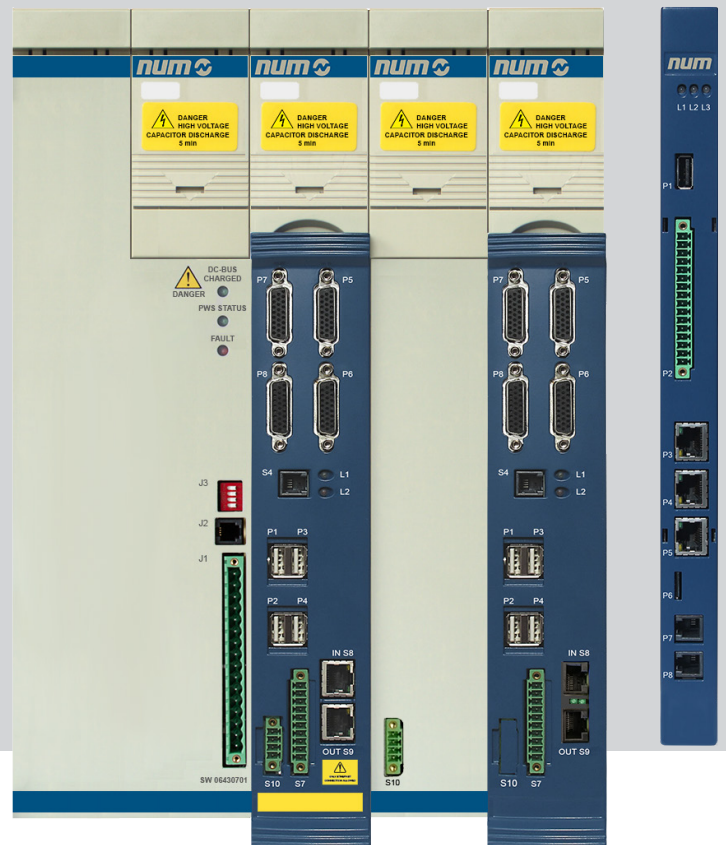


NUM DrivePro Mono-Axis, Bi and Quad-Axes Compact drives

Installation and maintenance manual

M00067EN-00

Edition 01.2025



Summary

1	Foreword.....	13
1.1	Products certification and normatives	13
1.2	Machinery directive.....	13
1.3	Use of the manual.....	14
1.4	How to read the manual.....	15
1.5	Hazard and safety use instructions - Symbology use in the manual	16
1.6	NUM DrivePro documentation evolution index.....	17
1.7	Glossaries - Abbreviations	18
1.8	NUM Agencies.....	19
2	General warnings on product use.....	23
2.1	NUM DrivePro User's informations	23
2.2	NUM DrivePro and MDLL3 unpacking inspection.....	23
2.3	General drives installation warnings instructions	24
2.4	Drive switched on condition general warnings	25
2.5	View of the hazardous areas around MDLUF units.....	26
2.6	Motors general installation warnings instructions.....	27
2.7	View of the hazardous areas around the motors.....	28
2.8	Derating of the drive nominal current due to DC Bus Voltage.....	29
2.9	Derating due to environmental and temperature conditions	30
2.10	Derating due to altitude conditions	31
2.11	Drives storage and transport conditions.....	32
3	NUM DrivePro - Overview	37
3.1	NUM DrivePro High and Standard performance compact drives	37
3.2	NUM DrivePro functions	38
3.3	NUM DrivePro standard and optional functions	40
3.3.1	NUM DrivePro standard and optional safety functions	43
3.4	NUM DrivePro compatible sensor configurations	44
3.4.1	Mono-Axis	44
3.4.2	Bi-Axes	44
3.4.3	Quad-Axes.....	45
3.5	NUM DrivePro System configuration.....	46
3.6	NUM DrivePro solution examples.....	47
3.7	NUM DrivePro, FlexiumPro System Architecture.....	48
3.7.1	System overview.....	48
3.7.2	Dual rows DISC ET bus solution with AEOADA023 adapter	49
3.7.3	MDLUF with NUM-SAMX typical architecture	50
4	Power Supplies	55
4.1	Passive Power Supplies general characteristics.....	55
4.2	Regenerative and Regulated DC bus Power Supplies general characteristics	56

4.3	Power Supply for 230Vac mains general characteristics	57
4.4	MDLL3 ordering code	58
4.5	MDLL3 layout and connectors.....	59
4.5.1	MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I layout and connectors	59
4.5.2	MDLL3025N00xN0I, 3050N00xN0I layout and connectors.....	60
4.5.3	MDLL3120N00xN0I layout and connectors	61
4.6	MDLL3 enclosed accessories	62
4.6.1	MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I enclosed accessories	62
4.6.2	MDLL3025N00xN0I, 3050N00xN0I enclosed accessories	63
4.6.3	MDLL3120N00AN0I, 3120N00RN0I mandatory accessori.....	64
4.6.4	MDLL3120N00HN0I mandatory accessories.....	64
4.7	MDLQ3001N00 250W AUX Power Supply.....	65
4.7.1	General characteristics.....	65
4.7.2	MDLQ3001N00 with MDLUF solution example.....	66
4.7.3	MDLQ3001N00 layout, connectors and enclosed accessories	67
5	MDLUF modules	71
5.1	Available MDLUF units	71
5.2	MDLUF Power Unit general characteristics	73
5.2.1	Mono-Axis MDLUF007A, 014A, 021A, 034A, 050A.....	73
5.2.2	Mono-Axis MDLUF075A, 100A, 150A.....	74
5.2.3	Mono-Axis MDLUF200A, 400A.....	75
5.2.4	Bi-Axes MDLUF007B, 014B, 021B.....	76
5.2.5	Bi-Axes MDLUF050B, 075B	77
5.2.6	Quad-Axes MDLUF014D.....	78
5.3	MDLUF Control Unit general characteristics	79
5.4	MDLUF Ordering code	80
5.5	Module identification (i.e. for Bi-Axes 50mm with NUM-SAMX).....	81
5.6	MDLUF layout and connectors	82
5.6.1	Mono-Axis MDLUF007A, 014A, 021A, 034A layout and connectors.....	82
5.6.2	Mono-Axis MDLUF050A, 075A layout and connectors.....	83
5.6.3	Mono-Axis MDLUF100A, 150A layout and connectors.....	84
5.6.4	Mono-Axis MDLUF200A layout and connectors	85
5.6.5	Mono-Axis MDLUF400A layout and connectors	86
5.6.6	Bi-Axes MDLUF007B, 014B, 021B layout and connectors	87
5.6.7	Bi-Axes MDLUF050B layout and connectors	88
5.6.8	Bi-Axes MDLUF075B layout and connectors	89
5.6.9	Quad-Axes MDLUF014D layout and connectors	90
5.6.10	MDLUF with NUM-SAMX Safety module.....	91
5.6.11	MDLUF with NUM-STOX Safety module	92
5.7	MDLUF enclosed accessories	93
5.7.1	MDLUF007A, 014A, 021A, 034A , 007B, 014B, 021B enclosed accessories	93
5.7.2	MDLUF050A, 075A , 050B enclosed accessories	94
5.7.3	MDLUF014D enclosed accessories	95
5.7.4	MDLUF100A, 150A, 075B enclosed accessories	96
5.7.5	MDLUF200A enclosed accessories	97
5.7.6	MDLUF400A mandatory accessories	98
6	Safety modules	103
6.1	Introduction	103
6.2	NUM-SAMX safety module	103
6.3	NUM-STOX safety module	103
6.3.1	Safety function - STO (Safe Torque Off)	104
6.3.2	STO Safety Function	104
6.3.3	STO function priority and System interaction	105
6.3.4	Other monitoring functions	105
6.3.5	Muting and suspension of safety functions	105

6.3.6	NUM-STOX Functional safety reliability data	106
6.3.7	Fault Reaction Function	107
6.3.8	Feedback management	108
6.3.9	Environmental conditions	109
6.3.10	MDLUF and NUM-STOX installation and connections	109
6.3.11	Operational test on NUM-STOX module	109
6.3.12	Commissioning	109
6.3.13	Trouble shooting	110
7	NUM DrivePro and motors associations	115
7.1	BHX / SHX motors and NUM DrivePro	115
7.2	BPX / SPX motors and NUM DrivePro	116
7.3	BPH motors and NUM DrivePro	117
7.4	BPG motors and NUM DrivePro	119
7.5	BHL260 motors and NUM DrivePro	120
7.6	TMX motors and NUM DrivePro	121
7.7	AMS motors and NUM DrivePro	122
7.8	M18MK14 motor and NUM DrivePro	124
8	Dimensioning of the system	129
8.1	General guide of the system dimensioning	129
8.2	Requested power supply for axis motors	130
8.2.1	Nominal power (continuous)	130
8.2.2	Simultaneous factor	130
8.3	Requested power supply for asynchronous motors	131
8.3.1	Peak power requested	131
8.4	Auxiliary power supply (AUX)	132
8.4.1	How to determine total auxiliary power consumption	132
8.5	MDLL3 power supply admissible duty cycle	133
8.5.1	S3-Repetitive overload starting from zero to power max Ps	133
8.6	Bi-Axes and Quad-Axes admissible duty cycle	134
8.6.1	Bi-Axes and Quad-Axes rated current useful area	135
8.6.2	Rated current useful area - User's example with MDLUF014B... 5kHz	136
8.7	MDLL3 external braking resistor dimensioning	137
8.7.1	Continuous and maximum braking power	137
8.8	MDLL3 transformer and autotransformer dimensioning	138
9	Installation and Operational Testing	145
9.1	Modules overall dimensions	145
9.1.1	MDLL3 Power supply - size 2 - 100mm - overall dimensions	145
9.1.2	MDLL3 Power supply - size 4 - 200mm - overall dimensions	146
9.1.3	MDLL3 Power supply - size 4 - 200mm - with metal plate dimensions	147
9.1.4	MDLL3 Power supply - size 6 - 300mm - overall dimensions	148
9.1.5	MDLQ3 Auxiliary Power Supply - size 1 - 50mm - overall dimensions	149
9.1.6	MDLUF NUMDrive - size 1 - 50mm - overall dimensions	150
9.1.7	MDLUF NUMDrive - size 2 - 100mm - overall dimensions	151
9.1.8	MDLUF NUMDrive - size 2 - 100mm - overall dimensions	152
9.1.9	MDLUF NUMDrive - size 3 - 150mm - overall dimensions	153
9.1.10	MDLUF NUMDrive - size 4 - 200mm - overall dimensions	154
9.1.11	MDLUF NUMDrive - size 4 - 200mm - with metal plate dimensions	155
9.1.12	MDLUF NUMDrive - size 6 - 300mm - overall dimensions	156
9.1.13	MDLC3 Capacitor module - size 2 - 100 mm - overall dimensions	157
9.2	Electrical cabinet requirements	158
9.3	Assembly the modules in electrical cabinet	159
9.3.1	Assembly MDLL3 and NUM DrivePro modules size 1, 2, 3, 4 in electrical cabinet	159
9.3.2	Assembly MDLL3 or MDLUF size 6 and module fan in electrical cabinet	160

9.3.3	Assembly MDLL3 or MDLUF size 6 metal plate in electrical cabinet.....	161
9.4	Cabinet requirements	162
9.4.1	PDS mains connection (distribution TN, TT systems).....	162
9.4.2	Use of differential protection devices.....	163
9.5	MDLL3 power supplies connections and configurations.....	164
9.5.1	General power supplies connections diagram	164
9.5.1.1	MDLL3015N00AN0I, 3030N00AN0I and MDLQ3001N00 connections diagram.....	164
9.5.1.2	MDLL3050N00AN0I, 3120N00AN0I connections diagram	165
9.5.1.3	MDLL3025N00R/H, 3050N00R/H, 3120N00R/H and MDLQ3001N00 connections diagram	166
9.5.1.4	MDLL3005M00AN0I 230V Power supply connections diagram	167
9.5.2	MDLL3 connections.....	168
9.5.2.1	MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I connections	168
9.5.2.2	MDLL3025N00R/H..., 3050N00A/R/H... connections.....	169
9.5.2.3	MDLL3120N00A/R/H... connections.....	170
9.5.2.4	MDLL3120N00A/R/HN0I mounting the mains terminal insulated cover	171
9.5.3	MDLL3 configuration	172
9.5.3.1	MDLL3015N00AN0I, 3030N00AN0I configurations.....	172
9.5.3.2	MDLL3...N00HN0I DC Bus voltage configuration	173
9.5.3.3	MDLL3050N00AN0I, 3120N00AN0I, ...N00RN0I configuration	174
9.5.4	MDLL3 J5 and S12 connections.....	175
9.5.5	MDLUF S12 connections.....	176
9.5.6	MDLL3 to MDLUF digital bus connections.....	177
9.5.7	MDLL3 and NUM DrivePro module / module DC Bus connections	178
9.5.8	J1 pin-out connector connections	179
9.5.8.1	J1 pin-out for MDLL3005M00AN0I.....	179
9.5.8.2	J1 pin-out for MDLL3015N00AN0I, 3030N00AN0I	180
9.5.8.3	J1 pin-out for MDLL3025N00R/H..., 3050N00R/H..., 3120N00R/H...	181
9.5.8.4	J1 pin-out for MDLL3050N00AN0I, 3120N00AN0I	182
9.5.8.5	J1 pin-out for MDLQ3001N00	183
9.6	NUM-STOX module connections	184
9.6.1	S8, S9 connector with NUM-STOX module connections	184
9.6.2	NUM-STOX module connections with RJ45 adapter AEOADA011	185
9.6.3	NUM-STOX multi-drive connections example diagram	186
9.6.4	E-STOP CAT-0 connections	187
9.6.4.1	E-STOP CAT-0 with Mono-Axis and NUM-STOX module	187
9.6.4.2	E-STOP CAT-0 with Bi-Axes and NUM-STOX module	188
9.6.4.3	E-STOP CAT-0 with separated axes on Bi-Axes and NUM-STOX module	189
9.6.4.4	E-STOP CAT-0 sequential diagram with NUM-STOX module	190
9.6.5	E-STOP CAT-1 connections	191
9.6.5.1	E-STOP CAT-1 with Mono-Axis and NUM-STOX module.....	191
9.6.5.2	E-STOP CAT-1 sequential diagram with NUM-STOX module	192
9.7	NUM-SAMX Safety certified module connections	193
9.7.1	S8, S9 connector for NUM-SAMX Safety connections.....	193
9.8	P1, P2, P3, P4 sensor connections	194
9.8.1	Connector pin-out for motor sensor	194
9.9	P5, P6, P7, P8 sensor connections	195
9.9.1	Connector pin-out for motor and/or direct measure sensor	195
9.9.2	Encoder P, Q, J, K, A, B, connections for BHX, BPX, BPH, BPG, BHL and IM18MK14 motors	196
9.9.3	Standard Hiperface encoder connections	197
9.9.4	LENORD&BAUER GEL244K sinusoidal toothed wheel sensor	198
9.9.5	Standard encoder 1Vpp connections	199
9.9.6	TTL incremental encoder sensor connections.....	200
9.9.7	Incremental encoder signals (optical scale) and HALL effect sensor	201
9.9.8	HEIDENHAIN type ENDAT 2.1 or 2.2 with incremental signals connections	202
9.9.9	HEIDENHAIN type ENDAT 2.2 without incremental signals connections	203
9.9.10	BiSS Rabsolute Renishaw encoder connections	204
9.9.11	BiSS C Fagor encoder connections	205
9.9.12	Magnescale encoder connections.....	206

9.9.13	Encoder P, Q connections for AMS100, 132, 160 spindle motors	207
9.10	Vibration detector VDR (accelerometer).....	208
9.11	Wiring the sensor and thermal probe connectors	210
9.11.1	Mounting SC007SH00 cable onto sensor connector AMOCON002D motor side	210
9.11.2	Mounting SC007SH00 cable onto sensor connector AEOCON012 drive side	211
9.11.3	NUM sensor and thermal probe cable assemblies	212
9.11.3.1	SC007SH20Mxxxx.....	212
9.11.3.2	SC007SH10Mxxxx.....	212
9.12	Tandem connections and Torque Duplication	213
9.12.1	Hardware requirement and limitation.....	213
9.12.2	Torque Duplication with 2 Mono-Axis drives	214
9.12.3	Torque Duplication with more then 2 Mono-Axis drives.....	215
9.13	S7 - Programmable input / outputs	216
9.14	S10, S13 Motors brake connections	217
9.14.1	S10 - Motors brake connections module MDLUF007, 014, 021, 034	217
9.14.2	S10 - Motors brake control connections module MDLUF050, 075A	218
9.14.3	S10 - Motors brake control connections module MDLUF100A, 150A, 075B	219
9.14.3.1	General application example for Mono-Axis and Bi-Axes	219
9.14.3.2	Application example using drive command	220
9.14.4	S10 - Motors brake control connections module MDLUF100A, 150A, 075B	221
9.14.4.1	Safety I/O connections example for Mono-Axis and Bi-Axes	221
9.14.5	S13 - Motors brake control connections module MDLUF200A, 400A	222
9.14.6	Brake voltage definition and tollerance	223
9.15	Motors power connections	224
9.15.1	Motor connections with module MDLUF007, 014, 021, 034	224
9.15.2	Motor connections with module MDLUF050, 075A	225
9.15.3	Motor connections with module MDLUF014D	226
9.15.4	Motor connections with module MDLUF075B, 100A.....	227
9.15.5	Motor connections with module MDLUF150A	228
9.15.6	Motor connections with module MDLUF200A	229
9.15.7	Motor connections with module MDLUF400A.....	230
9.15.8	MDLUF400A mounting the motor terminal insulated cover	231
9.15.9	BHX, BPX, BPH, BPG motors connections	232
9.15.9.1	Connections with MDLUF007, 014, 021, 034 modules	232
9.15.9.2	Connections with MDLUF050, 075, 100A modules	233
9.15.9.3	Connections with MDLUF150A modules	234
9.15.9.4	Connections with MDLUF200A, 400A modules	235
9.15.9.5	Motor connectors rotation procedure	236
9.15.10	SHX, SPX motors connections.....	237
9.15.10.1	Connections with MDLUF007, 014, 021, 034 modules	237
9.15.10.2	Connections with MDLUF050, 075 modules	238
9.15.10.3	SHX, SPX motor connector rotation procedure	239
9.16	BHL260 motors connections	240
9.16.1	BHL260 motors connections with ventilation version.....	240
9.16.2	Motor terminal box connections	240
9.16.3	BHL260 fan connection	241
9.16.4	BHL260 without ventilation connections	242
9.17	TMX motors connections	243
9.17.1	Motor connector AEOCON018	243
9.17.2	Motor connector AEOCON013	244
9.18	AMS spindle motors connections	245
9.18.1	AMS100, 132 motors connections with MDLUF050, 075, 150A	245
9.18.2	AMS100, 132 motors connections with MDLUF200A	246
9.18.3	AMS160MA, LA, motors connections (Y/Δ) and MDLUF150A.....	247
9.18.4	AMS160MC, LC motors connections with MDLUF200A.....	248
9.18.5	AMS160MA, MB, LA, LB motors connections (Y/Δ) and MDLUF200A	249
9.19	IM18MK14 spindle motor connections	250
9.20	Wiring the drive side motor power connector	251
9.20.1	Wiring the drive side motor power connector AEOCON018 with PC... cable	251

9.20.2	Wiring the drive side motor power connector AEOCON013 with PC... cable	252
9.20.3	Wiring the drive side motor power connector AEOCON015 with PC... cable	253
9.21	Wiring the drive side motor / brake power and sensor cable connectors	254
9.21.1	AEOCON018 and AEOCON019 connectors with PX007 and PX015 cables	254
9.21.2	AEOCON013 and AEOCON019 connectors with PX007 and PX015 cables	256
9.21.3	Polarization key configuration of the drive side motor power connector	258
9.22	Wiring the motor side power and brake connector	259
9.22.1	Wiring the motor side power and brake connector AMOCON004D with PC... cable	259
9.22.2	Wiring the motor side power and brake connector AMOCON005D with PC... cable	260
9.22.3	Wiring the motor side power and brake connector AMOCON006D with PX... cable	261
9.22.4	Wiring the shielding over the metal cable gland BMHQPRE	262
9.22.5	NUM power and brake cable assemblies	263
9.22.5.1	PC015Bx40Mxxxx , PC040Bx40Mxxxx , PC100Bx50Mxxxx	263
9.22.5.2	PC015Nx40Mxxxx , PC040Nx40Mxxxx , PC100Nx50Mxxxx	263
9.22.5.3	PX007BH60Mxxxx, PX015BH60Mxxxx	264
9.23	Motor thermal protection	265
9.24	Motor holding brake	266
9.24.1	Technical brake characteristics	267
9.25	MDLUF Control Unit replacement	268
10	Available accessories and spare parts	273
10.1	System cables	273
10.2	NUM DrivePro adapters	274
10.3	NUM DrivePro connectors kit	275
10.4	AEOKIT003 accessories kit for MDLL3120N00A/R/H	277
10.5	AEOKIT006 accessories kit for MDLUF400AExxN0I	278
10.6	Fan kit AGOFAN001	279
10.7	AGORESxxx MDLL3 external braking resistor	280
10.7.1	Technical characteristics	281
10.7.2	Operating example	282
10.7.3	AGORES008, AGORES009 - Overall dimensions and installation	284
10.7.4	AGORES010, AGORES011 - Overall dimensions and installation	285
10.8	Line filter for MDLL3 power supply	286
10.8.1	Line filter AGOFIL024A, AGOFIL025A, AGOFIL026, AGOFIL027	286
10.8.2	Line filter AGOFIL028	287
10.8.3	AGOFIL001S auxiliary power supply (AUX) filter	288
10.8.4	Line filter HPPM166 module	289
10.9	Line chokes	290
10.9.1	Line choke AGOIND001 and AGOIND002	290
10.9.2	Line choke AGOIND006	291
10.9.3	Line choke AGOIND007	292
10.9.4	Line choke AGOIND009	293
10.9.5	Auto-transformer for BHL260 fan (with 480V network)	294
10.10	Capacitor module MDLC3010N00	295
10.10.1	General characteristics	295
10.10.2	Module layout and enclosed accessories	295
10.10.3	MDLC3010N00 DC Bus connections	296
10.11	Motor cables and motor connectors	297
10.11.1	High performance power cable	297
10.11.2	Basic performance power cable	298
10.11.3	High Performance motor cable for SHX and SPX motors (Single Cable Motor)	299
10.11.4	Sensor cable	300
10.11.5	Fan cable (for BHL and AMS motors)	300
10.11.6	Raw cable ordering codes	301
10.11.7	Power assembly cable ordering codes	303
10.11.8	Sensor assembly cable ordering codes	304

10.11.9	Single Cable Motor assembly cable ordering codes	305
10.11.10	Fan assembly cable (for BHL and AMS motors) ordering codes	306
10.12	Motor cable assemblies and motor connectors.....	307
10.12.1	BHX, BPX cable assemblies and motor connectors	307
10.12.2	SHX, SPX cable assemblies and motor connectors	308
10.12.3	BPH cable assemblies and motor connectors	309
10.12.4	BPG cable assemblies and motor connectors	310
10.12.5	BHL cable assemblies and motor connectors.....	311
10.12.6	AMS cable assemblies, motor connectors and cable gland	312
10.12.7	Connectors dimensions	313
10.12.8	Accessories and spare parts for power and sensor cable mounting	314
11	Diagnostic	319
11.1	MDLL3005M00AN0I, MDLL3015N00AN0I, MDLL3030N00AN0I led status	319
11.2	MDLL3015N00AN0I, MDLL3030N00AN0I led fault blinks	320
11.2.1	Faults blinks signalling from software version SW06420001	320
11.2.2	Faults blinks signalling software from version SW06430501 (from version SW07830701 for MDLL3005M00AN0I)	322
11.3	MDLL3025N00R/H, MDLL3050N00A/R/H, MDLL3120N00A/R/H led status.....	324
11.3.1	Meaning of the REGULATED DC-BUS and PWS STATUS leds	325
11.4	MDLL3025N00R/H, MDLL3050N00A/R/H, MDLL3120N00A/R/H led fault blinks	328
11.4.1	Faults blinks signalling software version SW06630x01 and SW06730x01	328
11.4.2	Faults blinks signalling software version SW06631x01 and SW06731x01	330
11.5	Alarms signalling for MDLL3....R/H	332
11.5.1	Reading the alarms signalling table.....	332
11.5.2	Alarms signalling list SW06732x01 for MDLL3...R and SW06632x01 for MDLL3...H.....	333
11.5.3	Alarms signalling from SW06733x01 for MDLL3...R and SW06633x01 for MDLL3...H.....	340
11.5.4	Alarms signalling from SW06734x01 for MDLL3...R/A and SW06634x01 for MDLL3...H.....	341
11.6	MDLQ3001N00 status led signalling	342
11.7	NUM DrivePro module status led signalling	343
11.7.1	Meaning of LED signalling in NUM DrivePRO	344
11.8	NUM DrivePro with NUM-STOX module alarm description	346
11.9	NUM-SAMX module Status connector S8, S9 LEDs	347

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Summary

1	Foreword.....	13
1.1	Products certification and normatives	13
1.2	Machinery directive.....	13
1.3	Use of the manual.....	14
1.4	How to read the manual.....	15
1.5	Hazard and safety use instructions - Symbology use in the manual	16
1.6	NUM DrivePro documentation evolution index.....	17
1.7	Glossaries - Abbreviations	18
1.8	NUM Agencies.....	19

1

2

3

4

5

6

7

8

9

10

11

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1 Foreword

1.1 Products certification and normatives



NUM DrivePro used in conformity with the relevant manuals M00066 and M00067 full fills the basic requirements of Electromagnetic Compatibility and of Electrical Safety as prescribed by the Directives:

- EMC 2014/30/EU dated 20th April 2016
- LVD 2014/35/EU dated 20th April 2016

The NUM DrivePro conformity to the EMC directive 2014/30/EC can only be assessed if the drive is installed inside a machine or cabinet. The installation instruction inside of this manual must be followed.

For more EMC detailed informations please refer to the M00027 "Cabinet layout and EMC Guide - Installation and Wiring Guide manual".

1.2 Machinery directive

Machinery directive 2006/42/EC dated 17th May 2006

The designed products are intended to be incorporated into machinery or assembled with other machinery to constitute products covered by the council directive. Commissioning is forbidden until the products have been integrated in a machine that conforms with the directive 2006/42/EC.

1.3 Use of the manual

This manual is for use by qualified service personnel only. To reduce the risk due to an impropriety use of the product, do not perform any servicing other than that contained in this manual unless you are qualified to do so.

To ensure proper use of these products, please always read this User's manual carefully and retain for future reference. Should the unit require maintenance, please contact a Num authorized service center only.

1.4 How to read the manual

This manual is structured and divided main sections as indicated here below. We suggest to follow these indicated manual sections.

1	Foreword
2	This section introduces all warnings, hazardous areas and all safety information on product use. Please take into account these sections before to switch on the drive.
3	This section introduces the main drive presentation, overview and available configurations.
4	This section introduces the MDLL3 Power Supplies presentation, general characteristics, identification, layout and accessories.
5	This section introduces the MDLUF presentation, general characteristics, identification, layout and accessories.
6	This section introduces the NUM Safety module NUM-SAMX and NUM-STOX.
7	This section introduces the MDLUF and motors associations.
8	This section introduces the dimensioning of the system as MDLL3 size guide, auxiliary power supply (AUX), Power Unit for Bi-Axes useful area, how to determine the maximum useful modules configuration number and the external braking resistance dimensioning.
9	This section introduces the installation and operational testing, all power supply and drive installation and connections phases, as assembly the Power and Control Unit, assembly the drives in electrical cabinet, the drive safety connections, NUM-STOX and E-STOP function connections; all power, signal and sensor connections.
10	This section introduces all available accessories and spare parts.
11	This section introduces all Power supply and Drive's diagnostic. Moreover, are included "Possible cause / Possible remedy" by troubleshoot information tables.

1.5 Hazard and safety use instructions - Symbology use in the manual

Symbol	Meaning of the symbol
	The information “ i ” icon indicates notes on product use.
	The STOP icon indicates a wrong operation which may damage the product or indicates important notes on product use .
	The TRIANGLE icon indicates hazard for human beings and this information is referring to personal damage! Whenever one of these icons appear, please beware, use and apply adequate precautions to avoid hazards or damage situations during the drive installation and commissioning operations! Please beware, consult chapter 2.5 Please beware! Prevent and safety instruction against accidental contact with electrical components.

1.6 NUM DrivePro documentation evolution index

Edition	Evolution index	Code	Meaning of documentation evolution	See section
01.2025	00	M00067EN	DRAFT version.	-

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7

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9

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11

1.7 Glossaries - Abbreviations

Abbreviations	Meaning
AUX	Auxiliary power supply
Bi-Axes	Drive for two motors control
BHX, BPX, SHX, SPX BPH, BPG	NUM axis motor range
CNC	NUM CNC
Crimping tool	Tool for connector assembly
DEMF	Drive Embedded Macro
DISC ET	Digital bus communication type
EMC	Electromagnetic Compatibility
EPS	Electrical Positions Synchronization
EU	European Union
HOMING	CNC procedure
HP	High Performance Drive
LED	Light Emitting Diode
M	Motor
M00027	Cabinet layout and EMC Guide - Installation and Wiring Guide
MASTER	NUM DrivePro module for TANDEM application
MDLC	Capacitor module
MDLL3	Power Supply module
MDLUF	NUM digital drive
MDLQ	Auxiliary power supply
Mono-Axis	Drive for one motor control
NUM DrivePro	Digital drive module (Power + Control Units)
NUM-STOX	Safe Torque Off certified SIL 3 module
NUM-SAMX	NUM-Safety certified SIL 3 module
PC	Personal computer
PDS	Power Drive System (line filter + power cable + power supply + drives + power cables + motors)
Quad-Axes	Drive for four motor control
RJ11/ RJ45	Type of connector
RTK	Real Time Kernel
SDM	Safe Direction Monitoring
Size x	Module width (50mm, 100mm, 150mm, 200mm or 300mm)
SLS	Safely Limited Speed
SLP	Safe Limited Position
SOS	Safe Operational Stop
SP	Standard Performance Drive
SS1	Safe Stop 1
SS2	Safe Stop 2
SSM	Safe speed Monitoring
STO	Safe Torque Off
STOP function Category x	See standard EN60204-1
SLAVE	NUM DrivePro module for TANDEM application
Sub HD	Multipolar connector
TANDEM	Anti-backlash and torque duplication applications
TN, TT	Distribution systems
UPS	Uninterruptible Power Supply

1.8 NUM Agencies

The list of NUM agencies is given on <http://www.num.com>

1

2

3

4

5

6

7

8

9

10

11

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Summary

2	General warnings on product use.....	23
2.1	NUM DrivePro User's informations	23
2.2	NUM DrivePro and MDLL3 unpacking inspection.....	23
2.3	General drives installation warnings instructions	24
2.4	Drive switched on condition general warnings	25
2.5	View of the hazardous areas around MDLUF units.....	26
2.6	Motors general installation warnings instructions.....	27
2.7	View of the hazardous areas around the motors.....	28
2.8	Derating of the drive nominal current due to DC Bus Voltage.....	29
2.9	Derating due to environmental and temperature conditions	30
2.10	Derating due to altitude conditions	31
2.11	Drives storage and transport conditions.....	32

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2 General warnings on product use

2.1 NUM DrivePro User's informations

Before connecting, operating or adjusting these products, please read carefully the NUM DrivePro Parameters manual M00066.

In this manual you will find information to adjust in the right mode the drive parameters and all the drive alarms description.



NUM declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.

2.2 NUM DrivePro and MDLL3 unpacking inspection

You are advised to check that you have all the equipment before starting to install the drive.

Please always control the item reference on the label package.



Do not operate if you have recognized a transport damage.
In this case contact immediately NUM.

2.3 General drives installation warnings instructions

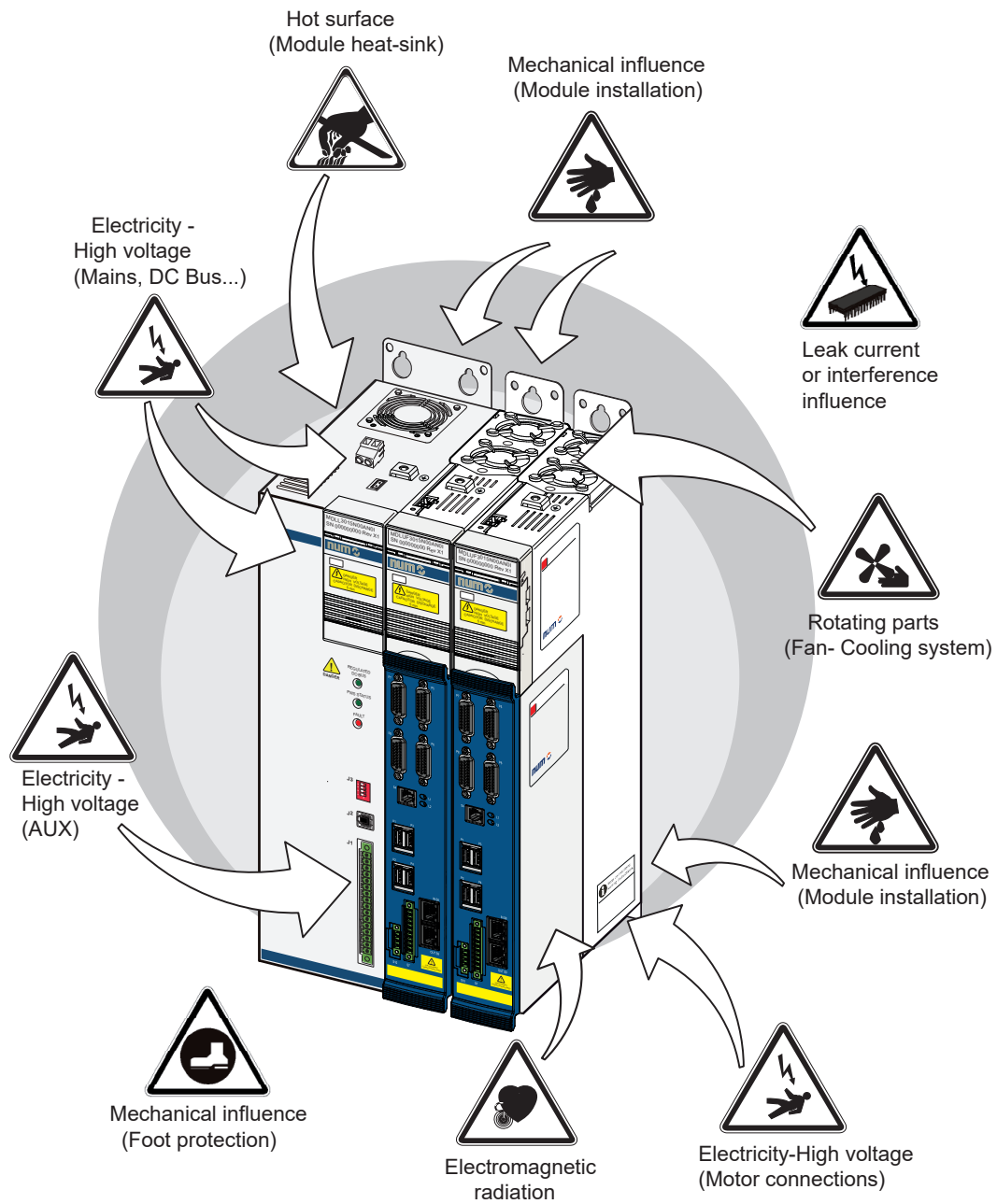


- All the international, state, regional and local standards must be complied with during the installation and during the use of this product. Only properly qualified personnel having extensive knowledge in servo drive system should install, commission and/or maintain the product.
- To comply with current safety regulations, all wiring and connections must be made in accordance with the electrical diagrams shown in this manual.
NUM declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.
- During the servomotor installation, always make sure that the connection cable used is the one established in the chapter 9 of this manual. The use of an incorrect cable leads to the violation of the international standards.
- NUM DrivePro operate correctly only by distribution systems such as “TN, TT”. Please refer to chapter 9.4.
- NUM DrivePro to operate correctly must always be equipped with a line filter. Please refer to chapter 9.5.
- NUM DrivePro are designed to be installed in electrical cabinets, free of fluids and dust, with a degree of protection equal or higher than IP54.
- All the components (PDS, CNC, filter, etc.) must be correctly connected to the cabinet structure. The PDS must be mounted on a earthed unvarnished plate.
For more detailed information please refer to chapter 9 or refer to M00027 manual.
- Use only original NUM cables. The original NUM cables have special characteristics.
The usage of different cables can lead to EMC / EMI and safety problems and the violation of standards.
- The total length of the power cables used in each PDS must be <400m at 5kHz PWM and < 200m at 10kHz PWM.
- The total length of the cable for the drive digital bus interconnections must comply Ethernet 100Base-TX cabling specification.
- **It's allowed to directly connect the motor thermal probe (KTY, PTC, Thermal switch ...) to the drive, if and only if the thermal probe is suitable to direct connection to SELV / PELV circuits according to EN 50178.**
- The external braking resistor frame may reach high temperatures in the case of heavy duty. We also suggest to place the braking resistor where they will not be accidentally touched by personnel.
- The line filter frame may reach high temperatures. Therefore to facilitate sufficient air circulation and ensure an adequate heat exchange it is recommended that a minimum clearance of 30mm is left when installing the filter in the electrical cabinet. We suggest to place them where they will not be accidentally touched by personnel.
- The line choke frame may reach high temperatures.
We therefore suggest to place them where they will not be accidentally touched by personnel.
To prevent eventual electromagnetic disturbances emitted from the inductance, we suggest that it is placed at least 500mm far from particularly sensitive apparatus, from the digital bus flat cable interconnections or from sensor cable.

2.4 Drive switched on condition general warnings



- Before switching on the System, active live parts must be covered to avoid accidental contacts. Do not touch the active live parts while the system is energised (ON).
- Before touching active live parts, **auxiliary supply voltage (CL1 / CL2) must be switched OFF** as well.
- **Active live parts** are described at chapter 2.5 but the description is not exhaustive. Additional hazardous areas are all connections points (including motor connectors and terminal boards).
- When the drive is switched on, the power components, such as the connectors or braking resistor, are connected to the mains power supply. Be very careful not to touch these components.
- The drive must always be switched off before handling. Wait at least 5 minutes before carrying out any operation, i.e. the time needed for the intermediate circuit capacitors to discharge (standard IEC 60204-1). A clear warning must be placed on the modules in the relevant language of the country where the equipment is shipped. (Including discharge time).
- During operation, the motor can be stopped by disabled or by the start of speed reference control circuits, whilst the drive remains enabled. To avoid sudden restarting of the system and ensure the safety of operating personnel, ensure that the current is cut off directly on the power circuit.
- In the event of an alarm, the drive is fitted with safety devices which can cause the drive or the motor to stop in the following circumstances: mechanical locking of the motor, voltage variations, break in power supply.
- Elimination of the cause of a stoppage can cause sudden, unexpected restarting of the system which can constitute a hazard in certain conditions, in particular for machines or installations which must comply to EN 60204-1, relating to the safety of electrical machines.
- It is therefore important, in these cases, for users to protect themselves against the possibility of sudden restarting by proceeding as indicated above.



NUM declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.

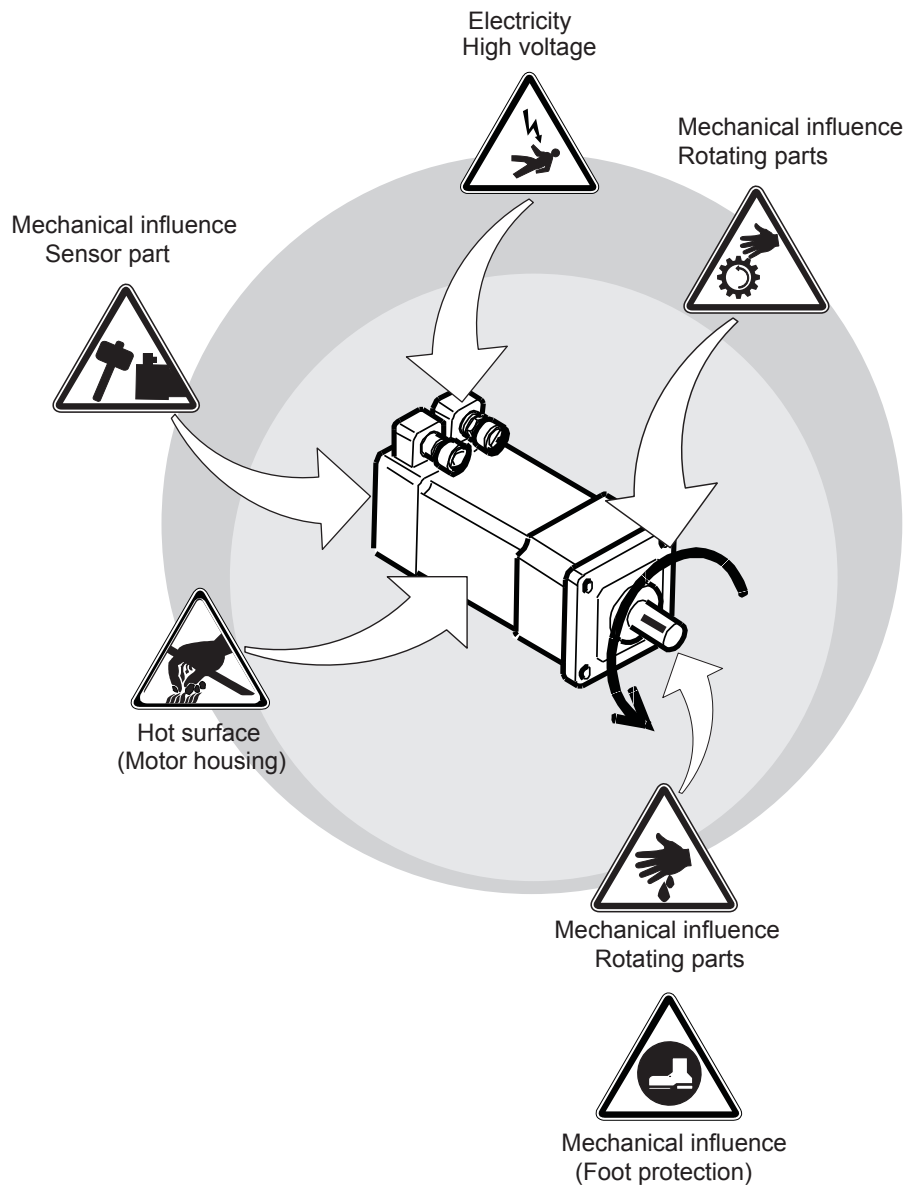
2.6 Motors general installation warnings instructions



- These servomotors are suitable for operation at a temperature $>100^{\circ}\text{C}$. Safeguards must therefore be used to provide protection against accidental or direct contact with the motor housing.
- The motors with keyed shaft must never be rotated under power unless connected to the mechanics of the machine. The key could come out from the shaft and due to the centrifugal force could cause damage to personnel and machines.
- The holding brake is not to be considered a safety device. In case of a vertical axis, interpose safety interlock or additional safety brakes to stop the axis from falling.
- The motors assembled vertically (with the shaft upwards) may be seriously damaged by the storage of liquid or impurities that could form by the shaft end of motors. It is therefore recommended to check the motor periodically.
- Always disable the system and disconnect the cables from the motor before carrying out the connector or the terminal box orientation (turnable by the customer).
- To comply with current safety regulations, all motor wiring and connections must be made in accordance with the electrical diagrams shown in this manual.



NUM declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.



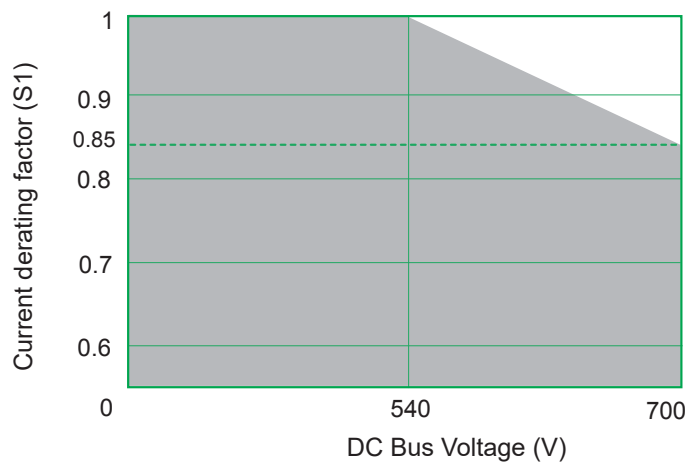
NUM declines all responsibility for injury or damage to persons or objects due to incorrect use of this product.

2.8 Derating of the drive nominal current due to DC Bus Voltage

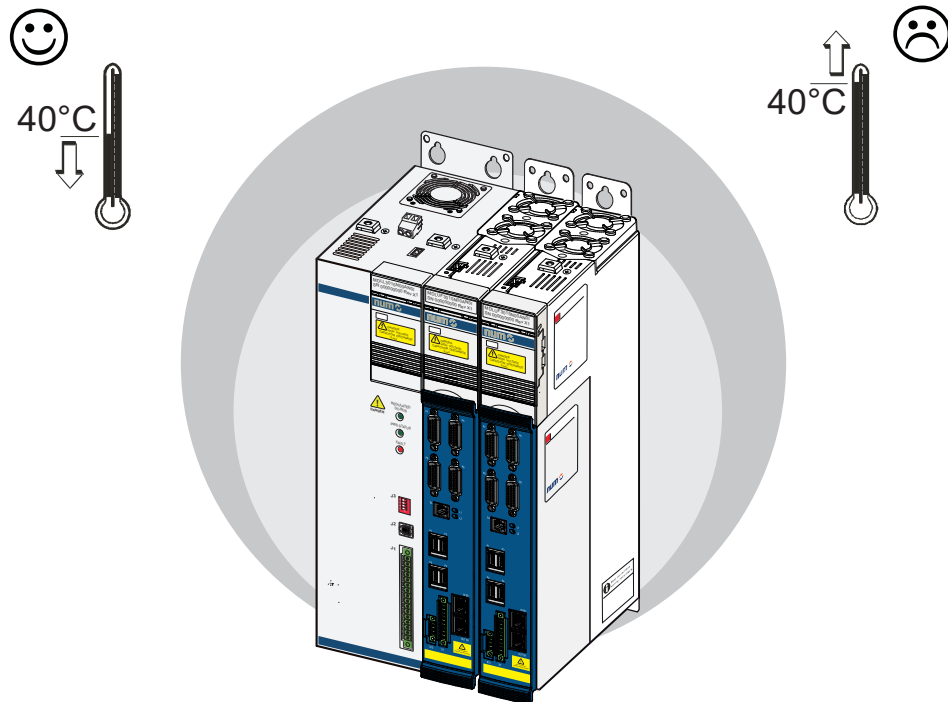
The NUM DrivePro drives and MDLL3 power supply are designed for use up to 700Vdc. The drive rated current (S1) is referred to a 540Vdc Bus voltage. See chapter 4 and 5.

With different DC Bus Voltages, it is necessary to determine the drive S1 current derating factor as shown in the diagram below. Values exceeding are not permitted.

Multiply the nominal drive current by the factor found in the diagram. Check that the derated current is still useful for your application.



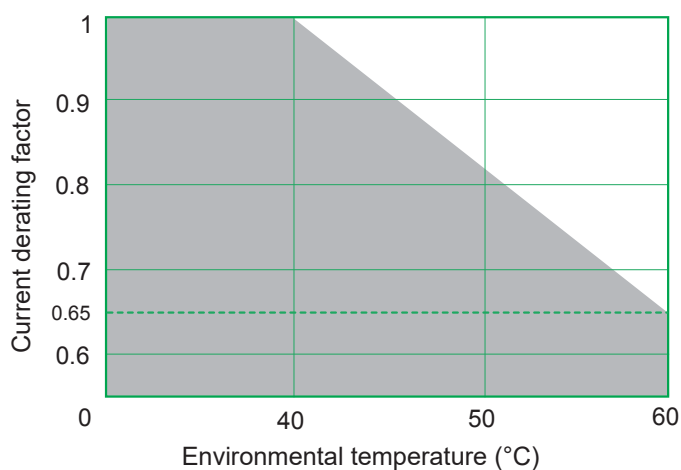
NUM DrivePro drives operated outside of this range could be seriously damaged.



The NUM DrivePro drives and MDLL3 power supply are designed for use in this temperature range: 0 ÷ 40°C max. In other cases, with ambient temperatures higher than 40°C, it is necessary to determine the current derating factor as shown in the diagram below. Values exceeding are basically not permitted.

Multiply the nominal drive current by the factor found in the diagram.

Check that the derated current is still useful for your application.



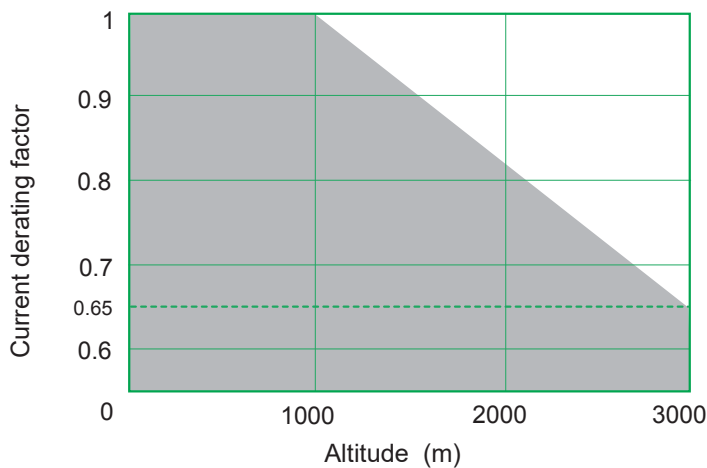
NUM DrivePro drives operated outside of this range could be seriously damaged.

2.10 Derating due to altitude conditions

The NUM DrivePro drives and MDLL3 power supply are designed for use up to 1000m above sea level. In other cases, with altitudes above 1000m, it is necessary to determine the current derating factor as shown in the diagram below. Values exceeding are basically not permitted.

Multiply the nominal drive current by the factor found in the diagram.

Check that the derated current is still useful for your application.

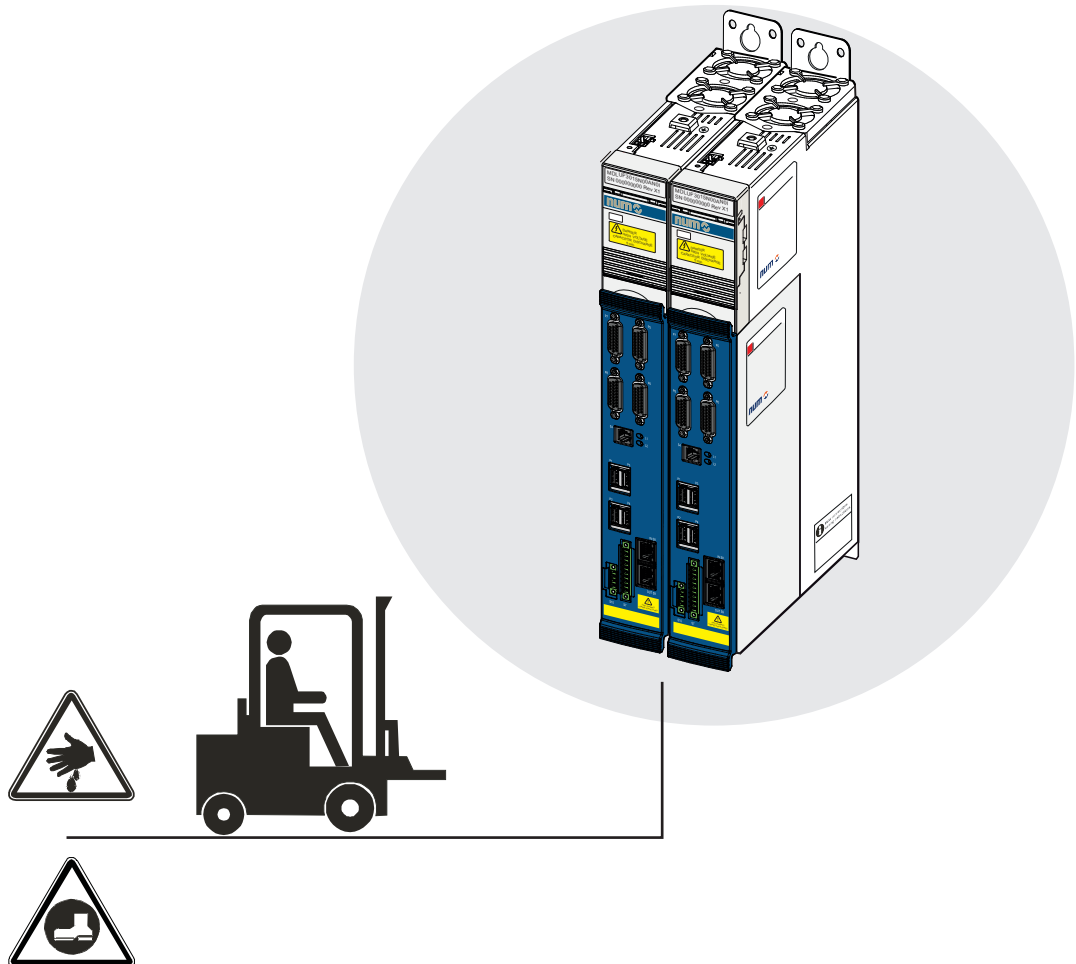


NUM DrivePro drives operated outside of this range could be seriously damaged.

2.11 Drives storage and transport conditions

In order to avoid possible damage or malfunctioning of the drives it is suggested to follow the storage and transport instructions below:

- Storage temperature - 40°C / + 80°C. (0°C / + 70°C with NUM-SAMX module)
- Humidity ratio 75% maximum without condensation.
- Make sure that the environment is a dry place free of dust, oils and vibrations.
- Always use suitable and safe transport.
- Pay a particular attention to avoiding impacts or shocks that could damage the drive.



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3

4

5

6

7

8

9

10

11

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Summary

3	NUM DrivePro - Overview	37
3.1	NUM DrivePro High and Standard performance compact drives	37
3.2	NUM DrivePro functions	38
3.3	NUM DrivePro standard and optional functions	40
3.3.1	NUM DrivePro standard and optional safety functions	43
3.4	NUM DrivePro compatible sensor configurations	44
3.4.1	Mono-Axis	44
3.4.2	Bi-Axes	44
3.4.3	Quad-Axes.....	45
3.5	NUM DrivePro System configuration.....	46
3.6	NUM DrivePro solution examples.....	47
3.7	NUM DrivePro, FlexiumPro System Architecture.....	48
3.7.1	System overview.....	48
3.7.2	Dual rows DISC ET bus solution with AEOADA023 adapter	49
3.7.3	MDLUF with NUM-SAMX typical architecture	50

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3 NUM DrivePro - Overview

3.1 NUM DrivePro High and Standard performance compact drives

Applications	The NUM DrivePro drives are aimed particularly for CNC machinery applications in the machine tool and in robotics. NUM DrivePro are available both in Mono-Axis and Bi-Axes version and they are suitable to control SHX⁽¹⁾, SPX⁽¹⁾ BHX, BPX, BPH, BPG and BHL series brushless motors and even are suitable to control AMS100, AMS132, AMS160 and IM18 spindle motors. ⁽¹⁾ SHX and SPX brushless Single Cable Motor only require a single cable for power / sensor. connections.
Feature and Technology	• The NUM DrivePro servo drives with their modern design are the ideal counterpart to the powerful Flexium+ CNC. • One distinguishing feature of the NUM DrivePro is its high power density. The servo drives offer an enormous amount of computing and drive power within a very small space and thus have one of the highest power/volume ratios available. • A high degree of integration and efficiency has allowed us to achieve an extremely compact design that makes NUM DrivePro one of the smallest high-end drives on the market. Thanks to a small depth and a modular width (a multiple of 50 mm) the cabinet layout is greatly simplified. • The range is characterized by a wide choice of current from a few amperes up to 282 Arms, Bi-Axes versions are available up to 2x53 Arms to enable each application to be optimized at the lowest cost. • For the maximum contour precision, speeds and cost-effectiveness, the NUM DrivePro servo drives can be exactly adapted to the particular machine and application. • NUM DrivePro as a modular drive system is optimized for multi-axis applications. Use of a common power supply unit means that only one mains connection, one line filter and one braking resistor are required per system, reducing cabling and overall costs. • The system's modularity also facilitates energy exchange between different axes via the DC bus, offers the possibility of using stored energy for retraction purposes, and in the case of regenerative power supplies allows energy to be re-injected into the mains to reduce machine operating cost. Such system conception also leads the way for a greener approach. • NUM DrivePro offers a choice of two performance levels: - Standard-Performance (SP) drives. - High-Performance (HP) drives. • Featuring high internal resolution, a short sampling time and specially developed algorithms, the HP versions are designed for sophisticated and complex applications in precision machine tools. The position control loop is closed with a very high bandwidth, achieving exceptional precision and speed at the mechanical interface of the machine (motor axis, linear motor). • NUM DrivePro accepts almost all measuring systems and can control a broad range of motors (servo, torque, linear, asynchronous motors) from NUM or other manufacturers. This ensures that a solution can be optimized from the technical and economic perspectives. • The standard performance units are suited to systems and precision machine tools of medium complexity as well as to cost-effective solutions
Available Input / Output	• The inputs and outputs are opto isolated and protected against short circuit. • Inputs are provided for parameters exchange of the speed loop, for the electrical range change control, for the torque current limitation, for the alarm remote control switch. • Separated protected inputs allow the possibility to control two connected brakes.
Configuration and Diagnostic	All functions control and parameters optimization are carried out by means of Flexium Tools system. Some of the main operations are: • Load and configure the motor / drive personalization parameters • Display and modify the drive parameters / digital test points • Display the internal quantities in physical unit • Configure and display the drive digital test point • Loading / Saving the parameters from / to E2PROM memory • Display the performance by means of a digital oscilloscope ... The diagnostic display by means MDLUF leds or by CNC allows rapid pin-pointing of a possible alarm.

3.2 NUM DrivePro functions

		Bi-Axes and Quad-Axes SP (Standard Performance)	Mono-Axis, Bi-Axes and Quad-Axes HP (High Performance)
Interface	High speed digital bus DISC ET	•	•
Control Performance	- Standard performance control loops - High performance control loops	• -	• •
Compatible Motors	- Closed loop: synchronous rotary motors ⁽¹⁾ - Closed loop: synchronous torque and linear motors - Closed loop: asynchronous motors - Open loop: synchronous or asynchronous rotarymotors (V/F mode)	• ⁽²⁾ - • •	• • • •
Compatible Motor Sensor	- Single cable motor encoder (SHX, SPX motors) - EnDat 2.1 & EnDat 2.2 encoder 1 Vpp toothed wheel / encoder - Renishaw RESOLUTE™ encoders with BiSS unidirectional interface - Magnescape encoders	• • • • •	• • • • •
Compatible Direct Measure Sensors	- EnDat 2.1 & EnDat 2.2 encoder / linear scale - Hall sensors 1 Vpp encoder / linear scale (also with coded references) - Renishaw RESOLUTE™ encoder with BiSS unidirectional interface - Magnescape encoders	- - - - -	• • • • •
Special Functions	- Spindle operation for synchronous and asynchronous motors - Synchronous motor phasing without movement ⁽³⁾ - Spindle-Axis commutation - Star/Delta commutation on the fly (for asynchronous motor) - Rotary axis with mechanical ratio not 2ⁿ or managing, as absolute axis, machine linear axis with lengths longer than the maximum number of the encoder revolution counter (AP02)	• • • • •	• • • • •
	- Anti-backlash function (AP03) ⁽⁴⁾ ⁽⁵⁾ - Torque duplication (AP04) ⁽⁵⁾ ⁽⁶⁾ - Winding duplication (AP05) ⁽⁵⁾ ⁽⁶⁾	- - -	○ ○ ○
	DEMF (Drive Embedded Macro / AP07) ⁽⁷⁾	-	○
	- Coherence control between motor and direct measure sensor (AP06) - Various active damping functions - Various freely settable filters (AP11, AP12) - Electrical Position Synchronization (EPS) - Absolute position with motor's multi-turn encoder and incremental direct measure sensor	- - • • -	• • • • •

⁽¹⁾ Having a compatible position sensor.

⁽²⁾ For standard performance, max. 8 pole pairs motors.

⁽³⁾ Required with incremental encoders.

⁽⁴⁾ Not allowed for asynchronous motors in V/F mode.

⁽⁵⁾ On Mono-axis drive, available with dedicated version MDLUF---AED----

⁽⁶⁾ Not allowed for asynchronous motors.

⁽⁷⁾ Subject to international export control.

• Standard ○ Optional - Not Available

		Bi-Axes and Quad-Axes SP (Standard Performance)	Mono-Axis, Bi-Axes and Quad-Axes HP (High Performance)
Safety Functions compliant with EN 61800-5-2	NUM-STO module with Safe Torque Off ⁽⁸⁾ NUM-SAMX module with ⁽⁹⁾ • STO Safe Torque Off • SLS Safely Limited Speed • SOS Safe Operational Stop • SS1 Safe Stop 1 • SS2 Safe Stop 2 • SLP Safe Limited Position • SDM Safe Direction Monitoring • SCA Safe CAMs • SSM Safe Speed Monitor	○ ○	○ ⁽¹⁰⁾ ○ ⁽¹⁰⁾

⁽⁸⁾ Not Available on Quad-Axes drive

⁽⁹⁾ The motor sensor protocol MAGNETSCALE and "T" (BHX040) are not yet managed by NUM-SAMX so they cannot be used for NUM-SAMX application.

⁽¹⁰⁾ Not available on MDLUF200

- Standard ○ Optional - Not Available

Standard functions	Motor type and control method NUM DrivePro can control in open and closed loop different motor types: • Closed loop with current vector control: synchronous rotary motors; • Closed loop with current vector control: synchronous torque and linear motors (optional for Bi-Axes and Quad-Axes drives, High Performance version is needed: MDLUF---BE-C----); • Closed loop with current vector control: asynchronous rotary motors; • Open loop in V/f mode: synchronous and asynchronous rotary motors.
	Motor sensor NUM DrivePro can inter operate with different motor feedback types: • Sick Stegmann Hiperface encoder; • Sick Stegmann Hiperface DSL encoder (2 wires) (encoder used in SHX, SPX motors); • Heidenhain EnDat 2.1 EnDat 2.2 with 1Vpp incremental traces, rotary encoder and linear scale (both with coded references mark too); • Heidenhain EnDat 2.2 without 1Vpp incremental traces, rotary encoder and linear scale; • 1 Vpp toothed wheel; • 1 Vpp rotary encoder, linear scale (both with coded references mark too); • Magnescale; • Renishaw RESOLUTE™ encoder with BiSS C unidirectional interface; • Fagor encoder with BiSS C unidirectional interface.
	High performance control loop NUM DrivePro features high internal resolution, a short sampling time (10 kHz) and specially developed control algorithms, which all contribute to its very wide bandwidth (optional for Bi-Axes and Quad-Axes drives, High Performance version is needed: MDLUF----EC----). The drive's wide bandwidth ensures exceptional dynamic performance, as well as precision and stiffness at the mechanical interface of the machine.
	Direct measure sensor (optional for Bi-Axes and Quad-Axes drives High Performance version is needed: MDLUF----EC----) NUM DrivePro can inter operate with different direct measure sensor: • Sick Stegmann Hiperface encoder; • Sick Stegmann Hiperface DSL encoder (2 wires); • Heidenhain EnDat 2.1 EnDat 2.2 with 1Vpp incremental traces, rotary encoder and linear scale (both with coded references mark too); • Heidenhain EnDat 2.2 without 1Vpp incremental traces, rotary encoder and linear scale; • 1 Vpp toothed wheel; • 1 Vpp rotary encoder, linear scale (both with coded references mark too); • Magnescale; • Renishaw RESOLUTE™ encoder with BiSS C unidirectional interface; • Fagor encoder with BiSS C unidirectional interface; • Hall effect sensor.
	EPS: Electrical Position Synchronization To drive synchronous motors correctly, the relative position of the rotor (or magnet plates for linear motors) has to be known; this is typically realized by using and configuring absolute encoders (single or multi-turn). The EPS function allows incremental encoders to be used for this purpose; detection of the rotor (or magnet plates for linear motors) position is realized at each power on.
	Spindle-Axis commutation, Star/Delta commutation on the fly NUM DrivePro manages synchronous and asynchronous motors either as axis feed or as spindle feed. As well as each axis can become a spindle and vice versa. For each operation mode a dedicated parameter set is defined in order to optimise the motor working conditions and the sensor configuration. For asynchronous motors star/delta commutation on fly is supported in NUM DrivePro.
	Parameter set change on fly or in HALT NUM DrivePro manages 99 parameters set from Set_0 to Set_98. Depending on the parameter change required, moving from the parameter set in use to the next parameter set the drive could accept the parameter set change on fly. This could be useful used in case of different motor tuning depending on the applied load. The parameter which value could be not changed on fly are the parameter which value could be changed when drive is in HALT status. Refer to NUM DrivePro Parameters manual M00066 to check this requirement. The parameter set change in HALT could be useful used in case of motor change, for example on machine head exchange.

	AP01: Absolute position with motor's multi-turn encoder and incremental direct measure sensor The AP01 function allows the absolute position of an axis to be obtained from its motor's multi-turn encoder; the incremental direct measure sensor is initialized during initialization of the CNC-drive system. The CNC won't require the homing on the axis even if the direct measure sensor is not absolute. (Optional for Bi-Axes and Quad-Axes drives High Performance version is needed: MDLUF----EC-----)
Standard functions	AP02: Rotary axes with mechanical ratio different from 2n The AP02 function allow to manage the absolute position (without to perform the HOMING procedure) even in case of rotary axes with a mechanical ratio between the motor sensor (or direct measure sensor) and the load which is not 2n. Furthermore, this feature allows managing, as absolute axis, machine linear axis with lengths longer than the maximum number of the encoder revolution counter. AP06: Coherence control between motor and direct measure sensor The AP06 function controls the coherence between a motor and its direct measure sensor; its parameters define the maximum accepted displacement and the minimum time for which the displacement is accepted. (Optional for Bi-Axes and Quad-Axes drives High Performance version is needed: MDLUF----EC-----) Digital filters Various digital filters are available, which can be freely set and cascaded to act at different points in the control loop. Types include first or second order low/high pass and notch filters, which can be applied to any combination of torque reference, speed reference. For speed feedback only first order low pass filter is allowed. AP11: Active Damping by VDR As well as for measuring accelerations it can be used in closed loop to damp mechanical resonances. (Optional for Bi-Axes and Quad-Axes drives High Performance version is needed: MDLUF----EC-----) AP12: Active Damping by Direct Measure Sensor As well as digital filters which can be used to dump mechanical resonances, the active damping function is a complex closed loop algorithm particularly suitable for smoothing low frequency vibrations (below 150 Hz). (Optional for Bi-Axes and Quad-Axes drives High Performance version is needed: MDLUF----EC-----)

Optional functions	AP03: Anti-backlash function Rack and pinion kinematic solutions usually have an unacceptable backlash; mechanical solutions to reduce backlash exist, but they decrease the efficiency of the transmission significantly, and deteriorate over time due to wear. The NUM DrivePro anti-backlash function provides a better approach, in which gear pinions are driven by two motors preloaded to compensate for the backlash. The function can be used for linear or rotary axes driven by synchronous or asynchronous motor. For proper functionality, the mechanical drive train from motor shaft to rack should be $\geq 80\%$ efficient. For implementing the anti-backlash function the following is needed: • NCK Option FPSO000453; • A Bi-Axes or Quad-Axes drive in High Performance version is needed: MDLUF----EC---- (Limited to the motors in the drive); • Two or three o four Mono-Axis drives with dedicated version: MDLUF---AED---- (The drives and the motor must be of the same size, one master and till three slaves are allowed). AP04: Torque duplication Similarly to the anti-backlash function, more than two drives/motors can be electronically connected so that the torque/force supplied to the rack is the sum up of all motor forces. For implementing the anti-backlash function the following is needed: • NCK Option FPSO000453; • A Bi-Axes or Quad-Axes drive in High Performance version is needed: MDLUF----EC---- (Limited to the motors in the drive); • Two or three o four Mono-Axis drives with dedicated version: MDLUF---AED---- (The drives and the motor must be of the same size, one master and till three slaves are allowed). AP05: Winding duplication Some specialized applications demand very high power motors (>100 kW), with their windings divided into N independent sets. With NUM DrivePro it's possible to drive such independent windings by using N drives; the drives are hard synchronized so that the system performance is equivalent to a motor driven by one drive only. For implementing the anti-backlash function the following is needed: • NCK Option FPSO100454; • A Bi-Axes or Quad-Axes drive in High Performance version is needed: MDLUF----EC---- (Limited to the motors in the drive); • Two or three o four Mono-Axis drives with dedicated version: MDLUF---AED---- (The drives must be of the same size, one master and till three slaves are allowed).
Optional functions	AP07: DEMF (Drive Embedded Macro) • This allows users to create their own real-time macro which can interact with all physical and virtual drive resources – even to the extent of manipulating the regulation algorithms. Users can design and implement filters and monitors, define test points and create pilot outputs that obey user-stipulated rules. For implementing the DEMF function the following is needed: • NCK Option FPSO000456; • A Bi-Axes or Quad-Axes drive in High Performance version is needed: MDLUF----EC----; • Subject to international export control.
	AP08: Inter drive DEMF data exchange This allows users to exchange data between two DEMF programs running on different axis on the same drive (Bi-Axes or Quad-Axes) or between two DEMF programs running on two Mono-Axis drive. • DEMF option is required

3.3.1 NUM DrivePro standard and optional safety functions

Standard safety functions	As standard NUM DrivePro servodrives (see chapter 5.4) are equipped with the NUM-STO safety. This provides the Safe Torque Off function as specified by the EN 61800-5-2. When the STO function is activated NUM DrivePro will not provide the motor with any energy that could generate torque (or force in the case of a linear motor).
Optional safety functions	The safe monitoring of axes speed and position is carried out by NUM-SAMX safety module. NUM-SAMX interoperates by means of the EtherCAT (and FSoE) with the NUMSafe PLC and I/Os. NUM-SAMX is a hardware option of NUM DrivePro; please refer to chapter 5.4 for part number definition. NUM-SAMX performs the following safety functions: Safe Torque Off (STO) Like NUM-STO, NUM-SAMX provides the STO function but in this case the activation of the function is performed by means of the NUMSafe PLC and FSoE. When the STO function is activated NUM DrivePro will not provide the motor with any energy that could generate torque (or force in the case of a linear motor). Safe Operational Stop (SOS) The SOS function prevents the motor from deviating more than a defined amount from the stopped position. The NUM DrivePro provides energy to the motor to enable it to resist external forces. Safe Stop 1 (SS1) The SS1 function monitors the motor deceleration rate within set limits to stop the motor and initiates the STO function when the motor speed is below a specified limit. Safe Stop 2 (SS2) The SS2 function monitors the motor deceleration rate within set limits to stop the motor and initiates the safe operating stop function when the motor speed is below a specified limit. Safe Limited Speed (SLS) The SLS function prevents the motor from exceeding specified speed limit(s). Safe Limited Position (SLP) The SLP function prevents the axes from exceeding specified position limit(s). Safe Direction Monitoring (SDM) The SDM function prevents the motor shaft from moving in an unintended direction. Safe InterlockOut Signal NUM-SAMX provides a safe signal to indicate when safety guard opening is allowed. Safe CAMs (SCA) The SCA function provides a safe output signal to indicate whether the motor shaft position is within a specified range. Safe Speed Monitor (SSM) The SSM function provides a safe output signal to indicate whether the motor speed is below a specified limit.

3.4 NUM DrivePro compatible sensor configurations

3.4.1 Mono-Axis

Sensor		With incremental signals				Serial interface only					Sensorless	Hall effect sensor	Vibration Detector (accelerometer)
	Connector	Hiperface	Endat 2.1	Endat 2.2	SinCos (1Vpp)	Endat 2.2	Hiperface DSL 2-wires	Magnescape ⁽¹⁾	Tamagawa ⁽¹⁾	(Resolute Renishaw) (Fagor BiSS)			
M1	S1 ⁽²⁾ Motor sensor	P1...P4	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁶⁾	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁶⁾	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁶⁾	-	-	-	-	-	-	-	-	-	-	•

3.4.2 Bi-Axes

Sensor		With incremental signals				Serial interface only					Sensorless	Hall effect sensor	Vibration Detector (accelerometer)
	Connector	Hiperface	Endat 2.1	Endat 2.2	SinCos (1Vpp)	Endat 2.2	Hiperface DSL 2-wires	Magnescape ⁽¹⁾	Tamagawa ⁽¹⁾	(Resolute Renishaw) (Fagor BiSS)			
Axis 1 - M1	S1 ⁽²⁾ Motor sensor	P1...P4	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁷⁾	-	-	-	-	-	-	-	-	-	-	•
Axis 2 - M2	S1 ⁽³⁾ Motor sensor	P1...P4	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁷⁾	-	-	-	-	-	-	-	-	-	-	•

- = Authorized sensor configuration
 - = Not authorized sensor configuration



⁽¹⁾ Not yet allowed for NUM-SAMx application

⁽²⁾ Only P1 or P5 allowed with NUM-SAMX.

⁽³⁾ Only P2 or P6 allowed with NUM-SAMX.

⁽⁶⁾ Optional available with dedicated version MDLUF---AED----

⁽⁷⁾ Optional available with dedicated version MDLUF---BEC----

3.4.3 Quad-Axes

		Sensor	With incremental signals				Serial interface only					Sensorless	Hall effect sensor	Vibration Detector (accelerometer)
		Connector	HiPerface	Endat 2.1	Endat 2.2	SinCos (1Vpp)	Endat 2.2	HiPerface DSL 2-wires	Magnescape ⁽¹⁾	Tamagawa ⁽¹⁾	(Resolute Renishaw) (Fagor BiSS)			
Axis 1 - M1	S1 ⁽²⁾ Motor sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁷⁾	-	-	-	-	-	-	-	-	-	-	-	•
Axis 2 - M2	S1 ⁽³⁾ Motor sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁷⁾	-	-	-	-	-	-	-	-	-	-	-	•
Axis 3 - M3	S1 ⁽⁴⁾ Motor sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁷⁾	-	-	-	-	-	-	-	-	-	-	-	•
Axis 4 - M4	S1 ⁽⁵⁾ Motor sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	•	•	-	-	-
	S2 Direct measure sensor	P1...P4	-	-	-	-	-	•	-	-	-	-	-	-
		P5,P6 P7,P8 ⁽⁷⁾	•	•	•	•	•	-	•	-	•	-	•	-
	S3 VDR	P5,P6 P7,P8 ⁽⁷⁾	-	-	-	-	-	-	-	-	-	-	-	•

- = Authorized sensor configuration
 - = Not authorized sensor configuration



⁽¹⁾ Not yet allowed for NUM-SAMx application

⁽²⁾ Only P1 or P5 allowed with NUM-SAMX.

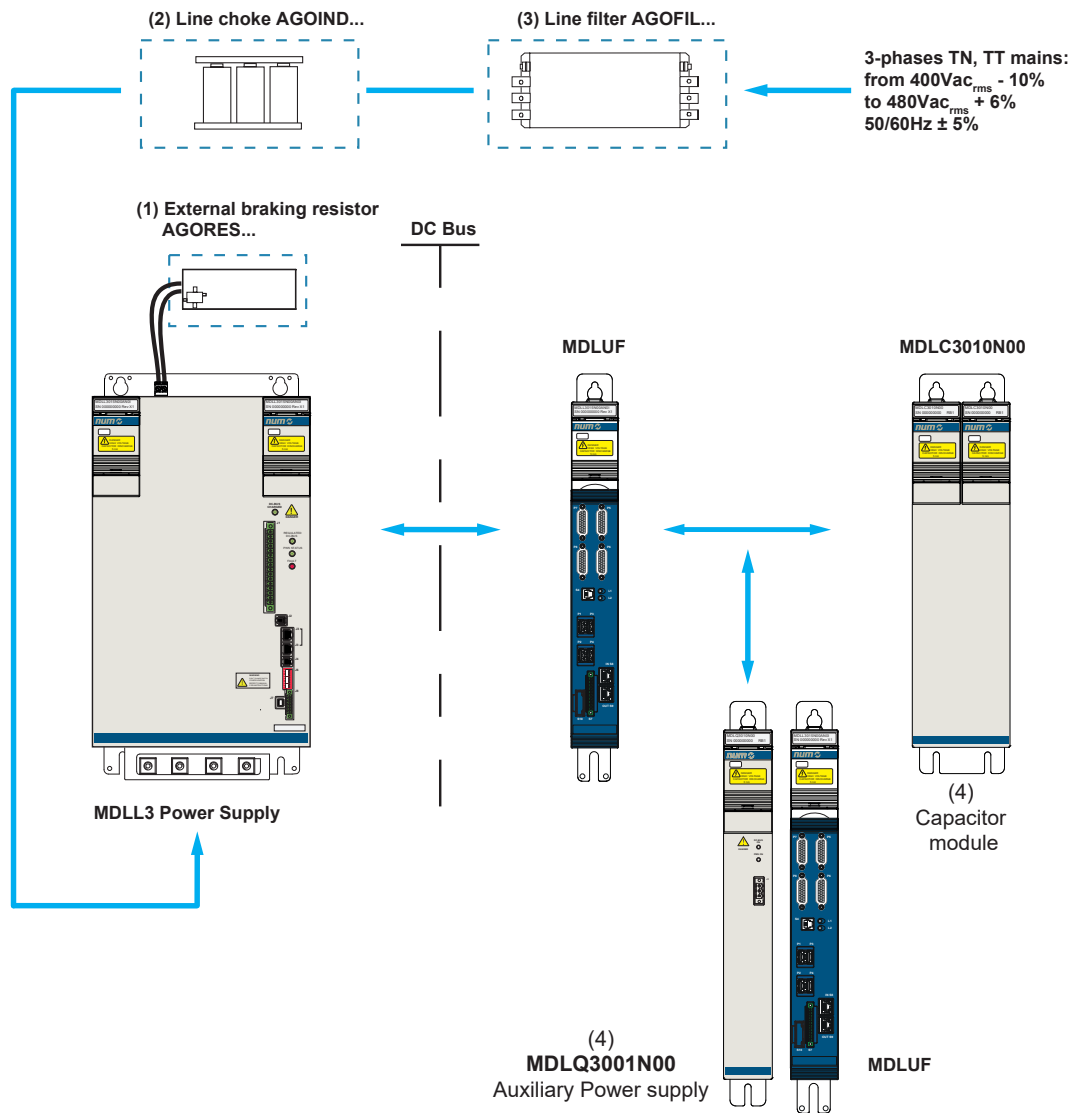
⁽³⁾ Only P2 or P6 allowed with NUM-SAMX.

⁽⁴⁾ Only P3 allowed with NUM-SAMX.

⁽⁵⁾ Only P4 allowed with NUM-SAMX.

⁽⁷⁾ Optional available with dedicated version MDLUF---DEC----

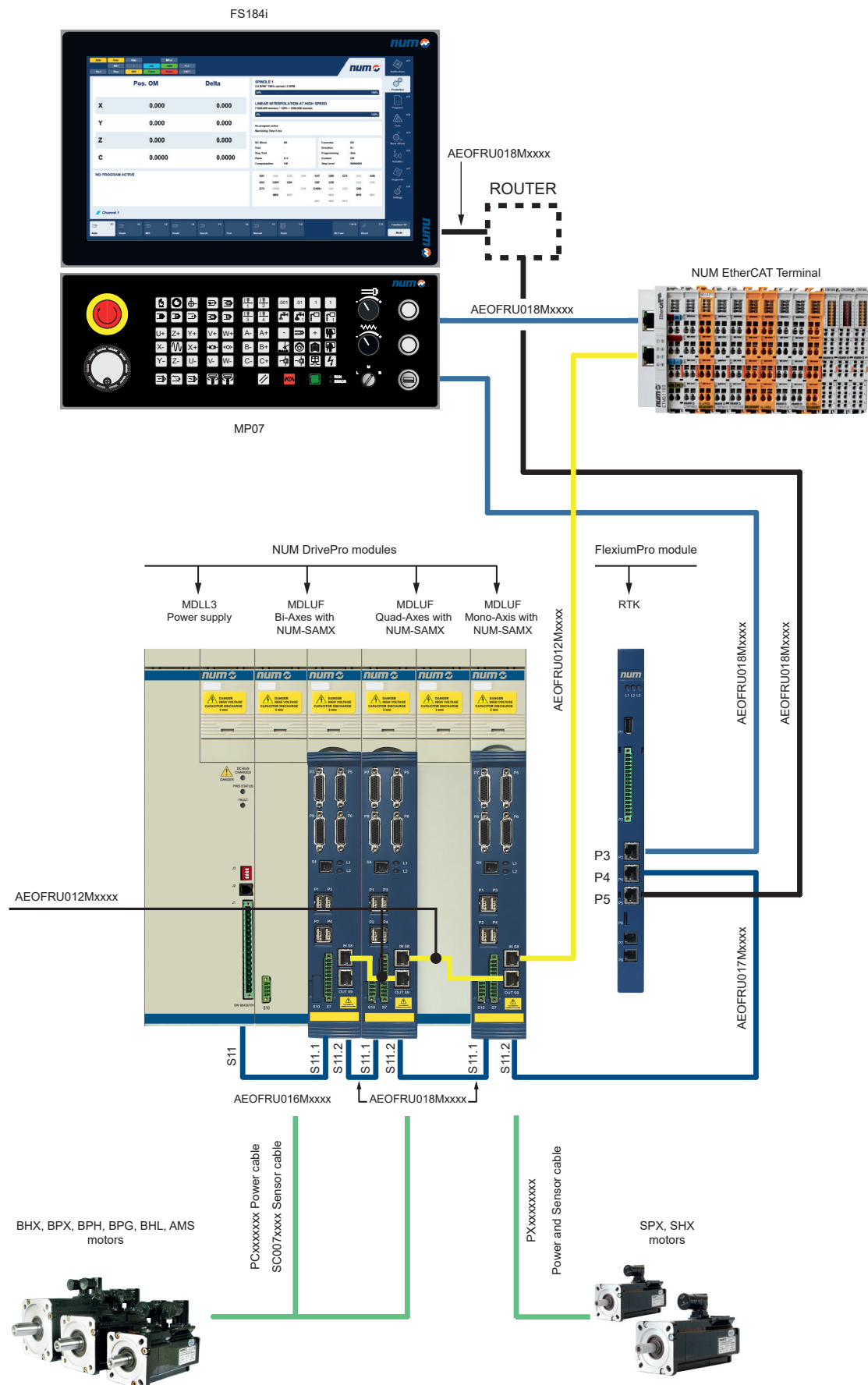
3.5 NUM DrivePro System configuration



- (1) Mandatory accessory
- (2) Mandatory with MDLL3050N00A, MDLL3120N00A, MDLL3xxxN00R and MDLL3xxxN00H
- (3) Mandatory accessory
- (4) Optional.

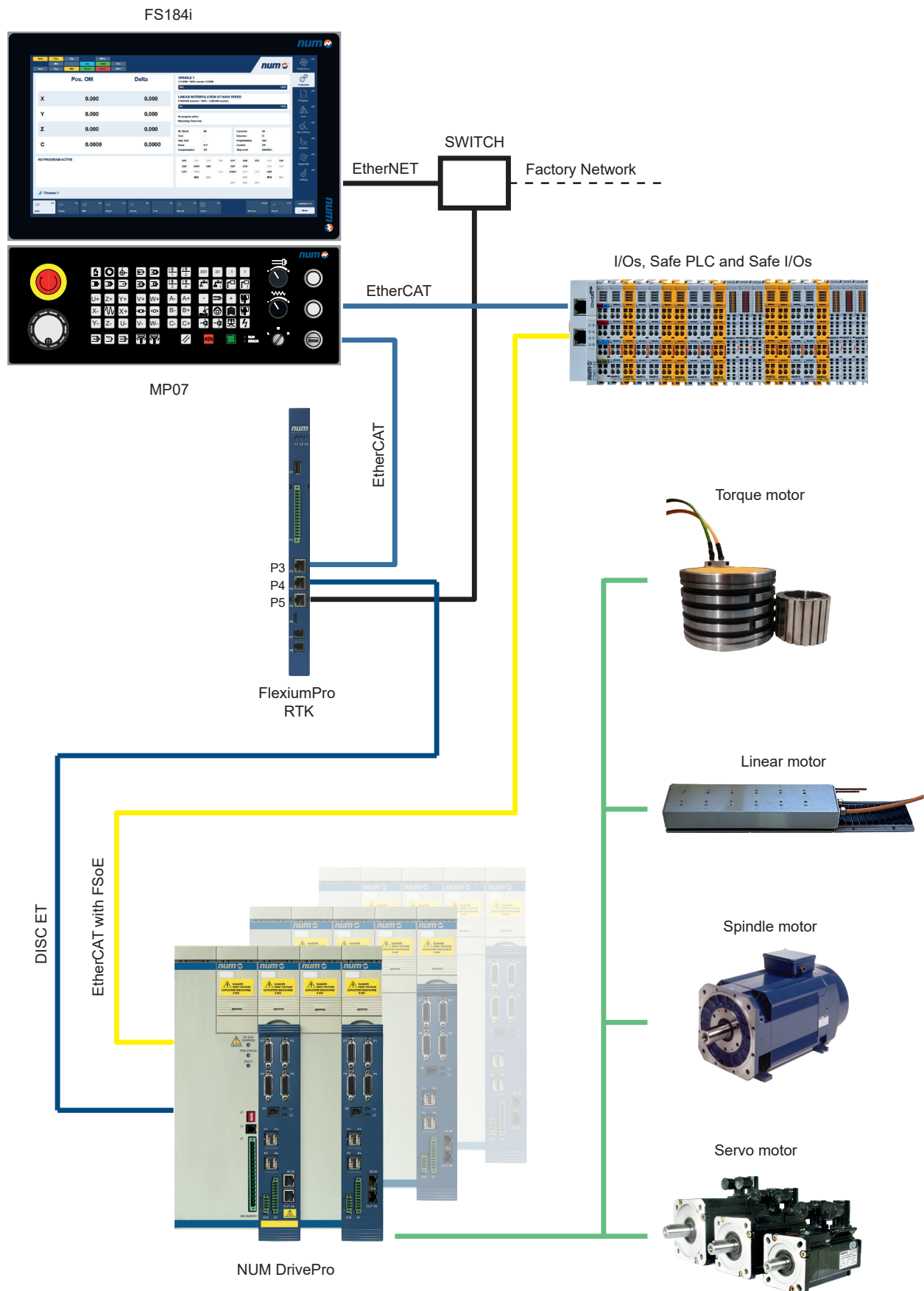
Please refer to chapter 10 for more detailed informations.

3.6 NUM DrivePro solution examples



3.7 NUM DrivePro, FlexiumPro System Architecture

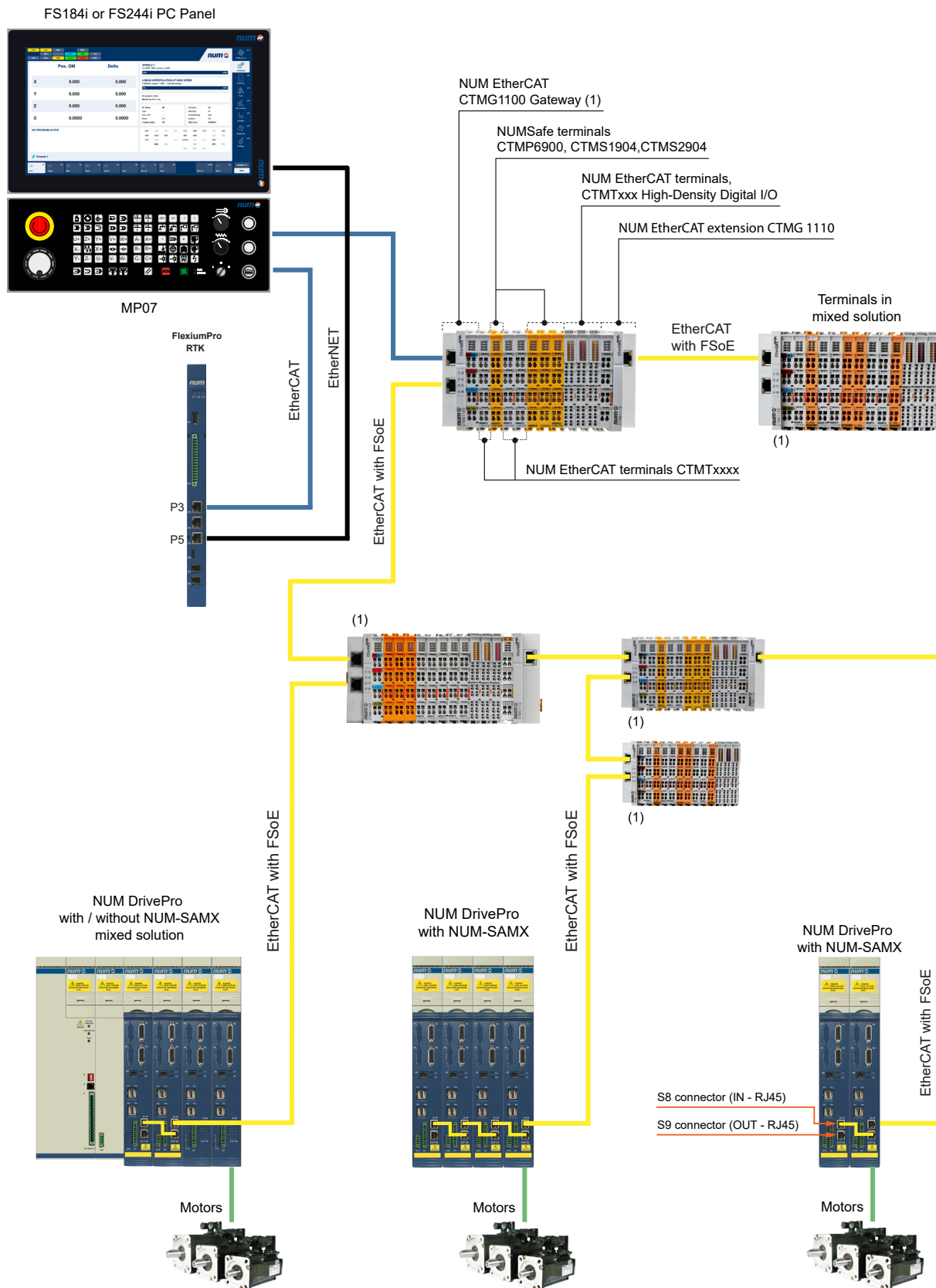
3.7.1 System overview



NUM DrivePro Installation and maintenance manual - M00067EN-00



3.7.3 MDLUF with NUM-SAMX typical architecture



For more detailed information of the NUM-SAMX connections please refer to the chapter [9.7](#).
For more detailed information of the NUMSafe terminals and NUM EtherCAT terminal please refer to the manuals code M00032, M00033, M00034 and M00035.

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7

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9

10

11

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Summary

4	Power Supplies	55
4.1	Passive Power Supplies general characteristics	55
4.2	Regenerative and Regulated DC bus Power Supplies general characteristics	56
4.3	Power Supply for 230Vac mains general characteristics	57
4.4	MDLL3 ordering code	58
4.5	MDLL3 layout and connectors	59
4.5.1	MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I layout and connectors	59
4.5.2	MDLL3025N00xN0I, 3050N00xN0I layout and connectors	60
4.5.3	MDLL3120N00xN0I layout and connectors	61
4.6	MDLL3 enclosed accessories	62
4.6.1	MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I enclosed accessories	62
4.6.2	MDLL3025N00xN0I, 3050N00xN0I enclosed accessories	63
4.6.3	MDLL3120N00AN0I, 3120N00RN0I mandatory accessori.....	64
4.6.4	MDLL3120N00HN0I mandatory accessories.....	64
4.7	MDLQ3001N00 250W AUX Power Supply	65
4.7.1	General characteristics.....	65
4.7.2	MDLQ3001N00 with MDLUF solution example.....	66
4.7.3	MDLQ3001N00 layout, connectors and enclosed accessories	67

1

2

3

4

5

6

7

8

9

10

11

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4 Power Supplies

4.1 Passive Power Supplies general characteristics

MDLL3...	...015N00AN0I	...030N00AN0I	...050N00AN0I	..120N00AN0I
Rated output power (S1)	15kW	30kW	50kW	120kW
S3 power - 4s ON-6s OFF (PS3)	40kW	45kW	97kW	150kW
Peak power (Pmax)	50kW	50kW	97kW	175kW
Maximum continuous braking power	15kW	30kW	20kW	20kW
Peak braking power	51kW	61kW	120kW	170kW
Minimum braking resistance value	10Ω	8.5Ω	4.25Ω	2.8Ω
Maximum dissipation (S1) @ 400Vac	75W	170W	350W	1400W
Rated input voltage	400Vrms -10% ÷ 480Vrms +6% (3 phases)			
Rated input current	31Arms	62Arms	100Arms	194Arms
Power factor	> 0.85	> 0.85	> 0.85	> 0.85
Input frequency	50Hz -5% ÷ 60Hz +5%			
DC link voltage (intermed. bus at rated current)	540Vdc with 400Vrms input / 650Vdc with 480Vrms input			
AUXILIARY SUPPLY				
Rated power	230W		180W	200W
Rated input voltage	400Vrms -10% ÷ 480Vrms +6% (2 phases)			
Rated input current	1Arms			
Input frequency	50Hz -5% ÷ 60Hz +5%			
Output voltage	48Vrms 35kHz			
OTHER CHARACTERISTICS				
Output supplies for digital I/O	+24Vdc 500mA			
Input cable cross section (L1, L2, L3)	10mm2	16mm2	35mm2	95mm2
Cooling type	Internal			External fan
Degree of protection	IP20		IP00	
Pollution degree	2			
Environmental installation conditions	At least of IP54 degree protection			
Electromagnetic Compatibility	Conform to EN 61800-3			
Vibration stressing in operation	Conform to EN 61800-5-1			
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 10			
Storage temperature	From -40°C to +80°C			
Altitude	1000m. Over 1000m see derating Altitude conditions diagram on chapter 2.10			
Relative humidity degree	Max 75% without condensation			
Overall dimensions W x H x D	100 x 355 x 206 mm		200 x 355 x 206 mm	300 x 355 x 206mm (1)
Weight	5.5kg		11.5kg	19kg

⁽¹⁾ Add 355 + 310mm due to fan dimensions. (see chapter 9.1.4)



One braking resistance must always be provided in the system.
The total length of the power cables used in each PDS must be <400m at 5kHz PWM and < 200m at 10kHz PWM. (These performance are valid using NUM cables)

4.2 Regenerative and Regulated DC bus Power Supplies general characteristics

MDLL3...	...025N00RNOI	...050N00RNOI	...120N00RNOI	...025N00HNOI	...050N00HNOI	...120N00HNOI
Rated output power (S1)	25kW	50kW	120kW	25kW	50kW	120kW
S3 power - 4s ON-6s OFF (PS3)	50kW	97kW	150kW	50kW	97kW	150kW
Peak power (Pmax)	50kW	97kW	175kW	50kW	97kW	190kW
Maximum continuous braking power	25kW	50kW	120kW	25kW	50kW	120kW
Peak braking power	61kW	120kW	170kW	61kW	120kW	200kW
Minimum braking resistance value	8.5Ω	4.25Ω (1)	2.8Ω	8.5Ω	4.25Ω (1)	2.8Ω
Maximum dissipation (S1) @ 400Vac	500W	700W	2000W	500W	700W	2000W
Rated input voltage	400Vrms -10% ÷ 480Vrms +6% (3 phases)					
Rated input current	50Arms	100Arms	194Arms	36Arms	72Arms	173Arms
Power factor	> 0.7	> 0.7	> 0.85	> 0.95	> 0.95	> 0.95
Input frequency	50Hz -5% ÷ 60Hz +5%					
DC link voltage (intermed. bus at rated current)	540Vdc with 400Vrms input 650Vdc with 480Vrms input			See DC Bus voltage configuration on chapter 9.5.3.2		
AUXILIARY SUPPLY						
Rated power	180W		200W	180W		200W
Rated input voltage	400Vrms -10% ÷ 480Vrms +6% (2 phases)					
Rated input current	1Arms					
Input frequency	50Hz -5% ÷ 60Hz +5%					
Output voltage	48Vrms 35kHz					
OTHER CHARACTERISTICS						
Output supplies for digital I/O	+24Vdc 500mA					
Input cable cross section (L1, L2, L3)	16mm2	35mm2	92mm2	16mm2	35mm2	95mm2
Cooling type	Internal		External fan	Internal		External fan
Degree of protection	IP00					
Pollution degree	2					
Environmental installation conditions	At least of IP54 degree protection					
Electromagnetic Compatibility	Conform to EN 61800-3					
Vibration stressing in operation	Conform to EN 61800-5-1					
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 10					
Storage temperature	From -40°C to +80°C					
Altitude	1000m. Over 1000m see derating Altitude conditions diagram on chapter 2.10					
Relative humidity degree	Max 75% without condensation					
Overall dimensions W x H x D	200 x 355 x 206 mm		300 x 355 x 206 mm (2)	200 x 355 x 206 mm		300 x 355 x 206 mm (2)
Weight	11.5kg		19kg	11.5kg		19kg

⁽¹⁾ Provide the MDLL3 at least of two AGORES009 braking resistors (see chapter [10.7.2](#))

⁽²⁾ Add 355 + 310mm due to fan dimensions. (see chapter [9.1.4](#))



One braking resistance must always be provided in the system.
The total length of the power cables used in each PDS must be <400m at 5kHz PWM and < 200m at 10kHz PWM. (These performance are valid using NUM cables).

4.3 Power Supply for 230Vac mains general characteristics

MDLL3...	...005M00AN01
Rated output power (S1)	5kW
S3 power - 4s ON-6s OFF (PS3)	6kW
Peak power (Pmax)	6kW
Maximum continuous braking power	5kW
Peak braking power	9kW
Minimum braking resistance value	17Ω
Maximum dissipation (S1) @ 230Vac	50W
Rated input voltage	230Vrms -10% ÷ 230Vrms +10% (Single-phase)
Rated input current	31Arms
Power factor	> 0.7
DC link voltage (intermed bus at rated current)	300Vdc with 230Vrms input
AUXILIARY SUPPLY	
Rated power	200W
Rated input voltage	230Vrms -10% ÷ 230Vrms +6% (Single-phase)
Rated input current	0.9Arms
Input frequency	50Hz -5% ÷ 60Hz +5%
Output voltage	48Vrms 35kHz
OTHER CHARACTERISTICS	
Service supplies output	+/-10Vdc 50mA
Output supplies for digital I /O	+24Vdc 500mA
Input cable cross section (L1, N)	10mm ²
Cooling type	Internal
Degree of protection	IP20
Pollution degree	2
Environmental installation conditions	At least of IP54 degree protection
Electromagnetic Compatibility	Conform to EN 61800-3
Vibration stressing in operation	Conform to EN 61800-5-1
Operating temperature range	From 0 to +40°C.
Storage temperature	From -40°C to +80°C
Altitude	1000m.
Relative humidity degree	Max 75% without condensation
Overall dimensions W x H x D	100 x 355 x 206 mm
Weight	5.5kg



One braking resistance must always be provided in the system. The total length of the power cables used in each PDS must be <400m at 5kHz PWM and < 200m at 10kHz PWM. (These performance are valid using NUM cables)

4.4 MDLL3 ordering code

	MDLL	3	015	N	00	A	N	0	I
Series									
Evolution index									
Rated power									
- Size 2: Pn 5 kW			005						
- Size 2: Pn 15 kW			015						
- Size 2: Pn 30 kW			030						
- Size 4: Pn 25 kW			025						
- Size 4: Pn 50 kW			050						
- Size 6: Pn 120 kW ⁽⁶⁾			120						
Mains supply									
- From 230Vrms -10% to 230Vrms +6% 50/60Hz +/-5%, Single phase				M ⁽¹⁾					
- From 400Vac -10% to 480Vac +6% 50/60Hz +/-5%, 3 phases				N ⁽²⁾					
Options									
- None					00				
Type									
- Passive power supply ^{(3) (4)}						A			
- Regenerative power supply ^{(3) (5)}						R			
- Regulated DC Bus power supply ^{(3) (5)}						H			
Version									
- Standard NUM							N		
Standard NUM								0	
Heat-sink position									
- Internal heat-sink									I

⁽¹⁾ Available only on Pn 5kW rated power.

⁽²⁾ Not available on Pn 5kW rated power.

⁽³⁾ An external resistor must be always taken in account.

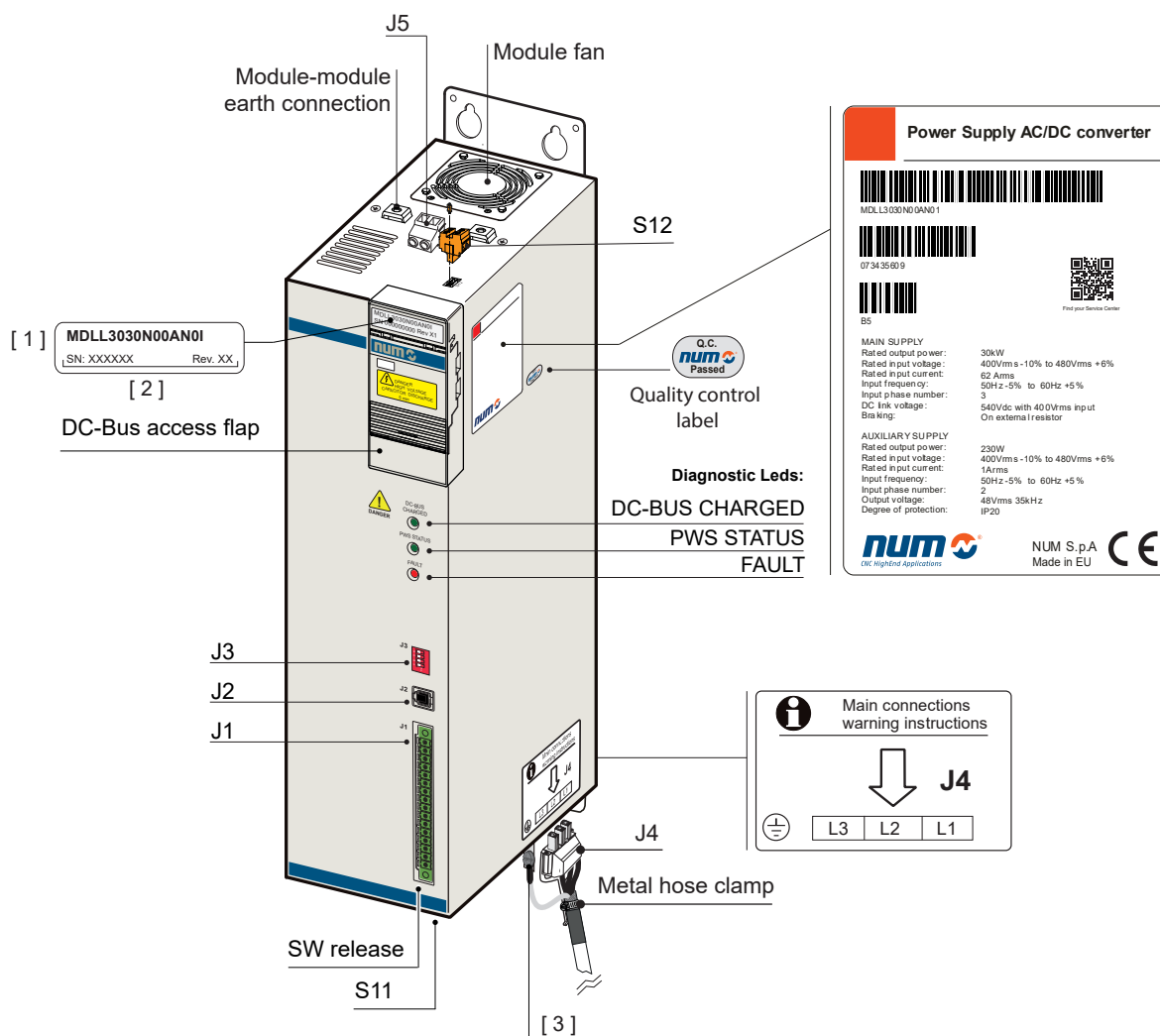
⁽⁴⁾ Not available on Pn 25kW rated power.

⁽⁵⁾ Not available on Pn 5kW, Pn 15kW and Pn 30kW rated power.

⁽⁶⁾ An external fan AGOFAN001 + AEOKIT003 must be always taken in account.
Please refer to chapter 10.

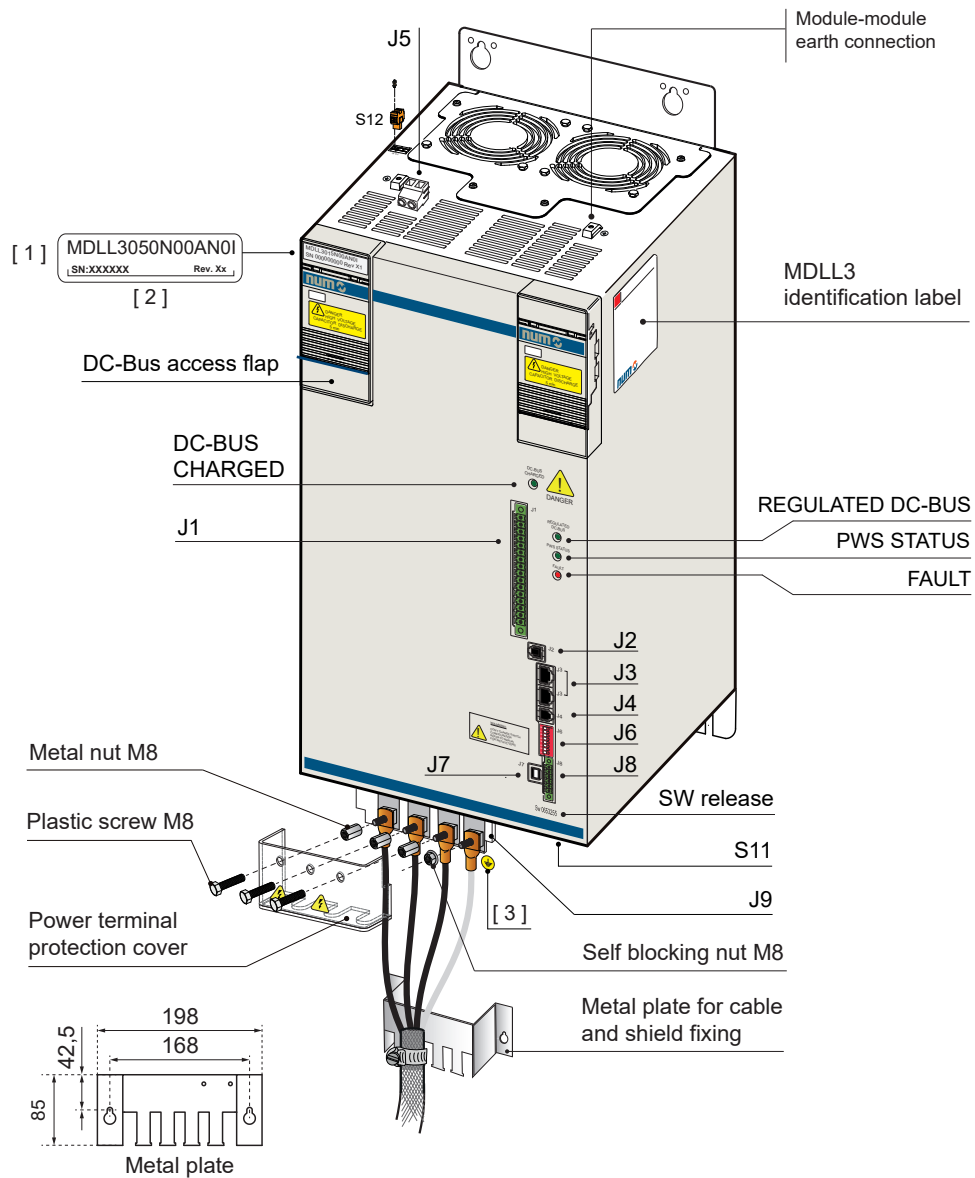
4.5 MDLL3 layout and connectors

4.5.1 MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I layout and connectors



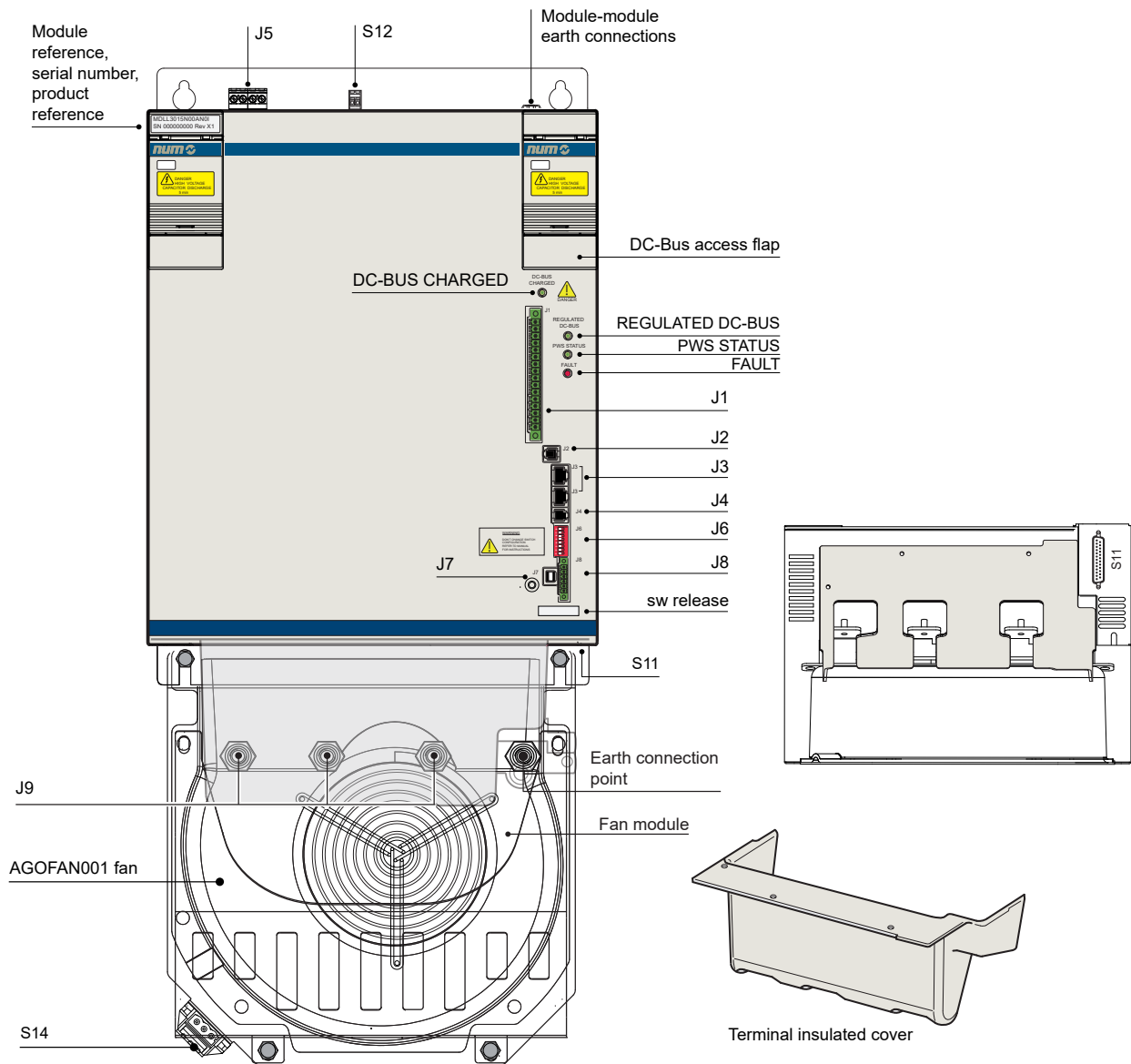
Connector	Description
J1	AUX Bi-phase supply, IN/OUT 24V-500mA
J2	Service NUM
J3	Dip switches for PWS settings
J4	Mains L1, L2, L3 connections
J5	External braking resistor connections
S11	Digital Bus interconnections
S12	AUX 48Vac output 35kHz connections
other:	
[1]	Module reference
[2]	Serial number and product revision
[3]	General earth point connection

4.5.2 MDLL3025N00xN0I, 3050N00xN0I layout and connectors



Connector	Description
J1	AUX Bi-phase supply, IN/OUT 24V-500mA....
J2, J3, J8	Not used
J4, J7	Service NUM
J5	External braking resistor connections
J6	Dip switches for PWS settings
J9	L1, L2, L3 mains and earth connections
S11	Digital Bus interconnections
S12	AUX 48Vac output 35kHz connections
other:	
[1]	Module reference
[2]	Serial number and product revision
[3]	General earth point connection

4.5.3 MDLL3120N00xN0I layout and connectors



Connector	Description
J1	AUX Bi-phase supply, IN/OUT 24V-500mA
J2, J3, J8	Not used
J4, J7	Service NUM
J5	External braking resistor connections
J6	Dip switches for PWS settings
J9	L1, L2, L3 mains connections
S11	Digital Bus interconnections
S12	AUX 48Vac output 35kHz connections
S14	Fan connector

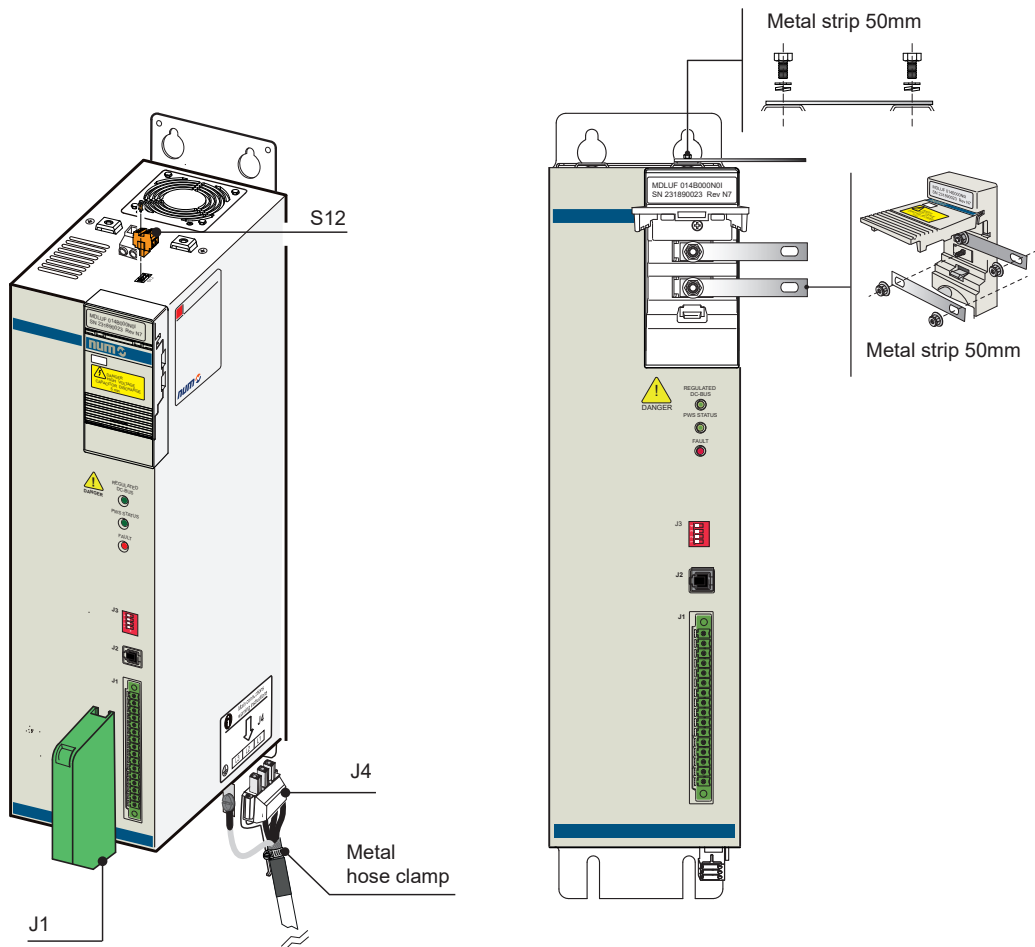
4.6 MDLL3 enclosed accessories

4.6.1 MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I enclosed accessories

Description	Qty
3 pins F connector for L1, L2, L3 mains connections (J4)	1
16 pins F connector for auxiliary power supply and I/O (J1)	1
Auxiliary 48Vac 35kHz supply connector (S12)	1
Metal hose clamp for cable and shield fixing	1
Metal strip 50mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1

Mandatory accessories which has to be selected depending on the system application requirements. These accessories has to be ordered separately. See chapter 10.

Mandatory accessories	Qty
More external braking resistor, depending on the power dissipation of the MDLL3 module AGORES008 or AGORES009	1 or x
Line filter.	1

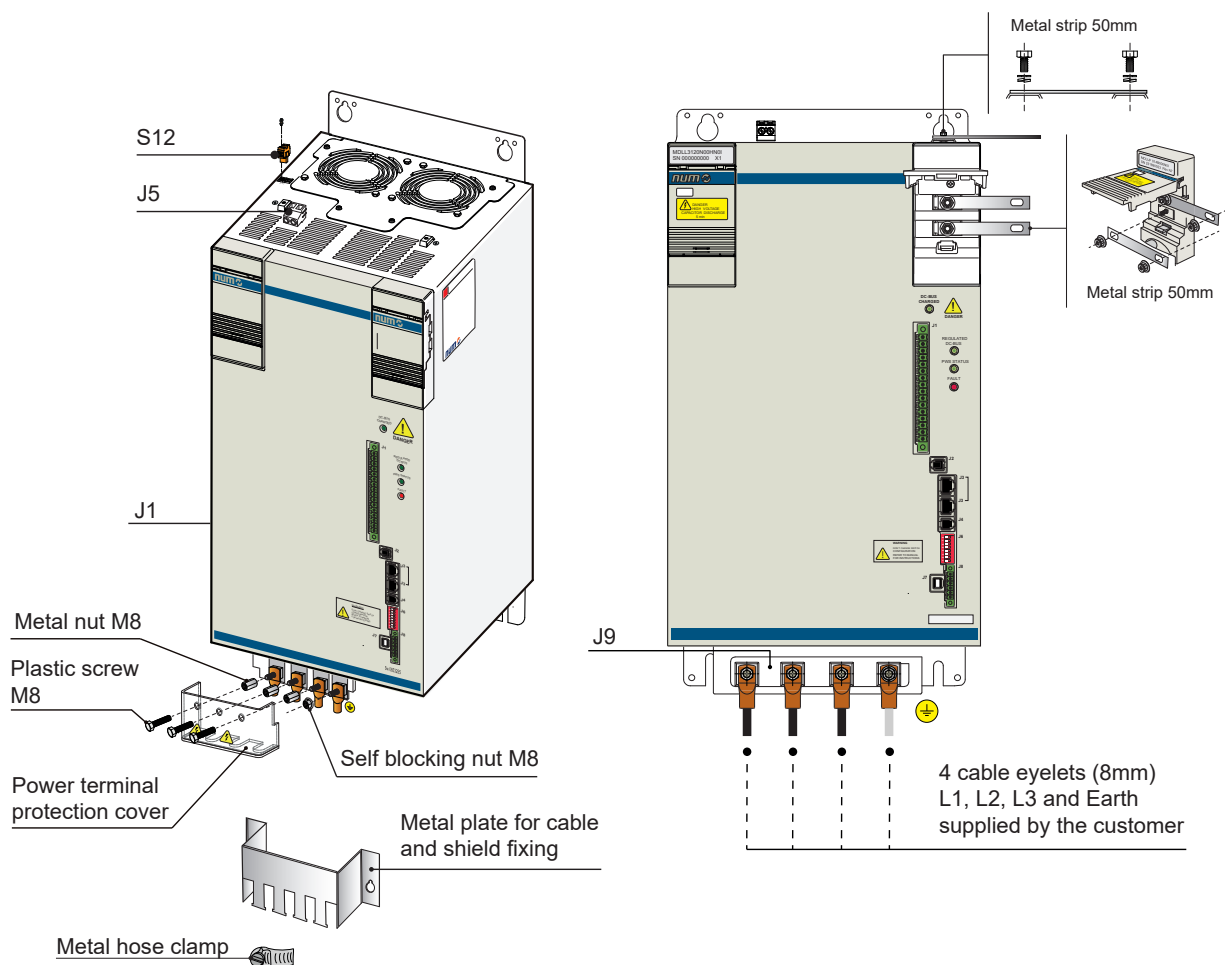


4.6.2 MDLL3025N00xN0I, 3050N00xN0I enclosed accessories

Description	Qty
Metal nut M8 for L1, L2, L3 mains connections (J9)	3
Self blocking nut M8 for earth connection (J9)	1
Power terminal protection cover with 3 plastic screws M8 (J9)	1
Metal plate for mechanical cable shield fixing + metal hose clamp for cable and shield fixing	1
16 pins F connector for auxiliary power supply and I/O (J1)	1
Auxiliary 48Vac 35kHz supply connector (S12)	1
Metal strip 50mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1

Mandatory accessories which has to be selected depending on the system application requirements. These accessories has to be ordered separately. See chapter 10.

Mandatory accessories	Qty
More external braking resistor, depending on the power dissipation of the MDLL3 module AGORES008 or AGORES009	1 or x
Line choke.	1
Line filter.	1



4.6.3 MDLL3120N00AN0I, 3120N00RN0I mandatory accessori

The module MDLL3120N00xN0I is delivered as alone module.

Therefore the module always requires mandatory accessories which must be selected depending on the system application requirements. Please refer to the [chapter 10](#).

Mandatory accessories	Qty
AEOKIT003 accessories kit	1
AGOFIL027 Line filter	1
HPPM166 Line filter (MDLL3120N00RN0I only)	1
AGOIND009 Line choke	1
AGOFAN001 Module fan	1
AGORES010 or AGORES011 External braking resistor. One or more external braking resistors, depending on the power dissipation of the MDLL3 module.	1 or x

4.6.4 MDLL3120N00HN0I mandatory accessories

The module MDLL3120N00HN0I is delivered as alone module.

Therefore the module always requires mandatory accessories which must be selected depending on the system application requirements. Please refer to the [chapter 10](#).

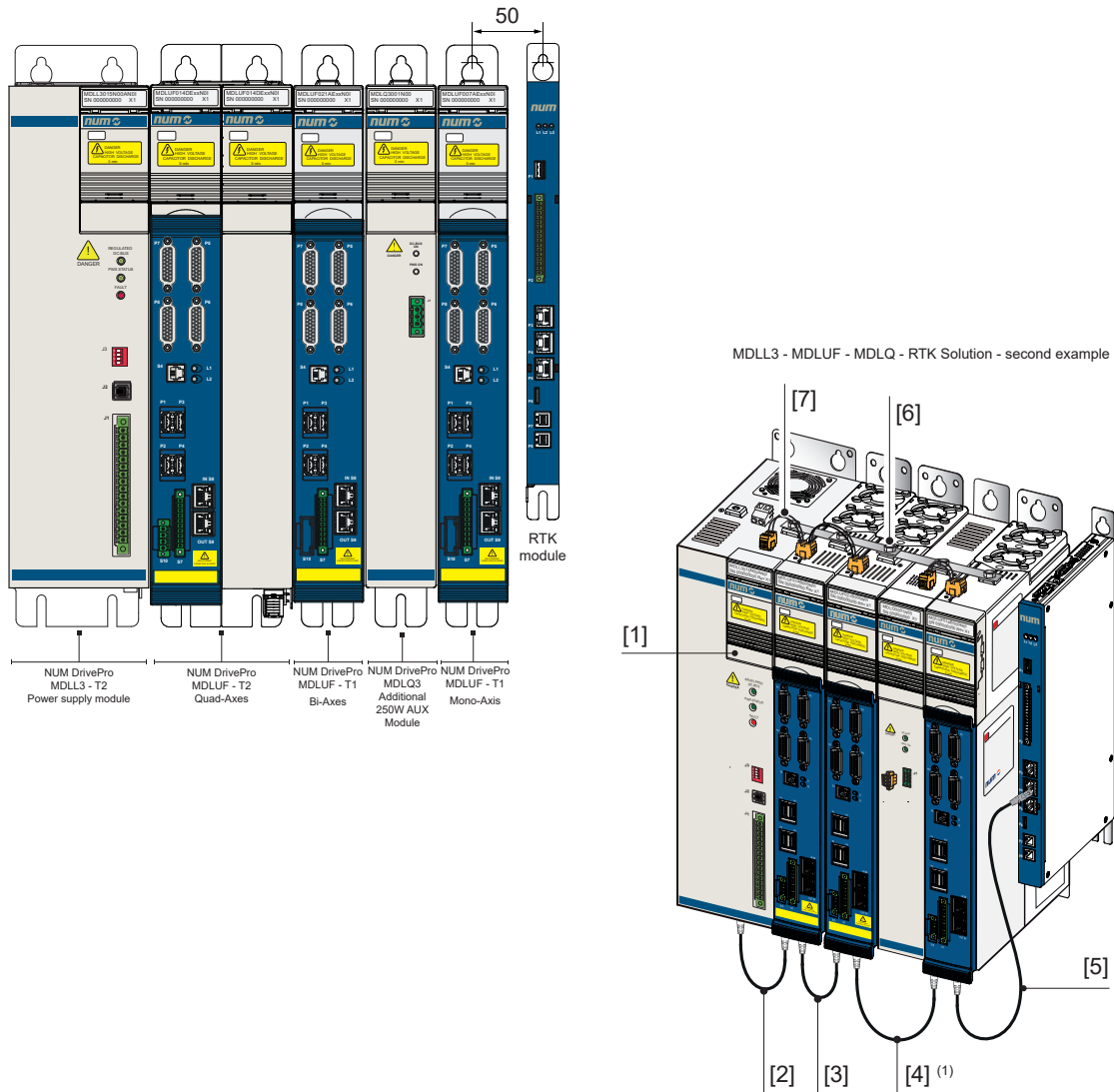
Mandatory accessories	Qty
AEOKIT003 accessories kit	1
AGOFIL027 Line filter	1
HPPM166 Line filter	1
AGOIND009 Line choke	1
AGOFAN001 Module fan	1
AGORES010 External braking resistor. One or more external braking resistors, depending on the power dissipation of the MDLL3 module.	1 or x

4.7 MDLQ3001N00 250W AUX Power Supply

4.7.1 General characteristics

Auxiliary power supply AC/AC converter	MDLQ3001N00
Rated output power	250W
Rated input voltage	400Vrms -10% ÷ 480Vrms +6%
Rated input current	1Arms
Input frequency	50Hz -5% ÷ 60Hz +5%
Phase number	2
Output voltage	48Vrms 35kHz
Degree of protection	IP20
Pollution degree	2
Electromagnetic Compatibility	Conform to EN 61800-3
Vibration stressing in operation	Conform to EN 61800-5-1
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 10
Storage temperature	From -40°C to +80°C
Altitude	1000m. Over 1000m see derating Altitude conditions diagram on chapter 2.10
Relative humidity degree	Max 75% without condensation
Overall dimensions "mm"	50 x 355 x 206
Weight	2.8kg

4.7.2 MDLQ3001N00 with MDLUF solution example



- (1) Remember to choose the AEOFRU018Mxxxx length taking in account the width of the MDLQ auxiliary power supply. AEOFRU018Mxxxx length must be one size more then size of the drive on its right.

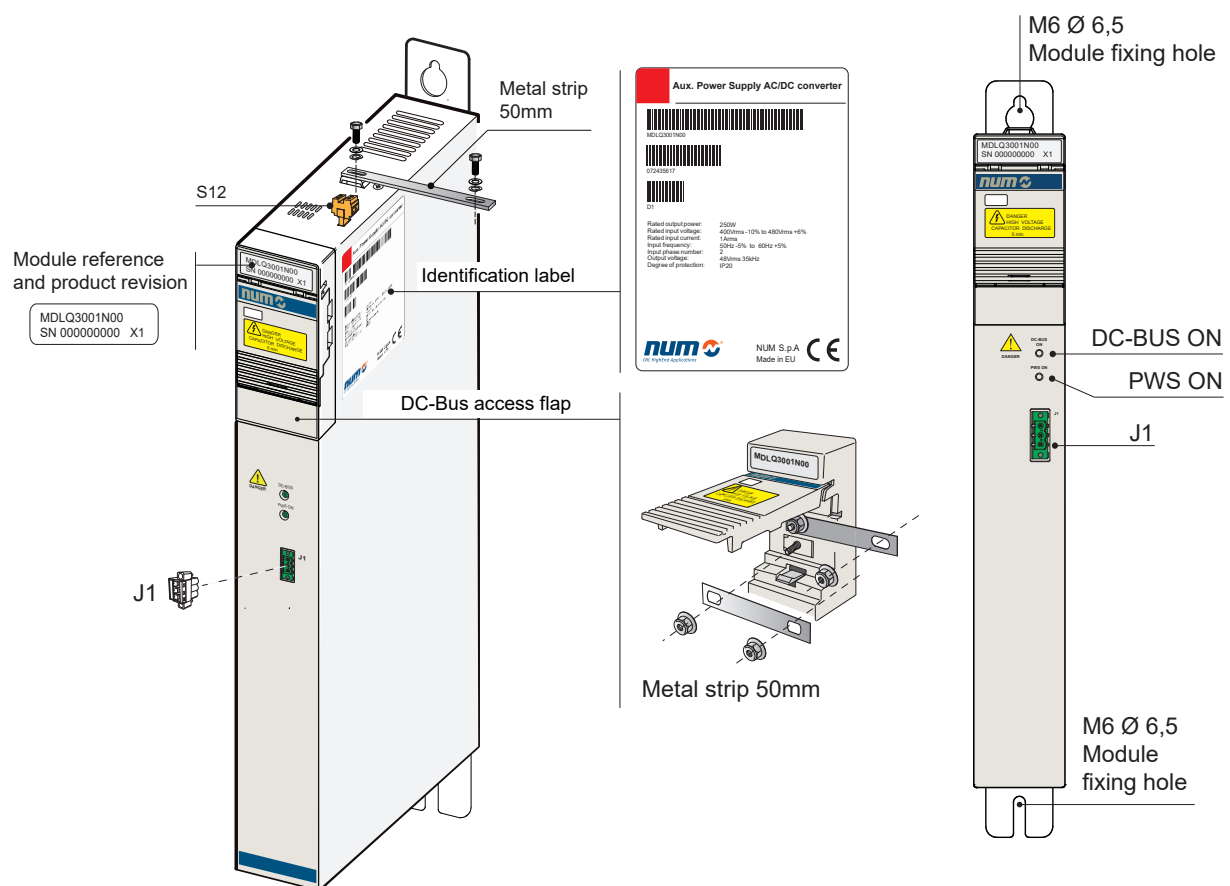
item	Description
[1]	Common DC Bus connections
[2]	AEOFRU016Mxxxx - cable interconnections (S11 - S11.1)
[3] [4]	AEOFRU018Mxxxx - cable interconnections (S11.2 - S11.1)
[5]	AEOFRU017Mxxxx - RTK to MDLUF Cable (P4 - S11.2)
[6]	Common module / module earth connections
[7]	Common AUX. 48Vac/35kHz module connections



The MDLL3 power supply with axis modular drives as shown in the drawing, must always be installed in the left side.
The drive's modules must always be installed in decreasing size order.

4.7.3 MDLQ3001N00 layout, connectors and enclosed accessories

Description	Qty
3 pins screws F connector Mains Bi-phase connection (J1)	1
Auxiliary 48Vac 35kHz supply connector (S12)	1
Metal strip 50mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1



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Summary

5	MDLUF modules	71
5.1	Available MDLUF units	71
5.2	MDLUF Power Unit general characteristics	73
5.2.1	Mono-Axis MDLUF007A, 014A, 021A, 034A, 050A.....	73
5.2.2	Mono-Axis MDLUF075A, 100A, 150A.....	74
5.2.3	Mono-Axis MDLUF200A, 400A.....	75
5.2.4	Bi-Axes MDLUF007B, 014B, 021B.....	76
5.2.5	Bi-Axes MDLUF050B, 075B	77
5.2.6	Quad-Axes MDLUF014D.....	78
5.3	MDLUF Control Unit general characteristics	79
5.4	MDLUF Ordering code	80
5.5	Module identification (i.e. for Bi-Axes 50mm with NUM-SAMX).....	81
5.6	MDLUF layout and connectors	82
5.6.1	Mono-Axis MDLUF007A, 014A, 021A, 034A layout and connectors.....	82
5.6.2	Mono-Axis MDLUF050A, 075A layout and connectors.....	83
5.6.3	Mono-Axis MDLUF100A, 150A layout and connectors.....	84
5.6.4	Mono-Axis MDLUF200A layout and connectors	85
5.6.5	Mono-Axis MDLUF400A layout and connectors	86
5.6.6	Bi-Axes MDLUF007B, 014B, 021B layout and connectors	87
5.6.7	Bi-Axes MDLUF050B layout and connectors	88
5.6.8	Bi-Axes MDLUF075B layout and connectors	89
5.6.9	Quad-Axes MDLUF014D layout and connectors	90
5.6.10	MDLUF with NUM-SAMX Safety module.....	91
5.6.11	MDLUF with NUM-STOX Safety module	92
5.7	MDLUF enclosed accessories	93
5.7.1	MDLUF007A, 014A, 021A, 034A , 007B, 014B, 021B enclosed accessories	93
5.7.2	MDLUF050A, 075A , 050B enclosed accessories	94
5.7.3	MDLUF014D enclosed accessories	95
5.7.4	MDLUF100A, 150A, 075B enclosed accessories	96
5.7.5	MDLUF200A enclosed accessories.....	97
5.7.6	MDLUF400A mandatory accessories	98

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5 MDLUF modules

5.1 Available MDLUF units

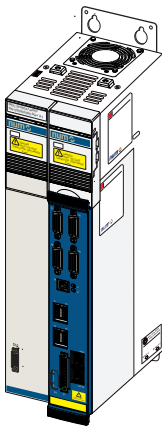
The MDLUF modules must always be selected depending on the associated motor. They are available in 15 ratings as indicated here-under. The rated current is referred at 5kHz PWM.

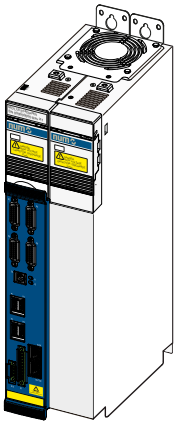
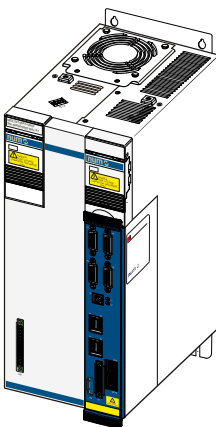
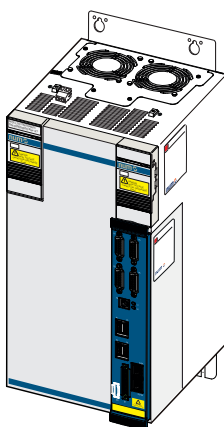
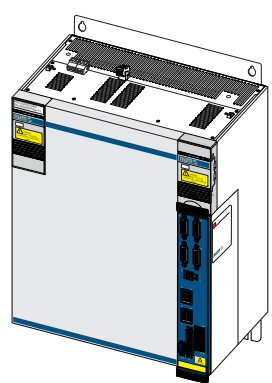
(For 10kHz please refer to the following pages)

The module is also characterized by a modular construction (same depth and height) which allows an easy mounting in the electrical cabinet.

A build-in brake management allows to eliminate an external control relay.

The maximum useful modules configuration number is shown in the chapter 8.

MDLUF module size	Type	Reference	Rated current	Maximum current
Size 1 50mm 	Mono-Axis	MDLUF007AExxN0I MDLUF014AExxN0I MDLUF021AExxN0I MDLUF034AExxN0I	4.4 Arms 8.9 Arms 13 Arms 13 Arms	5 Arms 10 Arms 15 Arms 24 Arms
	Bi-Axes	MDLUF007BExxN0I MDLUF014BExxN0I MDLUF021BExxN0I	3.1 + 3.1 Arms 6.3 + 6.3 Arms 6.3 + 6.3 Arms	5 + 5 Arms 10 + 10 Arms 15 + 15 Arms
Size 2 100mm 	Mono-Axis	MDLUF050AExxN0I MDLUF075AExxN0I	28 Arms 34 Arms	35 Arms 53 Arms
	Bi-Axes	MDLUF050BExxN0I	20 + 20 Arms	35 + 35 Arms

MDLUF module size	Type	Reference	Rated current	Maximum current
Size 2 100mm 	Quad-Axes	MDLUF014DExxN0I	6.3 + 6.3 + 6.3 + 6.3 Arms	10 + 10 + 10 + 10 Arms
Size 3 150mm 	Mono-Axis	MDLUF100AExxN0I MDLUF150AExxN0I	45 Arms 60 Arms	71 Arms 106 Arms
	Bi-Axis	MDLUF075BExxN0I	29 + 29 Arms	53 + 53 Arms
Size 4 200mm 	Mono-Axis	MDLUF200AExxN0I	100 Arms	141 Arms
Size 6 300mm 	Mono-Axis	MDLUF400AExxN0I	200 Arms	282 Arms

5.2 MDLUF Power Unit general characteristics

5.2.1 Mono-Axis MDLUF007A, 014A, 021A, 034A, 050A

MDLUF Power side	MDLUF007A...		MDLUF014A...		MDLUF021A...		MDLUF034A...		MDLUF050A...	
Switching frequency (PWM)	5kHz	10kHz	5kHz	10kHz	5kHz	10kHz	5kHz	10kHz	5kHz	10kHz
Rated continuous output current (Inom)	4.4 _{A_{rms}}	4.4 _{A_{rms}}	8.9 _{A_{rms}}	6 _{A_{rms}}	13 _{A_{rms}}	8 _{A_{rms}}	13 _{A_{rms}}	8 _{A_{rms}}	28 _{A_{rms}}	18 _{A_{rms}}
Maximum output current (Imax)	5 _{A_{rms}}	5 _{A_{rms}}	10 _{A_{rms}}		15 _{A_{rms}}		24 _{A_{rms}}		35 _{A_{rms}}	
Rated input voltage ⁽¹⁾	420 ÷ 700Vdc									
Maximum rated output voltage	480Vac									
Output phase number	3									
Output frequency range	0 ÷ 1200Hz									
Power losses at rated current	65W		95W		120W		120W		230W	
Auxiliary power	48Vac 35kHz									
Auxiliary power service consumption ⁽²⁾	18.5W								22.5W	
Motors brake command	+24Vdc									
Protections	Over temperature and short circuit									
Degree of protection	IP20									
Pollution degree	2									
Electromagnetic Compatibility	Conform to EN 61800-3									
Vibration stressing in operation	Max deflection 75µm, frequency 10÷58Hz conform EN60068-2-6									
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 2.9									
Storage temperature	From -40°C to +80°C (0°C / + 70°C with NUM-SAMX module)									
Altitude	Max 3000m. Over 1000m see derating Altitude conditions diagram on chapter 2.10									
Relative humidity degree	Max 75% without condensation									
Cooling type	Internal									
Overall dimensions W x H x D	50 x 355 x 206 mm								100 x 355 x 206 mm	
Weight	3kg								5.9kg	

(1) See "Derating of the drive current due to DC Bus Voltage" on chapter 2.8.

(2) Internal consumption without considering outputs and sensors power supply as for:

- Add 1W supplementary for each NUM P, Q, J, K connected sensor.
- Add 1.5W supplementary for each NUM I, L, 3, 4, Y, Z connected (DSL) sensor.
- For each supplementary not NUM sensor, check the power required. Add 1.5W supplementary for NUM-SAMX Safety module if present.
- Add 1.5W supplementary for "P7-P8 sensor board".
- NUM-STOX not required to add supplementary power.

5.2.2 Mono-Axis MDLUF075A, 100A, 150A

MDLUF Power side	MDLUF075A...		MDLUF100A...		MDLUF150A...	
Switching frequency (PWM)	5kHz	10kHz	5kHz	10kHz	5kHz	10kHz
Rated continuous output current (Inom)	34 _{A_{rms}}	23 _{A_{rms}}	45 _{A_{rms}}	34 _{A_{rms}}	60 _{A_{rms}}	40 _{A_{rms}}
Maximum output current (Imax)	53 _{A_{rms}}		71 _{A_{rms}}		106 _{A_{rms}}	
Rated input voltage ⁽¹⁾	420 ÷ 700Vdc					
Maximum rated output voltage	480Vac					
Output phase number	3					
Output frequency range	0 ÷ 1200Hz					
Power losses at rated current	290W		530W		590W	
Auxiliary power	48Vac 35kHz					
Auxiliary power service consumption ⁽²⁾	22.5W		32W			
Motors brake command	+24Vdc					
Protections	Over temperature and short circuit					
Degree of protection	IP20		IP20			
Pollution degree	2					
Electromagnetic Compatibility	Conform to EN 61800-3					
Vibration stressing in operation	Conform to EN 61800-5-1					
Environmental installation conditions	At least of IP54 degree protection					
Vibration stressing in operation	Max deflection 75µm, frequency 10÷58Hz conform EN60068-2-6					
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 2.9					
Storage temperature	From -40°C to +80°C (0°C / + 70°C with NUM-SAMX module)					
Altitude	Max 3000m. Over 1000m see derating Altitude conditions diagram on chapter 2.10					
Relative humidity degree	Max 75% without condensation					
Cooling type	Internal					
Overall dimensions W x H x D	100 x 355 x 206 mm		150 x 355 x 206 mm			
Weight	5.9kg		8.2kg			

(1) See "Derating of the drive current due to DC Bus Voltage" on chapter [2.8](#).

(2) Internal consumption without considering outputs and sensors power supply as for:

- Add 1W supplementary for each NUM P, Q, J, K connected sensor.
- Add 1.5W supplementary for each NUM I, L, 3, 4, Y, Z connected (DSL) sensor.
- For each supplementary not NUM sensor, check the power required.
- Add 1.5W supplementary for NUM-SAMX Safety module if present.
- Add 1.5W supplementary for "P7-P8 sensor board".
- NUM-STOX not required to add supplementary power.

5.2.3 Mono-Axis MDLUF200A, 400A

MDLUF Power side	MDLUF200A...		MDLUF400A...	
Switching frequency (PWM)	5kHz	10kHz	5kHz	10kHz
Rated continuous output current (Inom)	100 _{A_{rms}}	70 _{A_{rms}}	200 _{A_{rms}}	130 _{A_{rms}}
Maximum output current (Imax)	141 _{A_{rms}}		282 _{A_{rms}}	
Rated input voltage ⁽¹⁾	420 ÷ 700Vdc			
Maximum rated output voltage	480Vac			
Output phase number	3			
Output frequency range	0 ÷ 1200Hz			
Power losses at rated current	600W		2000W	
Auxiliary power	48Vac 35kHz			
Auxiliary power service consumption ⁽²⁾	42.5W		27.5W	
Motors brake command	Not available			
Protections	Over temperature and short circuit			
Degree of protection	IP00			
Pollution degree	2			
Electromagnetic Compatibility	Conform to EN 61800-3			
Vibration stressing in operation	Conform to EN 61800-5-1			
Environmental installation conditions	At least of IP54 degree protection			
Vibration stressing in operation	Max deflection 75µm, frequency 10÷58Hz conform EN60068-2-6			
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 2.9			
Storage temperature	From -40°C to +80°C (0°C / + 70°C with NUM-SAMX module)			
Altitude	Max 3000m. Over 1000m see derating Altitude conditions diagram on chapter 2.10			
Relative humidity degree	Max 75% without condensation			
Cooling type ⁽³⁾	Internal		External fan	
Overall dimensions W x H x D	200 x 355 x 206 mm		300 x 355 x 206mm ⁽³⁾	
Weight	11kg		18kg	

(1) See "Derating of the drive current due to DC Bus Voltage" on chapter [2.8](#).

(2) Internal consumption without considering outputs and sensors power supply as for:

- Add 1W supplementary for each NUM P, Q, J, K connected sensor.
- Add 1.5W supplementary for each NUM I, L, 3, 4, Y, Z connected (DSL) sensor.
- For each supplementary not NUM sensor, check the power required.
- Add 1.5W supplementary for NUM-SAMX Safety module if present.
- Add 1.5W supplementary for "P7-P8 sensor board".
- NUM-STOX not required to add supplementary power.

(3) Add 355+310 mm due to the external fan dimensions. (see chapter [9.1.12](#))

5.2.4 Bi-Axes MDLUF007B, 014B, 021B

MDLUF Power side	MDLUF007B...		MDLUF014B...		MDLUF021B...	
Switching frequency (PWM)	5kHz	10kHz	5kHz	10kHz	5kHz	10kHz
Rated continuous output current (Inom)	3.1+3.1 _{A_{rms}}	3.1+3.1 _{A_{rms}}	6.3+6.3 _{A_{rms}}	4.2+4.2 _{A_{rms}}	6.3+6.3 _{A_{rms}}	4.2+4.2 _{A_{rms}}
Maximum output current (Imax)	5+5 _{A_{rms}}	5+5 _{A_{rms}}	10+10 _{A_{rms}}		15+15 _{A_{rms}}	
Rated input voltage ⁽¹⁾	420 ÷ 700Vdc					
Maximum rated output voltage	480Vac					
Output phase number	3					
Output frequency range	0 ÷ 1200Hz					
Power losses at rated current	65W		115W			
Auxiliary power	48Vac 35kHz					
Auxiliary power service consumption ⁽²⁾	21.5W					
Motors brake command	+24Vdc					
Protections	Over temperature and short circuit					
Degree of protection	IP20					
Pollution degree	2					
Electromagnetic Compatibility	Conform to EN 61800-3					
Vibration stressing in operation	Conform to EN 61800-5-1					
Environmental installation conditions	At least of IP54 degree protection					
Vibration stressing in operation	Max deflection 75µm, frequency 10÷58Hz conform EN60068-2-6					
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 2.9					
Storage temperature	From -40°C to +80°C (0°C / + 70°C with NUM-SAMX module)					
Altitude	Max 3000m. Over 1000m see derating Altitude conditions diagram. See chapter 2.10					
Relative humidity degree	Max 75% without condensation					
Cooling type	Internal					
Overall dimensions W x H x D	50 x 355 x 206mm					
Weight	3kg					

- (1) See Derating of the drive current due to DC Bus Voltage on chapter [2.8](#).
- (2) Internal consumption without considering outputs and sensors power supply as for:
- Add 1W supplementary for each NUM P, Q, J, K connected sensor.
 - Add 1.5W supplementary for each NUM I, L, 3, 4, Y, Z connected (DSL) sensor.
 - For each supplementary not NUM sensor, check the power required.
 - Add 1.5W supplementary for NUM-SAMX Safety module if present.
 - Add 1.5W supplementary for "P7-P8 sensor board" if present.
 - NUM-STOX not required to add supplementary power.

5.2.5 Bi-Axes MDLUF050B, 075B

MDLUF Power side	MDLUF050B...		MDLUF075B...	
Switching frequency (PWM)	5kHz	10kHz	5kHz	10kHz
Rated continuous output current (Inom)	20+20 _{A_{rms}}	13+13 _{A_{rms}}	29+29 _{A_{rms}}	20+20 _{A_{rms}}
Maximum output current (Imax)	35+35 _{A_{rms}}		53+53 _{A_{rms}}	
Rated input voltage ⁽¹⁾	420 ÷ 700Vdc			
Maximum rated output voltage	480Vac			
Output phase number	3			
Output frequency range	0 ÷ 1200Hz			
Power losses at rated current	340W		550W	
Auxiliary power	48Vac 35kHz			
Auxiliary power service consumption ⁽²⁾	28.5W		35W	
Motors brake command	+24Vdc			
Protections	Over temperature and short circuit			
Degree of protection	IP20			
Pollution degree	2			
Electromagnetic Compatibility	Conform to EN 61800-3			
Vibration stressing in operation	Conform to EN 61800-5-1			
Environmental installation conditions	At least of IP54 degree protection			
Vibration stressing in operation	Max deflection 75µm, frequency 10÷58Hz conform EN60068-2-6			
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 2.9			
Storage temperature	From -40°C to +80°C (0°C / + 70°C with NUM-SAMX module)			
Altitude	Max 3000m. Over 1000m see derating Altitude conditions diagram. See chapter 2.10			
Relative humidity degree	Max 75% without condensation			
Cooling type	Internal			
Overall dimensions W x H x D	100 x 355 x 206mm		150 x 355 x 206mm	
Weight	6.2kg		8.2kg	

(1) See Derating of the drive current due to DC Bus Voltage on chapter [2.8](#).

(2) Internal consumption without considering outputs and sensors power supply as for:

- Add 1W supplementary for each NUM P, Q, J, K connected sensor.
- Add 1.5W supplementary for each NUM I, L, 3, 4, Y, Z connected (DSL) sensor.
- For each supplementary not NUM sensor, check the power required.
- Add 1.5W supplementary for NUM-SAMX Safety module if present.
- Add 1.5W supplementary for "P7-P8 sensor board" if present.
- NUM-STOX not required to add supplementary power.

5.2.6 Quad-Axes MDLUF014D

MDLUF Power side	MDLUF014D...	
Switching frequency (PWM)	5kHz	10kHz
Rated continuous output current (I _{nom})	6.3+6.3+6.3+6.3 _{Arms}	4.2+4.2+4.2+4.2 _{Arms}
Maximum output current (I _{max})	10+10+10+10 _{Arms}	
Rated input voltage ⁽¹⁾	420 ÷ 700Vdc	
Maximum rated output voltage	480Vac	
Output phase number	3	
Output frequency range	0 ÷ 1200Hz	
Power losses at rated current	240W	
Auxiliary power	48Vac 35kHz	
Auxiliary power service consumption ⁽²⁾	30W	
Motors brake command	+24Vdc	
Protections	Over temperature and short circuit	
Degree of protection	IP20	
Pollution degree	2	
Electromagnetic Compatibility	Conform to EN 61800-3	
Vibration stressing in operation	Conform to EN 61800-5-1	
Environmental installation conditions	At least of IP54 degree protection	
Vibration stressing in operation	Max deflection 75µm, frequency 10÷58Hz conform EN60068-2-6	
Operating temperature range	From 0 to +40°C. For derating see Environmental and temperature diagram on chapter 2.9	
Storage temperature	From -40°C to +80°C (0°C / + 70°C with NUM-SAMX module)	
Altitude	Max 3000m. Over 1000m see derating Altitude conditions diagram. See chapter 2.10	
Relative humidity degree	Max 75% without condensation	
Cooling type	Internal	
Overall dimensions W x H x D	100 x 355 x 206mm	
Weight	5,9 Kg	

(1) Without considering sensor power supply. Add 1W for each connected sensor (motor or direct).

(2) Internal consumption without considering outputs and sensors power supply as for:

- Add 1W supplementary for each NUM P, Q, J, K connected sensor.
- Add 1.5W supplementary for each NUM I, L, 3, 4, Y, Z connected (DSL) sensor.
- For each supplementary not NUM sensor, check the power required.
- Add 1.5W supplementary for NUM-SAMX Safety module if present.
- Add 1.5W supplementary for "P7-P8 sensor board" if present.

5.3 MDLUF Control Unit general characteristics

MDLUF Control side description	Mono-Axis (HP)	Bi-Axes (SP)	Bi-Axes (HP)	Quad-Axes (SP)	Quad-Axes (HP)
Available sensor connections (1Vpp, EnDat, Hiperface...)	P5, P6	P5, P6	P5, P6, P7, P8	P5, P6	P5, P6, P7, P8
Hiperface DSL 2-wires sensor	P1, P2, P3, P4	P1, P2, P3, P4	P1, P2, P3, P4	P1, P2, P3, P4	P1, P2, P3, P4
Sensor supply	+5V or 9V - 500mA max				
Configurations	High Performance	Standard Performance	High Performance	Standard Performance	High Performance
Communication type	DISC ET Digital bus				
External power supply	+ 24Vdc supply by the customer (if digital I/O are connected).				
NUM-STOX (S8/S9)	2xRJ45 (type 8P/8C) connection (Available as optional).				
NUM-SAMX (S8/S9)	2xRJ45 (type 8P/8C) connection (Available as optional).				
Digital programmable input: - I1...I4 (S7)	Level 0:<5Vdc, Level 1: from 18 to 30Vdc / Load 30mA max at 24Vdc (Optoisolated).				
Digital programmable output ⁽¹⁾ : - O1...O4 (S7)	Level 0:<5Vdc, Level 1: supplied Vdc -6V (max). Maximum load 100mA (Optoisolated).				
NUM Service Tool communication (S4)	Available as standard by RJ10 (type 4P/4C)				
Degree of protection	IP20				
Life time	20 years				
Pollution degree	2				
Vibration stressing in operation	Conform to EN 61800-5-1				
Operating temperature range ⁽²⁾	From 0 to +40°C				
Storage temperature	From -40 to +80°C (0°C / + 70°C with NUM-SAMX module).				
Altitude ⁽³⁾	Max 3000m				
Relative humidity degree	Max 75% without condensation				

(1) They cannot be used as safe device to control an external brake.

(2) For drive with NUM-SAMX module the operating maximum temperature is 40°C.

(3) For drive with NUM-SAMX module the maximum altitude is 1000m.

5.4 MDLUF Ordering code

	MDLUF	014	A	E	C	F	N	0	I
Series									
Flated Power									
Mono-Axis									
- Size 1: In 4.4 Arms, lpeak 5 Arms		007							
- Size 1: In 8.9 Arms, lpeak 10 Arms		014							
- Size 1: In 13 Arms, lpeak 15 Arms		021							
- Size 1: In 13 Arms, lpeak 24 Arms		034							
- Size 2: In 28 Arms, lpeak 35 Arms		050							
- Size 2: In 34 Arms, lpeak 53 Arms		075							
- Size 3: In 45 Arms, lpeak 71 Arms		100							
- Size 3: In 60 Arms, lpeak 106 Arms		150							
- Size 4: In 100 Arms, lpeak 141 Arms ⁽⁷⁾		200							
- Size 6: In 200 Arms, lpeak 282 Arms ⁽¹⁾		400							
Bi-Axes									
- Size 1: In 3.1+3.1 Arms, lpeak 5+5 Arms		007							
- Size 1: In 6.3+6.3 Arms, lpeak 10+10 Arms		014							
- Size 1: In 6.3+6.3 Arms, lpeak 15+15 Arms		021							
- Size 2: In 20+20 Arms, lpeak 35+35 Arms		050							
- Size 3: In 29+29 Arms, lpeak 53+53 Arms		075							
QUAD-Axes									
- Size 2: In 6.6+6.3+6.3+6.3 Arms, lpeak 10+10+10+10 Arms		014							
Axis number									
- Mono-Axis			A						
- Bi-Axes			B						
- Quad-Axes			D						
Communication									
- DISC ET ⁽²⁾				E					
Version									
- Standard Performance ⁽³⁾					A				
- High Performance					C				
- High Performance with external link ⁽⁴⁾					D				
Safety									
- Without Safety module						A			
- Certified NUM-STOX (Safe Torque Off) module according to EN61800-5-2 up to SIL3 ⁽⁵⁾ (only for Mono and Bi-Axes)						E			
- Certified NUM-SAMX G2 Safety module according to EN61800-5-2 up to SIL3 ⁽⁶⁾						F			
Standard NUM							N		
Fixed value								0	
Heat-sink position									
- Internal heat-sink									I

⁽¹⁾ An external fan AGOFAN001 and AEOKIT006 must be always taken in account.

⁽²⁾ One DISC ET digital bus RJ45-RJ45 cable connection AEOF RU018Mxxxx must be always taken in account for each drive. One AEOF RU016Mxxxx DB25-RJ45 cable must be always taken in account for the first drive located on the right of the power supply. One AEOF RU017Mxxxx RJ45-RJ45 cable must be always taken in account for the last drive to be connected with the RTK module.

⁽³⁾ Not available for Mono-Axis version.

⁽⁴⁾ Not available for Bi-Axes and Quad-Axes version, required for Mono-Axis tandem function.

⁽⁵⁾ Not available for Quad-Axes version and MDLUF200.

⁽⁶⁾ No motor sensor on P7 or P8 allowed and not available for MDLUF200.

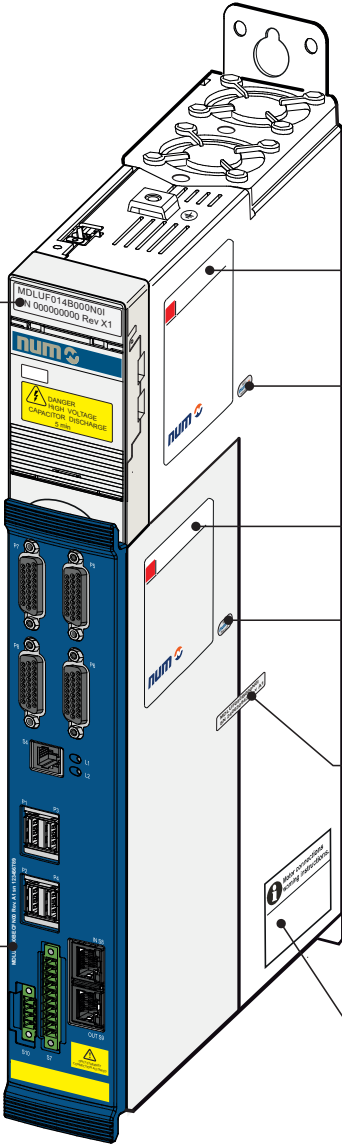
⁽⁷⁾ Not available with NUM-STOX or NUM-SAMX G2

5.5 Module identification (i.e. for Bi-Axes 50mm with NUM-SAMX)

MDLUF014BECFN0I identification example

Module Power Unit
identification label

Module Control Unit
identification label



Q.C.
num
Passed
Quality control
label

Q.C.
num
Passed
Quality control
label

MDLUF014B000N0I
SN 000000000 Rev A1
Product first
delivery label

Motor connections
warning instruction

NUM DrivePro PWU 14A
Bi-Axes 100mm

MDLUF014B000N0I

240630543

A1

Rated input voltage: 420 + 700Vdc
Maximum rated output voltage: 480 Vdc
Rated continuous output current (1): 6.3 Arms
Rated continuous output current (2): 6.3 Arms
Maximum output current (1): 10 Arms
Maximum output current (2): 10 Arms

Output phase number: 3
Degree of protection: IP00

num NUM S.p.A Made in EU CE

NUM DrivePro CTU Bi-Axes
HP F

MDLUF000BECFN00

240630543

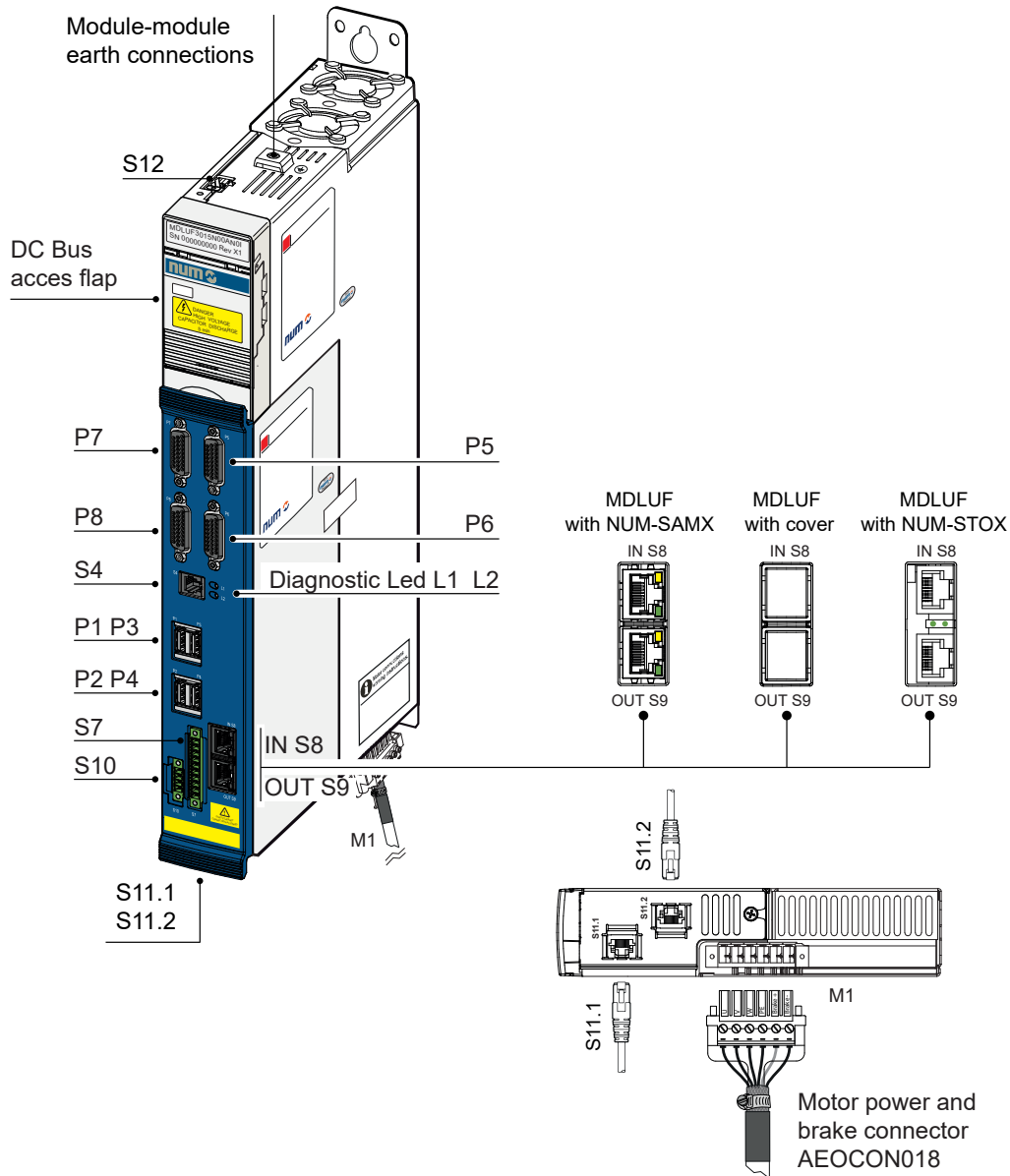
A1

P1 / P5: Motor sensor Axis 1
P2 / P6: Motor sensor Axis 2
P3 / P7: Direct measure sensor Axis 1
P4 / P8: Direct measure sensor Axis 2
Degree of protection: IP00

num NUM S.p.A Made in EU CE

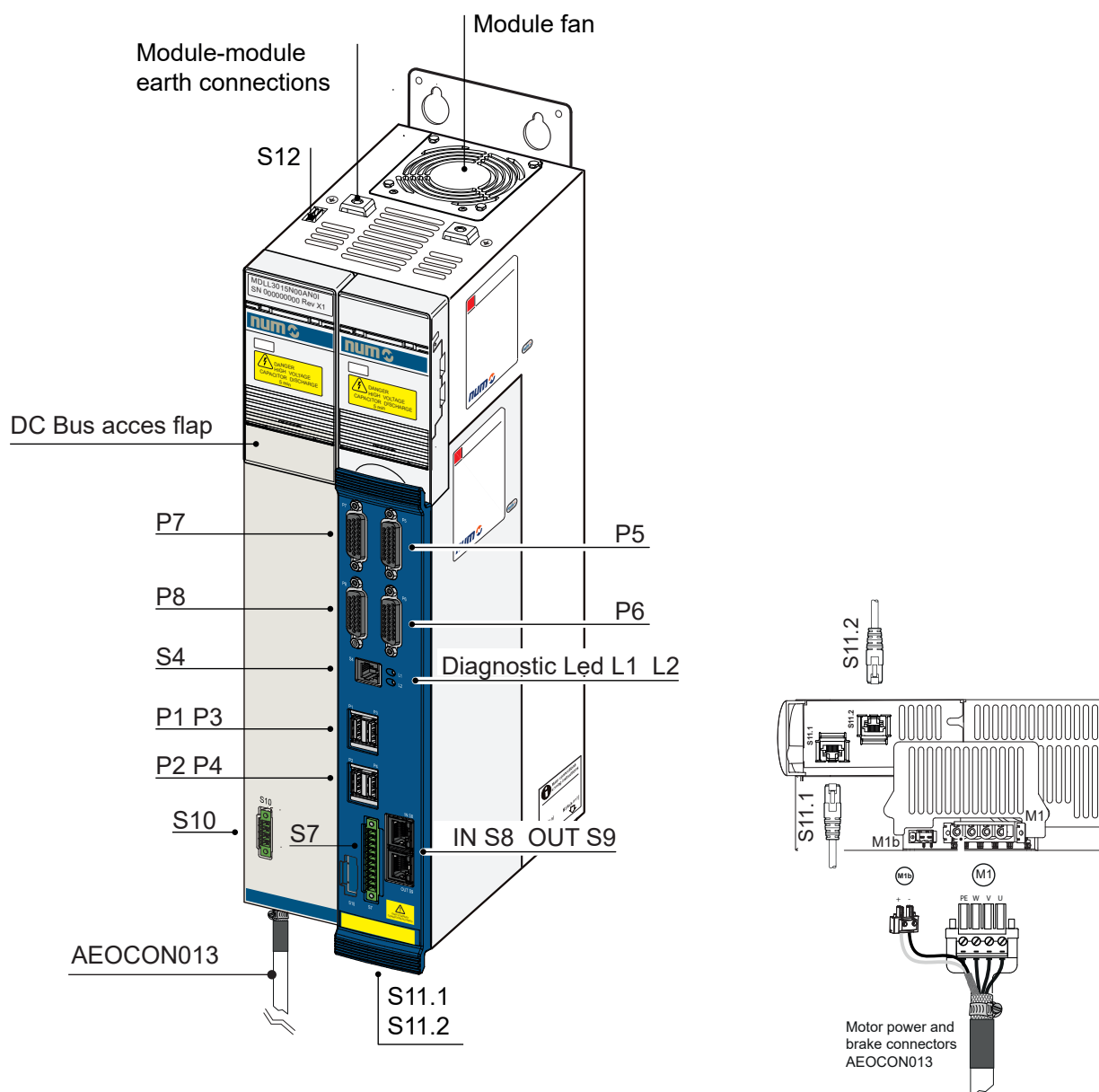
5.6 MDLUF layout and connectors

5.6.1 Mono-Axis MDLUF007A, 014A, 021A, 034A layout and connectors



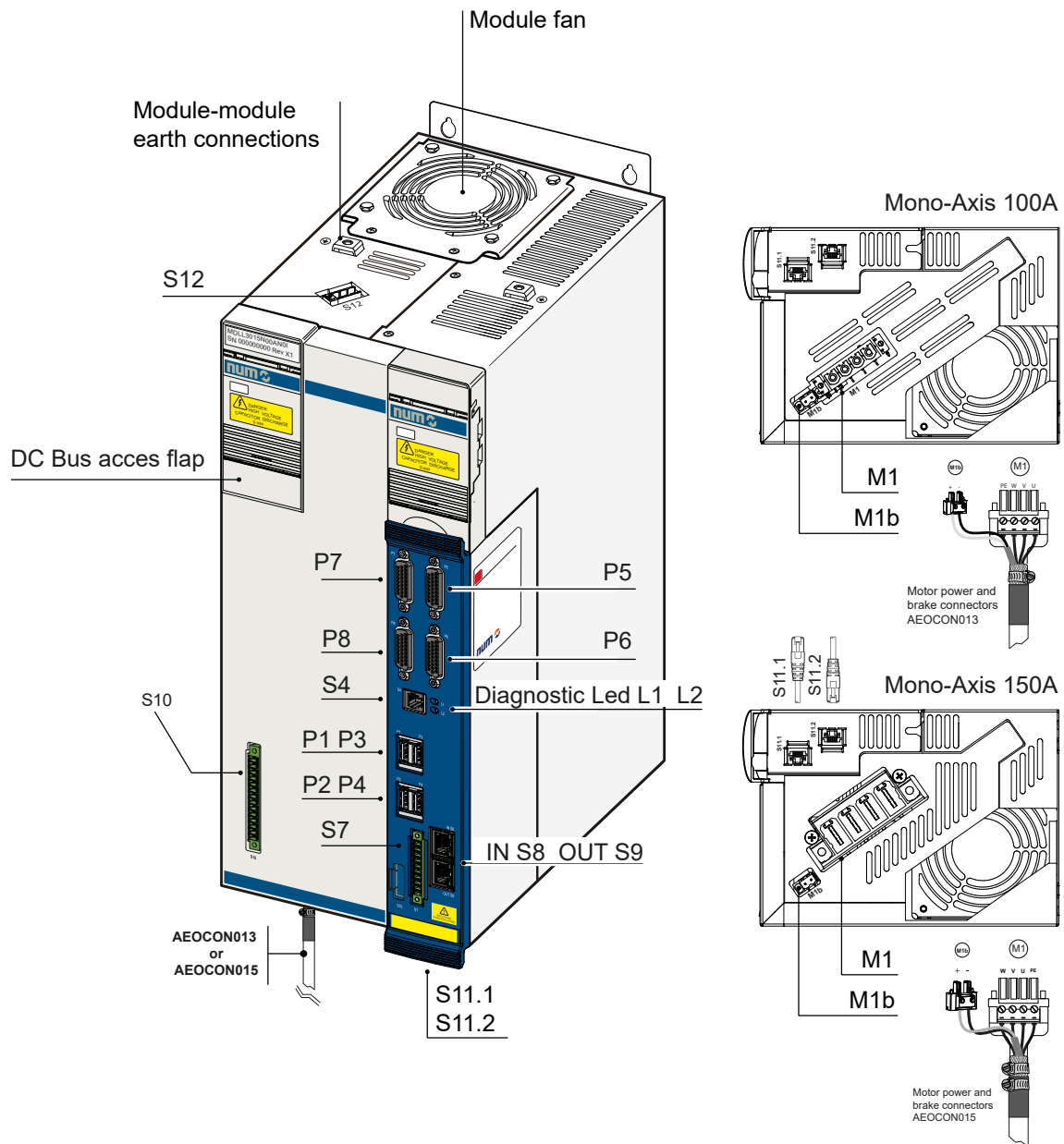
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED--- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1	6 screw pins	M1 motor power and brake connector AEOCON018

5.6.2 Mono-Axis MDLUF050A, 075A layout and connectors



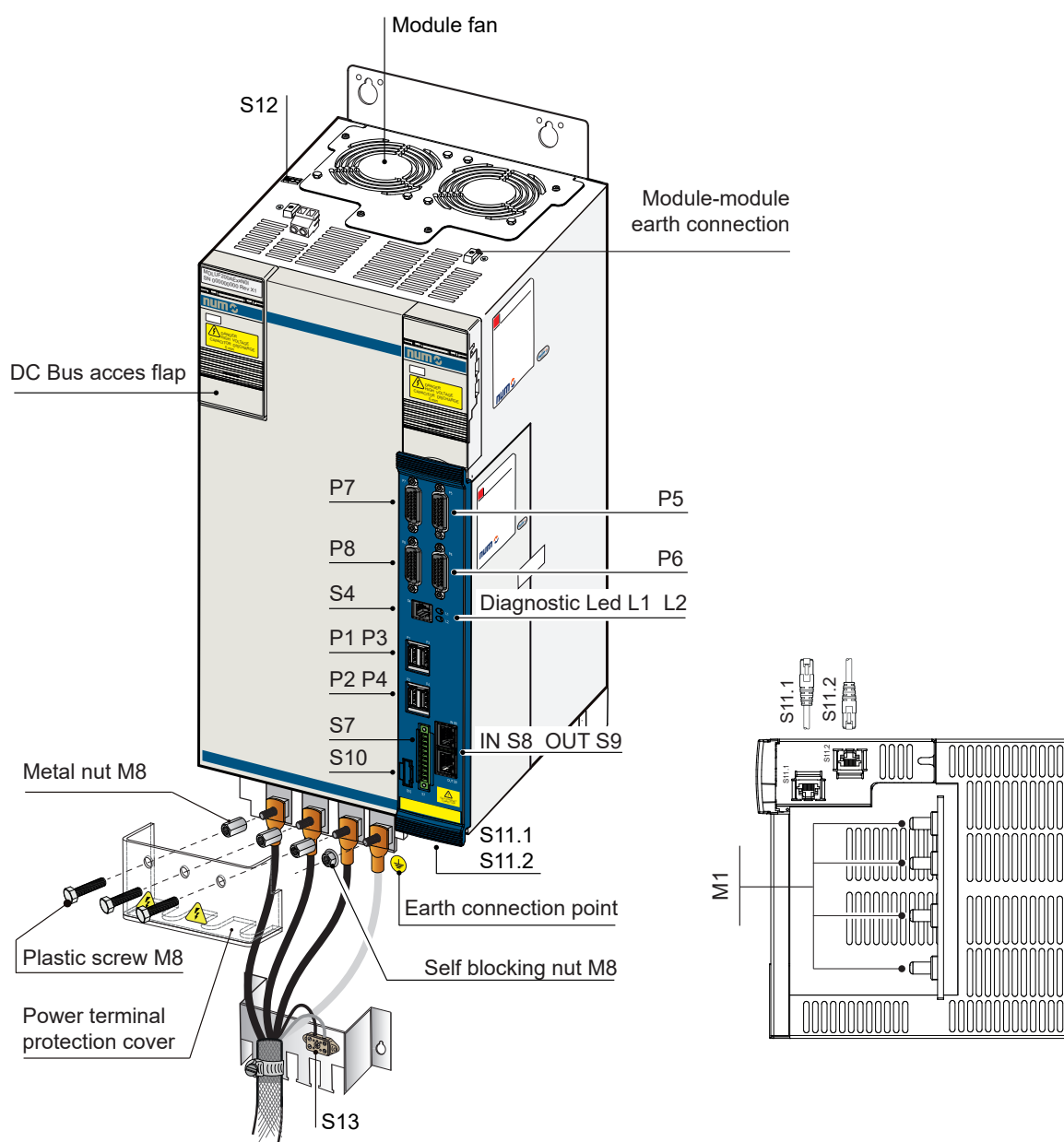
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED--- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1, M1b	4+2 screw pins	Motor power (M1) and brake connector (M1b) AEOCON013

5.6.3 Mono-Axis MDLUF100A, 150A layout and connectors



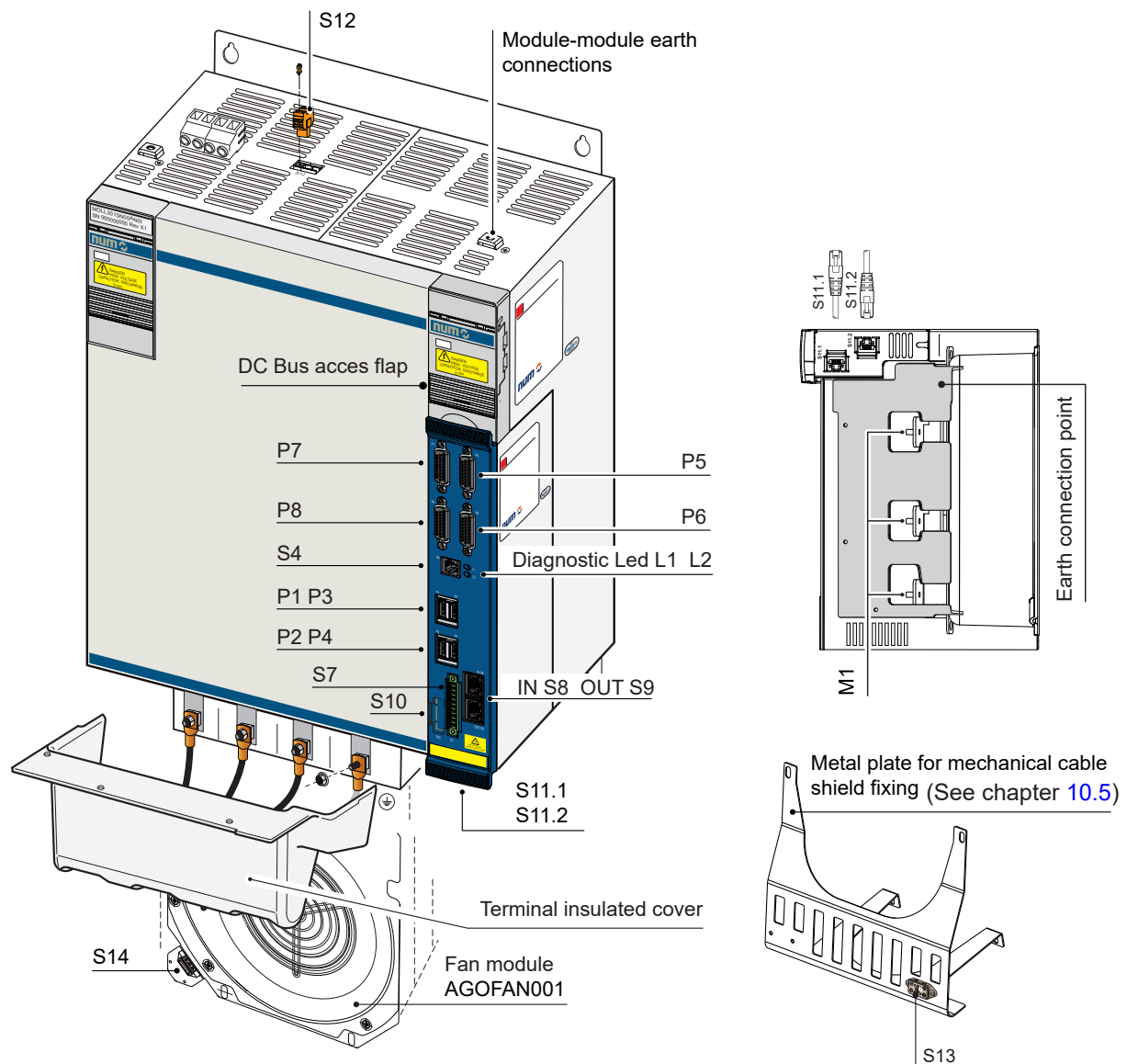
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED---- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	14 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	3 screw pins	AUX 48Vac input 35kHz Supply connections
M1, M1b	4+2 screw pins	Motor power (M1) and brake connector (M1b) AEOCON013 (100A)
M1, M1b	4+2 screw pins	Motor power (M1) and brake connector (M1b) AEOCON015 (150A)

5.6.4 Mono-Axis MDLUF200A layout and connectors



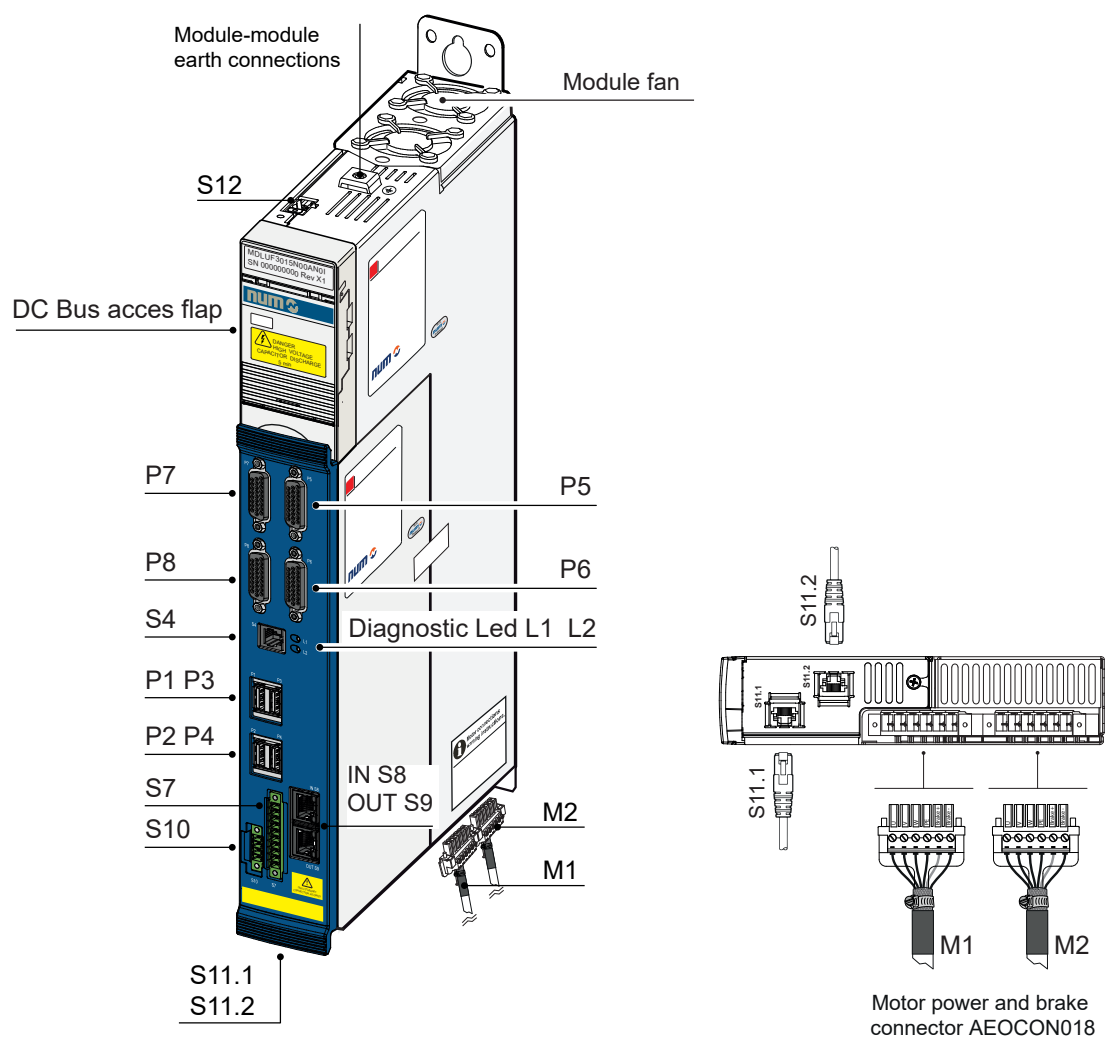
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED--- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
S13	2 screws pins	Motor brake connector
M1		Motor power connection

5.6.5 Mono-Axis MDLUF400A layout and connectors



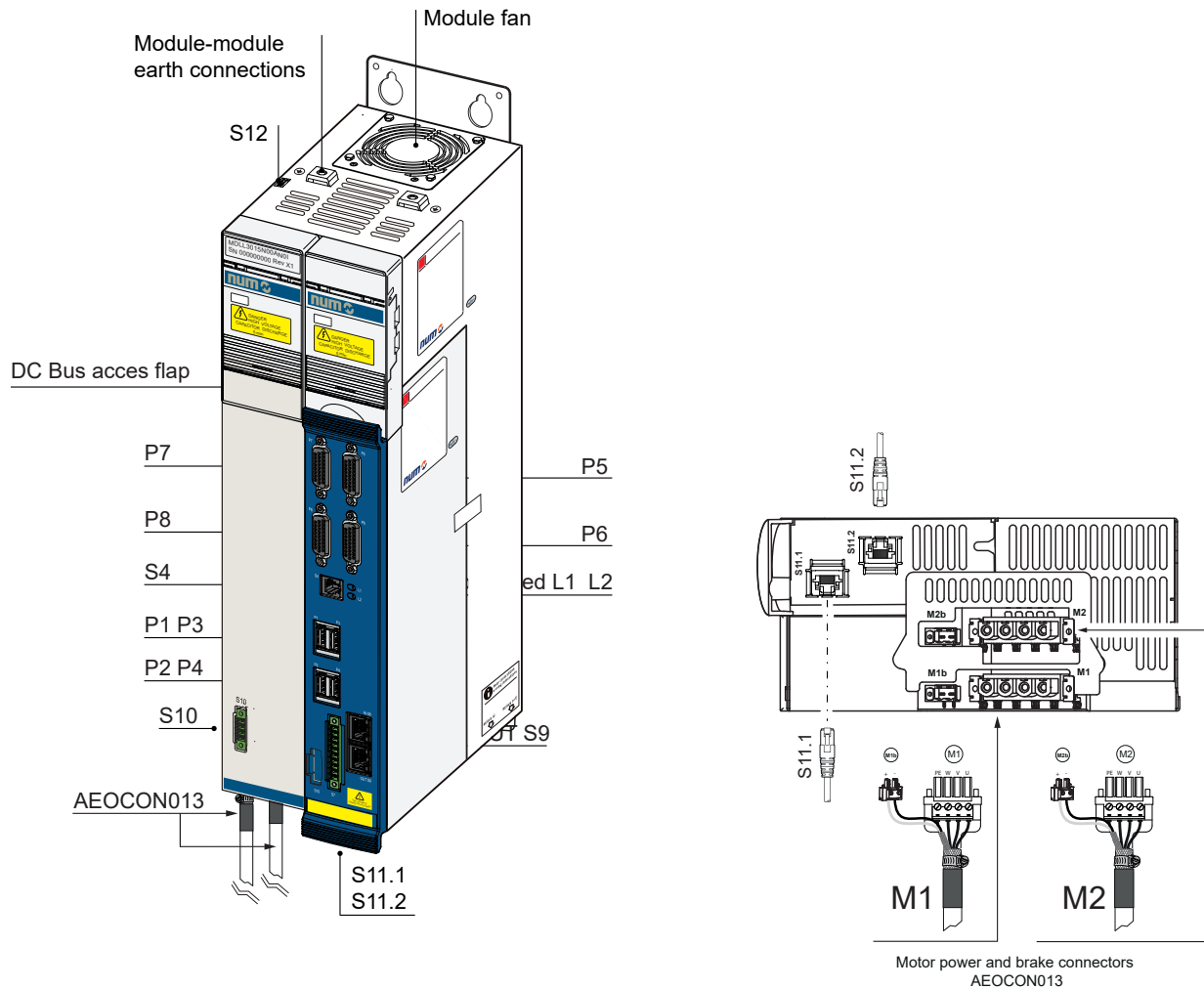
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED---- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
S13	2 screws pins	Motor brake connector
S14	3 screws pins	Fan connectors
M1		Motor power connection

5.6.6 Bi-Axes MDLUF007B, 014B, 021B layout and connectors



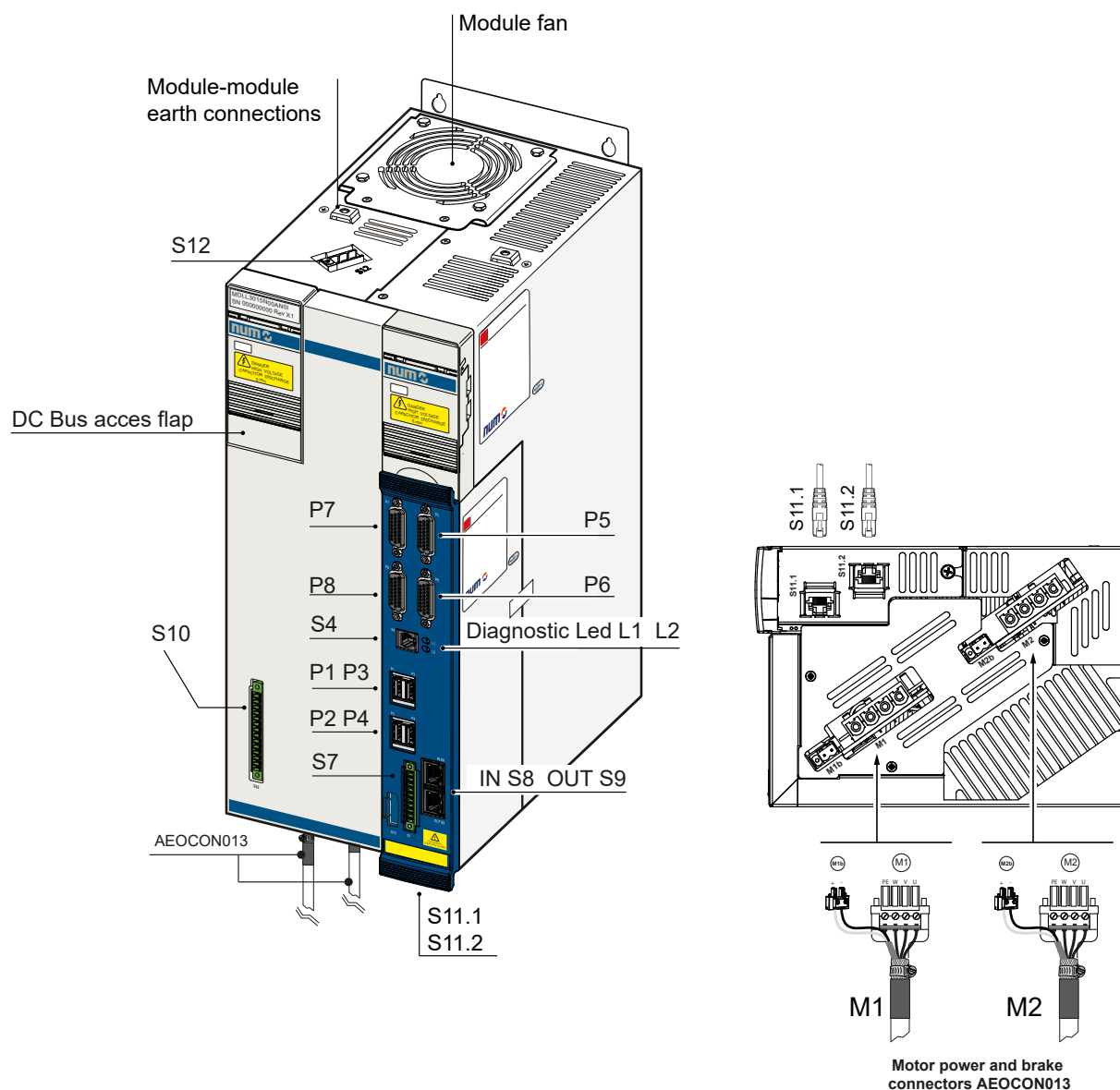
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections Available with version MDLUF---BEC--- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1, M2	6 pins screws	M1, M2 motor power and brake connector AEOCON018

5.6.7 Bi-Axes MDLUF050B layout and connectors



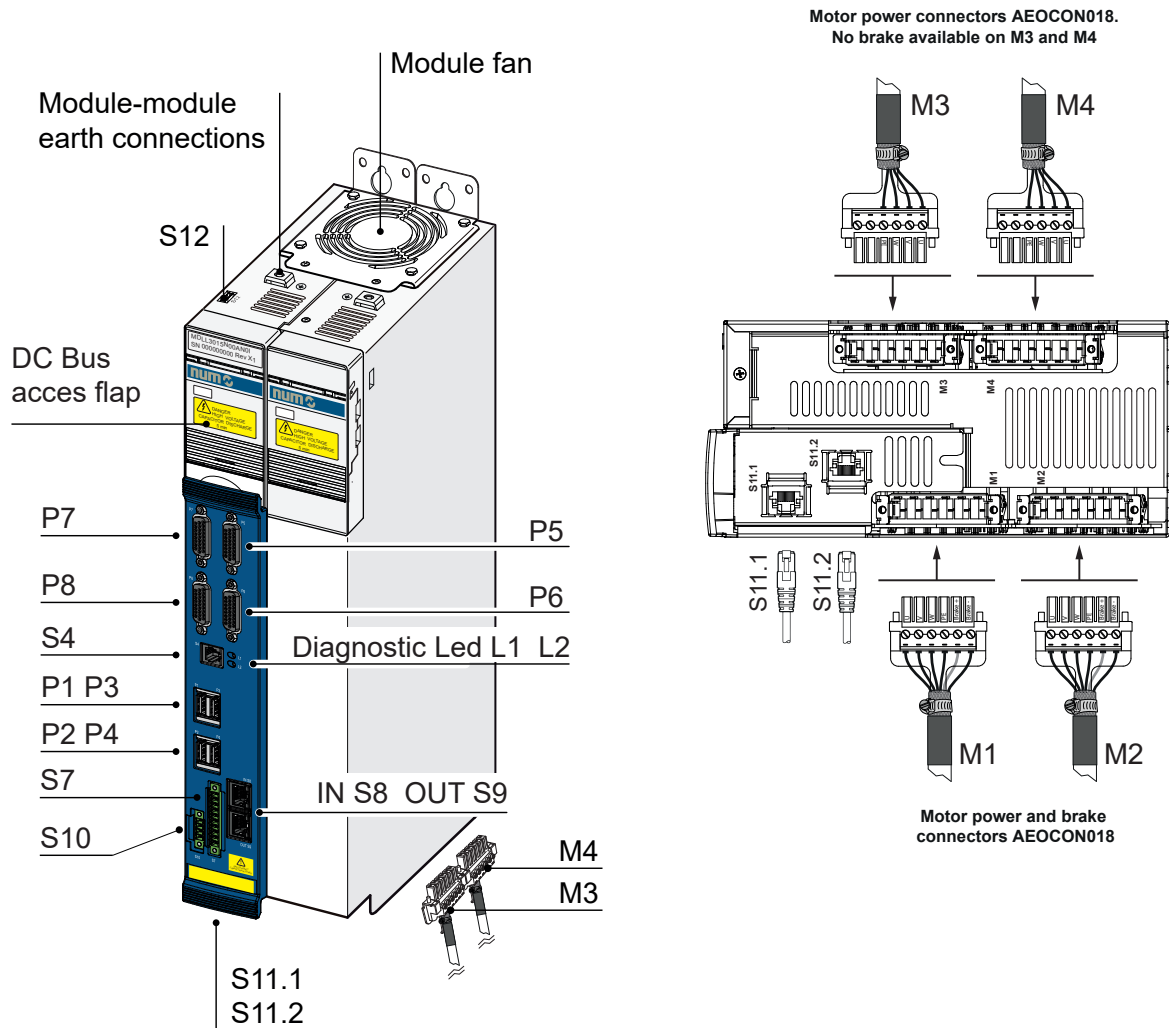
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections Available with version MDLUF---BEC---- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1, M2 + M1b, M2b	4+2 pins screws	M1, M2 motor power and brake connectors AEOCON013 (M1b, M2b brake connectors)

5.6.8 Bi-Axes MDLUF075B layout and connectors



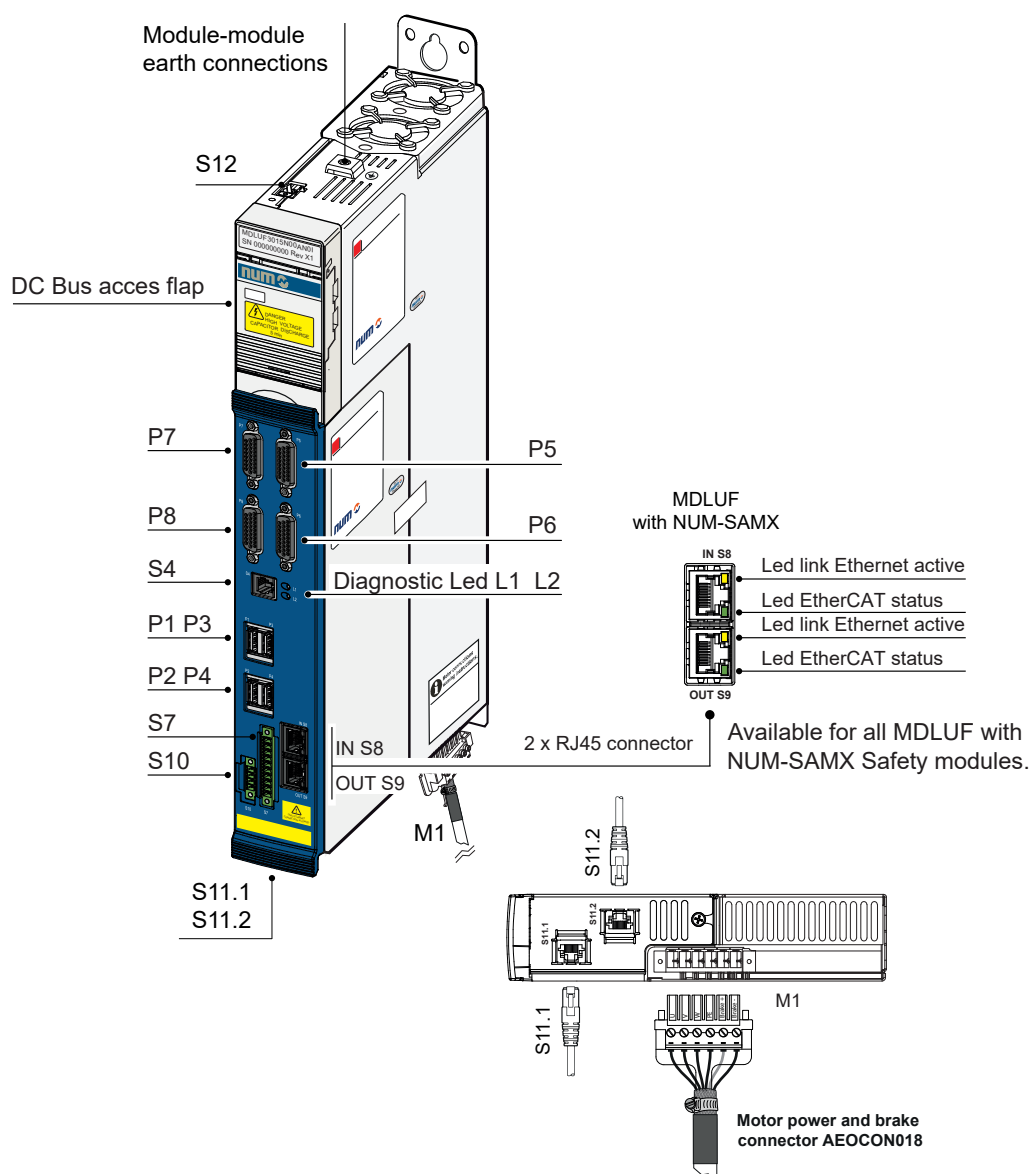
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections Available with version MDLUF---BEC---- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX / NUM-STOX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	3 screw pins	AUX 48Vac input 35kHz Supply connections
M1, M2 + M1b, M2b	4+2 pins screws	M1, M2 motor power and brake connectors AEOCON013 (M1b, M2b brake connectors)

5.6.9 Quad-Axes MDLUF014D layout and connectors



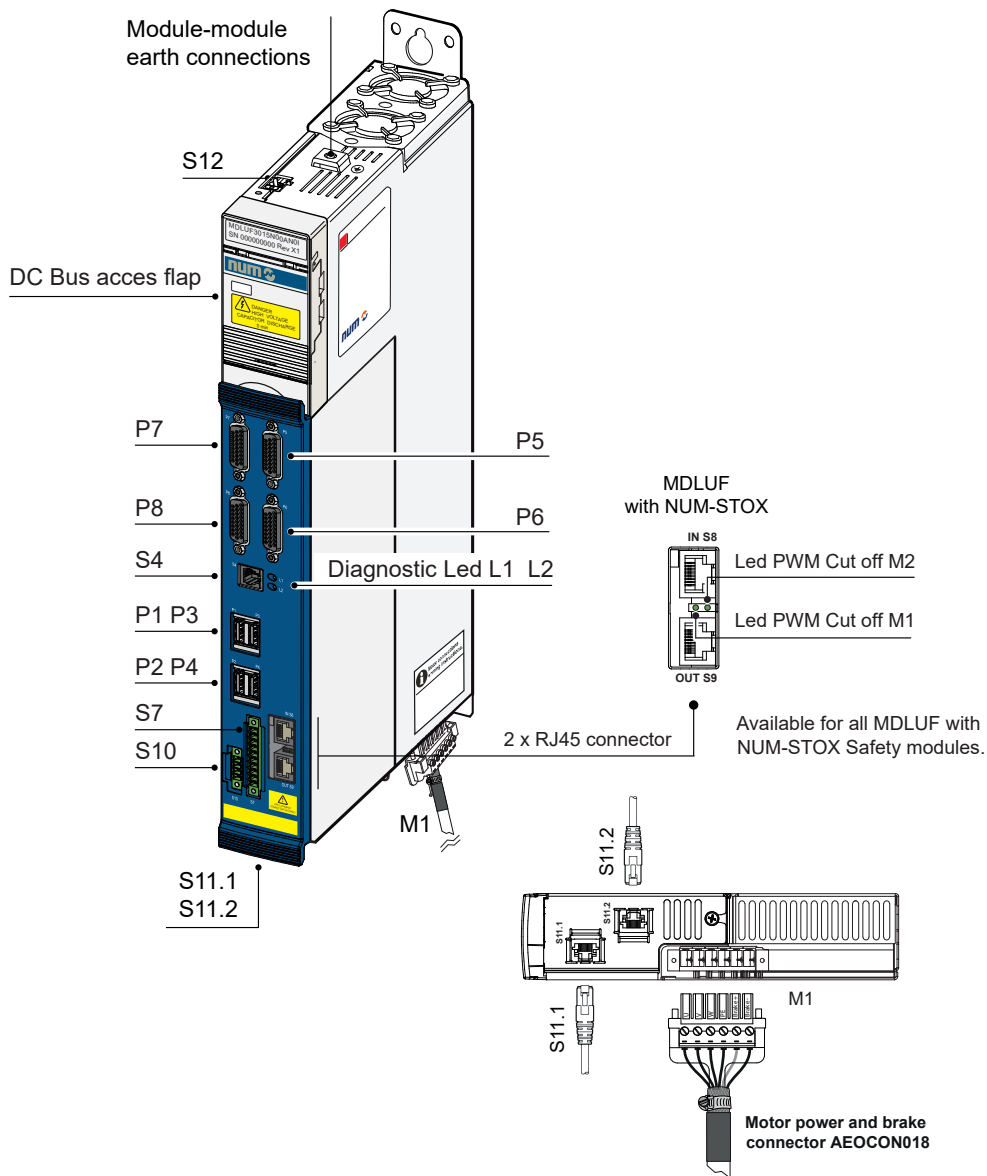
Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections Available with version MDLUF---DEC---- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	Available with NUM-SAMX version only
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1, M2	6 screw pins	M1, M2 motor power and brake connectors AEOCON018
M3, M4	6 screw pins	M3, M4 motor power connectors AEOCON018

5.6.10 MDLUF with NUM-SAMX Safety module



Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED--- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	NUM-SAMX IN /OUT connections
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1	6 screw pins	Motor power and brake connector AEOCON018

5.6.11 MDLUF with NUM-STOX Safety module

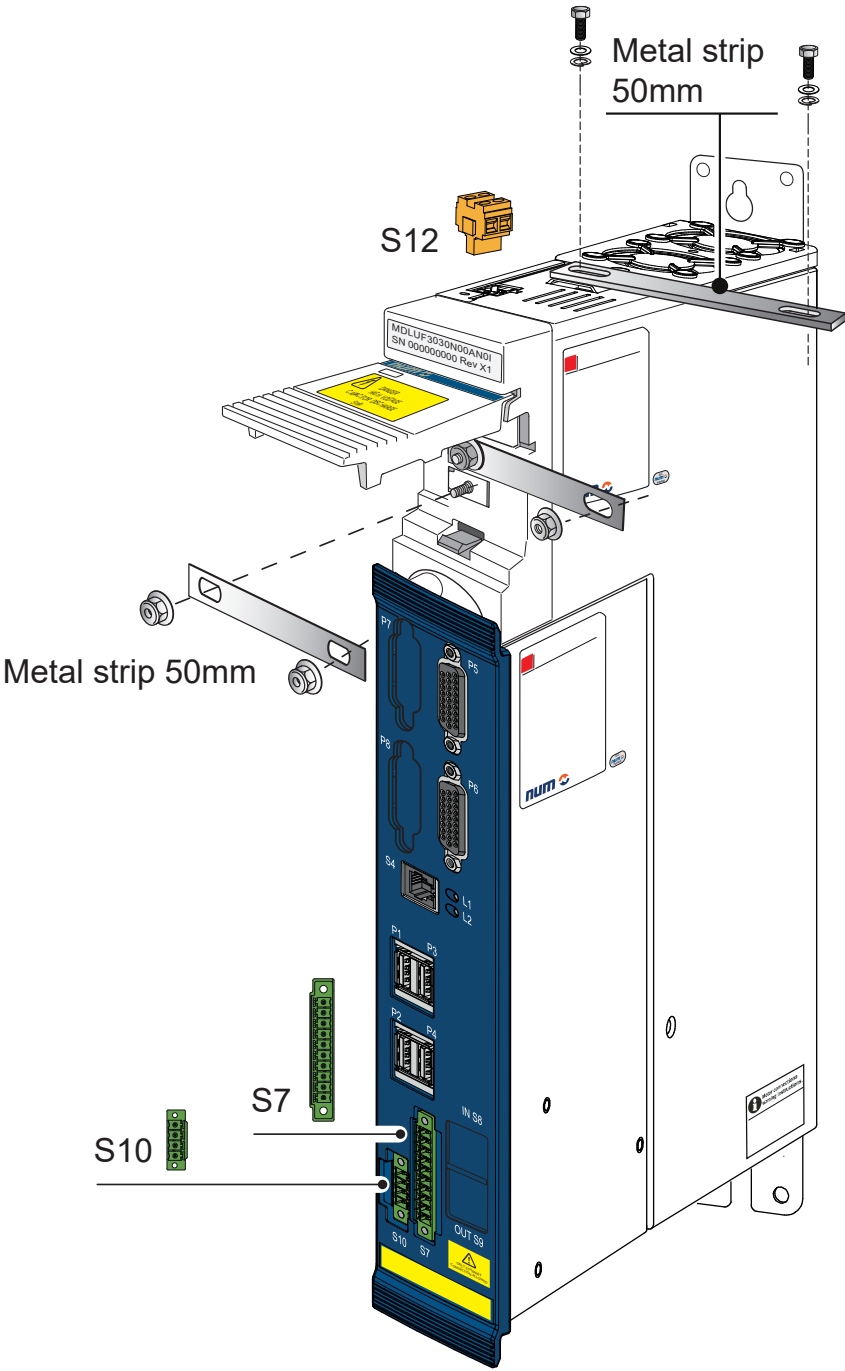


Connector	Type	Description
L1, L2		L1 = DISC ET status, L2 = DISC ET error
P1, P2, P3, P4	Hiperface-DSL	2-wires Motor sensor connections (See chapter 3.4)
P5, P6	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR connections (See chapter 3.4)
P7, P8	Sub D HD 26 pins F	Motor sensor / Direct Axis measure sensor / VDR / Local Link connections Available with version MDLUF---AED---- (See chapter 3.4)
S4	NUM service	
S7	10 screw pins	+24Vdc programmable IN/OUT
S8, S9	RJ45 (8P/8C)	NUM-STOX IN /OUT connections
S10	4 screw pins	Motors brake control
S11.1, S11.2	RJ45 (8P/8C)	Module/module digital bus interconnections
S12	2 screw pins	AUX 48Vac input 35kHz Supply connections
M1	6 screw pins	Motor power and brake connector AEOCON018

5.7 MDLUF enclosed accessories

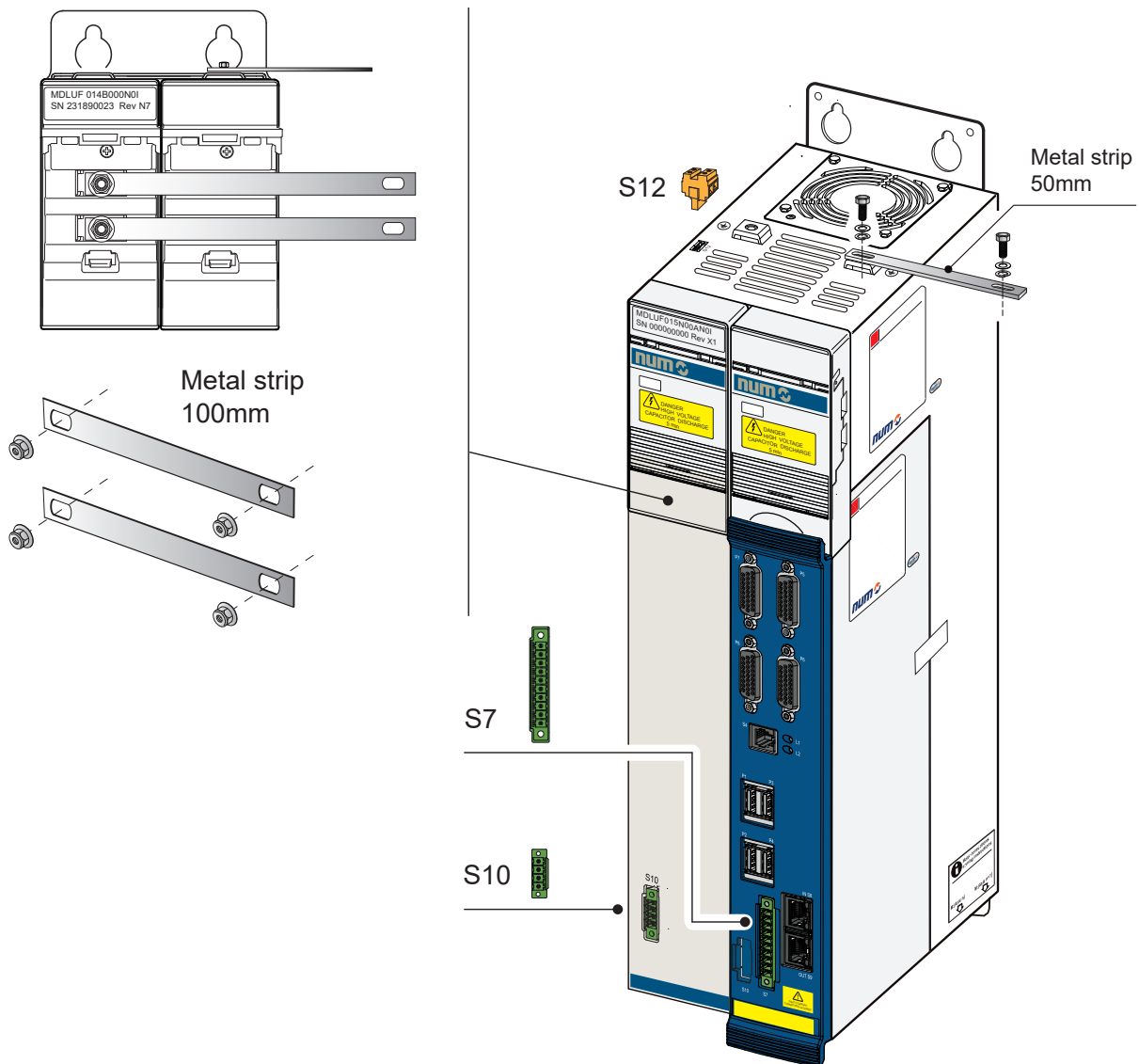
5.7.1 MDLUF007A, 014A, 021A, 034A , 007B, 014B, 021B enclosed accessories

Description	Qty
Auxiliary 48Vac 35kHz supply connector (S12).	1
10 pins screws connector. (S7 Programmable input / outputs connections)	1
4 pins screws connector. (S10 Motors 1, 2 brakes control connections)	1
Metal strip 50mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1



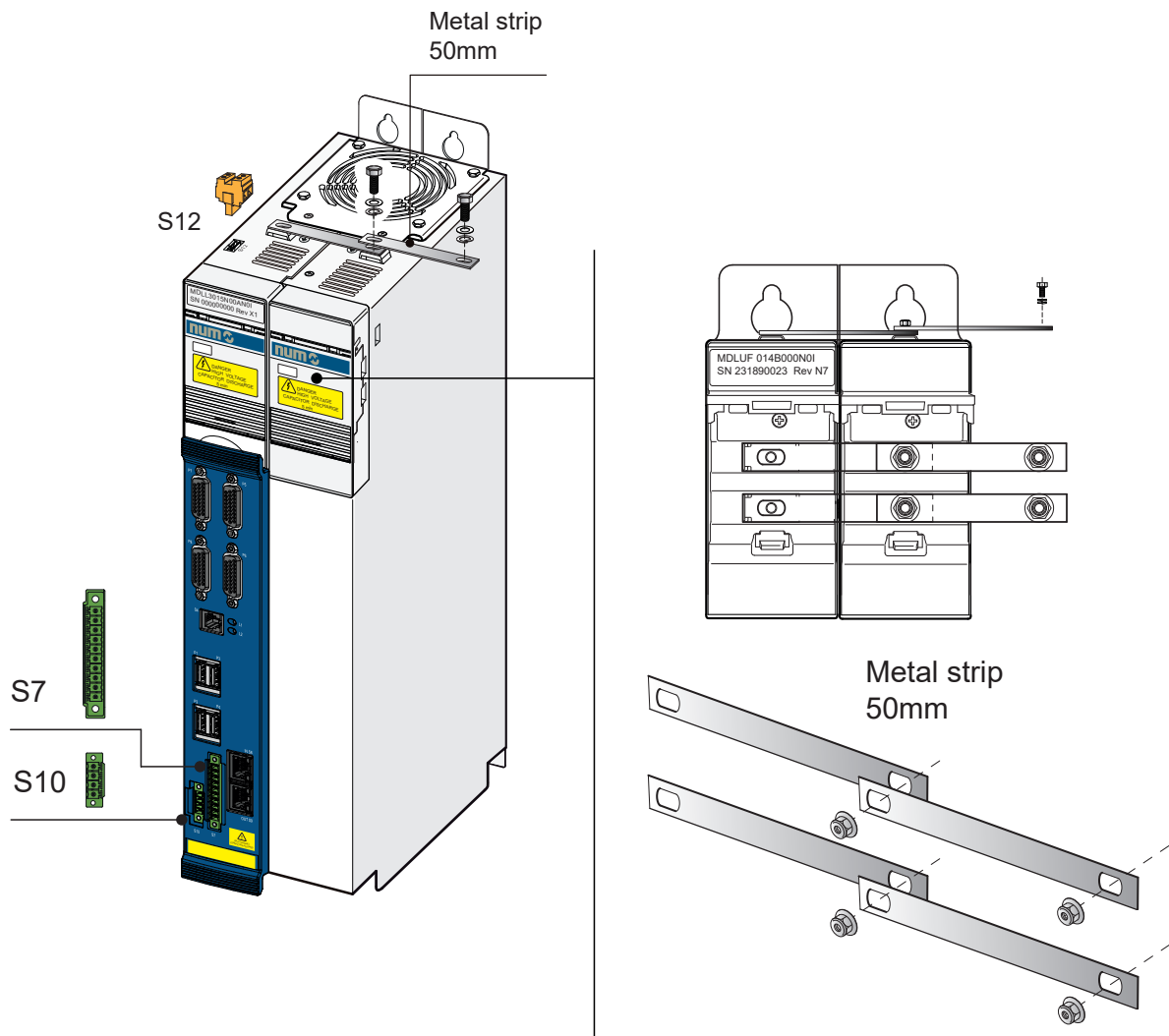
5.7.2 MDLUF050A, 075A , 050B enclosed accessories

Description	Qty
Auxiliary 48Vac 35kHz supply connector (S12).	1
10 pins screws connector. (S7 Programmable input / outputs connections)	1
4 pins screws connector. (S10 Motors 1, 2 brakes control connections)	1
Metal strip 100mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1



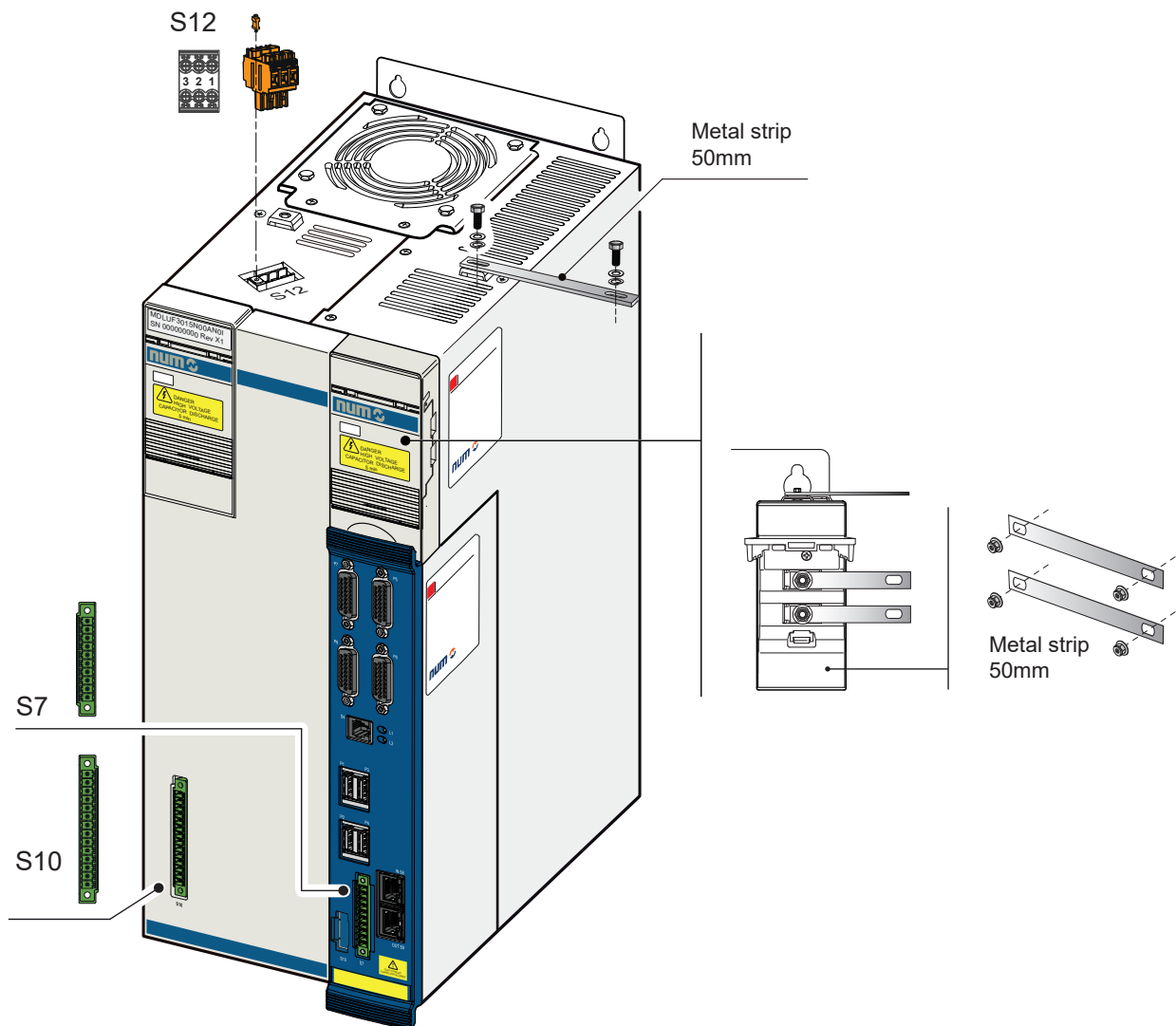
5.7.3 MDLUF014D enclosed accessories

Description	Qty
Auxiliary 48Vac 35kHz supply connector (S12).	1
10 pins screws connector. (S7 Programmable input / outputs connections)	1
4 pins screws connector. (S10 Motors 1, 2 brakes control connections)	1
Metal strip 50mm for DC Bus module / module interconnections (with 4 assembled nuts M5)	4
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	2



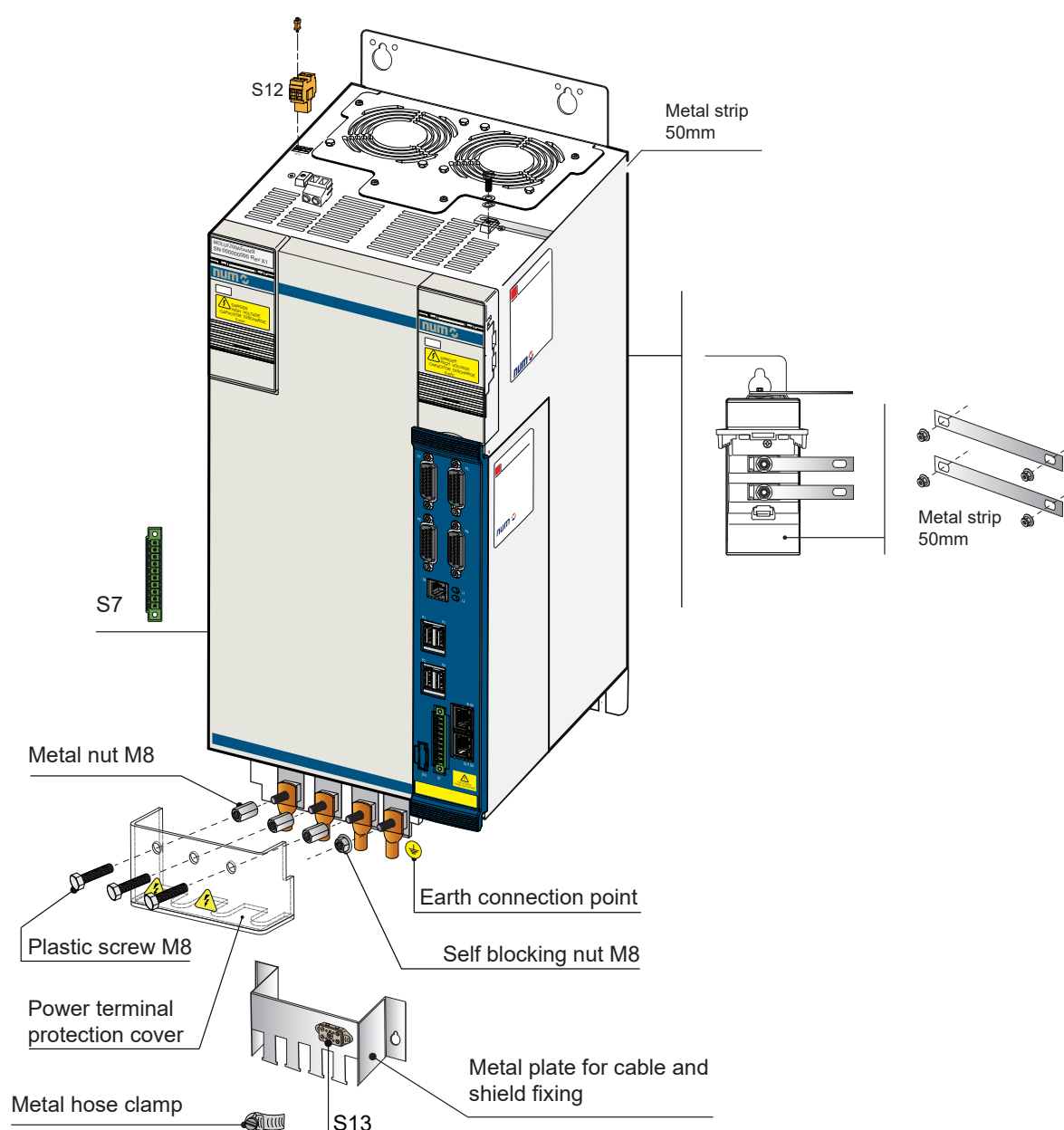
5.7.4 MDLUF100A, 150A, 075B enclosed accessories

Description	Qty
Auxiliary 48Vac 35kHz supply connector (S12).	1
10 pins screws connector. (S7 Programmable input / outputs connections)	1
14 pins screws connector. (S10 Motors 1, 2 brakes control connections)	1
Metal strip 50mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1



5.7.5 MDLUF200A enclosed accessories

Description	Qty
Auxiliary 48Vac 35kHz supply connector (S12).	1
10 pins screws connector. (S7 Programmable input / outputs connections)	1
Power terminal protection cover. (U, V, W connections) with 3 plastic screws M8	1
Metal nut M8 for U, V, W motor connections	3
Self blocking nut M8 for earth connection	1
Metal plate for cable and shield fixing + brake connector (S13) with 2 screws M3x8 + metal hose clamp for cable and shield fixing	1
Metal strip 50mm for DC Bus module / module interconnections (with 2 assembled nuts M5 each)	2
Metal strip 50mm for earth module / module interconnections (with 2 screws M5x8 + 2 fixing washer)	1



5.7.6 MDLUF400A mandatory accessories

The module always requires mandatory accessories as indicated in the table below.
Please refer to the chapter [10](#).

Mandatory accessories	Qty
AEOKIT006 accessories kit	1
AGOFAN001 fan	1

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Summary

6	Safety modules.....	103
6.1	Introduction	103
6.2	NUM-SAMX safety module	103
6.3	NUM-STOX safety module	103
6.3.1	Safety function - STO (Safe Torque Off)	105
6.3.2	STO Safety Function.....	105
6.3.3	STO function priority and System interaction	107
6.3.4	Other monitoring functions	107
6.3.5	Muting and suspension of safety functions.....	107
6.3.6	NUM-STOX Functional safety reliability data	108
6.3.7	Fault Reaction Function	109
6.3.8	Feedback management	110
6.3.9	Environmental conditions.....	110
6.3.10	MDLUF and NUM-STOX installation and connections.....	110
6.3.11	Operational test on NUM-STOX module	110
6.3.12	Commissioning	110
6.3.13	Trouble shooting	110

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6 Safety modules

6.1 Introduction

Within the NUMSafe architecture, NUM DrivePro provides safe motion functionalities by means of two different safety modules:

NUM-STOX is the basic module for implementing the Safe Torque Off function up to SIL 3 according to IEC/EN 61800-5-2 and PL “e” according to EN ISO 13849-1”. This allows the realization of E-STOP functions category 0 and 1 according to EN60204-1.

NUM-SAMX is an extended functionalities module which provides a huge number of safe motion monitoring functions. STO Safe Torque Off, SLS Safely Limited Speed, SOS Safe Operational Stop, SS1 Safe Stop 1, SS2 Safe Stop 2, SLP Safe Limited Position, SDM Safe Direction Monitoring, SCA Safe CAMs and SSM Safe Speed Monitor.

NUM-SAMX cannot be yet used with motor equipped with sensor “T” (BHX040) or Magnescale protocol. It inter operates with the NUMSafe architecture by means of FSoE (Fail Safe over EtherCAT).

6.2 NUM-SAMX safety module

Please refer to the specific manual M00069 for more details.

6.3 NUM-STOX safety module

The NUM-STOX Safety module provides a Safe Torque Off function (STO) compliant to IEC/EN 61800-5-2 with a safety integrity level (SIL) up to 3 and complaint to EN ISO 13849-1 with a performance level (PL) up to “e”.

The NUM-STOX safety module can be used to integrate the STO function for personal protection against dangerous movements into the MDLUF drive positioning controllers.

The NUM-STOX is available for Bi-Axes and Mono-Axis drives; in case of Bi-Axes it provides two independent Safe Torque Off functions.

The NUM-STOX is NOT available for Quad-Axes drive.

NUM-STOX can be used either directly connected to safe devices (like safety relays), or within a NUMSafe architecture with NUMSafe PLC and NUMSafe I/Os. However, the use of a complete NUMSafe architecture allows the reduction of the wiring and the flexibility and scalability is maximized.

All safety related information are processed by the NUMSafe PLC and translated in the associated cutoff commands to the NUM-STOX Module if applicable.

The following system components can be connected to the system through the safe I/Os or directly to the NUM-STOX using fixed cable connections.

- Emergency Stop control devices
- Push button for unblocking the power amplifier
- Safety door position switches or outputs of an optical protection device (e.g. light curtain)
- Push button for safety door confirmation
- Enabling devices for enabling motor movements in setup mode
- Power contacts for switching external loads, if necessary with linked contacts
- Electromechanical safety door interlocking.

The safety module offers a more convenient implementation of safe power removal rather than using an expensive power contactors.

6.3.1 Safety function - STO (Safe Torque Off)

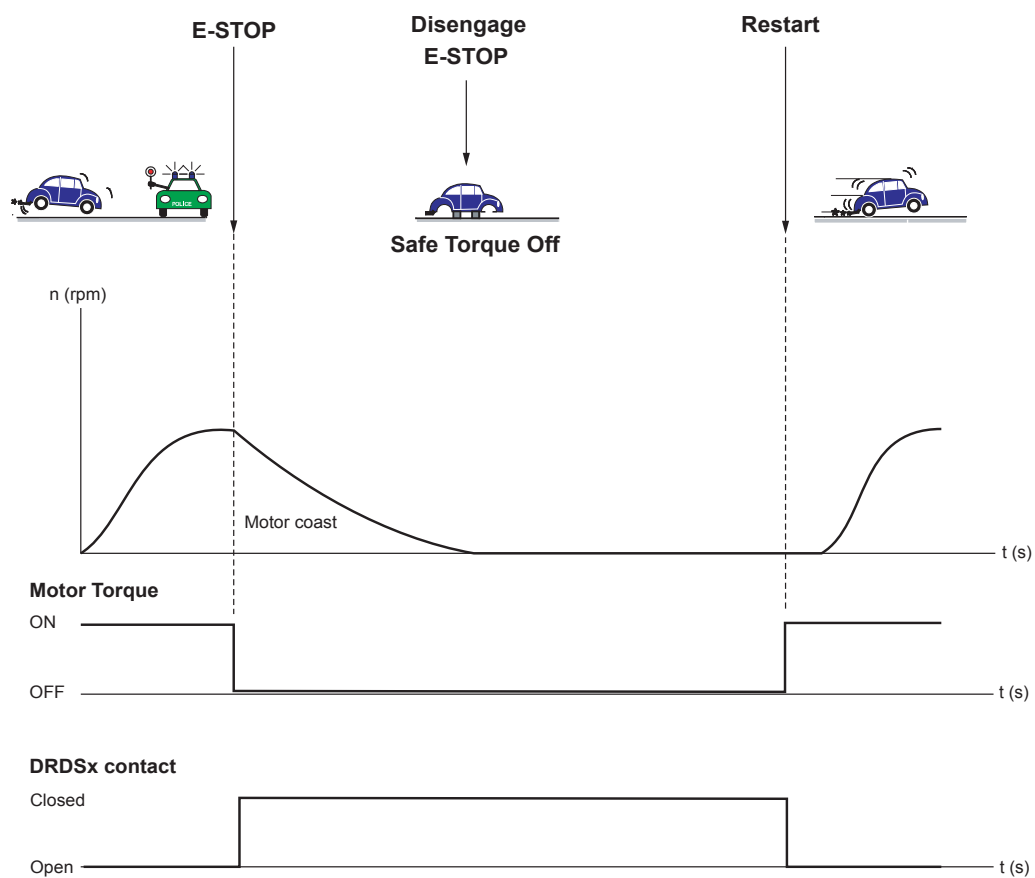
NUM-STOX implement the STO safety function so as described in IEC61800-5-2.

Safety function	Description	Response time
Safety Torque Off (STO)	When activated the PDS (SR) will not provide energy to the motor which can generate torque (or force in the case of a linear motor). The activation of the function is performed by means of the NUM-STOX physical inputs named ENxA and ENxB. (De-energize=STO activated)	< 10ms

The activation of the specific safety function is triggered by the external I/O system connected to safety devices such as E-Stop buttons, Light Curtains, Mode switches and transmitted by the safe PLC hardwired to the NUM-STOX safety module.

The safe torque off function is without limits applicable for both asynchronous and synchronous motors.

6.3.2 STO Safety Function



6.3.3 STO function priority and System interaction

The priority is the highest.

The function is realized through HW channels only, and have no interaction with the drives Firmware. The activation of the safety function will override all other HW and SW and will remove current/ torque from the motor(s).

The function will override the drive current regulator commands. Internal Feedbacks of the state of the NUM-STOX Inputs will inform the drive SW in order to inhibit saturation of the regulators and avoid unexpected behaviour when the safety function is removed.

NUM-STOX Feedbacks inform at system level the CNC/Operator of the state of the function.

6.3.4 Other monitoring functions

Safety function	Description
Test of ENxA-ENxB coherent	An alarm is issued by NUM DrivePro if the NUM-STOX inputs ENxA, ENxB are not level coherent for at least 200ms. The internal test is performed on the feedback signals of the NUM-STOX Module.
Test of ENxA-ENxB unstable	An alarm is issued if the NUM-STOX inputs ENxA, ENxB are flickering, the level are not stable for at least 200ms. The internal test is performed on the feedback signals of the NUM-STOX Module. Check the signal used to manage ENxA and ENxB or the connections to S8/S9.

6.3.5 Muting and suspension of safety functions



It not possible to exclude the safety functions whenever are activated.

6.3.6 NUM-STOX Functional safety reliability data

NUM-STOX is applicable for all applications with synchronous and asynchronous motors for machines where the risk assessment requires additional safety devices.

The reliability parameters of the complete NUM DrivePro power drive system with NUM-STOX safety module according to IEC EN 61800-5-2 and EN ISO13849-1 are:

Product life time [years]	20
SIL (EN 61800-5-2)	3
PL (EN ISO 13849-1/2)	e
PFH [1/h]	$2,27 \cdot 10^{-10}$
DC (EN ISO 13849-1/2)	≥ 90%
SFF (EN 61800-5-2)	≥ 90%
MTTFd (EN ISO 13849-1/2) [years]	> 100
Category (EN ISO 13849-1/2)	3

The system is suitable for High demand application. The function can be used during normal machine operation with a daily frequency. The Hardware fault-tolerance is equal to 1, because of the 1oo2 (one out of two) architecture.

Since the safety module contains 2 redundant channels, a single failure does not inhibit the safety function.



An accumulation of failures may result in a dangerous condition. Cyclic tests can be implemented at system level to avoid accumulation of failures.



The use of the safety module for vertical axis is not permitted without additional means.

6.3.7 Fault Reaction Function

The drive will check the congruence of the feedbacks of both channels. In case of mismatch the drive will stop the machinery and issue an alarm.

The NUM-STOX module will provide for this purpose a clean contact (DRDSx), which will be closed in case of safe state and which must be monitored cyclically by the PLC.

No	STO*	Feedback Channel #A	Feedback Channel #B	Clean contact (DRDSx)	Reaction	Failure Type
1	0	LOW	LOW	Open	None	No Failure
2	1	HIGH	HIGH	Closed	None	No Failure
3	1	LOW	HIGH	Closed	Machine Stop and diagnostic message.	Safe detected
4	1	HIGH	LOW	Closed	Machine Stop and diagnostic message.	Safe detected
5	0	LOW	HIGH	Closed	Machine Stop and diagnostic message.	dangerous detected
6	0	HIGH	LOW	Closed	Machine Stop and diagnostic message.	dangerous detected
7	0	HIGH	HIGH	Closed	Safety function STO not working. diagnostic message and supervisor system PLC will stop machine.	Dangerous failure on both channels**

(*) Safe Torque Off = 0: ENxA and ENxB = 1 (motor can run)

Safe Torque Off = 1: ENxA and/or ENxB = 0 (motor cannot run)

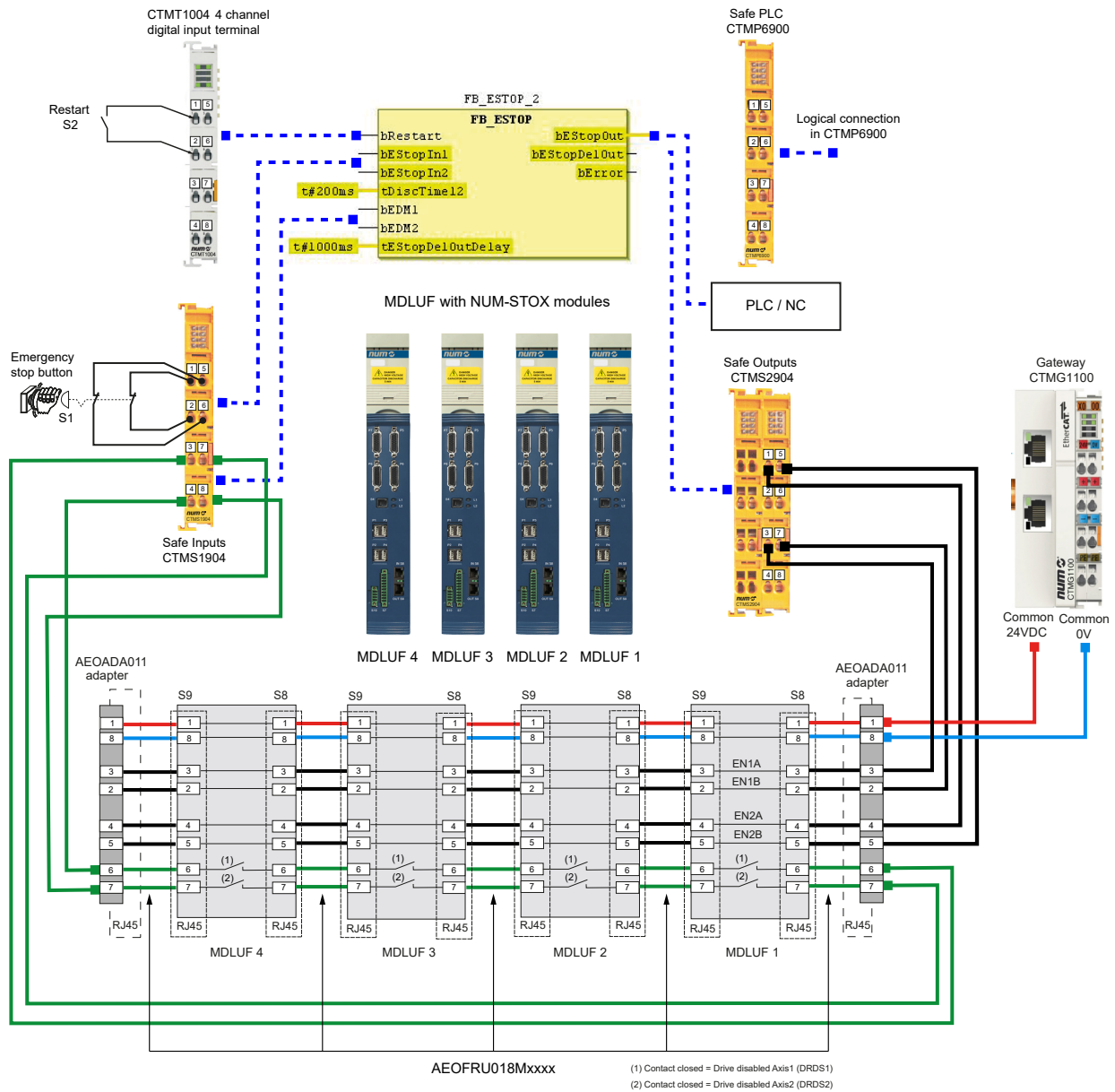
(**) This condition must be monitored by the PLC with an instruction like

Fault:= ENxA AND ENxB AND DRDSx;

6.3.8 Feedback management

The DRDSx contacts will be managed by the PLC. The customer should connect the DRDSx to the an input terminal of the PLC.

In the following an example of configuration is reported.



Response time

The response time of the fault reaction time is less than 10ms from the demand of the safety function to the change of the feedback.

6.3.9 Environmental conditions



Please refer to this manual chapter [2](#) for more detailed informations.



Whenever the safety module is used, the Drive has to be used in a protected environment (min. IP54). The Electrical Cabinet may be applicable for this NUM DrivePro must be installed in conformity with this manual chapter [9](#).

6.3.10 MDLUF and NUM-STOX installation and connections



Please refer to this manual chapter [9.6](#) for more detailed informations.

6.3.11 Operational test on NUM-STOX module



The safety function should be verified at least once a month after a startup of the machine

Once a month the Safe Torque Off function must be verified as follows:

- Run the motor connected to the drive under test at a low speed ⁽¹⁾.
- Active the Safe Torque Off function by pressing the Emergency STOP button.
- Verify that the motor stops moving.

⁽¹⁾ Not dangerous for mechanics and health.

6.3.12 Commissioning

After the complete machine commissioning the Safe Torque Off function must be verified as for the periodic test.

6.3.13 Trouble shooting

The DRDSx contact reflect the input levels ENxA / ENxB in reversed logic.

If the DRDSx status have an unexpected behaviour the possible failure reasons maybe:

ENxA/ENxB level	DRDSx status	Possible cause	Possible remedy
0VDC	Open	Drive internal fault	Verify or change the Control Unit.
		Missing external 24VDC supply on S8/S9 connector.	Verify the external S8/S9 connector connections.
24VDC	Closed	Drive internal fault .	Verify or change the Control Unit.
Whenever a software alarms occurs	Please refer to the chapter 11		

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1

2

3

4

5

6

7

8

9

10

11

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Summary

7	NUM DrivePro and motors associations.....	115
7.1	BHX / SHX motors and NUM DrivePro.....	115
7.2	BPX / SPX motors and NUM DrivePro	116
7.3	BPH motors and NUM DrivePro	117
7.4	BPG motors and NUM DrivePro	119
7.5	BHL260 motors and NUM DrivePro	120
7.6	TMX motors and NUM DrivePro	121
7.7	AMS motors and NUM DrivePro.....	122
7.8	M18MK14 motor and NUM DrivePro.....	124

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7 NUM DrivePro and motors associations

7.1 BHX / SHX motors and NUM DrivePro

Association of BHX & SHX Motors with NUM DrivePro (Switching Frequency 5 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BHX SHX	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BHX0403V5...	6 000	0.318	0.96	0.96	0.96	0.96											
0751V5...	6 000	1.2	3.5	3.5	4.3	4.3	4.3										
0752V5...	6 000	2.1	3.4	3.4	6.6	6.6	7.8	7.8		7.8							
0951V5...	6 000	2.4	4	4	6.4	6.4	7.5	7.5		7.5							
0952N5...	3 000	4.3	7.7	7.7	13.2	13.2	14.5	14.5		14.5							
0952V5...	6 000				7.8	7.8	10.5	10.5	14.5	14.5		14.5					
1261N5...	3 000	4.5	7	7	11.5	11.5	13	13		13							
1261V5...	6 000				7	7	9.5	9.5	12.4	13							
1262N5...	3 000	8.4			13.8	13.8	20	20	27	27		27					
1262V5...	6 000							10.5	16	22	22	27	27				
1263R5...	4 500	11						16.5	25	34	34	37					
1552N5...	3 000	12			16	16	23	23	33	39	39	39					
1552R5...	4 500							17	26.5	35	35	39					
1554N5...	3 000	20						24	38	53	53	69	69				

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

Association of BHX & SHX Motors with NUM DrivePro (Switching Frequency 10 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BHX SHX	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BHX0403V5...	6 000	0.318	0.96	0.96	0.96	0.96											
0751V5...	6 000	1.2	3.5	3.5	4.3	4.3	4.3										
0752V5...	6 000	2.1	3.4	3.4	6.6	6.6	7.8	7.8		7.8							
0951V5...	6 000	2.4	4	4	6.4	6.4	7.5	7.5		7.5							
0952N5...	3 000	4.3	7.7	7.7	13.2	13.2	14.5	14.5		14.5							
0952V5...	6 000				7.8	7.8	10.5	10.5	14.5	14.5		14.5					
1261N5...	3 000	4.5	7	7	11.5	11.5	13	13		13							
1261V5...	6 000							9.5	12.4	13	13	13					
1262N5...	3 000	8.4			13.8	13.8	20	20	27	27							
1262V5...	6 000									22	22	27	27				
1263R5...	4 500	11								34	34	37					
1552N5...	3 000	12						23	33	39	39	39					
1552R5...	4 500									35	35	39	39				
1554N5...	3 000	20								53	53	69	69				

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

7.2 BPX / SPX motors and NUM DrivePro

Association of BPX & SPX Motors with NUM DrivePro (Switching Frequency 5 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BPX SPX	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPX0551V5...	6 000	0.5	1.5	1.5	1.5												
0751V5...	6 000	1.4	3.5	3.5	4.3	4.3	4.3										
0752V5...	6 000	2.3	3.4	3.4	6.6	6.6	7.8	7.8		7.8							
0951V5...	6 000	2.7	4	4	6.4	6.4	7.5	7.5		7.5							
0952N5...	3 000	5	7.7	7.7	13.2	13.2	14.5	14.5		14.5							
0952V5...	6 000				7.8	7.8	10.5	10.5	14.5	14.5		14.5					
1261N5...	3 000	5.2	7	7	11.5	11.5	13	13		13							
1261V5...	6 000				7	7	9.5	9.5	12.4	13		13					
1262N5...	3 000	9.8			13.8	13.8	20	20	27	27		27					
1262V5...	6 000									22	22	27	27				
1263R5...	4 500	12.6						16.5	25	34	34	37					
1552N5...	3 000	13.8				16	23	23	33	39	39	39					
1552R5...	4 500							17	26.5	35	35	39					
1554N5...	3 000	23								53	53	69	69				

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

Association of BPX & SPX Motors with NUM DrivePro (Switching Frequency 10 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BPX SPX	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPX0551V5...	6 000	0.5	1.5	1.5													
0751V5...	6 000	1.4	3.5	3.5	4.3	4.3	4.3										
0752V5...	6 000	2.3	3.4	3.4	6.6	6.6	7.8	7.8		7.8							
0951V5...	6 000	2.7	4	4	6.4	6.4	7.5	7.5		7.5							
0952N5...	3 000	5	7.7	7.7	13.2	13.2	14.5	14.5		14.5							
0952V5...	6 000							10.5	14.5	14.5		14.5					
1261N5...	3 000	5.2	7	7	11.5	11.5	13	13		13							
1261V5...	6 000							9.5	12.4	13	13	13					
1262N5...	3 000	9.8						20	27	27		27					
1262V5...	6 000									22	22	27	27				
1263R5...	4 500	12.6								34	34	37					
1552N5...	3 000	13.8								39	39	39					
1552R5...	4 500									35	35	39	39				
1554N5...	3 000	23								53	53	69	69				

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

7.3 BPH motors and NUM DrivePro

Association of BPH Motors with NUM DrivePro (Switching Frequency 5 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BPH	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPH0552S5...	8 000	0.4			1.4	1.4											
0751N5...	3 000	1.3			4.8	4.8	4.8										
0751V5...	6 000				3.9	3.9	3.9			3.9							
0752N5...	3 000	2.3			7.5	7.5	7.5			7.5							
0752V5...	6 000				5.9	5.9	5.9			5.9							
0754N5...	3 000	4			11	11	11			11							
0952N5...	3 000	4.3			11	11	11			11							
0952V5...	6 000				7.2	7.2	10	10		10		10					
0953N5...	3 000	6			11.2	11.2	16	16		16		16					
0953V5...	6 000								14	14	14	14					
0955N5...	3 000	9.2			15.7	15.7	22	22		22		22					
1152N5...	3 000	7.4			11.9	11.9	16	16		16		16					
1152V5...	6 000								14	14	14	14					
1153K5...	2 000				17.2	17.2	24	24		24		24					
1153N5...	3 000	10.5							22	22	22	22					
1153V5...	6 000								18	18	18	18					
1154K5...	2 000				19.8	19.8	27	27		27		27					
1154N5...	3 000	13.3							27	27	27	27					
1154V5...	6 000									23	23	23					
1156N5...	3 000	18.7							33	33	33	33					
1422K5...	2 000				19.2	19.2	22	22		22		22					
1422N5...	3 000	12							20	27	27	31					
1422R5...	4 250								19	19	19	19					
1423K5...	2 000								33	33	33	33					
1423N5...	3 000	17							28	28	28	28					
1423R5...	4 250									28	28	28					
1424K5...	2 000								41	41	41	41					
1424N5...	3 000	22								41	41	41					
1424R5...	4 250											45	45				
1427N5...	3 000	35										71	71				
1902K5...	2 000									40	40	40					
1902N5...	3 000	25								35	35	35	35				
1902R5...	4 250											36	36	36			
1903K5...	2 000									52	52	52	52				
1903N5...	3 000	36										54	54	54			
1904K5...	2 000											90	90				
1904N5...	3 000	46										69	69	69			
1905H5...	1 500									82	82	82	82				
1905L5...	2 500	56										79	79	79			
1907K5...	2 000											120	120	120			
1907N5...	3 000	75													125	125	
190AK5...	2 000	100												145		145	

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

Association of BPH Motors with NUM DrivePro (Switching Frequency 10 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BPH	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
BPH0552S5...	8 000	0.4			1.4	1.4											
0751N5...	3 000	1.3			4.8	4.8	4.8										
0751V5...	6 000				3.9	3.9	3.9			3.9							
0752N5...	3 000	2.3			7.5	7.5	7.5			7.5							
0752V5...	6 000				5.9	5.9	5.9			5.9							
0754N5...	3 000	4			11	11	11			11							
0952N5...	3 000	4.3			11	11	11			11							
0952V5...	6 000				7.2	7.2	10	10		10		10					
0953N5...	3 000	6			11.2	11.2	16	16		16		16					
0953V5...	6 000									14	14	14					
0955N5...	3 000	9.2			15.7	15.7	22	22		22		22					
1152N5...	3 000	7.4			11.9	11.9	16	16		16		16					
1152V5...	6 000									14	14	14					
1153K5...	2 000	10.5			17.2	17.2	24	24		24		24					
1153N5...	3 000									22	22	22					
1153V5...	6 000	13.3								18	18	18					
1154K5...	2 000							27		27		27					
1154N5...	3 000	18.7								27	27	27					
1154V5...	6 000									23	23	23					
1156N5...	3 000	12								33	33	33					
1422K5...	2 000				19.2	19.2	22	22		22		22					
1422N5...	3 000	17								27	27	31					
1422R5...	4 250									19	19	19					
1423K5...	2 000	22								33	33	33					
1423N5...	3 000									28	28	28					
1423R5...	4 250	35								28	28	28					
1424K5...	2 000									41	41	41					
1424N5...	3 000	46								41	41	41					
1424R5...	4 250											45	45				
1427N5...	3 000	56										71		71			
1902K5...	2 000									40	40	40					
1902N5...	3 000	36										35	35				
1902R5...	4 250													36			
1903K5...	2 000	75										52	52				
1903N5...	3 000											54		54			
1904K5...	2 000	100										90	90				
1904N5...	3 000													69			
1905H5...	1 500	125										82	82				
1905L5...	2 500													79			
1907K5...	2 000	145										120		120			
1907N5...	3 000															125	
190AK5...	2 000															145	

In case the motor is associated to a bi-axes drive, the motor's low speed contin. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

7.4 BPG motors and NUM DrivePro

Association of BPG Motors with NUM DrivePro (Switching Frequency 5 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BPG	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
0751N5...	3 000	1.3			4.8	4.8	4.8										
0752N5...	3 000	2.3			7.5	7.5	7.5			7.5							
0952N5...	3 000	4.3			11	11	11			11							
0953N5...	3 000	6			11.2	11.2	16	16		16		16					
1152N5...	3 000	7.4			11.9	11.9	16	16		16		16					
1153K5...	2 000				17.2	17.2	24	24		24		24					
1153N5...	3 000	10.5							22	22	22	22					
1153V5...	6 000								18	18	18	18					
1422N5...	3 000	12							20	31	31	31					
1423N5...	3 000	17							28	28	28	28					
1424K5...	2 000								41	41	41	41					
1424R5...	4 250	22										45	45				
1427N5...	3 000	35										71	71				
1902K5...	2 000									40	40	40					
1902N5...	3 000	25								35	35	35	35				
1903K5...	2 000									52	52	52	52				
1903N5...	3 000	36										54	54	54			
1904N5...	3 000	46										69	69	69			
1905L5...	2 500	56										79	79	79			

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

Association of BPG Motors with NUM DrivePro (Switching Frequency 10 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BPG	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
0751N5...	3 000	1.3			4.8	4.8	4.8										
0752N5...	3 000	2.3			7.5	7.5	7.5			7.5							
0952N5...	3 000	4.3			11	11	11			11							
0953N5...	3 000	6			11.2	11.2	16	16		16		16					
1152N5...	3 000	7.4			11.9	11.9	16	16		16		16					
1153K5...	2 000				17.2	17.2	24	24		24		24					
1153N5...	3 000	10.5								22	22	22					
1153V5...	6 000									18	18	18					
1422N5...	3 000	12								27	27	31					
1423N5...	3 000	17								28	28	28					
1424K5...	2 000									41	41	41					
1424R5...	4 250	22										45	45				
1427N5...	3 000	35										71		71			
1902K5...	2 000									40	40	40					
1902N5...	3 000	25										35	35				
1903K5...	2 000											52	52				
1903N5...	3 000	36										54		54			
1904N5...	3 000	46												69			
1905L5...	2 500	56												79			

In case the motor is associated to a bi-axes drive, the motor's low speed cont. torque depends on which motor type is connected at the same power unit. Refer to chapter 8.6 for details.

7.5 BHL260 motors and NUM DrivePro

Association of BHL Motors with NUM DrivePro (Switching Frequency 5 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BHL	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
2601N5xx2...	3000	85													165	210	
2601N1xxV...		120														210	
2602K5xx2...	2000	120													230	290	
2602K1xxV...		160														290	

Association of BHL Motors with NUM DrivePro (Switching Frequency 10 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
BHL	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
2601N5xx2...	3000	85														210	
2601N1xxV...		112														210	
2602K5xx2...	2000	120														290	
2602K1xxV...		160														290	

V = Ventilated version

7.6 TMX motors and NUM DrivePro

Association of TMX Motors with NUM DrivePro (Switching Frequency 5 kHz)

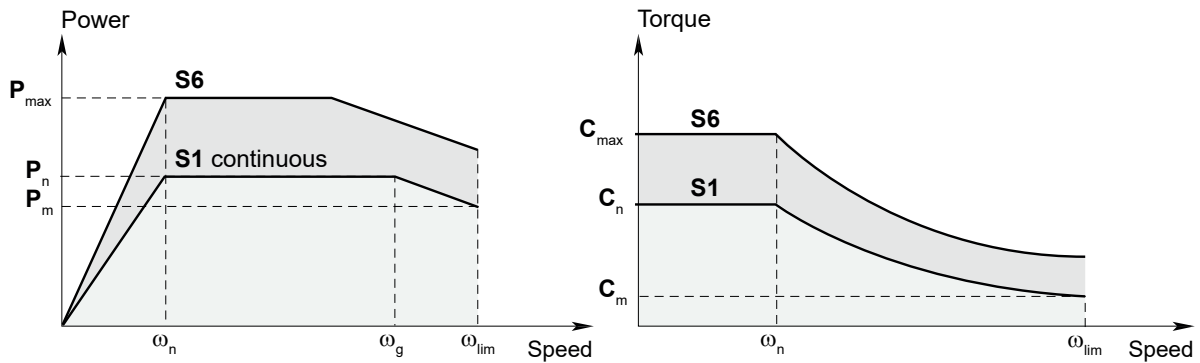
MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
TMX Water cooled	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
140050D..	1500	33			43	43	51	51	57	57							
140070C..	1500	50							70	81	81	81					
210050G..	500	124							203	250	250	250					
210070I..	500	174							285	350	350	350					
291050H..	500	230								360	360	435	435				
291070I..	500	325								442	442	560	560	610			
291150P..	200	705								947	947	1193	1193	1307			

Association of TMX Motors with NUM DrivePro (Switching Frequency 10 kHz)

MDLUF....			007B	007A	014B 014D	014A	021B	021A	034A	050B	050A	075B	075A	100A	150A	200A	400A
TMX Water cooled	Rated speed	Low speed contin. torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque	Peak torque
	[rpm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
140050D..	1500	33						51	57	57							
140070C..	1500	50								81	81	81					
210050G..	500	124							203	250	250	250					
210070I..	500	174								350	350	350					
291050H..	500	230								360	360	435	435				
291070I..	500	325										560	560	610			
291150P..	200	705										1193	1193	1307			

7.7 AMS motors and NUM DrivePro

AMS Motor Power vs Speed and Torque vs Speed Characteristics



P_n	Rated continuous power (S1)
P_{max}	Overload power (S6)
P_m	Continuous power at maximum speed (S1)
ω_n	Rated speed
C_n	Rated torque
C_{max}	Overload torque (S6)
C_m	Continuous torque at maximum speed (S1)
ω_g	Maximum speed at constant power (S1)
ω_{lim}	Maximum speed
I_{cont}	Rated continuous current (S1)
I_{ms}	Overload current with the associated drive (S6)

Working cycle: Sx

S1	S2	S3	S6
Load: P_n Electrical losses: θ_n Temperature: θ_n	Load: P_{max} Electrical losses: θ_{max} Temperature: θ_{max}	Load: P_{max} Electrical losses: θ_{max} Temperature: θ_{max}	Load: P_{max} Electrical losses: θ_{max} Temperature: θ_{max}
—	—	$f_m = \frac{N}{N+R} \times 100 (\%)$	$f_m = \frac{N}{N+V} \times 100 (\%)$

N	Operation at power P_{max}
R	Idle
V	Off-load operation
f_n	Duty cycle

Association of AMS Motors with NUM DrivePro (Switching Frequency 5 kHz)

AMS...		Connection	MDLUF... 5 kHz	Continuous operation S1							Overload S6			
				Pn	ωn	ωg	ωlim	Pm	Cn	Icont	Pmax	Cmax	Ims	10 min
				(kW)	(rpm)	(rpm)	(rpm)	(kW)	(Nm)	(Arms)	(kW)	(Nm)	(Arms)	(%)
100	SB	Y	050A	3.7	1 500	6 500	6 500	3.7	24	20	6	40	35	22
			050B											15 *
	MB	Y	075A	5.5				5.5	35	26	10	80	53	13
			075B											
	GB	Y	100A	9			9	57	39	17	120	71	16	
	SD	Y	050A	3.7			12 000	1.8	24	20	6	40	35	22
			050B											15 *
	MD	Y	075A	5.5				2.8	35	26	10	80	53	13
075B														
GD	Y	100A	9	6.2	57	39	17	120	71	16				
132	SA	Y	075A	5	750	6 000	7 000	2.8	64	26	10	150	53	16
			075B											
	SC	Y	100A	10	1 500			8	64	39	19	122	71	20
	SE	Δ	150A	15	1 750	4 000		10	82	52	29	160	106	13
	MA	Y	100A	7.5	750	6 000		5.7	95	39	15	190	71	20
	MC	Y	150A	15	1 500			12.5		52	30	190	106	16
	ME	Δ	200A	19.5	2 000	6 500		19	100	72	35	149	106	30
	LA	Y	150A	11	750	6 000		9	140	52	23	292	106	16
	LE	Y	200A	22	1 250	4 200		15	168	72	36	229	106	30
	SF	Y	075A	5	750	6 000	10 000	2	64	26	10	150	53	16
			075B											
	SG	Y	100A	10	1 500			6		39	19	122	71	20
	SH	Δ	150A	15	1 750	4 000		7.5	82	52	29	160	106	13
	MF	Y	100A	7.5	750	6 000		4	95	39	15	190	71	20
	MG	Y	150A	15	1 500			9		52	30	190	106	16
	MH	Δ	200A	19.5	2 000	6 500		13.5	93	72	35	149	106	30
	LF	Y	150A	11	750	6 000		7	140	52	23	292	106	16
	LI	Y	100A	12.5	680	2 300	9 000	3	175	39	19	270	71	16
	LH	Y	200A	22	1 250	4 200		12	168	72	36	229	106	30
160	MA	Y	150A	18	650	1 300	8 500	2.7	264	52	29	570	106	15
		Δ			1 300	2 600		5.4	132		29	255	106	15
	MB	Y	200A	26	1 200	2 400		7.3	208	72	36	290	106	35
		Δ			2 400	5 500		14.5	104		36	145	106	35
	MC	Δ	200A	36	1 700	2 800		11.8	202	100	47	265	141	10
	LA	Y	150A	18	500	1 000	6 500	2.8	344	52	27	740	106	15
		Δ			1 000	2 500		5.6	172		27	400	106	15
	LB	Y	200A	26	950	1 900		7.6	260	72	36.4	364	106	35
		Δ			1 900	4 000		15.2	130		36.4	182	106	35
	LC	Δ	200A	36	1 050	2 100	11.6	328	100	48	437	141	10	

* Performance limited by drive type association (Bi-Axis drive)

7.8 M18MK14 motor and NUM DrivePro

NUM DrivePro at 5kHz switching frequency

IM ...	Connection	MDLUF....	Continuous operation S1							Overload S6			
			Pn	wn	wg	wlim	Pm	Cn	Icont	Pmax	Cmax	Ims	10 min
			(kW)	(rpm)	(rpm)	(rpm)	(kW)	(Nm)	(Arms)	(kW)	(Nm)	(Arms)	(%)
18MK14	YY	400A	55	1 050	2 100	7 500	16.5	500	145	76	690	200	40

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1

2

3

4

5

6

7

8

9

10

11

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Summary

8	Dimensioning of the system	129
8.1	General guide of the system dimensioning	129
8.2	Requested power supply for axis motors	130
8.2.1	Nominal power (continuous)	130
8.2.2	Simultaneous factor	130
8.3	Requested power supply for asynchronous motors	131
8.3.1	Peak power requested	131
8.4	Auxiliary power supply (AUX)	132
8.4.1	How to determine total auxiliary power consumption	132
8.5	MDLL3 power supply admissible duty cycle	133
8.5.1	S3-Repetitive overload starting from zero to power max Ps	133
8.6	Bi-Axes and Quad-Axes admissible duty cycle	134
8.6.1	Bi-Axes and Quad-Axes rated current useful area	135
8.6.2	Rated current useful area - User's example with MDLUF014B... 5kHz	136
8.7	MDLL3 external braking resistor dimensioning	137
8.7.1	Continuous and maximum braking power	137
8.8	MDLL3 transformer and autotransformer dimensioning	137

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8 Dimensioning of the system

8.1 General guide of the system dimensioning

The composition of a complete system, composed by axis motors controlled by NUM DrivePro drives is carried out by the following points.

- Choice of axis motors considering:
 - nominal, max and working speed
 - stall, nominal and working torque
 - inertial ratio between motor and load.
- Selection for each axis motor of the relative NUM DrivePro module according to the associations mentioned in the [7](#).
For further more detailed information upon the NUM motors range, please consult the Flexium+ System Catalogue.
- Axis working cycle calculation.
- Calculation of the power requested by the motors to the drive in continuous (P_{BUS}^{DC}) and peak (P_{BUS}^{MAX}) power terms for intermediate and power circuit.
- Calculation of the requested auxiliary drives auxiliary power (P_{MDLU3}^{AUX}).

8.2 Requested power supply for axis motors

8.2.1 Nominal power (continuous)

The continuous power supplied by the power supply module (P_{ALIM}^{DC}) must be greater or equal to the sum of the electric powers requested to the intermediate circuit of axis and spindle motors (P_{BUS}^{DC}) :

$$P_{ALIM}^{DC} > P_{BUS}^{DC} = \sum_{n=1}^N P_{GROUPn}^{DC}$$

The formula $\sum_{n=1}^N P_{GROUPn}^{DC}$ is the sum of the nominal powers requested from N axis groups according which the motion of the machine can be considered divided. In case the traverses on the machine are coordinated by all the axes, refer to only one group (N = 1).

The formula P_{GROUPn}^{DC} has therefore the meaning of power requested by n axis group and must consider the simultaneous factor of F_n group due to the fact that usually the axes of this group do not work simultaneously.

$$P_{GROUPn}^{DC} = F_n * \sum_{i=1}^{I_n} P_{AXES i}^{DC} \quad (I_n = \text{number of axes belonging to n group}).$$

8.2.2 Simultaneous factor

The simultaneous factor is a characteristic of the machine and decreases by the increasing of the number of the working axes.

Approximately, it can be considered the following contemporaneity factors:

Axis number	1	2	3	4	5	6
F _n simultaneous factor	1	0.75	0.63	0.47	0.41	0.36

From this table data it can be extrapolated the following formula for the approximate calculation of the power requested by the axes:

$$P_{GROUPn}^{DC} = \sum_{i=1}^{I_n} P_{AXIS i}^{DC} / \sqrt{I_n}$$

Use a more pertinent simultaneous factor if known from your experience.

The formula $P_{AXIS i}^{DC}$ is the electric power requested by each axis motor. Its nominal electric power, considering an output η of 90% is:

$$P_{ELN} = \frac{P_{MECN}}{\eta} = \frac{1}{0.9} * C_N * \omega_N = \frac{1}{0.9} * C_N * \frac{n_N}{60} * 2\pi = 0.116 * C_N * n_N \text{ (W)}$$

n_N = nominal speed (rpm)

C_N = nominal torque (Nm)

ω = Rad/s.

However, in order not to oversize the request, it is necessary to consider that the real working speed n^* is usually inferior to the nominal n_N . Therefore the real electric power request will be:

$$P_{AXEi}^{DC} = \frac{1}{0.9} * C_N * \omega^* = \frac{1}{0.9} * C_N * \omega_N * \frac{\omega^*}{\omega_N} = P_N^{EL} * \frac{n^*}{n_N}$$

A further reduction of the real requested power is obtained by considering the connection between the really developed torque and the nominal one.

8.3 Requested power supply for asynchronous motors

For the electric power requested by asynchronous motor type, knowing the mechanical power developed by the shaft, consider a motor output equal to 80%.

$$P_{SPINDLE}^{DC} = \frac{P_N^{MEC}}{\eta} = \frac{1}{0.8} * P_N^{MEC}$$

It is however useful to consider that a certain oversize percentage allows a possible future use of the machine with heavier working cycles, from the requested power point of view.

8.3.1 Peak power requested

During the dynamic functioning, it is necessary to verify that the electric peak power requested by the accelerating axis and spindle motors, can be obtained by the MDLL3 power supply module.

This by respecting the limits (max delivered power) and the operating times (max power delivered in the time and therefore the max delivered energy) mentioned as technical data (overload cycles from zero power to max power and occasional overload over the nominal power).

In this case, besides keeping always present the contemporaneity factor, the electric power request for each axis will have to include the fact that the motor can develop the max torque up to the nominal speed.

$$P_{AXISi}^{MAX} = \frac{1}{0.9} * P_N^{MEC} * \frac{C_{MAX}}{C_N}$$

It is furthermore necessary to consider the overload cycles at the max power P_{MAX}^{MEC} that can be requested on the spindle motor.

8.4 Auxiliary power supply (AUX)

Besides the intermediate circuit power it is mandatory to check that the power supplied by MDLL3 for the auxiliary supply of NUM DrivePro modules is enough.

8.4.1 How to determine total auxiliary power consumption

To determine the total auxiliary power consumption (AUX) sum up consumption of each single MDLUF drive used in the system. Sensor, NUM-SAMX boards and tandem axes must be considered as well.

NUM DrivePro Auxiliary power supply (AUX) calculation			
Module type	Consumption	Number of modules	Result
MDLUF007AE..N0I	18.5W	.....	..... W
MDLUF014AE..N0I	18.5W	.....	..... W
MDLUF021AE..N0I	18.5W	.....	..... W
MDLUF034AE..N0I	18.5W	.....	..... W
MDLUF050AE..N0I	22.5W	.....	..... W
MDLUF075AE..N0I	22.5W	.....	..... W
MDLUF100AE..N0I	32W	.....	..... W
MDLUF150AE..N0I	32W	.....	..... W
MDLUF200AE..N0I	42.5W	.....	..... W
MDLUF400AE..N0I	27.5W	.....	..... W
MDLUF007BE..N0I	21.5W	.....	..... W
MDLUF014BE..N0I	21.5W	.....	..... W
MDLUF021BE..N0I	21.5W	.....	..... W
MDLUF050BE..N0I	28.5W	.....	..... W
MDLUF075BE..N0I	35W	.....	..... W
MDLUF014DE..N0I	33W	.....	..... W
NUM sensor P, Q, J, K (for each sensor)	1W	.....	..... W
NUM sensor I, L, 3, 4, Y, Z (for each sensor)	1.5W	.....	..... W
For each supplementary not NUM sensor, check the power required	...W	.....	..... W
NUM-SAMX (for each module)	1.5W	.....	..... W
Second sensor board P7, P8 (for each board)	1.5W	.....	..... W
Total AUX power consumption			 W

MDLL3 Auxiliary power supply "Rated power" (see chapter 4) > 1.05 x Total AUX. power consumption.

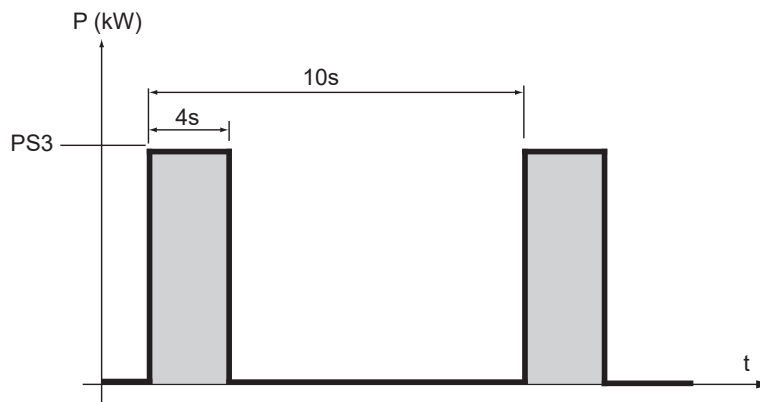
In case the rule above is NOT respected one or more MDLQ3001N00 module, which supply supplementary 250W, must be used!



NUM DrivePro drives operated outside of this range could be seriously damaged.

8.5 MDLL3 power supply admissible duty cycle

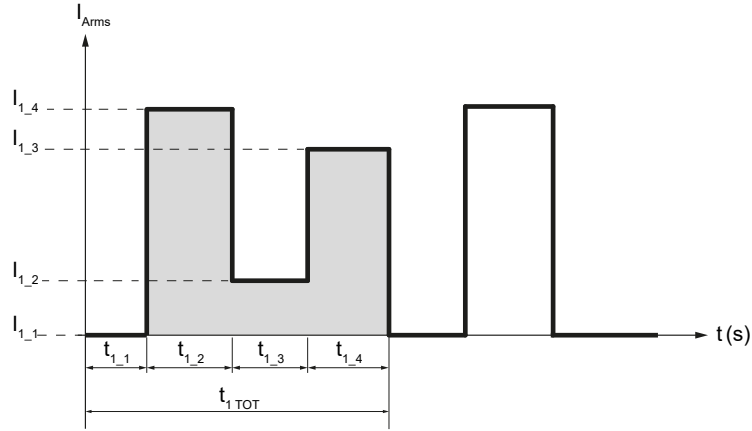
8.5.1 S3-Repetitive overload starting from zero to power max Ps



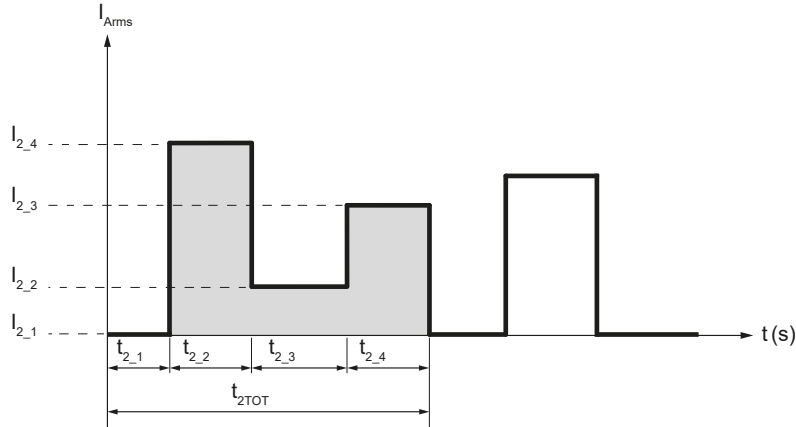
For a correct system dimensioning we always suggest you to check with particular attention the overload dimensioning.

8.6 Bi-Axes and Quad-Axes admissible duty cycle

Axis1 cycle



Axis2 cycle



The Bi-Axes admissible duty cycle is expressed in the following formula:

$$\sqrt{\left(\frac{\sum I_{1_}^2 * t_{1_}}{\sum t_{1_TOT}} + \frac{\sum I_{2_}^2 * t_{2_}}{\sum t_{2_TOT}} \right) / 2} \leq I_{nom} \quad \text{(Drive axis rated current)}$$

Moreover $t_{1_}$ and $t_{2_}$ must be $< 2s$ whenever the drive maximum current (I_{max}) is required.

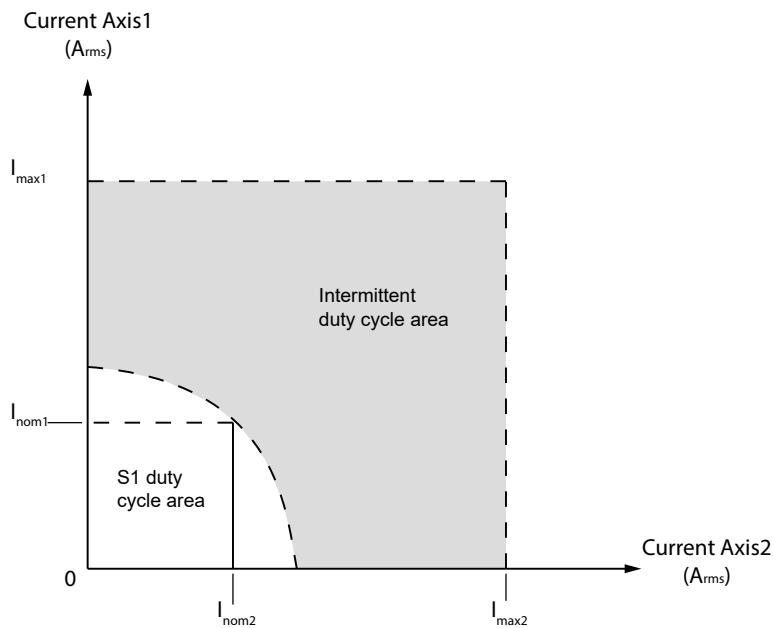


The Quad-Axes drive has to be intended as 2 Bi-axes drive module (Axis1+Axis2 and Axis3+Axis4). So the above example is applicable to each couple of axes of the Quad-Axes drive.

8.6.1 Bi-Axes and Quad-Axes rated current useful area

The diagram below determines the drive useful area of a Bi-Axes drive or the useful area for each couple of axis (Axis1+Axis2 or Axis3+Axis4) of a Quad-Axes drive.

The equivalent continuous currents of the axes are dependant one each other and they cannot exceed the S1 area. See also the formula to verify the feasibility of the association.



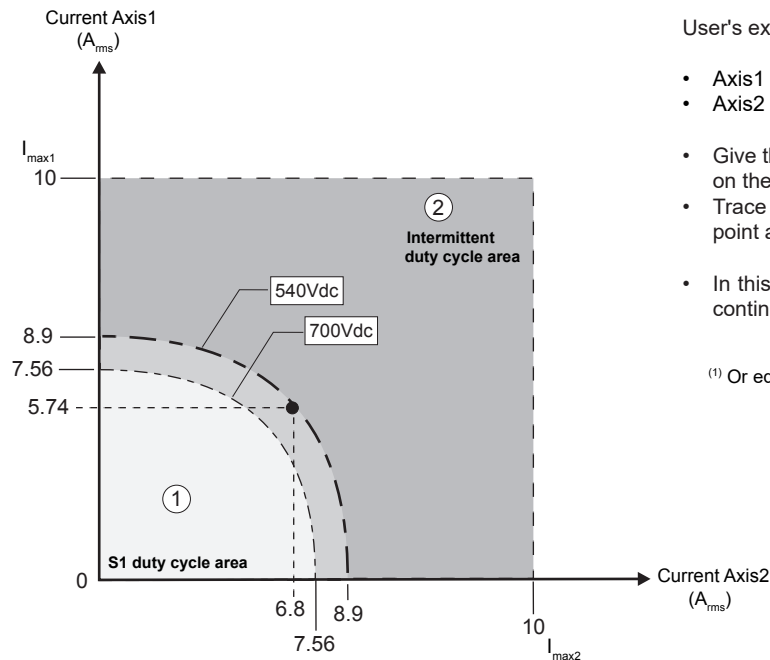
$$\sqrt{\text{Current Axis1}^2 + \text{Current Axis2}^2} \leq \sqrt{2 * I_{\text{nom}}}$$



Moreover, for a correct application of the admissible duty cycle example please check the drive derating due to DC Bus Voltage, environmental, temperature and altitude condition as indicated on chapter [2](#).

8.6.2 Rated current useful area - User's example with MDLUF014B... 5kHz

Permitted application

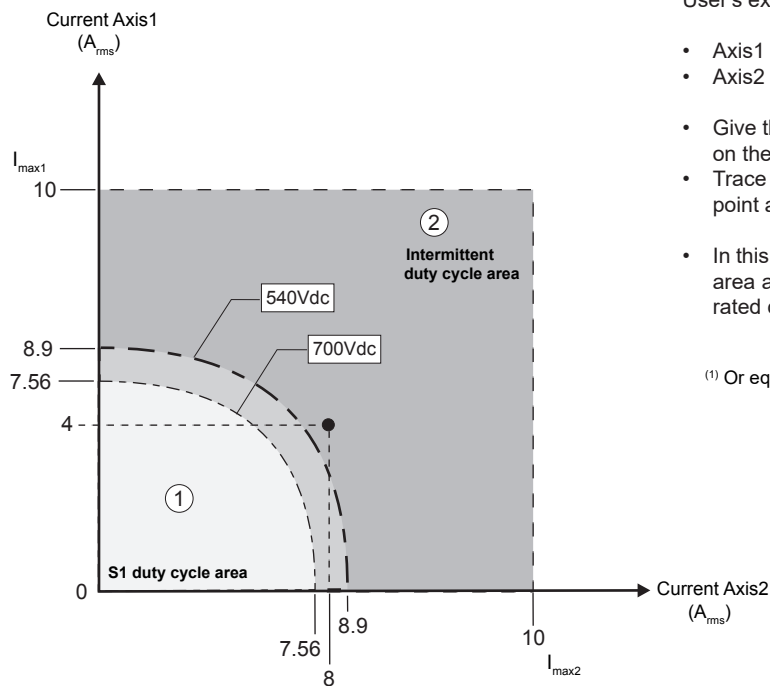


User's example.

- Axis1 current ⁽¹⁾ = 5.74A
- Axis2 current ⁽¹⁾ = 6.8A.
- Give these current values and record them on the diagram.
- Trace the lines to determine the working point area as shown in the diagram.
- In this case the Axis1 and Axis2 can work continuously in the S1 duty cycle area.

⁽¹⁾ Or equivalent S1 current.

Not permitted application



User's example.

- Axis1 current ⁽¹⁾ = 4A
- Axis2 current ⁽¹⁾ = 8A.
- Give these current values and record them on the diagram.
- Trace the lines to determine the working point area as shown in the diagram.
- In this case the Axis1 and Axis2 exceed S1 area and they cannot work continuously at rated current. (Thermal protection)

⁽¹⁾ Or equivalent S1 current.

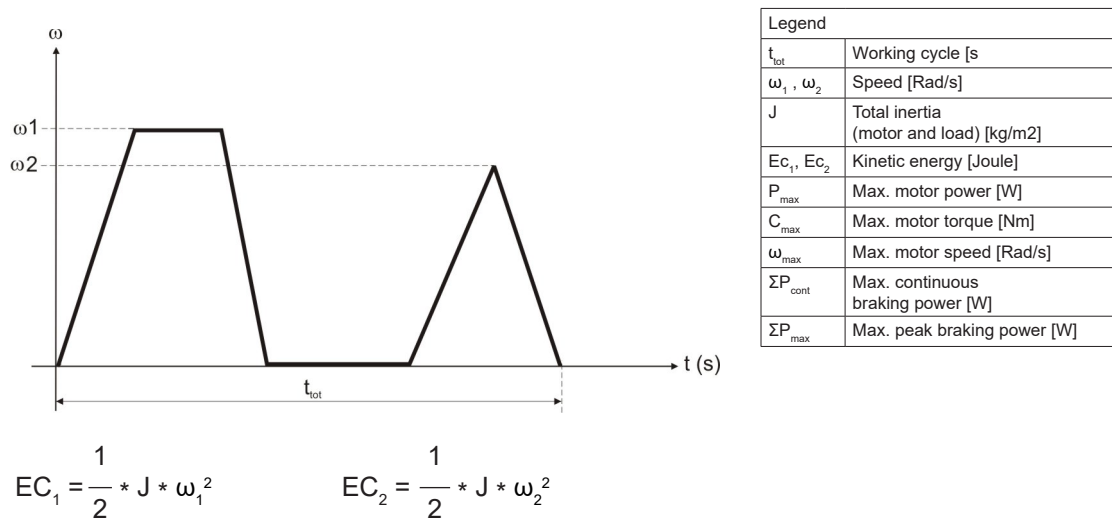
8.7 MDLL3 external braking resistor dimensioning

For a correct dimensioning of the continuous braking power always take the worst case duty cycle into account, and if required by the duty cycle may be necessary to equip the system with more than one external resistors in order to increase the continuous dispersible power.

One braking resistor AGORES008, AGORES009 or AGORES010 must always be provide in the system. For further more detailed information upon the external braking resistors technical characteristics, installation and wiring please refer to the [10.7](#)

8.7.1 Continuous and maximum braking power

Continuous braking power



$$P_{cont} = \frac{EC_1 + EC_2}{t_{tot}} \quad (1) \quad \Sigma P_{cont} = P_{cont1} + P_{cont2} + P_{cont...} \quad (2)$$

Maximum braking power

$$P_{max} = C_{max} * \omega_{max} \quad \Sigma P_{max} = P_{max1} + P_{max2} + P_{max...}$$



- (1) P_{cont} is the continuous braking power requested by the working cycle of each axis of the machine. To determine the maximum continuous braking power (ΣP_{cont}) requested by the machine, add the continuous braking power of each machine axis working simultaneously.
- (2) P_{max} is the peak braking power requested by the working cycle of each axis of the machine. To determine the maximum peak braking power (ΣP_{max}) requested by the machine, add the peak braking power of each machine axis working simultaneously.

In both cases, taking always into consideration the simultaneous factor of the whole axes working in the machine.

Attention: ΣP_{cont} and ΣP_{max} values must not be greater than the maximum continuous and peak braking power as indicated on the MDLL3.

Please refer to chapter [4.1](#).

8.8 MDLL3 transformer and autotransformer dimensioning

As regards a dimension dedicated to the application department, it is possible to calculate the transformer or autotransformer power, keeping into consideration the power dimension of the power supply mentioned in the chapter 8.2 of the manual and multiplying it by the power resulting from the following coefficients:

- $P_{ALIM}^{DC} * 1.6$

Transformers and autotransformers nominal power dimensioning	
MDLL3 power supply	Power [kVA]
MDLL3005M...	8
MDLL3015N...	24
MDLL3025N...	40
MDLL3030N...	48
MDLL3050N...	80
MDLL3120N...	192



U_{cc} of transformer and autotransformer must be $\leq 3\%$.
(U_{cc} = Short-circuit voltage % of the mains).

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1

2

3

4

5

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7

8

9

10

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Summary

9	Installation and Operational Testing	145
9.1	Modules overall dimensions	145
9.1.1	MDLL3 Power supply - size 2 - 100mm - overall dimensions.....	145
9.1.2	MDLL3 Power supply - size 4 - 200mm - overall dimensions.....	146
9.1.3	MDLL3 Power supply - size 4 - 200mm - with metal plate dimensions	147
9.1.4	MDLL3 Power supply - size 6 - 300mm - overall dimensions.....	148
9.1.5	MDLQ3 Auxiliary Power Supply - size 1 - 50mm - overall dimensions	149
9.1.6	MDLUF NUMDrive - size 1 - 50mm - overall dimensions.....	150
9.1.7	MDLUF NUMDrive - size 2 - 100mm - overall dimensions.....	151
9.1.8	MDLUF NUMDrive - size 2 - 100mm - overall dimensions.....	152
9.1.9	MDLUF NUMDrive - size 3 - 150mm - overall dimensions.....	153
9.1.10	MDLUF NUMDrive - size 4 - 200mm - overall dimensions.....	154
9.1.11	MDLUF NUMDrive - size 4 - 200mm - with metal plate dimensions	155
9.1.12	MDLUF NUMDrive - size 6 - 300mm - overall dimensions.....	156
9.1.13	MDLC3 Capacitor module - size 2 - 100 mm - overall dimensions	157
9.2	Electrical cabinet requirements	158
9.3	Assembly the modules in electrical cabinet.....	159
9.3.1	Assembly MDLL3 and NUM DrivePro modules size 1, 2, 3, 4 in electrical cabinet	159
9.3.2	Assembly MDLL3 or MDLUF size 6 and module fan in electrical cabinet	160
9.3.3	Assembly MDLL3 or MDLUF size 6 metal plate in electrical cabinet.....	161
9.4	Cabinet requirements.....	162
9.4.1	PDS mains connection (distribution TN, TT systems)	162
9.4.2	Use of differential protection devices.....	163
9.5	MDLL3 power supplies connections and configurations	164
9.5.1	General power supplies connections diagram	164
9.5.1.1	MDLL3015N00AN0I, 3030N00AN0I and MDLQ3001N00 connections diagram	164
9.5.1.2	MDLL3050N00AN0I, 3120N00AN0I connections diagram.....	165
9.5.1.3	MDLL3025N00R/H, 3050N00R/H, 3120N00R/H and MDLQ3001N00 connections diagram.....	166
9.5.1.4	MDLL3005M00AN0I 230V Power supply connections diagram	167
9.5.2	MDLL3 connections.....	168
9.5.2.1	MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I connections	168
9.5.2.2	MDLL3025N00R/H..., 3050N00A/R/H... connections.....	169
9.5.2.3	MDLL3120N00A/R/H... connections	170
9.5.2.4	MDLL3120N00A/R/HN0I mounting the mains terminal insulated cover	171
9.5.3	MDLL3 configuration.....	172
9.5.3.1	MDLL3015N00AN0I, 3030N00AN0I configurations.....	172
9.5.3.2	MDLL3...N00HN0I DC Bus voltage configuration	173
9.5.3.3	MDLL3050N00AN0I, 3120N00AN0I, ...N00RN0I configuration	174
9.5.4	MDLL3 J5 and S12 connections.....	175
9.5.5	MDLUF S12 connections	176
9.5.6	MDLL3 to MDLUF digital bus connections	177
9.5.7	MDLL3 and NUM DrivePro module / module DC Bus connections	178
9.5.8	J1 pin-out connector connections	179
9.5.8.1	J1 pin-out for MDLL3005M00AN0I.....	179
9.5.8.2	J1 pin-out for MDLL3015N00AN0I, 3030N00AN0I	180
9.5.8.3	J1 pin-out for MDLL3025N00R/H..., 3050N00R/H..., 3120N00R/H...	181
9.5.8.4	J1 pin-out for MDLL3050N00AN0I, 3120N00AN0I	182
9.5.8.5	J1 pin-out for MDLQ3001N00	183
9.6	NUM-STOX module connections	184

9.6.1	S8, S9 connector with NUM-STOX module connections	184
9.6.2	NUM-STOX module connections with RJ45 adapter AEOADA011.....	185
9.6.3	NUM-STOX multi-drive connections example diagram.....	186
9.6.4	E-STOP CAT-0 connections	187
9.6.4.1	E-STOP CAT-0 with Mono-Axis and NUM-STOX module	187
9.6.4.2	E-STOP CAT-0 with Bi-Axes and NUM-STOX module	188
9.6.4.3	E-STOP CAT-0 with separated axes on Bi-Axes and NUM-STOX module	189
9.6.4.4	E-STOP CAT-0 sequential diagram with NUM-STOX module	190
9.6.5	E-STOP CAT-1 connections	191
9.6.5.1	E-STOP CAT-1 with Mono-Axis and NUM-STOX module.....	191
9.6.5.2	E-STOP CAT-1 sequential diagram with NUM-STOX module	192
9.7	NUM-SAMX Safety certified module connections	193
9.7.1	S8, S9 connector for NUM-SAMX Safety connections	193
9.8	P1, P2, P3, P4 sensor connections	194
9.8.1	Connector pin-out for motor sensor	194
9.9	P5, P6, P7, P8 sensor connections	195
9.9.1	Connector pin-out for motor and/or direct measure sensor	195
9.9.2	Encoder P, Q, J, K, A, B, connections for BHX, BPX, BPH, BPG, BHL and IM18MK14 motors	196
9.9.3	Standard Hiperface encoder connections	197
9.9.4	LENORD&BAUER GEL244K sinusoidal toothed wheel sensor	198
9.9.5	Standard encoder 1Vpp connections.....	199
9.9.6	TTL incremental encoder sensor connections	200
9.9.7	Incremental encoder signals (optical scale) and HALL effect sensor.....	201
9.9.8	HEIDENHAIN type ENDAT 2.1 or 2.2 with incremental signals connections.....	202
9.9.9	HEIDENHAIN type ENDAT 2.2 without incremental signals connections.....	203
9.9.10	BiSS Resolute Renishaw encoder connections	204
9.9.11	BiSS C Fagor encoder connections	205
9.9.12	Magnescale encoder connections.....	206
9.9.13	Encoder P, Q connections for AMS100, 132, 160 spindle motors	207
9.10	Vibration detector VDR (accelerometer).....	208
9.11	Wiring the sensor and thermal probe connectors	210
9.11.1	Mounting SC007SH00 cable onto sensor connector AMOCON002D motor side	210
9.11.2	Mounting SC007SH00 cable onto sensor connector AEOCON012 drive side	211
9.11.3	NUM sensor and thermal probe cable assemblies.....	212
9.11.3.1	SC007SH20Mxxxx	212
9.11.3.2	SC007SH10Mxxxx.....	212
9.12	Tandem connections and Torque Duplication	213
9.12.1	Hardware requirement and limitation.....	213
9.12.2	Torque Duplication with 2 Mono-Axis drives	214
9.12.3	Torque Duplication with more then 2 Mono-Axis drives.....	215
9.13	S7 - Programmable input / outputs	216
9.14	S10, S13 Motors brake connections	217
9.14.1	S10 - Motors brake connections module MDLUF007, 014, 021, 034	217
9.14.2	S10 - Motors brake control connections module MDLUF050, 075A	218
9.14.3	S10 - Motors brake control connections module MDLUF100A, 150A, 075B.....	219
9.14.3.1	General application example for Mono-Axis and Bi-Axes	219
9.14.3.2	Application example using drive command	220
9.14.4	S10 - Motors brake control connections module MDLUF100A, 150A, 075B.....	221
9.14.4.1	Safety I/O connections example for Mono-Axis and Bi-Axes	221
9.14.5	S13 - Motors brake control connections module MDLUF200A, 400A.....	222
9.14.6	Brake voltage definition and tolerance.....	223
9.15	Motors power connections.....	224
9.15.1	Motor connections with module MDLUF007, 014, 021, 034	224
9.15.2	Motor connections with module MDLUF050, 075A	225
9.15.3	Motor connections with module MDLUF014D	226
9.15.4	Motor connections with module MDLUF075B, 100A.....	227
9.15.5	Motor connections with module MDLUF150A	228
9.15.6	Motor connections with module MDLUF200A	229

9.15.7	Motor connections with module MDLUF400A	230
9.15.8	MDLUF400A mounting the motor terminal insulated cover	231
9.15.9	BHX, BPX, BPH, BPG motors connections	232
9.15.9.1	Connections with MDLUF007, 014, 021, 034 modules	232
9.15.9.2	Connections with MDLUF050, 075, 100A modules	233
9.15.9.3	Connections with MDLUF150A modules	234
9.15.9.4	Connections with MDLUF200A, 400A modules	235
9.15.9.5	Motor connectors rotation procedure	236
9.15.10	SHX, SPX motors connections	237
9.15.10.1	Connections with MDLUF007, 014, 021, 034 modules	237
9.15.10.2	Connections with MDLUF050, 075 modules	238
9.15.10.3	SHX, SPX motor connector rotation procedure	239
9.16	BHL260 motors connections	240
9.16.1	BHL260 motors connections with ventilation version	240
9.16.2	Motor terminal box connections	240
9.16.3	BHL260 fan connection	241
9.16.4	BHL260 without ventilation connections	242
9.17	TMX motors connections	243
9.17.1	Motor connector AEOCON018	243
9.17.2	Motor connector AEOCON013	244
9.18	AMS spindle motors connections	245
9.18.1	AMS100, 132 motors connections with MDLUF050, 075, 150A	245
9.18.2	AMS100, 132 motors connections with MDLUF200A	246
9.18.3	AMS160MA, LA, motors connections (Y/Δ) and MDLUF150A	247
9.18.4	AMS160MC, LC motors connections with MDLUF200A	248
9.18.5	AMS160MA, MB, LA, LB motors connections (Y/Δ) and MDLUF200A	249
9.19	IM18MK14 spindle motor connections	250
9.20	Wiring the drive side motor power connector	251
9.20.1	Wiring the drive side motor power connector AEOCON018 with PC... cable	251
9.20.2	Wiring the drive side motor power connector AEOCON013 with PC... cable	252
9.20.3	Wiring the drive side motor power connector AEOCON015 with PC... cable	253
9.21	Wiring the drive side motor / brake power and sensor cable connectors	254
9.21.1	AEOCON018 and AEOCON019 connectors with PX007 and PX015 cables	254
9.21.2	AEOCON013 and AEOCON019 connectors with PX007 and PX015 cables	256
9.21.3	Polarization key configuration of the drive side motor power connector	258
9.22	Wiring the motor side power and brake connector	259
9.22.1	Wiring the motor side power and brake connector AMOCON004D with PC... cable	259
9.22.2	Wiring the motor side power and brake connector AMOCON005D with PC... cable	260
9.22.3	Wiring the motor side power and brake connector AMOCON006D with PX... cable	261
9.22.4	Wiring the shielding over the metal cable gland BMHQPRE	262
9.22.5	NUM power and brake cable assemblies	263
9.22.5.1	PC015Bx40Mxxxx , PC040Bx40Mxxxx , PC100Bx50Mxxxx	263
9.22.5.2	PC015Nx40Mxxxx , PC040Nx40Mxxxx , PC100Nx50Mxxxx	263
9.22.5.3	PX007BH60Mxxxx, PX015BH60Mxxxx	264
9.23	Motor thermal protection	265
9.24	Motor holding brake	266
9.24.1	Technical brake characteristics	267
9.25	MDLUF Control Unit replacement	268

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9 Installation and Operational Testing

9.1 Modules overall dimensions

9.1.1 MDLL3 Power supply - size 2 - 100mm - overall dimensions

MDLL3 modules:

MDLL3015N00AN0I

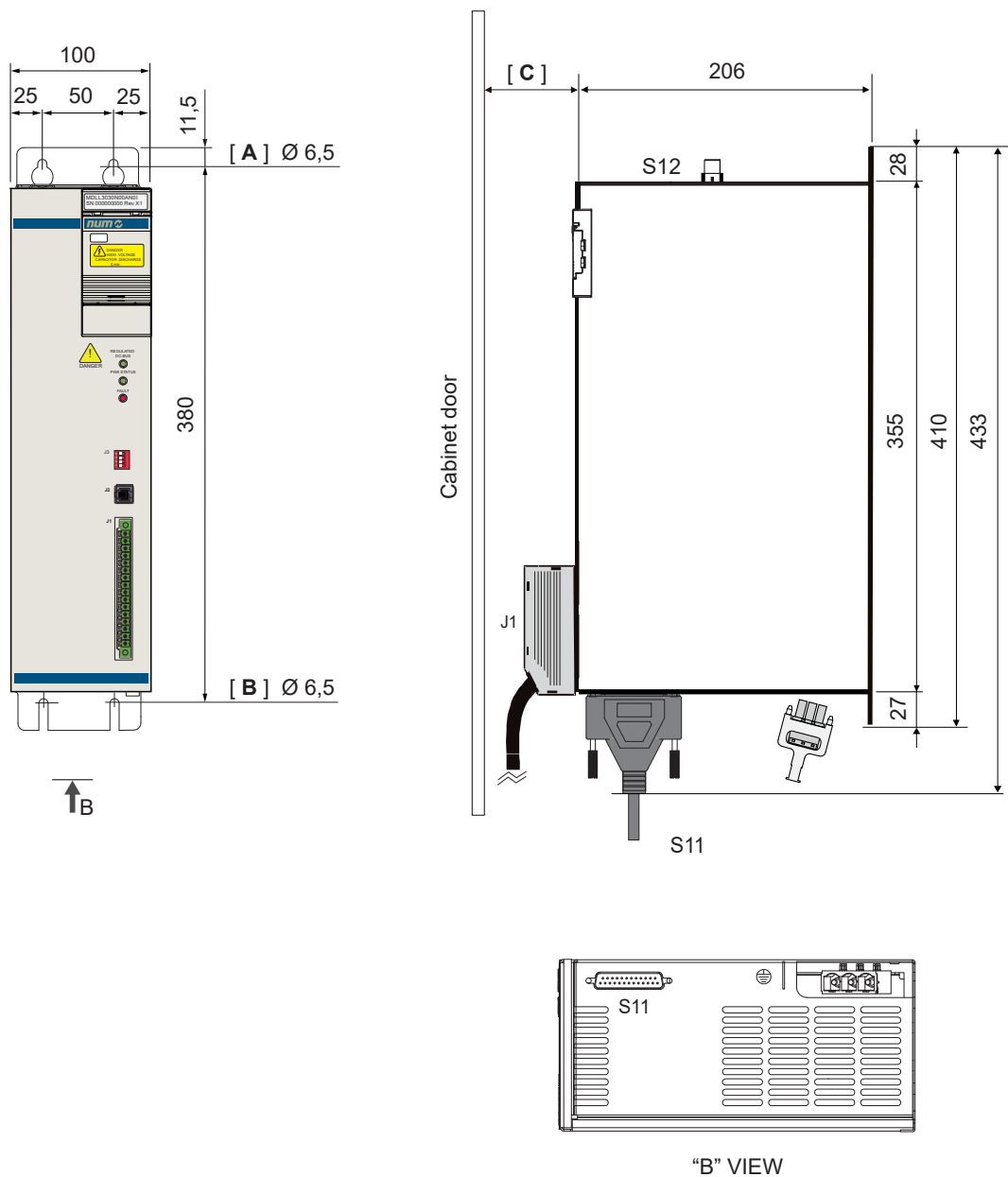
MDLL3030N00AN0I

MDLL3005M00AN0I

Dimensions in millimeters

[A] [B] See module fixing point on chapter 9.3.1

[C] Minimum distance 75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.2 MDLL3 Power supply - size 4 - 200mm - overall dimensions

MDLL3 modules:

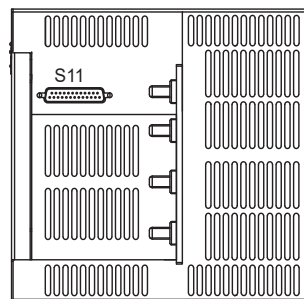
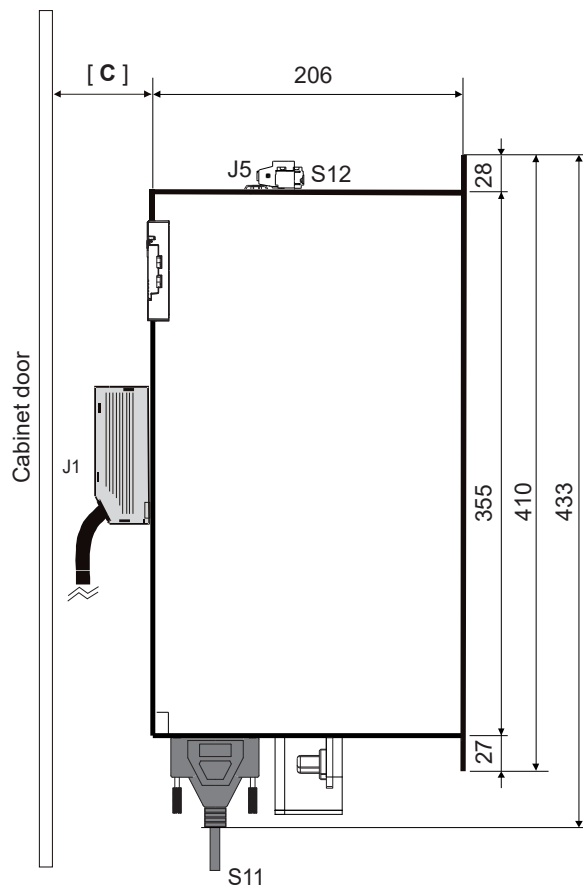
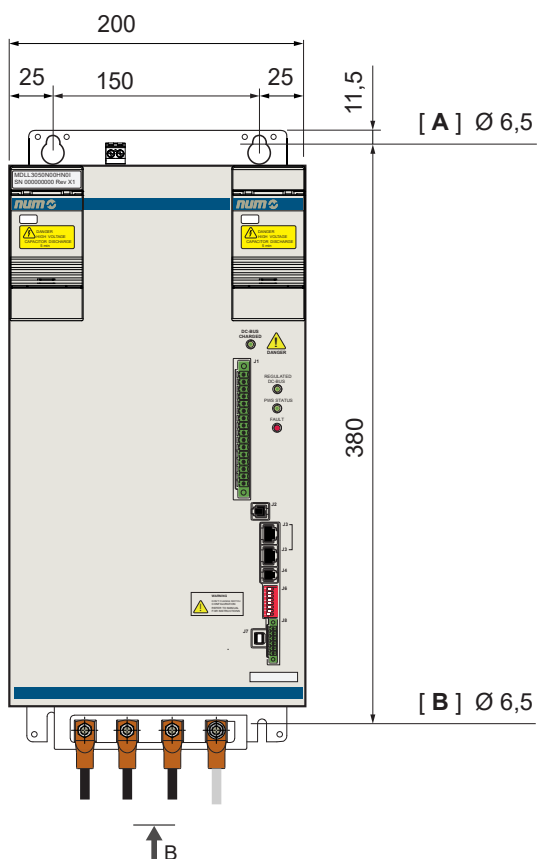
MDLL3025N00HN0I
MDLL3025N00RN0I

MDLL3050N00AN0I
MDLL3050N00HN0I
MDLL3050N00RN0I

Dimensions in millimeters

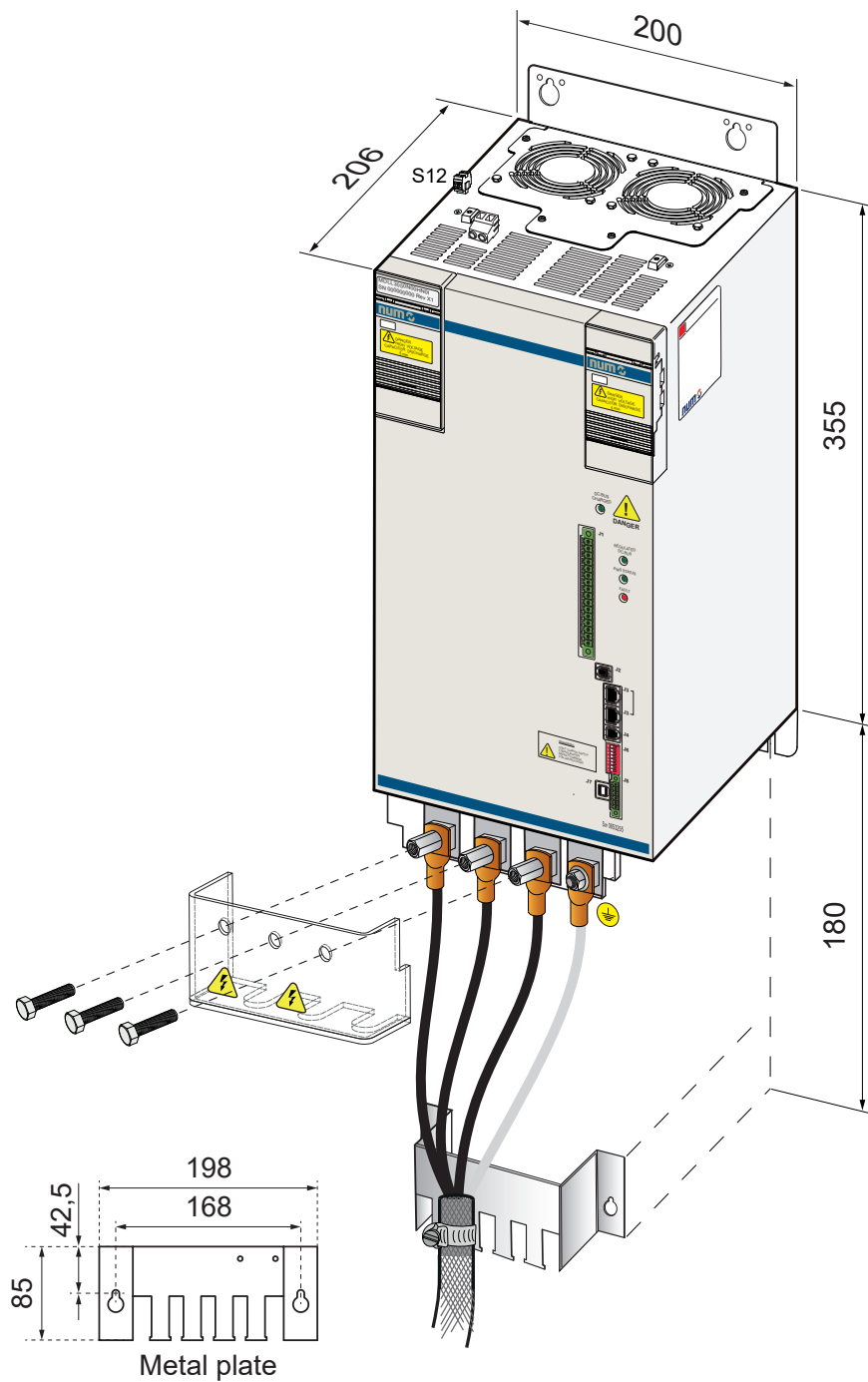
[A] [B] See module fixing point on chapter 9.3.1

[C] Minimum distance 75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



"B" VIEW

9.1.3 MDLL3 Power supply - size 4 - 200mm - with metal plate dimensions



[A] [B] See module fixing point on chapter [9.3.1](#)

Dimensions in millimeters

9.1.4 MDLL3 Power supply - size 6 - 300mm - overall dimensions

MDLL3 modules:

MDLL3120N00AN0I

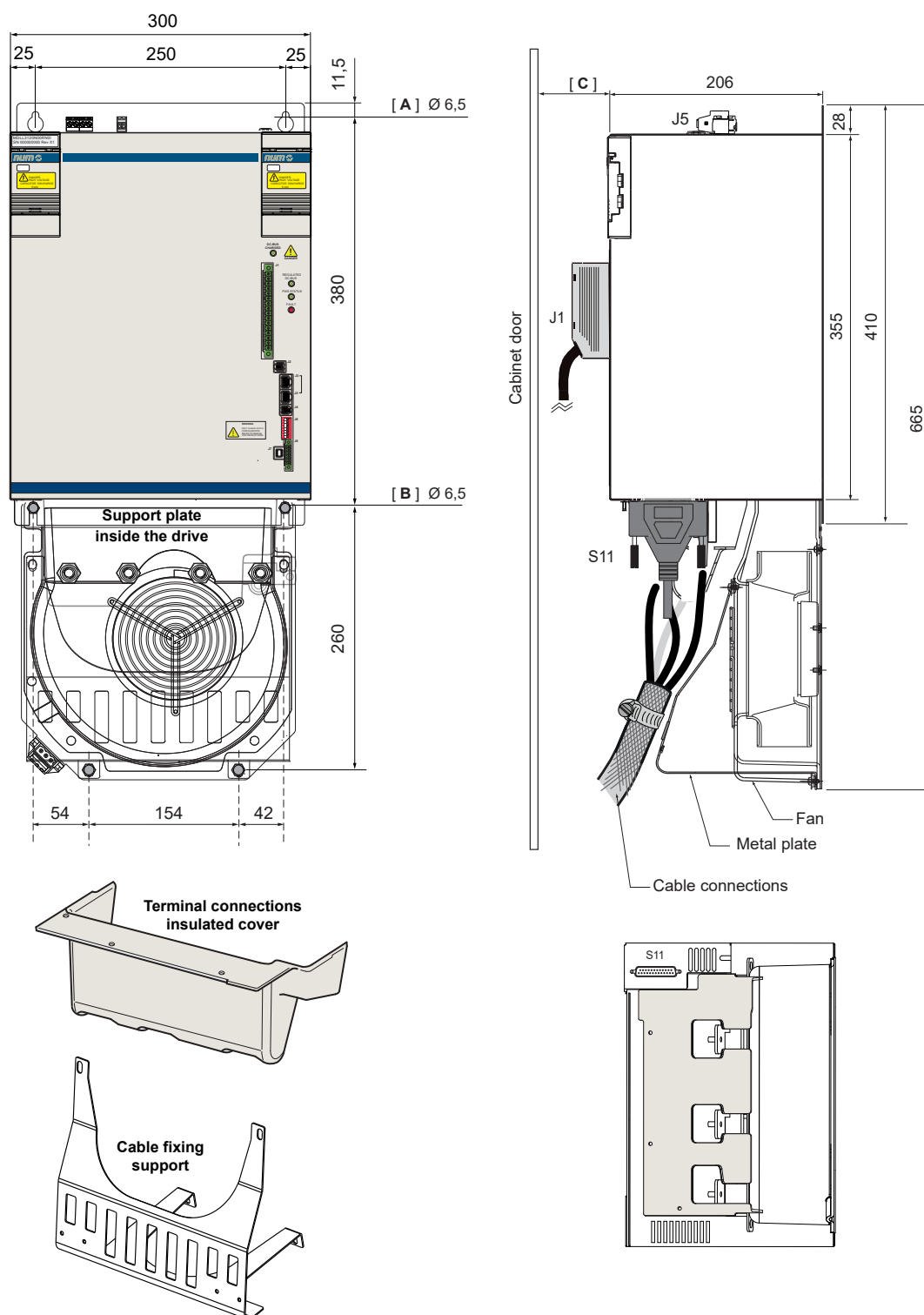
MDLL3120N00RN0I

MDLL3120N00HN0I

Dimensions in millimeters

[A][B] See module fixing point on chapter [9.3.1](#)

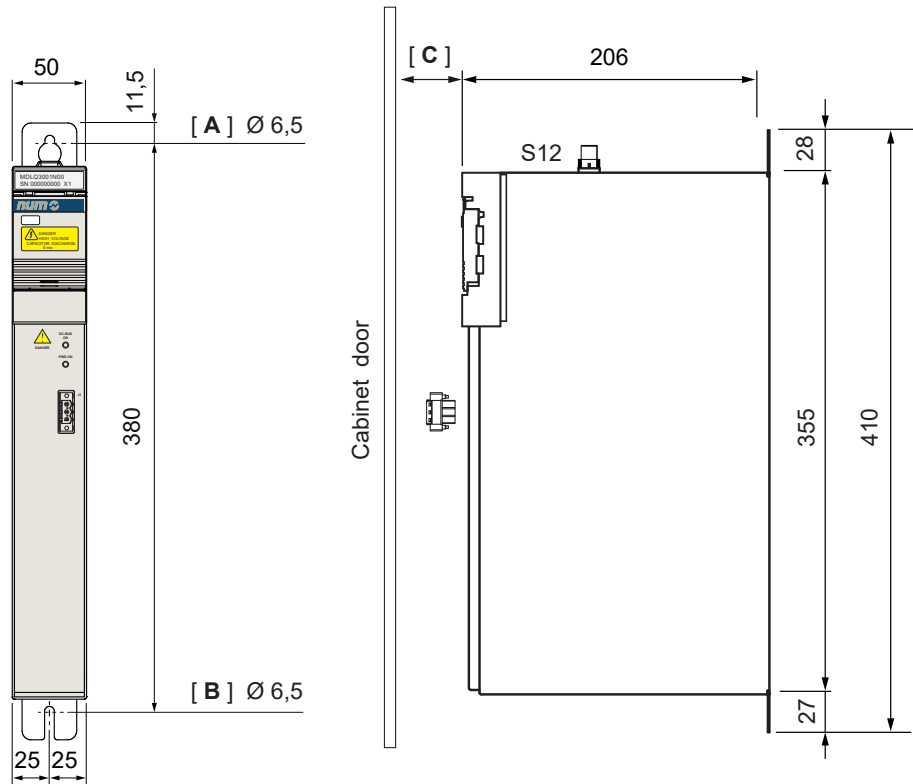
[C] Minimum distance 75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.5 MDLQ3 Auxiliary Power Supply - size 1 - 50mm - overall dimensions

MDLQ3 module:
MDLQ3001N00

Dimensions in millimeters
[A] [B] See module fixing point on chapter 9.3.1
[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.6 MDLUF NUMDrive - size 1 - 50mm - overall dimensions

MDLUF modules:

Mono-Axis

MDLUF007AxxxN01
MDLUF014AxxxN01
MDLUF021AxxxN01
MDLUF034AxxxN01

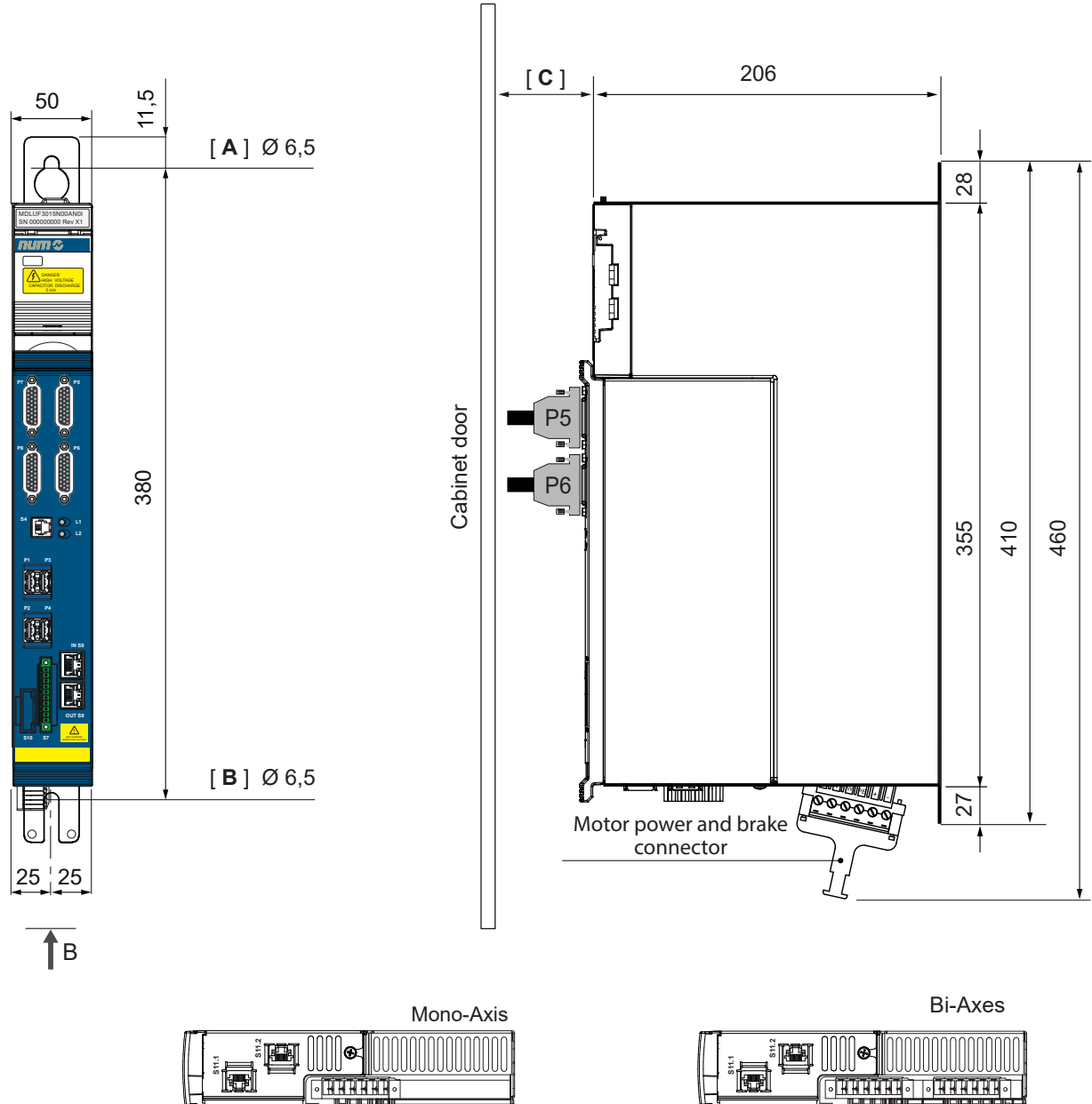
Bi-Axes:

MDLUF007BxxxN01
MDLUF014BxxxN01
MDLUF021BxxxN01

Dimensions in millimeters

[A] [B] See module fixing point on chapter 9.3.1

[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.7 MDLUF NUMDrive - size 2 - 100mm - overall dimensions

MDLUF modules:

Mono-Axis

MDLUF050AxxxN0I
MDLUF075AxxxN0I

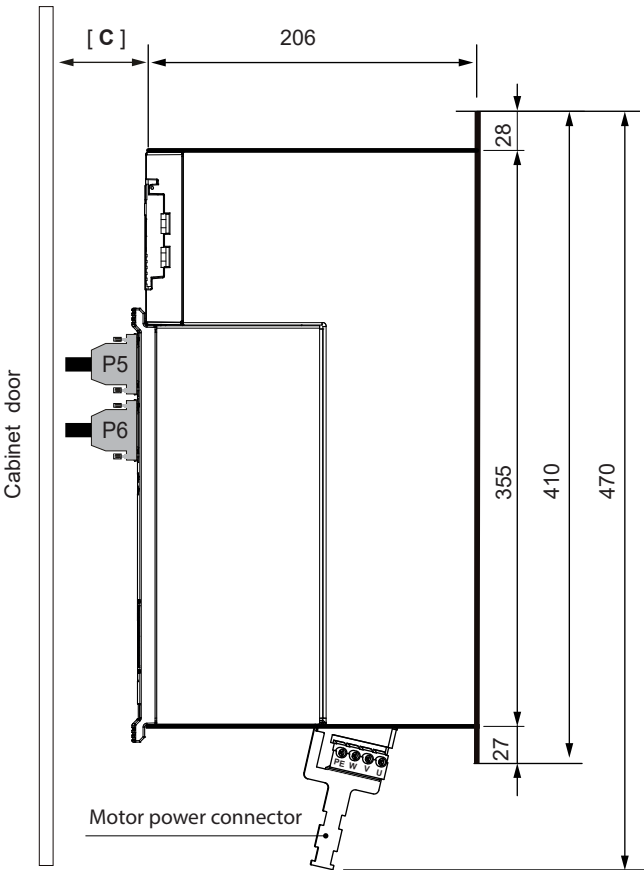
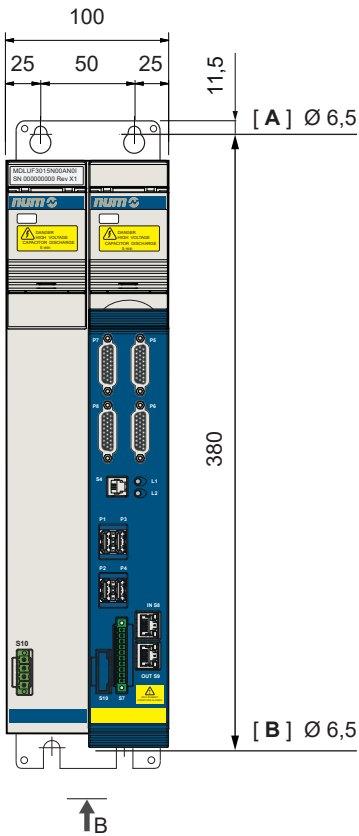
Bi-Axes:

MDLUF050BxxxN0I

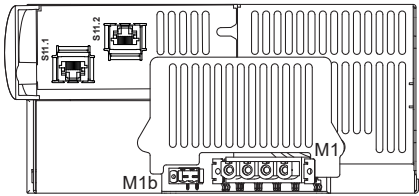
Dimensions in millimeters

[A] [B] See module fixing point on chapter 9.3.1

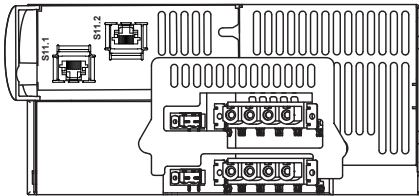
[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



Mono-Axis



Bi-Axes



"B" VIEW

9.1.8 MDLUF NUMDrive - size 2 - 100mm - overall dimensions

MDLUF module:

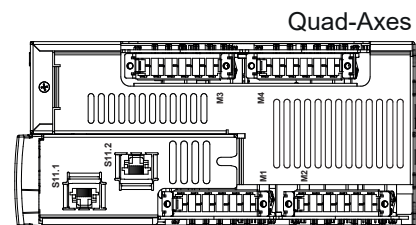
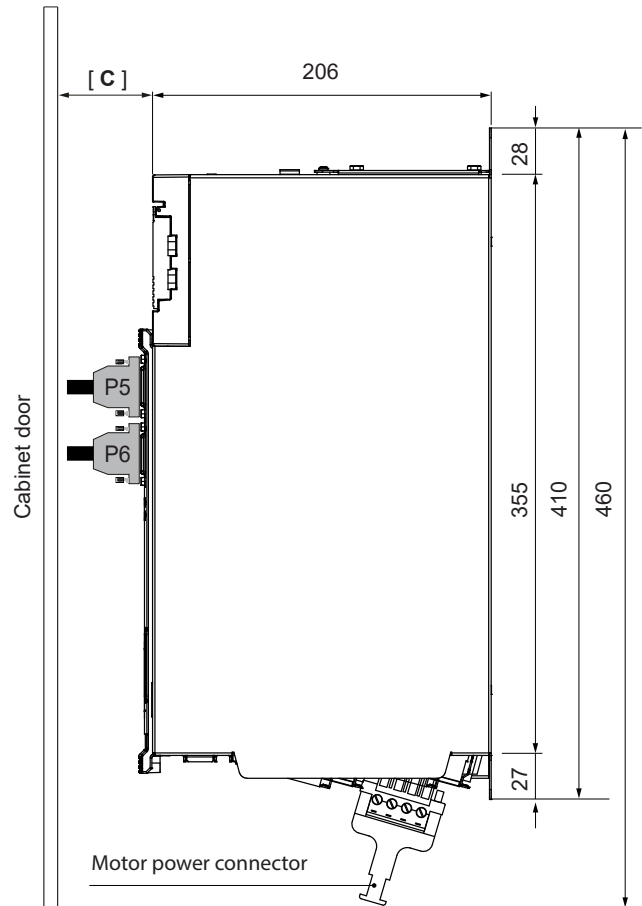
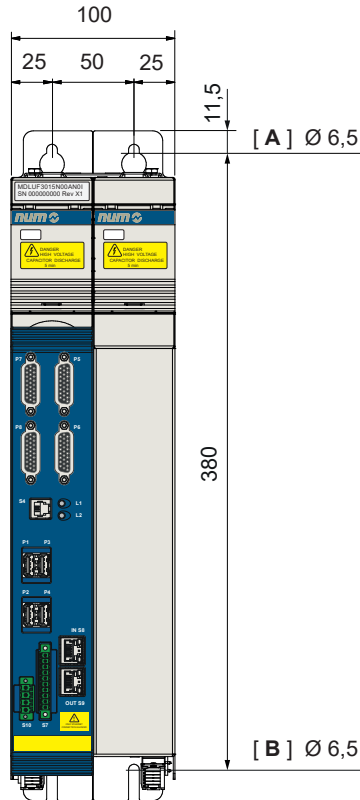
Quad-Axes

MDLUF014DxxxN01

Dimensions in millimeters

[A] [B] See module fixing point on chapter [9.3.1](#)

[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.9 MDLUF NUMDrive - size 3 - 150mm - overall dimensions

MDLUF modules:

Mono-Axis

MDLUF100AxxxN0I
MDLUF150AxxxN0I

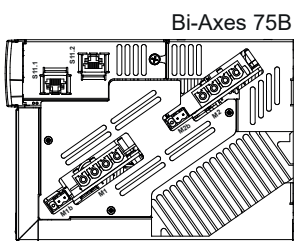
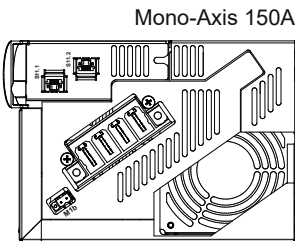
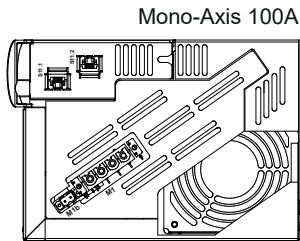
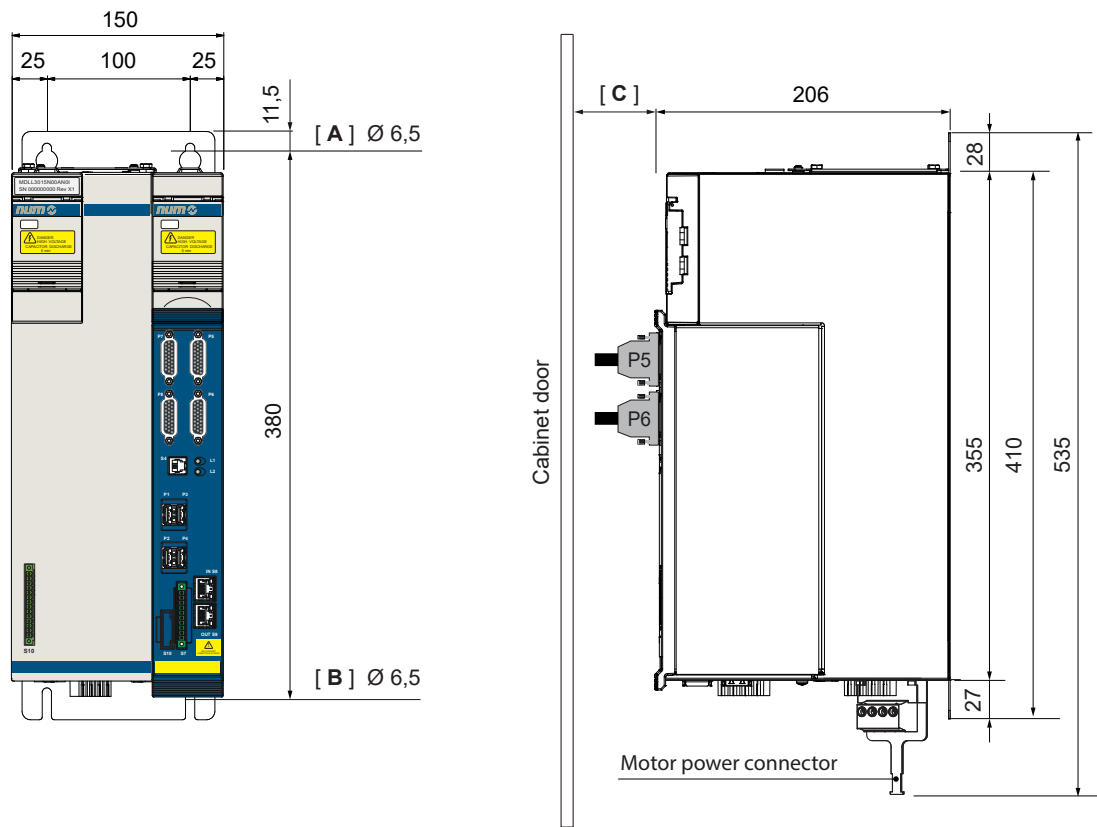
Bi-Axes:

MDLUF075BxxxN0I

Dimensions in millimeters

[A] [B] See module fixing point on chapter 9.3.1

[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.10 MDLUF NUMDrive - size 4 - 200mm - overall dimensions

MDLUF module:

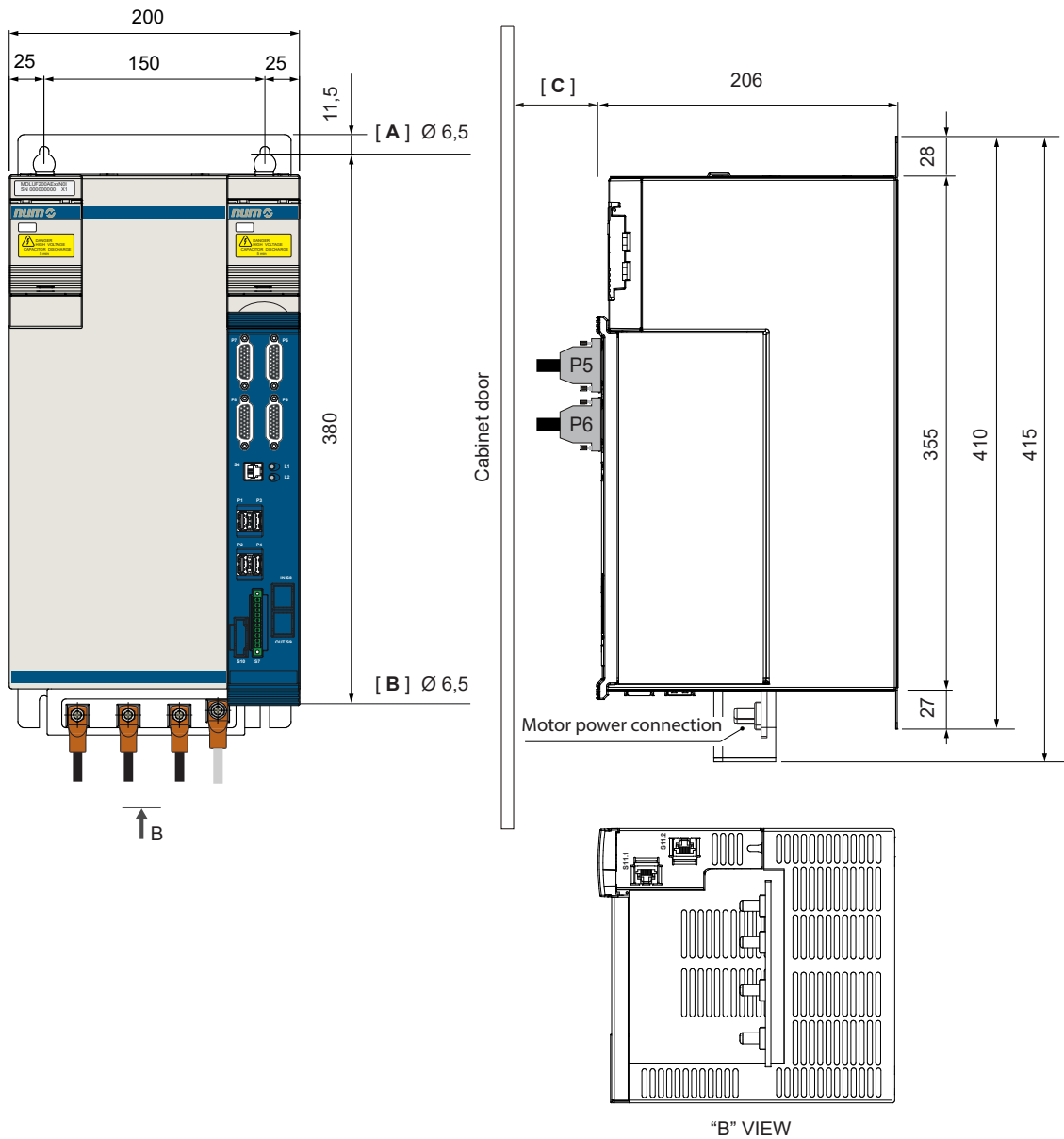
Mono-Axis

MDLUF200AxxxN01

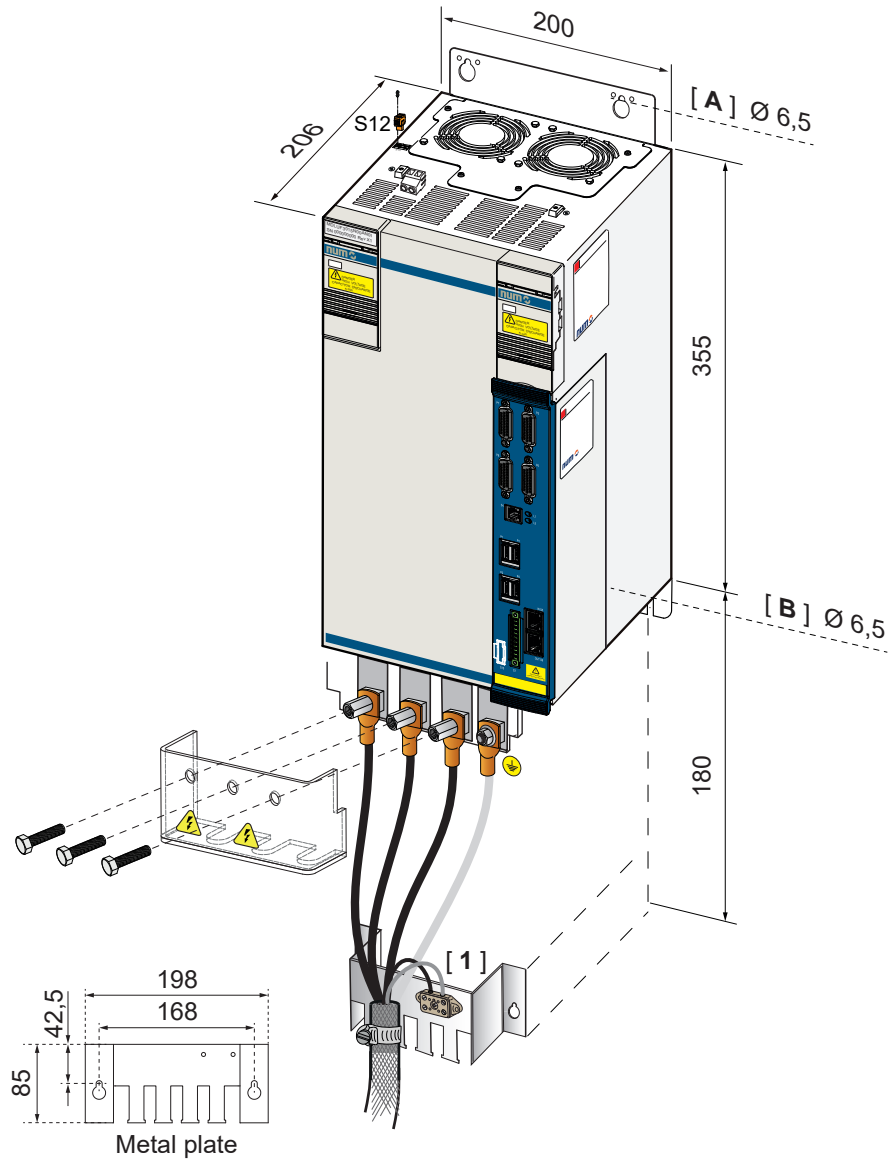
Dimensions in millimeters

[A] [B] See module fixing point on chapter [9.3.1](#)

[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.11 MDLUF NUMDrive - size 4 - 200mm - with metal plate dimensions



[A] [B] See module fixing point on chapter [9.3.1](#)

Dimensions in millimeters

[1] Motor brake connections (S13)

9.1.12 MDLUF NUMDrive - size 6 - 300mm - overall dimensions

MDLUF module:

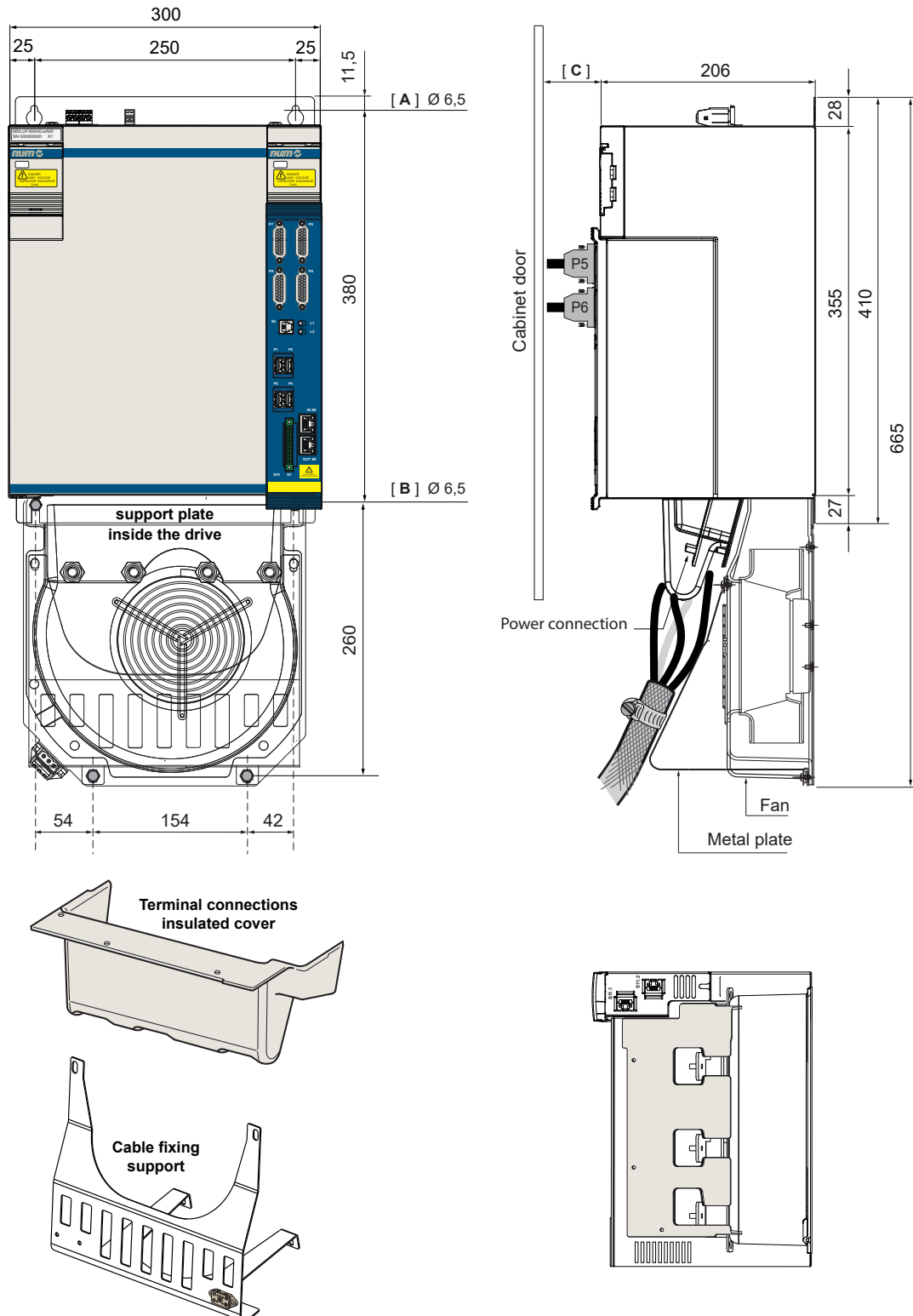
Mono-Axis

MDLUF400AxxxN01

Dimensions in millimeters

[A] [B] See module fixing point on chapter [9.3.1](#)

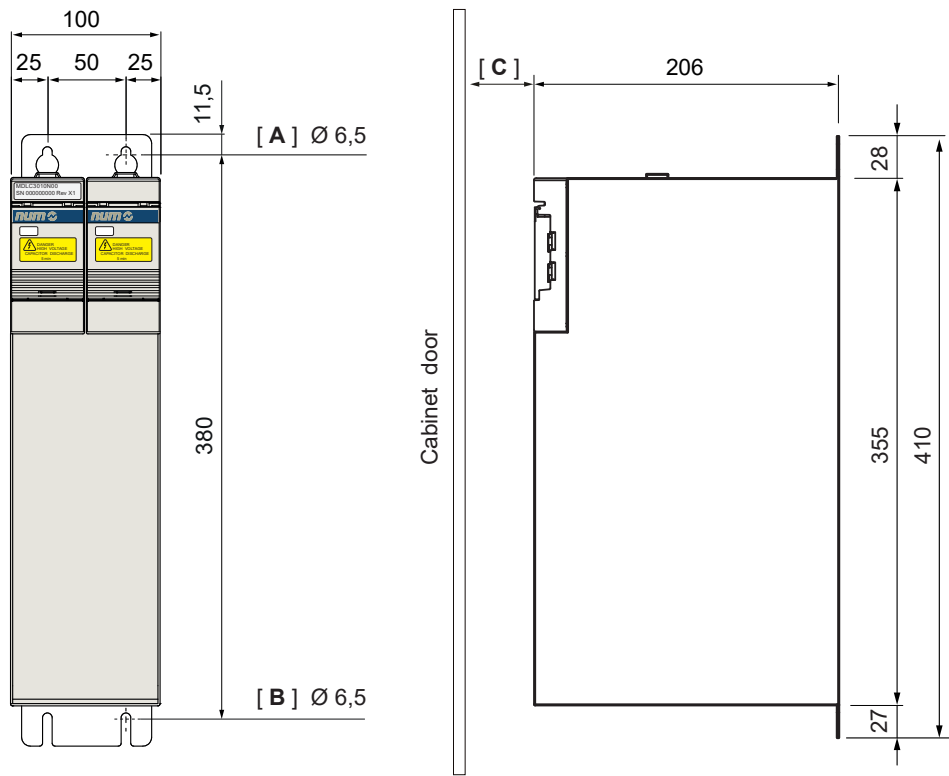
[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.



9.1.13 MDLC3 Capacitor module - size 2 - 100 mm - overall dimensions

MDLC3 module:
MDLC3010N00

Dimensions in millimeters
[A] [B] See module fixing point on chapter 9.3.1
[C] Minimum distance >75 mm During the modules installation in the electrical cabinet always take into consideration the cable + connector depth.

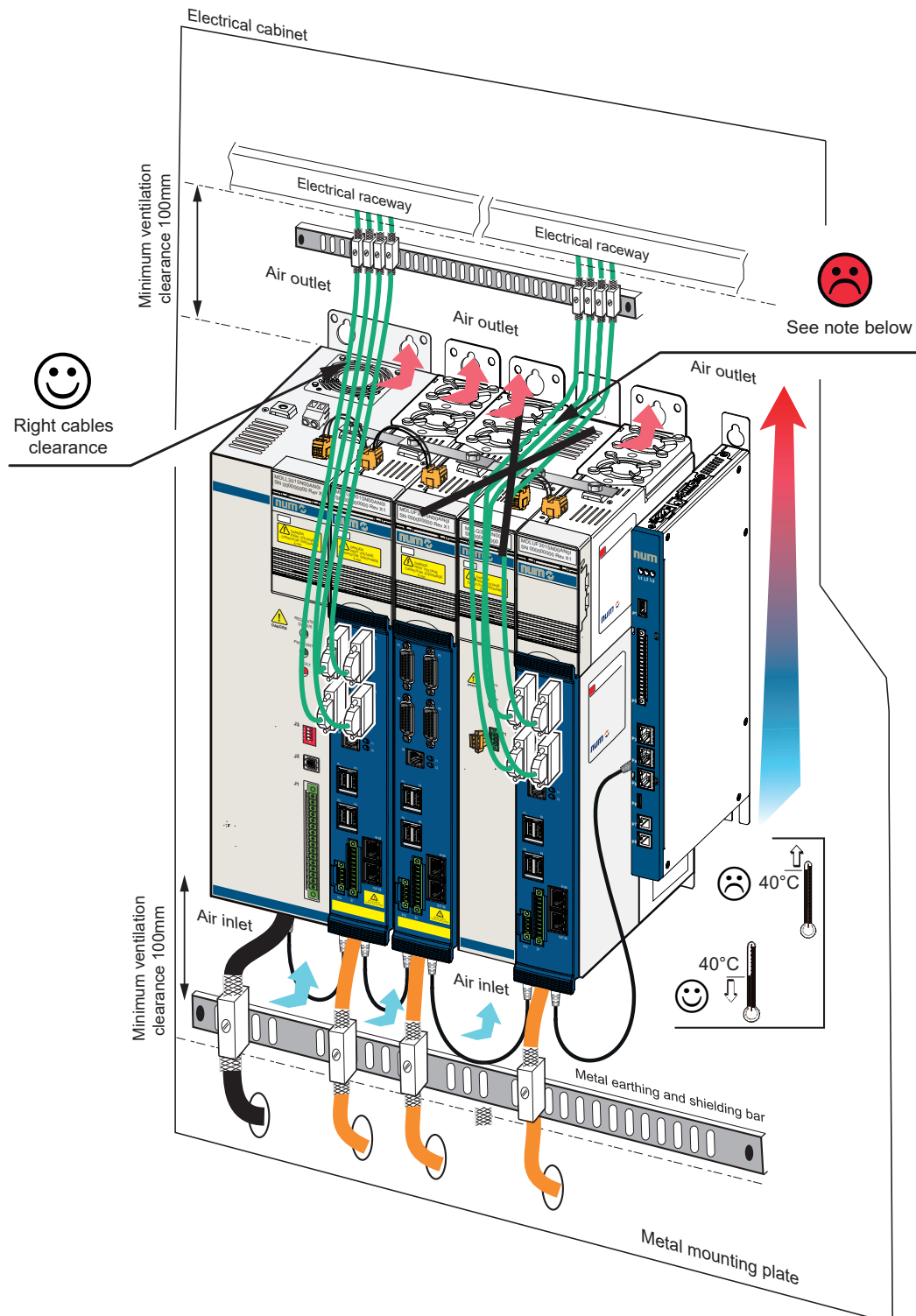


9.2 Electrical cabinet requirements



To facilitate sufficient air circulation and so ensure an adequate heat exchange in the system, it is recommended that a minimum ventilation clearance of 100mm is left at top and bottom side when installing the modules in the electrical cabinet. Do not cover the ventilation grilles with cables or anything else, this may cause the rise temperature inside the drives.

Please also refer to the M00027 manual for more detailed information.

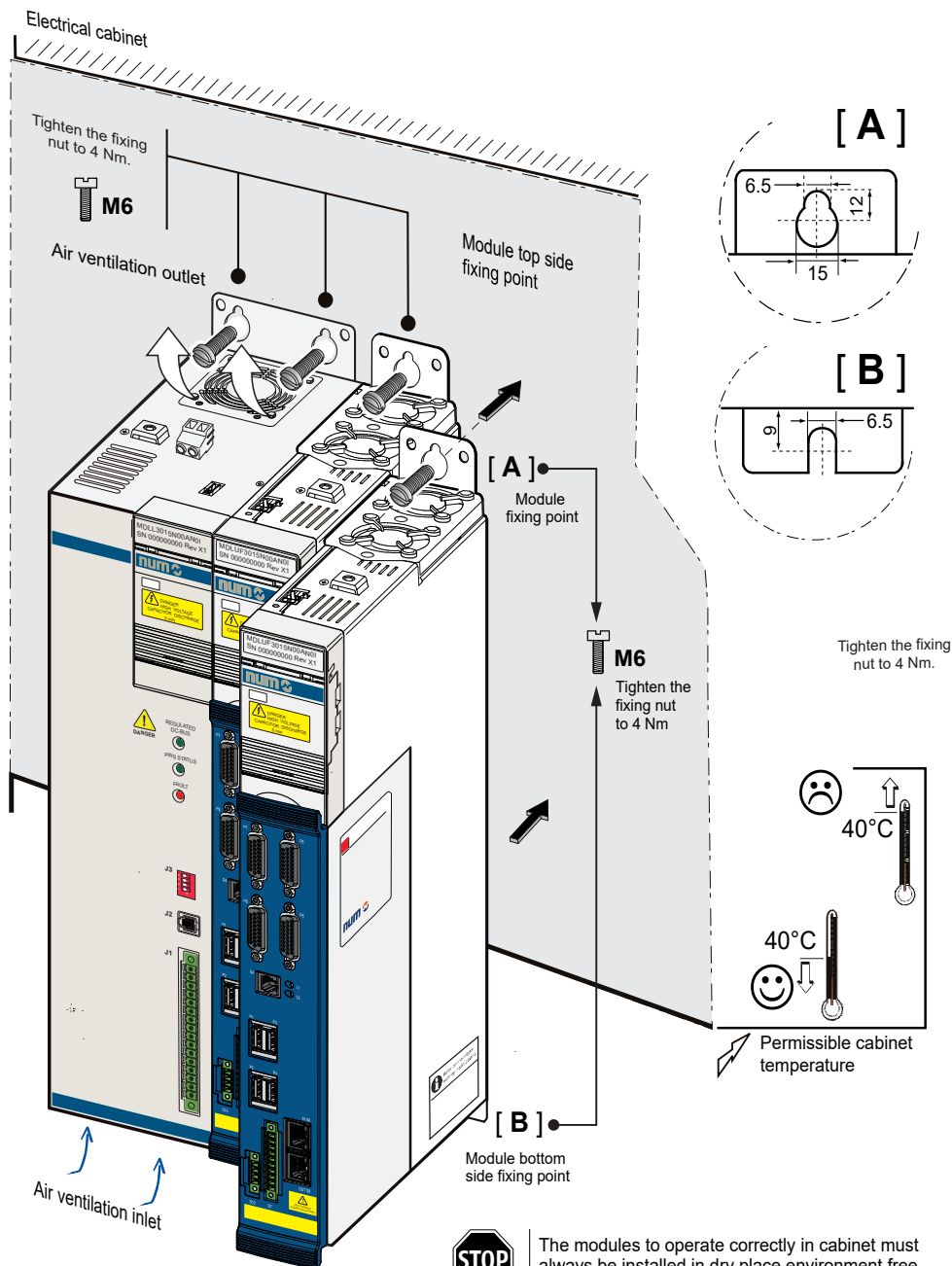


9.3 Assembly the modules in electrical cabinet

9.3.1 Assembly MDLL3 and NUM DrivePro modules size 1, 2, 3, 4 in electrical cabinet



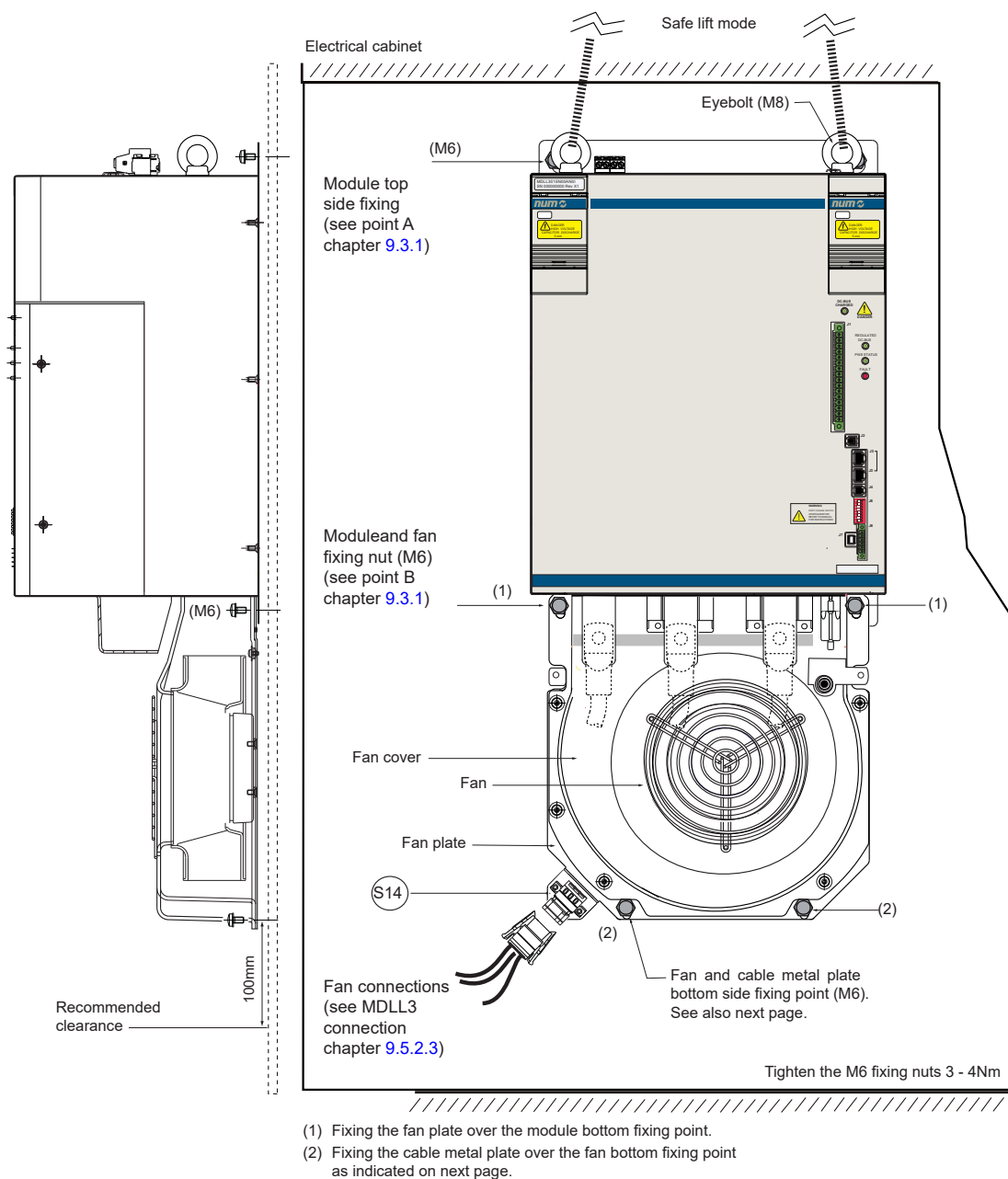
- The modules must be installed in the electrical cabinet using the fixing points as shown in the figure. They must always be mounted vertically.
- The MDLL3 module must always be installed on the left-hand side as shown in the figure and must always be installed in decreasing size order.
- To prevent eventual disturbances on the signals coming from sensors, when you make the wiring layout in the cabinet make sure that the minimum distance between the sensor cables and the power input cables is $\geq 150\text{mm}$.
- For the general installation layout in electrical cabinet please refer to the manual M00027.



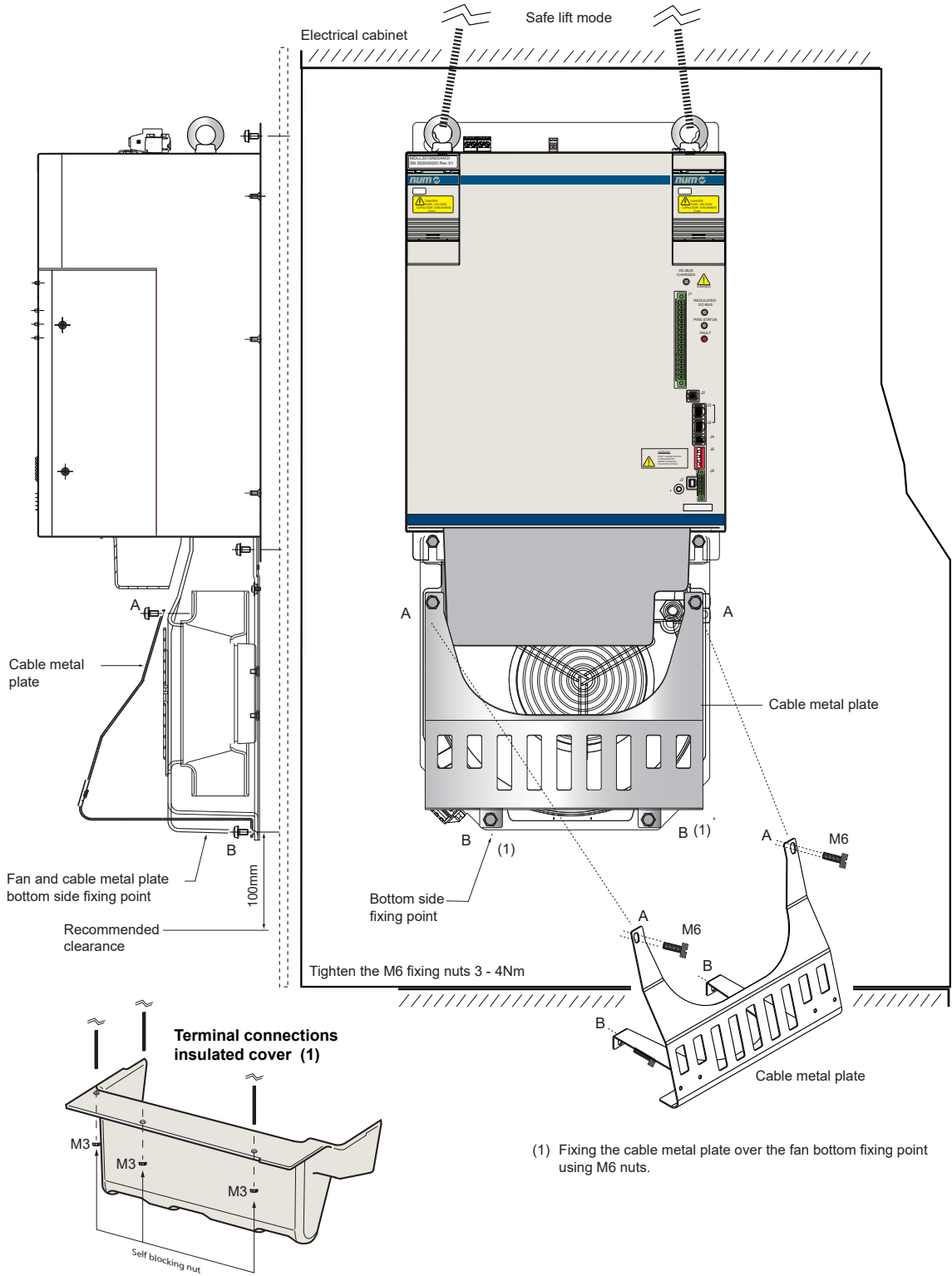
The modules to operate correctly in cabinet must always be installed in dry place environment free of dust and oils at least of IP54 degree protection.



- The modules must be installed in the electrical cabinet using the fixing points as shown in the figure using its own eyebolts to lift it. They must always be mounted vertically.
- The MDLL3 power supply module must always be installed on the left-hand side as shown in the figure and must always be installed in decreasing size order.
- To prevent eventual disturbances on the signals coming from sensors, when you make the wiring layout in the cabinet make sure that the minimum distance between the sensor cables and the power input cables is $\geq 150\text{mm}$.
- For general installation layout in electrical cabinet please refer to the manual M00027.



9.3.3 Assembly MDLL3 or MDLUF size 6 metal plate in electrical cabinet



9.4 Cabinet requirements

9.4.1 PDS mains connection (distribution TN, TT systems)

- NUM drives operate correctly only by distribution systems such as “TN, TT”.
(By saying distribution systems we mean the network to which the drive is connected).
- The possible use of a transformer or of an autotransformer in “TN and TT” systems (see fig. 1) is possible only if the secondary is star connected and the available star point is connected to earth.
- It is not possible to connect the drives directly to “IT” type distribution systems.
- In “IT” type distribution systems (see fig. 2) it is possible to connect NUM drives only by means of a transformer with a secondary having the available star point connected to earth.
- It is not possible to use UPS or other mains regulators system for supplying the mains connections (L1, L2, L3) of the MDLL3...R/H power supply.



The “IT” type distribution systems do not guarantee the correct functioning of line filters.

Fig.1 TN -C, TN -S type and TT type distribution systems

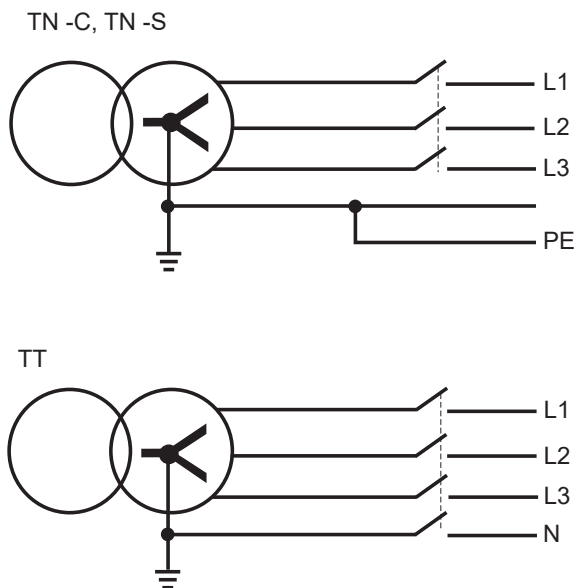
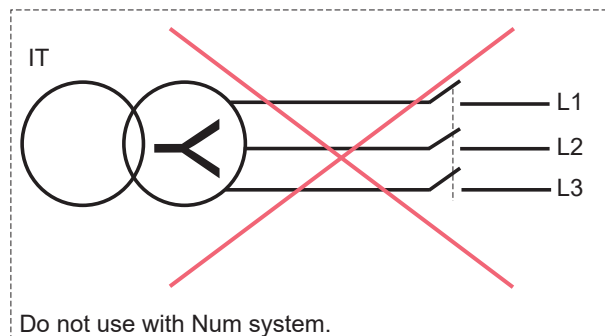


Fig.2 IT



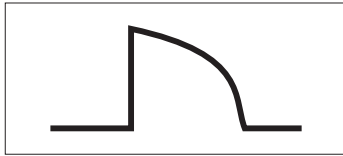
9.4.2 Use of differential protection devices

For the use of differential protective devices must be considered that the Line filter has a high capacitance versus PE, and that during activation of the MAINS-contactor the differential protective devices can be triggered when used without delay.

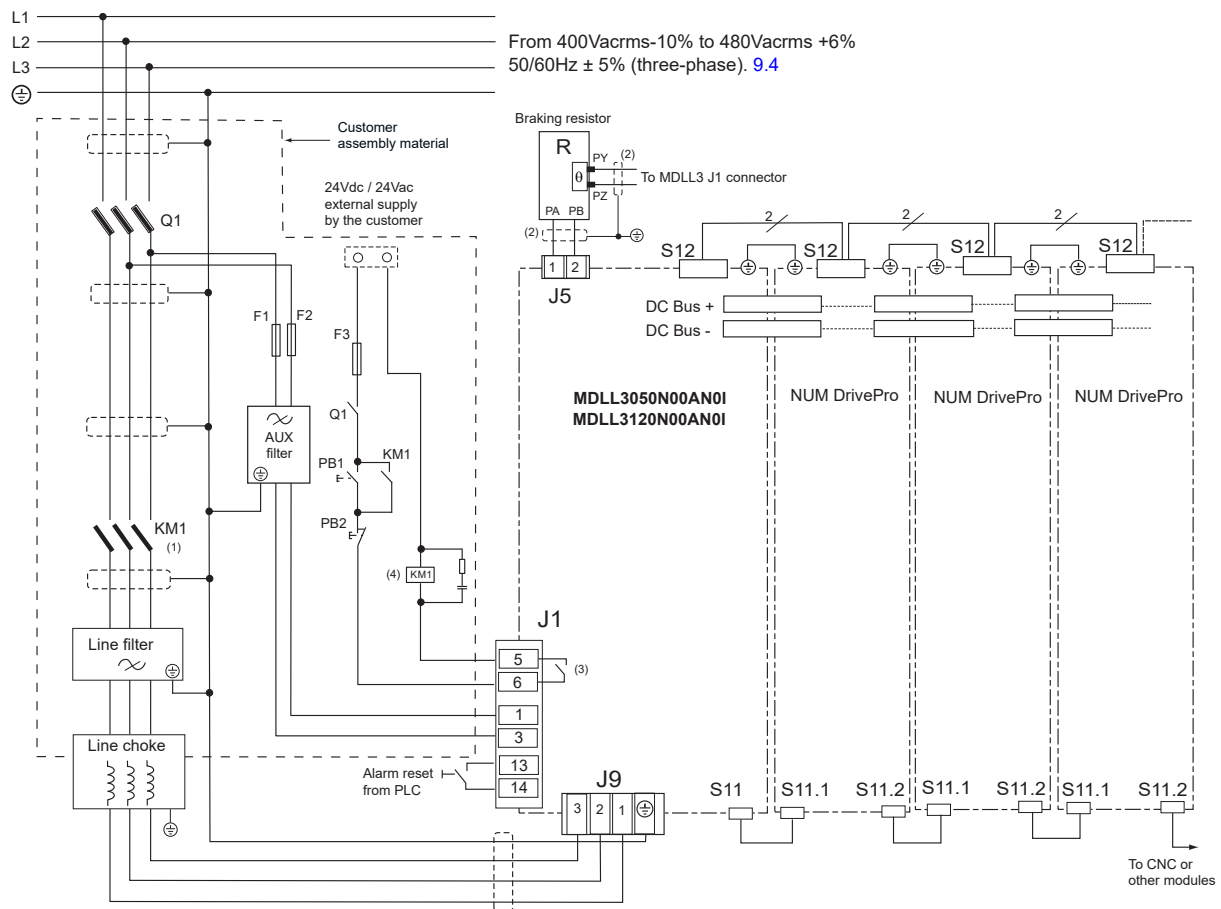
For that reason a idoneous delay to that type of device must be choosen (suggested delay $\leq 50\text{ms}$). It must be also considered that the PDS, when operating may create differential leakage currents, that can be several hundred's of mA.

These leakage currents are locally short cicuited by the Line filter, but it is not possbile to avoid a partial reflow through the mains-input.

In order to avoid untimely interventions it is necessary to use differential devices marked with the symbol below, and with a selectable trigger current (i.e. 30/300/3000mA).



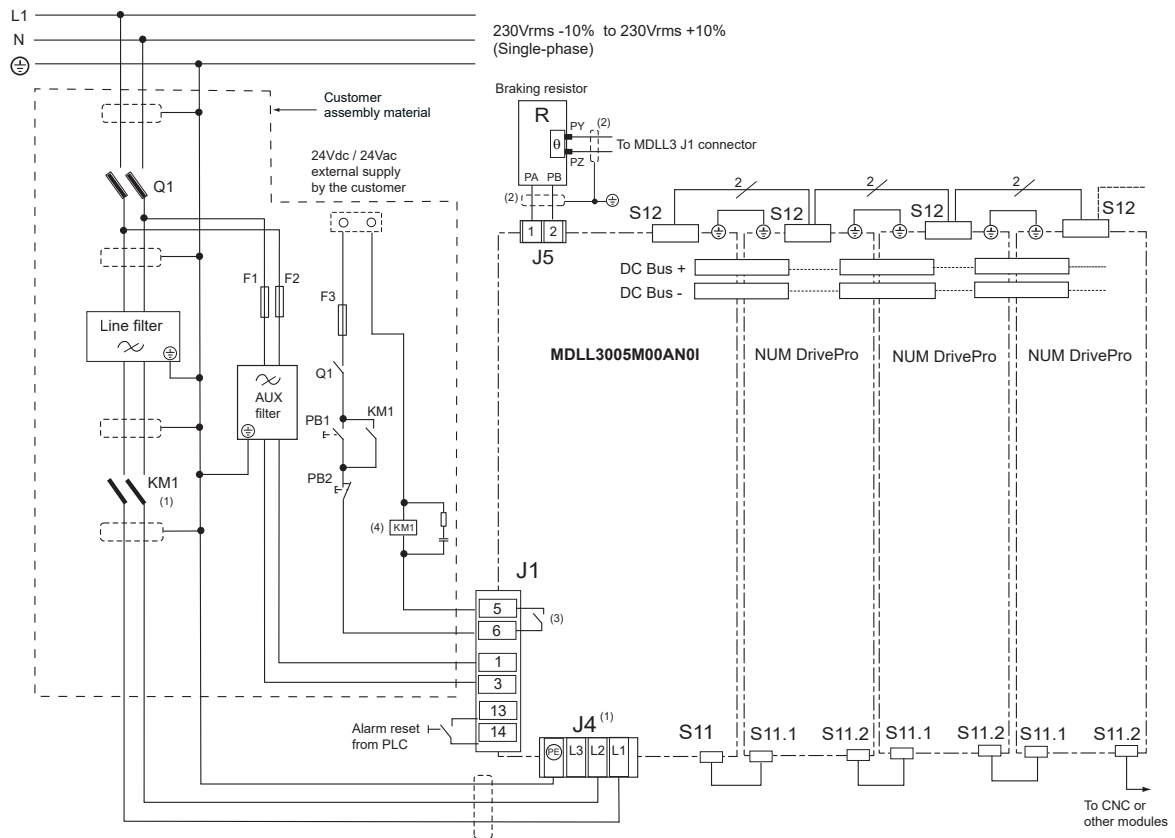
9.5.1.2 MDLL3050N00AN0I, 3120N00AN0I connections diagram



- (1) Provide a KM1 line contactors for each MDLL3xxx power supply module.
- (2) Braking resistor shield supplied by the customer.
- (3) Delays are not allowed upon KM1 (DF1/DF2 command contacts).
- (4) Before KM1 closing a minimum delay of 1s from the previous KM1 opening must be executed. Not to respect such delay may damage the system.

F1, F2	4A/500V protection fuse gL, gG type
F3	6A/250V protection fuse gL, gG type
Q1	Cabinet line disconnecting device with protection fuse: MDLL3050... : 200A/600V protection fuse gL, gG type MDLL3120... : 315A/600V protection fuse gL, gG type
KM1	Line contactor
PB1	Start command push button
PB2	Stop command push button
Line filter	"AGOFIL.... See chapter 10.8 "Mandatory"
AUX filter	AGOFIL001S auxiliary filter. See chapter 10.8.3 The minimum distance between the filter and the motor power cables must be $\geq$ 150mm.
Line choke	AGOIND.... See chapter 10.9
R	AGORES... external braking resistor. See chapter 10.7

9.5.1.4 MDLL3005M00AN0I 230V Power supply connections diagram



- (1) Provide a KM1 line contactor for each MDLL3xxx power supply module.
 (2) Braking resistor shield supplied by the customer.
 (3) Delays are not allowed upon KM1 (DF1/DF2 command contacts).
 (4) Before KM1 closing a minimum delay of 1s from the previous KM1 opening must be executed. Not to respect such delay may damage the system.

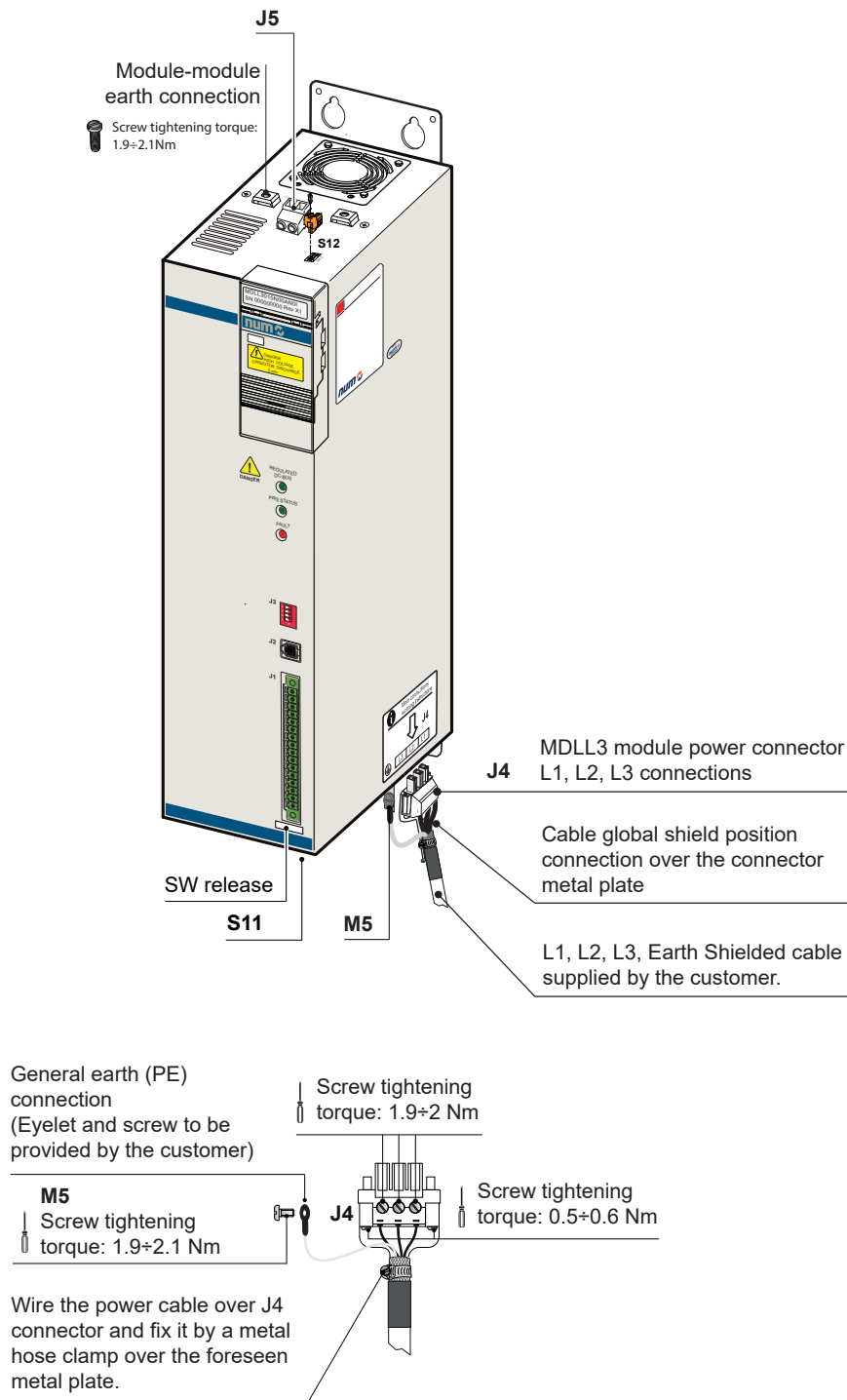
F1, F2	4A/400V protection fuse gL, gG type
F3	6A/250V protection fuse gL, gG type
Q1	63A/400V protection fuse gL, gG type
KM1	Line contactor
PB1	Start command push button
PB2	Stop command push button
Line filter	AGOFIL028 "Mandatory" See chapter 10.8.2
AUX filter	AGOFIL001S auxiliary filter. See chapter 10 The minimum distance between the filter and the motor power cables must be $\geq 150\text{mm}$.
R	AGORES... external braking resistor. See chapter 10.7 Minimum braking resistance value $\geq 17\Omega$.

(1) J4 connections

L1	L1
L2	N
L3	Not connected
PE	Earth screw

9.5.2 MDLL3 connections

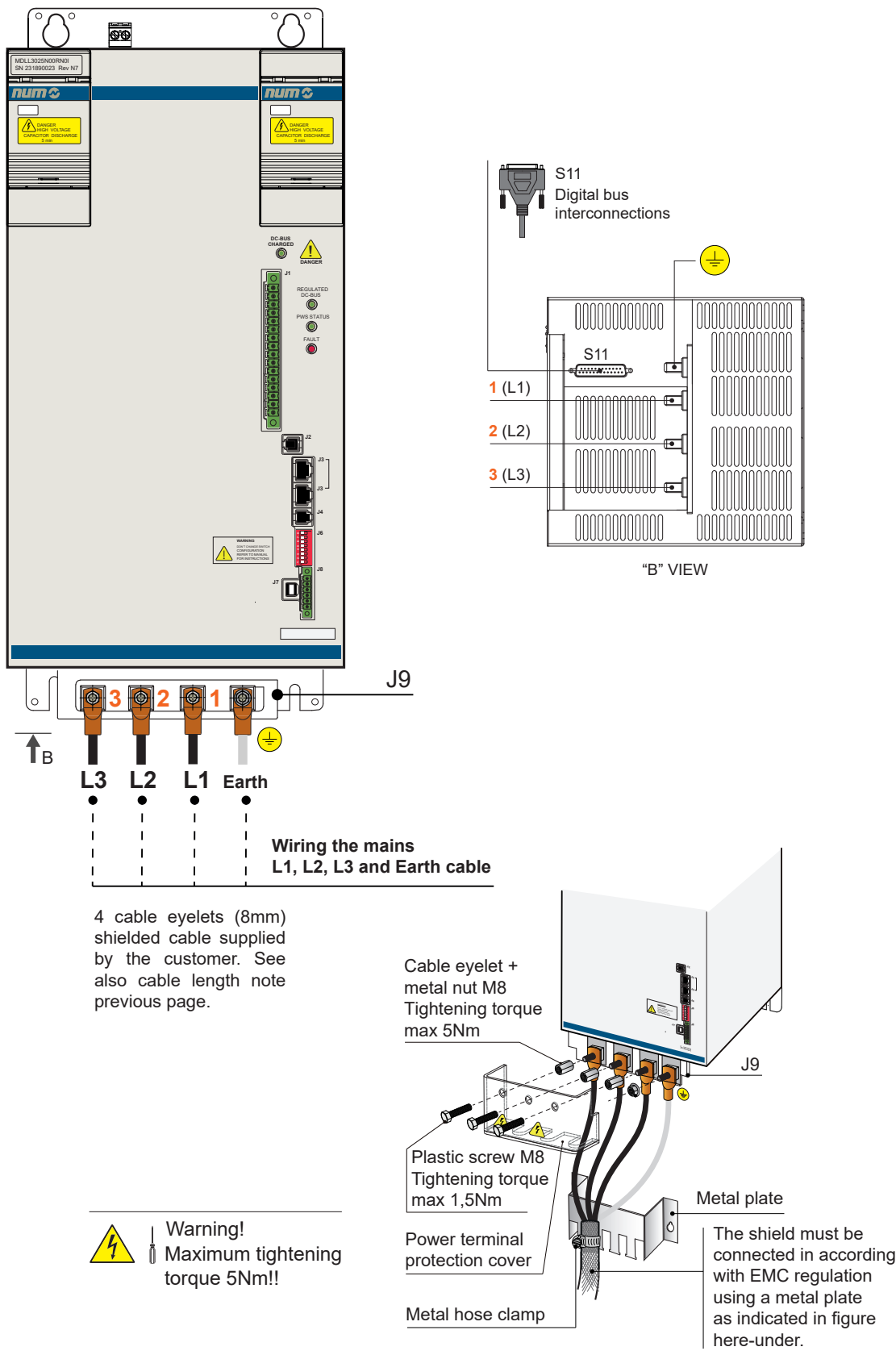
9.5.2.1 MDLL3015N00AN0I, 3030N00AN0I, 3005M00AN0I connections



The total length of the power cables used in the drive group (motor to drive + power supply to line filter) must be $< 400 \text{ m}$ at 5 kHz PWM and $< 200 \text{ m}$ at 10 kHz PWM . (These performance are valid using NUM cables)

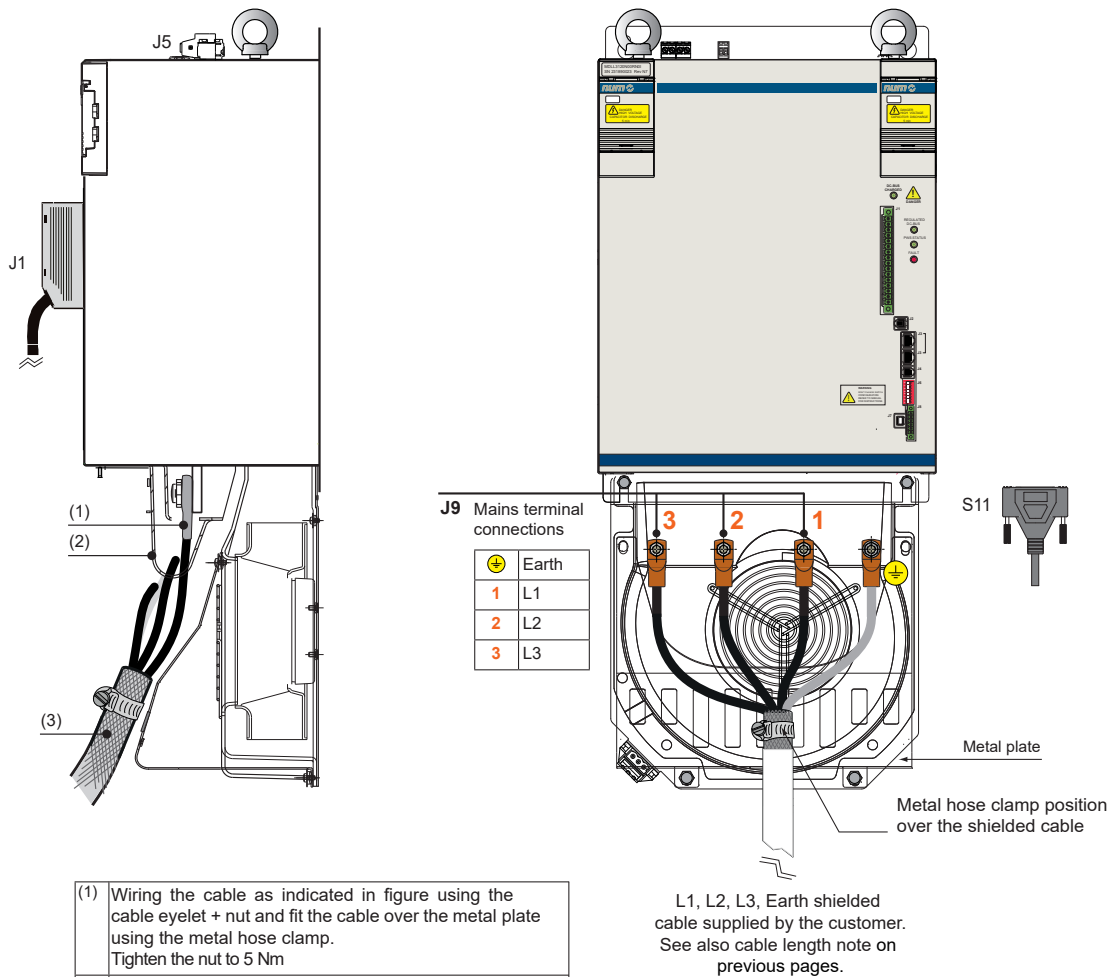
9.5.2.2 MDLL3025N00R/H..., 3050N00A/R/H... connections

Mains terminal connections

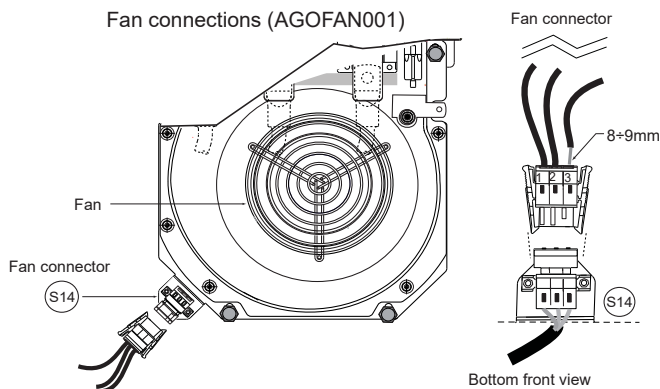


9.5.2.3 MDLL3120N00A/R/H... connections

Mains terminal connections



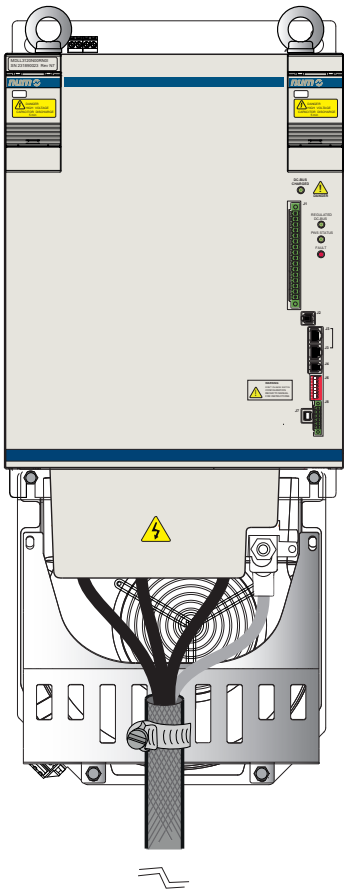
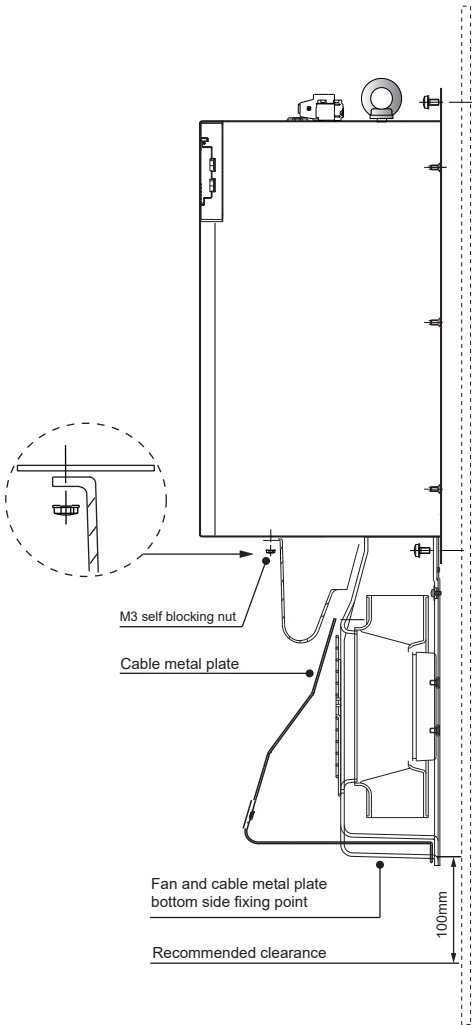
- | | |
|-----|---|
| (1) | Wiring the cable as indicated in figure using the cable eyelet + nut and fit the cable over the metal plate using the metal hose clamp. Tighten the nut to 5 Nm |
| (2) | Mains insulated cover position. See next page. |
| (3) | The shield must be connected in according to the wiring instruction of the manual M00027. |



Pin	Description
1	+24Vdc (supplied by the customer)
2	FUN_RUN_OUT (see note here under)
3	0 _{24V}
Cable 1.5mm² supplied by the customer	
other:	
Fan consumption : 3.7A	
Recommended protection fuse : 6A type aM	

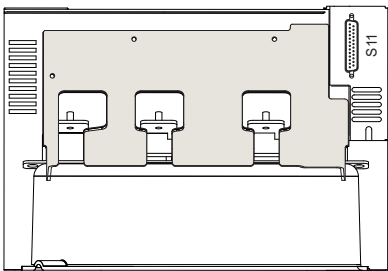
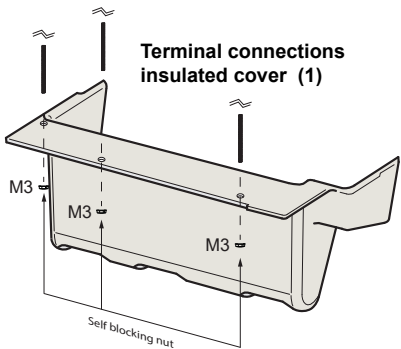
Note: (24V/10mA open collector, 1 pulse per fan rev.).
Signal OUT Duty cycle = 50%, period = 6ms.

9.5.2.4 MDLL3120N00A/R/HN0I mounting the mains terminal insulated cover



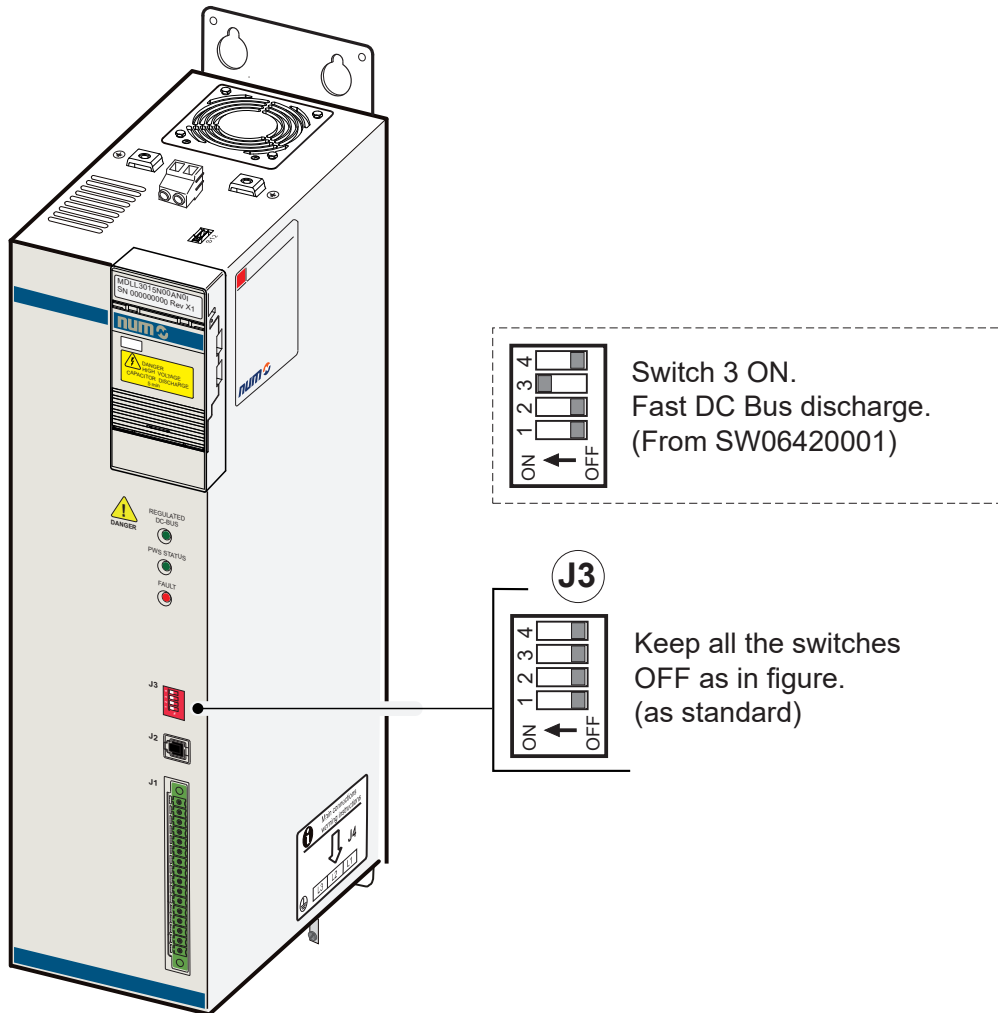
L1, L2, L3, Earth shielded cable supplied by the customer.
See note cable length on previous pages.

- | | |
|-----|---|
| (1) | Place the insulated cover over the terminal as indicated in figure and fix it using the three M3 nuts. (Tighten the screw to 1 Nm). |
| (2) | Control the correct cable position as indicated in figure. |



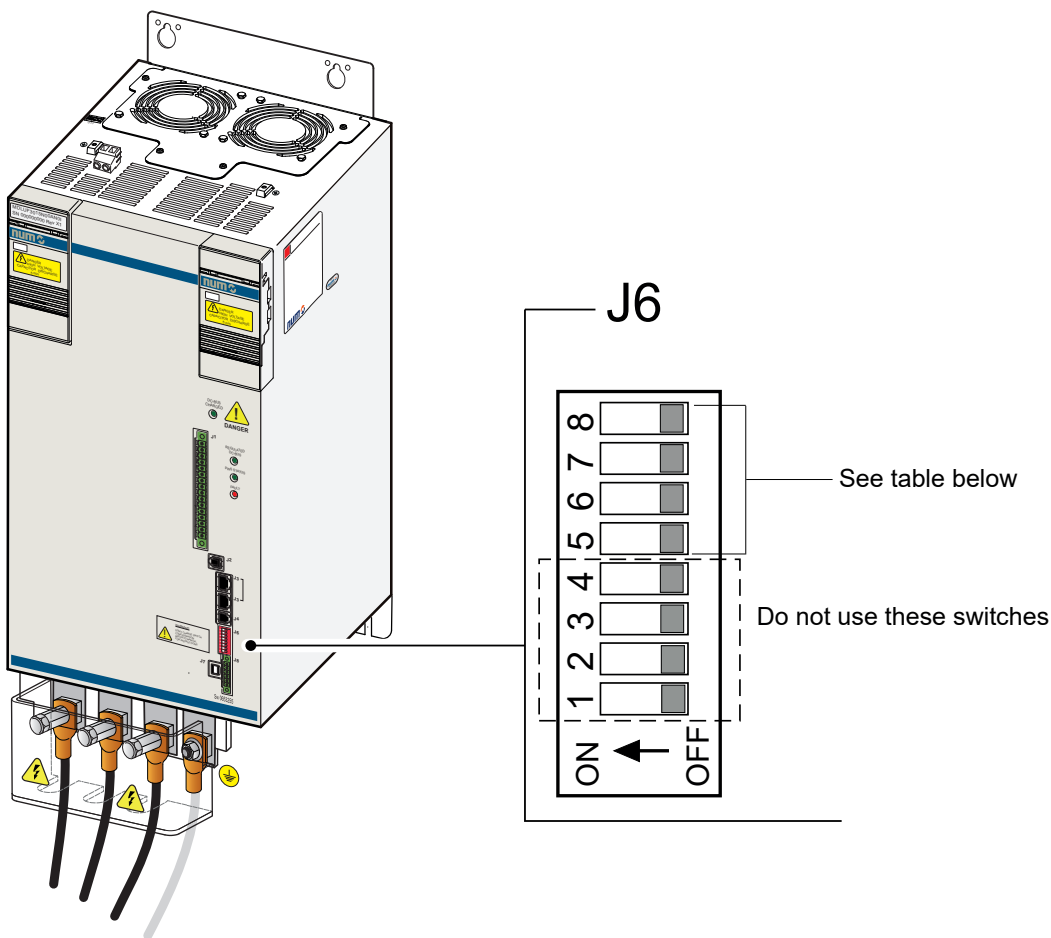
9.5.3 MDLL3 configuration

9.5.3.1 MDLL3015N00AN0I, 3030N00AN0I configurations



Switch 3 OFF: the DCBus discharge is activated about 15sec after mains lost.
Switch 3 ON: the DCBus discharge is activated about 1sec after mains lost.

9.5.3.2 MDLL3...N00HN0I DC Bus voltage configuration



Dip switches 7	Dip switches 6	DC Bus voltage configuration
OFF	OFF	600Vdc
OFF	ON	650Vdc
ON	OFF	700Vdc
ON	ON	700Vdc

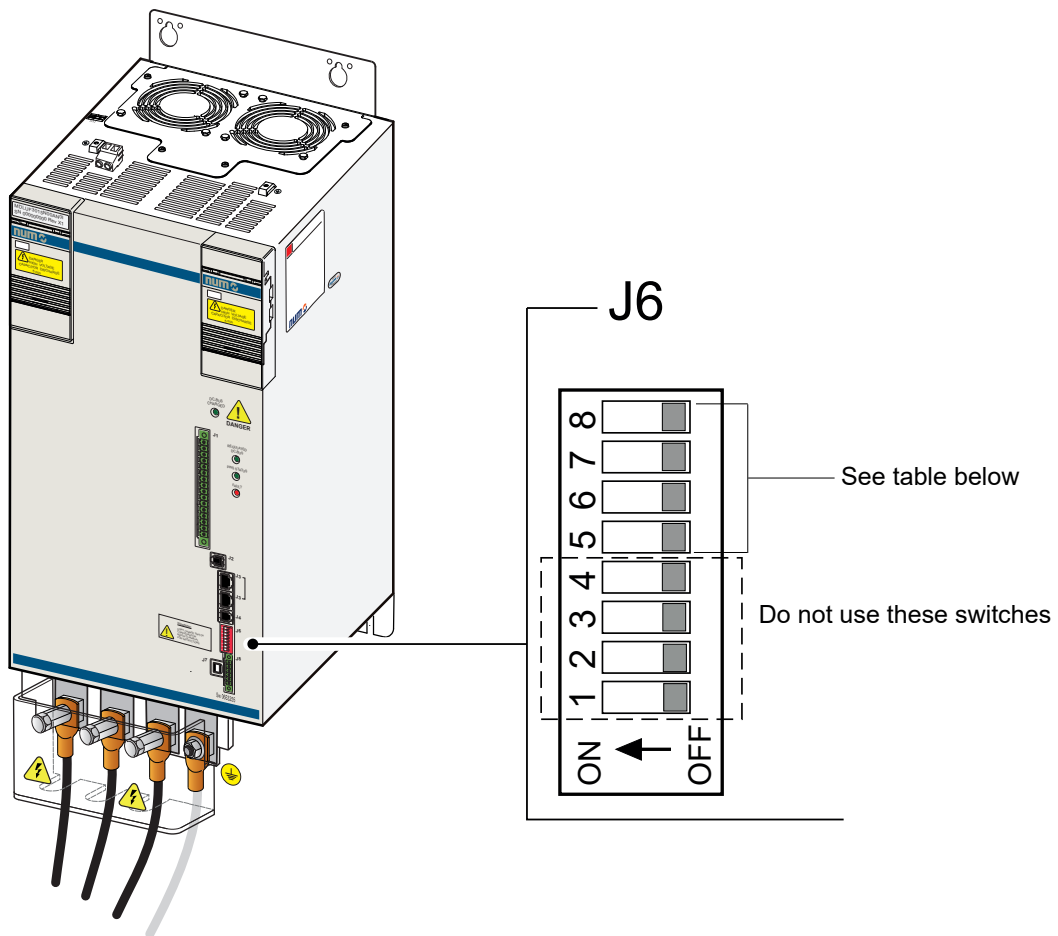
Dip switches settings		
5	OFF (default)	Mains 400V
5	ON	Mains 480V
8	OFF	Bus voltage regulated
8	ON	Only re-injection enabled



Switch OFF the system before to perform the DC Bus voltage configuration. Do not perform any configuration with the system switched ON; otherwise the led REGULATED DC-BUS with status blinking (10 blinks) will appear.

In presence of the mains 480Vac set the dip switches as for 700Vdc and the switch 5 ON.
This configuration is referred to the MDLL3... from software version 3.20.

9.5.3.3 MDLL3050N00AN0I, 3120N00AN0I, ...N00RN0I configuration



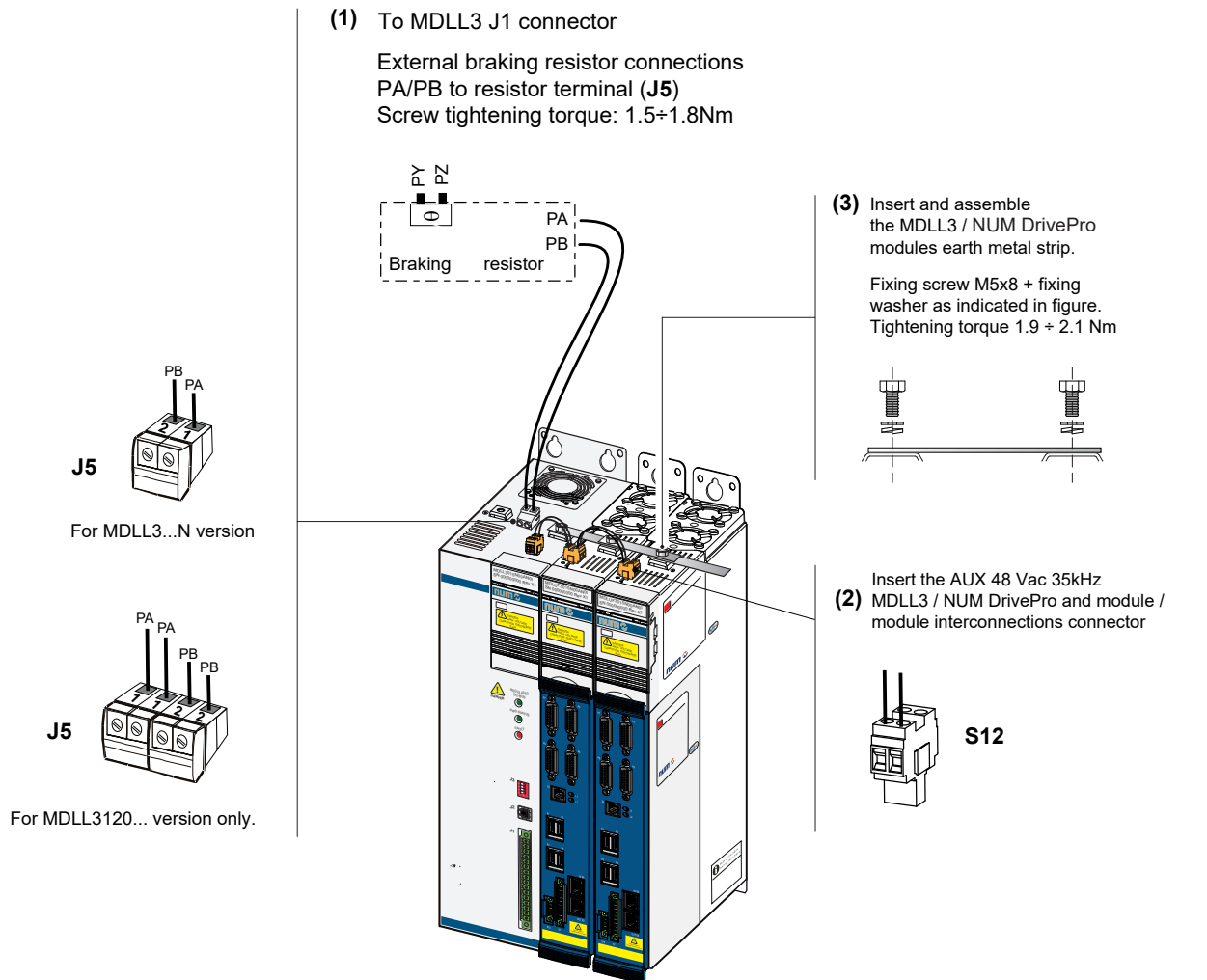
Dip switches settings		
5	OFF (default)	Mains 400V
5	ON	Mains 480V



Do not perform any settings when the system is switched ON.

Perform the dip switch 5 depending on the mains as indicated in the table. This configuration is referred to the MDLL3... from software version 3.20. All other switches must be always in OFF position.

9.5.4 MDLL3 J5 and S12 connections

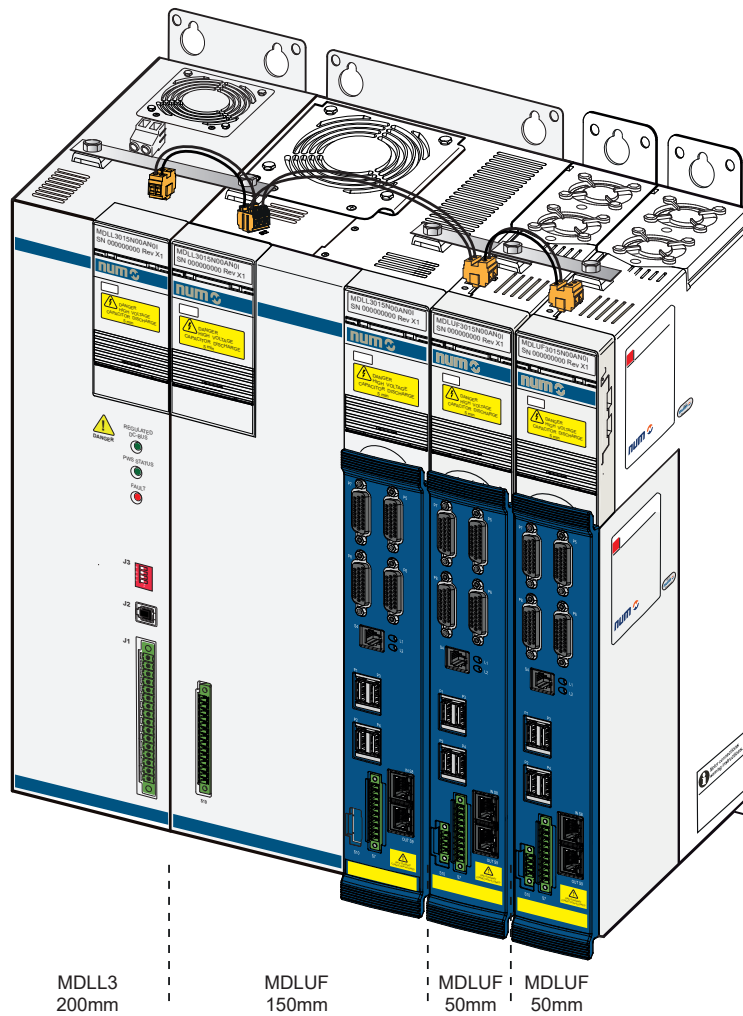
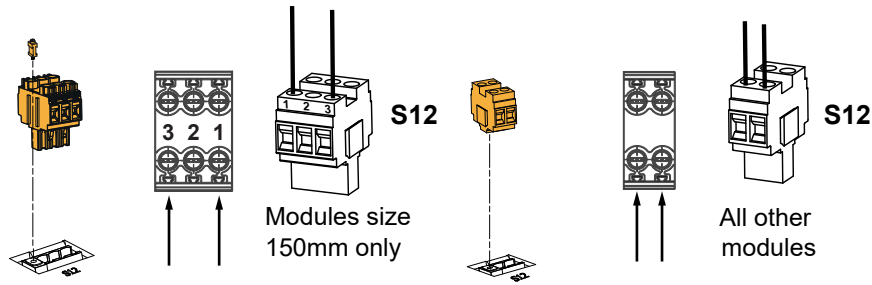


- (1) Connect the braking resistor thermo-contact (PY/PZ) to the MDLL3 J1 connector using the thermally insulated cable connections supplied with the resistor (see chapter 10.7).
- (2) Cable AWG18 (PVC 600V insulated, section 1mm²) and connections supplied by the customer.
- (3) Do not use different nut length from as indicated in the picture.



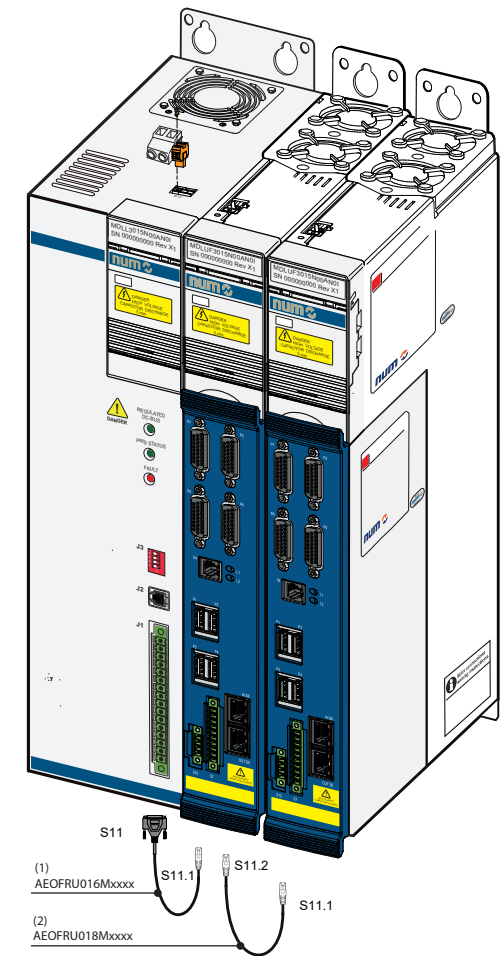
If the braking resistor is not present when the drive is switched on, the power supply module will not supply the intermediated bus voltage.
 If the resistor thermo-contact (PY/PZ) is not connected the drive stops under alarm 5 Ext 0 condition..
 Provide a dedicated shield for the braking resistance cable and for the thermo-contact cable. (Supplied by the customer).

9.5.5 MDLUF S12 connections

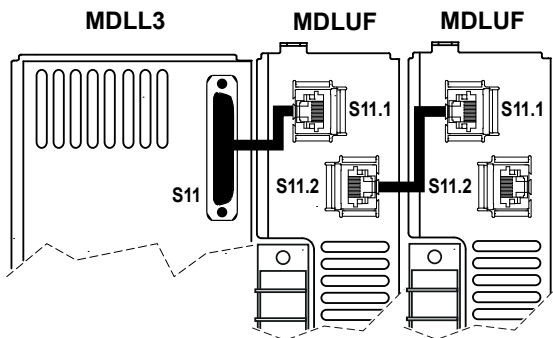


Connector	Description
S12	Auxiliary 48Vac 35kHz supply connector.

9.5.6 MDLL3 to MDLUF digital bus connections



Insert the S11 / RJ45 (8P/8C) connectors for the digital bus interconnections as indicated.

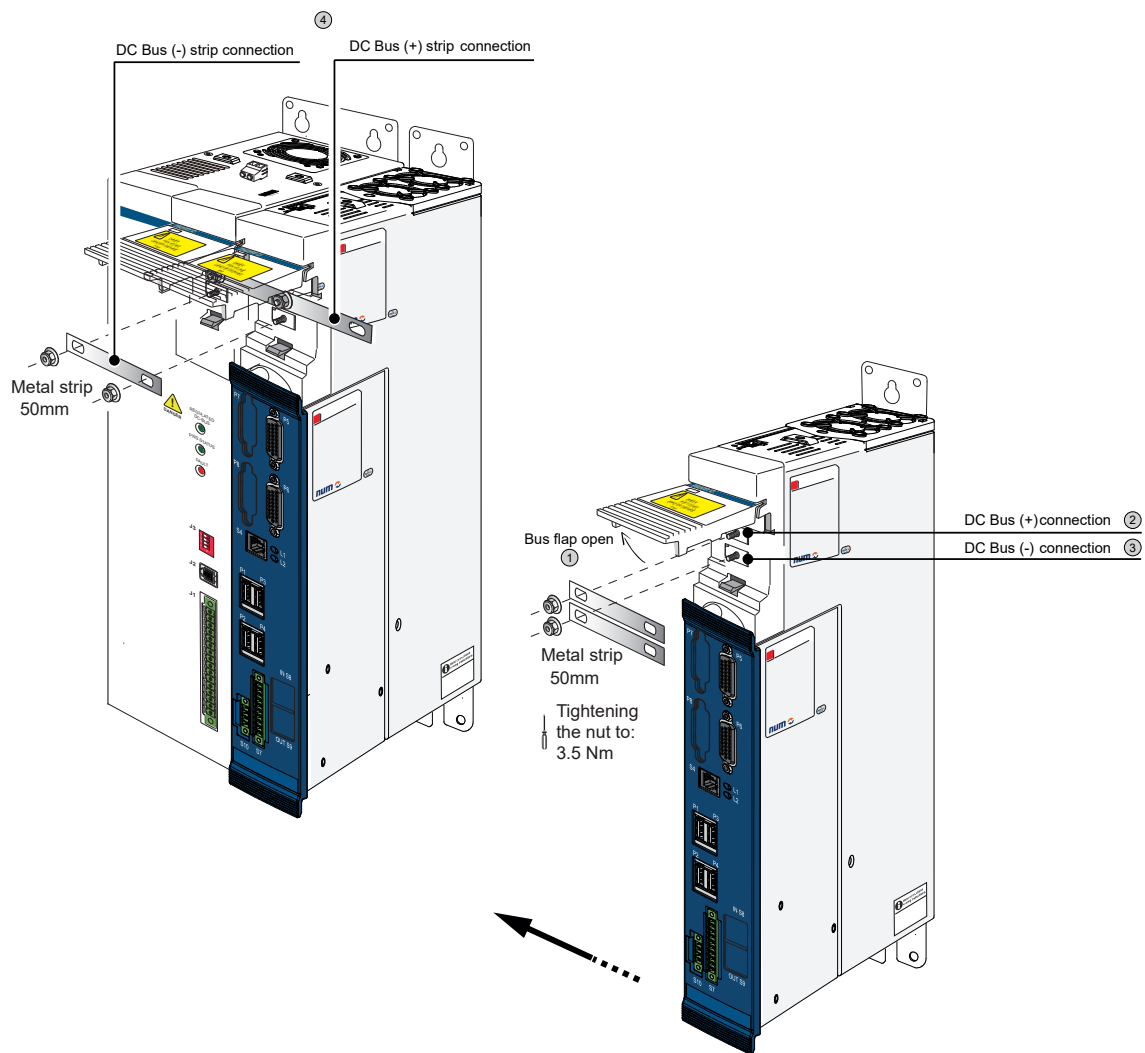


Modules bottom front view

- (1) AEOFRU016M000x MDLL3 / MDLUF cable for size x
- (2) AEOFRU018M000x MDLUF digital bus interconnection cable size x

Please [10.1](#) for more detailed information about the cables length.

9.5.7 MDLL3 and NUM DrivePro module / module DC Bus connections



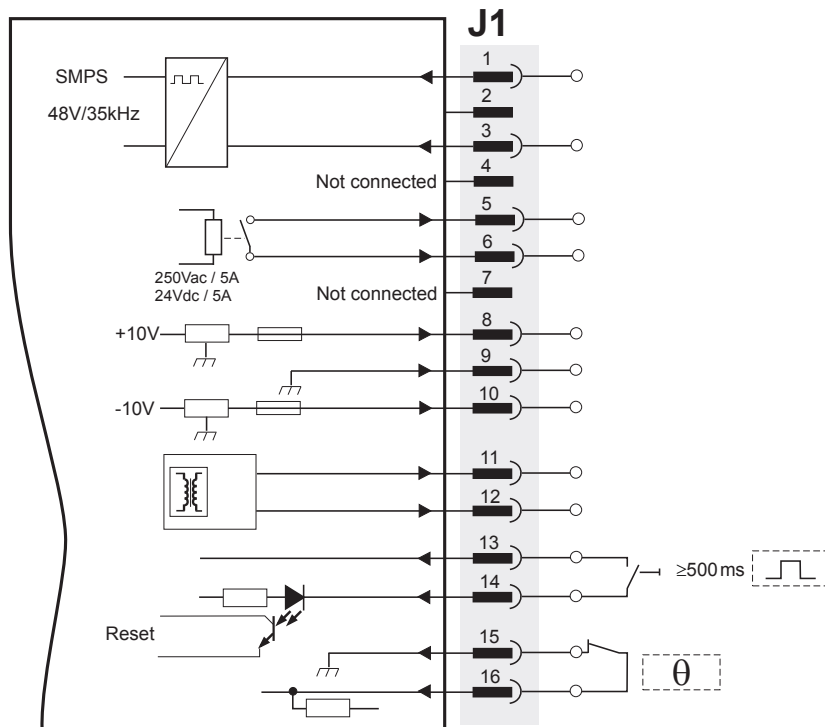
- The MDLL3 and NUM DrivePro modules DC Bus (+) and DC Bus (-) connections must be connected by means of two interconnections metal strip. See point 2 and 3 (Strips 50mm length for module size 1 and 2).
- The metal strips and its fixing nuts are placed in the interconnections kit. (See chapter 5.7)
- To gain access to the DC Bus interconnection points, open the flap by pressing lightly upward with a screwdriver and lift the flap to reach the connections. See point 1.
- Assemble the DC Bus metal strips starting from the MDLL3 power supply module.
- Pay particular attention during the metal strips mounting, the tightening torque value of the nuts must be maximum 3.5Nm, then close the DC Bus flap.



Not to respect these fixing nuts values or inadequate tightening torque value can cause serious damage to the system.

9.5.8 J1 pin-out connector connections

9.5.8.1 J1 pin-out for MDLL3005M00AN0I

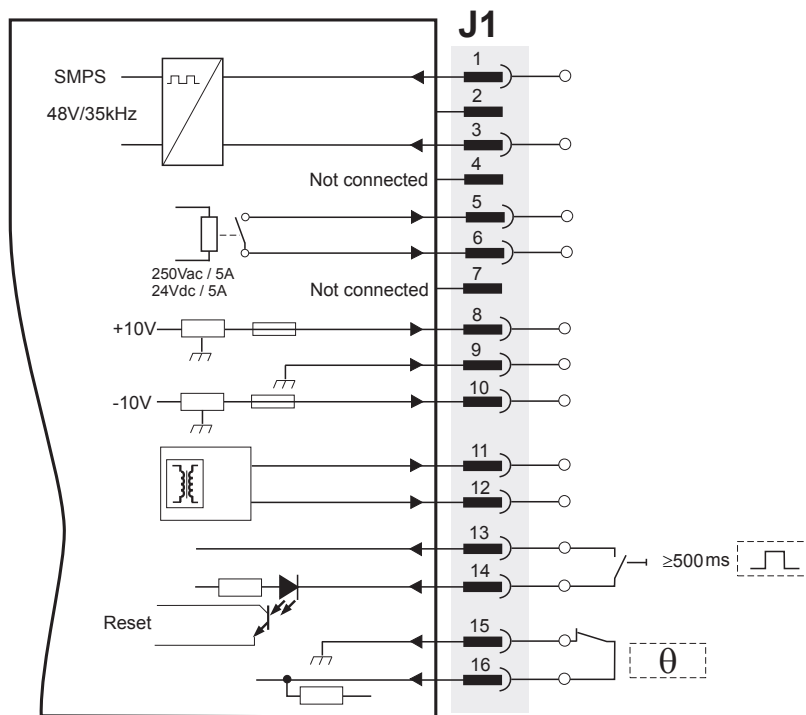


Pin	J1 - 16 screw pins F connector description			
1	CL1	IN	From 230Vac _{rms} -10% to 230Vac _{rms} +6%, 50/60Hz +/-5% (Single-phase)	
2	Do not wire			
3	CL2	IN	From 230Vac _{rms} -10% to 230Vac _{rms} +6%, 50/60Hz +/-5% (Single-phase)	
4	Do not wire			
5	DF1	OUT	Remote switch contact 250Vac/5A - 24Vdc/5A	
6	DF2	OUT		
7	Do not wire			
8	P10	OUT	+10V	+/-10V - 50mA
9	0VA	OUT	0V	
10	N10	OUT	-10V	
11	PL	OUT	+24V	500mA
12	0PL	OUT	0V	To be connected to earth point
13	CF1	IN	Alarm reset. Please refer to the See chapter 11.	
14	CF2	IN		
15	PY	IN	Braking resistor thermo-contact.	
16	PZ	IN		
Cable			- 1.5mm ² for CL1 - CL2, DF1-DF2 - 0.5mm ² for all other connections.	
Screw pins			Screw tightening torque: 0.5±0.6Nm.	



The thermal sensor wires of the braking resistor (typically connected to pins 15 and 16) have to be considered signal wires and they must be laid separately from power wires. It also means that signal wires must not run close to the braking resistor power cables.

9.5.8.2 J1 pin-out for MDLL3015N00AN0I, 3030N00AN0I

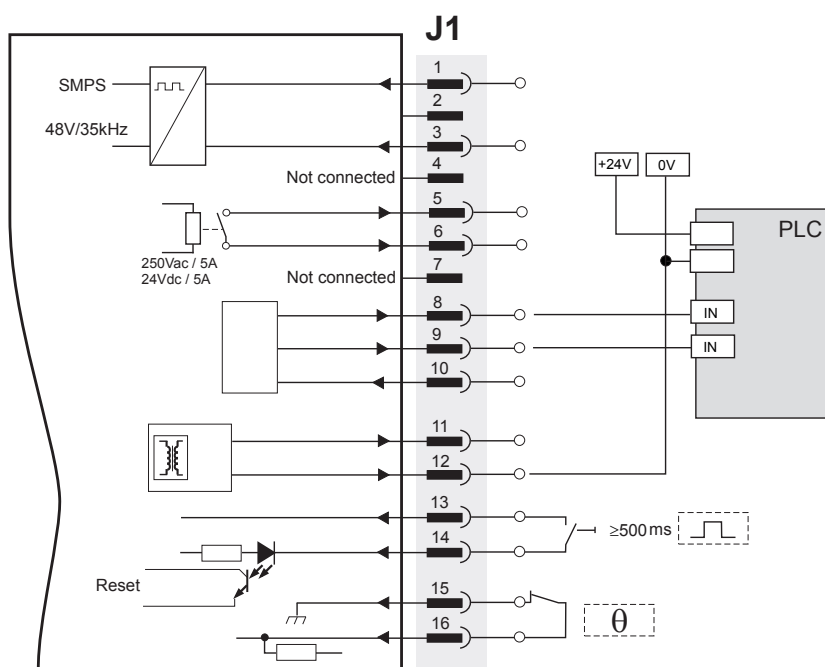


Pin	J1 - 16 screw pins F connector description			
1	CL1	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)	
2	Do not wire			
3	CL2	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)	
4	Do not wire			
5	DF1	OUT	Remote switch contact 250Vac/5A - 24Vdc/5A	
6	DF2	OUT		
7	Do not wire			
8	P10	OUT	+10V	+/-10V - 50mA
9	0VA	OUT	0V	
10	N10	OUT	-10V	
11	PL	OUT	+24V	500mA
12	0PL	OUT	0V	To be connected to earth point
13	CF1	IN	Alarm reset. Please refer to the See chapter 11.	
14	CF2	IN		
15	PY	IN	Braking resistor thermo-contact.	
16	PZ	IN		
Cable			Cable supplied by the customer: - 1.5mm² for CL1 - CL2, DF1-DF2 - 0.5mm² for all other connections.	
Screw pins			Screw tightening torque: 0.5÷0.6Nm.	



The thermal sensor wires of the braking resistor (typically connected to pins 15 and 16) have to be considered signal wires and they must be laid separately from power wires. It also means that signal wires must not run close to the braking resistor power cables.

9.5.8.3 J1 pin-out for MDLL3025N00R/H..., 3050N00R/H..., 3120N00R/H...

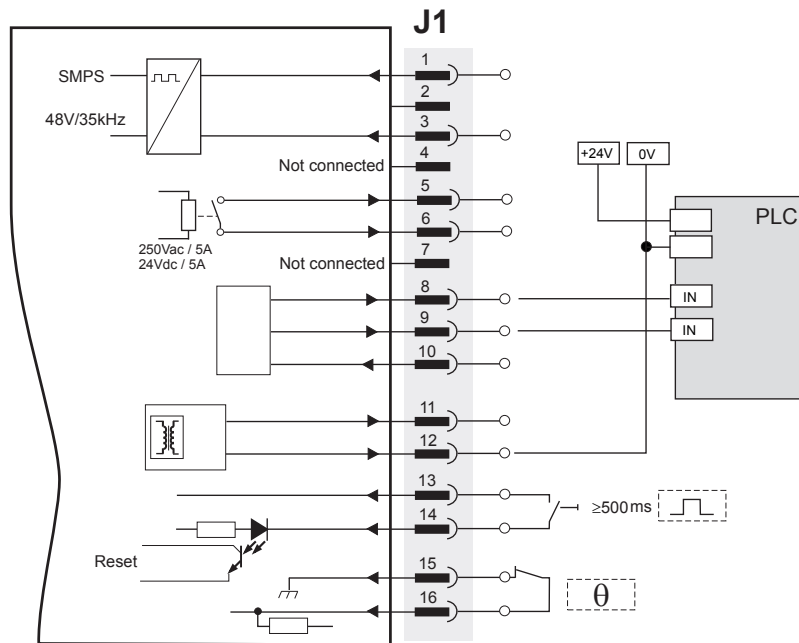


Pin	J1 - 16 screw pins F connector description		
1	CL1	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)
2	Do not wire		
3	CL2	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)
4	Do not wire		
5	DF1	OUT	Remote switch contact 250Vac/5A - 24Vdc/5A
6	DF2	OUT	
7	Do not wire		
8	O1	OUT ⁽¹⁾	+24V = PWS OK = Not faults present into the Power supply module
9	O2	OUT ⁽¹⁾	+24V = MAINS ON
10	I1	IN ⁽²⁾	+24V = PWM DISABLE: - R version = Re-injection in the mains disabled. - H version = Re-injection / Regulation disabled.
11	PL	OUT	+24V, 500mA
12	0PL	OUT	0V to be connected to earth point
13	CF1	IN	Alarm reset. Please refer to the See chapter 11.
14	CF2	IN	
15	PY	IN	Braking resistor thermo-contact.
16	PZ	IN	
Cable			- 1.5mm ² for CL1 - CL2, DF1-DF2 - 0.5mm ² for all other connections.
Screw pins			Screw tightening torque: 0.5÷0.6Nm.
⁽¹⁾ OUT			Level 0:<5Vdc, Level 1:supplied Vdc -6V (max). Maximum load 100mA (Optoisolated)
⁽²⁾ IN			Level 0:<5Vdc, Level 1:from 18 to 30Vd / Load 30mA max at 24Vdc (Optoisolated)



The thermal sensor wires of the braking resistor (typically connected to pins 15 and 16) have to be considered signal wires and they must be laid separately from power wires. It also means that signal wires must not run close to the braking resistor power cables.

9.5.8.4 J1 pin-out for MDLL3050N00AN0I, 3120N00AN0I

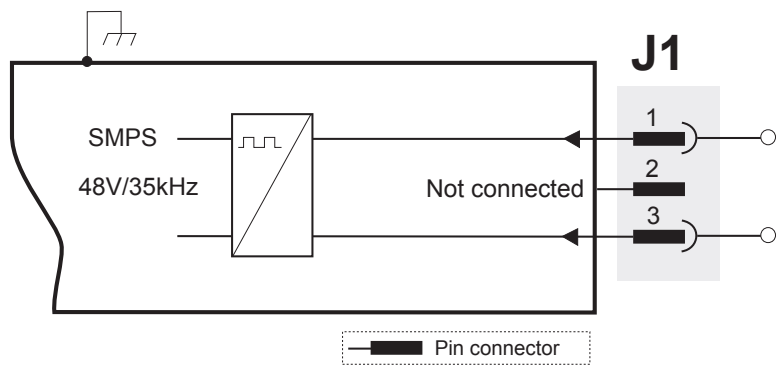


Pin	J1 - 16 screw pins F connector description		
1	CL1	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)
2	Do not wire		
3	CL2	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)
4	Do not wire		
5	DF1	OUT	Remote switch contact 250Vac/5A - 24Vdc/5A
6	DF2	OUT	
7	Do not wire		
8	O1	OUT ⁽¹⁾	+24V = PWS OK = Not faults present into the Power supply module
9	O2	OUT ⁽¹⁾	+24V = MAINS ON
10	Do not wire		
11	PL	OUT	+24V, 500mA
12	0PL	OUT	0V to be connected to earth point
13	CF1	IN	Alarm reset. Please refer to the See chapter 11.
14	CF2	IN	
15	PY	IN	Braking resistor thermo-contact.
16	PZ	IN	
Cable			Cable supplied by the customer: - 1.5mm² for CL1 - CL2, DF1-DF2 - 0.5mm² for all other connections.
Screw pins			Screw tightening torque: 0.5÷0.6Nm.
⁽¹⁾ OUT			Level 0:<5Vdc, Level 1:supplied Vdc -6V (max). Maximum load 100mA (Optoisolated)



The thermal sensor wires of the braking resistor (typically connected to pins 15 and 16) have to be considered signal wires and they must be laid separately from power wires. It also means that signal wires must not run close to the braking resistor power cables.

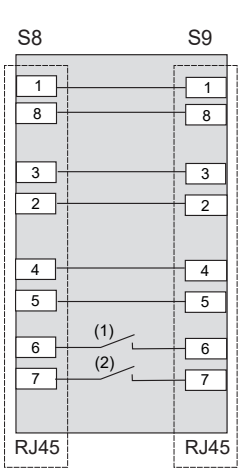
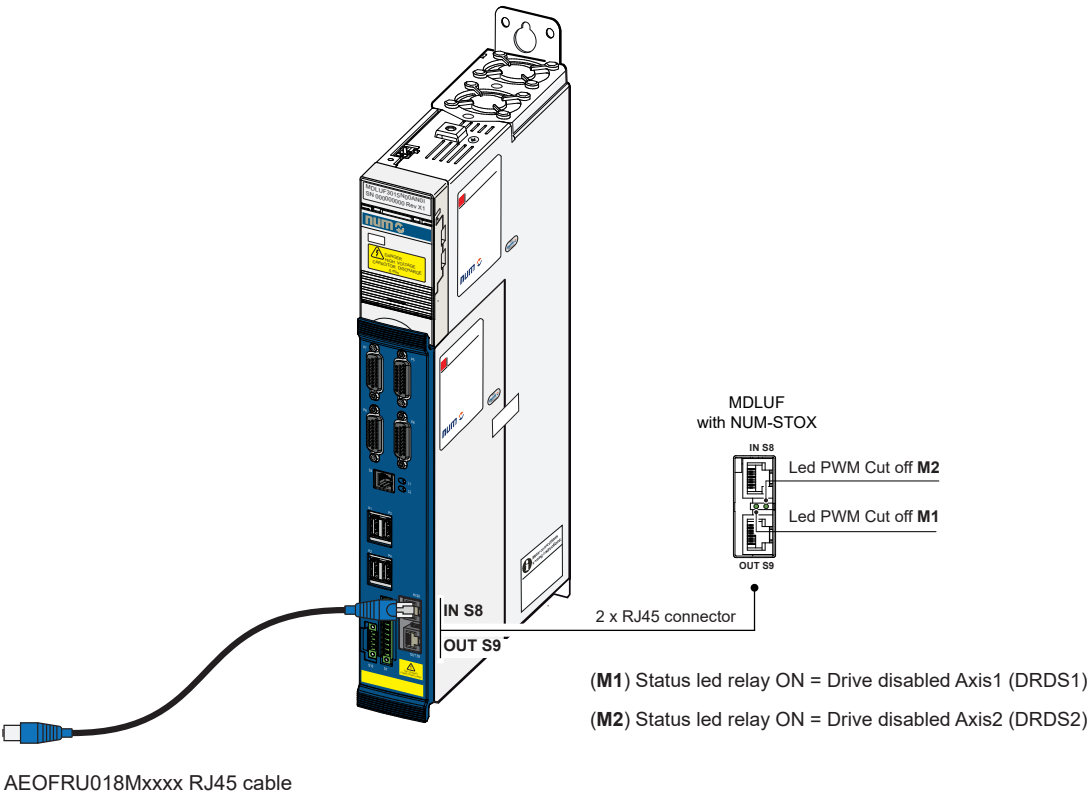
9.5.8.5 J1 pin-out for MDLQ3001N00



J1 - 3 screw pins F connector description		
1	IN	From 400Vac _{rms} -10% to 480Vac _{rms} +6%, 50/60Hz +/-5% (Bi-phases)
3	IN	
Cable		Cable 1.5mm ² supplied by the customer:
Screw pins		Screw tightening torque: 0.5±0.6Nm.

9.6 NUM-STOX module connections

9.6.1 S8, S9 connector with NUM-STOX module connections



Terminal	Signal	I/O	Description
1	+24V	IN	+24Vdc supplied by the customer (50mA)
2	EN1B	IN	Drive enable Axis1 channel B
3	EN1A	IN	Drive enable Axis1 channel A
4	EN2A	IN	Drive enable Axis2 channel A
5	EN2B	IN	Drive enable Axis2 channel B
6	DRDS1	IN/OUT	Drive disabled Axis1
7	DRDS2	IN/OUT	Drive disabled Axis2
8	0V	IN	0 _{24V}

(1) Contact closed = Drive disabled Axis1 (DRDS1)

(2) Contact closed = Drive disabled Axis2 (DRDS2)

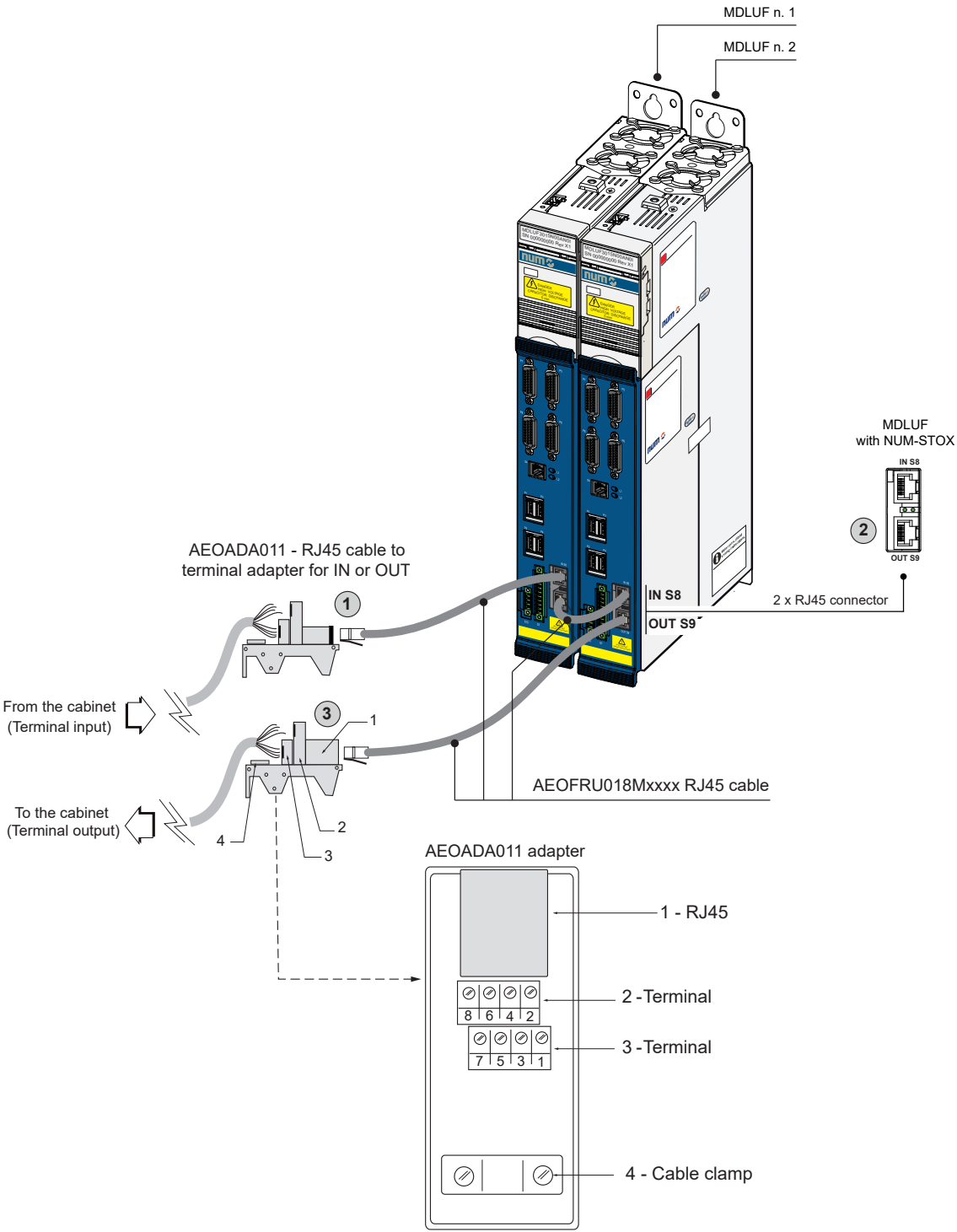
Relay contact characteristics: 24Vdc -100mA.

For more information concerning cables and adapter. See chapter 10



In case of NUM-STOX installation on Mono-Axis drive only signals related to Axis1 have meaning and can be used.

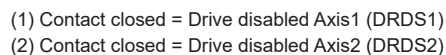
9.6.2 NUM-STOX module connections with RJ45 adapter AEOADA011



For more information concerning cables and adapter please [10](#).

(x) See diagram on next page.

9.6.3 NUM-STOX multi-drive connections example diagram

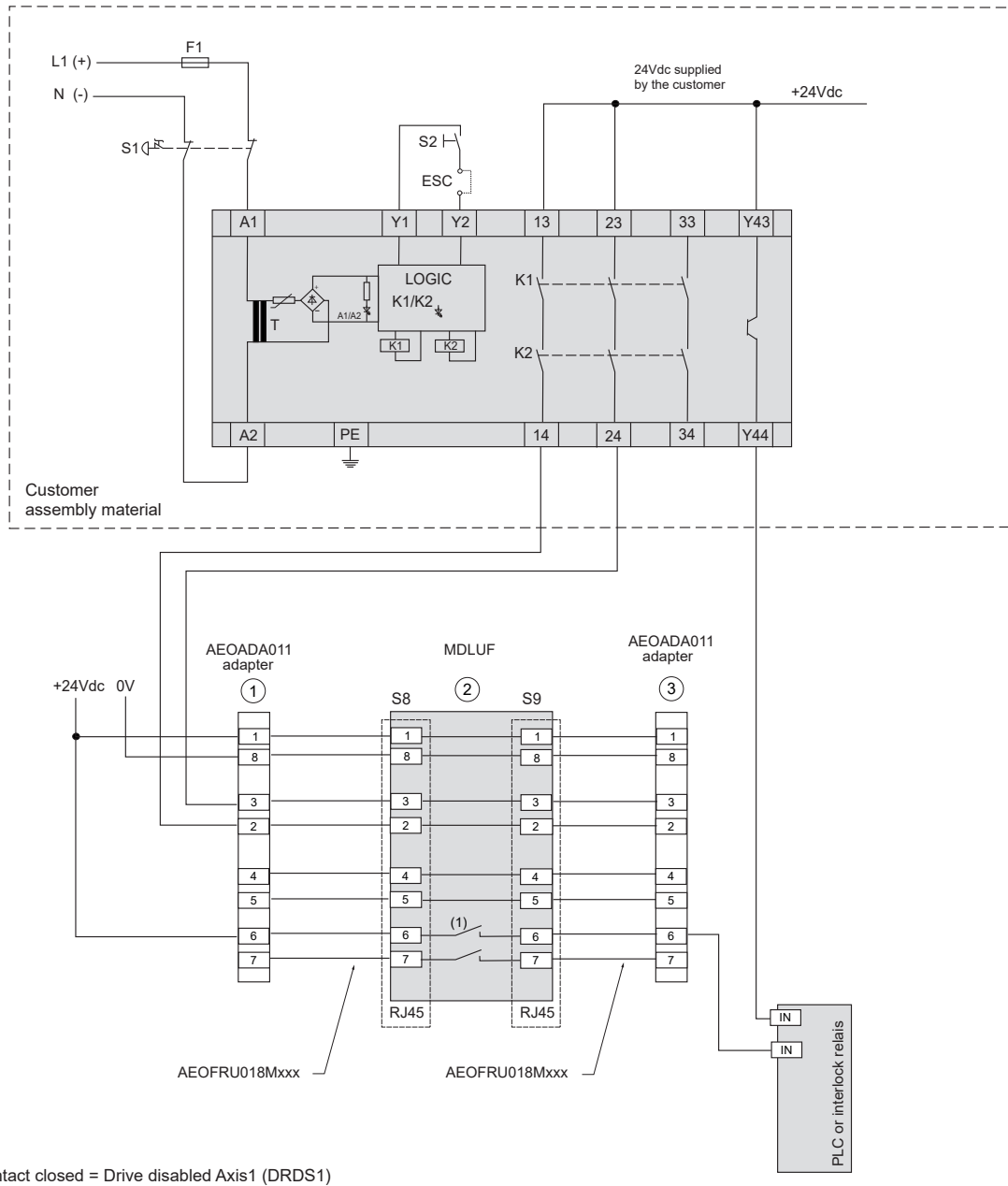


For more information concerning cables and adapter. See chapter 10.

9.6.4 E-STOP CAT-0 connections

9.6.4.1 E-STOP CAT-0 with Mono-Axis and NUM-STOX module

Connection diagram for E-stop category 0 according to EN 60204-1



PB1: Emergency STOP button.

PB2: Start command button.

ESC: External interlock

F1: Fuse

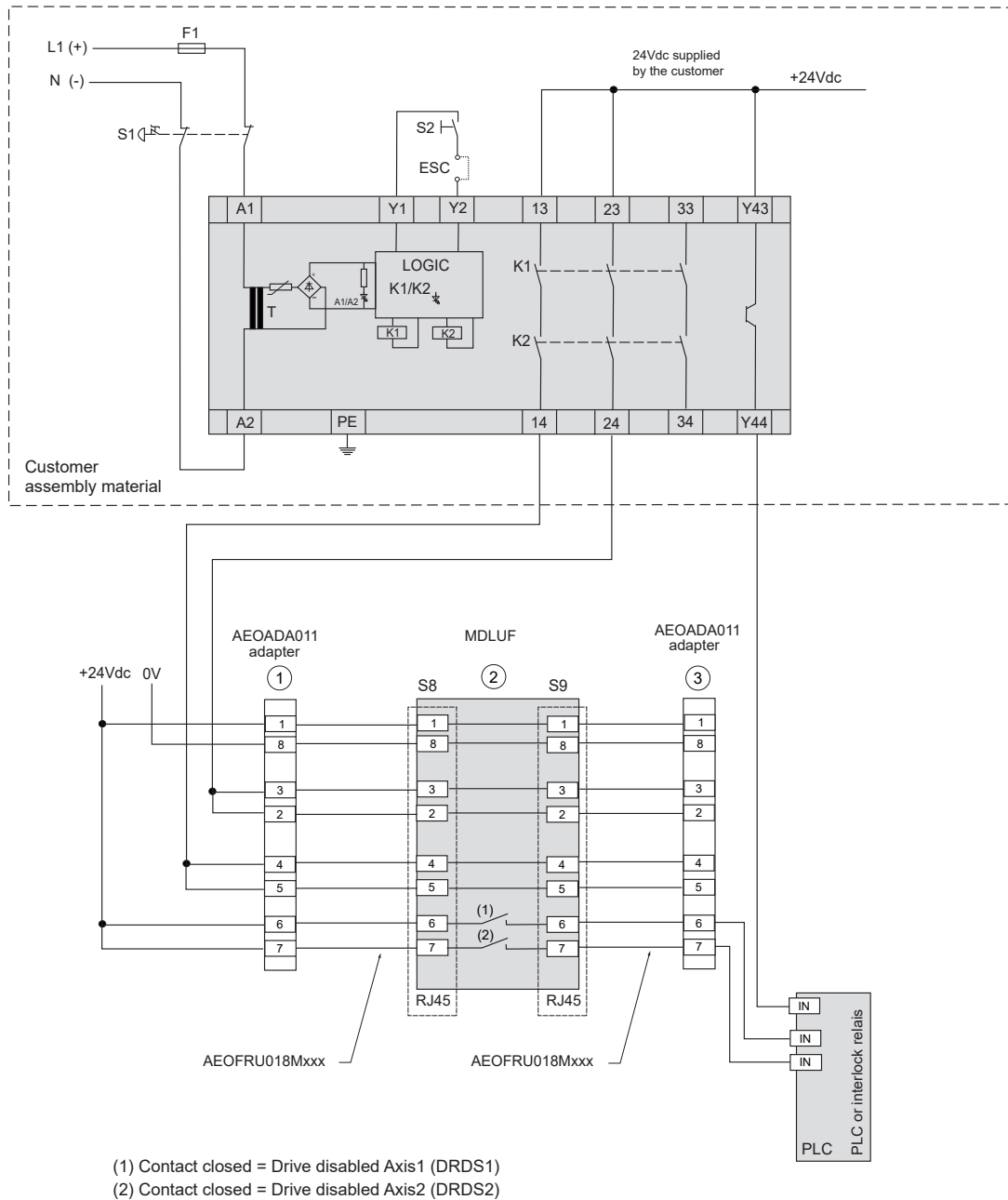
S8, S9: E-STOP connector see previous pages.



The E-STOP CAT-0 sequential diagram is shown in the following pages. To obtain E-STOP CAT-1 is required a delay device as indicated in the diagram.

9.6.4.2 E-STOP CAT-0 with Bi-Axes and NUM-STOX module

Connection diagram for E-stop category 0 according to EN 60204-1



PB1: Emergency STOP button.

PB2: Start command button.

ESC: External interlock

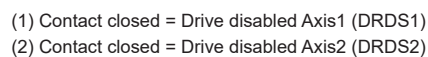
F1: Fuse

S8, S9: E-STOP connector see previous pages.



The E-STOP CAT-0 sequential diagram is shown in the following pages. To obtain E-STOP CAT-1 is required a delay device as indicated in the diagram.

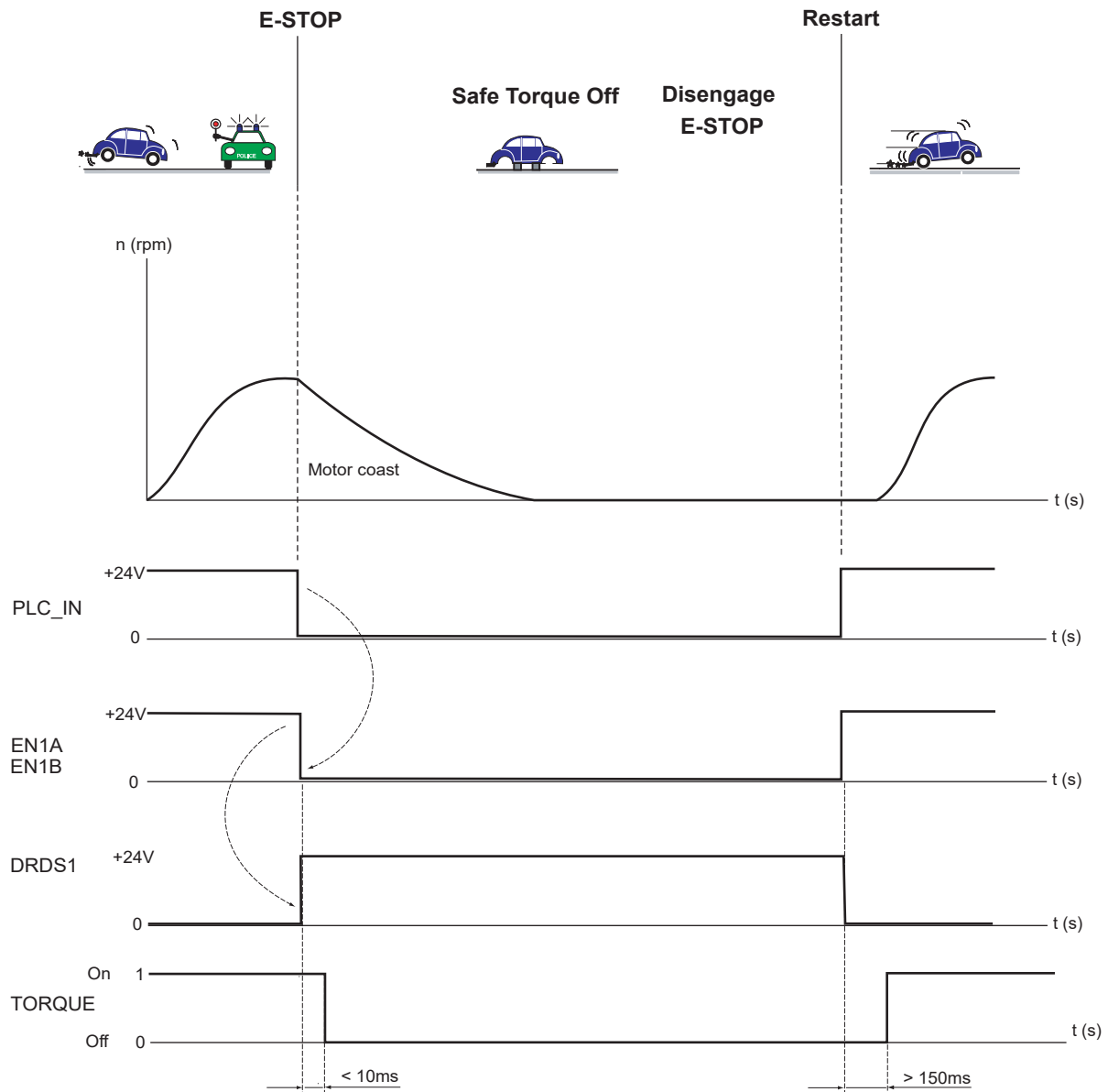
Connection diagram for E-stop category 0 according to EN 60204-1



189

9.6.4.4 E-STOP CAT-0 sequential diagram with NUM-STOX module

Connection diagram for E-stop category 0 according to EN 60204-1

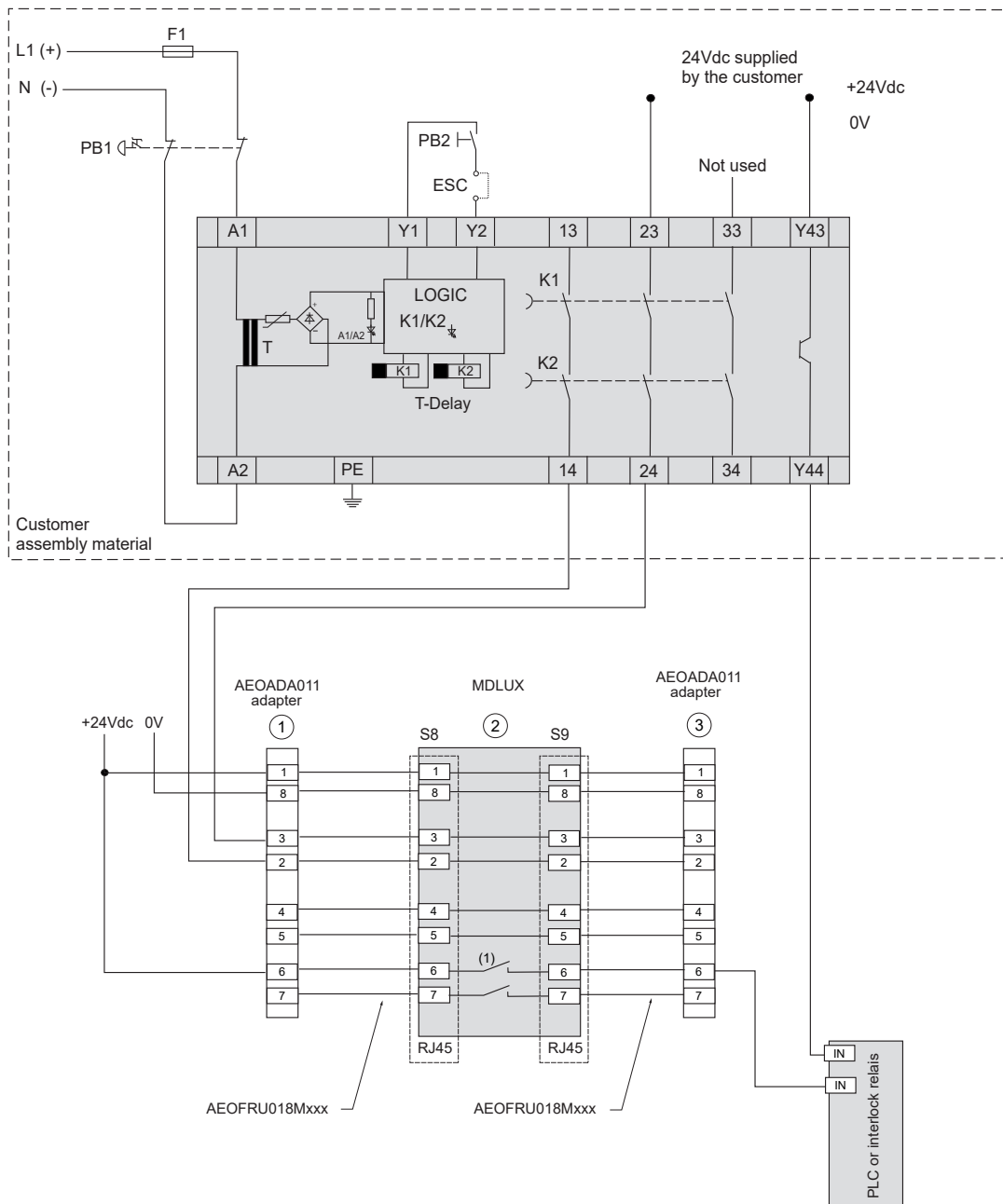


Legend	
PLC_IN	PLC input
TORQUE	Torque enabled FlexiumPro_NCK.RCNC.Axis[0].DigitalAxis.TorqueEnabled ⁽¹⁾
DRDS1	PWM Cut Off FlexiumPro_NCK.RCNC.Axis[0].DigitalAxis.PWMCutOff ⁽¹⁾
EN1A	Drive enable Axis1 channel A
EN1B	Drive enable Axis1 channel B
⁽¹⁾ Please refer to MDLUF Parameters manual M00066.	

9.6.5 E-STOP CAT-1 connections

9.6.5.1 E-STOP CAT-1 with Mono-Axis and NUM-STOX module

Connection diagram for E-stop category 1 according to EN 60204-1



PB1: Emergency STOP button.

PB2: Start command button.

ESC: External interlock

F1: Fuse

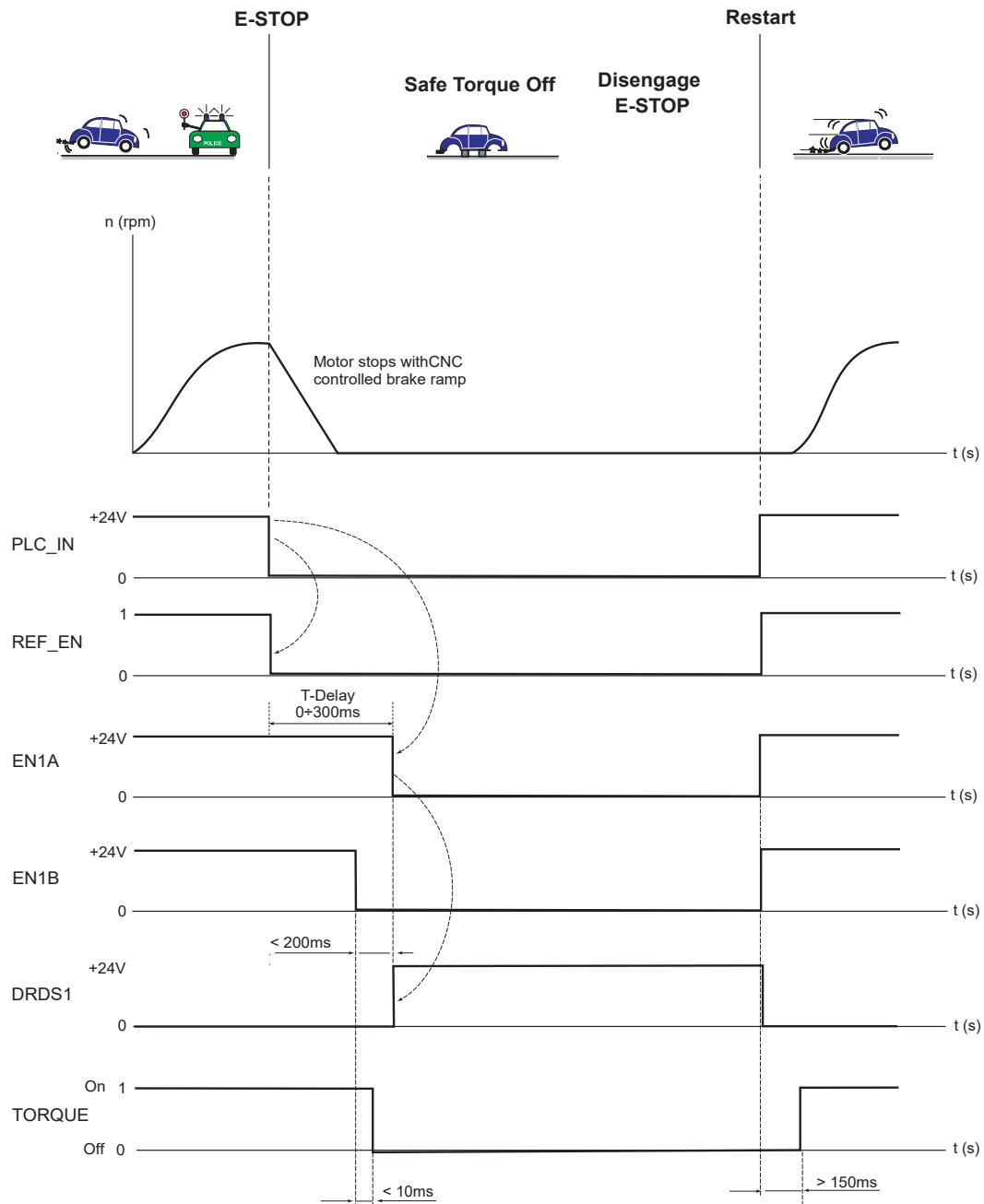
S8, S9: E-STOP connector see previous pages.



The E-STOP CAT-1 sequential diagram is shown on next page.

9.6.5.2 E-STOP CAT-1 sequential diagram with NUM-STOX module

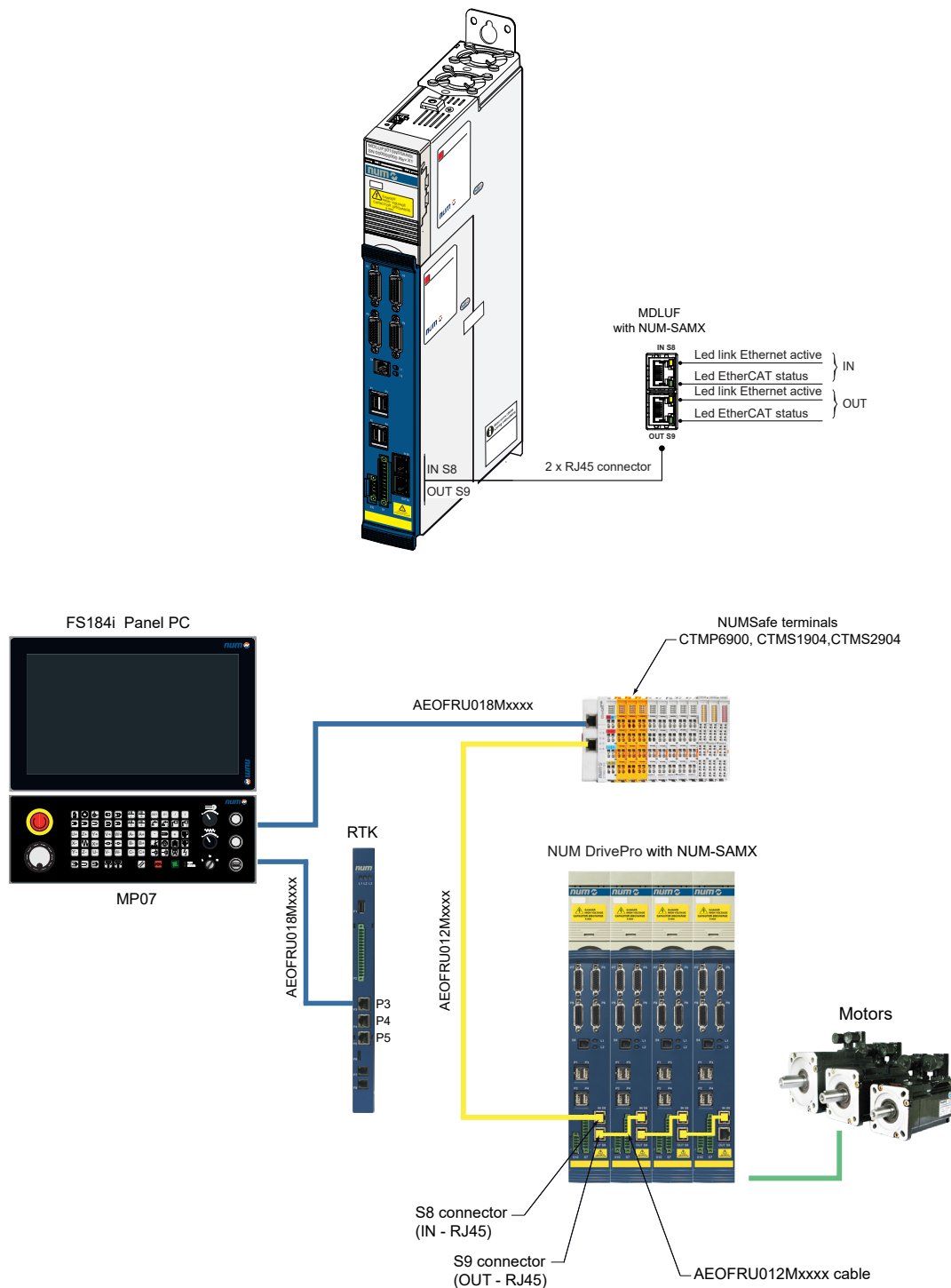
Connection diagram for E-stop category 1 according to EN 60204-1



Legend	
PLC_IN	PLC input
TORQUE	Torque enabled: FlexiumPro_NCK.RCNC.Axis[0].DigitalAxis.TorqueEnabled ⁽¹⁾
DRDS1	PWM Cut Off: FlexiumPro_NCK.RCNC.Axis[0].DigitalAxis.PWMCutOf ⁽¹⁾
EN1A	Drive enable Axis1 channel A
EN1B	Drive enable Axis1 channel B
⁽¹⁾ Please refer to MDLUF Parameters manual M00066.	

9.7 NUM-SAMX Safety certified module connections

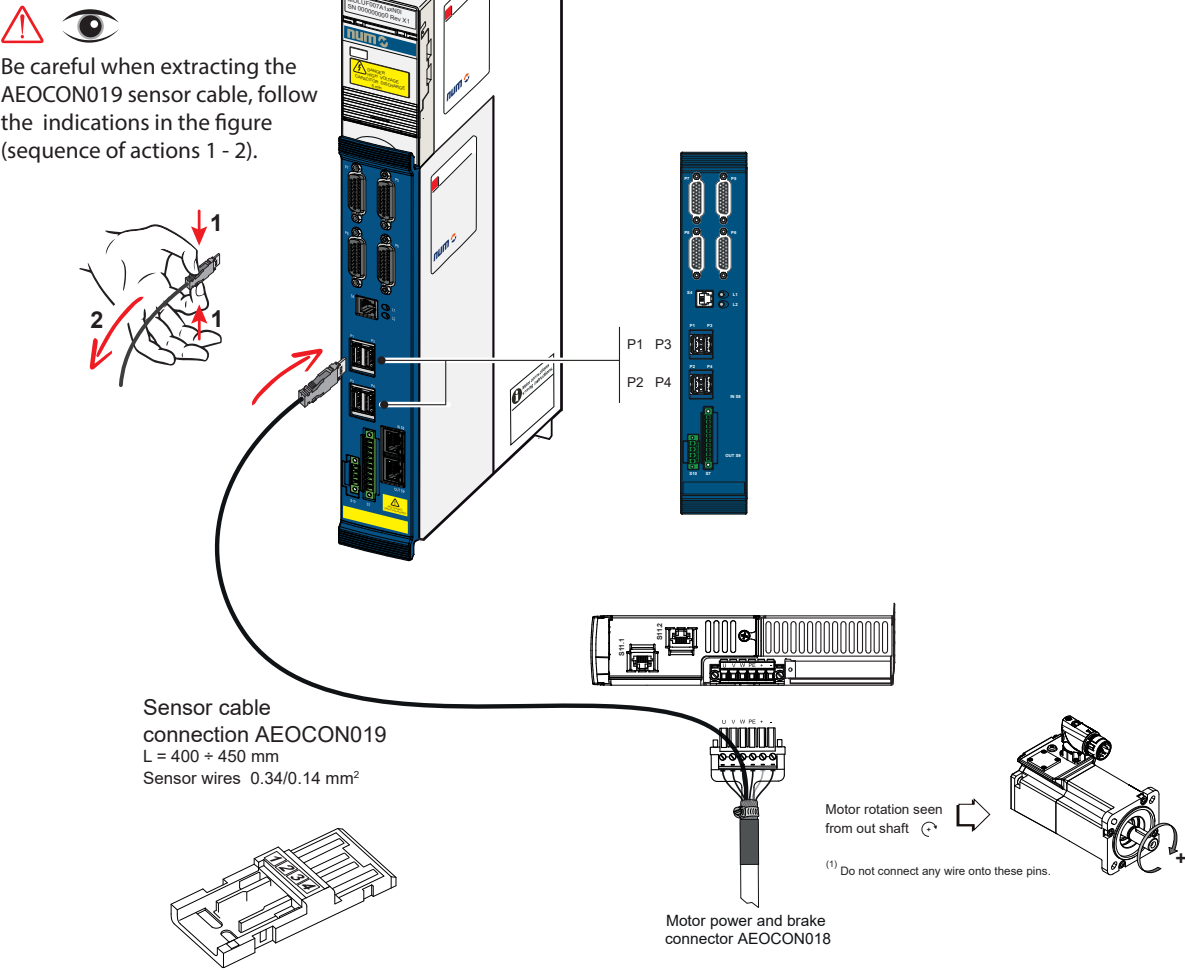
9.7.1 S8, S9 connector for NUM-SAMX Safety connections



Please refer to M00069 NUM-SAMX Instruction manual for more detailed information on the NUM-SAMX modules connections and configuration and refer to M00032, M00033 and M00034 for the NUM Safe modules connections and configuration.

9.8 P1, P2, P3, P4 sensor connections

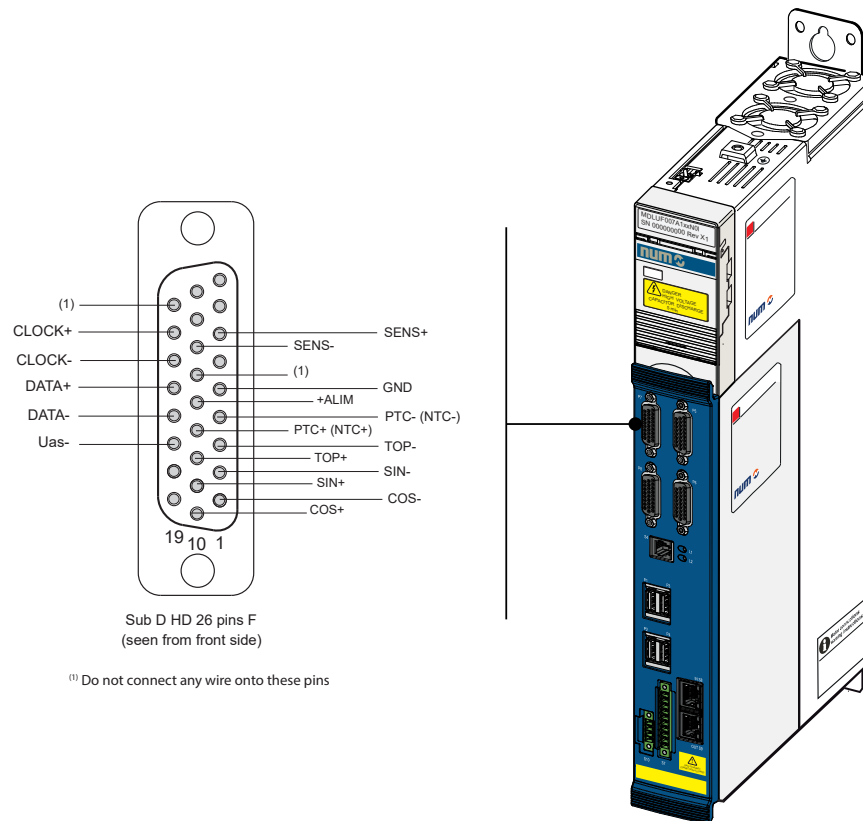
9.8.1 Connector pin-out for motor sensor



Pin n°	Signal	I/O	Description
1, 4	Not used	-	-
2	DATA -	O	Hyperface DATA -
3	DATA +	O	Hyperface DATA +
See chapter 9.21			

9.9 P5, P6, P7, P8 sensor connections

9.9.1 Connector pin-out for motor and/or direct measure sensor



Pin n°	Signal	I/O	Description
1, 10	COS- (Ref Cos) / COS + (Cos+)	I	Differential cosine - / cosine+ analog value
2, 11	SIN- (Ref Sin) / SIN + (Sin+)	I	Differential sine - / sine + analog value
3, 12	TOP- / TOP +	I	Differential zero TOP - / TOP+ analog value
4, 13	PTC- (NTC-) / PTC+ (NTC+)	I/O	PTC / NTC motor thermal probe
5	GND	O	0V of ALIM_REG
14	+ALIM	O	Encoder supply (+5V or +9V - 500mA max)
16, 7	SENS- / SENS+	I	Encoder supply feedback signal
22, 23	DATA- / DATA+ (RS485- / RS485+)	I	ENDAT (RS485) sensor signals
24, 25	CLOCK- / CLOCK+	O	ENDAT (RS485) sensor clock signals
21	Uas-	I	Sensor error (0V = error)

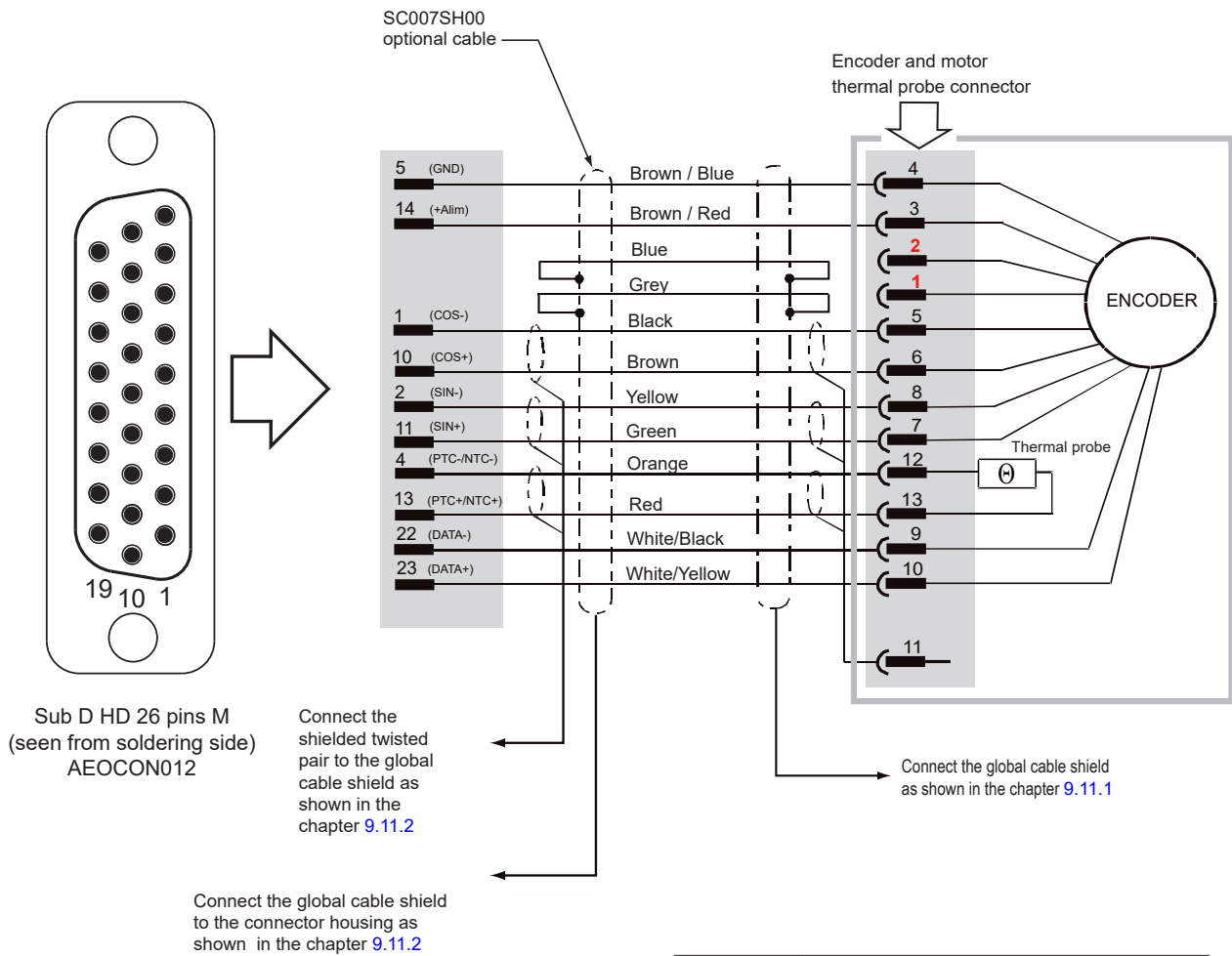


It's allowed to directly connect the motor thermal probe (KTY, PTC, Thermal switch ...) to the drive, if and only if the thermal probe is suitable to direct connection to SELV / PELV circuits according to EN 50178.



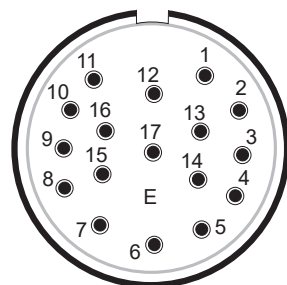
Connecting the sensor as indicated in the here-above figure and feeding the system with positive speed reference (+), the NUM motors turn clockwise seen from out shaft side.

9.9.2 Encoder P, Q, J, K, A, B, connections for BHX, BPX, BPH, BPG, BHL and IM18MK14 motors



Warning!

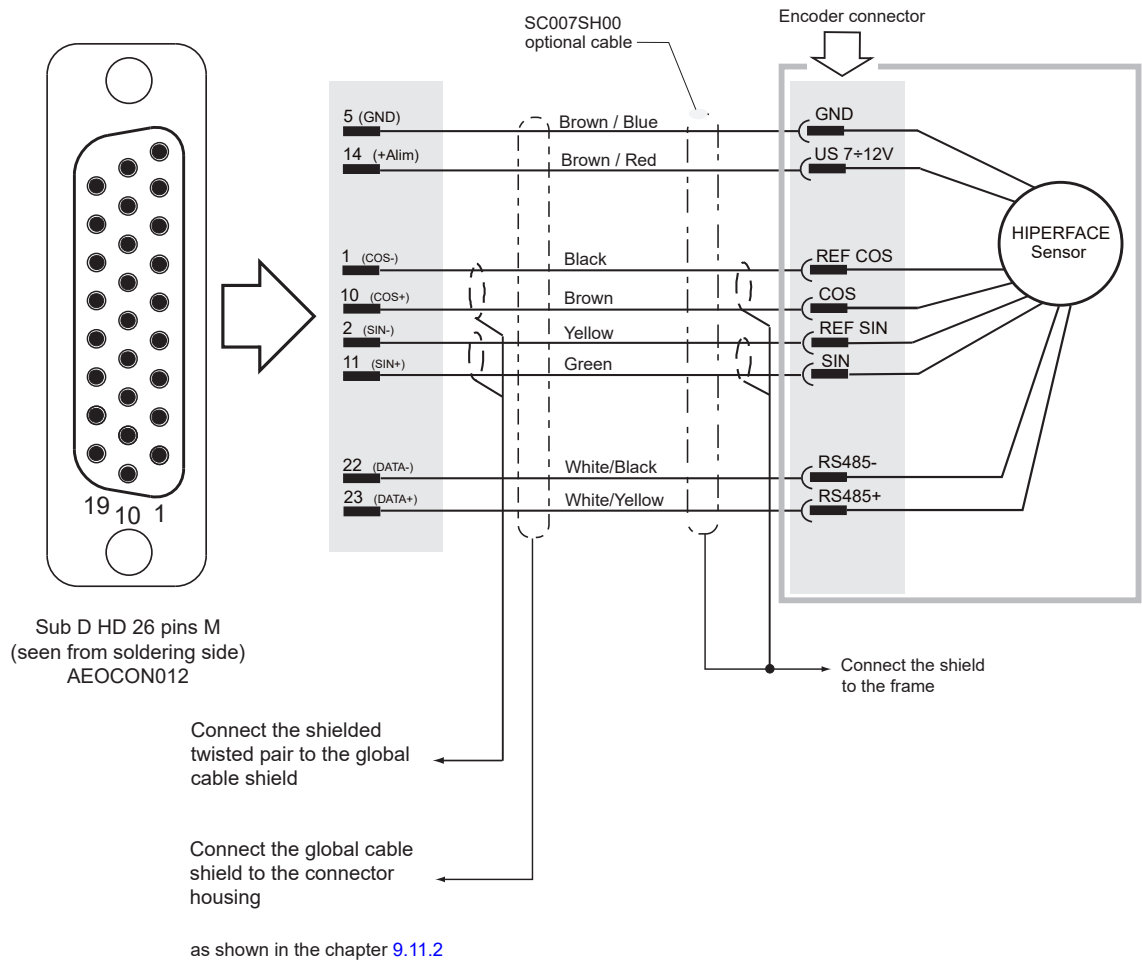
Pins **1** and **2** of the encoder connector must not be used.



AMOCON002D

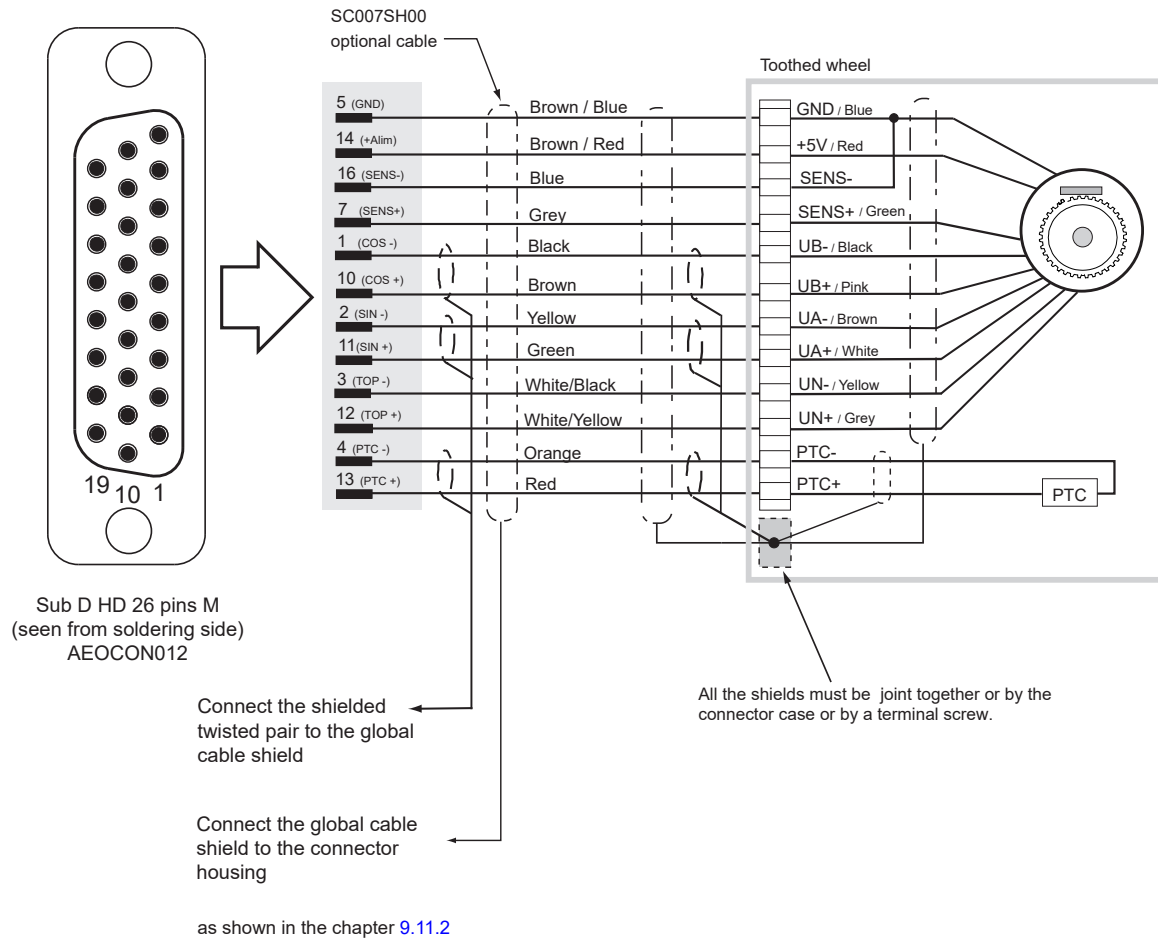
The sensor connector with SC007SH00 cable mounting and crimping procedure are indicated in the chapter 9.11.1

9.9.3 Standard Hiperface encoder connections



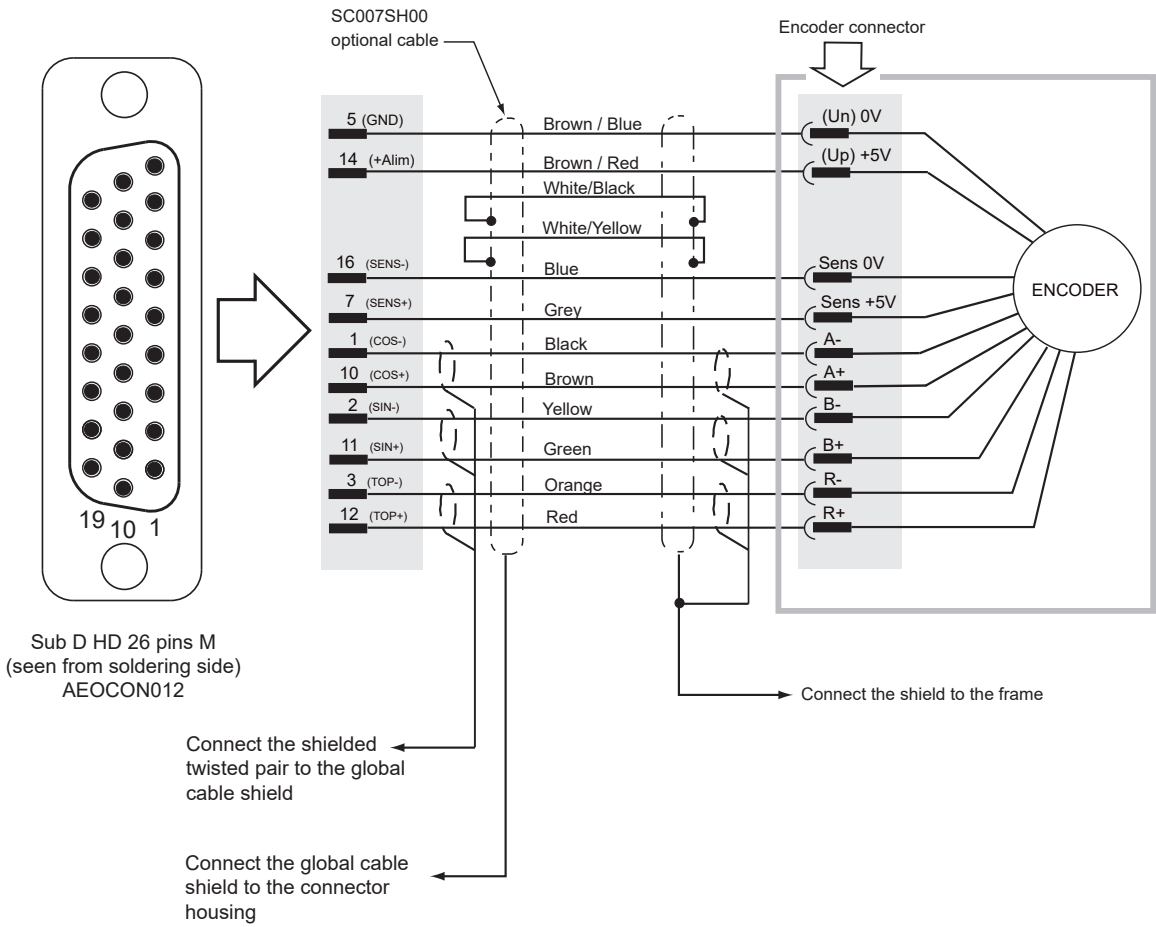
The sensor connector with SC007SH00 cable mounting and crimping procedure are indicated in the chapter 9.11.1

9.9.4 LENORD&BAUER GEL244K sinusoidal toothed wheel sensor



The sensor connector with SC007SH00 cable mounting and crimping procedure are indicated in the chapter [9.11.1](#)

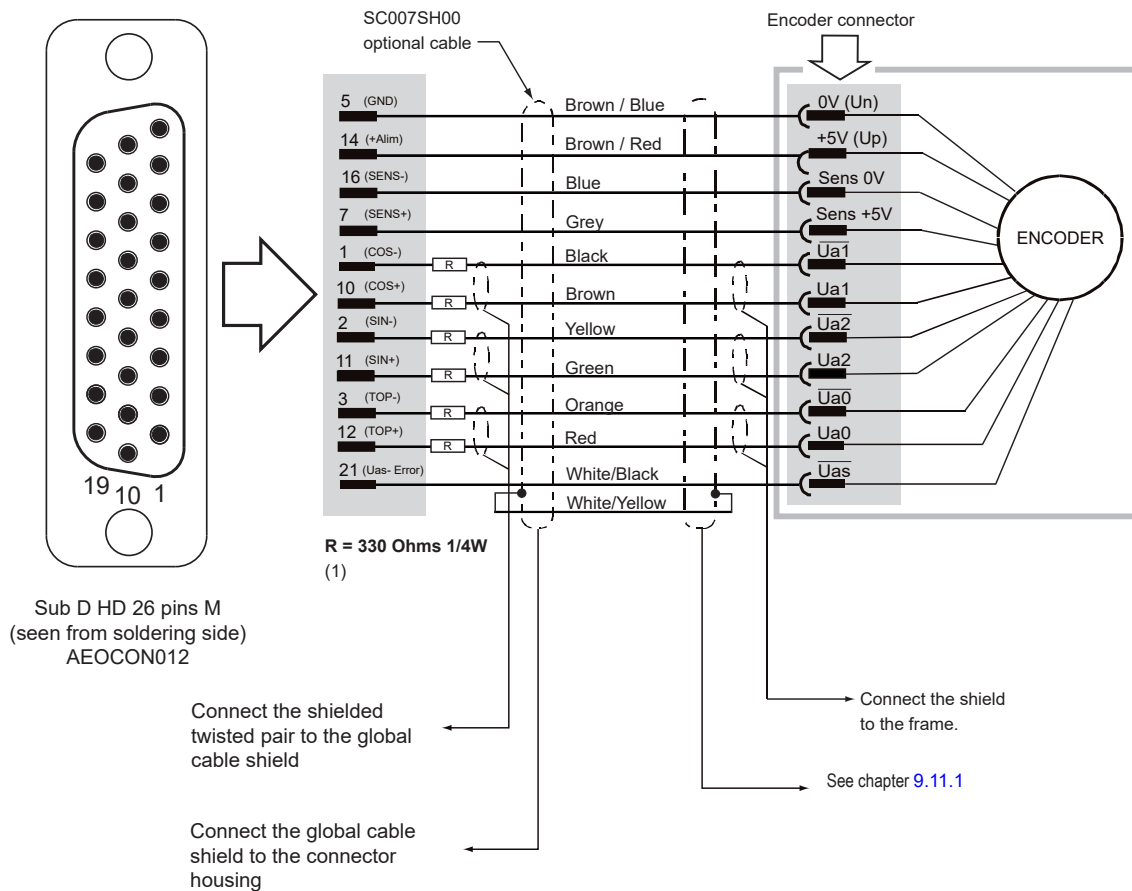
9.9.5 Standard encoder 1Vpp connections



as shown in the chapter [9.11.2](#)

The sensor connector with SC007SH00 cable mounting and crimping procedure are indicated in the chapter [9.11.1](#)

9.9.6 TTL incremental encoder sensor connections



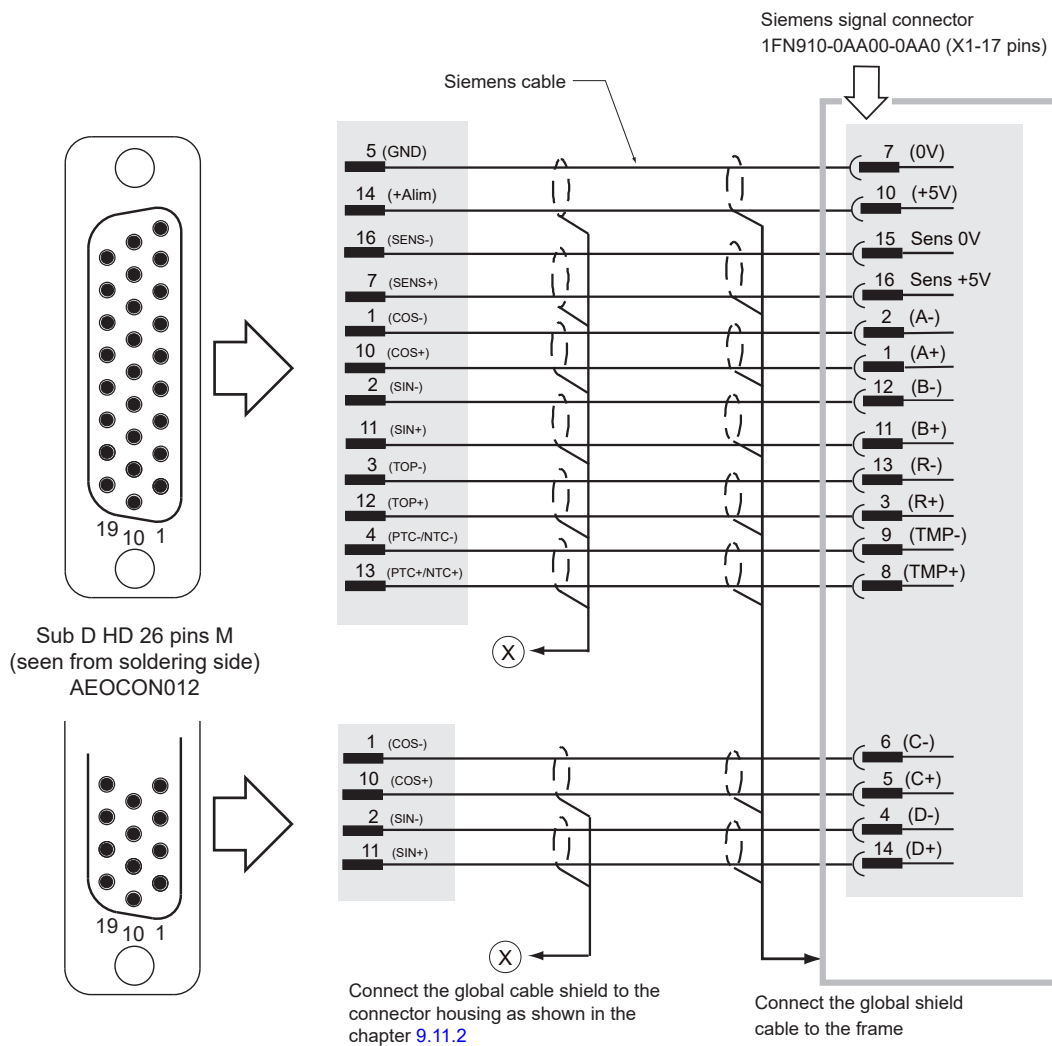
as shown in the chapter 9.11.2

The sensor connector with SC007SH00 cable mounting and crimping procedure are indicated in the chapter 9.11.1



(1) In case the encoder has output signal amplitude different from 5Vdc, as for example HTL encoder, contact NUM application center to choose a different R value.

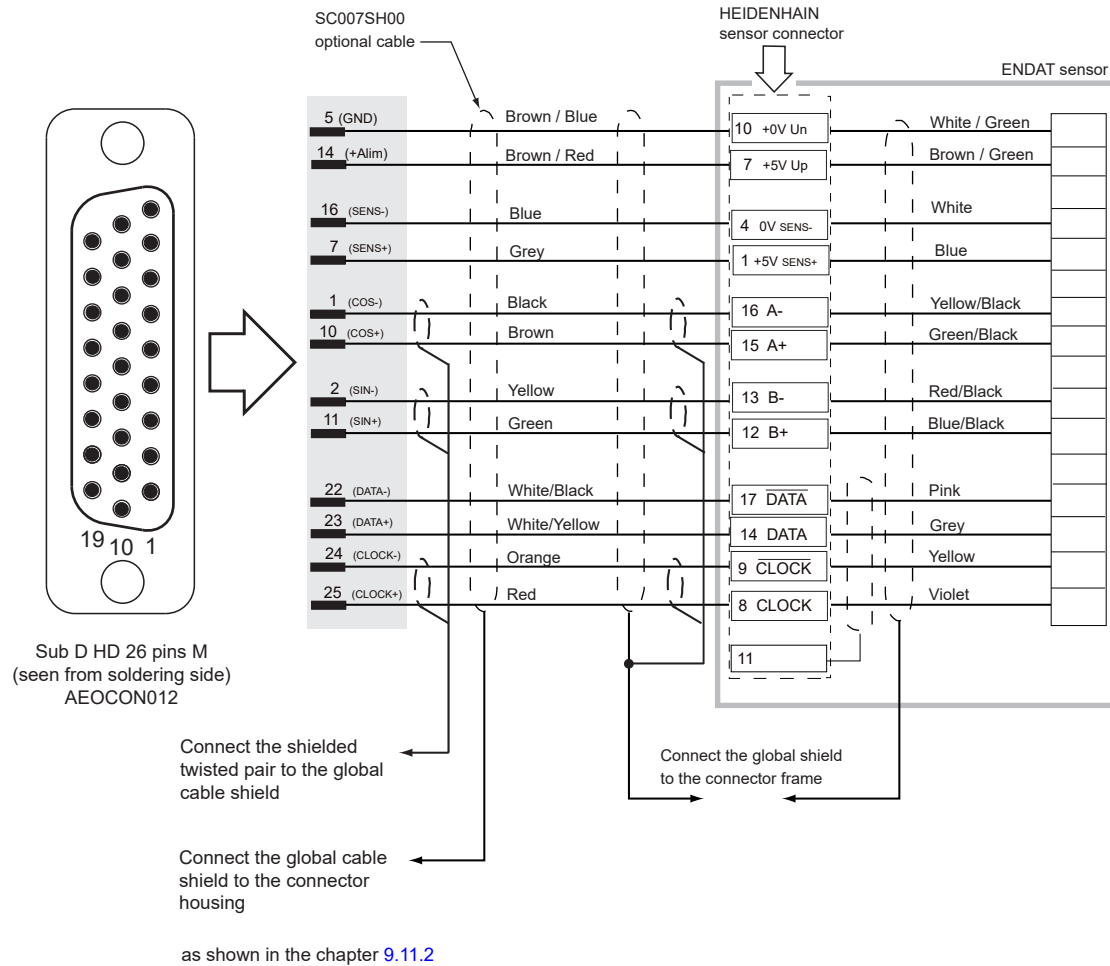
9.9.7 Incremental encoder signals (optical scale) and HALL effect sensor



The sensor connector with SC007SH00 cable mounting and crimping procedure are indicated in the chapter 9.11.1

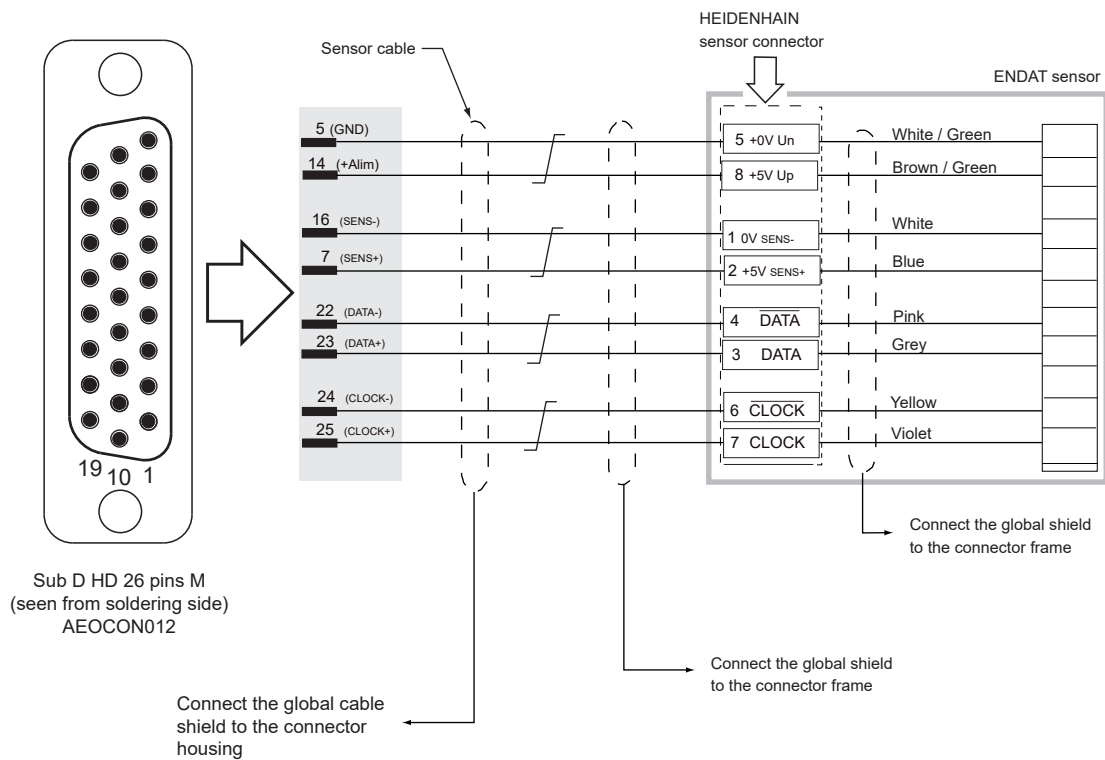
Connections example by using Siemens cable.

9.9.8 HEIDENHAIN type ENDAT 2.1 or 2.2 with incremental signals connections



For wiring the sensor connector. See chapter [9.11.1](#)

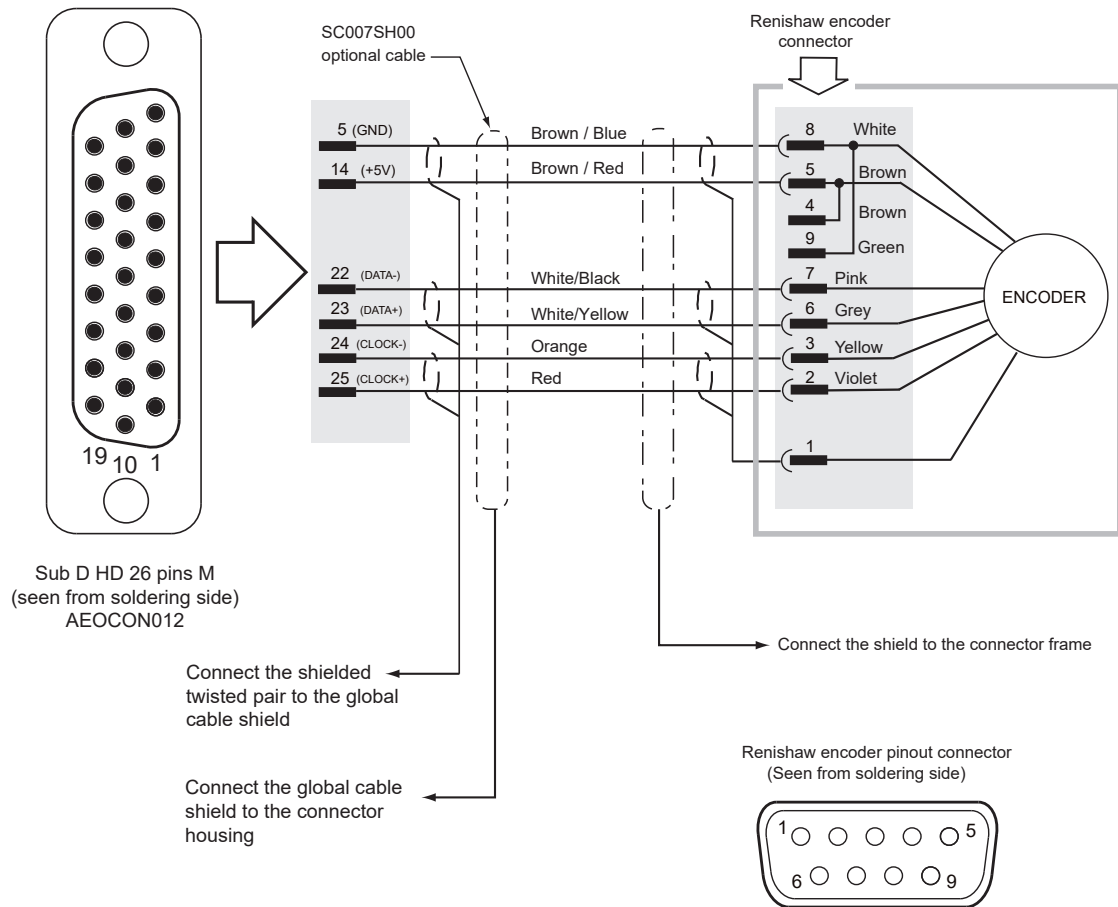
9.9.9 HEIDENHAIN type ENDAT 2.2 without incremental signals connections



as shown in the chapter [9.11.2](#)

For wiring the sensor connector. See chapter [9.11.1](#)

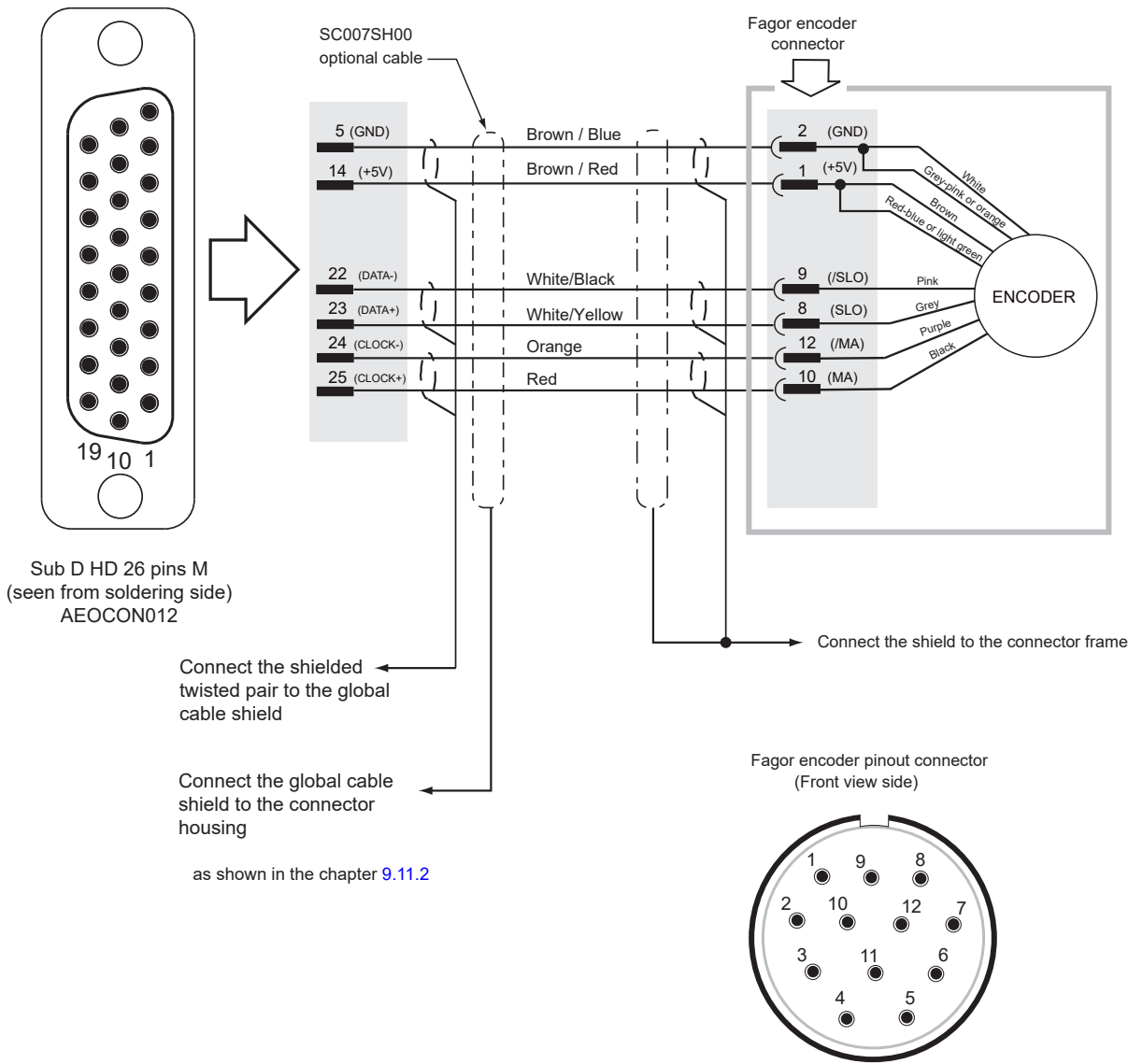
9.9.10 BiSS Resolute Renishaw encoder connections



as shown in the chapter [9.11.2](#)

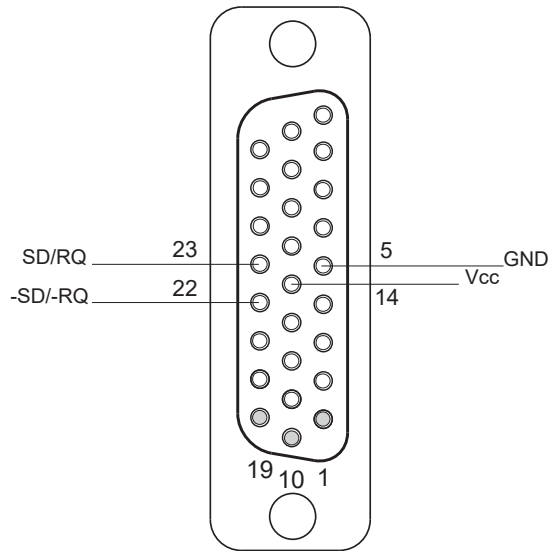
For wiring the sensor connector. See chapter [9.11.1](#)

9.9.11 BiSS C Fagor encoder connections

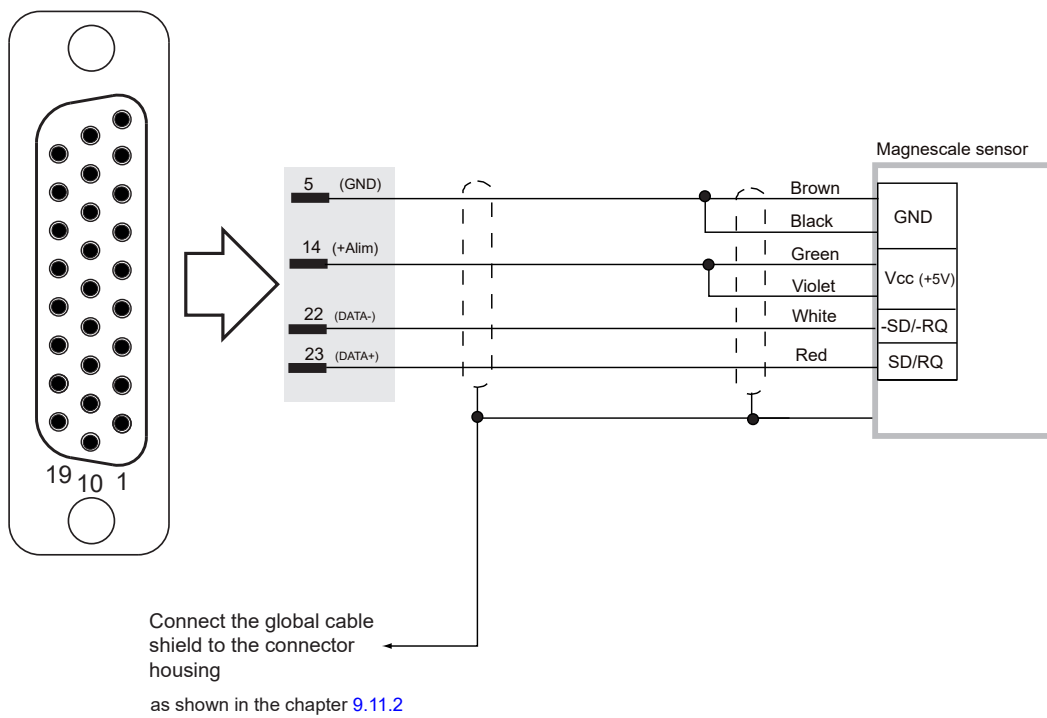


For wiring the sensor connector. See chapter [9.11.1](#)

9.9.12 Magnescale encoder connections

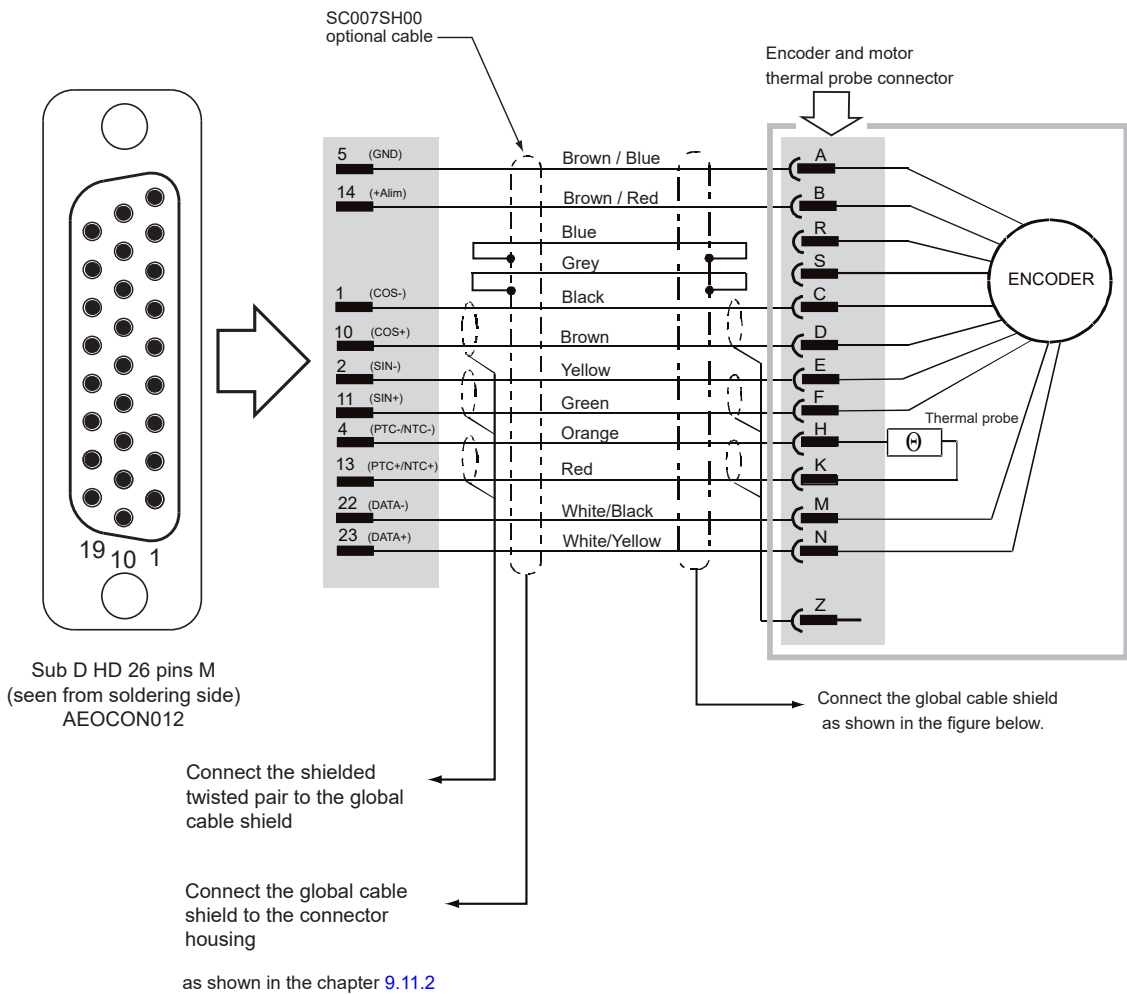


Sub D HD 26 pins M
(seen from soldering side)
AEOCON012

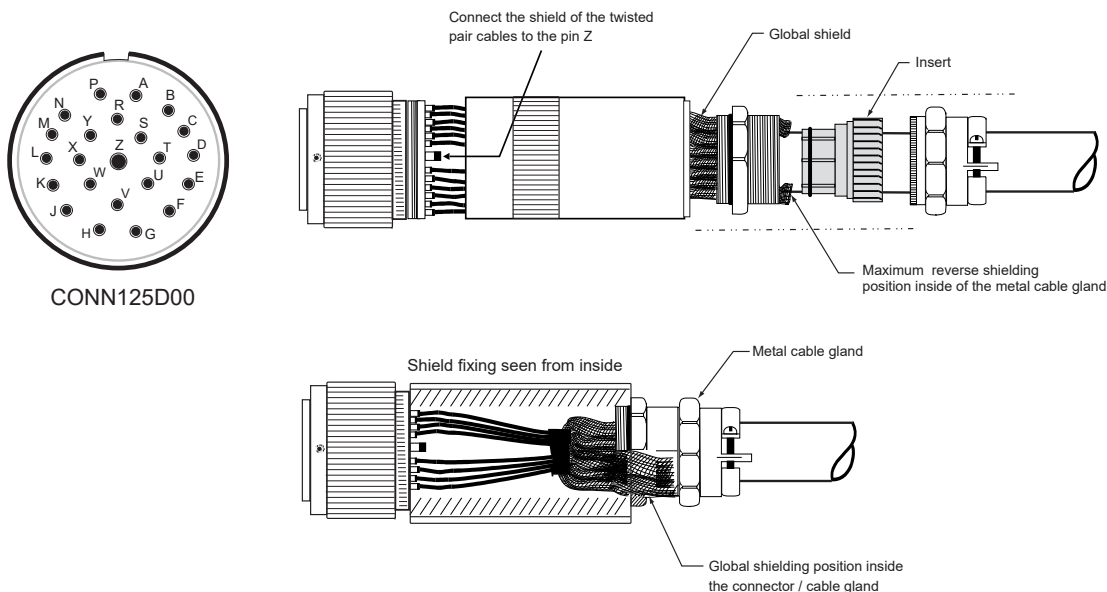


It is possible to manage HALF-DUPLEX connections only!
(FULL-DUPLEX connections not supported)

9.9.13 Encoder P, Q connections for AMS100, 132, 160 spindle motors



Encoder and thermal probe connector pinout (Seen from soldering side) and shield fixing over the metal cable gland.



The cable must be soldered over the connector as indicated in figure.
The global shield must be always reverse on the internal side of the insert as far as the gasket cable clamp in such a way to use the largest contact areas.

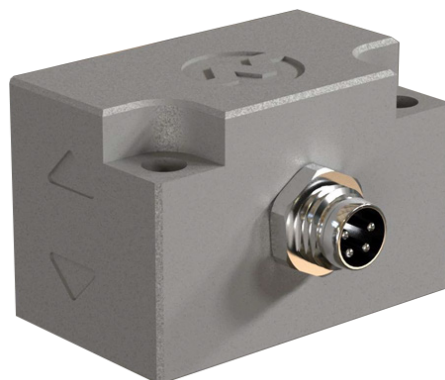
9.10 Vibration detector VDR (accelerometer)

The NUM vibration detector (machine sensor) allows to measure, with a wide bandwidth, accelerations within a range of $\pm 2g$.

It is directly connected to NUM's servo drives (MDLUF). The accelerometer is sampled at 50 microseconds, it can be used in closed loop with bandwidths up to some hundreds of hertz and used in for different applications:

- Cost effective solution for implementing an active damping close loop function (without the need of a machine sensor like linear scale)
- Dumping the tool center point vibrations
- Use the acceleration information to optimize the milling/turning process (avoid chattering for example)
- Detect and log machine crashes
- Estimate tool life and tool breakage even associated with NUMmonitor
- Detect spindle vibrations (bearing issues)
- Detect mechanical backlash
- Compensate cross-axes deformation.

Technical Data	VDX1002A00AC000
Acceleration range	$\pm 2g$
Direction of measurement	mono-axis, normal to mounting plane
Max measurable frequency	2 kHz
Output signal type	analogue (differential) 1 Vpp
Max output	60% of 1 Vpp at 2g
Power supply input	8÷15V
Working temperature range	0-85 °C
Storage temperature range	0÷100°C
Case material	Aluminium
Weight	~55g
Mounting	2 screws M4x30 ISO4762 (DIN912)
Protection degree	IP67 (with plugged female connector)



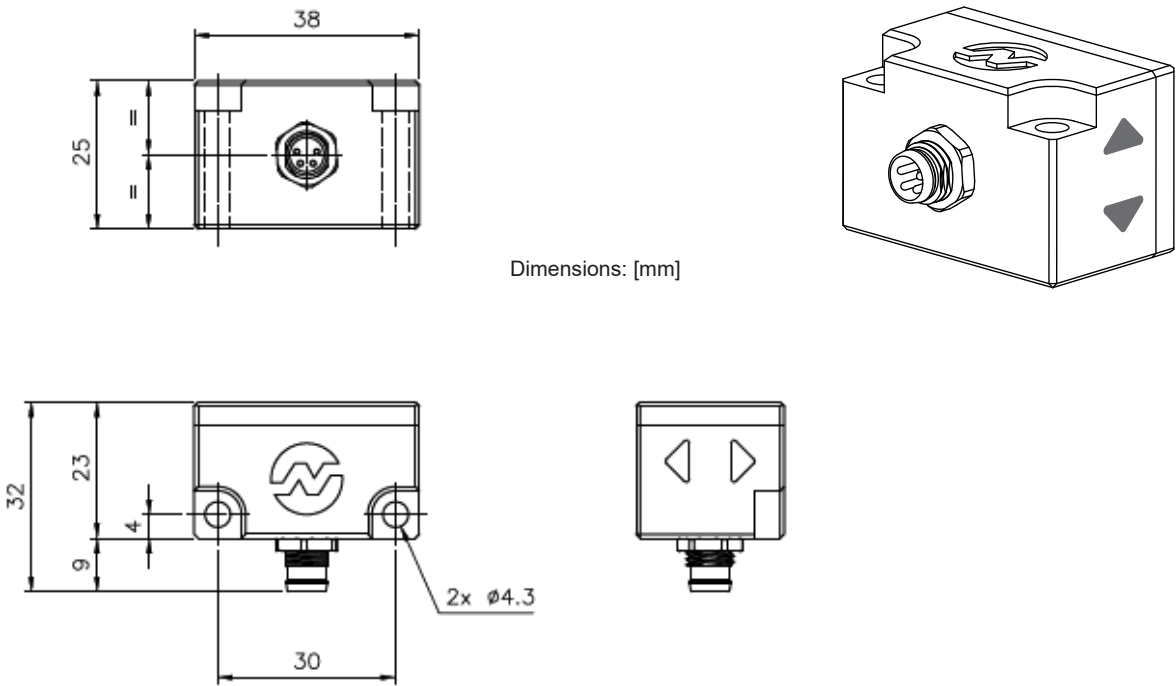
VDX1002A00AC000



AEOCON016

Accelerometer cable connector (optional)

Outlines



Wiring



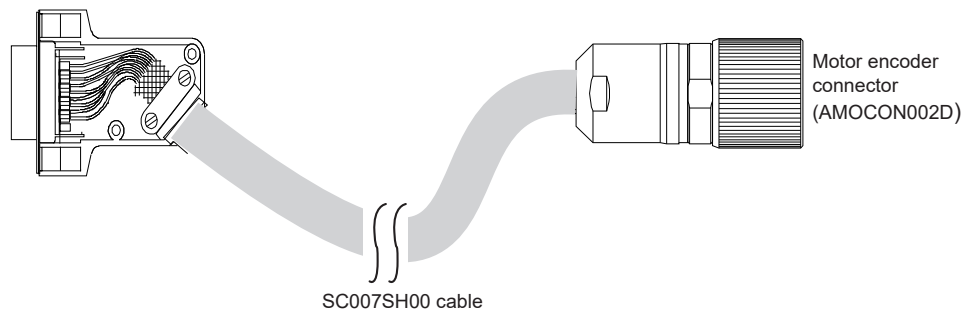
See chapter 3.4 for drive connector choose.



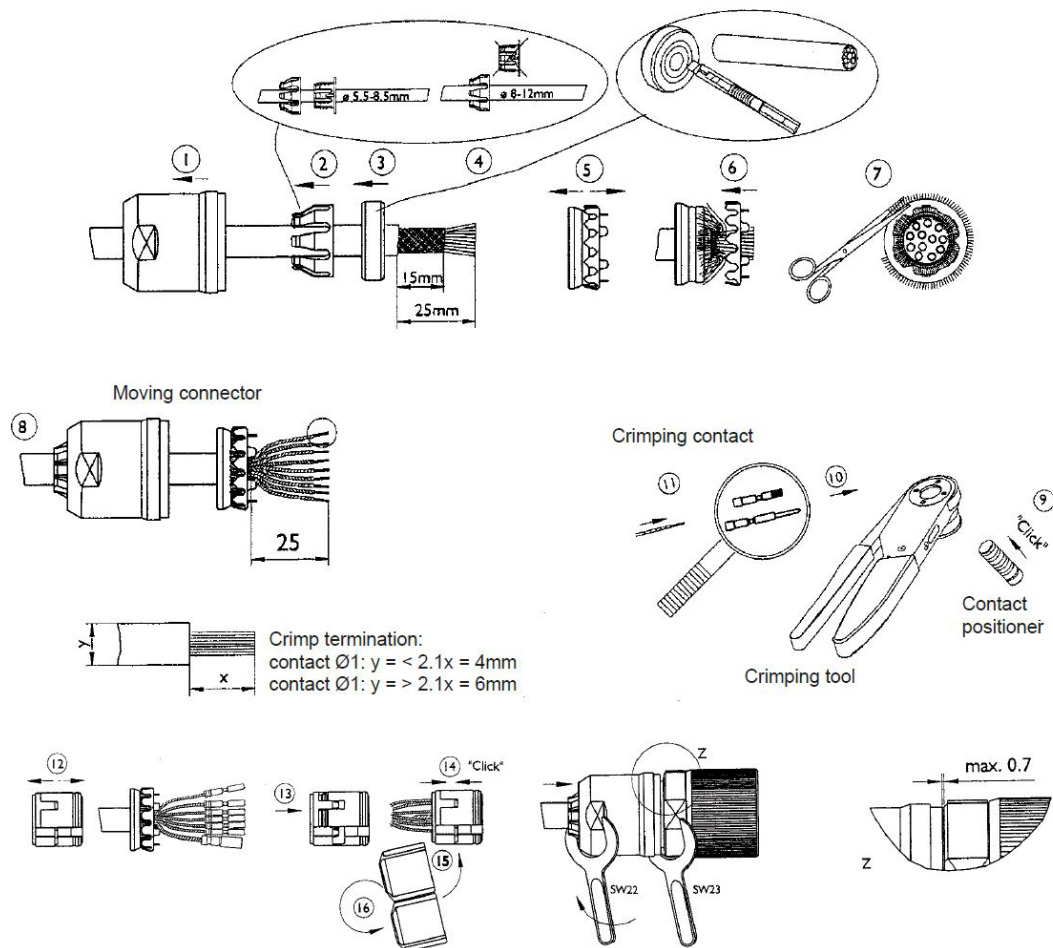
Allowed cable section 4x0.50 mm² with shield.

9.11 Wiring the sensor and thermal probe connectors

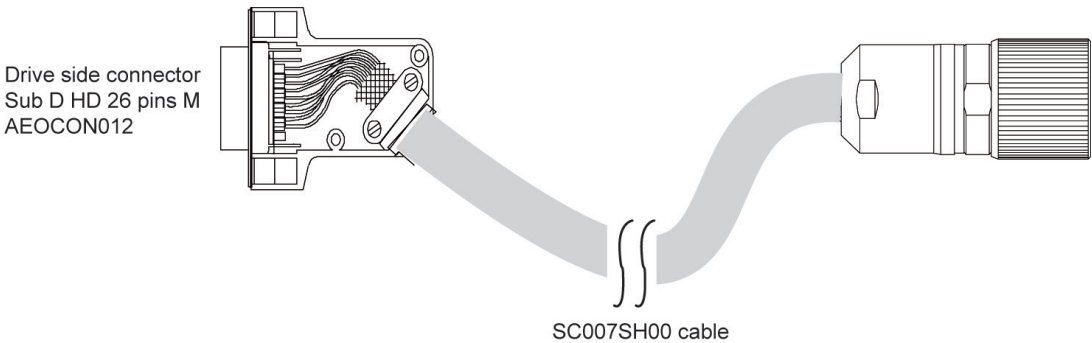
9.11.1 Mounting SC007SH00 cable onto sensor connector AMOCON002D motor side



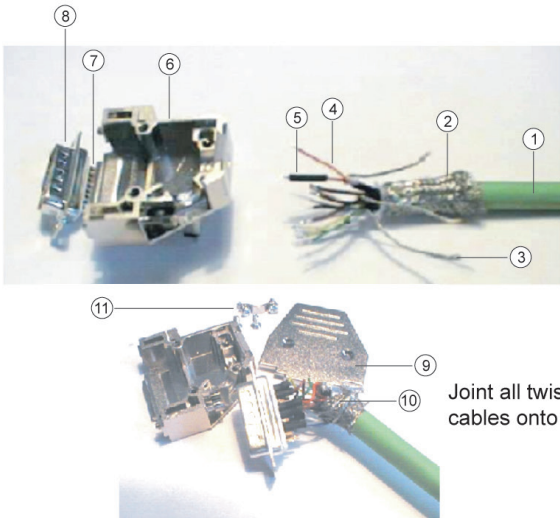
If you assemble your own motor encoder and motor thermal probe cable in the connector, please do so according to the following procedure.



9.11.2 Mounting SC007SH00 cable onto sensor connector AEOCON012 drive side

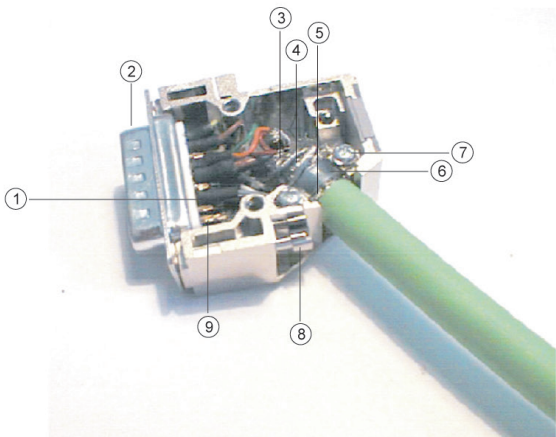


If you assemble your own motor encoder and motor thermal probe cable in the connector, please do so according to the following procedure.



Item	Description
1	SC007SH00 cable
2	Global shield
3	Shielded twisted pair
4	Cables
5	Cable termo-protection
6	Connector open housing
7	Connector pins view
8	Connector sheath
9	Connector cover
10	Whole shield position
11	Metal blocking cable

Joint all twisted shielded cables onto global shield



Assembled connector view



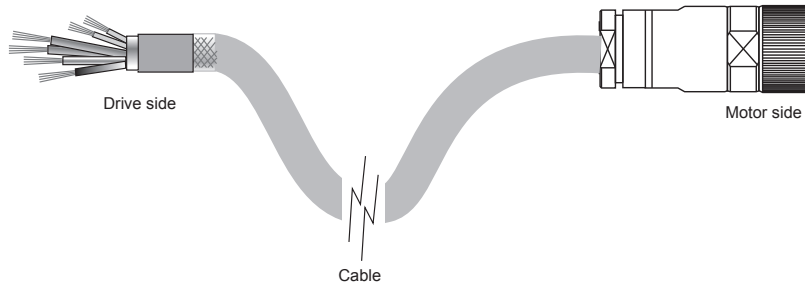
Item	Description
1	Soldered cables position
2	Connector sheath
3	Shielded twisted pair position
4	Shielded twisted pair position
5	Global shield position
6	Metal blocking shield and cable
7	Metal blocking fixing screw
8	Connector fixing screw (see note)
9	Connector pins

Pay particular attention during the connector mounting / fixing screw. Take always into consideration the tightening torque value (0.3Nm), value that is achieved by hand-tightening the screw. Not to respect these values can cause damage or breakage of the screw.

9.11.3 NUM sensor and thermal probe cable assemblies

9.11.3.1 SC007SH20Mxxxx

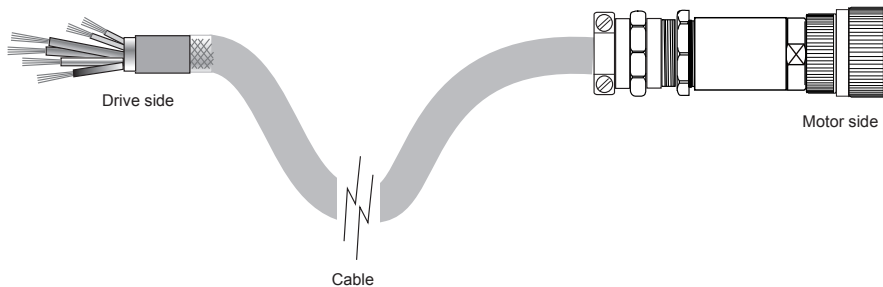
Motor encoder and thermal probe cable connections



Cable connections		Connector pinout
Brown / Red	+Alim	3
Brown / Blue	GND	4
Blue	Connected to the global shield	
Gray		
Black	COS-	5
Brown	COS+	6
Green	SIN+	7
Yellow	SIN-	8
White / Black	DATA-	9
White / Yellow	DATA+	10
Orange	PTC- or NTC-	12
Red	PTC+ or NTC+	13

9.11.3.2 SC007SH10Mxxxx

Motor encoder and thermal probe cable connections



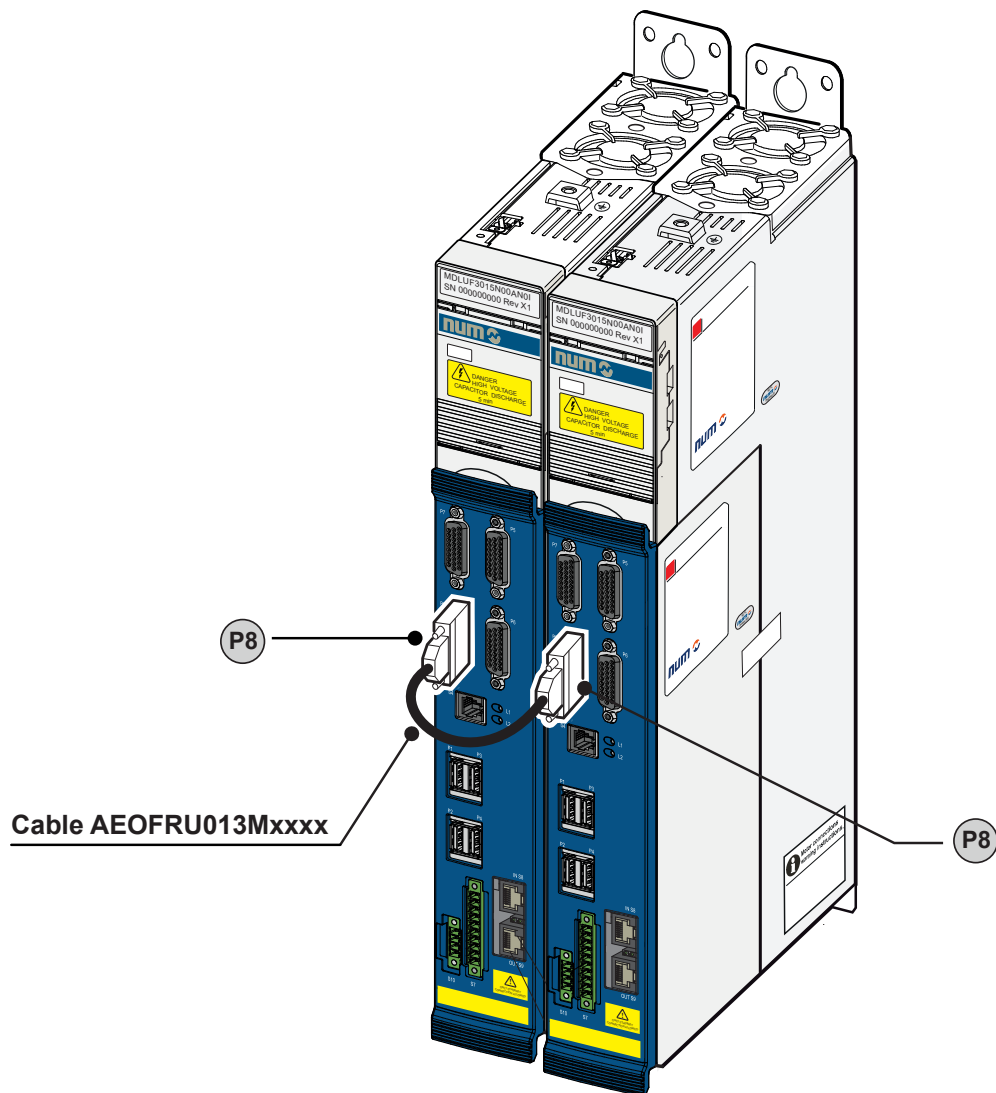
Cable connections		Connector pinout
Brown / Red	+Alim	B
Brown / Blue	GND	A
Blue	Connected to the global shield	
Gray		
Black	COS-	C
Brown	COS+	D
Green	SIN+	F
Yellow	SIN-	E
White / Black	DATA-	M
White / Yellow	DATA+	N
Orange	PTC- or NTC-	H
Red	PTC+ or NTC+	K

9.12 Tandem connections and Torque Duplication

9.12.1 Hardware requirement and limitation

- **Mono-Axis drive:**
 - POSSIBLE functions only on “D” labeled drives:
 - AP03: Anti-backlash function
 - AP04: Torque duplication
 - AP05: Winding duplication
 - Involving up to 4 drives (one master and 3 slaves);
 - Hierarchic structures possible;
 - Communication cable required (AEOF RU013M000_).
- **Enhanced performance Mono-Axis drive:**
 - NO POSSIBLE:
 - AP03: Anti-backlash function
 - AP04: Torque duplication
 - AP05: Winding duplication
- **Standard performance Bi-Axes and Quad-Axes drive:**
 - NO POSSIBLE:
 - AP03: Anti-backlash function
 - AP04: Torque duplication
 - AP05: Winding duplication
- **High performance Bi-Axes drive:**
 - POSSIBLE:
 - AP03: Anti-backlash function
 - AP04: Torque duplication
 - AP05: Winding duplication
 - Involving ONLY 2 motors (master and slave) in the common Bi-Axes drive;
 - NO communication cable required;
 - NO hierarchic structures possible.
- **High performance Quad-Axes drive:**
 - POSSIBLE:
 - AP03: Anti-backlash function
 - AP04: Torque duplication
 - AP05: Winding duplication
 - Involving up to 4 drives (one master and 3 slaves) in the common Quad-Axes drive;
 - NO communication cable required.

9.12.2 Torque Duplication with 2 Mono-Axis drives



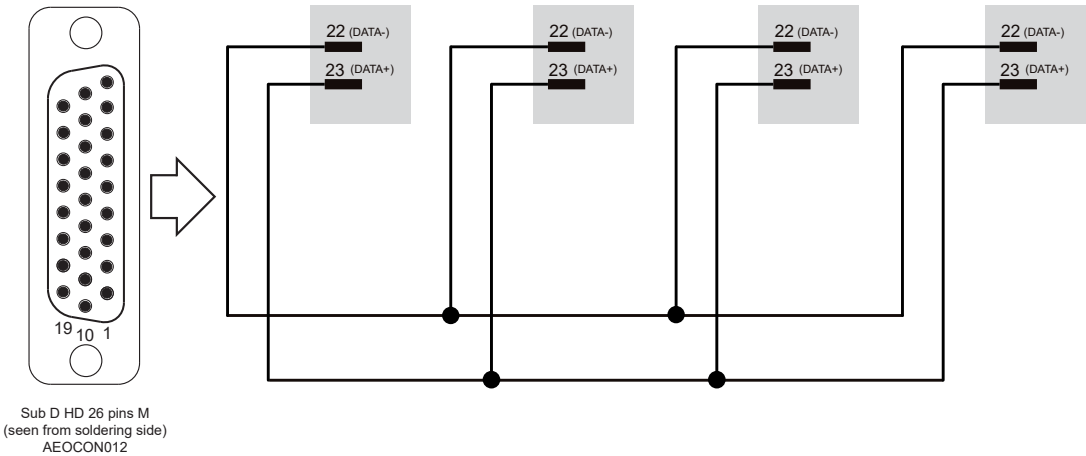
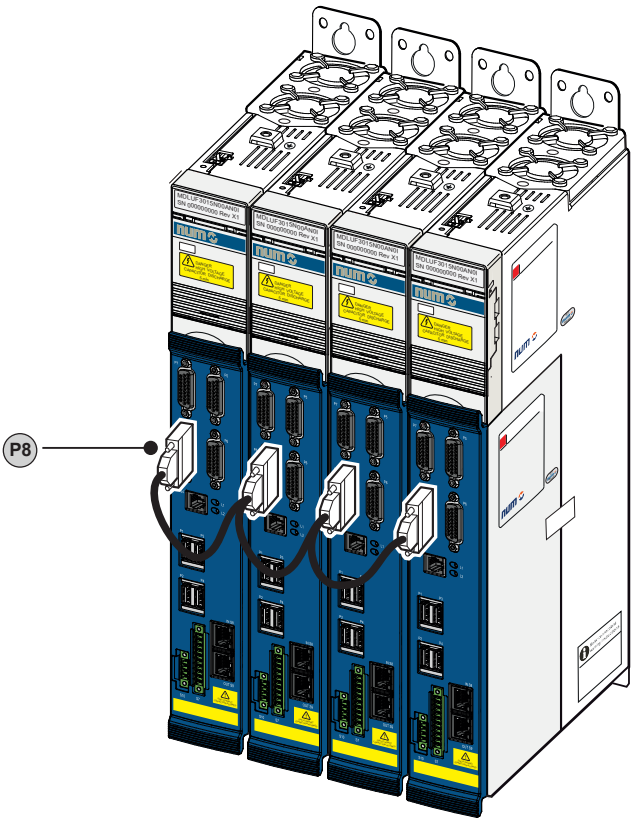
The Tandem cable connections length depends on the module size.

Please refer to chapter 10 for more detailed informations.



Please refer to MDLUF Parameters manual M00066 for more detailed informations upon the Tandem configuration.

9.12.3 Torque Duplication with more then 2 Mono-Axis drives

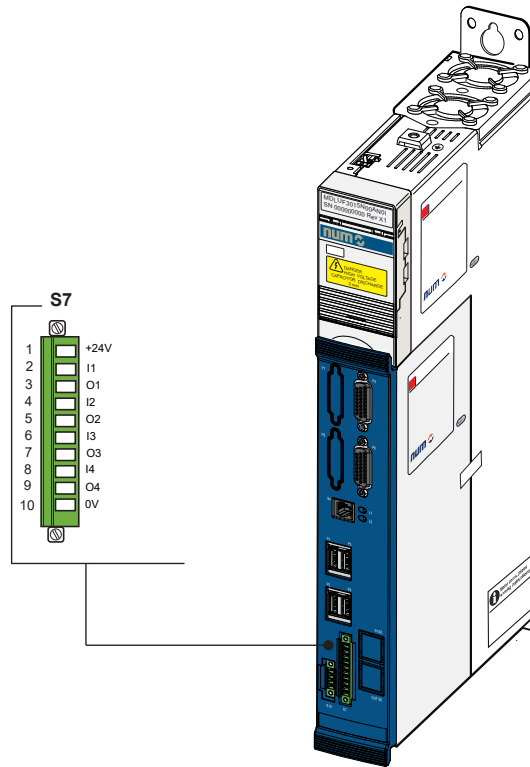


Sub D HD 26 pins M
(seen from soldering side)
AEOCON012



This application requires drives MDLUFxxxAEDxN0I.
Please refer to MDLUF Parameters manual M00066 for more detailed informations
upon the Torque Duplication configuration.

9.13 S7 - Programmable input / outputs



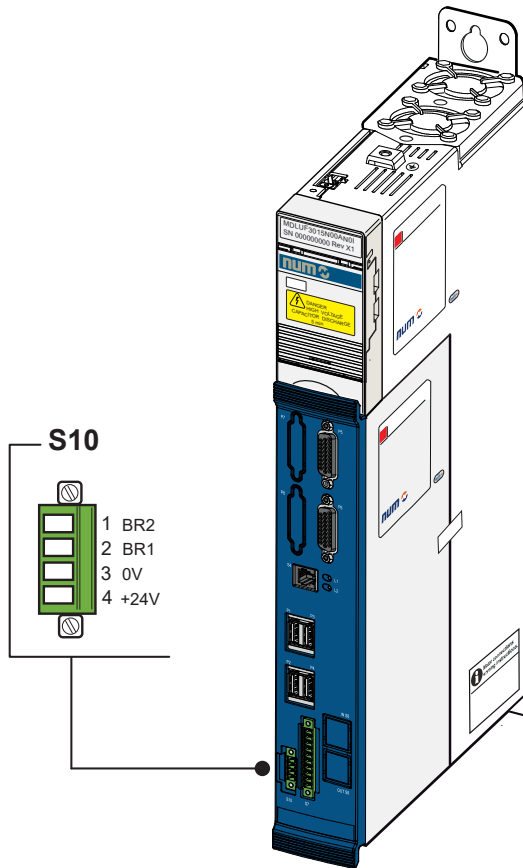
Pin	Signal	I/O	S7 Description
1	+24V	IN	+24Vdc / 50mA + Out-load external power supply. (Supplied by the customer)
2	I1	IN	Programmable I1 input
3	O1	OUT	Programmable O1 input
4	I2	IN	Programmable I2 input
5	O2	OUT	Programmable O2 input
6	I3	IN	Programmable I3 input
7	O3	OUT	Programmable O3 input
8	I4	IN	Programmable I3 input
9	O4	OUT	Programmable O3 input
10	0V	IN	0 _{24V} common for I/Os and external power supply
Screw tightening			Screw tightening torque: Min. 0.5Nm / Max. 0.6Nm
Cable			0.5mm² cable supply by the customer
Please also refer to NUM DrivePro Parameters manual M00066 (V22 ...V29 parameters) for more detailed informations about IN/OUT use. Refer to chapter 5.3 for detailed information about digital input / output level.			



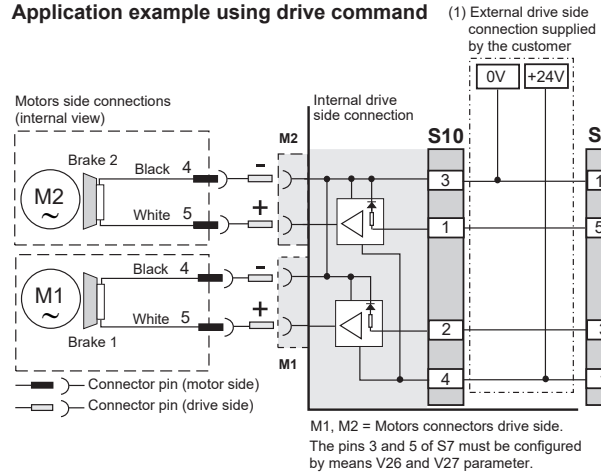
The built-in brake driver and S7 O_x outputs are not compliance to the EN61800-5-2 standards. They cannot be used as safe device to control an external brake.

9.14 S10, S13 Motors brake connections

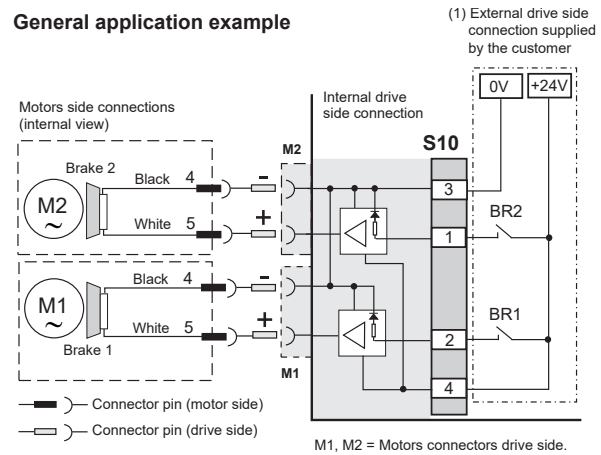
9.14.1 S10 - Motors brake connections module MDLUF007, 014, 021, 034



Application example using drive command



General application example



Pin	Signal	I/O	S10 Description
1	BR2	IN	Brake command Motor M2 : $V_{ON\ min} > 15Vdc$ / $V_{OFF\ max} < 10Vdc$ (10mA)
2	BR1	IN	Brake command Motor M1 : $V_{ON\ min} > 15Vdc$ / $V_{OFF\ max} < 10Vdc$ (10mA)
3	0V	IN	0V _{24V} supply by the customer
4	+24V	IN	From +21.6Vdc to +30Vdc ⁽¹⁾ supplied by the customer (50mA + brakes current). Maximum current for each brake = 1.9A
Screw tightening			Screw tightening torque: Min. 0.5Nm / Max. 0.6Nm
Cable			0.5mm ² cable supply by the customer

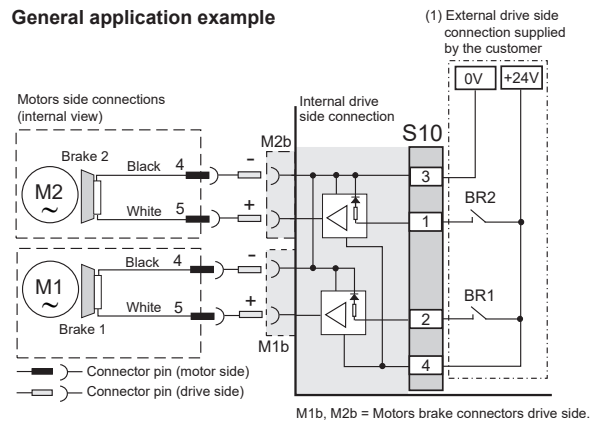
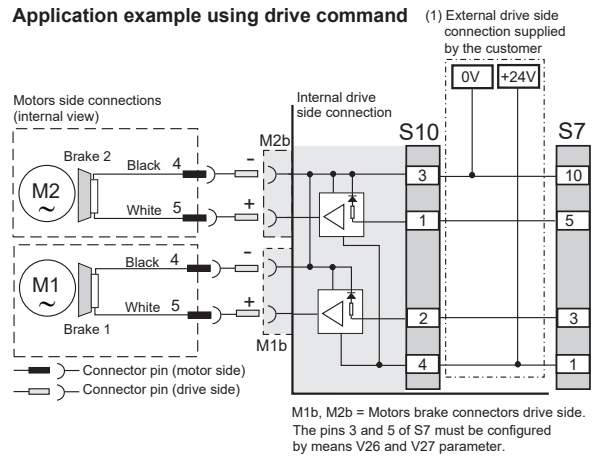
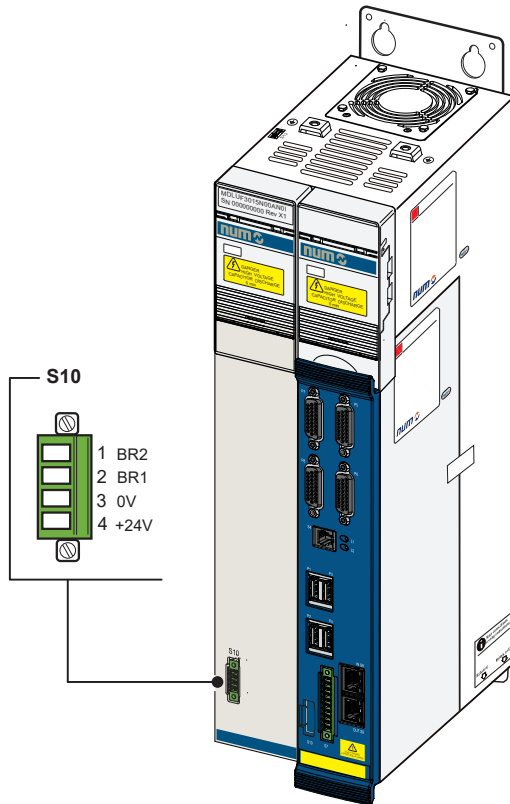


For the brake consumption see chapter 9.24.1

⁽¹⁾ See V_{Brake} ... definition and tolerance on chapter 9.14.6

The built-in brake driver and S7 Ox outputs are not compliance to the EN61800-5-2 standards. They cannot be used as safe device to control an external brake.

9.14.2 S10 - Motors brake control connections module MDLUF050, 075A



Pin	Signal	I/O	S10 Description
1	BR2	IN	Brake command Motor M2b : $V_{ON min}$ 15Vdc / $V_{OFF max}$ 10Vdc (10mA)
2	BR1	IN	Brake command Motor M1b : $V_{ON min}$ 15Vdc / $V_{OFF max}$ 10Vdc (10mA)
3	0V	IN	0V _{24V} supply by the customer
4	+24V	IN	From +21.6Vdc to +30Vdc ⁽¹⁾ supplied by the customer (50mA + brakes current). Maximum current for each brake = 1.9A
Screw tightening			Screw tightening torque: Min. 0.5Nm / Max. 0.6Nm
Cable			0.5mm ² cable supply by the customer



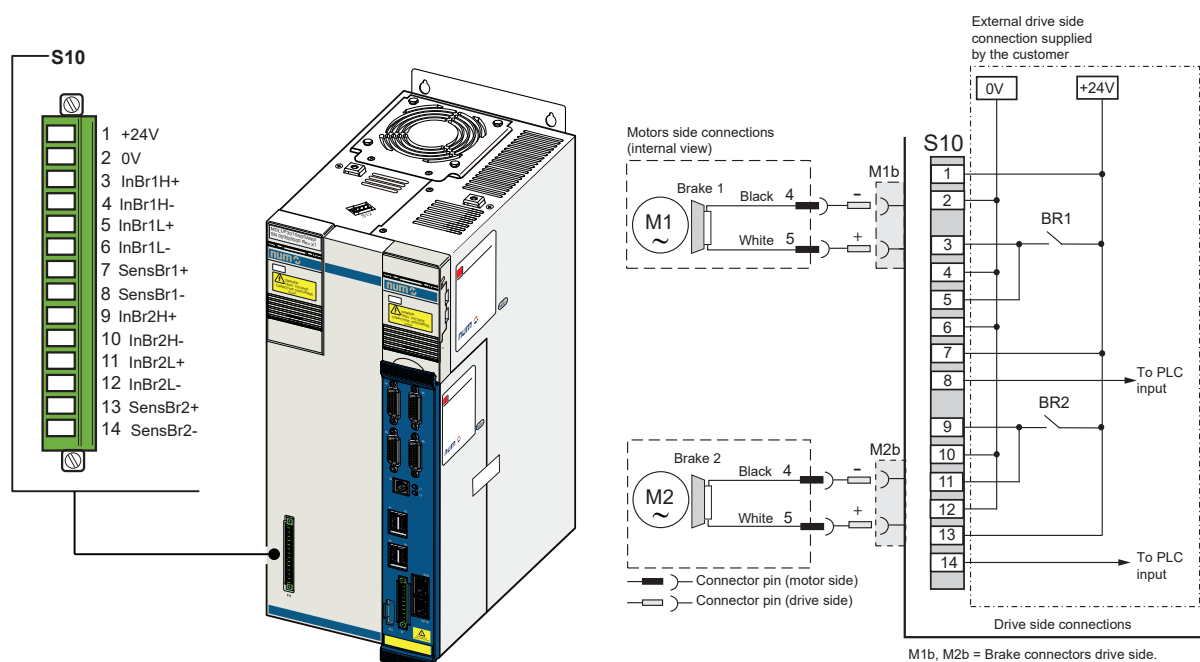
For the brake consumption see chapter 9.24.1

⁽¹⁾ See V_{Brake} ... definition and tolerance on chapter 9.14.6

The built-in brake driver and S7 Ox outputs are not compliance to the EN61800-5-2 standards. They cannot be used as safe device to control an external brake.

9.14.3 S10 - Motors brake control connections module MDLUF100A, 150A, 075B

9.14.3.1 General application example for Mono-Axis and Bi-Axes



Pin	Signal	I/O	S10 Description
1	+24V	IN	From +21.6Vdc to +30Vdc ⁽¹⁾ supplied by the customer (30mA + brakes current). Maximum current for each brake = 1.9A
2	0V	IN	0V _{24V} supplied by the customer
3, 4	InBr1H+ InBr1H-	IN	Motor M1, Brake command channel H: $V = (InBr1H+ - InBr1H-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$
5, 6	InBr1L+ InBr1L-	IN	Motor M1, Brake command channel L: $V = (InBr1L+ - InBr1L-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$
7, 8	SensBr1+ SensBr1-	IN	Motor M1, Feedback Brake command circuit status: - Low impedance (drop voltage 2V with maximum load 10mA): with S10 supplied with 24VDC and brake connected - High impedance: with S10 not supplied with 24VDC or brake not connected on M1b or brake energized (motor shaft free)
9, 10	InBr2H+ InBr2H-	IN	Motor M2, Brake command channel H: $V = (InBr2H+ - InBr2H-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$
11, 12	InBr2L+ InBr2L-	IN	Motor M2, Brake command channel L: $V = (InBr2L+ - InBr2L-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$
13, 14	SensBr2+ SensBr2-	IN	Motor M2, Feedback Brake command circuit status: - Low impedance (drop voltage 2V with maximum load 10mA): with S10 supplied with 24VDC and brake connected - High impedance: with S10 not supplied with 24VDC o brake not connected on M1b or brake energized (motor shaft free)
Screw tightening			Screw tightening torque: Min. 0.5Nm / Max. 0.6Nm
Cable			0.5mm ² cable supplied by the customer

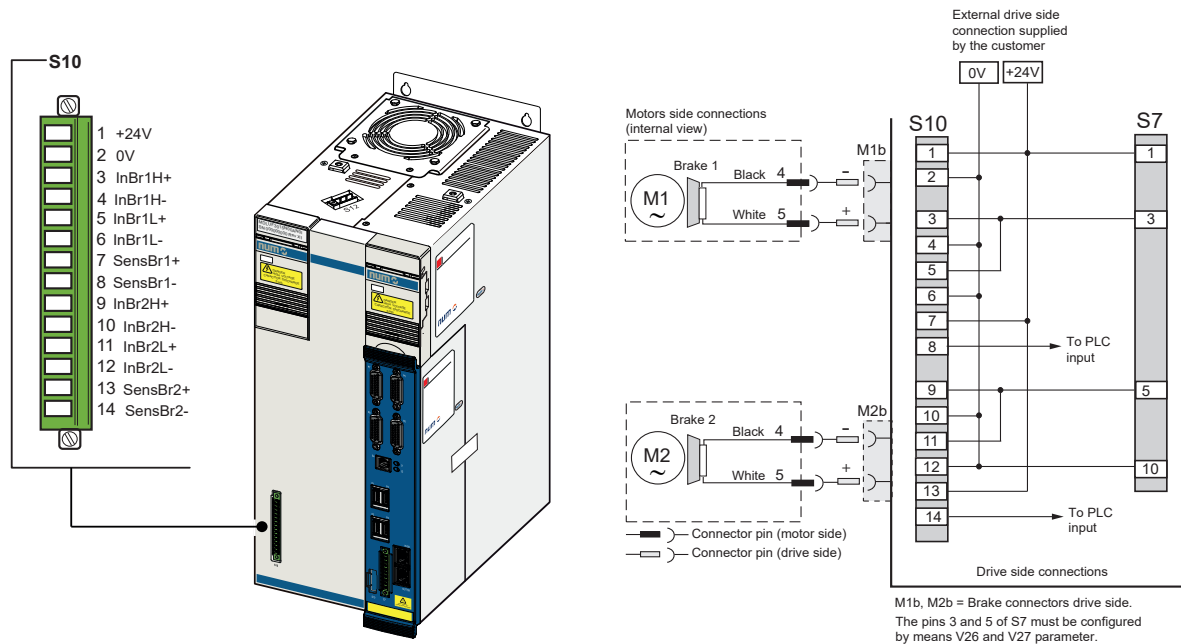


For the brake consumption see chapter 9.24.1

⁽¹⁾ See V_{Brake} ... definition and tolerance on chapter 9.14.6

The built-in brake driver and S7 Ox outputs are not compliance to the EN61800-5-2 standards. They cannot be used as safe device to control an external brake.

9.14.3.2 Application example using drive command



Pin	Signal	I/O	S10 Description
1	+24V	IN	From +21.6Vdc to +30Vdc ⁽¹⁾ supplied by the customer (30mA + brakes current). Maximum current for each brake = 1.9A
2	0V	IN	0V _{24V} supply by the customer
3, 4	InBr1H+ InBr1H-	IN	Motor M1, Brake command channel H: $V = (InBr1H+ - InBr1H-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$
5, 6	InBr1L+ InBr1L-	IN	Motor M1, Brake command channel L: $V = (InBr1L+ - InBr1L-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$
7, 8	SensBr1+ SensBr1-	IN	Motor M1, Feedback Brake command circuit status: - Brake energized (motor shaft free) (SensBr1+/SensBr1-): High impedance - Brake not energized (SensBr1+/SensBr1-): Low impedance, drop voltage 2V with maximum load 10mA.
9, 10	InBr2H+ InBr2H-	IN	Motor M2, Brake command channel H: $V = (InBr2H+ - InBr2H-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$.
11, 12	InBr2L+ InBr2L-	IN	Motor M2, Brake command channel L: $V = (InBr2L+ - InBr2L-) V_{ON} \min 12Vdc / V_{OFF} \max 4.5Vdc (10mA)$.
13, 14	SensBr2+ SensBr2-	IN	Motor M2, Feedback Brake command circuit status: - Brake energized (motor shaft free) (SensBr2+/SensBr2-): High impedance - Brake not energized (SensBr2+/SensBr2-): Low impedance, drop voltage 2V with maximum load 10mA.
Screw tightening			Screw tightening torque: Min. 0.5Nm / Max. 0.6Nm
Cable			0.5mm ² cable supply by the customer



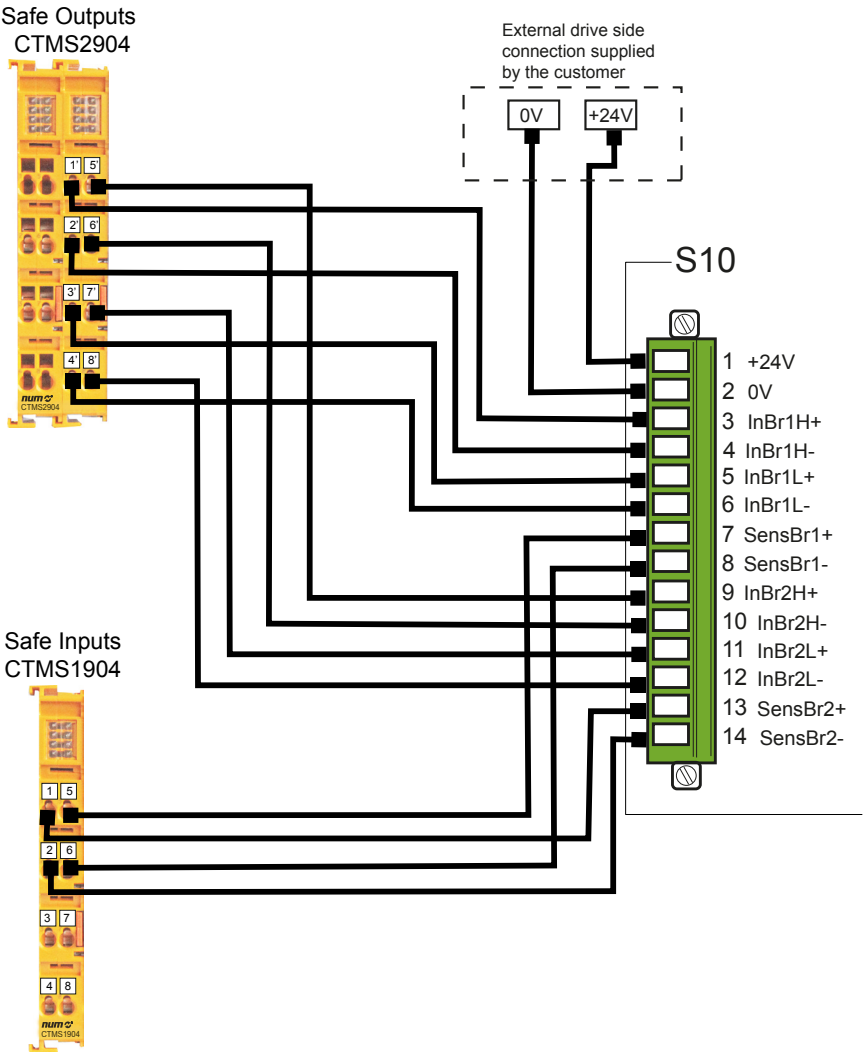
For the brake consumption see chapter 9.24.1

⁽¹⁾ See V_{Brake} ... definition and tolerance on chapter 9.14.6

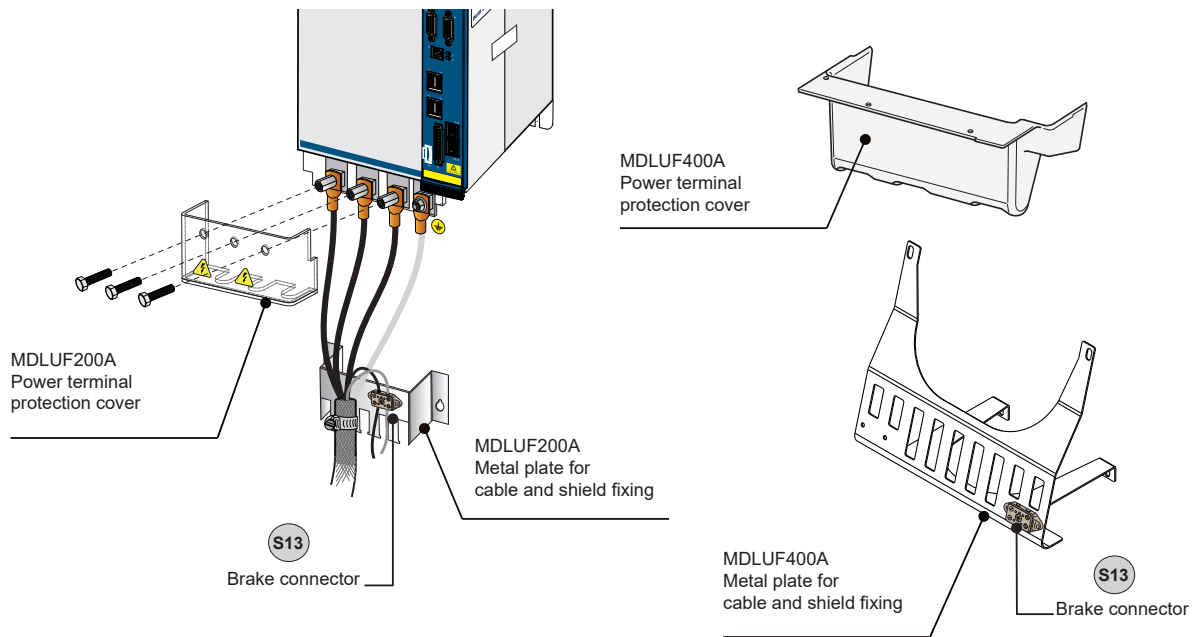
The built-in brake driver and S7 Ox outputs are not compliance to the EN61800-5-2 standards. They cannot be used as safe device to control an external brake.

9.14.4 S10 - Motors brake control connections module MDLUF100A, 150A, 075B

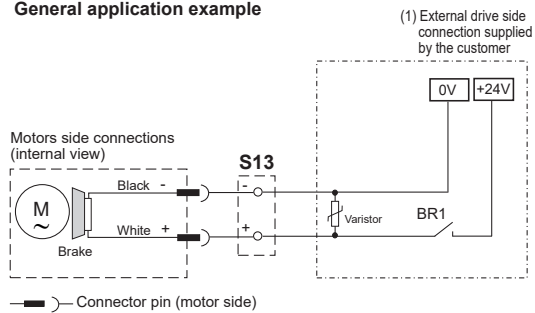
9.14.4.1 Safety I/O connections example for Mono-Axis and Bi-Axes



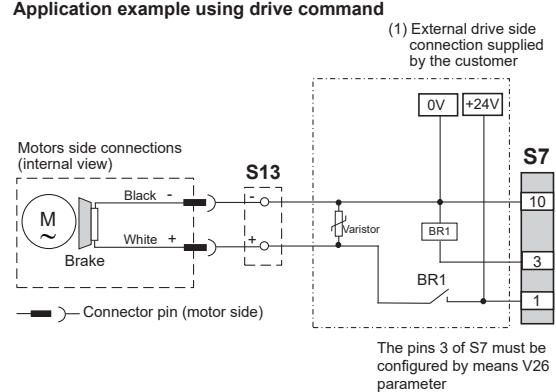
9.14.5 S13 - Motors brake control connections module MDLUF200A, 400A



General application example



Application example using drive command



Signal	Description
BR1	Relay supply by the customer
0V	0V _{24V} supply by the customer
+24V	From +21.6Vdc to +30Vdc ⁽¹⁾ supplied by the customer



For the brake consumption see chapter [9.24.1](#)

⁽¹⁾ See V_{Brake}... definition and tolerance on chapter [9.14.6](#).

The S7 Ox output is not compliance to the EN61800-5-2 standards.
It cannot be used as safe device to control an external brake.

9.14.6 Brake voltage definition and tolerance

Due to voltage drops of the drive brake circuit and due to brake cable length, the external supply voltage must always respect the following rules:

$$V_{Brake-Driver MIN} = V_{Brake-Min} + (R_{Brake-Driver} + 2 \cdot L_{Brake-Cable} \cdot \rho_{Brake-Cable}) \cdot I_{Brake-Nom}$$

$$V_{Brake-Driver MAX} = V_{Brake-Max} + (R_{Brake-Driver} + 2 \cdot L_{Brake-Cable} \cdot \rho_{Brake-Cable}) \cdot I_{Brake-Nom}$$

Legend

$V_{Brake-Min}$ = Minimum acceptable brake voltage at the motor terminals [Vdc]

$V_{Brake-Max}$ = Maximum acceptable brake voltage at the motor terminals [Vdc]

$I_{Brake-Nom}$ = Nominal brake current [Adc]

$L_{Brake-Cable}$ = Brake cable length [m]

$\rho_{Brake-Cable}$ = Brake cable resistivity [Ω/m] ⁽¹⁾

$R_{Brake-Driver}$ = Brake driver circuit resistance [Ω]

$V_{Brake-Driver}$ = Supply voltage of the brake drive circuit [Vdc]

For the brake cable resistivity values see the table on chapter 10.11.
(Attention: the cable length values in the table are expressed in Ω/km)

Example

Example in case of a BPH0752N connected to a NUM DrivePro using PC015BH00 cable 25m long the needed power supply voltage $V_{Brake-Driver}$ is:

$$V_{Brake-Min} = 21.6 \text{ Vdc}$$

$$V_{Brake-Max} = 25.2 \text{ Vdc}$$

$$I_{Brake-Nom} = 0.5 \text{ Adc}$$

$$L_{Brake-Cable} = 25 \text{ m}$$

$$\rho_{Brake-Cable} = 0.0205 \text{ } \Omega/m$$

$$R_{Brake-Driver} = 0.8 \text{ } \Omega$$

$$V_{Brake-Driver MIN} = 21.6 + (0.8 + 2 \cdot 25 \cdot 0.0205) \cdot 0.5 = 22.5 \text{ Vdc}$$

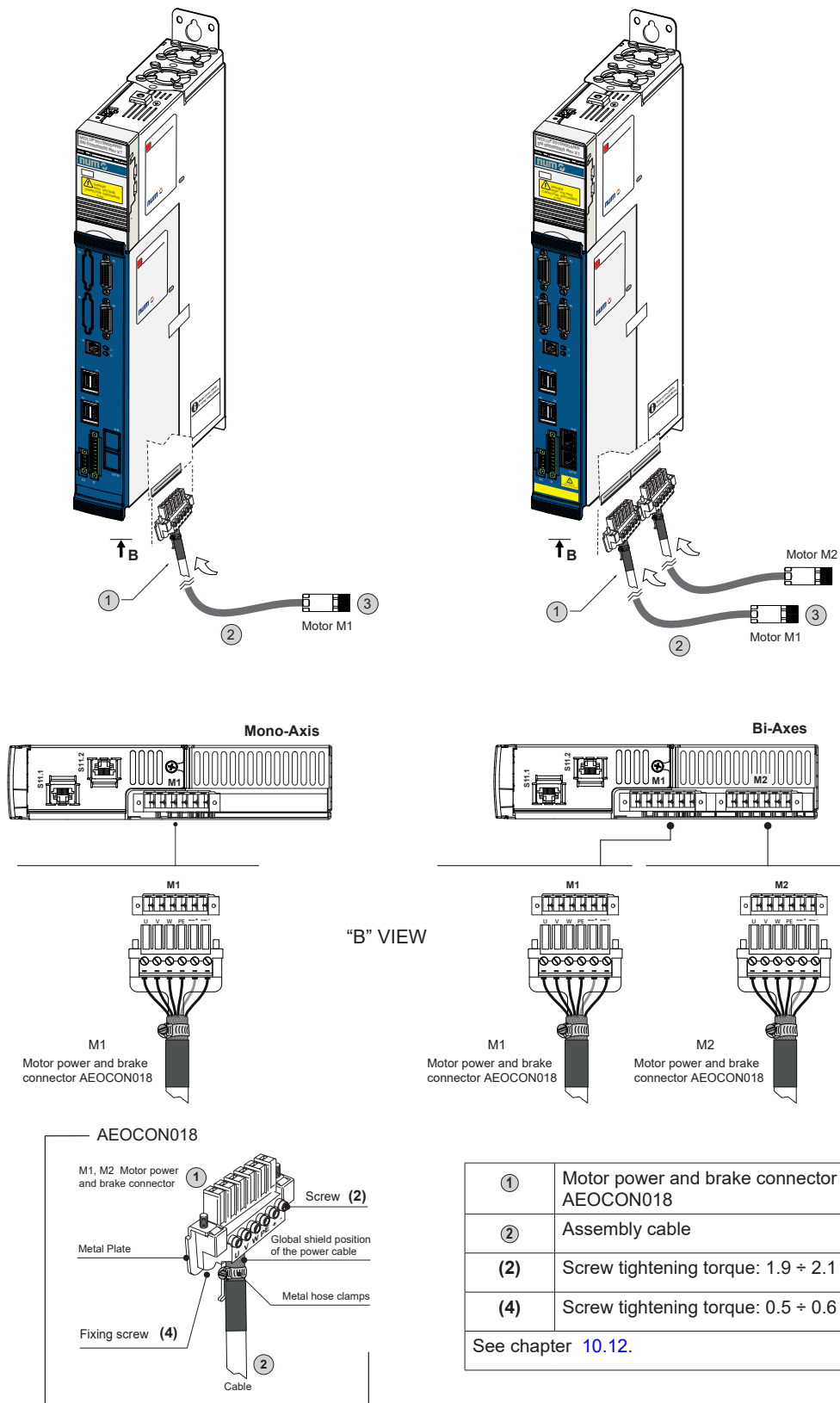
$$V_{Brake-Driver MAX} = 25.2 + (0.8 + 2 \cdot 25 \cdot 0.0205) \cdot 0.5 = 26.1 \text{ Vdc}$$



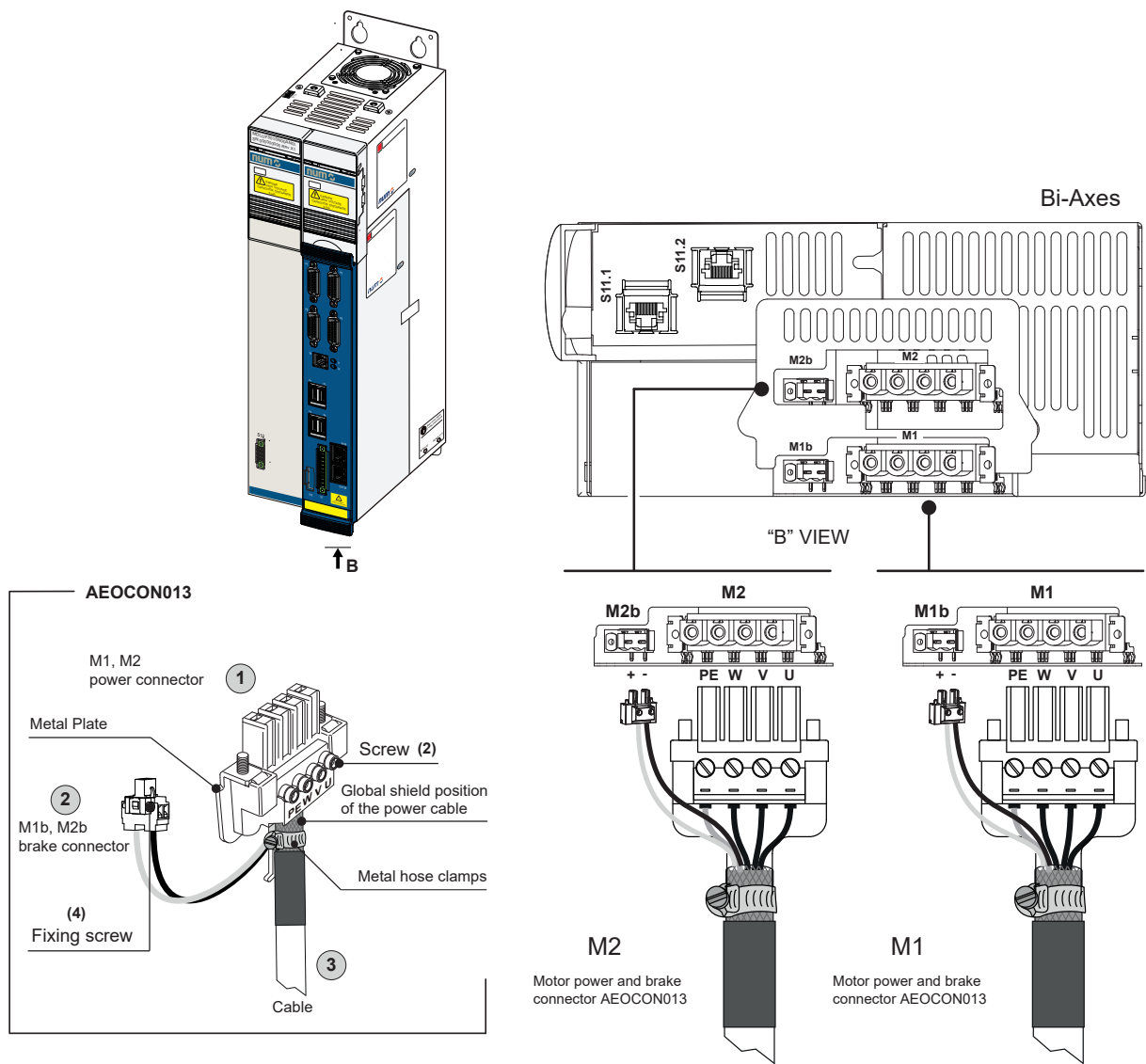
Not to respect these rules may generate hazard problems on the motor brake functionality.

9.15 Motors power connections

9.15.1 Motor connections with module MDLUF007, 014, 021, 034

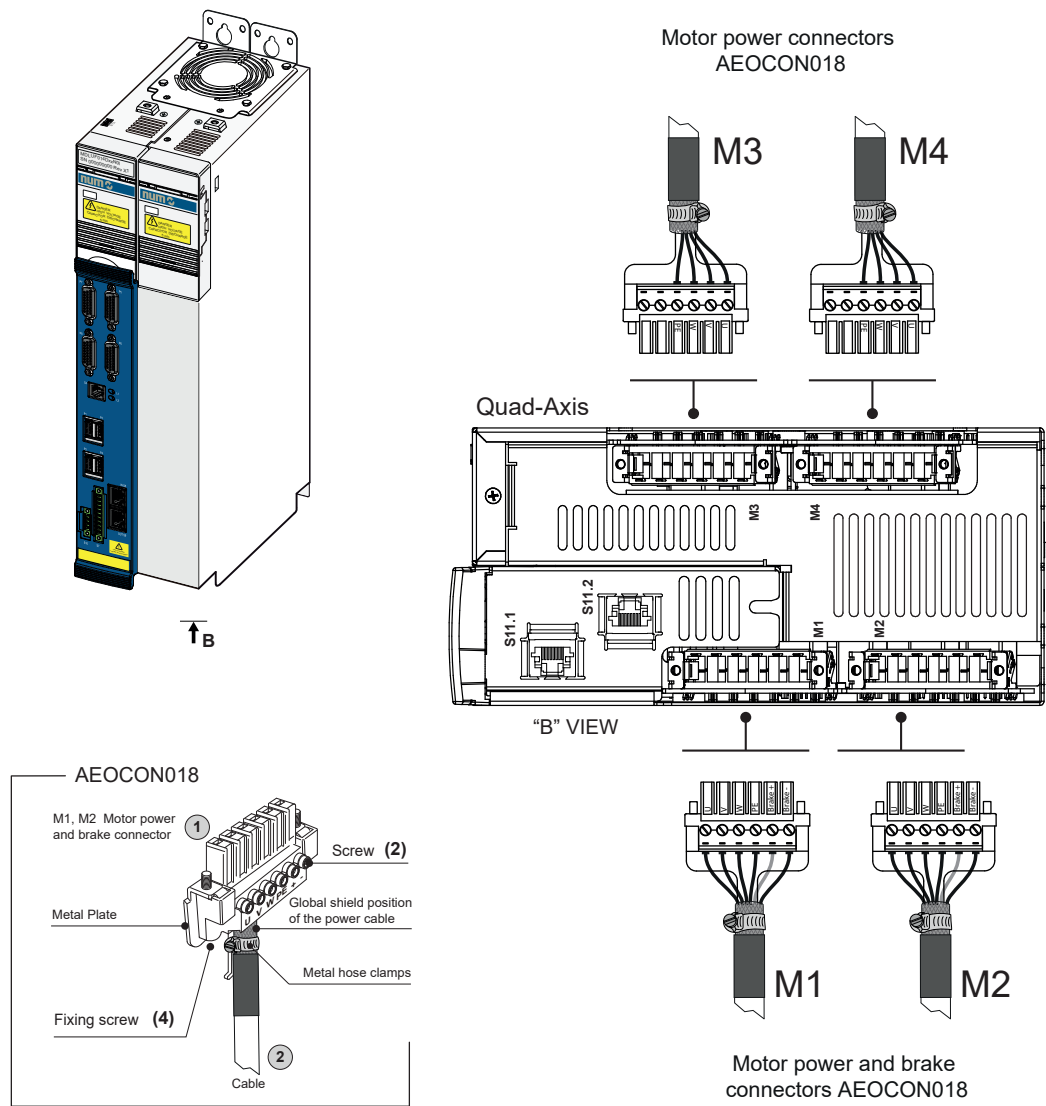


9.15.2 Motor connections with module MDLUF050, 075A



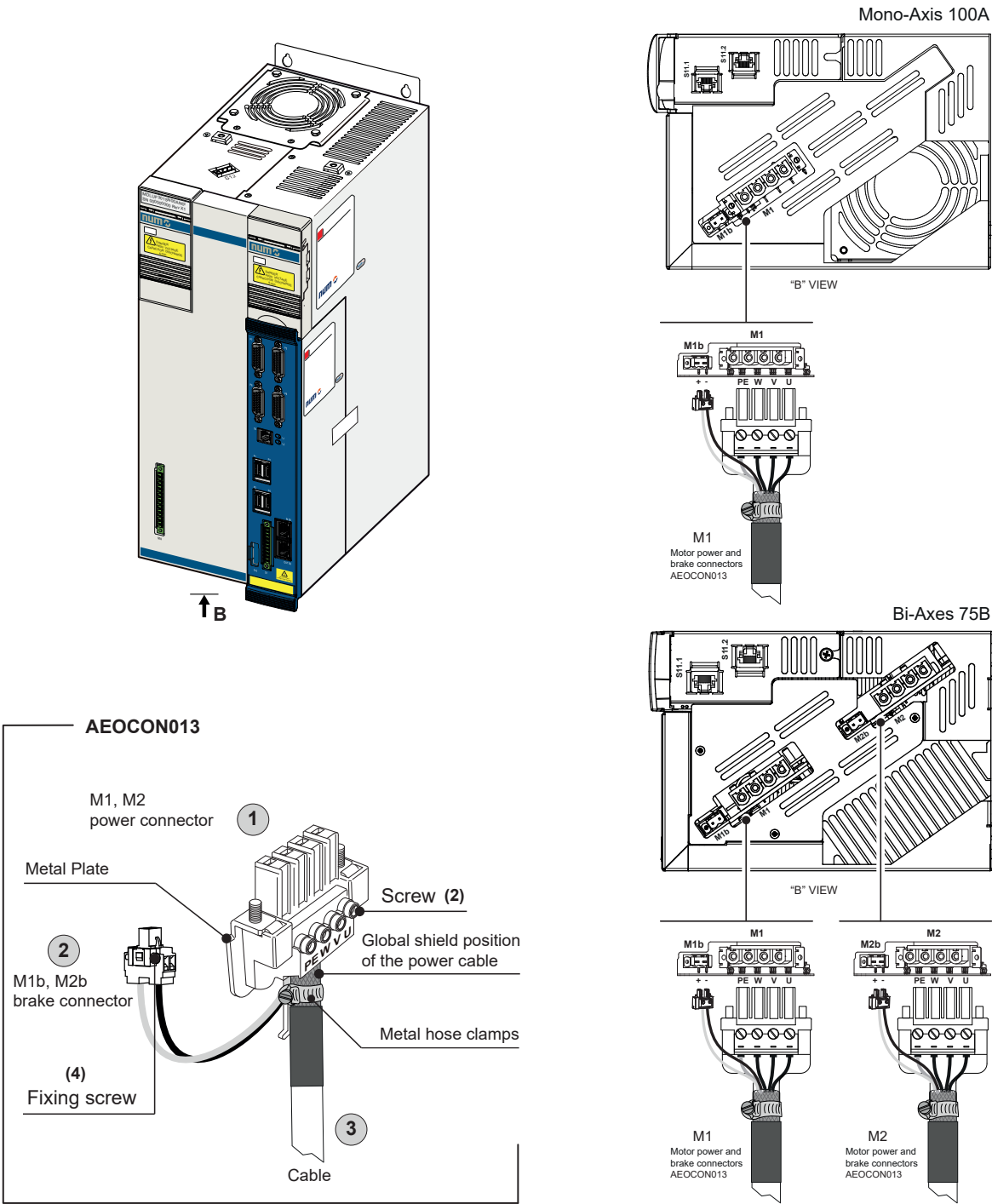
①	Motor power connector AEOCON013	(2)	Screw tightening torque: 1.9 ± 2.1 Nm
②	Motor Brake connector	(4)	Screw tightening torque: 0.5 ± 0.6 Nm
③	Assembly cable		
See chapter 10.12.			

9.15.3 Motor connections with module MDLUF014D



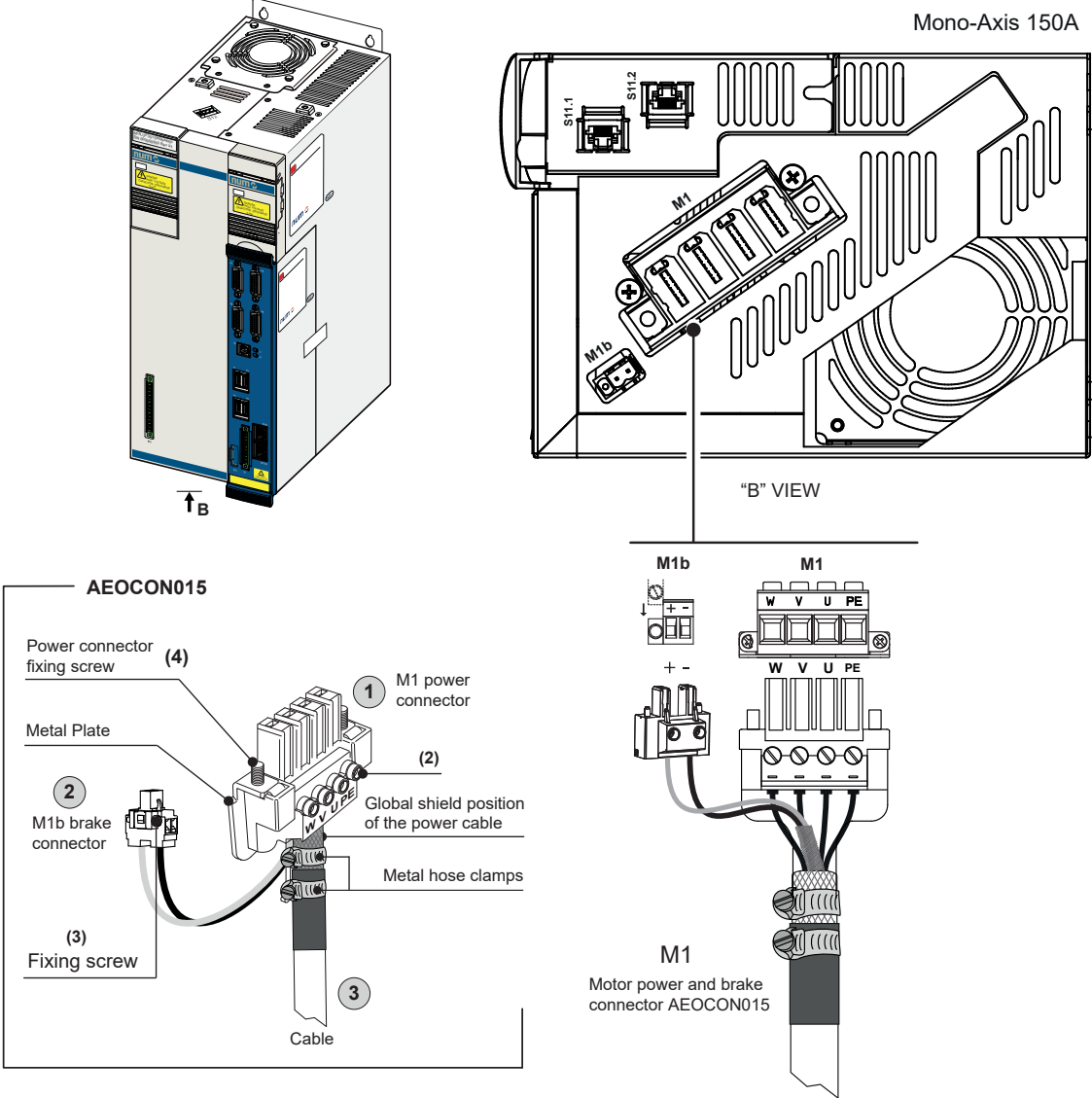
①	Motor power and brake connector AEOCON018	②	Screw tightening torque: 1.9 ÷ 2.1 Nm
②	Assembly cable	④	Screw tightening torque: 0.5 ÷ 0.6 Nm
See chapter 10.12			

9.15.4 Motor connections with module MDLUF075B, 100A



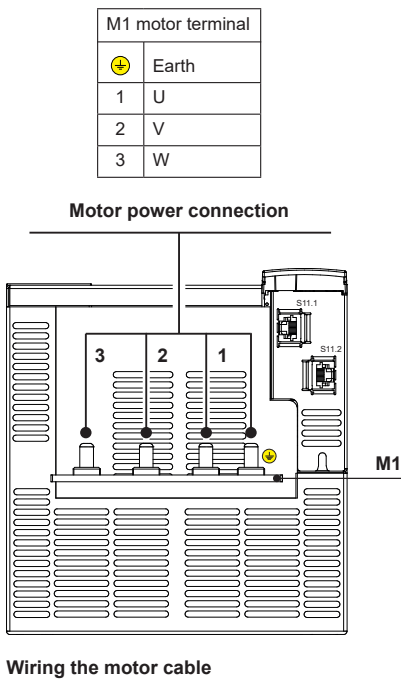
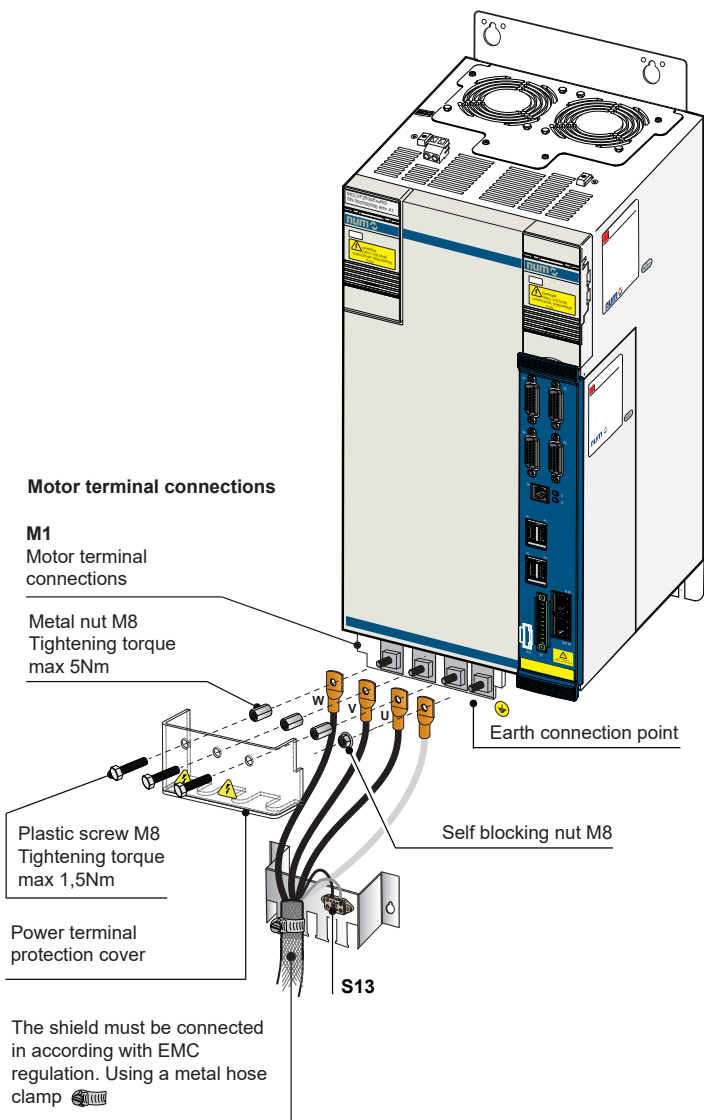
①	Motor power connector AEOCON013	(2)	Screw tightening torque: 1.9 ÷ 2.1 Nm
②	Motor Brake connector	(4)	Screw tightening torque: 0.5 ÷ 0.6 Nm Please refer to the chapter 9.22
③	Assembly cable		
See chapter 10.12.			

9.15.5 Motor connections with module MDLUF150A



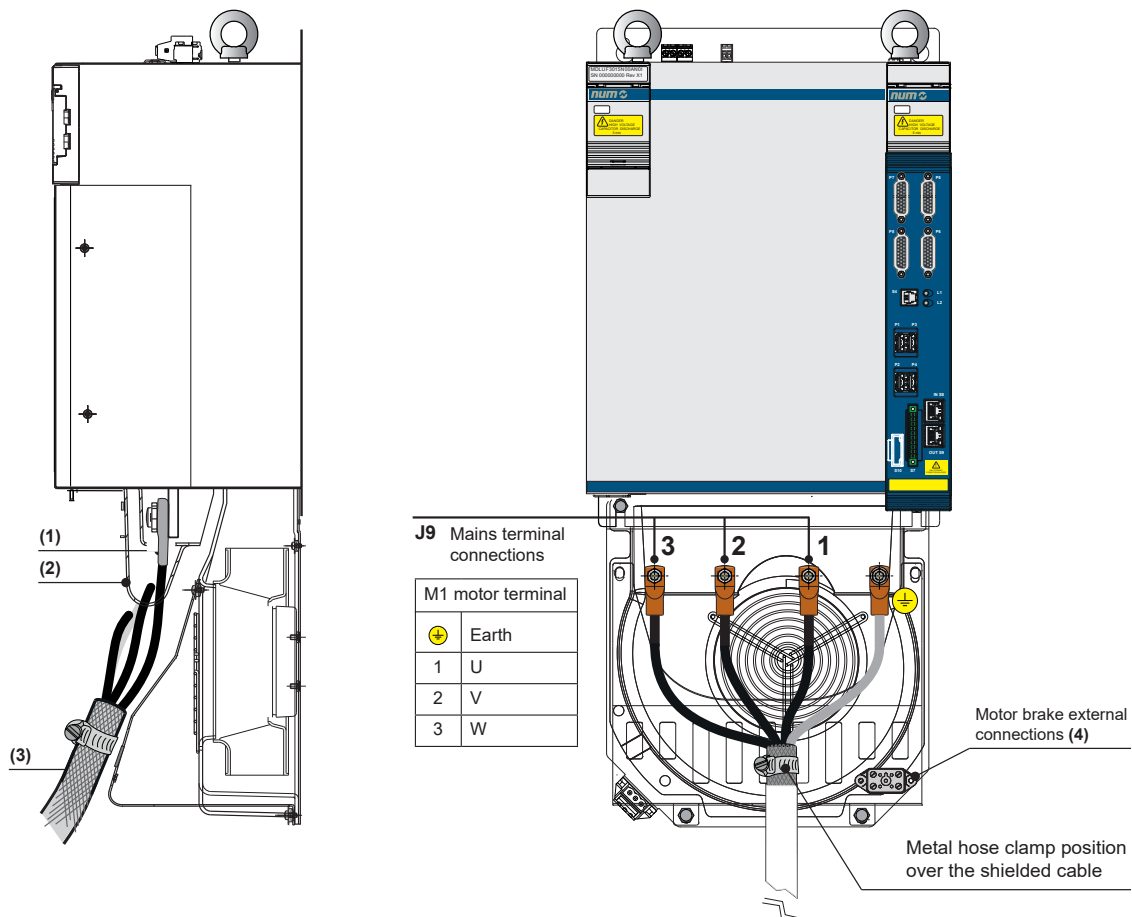
(1)	Drive side power connector	(1)	Screw tightening torque: 0.5 ÷ 0.6 Nm
(2)	Drive side brake connector	(2)	Screw tightening torque: 2.5 ÷ 3 Nm
(3)	Assembly cable	(3)	Please refer to the chapter 9.22
		(4)	Screw tightening torque: 0.5 ÷ 0.6 Nm
See chapter 10.12 .			

9.15.6 Motor connections with module MDLUF200A



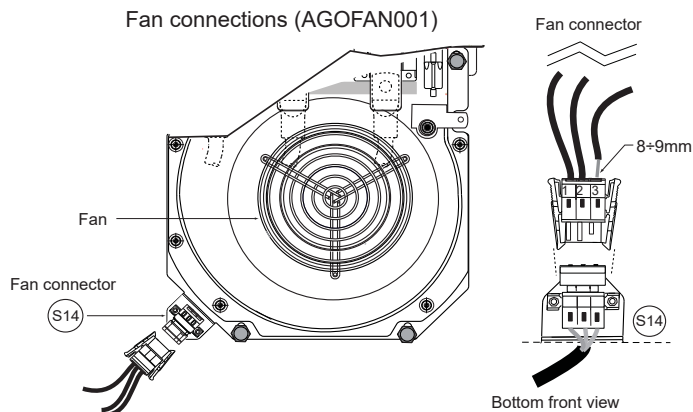
Motor power cable. See NUM cable chapter [10.11](#)

9.15.7 Motor connections with module MDLUF400A



- | | |
|-----|---|
| (1) | Wiring the cable as indicated in figure using the cable eyelet + nut and fit the cable over the metal plate using the metal hose clamp. (Tighten the nut to 5 Nm) |
| (2) | Mains insulated cover position. See next page. |
| (3) | The shield must be connected in according to the wiring instruction of the manual M00027. |
| (4) | S13 mounting position. Screw tightening torque: 0.5 - 0.6Nm. |

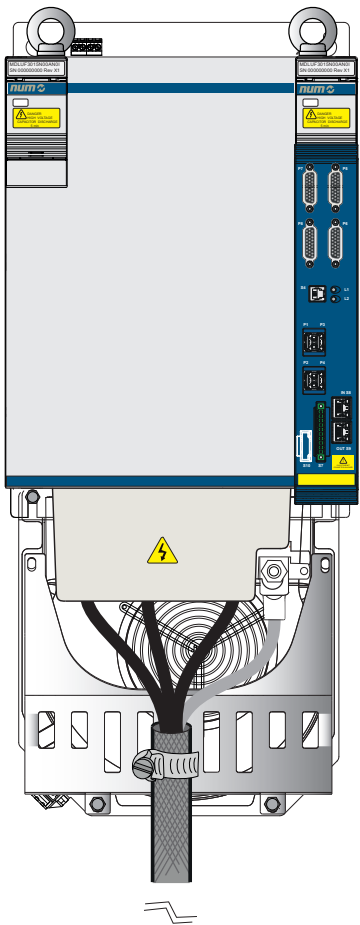
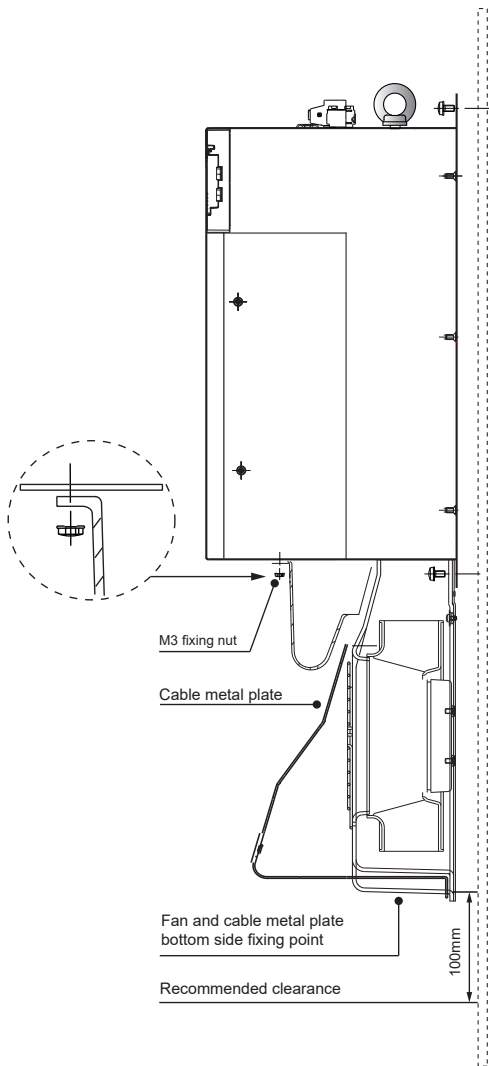
U, V, W, Earth shielded cable supplied by the customer.
See also cable length note on previous pages.



Pin	Description
1	+24Vdc (supplied by the customer)
2	FUN_RUN_OUT (24V/10mA open collector - 1 pulse per fan rev.)
3	0 _{24V}
Cable	1.5mm ² supplied by the customer
other:	
Fan consumption : 3.7A	
Recommended protection fuse : 6A type aM	

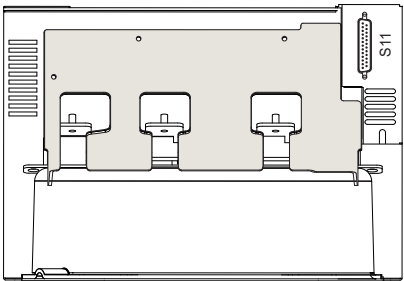
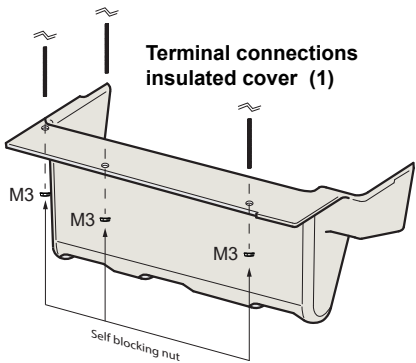
Note: (24V/10mA open collector, 1 pulse per fan rev.).
Signal OUT Duty cycle = 50%, period = 6ms.

9.15.8 MDLUF400A mounting the motor terminal insulated cover



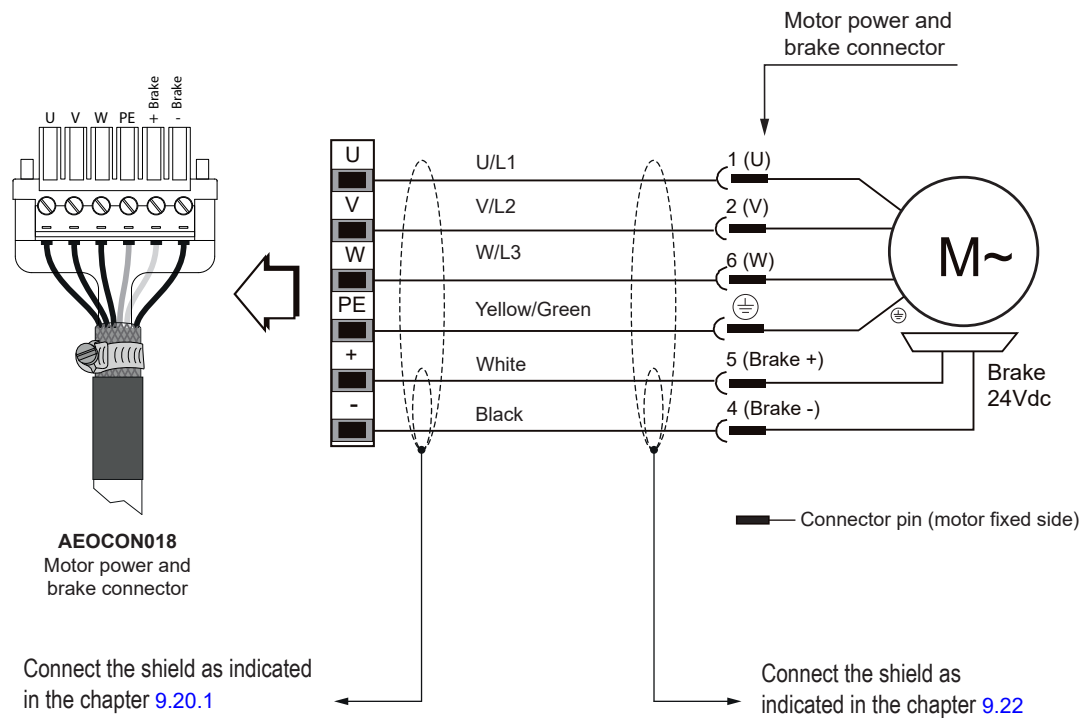
Motor side power connections.
Cable supplied by the customer.

- | | |
|-----|---|
| (1) | Place the insulated cover over the terminal as indicated in figure and fix it using the three M3 nuts. (Tighten the screw to 1 Nm). |
| (2) | Control the correct cable position as indicated in figure. |



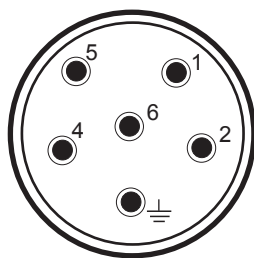
9.15.9 BHX, BPX, BPH, BPG motors connections

9.15.9.1 Connections with MDLUF007, 014, 021, 034 modules



Power and brake connectors
(Seen from soldering side)

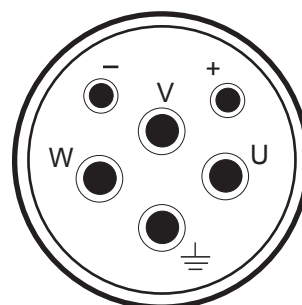
AMOCN004D



Connections
1 - U
2 - V
6 - W
4 Brake (-)
5 Brake (+)
⊕ Earth

BHX, BPX: 055, 075, 095, 126, 155
BPH, BPG: 075, 095, 115, 142

AMOCN005D



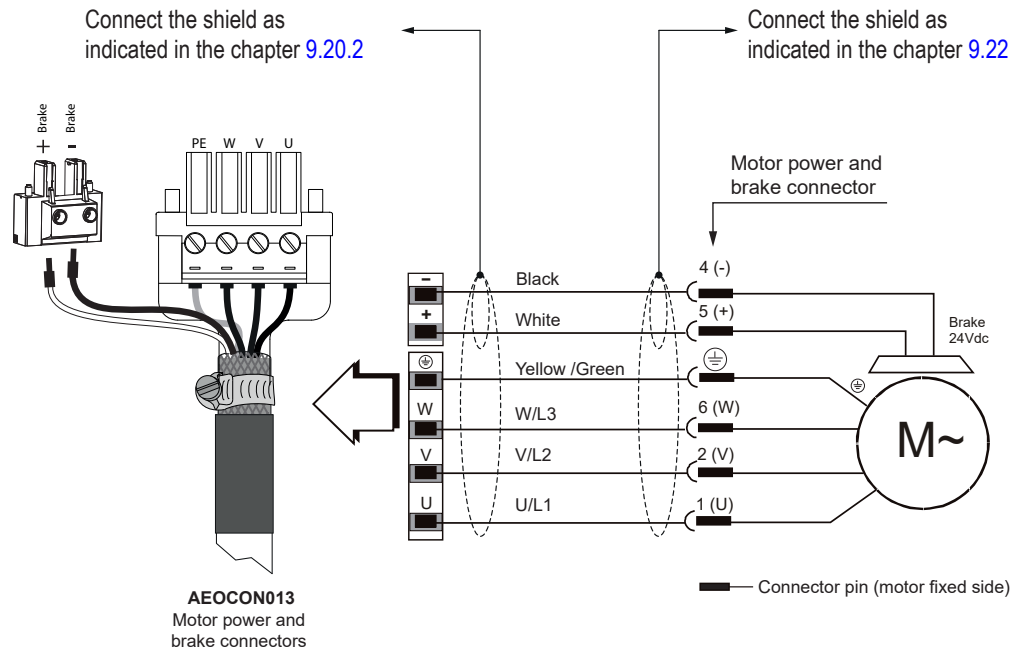
Connections
U - U
W - W
V - V
+ (Brake +)
- (Brake -)
⊕ Earth

BPH, BPG: 1902R,3N,4N,5L,7K



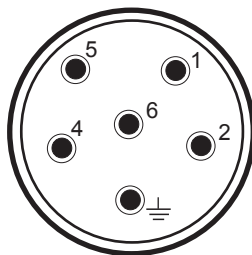
- For the sensor connections see chapter 9.8
- The brake is not available for BPG motors.
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.
- The motor power connector mounting and crimping procedures are indicated on chapter 9.22

9.15.9.2 Connections with MDLUF050, 075, 100A modules



Power and brake connectors
(Seen from soldering side)

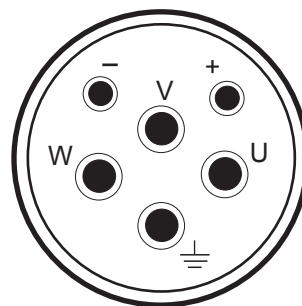
AMOCN004D



Connections
1 - U
2 - V
6 - W
4 Brake (-)
5 Brake (+)
⊕ Earth

BHX, BPX: 055, 075, 095, 126, 155
BPH, BPG: 075, 095, 115, 142

AMOCN005D



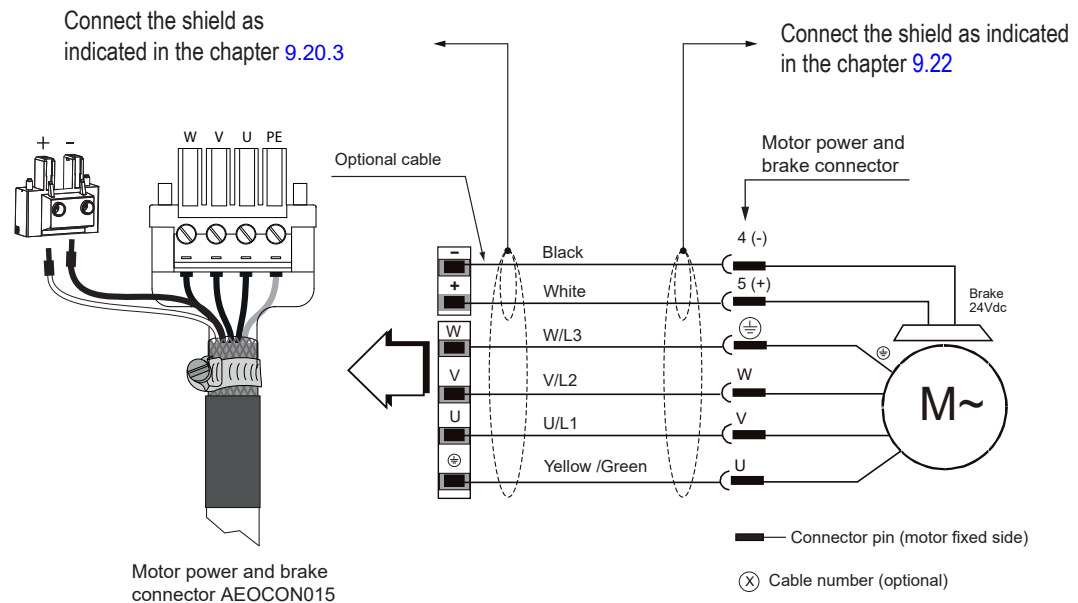
Connections
U - U
W - W
V - V
+ (Brake +)
- (Brake -)
⊕ Earth

BPH, BPG: 1902R, 3N, 4N, 5L, 7K



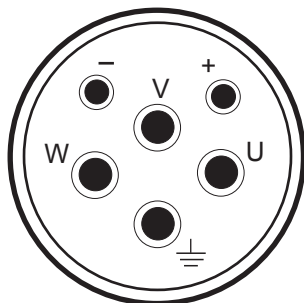
- For the sensor connections see chapter 9.8
- The brake is not available for BPG motors.
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.
- The motor power connector mounting and crimping procedures are indicated on chapter 9.22

9.15.9.3 Connections with MDLUF150A modules



Power and brake connectors
(Seen from soldering side)

AMOCN005D



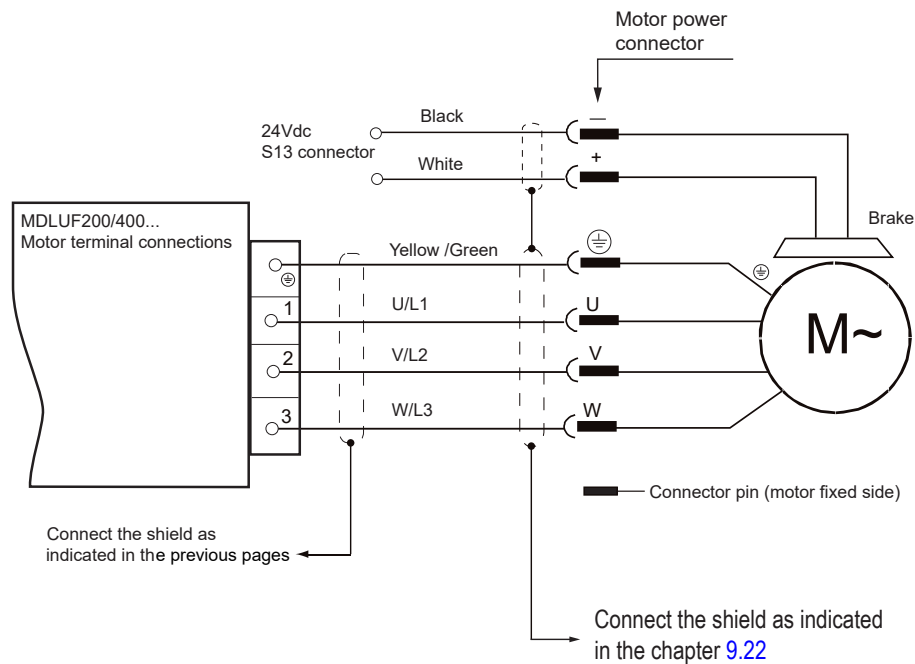
BPH190AK

Connections
U - U
W - W
V - V
+ (Brake +)
- (Brake -)
⊕ Earth



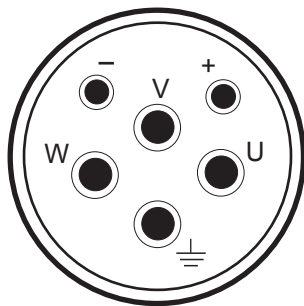
- For the sensor connections see chapter [9.8](#)
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.
- The motor power connector mounting and crimping procedures are indicated on chapter [9.22](#)

9.15.9.4 Connections with MDLUF200A, 400A modules



Power and brake connectors
(Seen from soldering side)

AMOCN005D



BPH190AK

Connections

U - U

W - W

V - V

+ (Brake +)

- (Brake -)

⊕ Earth



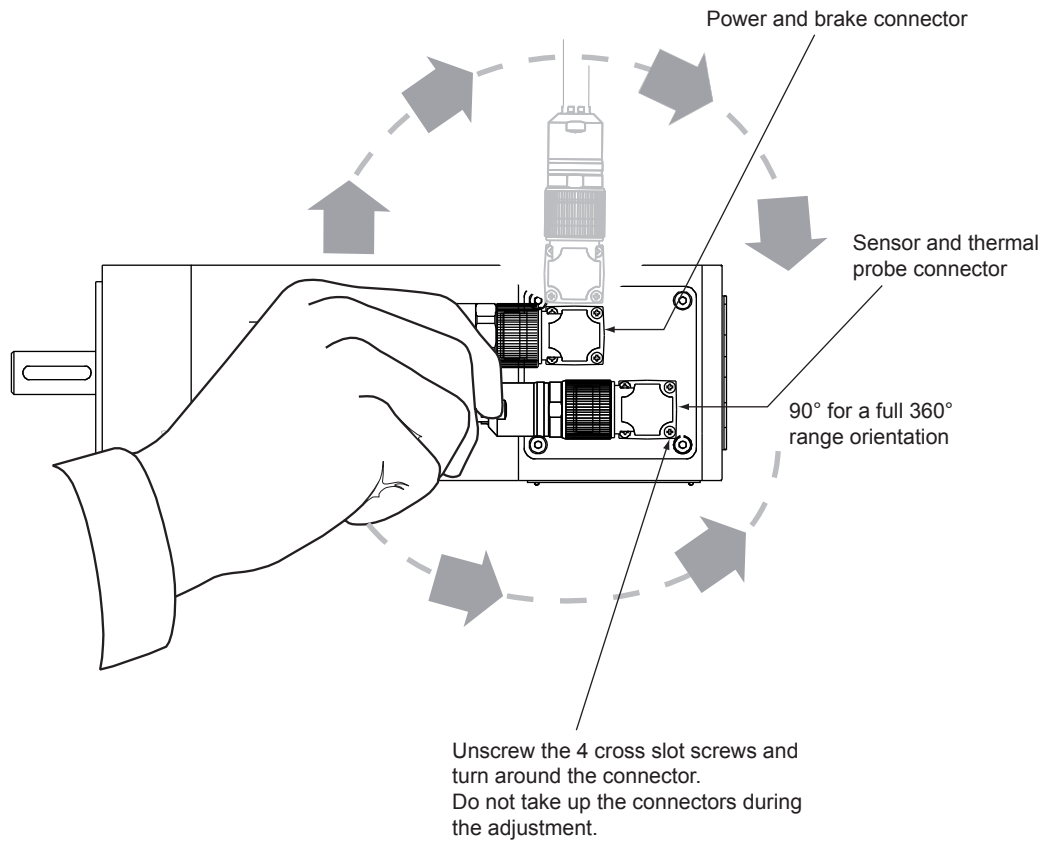
- For the sensor connections see chapter 9.8
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.
- The motor power connector mounting and crimping procedures are indicated on chapter 9.22

9.15.9.5 Motor connectors rotation procedure

BPH, BPG connectors orientation

Always disable the system and disconnect the cables from the motor before carrying out the connector orientation (turnable each 90° by the customer).

Inadequate earthing of the motor causes capacitive currents to flow, which can damage the electronic components in the modules.

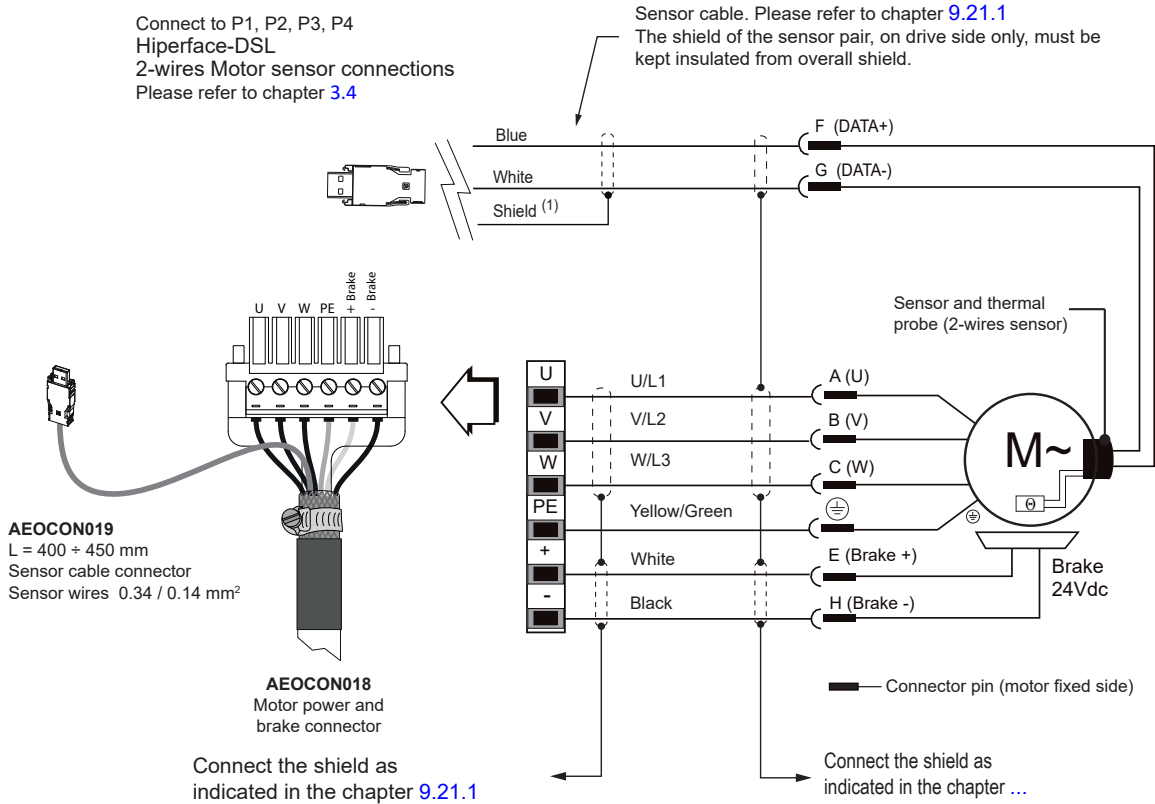


BHX, BPX connectors orientation

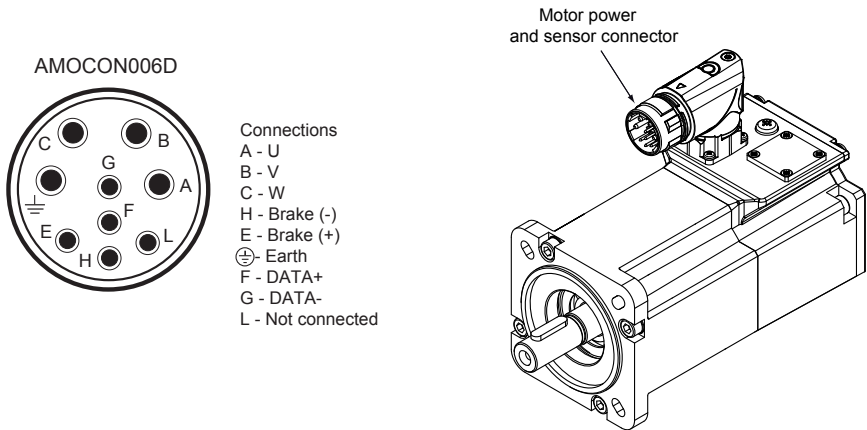
The motor connectors orientation is carried out rotating the upper external part without unscrewing the connector. The continuously rotation range is 270°. SHX, SPX motors power and sensor connections

9.15.10 SHX, SPX motors connections

9.15.10.1 Connections with MDLUF007, 014, 021, 034 modules

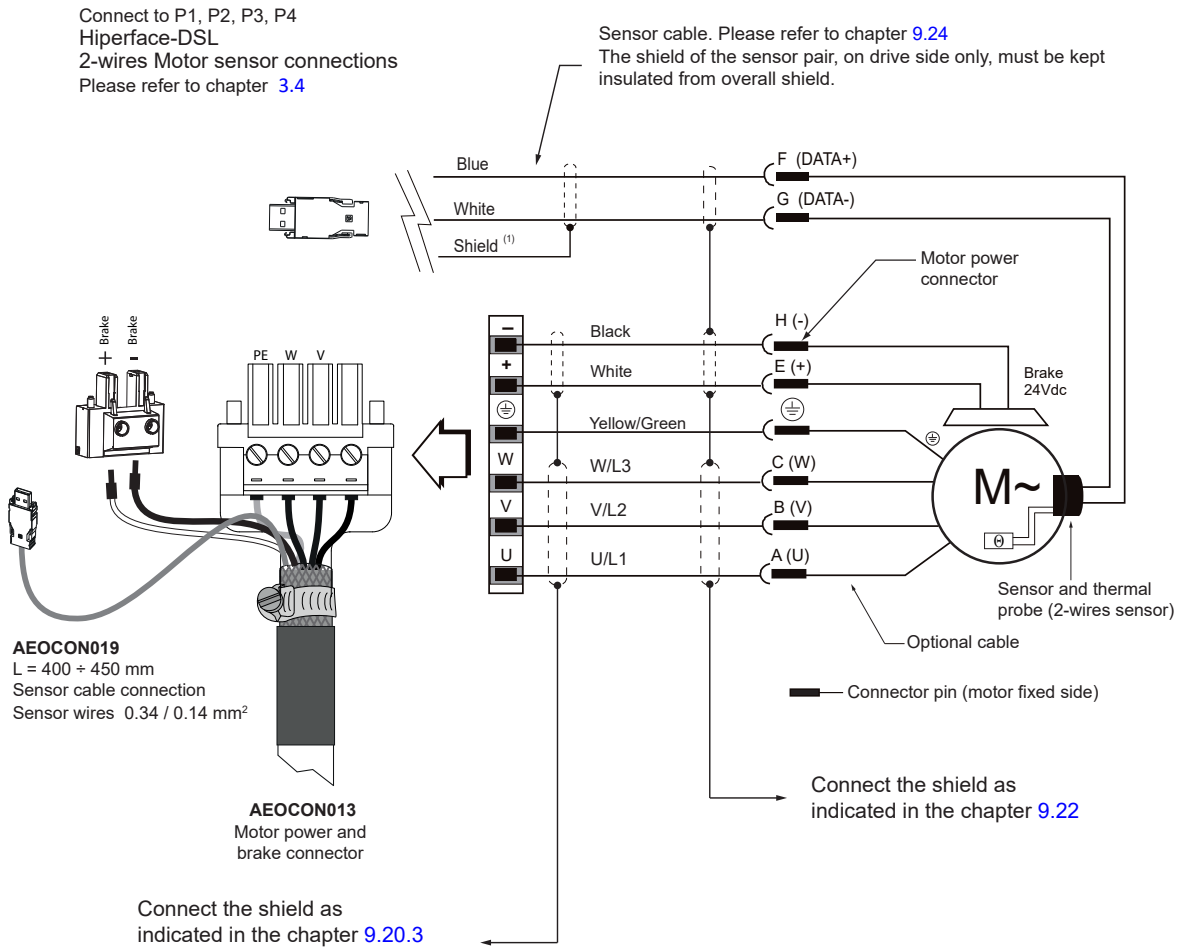


Motor power, brake and sensor connector (Seen from soldering side)

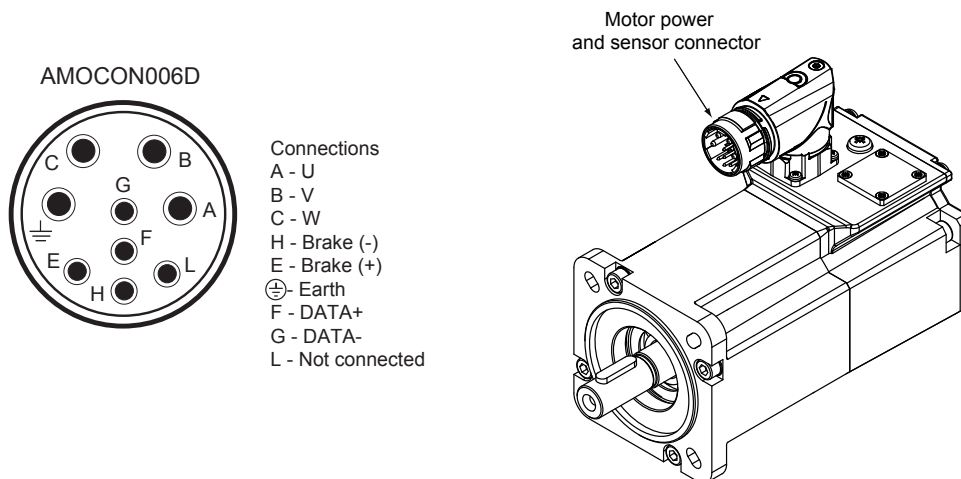


Due to the cable layout, the shield connection by means of the metal strip to the cabinet frame as shown on M00027 chapter 2.2.6 is not possible and not needed. Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.

9.15.10.2 Connections with MDLUF050, 075 modules



Motor power, brake and sensor connector (Seen from soldering side)



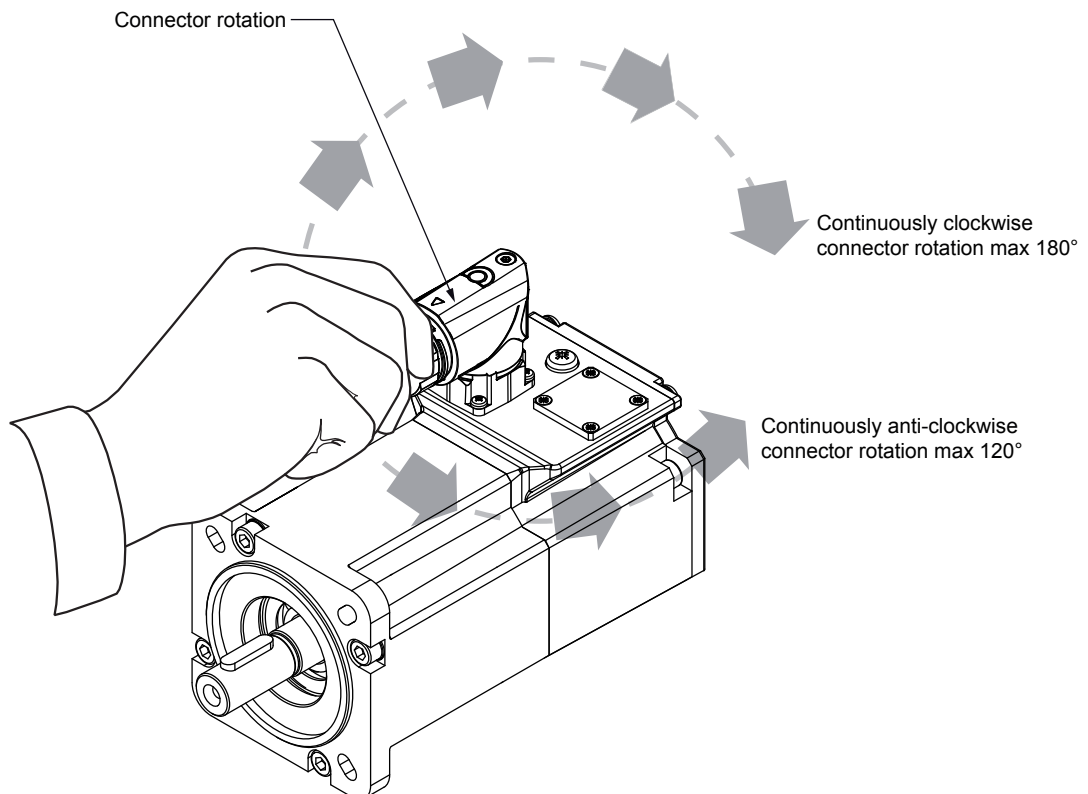
Due to the cable layout, the shield connection by means of the metal strip to the cabinet frame as shown on M0027 chapter 2.2.6 is not possible and not needed. Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.

9.15.10.3 SHX, SPX motor connector rotation procedure

Always disable the system and disconnect the cables from the motor before carrying out the connector orientation.

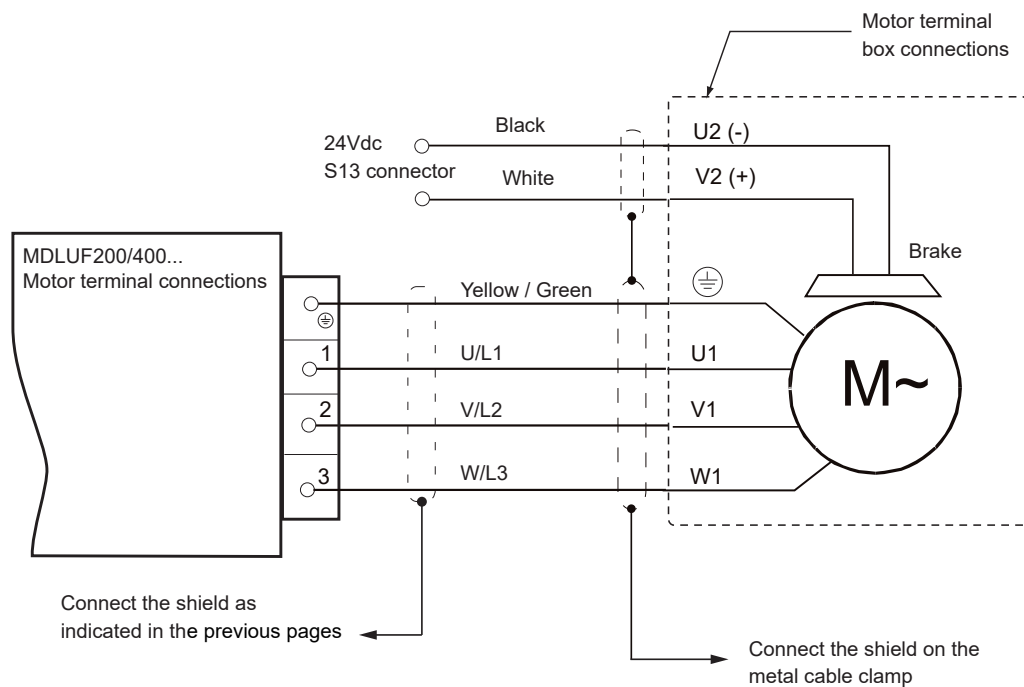
The motor connectors orientation is carried out rotating the upper external part without unscrewing the connector. The continuously rotation range is about 300°. (turnable by the customer)

Inadequate earthing of the motor causes capacitive currents to flow, which can damage the electronic components in the modules.

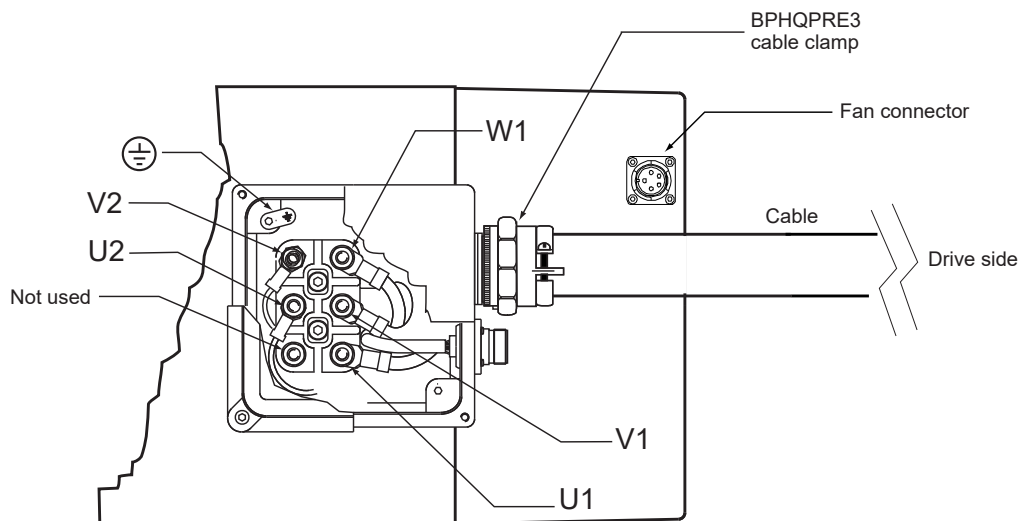


9.16 BHL260 motors connections

9.16.1 BHL260 motors connections with ventilation version

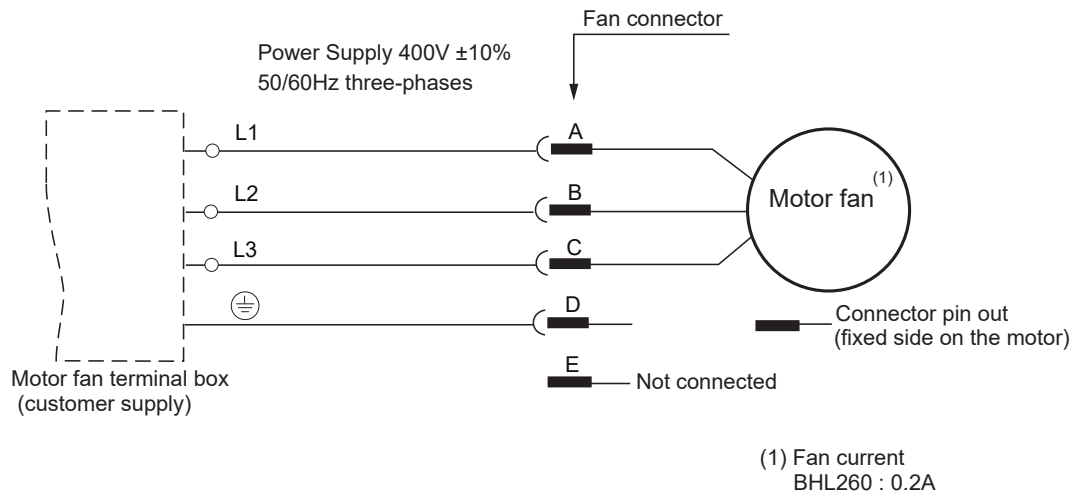


9.16.2 Motor terminal box connections



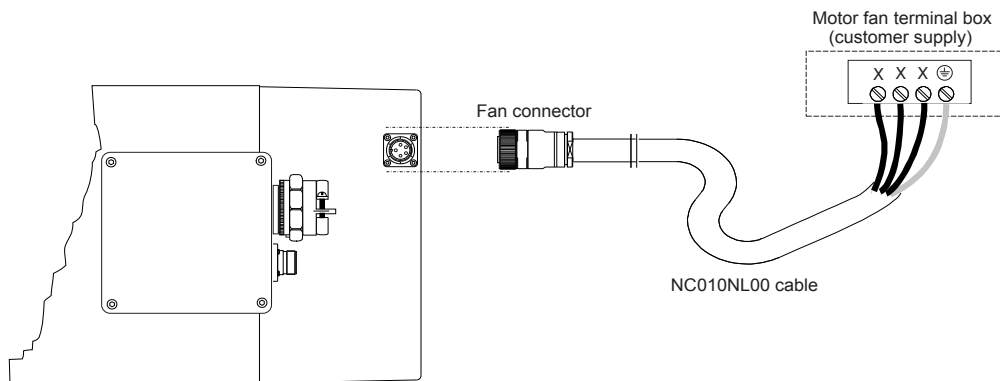
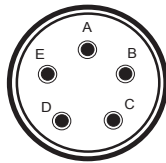
- For the fan connections see next page.
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.
- The motor power connector mounting and crimping procedures are indicated on chapter [9.22](#)

9.16.3 BHL260 fan connection



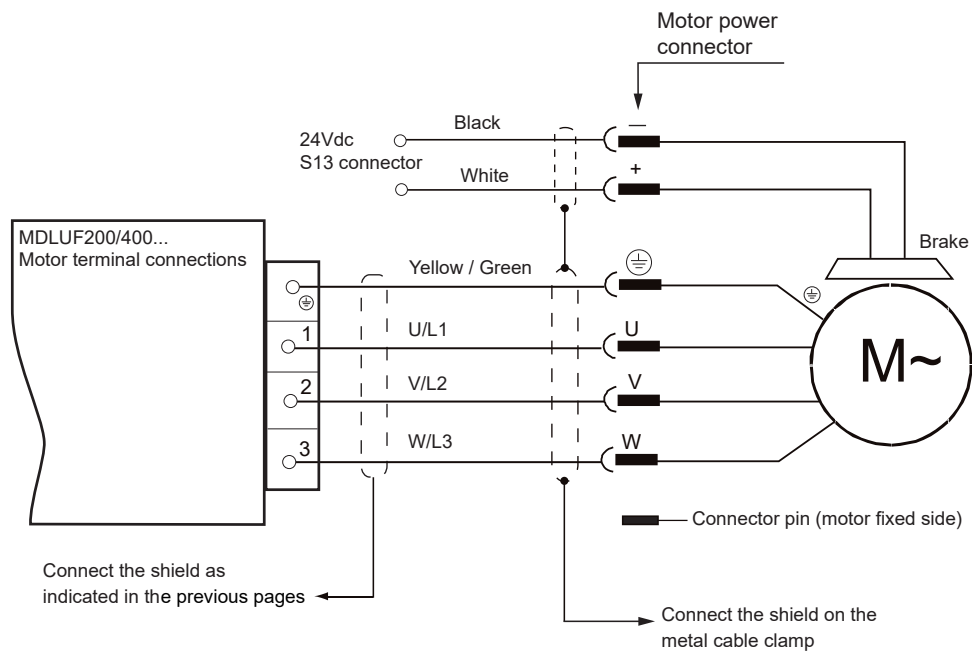
Fan connector
(Seen from soldering side)

CONN113D00



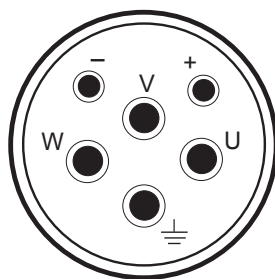
- The motor ventilation must be with air inlet coming from the rear end of the motor and outflow from motor shaft side. Inadequate minimum clearance of the fan can damage motor. To facilitate sufficient air circulation and so ensure an adequate heat exchange in the motor, it is recommended a minimum ventilation clearance of 150mm.
- Check the correct fan rotation as shown (see arrow) in the rear end of the motor. In the opposite reverse two phases.
- With 460V network, appropriate transformer code AMOTRF001 must be used for the fan. See chapter 10.9.5 for the fan cables description.

9.16.4 BHL260 without ventilation connections



Power and brake connectors
(Seen from soldering side)

AMOCN005D



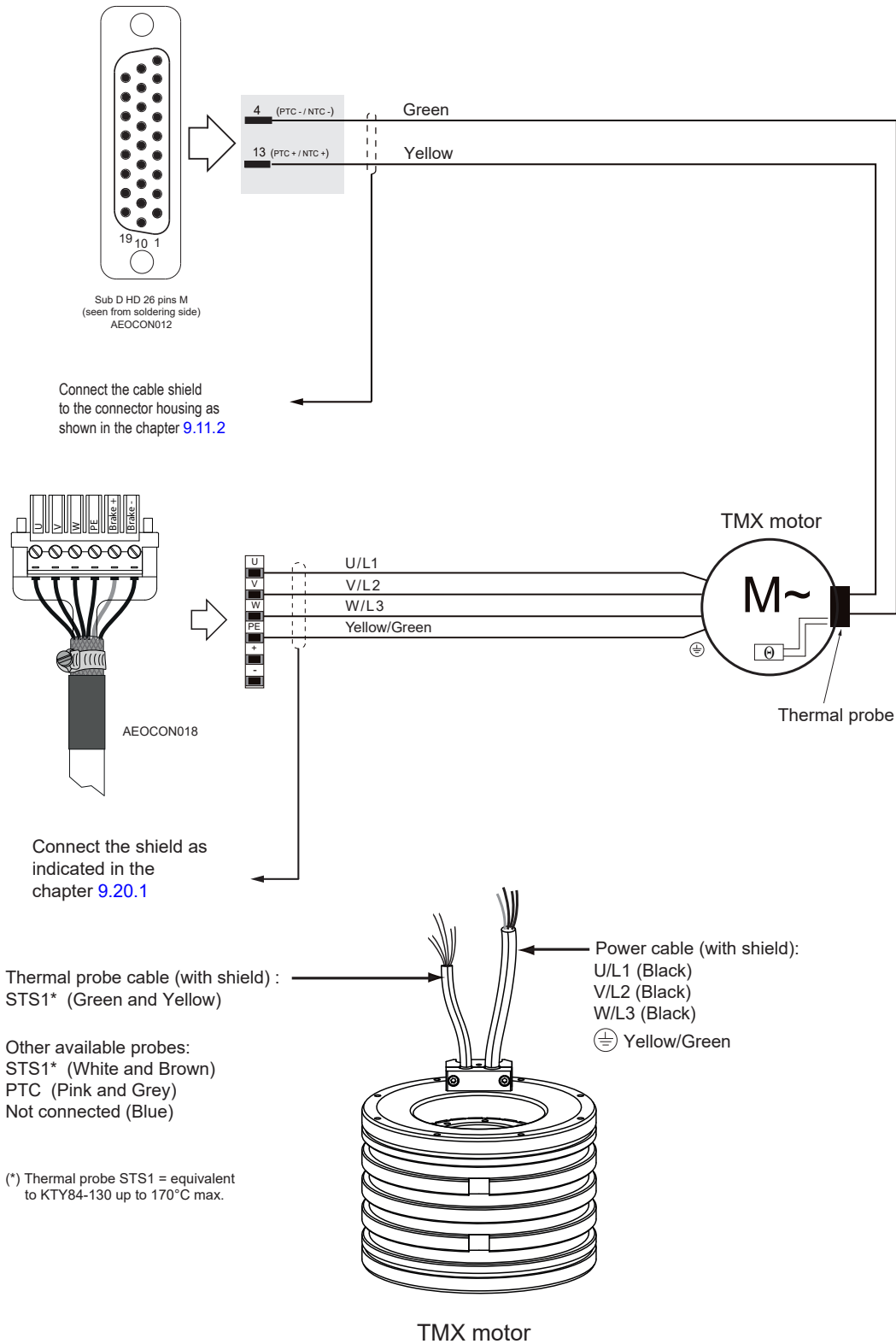
Connections
U - U
W - W
V - V
+ (Brake +)
- (Brake -)
⊕ Earth



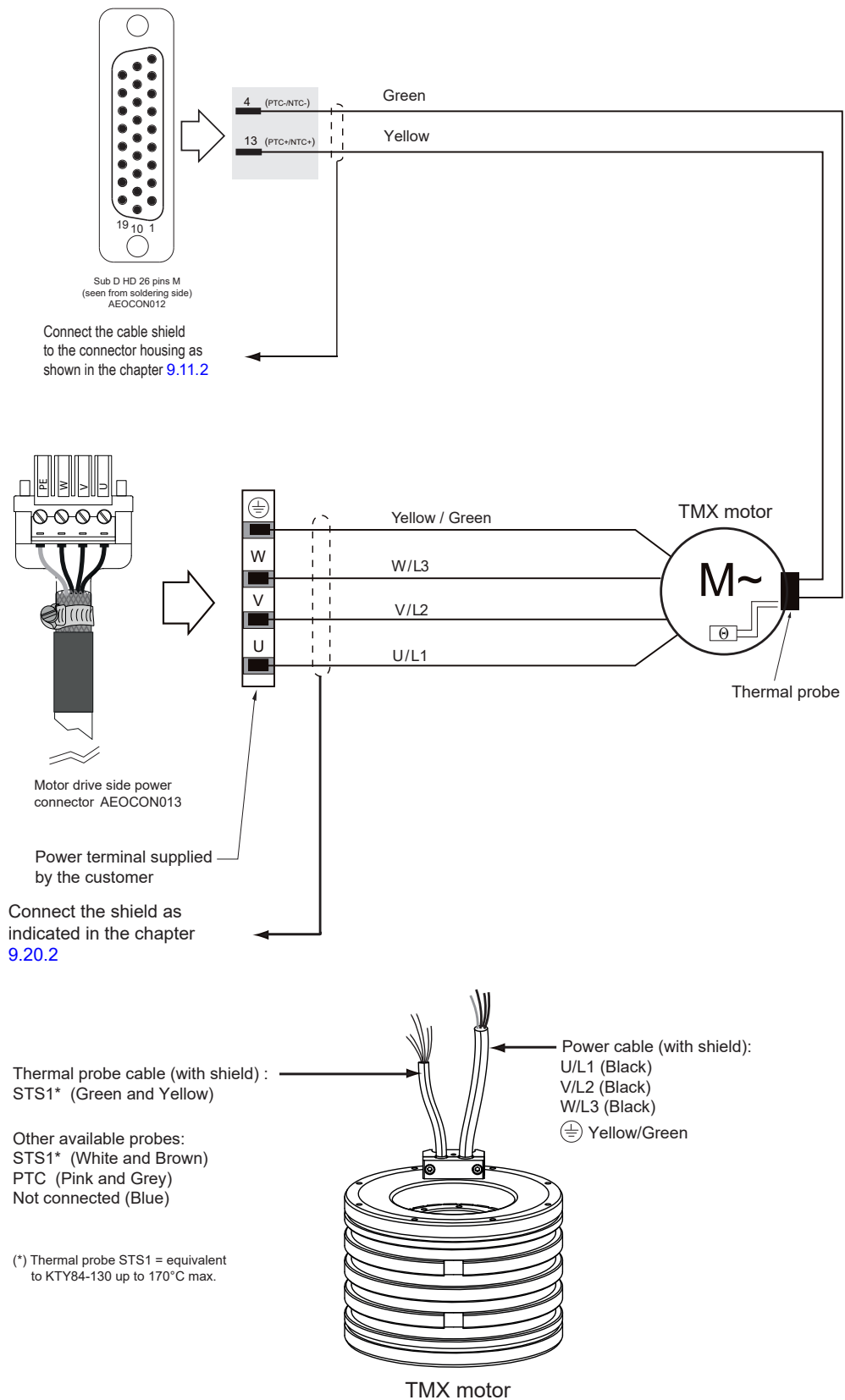
- For the sensor connections [9.8](#)
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.
- The motor power connector mounting and crimping procedures are indicated on [9.22](#)

9.17 TMX motors connections

9.17.1 Motor connector AEOCON018

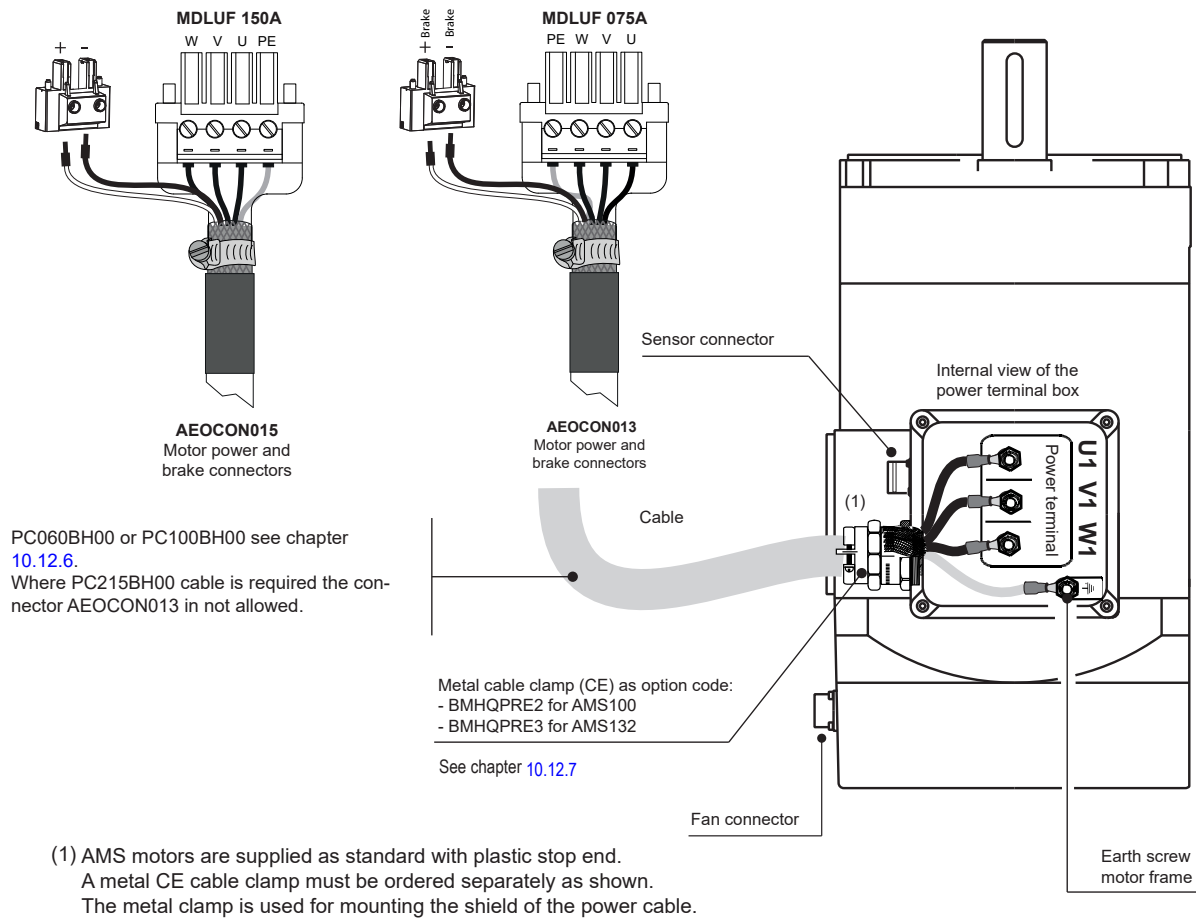


9.17.2 Motor connector AEOCON013

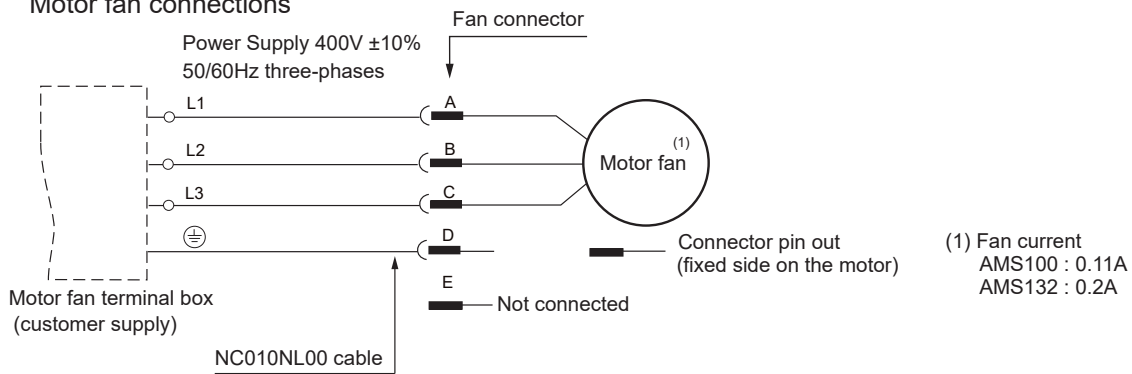


9.18 AMS spindle motors connections

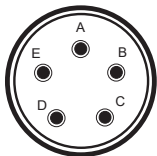
9.18.1 AMS100, 132 motors connections with MDLUF050, 075, 150A



Motor fan connections

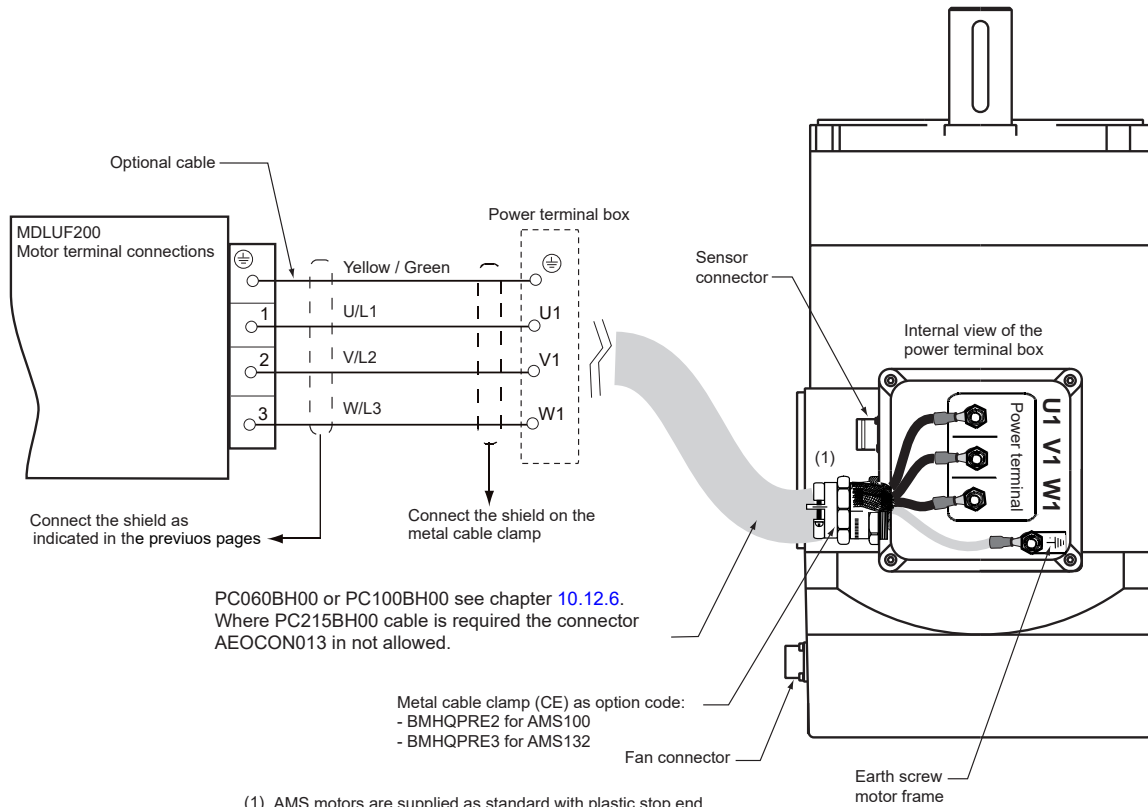


CONN113D00 Fan connector (Seen from soldering side)



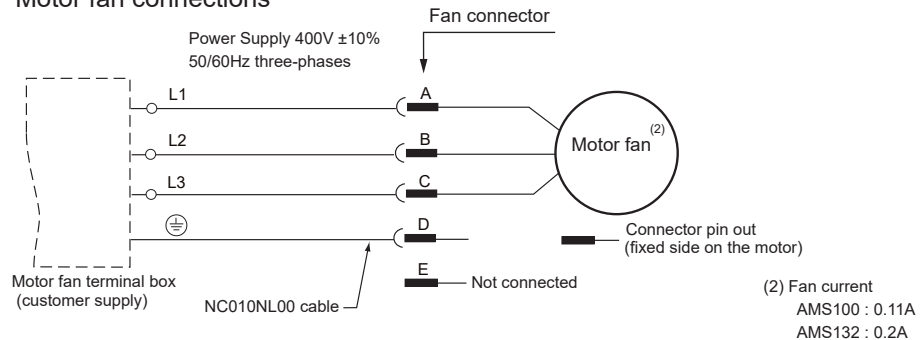
The ventilation must be with air input coming from the rear end of the motor and the exhaust from the end shaft (in the opposite reverse two phases).

9.18.2 AMS100, 132 motors connections with MDLUF200A



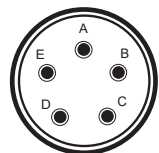
See chapter 10.12.7

Motor fan connections



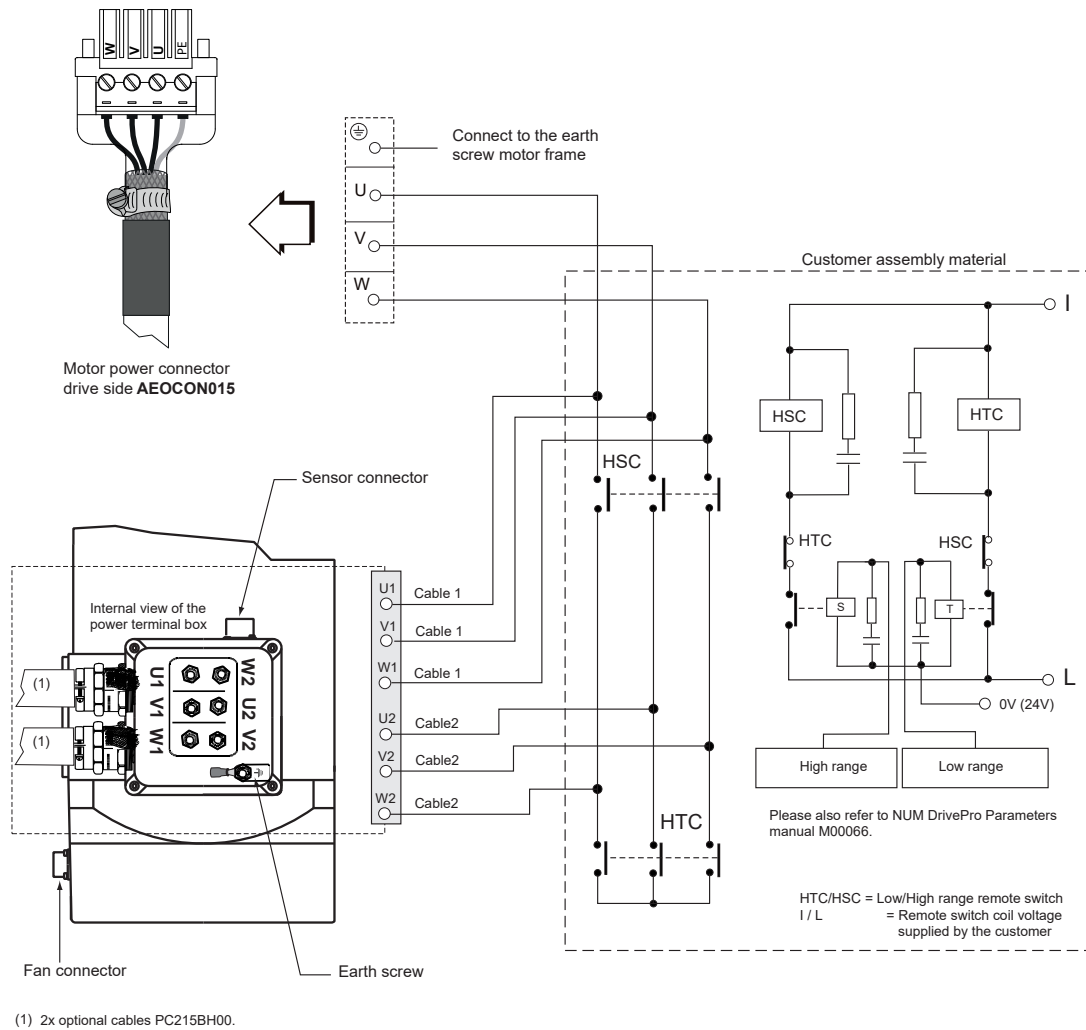
Fan connector (External view of the fixed side on the motor)

CONN113D00



The ventilation must be with air input coming from the rear end of the motor and the exhaust from the end shaft (in the opposite reverse two phases).

9.18.3 AMS160MA, LA, motors connections (Y/Δ) and MDLUF150A



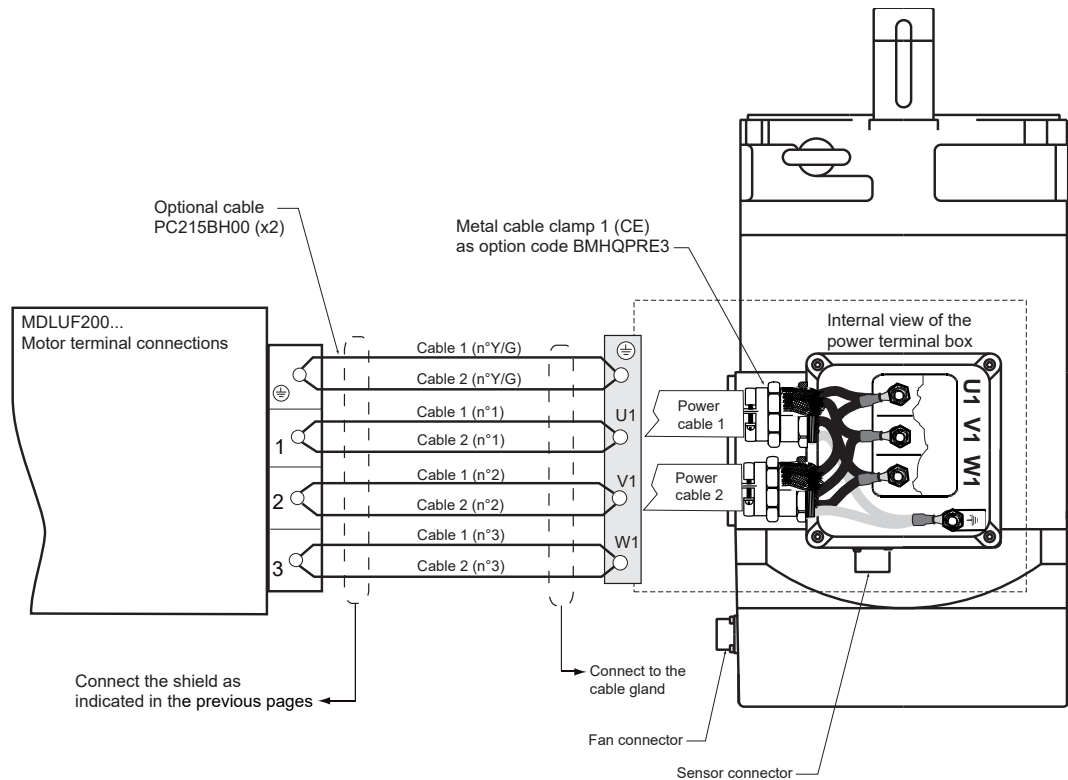
Single range connections

- By using the motor in only one range the contactors (HSC and HTC) and the relays (S and T) have not to be used.
- Low range connection (Star):
Connect the motor in such a way that HTC contactor is closed and HSC is open.
- High range connection (Delta):
Connect the motor in such a way that HSC contactor is closed and HTC is open.

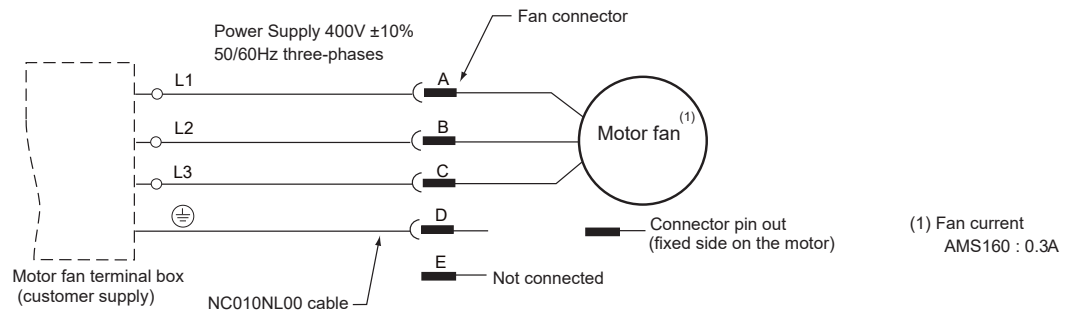


- For the sensor connections. See chapter [9.9](#)
- For the fan connections see previous pages.
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.

9.18.4 AMS160MC, LC motors connections with MDLUF200A

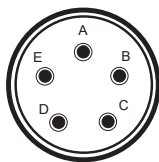


Motor fan connections



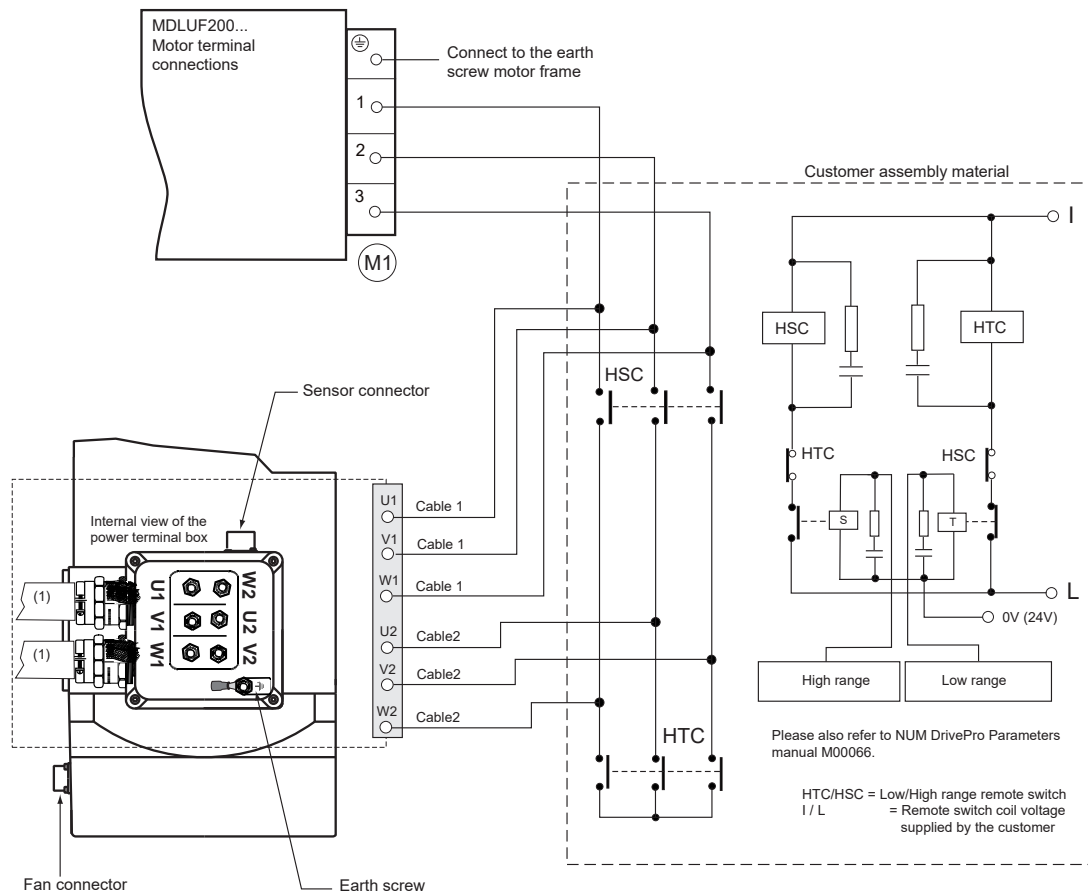
Fan connector (Seen from soldering side)

CONN113D00



- The ventilation must be with air input coming from end shaft side and exhaust in the rear end of the motor.
- Check the correct fan rotation as shown (see arrow) in the rear end of the motor. In the opposite reverse two phases.

9.18.5 AMS160MA, MB, LA, LB motors connections (Y/Δ) and MDLUF200A



(1) 2x optional cables PC215BH00.

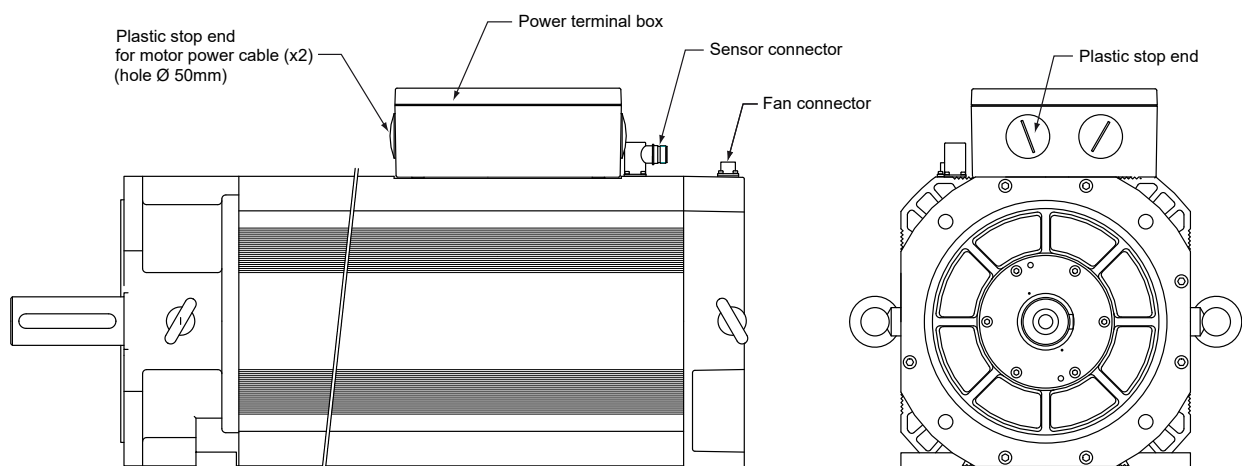
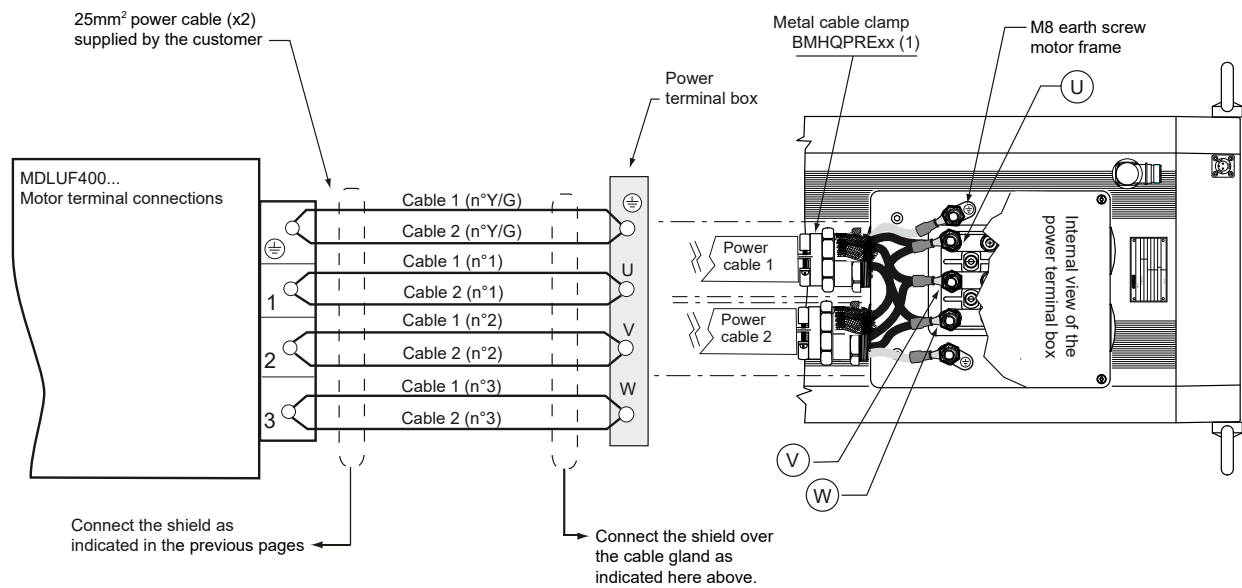
Single range connections

- By using the motor in only one range the contactors (HSC and HTC) and the relays (S and T) have not to be used.
- Low range connection (Star):
Connect the motor in such a way that HTC contactor is closed and HSC is open.
- High range connection (Delta):
Connect the motor in such a way that HSC contactor is closed and HTC is open.



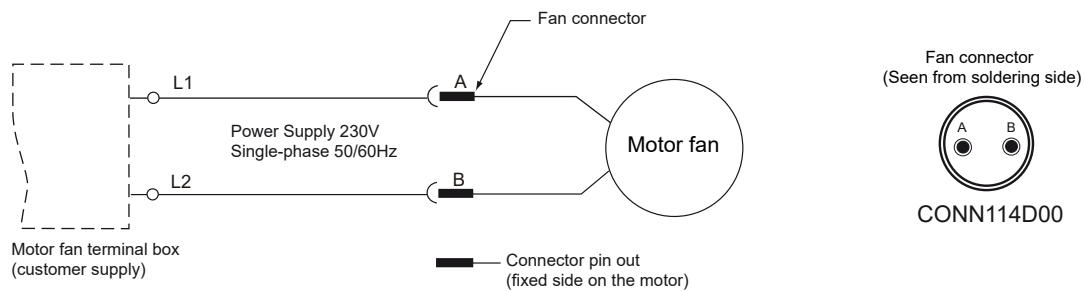
- For the sensor connections. See chapter 9.9
- For the fan connections see previous pages.
- Inadequate earthing of the motor causes capacitive currents to flow which can damage the electronic components in the modules.

9.19 IM18MK14 spindle motor connections



- (1) The motors are supplied as standard with plastic stop end.
Two metal CE cable clamps must be ordered separately as shown.
The metal clamp is used for mounting the shield of the power cable

Motor fan connections

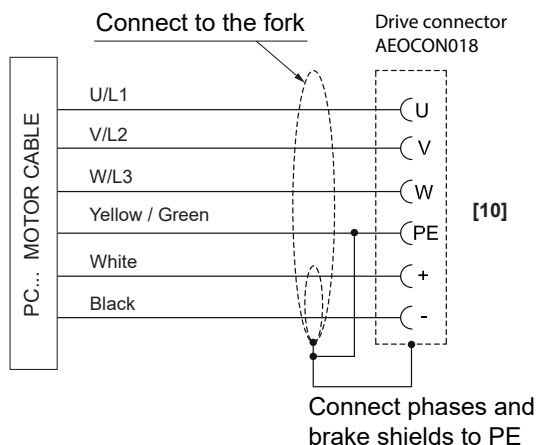
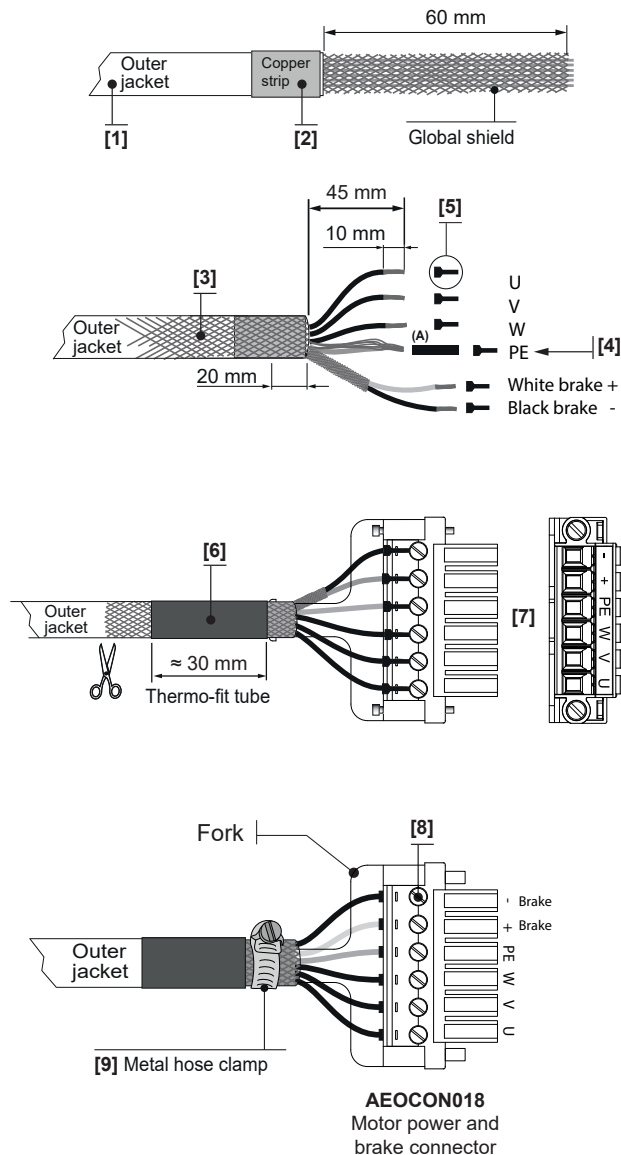


Fan current : 0.8A

9.20 Wiring the drive side motor power connector

9.20.1 Wiring the drive side motor power connector AEOCON018 with PC... cable

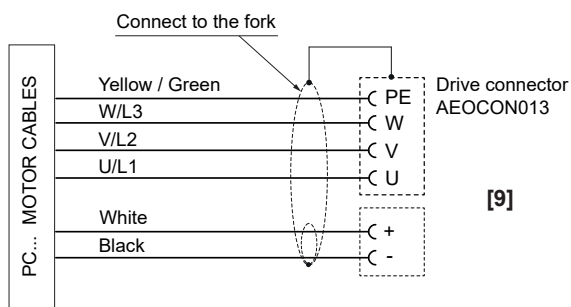
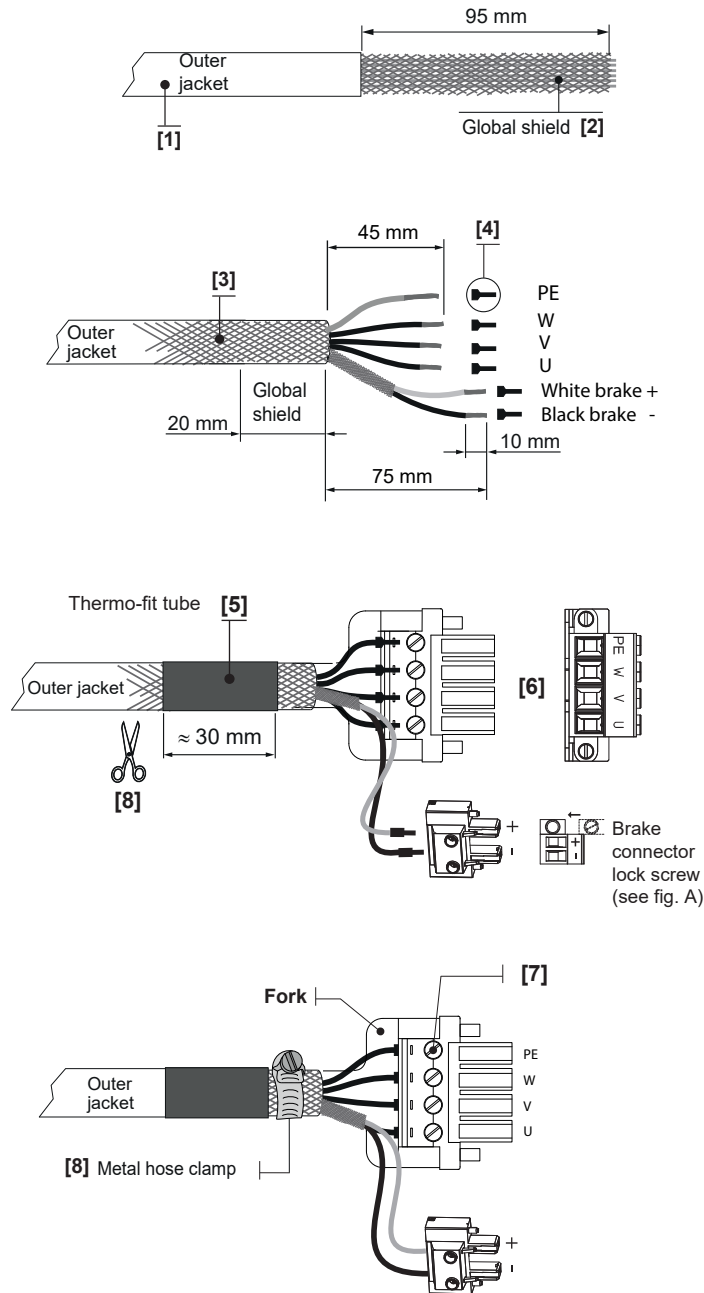
If you assemble your own drive side motor power connector with shielding, please do so according to the following procedure.



- [1] Remove 60mm of the outer jacket;
- [2] Apply the copper strip (and insertion onto the cable of metal hose clamp is suggested);
- [3] Reverse the global shield;
- [4] Wind part of the power cable shield and brake shields to the yellow/green PE wire and insulate PE wire with heat shrink tubing (A);
- [5] Crimp the power / PE / brake terminals 1.5mm²
- [6] Apply the thermo-fit tube L ≈ 30mm and remove the excessive power and brake shield;
- [7] Insert power / PE / brake wires+terminals into the connector and verify the correct pin assignments (see connections diagram below);
- [8] For power / PE / brake terminal screws the tightening torque is 0.6 Nm;
- [9] Secure the cable onto the connector shield (fork) with a metal hose clamp as shown in figure (tightening torque 2.5 Nm);
- [10] Connections diagram.

9.20.2 Wiring the drive side motor power connector AEOCON013 with PC... cable

If you assemble your own drive side motor power connector with shielding, please do so according to the following procedure.



[1] Remove 95mm of the outer jacket;

[2] Take care not damage the global shield;

[3] Reverse the global shield;

[4] Crimp the power / PE / brake wires with suitable connector terminals (10 / 4 / 1.5 mm²)

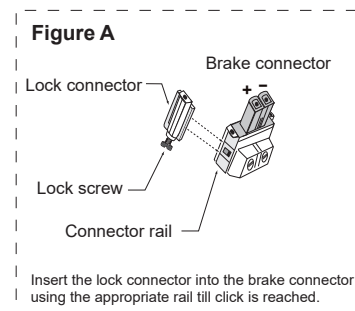
[5] Apply the thermo-fit tube L ≈ 30mm and remove the excessive power and brake shield;

[6] Insert power / PE / brake wires+terminals into the connector and verify the correct pin assignments (see connections diagram below);

[7] The tightening torque for the terminal screws are:
 - for power / PE 1,7 Nm
 - for brake 0,4 Nm;

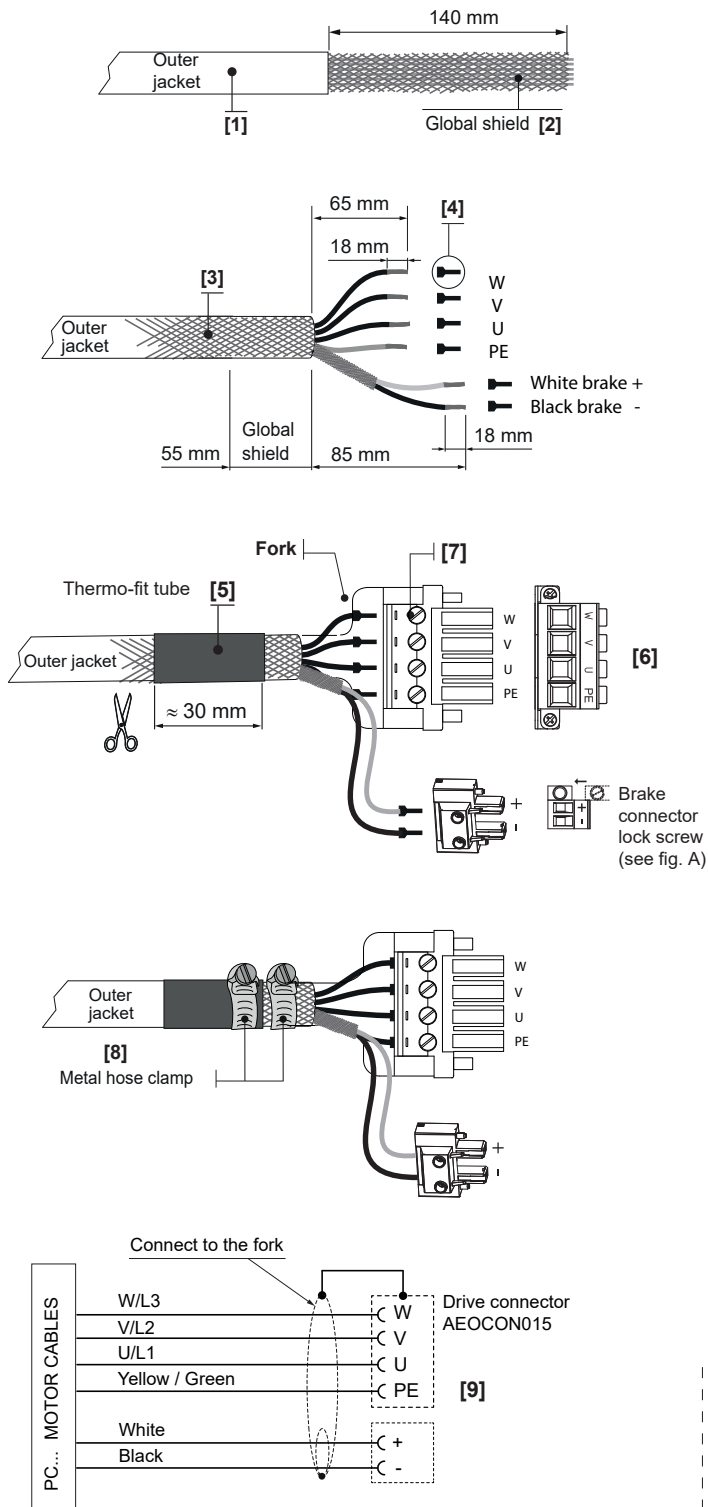
[8] Secure the cable onto the connector shield (fork) with a metal hose clamp as shown in figure (tightening torque 2.5 Nm);

[9] Connections diagram.



9.20.3 Wiring the drive side motor power connector AEOCON015 with PC... cable

If you assemble your own drive side motor power connector with shielding, please do so according to the following procedure.



[1] Remove 140mm of the outer jacket;

[2] Take care not damage the global shield;

[3] Reverse the global shield;

[4] Crimp the power / PE / brake wires with suitable connector terminals (10 / 1.5 mm²)

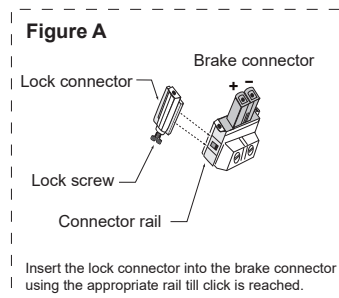
[5] Apply the thermo-fit tube L ≈ 30mm and remove the excessive power and brake shield;

[6] Insert power / PE / brake wires+terminals into the connector and verify the correct pin assignments (see connections diagram below);

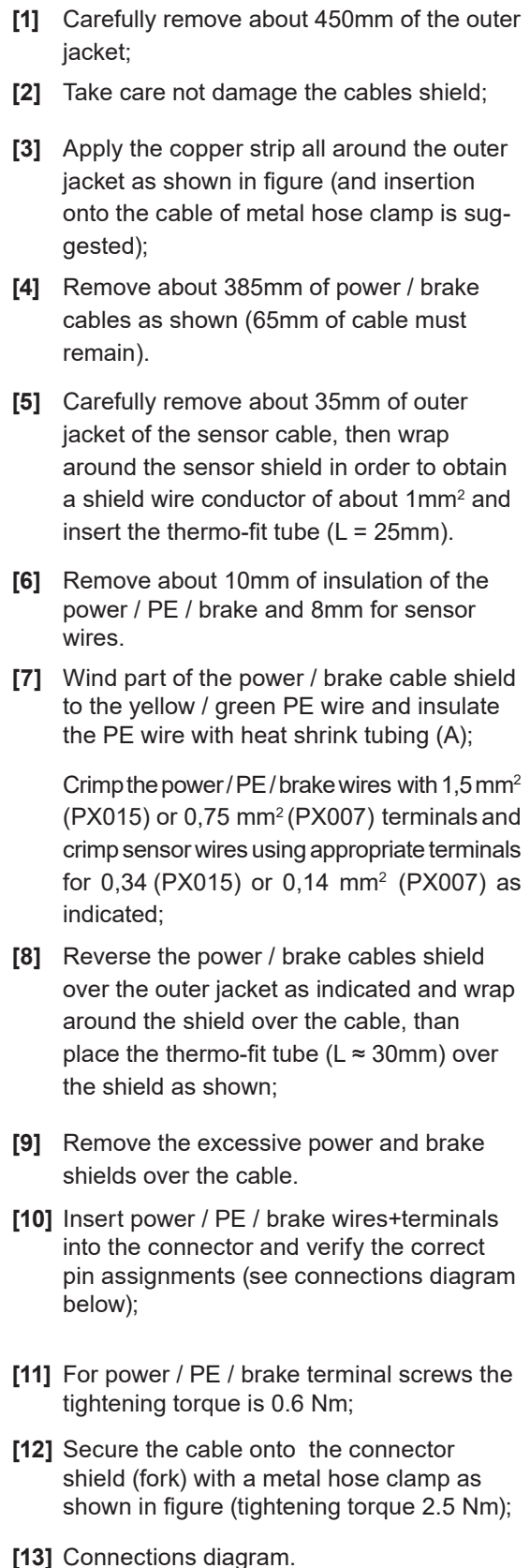
[7] The tightening torque for the terminal screws are:
- for power / PE 3,5 Nm
- for brake 0,4 Nm;

[8] Secure the cable onto the connector shield (fork) with 2 metal hose clamp as shown in figure (tightening torque 2.5 Nm);

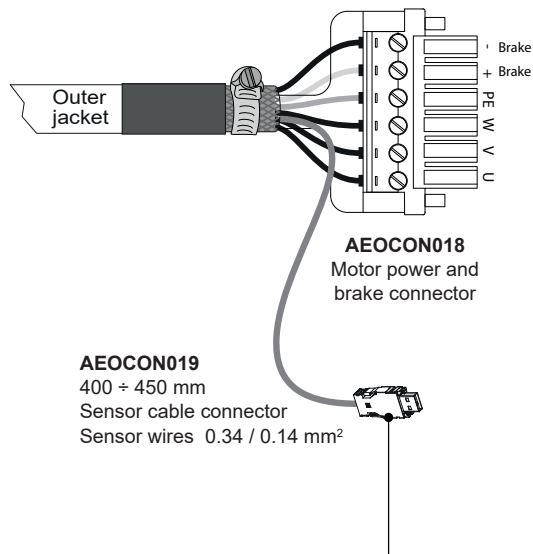
[9] Connections diagram.



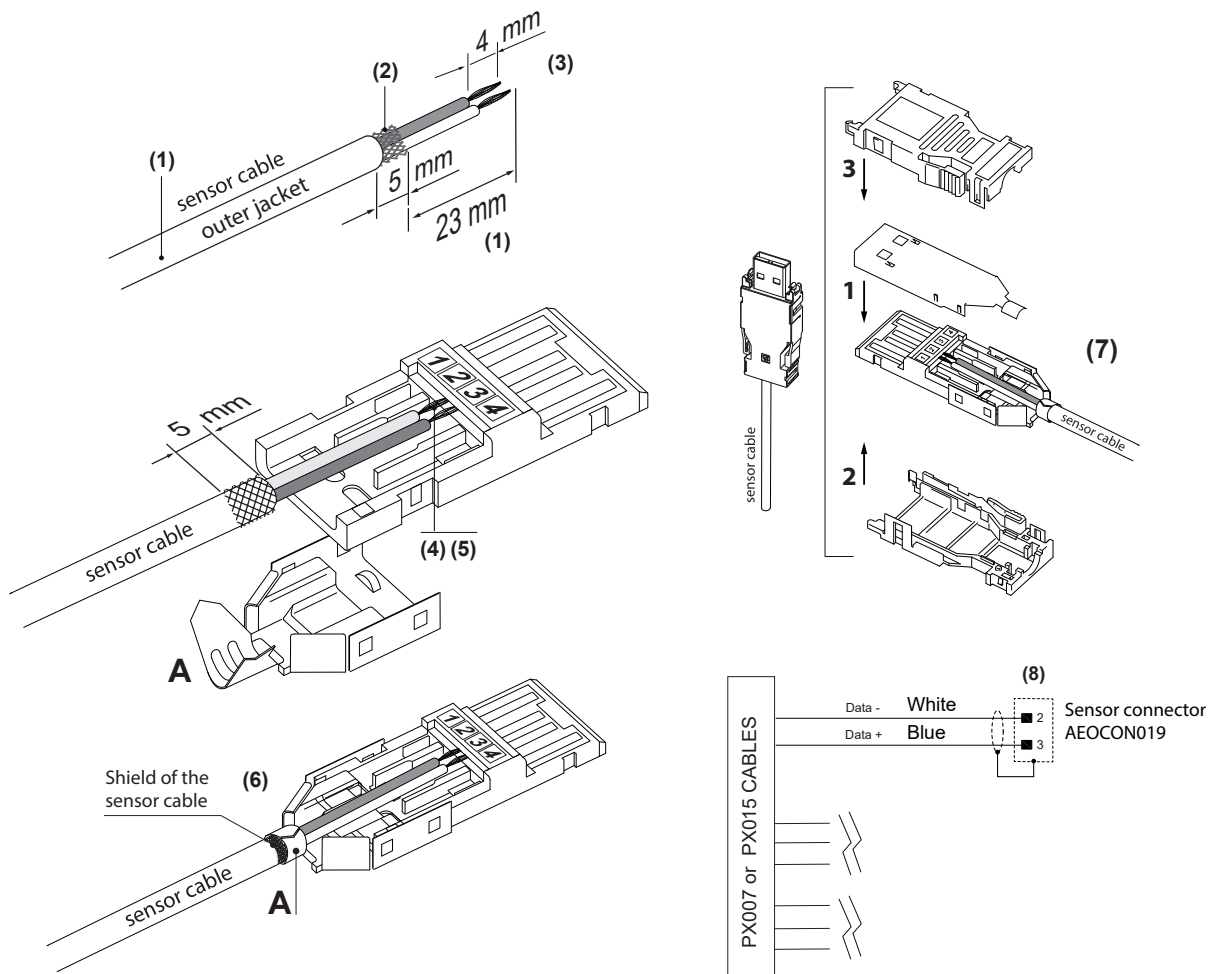
9.21.1 AEOCON018 and AEOCON019 connectors with PX007 and PX015 cables



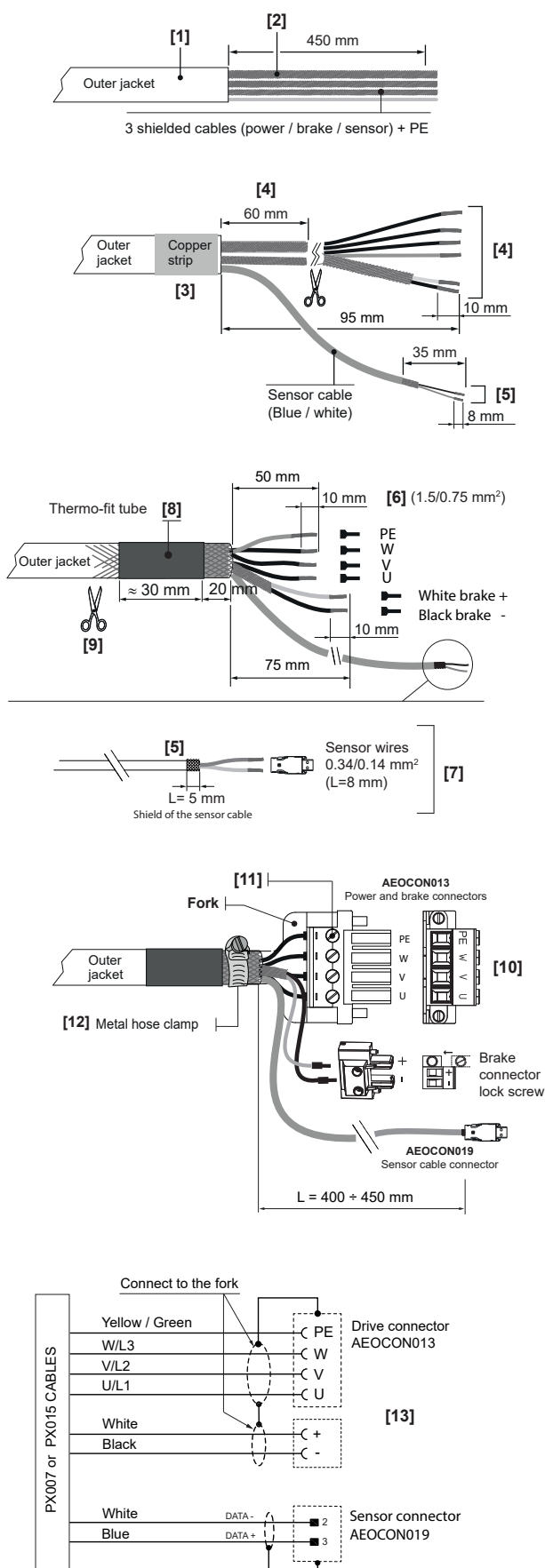
If you assemble your own AEOCON019 drive side encoder connector for PX007 and PX015 cables, please do so according to the following procedure:



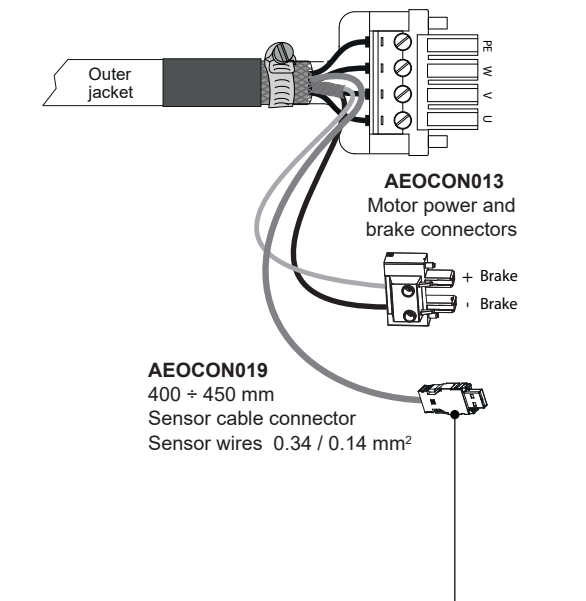
- (1) Carefully remove about 23mm of outer jacket and shield of the sensor cable;
- (2) Remove other 5mm of the outer jacket and let the shield intact as shown in the figure;
- (3) Remove about 4mm of sensor wires insulation.
- (4) Insert the sensor cable wires into the correct USB connector pins;
- (5) Solder the wires onto USB pins (Positions 2 and 3).
- (6) Assemble the first part of connector shield (A) as indicated in point [6], then close the metallic bend hose onto the cable shield.
- (7) Assemble in the order indicated the USB plug connector kit as shown in figure;
- (8) Sensor cable connections diagram.



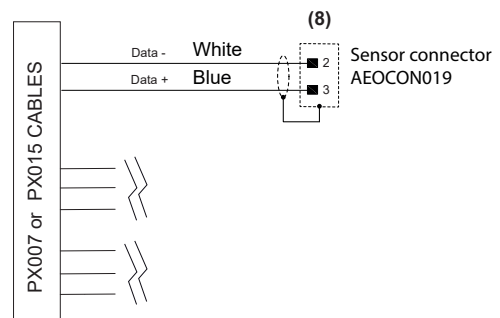
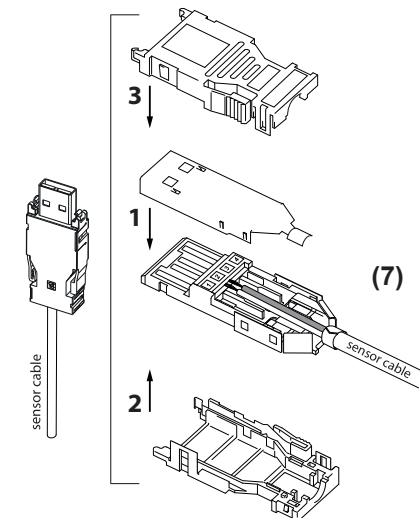
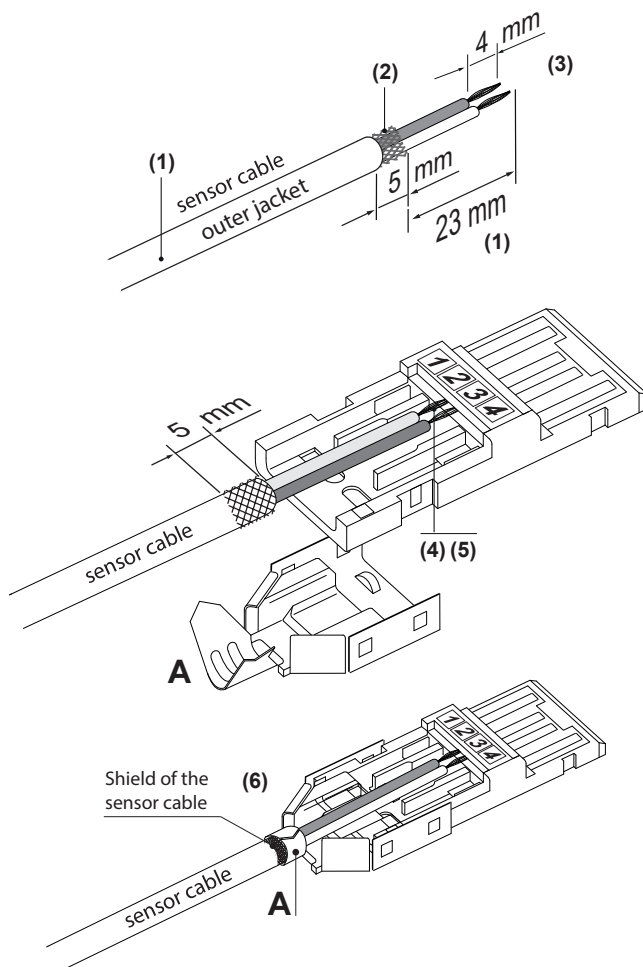
9.21.2 AEOCON013 and AEOCON019 connectors with PX007 and PX015 cables



If you assemble your own AEOCON019 drive side encoder connector for PX007 and PX015 cables, please do so according to the following procedure:



- (1) Carefully remove about 23mm of outer jacket and shield of the sensor cable;
- (2) Remove other 5mm of the outer jacket and let the shield intact as shown in the figure;
- (3) Remove about 4mm of sensor wires insulation.
- (4) Insert the sensor cable wires into the correct USB connector pins;
- (5) Solder the wires onto USB pins (Positions 2 and 3).
- (6) Assemble the first part of connector shield (A) as indicated in point [6], then close the metallic bend hose onto the cable shield.
- (7) Assemble in the order indicated the USB plug connector kit as shown in figure;
- (8) Sensor cable connections diagram.

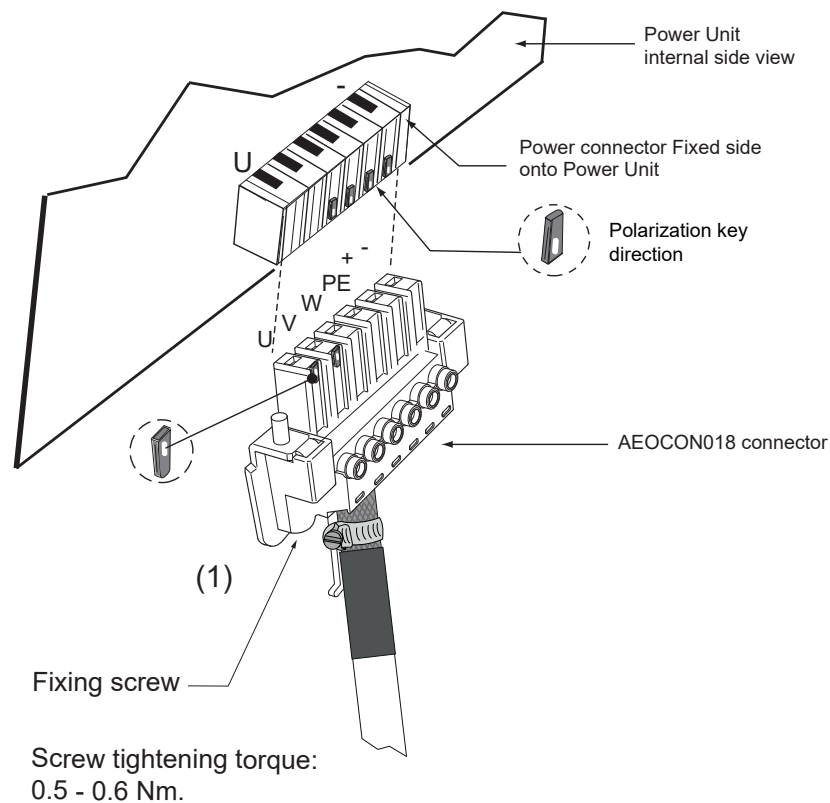


9.21.3 Polarization key configuration of the drive side motor power connector

If your construction requires own polarization key configuration of the drive side power connector, please do so according to the following procedure. The same procedure must be used for AEOCON013 connector.

Example of key configuration using AEOCON018 connector as:

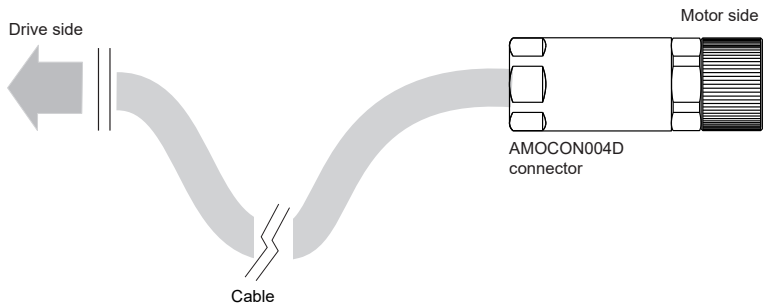
- pin U, V polarized onto the AEOCON018 connector.
- pin W, PE, +, - polarized onto the drive connector power fixed side.



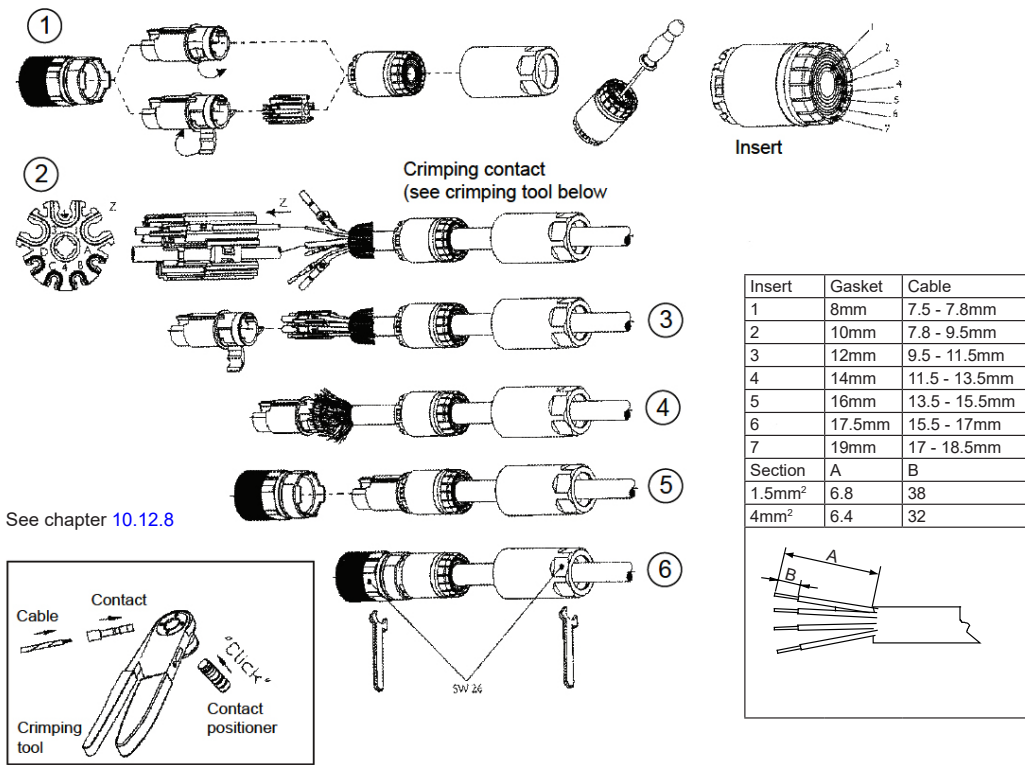
Please observe the here-above example for all other type of possible configurations. A particular attention must be paid during the key position and key direction. Not to respect these instruction may generate problems during the connector insertion.

9.22 Wiring the motor side power and brake connector

9.22.1 Wiring the motor side power and brake connector AMOCON004D with PC... cable

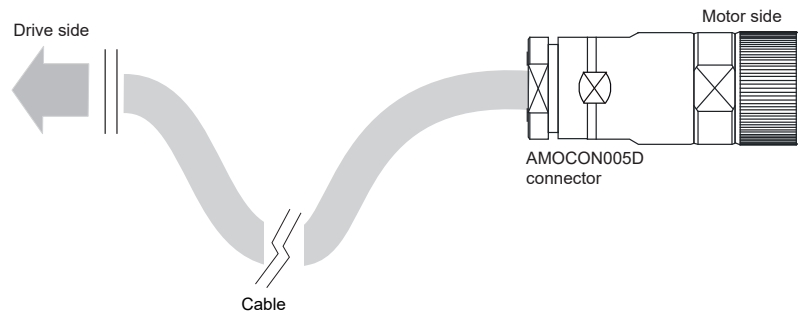


If you assemble your own motor power connector with shielding, please do so according to the following procedure.

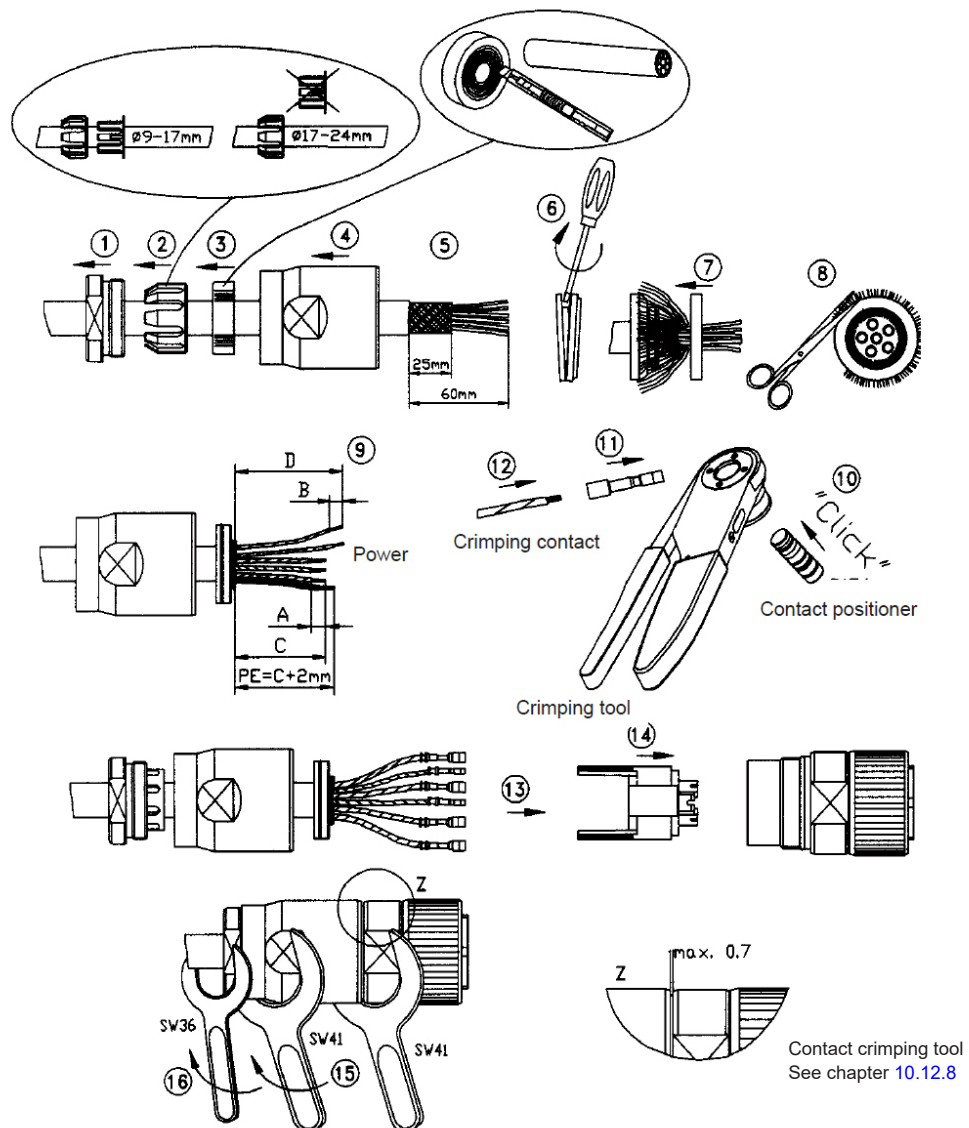


The global shield must be always reverse on the internal side of the insert as far as the gasket cable clamp, in such a way to use the largest contact areas. (see figure above).

9.22.2 Wiring the motor side power and brake connector AMOCON005D with PC... cable

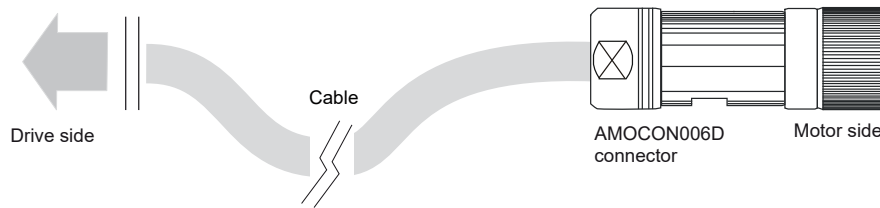


If you assemble your own motor power connector with shielding, please do so according to the following procedure.

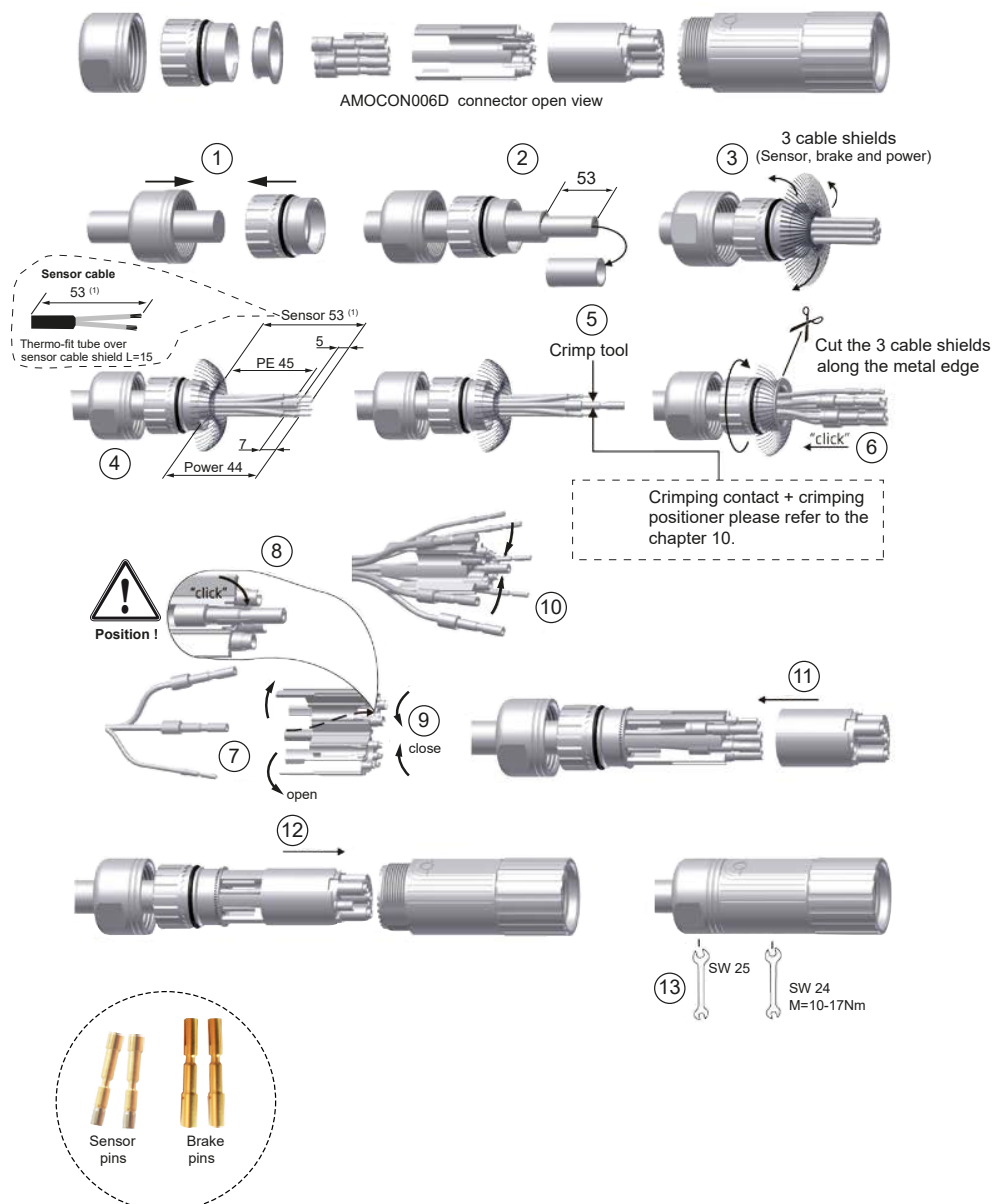


The global shield must be always reverse on the internal side of the insert as far as the gasket cable clamp, in such a way to use the largest contact areas. (see figure above).

9.22.3 Wiring the motor side power and brake connector AMOCON006D with PX... cable



If you assemble your own motor power connector with shielding, please do so according to the following procedure. The cables length are expressed in mm.



All 3 cables shields (sensor pair, brake pair and power shield) must be joint together and connected to the connector body as indicated above. The shields must be always reverse on the internal side of the insert as far as the gasket cable clamp, in such a way to use the largest contact areas. (see figure above)

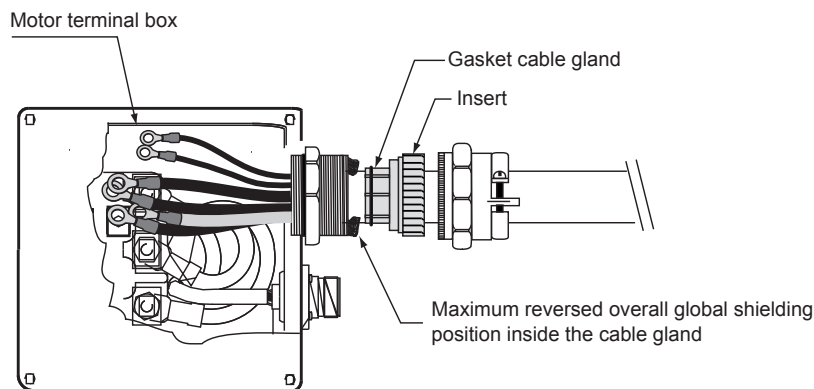
9.22.4 Wiring the shielding over the metal cable gland BMHQPRE

The metal cable gland is used for mounting the shield of the power cable as indicated for BHL260 and AMS motors power connection chapter.

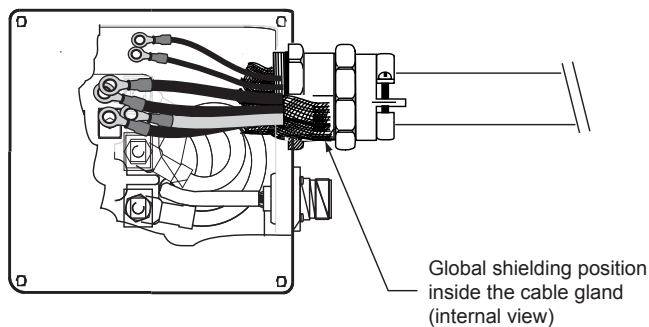
Motors versions with moving connector the metal cable gland are always supplied attached to the connector.

Motors with terminal box configuration are supplied as a standard with plastic cable gland. A metal CE cable gland must be ordered separately.

Wiring the shield over the cable gland



Internal shield position over the cable gland

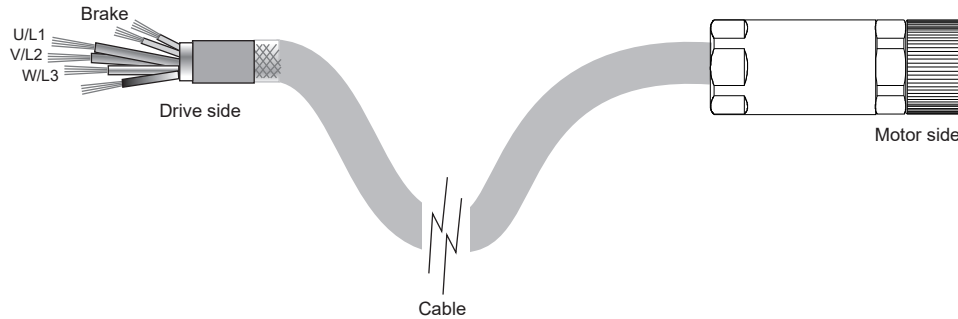


The overall global shield must be laid back on the inside of the insert as far as the gasket cable gland, in such a way as to use the largest contact area. The global shield must never overcome the gasket limit.

9.22.5 NUM power and brake cable assemblies

9.22.5.1 PC015Bx40Mxxxx , PC040Bx40Mxxxx , PC100Bx50Mxxxx

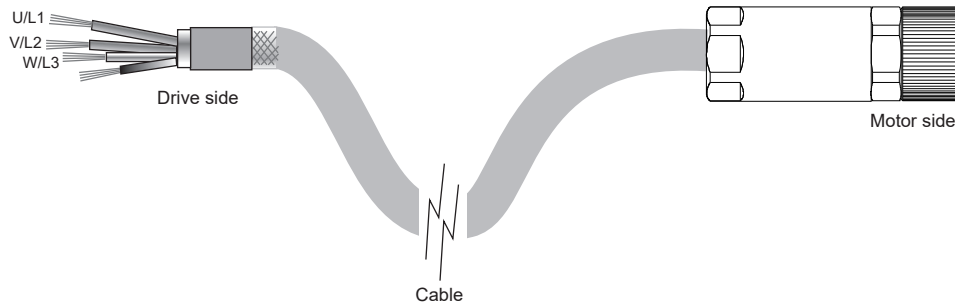
Motor power and brake cable connections



Cable PC015Bx40Mxxxx connections Cable PC040Bx40Mxxxx connections		Cable PC100Bx50Mxxxx connections	
Wire	Motor side connector pinout AMOCON004D	Wire	Motor side connector pinout AMOCON005D
U/L1	1	U/L1	U
V/L2	2	V/L2	V
W/L3	6	W/L3	W
Yellow / Green	⊕	Yellow / Green	⊕
White	5 (Brake +)	White	+ (Brake +)
Black	4 (Brake -)	Black	- (Brake -)

9.22.5.2 PC015Nx40Mxxxx , PC040Nx40Mxxxx , PC100Nx50Mxxxx

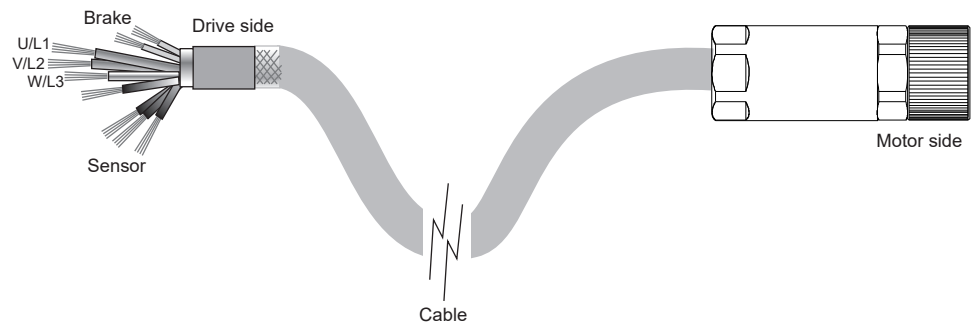
Motor power cable connections (without brake)



Cable PC015Nx40Mxxxx connections Cable PC040Nx40Mxxxx connections		Cable PC100Nx50Mxxxx connections	
Wire	Motor side connector pinout AMOCON004D	Wire	Motor side connector pinout AMOCON005D
U/L1	1	U/L1	U
V/L2	2	V/L2	V
W/L3	6	W/L3	W
Yellow / Green	⊕	Yellow / Green	⊕

9.22.5.3 PX007BH60Mxxxx, PX015BH60Mxxxx

Motor power / brake and sensor cable connections



Cable PX007BH60Mxxxx connections Cable PX015BH60Mxxxx connections	
Wire	Motor side connector pinout AMOCON006D
U/L1	A
V/L2	B
W/L3	C
Yellow / Green	⊕
White	E (Brake +)
Black	H (Brake -)
Blue	F (DATA+)
White	G (DATA-)

9.23 Motor thermal protection

Axis motors

The motor is thermically protected by a temperature sensor embedded in the motor winding.

The motor thermal probe is connected via the sensor motor cable.

For a correct use and management of the probe, select the parameter V270.

Please refer to Parameters manual code M00066 parameter V270.



For a correct connection of the motor thermal probe see chapter [9.8](#)

AMS motors

The motor is thermically protected by a probe located inside the motor.

The thermal sensor is electronically connected with contacts normally closed.
The contacts open when the motor temperature is $>180^{\circ}\text{C}$.

The thermal switch of the motor is connected by the sensor motor cable.

Electrical characteristics of the thermal switches:

- V_{max} applicable = 250VDC
- I_{max} applicable = 1.2A.



For a correct connection of the motor thermal probe see chapter [9.8](#)

9.24 Motor holding brake

The holding brake (optional) is incorporated in the motor and is normally active when not supplied with power. The permanent magnets brake works on the principle of zero current, therefore it closes when not supplied.

The holding brake is normally used for blocking torqueless axes without any clearance (without current circulating in the windings) or with line power failure.

With powered motor and brake on, it is possible to detect small braking torque differences between two identical motors.



- If a brake is provided on the motor, no axial loadings must be applied.
- If it is supplied with reverse polarity, the brake stays locked on.
- The holding brake is not to be considered a safety device.
- The brake is only intended for use as a holding static brake and not as a dynamic brake; about 1800-2000 braking operations can be performed in case of emergency or power failure with a total inertia equal to twice the rotor inertia value.
- Supplying the holding brake with voltage⁽¹⁾ values different from the permissible values will cause the brake locked and, in some cases, irrevocable damage to the brake coil.
- If the holding brake is not being used for a long time, the oxidation of its parts may lead to a braking torque reduction.

⁽¹⁾ See chapter [9.14.6](#) Brake voltage definition and tolerance.

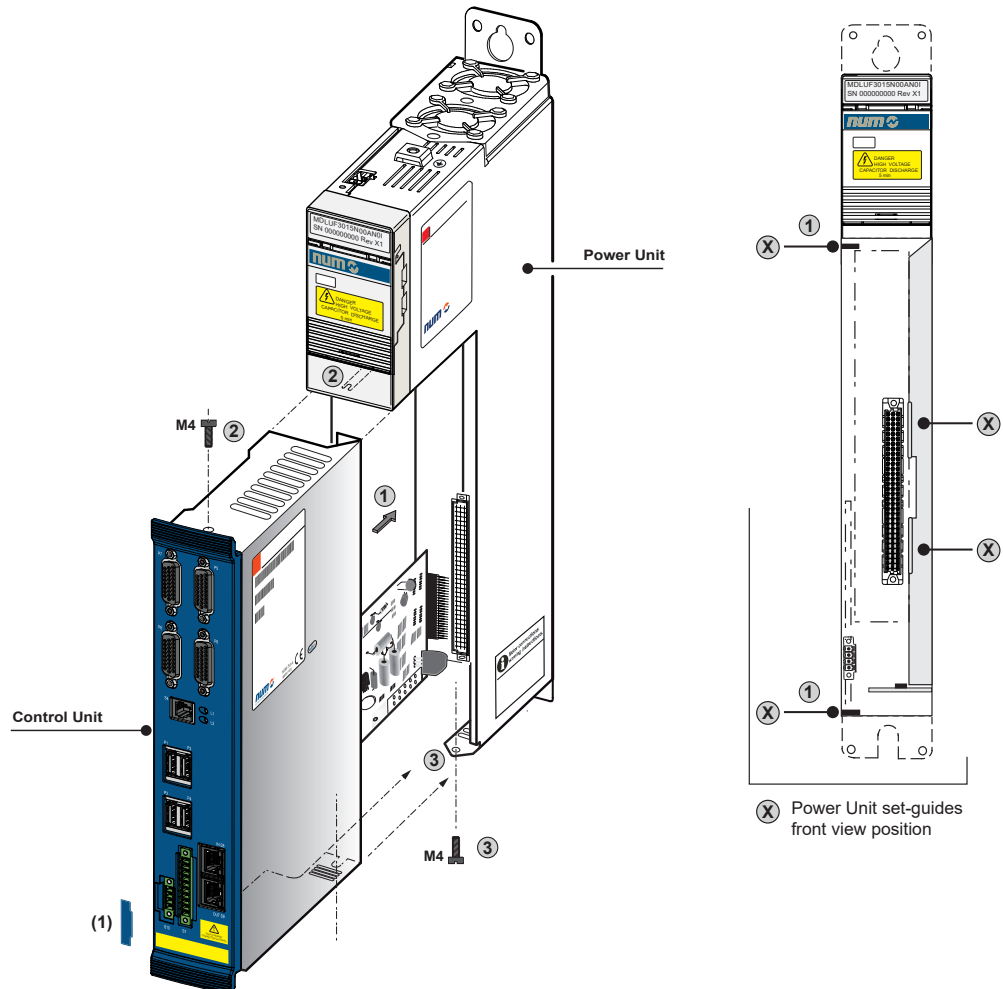
9.24.1 Technical brake characteristics

Motor type	Brake torque	Power	Brake release time	Brake insertion time
BPX055	0.8Nm	10W	30ms	20ms
BPX, BHX 075 SPX, SHX 075	2.2Nm	10W	100ms	100ms
BPX, BHX 095 SPX, SHX 095	6Nm	17W	150ms	250ms
BPX, BHX 126 SPX, SHX 126	13Nm	19W	100ms	100ms
BPX, BHX 155 SPX, SHX 155	29Nm	22.5W	200ms	60ms
BPH 075/1/2	2.5Nm	12W	100ms	200ms
BPH 075/4	5Nm			
BPH 095/2/3	5Nm	16W	100ms	100ms
BPH 095/5	11Nm			
BPH 115/2/3/4	12Nm	19W	150ms	150ms
BPH 115/6	22Nm			
BPH 142/2/3/4	20Nm	24W	250ms	250ms
BPH 142/7	40Nm	24W		
BPH 190/2/3/4	40Nm	36W	300ms	300ms
BPH 190/5/7/A	80Nm		400ms	400ms
BHL 260				

9.25 MDLUF Control Unit replacement



Do not replace or plug the Control Unit when the drive is powered with mains or auxiliary supply.



(1) For module size 50mm only: remove the plastic cover before to assembly the Control Unit into the Power Unit pressing lightly from the rear side of the Control Unit.

- Remove the Control Unit by unscrew the M4 lower and upper screws as indicated in the figure here above.
- Make the Control Unit replacement following this instructions:

①	Insert the Control Unit in the Power Unit by means the module set-guides (x) as indicated in the figure.
②	Align the modules as indicated in order to get an freely screw assembly and insert the upper screw as indicated in the figure. Tighten the fixing screw to 1.5Nm.
③	Insert the lower screw as indicated in the figure. Tighten the fixing screw to 1.5Nm.



This replacement procedure must be used for all range of modules.

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1
2
3
4
5
6
7
8
9
10
11

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Summary

10	Available accessories and spare parts	273
10.1	System cables	273
10.2	NUM DrivePro adapters	274
10.3	NUM DrivePro connectors kit	275
10.4	AEOKIT003 accessories kit for MDLL3120N00A/R/H.....	277
10.5	AEOKIT006 accessories kit for MDLUF400AExxN0I	278
10.6	Fan kit AGOFAN001	279
10.7	AGORESxxx MDLL3 external braking resistor	280
10.7.1	Technical characteristics	281
10.7.2	Operating example	282
10.7.3	AGORES008, AGORES009 - Overall dimensions and installation	284
10.7.4	AGORES010, AGORES011 - Overall dimensions and installation	285
10.8	Line filter for MDLL3 power supply	286
10.8.1	Line filter AGOFIL024A, AGOFIL025A, AGOFIL026, AGOFIL027	286
10.8.2	Line filter AGOFIL028	287
10.8.3	AGOFIL001S auxiliary power supply (AUX) filter	288
10.8.4	Line filter HPPM166 module	289
10.9	Line chokes.....	290
10.9.1	Line choke AGOIND001 and AGOIND002.....	290
10.9.2	Line choke AGOIND006.....	291
10.9.3	Line choke AGOIND007.....	292
10.9.4	Line choke AGOIND009.....	293
10.9.5	Auto-transformer for BHL260 fan (with 480V network).....	294
10.10	Capacitor module MDLC3010N00	295
10.10.1	General characteristics.....	295
10.10.2	Module layout and enclosed accessories	295
10.10.3	MDLC3010N00 DC Bus connections.....	296
10.11	Motor cables and motor connectors.....	297
10.11.1	High performance power cable	297
10.11.2	Basic performance power cable.....	298
10.11.3	High Performance motor cable for SHX and SPX motors (Single Cable Motor)	299
10.11.4	Sensor cable.....	300
10.11.5	Fan cable (for BHL and AMS motors).....	300
10.11.6	Raw cable ordering codes.....	301
10.11.7	Power assembly cable ordering codes.....	303
10.11.8	Sensor assembly cable ordering codes	304
10.11.9	Single Cable Motor assembly cable ordering codes	305
10.11.10	Fan assembly cable (for BHL and AMS motors) ordering codes	306
10.12	Motor cable assemblies and motor connectors.....	307
10.12.1	BHX, BPX cable assemblies and motor connectors	307
10.12.2	SHX, SPX cable assemblies and motor connectors	308
10.12.3	BPH cable assemblies and motor connectors	309
10.12.4	BPG cable assemblies and motor connectors	310
10.12.5	BHL cable assemblies and motor connectors.....	311
10.12.6	AMS cable assemblies, motor connectors and cable gland	312
10.12.7	Connectors dimensions	313
10.12.8	Accessories and spare parts for power and sensor cable mounting	314

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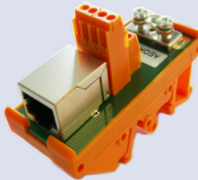
10 Available accessories and spare parts

10.1 System cables

Accessories	Order Code	Description	
MDLL3 / MDLUF	AEOF016M0002 AEOF016M0003 AEOF016M0004	MDLUF size 1 - 2 MDLUF size 3 MDLUF size 4 - 6	
EtherCAT Cable (yellow RJ45) for NUM-SAMX Connections	AEOF012M0001 AEOF012M0002 AEOF012M00A3 AEOF012M0004 AEOF012M0006 AEOF012M0015 AEOF012M0020 AEOF012M0030	MDLUF size 1 MDLUF size 2 MDLUF size 3 MDLUF size 4 MDLUF size 6 Cable length 1.5 m Cable length 2 m Cable length 3m	
Cable for Tandem: Anti-Backlash Torque Duplication Winding Duplication	AEOF013M0001 AEOF013M0002 AEOF013M00A2 AEOF013M0003 AEOF013M0004	MDLUF size 1 MDLUF size 2 MDLUF size 3 MDLUF size 4 MDLUF size 6	
Ethernet cable (RJ45) for: MDLUF to MDLUF, NUM- STOX to NUM-STOX, RTK to PC, EtherCAT Gateway interconnection, RTK to EtherCAT Gateway	AEOF018M0001 AEOF018M0002 AEOF018M00A2 AEOF018M0003 AEOF018M0004 AEOF018M0010 AEOF018M0025 AEOF018M0050 AEOF018M0100	MDLUF size 1 MDLUF size 2 MDLUF size 3 MDLUF size 4 MDLUF size 6 Cable length 1 m Cable length 2.5 m Cable length 15 m Cable length 10 m	
RTK to MDLUF Cable	AEOF017M0006 AEOF017M0010 AEOF017M0025 AEOF017M0050	Cable length 0.6 m Cable length 1 m Cable length 2.5 m Cable length 5 m	

Accessories	Order Code	Description	
NUMSmartBackup 64GB	FXHE557102	The NUMSmartBackup system is an own developed tool to backup or restore all FlexiumPro.	

10.2 NUM DrivePro adapters

Accessories	Order code	Description	
RJ45 NUM-STOX Cable toTerminal Adapter	AEOADA011	NUM-STOX adapter with wire terminal connections (8 screws terminals) Dimensions: 70x30x48 mm	
MDLUF Dual Row adapter	AEOADA023	3 RJ45 (J1, J2, J3) Dimensions: 60x25x58 mm	

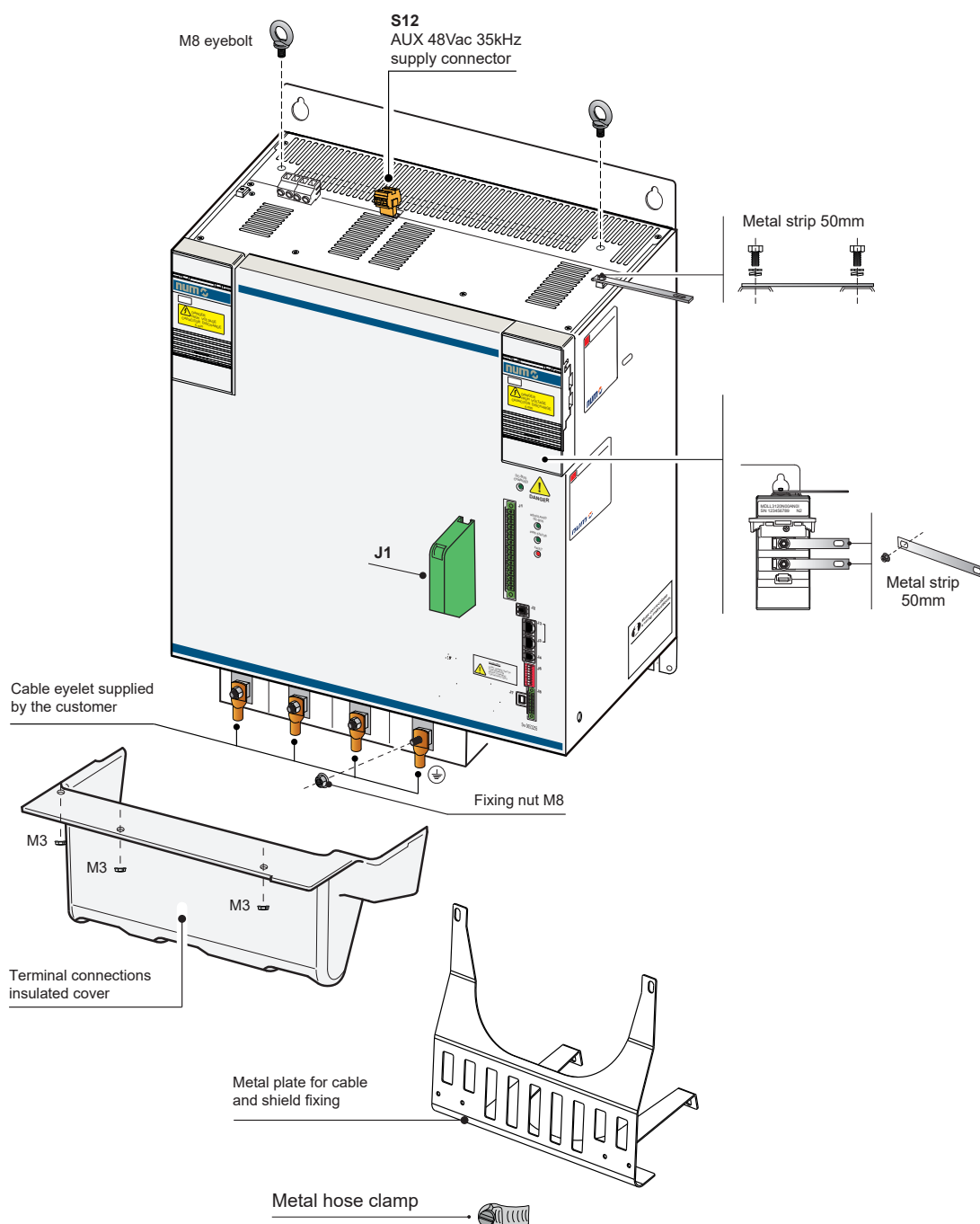
10.3 NUM DrivePro connectors kit

Accessories	Order code	Description	
Drive Side Sensor Connector (P5, P6, P7, P8)	AEOCON012	Suitable for all MDLUF Sensor connector Sub D HD 26 pin M (4/40" screw thread connector).	
MDLUF Size 2 and 3 Power and Brake Connector	AEOCON013	Suitable for: MDLUF050AExxN01 MDLUF075AExxN01 MDLUF100AExxN01 MDLUF050BExxN01 MDLUF075BExxN01 Drive power connector, brake connectors + fixing device, metal hose clamp and polarization keys.	
MDLUF Size 3 Power and Brake Connector	AEOCON015	Suitable for: MDLUF150AExxN01 Drive power connector, brake connectors + fixing device, metal hose clamp and polarization keys.	
Vibration detector connector	AEOCON016	Suitable for Vibration Detector VDR VDX1002A00AC000	

Accessories	Order code	Description	
MDLUF Size 1 Power and Brake Connector	AEOCON018	Suitable for: MDLUF007AExxN0I MDLUF014AExxN0I MDLUF021AExxN0I MDLUF034AExxN0I MDLUF007BExxN0I MDLUF014BExxN0I MDLUF021BExxN0I MDLUF014DExxN0I Drive power connector with polarization key.	
MDLUF Sensor Connector for Single Cable Motor (P1, P2, P3, P4)	AEOCON019	Suitable for all MDLUF Industrial USB	 

10.4 AEOKIT003 accessories kit for MDLL3120N00A/R/H...

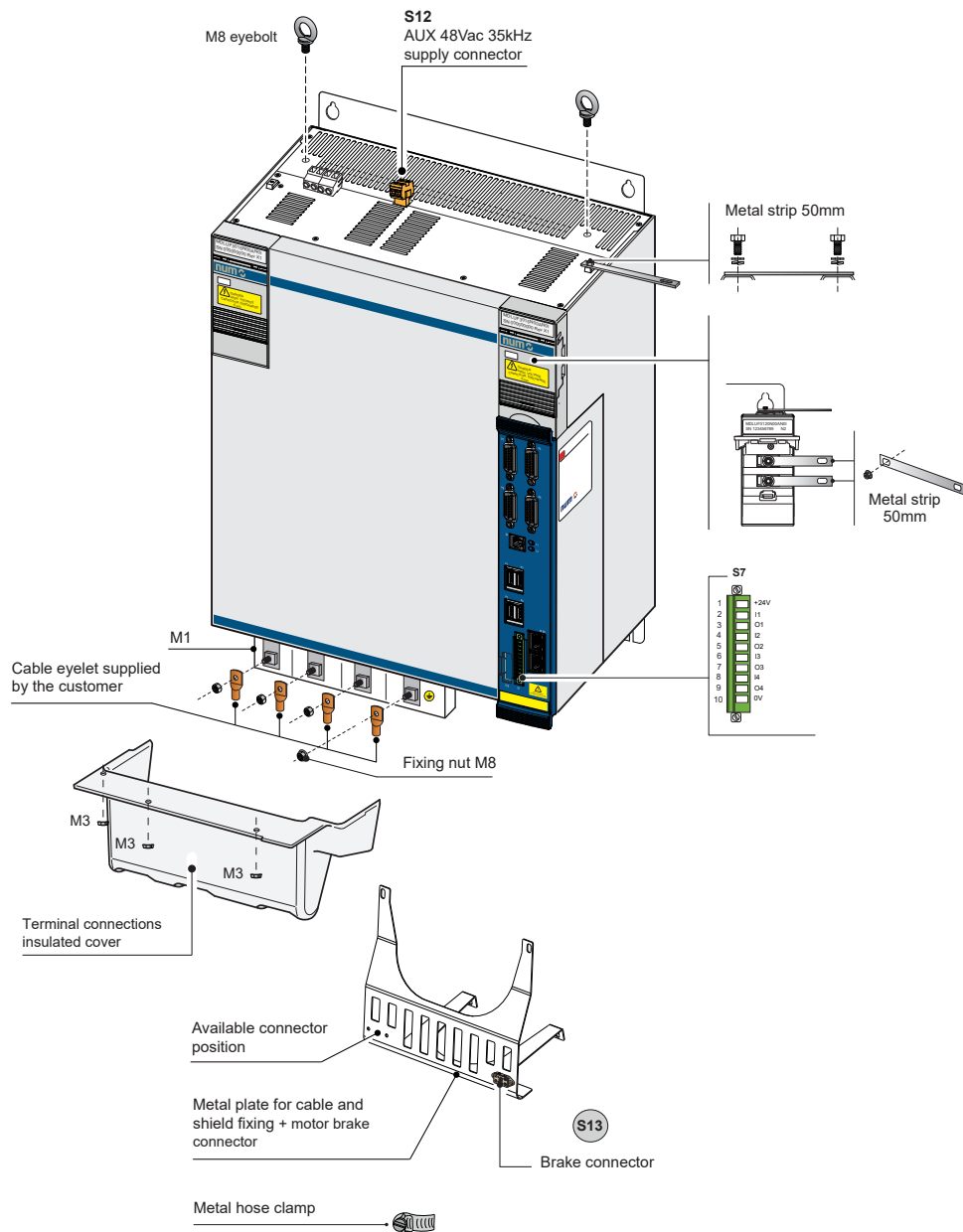
Description	Qty
Terminal insulated cover for L1, L2, L3 mains connections (plastic protection) + three M3 fixing nuts	1
Fixing nuts M8 (self blocking)	4
Metal plate for mechanical cable shield fixing + metal hose clamp for cable and shield fixing	1
16 pins F connector for auxiliary power supply and I/O (J1) + shell connector	1
Auxiliary 48Vac 35kHz supply plug connector (S12)	1
M8 eyebolts for module installation	2
Metal strip for DC Bus module / module interconnections with fixing nuts M5 + fixing washers	2
Metal strip for earth module/module interconnections with screw M5x8 + fixing washer	1

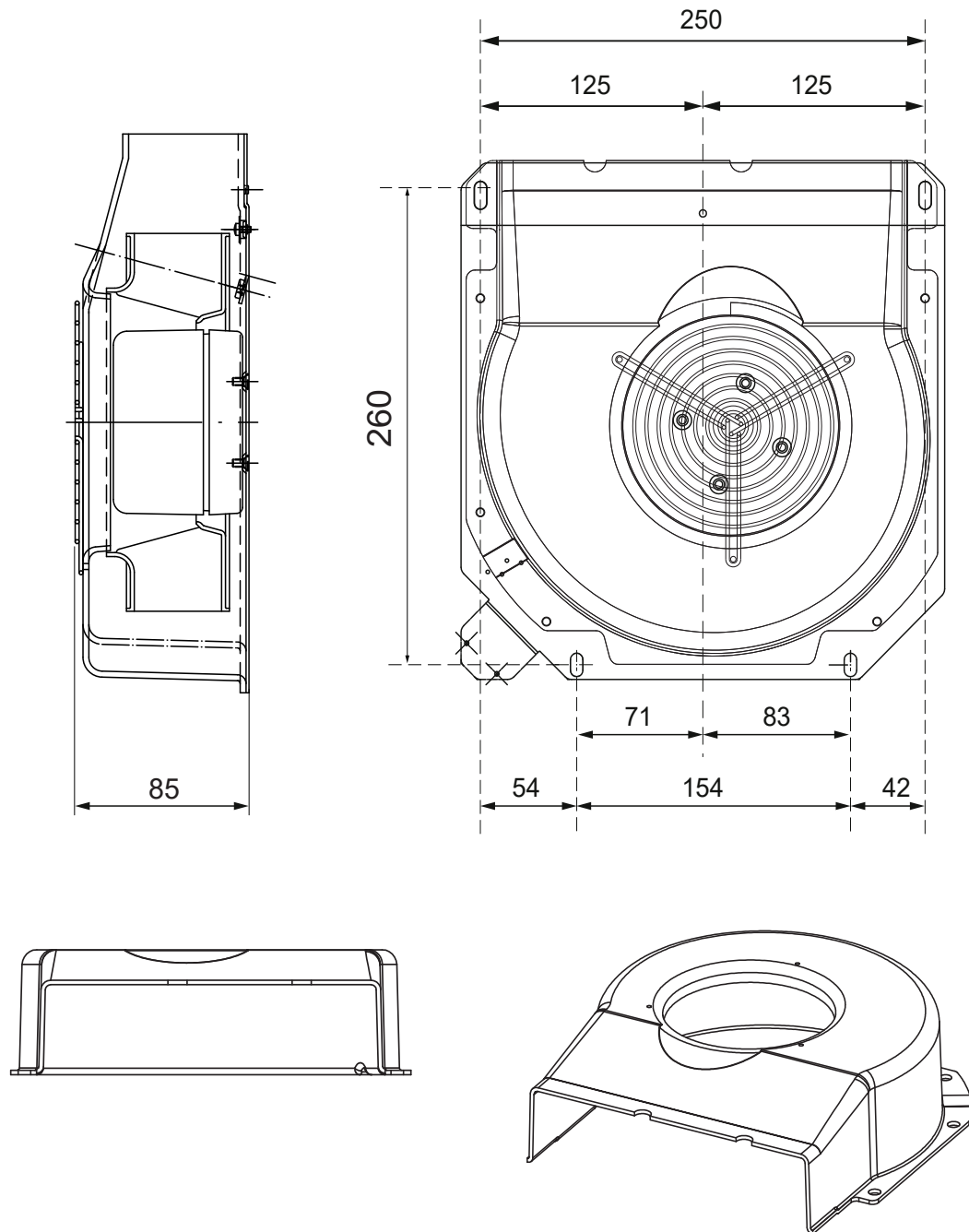


10.5

AEOKIT006 accessories kit for MDLUF400AExxN01

Description	Qty
Terminal insulated cover for U, V, W motor terminal connections (plastic protection) + three M3 fixing nuts	1
Fixing nuts M8 (self blocking)	4
Metal plate for mechanical cable and shield fixing + brake connector (S13) with 2 screws M3x8 type and metal hose clamp for cable and shield fixing	1
Auxiliary 48Vac 35kHz supply connector (S12)	1
10 screw pins IN/OUT and general purpose connections connector (S7)	1
M8 eyebolts for module installation	2
Metal strip for DC Bus module / module interconnections with fixing nuts M5 + fixing washers	2
Metal strip for earth module/module interconnections with screw M5x8 + fixing washer	1



10.6 Fan kit AGOFAN001

Weight: 2.5 kg.

The fan installation and connection is described on chapter [9.5.2.3](#).

10.7 AGORESxxx MDLL3 external braking resistor

The braking resistor is external to the MDLL3 power supply module and is fitted with a thermal switch to be connected to the module.

One braking resistor must always be provided in the system, and if required by the duty cycle, it may be necessary to equip the system with more external resistors in order to increase the continuous dispersible power.

The external braking resistor must be connected by PA / PB cables to the J5 connector of the MDLL3 module. The thermal switch must be connected to the PY / PZ contacts J1 connector of the MDLL3 module. See chapter [9.5.8](#).

If several resistors are fitted the thermal switch contacts must be connected in series.

To increase the dispersible power supply, the resistors may be connected in series or in parallel on the condition that the resistive value of each group is in according to the MDLL3 minimum braking resistance value. See next pages.



- The resistor frame may reach high temperatures in case of a particularly heavy use, due to a high number of braking, we therefore suggest:
 - they are placed where they will not be accidentally touched by personnel;
 - a minimum clearance of 100mm from the electrical raceway to avoid their melting;
 - the insulating material of the cables used to connect the braking resistors, in case they must be placed near the braking resistor frame, must guarantee a temperature resistance compatible with the over temperature sensor of the used braking resistor
- To ensure correct heat dissipation, the braking resistor must be installed vertically or horizontal as shown in the next pages.
- If several resistors are fitted, make sure that a safety clearance of 100mm is left between resistors.
- The braking resistors are supplied with lead wires suitable for installation in a protected area (typically cabinet) and they cannot be used externally. In case the braking resistors lead wires are laid (even partially) outside the electrical cabinet, additional insulation measures and protection must be taken.

10.7.1 Technical characteristics

External braking resistor	Unit	AGORES008	AGORES009	AGORES010	AGORES011
Continuous nominal power (environment temperature 40°C)	W	480		2500	2500
Resistive value	Ω	17	8.5	5.6	8.5
Resistor thermal protection device by means of thermal switches		- Thermal switch 1 fitted on the frame with N.C contact. - Contact interruption 10A/250Vac. - Operative contact > 400°C~ . (AGORES010/011 > 160°C~)			
Energy pulse <500ms	kJ	12		125	125
Weight	kg	0.35		7	7



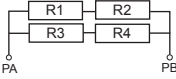
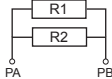
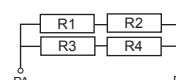
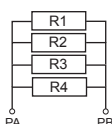
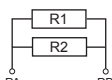
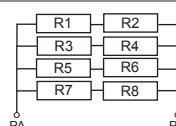
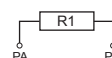
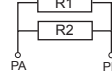
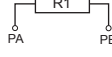
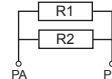
Please take always into consideration the medium dissipation value during the braking cycle, and check that the value must be $\leq$ to the continuative nominal power as indicated in the table.

Please take always into consideration the minimum braking resistance value as indicated in the table below. This limit must be always respected not to damage the MDLL3.

Power Supply MDLL3	Minimum braking resistance value
MDLL3005M...	$\geq 17\Omega$
MDLL3015N...	$\geq 10\Omega$
MDLL3025N...	$\geq 8.5\Omega$
MDLL3030N...	$\geq 8.5\Omega$
MDLL3050N...	$\geq 4.25\Omega^{(1)}$
MDLL3120N...	$\geq 2.8\Omega$

⁽¹⁾ Always provide as basic configuration a minimum of two AGORES009 braking resistors as indicated on next page.

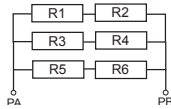
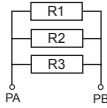
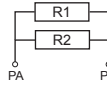
10.7.2 Operating example

MDLL3 ...	Braking resistor	Connections configuration	Value [Ω]	P cont. [W]	Peak power <100ms [kW]
MDLL3015N00AN0I MDLL3005M00AN0I	AGORES008		17	480	30
	AGORES008 (X4)			1920	30
MDLL3030N00AN0I MDLL3025N00RN0I MDLL3025N00HN0I	AGORES008 (X2)		8.5	960	61
	AGORES009			480	61
	AGORES009 (X4)			1920	61
MDLL3050N00RN0I MDLL3050N00HN0I	AGORES008 (X4)		4.25	1920	120
	AGORES009 (X2) Basic configuration			960	120
	AGORES009 (X8)			3840	120
	AGORES010			2500	100
MDLL3050N00AN0I	AGORES010		5.6	2500	100
	AGORES011		8.5	2500	60
	AGORES011 (X2)		4.25	5000	120
MDLL3120N00HN0I	AGORES010		5.6	2500	100 (Peak power <1s)
	AGORES010 (X2)		2.8	5000	200 (Peak power <1s)



In all cases the Ohmic values of the resistor must operate as indicated in the previous page. Drives operated outside of these ranges could be seriously damaged. For the limits of the peak braking power see chapter 4.

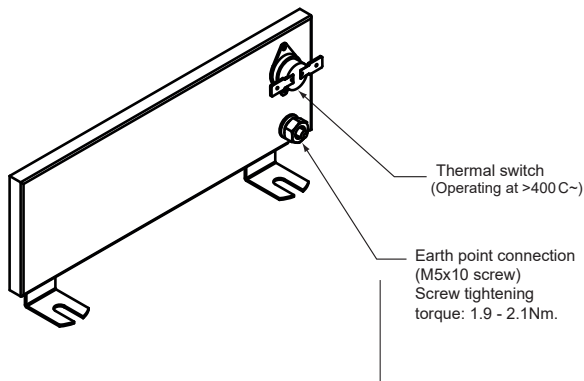
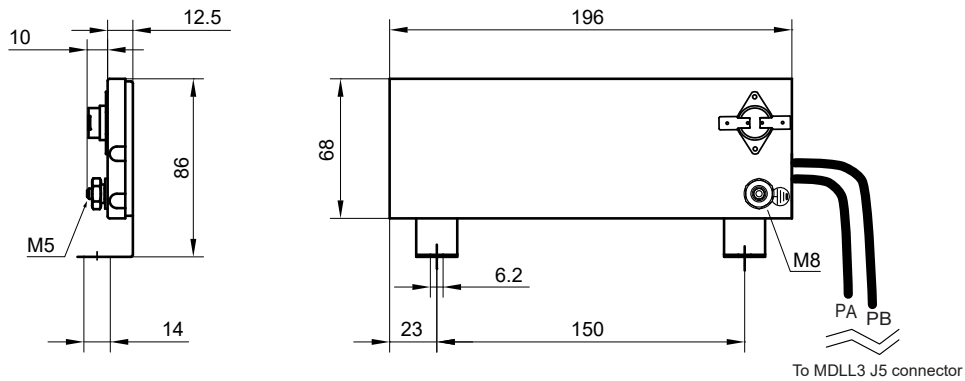
Operating example

MDLL3 ...	Braking resistor	Connections configuration	Value [Ω]	P cont. [W]	Peak power <100ms [kW]
MDLL3120N00AN0I	AGORES010 (X6)		3.73	15000	120 (Peak power <2s)
	AGORES011 (X3)		2.8	7500	160 (Peak power <1s)
MDLL3120N00RN0I	AGORES010		5.6	2500	100 (Peak power <1s)
	AGORES010 (X2)		2.8	5000	200 (Peak power <1s)



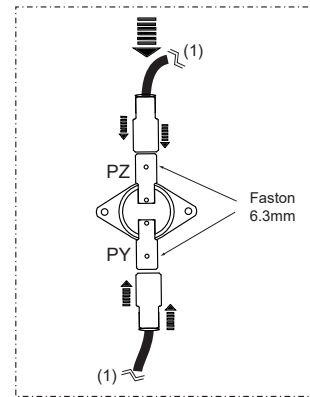
In all cases the Ohmic values of the resistor must operate as indicated in the previous page. Drives operated outside of these ranges could be seriously damaged. For the limits of the peak braking power see chapter 4.

10.7.3 AGORES008, AGORES009 - Overall dimensions and installation



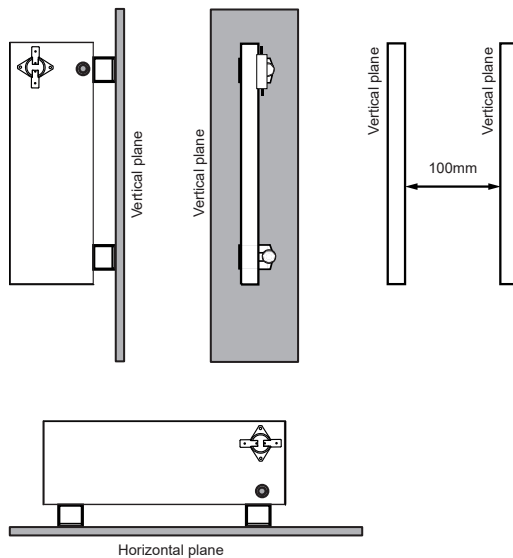
Be sure to use a high temperature cable.
In any case, if the panel, where the resistor is fixed, is properly earthed, it is not necessary to connect an additional earth cable.

Thermal switch - Connect to MDLL3
J1 connector (PY, PZ pins)

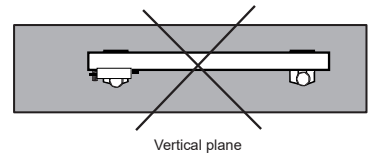


(1) Thermally insulated cable (1 mm²)
supplied with the resistor 1.3m length.

Allowed mounting arrangements

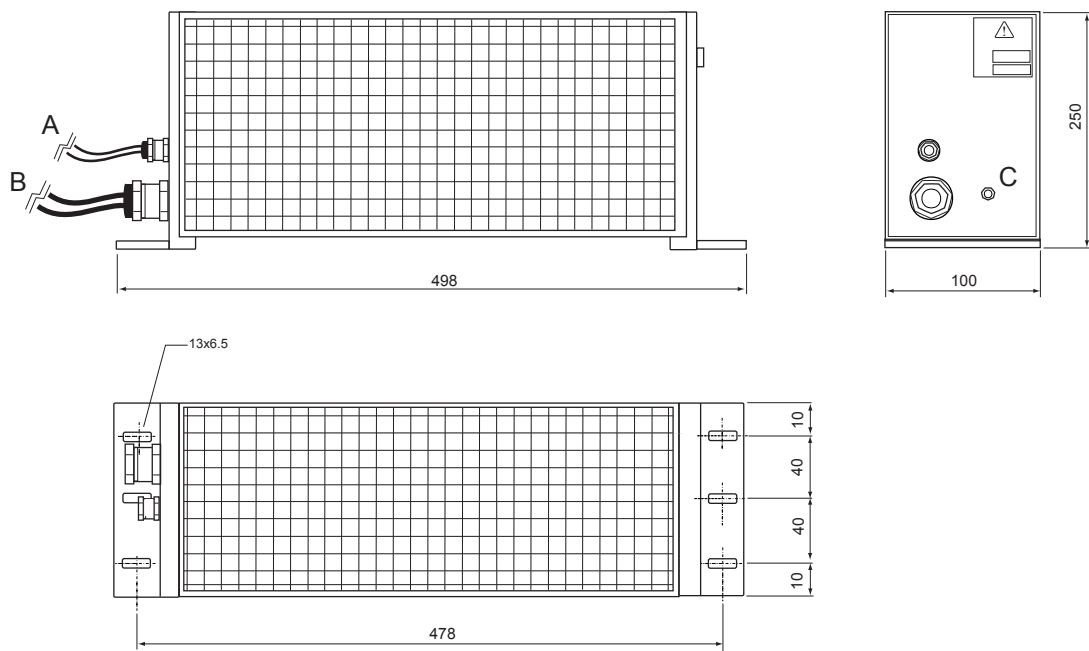


Not allowed mounting arrangements

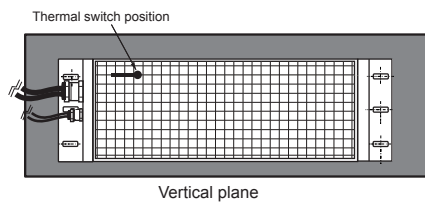
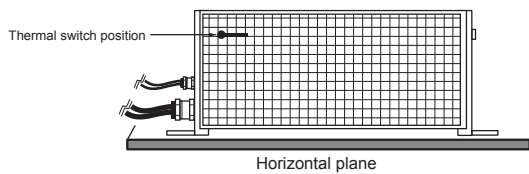


Insert the faston applying a direct axial force only.
A wrong radial force insertion or any faston movement during the insertion
can damage the thermal switch.

10.7.4 AGORES010, AGORES011 - Overall dimensions and installation

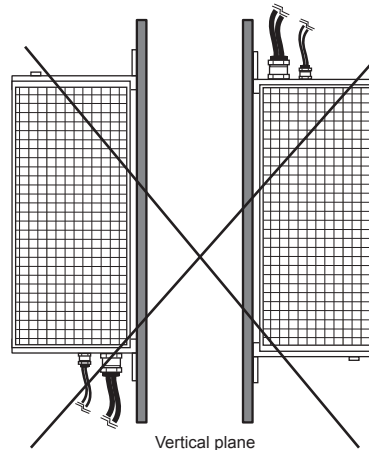


Allowed mounting arrangements



The thermal switch position must always be located in the upper side as indicated above.

Not allowed mounting arrangements



- To ensure correct heat dissipation the braking resistor must be installed horizontal as shown.
- If several resistors are fitted, make sure that a safety clearance of 100mm is left between resistors.

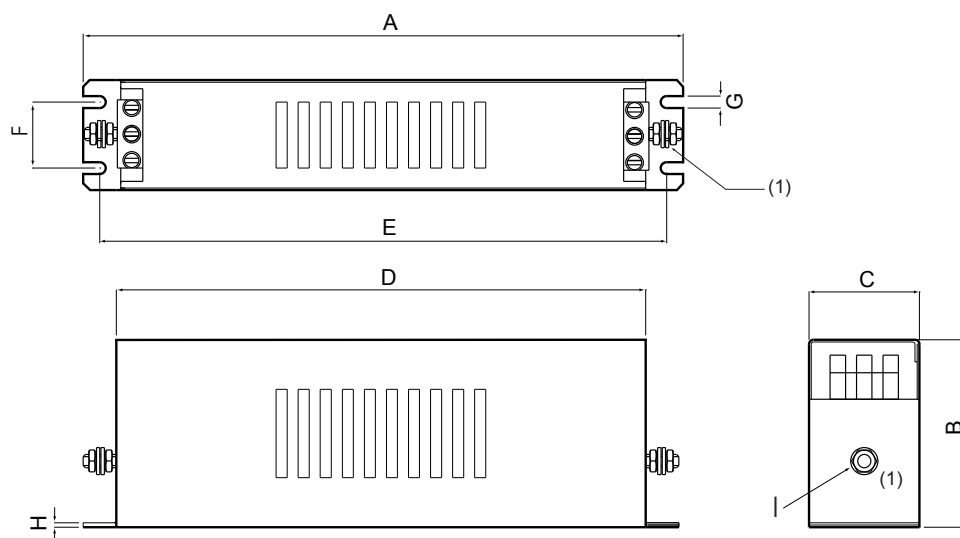
A	Thermal switch cable: - Thermally insulated cable (1.5 mm²) supplied with the resistor. - Cable length 5m. - Thermal switch operating temperature >160°C~ - Connect to MDLL3 J1 connector pins PY, PZ.
B	Resistor cable: - Thermally insulated cable (6 mm²) supplied with the resistor. - Cable length 5m. - Connect PA, PB to MDLL3 J5 connector pins 1, 2.
C	Earth point screw connection (M5x10) Screw tightening torque 1.9 - 2.1Nm.

10.8 Line filter for MDLL3 power supply

10.8.1 Line filter AGOFIL024A, AGOFIL025A, AGOFIL026, AGOFIL027

Technical data	AGOFIL024A	AGOFIL025A	AGOFIL026	AGOFIL027
MDLL3 association	MDLL3015N00AN0I	MDLL3030N00AN0I	MDLL3025N00RN0I MDLL3025N00HN0I MDLL3050N00AN0I MDLL3050N00RN0I MDLL3050N00HN0I	MDLL3120N00AN0I MDLL3120N00RN0I MDLL3120N00HN0I
Rated voltage	480Vac 50/60 Hz			
Rated current (refer. to 50°C ambient temperature)	42Arms	75Arms	100Arms	180Arms
Test voltage	3470Vdc, 2s (line to ground) 1700Vdc, 2s (line to line)			
Leakage current	Normal condition < 3mA Fault condition 260mA (only one phase remaining)			
Approvals	EN61800-3 category C3 - I <100mA (second environment (industrial low-voltage supply network))			
Terminal block cross section - LINE / LOAD	10mm ²	16mm ²	50mm ²	95mm ²
Weight	2.8kg	4.4kg	4.7kg	7.5kg
Power connections screw tightening torque	1.5 - 1.8 Nm	2 - 2.2 Nm	6 - 8 Nm	15 - 20 Nm
Overall dimensions	See table here under			

For the filter use and connections criteria please refer to M00027 manual.



(1) Earth point connections (M6 or M10). Screw tightening torque: M6: 3 - 4 Nm, M10: 10 - 17 Nm

Line filter	A	B	C	D	E	F	G	H	I
AGOFIL024A	310	85	50	280	295	30	5.4	2	M6
AGOFIL025A	270	135	80	240	255	60	6.5	3	M6
AGOFIL026	270	150	90	240	255	65	6.5	3	M10
AGOFIL027	380	170	120	350	365	102	6.5	3	M10

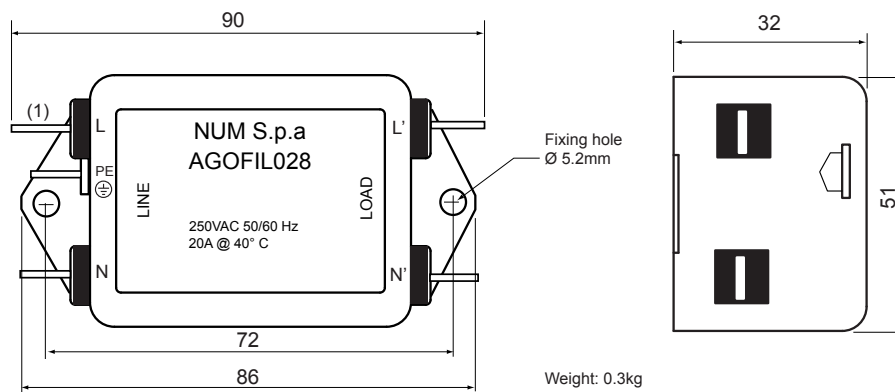


The line filter frame may reach high temperatures. Therefore to facilitate sufficient air circulation and ensure an adequate heat exchange it is recommended that a minimum clearance of 30mm is left when installing the filter in the electrical cabinet. We suggest to place the filter where they will not be accidentally touched by personnel.

10.8.2 Line filter AGOFIL028

Technical data	AGOFIL028
MDLL3 association	MDLL3005M00AN0I
Rated voltage	250Vac 50/60Hz
Rated current (refer. to 40°C ambient temperature)	20 Arms
Test voltage	1700Vdc, 2s (L/N) 2700Vdc, 2s (L/N-PE)
Climatic category	25/100/21 acc. to IEC 60068-1
Approvals	UL Recognized
Terminal cross section	Faston 6.3x0.8mm
Weight	0.3kg

For the filter use and connections criteria please refer to M00027 manual.

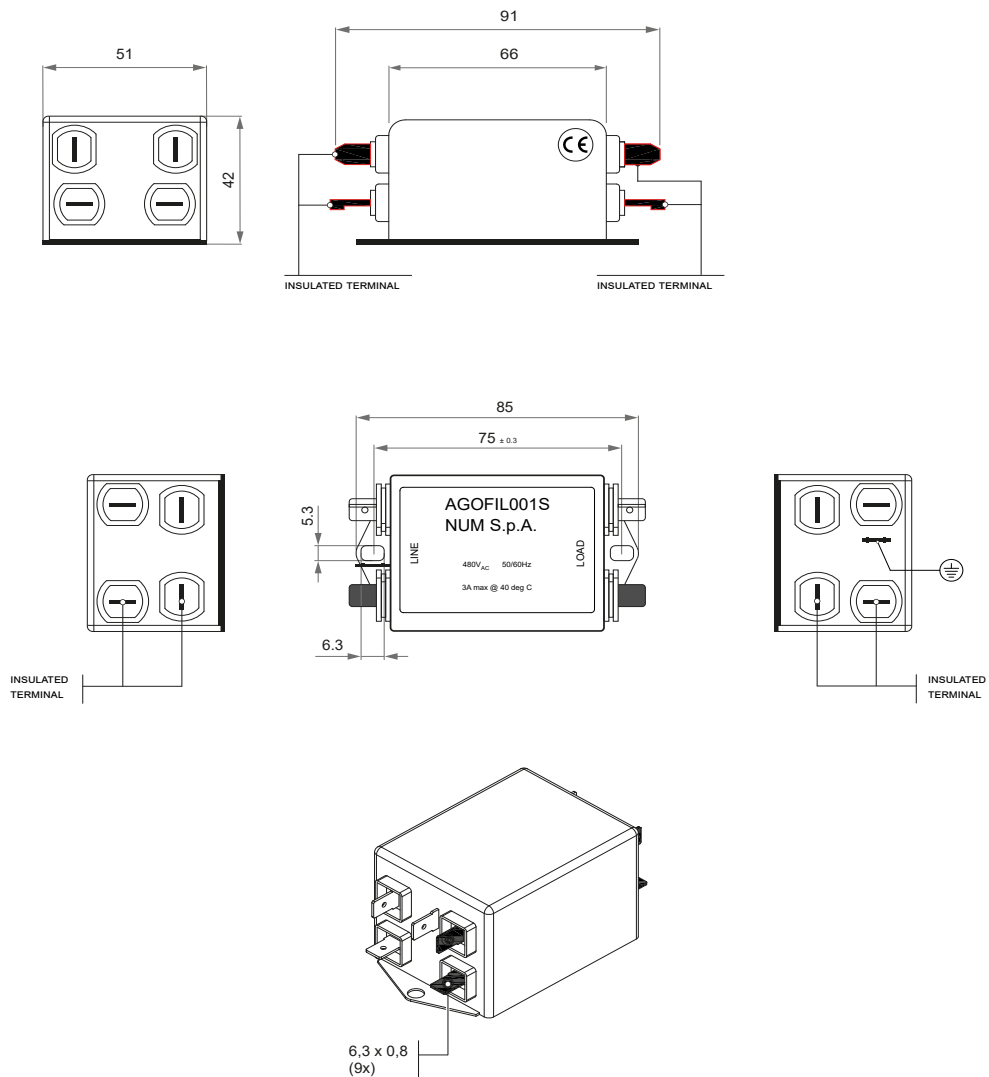


(1) Terminal cross section: Faston 6.3x0.8mm

10.8.3 AGOFIL001S auxiliary power supply (AUX) filter

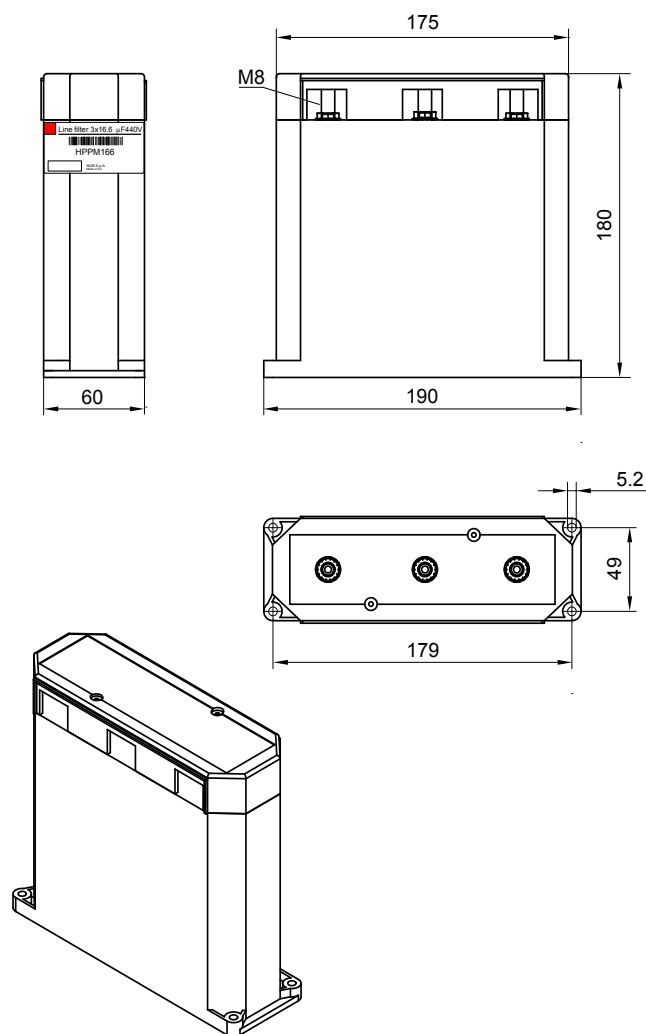
Technical data	AGOFIL001S
Rated voltage	480Vac 50/60Hz
Rated current (refer. to 40°C ambient temperature)	3 Arms
Test voltage	1075Vdc, 2s (line/line) 2700Vdc, 2s (line to ground)
Climatic category	HPF 25/085/21 (-25°C/+85°C)
Approvals	UL Recognized
Terminal cross section	Faston 6.3x0.8mm
Weight	0.3kg

For the filter use and connections criteria please refer to M00027 manual.



10.8.4 Line filter HPPM166 module

Technical data	HPPM166
Rated voltage	440Vac 50/60Hz
Rated current	20 A
Capacity	3x16.6μF
Terminal connections	M8 screw
Weight	1.2 kg
Overall dimensions	See figure here under

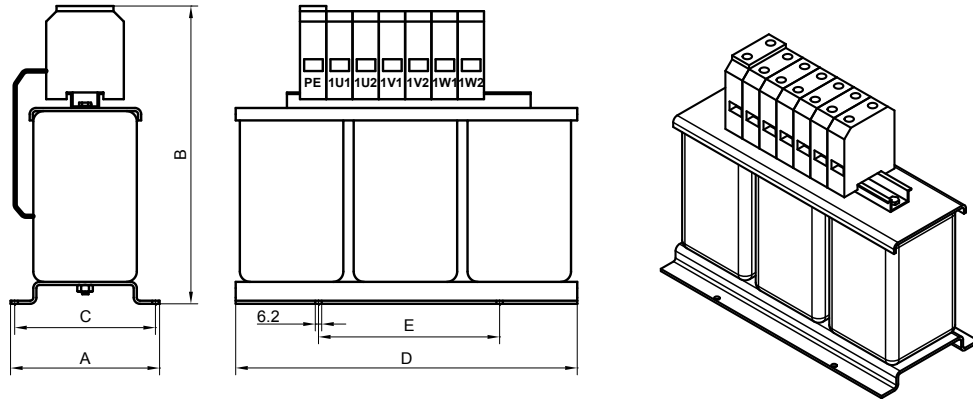


- (1) To gain the access to the connections terminal remove the cover by unscrew the two screw.
Connect the cable using eyelets and tighten the nut to 5Nm.
Eyelet supplied by the customer M8.

10.9 Line chokes

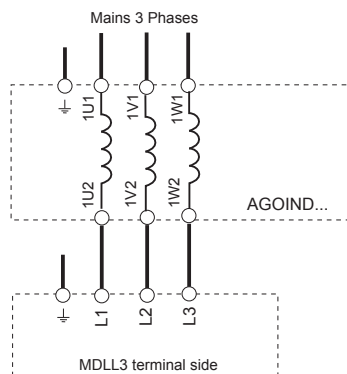
10.9.1 Line choke AGOIND001 and AGOIND002

Line choke	Characteristics	Associated MDLL3
AGOIND001	- ~0.45mH - 67Arms - $P_{diss} = 250W$	MDLL3025N00HN0I It can also be used for: MDLL3025N00RN0I
AGOIND002	- ~0.27mH - 103Arms - $P_{diss} = 350W$	MDLL3050N00HN0I It can also be used for: MDLL3050N00AN0I MDLL3050N00RN0I

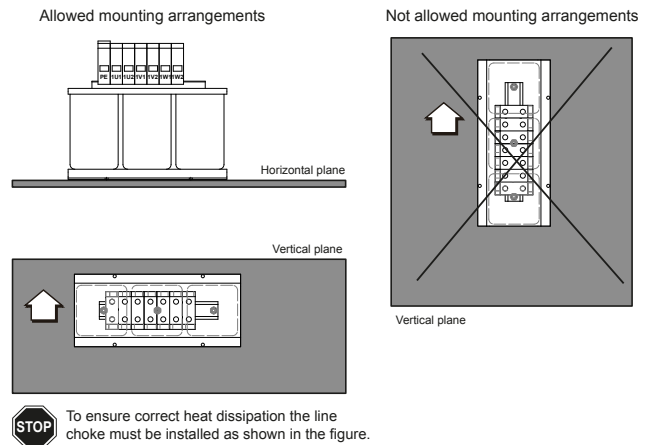


Line choke	A	B	C	D	E	Weight	Terminal block cross section
AGOIND001	150	230	136	330	175	13kg	35mm ²
AGOIND002	150	280	136	330	175	18kg	50mm ²

Connections



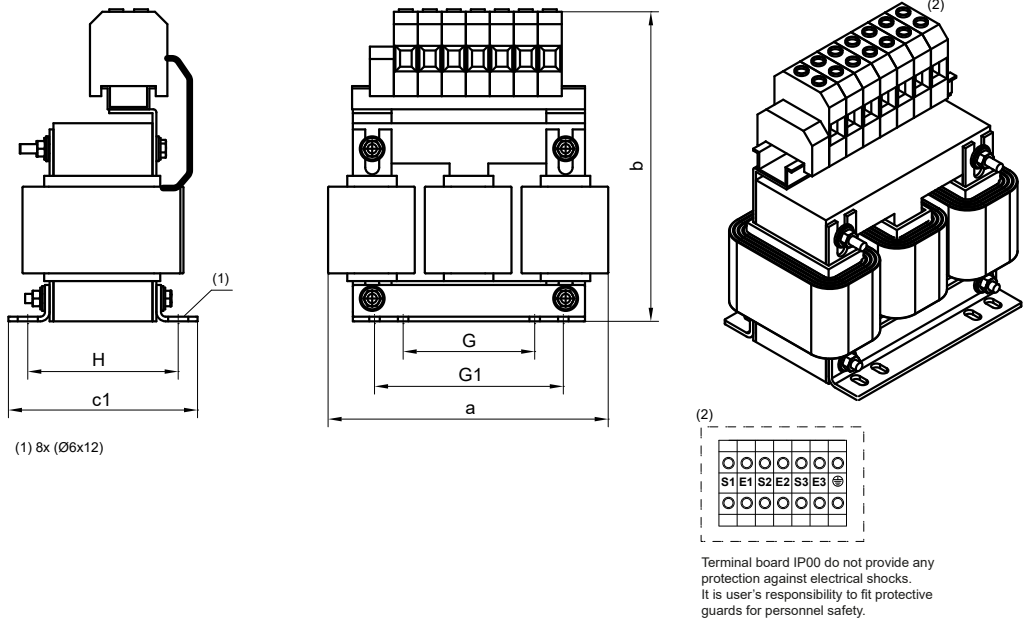
Mounting arrangements



In case of particularly heavy use, the line choke casing may reach high temperatures, we therefore suggest that they are placed where they will not be accidentally touched by personnel in bottom cabinet side. To prevent eventual electromagnetic disturbances emitted from the inductance, we suggest that it is placed at least 500mm from particularly sensitive apparatus, from the digital bus flat cable interconnections or from sensor cables.

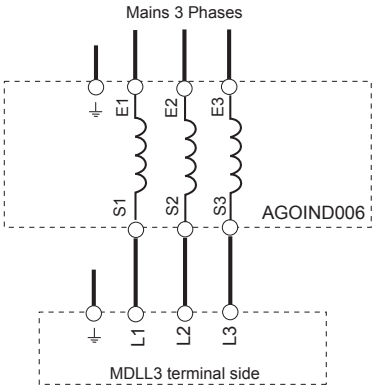
10.9.2 Line choke AGOIND006

Line choke	Characteristics	Associated MDLL3
AGOIND006	- ~0.5mH - 60Arms - $P_{diss} = 94W$	MDLL3025N00RN0I

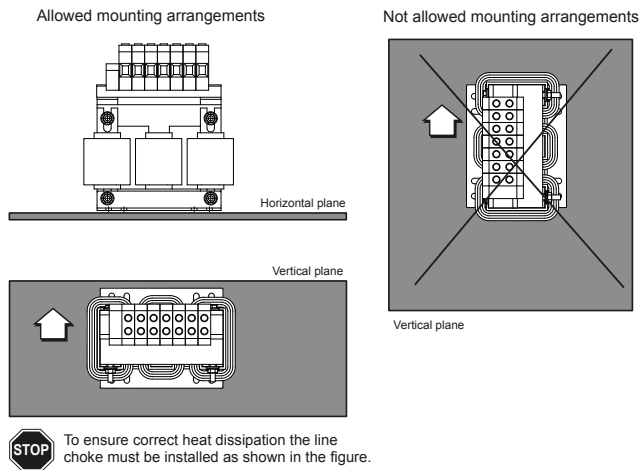


Line choke	a	b	c1	G	G1	H	(1)	Weight	Terminal block cross section
AGOIND006	180	210	130	85	122	105	8x (Ø6x12)	11kg	16mm ²

Connections



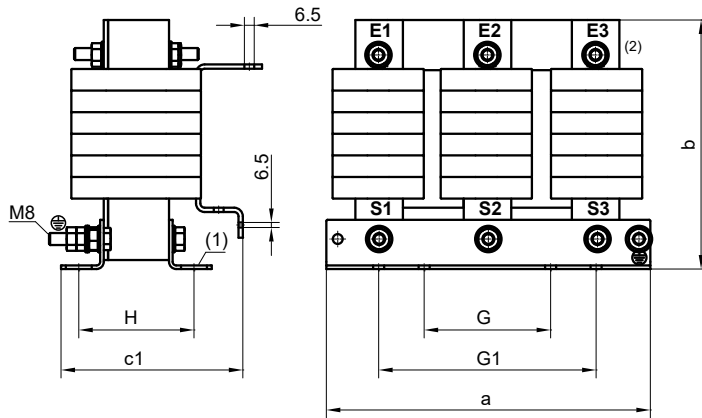
Mounting arrangements



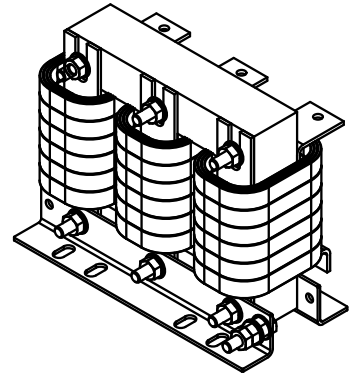
In case of particularly heavy use, the line choke casing may reach high temperatures, we therefore suggest that they are placed where they will not be accidentally touched by personnel in bottom cabinet side. To prevent eventual electromagnetic disturbances emitted from the inductance, we suggest that it is placed at least 500mm from particularly sensitive apparatus, from the digital bus flat cable interconnections or from sensor cables..

10.9.3 Line choke AGOIND007

Line choke	Characteristics	Associated MDLL3
AGOIND007	- ~0.3mH - 100Arms - $P_{diss} = 260W$	MDLL3050N00AN0I MDLL3050N00RN0I



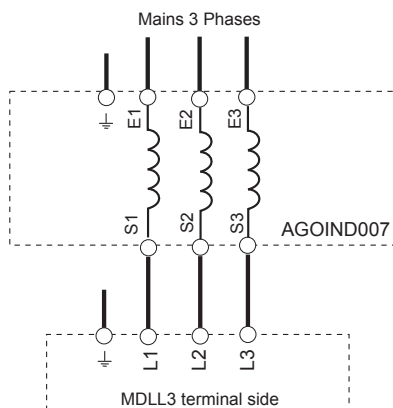
(1) 8x (Ø11x22)



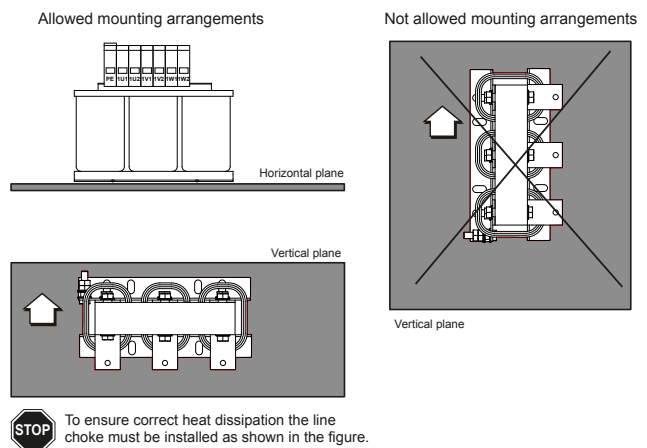
(2) Terminal board IP00 do not provide any protection against electrical shocks. It is user's responsibility to fit protective guards for personnel safety.

Line choke	a	b	c1	G	G1	H	(1)	Weight	Terminal block cross section
AGOIND007	270	210	180	105	181	100	8x (Ø11x22)	16kg	-

Connections



Mounting arrangements

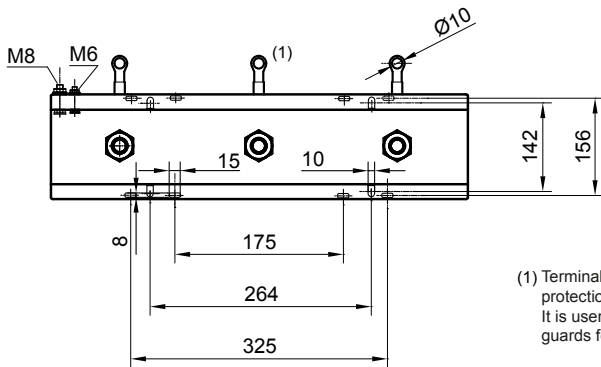
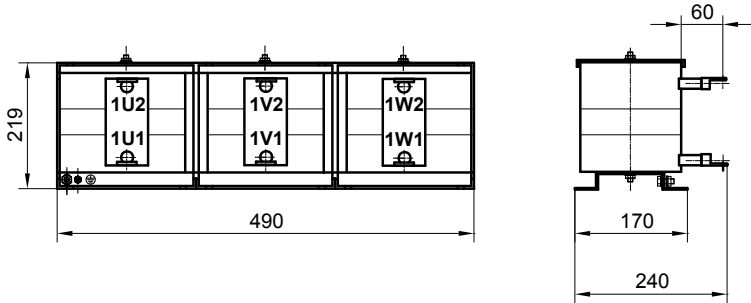


In case of particularly heavy use, the line choke casing may reach high temperatures, we therefore suggest that they are placed where they will not be accidentally touched by personnel in bottom cabinet side.

To prevent eventual electromagnetic disturbances emitted from the inductance, we suggest that it is placed at least 500mm from particularly sensitive apparatus, from the digital bus flat cable interconnections or from sensor cables.

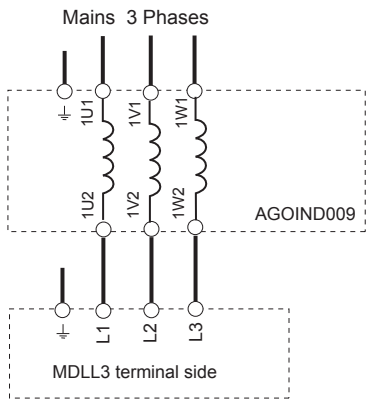
10.9.4 Line choke AGOIND009

Line choke	Characteristics	Associated MDLL3
AGOIND009	- ~0.15mH - 210Arms - $P_{diss} = 300W$	MDLL3120N00AN0I MDLL3120N00RN0I MDLL3120N00HN0I

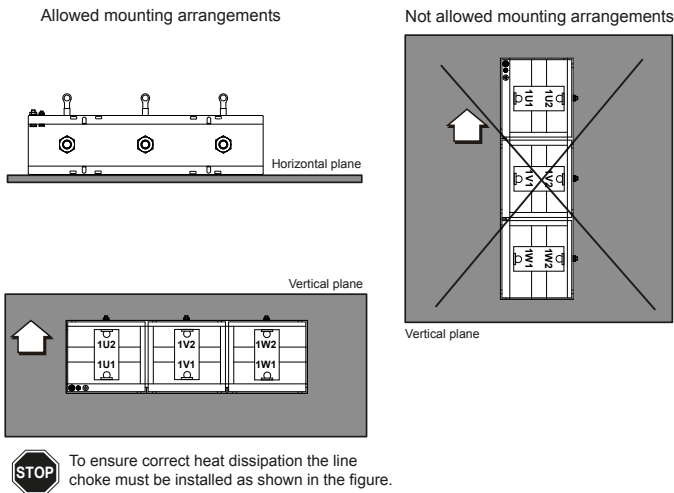


(1) Terminal board IP00 do not provide any protection against electrical shocks. It is user's responsibility to fit protective guards for personnel safety.

Connections



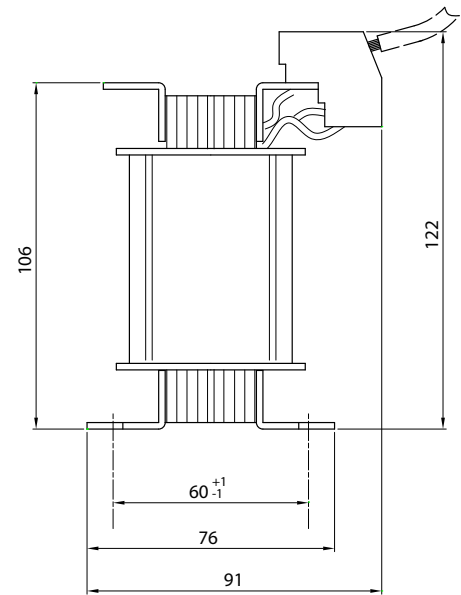
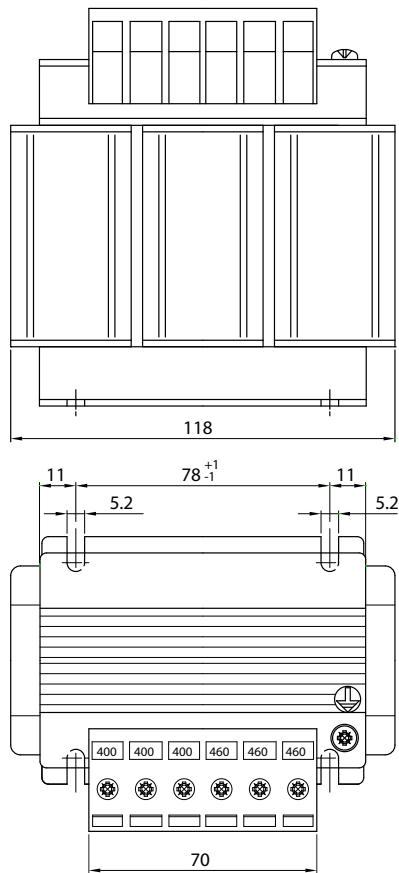
Mounting arrangements



In case of particularly heavy use, the line choke casing may reach high temperatures, we therefore suggest that they are placed where they will not be accidentally touched by personnel in bottom cabinet side. To prevent eventual electromagnetic disturbances emitted from the inductance, we suggest that it is placed at least 500mm from particularly sensitive apparatus, from the digital bus flat cable interconnections or from sensor cables.

10.9.5 Auto-transformer for BHL260 fan (with 480V network)

Technical data	AMOTRAF001
Rated power	500VA
Input voltage	400Vac / 480Vac 3phases
Frequency	50/60Hz
Protection Class as per EN60529	IP00
Weight	2.8kg



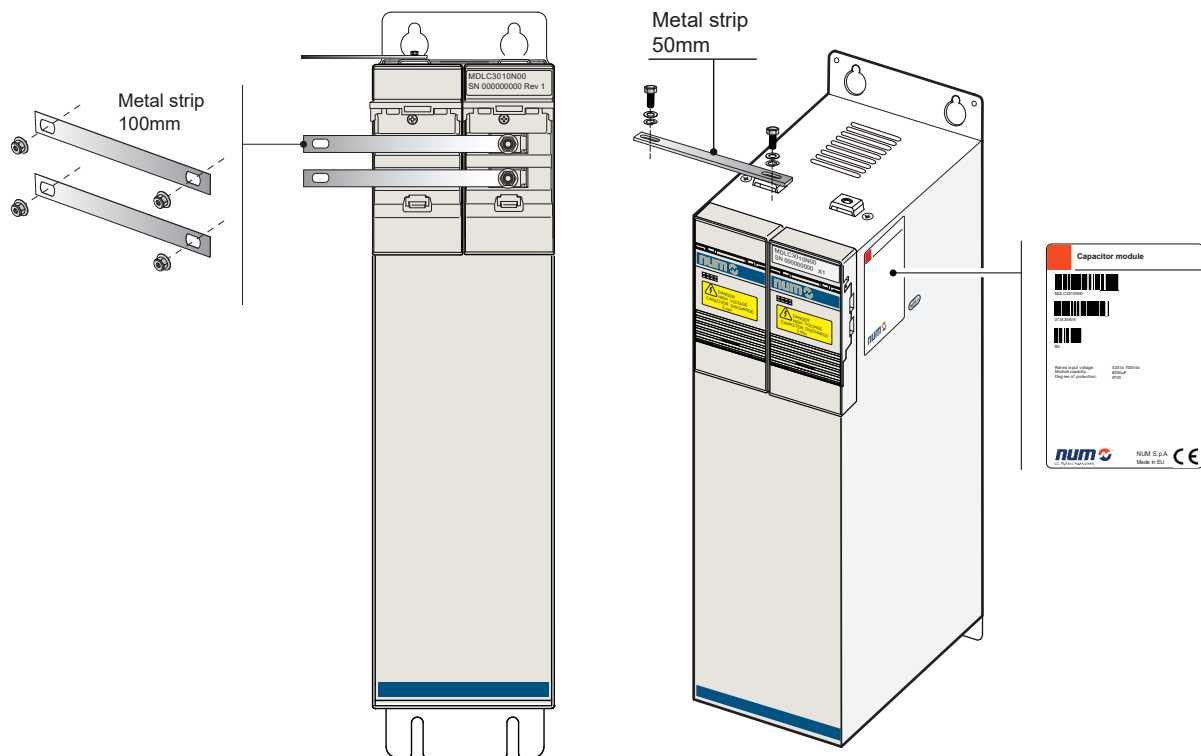
10.10 Capacitor module MDLC3010N00

10.10.1 General characteristics

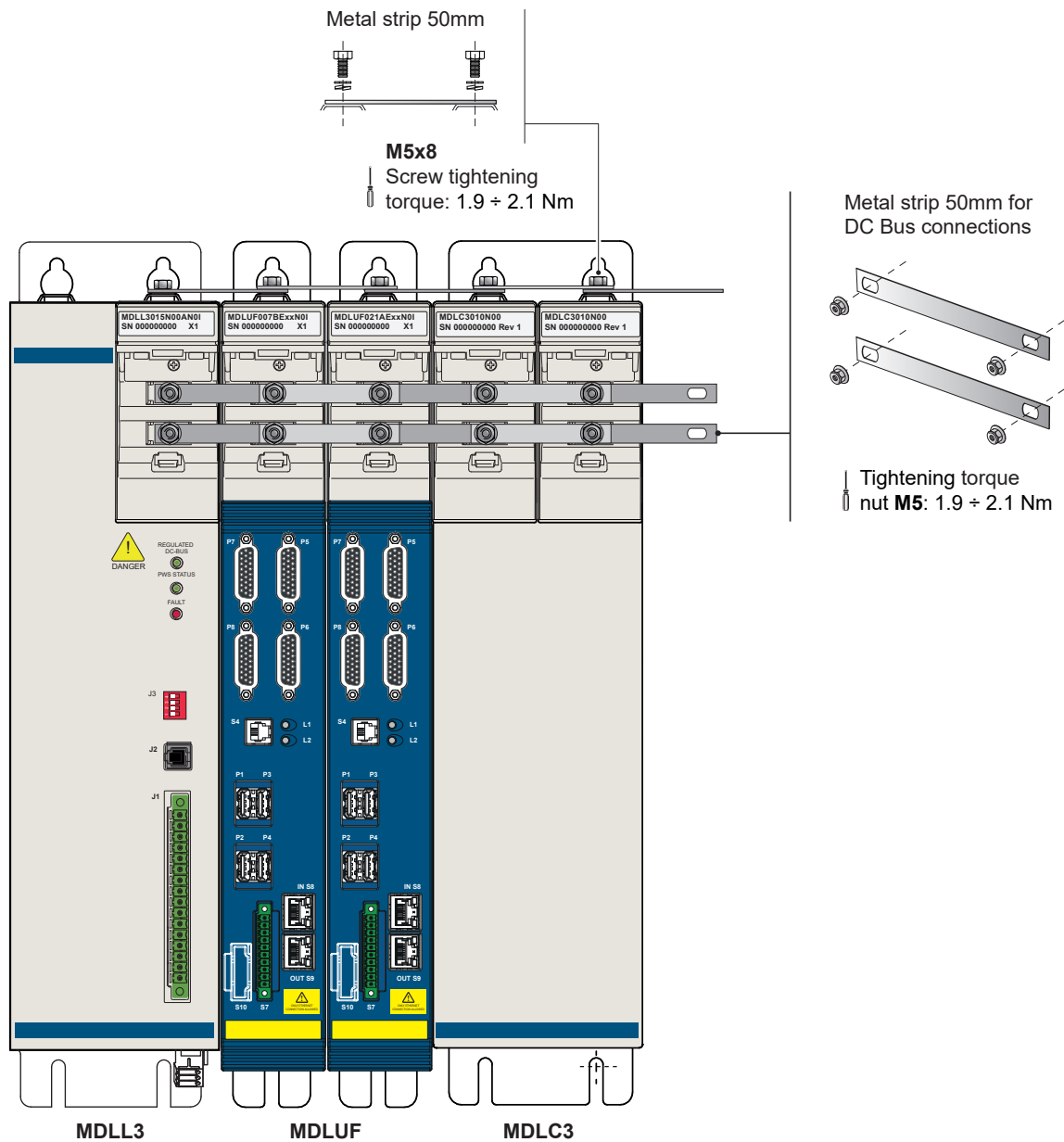
MDLC3010N00	
Rated input voltage	420 to 700Vdc
Module capacity	8250μF
Degree protection	IP20
Storage temperature	From -40°C to +80°C
Relative humidity degree	Max 75% without condensation
Overall dimensions W x H x D	100 x 355 x 206 mm (as for Size 2 module)
Weight	6kg

10.10.2 Module layout and enclosed accessories

Description	Qty
Metal strip for DC Bus module / module interconnections with fixing nuts M5 + fixing washers (50mm)	2
Metal strip for earth module/module interconnections with screw M5x8 + fixing washer (50mm)	1



10.10.3 MDLC3010N00 DC Bus connections



- The module must always be installed on the right-hand side as last one module in the system. See figure here above.
- To assembly the DC Bus interconnections see instruction as indicated on chapter [9.5.6](#).

10.11 Motor cables and motor connectors

The NUM cables are available as an option for making power and sensor connections for axis, spindle motors and the corresponding drives. The cables are available in different sections, characteristics and composition as for High performance, Basic performance or single cable motor (power / sensor) cable for SHX and SPX motors range application.

The cables are accordance with UL and cUL Recognized, DESINA, EC standards:

- The cables are of a multipolar type for removable laying in flexure
- The motor thermal probe is connected by the sensor motor cable
- The brake is connected by the power cable.
- The connection between the power / sensor cable and the moving part of the connector must be made using the crimping tool.



The use of an incorrect cable leads to the violation of the international standard. The total length of the power cables used in each PDS must be <400m at 5kHz PWM and < 200m at 10kHz PWM. (These performance are valid using NUM cables).

10.11.1 High performance power cable

Cable code	Brake wires	Cable composition	External diameter (mm)
PC015BH00	Yes	([3+T] x 1.5mm ² + (2x1.5mm ²))	11.8 ± 0.5
PC040BH00	Yes	([3+T] x 4mm ² + (2x1.5mm ²))	14.4 ± 0.6
PC060BH00	Yes	([3+T] x 6mm ² + (2x1.5mm ²))	16.3 ± 0.7
PC100BH00	Yes	([3+T] x 10mm ² + (2x1.5mm ²))	19.2 ± 0.8
PC215BH00	Yes	([3+T] x AWG04 + (2x1.5mm ²))	24.7 ± 0.9
PC015NH00	No	([3+T] x 1.5mm ²)	10.6 ± 0.5
PC040NH00	No	([3+T] x 4mm ²)	13.2 ± 0.6
PC100NH00	No	([3+T] x 10mm ²)	18.1 ± 0.8
Operating temperature	-30°C ... to + 80°C		
Storage temperature	-50°C ... to + 80°C		
Nominal voltage	Power: U _o /U = 0.6/1KV (VDE), U = 1000V (UL AWM/CSA AWM), Brake U = 24V (VDE)		
Bending radius (Dynamic)	≥ 7.5 x external diameter		
Bending radius (Static)	≥ 4 x external diameter		
Maximum speed	300 m/min		
Maximum acceleration	50 m/sec ²		
Cycles	10.000.000		
Torsion max	+/- 30°/m		
Pulling force (Dynamic)	≤ 20 N/mm ²		
Pulling force (Static)	≤ 50 N/mm ²		
Capacitance [pF/m] power	Conductor/conductor		Conductor/shield
	- sez. 1.5-2.5 mm ² <90 (Typical 80)		<160 (Typical 130)
	- sez. 4.0-6.0 mm ² <110 (Typical 90)		<180 (Typical 140)
	- sez. 10.0-35.0 mm ² <120 (Typical 100)		<210 (Typical 180)
Capacitance [pF/m] brake	Conductor/conductor		Conductor/shield
	- sez. 1.5mm ² <120 (Typical 100)		<200 (Typical 170)
Oil resistant	HD 22.10 S2 (VDE 0282 p.10)//VDE 0472 p.803 B//EN 60811.2.1		
Flame resistant	EN 60332-1-1 // EN 60332-1-3 // FT1// UL 1581 sce.1061//EN 50265.2.1		
UL/CSA LISTED, DESINA	Yes		
Jacket colour	PUR - Orange - RAL2003		
Resistivity of cable at 20°C [Ohm/km]	1.5mm ² = 13.3, 4mm ² = 4.95, 6mm ² = 3.3, 10mm ² = 1.91, 21mm ² = 0.83		
Max useful length	75m		

10.11.2 Basic performance power cable

The NUM Basic performance cable range are normally used where high flexibility are not strictly required.

Cable code	Brake wires	Cable composition	External diameter (mm)
PC015BL00	Yes	$([3+T] \times 1.5\text{mm}^2 + (2 \times 1.5\text{mm}^2))$	10.4 ± 0.4
PC040BL00	Yes	$([3+T] \times 4\text{mm}^2 + (2 \times 1.5\text{mm}^2))$	13 ± 0.5
PC015NL00	No	$([3+T] \times 1.5\text{mm}^2)$	8.1 ± 0.4
PC040NL00	No	$([3+T] \times 4\text{mm}^2)$	11.0 ± 0.5
Operating temperature	-10°C ... to + 80°C		
Storage temperature	-20°C ... to + 80°C		
Nominal voltage	- Power : $U_0/U = 0.6/1\text{KV}$ (VDE) - $U = 1000\text{ V}$ (UL AWM/CSA AWM) - Brake $U = 24\text{ V}$ (VDE)		
Bending radius (Dynamic)	$\geq 15 \times \text{external diameter}$		
Bending radius (Static)	$\geq 5 \times \text{external diameter}$		
Maximum speed	30 m/min		
Maximum acceleration	2 m/sec ²		
Cycles	2.000.000		
Torsion max	Not admitted		
Pulling force (Dynamic)	$\leq 20\text{ N/mm}^2$		
Pulling force (Static)	$\leq 50\text{ N/mm}^2$		
Capacitance [pF/m] power	Conductor/conductor		Conductor/shield
	- sez. 1.5-2.5 mm ² <90 (Typical 80) - sez. 4.0-6.0 mm ² <110 (Typical 90)		<160 (Typical 130) <180 (Typical 140)
Capacitance [pF/m] brake	Conductor/conductor		Conductor/shield
	- sez. 1.5mm ² <120(Typical 100)		<200 (Typical 170)
Oil resistant	VDE 0472 p.803 B//EN 60811.2.1		
Flame resistant	EN 60332-1-1 // EN 60332-1-3 // FT1// UL 1581 sce.1061//EN 50265.2.1		
UL/CSA LISTED, DESINA	Yes		
Jacket colour	Thermoplastic compound - Orange - RAL2003		
Resistivity of cable at 20°C [Ohm/km]	- 1.5mm ² = 13.3, 4mm ² = 4.95		
Max useful length	75m		

10.11.3 High Performance motor cable for SHX and SPX motors (Single Cable Motor)

High Performance motor cable for SHX and SPX motors contains:

- 3 x power wires
- PE wire
- 2 x Brake wires
- 2 x Encoder wires.

Cable code	Brake wires	Cable composition	External diameter (mm)
PX007BH00	Yes	(3 x 0.75 mm ²) + T x 0.75 mm ² + (2x0.75 mm ²) + (2x AWG26)	12 ± 0.5
PX015BH00	Yes	(3 x 1.5 mm ²) + T x 1.5 mm ² + (2x1.5 mm ²) + (2x AWG22)	14.4 ± 0.5
Operating Temperature	-40°C ... to + 80°C		
Storage Temperature	-40°C ... to + 80°C		
Nominal Voltage	Power: U _o /U = 0.6/1KV (VDE) Brake U = 24V (VDE)		
Bending Radius (Dynamic)	≥ 7.5 x external diameter		
Bending Radius (Static)	≥ 5 x external diameter		
Maximum Speed	300 m/min		
Maximum Acceleration	50 m/sec ²		
Cycles	5,000,000		
Torsion max	+/- 30°/m		
Pulling Force (Dynamic)	≤ 20 N/mm ²		
Pulling Force (Static)	≤ 50 N/mm ²		
Oil Resistant	UL 1581 – VDE 0472 part 803 A/B		
Flame Resistant	CEI 20-35-1-2 – EN 50265-1-2 – IEC 60332-1-2 – UL VW-1 – CSA FT1		
UL/CSA LISTED, DESINA	Yes		
Jacket Colour	PUR - Orange - RAL2003		
Resistivity of Cable at 20°C [Ohm/km]	(PX007) AWG26 ≤ 131 , 0.75mm ² ≤ 39		
	(PX015) AWG22 ≤ 59 , 1.50mm ² ≤ 13.3		
Max Useful Length	(PX007) 20 m		
	(PX015) 75 m		

10.11.4 Sensor cable

Cable code	Cable composition	External diameter
SC007SH00	(3+ (2x 0.14mm ²) + 4x 0.14mm ² + 2x 0.50mm ²)	9 ± 0.4mm
Operating temperature	-20°C ... to + 60°C	
Storage temperature	-50°C ... to + 60°C	
Nominal voltage	UL AWM – CSA AWM U = 30 V	
Bending radius (Dynamic)	≥ 10.5 x external diameter	
Bending radius (Static)	≥ 7 x external diameter	
Maximum speed	220m/min	
Maximum acceleration	10m/sec ²	
Cycles	10.000.000	
Torsion max	+/- 30°/m	
Pulling force (Dynamic)	≤ 50N/mm ²	
Pulling force (Static)	≤ 120N/mm ²	
Capacitance (800Hz)	0.14mm ² ≤ 90pF/m ± 30pF/m 0.50mm ² ≤ 250pF/m	
Oil resistant	VDE 0282 p.10 HD 22.10 S1	
Flame resistant	EN 60332-1 - EN 50265-2-1	
UL/CSA LISTED, DESINA	Yes	
DESINA	Yes	
Jacket colour	Green - RAL6018	
Resistivity of cable at 20°C	0.14mm ² ≤ 149 Ohm/km 0.50mm ² ≤ 41 Ohm/km	
Max useful length	75m	

10.11.5 Fan cable (for BHL and AMS motors)

Cable code	Cable composition	External diameter (mm)
NC010NL00	[3+T] x1,5mm ² (Not shielded cable)	8 ± 0.2

10.11.6 Raw cable ordering codes

Power row cable ordering code

	PC	015	B	H	00
Cable type					
- Power cable					
Power cable section					
- 1.5 mm ²		015			
- 4 mm ²		040			
- 6 mm ²		060			
- 10 mm ²		100			
- 21.5 mm ²		215			
Brake					
- With brake			B		
- Without brake			N		
Application					
- High performance				H	
- Basic performance				L	
Cable Alone					
- Fixed Value					00

Note:

The raw cable length is defined as quantity into the order, max length 75m.
Not all the codes combination are offered.

Power/sensor row cable ordering code

	PX	007	B	H	00
Cable type					
- Power and signal cable (for SHX, SPX motors)					
Power cable section					
- 0.75 mm ²		007			
- 1.5 mm ²		015			
Brake					
- With brake			B		
Application					
- High performance				H	
Cable Alone					
- Fixed Value					00

Note:

The raw cable length is defined as quantity into the order (max 20m for PX007, max 75m for PX015).

Sensor row cable ordering code

	SC	007	S	H	00
Cable type					
- Sensor cable					
Identification number					
Variant					
Application					
- High performance				H	
Cable alone					
- Fixed value					00

Note:

The raw cable length is defined as quantity into the order, max length 75m.

Other row cable ordering code

	NC	010	N	L	00
Cable type					
- Others cable					
Identification number					
Variant					
Application					
- Basic performance				L	
Cable alone					
- Fixed value					00

Note:

The raw cable length is defined as quantity into the order, max length 75m.

Ordering row cable - Example

Cable code example	Raw cable length definition
PC015BH00 "quantity" 50m	The raw cable length is defined as " quantity " into the order. In this case the raw power + brake cable length is 50m.

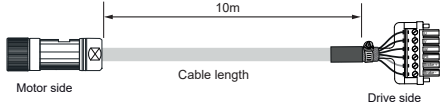
10.11.7 Power assembly cable ordering codes

	PC	015	B	H	0	0	M	000	0
Cable type									
- Power cable									
Power cable section									
- 1.5 mm ²									
- 4 mm ²									
- 10 mm ²									
Brake									
- With brake									
- Without brake									
Application									
- High performance									
- Basic performance									
Motor connector									
- Without connector									
- AMOCON004D									
- AMOCON005D									
Drive connector									
- Without connector									
- AEOCON018									
- AEOCON013									
- AEOCON015									
Cable assembly									
Cable length									
- meter (m)									
Cable length									
- 0.1 meter (dm)									

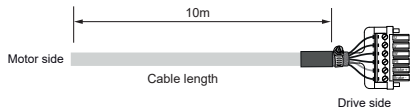
Note:

- The max cable length is 75m.
- Not all the cable/connector couplings are possible.
- Whenever the drive connector is not required add 7cm of cable for the brake connections in case of AEOCON013.

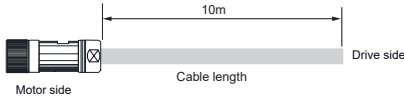
Example: ordering **PC015BH41M0100**



Example: ordering **PC015BH01M0100**



Example: ordering **PC015BH40M0100**



Accessories

Power and brake cable

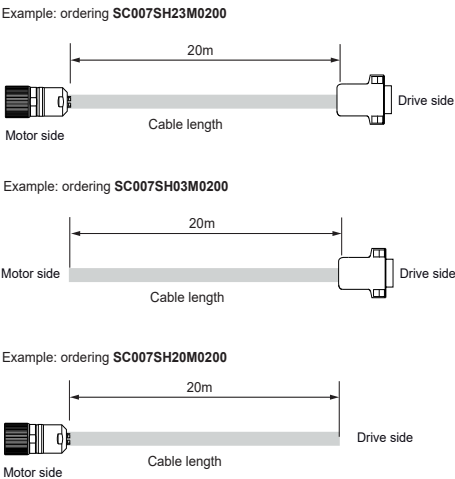


10.11.8 **Sensor assembly cable ordering codes**

	SC	007	S	H	0	0	M	000	0
Cable type									
- Sensor cable									
Identification number									
Variant									
Application									
- High performance									
Motor connector									
- Without connector									
- CONN125D00									
- AMOCON002D									
Drive connector									
- Without connector									
- AEOCON012									
Cable assembly									
Cable length									
- meter (m)									
Cable length									
- 0.1 meter (dm)									

Note:

- The max cable length is 75m.



Accessories

Sensor cable



10.11.9

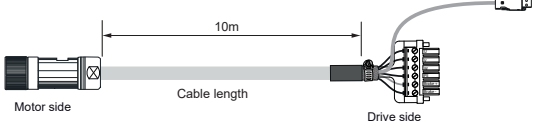
Single Cable Motor assembly cable ordering codes

	PX	007	B	H	6	0	M	000	0
Cable type									
- Power and signal cable (for SHX, SPX motors)									
Power cable section									
- 0.75 mm ²									
- 1.5 mm ²									
Brake									
- With brake									
Application									
- High performance									
Motor connector									
- Without connector									
- AMOCON006D									
Drive connector									
- Without connector									
- AEOCON018 + AEOCON019									
- AEOCON013 + AEOCON019									
Cable assembly									
Cable length									
- meter (m)									
Cable length									
- 0.1 meter (dm)									

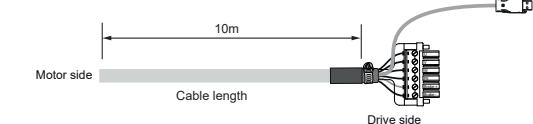
Note:

- The max cable length is: 20m for PX007 and 75m for PX015.
- Not all the cable/connector couplings are possible.
- Whenever the drive connector is not required add 50cm of cable for the encoder connections as indicated in the figure below.

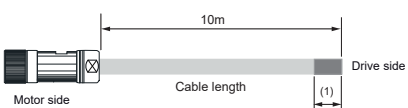
Example: ordering **PX015BH66M0100**



Example: ordering **PX015BH06M0100**



Example: ordering **PX015BH60M0100**



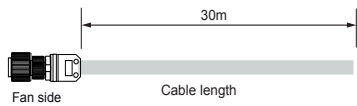
(1) Please take into consideration 50cm for drive side connector wiring as indicated in the chapter [9.22.4](#).

Accessories	
Encoder cable (power/sensor)	

10.11.10 Fan assembly cable (for BHL and AMS motors) ordering codes

	NC	010	N	L	7	0	M	000	0
Cable type									
- Fan cable									
Identification number									
VARIANT									
Application									
- Basic performance									
Motor connector									
- CONN113D00									
Drive connector									
- Without connector									
Cable assembly									
Cable length									
- meter (m)									
Cable length									
- 0.1 meter (dm)									

Example: ordering NC010NL70M0300



Accessories	
Fan cable	

10.12 Motor cable assemblies and motor connectors

10.12.1 BHX, BPX cable assemblies and motor connectors

BHX / BPX	Connectors		Cable		Cable assemblies ⁽¹⁾	
	Power	Sensor	Power	Sensor	Power	Sensor
0551V5... ⁽²⁾	AMOC0N004D	AMOC0N002D	PC015xy00	SC007SH00	PC015xy4zMnnnn	SC007SH2wMnnnn
0751V5...						
0752V5...						
0951V5...						
0952N5...						
0952V5...						
1261N5...						
1261V5...						
1262N5...						
1262V5...						
1263N5...						
1263R5...						
1552N5...						
1552R5...						
1554N5...						

(1) Note for the cable assemblies:

x : cable with or without brake wires
 x = B for cable with brake wires
 x = N for cable without brake wires

y : cable performance
 y = H for High performance cable
 y = L for Basic performance cable

z : power connector on drive side
 z = 0 without connector
 z = 1 with connector AEOCON018
 z = 2 with connector AEOCON013

w : sensor connector on drive side
 w = 0 without connector
 w = 4 with connector AEOCON012

nnnn = cable length in 0.1m
 nnnn = 0105 = 10.5m

(2) Available as BPX only.

10.12.2 SHX, SPX cable assemblies and motor connectors

SHX / SPX	Motor connector	Cable	Cable assemblies ⁽¹⁾
0751V5...	AMOC0N006D	PX007BH00 or PX015BH00	PX007BH6yMnnnn or PX015BH6zMnnnn
0752V5...			
0951V5...			
0952N5...			
0952V5...			
1261N5...			
1261V5...			
1262N5...		PX015BH00	PX015BH6zMnnnn
1262V5...			
1263R5...		PX007BH00 or PX015BH00	PX007BH6yMnnnn or PX015BH6zMnnnn
1552N5...			
1552R5...		PX015BH00	PX015BH6zMnnnn
1554N5...			

(1) Note for the cable assemblies:

y: power connector on drive side
y = 0 without connector
y = 1 with connector AEOCON018

z: power connector on drive side
z = 0 without connector
z = 1 with connector AEOCON018
z = 2 with connector AEOCON013

nnnn = cable length in 0.1 m
nnnn = 0105 = 10.5 m

10.12.3 BPH cable assemblies and motor connectors

BPH	Connectors		Cable		Cable assemblies ⁽¹⁾				
	Power	Sensor	Power	Sensor	Power	Sensor			
0751N5...	AMOC0N004D		PC015xy00		PC015xy4zMnnnn				
0751V5...									
0752N5...									
0752V5...									
0754N5...									
0952N5...									
0952V5...									
0953N5...									
0953V5...									
0955N5...									
1152N5...									
1152V5...									
1153K5...									
1153N5...									
1153V5...									
1154K5...									
1154N5...									
1154V5...			PC040xy00		PC040xy4zMnnnn				
1156N5...			AMOC0N002D		PC015xy00		SC007SH00	PC015xy4zMnnnn	SC007SH2wMnnnn
1422K5...									
1422N5...									
1422R5...									
1423K5...									
1423N5...									
1423R5...									
1424K5...									
1424N5...									
1424R5...									
1427N5...									
1902K5...									
1902N5...									
1902R5...	AMOC0N005D	PC100xy00	PC100xy5zMnnnn						
1903K5...	AMOC0N004D	PC040xy00	PC040xy4zMnnnn						
1903N5...	AMOC0N005D	PC100xy00	PC100xy5zMnnnn						
1904K5...	AMOC0N004D	PC040xy00	PC040xy4zMnnnn						
1904N5...	AMOC0N005D	PC100xy00	PC100xy5zMnnnn						
1905H5...	AMOC0N004D	PC040xy00	PC040xy4zMnnnn						
1905L5...	AMOC0N005D	PC100xy00	PC100xy5zMnnnn						
1907K5...									
1907N5...									
190AK5...									

(1) Note for the cable assemblies: please refer to next page.

10.12.4 BPG cable assemblies and motor connectors

BPG	Connectors		Cable		Cable assemblies ⁽¹⁾			
	Power	Sensor	Power	Sensor	Power	Sensor		
0751N5...	AMOCON004D	AMOCON002D	PC015Ny00	SC007SH00	PC015Ny4zMnnnn	SC007SH2wMnnnn		
0752N5...								
0952N5...								
0953N5...								
1152N5...								
1153K5...								
1153N5...								
1153V5...								
1422N5...								
1423N5...								
1424K5...								
1424R5...								
1427N5...								
1902K5...								
1902N5...								
1903K5...								
1903N5...								
1904N5...	AMOCON005D		PC100Ny00				PC100Ny5zMnnnn	
1905L5...								

(1) Note for the cable assemblies:

x : cable with or without brake wires
x = B for cable with brake wires
x = N for cable without brake wires

y : cable performance
y = H for High performance cable
y = L for Basic performance cable

z : power connector on drive side
z = 0 without connector
z = 1 with connector AEOCON018
z = 2 with connector AEOCON013
z = 5 with connector AEOCON015

w : sensor connector on drive side
w = 0 without connector
w = 4 with connector AEOCON012

n timer = cable length in 0.1m
n timer = 0105 = 10.5m

Not all the codes combination are offered.

10.12.5 BHL cable assemblies and motor connectors

BHL	Connectors			Cables		
	Power	Sensor	Fan	Power	Sensor	Fan
2601N5...	AMOC0N005D	AMOC0N002D	CONN113D00	PC100xH00	SC007SH00	NC010NL00
2601N1...	None			PC215BH00		
2602K5...	AMOC0N005D			PC100xH00		
2602K1...	None			PC215BH00		

BHL	Cable assemblies ⁽¹⁾		
	Power	Sensor	Fan
2601N5...	PC100xH50Mnnnn	SC007SH2wMnnnn	NC010NL70Mnnnn
2601N1...	PC215BH00		
2602K5...	PC100xH50Mnnnn		
2602K1...	PC215BH00		

1) Note for the cable assemblies:

x : cable with or without brake wires
 x = B for cable with brake wires
 x = N for cable without brake wires

w : sensor connector on drive side
 w = 0 without connector
 w = 4 with connector AEOCON012

nnnn = cable length in 0.1m
 nnnn = 0105 = 10.5m

10.12.6 AMS cable assemblies, motor connectors and cable gland

AMS	Connectors		High-Strength Cable gland	Cables			Cable assemblies ⁽¹⁾	
	Sensor	Fan		Power	Sensor	Fan	Sensor	Fan ⁽²⁾
100SB1...	CONN125D00	CONN113D00	BMHQPRE2	PC060BH00	SC007SH00	NC010NL00	SC007SH1wMnnnn	NC010NL70Mnnnn
100MB1...								
100GB1...								
100SD1...								
100MD1...								
100GD1...								
132SA1...				PC100BH00				
132SC1...				PC215BH00				
132SE1...				PC100BH00				
132MA1...								
132MC1...								
132ME1...								
132LA1...								
132LE1...								
132SF1...			BMHQPRE3	PC100BH00				
132SG1...				PC215BH00				
132SH1...				PC100BH00				
132MF1...								
132MG1...								
132MH1...								
132LF1...								
132LI1...								
132LH1...			PC215BH00					
160MA1...			2 x BMHQPRE2	2 x PC215BH00				
160MB1...								
160MC1...								
160LA1...								
160LB1...								
160LC1...								
IM18MK14	AMOCON002D	CONN114D00	2 x M50	2 x (4x25mm ²)	SC007SH00	2x1mm ²	SC007SH2wMnnnn	--

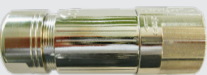
(1) Note for the cable assemblies:

w : Sensor connector on drive side
w = 0 without connector
w = 4 with connector AEOCON012

nnnn = cable length in 0.1m
nnnn = 0105 = 10.5m

(2) Only the motor connector is present and assembled.

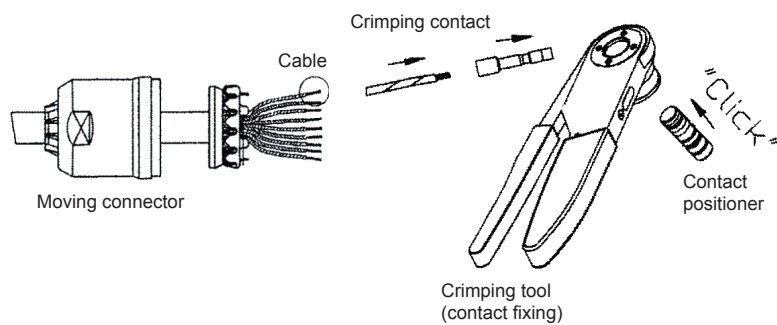
10.12.7 Connectors dimensions

Accessories	Order code	Description	
Motor sensor connector	AMOCN002D	17 poles connector Dimension: ø26x57mm	
Motor power connector	AMOCN004D	6 poles connector Dimension: ø28.2x76.5mm	
Motor power connector	AMOCN005D	6 poles connector Dimension: ø46x100mm	
Motor power / encoder connector	AMOCN006D	9 poles connector Dimension: ø28x78mm	
Motor fan connector	CONN113D00	5 poles connector Dimension: ø29x65mm	
Motor fan connector	CONN114D00	2 poles connector Dimension: ø20x58mm	
Motor sensor connector	CONN125D00	23 poles connector Dimension: ø32x93mm	
Power cable gland	BMHQPRE2	High-Strength Cable gland Dimension: PG21x44mm	
Power cable gland	BMHQPRE3	High-Strength Cable gland Dimension: PG29x50mm	

Please refer to the previous pages for more detailed informations.

10.12.8 Accessories and spare parts for power and sensor cable mounting

Description	Sensor moving connector	Power and brake moving connector	Power and brake moving connector
Moving connector	AMOCON002D	AMOCON004D	AMOCON005D
Internal crimping contact	AMOCTC001F	AMOCTC002F	AMOCTC003F brake AMOCTC004F power
Crimping contact positioner	AMOPOS001	AMOPOS002	AMOPOS003 brake AMOPOS004 power
Crimping tool (for connector contact fixing)	AMOPNZ001	AMOPNZ001	AMOPNZ002



High Performance and Basic Performance accessories and spare parts cable are equal except the motor brake connections cable not available in the Basic.

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11

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Summary

11	Diagnostic	319
11.1	MDLL3005M00AN0I, MDLL3015N00AN0I, MDLL3030N00AN0I led status.....	319
11.2	MDLL3015N00AN0I, MDLL3030N00AN0I led fault blinks.....	320
11.2.1	Faults blinks signalling from software version SW06420001	320
11.2.2	Faults blinks signalling software from version SW06430501 (from version SW07830701 for MDLL3005M00AN0I).....	322
11.3	MDLL3025N00R/H, MDLL3050N00A/R/H, MDLL3120N00A/R/H led status	324
11.3.1	Meaning of the REGULATED DC-BUS and PWS STATUS leds	325
11.4	MDLL3025N00R/H, MDLL3050N00A/R/H, MDLL3120N00A/R/H led fault blinks	328
11.4.1	Faults blinks signalling software version SW06630x01 and SW06730x01	328
11.4.2	Faults blinks signalling software version SW06631x01 and SW06731x01	330
11.5	Alarms signalling for MDLL3....R/H	332
11.5.1	Reading the alarms signalling table.....	332
11.5.2	Alarms signalling list SW06732x01 for MDLL3...R and SW06632x01 for MDLL3...H.....	333
11.5.3	Alarms signalling from SW06733x01 for MDLL3...R and SW06633x01 for MDLL3...H.....	340
11.5.4	Alarms signalling from SW06734x01 for MDLL3...R/A and SW06634x01 for MDLL3...H.....	341
11.6	MDLQ3001N00 status led signalling	342
11.7	NUM DrivePro module status led signalling	343
11.7.1	Meaning of LED signalling in NUM DrivePRO	344
11.8	NUM DrivePro with NUM-STOX module alarm description	346
11.9	NUM-SAMX module Status connector S8, S9 LEDs	347

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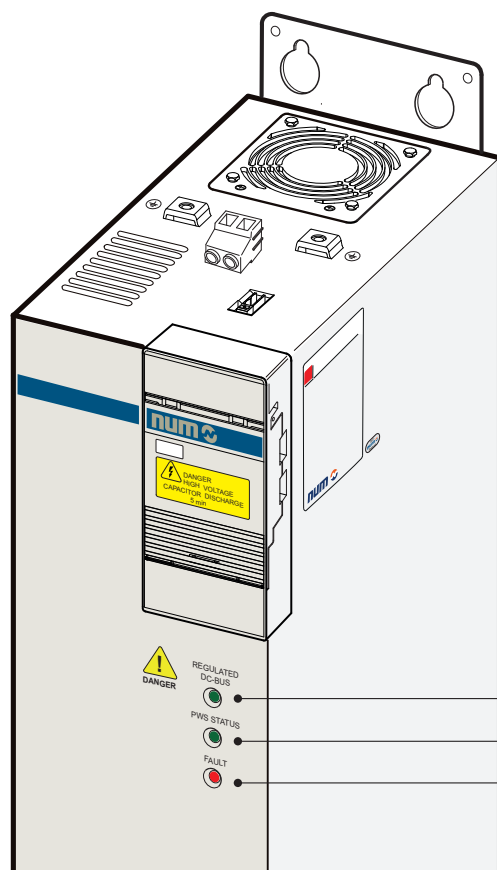
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11 Diagnostic

11.1 MDLL3005M00AN0I, MDLL3015N00AN0I, MDLL3030N00AN0I led status



Diagnostic Leds:
Regulated DC-BUS
PWS Status
Fault

Led status	Status signalling	Possible cause	Possible remedy
DC-BUS CHARGED status ON	The green led is ON when the module is correctly connected and supplied. (DC Bus voltage $\geq 60V$.)		
DC-BUS CHARGED status OFF	The green led is OFF.	The three- phase line voltage is not present. DC Bus not present.	Verify the presence of the line power supply on terminals L1 - L2 - L3. (L1, L2 for MDLL3005M...) Verify the presence of correct DC Bus voltage
PWS STATUS status ON	The green led is ON when the mains and the auxiliary power supply (CL1, CL2 terminals) are present.		
PWS STATUS status OFF	The green led is OFF.	Auxiliary power supply voltage Bi-phase not present.	Verify the presence of the power supply on terminals CL1 / CL2 (J1 connector).
PWS STATUS status BLINKING	The green led is blinking when only the auxiliary power supply (CL1, CL2 terminals) is connected.	It is present the auxiliary supply and the mains it is not present, or during the DC Bus charging phase.	
FAULT status ON or BLINKING	The red led is ON or blinking whenever a fault on the module occurs.	See next pages.	

11.2 MDLL3015N00AN0I, MDLL3030N00AN0I led fault blinks

11.2.1 Faults blinks signalling from software version SW06420001

Number of blinks	Drive fault reaction	Fault description	Possible cause	Internal power supply action	Possible remedy
0 (1) (3)	THFR	Braking resistor overtemperature	The working cycle is characterized with very heavy accelerations/ decelerations and the external braking resistor has reached a too high temperature. Braking resistor wires wrong connections.	Generation of the blinking sequence. Transmission of the alarm.	Use a less heavy working cycle by increasing the time between the accelerations or by increasing the braking resistor power. (See chapter 8) Check the resistor thermo-contact wires connections. (See chapter 9.5.4)
1 (4)	ST	Clamping IGBT desaturation	Braking resistor wires wrong connections. The value of the used resistance is too low.	Generation of the blinking sequence. This alarm causes the turn off of the SCR input bridge and the consecutive progressive lowering of the DC Bus voltage.	Check the resistor wires connections. Connect a correct resistance value. (See chapter 5, 10.7)
2 (4)	ST	Bridge fault	Possible hardware failure of the SCR devices or diving circuits (pre-charging phase included). Input mains voltage not correct.	Consequently at 420Vdc is commutated the ST signal.	Verify the correct values of the input voltages.
3 (4)	THFR ST	Module overtemperature	The power supply heatsink has reached a temperature >90°. Problem due to the fan system.		Use a less heavy working cycle or check the correct thermal exchange inside the enclosure of the electrical cabinet. Check the fan system functionality.
4 (4)	ST	Braking resistor fault	Disconnected braking resistor. Braking resistor wrong value. Heavy working cycle of the resistor without thermal protection. Wrong value of DC Bus could generate a wrong detection of this fault.	Generation of the blinking sequence. The braking resistor presence is verified only at the power turn on after the soft start, if the resistor is not present, the ST signal doesn't become never low (low = all OK), therefore it remains high.	Verify the correct braking resistor wiring. Check the value of the braking resistor. Use a less heavy working cycle (See chapter 8). Disconnected the drive, removing the DC Bus metal strip (bar) and Power ON again the MDLL3. (Warning. Before to remove the DC Bus wait the discharged time as indicated on the MDLL3 label)
5 (5)	DT ST	Overload fault	The working cycle used is out of specifications.	Generation of the blinking sequence. Transmission of the alarm.	Use a working cycle comply with specifications. (See chapter 8)
6 (5)	DT ST	Short circuit to earth	Dispersion to earth.	This alarm causes the turn off of the SCR input bridge and the consecutive progressive lowering of the DC Bus voltage. Consequently at 420Vdc is commutated the ST signal.	Verify the presence of dispersion to earth in drives, motors and wires.

Number of blinks	Drive fault reaction	Fault description	Possible cause	Internal power supply action	Possible remedy
7 (2)	ST	Mains overvoltage fault	The mains voltage has repetitively exceeded 5% of the maximum value. (510Vrms)	Generation of the blinking sequence. Transmission of the alarm. This alarm causes the turn off of the SCR input bridge and the consecutive progressive lowering of the DC Bus voltage. Consequently at 420Vdc is commutated the ST signal.	Check the mains voltage value. (See chapter 5)
Legend (1) Led continuously ON. (2) This type of fault opens DF1/DF2 contact. See J1 connector on chapter 9.5.8.2 The alarm will be automatically resetted whenever KM1 is closed. (System switched ON) (3) Automatically alarm reset whenever the temperature becomes OK. (4) Alarm reset by CF1/CF2 contact. See J1 connector on chapter 9.5.8.2. (5) Alarm reset by switch OFF mains and auxiliary power supply.					



- ST: When the DC Bus voltage value becomes lower than a fixed threshold the drives go in torque disabled.
- DT: This signal puts the drives in alarm 6 Ext 0
- THFR: This signal puts the drives in alarm 5 Ext 0
- SRT: This signal puts the drives in alarm 2 Ext 0

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11.2.2 Faults blinks signalling software from version SW06430501 (from version SW07830701 for MDLL3005M00AN01)

Number of blinks	Drive fault without serial link	Drive fault with serial link	Fault description	Possible cause	Internal power supply action	Possible remedy
0 (1) (3)	A5.0	A5.0	Braking resistor overtemperature	The working cycle is characterized with very heavy accelerations/ decelerations and the external braking resistor has reached a too high temperature. Braking resistor wires wrong connections.	Generation of the blinking sequence. Transmission of the alarm.	Use a less heavy working cycle by increasing the time between the accelerations or by increasing the braking resistor power. (See chapter 8) Check the resistor thermo-contact wires connections. (See chapter 9.5.4)
1 (4)	ST	A58.0	Clamping IGBT desaturation	Braking resistor wires wrong connections. The value of the used resistance is too low.	Generation of the blinking sequence. This alarm causes the turn off of the SCR input bridge and the consecutive progressive lowering of the DC Bus voltage.	Check the resistor wires connections. Connect a correct resistance value. (See chapter 10.7)
2 (4)	ST	A58.1	Bridge fault	Possible hardware failure of the SCR devices or diving circuits (pre-charging phase included). Input mains voltage not correct.	Consequently at 420Vdc is commutated the ST signal.	Verify the correct values of the input voltages.
3 (4)	A5.0 ST	A57.0	Module overtemperature	The power supply heatsink has reached a temperature >90°. Problem due to the fan system.		Use a less heavy working cycle or check the correct thermal exchange inside the enclosure of the electrical cabinet. Check the fan system functionality.
4 (4)	ST	A58.2	Braking resistor fault	Disconnected braking resistor. Braking resistor wrong value. Heavy working cycle of the resistor without thermal protection. Wrong value of DC Bus could generate a wrong detection of this fault.	Generation of the blinking sequence. The braking resistor presence is verified only at the power turn on after the soft start, if the resistor is not present, the ST signal doesn't become never low (low = all OK), therefore it remains high.	Verify the correct braking resistor wiring. Check the value of the braking resistor. Use a less heavy working cycle (See chapter 8) Disconnected the drive, removing the DC Bus metal strip (bar) and Power ON again the MDLL3. (Warning. Before to remove the DC Bus wait the discharged time as indicated on the MDLL3 label)
5 (5)	A6.0 ST	A57.1	Overload fault	The working cycle used is out of specifications.	Generation of the blinking sequence. Transmission of the alarm.	Use a working cycle comply with specifications. (See chapter 8)
6 (5)	A6.0 ST	-	Short circuit to earth	Dispersion to earth.	This alarm causes the turn off of the SCR input bridge and the consecutive progressive lowering of the DC Bus voltage. Consequently at 420Vdc is commutated the ST signal.	Verify the presence of dispersion to earth in drives, motors and wires.

Number of blinks	Drive fault without serial link	Drive fault with serial link	Fault description	Possible cause	Internal power supply action	Possible remedy
7 (2)	ST	-	Mains overvoltage fault	The mains voltage has repetitively exceeded 5% of the maximum value. (510Vrms)	Generation of the blinking sequence. Transmission of the alarm. This alarm causes the turn off of the SCR input bridge and the consecutive progressive lowering of the DC Bus voltage. Consequently at 420Vdc is commutated the ST signal.	Check the mains voltage value. (See chapter 9.5.3)
Legend (1) Led continuously ON. (2) This type of fault opens DF1/DF2 contact. See J1 connector on chapter 9.5.8.2. The alarm will be automatically resetted whenever KM1 is closed. (System switched ON) (3) Automatically alarm reset whenever the temperature becomes OK. (4) Alarm reset by CF1/CF2 contact. See J1 connector on chapter 9.5.8.2. (5) Alarm reset by switch OFF mains and auxiliary power supply.						



ST : When the DC Bus voltage value becomes lower than a fixed threshold the drives go in torque disabled.

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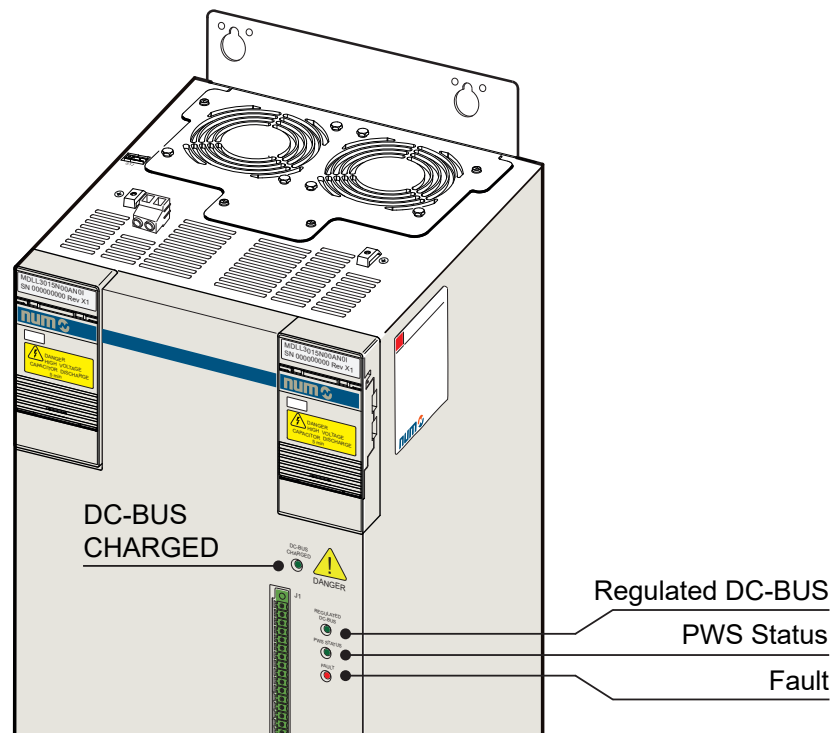
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Led status	Status signalling	Possible cause	Possible remedy
DC-BUS CHARGED status ON	The green led is ON whenever the DC Bus present. ($V_{dc} > 50V$)		
DC-BUS CHARGED status OFF	The green led is OFF.	The three- phase line voltage is not present. DC Bus not present.	Verify the presence of the line power supply on terminals L1 - L2 - L3. Verify the presence of correct DC Bus voltage
REGULATED DC-BUS status ON	The green led is ON whenever DC Bus is Charged (R) The green led is always OFF in (A) The green led is ON whenever DC Bus is charged and regulated at the selected voltage (H). See dip-switches DC Bus voltage selection on chapter 9.5.3.		
REGULATED DC-BUS status OFF	The green led is OFF.	DC Bus not charged. MDLL3 in fault with alarm code greater than 1. Re-injection (R) or regulation (H) disabled by digital input I1 . See J1 connector on chapter 9.5.8.3.	Verify the presence of the line power supply on terminals L1 - L2 - L3. See MDLL3 Led Faults blinks signalling on next pages. Verify the correct status of the digital input I1. See J1 connector on chapter 9.5.8.3.
REGULATED DC-BUS status BLINKING		(H) DC Bus is charged but it is not regulated.	Verify the position of the dip switch 8 setting on chapter 9.5.3
PWS STATUS status ON	The green led is ON when the mains and the auxiliary power supply (CL1, CL2 terminals) are present.		
PWS STATUS status OFF	The green led is OFF.	Auxiliary power supply voltage Bi-phase not present.	Verify the presence of the power supply on terminals CL1 / CL2 (J1 connector).
PWS STATUS status BLINKING	The green led is blinking when only the auxiliary power supply (CL1, CL2 terminals) is connected.	It is present the auxiliary supply and the mains it is not present, or during the DC Bus charging phase.	
FAULT status ON or BLINKING	The red led is ON or blinking whenever a fault on the module occurs.	See next pages.	

11.3.1 Meaning of the REGULATED DC-BUS and PWS STATUS leds

REGULATED DC-BUS

The indication of this led is different depending on the type of power supply MDLL3... A (passive) MDLL3... R (only regenerative) or MDLL3...H (boost converter)

MDLL3...A (passive)

This led is switched OFF (in fixed way).

The power supply is ready to operate in powering.

MDLL3...R (only regenerative)

This led is switched on (in fixed way) to indicate the end of DC-Bus precharge operation.

The power supply is ready to operate in powering and regenerating.

MDLL3...H (boost converter)

The MDLL3...H can operate in two different modes, which are selectable by means of the dip switch as indicated on chapter [9.5.3](#)

- **Booster (H-mode)**
In this operation mode the DC Bus is always regulated and the green led is switched on (in fixed way) when the DC Bus has been ramped to the pre-fixed value (600V, 650V or 700V).
- **Only regenerative (R-mode)**
In this operation the pws behaves like the PWS-R (it operates as passive diode rectifier in powering and regulates the DC Bus voltage when it regenerates the braking energy).
In this case the green led begins blinking after precharging of the DC Bus.
It always blinks while operating to indicate that a H-type power supply is working in R-mode.

For both MDLL3 this led is switched off when one of following event happens:

- The power supply is in fault state
- The PWM signal generation is blocked by means of digital input I1
- Power disconnection (mains voltage has been removed).

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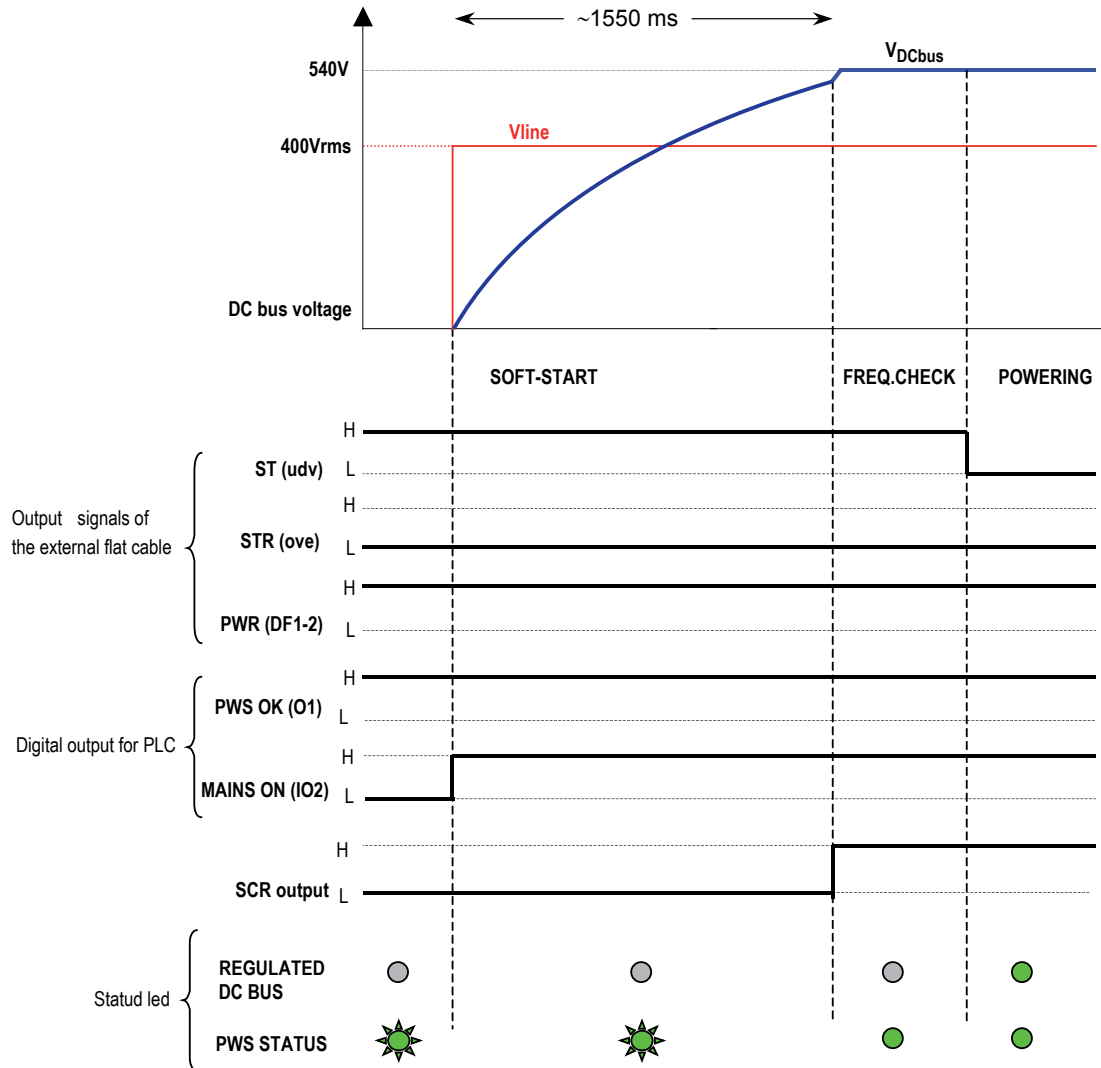
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PWS STATUS

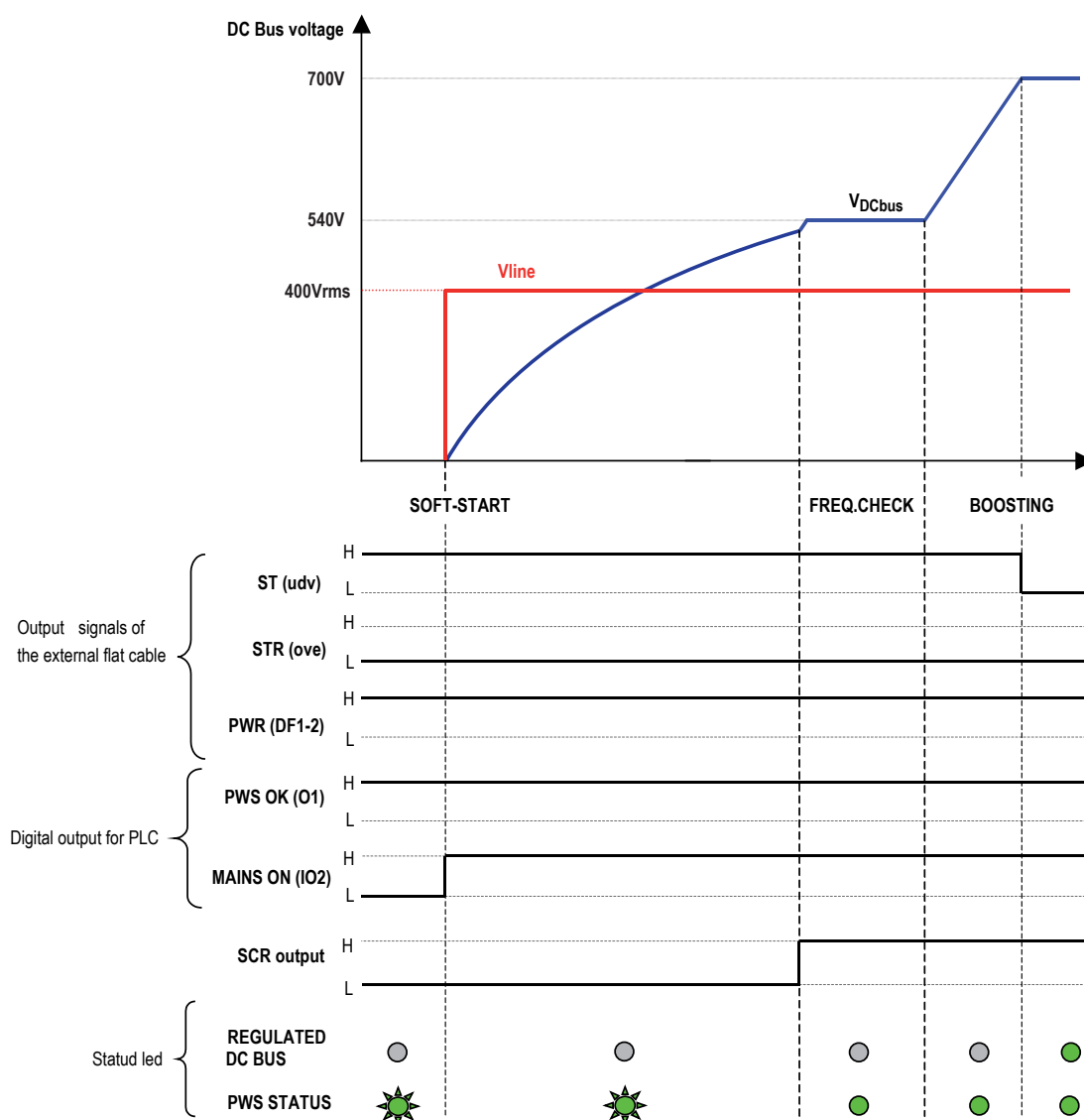
The indication of this led is the same for both MDLL3...A/R or MDLL3...H.
The blinking led indicates the status of discharged DC Bus.

The led stops blinking (it remains switched on) once the DC Bus has been pre-charged.

Sequence operation charging of the power supply MDLL3...A/R



Sequence operation charging the power supply MDLL3...H operating in boost mode



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11.4 MDLL3025N00R/H, MDLL3050N00A/R/H, MDLL3120N00A/R/H led fault blinks

11.4.1 Faults blinks signalling software version SW06630x01 and SW06730x01

Number of blinks	Drive fault without serial link	Fault description	Possible cause	Internal power supply action	Possible remedy
0 (1)	A5.0	Braking resistor overtemperature. Brake resistor overheating.	The power supply is working in overload condition when regenerating. If the energy generated by one or more braking motors is higher than maximum regenerable one, in order to limit the DC Bus voltage, the amount of energy in excess is dissipated on the brake resistor. This energy dissipation will produce the overheating of the resistor. Excessive number of DC Bus charging/discharging cycles. Disconnected temperature sensor.	This alarm does not interrupt the dc bus regulation (boosting or regenerating). But the clamping function is disabled until the overtemperature or overheating condition disappear. THFR signal is set to high level. It comes back to low level as soon as the temperature or the power dissipation returns to their rated value.	Use a less heavy working cycle by reducing the braking ramp of the spindle motors. Avoid frequent DC Bus discharging cycles Check the resistor thermo-contact wires connections. (See chapter 9.5.4)
1	ST	Clamping IGBT desaturation	Braking resistor wires wrong connections. The value of the used resistance is too low.	This alarm does not interrupt the dc bus regulation (boosting or regenerating). But the clamping function is disabled. The THFR signal is set to high level. It comes back to low level as soon as the failure disappeared.	Check the resistor wires connections. Connect a correct resistance value. (See chapter 10.7)
2 (4)	ST	DC Bus pre-charging fault	Possible hardware failure of the pre-charging circuit as SCR device, diode bridge, braking resistor. DC Bus charging/ discharging cycles executed in short time interval.	DC Bus voltage regulation is disabled. That means the power supply cannot boost and regenerate. This failure can be only detected when the power is applied. The ST signal is kept to high level.	Check the value of the braking resistor (it must be equal or greater than acceptable minimum limit). (See chapter 10.7) Check the mains voltage
3 (3)	A5.0	Module overtemperature	The power supply heatsink has reached a temperature >90°. Problem due to the fan system.	The bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. THFR signal is set to high level.	Use a less heavy working cycle or check the correct thermal exchange inside the enclosure of the electrical cabinet. Check the fan system functionality.
4 (4)	ST	Braking resistor fault	Disconnected braking resistor. Braking resistor wrong value.	DC Bus voltage regulation is disabled. That means the power supply cannot boost and regenerate. This fault can be only detected during the dc bus precharging phase. The ST signal is kept to high level.	Verify the correct brake resistor wiring. (See chapter 9.5.4) Check the value of the brake resistor is not greater than acceptable maximum one.
5 (3)	A6.0	Module overload	The working cycle used is out of specifications.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DT signal is set to high level.	Use a working cycle comply with specifications. (See chapter 8)

Number of blinks	Drive fault without serial link	Fault description	Possible cause	Internal power supply action	Possible remedy
6 (3)	A6.0	Short circuit to earth	Dispersion to earth.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DT signal are set to high level.	Verify the presence of dispersion to earth in drives, motors and wires.
7 (2)	ST	Mains overvoltage	The mains voltage has repetitively exceeded 5% of the maximum value.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DF1-DF2 contact is opened in order to disconnected the mains and avoid any damage to the module. The signal ST will be activated as soon as the bus voltage fell down below the minimum threshold.	Check the mains voltage value. (See chapter 9.5.3)
8 (3)	A2.0	DC Bus overvoltage	This alarm can happen when the power supply is working in overload condition while regenerating. If the energy generated by one or more braking motors is higher than one the power supply can regenerate and dissipate on brake resistor, the dc bus voltage could increase over the acceptable maximum threshold.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. SRT signal is set to high level.	To avoid heavy working cycle.
9 (2) (3)	ST	Unbalanced mains	A missing phase or an unbalanced three-phase voltage.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. ST signal is kept to high level.	Check the power wiring between the power supply unit and the cabinet. Check if the value of the applied voltage is in the allowed range.
10 (2) (3)	ST	General alarm	Hardware or software malfunction. The Dip-switch configuration has been changed before removing the auxiliary power supply (Only version H).	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DF1-DF2 contact is opened in order to disconnected the mains. The signal ST will be activated when the bus voltage fell down below the minimum threshold.	
Legend (1) Led continuously ON. (2) This type of fault opens DF1/DF2 contact. See J1 connector on chapter 9.5.8.3. (3) Alarm reset by CF1/CF2 contact. See J1 connector on chapter 9.5.8.3. (4) Alarm reset by CF1/CF2 contact with mains OFF only. See J1 connector on chapter 9.5.8.3.					



ST: When the DC Bus voltage value becomes lower than a fixed threshold the drives go in torque disabled. Such signal disappear whenever the DC Bus is charged.

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11.4.2 Faults blinks signalling software version SW06631x01 and SW06731x01

Number of blinks	Drive fault without serial link	Fault description	Possible cause	Internal power supply action	Possible remedy
0 (1)	A5.0	Braking resistor overtemperature.	The power supply is working in overload condition when regenerating. If the energy generated by one or more braking motors is higher than maximum regenerable one, in order to limit the DC Bus voltage, the amount of energy in excess is dissipated on the brake resistor. This energy dissipation will produce the overheating of the resistor. Excessive number of DC Bus charging/discharging cycles. Disconnected temperature sensor.	DC Bus voltage regulation is disabled. That means the power supply cannot boost and regenerate anymore.. THFR signal is set to high level. It comes back to low level as soon as the temperature or the power dissipation returns to their rated value.	Use a less heavy working cycle by reducing the braking ramp of the spindle motors. Avoid frequent DC Bus discharging cycles. Check the resistor thermo-contact wires connections. (See chapter 9.5.1, 9.5.4)
1	A2.0	Clamping IGBT desaturation	Braking resistor wires wrong connections. The value of the used resistance is too low.	The bus voltage regulation is disabled. That means the power supply cannot boost and regenerate anymore. The clamping function is disabled.	Check the resistor wires connections. Connect a correct resistance value. (See chapter 10.7)
2 (4)	ST	DC Bus pre-charging fault	Possible hardware failure of the pre-charging circuit as SCR device, diode bridge, braking resistor. DC Bus charging/discharging cycles executed in short time interval.	DC Bus voltage regulation is disabled. That means the power supply cannot boost and regenerate. This failure can be only detected when the power is applied. The ST signal is kept to high level.	Check the value of the braking resistor, it must be equal or greater than acceptable minimum limit. (See chapter 10.7) Check the mains voltage.
3 (3)	A5.0	Module overtemperature	The power supply heatsink has reached a temperature >90°. Problem due to the fan system.	The bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. The THFR signal is set to high level.	Use a less heavy working cycle or check the correct thermal exchange inside the enclosure of the electrical cabinet. Check the fan system functionality.
4 (4)	ST	Braking resistor fault	Disconnected braking resistor. Braking resistor wrong value.	DC Bus voltage regulation is disabled. That means the power supply cannot boost and regenerate. This fault can be only detected during the DC Bus precharging phase. The ST signal is kept to high level.	Verify the correct brake resistor wiring. (See chapter 9.5.1, 9.5.4) Check the value of the brake resistor is not greater than acceptable maximum one.
5 (3)	A6.0	Module overload	The working cycle used is out of specifications.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. The DT signal is set to high level.	Use a working cycle comply with specifications. (See chapter 8)
6 (3)	A6.0	Short circuit to earth	Dispersion to earth.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DT signal are set to high level.	Verify the presence of dispersion to earth in drives, motors and wires.

Number of blinks	Drive fault without serial link	Fault description	Possible cause	Internal power supply action	Possible remedy
7 (2)	ST	Mains overvoltage	The mains voltage has repetitively exceeded 5% of the maximum value.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DF1-DF2 contact is opened in order to disconnect the mains and avoid any damage to the module. The signal ST will be activated as soon as the bus voltage fell down below the minimum threshold.	Check the mains voltage value. (See chapter 9.5.3)
8 (3)	A2.0	DC Bus overvoltage	This alarm can happen when the power supply is working in overload condition while regenerating. If the energy generated by one or more braking motors is higher than one the power supply can regenerate and dissipate on brake resistor, the DC Bus voltage could increase over the acceptable maximum threshold.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. The SRT signal is set to high level.	To avoid heavy working cycle.
9 (2) (3)	ST	Unbalanced mains	A missing phase or an unbalanced three-phase voltage.	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. ST signal is kept to high level.	Check the power wiring between the power supply unit and the cabinet. Check if the value of the applied voltage is in the allowed range.
10 (2) (3)	ST	General alarm	Hardware or software malfunction. The Dip-switch configuration has been changed before removing the auxiliary power supply (Only version H).	DC Bus voltage regulation is disabled. The power supply cannot boost and regenerate anymore. DF1-DF2 contact is opened in order to disconnect the mains. The signal ST will be activated when the bus voltage fell down below the minimum threshold.	
Legend (1) Led continuously ON. (2) This type of fault opens DF1/DF2 contact. See J1 connector on chapter 9.5.8.3. (3) Alarm reset by CF1/CF2 contact. See J1 connector on chapter 9.5.8.3. (4) Alarm reset by CF1/CF2 contact with mains OFF only. See J1 connector on chapter 9.5.8.3.					



ST: When the DC Bus voltage value became lower than a fixed threshold the drives go in torque disabled. Such signal disappear whenever the DC Bus is charged.

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11.5 Alarms signalling for MDLL3.....R/H

11.5.1 Reading the alarms signalling table

Alarm code AXXX	Alarm description				
	Ext. code	Extension description			
	Blink N°	DF1 / DF2 contact	Standard interface	Serial interface	Reset
Possible cause		PWS action		Possible remedy	

Alarm code	It is a code number indicating the type of alarm. This number is displayed on the page of WPM software tool only.
Alarm description	This field contains the description text of the alarm type. It is displayed on the page of WPM tool only.
Ext. code	It is an additional number (extension code) which indicates what particular parameter is involved or the cause of the failure.
Extension description	It is an additional text which describes the single cause of the alarm . It is readable with WPM tool only.
Blink N°	This field indicates the blinks number of the red led (fault led) on the front panel. This number is associated to the Alarm code.
DF1 / DF2 contact	This fields specifies if the type of alarm forces the opening of the DF1-DF2 contact (to switch off the mains contactor). Possible entries for this fields are the following: Open (C/NC) → the DF1-DF2 contact is opened on alarm Closed (C/NC) → the DF1-DF2 contact remains closed where: • (C) → Configurable alarm • (NC) → Not configurable alarm. The opening of the DF1-DF2 contact can be programmed in the V30.19 configuration parameter of the power supply except for some alarm. For those alarm whose effect on the DF1-DF2 contact is configurable this field specifies the action configured in factory. Drive fault reaction. The behaviour of the drive in response to some alarm of the power supply can be different depending on the interface type (bit 19 of V30 drive parameter) used by the drive to diagnostic the status of the power supply.
Standard interface	This field indicates the drive's action in response to the alarm transmitted by the power supply on standard interface. The signal ST enables the drives to operate (when it is at low logic level). Its assertion logic is the following: Possible entries for this fields are the following: • ST⁽¹⁾ At power on it remains at high level (it keeps the drives disabled) until the DC Bus has been pre-charged (when the power supply operates in R – mode) or ramped to the pre-fixed value (when it operates as booster H-mode). At the end of pre-charge / boost ramp operation the ST signal is set to low level (the drives are enabled to operate). But if an error or failure is detected during this operation the ST signal remains at high level (even if the DC Bus is charged). • ST⁽²⁾ The ST returns to high level (to disable the drive operation) when the DC Bus voltage falls under the minimum threshold (385Vdc). It can happen due to a fault condition which forces the opening of the power contactor. The AC side voltage is disconnected and the DC Bus starts discharging. • DT This signal puts the drives in alarm 6 Ext 0. • THFR This signal puts the drives in alarm 5 Ext 0. • SRT This signal puts the drives in alarm 2 Ext 0.
Serial interface	This field indicates the drive's action in response to the alarm transmitted by the power supply on serial interface. It provides a fuller diagnostic. It specifies the alarm code generated by the drive.
Reset	This field indicates if the type of the alarm can be cleared by means of CF1 / CF2 reset command or a proper command of the WPM tool. Possible entries for this fields are the following: • Yes The alarm can be cleared • Mains off The alarm can be only cleared after removing the AC mains power (leaving turned auxiliary power on) • No The alarm cannot be cleared. It should be cleared by turning the unit off, removing the cause, and turning the unit on.
- PWS action - Possible cause - Possible remedy	Additional user information.

11.5.2 Alarms signalling list SW06732x01 for MDLL3...R and SW06632x01 for MDLL3...H

Alarm code A900	Alarm description Overtemperature/Overload of the braking resistor				
	Ext. code	Extension description			
	0	Overtemperature of the braking resistor (PTC)			
	1	Overload of the braking resistor (I2T)			
	Blink N°	DF1 / DF2 contact	Standard interface	Serial interface	Reset
	0	Open (C)	THFR (A5.0)	A5.0	Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		• The power supply is working in overload condition while regenerating. If the energy generated by one or more braking motors is higher than the maximum regenerable one, the amount of energy in excess is dissipated on the brake resistor in order to limit the DC Bus voltage. • Frequent cycles of charging and discharging of the DC Bus voltage. • The temperature sensor is disconnected.		• Use a less heavy working cycle by reducing the deceleration and the braking ramps of the spindle motors. • Avoid frequent cycles of charging and discharging of the DC Bus. • Check the connections of the resistor thermo-contact wires. (See chapter 9.5.1, 9.5.4)	

Alarm code A901	Alarm description Desaturation of the Clamp IGBT				
	Ext. code	Extension description			
	0	Desaturation of the Clamp IGBT			
	Blink N°	DF1 / DF2 contact	Standard interface	Serial interface	Reset
	1	Open (C)	SRT (A2.0)	A2.0	Yes
PWS action		PWS possible cause		Possible remedy	
Short circuit on braking resistor connector J5 due to resistor broken or wrong wiring.		• The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears. In this alarm status the power supply does not perform the self-discharging of the DC Bus.		• Check braking resistor integrity, resistance value and cabling. (See chapter 9.5.1, 9.5.4)	

Alarm code A902	Alarm description DC Bus precharge error				
	Ext. code	Extension description			
	0	DC Bus precharge error			
	Blink N°	DF1 / DF2 contact	Standard interface	Serial interface	Reset
	2	Open (C)	ST ⁽¹⁾	A58.1	Mains off
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears. In this alarm status the power supply does not perform the self-discharging of the DC Bus.		• Possible hardware failure of the pre-charge circuit: SCR device, diode bridge, brake resistor. • Short time interval between cycles of charging/discharging of the DC Bus.		• Check the value of the brakig resistor (it must be equal or greater than acceptable minimum limit. (See chapter 10.7) • Check if the AC mains voltage is in the specified range.	

Note. This fault can be only detected when the AC mains voltage is applied to the power terminal.

Alarm code A903	Alarm description Overtemperature				
	Ext. code	Extension description			
	0	Heatsink overtemperature			
	Blink N° 3	DF1 / DF2 contact Open (C)	Standard interface THFR (A5.0)	Serial interface A57.0	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		• The heatsink has reached a temperature >90°. The IGBT of the power bridge are overheated.		• Check the load rate. Use a less heavy working cycle. (See chapter 8) • Check the cooling condition inside the electrical cabinet. • Check the functionality of the fan system. (See chapter 9)	

Alarm code A904	Alarm description Braking resistor				
	Ext. code	Extension description			
	0	Braking resistor			
	Blink N° 4	DF1 / DF2 contact Closed (C)	Standard interface ST ⁽¹⁾	Serial interface A58.2	Reset Mains off
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears. In this alarm status the power supply does not perform the self-discharging of the DC Bus.		• Braking resistor not connected. • Resistance value too high.		• Verify the wiring of the brake resistor. (See chapter 9.5.1, 9.5.4) • Check the value of the brake resistor is not greater than recommended maximum one. (See chapter 8.7, 10.7)	
Note. This alarm can be only generated during the pre-charge phase of the DC Bus . A failure or a wrong value of the brake resistor is only detected when the AC mains voltage is applied to the power terminal					

Alarm code A905	Alarm description Overload (I2T)				
	Ext. code	Extension description			
	0	Overload (I2T)			
	Blink N° 5	DF1 / DF2 contact Open (C)	Standard interface DT	Serial interface A57.1	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		• The working cycle is out of specifications. • Use a working cycle comply with specifications. (See chapter 8)		• Verify the wiring of the brake resistor. (See chapter 9.5.1, 9.5.4) • Check the value of the brake resistor is not greater than recommended maximum one. (See chapter 8.7, 10.7)	

Alarm code A906	Alarm description Short circuit to earth				
	Ext. code	Extension description			
	0	Short circuit to earth			
	Blink N° 6	DF1 / DF2 contact Open (C)	Standard interface DT	Serial interface A6.0	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		Dispersion to earth in somewhere of the high voltage system.		Verify the presence of dispersion or shorts to earth in drives, motors and wires.	

Alarm code A907	Alarm description Mains overvoltage				
	Ext. code	Extension description			
	0	Mains overvoltage			
	Blink N° 7	DF1 / DF2 contact Open (C)	Standard interface ST ⁽²⁾	Serial interface A57.3	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		The mains voltage exceeds the maximum value 540Vrms.		Check the value of the mains voltage. (See chapter 5.1, 5.2 and 9.5.3)	

Alarm code A908	Alarm description DC Bus overvoltage				
	Ext. code	Extension description			
	0	Software detection			
	1	Hardware detection			
	Blink N° 8	DF1 / DF2 contact Open (C)	Standard interface SRT (A2.2)	Serial interface A2.0	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		The DC bus voltage is too high.		Avoid heavy working cycle. (See chapter 8)	

Alarm code A909	Alarm description Unbalanced mains				
	Ext. code	Extension description			
	0	Missing phase			
	1	Unbalanced voltage			
	Blink N° 9	DF1 / DF2 contact Open (C)	Standard interface ST ⁽²⁾	Serial interface A57.2	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		Phase loss or an unbalanced three-phase voltage occurred for AC mains power.		- Check the power wiring between the power supply unit and the cabinet. (See chapter 9) - Check if the value of the applied voltage is in the allowed range. (See chapter 9.5.3) - Check fuses or any other protection on mains. (See chapter 9.5)	

Alarm code A910	Alarm description Time out				
	Ext. code	Extension description			
	0	PWM timing error: PWM not refreshed			
	Blink N° 10	DF1 / DF2 contact Open (C)	Standard interface ST ⁽²⁾	Serial interface A57.3	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		- Synchronization problem with the NC unit. - Failure of the DSP.		Clear the alarm and apply the AC mains power again.	
Note. This alarm can only appears when the IGBT of the power bridge are switching. In other terms when the power supply is boosting (H mode) or regenerating the braking energy (R mode).					

Alarm code A911	Alarm description Self-test hardware				
	Ext. code	Extension description			
	0	Current sensing A/D converter not properly initialized			
	1	An error has occurred in the FPGAs reset procedure			
	2	Checksum error on control FPGA program in flash memory			
	3	The DONE pin hasn't gone high after the configuration of the control FPGA			
	4	Checksum error of the PWS interface board FPGA program in flash memory			
	6	The DONE pin hasn't gone high after configuration of PWS interface board FPGA			
	7	The control board PLL isn't working			
	8	The PWS interface board PLL isn't working			
	10	The control board address and data buses aren't working properly			
	11	The PWS interface board address and data buses aren't working properly			
	13	The control board programming code is missing			
	14	The PWS interface board programming code is missing			
	16	PWR EEprom I2C not detected			
	17	PWR EEprom I2C: checksum error			
	18	PWR EEprom I2C: missing I_{max} data			
	19	PWR EEprom I2C: missing I_{nom} data			
	20	PWR EEprom I2C: invalid hardware revision			
	21	PWR EEprom I2C: hardware revision not supported			
	22	Power board not coherent with power supply type			
	23	Reading / writing information in flash memory failed			
	24	Erroneous AD conversion on PWS interface board			
	Blink N° 11	DF1 / DF2 contact Open (C)	Standard interface ST ⁽¹⁾	Serial interface A58.5	Reset No
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		Bad hardware functionality of the control or interface board.		Turn the unit off and turn it on again. If the alarm is still present, contact NUM technical assistance.	

Alarm code A912	Alarm description Overcurrent				
	Ext. code	Extension description			
	0	Alarm from control board FPGA			
	Blink N° 12	DF1 / DF2 contact Open (C)	Standard interface ST ⁽²⁾	Serial interface A57.3	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		The current flowing in the unit is greater than the maximum limit. - Failure of the IGBT bridge (cross-circuit). - The power size of the motor drive is not compatible with the size of the power supply. - Failure of the SCR.		- Check IGBT functionality. - Turn AC mains power on by keeping disabled the motor drive. Check the size of the motor drive. If the size is not compatible (too high) with the power supply, replace it with a correct one or limit the current.	

Alarm code A913	Alarm description Auxiliary Power Supply fault				
	Ext. code	Extension description			
	0 1	+/-15V auxiliary power supply missing 3.3V auxiliary power supply overvoltage			
	Blink N° 13	DF1 / DF2 contact Open (C)	Standard interface ST ⁽¹⁾	Serial interface A58.5	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		One or more of the auxiliary voltage inside the unit is not available.		Contact NUM technical service.	

Alarm code A914	Alarm description Flash checksum error				
	Ext. code	Extension description			
	0 1 2 3	Error in the SW DSP checksum (SW missing) Error in the KFPGA programming (possible HW error) Error in the KFPGA checksum (SW missing) DSP software version incompatible			
	Blink N° 14	DF1 / DF2 contact Open (C)	Standard interface ST ⁽¹⁾	Serial interface A58.5	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears. In this alarm status the power supply does not perform the self-discharging of the DC Bus.		Sw checksum incompatibility in Flash memory (managed by Boot program).		Contact NUM technical service.	
Note. This alarm is issued during the initialization phase of the power supply.					

Alarm code A915	Alarm description Data memory checksum error				
	Ext. code	Extension description			
	0 1	Error in the parameters table checksum Error in the alarm table checksum			
	Blink N° 15	DF1 / DF2 contact Open (NC)	Standard interface ST ⁽¹⁾	Serial interface A57.3	Reset No
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		The checksum of the E2PROM memory of the unit is wrong.		Contact NUM technical service.	
Note. This alarm is issued during the initialization phase of the power supply.					

Alarm code A916	Alarm description Incompatible parameters				
	Ext. code	Extension description			
	4 9030 9108 9251 9252 9253 9267 9271	HW/SW incompatibility 2nd DC Bus voltage sensor not foreseen Inom derating incorrect ST Parameters incompatibility Power supply type incorrect Power supply size incorrect ST Peak current incorrect FPGA re-synchronization after sampling time current loop change			
	Blink N° 16	DF1 / DF2 contact Open (NC)	Standard interface ST ⁽¹⁾	Serial interface A58.5	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		- Hardware not compatible with the downloaded firmware code. - Parameter incompatibility.		Load the correct parameter configuration.	

Alarm code A917	Alarm description Dip-switch				
	Ext. code	Extension description			
	0 1	Changing of dip-switch layout Dip-switch 5 wrong It checks if the setting of the Dip-switch SW7 is coherent with the mains voltage. This alarm is issued only in H type if the mains 480V is present and the dip-switch 5 is set correctly. The target is to force the BUS regulation to 700V. The alarm 917 Ext 1 "Dip-switch 5 wrong" has a priority higher than the alarm 917 Ext 2.			
	Blink N° 17	DF1 / DF2 contact Open (C)	Standard interface ST ⁽²⁾	Serial interface A57.3	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		- The setting of the switches (from switch 5 to switch 8) has been changed after turning the unit on. - For high AC mains voltage (500Vrms) the configuration switch 7 → ON (H-mode) and switch 5 → ON is the only one allowed. Different settings are signalled with this alarm code.		- If the extension code is 001 it means the setting of the switch 5 is not compatible with the AC mains voltage applied to the power terminal. Turn switch 5 on ON side. Then turn the unit off and turn it on again. - Turn the unit off, set properly the switches and turn it on again. If the extension code is 002 turn switch 7 on ON side. Then turn the unit off and turn it on again.	

Alarm code A918	Alarm description DC Bus voltage dip				
	Ext. code	Extension description			
	0	Detected DC Bus voltage dip with Mains ON			
	Blink N° 18	DF1 / DF2 contact Open (C)	Standard interface ST ⁽²⁾	Serial interface A57.3	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		The DC Bus voltage is dropped until its minimum value in presence of AC mains power.		Check the AC mains voltage.	

Alarm code A919	Alarm description PWM disabled by I1(J1) during power ON				
	Ext. code	Extension description			
	0	-			
	Blink N° 19	DF1 / DF2 contact Open (C)	Standard interface ST ⁽¹⁾	Serial interface A58.5	Reset Yes
PWS action		PWS possible cause		Possible remedy	
The alarm issues only in the Power ON phase and the input I1 is equal to +24V after the precharge phase.		The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		Check the I1 input voltage value on J1 connector. Please refer to chapter 9.5.8.3 .	

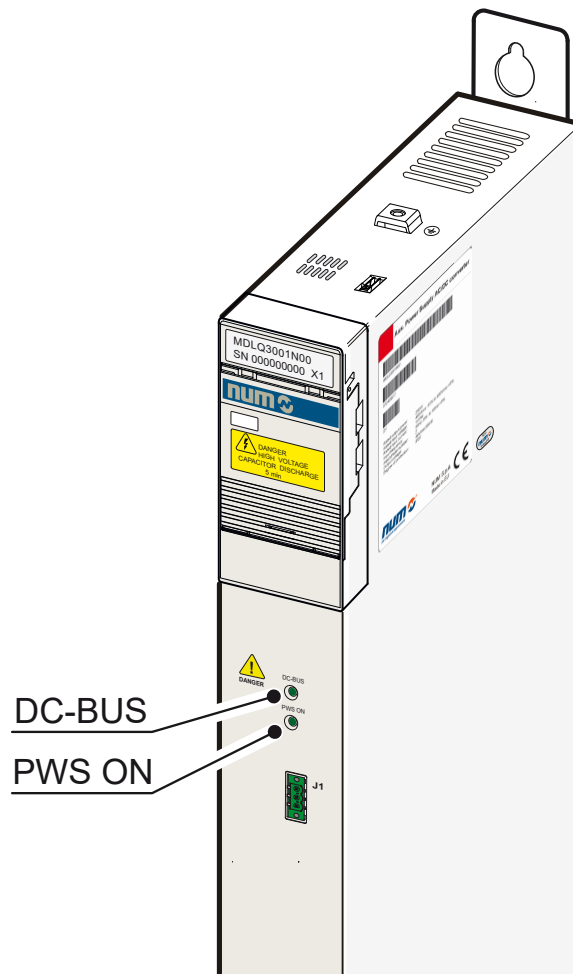
11.5.3 Alarms signalling from SW06733x01 for MDLL3...R and SW06633x01 for MDLL3...H

Alarm code A911	Alarm description Self-test hardware				
	Ext. code	Extension description			
	0 1 2 3 4 6 7 8 10 11 13 14 16 17 18 19 20 21 22 23 24 25	Current sensing A/D converter not properly initialized An error has occurred in the FPGAs reset procedure Checksum error on control FPGA program in flash memory The DONE pin hasn't gone high after the configuration of the control FPGA Checksum error of the PWS interface board FPGA program in flash memory The DONE pin hasn't gone high after configuration of PWS interface board FPGA The control board PLL isn't working The PWS interface board PLL isn't working The control board address and data buses aren't working properly The PWS interface board address and data buses aren't working properly The control board programming code is missing The PWS interface board programming code is missing PWR EEPROM I2C not detected PWR EEPROM I2C: checksum error PWR EEPROM I2C: missing I_{max} data PWR EEPROM I2C: missing I_{nom} data PWR EEPROM I2C: invalid hardware revision PWR EEPROM I2C: hardware revision not supported Power board not coherent with power supply type Reading / writing information in flash memory failed Erroneous AD conversion on PWS interface board DSP reset occurred during PWS regulation			
	Blink N° 11	DF1 / DF2 contact Open (C)	Standard interface ST ⁽¹⁾	Serial interface A58.5	Reset No
PWS action		PWS possible cause		Possible remedy	
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		Bad hardware functionality of the control or interface board.		Turn the unit off and turn it on again. If the alarm is still present, contact NUM technical assistance.	

11.5.4 Alarms signalling from SW06734x01 for MDLL3...R/A and SW06634x01 for MDLL3...H

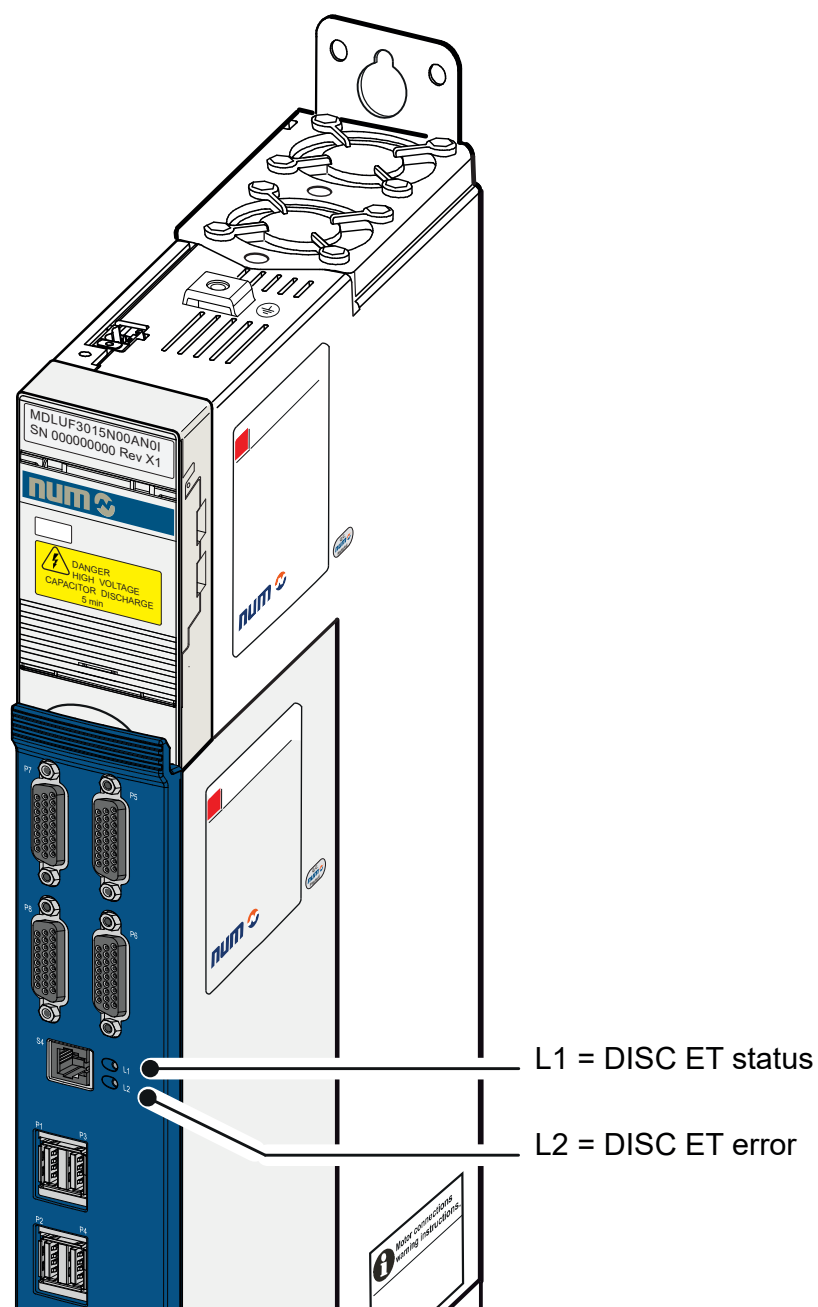
Alarm code A911	Alarm description Self-test hardware			
	Ext. code	Extension description		
	0	Current sensing A/D converter not properly initialized		
	1	An error has occurred in the FPGAs reset procedure		
	2	Checksum error on control FPGA program in flash memory		
	3	The DONE pin hasn't gone high after the configuration of the control FPGA		
	4	Checksum error of the PWS interface board FPGA program in flash memory		
	6	The DONE pin hasn't gone high after configuration of PWS interface board FPGA		
	7	The control board PLL isn't working		
	8	The PWS interface board PLL isn't working		
	10	The control board address and data buses aren't working properly		
	11	The PWS interface board address and data buses aren't working properly		
	13	The control board programming code is missing		
	14	The PWS interface board programming code is missing		
	16	PWR EEPROM I2C not detected		
	17	PWR EEPROM I2C: checksum error		
	18	PWR EEPROM I2C: missing I _{max} data		
	19	PWR EEPROM I2C: missing I _{nom} data		
	20	PWR EEPROM I2C: invalid hardware revision		
	21	PWR EEPROM I2C: hardware revision not supported		
	22	Power board not coherent with power supply type		
	23	Reading / writing information in flash memory failed		
	24	Erroneous AD conversion on PWS interface board		
	25	DSP reset occurred during PWS regulation		
	26	Current offset not initialized: switch PWS DISABLE on (J1 pin 10) with MAINS ON is NOT allowed !		
	Blink N° 11	DF1 / DF2 contact Open (C)	Standard interface ST ⁽¹⁾	Serial interface A58.5 Reset No
PWS action		PWS possible cause		Possible remedy
The power supply stops operating. That means it cannot boost and regenerate the braking energy. It remains in alarm state until a reset command is received (by means the CF1-CF2 contact or WPM tool) and the cause of the alarm disappears.		Bad hardware functionality of the control or interface board.		Turn the unit off and turn it on again. If the alarm is still present, contact NUM technical assistance.

11.6 MDLQ3001N00 status led signalling



Led status	Status signalling	Possible cause	Possible remedy
DC BUS ON ON	The green led is ON whenever the DC Bus is present.		
DC BUS ON status OFF		DC Bus not present.	Verify the presence of correct DC Bus voltage. Verify the presence of the line power supply on terminals L1 - L2 - L3. Please refer to chapter 9.5.
PWS ON status ON	The green led is ON whenever the auxiliary 48Vac 35kHz power supply is present.		
PWS ON status OFF		Auxiliary 48Vac 35kHz power supply not present.	Verify the presence of correct connections on J1 connector. Please refer to chapter 9.5.8.5.

11.7 NUM DrivePro module status led signalling



For NUM DrivePro Mono-Axis and Bi-Axes alarms status signalling, software alarms and alarms extension please refer to NUM DrivePro Parameters manual M00066.

11.7.1 Meaning of LED signalling in NUM DrivePRO

MDLUF is equipped with 2 LEDs : a green one and a red one.

Both LEDS are devoted to DISC ET status signalling ONLY !

GREEN led indicates also the presence of power supply, in addition to DISC ET status, so it is used also to indicate the initial "power-up" state of the whole drive.

RED led is used during the initial drive "power-up" phase and also to indicate an DISC ET communication ERROR condition.

Sequence of states that NUM DrivePro pass through after switch-ON:

NUM DrivePro status	Description	GREEN led	RED led
BOOT	NUM DrivePro is switched ON and the BOOT loading is in execution	OFF	OFF
BOOT ERR	...in case of BOOT ERROR, then, NUM DrivePro remains "stuck" here forever...	OFF	OFF
INIT core#0	BOOT ended successfully, core#0 is started: - POWER module EEprom is read - ECAT EEprom is configured accordingly - FPGA µP is started	ON	ON
INIT core#0 ERR	The drive tries anyway to continue...	OFF	ON
INIT core#1	INIT core#0 is successful, then core#1 is started	ON	OFF
INIT core#1 ERR	NUM DrivePro remains stuck" here forever...	OFF	ON
WAIT for DISC ET communication	INIT core#1 ended successfully, then NUM DrivePro is waiting for DISC ET communication with RTK to be started...	SMOOTHLY varying pattern	OFF
DISC ET INIT	DISC ET communication started	OFF	OFF
DISC ET PRE-OP	DISC ET PRE-operational state	BLINKing	OFF
DISC ET SAFE-OP	DISC ET SAFE-operational state, Acyclic communication works (FoE)	SINGLE flash	OFF
DISC ET OPERATIONAL	DISC ET OPERATIONAL state, Cyclic communication is working	FLICKERing	OFF
DISC ET OPERATIONAL + ANY axis in FAULT	DISC ET OPERATIONAL state, Cyclic communication is working BUT there is at least one axis that is in FAULT state the FAULT is indicate by proper ALARM + EXTension	FLICKERing	ON
DISC ET SYNChro ERR	case of DISC ET DC synchronization error	...see ECAT state...	SINGLE flash
DISC ET watchdog ERR	case of DISC ET watchdog expiration errpr	...see ECAT state...	DOUBLE flash
DISC ET other ERR	case of any other DISC ET error condition	...see ECAT state...	BLINKing

Graphs of LED behaviour

behaviour	graph luminosity vs. time
SMOOTHLY varying pattern (periodical period = 0,5 sec)	
SINGLE flash (periodical period = 1,2 sec)	
DOUBLE flash (periodical period = 1,6 sec)	
BLINKing (periodical period = 0,4 sec)	
FLICKering (NOT periodic, very fast...)	

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11.8 NUM DrivePro with NUM-STOX module alarm description

Alarm	Possible cause	Possible remedy
60 Ext 265	NUM-STOX requested by control board but not detected	HW Failure: exchange the NUM DrivePro.
60 Ext 266	NUM-STOX detected but not requested by control board	Invalid NUM DrivePro Configuration (exchange the NUM DrivePro).
60 Ext 267	NUM-STOX feedback signals - inputs not coherent	This alarm is issued if the NUM-STOX inputs ENxA , ENxB are not level coherent for at least 200ms.
60 Ext 268	NUM-STOX feedback signals - inputs NOT changing for 36h	The ENxA and ENxB of the axis are not put to 0 for the previous 36 hours. Put ENxA and ENxB to 0 to make the alarm clearable. This is test of the hardware signal used to cut the PWM. Before to perform the test remove the motor torque.
60 Ext 269	NUM-STOX feedback signals - inputs unstable	This alarm is issued if the NUM-STOX inputs ENxA , ENxB are flickering, the level are not stable for at least 200ms. Check the signal used to manage ENxA and ENxB or the connections to S8 / S9.
60 Ext 300	PWM disabled while axis in Operational state	NUM-STOX cut the PWM with motor torque present. Check the ENxA and ENxB signals or S8/S9 connection or the presence of Alarm 60 Ext 267, Alarm 60 Ext 268, Alarm 60 Ext 269.
Other	Missing torque.	In case of missing torque of the motor check the wiring of the S8 / S9 connectors and the status of the enabling signals.
	Remaining torque with Safe torque Off.	In case the motor torque remains even with activated the Safe Torque Off function check the wiring of the S8 / S9 connectors and status of the enabling signals.

11.9 NUM-SAMX module Status connector S8, S9 LEDs

Please refer to NUM-SAMX Safety module instruction manual M00069.

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