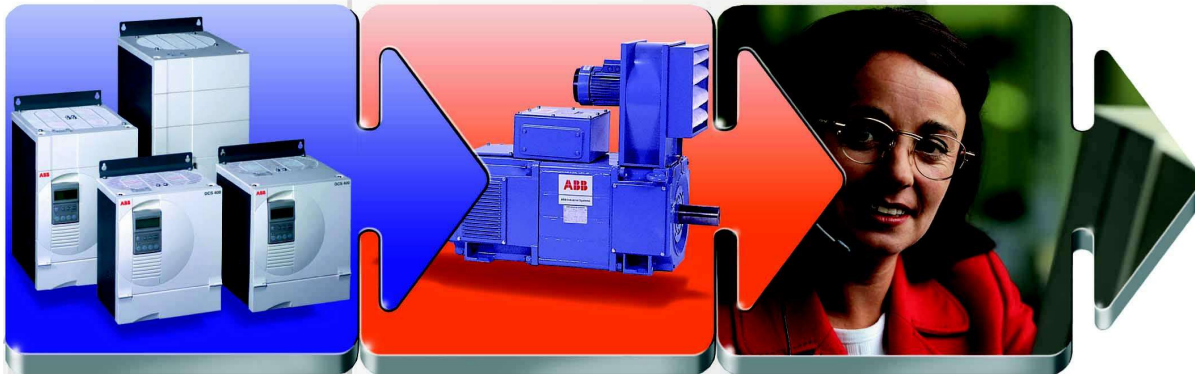


DCS Thyristor power converter
for DC drive systems
20 to 1000 A
9 to 522 kW

Manual
DCS 400



ABB

This manual is valid for DCS 400 Rev A including software version 108.0

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1 DCS 400 - the compact-size DC drive

DCS 400 is a new generation of DC drives, which is rated from 9 to 522 kW and for use on all line supply voltages from 230 to 500 V.

Total ease of use was the brief given to the drive's designers. The result is a DC drive that meets the needs of machine builders. It is:

- ☆ as easy to handle as an analogue drive but with all the advantages of a digital drive
- ☆ easy to design into machine equipment, being compact and having just the right number of features
- ☆ easy to install and set up

The DCS 400 is an **innovative design**, using the latest semiconductor technology together with an advanced software which helps to reduce maintenance, increase product reliability and enables extremely rapid commissioning.

The DCS 400's small size brings substantial space savings to machine builders, allowing them to

integrate more accessories within the same space. The compact design has been partly achieved by a fully integrated field exciter, which includes the field fuse and choke.

Based on **new IGBT technology** used for the field exciter, there is no need for a field voltage adaptation transformer to match the line supply voltage with that of the motor.

The **commissioning wizard** -available on the control panel and the PC tool - makes start up of the drive extremely easy, by simply guiding the user through the start up procedure.

In addition, the DCS 400 contains **application macros**. By selecting a macro from a menu, the user can pre-select the software structure and the I/O connection, thus saving time and eliminating any errors.

The DCS 400 carries the CE Mark and is designed and produced according to the quality standard ISO 9001.



Unit functions

Drive functions

- Speed ramp function generator (S-ramp, 2 accel / decel ramps)
- Speed feedback via tacho, encoder, EMF
- Speed controlling
- Torque / current reference processing
- External torque limitation
- Current controlling
- Automatic field weakening
- Automatic optimization for armature-circuit current, field current, speed controller, EMF regulator, flux adaptation
- Speed monitor
- On/Off control logic
- Remote/local operation
- Emergency stop
- Automatic phase sequence detection
- Motor overload detection
- Internal motor potentiometer function for the speed reference
- Jog function
- Configuration macros

Monitoring functions

Self-test

Fault logger

Motor monitoring

- Speed feedback error
- Overtemperature (PTC evaluation)
- Overload ($I^2 t$)
- Overspeed
- Stalled motor
- Armature-circuit overcurrent
- Armature-circuit overvoltage
- Minimum field current
- Field overcurrent

Power converter protection

- Overtemperature
- Watchdog function
- Mains voltage interruption

Thyristor diagnosis

Activation and operator-control

analogue and digital **inputs** and **outputs**

fieldbusses

MMC (man-machine communication) via:

Drive Window Light

(start-up and maintenance program) PC programs can be run under all commonly used Windows® environments (3.1x, 95, 98, NT):

- Parameter programming
- Fault detection
- Feedback display and analysis
- Fault logger

DCS400PAN

Removable control and display panel with plain text display for:

- **Guided** commissioning
- Parameter programming
- Fault detection
- Reference and feedback display
- Local operation

2 System overview of DCS 400

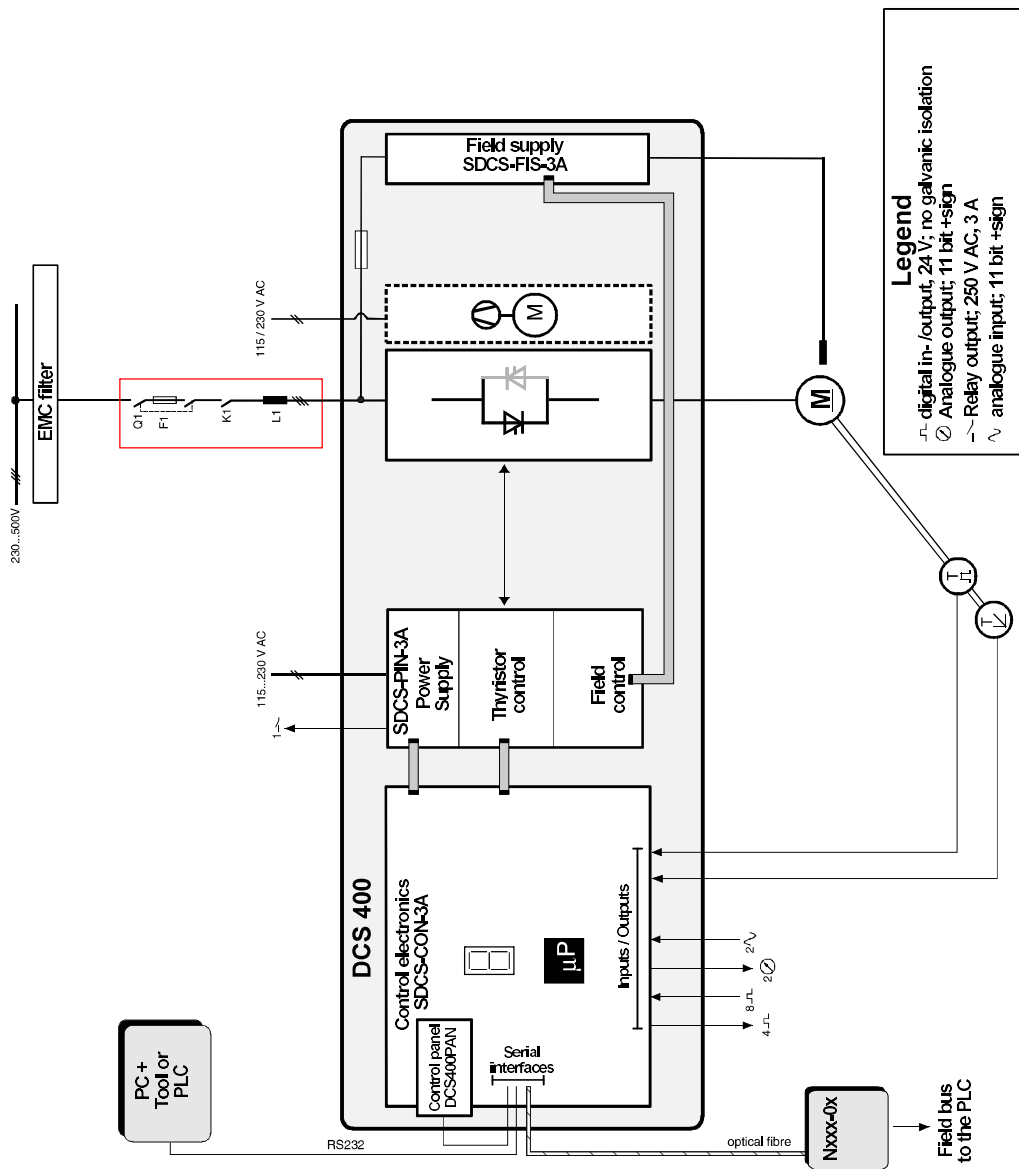


Fig. 2/1: System overview of DCS 400

Mains supply - power part

Voltage, 3-phase:	230 to 500 V in acc. with IEC 38
Voltage deviation:	±10% permanent
Rated frequency:	50 Hz or 60 Hz
Static frequency deviation:	50 Hz ±2 %; 60 Hz ±2 %
Dynamic: frequency range:	50 Hz: ±5 Hz; 60 Hz: ± 5 Hz
df/dt:	17 % / s

Mains supply - Electronics supply

Voltage, 1-phase:	115 to 230 V in acc. with IEC 38
Voltage deviation:	-15% / +10%
Frequency range:	45 Hz to 65 Hz

Degree of protection

Power converter module:	IP 00
-------------------------	-------

Paint finish

Power converter module, cover:	RAL 9002 light-grey
housing:	RAL 7012 dark-grey

Environmental limit values

Permissible ambient temp. with rated current I_{DC} :	+5 to +40°C
Ambient temp., power conv. module:	+40°C to 55°C; s. Fig. 2.1/2
Alteration in the ambient temp.:	< 0,5°C / minute
Storage temperature:	-40 to +55°C
Transport temperature:	-40 to +70°C
Relative humidity:	5 to 95%, no condensation
Pollution degree:	Grade 2

Site elevation:	
<1000 m above M.S.L.:	100%, without current reduction
>1000 m above M.S.L.:	with current reduct., s. Fig. 2.1/1

Vibration converter module: 0,5 g; 5 Hz to 55 Hz

Noises:	Size	as module
(1 m distance)		
	A1	55 dBA
	A2	55 dBA
	A3	60 dBA
	A4	66...70 dBA, dependent on fan

Current reduction to (%) for armature circuit and field supply

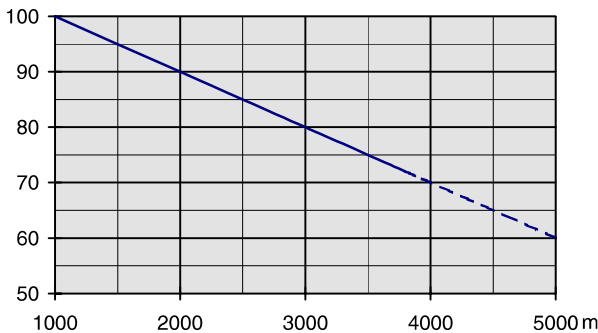


Fig. 2.1/1: Effect of the site elevation above sea level on the power converter's load capacity

Current reduction to (%) for armature circuit and field supply

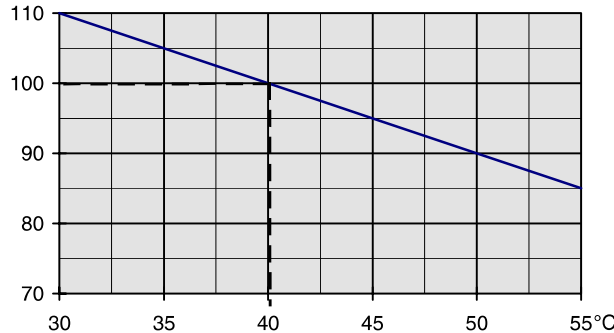


Fig. 2.1/2: Effect of the ambient temperature on the converter module load capacity.

Compliance with standards

The power converter modules and cubicles are designed for industrial applications. Within the EU, the components satisfy the requirements European guidelines, shown in the table below.

European Union Directive	Manufacturer's Assurance	Harmonized Standards
		Converter module
Machinery Directive 89/392/EEC 93/68/EEC	Declaration of Incorporation	EN 60204-1 [IEC 204-1]
Low Voltage Directive 73/23/EEC 93/68/EEC	Declaration of Conformity	EN 60146-1-1 [IEC 146-1-1] EN 50178 [IEC --] see additional IEC 664
EMC Directive 89/336/EEC 93/68/EEC	Declaration of Conformity. Provided that all installation instructions concerning cable selection, cabling and EMC filters or dedicated transformer are followed.	EN 61800-3 [IEC 1800-3]
		where limits are under consideration EN 50081-2 / EN 50082-2 has been supplied
		in accordance with 3ADW 000 032 'Installation in accordance with EMC'
		The Technical Construction File to which this Declaration relates has been assessed by Report and Certificate from ABB EMC Certification AB being the Competent Body according to the EMC Directive.

Standards in North America

In North America, the system components satisfy the requirements as listed in the table below.

Safety for Power conversion Equipment ≤ 600 V	Standard for module UL 508 C
Industrial control Equipment: industrial products ≤ 600 V	CSA C 22.2. No.1495

Please note:
applies for power converter modules only.

Sizes



Size A1



Size A2



Size A3



Size A4

Size	Current range	Dimensions H x W x D [mm]	Weight appr. [kg]	Min. Clearances top/bottom/side [mm]	Fan connection	Fuses
A1	20...25 A	310x270x200	11	150x100x5	-	external
A1	45...140 A	310x270x200	11	150x100x5	115/230 V/1 ph	external
A2	180...260 A	310x270x270	16	250x150x5	115/230 V/1 ph	external
A3	315...550 A	400x270x310	25	250x150x10	115/230 V/1 ph	external
A4	610...1000 A	580x270x345	38	250x150x10	① 230 V/1 ph	external

Table 2.2/1: Sizes of DCS 400

① Fan with 115 V/1 ph available as option

Unit table

DCS 401 2-quadrant converter

DCS 402 4-quadrant converter

Converter type	Line voltage					Size	Converter type	Line voltage				
	I_{DC} [A]	I_{AC} [A]	I_F [A]	P [kW]	P [kW]			I_{DC} [A]	I_{AC} [A]	I_F [A]	P [kW]	P [kW]
DCS401.0020	20	16	4	9	12	A1	DCS402.0025	25	20	4	10	13
DCS401.0045	45	36	6	21	26	A1	DCS402.0050	50	41	6	21	26
DCS401.0065	65	52	6	31	39	A1	DCS402.0075	75	61	6	31	39
DCS401.0090	90	74	6	41	52	A1	DCS402.0100	100	82	6	41	52
DCS401.0125	125	102	6	58	73	A1	DCS402.0140	140	114	6	58	73
DCS401.0180	180	147	16	84	104	A2	DCS402.0200	200	163	16	83	104
DCS401.0230	230	188	16	107	133	A2	DCS402.0260	260	212	16	108	135
DCS401.0315	315	257	16	146	183	A3	DCS402.0350	350	286	16	145	182
DCS401.0405	405	330	16	188	235	A3	DCS402.0450	450	367	16	187	234
DCS401.0500	500	408	16	232	290	A3	DCS402.0550	550	448	16	232	290
DCS401.0610	610	498	20	284	354	A4	DCS402.0680	680	555	20	282	354
DCS401.0740	740	604	20	344	429	A4	DCS402.0820	820	669	20	340	426
DCS401.0900	900	735	20	419	522	A4	DCS402.1000	1000	816	20	415	520

Table 2.2/2: DCS 401 unit table

Table 2.2/3: DCS 402 unit table

DC voltage characteristic

The DC voltage characteristics are calculated according to:

- U_{VN} = rated supply voltage, 3-phase
- Voltage tolerance $\pm 10\%$

$$U_d = (U_{VN} - 10\%) * 1.35 * \cos \alpha$$

$$\cos \alpha = \begin{matrix} 0.966 & (2\text{-Q}) \\ 0.866 & (4\text{-Q}) \end{matrix}$$

System connection voltage U_{VN}	DC voltage (max. Motor voltage) U_d	
	2Q ①	4Q
230	270	240
380	460	400
400	470	420
415	490	430
440	520	460
460	540	480
480	570	500
500	600	520

① in case of a 2-Q converter, which is used in regenerative mode, please use 4-Q voltage values

Table 2.2/4: Recommended DC voltage with specified input voltage

To match a drive system's components as efficiently as possible to the driven machine's load profile, the power converters can be dimensioned by means of the load cycle. Load cycles for driven machines have been defined in the IEC 146 or IEEE specifications, for example.

The characteristics are based on an ambient temperature of max. 40°C and an elevation of max. 1000 m.

Types of load

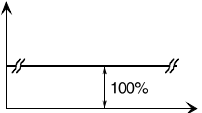
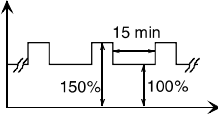
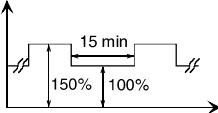
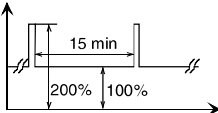
Operating cycle	Load for converter	Typical applications	Load cycle
DC I	$I_{DC I}$ continuous (I_{dN})	pumps, fans	
DC II	$I_{DC II}$ for 15 min and $1,5 * I_{DC II}$ for 60 s	extruders, conveyor belts	
DC III	$I_{DC III}$ for 15 min and $1,5 * I_{DC III}$ for 120 s	extruders, conveyor belts	
DC IV	$I_{DC IV}$ for 15 min and $2 * I_{DC IV}$ for 10 s		

Table 2.3/1: Definition of the load cycles

Load cycles of driven machines

DC I	DC II		DC III		DC IV	
$I_{DC I}$	$I_{DC II}$		$I_{DC III}$		$I_{DC IV}$	
contin- uous [A]	100 % 15 min	150 % 60 s	100 % 15 min	150 % 120 s	100 % 15 min	200 % 10 s
2-quadrant applications						
20	18	27	18	27	18	36
45	40	60	37	56	38	76
65	54	81	52	78	55	110
90	78	117	72	108	66	132
125	104	156	100	150	94	188
180	148	222	144	216	124	248
230	200	300	188	282	178	356
315	264	396	250	375	230	460
405	320	480	310	465	308	616
500	404	606	388	582	350	700
610	490	735	482	723	454	908
740	596	894	578	867	538	1076
900	700	1050	670	1005	620	1240
4-quadrant applications						
25	23	35	22	33	21	42
50	45	68	43	65	38	76
75	66	99	64	96	57	114
100	78	117	75	113	67	134
140	110	165	105	158	99	198
200	152	228	148	222	126	252
260	214	321	206	309	184	368
350	286	429	276	414	265	530
450	360	540	346	519	315	630
550	436	654	418	627	380	760
680	544	816	538	807	492	984
820	664	996	648	972	598	1196
1000	766	1149	736	1104	675	1350

Table 2.3/2: Selection of converter modules according to the corresponding load cycles.

Recommended Converter type

Converter type
2-quadrant converter
DCS 401.0020
DCS 401.0045
DCS 401.0065
DCS 401.0090
DCS 401.0125
DCS 401.0180
DCS 401.0230
DCS 401.0315
DCS 401.0405
DCS 401.0500
DCS 401.0610
DCS 401.0740
DCS 401.0900
4-quadrant converter
DCS 402.0025
DCS 402.0050
DCS 402.0075
DCS 402.0100
DCS 402.0140
DCS 402.0200
DCS 402.0260
DCS 402.0350
DCS 402.0450
DCS 402.0550
DCS 402.0680
DCS 402.0820
DCS 402.1000

For operation, commissioning, diagnosis and for controlling the drive, there are different possibilities available.

The coupling to an overriding system (PLC) takes place over a serial interface with a fibre-optic link to a field bus adapter.

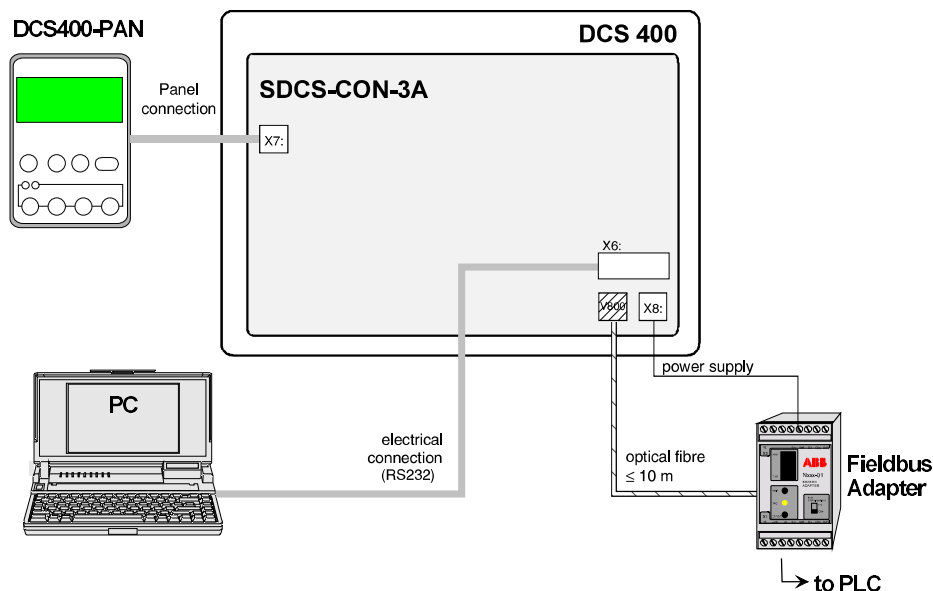


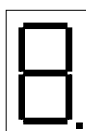
Fig. 2.4/1: Possibilities of operation



Panel DCS 400 PAN

Features

- Guided commissioning (Panel Wizard)
- Drive control
- Parameter programming
- Display of reference and actual values
- Status information
- Fault reset
- Multilingual
- removable during operation



7-Segment display

Features

- RAM/ROM memory test error
- Program is not running
- Normal situation
- During download sequence
- Alarm
- Fault

Fieldbus Adapter

Components:

- plastic optical fibre
- field bus adaptor

available Fieldbus adapters:

- PROFIBUS
- AC 31
- MODBUS
- MODBUS+
- CAN-BUS
- DeviceNet

You will find more detailed information on data exchange in the related documentation for field bus adapters.

Operation by PC

Components :

- RS232 standard cable, 9-pin sub-D connector, male-female, non-crossing

Functionality:

- Software package "Drive Window Light"

System requirements/recommendation:

- PC with 386 processor or higher
- hard disk with 5 MB free memory
- VGA monitor
- Windows 3.1, 3.11, 95, 98, NT
- 3 1/2" floppy disk drive

CAUTION!

To avoid unintentional operating states, or to shut the unit down in case of any imminent danger according to the standards in the safety instructions it is not sufficient to merely shut down the drive via signals 'RUN', drive 'OFF' or 'Emergency Stop' respectively 'control panel' or 'PC tool'.

Drive Window Light

Drive Window Light is a PC tool for on-line start-up, diagnosis, maintenance and troubleshooting.



System configuration display

offers an overview the system.



Drive control

to be used for control of a selected drive.



Parameter programming

to be used to process signals and parameters of the destination drive.



Trending

monitors the feedback values of the destination drive.



Fault logger

enables you to view the error memory.

Start-up wizard

The start-up wizard makes it easier to parameterize and optimize a drive. It guides the user through the various sequences involved in a start-up.

The screenshot shows the 'DCS400 - general data' window. It contains several sections for configuring the drive:

- Motor-Data:**
 - Armature Voltage (1.02): 400 V
 - Armature Current (1.01): 25 A
 - Field Voltage (1.04): 310 V
 - Field Current (1.03): 1 A
 - Base Speed (1.05): 2000 rpm
 - Fieldweakening: ☒
 - Max Speed (1.06): 3000 rpm
- Stop - Mode (2.02):**
 - ☒ Stop by Ramp
 - ☐ Stop by Torque
 - ☐ Stop by Coasting
- Emergency Stop - Mode (2.03):**
 - ☒ Stop by Ramp
 - ☐ Stop by Torque
 - ☐ Stop by Coasting
- Converter-Data:**
 - Panel Language (7.01): english
 - Applicat. Macro (2.01): Makro 1
- Rampgenerator:**
 - Accel. Ramp (5.09): 20 sec
 - Decel. Ramp (5.10): 20 sec
 - Eme. Stop Ramp (5.11): 20 sec
- Speed Feedback (5.02):**
 - ☐ EMF
 - ☒ Tacho
 - ☐ Encoder
 - Encoder Incr. (5.03): 2048

Buttons at the bottom: Help, next >>, cancel.

Fig. 2.4/2: Example for a Start-up wizard display

3.1 Module dimensions

DCS 401.0020
DCS 401.0045
DCS 401.0065
DCS 401.0090
DCS 401.0125

DCS 402.0025
DCS 402.0050
DCS 402.0075
DCS 402.0100
DCS 402.0140

DCS 401.0180
DCS 401.0230

DCS 402.0200
DCS 402.0260

DCS 401.0315
DCS 401.0405
DCS 401.0500

DCS 402.0350
DCS 402.0450
DCS 402.0550

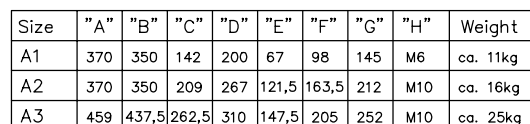
[illegible]

Fig. 3.1/1: Dimension drawing A1, A2, A3-Module

Module A4

DCS 401.0610

DCS 401.0740

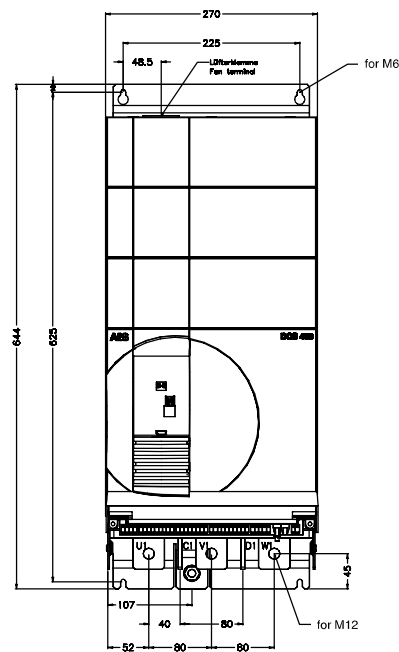
DCS 401.0900

DCS 402.0680

DCS 402.0820

DCS 402.1000

Dimensions in mm



Anschlußschienen 40x5mm
Power terminal : Busbar 40x5mm
Gewicht ca. 38kg
Weight ca. 38kg

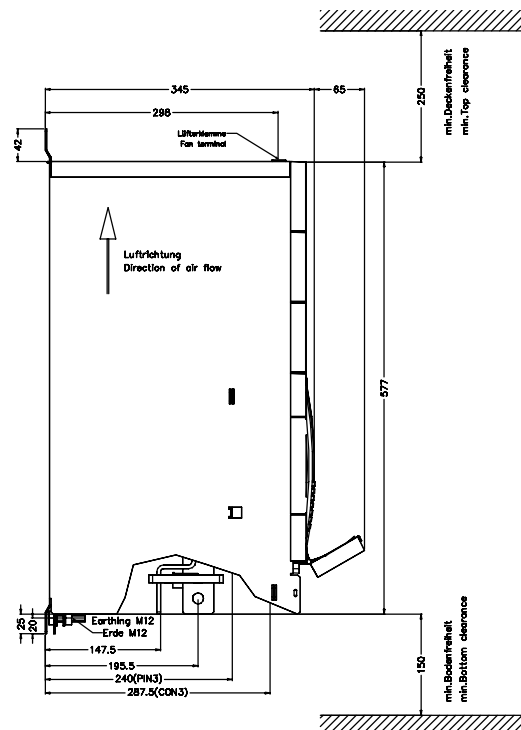


Fig. 3.1/2: Dimension drawing A4-Module

3.2 Cross-sectional areas - Tightening torques

Technical data

3.2.1 Recommended cross-sectional area to **DIN VDE 0276-1000** and **DIN VDE 0100-540** (PE), trefoil arrangement, up to 40°C ambient temperature and a 90°C operating temperature of the conductor.

Unit type	C1, D1				U1, V1, W1				PE ❶				
	IDC [A-]	HO7V  [mm²]	NSGA FÖU  [mm²]	N2XY  [mm²]	Iv [A-]	HO7V  [mm²]	NSGA FÖU  [mm²]	N2XY  [mm²]	HO7V  [mm²]	NSGA FÖU  [mm²]	N2XY  [mm²]		
DCS 401.0020	20	1 x 2.5	1 x 1.5	1 x 1.5	16	1 x 2.5	1 x 1.5	1 x 1.5	1 x 2.5	1 x 1.5	1 x 1.5	M6	6
DCS 401.0045	45	1 x 10	1 x 6	1 x 6	36	1 x 6	1 x 6	1 x 4	1 x 6	1 x 6	1 x 4	M6	6
DCS 401.0065	65	1 x 16	1 x 10	1 x 10	52	1 x 16	1 x 10	1 x 6	1 x 16	1 x 10	1 x 6	M6	6
DCS 401.0090	90	1 x 25	1 x 16	1 x 16	74	1 x 25	1 x 16	1 x 16	1 x 16	1 x 16	1 x 16	M6	6
DCS 401.0125	125	1 x 35	1 x 25	1 x 25	102	1 x 35	1 x 25	1 x 25	1 x 16	1 x 16	1 x 16	M6	6
DCS 401.0180	180	1 x 70	1 x 50	1 x 50	147	1 x 50	1 x 50	1 x 35	1 x 25	1 x 25	1 x 16	M10	25
DCS 401.0230	230	1 x 95	1 x 70	1 x 70	188	1 x 70	1 x 70	1 x 50	1 x 35	1 x 35	1 x 25	M10	25
DCS 401.0315	315	2 x 50	1 x 95	1 x 120	257	2 x 50	1 x 95	1 x 95	1 x 50	1 x 50	1 x 50	M10	25
DCS 401.0405	405	2 x 70	2 x 50	1 x 150	330	2 x 70	2 x 50	1 x 120	1 x 70	1 x 50	1 x 70	M10	25
DCS 401.0500	500	2 x 120	2 x 70	2 x 70	408	2 x 95	2 x 70	2 x 70	1 x 95	1 x 70	1 x 70	M10	25
DCS 401.0610 *	610	2 x 150	2 x 95	2 x 95	498	2 x 150	2 x 95	2 x 70	1 x 150	1 x 95	1 x 70	M12	50
DCS 401.0740 *	740	2 x 240	2 x 150	2 x 150	604	2 x 185	2 x 120	2 x 95	1 x 185	1 x 120	1 x 95	M12	50
DCS 401.0900 *	900	2 x 240	2 x 185	2 x 185	735	2 x 240	2 x 150	2 x 150	1 x 240	1 x 150	1 x 150	M12	50
DCS 402.0025	25	1 x 2.5	1 x 2.5	1 x 2.5	20	1 x 2.5	1 x 2.5	1 x 1.5	1 x 2.5	1 x 2.5	1 x 1.5	M6	6
DCS 402.0050	50	1 x 10	1 x 6	1 x 6	41	1 x 10	1 x 6	1 x 4	1 x 10	1 x 6	1 x 4	M6	6
DCS 402.0075	75	1 x 16	1 x 10	1 x 16	61	1 x 16	1 x 10	1 x 10	1 x 16	1 x 10	1 x 10	M6	6
DCS 402.0100	100	1 x 25	1 x 16	1 x 25	82	1 x 25	1 x 16	1 x 16	1 x 16	1 x 16	1 x 16	M6	6
DCS 402.0140	140	1 x 50	1 x 35	1 x 35	114	1 x 35	1 x 25	1 x 25	1 x 16	1 x 16	1 x 16	M6	6
DCS 402.0200	200	1 x 70	1 x 50	1 x 70	163	1 x 70	1 x 50	1 x 50	1 x 35	1 x 25	1 x 25	M10	25
DCS 402.0260	260	1 x 120	1 x 70	1 x 95	212	1 x 95	1 x 70	1 x 70	1 x 50	1 x 35	1 x 35	M10	25
DCS 402.0350	350	2 x 70	1 x 120	1 x 120	286	2 x 50	1 x 120	1 x 95	1 x 50	1 x 70	1 x 50	M10	25
DCS 402.0450	450	2 x 95	2 x 70	2 x 70	367	2 x 70	2 x 70	2 x 50	1 x 70	1 x 70	1 x 50	M10	25
DCS 402.0550	550	2 x 120	2 x 95	2 x 95	465	2 x 120	2 x 70	2 x 70	1 x 120	1 x 70	1 x 70	M10	25
DCS 402.0680 *	680	2 x 185	2 x 120	2 x 120	555	2 x 150	2 x 120	2 x 95	1 x 150	1 x 120	1 x 95	M12	50
DCS 402.0820 *	820	2 x 240	2 x 150	2 x 150	669	2 x 240	2 x 150	2 x 120	1 x 240	1 x 150	1 x 120	M12	50
DCS 401.1000 *	1000	2 x 300	2 x 185	2 x 185	816	2 x 240	2 x 150	2 x 150	1 x 240	1 x 150	1 x 150	M12	50

* Busbar connection 5 x 40 mm is recommended

Table 3.2/1: Cross-sectional areas - tightening torques DCS 400

① 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. This can lead to other values than recommended.

Definition of the recommended cables above:

HO7V: DIN-VDE 0281-1; Polyvinyl chloride insulated cables

NSGAFÖU: DIN-VDE 0250-602; Special rubber-insulated single-core cables

N2XY: DIN-VDE 0276-604; Power cable with special fire performance

3.2.2 Cross-sectional areas for UL installations

- The DCS 400 should be installed in an enclosure that is minimum 150% of the dimensions of converter.
- The DCS 400 is suitable for use in a circuit capable of delivering not more than 18 kA rms Symetrical amperes, 500 V AC maximum. Recommended fuses must be used to provide short circuit protection.

Unit type	C1, D1		U1, V1, W1		PE	1 x M...	[Nm]
	IDC [A-]	Wire size [AWG or MCM]	Iv [A~]	Wire size [AWG]	Wire size [AWG]		
DCS 401.0020	20	1 x 10	16	1 x 14	12	M6	6
DCS 401.0045	45	1 x 4	36	1 x 6	10	M6	6
DCS 401.0065	65	1 x 3	52	1 x 4	8	M6	6
DCS 401.0090	90	1 x 1/0	74	1 x 2	8	M6	6
DCS 401.0125	125	1 x 2/0	102	1 x 2/0	6	M6	6
DCS 401.0180	180	1 x 4/0	147	1 x 4/0	6	M10	25
DCS 401.0230	230	1 x 350	188	1 x 300	4	M10	25
DCS 401.0315	315	2 x 3/0	257	2 x 3/0	3	M10	25
DCS 401.0405	405	2 x 250	330	2 x 250	2	M10	25
DCS 401.0500	500	2 x 400	408	2 x 350	2	M10	25
DCS 401.0610	610	Under preparation					
DCS 401.0740	740						
DCS 401.0900	900						
DCS 402.0025	25	1 x 8	20	1 x 12	10	M6	6
DCS 402.0050	50	1 x 4	41	1 x 6	10	M6	6
DCS 402.0075	75	1 x 2	61	1 x 3	10	M6	6
DCS 402.0100	100	1 x 1/0	82	1 x 1	8	M6	6
DCS 402.0140	140	1 x 2/0	114	1 x 2/0	6	M6	6
DCS 402.0200	200	1 x 250	163	1 x 250	6	M10	25
DCS 402.0260	260	2 x 2/0	212	1 x 400	4	M10	25
DCS 402.0350	350	2 x 4/0	286	2 x 4/0	3	M10	25
DCS 402.0450	450	2 x 300	367	2 x 300	2	M10	25
DCS 402.0550	550	2 x 500	465	2 x 400	1	M10	25
DCS 402.0680	680	Under preparation					
DCS 402.0820	820						
DCS 401.1000	1000						

* Busbar connection 5 x 40 mm required

Note: 60°C wire up to 100 A, 75°C wire over 100 A

Note: Use UL listed ring terminals for connections to drives

Table 3.2/2: Cross-sectional areas for UL installations of DCS 400

DCS 400 armature circuit

Converter type	I_{DC} [A]	Power losses P_L [W]			
		Load			
		25%	50%	75%	100%
DCS401.0020 DCS401.0045 DCS401.0065 DCS401.0090 DCS401.0125 DCS401.0180 DCS401.0230 DCS401.0315 DCS401.0405 DCS401.0500 DCS401.0610 DCS401.0740 DCS401.0900	20	10	22	35	49
	45	25	57	95	145
	65	38	80	128	181
	90	48	103	166	236
	125	65	138	220	311
	180	96	210	341	490
	230	116	254	413	594
	315	163	339	526	726
	405	218	444	697	969
	500	236	513	830	1188
	610	312	653	1025	1427
	740	380	799	1259	1758
	900	467	993	1578	2222
DCS402.0025 DCS402.0050 DCS402.0075 DCS402.0100 DCS402.0140 DCS402.0200 DCS402.0260 DCS402.0350 DCS402.0450 DCS402.0550 DCS402.0680 DCS402.0820 DCS402.1000	25	13	28	46	65
	50	28	65	109	162
	75	44	95	152	217
	100	53	116	188	270
	140	73	157	252	357
	200	108	238	389	562
	260	133	293	481	696
	350	182	265	591	818
	450	237	499	785	1096
	550	262	573	933	1342
	680	349	736	1160	1622
	820	423	895	1416	1986
	1000	522	1116	1786	2527

Table 3.3/1: DCS 400 Power losses of armature circuit

Remarks on the table

- The values stated are are maximum values obtained under the most unfavourable conditions.

DCS 400 field supply

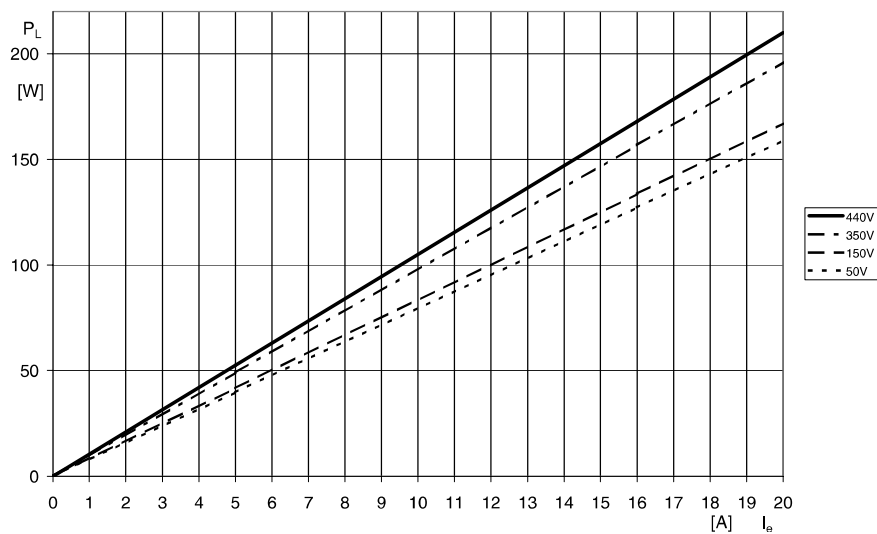


Fig. 3.3/1: DCS 400 Power losses of field supply

3.4 Power section cooling

Technical data

Fan assignment for DCS 400

Converter type	Size	Fan type	Configuration
DCS 40x.0020...DCS 40x.0025	A1	no Fan	-
DCS 40x.0045...DCS 40x.0140	A1	2x CN2B2	1
DCS 40x.0180...DCS 40x.0260	A2	2x CN2B2	1
DCS 40x.0315...DCS 40x.0350	A3	2x CN2B2	1
DCS 40x.0405...DCS 40x.0550	A3	4x CN2B2	2
DCS 40x.0610...DCS 40x.0820	A4	1x W2E200 (230 V)	3
DCS 40x.0610. 2...DCS 40x.0820. 2	A4	1x W2E200 (115 V)	3
DCS 40x.0900...DCS 40x.1000	A4	1x W2E250 (230 V)	3
DCS 40x.0900. 2...DCS 40x.1000. 2	A4	1x W2E250 (115 V)	3

Table 3.4/1: Fan assignment for DCS 400

Fan data for DCS 400 (data per fan)

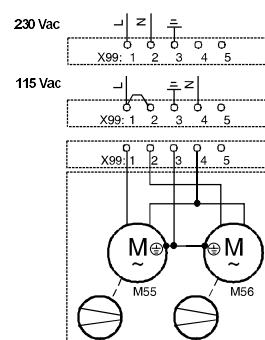
Fan type	CN2B2		W2E200		W2E200		W2E250		W2E250	
Rated voltage [V]	115; 1~		230; 1~		115; 1~		115; 1~		230; 1~	
Tolerance [%]	±10		+6/-10		+6/-10		±10		+6/-10	
Frequency [Hz]	50	60	50	60	50	60	50	60	50	60
Power consumption [W]	16	13	64	80	64	80	120	165	135	185
Current consumption [A]	0.2	0.17	0.29	0.35	0.6	0.7	1.06	1.44	0.59	0.82
Stall current [A]	< 0.3	< 0.26	< 0.7	< 0.8	<1.5	<1.8	<1.8	<1.8	<0.9	<0.9
Air volume, freely blowing [m³/h]	156	180	925	1030	925	1030	1835	1940	1860	1975
Noise level [dBA]	44	48	59	61	59	61	66	67	68	70
Max. ambient temperature [° C]	< 60		< 75		< 75		60		60	
Useful lifetime of fan	appr. 40000 h/60°		appr. 45000 h/60°		appr. 45000 h/60°		appr. 40000 h		appr. 40000 h	
Protection	Stall		Overtemperature							

Table 3.4/2: Fan data for DCS 400

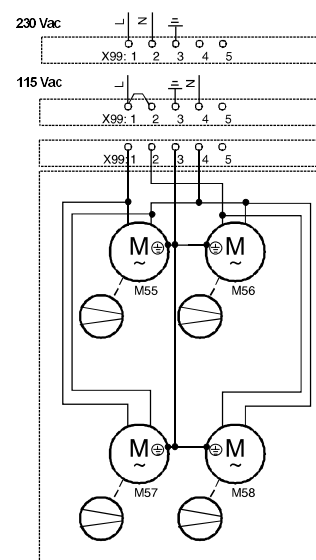
Monitoring the DCS 400 power section

The power sections are monitored by an electrically isolated PTC thermistor detector. First an alarm will be outputted, and - if the temperature continues to rise - an error message. This will switch off the unit in a controlled manner.

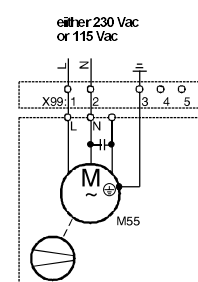
Fan connection for DCS 400



Configuration 1



Configuration 2



Configuration 3

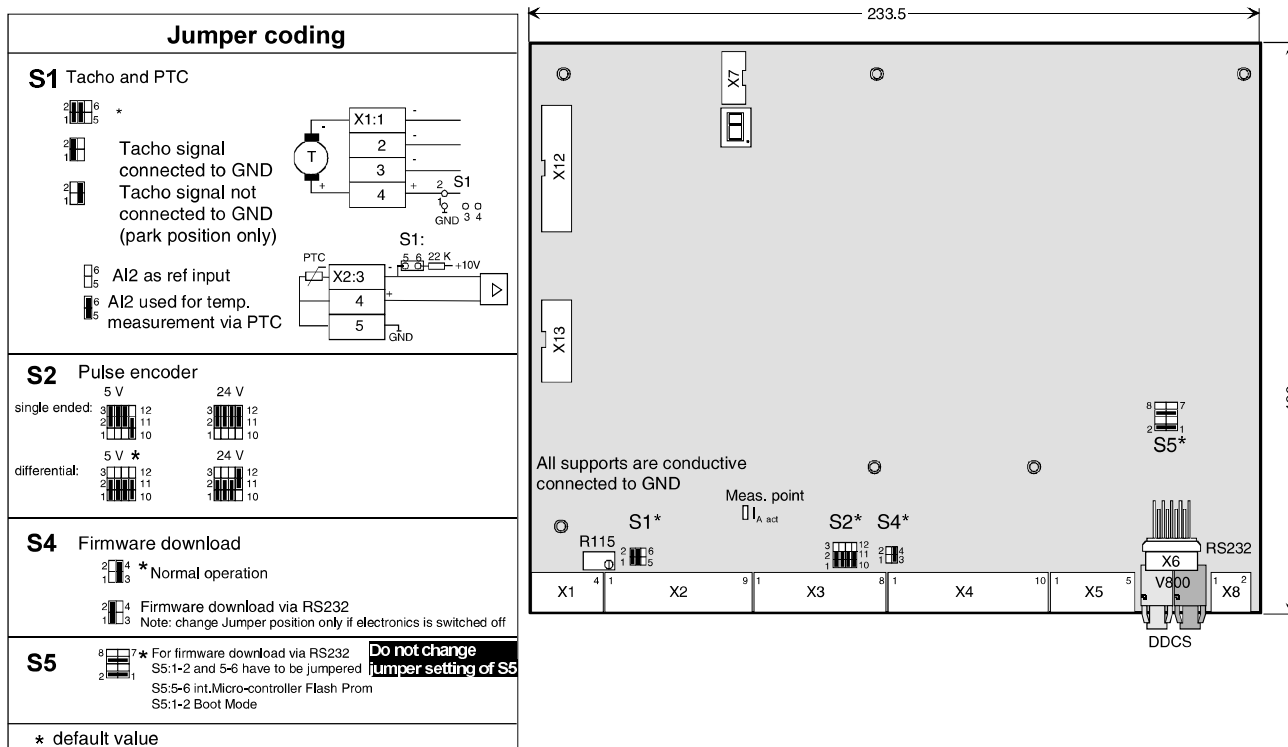


Fig. 3.5/1 Layout of the control board SDCS-CON-3A

Control functions (Watchdog)

The control board has an internal watchdog. The watchdog trip has the following effects:

- Thyristor firing control is reset and disabled.
- Digital outputs are forced to '0 V'.

Supply voltage monitoring

Supply voltage	+5 V	Mains
Undervoltage tripping level	+4.50 V	≤97 VAC

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.

If mains monitor trips, firing pulses are forced to inverter stability limit.

Seven segment display

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

0.7s	0.7s	0.7s	RAM/ROM memory test error
8	8	8	Program is not running
			Normal situation
A	A	A	Alarm
F	F	F	Fault

Fig. 3.5/2 Seven segment display of the SDCS-CON-3A

Serial interfaces

The control board SDCS-CON-3A has three serial communication channels:

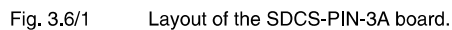
- **X7:** is a serial communication channel which is used for
 - DCS 400 PAN
 - Adapter (3AFE 10035368)
- **X6:** is a standard RS232 serial communication channel. It is a 9-pin D-Sub female connector
- **V800** is an integrated channel and can be used for Fieldbus Adapter by using optical fibre



Unless otherwise stated, all signals are referenced to a 0 V potential. On all PCBs, this potential is firmly connected to the unit's casing by means of plating-through at the fixing points.

Technical data

- power supply for complete converter electronics
- fuses for field supply. Fuse data F100...F102:
Bussmann KTK-15A (600V)



Potential isolated by relay (N.O. contact)
MOV- element (275 V)
Contact rating: **AC:** $\leq 250 \text{ V-} / \leq 3 \text{ A-}$
DC: $\leq 24 \text{ V-} / \leq 3 \text{ A-}$
or $\leq 115/230 \text{ V-} / \leq 0.3 \text{ A-}$

The DCS 400 converter has an build-in three-phase field exciter with the following features:

- smoothed field voltage
 - better commutation of the motor
 - increased brush life
- less heat generation in the motor
- less effort of cabling

Remark:
The DC link capacitor of the IGBT based field exciter serves as an overvoltage protection for the armature converter.

Overloading of the DC link capacitor is prevented by the connected motor field winding.
The energy of glitches caused by the commutation of the armature converter is no longer waste energy but is used by the field exciter.

The overvoltage protection only works if a field winding is connected.

Therefore DCS400 can not be used with disconnected field.

Electrical data of SDCS-FIS-3A

AC input voltage:	230 V...500 V $\pm 10\%$; three-phase
DC output voltage	50...440 V programmable
AC input current:	$\leq$ output current
AC isolation voltage:	600 V
Frequency:	same as DCS converter module
DC output current:	0.1 A...4 A for armature converter modules from 20 A to 25 A 0.1 A...6 A for armature converter mod. from 45 A to 140 A 0.3 A...16 A for armature converter mod. from 180 A to 550 A 0.3 A...20 A for armature converter mod. for ≥ 610 A
Power loss	see chapter 3.3
Terminal X10:1,2	on SDCS-PIN-3A
Cross sectional area	4 mm ²

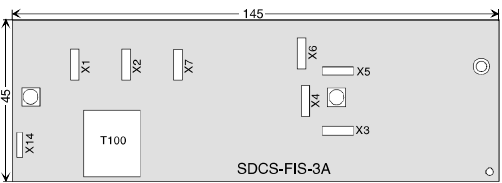


Fig. 3.7/1 Layout of the SDCS-FIS-3A field exciter board

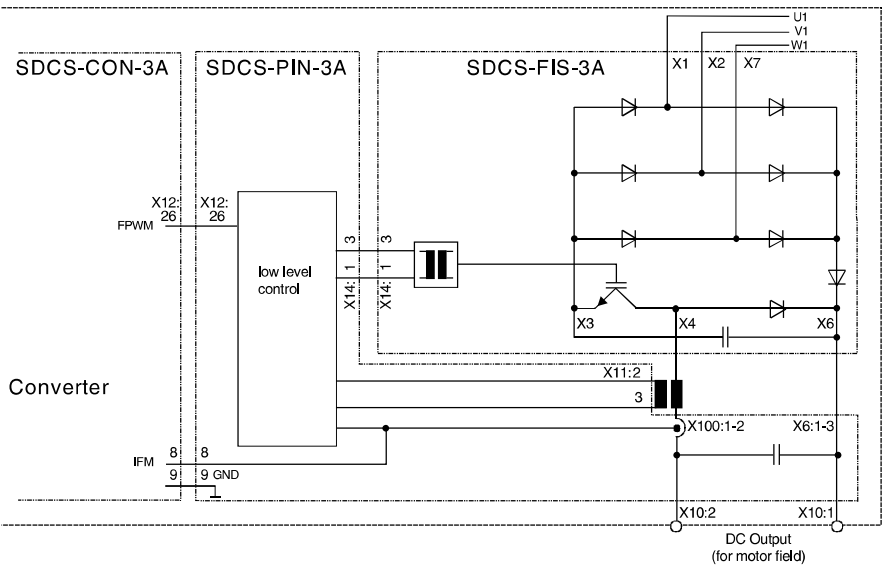


Fig. 3.7/2 Diagram of the field exciter unit

II K 3-10

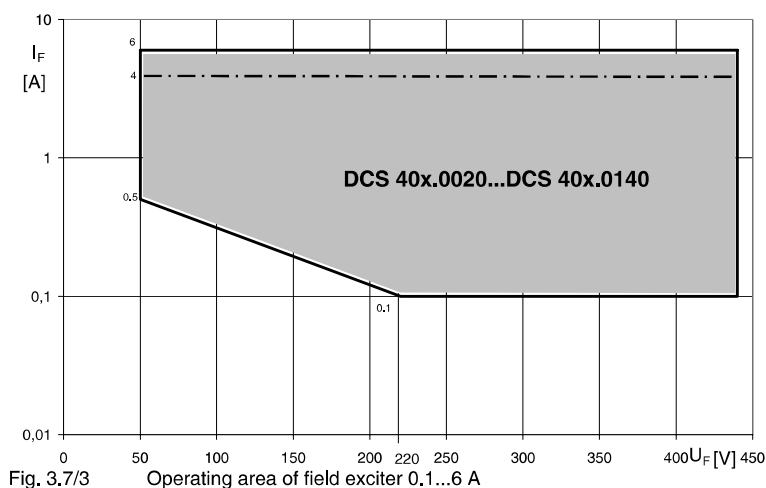


Fig. 3.7/3 Operating area of field exciter 0.1...6 A

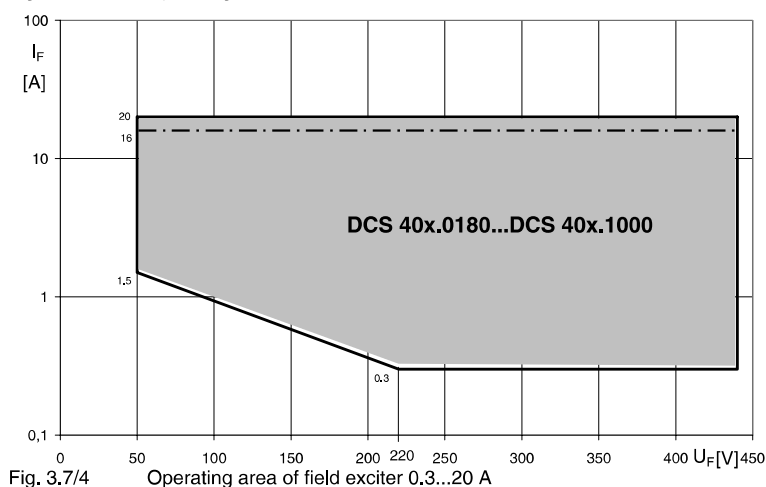


Fig. 3.7/4 Operating area of field exciter 0.3...20 A

Important note:

Nominal field voltage and field current of the motor has to be within the field controller operating range. For application with constant field it is easy to check:

Transfer values of field current and field voltage to the diagram and check that the point of intersection is within the operating range.

System connection	Field voltage range
U_{Line} [V~]	[V~]
230	50...237
380	50...392
400	50...413
415	50...428
440	50...440
460	50...440
480	50...440
500	50...440

Table 3.7/1:
Field voltage range related to specified input voltage

For field weakening application do that check with nominal values and minimal values. Both points of intersection have to be within the operating range.

Example:

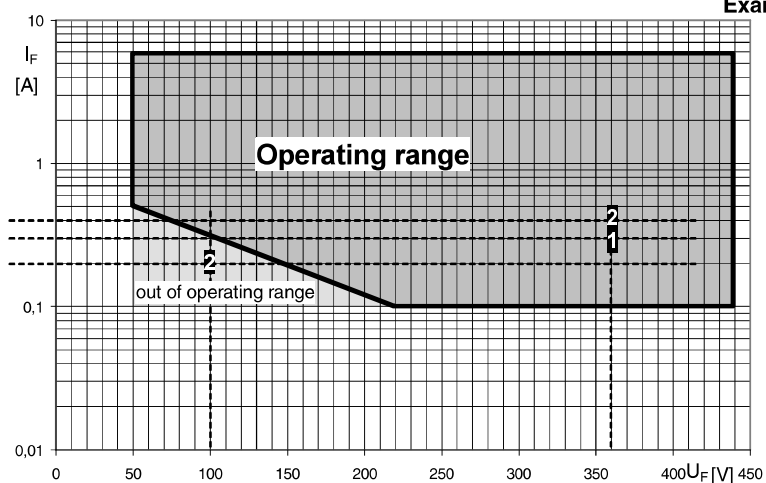


Fig. 3.7/5 Example of Field exciter operating range

- 1 Depend on the converter use the right diagram (6 A or 20 A)
e.g. DCS401.0045
 U_e 310 V / I_e 0.3 A
→ 6A diagram → ok
- 2 Depend on the converter use the right diagram (6 A or 20 A)
e.g. DCS402.0050
 $U_{e_{nom}}$ 310 V / $I_{e_{nom}}$ 0.4 A
→ 6A diagram → ok

 $U_{e_{min}}$ 100 V / $I_{e_{min}}$ 0.2 A
→ 6A diagram → not ok, not to realize !

