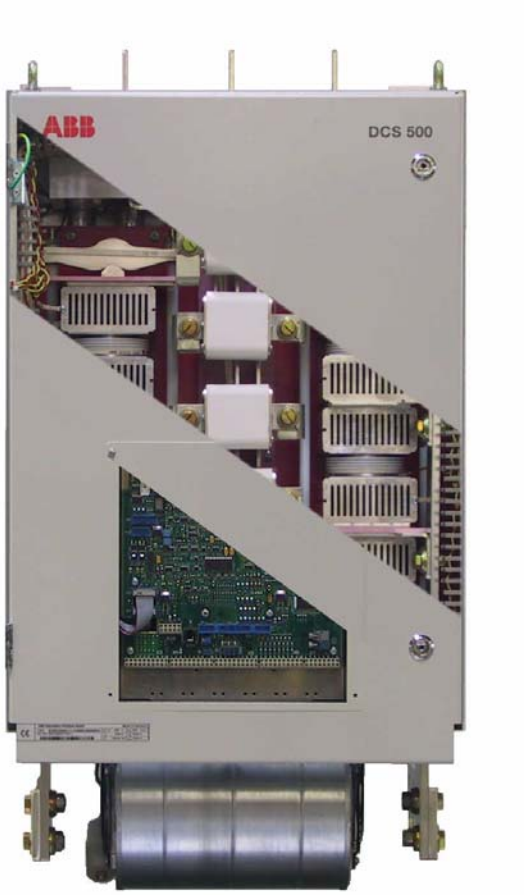
DCS Thyristor Power Converters

for DC drive systems

25 to 5200 A

Technical Data

DCS 400
DCS 500B
DCS 600
DCF 500B
DCF 600



3ADW000165R0201_Technical_Data_e_b

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 transferred.

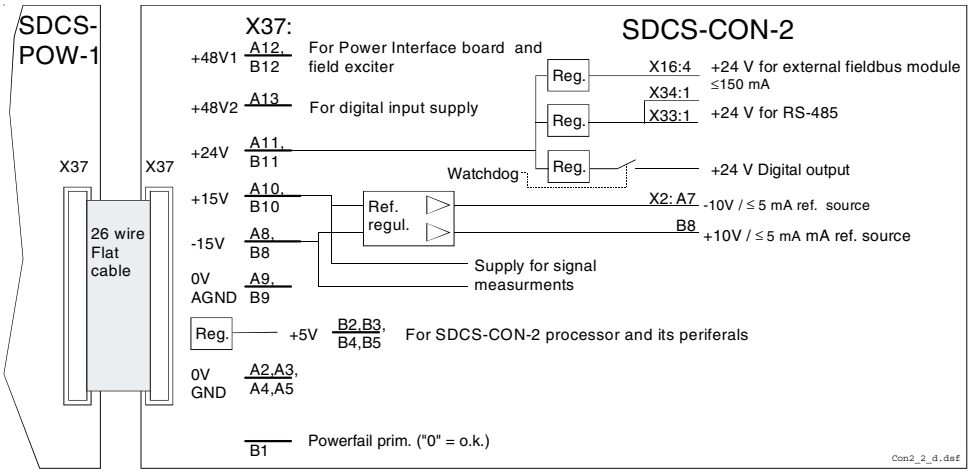


Fig. 3.1/3 Auxiliary power distribution on the board SDCS-CON-2

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 used for field exciter control of DCF 501B/ 502B, DCF 503A/504A 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.

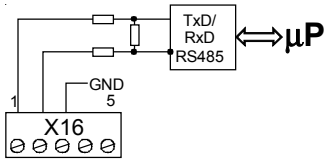


Fig. 3.1/4 Connection for field supply units DCF xxx to the RS485 Communication Interface of the SDCS-CON-2 board.

DDCS Channel integrated
The control board SDCS-CON-2 has an integrated DDCS (**D**igital **D**rive **C**ontrol **S**ystem) channel with a transfer rate up to 4 Mbits/s. This channel (V260) can be used for fieldbus modules with the DCS 500B converters or for the 12_PULE LINK with DCS 600 converters. The terminals X16:4 and 5 are provided for power supply of the modules (+24 V / ≤150 mA).

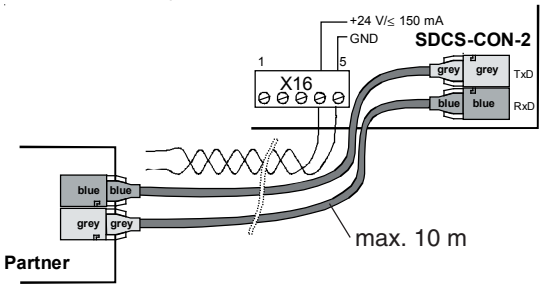
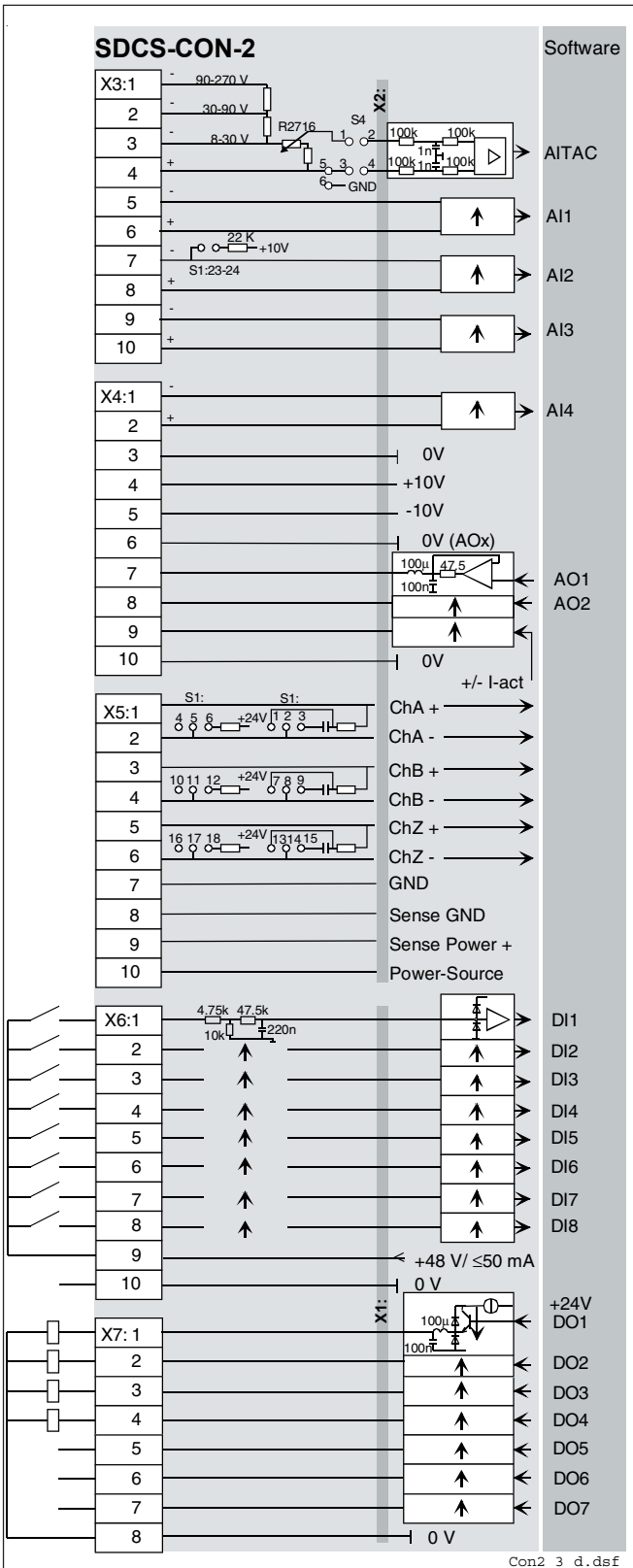


Fig. 3.1/5 Connection of the DDCS channel with power supply to the control board SDCS-CON-2



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.

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 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. frequency ≤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	DO8: see SDCS-POW-1 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. 3.1/6 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 independent 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-2 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-2 (without I/O board SDCS-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.

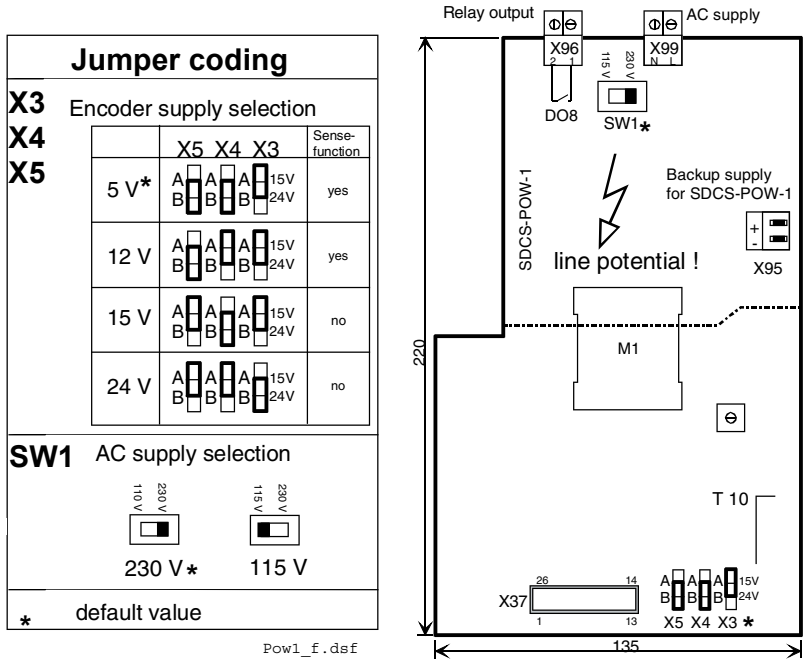


Fig. 4.1/1 Layout of the SDCS-POW-1 board

AC Supply voltage

Supply voltage	115 V AC	230 V AC
Tolerance	-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 (e.g. KJ 2001) to the existing ones to increase the mains buffering time. More detailed data is available on request via your ABB representative.

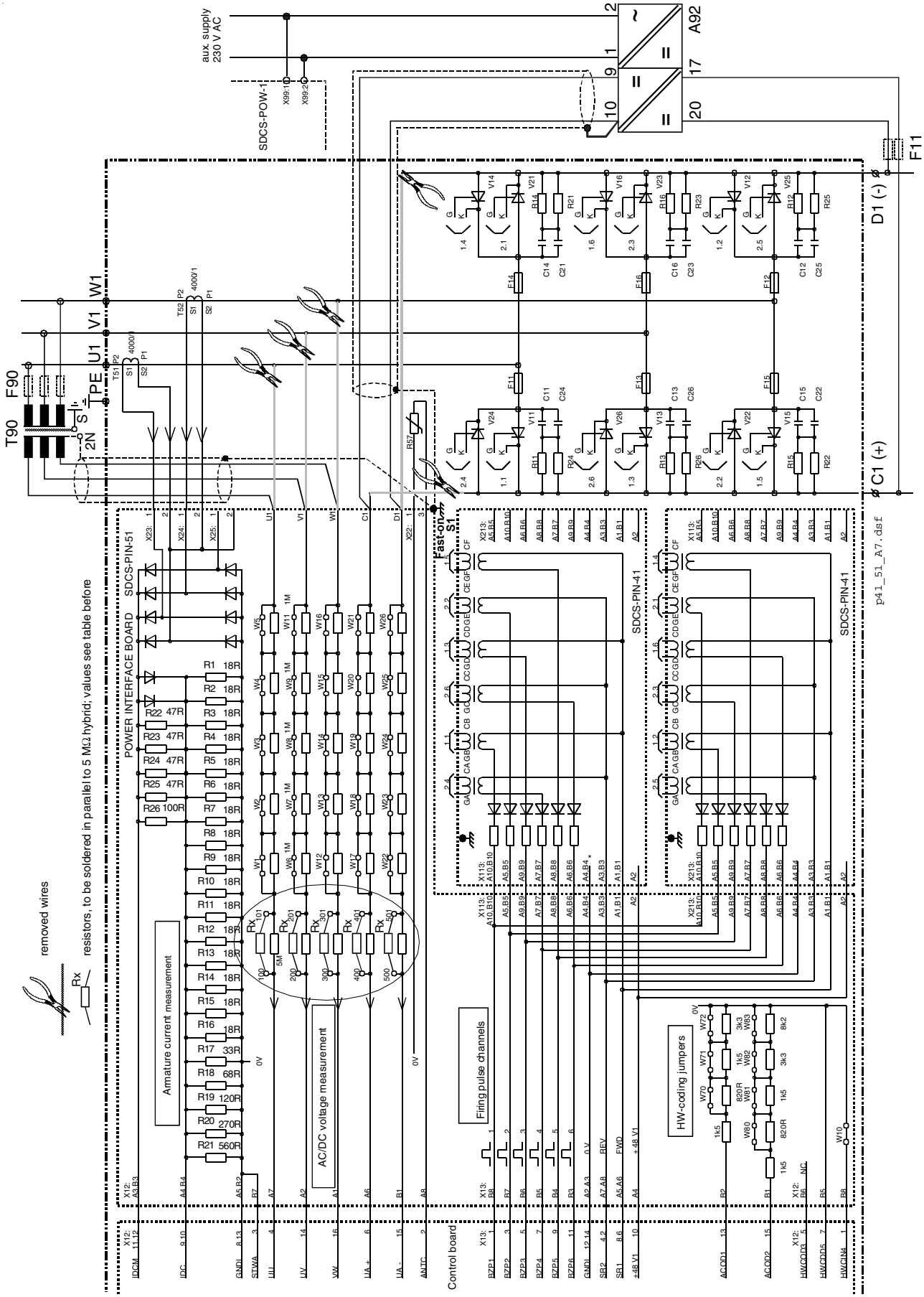


Fig. 5.3/1 Typical armature circuit thyristor converter diagram with SDCS-PIN-41 and SDCS-PIN-51 boards for a 4-Q A7 type converter with galvanic isolation

Connecting a pulse encoder to the DCS 500B / DCS 600 converter

The connection diagram for a pulse encoder to the electronics of a DCS converter is quite similar, if the 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.

If the **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 6.2/4.

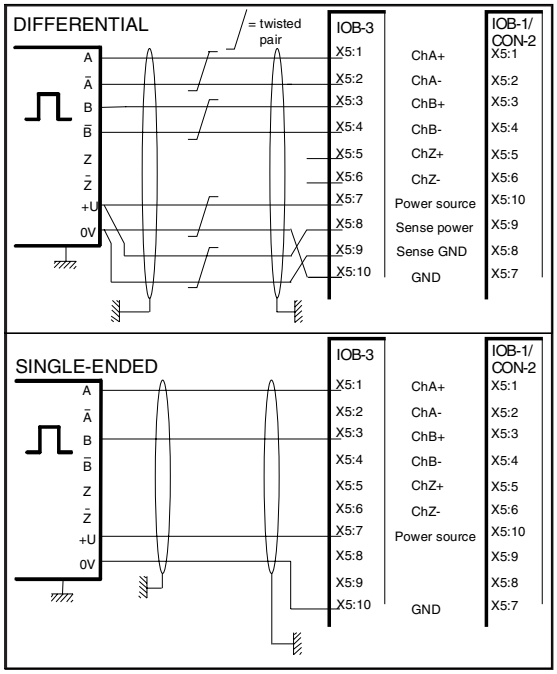


Fig. 6.2/4 Connections incremental encoder - electronics

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.

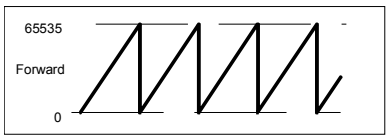


Fig. 6.2/5 TACHO_PULSES signal

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-2A) 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 DCF 50xB/60x are converter modules themselves, similar to the DCS 501B/601 or DCS 502B/602 additionally a overvoltage protection unit is needed see chapter 8.4.

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-2 by using terminal X14.

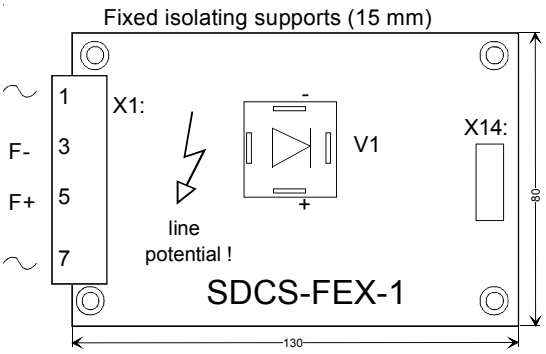


Fig. 8.1/1 Layout of the SDCS-FEX-1 field exciter board

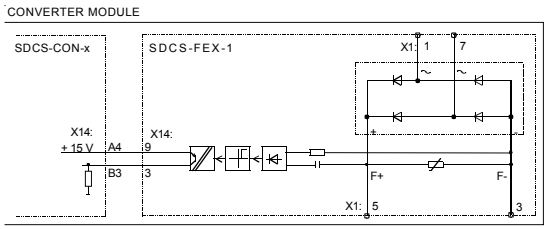


Fig. 8.1/2 Diode field exciter with field loss monitoring

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).

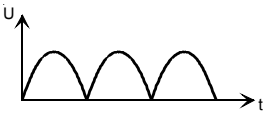


Fig. 8.1/3 Output voltage with inductive or resistive load - **High-signal at X14:B3**

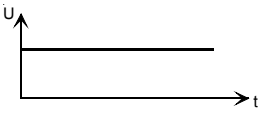


Fig. 8.1/4 Output voltage without load
Low-signal at X14:B3

8.2 SDCS-FEX-2 / SDCS-FEX-2A (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 A5, not for A6 and A7 (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-2 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.

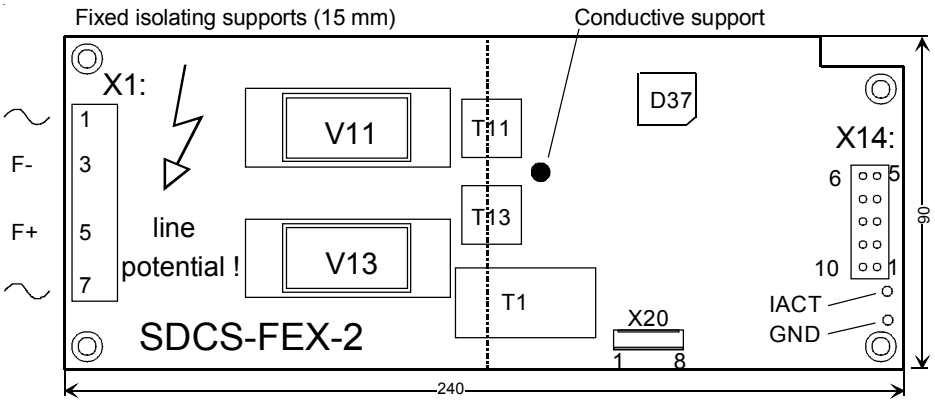


Fig. 8.2/1 Layout of the SDCS-FEX-2A field exciter board

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