DCS thyristor power converter

for DC drive systems
20 to 820 A
9 to 429 kW

Manual

DCS 400

List of contents

MANUAL

1 DCS 400 - the compact-size DC drive

DCS 400 is a new generation of DC drives, which is rated from 10 to 430 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
- 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 memory
Motor monitoring
- Speed feedback error
- Overtemperature (PTC evaluation)
- Overload ($I^2 t$)
- Overspeed
- Stalled motor
- Armature-circuit overcurrent
- Armature-circuit ripples
- Armature-circuit overvoltage
- Minimum field current
- Field overcurrent

Power converter protection
- Overtemperature
- Watchdog function
- Mains voltage interruption

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, NT):
- Parameter programming
- Fault detection
- Feedback display and analysis
- Fault logger

DCS-400-PAN
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

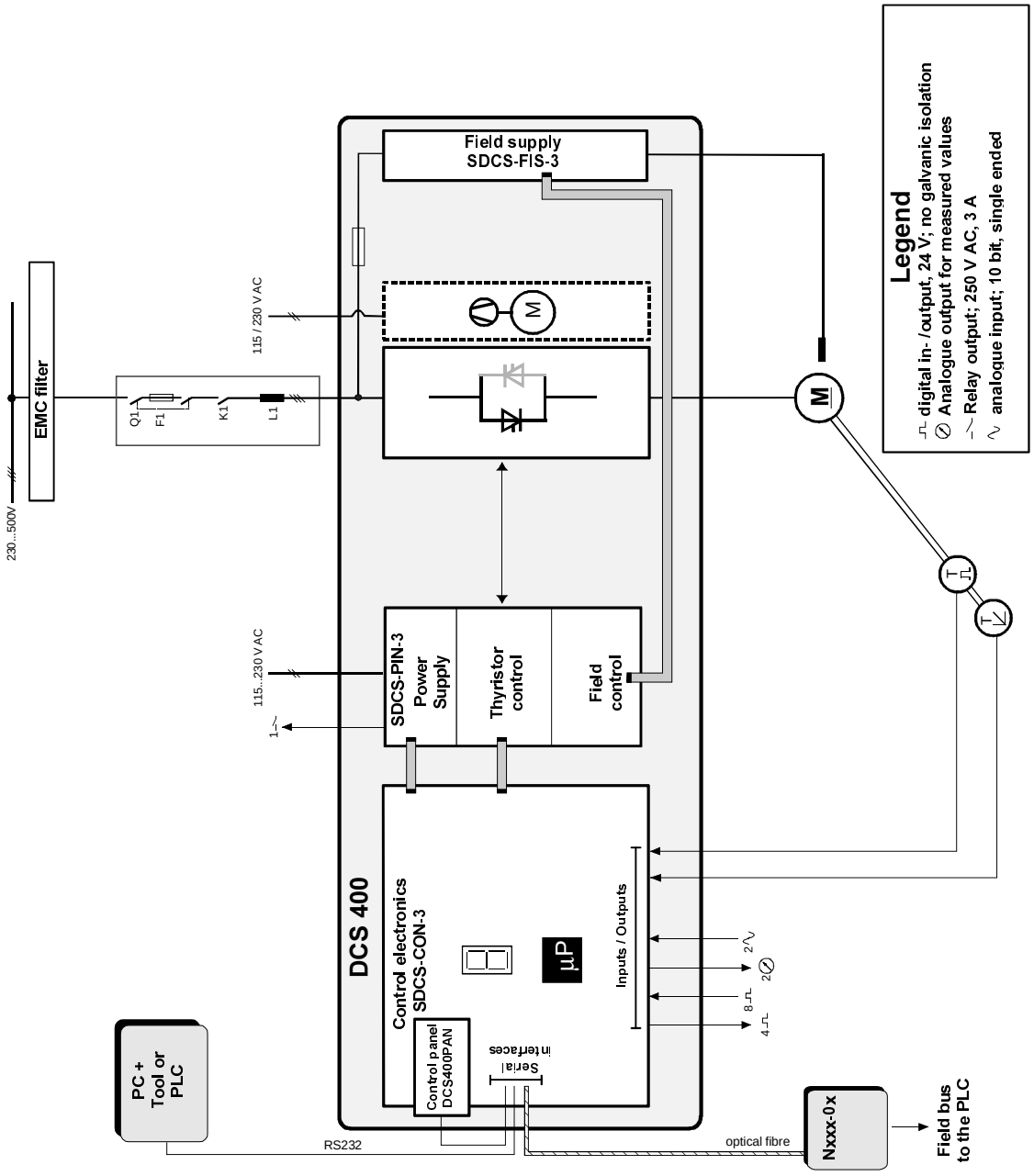


Fig. 2/1: System overview of DCS 400

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: (1 m distance)	Size	as module
	A1	55 dBA
	A2	55 dBA
	A3	60 dBA
	A4	68 dBA

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

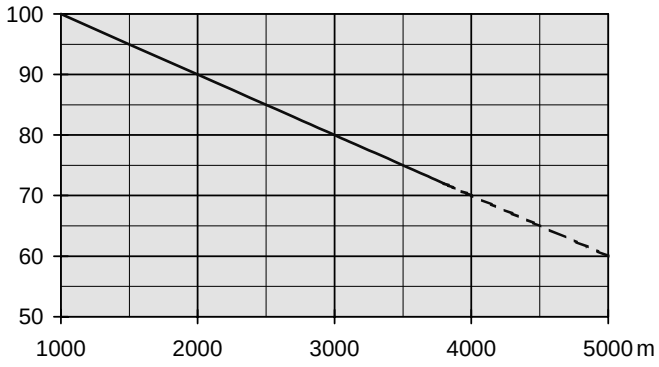


Fig. 2.1/1: Effect of the site elevation above sea level on the power converter's load capacity

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

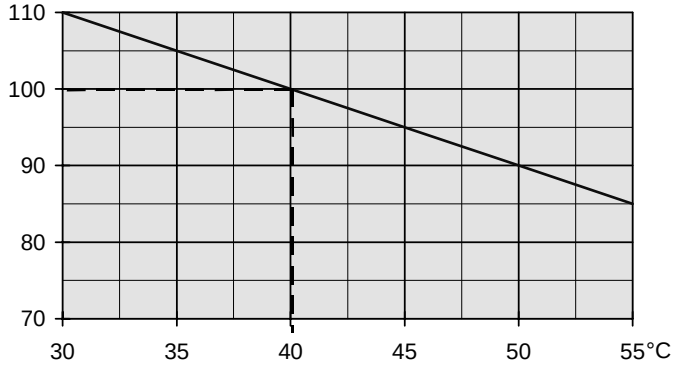


Fig. 2.1/2: Effect of the ambient temperature on the converter module load capacity.

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 ① [IEC 1800-3] where limits are under consideration EN 50081-2 / EN 50082-2 has been supplied ① 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/butom/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...820 A	580x270x345	38	250x150x10	① 230 V/1 ph	external

① Fan with 115 V/1 ph available as option

Table 2.2/1: Sizes of DCS 400

Unit table

DCS 401 2-quadrant converter

Converter type	I_{DC} [A]	I_{AC} [A]	I_F [A]	Line voltage 400 V P [kW]	Line voltage 500 V P [kW]	Size
DCS401.0020	20	16	6	9	12	A1
DCS401.0045	45	36	6	21	26	A1
DCS401.0065	65	52	6	31	39	A1
DCS401.0090	90	74	6	41	52	A1
DCS401.0125	125	102	6	58	73	A1
DCS401.0180	180	147	12	84	104	A2
DCS401.0230	230	188	12	107	133	A2
DCS401.0315	315	257	14	146	183	A3
DCS401.0405	405	330	14	188	235	A3
DCS401.0500	500	408	14	232	290	A3
DCS401.0610	610	498	16	284	354	A4
DCS401.0740	740	604	16	344	429	A4

Table 2.2/2: DCS 401 unit table

DCS 402 4-quadrant converter

Converter type	I_{DC} [A]	I_{AC} [A]	I_F [A]	Line voltage 400 V P [kW]	Line voltage 500 V P [kW]
DCS402.0025	25	20	6	10	13
DCS402.0050	50	41	6	21	26
DCS402.0075	75	61	6	31	39
DCS402.0100	100	82	6	41	52
DCS402.0140	140	114	6	58	73
DCS402.0200	200	163	12	83	104
DCS402.0260	260	212	12	108	135
DCS402.0350	350	286	14	145	182
DCS402.0450	450	367	14	187	234
DCS402.0550	550	448	14	232	290
DCS402.0680	680	555	16	282	354
DCS402.0820	820	669	16	340	426

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 ±10 %

System connection voltage U_v	DC voltage (max. Motor voltage) U_d 2Q ①	4Q	Ideal DC voltage without load U_{di0}
230	270	240	310
380	460	400	510
400	470	420	540
415	490	430	560
440	520	460	590
460	540	480	620
480	570	500	640
500	600	520	670

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

Table 2.2/4: Recommendet 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

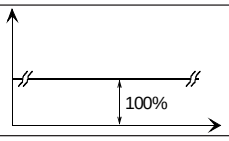
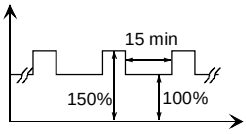
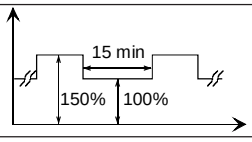
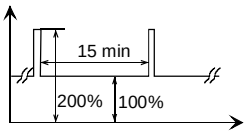
Operating cycle	Load for converter	Typical applications	Load cycle
DC I	$I_{DC\ I}$ continuous (I_{dN})	pumps, fans	
DC II	$I_{DC\ II}$ for 15 min and 1,5 * $I_{DC\ II}$ for 60 s	extruders, conveyor belts	
DC III	$I_{DC\ III}$ for 15 min and 1,5 * $I_{DC\ III}$ for 120 s	extruders, conveyor belts	
DC 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	
$I_{DC\ I}$	$I_{DC\ II}$		$I_{DC\ III}$		$I_{DC\ IV}$	
continuous [A]	100 % 15 min [A]	150 % 60 s	100 % 15 min [A]	150 % 120 s	100 % 15 min [A]	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
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

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
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

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

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.

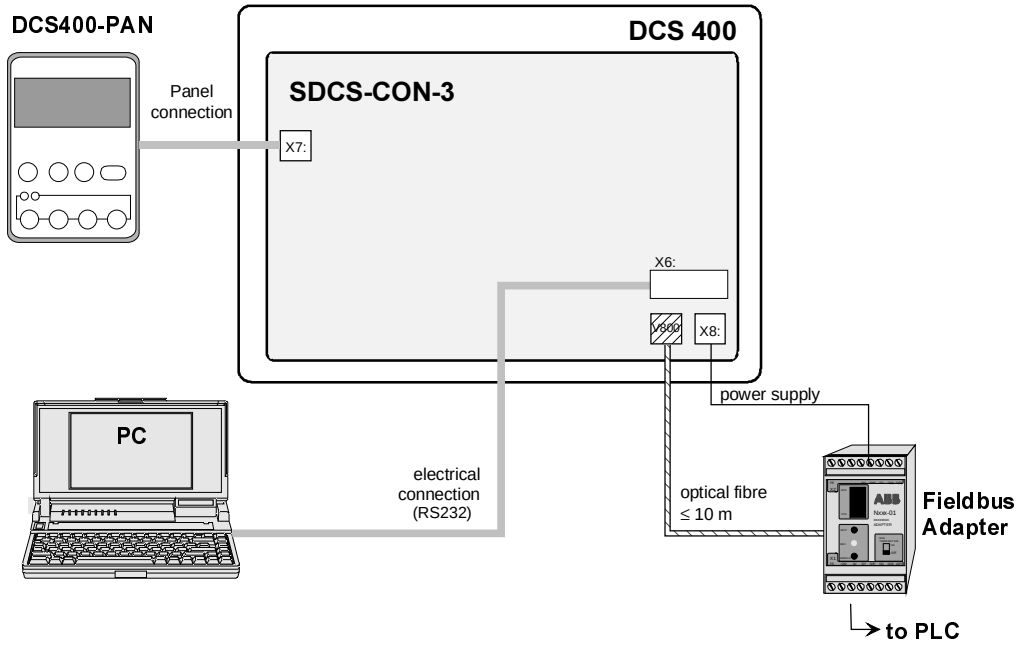
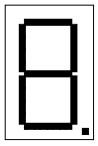


Fig. 2.4/1: Possibilities of operation

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

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 1MB 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 and erase 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.

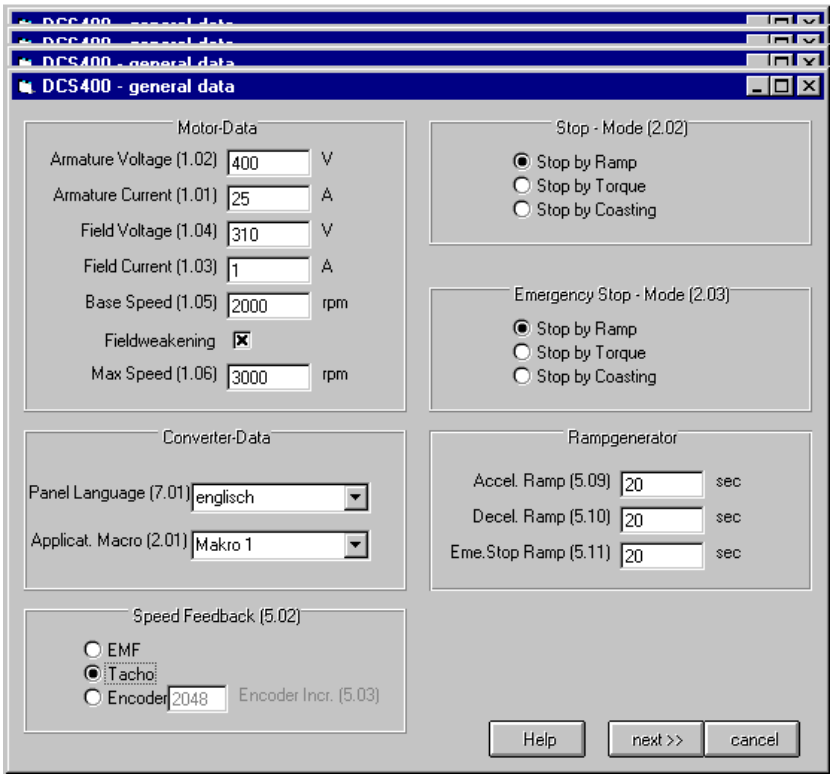


Fig. 2.4/2: Example for a Start-up wizard display

3 Technical Data

3.1 Module dimensions

Module A1
- **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**

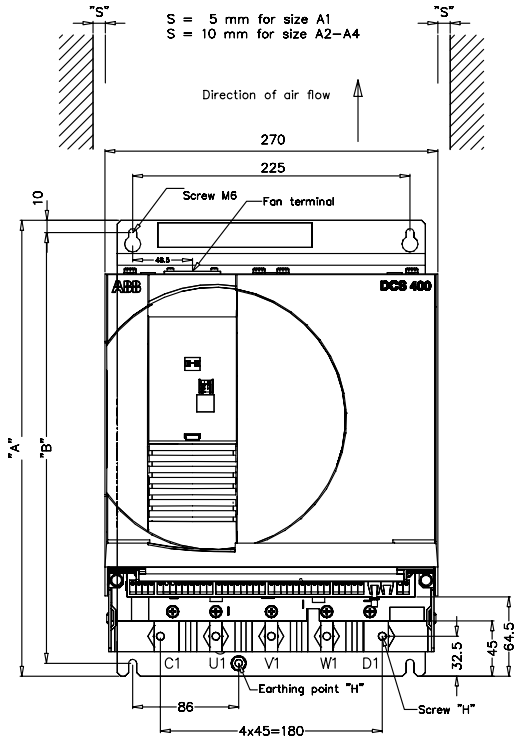
Module A2
- **DCS 401.0180**
- **DCS 401.0230**

- **DCS 402.0200**
- **DCS 402.0260**

Module A3
- **DCS 401.0315**
- **DCS 401.0405**
- **DCS 401.0500**

- **DCS 402.0310**
- **DCS 402.0450**
- **DCS 402.0550**

Dimensions in mm



Size	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	Weight
A1	370	350	142	200	67	98	145	M6	ca. 11kg
A2	370	350	209	267	121,5	163,5	212	M10	ca. 16kg
A3	459	437,5	262,5	310	147,5	205	252	M10	ca. 25kg

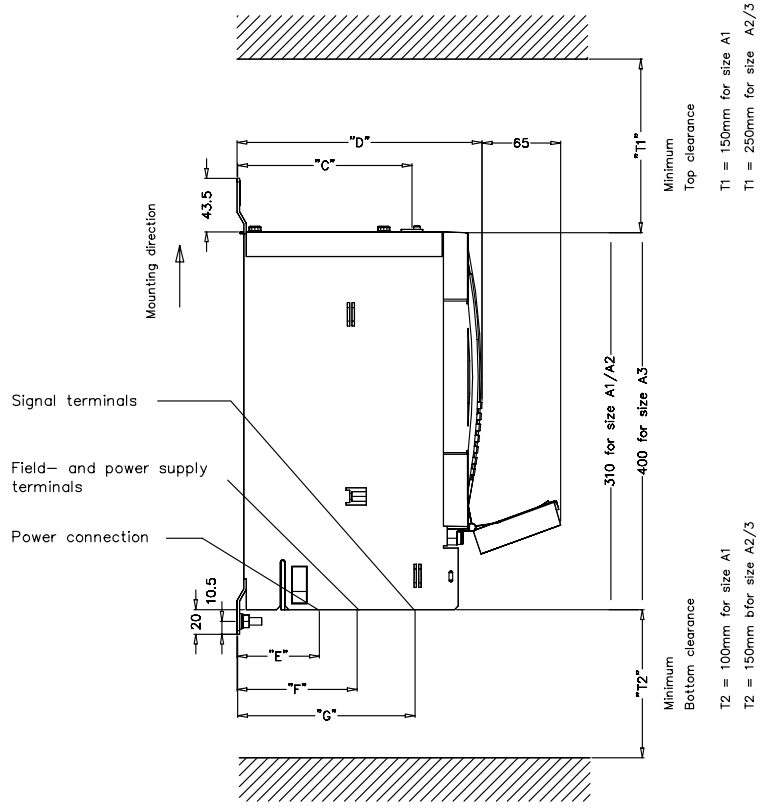


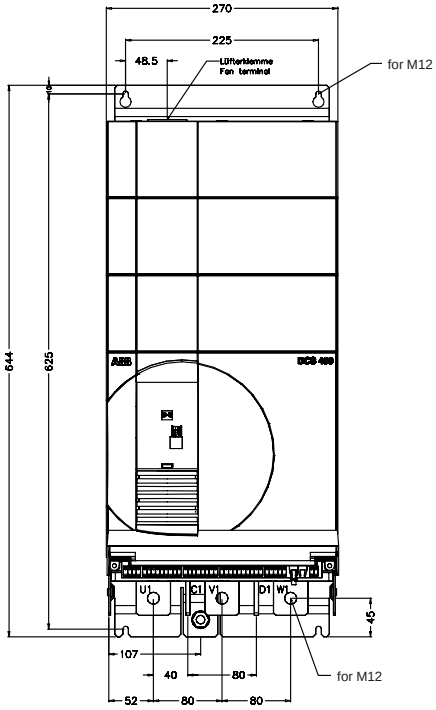
Fig. 3.1/1: Dimension drawing A1, A2, A3-Module

Module A4

DCS 401.0610
DCS 401.0740

DCS 402.0680
DCS 402.0820

Dimensions in mm



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

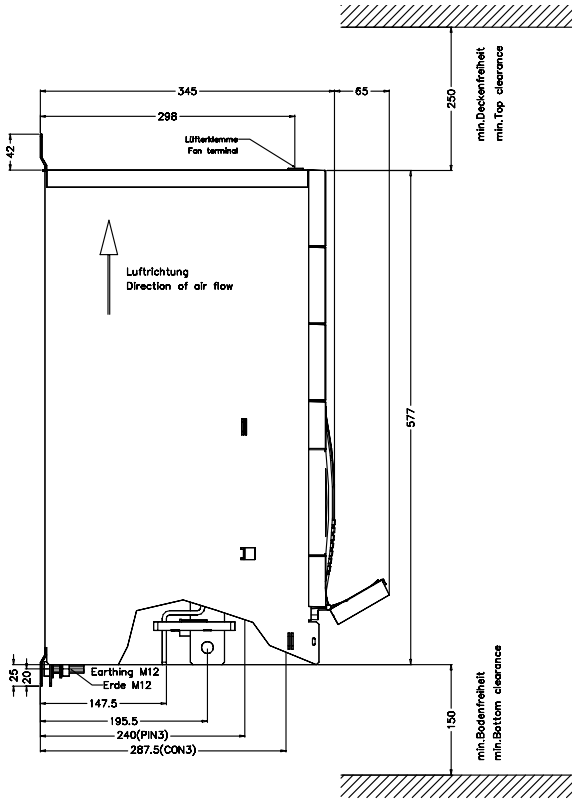


Fig. 3.1/2: Dimension drawing A4-Module

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]	1 x M..	[Nm]
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 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

* Busbar connection 5 x 40 mm is recommended

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

❶ 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 that recommended.

Definition of the recommended cables above:
H07V: 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

DCS 400 armature circuit

Converter type		I_{DC} [A]	Power losses P_L [W] Load 25%	50%	75%	100%
DCS401.0020	2-Quadrant	20	10	22	35	49
DCS401.0045		45	25	57	95	145
DCS401.0065		65	38	80	128	181
DCS401.0090		90	48	103	166	236
DCS401.0125		125	65	138	220	311
DCS401.0180		180	96	210	341	490
DCS401.0230		230	116	254	413	594
DCS401.0315		315	163	339	526	726
DCS401.0405		405	218	444	697	969
DCS401.0500		500	236	513	830	1188
DCS401.0610		610	312	653	1025	1427
DCS401.0740		740	380	799	1259	1758
DCS402.0025	4-Quadrant	25	13	28	46	65
DCS402.0050		50	28	65	109	162
DCS402.0075		75	44	95	152	217
DCS402.0100		100	53	116	188	270
DCS402.0140		140	73	157	252	357
DCS402.0200		200	108	238	389	562
DCS402.0260		260	133	293	481	696
DCS402.0350		350	182	265	591	818
DCS402.0450		450	237	499	785	1096
DCS402.0550		550	262	573	933	1342
DCS402.0680		680	349	736	1160	1622
DCS402.0820		820	423	895	1416	1986

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

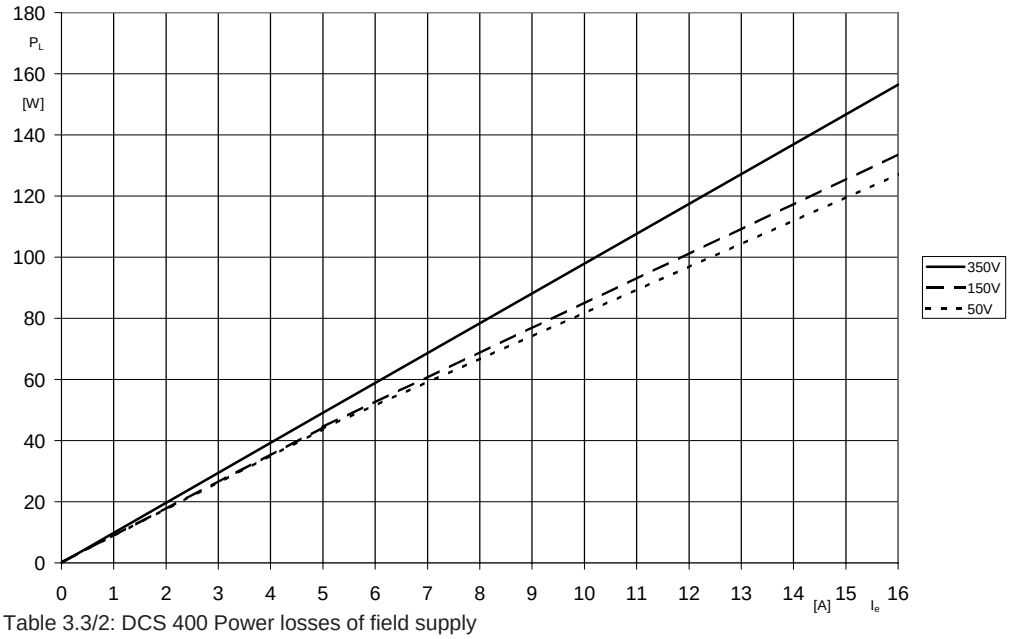


Table 3.3/2: DCS 400 Power losses of field supply

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.0570	A3	4x CN2B2	2
DCS 40x.0610...DCS 40x.0820	A4	1x W2E200 (230 V)	3
DCS 40x.0610. 2...DCS 40x.082. 2	A4	1x W2E200 (115 V)	3

Table 3.4/1: Fan assignment for DCS 400

Fan data for DCS 400 (data per fan)

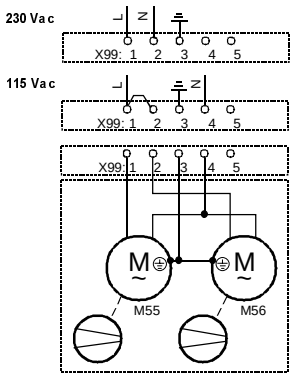
Fan type	CN2B2		W2E200		W2E200	
Rated voltage [V]	115; 1~		230; 1~		115; 1~	
Tolerance [%]	±10		+6/-10		+6/-10	
Frequency [Hz]	50	60	50	60	50	60
Power consuption [W]	16	13	64	80	64	80
Current consumption [A]	0.2	0.17	0.29	0.35	0.6	0.7
Stall current [A]	< 0.3	< 0.26	< 0.7	< 0.8	<1.5	<1.8
Air volume, freely blowing [m³/h]	156	180	925	1030	925	1030
Working point [m³/h] at A	-		-		-	
Max. ambient temperature [° C]	< 60		< 75		< 75	
Useful lifetime of fan	appr. 40000 h/60°		appr. 45000 h/60°		appr. 45000 h/60°	
Protection	Stall		Overtemperature			

Table 3.4/2: Fan data for DCS 400

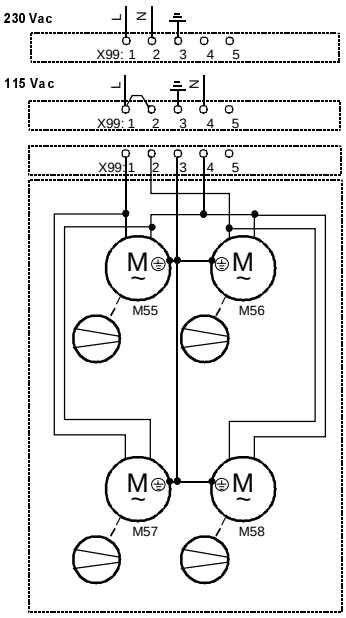
Monitoring the DCS 400 power section

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.

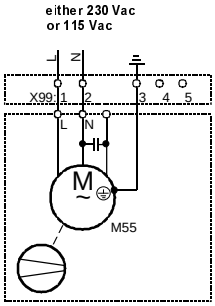
Fan connection for DCS 400



Configuration 1



Configuration 2



Configuration 3

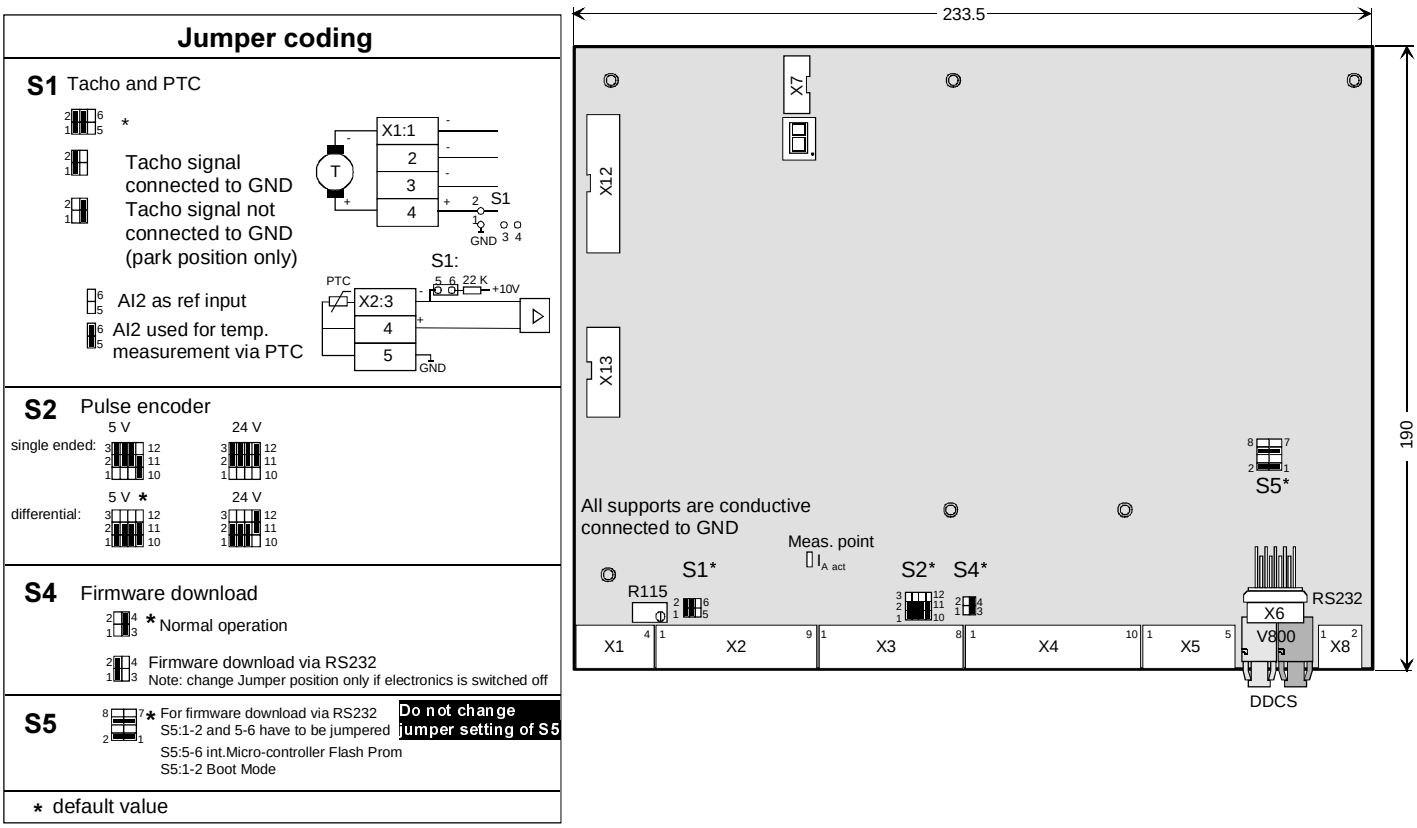


Fig. 3.5/1 Layout of the control board SDCS-CON-3

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.

Serial interfaces
The control board SDCS-CON-3 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

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

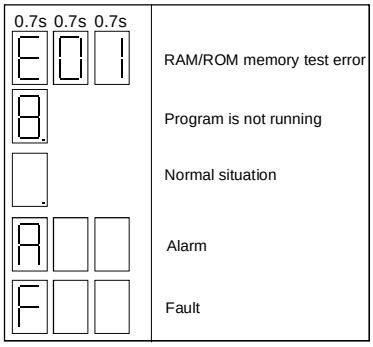
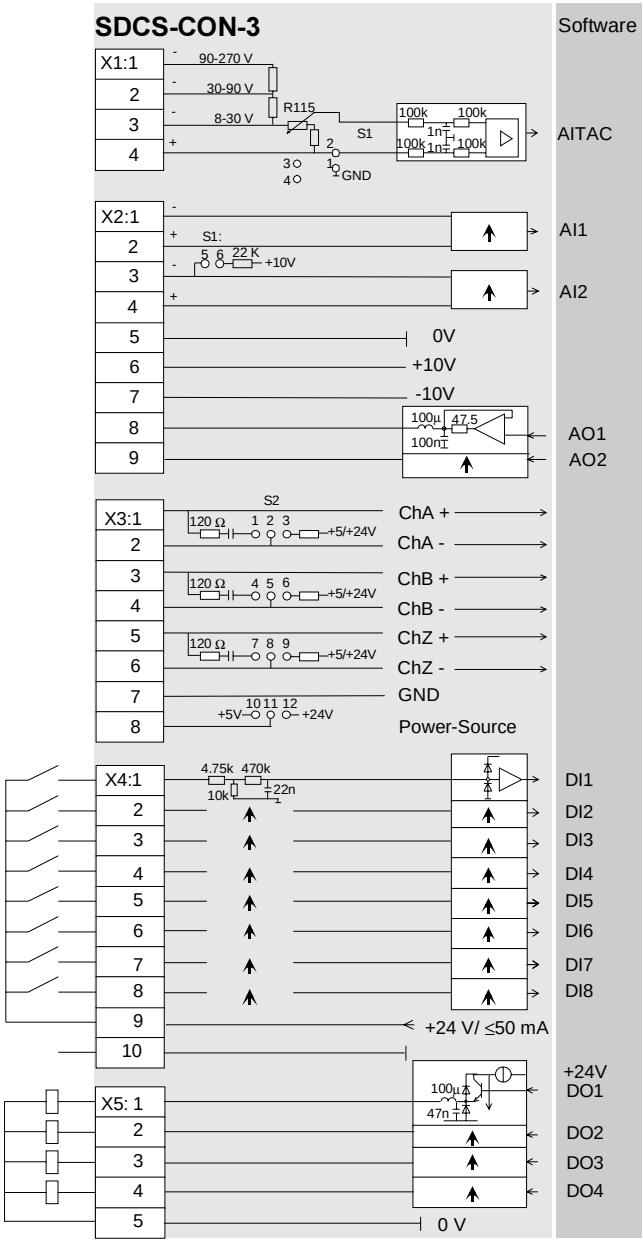


Fig. 3.5/2 Seven segment display of the SDCS-CON-3



Reso-lution [bit]	Input/output values Hardware	Scaling by	Load	Common mode range	Remarks
9 + sign	±90...270 V ±30...90 V ±8...30 V	R 115/ Software		±20 V	① ②
9 + sign	-10...0...+10 V	Software		±20 V	① ②
9 + sign	-10...0...+10 V	Software		±40 V	① ②
			≤10* mA ≤10* mA		for external use e.g. reference pot.
7 + sign 7 + sign	-10...0...+10 V -10...0...+10 V	Software Software	≤5 * mA ≤5 * mA		

Encoder supply		Remarks
		Inputs not isolated max. frequency ≤300 kHz
5V/ 24V	≤ 200 mA*	Selectable with jumper S2: 10-12

Input value	Signal definition by	Remarks
0...+5 V +15...+30 V	Software	≙ "0" status ≙ "1" status

Output value	Signal definition by	Remarks
50 * mA	Software	Current limit for all 4 outputs = 160 mA

The terminal connectors X1: ... X5: are removable. They cannot be interchanged

① total smoothing time ≤2 ms
② -20...0...+20 mA by external 500 Ω resistor

* short circuit proof

Fig. 3.5/3 Terminal connection of the SDCS-CON-3 board

Note
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.

The power interface board SDCS-PIN-3 is used for all converter modules model A1...A4.

Functions:
- firing pulse circuits
- measurement of the armature current
- snubber circuit
- AC and DC voltage measurement
- heat sink temperature measurement
- power supply for complete converter electronics
- fuses for overvoltage protection and field supply. Fuse data F100...F102:
  Bussmann KTK-R-10A (600V)

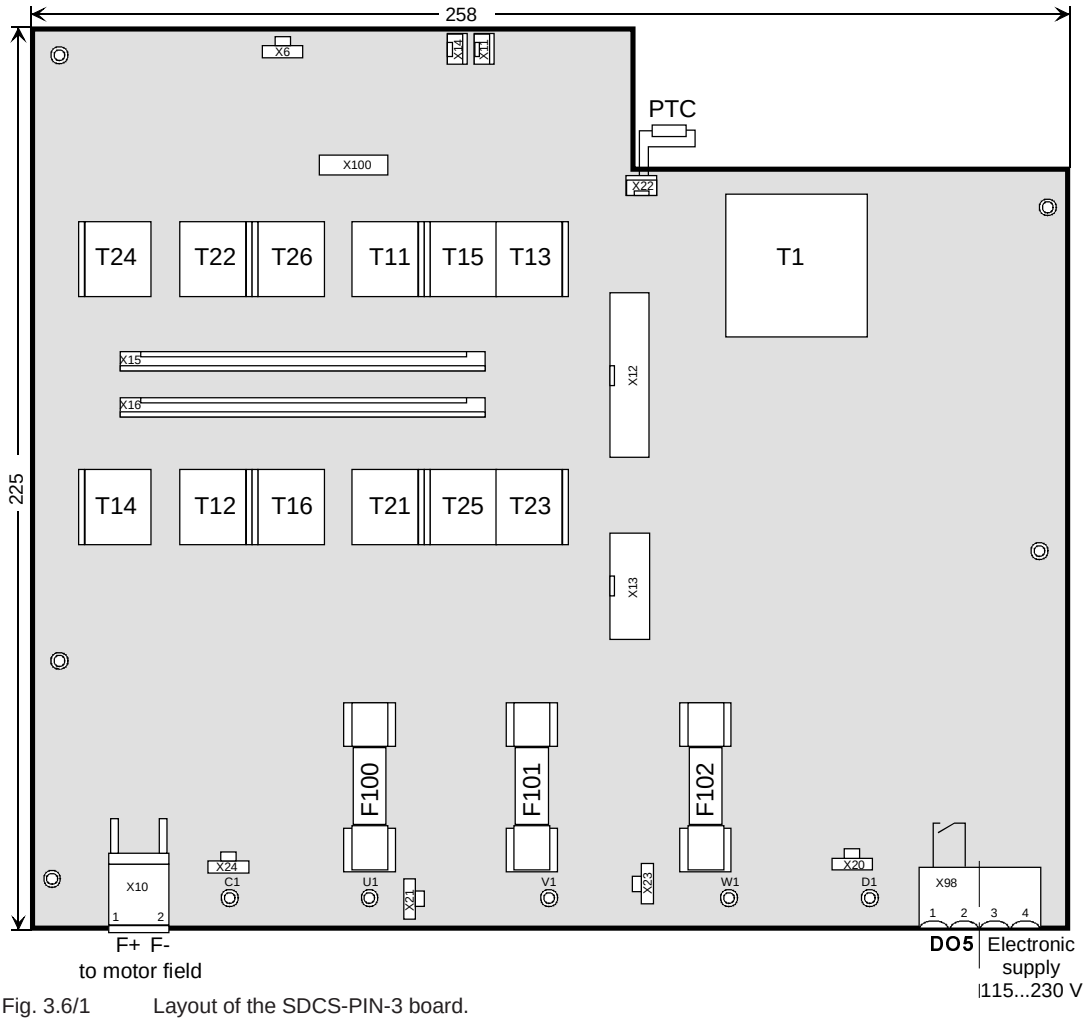


Fig. 3.6/1 Layout of the SDCS-PIN-3 board.

AC Supply voltage (X98:3-4)

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

Output X98:1-2 (DO5)

Potential isolated by relay (N.O. contact)
MOV- element (275 V)
Contact rating: **AC**: ≤250 V~/ ≤3 A~
DC: ≤24 V-/ ≤3 A-
or ≤115/230 V-/ ≤0.3 A-)

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

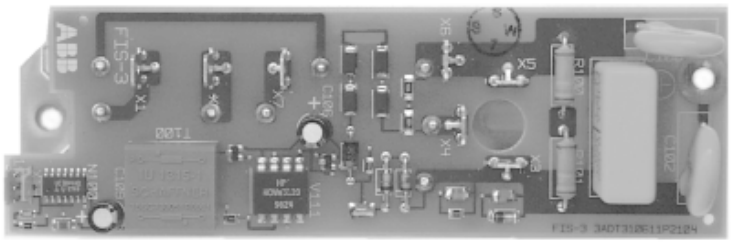
- smoothed field voltage
  - better commutation of the motor
  - increased brush life
- less heat generation in the motor
- less effort of cabling

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.

Only with a connected field winding the overvoltage protection is working.

Therefore DCS400 can not be used with disconnected field.



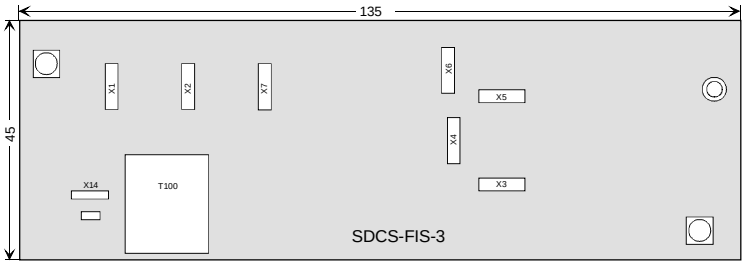


Fig. 3.7/1 Layout of the SDCS-FIS-3 field exciter board

Electrical data of SDCS-FIS-3

AC input voltage:	230 V...500 V ±10%; three-phase
DC output voltage	50...350 V programmable
AC input current:	≤ output current
AC isolation voltage:	600 V
Frequency:	same as DCS converter module
DC output current:	0.1 A...6 A for armature converter modules from 20 A to 140 A 0.3 A...12 A for armature converter mod. from 180 A to 260 A 0.3 A...14 A for armature converter mod. from 315 A to 550 A 0.3 A...16 A for armature converter mod. for ≥ 610 A
Power loss at $I_{F\ rated}$:	≤40 W
Terminal X10:1,2 Cross sectional area	on SDCS-PIN-3 4 mm²

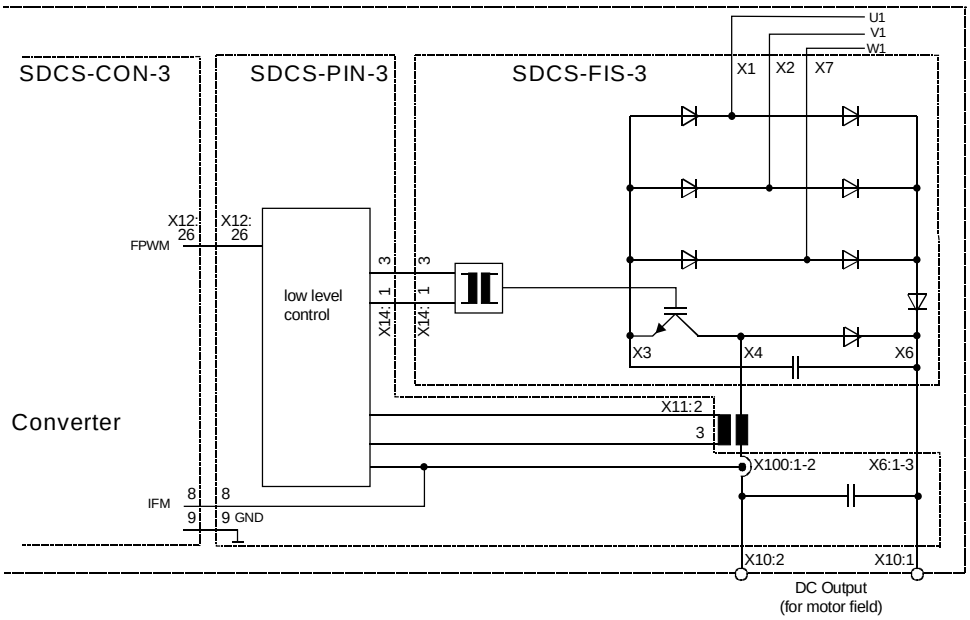


Fig. 3.7/2 Diagram of the field exciter unit

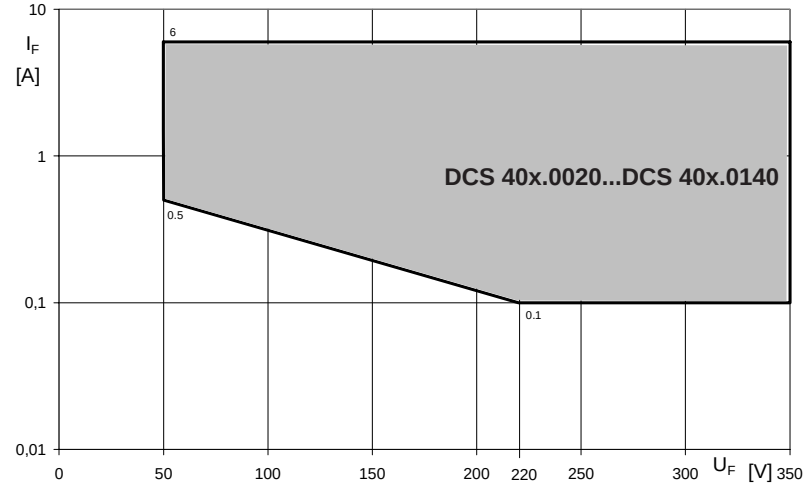


Fig. 3.7/3 Operating area of field exciter 0.1...6 A

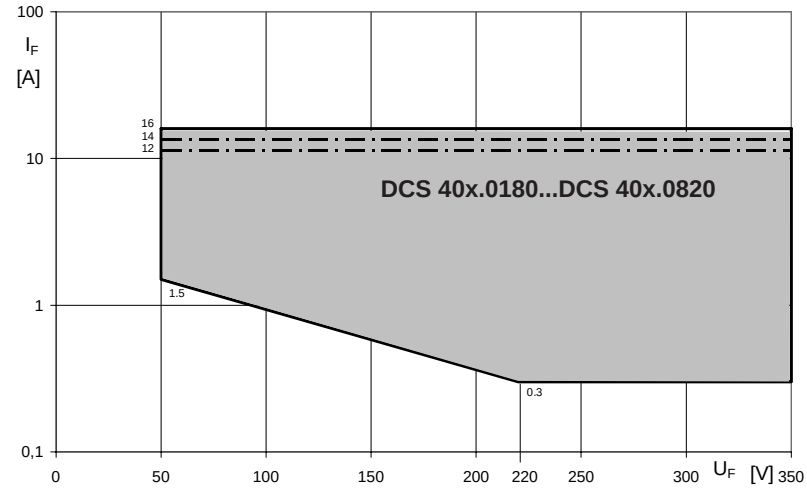


Fig. 3.7/4 Operating area of field exciter 0.3...16 A

System connection U_{Line} [V~]	Field voltage range [V-]	recommended rated field voltage U_{field} [V-]
230	50...237	190
380	50...350	310
400	50...350	310
415	50...350	310
440	50...350	310
460	50...350	310
480	50...350	310
500	50...350	310

Table 3.7/1: Recommendet rated field voltage related to specified input voltage

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.

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

Example:

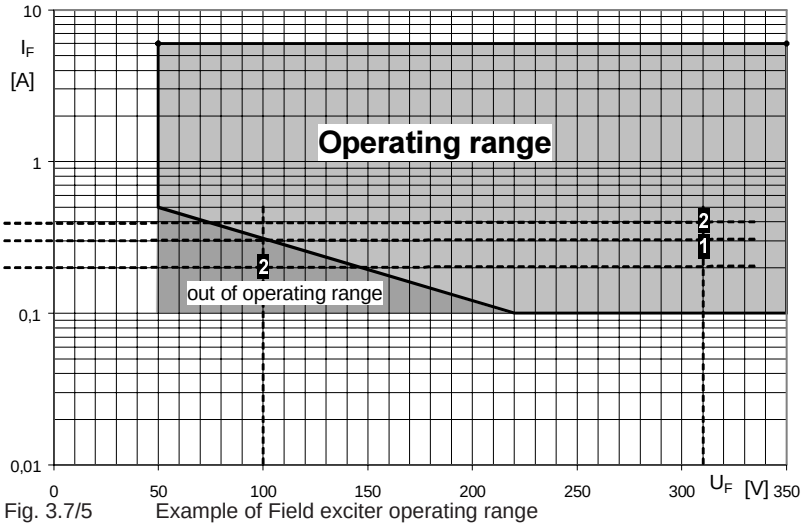


Fig. 3.7/5 Example of Field exciter operating range

1 Depend on the converter use the right diagram (6A or 16A)

e.g. DCS401.0045
Ue 310 V / Ie 0.3 A
➔ 6A diagram ➔ ok

2 Depend on the converter use the right diagram (6A or 16A)

e.g. DCS402.0050
Ue_{nom} 310 V / Ie_{nom} 0.4 A
➔ 6A diagram ➔ ok

Ue_{min} 100 V / Ie_{min} 0.2 A
➔ 6A diagramm ➔ not ok, not to realize !

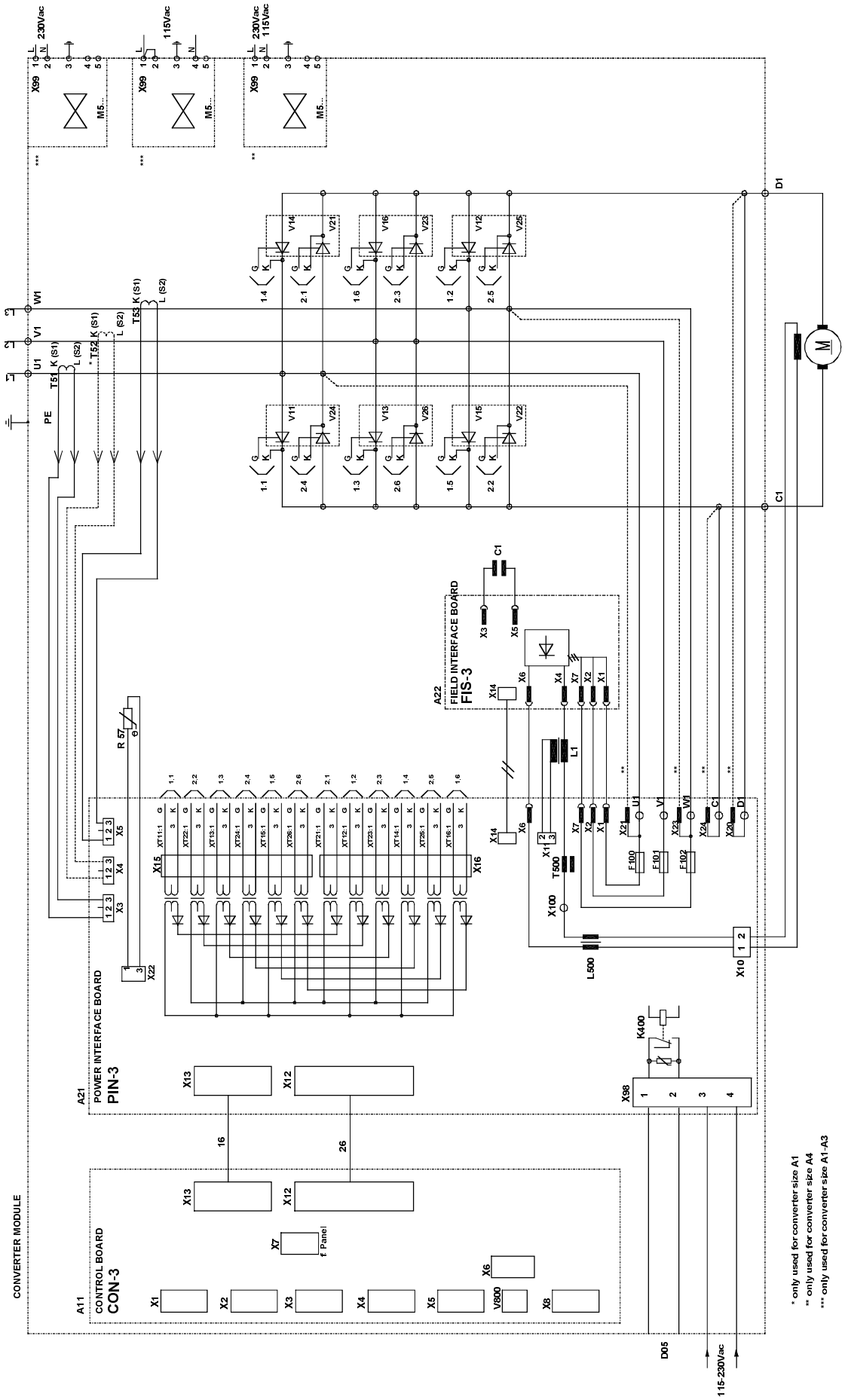


Fig. 3.8/1 Circuit diagram 4-Q converter

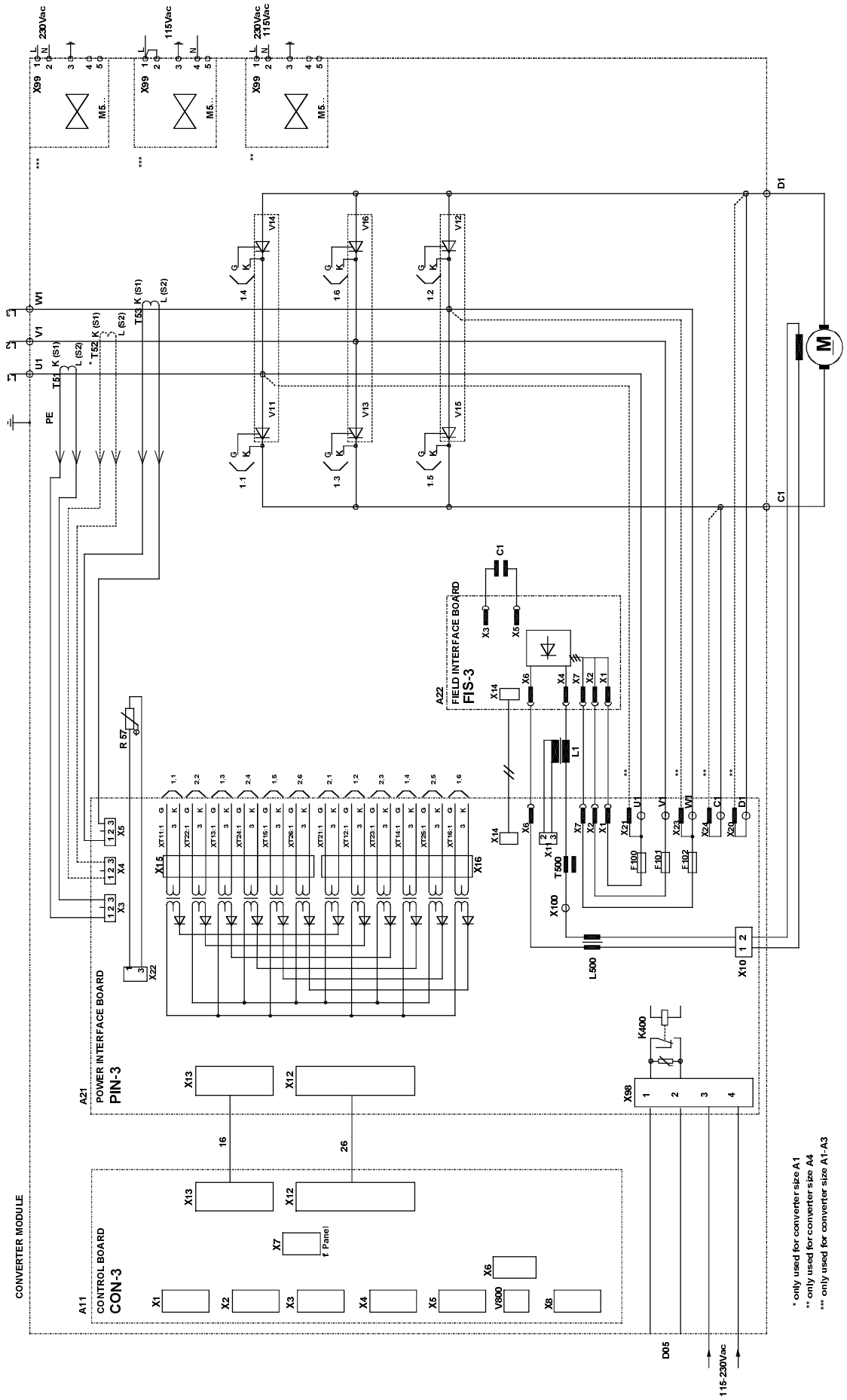


Fig. 3.8/2 Circuit diagram 2-Q converter

4 Overview of software

(The software delivered may contain minor changes to the product described here.)

Parameter

The parameters of the converter are subdivided into functional groups. These groups are listed in the table below.

Parameter group	Functions
1 - Motor Settings	Motor settings, actual line values, auto reclosing
2 - Operating Mode	Macro selection, behaviour during switching on/off, control/status information, control location
3 - Armature	Actual value signals, high current dosage, controller settings, stall protection, reference sources
4 - Field	Actual value signals, controller settings, overcurrent/ undercurrent tripping, flux adaptation, field heating
5 - Speed Controller	Reference sources, actual value acquisition, controller settings, ramp generator, constant speeds, alternative settings, speed monitoring, actual value filtering
6 - Input/Output	Scaling and allocation of the analog and digital inputs and outputs, display selection for the control panel, field bus allocation, actual value signals
7 - Maintenance	Language selection, service procedures, diagnostics, fault and alarm information, square-wave generator
8 - Field Bus	Serial communication via the field bus, RS232 or panel adapter
9 - Macro Adaptation	Re-configure digital inputs DI1...DI4 of macros 1, 5, 6, 7, and 8.

Function menu

Special functions of the control panel are listed in the table below.

Menu function	Significance
Set Typecode	Typecode adaptation for replacement of SDCS-CON-3
Read Faultlogger	Read / Clear the last 16 Faults or Alarms
Factory Settings	Reset all parameters to factory values (default values)
Copy to Panel	Parameter uploading from drive to control panel
Copy to Drive	Parameter downloading from control panel to drive
Long/Short Par List	Some parameter visible / invisible
Panel Lock	Lock the control panel for maloperation
LCD Contrast	Contrast of cotrol panel display
Commissioning	Guided commissioning via control panel

Parameter saving

Any changes of the parameters are stored automatically in the FlashProm of the converter. The storage is executed in a time interval of approx. 10 seconds.

4.1 General information about application Macros

Macros are pre-programmed parameter sets. During start-up, the drive can be configured easily without changing individual parameters.

The functions of all inputs and outputs and of allocations in the control structure are influenced by the selection of a macro. Any allocation which can be set manually with a "selector" (parameter) is preset by the selection of a macro. The means, whether the drive is speed-controlled or torque-controlled, whether supplementary references are processed, which actual values are available at the analog outputs, which reference value sources are used, etc. is already defined in the macro.

A macro is selected in the **Macro Select (2.01)** parameter. After selection a function is assigned to each of the digital inputs **DI1…DI8**. The functions are described in the chapter **Application Macros**.

The following "selectors" (parameters) are predefined when you are selecting the macro provided that these parameters have their default settings or are set to Macro Depend:

Selector	Remark
Cmd Location (2.02)	Control location
Cur Contr Mode (3.14)	Current controller operating mode
Torque Ref Sel (3.15)	Torque reference source
Speed Ref Sel (5.01)	Speed reference source
Alt Par Sel (5.21)	Switching event for alternative speed control parameters
Aux Sp Ref Sel (5.26)	Auxiliary reference source
AO1 Assign (6.05)	Actual value output at analog output AO1
AO2 Assign (6.08)	Actual value output at analog output AO2
DO1 Assign (6.11)	Signal output at digital output DO1
DO2 Assign (6.12)	Signal output at digital output DO2
DO3 Assign (6.13)	Signal output at digital output DO3
DO4 Assign (6.14)	Signal output at digital output DO4
DO5 Assign (6.15)	Signal output at digital output DO5
MSW bit 11 Ass (6.22)	Signal transmission in bit 11 of the status word
MSW bit 12 Ass (6.23)	Signal transmission in bit 12 of the status word
MSW bit 13 Ass (6.24)	Signal transmission in bit 13 of the status word
MSW bit 14 Ass (6.25)	Signal transmission in bit 14 of the status word
Jog 1 (9.02)	Jogging 1 function via Fixed Speed 1 (5.13)
Jog 2 (9.03)	Jogging 2 function via Fixed Speed 2 (5.14)
COAST (9.04)	Coast stop function
User Fault (9.05)	external User Fault event
User Fault Inv (9.06)	external User Fault (invers) event

Selector	Remark
User Alarm (9.07)	external User Alarm event
User Alarm Inv (9.08)	external User Alarm (inverse) event
Dir of Rotation (9.09)	Direction of Rotation only for speed controlled drive
Mot Pot Incr (9.10)	Motor Potentiometer Increment to increase speed ref.
Mot Pot Decr (9.11)	Motor Potentiometer Decrement to decrease speed ref.
MotPotMinSpeed (9.12)	Motor Potentiometer Minimum Speed ref.
Ext Field Rev (9.13)	external Field Reversal via external field reversing switch
AlternativParam (9.14)	switch over between Standard Parameter Set and Alternative Parameter Set
Ext Speed Lim (9.15)	external Speed Limitation via Fixed Speed 1 (5.13)
Add AuxSpRef (9.16)	additional aux. speed ref.
Curr Lim 2 Inv (9.17)	second current limitation via Arm Cur Lim 2 (3.24)
Speed/Torque (9.18)	switch over between speed controlled and torque controlled drive

Then the allocations will be dependent on the selected macro, see chapter *Application Macros*.

The user can *change* the allocations manually any time. Then they are no longer "*Macro Depend*". Hence the macro technique also allows the flexible, user-friendly adaptation to special requirements.

In addition to analog and digital outputs some of the digital inputs are re-configurable. The digital inputs DI1…DI4 in macros 1+5+6+7+8 can be set individually via parameter group 9 - MacroAdaptation. Macros 2+3+4 are fixed, not re-configurable.

Example of MacroAdaptation:

macro 6 - MotorPot should be selected
digital input DI1 should be re-defined from "direction of rotation" to "alternativ parameter set" for using ramp 1 / 2

- Set parameter „Dir of Rotation" (9.09) from Macro depend to Disable
- Set parameter „AlternativParam" (9.14) from Macro depend to DI1
- Set standard parameter set (5.07…5.10) and alternative parameter set (5.22…5.25) to values as required

Overview of factory settings of macro-dependent parameters:

Macro ➔ / ➘ Parameter	1 Standard	2 Man/Const Sp	3 Hand/Auto	4 Hand/MotPot	5 Jogging	6 Motor Pot	7 ext Field Rev	8 Torque Ctrl
Cmd Location (2.02)	Terminals	Terminals	Terminals	Terminals	Terminals	Terminals	Terminals	Terminals
Cur Contr Mode (3.14)	Speed Contr	Speed Contr	Speed Contr	Speed Contr	Speed Contr	Speed Contr	Speed Contr	Torque Contr
Torque Ref Sel (3.15)	AI2	AI2	Const Zero	AI2	Const Zero	AI2	AI2	AI1
Speed Ref Sel (5.01)	AI1	AI1	AI1	AI1	AI1	Const Zero	AI1	Const Zero
Alt Par Sel (5.21)	Sp < Lev1	Digital Input 4	Sp < Lev1	Sp < Lev1	Sp < Lev1	Sp < Lev1	Sp < Lev1	Sp < Lev1
Aux Sp Ref Sel (5.26)	Const Zero	Const Zero	Const Zero	Const Zero	AI2	Const Zero	Const Zero	Const Zero
AO1 Assign (6.05)	Speed Act	Speed Act	Speed Act	Speed Act	Speed Act	Speed Act	Speed Act	Speed Act
AO2 Assign (6.08)	Arm Volt Act	Arm Cur Act	Arm Cur Act	Arm Cur Act	Torque Act	Arm Volt Act	Arm Volt Act	Torque Act
DO1 Assign (6.11)	Rdy for Run	Rdy for On	Rdy for On	Rdy for On	Rdy for Run	Rdy for Run	Rdy for Run	Rdy for Run
DO2 Assign (6.12)	Running	Running	Running	Running	Zero Speed	Speed Level 1	Running	Running
DO3 Assign (6.13)	Zero Speed	Fault	Fault	Fault	At Setpoint	Speed Level 2	Field Rev Act	Zero Speed
DO4 Assign (6.14)	Flt or Alarm	Zero Speed	Zero Speed	Zero Speed	Flt or Alarm	Flt or Alarm	Flt or Alarm	Flt or Alarm
DO5 Assign (6.15)	Main Cont On	Main Cont On	Main Cont On	Main Cont On	Main Cont On	Main Cont On	Main Cont On	Main Cont On
MSW Bit11 Ass (6.22)	none	none	none	none	none	none	none	none
MSW Bit12 Ass (6.23)	none	none	none	none	none	none	none	none
MSW Bit13 Ass (6.24)	none	none	none	none	none	none	none	none
MSW Bit14 Ass (6.25)	none	none	none	none	none	none	none	none
Assignment of DI1	Jog 1	Start	Start/Stop Hand	Start/Stop	Direc of Rotat.	Direc of Rotat.	Ext Field Rev	Coast
DI2	Jog 2	Stop	Hand/Auto	Jog 1	Jog 1	Incr. Speed	Jog 1	not used
DI3	External Fault	Direc of Rotat.	Direc of Rotat.	Direc of Rotat.	Jog 2	Decr. Speed	External Fault	External Fault
DI4	External Alarm	Ramp 1 / 2	AI1/Fixed Sp 1	AI1/MotPot	not used	Min Speed	External Alrm	External Alrm
DI5	Emerg. Stop	Emerg. Stop	Emerg. Stop	Emerg. Stop	Emerg. Stop	Emerg. Stop	Emerg. Stop	Emerg. Stop
DI6	Reset	Reset	Reset	Reset	Reset	Reset	Reset	Reset
DI7	On/Off	Fixed Speed 1	Direc of Rotat.	Incr. Speed	On/Off	On/Off	On/Off	On/Off
DI8	Run	Fixed Speed 2	Start/Stop Auto	Decr. Speed	Run	Run	Run	Run

The following application macros are available:

Macro 1: Standard
Drive switch-on/switch-off and enable via 2 digital inputs.
Speed reference via analog input.
External torque limiting via analog input.
Jogging via 2 digital inputs.
2 digital inputs for external events (fault/ alarm).
2 digital inputs for emergency stop and fault acknowledgement.

Macro 2: Man/Const Sp
Starting and stopping of the drive via 2 digital inputs.
Speed reference via analog input.
Reversal of rotational direction via 1 digital input.
2 ramp sets selectable via 1 digital input.
Selection of speed reference or 2 fixed speeds via 2 digital inputs.
2 digital inputs for emergency stop and fault acknowledgement.

Macro 3: Hand/Auto
Switchover between manual and auto. control effected via 1 digital input.
Manual control:
- Starting and stopping of the drive via 1 digital input.
- Speed reference via analog input 1.
- Selection of speed reference or 1 fixed speed via 1 digital input.
- Reversal of rotational direction via 1 digital input.

Automatic control:
- Starting and stopping of the drive via 1 digital input.
- Speed reference via analog input 2.
- Reversal of rotational direction via 1 digital input.

2 digital inputs for emergency stop and fault acknowledgement.

Macro 4: Hand/MotPot
Starting and stopping of the drive via 1 digital input.
Jogging via 1 digital input.
Speed reference via analog input.
Reversal of rotational direction via 1 digital input.
Motor potentiometer function via 2 digital inputs.
Selection of speed reference or motor pot via 1 digital input.
2 digital inputs for emergency stop and fault acknowledgement.

Macro 5: Jogging
Drive switch-on/switch-off and enable via 2 digital inputs.
Speed reference via analog input 1.
Additional reference via analog input 2.
Jogging via 2 digital inputs.
Reversal of rotational direction via 1 digital input.
2 digital inputs for emergency stop and fault acknowledgement.

Macro 6: Motor Pot
Drive switch-on/switch-off and enable via 2 digital inputs.
Reversal of rotational direction via 1 digital input.
Minimum speed can be activated via 1 digital input.
Motor pot function via 2 digital inputs.
2 digital inputs for emergency stop and fault acknowledgement.

Macro 7: ext Field Rev
Drive switch-on/switch-off and enable via 2 digital inputs.
Speed reference via analog input 1.
External torque limiting via analog input 2.
Jogging via 1 digital input.
External field reversal can be activated via 1 digital input.
2 digital inputs for external events (fault/ alarm).
2 digital inputs for emergency stop and fault acknowledgement.

Macro 8: Torque Ctrl
Drive switch-on/switch-off and enable via 2 digital inputs.
Torque reference via analog input.
Coast Stop via 1 digital input.
2 digital inputs for external events (fault/ alarm).
2 digital inputs for emergency stop and fault acknowledgement.

Description of I/O's functionality

I/O	Param	Function
DI1	2.01	Jog speed 1. Speed can be defined in parameter 5.13. Accel/Decel Ramp for Jogging can be defined in parameter 5.19/5.20.
DI2		Jog speed 2. Speed can be defined in parameter 5.14. Accel/Decel Ramp for Jogging can be defined in parameter 5.19/5.20.
DI3		External fault signal. Triggers a fault response and trips the drive
DI4		External alarm signal. Triggers a warning in DCS400
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Drive ON / OFF. DI7=0=OFF , DI7=1=ON
DI8		Drive START / STOP. DI8=0=STOP , DI8=1=START
DO1	6.11	Ready for Run. Converter switched ON, but not yet STARTed
DO2	6.12	Running. Drive is STARTed (Current controller enabled)
DO3	6.13	Zero-speed signal. Motor at standstill
DO4	6.14	Group fault signal. Common signal for all faults or alarms
DO5	6.15	Main contactor on. Controlled by ON command (DI7)
AI1	5.01	Speed reference
AI2	3.15	External torque limitation possible. First the parameter **Cur Contr Mode 3.14** has to be changed from Macro depend to **Lim Sp Ctr**. Without changes the factory settings for torque limitation is effective (**100%)**.
AO1	6.05	Speed actual
AO2	6.08	Armatue voltage actual

Inter locking of Jog speed 1 – Jog speed 2 – Drive START

Jog 1 DI1	Jog 2 DI2	START DI8	Drive is ON (DI7=1)
0	0	0	Drive is STOPped (Current controller disabled)
1	0	0	Drive STARTed via DI1 , speed reference=parameter 5.13
x	1	0	Drive STARTed via DI2 , speed reference=parameter 5.14
x	x	1	Drive STARTed via START command (DI8) , speed reference via analog input AI1

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Standard]	3.04 Arm Cur Max	5.01 Speed Ref Sel [AI1]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [AI2]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Arm Volt Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy for Run]
			5.17 Speed Level 2	6.12 DO2 Assign [Running]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [Zero Speed]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Flt or Alarm]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [Const Zero]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 11 Ass [none]
				6.24 MSW Bit 11 Ass [none]
				6.25 MSW Bit 11 Ass [none]

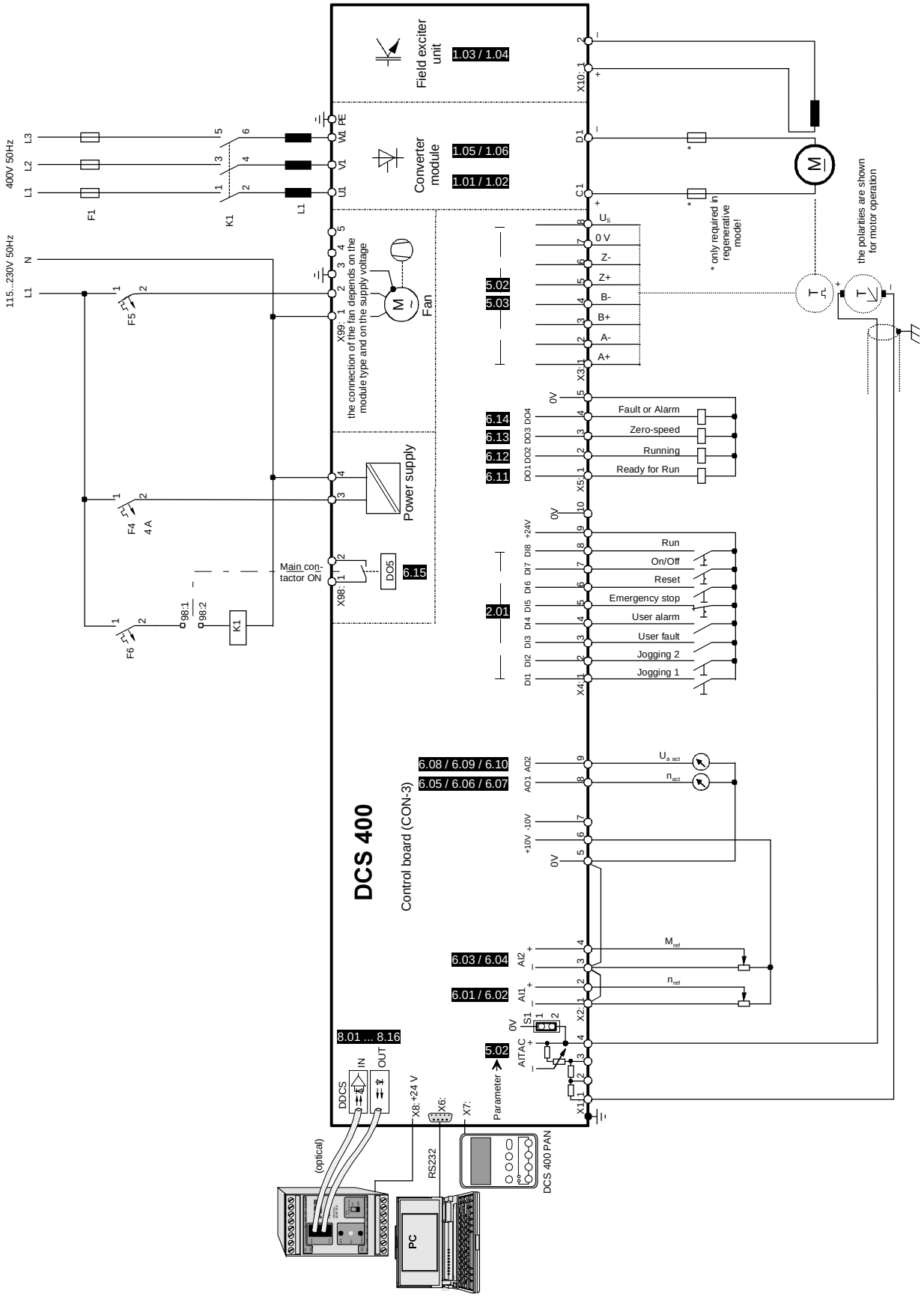


Fig. 4.2/1: Connection example application-Macro 1 - Standard

Macro description

I/O	Param	Function
DI1	2.01	Drive is started by closing digital input DI1 (DI=1). Switches the drive ON and START
DI2		Drive is stopped by opening digital input DI2 (DI2=0). DI2 has a higher priority than DI1, i.e. if DI2 is open the drive can not be started. Stop the drive in according to parameter Stop-Mode and afterwards switch the drive off.
DI3		Direction of rotation. DI3=0=forward, DI3=1=reverse
DI4		2 ramp sets selectable. DI4=0=Ramp 1 Accel Ramp 5.09 / Decel Ramp 5.10 / Speed Reg KP 5.07 / Speed Reg TI 5.08 DI4=1=Ramp 2 Alt Accel Ramp 5.24 / Alt Decel Ramp 5.25 / Alt Speed KP 5.22 / Alt Speed TI 5.23
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Fixed speed 1, speed can be defined in parameter 5.13 (Ramp 5.19/5.20)
DI8		Fixed speed 2, speed can be defined in parameter 5.14 (Ramp 5.19/5.20)
DO1	6.11	Ready for On. Elektronics powered up, no fault signals present
DO2	6.12	Running. Current controller enabled
DO3	6.13	Fault signal. Converter tripped
DO4	6.14	Zero-speed signal. Motor at standstill
DO5	6.15	Main contactor on. Controlled by START command (DI1)
AI1	5.01	Speed reference
AO1	6.05	Speed actual
AO2	6.08	Armature current actual

Selection of speed reference or 2 fixed speed via DI7 and DI8

DI7	DI8	Drive is STARTed (DI1=1)
0	0	Speed reference via analog input AI1
1	0	Fixed speed 1, speed can be defined in parameter 5.13 (Ramp 5.19/5.20)
x	1	Fixed speed 2, speed can be defined in parameter 5.14 (Ramp 5.19/5.20)

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Man/Const Sp]	3.04 Arm Cur Max	5.01 Speed Ref Sel [AI1]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [AI2]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Arm Cur Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy On]
			5.17 Speed Level 2	6.12 DO2 Assign [Running]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [Fault]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Zero Speed]
			5.21 Alt Par Sel [DI4]	6.15 DO5 Assign [Main Cont On]
			5.24 Alt Accel Ramp	6.22 MSW Bit 11 Ass [none]
			5.25 Alt Decel Ramp	6.23 MSW Bit 12 Ass [none]
			5.26 Aux Sp Ref Sel [Const Zero]	6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

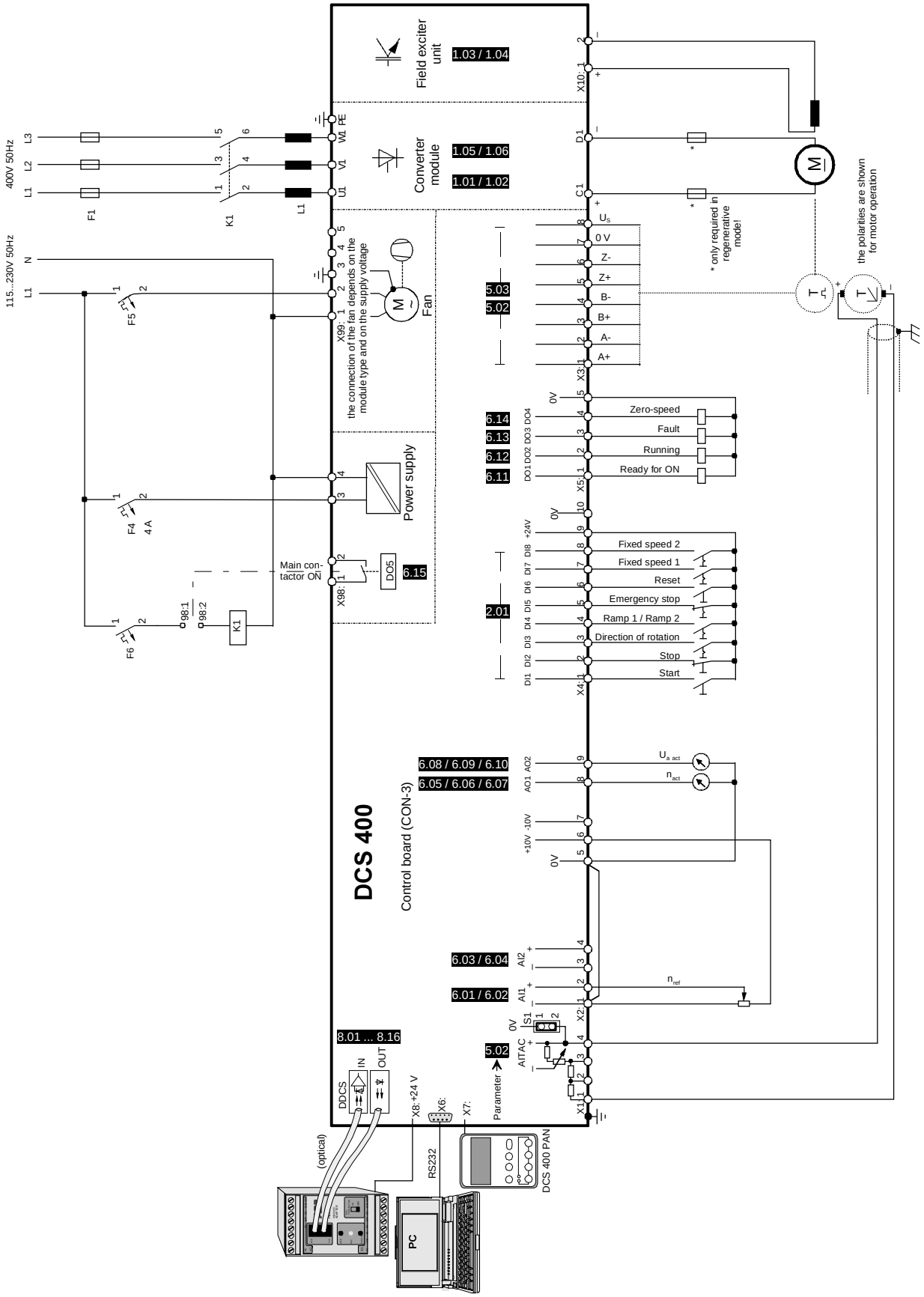


Fig. 4.2/2: Connection example application-Macro 2 - Man/Const Sp

Description of I/O's functionality

I/O	Param	Function
DI1		Start / Stop **Hand.** Start and stop the drive. DI1=0=STOP , DI1=1=START Start switches the drive ON and START. Stop the drive in according to parameter Stop-Mode and afterwards switch the drive off.
DI2		Switchover between manual and automatic control. Present Start/Stop command will be of effect after switching: DI2=0=**Hand control**: The drive is started and stoped via digital input DI1. Speed reference via analog input AI1. Direction of rotation via digital input DI3. Selection of speed reference or 1 fixed speed via digital input DI4 DI2=1=**Automatic control**: The drive is started and stoped via digital input DI8. Speed reference from PLC via analog input AI2. Direction of rotation via digital input DI7.
DI3	2.01	Direction of rotation **Hand.** DI3=0=forward, DI3=1=reverse
DI4		Selection of speed reference AI1 / Fixed speed 1 **Hand** DI4=0=speed reference via analog input AI1 DI4=1=fixed speed 1 , speed can be defined in parameter 5.13 (Ramp 5.19/5.20)
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Direction of rotation **Auto.** DI7=0=forward , DI3=1=reverse
DI8		Start / Stop **Auto.** Start and stop the drive. DI8=0=STOP , DI8=1=START Start switches the drive ON and START. Stop the drive in according to parameter Stop-Mode and afterwards switch the drive off.
DO1	6.11	Ready for On. Elektronics powered up, no fault signals present
DO2	6.12	Running. Current controller enabled
DO3	6.13	Fault signal. Converter tripped
DO4	6.14	Zero-speed signal. Motor at standstill
DO5	6.15	Main contactor on. Controlled by START command (DI1)
AI1	5.01	Speed refernece Hand
AI2	5.26	Speed reference Auto, from PLC
AO1	6.05	Speed actual
AO2	6.08	Armature current actual

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Hand/Auto]	3.04 Arm Cur Max	5.01 Speed Ref Sel [AI1]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [Const Zero]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Arm Cur Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy On]
			5.17 Speed Level 2	6.12 DO2 Assign [Running]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [Fault]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Zero Speed]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [Const Zero]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 12 Ass [none]
				6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

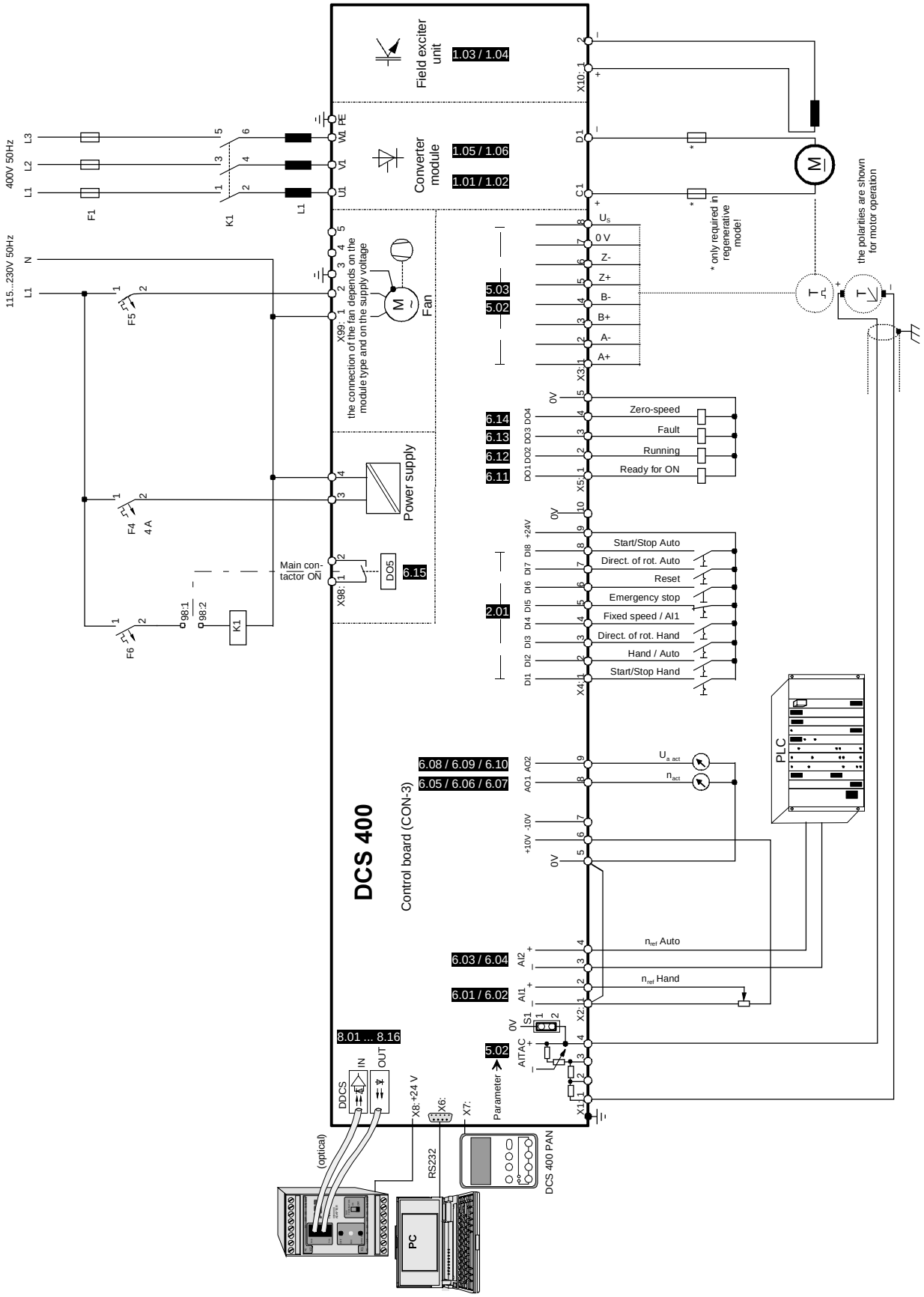


Fig. 4.2/3: Connection example application-Macro 3 - Hand/Auto

Description of I/O's functionality

I/O	Param	Function
DI1	2.01	Start / Stop. Start and stop the drive. DI1=0=STOP , DI1=1=START. Start switches the drive ON and START. Stop the drive in according to parameter Stop-Mode and afterwards switch the drive off.
DI2		Jog speed 1. Speed can be defined in parameter 5.13. Accel/Decel Ramp for Jogging can be defined in parameter 5.19/5.20. Jog speed 1 has precedence above AI1/MotPot
DI3		Direction of rotation. DI3=0=forward , DI3=1=reverse
DI4		AI1/MotPot, Selection of speed reference or motor pot function. DI4=0=speed reference via AI1 DI4=1=Motor pot function via DI7 und DI8
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Motor pot function „faster". Accel Ramp 5.09
DI8		Motor pot function „slower". Decel Rampe 5.10. Slower has precedence above faster.
DO1	6.11	Ready for On. Elektronics powered up, no fault signals present
DO2	6.12	Running. Current controller enabled
DO3	6.13	Fault signal. Converter tripped
DO4	6.14	Zero-speed signal. Motor at standstill
DO5	6.15	Main contactor on. Controlled by START command (DI1)
AI1	5.01	Speed reference
AO1	6.05	Speed actual
AO2	6.08	Armature current actual

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Hand/MotPot]	3.04 Arm Cur Max	5.01 Speed Ref Sel [AI1]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [AI2]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Arm Cur Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy On]
			5.17 Speed Level 2	6.12 DO2 Assign [Running]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [Fault]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Zero Speed]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [Const Zero]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 12 Ass [none]
				6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

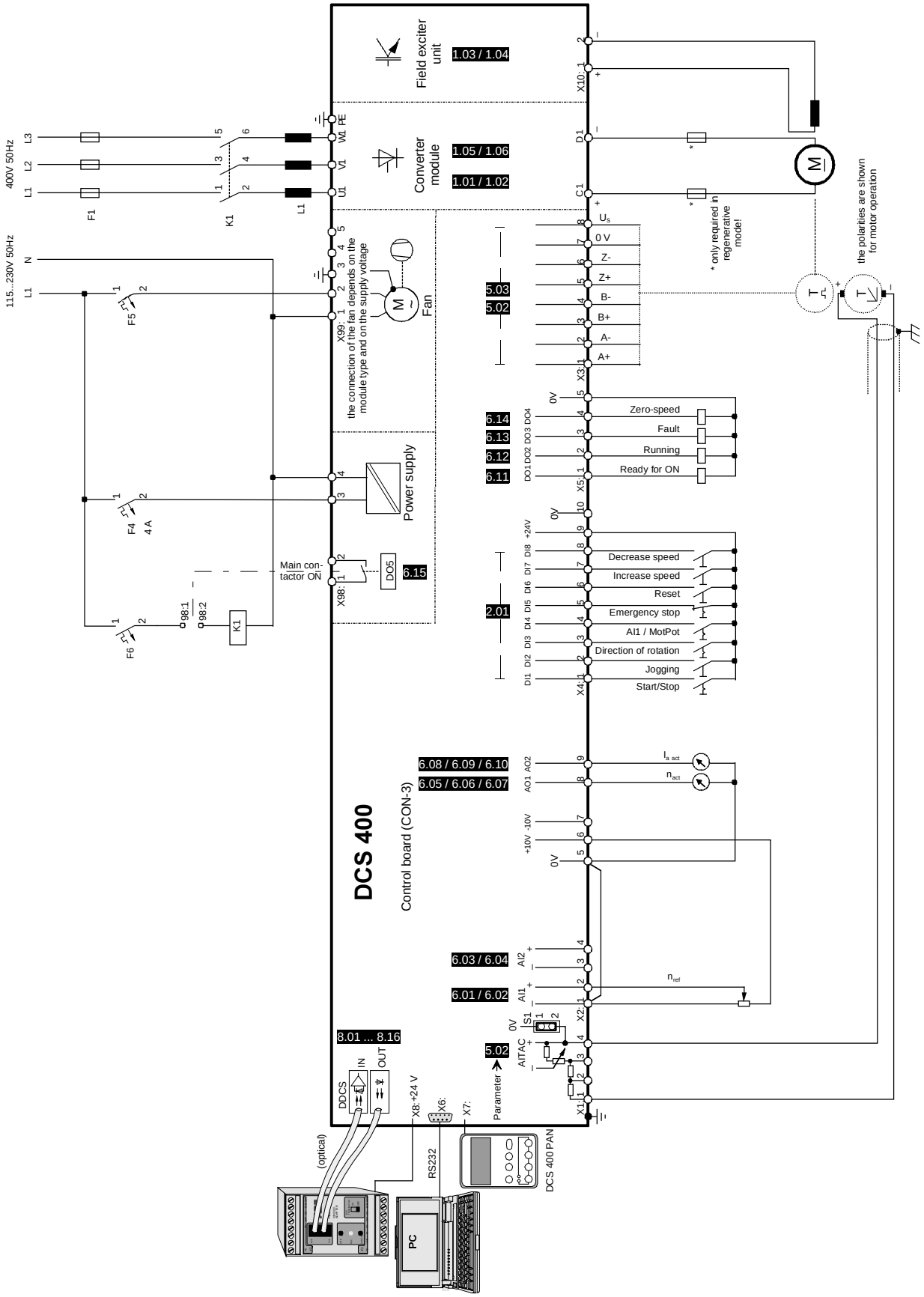


Fig. 4.2/4: Connection example application-Macro 4 - Hand/MotPot

Description of I/O's functionality

I/O	Param	Function
DI1	2.01	Direction of rotation. DI1=0=forward , DI1=1=reverse
DI2		Jog speed 1. Speed can be defined in parameter 5.13. Accel/Decel Ramp for Jogging can be defined in parameter 5.19/5.20.
DI3		Jog speed 2. Speed can be defined in parameter 5.14. Accel/Decel Ramp for Jogging can be defined in parameter 5.19/5.20.
DI4		not used
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Drive ON / OFF. DI7=0=OFF , DI7=1=ON
DI8		Drive START / STOP. DI8=0=STOP , DI8=1=START
DO1	6.11	Ready for Run. Converter switched ON, but not yet STARTed
DO2	6.12	Zero-speed signal. Motor at standstill
DO3	6.13	At set point. Speed reference = speed actual
DO4	6.14	Group fault signal. Common signal for all faults or alarms
DO5	6.15	Main contactor on. Controlled by ON command (DI7)
AI1	5.01	Speed reference
AI2	5.26	Auxiliary reference
AO1	6.05	Speed actual
AO2	6.08	Torque actual

Mutual locking of Jog speed 1 – Jog speed 2 – Drive START

Jog 1 DI2	Jog 2 DI3	START DI8	Drive is ON (DI7=1)
0	0	0	Drive is STOPped (Current controller disabled)
1	0	0	Drive STARTed via DI1 , speed reference=parameter 5.13
x	1	0	Drive STARTed via DI2 , speed reference=parameter 5.14
x	x	1	Drive STARTed via START command (DI8) , speed reference via analog input AI1

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Jogging]	3.04 Arm Cur Max	5.01 Speed Ref Sel [AI1]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [Const Zero]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Torque Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy for Run]
			5.17 Speed Level 2	6.12 DO2 Assign [Zero Speed]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [At Setpoint]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Flt or Alarm]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [AI2]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 12 Ass [none]
				6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

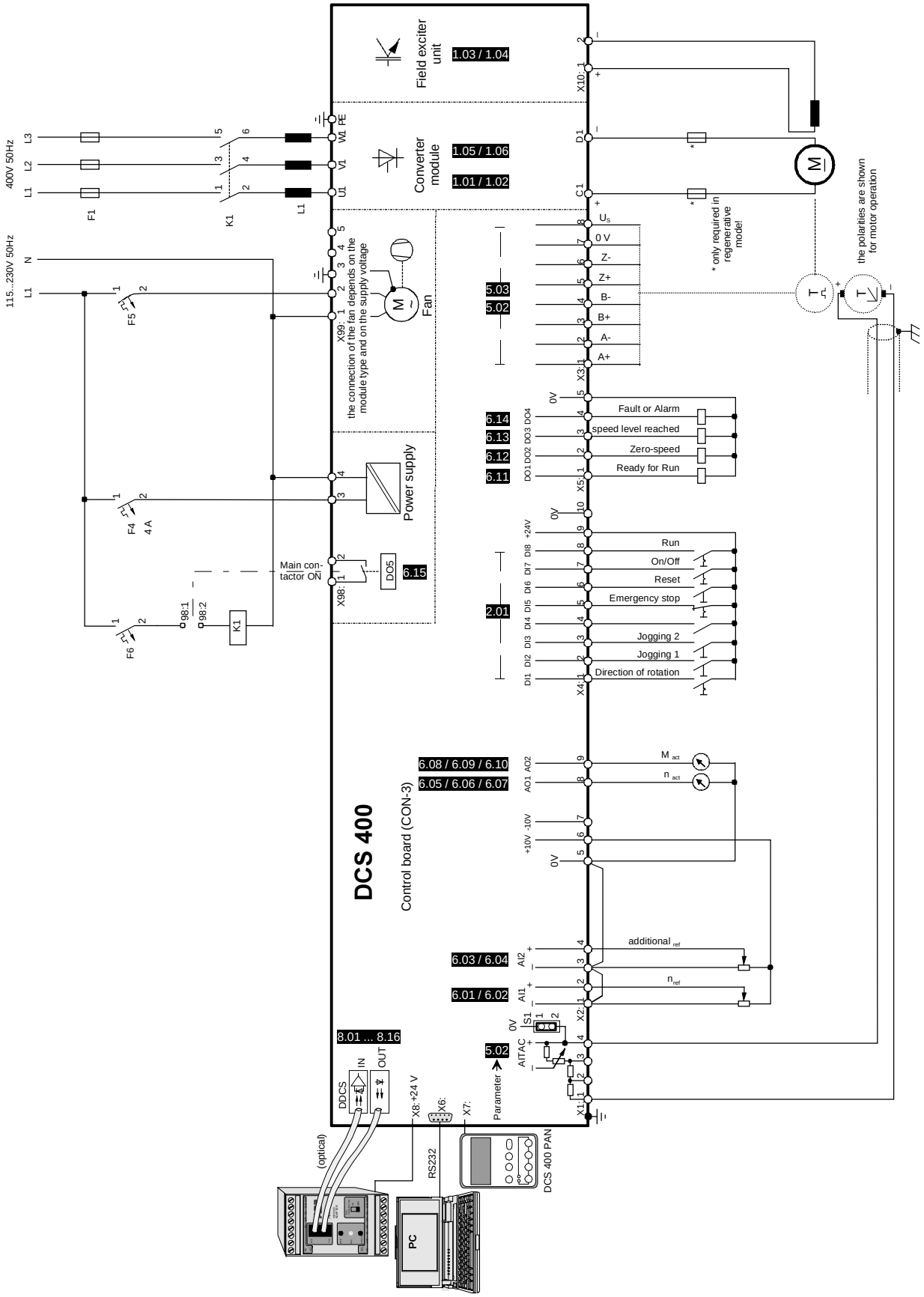


Fig. 4.2/5: Connection example application-Macro 5 - Jogging

Description of I/O's functionality

I/O	Param	Function
DI1	2.01	Direction of rotation. DI1=0=forward , DI1=1=reverse
DI2		Motor pot function „faster".Accel Ramp 5.09
DI3		Motor pot function „slower". Decel Ramp 5.10. Slower has precedence above faster.
DI4		Minimum speed. Speed can be defined in parameter 5.13. When the drive is STARTed the speed will be accelerated to this minimum speed and it is not possible to set the speed below this minimum with motor pot function.
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Drive ON / OFF. DI7=0=OFF , DI7=1=ON
DI8		Drive START / STOP. DI8=0=STOP , DI8=1=START
DO1	6.11	Ready for Run. Converter switched ON, but not yet STARTed
DO2	6.12	n_{max} reached (n_{max} can be defined in parameter 5.16) $n_{act} \geq$ Level 1 / Level2
DO3	6.13	n_{min} reached (n_{min} can be defined in parameter 5.17) $n_{act} \geq$ Level 1
DO4	6.14	Group fault signal. Common signal for all faults or alarms
DO5	6.15	Main contactor on. Controlled by ON command (DI7)
AO1	6.05	Speed actual
AO2	6.08	Armature voltage actual

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Motor Pot]	3.04 Arm Cur Max	5.01 Speed Ref Sel [Const Zero]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [AI2]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Arm Volt Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy for Run]
			5.17 Speed Level 2	6.12 DO2 Assign [Speed Level 1]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [Speed Level 2]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Flt or Alarm]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [Const Zero]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 12 Ass [none]
				6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

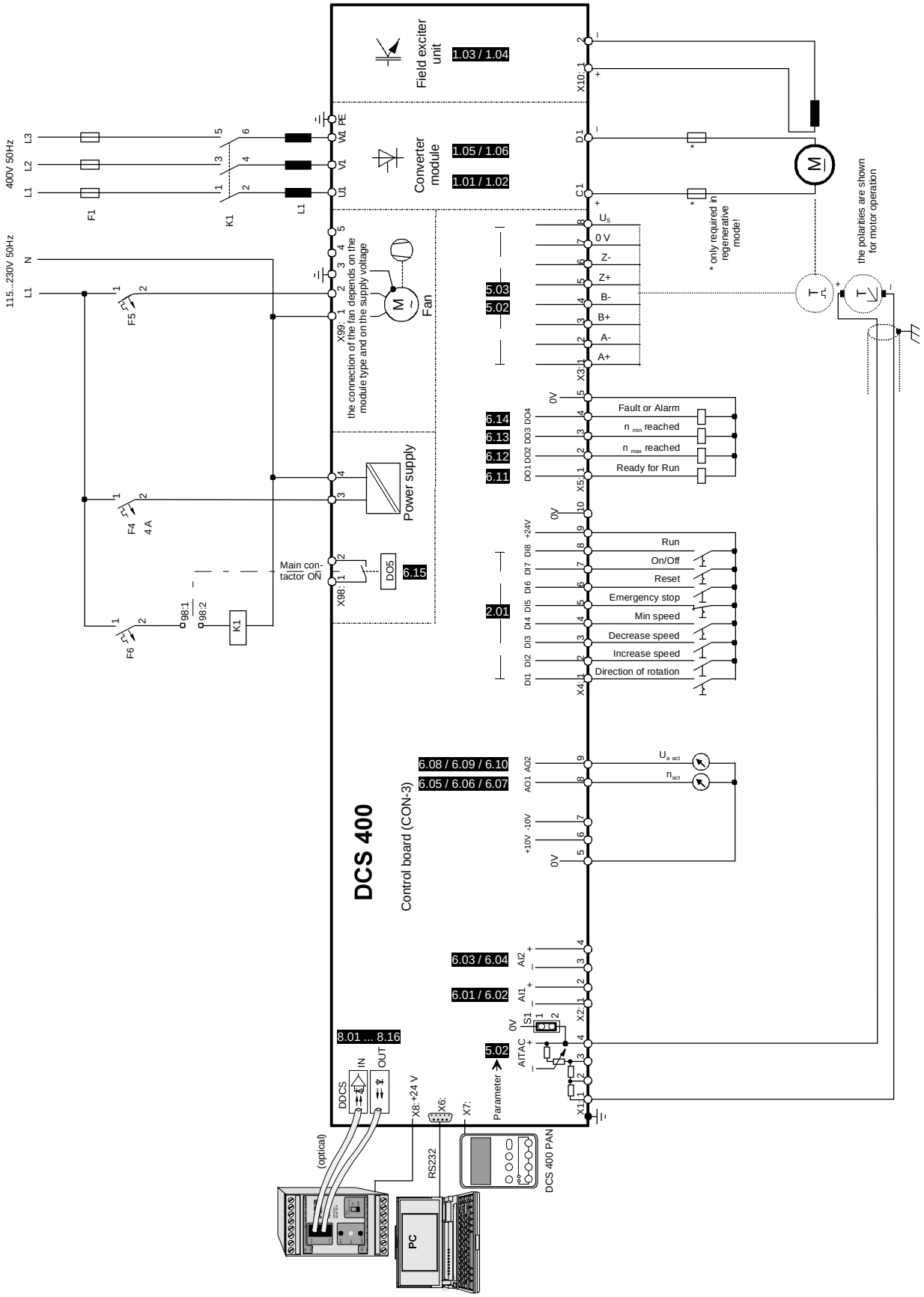


Fig. 4.2/6: Connection example application-Macro 6 - Motor Pot

Description of I/O's functionality

I/O	Param	Function
DI1		External field reversal with external field reversing switch. **Only for 2Q application.** DI1=0=no field reversal DI1=1=field reversal Depend on field reversal (DI1=1) the signal „Field reversal active" has log. state „1". Field reversal is only possible when the drive is OFF (DI7=0). When field reversal is active the polarity of speed actual value is changed in the software. It's recommended to use a remanence contactor relay to store the state of this relay when the main supply failes. Otherwise the relay contactors can burn due to the field inductance.
DI2	2.01	Jog speed 1. Speed can be defined in parameter 5.13. Accel/Decel Ramp for Jogging can be defined in parameter 5.19/5.20.
DI3		External fault signal. Triggers a fault response and trips the drive
DI4		External alarm signal. Triggers a warning in DCS400
DI5		Emergency stop. Closed-circuit principle, must be closed for operation
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Drive ON / OFF. DI7=0=OFF , DI7=1=ON
DI8		Drive START / STOP. DI8=0=STOP , DI8=1=START
DO1	6.11	Ready for Run. Converter switched ON, but not yet STARTed
DO2	6.12	Running. Drive is STARTed (Current controller enabled)
DO3	6.13	Field reversal active
DO4	6.14	Group fault signal. Common signal for all faults or alarms
DO5	6.15	Main contactor on. Controlled by ON command (DI7)
AI1	5.01	Speed reference
AI2	3.15	External torque limitation possible. First the parameter **Cur Contr Mode 3.14** has to be changed from Macro depend to **Lim Sp Ctr**. Without changes the factory settings for torque limitation is effective (**100%)**.
AO1	6.05	Speed actual
AO2	6.08	Armatue voltage actual

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [ext Field Rev]	3.04 Arm Cur Max	5.01 Speed Ref Sel [AI1]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Speed Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [AI2]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Arm Volt Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy for Run]
			5.17 Speed Level 2	6.12 DO2 Assign [Running]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [FieldRev Act]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Flt or Alarm]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [Const Zero]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 12 Ass [none]
				6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

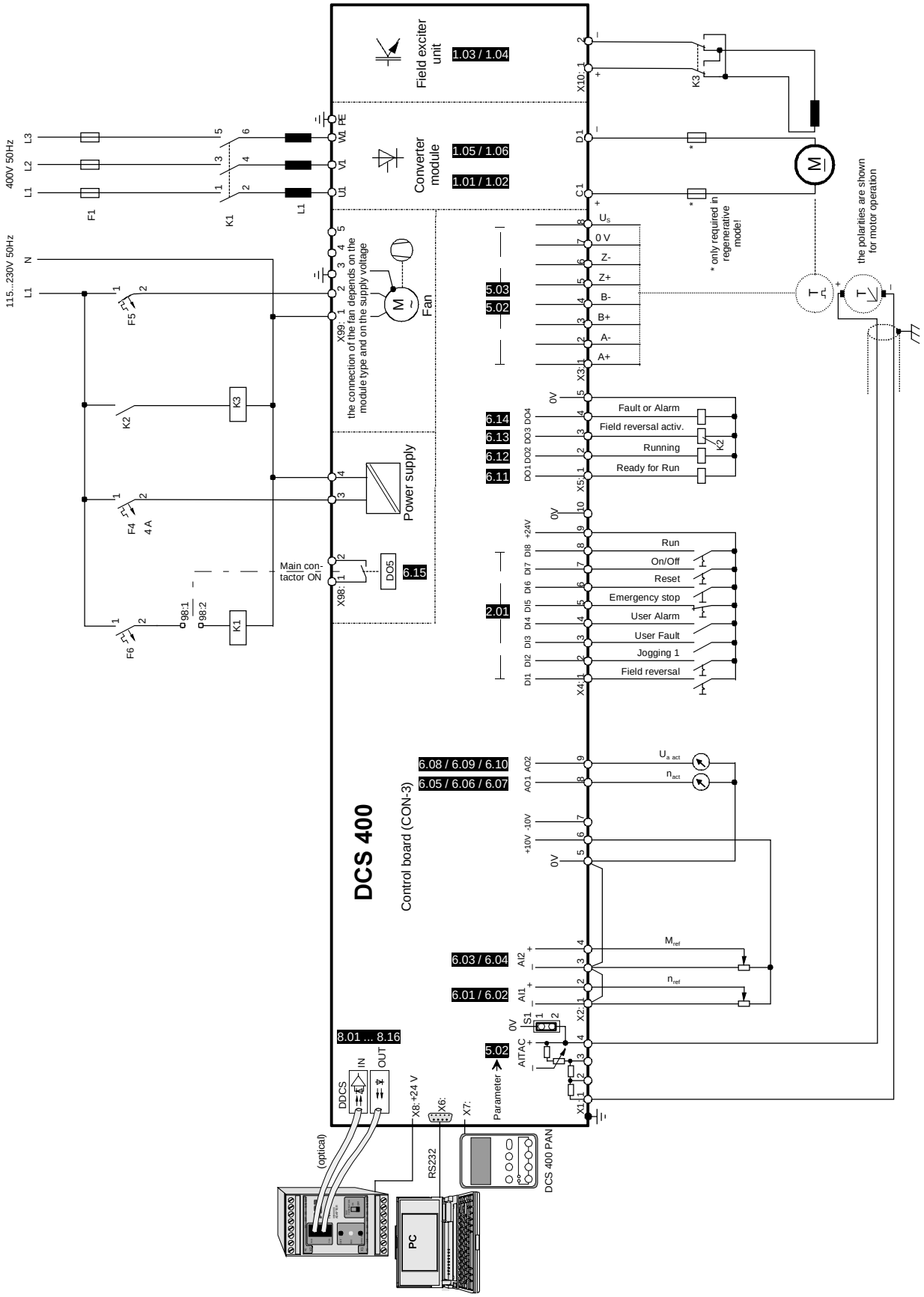


Fig. 4.2/7: Connection example application-Macro 7 - ext Field Rev

Description of I/O's functionality

I/O	Param	Funktion
DI1	2.01	COAST. Closed-circuit principle, must be closed for operation. COAST is the fastest way to stop the current controller. The current controller will decrease the armature current to zero as fast as possible. This command will stop the drive so that the motor is left running and friction together with the load will decrease the speed to zero.
DI2		not used
DI3		External fault signal. Triggers a fault response and trips the drive
DI4		External alarm signal. Triggers a warning in DCS400
DI5		Emergency stop. Closed-circuit principle, must be closed for operation. In case of Emergencey stop the drive will be changed to speed control and stopped the drive in according to parameter Eme Stop Mode (2.04)
DI6		Reset. Faultacknowledgement, reset faults signaled by the drive
DI7		Drive ON / OFF. DI7=0=OFF , DI7=1=ON
DI8		Drive START / STOP. DI8=0=STOP , DI8=1=START. In case of STOP command the drive will be changed to speed control and stopped the drive in according to parameter Stop Mode (2.03).
DO1	6.11	Ready for Run. Converter switched ON, but not yet STARTed
DO2	6.12	Running. Drive is STARTed (Current controller enabled)
DO3	6.13	Zero-speed signal. Motor at standstill
DO4	6.14	Group fault signal. Common signal for all faults or alarms
DO5	6.15	Main contactor on. Controlled by ON command (DI7)
AI1	5.01	Torque reference
AO1	6.05	Speed actual
AO2	6.08	Torque actual

Parameter settings, shaded areas are set by macro - all others are set during commissioning

1 - Motor Settings	2 - Operation Mode	3 - Armature	5 - Speed Controller	6 - Input/Output
1.01 Arm Cur Nom	2.01 Macro Select [Torque Cntrl]	3.04 Arm Cur Max	5.01 Speed Ref Sel [Const Zero]	6.01 AI1 Scale 100%
1.02 Arm Volt Nom	2.02 Cmd Location [Terminals]	3.07 Torque Lim Pos	5.02 Speed Meas Mode	6.02 AI1 Scale 0%
1.03 Field Cur Nom	2.03 Stop Mode	3.08 Torque Lim Neg	5.03 Encoder Inc	6.03 AI2 Scale 100%
1.04 Field Volt Nom	2.04 Eme Stop Mode	3.14 Cur Contr Mode [Torque Contr]	5.09 Accel Ramp	6.04 AI2 Scale 0%
1.05 Base Speed		3.15 Torque Ref Sel [AI1]	5.10 Decel Ramp	6.05 AO1 Assign [Speed Act]
1.06 Max Speed		3.17 Stall Torque	5.11 Eme Stop Ramp	6.06 AO1 Mode
		3.18 Stall Time	5.12 Ramp Shape	6.07 AO1 Scale 100%
			5.13 Fixed Speed 1	6.08 AO2 Assign [Torque Act]
			5.14 Fixed Speed 2	6.09 AO2 Mode
			5.15 Zero Speed Lev	6.10 AO2 Scale 100%
			5.16 Speed Level 1	6.11 DO1 Assign [Rdy for Run]
			5.17 Speed Level 2	6.12 DO2 Assign [Running]
			5.19 Jog Accel Ramp	6.13 DO3 Assign [Zero Speed]
			5.20 Jog Decel Ramp	6.14 DO4 Assign [Flt or Alarm]
			5.21 Alt Par Sel [Sp < Lev1]	6.15 DO5 Assign [Main Cont On]
			5.26 Aux Sp Ref Sel [Const Zero]	6.22 MSW Bit 11 Ass [none]
				6.23 MSW Bit 12 Ass [none]
				6.24 MSW Bit 13 Ass [none]
				6.25 MSW Bit 14 Ass [none]

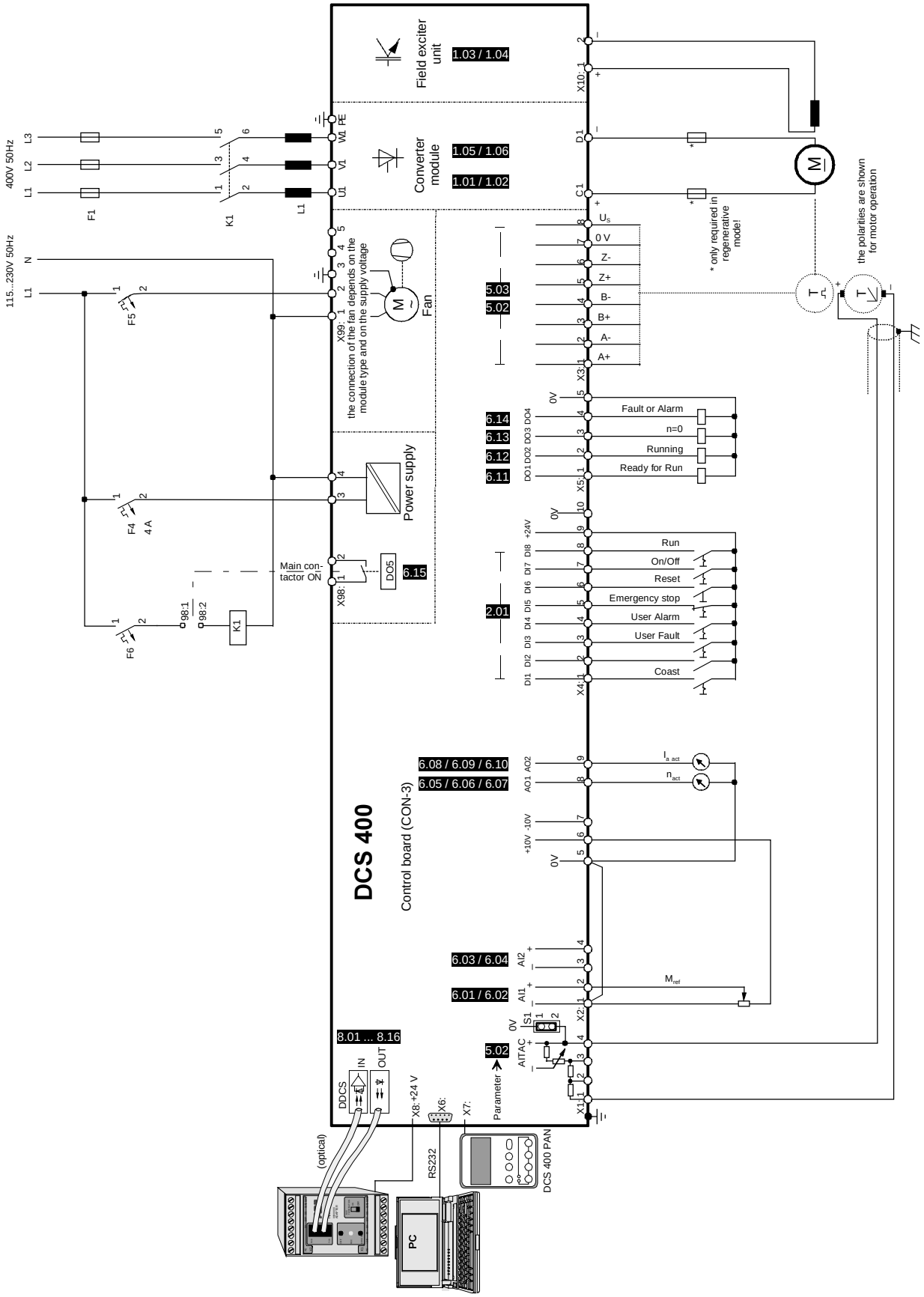


Fig. 4.2/8: Connection example application-Macro 8 - Torque Ctrl

Digital inputs DI1…DI8
The drive is controlled via the digital inputs DI1…DI8. The significance of the inputs are defined by a macro. When you select a macro in the Macro Select (2.01) parameter the functions are assigned to the 8 digital inputs. The functions are described in the context of respective macros in section *4.2 Application Macros*. The functions of the digital inputs DI1...DI4 of macros 1, 5, 6, 7 and 8 are re-configurable via parameter group 9.

Digital outputs DO1…DO5
Any signal of a signal list can be assigned to each digital output. The list is available in the parameters of the digital outputs DO1…DO5 (DO1 Assign (6.11)…DO5 Assign (6.15)). The significance and/or mode of operation of the signals is described there. The outputs are connected with the application macro by default i.e. changing the macro will change the significance of the outputs. The linking of the macro will be revoked if you allocate another signal. Then the output will keep its significance even if the setting of the macro changes.

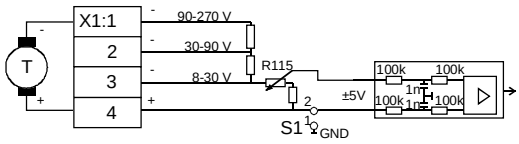
Analog inputs AI1…AI2 (9 Bits + sign)
The analog inputs are 10V inputs. Offset voltages for 0% and 100% reference can be entered into the scaling parameters 6.01…6.04:
e.g.: A reference value is preset by means of a potentiometer. The zero position of the potentiometer is not exactly 0V but 0.8V and the full-scale deflection is not exactly 10V but 9.3 V. Enter 9.30 V into parameter AIx Scale 100 % (6.01 / 6.03) and 0.80V into parameter AIx Scale 0 % (6.02 / 6.04). The range between 0.80V and 9.30V is then considered to be the 100% reference value.

Analog outputs AO1…AO2 (7 Bits + sign)
Any actual value of an actual value list can be assigned to the analog outputs. The list is available in the AOx Assign parameters (6.05 / 6.08). The outputs are connected with the application macro by default i.e. changing the macro will change the significance of the outputs. The linking of the macro will be revoked if you allocate another actual value. Then the output will keep its new significance even if the setting of the macro changes.

Using the parameter AOx Mode (6.06 / 6.09) you can choose between unipolar (0…10V) or bipolar (-10V…0V…+10V) output.

The parameters AOx Scale 100 % (6.07 / 6.10) define which voltage level corresponds to 100% actual value.
E.g.: A 200% armature current is required in a drive. These 200% can be represented maximally by 10V. According to a simple formula:
(10V / 200%) x 100%
AOx Scale shall be set to 5.00V (=100% armature current).

Tachogenerator input (9 Bits + sign)
The speed feedback with tachogenerator is set with the parameter Speed Meas mode (5.02) = Tacho. The tachogenerator shall be connected to the appropriate inputs of the terminal block corresponding to its voltage level. The maximum tachogenerator voltage at maximum speed is decisive, e.g.:
Tachogenerator selection: 60 V / 1000 rpm
max. motor speed: 3000 rpm
max. tachogenerator voltage: 180V



The right connections for this tachogenerator are **X1:1** and **X1:4**

Some applications may require that the voltage potential of the tachogenerator be connected to the 0V potential of the converter and/or not be connected. This setting is made with the jumper S1:1-2.
S1:1-2 jumpered: 0V connection between tachogenerator and converter
S1:1-2 open: no 0V connection

If a tachogenerator feedback is used the speed will require adjustment by means of potentiometer R115. The control panel or the PC tool support the adjustment during the prompted start-up.

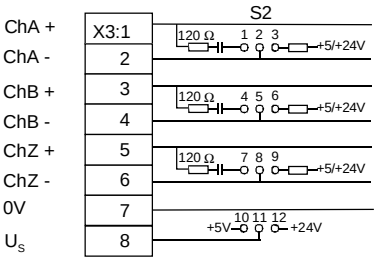
Input voltage range of the A/D converter is ±5V. Scaling of speed actual signal is 4V = 100% speed.

Encoder inputs ChA+…ChZ-
Speed feedback with a encoder is set in the parameter Speed Meas Mode (5.02) = Encoder and the encoder increments per revolution are set with the parameter Encoder Inc (5.03). The supply voltage for the encoder can be taken from the converter by setting the jumper appropriately.
Jumper setting S2: 10-11 +5V encoder supply
S2: 11-12 +24V encoder supply

Connecting the signal lines can be unsymmetrical (without inverted signals) to the terminals X3:1 and X3:3 or symmetrical (with inverted signals) to X3:1...X3:4. The Z signal (including the inverted signal) is not needed in the DCS400.

Jumper S2:
unsymmetrical:
jumpered
ChA- 2-3
ChB- 5-6
(ChZ- 8-9)

symmetrical:
jumpered
ChA- 1-2
ChB- 4-5
(ChZ- 7-8)



DCS400 accuracy

Analog values will be converted to digital values via Anlog Digital Converter (ADC). The accuracy of resolution depends on how much bits are used and is related to 100%. Bipolar values are marked at most significant bit (sign bit).

Resolution of DCS400 inputs and outputs:

Resolution	Steps	Input / Output	Accuracy
Drive controlled by Serial Communication			
15 Bit + sign	±20000	Speed reference/actual val.	0.005%
	±4095	all other reference/actual val.	0.025%
Drive controlled by digital/analogue I/O			
14 Bit + sign	±16383	Incremental Encoder	0.006%
12 Bit + sign	±4095	Current / Torque	0.025%
9 Bit + sign	±511	AI1, AI2	0.2%
9 Bit + sign	±511	AITAC (10V=125%)	0.25%
7 Bit + sign	±127	AO1, AO2	0.8%

If serial communication is used all reference and actual values are representet in a 16 bit data word scaled between +32767 and -32768. For speed reference/actual values only ±20000 are used, all other reference/actual values are scaled to ±4095.

If tacho feedback is used the nominal speed value is scaled to 80% of full resolution. A speed measurement up to 125% of nominal speed is possible. The accuracy is 0,25% related to nominal speed.

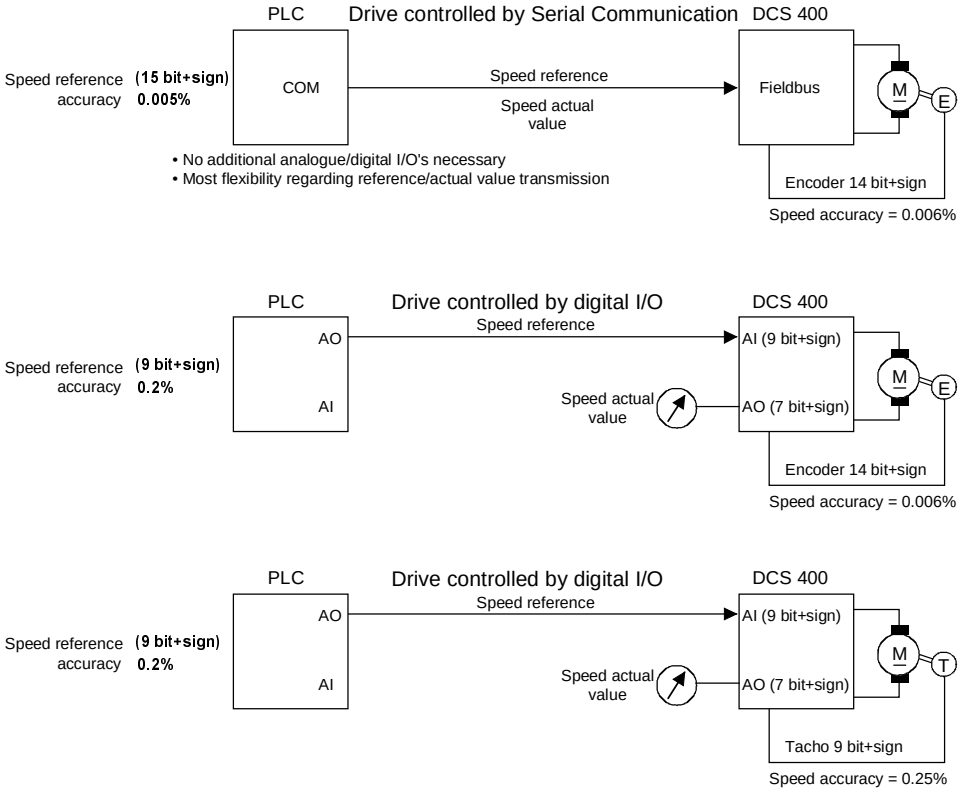


Fig. 4.3/1: Comparison regarding the accuracy between the different control modes

The drive logic controls the switching on and off of the converter and the motor and protects both in exceptional situations, in case of fault or emergency stop. This logic switches on the main contactor, the fans and the field supply. The drive logic uses rising/falling edges, i.e. it responds to 0-1 and 1-0 signal changes.

Switching on and off
The main commands for switching the drive on and off are ON and RUN. The behaviour during switching on and off with the default setting is described below.

Switching on
When the electronic supply has been switched on (or after a fault) the ON and the RUN command must be reset to "0" before logic will accept the switching on commands.

The rising edge of the ON command switches on the main contactor, the fans and the field supply and the converter synchronizes itself to the mains.

The rising edge of the RUN command (starting the drive) enables the ramp generator, the current and speed controller and the drive accelerates to the speed reference value on the ramp set with Accel Ramp (5.09).

The RUN command can be set simultaneously with the ON command.

Switching off
The falling edge of the RUN command (stopping the drive) and Stop Mode (2.03) = Ramp brake the drive on the ramp set with Decel Ramp (5.10), until the actual speed has fallen below the speed set with Zero Speed Lev (5.15). Then the current and the speed controller will be blocked.

If Start Mode (2.09) = Flying Start is set and the RUN command is output again during stopping the drive will accelerate again, irrespective of the selected Stop Mode (2.03).

If Start Mode (2.09) = Flying Start is set and the drive is switched off with the ON command (RUN=1) only switching the drive on will require only the rising edge of the ON command. If the drive has not yet come to a standstill, the drive will accelerate from the actual speed.

The pulses are blocked with the falling edge of the ON command, 100 ms will pass, the main contactor, the fans and the field supply will be switched off and hence the drive will be disconnected from the mains. This command is also effective when the drive is running, braking or has already come to a standstill.

Other behaviour during switching on and off
Switching off modes other than the default setting can be selected with Stop Mode (2.03):

If Stop Mode (2.03) = Torque Lim, the internal speed reference is set to 0 rpm and speed controller brakes the drive along the torque and/or current limit. This requires the balancing of the speed controller before braking. After the minimum speed has been reached the pulses are blocked, the main contactor, the fans and the field supply are switched off and thereby the drive is disconnected from the main.

Stop Mode (2.03) = Coast blocks the pulses and the drive is coasting without control.

If Start Mode (2.09) = Start from Zero is set and the RUN command is output again during stopping this command will be ineffective, i.e. the drive will not start again by itself after the minimum speed has been reached. Only if the RUN command is reset and set again during standstill the drive can be started again.

Switching off with emergency stop
In addition to ON or RUN the drive can be stopped with the Eme Stop command. The procedure is as follows with the default values:

The falling edge of the Eme Stop command generates the warning Eme Stop Pending (A09). At the same time the drive is braking on the ramp set with Eme Stop Ramp (5.11) until the actual speed has fallen below the speed set with Zero Speed Lev (5.15) (minimum speed). Current and speed controllers are blocked, the main contactor, the fans and the field supply are switched off and thereby the drive is disconnected from the mains.

Neither the ON nor the RUN command is effective in this phase. Only upon reaching the minimum speed, can the drive be restarted with the rising edge of the ON and the RUN command.

Switching off behaviour at emergency stop
Eme Mode Stop (2.04) allows the selection of other switching off modes than those provided by the default setting.

If Eme Stop Mode (2.04) = Torque Lim is set the internal speed reference value is set to 0 rpm and the drive will brake along the torque or current limit via the speed controller. this requires the balancing of the speed controller before braking. The pulses are blocked, the main contactor, the fans and the field supply are switched off and thereby the drive is disconnected from the mains after the minimum speed has been reached.

Neither the ON nor the RUN command is active in this phase. Only upon reaching the minimum speed, can the drive be restarted with the rising edges of the ON and the RUN command.

If Eme Stop Mode (2.04) = Coast is set the pulses will be blocked, the main contactor, the fans and the field input will be switched off and thereby the drive will be disconnected from the mains. The drive is coasting without control.

Neither the ON nor the RUN command is effective in this phase. Only upon reaching the minimum speed, can the drive be restarted with the rising edges of the ON and the RUN command.

Special cases
When the stop command (RUN = 0) is present the drive may change to the following events of higher priority which may occur: Comm Fault Mode (2.07) or Eme Stop Mode (2.04) with Eme Stop Mode being able to interrupt Comm Fault Mode.

While the drive is being stopped in accordance with Comm Fault Mode (2.07) or Eme Stop Mode (2.04), an Off command (ON = 0) is prevented and vice versa.

Coasting via field bus communication
The coast bit (COAST) in the control word allows the drive to be de-energized as quickly as possible. The falling edge blocks the pulses, switches off the main contactor, the fans and the field supply and thereby disconnects the drive from the mains. The drive is coasting without control. The coast command (COAST) is executed internally with the highest priority and has the same effect as emergency stop if Eme Stop Mode (2.04) = Coast is set.

Neither the ON nor the RUN command is effective in this phase. Only upon reaching the minimum speed, can the drive be restarted with the rising edges of the ON and the RUN command.

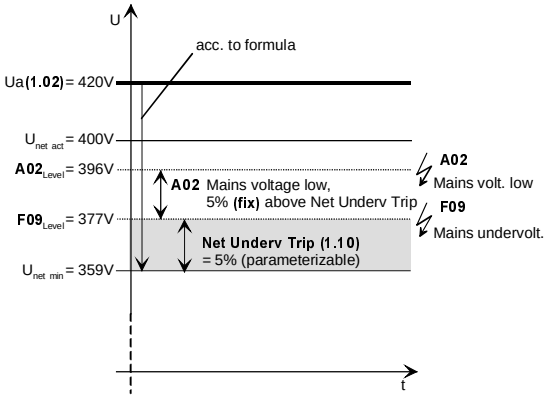
Software functions are described in the context of the individual parameters (see parameter list). Special functions which require an comprehensive parameterization or no parameterization and the service procedures are described below.

4.5.1 Monitoring the Mains Voltage and Auto Reclosing

Monitoring the Mains Voltage
The DCS 400 power part can be connected to mains voltages from 230...500 V. No parameter setting is required for different mains voltages. The minimum tolerated mains voltage is derived from parameter Arm Volt Nom (1.02) [Ua]. If the actual mains voltage is lower than the calculated value fault message F09 is displayed and the drive trips. The minimum tolerated mains voltage is calculated using the following formulas:

$U_{Mains} \geq Ua / (1{,}35 \times \cos alpha)$
cos alpha: 4Q = 30° = 0,866
2Q = 15° = 0,966
4Q: $U_{Mains} \geq Ua / (1{,}35 \times 0{,}866)$
2Q: $U_{Mains} \geq Ua / (1{,}35 \times 0{,}966)$

Using parameter Net Underv Trip (1.10) the trigger level for mains undervoltage detection can be increased. In this way the trigger level can be used as an additional safety distance to the minimum tolerated mains voltage as calculated following the formulas given above.



Example:
Armature voltage (1.02) = 420V (4-Q application)
Main supply = 400V

$U_{net\ min}$ = 420V/(1,35x0,866) = 359V (acc. to 4-Q-form.)
$F09_{Level}$ = $U_{net\ min}$ + 5% = 377V (5% = content of 1.10)
$A02_{Level}$ = $F09_{Level}$ + 5% = 396V (5% = fix)

Auto Reclosing
In parameter Net Fail Time (1.11) the maximum tolerated mains voltage failure time is set. In case of mains undervoltage the drive is blocked and alarm A02 is displayed during this time. If during this time the mains voltage returns to a voltage level higher than the trigger level the drive restarts automatically. After this time elapsed and the mains voltage did not return to a voltage level higher than the trigger level the drive stops operation and fault F09 is displayed. Auto Reclosing is not possible in this case.

Auto Reclosing is prevented if Net Fail Time = 0,0sec is set. In this case the drive will always stop operation with fault message F09 displayed if mains undervoltage occurs.

4.5.2 Monitoring the Actual Speed Value

The speed feedback via tacho-generator or encoder is monitored. If the deviation between the speed calculated from the EMF and the speed feedback is too big the drive will be switched off with a fault message **Speed Meas Fault (F16)**.

Fault conditions:
EMF Act > 50% nominal EMF **and**
Tacho Speed Act < 12.5% Base Speed (1.05)

4.5.3 Automatic field weakening

Without speed-dependent current limiting
The field weakening mode is selected or not selected as a function of the parameter values Base Speed (1.05) and Max Speed (1.06):

no field weakening:
If the contents of Base Speed (1.05) **is identical** with Max Speed (1.06)

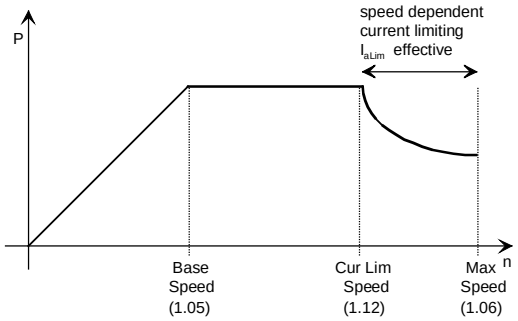
field weakening:
If the contents of Base Speed (1.05) **is smaller** than Max Speed (1.05)

In the case of manual parameterization and no field weakening set both parameters to identical values. With field weakening: set the Base Speed to the nominal speed at nominal armature voltage and Max Speed to the maximum speed at maximum field weakening. If you parameterize the converter with the prompted start-up procedure (Panel Wizard) the parameters will be interrogated during entry and will be set appropriately.

Field weakening is possible only with a tacho-generator or encoder feedback. If the EMF feedback is used the motor can be run only up to the nominal speed Base Speed (1.05). Higher reference values will not cause any increase in speed, there will be no field weakening.

With speed-dependent current limiting
Beyond the normal field weakening range, the armature current of a motor must be reduced because of the commutation problems to be expected. This speed is the maximum electrical speed of a motor. Set the parameter Cur Lim Speed (1.12) to the speed, from which the limitation shall be effective, for this speed dependent current limiting. Within the speed range between Cur Lim Speed (1.12) and Max Speed (1.06) the permissible armature current Cur Arm Max (3.04) is reduced to Ia_{Lim} as a function of speed according to the following formula:

Ia_{Lim} = Arm Cur Max * (Cur Lim Speed / Speed Act)



4.5.4 Overtemperature Protection

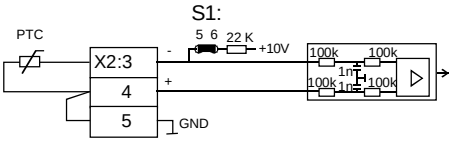
Converter:
DCS400 is equipped with an overtemperature protection on the heat sinks of the thyristors. When the maximum bridge temperature is reached DCS400 switches off with the fault message Converter Overtemp (F7). The converter can be switched on again only after sufficient cooling and acknowledgement of the fault. 5 °C below the cut-out temperature the warning Converter High Temp (A4) is output but the drive is not switched off.

In case of overheating the Fan On signal will be active (fan coasting) until the converter has cooled down. The signal can be evaluated by means of the digital outputs DO1…DO5.

Motor:
The temperature protection of the motor can be evaluated via a PTC element (usually in the field or commutating winding of the motor) in the DCS400. For this purpose the PTC element shall be connected to the AI2 analog input. The response of the DCS400 when the temperature monitor trips is set with the parameter PTC Mode (2.12).

The tripping of the temperature monitor of the motor has the same effect on the Fan ON signal as the converter temperature monitor: The signal remains present until the motor temperature has decreased sufficiently.

PTC connection diagramm:



4.5.5 I^2t function

The DCS400 is equiped with an I^2t-protection for the motor, which can be enabled if required. Parameter Arm Cur Nom (1.01) is the 100% value for the current. All current depending values are related to this parameter.

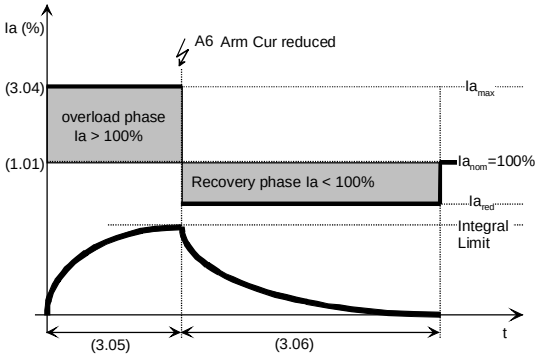
The I^2t-function is enabled if the parameters Overload Time (3.05) and Recovery Time (3.06) are set to a value higher than 0 seconds and the overcurrent in parameter Arm Cur Max (3.04) is set to a value higher than the Arm Cur Nom (1.01).

The function is disabled if the parameter Overload Time (3.05) = 0s, or Recovery Time = 0s, or Arm Cur Max (3.04) = Arm Cur Nom (1.01).

If the recovery time is set to a value too low compared to the overload time, the alarm message Parameter Conflict (A16) "Recovery Time to low" is generated.

In addition to the overcurrent parameters the reference limititations Torque Lim Pos (3.07) and Torque Lim Neg (3.08) have to be set.

It has to be ensured that the parameterized overload times correspond to the overload capability of motor and drive. This has already to be taken into account during the selection process of the drive system.



The overload phase is set using parameters Arm Cur Max (3.04) and Overload Time (3.05). The recovery phase is set using parameter Recovery Time (3.06). In order not to overload the Motor, the I^2t-plane of the two phases have to be identical:

overload phase = recovery phase

$(Ia_{max}^2 - Ia_{nom}^2) \times \text{overload time} = (Ia_{nom}^2 - Ia_{red}^2) \times \text{recovery time}$

In this case it is ensured that the mean value of the armature current does not exceed 100%. To calculate the recovery current the formula is rewritten:

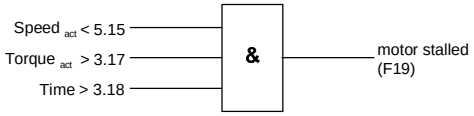
$$Ia_{red} = \sqrt{Ia_{nom}^2 - \frac{\text{overload time}}{\text{recovery time}} * (Ia_{max}^2 - Ia_{nom}^2)}$$

After the overload phase the armature current is automatically reduced / limited to Ia_{red} during the recovery phase. The current reduction during the recovery phase is signaled using alarm message Armature Current reduced (A6). This message is also available at the digital outputs.

Shorter overload phases result in higher recovery currents.

4.5.6 Stall Protection

The stall protection of the motor can be activated with the Stall Time (3.18) parameter. If the value of this parameter is 0.0s the stall protection is switched off. A time >0.0s switches the stall protection on. The following conditions must be fulfilled to trip the monitor:
The actual speed value is smaller than the value in Zero Speed Lev (5.15) and the actual torque value is bigger than the value in Stall Torque (3.17) for a time longer than the value in Stall Time (3.18).



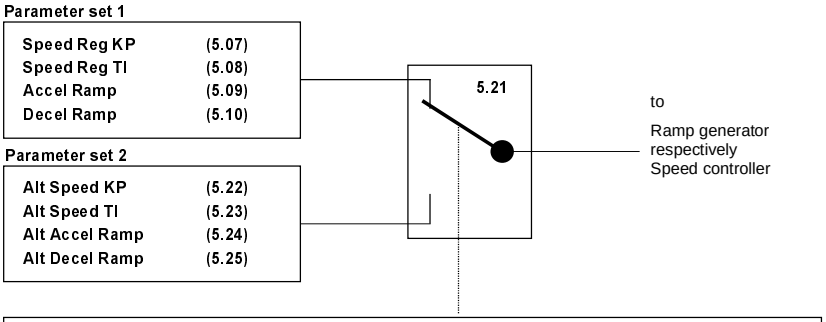
4.5.7 Flux Adaptation

The flux characteristic of the field is not linear to the increase in speed in the field weakening mode. Every field has a characteristic of its own within certain limits. This characteristic can be emulated by means of the parameters Field Cur 40 % (4.07), Field Cur 70% (4.08) and Field Cur 90% (4.09). The characteristic can be determined automatically by means of a service procedure in the parameter Contr Service (7.02).

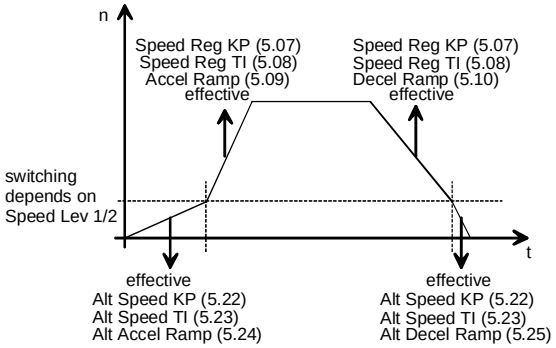
In the case of manual parameterization, make sure that the parameter values are plausible i.e. the value in the parameter Field Cur 40 %(4.07) must be set to a value smaller than the value in Field Cur 70% (4.08), its value in turn must be smaller than the value in Field Cur 90% (4.09). Otherwise, the warning Parameter Conflict (A16) will be generated.

4.5.8 Alternative Parameters for the Speed Controller

A second parameter set is available for the speed controller (Alternative Parameters), which can be activated through events. The speed controller parameters KP and TI and the parameters for the accelerating and deccelerating ramps are switched over. Depending on the speed actual value or the speed deviation (difference between speed actual and speed reference) the behaviour of the speed controller can be influenced. In this way different behaviour during acceleration and deccelleration can be parameterized easily.



Select switch over event for parameter set 2 in parameter **Alt Par Sel (5.21)**:	
0 = disable	Parameter set **1 always** active
1 = enable	Parameter set 2 **always** active
2 = makro depend	depends on the selected macro
3 = Sp < Lev1	if Speed Actual < Speed Level 1 (5.16) parameter set 2 aktive
4 = Sp < Lev2	if Speed Actual < Speed Level 2 (5.17) parameter set 2 aktive
5 = Sp Err<Lev1	if Speed Error < Speed Level 1 (5.16) parameter set 2 aktive
6 = Sp Err<Lev2	if Speed Error < Speed Level 2 (5.17) parameter set 2 aktive



Hint: If the motor drifts during standstill even if speed reference = 0 rpm the following settings are recommended:

Alt Par Sel	= Sp < Lev 1
Alt Accel Ramp	= Accel Ramp (or required)
Alt Decel Ramp	= Decel Ramp (or required)
Alt Speed KP	= Speed Reg KP (or required)
Alt Speed TI	**= 0 ms !**
Speed Lev 1	= Zero Speed Lev (or required)

Through Alt Par Sel = Sp < Lev 1 the switch over to the second parameter set is triggered if the actual motor speed is smaller than the value set with Speed Level 1. After successful switch over the integral part of the speed controller is set to 0 with Alt Speed TI = 0 ms and the motor stops.

Hint: The DCS 400 has no gear protection. However, using the alternative parameters it is possible to reach a smooth rotation change over, if the alternativ parameters for KP and TI are set to appropriate values.

4.5.9 Service Procedures, Contr Service (7.02)

Armature current controller

Autotuning

- On the panel press button LOC; LOC is displayed in the panel status row.
- Select parameter **Contr Service (7.02)** = **Arm Autotun** and confirm with ENTER.
- Within the next 30 seconds press the (I) button on the panel. This starts the autotuning procedure.

The autotuning procedure is successfully finished if the panel displays the message **None**.

After successful autotuning the following controller parameters are set:

Arm Cur Reg KP (3.09)
Current controller proportional gain
Arm Cur Reg TI (3.10)
Current controller integral time constant
Cont Cur Lim (3.11)
Continuous current limit
Arm Inductance (3.12)
Armature motor inductance
Arm Resistance (3.13)
Armature motor resistance

If the autotuning procedure failed the alarm message **Autotuning Failed (A10)** is displayed. Detailed information for the failure reason can be read from parameter **Diagnosis (7.03)**. More explanations to the diagnosis messages are available in the chapter Troubleshooting.

Pressing the LOC button on the panel again the control is switched back to the input/output terminals. The LOC message in the panel status row disappears.

Field current controller

Autotuning

- On the panel press button LOC; LOC is displayed in the panel status row.
- Select parameter **Contr Service (7.02)** = **Fld Autotun** and confirm with ENTER.
- Within the next 30 seconds press the (I) button on the panel. This starts the autotuning procedure.

The autotuning procedure is successfully finished if the panel displays the message **None**.

After successful autotuning the following controller parameters are set:

Field Cur KP (4.03)
Field current controller proportional gain
Field Cur TI (4.04)
Field current controller integral time constant
EMF Reg KP (4.11)
EMF controller proportional gain
EMF Reg TI (4.12)
EMF controller integral time constant

If the autotuning procedure failed the alarm message **Autotuning Failed (A10)** is displayed. Detailed information for the failure reason can be read from parameter **Diagnosis (7.03)**. More explanations to the diagnosis messages are available in the chapter Troubleshooting.

Pressing the LOC button on the panel again the control is switched back to the input/output terminals. The LOC message in the panel status row disappears.

Manual Tuning

Preparation:

- Set Commis Ref 1 (7.15) = 0
- Commis Ref 2 (7.16) = 4096.
- Set Squarewave Per (7.17) = 5s.

The output of the Squarewave Generator (7.18) switches between 0 and 4096. 4096 corresponds to the set nominal field current (Field Cur Nom 1.03).

- Assign the actual current value (4.02) to analog output AO1 Ass (6.05) or AO2 Ass (6.06) and measure it or check the field current with a current probe.

Activate tuning:

- Set parameter Contr Service (7.02) = Fld Man.
- Switch on and enable the drive via the terminal block (ON=1, RUN=1) or switch on (I) the drive with operating panel in the LOCAL mode. The field current is flowing, but there is no armature current. The reference value of the field current is now following the output limited to 0 to 4096 of the Squarewave Generator (7.18).

Tuning:

- Now set the field current controller with the parameters Field Cur KP (4.03) and Field Cur TI (4.04). The procedure can aborted by setting the parameter Contr Services (7.02) = 0 or switching the drive off (ON=0, RUN=0). In this case, Contr Service (7.02) is reset automatically.

Speed controller

Autotuning

- On the panel press button LOC; LOC is displayed in the panel status row.
- Select parameter **Contr Service (7.02)** = **Sp Autotun** and confirm with ENTER.
- Within the next 30 seconds press the (I) button on the panel. This starts the autotuning procedure.

Attention: Motor will accelerate twice to 80% of Base Speed

The autotuning procedure is successfully finished if the panel displays the message **None**.

After successful autotuning the following controller parameters are set:

Speed Reg KP (5.07)
Speed controller proportional gain
Speed Reg TI (5.08)
Speed controller integral time constant

If the autotuning procedure failed the alarm message **Autotuning Failed (A10)** is displayed. Detailed information for the failure reason can be read from parameter **Diagnosis (7.03)**. More explanations to the diagnosis messages are available in the chapter Troubleshooting.

Pressing the LOC button on the panel again the control is switched back to the input/output terminals. The LOC message in the panel status row disappears.

Flux adaptation

Autotuning

- On the panel press button LOC; LOC is displayed in the panel status row.
- Select parameter **Contr Service (7.02)** = **Flux Adapt** and confirm with ENTER.
- Within the next 30 seconds press the (I) button on the panel. This starts the autotuning procedure.

Attention: Motor will accelerate to 50% of Base Speed

The autotuning procedure is successfully finished if the panel displays the message **None**.

After successful autotuning the following controller parameters are set:

Field Cur 40% (4.07)
Field current for 40% flux
Field Cur 70% (4.08)
Field current for 70% flux
Field Cur 90% (4.09)
Field current for 90% flux

If the autotuning procedure failed the alarm message **Autotuning Failed (A10)** is displayed. Detailed information for the failure reason can be read from parameter **Diagnosis (7.03)**. More explanations to the diagnosis messages are available in the chapter Troubleshooting.

Pressing the LOC button on the panel again the control is switched back to the input/output terminals. The LOC message in the panel status row disappears.

Thyristor diagnosis

Self diagnosis

- On the panel press button LOC; LOC is displayed in the panel status row.
- Select parameter **Contr Service (7.02)** = **Thyr Diag** and confirm with ENTER.
- Within the next 30 seconds press the (I) button on the panel. This starts the self-diagnosis procedure.

The thyristor diagnosis procedure is successfully finished if the panel displays the message **None**. That means no defective thyristor(s) were detected.

If the diagnosis procedure failed the fault message **Hardware Fault (F02)** is displayed. Detailed information for the failure reason can be read from parameter **Diagnosis (7.03)**. More explanations to the diagnosis messages are available in the chapter Troubleshooting.

Pressing the LOC button on the panel again the control is switched back to the input/output terminals. The LOC message in the panel status row disappears.

4.5.10 Internal Scaling

You can display all parameters of the DCS400 in their physical quantities by means of operating panel or the PC tool, in the way they are specified in the column "Unit" at the parameter list:
A, V, rpm, Hz, %, s, ms, text, integer, mH, mOhm, %/msec, °C, kW, hex.

In case of serial drive control (**reference/actual value transmission**) with PLC (field bus coupling, RS232 port, panel port) the internal scaling of these values shall be considered. There is no transmission of physical quantities but values are transmitted in binary representation.

Example: The maximum speed reference of a drive of 3000 rpm is transmitted in a 16-bit telegram word. In this case 3000 rpm are equal to the maximum value of 20.000 decimal i.e. the resolution of the speed is in steps of 1/20,000. This value 20,000 is transmitted on the bus as a binary value in a 16-bit combination of "0" and "1". Each bit has a decimal valency. Hence 20,000 shall be distributed over these 16 bits in such a way that the decimal sum of set "1's" is again 20,000.

Representation of the decimal value 20,000 as 16-bit pattern

line1	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
line2	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
line3	**0**	**1**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

Line 1 - positions of the 16 bits
Line 2 - decimal valency of each bit
Line 3 - bit combination of "0" and "1", whose checksum is 20,000

Other values of the DCS400 are resolved with a maximum value of 4096.

Table of internal scaling:

This internal scaling does not apply to the transmission of **parameters** via PLC. In this kind of transmission, decimal values are simply transmitted in binary form i.e. the values of the parameter list are represented in decimal form and without a decimal point in a 16-bit word.

Decimal values without decimal point are transmitted in the same form as they are represented in the parameter list. In this case, e.g. the parameter Base Speed (1.05) will be set to 3000 if the nominal speed is intended to be 3000 rpm.

Decimal values with decimal point are simply transmitted as a number without decimal point but with all decimal digits. In this case, e.g. the parameter Field Cur Nom (1.03) will be set to 650 if the nominal field current is intended to be 6.50 A. Parameters with other engineering units shall be treated in the same way.

Exception:
Selection parameters (unit: Text) have a number preceding the text in the parameter list. Every number represents a text and/or a function. Overwriting the number changes the selection in the parameter. If a such parameter is read the number will be transmitted, not the text.

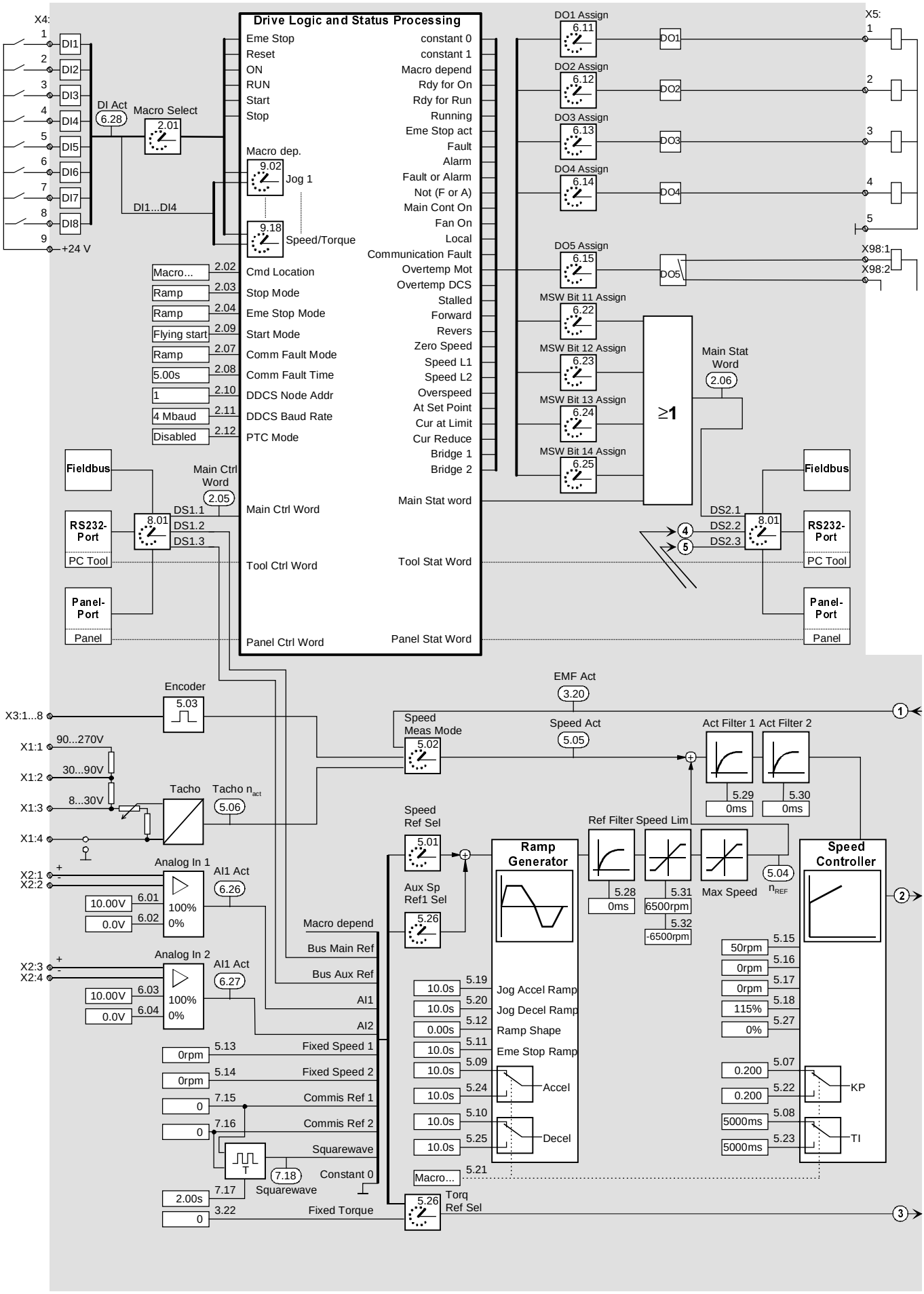
Incorrect parameter transmission
Writing parameters may cause the output of fault messages if

- the values are outside of the min. / max. definition (according to the parameter list)
- writing is on actual value parameters (signals) or constants
- writing is on parameters which are blocked during operation

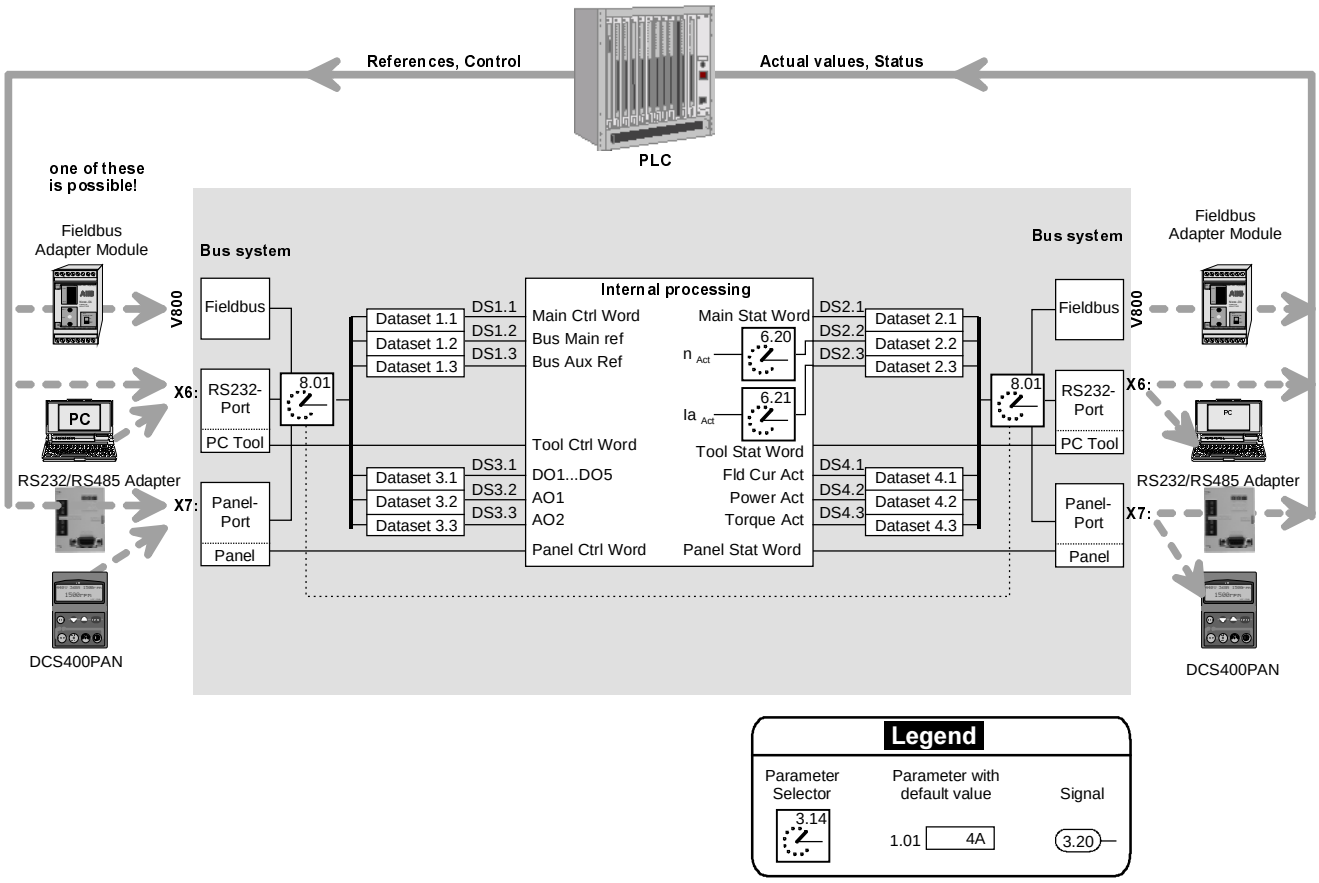
In such cases, a fault telegram will be generated which must be evaluated in the PLC.

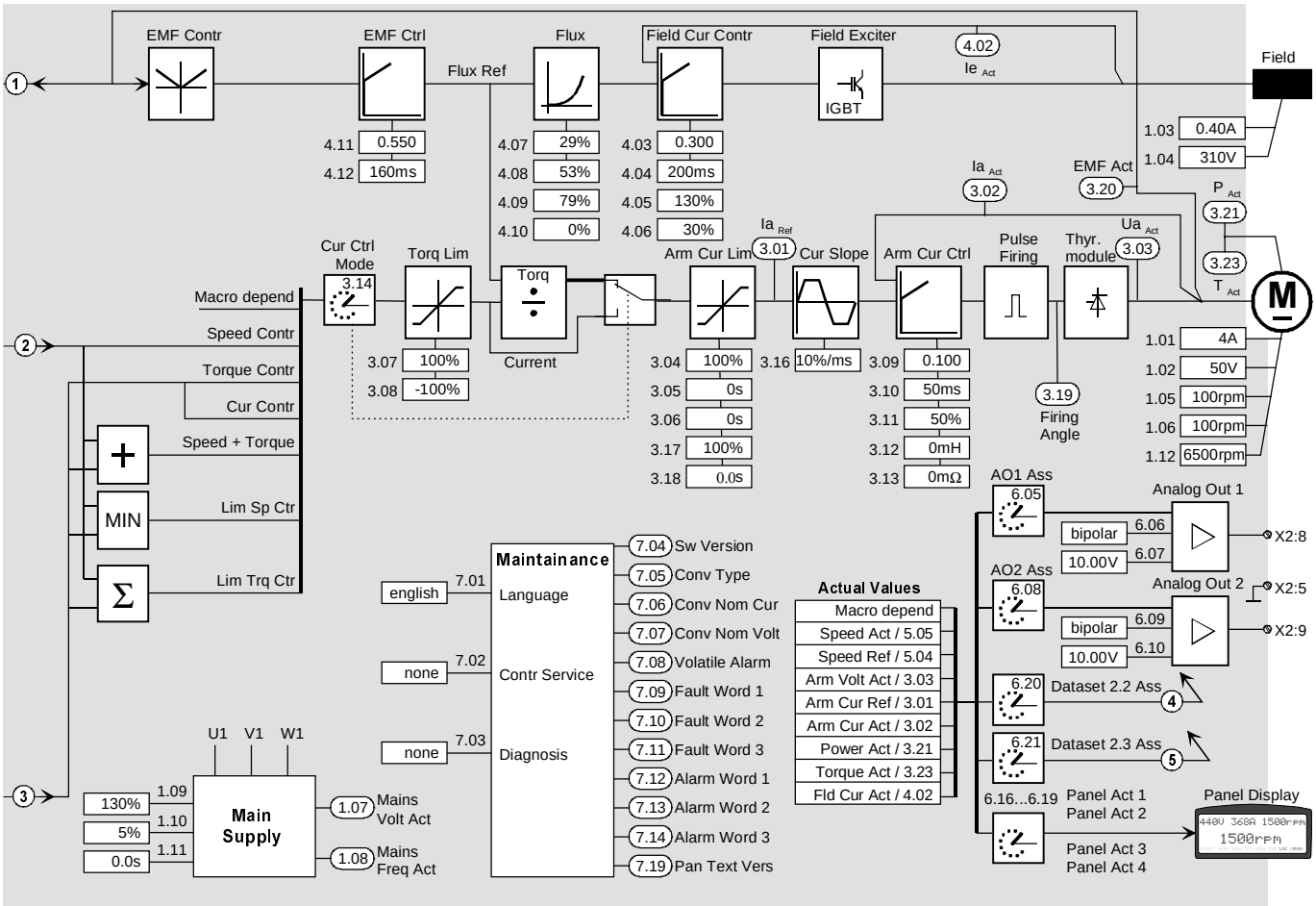
Signal	Internal value (decimal)	Corresponds to value (on operating panel or PC tool)
Actual speed value (5.05)	20,000	100% speed in rpm
Speed reference value (5.04)	20,000	100% speed in rpm.
Armature voltage actual value (3.03)	4,096•(U_a/EMF)	100% nominal armature voltage in V
Armature current reference value (3.01)	4,096	100% nominal armature current in A
Armature current actual value (3.02)	4,096	100% nominal armature current in A
Actual power value (3.21)	4,096	100% power in %
Actual torque value (3.23)	4,096	100% torque in %
Actual field current value (4.02)	4,096	100% nominal field current in A
Actual EMF of motor (3.20)	4,096	100% nominal EMF in V

Default in service procedure Contr Service (7.02)	Internal value (decimal)	Corresponds to value
Field current reference	4,096	100% of nominal field current in A


Drive Logic and Status Processing
Eme Stop
Reset
ON
RUN
Start
Stop
Macro dep.
Jog 1
Speed/Torque
Cmd Location
Stop Mode
Eme Stop Mode
Start Mode
Comm Fault Mode
Comm Fault Time
DDCS Node Addr
DDCS Baud Rate
PTC Mode
Main Ctrl Word
Tool Ctrl Word
Panel Ctrl Word
constant 0
constant 1
Macro depend
Rdy for On
Rdy for Run
Running
Eme Stop act
Fault
Alarm
Fault or Alarm
Not (F or A)
Main Cont On
Fan On
Local
Communication Fault
Overtemp Mot
Overtemp DCS
Stalled
Forward
Revers
Zero Speed
Speed L1
Speed L2
Overspeed
At Set Point
Cur at Limit
Cur Reduce
Bridge 1
Bridge 2
Main Stat word
Tool Stat Word
Panel Stat Word
DI Act
Macro Select
DI1...DI4
+24 V
DO1 Assign
DO2 Assign
DO3 Assign
DO4 Assign
DO5 Assign
MSW Bit 11 Assign
MSW Bit 12 Assign
MSW Bit 13 Assign
MSW Bit 14 Assign
Main Stat Word
Fieldbus
RS232-Port
PC Tool
Panel-Port
Panel
Encoder
Speed Meas Mode
EMF Act
Speed Act
Act Filter 1
Act Filter 2
Tacho
Analog In 1
Analog In 2
Speed Ref Sel
Aux Sp Ref1 Sel
Ramp Generator
Ref Filter
Speed Lim
Max Speed
Speed Controller
Macro depend
Bus Main Ref
Bus Aux Ref
AI1
AI2
Fixed Speed 1
Fixed Speed 2
Commis Ref 1
Commis Ref 2
Squarewave
Constant 0
Fixed Torque
Jog Accel Ramp
Jog Decel Ramp
Ramp Shape
Eme Stop Ramp
Accel
Decel
KP
TI
Torq Ref Sel

Overview of alternatve Drive Controlling possibilities





Parameter overview

1 - Motor Settings	2 - Operation Mode	3 - Armature	4 - Field
1.01 Arm Cur Nom *	2.01 Macro Select *	**3.01 Arm Cur Ref**	**4.01 Field Cur Ref**
1.02 Arm Volt Nom *	2.02 Cmd Location	**3.02 Arm Cur Act**	**4.02 Field Cur Act**
1.03 Field Cur Nom *	2.03 Stop Mode *	**3.03 Arm Volt Act**	4.03 Field Cur KP
1.04 Field Volt Nom *	2.04 Eme Stop Mode *	3.04 Arm Cur Max *	4.04 Field Cur TI
1.05 Base Speed *	**2.05 Main Ctrl Word**	3.05 Overload Time	4.05 Fld Ov Cur Trip
1.06 Max Speed *	**2.06 Main Stat Word**	3.06 Recovery Time	4.06 Field Low Trip
1.07 Mains Volt Act	2.07 Comm Fault Mode	3.07 Torque Lim Pos *	4.07 Field Cur 40%
1.08 Mains Freq Act	2.08 Comm Fault Time	3.08 Torque Lim Neg *	4.08 Field Cur 70%
1.09 Arm Overv Trip	2.09 Start Mode	3.09 Arm Cur Reg KP	4.09 Field Cur 90%
1.10 Net Underv Trip	2.10 DDCS Node Addr	3.10 Arm Cur Reg TI	4.10 Field Heat Ref
1.11 Net Fail Time	2.11 DDCS Baud Rate	3.11 Cont Cur Lim	4.11 EMF KP
1.12 Cur Lim Speed	2.12 PTC Mode	3.12 Arm Inductance	4.12 EMF TI
	2.13 Fan Delay	3.13 Arm Resistance	
		3.14 Cur Contr Mode	
		3.15 Torque Ref Sel	
		3.16 Cur Slope	
		3.17 Stall Torque *	
		3.18 Stall Time *	
		3.19 Firing Angle	
		3.20 EMF Act	
		3.21 Power Act	
		3.22 Fixed Torque	
		3.23 Torque Act	
		3.24 Cur Lim 2 Inv	

5 - Speed Controller	6 - Input/Output	7 - Maintenance	8 - Fieldbus	9 - Macro Adaptation
5.01 Speed Ref Sel	6.01 AI1 Scale 100%	7.01 Language *	8.01 Fieldbus Par 1	9.01 MacParGrpAction
5.02 Speed Meas Mode *	6.02 AI1 Scale 0%	7.02 Contr Service	8.02 Fieldbus Par 2	9.02 Jog 1
5.03 Encoder Inc *	6.03 AI2 Scale 100%	**7.03 Diagnosis**	8.03 Fieldbus Par 3	9.03 Jog 2
5.04 Speed Ref	6.04 AI2 Scale 0%	**7.04 SW Version**	8.04 Fieldbus Par 4	9.04 COAST
5.05 Speed Act	6.05 AO1 Assign *	**7.05 Conv Type**	8.05 Fieldbus Par 5	9.05 User Fault
5.06 Tacho Speed Act	6.06 AO1 Mode *	**7.06 Conv Nom Cur**	8.06 Fieldbus Par 6	9.06 User Fault Inv
5.07 Speed Reg KP	6.07 AO1 Scale 100% *	**7.07 Conv Nom Volt**	8.07 Fieldbus Par 7	9.07 User Alarm
5.08 Speed Reg TI	6.08 AO2 Assign *	**7.08 Volatile Alarm**	8.08 Fieldbus Par 8	9.08 User Alarm Inv
5.09 Accel Ramp *	6.09 AO2 Mode *	**7.09 Fault Word 1**	8.09 Fieldbus Par 9	9.09 Dir of Rotation
5.10 Decel Ramp *	6.10 AO2 Scale 100% *	**7.10 Fault Word 2**	8.10 Fieldbus Par 10	9.10 MotPot Incr
5.11 Eme Stop Ramp *	6.11 DO1 Assign *	**7.11 Fault Word 3**	8.11 Fieldbus Par 11	9.11 MotPot Decr
5.12 Ramp Shape	6.12 DO2 Assign *	**7.12 Alarm Word 1**	8.12 Fieldbus Par 12	9.12 MotPotMinSpeed
5.13 Fixed Speed 1	6.13 DO3 Assign *	**7.13 Alarm Word 2**	8.13 Fieldbus Par 13	9.13 Ext Field Rev
5.14 Fixed Speed 2	6.14 DO4 Assign *	**7.14 Alarm Word 3**	8.14 Fieldbus Par 14	9.14 AlternativParam
5.15 Zero Speed Lev *	6.15 DO5 Assign *	7.15 Commis Ref 1	8.15 Fieldbus Par 15	9.15 Ext Speed Lim
5.16 Speed Level 1 *	6.16 Panel Act 1	7.16 Commis Ref 2	8.16 Fieldbus Par 16	9.16 Add AuxSpRef
5.17 Speed Level 2 *	6.17 Panel Act 2	7.17 Squarewave Per		9.17 Curr Lim 2 Inv
5.18 Overspeed Trip	6.18 Panel Act 3	**7.18 Squarewave Act**		9.18 Speed/Torque
5.19 Jog Accel Ramp	6.19 Panel Act 4	**7.19 Pan Text Vers**		
5.20 Jog Decel Ramp	6.20 Dataset 2.2 Ass	**7.20 CPU Load**		
5.21 Alt Par Sel	6.21 Dataset 2.3 Ass			
5.22 Alt Speed KP	6.22 MSW Bit 11 Ass			
5.23 Alt Speed TI	6.23 MSW Bit 12 Ass			
5.24 Alt Accel Ramp	6.24 MSW Bit 13 Ass			
5.25 Alt Decel Ramp	6.25 MSW Bit 14 Ass			
5.26 Aux Sp Ref Sel	**6.26 AI1 Act**			
5.27 Drooping	**6.27 AI2 Act**			
5.28 Ref Filt Time	**6.28 DI Act**			
5.29 Act Filt 1 Time				
5.30 Act Filt 2 Time				
5.31 Speed Lim Fwd				
5.32 Speed Lim Rev				

Legend

normal	Parameter, constantly available
Grey shaded	hidden Parameters and **Signals (actual values)**
Bold	**Signals (actual values)**
underlined	by Autotuning influenced parameters
*	by Start-up wizard influenced parameters (Panel & PC)

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom setting
Grp 1	**Motor Settings**						
1.01 Wizard	**Arm Cur Nom** Nominal motor current in amperes (indicated on the motor's rating plate).	4	820	4	A	x	
1.02 Wizard	**Arm Volt Nom** Nominal motor voltage in volts (indicated on the motor's rating plate).	50	700	50	V	x	
1.03 Wizard	**Field Cur Nom** Nominal field current in amperes (indicated on the motor's rating plate).	0.10	16.00	0.40	A	x	
1.04 Wizard	**Field Volt Nom** Nominal field voltage in volts (indicated on the motor's rating plate).	50	350	310	V	x	
1.05 Wizard	**Base Speed** Nominal motor speed in revolutions/minute (indicated on the motor's rating plate). Base Speed = Max Speed = **no** Fieldweakening Base Speed < Max Speed = **Fieldweakening** Base Speed > Max Speed = **Speed Limitation**	100	6500	100	rpm	x	
1.06 Wizard	**Max Speed** Maximum motor speed in revolutions/minute (indicated on the motor's rating plate). Base Speed = Max Speed = **no** Fieldweakening Base Speed < Max Speed = **Fieldweakening** Base Speed > Max Speed = **Speed Limitation**	100	6500	100	rpm	x	
1.07 Signal	**Mains Volt Act** Measured mains voltage in volts.	-	-	-	V		
1.08 Signal	**Mains Freq Act** Measured mains frequency in hertz.	-	-	-	Hz		
	Long Parameter Menu						
1.09	**Arm Overv Trip** Motor overvoltage tripping limit in % related to the nominal motor voltage (1.02)	20	150	130	%		
1.10	**Net Underv Trip** Depending on the nominal motor voltage (1.02) is calculated the smallest allowable mains voltage. With this parameter, an additional security-spacing, with reference to the smallest mains voltage, is determined. The smallest mains voltage amount is $U_{mains} \geq Ua / (1{,}35 \times \cos alpha)$ cos alpha: 4Q = 30° = 0,866 2Q = 15° = 0,966 4Q: $U_{mains} \geq Ua / (1{,}35 \times 0{,}866)$ 2Q: $U_{mains} \geq Ua / (1{,}35 \times 0{,}966)$	0	50	5	%		
1.11	**Net Fail Time** During this time the supply voltage must return to a value higher than Net Underv Trip (1.10). Otherwise an undervoltage trip will be generated. 0 = restart prevented. In case of mains under-voltage the drive will switch off with a fault message. >0 = automatic restart of the drive if the mains voltage recovers within the set time. ($U_{line>}$ result of (**1.10**))	0.0	10.0	0.0	s	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom setting
Grp 1	**Motor Settings (continued)**						
1.12	**Cur Lim Speed** Speed-dependent current limitation. From this speed value onward, the armature current will be reduced to a proportional basis of 1/n. Cur Lim Speed > Max Speed = no speed depend current limit. Cur Lim Speed < Max Speed = speed depend current limitation	100	6500	6500	rpm	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 2	**Operation Mode**						
2.01 Wizard	**Macro Select** Selection of desired macro: 0 = Standard 1 = Man/Const Sp 2 = Hand/Auto 3 = Hand/MotPot 4 = Jogging 5 = Motor Pot 6 = ext FieldRev 7 = Torque Cntrl	0	7	0	Text	X	
2.02	**Cmd Location** Selection of the desired command location. The command location which has been set controls the drive (**ON** / **RUN**). **Emergency stop** and **reset** from the **terminal block** are **also** effective in the case of **bus** control. 0 = macro depend command location is depend on the selected macro 1 = Terminals command location is Terminal X4:1…8 2 = Bus command location is a PLC, connected to the Panel-Port or RS232-Port or Fieldbus Adapter 3 = Key Automatic switch over between Bus (2) and Terminals (1). Standard command location is Bus. In case of communication faults the command location switches over from Bus to Terminals. In this case it is possible to control the drive via ON and RUN commands from Terminals. The commands could be connected to a key switch. When the switch will be closed the drive starts and accelerate to a speed defined in parameter Fixed Speed (5.13) (provided that Speed Ref Sel (5.01) has been set to Bus Main Ref). When the switch will be opened the command location switches back to Bus only in case of no communication faults.	0	2	0	Text	X	
2.03 Wizard	**Stop Mode** Selection of the desired operating response to a stop command (controller blocking): 0 = Ramp Motor is decelerated in acc. with a ramp (5.10) 1 = Torque Lim Motor is decelerated in accordance with the torque limit 2 = Coast Motor coasts to zero speed Response time of deceleration by Ramp or Torque depends on optimization of speed regulator.	0	2	0	Text	X	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 2	**Operation Mode (continued)**						
2.04 Wizard	**Eme Stop Mode** Selection of the desired operating response to an emergency stop command: 0 = Ramp Motor is decelerated in acc. with a ramp (5.11) 1 = Torque Lim Motor is decelerated in accordance with the torque limit 2 = Coast Motor coasts to zero speed Response time of deceleration by Ramp or Torque depends on optimization of speed regulator.	0	2	0	Text	X	
2.05 Signal	**Main Ctrl Word** The Main Ctrl Word maps the control bits of the drive. This parameter indicates the control bits of the terminal block or of the bus communication. The allocation is identical with the control word of field bus communication. Bit hex definition (log. „1“state) 00 0001 On 01 0002 Coast 02 0004 Eme Stop 03 0008 Run 04 0010 - 05 0020 - 06 0040 - 07 0080 Reset 08 0100 Jog 1 09 0200 Jog 2 10 0400 - 11 0800 MCW Bit 11 12 1000 MCW Bit 12 13 2000 MCW Bit 13 14 4000 MCW Bit 14 15 8000 MCW Bit 15	-	-	-	hex		
2.06 Signal	**Main Stat Word** The Main Stat Word maps the status bits of drive and status logic. The allocation is identical with the status word of field bus communication. Bit hex definition (log. "1" state) 00 0001 Rdy On 01 0002 Rdy Running 02 0004 Running 03 0008 Fault 04 0010 Coast Act (not) 05 0020 Eme Stop Act (not) 06 0040 - 07 0080 Alarm 08 0100 At Setpoint 09 0200 Remote 10 0400 Above Limit 1 11 0800 MSW Bitt 11 Ass 12 1000 MSW Bitt 12 Ass 13 2000 MSW Bitt 13 Ass 14 4000 MSW Bitt 14 Ass 15 8000 DDCS Breakdown	-	-	-	hex		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 2	**Operation Mode (continued)**						
	Long Parameter Menu						
2.07	**Comm Fault Mode** Selection of the desired operating response to a communication failure: 0 = Ramp Motor is decelerated in accordance with a ramp 1 = Torque Lim Motor is decelerated in accordance with the torque limit 2 = Coast fault message and shutdown of drive Response time of deceleration by Ramp or Torque depends on optimization of speed regulator.	0	2	0	Text		
2.08	**Comm Fault Time** Tolerance time for fault messages in the case of communication faults. Time between two successive messages. If (2.08) = 0.00 s ignore, and continue with ongoing operation	0.00	10.00	5.00	s	X	
2.09	**Start Mode** Selection of the desired operating response to a start command, while drive is still rotating, braking or coasting 0 = Start From 0: wait until motor has reached zero speed, then re-start 1 = Flying start: Start with the motor actual speed	0	1	1	Text	X	
2.10	**DDCS Node Addr** Internal DDCS address between DCS400 and the field bus adapter.	1	254	1	integer	X	
2.11	**DDCS Baud Rate** Transmission speed between DCS400 and field bus adapter. 0 = 8 Mbaud 1 = 4 Mbaud 2 = 2 Mbaud 3 = 1 Mbaud	0	3	1	integer	X	
2.12	**PTC Mode** The response of the drive when the thermistor trips is selectable: 0 = Disabled no PTC evaluation 1 = Alarm generates **Alarm A05** only 2 = Fault generates **Fault F08** and switches the drive off. A thermistor in the motor (PTC element) can be evaluated via the analog input **AI2** in DCS400. Thermistor connection to **X2:3** and **X2:4.** Connect **X2:4** with **X2:5 (0V).** Insert the jumper **S1:5-6** (22k to 10V). If PTC is allocated to **AI2** this input will not be available to other functions any more. If **AI2** is parameterized as a reference source, the Alarm **Parameter Conflict (A16)** will be generated**.**	0	2	0	Text	X	
2.13	**Fan Delay** Adjustable time for signal „**Fan On**“. Will be started when the drive is switched off (ON=0). If motor or DCS400 is overheated, Fan Delay will be started after cooling.	0	1200	0	s		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 3	**Armature**						
3.01 Signal	**Arm Cur Ref** Armature current reference value in amperes.	-	-	-	A		
3.02 Signal	**Arm Cur Act** Measured armature current actual value in amperes.	-	-	-	A		
3.03 Signal	**Arm Volt Act** Measured armature voltage actual value in volts.	-	-	-	V		
3.04 Wizard	**Arm Cur Max** Overload current. Max. permissible armature current in % related to the nominal motor current (1.01). **In**dependent of the sign, applies to either direction. Directional limitations are set in par. Torque Lim Pos (3.07) and Torque Lim Neg (3.08).	0	200	100	%	x	
3.05	**Overload Time** Overload time for I^2t function. Max. permissible time for the armature current (3.04). 0 = I^2t function disabled.	0	180	0	s		
3.06	**Recovery Time** Recovery time for I^2t function, during which a reduced current must flow. 0 = I^2t function disabled.	0	3600	0	s		
3.07 Wizard	**Torque Lim Pos** Positive overload torque. Max. permissible positive torque in % related to the nominal torque. (The nominal torque is defined as the torque resulting from nominal field current and nominal armature current) The torque reference is limited as a function of the sign. The current resulting from this operation is then limited in parameter Arm Cur Max (3.04) independent of the sign i.e. the smaller the two values will be effective. Is also used as positive current limitation if Cur Contr Mode (3.14) = Cur Contr	0	200	100	%	X	
3.08 Wizard	**Torque Lim Neg** Negative overload torque. Max. permissible negative torque in % related to the nominal torque. (The nominal torque is defined as the torque resulting from nominal field current and nominal armature current) Limits the torque reference as a function of the sign. The current resulting from this operation is then limited in par. Arm Cur Max (3.04) independent of the sign i.e. the smaller the two values (amounts) will be effective. Is also used as negative current limitation if Cur Contr Mode (3.14) = Cur Contr	-200	0	-100 (4-Q) 0 (2-Q)	%	X	
3.09 auto-tuning	**Arm Cur Reg KP** Proportional gain of the armature current controller (PI controller).	0.000	10.000	0.100	integer		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 3	**Armature (continued)**						
3.10 auto-tuning	**Arm Cur Reg TI** Integration time constant of the armature current controller (PI controller) in milliseconds.	0.0	1000.0	50.0	ms		
3.11 auto-tuning	**Cont Cur Lim** Armature current value at the limit between intermittent and continuous current in % related to the nominal motor current (1.01)	0	100	50	%		
3.12 auto-tuning	**Arm Inductance** Armature circuit inductance in millihenries.	0.00	655.35	0.00	mH	x	
3.13 auto-tuning	**Arm Resistance** Armature circuit resistance in milliohms.	0	65535	0	mOhm	x	
	Long Parameter Menu						
3.14	**Cur Contr Mode** 0 = Macro depend: The operating mode is defined by macro, see macro descript. 1 = Speed Contr: Speed control 2 = Torque Contr: Torque control 3 = Cur Contr: Current control 4 = Speed+Torque: Speed + torque, both reference values are added 5 = Lim SP Ctr: Speed control with external torque limitation. That speed reference via AI1 can be limited externally via AI2 in its torque. The torque limitation is sign-independent. 6 = Lim Trq Ctr: Torque control with speed limitation (window control mode) for master-slave applications. Master and slave receive the same speed reference. The slave has its own speed feedback (tacho-generator / encoder), but is working in the current or torque control mode. If the speed deviation (reference / actual value) is too big, there will be an automatic changeover to speed control until the deviation is corrected. Then this mode will be resumed.	0	6	0	Text	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 3	**Armature (continued)**						
3.15	**Torque Ref Sel** Selection of the desired torque reference location: 0 = Macro depend / dependent on the select. macro 1 = AI1 / analog input 1 (X2:1-2) 2 = AI2 / analog input 2 (X2:3-4) 3 = Bus Main Ref / main fieldbus reference value 4 = Bus Aux Ref / auxiliary fieldbus reference value 5 = Fixed Torque / fixed torque value (3.22) 6 = Commis Ref1 / commissioning reference value 1 7 = Commis Ref2 / commissioning reference value 2 8 = Squarewave / square-wave generator 9 = Const Zero / constant zero speed It is also used as current reference source if Cur Contr Mode (3.14) = Cur Contr	0	9	0	Text	X	
3.16	**Cur Slope** Max. permissble modification of the armature current reference value (di/dt) in % per millisecond related to the nominal motor current (1.01).	0.1	30.0	10.0	% / ms		
3.17 Wizard	**Stall Torque** Motor stall protection. Stall protection tripping threshold in % of the nominal torque at stalled motor. (The nominal torque is defined as the torque resulting from nominal field current and nominal armature current)	0	200	100	%		
3.18 Wizard	**Stall Time** Motor stall protection. Time interval in seconds, during which the stall protection tripping threshold at stalled motor must be exceeded.	0.0	60.0	0.0	s		
3.19 Signal	**Firing Angle** Actual firing angle in degrees	-	-	-	°		
3.20 Signal	**EMF Act** Actual counter EMF of motor in volts.	-	-	-	V		
3.21 Signal	**Power Act** Actual power output in kilowatts (updating all 20 ms)	-	-	-	kW		
3.22	**Fixed Torque** Fixed torque value presetting. Fixed torque value in % related to the nominal torque. (The nominal torque is defined as the torque resulting from nominal field current and nominal armature current)	-100	100	0	%		
3.23 Signal	**Torque Act** Actual torque value in % related to the nominal torque. (The nominal torque is defined as the torque resulting from nominal field current and nominal armature current)	-	-	-	%		
3.24	**Cur Lim 2 Inv** Second current limitation in % related to the nominal motor current (1.01). Can be activated via binary signal. Refer also to parameter (9.17).	0	200	100	%	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 4	**Field**						
4.01 Signal	**Field Cur Ref** Field current reference value in amperes.	-	-	-	A		
4.02 Signal	**Field Cur Act** Measured field current actual value in amperes.	-	-	-	A		
4.03 auto-tuning	**Field Cur KP** Proportional gain of the field current controller (PI controller).	0.000	13.499	0.300	integer		
4.04 auto-tuning	**Field Cur TI** Integration time constant of the field current controller (PI controller) in milliseconds.	0	5120	200	ms		
	Long Parameter Menu						
4.05	**Fld Ov Cur Trip** Field **over**current tripping in % related to the field current nominal value (1.03).	0	200	130	%		
4.06	**Field Low Trip** Field undercurrent tripping value in % related to the field current nominal value (1.03). Considerably lower values than the default setting may be required for field weakening or field heating. In the field weakening mode a value smaller than the field weakening current (acc. to the name plate of the motor) shall be entered. In field heating this value must be smaller than the value of Field Heat Ref (4.10). Otherwise the drive may switch off with the fault message Field Undercurrent (F12).	0	100	30	%		
4.07 auto-tuning	**Field Cur 40%** Field current, at which 40% of field flux is reached. Proportion of the nominal field current (1.03) in %.	0	100	29	%		
4.08 auto-tuning	**Field Cur 70%** Field current, at which 70% of field flux is reached. Proportion of the nominal field current (1.03) in %.	0	100	53	%		
4.09 auto-tuning	**Field Cur 90%** Field current, at which 90% of field flux is reached. Proportion of the nominal field current (1.03) in %.	0	100	79	%		
4.10	**Field Heat Ref** Current reference value for the field heating in % related to the nominal field current value (1.03). 0 = **without** field heating >0 = **with** field heating (heating current in %) With this parameter, an anti-condensation heating via the field winding can be implemented for the motor. The field heating will switch on automatically when the drive is stopped (**RUN**=0) and the actual speed is lower than **Zero Speed Lev (5.15)**. When the drive starts again (**RUN**=1) the drive will switch over to nominal field current. In case of field heating this value must be higher than the value of **Field Low Trip (4.06).**	0	30	0	%		
4.11 auto-tuning	**EMF KP** Proportional gain of the EMF controller (PI controller).	0.000	10.000	0.550	integer		
4.12 auto-tuning	**EMF TI** Integration time constant of the EMF controller (PI controller) in milliseconds.	0	10240	160	ms		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 5	**Speed Controller**						
5.01	**Speed Ref Sel** Selection of the desired speed reference location: 0 = Macro depend / dependent on the selected macro 1 = AI1 / analog input 1 (X2:1-2) 2 = AI2 / analog input 2 (X2:3-4) 3 = Bus Main Ref / main fieldbus reference value 4 = Bus Aux Ref / auxiliary fieldbus reference value 5 = Fixed Sp1 / fixed speed value 1 (5.13) 6 = Fixed Sp2 / fixed speed value 2 (5.14) 7 = Commis Ref1 / commissioning ref. value 1 8 = Commis Ref2 / commissioning ref. value 2 9 = Squarewave / square-wave generator 10 = Const Zero / constant zero speed	0	10	0	Text	x	
5.02 Wizard	**Speed Meas Mode** Selection of the desired speed feedback: 0 = EMF (i.e. without speed measurement) 1 = Analog Tacho 2 = Encoder	0	2	0	Text	x	
5.03 Wizard	**Encoder Inc** Number of the encoder increments per revolution.	20	10000	1024	integer	x	
5.04 Signal	**Speed Ref** Actual speed reference value in revolutions/minute.	-	-	-	rpm		
5.05 Signal	**Speed Act** Actual speed value used by the speed controller, in revolutions/minute.	-	-	-	rpm		
5.06 Signal	**Tacho Speed Act** Actual speed value measured by the analog tachometer, in revolutions/minute.	-	-	-	rpm		
5.07 auto-tuning	**Speed Reg KP** Proportional gain of the speed controller (PI controller).	0.000	15.000	0.200	integer		
5.08 auto-tuning	**Speed Reg TI** Integration time constant of the speed controller (PI controller) in milliseconds.	0.0	6553.5	5000.0	ms		
5.09 Wizard	**Accel Ramp** Duration of the acceleration ramp in seconds in the case of acceleration from 0 to maximum speed (1.06).	0.0	3000.0	10.0	s	x	
5.10 Wizard	**Decel Ramp** Duration of the deceleration ramp in seconds in the case of deceleration from maximum speed (1.06) to 0.	0.0	3000.0	10.0	s	x	
5.11 Wizard	**Eme Stop Ramp** Duration of the deceleration ramp in seconds in the case of deceleration from maximum speed (1.06) to 0, as a consequence of an emergency stop trip.	0.0	3000.0	10.0	s	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 5	**Speed Controller (continued)**						
	Long Parameter Menu						
5.12	**Ramp Shape** 0 = linear >0 = ramp shape time Setting the ramp shape: This parameter adds a filter to the output of the ramp generator to create a ramp shape. The value of this parameter defines the ramp shape time which can be set between 0.08 and 10.00 s. A value < 0.08 but > 0.00 s is set to 0.08 s. The value 0.00 **disables the ramp shape time.** Operating mode with ramp shape time: The selected ramp shape time will be effective for every reference value change, i.e. for the motor potentiometer function, the constant speeds 1 and 2 and during switching on and off with the **RUN** command**.** If a communication fault occurs and if the parameter **Comm Fault Mode (2.07) = Ramp** the ramp shape time will be effective, too. Operating modes without ramp shape time: A selected ramp shape time command will not be effective during switching off with the **RUN** command if the parameter **Stop Mode (2.03) = Torque Lim** or **Coast**. The same applies in case of a communication fault. In case of emergency stop by means of the digital input DI5 the ramp shape time will be ineffective, too even if the parameter **Eme Stop Mode (2.04) = Ramp**.	0.00	10.00	0.00	s	x	
5.13	**Fixed Speed 1** Fixed speed value 1 in revolutions/minute. Parameter specifying a constant speed reference value. Can activated with parameter **Speed Ref Sel (5.01)** or by a macro. The applicable ramp times are set with the parameters **Jog Accel Ramp (5.19)** and **Jog Decel Ramp (5.20).** Is used as jogging and/or constant speed in the **macros 1 / 2 / 3 / 4 / 5 / 6 / 7**.	-6500	6500	0	rpm		
5.14	**Fixed Speed 2** Fixed speed value 2 in revolutions/minute. Parameter specifying a second constant speed reference value. Can be activated with parameter **Speed Ref Sel (5.01)** or by a macro. The applicable ramp times are set with the parameters **Jog Accel Ramp (5.19)** and **Jog Decel Ramp (5.20).** Is used as jogging and/or constant speed in the **macros 1 / 2 / 5**.	-6500	6500	0	rpm		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 5	**Speed Controller (continued)**						
5.15 Wizard	**Zero Speed Lev** Zero speed signal. Speed level below which the signal is issued that the motor has reached zero speed. Is used for stall protection, as a standstill message to the drive logic and for the generation of the **Zero Speed** signal.	0	100	50	rpm		
5.16 Wizard	**Speed Level 1** Speed limit value for "Speed 1 reached" signal. Is used as "speed reached" message for the macros 5 / 6, field bus status **Above Limit 1** and the generation of the **Speed L1** signal.	0	6500	0	rpm		
5.17 Wizard	**Speed Level 2** Speed limit value for "Speed 2 reached" signal. Is used as "speed reached" message for macro 6 and the generation of the **Speed L2** signal.	0	6500	0	rpm		
5.18	**Overspeed Trip** Overspeed signal tripping value. If the actual speed value exceeds the threshold defined with this parameter the drive will switch off with the fault message **Overspeed (F18).** Possible causes for Overspeed are described in the chapter Troubleshooting.	100	200	115	%		
5.19	**Jog Accel Ramp** Duration of the acceleration ramp for jogging in the case of acceleration from 0 to maximum speed (1.06). Used for **Fixed Speed 1 (5.13)** or **Fixed Speed 2 (5.14)**. Is also used for the **macros 1 / 2 / 3 / 4 / 5 / 6 / 7**.	0.0	3000.0	10.0	s	x	
5.20	**Jog Decel Ramp** Duration of the deceleration ramp for jogging in the case of deceleration from maximum speed (1.06) to 0. Used for **Fixed Speed 1 (5.13)** or **Fixed Speed 2 (5.14)**. Is used for the **macro 1 / 2 / 5**.	0.0	3000.0	10.0	s	x	
5.21	**Alt Par Sel** Selection of the alternative parameter set: 0 = disabled, i.e. standard parameter set permanently selected 1 = enabled, i.e. alternative parameter set permanently selected 2 = Macro depend / dependent on the selected macro 3 = Sp < Lev1 /Actual speed < Speed level 1 (5.16) 4 = Sp < Lev2 /Actual speed < Speed level 2 (5.17) 5 = Sp Err<Lev1 /Speed error < Speed level 1 (5.16) 6 = Sp Err<Lev2 /Speed error < Speed level 2 (5.17) For items 2...6, the alternative parameter set is selected in dependence on the defined event.	0	6	2	Text		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 5	**Speed Controller (continued)**						
5.22	**Alt Speed KP** Proportional gain of the speed controller (PI controller) for the alternative parameter set.	0.000	15.000	0.200	integer		
5.23	**Alt Speed TI** Integration time constant of the speed controller (PI controller) in milliseconds for the alternative parameter set.	0.0	6553.5	5000.0	ms		
5.24	**Alt Accel Ramp** Duration of the acceleration ramp in the case of acceleration from 0 to maximum speed (1.06) in seconds for the alternative parameter set.	0.0	3000.0	10.0	s	x	
5.25	**Alt Decel Ramp** Duration of the deceleration ramp in the case of decelerationen from maximum speed (1.06) to 0 in seconds for the alternative parameter set.	0.0	3000.0	10.0	s	x	
5.26	**Aux Sp Ref Sel** Selection of the desired location for the auxiliary speed reference value: 0 = Macro depend/ dependent on the selected macro 1 = AI1 / analog input 1 (X2:1-2) 2 = AI2 / analog input 2 (X2:3-4) 3 = Bus Main Ref / main fieldbus reference value 4 = Bus Aux Ref / auxiliary fieldbus reference value 5 = Fixed Sp1 / fixed speed value 1 (5.13) 6 = Fixed Sp2 / fixed speed value 2 (5.14) 7 = Commis Ref1 / commissioning reference val. 1 8 = Commis Ref2 / commissioning reference val. 2 9 = Squarewave / square-wave generator 10 = Const Zero / constant zero speed	0	10	0	Text	x	
5.27	**Drooping** Desired decrease in speed at nominal torque in % related to the maximum speed (1.06). Is usually used in slave drives, which are temporarily speed-controlled in order to lower the speed by a specific value in the case of increasing load. The master is not influenced by the slave when the slave is switching over to torque control. This function will also used in drives with a mechanical coupling which is not suited for torque control.	0	10	0	%		
5.28	**Ref Filt Time** Filter time constant for smoothing speed reference before the speed regulator.	0.00	10.00	0.00	s		
5.29	**Act Filt 1 Time** Filter time constant 1 for smoothing speed deviation at the input of the speed regulator.	0.00	10.00	0.00	s		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 5	**Speed Controller (continued)**						
5.30	**Act Filt 2 Time** Filter time constant 2 for smoothing speed deviation at the input of the speed regulator.	0.00	10.00	0.00	s		
5.31	**Speed Lim Fwd** Speed reference limitation in forward direction. For reason of safety, this settable limitation is supplemented by an absolute, unchangeable limitation to **Max Speed (1.06).**	0	6500	6500	rpm	x	
5.32	**Speed Lim Rev** Speed reference limitation in reverse direction. For reason of safety, this settable limitation is supplemented by an absolute, unchangeable limitation to **Max Speed (1.06).**	-6500	0	-6500	rpm	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 6	**Input / Output**						
6.01	**AI1 Scale 100%** Scaling of analog input 1: input of a voltage value in volts, which correspond to 100% reference.	2.00	10.00	10.00	V		
6.02	**AI1 Scale 0%** Scaling of analog input 1: input of a voltage value in volts, which corresponds to 0% reference.	-1.00	1.00	0.00	V		
6.03	**AI2 Scale 100%** Scaling of the analog input 2: input of a voltage value in volts, which corresponds to 100%.	2.00	10.00	10.00	V		
6.04	**AI2 Scale 0%** Scaling of the analog input 2: input of a voltage value, which corresponds to 0%.	-1.00	1.00	0.00	V		
	Long Parameter Menu						
6.05 Wizard	**AO1 Assign** Desired assignment of analog output 1: 0 = Macro depend/ dependent on the selected macro 1 = Speed Act / actual speed value (5.05) 2 = Speed Ref / speed reference value (5.04) 3 = Arm Volt Act / armature voltage actual value (3.03) 4 = Arm Cur Ref / armature current refer. val. (3.01) 5 = Arm Cur Act / armature current actual value (3.02) 6 = Power Act / actual power (3.21) 7 = Torque Act / torque actual value (3.23) 8 = Fld Cur Act / field current actual value (4.02) 9 = Dataset 3.2 10 = Dataset 3.3 11 = AI1 Act / Analogue Input 1 actual value 12 = AI2 Act / Analogue Input 2 actual value	0	12	0	Text		
6.06 Wizard	**AO1 Mode** Selection of the desired operating mode of analog output 1: 0 = bipolar 1 = unipolar	0	1	0	Text		
6.07 Wizard	**AO1 Scale 100%** Scaling of analog output 1: Input of a voltage value in volts, which corresponds to 100% of the output signal.	0.00	10.00	10.00	V		
6.08 Wizard	**AO2 Assign** Desired assignment of the analog output 2: **Assignment identical with AO1 (6.05).**	0	12	0	Text		
6.09 Wizard	**AO2 Mode** Selection of the desired operating mode of analog output 2: 0 = bipolar 1 = unipolar	0	1	0	Text		
6.10 Wizard	**AO2 Scale 100%** Scaling of analog output 2: input of a voltage value in volts, which corresponds to 100% of the output signal.	0.00	10.00	10.00	V		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 6	**Input / Output (continued)**						
6.11 Wizard	**DO1 Assign** Desired assignment of digital output 1: **0 = none** 0 constant (for test purposes) **1 = Constant 1** 1 constant (for test purposes) **2 = Macro depend** the output is defined by macro, see macro description. **3 = Rdy for On** Ready for ON Command. The electronic supply is switched on, there are no faults. but the drive is still switched OFF (ON=0). **4 = Rdy for Run** Ready for RUN Command. Drive is ON (ON=1) but not yet enabled (RUN=0). Main contactor, fan and field supply are switched on. **5 = Running** The drive is enabled (RUN=1). **6 = Not Eme Stop** No emergency stop. **7 = Fault** A fault has occurred- **8 = Alarm** A warning has been output. **9 = Flt or Alarm** Summary alarm. A fault has occurred OR a warning has been output. **10 = Not (F or A)** Summary alarm as above, but inverted. **11 = Main Cont On** Control signal to switch ON the main contactor. **12 = Fan On** Control signal to switch ON the fan. **13 = Local** The drive is controlled LOCALly from the control panel or the PC tool. **14 = Comm Fault** The communication between panel/PC tool/PLC and the drive is faulty. **15 = Overtemp Mot** The motor overtemperature protection has tripped (PTC to AI2). **16 = Overtemp DCS** The converter overtemperature protection has tripped **17 = Stalled** The motor is stalled. **18 = Forward** The motor is rotating clockwise. **19 = Reverse** The motor is rotating conter-clockwise. **20 = Zero Speed** Standstill message, speed smaller than **Zero Speed Lev (5.15).** **21 = Speed L1** Speed 1 reached, speed is bigger than or equal to **Speed Level 1 (5.16).** **22 = Speed L2** Speed 2 reached, speed is bigger than or equal to **Speed Level 2 (5.17).** **23 = Overspeed** Overspeed, speed is bigger than or equal to **Overspeed Trip (5.18).** **24 = At Set Point** Speed reference reached (reference value before the ramp corresponds to actual value) **25 = Cur at Limit** Armature current is being limited, value of **Arm Cur Max (3.04)** has been reached**.** **26 = Cur Reduced** Reduced armature current, recovery current after high current dosage. **27 = Bridge 1** Bridge 1 is active. **28 = Bridge 2** Bridge 2 is active. **29 = Field Rev** Field reversal is active. **30 = Reserved** not used **31 = Reserved** not used **32 = Dataset 3.1** DO is controlled by Dataset 3.1	0	32	2	Text		
6.12 Wizard	**DO2 Assign** Desired assignment of digital output 2: **Assignment identical with DO1 (6.11).**	0	32	2	Text		
6.13 Wizard	**DO3 Assign** Desired assignment of digital output 3: **Assignment identical with DO1 (6.11).**	0	32	2	Text		
6.14 Wizard	**DO4 Assign** Desired assignment of digital output 4: **Assignment identical with DO1 (6.11).**	0	32	2	Text		
6.15 Wizard	**DO5 Assign** Desired assignment of digital output 5: (relay X98:1-2): **Assignment identical with DO1 (6.11).**	0	32	2	Text		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 6	**Input / Output (continued)**						
6.16	**Panel Act 1** Selection of the desired panel display of actual value 1: (top left corner of display) 0 = Speed Act / speed actual value (5.05) 1 = Speed Ref / speed reference value (5.04) 2 = Arm Volt Act / armature voltage act. value (3.03) 3 = Arm Cur Ref / armature current ref. (3.01) 4 = Arm Cur Act / armature current act. value (3.02) 5 = Power Act / actual power (3.21) 6 = Torque Act / torque actual value 7 = Fld Cur Act / field current actual value (4.02) 8 = AI1 Act 9 = AI2 Act 10 = DI1 Act	0	10	2	Text		
6.17	**Panel Act 2** Selection of the desired panel display of actual value 2: (top centre of display) **Assignment identical with Panel Act 1 (616)**	0	10	4	Text		
6.18	**Panel Act 3** Selection of the desired panel display of actual value 3: (top right corner of display) **Assignment identical with Panel Act 1 (616)**	0	10	1	Text		
6.19	**Panel Act 4** Selection of the desired panel display of actual value 4: (bottom of display) **Assignment identical with Panel Act 1 (616)**	0	10	0	Text		
6.20	**Dataset 2.2 Ass** Selection of the desired assignment for fieldbus dataset 2.2: 0 = Speed Act / speed actual value (5.05) 1 = Speed Ref / speed reference value (5.04) 2 = Arm Volt Act / armature voltage act. value (3.03) 3 = Arm Cur Ref / armature current ref. val. (3.01) 4 = Arm Cur Act / armature current act. value (3.02) 5 = Power Act / actual power (3.21) 6 = Torque Act / torque actual value 7 = Fld Cur Act / field current actual value (4.02) 8 = Dataset 3.2 9 = Dataset 3.3 10 = AI1 Act / Analogue Input 1 actual value 11 = AI2 Act / Analogue Input 2 actual value	0	11	0	Text		
6.21	**Dataset 2.3 Ass** Selection of the desired assignment for fieldbus dataset 2.3: **Assignment identical with Dataset 2.2 Ass (620)**	0	11	4	Text		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 6	**Input / Output (continued)**						
6.22	**MSW Bit 11 Ass** Function assignement for bit 11 in the main fieldbus status word (2.06): 0 = None 1 = Constant 1 2 = Macro depend/ dependent on the selected macro 3 = Rdy for On / ready for switching on 4 = Rdy for Run / ready for running 5 = Running 6 = Not Eme-Stop / no emergency stop 7 = Fault 8 = Alarm 9 = Flt or Alarm / fault or alarm 10 = Not (F or A) / no fault and no alarm 11 = Main Cont On / main contactor ON 12 = Fan On 13 = Local / Local operation fr. the control panel/Tool 14 = Comm Fault / communication fault 15 = Overtemp Mot / motor overheated 16 = Overtemp DCS / DCS overheated 17 = Stalled / motor stalled 18 = Forward / forward direction of rotation 19 = Reverse / reverse direction of rotation 20 = Zero Speed / zero speed signal 21 = Speed L1 / speed value 1 reached (5.16) 22 = Speed L2 / speed value 2 reached (5.17) 23 = Overspeed / overspeed (5.18) 24 = At Set Point / speed reference value reached 25 = Cur at Limit / armature current is at limit 26 = Cur Reduced / reduced armature current 27 = Bridge 1 / bridge 1 active 28 = Bridge 2 / bridge 2 active 29 = Field Revers / Field reversal is active 30 = Reserved / not used 31 = Reserved / not used 32 = DI1 / Digital Input 1 33 = DI2 / Digital Input 2 34 = DI3 / Digital Input 3 35 = DI4 / Digital Input 4	0	35	2	Text		
6.23	**MSW Bit 12 Ass** Function assignment for bit 12 in the main fieldbus status word (2.06): **Assignment identical with MSW Bit 11 Ass (622)**	0	35	2	Text		
6.24	**MSW Bit 13 Ass** Function assignment for bit 13 in the main fieldbus status word (2.06): **Assignment identical with MSW Bit 11 Ass (622)**	0	35	2	Text		
6.25	**MSW Bit 14 Ass** Function assignment for bit 14 in the main fieldbus status word (2.06): **Assignment identical with MSW Bit 11 Ass (622)**	0	35	2	Text		
6.26 Signal	**AI1 Act** Reference display of analogue input 1	-	-	-	%		
6.27 Signal	**AI2 Act** Reference display of analogue input 2	-	-	-	%		
6.28 Signal	**DI Act** Status display of the eight digital inputs	-	-	-	hex		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 7	**Maintenance**						
7.01 Wizard	**Language** Selection of the panel language: 0 = English 1 = Deutsch 2 = Français 3 = Italiano 4 = Español	0	4	0	Text		
7.02 Action	**Contr Service** Selection of the desired service activity: 0 = None 1 = Arm Autotun / armature current controller auto-tuning 2 = Fld Autotun / field current controller auto-tuning 3 = Flux Adapt / flux adaptation 4 = Sp Autotun / speed controller auto-tuning 5 = Arm Man Tun / manual armature current controller auto-tuning 6 = Fld Man Tun / manual field current controller auto-tuning 7 = Thyr Diag / thyristor diagnossis	0	7	0	Text		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 7	**Maintenance (continued)**						
7.03 Signal	**Diagnosis** Display of all diagnostic messages: Further information see chapter 'Troubleshooting' 0 = none 1…10 = 1…10 (internal software causes) 11 = Tune Aborted 12 = No Run Cmd 13 = No ZeroSpeed 14 = Fld Cur <> 0 15 = Arm Cur <> 0 16 = Arm L Meas 17 = Arm R Meas 18 = Field L Meas 19 = Field R Meas 20 = TuneParWrite 21 = 21 (internal software causes) 22 = Tacho Adjust 23 = Not Running 24 = Not At Speed 25 = TachPolarity 26 = Enc Polarity 27 = No EncSignal 28 = StillRunning 29 = 29 (internal software causes) 30 = Wiz ParWrite 31 = 31 (internal software causes) 32 = UpDn Aborted 33 = NoStandstill 34 = Par Checksum 35 = 35 (internal software causes) 36 = 36 (internal software causes) 37 = Pan Is LOCAL 38…69 = reserved 70 = Fld Low Lim 71 = Flux Char 72 = Field Range 73 = Arm Data 74 = AI2 vs PTC 75 = RecoveryTime 76 = Grp9 Disable 77…79 = reserved 80 = Speed does not reach setpoint 81 = Motor is not accelerating 82 = Not enough measurement for speed KP and TI 83…89 = reserved 90 = Shortcut V11 91 = Shortcut V12 92 = Shortcut V13 93 = Shortcut V14 94 = Shortcut V15 95 = Shortcut V16 96 = Result False 97 = ShortcV15/22 98 = ShortcV16/23 99 = ShortcV11/24 100 = ShortcV12/25 101 = ShortcV13/26 102 = ShortcV14/21 103 = Ground Fault 104 = NoThrConduc	-	-	-	Text		
7.04 Const.	**SW Version** Display of the software version used.	-	-	-	integer		
7.05 Const.	**Conv Type** Display of the converter type: 0 = DCS401 (2Q) 1 = DCS402 (4Q)	-	-	-	integer		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 7	**Maintenance (continued)**						
7.06 Const.	**Conv Nom Cur** Display of the converter's nominal current in amperes.	-	-	-	A		
7.07 Const.	**Conv Nom Volt** Display of the converter's nominal voltage in volts.	-	-	-	V		
7.08 Signal	**Volatile Alarm** Display of the last alarm.	-	-	-	Text		
7.09 Signal	**Fault Word 1** All the pending faults are displayed if the corresponding bits are set to log. "1". Bit hex Fault definition 00 0001 01 Aux Voltage Fault 01 0002 02 Hardware Fault 02 0004 03 Software Fault 03 0008 04 Par Flash Read Fault 04 0010 05 Compatibility Fault 05 0020 06 Typecode Read Fault 06 0040 07 Converter Overtemp 07 0080 08 Motor Overtemp 08 0100 09 Mains Undervoltage 09 0200 10 Mains Overvoltage 10 0400 11 Mains Sync Fault 11 0800 12 Field Undercurrent 12 1000 13 Field Overcurrent 13 2000 14 Armature Overcurrent 14 4000 15 Armature Overvoltage 15 8000 16 Speed Meas Fault	-	-	-	hex		
7.10 Signal	**Fault Word 2** Fault word 2. Significance of the individual bits: All the pending faults are displayed if the corresponding bits are set to log. "1". Bit hex Fault definition 00 0001 17 Tacho Polarity fault 01 0002 18 Overspeed 02 0004 19 Motor Stalled 03 0008 20 Communication Fault 04 0010 21 Local Control Lost 05 0020 22 External Fault 06 0040 23 - 07 0080 24 - 08 0100 25 - 09 0200 26 - 10 0400 27 - 11 0800 28 - 12 1000 29 - 13 2000 30 - 14 4000 31 - 15 8000 32 -	-	-	-	hex		
7.11 Signal	**Fault Word 3** Fault word 3. Significance of the individual bits: All the pending faults are displayed if the corresponding bits are set to log. "1". Bit hex Fault definition 00 0001 33 - 01 0002 34 - 02 0004 35 - 03 0008 36 - 04 0010 37 - 05 0020 38 - 06 0040 39 - 07 0080 40 - 08 0100 41 - 09 0200 42 - 10 0400 43 - 11 0800 44 - 12 1000 45 - 13 2000 46 - 14 4000 47 - 15 8000 48 -	-	-	-	hex		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 7	**Maintenance (continued)**						
7.12 Signal	**Alarm Word 1** Alarm word 1. Significance of the individual bits: All the pending alarms are displayed if the corresponding bits are set to log. "1". Bit hex Alarm definition 00 0001 01 Parameters Added 01 0002 02 Mains Voltage Low 02 0004 03 Arm Circuit Break 03 0008 04 Converter Temp High 04 0010 05 Motor Temp High 05 0020 06 Arm Current Reduced 06 0040 07 Field Volt Limited 07 0080 08 Mains Drop Out 08 0100 09 Eme Stop Pending 09 0200 10 Autotuning Failed 10 0400 11 Comm Interrupt 11 0800 12 External Alarm 12 1000 13 ill Fieldbus Setting 13 2000 14 Up/Download Failed 14 4000 15 PanTxt Not UpToDate 15 8000 16 Par Setting Conflict	-	-	-	hex		
7.13 Signal	**Alarm Word 2** Alarm word 2. Significance of the individual bits: All the pending alarms are displayed if the corresponding bits are set to log. "1". Bit hex Alarm definition 00 0001 17 Compatibility Alarm 01 0002 18 - 02 0004 19 - 03 0008 20 - 04 0010 21 - 05 0020 22 - 06 0040 23 - 07 0080 24 - 08 0100 25 - 09 0200 26 - 10 0400 27 - 11 0800 28 - 12 1000 29 - 13 2000 30 - 14 4000 31 - 15 8000 32 -	-	-	-	hex		
7.14 Signal	**Alarm Word 3** Alarm word 3. Significance of the individual bits: All the pending alarms are displayed if the corresponding bits are set to log. "1". Bit hex Alarm definition 00 0001 33 - 01 0002 34 - 02 0004 35 - 03 0008 36 - 04 0010 37 - 05 0020 38 - 06 0040 39 - 07 0080 40 - 08 0100 41 - 09 0200 42 - 10 0400 43 - 11 0800 44 - 12 1000 45 - 13 2000 46 - 14 4000 47 - 15 8000 48 -	-	-	-	hex		

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 7	**Maintenance (continued)**						
7.15	**Commis Ref 1** Commissioning reference value 1 Scaling: Field current 0…100% = 0…4096 Torque 0…100% = 0…4096 Armature current 0…100% = 0…4096 Speed 0…max = 0…max rpm	-32768	32767	0	integer		
7.16	**Commis Ref 2** Commissioning reference value 2 Scaling: Field current 0…100% = 0…4096 Torque 0…100% = 0…4096 Armature current 0…100% = 0…4096 Speed 0…max = 0…max rpm	-32768	32767	0	integer		
7.17	**Squarewave Per** Duration of cycle of the square-wave generator.	0.01	60.00	2.00	s		
7.18 Signal	**Squarewave Act** Actual value of the square-wave generator.	-	-	-	integer		
7.19 Signal	**Pan Text Vers** Display of text version in the control panel						
7.20 Signal	**CPU Load** Operating performance of CPU in %				%		

(1) no changes possible if the drive is in ON-status

For detailed description see "Fieldbus Description"

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 8	**Fieldbus**						
	Long Parameter Menu						
8.01	**Fieldbus Par 1** 0 = Disable no communication with PLC 1 = Fieldbus PLC communication via fieldbus adapter 2 = RS232-Port PLC communication via RS232 Port / Modbus protocol 3 = Panel-Port PLC communication via Panel Port / Modbus protocol 4 = Res Fieldbus Reset Fieldbus adapter parameter	0	65535	0	Text	x	
8.02	**Fieldbus Par 2** further information see chapter 7	0	65535	0	integer	x	
8.03	**Fieldbus Par 3** further information see chapter 7	0	65535	0	integer	x	
8.04	**Fieldbus Par 4** further information see chapter 7	0	65535	0	integer	x	
8.05	**Fieldbus Par 5** further information see chapter 7	0	65535	0	integer	x	
8.06	**Fieldbus Par 6** further information see chapter 7	0	65535	0	integer	x	
8.07	**Fieldbus Par 7** further information see chapter 7	0	65535	0	integer	x	
8.08	**Fieldbus Par 8** further information see chapter 7	0	65535	0	integer	x	
8.09	**Fieldbus Par 9** further information see chapter 7	0	65535	0	integer	x	
8.10	**Fieldbus Par 10** further information see chapter 7	0	65535	0	integer	x	
8.11	**Fieldbus Par 11** further information see chapter 7	0	65535	0	integer	x	
8.12	**Fieldbus Par 12** further information see chapter 7	0	65535	0	integer	x	
8.13	**Fieldbus Par 13** further information see chapter 7	0	65535	0	integer	x	
8.14	**Fieldbus Par 14** further information see chapter 7	0	65535	0	integer	x	
8.15	**Fieldbus Par 15** further information see chapter 7	0	65535	0	integer	x	
8.16	**Fieldbus Par 16** further information see chapter 7	0	65535	0	integer	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 9	**Macro Adaptation**						
	Long Parameter Menu						
9.01	**MacParGrpAction** All parameters of group 9 (9.02 … 9.18) can be set to the same value 0=unchanged no parameters changes 1=Macro depend set all parameters to macro depend 2=Disable disable all parameters	0	2	0	Text	x	
9.02	**Jog 1** Jog function will be controlled from a binary signal which is assigned in this parameter: 0=Macro depend 1=Disable 2=DI1 3=DI2 4=DI3 5=DI4 State of binary signal: 0=no Jog 1 Decelerate the motor by using Jog Decel Ramp (5.20) till zero speed afterwards disable of current controller . 1=Jog 1 enable current controller and accelerate the motor by using Jog Acel Ramp (5.19) up to Fixed Speed 1 (5.13) The parameter setting Jog 1 function is also controlled by bit 8 of Main Control Word via serial communication (OR-function).	0	5	0	Text	x	
9.03	**Jog 2** Jog function will be controlled from a binary signal which is assigned in this parameter. Assignment identical with **9.02** State of binary signal: 0=no Jog 2 Decelerate the motor by using Jog Decel Ramp (5.20) till zero speed afterwards disable of current controller . 1=Jog 2 enable current controller and accelerate the motor by using Jog Acel Ramp (5.19) up to Fixed Speed 2 (5.14) The Jog 2 function is also controlled by bit 9 of Main Control Word via serial communication (OR-function).	0	5	0	Text	x	
9.04	**COAST** Coast function will be controlled from a binary signal which is assigned in this parameter. Assignment identical with **9.02** State of binary signal: 0=COAST disable current controller, switch Main Contactor Off, motor is coasting till zero speed 1=no COAST Closed-circuit principle, must be closed for operation The Coast function is also controlled by bit 1 of Main Control Word via serial communication (AND-function).	0	5	0		x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 9	**Macro Adaptation (continued)**						
9.05	**User Fault** Fault function will be controlled from a binary signal which is assigned in this parameter: 0=Macro depend 1=Disable 2=DI1 3=DI2 4=DI3 5=DI4 6=MCW Bit 11 7=MCW Bit 12 8=MCW Bit 13 9=MCW Bit 14 10=MCW Bit 15 effective independent of Cmd Location (2.02) State of binary signal: 0=no Fault 1=Fault Triggers an External Fault (F22) and trips the drive	0	10	0	Text	x	
9.06	**User Fault Inv** Fault (inv) function will be controlled from binary signal which is assigned in this parameter: **Assignment identical with 9.02** State of binary signal: 0=Fault Triggers an External Fault (F22) and trips the drive 1=no fault Closed-circuit principle, must be closed for operation	0	5	0	Text	x	
9.07	**User Alarm** Alarm function will be controlled from binary signal which is assigned in this parameter: **Assignment identical with 9.05** State of binary signal: 0=no Alarm 1=Alarm Triggers an External Alarm (A12) in DCS400	0	10	0	Text	x	
9.08	**User Alarm Inv** Alarm (inv) function will be controlled from binary signal which is assigned in this parameter: **Assignment identical with 9.02** State of binary signal: 0=Alarm Triggers an External Alarm (A12) in DCS400 1=no Alarm Closed-circuit principle, must be closed for operation	0	5	0	Text	x	
9.09	**Dir of Rotation** Direction of rotation will be controlled from binary signal which is assigned in this parameter: **Assignment identical with 9.05** State of binary signal: 0=forward 1=reverse Effective only when the drive is speed controlled.	0	10	0	Text	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 9	**Macro Adaptation (continued)**						
9.10	**MotPot Incr** MotorPot Increase speed function will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=hold speed 1=increase speed accelerate speed at Acel Ramp (5.09) until Max Speed (1.06)	0	10	0	Text	x	
9.11	**MotPot Decr** MotorPot Decrease speed function will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=hold speed 1=decrease speed decelerate speed at Decel Ramp (5.10) until zero speed respectively MotPotMinSpeed (9.12) if active. MotPot Decr has precedence above MotPot Incr	0	10	0	Text	x	
9.12	**MotPotMinSpeed** MotorPot minimum speed function will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=Start from zero. MotPotMinSpeed is inactive. 1=Start from MotPotMinSpeed activate MinimumSpeed. Speed can be defined in parameter Fixed Speed 1 (5.13). When the drive is started the speed will be accelerated to this minimum speed and it is not possible to set the speed below this minimum with motor pot function.	0	10	0	Text	x	
9.13	**Ext Field Rev** External field reversal will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=no field reversal 1=field reversal External field reversal with external field reversing switch. **Only for 2-Q application.** Depend on field reversal the signal „Field reversal active“ has log. state „1“. Field reversal is only possible when the drive is OFF (DI7=0). When field reversal is active the polarity of speed actual value is changed in the software. It’s recommended to use a remanence contactor relay to store the state of this relay when the main supply failes. Otherwise the relay contactors can burn due to the field inductance.	0	10	0	Text	x	

(1) no changes possible if the drive is in ON-status

ParNo.	Parameter name and significance	Min	Max	Default	Unit	(1)	custom. setting
Grp 9	**Macro Adaptation (continued)**						
9.14	**AlternativParam** Alternative parameter set will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0= Standard parameter set for speed controller effective 5.07 Speed Reg KP 5.08 Speed Reg TI 5.09 Accel Ramp 5.10 Decel Ramp 1= IF Alt Par Sel (5.21) = Macro depend THEN alternativ parameter set for speed controller effective 5.22 Alt Speed KP 5.23 Alt Speed TI 5.24 Alt Accel Ramp 5.25 Alt Decel Ramp ELSE alternativ parameter set for speed controller effective depending on an event selected in Alt Par Sel (5.21)	0	10	0	Text	x	
9.15	**Ext Speed Lim** External speed limitation will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=no speed limitation 1=speed limitation to parameter Fixed Speed 1 (5.13)	0	10	0	Text	x	
9.16	**Add AuxSpRef** Additional aux speed reference will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=no additional aux. speed reference 1= IF Aux Sp Ref Sel (5.26) = Macro depend THEN value of Fixed Speed 2 (5.14) is added to speed reference. ELSE value in Aux Sp Ref Sel (5.26) is added to speed reference.	0	10	0	Text	x	
9.17	**Curr Lim 2 Inv** Second current limitation will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0=current limitation 2 effective (3.24 Arm Cur Lim 2) 1=current limitation 1 effective (3.04 Arm Cur Max) Value of Arm Cur Max (3.04) has to be greater than value of Arm Cur Lim 2 (3.24).	0	10	0	Text	x	
9.18	**Speed/Torque** Speed/torque function will be controlled from a binary signal which is assigned in this parameter. **Assignment identical with 9.05** State of binary signal: 0= drive is speed controlled 1= IF Cur Contr Mode (3.14) = Macro depend THEN drive is torque controlled ELSE drive is controlled as selected in Cur Contr Mode (3.14)	0	10	0	Text	x	

(1) no changes possible if the drive is in ON-status

5 Installation

General

Incoming inspection
Check the contents of delivery
- DCS 400
- Manual
- Mounting template
- Quick installation & commissioning guide

Check the consignment for any signs of damage. If you find any, please contact the insurance company or the supplier.
Check the particulars given on the unit's rating plate to make sure prior to installation and start-up that you have received the correct unit type and unit version.
If the consignment is incomplete or contains any incorrect items, please contact the supplier.

CAUTION!
The thyristor power converter weighs quite a lot and should therefore not be held by the front cover. Please put the unit down only on its back. Always use due care when handling the unit, so as to avoid injuries or damage.

Storage and transport
If the unit had been in storage prior to installation or is transported to another location, care must be taken to ensure that the environmental conditions are complied with.

Rating plate
For purposes of identification, each thyristor power converter is fitted with rating plates, stating the type code and the serial number, which serve for each unit's individual identification.
The type code contains information on the characteristics and the configuration of the unit.

The technical data and specifications are valid as of going to press. ABB reserves the right to make subsequent alterations.

If you have any questions concerning your drive system, please contact your local ABB agent.

5.1 Safety instructions

in conformity with the low-voltage directive 73/23/EEC

1. General

In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving or rotating parts, as well as hot surfaces.

In case of inadmissible removal of the required covers, of improper use, wrong installation or maloperation, there is the danger of serious personal injury and damage to property.

For further information, see documentation.

All operations serving transport, installation and commissioninng as well as maintenance are to be carried out by skilled technical personnel (Observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC 664 or DIN/VDE 0110 and national accident prevention rules!).

For the purposes of these basic safety instructions, “skilled technical personnel” means persons who are familiar with the installation, mounting, commissioning and operation of the product and have the qualifications needed for the performance of their functions.

2. Intended use

Drive converters are components designed for inclusion in electrical installations or machinery.

In case of installation in machinery, commissioning of the drive converter (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions of the directive 89/392/EEC (Machinery Safety Directive - MSD). Account is to be taken of EN 60204.

Commissioning (i.e. the starting of normal opertion) is admissible only where conformity with the EMC directive (89/336/EEC) has been established.

The drive converters meet the requirements of the low-voltage directive 73/23/EEC. They are subject to the harmonized standards of the series prEN 50178/DIN VDE 0160 in conjunction with EN 60439-1/ VDE 0660, part 500, and EN 60146/ VDE 0558.

The technical data as well as information concerning the supply conditions shall be taken from the rating plate and from the documentation and shall be strictly observed.

3. Transport, storage

The instructions for transport, storage and proper use shall be complied with.

The climatic conditions shall be in conformity with prEN 50178.

4. Installation

The installation and cooling of the appliances shall be in accordance with the specifications in the pertinent documentation.

The drive converters shall be protected against excessive strains. In particular, no components must be bent or isolating distances altered in the course of transportation or handling. No contact shall be made with electronic components and contacts.

Drive converters contain electrostatic sensitive components which are liable to damage through improper use. Electric components must not be mechanically damaged or destroyed (potential health risks).

5. Electrical connection

When working on live drive converters, the applicable national accident prevention rules (e.g. VBG 4) must be complied with.
The electrical installation shall be carried out in accordance with the relevant requirements (e.g. cross-sectional areas of conductors, fusing, PE connection). For further information, see documentation.

Instructions for the installation in accordance with EMC requirements, like screening, earthing, location of filters and wiring, are contained in the drive converter documentation. They must always be complied with, also for drive converters bearing a CE marking. Observance of the limit values required by EMC law is the responsibility of the manufacturer of the installation or machine.

6. Operation

Installations which include drive converters shall be equipped with additional control and protective devices in accordance with the relevant applicable safety requirements, e.g. Act respecting technical equipment, accident prevention rules etc. Changes to the drive converters by means of the operating software are admissible.

After disconnection of the drive converter from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this respect, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer’s documentation shall be followed.

KEEP SAFETY INSTRUCTIONS IN A SAFE PLACE!

Warnings
Warnings provide information on states which if the specified procedure for the state concerned is not meticulously complied with may result in a serious error, in major damage to the unit, in injury to persons and even in death. They are identified by the following symbols:

Danger: High Voltage:

This symbol warns you of high voltages which may result in injuries to persons and/or damage to equipment. Where appropriate, the text printed adjacent to this symbol describes how risks of this kind may be avoided.

- All electrical installation and maintenance work on the thyristor power converter must be carried out by properly qualified staff who have been thoroughly trained in electrical engineering.
- The thyristor power converter and its adjacent units must be properly earthed by qualified professionals.
- You must NEVER perform any work on the thyristor power converter while it is still switched on. First switch the unit off, use a measuring instrument to make absolutely sure that the power converter has really been de-energized, and only then you may start with the work concerned.
- Due to external control circuits, there may be dangerously high voltages present at the thyristor power converter even after the line voltage has been switched off. So always work at the unit with appropriate caution! Non-compliance with these instructions may result in injury (or even death!).

General Warning:

This symbol warns you of non-electrical risks and dangers which may result in serious or even fatal injury to persons and/or in damage to equipment. Where appropriate, the text printed adjacent to this symbol describes how risks of this kind may be avoided.

- When thyristor power converters are in use, the electric motors, power transmission elements and the driven machines are working in an extended operating range, which means they have to cope with a relatively high loading.
  - You should have made sure that all units, devices and appliances used are actually suitable for this higher loading.
  - If you have to operate the thyristor power converter at a rated motor voltage and/or a rated motor current significantly below the figures stated in the thyristor power converter's output data, you must take appropriate precautionary measures to protect the unit against overspeed, overload, breakage, etc., by modifying the software or hardware appropriately.
  - For insulation testing, you must disconnect all cables from the thyristor power converter. You should avoid operating your unit at values other than the rated data. Non-compliance with these instructions may cause lasting damage to the thyristor power converter.
- The thyristor power converter possesses a number of automatic reset functions. When these functions are executed, the unit will be reset after an error and will then resume operation. These functions should not be used if other units and devices are not suitable for an operating mode of this kind, or if their use might entail dangerous situations.

Warning of electrostatic discharge:

This symbol warns you against electrostatic discharges which may damage the unit. Where appropriate, the text printed next to this symbol describes how a risk of this kind may be avoided.

Notes
Notes supply information on states requiring particular attention, or indicate that additional information is available on a specific topic. For this purpose, the following symbols are used:

CAUTION!
Cautions are designed to draw your attention to a particular state of affairs.

Note
A **note** contains or refers you to additional information available on the particular topic concerned.

Mains connection
You can use a switch disconnector (with fuses) in the power supply of the thyristor power converter to disconnect the electrical components of the unit from the power supply for installation and maintenance work. The type of disconnector used must be a switch disconnector as per EN 60947-3, Class B, so as to comply with EU regulations, or a circuit-breaker type which switches off the load circuit by means of an auxiliary contact causing the breaker's main contacts to open. The mains disconnector must be locked in its "OPEN" position during any installation and maintenance work.

EMERGENCY STOP buttons
EMERGENCY STOP buttons must be installed at each control desk and at all other control panels requiring an emergency stop function.

Intended use
The operating instructions cannot take into consideration every possible case of configuration, operation or maintenance. Thus, they mainly give such advice only, which is required by qualified personnel for normal operation of the machines and devices in industrial installations.

If in special cases the electrical machines and devices are intended for use in non-industrial installations - which may require stricter safety regulations (e.g. protection against contact by children or similar) -, these additional safety measures for the installation must be provided by the customer during assembly.

Remark
This is the content of the manual *Installation of converters for armature and field supply in accordance with EMC* with the original chapter-numbering!

General

Converters and the major part of the devices, which constitute a DC drive, cannot fulfil the EMC requirements independently from each other. They must be installed and connected by skilled people according to this guide. This restriction is related to the expression "restricted area" in the short description of EN 61800-3 which is the EMC standard for a power drive system.

EN 61800-3

EMC standard for **P**ower **D**rive **S**ystems (PDS), immunity and emission in domestic, residential and light industry restricted area and in industry.

This standard must be complied with to meet the EMC requirements for plants and machines in the EC!

If the DC drive is designed and built-up according to this installation guide then it meets the requirements of EN 61800-3 and of the following standards:

EN 50082-2	Generic standard for noise immunity in **industrial environment** (includes EN 50082-1, domestic environ.)
EN 50081-2	Generic standard for noise emission in **industrial environment**
EN 50081-1	Generic standard for noise emission in **domestic environment,** can be fulfilled with special means (line filters, screened power cables) in the lower power range

NOTE!

The conformity procedure is a matter of responsibility of ABB Industrietechnik GmbH and of the machine manufacturers or the plant builders corresponding to their share of the extension of the electrical equipment.

Definitions

 Earth, earthing for safety

 Ground, grounding for EMC, connection with mass or housing with low inductance

Important instructions for plants with line filters

Filter in an earthed line (TN or TT network)
The filters are suitable for earthed lines only, for example in public European 400 V lines. According to EN 61800-3, filters are not compatible in insulated industrial lines with own supply transformers due to their safety risks in such floating lines (IT networks).

Earth fault detection
Filters (with internal discharging resistors), cables, the converter and the motor have together a considerable capacity to ground which can cause an increased capacitive earth current. The tripping threshold of an earth fault detector which measures this current must be adapted to this higher value.

High voltage test
Because of the capacitors of the line filter the high voltage test has to be done with dc voltage to protect the components.

Warning

Line filters contain capacitors which can keep dangerous voltages at the terminals after the switch off of the mains voltage. The discharge by internal resistors takes some seconds. Therefore a waiting time of **at least 10 s** and a voltage check are obligatory before you begin your work at the equipment.

General safety instructions

Electrical machines or devices are items of equipment used in industrial power installations. During operation, parts of this equipment are live and bare, or moving, rotating, etc. These parts may cause great material damage and serious heavy injuries, if, for instance, their covers are removed or if they are not properly used or operated.

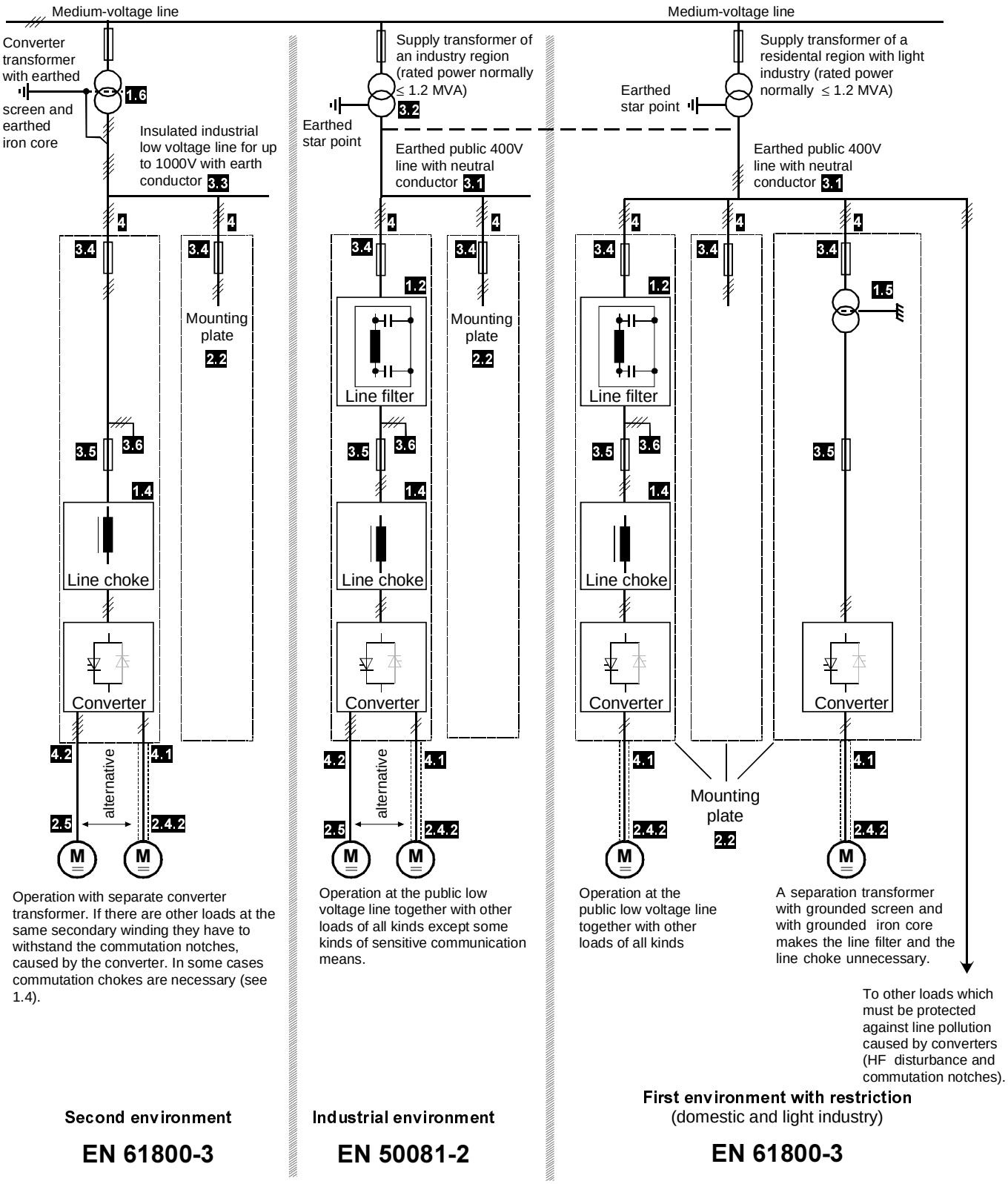
It must therefore be ensured that
- only qualified experts perform work at these machines and devices,
- these persons always have available - among other things - the operating instructions and other product-specific documentation supplied along when performing work, and are obliged to meet the requirements laid down in these documents,
- non-qualified persons are not authorized to perform any work at or near these machines and devices.

The operating instructions cannot take into consideration every possible case of configuration, operation or maintenance. Thus, they mainly give such advice only, which is required by qualified personnel for normal operation of the machines and devices in industrial installations.

If in special cases the electrical machines and devices are intended for use in non-industrial installations - which may require stricter safety regulations (e.g. protection against contact by children or similar) -, these additional safety measures must be carried out by the customer during assembly.

Earth connections must be made according to IEC 364!

Classification



The field supply is not shown in this synopsis drawing. The rules for the field supply cables are the same as for the armature supply cables.

Figures e.g. 3.1	see 3.1 or explanation available in chapter 3, paragraph 1
	screened cable, see 2.4.2
	unscreened cable with limitation, see 2.5

Legend

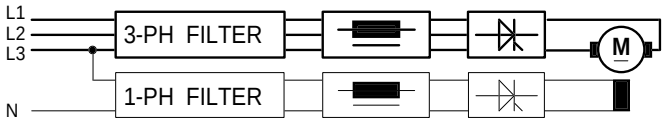
1.2 Three - phase filters

EMC filters are necessary to fulfill EN 50081 if a converter shall be run at a public low voltage line, in Europe for example with 400 V between the phases. Such lines have an earthed neutral conductor. ABB offers suitable three - phase filters for 400 V and 25 A....600 A and 500 V filters for 440 V lines outside Europe (see separate filter documentation).
Lines with 500 V to 1000 V are not public. They are local lines inside factories, and they do not supply sensitive electronics. Therefore converters do not need EMC filters if they shall run with 500 V and more (see also 1.6).

1.3 Single - phase filters for field supply

Many field supply units are single - phase converters for up to 50 A excitation current. They can be supplied by two of the three input phases of the armature supply converter. Then a field supply unit does not need an own filter as shown at the connection example (chapter 4).

If the phase voltage to the neutral conductor shall be taken (230 V in a 400 V line) then a separate filter is necessary as shown below. ABB offers such filters for 250 V and 6...30 A (see the specific converter documentation).



1.4 Commutation and line chokes

Converters cause short-duration short circuits at their AC inputs, so - called commutation notches. Such notches down to 0 V (100% depth) can be accepted at the secondary windings of converter transformers (operation without commutation chokes). However, their depth must be reduced if more than two converters of comparable power shall be supplied by the same transformer. Then commutation chokes are necessary. They must cause about 1% relative voltage drop at rated current. So - called 1% chokes are also necessary if the power of the converter is very low compared with the available power of the transformer or supply line. ABB offers suitable 1% chokes (see separate documentation).

According to the European standard EN 50178, §A6, the commutation notches must be kept below 20% of the line voltage if the line is public. This target can be achieved with the aid of line chokes. The inductance of these chokes must have 4 times the value of the network inductance at the converter's connection point. Therefore in many cases so-called 4% chokes are necessary, and therefore ABB offers also suitable 4% line chokes besides the 1% chokes (see separate documentation).

Due to the maximum power of public 400 V transformers (P_{MAX} = 1.2 MVA $\Rightarrow$ I_{MAX} = 1732 A) and due to their relative voltage drop 6% or 4% the maximum AC current which is available for a converter is 346 A or 520 A ($I_{DC} \leq$ 422 A or 633 A).

Often the maximum current is not limited by the transformer but by the power cable to the industry region. Therefore it is necessary to ask the energy supply company concerning the line impedance and the current which is available at the desired connection point of the converter.

1.5 Separation transformers

A separation transformer makes line chokes unnecessary because of its leakage inductance, and a grounded screen between its windings saves an EMC filter, see1.1 and 1.4. The screen and the iron core must be well connected with the mounting plate of the converter. If the transformer is located outside the converter cubicle the screen of a screened 3-phase cable ("first" environment, page 2 at the right) or a ground cable ("second" environment, page 2 at the left) must make this connection (see chapter 4 "Connection example").

1.6 Converter transformers

A converter transformer transfers high power directly from a medium voltage line to a single large converter or to a local low voltage line for several converters (see 3.3). Furthermore it acts as separation transformer according to 1.5.
If such a converter transformer has no screen the EMC demands are nevertheless fulfilled in most cases because the RF interference energy can hardly get via the medium-voltage line and the transformer of the public line to the loads which must be protected against pertubances. In the case of a dispute a measurement must be done at the point of coupling (public low - voltage line) according to EN 61 800-3.

2 Installation hints

2.1 Cabinets

All metal cubicles available on the market can be used, however, their mounting plates must have well conducting surfaces according to 2.2.
If a drive system is placed in more than one cubicle their mounting plates must be connected by broad pieces of well conducting sheet metal.

2.2 Mounting plate

The mounting plate must be made from steel with zinc surfaces and without any painting. It shall be connected with the PE copper bar by several bolts distributed in equal distances along the bar.

2.3 Placement of devices

The converter, the line choke, fuses, contactors and the EMC filter are to be placed on the mounting plate so that the connections can be made as short as possible, especially those from the converter via the line choke to the filter, and that point 2.6 can be fulfilled. The surface of the components to be mounted to the mounting plate has to be free of coating material.

2.4 Screening

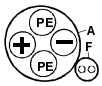
2.4.1 Signal cables

The cables for digital signals which are longer than 3m and all cables for analogue signals must be screened. Each screen must be connected at **both** ends by metal clamps or comparable means directly on clean metal surfaces, if both earthing points belong to the same earth line. Otherwise a capacitor must be connected to earth on one end. In the converter cubicle this kind of connection must be made directly on the sheet metal close to the terminals (see 4.3) and if the cable comes from outside also on the PE bar (see 4.1 and 4.2). At the other end of the cable the screen must be well connected with the housing of the signal emitter or receiver.

2.4.2 Power cables with screens

Power cables with screens are necessary, if they run over long distances (>20 m) where they are susceptible to EMC environmental conditions. The cable may have e.g. either a braided or spiral screen made preferably of copper or aluminium. The transfer impedance Z_T of the power cable must be less than 0.1 Ω/m in the frequency range up to 100 MHz, in order to ensure an effective reduction of emission and a significant increase of immunity. The screen must be pressed by a well conducting metal clamp directly against the mounting plate or the PE bar of the converter cubicle (see 4). There the contact surface shall be clean and as large as possible. The PE wire can be connected with a normal cable socket at the PE bar.
Screened cables to the armature and to the excitation winding cause the lowest noise level.

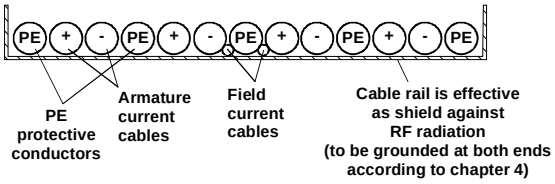
2.5 Power cables without screens



If a screen is not necessary (see 2.4.2) the armature current cable must be a four-wire cable because two wires are needed as conductors for the parasitic RF currents from the motor to the RF filter in the cubicle. The unscreened field current cable **F** must be installed directly along the armature cable **A**. A 2-wire cable is sufficient.

The arrangement according to 4.2 has been tested with a 20 m long motor cable with the result that the conducted emission requirements are fulfilled.

If the connections to the armature are made from single-wire cables, especially if n parallel wires are necessary for higher currents, then n+1 PE cables must be arranged together with them on a cable rail as shown in principal by the following drawing with n=4.



2.6 Placement of cables within the cabinet

All power cables which are directly connected with the converter (U1, V1, W1, C1, D1) must either be screened or be kept close together and close to the mounting plate and separate from all other cables (L1, L2, L3 included) and especially from unscreened signal cables. A recommended separation possibility is to place these power cables at the rear side of the mounting plate. If direct crossings of "polluted" cables and others, especially signal cables, are inevitable then they must be made rectangular.

2.7 Placement of cables outside the cabinet

The power cables must be arranged parallel and close together, see drawings in section 2.5. The speed feedback must be screened and placed directly along the power cables to the motor if the housing of the tacho machine is electrically connected with the housing of the motor. If the housing of the tachometer or the encoder is insulated from the motor then a distance between the power and signal cables is advantageous.

3 Others

3.1 Earthed public low voltage lines

The rated voltages of a public European low voltage line are 400 V between the 3 phases and 230 V between a phase and the neutral conductor. These voltages are provided by a transformer with its 3-phase secondary winding in star connection. The star point is connected with the neutral conductor and it is earthed at the transformer station. The electrical power is distributed by 4-wire cables to the electricity consumers. At a cable stub to a consumer, the neutral conductor must be earthed (local earth of the house or plant), and then it is splitted into a neutral and a PE conductor. Therefore a 3-phase load with neutral conductor must be supplied by a 5-wire cable. Converters, however, are 3-phase loads which do not need the neutral conductor in most cases. They can be supplied by 4-wire cables as shown in the drawing 1.1. The change from the earthed neutral conductor outside the house, plant or factory to the internal PE conductor with the local earthing point between is not shown in this drawing. See also chapter 4.
Power limitation: see end of 1.4!

3.2 Public low voltage lines in industrial regions

In an industrial region the noise level which is caused by converters is allowed to be 10 dB higher than in a residential region with included light industry. Therefore the protection targets concerning EMC can be met without screened motor cables if these cables are configurated according to 2.5.

A public low voltage line of an industrial region may have an own supply transformer as shown in the drawing 1.1, but often the lines of an industrial region and of a residential one are supplied by a common transformer. This depends on the power consumption of both regions and their distance. Power limitation: see end of 1.4!

The version with only one transformer, the right one in the drawing 1.1, is indicated by the dashed line between the lines of both regions. This dashed line represents a power cable from the transformer at the right to the industrial region at the left.

The power cable is important also for the EMC. Due to its length it reduces the noise level by at least 10 dB from the industrial to the residential region.

3.3 Industrial low voltage lines

Industrial low voltage lines are local lines in plants or factories. They have own supply transformers (see 1.6). In most cases they are insulated (IT network / no earthed star point) and their voltages are often higher than 400 V. The loads tolerate higher noise levels. Therefore and because industrial lines are decoupled from public lines by their transformers and distances converters do not need EMC filters at industrial low-voltage lines (see 1.6). Problems for other loads at the same line caused by commutation notches can be solved with the aid of commutation chokes (see 1.4).

Insulated lines must have also an earth conductor. The earth conductor is important for the feedback of parasitic RF noise currents from the DC motor via the converter to the earth point of the supply transformer of the line. Without such a conducted feedback the loop of the parasitic RF noise current is closed via the earth with the result that roving parts of this current can interfere electronical equipment far away from the drive.

3.4 Fuses at the stubs from the low voltage line

At the stubs the cross sections of the conductors become lower than in the main cable. Therefore fuses are prescribed which are adapted to the reduced cross section, and they must be located close to the stubs. This principle must be repeated at each reduction of the cross section from the stub at the main cable via the distribution net in a house or factory down to the connection point of a converter. The resulting fuse hierarchy is not shown in the drawing 1.1. Only the fuses of the lowest rank are mentioned. They are indicated at the top of the converter units. However, if the distance to the stub is too long the fuses must be located at the stub and not at the converter unit. This is the base for the connection example at the beginning of chapter 4.

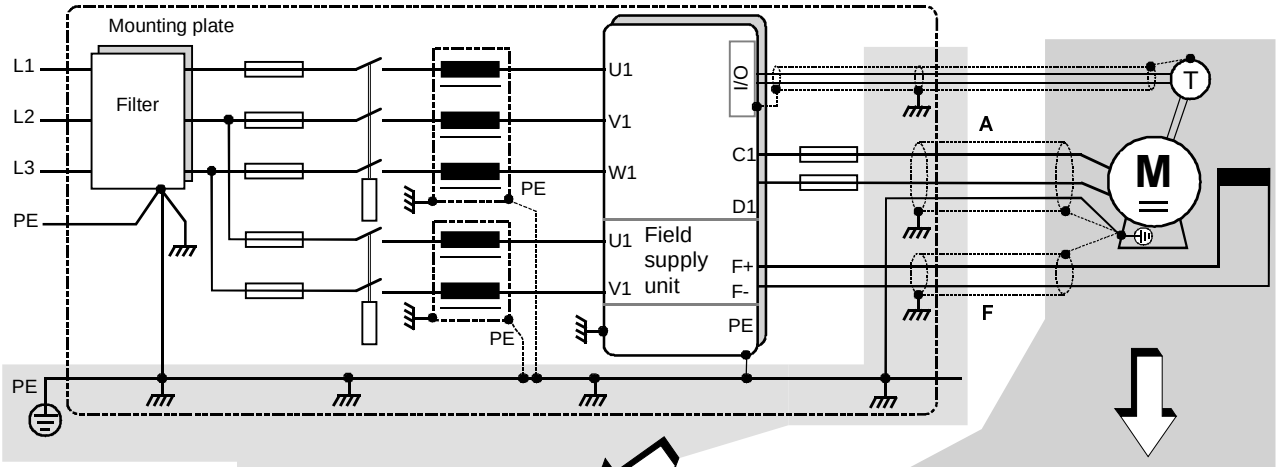
3.5 Fast fuses

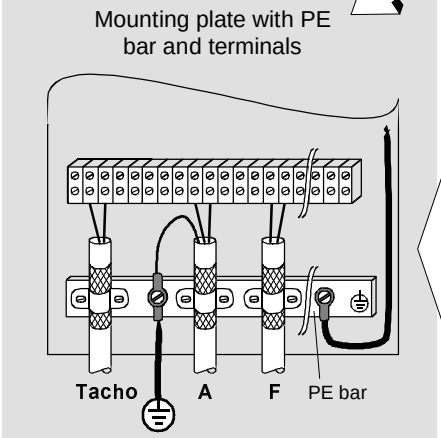
The converters are protected against overload by their control systems. Therefore dangerous overcurrents can be caused only by faults in the converters themselves or in the loads. In such cases the thyristors can be protected only with the aid of special fast fuses. Such fast fuses are shown directly at the AC connection points of the converters as well in the drawing 1.1 as with more details in the connection example at the beginning of chapter 4. But fast fuses outside the converters are necessary only for units of the lower power range. Larger converters comprise the fast semiconductor fuses.

3.6 Stub for auxiliary devices

Examples for auxiliary devices: field supply converters, transformers, fan motors.

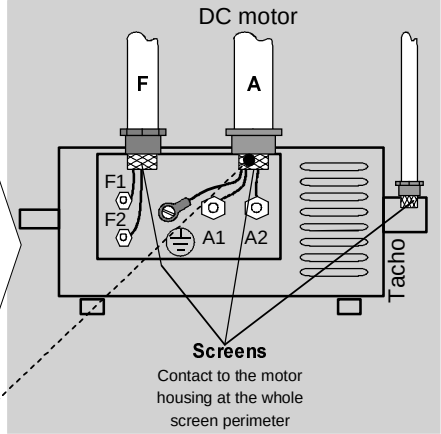
4 Connection example in accordance with EMC



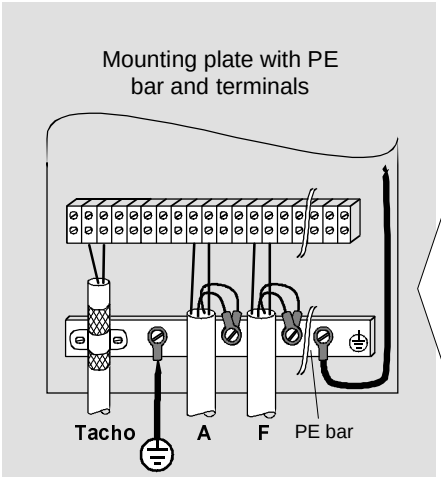


4.1

Armature and field cables with screens for "first environment"

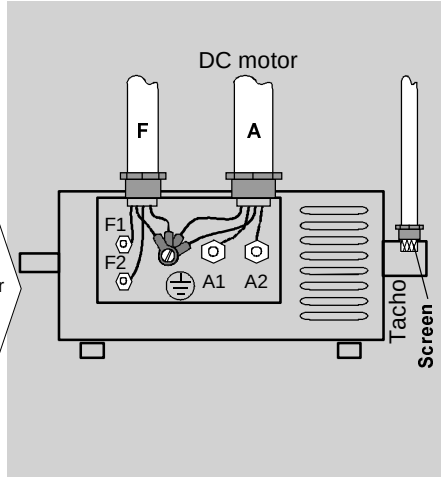


Hint: The armature current cable must contain a third wire for a PE connection if the copper cross section of the screen cannot fulfil the PE safety demands.



4.2

Armature and field cables without screens suitable for "second environment"



4.4 Remarks

4.4.1 Internal ground connections

Additionally to the PE connections good HF connections to ground must be realized with the aid of a mounting plate which has a well conducting surface (sheet metal from zinc - plated steel for example). This means, the housings of the line filter and of the converter must be pressed directly to the mounting plate by at least four fixing bolts, and the seating surfaces of the housings must be free from non conducting coating. These ground connections are indicated in the drawing at the top by the mass or chassis symbol: ⏚

The PE bar must be connected with the mounting plate by many bolts which are distributed along its whole length with equal distances.

4.4.2 Internal earth connections

All devices are connected with the PE bar by the mounting plate (and also by PE conductors), and the PE bar is earthed via the PE conductor of the 3-phase power cable.

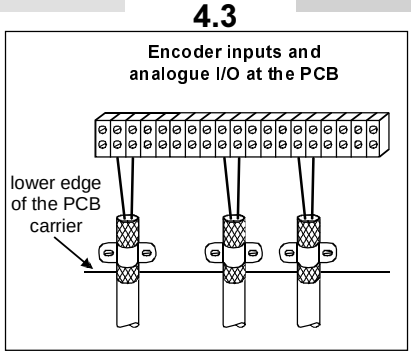
4.4.3 External earth connections ⏚

The drive shall be earthed only by the earth conductor of the line cable, see 4.4.2. An additional local earthing, especially at the motor, raises the level of the RF noise on the line cable.

4.4.4 Earth connections between motor and driven machine

The earth of a grounded driven machine must be connected to the earth of the driving motor, in order to avoid floating potential.

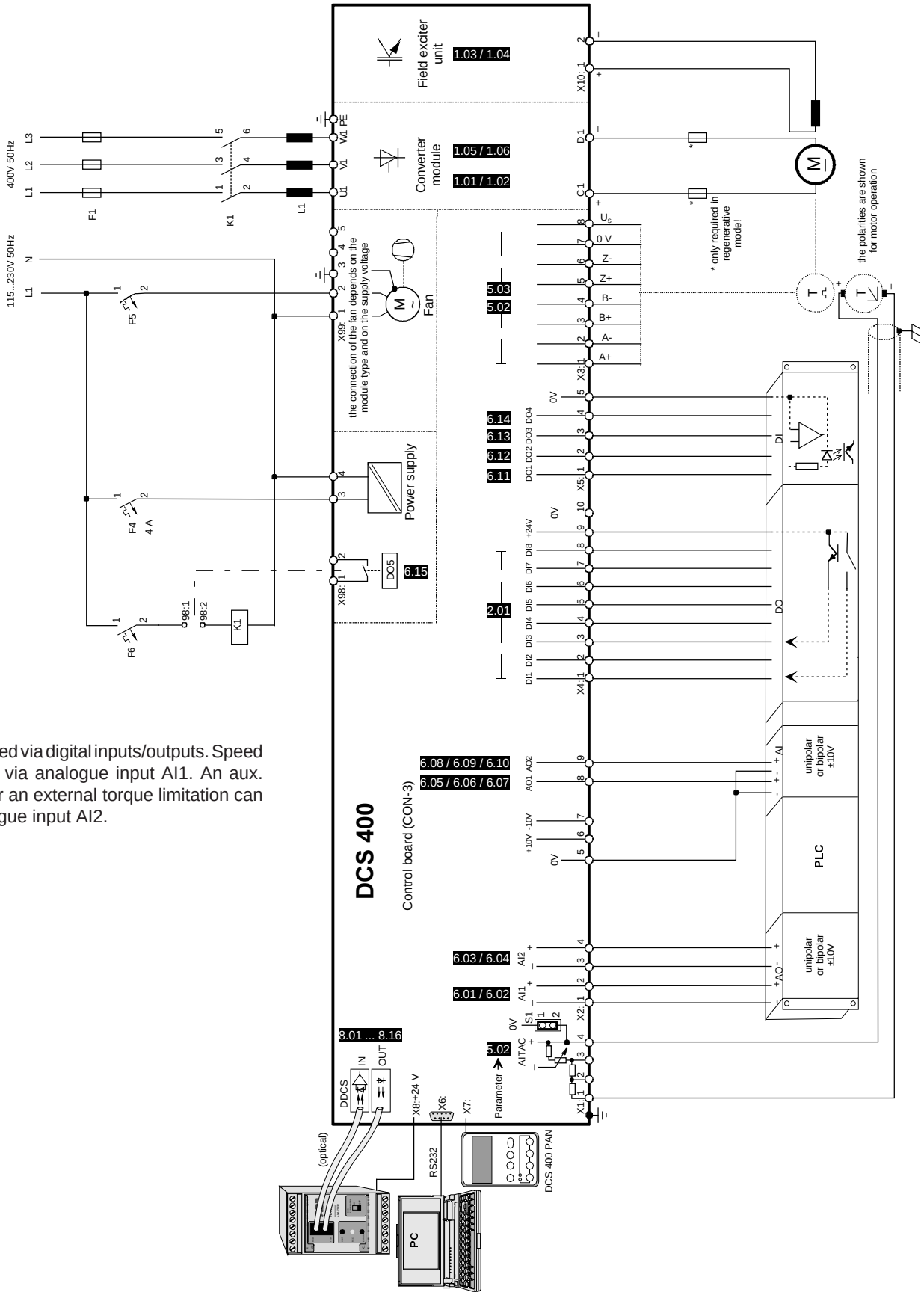
4.3



5 Important hint

The example shows the principle structure of a DC drive and its connections. It is a not binding recommendation, and it cannot respect all conditions of a plant. Therefore each drive must be considered separately and with respect to the special application. Additionally the general installation and safety rules must be taken in account.

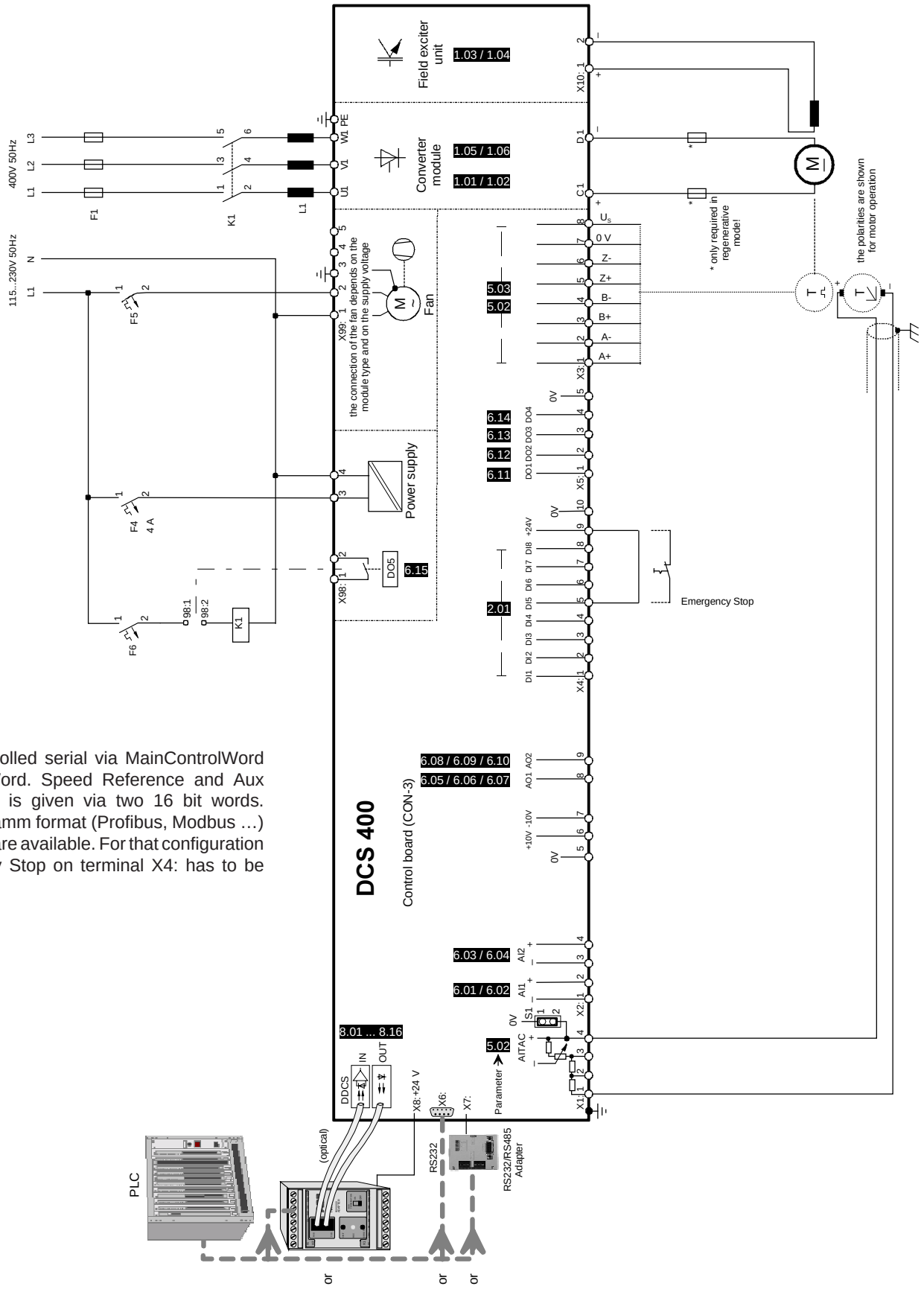
5.3.1 Connection example for digital and analogue coupling of a PLC



Remark
The drive is controlled via digital inputs/outputs. Speed reference is given via analogue input AI1. An aux. speed reference or an external torque limitation can be given via analogue input AI2.

Fig. 5.3/1: Connection example for digital and analogue coupling of a PLC

5.3.2 Connection example for serial communication of a PLC



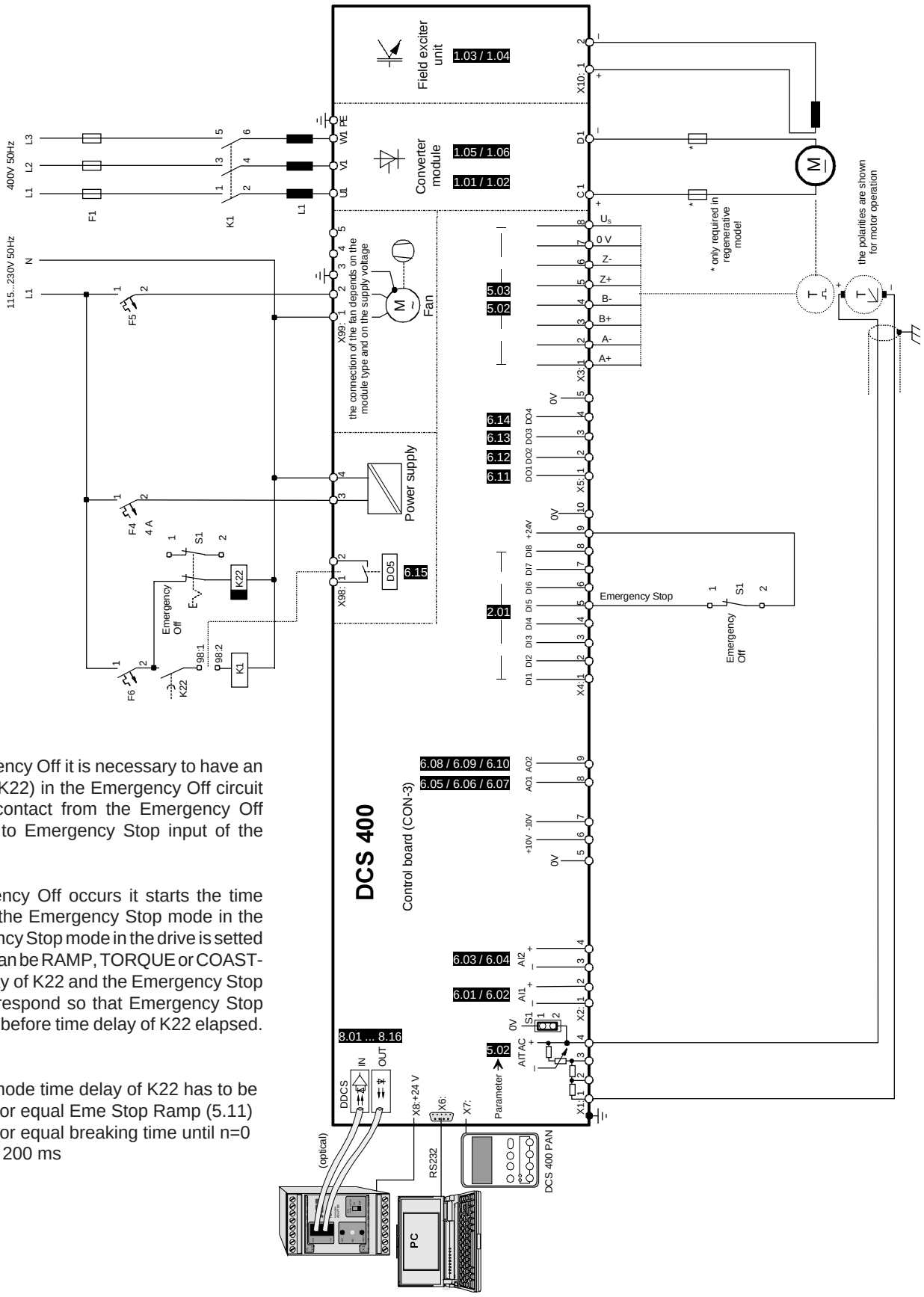
Remark

The drive is controlled serial via MainControlWord and MainStatusWord. Speed Reference and Aux Speed Reference is given via two 16 bit words. Depend on telegramm format (Profibus, Modbus …) five actual values are available. For that configuration only Ermergencey Stop on terminal X4: has to be connected.

Fig. 5.3/2: Connection example for a serial communication of a PLC

5.3.3 Connection example for Emergeny Off (valid for all macros)

General situation



Remark

In cases of Emergency Off it is necessary to have an OFF-delay relais (K22) in the Emergency Off circuit and an auxiliary contact from the Emergency Off button connected to Emergency Stop input of the drive.

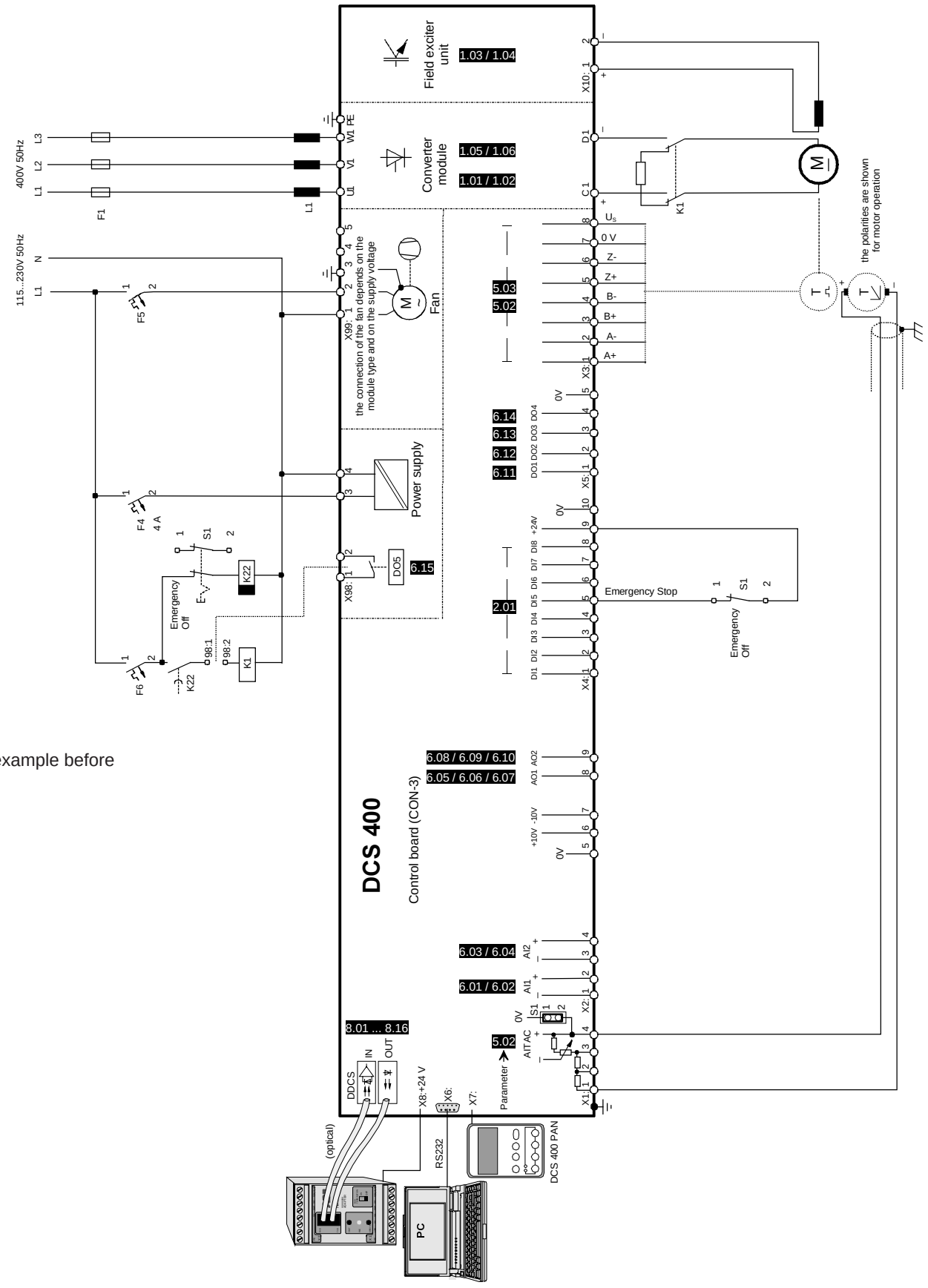
When the Emergency Off occurs it starts the time delay of K22 **and** the Emergency Stop mode in the drive. The Emergency Stop mode in the drive is setted by parameter and can be RAMP, TORQUE or COASTING. The time delay of K22 and the Emergency Stop mode have to correspond so that Emergency Stop mode has finished before time delay of K22 elapsed.

Depending on
Emergency Stop mode time delay of K22 has to be

Ramp	greater or equal Eme Stop Ramp (5.11)
Torque	greater or equal breaking time until n=0
Coasting	approx. 200 ms

Fig. 5.3/3: Connection example for Emergeny Off - General situation

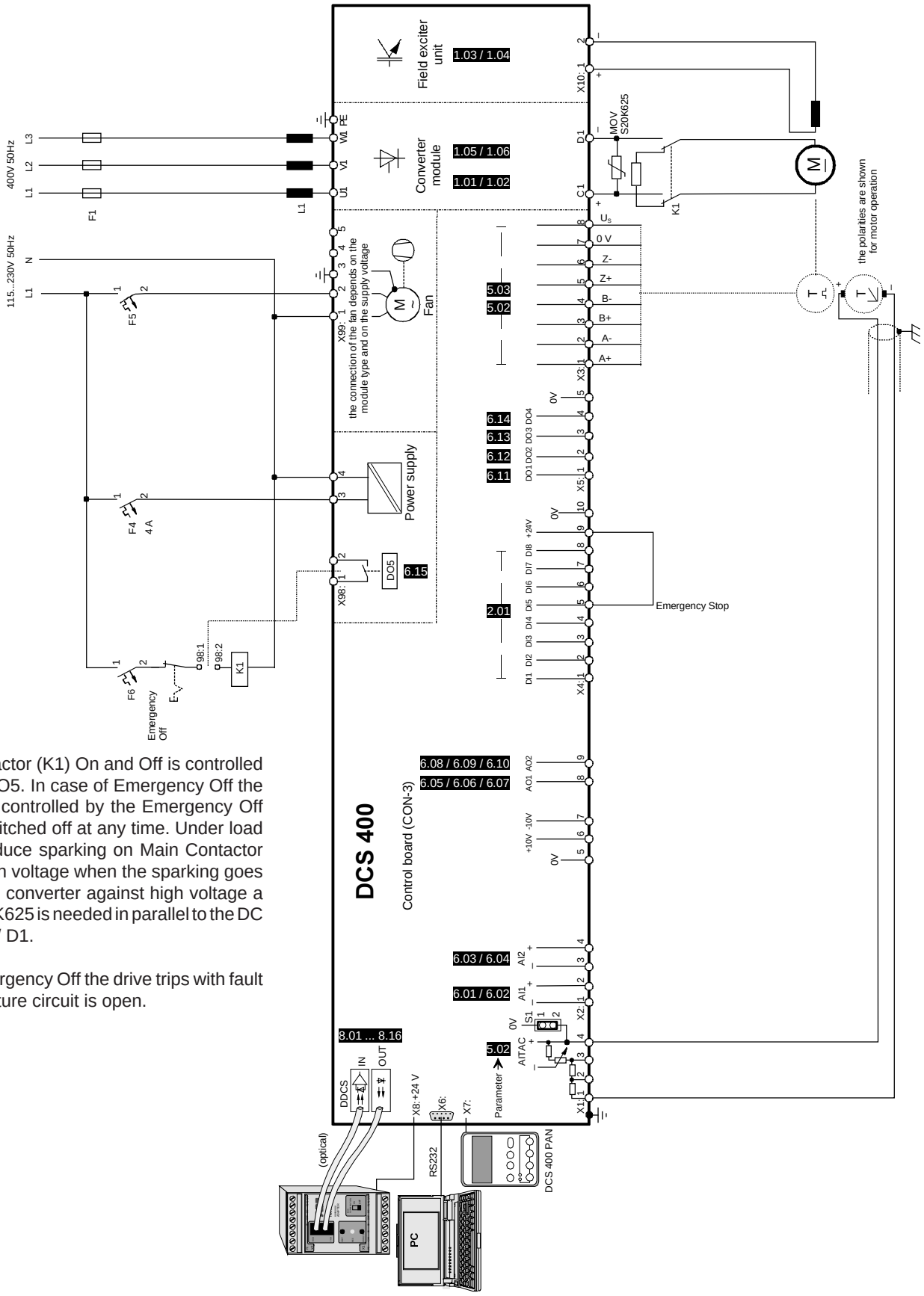
5.3.4 Connection example with DC breaker and controlled deceleration



Remark
see Connection example before

Fig. 5.3/4: Connection example with DC breaker and controlled deceleration

5.3.5 Connection example with DC breaker and drive coasting



Remark

Switch Main Contactor (K1) On and Off is controlled by digital output DO5. In case of Emergency Off the Main Contactor is controlled by the Emergency Off button and can switched off at any time. Under load condition that produce sparking on Main Contactor which produce high voltage when the sparking goes out. To protect the converter against high voltage a Varistor MOV S20K625 is needed in parallel to the DC terminal block C1 / D1.

In all cases of Emergency Off the drive trips with fault because the armature circuit is open.

Fig. 5.3/5: Connection example for Emergeny Stop - DC breaker with drive coasting

6 Operating Instructions

General
This manual is designed to help those responsible for planning, installing, start-up and servicing the thyristor power converter.
These people should possess:

- basic knowledge of physics and electrical engineering, electrical wiring principles, components and symbols used in electrical engineering, and
- basic experience with DC drives and products.

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'.

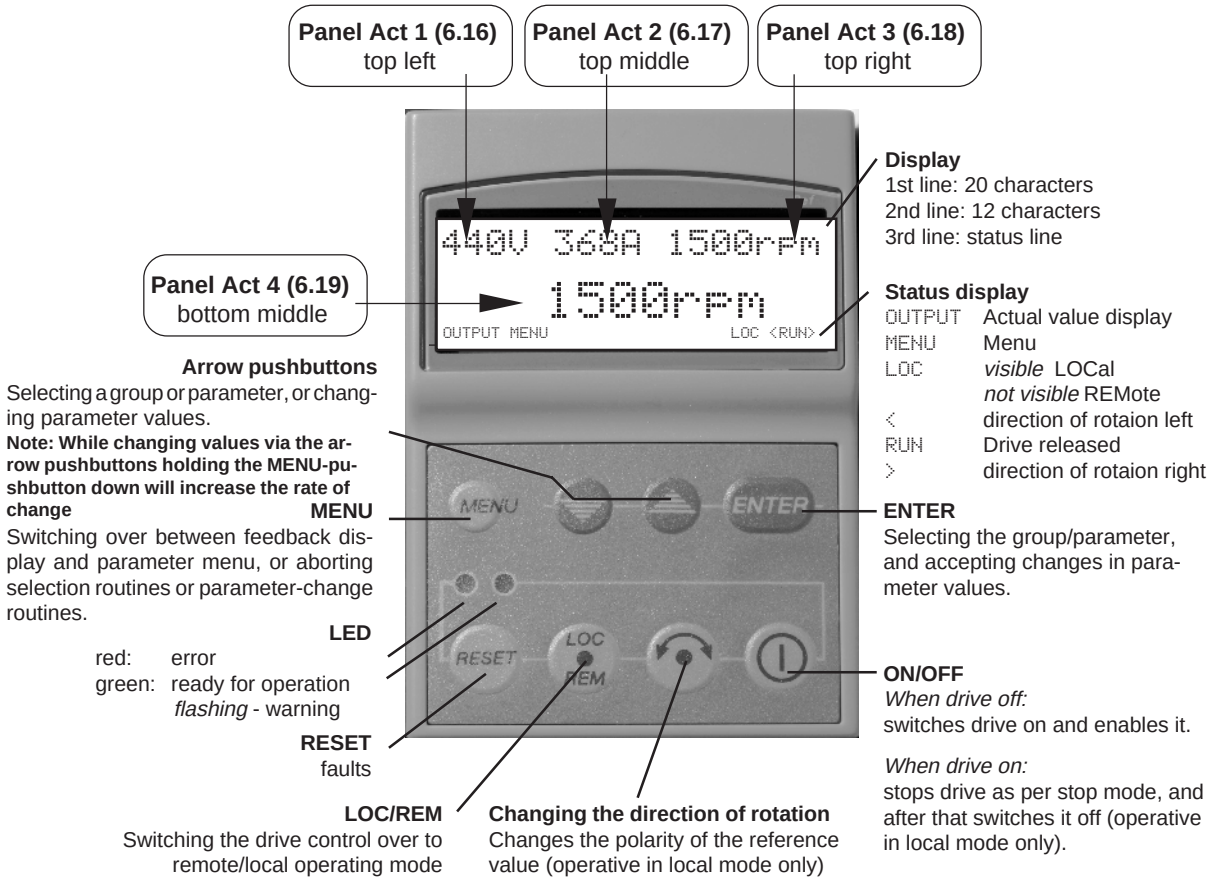
Operating panel DCS 400 PAN

The Control and Display Panel is used for parameter setting, for feedback value measuring and for drive control with series DCS 400 thyristor power converters.

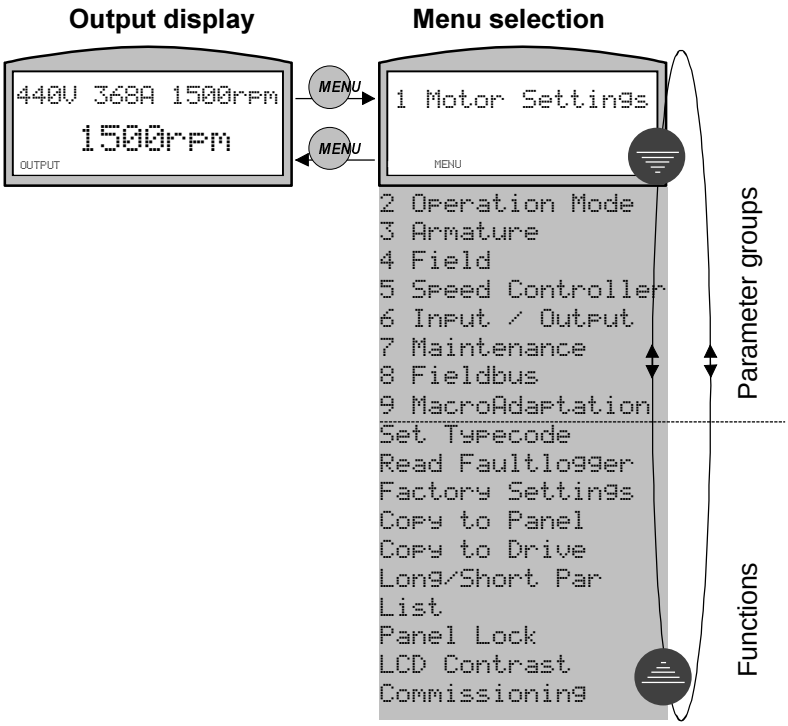
Panel link
The DCS 400 PAN is connected to the drive via a serial interface and is removable under power.

Initialization
After switch on electronics supply the panel shows actual values immediately.

OUPUT display
The panel display can show up to four actual values. Three values at the first line and one at the second line. For individual display it is possible to arrange these in any order via Parameter **Panel Act 1…4** .



Panel mode: Menu selection



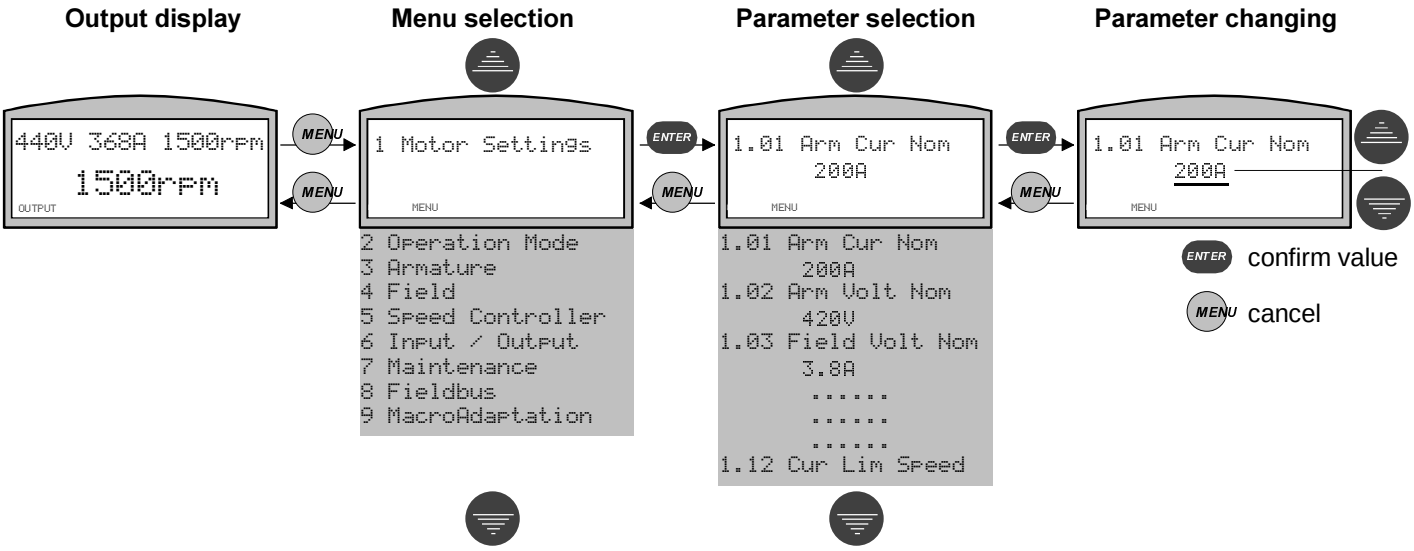
If **OUTPUT** is indicated in the status line of the panel display, press the MENU key to change over to menu selection. The menu selection mode allows you to access the parameter groups as well as the functions available.

After pressing the MENU key, menu item **1 Motor Settings** will always be displayed.

Using the ▼▲ keys, the list shown above can be scrolled endlessly.

To effectively select a specific menu item displayed, confirm the selection by pressing ENTER. The display will then switch to the menu item selected.

Panel mode: Parameter programming



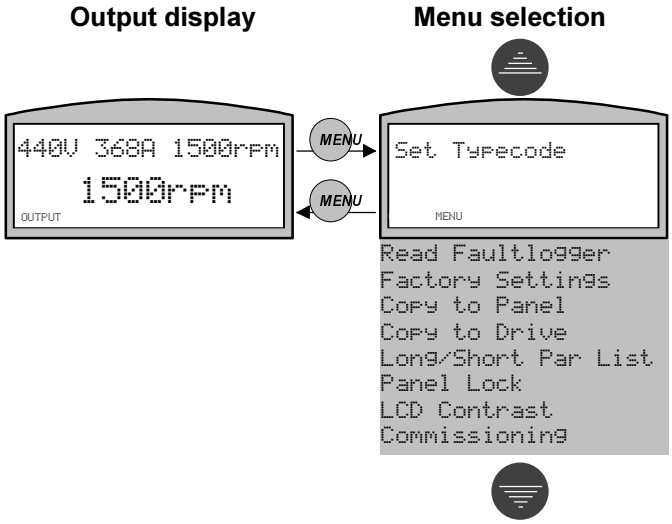
The first nine menu items or parameter groups are used for setting the drive parameters.
To access the desired parameter group, select the group concerned using the scrolling functions and confirm by pressing ENTER . The display now switches to the parameter selection level. To access a parameter from this group, select and confirm the parameter concerned as described above for the parameter group. The number, name and underlined value of the parameter selected is now displayed.

Only the underlined values can be changed with the keys. To confirm a changed value, press ENTER. If you want to preserve the original value, confirm this by pressing the MENU key. Pressing MENU key will return you to the parameter selection level.

Further parameters within the same group can be selected directly. To switch to a different parameter group, first press the MENU key to return to the menu selection level, then select the next group using the keys, etc.

Don't forget to upload parameters into the panel.

Panel mode: Function selection



Functions are selected in the menu selection mode and confirmed with ENTER .
The function concerned will be executed immediately:

Set Typecode

Use only for replacement of SDCS-CON-3.

Select 'Yes' for Typecode adaptation.

Enter correct PIN number ('**400**').

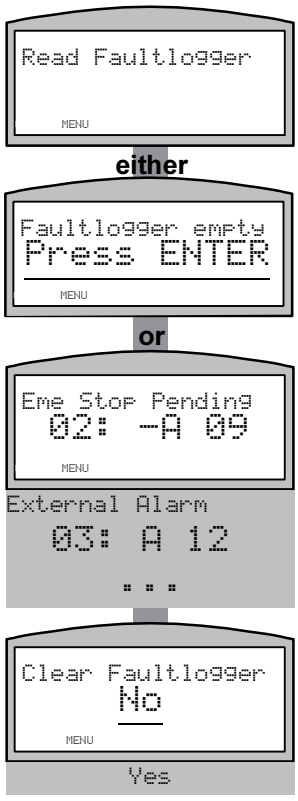
See converter name plate and select the same type in the list.

Cancel function, back to Select Typekey with ENTER.

Confirm the right Typekey with ENTER.

Reboot the drive system by switching the electronis Off and On.

Read Faultlogger



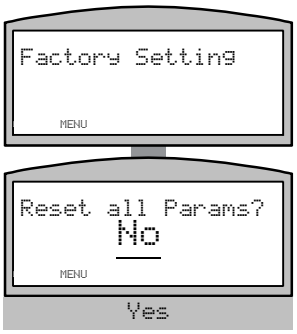
If the Faultlogger is empty this message will appear, back to OUTPUT Display with ENTER.

If there Faultlogger contents a message (as examle) will appear.
The **-** sign before the **A** means the alarm is existing in this moment no longer. Use the ▼▲ keys for scrolling in the Faultlogger. To escape the Faultlogger press the ENTER or MENU key.

The Faultlogger contents will be deleted, back to OUTPUT Display with ENTER.

The Faultlogger is deleted during shut-down of electronics supply.

Factory Setting

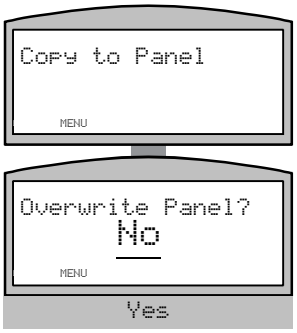


Resets all parameters to the factory settings.

⇨Cancel function, no reset of parameters.

⇨Resets all parameters to the factory settings.

Copy to Panel



Copies all drive parameters into the panel. **Should be the last action after commissioning.**

⇨Cancel function, no transfer of parameters to the panel

⇨Transfer of parameters from drive to the panel.

Copy to Drive

Transfers all previously copied parameters to the drive.

⇨Cancel function, no transfer of parameters to the drive.

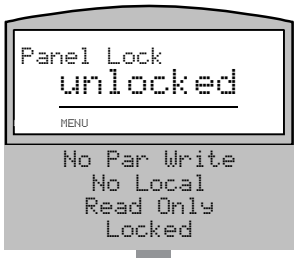
⇨Transfer of parameters from panel to the drive.

Long/Short Par List

⇨Switches to short parameter list.

⇨Complete parameter list visible.

Panel Lock



⇨All entries possible.

⇨Parameter modification disabled
⇨Drive control from panel disabled
⇨Parameter modification and drive control disabled
⇨Only display of actual values possible

Before any change in the Panel Lock mode can become effective, the **PIN number** (“400“) first has to be entered.

Select the desired lock mode and press ENTER.

Enter the PIN number using the keys, then press ENTER .

If the correct PIN number has been entered, the Panel Lock mode will be changed and the display updated accordingly.

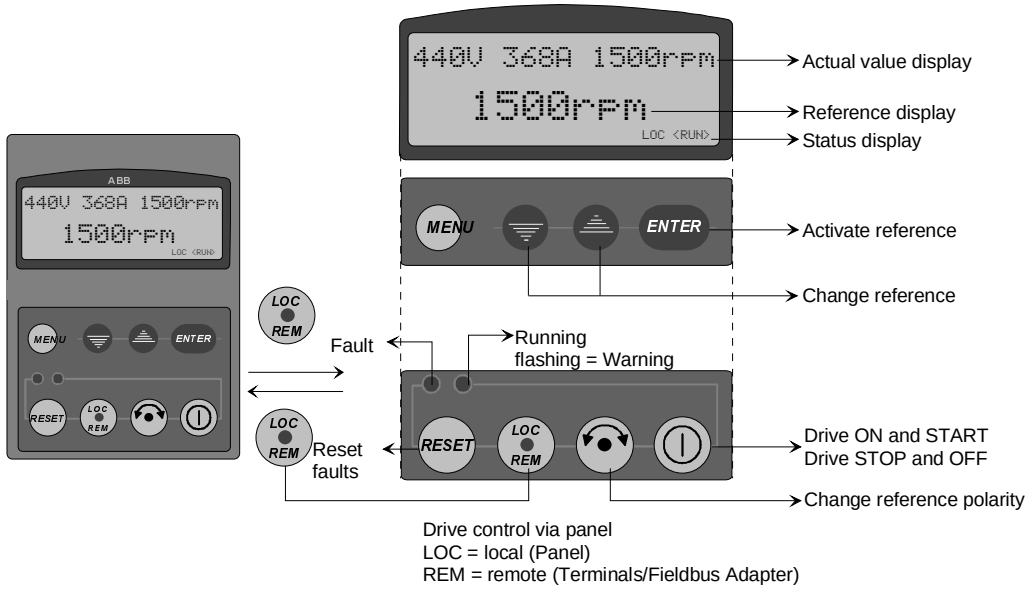
If the PIN number entered is incorrect, the Panel Lock mode will **not** be changed and the original mode will still be displayed.

LCD Contrast

Change the LCD contast by using the keys. The result will be shown immediately.

Commissioning

See chapter: **Guided commissioning**



Drive control from the panel

⚠ CAUTION: Appropriate safety precautions must be taken before starting the drive.

Before the drive can be controlled from the panel, the panel first must be given permission to take control. The panel's ability to control the drive is determined by the **Panel Lock** function which can be accessed through menu selection and by the **LOC/REM** key provided on the panel. The Panel Lock mode must be set to **unlocked** or **no par write**, since all other entries will **prevent** the panel from taking control of the drive. The LOC/REM key is used to actually transfer control to the panel. This is then signaled by the LOC status indication in the status line. Pressing the key once again will cause the panel to give up its command of the drive, and the LOC indication in the status line will disappear.

Actual value display
In the first line of the panel display, the actual values selected with the parameters Panel Act 1 (6.16) to Panel Act 3 (6.18) are indicated. The desired actual values have to be defined beforehand with these parameters. When the drive is being controlled from the panel, the actual values are continually updated.

Reference display
In this line, the speed reference set by means of the UP/DOWN keys is displayed.

Status display
LOC in the status line indicates that the drive is being controlled from the panel.
RUN in der status line indicates that the drive is switched on and enabled.

Activate reference
Any modification of a reference value has to be initiated by pressing the ENTER key, which will result in the reference value displayed being underlined. The desired reference value is then set using the UP/DOWN keys. The new reference value will only become effective after the ENTER key is pressed once again. The underline then disappears.

Change reference
A reference value can be changed only when it is displayed with an underline. Using the UP/DOWN keys, you can set any speed reference between 0 rpm and the maximum speed defined with the parameter Max Speed (1.06). Only positive speed references are set, since the reference's polarity can be changed by pressing the appropriate key.

Drive ON and START, Drive OFF and STOP

⚠ CAUTION: Appropriate safety precautions must be taken before starting the drive.

The function of this key is dependent on the current drive status. If the drive is in the OFF state, pressing this key will switch ON the line contactor and enable the controller. The drive will the accelerate in accordance with the preset ramp time (5.09) up to the selected speed reference.
If the drive is in the ON state, pressing this key will stop the drive. The drive will then decelerate in accordance with the preset stop mode (2.03) and ramp time (5.10, if activated) and will switch OFF the line contactor.

Change reference polarity
The polarity of the speed reference indicated in the reference display can be changed by pressing this key. The motor will first decelerate and then accelerate - only in 4Q applications - in the reverse direction.

Reset (Fault acknowledgement)
All faults detected by the converter can be reset by simply pressing this key, provided that the faults concerned are no longer active.

The DCS 400 converters of ABB offer the possibility to have a guided commissioning by means of **interactive dialogue** through the parameter programming. One guarantees with it, that the drive is set up right and is optimized.

This section describes the **guided commissioning** with the panel. The necessary dialogue, also Panel Wizard named, is used by the command sequence shown below.

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'.

Start the guided commissioning:

- **Switch electronics on**
- **press** MENU
- **press**
- **press** ENTER
- **follow the instructions**

The following conventions apply for the commissioning procedure:

MENU			ENTER
Aborts the commissioning procedure or returns you to the previous step. Pressing MENU will always stop a running machine.	Scrolls downward through selection parameters or decrements value parameters.	Scrolls upward through selection parameters or increments value parameters.	Confirms an entry and takes you to the next step of the commissioning procedure, or confirms MENU.

Parameter entries
The entries required during the guided commissioning procedure are divided into selection parameters and value parameters.

Selection parameters are selected from a predefined text list and confirmed.
The control panel display only shows one line of this text list at a time. Therefore, the list must be scrolled line by line, using the ▼▲ keys. To confirm a selection, press ENTER .

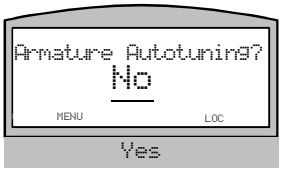
Panel display

Line 1: Parameter number and parameter name.
Line 2: Line currently selected in the text list.

In the commissioning instructions, alternative lines of a text list are displayed against a grey-shaded background.

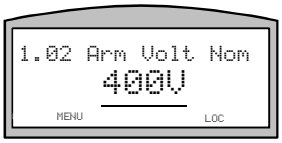
Select the desired line using the ▼▲ keys.

Confirm your selection by pressing ENTER .



Yes/No decisions are treated in the same manner as selection parameters.

Value parameters are parameters with numerical contents, whose values can be incremented or decremented by pressing the ▼▲ keys. Each key stroke will increment or decrement the selected parameter by 1.
Holding down one of these keys will cause the parameter value concerned to be increased or decreased rapidly.
Confirm the desired values by pressing ENTER .



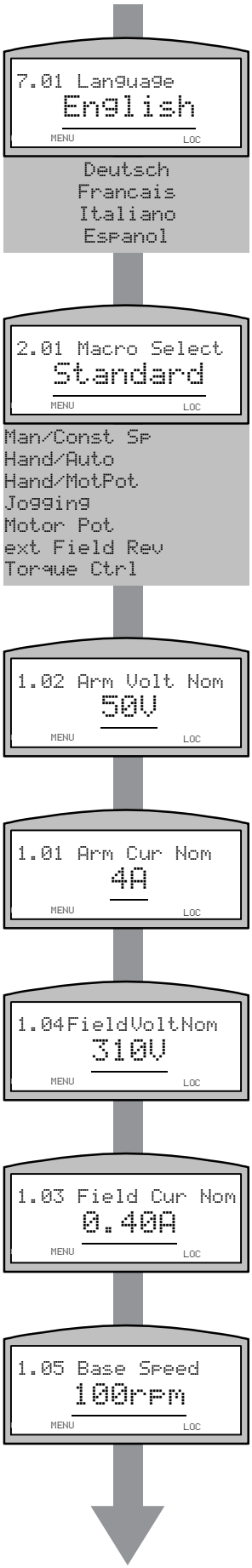
Line 1: Parameter number and parameter name.
Line 2: Parameter value.
During the guided commissioning procedure, all values which can be changed are displayed with an underline. Use the ▼▲ keys to change the values and confirm the entry by pressing ENTER . This will take you to the next step of the commissioning procedure.

Interrupting the guided commissioning procedure
The guided commissioning procedure can be interrupted by pressing MENU . There are three posibilities for selection for going on the process.
⇨One **step back** in commissioning procedure.

⇨**Continue** with the same step.
⇨**Exit** guided commission procedure.

Confirm your selection by pressing ENTER .

Commissioning step



Comments

Language
Select and confirm.

Macro
Select and confirm.
Detailed information abaut macros see ch. 4.2 *Application Macros*

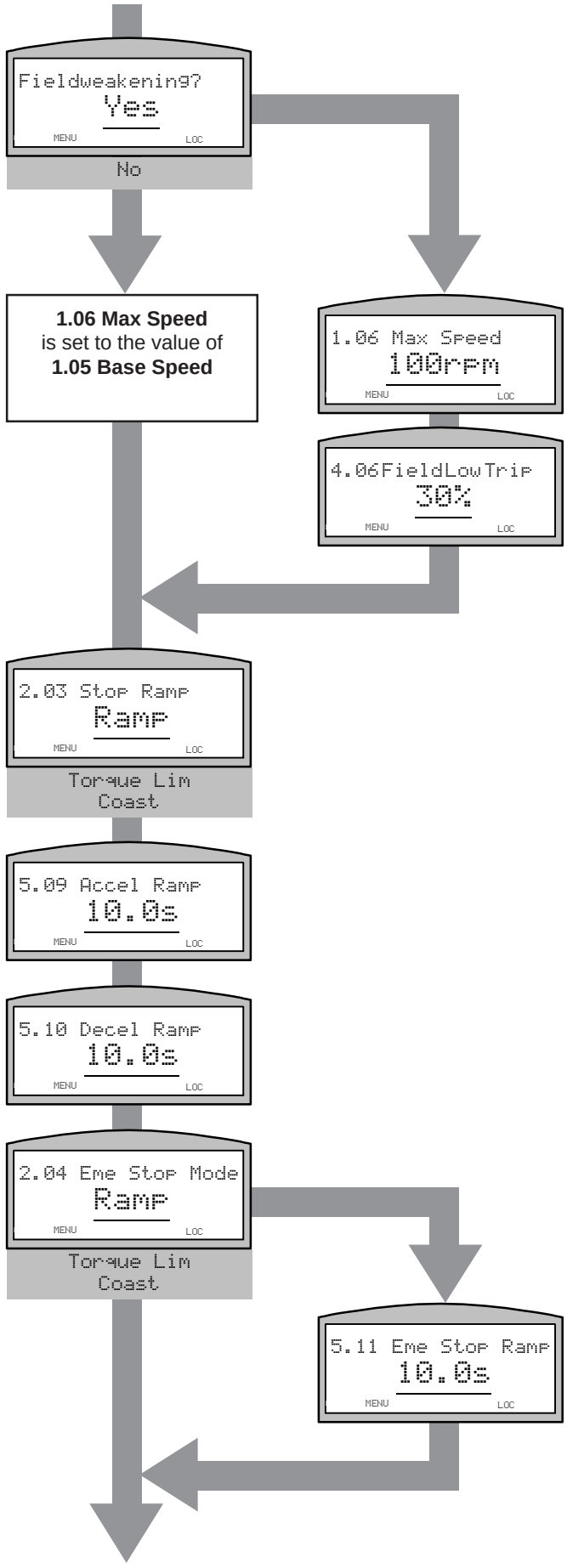
Nominal armature voltage
see motor name plate

Nominal armature current
see motor name plate

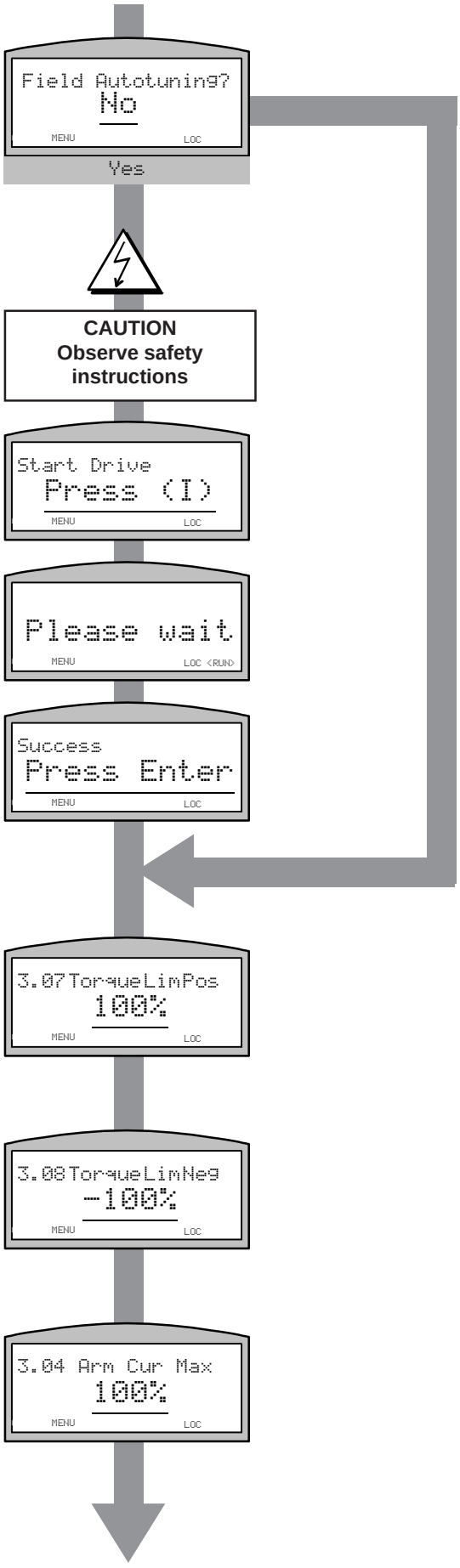
Nominal field voltage
see motor name plate

Nominal field current
see motor name plate

Nominal speed
see motor name plate


Commissioning step
Comments
Fieldweakening?
Yes
MENU
LOC
No
Field weakening Yes/No
1.06 Max Speed
is set to the value of
1.05 Base Speed
1.06 Max Speed
100rpm
MENU
LOC
Maximum speed for field-weakening operation
see motor name plate
4.06FieldLowTrip
30%
MENU
LOC
Minimum field current in field weakening operation
see motor name plate
2.03 Stop Ramp
Ramp
MENU
LOC
Torque Lim
Coast
Selection of desired operating response at Stop Mode
5.09 Accel Ramp
10.0s
MENU
LOC
Acceleration ramp
5.10 Decel Ramp
10.0s
MENU
LOC
Deceleration ramp
2.04 Eme Stop Mode
Ramp
MENU
LOC
Torque Lim
Coast
Selection of desired operating response at Emergency stop mode
5.11 Eme Stop Ramp
10.0s
MENU
LOC
Deceleration ramp for Emergency Stop Mode

Commissioning step



Comments

Field current controller optimization

CAUTION
Field voltage of the motor will be energized.

Press (I) key on panel to apply field voltage to the motor.

Optimization running.
If any faults or alarms have occured during optimization, further action depends on the messages displayed; see chapter Troubleshooting. To repeat the optimization process, press MENU

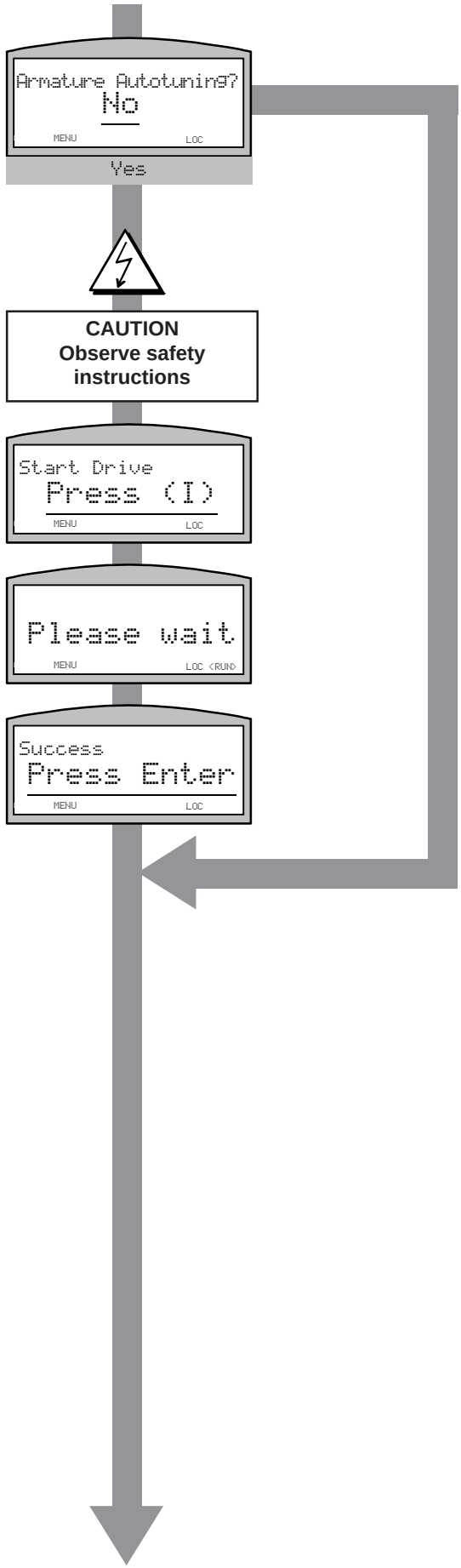
After successful optimization, the following parameters have been set:
4.03 - Proportional component
4.04 - Integral component
ENTER will continue the commissioning procedure.

Positive torque limit

Negative torque limit

Maximum permissible armature overcurrent

Commissioning step



Comments

Armature current controller optimization

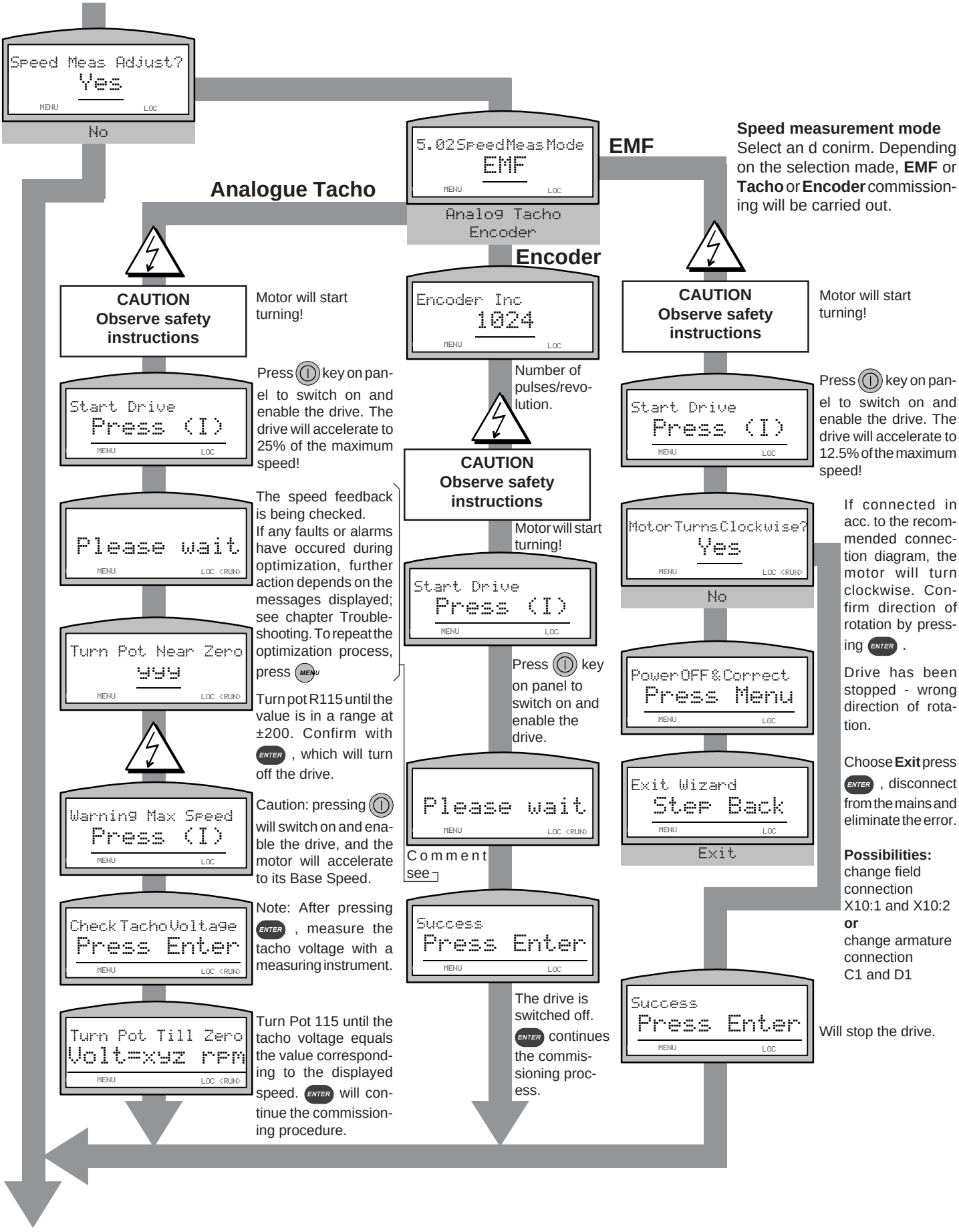
CAUTION
Motor will be energized.

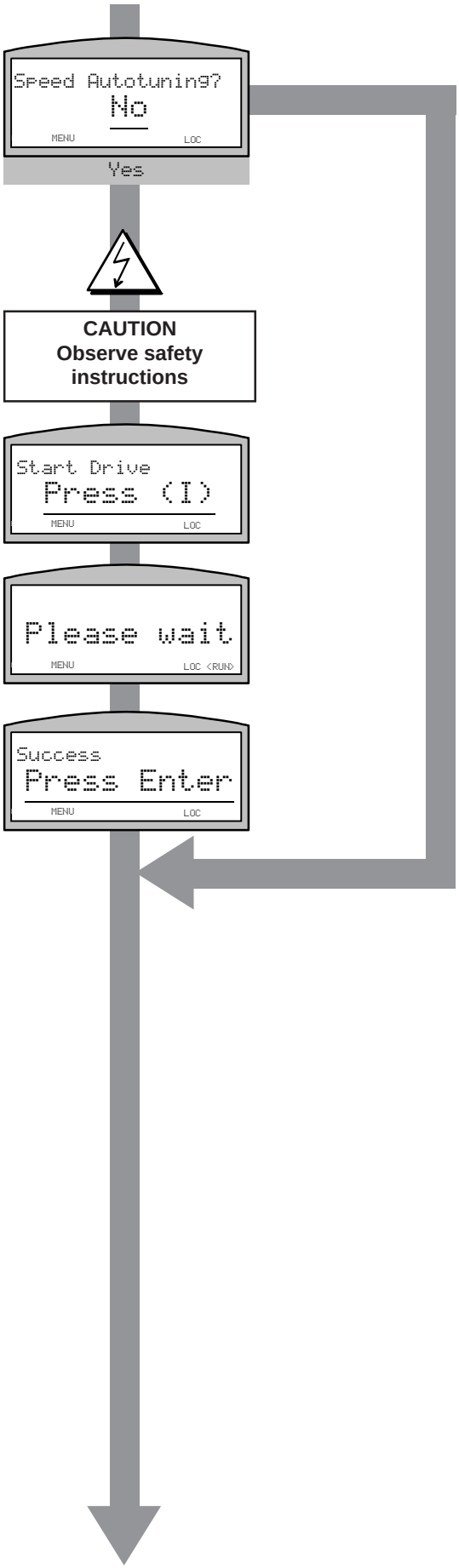
Press (I) key on panel to apply field voltage armature voltage to the motor.

Optimization running.
If any faults or alarms have occured during optimization, further action depends on the messages displayed; see chapter Troubleshooting. To repeat the optimization process, press MENU

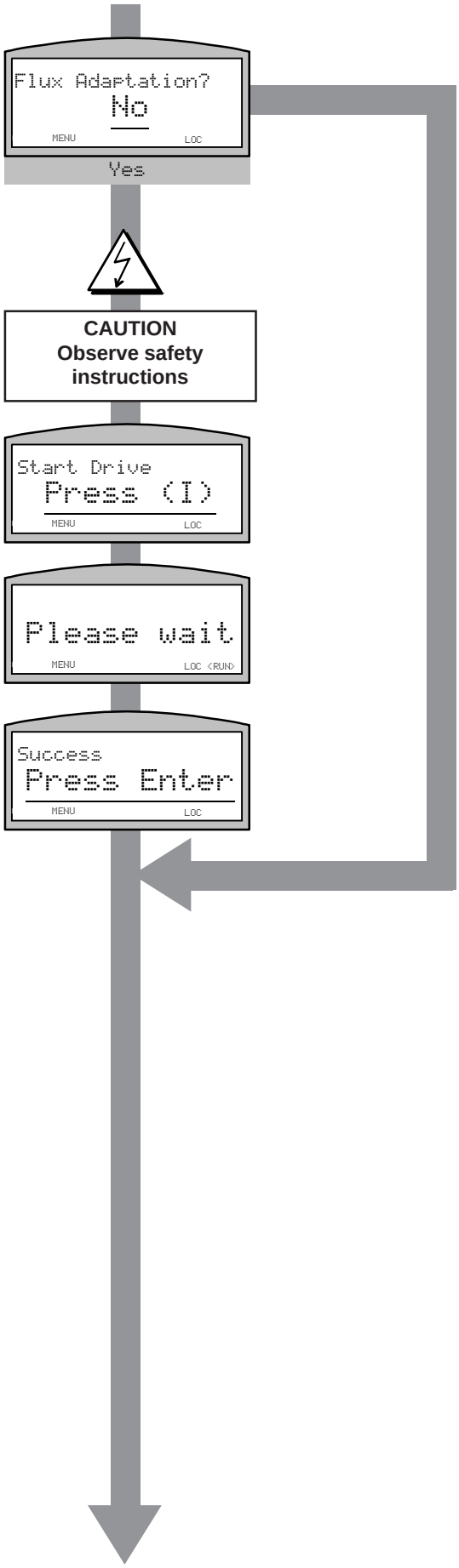
After successful optimization, the following parameters have been set:
3.09 - Proportional component
3.10 - Integral component
3.11 - Limit for continuous current flow
3.12 - Armature inductance
3.13 - Armature resistance
ENTER will continue the commissioning procedure.

Commissioning step



Commissioning step	Comments
	**Speed controller optimization** Select and confirm. CAUTION Motor will start turning! Press (I) key on panel to switch on and enable the drive. Optimization running. The drive will accelerate twice to 80% of Base Speed. If any faults or alarms have occured during optimization, further action depends on the messages displayed; see chapter Troubleshooting. To repeat the optimization process, press MENU After successful optimization, the following parameters have been set: 5.07 - Proportional component 5.08 - Integral component ENTER will continue the commissioning procedure.

Commissioning step



Comments

Flux optimization
not available in EMF Mode.

CAUTION
Motor will start turning!

Press (I) key on panel to switch on and enable the drive.

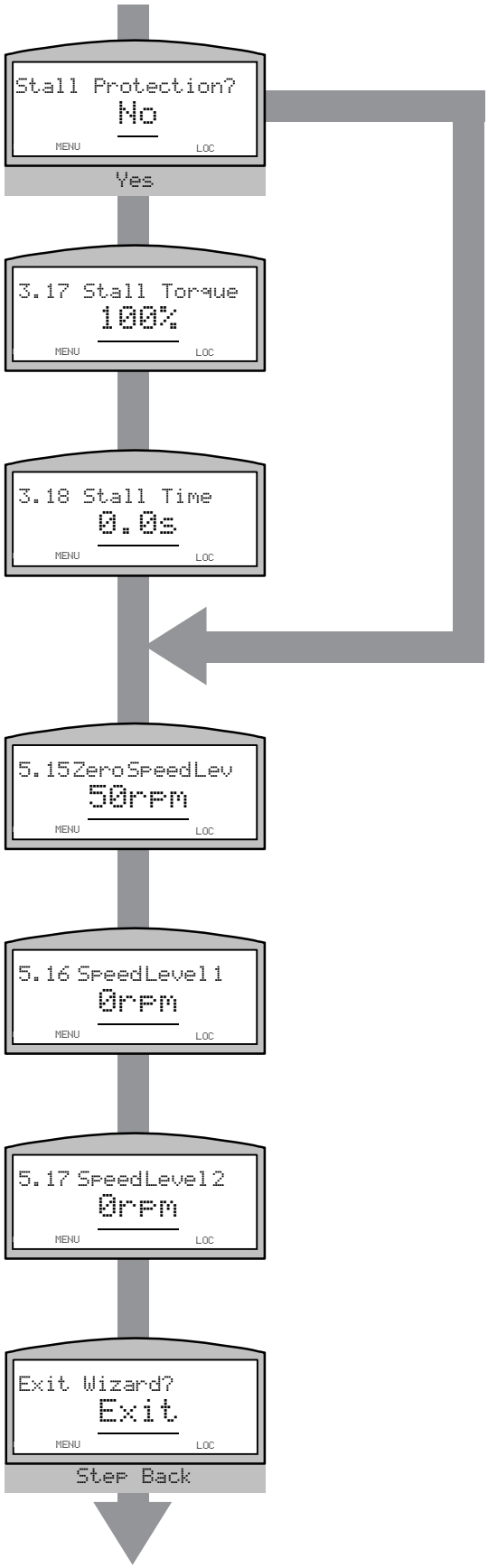
Optimization running.
The drive will accelerate to 50% of Base Speed.
If any faults or alarms have occured during optimization, further action depends on the messages displayed; see chapter Troubleshooting. To repeat the optimization process, press MENU

After successful optimization, the following parameters have been set:
4.07 - I_e for 40% flux
4.08 - I_e for 70% flux
4.07 - I_e for 90% flux

ENTER will continue the commissioning procedure.

Commissioning step

Comments



Stall protection

Stall torque

Stall time

Minimum speed
for zero speed detection

Intermediate speed 1

Intermediate speed 2

ENTER to terminate the guided commissioning procedure.

End of guided commissioning

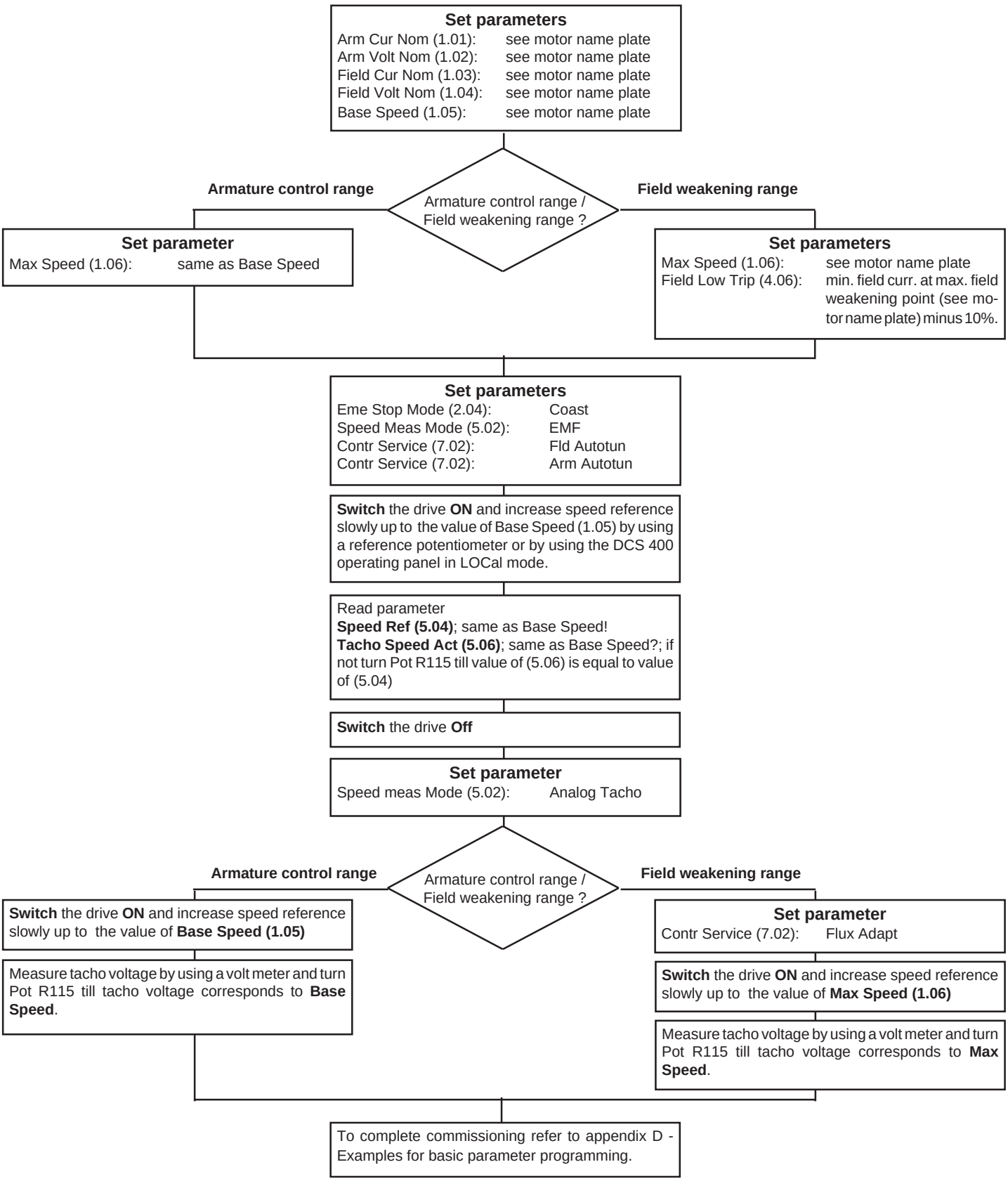
Don't forget to upload parameters into the panel. Use function 'Copy to Panel'

Manually commissioning

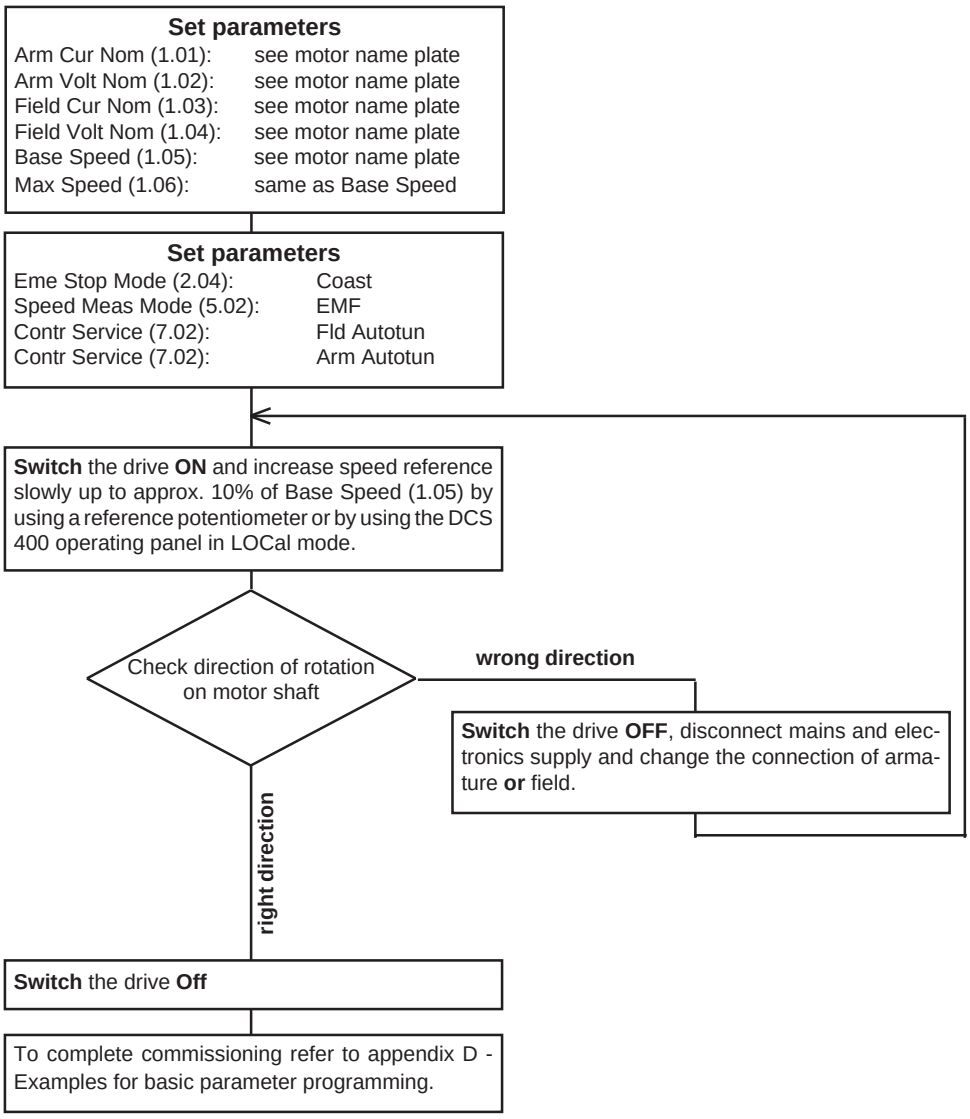
Short description for manual commissioning a DCS400 via control panel.
Follow this guide if panel commissioning wizard has failed.
Valid for software version 106.0 and higher.

In the following charts the main structure of the different commissioning steps refering to the speed measurement are given. For the specific information related to the parameters and panel handling see the corresponding chapters.

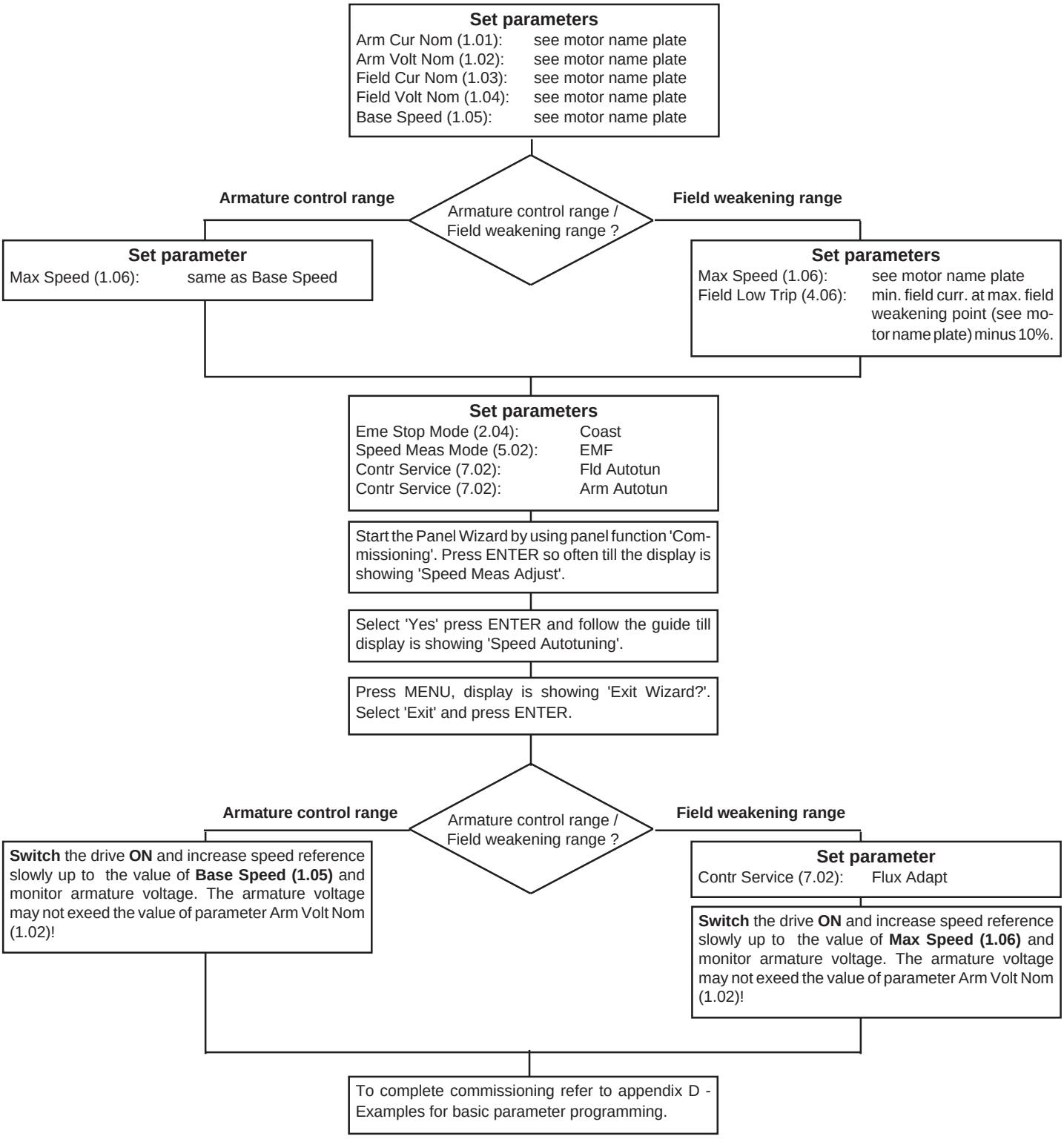
with **Analogue Tacho** feedback



with **EMF** feedback



with **Encoder** feedback



6.3.1 Display of status, alarm and fault signals

The available signals (messages) for thyristor power converters series DCS 400 are subdivided into five categories:

 General messages

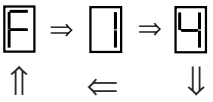
 Starting errors

 Fault signals

 Alarm signals

7.03 Diagnostic messages

A **seven segment display** on the control board SDCS-CON-3 of the thyristor power converters series DCS 400 is used to show general messages, starting errors, fault and alarm signals. The signals (messages) are displayed as codes. If the codes consist of several parts, the characters/individual digits will be indicated respectively e.g.:

 F 14 = Armature Overcurrent

In addition to the seven segment display, the LCD of the control panel DCS 400 PAN will be able to show the fault and alarm signals as well as the diagnostic messages as clear text.
Note: The languages available for display as text depend on Parameter 7.01.

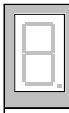
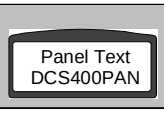
FAULT WORD1 [7.09]
FAULT WORD2 [7.10]
FAULT WORD3 [7.11]
ALARM WORD1 [7.12]
ALARM WORD2 [7.13]
ALARM WORD3 [7.14]
contain several fault and alarm signals as a binary code. For subsequent evaluation the information is available via serial interfaces using parameter transmission.

Last alarm signal is coded as an individual error code in the location **VOLATILE ALARM [7.08]**.

Also a Faultlogger is available where the last 16 faults and alarms occured are stored. Read the messages by using panel function 'Read Faultlogger' or using the PC tool 'Drives Window Light' to recognize the fault and alarm history.

6.3.2 General messages

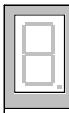
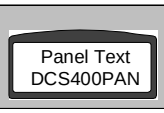
The general messages will only be shown on the seven segment display of the control board SDCS-CON-3.

	 Panel Text DCS400PAN	Definition	Remark
8.	Comm Loss	Program is not running	**(1)**
.	normal output display	Normal situation, no fault / no alarm signal	

(1) Visible for short time during boot up.
Visible during Boot mode of Firmware Download Program.
Units should be switched off. Please check jumper S4=3-4 and S5=5-6 and switch on electrically; if fault occurs again, the PCB SDCS-CON-3 has to be checked and if necessary to be changed.

6.3.3 Starting errors (E)

The starting errors will only be shown on the seven segment display of the control board SDCS-CON-3. With starting errors it will not be possible to start the drive.

	 Panel Text DCS400PAN	Definition	Remark
E1	COMM LOSS	Internal FPROM checksum error	(1)
E2	COMM LOSS	Reserved for External FPROM checksum error	(1)
E3	COMM LOSS	Internal error in even address of ROM	(1)
E4	COMM LOSS	Internal error in odd address of ROM	(1)
E5	COMM LOSS	Reserved	(1)
E6	COMM LOSS	Software hold by watchdog function	(1)

(1) Units should be switched off and on electrically; if fault occurs again please contact local ABB service center.

6.3.4 Fault Signals (F)

The fault signals will be shown on the seven segment display of the control board SDCS-CON-3 as codes **F . .** as well as on the LCD of the control panel DCS 400 PAN as plain text.

All fault signals - with the exception of F1 to F6 - can be reset (after elimination of the fault cause).

Note: „F1“ , „Fault 1“ and „F01“ are equivalent

For resetting (RESET) of fault signals the following steps are required:

- Switching off the commands ON/OFF and RUN
- Elimination of the fault causes
- Fault acknowledgement, i.e. resetting (RESET)
  - a) press „RESET“ key on DCS400PAN
  - **or** b) by setting of the RESET digital input (DI6) for at least 100ms to high (logical **1**)
  - **or** c) if a Fieldbus is selected by setting the „RESET“ bit in the Main Control Word to „high“ for at least 100ms.
- Depending on the application conditions generate the commands ON/OFF and RUN once more.

All faults will switch off the signal energizing the main contactor.

	Fault message Fault no.	Definition / Possible source	Param.
F 1	Aux Voltage Fault	**Auxiliary Voltage Fault** (Not implemented yet)	**7.09 bit 0**
F 2	Hardware Fault	**Hardware Fault** Something is wrong with FlashProm or thyristor diagnosis has detected a short circuit.	**7.09 bit 1**
F 3	Software Fault	**Software Fault** There may be an internal error in software. If this fault occurs please read out Parameter **7.03 Diagnosis** and **7.04 SW Version** from the control panel for use to **contact ABB local service center.**	**7.09 bit 2**
F 4	Par Flash Read Fault	**Parameters Flash Read Fault** While booting up the software.The parameter checksum in the Flash is incorrect. A possible problem cause is that the power supply was switched off during storage of parameters. In this case all parameters are set back to their default values. If you have uploaded the parameters for your application to the control panel before, please download them to the drive again. Otherwise you have to set all parameters again.	**7.09 bit 3**
F 5	Compatibility Fault	**Compatibility Fault** Software or Typecode was changed to a version that is not compatible with the parameters which have been stored in the Flash memory of the drive (e.g. min/max check). Some parameters may have been set back to default value. You can look up from parameter **7.03 Diagnosis** the number of the last of the concerned parameters.	**7.09 bit 4**
F 6	Typecode Read Fault	**Typecode Read Fault** The nominal data of the converter was found incorrect during boot up (checksum error). FlashProm broken or power supply shut down during 'Set Typecode' function. Try to correct the Typecode again. Please contact **ABB local service center** to have your typecode correctly programmed.	**7.09 bit 5**

	Fault message Fault no.	Definition / Possible source	Param.
F 7	Converter Overtemp see also **A4**	**Converter Over Temperature** Temperature of the converter too high. Please wait until the temperature of the converter has cooled down. After that you can clear the fault by pressing the **Reset** button on the control panel. Please check: • fan supply • fan components • air inlet • ambient temperature • load cycle too high?	**7.09 bit 6**
F 8	Motor Overtemp see also **A5**	**Motor Over Temperature** Temperature of the motor too high (if PTC resistor connected to AI2). Please wait until the motor has cooled down. If you have any digital output assigned to „Fan On“ this output will be energized until the temperature drops below the alarm level. After that you can clear the fault by pressing the **Reset** button on control panel. Please check • temperature sensor and its cabling • motor cooling fan supply direction of rotation filter • load cycle too high?	**7.09 bit 7**
F 9	Mains Undervoltage see also **A2** see also **A8…**	**Mains Undervoltage** The actual mains voltage is too low for safe operation. Please check • all incoming fuses measure the voltage level of network compare with the value from the formula Unet ≥ Ua / (1,35 x cos alpha) cos alpha: 4Q = 30° = 0,866 2Q = 15° = 0,966 4Q: Unet ≥ Ua / (1,35 x 0,866) 2Q: Unet ≥ Ua / (1,35 x 0,966)	**7.09 bit 8**
F 10	Mains Overvoltage	**Mains Overvoltage** The mains voltage is higher than 120% of the rated converter voltage. This limit is fixed. Please switch off the drive and measure the mains voltage.	**7.09 bit 9**

	Fault message Fault no.	Definition / Possible source	Param.
F 11	Mains Sync Fault see also **A8**	**Mains Synchronization Fault** The synchronization to the mains frequency has been lost during operation. Possible problems causes: • Problems with the connection of the cable or with the main contactor • Blown fuses • Mains frequency out of range (47...63 Hz) • Mains frequency not stable or varying too fast	**7.09 bit 10**
F 12	Field Undercurrent see also **A8**	**Field Undercurrent** Field current lower than the level for safe operation that was set in Parameter **Field Low Trip (4.06)**. Please check connections of the field circuit. Maybe parameter **Field Cur KP (4.03)** too high. Check also that field current in field weakening range is higher than value of Parameter **Field Low Trip (4.06)**. Read the faultlogger - may be Mains Undervoltage before?	**7.09 bit 11**
F 13	Field Overcurrent	**Field Overcurrent** Field current has reached a limit (Parameter **Field Ov Cur Trip (4.05**)) that could damage the motor. Please check • the field related parameters • the resistance of the field • connections of the field • insulation level of cable and field winding	**7.09 bit 12**
F 14	Armature Overcurrent	**Armature Overcurrent** Armature current higher than value of Parameter **3.04 Armature current max** . The problem can be caused by a short circuit in the armature circuit or a thyristor is defective. Please switch off the drive and check • measure the resistance of armature • all connections in the armature circuit • function of all thyristors • parameters of the Current Controller (**Group 3**) for instability.	**7.09 bit 13**

	Fault message Fault no.	Definition / Possible source	Param.
F 15	Armature Overvoltage	**Armature Overvoltage** The voltage of the armature has grown higher than the value in Parameter **Arm Overv Trip (1.09)**. Possible problems: • Too low fault level set (consider voltage overshoots) or wrong nominal motor voltage • Too high field current, maybe problems with field weakening (see field parameters) • Overshoot or instability of speed/armature current controller • Overspeed	**7.09 bit 14**
F 16	Speed Meas Fault	**Speed Measurement Fault** The comparison of the speed feed back signal from the tacho generator or pulse encoder has failed or overflow of analogue input AITAC. Please check • all connections of tacho generator or pulse encoder • encoder supply • converter connections - armature ciruit open?	**7.09 bit 15**
F 17	Tacho Polarity Fault	**Tacho Polarity Fault** Polarity of feed back signal from tacho generator incorrect. Please check • the polarity of tacho generator cable • polarity of armature and field cable • direction sense of rotation of the motor	**7.10 bit 0**
F 18	Overspeed	**Overspeed** The actual speed of motor too high. Possible causes: • Running in torque/current controlled mode instead of speed controlled. • Speed regulator parameters are not correct (overshoot or instability , see Parameter **Group 5**) • Motor driven by external load.	**7.10 bit 1**

	Fault message Fault no.	Definition / Possible source	Param.
F 19	Motor Stalled	**Motor Stalled** Motor not turning at zero speed level (Parameter **Zero Speed Lev (5.15))** with actual torque higher than the torque limit (Parameter **Stall Torque (3.17)**) for a time longer than the limiting time (Parameter **Stall Time (3.18**)). Please check • all mechanical couplings of the motor • the proper condition of load • current/torque limitation • parameter settings (**Group 3**)	**7.10 bit 2**
F 20	Communication Fault see also **A11**	**Communication Fault** if **command location** Parameter **2.02** is set to „Fieldbus“. Fieldbus communication errors appear if no messages have been received for longer than the time which is set in Parameter **Comm Fault Time (2.08)** . If command location is **not** „Fieldbus“ Alarm 11 appears instead. Please check the connection of Fieldbus cable and check the function of all Fieldbus devices according to the values in Parameter **Group 8**	**7.10 bit 3**
F 21	Local Control Lost	**Local Control Lost** During operation in Local control mode no message has been received for a time longer than the value that has been set in Parameter **Comm Fault Time (2.08)**. Please check the connection of the Control panel.	**7.10 bit 4**
F 22	External Fault see also **A12**	**External Fault** This fault can be set by the customer via one of the digital input if the selected macro offers this function. There is no problem with the drive itself! In case of problems please check the logical level and the connection of the circuit that is connected to the related digital input.	**7.10 bit 5**

6.3.5 Alarm Signals (A)

The alarm signals will be shown on the seven segment display of the control board SDCS-CON-3 as codes **A . .** as well as on the LCD of the control panel DCS 400 PAN as clear text. Alarm signals will only be displayed, if there is no fault signal active.
The alarm signals with the exception of **A9 (Emergency Stop)** do not cause the drive to stop.

	Alarm message Alarm no.	Definition / Possible source	Param.
A 1	Parameters Added	**Alarm Parameters Added** A new software version was downloaded that contains more parameters than the old software . These new parameters have been set to their default values. The last one of them is showing by its number in Parameter **7.03 Diagnosis**. Please check the new parameters and, if you intend to use them please set them to desired value. Also please update the text of your control panel by using a service program or contact your local **ABB service center.**	**7.12 bit 0**
A 2	Mains Voltage Low see also **F9**	**Alarm Mains Voltage Low** The main voltage has droped down to 5% (fix) higher than the level which causes F9. Please check the level of main voltage.	**7.12 bit 1**
A 3	Arm Circuit Break	**Alarm Armature Circuit Break** The armature reference is not equal to zero but the actual armature current stays at zero level for sometime. Please check all connections and fuses of the armature circuit.	**7.12 bit 2**
A 4	Converter Temp High see also **F7**	**Alarm Converter Temperature High** The Temperature of the converter has reached a value that is 5°C lower than the level which causes F7 fault. Please check the correct operation of the converter fan and the load conditions.	**7.12 bit 3**
A 5	Motor Temp High see also **F8**	**Alarm Motor Temperature High** The temperature of the motor is too high (if PTC resistor is connected to AI2. Please check the correct operation of the motor fan and the load conditions.	**7.12 bit 4**
A 6	Arm Current Reduced	**Alarm Armature Current Reduce** The drive is equipped with an I^2t protection for the motor. This alarm is issued while this protection function forces the armature current down to the specified recovery level (see description of I^2t protection after the specified overload time Parameter **Overload Time (3.05)**). Please check the suitable load cycle for your motor.	**7.12 bit 5**

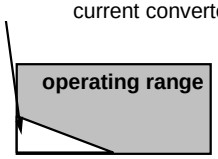
	Alarm message Alarm no.	Definition / Possible source	Param.
A 7	Field Volt Limited	**Alarm Field Voltage at Limit** This alarm is issued if the field voltage reaches the value that was set in Parameter **Field Volt Nom (1.04)** and therefore the field current cannot be set to the required value. Please check the resistance and the temperature of the field and the Parameters **Field Cur Nom** (**1.03)** and **Field Volt Nom** (**1.04)**.	**7.12 bit 6**
A 8	Mains Drop Out	**Alarm Main Voltage Drop Out** DCS 400 is equipped with an „Auto Reclosing“ that allows for a continous operation after short-time mains dropout (provided that the power supply for the controller is not interrupted). If the mains voltage comes back within the time period that was set in Parameter **Net Fail Time (1.11)**. This alarm will automatically be reset if the mains voltage comes back within that period, otherwise the relevant faults are issued (F9, F11, F12).	**7.12 bit 7**
A 9	Eme Stop Pending	**Alarm Emergency Stop** This alarm is issued if the emergency stop bit from Fieldbus communication is missing **or** if the digital input DI5 „Emergency Stop“ is not set to „high“. Please check the digital input or the condition of all related emergency stop buttons. Also, if the control is done via Fieldbus device, please check the situation of the Fieldbus control program or the communication state of the Fieldbus. If Parameter **Cmd Location (2.02)** is set to „Fieldbus“, a Fieldbus device must be connected and selected in Parameter **Group 8**.	**7.12 bit 8**
A 10	Autotuning Failed	**Alarm Autotuning Failed** The autotuning procedure that was started from Commissioning Wizard or maintenance tool or by setting Parameter **Contr Service (7.02)** can not get the appropriate values for the regulators. Please read out Parameter **7.03 Diagnosis** for information about the problem and try to correct it. After that try to run autotuning again.	**7.12 bit 9**
A 11	Comm Interrupt see also **F20**	**Alarm Communication Interrupt** If the Parameter **Cmd Location (2.02)** is **not** „Fieldbus“, this alarm is issued instead of F20, if no message have been recieved for a period longer than the time which has been set in Parameter **Comm Fault Time (2.08)**. Please check the connection of Fieldbus cable and check the function of all Fieldbus devices according to the values in Parameter **Group 8**	**7.12 bit 10**
A 12	External Alarm see also **F22**	**Alarm External Alarm** This alarm can be issued by the customer via one of the digital inputs if the selected macro offers this function. There is no problem with the drive itself! In case of problems please check the logical level and the connection of the circuit that is connected to the related digital input.	**7.12 bit 11**
A 13	ill Fieldbus Setting	**Alarm illegal Fieldbus Setting** The Fieldbus parameters in Parameter **Group 8** are not set according to the Fieldbus device. The device has not been selected. Please check the configuration of the Fieldbus device and set all related parameters in Parameter **Group 8** accordingly.	**7.12 bit 12**
A 14	Up/Download Failed	**Alarm Upload Download Failed** The checksum verification failed during uploading or downloading between drive and control panel. Try again.	**7.12 bit 13**
A 15	PanTxt not UpToDate	**Alarm Panel Texts not Up-to-Date** You are using a panel with an older text version than required by your drive software. Some texts may be missing and displayed as „?TEXT“. Have your panel updated.	**7.12 bit 14**
A 16	Par Setting Conflict	**Alarm Parameter Conflict** is triggered by parameters the contents of which is conflicting with other parameters. Possible conflicts are described in the **Diagnostic Messages 70…74**, see following chapter.	**7.12 bit 15**

	Alarm message Alarm no.	**Definition / Possible source**	**Param.**
A 17	Compatibility Alarm	**Alarm Parameter Compatibility** When downloading the parameters from panel to drive the software attempts to set the parameter. If the value is actually not possible to be set (e.g. min/max check fails or not compatible to typecode) this parameter is set to default value. That's mainly possible at parameter **Arm Cur Nom (1.01).** You can look up from parameter **Diagnosis (7.03)** the number of the last of the concerned parameters. All parameter that are not concerned are set to downloaded values.	**7.13 bit 0**

6.3.6 Diagnostic Messages

The „Diagnosis“ Parameter (**7.03**) shows more detailed problem causes to some of the alarms and faults. It is shown automatically if a problem occurs while using the commissioning wizard.

internal code	7.03 Diagnosis Diagn. message	Definition / Possible source
0	None	Actually no problems
1 to 10	1 to 10	Internal software causes. **Please contact your ABB local service center.**
11	Tune Aborted	Procedure aborted by FAULT or switching off the RUN command.
12	No Run Cmd	Timeout of procedure was given, if Run signal is not present in time. Possible problems causes: emergency stop pending field undercurrent no main supply blown fuses (I) has been pressed too late or not at all (I) has been pressed twice
13	No ZeroSpeed	Motor is still turning when it is expected to stand still. Maybe parameter **Zero Speed Lev (5.15)** to low.
14	Fld Cur <> 0	Field current not zero when it is expected to be zero. Try it again. Otherwise decrease Field Cur Nom (1.03) to 50% of current value temporaryly and try it again. After Armature Autotuning set parameter Field Cur Nom (1.03) back to 100%.
15	Arm Cur <> 0	Armature current not zero when it is expected to be zero. Try it again. Otherwise disconnect the armature.
16	Arm L Meas	Measurement Armature Inductance value is higher than maximum value of Parameter 3.12 (Arm Inductance). Not possible to set it by Arm Autotuning. Set it manually to the right value or to maximum value.
17	Arm R Meas	Measuremens Armature Resistance value is higher than maximum value of Parameter 3.13 (Arm Resistance). Not possible to set it by Arm Autotuning. Set it manually to the right value or to maximum value.
18	Field L Meas	Not enough measurement for the detection of field inductance. The value of “Field L” is used for calculation the Parameter 4.03 (Field Cur KP). Not possible to set it by Fld Autotuning. Use Field Man Tuning.
19	Field R Meas	Not enough measurement for the detection of field resistance. The value of “Field R” is used for calculation the Parameter 4.04 (Field Cur TI). Not possible to set it by Fld Autotuning. Use Field Man Tuning.
20	TuneParWrite	Writing of control parameters or discontinuous current, parameter generates fault. Is the motor still turning?. Try it again.
21	21	Autotuning timeout. **Please contact your ABB local service center.**
22	Tacho Adjust	Wizard had called you to turn potentiometer until panel display shows zero, but you have adjusted inaccurately. **Note**: A valid range around zero is +/- 200.
23	Not Running	Drive start timeout. Wizard had activated drive start command, but drive was not running in time. This can be caused by: • emergency stop • field undercurrent • no mains supply • blown fuses
24	Not At Speed	Wizard had started the drive, but speed did not reach set point in time. Speed KP too small? Motor stalled? Armature circuit open?
25	TachPolarity	Wrong tacho signal polarity. Check wiring of tacho, armature and field.
26	Enc Polarity	Wrong encoder signal polarity. Check wiring of encoder, armature and field.
27	No EncSignal	No encoder signal. Check wiring of encoder.
28	StillRunning	Drive stop timeout. Wizard had activated drive stop command , but drive did not reach zero speed in time.
29	29	Parameter read fault. **Please contact your ABB local service center.**
30	Wiz ParWrite	Parameter write fault. Wizard tried to write a parameter, but the write operation failed. Is motor still turning? Try it again.
31	31	Upload or Download start timeout. **Please contact your ABB local service center.**
32	UpDn Aborted	Uploading or Downloading data transfer timeout. Data was not uploaded or downloaded in time. Perhaps the connection to the panel has broken.
33	NoStandstill	The drive requested to lock the drive in OFF state, but this was not possible. During download the drive must standstill.

internal code	7.03 Diagnosis Diagn. message	Definition / Possible source
34	Par Checksum	Upload or Download checksum fault (may be transfer error). Try once more. **Note**: If occuring during upload there are actually no valid parameters in the panel. If occuring during download the parameters in the drive remains unchanged.
35	35	Upload or Download software error. **Please contact your ABB local service center.**
36	36	Upload or Download software error. **Please contact your ABB local service center.**
37	Pan Is LOCAL	Control panel is LOCal
38-39	38…39	not used
40-49	40…49	reserved for SW Messages (F3)
50-59	50…59	reserved for HW Messages (F2)
60-69	60…69	not used
70	Fld Low Lim	The ratio of the **nominal field current (1.03)** to the **minimum field current (4.06)** does not match the ratio of the **maximum speed (1.06)** to the **base speed (1.05)**.
71	Flux Char	Determination of the flux characteristic failed. The values of the parameters **Field Cur 40% (4.07)**, **Field Cur 70% (4.08)** and **Field Cur 90% (4.09)** are not arranged in ascending order.
72	Field Range	The parameters for **field voltage (1.04)** and **field current (1.03)** are outside the operating range of the field current converter.  see manual chapter 3.7
73	Arm Data	The parameters **armature voltage** [Ua] **(1.02), armature current** [Ia] **(1.01)** and **armature resistance** [Ra] **(3.13)** do not match. Ua is smaller than (Ia x Ra).
74	AI2 vs PTC	AI2 is set as PTC evaluation **and** reference value source. Multiple setting is not permissible. Correct the setting!
75	RecoveryTime	Recovery Time to short. Increase Recovery Time (3.06) or decrease Arm Cur Max (3.04) or Overload Time (3.05).
76	Grp9 Disable	For macros 2+3+4 its not possible to assign parameters in group 9. Group 9 has to be Macro depend when these macros are selected. There is anyone disabled or defined different than Macro depend.
77-79	77…79	not used
80	Sp Deviation	Speed does not reach setpoint
81	No Accel	Motor is not accelerating
82	SpPar Detect	Not enough measurement for the detection of speed control parameters **Speed Reg KP (5.07)** and **Speed Reg TI (5.08)**.
83-89	83…89	not used
90	Shortcut V11	Short circuit caused by V11
91	Shortcut V12	Short circuit caused by V12
92	Shortcut V13	Short circuit caused by V13
93	Shortcut V14	Short circuit caused by V14
94	Shortcut V15	Short circuit caused by V15
95	Shortcut V16	Short circuit caused by V16
96	Result False	Result of block test unusable for a clear diagnosis message but there is a problem. A manual test has to be made.
97	ShortcV15/22	Short circuit caused by V15 or V22
98	ShortcV16/23	Short circuit caused by V16 or V23
99	ShortcV11/24	Short circuit caused by V11 or V24
100	ShortcV12/25	Short circuit caused by V12 or V25
101	ShortcV13/26	Short circuit caused by V13 or V26
102	ShortcV14/21	Short circuit caused by V14 or V21
103	Ground Fault	Motor connected to ground
104	NoThyrConduc	No thyristor is conductive. Armature winding not connected ?

7 Serial interfaces

General

The DCS 400 is equipped with the following serial interfaces:

- Panel-Port (standard, built-in)
- RS232-Port (standard, built-in)
- Fieldbus-Interface (Adapter available as option)

The fieldbus interface is designed for control via an external PLC, whereas RS232-Port and Panel-Port are intended for setting the parameters in the drive. However, both of the standard interfaces (RS232 and Panel-Port) can be configured to serve as an interface for external drive control.

If one of the three serial interfaces is used for external drive control, the communication of this interface should be supervised. The response of the drive in case of a communication error can be pre-determined by setting the communication parameters below.

Note:
All three serial interfaces may operate in parallel. However, it is only possible to customize (i.e. deviate from the default) the settings of one port, which is selected in Parameter Modul Type (8.01). The other ports are then operating with their default settings.

Communcation Parameters
The following communication paramters are relevant in case of external drives control.

Cmd Location (2.02)
Purpose: Determines whether Drive is externally controlled via conventional I/O or serial interface.
Value:

- **0** Macro depend
- **1** Terminals (X1...X5 on SDCS-CON-3)
- **2** Bus - The serial interface for external control is specified in Parameter **Modul Type (8.01)** (Fieldbus, RS232-Port or Panel-Port)
- **3** Key - Automatic switch over between bus and terminals

Comm Fault Time (2.08)
Purpose: For supervision of communication on the serial interface which is used for external drive control (defined in Paramter **Modul Type (8.01)**.
Value:
0.01...10 sec
Determines the maximum allowed down time for communication in seconds. If no messages are received within this time, an error message will be issued and the drive will behave according to Parameter **Comm Fault Mode (2.07)**;
0.00s = ignore error, Continue drive operation.

Comm Fault Mode (2.07)
Purpose: Defines how the drive will behave in case of communication error.
Value:

- **0** Brake with deceleration ramp **(Parameter 5.10)**, then switch off drive and error message
- **1** Brake with torque = torque limit **(Parameter 3.07, 3.08)**, then switch off of drive and error message.
- **2** Immediate switch off drive and error message

Necessary parameter-settings for fieldbus communication

Parameter	Parameter name	possible settings	recommended
2.02	Cmd Location	0=Macro depend 1=Terminals 2=Bus 3=Key	**2=Bus**
2.07	Comm Fault Mode	0=Ramp 1=Torque Lim 2=Coast	**0=Ramp**
2.08	Comm Fault Time	0.00s=no supervision 0.01…10.00s=Fault Time	**0.20s**
5.01	Speed Ref Sel	0=Macro depend 1=AI1 2=AI2 3=Bus Main Ref 4=Bus Aux Ref 5=Fixed Sp1 6=Fixed Sp2 7=Commis Ref1 8=Commis Ref2 9=Squarewave 10=Const Zero	**3=Bus Main Ref**
5.26	Aux Sp Ref Sel	0=Macro depend 1=AI1 2=AI2 3=Bus Main Ref 4=Bus Aux Ref 5=Fixed Sp1 6=Fixed Sp2 7=Commis Ref1 8=Commis Ref2 9=Squarewave 10=Const Zero	**4=Bus Aux Ref**
8.01	Fieldbus Par 1	0=Disable 1=Fieldbus 2=RS232-Port 3=Panel-Port 4=Res Fieldbus	**depend on application**
8.02 .... 8.16	Fieldbus Par 2 .... Fieldbus Par 16	....	**depend on parameter 8.01**

Telegram Structure

The serial communication with a PLC can be carried out via a field bus adapter, a RS232 port or a panel port. Irrespective of the bus protocol, these ports communicate with the DCS400 software via specified data sets. Four data sets are available with three 16-bit words each. The data sets have the following significance:

Control and reference transmission, from the PLC to the drive

Data set 1.1: Main Ctrl Word (5 bits set by parameter group 9)
Data set 1.2: Bus Main Ref
Data set 1.3: Bus Aux Ref

Status information and actual value transmission, from the drive to the PLC

Data set 2.1: Main Status Word (4 bits set by parameter MSW bit 1x Ass (6.22…6.25))
Data set 2.2: Actual value 1 (set by param. Dataset 2.2 As (6.20))
Data set 2.3: Actual value 2 (set by param. Dataset 2.3 As (6.21))

Digital and analogue value transmission, from the PLC to the drive

Data set 3.1: DO1...DO5 (set by 6.11...6.15)
Data set 3.2: AOx, Scaling: ±4096 $\hat{=}$ ±10V (set by 6.05/6.08)
Data set 3.3: AOx, Scaling: ±4096 $\hat{=}$ ±10V (set by 6.05/6.08)

Actual value transmission, from the drive to the PLC

Data set 4.1: Fld Cur Act (fixed)
Data set 4.2: Power Act (fixed)
Data set 4.3: Torque Act (fixed)

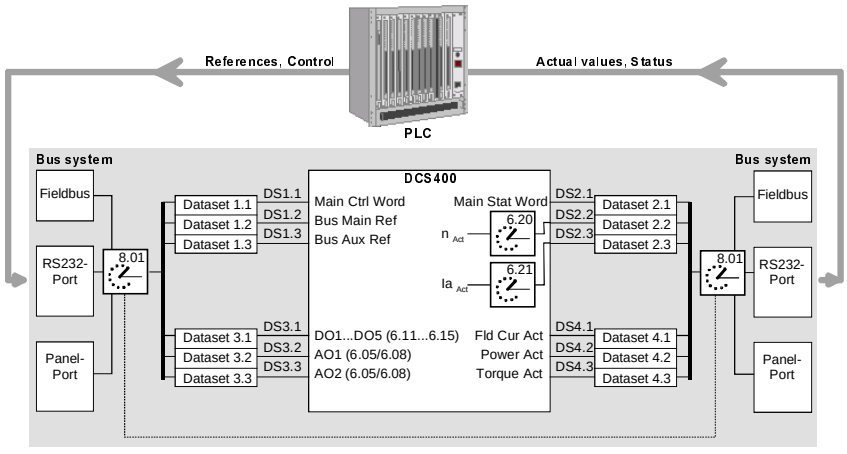


Fig.: 7/1 Data transmission between PLC and DCS 400

Control and status word allocation

The allocation of the main control word (data set 1.1) and the main status word (data set 2.1) is identical to **main control word (2.05)** and **main status word (2.06)** of the DCS 400 converter. The allocation is as follows:

Main Control Word (2.05)

Bit	Name	Definition
0 *	ON	1=Drive ON 0=Drive OFF
1 *	COAST	**1**=not COAST 0=COAST
2 *	EME_STOP	**1**=no EME_STOP 0=EME_STOP
3 *	RUN	1=START 0=STOP
4		1= 0=
5		1= 0=
6		1= 0=
7	RESET	0>1=RESET 0 =no RESET
8	JOG_1	1=JOG 1 0=no JOG 1
9	JOG_2	1=JOG 2 0=no JOG 2
10		1= 0=
11	MCW_BIT_11	Definition see Parameter group 9
12	MCW_BIT_12	Definition see Parameter group 9
13	MCW_BIT_13	Definition see Parameter group 9
14	MCW_BIT_14	Definition see Parameter group 9
15	MCW_BIT_15	Definition see Parameter group 9
* effective when Cmd Location (2.02) = Bus; all others are independent from Cmd Location.		

Note: For a proper operation **COAST** and **EME STOP** in the Main Control Word has to be setted to log. state **1**.

Main Status Word (2.06)

Bit	Name	Definition
0	RDY_ON	**1**=RDY for ON 0=not RDY_ON
1	RDY_RUNNING	1=RDY for RUN 0=not RDY_RUN
2	RUNNING	1=RUNNING 0=not RUNNING
3	FAULT	1=FAULT 0=no FAULT
4	COAST_ACT	**1**=not COAST 0=COAST
5	EME_STOP_ACT	**1**=not EME_STOP 0=EME_STOP
6		1= 0=
7	ALARM	1=ALARM 0=no ALARM
8	AT_SETPOINT	1=Ref=Act 0=Ref<>Act
9	REMOTE	**1**=Terminal/Bus 0=Local (Panel/Tool)
10	ABOVE_LIMIT	1=Speed > SpLev1 0=Speed < SpLev1
11	MSW_BIT_11_ASS	Definition see Parameter 6.22
12	MSW_BIT_12_ASS	Definition see Parameter 6.23
13	MSW_BIT_13_ASS	Definition see Parameter 6.24
14	MSW_BIT_14_ASS	Definition see Parameter 6.25
15	DDCS-Protocol (DCS400 to Adapter)	1=DDCS fault 0=DDCS ok

Note: In the Main Stat Word **RDY ON**, **COAST ACT**, **EME STOP ACT** and **REMOTE** is setted to log. state **1**, if Elektronics supply is on, Drive is off and no Faults appears.

Status word allocation
4 bits of the status word (data set 2.1) can be parameterized. The signals are selected in the parameters MSW bit 11 Ass (6.22), MSW bit 12 Ass (6.23), MSW bit 13 Ass (6.24) and MSW bit 14 Ass (6.25).

Data set allocation
The data sets 2.2 and 2.3 transmit two actual values. The actual values are selected in the parameters data set 2.2 Ass (6.20) and data set 2.3 Ass (6.21).
Default value for data set 2.2 is Speed Act
data set 2.3 is Arm Cur Act

For special purposes data set 3 can transmit directly five digital values and two analogue values which are fix assigned to the outputs.
Assignment:

Data set 3.1 bit 0	=	DO1	digital value
Data set 3.1 bit 1	=	DO2	digital value
Data set 3.1 bit 2	=	DO3	digital value
Data set 3.1 bit 3	=	DO4	digital value
Data set 3.1 bit 4	=	DO5	digital value
Data set 3.2	=	AO1/2	analogue value
Data set 3.3	=	AO1/2	analogue value

In the following sections, the three available serial interfaces are described in detail.

7.1 Panel-Port

The Panel Port is normally used for connection of the control panel. The default settings of this interface are as follows:

Signal level:	+12V / 0V
Data format:	UART
Message format:	Modbus-Protocoll
Transmission method:	half-duplex
Baudrate:	9.600 Baud
Number of Data bits:	8
Number of Stop bits:	2
Parity-Bit:	none

Alternatively, this interface may be used for purpose of external drive control, e.g. for connection to RS232-COM-Ports of PC's or to RS485 busses. A specific adapter ("RS232/RS485-Adapter") is available as an option which converts the internal interface signals according to the requirements of the selected RS 232 or RS 485 interface. This adapter is plugged into the drive, instead of the control panel, and is ready for operation. **Either the control panel or the special adapter can be used, not both together.**

The adapter provides screw connectors for the RS 485-Bus and a 9-pole SUB-D connector for the RS232. Either the RS 485 or RS232 can be used, not both together.

Parameter Settings of Panel-Port, for purpose of external drive control via Modbus protocol:

Parameter	Meaning	Alternative settings	**Typical Setting**
8.01 Fieldbus Par 1	Module Type	Disable Fieldbus RS232-Port Panel-Port Res Fieldbus	**Panel-Port**
8.02 Fieldbus Par 2	Station Number	1…247	
8.03 Fieldbus Par 3	Baudrate	0 = 9.600 Bd 1 = 19.200 Bd	**0 = 9.600 Bd**
8.04 Fieldbus Par 4	Parity	0 = none (2 Stop bits) 1 = odd (1 Stop bit) 2 = even (1 Stop bit)	**0 = none**

Table 7.1/1: Settings of Panel-Port

Switch Off and On electronics supply to initialize the Panel-Port for drive control via PLC.
If these parameter settings done via panel after electronics supply On, panel display will show 'Comm Loss' due to the panel communication is disabled now. For resetting parameters PC Tool Drive Window Light is needed!

7.2 RS232-Port

The RS232 interface is normally used for setting parameter in the drive via the PC Tool Drive Window Light.
Therefore normally the communication supervision is de-activated.
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

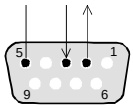


Fig. 7.2/1 Pin assignment of RS232-Port

Parameter Settings of RS232-Port, for purpose of external drive control via Modbus protocol:

Parameter	Meaning	Alternative settings	**Typical Setting**
8.01 Fieldbus Par 1	Module Type	Disable Fieldbus RS232-Port Panel-Port Res Fieldbus	**RS232-Port**
8.02 Fieldbus Par 2	Station Number	1…247	
8.03 Fieldbus Par 3	Baudrate	0 = 9.600 Bd 1 = 19.200 Bd	**0 = 9.600 Bd**
8.04 Fieldbus Par 4	Parity	0 = none (2 Stop bits) 1 = odd (1 Stop bit) 2 = even (1 Stop bit)	**0 = none**

Table 7.2/1: Settings of RS232-Port

Switch Off and On electronics supply to initialize the RS232-Port for drive control via PLC.
If these parameter settings done via PC Tool Drive Window Light after electronics supply On, Drive Window Light does not work longer due to the Tool communication is disabled now.
For resetting parameters the control panel is needed!

7.3 Fieldbus interface

For connection to external control devices, like PLCs, typically the third serial interface, "fieldbus interface" is used.
Several fieldbus protocol specific adapters are available as options for the DCS 400. The following description is an overview. Detailed information is available from the specific adapter descriptions.

Characteristics:
- Fieldbus adapter is mounted on external mounting rail
- Power supply from DCS 400 (built-in)
- Connection between adapter and DCS 400 is optical cable
- DCS 400 automatically detects the connected fieldbus type
- Therefore, the user specific paramter settings are drastically reduced

User specific parameters like e.g. station addresses or Modbus settings are only set once, during the commissioning.

Short Commissioning Guide
- Switch **Off** DCS 400 electronics power suppl.
- Mount fieldbus adapter on mounting rail.
- Connect adapter to power supply (X8).
- Connect optical cables from adapter to DCS 400 (V800).
- Connect fieldbus cable to fieldbus adapter.
- Switch **On** DCS 400 electronics power supply.
- Wait approximately 10 s.
  During this time an initialization is done between fieldbus adapter and DCS 400. Most of fieldbus parameter are pre-defined by the fieldbus adapter automatically after that procedure.
- Set Fieldbus Par 1 (8.01) (Module Type) = Fieldbus.
- Set user specific parameters. For detailed description, refer to the description which is following the fieldbus adapaters.
- Wait 10 s.
- Switch **Off and On** again the electronics power supply, in order to re-initialize the user specific parameter settings, which have been changed to include the serial communications.

The communication parameters **Cmd Location (2.02)**, **Comm Fault Mode (2.07)** and **Comm Fault Time (2.08)** need to be set manually, for the purpose of communication supervision. See chapter about ***communication parameters*** earlier in this document.

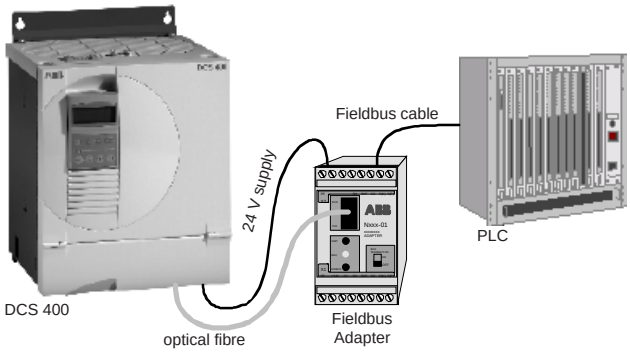


Fig: 7.3/1 Connection of a Fieldbus Adapter to DCS 400 and PLC

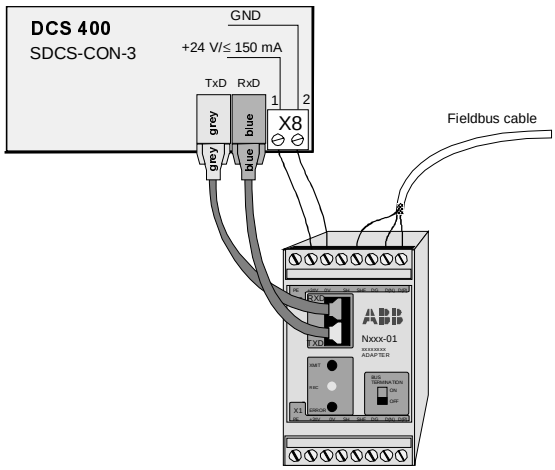


Fig.: 7.3/2 Connection of Fieldbus Adapter to DCS 400

Parameter overview for the most commonly used fieldbuses

For parameter setting, with the control panel, intially switch to **Long Par List**, in the MENU selection, in order to make the parameters visible. Continue with setting of the user specific parameters (**bold** typed).

Profibus (including parameter transfer)

Parameter	Meaning	Alternative settings	Typical settings
8.01	**Module Type**	**0 = Disable** **1 = Fieldbus** **2 = RS232-Port** **3 = Panel-Port** **4 = Res Feldbus**	**Fieldbus**
8.02	**Profibus Mode**	**0 = FMS** **1 = PPO1** *Data transf. PLC to DCS* **(DS1.1, 1.2+Par)** *Data transf. DCS to PLC* **(DS2.1, 2.2+Par)** **2 = PPO2** *Data transf. PLC to DCS* **(DS1.1…1.3, 3.1…3.3 +Par)** *Data transf. DCS to PLC* **(DS2.1…2.3, 4.1…4.3 +Par)** **3 = PPO3** *Data transf. PLC to DCS* **(DS1.1, 1.2)** *Data transf. DCS to PLC* **(DS2.1, 2.2)** **4 = PPO4** (DS1.1, 1.2+Par) *Data transf. PLC to DCS* **(DS1.1…1.3, 3.1…3.3)** *Data transf. DCS to PLC* **(DS2.1…2.3, 4.1…4.3)**	**1 = PPO1**
8.03	**Station Number**	**2…126**	**2**
8.04	Baudrate	0 = 9,6 kBd 1 = 19,2 kBd 2 = 93,75 kBd 3 = 187,5 kBd 4 = 500 kBd 5 = 1,5 MBd 6 = Auto	6 = Auto
8.05	**Number of Data Set Pairs**	**1 = if 8.02 = 1 or 3** **2 = if 8.02 = 2 or 4**	**1 (8.02 = 1)**
8.06	Data Set Offset	0…255	0 = no Offset
8.07	Cut Off Timeout	0…255 (20ms grid) between NPBA-02 and Master	30 = 600ms
8.08	Comm Profile	0 = ABB DRIVES 1 = CSA 2.8/3.0	0 = ABB DRIVES

Modbus (including parameter transfer)

Parameter	Meaning	Alternative settings	Typical settings
8.01	**Module Type**	**0 = Disable** **1 = Fieldbus** **2 = RS232-Port** **3 = Panel-Port** **4 = Res Feldbus**	**Fieldbus**
8.02	Modbus Mode	0 = RTU wdg:flt 1 = RTU wdg:rst	0 = RTU wdg:flt
8.03	**Station Number**	**1…247**	**1**
8.04	Baudrate	0 = 1.200 Bd 1 = 2.400 Bd 2 = 4.800 Bd 3 = 9.600 Bd 4 = 19.200 Bd	3 = 9.600 Bd
8.05	Parity	0 = even (1 Stop bit) 1 = odd (1 Stop bit) 2 = none (2 Stop bits)	2 = ohne
8.06	Good message	0…65535	-
8.07	Bad message	0…65535	-

CS31 (without parameter transfer)

Parameter	Meaning	Alternative settings	Typical settings
8.01	**Module Type**	**0 = Disable** **1 = Fieldbus** **2 = RS232-Port** **3 = Panel-Port** **4 = Res Feldbus**	**Fieldbus**
8.02	Protocol	1	1 = ABB CS31
8.03	Modul ID	0 = Word 1 = Binary	0 = Word
8.04	**Station Number**	**0… 5 (Word Mode)** **0…57 (Binary Mode)**	**1**
8.05	Addr Index	0 = lower 1 = upper	0 = lower
8.06	Data Sets	1…3	1
8.07	Data Set 1 Const	1…32767 (1=6ms)	1
8.08	Data Set 2 Const	1…32767 (1=6ms)	1
8.09	Data Set 3 Const	1…32767 (1=6ms)	1
8.10	Data Set Offset	1…255	1

CAN-Bus (including parameter transfer)

Parameter	Meaning	Alternative settings	Typical settings
8.01	**Module Type**	**0 = Disable** **1 = Fieldbus** **2 = RS232-Port** **3 = Panel-Port** **4 = Res Feldbus**	**Fieldbus**
8.02	Protocoll	0 = CANopen: flt 1 = CANopen: rst	0 = CANopen: flt
8.03	**Station nor**	**1…127**	**1**
8.04	Baudrate	0 = 1 MBd 1 = 500 kBd 2 = 250 kBd 3 = 125 kBd 4 = 100 kBd 5 = 50 kBd 6 = 20 kBd 7 = 10 kBd	3 = 125 kBd
8.05	Comm Profile	0 = CSA 2.8/3.0 1 = ABB Drives	1 = ABB Drives
8.06	Cut Off Timeout	0…255 (20ms grid) between NCAN-02 und Master	10 = 200ms
8.07	Status messages of fieldbus adapter	0 = Self Test 1 = RX Q Overrun 2 = CAN Overrun 3 = Bus Off 4 = Error Set 5 = Error Reset 6 = TX Q Overrun 7 = Disconnected 8 = Started 9 = Stopped 10 = G Fails 11 Pre-Operat 12 = Reset Comm 13 = Reset Node	0 = adapter self test 1 = receiver overrun (SW) 2 = receiver overrun (HW) 3 = adapter in Bus Off State 4 = adapter error bit setted 5 = adapter error bit resetted 6 = transmitter overrun 7 = node disconnected 8 = node started 9 = node stopped 10 = node active during 11 = node has changed to pre-operation 12 = reset communication 13 = reset node

Table 7.3/1: Parameter settings for the most commonly used fieldbus adapters

For detailed information please refer to the related fieldbus adapter description.

In the case you need a fieldbus other than shown, please contact your local ABB sales office. ABB is continuously developing on new solutions.

Appendix

Appendix A - Accessories

Line chokes L1

DCS type 500V	Type of reactor	Fig.
2-quadrant converter		
DCS401.0020	ND01	1
DCS401.0045	ND02	1
DCS401.0065	ND04	1
DCS401.0090	ND05	1
DCS401.0125	ND06	1
DCS401.0180	ND07	2
DCS401.0230	ND07	2
DCS401.0315	ND09	2
DCS401.0405	ND10	2
DCS401.0500	ND10	2
DCS401.0610	ND12	2
DCS401.0740	ND12	2
4-quadrant converter		
DCS402.0025	ND01	1
DCS402.0050	ND02	1
DCS402.0075	ND04	1
DCS402.0100	ND05	1
DCS402.0140	ND06	1
DCS402.0200	ND07	2
DCS402.0260	ND07	2
DCS402.0350	ND09	2
DCS402.0450	ND10	2
DCS402.0550	ND10	2
DCS402.0680	ND12	2
DCS402.0820	ND13	3

Table A/1: Line chokes

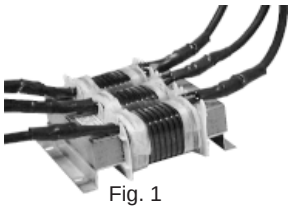


Fig. 1

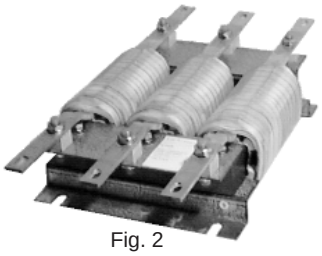


Fig. 2

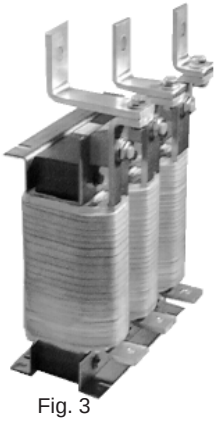


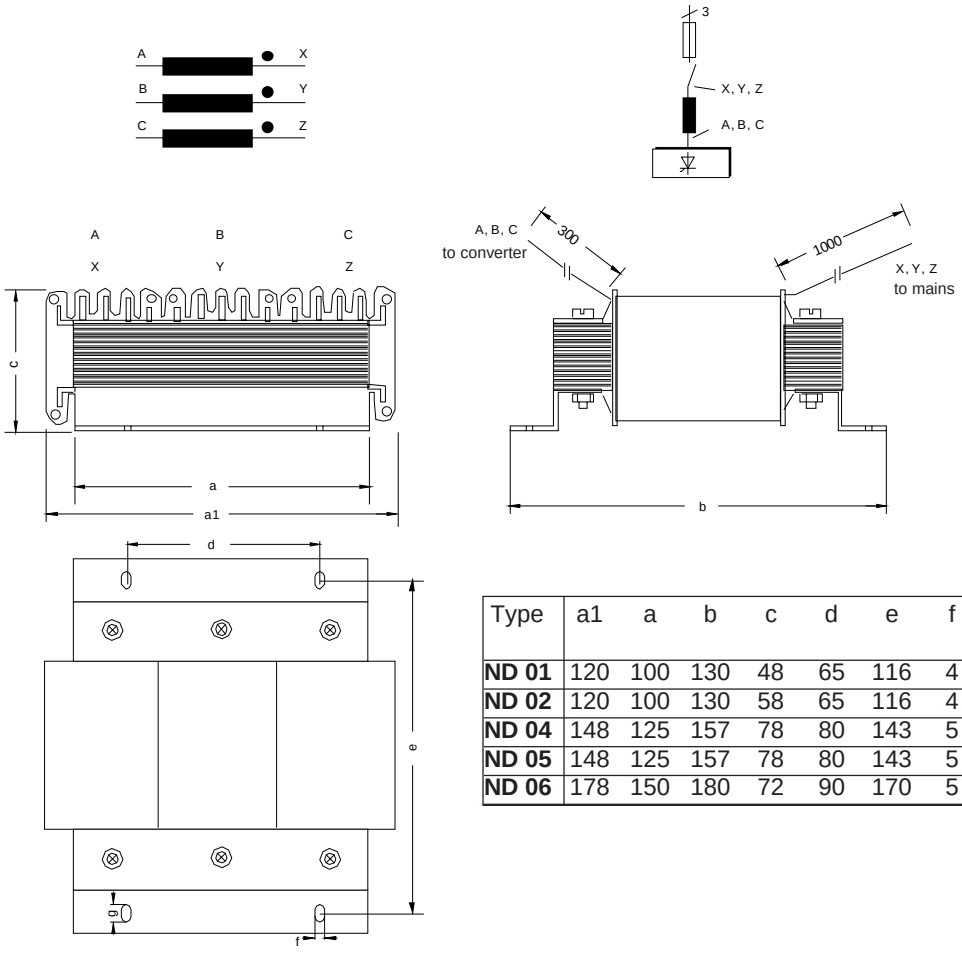
Fig. 3

Line chokes type ND

Type	Choke L [µH]	I_{rms} [A]	I_{peak} [A]	Weight [kg]	Power loss Fe [W]	Power loss Cu [W]
ND 01	512	18	27	2.0	5	16
ND 02	250	37	68	3.0	7	22
ND 04	168	55	82	5.8	10	33
ND 05	135	82	122	6.4	5	30
ND 06	90	102	153	7.6	7	41
ND 07	50	184	275	12.6	45	90
ND 09	37.5	245	367	16.0	50	140
ND 10	25.0	367	551	22.2	80	185
ND 12	18.8	490	734	36.0	95	290
ND 13	18.2	698	1047	46.8	170	160

Table A/2: Data of line chokes

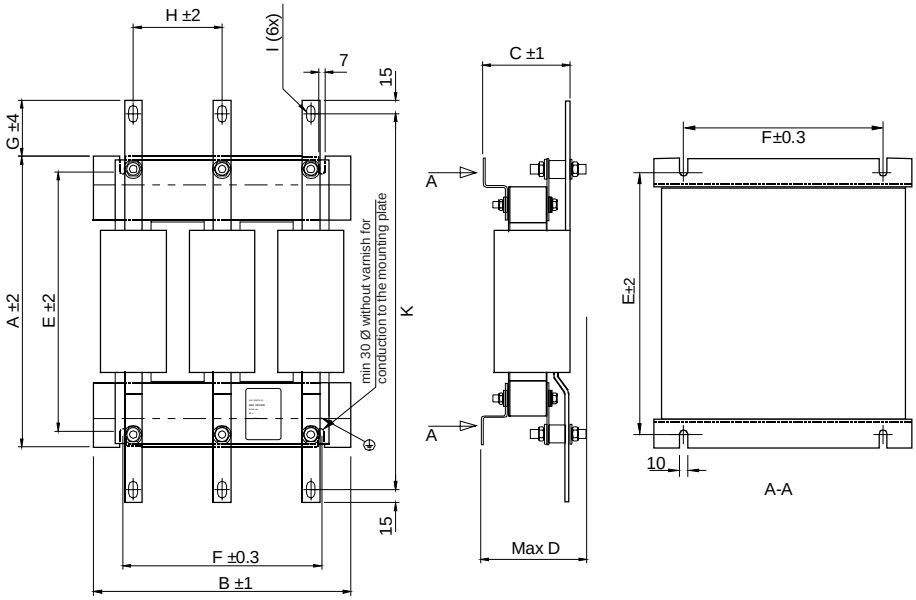
Line chokes type ND 01...ND 06



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 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. A/1: Line choke type ND 01...ND 06

Line chokes type ND 07...ND 12



Type	A	B	C	D	E	F	G	H	I	K
ND 07	285	230	86	115	253	176	65	80	9x17	385
ND 09	327	290	99	120	292	224	63	100	11x21	423
ND 10	408	290	99	120	373	224	63	100	11x21	504
ND 12	458	290	120	145	423	224	63	100	11x21	554

Fig. A4/2: Line chokes type ND 07...ND 12

Line chokes type ND 13

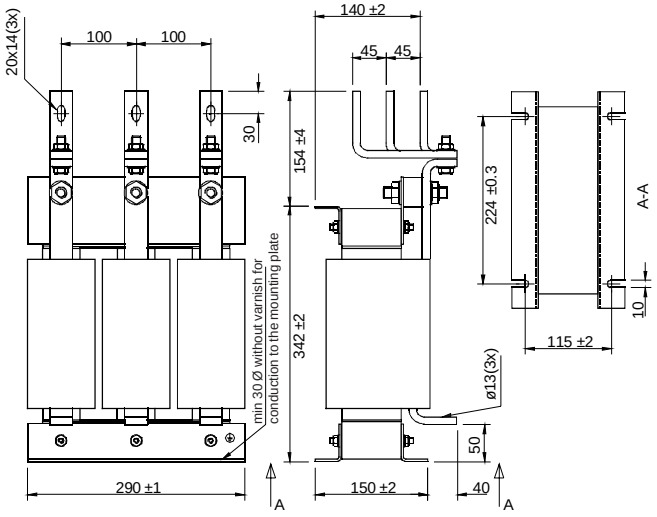


Fig. A/3: Line chokes type ND 13

Fuses and fuse holders for armature-circuit supply

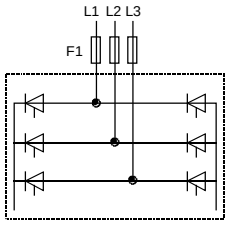
The semiconductor fuses used are blade fuses. The relevant data are listed in the table below. The fuses' construction requires special fuse holders. Fuse holder of the OFAX and OFAS type series are available for this purpose.

Conerter type	Manufacturer/ Type	Fuse holder
2-quadrant converter		
DCS401.0020	Bussman 170M 1564	OFAX 00 S3L
DCS401.0045	Bussman 170M 1566	OFAX 00 S3L
DCS401.0065	Bussman 170M 1568	OFAX 00 S3L
DCS401.0090	Bussman 170M 1568	OFAX 00 S3L
DCS401.0125	Bussman 170M 3815	OFAX 1 S3
DCS401.0180	Bussman 170M 3815	OFAX 1 S3
DCS401.0230	Bussman 170M 3817	OFAX 1 S3
DCS401.0315	Bussman 170M 5810	OFAX 2 S3
DCS401.0405	Bussman 170M 6811	OFAS B 3
DCS401.0500	Bussman 170M 6811	OFAS B 3
DCS401.0610	Bussman 170M 6813	OFAS B 3
DCS401.0740	Bussman 170M 6813	OFAS B 3
4-quadrant converter		
DCS402.0025	Bussman 170M 1564	OFAX 00 S3L
DCS402.0050	Bussman 170M 1566	OFAX 00 S3L
DCS402.0075	Bussman 170M 1568	OFAX 00 S3L
DCS402.0100	Bussman 170M 1568	OFAX 00 S3L
DCS402.0140	Bussman 170M 3815	OFAX 1 S3
DCS402.0200	Bussman 170M 3816	OFAX 1 S3
DCS402.0260	Bussman 170M 3817	OFAX 1 S3
DCS402.0350	Bussman 170M 5810	OFAX 2 S3
DCS402.0450	Bussman 170M 6811	OFAS B 3
DCS402.0550	Bussman 170M 6811	OFAS B 3
DCS402.0680	Bussman 170M 6813	OFAS B 3
DCS402.0820	Bussman 170M 6813	OFAS B 3

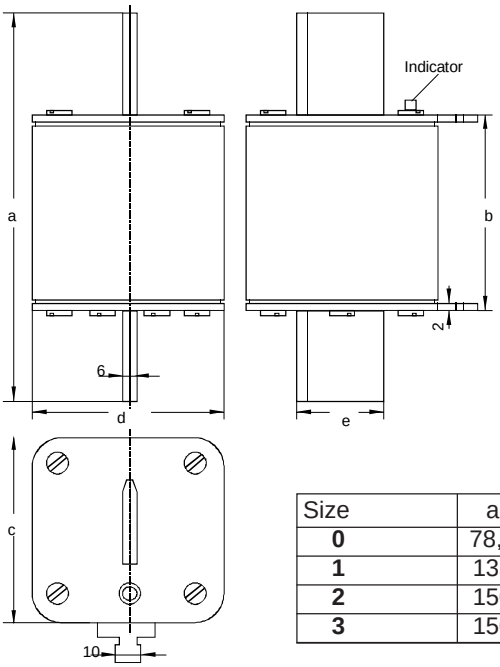
Table A/3: Fuses and fuse holders

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		250A 660V UR	1	OFAX 1 S3	135
Bussman 170M 3817		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

Table A/4: Fuses and fuse holders



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. A/5: 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 A/5: Fuse holders

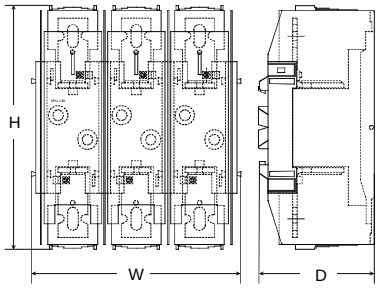


Fig. A/6: Fuse holder OFAX ...

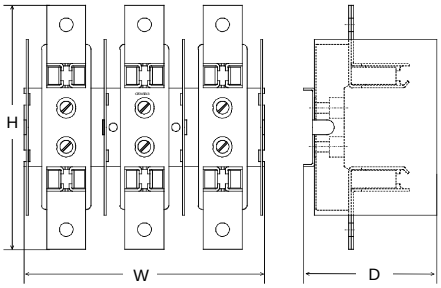


Fig. A/7: Fuse holder OFAS B 3

EMC Filters

Three-phase filters

EMC mains filters are necessary so as to comply with EN 50 081 if a power converter is to be operated at a public low-voltage grid, in Europe, for example, with 400 V between the phases. Grids of this kind have an **earthed neutral conductor**. For these cases, ABB offers its three-phase mains filters for 500 V and 25 A ... 1000 A.

On local lines inside factories they do not supply sensitive electronics. Therefore converters do not need EMC filters.

In chapter *5.2 Installation in accordance with EMC* the topic EMC filter is described.

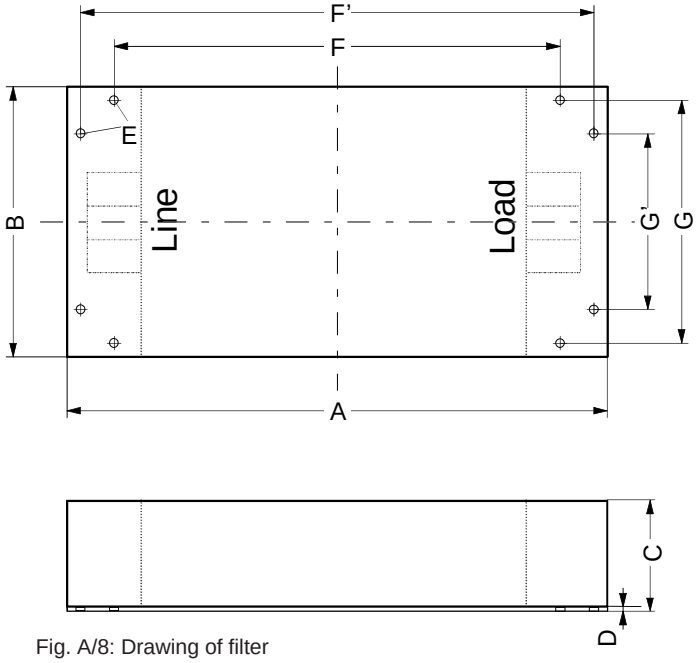


Fig. A/8: Drawing of filter

Converter type	Rat. direct current [A]	Filter type ❶	Weight appr. [kg]	Dimensions L x W x H [mm]
2-quadr. convert.				
DCS401.0020	20	NF3-500-25	3	200x150x65
DCS401.0045	45	NF3-500-50	3.1	200x150x65
DCS401.0065	65	NF3-500-64	3.1	200x150x65
DCS401.0090	90	NF3-500-80	9.5	400x170x90
DCS401.0125	125	NF3-500-110	9.5	400x170x90
DCS401.0180	180	NF3-500-320	28	450x285x171
DCS401.0230	230	NF3-500-320	28	450x285x171
DCS401.0315	315	NF3-500-320	28	450x285x171
DCS401.0405	405	NF3-500-320	28	450x285x171
DCS401.0500	500	NF3-500-600	49	590x305x158
DCS401.0610	610	NF3-500-600	49	590x305x158
DCS401.0740	740	NF3-500-600	49	590x305x158
4-quadr. convert.				
DCS402.0025	25	NF3-500-25	3	200x150x65
DCS402.0050	50	NF3-500-50	3.1	200x150x65
DCS402.0075	75	NF3-500-80	9.5	400x170x90
DCS402.0100	100	NF3-500-80	9.5	400x170x90
DCS402.0140	140	NF3-500-110	9.5	400x170x90
DCS402.0200	200	NF3-500-320	28	450x285x171
DCS402.0260	260	NF3-500-320	28	450x285x171
DCS402.0350	350	NF3-500-320	28	450x285x171
DCS402.0450	450	NF3-500-600	49	590x305x158
DCS402.0550	550	NF3-500-600	49	590x305x158
DCS402.0680	680	NF3-500-600	49	590x305x158
DCS402.0820	820	NF3-690-1000	90	610x305x198

The filters 25 ... 600 A are available for 440 V and for 500 V.

❶ The filters can be optimized to suit the actual motor currents encountered:
$I_{Filter} = 0{,}8 \bullet I_{MOT\ max}$; the factor 0.8 takes into account the current ripple.

Table A/6: Main filter data

Filter type	max. voltage	I_N	A	B	C	D	Fixing dimensions E ∅	F	F'	G	G'	Connection bar with hole ∅	Connection Term. (mm²)*	Weight kg	PE
NF3-440-25	440	25	250	150	65	0.75	6.5	115		135			4	3.0	M6
NF3-440-50	440	50	250	150	65	0.75	6.5	115		135			10/16	3.1	M6
NF3-440-64	440	64	250	150	65	0.75	6.5	115		135			10/16	3.1	M6
NF3-440-80	440	80	427	170	90	1.13	6.5		375		130		25/35	9.5	M10
NF3-440-110	440	110	436	170	90	1.13	6.5		375		130		50	9.5	M10
NF3-500-25	500	25	250	150	65	0.75	6.5	115		135			4	3.0	M6
NF3-500-50	500	50	250	150	65	0.75	6.5	115		135			10/16	3.1	M6
NF3-500-64	500	64	250	150	65	0.75	6.5	115		135			10/16	3.1	M6
NF3-500-80	500	80	427	170	90	1.13	6.5		375		130		25/35	9.5	M10
NF3-500-110	500	110	436	170	90	1.13	6.5		375		130		50	9.5	M10
NF3-500-320	500	320	450	285	171	4	12	200		260		11		32	M10
NF3-500-600	500	600	590	305	158	6	12	280		280		11		50	M10
NF3-690-600	690	600	590	305	158	6	12	280		280		11		50	M10
NF3-690-1000	690	1000	610	305	198	6	12	280		280		14		64	M10
NF3-690-1600	690	1600	844	465	210	8	12	320		440		2x14		195	M12
NF3-690-2500	690	2500	950	520	293	10	14	380		490		2x14		350	M16

* sigle cor / litz wire

Fig. A/7: Dimensions of filter

EC Declaration of Conformity

(Directive 73/23/EEC [Low Voltage], as amended by 93/68/EEC)
(Directive 89/336/EEC [EMC], as amended by 93/68/EEC)

Document code : ABB/DEIND/A 99-01 Date : 14.04.1999

We ABB Industrietechnik GmbH
Division Drives
Edisonstraße 15, D - 68623 Lampertheim, Germany

declare under our sole responsibility that the product series

DCS 400 Converter Module

to which this declaration relates is in conformity with following standards

EN 60146-1-1	: 1991	[IEC 146-1-1]
EN 60204-1	: 1992 + 1993	[IEC 204-1]

(furthermore applied standards : IEC 664-1, EN 60529 / IEC 529, EN 50178)

following the provisions of Directive 73/23/EEC, as amended by 93/68/EEC

and

to which this declaration relates is in conformity with following standard

EN 61800-3	: 1997	[IEC 1800-3]
EN 50081-2	: 1994	
EN 50082-2	: 1996	

following the provisions of Directive 89/336/EEC, as amended by 93/68/EEC provided that the DCS 400 Converter Module is equipped with a dedicated transformer or any other adequate mitigation method to reduce the disturbance voltage level to a permissible value at the point of connection of other low voltage equipment, and that the provisions of the final installation at the place of operation presented in the

3 ADW 000 032	Installation of Converters in accordance with EMC
3 ADW 000 095	Manual
3 ADW 000 033	Safety and operating instructions for drive converters

are met.

The Technical Construction File, code 3ADT 061003, to which this declaration relates has been assessed by Report and Certificate 9019a from ABB EMC Certification AB being the Competent Body according to EMC Directive 89/336/EEC. The File conforms with the protection requirements of the Directive 89/336/EEC article 10(2).

Lampertheim 14.04.1999

IND / A Thomas Wagner
Senior Vice President

ppa Ralf Form
IND / AM Ralf Form
Vice President

This declaration does not express any assurance of characteristics.
Installation and safety instructions mentioned **in our installation manual must be obeyed.**
The complince was tested in a typical configuration.

8 0102 f

Formular : AQ96001

Before Starting Installation

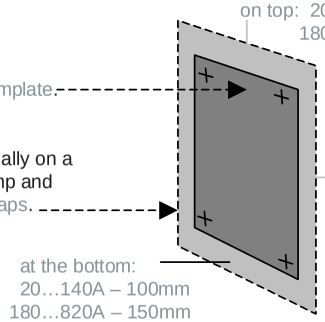
CHECK BOX CONTENTS: DCS 400, Manual, Mounting Template, Quick Inst. & Commissg. Guide
CHECK INSTALLATION SITE: See Manual
TOOLS NEEDED: Screwdriver, Torque wrench
FROM MOTOR NAMEPLATE: Armature Current Nominal, Armature Voltage Nominal, Field Current Nominal, Field Voltage Nominal, Base Speed
Note! This Guide is only for settings basically parameters of a EMF controlled motor

STOP ! ENSURE MAINS SUPPLY TO INSTALLATION IS OFF.
ENSURE MOTOR IS SUITABLE FOR USE WITH DCS 400.

1

Packing box lid contains wall mounting template. Remove it from the box.

DCS 400 should ONLY be mounted vertically on a smooth, solid surface, free from heat, damp and condensation. Ensure minimum air flow gaps.



2

Position DCS 400 onto fixings and securely tighten in all four corners.

Note! Lift DCS 400 by its chassis and not by its cover.

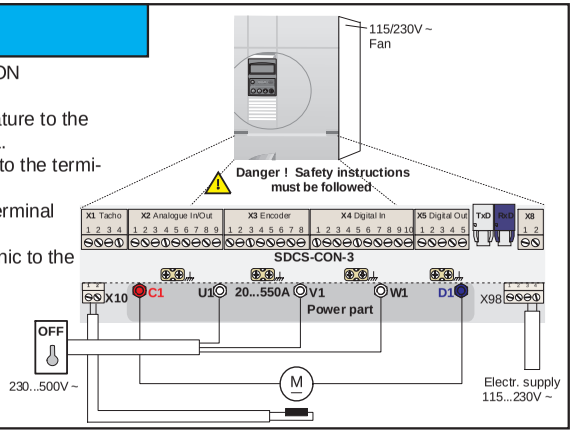
3

STOP ! CHECK THE INSULATIONS OF MOTOR AND MAINS AND MOTOR CABLES

4

MOTOR AND MAINS CONNECTION

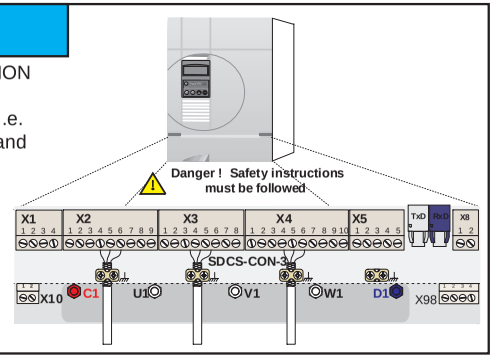
- Connect the motor cable for armature to the terminal block marked C1 and D1.
- Connect the motor cable for field to the terminal block marked X10:1 / 2.
- Connect the mains cable to the terminal block marked U1 V1 W1.
- Connect power supply for electronic to the terminal block marked X98:3 / 4.
- Connect power supply for fan on the top of the DCS 400.



5

ANALOGUE AND DIGITAL I / O CONNECTION

Strip off the insulation from all signal cables i.e. tacho or encoder cable and other analogue and digital input / output cable.
Connect the screen to earthing plate of DCS 400.
Ensure proper Earthings.



NOTE! DCS 400 does not carry internal fusing.
Please ensure correct fuses are installed at the supply.

6

STOP ! CHECK that starting the motor does not cause any danger. If there is a risk of damage to the driven equipment in case of incorrect rotation direction of the motor, it is recommended having the driven equipment disengaged when first start is performed.

7 Application macro Standard

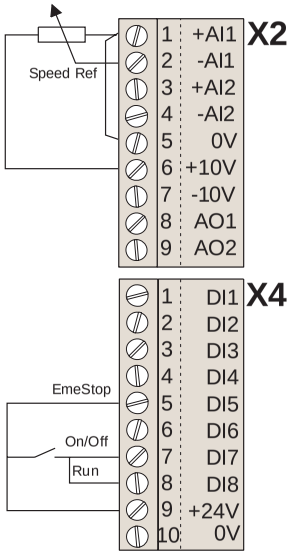
This example of connection based on application macro **Standard** and EMF speed feedback

Note! The drive may start when mains is switched on.

For analogue speed reference, connect potentiometer (2-10 kOhms) to terminal X2:1,2,5,6.

To start the drive activate digital inputs DI7 / DI8

Switch on mains.

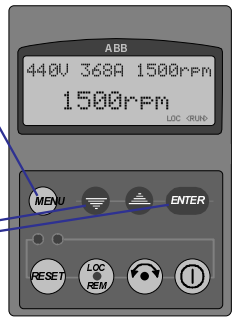


Note! For further information on I/O settings, refer to DCS 400 Manual, Chapter application macros and / or parameter list.

Note! There are several ways for commissioning the DCS 400.
- parameter programming by panel
- **guided commissioning** by panel via **panel wizard**
- parameter programming by PC Tool *Drive Window Light*
- **guided commissioning** via **PC commissioning wizard** (as a part of Drive Window Light)

This guide described parameter programming by panel.
For **guided commissioning** by panel via **panel wizard** start the panel wizard as follows:

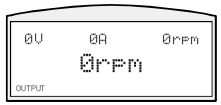
- **Electronic supply on**
- **Press** MENU
- **Press**
- **Press** ENTER
- **and follow the instruction**



Continue with point 9

8 Parameter programming by panel

Display shows the **OUTPUT** mode

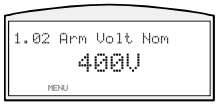


For application macro **Standard** the following DCS 400 parameter must be set:

1.01 - Armature Current Nominal
1.02 - Armature Voltage Nominal
1.03 - Field Current Nominal
1.04 - Field Voltage Nominal
1.05 - Base Speed
7.01 - Language

Instructions for settings the parameters:
- Press **MENU** to enter the MENU. MENU flag becomes visible

- Press **ENTER** to select the Motor Settings group
- Select the parameter with **UP** and **DOWN** buttons



- Press **ENTER** to get the parameter set mode
- Alter the value by using **UP** and **DOWN** buttons
- Store the modified value by pressing **ENTER**
- After settings all parameters press **MENU** button twice to resume **OUTPUT** display.

9

Motor is now ready to run.
Drive controlled by digital inputs: Close **On/Off** switch to turn on motor.
Drive controlled by panel: Set the control mode to local by pressing the **LOC/REM** button. Press **START/STOP** button to turn on motor

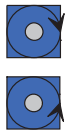
10

Note! Before increasing motor speed, check that the motor is running in desired direction.

To set the reference by analogue input:
- To increase or decrease the speed reference turn the potentiometer.
- To stop motor open **On/Off** switch.

To set the reference by panel:
- To increase the reference press **UP**
- To decrease the Reference press **DOWN**
- To stop motor press **START/STOP** button.

direction



Note! Always disconnect mains supply before working on DCS 400 or motor.

Appendix D - Examples for basic parameter programming

The experience has shown that certain parameters must be adapted in most applications.

These parameters show the following tables.

Table 1: Operation for armature control mode
Table 2: Operation for field control mode
Table 3: Operation for field control mode with speed-dependent current limitation
Table 4: Common parameters for the three operating modes

Operation for armature control mode

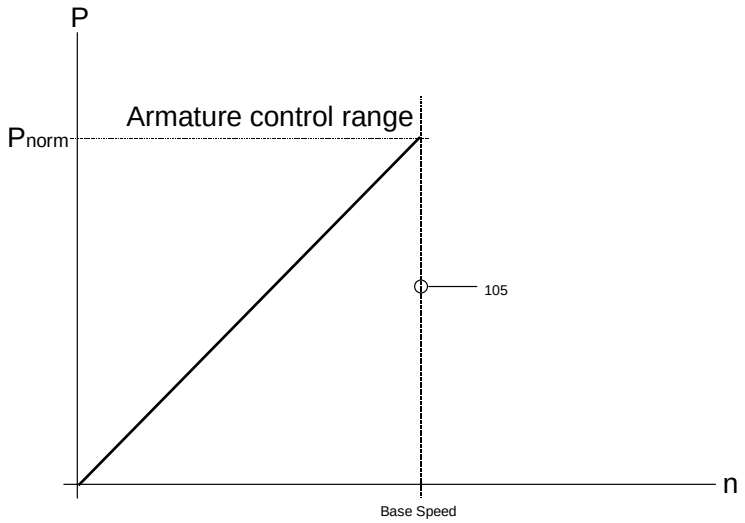


Table 1

Parameter number	Parameter name	Significance	Contents	Entry
101	Arm Cur Nom	Nominal armature current	Ia_{nom}	
102	Arm Volt Nom	Nominal armature voltage	Ua_{nom}	
103	Field Cur Nom	Nominal field current	Ie_{nom}	
104	Field Volt Nom	Nominal field voltage	Ue_{nom}	
105	Base Speed	Nominal speed	n_{nom}	
106	Max Speed	Nominal speed = (1.05)	n_{nom}	
201	Macro Select	Application macro selection	Selection	
203	Stop Mode	Stop mode selection	Selection	
204	Eme Stop Mode	Emergency stop mode selection	Selection	
502	Speed Meas Mode	EMF or tacho or encoder (Initial start-up = EMF)	Selection	
503	Encoder Inc	Number of increments per rev. (if parameter 502 = Encoder)	Number of pulses	
509	Accel Ramp	Acceleration ramp	sec	
510	Decel Ramp	Deceleration ramp	sec	
511	Eme Stop Ramp	Emergency stop ramp (if parameter 204 = Ramp)	sec	
601	AI1 Scale 100%	Reference signal voltage at 100% speed	10 V	
602	AI1 Scale 0%	Reference signal voltage at 0% speed	0 V	
701	Language	Panel language selection	Selection	

continue with table 4

Operation for field control mode

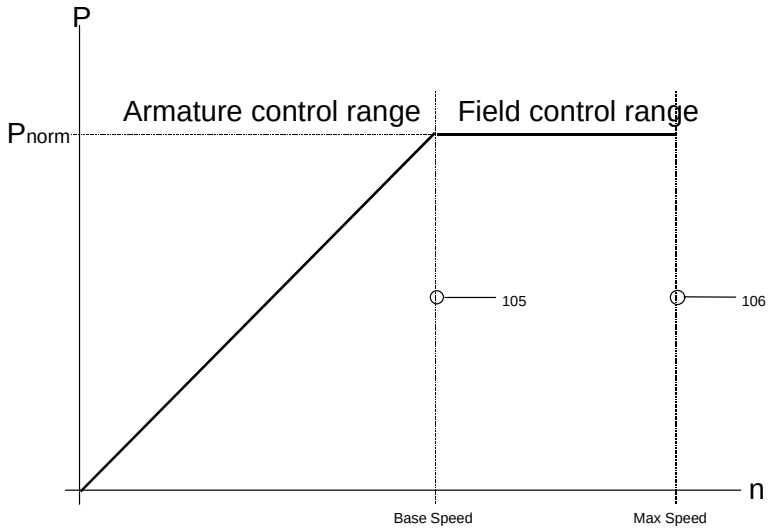


Table 2

Parameter number	Parameter name	Significance	Contents	Entry
101	Arm Cur Nom	Nominal armature current	Ia_{nom}	
102	Arm Volt Nom	Nominal armature voltage	Ua_{nom}	
103	Field Cur Nom	Nominal field current	Ie_{nom}	
104	Field Volt Nom	Nominal field voltage	Ue_{nom}	
105	Base Speed	Nominal speed	n_{nom}	
106	Max Speed	Max. field weakening speed	n_{max}	
201	Macro Select	Application macro selection	Selection	
203	Stop Mode	Stop mode selection	Selection	
204	Eme Stop Mode	Emergency stop mode selection	Selection	
502	Speed Meas Mode	EMF or tacho or encoder (Initial start-up = EMF)	Selection	
503	Encoder Inc	Number of increments per rev. (if parameter 502 = Encoder)	Number of pulses	
509	Accel Ramp	Acceleration ramp	sec	
510	Decel Ramp	Deceleration ramp	sec	
511	Eme Stop Ramp	Emergency stop ramp (if parameter 204 = Ramp)	sec	
601	AI1 Scale 100%	Reference signal voltage at 100% speed	10 V	
602	AI1 Scale 0%	Reference signal voltage at 0% speed	5 V	
701	Language	Panel language selection	Selection	

continue with table 4

Operation for field control mode with speed-dependent current limiting

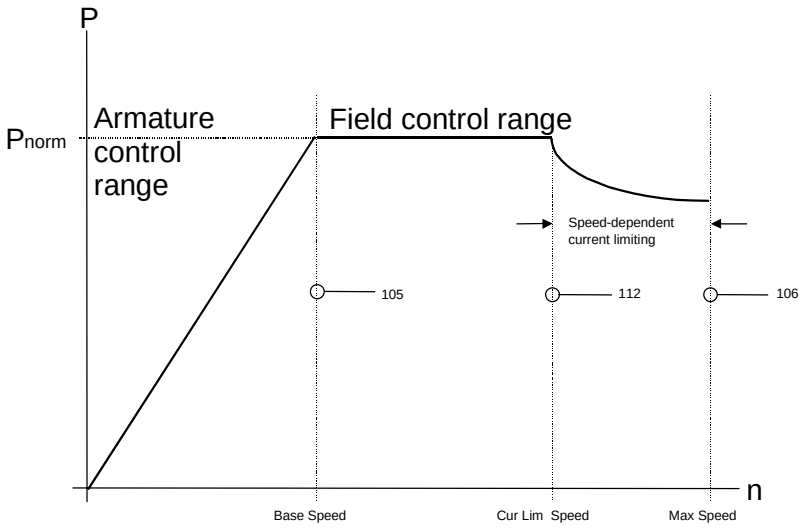


Table 3

Parameter number	Parameter name	Significance	Contents	Entry
101	Arm Cur Nom	Nominal armature current	Ia_{nom}	
102	Arm Volt Nom	Nominal armature voltage	Ua_{nom}	
103	Field Cur Nom	Nominal field current	Ie_{nom}	
104	Field Volt Nom	Nominal field voltage	Ue_{nom}	
105	Base Speed	Nominal speed	n_{nom}	
106	Max Speed	Max. field weakening speed	n_{max}	
112	Cur Lim Sped	Speed-dependent current limiting	n_{electr}	
201	Macro Select	Application macro selection	Selection	
203	Stop Mode	Stop mode selection	Selection	
204	Eme Stop Mode	Emergency stop mode selection	Selection	
502	Speed Meas Mode	EMF or tacho or encoder (Initial start-up = EMF)	Selection	
503	Encoder Inc	Number of increments per rev. (if parameter 502 = Encoder)	Number of pulses	
509	Accel Ramp	Acceleration ramp	sec	
510	Decel Ramp	Deceleration ramp	sec	
511	Eme Stop Ramp	Emergency stop ramp (if parameter 204 = Ramp)	sec	
601	AI1 Scale 100%	Reference signal voltage at 100% speed	10 V	
602	AI1 Scale 0%	Reference signal voltage at 0% speed	5 V	
701	Language	Panel language selection	Selection	

continue with table 4

Common parameters for the three operating modes

Table 4

Parameter number	Parameter name	Significance	Contents	Entry
304	Arm Cur Max	Maximum current limit	% I_a	
305	Overload Time	Overload time	sec	
306	Recovery Time	Recovery time	sec	
307	Torque Lim Pos	Positive torque limit	% M_{nom}	
308	Torque Lim Neg	Negative torque limit	% M_{nom}	
317	Stall Torque	Stall torque	% M_{nom}	
318	Stall Time	Stall time	sec	
515	Zero Speed Lev	Zero speed level	rpm	
516	Speed Level 1	Speed level 1 reached	rpm	
517	Speed Level 2	Speed level 2 reached	rpm	
605	AO1 Assign	Analog output signal 1	Selection	
606	AO1 Mode	Unipolar or bipolar signaling	Selection	
607	AO1 Scale	100% scaling = ? volts	Selection	
608	AO2 Assign	Analog output signal 2	Selection	
609	AO2 Mode	Unipolar or bipolar signaling	Selection	
610	AO2 Scale	100% scaling = ? volts	Selection	
611	DO1 Assign	Digital output signal 1	Selection	
612	DO2 Assign	Digital output signal 2	Selection	
613	DO3 Assign	Digital output signal 3	Selection	
614	DO4 Assign	Digital output signal 4	Selection	
615	DO5 Assign	Digital output signal 5	Selection	
616	Panel Act 1	Panel display top left	Selection	
617	Panel Act 2	Panel display top center	Selection	
618	Panel Act 3	Panel display top right	Selection	
619	Panel Act 4	Panel display bottom	Selection	
702	Contr Service	Self-setting procedures	Selection	

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.

ABB Industrietechnik GmbH
Antriebe und Automation
Postfach 1180
D-68619 Lampertheim
Telefon +49(0) 62 06 5 03-0
Telefax +49(0) 62 06 5 03-6 09

3ADW 000 095 R0401 REV D
09_99