins)			

8.4 G33, CBE20 Communication Board

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description



Figure 8-3 CBE20 Communication Board Ethernet

Interface module CBE20 is used for communication via PROFINET.

The module is installed in the factory in the option slot of the CU320-2 Control Unit.

Four Ethernet interfaces are available on the module. Diagnosis of the function mode and communication are possible via LEDs.

Interface overview

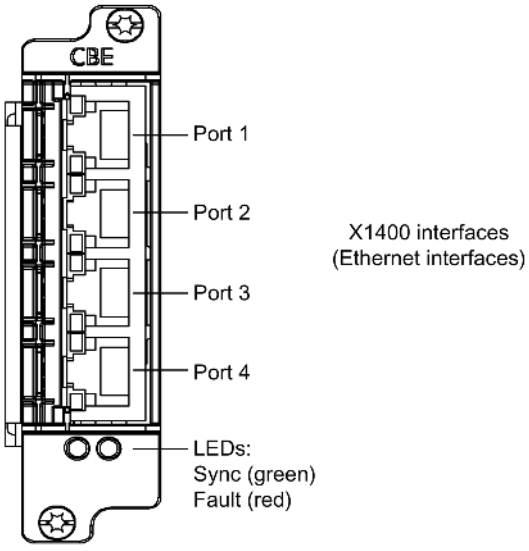


Figure 8-4 CBE20 Ethernet Communication Board, interface overview

MAC address

The MAC address of the Ethernet interfaces is indicated on the upper side of the CBE20. The label is only visible when the module has been removed.

Note

Note the MAC address

Remove the module and note down the MAC address of the module so that you have it available for subsequent commissioning. Re-install the module.

Removal/installation

NOTICE

Damage or malfunctions to the Option Board by inserting and withdrawing in operation

Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction.

- Only withdraw or insert Option Boards when the Control Unit is in a no voltage state.

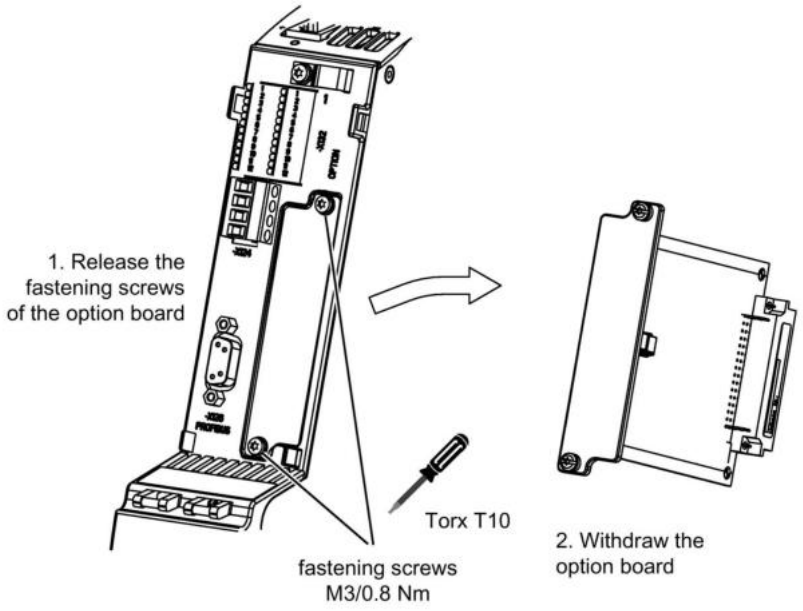
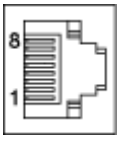


Figure 8-5 Removing the CBE20 from the option slot on the Control Unit

X1400 Ethernet interface

Table 8- 3 Connector X1400, port 1 - 4

Connector	Pin	Signal name	Technical data
	1	RX+	Receive data +
	2	RX-	Receive data -
	3	TX+	Transmit data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TX-	Transmit data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	Screened backshell	M_EXT	Shield, permanently connected
Connector type: RJ45 socket			

8.5 G51 to G54, temperature sensor module TM150

8.5.1 General information

Availability of option

These options are available for the following S120 Cabinet Modules:

- Line Connection Module
- Active Line Connection Modules-2

Description

The Terminal Module TM150 is used for acquiring and evaluating several temperature sensors.

In this case, option G51 is for 1 temperature sensor module, option G52 for 2 temperature sensor modules TM150 etc.:

- G51: 1 temperature sensor module TM150
- G52: 2 temperature sensor modules TM150
- G53: 3 temperature sensor modules TM150
- G54: 4 temperature sensor modules TM150

The temperature is measured in a temperature range from -99° C to +250° C for the following temperature sensors:

- PT100 (with monitoring for wire breakage and short-circuit)
- PT1000 (with monitoring for wire breakage and short-circuit)
- KTY84 (with monitoring for wire breakage and short-circuit)
- PTC (with short-circuit monitoring)
- Bimetallic NC contact (without monitoring)

For the temperature sensor inputs, for each terminal block the evaluation can be parameterized for 1x2-wire, 2x2-wire, 3-wire or 4-wire. There is no galvanic isolation in the TM150.

A maximum of 12 temperature sensors can be connected to Terminal Module TM150.

8.5.2 Interfaces

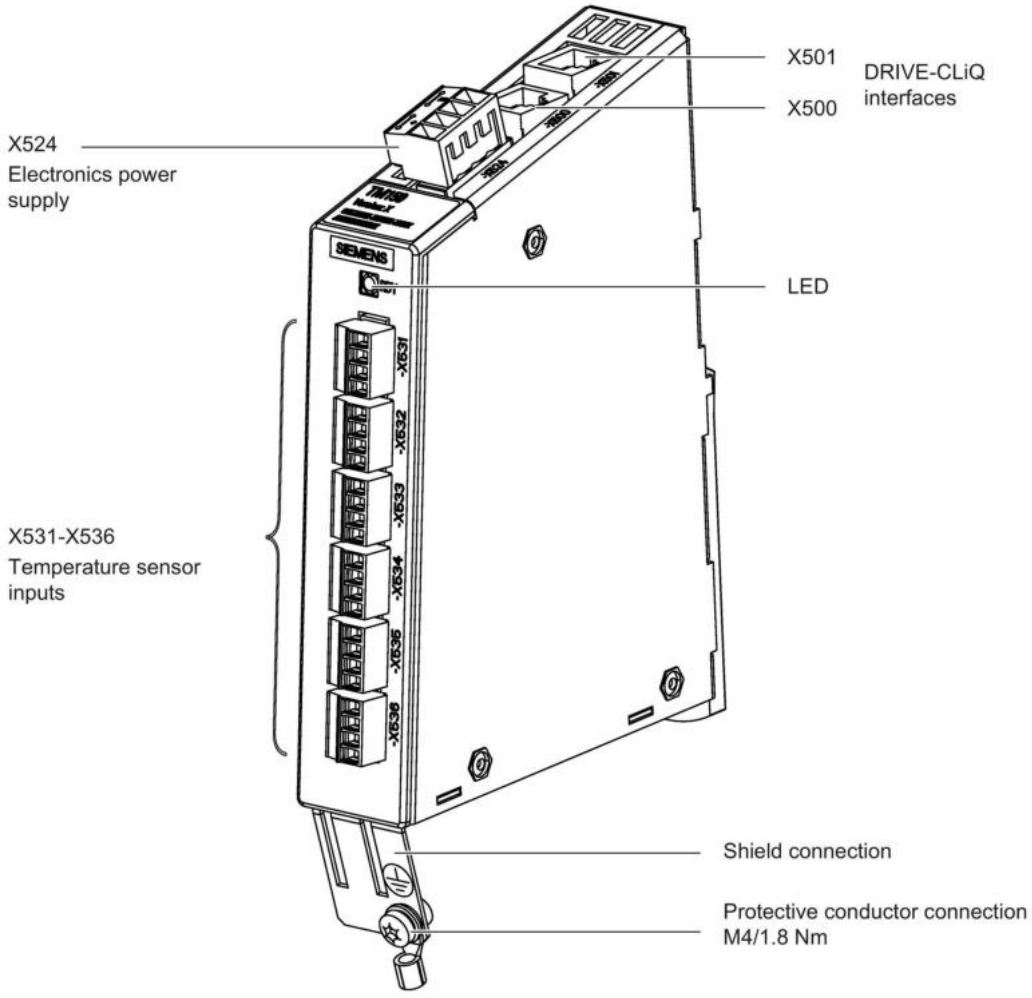
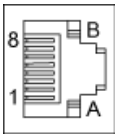


Figure 8-6 TM150 Terminal Module

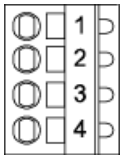
X500, X501: DRIVE-CLiQ interface

Table 8- 4 DRIVE-CLiQ interface X500 and X501

Connector	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

Temperature sensor connections

Table 8- 5 X531-X536 temperature sensor inputs

Connector	Terminal	Function 1x2- / 2x2-wire	Function 3 and 4-wire	Technical data
	1	+ Temp (channel x)	+ (Channel x)	Temperature sensor connection for sensors with 1x2 wires Connection of the 2nd measurement cable for sensors with 4 wires
	2	- Temp (channel x)	- (Channel x)	Temperature sensor connection for sensors with 1x2 wires Connection of the 1st measurement cable for sensors with 3 and 4 wires
	3	+ Temp (channel y)	+ I_c (constant current, positive channel x)	Temperature sensor connection for sensors with 2x2, 3 and 4 wires
	4	- Temp (channel y)	- I_c (constant current, negative channel x)	
Max. connectable cross-section: 1.5 mm²				

Measuring current via temperature sensor connection: approx. 0.83 mA

When connecting temperature sensors with 3 wires, a jumper must be inserted between X53x.2 and X53x.4.

Table 8- 6 Channel assignment

Terminal	Channel number [x] for 1x2, 3 and 4-wires	Channel number [y] for 2x2 wires
X531	0	6
X532	1	7
X533	2	8
X534	3	9
X535	4	10
X536	5	11



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Use temperature sensors that fully comply with the specifications of the safety isolation.

NOTICE

Damage to the motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

NOTICE

Overheating of the motor through jumpering the temperature sensor connections

Jumpering temperature sensor connections "+Temp" and "-Temp" results in incorrect measurement results. Damage to the motor can result if the overheating is not detected.

- When using several temperature sensors, separately connect the individual sensors to "+Temp" and "-Temp".

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

Note

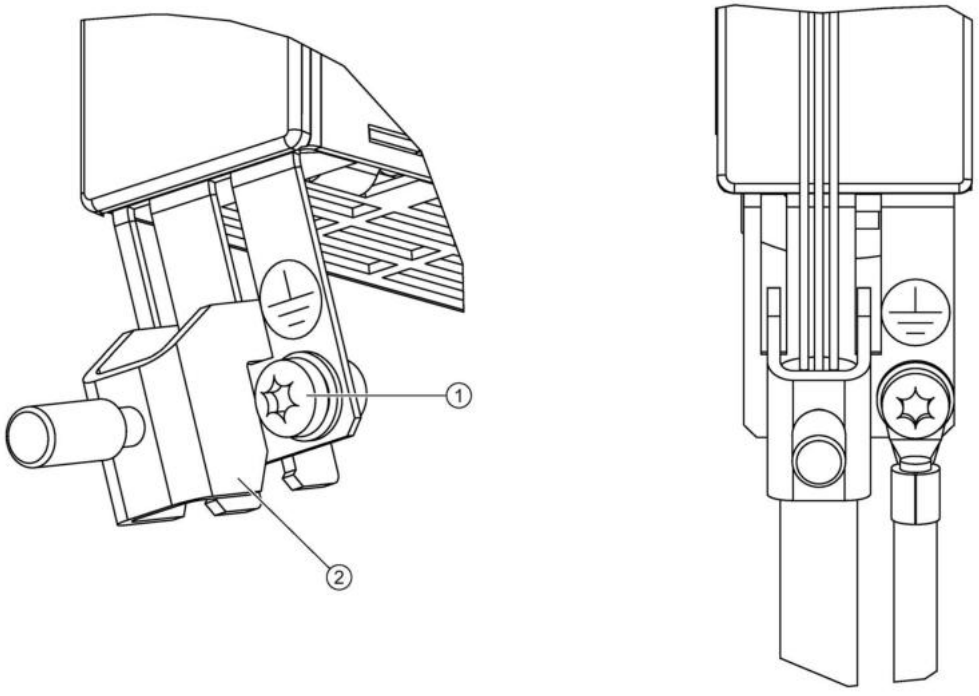
Incorrect temperature measured values as a result of cables with an excessively high resistance

An excessively long cable length or an excessively small cable cross-section can falsify the temperature measurement (for a PT100, 10 Ω cable resistance can falsify the measurement result by 10%). As a consequence, excessively high measured values are output, which could lead to the motor being unnecessarily tripped prematurely.

- Use only cable lengths ≤ 300 m.
- For cable lengths >100 m, use cables with a cross-section of ≥1 mm^2.
- Align the cable resistances (software function in the TM150).

Protective conductor connection and shield support

The following diagram shows a typical Weidmüller shield connection clamp for the shield supports.



① Protective conductor connection M4/1.8 Nm

② Shield connection terminal, Weidmüller company, type: KLBÜ CO1, order number: 1753311001

Figure 8-7 Shield support and protective conductor connection of the TM150

8.5.3 Connection example

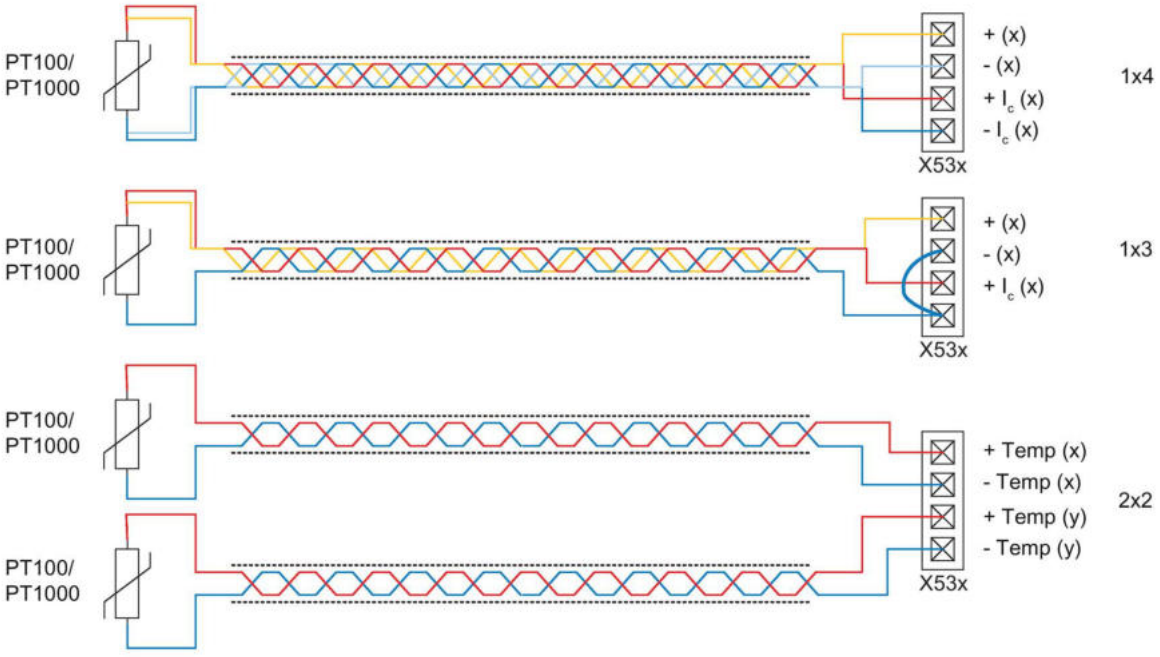


Figure 8-8 Connecting a PT100/PT1000 with 2x2, 3 and 4-wires to the temperature sensor inputs X53x of Terminal Module TM150

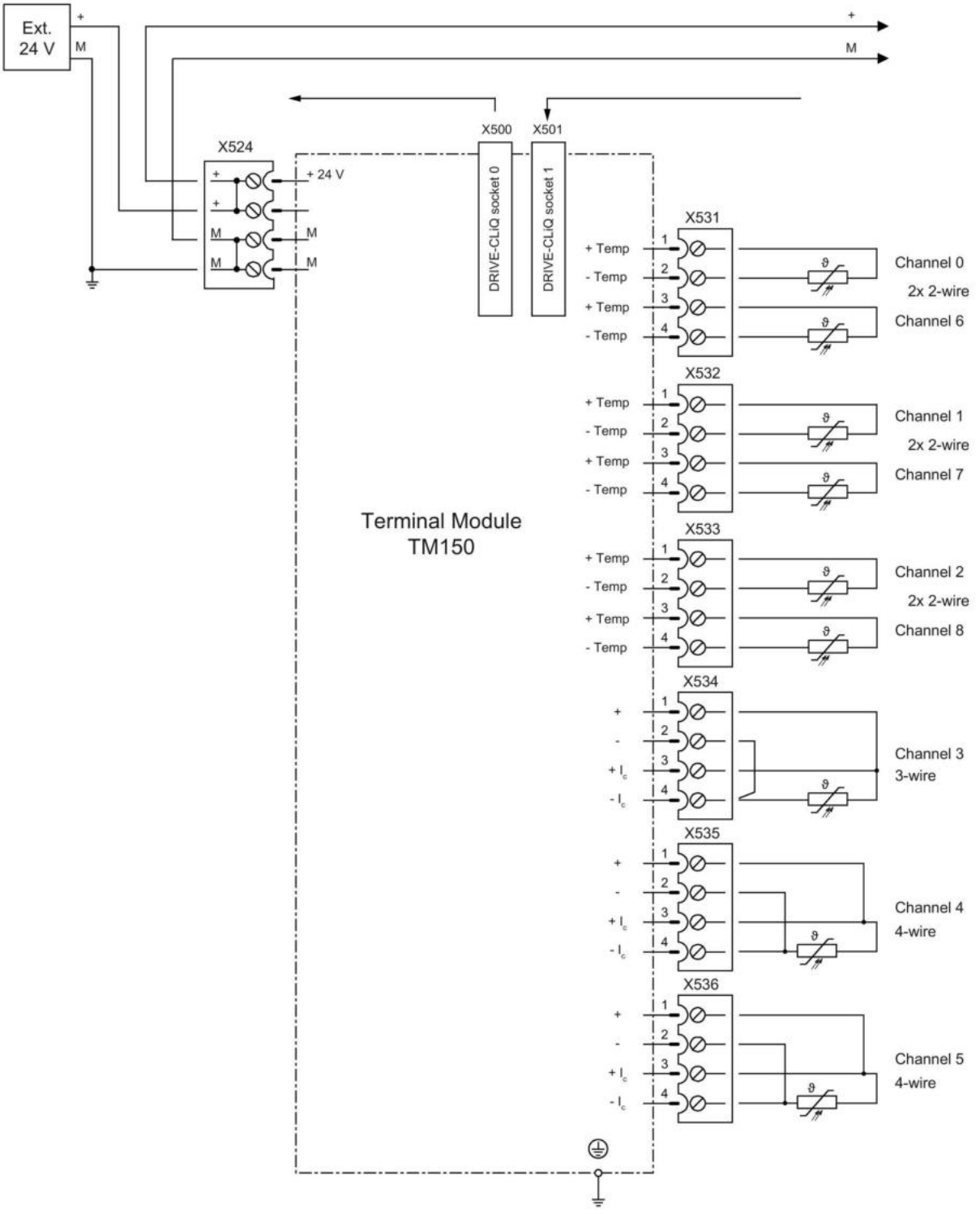


Figure 8-9 Connection example for a Terminal Module TM150

8.6 G56, contactor monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules

Description

The protective monitoring option is used for monitoring the pre-charging and bypass contactors of the Line Modules.

The connecting cable from the contactors to the Control Interface Module is factory-installed.

Activation

The monitoring is activated by the following parameters:

- p0255[0]: Precharging contactor closing time (factory setting = 0, max. 65535 ms)
- p0255[1]: Bypass contactor closing time (factory setting = 0, max. 65535 ms)
- p0255[2]: Precharging contactor opening time (factory setting = 0, max. 65535 ms)
- p0255[3]: Bypass contactor opening time (factory setting = 0, max. 65535 ms)

Fault messages

- F30060 (A) pre-charging contactor status monitoring
- F30061 (A) bypass contactor status monitoring

8.7 G62, TB30 Terminal Board

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in the chassis format
- Motor Modules - Chassis-2 format

Description



Figure 8-10 TB30 Terminal Board

The TB30 Terminal Board supports the addition of digital inputs/digital outputs and analog inputs/analog outputs to the Control Unit.

The following are located on the TB30 Terminal Board:

- Power supply for digital inputs/digital outputs
- 4 digital inputs
- 4 digital outputs
- 2 analog inputs
- 2 analog outputs

The TB30 Terminal Board plugs into the option slot on the Control Unit.

A shield connection for the signal cable shield is located on the Control Unit.

NOTICE
Damage or malfunctions to the Option Board by inserting and withdrawing in operation Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction. • Only withdraw or insert Option Boards when the Control Unit is in a no voltage state.

The module is inserted in the option slot of the Control Unit at the factory.

Interface overview

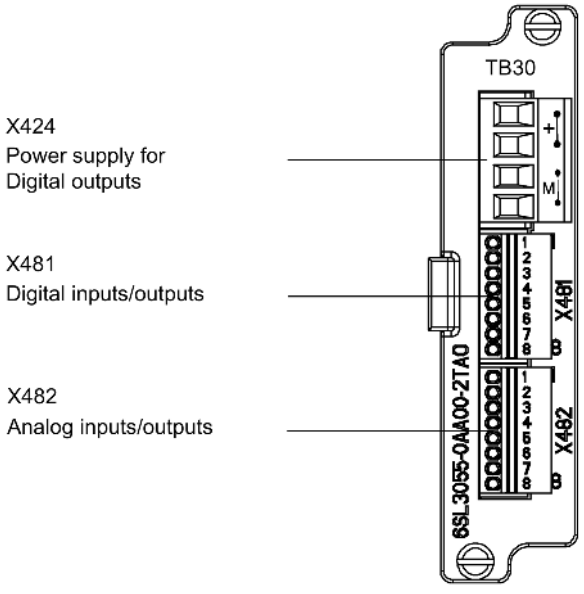


Figure 8-11 TB30 Terminal Board interface overview

Connection overview

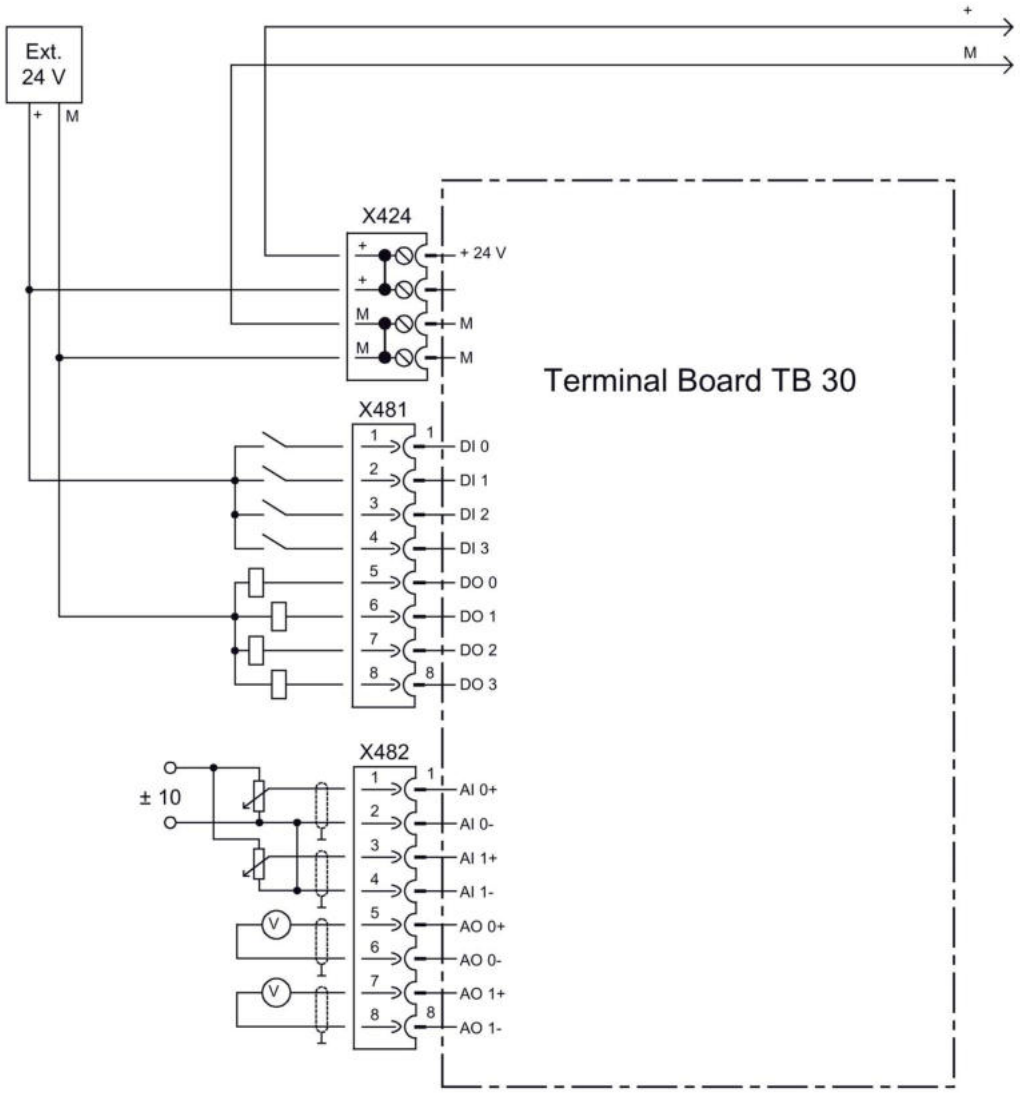
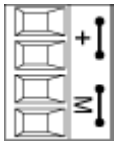


Figure 8-12 Connection overview TB30 Terminal Board

X424 power supply, digital outputs

Table 8- 7 Terminal block X424

Connector	Terminal	Function	Technical data
	+	Power supply	Voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: Max. 4 A (per digital output max. 0.5 A) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Power supply	
	M	Ground	
	M	Ground	
Max. connectable cross-section: 2.5 mm²			

The maximum cable length that can be connected is 10 m.

Note

The two "+" and "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.

This power supply is required for the digital outputs only.
The electronics power supply and the power supply for the analog inputs/outputs are taken from the option slot of the Control Unit.

Note

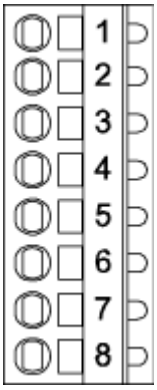
The power supply of the digital outputs and the electronic power supply of the Control Unit are isolated.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

X481 Digital inputs/outputs

Table 8- 8 Terminal block X481

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: - 3 ... 30 V Current consumption, typical: 10 mA at 24 V DC Ground reference: X424. M Input delay: - for "0" to "1": 20 µs - for "1" to "0": 100 µs Level (incl. ripple) High level: 15 … 30 V Low level: -3 … 5 V
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DO 0	Voltage: 24 V DC Max. load current per output: 500 mA Ground reference: X424.M Continued-short-circuit-proof Output delay: - for "0" to "1": Typ. 150 µs at 0.5 A resistive load (500 µs maximum) - For "1" to "0": Typically 50 µs at 0.5 A resistive load Switching frequency: - For resistive load: Max. 100 Hz - For inductive load: Max. 0.5 Hz - For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	6	DO 1	
	7	DO 2	
	8	DO 3	
Max. connectable cross-section: 0.5 mm²			

[1] DI: digital input, DO: Digital output

Note

Open input

An open input is interpreted as "low".

The power supply and the digital inputs/outputs are isolated from the Control Unit.

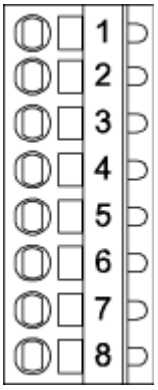
Note

Transient voltage interruptions

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

X482 Analog inputs/outputs

Table 8- 9 Terminal block X482

Connector	Terminal	Designation [1]	Technical data
	1	AI 0+	Analog inputs (AI)
	2	AI 0-	**Voltage**: -10 … +10 V; R_i: 65 kΩ
	3	AI 1+	**Common mode range**: ±30 V
	4	AI 1-	**Resolution**: 13 bits + sign
	5	AO 0+	Analog outputs (AO)
	6	AO 0-	**Voltage range**: -10 … +10 V
	7	AO 1+	**Load current**: max. -3 … +3 mA
	8	AO 1-	**Resolution**: 11 bit + signed Continuous short-circuit proof
Max. connectable cross-section: 0.5 mm²			

[1] AI: analog input, AO: Analog output

Note

Permissible voltage values

In order to avoid incorrect results of the analog-digital conversion, the analog differential voltage signals can have a maximum offset voltage of +/-30 V with respect to ground potential.

Note

Open input

An open input is interpreted as approximately "0 V".

The power supply of the analog inputs/outputs is drawn via the option slot of the Control Unit and not via X424.

The shield is connected to the Control Unit.

Shield connection of the TB30 on the Control Unit

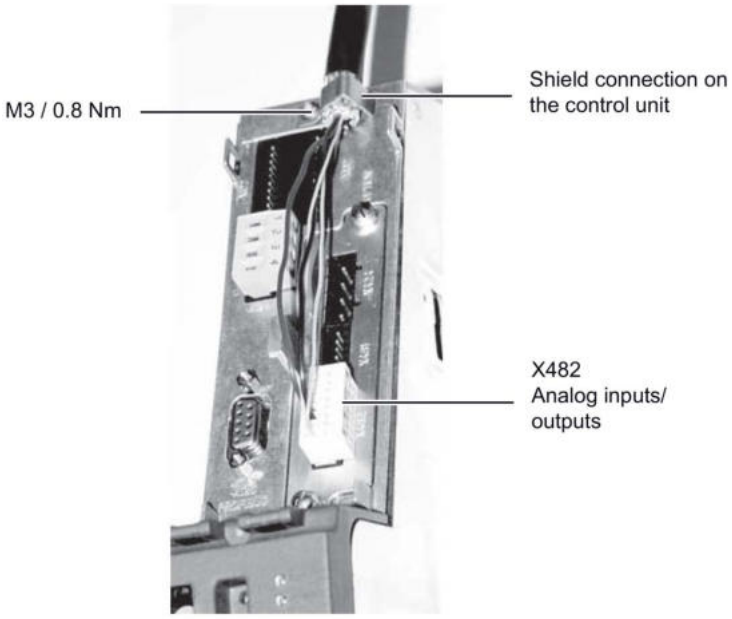


Figure 8-13 TB30 shield connection

The permissible bending radii for the cables must not be exceeded when the cables are being installed.

8.8 K01 to K05, safety license for 1 to 5 axes

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The Safety Integrated Basic functions do not require a license. A license is, however, required for each axis with safety functions in the case of Safety Integrated Extended functions. It is irrelevant which safety functions are used and how many.

In this case, option K01 is for 1 axis, option K02 for 2 axes etc. - up to option K05 for 5 axes.

- K01: Safety license for 1 axis
- K02: Safety license for 2 axes
- K03: Safety license for 3 axes
- K04: Safety license for 4 axes
- K05: Safety license for 5 axes

Note

Presently, a maximum of 5 safety axes with Safety Integrated Extended functions are possible on a Control Unit CU320-2.

Licenses

The required licenses can be ordered via options K01 - K05 together with the CompactFlash card.

Retroactive licensing is executed on the Internet via the "WEB License Manager" by generating a license key:
http://www.siemens.com/automation/license

Note

The generation of the license key is described in detail in the SINAMICS S120 Function Manual, Chapter "Basics of the drive system" under "Licensing".

Activation

The associated license key is entered into parameter p9920 in the ASCII code. The license key is activated by parameter p9921 = 1.

Diagnostics

An insufficient license is indicated via the following alarm and LED:

- Alarm A13000 → License not sufficient
- LED READY → Flashes green/red at 0.5 Hz

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.9 K08, AOP30 advanced operator panel

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules Chassis format
- Motor Modules Chassis-2 format

Note

Option K08 is only available in conjunction with the CU320-2 Control Unit (option K90 or K95).

Description



Figure 8-14 AOP30 Advanced Operator Panel (option K08)

The user-friendly AOP30 Advanced Operator Panel is an optional input/output device for commissioning, operation and diagnostic purposes.

The AOP30 communicates with the CU320-2 Control Unit via an RS 232 serial interface using the PPI protocol.

Characteristics

- Display with green backlighting (resolution: 240 x 64 pixels)
- 26-key keypad
- RS 232 interface
- Time and date memory powered by internal battery backup
- Selectable languages: German, English, French, Italian, Spanish, Chinese, Russian, Portuguese
- 4 LEDs indicate the operating condition of the drive unit:
  RUN, green
  ALARM, yellow
  FAULT, red
  LOCAL/REMOTE, green

Note

Additional documents

Detailed and comprehensive instructions and information for the AOP30 Advanced Operator Panel can be found in the relevant operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

→ See additional documentation "SINAMICS S120 Cabinet Module AOP30"

8.10 K46, Sensor Module Cabinet-Mounted SMC10

8.10.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle. The signals emitted by the resolver are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC10 Sensor Module:

- 2-pole resolver
- Resolver, multi-pole

The motor temperature can also be sensed using KTY84-130, PT1000 temperature sensors or PTC thermistors.

Table 8- 10 SMC10 specification

	Value
Transmission ratio of the resolver	ü = 0.5
Excitation voltage on the SMC10 for ü = 0.5 (cannot be parameterized)	4.1 V_{rms}
Amplitude monitoring threshold (secondary tracks) of the SMC10	1 V_{rms}

The maximum encoder cable length is 130 m.

The excitation frequency is synchronized to the current-controller clock cycle and lies in the range between 5 kHz and 10 kHz.

The ratio between ohmic resistance R and inductance L determines whether the resolver can be evaluated with the SMC10 (see diagram below).

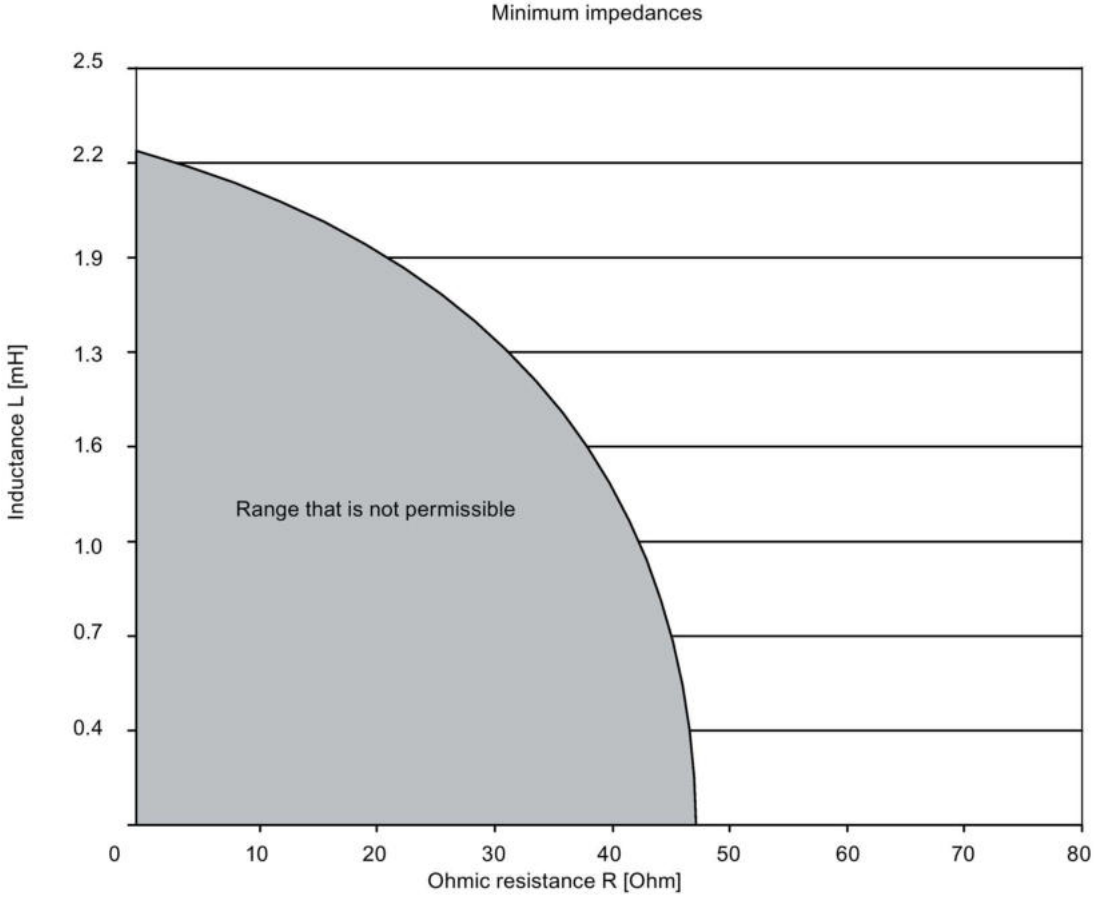


Figure 8-15 Connectable impedances with an excitation frequency f = 5000 Hz

8.10.2 Safety information



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Use temperature sensors that fully comply with the specifications of the safety isolation.

NOTICE

Damage when connecting an impermissible number of encoder systems

If more than the maximum permissible number of encoder systems are connected to a Sensor Module, this will cause damage.

- Only connect one encoder system to a Sensor Module.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

Note

Diminished level of interference immunity due to equalizing currents via the electronics ground

Ensure that there is no electrical connection between the encoder system housing and the signal cables, or the encoder system electronics.

If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

8.10.3 Interfaces

Overview

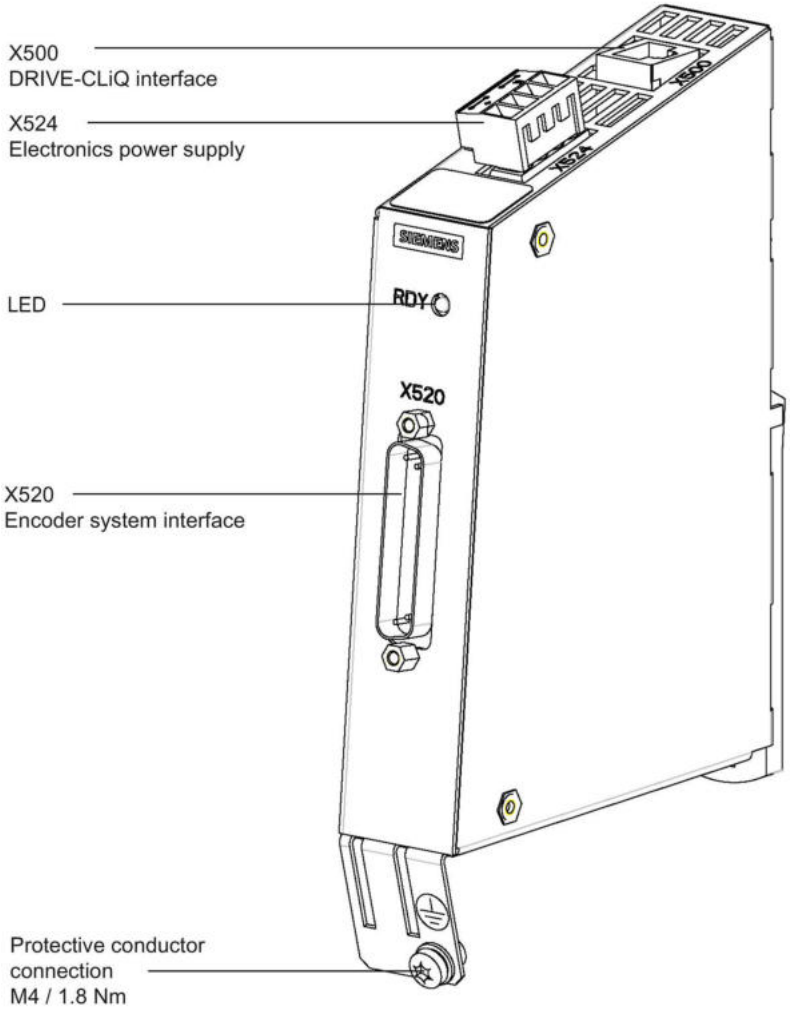
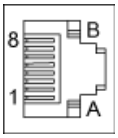


Figure 8-16 Interface overview for the SMC10

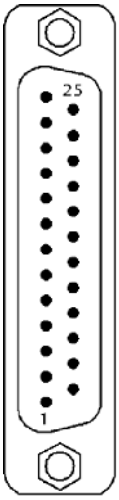
X500: DRIVE-CLiQ interface

Table 8- 11 DRIVE-CLiQ interface X500

Connector	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520 encoder interface

Table 8- 12 Encoder interface X520

Connector	Pin	Signal name	Technical data
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	S2	Resolver signal A (sin+)
	4	S4	Inverted resolver signal A (sin-)
	5	Ground	Ground (for internal shield)
	6	S1	Resolver signal B (cos+)
	7	S3	Inverted resolver signal B (cos-)
	8	Ground	Ground (for internal shield)
	9	R1	Resolver excitation positive
	10	Reserved, do not use	
	11	R2	Resolver excitation negative
	12	Reserved, do not use	
	13	+Temp [1)]	Temperature sensor KTY84-1C130 / PT1000 / PTC
	14	Reserved, do not use	
	15	Reserved, do not use	
	16	Reserved, do not use	
	17	Reserved, do not use	
	18	Reserved, do not use	
	19	Reserved, do not use	
	20	Reserved, do not use	
	21	Reserved, do not use	
	22	Reserved, do not use	
	23	Reserved, do not use	
	24	Ground	Ground (for internal shield)
	25	- Temp [1)]	Temperature sensor KTY84-1C130 / PT1000 / PTC
Connector type: 25-pin SUB D connector (pins)			
Measuring current via temperature sensor connection: 2 mA			

[1)] Accuracy of the temperature measurement:
- KTY: ±7 °C (including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B according to EN 60751 including evaluation)
- PTC: ±5 °C (including evaluation)

NOTICE
Damage to the motor in the event of incorrectly connected KTY temperature sensor If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor. • Connect a KTY temperature sensor with the correct polarity.

Note

Maximum signal cable length

The maximum signal cable length is 130 m.

8.10.4 Connection example

Connection example: Resolver, 8-pin

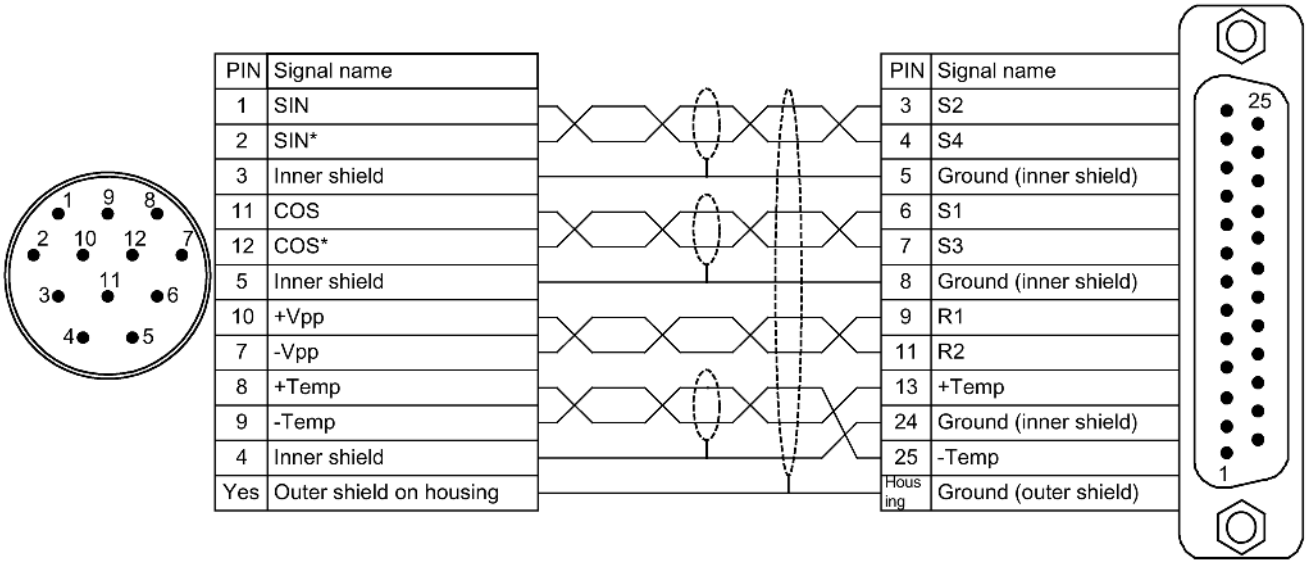


Figure 8-17 Connection example: Resolver, 8-pin

8.11 K48, Sensor Module Cabinet-Mounted SMC20

8.11.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The SMC20 Sensor Module is used to simultaneously record the speed and position. The signals emitted by the incremental encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC20 Sensor Module:

- Incremental encoder sin/cos 1 V_{pp}
- EnDat absolute encoder
- SSI encoder with incremental signals sin/cos 1 V_{pp}

The motor temperature can also be sensed using KTY84-130, PT1000 temperature sensors or PTC thermistors.

The maximum encoder cable length is 100 m.

8.11.2 Safety information



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Use temperature sensors that fully comply with the specifications of the safety isolation.

NOTICE

Damage when connecting an impermissible number of encoder systems

If more than the maximum permissible number of encoder systems are connected to a Sensor Module, this will cause damage.

- Only connect one encoder system to a Sensor Module.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

Note

Diminished level of interference immunity due to equalizing currents via the electronics ground

Ensure that there is no electrical connection between the encoder system housing and the signal cables, or the encoder system electronics.

If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

8.11.3 Interfaces

Overview

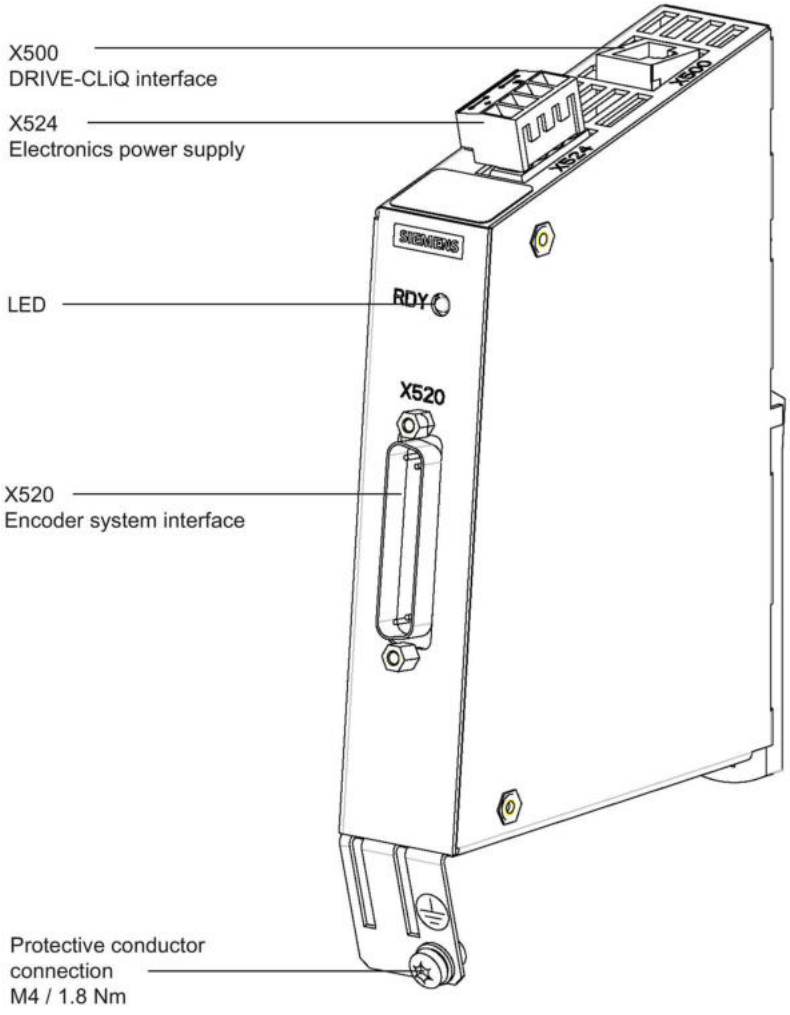
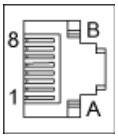


Figure 8-18 Interface overview for the SMC20

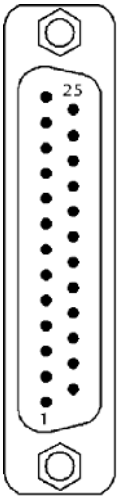
X500: DRIVE-CLiQ interface

Table 8- 13 DRIVE-CLiQ interface X500

Connector	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520 encoder interface

Table 8- 14 Encoder interface X520

Connector	Pin	Signal name	Technical data
	1	P encoder	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	A	Incremental signal A
	4	A*	Inverted incremental signal A
	5	Ground	Ground (for internal shield)
	6	B	Incremental signal B
	7	B*	Inverted incremental signal B
	8	Ground	Ground (for internal shield)
	9	Reserved, do not use	
	10	Clock	Clock, EnDat interface, SSI clock
	11	Reserved, do not use	
	12	Clock*	Inverted clock, EnDat interface, inverted SSI clock
	13	+Temp [1)]	Temperature sensor KTY84-1C130 / PT1000 / PTC
	14	P sense	Sense input for encoder power supply
	15	Data	Data, EnDat interface, SSI data
	16	M sense	Ground for sense input for encoder power supply
	17	R	Reference signal R
	18	R*	Inverted reference signal R
	19	C	Absolute track signal C
	20	C*	Inverted absolute value signal C
	21	D	Absolute track signal D
	22	D*	Inverted absolute track signal D
	23	Data*	Inverted data, EnDat interface, inverted SSI data
	24	Ground	Ground (for internal shield)
	25	-Temp [1)]	Temperature sensor KTY84-1C130 / PT1000 / PTC
Connector type: 25-pin SUB D connector (pins)			
Measuring current via temperature sensor connection: 2 mA			

[1)] Accuracy of the temperature measurement:
- KTY: ±7 °C (including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B according to EN 60751 including evaluation)
- PTC: ±5 °C (including evaluation)

NOTICE

Damage to the motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

P sense and M sense

The cables for P sense or M sense with P encoder or M encoder must be jumpered at the encoder end. The supply voltage of the encoder is detected by the SMC20 and automatically adjusted to 5 V to compensate any power loss.

Note

Maximum signal cable length

The maximum signal cable length is 100 m.

8.11.4 Connection example

Connection example: Incremental encoder sin/cos 1 Vpp, 2,048

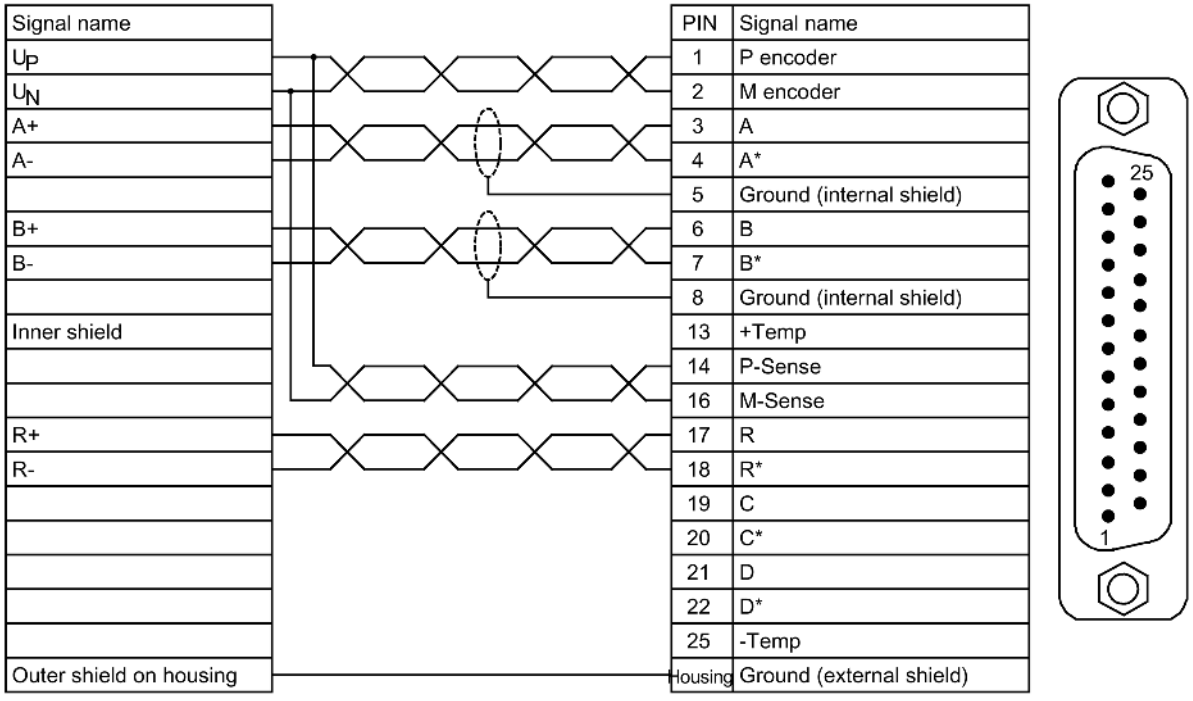


Figure 8-19 K48, connection example: Incremental encoder sin/cos 1 Vpp, 2,048

8.12 K50, Sensor Module Cabinet-Mounted SMC30

8.12.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The SMC30 Sensor Module is used for detecting the actual motor speed. The signals emitted by the rotary pulse encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC30 Sensor Module:

- TTL encoder
- HTL encoder
- SSI encoder
- KTY, PT1000 or PTC temperature sensor

Table 8- 15 Connectable encoders with supply voltage

Encoder type	X520 (SUB-D)	X521 (terminal)	X531 (terminal)	Open-circuit monitoring	Remote sense
HTL bipolar 24 V	Yes	Yes	Yes	Yes	No
HTL unipolar 24 V	Yes	Yes	Yes	No	No
TTL bipolar 24 V	Yes	Yes	Yes	Yes	No
TTL bipolar 5 V	Yes	Yes	Yes	Yes	To X520
TTL unipolar	No	No	No	No	No
SSI 24 V/5 V	Yes	Yes	Yes	No	No

Table 8- 16 Maximum encoder cable length

Encoder type	Maximum signal cable length in m
TTL	100
HTL unipolar	100
HTL bipolar	300
SSI	100

Note

Prefer a bipolar connection

Because the physical transmission media is more robust, the bipolar connection should always be used for HTL encoders. The unipolar connection should only be used if the encoder type does not output push-pull signals.

Note

Only connect one encoder system

Only one encoder system may be connected to the encoder module, either at X520 or at X521/X531. The corresponding unused interface must not be used.

Table 8- 17 Specification of encoder systems that can be connected

Parameter	Designation	Threshold [4]	Min.	Max.	Unit
High signal level (TTL bipolar at X520 or X521/X531) [1]	U_{Hdiff}		2	5	V
Low signal level (TTL bipolar at X520 or X521/X531) [1]	U_{Ldiff}		-5	-2	V
High signal level (HTL unipolar)	U_H [4]	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Low signal level (HTL unipolar)	U_L [4]	High	0	7	V
		Low	0	2	V
High signal level (HTL bipolar) [2]	U_{Hdiff}		3	V_{CC}	V
Low signal level (HTL bipolar) [2]	U_{Ldiff}		$-V_{CC}$	-3	V
High signal level (SSI bipolar at X520 or X521/X531) [1]	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531) [1]	U_{Ldiff}		-5	-2	V
Signal frequency	f_S		-	300	kHz
Edge clearance	t_{min}		100	-	ns
Zero pulse inactive time (before and after A=B=high)	t_{Lo}		640	$(t_{ALo\text{-}BHi} - t_{Hi})/2$ [3]	ns
Zero pulse active time (while A=B=high and beyond)	t_{Hi}		640	$t_{ALo\text{-}BHi} - 2 \times t_{Lo}$ [3]	ns

[1] Other signal levels according to the RS422 standard.

[2] The absolute level of the individual signals varies between 0 V and V_{CC} of the encoder system.

[3] $t_{ALo\text{-}BHi}$ is not a specified value, but is the time between the falling edge of track A and the next but one rising edge of track B.

[4] The threshold can be set via p0405.04 (switching threshold); the setting when delivered is "Low".

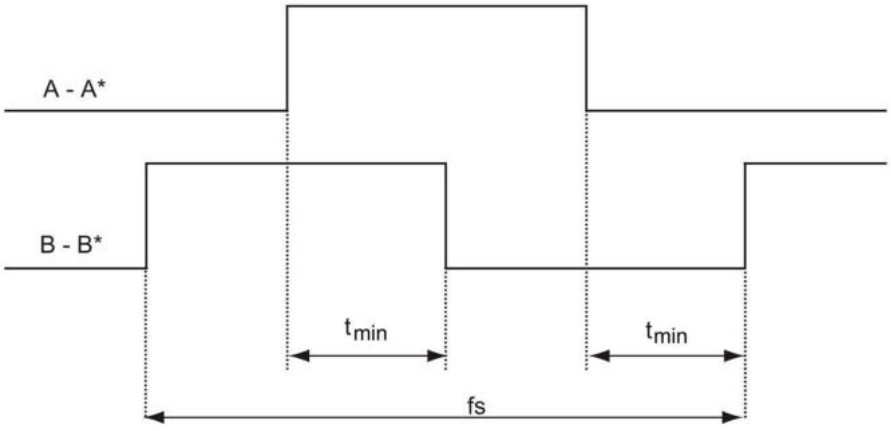


Figure 8-20 Signal characteristic of the A and B track between two edges: Time between two edges with pulse encoders

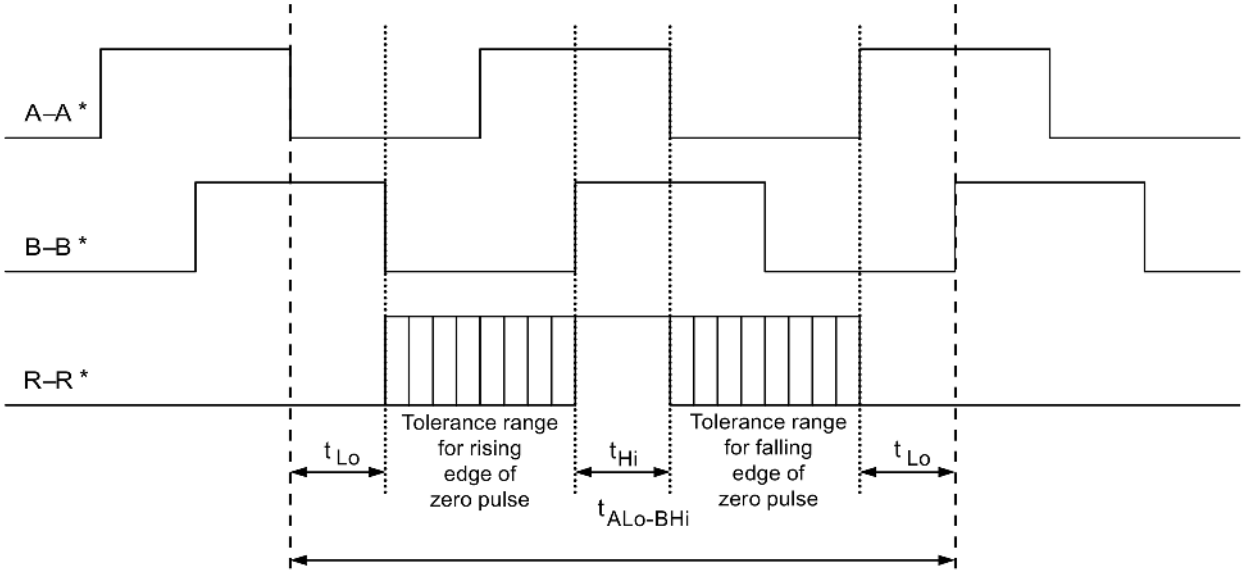


Figure 8-21 Position of the zero pulse to the track signals

For encoders with a 5 V supply at X521/X531, the cable length is dependent on the encoder current (this applies to cable cross-sections of 0.5 mm²):

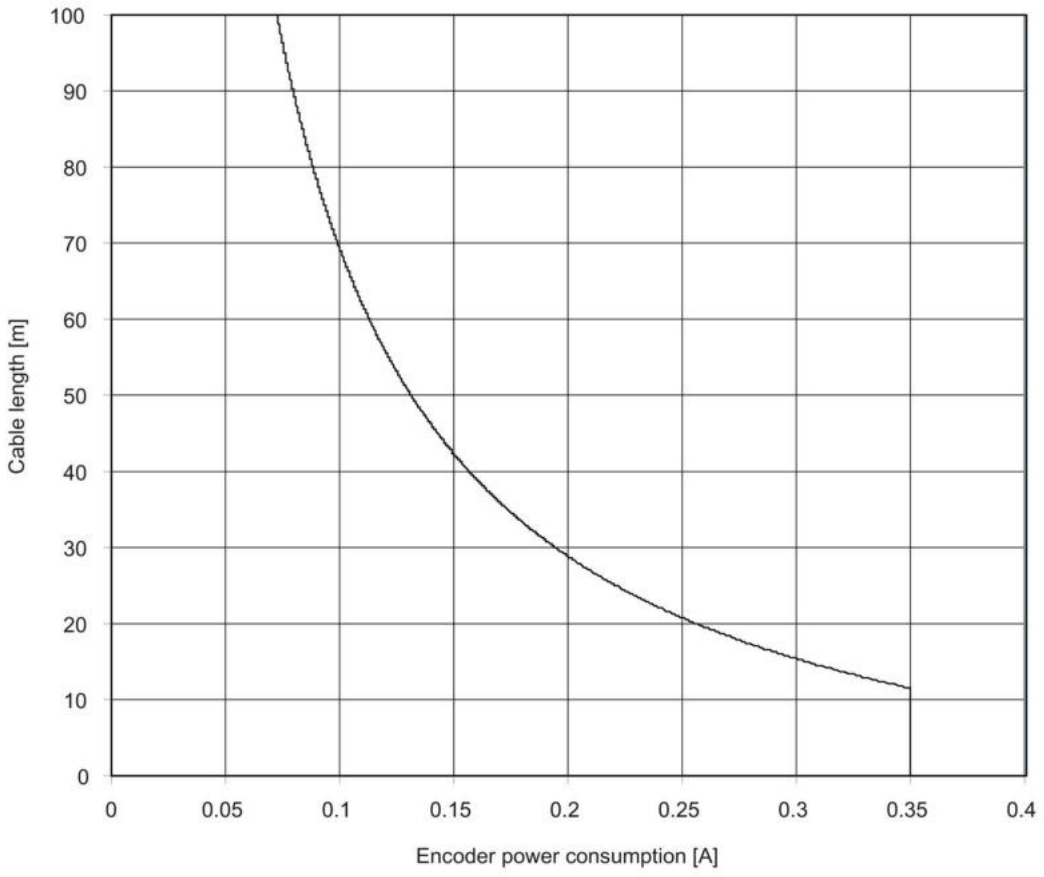


Figure 8-22 Signal cable length as a function of the encoder current consumption

For encoders without Remote Sense the permissible cable length is restricted to 100 m (reason: the voltage drop depends on the cable length and the encoder current).

8.12.2 Safety information



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Use temperature sensors that fully comply with the specifications of the safety isolation.

NOTICE

Damage when connecting an impermissible number of encoder systems

If more than the maximum permissible number of encoder systems are connected to a Sensor Module, this will cause damage.

- Only connect one encoder system to a Sensor Module.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

Note

Diminished level of interference immunity due to equalizing currents via the electronics ground

Ensure that there is no electrical connection between the encoder system housing and the signal cables, or the encoder system electronics.

If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

8.12.3 Interfaces

Overview

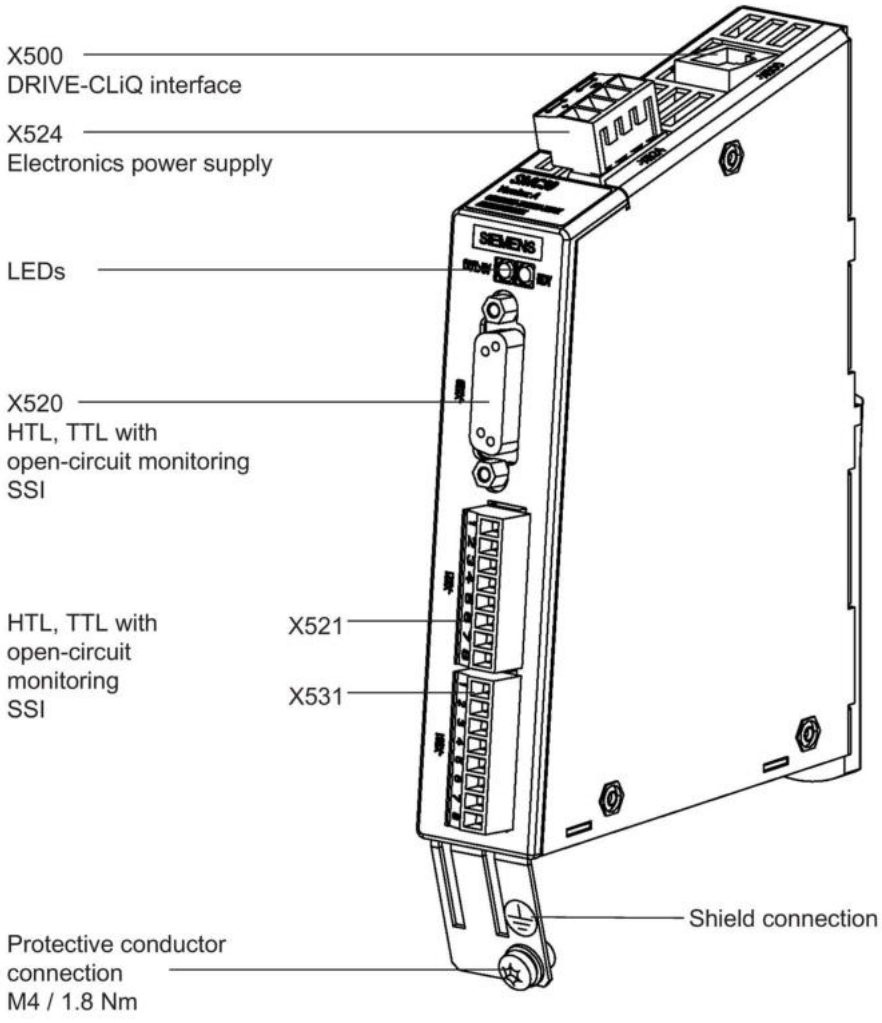
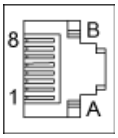


Figure 8-23 Interface overview for the SMC30

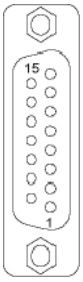
X500: DRIVE-CLiQ interface

Table 8- 18 DRIVE-CLiQ interface X500

Connector	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520 encoder connection 1 for HTL/TTL/SSI encoder with open-circuit monitoring

Table 8- 19 Encoder connection X520

Connector	Pin	Signal name	Technical data
	1	+Temp [1]	Temperature sensor connection KTY84-1C130 / PT1000 / PTC Bimetallic switch with NC contact
	2	Clock	SSI clock
	3	Clock*	Inverted SSI clock
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	Encoder power supply
	6	P sense	Sense input for encoder power supply
	7	M encoder (M)	Ground for encoder power supply
	8	-Temp [1]	Temperature sensor connection KTY84-1C130 / PT1000 / PTC Bimetallic switch with NC contact
	9	M sense	Ground for sense input
	10	R	Reference signal R
	11	R*	Inverted reference signal R
	12	B*	Inverted incremental signal B
	13	B	Incremental signal B
	14	A*/data*	Inverted incremental signal A/inverted SSI data
	15	A/data	Incremental signal A/SSI data
Connector type: 15-pin Sub-D socket			
Measuring current via temperature sensor connection: 2 mA			

[1] Accuracy of the temperature measurement:
- KTY: ±7 °C (including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B according to EN 60751 including evaluation)
- PTC: ±5 °C (including evaluation)

NOTICE

Damage to the motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

NOTICE

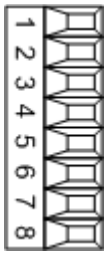
Damage to the encoder due to incorrect supply voltage

The encoder power supply can be parameterized to 5 V or 24 V. The encoder may be damaged if you enter the wrong parameter.

- Select the appropriate supply voltage.

X521/X531 encoder connection 2 for HTL/TTL/SSI encoder with open-circuit monitoring

Table 8- 20 Encoder connection X521

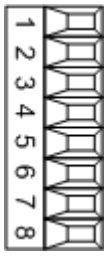
Connector	Terminal	Signal name	Technical data
	1	A	Incremental signal A
	2	A*	Inverted incremental signal A
	3	B	Incremental signal B
	4	B*	Inverted incremental signal B
	5	R	Reference signal R
	6	R*	Inverted reference signal R
	7	CTRL	Control signal
	8	M	Ground
Max. connectable cross-section: 1.5 mm²			

Note

Operation of unipolar HTL encoders

When unipolar HTL encoders are used, terminal block A*, B*, and R* must be jumpered with M encoder (-X531).

Table 8- 21 Encoder connection X531

Connector	Terminal	Signal name	Technical data
	1	P encoder 5 V / 24 V	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	-Temp [1]	Temperature sensor KTY84-1C130 / PT1000 / PTC Bimetallic switch with NC contact
	4	+Temp [1]	
	5	Clock	SSI clock
	6	Clock*	Inverted SSI clock
	7	Data	SSI data
	8	Data*	Inverted SSI data
Max. connectable cross-section: 1.5 mm²			
Measuring current via temperature sensor connection: 2 mA			

[1] Accuracy of the temperature measurement:
- KTY: ±7 °C (including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B according to EN 60751 including evaluation)
- PTC: ±5 °C (including evaluation)

NOTICE

Damage to the motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

NOTICE

Damage to the encoder due to incorrect supply voltage

The encoder power supply can be parameterized to 5 V or 24 V. The encoder may be damaged if you enter the wrong parameter.

- Select the appropriate supply voltage.

Note

Cable shield for the encoder connection via terminals

Note that when the encoder is connected via terminals, the cable shield must be applied to the module.

8.12.4 Connection example

Connection example 1: HTL encoder, bipolar, without zero mark -> p0405 = 9 (hex)

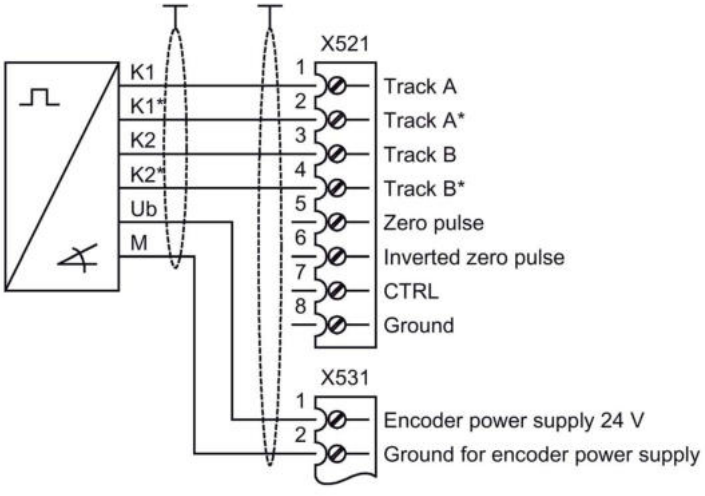


Figure 8-24 Connection example 1: HTL encoder, bipolar, without zero mark

Connection example 2: TTL encoder, unipolar, without zero track -> p0405 = A (hex)

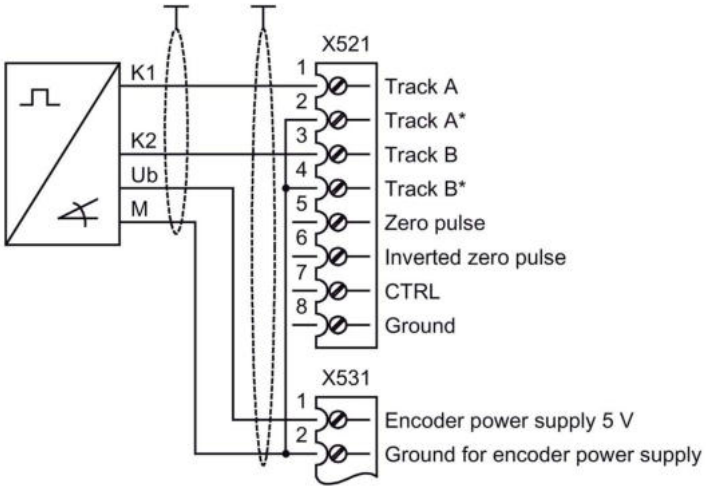


Figure 8-25 Connection example 2: TTL encoder, unipolar, without zero track

8.13 K51, VSM10 Voltage Sensing Module Cabinet-Mounted

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The VSM10 Voltage Sensing Module is used to sense the voltage characteristic on the motor side, so that the following functions can be implemented:

- Operation of a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function).
- Fast flying restart of large induction motors: The time for the demagnetization of the motor is eliminated as a result of the voltage sensing.

The terminals on the Voltage Sensing Module (-T1-B51) are pre-assigned in the factory and must not be changed by the customer.

When operating a permanent-magnet synchronous motor without encoder, the "Flying restart" function must be activated with p1200.

Interfaces

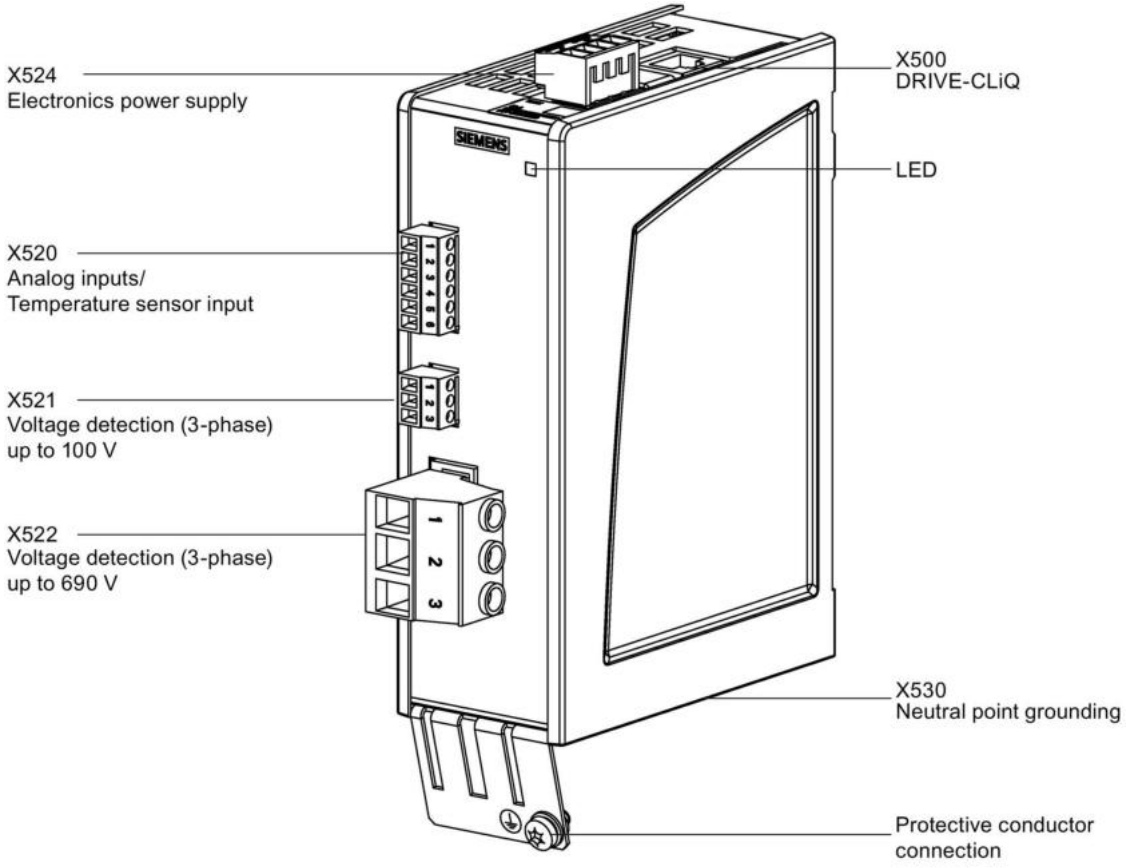


Figure 8-26 Interface overview for the Voltage Sensing Module (option K51)

Removing the connector jumper in the Voltage Sensing Module VSM10

At the Voltage Sensing Module (VSM10), the connector jumper in terminal X530 on the lower side of the component must be removed if you are using the cabinet unit on a non-grounded line supply (IT system).

Use two screwdrivers or a suitable tool in order to relieve the holding springs in the terminal and then withdraw the connector jumper.

	
Terminal X530 with connector jumper	Relieve the springs and withdraw the connector jumper

Note

False tripping caused by not removing the connection clip with a non-grounded line supply

Failure to remove the connector jumper on a non-grounded line supply (IT system) can cause false tripping in case of sensitive IT network monitoring.

- For an ungrounded line supply system (IT system), remove the plug-in jumper.

8.14 K52, Additional SMC30 Sensor Module

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

With option K50, an SMC30 Sensor Module is included in the cabinet unit. The additional SMC30 Sensor Module enables reliable actual value acquisition when using Safety Integrated Extended Functions.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.15 K70, fan power supply

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Module

Description

With this option, the line voltage supply for the auxiliary power supply system is picked off after the circuit-breaker (-Q10) and is protected using a motor protection circuit-breaker -(Q12).

Voltages 1 AC 230 V and 24 VDC of the auxiliary power supply system must be supplied on the plant side.

8.16 K73, auxiliary power supply 24 V DC

Availability of option

- Booksize Base Cabinets

Description

The 24 V DC supply for standard Booksize Cabinet Kits is tapped from the auxiliary power supply.

With option K73, the 24 V DC supply is provided by a dedicated SITOP.

8.17 K76, auxiliary voltage generating unit in the Line Connection Module

Availability of option

- Line Connection Modules
- Active Line Connection Modules-2

Description

Cabinet Modules require an auxiliary energy supply to function properly. This current demand must be included in the configuration and supplied from an external source. If an external supply is not possible, the required auxiliary voltages can be generated by an Auxiliary Power Supply Module.

Alternatively, option K76 can be selected to generate the auxiliary voltages in the Line Connection Module. This is particularly advisable for smaller device configurations.

The following auxiliary voltages are available:

- 2 AC 380 ... 480 V or 500 ... 690 V
  possible tap for the following Line Connection Modules:
  - Line Connection Module with rated current up to 800 A: 35 A
  - Line Connection Module with rated current up to 1000 ... 1600 A: 50 A
  - Line Connection Module 6SL3700-0LE42-0AA3: 50 A
  - Line Connection Module with rated current up to 2000 ... 3200 A: 80 A
- 230 VAC (poss. tap approx. 4 ... 6 A)
- 24 VDC (poss. tap approx. 20 ... 40 A)

In the Line Connection Module, the auxiliary voltages are connected to the auxiliary voltage module, and therefore supply the complete cabinet group.

If the Cabinet Modules are delivered as factory-assembled transport units (option Y11), the electrical installation work has already been carried out.
If the parts are delivered individually, the auxiliary power supply interface must be installed with three cables on site.

Depending on the version, the power loss is approx. 100 W.

Adapting the auxiliary power supply (-T10)

A transformer is installed in the Line Connection Module (-T10) for the 230 VAC auxiliary power supply for the cabinet. The location of the transformer is indicated in the layout diagrams supplied.

When delivered, the taps are always set to the highest level. The line-side terminals of the transformer may need to be reconnected to the existing line voltage.

The line voltage assignments for making the appropriate setting on the transformer for the internal power supply are indicated in the following tables.

Table 8- 22 Line voltage assignment for the internal power supply (380 ... 480 V AC, 3 phase)

Line supply voltage range	Tap	Adaptation transformer taps (-T10) LH1 – LH2
342 ... 390 V	380 V	1 – 2
391 ... 410 V	400 V	1 – 3
411 ... 430 V	415 V	1 – 4
431 ... 450 V	440 V	1 – 5
451 ... 470 V	460 V	1 – 6
471 ... 528 V	480 V	1 – 7

Table 8- 23 Line voltage assignment for the internal power supply (500 ... 690 V AC, 3 phase)

Line supply voltage range	Tap	Adaptation transformer taps (-T10) LH1 – LH2
450 ... 515 V	500 V	1 – 8
516 ... 540 V	525 V	1 – 9
541 ... 560 V	550 V	1 – 10
561 ... 590 V	575 V	1 – 11
591 ... 630 V	600 V	1 – 12
631 ... 680 V	660 V	1 to 14, terminals 12 and 13 are jumpered
681 ... 759 V	690 V	1 to 15, terminals 12 and 13 are jumpered

NOTICE

Material damage when the voltage is set too high

If the terminals are not reconnected corresponding to the actual line voltage, this can damage the device if the voltage is set too high.

- Set the terminals in accordance with the actual line voltage.

8.18 K82, terminal module for activating safety functions "Safe Torque Off" and "Safe Stop 1"

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The option K82 (Terminal Module for activating "Safe Torque Off" and "Safe STOP 1") is used for isolated activation via a variable control voltage range of the safety functions already present in the standard, which can also be used without option K82.

Use option K82 to activate the following Safety Integrated Functions (terminology according to EN 61800-5-2):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1, time-controlled)

Note

Standard requirements

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 (formerly EN 954-1) for Performance Level (PL) d and EN 61508 SIL2.

In combination with the option K82, the requirements specified in EN 61800-5-2, EN 60204-1, as well as in DIN EN ISO 13849-1 Category 3 (formerly EN 954-1) are satisfied for Performance Level (PL) d and EN 61508 SIL2.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.19 K87, Terminal Module TM54F



Figure 8-27 Option K87, Terminal Module TM54F

Availability of option

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The TM54F Terminal Module is a terminal expansion module with safe digital inputs and outputs for controlling the Safety Integrated functions of SINAMICS.

The TM54F must be directly connected to a Control Unit via DRIVE-CLiQ. Motor Modules or Line Modules must not be connected to a TM54F.
Precisely one TM54F can be assigned to each Control Unit.

TM54F features the following interfaces:

Table 8- 24 Overview of the TM54F interfaces

Type	Quantity
Fail-safe digital outputs (F-DO)	4
Fail-safe digital inputs (F-DI)	10
Sensor[1] power supplies, dynamic response supported [2]	2
Sensor[1] power supply, no dynamic response	1
Digital inputs to check F_DO for a test stop	4

[1] Sensors: Fail-safe devices to issue commands and sense, for example, emergency stop pushbuttons and safety locks, position switches and light arrays/light curtains.

[2] Dynamic response: The sensor power supply is switched on and off by the TM54F when the forced dormant error detection is active for the sensors, cable routing, and the evaluation electronics.

The TM54F provides 4 fail-safe digital outputs and 10 fail-safe digital inputs. A fail-safe digital output consists of a 24 VDC switching output, a ground switching output, and a digital input for checking the switching state. A fail-safe digital input comprises two digital inputs.

Note

Rated values of the F-DO

The rated values of the F-DO meet the requirements of EN 61131-2 for digital DC outputs with 0.5 A rated current.

The operating ranges of the F-DI meet the requirements of EN 61131-2 for Type 1 digital inputs.

Note

Shielding cables

Please note that the F-DIs must take the form of shielded cables if they are > 30 m in length.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.20 K88, Safe Brake Adapter SBA 230 V AC

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules in chassis format
- Motor Modules Chassis-2 format

Description

The Safe Brake Control (SBC) is a safety function, that is used in safety-related applications, e.g. in presses or in rolling mills. In the current-free state, the brake acts on the motor of the drive by spring force. The brake is released when current flows (=low active).

The maximum brake current is 2 A.

The Safe Brake Adapter 230 VAC is installed in the cabinet unit in the factory. An infeed is connected to terminal -X12 on the Safe Brake Adapter to provide the necessary power. For control, a connection is established between the Safe Brake Adapter and the Control Interface Module using a cable harness installed in the factory.

For controlling the brake, a connection must be established on-site between terminal -X14 on the Safe Brake Adapter and the rectifier of the brake. It is not permissible that AC brakes are directly controlled.

NOTICE

Device failure as a 24 V DC brake has been connected

When a 24 VDC brake is connected to option K88 (Safe Brake Adapter 230 VAC) this can damage the Safe Brake Adapter and cause the device to fail (when the brake closes this is not displayed by an LED, the fuses can then trip, the relay contact service life is reduced).

- Do not connect a 24 VDC brake to the 230 VAC Safe Brake Adapter.

Note

Maximum cable length of the brake control

The maximum permissible cable length of 300 m between the Safe Brake Adapter 230 VAC and the brake must be observed. To accurately calculate the maximum cable length, see the SINAMICS Low-Voltage Configuration Manual on the customer DVD supplied with the device.

Fast de-energization

Some brake rectifier types are equipped with two additional connections for switching the brake load on the DC side. This allows the brake coil to be quickly deenergized, i.e. braking starts earlier.

The Safe Brake Adapter supports such fast de-energizing using the two additional connections -X15:1 and -X15:2. This function does not belong to safe brake control.

Notes

Note

Replacement fuses

The article numbers for spare fuses can be taken from the spare parts list supplied.

Note

Standard requirements

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 (formerly EN 954-1) for Performance Level (PL) d and IEC 61508 SIL2.

With the Safe Brake Adapter (option K88), the requirements specified in EN 61800-5-2, EN 60204-1, DIN EN ISO 13849-1 Category 3 (formerly EN 954-1) as well as for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.21 K90, Control Unit CU320-2 DP

8.21.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

With option K90, a CU320-2 DP Control Unit is installed in the Line Modules and Motor Modules of the drive line-up; this assumes the functions of communication, open-loop control, and closed-loop control for up to 4 Motor Modules, in addition to 1 Line Module.

The connection to the relevant modules and any additional I/O modules is established via DRIVE-CLiQ. A standard PROFIBUS interface is available for higher-level communication.

The unit can communicate with other participants via PROFIBUS or the DRIVE-CLiQ interface, see SINAMICS Low-Voltage Configuration Manual on the customer DVD supplied with the device.

Note

CU320-2 Control Unit without performance enhancement

Without performance enhancement, it is generally possible to operate 2 Motor Modules plus 1 Line Module.

Note

Performance enhancement

The computing capacity required increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. The full computing capacity of the CU320-2 Control Unit is available only with performance enhancement.

8.21.2 Connection overview

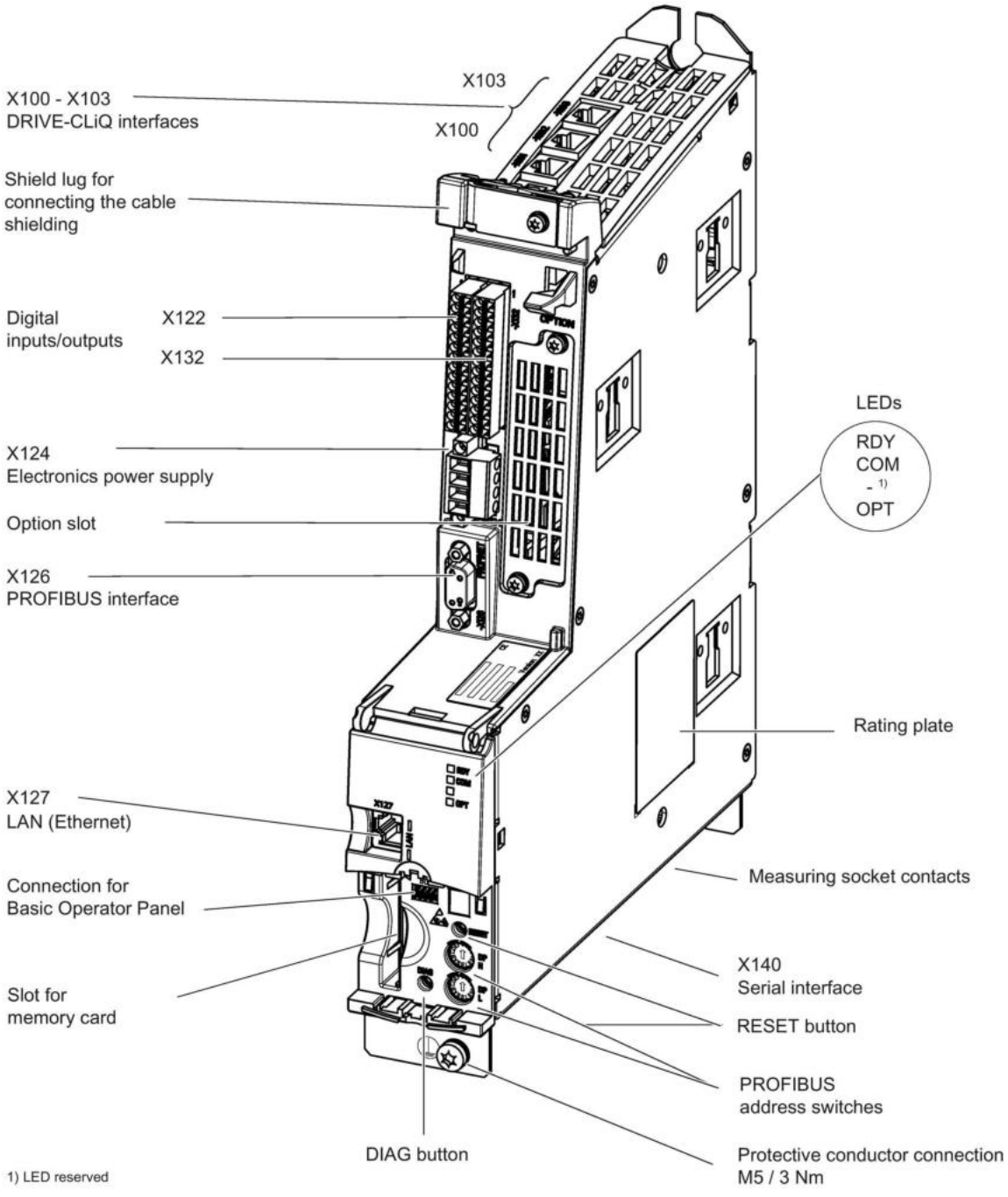


Figure 8-28 Connection overview of the CU320-2 DP Control Unit (without cover)

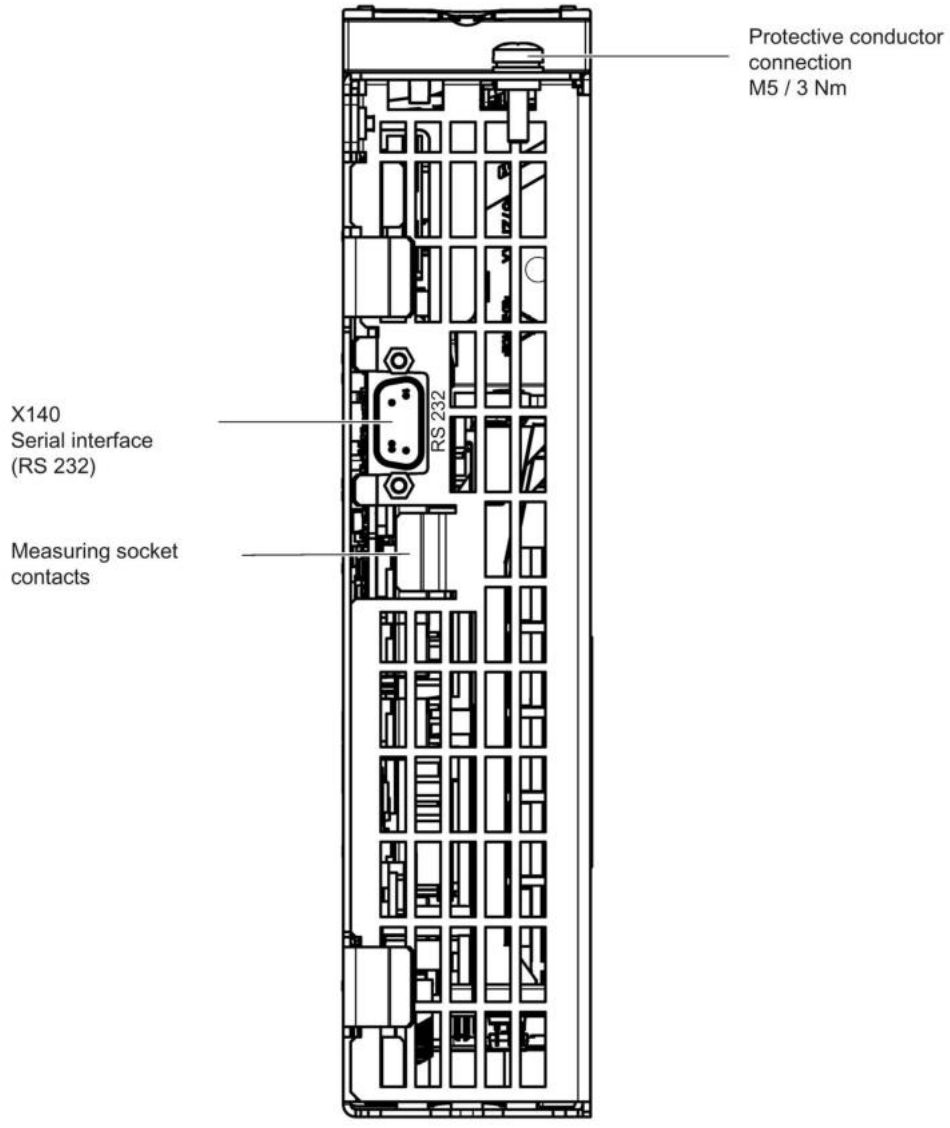


Figure 8-29 Interface X140 and measuring sockets T0 to T2 - CU320-2 DP (view from below)

NOTICE
Malfunctions or damage to the option board by inserting and withdrawing in operation Withdrawing and inserting the option board in operation can damage it or cause it to malfunction. • Only withdraw or insert the Option Board when the Control Unit is in a no-current condition.

8.21.3 Connection example

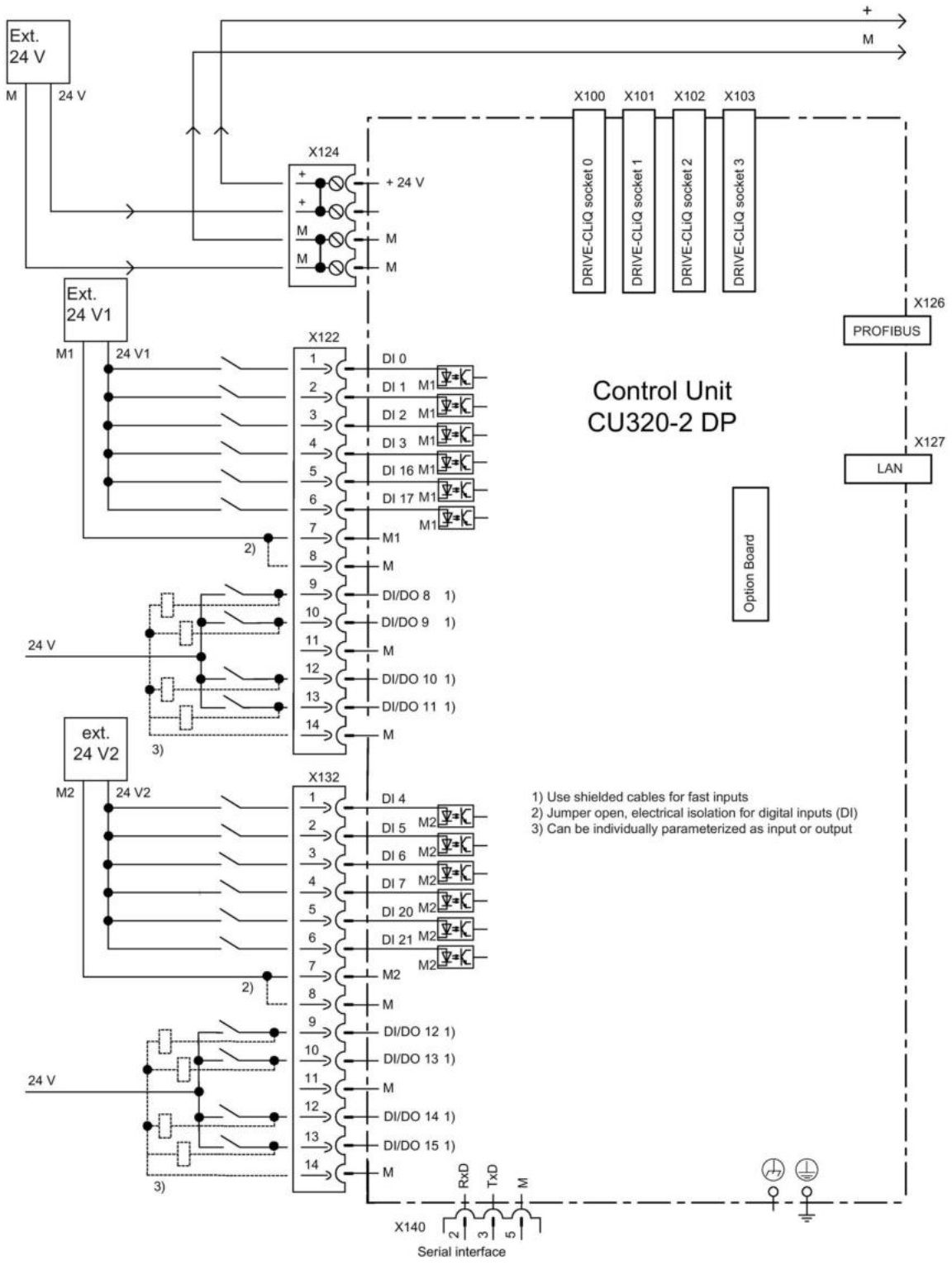


Figure 8-30 Connection example of CU320-2 DP

Note

Power supply for the digital inputs

In the circuit example, the power for the digital inputs (terminals -X122 and -X132) is supplied from the internal 24 V supply of the Control Unit (terminal -X124).

The two groups of digital inputs (optocoupler inputs) each have a common reference potential (reference ground M1 or M2). To close the circuit when the internal 24 V supply is used, the reference grounds M1 / M2 are connected to internal ground (M).

If power is not supplied from the internal 24 V supply (terminal -X124), the jumper between grounds M1 and M or M2 and M must be removed in order to avoid potential current loops. The external ground must then be connected to terminals M1 and M2.

8.21.4 X55 customer terminal strip

8.21.4.1 Overview

Description

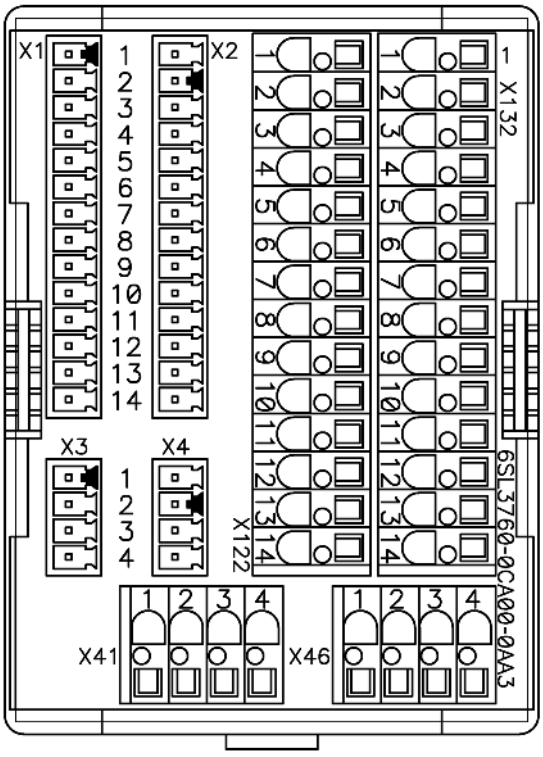


Figure 8-31 Customer terminal strip -X55

The customer terminal block- X55 is installed in the cabinet together with the CU320-2 Control Unit. The digital inputs/outputs of the Control Unit can be used via terminal blocks -X55-X122 and -X55-X132.

Note

Internally wired interfaces

Interfaces -X1, -X2, -X3 and -X4 are wired within the cabinet and are not available for customer connections!

If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be interchanged! Otherwise, "Safe Torque Off" and "Safe Stop 1" will malfunction!

Note

Customer terminal block as standard

The customer terminal block is a standard component in the cabinet for the Motor Module Cabinet Module (chassis format). The digital inputs/outputs of the CU320-2 Control Unit on terminal blocks -X55-X122 and -X55-X132 can only be used in conjunction with a Control Unit.

Note

Power supply for the digital inputs

The two groups of digital inputs (DI0 to DI3, DI16 and DI17 or DI4 ... DI7, DI20 and DI21) each have a common reference potential per group (reference ground M1 or M2). To close the circuit when the internal 24 V supply is used, the reference grounds M1 / M2 are connected to internal ground (M).

If power is supplied from an external source, the jumper between ground M1 and M or M2 and M must be removed in order to avoid potential looping. The external ground must then be connected to terminals M1 or M2.

Pin assignment of customer terminal strip –X55

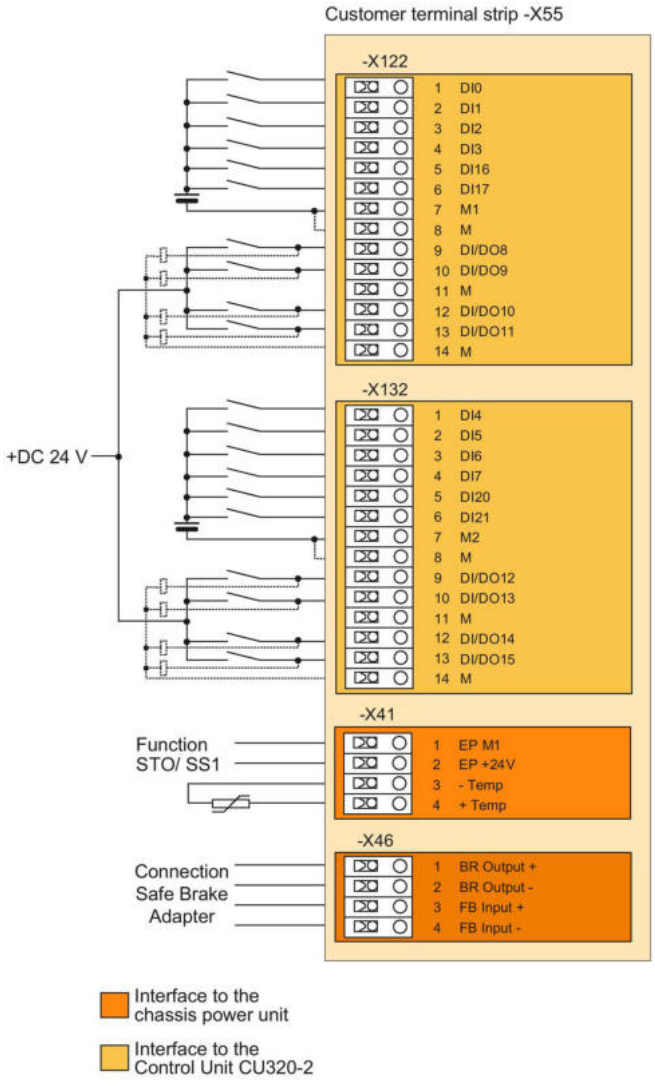
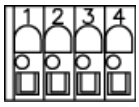


Figure 8-32 Connection assignment of customer terminal block -X55 (example: Motor Module Cabinet Module (chassis format))

8.21.4.2 X41 EP terminal / temperature sensor connection

Table 8- 25 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 to 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled.
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic switch with NC contact
	4	+ Temp	
Max. connectable cross-section: 2.5 mm²			



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

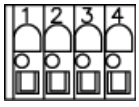
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated Functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.21.4.3 X46 Brake control and monitoring

Table 8- 26 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: 2.5 mm^2			

Note

The interface is intended for connection of the Safe Brake Adapter.

⚠WARNING

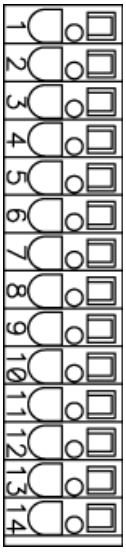
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables connected to terminal strip X46 can cause components to overheat with the associated risk of fire and smoke.

- Limit the length of the connecting cables to a maximum of 10 m.
- Do not route the connection cable outside the control cabinet or control cabinet group.

8.21.4.4 X122 digital inputs/outputs

Table 8- 27 Terminal block X122 on the customer terminal block X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage (max.): -3 ... +30 V DC Typical power consumption: 9 mA at 24 V Electrical isolation: reference potential is M1 terminal Level (with ripple) High level: 15 … 30 V Low level: -3 … +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (with ripple) High level: 15 … 30 V Low level: -3 … +5 V DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For resistive load: Max. 100 Hz For inductive load: max. 0.5 Hz For lamp load: max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 2.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronic ground; M1: Reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M1 must be connected.

This is achieved through one of the following measures:

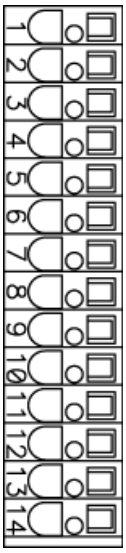
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

8.21.4.5 X132 digital inputs/outputs

Table 8- 28 Terminal block X132 on the customer terminal block X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage (max.): -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Electrical isolation: reference potential is M2 terminal Level (including ripple) High level: 15 … 30 V Low level: -3 … +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 … 30 V Low level: -3 … +5 V DI/DO 12, 13, 14, and 15 are "rapid inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For resistive load: Max. 100 Hz For inductive load: max. 0.5 Hz For lamp load: max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: 2.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved through one of the following measures:

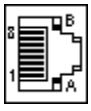
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

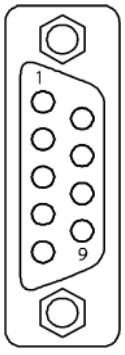
8.21.5 X100 - X103 DRIVE-CLiQ interface

Table 8- 29 DRIVE-CLiQ interface X100 - X103

Connector	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Connector type: RJ45 socket Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

8.21.6 X126 PROFIBUS

Table 8- 30 X126 PROFIBUS interface

Connector	Pin	Signal name	Meaning	Range
	1	-	Not assigned	
	2	M24_SERV	Teleservice supply, ground	0 V
	3	RxD / TxD–P	Receive/transmit data P (B)	RS485
	4	CNTR–P	Control signal	TTL
	5	DGND	PROFIBUS data reference potential	
	6	VP	Supply voltage plus	5 V ± 10%
	7	P24_SERV	Teleservice supply, + (24 V)	24 V (20.4 ... 28.8 V)
	8	RxD / TxD–N	Receive/transmit data N (A)	RS485
	9	-	Not assigned	
Connector type: 9-pin Sub-D socket				

NOTICE

Damage to the Control Unit or other PROFIBUS nodes due to high leakage currents

Significant leakage currents can flow along the PROFIBUS cable if a suitable equipotential bonding conductor is not used and destroy the Control Unit or other PROFIBUS nodes.

- An equipotential bonding conductor with a cross-section of at least 25 mm² must be used between components in a system that are located at a distance from each other.

NOTICE

Damage to the Control Unit or other CAN bus nodes due to the connection of a CAN cable

If a CAN cable is connected to the X126 interface, this can destroy the Control Unit or other CAN bus nodes.

- Do not connect any CAN cables to the X126 interface.

Note

Remote diagnostics

A teleservice adapter can be connected to the PROFIBUS interface (X126) for remote diagnostics.
The power supply for the teleservice (terminals 2 and 7) can have a max. load of 150 mA.

PROFIBUS connectors

The first and last nodes in a bus must contain terminating resistors. Otherwise, data transmission will not function correctly.

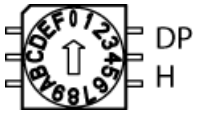
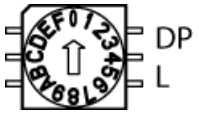
The bus terminating resistors are activated in the connector.

The cable shield must be connected at both ends and over a large surface area.

8.21.7 PROFIBUS address switch

The PROFIBUS address is set as a hexadecimal value via two rotary coding switches. Values between 0_{dec} (00_{hex}) and 127_{dec} ($7F_{hex}$) can be set as the address. The upper rotary coding switch (H) is used to set the hexadecimal value for 16^1 and the lower rotary coding switch (L) is used to set the hexadecimal value for 16^0.

Table 8- 31 PROFIBUS address switch

Rotary coding switches	Significance	Examples		
		21_{dec}	35_{dec}	126_{dec}
		15_{hex}	23_{hex}	$7E_{hex}$
	$16^1 = 16$	1	2	7
	$16^0 = 1$	5	3	E

Setting the PROFIBUS address

The factory setting for the rotary coding switches is 0_{dec} (00_{hex}).

There are two ways to set the PROFIBUS address:

1. Using parameter p0918
   - To set the bus address for a PROFIBUS node using STARTER, first set the rotary code switches to 0_{dec} (00_{hex}) and/or 127_{dec} ($7F_{hex}$).
   - Then use parameter p0918 to set the address to a value between 1 and 126.
2. Using the PROFIBUS address switches on the Control Unit
   - The address is set manually to values between 1 and 126 using the rotary coding switches. In this case, p0918 is only used to read the address.

The address switch is behind the blanking plate. The blanking plate is part of the scope of supply.

8.21.8 X127 LAN (Ethernet)

Note

Use

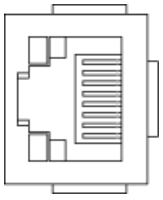
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

Further, the following restrictions apply to X127:

- Only local access is possible
- No networking - or only local networking in a closed and locked electrical cabinet permissible

If it is necessary to remotely access the electrical cabinet, then additional security measures must be applied so that misuse through sabotage, unqualified data manipulation and intercepting confidential data is completely ruled out (also see Chapter "Industrial Security (Page 23)").

Table 8- 32 X127 LAN (Ethernet)

Connector	Pin	Designation	Technical data
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket			

Note

The LAN (Ethernet) interface does not support Auto MDI(X). If the LAN interface of the communication partner also cannot handle auto-MDI(X), then a crossover cable must be used to establish the connection.

Note

Support during commissioning

The X127 LAN interface supports commissioning and diagnostic functions. It must not be connected for normal operation.

For diagnostic purposes, the X127 LAN interface features a green and a yellow LED. These LEDs indicate the following status information:

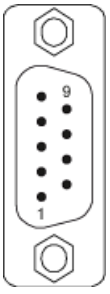
Table 8- 33 LED statuses for the X127 LAN interface

LED	State	Description
Green	On	10 or 100 Mbit link available
	Off	Missing or faulty link
Yellow	On	Sending or receiving
	Off	No activity

8.21.9 X140 serial interface (RS232)

The AOP30 operator panel for operating/parameterizing the device can be connected via the serial interface. The interface is located on the underside of the Control Unit.

Table 8- 34 Serial interface (RS232) X140

Connector	Pin	Designation	Technical data
	2	RxD	Receive data
	3	TxD	Transmit data
	5	Ground	Ground reference
Connector type: 9-pin Sub-D connector			

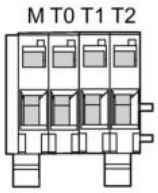
Note

Connecting cable to the AOP30

The connecting cable to AOP30 may only contain the three contacts which are listed in the table; a completely assigned cable may not be used.

8.21.10 Measuring sockets T0, T1, T2

Table 8- 35 Measuring sockets T0, T1, T2

Connector	Socket	Function	Technical data
	T0	Measuring socket 0	Voltage: 0 ... 5 V Resolution: 8 bits Load current: max. 3 mA Continuous short-circuit proof The reference potential is terminal M
	T1	Measuring socket 1	
	T2	Measuring socket 2	
	M	Ground	
PCB plug connector from Phoenix Contact, type: ZEC 1.0/ 4-ST-3.5 C1 R1.4, order number: 1893708			

Note

Cable cross-section

The measuring socket contacts are only suitable for cable cross-sections of 0.2 mm^2 to 1 mm^2.

Note

Using the measuring socket contacts

The measuring socket contacts support commissioning and diagnostic functions. It must not be connected for normal operation.

8.21.11 Memory card

Description

The computing capacity required and utilization of the CU320-2 Control Unit can be calculated with the SIZER engineering tool. The firmware options are supplied in license form, which are written to the memory card in the factory as license codes. The firmware options can also be enabled on-site, for example, if the required expanded performance is not known at the time of placing the order. You will need the serial number of the memory card and the article number of the firmware option to be released. With this information, you can purchase the associated license code from a license database and enable the firmware option.

The license code is only valid for the memory card declared and cannot be transferred to other memory cards.

⚠WARNING

Software manipulation when using exchangeable data storage media

Storing files onto exchangeable storage media amounts to an increased risk of infection, e.g. with viruses and malware. As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

Note

Data loss when the Control Unit with memory card is returned

When returning a defective Control Unit for repair or testing, the data on the memory card (parameters, firmware, licenses, etc.) could be lost.

- Do not return the memory card as well, but rather keep it in a safe place so that it can be inserted in the replacement unit.

Note

Please note that only SIEMENS memory cards can be used to operate the Control Unit.

8.21.11.1 Using the memory card

Description

The STARTER commissioning tool is used to store configuration data centrally on the memory card. This ensures that if the Control Unit is defective, it can be simply replaced without the loss of any data. It also enables data to be stored on external storage media.

The data on the memory card can also be accessed using a CompactFlash card reader connected to a PC. This card reader is not included in the scope of supply.

System preconditions for installing STARTER V5.3

Hardware

The following minimum requirements must be met:

- PG or PC with Pentium III min. 1 GHz (recommended > 1 GHz)
- 2 GB work memory (4 GB recommended)
- Screen resolution 1024 × 768 pixels, 16-bit color depth
- Free hard disk space > 5 GB

Software

The following minimum requirements must be met when using STARTER without an existing STEP 7 installation:

64-bit operating systems:

- Microsoft Windows 7 Professional SP1
- Microsoft Windows 7 Ultimate SP1
- Microsoft Windows 7 Enterprise SP1 (standard installation)
- Microsoft Windows 10 Professional, from version 1607
- Microsoft Windows 10 Enterprise, from version 1607
- Microsoft Windows 10 Enterprise 2016 LTSB (OS build 14393)
- Microsoft Windows Server 2008 R2 SP1
- Microsoft Windows Server 2016

STARTER setup is possible with native Windows versions with Asian languages only if the Windows 7 software is an MUI version.

Acrobat Reader V9.4 or higher is required to open the function diagrams in the online help.

Note

Preconditions in conjunction with STEP7

If STARTER is used in combination with other STEP7 components, the prerequisites for the S7 components shall apply.

Additional system requirements for installing a CompactFlash card reader

- Free USB connection

8.21.11.2 Data functions

Once a card reader has been connected and successfully installed, the data on the memory card can be accessed in the same way as data stored on other PC storage media (e.g. access to hard disk, memory stick, etc.). To access its data, the memory card must first be removed from the CU320-2 Control Unit and inserted in the card reader connected to the PC.

The actual procedure for accessing the memory card data depends on the operating system used.

8.21.11.3 Saving the memory card parameter settings

Following commissioning, it is advisable to back up the data on the memory card to an external storage medium (hard disk, data carrier, etc.).

To do this, the memory card is read out via a card reader connected to a PC. Ensure that all the files and directories are stored in the same form as on the memory card.

If necessary, the device status following commissioning of the drive can be restored by uploading the saved data to the memory card.

Note

Plant standstill by withdrawing or inserting the memory card while operational

If the memory card is withdrawn or inserted during operation, then data can be lost, possibly resulting in a plant standstill.

- Only withdraw and insert the memory card when the Control Unit is in a no-voltage condition.

8.21.11.4 Slot for the memory card

Slot for the memory card



Figure 8-33 Slot for the memory card

Note

Insertion direction for the memory card

Only insert the memory card as shown in the photo above (arrow at top right).

Note

Data loss when the Control Unit with memory card is returned

When returning a defective Control Unit for repair or testing, the data on the memory card (parameters, firmware, licenses, etc.) could be lost.

- Do not return the memory card as well, but rather keep it in a safe place so that it can be inserted in the replacement unit.

8.22 K94, Performance extension for CU320-2

Availability of option

This option is available for the following options:

- Option K90, Control Unit CU320-2 PROFIBUS
- Option K95, Control Unit CU320-2 PROFINET

Description

A CU320-2 Control Unit can perform the communication, open-loop and closed-loop control functions for several power units. The computing capacity requirement increases in proportion to the number of power units and system components and in relation to the dynamic response required. The full computing capacity of the CU320-2 Control Unit is available only with performance enhancement.

In addition to the firmware, the memory card also contains licensing codes, which are required to enable firmware options (such as performance enhancement and the Safety Integrated Extended functions).

8.23 K95, Control Unit CU320-2 PN

8.23.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

With option K95, a CU320-2 PN Control Unit is installed in the Line Modules and Motor Modules of the drive line-up; this assumes the functions of communication, open-loop control, and closed-loop control for up to 4 Motor Modules, in addition to 1 Line Module.

The connection to the relevant modules and any additional I/O modules is established via DRIVE-CLiQ. A standard PROFINET interface is available for higher-level communication.

The unit can communicate with other participants via PROFINET or the DRIVE-CLiQ interface, see SINAMICS Low-Voltage Configuration Manual on the customer DVD supplied with the device.

Note

CU320-2 Control Unit without performance enhancement

Without performance enhancement, it is generally possible to operate 2 Motor Modules plus 1 Line Module.

Note

Performance enhancement

The computing capacity required increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. The full computing capacity of the CU320-2 Control Unit is available only with performance enhancement.

8.23.2 Connection overview

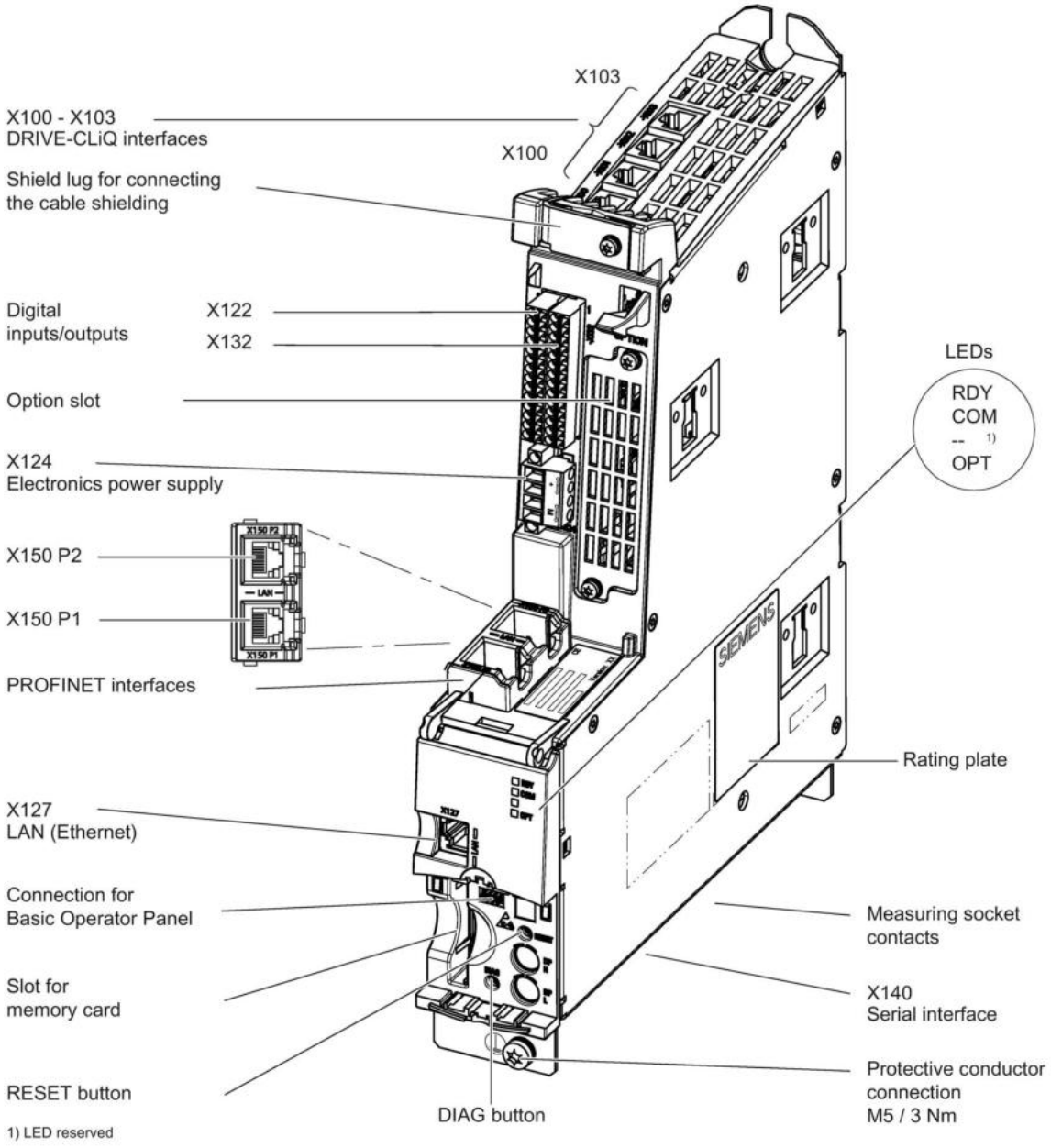


Figure 8-34 Overview of connections for the CU3202 PN Control Unit (without cover)

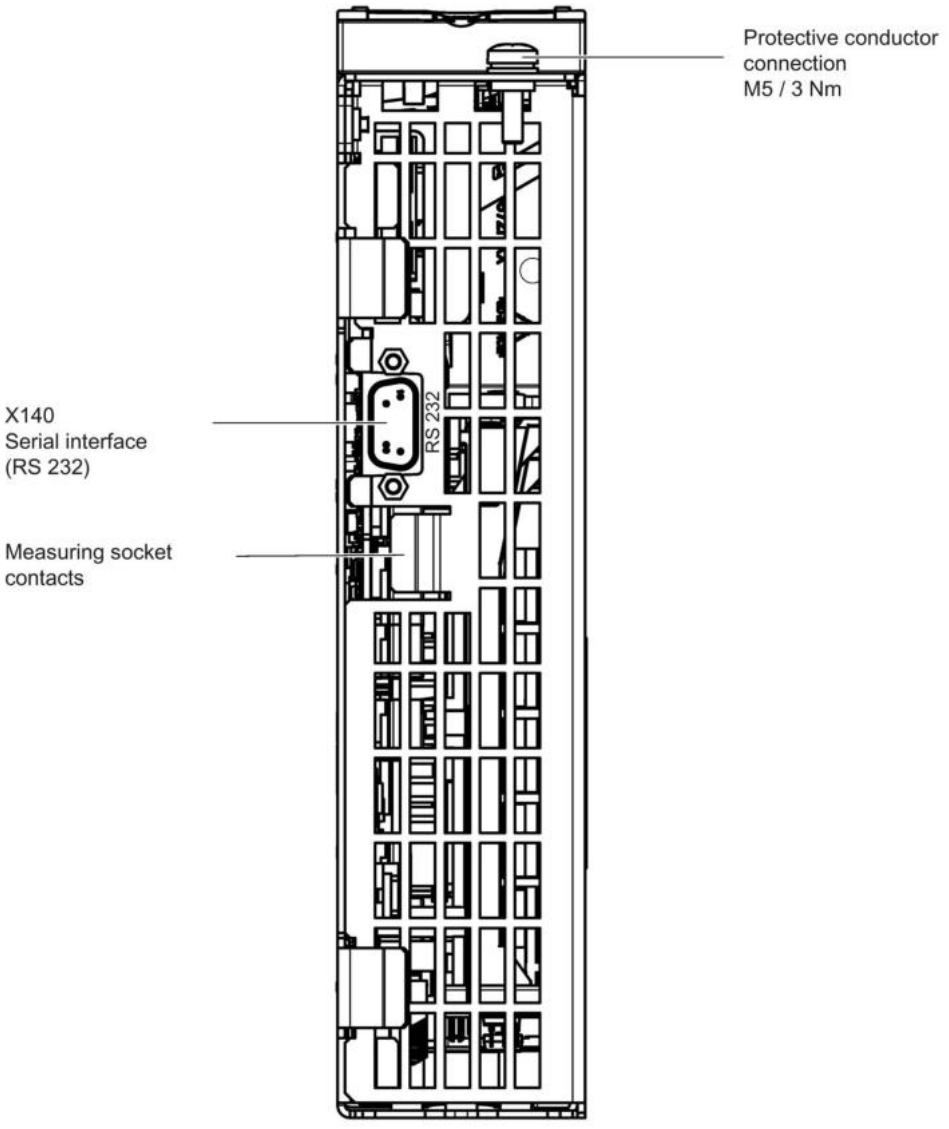


Figure 8-35 Interface X140 and measuring sockets T0 to T2 - CU320-2 PN (view from below)

NOTICE
Malfunctions or damage to the option board by inserting and withdrawing in operation Withdrawing and inserting the option board in operation can damage it or cause it to malfunction. • Only withdraw or insert the Option Board when the Control Unit is in a no-current condition.

8.23.3 Connection example

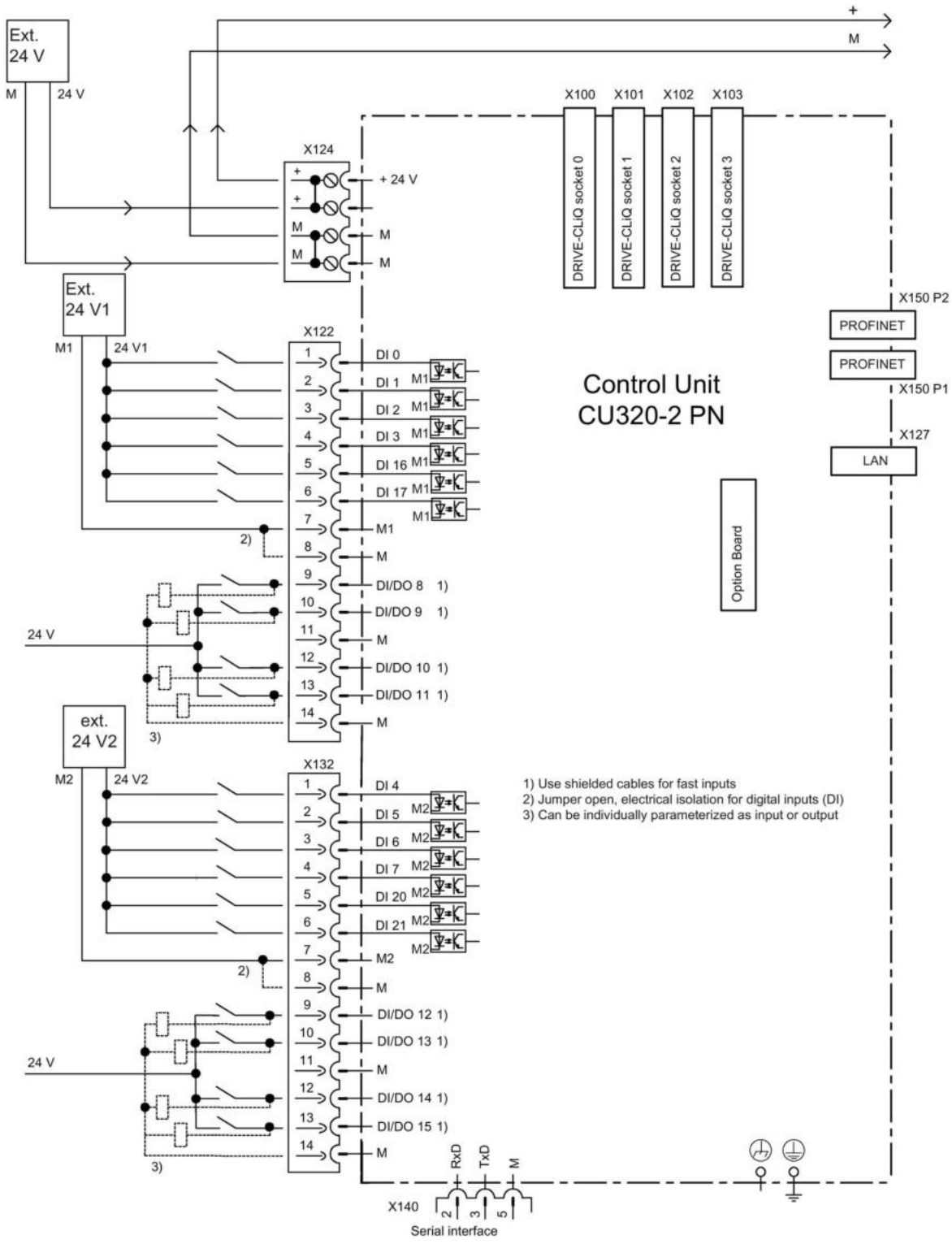


Figure 8-36 Connection example, CU320-2 PN

Note

Power supply for the digital inputs

In the circuit example, the power for the digital inputs (terminals -X122 and -X132) is supplied from the internal 24 V supply of the Control Unit (terminal -X124).

The two groups of digital inputs (optocoupler inputs) each have a common reference potential (reference ground M1 or M2). To close the circuit when the internal 24 V supply is used, the reference grounds M1 / M2 are connected to internal ground (M).

If power is not supplied from the internal 24 V supply (terminal -X124), the jumper between grounds M1 and M or M2 and M must be removed in order to avoid potential current loops. The external ground must then be connected to terminals M1 and M2.

8.23.4 X55 customer terminal strip

8.23.4.1 Overview

Description

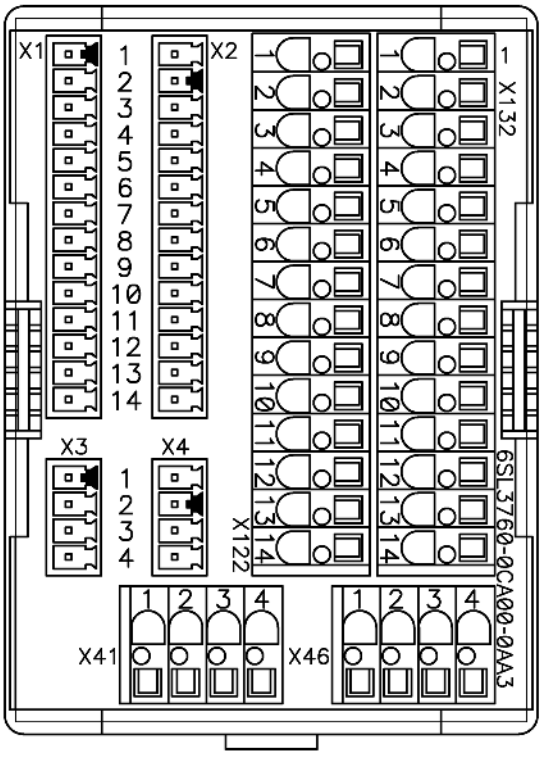


Figure 8-37 Customer terminal strip -X55

The customer terminal block- X55 is installed in the cabinet together with the CU320-2 Control Unit. The digital inputs/outputs of the Control Unit can be used via terminal blocks -X55-X122 and -X55-X132.

Note

Internally wired interfaces

Interfaces -X1, -X2, -X3 and -X4 are wired within the cabinet and are not available for customer connections!

If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be interchanged! Otherwise, "Safe Torque Off" and "Safe Stop 1" will malfunction!

Note

Customer terminal block as standard

The customer terminal block is a standard component in the cabinet for the Motor Module Cabinet Module (chassis format). The digital inputs/outputs of the CU320-2 Control Unit on terminal blocks -X55-X122 and -X55-X132 can only be used in conjunction with a Control Unit.

Note

Power supply for the digital inputs

The two groups of digital inputs (DI0 to DI3, DI16 and DI17 or DI4 ... DI7, DI20 and DI21) each have a common reference potential per group (reference ground M1 or M2). To close the circuit when the internal 24 V supply is used, the reference grounds M1 / M2 are connected to internal ground (M).

If power is supplied from an external source, the jumper between ground M1 and M or M2 and M must be removed in order to avoid potential looping. The external ground must then be connected to terminals M1 or M2.

Pin assignment of customer terminal strip –X55

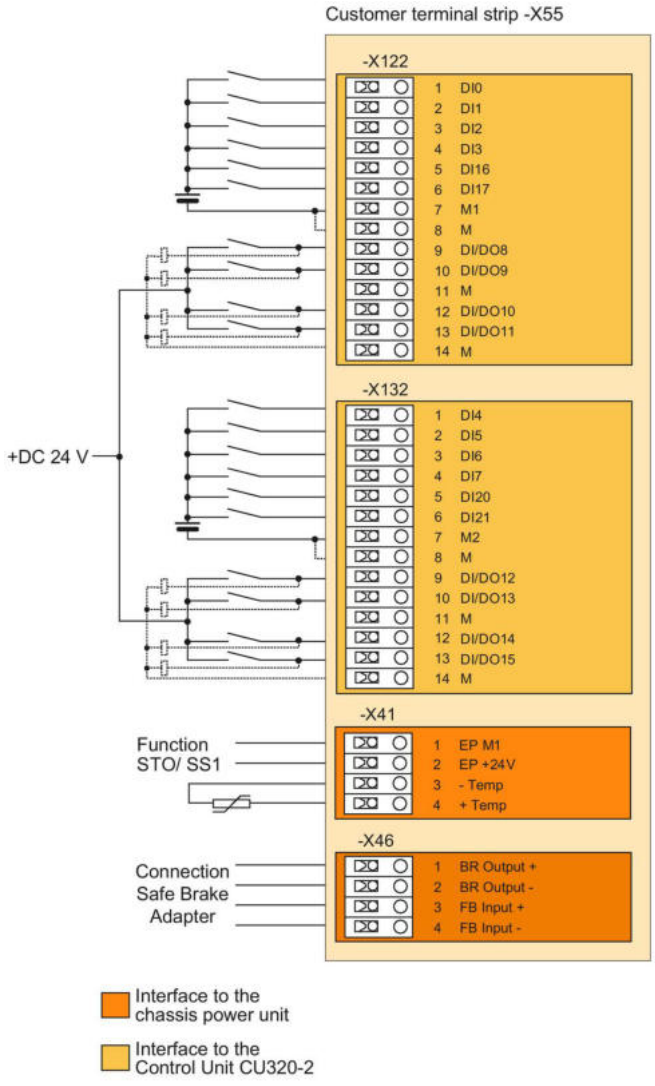
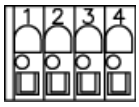


Figure 8-38 Connection assignment of customer terminal block -X55 (example: Motor Module Cabinet Module (chassis format))

8.23.4.2 X41 EP terminal / temperature sensor connection

Table 8- 36 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 to 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled.
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic switch with NC contact
	4	+ Temp	
Max. connectable cross-section: 2.5 mm^2			



WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

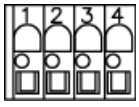
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated Functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.23.4.3 X46 Brake control and monitoring

Table 8- 37 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: 2.5 mm^2			

Note

The interface is intended for connection of the Safe Brake Adapter.

⚠WARNING

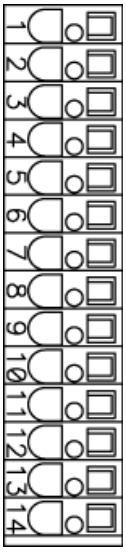
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables connected to terminal strip X46 can cause components to overheat with the associated risk of fire and smoke.

- Limit the length of the connecting cables to a maximum of 10 m.
- Do not route the connection cable outside the control cabinet or control cabinet group.

8.23.4.4 X122 digital inputs/outputs

Table 8- 38 Terminal block X122 on the customer terminal block X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage (max.): -3 ... +30 V DC Typical power consumption: 9 mA at 24 V Electrical isolation: reference potential is M1 terminal Level (with ripple) High level: 15 … 30 V Low level: -3 … +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (with ripple) High level: 15 … 30 V Low level: -3 … +5 V DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For resistive load: Max. 100 Hz For inductive load: max. 0.5 Hz For lamp load: max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 2.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronic ground; M1: Reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M1 must be connected.

This is achieved through one of the following measures:

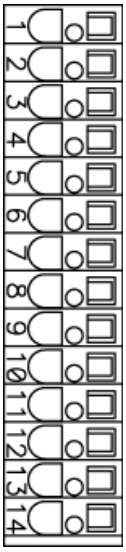
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

8.23.4.5 X132 digital inputs/outputs

Table 8- 39 Terminal block X132 on the customer terminal block X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage (max.): -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Electrical isolation: reference potential is M2 terminal Level (including ripple) High level: 15 … 30 V Low level: -3 … +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminals 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 … 30 V Low level: -3 … +5 V DI/DO 12, 13, 14, and 15 are "rapid inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For resistive load: Max. 100 Hz For inductive load: max. 0.5 Hz For lamp load: max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: 2.5 mm^2			

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronics ground; M2: Reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved through one of the following measures:

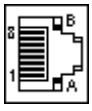
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

8.23.5 X100 - X103 DRIVE-CLiQ interface

Table 8- 40 DRIVE-CLiQ interface X100 - X103

Connector	Pin	Signal name	Technical data
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	M (0 V)	Electronics ground
Connector type: RJ45 socket Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

8.23.6 X127 LAN (Ethernet)

Note

Use

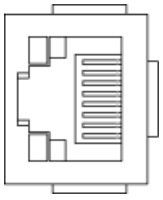
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

Further, the following restrictions apply to X127:

- Only local access is possible
- No networking - or only local networking in a closed and locked electrical cabinet permissible

If it is necessary to remotely access the electrical cabinet, then additional security measures must be applied so that misuse through sabotage, unqualified data manipulation and intercepting confidential data is completely ruled out (also see Chapter "Industrial Security (Page 23)").

Table 8- 41 X127 LAN (Ethernet)

Connector	Pin	Designation	Technical data
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket			

Note

The LAN (Ethernet) interface does not support Auto MDI(X). If the LAN interface of the communication partner also cannot handle auto-MDI(X), then a crossover cable must be used to establish the connection.

Note

Support during commissioning

The X127 LAN interface supports commissioning and diagnostic functions. It must not be connected for normal operation.

For diagnostic purposes, the X127 LAN interface features a green and a yellow LED. These LEDs indicate the following status information:

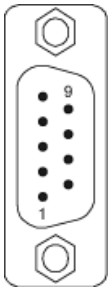
Table 8- 42 LED statuses for the X127 LAN interface

LED	State	Description
Green	On	10 or 100 Mbit link available
	Off	Missing or faulty link
Yellow	On	Sending or receiving
	Off	No activity

8.23.7 X140 serial interface (RS232)

The AOP30 operator panel for operating/parameterizing the device can be connected via the serial interface. The interface is located on the underside of the Control Unit.

Table 8- 43 Serial interface (RS232) X140

Connector	Pin	Designation	Technical data
	2	RxD	Receive data
	3	TxD	Transmit data
	5	Ground	Ground reference
Connector type: 9-pin Sub-D connector			

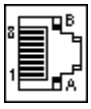
Note

Connecting cable to the AOP30

The connecting cable to AOP30 may only contain the three contacts which are listed in the table; a completely assigned cable may not be used.

8.23.8 X150 P1/P2 PROFINET connection

Table 8- 44 X150 P1 and X150 P2 PROFINET

Connector	Pin	Signal name	Technical data
	1	RXP	Receive data +
	2	RXN	Receive data -
	3	TXP	Transmit data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TXN	Transmit data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket Cable type: PROFINET			

Note

Connecting cables

The PROFINET interfaces support Auto MDI(X). It is therefore possible to use both crossed and uncrossed cables to connect the devices.

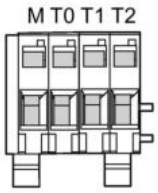
For diagnostic purposes, the two PROFINET interfaces are each equipped with a green and a yellow LED. These LEDs indicate the following status information:

Table 8- 45 LED states at the X150 P1/P2 PROFINET interface

LED	Color	State	Description
Link port	-	Off	Missing or faulty link
	Green	Steady light	10 or 100 Mbit link available
Activity port	-	Off	No activity
	Yellow	Flashing light	Data is being received or sent at port x

8.23.9 Measuring sockets T0, T1, T2

Table 8- 46 Measuring sockets T0, T1, T2

Connector	Socket	Function	Technical data
	T0	Measuring socket 0	Voltage: 0 ... 5 V Resolution: 8 bits Load current: max. 3 mA Continuous short-circuit proof The reference potential is terminal M
	T1	Measuring socket 1	
	T2	Measuring socket 2	
	M	Ground	
PCB plug connector from Phoenix Contact, type: ZEC 1.0/ 4-ST-3.5 C1 R1.4, order number: 1893708			

Note

Cable cross-section

The measuring socket contacts are only suitable for cable cross-sections of 0.2 mm^2 to 1 mm^2.

Note

Using the measuring socket contacts

The measuring socket contacts support commissioning and diagnostic functions. It must not be connected for normal operation.

8.23.10 Memory card

Description

The computing capacity required and utilization of the CU320-2 Control Unit can be calculated with the SIZER engineering tool. The firmware options are supplied in license form, which are written to the memory card in the factory as license codes. The firmware options can also be enabled on-site, for example, if the required expanded performance is not known at the time of placing the order. You will need the serial number of the memory card and the article number of the firmware option to be released. With this information, you can purchase the associated license code from a license database and enable the firmware option.

The license code is only valid for the memory card declared and cannot be transferred to other memory cards.

⚠WARNING

Software manipulation when using exchangeable data storage media

Storing files onto exchangeable storage media amounts to an increased risk of infection, e.g. with viruses and malware. As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

Note

Data loss when the Control Unit with memory card is returned

When returning a defective Control Unit for repair or testing, the data on the memory card (parameters, firmware, licenses, etc.) could be lost.

- Do not return the memory card as well, but rather keep it in a safe place so that it can be inserted in the replacement unit.

Note

Please note that only SIEMENS memory cards can be used to operate the Control Unit.

8.23.10.1 Using the memory card

Description

The STARTER commissioning tool is used to store configuration data centrally on the memory card. This ensures that if the Control Unit is defective, it can be simply replaced without the loss of any data. It also enables data to be stored on external storage media.

The data on the memory card can also be accessed using a CompactFlash card reader connected to a PC. This card reader is not included in the scope of supply.

System preconditions for installing STARTER V5.3

Hardware

The following minimum requirements must be met:

- PG or PC with Pentium III min. 1 GHz (recommended > 1 GHz)
- 2 GB work memory (4 GB recommended)
- Screen resolution 1024 × 768 pixels, 16-bit color depth
- Free hard disk space > 5 GB

Software
The following minimum requirements must be met when using STARTER without an existing STEP 7 installation:

64-bit operating systems:

- Microsoft Windows 7 Professional SP1
- Microsoft Windows 7 Ultimate SP1
- Microsoft Windows 7 Enterprise SP1 (standard installation)
- Microsoft Windows 10 Professional, from version 1607
- Microsoft Windows 10 Enterprise, from version 1607
- Microsoft Windows 10 Enterprise 2016 LTSB (OS build 14393)
- Microsoft Windows Server 2008 R2 SP1
- Microsoft Windows Server 2016

STARTER setup is possible with native Windows versions with Asian languages only if the Windows 7 software is an MUI version.

Acrobat Reader V9.4 or higher is required to open the function diagrams in the online help.

Note
Preconditions in conjunction with STEP7

If STARTER is used in combination with other STEP7 components, the prerequisites for the S7 components shall apply.

Additional system requirements for installing a CompactFlash card reader

- Free USB connection

8.23.10.2 Data functions

Once a card reader has been connected and successfully installed, the data on the memory card can be accessed in the same way as data stored on other PC storage media (e.g. access to hard disk, memory stick, etc.). To access its data, the memory card must first be removed from the CU320-2 Control Unit and inserted in the card reader connected to the PC.

The actual procedure for accessing the memory card data depends on the operating system used.

8.23.10.3 Saving the memory card parameter settings

Following commissioning, it is advisable to back up the data on the memory card to an external storage medium (hard disk, data carrier, etc.).

To do this, the memory card is read out via a card reader connected to a PC. Ensure that all the files and directories are stored in the same form as on the memory card.

If necessary, the device status following commissioning of the drive can be restored by uploading the saved data to the memory card.

Note

Plant standstill by withdrawing or inserting the memory card while operational

If the memory card is withdrawn or inserted during operation, then data can be lost, possibly resulting in a plant standstill.

- Only withdraw and insert the memory card when the Control Unit is in a no-voltage condition.

8.23.10.4 Slot for the memory card

Slot for the memory card



Figure 8-39 Slot for the memory card

Note

Insertion direction for the memory card

Only insert the memory card as shown in the photo above (arrow at top right).

Note

Data loss when the Control Unit with memory card is returned

When a defective Control Unit is returned, the data on the memory card (parameters, firmware, licenses, etc.) may be lost during repair and testing.

- Do not return the memory card with the Control Unit. Instead, keep it in a safe place so that it can be inserted in the replacement unit.

8.24 L00, use in the first environment according to EN 61800-3, Category C2 (TN/TT systems)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

To limit the emitted interference, the drive converters are equipped as standard with a radio interference suppression filter that conforms to the limits defined in Category C3. By using the optional line filter (option L00) and additional measures performed in the factory – which are required in the cabinets – then SINAMICS S120 Cabinet Modules also comply with the limit values for use in Category C2 (first and second environments) according to EN 61800-3.

The fine filters are suitable for TN or TT systems with grounded neutral point.

Restrictions

Note

Option L00 not available for a parallel connection

Option L00 for use in the first environment (category C2) according to EN 61800-3, is not available for Line Modules in a parallel connection.

Note

Additional information

The measures required on the customer's side, which must be performed to fulfill the limit values for use in Category C2 (first and second environment) according to EN 61800-3 are listed in the "Configuration Manual SINAMICS Low Voltage" on the customer DVD supplied with the device.

Note

Combining a line filter and line reactor

The optional line filter must always be combined with a line reactor, otherwise it cannot achieve its full filter effect.

Note

EMC shield bus

To allow the power cable shield to be connected in conformance with EMC requirements, an additional EMC shield bus (M70 option) is factory fitted at the converter input and output.

Note

It is not possible to combine insulation monitoring and line filter

It is not possible to use the insulation monitoring function (option L87) in conjunction with the optional line filter.

Note

Maximum permissible motor cable length

The maximum permissible total motor cable length when using the line filters in conjunction with Basic Line Modules is 100 m.
The maximum permissible total motor cable length when using the line filter in connection with Smart Line Modules and Active Line Modules is 300 m.

Shielded motor cables must always be used.

Note

Motor cable length exceeded

When the maximum permissible total motor cable length is exceeded, it can no longer be guaranteed that Class C2/C3 is maintained; for very long motor cables this can mean that the line-side or motor-side power components can overheat.

Additional information is provided in the Low Voltage Engineering Manual.

8.25 L07, dv/dt filter compact plus Voltage Peak Limiter

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules Chassis format
- Motor Modules Chassis-2 format

Description

The dv/dt filter compact plus Voltage Peak Limiter comprises two components: the dv/dt reactor and the voltage-limiting network (Voltage Peak Limiter), which cuts off the voltage peaks and feeds back the energy into the DC link. The dv/dt filter compact plus Voltage Peak Limiter is designed for use with motors for which the voltage strength of the insulation system is unknown or insufficient.

dv/dt filters compact plus Voltage Peak Limiters limit the voltage rate of rise dv/dt to values < 1600 V/µs - and the typical voltage peaks to the following values according to limit value curve A according to IEC 60034-25:2007:

- < 1150 V at U_{line} < 575 V
- < 1400 V at 660 V < U_{line} < 690 V.

For Motor Modules Chassis-2 format, option L07 is accommodated in a supplementary cabinet with a width of 600 mm, which is arranged to the right of the Motor Module.

Note

Operation of standard motors with standard insulation and without insulated bearing is possible on SINAMICS converters up to line supply voltages of 690 V.

Restrictions

The following constraints should be noted when a dv/dt filter compact plus Voltage Peak Limiter is used:

- The output frequency is limited to a maximum of 150 Hz.
- Maximum permissible motor cable lengths:
  - Shielded cables: max. 100 m (e.g. Protodur NYCWY)
  - Unshielded cables: max. 150 m (e.g. Protodur NYY)

NOTICE

Damage to the dv/dt filter compact by exceeding the maximum output frequency

The maximum permissible output frequency when a dv/dt filter compact is used is 150 Hz. The dv/dt filter compact can be damaged if the output frequency is exceeded.

- Operate the dv/dt filter compact with a maximum output frequency of 150 Hz.

NOTICE

Damage to the dv/dt filter compact during continuous operation with low output frequencies

Uninterrupted duty at an output frequency less than 10 Hz can result in thermal overload and destroy the dv/dt filter.

- When using a dv/dt filter compact plus Voltage Peak Limiter do not operate the drive continuously with an output frequency less than 10 Hz.
- You may operate the drive under load for a maximum of 5 minutes at an output frequency less than 10 Hz, provided that you then select operation with an output frequency higher than 10 Hz for a period of 5 minutes.

NOTICE

Damage to the dv/dt filter compact by exceeding the maximum pulse frequency

The maximum permissible pulse frequency when a dv/dt filter compact is used is 2.5 kHz or 4 kHz. The dv/dt filter compact can be damaged if the pulse frequency is exceeded.

- When using the dv/dt filter compact, only operate the Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

NOTICE

Damage to the dv/dt filter compact if it is not activated during commissioning

The dv/dt filter compact may be damaged if it is not activated during commissioning.

- Activate the dv/dt filter compact during commissioning using parameter p0230 = 2.

NOTICE

Damage to the dv/dt filter compact if a motor is not connected

dv/dt filters compact which are operated without a motor being connected can be damaged or destroyed.

- Never operate a dv/dt filter compact connected to the Motor Module without a connected motor.

Note

Setting pulse frequencies

It is permissible to set pulse frequencies in the range between the rated pulse frequency and the relevant maximum pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used. "Current derating as a function of the pulse frequency" of the converter must be observed here (refer to the Technical data).

Table 8- 47 Max. pulse frequency when a dv/dt filter compact plus VPL is used for units with a rated pulse frequency of 2 kHz

Article No. 6SL3720-...	Type rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)			
1TE32-1AA3	110	210	4 kHz
1TE32-6AA3	132	260	4 kHz
1TE33-1AA3	160	310	4 kHz
1TE33-8AA3	200	380	4 kHz
1TE35-0AA3	250	490	4 kHz

Table 8- 48 Max. pulse frequency when a dv/dt filter compact plus VPL is used for units with a rated pulse frequency of 1.25 kHz

Article No. 6SL3720-...	Type rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)			
1TE36-1AA3	315	605	2.5 kHz
1TE37-5AA3	400	745	2.5 kHz
1TE38-4AA3	450	840	2.5 kHz
1TE41-0AA3	560	985	2.5 kHz
1TE41-2AA3	710	1260	2.5 kHz
1TE41-4AA3	800	1405	2.5 kHz

Article No. 6SL3720-...	Type rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 500 ... 690 V 3 AC (DC link voltage 675 ... 1035 V DC)			
1TG28-5AA3	75	85	2.5 kHz
1TG31-0AA3	90	100	2.5 kHz
1TG31-2AA3	110	120	2.5 kHz
1TG31-5AA3	132	150	2.5 kHz
1TG31-8AA3	160	175	2.5 kHz
1TG32-2AA3	200	215	2.5 kHz
1TG32-6AA3	250	260	2.5 kHz
1TG33-3AA3	315	330	2.5 kHz
1TG34-1AA3	400	410	2.5 kHz
1TG34-7AA3	450	465	2.5 kHz
1TG35-8AA3	560	575	2.5 kHz
1TG37-4AA3	710	735	2.5 kHz
1TG38-1AA3	800	810	2.5 kHz
1TG38-8AA3	900	910	2.5 kHz
1TG41-0AA3	1000	1025	2.5 kHz
1TG41-3AA3	1200	1270	2.5 kHz

Table 8- 49 Max. pulse frequency when a dv/dt filter compact plus VPL is used for units with a rated pulse frequency of 2.5 kHz

Article No. 6SL3721-...	Type rating [kW]	Output current for a pulse frequency of 2.5 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)			
1TE36-6BE0	315	655	2.5 kHz
1TE37-4BE0	355	740	2.5 kHz
1TE38-1BE0	400	810	2.5 kHz
1TE38-8BE0	450	910	2.5 kHz
1TE41-0BE0	500	975	2.5 kHz
1TE41-1BE0	560	1075	2.5 kHz
1TE41-2BE0	630	1200	2.5 kHz

Commissioning

During commissioning, the dv/dt filter compact plus Voltage Peak Limiter must be logged on using STARTER or via the AOP30 operator panel (p0230 = 2).

Note

Reset when establishing the factory setting

Parameter p0230 is reset when the factory setting is established. The parameter has to be reset when recommissioning.

8.26 L08/L09, motor reactor/2 motor reactors in series

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits (L08/L09)
- Motor Module Chassis format (L08)
- Motor Module Chassis-2 format (L08)

Description

Motor reactors reduce the voltage stress on the motor windings by reducing the voltage gradients at the motor terminals that occur when motors are fed from drive converters. At the same time, the capacitive charge/discharge currents that also occur on the output of the Motor Module when long motor cables are used are reduced.

In addition, a motor reactor must be used for parallel connection of Motor Modules Chassis format when a motor with a single-winding system is being supplied and the required minimum motor cable lengths cannot be maintained.

With option L08, one motor reactor is used; with option L09, two motor reactors switched in series are used to enable the use of a longer motor cable.

Motor cable lengths

Table 8- 50 Maximum motor cable lengths when using motor reactors for Booksize Cabinet Kits

Article No. 6SL3720-	Power in kW	Current in A	Maximum motor cable length in m					
			without motor reactors		With 1 motor reactor (L08)		With 2 motor reactors (L09)	
			Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
1TE21-0AB4	4.8	9	50	75	135	200	-	-
1TE21-8AB4	9.7	18	70	100	160	240	320	480
1TE23-0AB4	16	30	100	150	190	280	375	560
1TE24-5AB3	24	45	100	150	200	300	400	600
1TE26-0AB3	32	60	100	150	200	300	400	600
1TE28-5AB3	46	85	100	150	200	300	400	600
1TE31-3AB3	71	132	100	150	200	300	400	600

Note

Maximum motor cable length

When motor reactors are used, the maximum motor cable lengths for Motor Modules Chassis and Chassis-2 formats is 300 m (shielded) or 450 m (unshielded).

Motor connection

If the L08/L09 option is used with Booksize Cabinet Kits, the motor cables are connected to terminal block -X1.

Table 8- 51 Maximum conductor cross-section when using motor reactors for Booksize Cabinet Kits

Article No. 6SL3720-	Power in kW	Maximum connection cross-section
1TE21-0AB4	4.8	6 mm²
1TE21-8AB4	9.7	6 mm²
1TE23-0AB4	16	6 mm²
1TE24-5AB3	24	16 mm²
1TE26-0AB3	32	16 mm²
1TE28-5AB3	46	35 mm²
1TE31-3AB3	71	95 mm²

8.27 L10, dv/dt filter plus Voltage Peak Limiter

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules Chassis format
- Motor Modules Chassis-2 format

Description

The dv/dt filter plus Voltage Peak Limiter comprises two components: the dv/dt reactor and the voltage-limiting network (Voltage Peak Limiter), which limits the voltage peaks to the level of the DC link voltage and returns energy to the DC link.

The dv/dt filters plus Voltage Peak Limiter must be deployed for motors for which the proof voltage of the insulation system is unknown or insufficient. Standard motors of the 1LA5, 1LA6, and 1LA8 series only require them at supply voltages > 500 V + 10%.

The dv/dt filter plus Voltage Peak Limiter limits the voltage gradient to values < 500 V/µs and the typical voltage peaks to the values below (for motor cable lengths of < 300 m for frame sizes FX, GX, HX or < 150 m for frame size JX, FS2, FS4):

< 1000 V at U_{line} < 575 V

< 1250 V at 660 V < U_{line} < 690 V.

Option L10 is accommodated in a supplementary cabinet with a width of 600 mm, which is arranged to the right of the Motor Modules.

Note

Parts of option L10 do not have nickel-plated copper busbars.

Restrictions

The following restrictions must be taken into account when a dv/dt filter is used:

- The output frequency is limited to a maximum of 150 Hz.
- Maximum permissible motor cable lengths:
  - Shielded cables: max. 300 m (frame sizes FX, GX, HX)/150 m (frame sizes JX, FS2+, FS2, FS4)
  - Unshielded cables: max. 450 m (frame sizes FX, GX, HX)/225 m (frame sizes JX, FS2, FS2+, FS4)

NOTICE

Damage to the dv/dt filter by exceeding the maximum output frequency

The maximum permissible output frequency when using a dv/dt filter is 150 Hz. The dv/dt filter can be damaged if the output frequency is exceeded.

- Operate the dv/dt filter with a maximum output frequency of 150 Hz.

NOTICE

Damage to the dv/dt filter by exceeding the maximum pulse frequency

The maximum permissible pulse frequency when using a dv/dt filter is 2.5 kHz or 4 kHz. The dv/dt filter can be damaged if the pulse frequency is exceeded.

- When using the dv/dt filter, operate the Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

NOTICE

Damage to the dv/dt filter if it is not activated during commissioning

The dv/dt filter may be damaged if it is not activated during commissioning.

- Activate the dv/dt filter during commissioning using parameter p0230 = 2.

NOTICE

Damage to the dv/dt filter if a motor is not connected

dv/dt filters which are operated without a motor being connected can be damaged or destroyed.

- Never operate a dv/dt filter connected to the Motor Module without a connected motor.

Note

Setting pulse frequencies

It is permissible to set pulse frequencies in the range between the rated pulse frequency and the relevant maximum pulse frequency when a dv/dt filter plus Voltage Peak Limiter is deployed. When doing so, take into account the "Current derating as a function of the pulse frequency"; refer to the Technical data.

Table 8- 52 Maximum permissible motor cable lengths for the DC link voltage 510 ... 720 V DC

Frame sizes FX, GX, HX **Shielded cable max. 300 m or unshielded cable max. 450 m**	**Frame sizes JX, FS2, FS2+, FS4** **Shielded cable max. 150 m or unshielded cable max. 225 m**
6SL3720-1TE32-1AA3	6SL3720-1TE41-0AA3
6SL3720-1TE32-6AA3	6SL3720-1TE41-2AA3
6SL3720-1TE33-1AA3	6SL3720-1TE41-4AA3
6SL3720-1TE33-8AA3	6SL3721-1TE36-6BE0
6SL3720-1TE35-0AA3	6SL3721-1TE37-4BE0
6SL3720-1TE36-1AA3	6SL3721-1TE38-1BE0
6SL3720-1TE37-5AA3	6SL3721-1TE38-8BE0
6SL3720-1TE38-4AA3	6SL3721-1TE41-0BE0
	6SL3721-1TE41-1BE0
	6SL3721-1TE41-2BE0

Table 8- 53 Maximum permissible motor cable lengths for the DC link voltage 675 ... 1035 V DC

Frame sizes FX, GX, HX **Shielded cable max. 300 m or unshielded cable max. 450 m**	**Frame size JX** **Shielded cable max. 150 m or unshielded cable max. 225 m**
6SL3720-1TG28-5AA3	6SL3720-1TG37-4AA3
6SL3720-1TG31-0AA3	6SL3720-1TG38-1AA3
6SL3720-1TG31-2AA3	6SL3720-1TG38-8AA3
6SL3720-1TG31-5AA3	6SL3720-1TG41-0AA3
6SL3720-1TG31-8AA3	6SL3720-1TG41-3AA3
6SL3720-1TG32-2AA3	-
6SL3720-1TG32-6AA3	-
6SL3720-1TG33-3AA3	-
6SL3720-1TG34-1AA3	-
6SL3720-1TG34-7AA3	-
6SL3720-1TG35-8AA3	-

Table 8- 54 Max. pulse frequency when a dv/dt filter plus VPL is used for units with a rated pulse frequency of 2 kHz

Article No. 6SL3720-...	Type rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)			
1TE32-1AA3	110	210	4 kHz
1TE32-6AA3	132	260	4 kHz
1TE33-1AA3	160	310	4 kHz
1TE33-8AA3	200	380	4 kHz
1TE35-0AA3	250	490	4 kHz

Table 8- 55 Max. pulse frequency when a dv/dt filter plus VPL is used for units with a rated pulse frequency of 1.25 kHz

Article No. 6SL3720-...	Type rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)			
1TE36-1AA3	315	605	2.5 kHz
1TE37-5AA3	400	745	2.5 kHz
1TE38-4AA3	450	840	2.5 kHz
1TE41-0AA3	560	985	2.5 kHz
1TE41-2AA3	710	1260	2.5 kHz
1TE41-4AA3	800	1405	2.5 kHz
Line voltage 500 ... 690 V 3 AC (DC link voltage 675 ... 1035 V DC)			
1TG28-5AA3	75	85	2.5 kHz
1TG31-0AA3	90	100	2.5 kHz
1TG31-2AA3	110	120	2.5 kHz
1TG31-5AA3	132	150	2.5 kHz
1TG31-8AA3	160	175	2.5 kHz
1TG32-2AA3	200	215	2.5 kHz
1TG32-6AA3	250	260	2.5 kHz
1TG33-3AA3	315	330	2.5 kHz
1TG34-1AA3	400	410	2.5 kHz
1TG34-7AA3	450	465	2.5 kHz
1TG35-8AA3	560	575	2.5 kHz
1TG37-4AA3	710	735	2.5 kHz
1TG38-1AA3	800	810	2.5 kHz
1TG38-8AA3	900	910	2.5 kHz
1TG41-0AA3	1000	1025	2.5 kHz
1TG41-3AA3	1200	1270	2.5 kHz

Table 8- 56 Max. pulse frequency when a dv/dt filter plus VPL is used for units with a rated pulse frequency of 2.5 kHz

Article No. 6SL3721-...	Type rating [kW]	Output current for a pulse frequency of 2.5 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC)			
1TE36-6BE0	315	655	2.5 kHz
1TE37-4BE0	355	740	2.5 kHz
1TE38-1BE0	400	810	2.5 kHz
1TE38-8BE0	450	910	2.5 kHz
1TE41-0BE0	500	975	2.5 kHz
1TE41-1BE0	560	1075	2.5 kHz
1TE41-2BE0	630	1200	2.5 kHz

Commissioning

When commissioning, the dv/dt filter must be registered with STARTER or using the AOP30 operator panel (p0230 = 2).

Note

Reset when establishing the factory setting

Parameter p0230 is reset when the factory setting is established. The parameter has to be reset when recommissioning.

8.28 L13, main contactor for Line Connection Modules < 800 A

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

The Line Connection Modules with option L43 (for Basic Line Modules) include a manually operated fuse switch disconnector as a standard feature for rated currents up to 800 A. Option L13 is needed if a switching element is also required for disconnecting the cabinet from the infeed. In this case, the contactor is activated from the connected Line Module.

- In conjunction with option L42 (for Active Line Module):
  - For a rated current < 605 A (380 ... 480 V 3 ph. AC) or < 575 A (3 AC 500... 690 V), the main contactor is included as a standard feature in the Active Interface Module of the Active Line Module.
  - For a rated current of 605 A (3 AC 380 ... 480 V) or 575 A and 730 A (3 AC 500 ... 690 V), option L13 (main contactor) is a standard feature in the Line Connection Module.
  - For a rated current > 605 A (3 AC 380 ... 480 V) or > 730 A (3 AC 500 ... 690 V), a circuit breaker is a standard feature in the Line Connection Module.
- In conjunction with option L43 (for Basic Line Module):
  - For a rated current < 800 A, option L13 (main contactor) can be ordered.
  - For a rated current > 800 A, a circuit breaker is a standard feature in the Line Connection Module.
- In conjunction with option L44 (for Smart Line Module):
  - For a rated current < 800 A, option L13 (main contactor) is a standard feature in the Line Connection Module.
  - For a rated current > 800 A, a circuit breaker is a standard feature in the Line Connection Module.

NOTICE
Material damage caused by switching the line contactor under load Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor. • Always switch the line contactor at zero current.

X50 "main contactor" checkback contact

Table 8- 57 Terminal block X50 "main contactor" checkback contact

Terminal	Designation [1]	Technical data
4	NO	Max. load current: 10 A Max. switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section: 4 mm²		

[1] NO: Normally-open contact, NC: Normally-closed contact, COM: Center contact

8.29 L20 - used in IT line systems

Availability of option

This option is available for the following S120 Cabinet Modules:

- Active Line Connection Modules-2
- Motor Modules Chassis-2 format

Description

When used in IT line systems, an isolating transformer is connected in the fan power supply circuit.

8.30 L21, surge suppression

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

The option includes the installation of surge arresters and upstream fuses for each line phase. The signaling contacts of the surge arresters are connected in series for monitoring purposes and routed to a customer interface.

Removal of the connection clip to the interference suppression capacitor for operation in an IT system

When operating the devices in an IT system, the connection clip to the interference suppression capacitor must be removed in the following Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
  (the connection clip is located behind the fan for frame sizes HX and JX)
- Active Line Modules (connection clip in the Active Interface Module)
- Active Line Connection Modules-2 (connection clip in the Active Interface Module)

For the positions of the connection links in the respective Cabinet Modules, see Chapter "Connection of the Cabinet Modules to non-grounded systems (IT systems)".

X700 - monitoring the surge arresters

Table 8- 58 Terminal block X700 Monitoring the surge arresters

Terminal	Designation [1]	Technical data
1	NC	Max. load current: - at 24 V DC: 1 A - At 230 VAC: 0.5 A
4	NC	
Max. connectable cross-section: 2.5 mm²		

[1] NC: NC contact

Reason why the monitoring function responds

After the monitoring function responds at terminal block X700:1/4, the cause must be identified:

- Surge arresters (-A703, -A704-, A705) have a display showing the operating state.
- In the event of a fault, the fuses (-Q700) must be checked and may have replaced once the fault cause has been eliminated.

Replacing surge arresters

The surge arrestor involved must be replaced in the case of a fault:

- Line Connection Modules 3 AC 380 ... 480 V:
  Remove the insert (protection module) by withdrawing the defective insert and inserting the replacement part.
- Line Connection Modules 3 AC 500 ... 690 V:
  Replacing the complete surge arrester.

8.31 L22, supplied as standard without line reactor

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules, only with option L43 (for Basic Line Modules)
- Smart Line Modules

Description

If the Basic Line Module or Smart Line Module is supplied via a separate transformer, or if the supply system has a sufficiently low supply short-circuit power, the standard line reactor can be omitted.

For the Line Connection Module with option L22, the standard line reactor is not supplied in conjunction with the Basic Line Module (option L43).

The Smart Line Module with option L22 is supplied without a standard line reactor.

8.32 L25, circuit breaker in withdrawable unit design

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

The circuit breaker in a withdrawable unit design is available as option for Line Connection Modules and Active Line Connection Modules-2 from a rated current of >800 A. This breaker replaces the standard built-in circuit breaker.

The circuit breaker in withdrawable unit design features a visible isolating distance.

X50 "circuit breaker" checkback contact

Table 8- 59 Terminal block X50 "Circuit-breaker" checkback contact

Terminal	Designation [1]	Technical data
1	NC	"Circuit breaker" checkback contacts
2	NO	Max. load current: 3 A
3	COM	Max. switching voltage: 250 VAC
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker, as well as the factory-installed options, can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.33 L34, output-side circuit breaker

8.33.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules in chassis format
- Motor Modules Chassis-2 format

Description

Option L34 (output-side circuit breaker) can be used to disconnect the motor terminals from the converter.

It is pre-wired and installed in a separate cabinet.



WARNING

Electric shock when permanent magnet synchronous motors rotate

As soon as the motor rotates, a voltage is generated at the terminals, which when touched, can result in death or severe injury.

- Electrically disconnect the motor when working on the converter.
  Option L34 can be used to isolate a circuit in the event of a fault, or for maintenance work.
- If it is not possible to disconnect the connecting cables to the motor, secure the motor so that it cannot undesirably rotate, e.g. using a holding brake.

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker can be found in the supplementary option description. This description is available as additional documentation on the customer DVD supplied with the device.

Option L34 (output-side circuit breaker) is required in the following applications where permanent-field motors are used:

- Drives with a high moment of inertia, which require a longer period of time to coast down and generate a voltage at the motor terminals during this time.
- Mechanically coupled auxiliary drives, which can be driven together by a main drive.
- When carrying out maintenance and repairs on a converter if the motor cannot be stopped safely (e.g. using a mechanical brake).
- During high field weakening in conjunction with a suitable level of overvoltage protection, which suppresses the applied overvoltage effectively until the switch trips.

Characteristics

Option L34 is completely pre-wired. It is controlled by a built-in TM31 Terminal Module. To control this, the parameterization specified in the following Chapter "Parameterization" must be made during commissioning.

Note

After setting the parameters, the user must ensure that the switch is operating correctly.

For this reason, the output-side breaker is automatically controlled via the converter.

Note

The "ON" pushbutton directly located at the output switch is only available with the full functional scope, if the following preconditions are fulfilled:

- There is no alarm or fault present.
- The customer remote OFF is set to "enable".

To close the output-side breaker, the following conditions must be fulfilled:

- There must be no faults on the Motor Module.
- There must be no OFF command active on the Motor Module.
- The Motor Module must receive an ON command.
- Pre-charging of the Motor Module must be complete.

The output-side breaker is opened under the following conditions:

- There is an active fault on the Motor Module.
- The power supply at the auxiliary power system for option L34 (230 VAC / 24 VDC) fails.
- The local "OFF" button on the output-side breaker is pressed.

Note

Pressing the "OFF" button directly on the output-side breaker will switch the Motor Module off (pulse suppression). The converter displays "External fault 3". The breaker can be closed again only by sending a new ON command via the Motor Module.

Note

To reduce the number of switching cycles, the output-side breaker will not open if the Motor Module receives an "OFF" command (OFF1, OFF2, OFF3).

If they are available, remote off switches (for optional use by customers) for disconnecting the output-side breaker must be connected accordingly via the undervoltage coil.



⚠WARNING

Malfunction because of neglected maintenance of the output-side breaker

After reaching the permissible number of switching cycles for the output-side breaker under pulse inhibit or under load, the correct functioning of the output-side breaker is no longer guaranteed and can result in death or serious injury in the event of a fault.

- Monitor the specified permissible number of switching cycles for the output-side breaker.
- Perform maintenance when this permissible number of switching cycles is reached in order to guarantee the correct functioning of the output-side breaker.

8.33.2 Switching cycles for the output-side circuit breaker

Table 8- 60 Switching cycles for the output-side circuit breaker, 510 ... 720 V DC

Article No. 6SL3720-	Type rating [kW]	Rated output current [A]	Switching cycles with pulse inhibit	Switching cycles under load (without pulse inhibit)
1TE32-1AA3	110	210	20000	10000
1TE32-6AA3	132	260	20000	10000
1TE33-1AA3	160	310	20000	10000
1TE33-8AA3	200	380	20000	10000
1TE35-0AA3	250	490	10000	5000
1TE36-1AA3	315	605	10000	5000
1TE37-5AA3	400	745	10000	3000
1TE38-4AA3	450	840	3000	1500
1TE41-0AA3	560	985	3000	1500
1TE41-2AA3	720	1260	3000	1500
1TE41-4AA3	800	1405	3000	1500

Table 8- 61 Switching cycles for the output-side circuit breaker, 510 ... 720 V DC

Article No. 6SL3721-	Type rating [kW]	Rated output current [A]	Switching cycles with pulse inhibit	Switching cycles under load (without pulse inhibit)
1TE36-6BE0	315	655	10000	5000
1TE37-4BE0	355	740	10000	5000
1TE41-0BE0	500	975	3000	1500
1TE41-1BE0	560	1075	3000	1500
1TE41-2BE0	630	1200	3000	1500

Table 8- 62 Switching cycles for the output-side circuit breaker, 675 ... 1035 V DC

Article No. 6SL3720-	Type rating [kW]	Rated output current [A]	Switching cycles with pulse inhibit	Switching cycles under load (without pulse inhibit)
1TG28-5AA3	75	85	20000	10000
1TG31-0AA3	90	100	20000	10000
1TG31-2AA3	110	120	20000	10000
1TG31-5AA3	132	150	20000	10000
1TG31-8AA3	160	175	20000	10000
1TG32-2AA3	200	215	20000	10000
1TG32-6AA3	250	260	20000	10000
1TG33-3AA3	315	330	20000	10000
1TG34-1AA3	400	410	10000	5000
1TG34-7AA3	450	465	10000	5000
1TG35-8AA3	560	575	10000	5000
1TG37-4AA3	710	735	10000	3000
1TG38-1AA3	800	810	3000	1500
1TG38-8AA3	900	910	3000	1500
1TG41-0AA3	1000	1025	3000	1500
1TG41-3AA3	1200	1270	3000	1500

8.33.3 Overview diagram of option L34

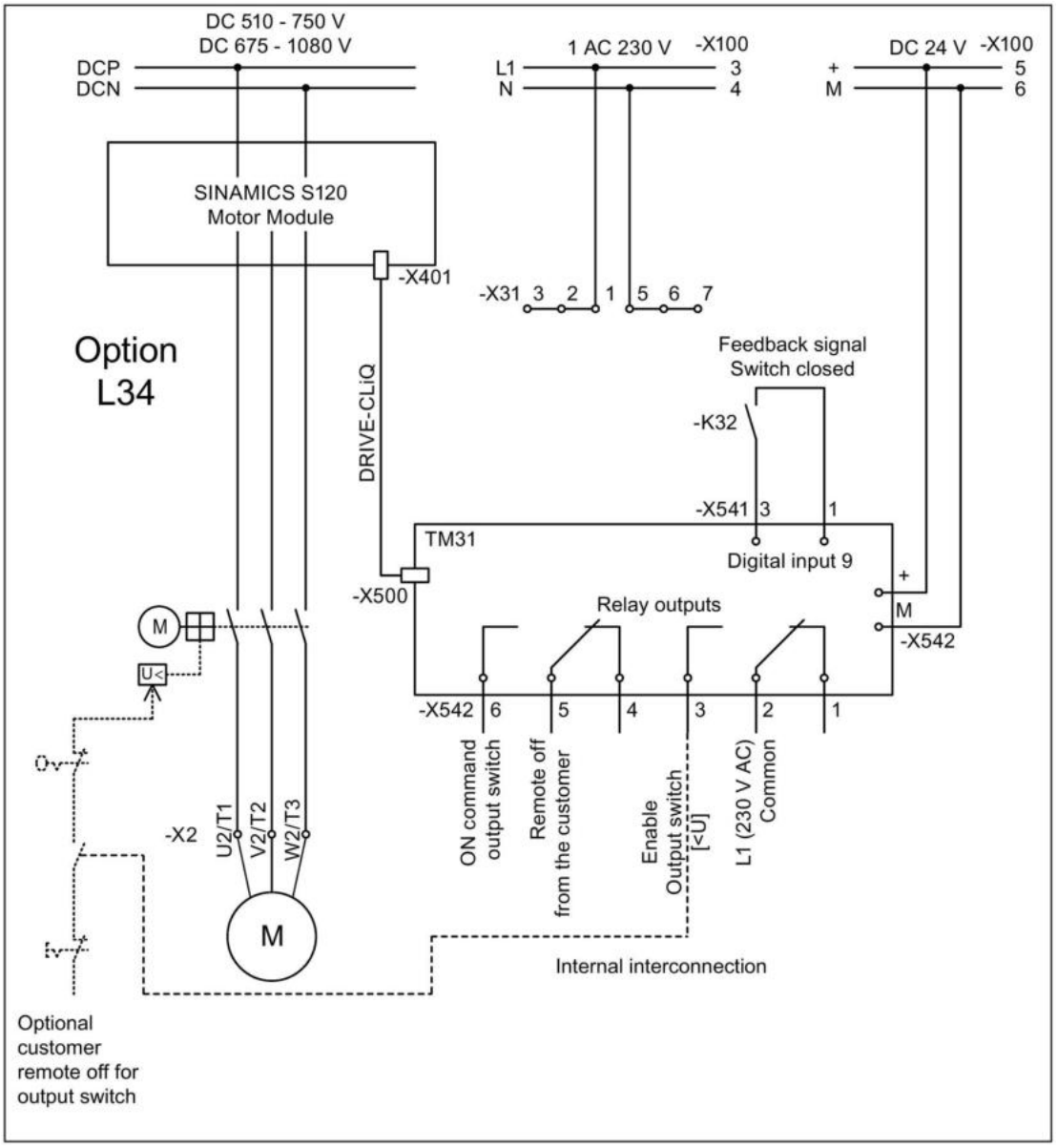


Figure 8-40 Overview diagram of option L34

8.33.4 Parameter assignment

8.33.4.1 Parameterization with script

A script can be used for the automatic parameterization, which automatically makes the parameter settings in STARTER. The script and the handling instructions for executing the script are provided on the customer DVD, which is supplied with the device when it is shipped.

Note

Additional information

The script and the handling instructions for executing the script are provided on the customer DVD in folder "99 SOFTWARE\SCRIPT_option_L34". The customer DVD is supplied with the device when it is shipped.

8.33.4.2 Parameterization with free function blocks

The free function blocks are used for the parameterization described in this section. You must start by activating them.

Activating the free function blocks

To be able to work with the free function blocks, they must first be activated/enabled:

- If you are not certain that the project in the STARTER corresponds to the drive configuration, you should start with an upload (load data to PG).
- In Offline mode -> Right-click the drive object -> Properties -> Activate the “Free function blocks” in the “Drive Properties” interactive screenform under “Select function modules”.
- You will then need to perform a download (load data to the target device) so that the “Free function blocks” function module is activated in the drive.

Setting the sampling time for run-time group 0 of the free function blocks

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 63 Setting the sampling time for run-time group 0 of the free function blocks

Parameterization	Description
(Drive_1) p20000[0] = 3	The sampling time of the free function blocks run-time group 0 is classified as 3 (= 3 x r20002).

Interconnection for “Enable output-side breaker”

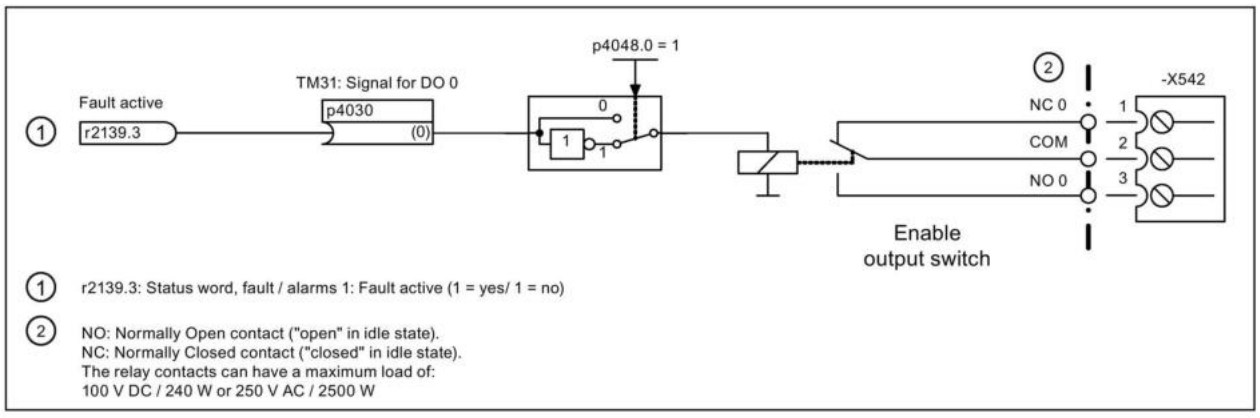


Figure 8-41 Interconnection for “Enable output-side breaker”

The breaker must also trip in the event of a converter fault. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 64 Parameterization for the interconnection for "Enable output-side breaker"

Parameterization	Description
(TM31) p4030 = (Drive_1) r2139.3	The "Fault active" drive signal is output at digital output 0 (DO 0) of the TM31.
(TM31) p4048.0 = 1 = inverted	Digital output 0 (DO 0) is inverted.

Interconnection for “Enable operation”

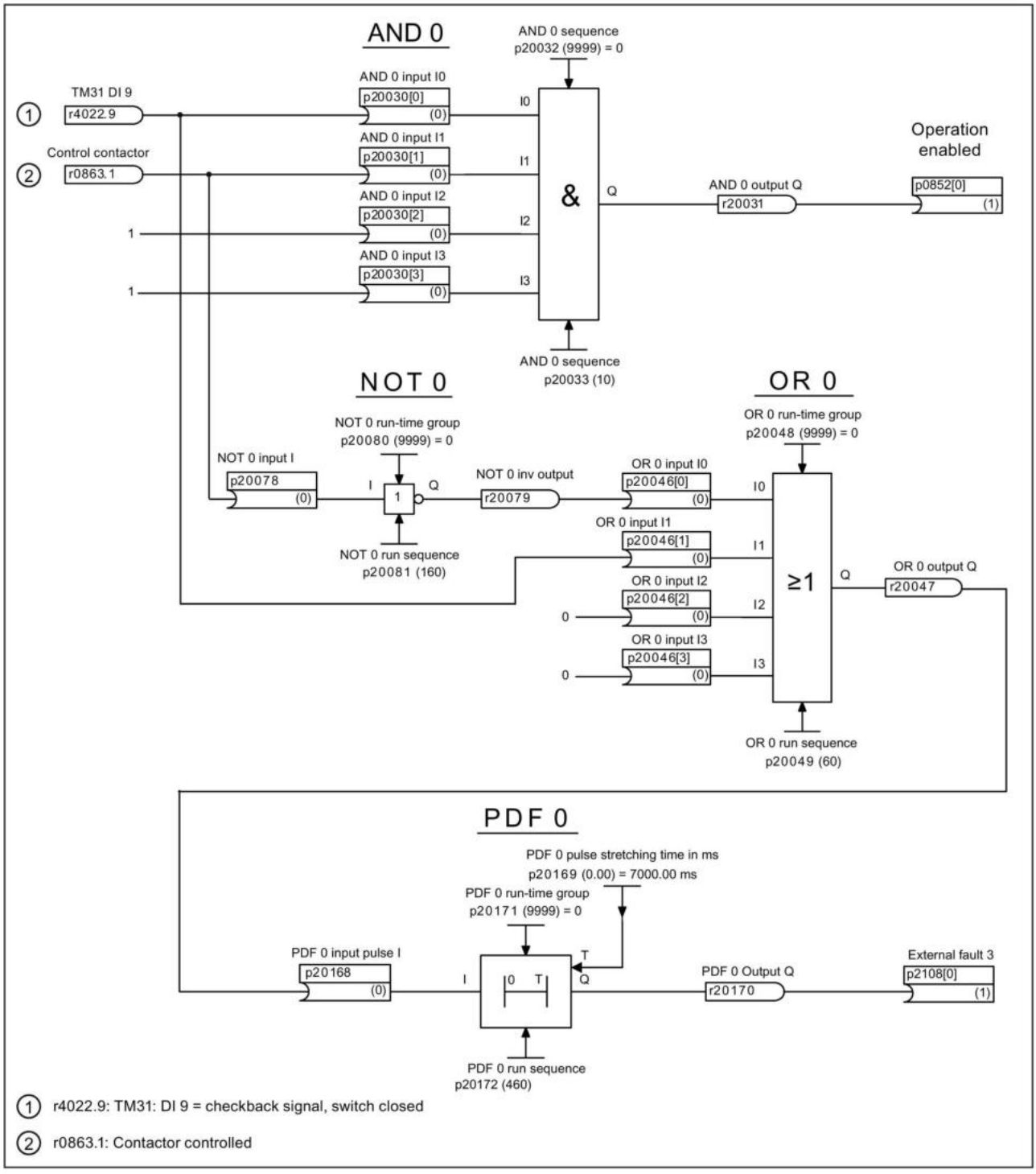


Figure 8-42 Interconnection for “Enable operation”

You must make sure that the converter only enables the pulses when the breaker is closed. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 65 Parameterization for the interconnection for "Operation enabled"

Parameterization	Description
(Drive_1) p20161 = 0	The "switch on delay 0 (PDE 0)" function block is assigned to run-time group 0.
(Drive_1) p20158 = (Drive_1) r0863.1	Input pulse I of the function block "Switch on delay 0 (PDE 0)" of the drive is interconnected using the "control contactor" drive signal.
(Drive_1) p20159 = 4000.00	The pulse delay time of function block "Switch on delay 0 (PDE 0) of the drive is set to 4000.00 ms.
(Drive_1) p20146 = 0	The "Pulse generator 1 (MFP 1)" function block is assigned to run-time group 0.
(Drive_1) p20143 = (Drive_1) r20160	Input pulse I of function block "Pulse generator 1 (MFP 1)" is interconnected with output Q of function block "Switch on delay 0 (PDE 0)".
(Drive_1) p20144 = 5000.00	The pulse duration of the "Pulse generator 1 (MFP 1)" function block is set to 5000.00 ms.
(Drive_1) p20048 = 0	The "OR 0" function block is assigned to run-time group 0.
(Drive_1) p20046[0] = (Drive_1) r20145	Output pulse Q of function block "Pulse generator 1 (MFP 1)" of the drive is interconnected at input I0 of the "OR 0" function block.
(Drive_1) p20046[1] = (TM31) r4022.9	Input signal DI9, terminal X541.3 of TM31 is interconnected at input I1 of function block "OR 0".
(Drive_1) p20046[2] = 0	A "0" signal is interconnected at input I2 of function block "OR 0"
(Drive_1) p20046[3] = 0	A "0" signal is interconnected at input I3 of function block "OR 0".
(Drive_1) p20032 = 0	The "AND 0" function block is assigned to run-time group 0.
(Drive_1) p20030[0] = (Drive_1) r20047	Output signal Q of function block "OR 0" of the drive is interconnected at input I0 of function block "AND 0" of the drive.
(Drive_1) p20030[1] = (Drive_1) r0863.1	The "control contactor" signal of the drive is interconnected at input I1 of the "AND 0" function block of the drive.
(Drive_1) p20030[2] = 1	A "1" signal is interconnected at input I2 of function block "AND 0" of the drive.
(Drive_1) p20030[3] = 1	A "1" signal is interconnected at input I3 of function block "AND 0" of the drive.
(Drive_1) p0860[0] = (Drive_1) r20031	The output signal of the "AND 0" function block of the drive is used for the "Line contactor feedback" signal of the drive.
(Drive_1) p0852[0] = (TM31) r4022.9	Input signal DI9, terminal X541.3 of TM31 is used for the signal "enable operation" of the drive.
(Drive_1) p0861 = 5000	The monitoring time of the line contactor is set to 5000 ms.

Interconnection for “ON command”

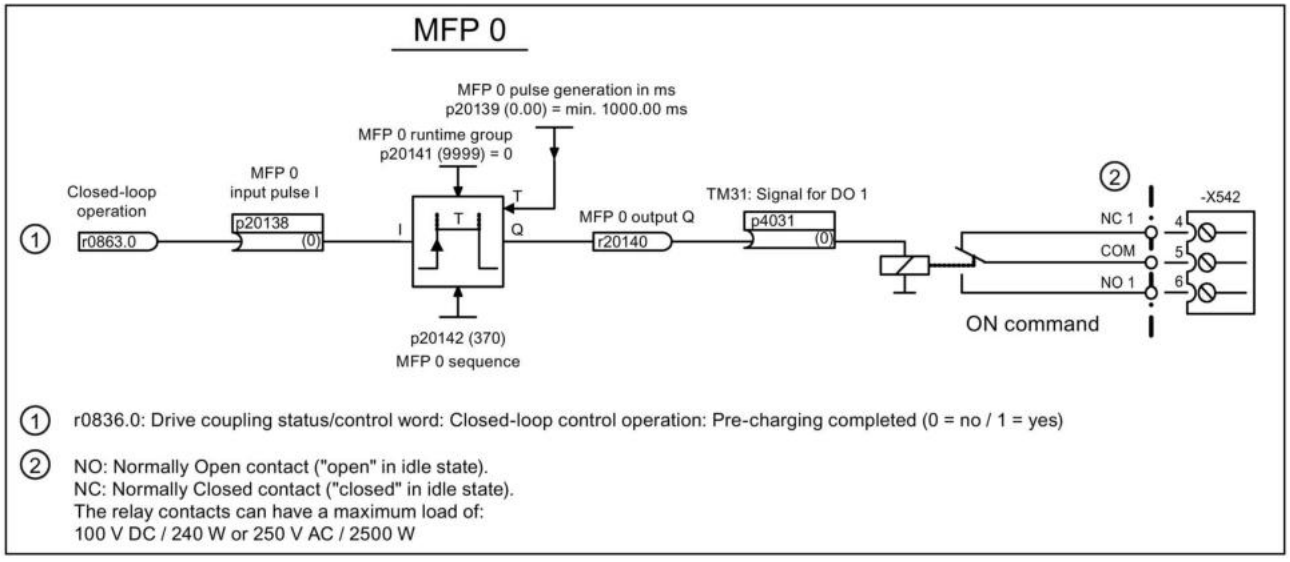


Figure 8-43 Interconnection for “ON command”

The drive must only be switched on when a DC link voltage is available. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 66 Parameterization for the interconnection for “On command”

Parameterization	Description
(Drive_1) p20141 = 0	The "Pulse generator 0 (MFP 0)" function block is assigned to run-time group 0.
(Drive_1) p20138 = (Drive_1) r0863.0	The "Control operation" signal of the drive is interconnected at the input of the “Pulse generator 0 (MFP 0)” function block.
(Drive_1) p20139 = 5000.00	The pulse duration of the "Pulse generator 0 (MFP 0)" function block is set to 5000.00 ms.
(TM31) p4031 = (Drive_1) r20140	The output signal of the “Pulse generator 0 (MPF 0)” function block of the drive is output to digital output 1 (DO 1) of the TM31.

8.33.4.3 Parameterization with DCC (Drive Control Chart)

The parameter settings described in section "Parameterization with free function blocks" can also be achieved using DCC. For this purpose the interconnections shown must be simulated with the corresponding DCC blocks.

8.34 L37, DC interface incl. pre-charging input circuit for the relevant DC link capacitance

8.34.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format

Description

If the Motor Module is to be disconnected or reconnected to the DC link of a drive line-up while the other Motor Modules and Line Modules remain in operation, this can be accomplished via the DC interface.

8.34.2 DC interface incl. pre-charging for Booksize Cabinet Kits

8.34.2.1 Important safety precautions

The Motor Module can be serviced after it has been disconnected from the DC busbar via the DC interface and after the capacitor discharge time has elapsed. However, the following safety precautions must be observed:

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.



⚠DANGER

Electric shock due to hazardous voltage

Once the DC busbar and the Motor Module in booksize format have been disconnected by means of the fuse switch disconnector (-Q7), dangerous voltages continue to be present in the adjacent Motor Modules in booksize format in the Cabinet Module:

- Up to 800 V on the DC busbar (protected against accidental contact).
- Line voltage (3 AC 380 ... 480 V) via the auxiliary power supply system or 2 AC 230 V downstream of the transformers for the fan supply.
- Up to 230 VAC via the auxiliary power supply system or via direct infeed for SITOP and fan supply.
- 24 VDC on the auxiliary power supply system (electronics power supply).
- On the motor connection (e.g. regenerative voltage due to residual speed).

Contact with live parts can result in death or serious injury.

- Only commission qualified specialists to carry out the work.
- Ensure that no voltage is present at the measuring points provided in the cabinet.
- Ensure that no voltage is present at the motor connections.
- When working close to the DC busbar in the cabinet, take care to avoid any contact with the DC busbar.
- When replacing components, make sure that no screws or small parts fall into the cabinet.
- Remove the fan fuse and fuse for the 24 VDC power supply

Note

Compliance with legal regulations

You must observe the applicable legal regulations when carrying out all work!

8.34.2.2 DC interface, principle of operation

The DC interface connects/disconnects the DC busbar and the Motor Module in the Cabinet Kit. This option is implemented with a pre-charging input circuit. A fuse switch disconnector, which is installed as a standard feature between the Motor Module and the DC busbar, as well as pre-charging resistors and contactor disconnectors connect the Motor Module with the DC busbar.

The contactor disconnector is triggered via a time relay, which is activated by the switch installed in the door.

Note

Switch when not under load

The DC interface should only be switched and the fuse switch disconnector should only be unplugged when not under load!

A checkback signal is transferred via the internal interconnection to the CU320-2 Control Unit which locks out switching under load.

8.34.2.3 Commissioning the DC interface with option K90/K95

With option K90/K95, a feedback signal contact from the fuse switch disconnector is connected to digital input 3 of the Control Unit (this connection is realized in the factory).

Note

Check the feedback signal after making changes to the parameterization

If changes are made to the factory-set parameters, you must verify that the "Infeed ready" feedback signal is connected to digital input 3 on the Control Unit (p0864 = r722.3).

If parameter p0864 is not wired to the feedback signal, then the switch can be operated under load. This can shorten the service life of the switch.

8.34.2.4 Commissioning the DC coupling without option K90/K95

If the cabinet does not contain a Control Unit (option K90 / K95), terminal -X41.12 of the DC coupling must be connected by the customer to a digital input of the Control Unit assigned to the controlled Motor Module. The 24 VDC supply for the feedback signal is provided via terminal -X41.11 (see circuit diagram).

The digital input to which the checkback contact is assigned must be connected to the "Infeed operation" parameter (p0864) of the drive object [Drive_1].

Example of digital input 3 on the Control Unit [CU]:

[Drive_1] p0864 = [CU] r722.3

The interconnection can be made with the STARTER commissioning tool or the AOP30 operator panel (option K08).

Note

Switching under load when feedback signal wiring is missing

If parameter p0864 is not wired to the feedback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

Note

Additional information

The digital input parameter assignment is described in the List Manual and S120 Commissioning Manual.

8.34.3 DC interface incl. pre-charging for Motor Modules in the chassis format

The main component of option L37 is a switch disconnector. This switch disconnector is installed on the busbar between the Motor Module and the DC busbar. This option also includes a pre-charging switch for the DC-link capacitors of the relevant Motor Module so that it can be switched in to the pre-charged DC busbar.

This switch can be actuated using an operating lever but only when the cabinet door is closed.

As an air guide, option L37 also includes option M60 (additional shock protection).

Note

This option is not used for switching the module on and off during operation.

Frame sizes FX and GX each contain two fuses, while frame size JX contains four fuses. Depending on the current carrying capacity, frame size HX contains either two or four fuses.

Four pre-charging resistors are also used in frame size JX for higher power ratings. For more detailed information, see the circuit diagrams.

Note

With option K90 (Control Unit), a checkback contact is wired from terminal -X41:12 to digital input 3 on customer terminal block -X55 to commission the DC interface via parameter interconnection (see "Commissioning the DC interface"). A jumper to the reference potential is also used.

8.34.3.1 Important safety precautions

The Motor Module can be serviced after it has been disconnected from the DC busbar via the DC interface and after the capacitor discharge time has elapsed. However, the following safety precautions must be observed:

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.



⚠DANGER

Electric shock due to hazardous voltage

Once the DC busbar and the Motor Module have been disconnected via the DC interface (-Q7), dangerous voltages may still be present in the Cabinet Module:

- Up to 1200 V on the DC busbar (protected against accidental contact).
- Line voltage (3 AC 380 ... 480 V or 3 AC 500 ... 690 V) on the auxiliary power supply system or 2 AC 230 V downstream of the transformers for the fan supply.
- Up to 230 VAC on the optional mounting locations.
- 24 VDC on the auxiliary power supply system (electronics power supply).
- On the motor connection (e.g. regenerative voltage due to residual speed).

Contact with live parts can result in death or serious injury.

- Only commission qualified specialists to carry out the work.
- Ensure that no voltage is present at the measuring points provided in the cabinet.
- Ensure that no voltage is present at the motor connections.
- When working close to the DC busbar in the cabinet, take care to avoid any contact with the DC busbar.
- When replacing components, make sure that no screws or small parts fall into the cabinet.
- Remove the fan fuse and fuse for the 24 VDC power supply.

Note

Compliance with legal regulations

You must observe the applicable legal regulations when carrying out all work!

The following figures show the location of the voltage source once disconnected from the DC busbar and the associated measuring points to verify isolation from the supply in the Cabinet Module.

8.34.3.2 Accessibility of the DC connection to the Motor Module

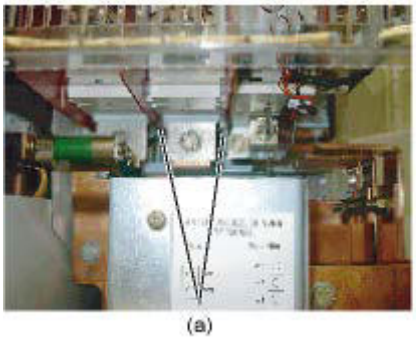


Figure 8-44 Front view



Figure 8-45 Side view (without side panel)

The current-conducting DC busbar behind the DC interface can be accessed once the power block has been removed ("(a)" in figure).

The DC busbar is sealed off sufficiently to prevent accidental contact.

8.34.3.3 Measuring points for verifying isolation from supply

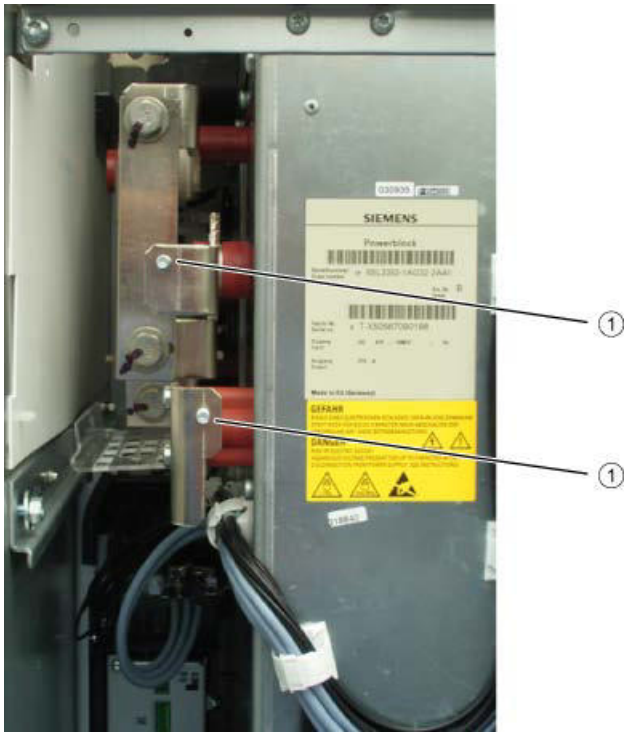


Figure 8-46 Measuring points at top, example for frame sizes FX and GX

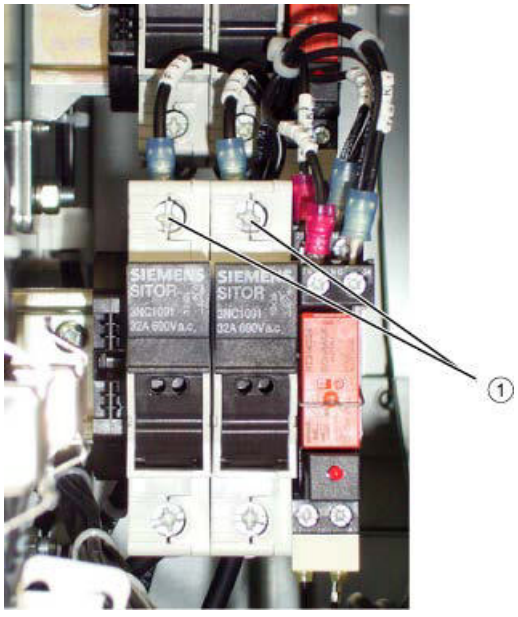


Figure 8-47 Measuring point, auxiliary power supply, fan supply bottom, frame sizes FX and GX

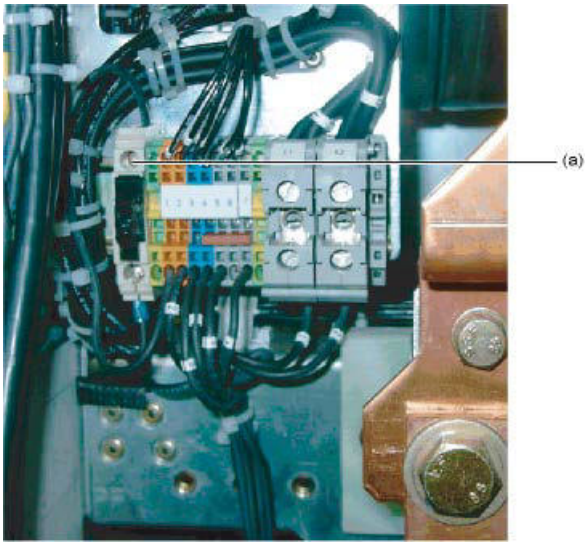


Figure 8-48 Measuring point, 24 VDC auxiliary power supply, frame sizes FX and GX

Take into account other voltages on optional components and refer to the circuit diagrams.

8.34.3.4 DC interface, principle of operation

Table 8- 67 DC interface, principle of operation

Switch setting	Meaning	Result/Comments
0	Switching contacts are open	Neither the pre-charging section nor the main charging section are switched in.
Precharging	DC interface is switched to PRECHARGE. DC-link capacitors are loaded. Pre-charging remains activated until the ON command is issued.	The pre-charging section is switched to the DC link busbar (the main section remains switched off). Once the unit is switched on with the ON command, the Motor Module unlocks the DC interface and moves it into the operating position.
1	Switching contacts are closed	The DC interface switches to position "1". When the DC switch is in the operating position, the connected auxiliary contacts are switched.

The required auxiliary power supply is provided via the auxiliary power supply system. To ensure that this functions properly, a digital input must be interconnected during commissioning. Like all the other required connections, this is pre-wired in the cabinet.

If any signals are required (e.g. for checkback purposes or for activating other units), two switching contacts can be used. Two normally-open contacts (NO) are available here for use as required. The contacts switch in "Pre-charging" (contacts 53, 54) or "Operation" position (contacts 63, 64). The auxiliary contacts can be loaded with a maximum of 3 A.

Note

Only activate the DC interface with the door closed

The DC interface must only be activated when the door is completely closed, otherwise the switch coupling and the door handle could be damaged!

The door must only be opened in position "0".

In the "Pre-charging" and "1 (Operation)" positions, the door cannot be opened. Attempting to open the door by force would damage the DC interface.

Note

Considerable force must be applied to move the DC interface between positions "0" and "Pre-charge"!

8.34.3.5 Commissioning the DC interface with option K90/K95

With option K90 or K95, a checkback contact from the switch is connected in the factory to digital input 3 of the Control Unit.

Note

Check the feedback signal after making changes to the parameterization

If changes are made to the factory-set parameters, you must verify that the "Infeed ready" feedback signal is connected to digital input 3 on the Control Unit (p0864 = r722.3).

If parameter p0864 is not wired to the feedback signal, then the switch can be operated under load. This can shorten the service life of the switch.

8.34.3.6 Commissioning the DC coupling without option K90/K95

If the cabinet does not contain a Control Unit (option K90/K95), terminal -X41:12 of the DC interface must be connected by the customer to a digital input of the Control Unit assigned to the controlled Motor Module.

The digital input to which the checkback contact is assigned must be connected to the "Infeed operation" parameter (p0864) of the drive object [Drive_1].

Example of digital input 3 on the Control Unit [CU]:

[Drive_1] p0864 = [CU] r722.3

The interconnection can be made with the STARTER commissioning tool or the AOP30 operator panel (option K08).

Note

Switching under load when feedback signal wiring is missing

If parameter p0864 is not wired to the feedback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

Note

To switch from the "Precharging" to the "1 (Operation)" position, a switching current of 6 A/24 V DC is required for 30 ms. This must be provided via the auxiliary power supply and taken into account during dimensioning (see the block diagram above).

Note

Additional information

When activating digital inputs, note the guidelines provided in the List Manual and S120 Commissioning Manual.

8.35 L40, line filter monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Active Line Modules
- Active Line Connection Modules-2

Description

The line filter monitoring option is used for monitoring the filter in the Active Interface Module for effectiveness against harmonic effects on the system.

By measuring the current and voltage in the Active Interface Module, the capacitance of the filter capacitors of the integrated filter is continuously calculated and compared with the installed nominal capacitance.

Alarm A06250 is triggered if the calculated capacitance is higher than the set comparison threshold.

Commissioning

To activate the comparison threshold of the nominal capacitance of the particular Active Interface Module, you must use a script. This automatically sets the corresponding parameters in STARTER.

The script "Option_L40_deu.txt" in German or "Option_L40_engl.txt" in English is provided on the customer DVD supplied with the device.

Inserting the script into the STARTER project:

1. Select the Infeed unit symbol in the STARTER project using the right mouse key, select "Expert" – "Insert script folder".
   The "SCRIPTS" folder is inserted.
2. Select the "SCRIPTS" folder using the right mouse key, select "Export/import" –"ASCII import…" and select the script "Option_L40_deu.txt" or "Option_L40_eng.txt".
   Script "Option_L40" is inserted after acknowledging the following screen form.
3. Select script "Option_L40" using the right mouse key and then select "Accept and execute".

After the script has been successfully executed, message "L40 option successfully parameterized!" is output.

If the message "No ALM/line filter found! The script execution was interrupted" or "Only for ALM", appears, then the script is in the incorrect folder, or an unknown Active Interface Module was found.

Alarm A06250 is output

If alarm A06250 "Infeed: Defective capacitor(s) in at least one phase of line filter" is output, there is a risk that the line harmonics no longer correspond to the original nominal values. As a consequence, sensitive devices that are connected to the same line connection point could be damaged.

Contact the Siemens AG hotline within the next 4 weeks.

8.36 L41, current transformer upstream of main switch

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

If current transformers are used for measuring or monitoring purposes, they are installed in the Line Connection Modules with option L41. The current transformers are installed upstream of the main breaker in all three line phases of the infeed.

The transformers have an accuracy class of 1.0. The secondary current is maximum 1 A.

The measuring connections for the current transformers are routed in the Line Connection Module to terminal block -X60.

Transformation ratio of the current transformer in the Line Connection Module

The assignment of the article numbers of the Line Connection Modules to the ratios of the current transformers are listed in the following table.

Table 8- 68 Transformation ratios of the current transformers

Article No.	V_{IN}	Transformation ratio
6SL3700-0LE32-5AA3	380 to 480 V AC, 3-phase	400/1
6SL3700-0LE34-0AA3	380 to 480 V AC, 3-phase	400/1
6SL3700-0LE36-3AA3	380 to 480 V AC, 3-phase	800/1
6SL3700-0LE38-0AA3	380 to 480 V AC, 3-phase	800/1
6SL3700-0LE41-0AA3	380 to 480 V AC, 3-phase	2000/1
6SL3700-0LE41-3AA3	380 to 480 V AC, 3-phase	2000/1
6SL3700-0LE41-6AA3	380 to 480 V AC, 3-phase	2000/1
6SL3700-0LE42-0AA3	380 to 480 V AC, 3-phase	4000/1
6SL3700-0LE42-0BA3	380 to 480 V AC, 3-phase	4000/1
6SL3700-0LE42-5BA3	380 to 480 V AC, 3-phase	4000/1
6SL3700-0LE43-2BA3	380 to 480 V AC, 3-phase	4000/1
6SL3700-0LG32-8AA3	500 to 690 V AC, 3-phase	400/1
6SL3700-0LG34-0AA3	500 to 690 V AC, 3-phase	800/1
6SL3700-0LG36-3AA3	500 to 690 V AC, 3-phase	800/1
6SL3700-0LG38-0AA3	500 to 690 V AC, 3-phase	800/1
6SL3700-0LG41-0AA3	500 to 690 V AC, 3-phase	2000/1
6SL3700-0LG41-3AA3	500 to 690 V AC, 3-phase	2000/1
6SL3700-0LG41-6AA3	500 to 690 V AC, 3-phase	2000/1
6SL3700-0LG42-0BA3	500 to 690 V AC, 3-phase	4000/1
6SL3700-0LG42-5BA3	500 to 690 V AC, 3-phase	4000/1
6SL3700-0LG43-2BA3	500 to 690 V AC, 3-phase	4000/1

Transformation ratio of the current transformer in the Active Line Connection Module-2

The assignment of the article numbers of the Active Line Connection Modules-2 to the ratios of the current transformers are listed in the following table.

Table 8- 69 Transformation ratios of the current transformers

Article No.	U_{IN}	Transformation ratio
6SL3731-7TE35-6RE0 6SL3731-7TE35-6LE0	3 AC 380 … 480 V	800/1
6SL3731-7TE36-4RE0 6SL3731-7TE36-4LE0	3 AC 380 … 480 V	800/1
6SL3731-7TE37-5RE0 6SL3731-7TE37-5LE0	3 AC 380 … 480 V	2000/1
6SL3731-7TE38-4RE0 6SL3731-7TE38-4LE0	3 AC 380 … 480 V	2000/1
6SL3731-7TE38-8RE0 6SL3731-7TE38-8LE0	3 AC 380 … 480 V	2000/1
6SL3731-7TE41-0RE0 6SL3731-7TE41-0LE0	3 AC 380 … 480 V	2000/1

X60 line current transformer

Table 8- 70 Terminal block X60

Terminal	Designation	Technical data
1	-T110: k/S1	Current transformer on phase U1/L1
2	-T110: l/S1	
3	-T111: k/S1	Current transformer on phase V1/L2
4	-T111: l/S1	
5	-T112: k/S1	Current transformer on phase W1/L3
6	-T112: l/S1	
Max. connectable cross-section: 2.5 mm²		

8.37 L42/L43/L44, Line Connection Module for Active/Basic/Smart Line Modules

Availability of options

These options are available for the following S120 Cabinet Modules:

- Line Connection Modules

Option L42, Line Connection Module for Active Line Modules

This option allows the Line Connection Module to be adjusted for connection to an Active Line Module.

If a main contactor is required in the Line Connection Module for correct functioning, then this contactor is included.

Option L43, Line Connection Module for Basic Line Modules

This option allows the Line Connection Module to be adjusted for connection to a Basic Line Module.

In this case, the Line Connection Modules are equipped with the line reactor for Basic Line Modules. If the line reactor is not required, it can be deselected with option L22 (line reactor not included in scope of supply).

Option L44, Line Connection Module for Smart Line Modules

This option means that the Line Connection Module is adjusted for connection to a Smart Line Module.

If a main contactor is required in the Line Connection Module for correct functioning, then this contactor is included.

8.38 L45, EMERGENCY OFF pushbutton installed in the cabinet door

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

The EMERGENCY OFF pushbutton with protective collar is integrated in the cabinet door of the Line Connection Module. The contacts of the pushbutton are connected to a terminal block. From here, the EMERGENCY OFF pushbutton can be integrated into the plant-side EMERGENCY OFF chain.

Note

Ensure the EMERGENCY OFF function on the plant side

The EMERGENCY OFF function must be ensured on the plant side.

X120 checkback contact "EMERGENCY OFF pushbutton in the cabinet door"

Table 8- 71 Terminal block X120

Terminal	Designation [1]	Technical data
1	NC	Feedback signal contacts from the EMERGENCY OFF pushbutton in the cabinet door Max. load current: 10 A Max. switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
2		
3	NC (internal)	
4		
Max. connectable cross-section: 4 mm²		

[1] NC: NC contact

8.39 L46/L47, grounding switch upstream/downstream of main switch

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules (frame sizes KL and LL)

Description

The grounding switch short-circuits the incoming supply line to ground for servicing. It is engaged manually by means of a rotary actuator and ensures, for example, safe isolation from supply in the Cabinet Module during servicing.

Two versions are available and can be supplied at the same time:

- Version 1 (L46) establishes a ground connection for the connected power lines.
- Version 2 (L47) grounds the cabinet's internal components located downstream of the circuit breaker.

8.39.1 Grounding switch upstream of main breaker (option L46)

The grounding switch upstream of the internal main switch shorts the supply network to ground.



WARNING

Closing the grounding switch with the line voltage present

Death or serious injury can result through closing the grounding switch with the line voltage present.

- Plant-side measures must be taken to prevent the grounding switch from engaging when the line voltage is present.
- For this purpose, connect the checkback signal "Interruption of higher-level switches" to the higher-level switching equipment so that, when required, the upstream main switch trips immediately.
- Ensure that the supply system cannot be connected when the grounding switch is engaged.

Note

The signals required for interlocking are available on the terminal block.

X70 "Grounding switch upstream of internal main switch"

Table 8- 72 Terminal block X70

Terminal	Designation [1]	Technical data
1	L1	Grounding switch enable 230 VAC / 0.1 A
2	N	
3	NC	"Interruption of higher-level switches" feedback signal Leading contact Max. load current: 3 A Max. switching voltage: 250 VAC
4	NO	
5	COM	
6	NC	"Switch actuated" checkback signal Max. load current: 3 A Max. switching voltage: 250 VAC
7	NO	
8	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

8.39.2 Grounding switch downstream of main breaker (option L47)

The grounding switch downstream of the internal main switch short-circuits the components downstream of the circuit-breaker to ground.

Note

Measures required when closing the grounding switch with the voltage available

In this case, the grounding switch and the main switch of the Line Connection Module are interlocked electrically. This ensures that when the main switch is closed, it is opened again when the grounding switch is switched on.

If the grounding switch is engaged, it is interlocked to ensure that the main switch cannot be switched in.

X71 terminal block "Grounding switch downstream of internal main switch"

Table 8- 73 Terminal block X71

Terminal	Designation [1]	Technical data
1	L1	Grounding switch enable 230 VAC / 0.1 A
2	N	
3	NC (reserved, do not use)	Circuit breaker interlock ("Grounding switch open")
4	NC (reserved, do not use)	
5	COM (reserved, do not use)	
6	NC	"Switch actuated" checkback signal Max. load current: 3 A Max. switching voltage: 250 VAC
7	NO	
8	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

8.40 L50, cabinet lighting with service socket

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

With option L50, cabinet lighting and an additional service socket outlet is included for grounding plug (connector type F) according to CEE 7/4. The power supply for the cabinet lighting and the service socket is external and must be fuse-protected for max. 10 A.

The cabinet lighting consists of an LED hand lamp with on/off switch and with magnetic fasteners and an approx. 3 m long connecting cable. When delivered from the factory, the lamp is already positioned at the defined marks in the cabinet door and the connecting cable is wound on the holder.

Note

During operation of the cabinet unit, the cabinet lighting must remain attached in its position on the cabinet door. The position on the cabinet door is marked by an adhesive label. The connecting cable must be wound on its holder.

Connection

Table 8- 74 Terminal block X390 – connection for cabinet lighting with service socket

Terminal	Designation	Technical data
1	L1	230 V AC power supply
2	N	
3	PE	Protective conductor
Max. connectable cross-section: 4 mm²		

8.41 L55, cabinet anti-condensation heating

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The cabinet anti-condensation heating prevents at low ambient temperatures and high levels of humidity the formation of condensation.

A 100 W heater (-E240) is deployed for 400 mm and 600 mm cabinets. Two 100 W heaters (-E240, -E241) are deployed for cabinet widths of 800 mm or higher.

The power supply (110 to 230 VAC) must be provided externally and protected with a fuse of up to 16 A.

X240 connection for cabinet anti-condensation heating

Table 8- 75 Terminal block X240

Terminal	Designation	Technical data
1	L1	110 to 230 VAC voltage supply
2	N	Current demand: - min.: approx. 0.43 A (for 230 VAC, 100 W) - max.: approx. 1.8 A (for 110 VAC, 200 W)
3	PE	Protective conductor
Max. connectable cross-section: 4 mm²		



⚠WARNING

Dangerous electrical voltage as a result of external auxiliary supplies

When the external supply voltage for the cabinet anti-condensation heating is connected, dangerous voltages are present in the cabinet unit even when the main switch is open. Death or serious injury can result when live parts are touched.

- Observe the general safety rules when working on the device.



⚠CAUTION

Burns caused by hot surfaces of the cabinet anti-condensation heating

In operation, the cabinet anti-condensation heating can reach high temperatures, which can cause burns if touched.

- Allow the cabinet anti-condensation heating to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

Note

Provide a temperature controlled supply voltage

The supply voltage can be provided by means of a temperature control, to prevent the anti-condensation heating unnecessarily operating at a higher ambient temperature.

8.42 L61/L62, L64/L65, braking units

8.42.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Motor Modules in chassis format

Description

Braking units may be required for drives in which motors might operate in generator mode but have no other facility for feeding energy back into the supply system.

The braking unit comprises two components:

- A Braking Module that is installed in the Power Module
- A braking resistor to be mounted externally (degree of protection IP20)

The braking unit functions as an autonomous unit, and does not require an external power supply.

The Braking Modules are installed in the air outlet channel of the Basic Line Module, Smart Line Module, Active Line Module, or Motor Module.

During the braking process, the kinetic energy is converted into heat in the externally mounted braking resistor.

A maximum cable length of 100 mm is permissible between the Braking Module and the braking resistor. This allows the braking resistor to be mounted externally so that heat losses can be released outside the converter enclosure. The braking resistor is connected directly to the Braking Module terminals.

The application threshold of the Braking Module can be adjusted to the plant-side requirements using a threshold switch.

Note

Higher braking powers are available on request.

8.42.2 Interfaces

Connection for the braking resistor

The connection is made directly at terminal -X5.

Table 8- 76 Connection for the braking resistor

Terminal	Designation
-X5:1	Braking resistor connection R+
-X5:2	Braking resistor connection R-

Recommended connection cross-sections:

- For option L61/L64 (25 kW): 35 mm²
- For option L62/L65 (50 kW): 50 mm²

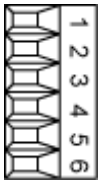
Note

Strain relief

For strain relief, the cables must be clamped on the cable propping bar (C-type mounting bar).

X21 digital inputs/outputs

Table 8- 77 Terminal strip X21

Connector	Terminal	Designation [1]	Technical data
	1	Shield	Shield connection for terminals 2 to 6
	2	0 V	High level: +15 ... 30 V Current drain: 2 ... 15 mA Low level: -3 … 5 V
	3	DI inhibit input	
	4	0 V	High signal: No fault Low signal: Fault present Voltage: 24 VDC Load current: 0.5 ... 0.6 A
	5	DO fault output	
	6	+24 V	Voltage: +18 ... 30 V Typical current consumption (intrinsic current consumption): 10 mA at 24 VDC
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; DO: digital output

The signals of terminal strip -X21 are factory-routed to customer interface -X55 (maximum connectable cross-section: 2.5 mm^2):

- Jumper from -X21:2 to -X55-X132:14 (ground)
- Jumper from -X21:3 to -X55-X132:12 (DI/DO14)
- Jumper from -X21:5 to -X55-X132:1 (DI4)
- Jumper from -X21:6 to -X55-X132:9 (DI/DO12)

Note

The "DO fault output" signal can be used for evaluation in the Control Unit.

On the "+24 V" signal, 24 VDC must be provided by the customer to supply the Braking Module.

Note

Signal characteristics of terminal X21.3

Applying a high signal to terminal X21.3 inhibits the Braking Module. On a falling edge, pending error messages are acknowledged.

Note

The Braking Module requires DC-link voltage so that the "No fault" message can be issued correctly.

Commissioning/parameterization

If a Control Unit is not available (option K90/K95), then the four signals of terminal block -X55-X132 must be wired to the corresponding Control Unit or to the customer interface -X55.

8.42.3 S1 - Threshold switch

The response threshold at which the Braking Module is activated and the DC-link voltage generated during braking is specified in the following table.

⚠WARNING

Electric shock when operating threshold switches

Operating the threshold switch when a voltage is present can cause death or serious injury.

- Only use the threshold switch when the Basic Line, Smart Line, Active Line or Motor Module are switched off and the DC-link capacitors are discharged.

Table 8- 78 Response thresholds of the Braking Modules

Voltage	Response threshold	Switch position	Comments
3 AC 380 ... 480 V	673 V	1	774 V is the default factory setting. For line voltages of between 3 AC 380 V and 400 V, the response threshold can be set to 673 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (673/774)² = 0.75. The maximum available braking power is therefore 75%.
	774 V	2	
3 AC 500 ... 600 V	841 V	1	967 V is the default factory setting. With a supply voltage of 500 V 3 AC, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (841/967)² = 0.75. The maximum available braking power is therefore 75%.
	967 V	2	
3 AC 660 ... 690 V	1070 V	1	1158 V is the default factory setting. With a supply voltage of 660 V 3 AC, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (1070/1158)² = 0.85. The maximum available braking power is therefore 85%.
	1158 V	2	

Note

Switch positions

The positions of the threshold switches for the braking modules are as follows when installed:

- Braking Modules for frame sizes FX, FB, GX, GB: Position "1" is up; position "2" is down
- Braking Modules for frame sizes HX, JX: Position "1" is at the back; position "2" is at the front

Note

"Overvoltage" fault

Even when the response threshold is set to a low value, the DC-link voltage can still reach the maximum voltage value (hardware shutdown threshold), thus triggering the "Overvoltage" fault. This can occur, for example, in cases where there is too much regenerative energy for the available braking power.

To prevent the DC-link voltage from exceeding the threshold, the Vdc-max controller must be enabled (p1240) and the device supply voltage set accordingly (p0210).

8.42.4 Braking Module

Braking Module for frame sizes FX, FB

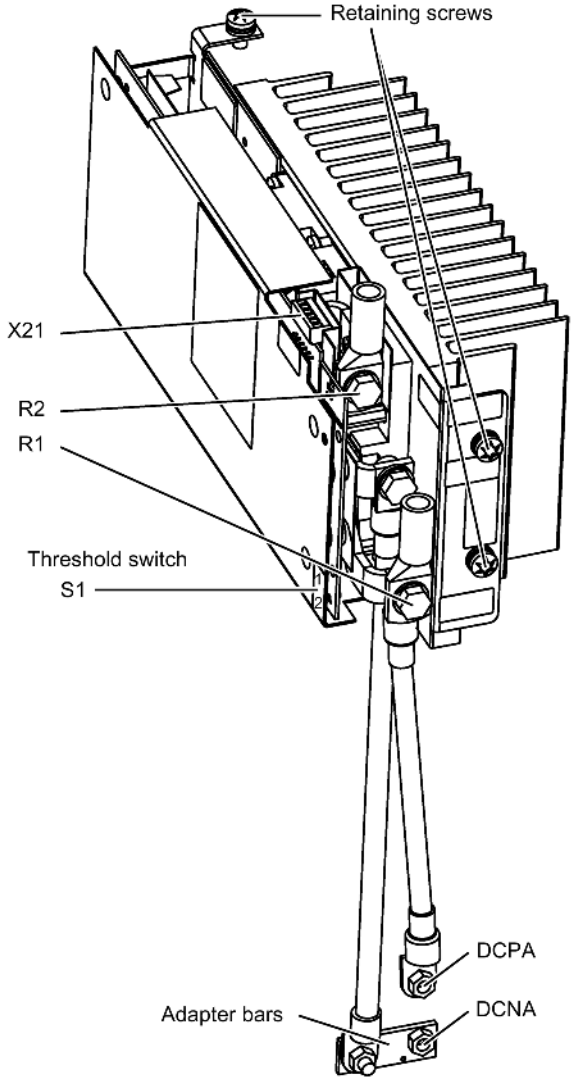


Figure 8-49 Braking Module for Active Line Module / Motor Module, frame size FX and for Basic Line Module, frame size FB

Note

Connecting interfaces

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame sizes GX, GB

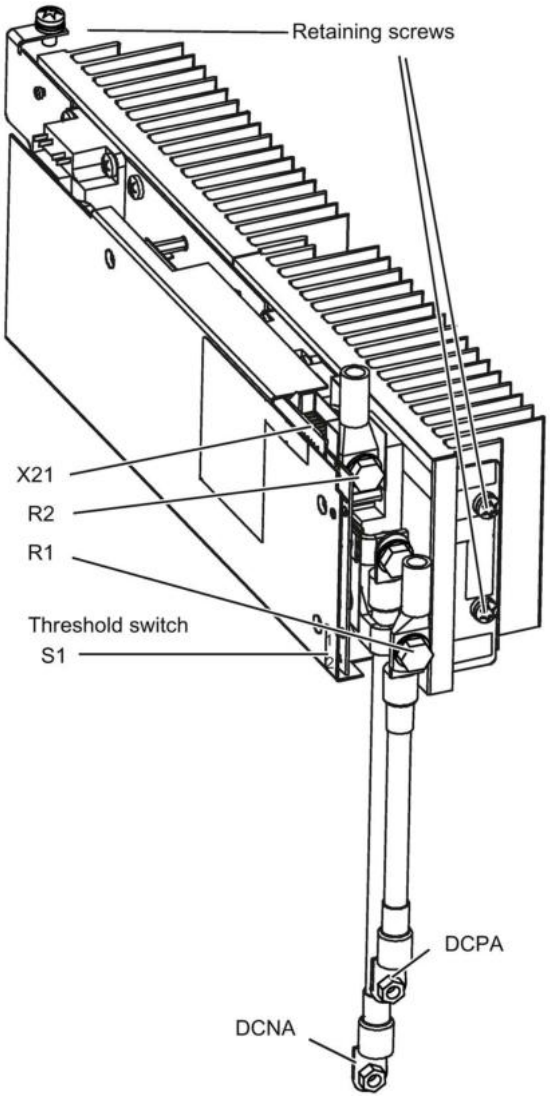


Figure 8-50 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame size GX and for Basic Line Module, frame size GB

Note

Connecting interfaces

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame sizes HX and JX

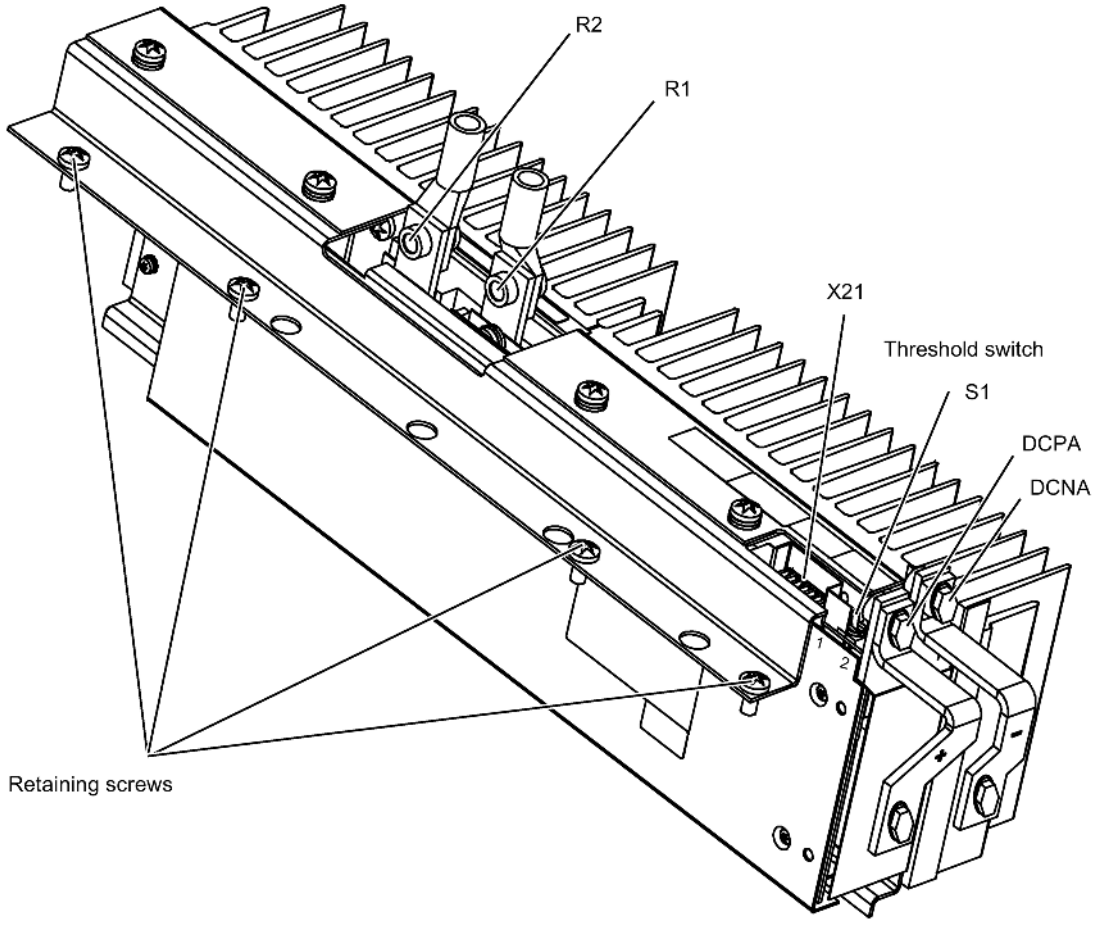


Figure 8-51 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame sizes HX and JX

8.42.5 Example connection of Braking Module

The connections between the Braking Module and the DC link and control terminal strip -X21 are made in the factory.

The braking resistor is connected directly to terminal -X5.

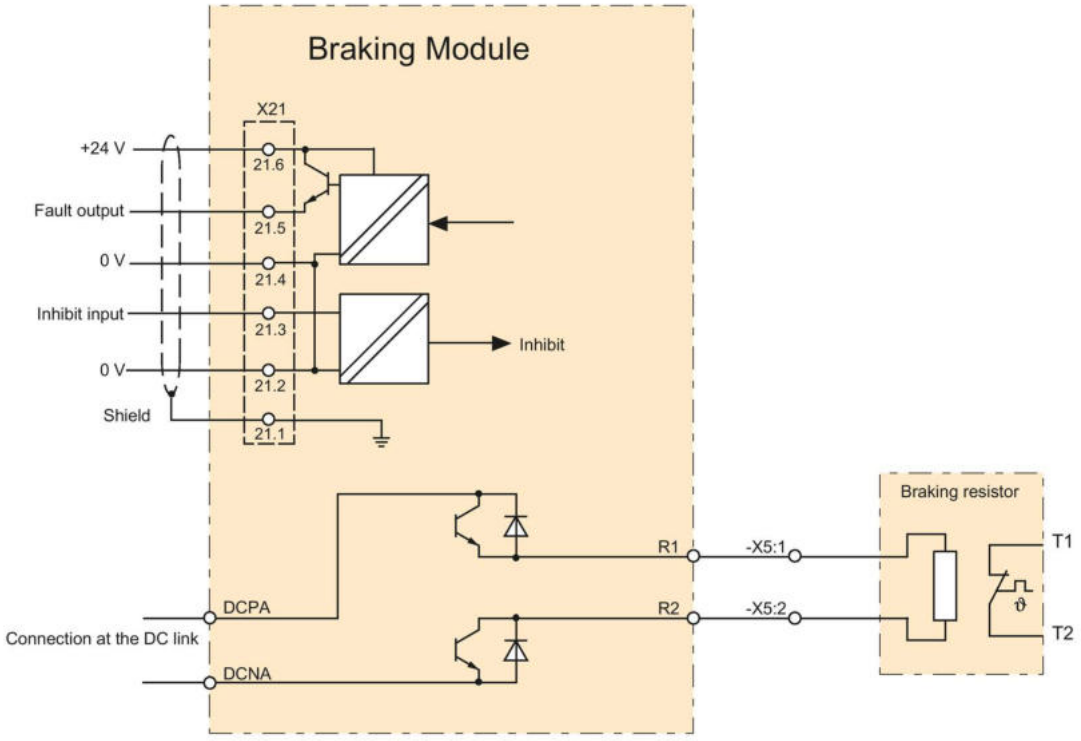


Figure 8-52 Example connection of Braking Module

8.42.6 Braking resistors

Description

The excess energy of the DC link is dissipated via the braking resistor.

The braking resistor is connected to a Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This enables the resulting heat loss around the Basic Line Module, Smart Line Module, Active Line Module, or Motor Module to be dissipated, thereby reducing the amount of air conditioning required.

Resistors with a rated power (continuous power) of 25 kW and 50 kW are available.

A thermostatic switch monitors the braking resistor for overtemperature and issues a signal on a floating contact if the limit value is exceeded.

Note

These braking resistors are not the same as the components described in the "Central Braking Module" Cabinet Module and must not be connected to this Cabinet Module.

Dimension drawings

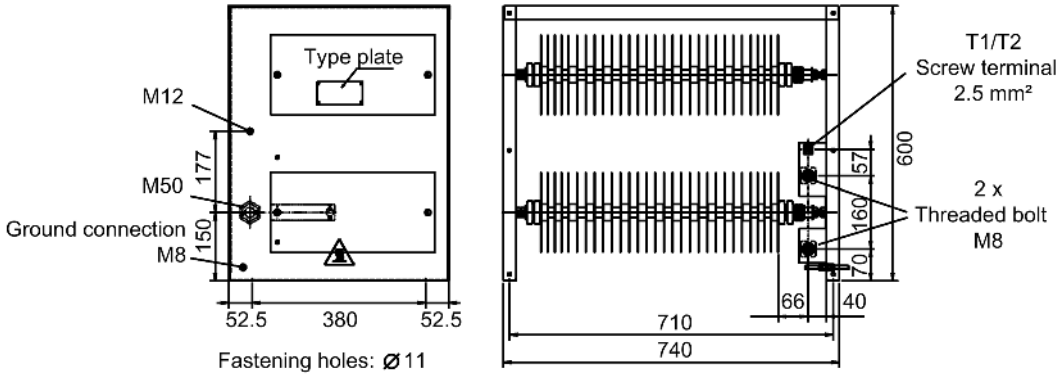


Figure 8-53 Dimension drawing for braking resistor 25 kW, 125 kW (option L61 / L64)

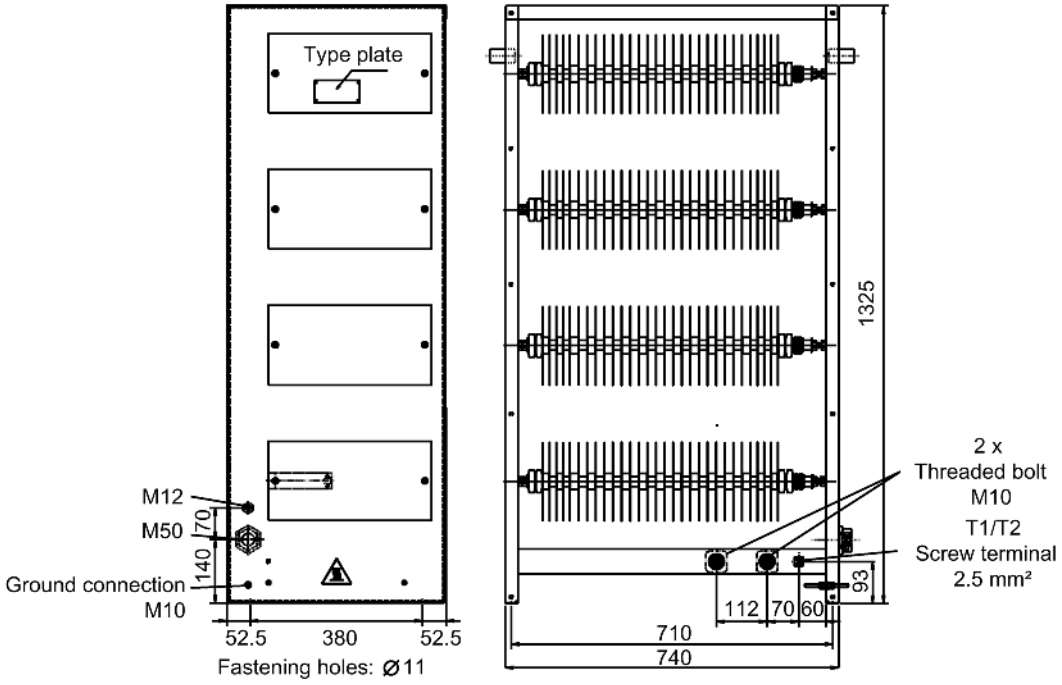


Figure 8-54 Dimension drawing for braking resistor 50 kW, 250 kW (option L62 / L65)

Safety instructions

⚠WARNING

Fire for an inadequate installation

If incorrectly installed (non-observance of the cooling clearances or inadequate clearances to flammable objects), there is the danger of fire damage with death or severe injury.

- It is essential that you maintain a cooling clearance of 200 mm on all sides of the braking resistor with ventilation grills.
- Maintain sufficient clearance to objects that can burn.



⚠CAUTION

Burns caused by hot surfaces of the braking resistor

In operation, the braking resistor can reach high temperatures, which can cause burns if touched.

- Allow the braking resistor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

⚠WARNING

Fire caused by ground fault / short-circuit for non-protected connections to the braking resistor

Non-protected connections to the braking resistor can cause fire with smoke in the event of a short-circuit or ground fault that can cause severe injuries or death.

- Route the cables to the braking resistor so that a ground fault or short-circuit can be ruled out.
- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- Apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. using spacers.
  - Route the cables in separate cable ducts or pipes.

NOTICE

Material damage when exceeding the maximum permitted cable length

Exceeding the maximum permitted cable length to the braking resistor can cause material damage in the event of component failure.

- Observe the maximum cable length between the cabinet unit and the braking resistor of 100 m.

Thermostatic switch

Table 8- 79 Thermostatic switch connection

Terminal	Description of function	Technical specifications
T1	Thermostatic switch connection	Voltage: 240 VAC Load current: Max. 10 A
T2	Thermostatic switch connection	

Max. connectable cross-section: 2.5 mm²

⚠WARNING

Fire when there is no evaluation of the thermostatic switch

If there is no evaluation of the thermostatic switch, there is the danger of fire damage with death or severe injury.

- Evaluate the thermostatic switch by the Control Unit or a higher-level controller, and a shutdown must be carried out if necessary.

8.42.7 Technical data

Load data for the braking units

Table 8- 80 Load data for the braking units

Line voltage	Braking Module continuous power P_{DB}	Braking Module peak power P_{15}	Braking Module P_{20} power	Braking Module P_{40} power	Braking resistor R_B	Max. current
380 ... 480 V	25 kW	125 kW	100 kW	50 kW	4.4 Ω ± 7.5%	189 A
380 ... 480 V	50 kW	250 kW	200 kW	100 kW	2.2 Ω ± 7.5%	378 A
500 ... 600 V	50 kW	250 kW	200 kW	100 kW	3.4 Ω ± 7.5%	306 A
660 ... 690 V	25 kW	125 kW	100 kW	50 kW	9.8 Ω ± 7.5%	127 A
660 ... 690 V	50 kW	250 kW	200 kW	100 kW	4.9 Ω ± 7.5%	255 A

Dimensions of the braking resistors

Table 8- 81 Dimensions of the braking resistors

	Unit	25 kW resistor (Option L61/L64)	50 kW resistor (Option L62/L65)
Width	mm	485	485
Height	mm	605	1325
Depth	mm	740	810

Duty cycle

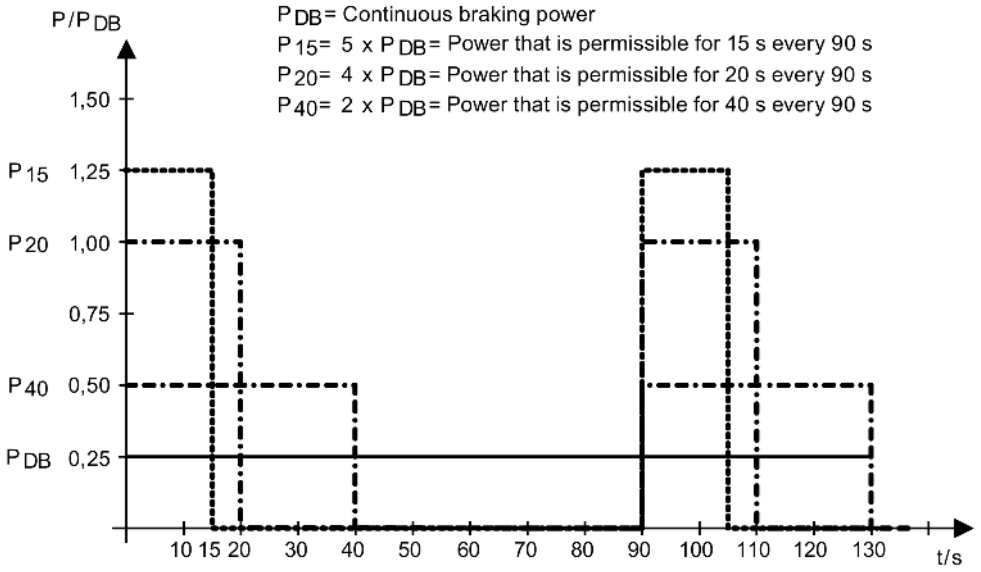


Figure 8-55 Duty cycle for braking resistors

8.43 L87, insulation monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

In non-grounded systems (IT systems), the insulation monitor checks the entire electrically-connected circuit for insulation faults. It measures the insulation resistance as well as all insulation faults in the Cabinet Modules, from the supply infeed to the motors. Two response values (between 1 kΩ and 10 MΩ) can be set. If a response value is undershot, a warning is output to the terminal. System errors are output via the signaling-relay system.

When the Cabinet Module is delivered, the plant configuration (one or several loads in one electrically-connected network) and the protection philosophy (immediate shutdown in the event of an insulation fault or restricted continued motion) can vary. This means that the signaling relays of the insulation monitor must be integrated by the customer in the fault and warning sequence.

Note

Number of insulation monitors

Only one insulation monitor can be used within the same electrically-connected network!

Note

The connection clip to the basic interference suppression module is removed in the factory

When using the insulation monitoring option, the connecting clip to the basic interference suppression module is removed in the factory in the following Cabinet Modules and attached loose in the cabinet device:

- Basic Line Modules
- Smart Line Modules (for frame sizes HX and JX, the connection clip is located behind the fan) - including the Voltage Sensing Module VSM10 included with it
- Active Line Modules (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10 included in it
- Active Line Connection Modules-2 (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10

The positions of the connection clips in the Cabinet Modules can be taken from Chapter "Connecting Cabinet Modules to non-grounded line supplies (IT systems) (Page 109)".

Controls and displays on the insulation monitor

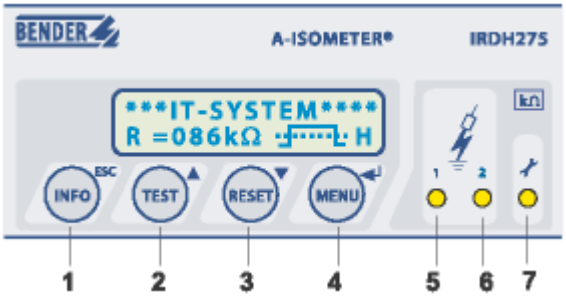


Figure 8-56 Controls and displays on the insulation monitor

Table 8- 82 Meaning of the controls and displays on the insulation monitor

Item	Meaning
1	INFO key: To request standard information/ ESC key: Back menu function
2	TEST key: Call up self-test/ Arrow key up: Parameter change, scrolling
3	RESET button: Delete insulation and error messages (A-Isometer only) Arrow key down: Parameter change, scrolling
4	Menu key: Call up menu system/ Enter key: Confirm parameter change
5	Alarm LED 1 lights up: Insulation fault, first alarm threshold reached
6	Alarm LED 2 lights up: Insulation fault, second alarm threshold reached
7	LED lights up: System error present

Connecting

Table 8- 83 Connections on insulation monitor

Terminal	Technical data
A1	Voltage supply via non-replaceable fusing 6 A:
A2	88 to 264 VAC, 77 to 286 VDC
L1	Connection of the 3 AC system to be monitored
L2	
AK	Connection to coupling device
KE	PE connection
T1	External test button
T2	External test button
R1	External reset button (NC contact or wire jumper, otherwise the error message is not stored)
R2	External reset button (NC contact or wire jumper)
F1	STANDBY with aid of F1, F2 function input:
F2	No insulation measurement when the contact is closed
M+	External kΩ display, analog output (0 to 400 µA)
M-	External kΩ display, analog output (0 to 400 µA)
A	Serial interface RS 485
B	(termination by means of 120 ohm resistor)
11	Signaling relay ALARM 1 (mid-position contact)
12	Signaling relay ALARM 1 (NC contact)
14	Signaling relay ALARM 1 (NO contact)
21	Signaling relay ALARM 2 (mid-position contact)
22	Signaling relay ALARM 2 (NC contact)
24	Signaling relay ALARM 2 (NO contact)
Max. connectable cross-section: 2.5 mm²	

Note

Additional information

Detailed and comprehensive instructions and information for the insulation monitor can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.44 M06, base 100 mm high, RAL 9005

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

Because it is raised 100 mm, the supplementary cabinet base facilitates higher cable bending radii (cable is fed in from below) and cable routing within the cabinet base.

The cabinet base comes completely assembled and is usually color RAL 9005.

Table 8- 84 Components of the cabinet base

Component	Connection element	Fixing elements
1 x base element (rear)		On the cabinet: The cabinet base is shipped pre-assembled.
1 x base element (front)		
Base covers (option M26/M27 only)		On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).
4 x cover caps		

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual bases are not connected for cabinet units installed in a side-by-side configuration. The connection from the base to the cabinet and between the cabinet units ensures sufficient stability.

Note

In transport units, the base covers inside the transport unit are only secured at the bottom and are folded down parallel to the ground.

8.45 M07, cable-marshalling compartment 200 mm high, RAL 7035

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

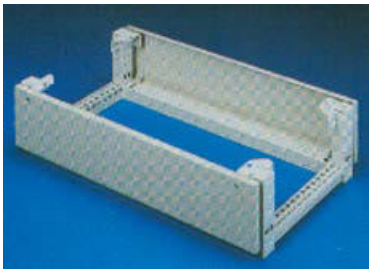
Because it is raised 200 mm, the supplementary cable marshalling compartment made of rigid sheet steel facilitates higher cable bending radii (cable is fed in from below) and cable routing within the cable marshalling compartment.

The cable-marshalling compartment comes completely assembled and has color RAL 7035 as standard.

Note

The cable marshalling compartment increases the cabinet height by 200 mm.

Table 8- 85 Components of the cable marshalling compartment

Component	Connection element	Fixing elements
1 x cable marshalling compartment element		On the cabinet: The cabinet's cable marshalling compartment is shipped pre-assembled.
Side shutters (not shown) for the cable marshalling compartment (option M26/M27 only).		On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual cable marshalling compartments are not connected for cabinet units installed in a side-by-side configuration. The connection from the cable marshalling compartments to the cabinet and between the cabinet units ensures sufficient stability.

Side shutters for cable marshalling compartments

When the cabinet units are installed in a side-by-side configuration, the side shutters can be folded inward and upward.

8.46 M21, degree of protection IP21

8.46.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

To increase the degree of protection of the cabinet units from IP20 (standard) to IP21, additional canopies are supplied.

Increasing the degree of protection in this way ensures that not only is the cabinet unit protected against the ingress of foreign bodies with a diameter of 12.5 mm and above (IP20, protection level provided as standard), but also against the ingress of water droplets falling vertically from above (IP21).

The canopy is mounted using spacers at a distance of 250 mm above the top cover of the cabinet. The canopy increases the height of a cabinet unit by 250 mm, as shown in the diagram below (number (1)).

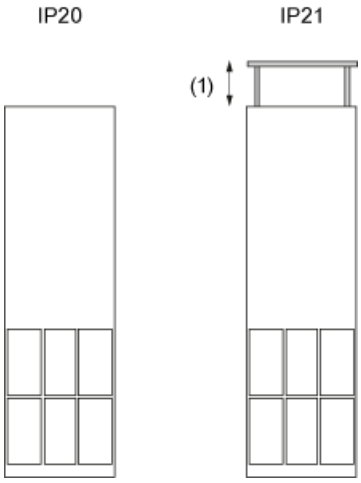


Figure 8-57 Cabinet with canopy (250 mm higher)

Note

Installing the canopy or hood at a an early stage!

It is recommended to attach the canopy or hood at an early stage to prevent foreign matter entering the cabinet units.

Canopies for Cabinet Modules in the Chassis-2 format

With option M21, a canopy is only used on the cabinet with an Active Line Module or Motor Module in the Chassis-2 format.

For a possible additional option control cabinet located to the right, no hood is used, as this control cabinet is equipped with a closed and sealed top plate.

8.46.2 Mounting

Mounting a drip plate to increase the degree of protection to IP21 (option M21)

The drip plate ② can be mounted variably in both directions (on the side and, to the front or back) on the top of the cabinet.
The arrangement can be adapted to the various installation conditions for the cabinets. This results in an adjustable protrusion of the drip plate at the front ① and rear ③.
In this way, it is possible to have a circumferential protrusion of the drip plate, or direct contact with the wall or between the drip plates in back-to-back installation. If necessary, seal the contact points in the case of wall-mounting or back-to-back installation.

- Remove any existing crane transport assemblies.
- Attach the spacers (A) to the roof of the cabinet at the positions specified. Under certain circumstances, it may be necessary to remove the protective grill for installation.
  Install the screws ④ with contact washers from below through the perforated protective grill (tightening torque: 13 Nm for M6).
- Mount the drip plate (B) on the spacers.
  Attach the screw ⑤ with contact washer from above through the drip plate (tightening torque: 13 Nm for M6).

Note

Mounting the drip plates for cabinets mounted side-by-side

In order to prevent water dripping into the spaces between the cabinet units connected in series, there are overlaps on the sides of the drip plates. When fitting the canopies, make sure that the overlap engage in one another.

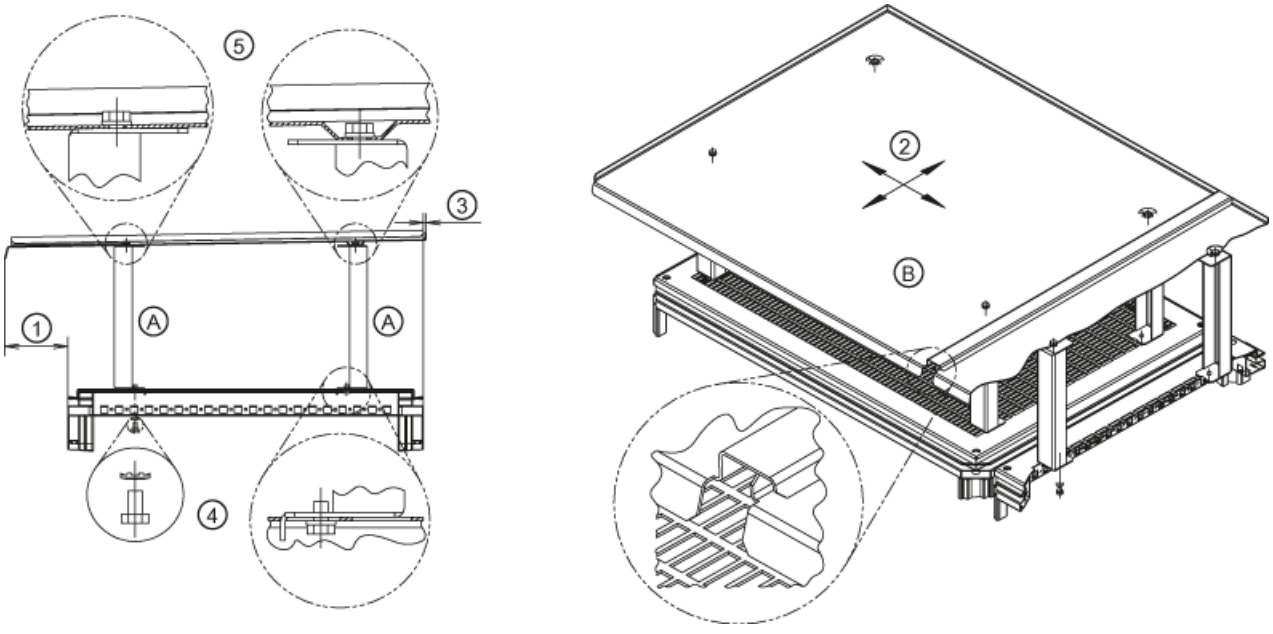


Figure 8-58 Fitting a canopy

8.47 M23/M43/M54, degree of protection IP23/IP43/IP54

8.47.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The table below explains the properties of the various degrees of protection that are available.

Table 8- 86 Degrees of protection

Degree of protection	Protection against contact	Protection against water
IP23	Protection against the ingress of solid foreign bodies with a diameter > 12.5 mm	Protection against spraying water (up to 60□° against the vertical)
IP43	Protection against the ingress of solid foreign bodies with a diameter > 1 mm	Protection against spraying water (up to 60□° against the vertical)
IP54	Complete shock protection Protection against damaging internal dust deposits	Protection against all-round splash water

Note

Hoods (1) increase the height of the cabinet units by 400 mm.

For degree of protection IP54, the derating values of the relevant Cabinet Modules must be observed.

Note

Installing a fan in the top cover

In the Line Connection Module with option L43 and in the Booksize Base Cabinet, a fan is installed in the hood for degrees of protection IP23, IP43, and IP54.

Note

Installing the canopy or hood at a an early stage!

It is recommended to attach the canopy or hood at an early stage to prevent foreign matter entering the cabinet units.

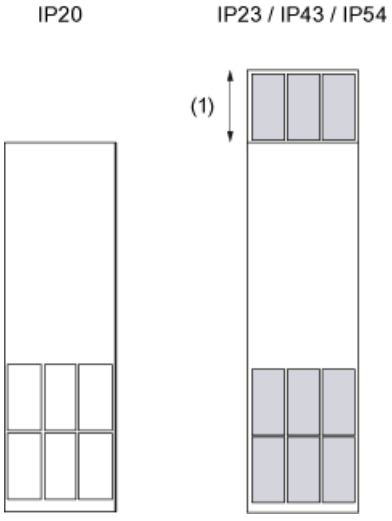


Figure 8-59 Cabinet with hood (400 mm higher)

If the degree of protection of the Cabinet Modules is to be increased, the additional hoods and filter media are delivered separately.

The hoods are flush with the cabinets at the side and front and have a recess at the rear so that air can escape even if the cabinet is wall mounted. Air escapes from the front and back.

The hoods are easily fitted and filter media easily changed from outside the cabinet. Air escapes from the front and back. Compliance with the increased degree of protection requires intact filter media, which must be replaced on a regular basis according to the prevailing environmental conditions.

Hoods for Cabinet Modules in the Chassis-2 format

For Cabinet Modules in the Chassis-2 format, for options M23, M43 and M54 special hoods are used:

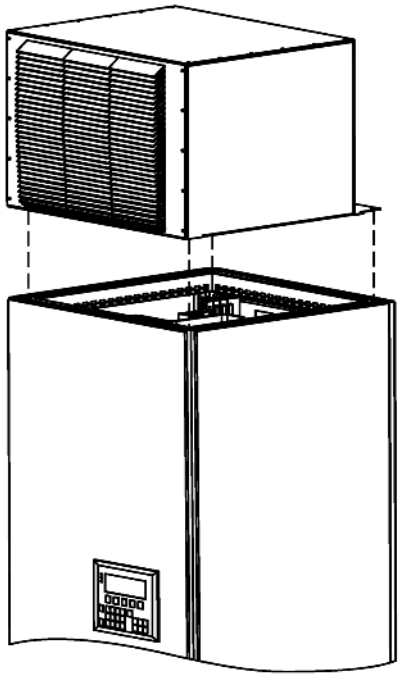
- For a cabinet with Active Line Modules or Motor Modules Chassis-2 format, a hood with additional air guidance plate is used at the front.
  This air guidance plate ensures that the hot air discharged from the hood cannot enter the upper air intake area of the control cabinet.
- For a possible additional option control cabinet located to the right, no hood is used, as this control cabinet is equipped with a closed and sealed top plate.

8.47.2 Mounting

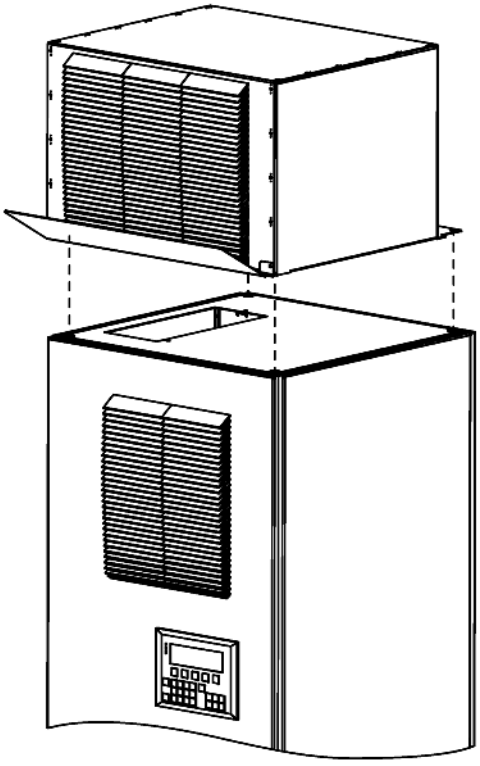
Preparatory steps

- Remove the crane transport assemblies (if fitted)
  (-> see Chapter "Mechanical installation").
- Cabinet Modules:
  Remove the perforated top plate on the upper side of the cabinet (if installed).
- Chassis-2 Cabinet Modules:
  It is not permissible that the installed top plate is removed.

Cover hood for Cabinet Modules



Cover hood for Chassis-2 Cabinet Modules



Attaching the hood

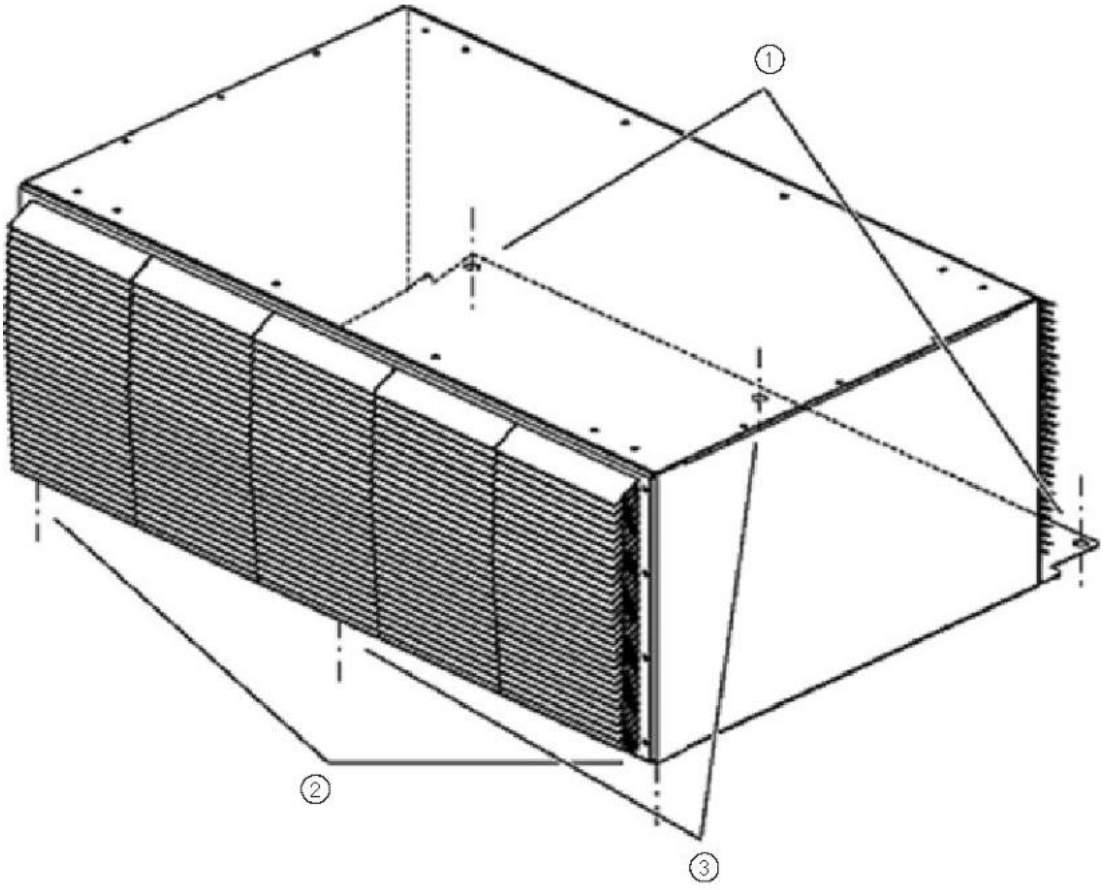


Figure 8-60 Mounted hood

The numbers in parentheses in the installation steps refer to the diagram.

1. Options M43 and M54 only:
   Use the sealing tape provided to attach the contact surfaces of the hood to the top of the cabinet.



Figure 8-61 Hood with attached sealing tape

2. Place the washers of the original roof screws between the cabinet upper side and the hood at the contact points of the cabinet front side. This prevents the hood from being pressed down too far when the screws are tightened, thus preventing the doors from being opened.



Figure 8-62 Attaching the washers

3. Fit the hood to the top of the enclosure at the positions specified (fixing points for the crane transport assemblies).
4. Attach the original M12 ① roof screws from above at the rear side.
5. Attach the M6 screws and washers at the front side (sequence: screw, spring-lock element, small washer, large washer) ② from below.
6. If the hood is very wide, insert additional screws ③ in the center of the hood (front and rear).



Figure 8-63 View with opened cabinet door



Figure 8-64 View with closed cabinet door

Note

Mounting the hoods in a side-by-side configuration

If cabinet units are installed in a side-by-side configuration, the hoods must be flush-mounted in a line across the cabinet units.

Note

Additional information

See also Chapter "Maintenance and servicing", Section "Replacing the filter mats".

8.48 M26/M27, side panels mounted on right and left

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The side panels (option M26 = side panel mounted on the right; option M27 = side panel mounted on the left) are fitted at either end of a side-by-side cabinet unit configuration.

With the option M26, the Cabinet Module is fitted with a side panel on the right.

With the option M27, the Cabinet Module is fitted with a side panel on the left.

Note

Installing the side panels

For each cabinet row installed, you must mount one side panel on the right (option M26) and one on the left (option M27)!

For Cabinet Modules that are delivered with a side panel, the DC connection clamp is omitted from the side panel. If the installation sequence is modified and the side panel removed, then a DC connection clamp must be inserted!

8.49 M51, motor reactor terminal connection

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits

Description

In conjunction with option M77 (version without component support plates and without additional control components), option L08/L09 (motor reactor / 2 motor reactors in series) allows the motor cables to be connected directly to the motor reactor.

With option M51, the connection of the motor cable is wired to a customer connection terminal -X1.

Table 8- 87 Maximum conductor cross-section when using motor reactors for Booksize Cabinet Kits

Article No. 6SL3720-	Power in kW	Maximum connection cross-section
1TE21-0AB4	4.8	6 mm²
1TE21-8AB4	9.7	6 mm²
1TE23-0AB4	16	6 mm²
1TE24-5AB3	24	16 mm²
1TE26-0AB3	32	16 mm²
1TE28-5AB3	46	35 mm²
1TE31-3AB3	71	95 mm²

8.50 M59, closed cabinet door, air inlet from below through floor opening

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The standard cabinet units are supplied with integrated ventilation grilles in the bottom of the doors as standard.

With option M59, the Cabinet Modules are delivered with closed doors.

Note

When closed doors are used, the base plates, which are available as standard for ensuring a sufficient cooling air supply, are not required.

In this case, the customer must ensure that no dirt/conductive dust or moisture can enter the Cabinet Module. Cables must not be routed in such a way that they impede the flow of air through the cabinet floor opening.

If the area beneath the Cabinet Modules can be accessed, the customer must provide shock protection.

The required ambient conditions must be taken into account to prevent, for example, overheating of the cabinet and the ingress of dirt or moisture.

When removing doors, take care not to damage the grounding strips attached to them. Make sure that the strips are reattached properly when the doors are installed.

Note

Opening angle of the door

The door opening angle with free-standing cabinet units is 180°.

With a side-by-side configuration of the cabinet units, this opening angle is 130°.

For degrees of protection IP23/IP43/IP54 and with option L37 (DC interface incl. pre-charging input circuit), the door opening angle is only 110°☐.

8.51 M60, additional shock protection

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

Description

The Cabinet Modules are designed in accordance with DGUV Regulation 3 as standard. With option M60, additional covers (out of reach of accessible control and contact elements) are installed upstream of the power unit.

Note

Do not operate without cabinet door(s)

The additional shock protection (option M60) is not a substitute for the cabinet door(s). It is not permissible to operate a cabinet unit **without** cabinet door or cabinet doors!

8.52 M70, EMC shield bus

8.52.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Auxiliary Power Supply Modules

Description

With option M70, an EMC shield bus is incorporated for the use of shielded power cables for power cables and motor supply cables.

The cable shields for the cables routed to the cabinet must be connected to the EMC shield bus in accordance with EMC guidelines. The shields can be applied over a large surface area with the supplied EMC shield clips.

8.52.2 Connecting the cables to the EMC shield bus

Preparatory steps

- Allow unimpeded access to the EMC shield bus (if necessary, remove the protective covers during installation work)

Securing the cables to the shield bus

1. Remove approximately 5 cm of the protective sheath of the cable around the shield bus.
2. Place the shielded cable on the shield bus.
3. Snap the clip into the opening provided and tighten it.

8.53 M77, version without component support plates and without additional control components

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Base Cabinets

Description

If electronic components (Control Unit, Terminal Module, Sensor Module) are not used in the Booksize Cabinet Kit, the mechanical component support plates are omitted with option M77.

When option L08/L09 is used (motor reactor / 2 motor reactors in series), the motor cables are connected directly to the motor reactor.

The motor cables are connected directly to the Booksize Motor Module.

Table 8- 88 Conductor cross-section when connecting motor cables directly to the Booksize Motor Module

Article No. 6SL3720-	Power in kW	Connection cross-section
1TE21-0AB4	4.8	1.5 ... 6 mm²
1TE21-8AB4	9.7	1.5 ... 6 mm²
1TE23-0AB4	16	1.5 ... 6 mm²
1TE24-5AB3	24	6 ... 50 mm²
1TE26-0AB3	32	6 ... 50 mm²
1TE28-5AB3	46	16 ... 120 mm²
1TE31-3AB3	71	25 ... 120 mm²

8.54 M80 to M87, DC busbar system

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in the chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The DC busbar connects the DC voltage across the drive line-up. The DC busbar comprises an upper busbar (DC P) and a lower busbar (DC N).

The following optional DC busbars are available:

- Option M80 = busbar system 1 x 60 x 10
- Option M81 = busbar system 1 x 80 x 10
- Option M82 = busbar system 1 x 100 x 10
- Option M83 = busbar system 2 x 60 x 10
- Option M84 = busbar system 2 x 80 x 10
- Option M85 = busbar system 2 x 100 x 10
- Option M86 = busbar system 3 x 80 x 10
- Option M87 = busbar system 3 x 100 x 10

Note

Current rating of the DC busbar

The required current intensity of the DC busbar depends on the individual plant configuration. For this reason, a fixed DC busbar thickness is not assigned to the individual Cabinet Modules. The required thickness must be configured for each individual case and specified as option M80 to M87 (mandatory option).

For transport units, integrated busbars are installed at the factory. Connection jumpers are not required inside a transport unit.

For option M26 (side panel on the right), connection jumpers are not required, nor are they permitted.

DC busbar



Figure 8-65 M80 - M87, DC busbar

8.55 M88, DC busbar system for line-side Cabinet Modules

Availability of option

This option is available for the following S120 Cabinet Modules:

- Active Line Connection Modules-2

Description

As standard, there are no DC busbars in the upper part of Line Connection Modules and Active Interface Modules in Active Line Connection Modules-2.

Option M88 is required for parallel connection of up to 6 Active Line Connection Modules-2.

With this option the DC busbars can also be installed in the upper part of the corresponding line-side Cabinet Modules.

The busbars are nickel plated as standard, and are dimensioned for different current carrying capacities depending on the selected option M80 – M87.

8.56 M89, extended motor connection panel

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules - Chassis-2 format

Description

With this option, the motor cables are not directly connected at the Motor Module Chassis-2 format, but at prefabricated connecting bars in the Cabinet Module. In turn, these establish the contact to the Motor Module, which can be simply disconnected using screws.

As a consequence, the Motor Module can be simply disconnected from the motor cable; this simplifies installation and connecting the cables.

For example, this means that the Motor Module can be removed from the cabinet to make it simpler to connect the motor cables.

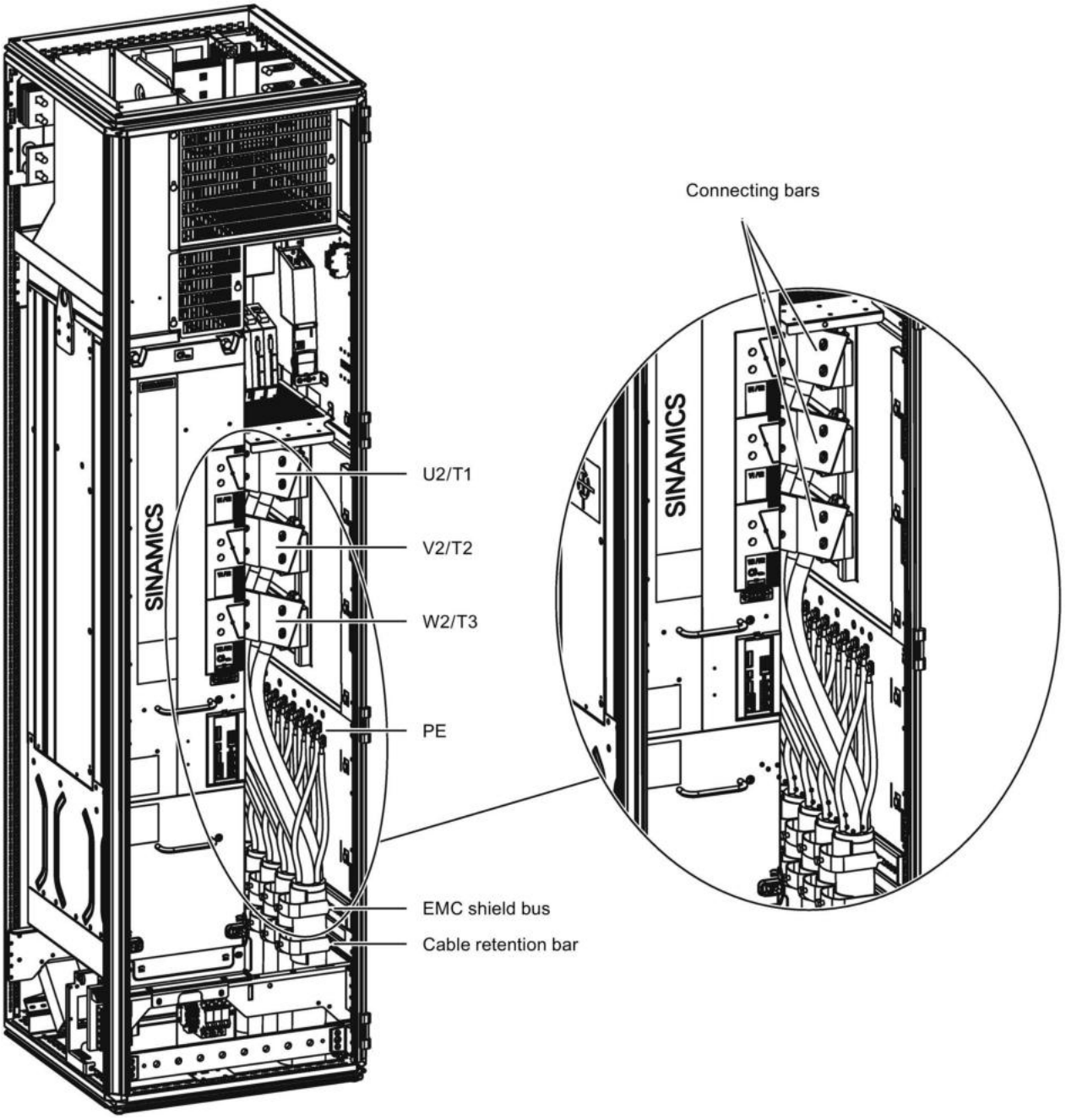
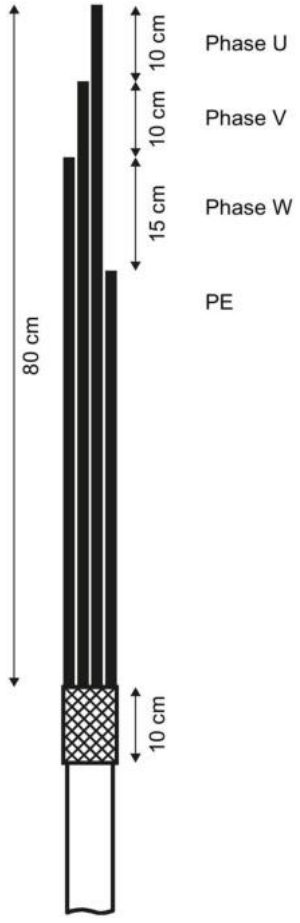


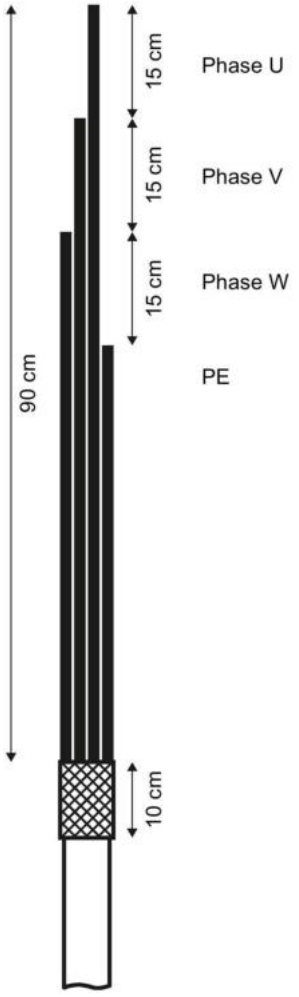
Figure 8-66 Connecting the motor feeder cables with option M89

Table 8- 89 Dimensions for stripping insulation and cutting the motor cables to length

FS2, FS2+



FS4



8.57 M90, crane transport assembly (top-mounted)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

A top-mounted crane transport assembly can be ordered as an option for Cabinet Modules.

Depending on the width of the module, the crane transport assembly consists of either transport eyebolts (for cabinet width ≤ 800 mm) or transport rails (for cabinet width > 800 mm).

Note

A crane transport assembly is included if transport units are supplied (option Y11).

After installing Cabinet Modules at the final installation location, crane transport aids must be removed, see also Chapter "Disassembling the crane transport assembly (Page 66)".

Safety instructions

⚠WARNING

Incorrect handling of the mounting rail

The improper handling of heavy carrying rails during disassembly can cause injuries or material damage.

- Ensure careful handling of the carrying rails during disassembly.
- Prevent screws from falling into the unit during disassembly and so causing damage during operation.

8.58 N52, DC link fuses for Basic Line Modules

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules

Description

Fuses are installed on the DC side to protect the Basic Line Module.

Installation of DC fuses is recommended if the DC current load in the configured drive line-up can be larger than the rated DC-link current of the Basic Line Module.

Furthermore, the DC fuses protect the Basic Line Module against an overvoltage on the DC busbar of the drive line-up in the event of a malfunction.

8.59 P10, measuring instrument for line values (installed in the cabinet doors)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

The measuring instrument "DIRIS A40" with display, installed in the cabinet door of the Line Connection Module, acquires measured values of the power supply. In addition to these measured values, additional plant values (such as power and power factor, etc.) are calculated from the measured values using powerful, state-of-the-art microprocessors. The measuring instrument is equipped with a serial RS485 interface with JBUS/MODBUS ®, which supports a max. transmission rate of 38.4 kbaud.

The device can measure the following as standard:

- Actual currents per phase and actual currents of the neutral conductor.
- Average currents and maximum currents over programmable time intervals from 8 to 30 min.
- Phase-to-neutral voltages and phase-to-phase voltages.
- Frequency (Hz)
- Four-quadrant measurement of the actual, average, and maximum active power (+/-), reactive power (+/-) and apparent power per phase and in total over programmable time intervals from 8 to 30 min.
- Display of active energy in kWh.
- Power factor (PF) per phase and in total with the specifications "L" for inductive and "C" for capacitive.

Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (current transformer upstream of the main switch) is included in option P10. The measuring instrument "DIRIS A40" is wired according to connection type 3NBL/4NBL in the factory.

The current transformers must not be operated unloaded.

Note

Additional information

Detailed and comprehensive instructions and information regarding the "DIRIS A40" measuring instrument can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.60 P11, measuring instrument for line values with PROFIBUS connection (installed in the cabinet door)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

Description

A measuring instrument "SENTRON PAC3200" with display, installed in the cabinet door of the Line Connection Module, acquires measured values of the power supply. In addition to these measured values, additional plant values (such as power and power factor, etc.) are calculated from the measured values using powerful, state-of-the-art microprocessors. The measuring instrument has a PROFIBUS interface that enables a transmission rate of up to 12 Mbit/s.

The device can measure the following as standard:

- Actual currents per phase and actual currents of the neutral conductor.
- Average currents and maximum currents over programmable time intervals from 1 to 60 min.
- Phase-to-neutral voltages and phase-to-phase voltages.
- Frequency (Hz)
- Four-quadrant measurement of the actual, average, and maximum active power (+/-), reactive power (+/-) and apparent power (+/-) per phase and in total over programmable time intervals from 1 to 60 min.
- Display of active energy in kWh.
- Power factor (PF) per phase and in total with the specifications "L" for inductive and "C" for capacitive.

Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (current transformer upstream of the main switch) is included in option P11. The measuring instrument "SENTRON PAC3200" is wired according to connection type 3P3W in the factory.

The current transformers must not be operated unloaded.

Note

Additional information

Detailed and comprehensive instructions and information regarding the "SENTRON PAC3200" measuring instrument can be found in the accompanying operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.61 Y11, factory assembly into transport units

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

With this option, Cabinet Modules can be ordered as factory-assembled transport units with a maximum width of up to 2400 mm. In this case, the relevant modules are shipped as interconnected units (both electrically and mechanically).

Note

No additional wiring between the Cabinet Modules is required, with the exception of the DRIVE-CLiQ connections to interconnect the cabinets.

A crane transport assembly in the form of a transport rail is already included if transport units are supplied.

Table 8- 90 Installation sequence of the transport unit

Plain text required to order	TU 1 - 1...6
Transport unit	TU
Consecutive number of the transport unit	1 -
Position of the Cabinet Module within the transport unit	1 ... 6

Index

"

"Fuse switch disconnector" checkback contact, 165, 239
"Main contactor" checkback contact, 165, 239, 603
"Siemens Industry Online Support" App, 4

A

Accessory kit
  Original roof screws, 67
Active Interface Modules
  LEDs, 482
Active Line Connection Module-2
  Interfaces, 242
  X47, 245
  X49, 246
Active Line Connection Modules-2, 33
  Cable routing, 140
  Connection example, 230
  Description, 228
  DRIVE-CLiQ connections and signal cables, 144
  Integration, 229
  Line infeed, 141
  Load cycle with maximum current, 254
  Low overload, 254
  Options, 248
  Parallel connection to increase power rating, 238
  PROFIBUS or PROFINET connection to the Control Unit, 143
  Technical data, 250
  Use in weak line supplies, 239
  Used in line supplies in conformance with Standard EN 61000-2-4, Class 2, 238
  X1 (line supply), 228
  X30, 142
  X40, 142
  X41 EP terminal / temperature sensor connection, 243
  X42, 245
  X50, 142
Active Line Module Chassis-2
  Mounting aid, 355
Active Line Module Chassis-2, frame size FS2
  Replacement, 387
Active Line Module Chassis-2, frame size FS2+
  Replacement, 387
Active Line Module Chassis-2, frame size FS4
  Replacement, 391
Active Line Modules, 31
  Cable routing, 133
  Connection example, 210
  Customer terminal block (X55), 138, 139
  Description, 209
  DRIVE-CLiQ connections and signal cables, 136, 137
  Integration, 210
  Options, 220
  Parallel connection to increase power rating, 216
  PROFIBUS or PROFINET connection to the Control Unit, 134, 135
  Technical data, 221
  X41, 217
  X55 (customer terminal block), 138, 139
Active Line Modules - Chassis-2 format
  LEDs, 478
Additional SMC30 Sensor Module (option K52), 537
AOP30, 510
AOP30 Advanced Operator Panel, 510
Auxiliary power module
  Connections, 97
Auxiliary Power Supply Module
  Basic Line Modules, 99
  Connecting cables, 97
  Description, 92
  Fuse, 96
  Line Connection Module, 95
  X100, 94
  X101, 94
Auxiliary Power Supply Modules
  Cable routing, 159
  Configuration, 341
  Configuration example, 342
  Connection example, 340
  Customer terminals, 346
  Description, 339
  Fuse switch disconnector (-Q1), 343
  Integration, 340
  Line infeed, 159
  Options, 346
  Technical data, 347
  Terminal blocks X45, X46, X47, 160
  X45, X46, X47, 160

Auxiliary power supply system
Availability, 92
Description, 92, 345
Fuse protection, 345
Infeed for supplying power, 99
Side-by-side installation of cabinet units, 98

B

Basic Line Modules, 29
Cable routing, 125
Connection example, 181
Customer terminal block (X55), 128
Description, 180
DRIVE-CLiQ connections and signal cables, 127
Integration, 181
Options, 188
Parallel connection to increase power rating, 184
PROFIBUS or PROFINET connection to the Control Unit, 126
X41, 185
X55 (customer terminal block), 128
Benefits, 28
Blade fuse
Replacement, 457
Booksize Base Cabinets, 34, 257
Technical data, 264
Booksize Cabinet Kits, 34, 257
Cable routing, 145
Braking Modules, 34
Connection example, 643
LEDs, 482
Response thresholds, 326, 639
X21, 643
Braking resistor
Cable length (max.), 331
Cable routing, 157
Configuring the "Overtemperature" checkback, 334
Connection, 637
Connection example, 643
Description, 331, 643
Dimension drawings, 644
Dimensions, 646
Duty cycle, 333, 647
PD, switch-on ratio of the braking resistor, 327
Power connections, 333
Setting of the switch-on ratio, 327
Technical data, 334
Braking units, 636
Description, 636
Dimensions, 646
Technical data, 646
Breakaway torques, 253, 291, 315

C

Cabinet anti-condensation heating, 634
Cabinet lighting with service socket, 633
Cabinet Modules
Connection overview, 84
System structure, 39
Cable and screw terminals, 351
Cable lugs, 82
2 cable lugs per phase, 83
Back-to-back, 83
Cable marshaling compartment, 651
Cable routing, 121
Active Line Connection Modules-2, 140
Active Line Modules, 133
Auxiliary Power Supply Modules, 159
Basic Line Modules, 125
Basic rules, 121
Booksize Cabinet Kits, 145
Braking resistor, 157
Central Braking Modules, 157
Line Connection Modules, 122
Motor cable, 145
Motor Modules - Chassis-2 format, 152
Motor Modules in chassis format, 145
Safe Torque Off and Safe Stop 1, 149
Smart Line Modules, 129
Terminal blocks X45, X46, X47, 160
Terminal Module TM54F, 149
CBC10 Communication Board
CAN bus, 488
Interface overview, 489
Option G20, 488
CBE20 Communication Board
Installation, 492
Interface overview, 492
LEDs, 473
MAC address, 492
Option G33, 491
PROFINET, 491
Center of gravity of the cabinet, 66
Central Braking Modules, 34
Cable length (max.), 331
Cable routing, 157
Configuration, 322
Connection example, 320
Description, 319
Duty cycle, 330
Integration, 320
Interface overview, 324

Interfaces, 323
LEDs, 482
Options, 328
Parallel connection, 323
Technical data, 329
X2, 158
X5.1, 157
X5.2, 157
Certification, 6
Chassis Cabinets, 35
Chassis-2 Cabinets, 35
Chassis-2 Motor Module
Replacement, 395
Checklist
Electrical installation, 74
Mechanical installation, 55
Circuit breaker
In withdrawable unit design, 605
Output-side, 606
Circuit breaker checkback contact, 167, 241
Connecting cabinet units, 69
Connection
Auxiliary power supply system, 97
Cabinet units installed side-by-side, 69
to the foundation, 68
Connection
work, 184, 199, 216, 242, 259, 277, 303, 345
Contactor monitoring, 501
Control Interface Module
LEDs, Active Line Module, 477
LEDs, Active Line Modules - Chassis-2 format, 478
LEDs, Basic Line Module, 475
LEDs, Motor Module, 479, 480
LEDs, Smart Line Module, 476
Replacing frame size FS2, 410
Replacing frame size FS4, 410
Replacing, frame size FB, 398
Replacing, frame size FX, 402
Replacing, frame size GB, 400
Replacing, frame size GX, 404
Replacing, frame size HX, 406
Replacing, frame size JX, 408
Control Unit
Replacing, 413
Control Unit CU320-2 DP, 546, 547
Description of the LED states, 468
LEDs after booting, 469
LEDs during booting, 468
Control Unit CU320-2 PN, 569, 570
Description of the LED states, 471
LEDs after booting, 472
LEDs during booting, 471
Crane transport aid, 66
Crane transport assembly (top-mounted), 674
CU320-2 DP, 547
CU320-2 PN, 570
Current transformer upstream of main breaker, 626
Customer terminal block -X55, 551, 574
Customer terminal block -X55.1, 260
Cylindrical fuses, 456

D

D14, 487
Data matrix code, 5
DC busbar, 88, 670
Availability, 88
Connecting different numbers of DC busbars, 91
For side-by-side installation of cabinet units, 89
Transition from three busbars to two busbars, 91
Transition from two busbars to one busbar, 91
DC busbar system, 669
DC busbar system for line-side Cabinet Modules, 671
DC fuses
Chassis-2 format, replacing, 455
Frame size HX, JX, replacement, 453
Frame sizes FX and GX, replacement, 451
DC interface, 616
Commissioning, 624
Principle of operation, 623
Replacing, 459
DC-link capacitors
Reforming, 463
DC-link fuses for Basic Line Modules, 675
Declaration of conformity
EMC directive, 6
Low-voltage directive, 6
Machinery directive, 6
Degrees of protection, 59, 656
Derating, 42, 47
Derating data, 42, 47
Current derating as a function of the installation altitude and ambient temperature, 42, 47
Installation altitudes between 2000 m and 5000 m above sea level, 43
Installation altitudes greater than 1000 to 5000 m above sea level, 48
Permissible output current as a function of the ambient temperature, 43, 48
Derating factors
Current derating as a function of the pulse frequency, 45, 50

Diagnostics, 467
using LEDs on Control Unit CU320-2 DP, 469
using LEDs on Control Unit CU320-2 PN, 472
Direction of motor rotation, 105
Disconnect the basic interference suppression module, 109
Disposal, 466
DRIVE-CLiQ
interface, 187, 202, 219, 247, 262, 280, 310, 496, 515, 521, 531, 559, 582
Dust deposits, 350
Duty cycle
Active Line Connection Modules-2, 253
Braking resistor, 333
Motor Modules Chassis format, 291
Motor Modules Chassis-2 format, 315
Motor Modules in booksize format, 267
dv/dt filter compact plus Voltage Peak Limiter, 592
dv/dt filter plus Voltage Peak Limiter, 597

E

Electrical installation
Checklist, 74
Electromagnetic fields, 19
Electronic fan
Replacing frame size FS2, 436
Replacing frame size FS2+, 436
Replacing frame size FS4, 436
Electrostatic sensitive devices, 22
EMC shield bus, 667
EMERGENCY OFF pushbutton, 630
EMERGENCY OFF pushbutton installed in the cabinet door, 629
Encapsulated fuses, 450
Encoder interface -X520, 516, 522
Extended motor connection panel, 671
External EMERGENCY OFF, 168, 241

F

Fan
Replacing frame size FS2, 433
Replacing frame size FS2+, 433
Replacing frame size FS4, 433
Replacing, Active Interface Module Chassis-2, 447
Replacing, Booksize Cabinet Kit, 419
Replacing, frame size FI, 439
Replacing, frame size GI, 441
Replacing, frame size HI, 443
Replacing, frame size HX - left, 427
Replacing, frame size HX - right, 429
Replacing, frame size JI, 445
Replacing, frame size JX, 431
Replacing, frame sizes FB, GB, GD, 423
Replacing, frame sizes FX, GX, 425
Fan power supply
K70, 538
Field of application, 27
Filter mats, replacing, 356
Floor levelness, 60
Forming the DC-link capacitors, 463
Foundation, 68
Fuses in the fuse switch disconnector
Replacing, 451

G

G20, 488
G33, 491
G51, 494
G56, 501
G62, 502
General Data Protection Regulation, 6
Grounded line supply, 109
Grounding switch, 630
Downstream of the internal main switch, 632
Upstream of the internal main switch, 631

H

Hood, 659
HTL encoder, 534

I

Identification number, 463
Incremental encoder sin/cos 1 Vpp, 2,048, 524
Infeed
Auxiliary power supply system, 99
Installation
CBE20 Communication Board, 492
Installation device for power blocks, 354
Installation site, 58
Insulation monitoring, 647
Internet addresses, 5
IP20, 59
IP21, 59
IP21 degree of protection, 653
IP23, IP43, IP54, 59, 656
IT line supply, 109

K

K01 - K05, 508
K08, 510
K46, 511
K48, 518
K50, 525
K51, 535
K52, 537
K70, 538
K73, 538
K76, 539
K82, 541
K87, 542
K88, 544
K90, 546
K94, 568
K95, 569

L

L00, 590
L07, 592
L08/L09, 596
L10, 597
L13, 602
L21, 603
L22, 603, 605
L25, 605
L34, 606
L37, 616
L40, 625
L41, 626
L42, 169, 629
L43, 170, 629
L44, 172, 629
L45, 629
L46, 630, 631
L47, 630, 632
L50, 633
L55, 634
L61, L62, L64, L65, 636
L87, 647
LEDs, 467
  Active Line Modules, 477
  Active Line Modules - Chassis-2 format, 478
  Basic Line Modules, 475
  CBE20 Communication Board, 473
  Central Braking Modules, 482
  Control Unit CU320-2 DP, 469
  Control Unit CU320-2 PN, 472
  Motor Modules - Chassis-2 format, 480
  Motor Modules in booksize format, 481
  Motor Modules in chassis format, 479
  SITOP power supply unit, 486
  Smart Line Modules, 476
  SMC10 Sensor Module, 483
  SMC20 Sensor Module, 483
  SMC30 Sensor Module, 484
  Terminal Module TM54F, 484
  TM150, 486
  TM54F, 484
  Voltage Sensing Module in the Active Interface Module, 482
License code, 564, 586
Line Connection Modules, 33
  Cable routing, 122
  Configuration example (frame size HL), 163
  Configuration example (frame size JL), 164
  Description, 162
  Line infeed, 123
  Options, 174
  Technical data, 175
  Versions, 168
  X30, 124
  X40, 124
  X50, 124
Line filter monitoring (option L40), 625
Line infeed
  Cable routing, 123
Line Modules, 29
LV HRC fuse with blade contacts, 457

M

M06, 650
M07, 651
M21, 653, 654
M23, M43, M54, 656
M26, M27, 663
M51, 664
M59, 665
M60, 666
M70, 667
M77, 668
M80 - M87, 669
M88, 671
M89, 671
M90, 674
MAC address
  CBE20 Ethernet interfaces, 492
Main contactor
  Line Connection Modules < 800 A, 602
Maintenance and servicing, 349

Measuring instrument
For line values, in cabinet door, 676
For line values, with PROFIBUS connection, 677
Measuring points, verification of isolation from supply, 622
Mechanical installation
Checklist, 55
Memory card, 564, 586
Slot, 567, 589
Motor cable
Cable routing, 145
Connection, 100
Motor cable lengths, 596
Motor Module Chassis-2
Mounting aid, 355
Motor Module in booksize format
Connection example, 256
Motor Modules, 34
Technical data, 282
X41 EP terminal / temperature sensor connection, 278, 305, 554, 577
X46, 279, 555, 578
X55, 277
Motor Modules - Chassis-2 format
Cable routing, 152
DRIVE-CLiQ connections and signal cables to the Control Unit, 153
LEDs, 480
Motor connection (U2/T1, V2/T2, W2/T3), 155
Options, 311
PROFIBUS or PROFINET connection to the Control Unit, 153
Terminal strips, 154
U2/T1, V2/T2, W2/T3, 155
Motor Modules Chassis format
Cable lengths (min.), 275
Configuration, 271
Connection example, 270
Description, 269
High overload, 292
Integration, 270
Low overload, 292
Parallel connection to increase power rating, 274
Motor Modules Chassis-2
Interfaces, 303
Technical data, 312
X42, 307
X46, 308
X47, 309
X49, 309
X51, 304
X9, 305
Motor Modules Chassis-2 format
Cable lengths (min.), 302
Configuration, 296
Connection example, 295
Description, 294
High overload, 316
Integration, 295
Low overload, 316
Parallel connection to increase power rating, 301
S6 duty cycle, 317
Motor Modules in booksize format
Configuration, 257
Description, 255
Duty cycle, 267
Integration, 256
LEDs, 481
Mounting grid arrangement in the cabinet, 259
Options, 262
Replacing, 365
Motor Modules in chassis format, 149
Cable routing, 145
Customer terminal block (X55), 148
DRIVE-CLiQ connections and signal cables to the Control Unit, 147
LEDs, 479
Motor connection (U2/T1, V2/T2, W2/T3), 151
Options, 281
PROFIBUS or PROFINET connection to the Control Unit, 146
Signal cables to the SMC10/20/30 Sensor Module, 150
Terminal Module TM54F, 149
U2/T1, V2/T2, W2/T3, 151
X55 (customer terminal block), 148
Motor reactor, 596
Mounting
Drip plate to increase the degree of protection to IP21, 654
Mounting aid for Chassis-2, 355
Mounting grid arrangement in the cabinet, 259
Mounting rails, 66

N

N52, 675

O

Operation on a non-grounded line supply, 109
Option
D14, 487

G20, 488
G33, 491
G56, 501
G62, 502
K01 - K05, 508
K08, 510
K46, 511
K48, 518
K50, 525
K51, 535
K52, 537
K70, 538
K73, 538
K76, 539
K82, 541
K87, 542
K88, 544
K90, 546
K94, 568
K95, 569
L00, 590
L07, 592
L08/L09, 596
L10, 597
L13, 602
L20, 603
L21, 603
L22, 605
L25, 605
L34, 606
L37, 616
L40, 625
L41, 626
L42, 629
L43, 629
L44, 629
L45, 629
L46, 630
L47, 630
L50, 633
L55, 634
L61, L62, L64, L65, 636
L87, 647
M06, 650
M07, 651
M21, 653
M23, M43, M54, 656
M26, M27, 663
M51, 664
M59, 665
M60, 666
M70, 667
M77, 668
M80 - M87, 669
M88, 671
M89, 671
M90, 66, 674
N52, 675
P10, 676
P11, 677
Y11, 66, 678
Option G62, 502
Options
Active Line Connection Modules-2, 248
Active Line Modules, 220
Auxiliary Power Supply Modules, 346
Basic Line Modules, 188
Central Braking Modules, 328
Line Connection Modules, 174
Motor Modules - Chassis-2 format, 311
Motor Modules in booksize format, 262
Motor Modules in chassis format, 281
Overview, 36
Smart Line Modules, 203
Original roof screws, 67
Output-side circuit breaker, 606
Overload reserve, 253, 291, 315

P

P10, 676
P11, 677
PE busbar, 85
Description, 85
External cables, 87
For side-by-side installation of cabinet units, 86
General information, 85
Power block
Crane lifting lugs, 360
Installation device, 354
Replacing, frame size FB, 366
Replacing, frame size FX, 372
Replacing, frame size GX, 375
Replacing, frame size HX - left, 378
Replacing, frame size HX - right, 381
Replacing, frame size JX, 384
Replacing, frame sizes GB, GD, 369
Power units
Replacing, 358
PROFIBUS
Address switches, 561
Setting the address, 561
PROFIBUS interface, 560

PROFINET
CBE20 Communication Board, 491
PROFINET interface, 585

Q

Q1 (fuse switch disconnector), 343

R

Rating plate, 463
Recycling, 466
Removal, 67
Replacement
Active Line Module Chassis-2, frame size FS2+, 387
Automatic firmware update, 353
Control Interface Module, frame size FS2, 410
Electronic fan, frame size FS2, 436
Electronic fan, frame size FS2+, 436
Error messages, 353
Fan, frame size FS2, 433
Fan, frame size FS2+, 433
Replacement fuses, 449, 449
Replacing, 352
Active Line Module Chassis-2, frame size FS2, 387
Active Line Module Chassis-2, frame size FS4, 391
Backup battery of the cabinet operator panel, 461
Control Interface Module, frame size FB, 398
Control Interface Module, frame size FS4, 410
Control Interface Module, frame size FX, 402
Control Interface Module, frame size GB, 400
Control Interface Module, frame size GX, 404
Control Interface Module, frame size HX, 406
Control Interface Module, frame size JX, 408
Control Unit, 413
Crane lifting lugs, 360
Cylindrical fuses, 456
DC fuses, Chassis-2 format, 455
DC fuses, frame size HX, JX, 453
DC fuses, frame sizes FX, GX, 451
DC interface, 459
Electronic fan, frame size FS4, 436
Encapsulated fuses, 450
Fan, Active Interface Module Chassis-2, 447
Fan, Booksize Cabinet Kit, 419
Fan, frame size FI, 439
Fan, frame size FS4, 433
Fan, frame size GI, 441
Fan, frame size HI, 443
Fan, frame size HX - left, 427
Fan, frame size HX - right, 429
Fan, frame size JX, 431, 445
Fan, frame sizes FB, GB, GD, 423
Fan, frame sizes FX and GX, 425
Filter mats, 356
Fuse in the auxiliary power supply module, 449
Fuses in the fuse switch disconnector, 451
LV HRC fuse with blade contacts, 457
Motor Module Chassis-2, 395
Motor Modules in booksize format, 365
Power block, frame size FB, 366
Power block, frame size FX, 372
Power block, frame size GX, 375
Power block, frame size HX - left, 378
Power block, frame size HX - right, 381
Power block, frame size JX, 384
Power block, frame sizes GB, GD, 369
Power units, 358
Pre-charging resistors of the DC interface, 460
Replacement fuses, 449, 449
Replacing components, 352
Required room height, 59
Residual risks, 24
Resolver
Connection example, 517
RS232, 510

S

S1 (reset key), 325
S1 (threshold switch), 638
S2 (reset key), 325
S3 (braking resistor monitoring), 326
Safe Brake Adapter, 544
230 VAC, 544
Safe Brake Control, 544
Safe STOP 1, 541
Safe Torque Off, 541
Safety instructions
Electromagnetic fields, 19
Electrostatic sensitive devices, 22
General safety instructions, 17
Maintenance and servicing, 349
Safety Integrated, 6
Safety Integrated Functions, 541
Saving the parameter settings, 567, 589
SBC (Safe Brake Control), 544
Scope of delivery without line reactor, 605
Serial interface (RS232), 510, 563, 584
Servicing, 350

Shipping and handling indicators, 61
Shock indicator, 62
Tilt indicator, 61
Shock indicator, 62
Shock protection, 666
Side panels, 663
Siemens Industry Online Support
App, 4
SINAMICS S120 Cabinet Modules
Example of a drive line-up, 26
Main components, 25
Overview, 25
Parallel connection, 26
Power range extension, 26
System data, 40
Technical data, 40
Voltage ranges and power ratings, 26
SITOP power supply unit
LEDs, 486
SIZER, 564, 586
Smart Line Modules, 30
Cable routing, 129
Connection example, 195
Customer terminal block (X55), 132
Description, 194
DRIVE-CLiQ connections and signal cables to the Control Unit, 131
Integration, 195
Options, 203
Parallel connection to increase power rating, 199
PROFIBUS or PROFINET connection to the Control Unit, 130
Technical data, 204
X41, 200
X55 (customer terminal block), 132
SMC10, 511
Interface overview, 514
SMC10 Sensor Module, 511
LEDs, 483
SMC20, 518
Interface overview, 520
SMC20 Sensor Module
LEDs, 483
SMC30, 525
Interface overview, 530
SMC30 Sensor Module
LEDs, 484
SS1 (Safe Stop 1) (time-controlled), 541
STARTER, 565, 587
System requirements, 565, 587
STO (Safe Torque Off), 541
Storage, 54
Surge suppression, 603
System data
SINAMICS S120 Cabinet Modules, 40
System structure, 39

T

T1 (thermostatic switch connection), 646
T2 (thermostatic switch connection), 646
T2 (transformer), 343
TB30 Terminal Board
Interface overview, 503
Shield connection, 508
X424, 505
X481, 506
X482, 507
Technical data
Active Line Connection Modules-2, 250
Active Line Modules, 221
Auxiliary Power Supply Modules, 347
Basic Line Modules, 189
Booksize Base Cabinets, 264
Braking resistors, 334
Braking units, 646
Central Braking Modules, 329
Line Connection Modules, 175
Motor Modules, 282
Motor Modules Chassis-2, 312
SINAMICS S120 Cabinet Modules, 40
Smart Line Modules, 204
Technical support, 4
Terminal block -X50, 165, 239
Terminal blocks X45, X46, X47
Cable routing, 160
Terminal Board TB30 (option G62), 502
Terminal Module TM54F, 542
Thermostatic switch
Connection, 646
Tightening torques, 64, 351
Tilt indicator, 61
TM150, 494
Connecting, 496
LEDs, 486
Protective conductor connection and shield support, 498
TM150 Terminal Module, 494
TM54F
LEDs, 484
Tool, 63, 350
Transformer (-T2), 343
Tap, 343
Transformer for voltage adaptation (-T2), 343

Transport, 53
Transport eyebolts, 66
Transport unit, 678
Transport units, 66
TTL encoder, 535

U

Use in an IT line system, 603

V

Ventilation, 350
Voltage Peak Limiter, 592, 597
Voltage Sensing Module
  K51, 535
  LEDs, 482
VSM10, 535

W

Web sites of third-party companies, 6

X

X1 (motor connection), 597, 664
X1 (supply infeed), 162
X10 (thermostatic switch checkback contact), 334
X100, 94, 559, 582
  Line Connection Module, 96
X101, 95, 559, 582
X101 (Auxiliary Power Supply Module), 98
X102, 559, 582
X103, 559, 582
X120 (EMERGENCY OFF pushbutton installed in the cabinet door), 630
X122 (digital inputs/outputs), 556, 579
X126, 560
X132 (digital inputs/outputs), 558, 581
X140, 563, 584
X1400 (Ethernet interface), 493
X150, 585
X2 (control terminals), 325
X2 (terminal block), 158
X21 (Braking Modules), 643
X21 (digital inputs/outputs), 637
X240 (cabinet anti-condensation heating), 634
X30
  Cable routing, 124
  Cabling, 142
X30 (external EMERGENCY OFF), 168, 241
X40
  Cable routing, 124
  Cabling, 142
X40 (external 230 VAC auxiliary infeed), 168, 241
X400, 187, 202, 219, 247, 262, 280, 310
X401, 187, 202, 219, 247, 262, 280, 310
X402, 187, 202, 219, 247, 262, 280, 310
X41 (Active Line Connection Modules-2), 243
X41 (Active Line Modules), 217
X41 (Basic Line Modules), 185
X41 (Motor Module - chassis format), 278, 554, 577
X41 (Motor Modules - Chassis-2 format), 305
X41 (Smart Line Modules), 200
X45, 160
X45 (for tapping the line voltage), 346
X451 (CAN bus), 490
X452 (CAN bus), 490
X46, 160
X46 (brake control and monitoring), 279, 308, 555, 578
X46 (power supply for SITOP), 346
X47, 160
X47 (contactor feedback signal), 245, 309
X47 (for tapping the 230 V AC, 1-phase voltage), 346
X5 (braking resistor connection), 325
X5.1, 157
X5.2, 157
X50
  Cable routing, 124
  Cabling, 142
X50 ("circuit breaker" checkback contact), 606
X50 ("main contactor" checkback contact), 603
X50 (checkback contact), 165, 167, 239, 241
X50 (circuit breaker checkback contact), 167, 241
X500, 496, 515, 521, 531
X501, 496
X51 (connection for the fan supply), 304
X520, 525
  SMC30, 532
X520 (encoder interface), 516
X520 (SMC20), 522
X521, 525, 533
X531, 525, 533
X55, 551, 574
X55 (customer terminal block), 277
X55.1 (temperature monitoring), 260
X60 (line current transformer), 628
X70 (Grounding switch upstream of internal main switch), 631
X71 (Grounding switch downstream of internal main switch), 632

Y

Y11, 678

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Siemens AG
Digital Industries
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D-91050 Erlangen
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