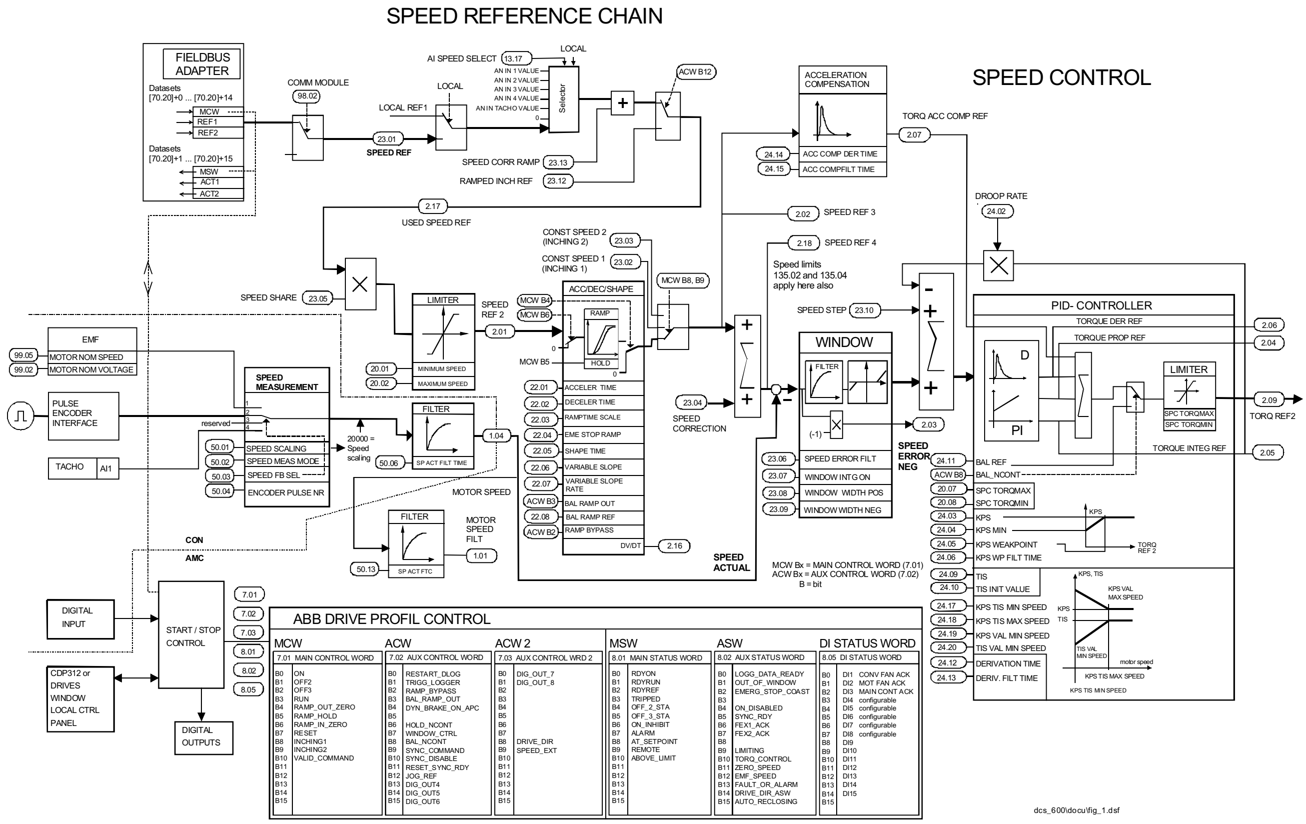
DCS Thyristor Power Converters

for DC Drive Systems

25 to 5150/10300 A

Software Description

DCS 600 MultiDrive



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How to use the DCS Documentation System

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

DC drive systems			System Drive								Standard Drive								Rebuild
			Cubicle				Module				Cubicle			Module					
Product documentation			DCA 600	DCA 620			DCS/DCF 600 MultiDrive	DCS 600 CraneDrive			DCA 500 / DCA 520	DCS 500 Easy Drive	DCS 400 Easy Drive	DCS 400	DCS/DCF 500B		DCE 400		DCR
System description	Language	Volume																	
3ADW000066	EN, DE,FR	II D									x	x			x				
3ADW000072	EN, DE	II F	x	x			x												available only for: DCS 500B / 600 drive systems
3ADW000121 ①	EN	II F1	x	x															
3ADW000095 (Manual) ②	EN,DE,FR,IT,SP	II K											x	x			x		
3ADW000139	EN	II F	x					x											
3ADW000071 (Flyer)	EN, DE											x							
3ADW000152	EN, DE,FR,IT,SP																x		
3ADW000173 (Flyer)	EN												x						
Technical Data	Language	Volume																	
3ADW000165	EN	III					x	x							x				
Operating Instructions	Language	Volume																	
3ADW000055	EN,DE,FR,SP	IV A									x	x			x				
3ADW000080	EN, DE	IV F	x	x			x												
3ADW000091 (Installation)	EN, DE	IV F1	x	x							x		x						
Software description	Language	Volume																	
3ADW000078	EN	V D1									x	x			x				
3ADW000076	EN	V F	x	x			x												
3AST000953 ③	EN		x					x											
Tools	Language	Volume																	
3AFE61178775 **CMT/DCS500**	EN	-									x	x			x				
EN 5926915-1 **GAD**	EN	-									x	x			x				
3ADW000048 (Application blocks)	EN	V A2									x	x			x				
3AFY61296123 **Drive *Window***	EN	-	x	x			x	x											
Service Instructions	Language	Volume																	
3ADW000093	EN, DE	VI A	x	x			x	x			x	x			x				
3ADW000131	EN	VI K											x	x			x		
Fieldbus	Language	Volume																	
3ADW000086	EN	-									x	x			x				
3ADW000097	EN	-	x	x			x	x											
Others	Language	Volume																	
3ADW000115 12-Pulse operation	EN	VIII F2	x				x												
3ADW000092 Rebuild manual	EN	XI H1					x												
3ADW000128 Paralleling DCS Conv.	EN	VIII D1	x				x				x				x				
3ADW000040 12-Puls operation	EN, DE	VIII A2									x				x				

Status: 25.March.2002

① Covers information of Technical data

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

③ Covers information of Operating Instructions, Software Description

Thyristor Power Converters

Series
DCS 600 MultiDrive
DC Drives 25 to 5150/10300 A

SOFTWARE DESCRIPTION

Code: 3ADW 000 076 R0701 Rev G

SWD6_e_g_1/2.DOC

EFFECTIVE: 2002-01-29
SUPERSEDES: Rev F

Contents

SOFTWARE DESCRIPTION

GENERAL

The documentation of the DCS600 MultiDrive is divided into separate manuals in order to provide quick access to the required information.
System Description DCS/DCF 600 gives an overview of the DCS/DCF 600 converter modules.
Software Description (this manual) describes in detail the DCS600 MultiDrive software and the utilization of field exciter units SDCS-FEX-1, SDCS-FEX-2 and DCF503/504.
Technical Data introduces and describes the hardware components of DCS600 MultiDrive (power stage as well as control electronics).
Operating Instructions provides detailed information for start-up the drive.
Service manual informs how to exchange power thyristors of the DCS 500/600 series.
System description DCA 600 provides detailed information of DCS 600 enclosed converters.
Installation manual DCA 600 provides detailed information of how to install DCS 600 enclosed converters.
12-Pulse manual describes the different 12-pulse configurations of DCS 600 converters.

Identification of the software revision

The control electronics of DCS600 MultiDrive consists of 2 processor boards:

- The SCDS-CON-2 board controls the converter (current control, firing, ...)
- The AMC-DC board controls the drive (speed control, speed and torque reference handling, interface to overriding systems, ...).

Accordingly, the software is split into 2 parts, the converter control software and the drive control software.

SW PACKAGE VER (4.01)
This signal is an 8-character string and describes the loaded software package:

DCS6_<t>15

<t> identifies the target the loaded software is assigned to:

C AMC-DC / CLASSIC
D AMC-DC 2 / CLASSIC 2

The number 15 is an identification number reserved for DCS600.
! This documentation is valid only for software with identification number 15 !

The loaded software package consists of

- base library for function block programming
- modlink interface software
- operating system
- drive control software
- application software created by function blocks (FCB)
- converter program stored into the SDCS-CON-2

Identification of the converter control software revision

The **converter control program** is stored in two FLASH-memory circuits on the control board SCDS-CON-2. The program revision number can be checked from the signal **CONV SW VERSION (4.11).**

Converter control software revision: DC**15.2xx**

The number 15. is an identification number reserved for DCS600.
The 1st digit of the 2nd part identifies a CON-2 software **(2).** The last 2 digits are a running number which will be increased always when the new program revision is released.
This version of the software description is valid for version DC 15.204 or higher.

Note: If a certain software release is a pre-release, the pre-release number is found in index **CON SW PRERELEASE (4.23).** This index is only available with pre-releases (value <> 0)

Identification of the drive control software revision

The **drive control program** is stored in a FLASH-memory circuit on the control board AMC-DC. The program revision number can be checked from the signal

DC VERSION (4.02)
This signals gives the version of the fix-code-software loaded to the AMC-DC board. The fix-code software consists of

- DC-drive control
- operating system
- FCB-base library
- modlink interface software

15 6 xx

The number 15 is an identification number reserved for DCS600.
The 1st digit of the 2nd part identifies an AMC-board software **(6)**. The last 2 digits are a running number which will be increased always when the new program revision is released.

Note1: The digits are represented by hexadecimal digits. Since the internal representation is longer than 16 bit, the value will be corrupted to 16 bit, if read by means of dataset communication (e.g. from a field bus interface, see chapter “Communication“).

Note2: If a certain software release is a pre-release, the sub-release number is found in index **AMC SW PRERELEASE (4.24)**. This index is only available with pre-releases (value <> 0)

The drive control part of the DCS600 MultiDrive created by FCB can be identified independently by means of the following signals:

- **APPLIC NAME (4.03)**

The application name of the software part created by function block programming (FCB) can be identified by means of an 8-character string.

For the standard DCS600 MultiDrive, this signal is

DCS600_X

x = A, B, C, ... according to the application release.
The application name is defined by the FCB's node name.

Drive Engineer Centers (DEC's) and System PRUs develop their own application coded with a different string.
! This documentation is valid only for software with application name DCS600_X !

- **APPLIC VERSION (4.12)**

This signal gives the version of the loaded application program. The version is identified by the date of it's creation:

yymmdd	yy:	year
	mm:	month
	dd:	day

Note: The digits are represented by hexadecimal digits. Since the internal representation is longer than 16 bit, the value will be corrupted to 16 bit, if read by means of dataset communication (e.g. from a field bus interface, see chapter "Communication").

- **BASELIB VERSION (4.13)**

This signals describes the loaded FCB base library version:

1210

Note: The digits are represented by hexadecimal digits. Since the internal representation is longer than 16 bit, the value will be corrupted to 16 bit, if read by means of dataset communication (e.g. from a field bus interface, see chapter "Communication").

Identification of the field exciter program revision

The software revisions of the field exciters can be checked from the signals:

FEX 1 SW VERSION (4.08)	SW version of 1st Fex
FEX 2 SW VERSION (4.09)	SW version of 2nd Fex

DRIVE-ID

The parameter **DRIVE ID NUMBER (99.10)** is freely definable by the user in order to mark the section number of the machine. The drive software does not use that parameter at all.

Handling of parameters and signals

Parameters and signals are values that define the operation of the DCS600 MultiDrive. Parameters can be modified by

- overriding control systems (e.g. APC, AC80, fieldbuses)
- a PC-based commisioning and maintenance tool, the **DriveWindow**
- the CDP312 control panel

The DCS600 MultiDrive has **36 parameter groups** in the group range from 10 to 99. Parameters of a certain group belong to the same functional part of the program.
All signals and parameters are defined within a data structure called AMC table. All accesses to values are done via this table. The AMC table defines for each value (depending on the data type)

  - group
  - index
  - name
  - unit
  - attribute
  - min/max values
  - scaling factors
  - text values in case of selection values

Signals are

- reference values or commands from the overriding system, control panel or DriveWindow
- results from measurements or calculations done by the DCS600 MultiDrive control program,

The drive tool can access the signals in the same way as parameters. The DCS600 MultiDrive has **9 signal groups** in the group range from 1 to 9. Signals of a certain group belong to the same functional part of the program as the parameters.

In this manual all references to the parameters and the signals are done by using brackets. **(50.01)** equals the group 50, index 01.

Detailed description of parameter and signal names as well as scaling factors are presented in document

DCS600 MultiDrive
Parameter and Signal Description.

Scaling of parameters and signals

For controlling DCS600 MultiDrive and the motor, parameters and signals are scaled according to the function where the values are used for. The values are represented as internal units. Absolute values like amps are generated for display purposes but are not used for controlling purposes. Main scaling factors used in DCS600 MultiDrive software are explained briefly here.
The scalings mentioned below are integer scalings. They apply, if the values are accessed as 16-bit integer values. If the type of a parameter or signal is R (real), they can also be accessed as physical value by means of the informations given in the AMC table (e.g. DriveWindow uses this format for the Parameter and Signal tool).

SPEED	**20000** Maximum speed value. Selected by the parameter **SPEED SCALING (50.01).** Used by the speed dependent functions like speed measurement, ramp, speed reference chain etc. **Note:** If the speed scaling parameter **(50.01)** is set by means of dataset communication, it is limited to 3275 rpm due to the numeric limit of signed 16-bit values. However, values up to 6550 rpm can be written to the same internal parameter by means of the (unsigned) packed boolean parameter **(50.11)**.
TORQUE	**10000** Nominal motor torque. Corresdponds to signal **MOTOR NOM TORQUE (4.22)**
CONVERTER CURRENT	**4095** Nominal converter current. Corresponds to signal **CONV NOM CURR (4.05)** Used by the converter protection functions like overcurrent limitation.
MOTOR CURRENT	**4095** Nominal motor current. Corresponds to parameter **MOT NOM CURRENT (99.03)** Used by the motor control.

FIELD CURRENT	**4095** Nominal field current. Corresponds to parameter **MOT 1 NOM FLD CURR (41.03)** **(in case of DCF600: corresponds to setting made in 99.03 of the DCF600; see description of 41.03, 41.17)** Used by the motor control.
MAINS VOLTAGE	**4096** Nominal mains voltage. Corresponds to parameter **NOM SUPPLY VOLT (42.06)** Used by the motor control.
ARMATURE VOLTAGE	**4096** Nominal DC voltage. Corresponds to parameter 1.35 * **NOM SUPPLY VOLT (42.06)** Used by the motor control.
EMF VOLTAGE	**3786** Nominal EMF voltage. Corresponds to parameter 1.35 * **NOM SUPPLY VOLT (42.06)** Used by the motor control.
MOTOR FLUX	**4096** Nominal motor FLUX. Used by the motor control.
TIME	**0,001...1 sec** Time scalings depends on the functions.

Overview of DCS600 MultiDrive functions

The DCS600 MultiDrive flexibility allows the user to configure functions of the drive easily suitable for different applications.

Functions of the DCS600 MultiDrive are normally activated by selecting a certain value to the function activation parameter.

Here are briefly explained most important parts of the DCS600 MultiDrive software and their main properties.

Controlling the drive

The DCS600 MultiDrive can be controlled by
- Overriding control systems like **AP**plication **C**ontroller **APC** AC80, AC70, AC800 or field bus interfaces
- **DriveWindow**, a PC-based commissioning and maintenance tool
- Control panel CDP312

Drive logic

is a part of the software which handles functions needed for controlling the drive like
- Local/Remote selection
- Start and stop sequences
- Fault handling
- Emergency stop etc.

Measurements

For controlling the motor in a proper way the DCS600 MultiDrive measures
- Speed
- Converter current
- Field current
- Armature DC voltage
- Mains AC voltage
- Heat sink temperature

There are also 5 DI-channels and 5 AI-channels that can be optionally used in various purposes e.g. measuring the motor temperature etc..

Speed reference

The **Speed Ramp** is used to fine tune the motor speed. The slope of the ramp can also be modified by the "**Variable Slope**" function. The output of the ramp can be **smoothen**ed if needed. The program can also calculate an additional torque reference needed during acceleration/deceleration using a function called "**Acceleration Compensation**". In case of **Master/Follower** connection the master drive can transfer it’s speed reference to the slave.

Speed control

The speed of the motor is controlled by the **PID**-control. The controller is designed so that it can easily be adjusted to the different environment in order to facilitate the commissioning work.

Torque reference

The DCS600 MultiDrive can also be commanded by using torque reference. In case of **Master/Follower** connection the master drive can transfer it's torque reference to the slave.

Current controller

The current of the motor is controlled by the PI-type controller. The controller can be tuned using an "Auto-Tuning" function.

Field excitation

There are several different ways to control motor field depending on the application like:

- uncontrolled diode field exciter **SDCS-FEX-1**
- 1-Q current controlled field exciter **SDCS-FEX-2** and **DCF503** enabling field weakening area.
- 4-Q current controlled field exciter **DCF504** enabling field weakening area and field reversal.
- The DCS600 MultiDrive itself allows operation as field exciter. The current reference is received either via the fex link by the converter control software or is set via the AMC-table from
    - Overriding control systems
    - DriveWindow
    - Control panel CDP312

In addition it is also possible to use non-ABB field exciters. In that case acknowledge signals are read using DCS600 MultiDrive's AI or DI -channels.

EMF-controller

When an accurate torque control is needed or the field weakening function is used, the EMF-control adjusts the field so that the armature voltage stays at a desired level.

Limitations

The user can select current limits for the armature controller. There is also a possibility to reduce the armature current limit proportionally to the speed. It is also possible to limit the speed controller output and the external torque reference independently, if the application demands that.

Diagnostic

The DCS600 MultiDrive checks the condition of the SCDS-CON-2 board and the AMC-DC board every time when the control electronics is switched on. For the user there are:

- **Fault logger** contains time stamped fault and alarm events. This logger is saved to FLASH memory when the power is switched off. The fault/alarm buffer can accomodate up to 24 events, after this the oldest event is overwritten. (An alarm event can be overwritten by a newer event, but a fault event is always protected and can not be overwritten before the fault has been acknowledged.)
- **Event logger** can accomodate up to 64 events before the oldest event is overwritten. The contents of the event logger is not saved when the power is switched off.
- **Data logger** samples up to 4 channels simultaneously. The size of the data logger buffer is 1000 samples, so if 4 channels are sampled at the same time, the amount of of samples is 256/channel. The shortest sampling interval is 1 ms.

Communication

The DCS600 MultiDrive has 4 communication links

- DDCS channel 0 (on the AMC-DC board) for the overriding control system
- DDCS channel 2 (on the AMC-DC board) for Master/Follower link between drives
- DDCS channel 3 (on the AMC-DC board) for DriveWindow
- RS485 interface (on the for control panel CDP312
- FEX link for SDCS-FEX-2, DCF503/504 and DCF600 MultiDrive units.

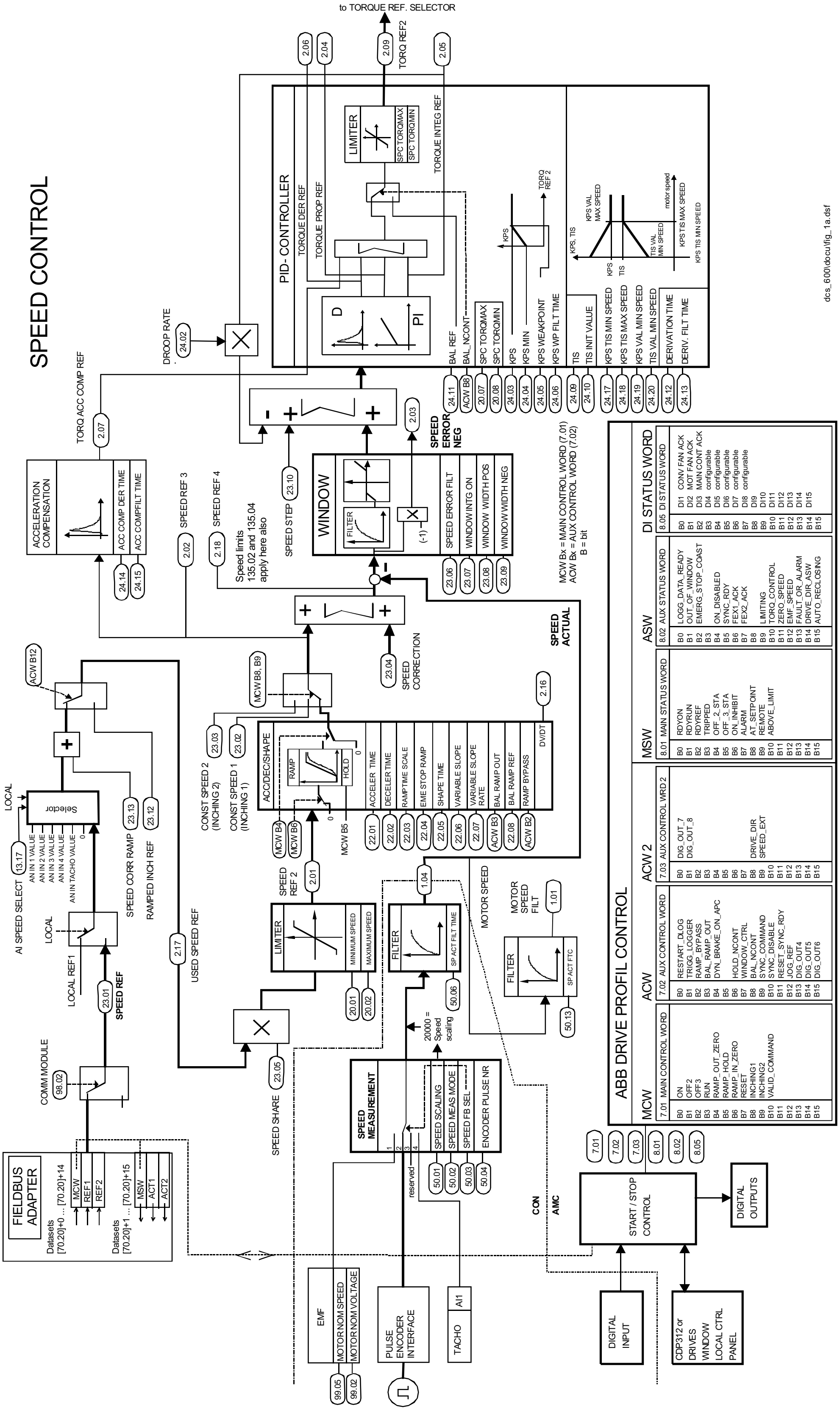


Figure 1-1 Speed reference chain

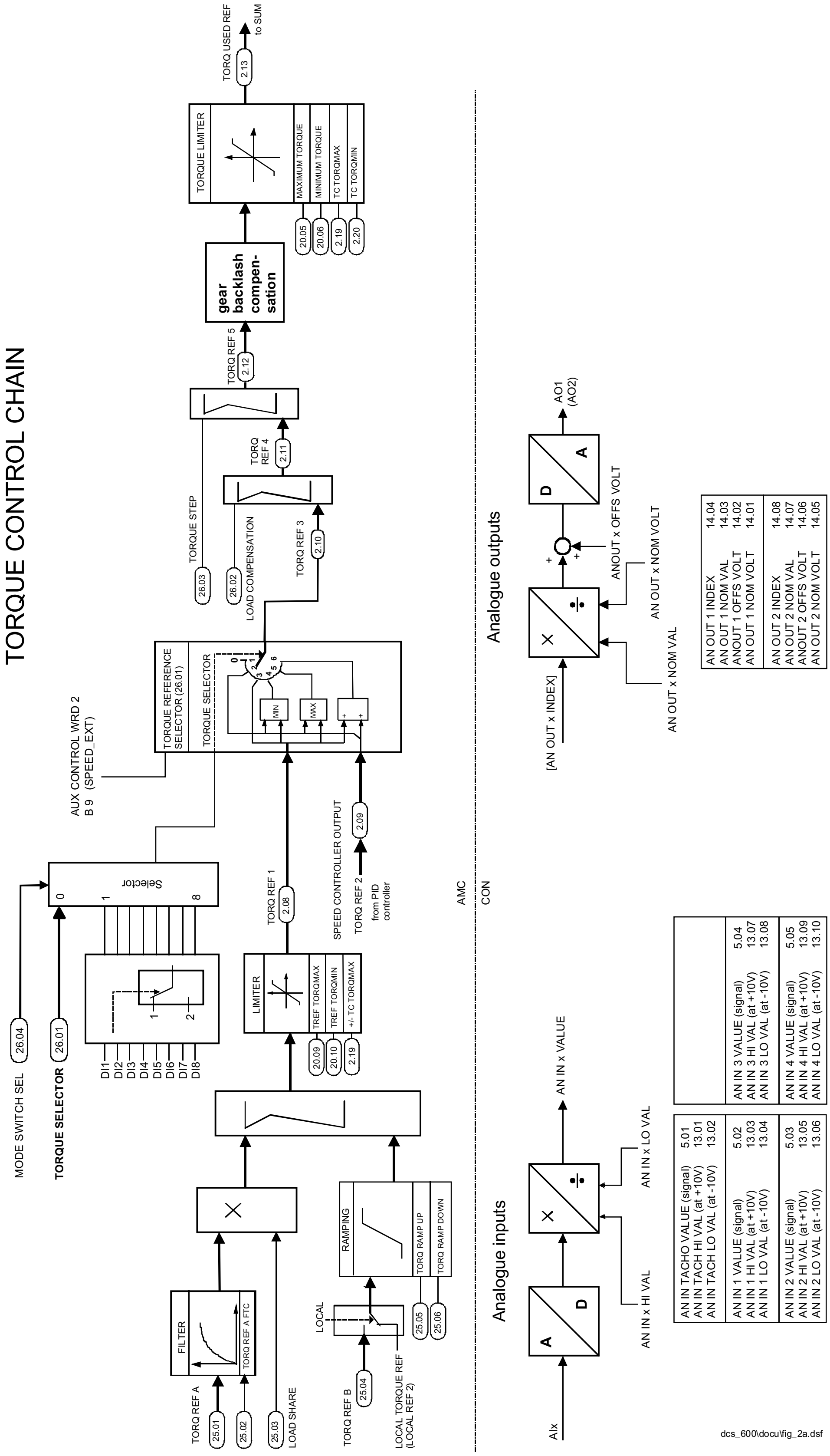


Figure 1-2 Torque reference chain

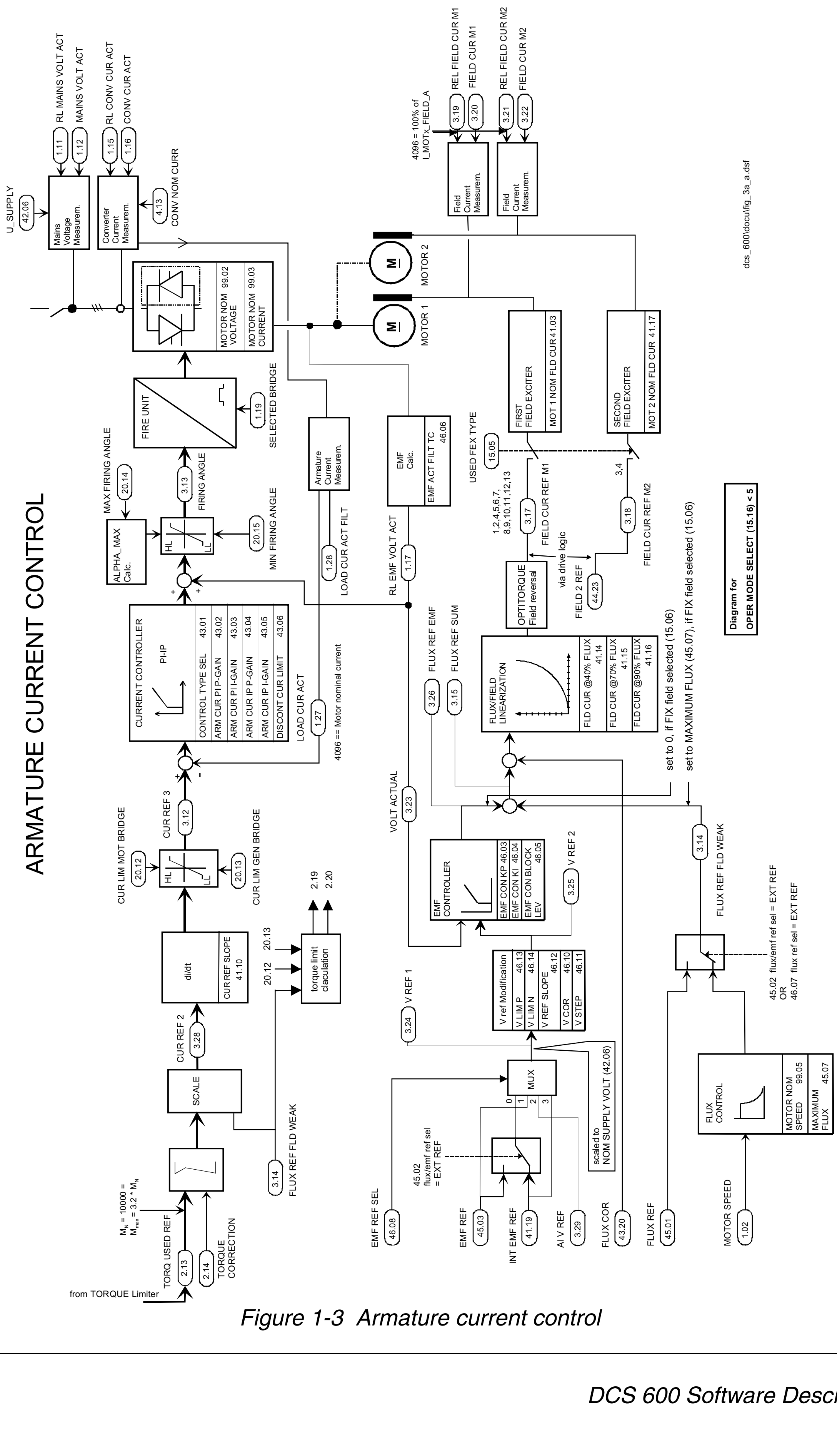


Figure 1-3 Armature current control

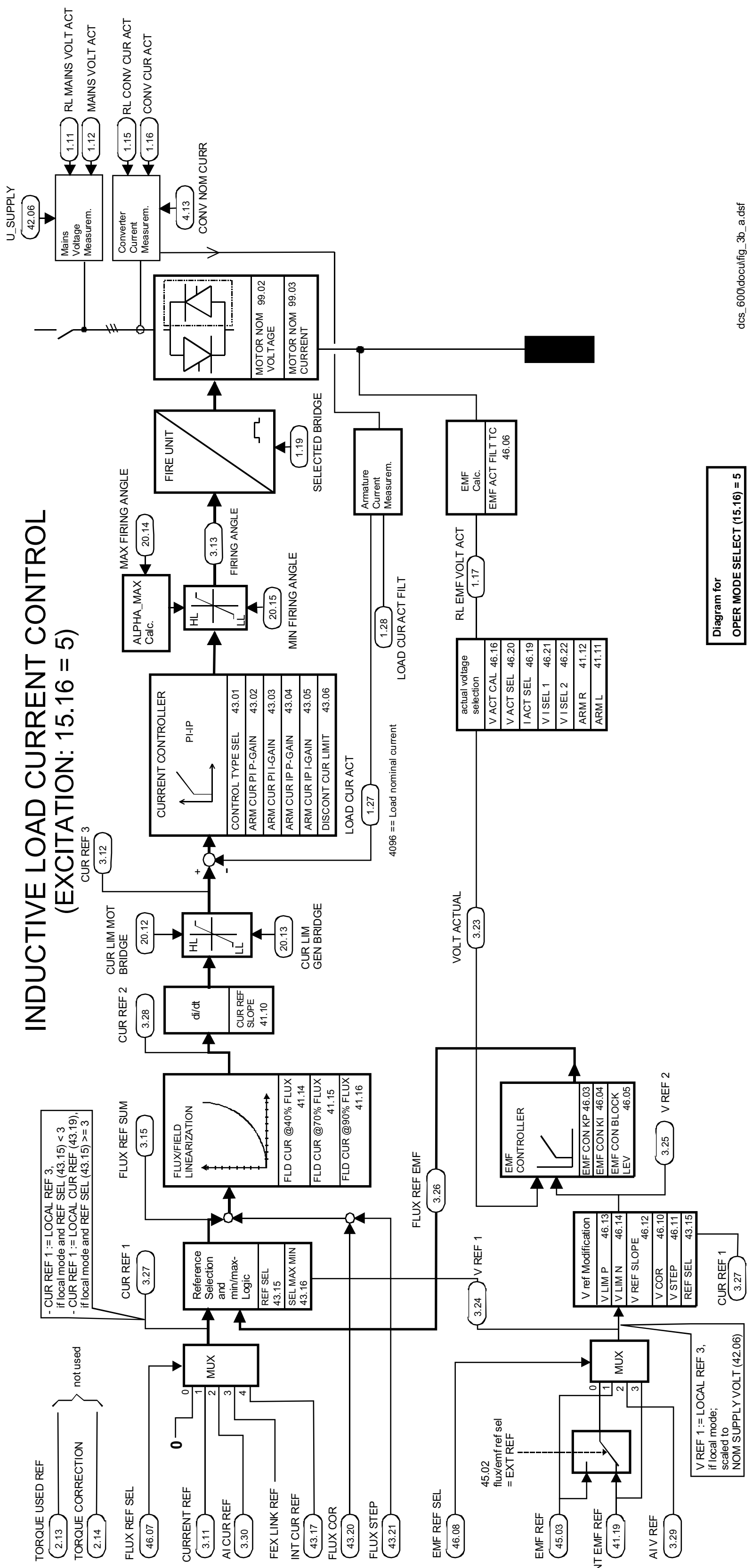


Figure 1-4 Inductive load current control

LOGIC

Local/Remote selection

Controlling of the DCS600 MultiDrive is based on using combined control words. The words are 16 bit wide and every bit has the defined function like "close the main contactor", "run"-command , "bypass ramp" etc. The Main Control Word **(7.01)** is defined according to the ABB drive profile. The Auxiliary Control Word **(7.02)** and the Auxiliary Control Word 2 **(7.03)** include additional DCS600 MultiDrive specific control bits.

If DriveWindow or the control panel CDP312 (= “local control place“) commands the drive to "LOCAL", the drive will be switched to use control words and the speed references from the local control place. Otherwise the program uses the command words and reference values written to the AMC table by e.g. overriding contol systems or a command word created by digital inputs (see **Local I/O** below)

The local mode can be blocked for safety reasons with the parameter

LOCAL LOCK (16.04)

0	**OFF**	local control is allowed (default)
1	**ON**	local control is disaabled

Note! The LOCAL LOCK function is NOT available with DriveWindow.

The local/remote state of the drive is displayed in bit 9 of the main status word **(8.02).**

If the connection to the local control place is lost in local mode, the fault reaction is always coast stop.

In LOCAL mode, stopping the drive is done according to parameter

STOP MODE (21.03)

0	**DYN BRAKING**	dynamic braking
1	**RAMP STOP**	stop according to eme stop ramp 22.04
2	**TORQUE LIMIT**	stop by torque limit
3	**COAST STOP**	torque is zero

On transitions from LOCAL to REMOTE mode, or from REMOTE to LOCAL mode, the drive stops according to the programmed STOP MODE (21.03), until either the ON- or the RUN-bit of the now active control word is set to 0 (e.g. by the STOP button after changing to LOCAL mode).
If the drive is in OFF-state during the LOCAL mode, the ON command is inhibited after changing to REMOTE mode, until the ON-bit of the now active control word is set to 0.

Local I/O and control links

In addition, the drive can be controlled by local I/O (DI6, DI7, DI8), the FEX link, or the 12-pulse link.

The source of the control word (for ON, RUN, RESET) is selected by the parameter:

COMMAND SEL (15.22)	0:	MAINCON WORD	overriding control system (via main control word **(7.01)**
	1:	LOCAL I/O	DI6 = RESET DI7 = ON DI8 = RUN
	2:	FEX LINK	Fex link (field exciter mode only, see chapter “Field Exciter Mode”)
	3:	12P LINK	12-pulse link (12-pulse slave only, see chapter "12-Pulse Operation")

In LOCAL I/O mode, stopping the drive (DI8/RUN = 0) is done according to parameter

STOP MODE (21.03)

0	**DYN BRAKING**	dynamic braking
1	**RAMP STOP**	stop according to eme stop ramp 22.04
2	**TORQUE LIMIT**	stop by torque limit
3	**COAST STOP**	torque is zero

The internal used/selected control word can be read from the signal **USED CONTROL WORD (7.04)**.

Note1: The control signals selected with the FEX LINK or 12P LINK configuration are not available for the drive control functions (speed and torque ramps, speed controller). For that reason, this parameter must be set to 0 or 1, if neither the field exciter mode nor a 12-pulse slave mode are active.

Note2: The RESET command from the local control place is always active.

Note3: In local I/O mode, the digital inputs DI6, DI7, DI8 mustn’t be used for purposes other than mentioned above.

Command Words

MAIN CONTROL WORD ABB Drive Profile control word of DCS600 MultiDrive			index: **7.01**
Bit	**Name**	**Value = 1**	**Value = 0**
0	ON (OFF1_N)	Command to **“RDYRUN“** state: start fans, field and close main contactor	Command to **“OFF“** state: Ramp Stop, then Open contactor, stop field and fans
1	OFF2_N	No OFF2 (Emergency OFF or Coast Stop)	Command to **“ON INHIBIT“** state via Coast Stop
2	OFF3_N	No OFF 3 (Emergency STOP)	Command to **“ON INHIBIT“** state via Emergency Stop
3	RUN	Command to **“RDYREF“** state: Run with selected reference	Stop by coasting
4	RAMP_OUT_ZERO	No other activities	Speed ramp output is forced to zero
5	RAMP_HOLD	No other activities	Speed ramping is stopped
6	RAMP_IN_ZERO	No other activities	Speed ramp input is forced to zero
7	RESET	acknowledge a fault indication	
8	INCHING_1	Constand speed 1 (23.2) selected	
9	INCHING_2	Constant speed 2 (23.3) selected	
10	VALID_COMMAND (has to be = 1)	No other activities	Freeze main command word and main references
11	reserved	(reserved)	
12	reserved	(reserved)	
13	reserved	(reserved)	
14	reserved	(reserved)	
15	reserved	(reserved)	

AUX CONTROL WORD Drive specific auxiliary control word of DCS 600 MultiDrive			index: **7.02**
Bit	**Name**	**Value = 1**	**Value = 0**
0	RESTART_DLOG	Restart of data logger **(not available)**	
1	TRIG_LOGGER	Data logger triggering **see note 1)**	
2	RAMP_BYPASS	Speed ramp is bypassed	
3	BAL_RAMP_OUT	Forcing of ramp output	
4	DYN_BRAKE_ON_APC	activate dynamic braking	
5	reserved	(reserved)	
6	HOLD_NCONT	Holding of the speed controller's integrator	
7	WINDOW_CTRL	Window control activated	
8	BAL_NCONT	Forcing of speed controller's output	
9	SYNC_COMMAND	synchronising command	
10	SYNC_DISABLE	synchronising is disabled	
11	RESET_SYNC_RDY	reset synchronised ready	
12	RAMPED_INCH_REF	Switch speed ramp input to RAMPED INCH REF (23.12)	
13	DIG_OUT_4 (14.11)	digital output 4 (IOB2: relay output)	
14	DIG_OUT_5 (14.14)	digital output 5 (IOB2: relay output)	
15	DIG_OUT_6 (14.17)	digital output 6 (IOB2: opto coupler output)	

Note 1)
To activate the external triggering of the datalogger, signal **[3.05]** must be selected as trigger source; the trigger level should be set between -30000 and +30000.
The selected edge of the trigger signal **[3.05]** equals the trigger edge of bit 1.

AUX CONTROL WRD 2 Drive specific auxiliary control word 2 of DCS 600 MultiDrive			index: **7.03**
Bit	**Name**	**Value = 1**	**Value = 0**
0	DIG_OUT_7 (14.20)	digital output 7 (IOB2: opto coupler output)	
1	DIG_OUT_8 (14.23)	digital output 8 (IOB2: relay output)	
2	DIG_OUT_1 (12.03)	FANS ON CMD	
3	DIG_OUT_2 (12.06)	FIELD ON CMD	
4	DIG_OUT_3 (12.09)	MAIN CONT ON CMD	
5	reserved	(reserved)	
6	reserved	(reserved)	
7	reserved	(reserved)	
8	DRIVE_DIR	drive direction negative see note 1	drive direction positive see note 1
9	SPEED_EXT	force selection of speed controller output in torque selector modes 4 and 5	torque reference according to min/max evaluation in torque selector modes 4 and 5
10	reserved	(reserved)	
11	reserved	(reserved)	
12	reserved	(reserved)	
13	reserved	(reserved)	
14	reserved	(reserved)	
15	reserved	(reserved)	

Note1:
Changes of the commanded drive direction get active only in the state RDY_RUN; reversal of a running drive by means of this control bit is not possible.

Note2:
Settings for DO1...DO3 are default.

Status words

MAIN STATUS WORD ABB Drive profile status word of DCS600 MultiDrive			index: **8.01**
Bit	**Name**	**Value = 1**	**Value = 0**
0	RDY_ON	ready to close the contactor	not ready to close contactor
1	RDY_RUN	ready to generate torque	not ready
2	RDY_REF	torque control operating (running)	operation inhibited
3	TRIPPED	indication of fault in DCS600 MultiDrive	
4	OFF_2_STA_N	No OFF2 active	OFF2 active
5	OFF_3_STA_N	No OFF3 active	OFF3 active
6	ON_INHIBITED	Switch on inhibited after • fault • emergency STOP • emergency OFF • ON INHIBIT via digital inputs (15.14, 15.15)	
7	ALARM	indication of alarm in DC Device	
8	AT_SETPOINT	Setpoint/act.value monitoring in the tolerance	
9	REMOTE	Remote control	Local control
10	ABOVE_LIMIT	speed treshold value (50.10) reached	
11	reserved	(reserved)	
12	reserved	(reserved)	
13	reserved	(reserved)	
14	reserved	(reserved)	
15	reserved	(reserved)	

AUX STATUS WORD Drive specific status word of DCS600 MultiDrive			index: **8.02**
Bit	**Name**	**Value = 1**	**Value = 0**
0	LOGG_DATA_READY	Content of data logger is readable	
1	OUT_OF_WINDOW	Speed actual value is outside of the defined window **(23.08 / 23.9)**	Speed actual value is outside of the defined window **(23.08 / 23.9)** Always cleared with TORQUE SELECTOR mode ZERO or TORQUE
2	EMERG_STOP_COAST	Emergency stop function has failed	
3	reserved	(reserved)	
4	ON_DISABLED	External interlocking ON INHIBIT 1 or ON INHIBIT 2 (ORed digital inputs selected by 15.14 and 15.15) prevent the run	
5	SYNC_RDY	Position counter synchronous ready status	
6	FEX1_ACK	Acknowledge of 1st Fex	
7	FEX2_ACK	Acknowledge of 2nd Fex	
8	reserved	(reserved)	
9	LIMITING	Drive is limiting, see signal 8.03	
10	TORQ_CONTROL	Drive is torque controlled	
11	ZERO_SPEED	Motor speed actual is zero	
12	EMF_SPEED	EMF speed feedback selected	
13	FAULT_OR_ALARM	Drive is faulted or alarming	
14	DRIVE_DIR_ASW	Negative drive direction active	
15	AUTO_RECLOSING	Auto reclosing logic activated	

DI STATUS WORD Digital Input status word of DCS600 MultiDrive		index: **8.05**
Bit	**Name**	**Function**
0	DI1	converter fan acknowledge (12.13)
1	DI2	external motor fan acknowledge (12.14)
2	DI3	main contactor acknowledge (12.15)
3	DI4	ON INHIBIT 1 SEL (15.14)
4	DI5	emergency stop / programmable, if emergency stop function not used (12.16)
5	DI6	programmable
6	DI7	V I SEL 2 (46.22)
7	DI8	V I SEL 1 (46.21)
8	DI9	available for application program, if SDCS-IOE-1 present
9	DI10	available for application program, if SDCS-IOE-1 present
10	DI11	available for application program, if SDCS-IOE-1 present
11	DI12	available for application program, if SDCS-IOE-1 present
12	DI13	available for application program, if SDCS-IOE-1 present
13	DI14	available for application program, if SDCS-IOE-1 present
14	DI15	available for application program, if SDCS-IOE-1 present
15	IOE1	1 == SDCS-IOE-1 is connected to SDCS-CON-2

Note: All DI's can be selected for several converter functions; inversion is available; in addition, it may be used for application programming. The default values are shown.

Available for application program: The DI is not selectable for converter functions, but is available for application programming.

Note: The emergency stop input (DIx) is active low, if parameter DIG IN x INVERT of selected DI (see 12.06) is set to INVERTED.

Start and stop sequences

The drive is controlled by control and status words. In order to control the drive in a proper way, a "hand shaking" sequence for the logic is necessary. The main functions of the hand shaking sequence is described here.

An overriding control system uses **MAIN CONTROL WORD** to command the drive, and **MAIN STATUS WORD** to read the actual status of the drive

❶-mark with a number describes the order of the instructions.
Control denotes an overriding control system like APC, AC80, field bus interface, ...

Start the drive

The start sequence given below is valid for **MAINCONT CON MODE (15.01)** = ON. See description of parameter 15.01 for further options.

Control **MAIN CONTROL WORD** **7.01**		DRIVE **MAIN STATUS WORD** **8.01**
		When the drive is ready to close the main contactor, the drive sets the bit **RDY_ON**
	❶	⇦ **RDY_ON = 1**; (Bit 0)
Control commands "ON"		
ON = 1; (Bit 0) ⇨	❷	
		Drive closes the contactors for the converter and motor fans, the field exciter contactor and the main contactor. After checking mains voltage, phase sequence and all acknowledges, program sets the RDY_RUN bit.
	❸	⇦ **RDY_RUN = 1**; (Bit 1)
Control commands "RUN"		
RUN = 1; (Bit 3) ⇨	❹	
		Drive releases references and controllers.
	❺	⇦ **RDY_REF = 1**; (Bit 3)
Control operates the drive by setting desired speed reference, torque reference etc.		

Stop the drive

The drive can be stopped in two ways, either taking off the "ON"-command which opens contactors as fast as possible or by following next sequence:

Control **MAIN CONTROL WORD** **7.01**		**DRIVE** **MAIN STATUS WORD** **8.01**
Control commands "RUN" off		
RUN = 0 ⇨	❶	
		Drive stops by coasting. It sets the bit
	❷ ⇦	**RDY_REF (RUNNING) = 0**
Control can keep "ON" command "1" if it is needed to start the drive rapidly		
Control commands "ON" off		
ON = 0 ⇨	❸	
		In speed controlled mode, the drive stops according to parameter DECELER TIME **(22.02)**. **In torque controlled mode**, the torque reference is reduced to zero according to parameters TORQUE REF A FTC **(25.02)** resp. TORQ RAMP DOWN **(25.06)**, depending on the used torque reference channel (A or B). The main, field and fan contactors are opened at standstill. The drive sets the bit
	❹ ⇦	**RDYRUN = 0**

Drive state

Besides the main status word, the drive's state is shown in signal **DRIVE STATE (8.08)**.

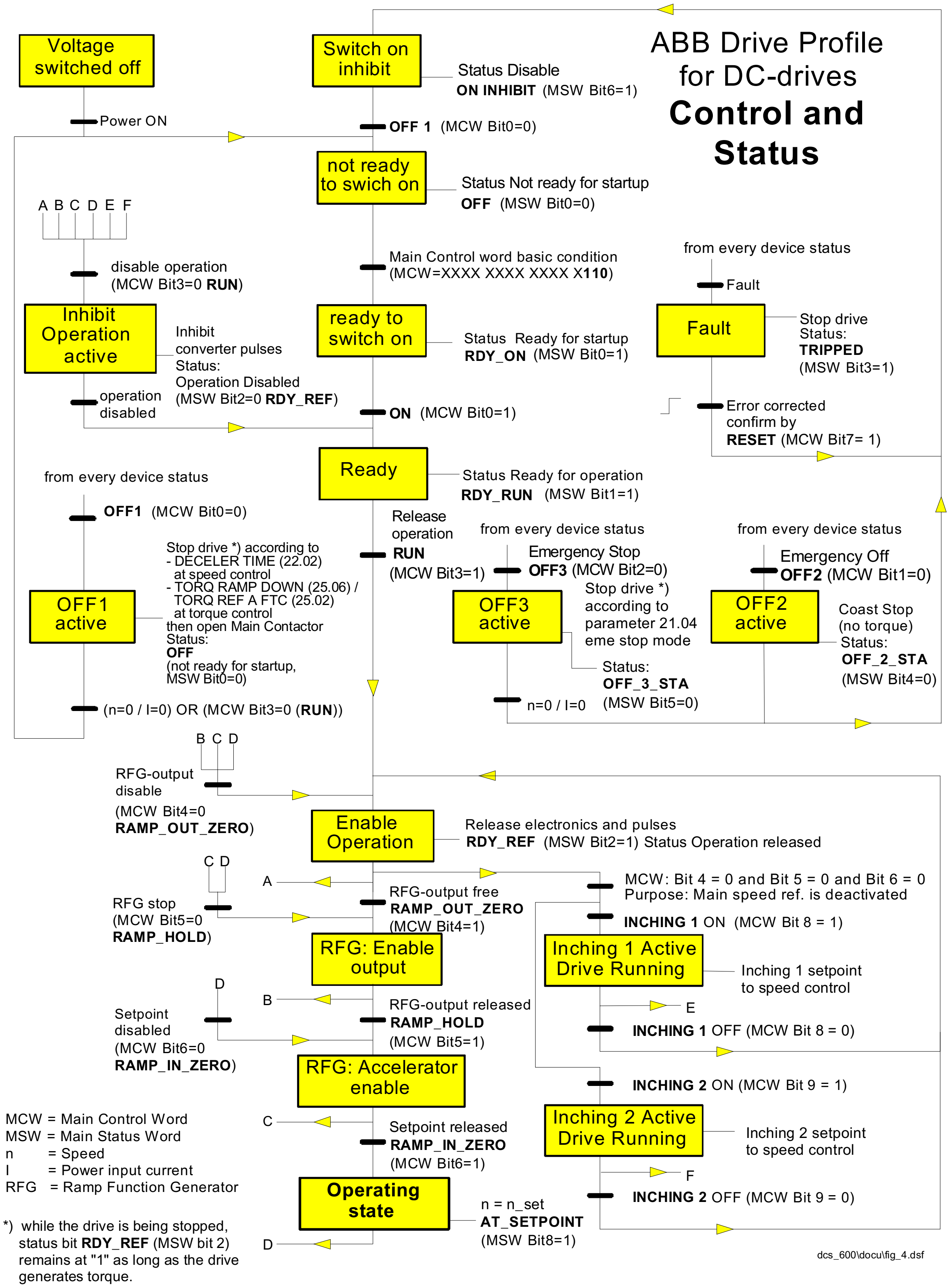


Figure 2-1 Control and State diagram

Drive is tripping

If the drive trips, the fan, the field and the main contactor are opened in defined order depending on the type of the fault. E.g. if the drive is tripped by converter overtemperature, the main contactor and the field contactor are opened while the fan contactor is kept closed until the bridge temperature drops below the overtemperature level of the bridge. Finally all contactors are opened. After this sequence the drive accepts the reset-command.

Faults that trip first the main contactor

OVERCURRENT	**-02-**
MAINS UNDERVOLTAGE	**-29-**
NOT IN SYNCHRONISM	**-31-**
ARM CURRENT RIPPLE	**-34-**
PHASE SEQUENCE FAULT	**-38-**
SPEED MEAS FAULT	**-14-**
NO MAIN CONT ACK	**-41-**
MOTOR STALLED	**-23-**
MOTOR OVERSPEED	**-37-**

Faults that trip first the main contactor and the field contactor

CURRENT RISE	**-08-**
MOTOR 1 OVERTEMP	**-06-**
MOTOR 1 OVERLOAD	**-07-**
MOTOR 2 OVERTEMP	**-48-**
MOTOR 2 OVERLOAD	**-27-**
CONVERTER OVERTEMP	**-04-**
NO CONV FAN ACK	**-50-**

Faults that trip the main, the field and the fan contactors

AUXIL UNDERVOLTAGE	**-01-**
CONV FAN CURRENT FAULT	**-03-**
ARMATURE OVERVOLTAGE	**-28-**
EARTH FAULT	**-05-**
I/O BOARD NOT FOUND	**-44-**
MAINS OVERVOLTAGE	**-30-**
FIELD EX 1 OVERCURR	**-32-**
FIELD EX 1 COMERROR	**-33-**
FIELD EX 2 OVERCURR	**-35-**
FIELD EX 2 COMERROR	**-36-**
NO FIELD ACK	**-39-**
NO EXT FAN ACK	**-40-**
TYPE CODING FAULT	**-17-**
FIELD EX 1 NOT OK	**-42-**
FIELD EX 2 NOT OK	**-43-**
REVERSAL FAULT	**-65-**
CURRENT DIFFERENCE 12 PULSE	**-66-**
12 PULSE COMMUNICATION FAULT	**-67-**
SLAVE CONVERTER FAULTED	**-68-**

The aforementioned converter specific faults are monitored by the converter control (inside SDCS-CON-2). Additional fault conditions are supervised by the drive control (inside AMC-DC).

DDCS CH0 TIMEOUT
SYSTEM FAULT
CON COMMUNICATION FAULT
M/F LINK FAULT
PANEL LOSS FAULT
EXT FAULT
SW MISMATCH (AMC <--> CON)

Fault resetting

The drive is reset by the "RESET"-bit in MAIN_CONTROL_WORD or by pressing the RESET button at the local control place, or by a digital input in local I/O mode. In addition, faults can be reset via the 12-pulse link, or by the ON command sent over the FEX-link, if this links are selected as control source. The drive notices the rising edge of the signal. To be able to restart the drive after tripping, a rising edge must be applied to the "ON" signal. The technique prevents the "RESET" signal to command contactors "ON" by itself.

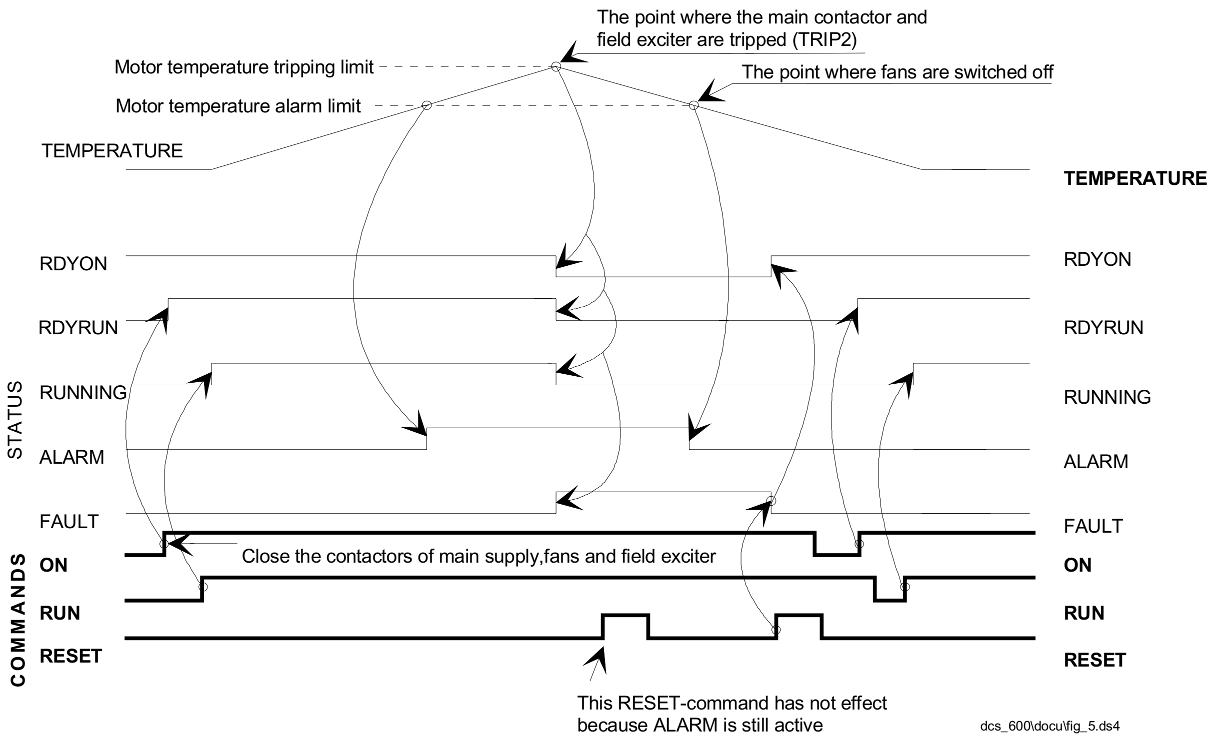


Figure 2-2 Example of the behaviour of the program in a case of over temperature fault.

Emergency stop

Emergency stop can be activated by

- the digital input **DIx** (selection of DI via 12.16, default DI5)
- **MAIN CONTROL WORD 7.01** bit 2 from overriding control system, if LOCAL mode is NOT active.

Note: The digital input selected for emergency stop is always active for emergency stop (if emergency stop function is selected), with settings MAINCON WORD (0) and LOCAL I/O (1) of **COMMAND SEL (15.22)**. **It is active low, if the parameter DIG IN x INVERT (12.10 ... 12.12, 13.11 ... 13.15) of the selected digital input is set to INVERTED.**

The function of the DCS600 MultiDrive when emergency stop is activated, can be defined by the parameter **EME STOP MODE (21.04).** Default mode is **stop with ramp**.

EME STOP MODE (21.04)

0 = dynamic brake
1 = stop with ramp (default)
2 = stop by the torque limit
3 = coast stop (torque is zero)
4 = not selected

The time within the drive will decelerate from maximum speed (50.01) to zero during emergency stop is set by the parameter

EMESTOP RAMP (22.04).

The bit 5 of the main status word **(8.01)** indicates the status of the emergency stop (0: emergency stop active).

During emergency stop the ramp smoothening function, if activated, is by-passed.

In torque controlled mode, the torque reference is disabled immediately (without torque reference ramp or torque reference filter) in case of emergency stop, even if the stop mode "ramp" or "torque limit" is selected. Dynamic braking, however, is available anyway.

The deceleration of the drive is supervised during an emergency stop condition. This supervision starts the time programmed to parameter **DECEL MON DELAY (21.07)** after the drive has received an emergency stop signal. If the drive isn't able to decelerate within the window defined by the parameters

EMSTOP DER MIN L (21.05) minimum value of absolute of deceleration
and
EMSTOP DER MAX L (21.06) maximum value of absolute of deceleration,

it is stopped by coasting. Bit 2 (EMERG_STOP_COAST) of the **AUX STATUS WORD (8.02)** is set.
The emergency stop supervision should be used only in case of emergency stop mode "ramp" in speed controlled mode.
Using the default values disables the monitoring of deceleration. The deceleration actual value can be monitored from the signal **DV/DT (2.16)**.

MEASUREMENTS

Speed measurement

The speed of the motor can be measured by three different methods; incremental encoder (pulse tachometer), analogue tachometer or calculated/measured EMF-voltage. Speed reference ±20000 corresponds to the maximum speed of the motor, the sign indicates the direction of the speed. The forward direction sign is (+) , and the reversal direction sign is (-).

The speed measurement source is selected by the parameter

SPEED FB SEL (50.03)

1:	**CALC BY EMF**	speed act calculated by EMF (8.02 bit 12=1)
2:	**CON-ENCODER**	incremental encoder interface of SDCS-CON-2
3:	**EXTERNAL**	speed feedback isn't updated, but initialized to 0 on the transition to EXTERNAL
4:	**ANALOG TAC**	analogue tacho connected to AI channel AITAC
5:	**CALC BY EMF**	speed act calculated by EMF (8.02 bit 12 = 1)

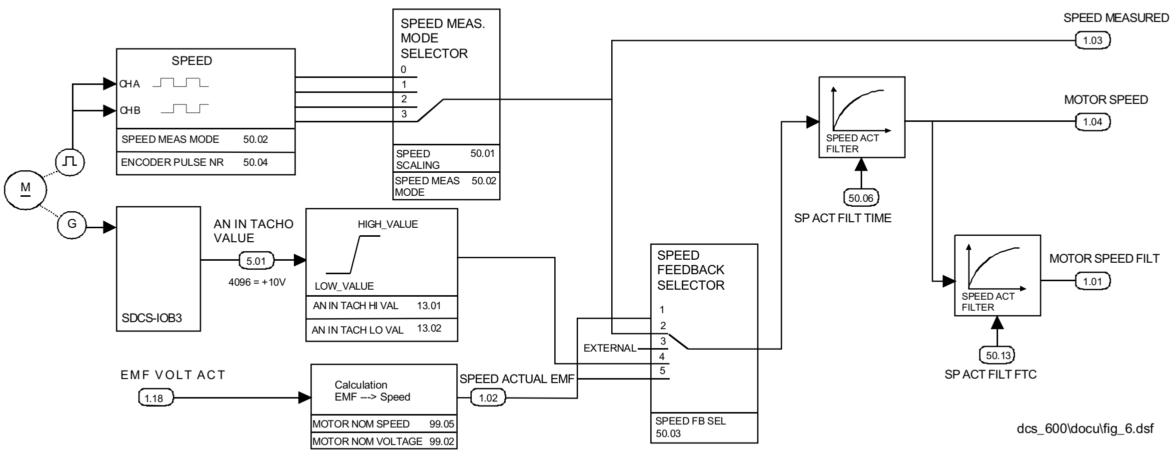


Figure 3-1 The actual speed measurement.

Scaling of the speed measurement

The internal scaling for the speed as integer units is 20000.
The according maximum speed of the drive is set by the parameter
SPEED SCALING (50.01) with the resolution of 0.1 rpm.

Note1: If the speed scaling parameter **(50.01)** is set by means of dataset communication, it is limited to 3275 rpm due to the numeric limit of signed 16-bit values. However, values up to 6550 rpm can be written to the same internal parameter via dataset communication by means of the (unsigned) packed boolean parameter **(50.11).**

Note2: **The speed scaling must be set in the range of 62.5%…500% of the motor nominal speed (99.05). If the scaling is out of this range, an alarm (SPEED SCALE) is generated.**

Pulse encoder

The incremental encoder connected to the CON-2 board can be used as one or two channel encoder. The range of tacho pulses per revolution is 125 - 6000. Selection of the speed measurement mode depends on the type of the pulse encoder:

SPEED MEAS MODE (50.02)

0:	**A _- B DIR**	rising edge of track A, track B direction
1:	**A _-_**	both edges of track A
2:	**A_-_ B DIR**	both edges of track A, track B direction
3:	**A _-_ B _-_**	both edges of both tracks

Number of pulses per revolution for the used pulse encoder is set by the parameter

ENCODER PULSE NR (50. 04) = 2048 (def.)

The speed measured with the pulse encoder is available at signal **SPEED MEASURED (1.03)**, independent from the selected speed feedback source.

Analogue tachometer

The signal of the analogue tachometer is recommended to scale so that the input value of the AITAC-channel at the maximum speed of the motor is below ±8 V. This provides safety margins for possible instantaneous overspeed due to the AITAC-channel's ±10 V conversion area.

The analogue tachometer is selected by setting

SPEED FB SEL (50.03) = 4

The scaling of the analogue channel for the speed is done by two parameters. The set values are the ***speed values in integer format*** at measured input voltage of +/- 10V. These are independent from the speed scaling parameter (see Note2) to allow the usage of the analogue tacho input for other purposes.

Note1: The input voltage is the voltage at the SDCS-CON-2 board's input. If there are any external voltage adaptions/adjustments, they must be taken into account when calculating the anaologue tachometer's output voltage.

Note2: There is no automatic link between the speed scaling parameter (50.01) and the analogue tachometer scaling parameters. On calculating the scaling parameters of the analogue tachometer input, it is mandatory to take into account the speed scaling parameter as well as the analogue tachometer's speed at 10V (referenced below as speed_10V).

AN IN TACH HI VAL (13.01)	Integer value of speed corresponding to input +10 V **Must be set to:** (20000 • speed_10V/[50.01]) Default 30000
AN IN TACH LO VAL (13.02)	Integer value of speed corresponding to input -10 V **Must be set to:** (-20000 • speed_10V/[50.01]) Default -30000

The polarity of the analogue channel can be checked by turning the motor slowly and at the same time checking the signal **AITACVALUE (5.01)**. Values ±4095 equal to input ±10 V.

EMF-based speed measurement

The motor speed can be controlled without any external measurement by using the EMF-measurement for the speed calculation. **This can be done when the motor is driven at a constant field area.**

The **SPEED ACTUAL EMF (1.02)** is calculated as follow:

SPEED ACTUAL EMF =
EMF VOLT ACT * MOTOR NOM SPEED / MOTOR NOM VOLTAGE

The scaling of the EMF-speed can be done by adjusting the parameter **MOTOR NOM VOLTAGE (99.02).** Normally the value should be 10...15% less than the rating plate value of the motor (DC) voltage. That is because the rating plate value includes also losses coming from the IR drop.

Speed actual measurement points

Three measurement points are available for monitoring the speed actual.

MOTOR SPEED (1.04)	Used for speed control. Can be filtered by setting time constant to the parameter **SP ACT FILT TIME (50.06)**, integer scale: 1==1ms.
MOTOR SPEED FILT (1.01)	Used for displays like DriveWindow Can be filtered by means of the parameter **SPEED ACT FILT FTC (50.13)**, integer scale: 1==1ms.

Armature current measurement

DC-armature current is measured on the AC-side using the current transformer. The measured AC -current is rectified and scaled to the burden signal so that 1.5V in SCDS-CON-2 board equals ***always*** the nominal current (signal 4.5) of the converter.

The measured current is scaled in two ways. The overcurrent protection needs the current measurement which is scaled so that the ***converter*** nominal current equals 4096.
The ***control of the motor current*** is scaled so that 4096 equals the nominal current of the motor.

Converter current

Converter current is relative to the nominal current of the converter.
The converter current is used for overcurrent protection.

RL CONV CUR ACT (1.15)	Converter armature current. 4096 equals to nominal converter current.
CONV CUR ACT (1.16)	Converter current in amps. 1 = 1A

Armature current

Armature current is relative to the nominal current of motor.
The measurement is divided into two signals where the sign of the signals is handled differently in order to facilitate diagnosing.

LOAD CUR ACT (1.27)	Measurement for the current controller **4096 = MOTOR NOM CURRENT (99.03)** The sign of this signal indicates **+ = forward bridge in use** **- = reversal bridge in use**
MOTOR CURRENT (1.06)	Measurement for diagnosing **4096 = MOTOR NOM CURRENT (99.03)** The sign of this signal indicates **+ = motor mode** **- = generator mode**

Torque

The calculation of actual torque is based on flux and armature **(=motor)** current. With nominal armature current and nominal flux the actual torque is nominal.

MOTOR TORQUE (1.08)	The torque of the motor in units integer scaling: 10000=Tn(motor)

Generally $T = I_A * \Phi$, where
T = torque
I_A = armature current
Φ = flux

Mains AC voltage

Measured mains voltage is used for the armature current control and the mains under/over voltage supervision. If the mains voltage changes, current control will adjust the firing angle so that armature voltage stays in the desired level .

RL MAINS VOLT ACT (1.11)	integer scaling: 4096	= **NOM SUPPLY VOLT (42.06)**
MAINS VOLT ACT (1.12)	integer scaling: 1	= 1V

Armature DC voltage

This value is used for the calculation of the actual EMF value.

RL ARM VOLT ACT (1.13)	integer scaling: 4096	= 1.35***NOM SUPPLY VOLT (42.06)**
ARM VOLT ACT (1.14)	integer scaling: 1	= 1V (in 12-pulse serial mode: 1 = 2V)

The aforementioned scaling requires the same interface circuits for both the mains voltage measurement and the armature voltage measurements. In case this is not possible (e.g. in some 12-pulse applications), the armature voltage can be adjusted by means of the parameter:

ADJ UDC (47.10) 12.5% ... 800%

In addition, the offset of the measured value may be tuned by means of the parameter:

OFFSET UDC (47.11) -80 ...81 (raw data format of A/D converion)

With value 81, the automatic offset calibration is active.This calibration is executed while the main contactor is open.

Actual EMF

The relative value of EMF is used for EMF-control and for the EMF-based speed measurement. The EMF is calculated by taking into account both the inductive and resistive voltage drops:

$$\mathrm{EMF} = \mathrm{U_{dc}} - (\mathrm{I_A} * \mathrm{R_A} + \mathrm{dI_A} / \mathrm{dt} * \mathrm{L_A})$$

RL EMF VOLT ACT (1.17)	integer scaling: 3786	= 1.35***NOM SUPPLY VOLT (42.06)**
EMF VOLT ACT (1.18)	integer scaling: 1	= 1V (in 12-pulse serial mode: 1 = 2V)

Normally the Auto-tuning function calculate the resistance and inductance values of the motor. Those values can also be defined manually using next formulas:

The relative resistance of armature (load) circuit **ARM R (41.12)**:

$$ARM\_R = 22444 * RA[\Omega] * \frac{CONV\_NOM\_CURR(4.13)}{NOM\_SUPPLY\_VOLT(42.06)}$$

where RA[Ω]=armature (load) resistance

The relative inductance of armature (load) circuit **ARM L (41.11)**:

$$ARM\_L = \frac{LA[mH] * CONV\_NOM\_CURR(4.13) * 245}{NOM\_SUPPLY\_VOLT(42.06) * scantime}$$

where LA[mH]	= armature (load) inductance in mH
scan time	= 3,33 ms (50 Hz mains) or 2,77 ms (60 Hz)

If the autotuning does not work refer to:
Manual for 12-Pulse operation, doc. no. 3ADW000 115

Field current

Two field exciters are possible to connect to one converter unit. (2) DCF503/504 or (1) SDCS-FEX-2 plus (1) DCF503/504.
From both field exciters there are two measurements available, relative and absolute current values.

Motor 1 field current

REL FIELD CUR M1 (3.19)	Motor 1 actual relative field current integer scaling: 4096 = current set in **MOT 1 NOM FLD CUR (41.03)** **(in case of DCF600 used as field exciter: see description of parameter 41.03)**
FIELD CUR M1 (3.20)	Motor 1 actual absolute field current in amps. integer scaling: 1 = 0.02 A **(in case of DCF600 used as field exciter: see description of parameter 41.03)**

Motor 2 field current

REL FIELD CUR M2 (3.21)	Motor 2 actual relative field current integer scaling: 4096 = current set in **MOT 2 NOM FLD CUR (41.17)** **(in case of DCF600 used as field exciter: see description of parameter 41.17)**
FIELD CUR M2 (3.22)	Motor 2 actual absolute field current in amps. integer scaling: 1 = 0.02 A **(in case of DCF600 used as field exciter: see description of parameter 41.17)**

Customer supplied field exciter

If a customer supplied field exciter is being used, the field current feedback is connected to an analogue or digital input. Analogue input is used if required to measure or control the field current, digital input if only field acknowledge is needed. The analogue channel must be scaled so, that the input value corresponds to field current scaling.

Cooling unit temperature

Actual temperature of the heat sink can be monitored from the signal

HEAT SINK TEMP (1.24), where 1 is equal to 1°C (integer scaling).

SPEED REFERENCE CHAIN

The integer scaling of speed values (ref./act.) is:
20000 = maximum speed of the drive

The speed reference chain consist of next items:

- Speed reference selection
- Speed reference limitation
- Speed ramp
- Additional speed reference
- Ramp smoothen function
- Acceleration compensation

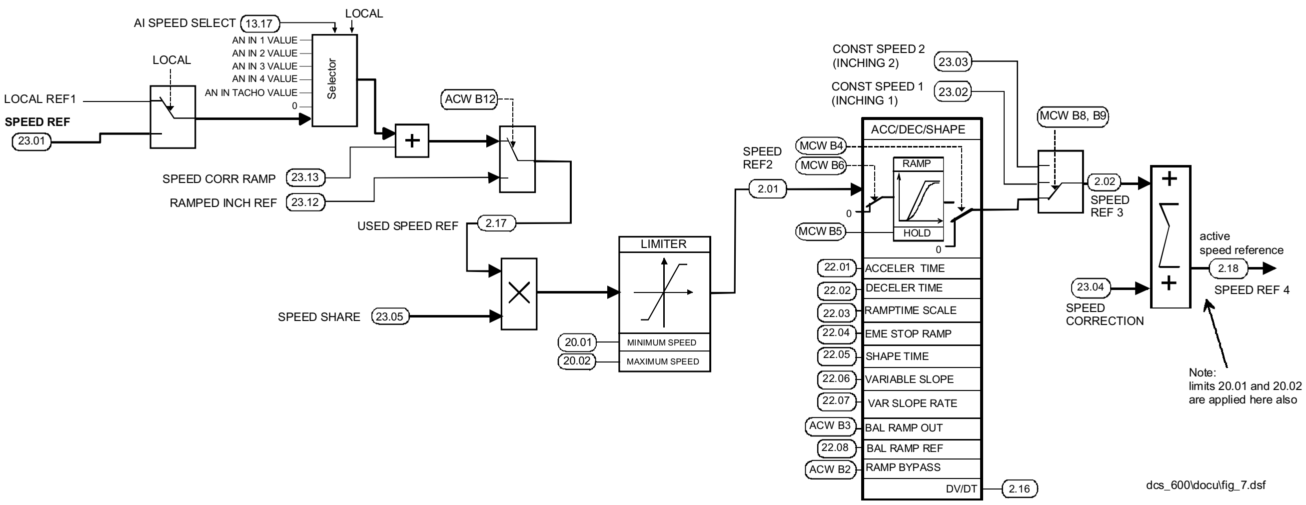


Figure 4-1 The speed reference chain.

Speed Reference Selection

The main speed reference of the DCS600 MultiDrive is either the signal **SPEED REF (23.01)** or the speed reference from the local control place, depending on whether the drive is in local mode or not. This speed reference is weighted by the factor:

SPEED SHARE (23.05)	Integer scaling: 1 = 0.1 %

Either this weighted speed reference value, or one of the analogue input values, or zero may be selected for the further processing of the speed reference:

AI SPEED SELECT (13.17)

0:	**NO SPEED REF**	speed reference is 0
1:	**AN IN 1 VAL**	analogue input 1 value
2:	**AN IN 2 VAL**	analogue input 2 value
3:	**AN IN 3 VAL**	analogue input 3 value
4:	**AN IN 4 VAL**	analogue input 4 value
5:	**AN TACH VAL**	analogue tacho value
6:	**SPEED REF**	(23.01) • (23.05)

A correction value **SPEED CORR RAMP (23.13)** is added to the selected speed referenece value. Another selection controlled by **bit 12 (JOG_SPEED)** of the **AUX CONTROL WORD (7.02)** switches between this sum and a **RAMPED INCH REF (23.12).**

Note: In local mode always the local reference weighted by the speed share factor is active, regardless of AI SPEED SELECT, SPEED CORR RAMP and RAMPED INCH REF.

Speed Reference Limitation

The selected reference value **USED SPEED REF (2.17)** is limited against the limits:

MINIMUM SPEED (20.01)	Negative speed reference limit
MAXIMUM SPEED (20.02)	Positive speed reference limit

The limited speed reference is the signal **SPEED REF 2 (2.01).**

Note! The speed limits are also applied to the input of the speed controller **(SPEED REF 4, 2.18)** in order to avoid exceeding the speed limits due to the **SPEED CORRECTION (23.04)** and the **SPEED STEP (23.10).** This may cause unramped speed reference steps in case the speed limits are changed while the drive is being operated **at speed limit.**

Speed Ramp

The speed reference value **SPEED REF 2 (2.01)** is passed through the speed ramp function. The output signal of the speed ramp is **SPEED REF 3 (2.02).**
The ramp times are related to the maximum speed, which is the greater value of the absolutes of the parameters 20.01 and 20.02.

The derivation of the speed reference at the output of the speed ramp is the signal **DV/DT (2.16)**.

Acceleration and deceleration times can be set by parameters:

ACCELER TIME (22.01)	The time the drive will accelerate within from zero speed to maximum speed Integer scaling: 1 = 0.01 sec
DECELER TIME (22.02)	The time the drive will decelerate within from maximum speed to zero Integer scaling: 1 = 0.01 sec

The ramp times can be scaled additionally by the parameter

RAMPTIME SCALE (22.03)	Tuning factor for ramp times (not emergency stop ramp) Integer scaling: 1 = 0.01

In case of the emergency stop, a different ramp down time can be chosen by the parameter

EME STOP RAMP (22.04)	The time in which the drive will decelerate from maximum speed to zero. Integer scaling: 1 = 0.1 sec.

An emergency stop supervision can be activated by means of the parameters

EME STOP DER MIN L (21.05)	Minimum deceleration; with default value 18000rpm/ms, the supervision is inactive
EME STOP DER MAX L (21.06)	Maximum deceleration; with default value 18000rpm/ms, the supervision is inactive
DECEL MON DELAY (21.07)	Delay of emergency stop supervision; the supervised deceleration value is filtered by a 2^{nd} order delay of (21.07)/10

The speed ramp follows the speed actual value in case of disabled drive in order to allow flying start. The speed ramp is also updated to the speed actual value in case of torque controlled operation.

Ramp output smooth function

The time constant of the speed ramp output filter (shape filter) is set by the parameter

SHAPE TIME (22.05)	Integer scaling: 1 = 0.01 sec

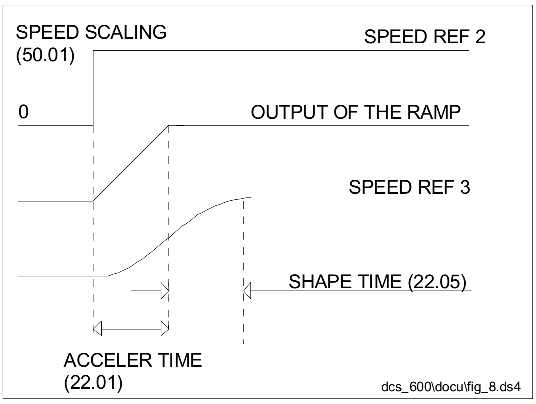


Figure 4-2 Effect of speed ramp and filters.

Variable slope

An overriding control system can set the slope of the ACS600 MultiDrive ramp. Speed reference changes are realized by means of interpolation within the programmed time.
The base idea is that the overriding control system performs the system main ramp. If the variable slope rate is programmed to the communication cycle time, the speed ramps follows the speed reference by interpolating within the communication cycle.

When stop-command or Emergency stop is given, the DCS600 MultiDrive uses always the defined ramp slope times.

The variable slope function is selected if the parameter **VARIABLE SLOPE (22.06)** is set to “ON“.

The speed ramp’s interpolation time is programmed with the parameter

VAR SLOPE RATE (22.07)	Speed interpolation time Integer scaling: 1 = 1 ms

Another selection, controlled by **bits 8 and 9** of the **AUX CONTROL WORD (7.02)** switches between this value and **CONST SPEED 1 (23.02)** or **CONST SPEED 2 (23.03).** To the selected value **SPEED REF 3 (2.02)** a **SPEED CORRECTION (23.04)** value is added. The result is **SPEED REF 4 (2.18)**, which is also limited against the speed limits **(20.01, 20.02).**

Acceleration compensation

An additional torque for the acceleration compensation (compensates known losses) can be calculated by the DCS600 MultiDrive when the inertia of the drive is known and the inertia is constant. Such systems like uncoilers where the inertia changes must be calculated by the overriding control system.
The compensation is calculated when the ramp function is released. When the ramp function is by-passed (e.g. stop by torque limit), the acceleration compensation output is clamped to zero. The compensation value is calculated from the derivation of **SPEED REF 3 (2.02)**.

The time in which the drive will accelerate from zero speed to maximum speed using nominal torque must be calculated and then set to the parameter

ACC COMP DER TIME (24.14)
The time in which the drive will accelerate from zero speed to maximum speed **(50.01)** using motor nominal torque (T_N)

The output of acceleration compensation function can be seen in signal

TORQ ACC COMP REF (2.07)
Integer scaling: 10000 = motor nominal torque (T_N)

SPEED CONTROL

Controlling of the motor speed is based on PID-type controller. In addition to PID there are also certain functions in order to facilitate the adjustment of the PID-controller to the demands of the various processes. The main functions to control the motor speed are:

- Speed error filter
- Speed error scaling
- Speed error window (in case of Master/Follower sections)
- Step response signals
- PID -controller
- Speed direction
- Drooping
- Adaptive load dependent P-gain
- PID output limitation

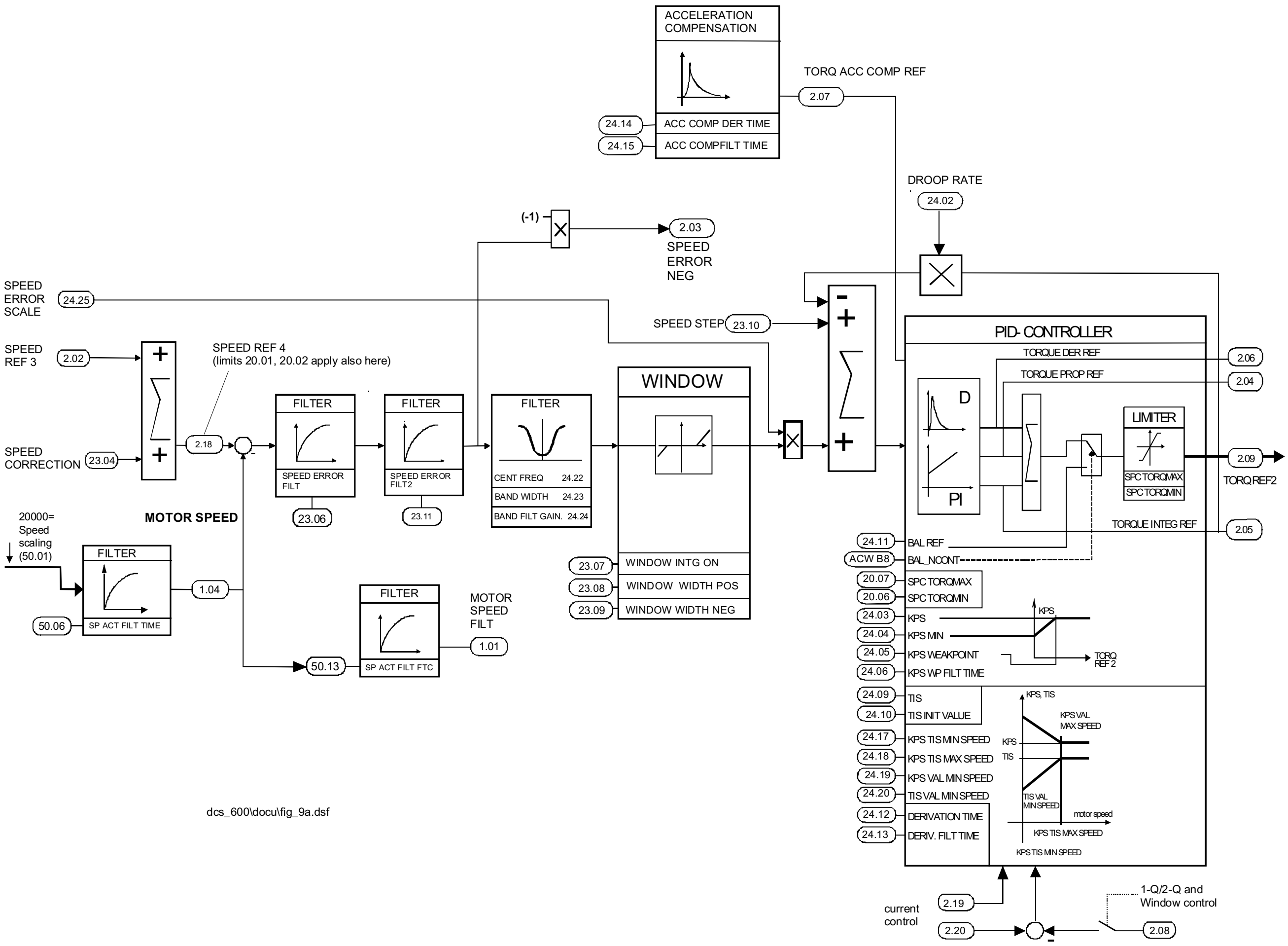


Figure 5-1 Speed error filters and window control

Speed error filters

Lowpass Filters

The speed reference **SPEED REF 4 (2.18)** is calculated as sum of the speed ramp's output value **SPEED REF 3 (2.02)** and an additional correction value **SPEED CORRECTION (23.04)**. After limiting against the speed reference limits **20.01** and **20.02**, the speed actual value **MOTOR SPEED (1.04)** is subtracted from the result**.**

The error value can be filtered by some filters:

1st low pass filter:	**SPEED ERROR FILT (23.06)**	Filter time constant Integer scaling: 1 = 0.001 sec
2nd low pass filter:	**SPEED ERROR FILT2 (23.11)**	Filter time constant Integer scaling: 1 = 0.001 sec

Band Rejection Filter (Notch Filter)

A resonant frequency of the drive and it's mechanical environment can be suppressed by means of a band rejection filter. The filter acts on the speed error. It is inactive, if all 3 parameters are set to 0.

CENT FREQ (24.22)	Center frequency Integer scaling: 1 = 0.01 Hz This parameter is to be set to the resonant frequency measured e.g. by means of an oscilloscope or DriveWindow.
BAND WIDTH (24.23)	Band width Integer scaling: 1 = 0.01 Hz This parameter sets the 3 db bandwidth of the band rejection filter. A usual value is the same value as programmed to the center frequency (24.22).
BAND FILT GAIN (24.24)	Gain of band rejection filter Integer scaling: 1 = 0.001 Usual value: 0.1

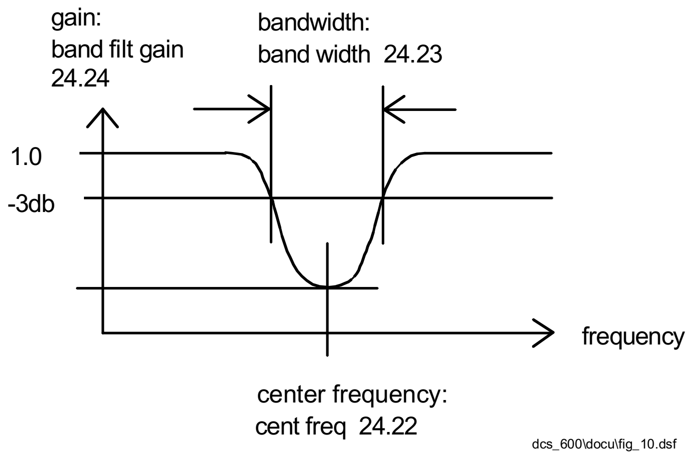


Figure 5-2 Frequency response of the band rejection filter

Speed error scaling

The speed error output of the band rejection filter can be scaled with the signal:

SPEED ERROR SCALE (24.25) Integer scaling: 1 = 0.1%

The range of this signal is internally limited to 1% ... 400%, the default value after power-up is 100%. The value of the signal is **not** stored to the FLASH memory.

PID-controller

For tuning of the PID four parameters are needed:

KPS (24.03)
The proportional gain of the speed controller
Integer saling: 100 = 1

TIS (24.09)
The integrator time constant (integral active time)
The integral active time defines the time required for the controller's integral part to integrate to the same torque reference as generated by the proportional part (KPS). Setting TIS to 32767ms disables the integral part of the controller; the integrator's accumulator is cleared.
Integer scaling: 1 = 1ms

DERIVATION TIME (24.12)
The time constant for derivation (Td)
Integer scaling: 1000 = 1s

DERIVATION FILT TIME (24.13)
The filter time constant for derivation.
Integer scaling: 1000 = 1s

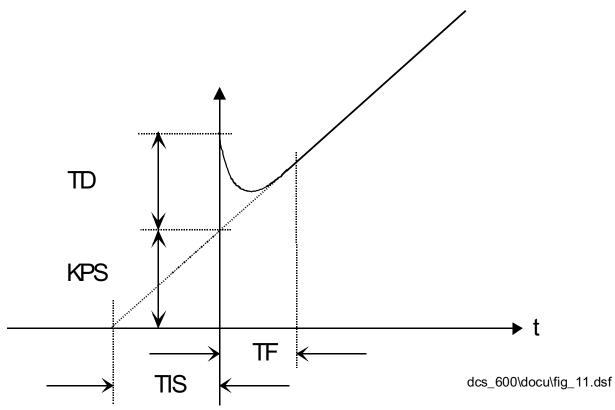
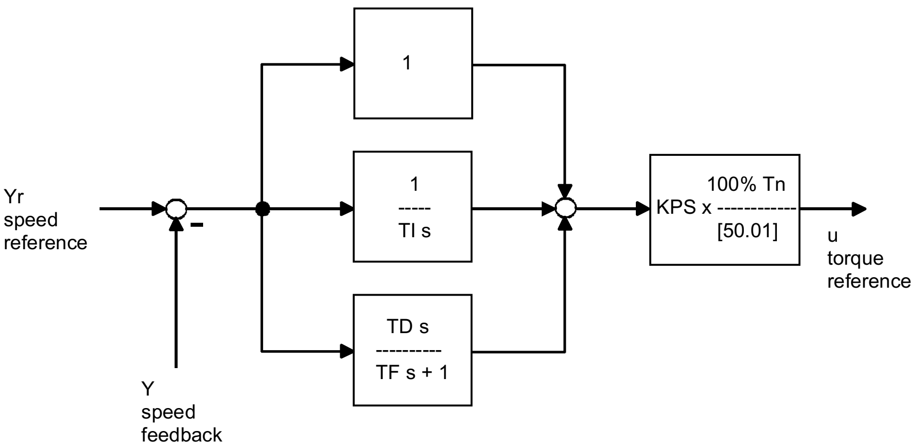


Figure 5-3 The step response of the PID-controller

Speed Control Algorithm

The speed control algorithm is implemented according to the following drawing:



TI:	Integration time (24.09)
TD:	Derivation time (24.12)
TF:	Derivation filter time (24.13)
KP:	Proportional gain (24.03)
Tn:	Nominal motor torque
[50.01]:	Speed scaling

$$\mathbf{u(s) = KPS\ [(Yr(s)-Y(s))\ \left(1 + \frac{1}{s\ TI} + \frac{s\ TD}{s\ TF + 1}\right)]\ \ 100\%Tn/[50.01]}$$

dcs_600\docu\fig_49.dsf

Figure 5-4 Speed control algorithm

Load-Adaptive P-Gain

The P-gain of the controller can be reduced automatically on low load. This is sometimes necessary in case of mechanical backlash of the load.

The proportional gain when the controller output is zero is defined by the parameter:

KPS MIN Integer scaling: 100 = 1
(24.04)

The amount of the load where P-gain is the same as KPS is set by the parameter:

KPS WEAKPOINT Integer scaling: 100 = 1%
(24.05) in % Tn

When the load is between zero and KPS WEAKPOINT, the used P-gain is interpolated .
The P-gain mustn't be changed too fast. For that reason the used P-gain is filtered. The time constant for this filter can be set by the parameter:

KPS WP FILT TIME Integer scaling: 1 = 0.001 sec
(24.06) in ms

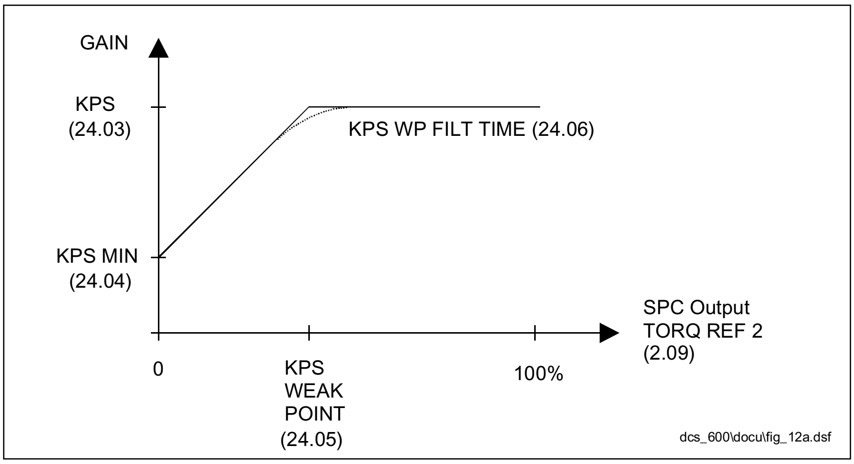


Figure 5-5 P-gain reduction as a function of torque reference

Speed-Adaptive Control Parameters

In certain applications it is useful to increase the relative gain and decrease the integration time at low speeds. This improves the performance of the speed control at low speeds. The linear increase and decrease of these parameters starts at speed KPS TIS MIN SPEED and ends at speed KPS TIS MAX SPEED. Changing the rate of relative gain and integration time is done by parameters KPS VAL MIN SPEED and TIS VAL MIN SPEED.

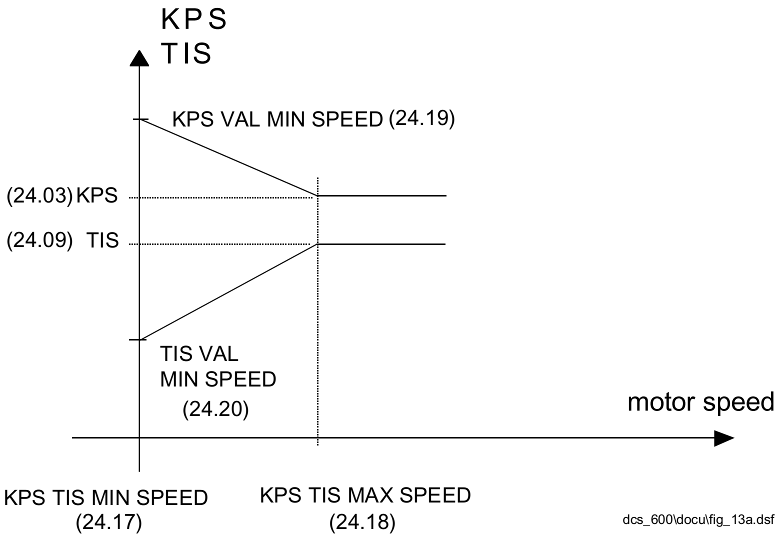


Figure 5-6 Speed adaptive control parameters

24.17		**KPS TIS MIN SPEED**
	Description:	The minimum motor speed limit above which the relative gain and integral time is defined by parameters KPS VAL MIN SPEED and TIS VAL MIN SPEED.
24.18		**KPS TIS MAX SPEED**
	Description:	The speed point KPS and TIS become constant at.
24.19		**KPS VAL MIN SPEED**
	Description:	Relative gain percentage of the KPS value at the speed defined by the parameter KPS TIS MIN SPEED.
24.20		**TIS VAL MIN SPEED**
	Description:	Relative integral time percentage of the TIS at the speed defined by the parameter KPS TIS MIN SPEED.

Speed Controller Output

The speed controller's output value (limited) is the signal

TORQ REF 2 (2.09)	Integer scaling: 10000 = nominal torque

It is the sum of the PID-controller terms and the acceleration compensation term.

Speed Controller Limits

The speed controller's output value is limited against the torque limits

SPC TORQMAX (20.07)	Maximum controller output value Integer scaling: 10000 = nominal torque
SPC TORQMIN (20.08)	Minimum controller output value Integer scaling: 10000 = nominal torque

In addition, also the torque limits due to the current control restrictions (current limits, field weakening, quadrant type) apply (signals **TC TORQMAX (2.19)** and **TC TORQMIN (2.20)**).

Force Speed Controller Output

The overriding control system can set the speed controller's output, if needed. The set-value is given by the signal

BAL REF (24.11)	Integer scaling: 10000 = motor nominal torque

The force-command is given by setting bit 8 **(BAL_NCONT)** in the signal **AUX CONTROL WORD (7.02).**

The speed controller's integrator as well as the output are set to the BAL REF value. When releasing the controller again, the integrator is initialised to:

TORQ REF 2 - (TORQUE PROP REF + TORQUE DER REF + TORQ ACC COMP REF)

This ensures a bumpless transition to normal operation.

Drooping

The drooping function is used when there is a need to adapt the speed proportionally to the load.

The amount of speed decrease caused by the load is determined by parameter

DROOP RATE (24.02)	Integer scaling: 10 = 1% The nominal torque reference will decrease the speed by the programmed percentage (e.g. 2% means 2% of n_{max} ≙ 400 speed units).

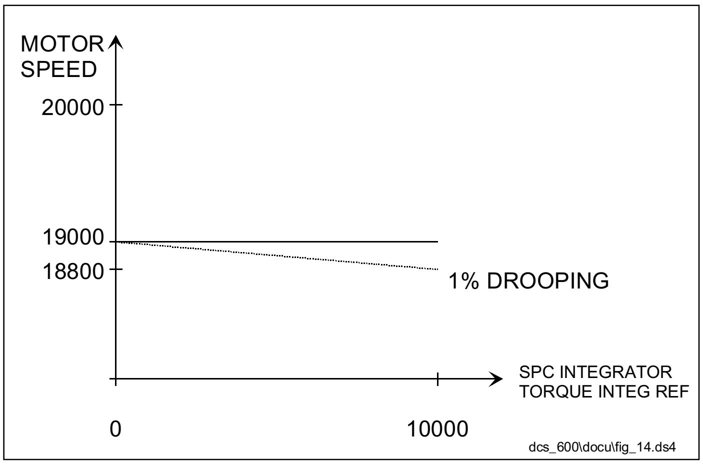


Figure 5-7 Drooping as a function of torque reference.

Drive direction

The drive's direction can be reversed by setting bit 8 of the **AUX CONTROL WORD 2 (7.03)** to 1. The reversing is realized by inverting the selected speed actual value **(MOTOR SPEED 1.04)** as well as the torque reference **(TORQUE USED REF 2.13).** The reversing is active in speed control as well as in torque control. Due to the inverting of the speed actual value, the reversing can't be seen in the speed actual value.
Changes of the commanded drive direction get active only in the state RDY_RUN; reversal of a running drive by means of this control bit is not possible.

Window control

The window control is used when master/follower connections are needed for e.g. deflector rolls. It is selected by setting **bit 7 (WINDOW_CTRL)** in the signal

AUX CONTROL WORD (7.02)

The purpose of the window control is to keep the speed of the slave section inside a defined (speed) window.

When window control is activated the speed controller is forced to zero as long as the speed deviation remains within defined limits.

In window control mode the speed controller output and the external torque reference are added together. The adding is done when the parameter

TORQUE SELECTOR (26.01) = ADD (6)

The window size is determined by the parameters

WINDOW WIDTH POS (23.08)	Positive window limit Integer scaling: speed / 20000 = maximum speed (see 50.01)
WINDOW WIDTH NEG (23.09)	Negative window limit Integer scaling: speed / 20000 = maximum speed (see 50.01)

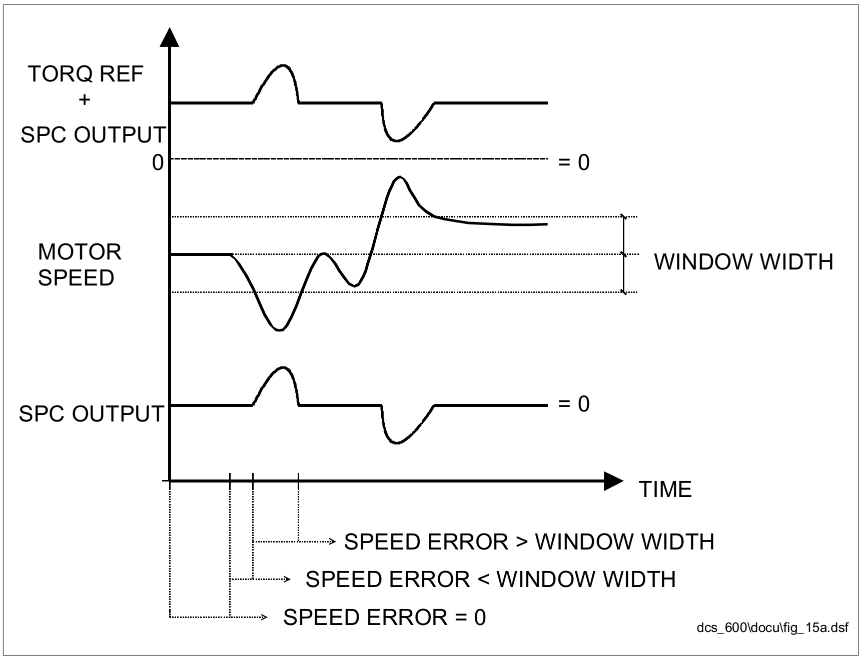


Figure 5-8 Effect of a load step on a torque controlled drive in window control

The overriding control system can supervise the performance of the window control by reading bit 1 **(OUT_OF_WINDOW)** in the

AUX STATUS WORD (8.02)

1: Speed actual value is outside of the defined window **(23.08 / 23.9).**
Always cleared with TORQUE SELECTOR mode ZERO or TORQUE

TORQUE REFERENCE

DCS600 MultiDrive has two inputs for the external torque reference. The handling features of the external torque references are

- Torque scaling (load sharing)
- reference filtering
- ramp for the torque reference
- torque reference limitation

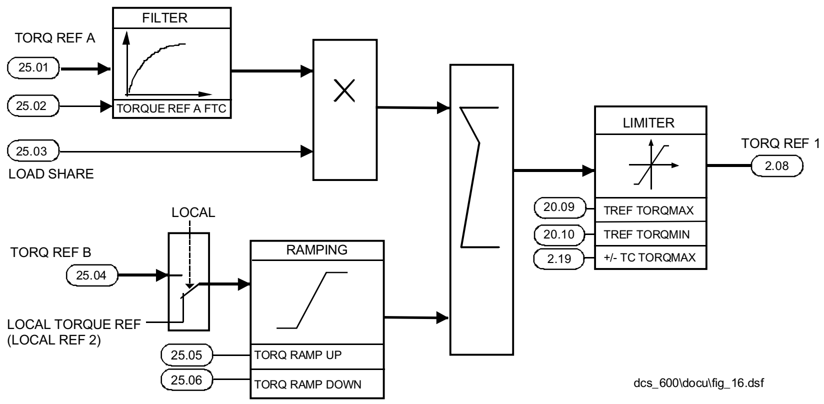


Figure 6-1 Torque reference modification

External torque reference A

The channel A can be filtered and scaled. The reference is written to the signal

TORQUE REF A (25.01)	Integer scaling: 10000 = nominal torque of the motor

The time constant for the filter is set by parameter

TORQUE REF A FTC (25.02)	Integer scaling: 1 = 0.001 sec

The scaling of the torque reference is done by signal

LOAD SHARE (25.03)	Integer scale: 1 = 0.1 %

External torque reference B

The channel B has a ramp function. The reference is written to the signal

TORQ REF B (25.04)	Integer scaling: 10000 = nominal torque of the motor

The time for the ramp is set by the parameters

TORQUE RAMP UP (25.05)	The time the torque will rise within from zero to nominal motor torque Integer scaling: 1 = 0.01 sec
TORQUE RAMP DOWN (25.06)	The time the torque will decrease within from nominal motor torque to zero Integer scaling: 1 = 0.01 sec

Note: There is no fly-start function with the torque reference ramp.

External torque reference limitation

Both above mentioned references are added together and then limited. The limited sum of the references can be measured from the signal

TORQ REF 1 (2.08)

The torque references are limited by the signals

TREF TORQMAX (20.09)	Integer scaling: 10000 = nominal torque of the motor Default value: 325 %
TREF TORQMIN (20.10)	Scaling: 10000 = nominal torque of the motor Default value: -325 %

In addition, also the torque limits due to the current control restrictions (current limits, field weakening, quadrant type) apply (signal **TC TORQMAX (2.19)**, used for both directions).

Switching to torque control mode

Both the filtered speed reference A and the output of the torque reference B ramp are reset to zero, if the drive is disabled, or if the torque selector (see next chapter) is set to 0. Thus, the torque reference ramp as well as the torque reference filter start at 0%, when the torque control is enabled.

While the drive is being operated in speed control
(**TORQUE SELECTOR (26.01)** = 2),
the limitation of the speed controller depends on the torque limits. The aim is to limit the speed control (integral part) to the remaining free operational torque. The torque reference ramp is initialized depending on the present torque references:

- The torque ramp is set to TORQ REF 3 (2.10) minus the filtered and "load shared" TORQ REF A (25.01).
- In LOCAL mode, the torque reference (A) filter is reset to 0%. The torque reference (B) ramp is set to the active torque reference **TORQ REF 3 (2.10)**.

Due to this presetting, the resulting torque reference starts at the used torque reference **(TORQ REF 3 (2.10)** of the previous mode / state, when the torque control mode is activated.

TORQUE REFERENCE CHAIN AND SELECTOR

DCS600 MultiDrive offers versatile possibilities for selecting the torque reference between speed controller output and an externally given torque references. These are:

- Speed controlled
- External torque reference controlled
- Minimum selector, either speed control or external torque reference
- Maximum selector, either speed control or external torque reference.
- Window controlled

If the drive is controlled by the external torque reference, the output of the speed controller is updated by the used torque reference value, while the speed reference ramp is updated by the speed actual value. This allows a bumpless transfer from the torque controlled mode to the speed controlled mode.

Torque reference selector

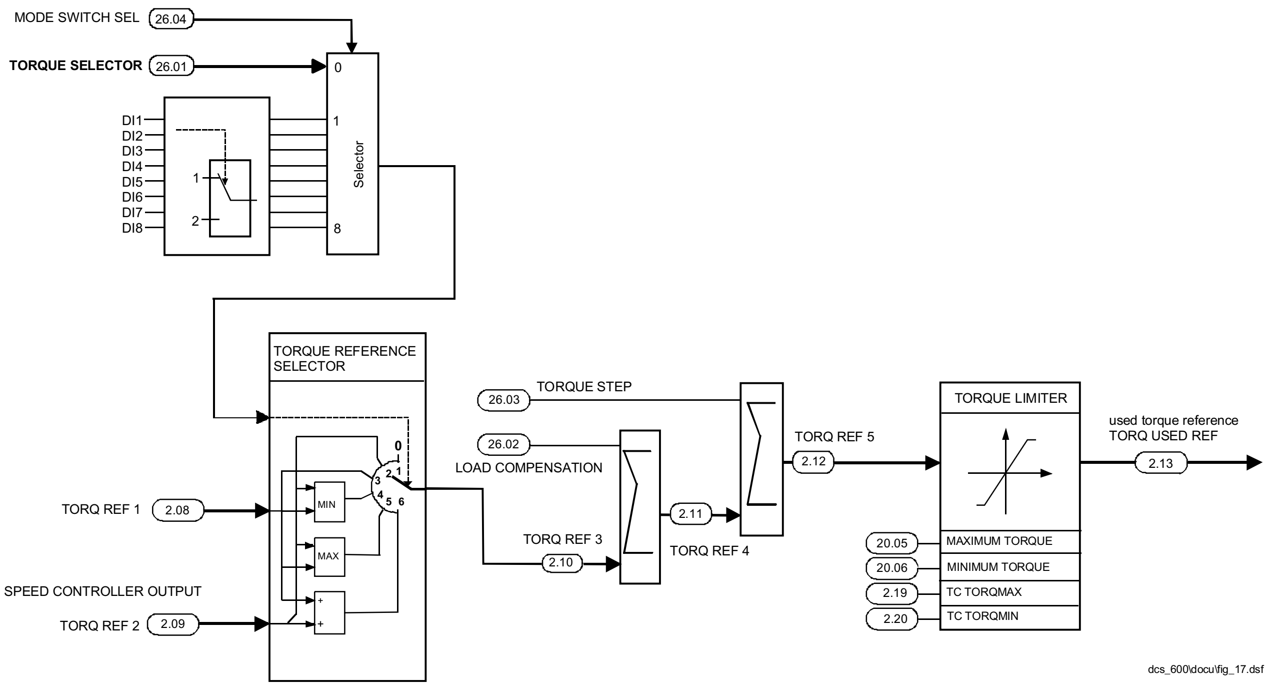


Figure 7-1 Torque reference selector and torque reference chain
Note: the torque limiter includes also the gear backlash function. See chapter "Limitations".

The operation mode of the torque control is selected by the torque reference selector. The selection mode is set by means of parameter

TORQUE SELECTOR (26.01)

1= no torque or speed control (torque reference = 0)

2= The output of the speed controller **(TORQ REF 2, 2.09)** is selected as torque reference

3= The external torque reference **(TORQ REF 1, 2.08)** is selected as torque reference

4= selects minimum value on the basis of the speed difference.
A negative speed difference
(**(SPEED REF 3+SPEED CORRECTION) < MOTOR SPEED**)
causes a change-over to speed control. A change-over from speed control to ext. torque ref. takes place when the torque reference is smaller than the speed controller output, (**TORQ REF 1 < TORQ REF 2** and
(SPEED REF 3+SPEED CORRECTION) >= MOTOR SPEED).
If bit 9 of the **AUX CONTROL WRD 2 (7.03)** is set, always the torque reference generated by the speed controller is active.

5= selects maximum value on the basis of the speed difference.
A positive speed difference
(**(SPEED REF 3 + SPEED CORRECTION)> MOTOR SPEED**)
causes a change-over to speed control. A change-over from speed control to ext. torque ref. takes place when the torque reference is greater than the speed controller output, (**TORQ_REF1 > TORQR_REF2** and
(SPEED REF 3+SPEED CORRECTION) <= MOTOR SPEED).
If bit 9 of the **AUX CONTROL W RD 2 (7.03)** is set, always the torque reference generated by the speed controller is active.

6= Window control, external torque reference and speed controller output are added together.

It is also possible to select either speed or torque control mode of the drive by means of a digital input. This function is enabled (and the aforementioned TORQUE SELECTOR mode disabled) by selecting a digital input with parameter

MODE SWITCH SEL (26.04).

0 = not used (default value, **TORQUE SELECTOR** is valid)
1 = DI1
2 = DI2
3 = DI3
4 = DI4
5 = DI5
6 = DI6
7 = DI7
8 = DI8

With 0-signal of the selected input, speed control is selected, while 1-signal selects torque control mode. (Note: this assignment can be reversed by setting the DIG IN x INVERT selection of the selected digital input to INVERT).

The overriding control system can read the status of the torque selector by reading bit 10 **(TORQ_CONTROL)** in the

AUX STATUS WORD (8.02)

1== torque control is active,
0==speed control is active.

The output signal of the torque selector is the signal **TORQ REF 3 (2.10).**

Torque reference chain

After the selection of the torque reference source, the program can add certain signals to the reference. These signals are:

- **LOAD COMPENSATION (26.02)**

The sum of **TORQ REF 3** and the **LOAD COMPENSATION** can be seen in the signal **TORQ REF 4 (2.11).**

- **TORQUE STEP (26.03)**

The sum of **TORQ REF 4** and the **TORQUE STEP** can be seen in the signal **TORQ REF 5 (2.12).**

After adding the reference is limited. The according parameters and signals are:

MAXIMUM TORQUE (20.05)	Maximum positive output torque Default value: 100 %
MINIMUM TORQUE (20.06)	Minimum negative output torque Default value: -100 %
TC TORQMAX (2.19)	Calculated positive motor torque limit
TC TORQMIN (2.20)	Calculated positive motor torque limit

The gear backlash function is also applied here. See chapter "Limitations".

The used limited torque reference signal can be seen in the signal **TORQ USED REF (2.13)**.

Chapter 8 - Drive Control <--> Converter Control

DRIVE CONTROL <----> CONVERTER CONTROL

The torque reference is calculated by the drive control software inside the AMC board. The torque generation is performed by the converter control software inside the SDCS-CON-2 board.

The converter control software allows an additional torque correction by means of an anlogue input (analogue input 1).

TORQUE CORR SRC	**1:**	**TQCORR = 0**	Torque correction := 0
(13.16)	**0:**	**TQCORR = AI1**	Torque correction := **AN IN 1 VALUE (5.02)**

The analogue input 1 must be configured to a suitable scaling in order to set the integer scaling of AI1 VALUE to the torque scaling (10000 = nominal motor torque). For more details please refer to chapter “Analogue and Digital I/O“.

ARMATURE CURRENT CONTROLLER

The current controller part of the software controls the armature current of the motor and forms firing pulses needed for thyristors. Main parts of the armature current controller are:

- Scaling from torque reference to current reference
- Current reference slope
- PI-controller
- Alpha limitation
- DXN, the load dependent alpha-limit
- Firing unit

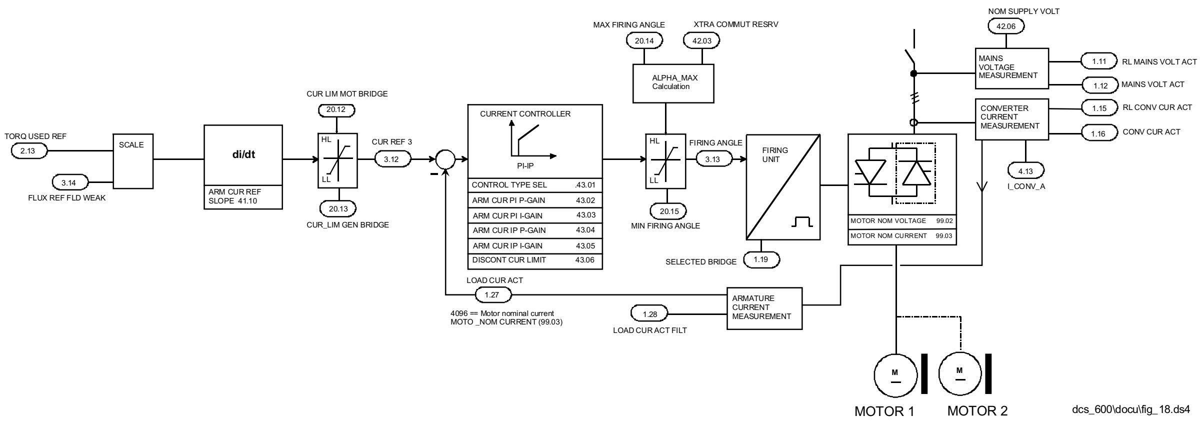


Figure 9-1 The armature current reference and controller

Reference scaling

The torque reference is scaled to the current reference by taking into account the flux reference.

With the nominal flux (integer value: 4096) and nominal torque (integer value: 10000) the current reference is the motor nominal current.

The integer scaling scale of the current reference is :

4096 == given data of motor **MOTOR NOM CURRENT (99.03).**

Reference slope

The rise and decrease time of the current reference can be adjusted, if a fast rise time causes problems to the motor commutator. The rise time is defined by the parameter

CUR REF SLOPE	Integer scaling: 4096 == 30% / ms [50 Hz] (≙ 100%/3.3 ms)	
(41.10)	Default:	10% / ms (equals 33% per 3.3 ms cycle at 50 Hz, 33% per 2.77 ms cycle at 60 Hz)

If the parameter is set to 20%/ms then the current needs 5 ms for a step from 0% to 100% current at 50 Hz.

Reference limitation

The current reference is limited by the parameters

CUR LIM MOT BRIDGE (20.12)	Positive (motor bridge) current limit Integer scaling: 4096 = motor nominal current
CUR LIM GEN BRIDGE (20.13)	Negative (motor bridge) current limit Integer scaling: 4096 = motor nominal current

Additionally the current reference can also be limited depending on the motor speed.

Current deviation alarm

If the current controller cannot follow the given reference, an alarm signal is created. Normally the reason is too small AC voltage compared to the motor EMF.

If the difference between the **CUR REF 3 (3.12)** and the **LOAD CUR ACT (1.27)** is bigger than 20% of nominal longer current than 5 seconds, the alarm

20 CURR_ DEV

will be generated. The drive is not tripped for that reason.

Note: The value (41.10) = 0 freezes the reference ramp.
Note: In case of this alarm there is usually not enough voltage reserve for the DC drive.

(1) min α-limit [20.15] too high
(2) transformer too weak (too high impedance)

Armature current controller

The armature current regulator has two controlling methods. These are PI-controller and IP- controller.

The selection between these types can be done, if wanted, by means of the parameter

CONTROL TYPE SEL (43.01)

Selection of the control method.

0= **PI CONTROL**
KP = **ARM CUR PI P-GAIN (43.02)**
KI = **ARM CUR PI I-GAIN (43.03)**

1= **IP CONTROL**
KP = **ARM CUR IP P-GAIN (43.04)**
KI = **ARM CUR IP I-GAIN (43.05)**

2= **PICONT FFREF**
KP = **ARM CUR PI P-GAIN (43.02)**
KI = **ARM CUR PI I-GAIN (43.03)**
PI Control; the R-L-correction of the EMF voltage feed forward is based on the current reference instead of the current actual value.

3= **PICONT WO FF**
KP = **ARM CUR PI P-GAIN (43.02)**
KI = **ARM CUR PI I-GAIN (43.03)**
PI Control; no R-L-correction of the EMF voltage feed forward takes place at all.

The parameters for the PI controller can be selected by either using the autotuning feature or by manual tuning. The parameters of the IP controller cannot be set according to the usual criteria, the autotuning feature is always needed.

Scaling of PI - controller

.
PI-controller is scaled so that the P-gain value 100% produces the same value to the output as can be seen in the input.

P-gain:

$$output = \frac{ARM\_CUR\_PI\_P\_GAIN * \Delta I}{256} = \Delta I * \frac{(43.02)}{256}$$

So the default value 300 results in the gain 300/256=1.17 (117%)

I-gain:

Integral time constant (ITC):

$$ARM\_CUR\_PI\_I\_GAIN = 16384 * \frac{scantime}{ITC} \Rightarrow ITC = 16384 * \frac{scantime}{(43.03)}$$

where   scan time   = 3.33 ms in 50 Hz mains frequency
                     = 2.77 ms in 60 Hz mains frequency

ITC = Integral time constant in ms of current controller.

Discontinuous/Continuous current limit

The current controller demands that the discontinuous current limit is defined. The limit is defined by parameter

DISCONT CUR LIMIT (43.06)	***converter actual current*** in the point where armature current changes from discontinuous to continuous current.

The autotuning feature will define the point automatically.

With the manual tuning the point must be measured from the armature circuit using e.g. an oscilloscope.

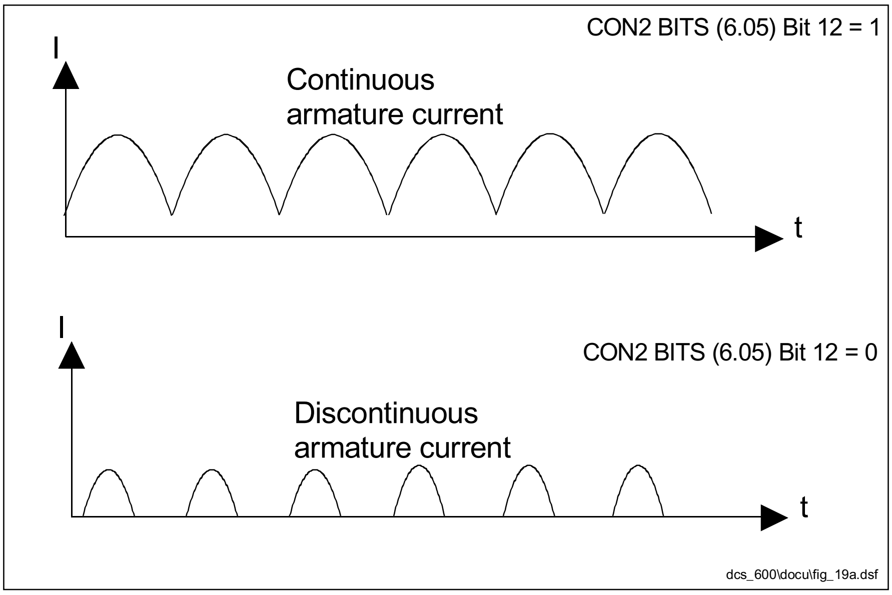


Figure 9-2 Wave forms of the armature current.

The discontinuous current state can be read from bit **12 / CONTINUOUS CURR** of the signal **CON2 BITS (6.05)**.

EMF feed forward

The measured EMF voltage is added to the output of the current controller (not in field control mode).
In case of EMF measurement is realised independent from the converter's armature terminals, ensure correct connection (sign !).

Alpha limitation

The current controller output is transferred to the firing unit. The actual firing angle can be measured from the signal

FIRING ANGLE (3.13)	Integer scaling: 1 = 1°

The firing angle's limits are set by parameters

MIN FIRING ANGLE (20.15)	Minimum firing angle Integer scaling: 1 = 1° / default value = 15°
MAX FIRING ANGLE (20.14)	Maximum firing angle Integer scaling: 1 = 1° / default value = 150°

Additional commutation reserve

This function is useful, if the maximum firing angle is required to be set to a higher value. Then the internal maximum firing angle limit can be reduced depending on the current and the mains short circuit reactance.

The commutation cannot take place infinitely fast due to the mains reactance. The time for the commutation can be expressed by the commutation angle u, which can be calculated using formula:

$u = \arccos(\cos\alpha - I_d/I_k) - \alpha$ where I_k = short circuit current
I_d = load current

The related mains short circuit voltage caused by the ***converter nominal current*** is (in per cent):

$$DXN = \frac{2 * X_L * CONV\_NOM\_CURR}{\sqrt{2} * NOM\_SUPPLY\_VOLT} * 100 = uk * 100 * \frac{Sc}{St}$$

CONV NOM CURR (4.05):	converter nominal current
NOM SUPPLY VOLT (42.06):	nominal supply voltage
X_L:	mains short circuit reactance ($\omega \bullet L_L$)
uk	related mains short circuit voltage
Sc	apparent power of converter
St	apparent power of transformer

The DXN value is set to the parameter

XTRA COMMUT RESRV (42.03)	Integer scaling: 1 = 0.1 % of NOM SUPPLY VOLT; default value = 0.

The resulting maximum firing angle limit is calculated as:

$$\text{max\_angle} = 179 - \sqrt{(180 - [20.14])^2 + 1.551 * [42.03] * [1.15]}$$

[20.14]: max. firing angle
[42.03]: XTRA COMMUT RESRV (DXN, in per cent)
[1.15]: actual relative converter current (in per cent); within this function, its value is limited to 100%

For a given max. firing angle at a given current, parameter 42.03 must be set to

$$[42.03] = \frac{(179 - \text{max\_angle})^2 - (180 - [20.14])^2}{1.551 * [1.15]}$$ (in per cent)

To avoid damage to the converter, the default firing angle values (limits, XTRA COMMUT RESRV) shouldn't be changed without consulting ABB !

uk dependent phase angle correction

The measured phase angle of the firing unit's PLL can be corrected in order to compensate the error caused by the commutation related voltage drops. The compensation depends on the uk of the mains supply.
The Parameter **UK PLL COMP (42.13)** defines for that compensation function the proportional mains short circuit voltage (in per cent) caused by the converter nominal current.

$$\text{UK\_PLL\_COMP} = \frac{2 * X_L * \text{CONV\_NOM\_CURR}}{\sqrt{2} * \text{NOM\_SUPPLY\_VOLT}} * 100$$

$$= \text{uk} * 100 * \frac{\text{Sc}}{\text{St}}$$

CONV NOM CURR (4.05):	converter nominal current
NOM SUPPLY VOLT (42.06):	nominal supply voltage
X_L:	mains short circuit reactance ($\omega \bullet L_L$)
uk	related mains short circuit voltage
Sc	apparent power of converter
St	apparent power of transformer

Commissioning hint: This parameter is used to compensate for measuring faults of the incoming voltage because of commutation notches, when the incoming voltage is measured on the secondary side of the drive's transormer.
Because of the bad synchronization the armature current becomes unstable (starts to oscillate) during very high loads.
Increase the parameter slowly (1 by 1) until the armature current is stable (for a large 12-pulse DCS 600 converter the value had to be set to 4).

Bridge reversal delay

The bridge reversal is initiated by changing the polarity of the current reference. Upon zero current detection, the bridge reversal is started. (Depending on the moment involved, the new bridge may be “fired” either in the same or in the next cycle). In addition, switchover can be delayed by a number of cycles programmed to parameter **REV DELAY (43.13)**, starting after zero current has been detected. This feature may prove usefule when operating with large inductances.
Note: If the bridge reversal takes more than 2 control cycles longer than the sum of the control cycles programmed to parameters **REV DELAY (43.13)** and **REV GAP (47.07)**, the fault **65 REVER FLT** (reversal fault) is activated.

The standard zero current detection evaluates the measured current. Due to **high inductances** (e.g. connected in field control mode), the current approaches zero very slow, causing a low reliability of the zero current state. For that reason, the bridge reversal can be delayed by means of the aforementioned paramer.

If an external zero detection unit ZV7001 is used, the bridge reversal delay can be disabled or set to small values (e.g. 0 or 1 cycles), even with high inductive loads. The converter control software must be informed about the connection of the ZV7001 by parameter

ZERO CUR DETECT (43.14)	**0:**	**INTERNAL**	ZV7001/ZCD01 **not** connected
	1:	**EXTERNAL**	ZV7001/ZCD01 **is** connected

Bridge selection monitoring

The active bridge can be monitored by the signal

SELECTED BRIDGE (1.19)

0 = no bridge
1 = motor bridge
2 = generator bridge

Current ripple monitoring

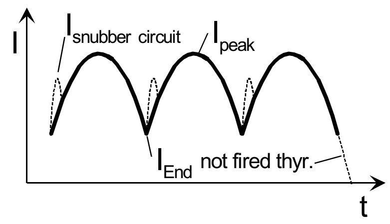
The current control is equipped with a current ripple monitoring
This function detects:

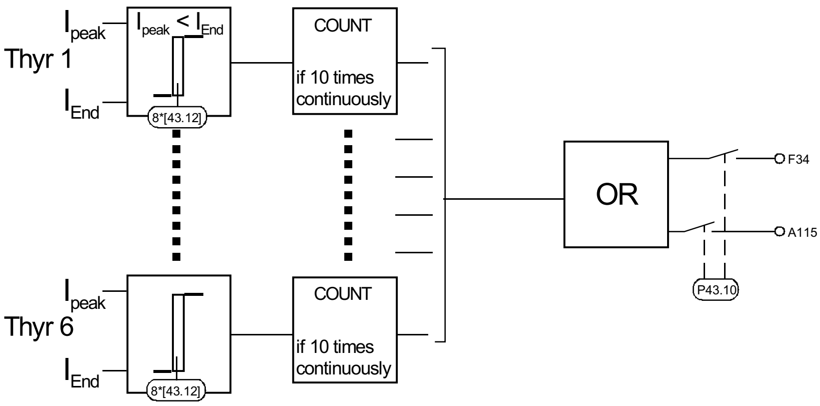
- a broken fuse or thyristor
- too high gain of the current controller
- a broken current transformer (T51, T52)

The function is adjusted by parameter (43.10); (43.11); (43.12).

Due to the wide range of applications two different methods of current ripple monitoring are available, selected by parameter (43.10)

Current ripple monitor method1
Principle: Detecting minimum and maximum of each current bubble. Each thyristor will be monitored.





Method 1 can fail for high inductive load (smooth current) in combination with slowly decreasing current curve.

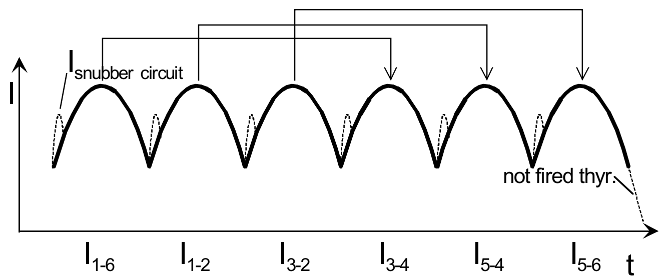
Note:
The current bubbles of the snubber circuit can also be detected as peak current. Adjustments below [43.11] < 0.25% are normally not possible.
If the selection for this method is too sensitive adjusted, then you can get also this fault/alarm:

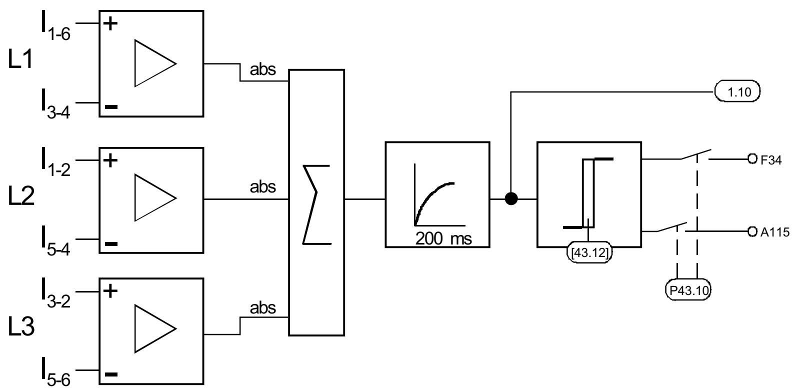
- during fast current decrease
- switching off the field current in the field exciter.

In discontinuosly current range this monitoring is not active

Current ripple monitoring method 2

Principle: Comparing positive and negative current of each phase. Calculation is done per thyristor pair.





Note:

The load influences the error signal (1.10).
Current near discontinuous limit will create (1.10) ~300% * (1.15) if a thyristor is not fired.
High inductive loads will create (1.10) ~90% * (1.15) if a thyristor is not fired.

Commissioning hint:

It is not possible to pre-calculate clear limits

- The current control reacts to unstable current feedback
- The load is continuously driving the current if a thyristor is not fired.

FIELD EXCITATION

DCS600 has a possibility to use several kind of field exciters or combinations of them, depending on the application. This chapter explains the basic differences of various field exciters. Functions using field exciters are also explained in this chapter.

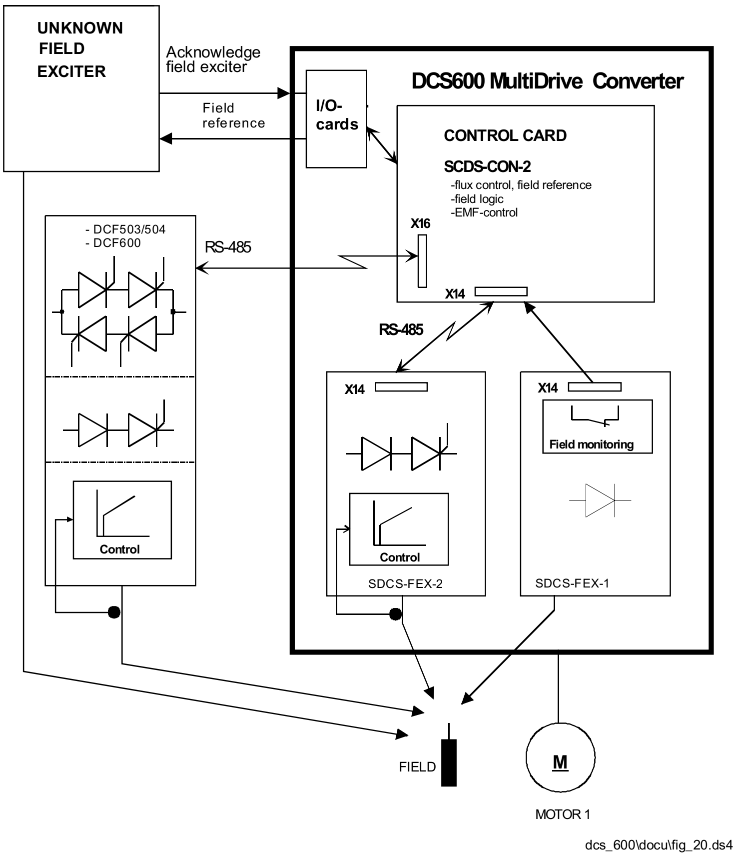


Figure 10-1Basic parts of the field excitation.

Field exciter type selection

The used type of the field exciter is selected by parameter

USED FEX TYPE (15.05)

0	No field exciter selected
1	Internal diode field exciter SDCS-FEX-1
2	Internal SDCS-FEX-2, or external DCF503/504 or DCF600
3	external DCF503/504 as a second field exciter
4	internal SDCS-FEX-2, or external DCF503/504 or DCF600, as a first field exciter and external DCF503/504 as a second field exciter.
5...8	other field exciter, acknowledge through DIx
9...13	other field exciter, acknowledge through AIx

Note: The digital inputs DI1 ... DI3 and DI5 are not available for the acknowledge signal of non-ABB field exciters.

The program by-passes the field acknowledge signal when "No field exciter" is selected. This selection is intended for testing purposes.

Instead of an external DCF503/504, a DCF600 MultiDrive can be used as field exciter. For more details, please refere to chapter “Field Exciter Mode“ of this manual.

Two field exciters are used with the function "Shared motion".

Internal diode field exciter SDCS-FEX-1

The current setpoint when using SDCS-FEX-1 is selected by adjusting appropriate voltage output from the field autotransformer. The program does not measure the current value but an acknowledge signal flags whether the field exciter has current or not. No more parameter settings are needed. If the current stucks at zero more than 6 second after "ON" -command is given, the drive will trip to the fault: **39 NO FIELD**.

Internal field exciter SDCS-FEX-2

Internal field exciter SDCS-FEX-2 is a half controlled bridge that can control the field current with one (positive) direction. Due to the nature of the half controlled bridge, a very small amount of current (5...10%) flows always through the bridge if the field contactor is closed. SDCS-FEX-2 is controlled via the serial communication link. SDCS-FEX-2 measures field current and sends the value to the drive via serial communication. The measured field current is used to generate an acknowledge signal. If the field current exceeds the trip level, the drive will trip to the fault **32 FEX1 OCUR**. If the current level drops below the minimum field current, the controllers are blocked after the delay time programmed to parameter **DEL MIN FLD TRIP (45.06)** and the drive will trip to the fault: **39 NO FIELD**. If the current stucks at zero more than 6 second after "ON" -command is given, the drive will also trip to the fault: **39 NO FIELD**.

External field exciters DCF503/504

External field exciter DCF504 can control the field current both in positive and negative direction. The desired direction is defined by the sign of the field current reference. A positive sign means "forward" bridge and negative sign "reverse" bridge.
The field current supervision logic is handled in a similar way than with SDCS-FEX-2.

External 3-phase field exciter DCF600

The field exciter version of DCS600 MultiDrive is the DCF600 three phase field exciter. For more details, please refer to chapter 13 “Field Exciter Mode“ of this manual.

AI/DI -based field exciters

When modifying already existing machines (so called revamping), the usage of alien field exciters might occur. In this case an acknowledge signal must be provided in order to supervise the field function. This can be done by either using one DI or AI.

Use of DI-channel

When DI is used to input the acknowledge signal, the function is similar to the usage of SDCS-FEX-1, diode field exciter. The function "Field reversal" is not possible with the DI-channel.

DI-channel selection

The acknowledge-signal is selected by the same parameter used to select a field exciter type

USED FEX TYPE (15.05)

...	
5	acknowledge via DI4
6	acknowledge via DI6
7	acknowledge via DI7
8	acknowledge via DI8
...	

Use of AI-channel

An analogue input is used when the field current is to be measured or controlled. When controlling AI-based field exciter, it is also needed to transfer the reference to the field exciter. This is done by means of connecting one AO channel to the signal

FIELD CUR REF M1 (3.17) (motor 1) or
FIELD CUR REF M2 (3.18) (motor 2)

The used analogue output must be programmed to a suitable scaling: the integer value 4096 must correspond with the field exciter's reference input voltage at nominal field current.

Accordingly, the value 4096 of the selected analogue input must correspond with the field exciter's actual value output valtage at nominal field current.

AI-channel selection

The selection for acknowledge-signal is selected by the same parameter that is used to select a field exciter type

USED FEX TYPE (15.05)

...	
9	acknowledge via AITAC
10	acknowledge via AI1
11	acknowledge via AI2
12	acknowledge via AI3
13	acknowledge via AI4

Two field exciters at the same time, field current references

When the same converter controls two motors as a "shared motion", the armature unit is switched between two motors by means of an extra contactor. Both motors have still their own field exciters. In the documents the main motor field exciter is called "first field exciter", while the second motor field exciter is called "second field exciter".

The "first field exciter" always is operated current controlled. Its reference value **FIELD CUR REF M1 (3.17)** is taken from the output of the flux/field linearization (see below). The "second field exciter" receives its reference value **FIELD CUR REF M2 (3.18)** from a fixed field current level **FIELD 2 REF (44.23).**

Motor heating function is possible for the unused motor by means of a reduced field current reference.

Settings

For proper operation of the field excitation, setting of the nominal field current *is mandatory.* The other parameters are normally not needed to change.

The nominal current of field exciters

MOT 1 NOM FLD CUR (41.03)	50 = 1 A
MOT 2 NOM FLD CUR (41.17)	

Note!
In case of DCF600 used as field exciter, the nominal field current mustn't be set at these parameters but at the DCF600 itself at parameter **MOTOR NOM CURRENT (99.03).** See also description of parameters 41.03, 41.17.

The minimum field current level

FIELD 1 MIN TRIP (44.17)	integer scaling:	4096 = rated current
FIELD 2 MIN TRIP (44.22)	default value:	50% of rated current

The delay of the minimum field trip can be programmed to parameter
DEL MIN FLD TRIP (45.06).
It defines the maximum time, the field current is allowed to be below the minimum field current level.

The maximum field current (in per cent of the nominal flux) can be programmed to parameter **MAXIMUM FLUX (45.07).** Default value: 100%.

The overcurrent level

FIELD1 OVRCUR LEV (20.16)	integer scaling:	4096 = rated current
FIELD2 OVRCUR LEV (20.17)	default value:	115% of rated current

Free-Wheeling Function

DCF504 has a free-wheeling function in order to give route to current if for some reason the AC-input voltage disappears, e.g. when field contactor opens in an uncontrolled way. When this happens, the current does not stop and current tends to increase the line voltage input of the field excitation unit. The AC input voltage is measured and if the value changes too fast, the field excitation unit fires two selected thyristors in order to close a free-wheeling circuit for the DC current. The sensitivity when to start the free-wheeling can be adjusted for the 1st field exciter and the 2nd field exciter independently by means of the parameters

FREEWHEEL LV FEX1 (44.04)	Scaling of parameters is %/ms,
FREEWHEEL LV FEX2 (44.10)	e.g., 10 == 10%/ms

The default value is 10. This causes the free-wheeling function to start if the AC-input voltage measurement exceeds 50V/ms at 500V AC input voltage.

Filter for actual field current

The field exciter unit has a filter for smoothing the actual field current measurement transferred to the drive software. The filter is meant for smoothen actual current measurement value for displays.
The filter time constant should not be increased too much since the same signal is also used for supervising field-overcurrent.

FLD ACT CUR 1 FTC (44.01)	Integers scaling: 1 = 0.01 sec.
FLD ACT CUR 2 FTC (44.07)	

Current controller

The current controller of the field excitation unit is located inside the field excitation unit. Some parameters are accessible via serial communication link if the current controller needs manual tuning. The current controller uses a standard PI-control algorithm.

P-gain parameters of 1st and 2nd field exciter:

P-GAIN FEX 1 (44.02)	Integer scaling: 1 = 100%
P-GAIN FEX 2 (44.08)	

I-time constant parameters of 1st and 2nd field exciter:

INTEG TIME FEX 1 (44.03)	Integer scale: 1 = 10 ms
INTEG TIME FEX 2 (44.09)	

The PI-controllers input value is the current error, while the output value is the field converter's output voltage.

The maximum output voltage of the PI-controller can be limited by means of 2 parameters. The maximum possible output voltage is 0.9 * VAC. This equals the limit value 4096. The limitation is linear: 2048 = 0.5 * 0.9 * VAC.

1st field exciter:

NEG LIM FEX 1 CON (44.05)	negative limit
POS LIM FEX 1 CON (44.06)	positive limit

2nd field exciter:

NEG LIM FEX 2 CON (44.11)	negative limit
POS LIM FEX 2 CON (44.12)	positive limit

Note: In case of a DCF 600 3-phase field exciter connected to a DCS600 armature converter, the parameters (44.02), (44.08), (44.03) and (44.08) of the armature converter are not active.
⇒ Use group 43 of the DCF 600 converter for current control.

Changing the Field Direction

Changing the field direction is needed when the drive has only one armature bridge (1-quadrant). This gives the possibility to change the speed direction and also regenerating energy back to mains when deccelerating with a big inertia. The sign of the torque reference defines the desired direction of the field. 4-quadrant drives do not have the field reverse function.

The field direction change is activated by means of the parameter
FIELD CONTRL MODE (15.06).

			armature converter type
0	**FIX**	EMF-controller OFF	4-Q
1	**EMF**	EMF-controller ON	4-Q
2	**FIX/REV**	**Field reversal**	1-Q
3	**EMF/REV**	**Field rev.** + EMF-control	1-Q
4	**FIX/OPTI/REV**	**Field rev.** + OPTITORQUE	1-Q
5	**EMF/OPTI/REV**	**Field rev.** + EMF-control + OPTITORQUE	1-Q
6	**FIX/OPTI**	OPTITORQUE	4-Q
7	**EMF/OPTI**	EMF-control + OPTITORQUE	4-Q

When using 4-quadrant-type drives, the field reference value is always positive 100%. If the EMF-controller is activated, the field current is controlled but will never exceed 100%.

Field direction change hysteresis

To prevent the field reversal function from too sensitive operation on small torque reference, a torque reference hysteresis is available with the field reversal function. The hysteresis is symmetrical. It’s value is set by the parameter

FIELD 1 REF HYST (44.19)	Integer scaling: 4096 = 100% of nominal field current

Force field direction

It is possible to force the drive to use a defined field direction. This gives the user the possibility to allow the direction change only when it is needed. Using the force-command makes the drive less sensitive to the torque reference.

FORCE FIELD1 DIR (45.04)	0 = NOT FORCED 1 = force field direction FORWARD 2 = force field direction REVERSE

Note: Field control mode (= 0, or = 1) used for 4-Q armature converter and 4-Q field converter can utilize field reversal by FORCE FIELD1 DIR (= 2) command.

Field monitoring when changing direction

Normally the field current is compared to a minimum level. If the current drops below this limit, all control functions are blocked and the drive goes to the state **RDYRUN** = 0 and **RDYREF** = 0. During the field change the situation differs. It is allowed to be below the minimum field level for a certain time due to transition from one current direction to the other. While the field reversal is in progress,

- the current controller is blocked
- the speed controller's I-part is frozen
- the speed ramp's output is updated by the measured speed value.

The field current must change it's direction within 2 sec. Otherwise the internal field exciter's acknowledge signal **ACK_FEXC1_ON** is reset. The drive will trip to the fault: **39 NO FIELD**. This causes the situation **RDYRUN** = 0 and **RDYREF** = 0.
The internal acknowledge signal of the 1st field exciter can be read from bit 6 of the signal **AUX STATUS WORD (8.02)**.
In order to supervise the function next parameters are needed:

FIELD 1 MIN TRIP (44.17)	the minimum level for the the field current. Integer scaling: 4096 = nominal field current
FIELD1 REVRS HYST (44.18)	The sign of the field current defines used direction. To avoid signal noise problems, a small hysteresis is used when detecting the sign. Integer scaling: 4096 = nominal field current
FLUX REVERS DELAY (44.16)	If real FLUX of the motor does not follow rapidly the field current, (old DC-motors), it could be necessary to make extra delay for defining field direction. The speed measurement fault is disabled during this time.

The following signals can be read from the packed boolean word **CON2 BITS (6.05)**. They are used from the controllers and some measurements:

TC_FIELD_CHANGE (bit 0)	During field reversal this signal blocks armature current controller, freeze I-part of the speed controller and update speed ramp output with a measured speed value.
FIELD1_REV_ACK (bit 15)	When the direction is changed to the reverse direction, the polarity of next signals must be changed: **SPEED ACTUAL EMF, MOTOR TORQUE**, armature current reference.

OPTI-Torque

Due to the big inductance of the motor, the field reversal takes normally a long time. This time can be reduced in certain cases by means of the OPTI-TORQUE-function. If the process requires only a small torque during field reversal, the field current may be reduced prior to the real change. This speeds up the procedure. The rate of the field current reduction depends on the process. E.g. if the speed direction is changed rather slowly, the required torque may also be quite small around zero speed, thus allowing to reduce the motor field.

Selection of OPTI-torque

The OPTI-TORQUE is selected by the parameter:
FIELD CONTRL MODE (15.06).

			armature converter type
0	**FIX**	EMF-controller OFF	4-Q
1	**EMF**	EMF-controller ON	4-Q
2	**FIX/REV**	Field reversal	1-Q
3	**EMF/REV**	Field rev. + EMF-control	1-Q
4	**FIX/OPTI/REV**	Field rev. + **OPTITORQUE**	1-Q
5	**EMF/OPTI/REV**	Field rev. + EMF-control + **OPTITORQUE**	1-Q
6	**FIX/OPTI**	**OPTITORQUE**	4-Q
7	**EMF/OPTI**	EMF-control + **OPTITORQUE**	4-Q

Field current reduction proportionally to torque ref.

The relation between torque reference and field current is defined by the parameter

FIELD 1 REF GAIN (44.20)
The scaling is (10000/4096)%. With the default value 80, 100% field current is available with 51% of nominal torque.

Field monitoring when OPTI-torque changes field direction

Field monitoring differs from normal field changes in that during field reversal the other controllers are not blocked. The signal **TC_FIELD_CHANGE (bit 0 of 6.05)** is clamped to zero. Minimum field signal is normally delayed by 2 seconds; this time is fixed. Since the duration of the field current to drop below the minimum level is also a function of the torque reference, this 2 seconds might be too short for some applications.
For that reason the minimum field monitoring is by-passed if the field ***current reference*** drops below a certain level. Two parameters are needed to define the by-passing of the minimum field monitoring:

FIELD 1 REF MIN L (44.14)	**4096 = nominal field current / 614 = 15% of nominal field current** When field reference drops below this limit, the minimum field monitoring is by-passed.
FIELD 1 MIN DELAY (44.15)	Extra delay to keep by-passing activated after the field current has rosen above the reference limit.

Field current / motor FLUX linearisation

If there is need to control accurate torque, e.g. winders, uncoilers, the field current is to be linearised. This is caused by the non-linear relation of motor flux and field current due to saturation effects of the field winding.

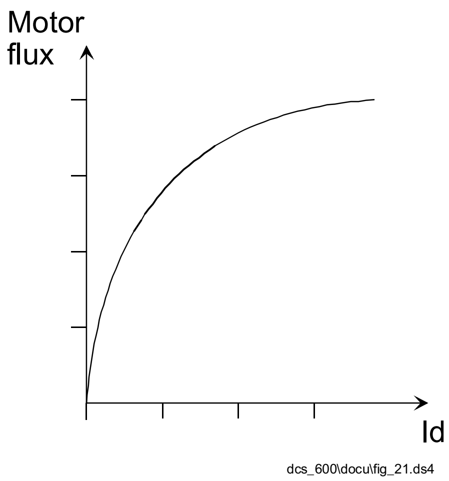


Figure 10-2Flux of DC-motor vs field current.

The magnetisation of the motor starts to saturate after certain field current and thus the motor flux does not increase linearly. For this reason the field current cannot be directly used to define FLUX inside the motor. On the other hand the motor armature voltage without load (=EMF) is directly proportional to the motor flux and motor speed below field weakening area. E.g. if motor nominal DC voltage is 440V and the motor is run using half speed and full FLUX, then the DC voltage is about 220V. Then if the flux is reduced by 50% and while keeping the same speed, the DC voltage is about 110V. (Example !).

Since the motor EMF-voltage is directly proportional to motor FLUX it is possible to define relationship between field current and motor FLUX by means of measuring motor armature voltage without load (EMF).

The main idea of linearisation is to find such field current which produces desired EMF-voltage at a certain speed. The linearisation is done by means of a function block provided with 3 defined values:
- 90% FLUX (41.16)
- 70% FLUX (41.15)
- 40% FLUX (41.14)

The intermediate values are interpolated. During commissioning the 3 aforementioned must be programmed, if the Flux-controller is desired to use.

Final flux reference

The flux reference at the input of the linearisation function is the sum of the following signals:

FLUX REF EMF (3.26)	EMF controller's output
FLUX REF FLD WEAK (3.14)	from field weakening function or external flux reference (see description of **FLUX/EMF reference selectors** in chapter 11)
FLUX COR (43.20)	external correction signal

The sum of **FLUX REF EMF (3.26)** and **FLUX REF FLD WEAK (3.14)** is available as **FLUX REF SUM (3.15).**

Note: In field control mode (described in chapter 13), some of the flux signals apply to a different control structure.

An example of the linearisation procedure

There are various ways to define the needed values for the field current linearisation. The following procedure is given as example to explain the linearisation.

1. Select Field Control Mode **(15.06)** = EMF
Set EMF-controllers output limits to zero
(46.01 POS LIM EMF CON = 0)
(46.02 NEG LIM EMF CON = 0)
Set **FLUX REF SEL (46.07)** = EXT REF
Set **FLUX REF (45.01)** = 100 %
Set **FIELD1 MIN TRIP (44.17)** = 10 %

2. Run the motor to half speed.
Read **EMF VOLT ACT (1.18)** e.g. measured value is 220 V

3. Reduce **FLUX REF** (45.01) until **EMF VOLT ACT** (1.18) reaches 90 % of the 1st measurement.
Read the value **REL FIELD CUR M1 (3.19)** and write it to parameter **FLD CUR @90% FLUX (41.16)**

4. Reduce **FLUX REF** (45.01) until **EMF VOLT ACT** (1.18) reaches 70 % of the 1st measurement.
Read the value **REL FIELD CUR M1 (3.19)** and write it to parameter **FLD CUR @70% FLUX (41.15)**

5. Reduce **FLUX REF** (45.01) until **EMF VOLT ACT** (1.18) reaches 40 % of the 1st measurement.
Read the value **REL FIELD CUR M1 (3.19)** and write it to parameter **FLD CUR @40% FLUX (41.14)**

6. Set **FIELD1 MIN TRIP (44.17)** = back

Field Reduction on Stand-Still

The motor field can be reduced at a stand-still situation in order to avoid overheating if the motor isn't running. The function is activated by means of two parameters:

FLD 1 HEAT SEL (15.11)	Selection for first motor
FLD 2 HEAT SEL (15.12)	Selection for second motor in case of shared motion.

The used current references are selected by means of two parameters:

FIELD 1 REF RED (44.13)	Reference for first motor
FIELD 2 REF RED (44.21)	Reference for second motor in case of shared motion.

The function is activated if

- the drive is not in **RDYREF** state **OR** motor is not selected by means of **MOTOR SELECT (6.03)**
- AND 10 seconds have elapsed

The nominal field current is activated, if

- the drive is in **RDYREF** state **AND** motor is selected by means of **MOTOR SELECT (6.03)**

Field Heating at "OFF"-State

The motor field can have a small value in order to avoid condensation when the motor is in "**OFF**"-state (main contactor open). The function can be activated by means of parameter:

FIELD HEAT SEL (15.10)

The used current references are the same as with the field reduction function:

FIELD 1 REF RED (44.13)	reference for first motor
FIELD 2 REF RED (44.21)	reference for second motor in case of shared motion.

The function is activated when command "**ON**" is "0", so the main contactor is open. The function closes the field contactor. The field heating is deactivated by trips or by ON_INHIBIT (via DI), if **15.10** is set to **ENABLED**.

EMF - CONTROLLER

The EMF - controller has three main control functions:

- When running the motor above nominal speed, the EMF-controller reduces motor field in order to keep the EMF-voltage constant at maximum level. This prevents armature over voltage and ensures the maximum possible flux.
- If an accurate torque control loop is needed, the EMF-controller can be used to generate the desired flux. The overriding control system can calculate the expected motor EMF according to the used speed and flux references. The EMF-controller adjust the field current in order to control the EMF-voltage.
- In field exciter mode, the EMF controller can calculate the converter's current reference in order to control the armature voltage of a motor by means of its field current (in case of MG set applications).

Selection of EMF - controller

The EMF-control function can be activated by means of parameter **FIELD CONTRL MODE (15.06)**.

			armature converter type
0	**FIX**	EMF-controller OFF	4-Q
1	**EMF**	**EMF-controller ON**	4-Q
2	**FIX/REV**	Field reversal	1-Q
3	**EMF/REV**	Field rev. + **EMF-control**	1-Q
4	**FIX/OPTI/REV**	Field rev. + OPTITORQUE	1-Q
5	**EMF/OPTI/REV**	Field rev. + **EMF-control** + OPTITORQUE	1-Q
6	**FIX/OPTI**	OPTITORQUE	4-Q
7	**EMF/OPTI**	**EMF-control** + OPTITORQUE	4-Q

In field exciter mode (**OPER MODE SELECT (15.16)** = 5), this parameter is not active.

Field reversal is normally used for 1-quadrant drive type. The type of the field exciter must also be such that field current can be controlled like SDCS-FEX-2, DCF503/504, DCF600.

Field weakening area

Above the motor's nominal speed the motor flux is to be reduced in order to avoid armature over voltage. This area is called "field weakening area" and the speed the field reduction starts at is called "field weakening point". Above field weakening point the motor FLUX is reduced according according to 1/speed. Two parameters are needed to define the function:

SPEED SCALING (50.01)	Max. speed of the drive in 0.1 rpm. This rpm value equals to integer speed value 20000. (See also 50.11.)

Note: The speed scaling must be set in the range of 62.5%…500% of the motor nominal speed (99.05). If the scaling is out of this range, an alarm (SPEED SCALE) is generated.

MOTOR NOM SPEED (99.05)	The motor field weakening point. Integer scaling: 20000 = maximum speed (as defined with **(50.01)**)

The motor flux below the field weakening point can be programmed to parameter **45.07 (MAXIMUM FLUX)**. The default value is 100% (of nominal flux).

FLUX reference

The FLUX reference can be internally calculated by the field weakening function or be set by the overriding control system in case of special demands from the process point of view.

The control range for the flux is 1:5. The minimum flux reference is 20% of the motor nominal flux. In case of EMERGENCY STOP the reduced flux reference is changed to the maximum possible flux reference defined by the field weakening area.

It is not possible to have a flux reference value above 100% of the motor nominal flux..

The overriding control systems commands the flux reference by means of the signal

FLUX REF (45.01)	Integer scaling: 4096 = nominal flux

EMF reference

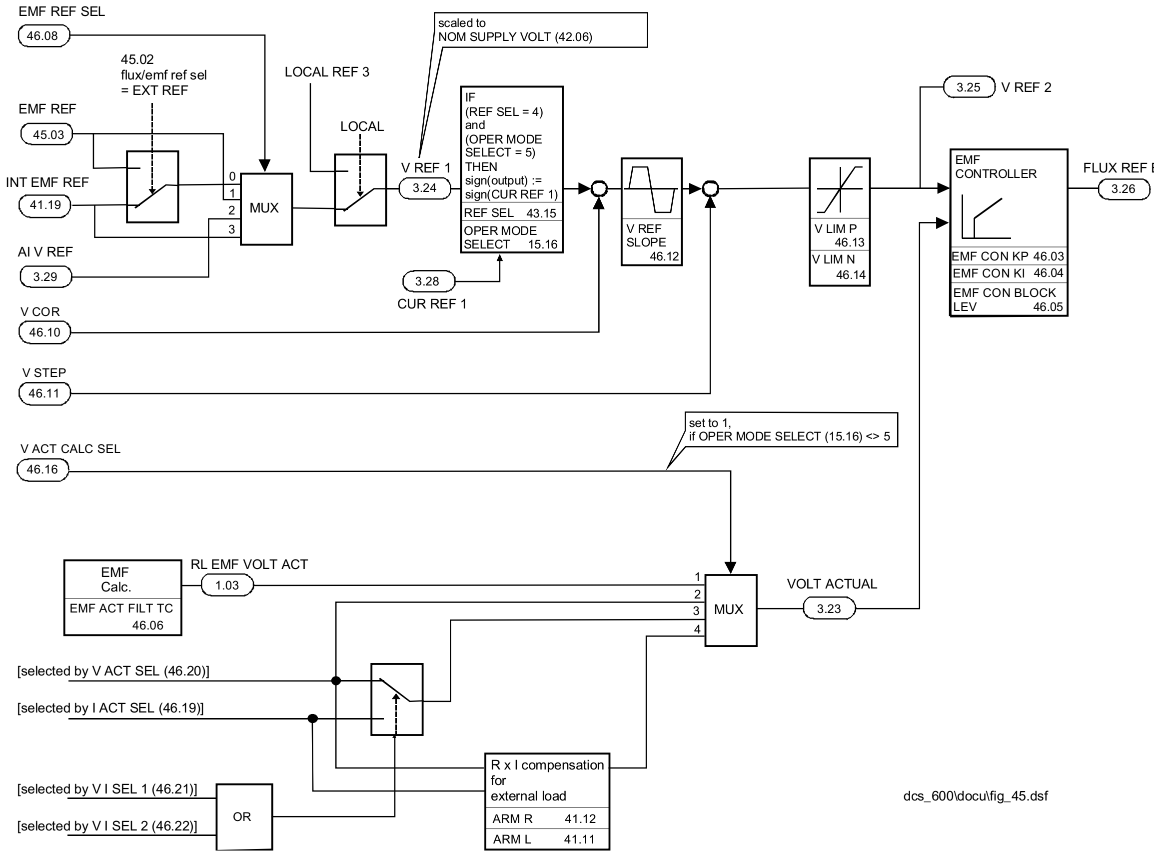


Figure 11-1EMF / voltage reference and control.

The EMF reference can be fixed internally or set by the overriding control system. The internal fixed level is used if the EMF-controller is only limiting the armature voltage above the field weakening point. The level is given by the parameter

INT EMF REF (41.19)	Integer scaling: 3786 = 135% of nominal supply voltage (**42.06)**

Note: EMF LIM GENERAT (41.20) ≤ 41.19

The EMF-reference can also be set by the overriding control system. This is used in case the most accurate torque control loop is needed. The EMF-reference must follow the speed actual of the drive.
The EMF reference is set by the signal

EMF REF (45.03)	Integer scaling: 3786 = 135% of nominal supply voltage **(42.06)**

Note:

$$\text{INT EMF REF}(41.19) = 100 * \frac{\text{MOTOR NOM VOLTAGE}\,(99.02)}{\text{NOM SUPPLY VOLT}\,(42.06)}$$

Reduced EMF reference in regenerative mode

With parameter **EMF LIM GENERAT (41.20)**, the used EMF reference can be limited in regenerative mode. This allows higher voltage in motor mode and prevents shooting through the converter in regenerative mode.
The limitation is deactivated, if set to a value above 146%Us.
The internal used limitation is [41.20] • [1.12] / [42.06].

FLUX/EMF reference selectors

There are two methods how to select between internal and external FLUX and EMF reference. Either selecting them separately by means of parameters or together by means of one signal.
When selecting FLUX and/or EMF reference separately, **EMERGENCY STOP** can by-pass the selection so that always the maximum possible flux is used on emergency stop.
The selection is done by the parameters:

FLUX REF SEL (46.07)	0:	SEL REF	use FLUX reference selected by parameter **(45.02)**
	1:	EXT REF	set by overriding control system (**FLUX REF (45.01)**)

Note! These settings apply to the non-field-exciter mode (**OPER MODE SELECT (15.16)** < 5). For the settings of the field exciter mode (**OPER MODE SELECT (15.16)** = 5) please refer to chapter **"Field Exciter Mode"**.

EMF REF SEL (46.08)	0:	SEL REF	use EMF reference selected by parameter **(45.02)**
	1:	EXT REF	set by overriding control system (**EMF REF (45.03)**)
	2:	AI REF	reference **AI V REF (3.29)** from analogue tacho input value, filtered by **AI V REF TC (46.15)**
	3:	INT REF	internal value (**INT EMF REF (41.19)**)

If the **FLUX REF SEL** and the **EMF REF SEL** are set to 0, the overriding control system can command both references by means of the signal

FLUX/EMF REF SEL (45.02)	0:	LOCAL REF	use calculated flux reference and internal EMF reference **(41.19)**
	1:	EXT REF	use flux reference **FLUX REF (45.01)** and EMF reference **EMF REF (45.03)**

Note! The selection of the flux reference by means of FLUX/EMF REF SEL doesn't apply for the field exciter mode (**OPER MODE SELECT (15.16)** = 5).

At emergency stop, the local reference (calculated / internal) is forced.

In field control mode (**OPER MODE SELECT (15.16)** = 5), the sign of the selected EMV / voltage reference **V REF 1 (3.24)** is forced to the sign of the selected current reference **CUR REF 1 (3.28)**, if the current reference mode selector **REF SEL (43.15)** is set to 4. This is used for MG set applications.

EMF reference modification

The selected EMF reference value can be modified by

- adding a voltage correction value **V COR (46.10)**; the addition is done prior to the ramping
- limiting the slope of the voltage reference by parameter **V REF SLOPE (46.12)**
- adding a voltage step value **V STEP (46.11)**; the addition is done after the voltage reference ramp
- limiting the final voltage reference value against the limits
    - **V LIM P (46.13)**: positive limit
    - **V LIM N (46.14)**: negative limit

The resulting reference value **V REF 2 (3.25)** is the input value to the EMF controller.

EMF actual value selection

The scaling of the EMF actual voltage is

3786 == 135% of the nominal supply voltage (42.06).

In normal drive mode (**OPER MODE SELECT (15.16)** <> 5), the EMF actual value is calculated from the armature voltage. The calculated value can be filtered by means of parameter **EMF ACT FILT TC (46.06).** The filtered value is the relative EMF voltage **RL EMF VOLT ACT (1.17).**

In field exciter mode (**OPER MODE SELECT (15.16)** = 5), there are several choices for the EMF controller's actual value, due to the different converter configurations used for MG-set applications. The actual value **VOLT ACTUAL (3.23)** is selected by parameter:

V ACT CALC SEL (46.16)	0:	EXT	nothing is written to 3.23; e.g. FCB application can write to the actual voltage
	1:	EMF	use **RL EMF VOLT ACT (1.17)** (default value)
	2:	V SEL	use value selected by parameter **V ACT SEL (46.20)**
	3:	SEL	use value selected by parameter **I ACT SEL (46.19)** or **V ACT SEL (46.20)** (see below)
	4:	V SEL COMP	use value selected by parameter **V ACT SEL (46.20)**; value is compensated against voltage drop by means of R x I compensation

With the setting 3: SEL, the selected value is the output signal of a crossover switch, selecting either the signal addressed by parameters **I ACT SEL (46.19)** or selected by parameter **V ACT SEL (46.20)**. The switch is controlled by the logical OR of 2 boolean signals selected by the parameters **V I SEL 1 (46.21)** or **V I SEL 2 (46.22).**

V I SEL 1 (46.21) / V I SEL 2 (46.22):

0 = not used (default value)
1 = DI4
2 = not used
3 = DI6
4 = DI7
5 = DI8
6 = DO4
7 = DO5
8 = DO6
9 = DO7
10 = DO8

Note: The digital inputs DI1 ... DI3 and DI5 are not available for this function.

I ACT SEL (46.19) / V ACT SEL (46.20):

0 = zero
1 = AI CUR REF (3.30)
2 = AI V REF (3.29)
3 = AN IN 2 VALUE (5.03)
4 = AN IN 3 VALUE (5.04)
5 = AN IN 4 VALUE (5.05)

The R x I compensation activated with **V ACT CALC SEL** = 4 uses the parameters **ARM R (41.12)** and **ARM L (41.11).** In field exciter mode, these parameters do not define the impedance of the load connected to the converter, but define an impedance related to the values selected by **V ACT SEL** and **I ACT SEL.**

The relative resistance **ARM R (41.12)**:

$$ARM\_R = RA[\Omega] * 32768 * \frac{SCALE\_CURRENT}{SCALE\_VOLTAGE}$$

where	RA[Ω] =	armature resistance in Ohm
	SCALE_CURRENT =	nominal current [A] / numerical value of selected signal at that current (e.g. [4.05] / 4096)
	SCALE_VOLTAGE =	nominal voltage [V] / numerical value of Selected signal at that voltage (e.g. [42.06] • 1.35/3786)

The relative inductance **ARM L (41.11)**:

$$ARM\_L = \frac{LA[mH] * 358 * SCALE\_CURRENT}{scantime[ms] * SCALE\_VOLTAGE}$$

where	LA[mH] =	armature (load) inductance in mH
	scan time =	3,33 ms (constant in field exciter mode)
	SCALE_CURRENT =	nominal current [A] / numerical value of selected signal at that current (e.g. [4.05] / 4096)
	SCALE_VOLTAGE =	nominal voltage [V] / numerical value of Selected signal at that voltage (e.g. [42.06] • 1.35/3786)

PI - controller

The PI-controller corrects errors caused by the process, e.g. mains AC voltage variations.
The I-part of the controller is reset below a certain EMF-level since the rotor resistance value IxR would otherwise cause an erroneous result.
The level the I-part is released at is defined by the parameter:

EMF CON BLOCK LEV (46.05)	Integer scaling: 3786 = 135% of nominal supply voltage (see **(42.06)**) Default value = 2 % of supply voltage

Scaling of PI

P-gain of the controller is reduced above field weakening point by the factor 1/n in order to keep the process gain constant. The P-gain is set adjusted by means of the parameter

EMF CON KP (46.03) Scaling is internal unit

277	= 100 %	
150	= 0.54 (54%)	

Integration time doesn't depend on the speed and is separated from the P-gain value. The Integration time is adjusted by means of the parameter

EMF CON KI (46.04) Scaling is internal unit

32767	= 6.67 ms	field exciter mode
7282	= 30 ms	-“-
32767	= 20 ms	drive control mode
7282	= 90 ms	-“-

PI-controller output limitation

The output of the PI-controller is limited so that 100% of the final flux reference is the absolute maximum. The positive level of PI-controller is limited so that exactly at the field weakening point the positive limit is zero. Above the field weakening point the positive limit starts to increase in order to achieve a smooth transfer to the field weakening area (see below):

When **LOCAL EMF REF** is used, the PI-controller stucks at the positive limit as long as the flux reference is below the field weakening point, since the reference is fixed while the measured **EMF** is less.

Limits for the PI-controller are set by means of the parameters:

POS LIM EMF CON (46.01)	Integer scaling: 4096 = nominal flux Default value: +10%
NEG LIM EMF CON (46.02)	Integer scaling: 4096 = nominal flux Default value: -99.9 %

Force to Max. Possible Field

In case of **EMERCENGY STOP** the maximum possible field is forced to the flux reference regardless of other control references.

Forcing can also be done using the signal **FLUX/EMF REF SEL (45.02).**

12-PULSE OPERATION

In 12-pulse operation, two 6-pulse converters are connected in a special master/slave configuration. The 12-pulse connection is obtained by feeding to the slave a main voltage with an offset of 30 degrees compared to the master.
Note: The 12-pulse communication link acts independently from the drive-control related Master/Follower link of the AMC-DC board.

12-Pulse parallel

In 12-pulse parallel operation, the DC-sides of the 2 converters are connected in parallel; but separated by an interphase reactor. The master converter is e.g. speed-controlled, while the slave converter is current-controlled. Both the master and the slave converter receive the same current reference which is provided by the master.
The 12-pulse parallel connection benefits are:

- **Reduction of converter-caused effects on the system in the supply network:**
  ⇒ Reduced harmonics; different frequencies in the network.
- **Large output direct currents**: ⇒ Output current doubled due to parallel connection of two 6-pulse converters.
- **Improved current ripple content:** ⇒ Smaller current ripple content; higher frequency proportion, smaller oscillation torques.
- **Emergency operation at half torque possible**

12-Pulse serial

In 12-pulse serial operation, the DC-outputs of the 2 converters are connected in serial. The master converter is e.g. speed-controlled, while the slave converter is controlled via firing angle.
The 12-pulse serial connection benefits are:

- **Reduction of converter-caused effects on the system in the supply network:**
  ⇒ Reduced harmonics; different frequencies in the network.
- **Motors with voltages up to 1200 V:** ⇒ Output voltage doubled due to serial connection of two 6-pulse converters.
- **Improved current ripple content:** ⇒ Smaller current ripple content; higher frequency proportion, smaller oscillation torques.
- **Lower reactive power in sequential mode**
- **Emergency operation at half speed possible**

12-Pulse communication

The DCS600 converters are equipped with a separate DDCS link on the SDCS-CON-2 board for the 12-pulse communication (V260, located close to connector X7). Neither other signal connections, nor any communication setup is required, except of a communication timeout parameter **COMM TIMEOUT 12P (47.09)**. This parameter defines the allowed number of control cycles (3.3 ms at 50 Hz) without receiving a valid message. This parameter must be set from default 1 **to at least 4.**

One DDCS dataset to each direction is exchanged between the 2 converters. Their content is:

12-pulse communication via SDCS-CON-2 channel V260:

parallel mode:

12-pulse Master			12-pulse Slave	
3.09	control status of 12-pulse master	⇒	control status of 12-pulse master	3.09
3.12	armature current reference 3	⇒	armature current reference 3	3.12
---	---	⇒	---	---
3.10	control status of 12-pulse slave	⇐	control status of 12-pulse slave	3.10
2.21	act. armature current of 12-pulse slave	⇐	act. converter current	1.15
---	act. armature voltage of slave	⇐	act. armature voltage	1.13

serial mode:

12-pulse Master			12-pulse Slave	
3.09	control status of 12-pulse master	⇒	control status of 12-pulse master	3.09
1.13	act. armature voltage	⇒	act armature voltage of master	---
2.24	firing angle of slave	⇒	firing angle reference	3.13
3.10	control status of 12-pulse slave	⇐	control status of 12-pulse slave	3.10
2.21	act. armature current of 12-pulse slave	⇐	act. converter current	1.15
---	act. armature voltage of slave	⇐	act. armature voltage	1.13

12-Pulse configuration

In control engineering terms, the two converters are divided into a 12-pulse master converter and a 12-pulse slave converter. This is done by setting function specific (master/slave) parameters and signals (the 12-pulse realated signals and parameters are mentioned within this chapters; 12-puls parameters are mainly inside parameter group 47).

The 12-pulse mode is activated by setting the desired control mode to parameter

OPER MODE SELECT (15.16)	0:	6P SINGLE	6-pulse operation
	1:	**12P PAR MAS**	**12-pulse parallel master**
	2:	**12P PAR SLA**	**12-pulse parallel slave**
	3:	**12P SER MAS**	**12-pulse serial master**
	4:	**12P SER SLA**	**12-pulse serial slave**
	5:	FIELD EXC	field exciter mode

Switch-on/switch-off logic

The possible switch-on/switch-off options for the DCS600 are multifarious, as are the possible switching and operator control locations, like unit terminals, overriding control system, control panel CDP312 and Drive Window. So as not to loose this flexibility, we have refrained from changing the 6-pulse standard logic. It is left to the user's responsibility how to operate the units properly, i.e. the switch-on and switch-off logics must be planned in the overriding control system for the specific system involved.
The signal ELECTRICAL DISCONNECT should be fed from one common source to master and slave in parallel.

With software versions
DC15.204 (SDCS-CON-2)
DC15.606 (SDCS-AMC-DC)
or later, it is also possible to control the 12-pulse slave converter via the 12-pulse master converter by setting the parameter
COMMAND SEL (15.22) to 12P LINK (3) at the 12-pulse slave.

The commands ON, RUN, and RESET which are valid in the 12-pulse master are transfered to the 12-pulse slave via the 12-pulse link. They are used by the 12-pulse slave, if it is NOT in local mode.

It is recommended, to disable the LOCAL mode in the 12-pulse slaves by setting **LOCAL LOCK (16.04)** to **TRUE**.

Note: The RESET command from local control is always active.

Dynamic response

The dynamic response of the 12-pulse configuration is delayed in comparison to a 6-pulse converter by:

+0.5 control cycles due to the 30-degree offset between mains supply of master and slave

+3 up to 4 control cycles due to the behaviour on bridge reversal (see “bridge reversal”)

The signals are processed independently in each converter.

Measuring the currents in parallel mode

The armature current values display the current share provided by each converter, since the armature current signals are scaled to the individual unit. This also applies to DC-current parameters (e.g. the motor nominal current (99.03) has to be set to 50% of the 'real' rated motor current).

Current controller in serial mode

Measuring the current:
The same current flows through both the master and the slave.

Current control mode:
The current controller is located inside the master, and generates the firing angles for both units. The parameters for angle limitation (20.14, 20.15) must be set to the same values for both units.

In 12-pulse serial operation, it is possible to select sequential mode. Master and slave are running with different angles. Only one unit at a time is controlling, while the other is in a limit, corresponding to the minimum and the maximum firing angle. The benefit is a reduced reactive power load for the mains. The current waveform ranges from pure 6-pulse to pure12-pulse, and inbetween with mixed waveforms and differing current peaks.

SEQUENTIAL MODE (47.01)	**0:**	**NORMAL**	both converters are controlled with the same firing angle
	1:	**SEQUENTIAL**	sequential control of the firing angles; only one unit changes its firing angle, while the other fires at the upper or lower firing angle limit.

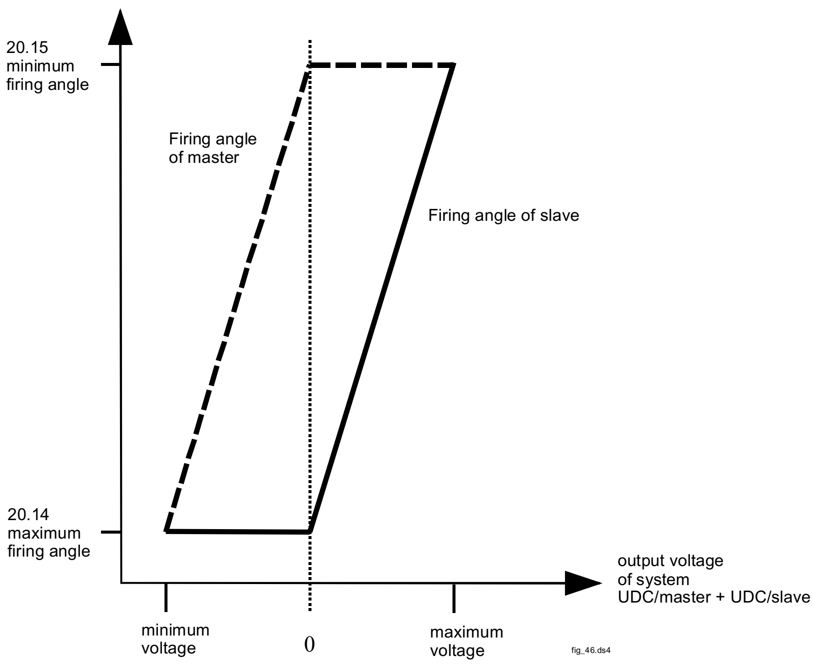


Figure 12-1Firing angle control in sequential mode

Controller adjustment:
Autotuning:
This has not yet been implemented in 12-pulse mode. It is proposed to determine the controller values using a unit in normal (6-pulse) operation. The values determined must then be appropriately corrected in 12-pulse serial mode:

- it can be assumed, that the values for **ARM CUR PI P-GAIN (43.02)**, **ARM CUR PI I-GAIN (43.03)** and **DISCONT CUR LIMIT (43.06)** will be approximately halved.
- The values for parameters **ARM L (41.11)** and **ARM R (41.12)** have to be halved, since the measured voltage values have been halved at the moment of measurement.

Extra commutation reserve (parameter 42.03):
This parameter is effective only, together with current feedback. If it's settings are changed, the current feedback has to be present at both, the 12-pulse master and the 12-pulse slave unit.

Measuring the voltage in serial mode:
The DC-voltage values display the voltage share provided by each converter, since the EMF and armature voltage signals in both the 12-pulse serial master and the 12-pulse serial slave are scaled to the individual unit. This also applies to DC-voltage parameters (e.g. armature overvoltage level, motor nominal voltage): these parameters must be set to the voltage share of the unit.

Depending on whether 1 or 2 motors are used, the following integer scalings apply:

	1 motor	2 motors
RL ARM VOLT ACT (1.13)	4096 == 1.35 • 2 • NOM SUPPLY VOLT (42.06)	4096 == 1.35 • NOM SUPPLY VOLT (42.06)
RL EMF VOLT ACT (1.17)	3786 == 1.35 • 2 • NOM SUPPLY VOLT (42.06)	3786 == 1.35 • NOM SUPPLY VOLT (42.06)
ARM VOLT ACT (1.14)	1 == 2V	1 == 1V
EMF VOLT ACT (1.18)	1 == 2V	1 == 1V

The parameters **ADJ UDC (47.10)** and **OFFSET UDC (47.11)** can be used to adjust the measured armature voltages to the aforementioned scaling, e.g. in case of different measurement channels (HW coding of PIN) for the armature and mains voltages:

$$ADJ\_UDC = \frac{nom\_converter\_DC\_voltage}{nom\_measured\_DC\_voltage} \bullet \frac{DC\_voltage\_coding}{AC\_voltage\_coding \bullet 1.35}$$

nom_converter_DC_voltage: nominal output voltage of 1 converter
nom_measured_DC_voltage: nominal voltage measured by the DC-voltage measurement channel

in standard configurations:
DC_voltage_coding == AC_voltage_coding • 1.35

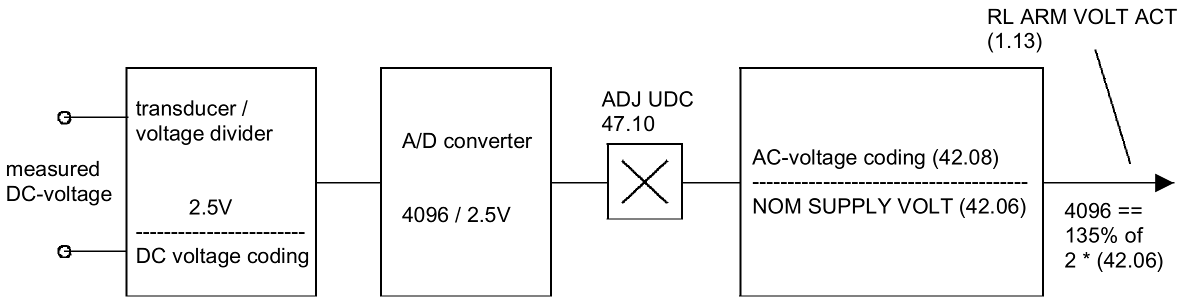


Figure 12-2 Armature voltage measurement chain

Different bridges

If the bridge 2 (regenerative mode) of a unit is different from the bridge 1, the voltage and current measurement can be adjusted accordingly by means of the parameters

ADJ IDC (47.02) Scaling factor (in per cent) to adjust the measured armature current of bridge 2 in case of different current measurements.

$$47.02 = \frac{100\% \bullet current\_ratio\_bridge\_2}{current\_ratio\_bridge\_1}$$

current_ratio: actual current / measured value

ADJ UAC (47.03) Scaling factor (in per cent) to adjust the internal EMF value used for EMF feed forward.

$$47.03 = \frac{100\% \bullet transformer\_voltage\_bridge\_2}{transformer\_voltage\_bridge\_1}$$

Note: bridge_2 ≙ revers bridge; bridge_1 ≙ forward bridge

Bridge reversal

With a 6-pulse converter, the bridge reversal is initiated by changing the polarity of the current reference. Upon zero current detection, the bridge reversal is started. Depending on the moment involved, the new bridge may be “fired” either in the same or in the next cycle. In addition, switchover can be delayed by a number of cycles programmed to parameter **REV DELAY (43.13)**, starting after zero current has been detected. Parameter (43.13) is the length of the forced current gap during a bridge changeover. This feature may prove useful when operating with large inductances. After the reversal delay the system changes to the selected bridge without any further consideration.
Note: If the bridge reversal takes more than 2 control cycles longer than the sum of the control cycles programmed to parameters **REV DELAY (43.13)** and **REV GAP (47.07)**, the fault **65 REVER FLT** (Reversal fault) is activated [F65 if T ≥ (43.13) + (47.07)+2]. Parameter (47.07) delays the reversal fault (F65).

In 12-pulse operation, the logic is the same as in 6-pulse operation. Depending on the firing angle, the current size, the current alteration, etc., the zero-current interval is extended by 1 to 2 cycles. In addition, the system keeps the current reference of the ramp output at 0 / -1, until both reversals (of 12-pulse master and of 12-puls slave) are finished. (**Note:** in serial operation, the slave’s current reference is set to a dummy value of 0 / -1 according to the master’s armature current reference).

If the bridge signals of master and slave are different for longer than the control cycles (3.3 ms at 50 Hz) programmed to parameter **REV FAULT DELAY (47.08)**, the fault **65 REVER FLT** (Reversal fault) is activated (by the master only). The parameter **REV FAULT DELAY (47.08)** must be greater than the sum of parameters **REV DELAY (43.13)** and **REV GAP (47.07)**. The two parameters **(43.13)** and **(47.07)** must be set to same values in both converters.

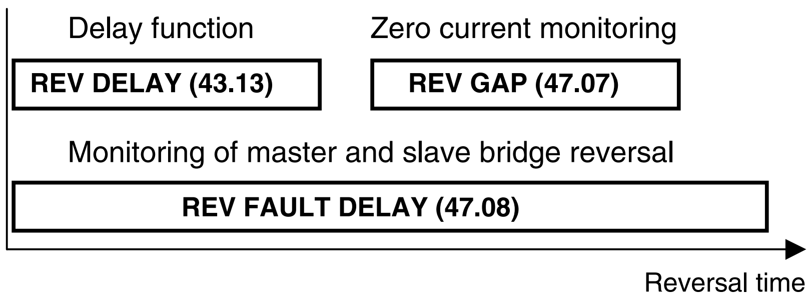


Figure 12/3: Time schedule for bridge reversal in 12 – pulse operation

Armature voltage adjustment

If the interface circuits of the armature voltage measurement is different from the one of the mains voltage measurement, the measured DC voltage values need to be adjusted. This can be done by means of the parameters

ADJ UDC (47.10)
OFFSET UDC (47.11)

For details, please refer to chapter **Measurements**.

Monitoring

In the 12-pulse parallel master, the following signals are available:
(The given scalings assume, that the parameter MOTOR NOM CURRENT (99.03) has been set to 50% of the motor's 'real' rated current, since it displays the rated current share of one converter.)

ARM CUR ACT SL (2.21)	12-pulse slave motor current. 100% corresponds to the share of the 'real' rated motor current provided by the slave converter, as programmed to parameter MOTOR NOM CURRENT (99.03).
ARM CUR ALL (2.22)	12-pulse motor current. Sum of the motor currents of both the master and the slave converter. 100% corresponds to the 'real' rated motor current.
CONV CUR ALL (2.23)	12-pulse current. Sum of the converter currents of both the master and the slave converter. 100% corresponds to the systems total current.

In the 12-pulse serial master, the following signal is available:

ARM ALPHA SL (2.24)	Firing angle of the 12-pulse slave converter.

Note: If other modes are active, this signals exist as well, but are not valid/updated.

In both the 12-pulse master and the 12-pulse slave converter, the current control status signals of both converters are available:

CTRL STAT MA (3.09)	current control state of the 12-pulse master
CTRL STAT SL (3.10)	current control state of the 12-pulse slave

	B0:	1: CURR CONTROL STAT (6.01) not zero
	B1:	Sign of CUR REF 3 (3.12)
	B2:	1: Bridge changeover is active
CTRL STAT **MA** only	B3:	1: RESET command to 12-pulse slave
CTRL STAT **MA** only	B4:	ON command to 12-pulse slave
CTRL STAT **MA** only	B5:	RUN command to 12-pulse slave
CTRL STAT **MA** only	B6:	OFF2_N (Emergency Off, low active)
CTRL STAT **SL** only	B7:	1: TRIPPED
CTRL STAT **MA** only	B7:	1: Command for dynamic braking

The 12-pulse slave and the 12-pulse master disable each other (firing angle to 150 deg) by means of the bit 0 in the exchanged current control status.

In 12-pulse parallel mode, the master converter monitors the slave current. If the currents of both converters differ more than the permitted difference programmed to parameter **DIFF CUR LIMIT (47.04)**, for more than the number of control cycles (3.3 ms at 50 Hz) programmed to parameter **DIFF CUR DELAY (47.05)**, the fault **66 CURR DIFF** (12-pulse current deviation) is activated.

If the 12-pulse communication timeout has been elapsed without receiving a valid DDCS message from the 12-pulse master, the slave activates the fault **67 12P COMM** (12-pulse communication fault). The same timeout monitoring is done by the 12-pulse master, too.

Fault Handling

The fault handling in the 12-pulse master is like in the 6-pulse mode. In addition, faults in the 12-pulse slave (notified by means of bit 7 in **CTRL STAT SL**) cause the 12-pulse master to trip as well (**F68, SLAVE DIS**).

Note! This fault is activated only, if no RESET command is active in the 12-pulse master. This ensures, that the master isn't tripped again, as long as the fault resetting of the 12-pulse slave via the 12-pulse link isn't completed.

Faults in the 12-pulse slave trip the slave immediately, if they occur in the converter control part (detected by the CON2-software). Faults detected in the AMC-board-software (communication faults, faults created by a function block application) are notified to the master by means of bit 7 in **CTRL STAT SL**. The complete 12-pulse converter is then switched off by the 12-pulse master. (This applies, if the 12-pulse link is selected for control word source by setting **COMMAND SEL (15.22)** to 12P LINK (3) at the 12-pulse slave.)

Faults in both the 12-pulse master and the 12-pulse slave can be reset at the master (slave only, if the 12-pulse link is selected for control word source). In addition, faults can be reset individually in the 12-pulse slave from the local control place in both local and remote mode. (The local mode for the 12-pulse slave is not recommended.)

Dynamic Braking

In case of 2 motors fed by the 12-pulse converter (e.g. in tandem mill applications), also the 12-pulse slave converter must control the dynamic brake contactor. For that reason, the dynamic brake command of the 12-pulse master is sent to the 12-pulse slave (bit 7 of **CTRL STAT MA**). Proper operation requires to

- select the 12-pulse link for the control word source of the 12-pulse slave
- set the **FAULT BRAKE SEL (15.09)** to the same value in both converters
- set the **EME STOP MODE (21.04)** to the same value in both converters

FIELD EXCITER MODE

The DCS600 MultiDrive can be operated as 3-phase field exciter DCF600.The converter current is a motor's field current (15.16 = FIELD EXC).

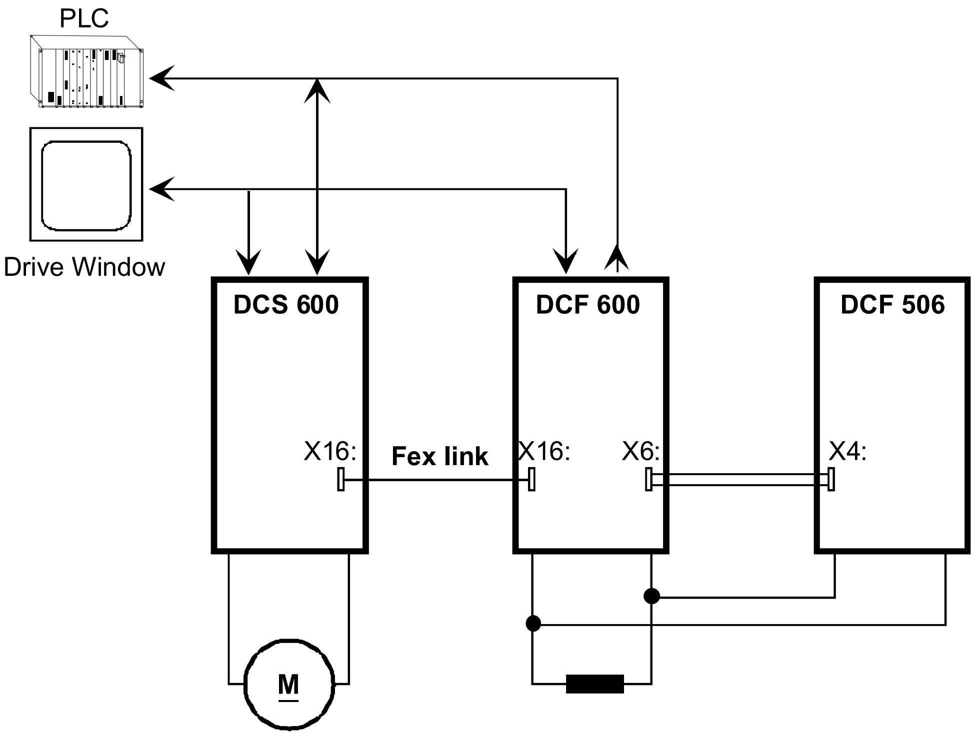


Figure 13-1Communication in field exciter mode

The three-phase field exciter can be fully controlled by X16: (Fex link).

For commissioning purpose it is recommended to connect the DCF unit also to Drive Window.

Also for monitoring purpose it can be connected the DCF unit to the PLC.

In field exciter mode, the actual current **LOAD CUR ACT (1.27)** isn't the armature current, but the field current. It is transferred via the FEX link to the connected armature converter.

The address of the DCS600 MultiDrive's FEX link must be programmed to the parameter:

FEXC NODE NUMBER (15.21)	1 ... 2

The FEX link is selected as source for the control word (for ON, RUN, RESET) by setting the parameter
COMMAND SEL (15.22) to FEX LINK (2) at the DCF600 field exciter.
The reference is selected by FLUX REF SEL(46.07 = to FEX LINK) and transmitted as relative value.
In the armature converter (DCS) the current is scaled (41.03).
In the field converter (DCF) the current is scaled (99.03).

Note: The RESET command from the local control place is always active.

The speed measurement as well as the related functions like overspeed monitoring are working also in the field exciter mode and can be used, if required by a certain application. If not needed, the speed feedback **SPEED FB SEL (50.03)** is recommended to be set to **EXTERNAL**. The default setting of the speed feedback selector **(CALC BY EMF)** causes an overspeed fault in field exciter mode.

Example for parameter of DCS used as excitation:

Armature Module (DCS):

Parameter	**Comments**
USED FEX TYPE (15.05)	set according to application
FIELD CONTROL MODE (15.06)	set according to application
MOT 1 NOM FLD CUR (41.03)	excitation current in A
FIELD 1 MIN TRIP (44.17)	sets min. excitation current trip level for “no field ack.” (F39)
MAX FEX COMM FLTS (44.24)	causes field exciter communication error (F33)
MAX FEX FAULTS (44.25)	blocks “no field ack.” (F39)
DEL MIN FLD TRIP (45.06)	delays min field trip “no field ack” (F39)

Excitation Module (DCF):

Parameter	**Comments**
OPER MODE SELECT (15.16)	set to FIELD EXC
FEXC NODE NUMBER (15.21)	set according to application
COMMAND SEL (15.22)	set to FEX LINK
DISCONT CUR LIMIT (43.06)	set to 0%
REV DELAY (43.13)	set to 15
REF SEL (43.15)	set to CURRENT (default)
FLUX REF SEL (46.07)	set to FEX LINK
SPEED FB SEL (50.03)	set to EXTERNAL to suppress overspeed fault (F37)
MOTOR NOM VOLTAGE (99.02)	rated excitation voltage in V
MOTOR NOM CURRENT (99.03)	rated excitation current in A

Control structure

The parameter **OPER MODE SELECT** changes the source for the current reference.

OPER MODE SELECT (15.16)	5:	FIELD EXC	Field exciter mode; current reference selected by **FLUX REF SEL (46.07)** and **REF SEL (43.15)**
	other:		Armature converter mode; current reference calculated from **2.13 / TORQUE USED REF**

Note: In field exciter mode, the parameter REV DELAY (43.13) should be set to an appropriate higher value according to the field inductance (e.g. Min: 4).

The following diagram shows the different converter control structures for drive control and field control.

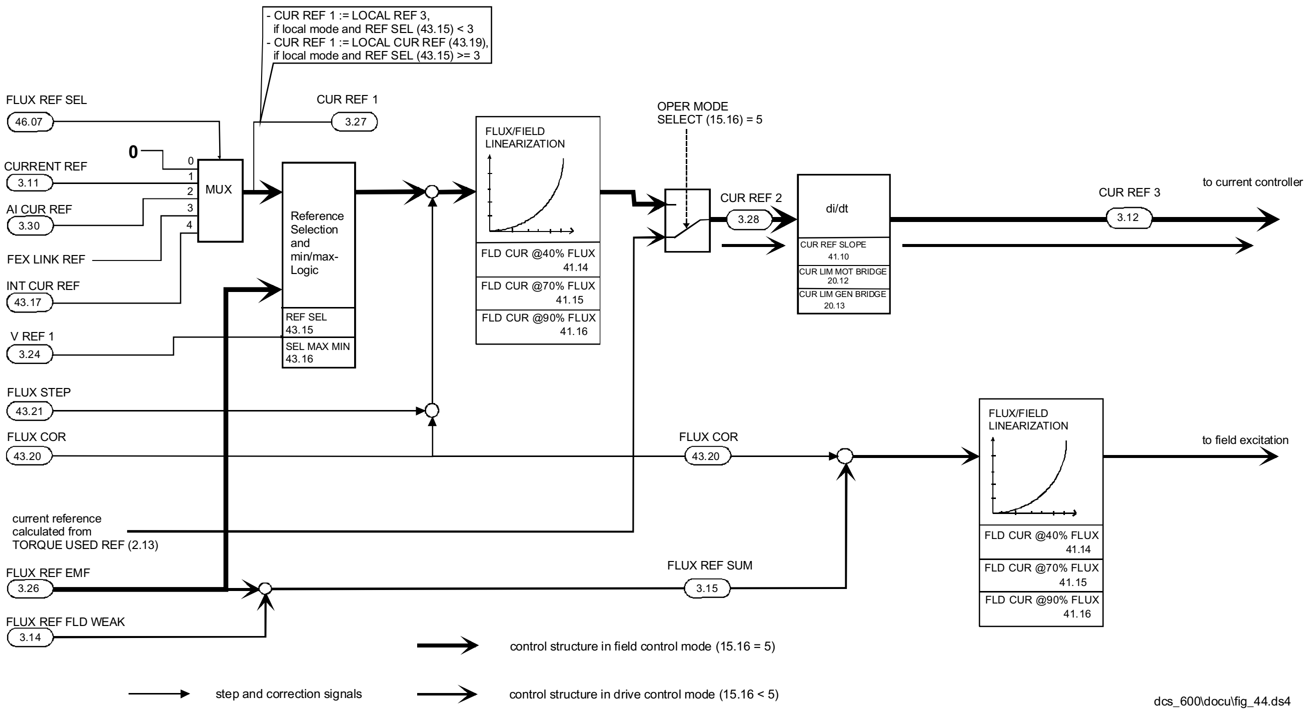


Figure 13-2Converter control structure in field exciter mode

Current reference

In the field exciter mode the functions generating the field current reference (EMF controller, field exciting) are included into the converter current control chain.

The current reference in field exciter mode is selected by the parameter

FLUX REF SEL (46.07)	0:	SEL REF	set to 0
	1:	EXT REF	external reference set by overriding control system (**CURRENT REF (3.11)**)
	2:	AI REF	reference **AI CUR REF (3.30)** from analogue input 1 value, filtered by **AI CUR REF TC (43.18)**
	3:	FEX LINK	read from FEX link
	4:	INT REF	internal current reference **INT CUR REF (43.17)**

In addition, a reference selection and min/max logic creates the active current reference according to the reference selection parameter:

REF SEL (43.15)	1:	CURRENT	use current reference selected by **FLUX REF SEL (46.07)**
	2:	VOLTAGE	use flux reference from voltage controller output **FLUX REF EMF (3.26)**
	3:	MIN/MAX 1	minimum or maximum absolute value (see parameter **SEL MAX MIN (43.16)**) of current reference or current reference from the voltage controller (see below) is selected
	4:	MIN/MAX 2	like MIN/MAX 1, but current reference **CUR REF 1 (3.27)** defines the sign of the voltage reference
	5:	MIN/MAX 3	like MIN/MAX 1, but voltage reference **V REF 1 (3.24)** defines the sign of the current reference

If **REF SEL** is set to values 3 … 5, the parameter **SEL MAX MIN (43.16)** is active:

0:	MAX	the maximum value is selected
1:	MIN	the minimum value is selected e.g. to ensure a minimum field current

A flux correction value **FLUX COR (43.20)** and a flux step **FLUX STEP (43.21)** is added to the resulting current reference.

The result **FLUX REF SUM (3.15)** can be linearized by means of a flux/field linearization curve. The behaviour of the linearization is programmed by 3 parameters, defining the current for 40%, 70% and 90% of nominal flux.
The resulting current reference is written to **CUR REF 2 (3.28)**, if the parameter **OPER MODE SELECT (15.16)** is set to **FIELD EXC**.

CUR REF 2 (3.28) is fed into the di/dt limitation and the reference limitation:

CUR REF SLOPE	**41.10**
CUR LIM MOT BRIDGE	**20.12**
CUR LIM GEN BRIDGE	**20.13**

The integer scaling of current reference and actual values is related to the load's nominal field current (4096 = 100%). For proper operation, the load's nominal current must be programmed to the parameter

MOTOR NOM CURRENT (99.03)	Field exciter mode: Nominal load current Integer scaling: 4096 = 100% of load's nominal current

Voltage control

In field exciter mode, the current reference can be generated by a voltage controller's output value **FLUX REF EMF (3.26).** Details about the voltage reference and control structure can be found in chapter **EMF CONTROL**.

Overvoltage protection

The digital input DI2 is assigned fixed to the signal from an external overvoltage protection unit. In case of overvoltage, the current controller is disabled (maximum firing angle, single pulses).

Disable any other functions, which have been assigned to DI2 previously (e.g. external fan acknowledge, see 12.14).

Load Monitoring

The connected load is monitored against overvoltage and minimum current. Packed boolean alarm signals are available. The levels as well as the time delay the alarms are generated after are programmable.

OVERVOLT ALARM L (43.22)	DC overvoltage alarm level in %. If 0, no monitoring
OVERVOLT ALARM DEL (43.23)	The time in ms after an overvoltage alarm is generated.
MIN CUR ALARM L (43.24)	DC overvoltage alarm level in %. If 0, no monitoring
MIN CUR ALARM DEL (43.25)	The time in ms after a minimum current alarm is generated
FIELD CON ALARM (6.06)	Packed boolean alarm signals: B0 = 1: overvoltage alarm is active. B1 = 1: minimum current alarm is active.

Fault Handling

The **F39 (NO FIELD)** at aramture converter contains all faults with field current below the limit. The reasons could be:

- Monitoring of field current MINIMUM LEVEL (44.17)
  (monitoring in the armature converter).
- Field exciter link Communication error *
  (monitoring in the armature converter).
- No Acknowledge signal from field DCF601/602 via field exciter link. It contains the sum of DCF current control faults.
  RESET of DCF with next ON command.

- Secondary fault after overcurrent (F39+F33). Monitoring of field current MAXIMUM Level (20.16)
  (monitoring in the armature drive).

Example:
Mains undervoltage in DCF601
causes F29 in DCF unit (field converter) + F39 in DCS unit (armature coverter)

Reset
DCF unit: Reset by next ON command after RESET of aramture converter.
DCS unit: reset by RESET command

* **Note**: To avoid interference problems of digital communication and different cycle times F39 can be delayed by (45.06). It is recommended to set (45.06) =1 or higher inside the armature converter.

Note: Tuning of field exciter DCF600 and monitoring signals in case of fault trips of the field current must be done with the unfiltered (fast) signals:
(3.19) Field current relative armature converter
(1.13) DC Voltage relative (only DCF601/602)
(1.15) DC current relative (only DCF601/602)
the physical signals are filtered with 500ms ((3.20) field) and 10ms ((1.16), (1.14) armature) are too slow.

Note: In Field exciter mode the sum of all alarm words is fed to the signal (6.05 bit 5) (Default output DO2).

ANALOG AND DIGITAL I/O

Digital Inputs

The digital inputs consist of 8 connections. With the I/O extension board SDCS-IOE-1, 7 additional inputs are available. All the connections of the 8 standard inputs are on the **SDCS-IOB-2** board (or **SDCS-CON-2**, if SDCS-IOB-2 is not used). The digital inputs are isolated and filtered. The time constant for filters can be selected. Input voltage levels are 24 V dc...48 V DC, 115 V AC or 230 V AC depending on the hardware of the board.
The update time for all DI's is 3.3 ms. However, the transfer cycle to the AMC board for application programming purposes is 8ms.

Digital inputs DI1-DI8 are configurable and they can be used in several purposes, like:

- acknowledge of main contactor
- acknowledge of converter fan
- acknowledge of external fan
- acknowledge of external field exciter
- disable local-mode
- disable ON-command
- motor temperature protection(Klixon)
- external fault and alarm
- application program of the overriding control system or the drive control (by means of FCB-programming inside the AMC board).
- acknowledge signals from non-ABB field exciters (not DI1 ... DI3 and DI5)
- selection of current and voltage actual values in field control mode (not DI1 ... DI3 and DI5)

Restrictions:

- In field exciter mode,
  OPER MODE SELECT (15.16) = FIELD EXC (5)
  the digital input DI2 is assigned fixed to the signal from an external overvoltage protection unit.

- In local I/O control mode,
  COMMAND SEL (15.22) = LOCAL I/O (1)
  the digital inputs DI6 ... DI8 are assigned fixed to the following functions:
  DI6 = RESET
  DI7 = ON
  DI8 = RUN

- The digital input DI7 is assigned fixed to the position counters SYNC input (if synchronizing via DI is selected).

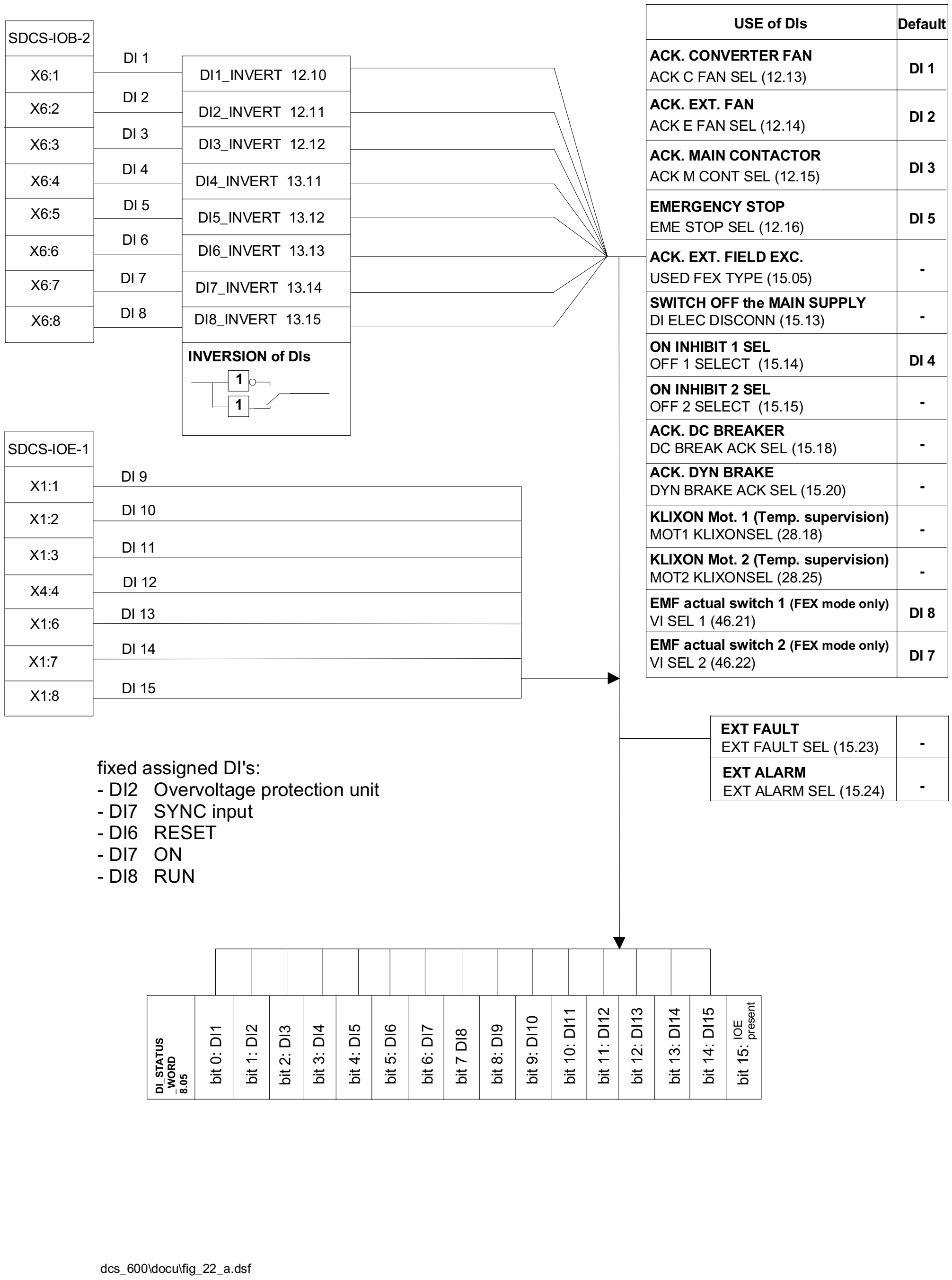


Figure 14-1Digital inputs of DCS600 MultiDrive and their usage

Digital Input Status Word

The digital input signals can be read from the packed boolean signal **DI STATUS WORD (8.05)**:

			default connected to:
Bit 0:	**DI1:**	**configurable**	**ACK. CONERTER FAN**
Bit 1:	**DI2:**	**configurable**	**ACK. EXT. FAN**
Bit 2:	**DI3:**	**configurable**	**ACK. MAIN CONTACTOR**
Bit 3:	**DI4:**	**configurable**	**ON INHIBIT 1 SEL**
Bit 4:	**DI5:**	**configurable**	**E-STOP**
Bit 5:	**DI6:**	**configurable**	**-**
Bit 6:	**DI7:**	**configurable**	**EMF ACTUAL SWITCH 2**
Bit 7:	**DI8:**	**configurable**	**EMF ACTUAL SWITCH 1**
Bit 8:	**DI9:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 9:	**DI10:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 10:	**DI11:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 11:	**DI12:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 12:	**DI13:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 13:	**DI14:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 14:	**DI15:**	**configurable for External Fault/Alarm * (SDCS-IOE-1)**	
Bit 15:	**1 == SDCS-IOE-1 is connected to SDCS-CON-2**		
	*** and available for application program**		

configurable: The DI can be selected for several converter functions; inversion function is available; in addition, it may be used for application programmingas well as for external alarm and fault.

available for application program: The DI is not selectable for converter functions, but is available for application programming as well as for external alarm and fault.

The DI STATUS WORD is always transferred from the CON2 to the AMC-DC board; thus there is no need to select it for updating by means of a group 94 index pointer.

Note: The emergency stop input is active low, if the according parameter DIG IN x INVERT (13.xx) is set to INVERTED.

Digital Outputs

Digital outputs consist of 8 connections. All the connections are on the **SDCS-IOB-2**- board (or **SDCS-CON-2**, if SDCS-IOB-2 is not used).
Two outputs are isolated by means of optocouplers, while the others are isolated by means of relays (if SDCS-IOB-2 is being used).

Connections of the digital output are made by means of parameters selecting the difital output's source index and bit position within the selected index.

Selecting the source index:	Selecting the source bit position:
DIG OUT 1 INDEX (12.02)	**DO1 BIT NUMBER (12.03)**
DIG OUT 2 INDEX (12.05)	**DO2 BIT NUMBER (12.06)**
DIG OUT 3 INDEX (12.08)	**DO3 BIT NUMBER (12.09)**
DIG OUT 4 INDEX (14.10)	**DO4 BIT NUMBER (14.11)**
DIG OUT 5 INDEX (14.13)	**DO5 BIT NUMBER (14.14)**
DIG OUT 6 INDEX (14.16)	**DO6 BIT NUMBER (14.17)**
DIG OUT 7 INDEX (14.19)	**DO7 BIT NUMBER (14.20)**
DIG OUT 8 INDEX (14.22)	**DO8 BIT NUMBER (14.23)**

Any packed boolean or boolean signal of DCS600 MultiDrive can be connected to DO's (Booleans: select bit 0).
Note: If bits from an AMC-resident index are selected, which isn't of datatype I, B or PB, the bit numbers 8 ... 23 must be selected instead of bit numbers 0 ... 15.

The overriding control system can also command the digital outputs. In this case the parameter DOx IND is set to zero. If zero, the program reads the according digital outut's source bit from the **AUX CONTROL WORDS (7.02, 7.03).**

Digital outputs can also be inverted by parameter(s): 1==invert.

DIG OUT 1 INVERT (12.01)
DIG OUT 2 INVERT (12.04)
DIG OUT 3 INVERT (12.07)
DIG OUT 4 INVERT (14.09)
DIG OUT 5 INVERT (14.12)
DIG OUT 6 INVERT (14.15)
DIG OUT 7 INVERT (14.18)
DIG OUT 8 INVERT (14.21)

Note 1: Digital output 8 is only available as relay output at the power supply module, if no SDCS-IOB-2 is used.

Note 2: If a relay output is required for the main contactor on command, and no SDCS-IOB-2 is used, the digital output 8 (relay output at the power supply module) can be used to switch the main contactor by programming:
DIG OUT 8 INDEX [14.22] = 605
DO8 BIT NUMBER [14.23] = 6

Restrictions:
In field exciter mode,
OPER MODE SELECT (15.16) = FIELD EXC (5)
the digital output DO2 is assigned fixed to the converter alarms.

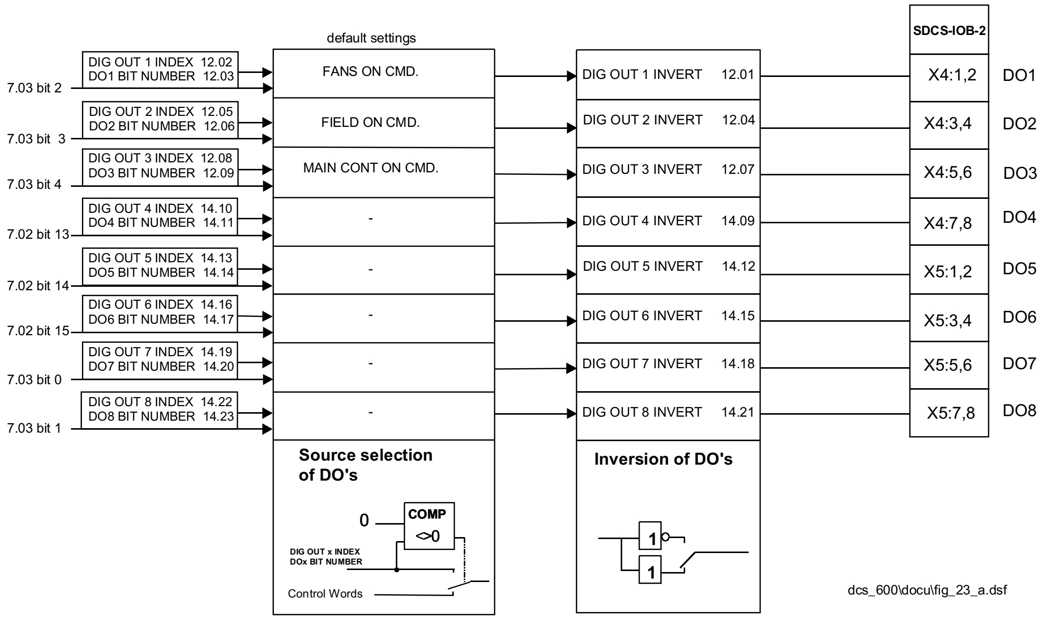


Figure 14-2 Structure of the digital outputs.

Note:
After changing the source index of digital outputs (DIG OUT 1 INDEX ... DIG OUT 8 INDEX), the digital outputs are invalid for up to 100ms. Thus, it is not recommended to change the digital output's source indexes, while the converter is running.

Analogue Inputs

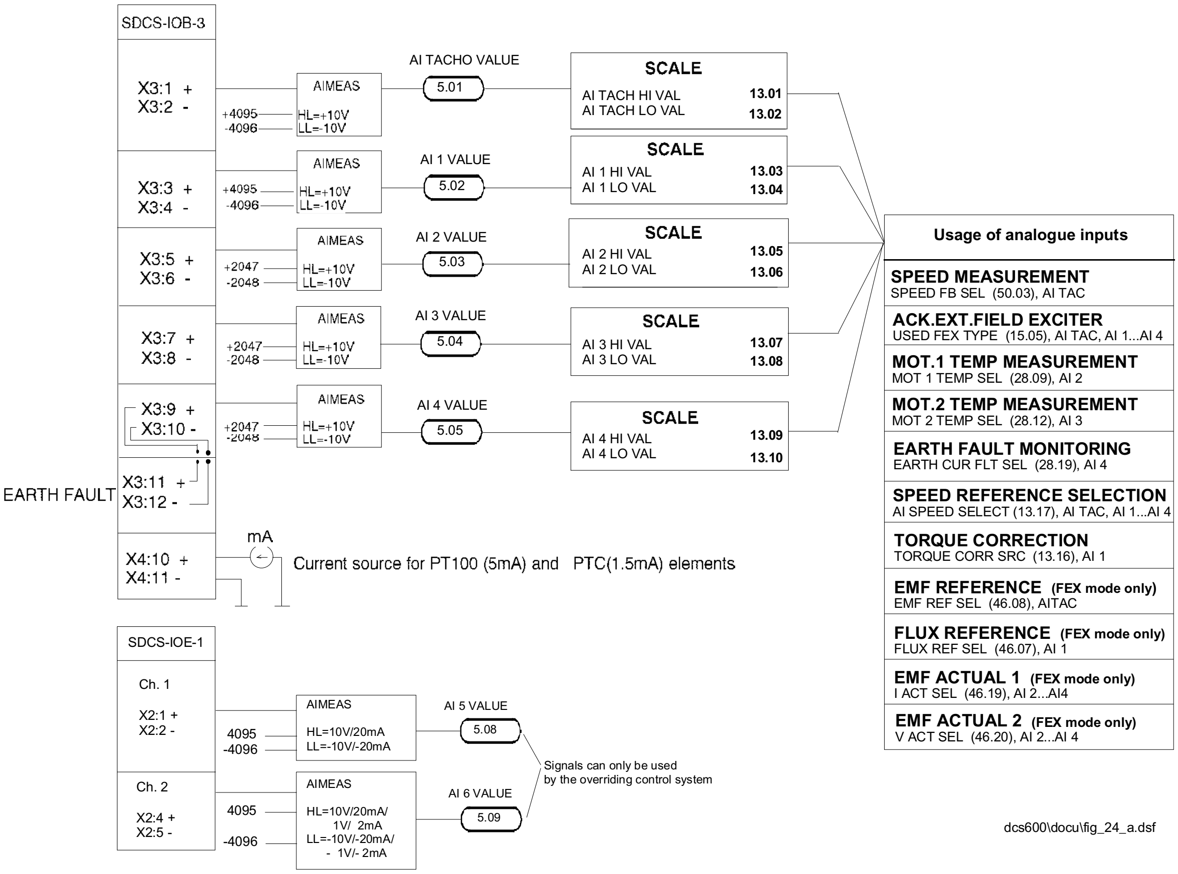


Figure 14-3 Structure of DCS600 MultiDrive's analogue inputs.

5 analogue input channels are available. 2 additional analogue inputs are available with the I/O extension board SDCS-IOE-1, see below). All connections are on the **SDCS-IOB-3** board (or **SDCS-CON-2**, if SDCS-IOB-2 is not used). All channels of the **standard I/O** are programmable and can be scaled according to the needs of the applications. Resolution of channels 1...2 is 12 bits +sign and channels 3...5 11 bits +sign.

SDCS-IOB-3:

- input range: -10 V...+10 V, 0/4 mA...20 mA, -1 V...+1 V (ch. 3 and ch. 4)
- The input range is selected by jumpers of the board, see figure below
- all analogue inputs are galvanically isolated
- current generator for PT100 (5 mA) and PTC (1,5 mA) elements
- Earth fault monitor input

Analogue inputs can be used for following internal applications:

- acknowledge of external field exciter if **USED FEX TYPE (15.05)** = 9..13
- speed measurement if **SPEED FB SEL (50.03)** = 4
- temperature measurement(s) of the motor(s)
  (see chapter MOTOR PROTECTION)
- torque correction via analogue input 1 (if **TORQUE CORR SRC (13.16)** = 1)
- speed reference (selection with parameter **AI SPEED SELECT (13.17)**)
- earth fault monitoring (see chapter EARTH FAULT MONITORING)

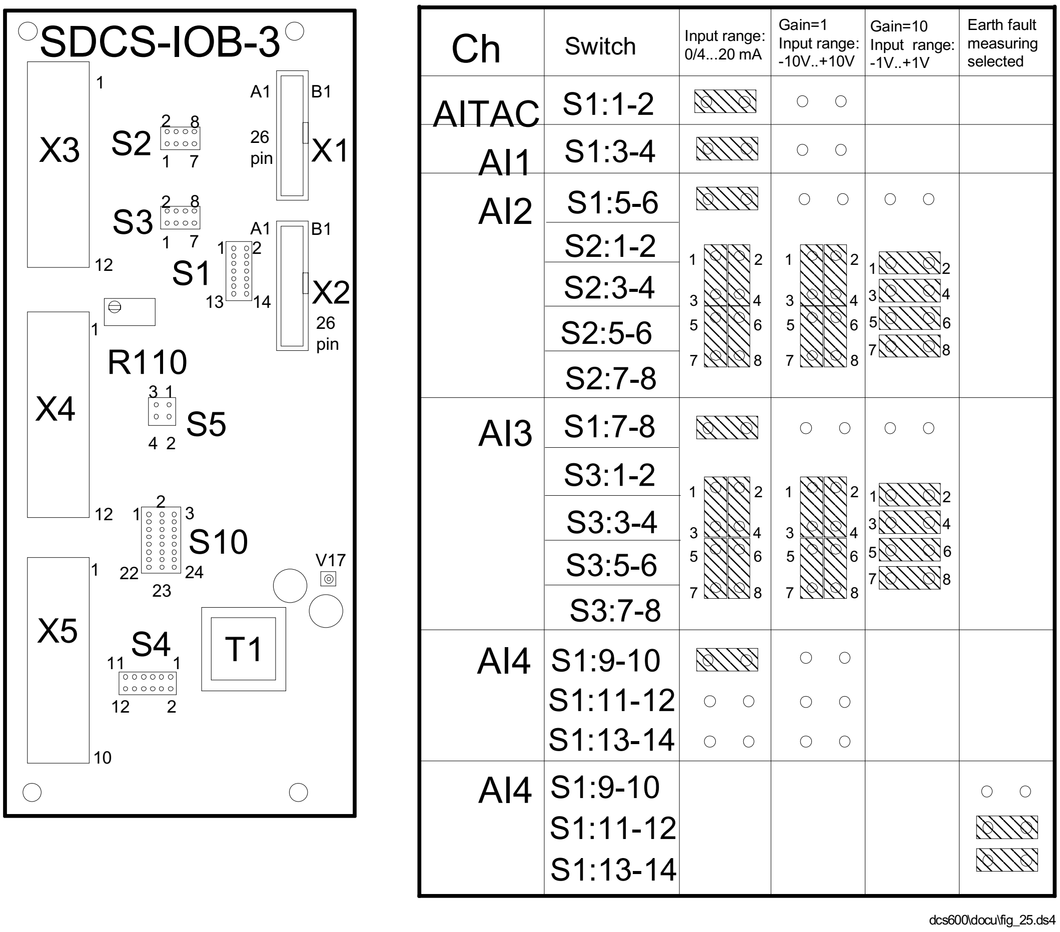


Figure 14-4 Jumper coding of the analogue inputs.

Current source settings for PT100 and PTC elements are following:

S5: 1-2 closed	**S5**:3-4 open	1,5 mA	(PTC)
S5: 1-2 open	**S5**:3-4 closed	5 mA	(PT100)

Analogue Outputs

Three (3) analogue output channels are available. All connections are at the **SDCS-IOB-3**-board (or **SDCS-CON-2**, if SDCS-IOB-2 is not used). The first two outputs are programmable. The range of outputs is +10V...-10V, while the resolution is 11 bits + sign.

The third output is fixed and used for indication of armature actual current directly from HW measurement. The basic scaling of the output is: 3V equals to the **converter's** nominal current.
The gain can be adjusted by means of potentiometer R110 in the SDCS-IOB-3 board.

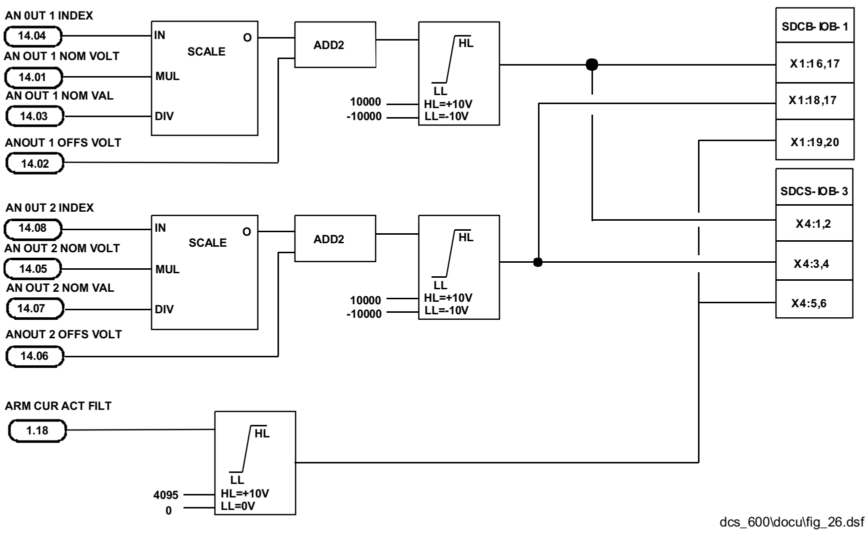


Figure 14-5 Structure of the analogue outputs.

The signal selections for analogue outputs are made by the parameters

AN OUT 1 INDEX (14.04)	0 or 506 = overriding control system commands analogue output 1 <>0 = signal group and index for analogue output 1
AN OUT 2 INDEX (14.08)	0 or 507 = overriding control system commands analogue output 2 <>0 = signal group and index for analogue output 2

If a selected signal doesn't exist, the according analogue output is set to 0.

The output is scaled by means of the parameters

AN OUT 1 NOM VOLT (14.01)	Output voltage 1 in mV when the connected signal equals to the value given by parameter **(14.03)** Integer scaling: 1 = 1mV
AN OUT 1 NOM VAL (14.03)	Nominal value of the connected signal
AN OUT 2 NOM VOLT (14.05)	Output voltage 2 in mV when the connected signal equals to the value given by parameter **(14.07)** Integer scaling: 1 = 1mV
AN OUT 2 NOM VAL (14.07)	Nominal value of the connected signal

An offset voltage can be set by means of the parameters

ANOUT 1 OFFS VOLT (14.02)	Integer scaling: 1 = 1mV.
ANOUT 2OFFS VOLT (14.06	Integer scaling: 1 = 1mV.

I/O-Extension Board

The I/O extension board SDCS-IOE-1 provides additional 7 digital inputs and 2 analogue inputs.

The digital inputs are described together with the standard digital inputs above. The 2 analogue inputs are available for application programming.

AN IN 5 VALUE (5.08)
Signal measured at the analogue input 5 (channel 1 of the SDCS-IOE-1). The nominal value depends on the jumper setting on the DCS-IOE-1

- 10V, range +/-10V
- 20mA, range +/-20mA

AN IN 6 VALUE (5.09)
Signal measured at the analogue input 6 (channel 2 of the SDCS-IOE-1). The nominal value depends on the jumper setting on the DCS-IOE-1

- 10V, range +/-10V
- 20mA, range +/-20mA
- 1V, range +/-1V
- 2mA, range +/-2mA

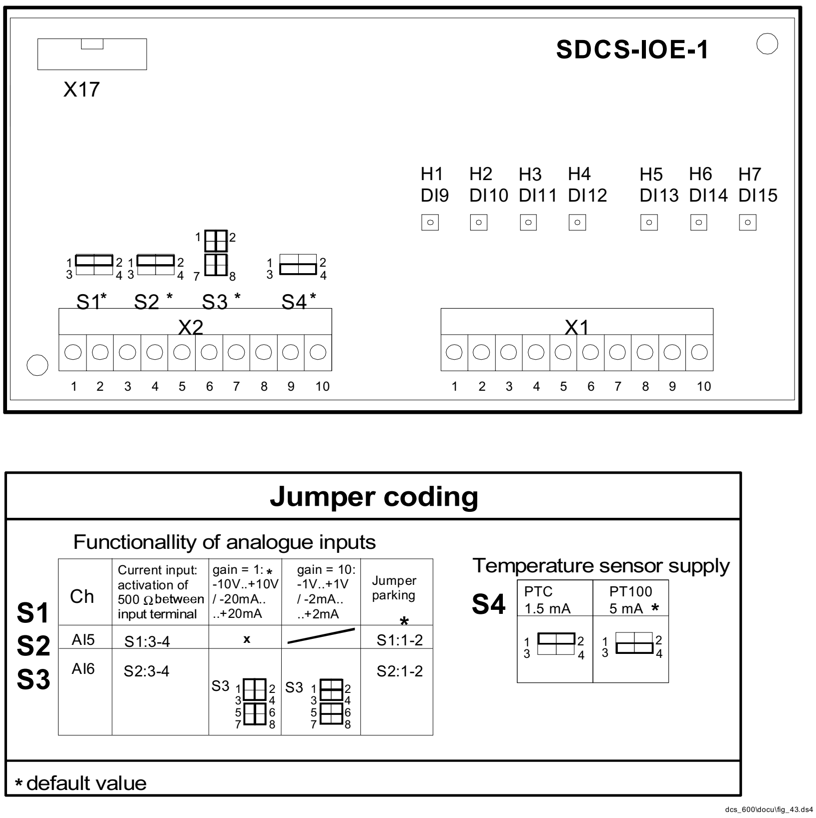


Figure 14-6 SDCS-IOE-1 and its jumper settings.

I/O-Board Configuration

The parameter **IO BOARD CONFIG [98.08]** selects the IO boards connected to the SDCS-CON2 board. The SDCS-IOB2 and SDCS-IOB3 boards do not extend the amount of available I/O resources, but change their electrical behaviour.

0: **NO I/O BOARD**
1: IOB2
2: IOB3
3: IOB2+3: SDCS-IOB2 + SDCS-IOB3

The SDCS-IOE board extends the amount of available I/O resources.

4: **IOE**: SDCS-IOE
5: **IOE+IOB2**: SDCS-IOE + SDCS-IOB2
6: **IOE+IOB3**: SDCS-IOE + SDCS-IOB3
7: **IOE+IOB2+3**: SDCS-IOE + SDCS-IOB2 + SDCS-IOB3

This parameter configures the I/O board supervision. A selected board must be present, a present board must be selected. Otherwise a fault **"44 NO I/O"** is generated.
The configuration of the available I/O resources is done by means of parameters inside the I/O-SETTINGS groups 13, 14).

Update Times of I/O

The update times given below are the sum of the cycle times of all involved SW-tasks. Thus, the given times are longer than the cycle time of the I/O-driver software.

Analogue inputs	5.3 ms
Digital inputs DI1 ... DI8	5.3 ms
Digital inputs DI9 ... DI15	22.0 ms
Analogue outputs	2.0 ms, if source in the CON-2 board 4.0 ms, if source in the AMC-DC board
Digital outputs	3.3 ms, if source in the CON-2 board 5.3 ms, if source in the AMC-DC board

ELECTRICAL DISCONNECTION

The start sequence can be prevented by digital inputs. This is normally used during maintenance of the motor. The operation of the current controller is also prevented.

The overriding control system can monitor the status of the electrical disconnection by reading bit 4 **ON_DISABLED** from the **AUX STATUS WORD (8.02)**.

DI4 is selected to control the OFF1 state as a default.

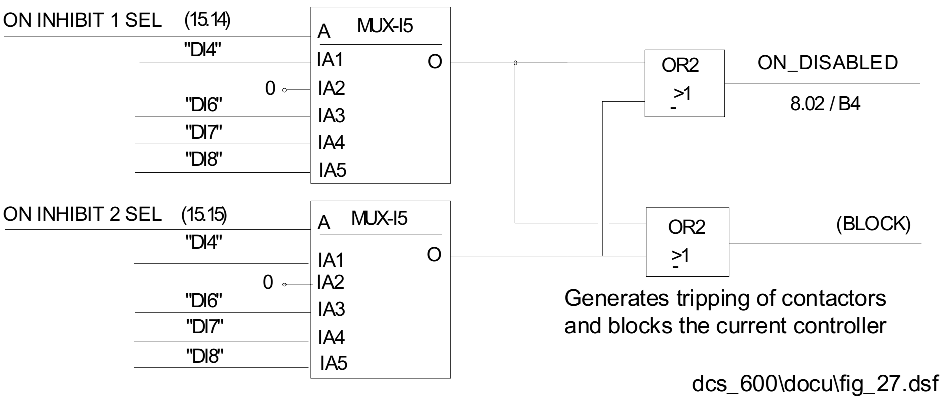


Figure 15-1The selections of the electrical disconnection.

The selections of the OFF-commands are made by the parameters:

ON INHIBIT 1 SEL (15.14):
ON INHIBIT 2 SEL (15.15):

0 = not used (default value of **ON INHIBIT 2 SEL**)
1 = DI1
2 = DI2
3 = DI3
4 = DI4 (default value of **ON INHIBIT 1 SEL**)
5 = DI5
6 = DI6
7 = DI7
8 = DI8

DC-BREAKER

The DC-breaker is used to protect the motor from overcurrent or, in case of mains under voltage, the generator bridge from blowing up.

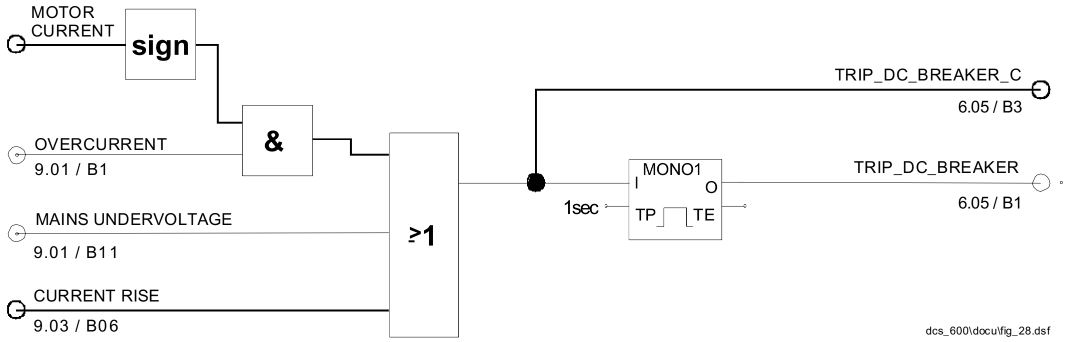


Figure 16-1Control of the DC-breaker.

The program produces the signal **TRIP_DC_BREAKER** (bit **1** of **CON2 BITS (6.05)**) on

- overcurrent
- undervoltage in regenerative mode

If a DO-channel is assigned to this signal, the DO-channel is updated as fast as possible (immediately after detecting the tripping situation).

The DC-breaker is opened also in case of too fast current rise (see chapter motor protection), and in case of dynamic braking.

The active acknowledge of a DC breaker disables the drive. This situation as well as the acknowledge of the dynamic brake contactor create the alarm 125 (alarm text "**25 NO ACK**").

DYNAMIC BRAKING

In cases of emergency stop or a communication break to the overriding system the drive can be stopped by using the function ***dynamic braking*** in order to transfer the power of the machine inertia into the braking resistor.

The function opens the main contactor (and trips the DC-breaker, if present). The field excitation is kept activated ("ON"). After either the acknowledge signal of the main contactor is "OFF", or the acknowledge signal of the DC breaker is "ON", the function generates the signal used to connect braking resistors in parallel to the armature circuit.

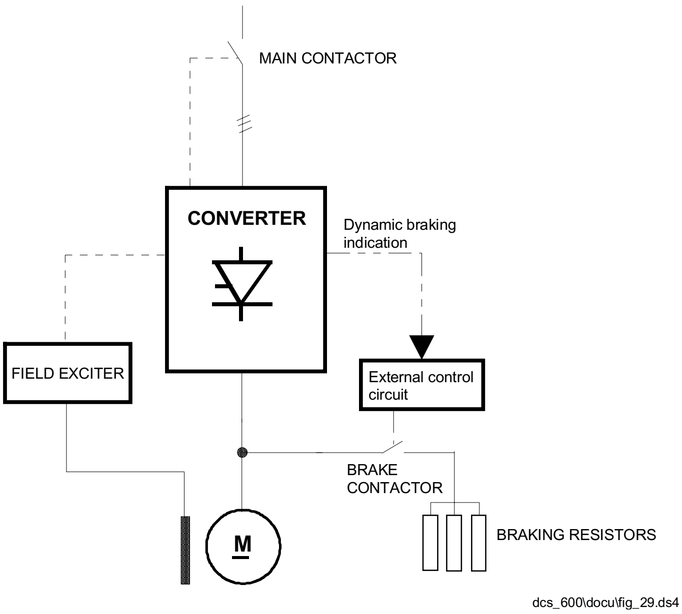


Figure 17-1Application example of dynamic breaking.

One channel of DO's is connected to the signal

DYN_BRAKE_ON bit **2** of **CON2 BITS (6.05)**

The overriding control system must keep the ON-command active during braking. Otherwise the field contactor will open.

The active acknowledge of a DC breaker disables the drive. This situation as well as the acknowledge of the dynamic brake contactor create the alarm 125 (alarm text "**25 NO ACK**").

The function is activated by the parameters:

CH0 COM LOSS CTRL (70.05)

0:	DYN BRAKING	use dynamic braking in case of communication time-out

EME STOP MODE (21.04)

0:	DYN BRAKING	use dynamic braking in case of emergency stop

STOP MODE (21.03)

0:	DYN BRAKING	use dynamic braking in case of stop in local mode or local I/O mode

In addition, the dynamic braking can be activated by setting the bit 4 DYN_BRAKE_ON_APC of the **AUX CONTROL WORD (7.02).**
At the same time the RUN bit (MCW (7.01) bit 3) must be reset to [0].

Dynamic braking is possible only, if at least one of the acknowlege signals of the main contactor or the DC-breaker is assigned to one of the digital inputs DI1 ... DI. Accordingly, at least one of the DI selectors

ACK M CONT SEL (12.15)
DC BREAK ACK SEL (15.18)

mustn't be set to NOT USED (0).

Note!
When the selections for parameters 70.05, 21.03 and 21.04 (see above) are choosen, please take into account in case of a DC breaker is being used, that the DC breaker is tripped also at dynamic braking.

SHARED MOTION

If one converter controls two motors, the connections for motors are made with external contactors. Both motors have still their own field exciters. The field exciter called "first field exciter" is controlled normally. Another field exciter for the motor 2 is controlled only by using constant field current reference. This function is used e.g. in the crane application where one motor is used for lift the load with adjustable field and the other motor is used e.g. moving the whole crane. Only one motor is driven simultaneously.

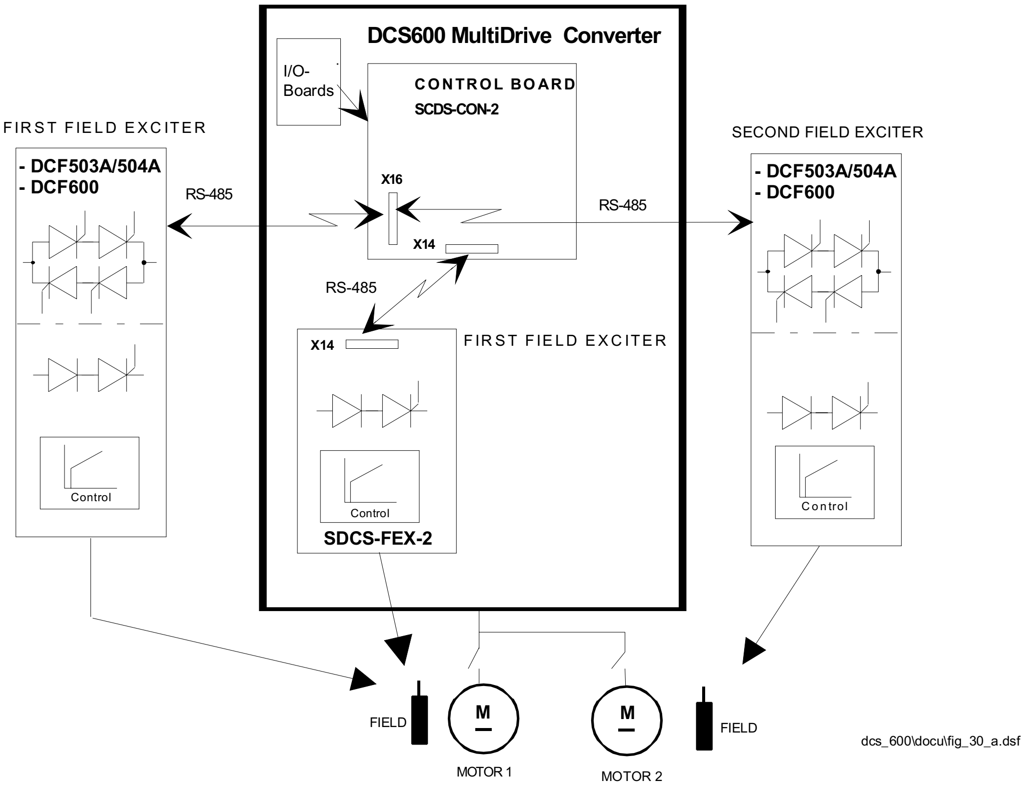


Figure 18-1Principle of shared motion.

The type of the first field exciter can be either SDCS-FEX-2 or DCF503A/504A or DCF600. The second unit must be DCF503A/504A or DCF600.

Note: The address of the RS485 is set as follows:

	DCF 50x	DCF 50xA	DCF 600
Node 1	-	X800:1 = OFF	Parameter (15.21) = 1
Node 2	jumper X2:4 - X2:5	X800:1 = ON	Parameter (15.21) = 2

The control program of the armature converter includes parameters and signals for both field exciters. However, the control parameters of a DCS600 operated as field exciter DCF600 must be set at that unit (e.g. by DriveWindow), since it doesn’t read the according parameters on power-up from it’s armature converter.

For more details about the DCF600, please refer to the chapter “Field Exciter Mode“.

If type of the motors or settings of controllers for motors are different the changes of these parameters must be handled by means of APC, AC80 application program or by changing the APPLICATION MACRO (99.11).

POWER LOSS MONITORING AND AUTO-RECLOSING

The Auto-Reclosing function allows to continue drive operation immediately after a short mains failure without any additional functions of the overriding control system.

In order to keep the overriding control system and the drive control electronics running through the short network dip, a UPS is always needed for 220 V AC auxiliary voltage. Without the UPS all DI-signals like emergency stop, faulty start inhibition (OFFx), acknowledge signals etc. would have false states although the system itself would stay alive.

The Auto-Reclosing function defines whether the drive is tripped immediately by mains under-voltage or if the drive will continue running after the mains voltage returns.

Short Power Loss

The supervision of main supply under voltage has two limits,

U NET MIN 1 (40.01)	alarm level
U NET MIN 2 (40.02)	tripping level (for U NET MIN 1 > U NET MIN 2).

If the mains voltage falls below the **U NET MIN 1 (40.01)** limit but stays above the **U NET MIN 2 (40.02)** limit, the following actions take place:

- Firing angle is set to max.
- Half pulses are applied in order to extinguish the current as fast as possible
- The alarm "**18 MAIN UVLT**" is generated.
- During net failure the speed ramp output is updated from the measured **MOTOR SPEED (1.04)**.
- the output of the EMF-controller is frozen.

If the mains voltage returns before the time defined by parameter **POWER DOWN TIME (40.03)** and the overriding control system keeps the commands "ON" and "RUN" = 1, the drive will start after 2 seconds. Otherwise the drive trips after this power down time has elapsed (fault "**29 MAIN UVLT**")

The control circuits of the main contactor must be supplied during the power down time.

During the power down time the field acknowlege is blocked. If the drive is also loosing the field current, the field current control setting must avoid a field current overshoot during refiring the field.

When the mains voltage drops below the limit **U NET MIN 2 (40.02)** , the action is selected by means of the parameter

PWRLOSS TRIP (15.04)

0	**IMMEDIAT**	the drive will trip immediately to the fault: "**29 MAIN UVLT**".
1	**DELAYED**	The drive starts automatically if possible (see **U NET MIN 1** above). Below the limit **U NET MIN 2** the field acknowledge signals are ignored.

Note: The U NET MIN 2 level isn't monitored, unless the mains voltage drops below the U NET MIN 1 level. Thus, for proper operation, U NET MIN 1 must be programmed to a higher value than U NET MIN 2.

If UPS is not available, **PWRLOSS TRIP (15.04)** *should be set to 0 (IMMEDIAT, the drive will trip to the mains under voltage fault) to avoid secondary phenomena due to missing power for DIs or AIs.*

Drive Behaviour During Auto-Reclosing

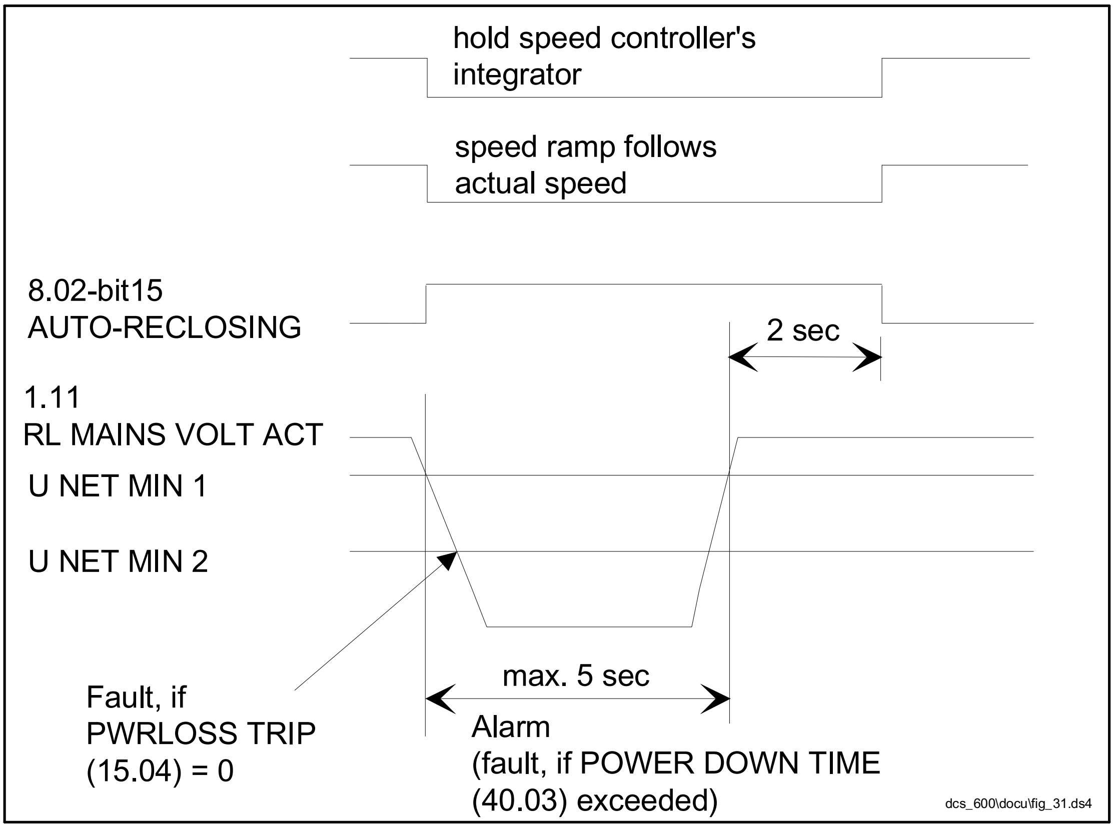


Figure 19-1Auto-reclosing

Loss of Auxiliary Supply Voltage

If the 220 V AC auxiliary supply voltage fails while the drive is running, the fault
"**01 AUX UVOLT**"
is generated and written to the fault logger.

If the 220 V AC drops on stand-still, the alarm
"**32 AUX UVOLT**"
is generated and written to the fault logger.

EARTH FAULT MONITORING

The earth fault indication is based on a sum current transformer T1 in the AC-side of the converter. The secondary side is connected to the analogue input channel AI4 of the SDCS-IOB-3-board. The sum current of three phases has to be zero, otherwise an earth fault is detected. The earth fault protection is activated by means of the parameter:

EARTH CUR FLT SEL (28.19)

0 **NOT USED** (default value)
1 **ACTIVATED**

The earth fault current tripping level is set in Amps to the parameter:

EARTH CUR FLT LIM (28.20)

4 = default = 4A

The delay before tripping is set in 0.001 s to the parameter:

EARTH CUR FLT DEL (28.21),

10 = default = 10 ms

The earth current signal connected to analogue input AI4 must be scaled as 1V == 4A.

POSITION COUNTER

The position counter is used for position measurement in DCS600 MultiDrive applications. The counter can be synchronised (=preset with SYNC-values) by the application software of the overriding control system or by the hardware. The counter output and SYNC-values are 32-bit signed values.

32-bit position values are sent to and received from the overriding control system as two 16-bit values.

Counting Procedure

Position counting is executed at 3.3 ms time intervals by means of a 32-bit up/down counter.
Counting is upwards when the motor is rotating forward and downwards when the motor is rotating backward.
The measurement mode of tacho pulses is selected by means of the parameter **SPEED MEAS MODE (50.02).**

Scaling of position value: see Calculation.

Synchronization

At the same time the programmed synchronization event the position counter is initialised by the defined value:

POS COUNT INIT LO (50.08)	⇒**POS COUNT LOW (3.07)**
POS COUNT INIT HI (50.09)	⇒**POS COUNT HIGH (3.08)**

At the same time the bit **SYNC_RDY** (5) in the **AUX STATUS WORD (8.02)** is set to 1.

The synchronization can be inhibited by setting bit **SYNC_DISABLE** (10) of the **AUX CONTROL WORD (7.02)** to 1.

Selection of synchronization input

The synchronising source is selected by means of the parameter

SYNC INPUT SELECT (50.12).

0 = **NOT IN USE**

1 = **DI7 _-**
digital input 7 rising edge (low to high edge sensitive)

2 = **DI7 HI & Z**
Zero channel pulse from encoder, DI7 at high-state

3 = **DI7 HI & Z+**
Zero channel pulse from encoder, DI7 at high-state, motor rotating forward

4 = **DI7 HI & Z-**
Zero channel pulse from encoder, DI7 at high-state, motor rotating backward

5 = **DI7 -_**
digital input 7 falling edge (high to low edge sensitive).

6 = **DI7 LO & Z**
Zero channel pulse from encoder, DI7 at low-state

7 = **DI7 LO & Z+**
Zero channel pulse from encoder, DI7 at low-state, motor rotating forward

8 = **DI7 LO & Z-**
Zero channel pulse from encoder, DI7 at low-state, motor rotating backward

9 = **Z**
Zero channel pulse.

10= **AUX CW.9 _-**
AUX CONTROL WORD (7.02) bit 9 high signal

11= **NOT IN USE**

Calculation

Each control cycle, the actual position POS COUNT is calculated using the formula:

with **POS COUNT MODE (50.07)** = **0 (PULSE EDGES)**:

DELTA POSITION =
(**TACHOPULSES**(new) - **TACHOPULSES**(old))

POS COUNT(new) = **POS COUNT**(old) + **DELTA POSITION**

with **POS COUNT MODE (50.07)** = **1 (SCALED)**:

DELTA POSITION =
(**TACHOPULSES**(new) - **TACHOPULSES**(old)) **• 65536 / ENCODER PULSE NR (50.04)**

POS COUNT(new) = **POS COUNT**(old) + **DELTA POSITION**

With **POS COUNT MODE (50.07) = SCALED**, the scaling of the low word of POS COUNT is : 65536 == 1 revolution.

The calculation takes into account the used encoder mode (**SPEED MEAS MODE (50.02)**). A loss free algorithm is used in order to avoid an increasing error due to rounding errors.

Synchronization:
The fastest synchronization is achieved with encoder zero pulse synchronization, since it is hardware based. Digital input DI7 synchronization is software based. (DI7 is read on 3.3 ms intervals).
Additional delay is caused by the HW-filter time 2 ms...10 ms of DI7 (depending on the settings of the terminal board SDCS-IOB-2).

With the parameter **POS SYNC MODE (50.14)** either single synchronization or cyclic synchronization is selected. With single synchronization, the next synchronization must be released with the RESET_SYNC_RDY bit (bit 11) of the auxiliary control word **(7.02).**

POS SYNC MODE (50.14):
0= SINGLE, default setting
1= CYCLIC

Position counter diagram

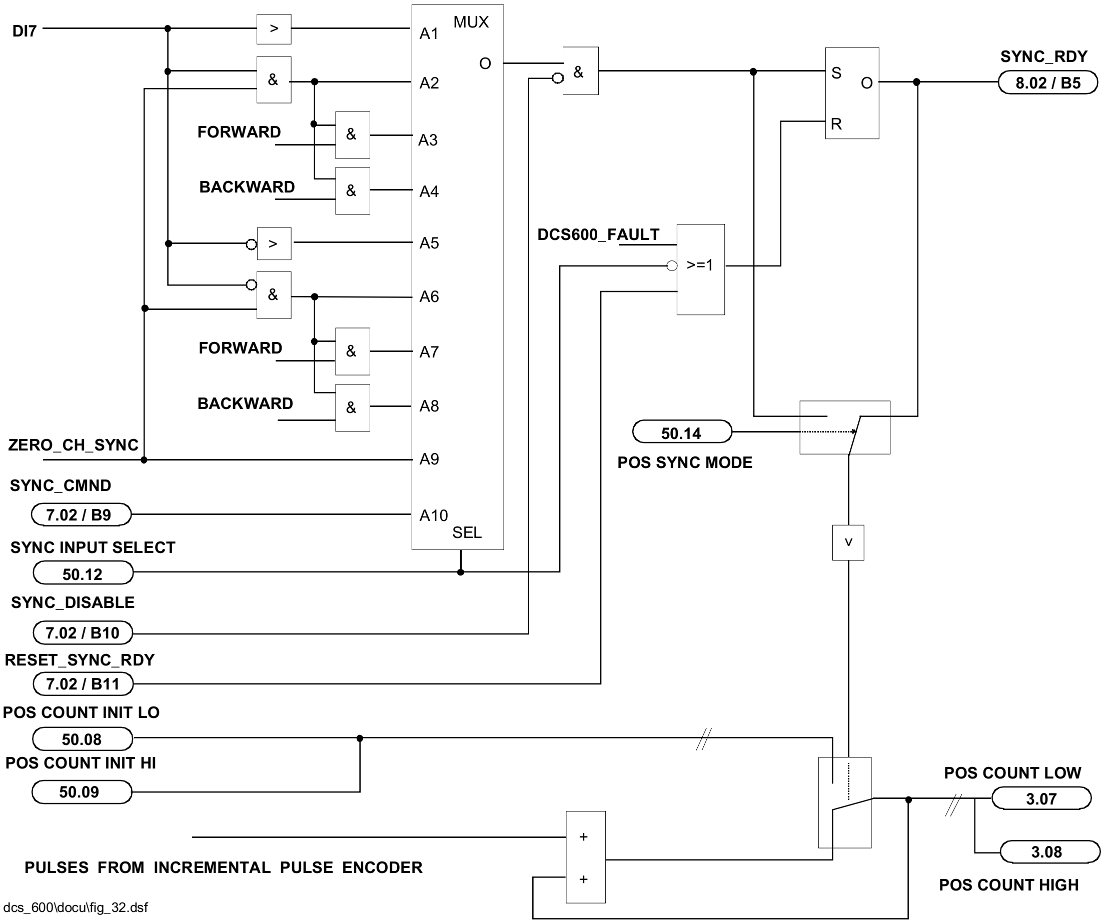


Figure 21-1Position counter logic.

MONITORING FUNCTIONS

Speed Measurement Supervision

The supervision of the speed measurement is based on the relation between the measured speed and measured/calculated EMF.

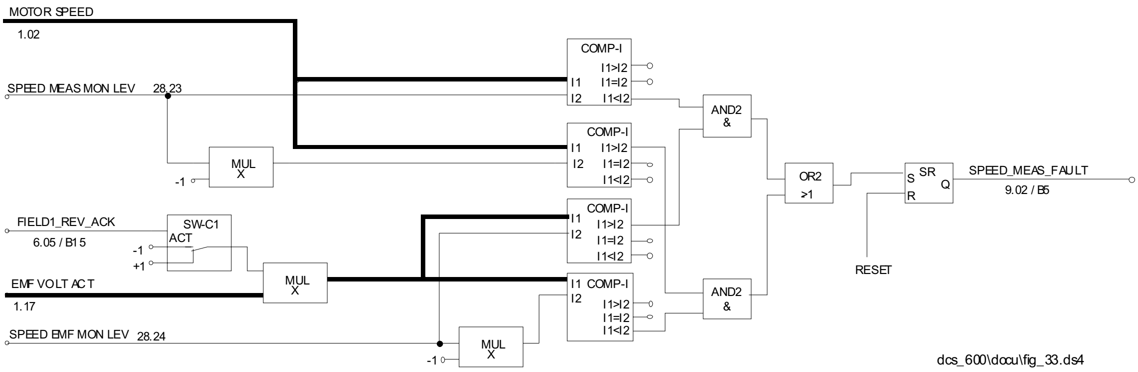


Figure 22-1Speed measurement supervision.

Above a certain EMF-voltage the measured speed must also be above zero and the sign of the speed measurement must be correct. Otherwise the fault
"14 SPD_MEAS " will be generated.
The level of EMF-voltage the supervision is activated at is set by the parameter

SPEED EMF MON LEV **(28.24)** default: 50V

The speed monitoring trips, if the measured speed drops below the value programmed to the parameter

SPEED MEAS MON LEV **(28.23).** default: 15rpm

Mains Phase Sequence

The direction of the mains phases is checked when the main contactor is closed. The measured direction must correspond to the value given by parameter

MAINS PHASE ORDER (42.01):
1= R-T-S
2= R-S-T, default setting

If there is a mismatch between the programmed and the measured phase sequence, the fault "**38 PHASE_SEQU**" is generated.

The firing unit is able to run with both mains phase directions. However, an unexpected phase sequence may cause problems with other devices like fans inside the cubicle.

Firing Unit Synchronization

Once that the main contactor is closed and the firing unit is synchronized with the incoming voltage, supervising of the synchronization gets active. If the synchronization fails, the fault "**31 NOT_SYNC**" will be generated.
The permitted deviation of the cycletime between 2 measurements is programmed to parameter **PLL DEV LIM (43.07)**.
The synchronization of the firing unit takes typically approx. 300 ms before the current controller is ready.

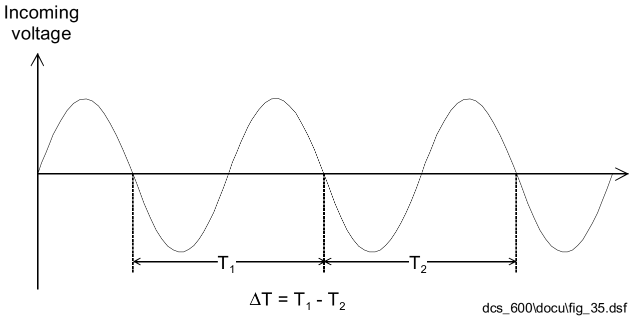


Figure 22-2 Synchronization measurement

If ΔT is longer than PLL DEV LIM (43.07) fault F31 "NOT_SYNC" will be generated.

Note: at 50 Hz one period == 40,000
at 60 Hz one period == 33,333

Fan, Field and Main Contactor Acknowledge

When the drive is started, the program closes the FAN contactor and waits for acknowledge. After it is received, the field contactor is closed and the program waits for the field acknowledge. Finally the main contactor is closed and it's ack is waited for.
If acknowledges are not received at the latest 6 seconds after the "ON"-command, the corresponding fault is generated. These are:

- **"40 NO_E_FAN"** no external fan acknowledge
- **"41 NO_M_CONT"** no main contactor acknowledge
- **"39 NO_FIELD"** no field acknowledge
- **"50 NO C FAN"** no converter fan acknowledge

Two acknowledges can alternatively generate alarms. These are:

- **"26 CONV_FAN"** no converter fan acknowledge
- **"27 EXT_FAN"** no external fan acknowledge

External FAN acknowledge

The function of the program can be selected in case where acknowledge information of the external fan(s) is not available:

EXT FAN ACK MODE (15.07)

0	**TRIP**	drive is tripped and **NO_E_FAN**-fault is generated
1	**ALARM**	alarm is generated
2	**NO SUPERVIS**	acknowledge not used.

Converter FAN acknowledge

Constructions C1, C2 and C3 generate an alarm when the acknowledge signal is missing. The construction C4 generates a fault.

CONVERTER PROTECTION

Armature Overcurrent

The used overcurrent limit can be read from the signal

CONV OVCUR LEVEL (4.16) Integer scaling: 1==1A

The limit can be reduced by the parameter:

ARM OVCUR LEVEL (42.05) Integer scaling: 1 == 1% of nominal converter current **CONV NOM CURR (4.05)**

(100% == $I_{\text{rated converter}}$)

Mains Overvoltage

The overvoltage limit is fixed to 130% (1.3 * **NOM SUPPLY VOLT (42.06)**). If the limit is exceeded for more than 10 seconds, the fault **"30 MAIN OVLT"** is generated.

Overtemperature

The maximum temperature of the bridge can be read from the signal
MAX BRIDGE TEMP (4.17) Integer scaling: 1 == 1°C.

The converter-type dependent temperature limit can be overridden by the parameter (if set to values <> 0)
S MAX BRIDGE TEMP (42.09) Integer scaling: 1 == 1°C.

Note: For C4 modules use (42.09) == 45°C

Exceeding this limit will cause the fault **"04 CONV TEMP"**. The treshold the alarm **"05 CONV_TEMP"** is generated at, is 5°C below the tripping limit.

The measured temperature can be read from the signal

HEAT SINK TEMP (1.24) Integer scaling 1 == 1°C

If the measured temperature drops below minus 10 °C, the overtemperature fault **"04 CONV TEMP"** is generated in order to monitor the temperature sensor against short circuit.

If not the converter temperature is monitored, but the converter fan current (by means of special hardware), the related fault can be delayed to avoid false faults during the fan acceleration time. This delay time is programmed to parameter

CONV TEMP DELAY (42.14) Integer scaling 1 == 10ms

If the programmed delay isn't zero, the fault 04 CONV TEMP is disabled. Instead, the fault **"03 C FAN CURR"** is generated, if

- the converter is in ON state
- and the current fault is active longer than the programmed delay

MOTOR PROTECTION

Stall Protection

The stall protection trips the converter when the motor is in apparent danger of overheating. The rotor is either mechanically stalled or the load is otherwise continuously too high. The selection of the stall protection is made by the parameter:

STALL PROT SELECT (15.08)

0	**NOT USED**	Stall protection not used
1	**IN USE**	Stall protection used

The stall protection trips the drive if:

- Actual speed is below a programmed limit
- Actual torque exceeds a programmed limit
- The condition is active longer than the programmed time

The stall protection's limits are set by means of the following parameters:

MAX STALL SPEED (28.16)	Integer scaling: speed, 200 == 1% of maximum speed **(50.01)**
MAX STALL TORQUE (28.17)	Integer scaling: 10000 == motor nominal torque **(4.22)**
MAX STALL TIME (28.15)	Integer scaling: 1 == 1 sec

Overspeed Protection

The drive is protected against overspeed e.g. in a case where the drive section is controlled by the torque reference and the load drops unexpected.
The overspeed limit is set by means of the parameter:

OVERSPEED LIMIT (20.11)	Integer scaling: speed, 200 == 1% of maximum speed **(50.01)**

Measured Motor Temperature

Two motor temperatures can be measured at the same time. Both measurements have an alarm limit and a tripping limit. The limits are programmable.

The temperature measurements use AI-channels **AI2** and **AI3.**

the **SDCS-IOB-3**-board features a selectable current generator for

- **PT100** (5 mA) or
- **PTC** (1.5 mA)-elements.

The unit of the measurement depends on the selected measurement mode. For PT100 the unit is Celsius.
For PTC the unit is Ω.

Measurement selection

Max. 3 PT100 elements can be connected in serial. In case of only one PT100 element the AI-channel measurement range must be configured by hardware jumpers to the voltage range 0...1V.

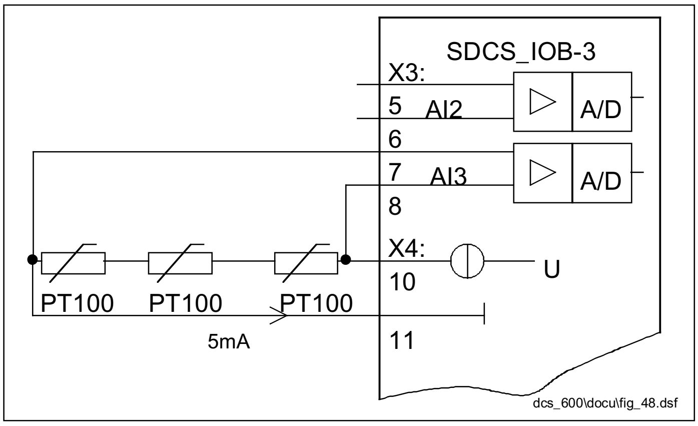


Figure 24-1 Three PT100 sensors in a common analogue input

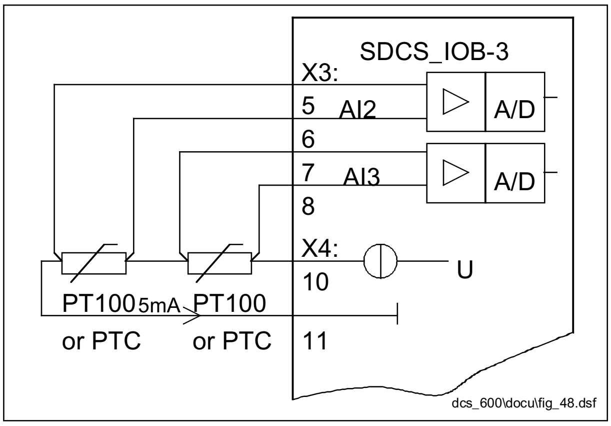


Figure 24-2 Two PT100 sensors in a common current source

See jumper settings of the input range and constant current generator in documentation *Technical data chapter 6*. See also paragraph *Analogue Inputs* in *chapter 14* in this document.

The measurements are configured by the parameters:

MOT 1 TEMP SEL (28.09) For analogue input 2
MOT 2 TEMP SEL (28.12) For analogue input 3

0	**NOT USED**	(default value)
1	**1 · PT100**	[°C], 5 mA current generator, voltage range **0..+1 V**
2	**2 · PT100**	[°C], 5 mA current generator, voltage range 0..+10 V
3	**3 · PT100**	[°C], 5 mA current generator, voltage range 0..+10 V
4	**PTC**	[Ω], 1.5 mA current generator, voltage range 0..+10 V
5	**SCALED A/D**	current or voltage measurement ranges: -1 V...+1 V, -10 V..+10 V, 0/4...20 mA

When voltage or current measurement is selected **(5)**, the scaling is set by means of the parameters:

AN IN 2 HI VAL (13.05)
AN IN 2 LO VAL (13.06), analogue input 2

AN IN 3 HI VAL (13.07)
AN IN 3 LO VAL (13.08), analogue input 3

Note! This configuration is not suitable for measurements using PT100 or PTC-elements.

Measured values can be read from signals:

MOT 1 MEAS TEMP (1.22), analogue input 2
MOT 2 MEAS TEMP (1.23), analogue input 3

The unit for the measurement:

PT100: Celsius
PTC: Ohms
Other: Scaled value.

Alarm and tripping limits

The overtemperature fault belongs to tripping level 2. In case of over temperature the main and the field contactors will be opened but fans are kept running until the temperature falls short of the alarm limit.

For the PT100-measurement alarm and tripping limits are set directly as Celsius-degrees.
In the case of thermistor measurement (PTC) limits are set as resistance values. (0...4000 ohms).

Alarm levels are set by the parameters:

ALARM LIM M1 TEMP (28.10), analogue input 2
ALARM LIM M2 TEMP (28.13), analogue input 3

Tripping limits are set by the parameters:

FAULT LIM M1 TEMP (28.11), analogue input 2
FAULT LIM M2 TEMP (28.14), analogue input 3

When a certain limit is set to zero then the according function is by-passed.

Motor thermal model

General

In DCS600 MultiDrive there are two thermal models that can be used at the same time. Two models at the same time are needed in case of one converter is shared to two motors, e.g. shared motion drive sections. By means of one signal the measured armature current is directed to the desired model. In normal case only one thermal model is needed.

The thermal model of the motor is recommended to use if a direct motor temperature measurement isn't available and the current limits of the drive are set higher than the motor nominal current.

The thermal model does not directly calculate the temperature of the motor. The thermal model calculates the ***Temperature rise*** of the motor based on the fact that when starting to run the cold motor with nominal current the motor will reach the end temperature after the specified time. This time is about four times the motor thermal time constant.

The temperature rise of the motor behaves like the time constant which is proportional to the motor current power of two.

$$\text{TRIP LIM LOAD Ix} = \Phi = \frac{I_{act}^2}{I_{ref}^2} * (1 - e^{-t/\tau}) * 100 \qquad (1)$$

(28.04/08)

where

TRIP LIM LOAD Ix = Φ temperature rise
(28.04/08)

I_{act}	motor current (overload e.g. 170%)
I_{ref}	reference current, Normally rated current of motor.
τ	temperature time constant (in minutes)
100	scaling factor
t	length of overload (e.g. 1 min) (in minutes)

When the motor is cooling down, the temperature model follows next formula

$$\text{TRIP LIM LOAD Ix} = \Phi = \frac{I_{act}^2}{I_{ref}^2} * e^{-t/\tau} * 100 \qquad (2)$$

(28.04/08)

As from the formulas (1) and (2) can be seen, the temperature model uses the same time constant when motor is heating or cooling down.

Thermal model selection

The activation of thermal models is made by the parameter

THERM MODEL SEL (15.03)

0	**NONE**	no thermal model (default)
1	**MOTOR 1**	thermal model of motor 1
2	**MOTOR 2**	thermal model of motor 2
3	**MOTOR 1 + 2**	thermal model of both motors

If both thermal models are activated, the overriding control system can select by means of the signal

MOTOR SELECT (6.03)

0	**MOTOR 1**
1	**MOTOR 2**

which thermal model follows the armature current measurement. The input value for the not selected one is always zero. So one thermal model follows armature current while the other is "cooling down".
If the thermal model is not activated, its output is forced to zero.

Alarm and tripping limits

Alarm and tripping limit calculations use as a base current (I_{ref}) a value given by the parameters

TEMP MODEL 1 CUR	**(28.02)**	quadratic threshold
TEMP MODEL 2 CUR	**(28.06)**	

The normal value of TEMP MODEL x CUR is 100% (integer:4096) (≅ motor rated current). This value should not normally be changed. If, for some reason, it is not possible to run the motor continuously with it's rated current, e.g. due to poor cooling environment,that value can be decreased. E.g. the desired continuous load is 85% of the used motor rated current. The value for parameters are then 85% (integer: 0.85 * 4096 = 3481).

Alarm and tripping limits are selected by means of four parameters

Φ = 120% = **ALARM LIM LOAD I1**	**(28.03)**	Integer scaling:
Φ = 130% = **TRIP LIM LOAD I1**	**(28.04)**	1 == 1 % of nominal load
Φ = 120% = **ALARM LIM LOAD I2**	**(28.07)**	-"-
Φ = 130% = **TRIP LIM LOAD I2**	**(28.08)**	-"-

The default values are selected in order to achieve quite high overload ability. E.g. the current must continuously be $\sqrt{120} * 100$ = 109.5% before alarming, while for tripping the current must be $\sqrt{130} * 100$ = 114%.

Recommended value for alarming is 102% and for tripping 106% (of nominal motor current).

Recommended value for ALARM LIM LOAD Ix (28.03/07) = $100 * 1.02^2 = 104$

Recommended value for TRIP LIM LOAD Ix (28.04/08) = $100 * 1.06^2 = 112$

Thermal time constant

The time constants for both thermal models are set by two parameters

TEMP MODEL 1 TC	**(28.01)**	Integer scaling:
TEMP MODEL 2 TC	**(28.05)**	1 == 1 sec

One has to take into account that the thermal time constant cannot be used directly when calculating the tripping time. In many cases the motor manufacturer provides a curve that defines how long the motor can be overloaded by a certain overload factor. In this case the proper thermal time constant must be calculated.

Example:
The drive is desired to trip if the motor current exceeds 170% of the motor nominal current for more than 1 minute.
Selected tripping base level is 106%. ⇒ **TRIP LIM LOAD I1 (28.04)** = 112%.

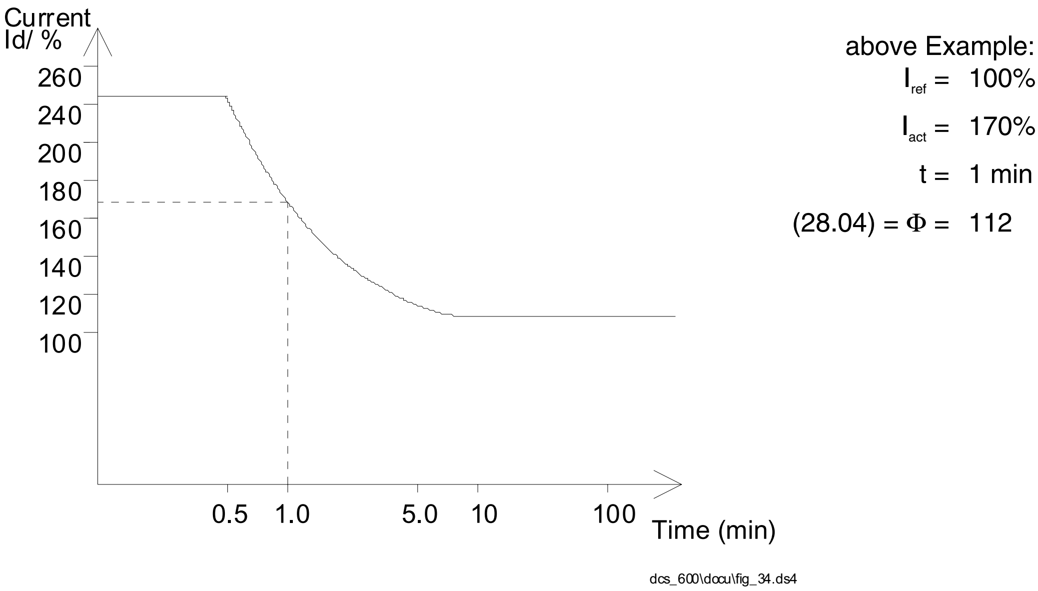


Figure 24-3 Motor load curve.

Note: this is an example and does not necessarily correspond to any motor !

Using formula (1) we can calculate a correct value for τ:

$$(28.04) = \Phi = \frac{I_{act}{}^2}{I_{reg}{}^2}\left(1 - e^{-\frac{t}{\tau}}\right) * 100$$

$$\Rightarrow \quad \tau = -\frac{t}{\ln\left(1 - \frac{(28.04)}{100} * \frac{I_{ref}{}^2}{I_{act}{}^2}\right)} = -\frac{1\min}{\ln\left(1 - \frac{112}{100} * \frac{1.0^2}{1.7^2}\right)} \quad = \quad \mathbf{2.04\ min}$$

Select **TEMP MODEL x TC** (28.01/05) = 60 sec * 2.04 = 122 sec

KLIXON

The temperature of the motor can also be supervised by means of a Klixon.The Klixon is a thermal switch opening it's contact at a defined temperature. This can be used for supervision of the temperature by connecting the switch to a digital input of the DCS600 MultiDrive. The digital inputs for the Klixon(s) are selected by the parameter

MOT1 KLIXONSEL	**(28.18)**	Select DI for motor 1
MOT1 KLIXONSEL	**(28.25)**	Select DI for motor 2

Armature Overvoltage

The nominal value (100%) of the armature voltage is

1.35*NOM SUPPLY VOLT (42.06)

The setting of the overvoltage limit is based on this value. The limit is set into the parameter

ARMAT OVERVOLT LEV (28.22)	Integer scaling: 4096 == 135% of **NOM SUPPLY VOLT (42.06)** default:150%.

Exceeding this limit causes the fault **"28 ARM_OVOLT"**.

Example for 120% overvoltage limit:

$$\text{ARMAT OVERVOLT LEV (28.22)} = 120\% * \frac{\text{MOTOR NOM VOLTAGE (99.02)}}{\text{NOM SUPPLY VOLT (42.06)}}$$

or

ARMAT OVERVOLT LEV (28.22) = 1.2 * INT EMF REF (41.19)

Current Rise Detection

The protection against fast current rise is configured by means of parameter

CURRENT RISE MAX (20.18)

The scaling is in per cent of the nominal converter current per control cycle (3.3ms at 50 Hz).

Exceeding this limit causes the fault "**08 CURR RISE**". The DC-breaker trips and the main contactor opens.

AUTOTUNING

Armature Current Controller

The parameters of the armature current controller can be defined by using the autotuning function. After nominal values of the motor and the converter are programmed, the autotuning feature can be executed.

If the DCS600 is operated as 3-phase field exciter DCF600 (**OPER MODE SELECT (15.16)** = 5), the armature current controller autotuning is not appropriate. See autotuning of field current controller (next chapter).

To start the autotuning follow the next steps:

Open the main contactor. Drive mustn't rotate, don't apply any external reference.
Set parameter **DRIVEMODE (15.02)** to 3
Close the main contactor and **start the converter within 20 seconds.**

Tuning is completed, if the **DRIVEMODE (15.02)** changes back to zero. The converter stops automatically.

If the drive trips during the autotuning, the program sets **DRIVEMODE (15.02)** to -1

The reason for tripping can be read from the signal **COMMISS STATUS (6.02)**.

Fault codes of the signal **COMMISS STATUS (6.02):**

49x: Field not nominal during start.

50x: Ohmic load not determined.

51x: Current feedback is less than current reference during measurement of armature resistance. Current limits lower than the limit for continuous current flow or lower than 20%.

52x: Inadmissible current curve. Fuse blown, thyristor not firing or no motor load.

53x: Wrong starting conditions. The drive is running when the autotuning is started or run command is not given within 20 s after start of autotuning.

54x: Too high speed during autotuning. Speed greater than 1% or EMF greater than 15%.

55x: Inductance cannot be determined. Fuse blown, thyristor not firing or no motor load.

56x: Limit for continous current flow cannot be determined.

57x: The field removal takes longer than 10 s. **If the SDCS-FEX-1 is used, ensure, that the field current is zero.**

58x: Blocking or stop signal appears during autotuning.

Field Current Controller

The parameters of the field current controller can be defined by using the autotuning function. After nominal values of the motor and the converter are programmed, the autotuning feature can be executed.

If the DCS600 is operated as 3-phase field exciter DCF600 (**OPER MODE SELECT (15.16)** = 5), the current controller autotuning isn't started at the armature converter but at the field converter DCF 600 itself. The parameters **43.02** and **43.03** are calculated instead of **44.02** and **44.03. DISCONT CUR LIMIT (43.06)** is set to 0, **REV DELAY (43.13)** is set to 10.

If the field contactor is controlled by the armature converter, take care for closing it.

To start the autotuning follow the next steps:

Command	the drive to ON state (main contactor closed, NOT running)
Set	parameter **DRIVEMODE (15.02)** to 5

Tuning is completed, if the **DRIVEMODE (15.02)** changes back to zero. The converter stops automatically.

If the drive trips during the autotuning, the program sets **DRIVEMODE (15.02)** to -1

The reason for tripping can be read from the signal **COMMISS STATUS (6.02)**.

Fault codes of the signal **COMMISS STATUS (6.02):**

61: Illegal start conditions (drive not in ON state).

62: FEX autotuning not possible.

63: FEX autotuning not possible.

64: Field time constant too big.

MANUAL TUNING

In order to facilitate the tuning of the drive, DCS600 MultDrive has several manual tuning functions. With help of the manual tuning the following functions can be tuned:

- Armature current controller
- Field exciters
- EMF controller
- Speed loop

When manual tuning is activated, the normal reference is switched off from the function and is replaced by test reference. The test reference can be either a square wave generator or an adjustable test-reference.

Manual tuning can be activated only in LOCAL-mode.

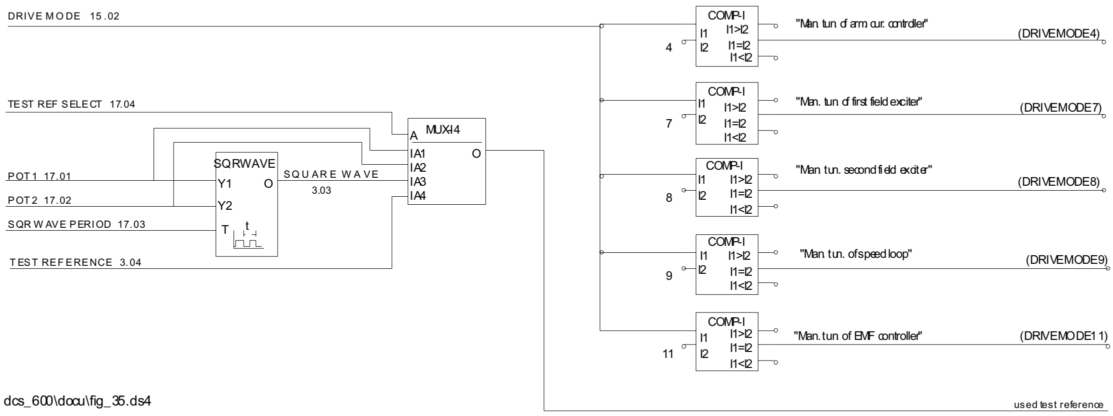


Figure 26-1 Object and test reference selections in the manual tuning.

The activation of the manual tuning parameter:

DRIVE MODE (15.02)

4 = armature current controller
7 = first field exciter
8 = second field exciter
9 = speed loop (reference chain and speed controller)
11 = EMF controller

Square Wave Generator

The output of the square wave generator is adjusted by using 3 parameters:

POT 1	**(17.01)**	Higher value of the generator
POT 2	**(17.02)**	Lower value of the generator
SQR WAVE PERIOD	**(17.03)**	Period of square wave generator Integer scale: 1 = 10 ms

The output of the square wave generator can be read from the signal

SQUARE WAVE **(3.03)**

For test purposes, the square wave signal can be copied to any index of the AMC-table by means of **INDX SQUARE WAVE (17.06).** This parameter is not stored to the FLASH and is inactive after power-up.

Test Reference Selection

The test reference is selected by the signal

TEST REF SEL **(17.04)**

0	**0**	Test signal is 0
1	**POT1**	use pot 1 (17.01)
2	**POT2**	use pot 2 (17.02)
3	**SQRWAV**	use sqr wave (3.03)
4	**TST REF**	use test reference (3.04)

Finally start the drive or only close main contactor in a case of field exciters. Measurements are recommended to do with DriveWindow.

Manual Tuning of the Speed Loop

The test reference replaces the currently used speed reference. When using the square wave function, the drive can be set to accelerate and decelerate continuously without applying a new reference.

Manual Tuning of Field Exciters

The test reference replaces the field exciter references. When using the square wave function, the field reference can be stepped. Actual values **REL FIELD CUR M1(2) 3.19(21)** can be monitored by the DriveWindow. By means of reference and actual value monitoring the gain values can easily be adjusted.

Manual Tuning of Armature Current Controller

During the test the field contactor is automatically opened to prevent the motor from running.

The test reference replaces CUR REF 3 (3.12), current limitation is not by-passed.

Find continuous/discontinuous current limit

The continuous current limit can be found by slowly increasing the current reference and at the same time monitoring the bit **CONTINOUS_CURR (12)** in **CON2 BITS (6.05)** with the DriveWindow. The limit is reached when the bit-signal oscillates.

After the limit is reached , the actual current is read and the value is set to the limit parameter:

RL CONV CUR ACT (1.15) ⇒ **DISCONT CUR LIMIT (43.06)**

Tuning of the armature current controller

After setting the discontinuous current limit, the PI-controller can be tuned normally by using the square wave generator.

Manual Tuning of the EMF-Controller

Prior to the tuning of the EMF-controller the field controller has to be tuned.

The tuning principle

- The motor is started to run about half speed of the used field weakening area.
- The signal **RL EMF VOLT ACT (1.17)** is read. The value is used to define the steps. The higher value of the step can be the value that are read. The lower value of the step can be 15% less.
- The manual tuning function is activated (**DRIVE MODE (15.02)** = 11). The PI-controller can be tuned normally by using the square wave generator.

LIMITATIONS

Torque and armature current limitation

Torque and current limits can be selected independently. If the selected armature current limits are smaller than the according selected torque limits, the program automatically limits used torque limits so that the output of the speed controller cannot be bigger than the torque the current controller can produce.

The armature current can also be limited proportionally to the actual speed.

The limits for the armature current are set by parameters:

CUR LIM MOT BRIDGE (20.12) **CUR LIM GEN BRIDGE(20.13)**	Integer scaling: 4096 == **MOTOR NOM CURRENT (99.03)**

Speed dependent limits for the armature current are set by the parameters:

MAX CUR LIM SPEED (41.04)	The speed level for armature current limit reduction Integer scaling: 20000 = max. speed **(50.01)**
ARM CUR LIM SPD1 (41.05)	Armature current limit at speed **[41.04]**
ARM CUR LIM SPD2 (41.06)	Armature current limit at speed **[41.04]** + (**[50.01]** - **[41.04]**) • 1/4
ARM CUR LIM SPD3 (41.07)	Armature current limit at speed **[41.04]** + (**[50.01]** - **[41.04]**) • 1/2
ARM CUR LIM SPD4 (41.08)	Armature current limit at speed **[41.04]** + (**[50.01]** - **[41.04]**) • 3/4
ARM CUR LIM SPD5 (41.09)	Armature current limit at speed **[50.01]**

Torque limits are set by the parameters:

MAXIMUM TORQUE (20.05) **MINIMUM TORQUE (20.06)**	Integer scaling: 10000 = Tn(motor)

Gear backlash compensation

The gear backlash compensation function can be used for backlash-affected drives. When the torque reference passes through zero, at first only small torque limits are used. After the **GEAR TORQUE TIME (26.09)** has elapsed the torque limits are ramped to the defined level.

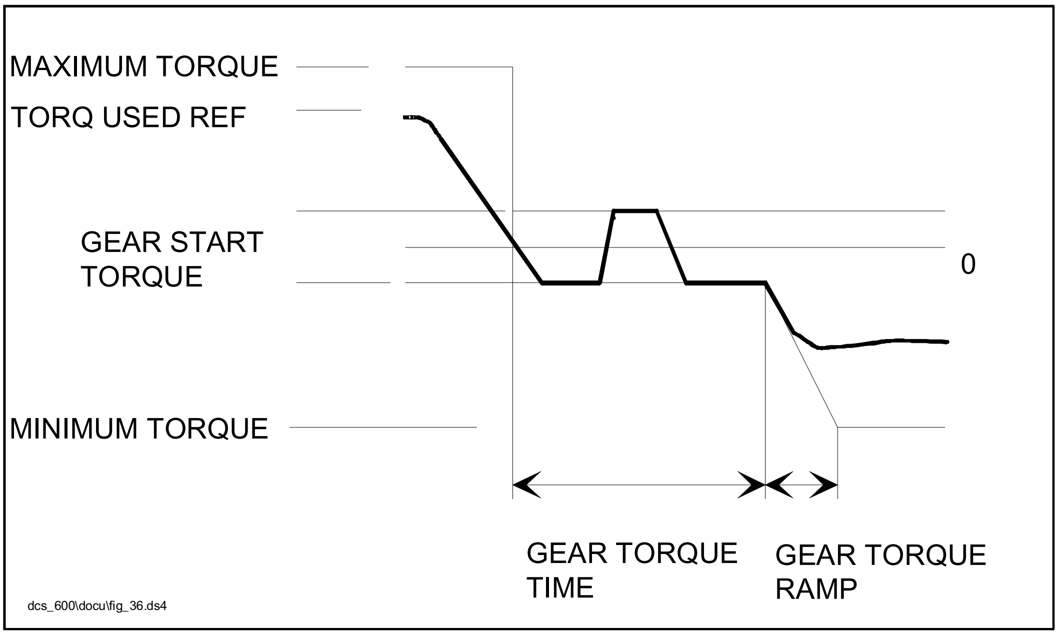


Figure 27-1 Torque limitation during gear backlash.

The gear backlash function's input signal is **TORQ REF 5 (2.12)**, while its output signal is connected to the torque limiter generating the signal **TORQ USED REF (2.13).**
The gear backlash function is adjusted by means of the parameters

GEAR START TORQUE (26.08)	When the torque is changing the direction, torque limits are reduced for a while. GEAR START TORQ is the torque limit right after the direction has changed. Integer scaling: 10000 == motor nominal torque
GEAR TORQUE TIME (26.09)	The time after the direction change when GEAR START TORQ is used. Integer scaling: 1 == 1ms
GEAR TORQUE RAMP (26.10)	When the torque is changing the direction, torque limits are reduced for a while. GEAR TORQ RAMP defines the time the torque will rise within from zero to nominal motor torque after GEAR TORQ TIMEhas elapsed. Integer scaling: 1 == 1ms

Speed reference limitation

The speed reference is limited by the parameters:

MINIMUM SPEED (20.01)	Integer scaling: speed (20000 == **[50.01]**)
MINIMUM SPEED (20.02)	Integer scaling: speed (20000 == **[50.01]**)

Zero speed limit

The zero speed limit is set into the parameter

ZERO SPEED LIMIT (20.03)	Integer scaling: speed (20000 == **[50.01]**)

The limit defines the speed when the drive stops generating current when the stop-command was given.

The indication of the zero speed can be read from bit **11 / ZERO_SPEED** of the **AUX STATUS WORD (8.02).**

0 = absolute speed bigger than **ZERO SPEED LIMIT (20.03)**
1 = absolute speed less than **ZERO SPEED LIMIT (20.03)**

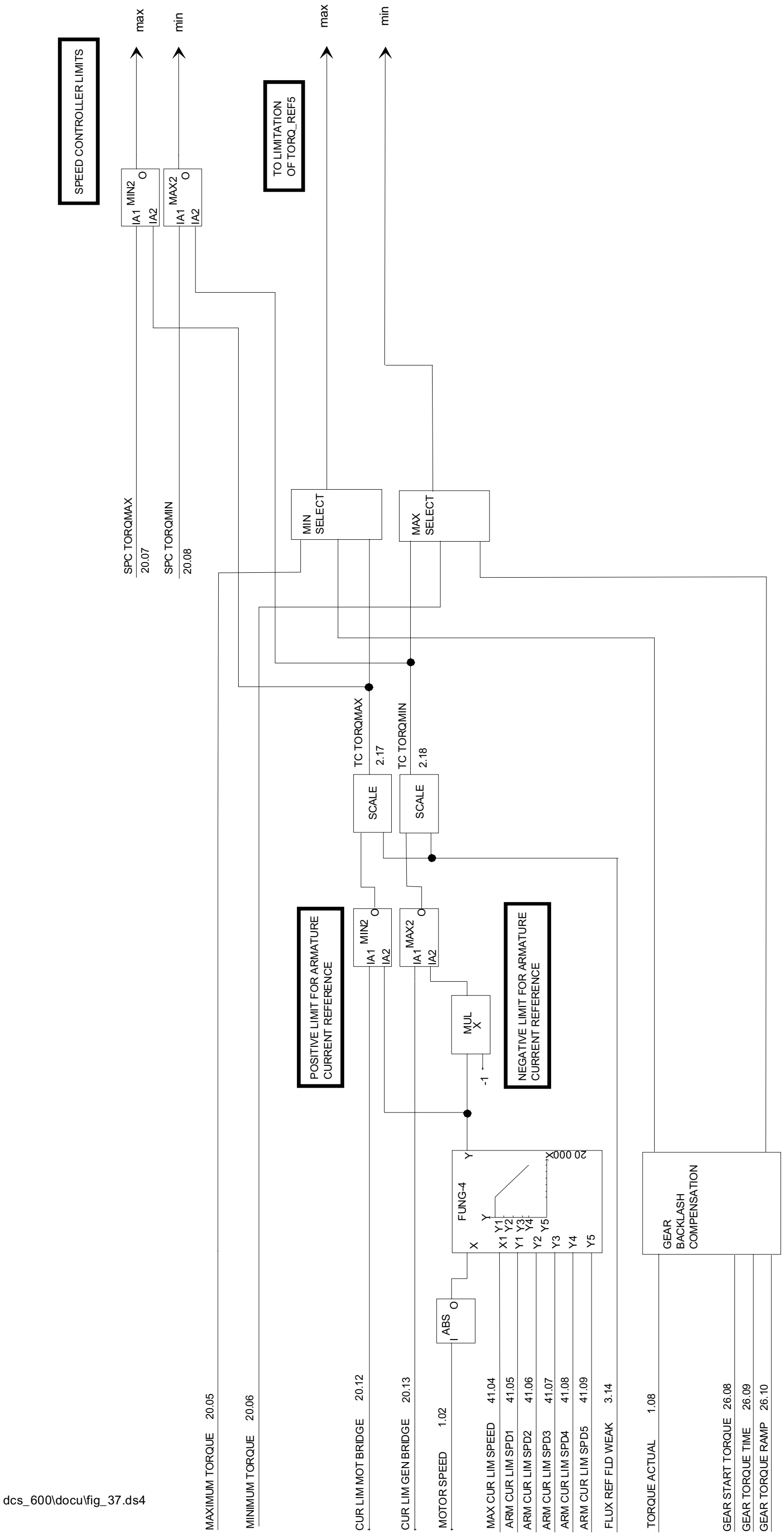


Figure 27-2Torque and armature current reference limitation.

CONVERTER SETTINGS

Converter rating plate data

With converter types **C1, C2** and **C3** nominal values of the converter are based on coding resistors of the PIN-board. These values are nominal/scaling current, nominal/scaling voltage, maximum bridge temperature, converter type and quadrant type. Values can be checked from signals:

CONV NOM CURR (4.05)	1 = 1 A	DC [A]
CONV NOM VOLT (4.04)	1 = 1 V	Supply [V]
MAX BRIDGE TEMP (4.17)	1 = 1 °C	
CONVERTER TYPE (4.14)	1 = C1, 2 = C2, 3 = C3, 4 = C4	
QUADRANT TYPE (4.15)	1 = 1Q, 4 = 4Q	

Values are used for scaling measurements and tripping levels.

If nominal values are needed to change, this can be done by parameters overwriting the informations read from the coding resistors.

S CONV NOM CURR (42.07)	1 = 1 A	DC [A]
S CONV NOM VOLT (42.08)	1 = 1 V	Supply [V]
S MAX BRIDGE TEMP (42.09)	1==1 °C	
S CONVERTER TYPE (42.10)	1 = C1, 2 = C2, 3 = C3, 4 = C4	
S QUADRANT TYPE (42.11)	1 = 1Q, 4 = 4Q	

0 = values read from coding resistors are used
<>0 programmed values are used

Changes of these parameters are visible in the signals (group 4) shown above, after DRIVE MODE (15.02) has been set to 22, or after next power-up.

C4 converters don't have coding resistors. For these converters, the nominal values must be set by means of the aforementioned S(et)**... parameters.**
The appropriate values can be read from the manual *Technical data* or *12-Pulse Manual*.

Note: The values read from the coding resistors on power-up aren't saved, when they are overwritten by the S(et) parameters. Thus, if any of these parameters is being changed **back to 0** (this occurs also on loading the AMC-DC software), this change will take effect and the alarm A129 (type code changed) will occur not before the next power-up. For that reason, storing of the type code specific parameters to the CON-2 board's FLASH memory (DRIVE MODE (15.02) = 22, see also chapter Memory Handling) is needed to be executed twice:

a) After changing the value (the first test of the S(et) parameters after next power-up is done before they have been written from the AMC-DC board to the CON-2 board).
b) After the next power-up to confirm the type-code-changed alarm (A129).

Nominal Mains Voltage

The nominal mains voltage must be set by means of the parameter.

NOM SUPPLY VOLT (42.06) Integer scaling: 1 == 1V

If this index hasn't yet been written to, or if it has been set to 0V *), it is initialized on power-up to the value of the converter nominal voltage **CONV NOM VOLT (4.04)** resp. **S CONV NOM VOLT (42.08).**

*)
Regardless of the voltage programmed to NOM SUPPLY VOLT, the internal used value is limited to values above 40V.

MOTOR SETTINGS

In order to ensure proper and optimal control of the motor, the program needs information about the motor. The rating plate data of the motor are defined as following:

MOTOR NOM VOLTAGE (99.02) Nominal motor voltage. Integer scaling: 1==1V. The value is used for scaling EMF-based measured / calculated actual speed (SPEED ACT EMF)

MOTOR NOM CURRENT (99.03) Nominal motor current. Integer scaling: 1==1A.The value is used for scaling the armature current by means of measured converter current.

MOT 1 NOM FLD CUR (41.03) Nominal field current of the 1st motor. Integer scaling: 1=0.02A. The value is used for scaling the field current measurement.
(in case of DCF600 used as field exciter: see description of parameter 41.03)

MEMORY HANDLING

Power-Up

The Power-Up procedure loads all needed files from the SCDS-AMC-DC boards FLASH-memory to the RAM. This takes about 15 seconds.

Parameter Backup

All parameters of the converter and field exciters except of the type code specific parameters mentioned below are stored inside the FPROM memory-circuit of the drive control board AMC-DC. The storing into the FLASH memory takes place immediately after changing a parameter.

Note: Parameters changes by the overriding control system via datset communication are NOT saved to the FLASH-memory. However, they can be saved to FPROM by means of the **PARAMETER BACKUP** function:

PARAMETER BACKUP (16.06):
Parameter save from the RAM memory to the FPROM. This is needed only, if parameter changes by overriding system have to be stored to FPROM memory instead of the RAM.
Note! Do not use the Parameter Backup function unnecessarily

0 = DONE Parameter value after the saving has been comleted
1 = SAVE.. Parameter save to FPROM

Note! The parameter value is held at SAVE.. as long as the parameters are written to the FPROM. If a compression of the FLASH memory is caused by the Parameter Backup, this can take up to 90s.

User Macros

There are two USER'S MACRO parameter sets as well as the factory default values available. They can be saved (save not for factory default !) and restored by means of the parameters **APPLIC RESTORE (99.09)** and **APPLICATION MACRO (99.11).**

APPLIC RESTORE (99.09)	**0**	**NO**	do not restore parameters
	1	**YES**	restore parameters
APPLICATION MACRO (99.11)	**1**	**FACTORY**	Default parameters are recalled
	2	**USER 1 LOAD**	User macro 1 is recalled
	3	**USER 1 SAVE**	User macro 1 is saved to the FPROM memory
	4	**USER 2 LOAD**	User macro 2 is recalled
	5	**USER 2 SAVE**	User macro 2 is saved to the FPROM memory

Note1! The parameters of group 99 are not restored to their default values by the factory default macro; parameter 99.11 is not changed by recalling of user macros (since it is not stored in the FLASH memory).

Note2! The Back-Up function in Drive Window only saves the active User Macro if called: thus, both User Macros must be backed-up separately.

Note3! The USER 1 SAVE and USER 2 SAVE functions create the acoording User Macro inside the FLASH memory as well as they save the currently loaded parameter values to the FLASH memory to get them active after the next power-up (if a User Macro is loaded only, the loaded parameter values are lost after the next power-up). Thus, these functions have 2 purposes:

1. Creation of a User Macro
2. Storing the parameter values to the FLASH memory **after loading** a User Macro

Note4! It takes about 3 sec (4 sec in case of FACTORY loading), until new parameter values become active.

Converter type change

When the converter type or the converter control board SDCS-CON-2 have been changed / replaced, the warning **"Type code changed"** is generated as long as the new converter type specific parameters haven't been stored inside the SDCS-CON-2's parameter FLASH memory (D35). This is done by setting the **DRIVE MODE** parameter **(15.02)** to **22**. This action is completed, when the DRIVE MODE parameter has changed back to 0.

The type code specific parameters of the SDCS-CON-2's are displayed in the signals:

4.04	**CONV NOM VOLT**	nominal converter voltage/ coding voltage measurement
4.05	**CONV NOM CURR**	nominal converter current
4.14	**CONVERTER TYPE**	converter type
4.15	**QUADRANT TYPE**	quadrant type
4.16	**CONV OVCUR LEVEL**	current tripping level
4.17	**MAX BRIDGE TEMP**	tripping level of heat sink temperature

Note: If the jumper field S2 of SDCS-CON-2 has the pins 1-2 connected, the SDCS-CON-2 software uses always the default parameters. To get the type code parameters stored in the parameter FLASH-memory active, the pins 3-4 of the jumper field S2 must be connected.

Software update

If the parameter structure of a new software version loaded to the SDCS-CON-2 board is different from the one loaded previously (meaning: there are new or deleted parameters), the jumper field S2 must have the pins 1-2 connected (jumpers must be set **before** power-up), until the new default parameters have been stored to the parameter FLASH-memory (by setting **DRIVE MODE (15.02)** to **22**). Afterwards, the jumper must be set back to 3-4 (to get the parameters out of the parameter FLASH-memory active on next power-up).

In case one doesn't know, if the new software version has different parameter structure, it is strongly recommended to assume, it has different structure.

INTERNAL SIGNAL CONNECTIONS

Due to the hardware structure of DCS600 MultiDrive's control electronics, the control functions are distributed to 2 microprocessors. The signal exchange is realized by means of DDCS-datasets, consisting each of 3 16-bit values. Each 16-bit value represents a transfer channel for signal exchange between both processors.

Fixed transfer channels

The following signals are always exchanged cyclically between the AMC-DC board and the SDCS-CON-2 board:

Signals from AMC-DC to SDCS-CON2

Signal-Number	Function	Cycle-Time
no user-accessable signal	internal control word	2 ms
---	reserved	2 ms
2.13	torque reference (torq used ref)	2 ms
5.06	analogue output 1	2 ms
5.07	analogue output 2	2 ms
No direct-user-accessable signal	local reference 3	8 ms

Signals from SDCS-CON2 to AMC-DC

Signal-Number	Function	Cycle-Time
no user-accessable signal	internal status word	2 ms
1.04	speed actual value (motor speed)	2 ms
1.08	torque actual value (motor torque)	2 ms
5.02	analogue input 1 from SDCS-CON-2	4 ms
5.03	analogue input 2 from SDCS-CON-2	4 ms
5.04	analogue input 3 from SDCS-CON-2	4 ms
5.05	analogue input 4 from SDCS-CON-2	4 ms
5.08	analogue input 5 (channel 1 of SDCS-IOE-1)	4 ms
5.09	analogue input 6 (channel 2 of SDCS-IOE-1)	4 ms
2.19	calculated positive motor torque limit (tc torqmax)	8 ms
2.20	calculated negative motor torque limit (tc torqmin)	8 ms
8.05	digital input status word (di status word)	8 ms
6.05	packed boolean signals (con2 bits)	8 ms

Programmable transfer channels

The usage of these transfer channels is programmable. They may be used for certain applications to update signals inside the AMC-DC board's AMC-table from signals generated by the SDCS-CON2 board's software. See also the DriveWindow related explanations below.

The configuration of the programmable transfer channels is done by means of pointer indexes. They have to be programmed to (group • 100 + index).

Signals from AMC-DC to SDCS-CON2 (Reference Values)

Pointer Index	Default Selection	Cycle-Time
95.01	Current reference **3.11**	2 ms
95.02	Flux reference **45.01**	2 ms
95.03	EMF reference **45.03**	2 ms
95.04	0	8 ms
95.05	0	8 ms
95.06	0	8 ms
95.07	0	8 ms
95.08	0	8 ms
95.09	0	8 ms
95.10	0	8 ms
95.11	0	8 ms
95.12	0	8 ms
95.13	0	8 ms
95.14	0	8 ms

Signals from SDCS-CON2 to AMC-DC (Actual Values)

Pointer Index	Default Selection	Cycle-Time
94.01	Firing Angle **3.13**	2 ms
94.02	Actual Converter Current **1.15**	2 ms
94.03	Active Current Reference **3.12**	2 ms
94.04	Actual Mains Voltage **1.11**	8 ms
94.05	Actual Armature Voltage **1.13**	8 ms
94.06	Filtered Actual Current **1.28**	8 ms
94.07	Actual EMF **1.17**	8 ms
94.08	Bridge Temperature **1.24**	8 ms
94.09	Calculated Temperature of Motor 1 **1.20**	8 ms
94.10	Field Current Reference of Motor 1 **3.17**	8 ms
94.11	Actual Field Current of Motor 1 **3.19**	8 ms

Parameters

All parameters are defined inside the AMC table of the AMC-DC board. If a parameter resides inside the SDCS-CON-2 board's software, it is transferred to the SDCS-CON-2 board by the parameter's hook function.

On certain functions, like autotuning of the armature current controller, parameters are changed inside the SDCS-CON-2 board. The DCS600 MultiDrive's state machine takes care for updating the involved AMC table parameters from the SDCS-CON-2 board and saving them to the FLASH memory after the according function has been completed.

Control Panel

The signals selected for the CDP312 control panel's actual value display are transferred to the AMC-DC board each 500ms, if they are generated by the converter control software inside the SDCS-CON-2 board.

Fault Logger

If Error or alarms are detected from the converter control software (SDCS-CON-2), the according codes are copied into the AMC-DC board's fault and alarm logger.

Data Logger and Monitoring Tool of DriveWindow

The data logger and the monitoring tool of DriveWindow access data inside the AMC-DC board. All signals of the SDCS-CON-2 board's software exist also inside the AMC-DC board's signal structure (the AMC table). If signals of the SDCS-CON-2 board are selected for such tool, they have to be updated cyclically.

Up to 6 SDCS-CON-2-resident signals are selected automatically (if not already selected for another transfer channel) for updating by means of a transfer channel used exclusively by the DriveWindow tools (transfer cycle: 2ms). DriveWindow writes the indexes of the selected signals into the DCS600 MultiDrive's AMC table (internal parameter group 156).
If the last signal selection inside DriveWindow has been made for the data logger, these 6 transfer channels are assigned first for the data logger, then (if any remained) for the monitoring tool.
If the last signal selection inside DriveWindow has been made for the monitoring tool, these 6 transfer channels are assigned first for the monitoring tool, then (if any remained) for the data logger.

If more than 6 signals are selected for monitoring and / or data logging at the same time, it is recommended, to program the indexes of the most often used signals into one of the pointer indexes for actual values (group 94), while up to 6 random used signals are selected automatically for cyclic updating. (This applies only, if the monitoring tool and the data logger are used at the same time.)

Note: If a SDCS-CON-2-resident signal is selected for cyclic updating neither by means of one of the programmable transfer channels nor for one of the 6 DriveWindow channels, a static, not updated value will be measured.

DIAGNOSTIC

DCS600 MultiDrive has versatile diagnostic functions in order to monitor HW-functions and to facilitate trouble-shooting. Functions are:

- Thyristor diagnosis
- Control board self diagnosis
- Supply voltage monitoring
- Watchdog
- Fault logger
- Data logger

Diagnostic information are divided into 2 main classes. These are:

ALARM	An announcement that some limit is reached. Alarm does not prevent the drive to run.
FAULT	The drive is always tripped.

Faults and alarms have a 12 character long text for the fault logger. The text language is English.
Faults and alarms detected by the converter control software (inside SDCS-CON-2) have also a numerical code for display at the SDCS-CON-2 board's 7-segment display. Codes between 0 and 99 are reserved for faults. Code numbers bigger than 100 are reserved for alarms (however, the alarm message written to the fault logger displays only the 2 least significant digits).

Thyristor diagnosis

The thyristor diagnosis requires the motor to be connected properly.

The thyristor diagnosis function is activated by the following steps:

- Open the main contactor e.g. by giving STOP command and OFF command in local mode.
- Set the **DRIVE MODE (15.02)** to 13.
- Close the main contactor after max. 10 sec e.g. by giving ON command and START command in local mode.
- Now the thyristor diagnosis is running:
    - ∗ Short pulses bridge 1, alpha = 175 deg for the detection of non-blocking thyristors:

    The peaks of six current bubbles are recorded. If one peak value is greater than 0.26 percent of the converter nominal current, at least one thyristor is not blocking.
    - ∗ Long pulses bridge 1, alpha = 150 deg for the detection of non-conducting thyristors:

    The mean values of six current bubbles are recorded. A thyristor is recognized as non-conducting, if its current bubble mean value is below the largest of the bubbles minus three times **CUR RIPPLE LIM 1 (43.11)**.
    - ∗ The same with bridge 2.
    - ∗ If a fault in the powerstage is recognized, then all pulses are suspended, and the electronics must be switched off. If no fault is detected, the drive starts running.

When the thyristor diagnosis is completed, **DRIVE MODE (15.02)** is reset to 0 (success), or set to -1 (faulted powerstage).

The result of the thyristor diagnosis can be read from **COMMISS STATUS (6.02)**:

0	no faults, diagnosis successfully completed
10	no controller release within 10 sec
11	at least one thyristor is not blocking
12	more than one thyristor of bridge 1 is not firing
13	more than one thyristor of bridge 2 is not firing
14+i	thyristor i (0...5) of bridge 1 is not firing
20+i	thyristor i (0...5) of bridge 2 is not firing

Note! If faulted thyristors are not detecetd, this could be caused by a too high value of **CUR RIPPLE LIM 1 (43.11)** or too high inductive load.
If the thyristor diagnosis fails in spite of an intact power stage, this could be caused by a too low value of **CUR RIPPLE LIM 1 (43.11)**.

Control board self diagnosis

The SDCS-CON-2 control board has one 7-segment display in order to facilitate trouble-shooting in various situations.

After switching on the supply voltages for the control board, the program starts to test HW. During initialization RAM and ROM (flash memories) memories are tested.
If ROM or RAM tests fail, the communication will not start and an error message will appear on the control board 7-segment display (E 1 or E 2).

Such faults that would prevent to start running the program totally is shown by the 7-segment display always with the letter:

E and code.

During normal running fault codes and alarm codes shown by the 7-segment.

If message/error code has more than one number or letter to display, the code is displayed so that every number and letter are alternating with each others in the period of 0.7 seconds . This sequence is repeated indefinitely.

The seven segment display is located on the converter control board SDCS-CON-2. Codes are:

Code		Description
0.7 s	0.7 s	
.		Normal situation, no fault no alarm
L		During downloading (PC->drive) sequence
8		Program is not running
E	1	ROM memory test error
E	2	RAM memory test error
E	5	No control program in memory
E	6	Incompatible hardware
A	XX	Alarm code
F	XX	Fault code

Table 1. Status codes of the drive shown on the seven segment display of the SDCS-CON-2.

Supply voltage monitoring

The control board SDCS-CON-2 monitors the following voltage levels:

Supply voltage	Under voltage limit
+5 V	+4.55 V
+15 V	+12.4 V
-15 V	- 12.0 V
+24 V	+19 V
+48 V1	+38 V

If +5 V drops below the tripping limit, it causes a master reset by hardware causing a power fail message to be displayed. The firing pulses are suppressed.

Watchdog function

The control board SDCS-CON-2 contains an internal watchdog. The watchdog supervises program running on the control board. If watchdog trips the HW takes care of the next functions:

- FPROM programming voltage is forced low.
- Thyristor firing control is reset and disabled.
- Digital outputs are forced low
- Programmable analogue outputs are reset to zero, 0V.

Jumpers on the SCDS-CON-2 board

The jumper S2 on the SDCS-CON-2 board allows to disable the reading of parameters out of the FPROM D35. However, the storage of parameters (except type code signals **4.04, 4.05, 4.14 ... 4.17**) is maintained by the drive control board AMC-DC. Thus, there is no need to change the setting of the jumper 2 at DCS600 MultiDrive (There is no effect on the parameter handling). The DCS600 MultiDrive's software doesn't utilize the parameter FPROM of SDCD-CON-2.

Jumpers must not be removed or connected if power is on!

Fault and Event Logger

The fault logger collects 22 of the most recent faults into the fault buffer in the RAM memory. The faults are stored into the FLASH-memory of the drive control board AMC-DC on the beginning of an auxiliary power loss. The fault logger consists of the all available information from the drive including the faults, alarms, reset and system messages.

AMC Time Format and Counting

Time for the loggered fault is taken from the time of a usage counter which format is 9999 hours, xx min, yy.yyyy s. However the time can be updated cyclically from the overriding system, if the system includes an overriding controller (for example APC2). DriveWindow tool and CDP 312 Control Panel show this time in real date and time format.

Data logger

The purpose of the Datalogger is to collect the history of signals related to an incident and stored in the drive for later retrieval and analysis. The content of the Datalogger is stored to the RAM memory.

The datalogger consist of 1...4 channels. The total memory size for the datalogger is 2048 words (1word == 3 bytes). The total samples/channel depends on the data type:

- Integer type signal or parameter reserves 1 word.
- Real type value reserves 2 words.

Example: Four real type signals are measured. The total sample/channel is 2048/(2 words x 4 channels) = 256 samples.

External triggering of the datalogger is possible by setting/resetting bit 1 of the auxiliary control word **[7.02]**. To activate the external triggering of the datalogger, signal **[3.05]** must be selected as trigger source; the trigger level should be set between -30000 and +30000. The selected edge of the trigger signal **[3.05]** equals the trigger edge of bit 1.

Datalogger signals can be selected by DriveWindow Tool. However, after power down / fail of the control electronics, the default values are valid.

Monitoring of overriding control system signals

DCS600 MultiDrive has 12 free signals which are not used by the DCS600 MultiDrive software. These can be used for measuring signals from the overriding control system by DriveWindow.

DATA 1	**(19.01)**
DATA 2	**(19.02)**
DATA 3	**(19.03)**
DATA 4	**(19.04)**
DATA 5	**(19.05)**
DATA 6	**(19.06)**
DATA 7	**(19.07)**
DATA 8	**(19.08)**
DATA 9	**(19.09)**
DATA 10	**(19.10)**
DATA 11	**(19.11)**
DATA 12	**(19.12)**

Fault and alarm texts and codes

The signal codes given in the following tables is displayed on the SDCS-CON-2's LED display H1. The given fault or alarm texts [in brackets] are displayed by the CDP312 or by DriveWindow.

Faults detected by the converter control software (SDCS-CON-2)

Signal Code (SDCS-CON-2)	Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
1	Auxiliary voltage fault [**01 AUX UVOLT**]	Fault	Trips	To be reset
2	Armature overcurrent [**02 OVERCURR**]	Fault	Trips	To be reset
3	Conferter fan current fault [**03 C FAN CUR**]	Fault	Trips	To be reset
4	Measured over temperature of converter [**04 CONV TEMP**] **Note!** • May also be caused by bad connector X12 of SDCS-CON-2. • May also be caused by temperatures below minus 10 deg, or by sensor short circuit.	Fault	Trips	To be reset
5	Earth fault [**05 EARTH FLT**]	Fault	Trips	To be reset
6	Measured over temperature of motor 1 [**06 MOT1 TEMP**]	Fault	Trips	To be reset
7	Calculated over temperature of motor 1 [**07 MOT1 LOAD**]	Fault	Trips	To be reset
8	Excessive current rise [**08 CURR RISE**]	Fault	Trips	To be reset
14	Speed measurement fault, see parameters SPEED MEAS MON LEV (28.23) SPEED EMF MON LEV (28.24) [**14 SPD MEAS**]	Fault	Trips	To be reset

Signal Code (SDCS-CON-2)	Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
17	Type code of the converter not found [**17 TYPE CODE**] **Note!** May also be caused by bad connector X13 of SDCS-CON-2.	Fault	Trips	Can't be reset
18	Type Code Backup fault [**18 CON FLASH**] Caused by a failure of the SDCS-CON-2 board's FLASH memory. This memory is used to store the type code signals of the drive.	Fault	Trips	Can't be reset
20	CON-systen fault [**20 CON SYS**] Caused by a failure of the communication to the AMC-DC board; i.e. if the AMC-DC board has failed.	Fault	- Trips - all digital outputs reset to 0	To be reset
23	Motor stalled [**23 MOT STALL**]	Fault	Trips	To be reset
27	Calculated over temperature of motor 2 [**27 MOT2 LOAD**]	Fault	Trips	To be reset
28	Armature DC over voltage [**28 ARM OVOLT**]	Fault	Trips	To be reset
29	Main AC supply under voltage [**29 MAIN UVLT**]	Fault	Trips	To be reset
30	Main AC supply over voltage [**30 MAIN OVLT**]	Fault	Trips	To be reset
31	Firing unit synchronization fault [**31 NO SYNC**]	Fault	Trips	To be reset

Signal Code (SDCS-CON-2)	Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
32	Field exciter 1 overcurrent [**32 FEX1 OCUR**]	Fault	Trips	To be reset
33	Field exciter 1 comm. error [**33 FEX1 COMM**]	Fault	Trips	To be reset
34	Armature current ripple [**34 CURR RIPP**]	Fault	Trips	To be reset
35	Field exciter 2 overcurrent [**35 FEX2 OCUR**]	Fault	Trips	To be reset
36	Field exciter 2 comm. error [**36 FEX2 COMM**]	Fault	Trips	To be reset
37	Motor overspeed [**37 OVERSPEED**]	Fault	Trips	To be reset
38	AC input hase sequence fault [**38 PHAS SEQU**]	Fault	Trips	To be reset
39	Missing field acknowledge / field current too low [**39 NO FIELD**]	Fault	Trips	To be reset
40	Missing ext. FAN acknowledge [**40 NO E FAN**]	Fault	Trips	To be reset
41	Missing main contactor acknowledge [**41 NO M CONT**]	Fault	Trips	To be reset
42	First field exciter status not OK [**42 FEX1 FLT**]	Fault	Trips	To be reset
43	Second field exciter status not OK [**43 FEX2 FLT**]	Fault	Trips	To be reset
44	I/O-board missing [**44 NO I/O**] **Note: check proper setting of 98.08**	Fault	Trips	Can't be reset
48	Measured overtemperature of motor 2 [**48 MOT2 TEMP**]	Fault	Trips	To be reset
50	Missing converter FAN acknowledge [**50 NO C FAN**]	Fault	Trips	To be reset
65	12-pulse or 6-pulse: reversal fault, see parameters REV GAP (47.07) REV FAULT DELAY (47.08) [**65 REVER FLT**]	Fault	Trips	To be reset
66	12-pulse: current difference fault, see parameters DIFF CURR LIMIT (47.04) DIFF CUR DELAY (47.05) [**66 CURR DIFF**]	Fault	Trips	To be reset
67	12-pulse: communication fault [**67 12P COMM**]	Fault	Trips	To be reset
68	12-pulse: slave is faulted [**68 SLAVE DIS**]	Fault	Trips	To be reset

Alarms detected by the converter control software (SDCS-CON-2)

Signal Code (SDCS-CON-2)	Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
101	Inhibition of false start switch has been switched [**01 START INH**] **Note: check proper setting of 13.11 and 15.14**	Status	Prevents start up	Resets when released
102	Emergency stop button has been pushed [**02 EMER STOP**]	Status	Prevents start up	Resets when released
103	Motor1 measured temperature [**03 MOT1 TEMP**]	Alarm	Alarm indicator	Self reset
104	Motor 1 thermal model alarm [**04 MOT1 LOAD**]	Alarm	Alarm indicator	Self reset
105	Converter unit temperature measurement [**05 CONV TEMP**]	Alarm	Alarm indicator	Self reset
108	CON RAM backup (due to power down time > 3 weeks) [**08 CON BCKUP**]	Alatm	Alarm indicator	Resets on next power-on
115	Armature current ripple [**15 CURR RIPP**]	Alarm	Alarm indicator	Self reset
118	Main supply under voltage [**18 MAIN UVLT**]	Alarm	Alarm indicator	Self reset
120	Armature current deviation [**20 CURR DEV**]	Alarm	Alarm indicator	Self reset
121	CON-communication alarm [**21 CON SYS**]	Alarm	Alarm indicator	Self reset
123	Motor2 temperature measurement [**23 MOT2 TEMP**]	Alarm	Alarm indicator	Self reset
124	Motor2 thermal model alarm [**24 MOT2 LOAD**]	Alarm	Alarm indicator	Self reset
125	Acknowledge of DC breaker or dynamic brake contactor prevents the drive from running [**25 NO ACK**]	Alarm	Alarm indicator	Self reset
126	Missing acknowledge of conv. FAN [**26 CONV FAN**]	Alarm	Alarm indicator	Self reset
127	Missing acknowledge of ext. FAN [**27 EXT FAN**]	Alarm	Alarm indicator	Self reset

Signal Code (SDCS-CON-2)	Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
129	Type code changed during power down [**29 TYPE CODE**] **Note: see 15.02 / selection 22**	Alarm	Alarm indicator	Self reset
132	Aux.voltage switched off (OFF-state) [**32 AUX UVOLT**]	Alarm	Alarm indicator	Self reset
133	Overvoltage protection alarm (via DI2 in field exciter mode) [**33 OVERVOLT**]	Alarm	Alarm indicator	Self reset

Note! The texts displayed by the fault logger or the panel include the signal code of the alarm without the base 100 (e.g. alarm 129 is entered with alarm code 29); the information whether an entry was caused by an alarm or a fault is displayed separately.

Faults and alarms detected by the drive control software (AMC-DC)

Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
Resets all resettable faults [**RESET FAULT**]	Reset		
AMC-DC board: operating system fault [**SYSTEM FAULT**]	Fault	Trips	To be reset
Mismatch of CON- and AMC-DC-software [**SW MISMATCH**]	Fault	Trips	Can’t be reset
AMC-DC / SDCS-CON-2 communication link fault [**CON COMMUNIC**]	Fault	Trips	To be reset
External fault via DI (selected by 15.23) [**EXT FAULT**]	Fault	Trips	To be reset
DDCS channel 0 communication fault [**CH0 COMMUN**]	Fault / Alarm	Parameter dependent	To be reset / Self reset
Master / follower link communication fault [**M/F LINK**]	Fault / Alarm	Parameter dependent	To be reset / Self reset
Control panel link fault [**PANEL LOSS**]	Fault / Alarm	Parameter dependent	To be reset / Self reset
Speed scaling out of range. [**SPEED SCALE**]	Alarm	Alarm indicator	Self reset
External alarm via DI (selected by 15.24) [**EXT ALARM**]	Alarm	Alarm indicator	Self reset

Combined fault words

Index **9.01**	**FAULT WORD 1** combined fault word 1	
Scaling: see below	Read only	Type: PB
Bit	**Fault text**	**Signal code** (fault code)
0	Auxil. under voltage	1
1	Overcurrent	2
2	Armature over voltage	28
3	Converter overtemp	4
4	Earth fault	5
5	**Motor 1** overtemp. (measured)	6
6	**Motor 1** overload (thermal model)	7
7	I/O board not found	44
8	**Motor 2** overtemp. (measured)	48
9	**Motor 2** overload (thermal model)	27
10	Converter fan current fault	3
11	Mains under voltage	29
12	Mains over voltage	30
13	Not in synchronism	31
14	**Field Ex. 1** overcurr.	32
15	**Field Ex. 1** comm. error	33

Index **9.02**	**FAULT WORD 2** combined fault word 2	
Scaling: see below	Read only	Type: PB
Bit	**Fault text**	**Signal code** (fault code)
0	Arm. current ripple	34
1	**Field Ex. 2** overcurr.	35
2	**Field Ex. 2** comm. error	36
3	Phase sequence fault	38
4	No field ack. / field current too low	39
5	Speed meas fault	14
6	No ext. FAN ack.	40
7	No main cont. ack.	41
8	Type coding fault	17
9	External fault via DI (selected by 15.23)	---
10	No C FAN ack	50
11	DDCS channel 0 communication fault	---
12	**Field Ex. 1** Not O.K.	42
13	**Field Ex. 2** Not O.K.	43
14	Motor stalled	23
15	Motor overspeed	37

Index **9.06**	**FAULT WORD 3** combined fault word 3	
Scaling: see below	Read only	Type: PB
Bit	**Fault text**	**Signal code** (fault code)
0	12-pulse or 6-pulse: reversal fault	66
1	12-pulse: current difference fault	66
2	12-pulse: communication fault	67
3	12-pulse: slave is faulted	68
4		
5		
6	Current rise	8
7	System fault (AMC-DC board)	---
8		
9	Mismatch of CON- and AMC-DC-software	---
10	CON2 communication fault	---
11	Master / follower link fault	---
12		
13	Panel loss fault	---
14	CON FLASH memory fault	18
15	CON-System fault	20

Combined alarm words

Index **9.04**	**ALARM WORD 1** combined alarm word 1	
Scaling: see below	Read only	Type: PB
Bit	**alarm text**	**Signal code** (alarm/status code)
0	Start inhibition	101
1	Emergency stop	102
2	Acknowledge of DC breakeror dynamic brake	125
3	Conv. overtemp. alarm	105
4		
5	**Motor 1** overtemp. alarm	103
6	**Motor 1** overload alarm	104
7		
8	**Motor 2** overtemp. alarm	123
9	**Motor 2** overload alarm	124
10	Mains undervolt. alarm	118
11	Master / follower link alarm	---
12	Conv. fan ack. alarm	126
13	Arm. current deviation alarm	120
14		
15	Ext. fan ack. alarm	127

Index **9.05**	**ALARM WORD 2** combined alarm word 2	
Scaling: see below	Read only	Type: PB
Bit	**alarm text**	**Signal code** (alarm/status code)
0	Armature current ripple	115
1	Type code changed	129
2	Aux. undervoltage alarm	132
3	Overvoltage protection (via DI2, in field exciter modus)	133
4		
5		
6		
7	Speed scaling out of range	---
8		
9	External alarm via DI (selected by 15.24)	---
10	CON communication alarm (2ms timeout)	121
11	DDCS channel 0 communication alarm	---
12	CON RAM backup	108
13	Panel loss alarm	---
14		
15		

Combined limit words

Index **8.03**	**LIMIT WORD 1** combined limit word 1	
Scaling: see below	Read only	Type: PB
Bit	**limit**	
0	Maximum output torque limit **(20.05)** or maximum converter limit **(2.19)**	
1	Minimum output torque limit **(20.06)** or minimum converter limit **(2.20)**	
2	Maximum speed controller **(20.07)** limit or maximum converter limit **(2.19)**	
3	Minimum speed controller **(20.08)** limit or minimum converter limit **(2.20)**	
4	Maximum torque reference limit **(20.09)**	
5	Minimum torque reference limit **(20.10)**	
6	Maximum speed reference limit **(20.02)**	
7	Minimum speed reference limit **(20.01)**	
8		
9		
10		
11		
12		
13		
14		
15		

AMC-DC board: Operating system alarms and faults

Definition [Fault or alarm text]	Type of Signal	Mode of Action	Reset Method
System stack underflow [**SS UNDERFLOW**]	Fault	Trips	To be reset
System stack overflow [**SS OVERFLOW**]	Fault	Trips	Can't be reset
Register stack overflow [**RS OVERFLOW**]	Fault	Trips	To be reset
DDF file format fault [**DDF**]	Fault	Trips	To be reset
File handling fault (FLASH) [**NVOS**]	Fault	Trips	To be reset
User macro file fault [**USER MACRO**]	Fault	Trips	To be reset
Default parameter file fault [**FACTORY FILE**]	Fault	Trips	To be reset
100us time level overflow [**T2 OVERFLOW**]	Fault	Trips	To be reset
1ms time level overflow [**T3 OVERFLOW**]	Fault	Trips	To be reset
50ms time level overflow [**T4 OVERFLOW**]	Fault	Trips	To be reset
1s time level overflow [**T5 OVERFLOW**]	Fault	Trips	To be reset
State machine time level (2ms) overflow [**STATE OVERF.**]	Fault	Trips	To be reset
Application window end fault [**APPL.W.END**]	Fault	Trips	To be reset
Application fault [**APPLICATION**]	Fault	Trips	To be reset
Illegal instruction [**ILLEGAL INST**]	Fault	Trips	To be reset
Panel application / Modlink alarm [**PANAP**]	Alarm	Alarm indicator	Self reset
Powerfail file missing [**POWFAIL FILE**]	Alarm	Alarm indicator	Self reset
Parameter store not successful [**PARAM STORE**]	Alarm	Alarm indicator	Self reset
DDCS channel 0 timeout [**CH0 TIMEOUT**]	Alarm	Alarm indicator	Self reset
Invalid message received at DDCS ch. 0 [**RDR1_0 READ**]	Alarm	Alarm indicator	Self reset
File handling alarms [**ALM (N1_xx)**]	Alarm	Alarm indicator	Self reset
File handling faults [**FLT (N1_xx)**]	Fault	Trips	To be reset

COMMUNICATION

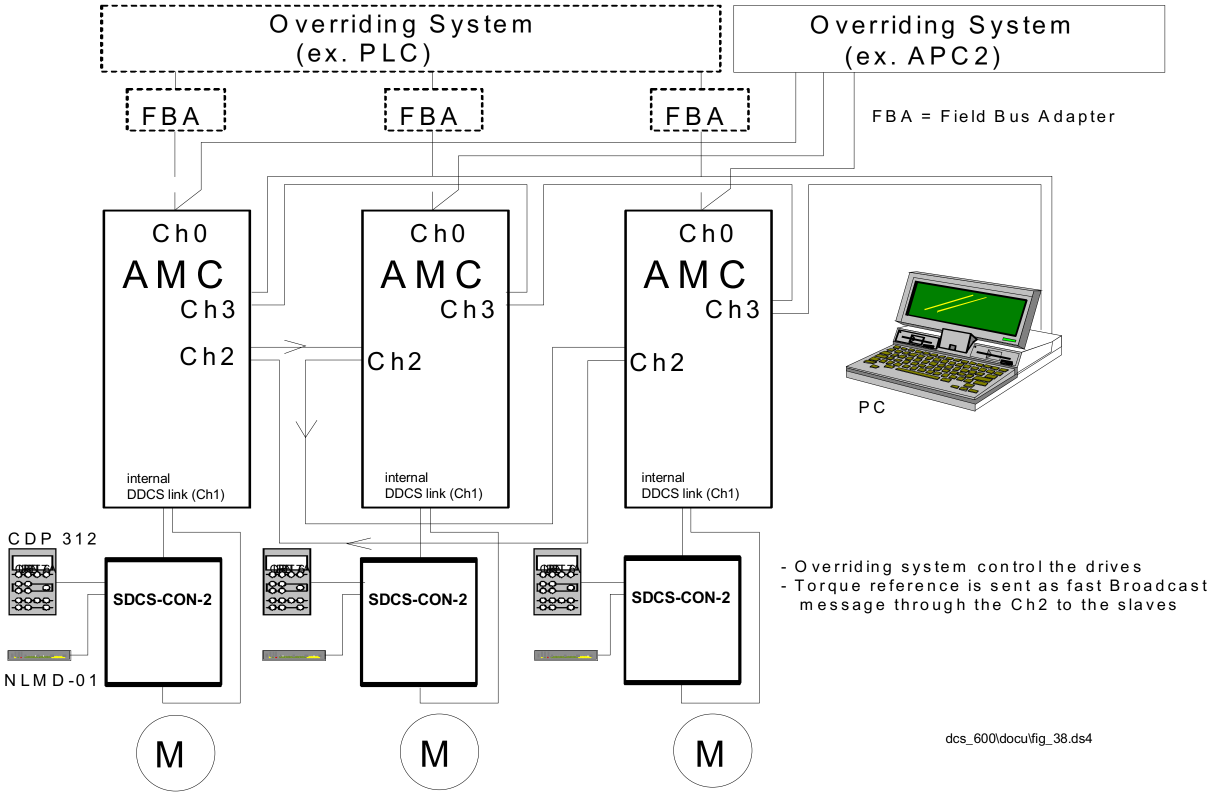


Figure 33-1 DDCS Channels

Several communication protocols are supported by using the Field Bus Adapters connected to DDCS channel 0 (CH0) on the AMC-DC-board. The communication protocol of channels CH0...CH3 is DDCS (Distributed Drives Communication System). The DDCS link between the overriding system and the drive uses what is called datasets for the information packet exchange. The link sends the information of a transmitted dataset to the Dataset table in the drive software and returns the content of the next dataset to the overriding system as a “return message”. The transmission rate is 4 Mbit/s and the link can send 1 dataset every 1 ms. The received data from the overriding system effects only the RAM memory on the AMC-DC-board, (not FPROM).

Field Bus Communication at Channel CH0

This communication is using datasets between the FBA-unit and the AMC-DC-board. The base datset number is programmed by means of the parameter **DSET BASE ADDRESS (70.20)** in the range from 1 to 16. The first dataset is sent to the drive, the second to the fieldbus module, and so on. Up to 8 datasets are possible for each direction. Communication for the Field Bus Adapter is activated from the parameter

COMM MODULE (98.2)	1 = NO	
	2 = FIELDBUS	
	3 = ADVANT	(e.g. APC, default)

Signals in the Field Bus

The contents of the fieldbus datasets is programmed by the same pointers as the Advant datasets (**groups 90 ... 93**). Also the update times are the same. See next chapter.

Addressing of Advant (or APC)-Data

This communication is using datasets between the Advant controller and the AMC-DC-board. The base datset number is programmed by means of the parameter **DSET BASE ADDRESS (70.20)** in the range from 1 to 16; **for Advant communication this parameter must be set to 10** (default). The first dataset is sent to the drive, the second to the Advant controller, and so on. Up to 8 datasets are possible for each direction. In addition, a set of 2 datasets (32 and 33) is available for a mailbox function.

Every dataset has a specified read and write task interval in the drive software. Addresses are set in the drive according to the parameter groups 90...93, these are not sent through the link except the datasets 32 and 33 which are dedicated for “mail box use”. Access to the APC-datasets is activated from the parameter

COMM MODULE (98.2)	1 = NO	
	2 = FIELDBUS	
	3 = ADVANT	(e.g. APC, default)

In case of the usage of a branching unit, the repeating of messages must be disabled. This is selected with parameter

CH0 HW CONFIG (70.21)	0 = RING	repeating of messages
	1 = STAR	no repeating of messages (default)

APC-Mail-Box Function

Individual parameter values can be read and set from the overriding system on the simple way by using the datasets 32 and 33. Transmitted and received parameter addresses and data are defined for the datasets 32 and 33 in the Overriding System application. This can be used as “mail box” to set or inquire the parameter values. Values written via dataset 32 are **NOT** stored to the FLASH memory.

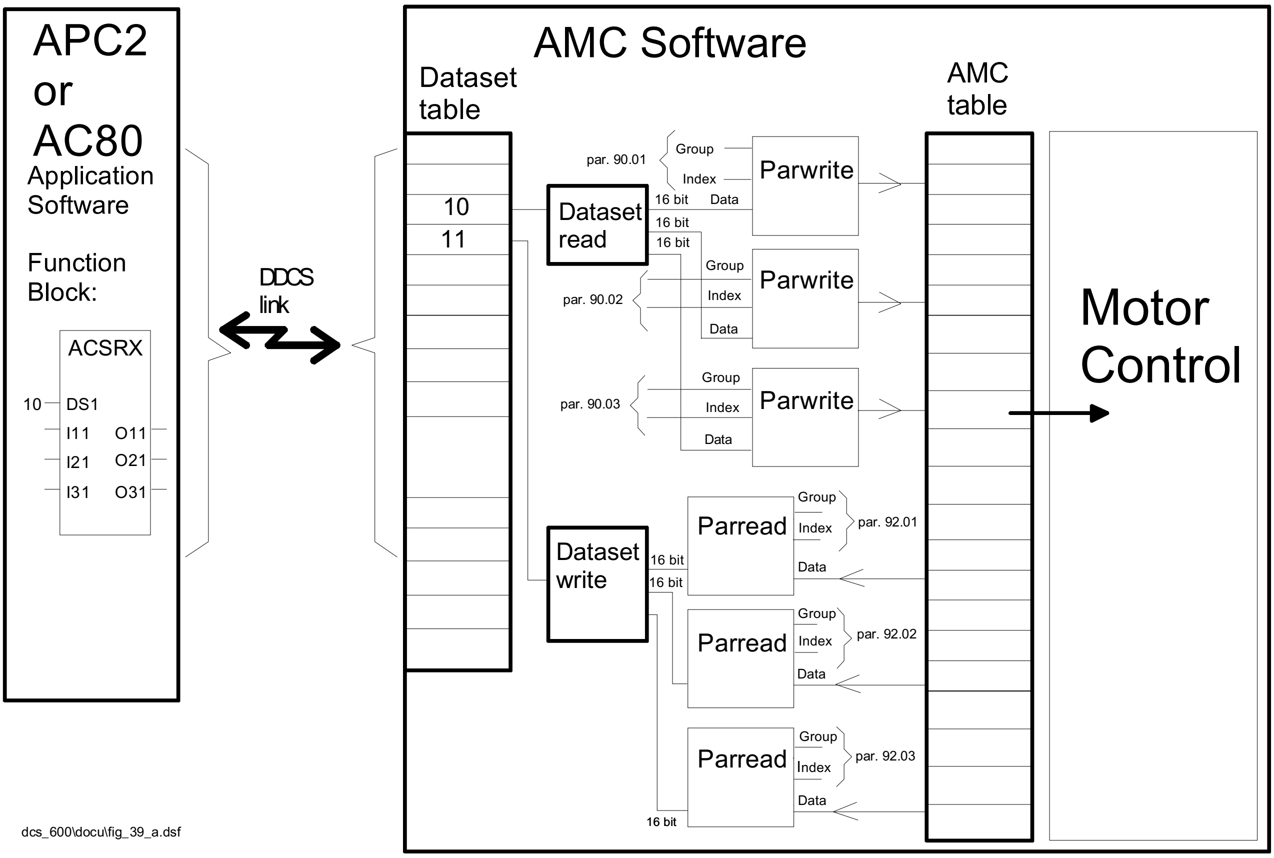


Figure 33-2 The Overriding Control and the idea of the data addressing

Integer Scaling in the DDCS Link

Due to the effectiveness of the communication method, the data is transferred as integer values through the link. Therefore the actual and reference values have to be scaled to 16 bits integers for the DDCS link. The integer scaling factor (== bit weight) is mentioned in the AMC table parameter list in a column Integer scaling.

Each parameter has two different gateway to write the value: integer format or decimal. Finally the result is exactly the same for the internal drive control-SW. This relationship is shown always in the signal and parameter table.

Received Dataset Table

Addresses are set by a CDP312 control panel or DriveWindow into the parameters 90...93 or by means of transmit dataset 32.

Addresses for Received Data from the Overriding System					
Dataset Number	**Dataset Index**	**Update Time**	**Default Address**	**Parameter Name (default values)**	**Selection Parameter**
10 **[70.20]+0**	1 2 3	2 ms 2 ms 2 ms	701 2301 2501	MAIN CTRL WORD SPEED REF TORQ REF A	90.01 90.02 90.03
12 **[70.20]+2**	1 2 3	2 ms 2 ms 2 ms	702 703	AUX CTRL WORD AUX CTRL WRD 2	90.04 90.05 90.06
14 **[70.20]+4**	1 2 3	10 ms 10 ms 10 ms			90.07 90.08 90.09
16 **[70.20]+6**	1 2 3	10 ms 10 ms 10 ms			90.10 90.11 90.12
18 **[70.20]+8**	1 2 3	10 ms 10 ms 10 ms			90.13 90.14 90.15
20 **[70.20]+10**	1 2 3	50 ms 50 ms 50 ms			90.16 90.17 90.18
22 **[70.20]+12**	1 2 3	50 ms 50 ms 50 ms			91.01 91.02 91.03
24 **[70.20]+14**	1 2 3	50 ms 50 ms 50 ms			91.04 91.05 91.06
26 **28** **30**	1 2 3			Not in use Not in use Not in use	
32	1 2 3	50 ms 50 ms 50 ms		Transmit address in AMC-DC-SW Transmit data Inquire address	91.07 91.08 91.09

Note 1: The given update times are the times within the drive is reading from the datasets. Since the drive is a slave to the communication master, the actual communication cycle time depends on the communication master’s cycle time.

Note 2: The dataset numbers 10 to 24 are examples for the parameter **DSET BASE ADDRESS (70.20)** set to **10**.

Transmitted Dataset Table

Addresses are set by a CDP312 control panel or DriveWindow into the parameters 90...93 or by means of transmit dataset 32.

Signal Addresses for the Transmitted Data to the Overriding System					
Dataset Number	**Dataset Index**	**Update Time**	**Default Address**	**Parameter name (default values)**	**Selection Parameter**
	1	2 ms	801	MAIN STATUS WORD	92.01
11	2	2 ms	104	MOTOR SPEED	92.02
[70.20]+1	3	2 ms	209	TORQUE REF 2	92.03
	1	2 ms	802	AUX STATUS WORD	92.04
13	2	2 ms	101	MOTOR SPEED FILT	92.05
[70.20]+3	3	2 ms	108	MOTOR TORQUE	92.06
	1	10ms	901	FAULT WORD 1	92.07
15	2	10 ms	902	FAULT WORD 2	92.08
[70.20]+5	3	10 ms	906	FAULT WORD 3	92.09
	1	10 ms	904	ALARM WORD 1	92.10
17	2	10 ms	905	ALARM WORD 2	92.11
[70.20]+7	3	10 ms	903	SYST. FAULT WORD	92.12
	1	10 ms	803	LIMIT WORD 1	92.13
19	2	10 ms	804	LIMIT WORD 2	92.14
[70.20]+9	3	10 ms	805	DI STATUS WORD	92.15
	1	50 ms	124	HEAT SINK TEMP	92.16
21	2	50 ms	122	MOT 1 MEAS TEMP	92.17
[70.20]+11	3	50 ms			92.18
	1	50 ms			93.01
23	2	50 ms			93.02
[70.20]+13	3	50 ms			93.03
	1	50 ms			93.04
25	2	50 ms			93.05
[70.20]+15	3	50 ms			93.06
27	1			Not in use	
29	2			Not in use	
31	3			Not in use	
	1	50 ms		Transmit address feedback	93.07
33	2	50 ms		Inquired data	93.08
	3	50 ms		Inquired addr. feedb.	93.09

Note1: The given update times are the times within the drive is writing to the datasets. Since the drive is a slave to the communication master, the actual communication cycle time depends on the communication master’s cycle time.

Note 2: The dataset numbers 11 to 25 are examples for the parameter **DSET BASE ADDRESS (70.20)** set to **10.**

I/O Devices on the Channel CH2 of AMC-DC board

All optional I/O devices must be connected in a ring to channel 2 (CH2), on the AMC-DC-board which is the master in the communication link. Each device has an individual device address number coded by DIP-switches on the I/O device.

Note! The standard DCS600 MultiDrive software doesn't support optional I/O modules. The according functions must be implemented by means of application programming. Optional I/O modules are not possible, if the channel 2 is configured to Master/Follower link, or if an AMC-DC-CLAS1 board (with 10MBaud components on channel 2) is being used.

Master Follower Link on the Channel CH2 of AMC-DC board

The Master Follower link can be formed by connecting channels CH2 to a ring between the drives. Parameters 70.07...70.14 defines the mode and the references. The message type is broadcast (dataset 41).

The Master/Follower function is designed for applications in which the system is operated by several DCS600 MultiDrive drives and the shafts are coupled to each other gearing, chain, belt etc. The Master controls the Followers via a fibre optic serial communication link.

The Master station is typically speed controlled and the other drives follow its torque or speed reference. In general, torque control of the Follower should be used when the motor shafts of the Master and Follower drives are coupled fixedly to each other by gearing, a chain etc. and no speed difference between the drives is possible/allowed.

Link Configuration

Channel 2 (CH2) on the AMC-DC board is used for the Master/Follower link between the drives. Channel 2 (CH2) is configurable by software either to be the master or follower in the communication in broadcast mode (dataset 41). Typically the speed controlled process master drive is configured also to be the communication master.

In addition to the broadcast communication, it is also possible to exchange multiple datasets between the master drive and several slave drives. The exchange, reading from and writing to the datasets must be implemented by means of application programming.

CH2 M/F MODE (70.8)

1 = NOT IN USE	no CH2 communication
2 = MASTER	CH2 Drive is a master (dset 41) broadcast
3 = FOLLOWER	CH2 Drive is a follower (dset 41) broadcast
4 = LINK MASTER	CH2 master available for application program
5 = LINK SLAVE	CH2 slave available for application program

Master drive

The torque reference source address is defined in the Master Drive by parameter **MASTER SIGNAL 3 (70.11)** to be sent to the dataset 41 in the follower drives. Also two other signals can be sent through the link in the same DDCS message, if required. Their addresses are defined by parameter **MASTER SIGNAL 1 (70.09)** and **MASTER SIGNAL 2 (70.10)**. Typical addresses are:

Signal Addresses for the Transmitted Data to the Overriding System					
Dataset Number	**Dataset Index**	**Update Time**	**Default Address**	**Parameter name (default values)**	**Selection Parameter**
41	1	2 ms	7.01	MAIN CTRL WORD	70.09
	2	2 ms	23.01	SPEED REF	70.10
	3	2 ms	2.10	TORQ REF 3	70.11

The Master Drive sends cyclically MASTER SIGNAL 1...3 in one DDCS message as broadcast every 2 ms period.

Follower drive(s)

If the Follower mode is selected by parameter **CH2 MF MODE (70.08)**, the connections are selected by the parameters **FOLLOWER SIGNAL 1 (70.17)**, **FOLLOWER SIGNAL 2 (70.18)** and **FOLLOWER SIGNAL 3 (70.19)** according to following table.

Signal Addresses for the Transmitted Data to the Overriding System					
Dataset Number	**Dataset Index**	**Update Time**	**Default Address**	**Parameter name (default values)**	**Selection Parameter**
41	1	2 ms	7.01	MAIN CTRL WORD	70.17
	2	2 ms	23.01	SPEED REF	70.18
	3	2 ms	25.01	TORQ REF A	70.19

Follower mode consist of only fast data transfer from the dataset 41 to the speed and torque reference chain. Therefore this dataset can also be used by using CH0 from the overriding system, when fast broadcast communication is required, but there is no need for real Master-Follower application.

Note! The configuration of the reference pointers (groups 70, 90, 91) has to take care, that each destination is addressed only once (e.g. in case of simultaneous usage of both overriding control system and master/follower link).

Note! The Master signal (2.10) is send via Master parameter (70.11) to the Follower signal (25.01) via Follower parameter (70.19).

Other settings: Master (70.08) = 2
Follower (70.08) = 3

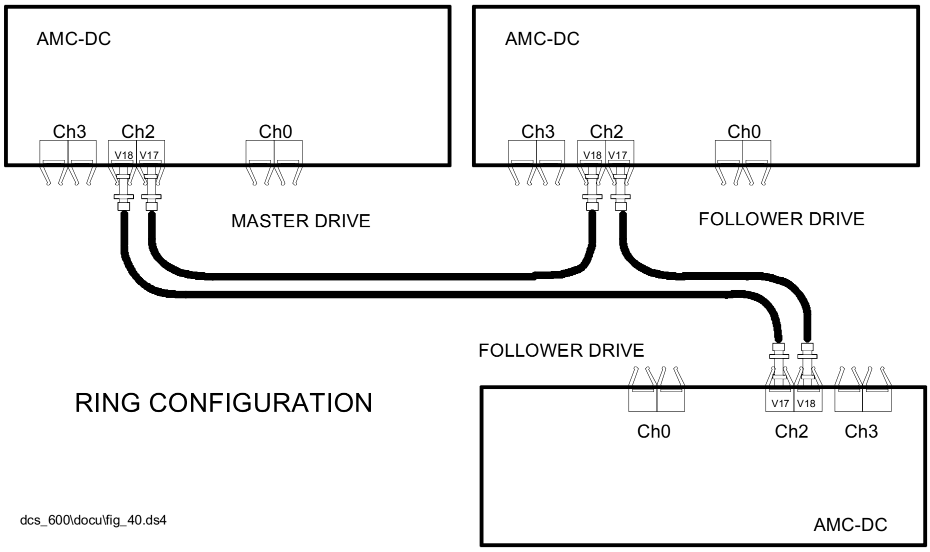


Figure 33-3 Master/Follower optic cable connection

Online switching between speed and torque control

In some application, both speed control and torque control of the Followers are required, e.g. if it is necessary to accelerate all drives along the same speed ramp up to a certain speed before the torque control can be started. In those cases, a flying switching between the speed and torque controls is required. The switching is done by controlling parameter **TORQUE SELECTOR (26.01)** from the overriding system. See parameter TORQ REF SEL (26.01).

Follower Diagnostics

All of the Followers receive the torque reference for the TORQUE REF A signal.

The follower drive is able to detect the communication break. After the receiption of the first valid message, the action is defined by parameter **CH2 TIMEOUT (70.13)** and **CH2 COM LOSS CTRL (70.14)**. Before, an alarm (**M/F LINK**) is generated, if the FOLLOWER mode is selected.

Diagnostics feedback from the followers must be handled by the overriding system through the channel 0 on the AMC-DC-board, or by additional dataset communication via channel 2 implemented by means of application blocks.

Master/Follower Link Specification

Size of the link: One Master and at maximum ten Follower stations. If more than ten followers are required, an ABB represantive should be consulted.

Configuration: Link is configurable by the application from the overriding system. See parameter **CH2 MF MODE (70.08)**. This makes possible to change Master and Follower ON LINE in the link by an overriding system or application without changes in the hardware.

Transmission rate: 4 Mbit/s

Total performance of the link: 2 ms (between the master and follower drives)

Commissioning and Supporting Tools at Channel CH3

The DriveWindow commissioning tool and other tools can be connected to channel CH3 on the AMC-DC-board either by a ring or star connection by using the branching unit boards. Node numbers must be set for each drive unit before starting the communication through the ring or star connection. See parameter **70.15 CH3 NODE ADDR**. This setting can be made by either point to point connection with either the control panel CDP312 or DriveWindow. The new node address becomes valid after auxiliary power shutdown of the AMC-DC-board. The AMC-DC-board channel 3 (CH3) has been configured to Slave in the communication point of view.

The string of parameter (97.1) (e.g. 12-pulse master) gives a clear identification in tool Drive Window.

Modbus Link

Modbus is a RS 485 serial, asynchronous protocol. The CDP 312 Control Panel, or NLMD-01 Led Monitoring Display panel can be connected to the DCS 600 drive through the MODBUS link. The communication speed is 9600 bit/s (8 data bits, 1 stop bit, odd parity). The connected device is the master of the communication link. A NBCI-01 Bus Connection units must be used if the distance between panel and drive is more than three meters.

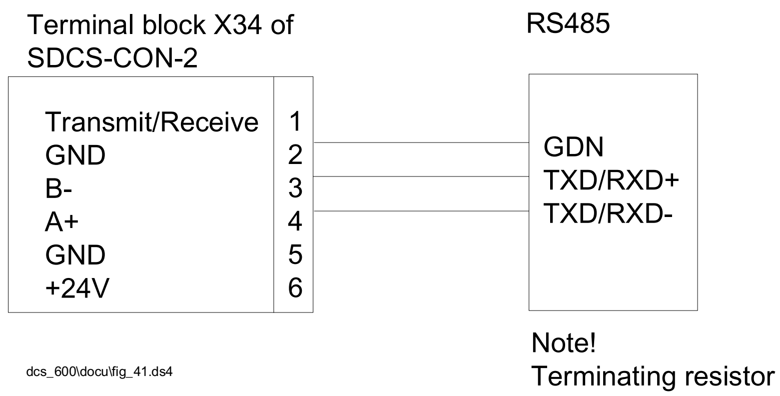


Figure 33-4 RS 485 connection principle

Register Read and Write

The DCS600 MultiDrive drive parameters and data set information is mapped into the 4xxxx register area. This holding register area can be read from an external device and it can modify the register values by writing to them.

There are no setup parameters for mapping the data to the 4xxxx registers. The mapping is pre-defined and corresponds directly to the drive parameter grouping which is being used by the local drive panel.

All parameters are available for both reading and writing. The parameter writes are verified for correct value and for valid register addresses. Some parameters never allow write access (including actual values), some parameters allow write access only when the drive is stopped (including setup variables), and some parameters can be modified at any time (including actual reference values).

Register Mapping

The drive parameters are mapped to the 4xxxx area so that:
40101 – 40999 registers are reserved for the actual values
41000 – 49999 registers are reserved for the parameter data

In this mapping, the thousands and hundreds correspond to the group number, while the tens and ones correspond to the parameter number within a group.

Other Fieldbus Connections

See DCS600-specific documentation of the according fieldbus adapters.

Field Excitation Communication

The control board SDCS-CON-2 and field exciters SDCS-FEX-2 / DCF50xA / DCS600 MultiDrive are connected together by means of an RS485 serial communication link with baud rate of 62.5 kbits. The update interval of the field current reference is 10 ms (100ms for the 2nd field exciter). It is possible to connect up to two field exciters. The second unit mustn't be the internal SDCS-FEX-2.
Address coding for the link is made by

- means of DIL-switch X800:1 (OFF == Node 1, ON == Node 2) on DCF 50xA
- parameter **(15.21)** at a DCS600 operated as field exciter DCF600

The unit reads the address only if the electronic power is switched on.

The parameters of field exciters are downloaded every time when the power is connected to the converter or during normal operation every time when some parameter changes are done.
The parameters of a DCS600 MultiDrive operated as field exciter aren't downloaded via the serial link. They must be set at the DCS600 MultiDrive itself.

In the program the selection between field exciters is made by means of the parameter:

USED FEX TYPE (15.05):

- 0= No field exciter
- 1= Internal diode field exciter SDCS-FEX-1
- 2= Internal SDCS-FEX-2 or external DCF503A/504A or DCS600 MultiDrive as first field exciter
- 3= Ext. DCF503A/504A or DCS600 MultiDrive as a second field exciter
- 4= Int. SDCS-FEX-2 or ext. DCF503A/504A or DCS600 MultiDrive as first field exciter and ext DCF503A/504A as second field exciter
- 5...13 External field exciters controlled via AI / DI (alien field exciters)

Both field exciters have own individual status signals for the communication:

Note: For correct scan of used Fex type (signals (4.06, 4.07)) it is recommended to cycle aux. supply after changing parameter (15.05).

FEX1 COM STATUS (4.18) first field exciter (Node 1)
FEX2 COM STATUS (4.19) second field exciter (Node 2)

- 0= OK
- B0 time-out when write parameter, no echo for address
- B1 time-out when write parameter, no values received
- B2 time-out when read parameters, no echo for address
- B3 time-out when read parameters, no values received
- B4 time-out when read actual values, no values received

Communication errors can be read out from the signals:

FEX1 COM ERRORS (4.20) first field exciter (Node 1)
FEX2 COM ERRORS (4.21) second field exciter (Node 2)

First field exciter:	is a full operative field exciter function including field weakening and field heat mode.
Second field exciter:	is a constant field exciter function including field heat mode.

The armature converter
is limiting **First** field exciter function to FEX Node 1.
is limiting **Second** field exciter function to FEX Node 2.

REVISION HISTORY

A brief description of the differences in program versions and the versions of the manuals related to revisions.

FPROM memory circuits are located on the control board SDCS-CON-2 (identification labels of circuits are in the board D33) and on the AMC-DC board.

1999-03-03
Rev. D: Added description of field control functions.

1999-11-04
Updated for Rev. E:
- Updated description for speed reference chain
- Clarified description of field heating and reduction
- Corrected some typing mistakes
- Updated the digital input description
- Updated the position counter description
- Changed fault logger events to 22
- Added Parameter Backup and Mode Switch Selection
- Added limiting of EMF reference in generative mode
- Added description of uk-dependent PLL compensation

2000-11-13
Updated for Rev. F:
- Added description of CH0 HW CONFIG
- Added description of current rise detection
- Added description of square wave pointer
- Added alarm for current ripple
- Corrected voltage scaling of 12-pulse serial mode
- Added hints how to set the nominal field current in case of DCF600 used as field exciter
- Corrected several typing mistakes

2002-01-29
Updated for Rev. G:
- Corrected typing mistakes
- Added SW changes of drive SW 15.210 / 15.620

Appendix A

Signals and Parameters of DCS600 MultiDrive

DCS600	**Armature Current Converter**
DCF600	**3-Phase Field Exciter**

CONTENTS

Parameter and signal list of DCS 600 MultiDrive

Par/Sig

s:	Signal	Signals are NOT stored in the FLASH memory
p:	Parameter	Parameters are stored in the FLASH memory **Note!** No parameter is stored to FLASH memory, if it is written by means of DDCS-dataset communication, (including the dataset's 32 mailbox function).

All signals are read only type. However, the overriding system can write to them, but it effects only to RAM memory.

Control board (ctrl. bd.)

AMC:	Signal or parameter resides in the AMC-DC board, or is always cyclically transfered from/to the SDCS-CON-2 board to the AMC-DC board.
CON:	Signal or parameter resides in the SDCS-CON-2 board. If more than 6 of these signals are selected for the data logger or the monitoring tool, they must be selected for cyclic updating to the AMC-DC board by means of a group **94** index pointer.

ID number

Parameter or Signal Number: **group.index**

All user visible parameter and signals have group numbers below 100.

Scaling
If the signal type is real value, it has also an integer scaling relation. This scaling is valid for accesses to parameters and signals by the overriding system (field bus, APC2, AC70, AC80, AC 800M).

Speed signals have a variable, user programmable scaling: the value programmed in parameter 50.1 programs the speed in rpm represented by the value 20000.

Units
Relative values are represented as percentage of their nominal values. A suffix to the unit **"%"** informs about the related nominal value:

%Tn	nominal motor torque
%Us	supply voltage (42.06)
%Im	nominal motor current (99.03)
%Ic	nominal converter current (4.13, 42.07)
%If1	nominal field current of motor 1
%If2	nominal field current of motor 2
%Fn	nominal flux
%Isys	nominal sum current of 12-pulse system
%I/ms	nominal converter current per ms
%Load	nominal thermal load

Type
The data type is given with a short code:

I:	16-bit signed integer value
Hex:	Hexadecimal display digits
PB:	packed boolean value **Note:** 16-bit packed boolean values are displayed on the CDP312 control panel or DrivesWindow as a 4-digit hexadecimal value
B:	boolean value (0 = false, 1 = true) Internal representation of a boolean value 1: ffff(ff) hex
R:	real value Real values are accessed from the control panel or from Drives Window as decimal values.
C:	Text string

Default value
The default values are given in this columns.

min./max. value
The programmable limits are given in this columns. If parameters are programmed to values exceeding this limits, they are limited to those values.

Signals

Most of the DCS600 MultiDrive's signals are inside the groups 1 ... 9. None of the indexes inside these groups is stored to the FLASH memory.

The following table gives an overview of the signal groups:

Signal Groups

Group	Size (Indexes)	Contents
1	27	Actual Values
2	24	Actual Values
3	27	Actual Values incl. System Values
4	24	Information
5	9	I/O signals
6	6	Drive Logic Signals
7	3	Control Words
8	5	Status and Limit Words
9	6	Fault and Alarm Words

Group 1: Actual Values

1	Group name:	**ACTUAL VALUES**			
	Description:	Measured or calculated values			
01 Index	Name:	**MOTOR SPEED FILT**			Par/Sig: s
	Description:	Filtered selected speed actual value Filter time constant: [50.06] + [50.13]			
unit: rpm	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: (50.01)	
02 Index	Name:	**SPEED ACTUAL EMF**			Par/Sig: s
	Description:	Actual speed calculated by EMF			
unit: rpm	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: (50.01)	
03 Index	Name:	**SPEED MEASURED**			Par/Sig: s
	Description:	Actual speed measured with pulse encoder.			
unit: rpm	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: (50.01)	
04 Index	Name:	**MOTOR SPEED**			Par/Sig: s
	Description:	Selected speed actual value The selected speed actual value is filtered by a speed feedback filter; time constant: see 50.06 If the speed feedback selection is set to EXTERNAL, this signal isn't updated by the motor control software. It can be written to by an external source by means of dataset communication.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: (50.01)	
06 Index	Name:	**MOTOR CURRENT**			Par/Sig: s
	Description:	actual relative motor current in per cent of the nominal motor current (see 99.03) Sign: **+** motor mode - generator mode			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	

1	Group name:	**ACTUAL VALUES (cont.)**			
	Description:	Measured or calculated values			
07 Index	Name:	**MOTOR TORQUE FILT**			Par/Sig: s
	Description:	Filtered motor torque (1.08) in per cent of the motor's nominal torque Filter time constant: 42.12.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
08 Index	Name:	**MOTOR TORQUE**			Par/Sig: s
	Description:	Motor torque of the active motor in per cent of the motor's nominal torque. Filtered by means of a 6th order FIR filter (sliding average filter, filter time 1 mains period).			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
09 Index	Name:	**CUR RIPPLE**			Par/Sig: s
	Description:	Current ripple monitor output (function 2)			
unit: %Ic	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
10 Index	Name:	**CUR RIPPLE FILT**			Par/Sig: s
	Description:	Filtered current ripple monitor output (function 2)			
unit: %Ic	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
11 Index	Name:	**RL MAINS VOLT ACT**			Par/Sig: s
	Description:	Actual relative mains voltage in per cent of the nominal supply voltage (see 42.06)			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
12 Index	Name:	**MAINS VOLT ACT**			Par/Sig: s
	Description:	Actual mains voltage (filtered with 10 ms).			
unit: V	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1V	
13 Index	Name:	**RL ARM VOLT ACT**			Par/Sig: s
	Description:	Actual relative DC voltage in per cent of the nominal supply voltage (see 42.06). In 12-pulse serial mode, this signal is related to the double nominal supply voltage (100% == 2 • [42.06]).			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 135%	
14 Index	Name:	**ARM VOLT ACT**			Par/Sig: s
	Description:	Actual DC voltage (filtered with 10 ms).			
unit: V	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1V	

1	Group name:	**ACTUAL VALUES (cont.)**			
	Description:	Measured or calculated values			
15 Index	Name:	**RL CONV CUR ACT**			Par/Sig: s
	Description:	Actual relative converter current in per cent of the nominal converter current.			
unit: %Ic	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
16 Index	Name:	**CONV CUR ACT**			Par/Sig: s
	Description:	Actual converter current (filtered with 10 ms).			
unit: A	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1A	
17 Index	Name:	**RL EMF VOLT ACT**			Par/Sig: s
	Description:	Actual relative EMF voltage in per cent of the nominal supply voltage (see 42.06). In 12-pulse serial mode, this signal is related to the double nominal supply voltage (100% == 2 • [42.06]).			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 3786 = 135%	
18 Index	Name:	**EMF VOLT ACT**			Par/Sig: s
	Description:	Actual EMF voltage (filtered with 10 ms).			
unit: V	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1V	
19 Index	Name:	**SELECTED BRIDGE**			Par/Sig: s
	Description:	Selected bridge **0** **NO BRIDGE** **1** **MOTOR BRIDGE** motor brigde **2** **GENER BRIDGE** generator bridge			
unit: ---	type: I	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
20 Index	Name:	**MOT 1 CALC TEMP**			Par/Sig: s
	Description:	Thermal model output for motor 1			
unit:%Load	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1%	
21 Index	Name:	**MOT 2 CALC TEMP**			Par/Sig: s
	Description:	Thermal model output for motor 2			
unit:%Load	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1%	

1	Group name:	**ACTUAL VALUES (cont.)**			
	Description:	Measured or calculated values			
22 Index	Name:	**MOT 1 MEAS TEMP**			Par/Sig: s
	Description:	Measured temperature of motor 1 The unit of this signal depends on parameter 28.09: NOT USED no units 1 ...3 • PT100 Cels PTC Ohm SCALED A/D no units			
unit: Cels Ohm ---	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1Cels / 1Ohm / 1	
23 Index	Name:	**MOT 2 MEAS TEMP**			Par/Sig: s
	Description:	Measured temperature of motor 2 The unit of this signal depends on parameter 28.12: NOT USED no units 1 ...3 • PT100 Cels PTC Ohm SCALED A/D no units			
unit: Cels Ohm ---	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1Cels / 1Ohm / 1	
24 Index	Name:	**HEAT SINK TEMP**			Par/Sig: s
	Description:	Temperature of the cooling element			
unit: Cels	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1Cels	

1	Group name:	**ACTUAL VALUES (cont.)**		
	Description:	Measured or calculated values		
25 Index	Name:	**CONTROL MODE**		Par/Sig: s
	Description:	Used control mode: 0: **NONE** 1: **SPEED CONT**: speed control 2: **TORQUE CONT**: torque control 3: **CURRENT CONT**: current control		
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---
26 Index	Name:	**LED PANEL OUTPUT**		Par/Sig: s
	Description:	The value of this signal is displayed at the LED panel (or the CDP312's actual value 1), if the panel's actual value 1 selection is set to 1.26. The selection for this signal is done by parameter 18.01. The scaling for this signal is programmed by parameter 18.02. **Note!** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: %	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 1 = 1%
27 Index	Name:	**LOAD CUR ACT**		Par/Sig: s
	Description:	actual relative armature (load) current in per cent of the nominal motor (load) current (see 99.03) Sign: **+** forward bridge **-** reverse bridge		
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 4096 = 100%
28 Index	Name:	**LOAD CUR ACT FILT**		Par/Sig: s
	Description:	Filtered actual relative motor (or load) current in per cent of the nominal motor current (see 99.03)		
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 4096 = 100%

Group 2: Actual Values

2	Group name:	**ACTUAL VALUES**		
	Description:	Measured or calculated values		
01 Index	Name:	**SPEED REF 2**		Par/Sig: s
	Description:	Limited speed reference.		
unit: rpm	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: (50.01)
02 Index	Name:	**SPEED REF 3**		Par/Sig: s
	Description:	Speed reference behind the speed ramp.		
unit: rpm	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: (50.01)
03 Index	Name:	**SPEED ERROR NEG**		Par/Sig: s
	Description:	speed actual value - speed reference.		
unit: rpm	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: (50.01)
04 Index	Name:	**TORQUE PROP REF**		Par/Sig: s
	Description:	P-part of the speed controller's output.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%
05 Index	Name:	**TORQUE INTEG REF**		Par/Sig: s
	Description:	I-part of the speed controller's output.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%
06 Index	Name:	**TORQUE DER REF**		Par/Sig: s
	Description:	D-part of the speed controller's output.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%
07 Index	Name:	**TORQ ACC COMP REF**		Par/Sig: s
	Description:	Acceleration compensation output.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%
08 Index	Name:	**TORQ REF 1**		Par/Sig: s
	Description:	Limited torque reference value in per cent of the motor's nominal torque.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%

2	Group name:	**ACTUAL VALUES (cont.)**			
	Description:	Measured or calculated values			
09 Index	Name:	**TORQ REF 2**			Par/Sig: s
	Description:	Output value of the speed controller in per cent of the motor's nominal torque.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
10 Index	Name:	**TORQ REF 3**			Par/Sig: s
	Description:	Torque reference behind the torque reference selector.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
11 Index	Name:	**TORQ REF 4**			Par/Sig: s
	Description:	torq ref 3 + load compensation (26.02).			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
12 Index	Name:	**TORQ REF 5**			Par/Sig: s
	Description:	torq ref 4 + torque step (26.03).			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
13 Index	Name:	**TORQ USED REF**			Par/Sig: s
	Description:	Limited final torque reference.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
14 Index	Name:	**TORQUE CORRECTION**			Par/Sig: s
	Description:	Additional torque reference via analogue input 1. See parameter (13.16)			
unit: %Tn	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 100 = 1%	
16 Index	Name:	**DV/DT**			Par/Sig: s
	Description:	Acceleration at the output of the speed reference ramp.			
unit: rpm/s	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: (50.01)/s	

2	Group name:	ACTUAL VALUES (cont.)		
	Description:	Measured or calculated values		
17 Index	Name:	**USED SPEED REF**		Par/Sig: s
	Description:	Selected speed reference. Either the speed reference 23.01, or one of the analogue input values, or the ramped inch ref (23.12), or zero.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: (50.01)
18 Index	Name:	**SPEED REF 4**		Par/Sig: s
	Description:	Input signal to the window function of the speed controller. Sum of SPEED REF 3 (2.02) and SPEED CORRECTION (23.04).		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: (50.01)
19 Index	Name:	**TC TORQMAX**		Par/Sig: s
	Description:	Calculated positive motor torque limit in per cent of the nominal motor torque. Calculated from armature current limits and actual field.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%
20 Index	Name:	**TC TORQMIN**		Par/Sig: s
	Description:	Calculated negative motor torque limit in per cent of the nominal motor torque. Calculated from armature current limits and actual field.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 100 = 1%

2	Group name:	**ACTUAL VALUES (cont.)**			
	Description:	Measured or calculated values			
21 Index	Name:	**ARM CUR ACT SL**			Par/Sig: s
	Description:	12-pulse slave motor current. 100% corresponds to the share of the rated motor current provided by one converter (see MOTOR NOM CURRENT (99.03)). Effective only in the 12-pulse master. In 12-pulse serial mode, the slave current is not available with SW versions 15.207 or earlier.			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	
22 Index	Name:	**ARM CUR ALL**			Par/Sig: s
	Description:	12-pulse motor current. Sum of the motor currents of both the master and the slave converter. 100% corresponds to 2 • MOTOR NOM CURRENT (99.03). Effective only in the 12-pulse master. Effective only for 12-pulse parallel.			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	
23 Index	Name:	**CONV CUR ALL**			Par/Sig: s
	Description:	12-pulse motor current. Sum of the converter currents of both the master and the slave converter. 100% corresponds to the system's total current (2 • CONV NOM CURR (4.05)). Effective only in the 12-pulse master.			
unit: %Isys	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	
24 Index	Name:	**ARM ALPHA SL**			Par/Sig: s
	Description:	Firing angle of the 12-pulse slave converter. Effective only in the 12-pulse master.			
unit: deg	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1deg	
25 Index	Name:	**ARM VOLT ALL**			Par/Sig: s
	Description:	Actual DC voltage (filtered with 10 ms) in 12-pulse serial mode. In other configuration, the displaid voltage is invalid.			
unit: V	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1V	

Group 3: Actual Values incl. Operating System

3	Group name:	**ACTUAL VALUES**		
	Description:	actual values including operating system values		
01 Index	Name:	**APPL DUTY**		Par/Sig: s
	Description:	Microprocessor load measurement concerning the function block programming (FCB)		
unit: %T	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 1 = 1%
03 Index	Name:	**SQUARE WAVE**		Par/Sig: s
	Description:	Output signal of the square wave generator. The square wave generator function is available at both control boards (SDCS-CON-2, AMC-DC). Both generators are provided with the same parameters, however they are not synchronized against each other.		
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---
04 Index	Name:	**TEST REFERENCE**		Par/Sig: s
	Description:	Additional test reference input for different drive modes. The selection of the active test reference signal depends on the test reference selection parameter (17.04) The test reference signal is also available at the SDCS-CON-2 board.		
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---
05 Index	Name:	**DLOG EXT TRIGG**		Par/Sig: s
	Description:	The value of this signal is controlled by bit 1 of the auxiliary control word: 0: value := -32768 1: value := 32767 The external triggering of the data logger by bit 1 of the auxiliary control word is activated, if this signal is selected as trigger source.		
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

3	Group name:	ACTUAL VALUES (cont.)			
	Description:	actual values including operating system values			
07 Index	Name:	**POS COUNT LOW**			Par/Sig: s
	Description:	Position counter low value with **POS COUNT MODE (50.07)** = **1 (SCALED)**: 0 = 0 deg 65536 = 360 deg with **POS COUNT MODE (50.07)** = **0 (PULSE EDGES)**: 1 = 1 pulse edge			
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
08 Index	Name:	**POS COUNT HIGH**			Par/Sig: s
	Description:	Position counter high value with **POS COUNT MODE (50.07)** = **1 (SCALED)**: 1 = 1 revolution with **POS COUNT MODE (50.07)** = **0 (PULSE EDGES)**: 1 = 65536 pulse edges			
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

3	Group name:	**ACTUAL VALUES (cont.)**		
	Description:	actual values including operating system values		

09 Index	Name:	**CTRL STAT MA**		Par/Sig: s
	Description:	Control status of the 12-pulse master. B0: 1 == CURR CONTROL STAT (6.01) not zero B1: Sign of CUR REF 3 B2: 1 == Bridge changeover active B3: 1 == RESET command to 12-pulse slave B4: 1 == ON command to 12-pulse slave B5: 1 == RUN command to 12-pulse slave B6: 1 == OFF2_N (Emergency Off, low active) B7: 1 == Dynamic Brake Command B8: 1 == zero current B9: 1 == Field exciter ON command This signal is visible in the master converter as well as in the slave converter. The control bits OFF2_N, RESET, ON and RUN are active in the 12-pulse slave converter only, if its parameter **COMMAND SEL (15.22)** is set to 12P LINK (3).This signal is visible in the master converter as well as in the slave converter.		
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

10 Index	Name:	**CTRL STAT SL**		Par/Sig: s
	Description:	Control status of the 12-pulse slave. B0: 1 == CURR CONTROL STAT (6.01) not zero B1: Sign of CUR REF 3 B2: 1 == Bridge changeover active B3 B4 B5 B6 B7: 1 == TRIPPED This signal is visible in the master converter as well as in the slave converter.		
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

3	Group name:	**ACTUAL VALUES (cont.)**			
	Description:	actual values including operating system values			
11 Index	Name:	**CURRENT REF**			Par/Sig: s
	Description:	External current reference in per cent of the motor's (or load's) nominal current (99.03) This current reference is active, if - oper mode select (15.16) = FIELD EXC (5) AND - flux ref sel (46.07) = EXT REF (1)			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
12 Index	Name:	**CUR REF 3**			Par/Sig: s
	Description:	Active current reference for armature current controller in per cent of the motor's (or load's) nominal current (99.03)			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
13 Index	Name:	**FIRING ANGLE**			Par/Sig: s
	Description:	Firing angle			
unit: deg	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1deg	
14 Index	Name:	**FLUX REF FLD WEAK**			Par/Sig: s
	Description:	Flux reference at speed above the field weakening point in per cent of the nominal flux			
unit: %Fn	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	
15 Index	Name:	**FLUX REF SUM**			Par/Sig: s
	Description:	flux ref fld weak (3.14) + flux reference from EMF controller (3.26). Input to magnetization curve interpolation. In field exciter mode fed by the current reference handling.			
unit: %Fn	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 100%	

3	Group name:	ACTUAL VALUES (cont.)		
	Description:	actual values including operating system values		
17 Index	Name:	**FIELD CUR REF M1**		Par/Sig: s
	Description:	Field current reference for motor 1 in per cent of the motor 1's nominal field current (41.03) Current reference set by the field current reference handler logic		
unit: %If1	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 4096 = 100%
18 Index	Name:	**FIELD CUR REF M2**		Par/Sig: s
	Description:	Field current reference for motor 2 in per cent of the motor 2's nominal field current (41.17) Current reference set by the field current reference handler logic		
unit: %If2	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 4096 = 100%
19 Index	Name:	**REL FIELD CUR M1**		Par/Sig: s
	Description:	Relative field current of motor 1 in per cent of the motor 1's nominal field current (41.03)		
unit: %If1	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 4096 = 100%
20 Index	Name:	**FIELD CUR M1**		Par/Sig: s
	Description:	Absolute field current of motor 1. This signal is filtered with 500ms time constant. In case of DCF600 used as field exciter, see also parameter 41.03.		
unit: A	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 50 = 1A
21 Index	Name:	**REL FIELD CUR M2**		Par/Sig: s
	Description:	Relative field current of motor 2 in per cent of the motor 2's nominal field current (41.17)		
unit: %If2	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 4096 = 100%
22 Index	Name:	**FIELD CUR M2**		Par/Sig: s
	Description:	Absolute field current of motor 2. This signal is filtered with 500ms time constant. In case of DCF600 used as field exciter, see also parameter 41.17.		
unit: A	type: R	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: 50 = 1A

3	Group name:	ACTUAL VALUES (cont.)			
	Description:	actual values including operating system values			
23 Index	Name:	**VOLT ACTUAL**			Par/Sig: s
	Description:	Actual EMF voltage; in field exciter mode: output of EMF actual value selector (see V ACT CAL). Scaled in per cent of the nominal supply voltage NOM SUPPLY VOLT.			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 3786=135%	
24 Index	Name:	**V REF 1**			Par/Sig: s
	Description:	Selected EMF voltage reference. Scaled in per cent of the nominal supply voltage NOM SUPPLY VOLT.			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 3786=135%	
25 Index	Name:	**V REF 2**			Par/Sig: s
	Description:	Ramped and limited EMF voltage reference; input to EMF controller. Scaled in per cent of the nominal supply voltage NOM SUPPLY VOLT.			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 3786=135%	
26 Index	Name:	**FLUX REF EMF**			Par/Sig: s
	Description:	Output value of the EMF controller in per cent of the motor's (or load's) nominal flux.			
unit: %Fn	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	
27 Index	Name:	**CUR REF 1**			Par/Sig: s
	Description:	Selected current reference. See parameter FLUX REF SEL (43.24). Valid/updated only in field exciter mode.			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	
28 Index	Name:	**CUR REF 2**			Par/Sig: s
	Description:	Input signal of the current reference slope function.			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	

3	Group name:	ACTUAL VALUES (cont.)			
	Description:	actual values including operating system values			
29 Index	Name:	**AI V REF**			Par/Sig: s
	Description:	Voltage reference read from analogue tacho input value; filtered with time constant programmed to parameter AI V REF TC. Scaled in per cent of the nominal supply voltage NOM SUPPLY VOLT. The scaling factors of the analogue tacho input must be set properly (see 13.01, 13.02).			
unit: %Us	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 3786=135%	
30 Index	Name:	**AI CUR REF**			Par/Sig: s
	Description:	Current reference value in per cent of the motor's (or load's) nominal current (170.09). Read from analogue input 1, filtered with time constant programmed to parameter AI CUR REF TC. The scaling factors of the analogue input 1 must be set properly (see 13.03, 13.04).			
unit: %Im	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096=100%	

Group 4: Information

4	Group name:	INFORMATION		
	Description:	Information about - the loaded software parts - the connected field exciters - the status of the field exciter link(s) - the converter nominal values		
01 Index	Name:	**SW PACKAGE VER**		Par/Sig: s
	Description:	Loaded software package; character string Format: DCS6_t15 DCS6: DCS600 <t> target the software was loaded for: C AMC-DC / AMC-DC-CLAS1 D AMC-DC-DRIB1 15 Identification number for DCS600 software		
unit: ---	type: C	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---
02 Index	Name:	**DC VERSION**		Par/Sig: s
	Description:	Version of the loaded drive control software (AMC-DC)		
unit: ---	type: Hex	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---
03 Index	Name:	**APPLIC NAME**		Par/Sig: s
	Description:	Name of the loaded FCB application software; character string		
unit: ---	type: C	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---
04 Index	Name:	**CONV NOM VOLT**		Par/Sig: s
	Description:	Converter nominal voltage / Coding of voltage measurement (Supply [V]). This signal is uploaded from the SDCS-CON-2 board during initialization.		
unit: V	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 1 = 1V
05 Index	Name:	**CONV NOM CURR**		Par/Sig: s
	Description:	Converter nominal current (DC [A]). This signal is uploaded from the SDCS-CON-2 board during initialization.		
unit: A	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 1 = 1A

4	Group name:	**INFORMATION (cont.)**			
	Description:	Information about - the loaded software parts - the connected field exciters - the status of the field exciter link(s) - the converter nominal values			
06 Index	Name:	**FEX 1 CODE**			Par/Sig: s
	Description:	Field exciter 1 type coding. This signal is uploaded from the SDCS-CON-2 board during initialization. 0000 ... 0307 FEX-2, half controlled, single 0308 ... 0819 FEX-31, full controlled, double 0820 ... 1023 FEX-32, half controlled, single 10000 DCF601/DCF602 3-phase converter			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
07 Index	Name:	**FEX 2 CODE**			Par/Sig: s
	Description:	Field exciter 2 type coding. This signal is uploaded from the SDCS-CON-2 board during initialization. 0000 ... 0307 FEX-2, half controlled, single 0308 ... 0819 FEX-31, full controlled, double 0820 ... 1023 FEX-32, half controlled, single 10000 DCF601/DCF602 3-phase converter			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
08 Index	Name:	**FEX 1 SW VERSION**			Par/Sig: s
	Description:	Software revision of field exciter 1. This signal is uploaded from the SDCS-CON-2 board during initialization.			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
09 Index	Name:	**FEX 2 SW VERSION**			Par/Sig: s
	Description:	Software revision of field exciter 2. This signal is uploaded from the SDCS-CON-2 board during initialization.			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
10 Index	Name:	**BOOT SW VERSION**			Par/Sig: s
	Description:	Boot software revision of SDCS-CON-2. This signal is uploaded from the SDCS-CON-2 board during initialization.			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
11 Index	Name:	**CONV SW VERSION**			Par/Sig: s
	Description:	Converter control software revision of SDCS-CON-2. This signal is uploaded from the SDCS-CON-2 board during initialization.			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

4	Group name:	INFORMATION (cont.)			
	Description:	Information about - the loaded software parts - the connected field exciters, including the fex link(s) status - the converter nominal values			
12 Index	Name:	**APPLIC VERSION**			Par/Sig: s
	Description:	Version (date) of the loaded FCB application software			
unit: ---	type: Hex	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
13 Index	Name:	**BASELIB VERSION**			Par/Sig: s
	Description:	FCB base library version			
unit: ---	type: Hex	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
14 Index	Name:	**CONVERTER TYPE**			Par/Sig: s
	Description:	Recognized converter type. This signal is uploaded from the SDCS-CON-2 board during initialization. **0:** **NONE** **1:** **C1** C1 converter **2:** **C2** C2 converter **3:** **C3** C3 converter **4:** **C4** C4 converter			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
15 Index	Name:	**QUADRANT TYPE**			Par/Sig: s
	Description:	Recognized converter quadrant type. This signal is uploaded from the SDCS-CON-2 board during initialization. **0:** **NONE** **1:** **1 QUADRANT** 1-quadrant converter **2:** **INVALID** illegal **3:** **INVALID** illegal **4:** **4 QUADRANT** 4-quadrant converter			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
16 Index	Name:	**CONV OVCUR LEVEL**			Par/Sig: s
	Description:	Converter current tripping level in amps. This signal is uploaded from the SDCS-CON-2 board during initialization.			
unit: A	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1A	
17 Index	Name:	**MAX BRIDGE TEMP**			Par/Sig: s
	Description:	Thyristor cooler temperature tripping level in Celsius. This signal is uploaded from the SDCS-CON-2 board during initialization.			
unit: Cels	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1Cels	

4	Group name:	**INFORMATION (cont.)**		
	Description:	Information about - the loaded software parts - the connected field exciters, including the fex link(s) status - the converter nominal values		

18 Index	Name:	**FEX 1 COM STATUS**		Par/Sig: s
	Description:	Timeout status of field exciter 1 communication link. Bit 0 = 1: timeout when write param., no echo for address Bit 1 = 1: timeout when write param., no values received Bit 2 = 1: timeout when read param., no echo for address Bit 3 = 1: timeout when read param., no values received Bit 4 = 1: timeout when read actual values, no values received		
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

19 Index	Name:	**FEX 2 COM STATUS**		Par/Sig: s
	Description:	Timeout status of field exciter 2 communication link. Bit 0 = 1: timeout when write param., no echo for address Bit 1 = 1: timeout when write param., no values received Bit 2 = 1: timeout when read param., no echo for address Bit 3 = 1: timeout when read param., no values received Bit 4 = 1: timeout when read actual values, no values received		
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

20 Index	Name:	**FEX 1 COM ERRORS**		Par/Sig: s
	Description:	Number of communication errors in field exciter 1 communication link		
unit: ---	type: I	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

21 Index	Name:	**FEX 2 COM ERRORS**		Par/Sig: s
	Description:	Number of communication errors in field exciter 2 communication link		
unit: ---	type: I	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

22 Index	Name:	**MOTOR NOM TORQUE**		Par/Sig: s
	Description:	Nominal motor torque, read only. Calculated as: $\frac{motor\_nominal\_power(99.06)\cdot 60000/2\pi}{field\_weak\_point(99.05)}$ **Note1!** motor nominal power is given in kilowatts. **Note2!** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: Nm	type: R	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: 1 = 1Nm

4	Group name:	**INFORMATION (cont.)**			
	Description:	Information about - the loaded software parts - the connected field exciters, including the fex link(s) status - the converter nominal values			
23 Index	Name:	**CON SW PRERELEASE**			Par/Sig: s
	Description:	Converter control software pre-release of SDCS-CON-2. 1 ... n ==> pre-release 1 ... n loaded into SDCS-CON-2. This signal is uploaded from the SDCS-CON-2 board during initialization. This signal is available only, if a pre-release is loaded into the SDCS-CON-2 board.			
unit: ---	type: I	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	
24 Index	Name:	**AMC SW PRERELEASE**			Par/Sig: s
	Description:	Drive control software pre-release of SDCS-AMC-DC. 1 ... n ==> pre-release 1 ... n loaded into SDCS-AMC-DC. This signal is available only, if a pre-release is loaded into the SDCS-AMC-DC board.			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Group 5: I/O Signals

5	Group name:	**I/O SIGNALS**			
	Description:	I/O signals			
01 Index	Name:	**AN IN TACHO VALUE**			Par/Sig: s
	Description:	Voltage measured at the analogue tacho input. The mentioned integer scaling may differ, depending on the connected analogue input hardware and its jumper setting. If this signal is to be used for the application program or the speed reference, its index (= 501) must be programmed to one of the group 94 pointer indexes.			
unit: V	type: R	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 10V	
02 Index	Name:	**AN IN 1 VALUE**			Par/Sig: s
	Description:	Voltage measured at the analogue input 1. The mentioned integer scaling may differ, depending on the connected analogue input hardware and its jumper setting.			
unit: V	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = 10V	
03 Index	Name:	**AN IN 2 VALUE**			Par/Sig: s
	Description:	Voltage measured at the analogue input 2. The mentioned integer scaling may differ, depending on the connected analogue input hardware and its jumper setting.			
unit: V	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 2048 = 10V	
04 Index	Name:	**AN IN 3 VALUE**			Par/Sig: s
	Description:	Voltage measured at the analogue input 3. The mentioned integer scaling may differ, depending on the connected analogue input hardware and its jumper setting.			
unit: V	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 2048 = 10V	
05 Index	Name:	**AN IN 4 VALUE**			Par/Sig: s
	Description:	Voltage measured at the analogue input 4. The mentioned integer scaling may differ, depending on the connected analogue input hardware and its jumper setting.			
unit: V	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 2048 = 10V	

5	Group name:	**I/O SIGNALS (cont.)**			
	Description:	I/O signals			
06 Index	Name:	**AN OUT 1 VALUE**			Par/Sig: s
	Description:	Data container to connect a signal residing in the AMC-DC board to analogue output 1. This data container is also suitable to connect data received by DDCS datasets to the analogue output 1: select signal 5.06 as destination of a dataset value (see groups 90/91) AND as source for analogue output 1 (parameter 14.04).			
unit: ---	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1	
07 Index	Name:	**AN OUT 2 VALUE**			Par/Sig: s
	Description:	Data container to connect a signal residing in the AMC-DC board to analogue output 2. This data container is also suitable to connect data received by DDCS datasets to the analogue output 2: select signal 5.07 as destination of a dataset value (see groups 90/91) AND as source for analogue output 2 (parameter 14.08).			
unit: ---	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 1 = 1	
08 Index	Name:	**AN IN 5 VALUE**			Par/Sig: s
	Description:	Signal measured at the analogue input 5 (channel 1 of the SDCS-IOE-1). The nominal value depends on the jumper setting on the SDCS-IOE-1 • 10V, range +/-10V • 20mA, range +/-20mA			
unit: ---	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = nominal value	
09 Index	Name:	**AN IN 6 VALUE**			Par/Sig: s
	Description:	Signal measured at the analogue input 6 (channel 2 of the SDCS-IOE-1). The nominal value depends on the jumper setting on the SDCS-IOE-1 • 10V, range +/-10V • 20mA, range +/-20mA • 1V, range +/-1V • 2mA, range+/-2mA			
unit: ---	type: R	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: 4096 = nominal value	

Group 6: Drive Logic Signals

6	Group name:	DRV LOG SIGNALS			
	Description:	Actual and reference signals of the drive logic			
01	Name:	**CURR CONTROL STAT**			Par/Sig: s
Index	Description:	Internal status of the current controller: 0 == O.K. If any of the bc-bits is set, this will block the controller B0 overcurrent B1 B2 field reversal B3 supply system undervoltage B4 12-pulse current difference fault (F66) or reversal fault (F65) B5 12-pulse mode: 12-pulse partner blocked field exciter mode: external overvoltage protection freewheeling B6 supply system overvoltage B7 type code error or connector X12 missing B8 B9 processor overload (SDCS-CON-2 board) B10 thyristor diagnostics running B11 B12 primary (AC) or secondary (48VAC) power failure B13 synchronization signal missing B14 pulse firing section not in synchronism B15 controller not released			
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

6	Group name:	**DRV LOG SIGNALS (cont.)**		
	Description:	Actual and reference signals of the drive logic		
02 Index	Name:	**COMMISS STATUS**		Par/Sig: s
	Description:	Commissioning status of the SDCS-CON-2 software. Gives feedback information on usage of the drive mode parameter (see 15.02). When the autotuning of the armature current controller (15.02 = 3) or the field current controller (15.02 = 5) has been selected, 15.02 is set to -1 by the software, if an error has occured during the autotuning procedure: commiss status values for armature current controller autotuning: 49x: Field not normal during start. 50x: Ohmic load not determined. 51x: Current feedback is less than current reference during. measurement of armature resistance. Current limits lower than the limit for continuous current flow or lower than 20%. 52x: Inadmissable current curve. Fuse blown, thyristor not firing or no motor load. 53x: Wrong start conditions. The drive is running when the autotuning is started or the run command is not given within 20s after the start of autotuning. 54x: Inadmissibly high speed during autotuning. Speed greater than 4% or EMF greater than 15%. 55x: Inductance cannot be determined. Fuse blown, thyristor not firing or no motor load. 56x: Limits for continuous current flow cannot be determined. 57x: The field removal takes longer time than 10s. 58x: Blocking or stop signal appears during autotuning. commiss status values for field current controller autotuning: 61: Illegal start conditions (drive not in ON state). 62: FEX autotuning not possible. 63: FEX autotuning not possible. 64: Field time constant too big. commiss status values dor thyristor diagnosis: 0 no faults, diagnosis successfully completed 10 no controller release within 10 sec 11 at least one thyristor is not blocking 12 more than one thyristor of bridge 1 is not firing 13 more than one thyristor of bridge 2 is not firing 14+i thyristor i (0...5) of bridge 1 is not firing 20+i thyristor i (0...5) of bridge 2 is not firing The commissioning status is updated from the SDCS-CON-2 board to the AMC-DC board during the autotuning procedures.		
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

6	Group name:	**DRV LOG SIGNALS (cont.)**		
	Description:	Actual and reference signals of the drive logic		

03 Index	Name:	**MOTOR SELECT**		Par/Sig: s
	Description:	Motor selection. **0:** **MOTOR 1** First motor with first field excitation unit **1:** **MOTOR 2** Second motor with second field excitation unit		
unit: ---	type: I	ctrl. bd.: CON	Min: MOTOR 1	Default: MOTOR 1
			Max: MOTOR 2	Integer scaling: ---

04 Index	Name:	**100 MS COUNTER**		Par/Sig: s
	Description:	This counter value can be set to 0 (or 1) by the overriding control system. It is incremented each 100 ms and limited to 2.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: ---
			Max: 2	Integer scaling: ---

05 Index	Name:	**CON2 BITS**		Par/Sig: s
	Description:	This packed binary signal includes boolean signals from the SDCS-CON-2 board's software. It is read from the SDCS-CON-2 board every 8ms. B0: 1 = field reversal active B1: 1 = command to trip DC-breaker (1s-pulse) B2: 1 = command for dynamic braking (continuous signal) B3: 1 = command to trip DC-breaker (continuous signal) B4: 1 = command for converter fan and external fan B5: 1 = command to field excitation unit B6: 1 = command to main contactor B7: 1 = command to switch off the main contactor B8: 1 = field excitation unit 1 ready for operation B9: 1 = field excitation unit 1 self test o.k. B10: 1 = field excitation unit 2 ready for operation B11: 1 = field excitation unit 2 self test o.k. B12: 1 = continuous current flow B13: B14: 1 = Status of motor heating function o.k. B15 1 = field direction reverse (0 = forward)		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

06 Index	Name:	**FIELD CON ALARM**		Par/Sig: s
	Description:	This packed binary signal includes boolean alarm signals from the field exciter mode related functions (load monitoring). B0: 1 = alarm is active, if the DC voltage is over alarm limit (see OVERVOLT ALARM L, 43.22) B1: 1 = alarm is active, if the DC current is below alarm limit (see MIN CUR ALARM L, 43.24)		
unit: ---	type: PB	ctrl. bd.: CON	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

Group 7: Control Words

7	Group name:	CONTROL WORDS		
	Description:	Control words		
01 Index	Name:	**MAIN CONTROL WORD**		Par/Sig: s
	Description:	Main control word See separate table below		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

MAIN CONTROL WORD — index: **7.01**

ABB Drive Profile control word of DCS600 MultiDrive

Bit	Name	Value = 1	Value = 0
0	ON (OFF1_N)	Command to **"RDYRUN"** state: start fans, field and close main contactor	Command to **"OFF"** state: Ramp Stop, then Open contactor, stop field and fans
1	OFF2_N	No OFF2 (Emergency OFF or Coast Stop)	Command to **"ON INHIBIT"** state via Coast Stop
2	OFF3_N	No OFF 3 (Emergency STOP)	Command to **"ON INHIBIT"** state via Emergency Stop
3	RUN	Command to **"RDYREF"** state: Run with selected reference	Stop by coasting
4	RAMP_OUT_ZERO	No other activities	Speed ramp output is forced to zero
5	RAMP_HOLD	No other activities	Speed ramping is stopped
6	RAMP_IN_ZERO	No other activities	Speed ramp input is forced to zero
7	RESET	acknowledge a fault indication	
8	INCHING_1	Constand speed 1 (23.2) selected	
9	INCHING_2	Constant speed 2 (23.3) selected	
10	VALID_COMMAND (has to be = 1)	No other activities	Freeze main command word and main references
11	reserved	(reserved)	
12	reserved	(reserved)	
13	reserved	(reserved)	
14	reserved	(reserved)	
15	reserved	(reserved)	

7	Group name:	**CONTROL WORDS (cont.)**		
	Description:	Control words		
02 Index	Name:	**AUX CONTROL WORD**		Par/Sig: s
	Description:	Auxiliary control word See separate table below		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

AUX CONTROL WORD Drive specific auxiliary control word of DCS 600 MultiDrive			index: **7.02**
Bit	**Name**	**Value = 1**	**Value = 0**
0	RESTART_DLOG	Restart of data logger **(not available)**	
1	TRIG_LOGGER	Data logger triggering **see note 1)**	
2	RAMP_BYPASS	Speed ramp is bypassed	
3	BAL_RAMP_OUT	Forcing of ramp output	
4	DYN_BRAKE_ON_APC	activate dynamic braking	
5	reserved	(reserved)	
6	HOLD_NCONT	Holding of the speed controller's integrator	
7	WINDOW_CTRL	Window control activated	
8	BAL_NCONT	Forcing of speed controller's output	
9	SYNC_COMMAND	synchronising command	
10	SYNC_DISABLE	synchronising is disabled	
11	RESET_SYNC_RDY	reset synchronised ready	
12	RAMPED_INCH_REF	Switch speed ramp input to RAMPED INCH REF (23.12)	
13	DIG_OUT4 (14.11)	digital output 4 (IOB2: relay output)	
14	DIG_OUT5 (14.14)	digital output 5 (IOB2: relay output)	
15	DIG_OUT6 (14.17)	digital output 6 (IOB2: opto coupler output)	

Note 1)
To activate the external triggering of the datalogger, signal **[3.05]** must be selected as trigger source; the trigger level should be set between -30000 and +30000.
The selected edge of the trigger signal **[3.05]** equals the trigger edge of bit 1.

7	Group name:	CONTROL WORDS (cont.)			
	Description:	Control words			
03 Index	Name:	**AUX CONTROL WRD 2**			Par/Sig: s
	Description:	Auxiliary control word 2 See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

AUX CONTROL WORD 2 Drive specific auxiliary control word of DCS 600 MultiDrive			index: **7.03**
Bit	**Name**	**Value = 1**	**Value = 0**
0	DIG_OUT_7 (14.20)	digital output 7 (IOB2: opto coupler output)	
1	DIG_OUT_8 (14.23)	digital output 8 (IOB2: relay output)	
2	DIG_OUT_1 (12.03)	FANS ON CMD	
3	DIG_OUT_2 (12.06)	FIELD ON CMD	
4	DIG_OUT_3 (12.09)	MAIN CONT ON CMD	
5	reserved	(reserved)	
6	reserved	(reserved)	
7	reserved	(reserved)	
8	DRIVE_DIR	drive direction negative see note 1	drive direction positive see note 1
9	SPEED_EXT	force speed controller output in torque selector modes 4 and 5	torque reference according to min/max evaluation in torque selector modes 4 and 5
10	reserved	(reserved)	
11	reserved	(reserved)	
12	reserved	(reserved)	
13	reserved	(reserved)	
14	reserved	(reserved)	
15	reserved	(reserved)	

Note1:
Changes of the commanded drive direction get active only in the state RDY_RUN; reversal of a running drive by means of this control bit is not possible.
Note2:
Settings for DO1...DO3, are default.

04 Index	Name:	**USED CONTROL WORD**			Par/Sig: s
	Description:	Internal used/selected main control word (selection according to local/remote and command sel (15.22)). Same bit functionality as the main control word (7.01). In local mode or local I/O mode not all functions are available.			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Group 8: Status and Limit Words

8	Group name:	**STATUS AND LIMIT WORDS**			
	Description:	Status and limit words			
01 Index	Name:	**MAIN STATUS WORD**			Par/Sig: s
	Description:	Main status word See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

MAIN STATUS WORD ABB Drive profile status word of DCS600 MultiDrive			index: **8.01**
Bit	**Name**	**Value = 1**	**Value = 0**
0	RDY_ON	ready to close the contactor	not ready to close contactor
1	RDY_RUN	ready to generate torque	not ready
2	RDY_REF	torque control operating (running)	operation inhibited
3	TRIPPED	indication of fault in DCS600 MultiDrive	
4	OFF_2_STA_N	No OFF2 active	OFF2 active
5	OFF_3_STA_N	No OFF3 active	OFF3 active
6	ON_INHIBITED	Switch on inhibited after • fault • emergency STOP • emergency OFF • ON INHIBIT via digital inputs (15.14, 15.15)	
7	ALARM	indication of alarm in DC Device	
8	AT_SETPOINT	Setpoint/act.value monitoring in the tolerance	
9	REMOTE	Remote control	Local control
10	ABOVE_LIMIT	speed treshold value (50.10) reached	
11	reserved	(reserved)	
12	reserved	(reserved)	
13	reserved	(reserved)	
14	reserved	(reserved)	
15	reserved	(reserved)	

8	Group name:	STATUS AND LIMIT WORDS (cont.)			
	Description:	Status and limit words			
02 Index	Name:	**AUX STATUS WORD**			Par/Sig: s
	Description:	Auxiliary status word See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

AUX STATUS WORD Drive specific status word of DCS600 MultiDrive			index: **8.02**
Bit	**Name**	**Value = 1**	**Value = 0**
0	LOGG_DATA_READY	Contents of data logger is readable	
1	OUT_OF_WINDOW	Speed actual value is outside of the defined window **(23.08 / 23.9)**	Speed actual value is outside of the defined window **(23.08 / 23.9)**. Always cleared with TORQUE SELECTOR mode ZERO or TORQUE
2	EMERG_STOP_COAST	Emergency stop function has failed	
3	reserved	(reserved)	
4	ON_DISABLED	External interlocking ON INHIBIT 1 or ON INHIBIT 2 (ORed digital inputs selected by 15.14 and 15.15) prevent the run	
5	SYNC_RDY	Position counter synchronous ready status	
6	FEX1_ACK	Acknowledge of 1st Fex	
7	FEX2_ACK	Acknowledge of 2nd Fex	
8	reserved	(reserved)	
9	LIMITING	Drive is limiting, see signal 8.03	
10	TORQ_CONTROL	Drive is torque controlled	
11	ZERO_SPEED	Motor speed actual is zero	
12	EMF_SPEED	EMF speed feedback selected if SPEED FB SEL (50.03) = 1	
13	FAULT_OR_ALARM	Drive is faulted or alarming	
14	DRIVE_DIR_ASW	Negative drive direction active	
15	AUTO_RECLOSING	auto reclosing logic activated	

8	Group name:	STATUS AND LIMIT WORDS (cont.)		
	Description:	Status and limit words		
03 Index	Name:	**LIMIT WORD 1**		Par/Sig: s
	Description:	Limit word 1 See separate table below		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

Index **8.03**	**LIMIT WORD 1** combined limit word 1
Bit	**limit**
0	Maximum output torque limit **(20.05)** or maximum converter limit **(2.19)**
1	Minimum output torque limit **(20.06)** or minimum converter limit **(2.20)**
2	Maximum speed controller **(20.07)** limit or maximum converter limit **(2.19)**
3	Minimum speed controller **(20.08)** limit or minimum converter limit **(2.20)**
4	Maximum torque reference limit **(20.09)**
5	Minimum torque reference limit **(20.10)**
6	Maximum speed reference limit **(20.02)**
7	Minimum speed reference limit **(20.01)**
8	
9	
10	
11	
12	
13	
14	
15	

8	Group name:	STATUS AND LIMIT WORDS (cont.)			
	Description:	Status and limit words			
05 Index	Name:	**DI STATUS WORD**			Par/Sig: s
	Description:	Digital inputs. See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

DI STATUS WORD Digital Input status word of DCS600 MultiDrive		index: **8.05**
Bit	**Name**	**Function**
0	DI1	converter fan acknowledge (12.13)
1	DI2	external motor fan acknowledge (12.14)
2	DI3	main contactor acknowledge (12.15)
3	DI4	ON INHIBIT 1 SEL (12.14)
4	DI5	emergency stop / programmable, if emergency stop function not used (12.16)
5	DI6	programmable
6	DI7	V I SEL 2 (46.22)
7	DI8	V I SEL 1 (46.21)
8	DI9	available for application program, if SDCS-IOE-1 is present
9	DI10	
10	DI11	
11	DI12	
12	DI13	
13	DI14	
14	DI15	
15	IOE1	1 == SDCS-IOE-1 is connected to SDCS-CON-2

Note: All DI's can be selected for several converter functions; inversion function is available; in addition, it may be used for application programming. The default values are shown.

available for application program: The DI is not selectable for converter functions, but is available for application programming.

Note: The emergency stop input (DIx) is active low, if parameter DIG IN x INVERT of the selected DI (see 12.16) is set to INVERTED.

8	Group name:	STATUS AND LIMIT WORDS (cont.)			
	Description:	Status and limit words			
06 Index	Name:	**DRIVE STATE**			Par/Sig: s
	Description:	Drive state: **0: ON INHIBIT** **1: CHNGE TO OFF** (usually not visible) **2: OFF** **3: READY ON** **4: READY RUN** **5: RUNNING** **6: STOPPING** **7: EMERG STOP** **8: EMERG OFF** **9: TRIPPED**			
unit: ---	type: I	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Group 9: Fault and Alarm Words

9	Group name:	FAULT AND ALARM WORDS			
	Description:	Packed boolean fault and alarm words			
01	Name:	FAULT WORD 1			Par/Sig: s
Index	Description:	See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Index **9.01**	**FAULT WORD 1** combined fault word 1	
Bit	**Fault text**	**Signal code** (fault code)
0	Auxil. under voltage	1
1	Overcurrent	2
2	Armature over voltage	28
3	Converter overtemperature *)	4
4	Earth fault	5
5	**Motor 1** overtemp. (measured)	6
6	**Motor 1** overload (thermal model)	7
7	I/O board not found	44
8	**Motor 2** overtemp. (measured)	48
9	**Motor 2** overload (thermal model)	27
10	Converter fan current fault	3
11	Mains under voltage	29
12	Mains over voltage	30
13	Not in synchronism	31
14	**Field Ex. 1** overcurr.	32
15	**Field Ex. 1** comm. error	33

*)
Note!
May also be caused by bad connector X12 of SDCS-CON-2.
May also be caused by temperatures below minus 10 deg, or by sensor short circuit.

9	Group name:	**FAULT AND ALARM WORDS (cont.)**			
	Description:	Packed boolean fault and alarm words			
02	Name:	**FAULT WORD 2**			Par/Sig: s
Index	Description:	See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Index **9.02**	**FAULT WORD 2** combined fault word 2	
Bit	**Fault text**	**Signal code** (fault code)
0	Arm. current ripple	34
1	**Field Ex. 2** overcurr.	35
2	**Field Ex. 2** comm. error	36
3	Phase sequence fault	38
4	No field ack.	39
5	Speed meas fault	14
6	No ext. FAN ack.	40
7	No main cont. ack.	41
8	Type coding fault	17
9	External fault via DI (selected by 15.23)	---
10	No C FAN ack	50
11	DDCS channel 0 communication fault	---
12	**Field Ex. 1** Not O.K.	42
13	**Field Ex. 2** Not O.K.	43
14	Motor stalled	23
15	Motor overspeed	37

9	Group name:	FAULT AND ALARM WORDS (cont.)		
	Description:	Packed boolean fault and alarm words		
03 Index	Name:	**SYSTEM FAULT WORD**		Par/Sig: s
	Description:	Operating system faults (AMC-DC board). Bits copied from internal index 180.26 (different order) See separate table below		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

Index **9.03**	**SYSTEM FAULT WORD** combined sys. fault word	
Bit	**Fault text**	**Signal code** (fault code)
0	Factory macro parameter file error	---
1	User macro parameter file error	---
2	Non volatile operating system error	---
3	File error in FLASH memory	---
4	Internal time level T2 overflow (100us)	---
5	Internal time level T3 overflow (1ms)	---
6	Internal time level T4 overflow (50ms)	---
7	Internal time level T5 overflow (1s)	---
8	State overflow	---
9	Application window ending overflow	---
10	Application program overflow	---
11	Illegal instruction	---
12	Register stack overflow	---
13	System stack overflow	---
14	System stack underflow	---
15		

9	Group name:	FAULT AND ALARM WORDS (cont.)		
	Description:	Packed boolean fault and alarm words		
04 Index	Name:	**ALARM WORD 1**		Par/Sig: s
	Description:	See separate table below		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

Index **9.04**	**ALARM WORD 1** combined alarm word 1	
Bit	**alarm text**	**Signal code** (alarm/status code)
0	Start inhibition	101
1	Emergency stop	102
2	Acknowledge of DC breaker or dynamic brake	125
3	Conv. overtemp. alarm	105
4		
5	**Motor 1** overtemp. alarm	103
6	**Motor 1** overload alarm	104
7		
8	**Motor 2** overtemp. alarm	123
9	**Motor 2** overload alarm	124
10	Mains undervolt. alarm	118
11	Master / follower link alarm	---
12	Conv. fan ack. alarm	126
13	Arm. current deviation alarm	120
14		
15	Ext. fan ack. alarm	127

9	Group name:	FAULT AND ALARM WORDS (cont.)			
	Description:	Packed boolean fault and alarm words			
05 Index	Name:	**ALARM WORD 2**			Par/Sig: s
	Description:	See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Index **9.05**	**ALARM WORD 2** combined alarm word 2	
Bit	**alarm text**	**Signal code** (alarm/status code)
0	Armature current ripple	115
1	Type code changed	129
2	Aux. undervoltage alarm	132
3	Overvoltage protection (via DI2, in field exciter mode)	133
4		
5		
6		
7	Speed scaling out of range	---
8		
9	External alarm via DI (selected by 15.24)	---
10	CON communication alarm (2ms timeout)	121
11	DDCS channel 0 communication alarm	---
12	CON RAM backup	108
13	Panel loss alarm	---
14		
15		

9	Group name:	FAULT AND ALARM WORDS (cont.)			
	Description:	Packed boolean fault and alarm words			
06 Index	Name:	**FAULT WORD 3**			Par/Sig: s
	Description:	See separate table below			
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---	
			Max: ---	Integer scaling: ---	

Index **9.06**	**FAULT WORD 3** combined fault word 3	
Bit	**Fault text**	**Signal code** (fault code)
0	12-pulse or 6-pulse: reversal fault	65
1	12-pulse: current difference fault	66
2	12-pulse: communication fault	67
3	12-pulse: slave is faulted	68
4		
5		
6	Current rise	8
7	System fault (AMC-DC board)	---
8		
9	Mismatch of CON- and AMC-DC-software	---
10	CON communication fault	---
11	Master / follower link fault	---
12		
13	Panel loss fault	---
14	CON FLASH memory fault	18
15	CON-System fault	20

Parameters

The following table gives an overview of the parameter groups:

Parameter Groups

Group	Size (Indexes)	Contents
12	16	Drive Logic I/O
13	17	I/O settings
14	23	I/O settings
15	24	Drive Logic Parameters
16	4	System Control Inputs
17	6	Test Signal Generator
18	2	LED Panel Control
19	12	Data Storage
20	17	Limits
21	5	Start/Stop Functions
22	8	Speed Ramp Functions
23	13	Speed Reference
24	20	Speed Controller
25	6	Torque Reference Chain
26	7	Active Torque Reference Generation
28	25	Motor Protection
40	3	Undervoltage Monitoring
41	16	Motor Nominal Values
42	12	Measurement Settings (except speed)
43	25	Current Controller
44	25	Field Excitation
45	7	Field Excitation
46	22	Field and EMF Control
47	11	12-Pulse Operation
50	13	Speed Measurement Settings / Initial Values
51	15	Communication Module
70	20	DDCS Control
71	1	DriveBus
90	18	Dataset Receive Addresses
91	9	Dataset Receive Addresses
92	18	Dataset Transmit Addresses
93	9	Dataset Transmit Addresses
94	11	Communication from CON board
95	13	Communication to CON board
97	1	Drive
98	2	Option Modules
99	8	Start-Up

Group 12: Drive Logic I/O

12	Group name:	DRIVE LOGIC I/O		
	Description:	Configuration of Drive Logic I/O functions		
01 Index	Name:	**DIG OUT 1 INVERT**		Par/Sig: p
	Description:	Inversion selection for digital output 1 0: direct 1: inverted		
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)
			Max: 1 (inverted)	Integer scaling: ---
02 Index	Name:	**DIG OUT 1 INDEX**		Par/Sig: p
	Description:	Index of the signal connected to digital output 1. If this parameter is set to 0, the digital output 1 is read from bit 2 of the auxiliary control word 2 (7.03) (prior to applying dig out 1 invert / 12.01).		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 605 (CON2 BITS)
			Max: 19999	Integer scaling: ---
03 Index	Name:	**DO1 BIT NUMBER**		Par/Sig: p
	Description:	Bit number of the signal connected to digital output 1. This parameter determines the bit number within a packed binary signal selected by parameter dig out 1 index (12.02). If a boolean signal has been selected, do1 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do1 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 4 (FANS ON CMD)
			Max: 23	Integer scaling: ---

12	Group name:	DRIVE LOGIC I/O (cont.)			
	Description:	Configuration of Drive Logic I/O functions			
04 Index	Name:	**DIG OUT 2 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital output 2 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
05 Index	Name:	**DIG OUT 2 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to digital output 2. If this parameter is set to 0, the digital output 2 is read from bit 3 of the auxiliary control word 2 (7.03) (prior to applying dig out 2 invert / 12.04).			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 605 (CON2 BITS)	
			Max: 19999	Integer scaling: ---	
06 Index	Name:	**DO2 BIT NUMBER**			Par/Sig: p
	Description:	Bit number of the signal connected to digital output 2. This parameter determines the bit number within a packed binary signal selected by parameter dig out 2 index (12.05). If a boolean signal has been selected, do2 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do2 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 5 (FIELD ON CMD)	
			Max: 23	Integer scaling: ---	

12	Group name:	DRIVE LOGIC I/O (cont.)		
	Description:	Configuration of Drive Logic I/O functions		
07 Index	Name:	**DIG OUT 3 INVERT**		Par/Sig: p
	Description:	Inversion selection for digital output 3 0: direct 1: inverted		
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)
			Max: 1 (inverted)	Integer scaling: ---
08 Index	Name:	**DIG OUT 3 INDEX**		Par/Sig: p
	Description:	Index of the signal connected to digital output 3. If this parameter is set to 0, the digital output 3 is read from bit 4 of the auxiliary control word 2 (7.03) (prior to applying dig out 3 invert / 12.07).		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 605 (CON2 BITS)
			Max: 19999	Integer scaling: ---
09 Index	Name:	**DO3 BIT NUMBER**		Par/Sig: p
	Description:	Bit number of the signal connected to digital output 3. This parameter determines the bit number within a packed binary signal selected by parameter dig out 3 index (12.08). If a boolean signal has been selected, do3 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do3 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 6 (MAIN CONT ON CMD)
			Max: 23	Integer scaling: ---

12	Group name:	DRIVE LOGIC I/O (cont.)			
	Description:	Configuration of Drive Logic I/O functions			
10 Index	Name:	**DIG IN 1 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 1 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
11 Index	Name:	**DIG IN 2 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 1 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
12 Index	Name:	**DIG IN 3 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 1 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
13 Index	Name:	**ACK C FAN SEL**			Par/Sig: p
	Description:	Selects a digital input for converter fan acknowledge. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: DI1	
			Max: DI8	Integer scaling: ---	

12	Group name:	**DRIVE LOGIC I/O (cont.)**		
	Description:	Configuration of Drive Logic I/O functions		
14 Index	Name:	**ACK E FAN SEL**		Par/Sig: p
	Description:	Selects a digital input for external / motor fan acknowledge. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**		
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: DI2
			Max: DI8	Integer scaling: ---
15 Index	Name:	**ACK M CONT SEL**		Par/Sig: p
	Description:	Selects a digital input for main contactor acknowledge. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**		
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: DI3
			Max: DI8	Integer scaling: ---
16 Index	Name:	**EME STOP SEL**		Par/Sig: p
	Description:	Selects a digital input for emergency stop. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**		
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: DI5
			Max: DI8	Integer scaling: ---

Group 13: I/O Settings 1

13	Group name:	**I/O SETTINGS 1**		
	Description:	Configuration of analogue and digital inputs		
01 Index	Name:	**AN IN TACH HI VAL**		Par/Sig: p
	Description:	Value corresponding to the maximum input voltage of the analogue tacho input. If the analogue tacho input is being used for the speed feedback, this parameter **must** be set to **20000 • speed_10V / speed_scaling** speed_10V: speed at 10V at the analogue tacho input speed_scaling: speed programmed to parameter (50.01)		
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: 30000
			Max: 32767	Integer scaling: 1 = 1
02 Index	Name:	**AN IN TACH LO VAL**		Par/Sig: p
	Description:	Value corresponding to the minimum input voltage of the analogue tacho input. If the analogue tacho input is being used for the speed feedback, this parameter **must** be set to **- 20000 • speed_10V / speed_scaling** speed_10V: speed at 10V at the analogue tacho input speed_scaling: speed programmed to parameter (50.01)		
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: -30000
			Max: 32767	Integer scaling: 1 = 1
03 Index	Name:	**AN IN 1 HI VAL**		Par/Sig: p
	Description:	Value corresponding to the maximum input of the analogue input 1		
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: 20000
			Max: 32767	Integer scaling: 1 = 1
04 Index	Name:	**AN IN 1 LO VAL**		Par/Sig: p
	Description:	Value corresponding to the minimum input of the analogue input 1		
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: -20000
			Max: 32767	Integer scaling: 1 = 1

13	Group name:	I/O SETTINGS 1 (cont.)			
	Description:	Configuration of analogue and digital inputs			
05	Name:	**AN IN 2 HI VAL**			Par/Sig: p
Index	Description:	Value corresponding to the maximum input of the analogue input 2			
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: 2000	
			Max: 32767	Integer scaling: 1 = 1	
06	Name:	**AN IN 2 LO VAL**			Par/Sig: p
Index	Description:	Value corresponding to the minimum input of the analogue input 2			
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: -2000	
			Max: 32767	Integer scaling: 1 = 1	
07	Name:	**AN IN 3 HI VAL**			Par/Sig: p
Index	Description:	Value corresponding to the maximum input of the analogue input 3			
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: 2000	
			Max: 32767	Integer scaling: 1 = 1	
08	Name:	**AN IN 3 LO VAL**			Par/Sig: p
Index	Description:	Value corresponding to the minimum input of the analogue input 3			
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: -2000	
			Max: 32767	Integer scaling: 1 = 1	
09	Name:	**AN IN 4 HI VAL**			Par/Sig: p
Index	Description:	Value corresponding to the maximum input of the analogue input 4			
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: 2000	
			Max: 32767	Integer scaling: 1 = 1	
10	Name:	**AN IN 4 LO VAL**			Par/Sig: p
Index	Description:	Value corresponding to the minimum input of the analogue input 4			
unit: ---	type: R	ctrl. bd.: CON	Min: -32767	Default: -2000	
			Max: 32767	Integer scaling: 1 = 1	

13	Group name:	I/O SETTINGS 1 (cont.)			
	Description:	Configuration of analogue and digital inputs			
11 Index	Name:	**DIG IN 4 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 4 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 1 (inverted)	
			Max: 1 (inverted)	Integer scaling: ---	
12 Index	Name:	**DIG IN 5 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 5 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
13 Index	Name:	**DIG IN 6 INVERT**			Par/Sig: p
	Description:	Invrsion selection for digital input 6 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
14 Index	Name:	**DIG IN 7 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 7 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
15 Index	Name:	**DIG IN 8 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital input 8 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	

13	Group name:	I/O SETTINGS 1 (cont.)		
	Description:	Configuration of analogue and digital inputs		

16 Index	Name:	**TORQUE CORR SRC**		Par/Sig: p
	Description:	Select analogue input 1 for additive torque reference TQCORR **0: TQCORR = 0** **1: TQCORR = AI1** If TQCORR = AI1 then AI1 is connected to signal TORQUE CORRECTION (2.14)		
unit: ---	type: I	ctrl. bd.: CON	Min: TQCORR = 0	Default: TQCORR = 0
			Max: TQCORR = AI1	Integer scaling: ---

17 Index	Name:	**AI SPEED SELECT**		Par/Sig: p
	Description:	Select analogue inputs or the speed reference (SPEED REF 23.01) for the speed reference source. **0: NO SPEED REF** speed reference is 0 **1: AN IN 1 VAL** analogue input 1 value **2: AN IN 2 VAL** analogue input 2 value **3: AN IN 3 VAL** analogue input 3 value **4: AN IN 4 VAL** analogue input 4 value **5: AN TACH VAL** analogue tacho value **6: SPEED REF** (23.01) **7: AI1 + AI2** an. input 1 value + an. input 2 value **8: AI1 + SPDREF** analogue input 1 value + (23.01) A scaled analogue input value of 20000 corresponds to 100% of the maximum speed (see parameter speed scaling 50.01). Scaling of analogue input values: see parameters 13.01 ... 13.10		
unit: ---	type: I	ctrl. bd.: CON	Min: NO SPEED REF	Default: SPEED REF
			Max: AI1 + SPDREF	Integer scaling: ---

Group 14: I/O Settings 2

14	Group name:	**I/O SETTINGS 2**			
	Description:	Configuration of analogue and digital outputs			
01 Index	Name:	**AN OUT 1 NOM VOLT**			Par/Sig: p
	Description:	Analogue output 1 voltage at nominal value			
unit: mV	type: R	ctrl. bd.: CON	Min: 0mV	Default: 10000mV	
			Max: 10000mV	Integer scaling: 1 = 1mV	
02 Index	Name:	**ANOUT 1 OFFS VOLT**			Par/Sig: p
	Description:	Offset voltage to analogue output 1			
unit: mV	type: R	ctrl. bd.: CON	Min: -10000mV	Default: 0mV	
			Max: 10000mV	Integer scaling: 1 = 1mV	
03 Index	Name:	**AN OUT 1 NOM VAL**			Par/Sig: p
	Description:	Nominal value of signal at analogue output 1			
unit: ---	type: R	ctrl. bd.: CON	Min: -32768	Default: 10000	
			Max: 32767	Integer scaling: 1 = 1	
04 Index	Name:	**AN OUT 1 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to analogue output 1. With selections 0 or 506, AN OUT 1 VALUE (5.06) is selected for analogue output. This can be used to control the analogue output 1 from an overriding control.			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	

14	Group name:	**I/O SETTINGS 2**			
	Description:	Configuration of analogue and digital outputs			
05 Index	Name:	**AN OUT 2 NOM VOLT**			Par/Sig: p
	Description:	Analogue output 2 voltage at nominal value			
unit: mV	type: R	ctrl. bd.: CON	Min: 0mV	Default: 10000mV	
			Max: 10000mV	Integer scaling: 1 = 1mV	
06 Index	Name:	**ANOUT 2 OFFS VOLT**			Par/Sig: p
	Description:	Offset voltage to analogue output 2			
unit: mV	type: R	ctrl. bd.: CON	Min: -10000mV	Default: 0mV	
			Max: 10000mV	Integer scaling: 1 = 1mV	
07 Index	Name:	**AN OUT 2 NOM VAL**			Par/Sig: p
	Description:	Nominal value of signal at analogue output 2			
unit: ---	type: R	ctrl. bd.: CON	Min: -32768	Default: 10000	
			Max: 32767	Integer scaling: 1 = 1	
08 Index	Name:	**AN OUT 2 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to analogue output 2. With selections 0 or 507, AN OUT 2 VALUE (5.07) is selected for analogue output. This can be used to control the analogue output 2 from an overriding control.			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	

14	Group name:	I/O SETTINGS 2 (cont.)			
	Description:	Configuration of analogue and digital outputs			
09 Index	Name:	**DIG OUT 4 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital output 4 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
10 Index	Name:	**DIG OUT 4 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to digital output 4. If this parameter is set to 0, the digital output 4 is read from bit 13 of the auxiliary control word (7.02) (prior to applying dig out 4 invert / 14.09).			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
11 Index	Name:	**DO4 BIT NUMBER**			Par/Sig: p
	Description:	Bit number of the signal connected to digital output 4. This parameter determines the bit number within a packed binary signal selected by parameter dig out 4 index (14.10). If a boolean signal has been selected, do4 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do4 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 23	Integer scaling: ---	

14	Group name:	I/O SETTINGS 2 (cont.)		
	Description:	Configuration of analogue and digital outputs		
12 Index	Name:	**DIG OUT 5 INVERT**		Par/Sig: p
	Description:	Inversion selection for digital output 5 0: direct 1: inverted		
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)
			Max: 1 (inverted)	Integer scaling: ---
13 Index	Name:	**DIG OUT 5 INDEX**		Par/Sig: p
	Description:	Index of the signal connected to digital output 5. If this parameter is set to 0, the digital output 5 is read from bit 14 of the auxiliary control word (7.02) (prior to applying dig out 5 invert / 14.12).		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 19999	Integer scaling: ---
14 Index	Name:	**DO5 BIT NUMBER**		Par/Sig: p
	Description:	Bit number of the signal connected to digital output 5. This parameter determines the bit number within a packed binary signal selected by parameter dig out 5 index (14.13). If a boolean signal has been selected, do5 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do5 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 23	Integer scaling: ---

14	Group name:	**I/O SETTINGS 2 (cont.)**			
	Description:	Configuration of analogue and digital outputs			
15 Index	Name:	**DIG OUT 6 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital output 6 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
16 Index	Name:	**DIG OUT 6 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to digital output 6. If this parameter is set to 0, the digital output 6 is read from bit 15 of the auxiliary control word (7.02) (prior to applying dig out 6 invert / 14.15).			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
17 Index	Name:	**DO6 BIT NUMBER**			Par/Sig: p
	Description:	Bit number of the signal connected to digital output 6. This parameter determines the bit number within a packed binary signal selected by parameter dig out 6 index (14.16). If a boolean signal has been selected, do6 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do6 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 23	Integer scaling: ---	

14	Group name:	**I/O SETTINGS 2 (cont.)**			
	Description:	Configuration of analogue and digital outputs			
18 Index	Name:	**DIG OUT 7 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital output 7 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
19 Index	Name:	**DIG OUT 7 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to digital output 7. If this parameter is set to 0, the digital output 7 is read from bit 0 of the auxiliary control word 2 (7.03) (prior to applying dig out 7 invert / 14.18).			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
20 Index	Name:	**DO7 BIT NUMBER**			Par/Sig: p
	Description:	Bit number of the signal connected to digital output 7. This parameter determines the bit number within a packed binary signal selected by parameter dig out 7 index (14.19). If a boolean signal has been selected, do7 bit number doesn't care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do7 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 23	Integer scaling: ---	

14	Group name:	I/O SETTINGS 2 (cont.)			
	Description:	Configuration of analogue and digital outputs			
21 Index	Name:	**DIG OUT 8 INVERT**			Par/Sig: p
	Description:	Inversion selection for digital output 8 0: direct 1: inverted			
unit: ---	type: I	ctrl. bd.: CON	Min: 0 (direct)	Default: 0 (direct)	
			Max: 1 (inverted)	Integer scaling: ---	
22 Index	Name:	**DIG OUT 8 INDEX**			Par/Sig: p
	Description:	Index of the signal connected to digital output 8. If this parameter is set to 0, the digital output 8 is read from bit 1 of the auxiliary control word 2 (7.03) (prior to applying dig out 8 invert / 14.21).			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
23 Index	Name:	**DO8 BIT NUMBER**			Par/Sig: p
	Description:	Bit number of the signal connected to digital output 8. This parameter determines the bit number within a packed binary signal selected by parameter dig out 8 index (14.22). If a boolean signal has been selected, do8 bit number doesn’t care, since all bits of a boolean signal have the same value. If the sign of a signal is to be outputted, do8 bit number must be set to 15. 0: rightmost bit (LSB) ... 15: leftmost bit (MSB)			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 23	Integer scaling: ---	

Group 15: Drive Logic Parameters

<table>
<tr><td>15</td><td>Group name:</td><td colspan="4">DRIVE LOGIC PARAMETERS</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Drive Logic Parameters</td></tr>
<tr><td rowspan="2">01
Index</td><td>Name:</td><td colspan="3">MAINCONT CON MODE</td><td>Par/Sig: p</td></tr>
<tr><td>Description:</td><td colspan="4">The main contactor control mode determines the reaction on the “ON“ and “RUN“ bits of the main control word (7.01) as well as the local control word:
0: ON & RUN: main contactor is closed,
if both “ON“ and “RUN“ bits are “1“
1: ON: main contactor is closed, if “ON“ bit is “1“
2: ON HVCB: reserved for future usage</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: ON & RUN</td><td colspan="2">Default: ON</td></tr>
<tr><td colspan="3"></td><td>Max: ON HVCB</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td rowspan="2">02
Index</td><td>Name:</td><td colspan="3">DRIVE MODE</td><td>Par/Sig: s</td></tr>
<tr><td>Description:</td><td colspan="4">Drive mode selector for several auto- and manual tuning procedures as well as for the thyristor diagnosis.
After autotuning of the armature or field current controller, or after the thyristor diagnosis, drive mode is reset to 0. If error(s) occur during the selected procedure, drive mode is set to -1. The reason of the error can be seen from the signal commissioning status (6.02).

0: Normal mode
1: Reserved
2: Reserved
3: Autotuning of the armature current controller
4: Manual tuning of the armature current controller
5: Autotuning of the 1st field exciter’s current controller
6: Reserved
7: Manual tuning of the 1st field exciter
8: Manual tuning of the 2nd field exciter
9: Manual tuning of the speed controller
10: Reserved
11: Manual tuning of the EMF controller
12: Reserved
13: Thyristor diagnosis
20: Reserved
21: Reserved
22: Save the type code parameters of the converter (4.12 ... 4.17) to the SDCS-CON-2 board’s internal FLASH memory. This has to be done after changing the SDCS-CON-2 board or after changing the physical type of the converter.</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: 0</td><td colspan="2">Default: 0</td></tr>
<tr><td colspan="3"></td><td>Max: 22</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

15	Group name:	**DRIVE LOGIC PARAMETERS (cont.)**			
	Description:	Drive L ogic Parameters			
03 Index	Name:	**THERM MODEL SEL**			Par/Sig: p
	Description:	Thermal model selector: **0**: **NONE** **1**: **MOTOR 1**: activates thermal model of motor 1 **2**: **MOTOR 2**: activates thermal model of motor 2 **3**: **MOTOR 1 + 2**: activates thermal model of both motors			
unit: ---	type: I	ctrl. bd.: CON	Min: NONE	Default: NONE	
			Max: MOTOR 1 + 2	Integer scaling: ---	
04 Index	Name:	**PWRLOSS TRIP**			Par/Sig: p
	Description:	The action taken, when the mains voltage drops below the limit defined by parameter u net min 2 (40.02) **0**: **IMMEDIAT**: The drive is tripped immediately **1**: **DELAYED**: The drive is tripped, if the mains voltage doesn't return within the time defined by parameter pwr down time (40.03)			
unit: ---	type: I	ctrl. bd.: CON	Min: IMMEDIAT	Default: IMMEDIAT	
			Max: DEALYED	Integer scaling: ---	

15	Group name:	DRIVE LOGIC PARAMETERS (cont.)			
	Description:	Drive Logic Parameters			
05	Name:	**USED FEX TYPE**		Par/Sig: p	
Index	Description:	Selection for used field exciter type **0**: No field exciter ABB field exciter, control via serial communication (FEX link) **1**: Internal diode field exciter SDCS-FEX-1 **2**: Internal SDCS-FEX-2 or external DCF503/504 **3**: external DCF503/504 as second field exciter **4**: internal SDCS-FEX-2 or external DCF503/504 as first field exciter and external DCF503/504 as second field exciter External field exciter, control via AI/DI (alien field exciters) **5**: External field exciter, acknowledge through DI4 **6**: External field exciter, acknowledge through DI6 **7**: External field exciter, acknowledge through DI7 **8**: External field exciter, acknowledge through DI8 **9**: External field exciter, acknowledge through AITAC **10**: External field exciter, acknowledge through AI1 **11**: External field exciter, acknowledge through AI2 **12**: External field exciter, acknowledge through AI3 **13**: External field exciter, acknowledge through AI4 SDCS-FEX-3: check 1st/second field exciter jumper from HW-documentation. Instead of an external DCF503/504, a DCF600 MultiDrive can be used as field exciter.			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 13	Integer scaling: ---	

15	Group name:	DRIVE LOGIC PARAMETERS (cont.)			
	Description:	Drive Logic Parameters			
06 Index	Name:	**FIELD CONTRL MODE**			Par/Sig: p
	Description:	Field control operating mode **0**: **FIX**: EMF-controller OFF (constant field) no field reversal **1**: **EMF**: EMF-controller ON no field reversal **2**: **FIX/REV**: no EMF-control (constant field) field reversal **3**: **EM/REV**: EMF-control field reversal **4**: **FIX/OPTI/REV**: no EMF-control (constant field) OPTITORQUE, field reversal **5**: **EMF/OPTI/REV**: EMF-control OPTITORQUE, field reversal **6**: **FIX/OPTI**: no EMF-control (constant field) OPTITORQUE, no field reversal **7**: **EMF/OPTI**: EMF-control OPTITORQUE, no field reversal			
unit: ---	type: I	ctrl. bd.: CON	Min: FIX	Default: FIX	
			Max: EMF/OPTI	Integer scaling: ---	
07 Index	Name:	**EXT FAN ACK MODE**			Par/Sig: p
	Description:	The action taken, if the external fan acknowledge is not “ON“ within 3 sec afer the “ON“-command **0**: **TRIP**: drive is tripped **1**: **ALARM**: only alarm **2**: **NO SUPERVIS**: no supervision			
unit: ---	type: I	ctrl. bd.: CON	Min: TRIP	Default: TRIP	
			Max: NO SUPERVIS	Integer scaling: ---	
08 Index	Name:	**STALL PROT SELECT**			Par/Sig: p
	Description:	Stall protection selector **0**: **NOT USED**: not in use **1**: **IN USE**: stall protection selected			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: IN USE	Integer scaling: ---	
09 Index	Name:	**FAULT BRAKE SEL**			Par/Sig: p
	Description:	Selects, whether faults detected in the converter control (CON-2 software) start dynamic braking or not. **0**: **NO DYN BRAKE**: not in use **1**: **DYN BRAKE**: dynamic braking on faults			
unit: ---	type: I	ctrl. bd.: CON	Min: NO DYN BRAKE	Default: NO DYN BRAKE	
			Max: DYN BRAKE	Integer scaling: ---	

15	Group name:	**DRIVE LOGIC PARAMETERS (cont.)**		
	Description:	Drive Logic Parameters		

10 Index	Name:	**FIELD HEAT SEL**		Par/Sig: p
	Description:	Enable field heating if the main contactor is open. **0**: **DISABLED**: disable field heating **1**: **ENABLED**: enable field heating, if ON_INHIBIT (via digital inputs) is NOT active **2**: **ALWAYS**: field is heated, regardless of ON_INHIBIT The field heating is deactivated by trip or by ON_INHIBIT (via DI, if setting **ENABLED**).		
unit: ---	type: I	ctrl. bd.: CON	Min: DISABLED	Default: DISABLED
			Max: ALWAYS	Integer scaling: ---

11 Index	Name:	**FLD 1 HEAT SEL**		Par/Sig: p
	Description:	• Enable field heating for motor 1 if “RUN“ = 0 and “RDYRUN“ = 1. • Enable field heating for motor 1 if motor 2 is selected (see **MOTOR SELECT (6.03)** The field reference is reduced after 10 sec. **0**: **DISABLE**: disable field heating **1**: **ENABLE**: enable field heating		
unit: ---	type: I	ctrl. bd.: CON	Min: DISABLE	Default: ENABLE
			Max: ENABLE	Integer scaling: ---

12 Index	Name:	**FLD 2 HEAT SEL**		Par/Sig: p
	Description:	• Enable field heating for motor 2 if “RUN“ = 0 and “RDYRUN“ = 1. • Enable field heating for motor 2 if motor 1 is selected (see **MOTOR SELECT (6.03)** **0**: **DISABLE**: disable field heating **1**: **ENABLE**: enable field heating		
unit: ---	type: I	ctrl. bd.: CON	Min: DISABLE	Default: DISABLE
			Max: ENABLE	Integer scaling: ---

13 Index	Name:	**DI ELEC DISCONN**		Par/Sig: p
	Description:	Selects a digital input for main supply OFF. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**		
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED
			Max: DI8	Integer scaling: ---

15	Group name:	DRIVE LOGIC PARAMETERS (cont.)			
	Description:	Drive Logic Parameters			
14 Index	Name:	**ON INHIBIT 1 SEL**			Par/Sig: p
	Description:	Selection of 1 st DI channel to disable the "ON"-command. The selected DI channel is Ored with the DI channel selected by ON INHIBIT 2 SEL (15.15). If the signal from the selected input becomes inactive, the drive stops (by coasting, main contactor off) and enters the state ON INHIBIT. In addition to the bit 6 ON INHIBITED in the main status word 8.01, the bit 4 ON_DISABLED in the auxiliary status word is set. **DI_INVERT** of the selected input must be set to **INVERT**, if inactive is "0-signal". **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: DI4	
			Max: DI8	Integer scaling: ---	
15 Index	Name:	**ON INHIBIT 2 SEL**			Par/Sig: p
	Description:	Selection of 2 nd DI channel to disable the "ON"-command. The selected DI channel is Ored with the DI channel selected by ON INHIBIT 1 SEL (15.14). If the signal from the selected input becomes inactive, the drive stops (by coasting, main contactor off) and enters the state ON INHIBIT. In addition to the bit 6 ON INHIBITED in the main status word 8.01, the bit 4 ON_DISABLED in the auxiliary status word is set. **DI_INVERT** of the selected input must be set to **INVERT**, if inactive is "0-signal". **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: DI8	Integer scaling: ---	

<table>
<tr><td>15</td><td>Group name:</td><td colspan="3">DRIVE LOGIC PARAMETERS (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="3">Drive Logic Parameters</td></tr>
<tr><td>16
Index</td><td>Name:</td><td colspan="2">OPER MODE SELECT</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="3">Converter mode selection
0: 6P SINGLE: 6-pulse operation
1: 12P PAR MAS: 12-pulse parallel master
2: 12P PAR SLA: 12-pulse parallel slave
3: 12P SER MAS: 12-pulse serial master
4: 12P SER SLA: 12-pulse serial slave
5: FIELD EXC: field exciter mode

This parameter is write-protected during RUNNING state of the drive.

In field exciter mode, the parameter REV DELAY (43.13) should be set to an appropriate higher value according to the field inductance.

In field exciter mode, the digital output DO2 is assigned fixed to the converter alarms, while the digital input DI2 is assigned fixed to the external overvoltage protection. Please disable any other functions, which have been assigned to DI2 previously (e.g. external fan acknowledge, see 12.14).</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: 6P SINGLE</td><td>Default: 6P SINGLE</td></tr>
<tr><td></td><td></td><td></td><td>Max: FIELD EXC</td><td>Integer scaling: ---</td></tr>
<tr><td>17
Index</td><td>Name:</td><td colspan="2">MAIN SUPP OFF DEL</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="3">Delay of switching off the main supply (command “main supply OFF“) after electrical disconnection or overcurrent</td></tr>
<tr><td>unit: ms</td><td>type: R</td><td>ctrl. bd.: CON</td><td>Min: 0</td><td>Default: 200ms</td></tr>
<tr><td></td><td></td><td></td><td>Max: 32767</td><td>Integer scaling: 1 = 1ms</td></tr>
</table>

15	Group name:	DRIVE LOGIC PARAMETERS (cont.)			
	Description:	Drive Logic Parameters			
18 Index	Name:	**DC BREAK ACK SEL**			Par/Sig: p
	Description:	Selection of DI channel for the DC-breaker's (active low) acknowledge signal **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: DI8	Integer scaling: ---	
19 Index	Name:	**DC BREAK OFF DEL**			Par/Sig: p
	Description:	Delay of opening the DC breaker after starting the dynamic braking			
unit: ms	type: R	ctrl. bd.: CON	Min: 0	Default: 100ms	
			Max: 32767	Integer scaling: 1 = 1ms	
20 Index	Name:	**DYN BRAKE ACK SEL**			Par/Sig: p
	Description:	Selection of DI channel for the dynamic braking switch's (active low) acknowledge signal **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: DI8	Integer scaling: ---	
21 Index	Name:	**FEXC NODE NUMBER**			Par/Sig: p
	Description:	This parameter programs the DCS600 MultiDrive's FEX link address. It is active only, if the converter mode (15.16) is set to 5 (field exciter mode) AND the command word or the field current reference is selected from the FEX link. **1: NODE NO 1** **2: NODE NO 2**			
unit: ---	type: I	ctrl. bd.: CON	Min: NODE NO 1	Default: NODE NO 1	
			Max: NODE NO 2	Integer scaling: ---	

15	Group name:	DRIVE LOGIC PARAMETERS (cont.)	
	Description:	Drive Logic Parameters	
22 Index	Name:	**COMMAND SEL**	Par/Sig: p
	Description:	This parameter selects the source of the control word (if the drive is NOT in local mode). The configuration FEX LINK (2) is only available in field exciter mode (15.16 = 5). The configuration 12P LINK (3) is only available for the 12-pulse slave converter. For both configurations, the converter mustn't be in local mode. Local control mode has higher priority than the selection made with this parameter. **0**: **MAINCON WORD**: overriding control system via main control word **(7.01)** **1**: **LOCAL I/O** DI6 = RESET DI7 = ON DI8 = RUN **2**: **FEX LINK** ON, RUN via FEX link; self-RESET at ON-command **3: 12P LINK** ON, RUN, RESET via 12-pulse link The internal used/selected control word can be read from the signal **USED CONTROL WORD (7.04)**. **Note1:** The control signals selected with the FEX LINK or 12P LINK configuration are not available for the drive control functions (speed and torque ramps, speed controller). For that reason, this parameter must be set to 0 or 1, if neither the field exciter mode nor a 12-pulse slave mode is active. **Note2:** The RESET command from the local control place is always active. **Note3:** In local I/O mode, the digital inputs DI6, DI7, DI8 mustn't be used for purposes other than mentioned above. **Note4:** The digital input selected for emergency stop is always active for emergency stop (if emergency stop function is selected), with settings 0 and 1. **It is active low, if the parameter DIG IN x INVERT of the selected digital input is set to INVERTED.**	
unit: ---	type: I	ctrl. bd.: CON	Min: MAINCON WORD / Default: MAINCON WORD
			Max: 12P LINK / Integer scaling: ---

15	Group name:	DRIVE LOGIC PARAMETERS (cont.)			
	Description:	Drive Logic Parameters			
23 Index	Name:	**EXT FAULT SEL**			Par/Sig: p
	Description:	This parameter selects a digital input for an external fault. The external fault EXT FAULT is generated, if the selected digital input signal is low after applying the according inversion parameter (inversion parameters for DI1 … DI8 only). 0: external fault not selected 1 … 8: DI1 … DI8 of SDCS-CON-2 selected for external fault 9 … 15: DI9 … DI5 of SDCS-IOE-1 selected for external fault			
unit: ---	Type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 15	Integer scaling: ---	
24 Index	Name:	**EXT ALARM SEL**			Par/Sig: p
	Description:	This parameter selects a digital input for an external alarm. The external alarm EXT ALARM is generated, if the selected digital input signal is low after applying the according inversion parameter (inversion parameters for DI1 … DI8 only). 0: external alarm not selected 1 … 8: DI1 … DI8 of SDCS-CON-2 selected for external alarm 9 … 15: DI9 … DI5 of SDCS-IOE-1 selected for external alarm			
unit: ---	Type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 15	Integer scaling: ---	

Group 16: System Control Inputs

16	Group name:	SYSTEM CONTROL INPUTS		
	Description:	System Control Inputs		
02 Index	Name:	**PARAMETER LOCK**		Par/Sig: p
	Description:	This parameter selects the state of the parameter lock. With the parameter lock you can inhibit unauthorised parameter changes by CDP312 or the Drives Window tool for the groups 0 ... 99. The **LOCKED** state can be left, if the correct passcode is entered. See **PASS CODE (16.03)** 1 = **LOCKED** parameter changes are disabled 0 = **OPEN** parameter changes are enabled		
unit: ---	type: B	ctrl. bd.: AMC	Min: 0 (open)	Default: 0 (open)
			Max: 1 (locked)	Integer scaling: ---
03 Index	Name:	**PASS CODE**		Par/Sig: s
	Description:	This parameter enters the pass code for the parameter lock (16.02). The default value of this parameter is 0. In order to open the parameter lock, change the value to 358. After the parameter lock is opened, the value automatically changes back to 0.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: 30000	Integer scaling: ---
04 Index	Name:	**LOCAL LOCK**		Par/Sig: p
	Description:	The control place change of the drive from remote to local can be disabled by setting this parameter to value TRUE. If LOCAL LOCK is activated during the local control mode, it becomes valid after the control place has been changed back to remote control mode. 0= FALSE no locking for control place change 1 = TRUE local control is disabled **Note!** **The LOCAL LOCK function is NOT available with DriveWindow.**		
unit: ---	type: B	ctrl. bd.: AMC	Min: 0 (FALSE)	Default: 0 (FALSE)
			Max: 1 (TRUE)	Integer scaling: ---

16	Group name:	**SYSTEM CONTROL INPUTS (cont.)**		
	Description:	System Control Inputs		
06 Index	Name:	**PARAMETER BACKUP**		Par/Sig: s
	Description:	Parameter save from the RAM memory to the FPROM. This is needed only, if parameter changes by overriding system have to be stored to FPROM memory instead of the RAM. **Note!** Do not use the Parameter Backup function unnecessarily **Note!** Parameter changes by CDP312 Control Panel or Drive*Window* are immediately saved to the FPROM. 0= DONE Parameter value after the saving has been comleted 1 = SAVE.. Parameter save to FPROM **Note!** The parameter value is held at SAVE.. as long as the parameters are written to the FPROM. If a compression of the FLASH memory is caused by the Parameter Backup, this can take up to 90s.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0 (DONE)	Default: 0 (DONE)
			Max: 1 (SAVE..)	Integer scaling: ---

Group 17: Test Signal Generator

17	Group name:	TEST SIGNAL GENERATOR		
	Description:	The test signal generator may be used for tuning purposes.		

01 Index	Name:	**POT 1**		Par/Sig: p
	Description:	Constant test reference 1 for the manual tuning function. Used also for the square wave generator.		
unit: ---	type: I	ctrl. bd.: AMC	Min: -32768	Default: 0
			Max: 32767	Integer scaling: ---

02 Index	Name:	**POT 2**		Par/Sig: p
	Description:	Constant test reference 2 for the manual tuning function. Used also for the square wave generator.		
unit: ---	type: I	ctrl. bd.: AMC	Min: -32768	Default: 0
			Max: 32767	Integer scaling: ---

03 Index	Name:	**SQR WAVE PERIOD**		Par/Sig: p
	Description:	The time period of the square wave generator		
unit: ms	type: R	ctrl. bd.: AMC	Min: 10ms	Default: 10ms
			Max: 100000ms	Integer scaling: 1 = 10ms

04 Index	Name:	**TEST REF SELECT**		Par/Sig: s
	Description:	Manual tuning reference selection for the function selected by the drive mode parameter (15.02) **0: 0** **1: POT1** **2: POT2** **3: SQR WAV** **4: TST REF**		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: TST REF	Integer scaling: ---

05 Index	Name:	**TEST RELEASE**		Par/Sig: s
	Description:	Release function selected by drive mode. Only some functions defined in drive mode need that.		
unit: ---	type: I	ctrl. bd.: CON	Min: -32768	Default: 0
			Max: 32767	Integer scaling: ---

06 Index	Name:	**INDX SQUARE WAVE**		Par/Sig: s
	Description:	Index pointer to the destination of the square wave signal. If a destination inside the CON is selected, the according index must also be configured by one of the group 95 pointers. The selection is not stored to the FLASH memory. After power-up, the function is inactive.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: 1999	Integer scaling: ---

Group 18: LED Panel Control

18	Group name:	**LED PANEL CONTROL**			
	Description:	The NLMD-01 Monitoring Display has a 0 ... 150% LED bar to show an absolute real type value. The source and the scale of this display is defined by this parameter group. Note! If NLMD-01 and CDP312 are used together, the first signal measurement in the Actual Signal Display Mode of CDP312 must be the signal **1.26 led panel output**. Otherwise the NLMD-01 LED bar display will not show the correct value.			
01	Name:	**LED PANEL OUTPUT**			Par/Sig: p
Index	Description:	Input signal for LED PANEL OUTPUT [1.26]. Group and index (group • 100 + index) for the LED monitor display. Indexes with data type real or integer are applicable for the LED panel output. The default value for this parameter is 1.07 (filtered torque actual value).			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 107	
			Max: 9999	Integer scaling: ---	
02	Name:	**SCALE PANEL**			Par/Sig: p
Index	Description:	The signal value (defined in 18.01) corresponding to 100% on the LED bar display. **Note!** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: ---	type: R	ctrl. bd.: AMC	Min: 0	Default: 100	
			Max: 32767	Integer scaling: 1 = 1	

Group 19: Data Storage

19	Group name:	**DATA STORAGE**			
	Description:	This parameter group consists of unconnected parameters for linking, testing and commissioning purposes. **Example1:** The 2nd value of the received dataset 14 is to be monitored by the Drives Window's Monitor Tool. By programming the pointer index of this dataset value (90.08) to 19.01, the desired value will be written to parameter 19.01. **Example 2:** The 2nd value of the transmitted dataset 15 is to be set by the CDP312 control panel or by Drives Window as a parameter for the overriding control system. By programming the pointer index of this dataset value (92.08) to 19.02, the desired value will be read from parameter 19.02.			
01 Index	Name:	**DATA 1**			Par/Sig: p
	Description:	Data container 1 (see group description above)			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
02 Index	Name:	**DATA 2**			Par/Sig: p
	Description:	Data container 2 (see group description above)			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
03 Index	Name:	**DATA 3**			Par/Sig: p
	Description:	Data container 3 (see group description above)			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
04 Index	Name:	**DATA 4**			Par/Sig: p
	Description:	Data container 4 (see group description above)			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
05 Index	Name:	**DATA 5**			Par/Sig: p
	Description:	Data container 5 (see group description above)			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
06 Index	Name:	**DATA 6**			Par/Sig: p
	Description:	Data container 6 (see group description above)			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	

19	Group name:	DATA STORAGE (cont.)			
	Description:	This parameter group consists of unconnected parameters for linking, testing and commissioning purposes. **Example1:** The 2nd value of the received dataset 14 is to be monitored by the Drives Window’s Monitor Tool. By programming the pointer index of this dataset value (90.08) to 19.01, the desired value will be written to parameter 19.01. **Example 2:** The 2nd value of the transmitted dataset 15 is to be set by the CDP312 control panel or by Drives Window as a parameter for the overriding control system. By programming the pointer index of this dataset value (92.08) to 19.02, the desired value will be read from parameter 19.02.			
07 Index	Name:	**DATA 7**			Par/Sig: s
	Description:	Data container 7 (see group description above) This data isn't written to the FLASH memory immediately, but is written to the FLASH memory on power-fail.			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
08 Index	Name:	**DATA 8**			Par/Sig: s
	Description:	Data container 8 (see group description above) This data isn't written to the FLASH memory immediately, but is written to the FLASH memory on power-fail.			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
09 Index	Name:	**DATA 9**			Par/Sig: s
	Description:	Data container 9 (see group description above) This data isn't written to the FLASH memory immediately, but is written to the FLASH memory on power-fail.			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	

19	Group name:	DATA STORAGE (cont.)			
	Description:	This parameter group consists of unconnected parameters for linking, testing and commissioning purposes. **Example1:** The 2nd value of the received dataset 14 is to be monitored by the Drives Window's Monitor Tool. By programming the pointer index of this dataset value (90.08) to 19.01, the desired value will be written to parameter 19.01. **Example 2:** The 2nd value of the transmitted dataset 15 is to be set by the CDP312 control panel or by Drives Window as a parameter for the overriding control system. By programming the pointer index of this dataset value (92.08) to 19.02, the desired value will be read from parameter 19.02.			
10 Index	Name:	**DATA 10**			Par/Sig: s
	Description:	Data container 10 (see group description above) This data isn't written to the FLASH memory immediately, but is written to the FLASH memory on power-fail.			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
11 Index	Name:	**DATA 11**			Par/Sig: s
	Description:	Data container 11 (see group description above) This data isn't written to the FLASH memory immediately, but is written to the FLASH memory on power-fail.			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	
12 Index	Name:	**DATA 12**			Par/Sig: s
	Description:	Data container 12 (see group description above) This data isn't written to the FLASH memory immediately, but is written to the FLASH memory on power-fail.			
unit: ---	type: R	ctrl. bd.: AMC	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: 1 = 1	

Group 20: Limits

20	Group name:	**LIMITS**			
	Description:	Limits			
01 Index	Name:	**MINIMUM SPEED**			Par/Sig: p
	Description:	Negative speed reference limit Internal limited to –((50.01) • 32767 / 20000) ... 0 rpm **Note1:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3. **Note2:** The speed limits are also applied to the input of the speed controller (SPEED REF 4, 2.18) in order to avoid exceeding the speed limits due to the SPEED CORRECTION (23.04) and the SPEED STEP (23.10). This may cause unramped speed reference steps in case the speed limits are changed while the drive is being operated at speed limit.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: -12000rpm	Default: -1500rpm	
			Max: 0rpm	Integer scaling: (50.01)	
02 Index	Name:	**MAXIMUM SPEED**			Par/Sig: p
	Description:	Positive speed reference limit Internal limited to 0 ... ((50.01) • 32767 / 20000) rpm **Note1:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3. **Note2:** The speed limits are also applied to the input of the speed controller (SPEED REF 4, 2.18) in order to avoid exceeding the speed limits due to the SPEED CORRECTION (23.04) and the SPEED STEP (23.10). This may cause unramped speed reference steps in case the speed limits are changed while the drive is being operated at speed limit.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 1500rpm	
			Max: 12000rpm	Integer scaling: (50.01)	
03 Index	Name:	**ZERO SPEED LIMIT**			Par/Sig: p
	Description:	Below this speed treshold the bit 11 (ZERO_SPEED) of the auxiliary status word (8.02) is set. On stop commands, the drive will coast below the speed programmed to this parameter. Internal limited to 0 ... (0.1 • (50.01)) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 22.5rpm	
			Max: 750rpm	Integer scaling: (50.01)	

20	Group name:	**LIMITS (cont.)**			
	Description:	Limits			
05 Index	Name:	**MAXIMUM TORQUE**			Par/Sig: p
	Description:	Maximum positive output torque in per cent of the nominal motor torque. The output torque of the torque selector (including load compensation and torque step) is limited against this value.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: 0.5%	Default: 100%	
			Max: 325%	Integer scaling: 100 = 1%	
06 Index	Name:	**MINIMUM TORQUE**			Par/Sig: p
	Description:	Minimum negative output torque in per cent of the nominal motor torque. The output torque of the torque selector (including load compensation and torque step) is limited against this value.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: -100%	
			Max: -0.5%	Integer scaling: 100 = 1%	
07 Index	Name:	**SPC TORQMAX**			Par/Sig: p
	Description:	Maximum torque limit in per cent of the nominal motor torque at the output of the speed controller.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: 0.5%	Default: 325%	
			Max: 325%	Integer scaling: 100 = 1%	
08 Index	Name:	**SPC TORQMIN**			Par/Sig: p
	Description:	Minimum torque limit in per cent of the nominal motor torque at the output of the speed controller.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: -325%	
			Max: -0.5%	Integer scaling: 100 = 1%	
09 Index	Name:	**TREF TORQMAX**			Par/Sig: p
	Description:	Maximum torque reference in per cent of the nom. motor torque.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: 0.5%	Default: 325%	
			Max: 325%	Integer scaling: 100 = 1%	
10 Index	Name:	**TREF TORQMIN**			Par/Sig: p
	Description:	Minimum torque reference in per cent of the nominal motor torque.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: -325%	
			Max: -0.5%	Integer scaling: 100 = 1%	
11 Index	Name:	**OVERSPEED LIMIT**			Par/Sig: p
	Description:	The speed value the drive will trip at Internal limited to 0 ... ((50.01) • 32000 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 1725rpm	
			Max: 12000rpm	Integer scaling: (50.01)	

20	Group name:	**LIMITS (cont.)**			
	Description:	Limits			
12 Index	Name:	**CUR LIM MOT BRIDGE**			Par/Sig: p
	Description:	Current limit for motor bridge related to the nominal motor current.			
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 100%	
			Max: 399.975%	Integer scaling:4096 = 100%	
13 Index	Name:	**CUR LIM GEN BRIDGE**			Par/Sig: p
	Description:	Current limit for generator bridge related to the nom. motor current **Note!** This limit is internally set to 0, if the quadrant type (4.15) is 1.			
unit: %Im	type: R	ctrl. bd.: CON	Min: -399.975%	Default: -100%	
			Max: 0%	Integer scaling:4096 = 100%	
14 Index	Name:	**MAX FIRING ANGLE**			Par/Sig: p
	Description:	Maximum firing angle in degrees			
unit: deg	type: R	ctrl. bd.: CON	Min: 0deg	Default: 150deg	
			Max: 165deg	Integer scaling: 1 = 1deg	
15 Index	Name:	**MIN FIRING ANGLE**			Par/Sig: p
	Description:	Minimum firing angle in degrees			
unit: deg	type: R	ctrl. bd.: CON	Min: 0deg	Default: 15deg	
			Max: 165deg	Integer scaling: 1 = 1deg	
16 Index	Name:	**FIELD1 OVRCUR LEV**			Par/Sig: p
	Description:	Field overcurrent limit for motor 1 in per cent of the motor 1's nominal field current			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 115%	
			Max: 199.975%	Integer scaling:4096 = 100%	
17 Index	Name:	**FIELD2 OVRCUR LEV**			Par/Sig: p
	Description:	Field overcurrent limit for motor 2 in per cent of the motor 2's nominal field current			
unit: %If2	type: R	ctrl. bd.: CON	Min: 0%	Default: 115%	
			Max: 199.975%	Integer scaling:4096 = 100%	
18 Index	Name:	**CURRENT RISE MAX**			Par/Sig: p
	Description:	Maximum allowed current rise within 1 control cycle (3.3ms at 50Hz). Exceeding this limit causes the fault "**08 CURR RISE**".			
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 800%	
			Max: 800%	Integer scaling:4096 = 100%	

Group 21: Start / Stop Functions

21	Group name:	**START / STOP FUNCTIONS**		
	Description:	Start / Stop Functions		
03 Index	Name:	**STOP MODE**		Par/Sig: p
	Description:	Conditions during motor deceleration in LOCAL control mode (except emergency stop). The programmed STOP function is also used in case of external STOP (via DI) in LOCAL IO control mode. **0**: **DYN BRAKING**: dynamic braking **1**: **RAMP STOP**: stop according to deceleration time 22.02 **2**: **TORQUE LIMIT**: stop by torque limit **3**: **COAST STOP**: torque is zero		
unit: ---	type: I	ctrl. bd.: AMC	Min: DYN BRAKING	Default: RAMP STOP
			Max: COAST STOP	Integer scaling: ---
04 Index	Name:	**EME STOP MODE**		Par/Sig: p
	Description:	Conditions during motor deceleration at emergency STOP. **0**: **DYN BRAKING**: dynamic braking **1**: **RAMP STOP**: stop according to eme stop ramp 22.04 **2**: **TORQUE LIMIT**: stop by torque limit **3**: **COAST STOP**: torque is zero **4**: **NOT SELECTED**: emergency stop function is not in use		
unit: ---	type: I	ctrl. bd.: AMC	Min: DYN BRAKING	Default: RAMP STOP
			Max: NOT SELECTED	Integer scaling: ---

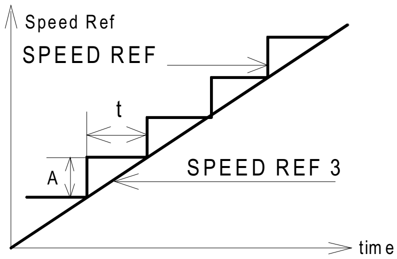
21	Group name:	**START / STOP FUNCTIONS (cont.)**		
	Description:	Start / Stop Functions		
05	Name:	**EMSTOP DER MIN L**		Par/Sig: p
Index	Description:	The deceleration of the drive is supervised during an emergency stop condition. This supervision starts the time defined in DECEL MON DELAY (see below) after the drive has received an emergency stop command. If the drive isn't able to decelerate within the window, whose limit is defined by this parameter and maximum limit by parameter 21.06 EMSTOP DER MAX L, it is stopped by coast stop. Bit 2 (EMERG_STOP_COAST) of the auxiliary status word (8.02) is set to "1". The supervision function is disabled by setting this parameter to its default value.		
unit: rpm/s	type: R	ctrl. bd.: AMC	Min: -5 rpm/s	Default: 18000rpm/s
			Max: 18000rpm/s	Integer scaling: 1=1rpm/s
06	Name:	**EMSTOP DER MAX L**		Par/Sig: p
Index	Description:	This parameter defines the maximum deceleration rate for emergency stop monitoring. See also parameter 21.05 above. The supervision function is disabled by setting this parameter to its default value.		
unit: rpm/s	type: R	ctrl. bd.: AMC	Min: 0rpm/s	Default: 18000rpm/s
			Max: 18000rpm/s	Integer scaling: 1=1rpm/s
07	Name:	**DECEL MON DELAY**		Par/Sig: p
Index	Description:	This parameter defines the delay before the deceleration monitoring of the emergency stop starts. See also parameters 21.05 and 21.06 above. This parameter defines also the filter time constant of a 2^{nd} order filter for the monitored deceleration: filter time = (21.07) / 10.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 20s
			Max: 100s	Integer scaling: 10 = 1s

Group 22: Speed Ramp Functions

22	Group name:	**SPEED RAMP FUNCTIONS**		
	Description:	Speed Ramp Functions		
01 Index	Name:	**ACCELER TIME**		Par/Sig: p
	Description:	The time the drive will accelerate within from zero speed to maximum speed. See also parameter 22.03, ramptimescale. The maximum speed is the greater value of the absolutes 20.01 and 20.02. Changes on this parameter take effect within 2ms.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 20s
			Max: 300s	Integer scaling: 100 = 1s
02 Index	Name:	**DECELER TIME**		Par/Sig: p
	Description:	The time the drive will decelerate within from maximum speed to zero speed. See also parameter 22.03, ramptimescale. The maximum speed is the greater value of the absolutes 20.01 and 20.02. Changes on this parameter take effect within 2ms.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 20s
			Max: 300s	Integer scaling: 100 = 1s
03 Index	Name:	**RAMPTIME SCALE**		Par/Sig: p
	Description:	Multiplier for acceler time (22.01) and deceler time (22.02) to expand the time.		
unit: ---	type: R	ctrl. bd.: AMC	Min: 0.1	Default: 1
			Max: 100	Integer scaling: 100 = 1
04 Index	Name:	**EME STOP RAMP**		Par/Sig: p
	Description:	If an emergency stop is activated and the parameter eme stop mode (21.04) = 1 (stop by ramp), the drive will decelerate according to this parameter from maximum speed to zero speed. The maximum speed is the greater value of the absolutes 20.01 and 20.02. **Note:** Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 20s
			Max: 3000s	Integer scaling: 10 = 1s
05 Index	Name:	**SHAPE TIME**		Par/Sig: p
	Description:	Speed reference softening time. This is the time constant of a filter at the output of the speed reference ramp. The filter is bypassed during an emergency stop condition.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 0s
			Max: 30s	Integer scaling: 100 = 1s

<table>
<tr><td>22</td><td>Group name:</td><td colspan="4">SPEED RAMP FUNCTIONS (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Speed Ramp Functions</td></tr>
<tr><td>06
Index</td><td>Name:</td><td colspan="3">VARIABLE SLOPE</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">This function is used to control the slope of the speed ramp during a speed reference change. The time t for step A is defined by parameter 22.07 VAR SLOPE RATE.

ON = Function enabled
OFF = Function disabled (normal ramp function)

Example: Overriding system transmit interval time for the speed reference and the VAR SLOPE RATE value are equal. As a result, the shape of SPEED REF 3 is a straight line.
</td></tr>
<tr><td>unit: ---</td><td>type: B</td><td>ctrl. bd.: AMC</td><td>Min: 0 (off)</td><td colspan="2">Default: 0 (off)</td></tr>
<tr><td></td><td></td><td></td><td>Max: 1 (on)</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td>07
Index</td><td>Name:</td><td colspan="3">VAR SLOPE RATE</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">see variable slope (22.06)</td></tr>
<tr><td>unit: ms</td><td>type: R</td><td>ctrl. bd.: AMC</td><td>Min: 2ms</td><td colspan="2">Default: 0s</td></tr>
<tr><td></td><td></td><td></td><td>Max: 30000ms</td><td colspan="2">Integer scaling: 1 = 1ms</td></tr>
<tr><td>08
Index</td><td>Name:</td><td colspan="3">BAL RAMP REF</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">The output of the speed ramp can be forced to the value defined by this parameter. The function is activated by setting bit 3 of the auxiliary control word (7.02) to 1.
Internal limited to +/- ((50.01) • 32767 / 20000) rpm
Note: Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.</td></tr>
<tr><td>unit: rpm</td><td>type: R</td><td>ctrl. bd.: AMC</td><td>Min: -12000rpm</td><td colspan="2">Default: 0rpm</td></tr>
<tr><td></td><td></td><td></td><td>Max: 12000rpm</td><td colspan="2">Integer scaling: (50.01)</td></tr>
</table>

Group 23: Speed Reference

23	Group name:	**SPEED REFERENCE**		
	Description:	Speed Reference		
01 Index	Name:	**SPEED REF**		Par/Sig: s
	Description:	Main speed reference input for the speed control of the drive. The given min/max values are related to the default value of the speed scaling parameter (50.01).		
unit: rpm	type: R	ctrl. bd.: AMC	Min: -2457rpm	Default: 0rpm
			Max: 2457rpm	Integer scaling: (50.01)
02 Index	Name:	**CONST SPEED 1**		Par/Sig: p
	Description:	The constant speed reference 1 is activated from the main control word (7.01), bit 8 Internal limited to +/- ((50.01) • 32767 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: rpm	type: R	ctrl. bd.: AMC	Min: -12000rpm	Default: 0rpm
			Max: 12000rpm	Integer scaling: (50.01)
03 Index	Name:	**CONST SPEED 2**		Par/Sig: p
	Description:	The constant speed reference 2 is activated from the main control word (7.01), bit 9 Internal limited to +/- ((50.01) • 32767 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: rpm	type: R	ctrl. bd.: AMC	Min: -12000rpm	Default: 0rpm
			Max: 12000rpm	Integer scaling: (50.01)
04 Index	Name:	**SPEED CORRECTION**		Par/Sig: s
	Description:	This parameter value can be added to the ramped reference value. The given min/max values are related to the default value of the speed scaling parameter (50.01). **Note!** Since this speed offset is added after the speed ramp, it must be set to zero prior to stopping the drive.		
unit: rpm	type: R	ctrl. bd.: AMC	Min: -2457rpm	Default: 0rpm
			Max: 2457rpm	Integer scaling: (50.01)

<table>
<tr><td>23</td><td>Group name:</td><td colspan="3">SPEED REFERENCE (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="3">Speed Reference</td></tr>
<tr><td>05</td><td>Name:</td><td colspan="2">SPEED SHARE</td><td>Par/Sig: p</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="3">Speed reference share coefficient.</td></tr>
<tr><td>unit: %</td><td>type: R</td><td>ctrl. bd.: AMC</td><td>Min: -400%</td><td>Default: 100%</td></tr>
<tr><td colspan="3"></td><td>Max: 400%</td><td>Integer scaling: 10 = 1%</td></tr>
<tr><td>06</td><td>Name:</td><td colspan="2">SPEED ERROR FILT</td><td>Par/Sig: p</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="3">Time constant of speed error low pass filter 1</td></tr>
<tr><td>unit: ms</td><td>type: R</td><td>ctrl. bd.: AMC</td><td>Min: 0ms</td><td>Default: 0ms</td></tr>
<tr><td colspan="3"></td><td>Max: 10000ms</td><td>Integer scaling: 1 = 1ms</td></tr>
<tr><td>07</td><td>Name:</td><td colspan="2">WINDOW INTG ON</td><td>Par/Sig: p</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="3">1: ON: Integrator of the speed controller is released, when the window control is on
0: OFF: Integrator of the speed controller is blocked, when the window control is on

Idea of Window Control
The idea of the Window Control is to deactivate the speed control as long as the speed deviation remains within the window set by parameters window width pos (23.08) and window width neg (23.09). This allows the external torque reference to affect the process directly. If the speed deviation exceeds the programmed window, the speed controller gets active.</td></tr>
<tr><td>unit: ---</td><td>type: B</td><td>ctrl. bd.: AMC</td><td>Min: OFF</td><td>Default: OFF</td></tr>
<tr><td colspan="3"></td><td>Max: ON</td><td>Integer scaling: ---</td></tr>
</table>

23	Group name:	SPEED REFERENCE (cont.)			
	Description:	Speed Reference			
08 Index	Name:	**WINDOW WIDTH POS**			Par/Sig: p
	Description:	Positive speed (deviation) limit for the window control. Internal limited to 0 ... ((50.01) • 32767 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 0rpm	
			Max: 12000	Integer scaling: (50.01)	
09 Index	Name:	**WINDOW WIDTH NEG**			Par/Sig: p
	Description:	Negative speed (deviation) limit for the window control. Internal limited to - ((50.01) • 32767 / 20000) ... 0 rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: -12000rpm	Default: 0rpm	
			Max: 0rpm	Integer scaling: (50.01)	
10 Index	Name:	**SPEED STEP**			Par/Sig: s
	Description:	An additional speed step can be added directly to the speed error at the speed controller's input. The given min/max values are related to the default value of the speed scaling parameter (50.01). **Note!** Since this speed offset is added after the speed ramp, it must be set to zero prior to stopping the drive.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: -2457rpm	Default: 0rpm	
			Max: 2457rpm	Integer scaling: (50.01)	

23	Group name:	SPEED REFERENCE (cont.)			
	Description:	Speed Reference			
11 Index	Name:	**SPEED ERROR FILT2**			Par/Sig: p
	Description:	Time constant of speed error low pass filter 2			
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 0ms	
			Max: 10000ms	Integer scaling: 1 = 1ms	
12 Index	Name:	**RAMPED INCH REF**			Par/Sig: p
	Description:	Jog speed value. Activated by bit 12 (RAMPED_INCH_REF) of the aux control word (7.02) at the input of the speed reference limiter / speed ramp. Internal limited to - ((50.01) • 32767 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: -12000rpm	Default: 0rpm	
			Max: 12000rpm	Integer scaling: (50.01)	
13 Index	Name:	**SPEED CORR RAMP**			Par/Sig: s
	Description:	Ramped speed correction. Added to the speed reference (23.01). The given min/max values are related to the default value of the speed scaling parameter (50.01).			
unit: rpm	type: R	ctrl. bd.: AMC	Min: -2457rpm	Default: 0rpm	
			Max: 2457rpm	Integer scaling: (50.01)	

Group 24: Speed Control

24	Group name:	SPEED CONTROL			
	Description:	Speed Control			
02 Index	Name:	**DROOP RATE**			Par/Sig: p
	Description:	The amount of speed decrease caused by the load is determined by means of this parameter. A value of 1% causes at nominal motor torque a speed decrease of 1% of the maximum speed (50.01).			
unit: %	type: R	ctrl. bd.: AMC	Min: 0%	Default: 0%	
			Max: 800%	Integer scaling: 10 = 1%	
03 Index	Name:	**KPS**			Par/Sig: p
	Description:	Relative gain of the speed controller. With the value 1, a speed error of 10% of the maximum speed (50.01) causes a torque reference of of 10% of the motor's nominal torque.			
unit: ---	type: R	ctrl. bd.: AMC	Min: 0	Default: 5	
			Max: 325	Integer scaling: 100 = 1	
04 Index	Name:	**KPS MIN**			Par/Sig: p
	Description:	kps min determines the proportional gain of the speed controller when it'soutput is zero. The adaptive gain of the speed controller is used to solve problems caused by low load and backlash. Below a programmable controller output value (kps weakpoint, 24.05), the gain is reduced linear to the value kps min at zero torque reference.			
unit: ---	type: R	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: (24.03)	Integer scaling: 100 = 1	
05 Index	Name:	**KPS WEAKPOINT**			Par/Sig: p
	Description:	The value of the speed controller output (torque reference) where the gain is kps. See also kps min (24.04)			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: 0%	Default: 0%	
			Max: 325%	Integer scaling: 100 = 1%	
06 Index	Name:	**KPS WP FILT TIME**			Par/Sig: p
	Description:	Filter time constant of a filter for the speed gain calculated by the torque adaption (see 24.04, 24.05).			
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 100ms	
			Max: 10000ms	Integer scaling: 1 = 1ms	

24	Group name:	SPEED CONTROL (cont.)		
	Description:	Speed Control		
09 Index	Name:	**TIS**		Par/Sig: p
	Description:	Integral active time of the speed controller. The time within the integral part of the controller achieves the same value as the proportional part. Setting TIS to 32767ms disables the integral part of the controller; the integrator's accumulator is cleared.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 2500ms
			Max: 32767ms	Integer scaling: 1 = 1ms
10 Index	Name:	**TIS INIT VALUE**		Par/Sig: p
	Description:	Initial vaue of the speed controller's integrator. The integrator is set to this value at the transition from state RDYRUN to state RDYREF.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: 0%
			Max: 325%	Integer scaling: 100 = 1%
11 Index	Name:	**BAL REF**		Par/Sig: p
	Description:	External value for the speed controller's output, when 7.02 AUX CONTROL WORD bit 8 BAL_NCONT is true. The speed controller's output is set to the BAL REF value.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: 0%
			Max: 325%	Integer scaling: 100 = 1%
12 Index	Name:	**DERIVATION TIME**		Par/Sig: p
	Description:	Derivation time for the speed controller. Defines the time in which the speed controller derivates the error value. If this parameter is set to zero, the derivative part of the speed controller is inactive.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 0ms
			Max: 10000ms	Integer scaling: 1 = 1ms
13 Index	Name:	**DERIV FILT TIME**		Par/Sig: p
	Description:	Derivative filter time constant		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 8ms
			Max: 32767ms	Integer scaling: 1 = 1ms

24	Group name:	**SPEED CONTROL (cont.)**			
	Description:	Speed Control			
14 Index	Name:	**ACC COMP DER TIME**			Par/Sig: p
	Description:	Derivation time used during acceleration in order to compensate the inertia. Defines the time in which the drive accelerates to maximum speed (50.01) at nominal motor torque. If this parameter is set to zero, the acceleration compensation is inactive.			
unit: s	Type: R	ctrl. bd.: AMC	Min: 0s	Default: 0s	
			Max: 100s	Integer scaling: 10 = 1s	
15 Index	Name:	**ACC COMPFILT TIME**			Par/Sig: p
	Description:	Acceleration compensation term filter time constant.			
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 8ms	
			Max: 32767ms	Integer scaling: 1 = 1ms	

24	Group name:	**SPEED CONTROL (cont.)**			
	Description:	Speed Control			
17 Index	Name:	**KPS TIS MIN SPEED**			Par/Sig: p
	Description:	The minimum speed limit below which the relative gain and the integral active time are defined by the parameters kps val min speed (24.19) and tis val min speed (24.20). In certain applications it is useful to increase the relative gain and decrease the integral active time at low speed to improves the performance of the speed control in that speed range. The linear increase and decrease of these parameters on deceleration towards zero speed starts at kps tis max speed (24.18) and ends at kps tis min speed (24.17) with the parameter values kps val min speed and tis val min speed. Internal limited to 0 ... ((50.01) • 32767 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 0rpm	
			Max: (24.18)	Integer scaling: (50.01)	
18 Index	Name:	**KPS TIS MAX SPEED**			Par/Sig: p
	Description:	The speed limit above which the relative gain and the integral active time become constant at their nominal values. Internal limited to 0 ... ((50.01) • 32767 / 20000) rpm See parameter (24.17) **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: (24.17)	Default: 0rpm	
			Max: 12000rpm	Integer scaling: (50.01)	

24	Group name:	SPEED CONTROL (cont.)			
	Description:	Speed Control			
19 Index	Name:	**KPS VAL MIN SPEED**			Par/Sig: p
	Description:	Relative gain percentage of the speed gain at the speed defined by parameter kps tis min speed (24.17) See parameter (24.17)			
unit: %	type: R	ctrl. bd.: AMC	Min: 100%	Default: 100%	
			Max: 500%	Integer scaling: 1 = 1%	
20 Index	Name:	**TIS VAL MIN SPEED**			Par/Sig: p
	Description:	Relative gain percentage of the integral active time at the speed defined by parameter kps tis min speed (24.17) See parameter (24.17)			
unit: %	type: R	ctrl. bd.: AMC	Min: 20%	Default: 100%	
			Max: 100%	Integer scaling: 1 = 1%	

24	Group name:	SPEED CONTROL (cont.)			
	Description:	Speed Control			
22 Index	Name:	**CENT FREQ**			Par/Sig: p
	Description:	Center frequency of the band rejection filter. This parameter is to be set to the resonant frequency measured e.g. by means of an oscilloscope or Drives Window. A resonant frequency of the drive and it's mechanical environment can be suppressed by means of a band rejection filter. The filter acts on the speed error (after the window function). It is inactive, if all 3 parameters are set to 0.			
unit: Hz	type: R	ctrl. bd.: AMC	Min: 0Hz	Default: 0Hz	
			Max: 75Hz	Integer scaling: 100 = 1Hz	
23 Index	Name:	**BAND WIDTH**			Par/Sig: p
	Description:	3db bandwidth of the band rejection filter. A usual value is the same value as programmed to the center frequency (24.22). See also parameter (24.22)			
unit: Hz	type: R	ctrl. bd.: AMC	Min: 0Hz	Default: 0Hz	
			Max: 75Hz	Integer scaling: 100 = 1Hz	
24 Index	Name:	**BAND FILT GAIN**			Par/Sig: p
	Description:	Gain of the band rejection filter. Usual value: 0.1 See also parameter (24.22)			
unit: ---	type: R	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 1.000	Integer scaling: 1000 = 1	
25 Index	Name:	**SPEED ERROR SCALE**			Par/Sig: s
	Description:	Speed error scaling factor			
unit: %	type: R	ctrl. bd.: AMC	Min: 1%	Default: 100%	
			Max: 400%	Integer scaling: 10 = 1%	

Group 25: Torque Reference

25	Group name:	**TORQUE REFERENCE**		
	Description:	Parameters for the torque reference and actual values		
01	Name:	**TORQUE REF A**		Par/Sig: s
Index	Description:	Torque reference in per cent of the nominal motor torque. Torque reference A can be scaled by the load share parameter (25.03).		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: 0%
			Max: 325%	Integer scaling: 100 = 1%
02	Name:	**TORQUE REF A FTC**		Par/Sig: p
Index	Description:	Time constant of TORQUE REF A (25.01) low pass filter.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 1000ms
			Max: 30000ms	Integer scaling: 1 = 1ms
03	Name:	**LOAD SHARE**		Par/Sig: p
Index	Description:	Scaling factor for TORQUE REF A (25.01).		
unit: %	type: R	ctrl. bd.: AMC	Min: -400%	Default: 100%
			Max: 400%	Integer scaling: 10 = 1%
04	Name:	**TORQUE REF B**		Par/Sig: s
Index	Description:	Torque reference in per cent of the nominal motor torque. Torque reference B is ramped by the parameters torq ramp up (25.05) and torq ramp down (25.06).		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: 0%
			Max: 325%	Integer scaling: 100 = 1%
05	Name:	**TORQUE RAMP UP**		Par/Sig: p
Index	Description:	Torque reference B ramp time from 0% to 100% of nominal motor torque.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 0s
			Max: 120s	Integer scaling: 100 = 1s
06	Name:	**TORQUE RAMP DOWN**		Par/Sig: p
Index	Description:	Torque reference B ramp time from 100% to 0% of nominal motor torque.		
unit: s	type: R	ctrl. bd.: AMC	Min: 0s	Default: 0s
			Max: 120s	Integer scaling: 100 = 1s

Group 26: Torque Reference Handling

26	Group name:	**TORQUE REFERENCE HANDLING**			
	Description:	The torque reference can be given from the speed reference chain (torq ref 2) or from the torque reference chain (torq ref 1), depending on the control mode. This group defines how to handle the reference after the torque selector block.			
01 Index	Name:	**TORQUE SELECTOR**			Par/Sig: p
	Description:	Torque reference selector **1**: **ZERO**: torque reference = 0 **2: SPEED** **3: TORQUE** **4: MINIMUM**: minimum control (min (torq ref 1, torq ref 2)) **5: MAXIMUM**: maximum control (max (torq ref 1, torq ref 2) **6: ADD**: torq ref 1 + torq ref 2; used for window control) The output of the torque reference selector is torq ref 3 (2.10). See also **MODE SWITCH SEL (26.04)**.			
unit: ---	type: I	ctrl. bd.: AMC	Min: ZERO	Default: SPEED	
			Max: ADD	Integer scaling: ---	
02 Index	Name:	**LOAD COMPENSATION**			Par/Sig: s
	Description:	Load compensation added to torq ref3. The sum of torq ref 3 and the load compensation is torq ref 4 (2.11) **Note!** Since this torque offset is added after the torque ramp, it must be set to zero prior to stopping the drive.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: 0%	
			Max: 325%	Integer scaling: 100 = 1%	
03 Index	Name:	**TORQUE STEP**			Par/Sig: s
	Description:	Additional torque step added to torq ref4. The result of the addition is torq ref 5 (2.12). **Note!** Since this torque offset is added after the torque ramp, it must be set to zero prior to stopping the drive.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: -325%	Default: 0%	
			Max: 325%	Integer scaling: 100 = 1%	

26	Group name:	TORQUE REFERENCE HANDLING (cont.)	
	Description:	The torque reference can be given from the speed reference chain (torq ref 2) or from the torque reference chain (torq ref1), depending on the control mode. This group defines how to handle the reference after the torque selector block.	
04	Name:	**MODE SWITCH SEL**	Par/Sig: p
Index	Description:	This parameter selects a digital input to command the operation mode of the drive. With 0-signal, speed control is selected, while 1-signal selects torque control. This assignment can be inverted by setting the DIG IN x INVERT parameter of the according digital input to INVERT. If this parameter is set to NOT USED, the operation mode is selected by parameter **TORQUE SELECTOR (26.01)**. If a digital input is selected for changing the operation mode, the selection made with **TORQUE SELECTOR (26.01)** is inactive. **0**: **NOT USED** (TORQUE SELECTOR determines the mode) **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**	

unit: ---	type: I	ctrl. bd.: AMC	Min: NOT USED	Default: NOT USED
			Max: DI8	Integer scaling: ---

26	Group name:	TORQUE REFERENCE HANDLING (cont.)		
	Description:	The torque reference can be given from the speed reference chain (torq ref 2) or from the torque reference chain (torq ref1), depending on the control mode. This group defines how to handle the reference after the torque selector block.		

08 Index	Name:	**GEAR START TORQUE**		Par/Sig: p
	Description:	Gear backlash compensation function: When the torque is changing it's direction, the torque limit is reduced for the time defined by parameter gear torq time (26.09). gear start torq is the reduced torque limit used after torque direction change.		
unit: %Tn	type: R	ctrl. bd.: AMC	Min: 0%	Default: 325%
			Max: 325%	Integer scaling: 100 = 1%

09 Index	Name:	**GEAR TORQUE TIME**		Par/Sig: p
	Description:	Gear backlash compensation function: When the torque is changing it's direction, the torque limit is reduced for the time defined by this parameter.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 100ms
			Max: 10000ms	Integer scaling: 1 = 1ms

10 Index	Name:	**GEAR TORQUE RAMP**		Par/Sig: p
	Description:	Gear backlash compensation function: When the torque is changing it's direction, the torque limit is reduced for the time defined with parameter gear torque time (26.09). When this time has elapsed, the torque limit is increased to it's nominal value according to the ramp time defined by this parameter. This ramp defines the time within the torque increases from zero to nominal motor torque.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 100ms
			Max: 32767ms	Integer scaling: 1 = 1ms

Group 28: Motor Protection

28	Group name:	**MOTOR PROTECTION**			
	Description:	Motor protection			
01 Index	Name:	**TEMP MODEL 1 TC**			Par/Sig: p
	Description:	Thermal time constant for motor 1. The time within the temperature rises to 63% of the nominal value.			
unit: s	type: R	ctrl. bd.: CON	Min: 0s	Default: 240s	
			Max: 5400s	Integer scaling: 1 = 1s	
02 Index	Name:	**TEMP MODEL 1 CUR**			Par/Sig: p
	Description:	Thermal model 1 nominal current. At this current, the output of the thermal model 1 will reach 100% after 5 • temp model 1 tc (28.01).			
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 100%	
			Max: 245%	Integer scaling:4096 = 100%	
03 Index	Name:	**ALARM LIM LOAD I1**			Par/Sig: p
	Description:	Alarm limit of the calculated motor’s load integral (model 1).			
unit:%Load	type: R	ctrl. bd.: CON	Min: 10%	Default: 120%	
			Max: 130%	Integer scaling: 1 = 1%	
04 Index	Name:	**TRIP LIM LOAD I1**			Par/Sig: p
	Description:	Tripping limit of the calculated motor’s load integral (model 1).			
unit:%Load	type: R	ctrl. bd.: CON	Min: 10%	Default: 130%	
			Max: 130%	Integer scaling: 1 = 1%	
05 Index	Name:	**TEMP MODEL 2 TC**			Par/Sig: p
	Description:	Thermal time constant for motor 2. The time within the temperature rises to 63% of the nominal value.			
unit: s	type: R	ctrl. bd.: CON	Min: 0s	Default: 240s	
			Max: 5400s	Integer scaling: 1 = 1s	
06 Index	Name:	**TEMP MODEL 2 CUR**			Par/Sig: p
	Description:	Thermal model 1 nominal current. At this current, the output of the thermal model 1 will reach 100% after 5 • temp model 1 tc (28.05).			
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 100%	
			Max: 245%	Integer scaling:4096 = 100%	
07 Index	Name:	**ALARM LIM LOAD I2**			Par/Sig: p
	Description:	Alarm limit of the calculated motor temperature (model 2).			
unit:%Load	type: R	ctrl. bd.: CON	Min: 10%	Default: 120%	
			Max: 130%	Integer scaling: 1 = 1%	

28	Group name:	**MOTOR PROTECTION (cont.)**			
	Description:	Motor protection			
08 Index	Name:	**TRIP LIM LOAD I2**			Par/Sig: p
	Description:	Tripping limit of the calculated motor temperature (model 2).			
unit:%Load	type: R	ctrl. bd.: CON	Min: 10%	Default: 130%	
			Max: 130%	Integer scaling: 1 = 1%	
09 Index	Name:	**MOT 1 TEMP SEL**			Par/Sig: p
	Description:	Motor 1 temperature measurement mode, using analogue input channel 2 (5.03): measurement units **0**: **NOT USED** **1**: **1 • PT100** °C **2**: **2 • PT100** °C **3**: **3 • PT100** °C **4**: **PTC** Ohm **5**: **SCALED A/D**: measurement scaled by parameters (13.05), (13.06) ⇒ AI2			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: SCALED A/D	Integer scaling: ---	
10 Index	Name:	**ALARM LIM M1 TEMP**			Par/Sig: p
	Description:	Temperature alarm limit for measured temperature of motor 1. The units depend on parameter (28.09).			
unit: Cels Ohm ---	type: R	ctrl. bd.: CON	Min: -10xxx	Default: 0xxx	
			Max: 4000xxx	Integer scaling: 1 = 1Cels / 1Ohm / 1	
11 Index	Name:	**FAULT LIM M1 TEMP**			Par/Sig: p
	Description:	Temperature trip limit for measured temperature of motor 1. The units depend on parameter (28.09).			
unit: Cels Ohm ---	type: R	ctrl. bd.: CON	Min: -10xxx	Default: 0xxx	
			Max: 4000xxx	Integer scaling: 1 = 1Cels / 1Ohm / 1	

28	Group name:	MOTOR PROTECTION (cont.)			
	Description:	Motor protection			
12 Index	Name:	**MOT 2 TEMP SEL**			Par/Sig: p
	Description:	Motor 2 temperature measurement mode, using analogue input channel 3 (5.04): measurement units **0**: **NOT USED** **1**: **1 • PT100** °C **2**: **2 • PT100** °C **3**: **3 • PT100** °C **4**: **PTC** Ohm **5**: **SCALED A/D**: measurement scaled by parameters (13.07), (13.08) ⇒ AI3			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: SCALED A/D	Integer scaling: ---	
13 Index	Name:	**ALARM LIM M2 TEMP**			Par/Sig: p
	Description:	Temperature alarm limit for measured temperature of motor 2. The units depend on parameter (28.12).			
unit: Cels Ohm ---	type: R	ctrl. bd.: CON	Min: -10xxx	Default: 0xxx	
			Max: 4000xxx	Integer scaling: 1 = 1Cels / 1Ohm / 1	
14 Index	Name:	**FAULT LIM M2 TEMP**			Par/Sig: p
	Description:	Temperature trip limit for measured temperature of motor 2. The units depend on parameter (28.12).			
unit: Cels Ohm ---	type: R	ctrl. bd.: CON	Min: -10xxx	Default: 0xxx	
			Max: 4000xxx	Integer scaling: 1 = 1Cels / 1Ohm / 1	

28	Group name:	MOTOR PROTECTION (cont.)			
	Description:	Motor protection			
15 Index	Name:	**MAX STALL TIME**			Par/Sig: p
	Description:	The time allowed for the drive to be below stall speed (28.16) and above stall torque (28.17).			
unit: s	type: R	ctrl. bd.: CON	Min: 1s	Default: 10s	
			Max: 180s	Integer scaling: 1 = 1s	
16 Index	Name:	**MAX STALL SPEED**			Par/Sig: p
	Description:	Limit for the speed actual value in stall protection. Internal limited to 0 ... ((50.01) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: CON	Min: 0rpm	Default: 3.75rpm	
			Max: 7500rpm	Integer scaling: (50.01)	
17 Index	Name:	**MAX STALL TORQUE**			Par/Sig: p
	Description:	Limit for the torque actual value in stall protection.			
unit: %Tn	type: R	ctrl. bd.: AMC	Min: 0%	Default: 75%	
			Max: 325%	Integer scaling: 100 = 1%	
18 Index	Name:	**MOT1 KLIXONSEL**			Par/Sig: p
	Description:	DI selection for motor 1 temperature switch. The drive is tripped, if the selected DI is activated. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: DI8	Integer scaling: ---	

28	Group name:	**MOTOR PROTECTION (cont.)**			
	Description:	Motor protection			
19 Index	Name:	**EARTH CUR FLT SEL**			Par/Sig: p
	Description:	Selection for earth fault monitoring connected to AI4 **0: NOT USED** **1: ACTIVATED**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: ACTIVATED	Integer scaling: ---	
20 Index	Name:	**EARTH CUR FLT LIM**			Par/Sig: p
	Description:	Earth fault current ripping level.			
unit: A	type: R	ctrl. bd.: CON	Min: 0A	Default: 4A	
			Max: 20A	Integer scaling: 1 = 1A	
21 Index	Name:	**EARTH CUR FLT DEL**			Par/Sig: p
	Description:	The time delay the earth fault is activated after.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 10ms	
			Max: 10000ms	Integer scaling: 1 = 1ms	

28	Group name:	MOTOR PROTECTION (cont.)			
	Description:	Motor protection			
22 Index	Name:	**ARMAT OVRVOLT LEV**			Par/Sig: p
	Description:	Armature overvoltage level in per cent of the supply voltage (42.06). Example for 120% overvoltage limit: $$\text{ARMAT OVRVOLT LEV (28.22)} = 120\% * \frac{\text{MOTOR NOM VOLTAGE (99.02)}}{\text{NOM SUPPLY VOLT (42.06)}}$$ ***or*** ARMAT OVRVOLT LEV (28.22) = 1.2 * INT EMF REF (41.19)			
unit: %Us	type: R	ctrl. bd.: CON	Min: 25%	Default: 150%	
			Max: 500%	Integer scal.: 4096 = 135%	
23 Index	Name:	**SPEED MEAS MON LEV**			Par/Sig: p
	Description:	Minimum absolute value the measured speed (pulse encoder, analogue tacho) must be when the measured EMF voltage (1.18) is above the limit (28.24). If the measured speed is below this limit, the drive trips (measurement fault). Internal limited to 0 ... ((50.01) rpm **Note!** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 15rpm	
			Max: 7500rpm	Integer scaling: (50.01)	
24 Index	Name:	**SPEED EMF MON LEV**			Par/Sig: p
	Description:	The speed measurement monitoring function is activated, when the measured EMF voltage (1.18) is above the limit programmed to this parameter. See (28.23).			
unit: V	type: R	ctrl. bd.: CON	Min: 0V	Default: 50V	
			Max: 1500V	Integer scaling: 1 = 1V	
25 Index	Name:	**MOT2 KLIXONSEL**			Par/Sig: p
	Description:	DI selection for motor 2 temperature switch. The drive is tripped, if the selected DI is activated. **0: NOT USED** **1: DI1** **2: DI2** **3: DI3** **4: DI4** **5: DI5** **6: DI6** **7: DI7** **8: DI8**			
unit: ---	type: I	ctrl. bd.: CON	Min: NOT USED	Default: NOT USED	
			Max: DI8	Integer scaling: ---	

Group 40: Undervoltage Monitoring

40	Group name:	**UNDERVOLTAGE MONITORING**			
	Description:	Undervoltage monitoring			
01 Index	Name:	**U NET MIN 1**			Par/Sig: p
	Description:	Upper limit for mains undervoltage monitoring in per cent of the supply voltage (42.06). If the mains voltage drops below this limit, the controllers are blocked. An undervoltage trip is generated, if the mains voltage doesn't recover within the time defined by parameter pwr down time (40.03).			
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 80%	
			Max: 130%	Integer scaling: 1 = 1%	
02 Index	Name:	**U NET MIN 2**			Par/Sig: p
	Description:	Lower limit for mains undervoltage monitoring in per cent of the supply voltage (42.06). • PWRLOSS TRIP (15.04) = IMMEDIAT (0): If the mains voltage drops below U NET MIN 2, an undervoltage trip is generated. • PWRLOSS TRIP (15.04) = DELAYED (1): If the mains voltage drops below U NET MIN 2, the controllers are blocked. An undervoltage trip is generated, if the mains voltage doesn't recover within the time defined by parameter pwr down time (40.03). **Note!** The U NET MIN 2 level isn't monitored, unless the mains voltage drops below the U NET MIN 1 level. Thus, for proper operation, U NET MIN 1 must be programmed to a higher value than U NET MIN 2.			
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 60%	
			Max: 130%	Integer scaling: 1 = 1%	
03 Index	Name:	**POWER DOWN TIME**			Par/Sig: p
	Description:	Within this time the mains voltage must return. Otherwise an undervoltage trip will be generated.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 5000ms	
			Max: 5000ms	Integer scaling: 1 = 1ms	

Group 41: Motor Nom Val

41	Group name:	**MOTOR NOM VAL**			
	Description:	Motor nominal values. See also group 99 for nominal power, current, voltage and speed. See also parameter 50.01 for the speed scaling			
03 Index	Name:	**MOT 1 NOM FLD CUR**			Par/Sig: p
	Description:	Nominal field current of the 1st motor. **Note!** If a DCF600 is used as field exciter, the nominal field current mustn't be set by means of this parameter, but at the DCF600 itself (parameter 99.03, MOTOR NOM CURRENT). (The parameter value transferred via the FEX link is limited to 163A.) The signal 3.20, FIELD CUR M1 is however valid only, if MOT 1 NOM FLD CUR is set correct (in case of field current > 655A it is recommended to set this parameter to e.g. 1/10 of the real value).			
unit: A	type: R	ctrl. bd.: CON	Min: 0.3A	Default: 0.3A	
			Max: 655.0A	Integer scaling: 50 = 1A	
04 Index	Name:	**MAX CUR LIM SPEED**			Par/Sig: p
	Description:	Speed level for armature current reduction. Internal limited to 0 ... ((50.01) rpm **Note!** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 1500rpm	
			Max: 7500rpm	Integer scaling: (50.01)	

41	Group name:	**MOTOR NOM VAL (cont.)**		
	Description:	Motor nominal values. See also group 99 for nominal power, current, voltage and speed. See also parameter 50.01 for the speed scaling		
05 Index	Name:	**ARM CUR LIM SPD1**		Par/Sig: p
	Description:	Armature current at speed (41.04)		
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 399.975%
			Max: 399.975%	Integer scaling:4096 = 100%
06 Index	Name:	**ARM CUR LIM SPD2**		Par/Sig: p
	Description:	Armature current at speed [41.04] + (max. speed - [41.04]) • ¼ max. speed: see [50.01]		
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 399.975%
			Max: 399.975%	Integer scaling:4096 = 100%
07 Index	Name:	**ARM CUR LIM SPD3**		Par/Sig: p
	Description:	Armature current at speed [41.04] + (max. speed - [41.04]) • ½ max. speed: see [50.01]		
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 399.975%
			Max: 399.975%	Integer scaling:4096 = 100%
08 Index	Name:	**ARM CUR LIM SPD4**		Par/Sig: p
	Description:	Armature current at speed [41.04] + (max. speed - [41.04]) • ¾ max. speed: see [50.01]		
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 399.975%
			Max: 399.975%	Integer scaling:4096 = 100%
09 Index	Name:	**ARM CUR LIM SPD5**		Par/Sig: p
	Description:	Armature current at max. speed [50.01]		
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 399.975%
			Max: 399.975%	Integer scaling:4096 = 100%

41	Group name:	MOTOR NOM VAL (cont.)		
	Description:	Motor nominal values. See also group 99 for nominal power, current, voltage and speed. See also parameter 50.01 for the speed scaling		
10 Index	Name:	**CUR REF SLOPE**		Par/Sig: p
	Description:	Current reference slope in per cent of the nominal motor current (99.03) per 1ms **(related to control cycle time 3.3ms).** This parameter limits the current reference slope (di/dt limitation) at the input of the current controller.		
unit: %I/ms	type: R	ctrl. bd.: CON	Min: 0.25%/ms	Default: 10%/ms
			Max: 30%/ms	Integer scaling: 4096 = 30%/ms
11 Index	Name:	**ARM L**		Par/Sig: p
	Description:	**Drive control mode (OPER MODE SELECT (15.16) < 5):** Relative inductance of the armature circuit. $ARM\_L = \frac{LA[mH] * CONV\_NOM\_CURR(4.13) * 245}{NOM\_SUPPLY\_VOLT(42.06) * scantime}$ where LA[mH] = armature (load) inductance in mH scan time = 3,33 ms (50 Hz mains) or 2,77 ms (60 Hz) **Field exciter mode (OPER MODE SELECT (15.16) = 5):** The R x I compensation activated with V ACT CAL = 4 uses also the parameters **ARM R** and **ARM L**. These parameters do not define the impedance of the load connected to the converter, but define an impedance related to the values selected by **V ACT SEL** and **I ACT SEL**. $ARM\_L = \frac{LA[mH] * 358 * SCALE\_CURRENT}{scantime[ms] * SCALE\_VOLTAGE}$ where LA[mH] = armature (load) inductance in mH scan time = 3,33 ms (constant) SCALE_CURRENT = nominal current [A] / numerical value of selected signal at that current (e.g. [4.13] / 4096) SCALE_VOLTAGE = nominal voltage [V] / numerical value of selected signal at that voltage (e.g. [42.06] • 1.35/3786)		
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 32767	Integer scaling: 1 = 1

41	Group name:	**MOTOR NOM VAL (cont.)**	
	Description:	Motor nominal values. See also group 99 for nominal power, current, voltage and speed. See also parameter 50.01 for the speed scaling	
12	Name:	**ARM R**	Par/Sig: p
Index	Description:	**Drive control mode (OPER MODE SELECT (15.16) < 5):** Relative resistance of the armature circuit. $ARM\_R = 22444 * RA[\Omega] * \frac{CONV\_NOM\_CURR(4.13)}{NOM\_SUPPLY\_VOLT(42.06)}$ where RA[Ω] = armature (load) resistance **Field exciter mode (OPER MODE SELECT (15.16) = 5):** see **ARM L** above $ARM\_R = RA[\Omega] * 32768 * \frac{SCALE\_CURRENT}{SCALE\_VOLTAGE}$ where RA[Ω] = armature (load) resistance in Ohm SCALE_CURRENT = nominal current [A] / numerical value of selected signal at that current (e.g. [4.13] / 4096) SCALE_VOLTAGE = nominal voltage [V] / numerical value of selected signal at that voltage (e.g. [42.06] • 1.35/3786)	

unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 32767	Integer scaling: 1 = 1

41	Group name:	**MOTOR NOM VAL (cont.)**			
	Description:	Motor nominal values. See also group 99 for nominal power, current, voltage and speed. See also parameter 50.01 for the speed scaling			
14 Index	Name:	**FLD CUR @40% FLUX**			Par/Sig: p
	Description:	Field current for 40% flux.			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 40%	
			Max: 99.975%	Integer scaling:4096 = 100%	
15 Index	Name:	**FLD CUR @70% FLUX**			Par/Sig: p
	Description:	Field current for 70% flux.			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 70%	
			Max: 99.975%	Integer scaling:4096 = 100%	
16 Index	Name:	**FLD CUR @90% FLUX**			Par/Sig: p
	Description:	Field current for 90% flux.			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 90%	
			Max: 99.975%	Integer scaling:4096 = 100%	
17 Index	Name:	**MOT 2 NOM FLD CUR**			Par/Sig: p
	Description:	Nominal field current of the 2nd motor **Note!** If a DCF600 is used as field exciter, the nominal field current mustn't be set by means of this parameter, but at the DCF600 itself (parameter 99.03, MOTOR NOM CURRENT). (The parameter value transferred via the FEX link is limited to 163A.) The signal 3.22, FIELD CUR M2 is however valid only, if MOT 2 NOM FLD CUR is set correct (in case of field current > 655A it is recommended to set this parameter to e.g. 1/10 of the real value).			
unit: A	type: R	ctrl. bd.: CON	Min: 0.3A	Default: 0.3A	
			Max: 655.0A	Integer scaling: 50 = 1A	

41	Group name:	**MOTOR NOM VAL (cont.)**			
	Description:	Motor nominal values. See also group 99 for nominal power, current, voltage and speed. See also parameter 50.01 for the speed scaling			
19 Index	Name:	**INT EMF REF**			Par/Sig: p
	Description:	Nominal EMF value; used as local EMF reference. INT EMF REF (41.19) ≥ EMF LIM GENERAT (41.20)			
unit: %Us	type: R	ctrl. bd.: CON	Min: 10%	Default: 105%	
			Max: 146%	Integer scaling:3786 = 135%	
20 Index	Name:	**EMF LIM GENERAT**			Par/Sig: p
	Description:	EMF limit in generative mode. This parameter is used to limit the EMF reference in generative mode. This allows higher voltage in motor mode and prevents shooting through of the converter in generative mode. The limitation is deactivated, if set to a value above 146%Us. The internal used limitation is [41.20] • [1.12] / [42.06]. Note: The regenerative bridge is released if reduced EMF reference = actual EMF. EMF LIM GENERAT (41.20) ≤ INT EMF REF (41.19)			
unit: %Us	type: R	ctrl. bd.: CON	Min: 10%	Default: 105%	
			Max: 150%	Integer scaling:3786 = 135%	

Group 42: Measurement Settings

42	Group name:	**MEASUREMENT SETTINGS**			
	Description:	Measurement settings (except speed)			
01 Index	Name:	**MAINS PHASE ORDER**			Par/Sig: p
	Description:	Mains phase order. If the measured phase order does not match with this parameter, the fault “Phase Sequence Order“ is generated. **1: R - T - S** **2: R - S - T**			
unit: ---	type: I	ctrl. bd.: CON	Min: 1 (R - T - S)	Default: 2 (R - S - T)	
			Max: 2 (R - S - T)	Integer scaling: ---	
03 Index	Name:	**XTRA COMMUT RESRV**			Par/Sig: p
	Description:	Extra commutation reserve to take into account the time required for commutation. This parameter is the proportional mains short circuit voltage caused by the converter nominal current. $\mathrm{XTRA\_COMMUT\_RESRV} = \mathrm{uk} * 100 * \frac{\mathrm{Sc}}{\mathrm{St}}$ **uk** related mains short circuit voltage **Sc** apparent power of converter **St** apparent power of transformer See chapter "Armature Current Controller" of the Software Description.			
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 0%	
			Max: 15%	Integer scaling: 10 = 1%	
05 Index	Name:	**ARM OVCUR LEVEL**			Par/Sig: p
	Description:	Armature overcurrent tripping level in per cent of the nominal converter current.			
unit: %Ic	type: R	ctrl. bd.: CON	Min: 20%	Default: 230%	
			Max: 400%	Integer scaling: 1 = 1%	
06 Index	Name:	**NOM SUPPLY VOLT**			Par/Sig: p
	Description:	Nominal supply voltage (Supply [V]). If this index hasn't yet been written to, or if it has been set to 0V, it is initialized on power-up to the value of the converter nominal voltage **CONV NOM VOLT (4.04)** resp. **S CONV NOM VOLT (42.08)**. **Limited internal to values above 40V.**			
unit: V	type: R	ctrl. bd.: CON	Min: 0V	Default: (4.04) or (42.08)	
			Max: 1400V	Integer scaling: 1 = 1V	

42	Group name:	**MEASUREMENT SETTINGS (cont.)**
	Description:	Measurement settings (except speed)

07 Index				
Name:	**S CONV NOM CURR**			Par/Sig: p
Description:	Set nominal converter current / scaling of current measurement (DC [A]); see rating plate I_2. **Note!** This parameter overwrites the nominal current of the converter defined by the type code resistors. **0**: type code resistors are in use **<>0**: type code resistors are bypassed value is visible in signal 4.05 after DRIVE MODE (15.02) has been set to 22, or after next power-up. This parameter has to be set for a C4 converter module.			
unit: A	type: R	ctrl. bd.: CON	Min: 0A	Default: 0A
			Max: 30000A	Integer scaling: 1 = 1A

08 Index				
Name:	**S CONV NOM VOLT**			Par/Sig: p
Description:	Voltage measurement class (Supply [V]); see rating plate U_1. **Note!** This parameter overwrites the voltage measurement settings defined by the type code resistors. **0**: type code resistors are in use **<>0**: type code resistors are bypassed value is visible in signal 4.04 after DRIVE MODE (15.02) has been set to 22, or after next power-up. This parameter has to be set for a C4 converter module.			
unit: V	type: R	ctrl. bd.: CON	Min: 0V	Default: 0V
			Max: 2000V	Integer scaling: 1 = 1V

09 Index				
Name:	**S MAX BRIDGE TEMP**			Par/Sig: p
Description:	Set tripping level of converter heat sink temperature in °C. **Note!** This parameter overwrites the max. bridge temperature defined by the type code resistors. **0**: type code resistors are in use **<>0**: type code resistors are bypassed value is visible in signal 4.17 after DRIVE MODE (15.02) has been set to 22, or after next power-up (for C4 = 45 °C). This parameter has to be set for a C4 converter module.			
unit: Cels	type: R	ctrl. bd.: CON	Min: 0Cels	Default: 0Cels
			Max: 150Cels	Integer scaling: 1 = 1Cels

42	Group name:	**MEASUREMENT SETTINGS (cont.)**		
	Description:	Measurement settings (except speed)		
10 Index	Name:	**S CONVERTER TYPE**		Par/Sig: p
	Description:	Set converter type; see rating plate I_2. **0:** **NONE** **1:** **C1** **2:** **C2** **3:** **C3** **4:** **MANUAL SET** (e.g. C4) **4:** **A5** **Note!** This parameter overwrites the converter type defined by the type code resistors. **0**: type code resistors are in use **<>0**: type code resistors are bypassed value is visible in signal 4.14 after DRIVE MODE (15.02) has been set to 22, or after next power-up. This parameter has to be set for a C4 converter module.		
unit: ---	type: I	ctrl. bd.: CON	Min: NONE	Default: NONE
			Max: C4	Integer scaling: ---
11 Index	Name:	**S QUADRANT TYPE**		Par/Sig: p
	Description:	Set quadrant type of the converter; see rating plate. **0**: **NONE** **1**: **1 QUADRANT**: 1-quadrant converter (DCSx01xxx) **2**: invalid **3**: invalid **4**: **4 QUADRANT**: 4-quadrant converter (DCSx02xxx) **Note!** This parameter overwrites the quadrant type of the converter defined by the type code resistors. **0**: type code resistors are in use **<>0**: type code resistors are bypassed value is visible in signal 4.15 after DRIVE MODE (15.02) has been set to 22, or after next power-up. This parameter has to be set for a C4 converter module.		
unit: ---	type: I	ctrl. bd.: CON	Min: NONE	Default: NONE
			Max: 4 QUADRANT	Integer scaling: ---

42	Group name:	MEASUREMENT SETTINGS (cont.)		
	Description:	Measurement settings (except speed)		

12 Index	Name:	**TORQUE ACT FTC**		Par/Sig: p
	Description:	Time constant of the MOTOR TORQUE FILT (1.08) low pass filter.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 1000ms
			Max: 30000ms	Integer scaling: 1 = 1ms

13 Index	Name:	**UK PLL COMP**		Par/Sig: p
	Description:	The measured phase angle of the firing unit's PLL can be corrected in order to compensate the error caused by the commutation related voltage drops. The compensation depends on the uk (short circuit voltage) of the mains supply. The parameter UK PLL COMP defines for that compensation function the proportional mains short circuit voltage caused by the converter nominal current. $UK\_PLL\_COMP = uk * 100 * \frac{Sc}{St}$ **uk** related mains short circuit voltage **Sc** apparent power of converter **St** apparent power of transformer See chapter 9 "Armature Current Controller" of the software description.		
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 0%
			Max: 15%	Integer scaling: 10 = 1%

14 Index	Name:	**CONV TEMP DELAY**		Par/Sig: p
	Description:	If not the converter temperature is monitored, but the converter fan current (by means of special hardware), the related fault can be delayed to avoid false faults during the fan acceleration time. This delay time is programmed to this parameter. If the programmed delay isn't zero, the fault 04 CONV TEMP is disabled. Instead, the fault **"03 C FAN CURR"** is generated, if • the converter is in ON state • and the current fault is active longer than the programmed delay		
unit: s	type: R	ctrl. bd.: CON	Min: 0s	Default: 0s
			Max: 100s	Integer scaling: 100 = 1s

Group 43: Current controller

43	Group name:	CURRENT CONTROL		
	Description:	Current control		
01 Index	Name:	**CONTROL TYPE SEL**		Par/Sig: p
	Description:	Current controller type selection **0: PI CONTROL** PI-controller **1: IP CONTROL** IP-controller **2: PICONT FFREF** PI-controller; the R-L-correction of the EMF voltage feed forward is based on the current reference instead of the current actual value. **3: PICONT WO FF** PI-controller; no R-L-correction of the EMF voltage feed forward takes place at all		
unit: ---	type: I	ctrl. bd.: CON	Min: PI CONTROL	Default: 0 (PI)
			Max: PICONT WO FF	Integer scaling: ---
02 Index	Name:	**ARM CUR PI P-GAIN**		Par/Sig: p
	Description:	P-gain of PI current controller (256 == Gain of 1)		
unit: ---	type: R	ctrl. bd.: CON	Min: 3	Default: 300
			Max: 2997	Integer scaling: 1 = 1
03 Index	Name:	**ARM CUR PI I-GAIN**		Par/Sig: p
	Description:	Integral time constant of PI current controller		
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 3200
			Max: 31968	Integer scaling: 1 = 1
04 Index	Name:	**ARM CUR IP P-GAIN**		Par/Sig: p
	Description:	P-gain of IP current controller		
unit: ---	type: R	ctrl. bd.: CON	Min: 3	Default: 3
			Max: 2997	Integer scaling: 1 = 1
05 Index	Name:	**ARM CUR IP I-GAIN**		Par/Sig: p
	Description:	Integral time constant of IP current controller		
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 3
			Max: 31968	Integer scaling: 1 = 1
06 Index	Name:	**DISCONT CUR LIMIT**		Par/Sig: p
	Description:	Current level from discontinuous to continuous current		
unit: %Ic	type: R	ctrl. bd.: CON	Min: 0%	Default: 50%
			Max: 99.975%	Integer scaling:4096 = 100%

43	Group name:	CURRENT CONTROL (cont.)		
	Description:	Current control		

07 Index	Name:	**PLL DEV LIM**		Par/Sig: p
	Description:	Possible deviation of the cycletime of the incoming voltage between two measurements. F31 (NO SYNC) is activated, if measurements are out of this limit. Scaling: 40000 == 20ms; 33333 == 16.67ms; 1024 == 9.21deg at 50Hz and 1024 == 11.06deg at 60Hz		
unit: ---	type: I	ctrl. bd.: CON	Min: 612	Default: 1024
			Max: 2048	Integer scaling: ---

08 Index	Name:	**KP PLL**		Par/Sig: p
	Description:	Gain of firing unit's phase lock loop. This parameter can be reduced in case of poor mains supply.		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 4
			Max: 8	Integer scaling: ---

09 Index	Name:	**MAINS COMPENS TC**		Par/Sig: p
	Description:	Time constant of mains voltage filter for mains-voltage-compensation. If set to 1000ms or above, the mains-voltage-compensation is disabled.		
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 10ms
			Max: 1100ms	Integer scaling: 1 = 1ms

10 Index	Name:	**CUR RIPPLE MONIT**		Par/Sig: p
	Description:	Selects whether the reaction on current ripple is fault or warning and which function is to be used. **0:** **FC 1 FAULT** function 1, fault **1:** **FC 1 WARN** function 1, warning **2:** **FC 2 FAULT** function 2, fault **3:** **FC 2 WARN** function 2, warning		
unit: ---	type: I	ctrl. bd.: CON	Min: FC 1 FAULT	Default: FC 1 FAULT
			Max: FC 2 WARN	Integer scaling: ---

11 Index	Name:	**CUR RIPPLE LIM 1**		Par/Sig: p
	Description:	Treshold for current ripple monitoring (function 1) and thyristor diagnosis		
unit: %Ic	type: R	ctrl. bd.: CON	Min: 0%	Default: 0.75%
			Max: 799.975%	Integer scaling:4096 = 100%

12 Index	Name:	**CUR RIPPLE LIM 2**		Par/Sig: p
	Description:	Treshold for current ripple monitoring (function 2)		
unit: %Ic	type: R	ctrl. bd.: CON	Min: 0%	Default: 25%
			Max: 799.975%	Integer scaling:4096 = 100%

43	Group name:	**CURRENT CONTROL (cont.)**	
	Description:	Current control	

13	Name:	**REV DELAY**	Par/Sig: p
Index	Description:	Delay of bridge reversal in number of control cycles. Effective both in 6- and 12-pulse mode. The delay starts after zero current has been detected. 12-pulse mode only: must have the same setting at 12-pulse master and 12-pulse slave with the exception described below. For 12-pulse serial mode **ONLY**: If there is no current measurement in the slave, set this parameter **in the slave** to its maximum value (199 or 200). **In the 12-pulse serial slave**, this setting causes the bridge changeover based on the zero current information received via the 12-pulse link (bit 8 of CTRL STAT MA, 3.09). No additional reversal delay is added, since the master delays this bit according to the delay programmed at the master. If a unit is NOT a 12-pulse serial slave, this specific meaning of the aforementioned maximum values doesn't apply. See also parameter 47.07. 1 control cycle = 3.3ms at 50Hz. **Note:** If the bridge reversal takes longer than ([43.13]+[47.07]+2) control cycles, fault **“65 REVER FLT”** is activated in both the 6- and 12-pulse mode.	

unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 200	Integer scaling: ---

14	Name:	**ZERO CUR DETECT**	Par/Sig: p
Index	Description:	Selects external zero current detection ZV7001. 0: INTERNAL ZV7001 not selected 1: EXTERNAL ZV7001 selected	

unit: ---	type: I	ctrl. bd.: CON	Min: INTERNAL	Default: INTERNAL
			Max: EXTERNAL	Integer scaling: ---

43	Group name:	CURRENT CONTROL (cont.)			
	Description:	Current control			
15 Index	Name:	**REF SEL**			Par/Sig: p
	Description:	Selects the current reference value in field exciter mode. 1: CURRENT — use current reference selected by FLUX REF SEL (46.07) 2: VOLTAGE — use current reference from voltage controller output; FLUX REF EMF (3.26) 3: MIN/MAX 1 — minimum or maximum absolut value (see SEL MAX MIN) of current reference or voltage controller output 4: MIN/MAX 2 — like MIN/MAX 1, but current reference CUR REF 1 defines the sign of the voltage reference 5: MIN/MAX 3 — like MIN/MAX 1, but voltage reference V REF 1 defines the sign of the current reference			
unit: ---	type: I	ctrl. bd.: CON	Min: CURRENT	Default: CURRENT	
			Max: MIN/MAX 3	Integer scaling: ---	
16 Index	Name:	**SEL MAX MIN**			Par/Sig: p
	Description:	If REF SEL is set to values 3 ... 5, the parameter SEL MAX MIN is active: 0: MAX — the maximum value is selected 1: MIN — the minimum value is selected e.g. to ensure a minimum field current			
unit: ---	type: I	ctrl. bd.: CON	Min: MAX	Default: MAX	
			Max: MIN	Integer scaling: ---	

43	Group name:	CURRENT CONTROL (cont.)			
	Description:	Current control			
17 Index	Name:	**INT CUR REF**			Par/Sig: p
	Description:	The internal current reference in field exciter mode is active, if FLUX REF SEL is set to 4 (INT REF).			
unit: %Im	type: R	ctrl. bd.: CON	Min: -399.975%	Default: 100%	
			Max: 399.975%	Integer scaling: 4096 = 100%	
18 Index	Name:	**AI CUR REF TC**			Par/Sig: p
	Description:	Filtering time constant for the current reference from the analogue input 1.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 0ms	
			Max: 100ms	Integer scaling: 1 = 1ms	
19 Index	Name:	**LOCAL CUR REF**			Par/Sig: p
	Description:	This current reference is active in local mode, if REF SEL >= 3.			
unit: %Im	type: R	ctrl. bd.: CON	Min: -399.975%	Default: 0%	
			Max: 399.975%	Integer scaling: 4096 = 100%	
20 Index	Name:	**FLUX COR**			Par/Sig: s
	Description:	Flux correction in per cent of the motor’s (or load’s) nominal flux. Added to the input value of the magnetization curve interpolation. Active in all drive modes.			
unit: %Fn	type: R	ctrl. bd.: CON	Min: -399.975%	Default: 0%	
			Max: 399.975%	Integer scaling: 4096=100%	
21 Index	Name:	**FLUX STEP**			Par/Sig: s
	Description:	Flux step in per cent of the motor’s (or load’s) nominal flux. Added to the input value of the magnetization curve interpolation. Active only in field exciter mode.			
unit: %Fn	type: R	ctrl. bd.: CON	Min: -399.975%	Default: 0%	
			Max: 399.975%	Integer scaling: 4096=100%	

43	Group name:	**CURRENT CONTROL (cont.)**			
	Description:	Current control			
22 Index	Name:	**OVERVOLT ALARM L**			Par/Sig: p
	Description:	DC voltage level in per cent of the nominal supply voltage, where an alarm is activated. If set to 0, no monitoring.			
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 0%	
			Max: 500%	Integer scaling: 3786=135%	
23 Index	Name:	**OVERVOLT ALM DEL**			Par/Sig: p
	Description:	The time after an overvoltage alarm is activated.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 0ms	
			Max: 10000ms	Integer scaling: 1=1ms	
24 Index	Name:	**MIN CUR ALARM L**			Par/Sig: p
	Description:	DC current in per cent of the motor's (or load's) nominal current (99.03), where a minimum current alarm is activated. If set to 0, no monitoring.			
unit: %Im	type: R	ctrl. bd.: CON	Min: 0%	Default: 0%	
			Max: 399.975%	Integer scaling: 4096=100%	
25 Index	Name:	**MIN CUR ALM DEL**			Par/Sig: p
	Description:	The time after a minimum current alarm is activated.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 0ms	
			Max: 10000ms	Integer scaling: 1=1ms	

Group 44: Field Excitation

44	Group name:	**FIELD EXCITATION**		
	Description:	Field excitation		
01 Index	Name:	**FLD ACT CUR 1 FTC**		Par/Sig: p
	Description:	Filter time constant for 1st field actual current		
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 16383	Integer scaling: 1 = 1
02 Index	Name:	**P-GAIN FEX 1**		Par/Sig: p
	Description:	P-gain for 1st field exciter's PI controller		
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 1
			Max: 4096	Integer scaling: 1 = 1
03 Index	Name:	**INTEG TIME FEX 1**		Par/Sig: p
	Description:	Integral time constant for 1st field exciter's PI controller		
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 200ms
			Max: 40950ms	Integer scaling: 1 = 10ms
04 Index	Name:	**FREEWHEEL LV FEX1**		Par/Sig: p
	Description:	Free wheeling treshold level of 1st field exciter (**DCF504 only**). If 2 successive AC-voltage measurements differ more than the programmed value, the free-wheeling function is activated.		
unit:%U/ms	type: R	ctrl. bd.: CON	Min: 0%/ms	Default: 10%/ms
			Max: 1000%/ms	Integer scaling: 1 = 1%/ms
05 Index	Name:	**NEG LIM FEX 1 CON**		Par/Sig: p
	Description:	Negative limit of 1st field exciter's PI controller		
unit: ---	type: R	ctrl. bd.: CON	Min: -4095	Default: -4095
			Max: 0	Integer scaling: 1 = 1
06 Index	Name:	**POS LIM FEX 1 CON**		Par/Sig: p
	Description:	Positive limit of 1st field exciter's PI controller		
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 4095
			Max: 4095	Integer scaling: 1 = 1

44	Group name:	FIELD EXCITATION (cont.)			
	Description:	Field excitation			
07 Index	Name:	**FLD ACT CUR 2 FTC**			Par/Sig: p
	Description:	Filter time constant for 2nd field actual current			
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 16383	Integer scaling: 1 = 1	
08 Index	Name:	**P-GAIN FEX 2**			Par/Sig: p
	Description:	P-gain for 2nd field exciter's PI controller			
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 1	
			Max: 4096	Integer scaling: 1 = 1	
09 Index	Name:	**INTEG TIME FEX 2**			Par/Sig: p
	Description:	Integral time constant for 2nd field exciter's PI controller			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 200ms	
			Max: 40950ms	Integer scaling: 1 = 10ms	
10 Index	Name:	**FREEWHEEL LV FEX2**			Par/Sig: p
	Description:	Free wheeling treshold level of 2nd field exciter (**DCF504 only**). If 2 successive AC-voltage measurements differ more than the programmed value, the free-wheeling function is activated.			
unit:%U/ms	type: R	ctrl. bd.: CON	Min: 0%/ms	Default: 10%/ms	
			Max: 1000%/ms	Integer scaling: 1 = 1%/ms	
11 Index	Name:	**NEG LIM FEX 2 CON**			Par/Sig: p
	Description:	Negative limit of 2nd field exciter's PI controller			
unit: ---	type: R	ctrl. bd.: CON	Min: -4095	Default: -4095	
			Max: 0	Integer scaling: 1 = 1	
12 Index	Name:	**POS LIM FEX 2 CON**			Par/Sig: p
	Description:	Positive limit of 2nd field exciter's PI controller			
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 4095	
			Max: 4095	Integer scaling: 1 = 1	
13 Index	Name:	**FIELD 1 REF RED**			Par/Sig: p
	Description:	1st field current reference on heating or standstill			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 30%	
			Max: 99.975%	Integer scaling:4096 = 100%	

44	Group name:	FIELD EXCITATION (cont.)			
	Description:	Field excitation			
14 Index	Name:	**FIELD 1 REF MIN L**			Par/Sig: p
	Description:	Activates minimum field level monitoring when OPTI TORQUE is selected. Activation is controlled by field current reference.			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 15%	
			Max: 99.975%	Integer scaling:4096 = 100%	
15 Index	Name:	**FIELD 1 MIN DELAY**			Par/Sig: p
	Description:	Time delay for minimum field. The field **reference** can be below field 1 ref min l (44.14) for maximum this time on active OPTI TORQUE and field reversal.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 200ms	
			Max: 20000ms	Integer scaling: 1 = 1ms	
16 Index	Name:	**FLUX REVERS DELAY**			Par/Sig: p
	Description:	Max. allowed time within the field current and the internal motor flux don’t correspond to each other during field reversal. During this time, the fault 14 "SPD MEAS" is disabled.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 0ms	
			Max: 20000ms	Integer scaling: 1 = 1ms	
17 Index	Name:	**FIELD 1 MIN TRIP**			Par/Sig: p
	Description:	Tripping level of minimum 1st field current			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 50%	
			Max: 99.975%	Integer scaling:4096 = 100%	
18 Index	Name:	**FIELD1 REVRS HYST**			Par/Sig: p
	Description:	Field current hysteresis for generating the field reversal acknowledge			
unit: %If1	type: R	ctrl. bd.: CON	Min: 0%	Default: 2%	
			Max: 99.975%	Integer scaling:4096 = 100%	
19 Index	Name:	**FIELD 1 REF HYST**			Par/Sig: p
	Description:	Torque reference hysteresis for field reversal. Not effective together with the OPTITORQUE function.			
unit: %Tn	type: R	ctrl. bd.: CON	Min: 0%	Default: 2%	
			Max: 100%	Integer scaling: 100 = 1%	
20 Index	Name:	**FIELD 1 REF GAIN**			Par/Sig: p
	Description:	Gain for OPTI TORQUE function. The active torque reference (torq used ref, 2.13) is multiplied by this gain to calculate the field 1 current reference.			
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 80	
			Max: 4000	Integer scaling: 1 = 1	

44	Group name:	FIELD EXCITATION (cont.)		
	Description:	Field excitation		
21 Index	Name:	**FIELD 2 REF RED**		Par/Sig: p
	Description:	2nd field current reference on heating or standstill		
unit: %If2	type: R	ctrl. bd.: CON	Min: 0%	Default: 30%
			Max: 99.975%	Integer scaling:4096 = 100%
22 Index	Name:	**FIELD 2 MIN TRIP**		Par/Sig: p
	Description:	Tripping level of minimum 2nd field current		
unit: %If2	type: R	ctrl. bd.: CON	Min: 0%	Default: 50%
			Max: 99.975%	Integer scaling:4096 = 100%
23 Index	Name:	**FIELD 2 REF**		Par/Sig: p
	Description:	2nd field current reference, when no fieldreduction is active		
unit: %If2	type: R	ctrl. bd.: CON	Min: -99.975%	Default: 99.975%
			Max: 99.975%	Integer scaling:4096 = 100%
24 Index	Name:	**MAX FEX COMM FLTS**		Par/Sig: p
	Description:	Maximum number of allowed bad telegrams to field excuters. Exceeding this value causes field exciter 1 communication error (error code 33) or field exciter 2 communication error (error code 36)		
unit: ---	type: I	ctrl. bd.: CON	Min: 5	Default: 5
			Max: 100	Integer scaling: ---
25 Index	Name:	**MAX FEX FAULTS**		Par/Sig: p
	Description:	Maximum allowed field exciter faults. Sets the number of events before the fault “No field acknowledge“ is generated. The value 0 causes the fault with the 1st event. The event counter can be read from the signal FIELD DELAY ACT (45.05). The event counter is decremented on each event; the fault is generated, when it reaches zero. After switching on the field supply, the event counter is set to 300 and decrements to (max fex faults+1) within 6 seconds.		
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0
			Max: 10	Integer scaling: ---

Group 45: Field Excitation

<table>
<tr><td>45</td><td>Group name:</td><td colspan="4">FIELD EXCITATION</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Field excitation</td></tr>
<tr><td>01</td><td>Name:</td><td colspan="3">FLUX REF</td><td>Par/Sig: s</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">External flux reference in per cent of the nominal flux</td></tr>
<tr><td>unit: %Fn</td><td>type: R</td><td>ctrl. bd.: CON</td><td>Min: 20%</td><td colspan="2">Default: 99.975%</td></tr>
<tr><td colspan="3"></td><td>Max: 99.975%</td><td colspan="2">Integer scaling:4096 = 100%</td></tr>
<tr><td>02</td><td>Name:</td><td colspan="3">FLUX/EMF REF SEL</td><td>Par/Sig: s</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">Selection of both flux reference and EMF reference.
0: LOCAL REF: internal calculated (local) EMF and flux references (selection by (46.07) = (46.08) = SEL REF)
The internal EMF reference is the nominal emf ref (41.19)
The internal flux reference is calculated by the field weakening.
1: EXT REF: external references (45.01, 45.03)
An external flux reference is used, if parameter FLUX REF SEL (46.07) is set to EXT REF.
An external EMF reference is used, if parameter EMF REF SEL (46.08) is set to EXT REF or AI REF.
On emergency stop, always the internal flux and EMF references are used.
Note! The selection of the flux reference by means of FLUX/EMF REF SEL doesn’t apply for the field exciter mode (OPER MODE SELECT (15.16) = 5).</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: LOCAL REF</td><td colspan="2">Default: LOCAL REF</td></tr>
<tr><td colspan="3"></td><td>Max: EXT REF</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td>03</td><td>Name:</td><td colspan="3">EMF REF</td><td>Par/Sig: s</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">External EMF reference in per cent of the supply voltage (42.06)</td></tr>
<tr><td>unit: %Us</td><td>type: R</td><td>ctrl. bd.: CON</td><td>Min: 10%</td><td colspan="2">Default: 105%</td></tr>
<tr><td colspan="3"></td><td>Max: 146%</td><td colspan="2">Integer scaling:3786 = 135%</td></tr>
<tr><td>04</td><td>Name:</td><td colspan="3">FORCE FIELD1 DIR</td><td>Par/Sig: s</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">Field direction force command.
0: not forced
1: forward
2: reverse</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: not forced</td><td colspan="2">Default: not forced</td></tr>
<tr><td colspan="3"></td><td>Max: reverse</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td>05</td><td>Name:</td><td colspan="3">FIELD DELAY ACT</td><td>Par/Sig: s</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">Event counter to delay the fault “No field acknowledge“ (error code 39).
For more details see parameter MAX FEX FAULTS (44.25).</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: ---</td><td colspan="2">Default: ---</td></tr>
<tr><td colspan="3"></td><td>Max: ---</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

45	Group name:	**FIELD EXCITATION (cont.)**		
	Description:	Field excitation		
06 Index	Name:	**DEL MIN FLD TRIP**		Par/Sig: p
	Description:	The time after which a minimum field current trip is activated (see parameters 44.17, 44.22). Active only in drive control mode (OPER MODE SELECT (15.16) < 5). This parameter must be set to values above (44.25) • 10ms.		
unit: ms	type: R	ctrl. bd.: CON	Min: 50ms	Default: 2000ms
			Max: 10000ms	Integer scaling: 1=1ms
07 Index	Name:	**MAXIMUM FLUX**		Par/Sig: p
	Description:	Maximum output value of the field weakening control in per cent of the nominal flux. If this parameter is set to 0, the flux reference is generated completely by the EMF controller.		
unit: %Fn	type: R	ctrl. bd.: CON	Min: 0%	Default: 100%
			Max: 100%	Integer scaling: 4096=100%

Group 46: EMF Control

46	Group name:	**EMF CONTROL**			
	Description:	EMF control			
01	Name:	**POS LIM EMF CON**			Par/Sig: p
Index	Description:	Positive limit for EMF controller			
unit: %Fn	type: R	ctrl. bd.: CON	Min: 0%	Default: 10%	
			Max: 99.975%	Integer scaling:4096 = 100%	
02	Name:	**NEG LIM EMF CON**			Par/Sig: p
Index	Description:	Negative limit for EMF controller			
unit: %Fn	type: R	ctrl. bd.: CON	Min: -99.975%	Default: -99.975%	
			Max: 0%	Integer scaling:4096 = 100%	
03	Name:	**EMF CON KP**			Par/Sig: p
Index	Description:	P-gain of EMF controller (277 == 100%)			
unit: ---	type: R	ctrl. bd.: CON	Min: 1	Default: 150	
			Max: 32767	Integer scaling: 1= 1	
04	Name:	**EMF CON KI**			Par/Sig: p
Index	Description:	Integral constant of EMF controller. Field exciter mode: 32767 == 6.67ms Drive control mode: 32767 == 20ms			
unit: ---	type: R	ctrl. bd.: CON	Min: 0	Default: 5000	
			Max: 32767	Integer scaling: 1= 1	
05	Name:	**EMF CON BLOCK LEV**			Par/Sig: p
Index	Description:	EMF controller block level. When the measured EMF is below this limit, the EMF controller is blocked.			
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 2%	
			Max: 36%	Integer scaling:3786 = 135%	
06	Name:	**EMF ACT FILT TC**			Par/Sig: p
Index	Description:	Filter time constant for calculated EMF actual value used for the EMF controller and the EMF feed forward.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 10ms	
			Max: 10000ms	Integer scaling: 1 = 1ms	

46	Group name:	EMF CONTROL (cont.)
	Description:	EMF control

07 Index	Name:	**FLUX REF SEL**		Par/Sig: p
	Description:	Selection of the flux reference or the current reference in field exciter mode. Selection of flux reference, if drive control (oper mode select (15.16) <> 5): **0**: **SEL REF**: reference selected by parameter (45.02) **1**: **EXT REF**: external reference (45.01), e.g. from AC80 **2**: reserved (functions like setting 1) **3**: reserved (functions like setting 1) **4**: reserved (functions like setting 1) Selection of current reference, if field exciter mode (oper mode select (15.16) = 5): **0**: **SEL REF**: current reference set to zero **1**: **EXT REF**: external current reference current ref (3.11), e.g. from AC80 **2**: **AI REF**: current reference from analogue input 1 **3**: **FEX LINK**: current reference from FEX link **4**: **INT REF**: internal current reference 43.17		
unit: ---	type: I	ctrl. bd.: CON	Min: SEL REF	Default: SEL REF
			Max: INT REF	Integer scaling: ---

08 Index	Name:	**EMF REF SEL**		Par/Sig: p
	Description:	Selection of the EMF reference. **0**: **SEL REF**: reference selected by parameter (45.02) **1**: **EXT REF**: external reference (45.03), e.g. from AC80 **2**: **AI REF**: current reference from analogue tacho input **3**: **INT REF**: internal EMF reference 41.19		
unit: ---	type: I	ctrl. bd.: CON	Min: SEL REF	Default: SEL REF
			Max: INT REF	Integer scaling: ---

09 Index	Name:	**EMF SPEED FILT TC**		Par/Sig: p
	Description:	Filter time constant for calculated EMF used for speed measurement supervision		
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 10ms
			Max: 10000ms	Integer scaling: 1 = 1ms

46	Group name:	EMF CONTROL (cont.)			
	Description:	EMF control			
10 Index	Name:	**V COR**			Par/Sig: s
	Description:	Voltage correction value in per cent of the nominal supply voltage; added to the selected voltage reference **V REF 1** prior to ramping			
unit: %Us	type: R	ctrl. bd.: CON	Min: -500%	Default: 0%	
			Max: 500%	Integer scaling: 3786=135%	
11 Index	Name:	**V STEP**			Par/Sig: s
	Description:	Voltage step value in per cent of the nominal supply voltage; added to the output of the voltage reference slope function.			
unit: %Us	type: R	ctrl. bd.: CON	Min: -500%	Default: 0%	
			Max: 500%	Integer scaling: 3786=135%	
12 Index	Name:	**V REF SLOPE**			Par/Sig: p
	Description:	Voltage reference slope in per cent of the nominal supply voltage per 1ms (related to control cycle time 3.3ms). This parameter limits the voltage reference slope (dv/dt limitation) at the input of the EMF controller.			
unit:%U/ms	type: R	ctrl. bd.: CON	Min: 0%/ms	Default: 40.5%/ms	
			Max: 150%/ms	Integer scaling: 3786=40.5%/ms	
13 Index	Name:	**V LIM P**			Par/Sig: p
	Description:	Positive voltage reference limit in per cent of the nominal supply voltage (limits the input of the EMF controller).			
unit: %Us	type: R	ctrl. bd.: CON	Min: 0%	Default: 135%	
			Max: 500%	Integer scaling: 3786=135%	
14 Index	Name:	**V LIM N**			Par/Sig: p
	Description:	Negative voltage reference limit in per cent of the nominal supply voltage (limits the input of the EMF controller).			
unit: %Us	type: R	ctrl. bd.: CON	Min: -500%	Default: -135%	
			Max: 0%	Integer scaling: 3786=135%	
15 Index	Name:	**AI V REF TC**			Par/Sig: p
	Description:	Filtering time constant for the voltage reference from the analogue tacho input.			
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 0ms	
			Max: 10000ms	Integer scaling: 1=1ms	

<table>
<tr><td>46</td><td>Group name:</td><td colspan="3">EMF CONTROL (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="3">EMF control</td></tr>
<tr><td>16</td><td>Name:</td><td colspan="2">V ACT CALC SEL</td><td>Par/Sig: p</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="3">EMF actual value selection for field control mode. (In drive control mode (OPER MODE SELECT < 5), always the EMF actual value calculated from the armature voltage is used).
0: EXT nothing is written to 3.23;
e.g. FCB application can write to the actual voltage
1: EMF use RL EMF VOLT ACT (1.17) (default value)
2: V SEL use value selected by parameter V ACT SEL
3: SEL use value selected by parameter I ACT SEL
or V ACT SEL (see below)
4: V SEL COMP
use value selected by parameter V ACT SEL;
value is compensated against voltage drop by
means of R x I compensation

With the setting 3: SEL, the selected value is the output signal of a crossover switch, selecting either the signal addressed by parameters I ACT SEL or selected by parameter V ACT SEL. The switch is controlled by the logical OR of 2 boolean signals selected by the parameters V I SEL 1 or V I SEL 2.</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: EXT</td><td>Default: EMF</td></tr>
<tr><td></td><td></td><td></td><td>Max: V SEL COMP</td><td>Integer scaling: ---</td></tr>
</table>

<table>
<tr><td>46</td><td>Group name:</td><td colspan="4">EMF CONTROL (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">EMF control</td></tr>
<tr><td>19
Index</td><td>Name:</td><td colspan="3">I ACT SEL</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Selects an actual current signal used in field exciter mode as a possible selection of the the actual EMF value selector (in case the EMF controller is “abused” for current control: MG-set applications).

0 = 0 zero selected
1 = AI CUR REF (3.30)
2 = AI V REF (3.29)
3 = AN IN 2 VAL (5.03)
4 = AN IN 3 VAL (5.04)
5 = AN IN 4 VAL (5.05)</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: 0</td><td colspan="2">Default: AI CUR REF</td></tr>
<tr><td colspan="3"></td><td>Max:
AN IN 4 VALUE</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td>20
Index</td><td>Name:</td><td colspan="3">V ACT SEL</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Selects an actual voltage signal used in field exciter mode as a possible selection of the the actual EMF value selector.

0 = 0 zero selected
1 = AI CUR REF (3.30)
2 = AI V REF (3.29)
3 = AN IN 2 VAL (5.03)
4 = AN IN 3 VAL (5.04)
5 = AN IN 4 VAL (5.05)</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: 0</td><td colspan="2">Default: AI V REF</td></tr>
<tr><td colspan="3"></td><td>Max:
AN IN 4 VALUE</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

<table>
<tr><td>46</td><td>Group name:</td><td colspan="4">EMF CONTROL (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">EMF control</td></tr>
<tr><td rowspan="2">21
Index</td><td>Name:</td><td colspan="3">V I SEL 1</td><td>Par/Sig: p</td></tr>
<tr><td>Description:</td><td colspan="4">In field exciter mode, with the setting 3: SEL of parameter V ACT CAL, the selected EMF actual value is the output signal of a crossover switch, selecting either the signal addressed by parameters I ACT SEL or addressed by parameter V ACT SEL. The switch is controlled by the logical OR of 2 boolean signals selected by the parameters
V I SEL 1 or V I SEL 2.

0 = not used (default value)
1 = DI4
2 = not used
3 = DI6
4 = DI7
5 = DI8
6 = DO4
7 = DO5
8 = DO6
9 = DO7
10 = DO8</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: NOT USED</td><td colspan="2">Default: DI8</td></tr>
<tr><td></td><td></td><td></td><td>Max: DO8</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td rowspan="2">22
Index</td><td>Name:</td><td colspan="3">V I SEL 2</td><td>Par/Sig: p</td></tr>
<tr><td>Description:</td><td colspan="4">In field exciter mode, with the setting 3: SEL of parameter V ACT CAL, the selected EMF actual value is the output signal of a crossover switch, selecting either the signal addressed by parameters I ACT SEL or addressed by parameter V ACT SEL. The switch is controlled by the logical OR of 2 boolean signals selected by the parameters
V I SEL 1 or V I SEL 2.

0 = not used (default value)
1 = DI4
2 = not used
3 = DI6
4 = DI7
5 = DI8
6 = DO4
7 = DO5
8 = DO6
9 = DO7
10 = DO8</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: NOT USED</td><td colspan="2">Default: DI7</td></tr>
<tr><td></td><td></td><td></td><td>Max: DO8</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

Group 47: 12-Pulse Operation

47	Group name:	**12-PULSE OPERATION**			
	Description:	12-pulse parameters			
01	Name:	**SEQUENTIAL MODE**			Par/Sig: p
Index	Description:	Select sequential mode for 12-pulse serial mode to reduce the reactive power. **0: NORMAL** master and slave are controlled with the same firing angle **1: SEQUENTIAL** sequential control of the firing angles; only one unit changes its firing angle, while the other's firing angle is at 15 or 165 deg.			
unit: ---	type: I	ctrl. bd.: CON	Min: NORMAL	Default: NORMAL	
			Max: SEQUENTIAL	Integer scaling: ---	
02	Name:	**ADJ IDC**			Par/Sig: p
Index	Description:	Scaling factor to adjust the measured armature current (in case the forward and reverse bridges are different). $47.02 = \frac{100\% \bullet current\_ratio\_bridge\_2}{current\_ratio\_bridge\_1}$ (reverse bridge) / (forward bridge) current_ratio: actual current / measured value			
unit: %	type: R	ctrl. bd.: CON	Min: 12.5%	Default: 100%	
			Max: 800%	Integer scaling: 2048=100%	
03	Name:	**ADJ UAC**			Par/Sig: p
Index	Description:	Scaling factor to adjust the internal EMF value used for the converter control (in case the forward and reverse bridges are different). $47.03 = \frac{100\% \bullet transformer\_voltage\_bridge\_2}{transformer\_voltage\_bridge\_1}$ (reverse bridge) / (forward bridge)			
unit: %	type: R	ctrl. bd.: CON	Min: 12.5%	Default: 100%	
			Max: 800%	Integer scaling: 2048=100%	

47	Group name:	**12-PULSE OPERATION (cont.)**			
	Description:	12-pulse parameters			
04 Index	Name:	**DIFF CUR LIMIT**			Par/Sig: p
	Description:	Permitted difference of currents (master/slave) in %. Effective only with the master drive.			
unit: %	type: R	ctrl. bd.: CON	Min: 1%	Default: 10%	
			Max: 50%	Integer scaling: 1 = 1%	
05 Index	Name:	**DIFF CUR DELAY**			Par/Sig: p
	Description:	Number of control cycles the currents are allowed to differ (see diff cur limit) without activating fault 66. 1 control cycle = 3.3ms at 50Hz.			
unit: ---	type: I	ctrl. bd.: CON	Min: 3	Default: 150	
			Max: 16383	Integer scaling: ---	
07 Index	Name:	**REV GAP**			Par/Sig: p
	Description:	If the bridge reversal takes longer than ([43.13]+[47.07]+2) control cycles, fault **F65 (REVER FLT)** is activated in both the 6- and 12-pulse mode. See also parameter 43.13. 1 control cycle = 3.3ms at 50Hz.			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 0	
			Max: 50	Integer scaling: ---	
08 Index	Name:	**REV FAULT DELAY**			Par/Sig: p
	Description:	Number of control cycles the bridges can be fired differently without activating fault **F65 (REVER FLT)**. Active in the 12-pulse master only. Must be > [43.13]+[47.07]. 1 control cycle = 3.3ms at 50Hz			
unit: ---	type: I	ctrl. bd.: CON	Min: 1	Default: 10	
			Max: 250	Integer scaling: ---	
09 Index	Name:	**COMM TIMEOUT 12P**			Par/Sig: p
	Description:	Timeout for the 12-pulse communication channel. The parameter programs the allowed cycles without receiving a valid message. Otherwise **F67 (12PCOMM)** follows. **For the 12-pulse slave, this parameter must be set at least to 4.** 1 cycle = 3.3ms at 50Hz			
unit: ---	type: I	ctrl. bd.: CON	Min: 0	Default: 1	
			Max: 32767	Integer scaling: ---	

47	Group name:	12-PULSE OPERATION (cont.)		
	Description:	12-pulse parameters		
10 Index	Name:	**ADJ UDC**		Par/Sig: p
	Description:	Scaling factor to adjust the measured armature voltage (in case the interface hardware of the armature voltage measurement is different from the one of the mains voltage measurement). Use to adjust real DC-voltage to DriveWindow display. Measure DC-voltage at drive (D1, C1) and compare with DriveWindow or panel (1.18).		
unit: %	type: R	ctrl. bd.: CON	Min: 12.5%	Default: 100%
			Max: 800%	Integer scaling: 2048=100%
11 Index	Name:	**OFFSET UDC**		Par/Sig: p
	Description:	Offset value to the armature voltage measurement. Added to the result of the A/D conversion (-4095 ... 4096). With the value 81, the value from the automatic offset adjustment is used (manual offset is switched off). Use to adjust real DC-voltage to DriveWindow display.		
unit: ---	type: I	ctrl. bd.: CON	Min: -80	Default: 81
			Max: 81	Integer scaling: ---

Group 50: Speed Measurement

50	Group name:	**SPEED MEASUREMENT**			
	Description:	Speed measurement			
01	Name:	**SPEED SCALING**			Par/Sig: p
Index	Description:	Speed scaling. The speed programmed to this parameter is represented in integer scaling as value 20000. **Note1!** There is no automatic link between the speed scaling parameter and the analogue tachometer scaling parameters (13.01, 13.02). If the analogue tacho input is being used for speed feedback, its scaling **must** match the used speed scaling (see formulas given at the description of these aforementioned scaling parameters, or chapter "Measurements" of the software description). **Note2! The speed scaling must be set in the range of 62.5%…500% of the motor nominal speed (99.05). If the scaling is out of this range, an alarm (SPEED SCALE) is generated.** **Note3!** The integer format (used on access by means of datasets) of this parameter is 16 bit **signed**. Thus, the numeric range is 1000 ... 32750, if accessed by means of datasets (e.g. by fieldbus adapters). However, parameter 50.11 accesses the same internal variable in 16-bit-packed-boolean format. Setting the speed scaling by means of 50.11 is suitable, if speed scalings above 3275 rpm are to be set via dataset communication. Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3. Attention: This parameter has to be set first, because all speed-depending parameters depend on it!			
unit: rpm	type: R	ctrl. bd.: CON	Min: 37.5rpm	Default: 1500rpm	
			Max: 6550rpm	Integer scaling: 10 = 1rpm	

50	Group name:	SPEED MEASUREMENT (cont.)		
	Description:	Speed measurement		

02 Index	Name:	**SPEED MEAS MODE**		Par/Sig: p
	Description:	Encoder evaluation mode selection for the encoder connected to SDCS-CON-2. **0**: **A _- B DIR**: rising edge of track A, track B direction **1**: **A _-_**: both edges of track A **2**: **A_-_ B DIR**: both edges of track A, track B direction **3**: **A _-_ B _-_**: both edges of both tracks		
unit: ---	type: I	ctrl. bd.: CON	Min: A _- B DIR	Default: A _-_ B _-_
			Max: A _-_ B _-_	Integer scaling: ---

03 Index	Name:	**SPEED FB SEL**		Par/Sig: p
	Description:	Speed feedback selection. **1**: **CALC BY EMF**: calculated by EMF **2**: **CON-ENCODER**: measured by encoder connected to SDCS-CON-2 **3**: **EXTERNAL**: MOTOR SPEED (1.04) is not updated and may be written to e.g. via dataset communication; it is initialized to 0 on the transition to EXTERNAL **4**: **ANALOG TAC**: analogue tacho connected to AITAC input **5**: **CALC BY EMF**: calculated by EMF		
unit: ---	type: I	ctrl. bd.: CON	Min: CALC BY EMF	Default: CALC BY EMF
			Max: CALC BY EMF	Integer scaling: ---

04 Index	Name:	**ENCODER PULSE NR**		Par/Sig: p
	Description:	Pulse count of the encoder connected to SDCS-CON-2 per revolution		
unit: ---	type: I	ctrl. bd.: CON	Min: 125	Default: 1024
			Max: 6000	Integer scaling: ---

06 Index	Name:	**SP ACT FILT TIME**		Par/Sig: p
	Description:	Time constant of the speed feedback filter to generate the speed actual value (1.02)		
unit: ms	type: R	ctrl. bd.: CON	Min: 0ms	Default: 0ms
			Max: 10000ms	Integer scaling: 1 = 1ms

50	Group name:	**SPEED MEASUREMENT (cont.)**			
	Description:	Speed measurement			
07 Index	Name:	**POS COUNT MODE**			Par/Sig: p
	Description:	Position counter mode. Determines the format of the position values. 0: PULSE EDGES: the 32-bit position values show the counted pulse edges 1: SCALED: the low word of the position values shows the position within one revolution, while the high word gives the whole revolutions			
unit: ---	type: I	ctrl. bd.: CON	Min: PULSE EDGES	Default: SCALED	
			Max: SCALED	Integer scaling: ---	

50	Group name:	SPEED MEASUREMENT (cont.)			
	Description:	Speed measurement			
08 Index	Name:	**POS COUNT INIT LO**			Par/Sig: p
	Description:	Position counter low initial value with **POS COUNT MODE (50.07)** = **1 (SCALED)**: 0 = 0 deg 65536 = 360 deg with **POS COUNT MODE (50.07)** = **0 (PULSE EDGES)**: 1 = 1 pulse edge See sync input select (50.12)			
unit: ---	type: PB	ctrl. bd.: CON	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: ---	
09 Index	Name:	**POS COUNT INIT HI**			Par/Sig: p
	Description:	Position counter high initial value with **POS COUNT MODE (50.07)** = **1 (SCALED)**: 1 = 1 revolution with **POS COUNT MODE (50.07)** = **0 (PULSE EDGES)**: 1 = 65536 pulse edges See sync input select (50.12)			
unit: ---	type: PB	ctrl. bd.: CON	Min: -32768	Default: 0	
			Max: 32767	Integer scaling: ---	
10 Index	Name:	**ABOVE SPEED LIMIT**			Par/Sig: p
	Description:	This parameter defines for the status of bit 10 ABOVE LIMIT in the main status word (8.01). When the actual speed has reached the programmed level, the ABOVE LIMIT bit 10 in the main status word is set. Internal limited to 0 ... ((50.01) • 32767 / 20000) rpm **Note:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: rpm	type: R	ctrl. bd.: AMC	Min: 0rpm	Default: 1500rpm	
			Max: 12000rpm	Integer scaling: (50.01)	

50	Group name:	SPEED MEASUREMENT (cont.)			
	Description:	Speed measurement			
11 Index	Name:	**SPEED SCALING PB**			Par/Sig: s
	Description:	Speed scaling in packed boolean format. Setting the speed scaling by means of this index is suitable, if speed scalings above 3275 rpm are to be set via dataset communication. The unsigned integer value of this index is written to the used speed scaling parameter, if the value doesn't equal 0. Internal, the limits of parameter 50.01 are applied to this index. See 50.01. **Values sent to the drive via this index are not stored to FLASH memory.** For setting the speed scaling on startup or commissioning, the usage of parameter 50.01 (via DriveWindow or CDP312 control panel) is recommended.			
unit: ---	type: PB	ctrl. bd.: CON	Min: 0	Default: 15000	
			Max: 65535	Integer scaling: ---	

<table>
<tr><td>50</td><td>Group name:</td><td colspan="3">SPEED MEASUREMENT (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="3">Speed measurement</td></tr>
<tr><td>12
Index</td><td>Name:

Description:</td><td colspan="3">SYNC INPUT SELECT — Par/Sig: p

Source of the synchronization signal.
At the programmed synchronisation event the position counter is initialised by the defined value:

POS COUNT INIT LO (50.08) ⇒ POS COUNT LOW (3.07)
POS COUNT INIT HI (50.09) ⇒ POS COUNT HIGH (3.08)

At the same time the bit SYNC RDY (5) in the AUX STATUS WORD (8.02) is set to 1.

The synchronisation can be inhibited by setting bit
SYNC DISABLE (10) of the
AUX CONTROL WORD (7.02) to 1.

Selection of the synchronization event:
0: NOT IN USE
1: DI7 _-
digital input 7 rising edge (low to high edge sensitive)
2: DI7 HI & Z
Zero channel pulse from encoder, DI7 at high-state
3: DI7 HI & Z+
Zero channel pulse from encoder, DI7 at high-state, motor rotating forward
4: DI7 HI & Z-
Zero channel pulse from encoder, DI7 at high-state, motor rotating backward
5: DI7 -_
digital input 7 falling edge (high to low edge sensitive).
6: DI7 LO & Z
Zero channel pulse from encoder, DI7 at low-state
7: DI7 LO & Z+
Zero channel pulse from encoder, DI7 at low-state, motor rotating forward
8: DI7 LO & Z-
Zero channel pulse from encoder, DI7 at low-state, motor rotating backward
9: Z
Zero channel pulse.
10: AUX CW.9 _-
AUX CONTROL WORD (7.02) bit 9 rising edge
11: NOT IN USE</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: CON</td><td>Min: NOT IN USE</td><td>Default: NOT IN USE</td></tr>
<tr><td></td><td></td><td></td><td>Max: NOT IN USE</td><td>Integer scaling: ---</td></tr>
</table>

50	Group name:	**SPEED MEASUREMENT (cont.)**		
	Description:	Speed measurement		
13 Index	Name:	**SP ACT FILT FTC**		Par/Sig: p
	Description:	Time constant of the actual speed filter to generate the filtered speed actual value (1.01)		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 200ms
			Max: 32767ms	Integer scaling: 1 = 1ms
14 Index	Name:	**POS SYNC MODE**		Par/Sig: p
	Description:	Position counter synchronization mode. The synchronization can be done either cyclic (on every occurance of the synchronization event), or only once after resetting the **SYNC_RDY** signal (bit 5) inside the **AUX STATUS WORD** by means of the **RESET_SYNC_RDY** command (bit 11) of the **AUX CONTROL WORD**. **0**: **SINGLE** **1**: **CYCLIC**		
unit: ---	type: I	ctrl. bd.: AMC	Min: SINGLE	Default: SINGLE
			Max: CYCLIC	Integer scaling: ---

Group 51: Communication Module

51	Group name:	**COMMUNICATION MODULE**			
	Description:	This parameter group defines the communication parameters, when FBA (Field Bus Adapters) are used. The parameter names depend on the selected FBA type. **Note!** Any changes in these parameters take effect only after the next power-up of the adapter module.			
01	Name:	**MODULE TYPE**			Par/Sig: p
Index	Description:	Field bus parameter 1: Module type			
unit: ---	type: C	ctrl. bd.: AMC	Min: ---	Default: “NOT DEFINED“	
			Max: ---	Integer scaling: ---	
02	Name:	**STATION NUMBER**			Par/Sig: p
Index	Description:	Fieldbus parameter 2: Station number			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
03	Name:	**FIELDBUS PAR3**			Par/Sig: p
Index	Description:	Fieldbus parameter 3			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
04	Name:	**FIELDBUS PAR4**			Par/Sig: p
Index	Description:	Fieldbus parameter 4			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
05	Name:	**FIELDBUS PAR5**			Par/Sig: p
Index	Description:	Fieldbus parameter 5			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
06	Name:	**FIELDBUS PAR6**			Par/Sig: p
Index	Description:	Fieldbus parameter 6			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
07	Name:	**FIELDBUS PAR7**			Par/Sig: p
Index	Description:	Fieldbus parameter 7			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	

51	Group name:	COMMUNICATION MODULE (cont.)			
	Description:	This parameter group defines the communication parameters, when FBA (Field Bus Adapters) are used. The parameter names depend on the selected FBA type. **Note!** Any changes in these parameters take effect only after the next power-up of the adapter module.			

08	Name:	**FIELDBUS PAR8**			Par/Sig: p
Index	Description:	Fieldbus parameter 8			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
09	Name:	**FIELDBUS PAR9**			Par/Sig: p
Index	Description:	Fieldbus parameter 9			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
10	Name:	**FIELDBUS PAR10**			Par/Sig: p
Index	Description:	Fieldbus parameter 10			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
11	Name:	**FIELDBUS PAR11**			Par/Sig: p
Index	Description:	Fieldbus parameter 11			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
12	Name:	**FIELDBUS PAR12**			Par/Sig: p
Index	Description:	Fieldbus parameter 12			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
13	Name:	**FIELDBUS PAR13**			Par/Sig: p
Index	Description:	Fieldbus parameter 13			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
14	Name:	**FIELDBUS PAR14**			Par/Sig: p
Index	Description:	Fieldbus parameter 14			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	
15	Name:	**FIELDBUS PARX**			Par/Sig: p
Index	Description:	Fieldbus parameter 15			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 32767	Integer scaling: ---	

Group 62: RFE Filter

62	Group name:	**RFE FILTER**		
	Description:	This parameter group defines the RFE filter parameters.		
01 Index	Name:	**FILTER CW**		Par/Sig: p
	Description:	Control word of RFE filter. B0: FILT_RELEASE B1: BAL_FILTER		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: 0
			Max: ---	Integer scaling: ---
02 Index	Name:	**FILTER SW**		Par/Sig: p
	Description:	Status word of RFE filter. B0: FILT_PAR_CALC_ACT B1: PARAM_UPD_REQ B2: FILT_RELEASED B3: PARAM_CHANGE		
unit: ---	type: PB	ctrl. bd.: AMC	Min: ---	Default: ---
			Max: ---	Integer scaling: ---

62	Group name:	**RFE FILTER**		
	Description:	This parameter group defines the RFE filter parameters.		
03 Index	Name:	**FREQUENCY OF FZERO**		Par/Sig: p
	Description:	RFE filter parameter. **Note:** Due to the internal used representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [154.03] ... [154.03]+3.		
unit: ---	type: R	ctrl. bd.: AMC	Min: 0.5Hz	Default: 45Hz
			Max: 250Hz	Integer scaling: 10 = 1Hz
04 Index	Name:	**DAMPING OF ZERO**		Par/Sig: p
	Description:	RFE filter parameter. **Note:** Due to the internal used representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [154.03] ... [154.03]+3.		
unit: ---	type: R	ctrl. bd.: AMC	Min: -1.0	Default: 0
			Max: 0.99999	Integer scaling: 100 = 1
05 Index	Name:	**FREQUENCY OF POLE**		Par/Sig: p
	Description:	RFE filter parameter . Note: Due to the internal used representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [154.03] ... [154.03]+3.		
unit: ---	type: R	ctrl. bd.: AMC	Min: 0.5Hz	Default: 40Hz
			Max: 250Hz	Integer scaling: 10 = 1Hz
06 Index	Name:	**DAMPING OF POLE**		Par/Sig: p
	Description:	RFE filter parameter. **Note:** Due to the internal used representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [154.03] ... [154.03]+3.		
unit: ---	type: R	ctrl. bd.: AMC	Min: -1.0	Default: 0.25
			Max: 0.99999	Integer scaling: 100 = 1

Group 70: DDCS Control

70	Group name:	DDCS CONTROL		
	Description:	Parameter settings of the DDCS communication channels		

01 Index	Name:	**CH0 NODE ADDR**		Par/Sig: p
	Description:	Node address for channel 0: – if APC2 or NCSA-01 (AC31) is used the address must be 1 – if AC70 or AC80 is used via the optical module bus (adapters TB810 or TB811) the CH0 NODE ADDR is calculated from the POSTION terminal of the DRIENG data base element as follows: 1. multiply the hundreds of the value POSITION by 16 2. add the tens and ones of the value POSITION to the result Example: **POSITION** I Par. **(70.01)** 101 I 16*1+01 = 17 712 I 16*7+12 = 124 – if AC 800M is used via the optical module bus the CH0 NODE ADDR is calculated from the position of the DCS600 ENG hardware module as follows: 1. multiply the hundreds of the value POSITION by 16 2. add the tens and ones of the value POSITION to the result Example: **POSITION** I Par. **(70.01)** 112 I 16*1+12 = 28 503 I 16*5+03 = 83		
unit: ---	type: I	ctrl. bd.: AMC	Min: 1	Default: 1
			Max: 254	Integer scaling: ---

02 Index	Name:	**CH0 LINK CONTROL**		Par/Sig: p
	Description:	DDCS channel 0 intensity control for transmission LEDs. This parameter can be used in special cases to optimize the communication performance of the link. Note: optical power / cable length		
unit: ---	type: I	ctrl. bd.: AMC	Min: 1	Default: 15
			Max: 15	Integer scaling: ---

03 Index	Name:	**CH0 BAUD RATE**		Par/Sig: p
	Description:	Channel 0 communication speed. This parameter has to be set to 4Mbits/s, when ADVANT communication module is being used. For other communication modules, the baud rate is set automatically by the overriding control system. **0**: **8 MBAUD**: 8Mbits/s (not in use) **1**: **4 MBAUD**: 4Mbits/s **2**: **2 MBAUD**: 2Mbits/s (not in use) **3**: **1 MBAUD**: 1Mbits/s		
unit: ---	type: I	ctrl. bd.: AMC	Min: 8 MBAUD	Default: 4 MBAUD
			Max: 1 MBAUD	Integer scaling: ---

<table>
<tr><td>70</td><td>Group name:</td><td colspan="4">DDCS CONTROL (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Parameter settings of the DDCS communication channels</td></tr>
<tr><td>04</td><td>Name:</td><td colspan="3">CH0 TIMEOUT</td><td>Par/Sig: p</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">The delay time before a communication break event is generated. The supervision is activated after the reception of the first valid message. Before, an alarm (CH0 COMMUN) is generated, if a communication module is configured.
In local mode, there is no timeout supervision at all.

The time count starts when the link doesn’t update any of the first 2 receive-datasets addressed by the dataset base address (70.20).
(Example: dataset base address = 10: the reception of datasets 10 and 12 is supervised.)
Whether an alarm or a fault is generated, depends on the programmed value of ch0 com loss ctrl (70.05).
With the value 0, the timeout supervision is disabled.

Note! Due to the used internal representation of this parameter, a scaling function is required for writing integer values (e.g. via datasets). For that reason it mustn’t be accessed via the fast datasets 41, [70.20] ... [70.20]+3.</td></tr>
<tr><td>unit: ms</td><td>type: R</td><td>ctrl. bd.: AMC</td><td>Min: 0ms</td><td colspan="2">Default: 0ms</td></tr>
<tr><td></td><td></td><td></td><td>Max: 30000ms</td><td colspan="2">Integer scaling: 1 = 1ms</td></tr>
<tr><td>05</td><td>Name:</td><td colspan="3">CH0 COM LOSS CTRL</td><td>Par/Sig: p</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">This parameter defines the action after a communication fault of the AMC-DC board’s DDCS channel 0.
0: DYN BRAKING: dynamic braking
1: RAMP STOP: stop according to eme stop ramp 22.04
2: TORQUE LIMIT: stop by torque limit
3: COAST STOP: torque is zero
4: LAST REF: use last reference (alarm is generated)
5: CONST SPEED1: use CONST SPEED 1 (23.02) (alarm is generated)

Note! If an emergency stop occurs simultaneous to the communication fault, the drive stops according to the programmed emergency stop mode.</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: AMC</td><td>Min: DYN BRAKING</td><td colspan="2">Default: RAMP STOP</td></tr>
<tr><td></td><td></td><td></td><td>Max:
CONST SPEED1</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

70	Group name:	**DDCS CONTROL (cont.)**			
	Description:	Parameter settings of the DDCS communication channels			
07 Index	Name:	**CH2 NODE ADDR**			Par/Sig: p
	Description:	Node address for channel 2. This is used for point to point communication connections between drives (e.g. master/slave communication). **0**: Master drive; this value is set internal, if CH2 is configured to master channel **1 ... 125**: Node addresses of slave drives			
unit: ---	type: I	ctrl. bd.: AMC	Min: 1	Default: 1	
			Max: 125	Integer scaling: ---	
08 Index	Name:	**CH2 M/F MODE**			Par/Sig: p
	Description:	Channel 2 can be used to send reference values from the master drive to one or several slave followers via the Master/Follower dataset. In the DCS600 MultiDrive's standard application this is the dataset 41. **1**: **NOT IN USE** Channel 2 is not used for Master/Follower operation, but may be used for external I/O modules **2**: **MASTER** Drive is a master in the channel 2 communication link and sends control words and reference values to the slave(s) via the Master/Follower dataset. **3**: **FOLLOWER** Drive is a slave in the channel 2 communication link and receives reference values and control words from the master via the Master/Follower dataset. 4: **LINK MASTER** CH 2 master available for applic. program 5: **LINK SLAVE** CH 2 slave available for applic. program **Note** for FCB programming: The internal indexes 105.06, 105.07 and 105.10 depend on this parameter.			
unit: ---	type: I	ctrl. bd.: AMC	Min: NOT IN USE	Default: NOT IN USE	
			Max: LINK SLAVE	Integer scaling: ---	

70	Group name:	**DDCS CONTROL (cont.)**		
	Description:	Parameter settings of the DDCS communication channels		
09	Name:	**MASTER SIGNAL 1**		Par/Sig: p
Index	Description:	Group + index of the signal the master sends as the 1st value in the dataset 41 to the follower drive(s). The dataset 41 is sent as broadcast message. Format: (group • 100 + index). Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: ---	type: F	ctrl. bd.: AMC	Min: 0	Default: 701 (MAIN CONTROL WORD)
			Max: 9999	Integer scaling: 1 = 1
10	Name:	**MASTER SIGNAL 2**		Par/Sig: p
Index	Description:	Group + index of the signal the master sends as the 2nd value in the dataset 41 to the follower drive(s). The dataset 41 is sent as broadcast message. Format: (group • 100 + index). Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: ---	type: F	ctrl. bd.: AMC	Min: 0	Default: 2301 (SPEED REF)
			Max: 9999	Integer scaling: 1 = 1
11	Name:	**MASTER SIGNAL 3**		Par/Sig: p
Index	Description:	Group + index of the signal the master sends as the 3rd value in the dataset 41 to the follower drive(s). The dataset 41 is sent as broadcast message. Format: (group • 100 + index). Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: ---	type: F	ctrl. bd.: AMC	Min: 0	Default: 210 (TORQ REF3)
			Max: 9999	Integer scaling: 1 = 1

70	Group name:	DDCS CONTROL (cont.)		
	Description:	Parameter settings of the DDCS communication channels		
12 Index	Name:	**CH2 LINK CONTROL**		Par/Sig: p
	Description:	DDCS channel 2 intensity control for transmission LEDs. This parameter can be used in special cases to optimize the communication performance of the link.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 1	Default: 8
			Max: 15	Integer scaling: ---
13 Index	Name:	**M/F TIMEOUT**		Par/Sig: p
	Description:	The delay time before a communication break event is generated. The supervision is activated after the reception of the first valid message. Before, an alarm (M/F LINK) is generated, if the FOLLOWER mode is selected. The time count starts when the link doesn't update the Master/Follower dataset. Whether an alarm or a fault is generated, depends on the programmed value of ch2 com loss ctrl (70.14). With the value 0, the timeout supervision is disabled. **Note!** Due to the used internal representation of this parameter, a scaling function is required for writing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.		
unit: ms	type: R	ctrl. bd.: AMC	Min: 0ms	Default: 100ms
			Max: 30000ms	Integer scaling: 1 = 1ms
14 Index	Name:	**CH2 COM LOSS CTRL**		Par/Sig: p
	Description:	This parameter defines the action after a communication fault of the AMC-DC board's Master/Follower link. **1**: **FAULT** drive stops by coasting **2**: **ALARM**		
unit: ---	type: I	ctrl. bd.: AMC	Min: FAULT	Default: FAULT
			Max: ALARM	Integer scaling: ---

70	Group name:	DDCS CONTROL (cont.)		
	Description:	Parameter settings of the DDCS communication channels		
15 Index	Name:	**CH3 NODE ADDR**		Par/Sig: p
	Description:	Node address for channel 3. This channel is normally used with the start-up and maintenance tools (Drives Window). If several drives are connected together via channel 3, each of them must be set to a unique node address. **A new node address becomes valid only after power-up of the drive's control electronics.**		
unit: ---	type: I	ctrl. bd.: AMC	Min: 1	Default: 1
			Max: 254	Integer scaling: ---
16 Index	Name:	**CH3 LINK CONTROL**		Par/Sig: p
	Description:	DDCS channel 3 intensity control for transmission LEDs. This value is adjusted by the link including each device in the link. This parameter can be used in special cases to optimize the communication performance of the link.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 1	Default: 15
			Max: 15	Integer scaling: ---

70	Group name:	DDCS CONTROL (cont.)			
	Description:	Parameter settings of the DDCS communication channels			
17 Index	Name:	**FOLLOWER SIGNAL 1**			Par/Sig: p
	Description:	Group + index of the signal the follower(s) receive(s) as the 1st value in the dataset 41 from the master drive. The dataset 41 is sent as broadcast message. Format: (group • 100 + index). Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: ---	type: F	ctrl. bd.: AMC	Min: 0	Default: 701 (MAIN CONTROL WORD)	
			Max: 9999	Integer scaling: 1 = 1	
18 Index	Name:	**FOLLOWER SIGNAL 2**			Par/Sig: p
	Description:	Group + index of the signal the follower(s) receive(s) as the 2nd value in the dataset 41 from the master drive. The dataset 41 is sent as broadcast message. Format: (group • 100 + index). Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: ---	type: F	ctrl. bd.: AMC	Min: 0	Default: 2301 (SPEED REF)	
			Max: 9999	Integer scaling: 1 = 1	
19 Index	Name:	**FOLLOWER SIGNAL 3**			Par/Sig: p
	Description:	Group + index of the signal the follower(s) receive(s) as the 3rd value in the dataset 41 from the master drive. The dataset 41 is sent as broadcast message. Format: (group • 100 + index). Due to the used internal representation of this parameter, a scaling function is required for accessing integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3.			
unit: ---	type: F	ctrl. bd.: AMC	Min: 0	Default: 2501 (TORQUE REF A)	
			Max: 9999	Integer scaling: 1 = 1	

<table>
<tr><td>70</td><td>Group name:</td><td colspan="4">DDCS CONTROL (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Parameter settings of the DDCS communication channels</td></tr>
<tr><td>20
Index</td><td>Name:</td><td colspan="3">DSET BASE ADDRESS</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Dataset number of the 1st dataset used for communication to the overriding control system (e.g. field bus adapters, Advant controllers, APC, AC 800M). The dataset addressed by this parameter is the 1st dataset to the drive, while the next dataset is the first dataset from the drive, and so on. Up to 8 dataset for each direction are supported (addressing of datasets: see groups 90 to 93).
70.20 = 1 dataset range 1 ... 16
70.20 = 16 dataset range 16 ... 31

Note! The dataset addresses for the APC-mailbox function (32, 33) as well as for the master/follower communication (41) are not programmable.</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: AMC</td><td>Min: 1</td><td colspan="2">Default: 10</td></tr>
<tr><td></td><td></td><td></td><td>Max: 16</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td>21
Index</td><td>Name:</td><td colspan="3">DDCS CH0 HW CONN</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">In case of the usage of a branching unit (NDBUx5) on DDCS channel 0, the repeating of messages must be disabled. The selection is made by means of this parameter

0: RING repeating of messages
1: STAR no repeating of messages (default)</td></tr>
<tr><td>unit: ---</td><td>type: B</td><td>ctrl. bd.: AMC</td><td>Min: RING</td><td colspan="2">Default: STAR</td></tr>
<tr><td></td><td></td><td></td><td>Max: STAR</td><td colspan="2">Integer scaling: ---</td></tr>
<tr><td>22
Index</td><td>Name:</td><td colspan="3">DDCS CH3 HW CONN</td><td>Par/Sig: p</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">In case of the usage of a branching unit (NDBUx5) on DDCS channel 3, the repeating of messages must be disabled. The selection is made by means of this parameter

0: RING repeating of messages (default)
1: STAR no repeating of messages</td></tr>
<tr><td>unit: ---</td><td>type: B</td><td>ctrl. bd.: AMC</td><td>Min: RING</td><td colspan="2">Default: RING</td></tr>
<tr><td></td><td></td><td></td><td>Max: STAR</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

Group 71 DriveBus

71	Group name:	**DriveBus**		
	Description:	Parameter settings of DriveBus communication on channel CH0. Available with SW ver. 15.620 or later. Available only with AMC-DC 2 boards.		
01 Index	Name:	**CH0 DRIVEBUS MODE**		Par/Sig: p
	Description:	Communication mode selection for channel CH0. The DriveBus mode is used with the AC 80 controller. 0 = **NO** DDCS mode 1 = **YES** DriveBus mode		
unit: ---	type: B	ctrl. bd.: AMC	Min: NO	Default: NO
			Max: YES	Integer scaling: ---

Group 90: Dataset Receive Addresses

90	Group name:	**D SET REC ADDR**			
	Description:	Addresses for received dataset contents (transmitted from the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
01	Name:	**DSET X VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20] value 1 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 701	
			Max: 9999	Integer scaling: ---	
02	Name:	**DSET X VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20] value 2 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 2301	
			Max: 9999	Integer scaling: ---	
03	Name:	**DSET X VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20] value 3 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 2501	
			Max: 9999	Integer scaling: ---	
04	Name:	**DSET X+2 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+2 value 1 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 702	
			Max: 9999	Integer scaling: ---	
05	Name:	**DSET X+2 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+2 value 2 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 703	
			Max: 9999	Integer scaling: ---	
06	Name:	**DSET X+2 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+2 value 3 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

90	Group name:	**D SET REC ADDR (cont.)**			
	Description:	Addresses for received dataset contents (transmitted from the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
07	Name:	**DSET X+4 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+4 value 1 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
08	Name:	**DSET X+4 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+4 value 2 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
09	Name:	**DSET X+4 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+4 value 3 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
10	Name:	**DSET X+6 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+6 value 1 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
11	Name:	**DSET X+6 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+6 value 2 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
12	Name:	**DSET X+6 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+6 value 3 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

90	Group name:	D SET REC ADDR (cont.)			
	Description:	Addresses for received dataset contents (transmitted from the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			

13	Name:	**DSET X+8 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+8 value 1 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
14	Name:	**DSET X+8 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+8 value 2 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
15	Name:	**DSET X+8 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+8 value 3 transmit address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
16	Name:	**DSET X+10 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+10 value 1 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
17	Name:	**DSET X+10 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+10 value 2 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
18	Name:	**DSET X+10 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+10 value 3 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

Group 91: Dataset Receive Addresses

91	Group name:	**D SET REC ADDR**			
	Description:	Addresses for received dataset contents (transmitted from the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
01	Name:	**DSET X+12 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+12 value 1 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
02	Name:	**DSET X+12 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+12 value 2 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
03	Name:	**DSET X+12 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+12 value 3 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
04	Name:	**DSET X+14 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+14 value 1 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
05	Name:	**DSET X+14 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+14 value 2 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
06	Name:	**DSET X+14 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+14 value 3 transmit address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

91	Group name:	**D SET REC ADDR (cont.)**			
	Description:	Addresses for received dataset contents (transmitted from the overriding control system). The address format is: (group • 100 + index).			
07 Index	Name:	**DSET 32 VAL 1**			Par/Sig: p
	Description:	Dataset 32 value 1 / mailbox function. Address of data received from overriding control system (50 ms interval).			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
08 Index	Name:	**DSET 32 VAL 2**			Par/Sig: p
	Description:	Dataset 32 value 2 / mailbox function. Data received from overriding control system (50 ms interval).			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
09 Index	Name:	**DSET 32 VAL 3**			Par/Sig: p
	Description:	Dataset 32 value 3 / mailbox function. Address of data inquired by the overriding control system (50 ms interval).			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

Group 92: Dataset Transmit Addresses

92	Group name:	**D SET TR ADDR**			
	Description:	Addresses for transmitted dataset contents (received by the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
01	Name:	**DSET X+1 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+1 value 1 receive address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 801	
			Max: 9999	Integer scaling: ---	
02	Name:	**DSET X+1 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+1 value 2 transmit address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 104	
			Max: 9999	Integer scaling: ---	
03	Name:	**DSET X+1 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+1 value 3 receive address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 209	
			Max: 9999	Integer scaling: ---	
04	Name:	**DSET X+3 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+3 value 1 receive address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 802	
			Max: 9999	Integer scaling: ---	
05	Name:	**DSET X+3 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+3 value 2 receive address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 101	
			Max: 9999	Integer scaling: ---	
06	Name:	**DSET X+3 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+3 value 3 receive address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 108	
			Max: 9999	Integer scaling: ---	

92	Group name:	**D SET TR ADDR (cont.)**			
	Description:	Addresses for transmitted dataset contents (received by the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
07 Index	Name:	**DSET X+5 VAL 1**			Par/Sig: p
	Description:	Dataset [70.20]+5 value 1 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 901	
			Max: 9999	Integer scaling: ---	
08 Index	Name:	**DSET X+5 VAL 2**			Par/Sig: p
	Description:	Dataset [70.20]+5 value 2 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 902	
			Max: 9999	Integer scaling: ---	
09 Index	Name:	**DSET X+5 VAL 3**			Par/Sig: p
	Description:	Dataset [70.20]+5 value 3 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 906	
			Max: 9999	Integer scaling: ---	
10 Index	Name:	**DSET X+7 VAL 1**			Par/Sig: p
	Description:	Dataset [70.20]+7 value 1 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 904	
			Max: 9999	Integer scaling: ---	
11 Index	Name:	**DSET X+7 VAL 2**			Par/Sig: p
	Description:	Dataset [70.20]+7 value 2 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 905	
			Max: 9999	Integer scaling: ---	
12 Index	Name:	**DSET X+7 VAL 3**			Par/Sig: p
	Description:	Dataset [70.20]+7 value 3 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 903	
			Max: 9999	Integer scaling: ---	

92	Group name:	**D SET TR ADDR (cont.)**			
	Description:	Addresses for transmitted dataset contents (received by the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
13	Name:	**DSET X+9 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+9 value 1 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 803	
			Max: 9999	Integer scaling: ---	
14	Name:	**DSET X+9 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+9 value 2 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 804	
			Max: 9999	Integer scaling: ---	
15	Name:	**DSET X+9 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+9 value 3 receive address (10 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 805	
			Max: 9999	Integer scaling: ---	
16	Name:	**DSET X+11 VAL 1**			Par/Sig: p
Index	Description:	Dataset [70.20]+11 value 1 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 124	
			Max: 9999	Integer scaling: ---	
17	Name:	**DSET X+11 VAL 2**			Par/Sig: p
Index	Description:	Dataset [70.20]+11 value 2 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 122	
			Max: 9999	Integer scaling: ---	
18	Name:	**DSET X+11 VAL 3**			Par/Sig: p
Index	Description:	Dataset [70.20]+11 value 3 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

Group 93: Dataset Transmit addresses

93	Group name:	**D SET TR ADDR**			
	Description:	Addresses for transmitted dataset contents (received by the overriding control system). The address format is: (group • 100 + index). X is the dataset base address programmed to parameter 70.20.			
01 Index	Name:	**DSET X+13 VAL 1**			Par/Sig: p
	Description:	Dataset [70.20]+13 value 1 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
02 Index	Name:	**DSET X+13 VAL 2**			Par/Sig: p
	Description:	Dataset [70.20]+13 value 2 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
03 Index	Name:	**DSET X+13 VAL 3**			Par/Sig: p
	Description:	Dataset [70.20]+13 value 3 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
04 Index	Name:	**DSET X+15 VAL 1**			Par/Sig: p
	Description:	Dataset [70.20]+15 value 1 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
05 Index	Name:	**DSET X+15 VAL 2**			Par/Sig: p
	Description:	Dataset [70.20]+15 value 2 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	
06 Index	Name:	**DSET X+15 VAL 3**			Par/Sig: p
	Description:	Dataset [70.20]+15 value 3 receive address (50 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 9999	Integer scaling: ---	

93	Group name:	**D SET TR ADDR (cont.)**		
	Description:	Addresses for transmitted dataset contents (received by the overriding control system). The address format is: (group • 100 + index).		
07 Index	Name:	**DSET 33 VAL 1**		Par/Sig: p
	Description:	Dataset 33 value 1 / mailbox function. Address feedback of data received from overriding control system (50 ms interval).		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: 9999	Integer scaling: ---
08 Index	Name:	**DSET 33 VAL 2**		Par/Sig: p
	Description:	Dataset 33 value 2 / mailbox function. Inquired data, sent to overriding control system (50 ms interval).		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: 9999	Integer scaling: ---
09 Index	Name:	**DSET 33 VAL 3**		Par/Sig: p
	Description:	Dataset 33 value 3 / mailbox function. Address feedback of inquired data (50 ms interval).		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: 9999	Integer scaling: ---

Group 94: CON Communication (Actual Values)

94	Group name:	**CON COMM / ACT**			
	Description:	Addresses of actual values transferred from the SDCS-CON-2 board to the AMC-DC board. The address format is: (group • 100 + index).			
01	Name:	**INDX ACT 01 /2MS**			Par/Sig: p
Index	Description:	Actual value 1 address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 313 (arm alpha)	
			Max: 19999	Integer scaling: ---	
02	Name:	**INDX ACT 02 /2MS**			Par/Sig: p
Index	Description:	Actual value 2 address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 115 (conv cur act)	
			Max: 19999	Integer scaling: ---	
03	Name:	**INDX ACT 03 /2MS**			Par/Sig: p
Index	Description:	Actual value 3 address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 312 (arm cur ref)	
			Max: 19999	Integer scaling: ---	
04	Name:	**INDX ACT 04 /8MS**			Par/Sig: p
Index	Description:	Actual value 4 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 111 (u net act)	
			Max: 19999	Integer scaling: ---	
05	Name:	**INDX ACT 05 /8MS**			Par/Sig: p
Index	Description:	Actual value 5 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 113 (u arm act)	
			Max: 19999	Integer scaling: ---	
06	Name:	**INDX ACT 06 /8MS**			Par/Sig: p
Index	Description:	Actual value 6 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 128 (load cur act filt)	
			Max: 19999	Integer scaling: ---	

94	Group name:	**CON COMM / ACT (cont.)**			
	Description:	Addresses of actual values transferred from the SDCS-CON-2 board to the AMC-DC board. The address format is: (group • 100 + index).			
07 Index	Name:	**INDX ACT 07 /8MS**			Par/Sig: p
	Description:	Actual value 7 address (8 ms interval)			
Unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 117 (emf act)	
			Max: 19999	Integer scaling: ---	
08 Index	Name:	**INDX ACT 08 /8MS**			Par/Sig: p
	Description:	Actual value 8 address (8 ms interval)			
Unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 124 (bridge temp)	
			Max: 19999	Integer scaling: ---	
09 Index	Name:	**INDX ACT 09 /8MS**			Par/Sig: p
	Description:	Actual value 9 address (8 ms interval)			
Unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default:120 (mot1 calc tmp)	
			Max: 19999	Integer scaling: ---	
10 Index	Name:	**INDX ACT 10 /8MS**			Par/Sig: p
	Description:	Actual value 10 address (8 ms interval)			
Unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 317 (field1 cur ref)	
			Max: 19999	Integer scaling: ---	
11 Index	Name:	**INDX ACT 11 /8MS**			Par/Sig: p
	Description:	Actual value 11 address (8 ms interval)			
Unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 319 (field1 cur act)	
			Max: 19999	Integer scaling: ---	

Group 95: CON Communication (Reference Values)

95	Group name:	**CON COMM / REF**			
	Description:	Addresses of reference values transferred from the AMC-DC board to the SDCS-CON-2 board. The address format is: (group • 100 + index).			
01 Index	Name:	**INDX REF 01 /2MS**			Par/Sig: p
	Description:	Reference value 1 address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 311 (current ref)	
			Max: 19999	Integer scaling: ---	
02 Index	Name:	**INDX REF 02 /2MS**			Par/Sig: p
	Description:	Reference value 2 address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 4501 (flux ref)	
			Max: 19999	Integer scaling: ---	
03 Index	Name:	**INDX REF 03 /2MS**			Par/Sig: p
	Description:	Reference value 3 address (2 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 4503 (emf ref)	
			Max: 19999	Integer scaling: ---	
04 Index	Name:	**INDX REF 04 /8MS**			Par/Sig: p
	Description:	Reference value 4 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 4503 (emf ref)	
			Max: 19999	Integer scaling: ---	
05 Index	Name:	**INDX REF 05 /8MS**			Par/Sig: p
	Description:	Reference value 5 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
06 Index	Name:	**INDX REF 06 /8MS**			Par/Sig: p
	Description:	Reference value 6 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	

95	Group name:	**CON COMM / REF (cont.)**			
	Description:	Addresses of reference values transferred from the AMC-DC board to the SDCS-CON-2 board. The address format is: (group • 100 + index).			
07 Index	Name:	**INDX REF 07 /8MS**			Par/Sig: p
	Description:	Reference value 7 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
08 Index	Name:	**INDX REF 08 /8MS**			Par/Sig: p
	Description:	Reference value 8 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
09 Index	Name:	**INDX REF 09 /8MS**			Par/Sig: p
	Description:	Reference value 9 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
10 Index	Name:	**INDX REF 10 /8MS**			Par/Sig: p
	Description:	Reference value 10 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
11 Index	Name:	**INDX REF 11 /8MS**			Par/Sig: p
	Description:	Reference value 11 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
12 Index	Name:	**INDX REF 12 /8MS**			Par/Sig: p
	Description:	Reference value 12 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	
13 Index	Name:	**INDX REF 13 /8MS**			Par/Sig: p
	Description:	Reference value 13 address (8 ms interval)			
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0	
			Max: 19999	Integer scaling: ---	

Group 97: Drive

97	Group name:	DRIVE			
	Description:				
01 Index	Name:	**DEVICE NAME**			Par/Sig: p
	Description:	The name of the drive section can be typed here by the DriveWindow PC tool.The name is shown in the System Configuration window of Drive Window. The maximum number of characters is 32.			
unit: ---	type: C	ctrl. bd.: AMC	Min: ---	Default: “Device name”	
			Max: ---	Integer scaling: ---	

Group 98: Option Modules

98	Group name:	OPTION MODULES		
	Description:	Configuration (enabling) of connected option modules		

02 Index	Name:	COMM MODULE		Par/Sig: p
	Description:	This parameter is used, if a FBA (Field Bus Adapter) or another type of communication is used to communicate to the drive by means of DDCS channel 0. **1**: **NO** **2**: **FIELDBUS**: Field Bus Adapter is used to control the drive (e.g. PROFIBUS). **3**: **ADVANT**: Overriding system, e.g. AC80 or AC 800M controls the drive (datasets 10 ... 33 should be activated by setting parameter 70.20 dset base address to 10).		
unit: ---	type: I	ctrl. bd.: AMC	Min: NO	Default: ADVANT
			Max: ADVANT	Integer scaling: ---

08 Index	Name:	IO BOARD CONFIG		Par/Sig: p
	Description:	This parameter selects the IO boards connected to the SDCS-CON2 board. The SDCS-IOB2 and SDCS-IOB3 boards do not extend the amount of available I/O resources, but change their electrical behaviour. **0: NO I/O BOARD** **1: IOB2** **2: IOB3** **3: IOB2+3: SDCS-IOB2 + SDCS-IOB3** The SDCS-IOE board extends the amount of available I/O resources. **4**: **IOE**: SDCS-IOE **5**: **IOE+IOB2**: SDCS-IOE + SDCS-IOB2 **6**: **IOE+IOB3**: SDCS-IOE + SDCS-IOB3 **7**: **IOE+IOB2+3**: SDCS-IOE + SDCS-IOB2 + SDCS-IOB3 This parameter enables the supervision of the selected I/O boards. The configuration of the available I/O resources is done by means of parameters inside the I/O-SETTINGS groups 13, 14).		
unit: ---	type: I	ctrl. bd.: AMC	Min: NO I/O BOARD	Default: IOB2+3
			Max: IOE+IOB2+3	Integer scaling: ---

Group 99: Start-up Data

99	Group name:	**START-UP DATA**		
	Description:	Start-up data		
01 Index	Name:	**LANGUAGE**		Par/Sig: p
	Description:	Only english parameter names and diagnosis texts are supported (internal value = 0).		
unit: ---	type: I	ctrl. bd.: AMC	Min: ENGLISH	Default: ENGLISH
			Max: ENGLISH	Integer scaling: ---
02 Index	Name:	**MOTOR NOM VOLTAGE**		Par/Sig: p
	Description:	Nominal armature voltage of the 1st motor; used for EMF speed feedback		
unit: V	type: R	ctrl. bd.: CON	Min: 5V	Default: 350V
			Max: 1800V	Integer scaling: 1 = 1V
03 Index	Name:	**MOTOR NOM CURRENT**		Par/Sig: p
	Description:	Nominal armature current of the 1st motor. **Note!** In 12-pulse parallel mode, this parameter has to be set to 50% of the rated motor current (share of the rated motor current provided by one converter).		
unit: A	type: R	ctrl. bd.: CON	Min: 0A	Default: 0A
			Max: 10000A	Integer scaling: 1 = 1A
05 Index	Name:	**MOTOR NOM SPEED**		Par/Sig: p
	Description:	Motor nominal speed. Usually the **field weak point**. used for: EMF speed feedback Flux control Internal limited to 0.2 • (50.01) ... 1.6 • (50.01) rpm. Take care on correct (limited) setting of parameter 50.01 (SPEED SCALING).		
unit: rpm	type: R	ctrl. bd.: AMC	Min: 20rpm	Default: 1500rpm
			Max: 7500rpm	Integer scaling: 1 = 1rpm
06 Index	Name:	**MOTOR NOM POWER**		Par/Sig: p
	Description:	Nominal motor (output) power. **Note1:** Due to the used internal representation of this signal, a scaling function is required for reading integer values (e.g. via datasets). For that reason it mustn't be accessed via the fast datasets 41, [70.20] ... [70.20]+3. **Note2:** The integer format (used on access by means of datasets) of this parameter is 16 bit **unsigned**. Thus, the numeric range is 0 ... 65534.		
unit: kW	type: R	ctrl. bd.: AMC	Min: 0kW	Default: 0kW
			Max: 6553.4kW	Integer scaling: 10 = 1kW

99	Group name:	START-UP DATA (cont.)		
	Description:	Start-up data		
09 Index	Name:	**APPLIC RESTORE**		Par/Sig: p
	Description:	Starts FLASH operation selected with index APPLICATION MACRO (99.11). **1**: **YES** FLASH operation selected with index 99.11 is started **0**: **NO** no action It takes about 3 sec (4 sec in case of FACTORY loading), until new parameter values become active.		
unit: ---	type: B	ctrl. bd.: AMC	Min: NO	Default: NO
			Max: YES	Integer scaling: ---
10 Index	Name:	**DRIVE ID NUMBER**		Par/Sig: p
	Description:	This parameter is used by the overriding control system to check the right connections of the optical cables to the drives. This parameter requires support from the overriding control system to verify the correct connection.		
unit: ---	type: I	ctrl. bd.: AMC	Min: 0	Default: 0
			Max: 32767	Integer scaling: ---

<table>
<tr><td>99</td><td>Group name:</td><td colspan="4">START-UP DATA (cont.)</td></tr>
<tr><td></td><td>Description:</td><td colspan="4">Start-up data</td></tr>
<tr><td>11</td><td>Name:</td><td colspan="3">APPLICATION MACRO</td><td>Par/Sig: s</td></tr>
<tr><td>Index</td><td>Description:</td><td colspan="4">This parameter selects the application macro to be used. In addition to the default settings (FACTORY), two user-definable parameter sets (USER) are available:
there is a selection for saving the current settings as a User Macro (USER 1 SAVE or USER 2 SAVE), and recalling these settings (USER 1 LOAD or USER 2 LOAD).
The FLASH operation selected with this parameter is started, when index 99.09 (APPLIC RESTORE) is set to YES.
If User Macro 1 or 2 is in use, the parameters are restored to the last saved values. Exception: The setting of parameter 99.11 remains unchanged when restoring User Macros (since it is not stored in the FLASH memory); the parameter group 99 remains unchanged by restoring the factory default values.

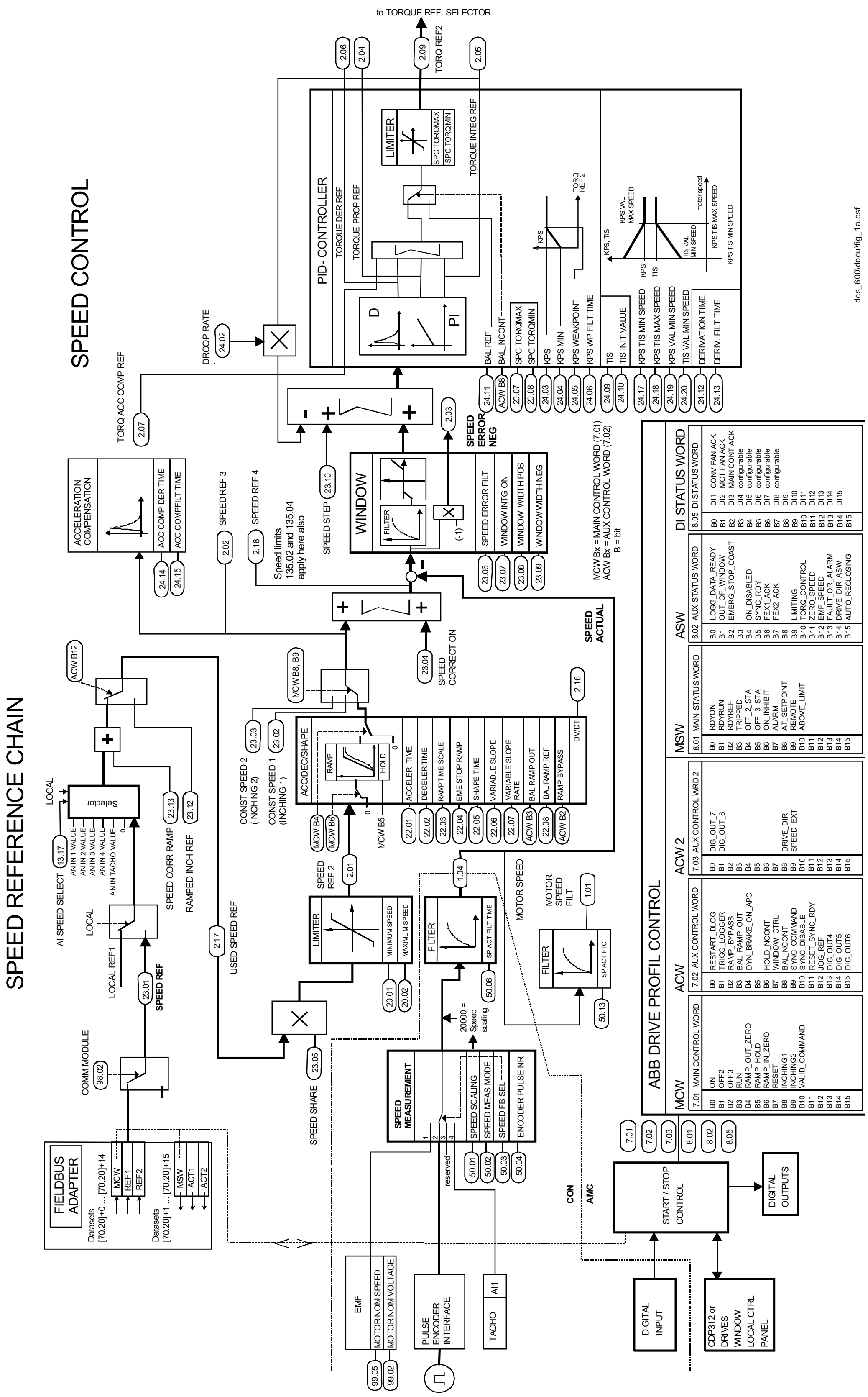
Note1! The Back-Up function in Drive Window only saves the active User Macro if called: thus, both User Macros must be backed-up separately.

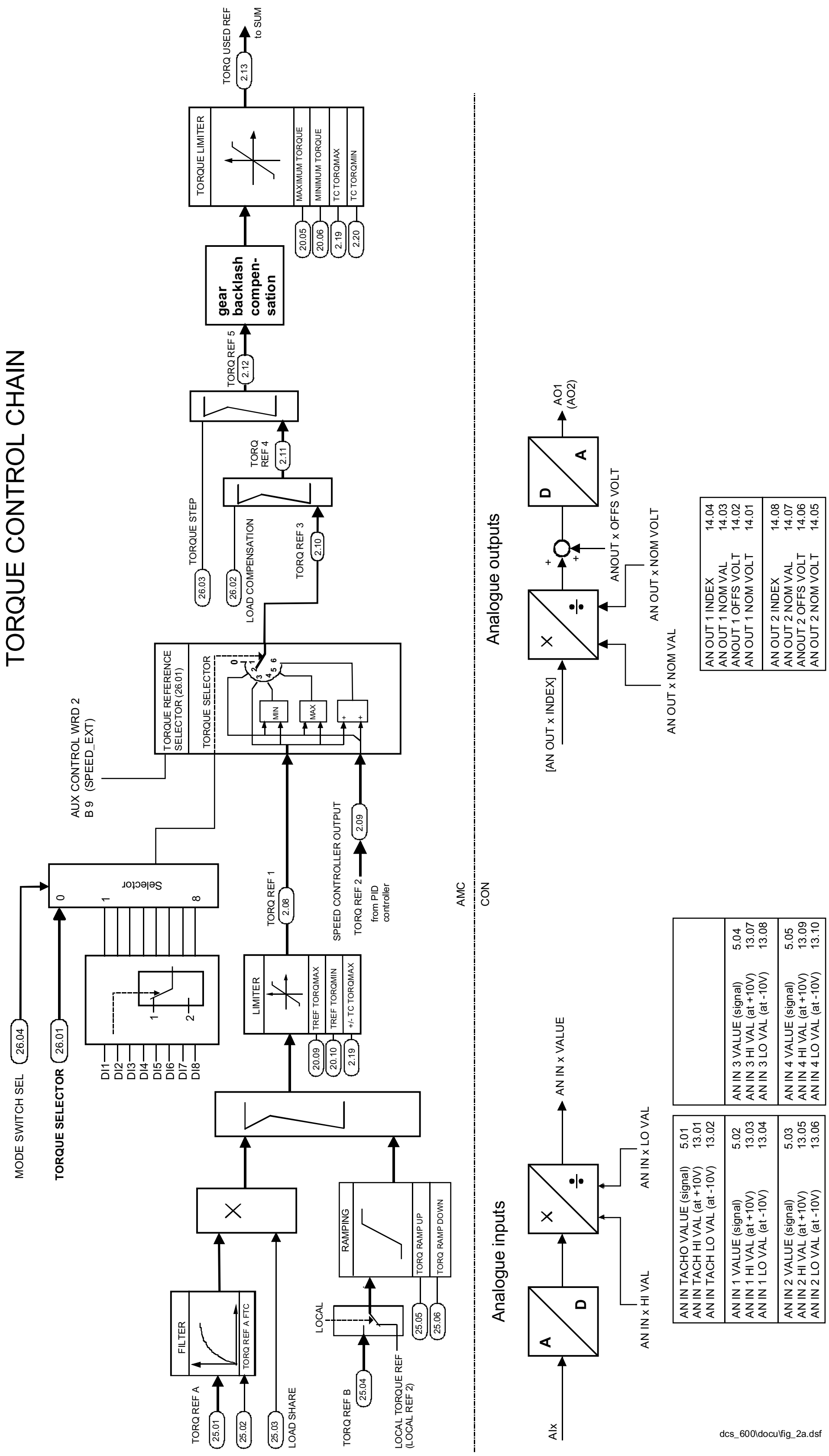
Note2! The USER 1 SAVE and USER 2 SAVE functions create the acoording User Macro inside the FLASH memory as well as they save the currently loaded parameter values to the FLASH memory to get them active after the next power-up (if a User Macro is loaded only, the loaded parameter values are lost after the next power-up). Thus, these functions have 2 purposes:
1. Creation of a User Macro
2. Storing the parameter values to the FLASH memory after loading a User Macro

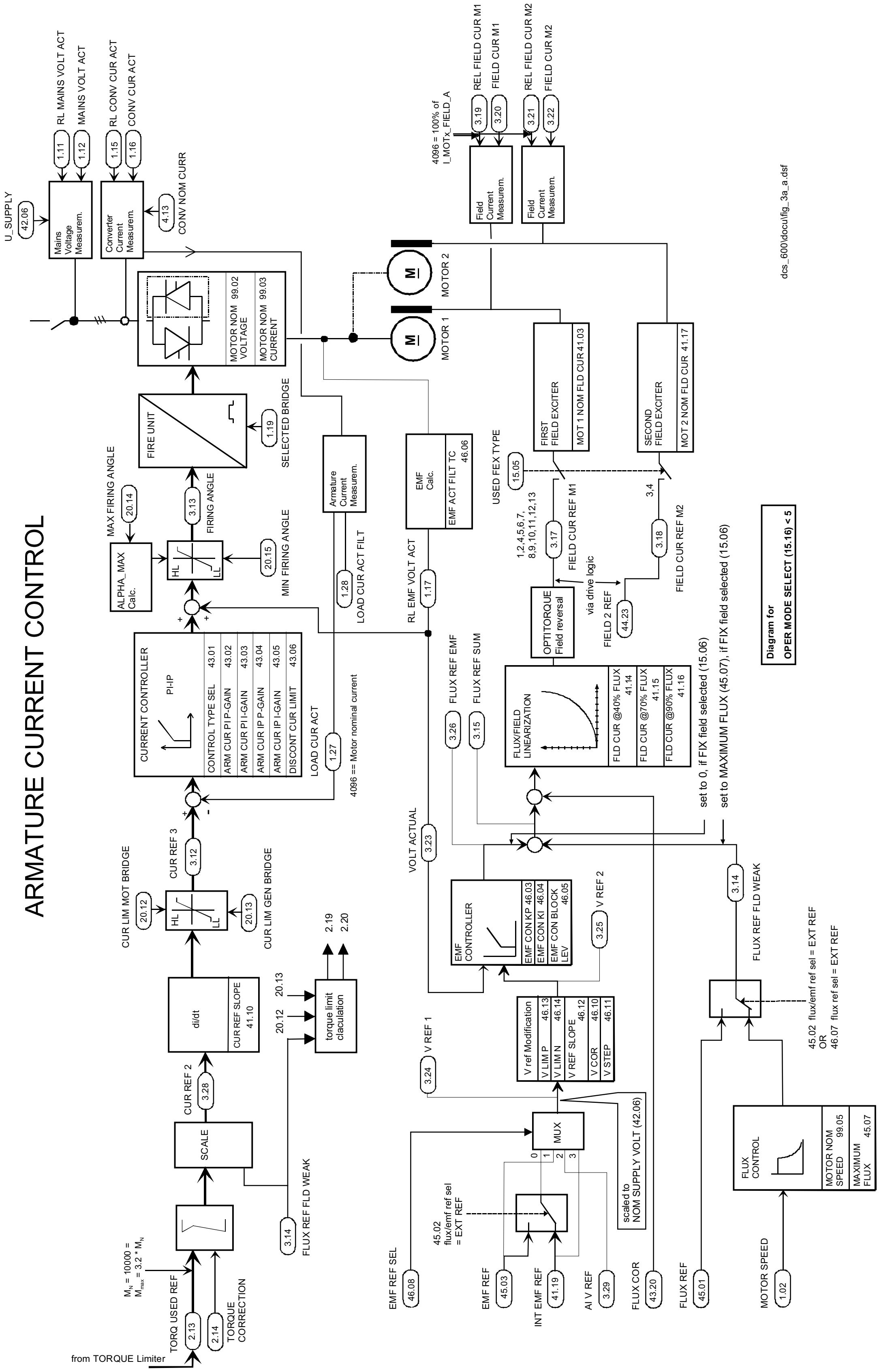
1 FACTORY Factory parameters (default values) are recalled and stored to the FPROM memory
2 USER 1 LOAD Parameter set 1 (User Macro 1) is loaded to the RAM memory
3 USER 1 SAVE Parameter set 1 (User Macro 1) is saved to the FPROM memory
4 USER 2 LOAD Parameter set 2 (User Macro 2) is loaded to the RAM memory
5 USER 2 SAVE Parameter set 2 (User Macro 2) is saved to the FPROM memory</td></tr>
<tr><td>unit: ---</td><td>type: I</td><td>ctrl. bd.: AMC</td><td>Min: FACTORY</td><td colspan="2">Default: FACTORY</td></tr>
<tr><td></td><td></td><td></td><td>Max:USER 2 SAVE</td><td colspan="2">Integer scaling: ---</td></tr>
</table>

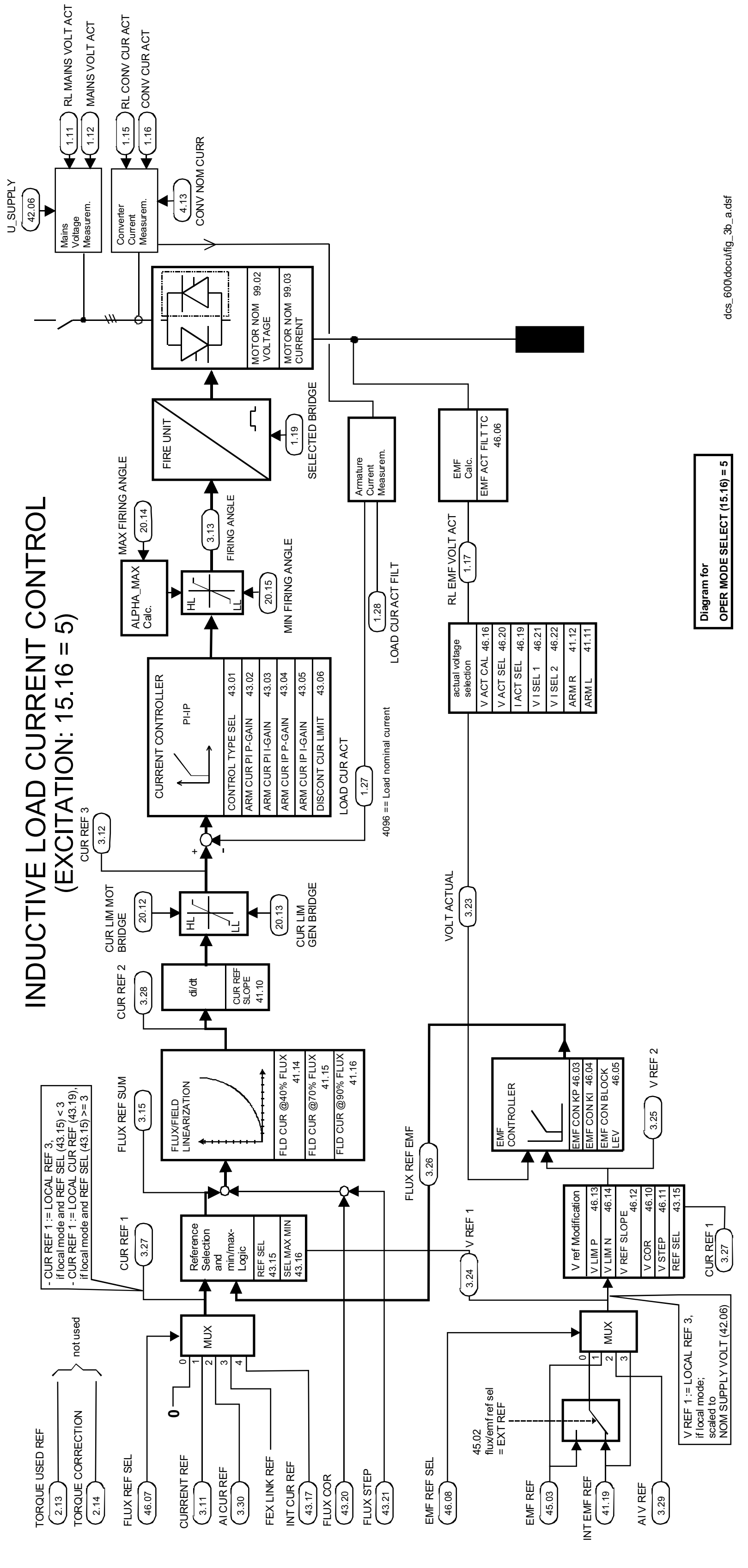
Appendix B

Software Structure Diagrams of DCS600 MultiDrive


SPEED CONTROL
SPEED REFERENCE CHAIN
PID - CONTROLLER
WINDOW
LIMITER
ACCELERATION COMPENSATION
SPEED MEASUREMENT
ABB DRIVE PROFIL CONTROL
to TORQUE REF. SELECTOR
dcs_600\docu\fig_1a.dsf


TORQUE CONTROL CHAIN
MODE SWITCH SEL 26.04
TORQUE SELECTOR 26.01
DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8
Selector
0 1 8
AUX CONTROL WRD 2
B 9 (SPEED_EXT)
TORQUE REFERENCE SELECTOR (26.01)
TORQUE SELECTOR
MIN
MAX
TORQ REF A 25.01
25.02
FILTER
TORQ REF A FTC
LOAD SHARE 25.03
TORQ REF B 25.04
LOCAL TORQUE REF (LOCAL REF 2)
LOCAL
RAMPING
TORQ RAMP UP 25.05
TORQ RAMP DOWN 25.06
LIMITER
TREF TORQMAX 20.09
TREF TORQMIN 20.10
+/- TC TORQMAX 2.19
TORQ REF 1 2.08
SPEED CONTROLLER OUTPUT 2.09
TORQ REF 2
from PID controller
TORQUE STEP 26.03
LOAD COMPENSATION 26.02
TORQ REF 3 2.10
TORQ REF 4 2.11
TORQ REF 5 2.12
gear backlash compen-sation
TORQUE LIMITER
MAXIMUM TORQUE 20.05
MINIMUM TORQUE 20.06
TC TORQMAX 2.19
TC TORQMIN 2.20
TORQ USED REF 2.13
to SUM
AMC
CON
Analogue inputs
AIx
A D
AN IN x HI VAL
AN IN x LO VAL
AN IN x VALUE
AN IN TACHO VALUE (signal) 5.01
AN IN TACH HI VAL (at +10V) 13.01
AN IN TACH LO VAL (at -10V) 13.02
AN IN 1 VALUE (signal) 5.02
AN IN 1 HI VAL (at +10V) 13.03
AN IN 1 LO VAL (at -10V) 13.04
AN IN 2 VALUE (signal) 5.03
AN IN 2 HI VAL (at +10V) 13.05
AN IN 2 LO VAL (at -10V) 13.06
AN IN 3 VALUE (signal) 5.04
AN IN 3 HI VAL (at +10V) 13.07
AN IN 3 LO VAL (at -10V) 13.08
AN IN 4 VALUE (signal) 5.05
AN IN 4 HI VAL (at +10V) 13.09
AN IN 4 LO VAL (at -10V) 13.10
Analogue outputs
[AN OUT x INDEX]
AN OUT x NOM VAL
AN OUT x NOM VOLT
ANOUT x OFFS VOLT
D A
AO1 (AO2)
AN OUT 1 INDEX 14.04
AN OUT 1 NOM VAL 14.03
ANOUT 1 OFFS VOLT 14.02
AN OUT 1 NOM VOLT 14.01
AN OUT 2 INDEX 14.08
AN OUT 2 NOM VAL 14.07
ANOUT 2 OFFS VOLT 14.06
AN OUT 2 NOM VOLT 14.05
dcs_600\docu\fig_2a.dsf


ARMATURE CURRENT CONTROL
U_SUPPLY
42.06
Mains Voltage Measurem.
RL MAINS VOLT ACT
MAINS VOLT ACT
Converter Current Measurem.
RL CONV CUR ACT
CONV CUR ACT
CONV NOM CURR
MOTOR NOM VOLTAGE 99.02
MOTOR NOM CURRENT 99.03
MOTOR 1
MOTOR 2
Field Current Measurem.
REL FIELD CUR M1
FIELD CUR M1
REL FIELD CUR M2
FIELD CUR M2
4096 = 100% of I_MOTx_FIELD_A
FIRST FIELD EXCITER
MOT 1 NOM FLD CUR 41.03
SECOND FIELD EXCITER
MOT 2 NOM FLD CUR 41.17
dcs_600\docu\fig_3a_a.dsf
FIRE UNIT
SELECTED BRIDGE
MAX FIRING ANGLE
FIRING ANGLE
ALPHA_MAX Calc.
MIN FIRING ANGLE
Armature Current Measurem.
LOAD CUR ACT FILT
EMF Calc.
EMF ACT FILT TC 46.06
RL EMF VOLT ACT
USED FEX TYPE
FIELD CUR REF M1
FIELD CUR REF M2
via drive logic
FIELD 2 REF
OPTITORQUE Field reversal
CURRENT CONTROLLER
PI-IP
CONTROL TYPE SEL 43.01
ARM CUR PI P-GAIN 43.02
ARM CUR PI I-GAIN 43.03
ARM CUR IP P-GAIN 43.04
ARM CUR IP I-GAIN 43.05
DISCONT CUR LIMIT 43.06
LOAD CUR ACT
4096 == Motor nominal current
FLUX REF EMF
FLUX REF SUM
FLUX/FIELD LINEARIZATION
FLD CUR @40% FLUX 41.14
FLD CUR @70% FLUX 41.15
FLD CUR @90% FLUX 41.16
set to 0, if FIX field selected (15.06)
set to MAXIMUM FLUX (45.07), if FIX field selected (15.06)
Diagram for OPER MODE SELECT (15.16) < 5
CUR LIM MOT BRIDGE
CUR REF 3
CUR LIM GEN BRIDGE
VOLT ACTUAL
EMF CONTROLLER
EMF CON KP 46.03
EMF CON KI 46.04
EMF CON BLOCK LEV 46.05
V REF 2
FLUX REF FLD WEAK
di/dt
CUR REF SLOPE 41.10
torque limit claculation
V REF 1
V ref Modification
V LIM P 46.13
V LIM N 46.14
V REF SLOPE 46.12
V COR 46.10
V STEP 46.11
45.02 flux/emf ref sel = EXT REF
OR
46.07 flux ref sel = EXT REF
CUR REF 2
SCALE
MUX
FLUX REF FLD WEAK
45.02 flux/emf ref sel = EXT REF
scaled to NOM SUPPLY VOLT (42.06)
FLUX CONTROL
MOTOR NOM SPEED 99.05
MAXIMUM FLUX 45.07
TORQ USED REF
TORQUE CORRECTION
from TORQUE Limiter
EMF REF SEL
EMF REF
INT EMF REF
AI V REF
FLUX COR
FLUX REF
MOTOR SPEED


INDUCTIVE LOAD CURRENT CONTROL
(EXCITATION: 15.16 = 5)
TORQUE USED REF 2.13
TORQUE CORRECTION 2.14
not used
FLUX REF SEL 46.07
CURRENT REF 3.11
AI CUR REF 3.30
FEX LINK REF
INT CUR REF 43.17
FLUX COR 43.20
FLUX STEP 43.21
MUX
Reference Selection and min/max-Logic
REF SEL 43.15
SEL MAX MIN 43.16
CUR REF 1 3.27
- CUR REF 1 := LOCAL REF 3, if local mode and REF SEL (43.15) < 3
- CUR REF 1 := LOCAL CUR REF (43.19), if local mode and REF SEL (43.15) >= 3
FLUX REF SUM 3.15
FLUX/FIELD LINEARIZATION
FLD CUR @40% FLUX 41.14
FLD CUR @70% FLUX 41.15
FLD CUR @90% FLUX 41.16
CUR REF 2 3.28
di/dt
CUR REF SLOPE 41.10
CUR LIM MOT BRIDGE 20.12
CUR LIM GEN BRIDGE 20.13
HL
LL
CUR REF 3 3.12
CURRENT CONTROLLER
PI-IP
CONTROL TYPE SEL 43.01
ARM CUR PI P-GAIN 43.02
ARM CUR PI I-GAIN 43.03
ARM CUR IP P-GAIN 43.04
ARM CUR IP I-GAIN 43.05
DISCONT CUR LIMIT 43.06
LOAD CUR ACT 1.27
4096 == Load nominal current
ALPHA_MAX Calc.
MAX FIRING ANGLE 20.14
MIN FIRING ANGLE 20.15
FIRING ANGLE 3.13
FIRE UNIT
SELECTED BRIDGE 1.19
U_SUPPLY 42.06
Mains Voltage Measurem.
RL MAINS VOLT ACT 1.11
MAINS VOLT ACT 1.12
Converter Current Measurem.
RL CONV CUR ACT 1.15
CONV CUR ACT 1.16
CONV NOM CURR 4.13
MOTOR NOM VOLTAGE 99.02
MOTOR NOM CURRENT 99.03
Armature Current Measurem.
LOAD CUR ACT FILT 1.28
EMF Calc.
EMF ACT FILT TC 46.06
RL EMF VOLT ACT 1.17
actual voltage selection
V ACT CAL 46.16
V ACT SEL 46.20
I ACT SEL 46.19
V I SEL 1 46.21
V I SEL 2 46.22
ARM R 41.12
ARM L 41.11
VOLT ACTUAL 3.23
FLUX REF EMF 3.26
EMF CONTROLLER
EMF CON KP 46.03
EMF CON KI 46.04
EMF CON BLOCK LEV 46.05
V REF 2 3.25
V ref Modification
V LIM P 46.13
V LIM N 46.14
V REF SLOPE 46.12
V COR 46.10
V STEP 46.11
REF SEL 43.15
V REF 1 3.24
CUR REF 1 3.27
EMF REF SEL 46.08
45.02 flux/emf ref sel = EXT REF
EMF REF 45.03
INT EMF REF 41.19
AI V REF 3.29
V REF 1 := LOCAL REF 3, if local mode; scaled to NOM SUPPLY VOLT (42.06)
Diagram for OPER MODE SELECT (15.16) = 5
dcs_600\docu\fig_3b_a.dsf

Appendix C

Index of DCS600 Parameters and Signals

Index of Parameters and Signals

E

F

G

H

I

K

L

ABB Automation Products GmbH
Postfach 1180
68619 Lampertheim • GERMANY
Tel: +49 (0) 62 06-5 03-0
Fax: +49 (0) 62 06-5 03-6 09
www.abb.com/dc

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