DCS Thyristor Power Converters

for DC drive systems

25 to 5150 A

Technical Data

DCS 400
DCS 500/500B
DCP 500/500B
DCS 600
DCF 500/600

How to use the DCS Documentation System

The matrix below indicates all available product documentation and its corresponding order numbers on its left columns as well as all existing DC Drive systems on its top rows. System descriptions, Technical data and Operating instructions (as far as they are available for the corresponding drive) are the basic documents and will be delivered together with each drive. All other documentation has to be ordered separately.

DC drive systems / *Product documentation*			System Drive								Standard Drive							Rebuild
			Cubicle				Module				Cubicle		Module					
			DCV 700	DCA 600	DCF 700/500	DCA 620	DCS 500...11	DCS/DCF 600 MultiDrive	DCF 500	DCS 600 CraneDrive	DCA 500	DCS 500B enclosed	DCS 400	DCS 500...21	DCS/DCF 500B	DCP 500	DCP 500B	DCR
System description	Language	Volume																
3ADW000049	EN, DE	II A									x			x				
3ADW000062	EN, DE	II B														x		
3ADW000066	EN, DE,FR	II D										x			x			
3ADW000069	EN, DE	II E															x	
3ADW000072	EN, DE	II F						x										
3ADW000121 ①	EN	II F1		x		x												
3ADW000095 (Manual) ②	EN,DE,FR,IT,SP	II K											x					
3ADW000139	EN	II F		x						x								
Technical Data	Language	Volume																
3ADW000054	EN, DE,FR	III					x	x	x	x				x	x	x	x	
Operating Instructions	Language	Volume																
3ADW000055	EN,DE,FR,SP	IV A									x	x		x	x	x	x	
3ADW000064	EN, DE	IV C			x				x									
3ADW000080	EN, DE	IV F		x		x		x										
3ADW000091 (Installation)	EN, DE	IV F1	x	x	x	x						x						
Software description	Language	Volume																
3ADW000056	EN	V A1									x			x		x		
3ADW000078	EN	V D1										x			x		x	
3ADW000076	EN	V F		x		x		x										
3ADW000050	EN	-	x				x											
3ADW000031 (Diagr.)	EN	-	x				x											
3ADW000053	EN	V C			x				x									
3ADW000052 (Diagr.)	EN	V C			x				x									
3AST000953 ③	EN			x						x								
Tools	Language	Volume																
3AFE61178775 **CMT/DCS500**	EN	-									x	x		x	x	x	x	
EN 5926915-1 **GAD**	EN	-									x	x		x	x	x	x	
3ADW000048 (Application blocks)	EN	V A2									x	x		x	x	x	x	
3AFY61041486 **DDCTool**	EN	-	x		x		x		x		x	x		x	x	x	x	
3AFY61296123 **Drive *Window***	EN	-		x		x		x		x								
Service Instructions	Language	Volume																
3ADW000093	EN, DE	VI A	x	x	x	x	x	x	x	x	x	x		x	x			
3ADW000131	EN	VI K											x					
Fieldbus	Language	Volume																
3ADW000086	EN	-										x			x		x	
3ADW000097	EN	-		x		x		x		x								
Others	Language	Volume																
3ADW000115 12-Pulse operation	EN	VIII F2		x				x										
3ADW000092 Rebuild manual	EN	XI H1	x	x	x	x	x	x	x		x	x		x	x			
3ADW000128 Paralleling DCS Conv.	EN	VIII D1		x				x				x			x			
3ADW000040 12-Puls operation	EN, DE	VIII A2										x			x		x	

available only for: DCS 500 / 500B / 600 drive systems

Status: 27.Sept.2001

① Covers information of Technical data

② Covers information of Technical data, Operating Instructions, Software Description

③ Covers information of Operating Instructions, Software Description

Contents

III TECHNICAL DATA

We recommend to use both, **SYSTEM DESCRIPTION** plus **TECHNICAL DATA** at the same time in case you are planning and engineering your drive.

You will find all necessary technical information in there to solve your problem.

1 Quick Guide

General remarks
The term “DCS thyristor power converter” is a general designation for basic DC converters from ABB. This term can be found in many parts of the relevant documentation. The precise product name in accordance with the brief descriptions given below characterizes a specific unit.

Brief description of DCS 500 and DCS 500B
The DSC 500**B** unit range is an enhancement developed from the DCS 500 range. The difference between the two ranges lies in the version of the control board: the control board used for the DCS 500B unit range is the SDCS-CON-2 type, which is different from the SDCS-CON-1 type in several points (see the table below).

Brief description of DCP 500 and DCP 500B
In the DCP 500 unit, the electronics of the DCS 500 unit have been equipped with a different power section, which changes its visual appearance, its installation dimensions and the interface between the power section and the electronics. The DCP unit is functionally compatible with the DCS unit, since the electronics (power pack, control board and options and/or control) are identical. The DCP 500B unit range is an enhancement developed from the DCP 500 range, with the difference between the two ranges lying in the control board: the control board used for the DCP 500B unit range is the SDCS-CON-2 type, which is different from the SDCS-CON-1 type in several points (see the table below).

Control board	**SDCS-CON-1**	**SDCS-CON-2**
Inputs and outputs	either via SDCS-IOB-1or via SDCS-IOB-2 **and** IOB-3	• SDCS-IOB-1 integrated on CON-2 (removable terminals) • SDCS-IOB-1 and IOB-2 • SDCS-IOB-1 and IOB-3 • SDCS-IOB-2 and IOB-3
PC operation	Communication board necessary. SDCS-COM-1 or COM-5 can be used.	Communication board necessary. SDCS-COM-1 or COM-5 can be used. COM-5 recommended.
Link via serial interface	SDCS-COM-5 and adapter module for the interface desired are necessary; power supply to adapter module from separate 24-V power pack	Only adapter module for the interface desired is necessary; power supply to adapter modules available on CON-2
Control panel	Panel CDP 310 or CDP 311	Panel CDP 312
Software versions	S 21.1xx (DCS 500)	S 21.2xx (DCS 500B) S 15.xxx (DCS 600)

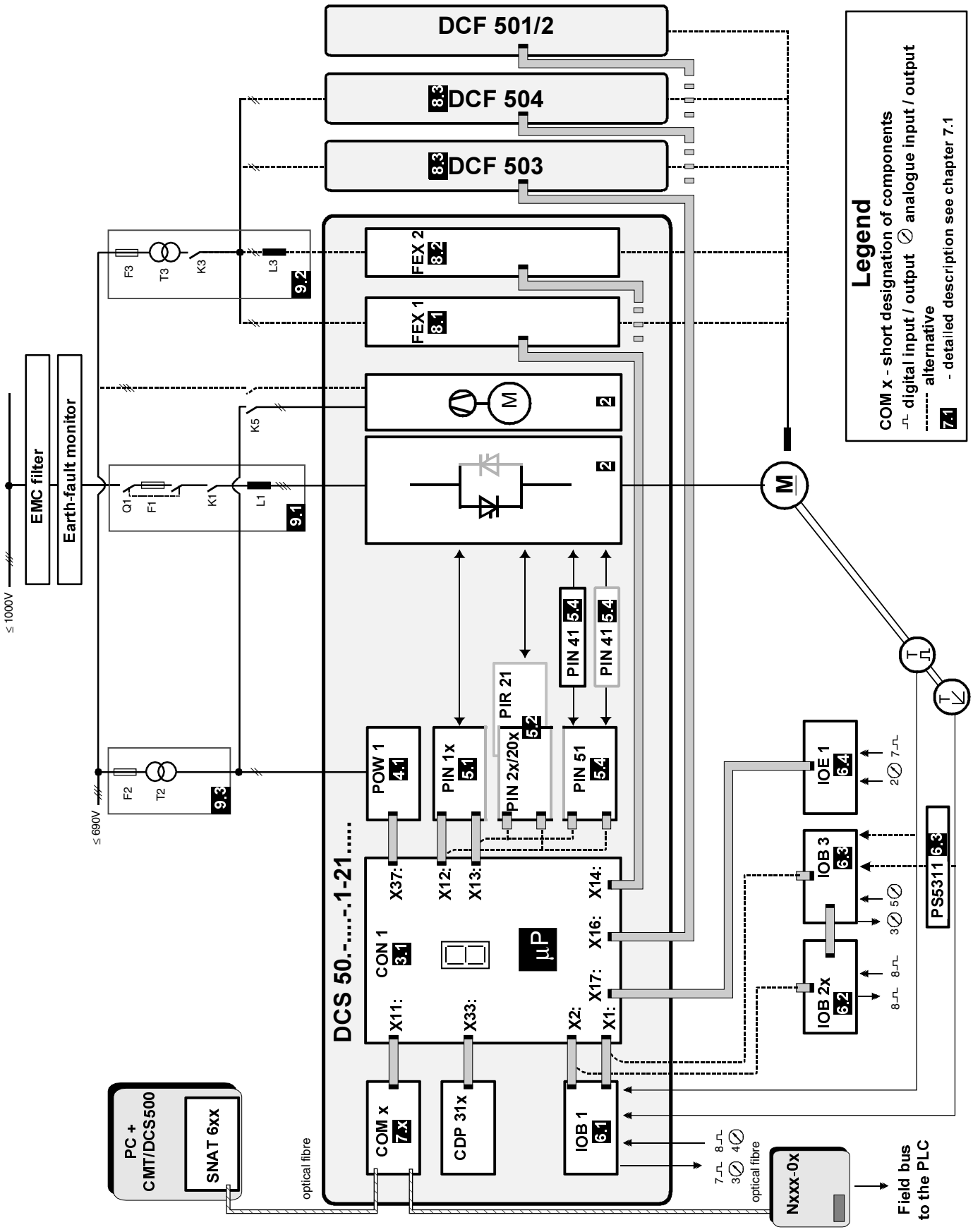
Table 1/1: Characteristics system features with various control boards

Brief description of DCF 500B
With software release 21.232 or higher DCS 500B has a '3-phase field exciter mode'. A DCF 500B is a three-phase field exciter based on the programmable DCS 500B software and the SDCS-CON-2 control board. The interface boards PIN-1x/PIN-2x are modified; - an overvoltage protection unit DCF 505/506 is required.

Brief description of DCS 600
The DCS 600 converter family is based on the hardware developed for the DCS 500B type.
Instead of a COM-x board, the SDCS_AMC_DC board is used. PC tools will be connected there, as well as the APC (Application controller), if the APC is used as a PLC. If a different PLC is used, separate adapter modules are needed. They must be connected to the AMC-DC board, too. The software code always begins with S15.xxx for MultiDrive or S18.xxx for Crane drives.

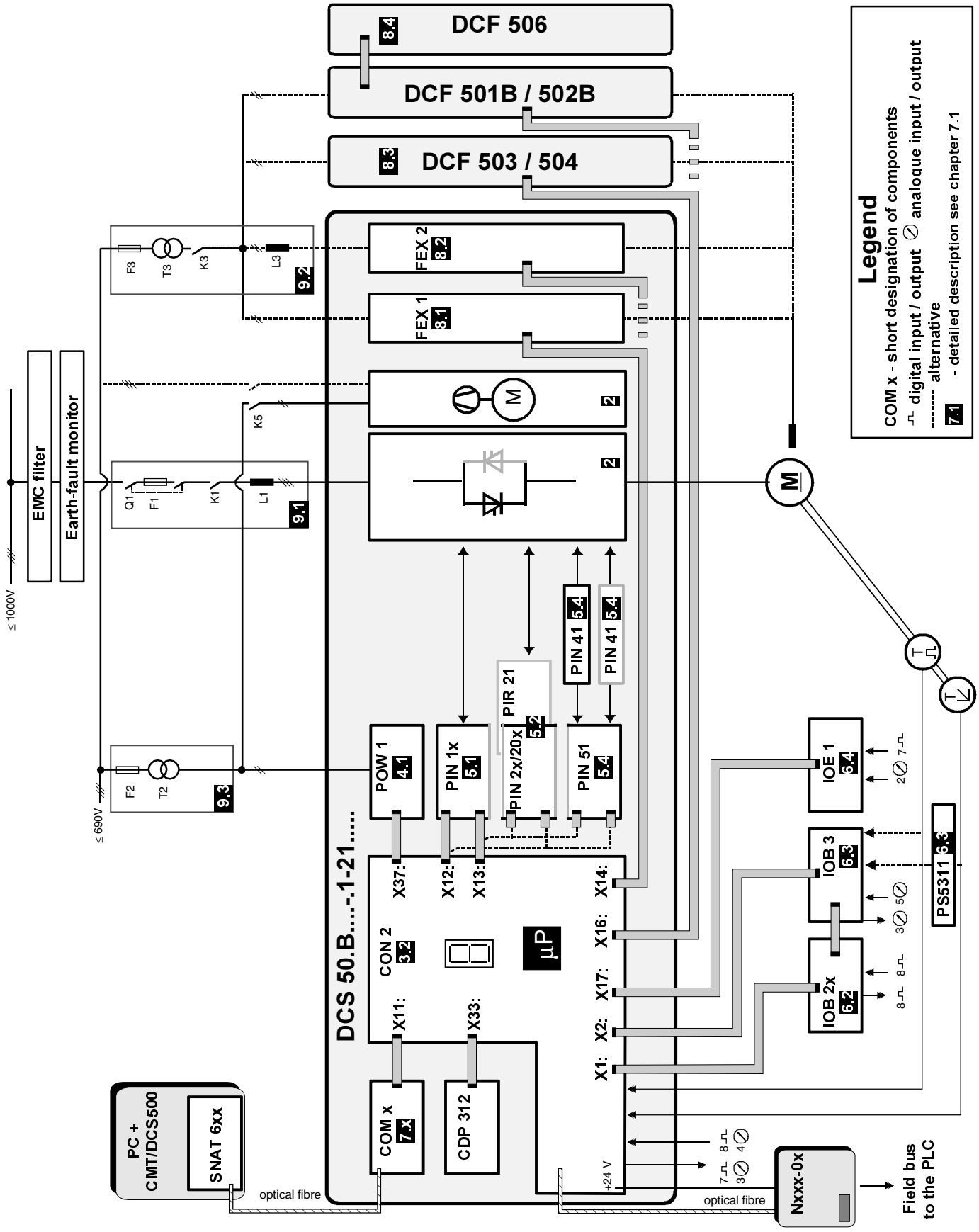
Brief description of DCF 600
The DCF 600 unit range is intended to be used for supplying motor fields and is based on the hardware and system configuration of the DCS 600 unit. The software is identical to the DCS 600 software. Similar to DCF 500 units the DCF 505/506 overvoltage protection unit is required. The same modification is applied to the PIN-1x/PIN-2x boards, compared to DCF 500.

Brief description of DCS 400
The DCS 400 is the smallest drive in its class. The compact design has been partly achieved by a fully integrated field exciter based on IGBT technology. A commissioning wizard - available on the control panel and the PC tool - makes start-up of the drive easy. In addition, the DCS 400 contains application macros.

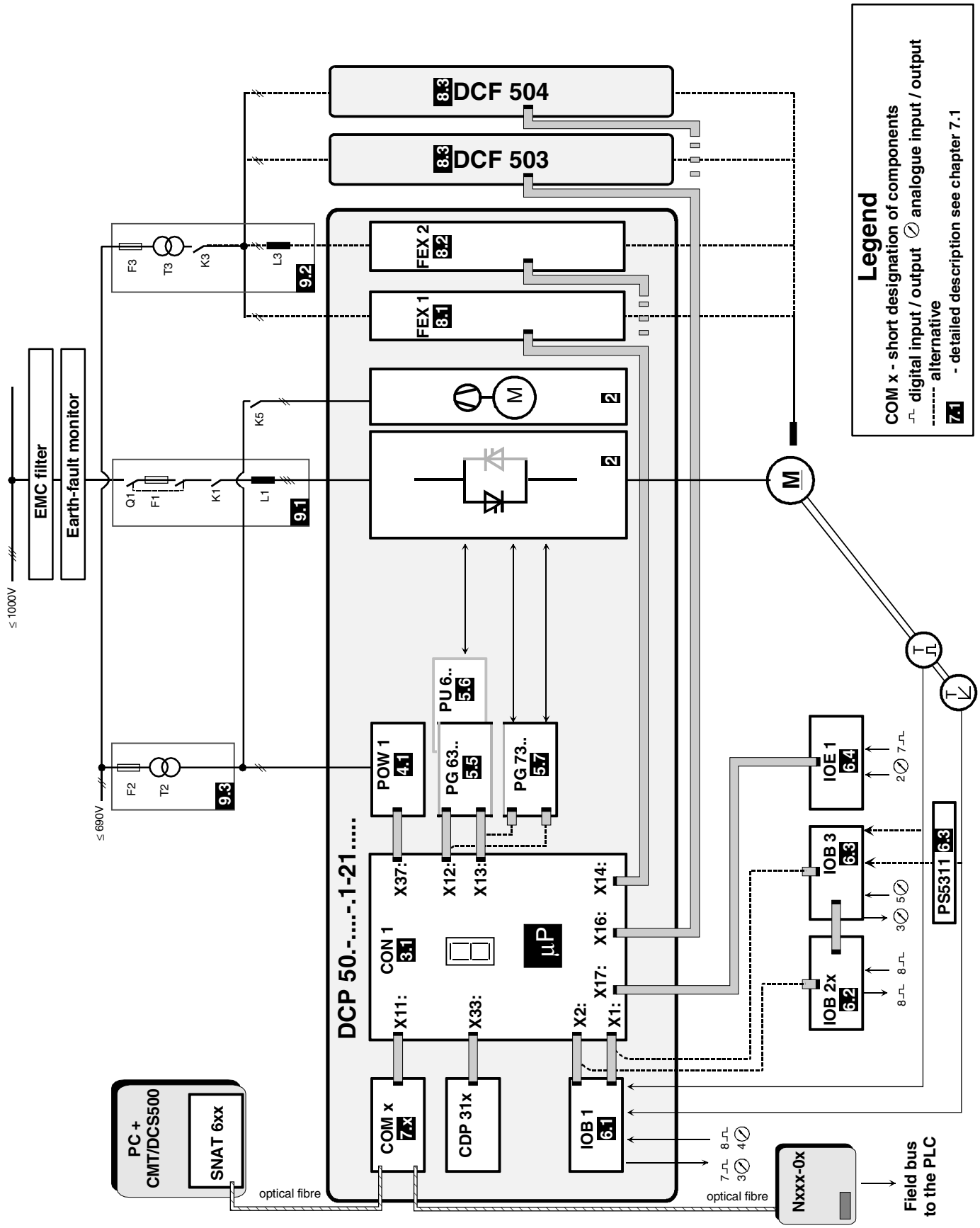


This functional overview of DCS 500 components makes it easy to find detailed technical data in the corresponding chapters.

1.2 DCS 500B

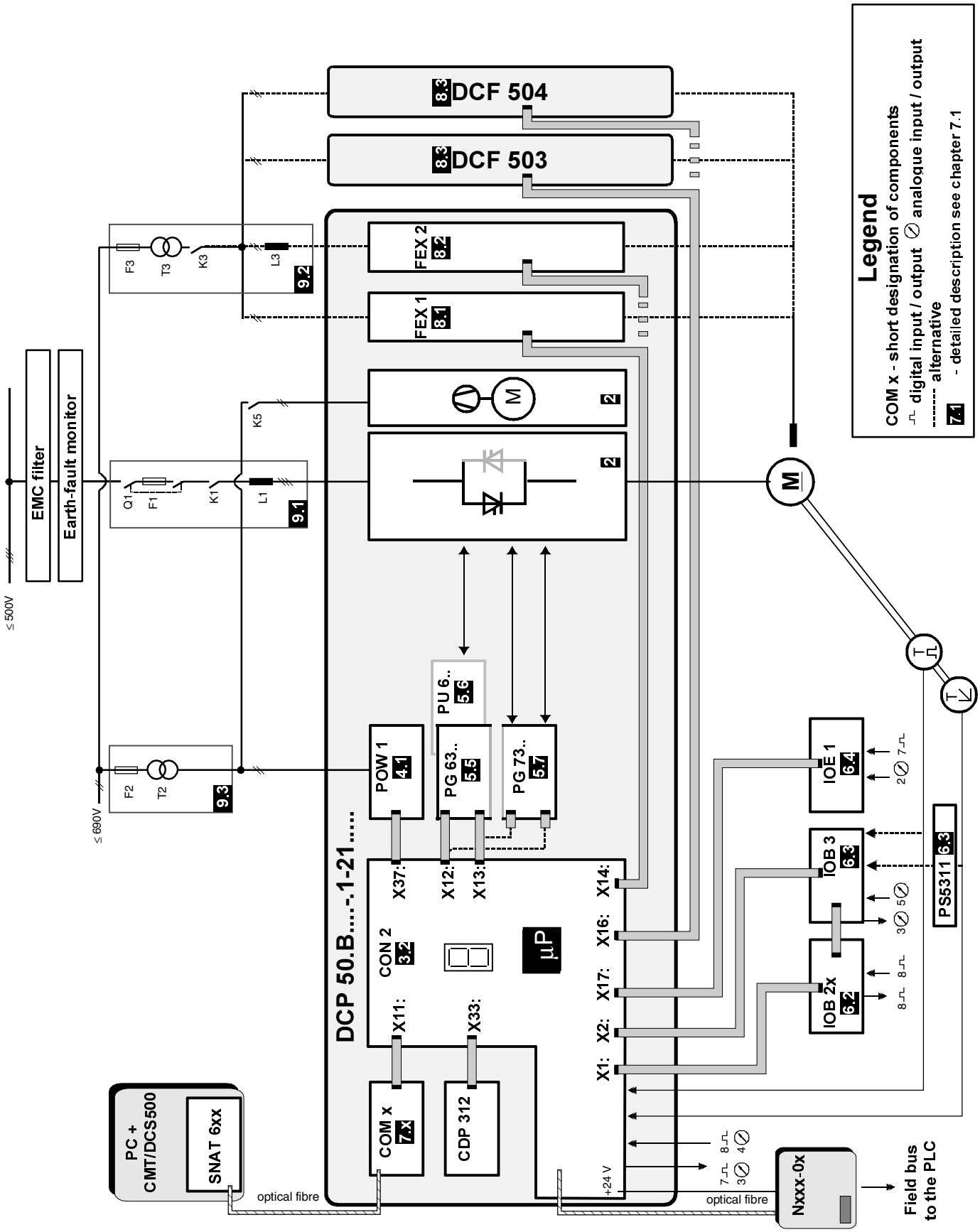


This functional overview of DCS 500B components makes it easy to find detailed technical data in the corresponding chapters.

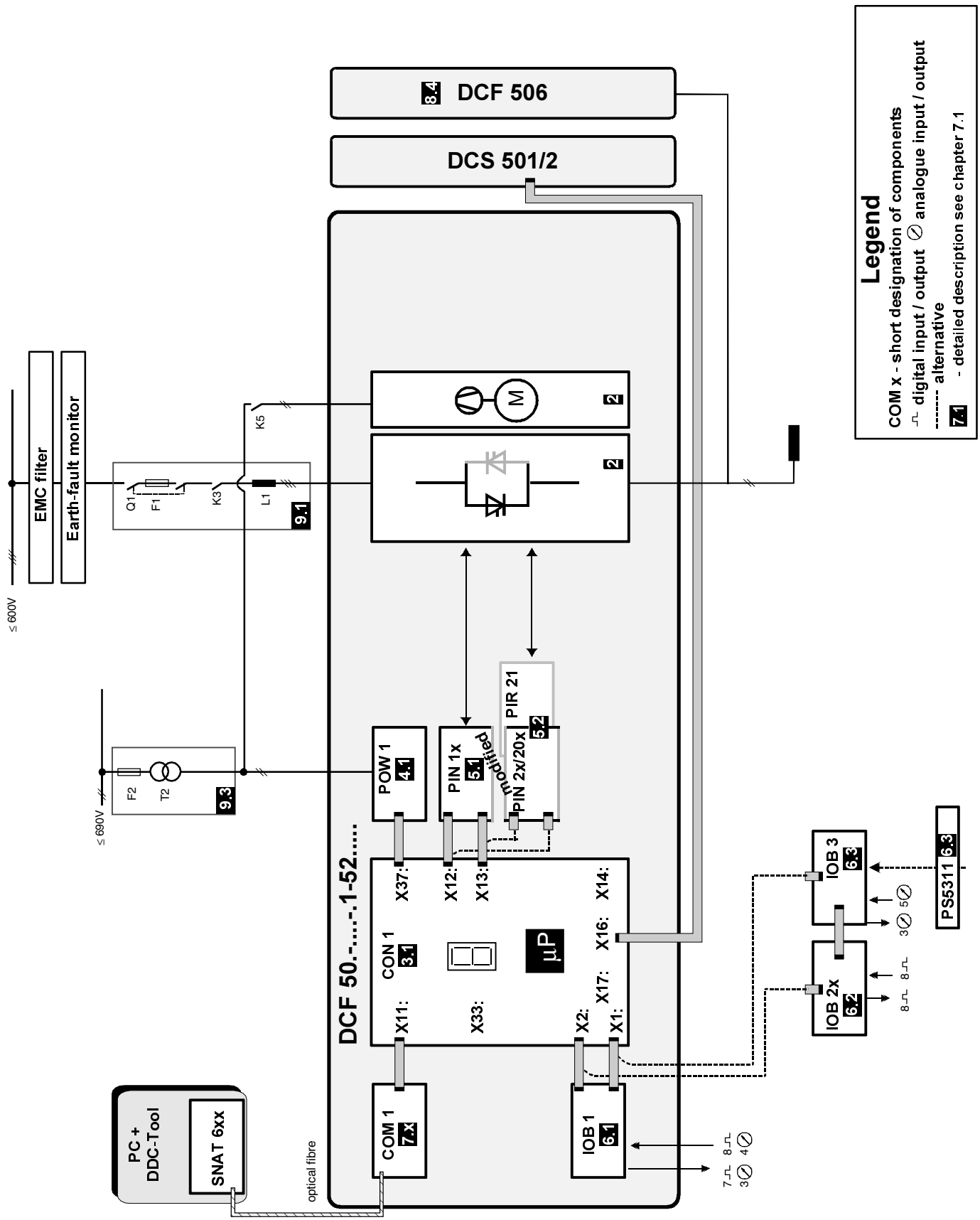


This functional overview of DCP 500 components makes it easy to find detailed technical data in the corresponding chapters.

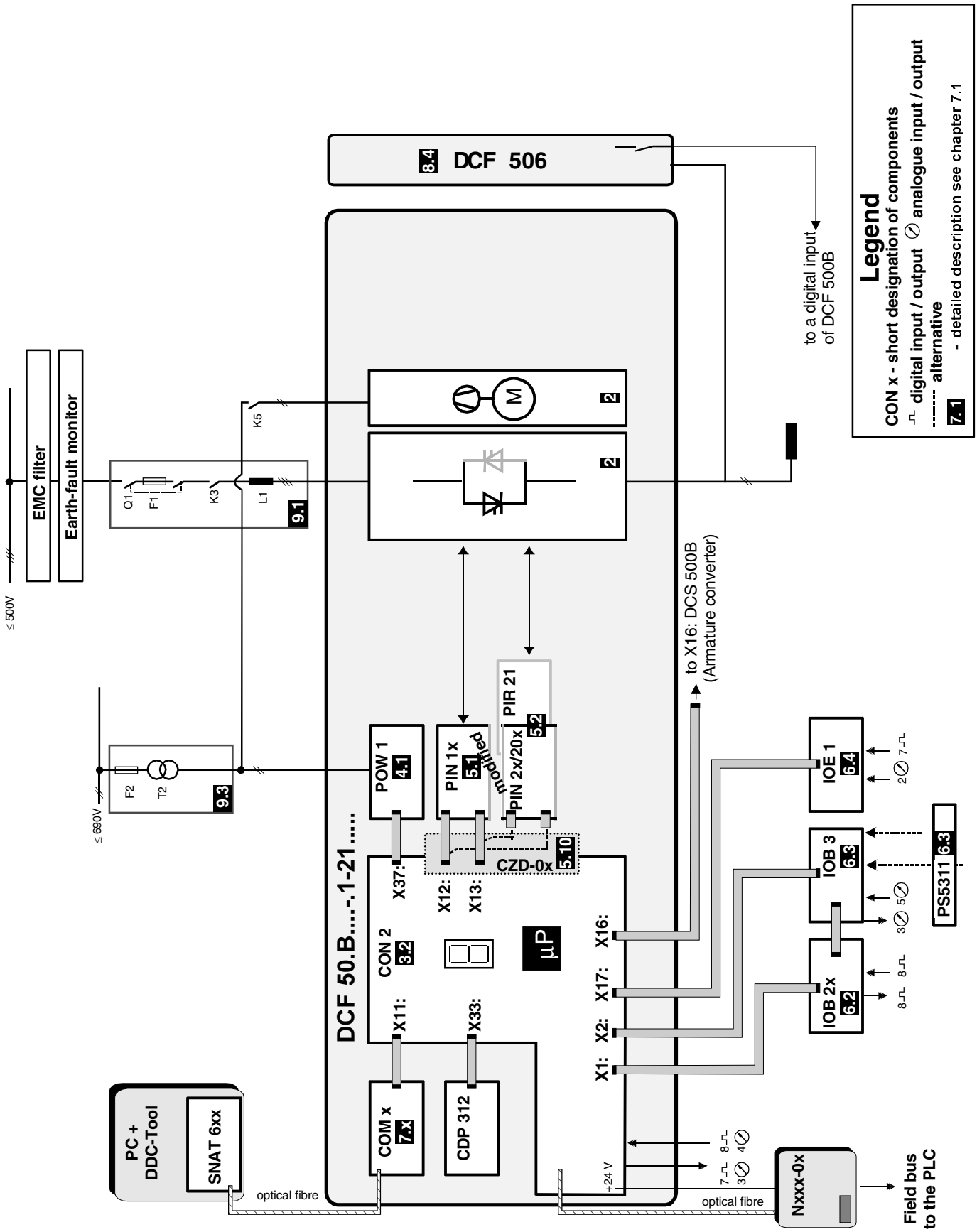
1.4 DCP 500B



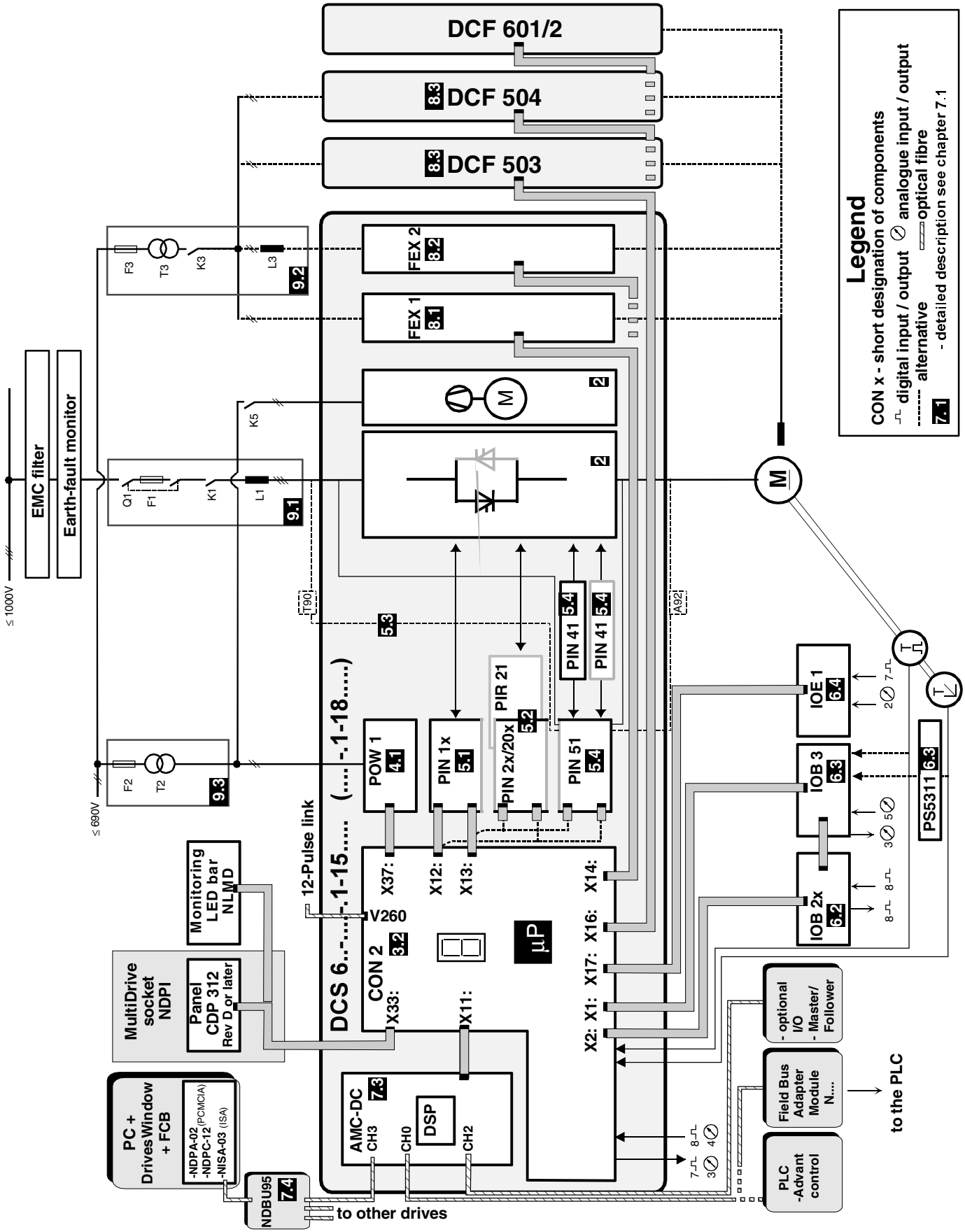
This functional overview of DCP 500B components makes it easy to find detailed technical data in the corresponding chapters.



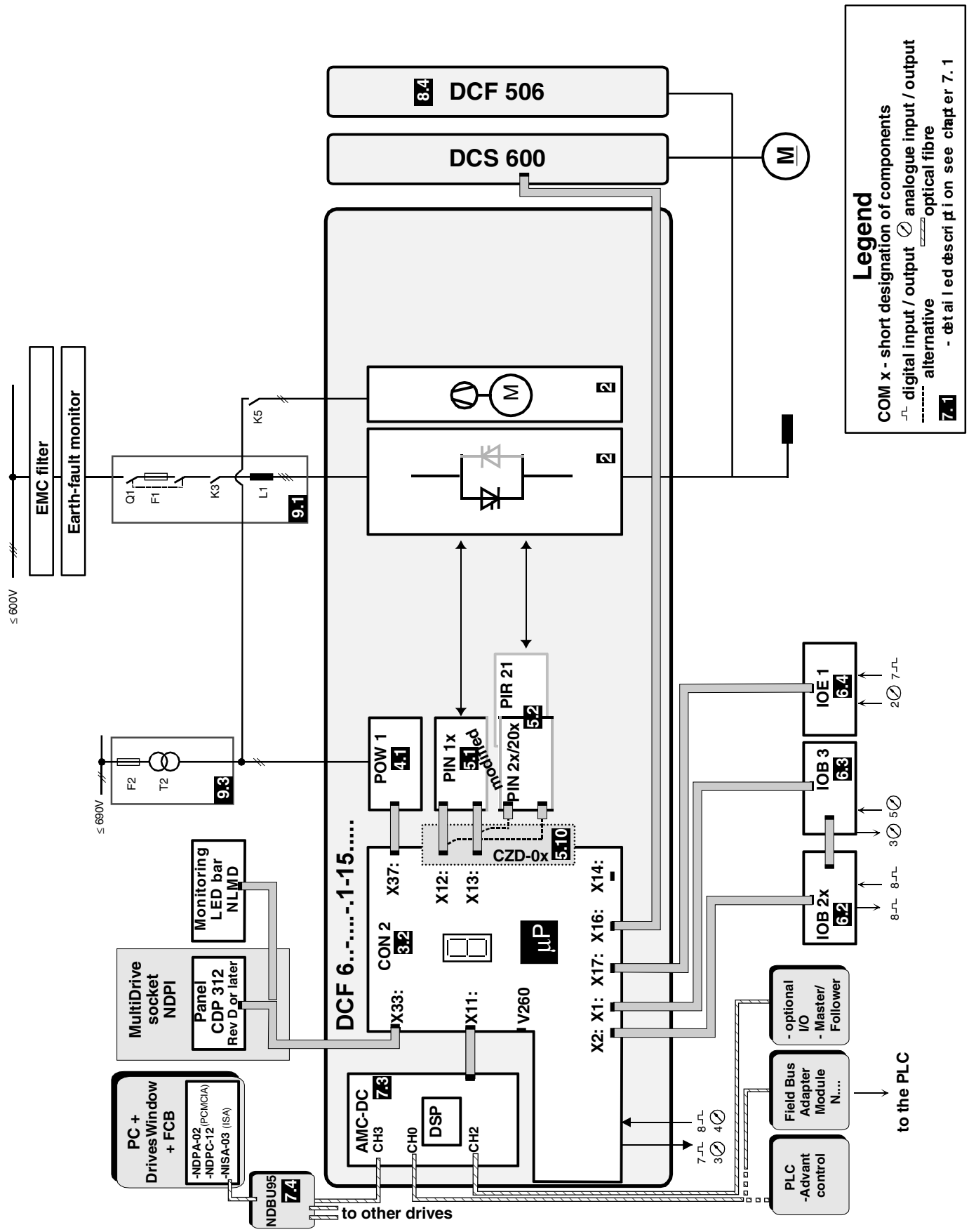
This functional overview of DCF 500 components makes it easy to find detailed technical data in the corresponding chapters.



This functional overview of DCF 500B components makes it easy to find detailed technical data in the corresponding chapters.

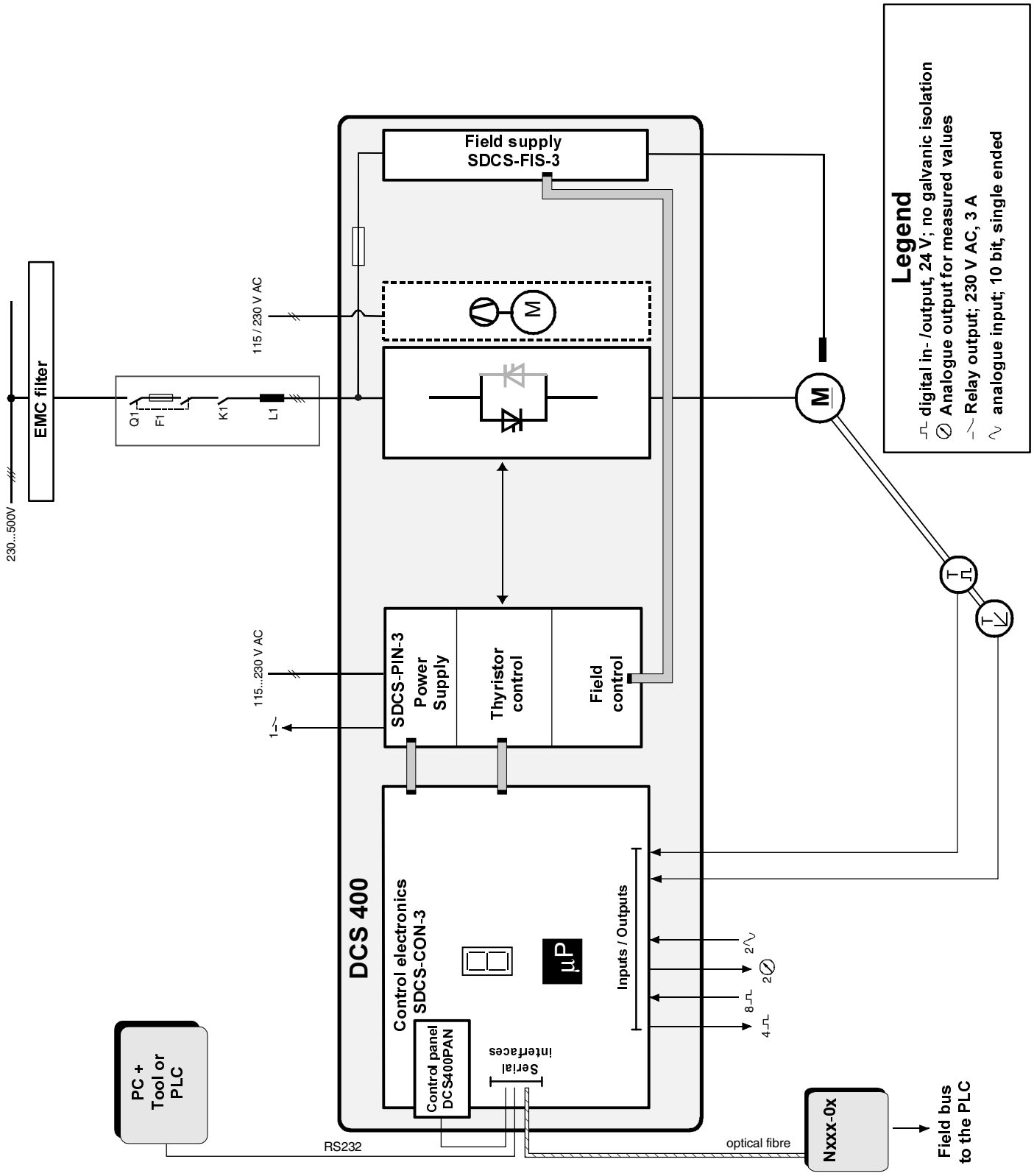


This functional overview of DCS 600 components makes it easy to find detailed technical data in the corresponding chapters.



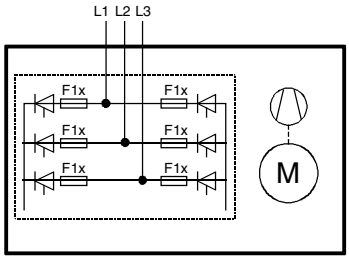
This functional overview of DCF 600 components makes it easy to find detailed technical data in the corresponding chapters.

1.9 DCS 400



Remark:
All detailed information about the DCS 400 DC drive you can only find in the DCS 400 Manual (documentation no. 3ADW 000 095).

2 Converter modules



DCS 500 / DCS 500B / DCS 600 / DCF 500 / DCF 500B / DCF 600

Unit range type DCF 500, DCF 500B and DCF 600 for output current of up to max. 520 A available

DCP 500 / DCP 500B

Note:
For clearness the type designation in this chapter is shown in the following way:

Designation	is valid for
DCS 500	DCS 500 DCS 500B DCS 600 DCF 500 DCF 500B DCF 600
DCP 500	DCP 500 DCP 500B

2.1 Dimensions

DCS 500 valid for DCS 500 / DCS 500B / DCS 600 / DCF 500 / DCF 500B / DCF 600

Module C1
DCS 50x-0025
DCS 50x-0050
DCS 50x-0075

Dimensions in mm
Weight appr. 7.6 kg

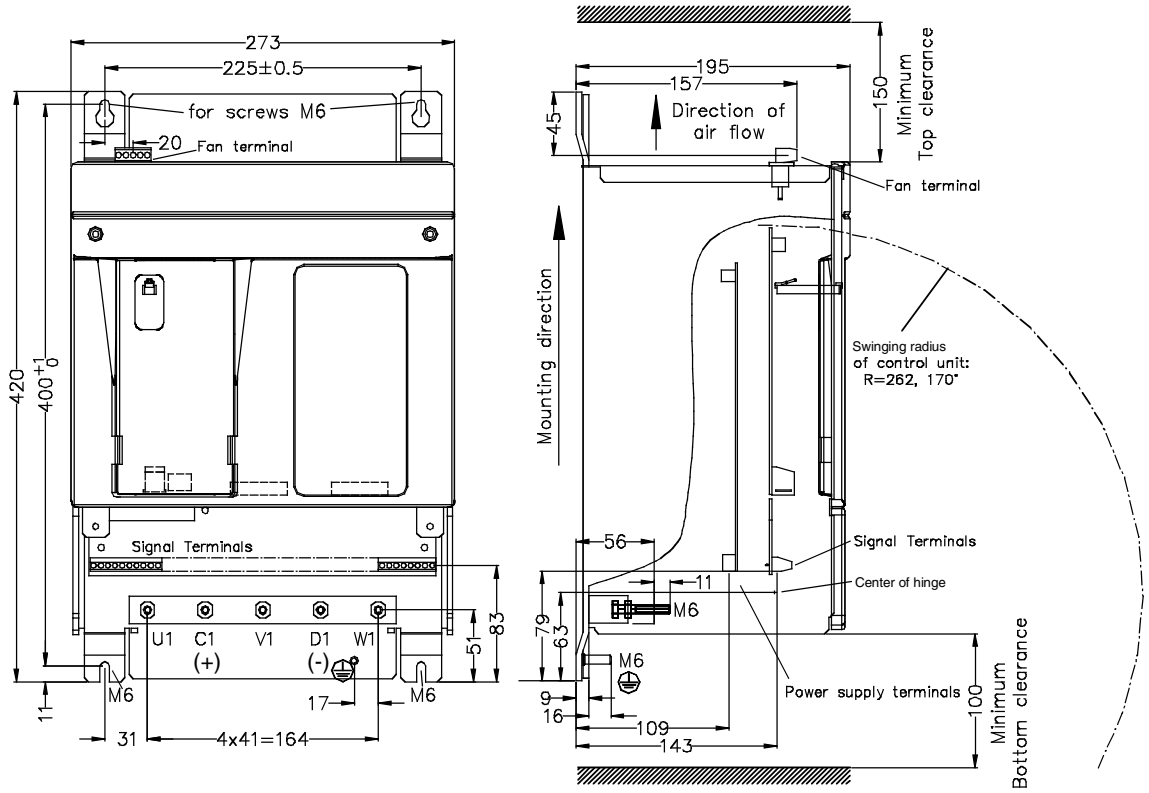


Fig. 2.1/1: Dimension drawing C1-Module

Module C1
DCS 50x-0100
DCS 50x-0110
DCS 50x-0140

Dimensions in mm
Weight appr. 11.5 kg

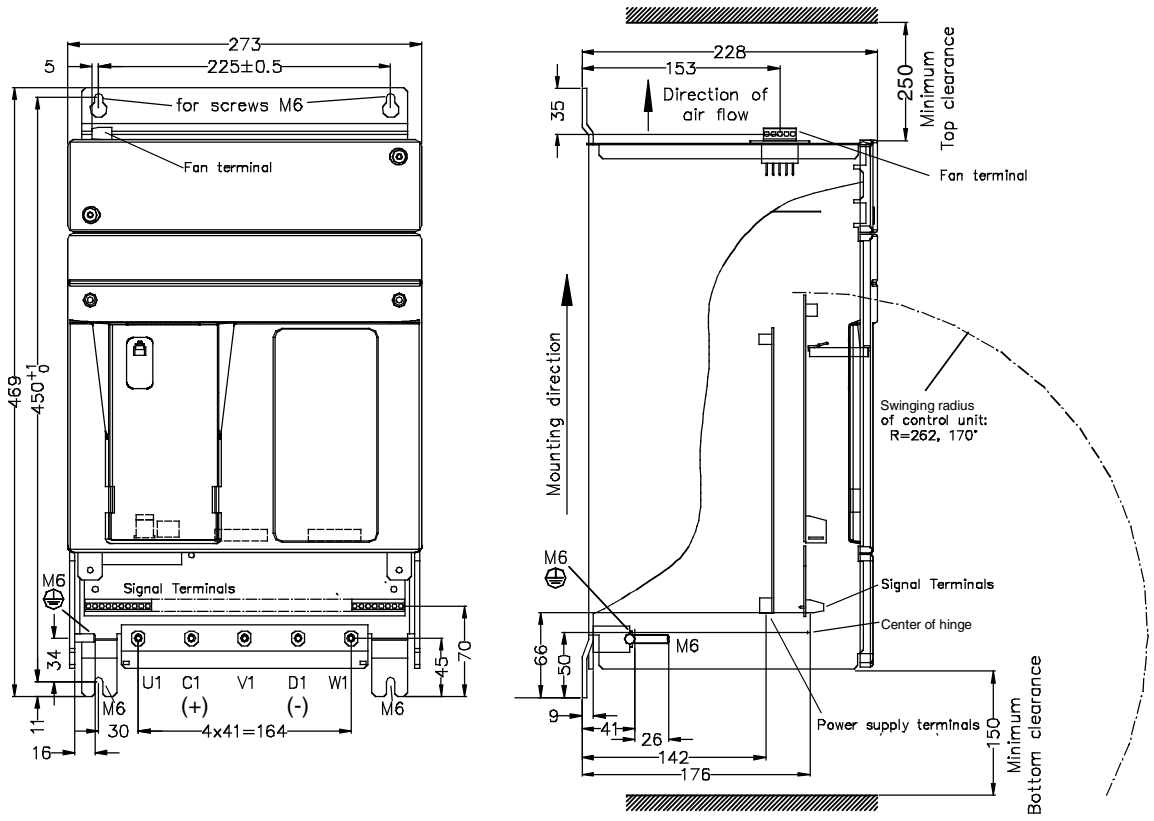
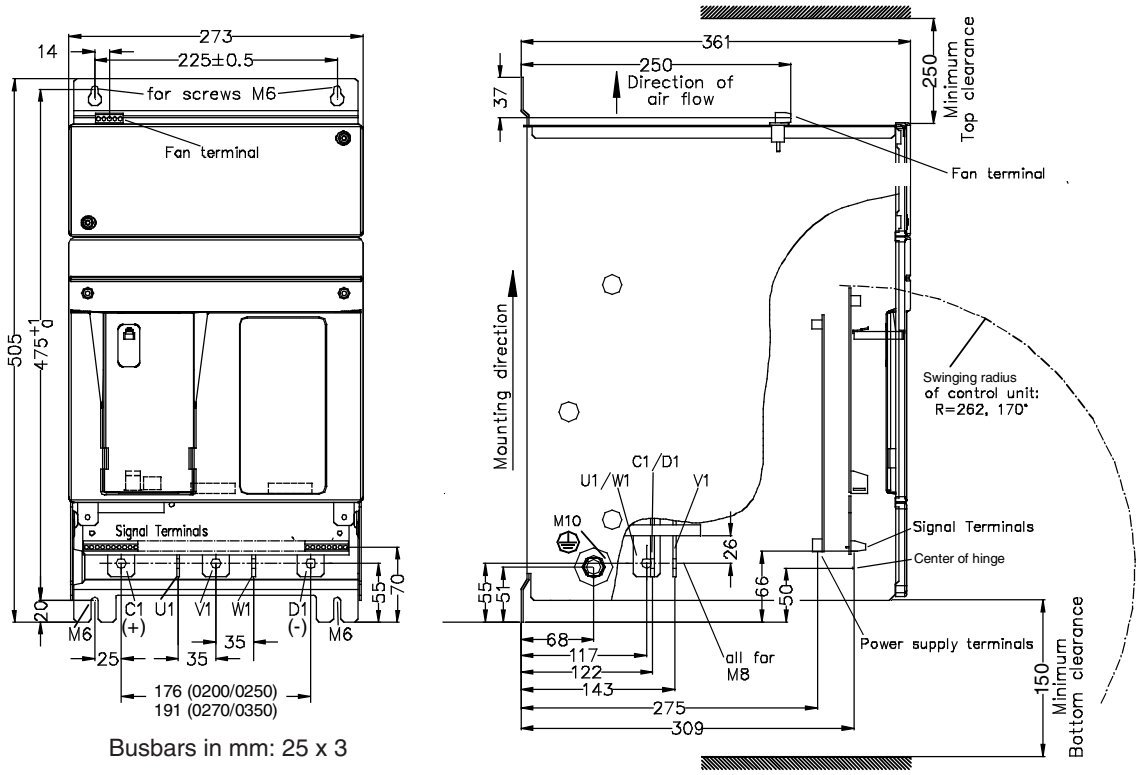


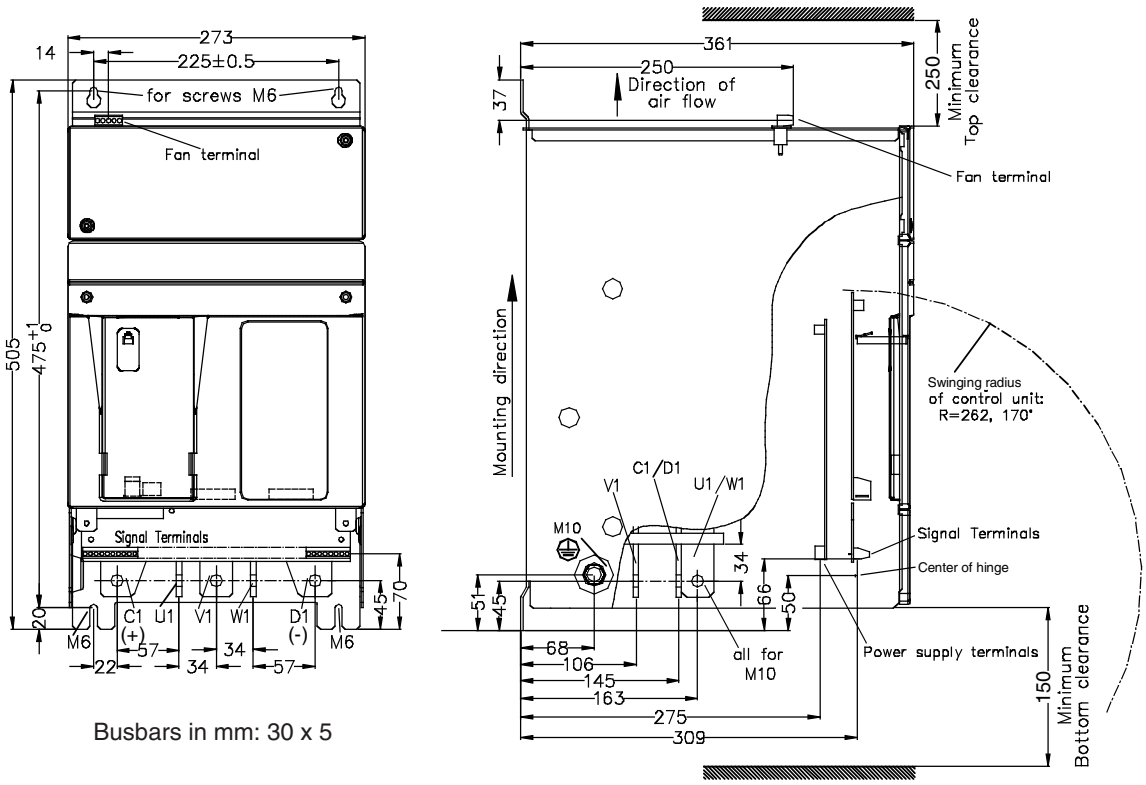
Fig. 2.1/2: Dimension drawing C1-Module



Module C2
DCS 50x-0200
DCS 50x-0250
DCS 50x-0270
DCS 50x-0350

Dimensions in mm
Weight appr. 22,8 kg

Fig. 2.1/3: Dimension drawing C2-Module



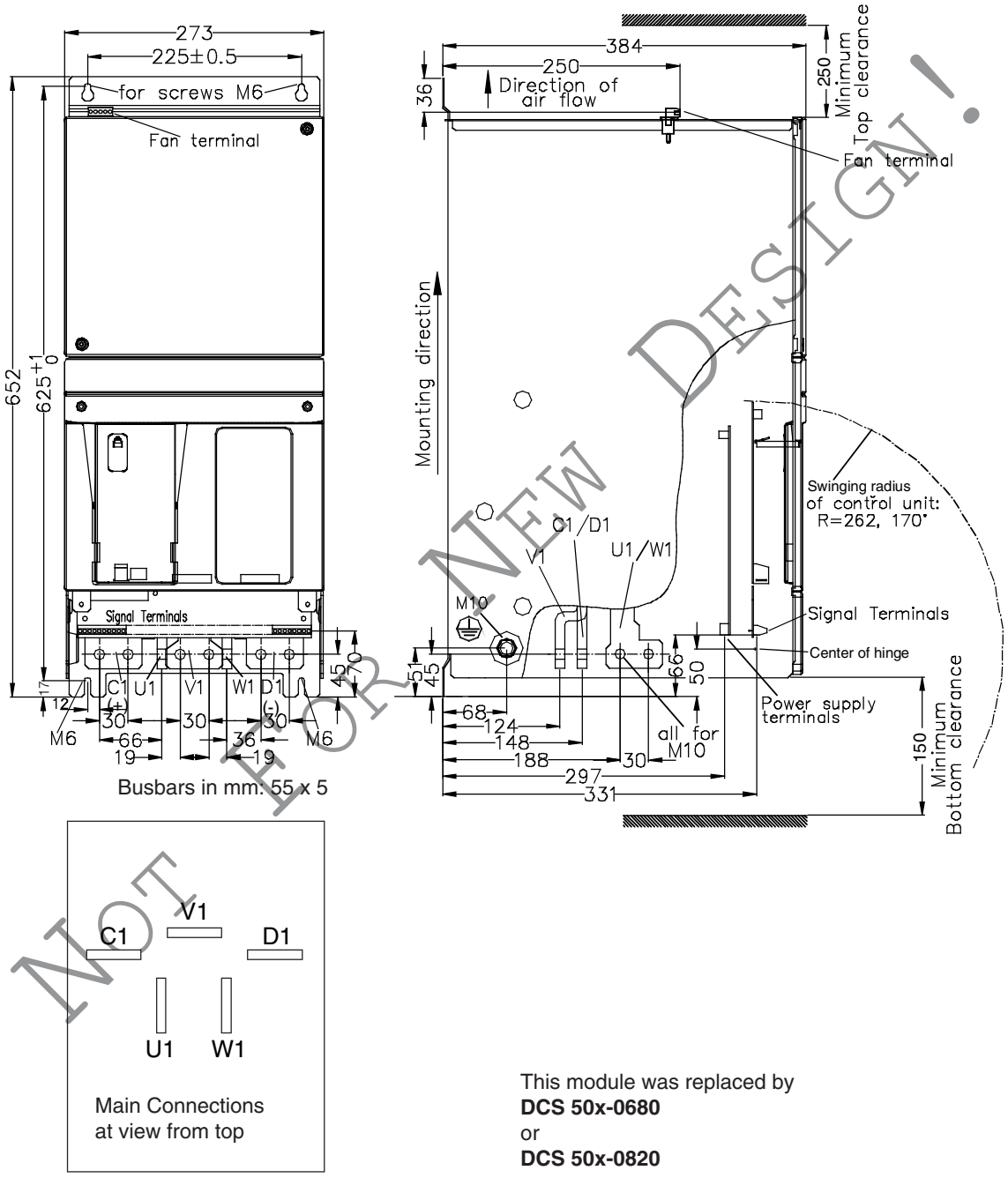
Module C2
DCS 50x-0450
DCS 50x-0520

Dimensions in mm
Weight appr. 29 kg

Fig. 2.1/4: Dimension drawing C2-Module

Module C2
DCS 50x-0700

Dimensions in mm
Weight appr. 57 kg

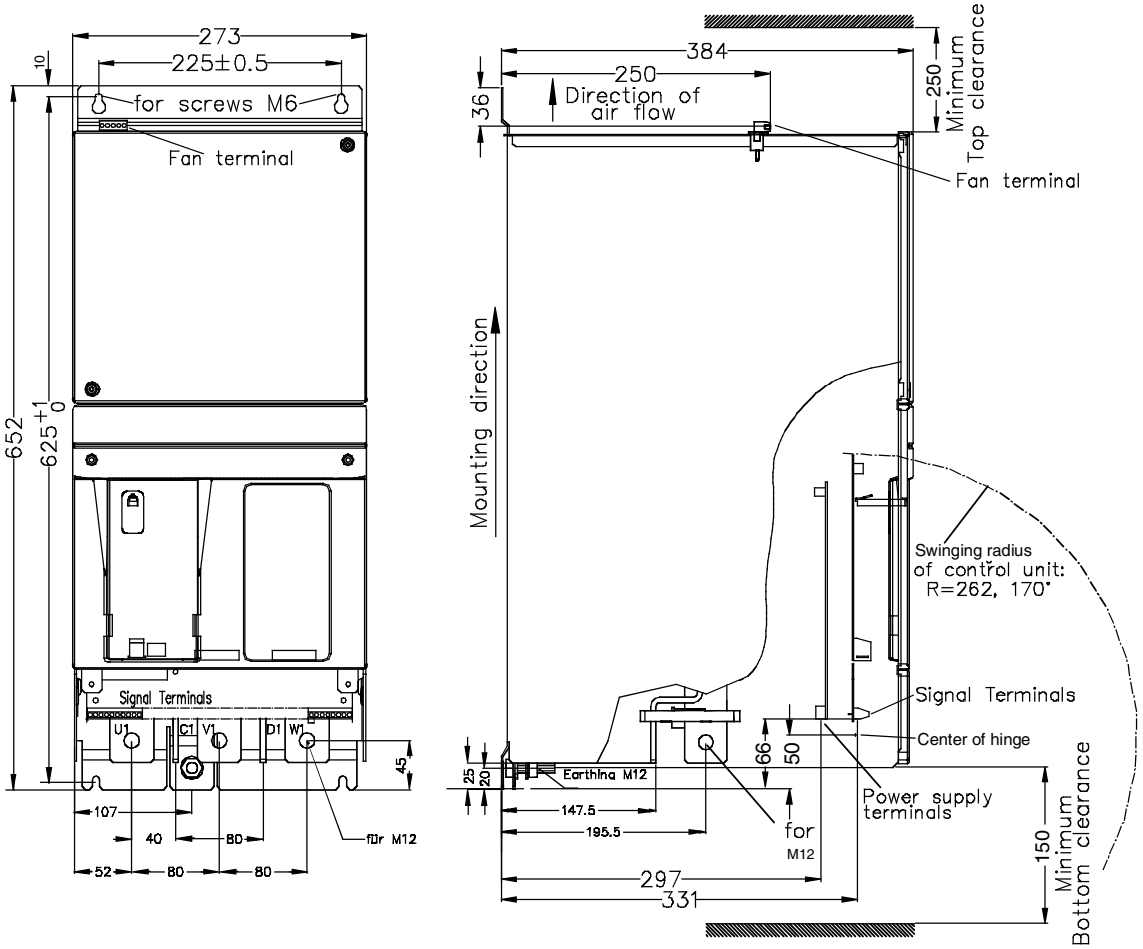


This module was replaced by
DCS 50x-0680
or
DCS 50x-0820

Fig. 2.1/5: Dimension drawing C2-Module

Module C2
DCS 50x-0680
DCS 50x-0820
DCS 50x-1000

Dimensions in mm
Weight appr. 42 kg



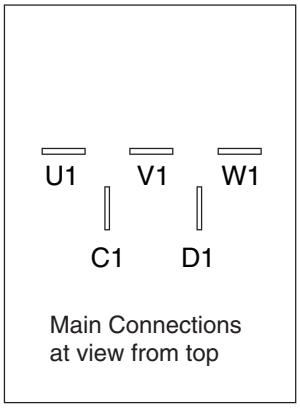


Fig. 2.1/6: Dimension drawing C2-Module

Module C3
DCS 50x-0900
DCS 50x-1200
DCS 50x-1500
DCS 50x-2000

Dimensions in mm
Weight appr. 150 kg

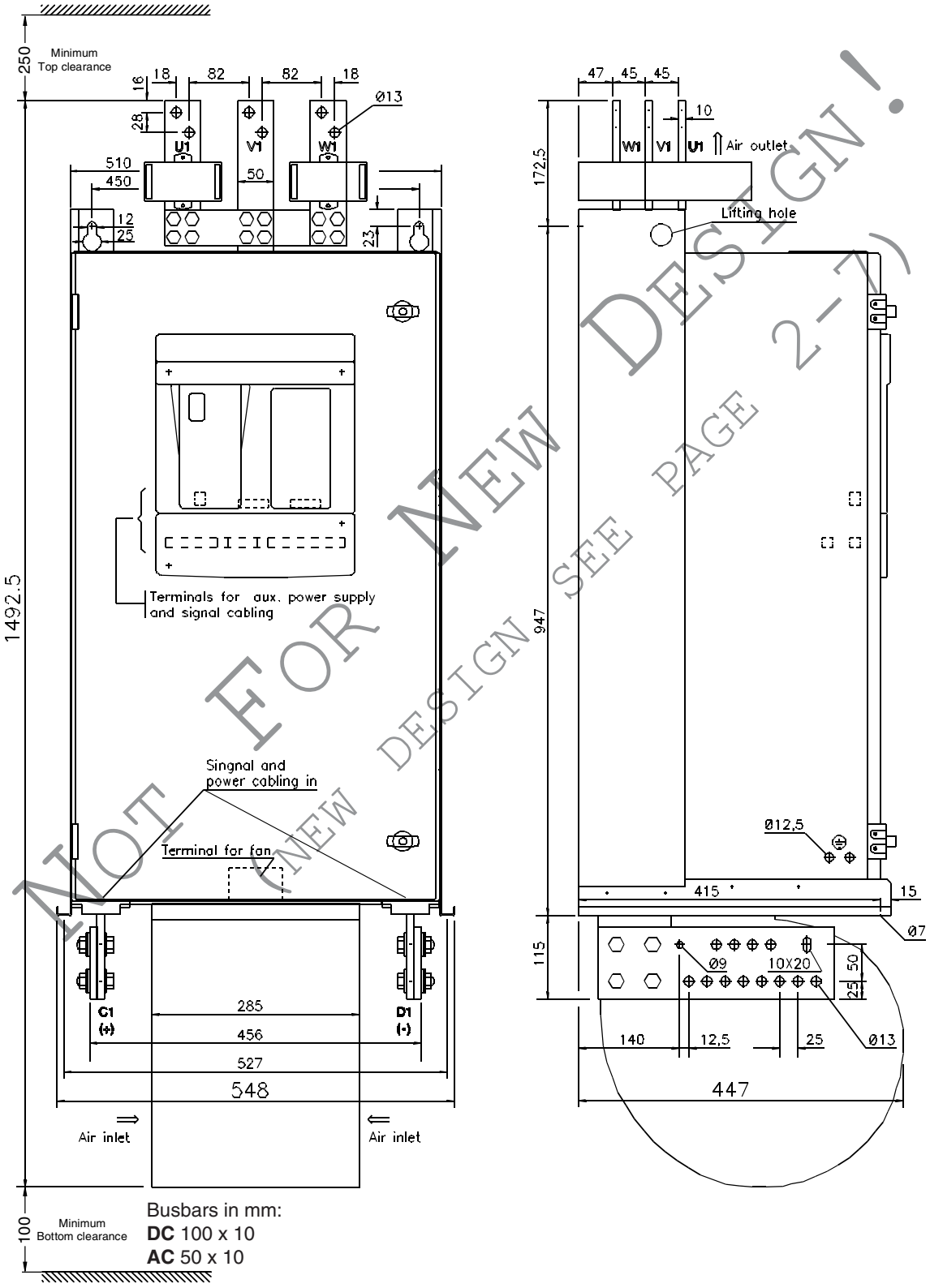
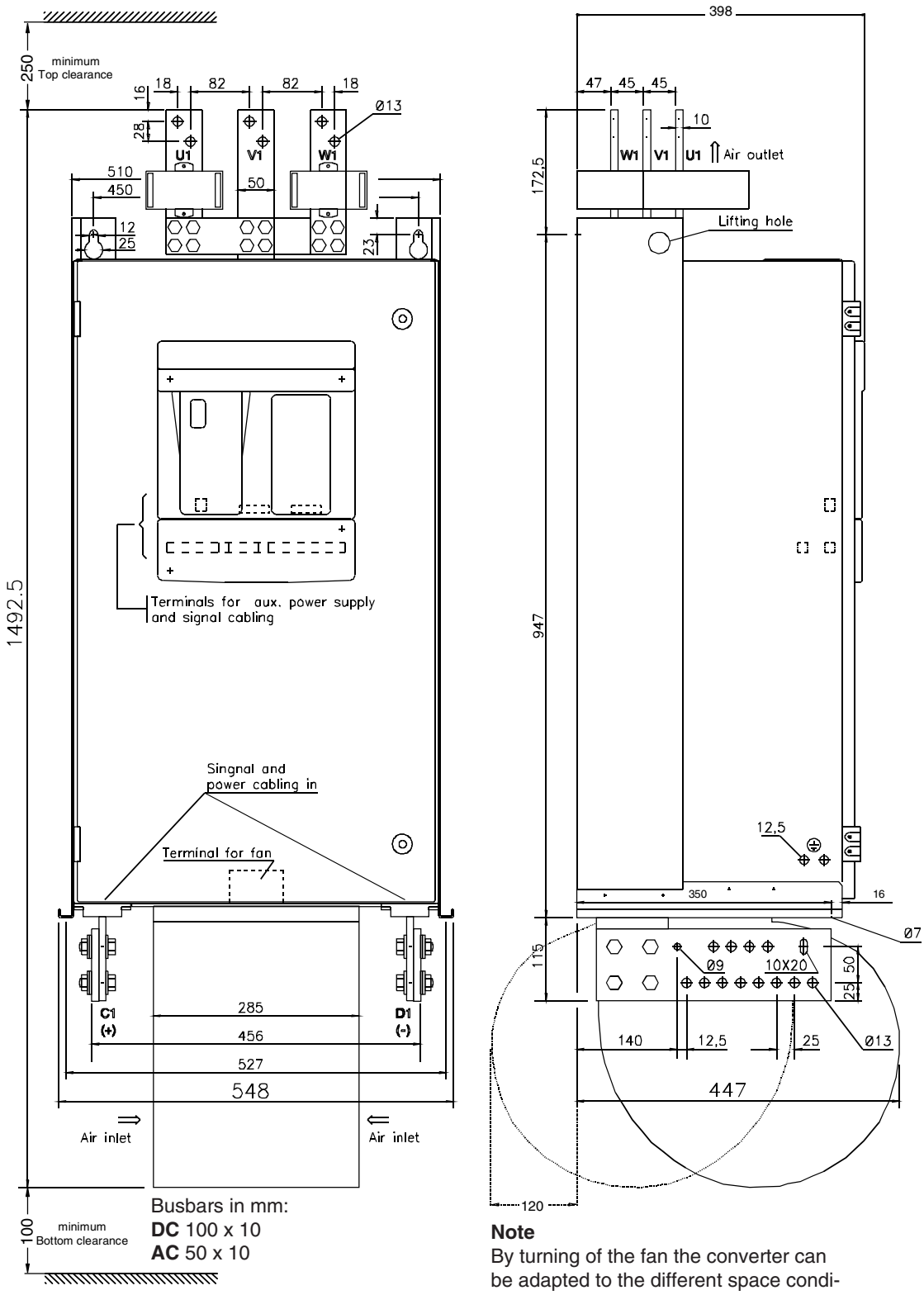


Fig. 2.1/7: Dimension drawing C3-Modul



Busbars in mm:
DC 100 x 10
AC 50 x 10

Note
By turning of the fan the converter can be adapted to the different space conditions.

Fig. 2.1/8: Dimension drawing C3-Module

Module C3
DCS 50x-0900
DCS 50x-1200
DCS 50x-1500
DCS 50x-2000

Dimensions in mm
Weight appr. 150 kg

Module C4
Connection right-hand side
DCS 50x-2050-xxRx..
DCS 50x-2500-xxRx..
DCS 50x-2650-xxRx..
DCS 50x-3200-xxRx..
DCS 50x-3300-xxRx..
DCS 50x-4000-xxRx..
DCS 50x-4750-xxRx..
DCS 50x-5150-xxRx..

Dimensions in mm
Weight appr. 350 kg

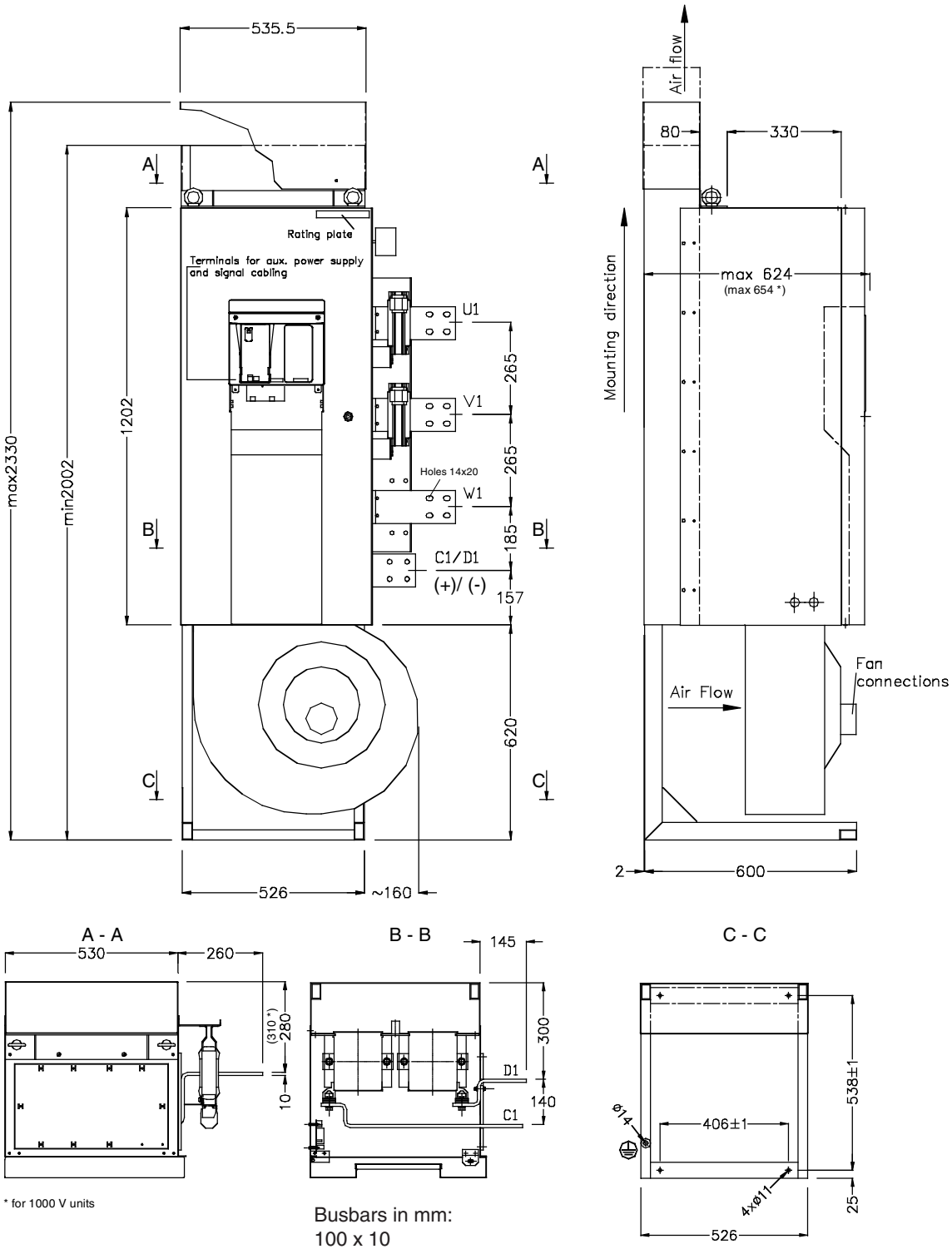
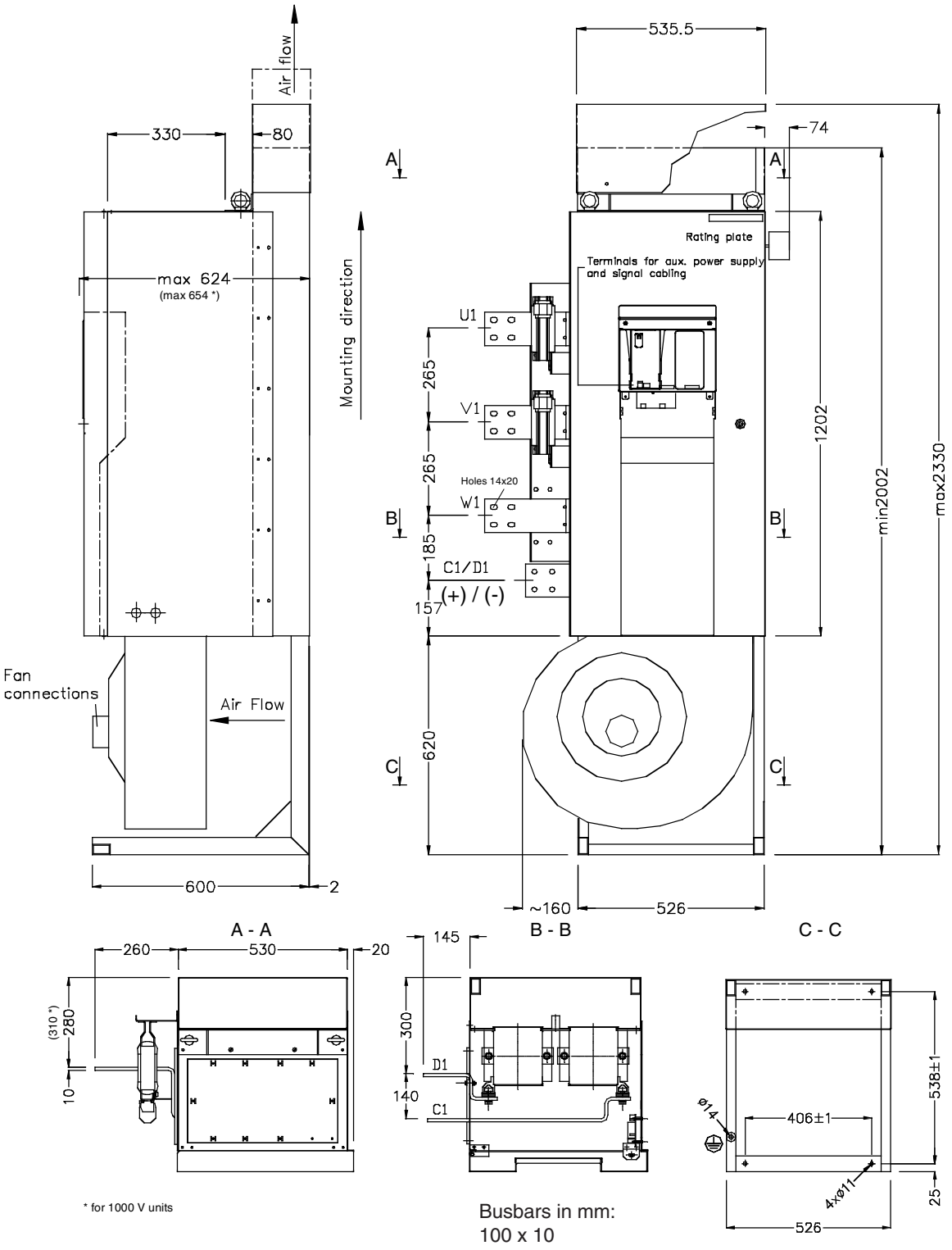


Fig. 2.1/9: Dimension drawing C4-Module with AC/DC power connection Right-hand side



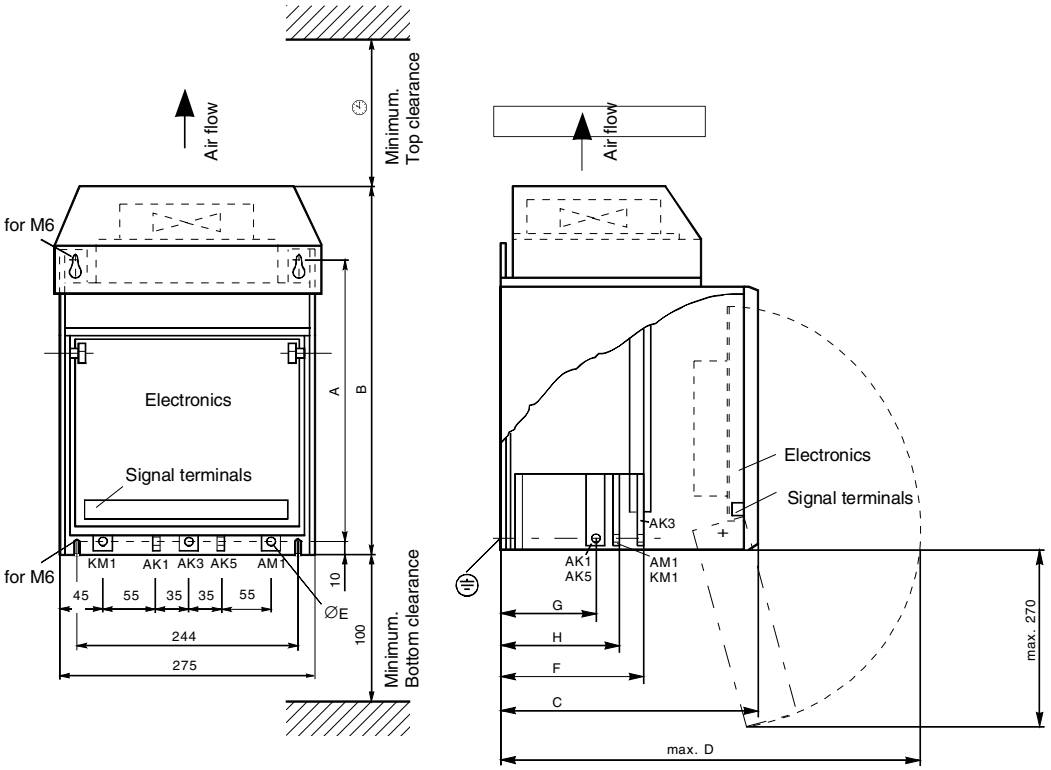
Module C4
Connection left-hand side
DCS 50x-2050-xxLx..
DCS 50x-2500-xxLx..
DCS 50x-2650-xxLx..
DCS 50x-3200-xxLx..
DCS 50x-3300-xxLx..
DCS 50x-4000-xxLx..
DCS 50x-4750-xxLx..
DCS 50x-5150-xxLx..

Dimensions in mm
Weight appr. 350 kg

Fig. 2.1/10: Dimension drawing C4-Module with AC/DC power connection Left-hand side

DCP 50x-0090...
DCP 50x-0540

Dimensions in mm



Type	A	B	C	D	E	F	G	H	⏚	①	Weight:
DCP 50x-0090 ②	320	340	280	530	9	150	115	128	M 8	150	16 kg
DCP 50x-0150 **DCP 50x-0250** **DCP 50x-0350**	320	400	280	530	9	150	115	128	M 8	250	18 kg
DCP 50x-0540	372	450	325	570	11	110	150	165	M 10	350	26 kg

② without fan

Fig. 2.1/11: Dimension drawing DCP 50x-0090...DCP 50x-0540

DCP 50x-0875
DCP 50x-1100
DCP 50x-1650

Dimensions in mm
Weight appr. 115 kg

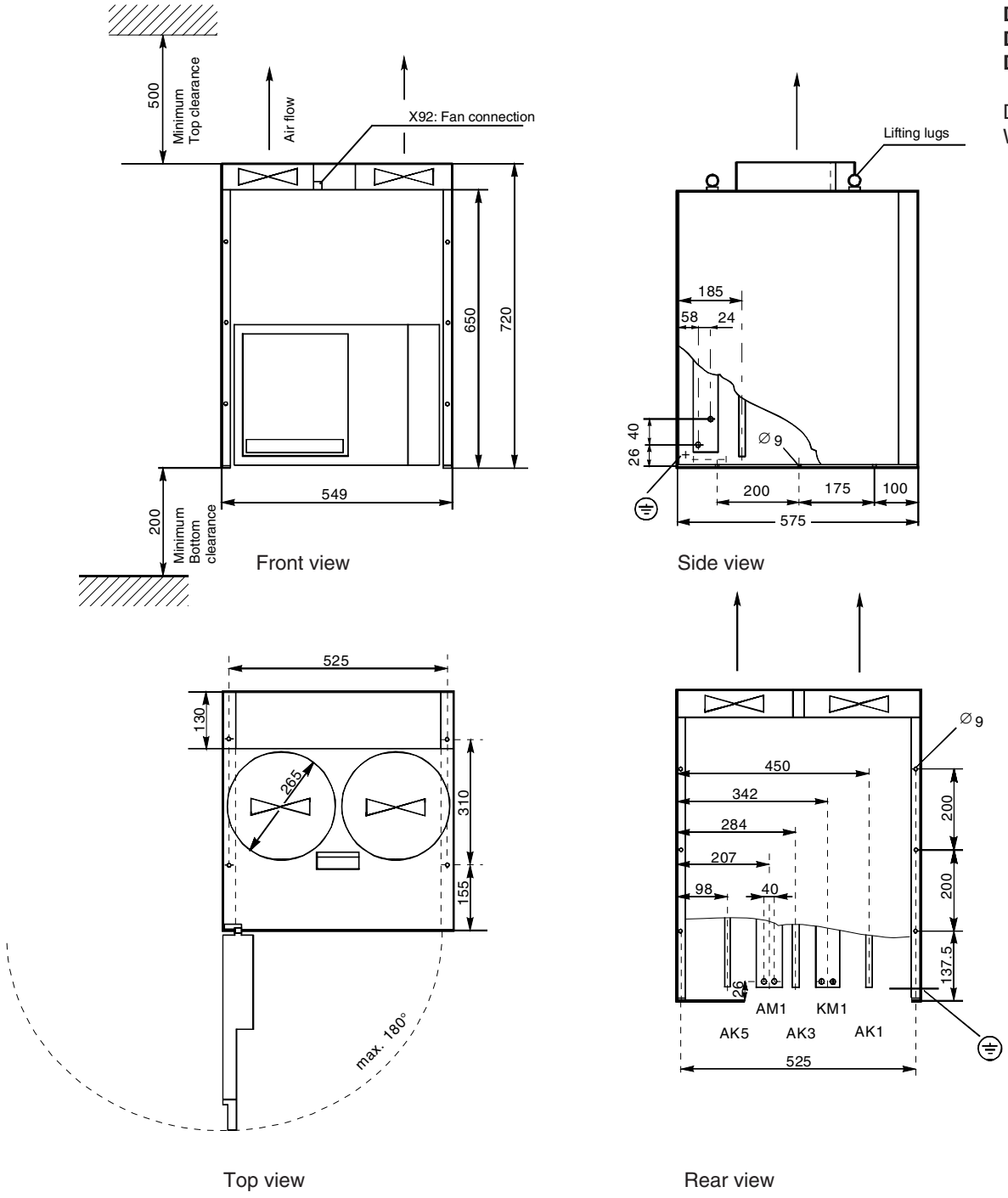
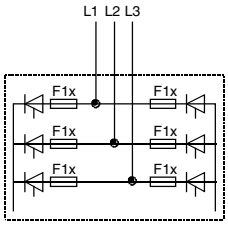


Fig. 2.1/12: Dimension drawing DCP 50x-0875...DCP 50x-1650

2.2 Fuses - installed inside the converter

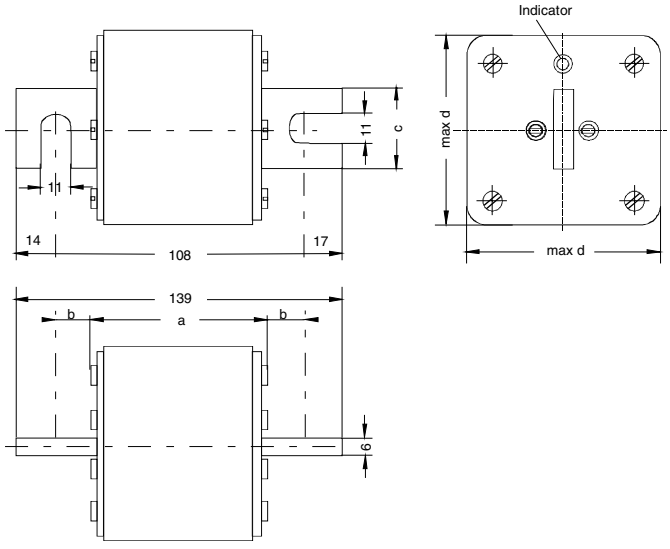
DCS 500 valid for DCS 500 / DCS 500B / DCS 600
DCP 500 valid for DCP 500 / DCP 500B

Converter type	Model	Fuse F1	Size	Manufacturer / Type	Inside calip. [mm]
400 V / 500 V					
DCS 50x-0900-41/51	C3	700A 690V UR	5	Bussman 170M 6035	110
DCS 50x-1200-41/51	C3	700A 690V UR	5	Bussman 170M 6035	110
DCS 50x-1500-41/51	C3	1250A 660V UR	5	Bussman 170M 6166	110
DCS 50x-2000-41/51	C3	1250A 660V UR	5	Bussman 170M 6166	110
DCS 50x-2500-41/51	C4	1700A 1000V UR	8	Bussman 170M 7034	
DCS 50x-3300-41/51	C4	2200A 1000V UR	8	Bussman 170M 7035	
DCS 50x-4000-41/51	C4	2500A 660V UR	7	Bussman 170M 7026	
DCS 50x-5150-41/51	C4	3000A 660V UR	7	Bussman 170M 7028	
DCP 50x-0875-41/51*	-	700A 690V UR	5a	Bussman 170M 6035	110
DCP 50x-1100-41/51*	-	900A 660V UR	5	Bussman 170M 6163	110
DCP 50x-1650-41/51*	-	2x700A 690V UR	5a	Bussman 170M 6035	110
		or 1250A 660V UR	5a	Bussman 170M 6166	110
600 V / 690 V					
DCS 50x-0900-61/71	C3	550A 1250V UR	6	Bussman 170M 6143	110
DCS 50x-1500-61/71	C3	1000A 1000V UR	6	Bussman 170L 7299	110
DCS 50x-2050-61/71	C4	1100A 1000V UR	8	Bussman 170M 7031	
DCS 50x-2500-61/71	C4	1700A 1000V UR	8	Bussman 170M 7034	
DCS 50x-3300-61/71	C4	2200A 1000V UR	8	Bussman 170M 7035	
DCS 50x-4000-61/71	C4	2500A 1000V UR	8	Bussman 170M 7036	
DCS 50x-4750-61/71	C4	2500A 1000V UR	8	Bussman 170M 7036	
790 V					
DCS 50x-2050-81	C4	1100A 1000V UR	8	Bussman 170M 7031	
DCS 50x-3200-81	C4	2200A 1000V UR	8	Bussman 170M 7035	
DCS 50x-4000-81	C4	2500A 1000V UR	8	Bussman 170M 7036	
DCS 50x-4750-81	C4	2500A 1000V UR	8	Bussman 170M 7036	
1000 V					
DCS 50x-2050-91	C4	1500A 1250V UR	9	Bussman 170M 7510	
DCS 50x-2650-91	C4	1500A 1250V UR	9	Bussman 170M 7510	
DCS 50x-3200-91	C4	2000A 1250V UR	9	Bussman 170M 7513	
DCS 50x-4000-91	C4	2100A 1500V UR	10	Bussman 170M 7520	



* for converters with index **D** (on name plate) i.e. DCP 50x**D**0875-41
Table 2.2/1: Fuses installed inside the converter

Size 5, 6, 11

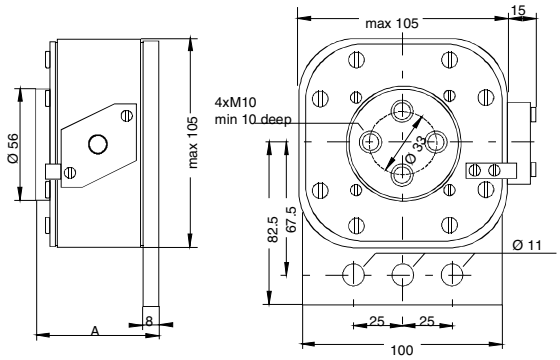


Size	a	b	c	d
5	50	29	30	76
5a	50	29	30	76+14*
6	80	14	30	76
11	50	29	25	61

* tag for clip-on switch

Fig. 2.2/1: Fuses size 5, 6, 11

Size 7...10



Size	A
7	62
8	90
9	105
10	120

Fig. 2.2/2: Fuses size 7...10

Remark:
Given dimensions may be exeeded in some cases. Please take them only for information.

2.3 Cross-sectional areas - Tightening torques

DCS 500 valid for DCS 500 / DCS 500B / DCS 600 / DCF 500 / DCF 600
DCP 500 valid for DCP 500 / DCP 500B, C, D

Recommended cross-sectional area **to DINVDE 0276-1000 and DINVDE 0100-540 (PE)** trefoil arrangement, up to 50°C ambient temperature.

Unit type	C1, D1 (AM1, KM1)			U1, V1, W1 (AK1, AK3, AK5)			PE		
		1.	(2.)		1.	(2.)			
	IDC [A-]	[mm²]	[mm²]	Iv [A~]	[mm²]	[mm²]	[mm²]		[Nm]
DCS 50x-0025-xx	25	1 x 4	-	20	1 x 4	-	1x 4	1 x M6	6
DCS 50x-0050-xx	50	1 x 10	-	41	1 x 6	-	1x 6	1 x M6	6
DCS 50x-0075-xx	75	1 x 25	-	61	1 x 25	-	1x 16	1 x M6	6
DCP 50x-0090-xx	90	1 x 25	-	74	1 x 25	-	1x 16	1 x M8	13
DCS 50x-0100-xx	100	1 x 25	-	82	1 x 25	-	1x 16	1 x M6	6
DCS 50x-0110-xx	110	1 x 25	-	90	1 x 25	-	1x 16	1 x M6	6
DCS 50x-0140-xx	140	1 x 35	-	114	1 x 35	-	1x 16	1 x M6	6
DCP 50x-0150-xx	150	1 x 50	-	123	1 x 35	-	1x 16	1 x M8	13
DCS 50x-0200-xx	200	2 x 35	1 x 95	163	2 x 25	1 x 95	1x 25	1 x M8	13
DCS 50x-0250-xx	250	2 x 35	1 x 95	204	2 x 25	1 x 95	1x 25	1 x M8	13
DCS 50x-0270-xx	270	2 x 35	1 x 95	220	2 x 25	1 x 95	1x 25	1 x M8	13
DCS 50x-0350-xx	350	2 x 70	-	286	2 x 50		1x 50	1 x M8	13
DCS 50x-0450-xx	450	2 x 95	-	367	2 x 95	-	1x 50	1 x M10	25
DCS 50x-0520-xx	520	2 x 95	-	424	2 x 95	-	1x 50	1 x M10	25
DCP 50x-0540-xx	540	2 x 120	-	443	2 x 95	-	1x 50	1 x M10	25
DCS 50x-0680-xx	680	2 x 120	-	555	2 x 120	-	1x120	1 x M12	50
DCS 50x-0700-xx	700	2 x 150	4 x 50	571	2 x 120	3 x 70	1x120	2 x M10	25
DCS 50x-0820-xx	820	2 x 150	-	669	2 x 120	-	1x120	1 x M12	50
DCP 50x-0875-xx	875	4 x 95	3 x 150	713	4 x 70	3 x 95	1x150	2 x M12	50
DCS 50x-0900-xx	900	4 x 95	3 x 150	734	4 x 70	3 x 95	1x150	2 x M12	50
DCS 50x-1000-xx	1000	2 x 185	-	816	2 x 150	-	1x150	1 x M12	50
DCP 50x-1100-xx	1100	4 x 120	-	897	4 x 95	3 x 95	1x185	2 x M12	50
DCS 50x-1200-xx	1200	4 x 120	-	979	4 x 95	3 x 95	1x185	2 x M12	50
DCS 50x-1500-xx	1500	4 x 185	-	1224	4 x 150	-	2x150	2 x M12	50
DCP 50x-1650-xx	1650	4 x 240	-	1346	4 x 185	-	2x185	2 x M12	50
DCS 50x-2000-xx	2000	8 x 120	6 x 185	1632	4 x 240	-	2x240	2 x M12	50
DCS 50x-2050-xx	2050	8 x 120	6 x 185	1673	6 x 120	5 x 150	3x120	4 x M12	50
DCS 50x-2500-xx	2500	7 x 185	-	2040	8 x 120	6 x 185	4x120	4 x M12	50
DCS 50x-2650-xx	2650	7 x 185	-	2162	8 x 120	6 x 185	4x120	4 x M12	50
DCS 50x-3200-xx	3200	8 x 185	-	2611	7 x 185	-	4x150	4 x M12	50
DCS 50x-3300-xx	3300	8 x 185	-	2693	7 x 185	-	4x150	4 x M12	50
DCS 50x-4000-xx	4000	7 x 300	-	3264	8 x 240	-	4x240	4 x M12	50
DCS 50x-4750-xx①	4750	8 x 300	-	3876	6 x 300	-	3x300	4 x M12	50
DCS 50x-5150-xx①	5150	8 x 300	-	4202	6 x 300	-	3x300	4 x M12	50

① Reduced ambient temperature 40°C

Table 2.3/1: Cross-sectional areas - tightening torques

You will find instructions on how to calculate the PE conductor's cross-sectional area in VDE 0100 or in equivalent national standards. We would remind you that power converters may have a current-limiting effect.

DCS 500 valid for DCS 500 / DCS 500B / DCS 600 / DCF 500 / DCF 600

DCS 500

The units' power loss is made up of several different components:

- current-dependent losses P_{V-I}
  - of the thyristors
  - of the fuses
  - of the busbar system
- voltage-dependent losses P_{V-U}
  - snubber circuit of the thyristors

  Remark: If the converter is equpped with SDCS-PIN-20x use values in brackets [ ]
- almost constant losses P_{V-C}
  - unit electronics
  - unit fan
  - field supply

Depending on what you want to achieve by your power-loss study, you must make up your mind on the following points:

- **Efficiency calculation** for the drive system concerned:

  For this purpose, all the power-loss components mentioned above (and additionally the losses caused, for instance, by the motor fan, line reactor, cabling of network/power converter/motor, field supply unit and matching transformer, etc.) must be added.
- **Fan losses** can be estimated by 85% of the fan power consumption (see table 2.5/2).

Converter type ➔	y →		**y=4** (400 V)		**y=5** (500 V)		**y=6** (600 V)		**y=7** (690 V)		**y=8** (790 V)		**y=9** (1000V)	
⬇ x=**1** → 2-Q	I_{DC} [A]		[W]		[W]		[W]		[W]		[W]		[W]	
x=**2** → 4-Q	4Q	2Q	P_{V-I}	P_{V-U}	P_{V-I}	P_{V-U}	P_{V-I}	P_{V-U}	P_{V-I}	P_{V-U}	P_{V-I}	P_{V-U}	P_{V-I}	P_{V-U}
DCS50x-0025-y1	25	25	60	30	60	47								
DCS50x-0050-y1	50	50	123	30	123	47								
DCS50x-0050-61	50	50					108	46						
DCS50x-0075-y1	75	75	175	30	175	47								
DCS50x-0100-y1	100	100	207	96[50]	207	149[70]								
DCS50x-0110-61	110	100					284	151[100]						
DCS50x-0140-y1	140	125	311	96[50]	311	149[70]								
DCS50x-0200-y1	200	180	488	96[50]	488	149[70]								
DCS50x-0250-y1	250	225	656	96[50]	656	149[70]								
DCS50x-0270-61	270	245					781	151[100]						
DCS50x-0350-y1	350	315	840	96[50]	840	149[70]								
DCS50x-0450-y1	450	405	1040	138[70]	1040	216[80]	1119	196[110]						
DCS50x-0520-y1	520	470	1238	138[70]	1238	216[80]								
DCS50x-0680-y1	680	610	1622	[105]	1622	[140]								
DCS50x-0700-y1	700	700	1604	447[80]	1604	698[100]								
DCS50x-0820-y1	820	740	1986	[125]	1986	[160]								
DCS50x-1000-y1	1000	900	2527	[125]	2527	[160]								
DCS50x-0900-y1	900	900	2664	203	2664	317	3801	457	3801	605				
DCS50x-1200-y1	1200	1200	4095	305	4095	476								
DCS50x-1500-y1	1500	1500	4069	406	4069	635	4963	914	4963	1209				
DCS50x-2000-y1	2000	2000	6127	609	6127	952								
DCS50x-2050-y1	2050	2050					8017	503	8017	665	8017	871	7278	1396
DCS50x-2500-y1	2500	2500	7611	305	7611	476	7611	685	7611	907				
DCS50x-2650-y1	2650	2650											10673	1396
DCS50x-3200-y1	3200	3200									10287	871	11073	1396
DCS50x-3300-y1	3300	3300	10764	305	10764	476	10764	685	10764	907				
DCS50x-4000-y1	4000	4000	12251	305	12251	476	12914	503	12914	665	12914	871	14430	1396
DCS50x-4750-y1	4750	4750					14309	503	14309	665	14309	871		
DCS50x-5150-y1	5150	5150	15322	305	15322	476								

Table 2.4/1: DCS 500 Power losses

Remarks on the table

- The values stated are "worst case", i.e. the values obtained under the most unfavourable conditions.
- The losses of the unit electronics can be assumed to be P_{V-C} = 30 ... 60 W, dependent on the loading involved (SDCS-COMx, number of binary inputs to "1-signal", pulse encoder used, etc.).
- The current-dependent losses can be converted as follows for the partial load range:

$$P_{V-I\,teil} \approx P_{V-I} * 0{,}6 * \frac{x\%}{100\%} + P_{V-I} * 0{,}4 * \left(\frac{x\%}{100\%}\right)^2$$

- For the units ≤ 1000 A, the losses due to external semiconductor busbars, busbar systems/wiring are not included.

DCP 500

Converter type ↓			at 400 V		at 500 V	
x=1 → 2-Q	I_{DC} [A]		P_V [W]		P_V [W]	
x=2 → 4-Q	4Q	2Q	4Q	2Q	4Q	2Q
DCP50x-0090-41/51	90	80	320	290	320	290
DCP50x-0150-41/51	150	140	530	490	540	500
DCP50x-0250-41/51	250	235	930	860	930	870
DCP50x-0350-41/51	350	320	1020	930	990	900
DCP50x-0540-41/51	540	500	1550	1390	1550	1430
DCP50x-0875-41/51	875	950	3830	4180	3900	4250
DCP50x-1100-41/51	1100	1180	4540	4900	4610	4980
DCP50x-1650-41/51	1650	1750	5940	6340	6080	6480

Table 2.4/2: DCP 500 Power losses (P_V)

2.5 Power section cooling

DCS 500 valid for DCS 500 / DCS 500B / DCS 600 / DCF 500 / DCF 600

Fan assignment for DCS 500

Converter type	Model	Configuration	Typ
DCS 50x-0025-y1 ... DCS 50x-0075-y1	C1	1	CN 52 B2
DCS 50x-0100-y1 ... DCS 50x-0140-y1	C1	2	W2E 143
DCS 50x-0200-y1 ... DCS 50x-0820-y	C2	3	W2E 200
DCS 50x-1000-y1	C2	3	W2E 250
DCS 50x-0900-y1 ... DCS 50x-2000-y1	C3	4	RD 23 P-4D
DCS 50x-2050-y1 ... DCS 50x-5150-y1	C4	5	RG 35 P-4D...R for DCS 50x-xxxxLy1 RG 35 P-4D...L for DCS 50x-xxxxRy1

Table 2.5/1: Fan assignment for DCS 500

Fan data for DCS 500

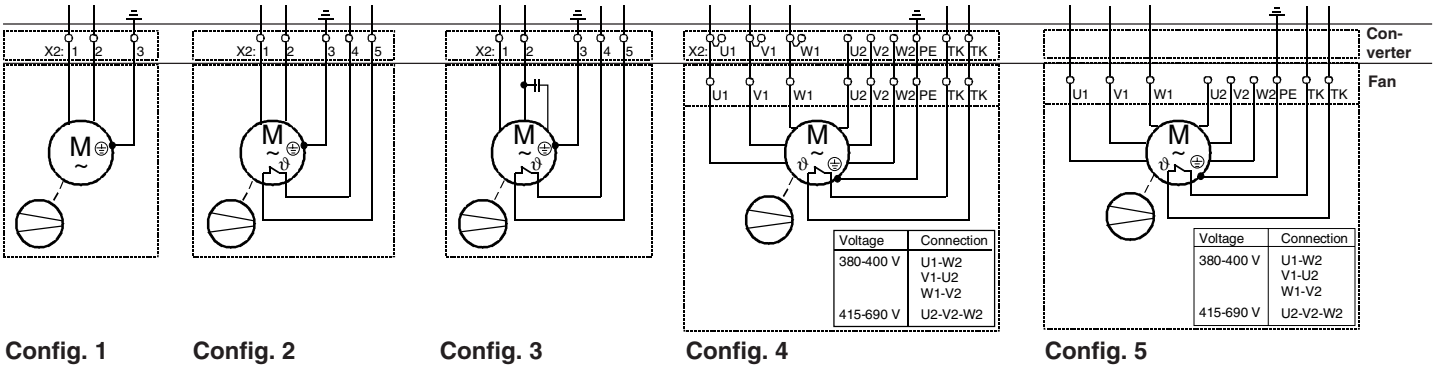
Fan	CN 52 B2		W2E 143		W2E 200		W2E 250		RD 23 P-4D		RG 35 P-4D...R for DCS 50x-xxxxLy1 RG 35 P-4D...L for DCS 50x-xxxxRy1	
Rated voltage [V]	208...230; 1~		230; 1~		230; 1~		230; 1~		400; 3~ Δ-conn. 690; 3~ ⅄-conn.		400; 3~ Δ-conn. 690; 3~ ⅄-conn.	
Tolerance [%]	±10		+6/-10		+6/-10		+6/-10		±10		±10	
Frequency [Hz]	50	60	50	60	50	60	50	60	50	60	50	60
Power consumption [W]	14	13	26	29	64	80	135	185	780	1200	3800	3800
Current consumption [A]	0.14	0.12	0.12	0.13	0.29	0.35	0.59	0.82	1.7/1.05	2.1/1.25	6.5/3.7	< 6.5/3.7
Blocking current [A]	< 0.25	< 0.2	< 0.3	< 0,4	< 0.7	< 0.8	< 0.9	< 0.9	6.3/3.8	7.8/4.6	27/15	< 27/15
Air volume, freely blowing [m³/h]	156	180	375	440	925	1030	1860	1975	-		-	
Working point [m³/h] at A	-		-		-				appr. 3000/ 0.72 A ⅄		appr. 3500/ 2.3 A ⅄②	appr. 4200/ 3.2 A ⅄ ②
Max. ambient temperature [° C]	< 60		< 85		< 75		60		< 40		< 40	
Useful lifetime of grease	appr. 25000 h/60°		appr. 45000 h/60°		appr. 45000h/60°		appr. 40000 h		appr. 40000 h/40°		appr. 40000 h/40°	
Protection	Impedance ①		Temperatur detector: $U_N \leq 230$ V~; $I_N \leq 2.5$ A~									

① Increased losses due to increased current with a blocked rotor will not result in a winding temperature, higher than permissible for the insulation class being involved.
② The motor current will be appr. 20% higher and the airflow appr. 20% lower, if the fan is used at 415 V ⅄

Table 2.5/2: Fan data for DCS 500

Fan connection for DCS 500

Phase sequence is different for L and R type. See cover of fan terminal box.



Config. 1 **Config. 2** **Config. 3** **Config. 4** **Config. 5**

Monitoring the DCS 500 power section

a. The power sections of sizes C1 and C2 are monitored by an electrically isolated PTC thermistor detector, which is installed on the likewise electrically isolated heat sink near the thyristors. The resistance change proportional to the temperature is acquired and evaluated in the unit's software. If the temperature rises above a certain value predefined by the unit coding involved, then first an alarm will be outputted, and - if the temperature continues to rise - an error message. This means that changes in the rated cooling conditions, such as cooling air volume and temperature, the fan itself, overload due to an excessively high load current, etc. are detected.

b. The size-C3 power section is likewise monitored by an electrically isolated PTC thermistor detector, which is installed on the non-isolated heat sink in an isolated configuration by means of an adaptor plate and an isolating disk. Evaluation of the resistance and the protection effect correspond to those mentioned for point (a.) above.

c. The size-C4 power section is not directly monitored by an electrically isolated PTC thermistor detector. For this size, the same thermistor detector is used as for (a.) and (b.) above, but it is here not mounted on a heat sink but at the unit's housing in the upper intake air zone. The detector thus measures the power section's radiated heat and any changes in the cooling air temperature and volume. Since the cooling air volume can only be detected indirectly, a differential-pressure switch has been additionally fitted at the unit's housing.
The resistance change proportional to the temperature is acquired and evaluated in the unit's software. If the temperature rises above the parameterized value, then first an alarm will be outputted, and - if the temperature continues to rise - an error message. The value to be set for this parameter must not be more than 10 degrees above the permissible ambient temperature.
The differential-pressure switch compares the pressure inside the unit with the normal atmospheric pressure. If the fan has been switched on and the unit door closed (and no unit casings have been removed), the pressure switch will signal "Cooling conditions ok", which means the drive may be enabled. There is no need to set any specific differential pressure (recommendation: centre setting).

Fan assignment for DCP 500

Converter type	Configuration	Type
DCP 50x-0150-y1	1	W2S 107
DCP 50x-0250-y1 ... DCP 50x-0350-y1	2	W2S 130
DCP 50x-0540-y1	3	W2E 200
DCP 50x-0875-y1 ... DCP 50x-1650-y1	4a/4b	2x W2E 250

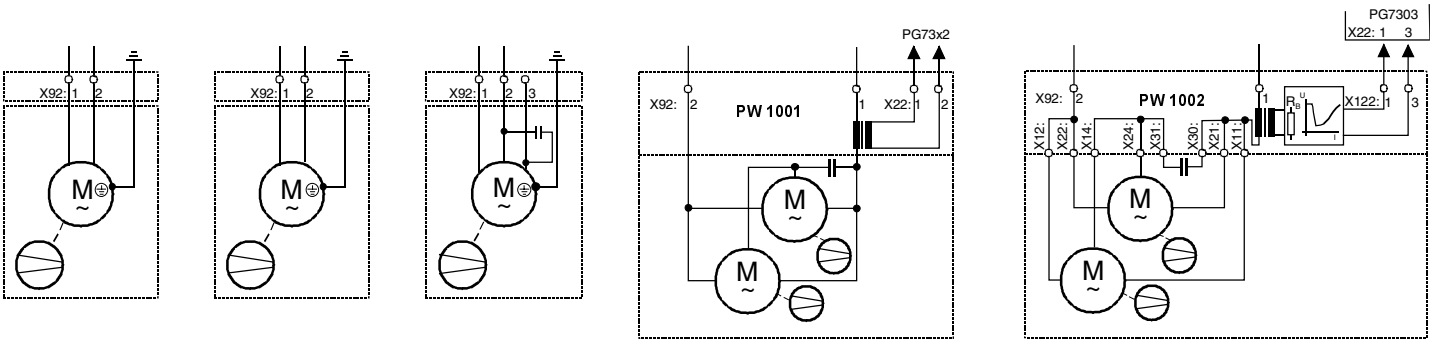
Table 2.5/3: Fan assignment for DCP 500

Fan data for DCP 500

Fan	W2S 107		W2S 130		W2E 200		W2E 250 Data per fan	
Rated voltage [V]	230; 1~		230; 1~		230; 1~		230; 1~	
Tolerance [%]	+10/-6		+10/-6		+10/-6		+10/-6	
Frequency [Hz]	50	60	50	60	50	60	50	60
Power consumption [W]	19	18	45	40	55	75	160	240
Current consumption [A]	0.12	0.11	0.25	0.26	0.26	0.33	0.75	1.08
Blocking current [A]	< 0.25	< 0.2	< 0.4	< 0.5	< 0.6	< 0.7	< 1.6	< 2.1
Air volume, freely blowing [m³/h]	160	180	330	380	670	770	1740	1810
Max. ambient temperature [° C]	< 60		50	70	< 75		55	40
Useful lifetime of grease	appr. 20000 h/35°C		appr. 20000 h/35°C		appr. 20000 h/35°C		appr. 39000 h/35°C, 50Hz appr. 24000 h/35°C, 60Hz	
Protection	Impedance		Impedance		Impedance		Impedance	

Table 2.5/4: Fan data for DCP 500

Fan connection for DCP 500



Config. 1 **Config. 2** **Config. 3** **Config. 4a** **Config. 4b**

for converters with index **A, B, C** (on name plate)

for converters with index **D** (on name plate) i.e. DCP 50x**D**0875-41

3 Control boards

3.1 Control Board SDCS-CON-1

The control board is based on the 80C186 microprocessor and the ASIC circuit DC94L01.

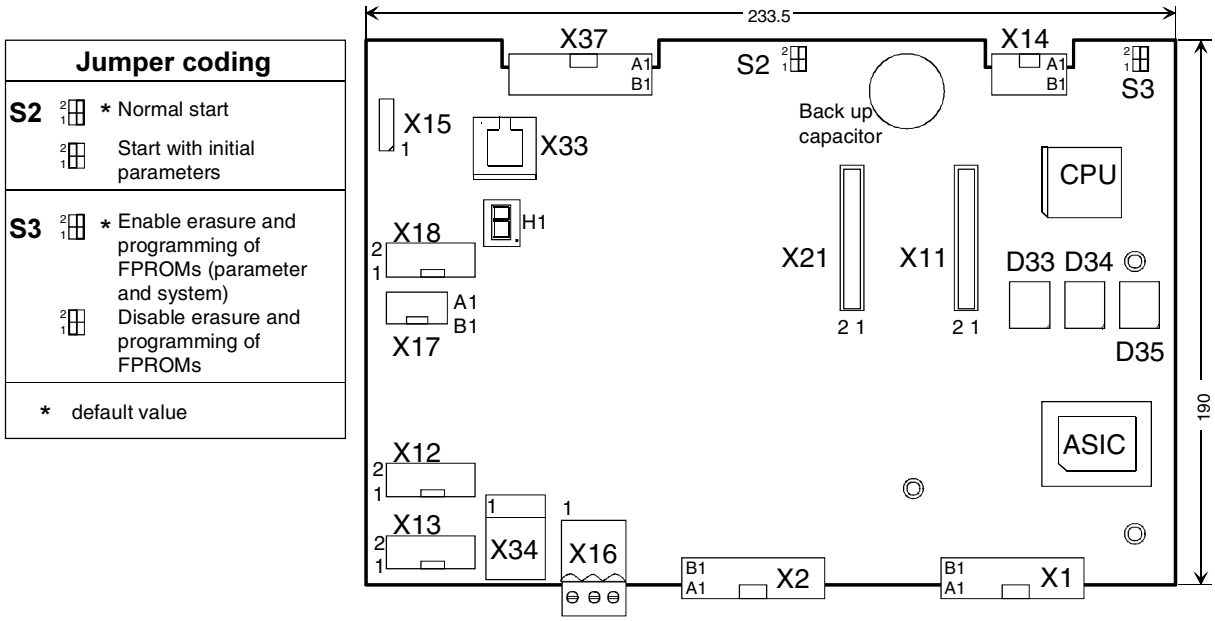


Fig. 3.1/1 Layout of the control board SDCS-CON-1

Memory circuits and the back-up
The program including system and parameter values is stored at Flash PROMs D33 and D34. Different programs can be downloaded directly to these PROMs. Application functionallity and parameter values are saved in the Flash PROM D35.
Fault and Alarm messages are stored in static RAM circuits. They have a back up capacitor of 1 F, which lasts minimum 8 hours, typically several days. It takes about 30 minutes to charge the backup capacitor.

ASIC function
ASIC = Application Specific Integrated Circuit
Most of the measurements and control functions for the DCS500 are done in the ASIC:
- communication with control panel (RS 485)
- communication with field exciters (RS 485)
- measurement
- watchdog function
- A/D and D/A-conversion control
- thyristor firing pulse generation

Watchdog function
The control board has an internal watchdog. The watchdog controls the running of the control board program. If the watchdog trips, it has the following effects:
- FPROM programming voltage is forced low.
- Thyristor firing control is reset and disabled.
- Digital outputs are forced low.
- Programmable analogue outputs are reset to zero, 0V.

Seven segment display
A seven segment display is located on the control board and it shows the state of drive.

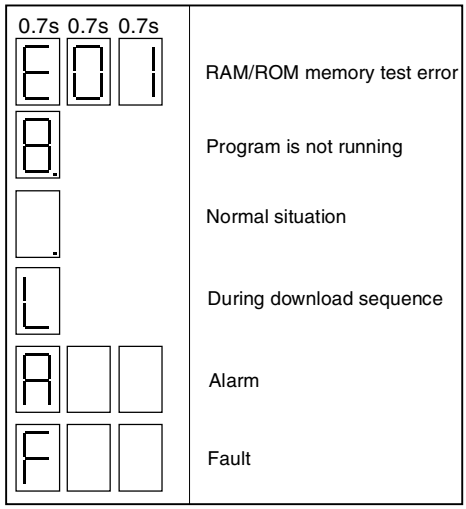


Fig. 3.1/2 Seven segment display of the SDCS-CON-1

RS485 serial communication channels
The control board has two RS485 channels. The first channel is for field exciter control (terminals X16:1...3) and the second for the control panel (CDP 310) at terminals X33 or X34. The terminals X33 and X34 are wired up in parallel internally.

Auxiliary power distribution

The electronic power supply board POW-1 (see separate chapter) generates different levels of voltages. Some of them are transferred via the CON-1 board directly to the boards, where they are used, others are manipulated and then transfered.

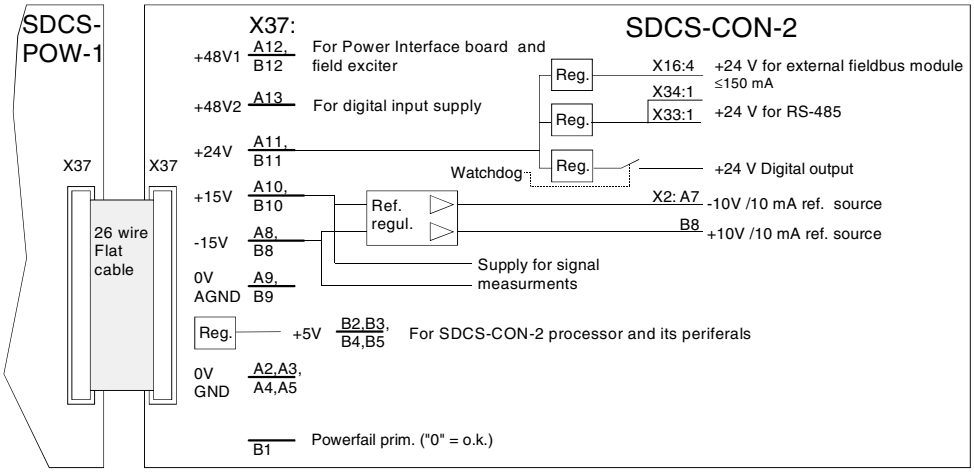


Fig. 3.1/3 Auxiliary power distribution on the board SDCS-CON-1

Supply voltage monitoring

The control board monitors the following voltage levels:

Supply voltage	+5 V	+15 V	-15 V	+24 V	+48 V1	+48 V2
Undervoltage tripping level	+4.55 V	+12.4 V	- 12.0 V	+19 V	+38 V	+38 V
Test terminals X37:	B4 / B5	B10	B8	B11	B12	--------

The electronic power supply system with the different voltage levels is monitored in two ways. There is a signal powerfail primary, which monitors the input power supply voltage of the POW-1 board and a signal powerfail secondary, which monitors the low voltage levels. If one voltage level drops below the threshold a trip signal is generated.
In addition to that there is a monitoring function for the 5 V level. If +5 V drops under the tripping level, it causes a master reset by hardware. All I/O registers are forced to 0 and the firing pulses are suppressed.

3.2 Control Board SDCS-CON-2

The control board is based on the 80186EM microprocessor and the ASIC circuit DC94L01.

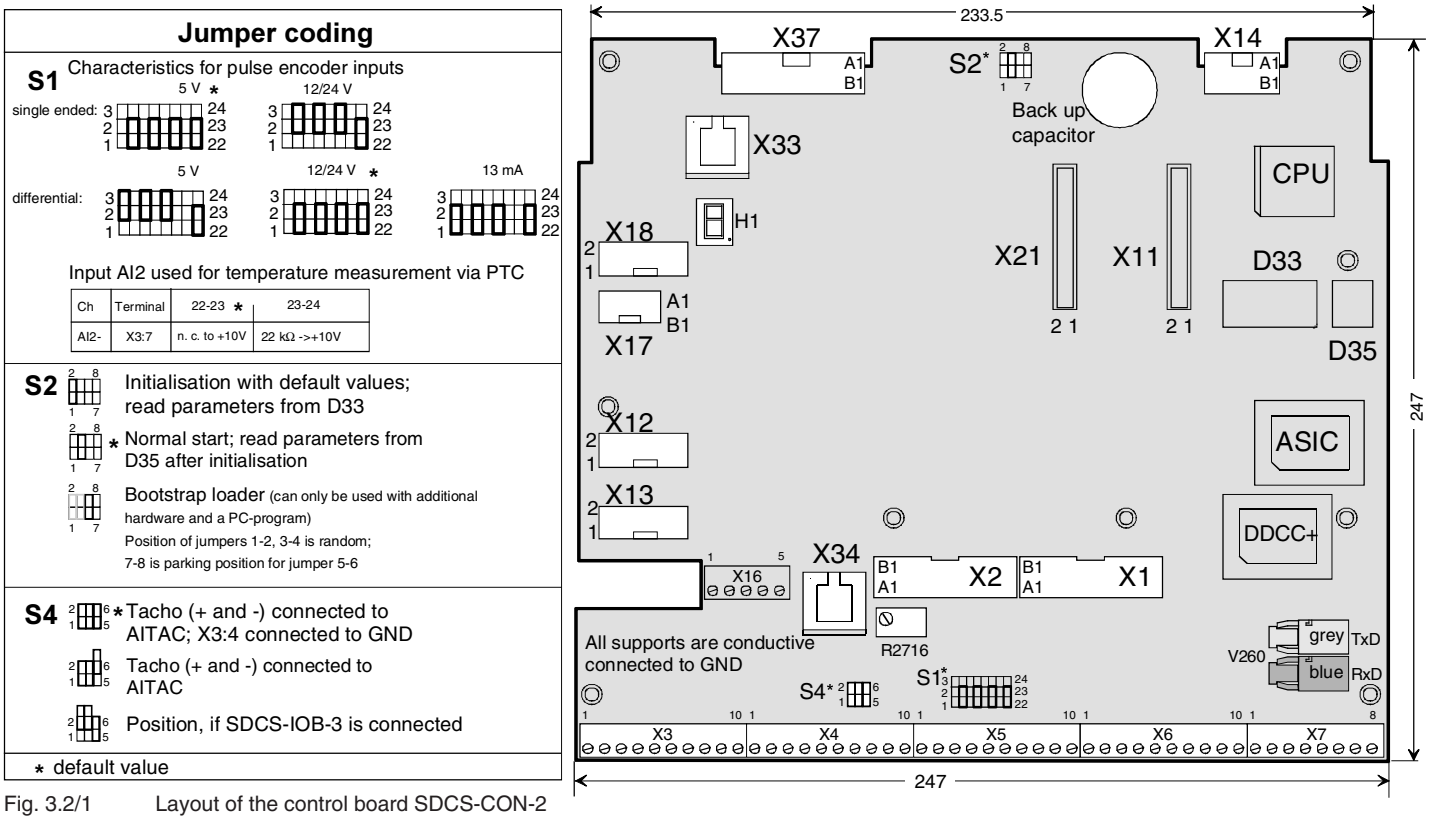


Fig. 3.2/1 Layout of the control board SDCS-CON-2

Memory circuits and the back-up
The program including system and parameter values is stored at Flash PROM D33. Different programs can be downloaded directly to these PROMs. Application functionallity and parameter values are saved in the Flash PROM D35.
Fault and Alarm messages -the time of their appearance and some other values like the operating hours and so on- are stored in static RAM circuits. They have a back up capacitor of 1 F, which lasts minimum 8 hours, typically several days. It takes about 30 minutes to charge the backup capacitor.

ASIC function
ASIC = Application Specific Integrated Circuit
Most of the measurements and control functions for the DCS500 are done in the ASIC:
- communication with control panel (RS 485)
- communication with field exciters (RS 485)
- measurement
- watchdog function
- A/D and D/A-conversion control
- thyristor firing pulse generation

Watchdog function
The control board has an internal watchdog. The watchdog controls the running of the control board program. If the watchdog trips, it has the following effects:
- Writing to FPROM is disabled.
- Thyristor firing control is reset and disabled.
- Digital outputs are forced low.
- Programmable analogue outputs are reset to zero, 0V.

Seven segment display
A seven segment display is located on the control board and it shows the state of drive.

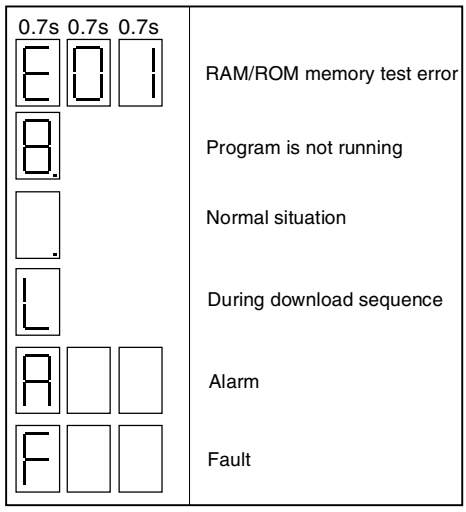


Fig. 3.2/2 Seven segment display of the SDCS-CON-2

Auxiliary power distribution

The electronic power supply board SDCS-POW-1 (see separate chapter) generates different levels of voltages. Some of them are transferred via the CON-2 board directly to the boards, where they are used, others are manipulated and then transfered.

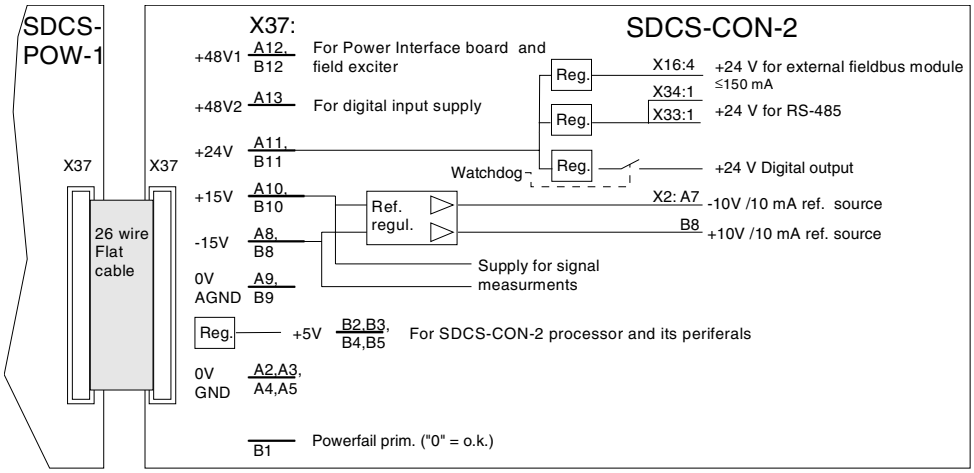


Fig. 3.2/3 Auxiliary power distribution on the board SDCS-CON-2

Supply voltage monitoring

The control board monitors the following voltage levels:

Supply voltage	+5 V	+15 V	-15 V	+24 V	+48 V1	+48 V2
Undervoltage tripping level	+4.55 V	+12.4 V	- 12.0 V	+19 V	+38 V	+38 V
Test terminals X37:	B4 / B5	B10	B8	B11	B12	--------

The electronic power supply system with the different voltage levels is monitored in two ways. There is a signal powerfail primary, which monitors the input power supply voltage of the POW-1 board and a signal powerfail secondary, which monitors the low voltage levels. If one voltage level drops below the threshold a trip signal is generated.

In addition to that there is a monitoring function for the 5 V level. If +5 V drops under the tripping level, it causes a master reset by hardware. All I/O registers are forced to 0 and the firing pulses are suppressed.

RS485 serial communication channels

The control board has two RS485 channels. The first channel is for field exciter control of DCF 501/502, DCF 503/504 or DCF 601/602 (terminals X16:1...3) and the second for the control panel (CDP) at terminals X33 or X34. The terminals X33 and X34 are wired up in parallel internally.

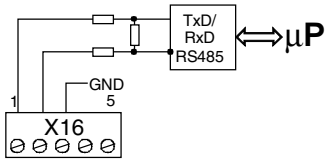


Fig. 3.2/4 Connection for field supply units DCF xxx to the RS485 Communication Interface of the SDCS-CON-2 board.

DDCS Channel integrated

The control board SDCS-CON-2 has an integrated DDCS (**D**igital **D**rive **C**ontrol **S**ystem) channel with a tranfer rate up to 4 Mbits/s. This channel (V260) e.g. can be used for fieldbus modules. The terminals X16:4 and 5 are provided for power supply of the modules.

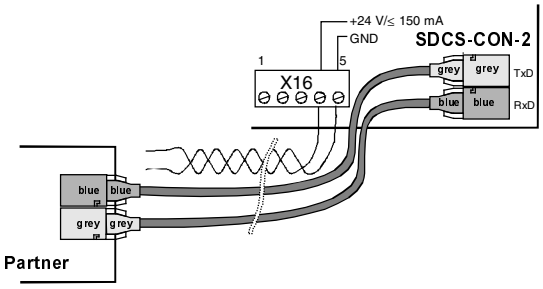
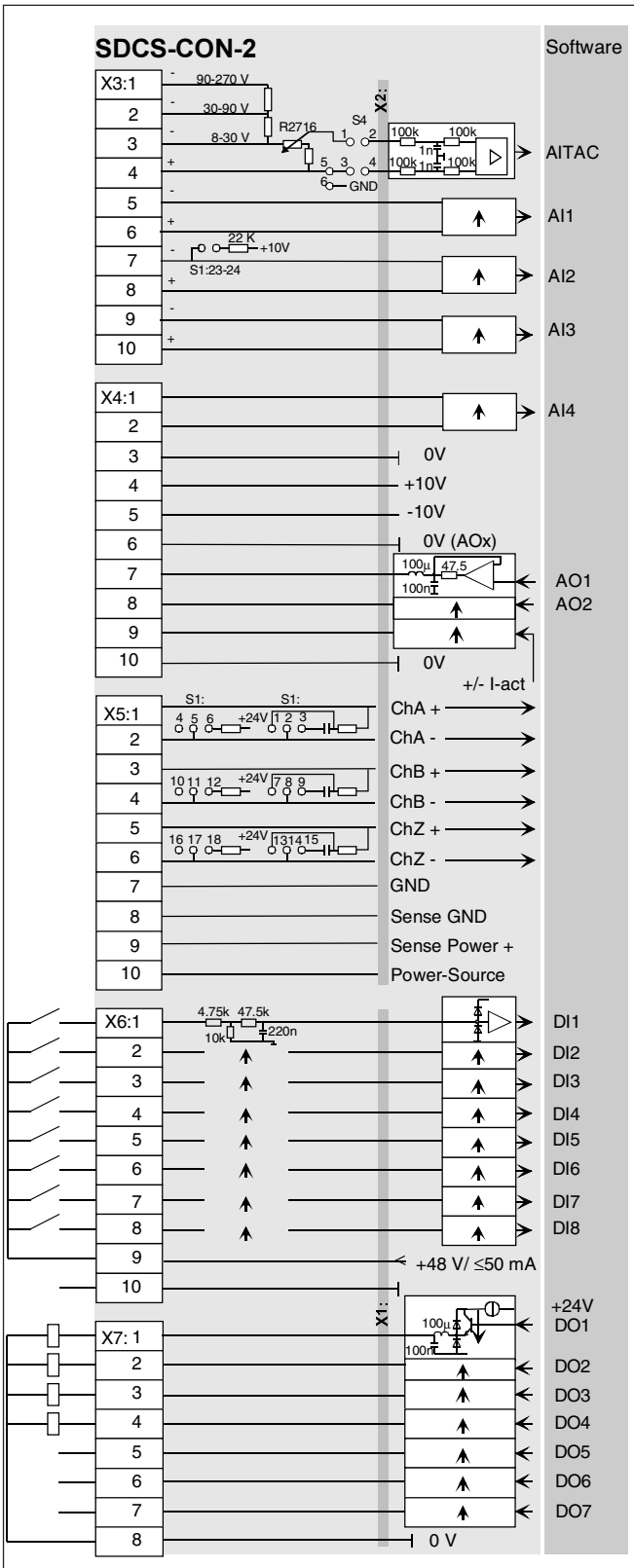


Fig. 3.2/5 Connection of the DDCS channel with power supply to the control board SDCS-CON-2



The terminal connectors X3: ... X7: and X16: are removable. When connecting the terminal blocks to the CON-2 board, please start with the left connector at first and make sure, that they will be placed on the board in the correct sequence and without spaces in between.

Resolution [bit]	Input/output values Hardware	Scaling by	Power	Common mode range	Remarks
12 + sign	±90...270 V ±30...90 V ±8...30 V	R 2716/ Software		±20 V	① ② ③ ④
12 + sign	-10...0...+10 V	Software		±20 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
			≤5 * mA ≤5 * mA		for external use e.g. reference pot.
11 + sign 11 + sign analogue	-10...0...+10 V -10...0...+10 V ±3 V	Software Software fixed	≤5 * mA ≤5 * mA ≤5 * mA		 3 V ≙ nom. conv. curr.

Encoder supply		Remarks
		Inputs not isolated Impedance = 120 Ω, if selected max. frequence ≤300 kHz
5V/ 12V/24V	≤0.25 mA * ≤0.2 mA *	Sense lines for GND and supply to correct voltage drops on cable (only if 5V/12V encoder is in use) Selectable on POW-1 board

Input value	Signal definition by	Remarks
0...8 V 16...60 V	Software	≙ "0" status ≙ "1" status

Output value	Signal definition by	Remarks
50 * mA	Software	Current limit for all 7 outputs = 160 mA **Do not apply any reverse voltages!**

① total smoothing time ≤2 ms
② -20...0...+20 mA by external 500 Ω resistor
③ 4...20 mA by ② + Software function
④ Remove jumper S4:1-2 and 3-4 if SDCS-IOB-3 is used
* short circuit proof (but a short-circuit can cause a malfunction of the drive)

Fig. 3.2/6 Terminal connection of the SDCS-CON-2 board

4 Power Supply Board

4.1 Power Supply Board SDCS-POW-1

The SDCS-POW-1 board is designed for DCS 500 converter modules and is mounted on the electronic support. This board is used for all types of modules independant from current or voltage range.

The SDCS-POW-1 works on a switched mode basis in fly back configuration. It generates all necessary DC voltages for the SDCS-CON-1 and all other electronic boards. The input voltage can be selected via the switch SW1 either to 230 V AC or to 115 V AC. The following figure shows the instructions for the selection of the AC input voltage and for the selection of the encoder supply voltage.

If an SDCS-CON-1 with SDCS-IOB-1 board, or an SDCS-CON-2 (without I/O board IOB-3) together with a pulse encoder is used for speed measurement, the incremental encoder supply voltage must be selected by jumpers X5, X4 and X3.

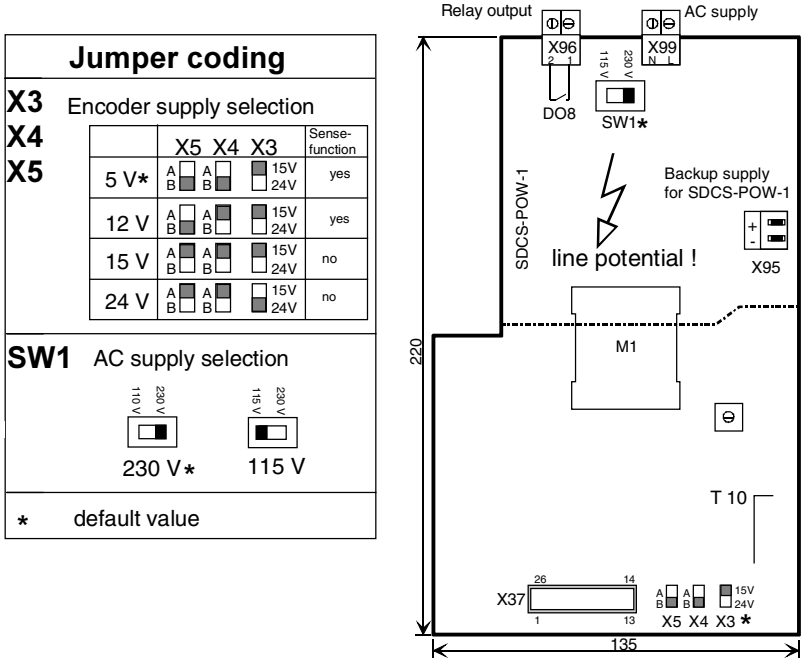


Fig. 4.1/1 Layout of the SDCS-POW-1 board

AC Supply voltage

Supply voltage	115 V AC	230 V AC
Tolerence	-15%/+10%	-15%/+10%
Frequency	45 Hz ... 65 Hz	45 Hz ... 65 Hz
Power consumption	120 VA	120 VA
Power loss	≤60 W	≤60 W
Inrush current	20 A / 20 ms	10 A / 20 ms
Mains buffering	min 30 ms	min 30 ms

Supply voltage	+5 V *	+15 V	+24 V	+48 V2
Test terminals	X 5 B	X3 A	X3 B	heat sink T 10

* The 5 volt level can be checked, if 5 volt is selected!

Output X96-DO8
Potential isolated by relay (NO contact)
MOV- element (275 V)
Contact rating: **AC**: ≤250 V~/ ≤3 A~
DC: ≤24 V-/ ≤3 A-
or ≤115/230 V-/ ≤0.3 A-)

Backup supply
These two terminals are used to add additional capacitance to the existing ones to increase the mains buffering time. More detailed data is available on request via your ABB representative.

5 Power interface boards

5.1 Power Interface Board SDCS-PIN-1x

The power interface board is used for converter modules model C1. There are 2 different versions in use. The used types are:

- SDCS-PIN-11 for **25 A**, **50 A** and **75 A** converters at **500V**
- SDCS PIN-12 for **50 A** converters at **600 V**

The SDCS-PIN-1x boards consists of:

- firing pulse circuits and pulse transformers
- measurement of the armature current via current transformers
- snubber circuit for thyristors protection (consists of RC circuits and MOV elements)
- AC and DC high ohmic voltage measurement
- heat sink temperature measurement via PTC sensor
- scaling for rated current, zero current detection and HW type coding
- If the SDCS-PIN-11 connection board is installed in a **DCF**50x-0025...0075 / **DCF**60x-0025...0075, then the resistors R113, R116 and R119 are not build-in

Note:
If this PCB is used as a spare part for a **DCF**.... , then the resistors R113/R116/R119 (value = 0 Ω) must be removed.

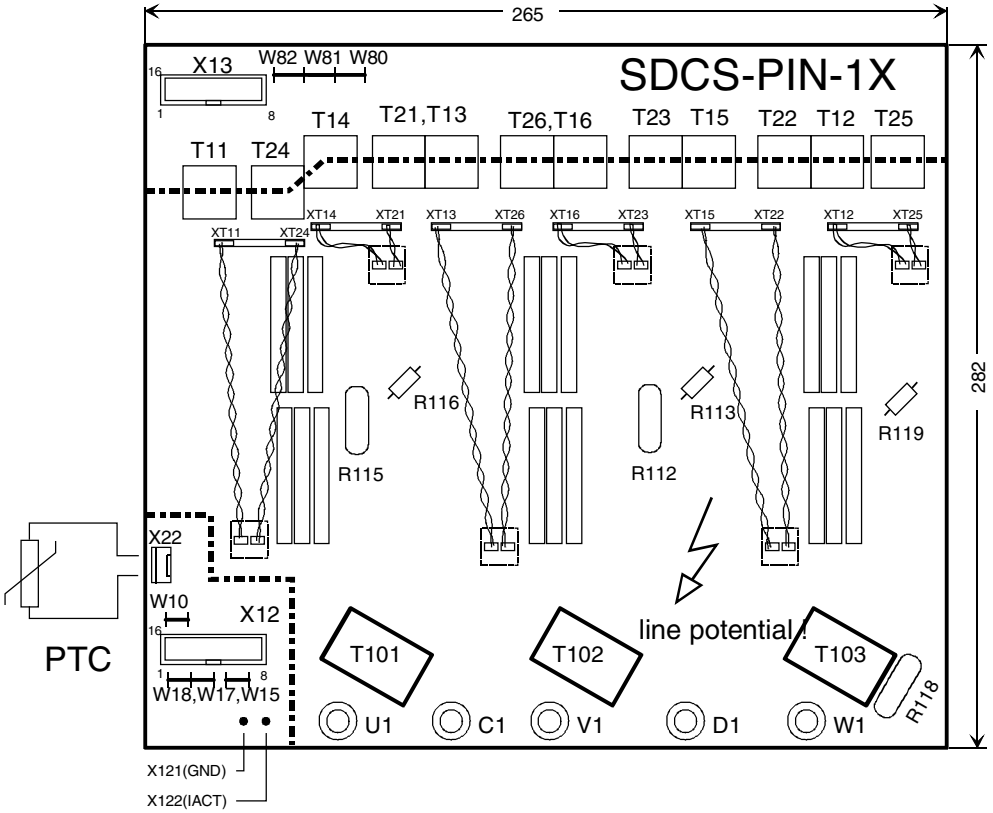


Fig. 5.1/1 Layout of the SDCS-PIN-1x board.

Board type		PIN 11			PIN 12
Current transformer ratio		1500:1			1500:1
Max. rated voltage [V]		500	500	500	600
Rated current [A]		25	50	75	50
W10	2Q= ⊖✕⊖; 4Q= ⊖—⊖	←	←	←	←
W15	zero current detection	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖
W17	rated current scaling	⊖✕⊖	⊖—⊖	⊖—⊖	⊖—⊖
W18	rated current scaling	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖
W80	HW type coding	⊖✕⊖	⊖✕⊖	⊖—⊖	⊖✕⊖
W81	HW type coding	⊖✕⊖	⊖—⊖	⊖✕⊖	⊖—⊖
W82	HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖

Board used as a spare part:
- default: all jumpers W10-W82 are in ⊖—⊖ condition
- ensure the correct converter type related settings

⊖✕⊖ indicates a removed jumper

Table 5.1/1 Settings of the SDCS-PIN-1x board if a DCS converter is equipped with it by ABB

5.2.1 Power Interface Board SDCS-PIN-2x

The power interface board is used for DCS 500 converter modules models C1 and C2. There are different versions in use. The used types are:

- SDCS-PIN-21 for **100 A...350 A** Converters at **500 V**
- SDCS-PIN-22 for **450 A...520 A** Converters at **500 V** ①
- SDCS-PIN-23 for **110 A...270 A** Converters at **600 V**
- SDCS-PIN-24 for **450 A** Converters at **600 V** ①
- SDCS-PIN-25 for **700 A** Converters at **500 V**

① at these boards the SDCS-PIR-21 is used

Resistors R112, R114 and R116 are fitted with MOV elements on the SDCS-PIN-23/24, and on all other PIN-boards with 0-Ω resistors.

The SDCS-PIN-2x board consists of:

- firing pulse circuits with pulse transformers
- measurement of the armature current
- snubber circuit for thyristors protection (consists of RC circuits and MOV elements)
- AC and DC high ohmic voltage measurement
- scaling for rated current, zero current detection and HW voltage type coding
- interface for heat sink temperature measurement with a PTC sensor
- fuses for overvoltage protection and voltage measuring
- If the SDCS-PIN-21/22 connection board is installed in a **DCF**50x-0100...0520 / **DCF**60x-0100...0520, then the components R112, R114 and R116 are not build-in

Note:
If this PCB is used as a spare part for a **DCF**.... , then the resistors R112/R114/R116 (value = 0 Ω) must be removed.

Spare part
The protection of the power part is done by using RC circuits and MOV elements. Snubber circuits are wired up in parallel to each thyristor directly without fuses in between. In addition to that MOV elements are wired up in between the phases and protected by the fuses F101 to F 103. The AC voltage measurement is taken from behind the fuse.

Fuse data: Bussmann KTK-R-6A (600V)

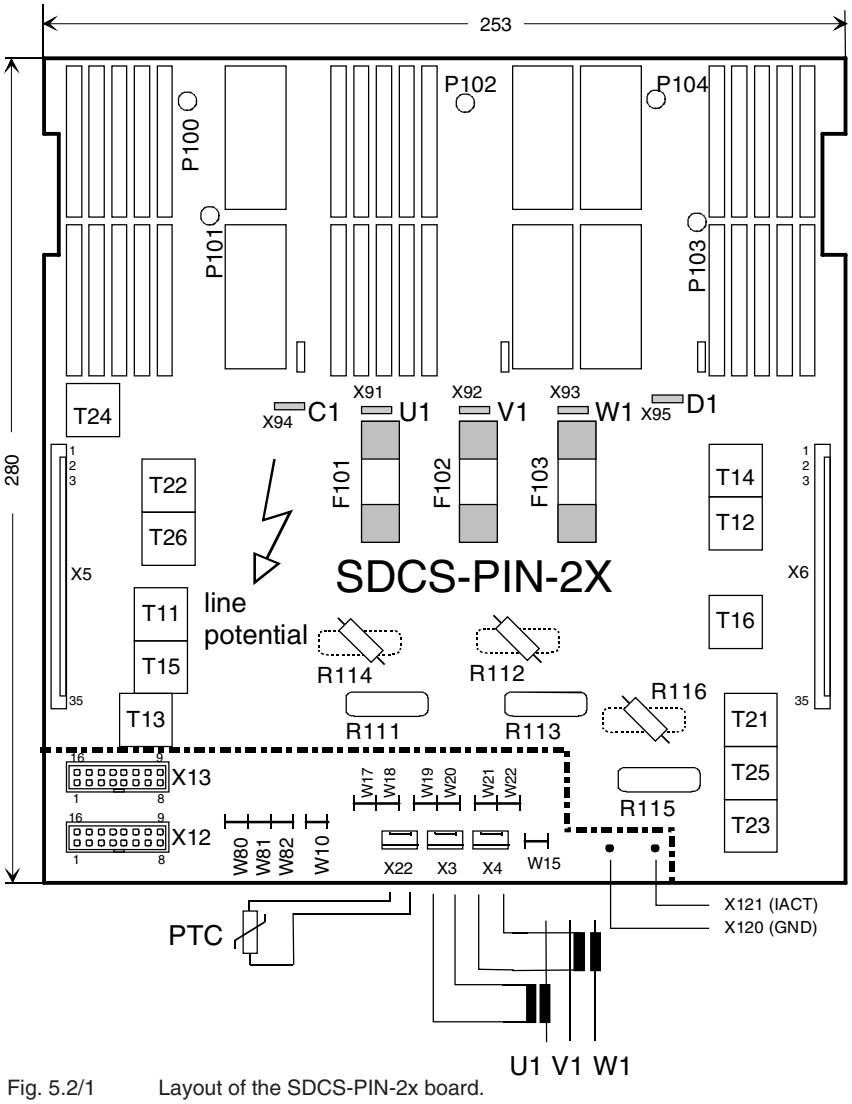


Fig. 5.2/1 Layout of the SDCS-PIN-2x board.

2-Q Converters

Board type		PIN 21					PIN 22		PIN 23		PIN 24	PIN 25
Current transformer ratio		1000:1					600:1		1000:1		600:1	2330:1
Rated voltage [V]		500	500	500	500	500	500	500	600	600	600	500
Rated current [A]		100	125	180	225	315	405	470	100	245	405	700
W10	2-Q/4-Q selection	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
W15	zero current detection	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
W17	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖
W18	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖
W19	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖
W20	rated current scaling	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖
W21	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
W22	rated current scaling	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖
W80	HW type coding	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
W81	HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
W82	HW type coding	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖

Table 5.2/1 Settings of the SDCS-PIN-2x board for 2-Q converters if a DCS converter is equipped with it by ABB

⊖X⊖ indicates a removed jumper

4-Q Converters

Board type		PIN 21					PIN 22		PIN 23		PIN 24	PIN 25
Current transformer ratio		1000:1					600:1		1000:1		600:1	2330:1
Rated voltage [V]		500	500	500	500	500	500	500	600	600	600	500
Rated current [A]		100	140	200	250	350	450	520	110	270	450	700
W10	2-Q/4-Q selection	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
W15	zero current detection	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖
W17	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖
W18	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖
W19	rated current scaling	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
W20	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖
W21	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖
W22	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
W80	HW type coding	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
W81	HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
W82	HW type coding	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖

Table 5.2/2 Settings of the SDCS-PIN-2x board for 4-Q converters if a DCS converter is equipped with it by ABB

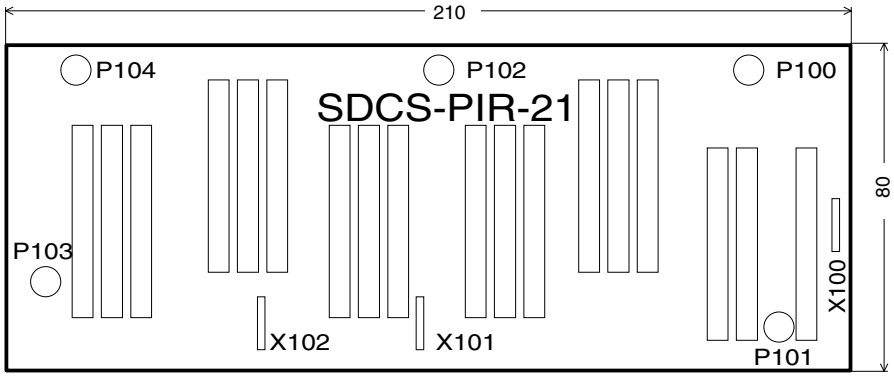
⊖X⊖ indicates a removed jumper

Board used as a spare part:
- default: all jumpers W10-W82 are in ⊖—⊖ condition
- ensure the correct converter type related settings

5.2.2 Power interface resistor board SDCS-PIR-21

This board contains only resistors to increase the power of the snubber circuit and it is connected by metal standoffs.
The SDCS-PIR-21 board is used with the following power interface boards:

- SDCS-PIN-22 **450 A/520 A** at **500 V**
- SDCS-PIN-24 **450 A** at **600 V**



ATTENTION:line potential on the complete board

Figure 5.2/2 Layout of the SDCS-PIR-21 board

If a 700 A converter is in use the power of the snubber circuit will be increased by resistors and capacitors mounted and wired up separately.

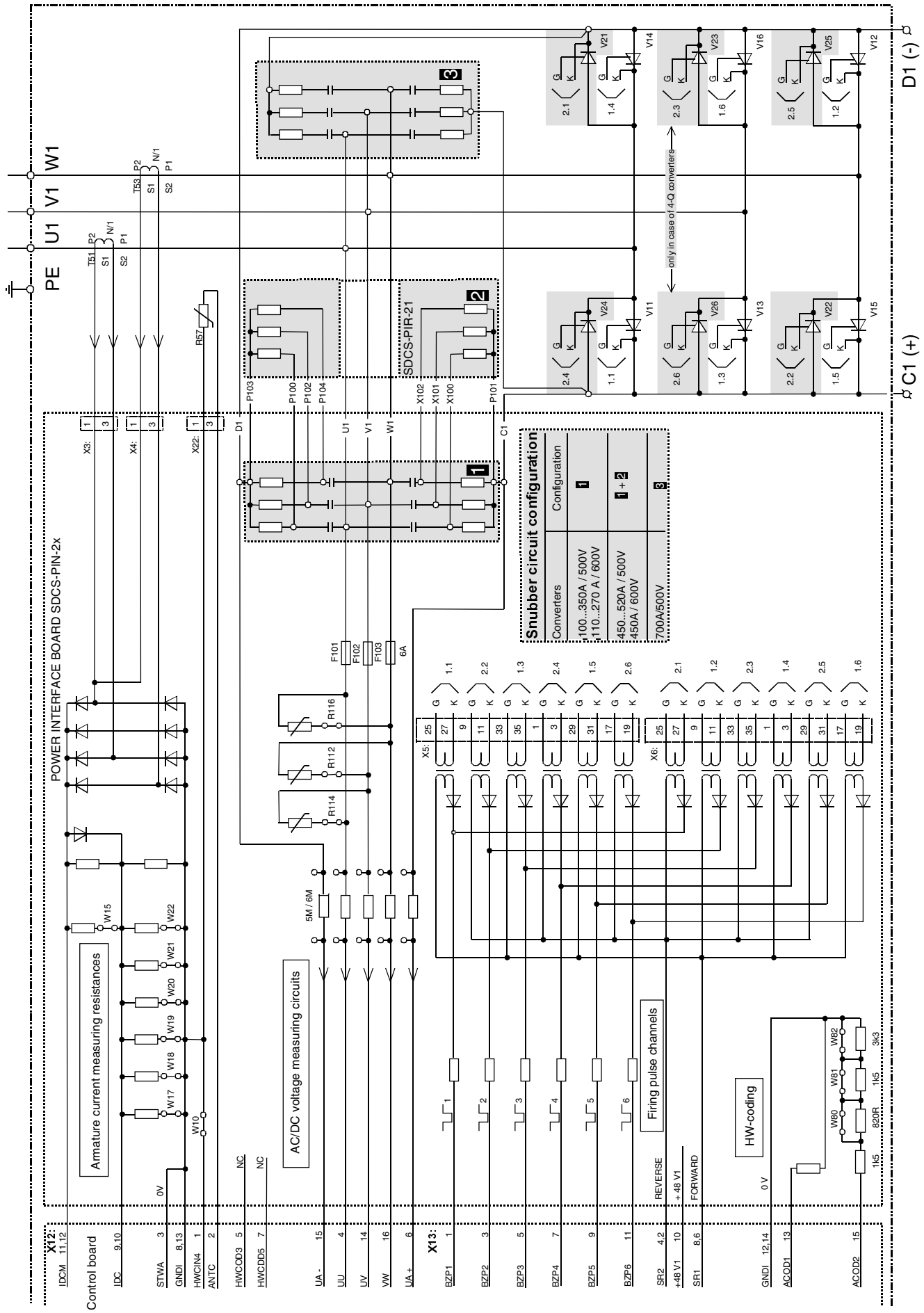


Fig. 5.2/3 Typical armature circuit thyristor converter diagram with SDCS-PIN-2x board for a 2Q/4Q C1/C2 type converter

5.2.3 Power interface board SDCS-PIN-20x

The power interface board is used for DCS converter modules construction type C1 and C2. There are different versions in use. The used types are:
- SDCS-PIN-205 for **100 A...700 A** Conv. at **500 V**
- SDCS-PIN-206 for **110 A...450 A** Conv. at **600 V**
- SDCS-PIN-205B for **100 A...1000 A** Conv. at **500 V**
- SDCS-PIN-206B for **110 A...450 A** Conv. at **600 V**

The boards are cyclic updated from SDCS-PIN-20x ⇨ PIN-20xA ⇨ PIN-20xB according to the technical requirements and the new C2 converter types. The SDCS-PIN20xB can replace the SDCS-PIN-20x and PIN-20xA.

The SDCS-PIN-20x board consists of:
- firing pulse circuits with pulse transformers
- measurement of the armature current
- snubber circuit for thyristor protection (consists of RC circuits in parallel of the thyristors and RCD network)
- AC and DC high ohmic voltage measurement
- rated current scaling with burden resistors, zero current detection and HW voltage type coding
- interface for heat sink temperature measurement with a PTC sensor
- fuses for overvoltage protection and voltage measuring
- the same board will be used without any modification at a converter used for three-phase field supply

Spare part

The protection of the power part is done by using RC circuits. Snubber circuits are wired up in parallel to each thyristor with fuses in between. RCD elements are protected by the fuses F 101 to F 103. The AC voltage measurement is taken from behind the fuse.

Fuse data: Bussmann KTK-R-6A (600V)

The power interface board SDCS-PIN205 can be used as a replacement of SDCS-PIN-21, 22 and 25. The board SDCS-PIN-206 can be used as a replacement of SDCS-PIN-23 and 24, but not vice-versa! In case of a converter with 450 A / 520 A / 700 A at 500 V or a converter of 450 A at 600 V additional actions have to be taken into account (the basic difference between the SDCS-PIN-2x and PIN-20x is marked by the grey-shaded areas numbered 1,2 and 3 in fig. 5.2/3).

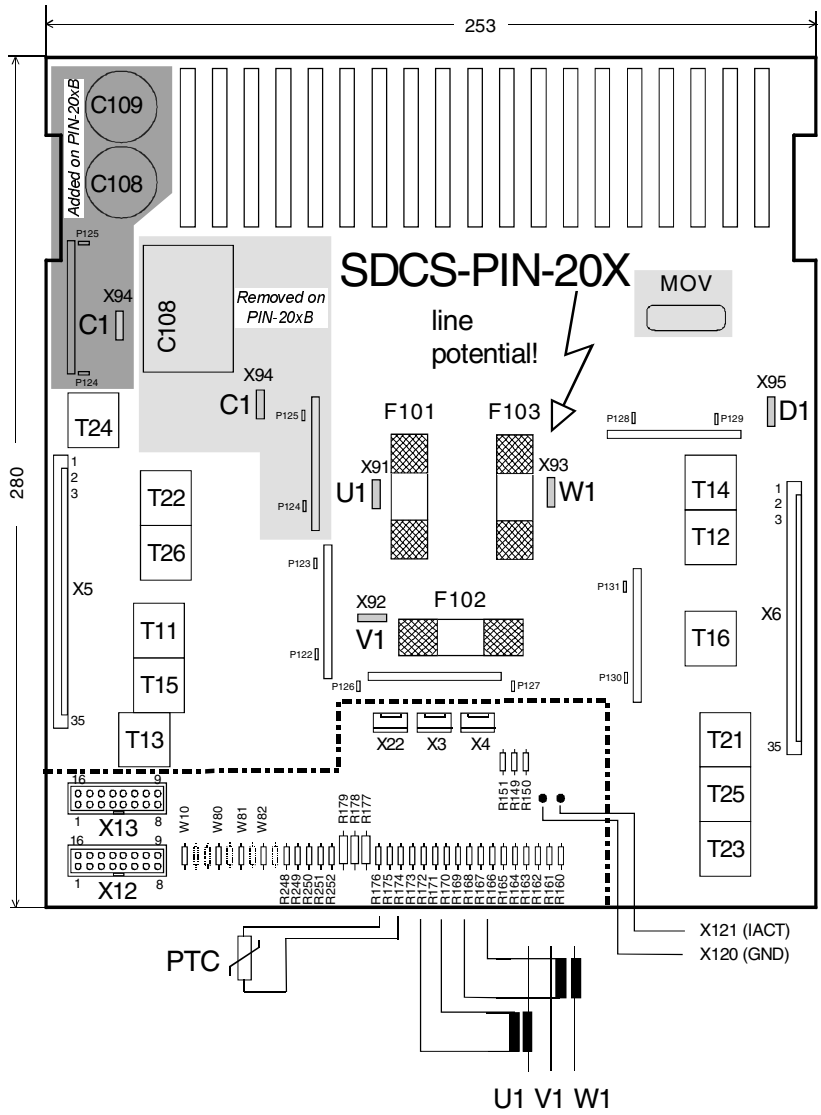


Fig. 5.2/4 Layout of the SDCS-PIN-20x, 20xA, 20xB board.

2-Q Converters

Board type			PIN 205											PIN 206		
Current transformer ratio			1000:1					600:1		2330:1	3000:1			1000:1		600:1
Rated voltage [V]			500											600		
Rated current [A]			100	125	180	225	315	405	470	700	610	740	900	100	245	405
W10		2-Q/4-Q selection	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
W80		HW type coding	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖
W81		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖
W82		HW type coding	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R248		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖
R249		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖
R250		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
R251		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
R252		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R149	33 Ω	zero current detection	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖
R150	47.5 Ω	zero current detection	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖
R151	100 Ω	zero current detection	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖
R160	1k Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖
R161	1k Ω	rated current scaling	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖
R162	332 Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R163	332 Ω	rated current scaling	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖
R164	332 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖
R165	332 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖
R166	332 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R167	47.5 Ω	rated current scaling	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R168	33.2 Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R169	33.2 Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R170	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖
R171	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
R172	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
R173	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R174	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R175	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R176	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R177	10 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
R178	10 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖
R179	10 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖

Table 5.2/3 Settings of the SDCS-PIN-20x, PIN-20xA, PIN-20xB board for 2-Q converters if a DCS converter is equipped with it by ABB

⊖X⊖ indicates a removed resistor

4-Q Converters

Board type			PIN 205											PIN 206		
Current transformer ratio			1000:1					600:1		2330:1	3000:1			1000:1		600:1
Rated voltage [V]			500											600		
Rated current [A]			100	140	200	250	350	450	520	700	680	820	1000	110	270	450
W10		2-Q/4-Q selection	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
W80		HW type coding	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖
W81		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖
W82		HW type coding	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R248		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖
R249		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖
R250		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
R251		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
R252		HW type coding	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R149	33 Ω	zero current detection	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
R150	47.5 Ω	zero current detection	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖
R151	100 Ω	zero current detection	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R160	1k Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖
R161	1k Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖
R162	332 Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖
R163	332 Ω	rated current scaling	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖
R164	332 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖
R165	332 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖
R166	332 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
R167	47.5 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
R168	33.2 Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R169	33.2 Ω	rated current scaling	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
R170	33.2 Ω	rated current scaling	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖
R171	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖
R172	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖
R173	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖—⊖
R174	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖
R175	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R176	33.2 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖
R177	10 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖
R178	10 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖
R179	10 Ω	rated current scaling	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖	⊖—⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖X⊖	⊖—⊖

Table 5.2/4 Settings of the SDCS-PIN-20x, PIN-20xA, PIN-20xB board for 4-Q converters if a DCS converter is equipped with it by ABB

⊖X⊖ indicates a removed resistor

Board used as a spare part:
- default: all resistors, represending a jumper Wxx / Rxx are in ⊖—⊖ condition
- ensure the correct converter type related settings

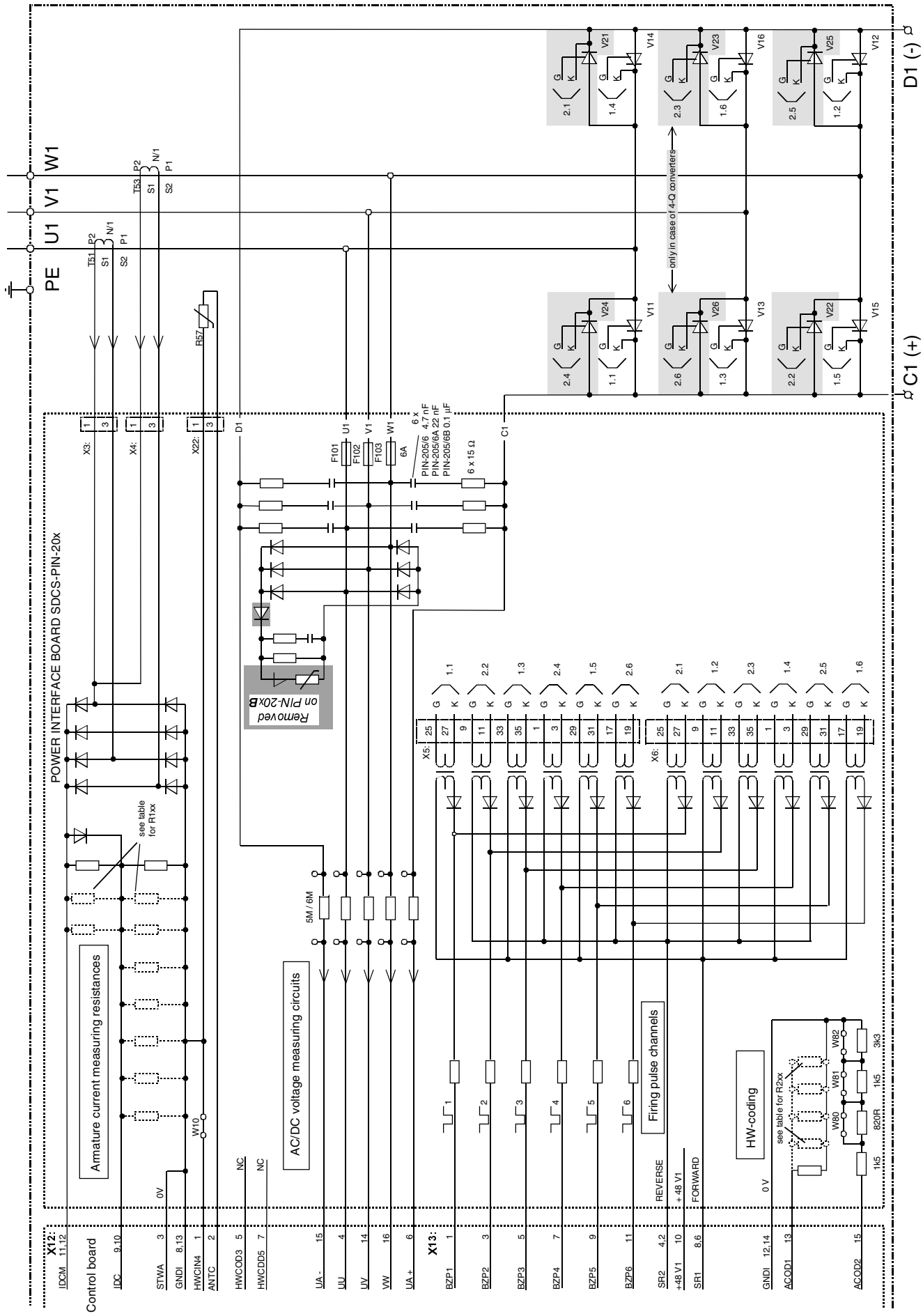
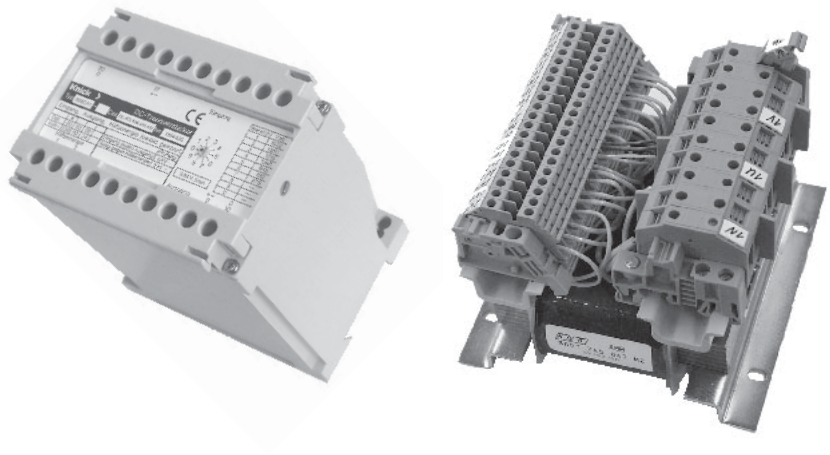


Fig. 5.2/5 Typical armature circuit thyristor converter diagram with SDCS-PIN-20x, PIN20xA, PIN-20B board for a 2Q/4Q C1/C2 type converter

5.3 Galvanic isolation - T90, A92



The Galvanic isolation is an option for converters in the current range 2050...5150 A and rated voltages ≤1000 V. For converters with a rated voltage of 1190 V and 12-pulse serial > 2x 500 V the galvanic isolation is a standard equipment. It is used to replace the high-ohmic resistance voltage measurement and gives the advantage of a total isolation from power part to electronic part.

The transformer T90 and the DC transducer A92 are located outside the converter module. The internal AC and DC voltage measurement channels are opened and connected to the T90 and A92 units.

Hard and software settings:

Actual type of galvanic isolation

Voltage coding on measuring board						
Construction type	**C4**					
Conv. nom. voltage [V] *	Y=4 (400V) Y=5 (500V)	Y=6 (600V)	Y=7 (690V)	Y=8 (790V)	Y=9 (1000V)	Y=1 (1190V)
Rated mains voltage [V]	220…500	270…600	300…690	350…790	450…1000	530…1190
Value f. conv. nom. volt at SET(TINGS) block *	500	600	700	800	1000	1200
Measuring board **SDCS-**	**PIN-52**	**PIN-51**	**PIN-51**	**PIN-51**	**PIN-51**	**PIN-51**
Resistors W1…W26	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖	⊖—⊖
	all resistors are 0 Ω					
Galvanic isolation 8680A1/3ADT745047						
Resistors Rx on PIN51/52	27.4 kΩ	27.4 kΩ	27.4 kΩ	27.4 kΩ	27.4 kΩ	27.4 kΩ
DC transducer **A92**	**8680A1**					
Switch position R_G *	675 V	810 V	945 V	1080 V	1350 V	1620 V
Transformer **T90**	**3ADT745047**					
Secondary Terminals *	2U1 2V1 2W1 2N	2U2 2V2 2W2 2N	2U3 2V3 2W3 2N	2U4 2V4 2W4 2N	2U5 2V5 2W5 2N	2U6 2V6 2W6 2N

* 12-pulse serial and sequential have a different selection between **Conv. nom. voltage** and the scaling of measurement channel. See *12-pulse manual.*

Old type** of Galvanic isolation

Galvanic isolation 8635A1/SLTF045						
Resistors Rx on PIN51/52	0 Ω	0 Ω	0 Ω	0 Ω	0 Ω	-
DC transducer **A92**	**8635A1**					
Switch position R_G	675 V	810 V	945 V	1080 V	1350 V	-
Transformer **T90**	**SLTF045**					
Primary Terminals	6-12-18	7-13-19	8-14-20	9-15-21	11-17-23	-

** Replaced 1.1.2000 by 8680A1/3ADT745047

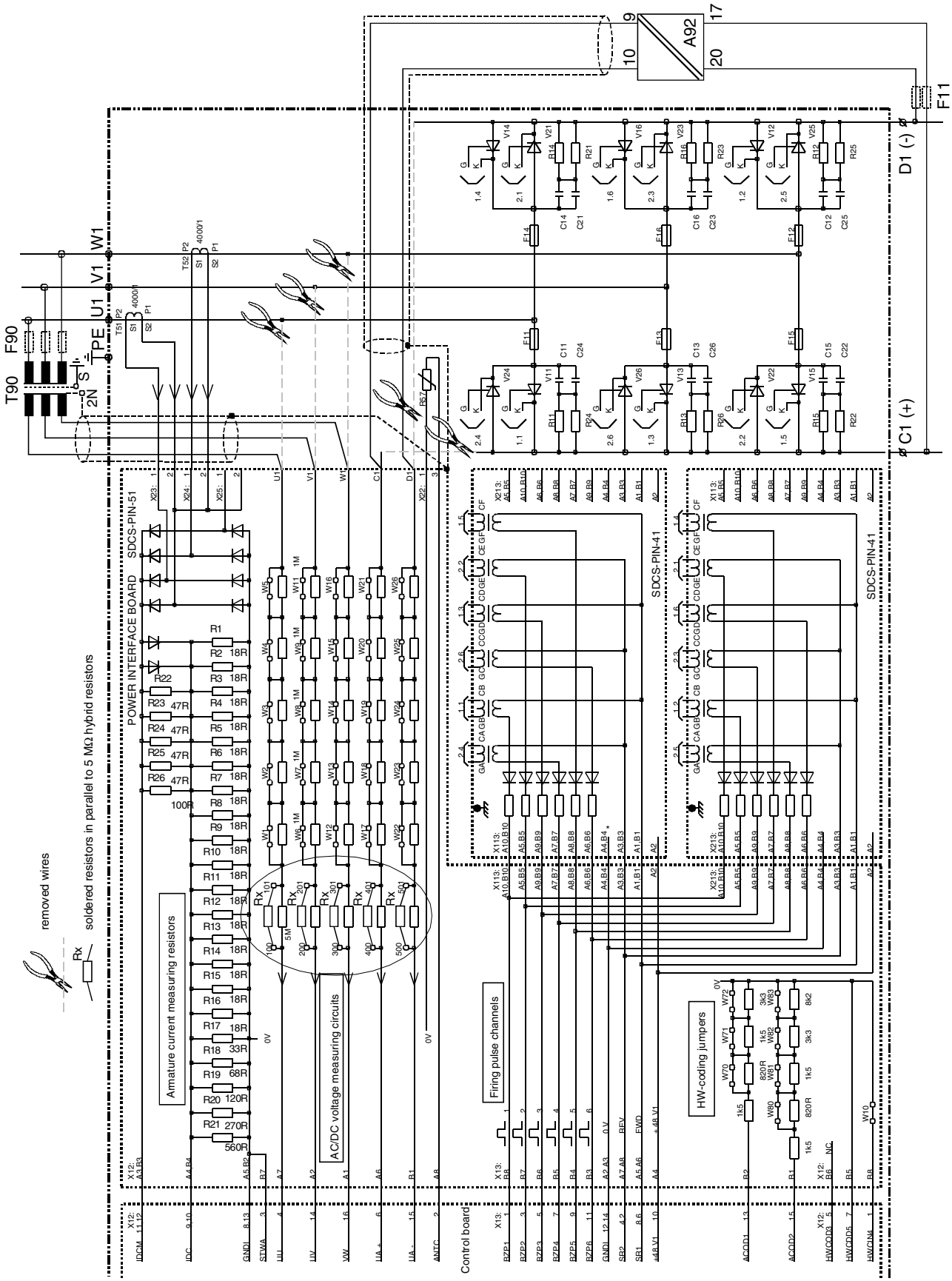


Fig. 5.3/1 Typical armature circuit thyristor converter diagram with SDCS-PIN-41 and SDCS-PIN-51 boards for a 4-Q C4 type converter with galvanic isolation

5.3.1 A92 DC-DC transducer (type 8680A1)

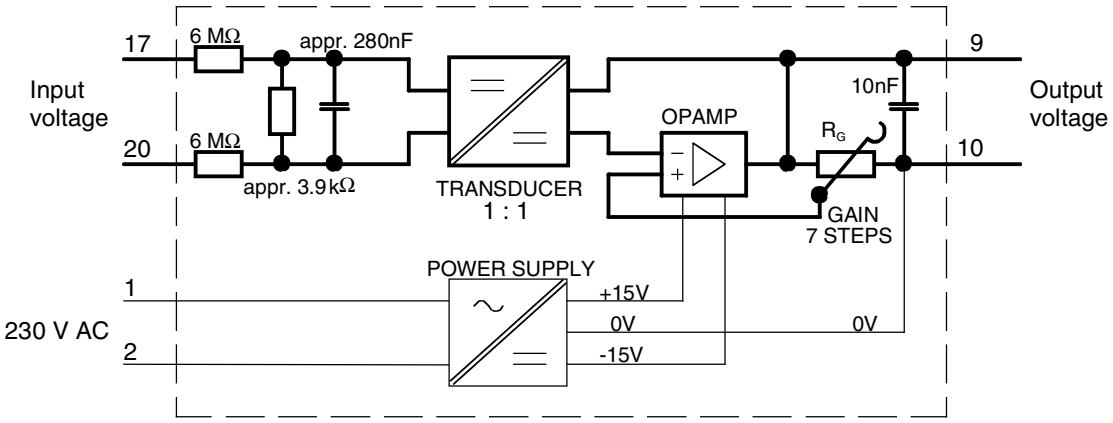
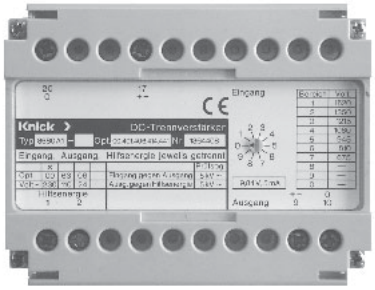


Fig. 5.3/2 Principle circuit diagram of the DC-DC transducer 8680A1

Data

Selectable voltage gains:	675, 810, 945, 1080, 1215, 1350, 1620 V DC
Output voltage:	9,84 V / 5 mA
Auxiliary power:	230 V ± 15 %; 50/60 Hz; 3 W
Clearence in air:	Auxiliary power to Output: >13 mm
	Input/Output to Auxiliary power: >14 mm
Insulation voltage:	2000 V
Insulation test voltage:	5000 V
Ambient temperature range:	- 10 …+ 70 °C
Weight:	appr. 0.4 kg



The voltage gain and frequency response is especially designed for DCS 500B and DCS 600 converters.

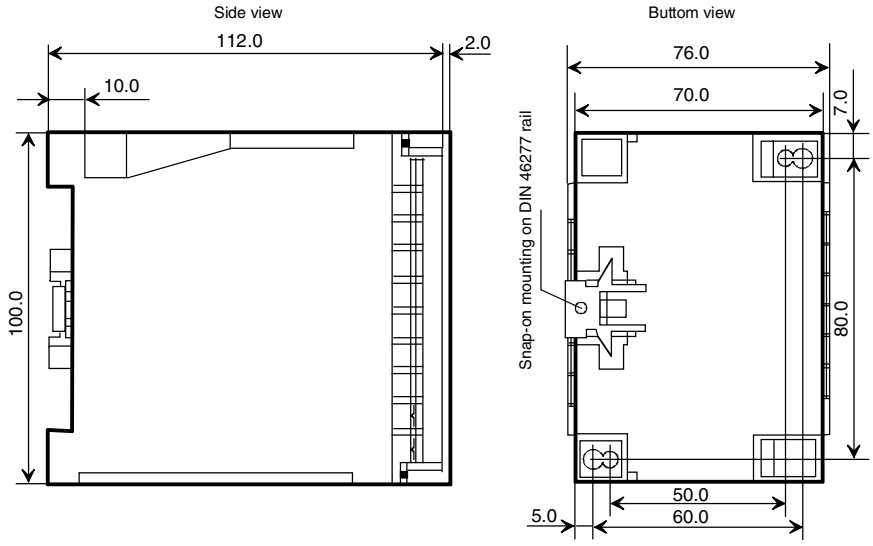


Fig. 5.3/3 Dimensions in mm

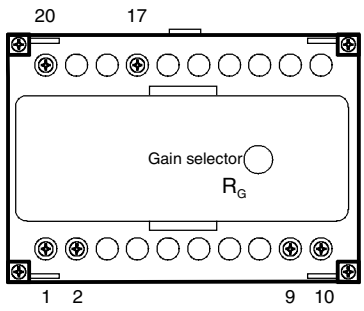
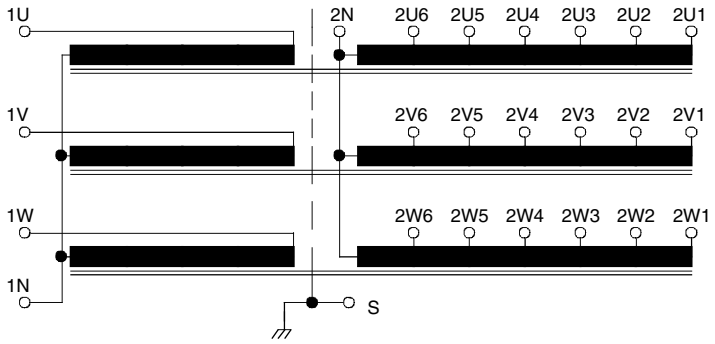


Fig. 5.3/4 Location of terminals

5.3.2 T90 Transformer (type 3ADT 745 047)



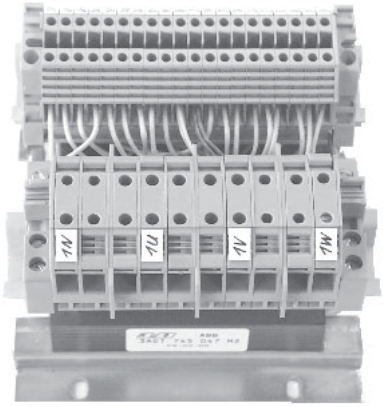


Fig. 5.3/5 Principle diagram of the transformer 3ADT 745 047

Data

Selectable transfer ratios U_{prim}:	502, 601, 701, 800,1000, 1200 V AC rms
Output voltage:	7.3 V AC rms
Insulation voltage:	3500 V
Partial discharge voltage:	1800 V
Ambient temperature range:	- 10 …+ 70 °C
Weight:	2.1 kg

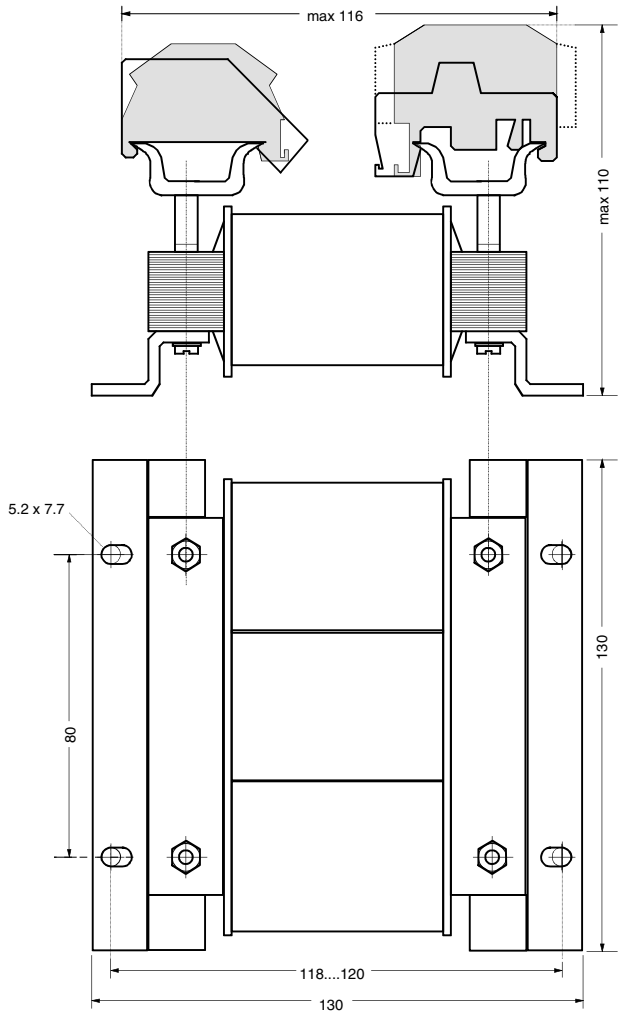


Fig. 5.3/6 Dimensions in mm

Remark

The terminals on the primary side of the transformer are in special design (lug terminals).

Handling hints: First turn the screw conterclockwise to the end stop, then swing out the shrowding cover. Put in the cable lug, swing in the the shrowding cover and fasten the connection by turning the screw clockwise.

5.4 Power Interface SDCS-PIN 41/SDCS-PIN-5x

The Power Interface of DCS converter modules model C3 and C4 from 900 A up to 5150 A consists of two boards - the Measuring board SDCS-PIN-5x and the Pulse transformer board SCDS-PIN-41.
There are different versions of the SDCS-PIN-5x:
SDCS-PIN-51 for converters with **all line voltages**
SDCS-PIN-52 for converters with line volt. ≤**500 V**

The following figures show the different connections between the SDCS-PIN-41 and SDCS-PIN-5x board depending on the application 2- or 4-quadrant and the construction type.
Converters, delivered from 1998 on, will be equipped with SDCS-PIN-41A, which is a full replacement for converters, which alredy in use.

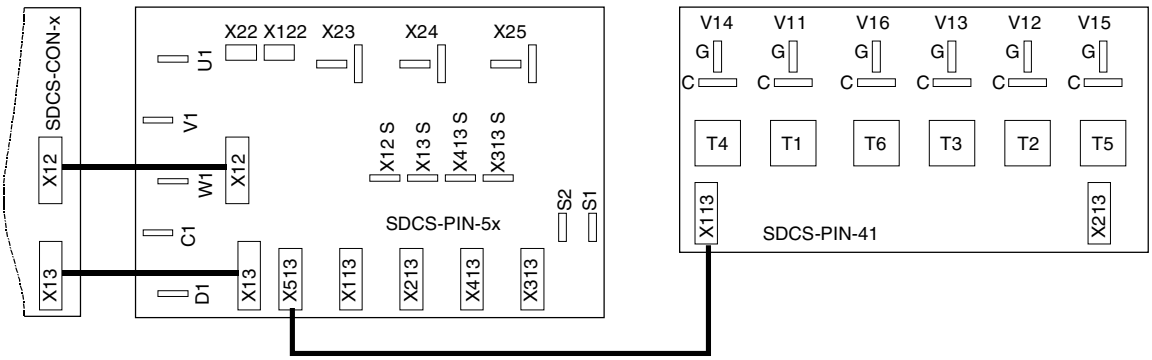


Fig. 5.4/1 **2-Quadrant** application, no parallel thyristors - Construction type **C3/C4**

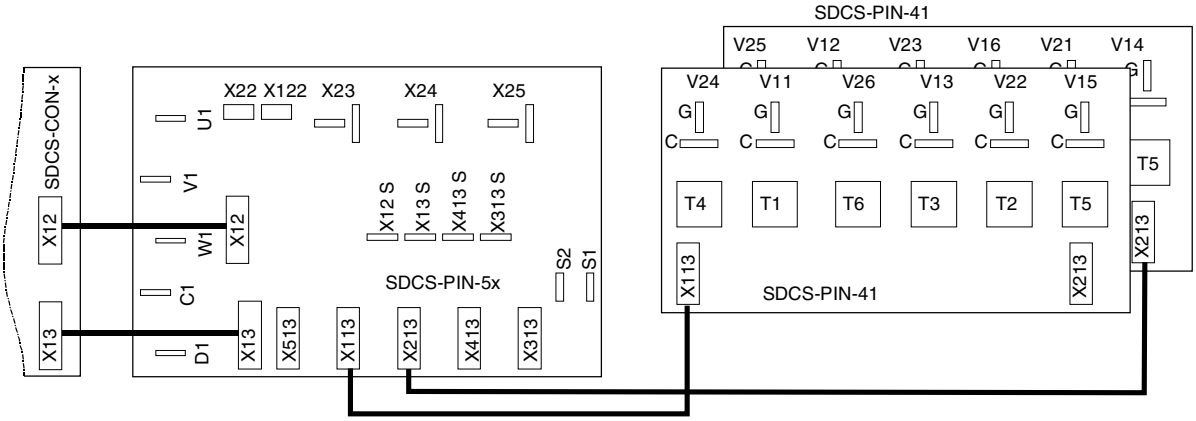


Fig. 5.4/2 **4-Quadrant** application, no parallel thyristors - Construction type **C3**

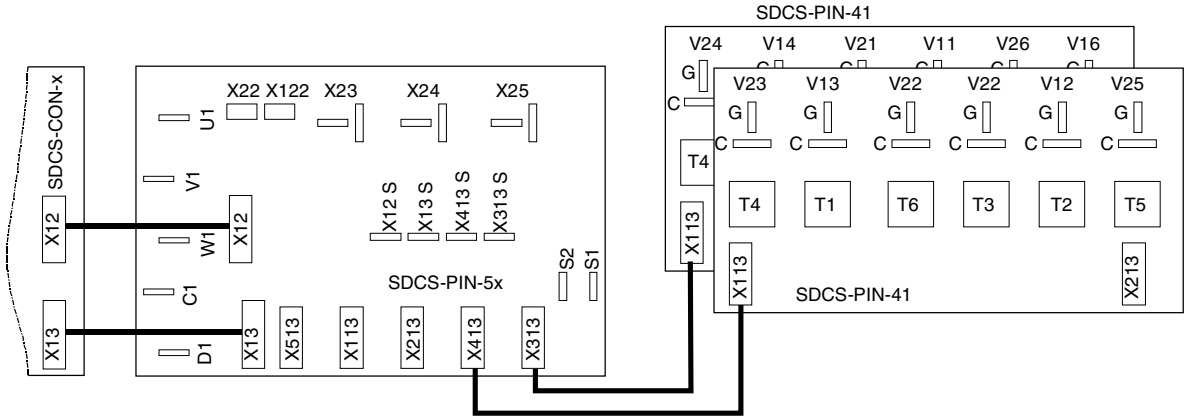
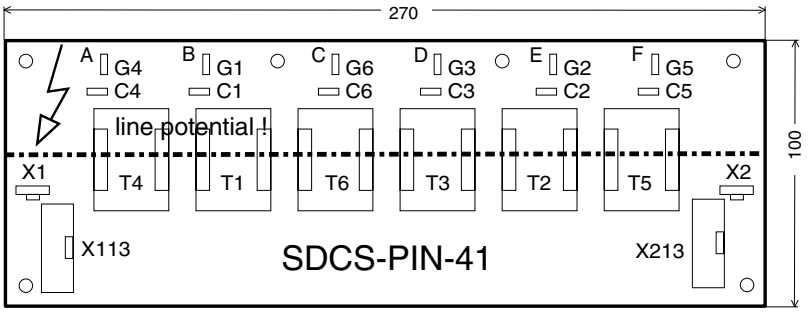


Fig. 5.4/3 **4-Quadrant** application, no parallel thyristors - Construction type **C4**

Pulse transformer board SDCS-PIN-41/PIN-41A



The board contains six pulse transformers with amplifiers.

Fig. 5.4/4 Layout of the SDCS-PIN-41/PIN-41A pulse transformer board

Measuring board SDCS-PIN-5x
This board is always used together with SDCS-PIN-41 board. On this board there are the circuits located needed for current, voltage and temperature measuring and for hardware coding.

The current is measured by current transformers at the AC supply, rectified by a diode bridge and scaled with burden resistors to 1.5 V as rated current. The current response is adjusted by cutting out resistors (R1 ... R21) from the board according to the coding table. The resistors R22 ... R26 are used for the current equal to zero detection. These resistors must be cut off according to a second table.

Voltages (U1, V1, W1 and C1(+) and D1(-)) are measured by using high ohm resistor chains. Scaling of AC and DC voltage is done by activating 1 MΩ resistors (= cutting out short circuit wires, which are represented by a low ohmic resistance).
For the voltage measurement 5 resistor chains are used:

U1:	W1	to	W5
V1:	W6	to	W11
W1:	W12	to	W16
C1(+):	W17	to	W21
D1(-):	W22	to	W26

If there is a need for voltage adaption, all 5 chains must be handled in the same way.

When gavanically isolated measurement is needed, please contact your ABB representative.

Note! Actual voltage signals U1, V1, W1, C1(+) and D1(-) of the main circuit are not galvanically isolated from the control board.

Note
For spare part reasons, please use only the SDCS-PIN-51 board!

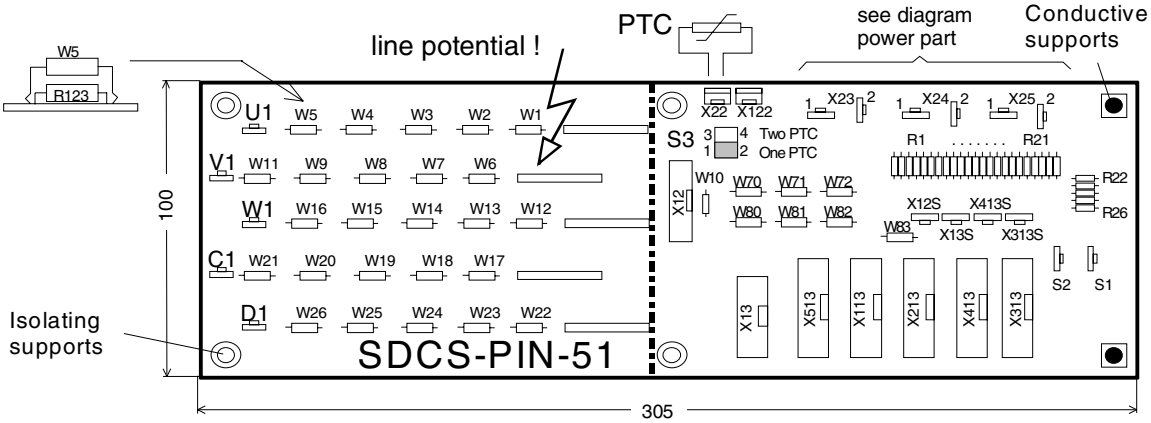


Fig. 5.4/5 Layout of the SDCS-PIN-51 board for converters with line volt. **>500 V**

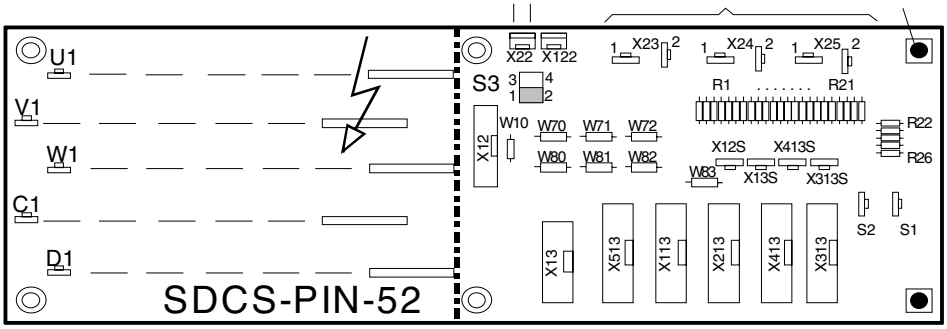


Figure 5.4/6 Layout of the SDCS-PIN-52 board for converters with line volt. ≤**500 V**

Current coding

Construction type			C3				C4							
Current transf. ratio			2500:1				4000:1							
Rated current [A]			900	1200	1500	2000	2050	2500	2650	3200	3300	4000	4750	5150
R1-R4	18 Ω	Rated current scaling	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
R5	18 Ω		○×○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
R6	18 Ω		○×○	○×○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
R7	18 Ω		○×○	○×○	○—○	○—○	○×○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
R8	18 Ω		○×○	○×○	○×○	○—○	○×○	○×○	○×○	○—○	○—○	○—○	○—○	○—○
R9	18 Ω		○×○	○×○	○×○	○—○	○×○	○×○	○×○	○—○	○—○	○—○	○—○	○—○
R10	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○	○—○	○—○
R11	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○	○—○	○—○
R12	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○	○—○	○—○
R13	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○	○—○
R14	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○	○—○
R15	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○
R16	18 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○
R17	33 Ω		○×○	○—○	○×○	○—○	○×○	○×○	○—○	○—○	○—○	○×○	○×○	○×○
R18	68 Ω		○—○	○×○	○×○	○×○	○×○	○—○	○—○	○×○	○—○	○×○	○×○	○—○
R19	120 Ω		○×○	○—○	○—○	○×○	○—○	○—○	○—○	○×○	○×○	○×○	○—○	○—○
R20	270 Ω		○—○	○—○	○—○	○—○	○×○	○—○	○×○	○—○	○—○	○×○	○—○	○×○
R21	560 Ω		○×○	○×○	○×○	○—○	○×○	○—○	○×○	○×○	○—○	○×○	○—○	○—○
R22	47 Ω	Zero current detection	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
R23	47 Ω		○×○	○×○	○—○	○—○	○×○	○—○	○—○	○—○	○—○	○—○	○—○	○—○
R24	47 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○	○—○	○—○
R25	47 Ω		○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○×○	○—○
R26	100 Ω		○×○	○—○	○×○	○—○	○—○	○×○	○×○	○—○	○—○	○×○	○—○	○×○

Voltage coding

Construction type	C3		C4				
Conv. nom. voltage [V] ①	Y=4 (400V) Y=5 (500V)	Y=6 (600V) Y=7 (690V)	Y=4 (400V) Y=5 (500V)	Y=6 (600V)	Y=7 (690V)	Y=8 (790V)	Y=9 (1000V)
Value f. conv. nom. volt at SET(TINGS) block	**0** = HW type coding		500	600	690	800	1000
Measuring board SDCS	PIN-52	PIN-51	PIN-52	PIN-51	PIN-51	PIN-51	PIN-51
W1, 6, 12, 17, 22	○—○	○×○	○—○	○×○	○×○	○×○	○×○
W2, 7, 13, 18, 23	○—○	○×○	○—○	○—○	○×○	○×○	○×○
W3, 8, 14, 19, 24	○—○	○—○	○—○	○—○	○—○	○×○	○×○
W4, 9, 15, 20, 25	○—○	○—○	○—○	○—○	○—○	○—○	○×○
W5, 11, 16, 21, 26	○—○	○—○	○—○	○—○	○—○	○—○	○×○

① the converters can be used at lower line voltage then specified by the y-value without hardware modifications, if the nominal line voltage applied to the converter is not lower than 45% for y=5...9 and not lower than 55% for y=4.

HW type coding

Current [A]	900	1200	1500	2000	900	1500	> 2000 *
Voltage max. [V]	500	500	500	500	600/690	600/690	
W70	○—○	○—○	○—○	○—○	○×○	○×○	○—○
W71	○—○	○—○	○—○	○—○	○—○	○—○	○—○
W72	○—○	○—○	○—○	○—○	○—○	○—○	○—○
W80	○×○	○—○	○×○	○—○	○×○	○×○	○—○
W81	○—○	○×○	○×○	○—○	○—○	○×○	○—○
W82	○—○	○—○	○—○	○×○	○—○	○—○	○—○
W83	○—○	○—○	○—○	○—○	○—○	○—○	○—○

* see Software description

Temp. sensor coding

R 57 as a temp. sensor for C3, C4-2Q, C4-4Q
S3 4 ○ ○ 3 2 ○—○ 1

2 Q - 4 Q coding

	2 Q	4 Q
W10	○×○	○—○

○×○ indicates a removed jumper

Table 5.4/1 Settings of the SDCS-PIN-51 board if a DCS converter is equipped with it by ABB

Board used as a spare part:
- default: all jumpers Wxx, Rxx are in ○—○ condition
- ensure the correct converter type related settings

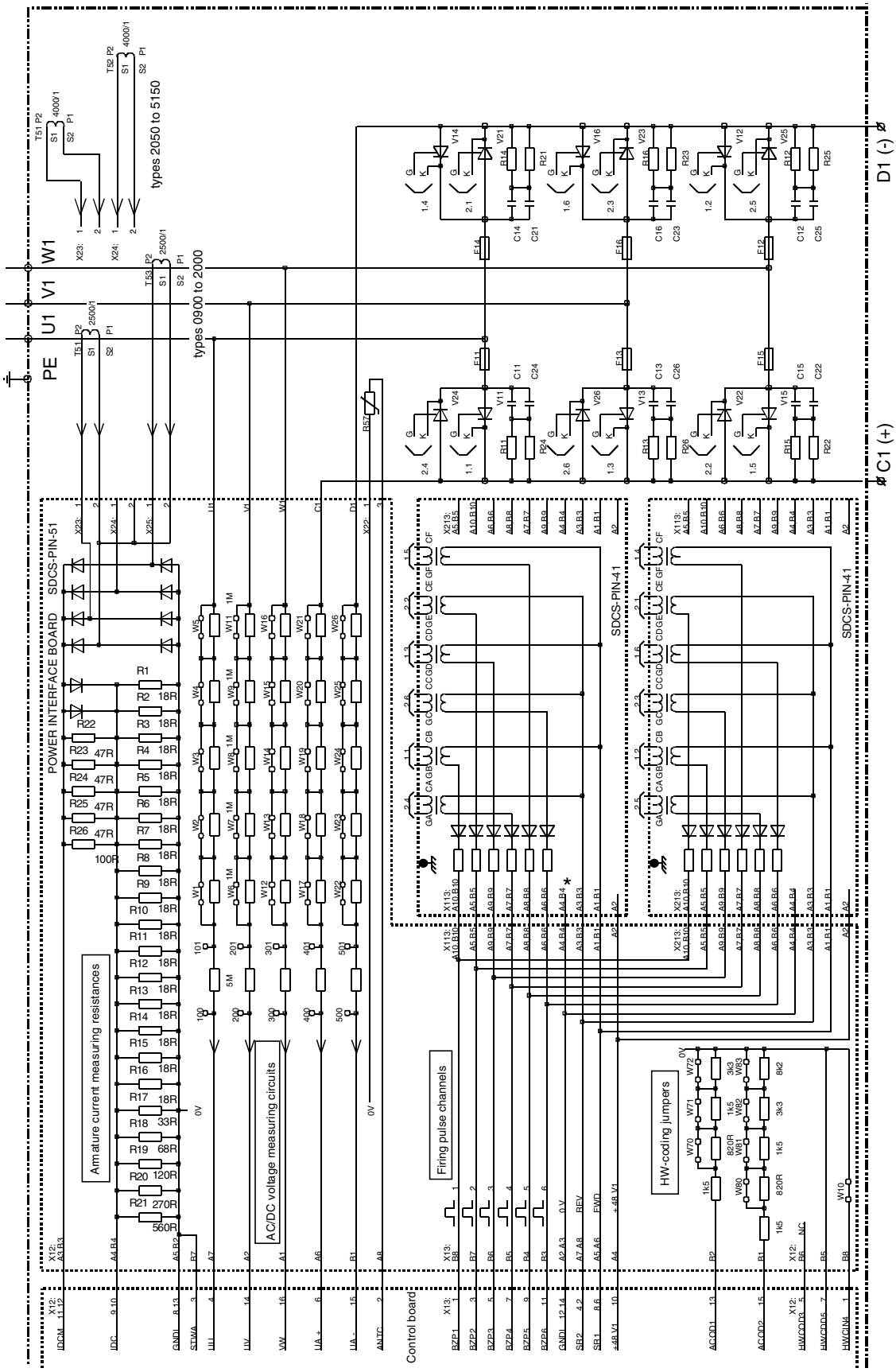


Fig. 5.4/7 Typical armature circuit thyristor converter diagram with SDCS-PIN-41 and SDCS-PIN-51 boards for a 4Q C3 type converter

5.5 Power interface board PG 63x0

The power interface board PG 63x0 is used for converter units type DCP50x. There are 2 different versions in use. The used types are:
- PG 6320 for **90 A...150 A** converters at **400/500 V**
- PG 6330 for **250 A...540 A** converters at **400/500 V**

The PG 63x0 boards consists of:
- firing pulse circuits and pulse transformers
- measurement of the armature current via current transformers
- snubber circuit for thyristors protection (consists of RC circuits and MOV elements)
- AC and DC high ohmic voltage measurement
- heat sink temperature measurement via PTC sensor
- scaling for rated current, zero current detection and HW type coding
- fuses for overvoltage protection and voltage measuring

Spare part
The protection of the power part is done by using RC circuits and MOV elements. Snubber circuits are wired up in parallel to each thyristor directly without fuses in between. In addition to that MOV elements are wired up in between the phases and protected by the fuses F271 to F 273. The AC voltage measurement is taken from behind the fuse.

Fuse data:
Bussmann KTK-R-6A (600V)
or F6A/500V (8x40mm) GNN976953P0001

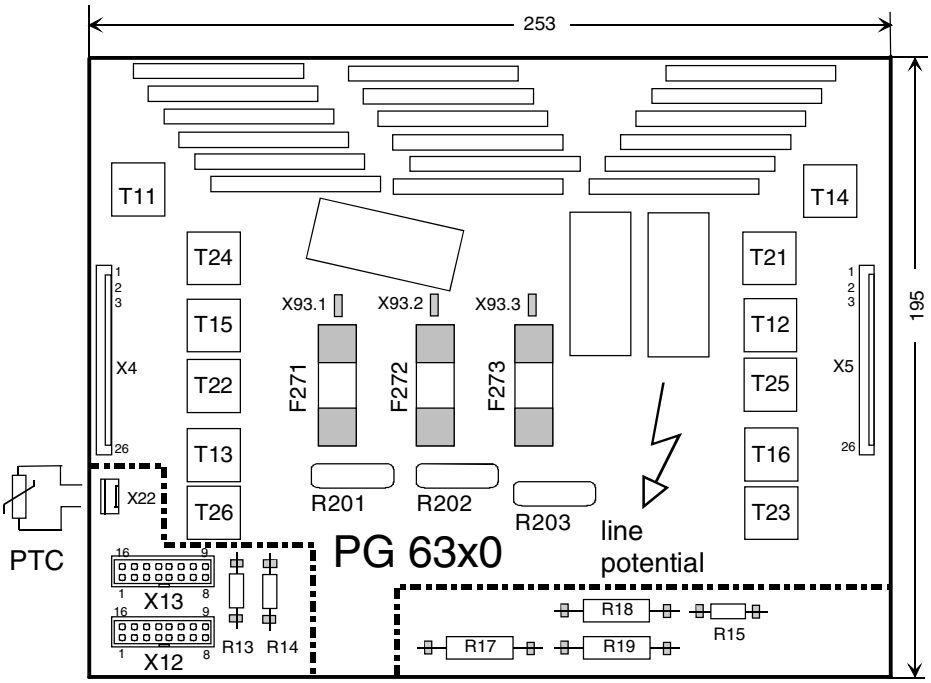


Fig. 5.5/1 Layout of the interface board PG 63x0.

2-Q Converters

Board type		PG 6320		PG 6330		
Current transformer ratio		1500:1		1000:1		500:1
Rated voltage [V]		400/500	400/500	400/500	400/500	400/500
Rated current [A]		80	140	235	320	500
Basic burden [W]		150	100	100	100	100
Zero current detection	R15 [Ω]	470	220	100	68	27
Rated current scaling	R17 [Ω]	39.2	47.5	10	10	4.7
Rated current scaling	R18 [Ω]	-	47.5	22.1	10	4.7
Rated current scaling	R19 [Ω]	-	100	560	-	4.7
Unit coding	R13 [Ω]	1500				
Unit coding	R14 [Ω]	1500				
Rated current	[P517] [A]	80	140	235	320	500
Rated voltage	[P518] [V]	500				
Max. heatsink temp.	[P519] [°C]	88	67	73	74	75
Converter type	[P520]	4				
Number of quadrants	[P521]	1	1	1	1	1

Table 5.5/1 Settings of the PG 63x0 board for 2-Q converters, if a DCP converter is equipped with it by ABB.

4-Q Converters

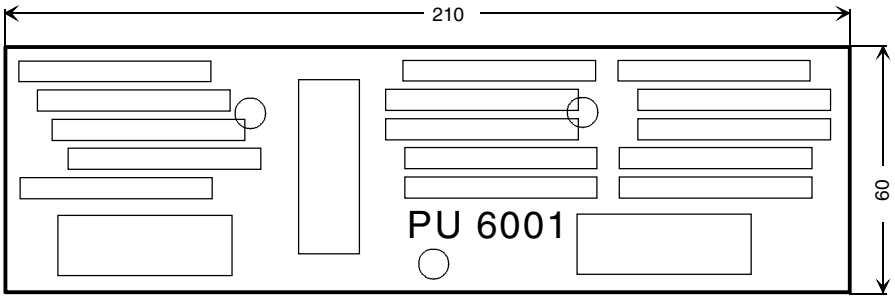
Board type		PG 6320		PG 6330		
Current transformer ratio		1500:1		1000:1		500:1
Rated voltage [V]		400/500	400/500	400/500	400/500	400/500
Rated current [A]		90	150	250	350	540
Basic burden [Ω]		150	100	100	100	100
Zero current detection	R15 [Ω]	470	220	100	68	22
Rated current scaling	R17 [Ω]	33.2	33.2	10	10	3.3
Rated current scaling	R18 [Ω]	-	39.2	33.2	10	3.3
Rated current scaling	R19 [Ω]	-	1000	39.2	47.5	12
Unit coding	R13 [Ω]	1500				
Unit coding	R14 [Ω]	1500				
Rated current	[P517] [A]	90	150	250	350	540
Rated voltage	[P518] [V]	500				
Max. heatsink temp.	[P519] [°C]	92	69	76	79	78
Converter type	[P520]	4				
Number of quadrants	[P521]	4	4	4	4	4

Table 5.5/2 Settings of the PG 63x0 board for 4-Q converters, if a DCP converter is equipped with it by ABB.

PG board as a spare part:
- Standard: all slots unoccupied!
- ensure the correct converter type related settings

5.6 Power interface resistor board PU 6001

This board contains only resistors and capacitors to increase the power of the snubber circuit and it is connected by metal standoffs.
The PU 6001 board is used with the power interface board PG 6330 for DCP units at 540 A.



Attention: Line potential on the complete board

Fig. 5.6/1 Layout of the PU 6001 board

5.7 Power interface board PG 73x2

The power interface board PG 73x2 is used for converter units type DCP50x. There are 2 different versions in use. The used types are:

- PG 7302 for **875 A...1650 A** 4-Q-converters at **400/500 V**
- PG 7352 for **875 A...1650 A** 2-Q-converters at **400/500 V**

The PG 73x2 boards consists of:

- firing pulse circuits and pulse transformers
- measurement of the armature current
- AC and DC high ohmic voltage measurement
- scaling for rated current, zero current detection and HW type coding
- interface to heat sink temperature measurement (fan current monitoring)

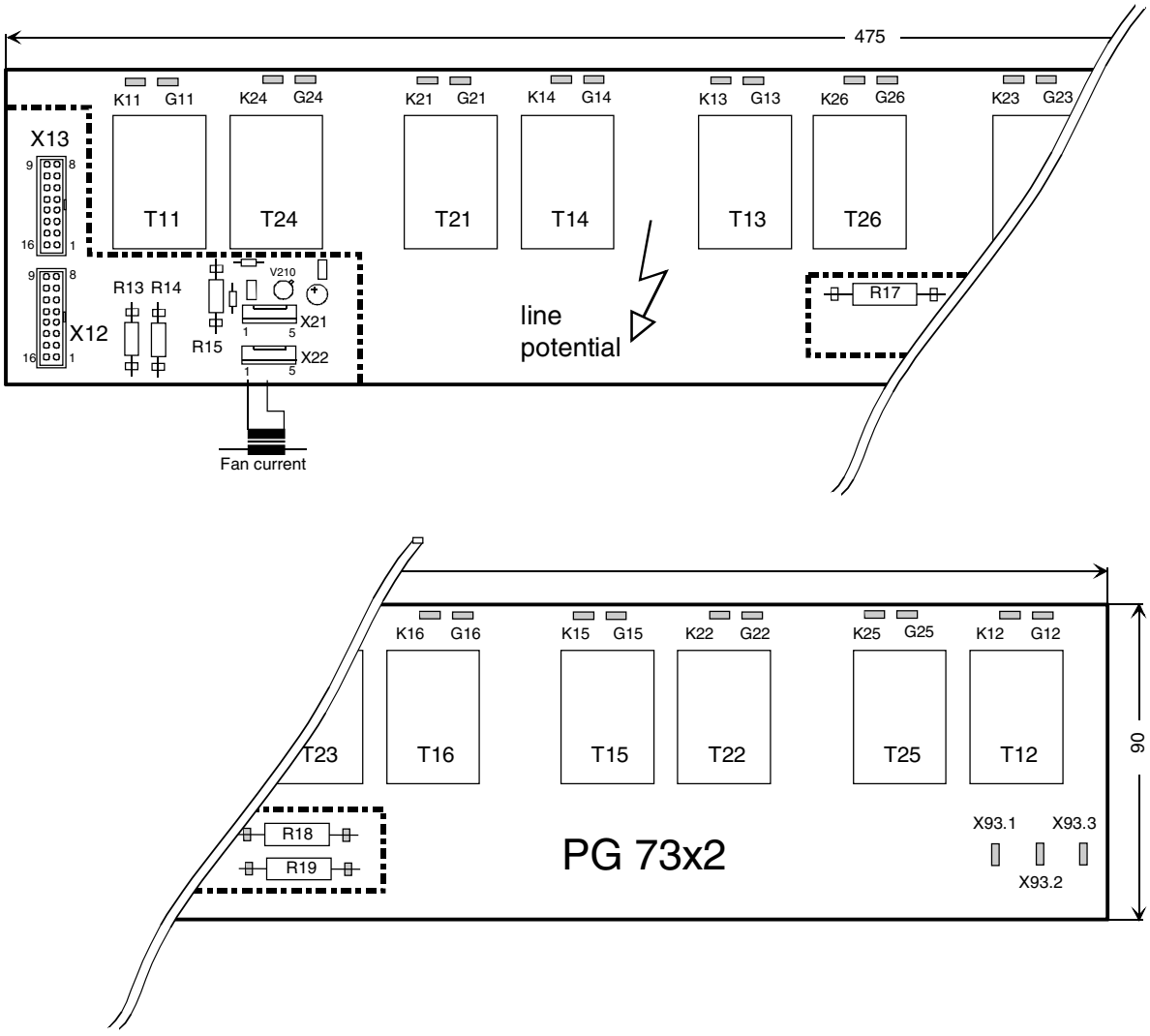


Fig. 5.7/1 Layout of the interface board PG 73x2.

Spare part

The protection of the power part is done by using RC and snubber circuits. The snubber circuit is protected by fuses F71, F72 and F73. The AC voltage measurement is taken from behind the fuse.

Fuse data: Ferraz 25 A/660 V;
Type 6,621 CP URD 22.58 Q/25

2-Q Converters

Board type		**PG 7352**		
Current transformer ratio		1200:1		1500:1
Rated voltage [V]		400/500	400/500	400/500
Rated current [A]		950	1180	1750
Basic burden [W]		5	5	5
Zero current detection	R15 [Ω]	22	22	22
Rated current scaling	R17 [Ω]	3.3	3.3	3.3
Rated current scaling	R18 [Ω]	47.5	10	3.3
Rated current scaling	R19 [Ω]	33.2	10	22
Unit coding	R13 [Ω]	1500		
Unit coding	R14 [Ω]	1500		
Rated current [A]	[P517] [A]	950	1180	1750
Rated voltage [V]	[P518] [V]	500		
Max. heatsink temp.	[P519] [°C]	100	100	100
Converter type	[P520]	4		
Number of quadrants	[P521]	1	1	1

Table 5.7/1 Settings of the PG 7352 board for 2-Q converters, if a DCP converter is equipped with it by ABB.

4-Q Converters

Board type		**PG 7302**		
Current transformer ratio		1200:1		1500:1
Rated voltage [V]		400/500	400/500	400/500
Rated current [A]		875	1100	1650
Basic burden [Ω]		5	5	5
Zero current detection	R15 [Ω]	22	22	22
Rated current scaling	R17 [Ω]	4.7	3.3	3.3
Rated current scaling	R18 [Ω]	22.1	10	4.7
Rated current scaling	R19 [Ω]	22.1	18	12
Unit coding	R13 [Ω]	1500		
Unit coding	R14 [Ω]	1500		
Rated current	[P517] [A]	875	1100	1650
Rated voltage	[P518] [V]	500		
Max. heatsink temp.	[P519] [°C]	100	100	100
Converter type	[P520]	4		
Number of quadrants	[P521]	4	4	4

Table 5.7/2 Settings of the PG 7302 board for 4-Q converters, if a DCP converter is equipped with it by ABB.

PG board as a spare part:
- Standard: all slots unoccupied!
- ensure the correct converter type related settings

5.8 Power interface board PG 7303

The power interface board PG 7303 is used for converter units type DCP50x with index **D**. There is only one version in use.
PG 7303 for **875 A...1650 A** for
2-Q and 4-Q-converters at **400/500 V**

Attention has to be paid to the exchangeability of the boards. The DCP converters are equipped with different boards. The types with the index A, B and C within the type code use the power interface board PG 7302 (4-Q) or PG 7352 (2-Q) and the fan monitoring board PW 1001 (the board PG 7302 can be used as a spare part for the PG 7352, but not vice-versa!). The types with index D use the power interface board PG 7303 (2-Q and 4-Q) and the fan monitoring board PW 1002. The control board SDCS-CON-2 has to be equipped either with software 21.232 (or higher) or with S15.208/15.610 (or higher).

The PG 7303 boards consists of:
- firing pulse circuits and pulse transformers
- measurement of the armature current
- AC and DC high ohmic voltage measurement
- scaling for rated current, zero current detection and HW type coding
- interface to heat sink temperature measurement (fan current monitoring)

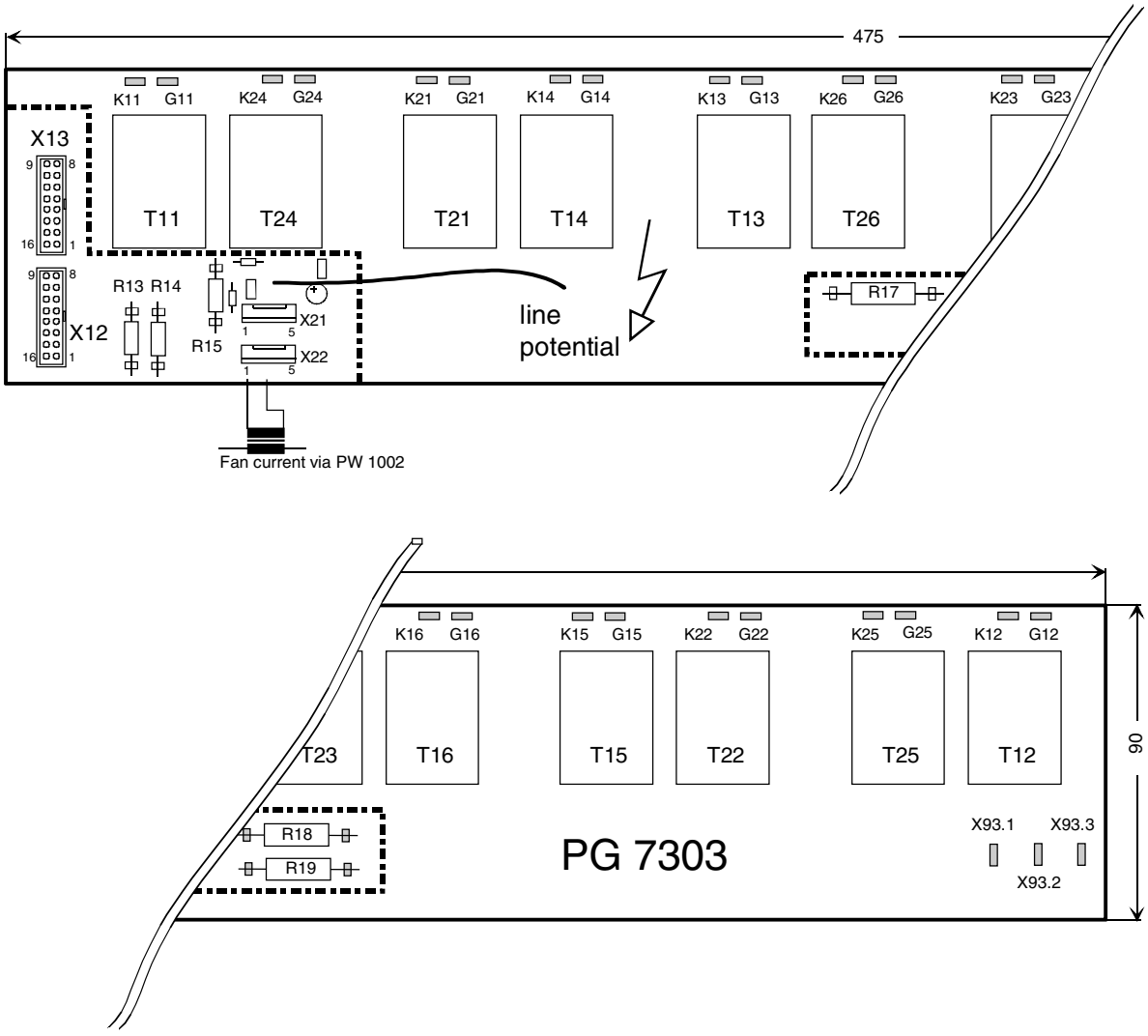


Fig. 5.8/1 Layout of the interface board PG 7303.

Spare part
The protection of the power part is done by using RC and snubber circuits. The snubber circuit is protected by fuses F71, F72 and F73. The AC voltage measurement is taken from behind the fuse.

Fuse data: Ferraz 25 A/660 V;
Type 6,621 CP URD 22.58 Q/25

2-Q Converters

Board type			PG 7303		
Current transformer ratio			1200:1		1500:1
Rated voltage [V]			400/500	400/500	400/500
Rated current [A]			950	1180	1750
Basic burden [W]			5	5	5
Zero current detection	R15 [Ω]		22	22	22
Rated current scaling	R17 [Ω]		3.3	3.3	3.3
Rated current scaling	R18 [Ω]		47.5	10	3.3
Rated current scaling	R19 [Ω]		33.2	10	22
Unit coding	R13 [Ω]		1500		
Unit coding	R14 [Ω]		1500		
Software	≥S21.232	≥S15.208/15.610			
Rated current [A]	[P517]	[P4207]	950	1180	1750
Rated voltage [V]	[P518]	[P4208]	500		
Max. heatsink temp.[°C]	[P519]	[P4209]	45	45	45
Converter type	[P520]	[P4210]	4		
Number of quadrants	[P521]	[P4211]	1	1	1
Time delay [10 ms]	[P527]		500	500	500
Time delay [100 ms]		[P4214]	50	50	50

Table 5.8/1 Settings of the PG 7303 board for **2-Q converters**, if a DCP converter index **D** is equipped with it by ABB.

4-Q Converters

Board type			PG 7303		
Current transformer ratio			1200:1		1500:1
Rated voltage [V]			400/500	400/500	400/500
Rated current [A]			875	1100	1650
Basic burden [Ω]			5	5	5
Zero current detection	R15 [Ω]		22	22	22
Rated current scaling	R17 [Ω]		4.7	3.3	3.3
Rated current scaling	R18 [Ω]		22.1	10	4.7
Rated current scaling	R19 [Ω]		22.1	18	12
Unit coding	R13 [Ω]		1500		
Unit coding	R14 [Ω]		1500		
Software	≥S21.232	≥S15.208/15.610			
Rated current [A]	[P517]	[P4207]	875	1100	1650
Rated voltage [V]	[P518]	[P4208]	500		
Max. heatsink temp.[°C]	[P519]	[P4209]	45	45	45
Converter type	[P520]	[P4210]	4		
Number of quadrants	[P521]	[P4211]	4	4	4
Time delay [10 ms]	[P527]		500	500	500
Time delay [100 ms]		[P4214]	50	50	50

Table 5.8/2 Settings of the PG 7303 board for **4-Q converters**, if a DCP converter index **D** is equipped with it by ABB.

PG board as a spare part:
- Standard: all slots unoccupied!
- ensure the correct converter type related settings

5.9 Fan current monitoring

The heatsink temperature of the power part of some DCS converters is monitored via a PTC element. Other DCS converters check the cooling air temperature and the airflow. The third option is this one, which measures the fan current being within limits. In case the fan current is too low or there is no fan current at all or it is too high, the drive needs to be switched off. The fan current may be too low because

- the fan may not be switched on or
- any protection device within the fan supply has acted or
- a wire is broken or
- the propeller became loose or something similar

The fan current may be too high because

- the fan may be blocked mechanically or
- there is a short circuit in the fan winding or something similar

The overcurrent during acceleration can be suppressed by the software.

5.9.1 PW 1002

This device is designed and used exclusively at DCP converters above 800 A directly in default condition. It is supplied by a 230 V single phase power supply and will monitor the two single phase fans mounted on top of the converter in parallel configuration. The transfer characteristic is identical to the one described at the PW 1003. The part power section cooling within this manual shows the interconnections between the power supply, the fans and the interface board PG 7xx3.

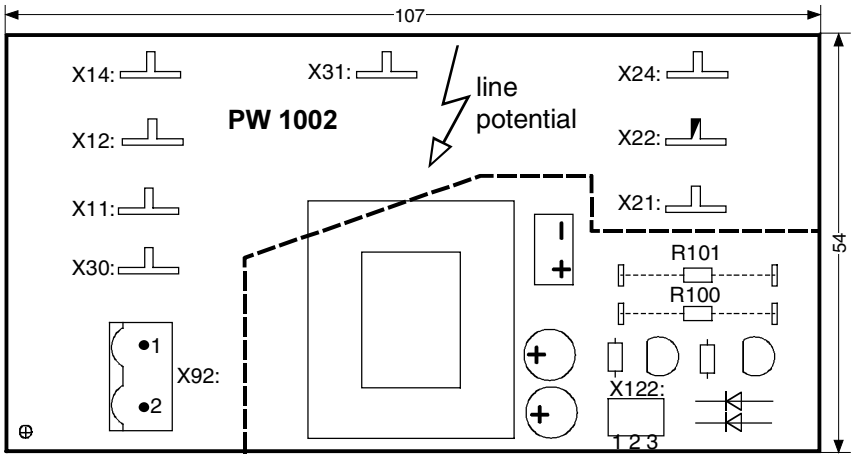


Fig. 5.9/1 Layout of the PW 1002

Data

AC input / output voltage:	single phase; 230 V
AC input / output current:	5 A
AC peak current:	according to fan starting current; external switching device needed
AC isolation voltage:	690 V (supply via autotransformer)
Load:	single phase AC motors with starting capacitor
Frequency:	50 Hz / 60 Hz
Output data:	passive device; to be used together with DCS electronics only
Terminal cross sectional area:	X92: power supply; max. 2.5 mm^2 X11: to X31: motor connection; 6.3 mm faston
Current scaling:	burden resistor R100 / R101; R100/R101 = 120 Ω each
Interconnection:	See part power section cooling of DCP converters

5.9.2 PW 1003

This device is designed to be used together with the DCR kit at any type of rebuild application. It can monitor the current of single or three phase fans and it can be cascaded, which means multiple devices can be connected to one PTC input to monitor several fan current. The transfer characteristic shown at figure 5.9/3 needs to be adapted to the fan current either by changing the burden resistors or by a software parameter, depending on the type of fan already used for the existing power part.

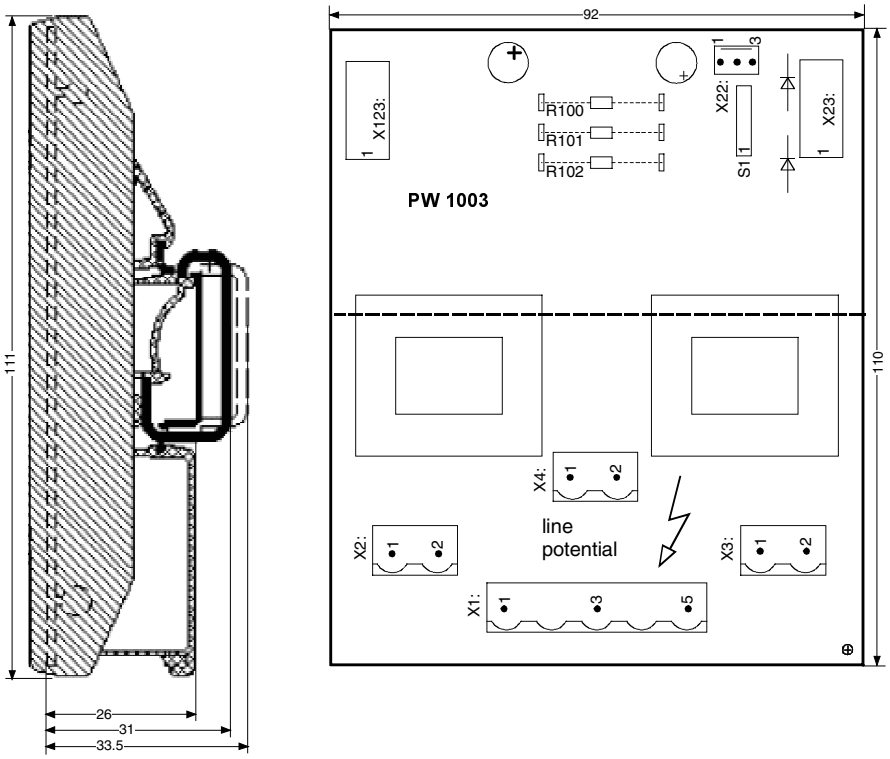


Fig. 5.9/2 Layout of the PW 1003

Data

AC input / output voltage:	1-ph / 3-ph; 400 V phase to phase / 230V phase to neutral
AC input / output current:	5 A
AC peak current:	According to fan starting current; external switching device needed
AC isolation voltage:	690 V (supply via autotransformer)
Load:	three phase AC motors or single phase AC motors with starting capacitor
Frequency:	50 Hz / 60 Hz
Output data:	passive device; to be used together with DCS electronics only
Terminal cross sectional area:	X1: power supply; max. 2.5 mm^2 X2: to X4: motor connection; 2.5 mm^2
Current scaling:	burden resistor R100 / R101 / R102; see Fig. 5.9/3
Interconnection:	X22:1 to X22:3 at SDCS-PIN20x / 5x X22:3 to X22:1 at SDCS-PIN20x / 5x
System configuration:	PW 1003 can be cascaded via terminal X23: - X123:
Jumpers:	S1:1 / S1:2 for future extensions S1:3 / S1:4 adapt the transfer characteristics

5.9.3 Transfer characteristic of PW1002/3

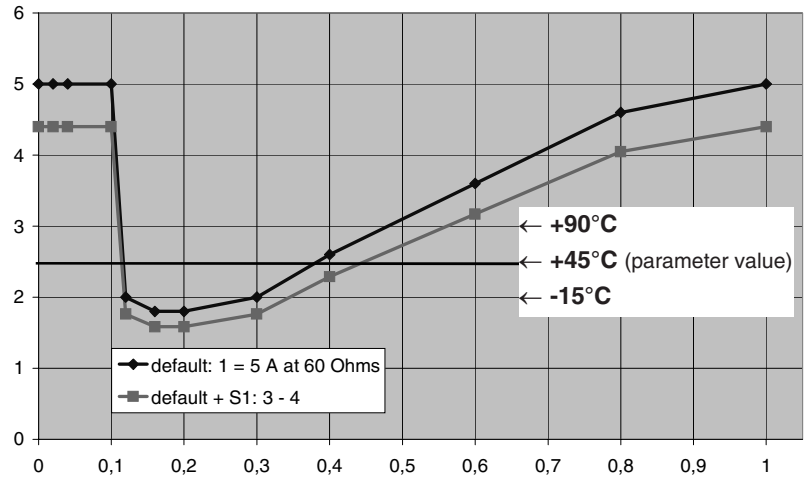


Fig. 5.9/3 Relationship between fan current and output voltage of PW 1002/1003

Fig. 5.9/3 is used to adapt the device PW1002/3 to the fan current. The X-axis is normalized to 1 and represents the fan current. With a burden resistor of 60 Ohms (equal to default) the 1 is equal to 5 A. The Y-axis is scaled in output voltage (with external pull-up resistor of 2k2 to 5 V) as the output signal towards the converter electronics. Values within 2 V and 3 V are of interest, because these values can be set via software as a threshold, using the temperature setting parameter. The converter generates an error message, if the current is lower / higher than the intersection -parameter value / -selected curve.

5.10 Zero current detection SDCS-CZD-01

This board is used for fast zero current detection especially for three phase field converter in **M**otor **G**enerator application. The board provides a safe zero current detection also for other very big load inductances.

The board is located on SDCS-CON-2 board and plugged on X12, X13 and X17.
X17: is only used for mechanical reasons. The electrical function (connection to IOE-1) is unchanged.

All DCS/DCF converter are equipped with a zero current detection by monitoring the current signal to a certain level.

The CZD-01 board has in addition a cathode / anode voltage measurement of all thyristors. The voltage measurement provides a sharp detection of DC load condition.

The requirement for zero current detection is:
- actual load current falls below a low treshold
- AND upper thristors are blocked (V11,V13,V15..)
  OR lower thyristors are blocked (V12,V14,V15..)

The activation of the board must be set in the software via parameter:

DCF500	4.19	ZERO CUR DETECT
DCF600	43.14	ZERO CUR DETECT

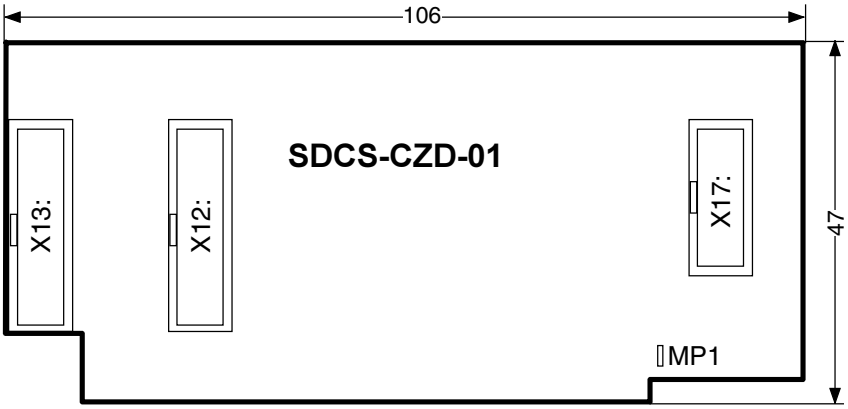


Fig. 5.10/1 Layout of the SDCS-CZD-01 board

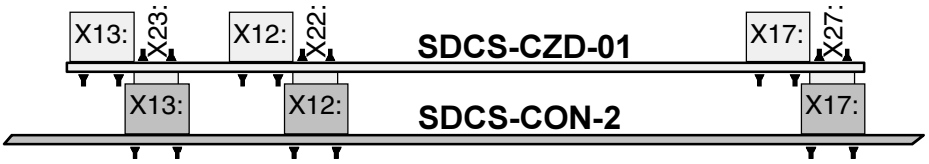


Fig. 5.10/2 Connection between the SDCS-CZD-01 and SDCS-CON-2 board

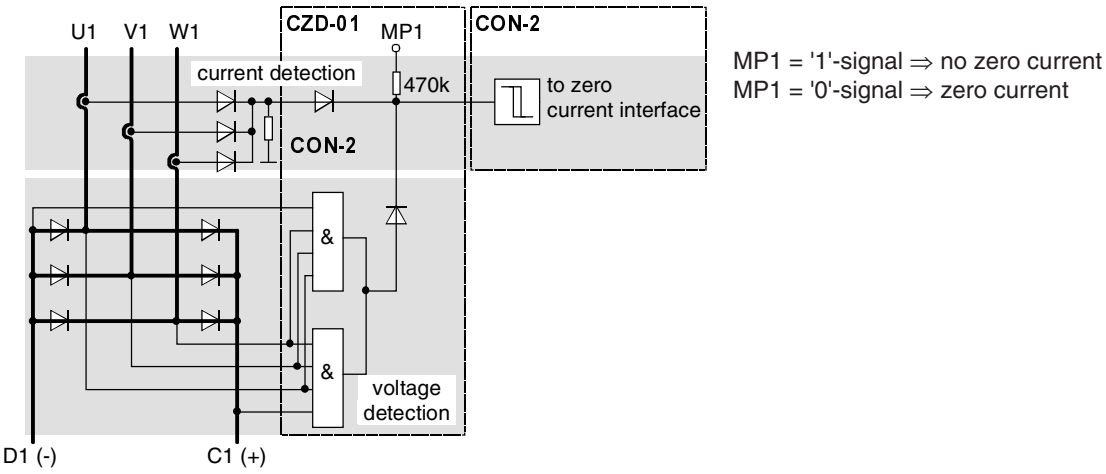


Fig. 5.10/3 Principle diagram of SDCSCZD-01

5.11 Power signal measurement board SDCS-MP-1

The power signal measurement board SDCS-MP-1 is intended to be used as a service and rebuild (DCR 500 /DCR 600 commissioning) aid. Without this board it is practically impossible to measure with oscilloscope or with general purpose meter signals between the control board and the power interface board(s).

The board is plugged to the control board connectors X12, X13 and X17. The ribbon cables normally connected to the control board are connected to the measurement board connectors having the same name as the respective connector on the control board.
Measurement points for following signals are provided:

- the three phase to ground voltages U_U, U_V and U_W
- the three phase to phase voltages U_{VU}, U_{WV} and U_{UW}
- one rectified and filtered phase to phase voltage U_{AC}
- armature voltage U_{DC} with sign filtered
- armature current I_{ACT} with sign
- the six thyristor firing commands BZP1...BZP6
- the two current direction commands SR1 and SR2 (measurement points SR11 and SR21)
- the sum of pulse transformer primary currents can be measured accross measurement points SR11-SR12 or SR21-SR22 depending on current direction
- the control board ground 0V.

The measurement points are separated from the control board signals either with 10 kΩ resistors or with operational amplifiers so that accidental short circuits between the measurement points do not affect the converter operation. Measurement point 0V is directly connected to control board ground.

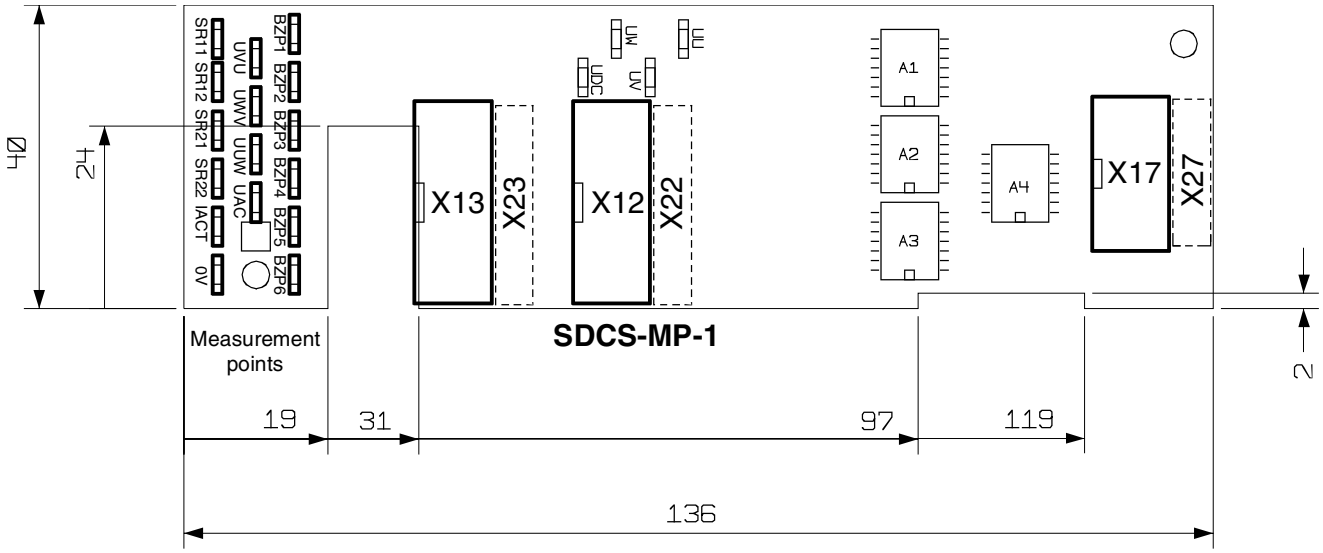


Fig. 5.11/1 Layout of the SDCS-MP-1 board

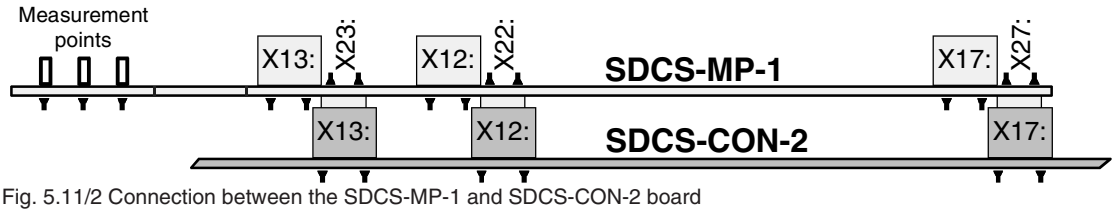
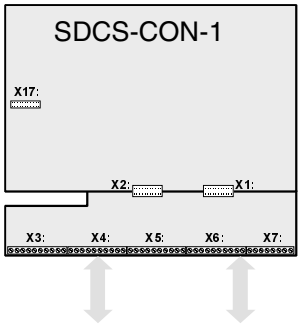


Fig. 5.11/2 Connection between the SDCS-MP-1 and SDCS-CON-2 board

6 Digital and analogue I/O boards

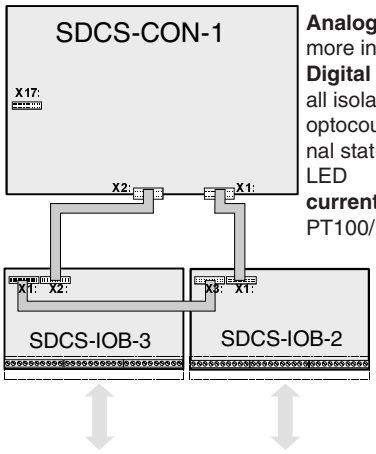
With control board SDCS-CON-1

There are two possibilities available for the interface between a PLC and the converter with a control board SDCS-CON-1. The first one consists of the SDCS-IOB-1 board, which can be mounted inside the converter module. The other one consists of the SDCS-IOB2x **and** SDCS-IOB-3 board. If these two boards are in use they must be mounted outside the converter.
In addition to this an extension of I/O´s by SDCS-IOE-1 is possible.



Analogue I/O´s:
standard
Digital I/O´s:
not isolated
Encoder input:
not isolated

Fig. 6/1 I/O via SDCS-IOB-1

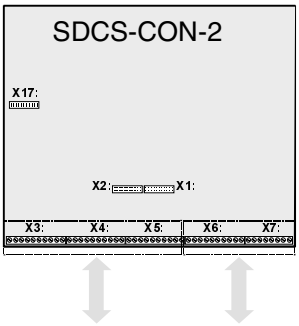


Analogue I/O´s:
more input capacity
Digital I/O´s:
all isolated by means of optocoupler/relay, the signal status is indicated by LED
current source for:
PT100/PTC element

Fig. 6/2 I/O via SDCS-IOB-2 and SDCS-IOB-3

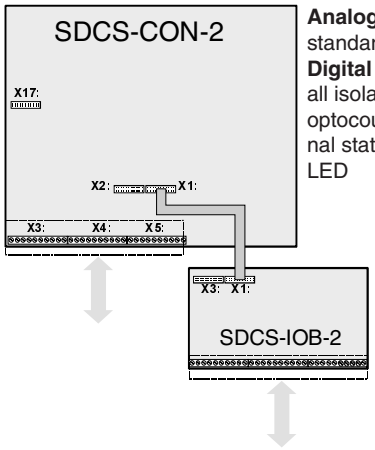
With control board SDCS-CON-2

The converter with a control board SDCS-CON-2 can be connected in 4 different ways to a control unit via analogue/digital links. Only one of the four choices can be used at the same time (Description of the I/O's see chapter SDCS-CON-2). In addition to this an extension of I/O´s by SDCS-IOE-1 is possible.



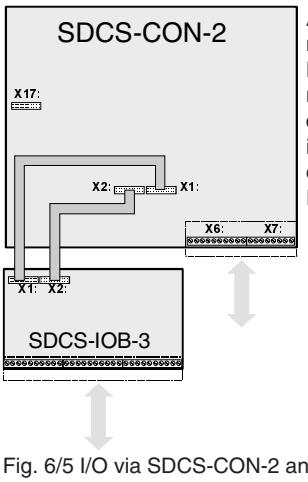
Analogue I/O´s:
standard
Digital I/O´s:
not isolated
Encoder input:
not isolated

Fig. 6/3 I/O via SDCS-CON-2



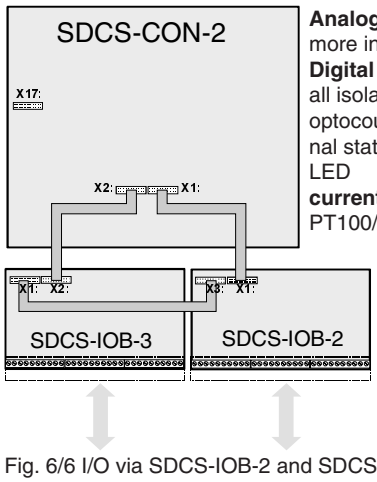
Analogue I/O´s:
standard
Digital I/O´s:
all isolated by means of optocoupler/relay, the signal status is indicated by LED

Fig. 6/4 I/O via SDCS-CON-2 and SDCS-IOB-2



Analogue I/O´s:
more input capacity
Digital I/O´s:
not isolated
encoder input:
isolated
current source for:
PT100/PTC element

Fig. 6/5 I/O via SDCS-CON-2 and SDCS-IOB-3



Analogue I/O´s:
more input capacity
Digital I/O´s:
all isolated by means of optocoupler/relay, the signal status is indicated by LED
current source for:
PT100/PTC element

Fig. 6/6 I/O via SDCS-IOB-2 and SDCS-IOB-3

6.1 Digital and analogue I/O connection board SDCS-IOB-1

The SDCS-IOB-1 board can be mounted inside the converter module equipped with a control board SDCS-CON-1.
The SDCS-IOB-1 board has 8 digital inputs, 7 digital outputs, 5 analogue inputs including a tacho generator interface, 2 analogue outputs, one dedicated analogue output of actual current and incremental encoder interface.

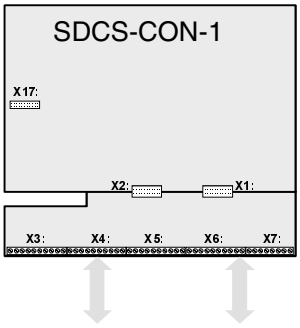


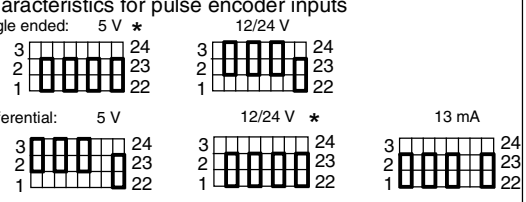
Fig. 6.1/1 I/O via SDCS-IOB-1

Jumper coding

S1 Characteristics for pulse encoder inputs

single ended: 5 V * 12/24 V

differential: 5 V 12/24 V * 13 mA



Input AI2 used for temperature measurement via PTC

Ch	Terminal	22-23 *	23-24
AI2-	X3:7	n. c. to +10V	22 kΩ ->+10V

* default value

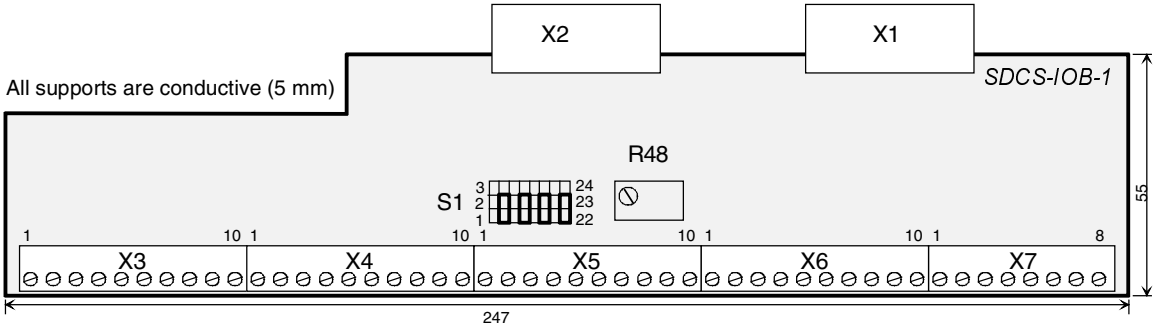
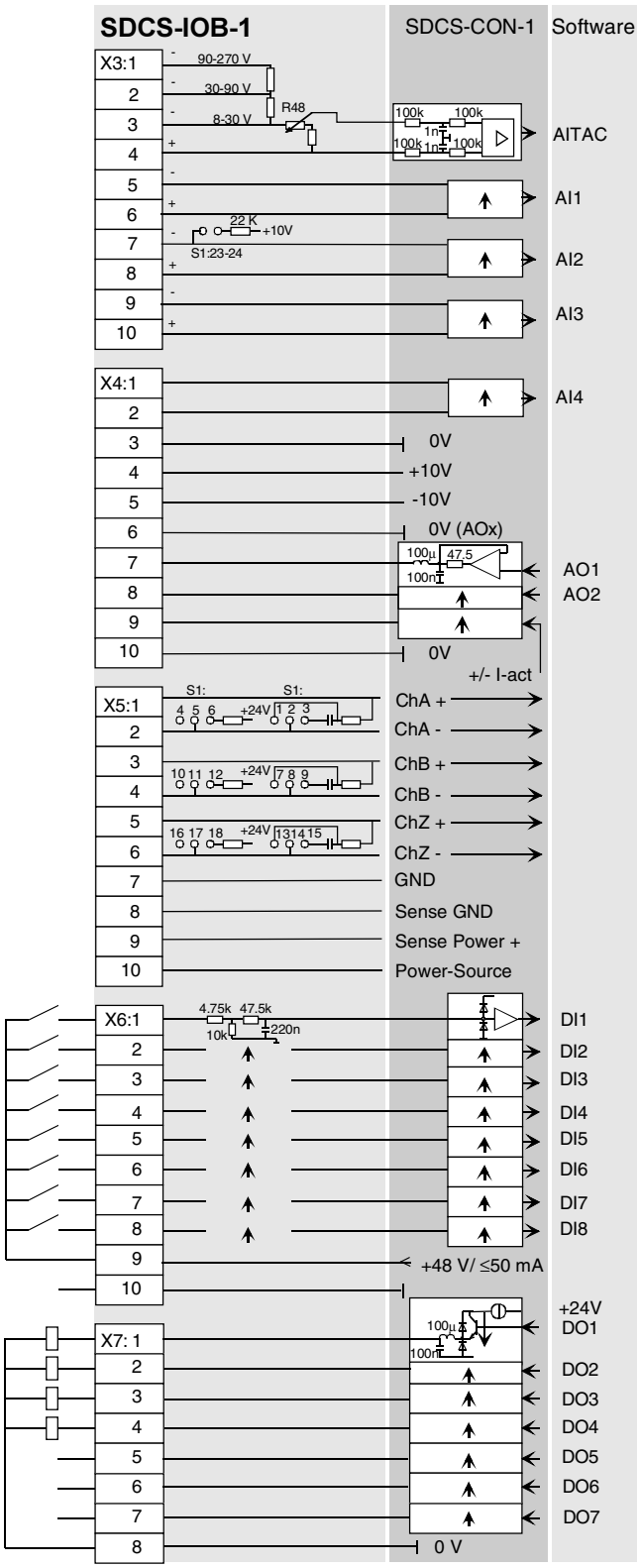


Fig. 6.1/2 Layout and jumper settings of the SDCS-IOB-1 board



Reso-lution [bit]	Input/output values Hardware	Scaling by	Power	Common mode range	Remarks
12 + sign	±90...270 V ±30...90 V ±8...30 V	R 48/ Software		±20 V	① ② ③
12 + sign	-10...0...+10 V	Software		±20 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
			≤5 * mA ≤5 * mA		for external use e.g. reference pot.
11 + sign 11 + sign analogue	-10...0...+10 V -10...0...+10 V ±3 V	Software Software fixed	≤5 * mA ≤5 * mA ≤5 * mA		3 V ≙ nom. conv. curr.

Encoder supply		Remarks
		Inputs not isolated Impedance = 120 Ω, if selected max. frequence ≤300 kHz
5V/ 12V/24V	≤0.25 A * ≤0.2 A *	Sense lines for GND and supply to correct voltage drops on cable (only if 5V/12V encoder is in use) Selectable on POW-1 board

Input value	Signal definition by	Remarks
0...8 V 16...60 V	Software	≙ "0" status ≙ "1" status

Output value	Signal definition by	Remarks
50 * mA	Software	Current limit for all 7 outputs = 160 mA **Do not apply any reverse voltages!**

① total smoothing time ≤2 ms
② -20...0...+20 mA by external 500 Ω resistor
③ 4...20 mA by ② + Software function
* short circuit proof (but a short-circuit can cause a malfunction of the drive)

Fig. 6.1/3 Terminal connection of the SDCS-IOB-1 board

As described at the beginning of the chapter, there are various options for configuring the inputs/outputs.

The board IOB-2x has 8 digital inputs and 8 digital outputs.
There are three different types existing, which differ at the input voltage level:

SDCS-IOB-21	24...48V DC
SDCS-IOB-22	115 V AC
SDCS-IOB-23	230 V AC

The inputs are filtered and galvanically isolated by using opto couplers. Inputs can form two galvanically separated groups by using either X7:1 or X7:2.

If these boards are in use, they have to be mounted outside the DCS module. They must be mounted in a way, that the conductive supports have a good connection to ground of the installation.

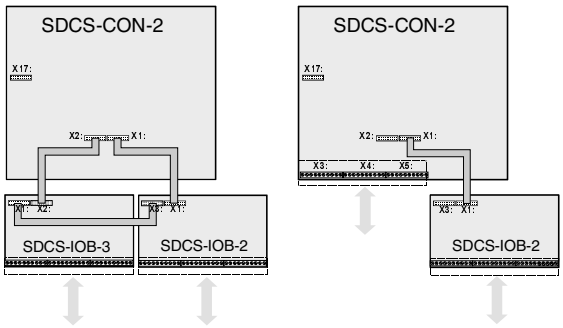
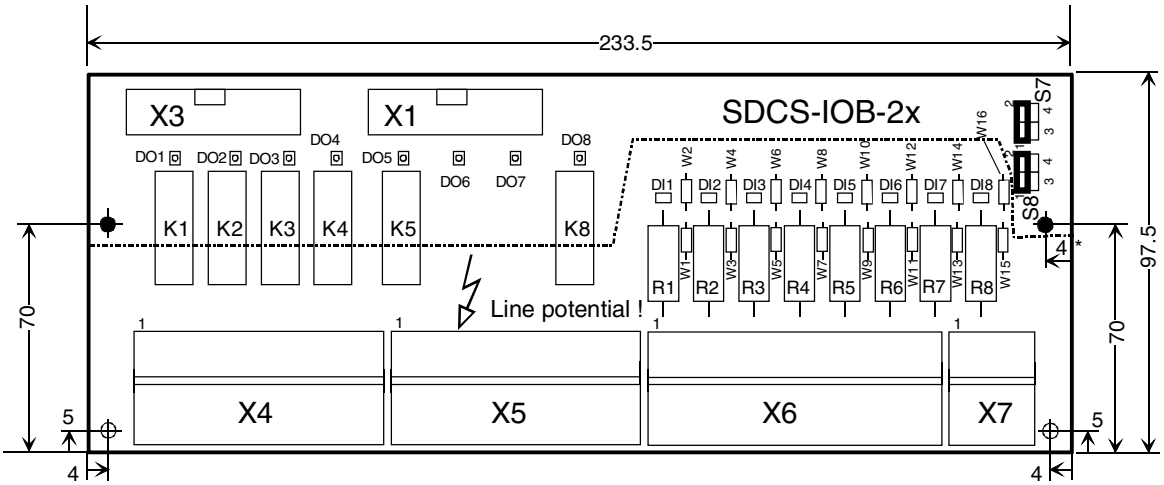


Fig. 6.2/1 I/O via SDCS-IOB-2x / IOB-3 and CON-x

The cable length between X1:/X1: and X2:/X2: is 1.7 m and between X1:/X3: is 0.5 m because of EMC reasons.



Jumper coding

	input	time constant 2ms	time constant 10ms
S7	DI 7		*
S8	DI 8		*

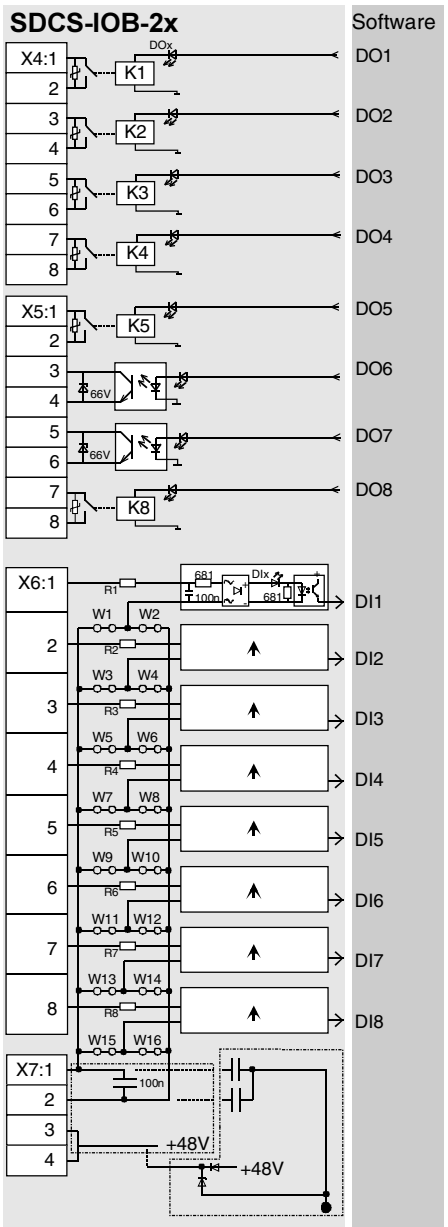
* default value

● supports are conductive

diameter of all supports: 4.3 mm

* this dimension may vary (4/5 mm) depending on revision

Fig. 6.2/2 Layout and jumper settings of the SDCS-IOB-2x board



Note:
When the SDCS-CON-2 control board with the SDCS-IOB-2 I/O board is installed, terminals X6: and X7: on the SDCS-CON-2 must not be used.

Output value	Signal definition by	Remarks
K1...K5, K8	Software	potential-isolated by relays (NO contact element) Contact ratings: **AC**: ≤250 V~/ ≤3 A~ **DC**: ≤24 V-/ ≤3 A- or ≤115/230 V-/ ≤0.3 A-) MOV-protected (275 V)
K6,7	Software	potential-isolated by optocoupler Switching capacity: ≤50 mA external voltage: ≤24 V-

X4:, X5: are screw-clamp terminal types for leads up to 4 mm² cross-sectional area.
Default values are shown within the software diagrams.
The ground potential of the digital outputs may vary within ±100 V to each other.

Input value	Signal definition by	Remarks
Channel 1...8 **IOB-21:** 0...8 V 18...60 V **IOB-22:** 0...20 V 60...130 V **IOB-23:** 0...40 V 90...250 V	Software	potential-isolated by optocoupler **(24...48V-)** R1...R8 = 4.7 kΩ ≦ "0 signal" ≧ "1 signal" **(115V~)** R1...R8 = 22 kΩ ≦ "0 signal" ≧ "1 signal" **(230 V~)** R1...R8 = 47 kΩ ≦ "0 signal" ≧ "1 sig." including tolerance; absolute max values

X6: / X7: are screw-clamp terminal types for leads up to 4 mm² cross-sectional area
Input resistance: see diagram.
Input smoothing time constant: see diagram.
Smoothing time constant of channel 7 and 8 can be changed; see layout of the board.
The functionality of the input channels, which will be read, can be defined by software; default values are shown within the software diagrams
Power supply for digital inputs: 48V / ≤ 50mA; not galv. isolated from the DCS electronics!

If the inputs are supplied from the internal +48 V (X7:3 and/or X7:4) a connection must be done from either X7:1 and/or X7:2 to ground of the DCS 500 modules. In default condition ground is identical to the converter's frame.

If the inputs are supplied by any external source (+48 V DC, 115 V AC or 230 V AC) the neutral line / - line must be connected to either X7:1 or X7:2. If the inputs should be controlled with the same voltage level, but from two different voltage sources, having probably two different ground levels, the first neutral line should be connected to X7:1 and the second to X7:2. In this case the jumpers Wx connecting the inputs to X7:2, but controlled by the source, connected to X7:1, must be cut off.
The same method is needed for the other jumpers Wx.

High frequency grounding is done by 100 nF capacitor.

Fig. 6.2/3 Terminal connection of the SDCS-IOB-2x board

As described at the beginning of the chapter, there are various options for configuring the inputs/outputs.

The board SDCS-IOB-3 consists of the 5 analogue inputs, 3 analogue outputs, the galvanical isolated pulse encoder interface and a current source for temperature measuring devices.

If these boards are in use, they have to be mounted outside the DCS module. They must be mounted in a way, that the conductive supports have a good connection to ground of the installation.

The cable length between X1:/X1: and X2:/X2: is 1.7 m and between X1:/X3: is 0.5 m because of EMC reasons.

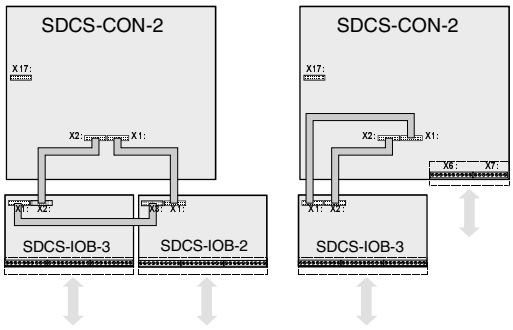
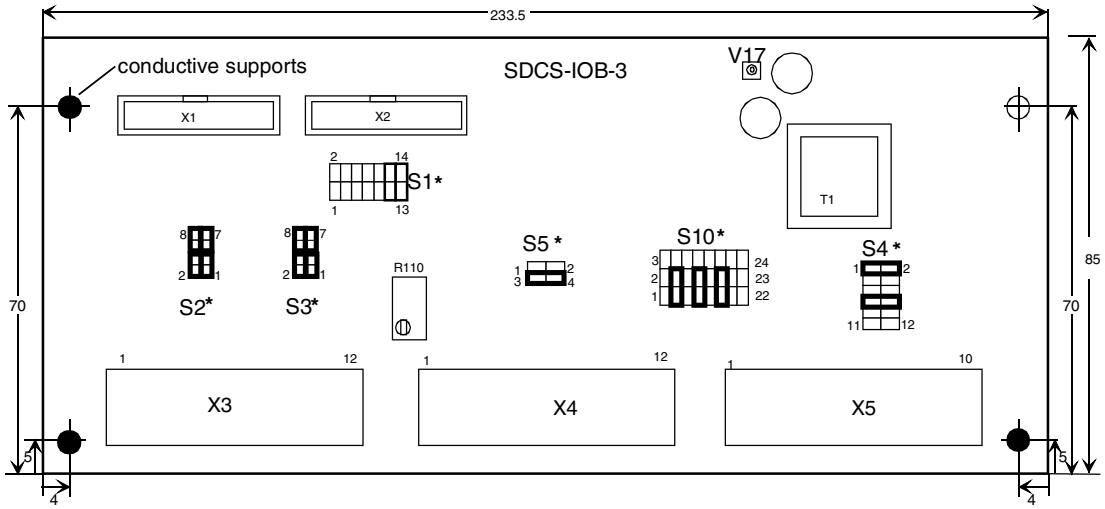


Fig. 6.3/1 I/O via SDCS-IOB-2x / IOB-3 and CON-x



Jumper coding

Functionallity of analogue inputs

	Ch	activation of 500 Ω between input terminal	gain = 1 * -10V..+10V	gain = 10 -1V..+1V	Sum I AC not equal to 0 *
S1 S2 S3	AITAC	S1:1-2	x		
	AI1	S1:3-4	x		
	AI2	S1:5-6	S2	S2	
	AI3	S1:7-8	S3	S3	
	AI4	S1:9-10	x		S1:11-12 S1:13-14

S4 Pulse encoder supply: 5 V | 12 V | 24 V *

S5 Temperature sensor supply: PTC 1.5 mA | PT100 5 mA *

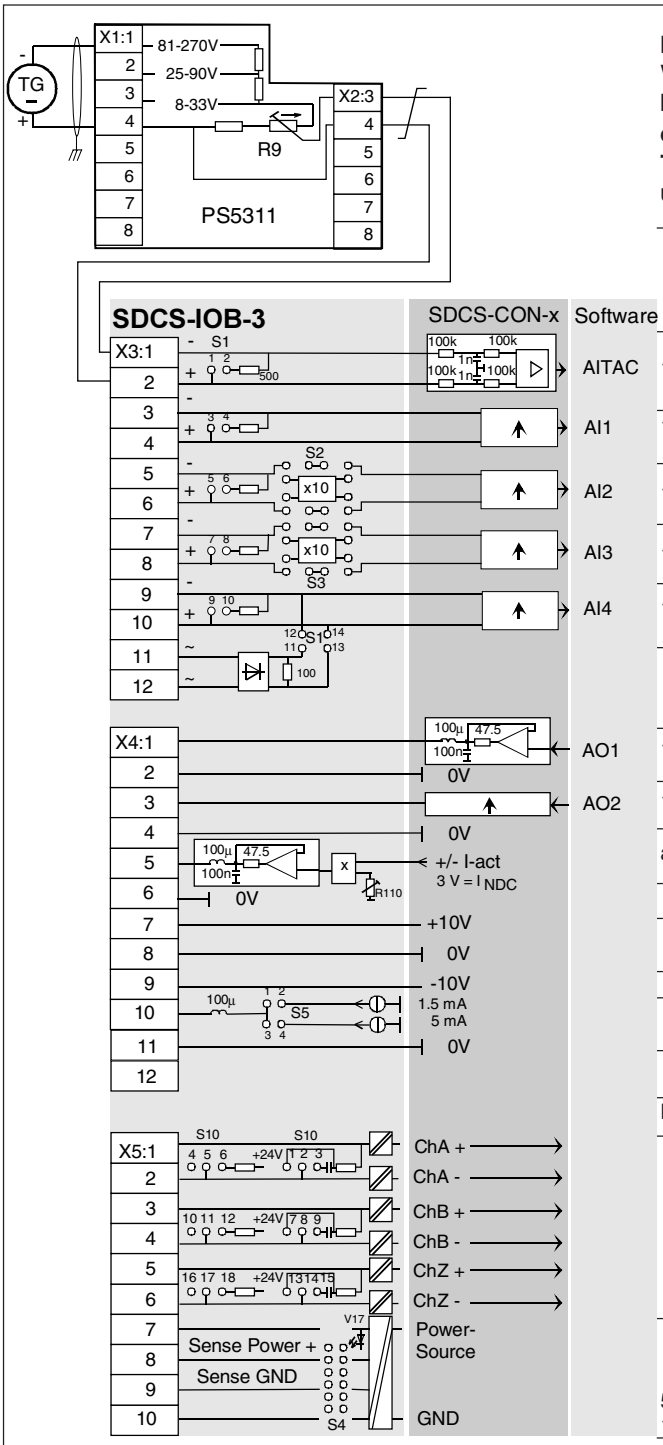
S10 Characteristics for pulse encoder inputs

single ended: 5 V * | 12/24 V

differential: 5 V | 12/24 V * | 13 mA

* default value

Fig. 6.3/2 Layout and jumper settings of the SDCS-IOB-3 board



Note:
When the SDCS-CON-2 control board with the SDCS-IOB-3 I/O board is installed, the connection through plugs S4:1-2 and 3-4 on the SDCS-CON-2 must be severed.
Terminals X3:, X4: and X5: on the SDCS-CON-2 must not be used.

Resolution [bit]	Input/output values Hardware	Scaling by	Power	Common mode range	Remarks
12 + sign	-10...0...+10 V	Software		±20 V	① ② ③ ⑥
12 + sign	-10...0...+10 V	Software		±20 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③ ④ ⑤
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③ ④ ⑤
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
11 + sign	-10...0...+10 V	Software	≤5 * mA		
11 + sign	-10...0...+10 V	Software	≤5 * mA		
analogue	-10...0...+10 V	R 110	≤5 * mA		gain: 0.5...5
			≤5 * mA ≤5 * mA		for external use e.g. reference pot.
	1.5 mA 5 mA				Curr. source for PTC Curr. source for PT100

Encoder supply		Remarks
		Inputs isolated; Impedance = 120 Ω, if selected max. frequence ≤300 kHz
		Sense lines for GND and supply to correct voltage drops on cable (only if 5V/12V enc. is in use)
5V/ 12V/24V	≤0.25 A * ≤0.2 A *	Incremental encoder power supply

Earth fault protection is based on a sum current transformer where the secondary is connected through 100 Ω resistor to a diode bridge. Voltage will appear across the resistor, if the sum of the 3 phase current is not zero.

Restrictions using jumper S1, S2 or S3:
The selection for the burden resistor across the input terminals can be done independent from S2 or S3 settings for inputs AITAC, AI1, AI2, AI3 and AI4.
If the gain is set to 10 by using S2 or S3 and the 500 Ω burden resistor is activated, the input signal level is changed to -2 mA...0...+2 mA.
For input AI4 there are the following configurations available:
- input range ”20mA” , or
- input range ”10V”, or
- earth fault monitoring by Isum not equal to zero

① total smoothing time ≤2 ms
② -20...0...+20 mA by setting S1
③ 4...20 mA by ② + Software function
④ -1...0...-1 V by setting S2/S3 (CMR ±10 V)
-2...0...-2 mA by setting S2/S3 + S1 (CMR ±10 V)
⑤ designated for PT100 evaluation per software and hardware
⑥ If the input is used for tacho feedback and the tacho voltage needs to be scaled, the board PS5311 must be ordered separate. If this input is used for feedback signals, there is a need for any additional margin of overshoot measurements. This margin is set by software and results e.g. in the 8 to 33 volts at PS5311.
* short circuit proof

Fig. 6.3/3 Terminal connection of the SDCS-IOB-3 board

Connecting a pulse encoder to the DCS 500 converter

The connection diagram for a pulse encoder to the electronics of a DCS converter is quite similar, if the SDCS-IOB-1/SDCS-CON-2 or the SDCS-IOB-3 is used. The basic difference between these 2 boards is the galvanical isolated circuit on the SDCS-IOB-3 board.

Power supply for incremental encoder

There is a galvanically isolated power supply for the incremental encoder on SDCS-IOB-3. The jumper S4 on this board is used to select either +5 V, +12 V or +24 V as a supply voltage for the pulse encoder. When LED indicator (V17) is lit, the supply is OK.

The pulses generated by the pulse encoder are transferred to the pulse receivers via opto couplers.

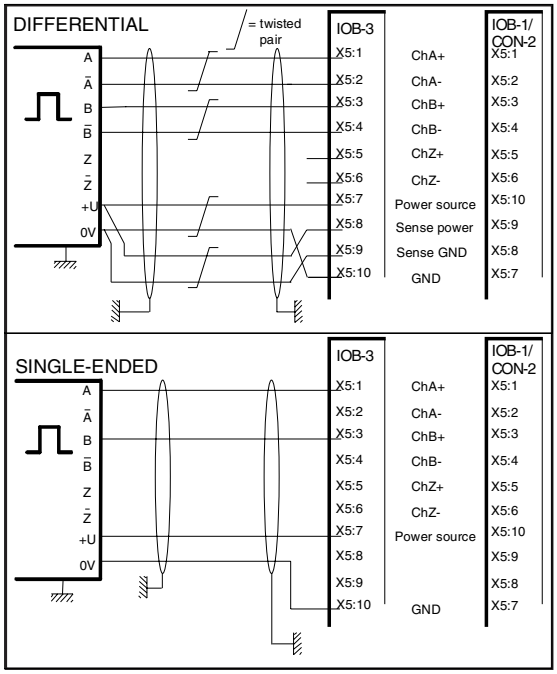


Fig. 6.3/4 Connections incremental encoder - electronics

If the **SDCS-IOB-1/SDCS-CON-2 board** is used the supply voltage for the pulse encoder is selected on the SDCS-POW-1 board (refer to SDCS-POW-1).

In both cases the voltage regulator has a feedback control with Sense power and Sense GND signals.

Feedback connection is recommended when power supply level for differential pulse encoder is 5V. If a 12 V pulse encoder type is in use the sense function is also available. The wiring is shown on figure 6.3/4.

Note:
If the drive's direction of rotation is correct (if necessary, correct by exchanging the field connections), the ***Tacho error*** message may appear during start-up.

If with a positive reference the TACHO_PULSES signal (with software 21.xxx: parameter 12104) does not look like the illustration below, then tracks A and Ā must be mutually exchanged with encoders with inverted signals, and tracks A and B with encoders without inverted signals.

If the TACHO_PULSES signal is missing or non-linear, the encoder's pulses are not being read correctly. Possible reasons for this may be the encoder supply, the encoder itself, or the wiring.

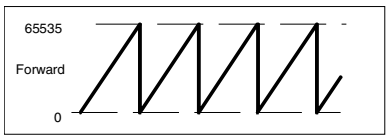


Fig. 6.3/5 TACHO_PULSES signal

Incremental encoder

Two different incremental encoder connections are available.

- differential connection; pulse encoders generating either voltage or current signals can be used
- single-ended (push pull) connection; voltage signals

Restrictions using jumper S1: or S10: depending on the board

Line termination via S1/S10: 2-3 / 8-9 / 14-15 should not be used at 12 V or 24 V encoders, because of the power consumption taken from the encoder. If a pulse encoder with a build in current source is used a burden resistor of 120 Ω is activated via jumper S1/ S10: 1-2 a.s.o.

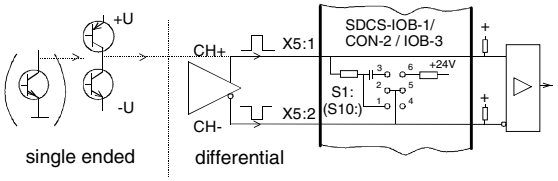


Fig. 6.3/6 Pulse encoder connection principles

If a single ended 12 V / 24 V encoder is used S1/S10 should be set to 5-6 / 11-12 / 17-18 according to the layouts of the boards. This setting results in an internal threshold of appr. 5 V. In case of a single ended 5 V encoder the jumpers will be set to a neutral position S1/ S10: 4-5 / 10-11 / 16-17. To get a threshold lower than 5 V each terminal X5:2 / X5:4 / X5:6 / X5:7 must be connected via a resistor according to the table below.

R	1 kΩ	1.5 Ω	2.2 kΩ
U_{thresh}	1.2 V	1.8 V	2.3 V

Three differential inputs are reserved for connecting the pulse encoder. CH A and CH B are the normal pulse channels having nominal 90° phase shift between the channels.

The channel CH A- (CH B-) is the inversed channel CH A (CH B). CH Z is the zero pulse channel which can be additionally used if the encoder has an output giving one “zero” pulse per revolution.

The distance between pulse encoder and interface board is dependent on the voltage drop on the connecting lines and on the output and input configuration of the used components. If cables are used according to the next table the voltage drop caused by the cable can be corrected by the voltage regulator.

Cable length	**parallel wires for** power source & GND	**Cable used**
0 ... 50 m	1x 0.25 mm²	12x 0.25 mm²
50 ... 100 m	2x 0.25 mm²	12x 0.25 mm²
100 ... 150 m	3x 0.25 mm²	14x 0.25 mm²

6.4 Extension board SDCS-IOE-1

The board consists of:

7 isolated digital inputs
2 analogue inputs
1 current source for the supply of PTC or PT 100 elements

The board is connected electrically via a 10 pin flat cable to the converter module electronics. The connection will be done to the SDCS-CON-x board from terminal row X17 to X17 on SDCS-IOE-1. It has to be mounted outside of the converter module. The cable length is 2 m because of EMC reasons.

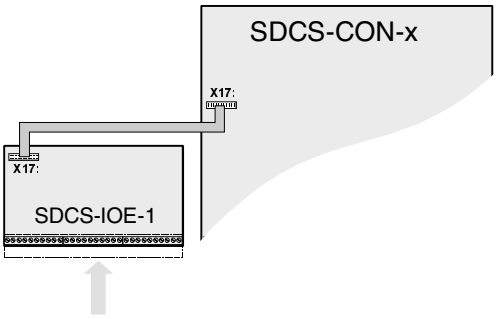


Fig. 6.4/1 Connection of the SDCS-IOE-1 board and the SDCS-CON-x board.

Mechanical Construction

The board is mounted on a plastic housing which has foot elements (Phoenix Contact series UMK). The foot elements permit snap-in assembly to a standard DIN EN rail (EN 50022, 50035).
The dimensions are including the plastic housing.

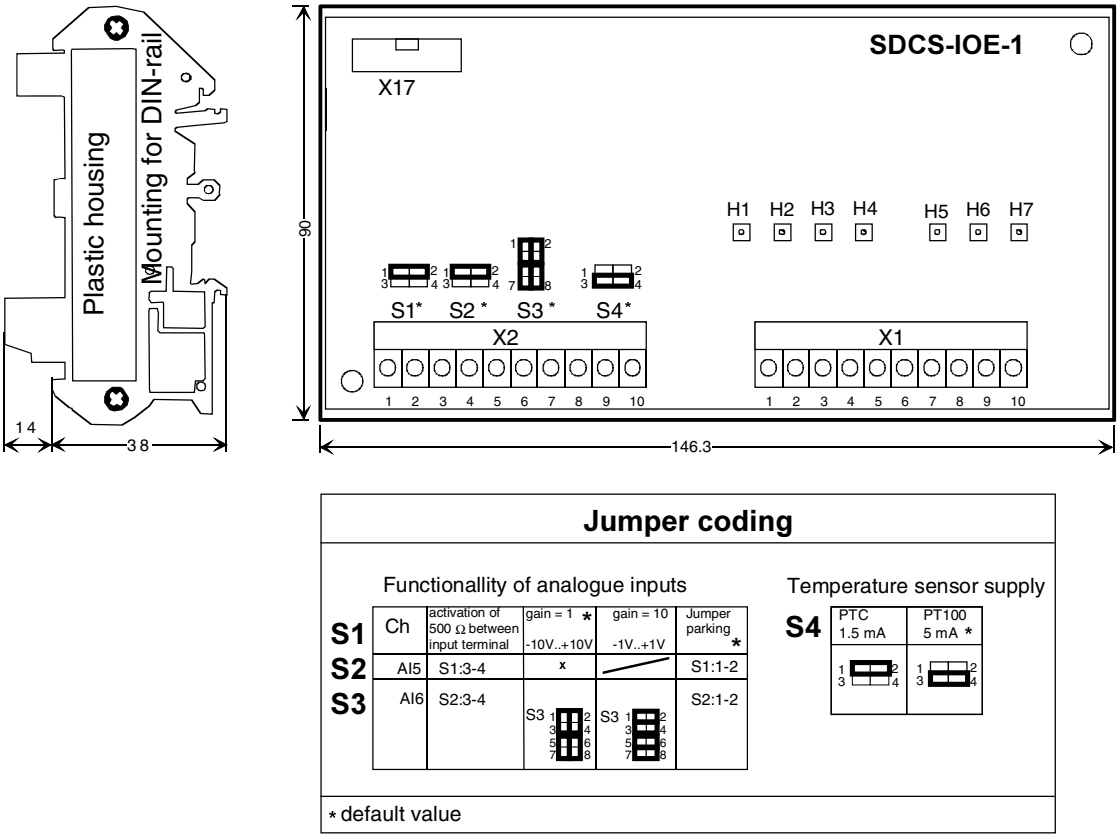
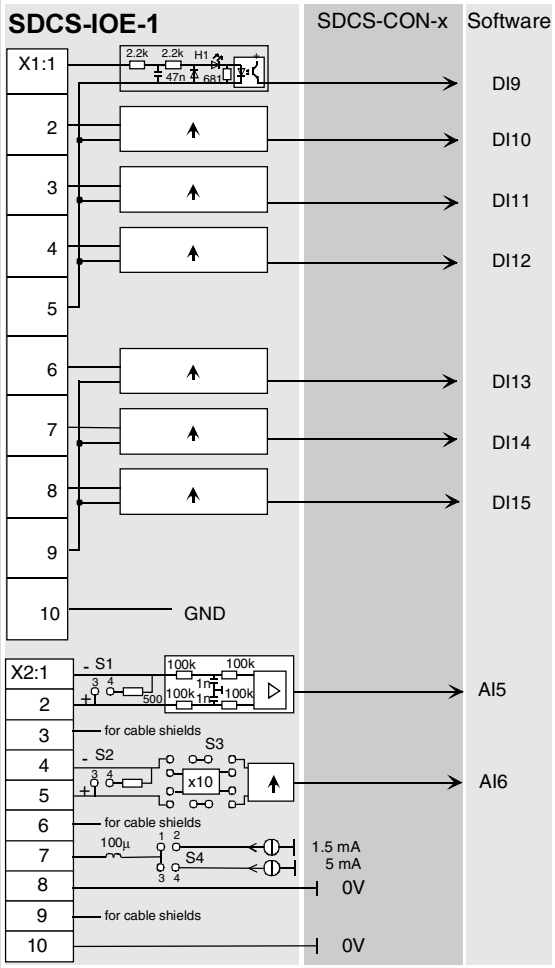


Fig. 6.4/2 Layout and jumper settings of the SDCS-IOE-1 board



Input value	Signal definition by	Remarks
0...8 V 16...31 V	Software	≙ "0" status ≙ "1" status Two potential isolated groups. Max. operating voltage between the groups and the control board is 50 V Filter time constant for all inputs is 2.2 ms

Resolution [bit]	Input/output values Hardware	Scaling by	Power	Common mode range	Remarks
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③
11 + sign	-10...0...+10 V	Software		±40 V	① ② ③ ④
	1.5 mA 5 mA				Curr. source for PTC Curr. source for PT100 absolute accuracy including the control-board is 0.7%

① total smoothing time ≤2 ms
② -20...0...+20 mA by setting S1/S2
③ 4...20 mA by ② + Software function
④ -1...0...-1 V by setting S3 (CMR ±10 V)
-2...0...-2 mA by setting S3 + S2 (CMR ±10 V)

Fig. 6.4/3 Terminal connection of the SDCS-IOE-1 board

7 Communication boards

7.1 Communication board SDCS-COM-1

This board is used for communications to all DCS 500 converter modules independent from their software version. It consists of 3 different communication channels. All RxD channels (receiver) have blue color, all TxD (transmitter) channels have grey color. If any connections should be made always connect the same color (plug and socket) with each other.

Channel 1 is a HDLC channel of 1.5 Mbits/s and is used for the communication with a PC in conjunction with a operation program. If the software version coded by S21.xxx is in use, the other channels cannot be used together.

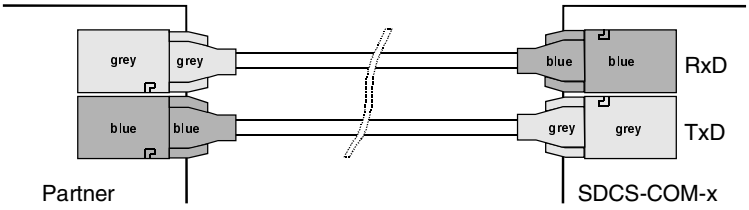
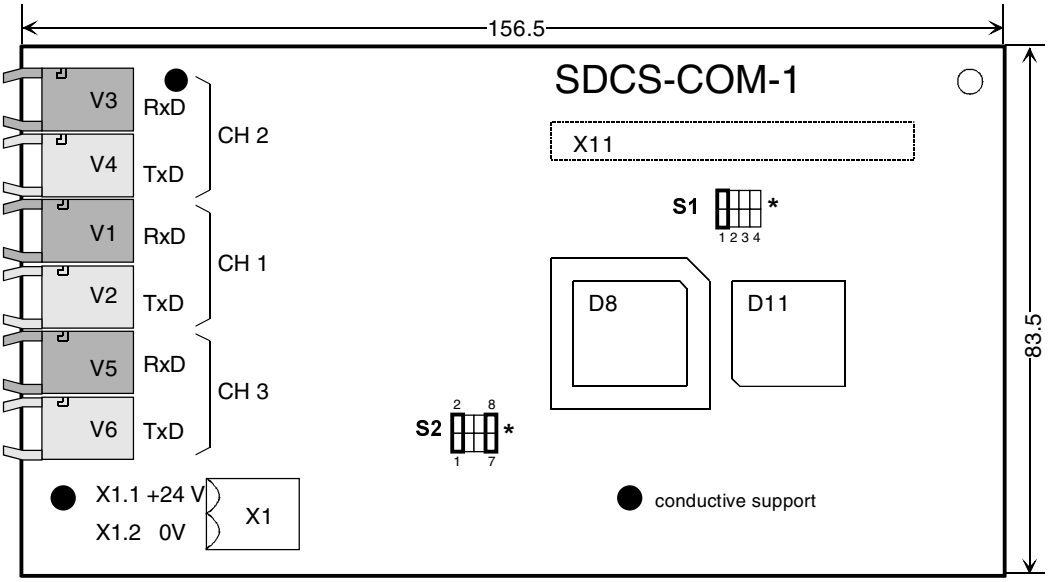


Fig. 7.1/1 Connection between SDCS-COM-x and a partner



Jumper coding

Converter number	Coding for channel 2
1	S1 1 2 3 4 *
2	S1 1 2 3 4
3	S1 1 2 3 4
4	S1 1 2 3 4

Setting for supply of Ch3:

Internal supply S2 2 8 1 7 *

External supply S2 2 8 1 7

* default value

Fig. 7.1/2 Layout and jumper settings of the SDCS-COM-1 board

7.2 Communication board SDCS-COM-5

This board is used for communications to DCS 500 converter modules equipped with software version up to S21.1xx. It consists of 3 different communication channels. All RxD channels (receiver) have blue color, all TxD channels (transmitter) have grey color. If any connections should be made always connect the same color with each other (plug and socket) .
Channel 1 is a HDLC channel of 1.5 Mbits/s and is used for the communication with a PC. Channel 2 cannot be used together with software version S21.xxx.
Channel 3 is a DDCS channel of up to 4 Mbits/s and is used if a serial link based on PROFIBUS hardware, CS31 hardware or MODBUS hardware should be realized. If one of these possibilities should be used an adaptation module is needed. Please refer to the documentation which is available for the link system needed.

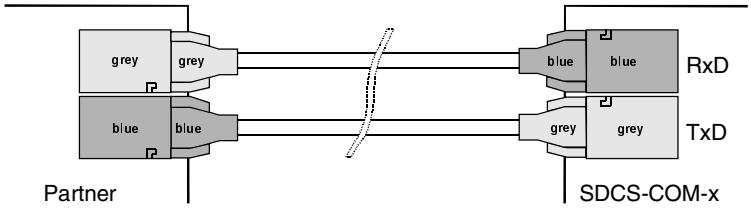
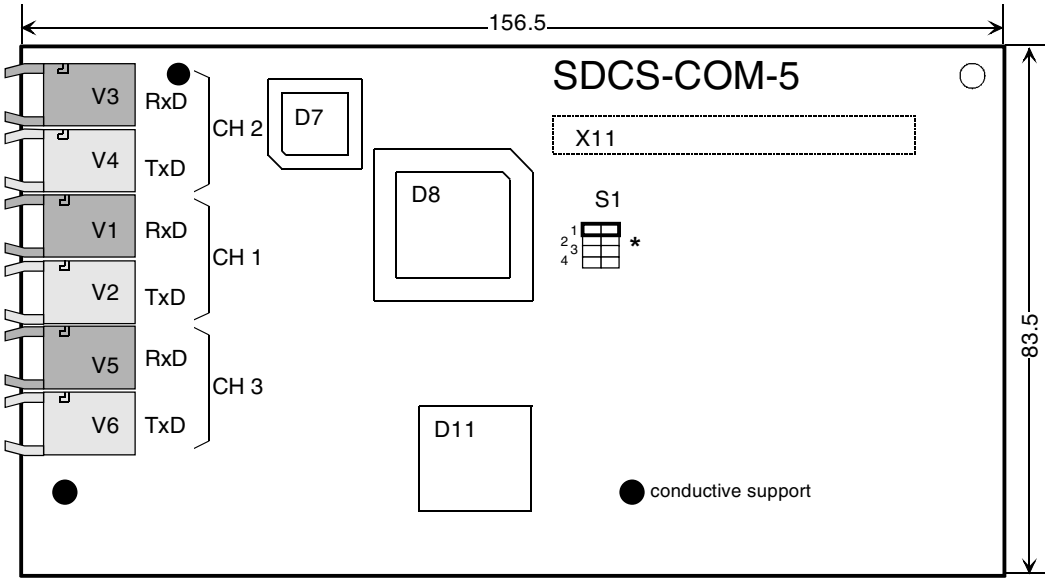


Fig. 7.2/1 Connection between SDCS-COM-x and a partner



Jumper coding

Converter number	Coding for channel 2
1	S1 *
2	S1
3	S1
4	S1

* default value

Fig. 7.2/2 Layout and jumper settings of the SDCS-COM-5 board

7.3 Control and communication board SDCS-AMC-DC

This board must be used together with a DCS 600 module equipped with a SDCS-CON-2 board including software S15.xxx.

The board is equipped with an own controller with the following main functionalities:

- The software structure implemented in this board is divided in two sections. The first section is built from the speed regulator and its additional functions which is producing the torque reference.
- The second section is prepared to be programmed with its own characteristics for control and regulation.
- Evaluation of the received data to produce a torque reference to be transmitted to the controller board CON-2. Actual values from the CON-2 are read, evaluated and retransmitted to the overriding control.

Furthermore the board is equipped with three optical channels (max. data transmission speed is 4 Mb for each optical channel):

- **Channel 0** is used to communicate data from the overriding control (APC2 or via adapter modules from other controllers) to the DCS600-drive.
- **Channel 2** (Master-Follower) is used to operate two or more drives dependent on each other. Commands and values needed for this application are produced on this board.
- **Channel 3** is prepared to connect the PC tool for commissioning and maintenance.

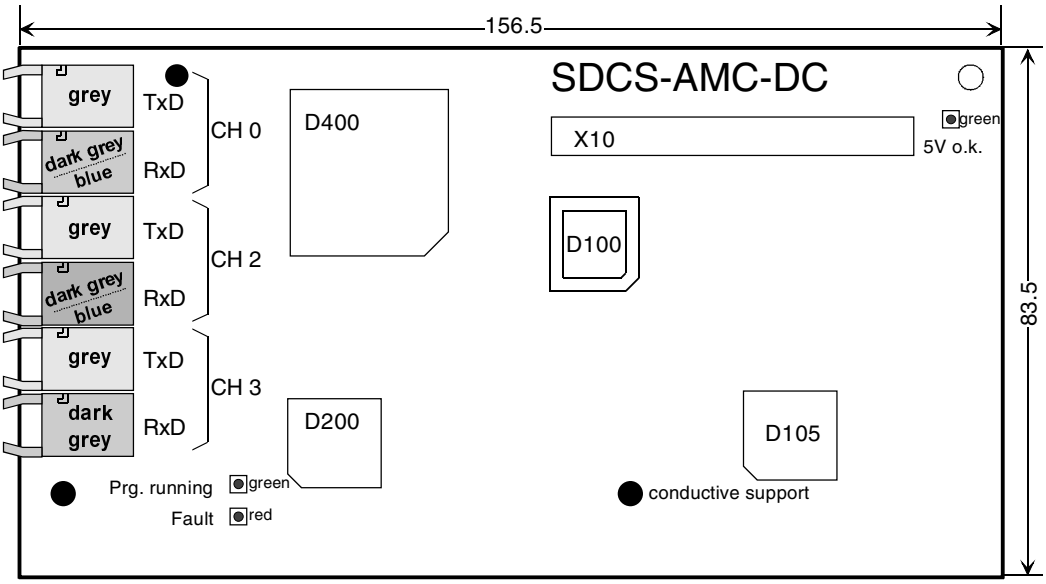


Fig. 7.3/1 Layout of the SDCS-AMC-DC / SDCS-AMC-DC Classic board / AMC-DC Drive Bus

The SDCS-AMC-DC and the SDCS-AMC-DC Classic boards are identical except the assembly of optical components for channel 0 and 2.

	optical Components Ch 0	Ch 2	Ch 3	Channel 0 used for	D400	driver current CHO, CH2, CH3	Communication ** CH0
SDCS-AMC-DC *	10 Mb	5 Mb	10 Mb	other interfaces	ICMC1	30 mA	DDCS
SDCS-AMC-DC Classic *	5 Mb	10 Mb	10 Mb	Fieldbus adapter modules NxxA-0x	ICMC1	30 mA	DDCS
SDCS-AMC-DC 2	10 Mb	5 Mb	10 Mb	other interfaces	ICMC2	30/50 mA ***	DDCS/Drive Bus
SDCS-AMC-DC Classic 2	5 Mb	10 Mb	10 Mb	Fieldbus adapter modules NxxA-xx	ICMC2	30/50 mA ***	DDCS/Drive Bus

* SDCS-AMC-DC 2, SDCS-AMC-DC Classic 2 are direct replacements of SDCS-AMC-DC and SDCS-AMC-DC Classic
** see additional parameter [71.01]

Color of optical components:
5 Mb ⇒ blue maximum 30 mA ***
10 Mb ⇒ dark grey maximum 50 mA ***

Remark: Only channels with the same components (e.g. 10 Mb component) may be connected to each other.

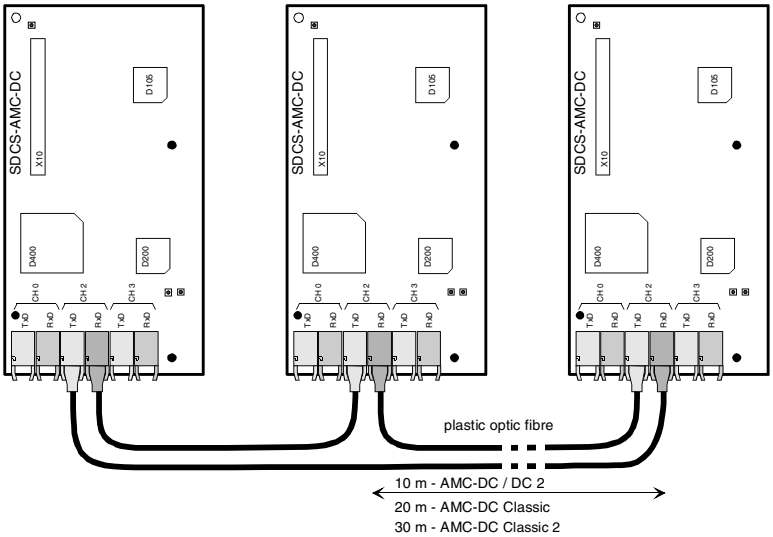


Fig. 7.3/2 Connections at Master-Follower mode

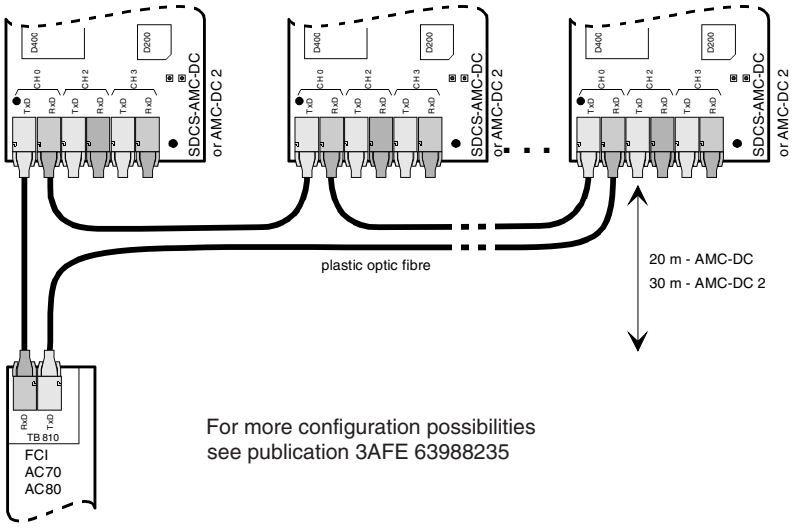


Fig. 7.3/3 Module Bus connections to Advant controllers (ring feeder)

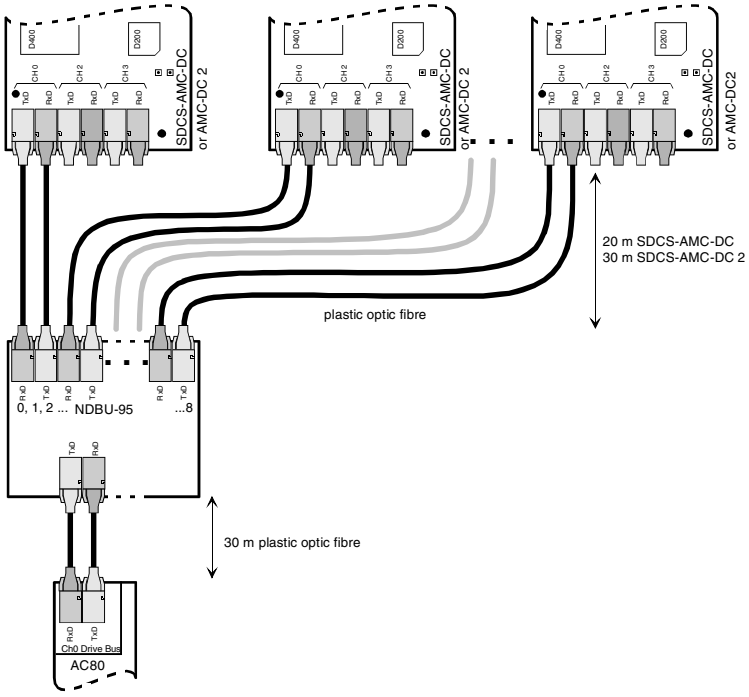


Fig. 7.3/4 Drive Bus connections to Advant Controller 80

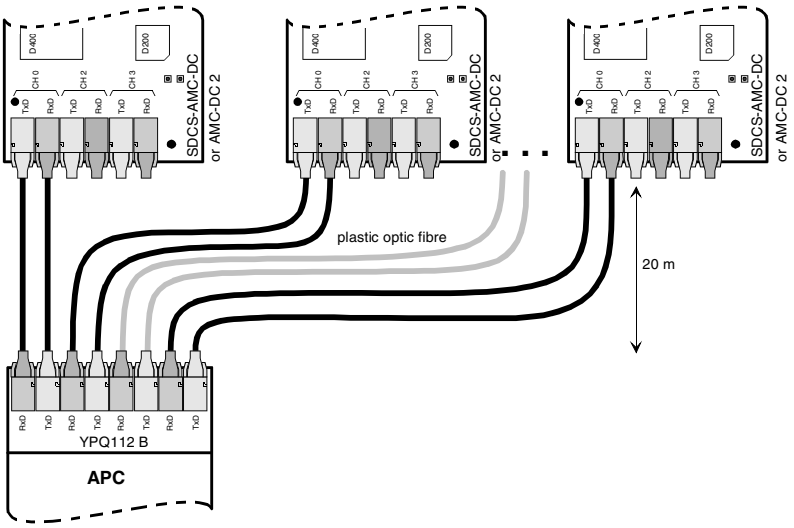


Fig. 7.3/5 Connections to higher-level system (APC)

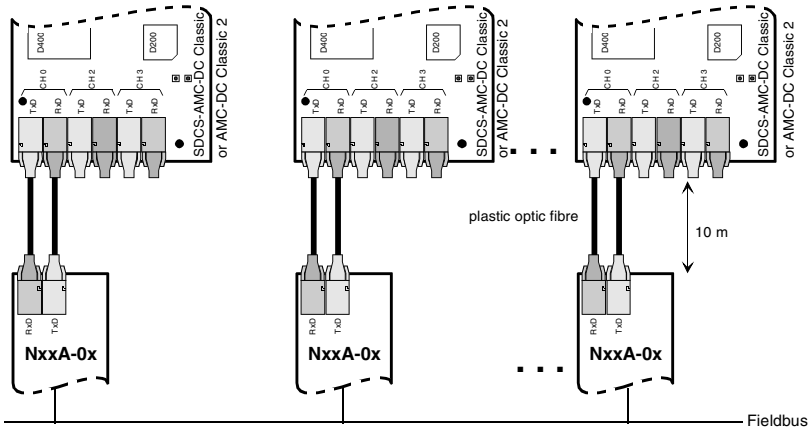


Fig. 7.3/6 Connections to higher-level system (Communication modules)

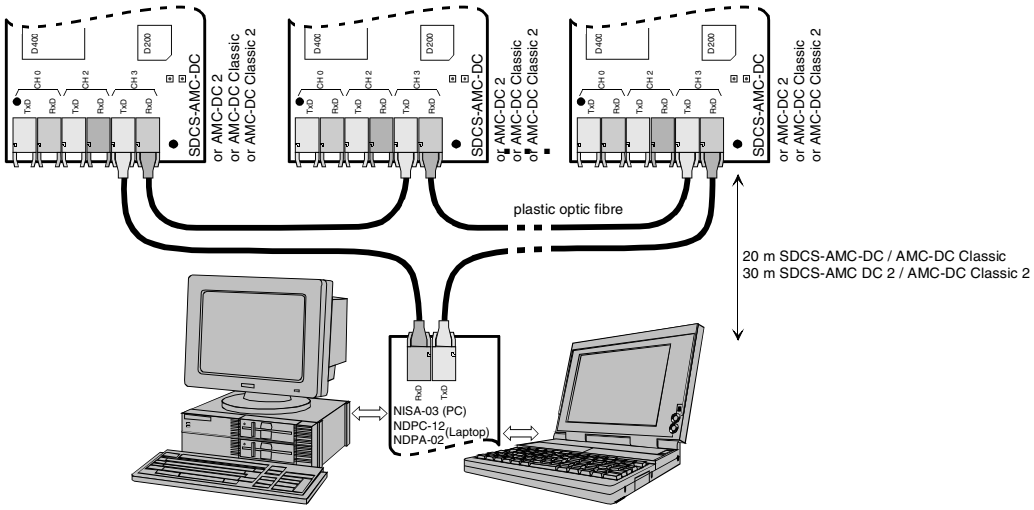


Fig. 7.3/7 Connections to PC by ring feeder (with control program **Drives Window 1.3**)

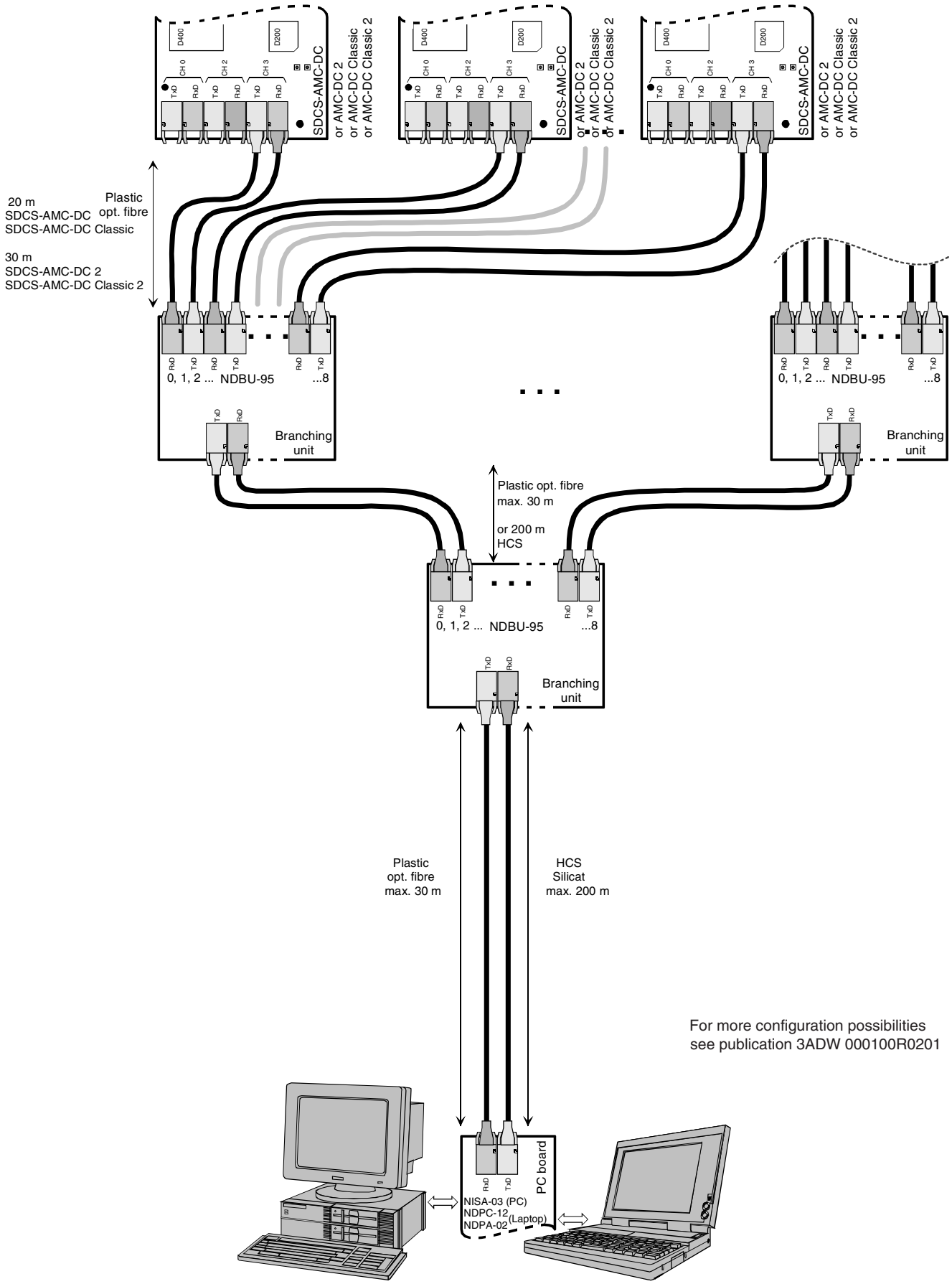


Fig. 7.3/8 Connections to PC by by star-type network (with control program **Drives Window 1.3**)

7.4 DDCS Branching unit NDBU-95

DDCS Branching Unit (DBU) is used (only for DCS 600/DCF 600) to implement the star topology of DDCS link. This allows a slave unit to fail or become unpowered without disabling the communication. The NDBU receives messages from the master (PC) and sends them to all the slave units simultaneously. Each slave unit has an individual address and only the addressed slave unit sends a reply message to the master. It is also possible to use NDBU thus enabling peer-to-peer communication.

NDBU-95 DDCS Branching Unit has nine output channels where messages from the master are sent. The reply message sent by one slave unit is delivered to the master and it can be delivered also to other slaves if necessary. Several NDBU-95s can be used in parallel, in series or in any combination of these. The maximum distance between the master and NDBU-95 as well as between two NDBU-95s, see *manual 3ADW000100R0201*.

Technical specifications

Optical links:	
Master channels	1 DDCS input and 1 DDCS output
Slave channels	9 DDCS inputs and 9 DDCS outputs
Data rate	1 - 4 MBd, programmable
Driving current	20 mA, 30 mA, 50 mA + channel disabling, programmable
Monitoring	a green LED for each channel, switched on when NDBU is receiving messages
Transmission device	10 Mb component for each channel
Power supply:	
Input voltage	+24 VDC ± 10%
Input current	300 mA
Monitoring	a green LED switched on when the output voltage is normal
Operating temperature:	+0 ... +50 °C
PCB dimensions:	s. diagram beside

Remark: Only channels with the same components (e.g. 10 Mb component) may be connected to each other.

For further information see *Appendix D in the Drives Window User's Manual*.

Note
For addressing and automatic node numbering of the drives and branching units see *Drives Window documentaion*.

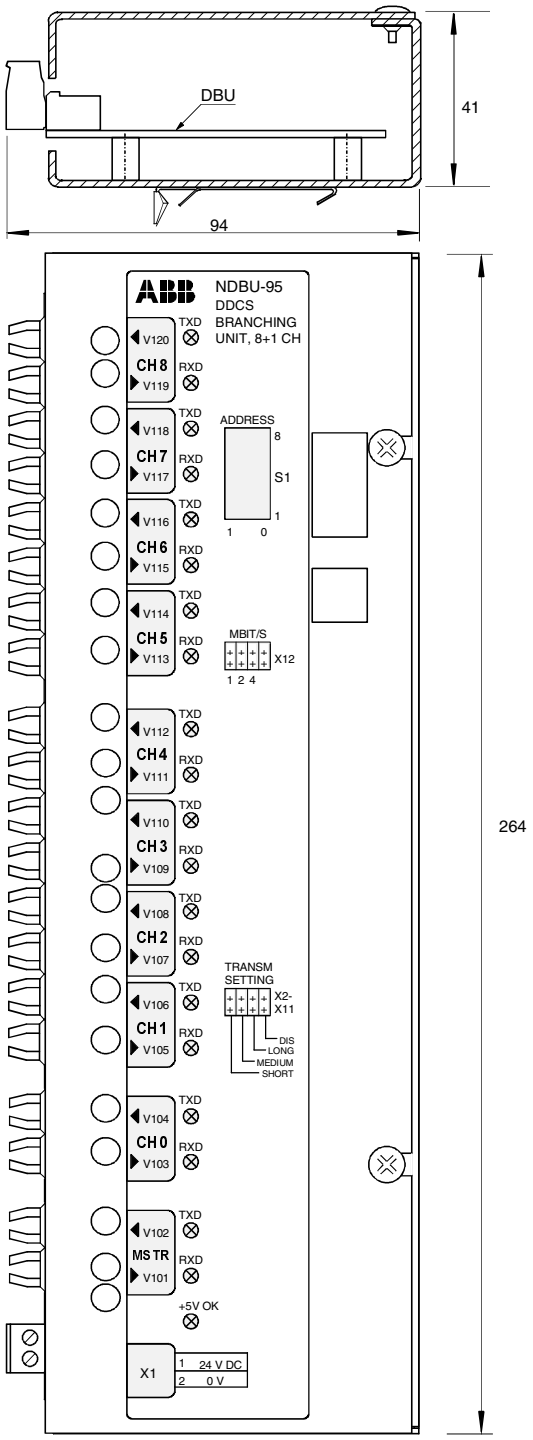


Fig. 7.4/1 Layout of the NDBU-95 branching unit

8 Field exciters

The DCS 500 system has different options for the field supply. There are one and three phase field exciters available, which can be either integrated (diode field exciter SDCS-FEX-1 and half controlled field exciter SDCS-FEX-2) or externally mounted (half controlled DCF503-0050 with the SDCS-FEX-32 board and fully controlled DCF504-0050 with the SDCS-FEX-31 board).

Three phase field exciters are converter modules themselves with the output current range similar to the DCS 501/601 or DCS 502/602. This possibility is described by a seperate documentation.

8.1 SDCS-FEX-1 (internal)

The Diode Field Exciter board SDCS-FEX-1 is a single phase diode rectifier for an AC input voltage up to 500 V and a DC output current of 6 A. The board has to be mounted inside the armature converter module. The excitation current is defined by the DC output voltage (line voltage multiplied by 0.9) and the resistance of the field winding. By using an external resistor in series with the field winding the field current can be adapted slightly.
If the SDCS-FEX-1 board isn't already installed it must be mechanically fixed beside the electronic power part SDCS-POW-1 and connected via a flat cable to the SDCS-CON-x by using terminal X14.

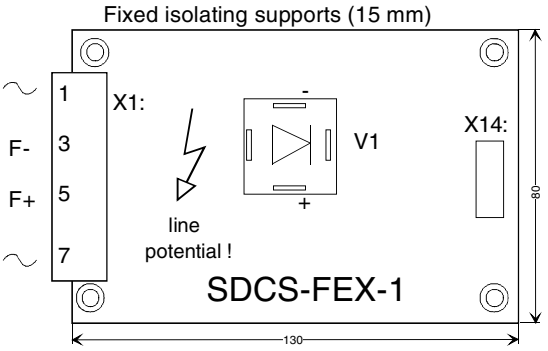


Fig. 8.1/1 Layout of the SDCS-FEX-1 field exciter board

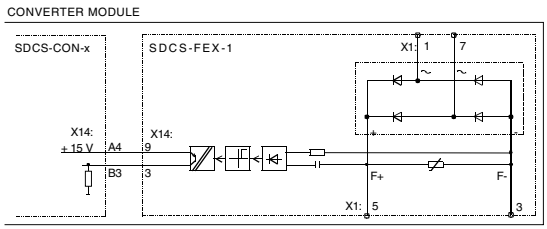


Fig. 8.1/2 Diode field exciter with field loss monitoring

8.1.1 Electrical data of FEX-1

AC input voltage:	110 V -15%...500 V +10%
max. DC output current:	6 A; $I_{F\ rated}$
DC output curr. monitoring:	20 mA...6 A
Power loss at $I_{F\ rated}$:	≤10 W
AC Isolating voltage:	600 V
Terminals X1: Cross sectional area	 2,5 mm²

The AC share of the output DC voltage is measured with a capacitor and an auxiliary rectifier and used for current monitoring.
Transistor relay is closed when the DC current is flowing (>0.02 A).

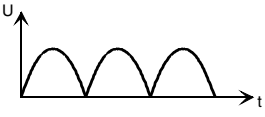


Fig. 8.1/3 Output voltage with inductive or resistive load - **High-signal at X14:B3**

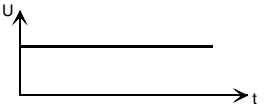


Fig. 8.1/4 Output voltage without load
Low-signal at X14:B3

8.2 SDCS-FEX-2 (internal)

The field exciter board SDCS-FEX-2 / FEX-2A consists of a power part and a control board,which connects all components electrically and mechanically to each other. This arrangement has to be mounted inside the armature converter module beside the electronic power supply SDCS-POW-1. This is intended to be done for DCS modules of type C1, C2 and C3, not for C4!

The power part is build up with two power modules. Each of the modules consists of one diode and one thyristor, so they are wired up and controlled like a half controlled bridge.

The control is based on a fully digital system. The µ-processor reads all information from the power part, is supplied with all needed voltage levels and control signals via the flat cable X14 by the SDCS-CON-x and generates the firing pulses for the power part.

The range of the single phase rated AC input voltage is 110 V to 500 V, the maximum current capability is 16 A. If this field exciter is used for smaller field current, the control unit automatically selects a lower current range between 3 A to 16 A to get the best resolution.

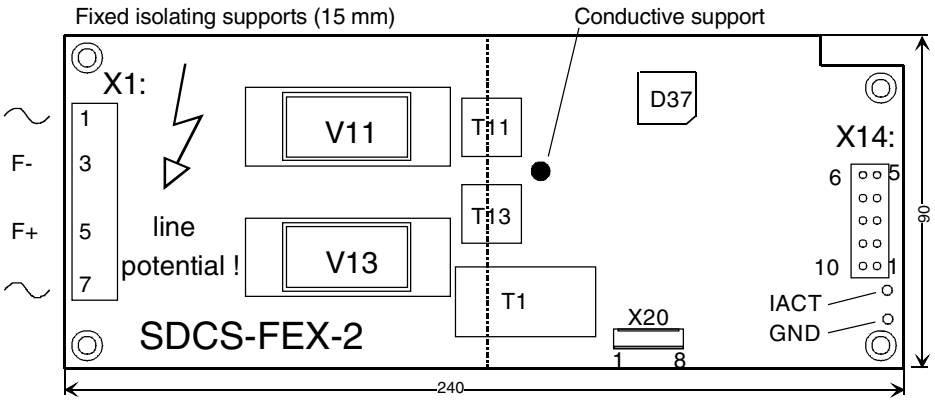


Fig. 8.2/1 Layout of the SDCS-FEX-2 field exciter board

8.2.1 Electrical data of SDCS-FEX-2 / FEX-2A

AC input voltage:	110 V -15%...500 V +10%; single phase
AC input current:	≤ output current
AC isolation voltage:	600 V
Frequency:	same as DCS converter module
DC output current: ①	0.3 A...8 A for armature converter module from 25 A to 75 A 0.3 A...16 A for armature converter mod. from 100 A to 2000 A
Power loss at $I_{F\ rated}$:	≤40 W
Output IACT:	U_{out} = 4 V *I_{act} / I_{lim}; I_{lim} = 3A, 5A, 7A, 9A, 11A, 13A, 15A, 17A
Terminal X1: Cross sectional area	 4 mm²

① If Field weakening is needed, actual field current of the motor at top speed must be higher than 0.3 A

8.2.2 Control unit

The control unit includes the following main blocks:

- Micro controller 80C198 for controlling and firing
- Actual DC current measurement with an AC current transformer.
- RS485 interface to the converter's controller board SDCS-CON-x.

The software for the field current control is stored in the ROM memory of the 80C198. The control is done by using a PI structure for the current controller. All parameters needed for the control or for scaling reasons (selection of burden resistors) are stored in the non-volatile memory of the armature converter and transferred to the field controller during each initializing process via the RS485 link. The Node number is always fix coded to Node number = 1.

The output Iact represents the actual field current, which is measured via the AC transformer, then rectified and transferred into a voltage signal with burden resistors. The burden resistors, as mentioned before, are adapted by the board itself depending on the setting of the nominal field current of the motor (see list before). The resulting burden voltage can be measured at test terminals beside X14:. The 2.2 KΩ resistor allows a short circuit at the terminals; the external measuring device should have an internal resistance higher than 1MΩ.

The terminal row X20: is used for test purposes.

8.2.3 Power section

Two diode-thyristor modules are arranged as a half-controlled single-phase rectifier. The anodes of the two diodes are not connected directly to each other as usual; they are now connected to the ends of the four turn primary winding of the current transformer. The centre tap is the negative output of the rectifier. Thus it is possible to measure the DC current with an AC current transformer.

A MOV (Metal Oxide Varistor) protects the AC input against voltage spikes from the external source. Another MOV protects the DC output against voltage surges which can be caused by the field winding of a DC machine.

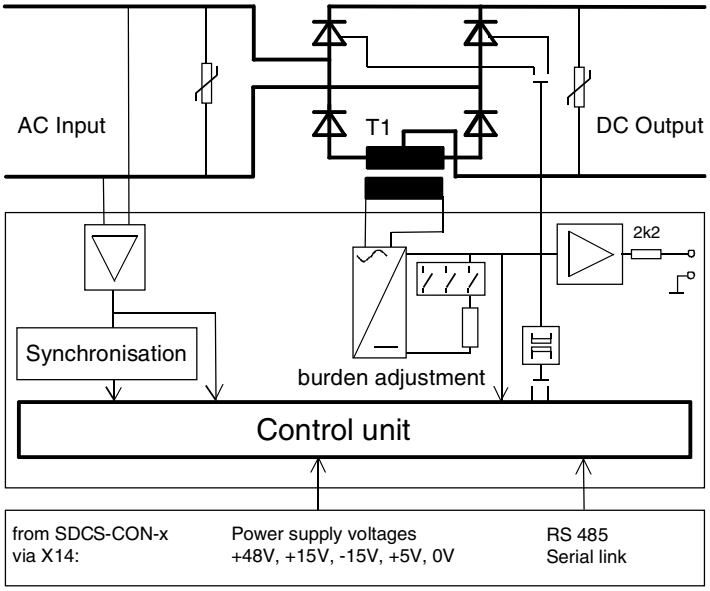


Fig. 8.2/2 Block diagram of the field exciter SDCS-FEX-2

8.3 DCF503-0050 and DCF504-0050 (external)

The **half controlled** field exciter unit DCF503-0050 consists of the SDCS-FEX-32 board, two thyristor/ diode power modules and auxiliaries (power supply, line choke). The **fully controlled** field exciter unit DCF504-0050 consists of the SDCS-FEX-31 board, four anti-parallel thyristor/ thyristor power modules and the same auxiliaries.

The control is structured similar to the SDCS-FEX-2 field supply. A micro controller is used for controlling and firing. The DC current is measured by using an AC current transformer (same configuration than at SDCS-FEX-2).

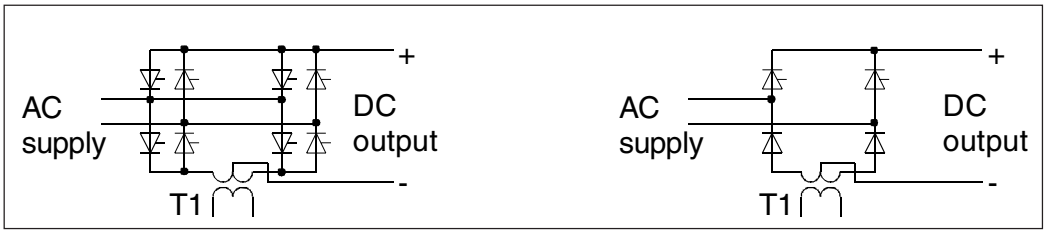


Fig. 8.3/1 Different versions of power section of the DCF50x-0050

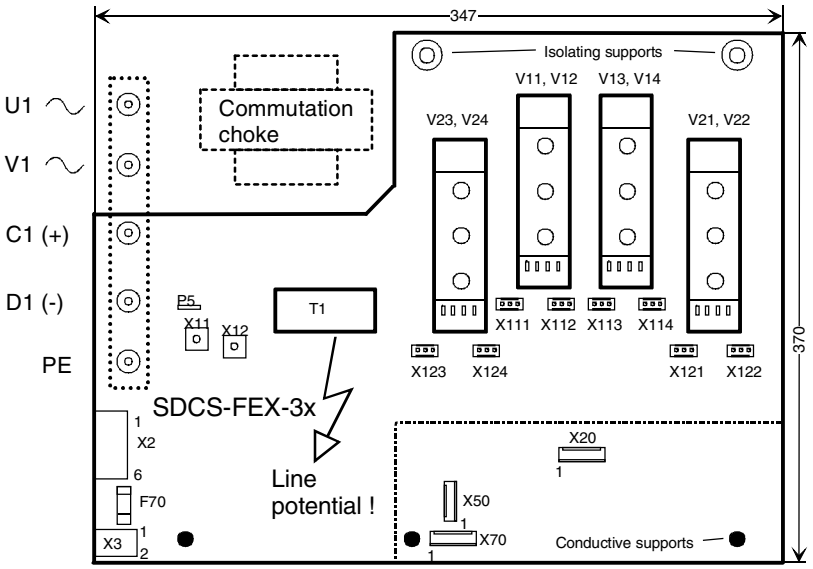


Fig. 8.3/2 Layout of the DCF504-0050 field exciter unit

8.3.1 Electrical data of DCF50x-0050

Power part	
AC input voltage:	110 V -15%...500 V +10%; single phase
AC input current:	≤ output current
Frequency:	same as DCS converter module
AC isolation voltage:	690 V
Line reactor:	160 µH; 45-65 Hz
DC output current: ①	0.3...50 A
Power loss at $I_{F\ rated}$:	≤180 W
Auxiliary voltage	
AC input voltage:	93 V ... 253 V; single phase terminal X3:1 and 2
Frequency:	45 ... 65 Hz
AC input power:	15 W; 30 VA
Inrush current:	<5 A / 20 ms
Mains buffering:	min 30 ms
Terminal row X2:	
X2: 1 RS 485	should be connected to X16: 1 at SDCS-CON-1
X2: 2 RS 485	should be connected to X16: 2 at SDCS-CON-1
X2: 3 Ground	should be connected to X16:3 at SDCS-CON-1via screen (connected via L = 100 µH to electronic ground)
X2: 4 Coding	defines first / second field exciter
X2: 5 Ground	connected via L = 100 µH to electronic ground
X2: 6 output IACT	U_{out} = 4 V *I_{act} / I_{lim}; I_{lim} = 3A, 5A, 7A, 9A, 11A, 13A, 15A, 17A, 21A, 27A, 33A, 39A, 45A, 51A

① If Field weakening is needed, actual field current of the motor at top speed must be higher than 0.3 A

8.3.2 Electronic power supply

There is a power supply unit on the board. Supply is connected at terminal X3. The rated AC voltages 115 V and 230 V can be applied without any changes. Fuse F70 is a protection fuse connected in series with the AC input of the power supply unit. The power supply unit provides the DC voltages 30 V, 15 V, 5 V and -15 V to the control electronics. Auxiliary voltages can be measured by means of a multimeter from the terminal X70 (see the layout).

Fuse data F70: dimensions 5x20 mm; T 500 mA/ 250 V - **S506 500 mA Bussmann**

Measured voltage	Positive measuring wire	Negative measuring wire
+5V	X70:1	X70:2
+30V	X70:3	X70:5
+15V	X70:4	X70:5
-15V	X70:6	X70:5

8.3.3 Control unit

The control unit includes the following main blocks:

- Micro controller 80C198 for controlling and firing
- Actual DC current measurement with an AC current transformer.
- RS485 interface to the converter's controller board SDCS-CON-x.

The software for the field current control is stored the ROM memory of the 80C198. The control is done by using a PI structure for the current controller. All parameters needed for the control or for scaling reasons (selection of burden resistors) are stored in the non-volatile memory of the armature converter and transferred to the field controller during each initializing process via the RS485 link.

The output Iact represents the actual field current, which is measured via the AC transformer, then rectified and transferred into a voltage signal with burden resistors. The burden resistors, as mentioned before, are adapted by the board itself depending on the setting of the nominal field current of the motor (see list before). The resulting burden voltage can be measured at test terminals beside X14:. The 2.2 KΩ resistor allows a short circuit at the terminals; the external measuring device should have an internal resistance higher than 1MΩ.

The terminal row X20: is used for test purposes.

8.3.4 Power section

If a DCF503-0050 is in use two diode-thyristor modules are arranged as a half-controlled single-phase rectifier. If a DCS504-0050 is in use four thyristor-thyristor modules are arranged as a fully-controlled single-phase rectifier. The anodes of the two diodes (anodes / cathodes of the thyristors) are not connected directly to each other as usual; they are now connected to the ends of the primary winding of the current transformer. The centre tap is the negative output of the rectifier. Thus it is possible to measure the DC current with an AC current transformer.

A MOV (Metal Oxide Varistor) protects the AC input against voltage spikes from the external source. Another MOV protects the DC output against voltage surges which can be caused by the field winding of a DC machine. The free wheeling function needed e.g. during network failure is ”build in” because of the diodes, if the half-controlled version is in use. If the fully-controlled version is used the free wheeling function is realized by using the thyristors in diode mode, controlled by the micro controller.

8.3.5 Field exciter configurations

The data exchange between the SDCS-CON-x and the field exciter SDCS-FEX-2 or the DCF503/504-0050 is done via a RS485 serial link, which is able to work not as a point to point connection, but as a bus structure. This link is used to transfer references, actual values and settings for up to two field exciter units.

The drive software located on the SDCS-CON-x board consists of two field supply modules. One of them is already connected to the EMF controller to allow the motor running in all points of his motor diagram. The other one is accessible via the field current reference.

The RS485 interface works with a screened two-wire cable. The allowed length is 5 m. The wires have to be connected to the terminals X2:1 and X2:2 and the screen to X2:3.

Typical application of this kind is two DC motors connected to one converter. The load sharing can be done by means of adjusting the excitation current of the second DC-motor.

There are two possible configurations for two field exciters:

- one SDCS-FEX-2 and one external field exciter (DCF503-0050, DCF504-0050 or 3 phase field exciter) or
- two external field exciter units (DCF503-0050, DCF504-0050 or 3 phase field exciter).

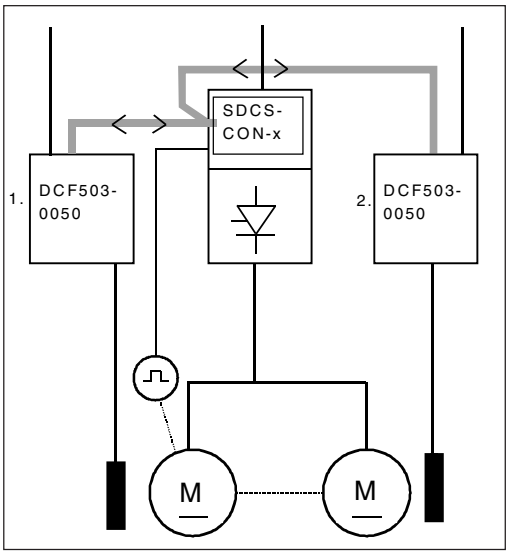
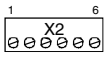
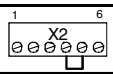
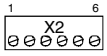
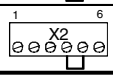


Fig. 8.3/3 Typical application example with two field exciter units and one converter.

If a SDCS-FEX-2 is used, it will be recognized as the first field exciter by the software and therefore, it cannot be coded as a second one. If a DCF503/504-0050 is used as the first or the second field exciter it must be coded according to the table below.

Field exciter 1		Field exciter 2	
Unit type	Connection X2:4-X2:5	Unit type	Connection X2:4-X2:5
SDCS-FEX-2	---	---	---
DCF 503/504		---	---
SDCS-FEX-2	---	DCF 503/504	
DCF 503/504		DCF 503/504	

Procedure for code changing of the DCS 503/504:

- Switch off the units voltage supply
- Set the appropriate connection according the table
- Initialization through switch on the electronics supply voltage

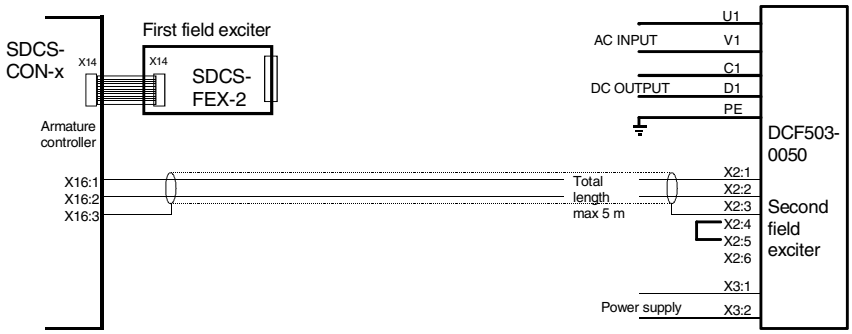


Fig. 8.3/4 Serial communication cable connection and address setting for first and second field exciter, using SDCS-FEX-2 and DCF50x-0050

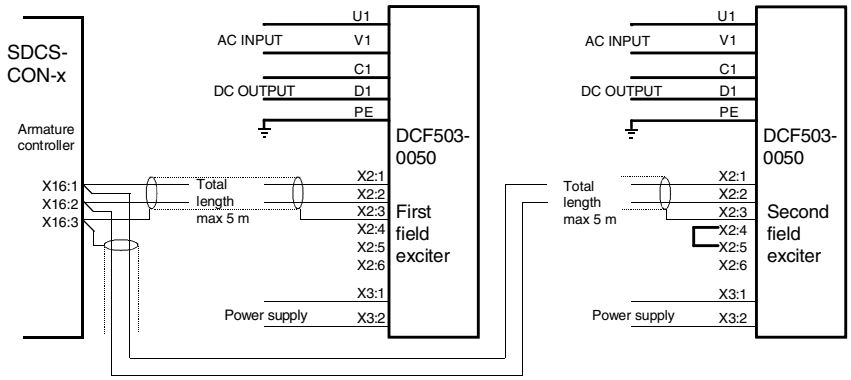


Fig. 8.3/5 Serial communication cable connection and address setting for first and second field exciter, using two times DCF50x-0050

8.3.6 Dimensions

External field exciter
DCF 503-0050
DCF 504-0050

Dimensions in mm
Weight appr. 10 kg

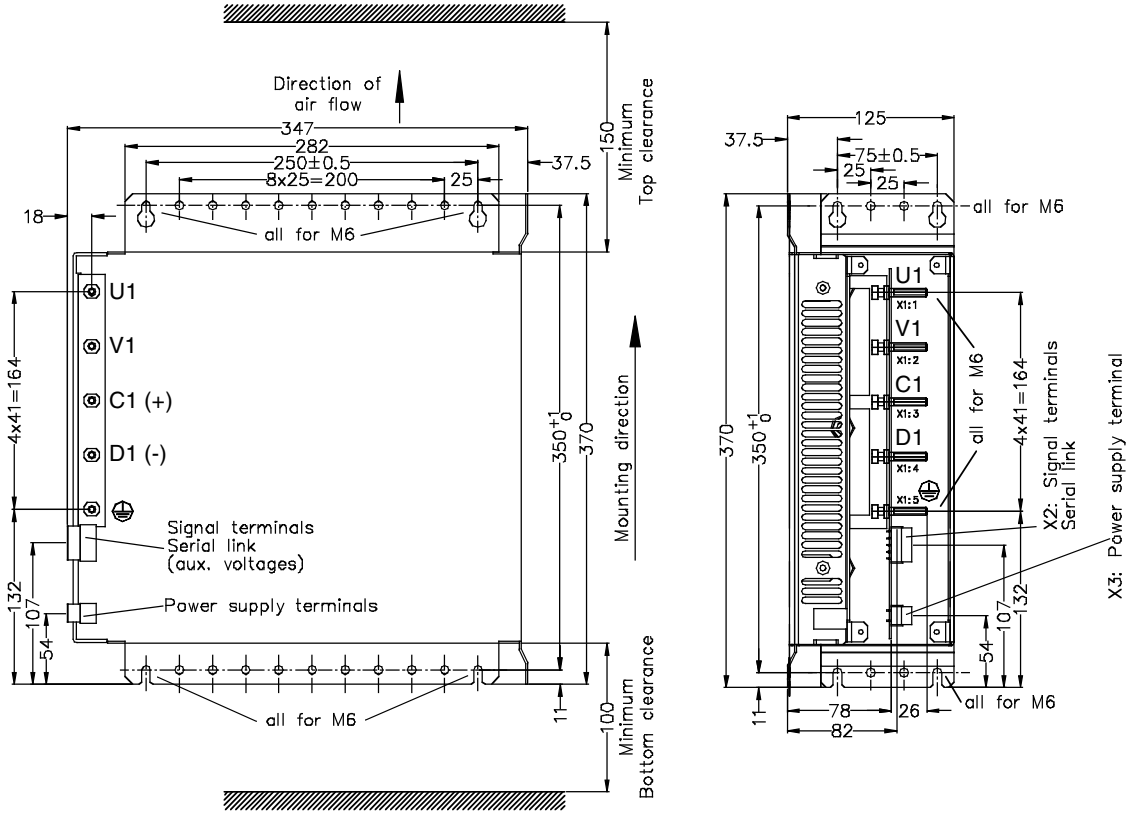


Fig. 8.3/6 Dimension drawing of DCF 503/4

DCF503**A** / DCF504**A** is based on a new CPU type compared to the DCF503/DCF504. The **half controlled** field exciter unit DCF503A-0050 consists of the SDCS-FEX-32A board, two thyristor/diode power modules and auxiliaries (power supply, line choke). The **full controlled** field exciter unit DCF504A-0050 consists of the SDCS-FEX-31A board, four anti-parallel thyristor/ thyristor power modules and the same auxiliaries.
The control is structured similar to the SDCS-FEX-2 field supply. A micro controller is used for controlling and firing. The DC current is measured by using an AC current transformer (same configuration than at SDCS-FEX-2).

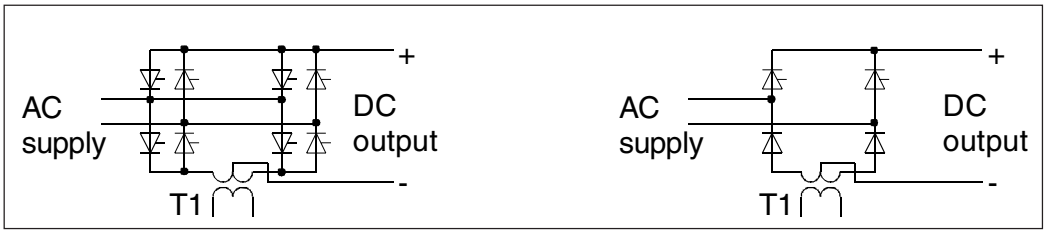


Fig. 8.4 /1 Different versions of power section of the DCF50xA-0050

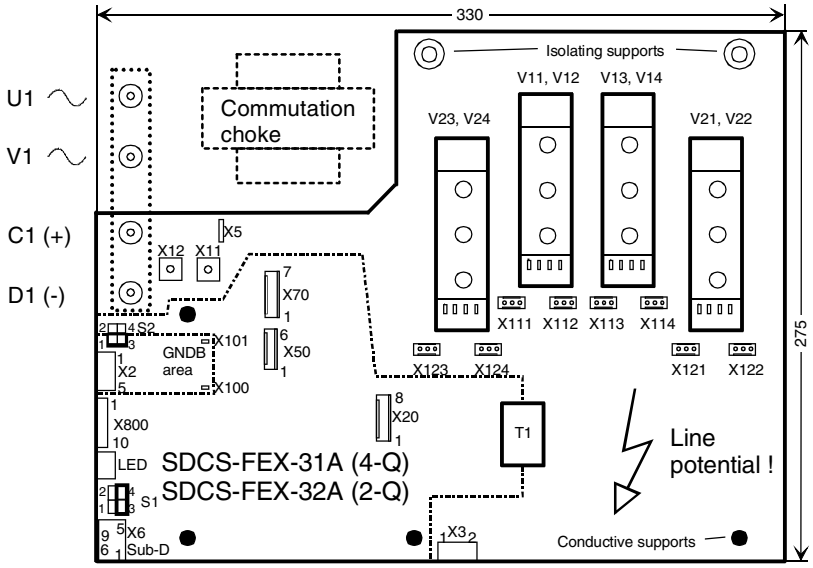


Fig. 8.4/2 Layout of the DCF504A-0050 field exciter unit

Setting X800 Switch		
	OFF *	ON
1	Node no. 1 serial link CON-2	Node no. 2 serial link CON-2
2 3 4 5 6 7	not used	not used
8	Field exciter mode	Test mode
9	Bridge reversal time: 4 cycles	extended; Bridge reversal time
10	Serial link to CON-1, CON-2	Not used - don't select

* Default value for all switches
The settings are read during initialization.

Jumper Coding	
Grounding of RS485 Transmission driver	
S2: 1-3 *	GNDB isolated
S2: 1-2	GNDB grounded via RC circuit
S2: 3-4	GNDB direct grounded
CPU mode	
S1: 1-2	Firmware download
S1: 3-4 *	Field exciter mode

* Default value

8.4.1 Electrical data of DCF50xA-0050

Power part	
AC input voltage:	110 V -15%...500 V +10%; single phase
AC input current:	≤ output current
Frequency:	same as DCS converter module
AC isolation voltage:	690 V
Line reactor:	160 μH; 45-65 Hz
DC output current: ①	0.3...50 A
Power loss at $I_{F\ rated}$:	≤180 W
Auxiliary voltage (X3:1-2)	
AC input voltage:	110 V -15%...230 V +10%; single phase
Frequency:	45 ... 65 Hz
AC input power:	15 W; 30 VA
Inrush current:	<5 A / 20 ms
Mains buffering:	min 30 ms
Terminal row X2:	
X2: 1 RS 485	serial link to X16: 1 at SDCS-CON-1 / CON-2
X2: 2 RS 485	serial link to X16: 2 at SDCS-CON-1 / CON-2
X2: 3 Ground B	grounded via cable screen and / or grounded via S2
X2: 4	not used
X2: 5	not used

① If Field weakening is needed, actual field current of the motor at top speed must be higher than 0.3 A

8.4.2 Electronic power supply

There is a power supply unit on the board. Supply is connected at terminal X3. The rated AC voltages 115 V and 230 V can be applied without any modification.
The power supply unit provides the DC voltages 30 V, 15 V, 5 V and -15 V to the control electronics. Voltages can be measured by means of a multimeter from the terminal X70 (see the layout).
In addition the power supply generates 5 V for galvanic isolated RS485 communication drivers. This voltages can be measured at terminals X100/X101.

Measured voltage	Terminal positive	Ground
+5V	X70:1	X70:2 (GND)
+30V	X70:3	X70:5 (GND)
+15V	X70:4	X70:5 (GND)
-15V	X70:6	X70:5 (GND)
+ 5V	X100	X101:1 (GNDB)

8.4.3 Control unit

The control unit includes the following main blocks:
- Micro controller H8 for control and firing
- Actual DC current measurement with an AC current transformer.
- RS485 interface to the converter's controller board SDCS-CON-x.

The software for the field current control is stored in the FlashPROM memory. This software contains a
PI current controller
Fault/reset logic
Synchronization and PLL function
Bridge reversal function (only DCF 504A)

The setting and updating of all control parameters are set from armature converter via RS485 interface. Actual current, field current reference, control and status bit are cyclic sent via RS 485 communication.

The field exciter is equipped with an auto-scaling function of burden resistor based on the nominal field current of the motor.

The output I_{act} represents the actual field current, which is measured via the AC transformer, then rectified and transferred into a voltage signal with burden resistors. The burden resistors -scaled to measurement range- are adapted by the board itself depending on the setting of the nominal motor field current. The current signal can be measured U_{Cursig} at X20:3-X70:2 and is scaled to

$$4\ V * I_{act} / I_{Scale}$$

I_{Scale} = 3A, 5A, 7A, 9A, 11A, 13A, 15A, 17A, 21A, 27A, 33A, 39A, 45A, 51A

8.4.4 Power section

If a DCF503A-0050 is in use two diode-thyristor modules are arranged as a half-controlled single-phase rectifier. If a DCS504A-0050 is in use four thyristor-thyristor modules are arranged as a full-controlled single-phase rectifier. The anodes of the two diodes (anodes / cathodes of the thyristors) are not connected directly to each other as usual; they are connected to the ends of the primary winding of the current transformer. The centre tap is the negative output of the rectifier. Thus it is possible to measure the DC current with an AC current transformer.

A MOV (Metal Oxide Varistor) protects the AC input against voltage spikes from the external source. Another MOV protects the DC output against voltage surges which can be caused by the field winding of a DC machine. The free wheeling function needed e.g. during network failure is ”build in” because of the diodes, if the half-controlled version is in use. If the full-controlled version is used the free wheeling function is realized by using the thyristors in diode mode, triggered by a fast voltage rise.

8.4.5 RS232-Port

The RS232 interface is used for download the 'Field exciter firmeware package'.

The default settings of this interface are as follows:

Signal level:	RS232 (+12V / -12V)
Data format:	UART
Message format:	Modbus-Protocol
Transmission method:	half-duplex
Baudrate:	9.600 Baud
Number of Data bits:	8
Number of Stop bits:	1
Parity-Bit:	odd

X6:	Description
1	not connected
2	TxD
3	RxD
4	not connected
5	SGND Signal ground
6...9	not connected

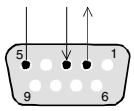


Fig. 8.4/3 Pin assignment of RS232-Port

The programming procedure is activated by setting S1:1-2 during auxiliary voltage is switched ON. Setting for field exciter mode is S1:3-4 (default).

8.4.6 Diagnosis

The aramarure converter receives via serial link the sum of all faults in "Fex status bit". A more detailed error code is given on the seven segment display of DCF 503A/ DCF 504A.

8	Boot sequence or empty FlashPROM	
F82	Hardware fault	
F83	Software fault	
F88	Mains undervoltage	< 40 V AC
F89	Mains overvoltage	> 620 V AC
F90	Mains synchron. fault	< 40Hz; > 70 Hz
F91	Load overcurrent	above 125% of actual selected measurment range
F92	Fast voltage rise	(parameter 44.04 / 44.10 / 13.10 / 13.07)
all faults are reset with the next **ON** command to the armatue converter		

8.4.7 Field exciter configurations

The data exchange between the SDCS-CON-x and the field exciter SDCS-FEX-2 or the DCF503A/504A-0050 is done via a RS485 serial link, which can be configured as a bus structure. This link is used to transfer references, actual values and settings for up to two field exciter units.

The drive software located on the SDCS-CON-x board consists of two field supply functions, first field exciter and second field exciter. The first field exciter is already connected to the EMF controller to control the motor in all points of the motor diagram. The second field exciter is accessible via the field current reference.

The RS485 interface works with a screened two-wire cable. The allowed length is 5 m. The wires have to be connected to the terminals X2:1 and X2:2 and the screen to X2:3.

Typical application of this kind is two DC motors connected to one converter. The load sharing can be done by means of adjusting the excitation current of the second DC-motor.

There are two possible configurations for two Node numbers of the field exciters:

- one SDCS-FEX-2 and one external field exciter (DCF503A-0050, DCF504A-0050 or 3-phase field exciter) or
- two external field exciter units (DCF503A-0050, DCF504A-0050 or 3-phase field exciter).

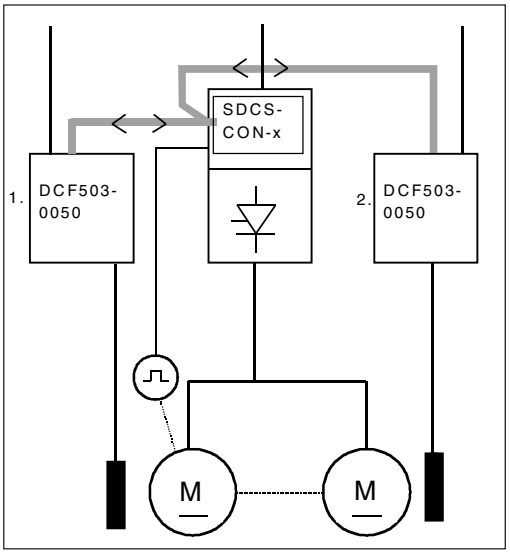


Fig. 8.4/4 Typical application example with two field exciter units and one converter (without field weakening).

If a SDCS-FEX-2 is used, it will be always recognized as the field exciter Node 1 by the software.
If a DCF503A/504A-0050 is used as Node 1 or Node 2 it must be coded according to the table below. Node 2 is operating with a cycle time of 100 ms.

Field exciter Node 1		Field exciter Node 2	
Unit type	Setting X800	Unit type	Setting X800
SDCS-FEX-2	---	---	---
DCF 503A/504A	X800:7 = OFF	---	---
SDCS-FEX-2	---	DCF 503A/504A	X800:7 = ON
DCF 503A/504A	X800:7 = OFF	DCF 503A/504A	X800:7 = ON

Procedure for code changing of the DCF 503A/504A:

- Switch off the units voltage supply
- Set the appropriate switch according to the table
- Initialization through switch on the electronics supply voltage

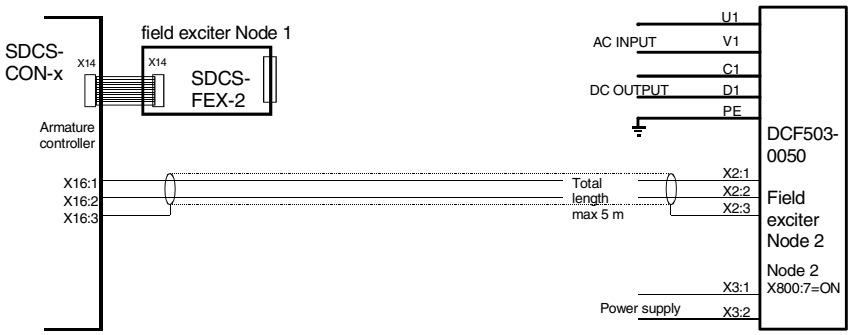


Fig. 8.4/5 Serial communication cable connection and address setting for Node 1 and field exciter Node 2, using SDCS-FEX-2 and DCF50xA-0050

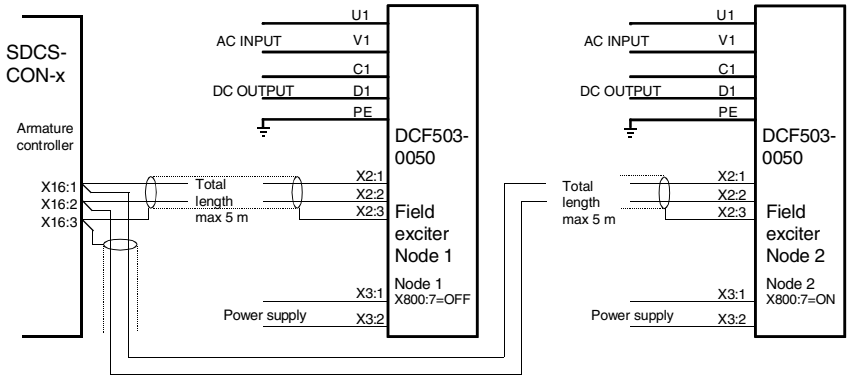


Fig. 8.4/6 Serial communication cable connection

Note: DCF 503 and DCF 503A (DCF 504 and DCF 504A can be combined if a suitable Node addressing is selected.

8.4.8 Dimensions

External field exciter
DCF 503A-0050
DCF 504A-0050

Dimensions in mm
Weight appr. 10 kg

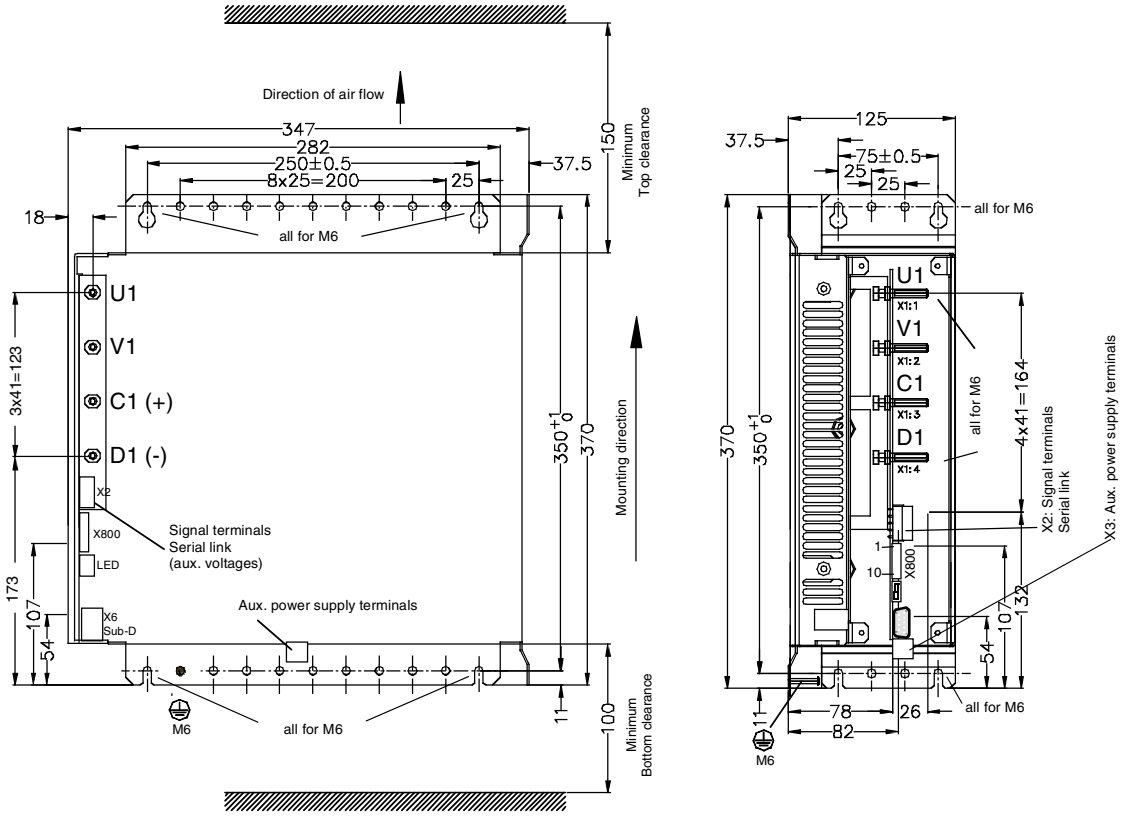


Fig. 8.4/7 Dimension drawing of DCF 503/4A

8.5 DCF505 / DCF506 Overvoltage Protection

The three-phase field supply converter DCF 501/502 and DCF 601/602 need a separate active Overvoltage Protection unit DCF 505 and DCF 506 for protection the power part against inadmissibly high voltages.

The protection unit operates by switch on a free-wheeling circuit between the F+ and F- connectors if a overvoltage occurs. The DCF 505/506 consists of a trigger unit and a free-wheeling thyristor (two in anti-parallel at DCF 506). Thyristor firing is caused by a 1400 V (FEP1 - 500 V) and 1800 V (FEP2 - 690 V) trigger diode.

The DCF 506 consist of a relay output for signalling the field supply converter that the overvoltage protection is active. The output is active in the free-wheeling process until the current is less than appr. 0.5 A.

The overvoltage protection unit DCF 505 is suitable for 2-Q converters DCF 501/601 with simple non-motoric inductive load.

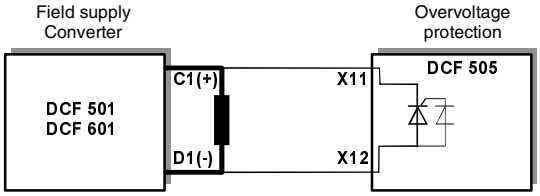


Fig. 8.5/1: Simple load with DCF 501/601 and 2-Q Overvoltage Protection DCF 505

For motor field supply units DCF 501/601 (2-Q), DCF 502/602 (4-Q) it is always overvoltage protection unit DCF 506 required.

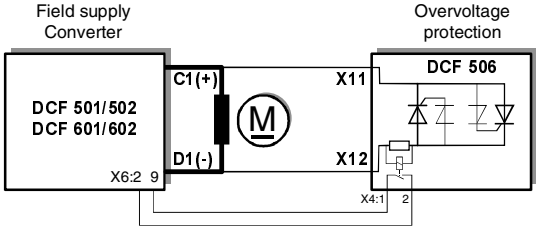


Fig. 8.5/2: Motor field supply with DCS 50x/DCF 60x and 4-Q Overvoltage Protection DCF 506

Assignment Field supply converter to Overvoltage protection unit

Field supply converter for motor fields	**Overvoltage Protection**
2-Q, 500 V DCF5(6)01-0025-51 ... DCF5(6)01-0140-51	DCF506-0140-51
DCF5(6)01-0200-51 ... DCF5(6)01-0520-51	DCF506-0520-51
4-Q, 500V DCF5(6)02-0025-51 ... DCF5(6)02-0140-51	DCF506-0140-51
DCF5(6)02-0200-51 ... DCF5(6)02-0520-51	DCF506-0520-51
DCS5(6)02-0900-51 DCS5(6)02-1200-51 DCS5(6)02-1500-51	DCF506-1200-51 DCF506-1200-51 DCF506-1500-51
4-Q, 690V DCS5(6)02-0900-71 DCS5(6)02-1500-71	DCF506-1500-71

Table 8.5/1: Assignment field supply converter for motor fields to Overvoltage Protection

Diagram

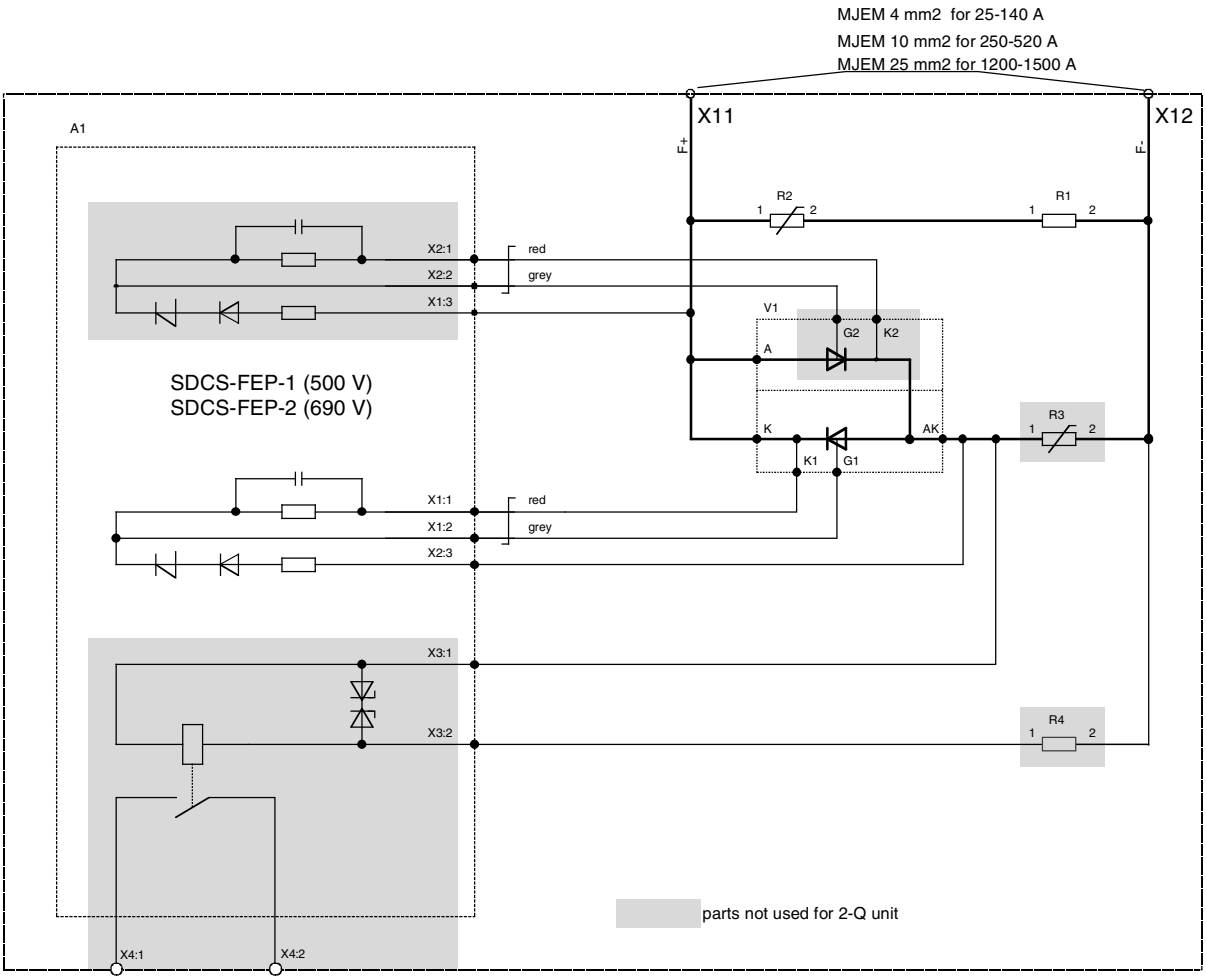
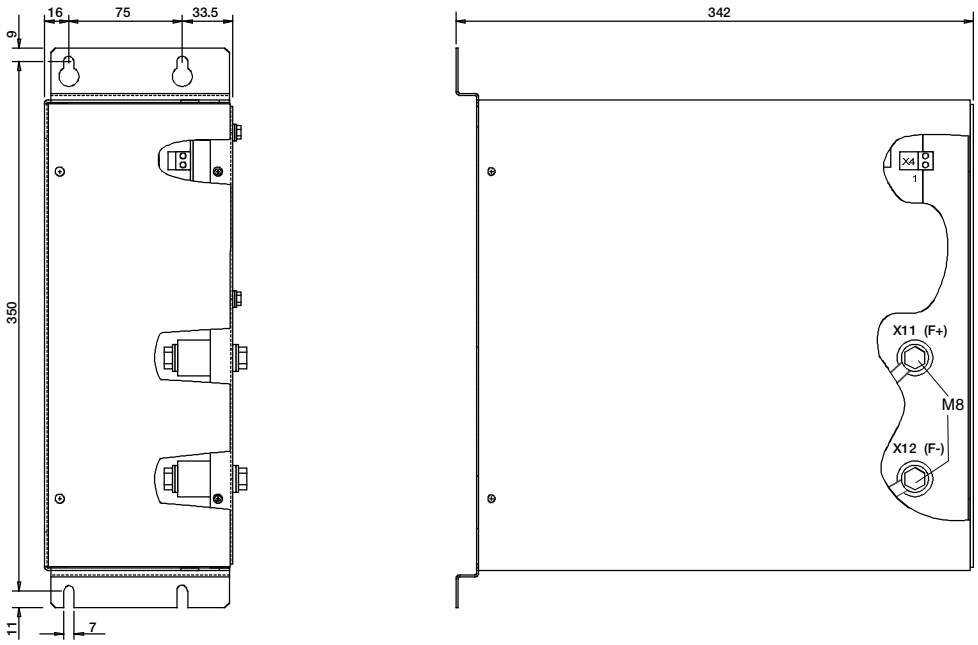


Fig. 8.5/3: Overvoltage Protection DCF 505 / DCF 506

Dimensions

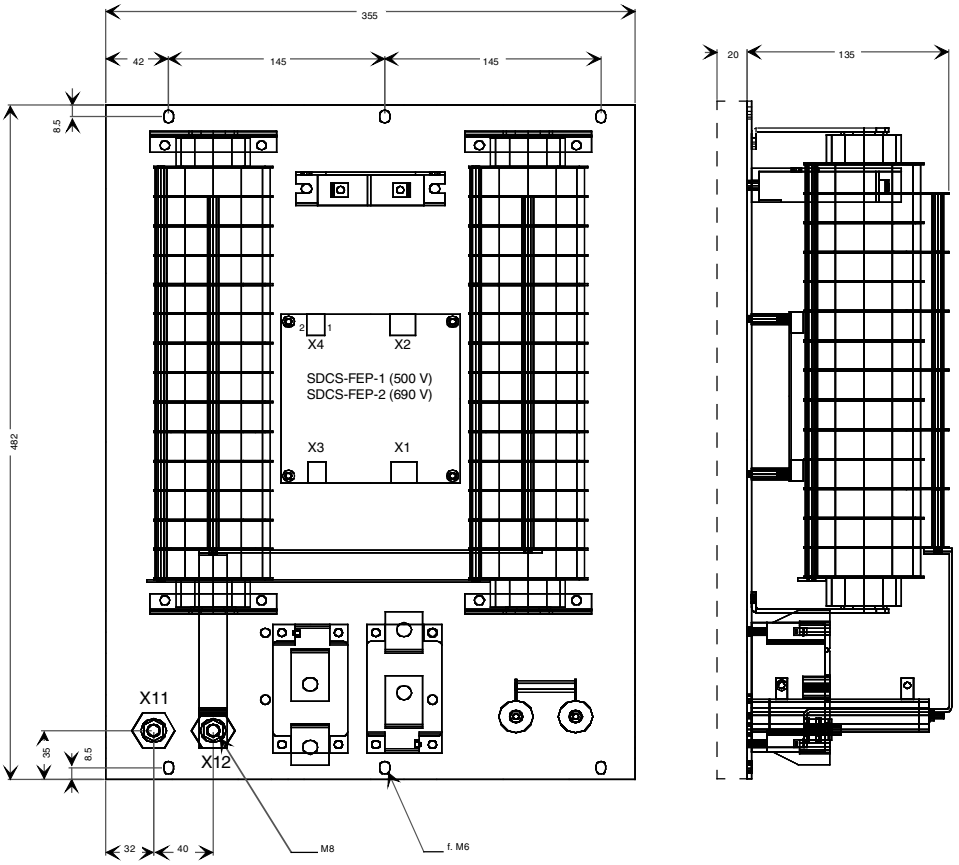
Overvoltage Protection
DCF 505-0140/0520-51
DCF 505-1200-51
DCF 506-0140/0520-51

Dimensions in mm
Weight appr. 8 kg



Overvoltage Protection
DCF 506-1200-51
DCF 506-1500-51
DCF 506-1500-71

Dimensions in mm
Weight appr. 20 kg



9 Accessories

9.1 Accessories - Power circuit

9.1.1 Fuses and fuse holders (Converter size C1, C2)

Manufacturer/ Type	Resistance [mΩ]	Fuse F1	Size	Fuse holder	Caliper [mm]
Bussman 170M 1564	6	50A 660V UR	0	OFAX 00 S3L	78.5
Bussman 170M 1566	3	80A 660V UR	0	OFAX 00 S3L	78.5
Bussman 170M 1568	1.8	125A 660V UR	0	OFAX 00 S3L	78.5
Bussman 170M 3815	0.87	200A 660V UR	1	OFAX 1 S3	135
Bussman 170M 3816	0.59	250A 600V UR	1	OFAX 1 S3	135
Bussman 170M 3817	0.47	315A 660V UR	1	OFAX 1 S3	135
Bussman 170M 3819	0.37	400A 660V UR	1	OFAX 1 S3	135
Bussman 170M 5810	0.3	500A 660V UR	2	OFAX 2 S3	150
Bussman 170M 6811	0.22	700A 660V UR	3	OFAS B 3	150
Bussman 170M 6813	0.15	900A 660V UR	3	OFAS B 3	150
Bussman 170M 6166	0.09	1250A 660V UR	*	170H 3006	110

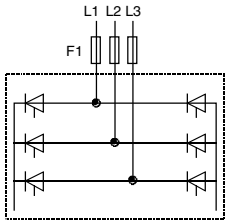
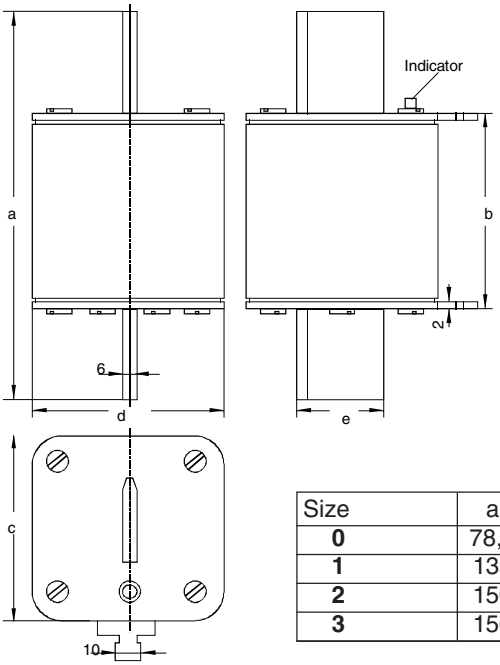


Table 9.1/1: Fuses and fuse holders

* details see chapter 2.2

Dimensions [mm] Size 0...3



Remark:
Given dimensions may be exeeded in some cases. Please take them only for information.

Size	a	b	c	d	e
0	78,5	50	35	20,5	15
1	135	69	45	45	20
2	150	69	55	55	26
3	150	68	76	76	33

Fig. 9.1/1: Fuses size 0...3

Main dimensions of fuse holders

Fuse holder	HxWxD [mm]
OFAX 00 S3L	148x112x111
OFAX 1 S3	250x174x123
OFAX 2 S3	250x214x133
OFAS B 3	250x246x136

Table 9.1/2: Fuse holders

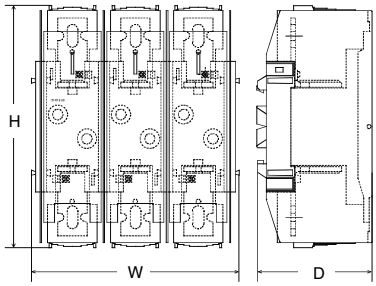


Fig. 9.1/2: Fuse holder OFAX ...

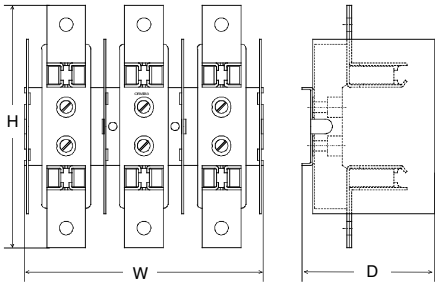


Fig. 9.1/3: Fuse holder OFAS B 3

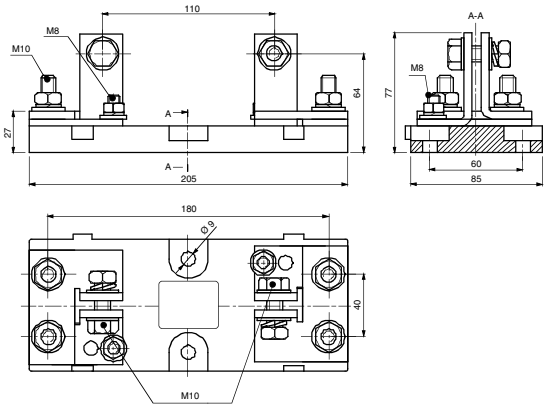


Fig. 9.1/4: Fuse holder 170H 3006

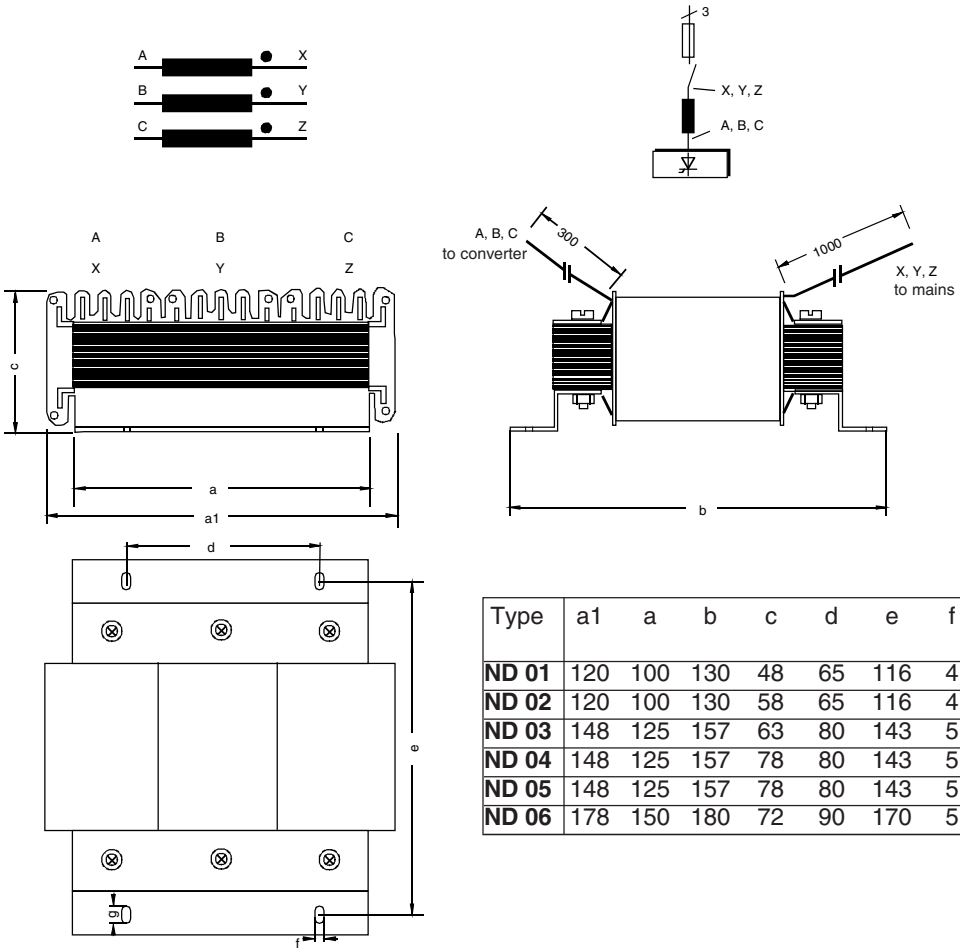
Line chokes type ND 01...ND 16

Line chokes for use in industrial environment (minimum requirements), low inductive voltage drop, deep commutation notches.

Type	Choke L [µH]	I_{rms} [A]	I_{peak} [A]	rated Voltage [U_N]	Weight [kg]	Power loss Fe [W]	Power loss Cu [W]	recommended for armature converter type
ND 01	512	18	27	500	2.0	5	16	DCS...-0025
ND 02	250	37	68	500	3.0	7	22	DCS...-0050
ND 03	300	37	68	600	3.8	9	20	DCS...-0050
ND 04	168	55	82	500	5.8	10	33	DCS...-0075
ND 05	135	82	122	600	6.4	5	30	DCS...-0110
ND 06	90	102	153	500	7.6	7	41	DCS...-0140
ND 07	50	184	275	500	12.6	45	90	DCS...-0250
ND 08	56.3	196	294	600	12.8	45	130	DCS...-0270
ND 09	37.5	245	367	500	16.0	50	140	DCS...-0350
ND 10	25.0	367	551	500	22.2	80	185	DCS...-0520
ND 11	33.8	326	490	600	22.6	80	185	DCS...-0450
ND 12	18.8	490	734	500	36.0	95	290	DCS...-0700
ND 13	18.2	698	1047	690	46.8	170	160	DCS...-0900
ND 14	9.9	930	1395	500	46.6	100	300	DCS...-1200
ND 15	10.9	1163	1744	690	84.0	190	680	DCS...-1500
ND 16	6.1	1510	2264	500	81.2	210	650	DCS...-2000

Table 9.1/3: Data of line chokes

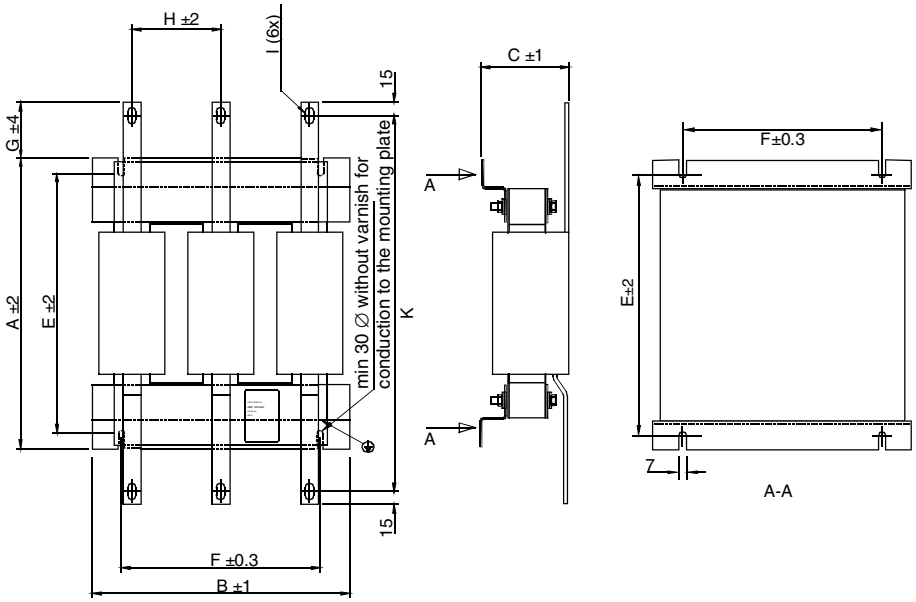
Line chokes type ND 01...ND 06



Type	a1	a	b	c	d	e	f	g	mm²
ND 01	120	100	130	48	65	116	4	8	6
ND 02	120	100	130	58	65	116	4	8	10
ND 03	148	125	157	63	80	143	5	10	10
ND 04	148	125	157	78	80	143	5	10	16
ND 05	148	125	157	78	80	143	5	10	25
ND 06	178	150	180	72	90	170	5	10	35

Fig. 9.1/4: Line choke type ND 01...ND 06

Line chokes type ND 07...ND 12



Type	A	B	C	E	F	G	H	I	K
ND 07, 08	285	230	86	250	176	65	80	9x18	385
ND 09	327	250	99	292	224	63	100	9x18	423
ND 10, 11	408	250	99	374	224	63	100	11x18	504
ND 12	458	250	112	424	224	63	100	11x18	554

Fig. 9.1/5: Line chokes type ND 07...ND 12

Line chokes type ND 13, 14

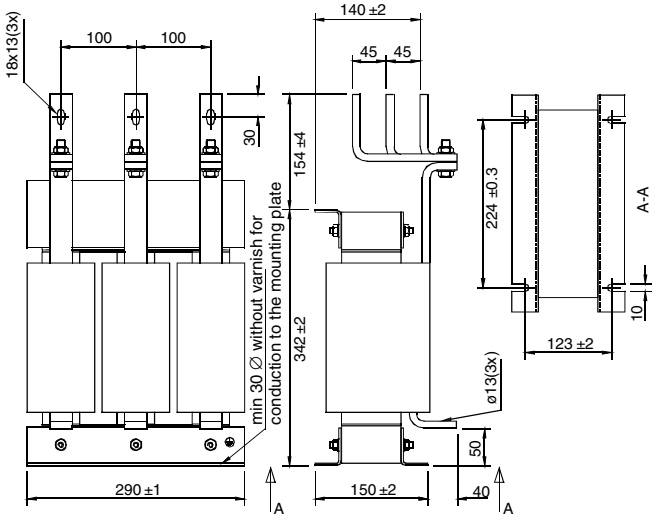


Fig. 9.1/6: Line chokes type ND 13, ND 14

Line chokes type ND 15, 16

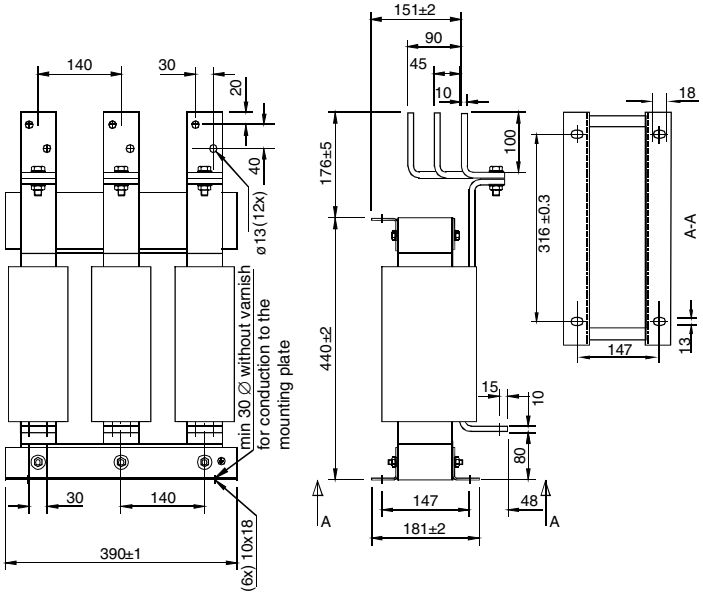


Fig. 9.1/7: Line chokes type ND 15, ND 16

Line chokes type ND 401...ND 413

Line chokes for use in light industrial/residential environment, high inductive voltage drop, reduced commutation notches.

These chokes are designed for drives which usual operate in speed control mode.
The maximum average DC load current depends on the operation point.
DC curr. 1 = maximum continuous current for $U_{rated\ supply}$ = 400 V
DC curr. 2 = maximum continuous current for $U_{rated\ supply}$ = 500 V

Type	Choke L [µH]	I_{rms} Line AC [A]	I_{peak} [A]	rated Voltage [U_N]	Weight [kg]	Power loss Fe [W]	Power loss Cu [W]	Load DC curr. 1	Load DC curr.2
ND 401	1000	18.5	27	500	3.5	13	35	22.6	18
ND 402	600	37	68	500	7.5	13	50	45	36
ND 403	450	55	82	500	11	42	90	67	54
ND 404	350	74	111	500	13	78	105	90	72
ND 405	250	104	156	500	19	91	105	127	101
ND 406	160	148	220	500	22	104	130	179	143
ND 407	120	192	288	500	23	117	130	234	187
ND 408	90	252	387	500	29	137	160	315	252
ND 409	70	332	498	500	33	170	215	405	324
ND 410	60	406	609	500	51	260	225	495	396
ND 411	50	502	753	500	56	260	300	612	490
ND 412	40	605	805	500	62	280	335	738	590
ND 413	35	740	1105	500	75	312	410	900	720

Table 9.1/4: Data of line chokes type ND4

Line chokes type ND 401...ND 402

Type	A	B	C	D	E	F	Ø G	Ø H
ND 401	160	190	75	80	51	175	7	9
ND 402	200	220	105	115	75	200	7	9

Table 9.1/5: Dimensions of line chokes type ND 401...ND 402

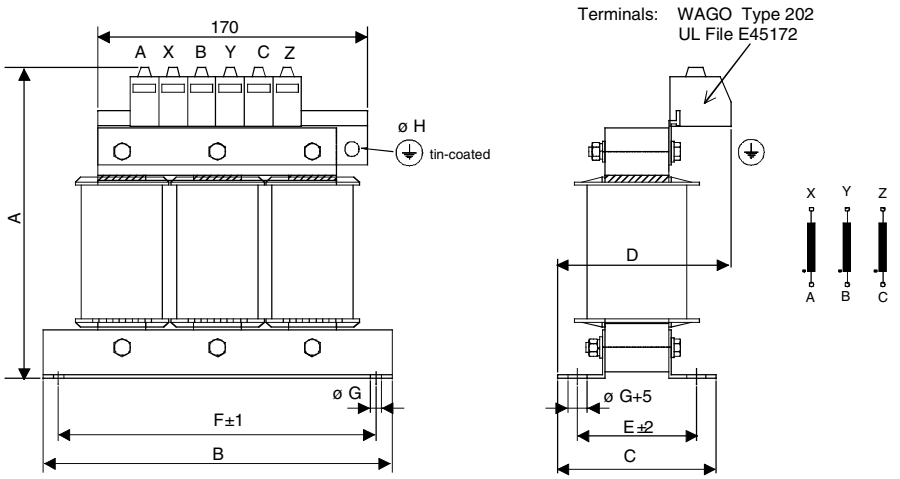


Fig. 9.1/8: Line choke type ND 401...ND 402

Line chokes type ND 403...ND 408

Type	A	B	C	D	E	F	Ø G	Ø H	Ø K
ND 403	220	230	120	135	100	77.5	7	9	6.6
ND 404	220	225	120	140	100	77.5	7	9	6.6
ND 405	235	250	155	170	125	85	10	9	6.6
ND 406	255	275	155	175	125	95	10	9	9
ND 407	255	275	155	175	125	95	10	9	11
ND 408	285	285	180	210	150	95	10	9	11

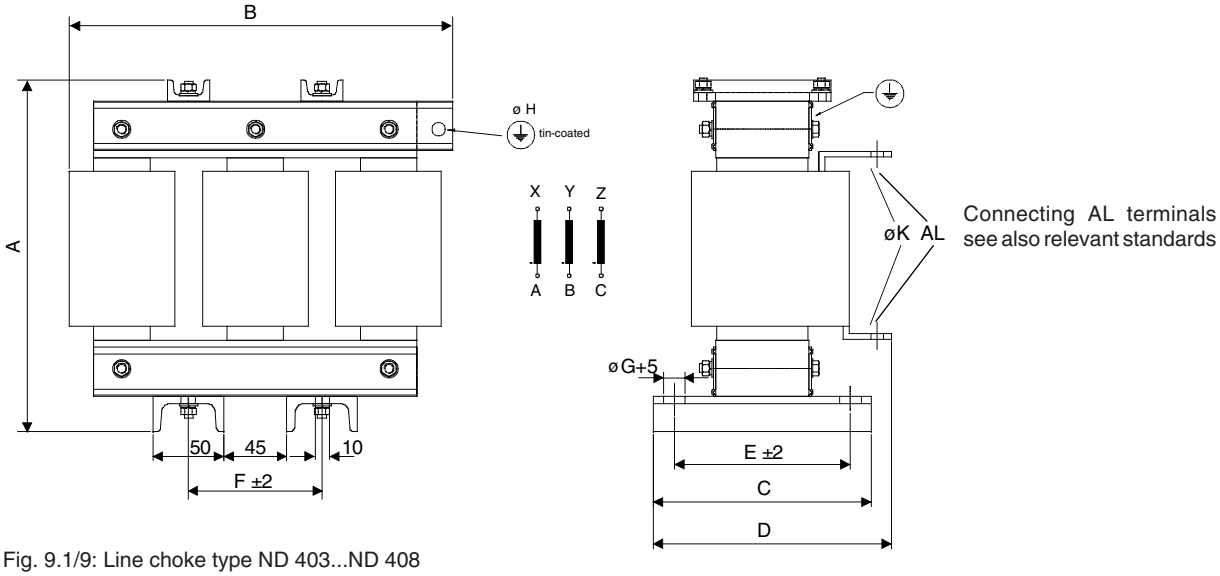


Fig. 9.1/9: Line choke type ND 403...ND 408

Line chokes type ND 409...ND 413

Type	A	B	C	D	E	F	Ø G	Ø H	Ø K
ND 409	320	280	180	210	150	95	10	11	11
ND 410	345	350	180	235	150	115	10	13	14
ND 411	345	350	205	270	175	115	12	13	2x11
ND 412	385	350	205	280	175	115	12	13	2x11
ND 413	445	350	205	280	175	115	12	13	2x11

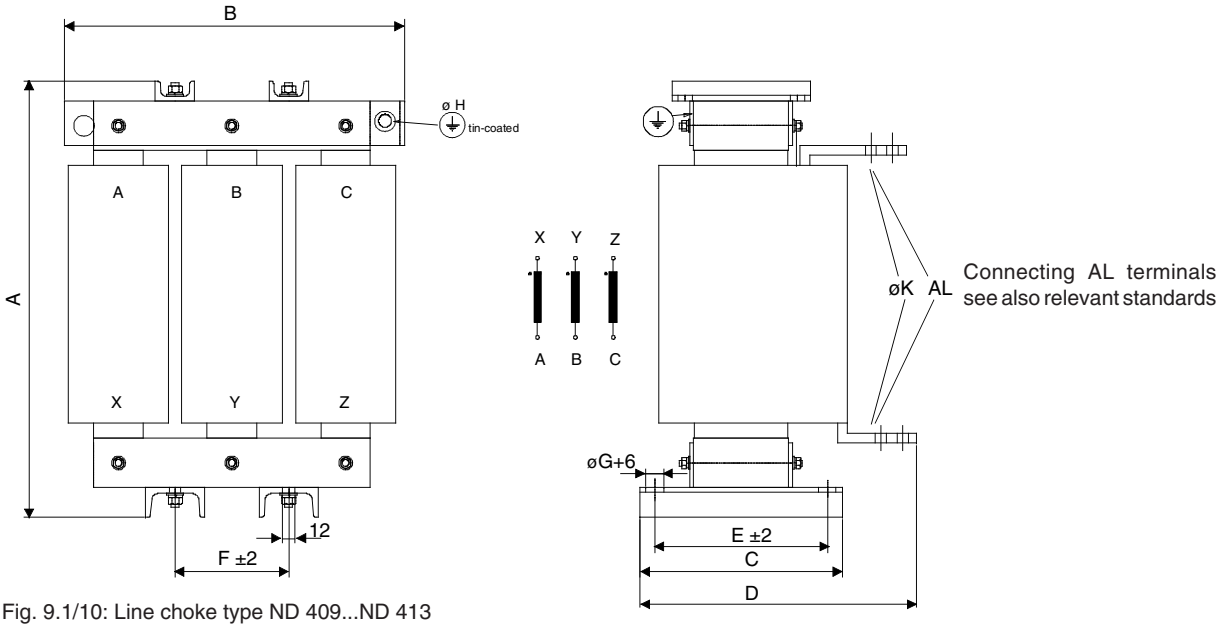


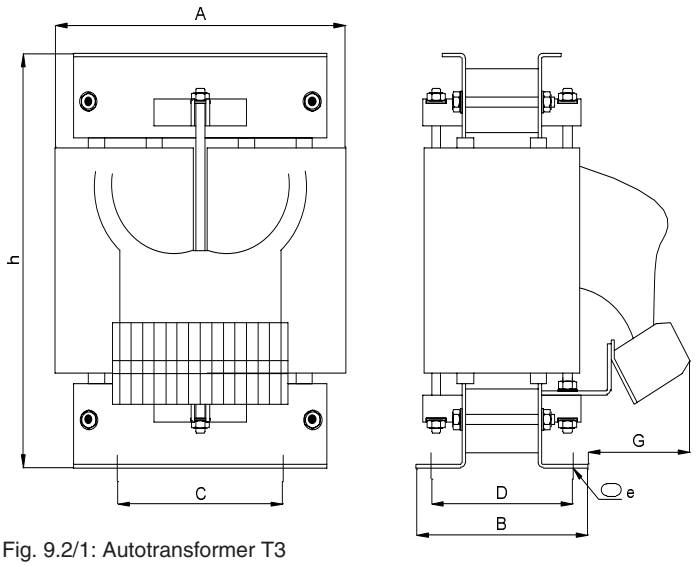
Fig. 9.1/10: Line choke type ND 409...ND 413

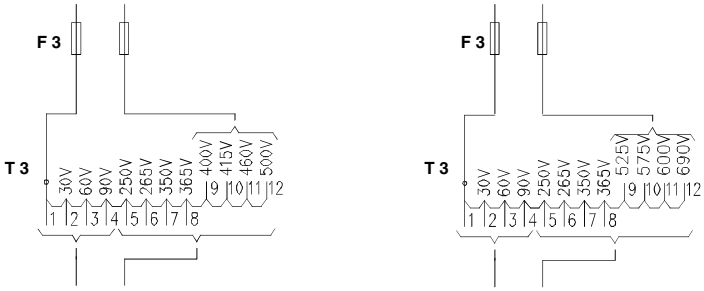
9.2.1 Autotransformer T3

Type	for Field curr. I_F	Transformer I_{sek}	Weight [kg]	Power loss P_V [W]	Fuse F3 [A]
		U_{prim} = **500 V; 50/60Hz**			
T 3.01	≤6 A	≤7 A	15	65	10
T 3.02	≤12 A	≤13 A	20	100	16
T 3.03	≤16 A	≤17 A	20	120	25
T 3.04	≤30 A	≤33 A	36	180	50
T 3.05	≤50 A	≤57 A	60	250	63
		U_{prim} = **690 V; 50/60Hz**			
T 3.11	≤6 A	≤7 A ①	15	80	10
T 3.12	≤12 A	≤13 A ①	20	125	16
T 3.13	≤16 A	≤17 A ①	30	150	20
T 3.14	≤30 A	≤33 A	60	230	50
T 3.15	≤50 A	≤57 A	60	320	63

① 690 V transformer input cannot be used for the field converters SDCS-FEX-1 and SDCS-FEX-2 (isolation only 600 V max.)

Table 9.2/1: Autotransformer data





Type	A	B	C	D	h	e	G
T 3.01 / T 3.11	210	110	112	75	240	10x18	95
T 3.02 / T 3.12 T 3.03	210	135	112	101	240	10x18	95
T 3.13	230	150	124	118	270	10x18	95
T 3.04	260	150	144	123	330	10x18	95
T 3.14 T 3.05 / T 3.15	295	175	176	141	380	12x18	95

Fig. 9.2/1: Autotransformer T3

9.2.2 Line choke L3 for SDCS-FEX-2

Type	line choke data L3 L [µH]	I_{rms} [A]	I_{peak} [A]	Weight [kg]	Power loss [W]	[mm²]
ND30	2x >500	16	16	1,1	8	2

Table 9.2/2: Data of line choke for field exciter

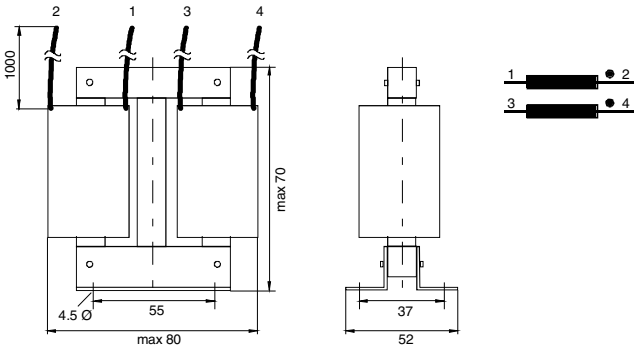
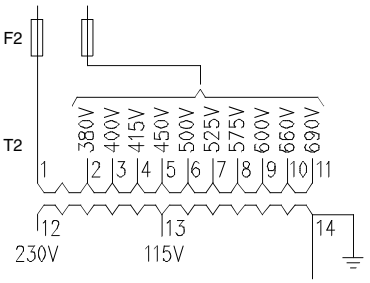


Fig. 9.2/2: Line choke L3

9.3 Fan, electronics

9.3.1 Supply transformer T2 for electronics and fan



Input voltage: 380...690 V/1~; 56 / 60 Hz
Output voltage: 115/230 V/1~

Type	Power [VA]	Weight [kg]	Fuse F2 [A]	Power loss [W]
T2	460	13	6	20

Table 9.3/1: Data supply transformer T2

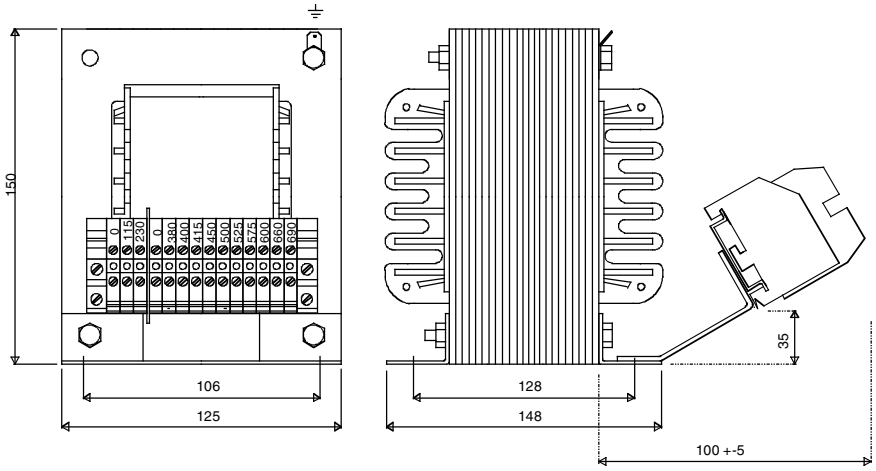


Fig. 9.3/1: Transformer T2

Appendix A

Optical cables

For the bus communication of the DCS converters
there are different optical cables available.

Kind of cable	Connector	cable length	Ident. no.	Fig.
plastic fibre optic single cable	plug	0.5...20 m	3ADT 693324	1
plastic fibre optic double cable	plug	0.5...20 m	3ADT 693318	2
HCS silica (double) without plastic jacket	plug	30...50 m	3ADT 693355	3
HCS silica (double) with plastic jacket	plug	50...200 m	3ADT 693356	4
Glass fibre optic (double) reinforced	FSMA	10...100 m	3ADV 300002	5

Figure 1

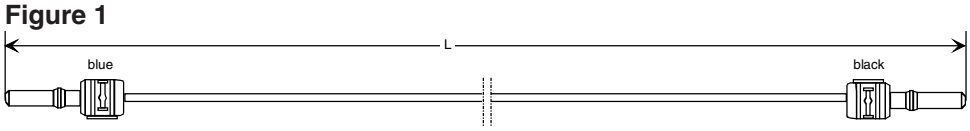
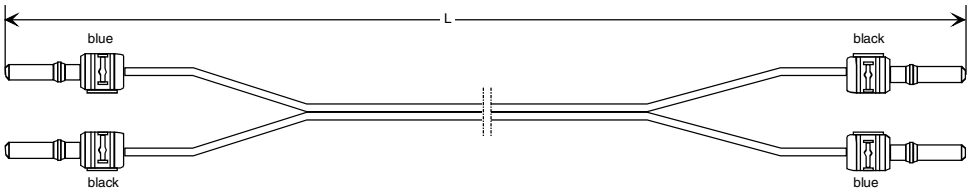


Figure 2



for DCS 400
DCS 500
DCS 600

Figure 3

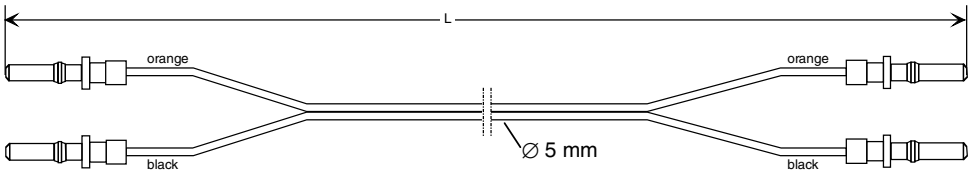
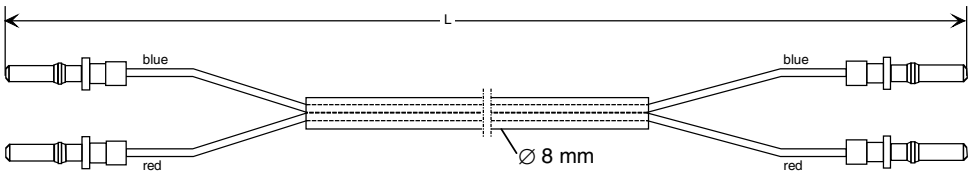
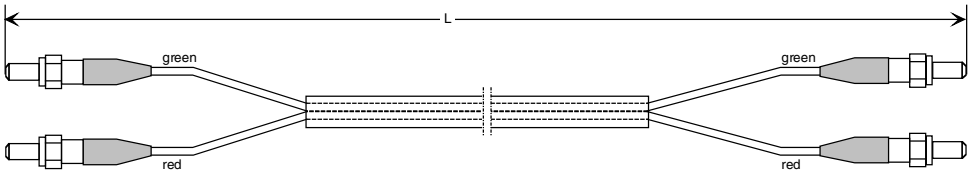


Figure 4



for DCS 600 selected channels.
see manual NDBU 3ADW 000 100 R0201

Figure 5



for DCS 500
+ YPC115

Notices

Since we aim to always meet the latest state-of-the-art standards with our products, we are sure you will understand when we reserve the right to alter particulars of design, figures, sizes, weights, etc. for our equipment as specified in this brochure.

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