ACSM1

Firmware Manual
ACSM1 Regen Supply Control Program

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Firmware Manual

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Introduction to the manual

What this chapter contains

The chapter includes a description of the contents of the manual. In addition it contains information about the compatibility, safety and intended audience.

Compatibility

The manual is compatible with ACSM1 Regen Supply Control Program version ULFI1020 and later. See signal 9.04 FIRMWARE VER or PC tool (View - Properties).

Safety instructions

Follow all safety instructions delivered with the regen supply module.

- Read the **complete safety instructions** before you install, commission, or use the regen supply module. The complete safety instructions are given at the beginning of the *Hardware Manual*.
- Read the **software function specific warnings and notes** before changing the default settings of the function. For each function, the warnings and notes are given in this manual in the section describing the related user-adjustable parameters.

Reader

The reader of the manual is expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

Contents

The manual consists of the following chapters:

- *Start-up* instructs in setting up the control program and how to control the regen supply module through the I/O interface.
- *Supply module programming using PC tools* introduces programming via PC tool (DriveStudio and/or DriveSPC).
- *Supply module control and features* describes the control locations and operation modes of the regen supply module, and the features of the application program.
- *Default connections of the control unit* presents the default connections of the JCU Control Unit.
- *Parameters and firmware blocks* describes the regen supply module parameters and firmware function blocks.
- *Parameter data* contains more information on the parameters of the regen supply module.
- *Fault tracing* lists the warning and fault messages with the possible causes and remedies.
- *Application program template*
- *Control chain block diagrams*
- *Appendix A – Fieldbus control* describes the communication between the regen supply module and a fieldbus.
- *Appendix B – Drive-to-drive link* describes the communication between regen supply modules connected together by the drive-to-drive link.

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type code and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Drives – Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Drives – Training courses*.

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Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Start-up

What this chapter contains

This chapter describes the basic start-up procedure of the regen supply module and instructs in how to control the regen supply module through the I/O interface.

How to start up the regen supply module

The regen supply module can be operated:

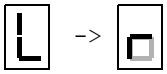
- locally from PC tool or control panel
- externally via I/O connections or fieldbus interface.

The start-up procedure presented uses the DriveStudio PC tool program. References and signals can be monitored with DriveStudio (Data Logger or Monitor Window). For instructions on how to use DriveStudio, see *DriveStudio User Manual* [3AFE68749026 (English)].

The start-up procedure includes actions which need to be performed only when the regen supply module is powered up for the first time. After the first start-up, the regen supply module can be powered up without using these start-up functions. The start-up procedure can be repeated later if start-up data needs to be changed.

If an alarm or a fault is generated during the start-up, see chapter *Fault tracing* for the possible causes and remedies. If problems continue, disconnect the main power and wait 5 minutes for the intermediate circuit capacitors to discharge and check the regen supply module connections.

Safety	
	The start-up may only be carried out by a qualified electrician. The safety instructions must be followed during the start-up procedure. See the safety instructions on the first pages of the appropriate hardware manual.
☐	Check the installation. See the installation checklist in the appropriate hardware manual.
PC tool	
☐	Install the DriveStudio PC tool (version 1.4 or later) on the PC. For instructions, see *DriveStudio User Manual* [3AFE68749026 (English)].
☐	Connect the regen supply module to the PC: Connect the other end of the communication cable (OPCA-02, code: 68239745) to the panel link of the regen supply module. Connect the other end of the communication cable via USB adapter or directly to the PC serial port.

I/O connections		
	Make the following I/O connections. The regen supply module does not start unless the connections have been made.	
☐	Connect the filter temperature monitoring cable between the regen filter module and regen supply module.	
☐	Connect the fan control signal cable between the regen filter module and regen supply module.	
☐	Use a jumper to close the Safe Torque Off circuits.	
Power up		
	By default, the regen supply module starts modulating when the power is switched on unless prevented by I/O. Use an external 24 V supply for the control unit if any settings have to be modified before power up **Note:** In a default configuration, the regen supply module can be started up without changing the parameter settings. If several regen supply modules are connected in parallel, see Connecting regen supply modules in parallel.	
☐	Switch the power on. Modulation is indicated by a rotating display of the lower segments on the 7-segment display.	7-segment display: 
☐	Start the DriveStudio program by clicking the DriveStudio icon on the PC desktop.	 DriveStudio.exe

Setting up fieldbus control

Fieldbus control		
Follow these instructions when the regen supply module is controlled from a fieldbus control system via fieldbus adapter Fxxx. The adapter is installed in supply module Slot 3.		
☐	Enable the communication between the regen supply module and fieldbus adapter.	50.01 FBA ENABLE
☐	Connect the fieldbus control system to the fieldbus adapter module.	
☐	Set the communication and adapter module parameters: See section *Setting up communication through a fieldbus adapter module* on page 138.	
☐	Test that the communication functions.	

Connecting regen supply modules in parallel

Connecting regen supply modules in parallel		
	If several regen supply modules are connected in parallel, you must change the parameter settings in each regen supply module to configure the system for the parallel connection. Because the regen supply module starts modulating when the power is switched on, do not power up the system before the parameters have been set. If the JCUs are not externally powered, however, it is not possible to set the parameters without powering up the system, and therefore, you must prevent the regen supply module from starting when powering up the system. **Note:** The released firmware (ULFI1020) also includes support for parallel connection of ACSM1-204 Regen Supplies. However, this is still in piloting mode because related ACSM1-204 types are not yet released for the sales at the date of publication of this manual.	
☐	*Externally powered JCUs* Power up the control board on each regen supply module. *No externally powered JCUs* Disconnect the filter temperature monitoring cable to prevent the regen supply module from starting during the power-up.	
	Set the parameters in each regen supply module:	
☐	Disable the earth fault detection by setting parameter 46.05 to 0 (No).	46.05 EARTH FAULT
☐	Set parameter 60.01 to P.60.02 so you can manually set the DC reference value. Set the DC voltage reference value with parameter 60.02. **Note:** The DC voltage reference must be set to the same value in each of the parallel connected supply units.	60.01 DC REF SEL 60.02 DC VOLT REF
☐	Eliminate circulating current by setting parameter 64.01 to 1 (Enable).	64.01 CIRC CURR ELIM
☐	Activate DC voltage control drooping by setting parameter 64.02 to 1 (Enable).	64.02 DC CTRL DROOP EN

Supply module programming using PC tools

What this chapter contains

This chapter introduces the regen supply module programming using the DriveStudio and DriveSPC applications. For more information, see *DriveStudio User Manual* [3AFE68749026 (English)] and *DriveSPC User Manual* [3AFE68836590 (English)].

General

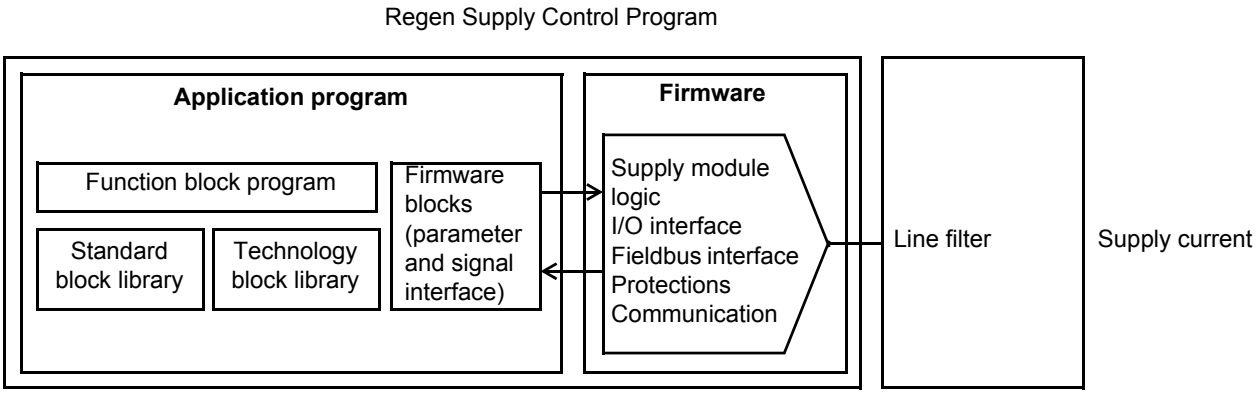
The Regen Supply Control Program is divided into two parts:

- firmware program
- application program.

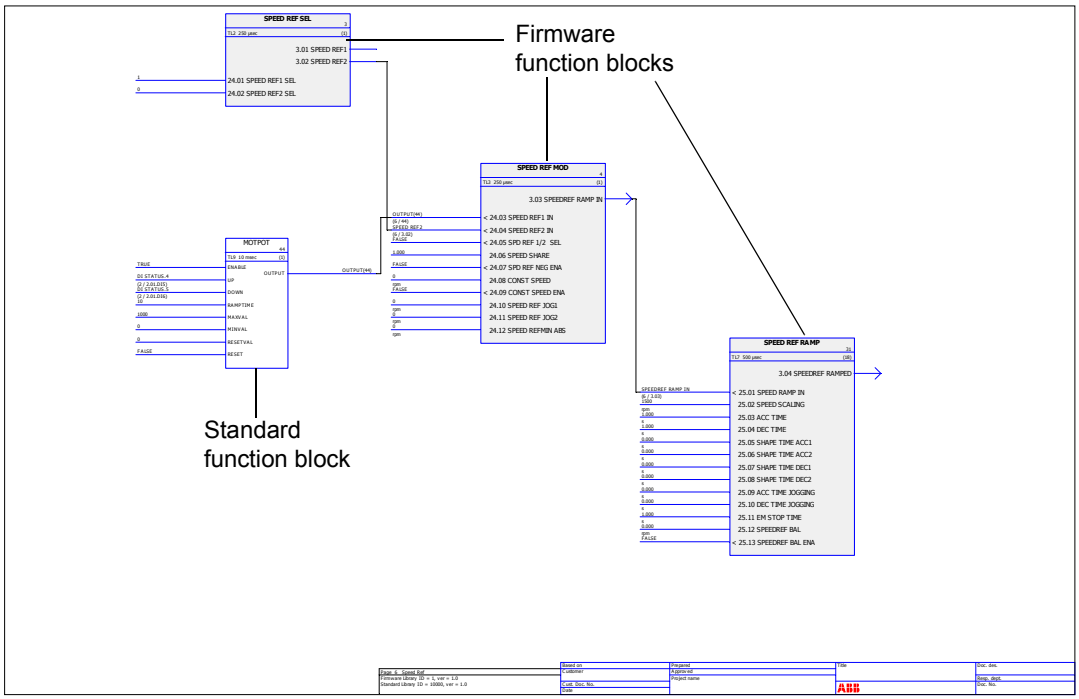
The firmware program performs the main control functions, including DC voltage and reactive power control, supply module logic (start/stop), I/O, communication and protection functions. Firmware functions are configured and programmed with parameters. The functions of the firmware program can be extended with application programming. Application programs are built out of function blocks.

The regen supply module supports two different programming methods:

- parameter programming
- application programming with function blocks (the blocks are based on the IEC-61131 standard).



The following picture presents a view from DriveSPC.



The application program template visible through DriveSPC is presented in chapter *Application program template* (page 123).

Programming via parameters

Parameters can be set via DriveStudio, supply module control panel (keypad) or the fieldbus interface. All parameter settings are stored automatically to the permanent memory of the regen supply module. (Exception: Parameters set via the fieldbus interface must be saved by par. 16.07 PARAM SAVE). Values are restored after the power switch-off. Default values can be restored by a parameter (16.04 PARAM RESTORE).

Because most parameters are used as firmware function block inputs, parameter values can also be modified via the DriveSPC tool.

Application programming

Application programs are created with the DriveSPC PC tool.

The normal delivery of the regen supply module does not include an application program. The user can create an application program with the standard and firmware function blocks. ABB also offers customised application programs and technology function blocks for specific applications. For more information, contact your local ABB representative.

Function blocks

The application program uses three types of function blocks: firmware function blocks, standard function blocks and technology function blocks.

Firmware function blocks

Most of the firmware functions are represented as function blocks in the DriveSPC tool. Firmware function blocks are part of the regen supply module control firmware, and used as an interface between the application and firmware programs. Parameters in groups 10…99 are used as function block inputs and parameters in groups 1…9 as function block outputs. Firmware function blocks are presented in chapter *Parameters and firmware blocks*.

Standard function blocks (library)

Standard function blocks (e.g. ADD, AND) are used to create an executable application program. Blocks are based on the IEC-61131 standard. Standard function blocks are presented in *ACSM1 Speed and Torque Control Program Firmware Manual* (3AFE68848261 [English]).

Standard function block library is always included in the regen supply module delivery.

Technology function blocks

Several technology function block libraries are available for different types of applications. One technology library can be used at a time. Technology blocks are used in a similar way as the standard blocks.

Program execution

The application program is loaded to the permanent memory (non-volatile) of the memory unit (JMU). The execution of the downloaded program starts after the next reset of the supply module control board. The program is executed in real time on the same Central Processing Unit (CPU of the supply module control board) as the regen supply module firmware. The program is executed with two cyclical tasks. The time level for these tasks can be defined by the programmer ($\geq$ 1ms).

Note: Because the firmware and application programs use the same CPU, the programmer must ensure that the regen supply module CPU is not overloaded. See parameter 1.21 CPU USAGE.

Operation modes

The DriveSPC tool offers the following operation modes:

Off-line

When the off-line mode is used without a regen supply module connection, the user can

- open a application program file (if exists).
- modify and save the application program.
- print the program pages.

When the off-line mode is used with a regen supply module(s) connection, the user can

- connect the selected regen supply module to DriveSPC.
- upload a application program from the connected regen supply module (an empty template which includes only the firmware blocks is available as default.)
- download the configured application program to the regen supply module and start the program execution. The downloaded program contains the function block program and the parameter values set in DriveSPC.
- remove the program from the connected regen supply module.

On-line

In the on-line mode, the user can

- modify firmware parameters (changes are stored directly to the regen supply module memory).
- modify application program parameters (i.e. parameters created in DriveSPC).
- monitor the actual values of all function blocks in real time.

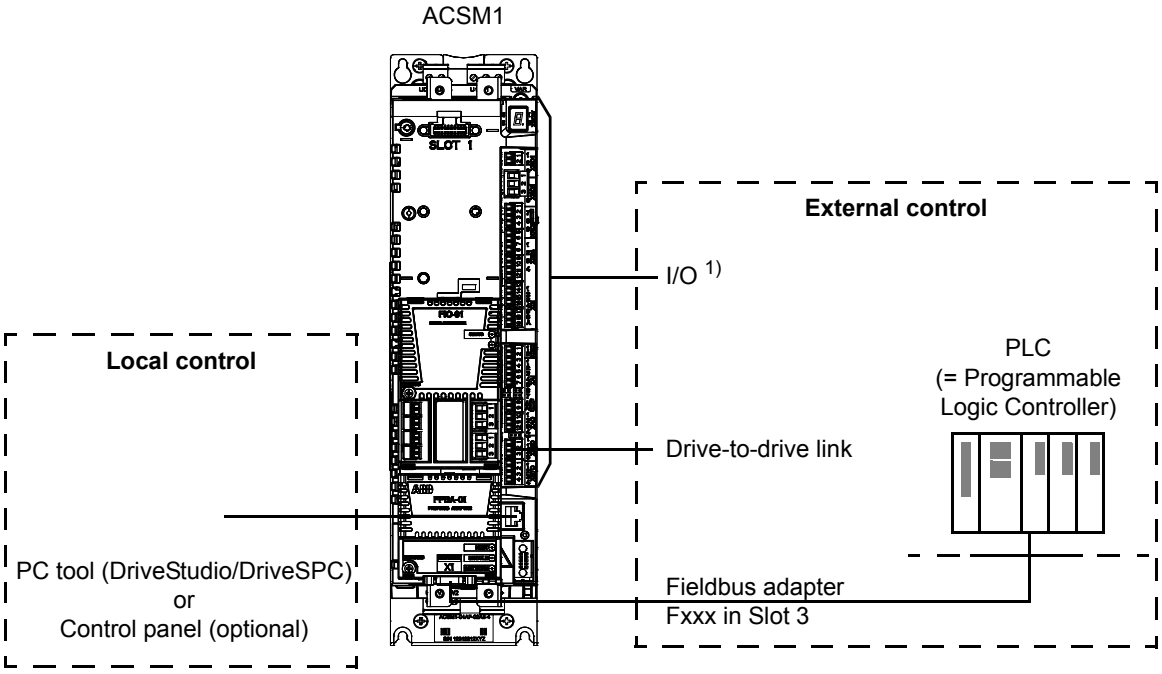
Supply module control and features

What this chapter contains

This chapter describes the control locations and operation modes of the regen supply module, and the features of the application program.

Local control vs. external control

The regen supply module has two main control locations: external and local. The control location is selected with the PC tool (Take/Release button) or with the LOC/REM key on the control panel.



1) Extra inputs/outputs can be added by installing optional I/O extension modules (FIO-xx) in drive Slot 1/2.

Local control

The control commands are given from a PC equipped with DriveStudio and/or DriveSPC, or from the control panel keypad when the regen supply module is in local control. DC-link voltage control and power control modes are available for local control.

Local control is mainly used during commissioning and maintenance. The control panel always overrides the external control signal sources when used in local control. Changing the control location to local can be disabled by parameter 16.01 LOCAL LOCK.

The user can select by a parameter (46.03 LOCAL CTRL LOSS) how the regen supply module reacts to a control panel or PC tool communication break.

External control

When the regen supply module is in external control, control commands (start/stop, reset, etc.) are given through the fieldbus interface (via an optional fieldbus adapter module), the I/O terminals (digital inputs), optional I/O extension modules or the drive-to-drive link. External references are given through the fieldbus interface, analogue inputs and drive-to-drive link.

Two external control locations, EXT1 and EXT2, are available. The user can select control signals (e.g. start/stop and reference) and control modes for both external control locations. Depending on the user selection, either EXT1 or EXT2 is active at a time. Selection between EXT1/EXT2 is done via digital inputs or fieldbus control word.

Voltage control in ACSM1-204

The ACSM1-204 regen supply module is a four-quadrant switching-mode converter which means that the power flow through the converter is reversible. The regen supply module can control the power flow between the DC bus and the AC network.

In the DC voltage control mode, the regen supply module controls the power so that the DC bus voltage remains at its reference value. If the load is connected to the DC bus, the DC bus voltage control will transfer required power from the network or to the network so that a power balance between AC and DC sides is achieved.

By default, the converter controls the DC link voltage approximately to the peak value of the line-to-line voltage. The DC voltage reference can be set also higher with a parameter. Two line currents and the DC link voltage are measured and used for controlling.

The regen supply module can effectively control the power flow only if the DC bus voltage is higher or equal to the peak-value of the line-to-line mains voltage. To ensure this, the regen supply module has a voltage reserve controller that automatically raises the DC bus voltage if that is necessary to maintain the voltage reserve.

In the default configuration, the regen supply module operates with unity power factor. If needed, the regen supply module may generate or consume reactive power by setting reactive power reference to a non-zero value.

Control modes of the regen supply module

ACSM1-204 regen supply module has two control modes, DC voltage control mode and power control mode. In DC voltage control mode, the regen supply module controls the DC bus voltage according to given reference. In power control mode, the regen supply module controls AC power according to given power reference.

The DC voltage control mode is the typical operation mode of the regen supply module. The power control mode can be used if external power source is connected to the DC bus of the regen supply module. Control modes corresponding to different control locations can be selected in parameters 34.03, 34.05 and 34.07.

DC voltage control mode

The DC voltage reference can be selected in parameter 60.01. The default value is Internal, which means that the regen supply module generates the DC voltage reference internally according to the network voltage, operating point and desired voltage reserve (parameter 40.04).

Other sources of DC voltage reference include analog inputs, fieldbus and drive-to-drive link. Parameter 60.02 provides a constant reference source. In DC voltage reference choices other than Internal, the DC voltage controller controls the DC bus voltage to the selected reference. If the DC voltage reference is lower than what is needed to maintain desired voltage reserve, the regen supply module will internally increase the DC voltage reference so that the desired voltage reserve is maintained.

The desired voltage reserve can be set in parameter 40.04. The default value of 2% is suitable for most cases.

The DC voltage controller has a drooping feature that can be used if multiple regen supply modules are feeding the same DC bus. The drooping is enabled in parameter 64.02. The drooping rate is 20 V per nominal power. Thus, with nominal power regenerating the drooping raises the DC voltage by 20 V from its reference value.

The DC reference maximum and minimum values can be set with parameters 60.03 and 60.04. The DC reference ramp times per 100 V can be set with parameters 60.05 and 60.06.

Power control mode

The power reference source of the power control mode can be selected in parameter 62.01. By default, the power reference is given in parameter 62.02. Maximum and minimum limits of power reference can be set with parameters 62.03 and 62.04. Power reference ramp times per 1000 kW can be set with parameters 62.05 and 62.06.

The power control mode includes a feature for controlling over and undervoltage. In the power control mode, the DC bus voltage is determined by the balance of AC power which is set by the power reference and the external power fed to the DC link. The over- and undervoltage control modifies the output power of the regen supply module so that the DC bus voltage remains within the limits set by parameters 60.03 and 60.04.

Control features

Reactive power control

The reactive power reference source can be selected in parameter 61.01. By default, the reactive power reference can be given in parameter 61.02. When the reference is positive, the regen supply module generates reactive power and appears as a capacitive component to the network. When the reference is negative, the regen supply module consumes reactive power and appears as an inductive component to the nerwork. If the current capacity of the regen supply module is fully used, the reactive power is reduced so that the required active power is delivered.

Note: Producing reactive power decreases available voltage reserve and may force the regen supply module to use a higher DC link voltage reference internally than is defined by the user.

Switching frequency reference

The switching frequency reference can be set with parameter 40.02 SF REF. The default value is 3 kHz but it can be increased up to 16 kHz.

Note: The higher the switching frequency, the more losses it produces at power stage, the available current magnitude may be reduced.

Braking chopper

The built-in braking chopper of the drive can be used to handle the energy generated by a decelerating motor. When the braking chopper is enabled and a resistor is connected, the chopper will start conducting when the DC link voltage of the drive reaches 780 V. The maximum braking power is achieved at 840 V.

Parallel connection

ACSM1-204 regen supply modules support redundant parallel connection of regen supply modules. Direct parallel connection without isolation transformers results in circulating zero-sequence current flow between paralleled units. In this case the circulating current elimination of parameter 64.01 must be enabled in all paralleled units.

In parallel configuration DC voltage controller drooping must be enabled in parameter 64.02 in all paralleled units. The same DC voltage reference must be used in all paralleled units.

If only one of the paralleled units is in the DC voltage control mode and the rest of them are in the power control mode, the DC voltage controller droop is not needed.

Paralleling regen supply modules without isolation transformers increases losses and may increase acoustic noise. Circulating current elimination decreases the maximum available current of the regen supply modules by 10%.

Synchronization

Before the regen supply module can start modulation, it must synchronize itself with the network. To perform synchronization, the regen supply module needs network voltage, frequency and rotation direction data. The regen supply module can get network data automatically or you can give it manually. The ID run can also be used to get the user network data.

In the automatic mode, the regen supply module identifies the required network data at the start. Particularly in disturbed network conditions the repeatability and reliability of synchronization can be improved by using the user given data.

Automatic mode

The network data is identified automatically if necessary. The duration of identification is approximately 5…10 ms during which the unit takes 2…3 short current pulses from the network.

The automatic identification is done in the first start-up after the power-up and when ID run results have been cleared. In a unit with an externally powered JCU, the automatic identification is also done in the first start-up after the PU has been switched off.

User given data

Set the mains voltage, frequency and direction. User given data overrides any automatically identified data.

Partial user data is also supported. For example, by providing only the frequency eliminates the possible inaccuracies of automatic frequency identification. To eliminate the 5…10 ms delay of automatic identification, frequency and direction need to be set.

Values can be cleared by writing them to zero or by setting parameter 99.13 to Clear Result.

Network identification

Network identification can be used to get user network data. Group 99 can be used to initiate a network identification routine.

In network identification regen supply module synchronizes to the network with several current pulses and modulates for a few seconds. The identified values are written in parameters 63.01…63.03. Setting parameter 99.13 to Clear Result clears the user network data and sets synchronization to automatic mode.

Note: Synchronization to network may be unreliable if the current exceeds 50% of the nominal current at start-up.

Protections

The regen supply module is protected against short circuit, overcurrent, overvoltage and undervoltage. The thermal protection scheme of the regen supply module includes a thermal model that estimates the critical power stage temperatures and limits AC current if that is necessary.

If excessive power is fed to the DC link, the regen supply module cannot keep the DC link voltage at its reference value and the voltage increases. If the DC link voltage reaches 880 V, the regen supply module trips on overvoltage. If the DC link voltage is increased beyond that, the regen supply module may be damaged.

If excessive power is taken from the DC link, the regen supply module cannot reduce the AC current. When the current capability of the regen supply module is exceeded, it can no longer control the DC link voltage and the power is transferred through the freewheeling diodes of the power stage. Excessive current causes the regen supply module to trip on overcurrent but it cannot reduce the current flow. Therefore, excessive power taken from the DC link may damage the regen supply module.

Default connections of the control unit

What this chapter contains

This chapter shows the default control connections of the JCU Control Unit.

More information on the connectivity of the JCU is given in the *Hardware Manual* of the regen supply module.

Notes:

*Total maximum current: 200 mA

1) Selected by par. 12.01 DIO1 CONF.

2) Selected by par. 12.02 DIO2 CONF.

3) Selected by par. 12.03 DIO3 CONF.

4) Selected by jumper J1.

5) Selected by jumper J2.

Current:

J1/2 

Voltage:

J1/2 

X1

External power input 24 V DC, 1.6 A	+24VI	1
	GND	2

X2

Relay output: Brake close/open 250 V AC / 30 V DC 2 A	NO	1
	COM	2
	NC	3

X3

+24 V DC*	+24VD	1
Digital I/O ground	DGND	2
Digital input 1: Stop/start (as EXT2, par. 10.05)	DI1	3
Digital input 2: EXT1/EXT2 (par. 34.01)	DI2	4
+24 V DC*	+24VD	5
Digital I/O ground	DGND	6
Digital input 3: Fault reset (par. 10.08)	DI3	7
Digital input 4: Force stop (par. 10.18)	DI4	8
+24 V DC*	+24VD	9
Digital I/O ground	DGND	10
Digital input 5: Not connected	DI5	11
Digital input 6: Not connected	DI6	12
+24 V DC*	+24VD	13
Digital I/O ground	DGND	14
Digital input/output 1 [1]: Fan control signal (output)	DIO1	15
Digital input/output 2 [2]: Running	DIO2	16
+24 V DC*	+24VD	17
Digital I/O ground	DGND	18
Digital input/output 3 [3]: Fault	DIO3	19

X4

Reference voltage (+)	+VREF	1
Reference voltage (–)	–VREF	2
Ground	AGND	3
Analogue input 1 (mA or V) [4]: Not connected	AI1+	4
	AI1–	5
Analogue input 2 (mA or V) [5]: Not connected	AI2+	6
	AI2–	7
AI1 current/voltage selection		J1
AI2 current/voltage selection		J2
Thermistor input: Line filter temperature supervision	TH	8
Ground	AGND	9
Analogue output 1 (mA): Output current	AO1 (I)	10
Analogue output 2 (V): Actual DC link voltage	AO2 (U)	11
Ground	AGND	12

X5

Drive-to-drive link termination		J3
Drive-to-drive link	B	1
	A	2
	BGND	3

X6

Not in use. Both circuits must be closed for the supply module to start. See the hardware manual.	OUT1	1
	OUT2	2
	IN1	3
	IN2	4

Control panel connection **X7**

Parameters and firmware blocks

What this chapter contains

This chapter lists and describes the parameters provided by the firmware.

Types of parameters

Parameters are user-adjustable operation instructions of the drive (groups 10…99). There are four basic types of parameters: Actual signals, value parameters, value pointer parameters and bit pointer parameters.

Actual signal

Type of parameter that is the result of a measurement or calculation by the drive. Actual signals can be monitored, but not adjusted, by the user. Actual signals are typically contained within parameter groups 1…9.

For additional actual signal data, e.g. update cycles and fieldbus equivalents, see chapter *Parameter data*.

Value parameter

A value parameter has a fixed set of choices or a setting range.

Example 1: You can select how the supply reacts when an earth fault or current unbalance is detected in the supply or the supply cable by selecting an option from the selection list of parameter 46.05.

Example 2: To define the constant value for DC voltage reference, set parameter 60.02 to an appropriate value.

Value pointer parameter

A value pointer parameter points to the value of another parameter. The source parameter is given in format **P.xx.yy**, where xx = Parameter group; yy = Parameter index. In addition, many value pointer parameters have a set of pre-selected choices.

Example: Converter current signal, 1.05 CURRENT PERC, is connected to analogue output AO1 by setting parameter 15.01 AO1 PTR to value P.01.05.

Bit pointer parameter

A bit pointer parameter points to the value of a bit in another parameter, or can be fixed to 0 (FALSE) or 1 (TRUE). In addition, many bit pointer parameters have a set of pre-selected choices.

When adjusting a bit pointer parameter on the optional control panel, CONST is selected in order to fix the value to 0 (displayed as “C.FALSE”) or 1 (“C.TRUE”). POINTER is selected to define a source from another parameter.

A pointer value is given in format **P.xx.yy.zz**, where xx = Parameter group, yy = Parameter index, zz = Bit number.

Example: Parameter 10.08 FAULT RESET SEL is used to select the source parameter for the external fault reset signal.

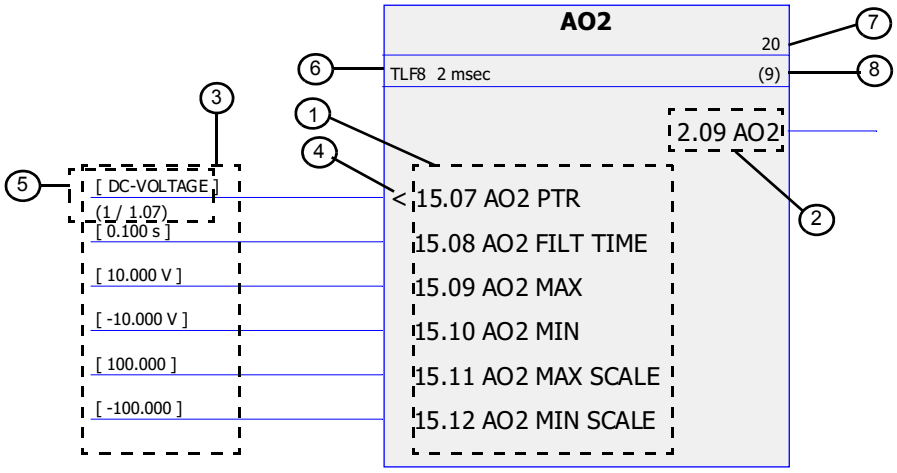
Note: Pointing to a nonexisting bit will be interpreted as 0 (FALSE).

For additional parameter data, e.g. update cycles and fieldbus equivalents, see chapter *Parameter data*.

Firmware blocks

Firmware blocks accessible from the DriveSPC PC tool are described in the parameter group most of the block inputs/outputs are included in. Whenever a block has inputs or outputs outside the current parameter group, a reference is given. Likewise, parameters have a reference to the firmware block they are included in (if any).

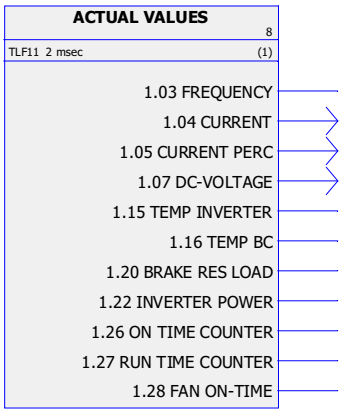
Note: Not all parameters are available through firmware blocks.



1	Inputs
2	Outputs
3	Input parameter values
4	Pointer parameter indicator “<“
5	Parameter 15.07 is set to value P.1.7, i.e. signal 1.07 DC-VOLTAGE. The “1” means the signal can be found on page 1 of DriveSPC.
6	ID of the time level (TLF8) and time level (2 ms). Time level, i.e. update cycle, is application-specific. See the time level of the block in DriveSPC.
7	Firmware block ID number in the application program
8	Firmware block execution order for the selected update cycle ID

Group 01 ACTUAL VALUES

This group contains basic actual signals for monitoring the drive.

01 ACTUAL VALUES		
Firmware block: **ACTUAL VALUES** (1)		
1.03	FREQUENCY	FW block: ACTUAL VALUES (see above)
	Estimated line frequency in Hz.	
1.04	CURRENT	FW block: ACTUAL VALUES (see above)
	Measured converter current in A. **Note:** Converter current is the AC current between the line filter and the converter.	
1.05	CURRENT PERC	FW block: ACTUAL VALUES (see above)
	Converter current in percent of the nominal converter current.	
1.07	DC-VOLTAGE	FW block: ACTUAL VALUES (see above)
	Measured DC link voltage in V (no filtering).	
1.15	TEMP INVERTER	FW block: ACTUAL VALUES (see above)
	Measured temperature of the heatsink in % of the maximum temperature.	
1.16	TEMP BC	FW block: ACTUAL VALUES (see above)
	Brake chopper IGBT temperature in % of the maximum temperature.	
1.17	EXT TEMP	FW block: EXT TEMP PROT (page 68)
	Measured external temperature in Celsius (when par. 45.02 is set to KTY JCU).	
1.19	USED SUPPLY VOLT	FW block: VOLTAGE CTRL (page 72)
	Either the supply voltage defined by parameter 47.04 SUPPLY VOLTAGE, or the automatically determined supply voltage if auto-identification is enabled by parameter 47.03 SUPPLVOLTAUTO-ID.	

1.20	BRAKE RES LOAD	FW block: ACTUAL VALUES (see above)
	Estimated temperature of the braking resistor. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter 48.04 BR POWER MAX CNT.	
1.21	CPU USAGE	FW block: None
	Microprocessor load in percent.	
1.22	INVERTER POWER	FW block: ACTUAL VALUES (see above)
	Calculated line-side converter power in kilowatts. Positive value: Power flow from the supply network to the intermediate circuit. Negative value: Power flow from the intermediate circuit to the supply network.	
1.26	ON TIME COUNTER	FW block: ACTUAL VALUES (see above)
	This counter runs when the regen supply module is powered. The counter can be reset using the DriveStudio tool. On-time is measured in hours.	
1.27	RUN TIME COUNTER	FW block: ACTUAL VALUES (see above)
	Run time counter. The counter runs when the regen supply module modulates. The counter can be reset using the DriveStudio tool. Run-time is measured in hours.	
1.28	FAN ON-TIME	FW block: None
	On-time counter of the power unit’s cooling fan. Fan on-time is measured in hours.	

Group 02 I/O VALUES

This group contains information on the I/Os of the drive.

02 I/O VALUES		
2.01	DI STATUS	FW block: DI (page 49)
	Status word of the digital inputs. Example: 000001 = DI1 is on, DI2 to DI6 are off.	
2.02	RO STATUS	FW block: RO (page 49)
	Status of relay output. 1 = RO is energized.	
2.03	DIO STATUS	FW blocks: DIO1 (page 47), DIO2 (page 47), DIO3 (page 47)
	Status word of digital inputs/outputs DIO1…3. Example: 001 = DIO1 is on, DIO2 and DIO3 are off.	
2.04	AI1	FW block: AI1 (page 51)
	Analogue input AI1 value in V or mA. The type is selected with jumper J1 on the JCU Control Unit.	
2.05	AI1 SCALED	FW block: AI1 (page 51)
	Scaled value of analogue input AI1. See parameters 13.04 AI1 MAX SCALE and 13.05 AI1 MIN SCALE.	
2.06	AI2	FW block: AI2 (page 52)
	Analogue input AI2 value in V or mA. The type is selected with jumper J2 on the JCU Control Unit.	
2.07	AI2 SCALED	FW block: AI2 (page 52)
	Scaled value of analogue input AI2. See parameters 13.09 AI2 MAX SCALE and 13.10 AI2 MIN SCALE.	
2.08	AO1	FW block: AO1 (page 55)
	Analogue output AO1 value in mA	
2.09	AO2	FW block: AO2 (page 56)
	Analogue output AO2 value in V	
2.10	DIO2 FREQ IN	FW block: DIO2 (page 47)
	Frequency input value in Hz when DIO2 is used as frequency input (12.02 DIO2 CONF is set to (2) FREQ INPUT).	
2.11	DIO3 FREQ OUT	FW block: DIO3 (page 47)
	Frequency output value in Hz when DIO3 is used as frequency output (12.03 DIO3 CONF is set to (2) FREQ OUTPUT).	

2.12	FBA MAIN CW	FW block: FIELDBUS (page 75)

Control Word for fieldbus communication.

Log. = Logical combination (i.e. Bit AND/OR Selection parameter). Par. = Selection parameter. See *State diagram* on page *143*.

Bit	Name	Val.	Information	Log.	Par.
0	STOP*	1	Modulation ends immediately. **Note:** Simultaneous STOP and START commands result in a stop command.	OR	10.02, 10.03, 10.05, 10.06
		0	No operation		
1	START	1	Start. **Note:** Simultaneous STOP and START commands result in a stop command.	OR	10.02, 10.03, 10.05, 10.06
		0	No operation		
2	STPMODE EM OFF*	1	Emergency OFF2 (bit 0 must be 1): Drive is stopped by cutting off the motor power supply (the inverter IGBTs are blocked). The motor coasts to stop. The drive will restart only with the next rising edge of the start signal when the run enable signal is on.	AND	-
		0	No operation		
3…6	Reserved				
7	RUN ENABLE	1	Activate run enable.	AND	10.09
		0	Activate run disable.		
8	RESET	0->1	Fault reset if an active fault exists.	OR	10.08
		other	No operation		
9…10	Reserved				
11	REMOTE CMD	1	Fieldbus control enabled	-	-
		0	Fieldbus control disabled		
12…14	Reserved				
15	EXT1/EXT2	1	Switch to external control location EXT2.	OR	34.01
		0	Switch to external control location EXT1.		
16	REQ STARTINH	1	Activate start inhibit.	-	-
		0	No start inhibit		
17	LOCAL CTL	1	Request local control for Control Word. Used when the drive is controlled via PC tool or panel. - Panel or PC tool: Transfer to local control.	-	-
		0	Request external control.		
18…27	Reserved				
28	CW B28		Freely programmable control bits.	-	-
29	CW B29				
30	CW B30				
31	CW B31				

2.13	FBA MAIN SW	FW block: FIELDBUS (page 75)

Status Word for fieldbus communication. See *State diagram* on page *143*.

Bit	Name	Value	Information
0	READY	1	Drive is ready to receive start command.
		0	Drive is not ready.
1	ENABLED	1	External run enable signal is received.
		0	No external run enable signal is received.
2	RUNNING	1	Regen supply module is modulating.
		0	Regen supply module is not modulating.
3	REF RUNNING	1	Normal operation is enabled. Regen supply module is running and following given reference.
		0	Normal operation is disabled. Regen supply module is not following given reference (for example, modulating during synchronization).
4	EM OFF (OFF2)	1	Emergency OFF2 is active.
		0	Emergency OFF2 is inactive.
5	EM STOP (OFF3)	1	Emergency stop OFF3 (ramp stop) is active.
		0	Emergency OFF3 is inactive.
6	ACK STARTINH	1	Start inhibit is active.
		0	Start inhibit is inactive.
7	ALARM	1	An alarm is active. See chapter *Fault tracing*.
		0	No alarm is active.
8	Reserved		
9	LIMIT	1	Operation is limited by an active limit (see 6.05 and 6.07).
		0	Operation is within limits.
10	Reserved		
11	EXT2 ACT	1	External control location EXT2 is active.
		0	External control location EXT1 is active.
12	Reserved		
13	ZERO SPEED	1	Bit 13 is internally forced to 1 to stop also if ramp stop (OFF1) or emergency stop (OFF3) is requested.
		0	
14	REV ACT	1	Line frequency is negative.
		0	Line frequency is positive.
15	Not in use		
16	FAULT	1	Fault is active. See chapter *Fault tracing*.
		0	No fault is active.
17	LOCAL PANEL	1	Local control is active, i.e. regen supply module is controlled from PC tool or control panel.
		0	Local control is inactive.
18…26	Reserved		

2.13 FBA MAIN SW (continued from previous page)

Bit	Name	Value	Information
27	REQUEST CTL	1	Control word is requested from fieldbus.
		0	Control word is not requested from fieldbus.
28	SW B28		Programmable status bits (unless fixed by the used profile). See parameters 50.08…50.11 and the user manual of the fieldbus adapter.
29	SW B29		
30	SW B30		
31	SW B31		

2.14 FBA MAIN REF1 — FW block: FIELDBUS (page 75)

Scaled fieldbus reference 1. See parameter 50.04 FBA REF1 SCALE.

2.15 FBA MAIN REF2 — FW block: FIELDBUS (page 75)

Scaled fieldbus reference 2. See parameter 50.05 FBA REF2 SCALE.

2.17 D2D MAIN CW — FW block: D2D COMMUNICATION (page 82)

Drive-to-drive control word received through the drive-to-drive link. See also actual signal 2.18 below.

Bit	Information
0	Stop.
1	Start.
2…6	Freely programmable control bits.
7	Run enable. By default, not connected in a follower drive.
8	Reset. By default, not connected in a follower drive.
9…14	Freely programmable control bits.
15	EXT1/EXT2 selection. 0 = EXT1 active, 1 = EXT2 active. By default, not connected in a follower drive.

2.18 D2D FOLLOWER CW — FW block: DRIVE LOGIC (page 43)

Drive-to-drive control word sent to the followers by default. See also firmware block D2D COMMUNICATION on page 82.

Bit	Information
0	Stop.
1	Start.
2…6	Freely programmable control bits.
7	Run enable.
8	Reset.
9…14	Freely programmable control bits.
15	EXT1/EXT2 selection. 0 = EXT1 active, 1 = EXT2 active.

2.19 D2D REF1 — FW block: D2D COMMUNICATION (page 82)

Drive-to-drive reference 1 received through the drive-to-drive link.

2.20 D2D REF2 — FW block: D2D COMMUNICATION (page 82)

Drive-to-drive reference 2 received through the drive-to-drive link.

Group 04 LINE CONV SIGNALS

Line-converter-specific signals.

04 LINE CONV SIGNALS		
4.01	REACTIVE POWER	FW block: REACTIVE POWER CTRL (page 88)
	Calculated reactive power in kVAr. Positive value = capacitive. Negative value = inductive.	
4.08	EXT FAN COMMAND	FW block: EXT FAN CTRL (page 94)
	External fan command.	
	(0) OFF	The regen filter module fan command is OFF.
	(1) ON	The regen filter module fan command is ON.
4.10	DC REF1	FW block: DC VOLTAGE CTRL (page 86)
	Value of DC voltage reference given by user.	
4.11	DC REF RAMP IN	FW block: DC VOLTAGE CTRL (page 86)
	DC voltage reference limited by DC REF MAX/MIN (see 60.03 and 60.04).	
4.12	DC REF RAMPED	FW block: DC VOLTAGE CTRL (page 86)
	Ramped DC voltage reference. Change of DC voltage is ramped according to DC RAMP UP/DOWN (see 60.05 and 60.06) time.	
4.20	Q POW REF	FW block: REACTIVE POWER CTRL (page 88)
	Value of reactive power reference selected by user (see 61.01).	
4.21	Q POW RAMP IN	FW block: REACTIVE POWER CTRL (page 88)
	Reactive power reference limited by Q POWER REF MAX/MIN (see 61.03 and 61.04).	
4.22	Q POW REF RAMPED	FW block: REACTIVE POWER CTRL (page 88)
	Ramped reactive power reference. Change of reactive power is ramped according to Q POW RAMP UP/DOWN (see 61.05 and 61.06) time.	
4.30	POW REF1	FW block: ACTIVE POWER REF (page 90)
	Value of active power reference given by user.	
4.31	POW REF RAMP IN	FW block: ACTIVE POWER REF (page 90)
	Active power reference limited by MAXIMUM/MINIMUM POW REF (see 62.03 and 62.04).	
4.32	POW REF RAMPED	FW block: ACTIVE POWER REF (page 90)
	Ramped active power reference. Change of active power is ramped according to POW RAMP UP/DOWN (see 62.05 and 62.06).	
4.34	POW REF USED	FW block: DC VOLTAGE CTRL (page 86)
	Final active power reference used by control core of the line converter.	

Group 06 DRIVE STATUS

Status words.

06 DRIVE STATUS

6.01 STATUS WORD 1 — FW block: DRIVE LOGIC (page 43)

Status word 1.

Bit	Name	Val.	Information
0	READY	1	Drive is ready to receive start command.
		0	Drive is not ready.
1	ENABLED	1	External run enable signal is received.
		0	No external run enable signal is received.
2	STARTED	1	Drive has received start command.
		0	Drive has not received start command.
3	RUNNING	1	Drive is modulating.
		0	Drive is not modulating.
4	EM OFF (OFF2)	1	Emergency OFF2 is active.
		0	Emergency OFF2 is inactive.
5	EM STOP (OFF3)	1	Emergency stop OFF3 (ramp stop) is active.
		0	Emergency OFF3 is inactive.
6	ACK STARTINH	1	Start inhibit is active.
		0	Start inhibit is inactive.
7	ALARM	1	An alarm is active. See chapter *Fault tracing*.
		0	No alarm
8	EXT2 ACT	1	External control EXT2 is active.
		0	External control EXT1 is active.
9	LOCAL FB	1	Fieldbus local control is active.
		0	Fieldbus local control is inactive.
10	FAULT	1	A fault is active. See chapter *Fault tracing*.
		0	No fault
11	LOCAL PANEL	1	Local control is active, i.e. drive is controlled from PC tool or control panel.
		0	Local control is inactive.
12…15	Reserved		

6.02	STATUS WORD 2	FW block: DRIVE LOGIC (page 43)

Status word 2.

Bit	Name	Val.	Information
0	START ACT	1	Drive start command is active.
		0	Drive start command is inactive.
1	STOP ACT	1	Drive stop command is active.
		0	Drive stop command is inactive.
2	READY RELAY	1	Ready to function: run enable signal on, no fault, emergency stop signal off, no ID run inhibition.
		0	Not ready to function
3	MODULATING	1	Modulating: IGBTs are controlled, i.e. the drive is RUNNING.
		0	No modulation: IGBTs are not controlled.
4	REF RUNNING	1	Normal operation is enabled. Running. Drive follows the given reference.
		0	Normal operation is disabled, Drive is not following the given reference (e.g. in synchronization phase converter is modulating).
5	JOGGING	1	Jogging function 1 or 2 is active.
		0	Jogging function is inactive.
6	OFF1	1	Emergency stop OFF1 is active.
		0	Emergency stop OFF1 is inactive.
7	START INH MASK	1	Maskable (by par. 10.12 START INHIBIT) start inhibit is active.
		0	No start inhibit (maskable)
8	START INH NOMASK	1	Non-maskable start inhibit is active.
		0	No start inhibit (non-maskable)
9	CHRG REL CLOSED	1	Charging relay is closed.
		0	Charging relay is open.
10	STO ACT	1	Safe Torque Off function is active. See parameter 46.07 STO DIAGNOSTIC.
		0	Safe Torque Off function is inactive.
11	Reserved		
12	RAMP IN 0	1	Ramp Function Generator input is forced to zero.
		0	Normal operation
13	RAMP HOLD	1	Ramp Function Generator output is held.
		0	Normal operation
14	RAMP OUT 0	1	Ramp Function Generator output is forced to zero.
		0	Normal operation
15	Reserved		

6.05 LIMIT WORD 1 — FW block: DRIVE LOGIC (page 43)

Limit word 1.

Bit	Name	Val.	Information
0	LIMIT	1	Combined limitation status of FA and LC. Set if any bit in 6.05 or 6.07 is set.
1	UDC REF MIN LIM	1	DC voltage reference at minimum limit.
2	UDC REF MAX LIM	1	DC voltage reference at maximum limit.
3	UDC REF INCREASED	1	DC voltage reference increased by LC based on 40.04 VOLTAGE RESERVE.
4	Q REF MIN LIM	1	Reactive power reference at minimum limit.
5	Q REF MAX LIM	1	Reactive power reference at maximum limit.
6	Q REF POS LIM	1	Capacitive power limited by LC.
7	Q REF NEG LIM	1	Inductive power limited by LC.
8…15	Reserved		

6.07 LC LIM STATUS — FW block: DRIVE LOGIC (page 43)

Line converter control limitation status word.

Bit	Name	Val.	Information
0	UNDERVOLTAGE	1	DC voltage controller is limiting power based on 60.04 (only in POWER control mode).
1	OVERVOLTAGE	1	DC voltage controller is limiting power based on 60.05 (only in POWER control mode).
2	MINIMUM POWER	1	Power reference minimum limit is active. Limit is defined by parameter 62.04 MINIMUM POW REF.
3	MAXIMUM POWER	1	Power reference maximum limit is active. Limit is defined by parameter 62.03 MAXIMUM POW REF.
4	ACTIVE CURRENT	1	Active current is limited.
5	REACTIVE CURRENT	1	Reactive current is limited.
6…8	Reserved		
9	I2MAX CURRENT	1	Inverter maximum output current limit is active.
10	USER CURRENT	1	Current limit defined by parameter 20.05 MAXIMUM CURRENT is active.
11	Reserved		
12	INU OVERTEMP	1	Current is limited based on thermal model.
13	INU OVERLOAD	1	Current is limited based on thermal model.
14	Reserved		

6.12	OP MODE ACK	FW block: REFERENCE CTRL (page 66)
	Operation mode acknowledge.	
	(0) STOPPED	Converter is not modulating or is not ready to follow given reference.
	(1) DC VOLTAGE	DC voltage reference is followed.
	(2) ACTIVE POWER	Power reference is followed in Power control mode.
	(3) INTERNAL REF	DC voltage control mode is active and input reference 4.10 DC REF1 is zero. DC voltage level is controlled based on parameter 40.04 VOLTAGE RESERVE.
6.13	SUPERV STATUS	FW block: NONE
	Supervision status word. Bits 0 and 2 reflect the status of supervisory functions 1 and 3, respectively. The functions are configured in parameter group 33 SUPERVISION.	

Group 08 ALARMS & FAULTS

Signals containing alarm and fault information.

<table>
<tr><th colspan="3">08 ALARMS & FAULTS</th></tr>
<tr><td>8.01</td><td>ACTIVE FAULT</td><td>FW block: FAULT FUNCTIONS (page 70)</td></tr>
<tr><td></td><td colspan="2">Fault code of the latest (active) fault.</td></tr>
<tr><td>8.02</td><td>LAST FAULT</td><td>FW block: FAULT FUNCTIONS (page 70)</td></tr>
<tr><td></td><td colspan="2">Fault code of the 2nd latest fault.</td></tr>
<tr><td>8.03</td><td>FAULT TIME HI</td><td>FW block: FAULT FUNCTIONS (page 70)</td></tr>
<tr><td></td><td colspan="2">Time (real time or power-on time) at which the active fault occurred in format dd.mm.yy (=day.month.year).</td></tr>
<tr><td>8.04</td><td>FAULT TIME LO</td><td>FW block: FAULT FUNCTIONS (page 70)</td></tr>
<tr><td></td><td colspan="2">Time (real time or power-on time) at which the active fault occurred in format hh.mm.ss (hours.minutes.seconds).</td></tr>
<tr><td>8.05</td><td>ALARM WORD 1</td><td>FW block: FAULT FUNCTIONS (page 70)</td></tr>
<tr><td></td><td colspan="2">Alarm word 1. For possible causes and remedies, see chapter Fault tracing.
<table>
<tr><th>Bit</th><th>Alarm</th></tr>
<tr><td>0…2</td><td>Reserved</td></tr>
<tr><td>3</td><td>SAFE TORQUE OFF</td></tr>
<tr><td>4</td><td>STO MODE CHANGE</td></tr>
<tr><td>5</td><td>EXT TEMPERATURE</td></tr>
<tr><td>6</td><td>EMERGENCY OFF</td></tr>
<tr><td>7</td><td>RUN ENABLE</td></tr>
<tr><td>8</td><td>ID-RUN</td></tr>
<tr><td>9</td><td>EMERGENCY STOP</td></tr>
<tr><td>10</td><td>Reserved</td></tr>
<tr><td>11</td><td>BR OVERHEAT</td></tr>
<tr><td>12</td><td>BC OVERHEAT</td></tr>
<tr><td>13</td><td>DEVICE OVERTEMP</td></tr>
<tr><td>14</td><td>INTBOARD OVERTEMP</td></tr>
<tr><td>15</td><td>BC MOD OVERTEMP</td></tr>
</table></td></tr>
</table>

8.06	ALARM WORD 2	FW block: FAULT FUNCTIONS (page 70)

Alarm word 2. For possible causes and remedies, see chapter *Fault tracing*.

Bit	Alarm
0	IGBT OVERTEMP
1	FIELDBUS COMM
2	LOCAL CTRL LOSS
3	AI SUPERVISION
4…15	Reserved

8.07	ALARM WORD 3	FW block: FAULT FUNCTIONS (page 70)

Alarm word 3. For possible causes and remedies, see chapter *Fault tracing*.

Bit	Alarm
0	Reserved
1	D2D COMMUNICATION
2	D2D BUF OVLOAD
3	PS COMM
4	RESTORE
5	CUR MEAS CALIBRATION
6	Reserved
7	EARTH FAULT
8…9	Reserved
10	D2D CONFIG
11…15	Reserved

8.08	ALARM WORD 4	FW block: FAULT FUNCTIONS (page 70)

Alarm word 4. For possible causes and remedies, see chapter *Fault tracing*.

Bit	Alarm
0	OPTION COMM LOSS
1…15	Reserved

Group 09 SYSTEM INFO

Regen supply module type, firmware version, option slot information.

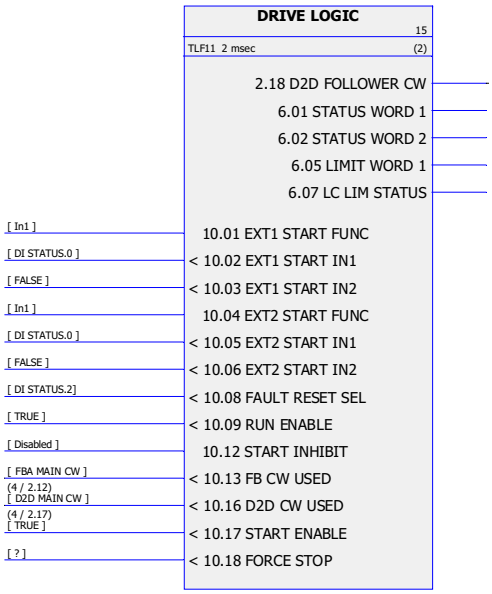
09 SYSTEM INFO		
9.01	DRIVE TYPE	FW block: None
	Displays the regen supply module application type. **(0)** UNDEFINED **(6)** ACSM1 REGEN: ACSM1 regenerative supply module.	
9.02	DRIVE RATING ID	FW block: None
	Displays the inverter type of the drive. **(0)** UNCONFIGURED, **(1)** ACSM1-xxAx-02A5-4, **(2)** ACSM1-xxAx-03A0-4, **(3)** ACSM1-xxAx-04A0-4, **(4)** ACSM1-xxAx-05A0-4, **(5)** ACSM1-xxAx-07A0-4, **(6)** ACSM1-xxAx-09A5-4, **(7)** ACSM1-xxAx-012A-4, **(8)** ACSM1-xxAx-016A-4, **(9)** ACSM1-xxAx-024A-4, **(10)** ACSM1-xxAx-031A-4, **(11)** ACSM1-xxAx-040A-4, **(12)** ACSM1-xxAx-046A-4, **(13)** ACSM1-xxAx-060A-4, **(14)** ACSM1-xxAx-073A-4, **(15)** ACSM1-xxAx-090A-4, **(20)** ACSM1-xxAx-110A-4, **(21)** ACSM1-xxAx-135A-4, **(22)** ACSM1-xxAx-175A-4, **(23)** ACSM1-xxAx-210A-4, **(24)** ACSM1-xxCx-024A-4, **(25)** ACSM1-xxCx-031A-4, **(26)** ACSM1-xxCx-040A-4, **(27)** ACSM1-xxCx-046A-4, **(28)** ACSM1-xxCx-060A-4, **(29)** ACSM1-xxCx-073A-4, **(30)** ACSM1-xxCx-090A-4, **(31)** ACSM1-xxLx-110A-4, **(32)** ACSM1-xxLx-135A-4, **(33)** ACSM1-xxLx-175A-4, **(34)** ACSM1-xxLx-210A-4, **(35)** ACSM1-xxLx-260A-4, **(124)** ACS850-430A, **(125)** ACS850-521A, **(126)** ACS850-602A, (**127)** ACS850-693A, **(128)** ACS850-720A	
9.03	FIRMWARE ID	FW block: None
	Displays the firmware name. E.g. ULFI.	
9.04	FIRMWARE VER	FW block: None
	Displays the version of the firmware package in the regen supply module, e.g. 0x1460 (1460 hex).	
9.05	FIRMWARE PATCH	FW block: None
	Displays the version of the firmware patch in the regen supply module.	
9.10	INT LOGIC VER	FW block: None
	Displays the version of the logic in the power unit interface.	
9.20	OPTION SLOT 1	FW block: None
	Displays the type of the optional module in option Slot 1. **(0)** NO OPTION, **(1)** NO COMM, **(2)** UNKNOWN, **(3)** FEN-01, **(4)** FEN-11, **(5)** FEN-21, **(6)** FIO-01, **(7)** FIO-11, **(8)** FPBA-01, **(9)** FPBA-02, **(10)** FCAN-01, **(11)** FDNA-01, **(12)** FENA-01, **(13)** FENA-02, **(14)** FLON-01, **(15)** FRSA-00, **(16)** FMBA-01, **(17)** FFOA-01, **(18)** FFOA-02, **(19)** FSEN-21, **(20)** FEN-31, **(21)** FIO-21, **(22)** FSCA-01, **(23)** FSEA-21	
9.21	OPTION SLOT 2	FW block: None
	Displays the type of the optional module in option Slot 2. See signal 9.20 OPTION SLOT 1.	
9.22	OPTION SLOT 3	FW block: None
	Displays the type of the optional module in option Slot 3. See signal 9.20 OPTION SLOT 1.	

Group 10 START/STOP

Settings for

- selecting start/stop signal sources for external control locations EXT1 and EXT2
- selecting sources for external fault reset, run enable and start enable signals
- enabling the start inhibit function.

<table>
<tr><th colspan="3">10 START/STOP</th></tr>
<tr><td colspan="2">Firmware block:
DRIVE LOGIC
(10)

This block
• selects the sources for the start/stop signals for external control locations EXT1 and EXT2
• selects the sources for external fault reset, run enable and start enable signals
• enables the start inhibit function.</td><td> 
</td></tr>
<tr><td colspan="2">Block outputs located in other parameter groups</td><td>2.18 D2D FOLLOWER CW (page 34)
6.01 STATUS WORD 1 (page 36)
6.02 STATUS WORD 2 (page 37)
6.05 LIMIT WORD 1 (page 38)
6.07 LC LIM STATUS (page 38)</td></tr>
<tr><td>10.01</td><td>EXT1 START FUNC</td><td>FW block: DRIVE LOGIC (see above)</td></tr>
<tr><td></td><td colspan="2">Selects the source for the start and stop control in external control location EXT1.
Note: This parameter cannot be changed while the regen supply module is running.</td></tr>
<tr><td></td><td>(0) NOT SEL</td><td>No source selected.</td></tr>
<tr><td></td><td>(1) IN1</td><td>Source of the start and stop commands are selected by parameter 10.02 EXT1 START IN1. The start/stop is controlled as follows:
<table>
<tr><th>Par. 10.02</th><th>Command</th></tr>
<tr><td>0 -> 1</td><td>Start</td></tr>
<tr><td>1 -> 0</td><td>Stop</td></tr>
</table></td></tr>
</table>

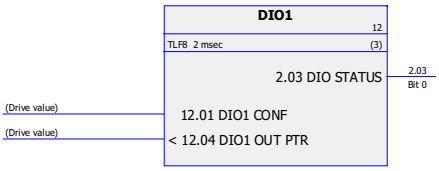
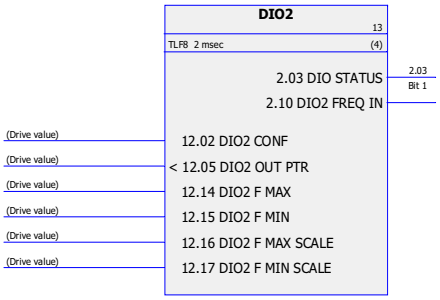
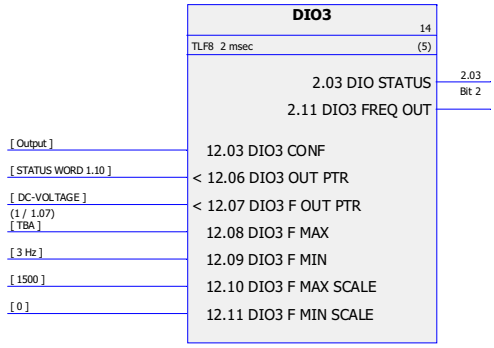
<table>
<tr><td></td><td>(2) 3-WIRE</td><td>Source of the start and stop commands are selected by parameters 10.02 EXT1 START IN1 and 10.03 EXT1 START IN2. The start/stop is controlled as follows:
<table><tr><th>Par. 10.02</th><th>Par. 10.03</th><th>Command</th></tr><tr><td>0 -> 1</td><td>1</td><td>Start</td></tr><tr><td>Any</td><td>1 -> 0</td><td>Stop</td></tr><tr><td>Any</td><td>0</td><td>Stop</td></tr></table></td></tr>
<tr><td></td><td>(3) FBA</td><td>Start and stop control from the source selected by parameter 10.13 FB CW USED.</td></tr>
<tr><td></td><td>(4) D2D</td><td>Start and stop control from another regen supply module via D2D Control Word.</td></tr>
<tr><td>10.02</td><td>EXT1 START IN1</td><td>FW block: DRIVE LOGIC (see above)</td></tr>
<tr><td></td><td colspan="2">Selects the source 1 for the start and stop commands in external control location EXT1. See parameter 10.01 EXT1 START FUNC selections (1) IN1 and (2) 3-WIRE.
Note: This parameter cannot be changed while the regen supply module is running.</td></tr>
<tr><td></td><td colspan="2">Bit pointer: Group, index and bit</td></tr>
<tr><td>10.03</td><td>EXT1 START IN2</td><td>FW block: DRIVE LOGIC (see above)</td></tr>
<tr><td></td><td colspan="2">Selects the source 2 for the start and stop commands in external control location EXT1. See parameter 10.01 EXT1 START FUNC selection (2) 3-WIRE.
Note: This parameter cannot be changed while the regen supply module is running.</td></tr>
<tr><td></td><td colspan="2">Bit pointer: Group, index and bit</td></tr>
<tr><td>10.04</td><td>EXT2 START FUNC</td><td>FW block: DRIVE LOGIC (see above)</td></tr>
<tr><td></td><td colspan="2">Selects the source for the start and stop control in external control location EXT2.
Note: This parameter cannot be changed while the regen supply module is running.</td></tr>
<tr><td></td><td>(0) NOT SEL</td><td>No source selected.</td></tr>
<tr><td></td><td>(1) IN1</td><td>Source of the start and stop commands are selected by parameter 10.05 EXT2 START IN1. The start/stop is controlled as follows:
<table><tr><th>Par. 10.05</th><th>Command</th></tr><tr><td>0 -> 1</td><td>Start</td></tr><tr><td>1 -> 0</td><td>Stop</td></tr></table></td></tr>
<tr><td></td><td>(2) 3-WIRE</td><td>Source of the start and stop commands are selected by parameters 10.05 EXT2 START IN1 and 10.06 EXT2 START IN2. The start/stop is controlled as follows:
<table><tr><th>Par. 10.05</th><th>Par. 10.06</th><th>Command</th></tr><tr><td>0 -> 1</td><td>1</td><td>Start</td></tr><tr><td>Any</td><td>1 -> 0</td><td>Stop</td></tr><tr><td>Any</td><td>0</td><td>Stop</td></tr></table></td></tr>
<tr><td></td><td>(3) FBA</td><td>Start and stop control from the source selected by parameter 10.13 FB CW USED.</td></tr>
</table>

	(4) D2D	Start and stop control from another regen supply module via D2D Control Word (par. 2.17 D2D MAIN CW).
10.05	EXT2 START IN1	FW block: DRIVE LOGIC (see above)
	Selects the source 1 for the start and stop commands in external control location EXT2. See parameter 10.04 EXT2 START FUNC selections (1) IN1 and (2) 3-WIRE. **Note:** This parameter cannot be changed while the regen supply module is running.	
	Bit pointer: Group, index and bit	
10.06	EXT2 START IN2	FW block: DRIVE LOGIC (see above)
	Selects the source 2 for the start and stop commands in external control location EXT2. See parameter 10.04 EXT2 START FUNC selection (2) 3-WIRE. **Note:** This parameter cannot be changed while the regen supply module is running.	
	Bit pointer: Group, index and bit	
10.08	FAULT RESET SEL	FW block: DRIVE LOGIC (see above)
	Selects the source for the external fault reset signal. The signal resets the regen supply module after a fault trip if the cause of the fault no longer exists. 1 = Fault reset.	
	Bit pointer: Group, index and bit	
10.09	RUN ENABLE	FW block: DRIVE LOGIC (see above)
	Selects the source for the run enable signal. If the run enable signal is switched off, the regen supply module will not start or stops if the regen supply module is running. 1 = Run enable. **Note:** This parameter cannot be changed while the regen supply module is running.	
	Bit pointer: Group, index and bit	
10.12	START INHIBIT	FW block: DRIVE LOGIC (see above)
	Enables the start inhibit function. The start inhibit function prevents regen supply module restart (i.e. protects against unexpected start) if • regen supply module trips on a fault and fault is reset. • run enable signal activates while the start command is active. See parameter 10.09 RUN ENABLE. • control changes from local to remote. • external control switches from EXT1 to EXT2 or from EXT2 to EXT1. An active start inhibit can be reset with a stop command. Note that in certain applications it is necessary to allow the regen supply module to restart.	
	(0) DISABLED	Start inhibit function disabled.
	(1) ENABLED	Start inhibit function enabled.
10.13	FB CW USED	FW block: DRIVE LOGIC (see above)
	Selects the source for the control word when fieldbus (FBA) is selected as the external start and stop control location (see parameters 10.01 EXT1 START FUNC and 10.04 EXT2 START FUNC). By default, the source is parameter 2.12 FBA MAIN CW. **Note:** This parameter cannot be changed while the regen supply module is running.	
	Value pointer: Group and index	

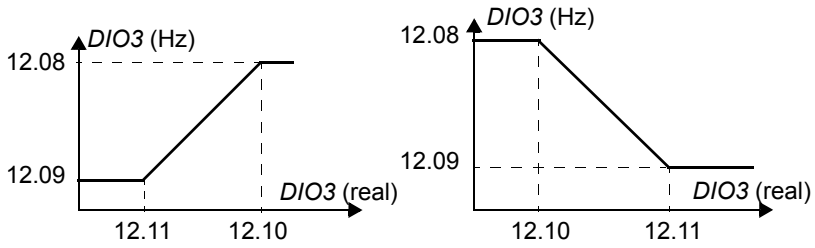
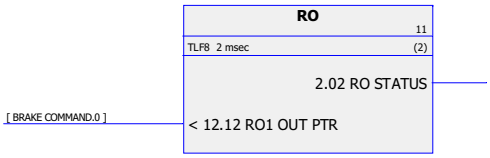
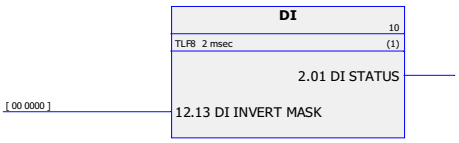
10.16	D2D CW USED	FW block: DRIVE LOGIC (see above)
	Selects the source for the control word for drive-to-drive communication. By default, the source is parameter 2.17 D2D MAIN CW.	
	Value pointer: Group and index	
10.17	START ENABLE	FW block: DRIVE LOGIC (see above)
	Selects the source for the start enable signal. If the start enable signal is switched off, the regen supply module will not start or stops if the regen supply module is running. 1 = Start enable. **Note:** This parameter cannot be changed while the regen supply module is running.	
	Bit pointer: Group, index and bit	
10.18	FORCE STOP	FW block: DRIVE LOGIC (see above)
	Stops modulation and prevents starting while active. **Note:** Force stop also prevents the start command in local control.	

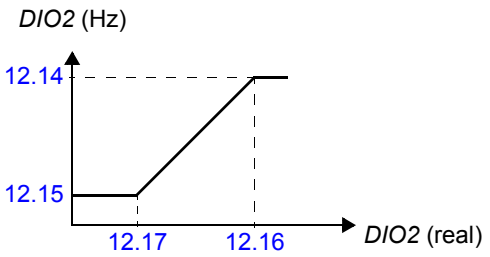
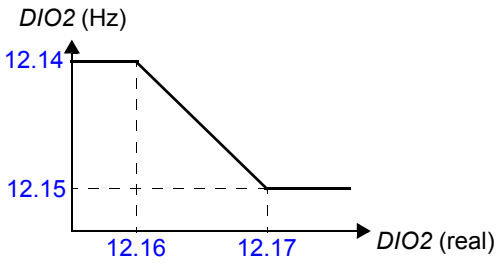
Group 12 DIGITAL IO

Settings for the digital inputs and outputs, and the relay output.

12 DIGITAL IO		
Firmware block: **DIO1** (6) Selects whether DIO1 is used as a digital input or as a digital output and connects an actual signal to the digital output. The block also shows the DIO status.		
Block outputs located in other parameter groups		2.03 DIO STATUS (page 31)
Firmware block: **DIO2** (7) Selects whether DIO2 is used as a digital or frequency input or as a digital output and connects an actual signal to the digital output. The block also shows the DIO status. Frequency input can be scaled with standard function blocks. See chapter *Standard function blocks*.		
Block outputs located in other parameter groups		2.03 DIO STATUS (page 31) 2.10 DIO2 FREQ IN (page 31)
Firmware block: **DIO3** (8) Selects whether DIO3 is used as a digital input or as a digital/frequency output, connects an actual signal to the digital/frequency output and scales the frequency output. The block also shows the DIO status.		
Block outputs located in other parameter groups		2.03 DIO STATUS (page 31) 2.11 DIO3 FREQ OUT (page 31)
12.01	DIO1 CONF	FW block: DIO1 (see above)
	Selects whether DIO1 is used as a digital input or as a digital output.	
	(0) OUTPUT	DIO1 is used as a digital output.

	(1) INPUT	DIO1 is used as a digital input.
12.02	DIO2 CONF	FW block: DIO2 (see above)
	Selects whether DIO2 is used as a digital input, as a digital output or as a frequency input.	
	(0) OUTPUT	DIO2 is used as a digital output.
	(1) INPUT	DIO2 is used as a digital input.
	(2) FREQ INPUT	DIO2 is used as a frequency input.
12.03	DIO3 CONF	FW block: DIO3 (see above)
	Selects whether DIO3 is used as a digital input, as a digital output or as a frequency output.	
	(0) OUTPUT	DIO2 is used as a digital output.
	(1) INPUT	DIO2 is used as a digital input.
	(2) FREQ OUTPUT	DIO2 is used as a frequency output.
12.04	DIO1 OUT PTR	FW block: DIO1 (see above)
	Selects a regen supply module signal to be connected to digital output DIO1 (when 12.01 DIO1 CONF is set to (0) OUTPUT).	
	Bit pointer: Group, index and bit	
12.05	DIO2 OUT PTR	FW block: DIO2 (see above)
	Selects a regen supply module signal to be connected to digital output DIO2 (when 12.02 DIO2 CONF is set to (0) OUTPUT).	
	Bit pointer: Group, index and bit	
12.06	DIO3 OUT PTR	FW block: DIO3 (see above)
	Selects a regen supply module signal to be connected to digital output DIO3 (when 12.03 DIO3 CONF is set to (0) OUTPUT).	
	Bit pointer: Group, index and bit	
12.07	DIO3 F OUT PTR	FW block: DIO3 (see above)
	Selects a regen supply module signal to be connected to frequency output (when 12.03 DIO3 CONF is set to (2) FREQ OUTPUT).	
	Value pointer: Group and index	
12.08	DIO3 F MAX	FW block: DIO3 (see above)
	Defines the maximum value for frequency output (when 12.03 DIO3 CONF is set to (2) FREQ OUTPUT).	
	3…32768 Hz	Maximum DIO3 output frequency.

12.09	DIO3 F MIN	FW block: DIO3 (see above)
	Defines the minimum value for frequency output (when 12.03 DIO3 CONF is set to (2) FREQ OUTPUT).	
	3…32768 Hz	Minimum DIO3 output frequency.
12.10	DIO3 F MAX SCALE	FW block: DIO3 (see above)
	Defines the real value that corresponds to the maximum frequency output value defined by parameter 12.08 DIO3 F MAX. 	
	0…32768	Real value corresponding to value of parameter 12.08.
12.11	DIO3 F MIN SCALE	FW block: DIO3 (see above)
	Defines the real value that corresponds to the minimum frequency output value defined by parameter 12.09 DIO3 F MIN. See parameter 12.10 DIO3 F MAX SCALE.	
	0…32768	Real value corresponding to value of parameter 12.09.
Firmware block: **RO** (5) Connects an actual signal to the relay output. The block also shows the relay output status.		
Block outputs located in other parameter groups		2.02 RO STATUS (page 31)
12.12	RO1 OUT PTR	FW block: RO (see above)
	Selects a regen supply module signal to be connected to relay output RO1.	
	Bit pointer: Group, index and bit	
Firmware block: **DI** (4) Shows the status of the digital inputs. Inverts the status of any DI if desired.		
Block outputs located in other parameter groups		2.01 DI STATUS (page 31)

12.13	DI INVERT MASK	FW block: DI (see above)
	Inverts status of digital inputs as reported by 2.01 DI STATUS. For example, a value of 0b000100 inverts the status of DI3 in the signal.	
	0b000000…0b111111	DI status inversion mask.
12.14	DIO2 F MAX	FW block: DIO2 (see above)
	Defines the maximum value for frequency input (when 12.02 DIO2 CONF is set to (2) FREQ INPUT).	
	3…32768 Hz	Maximum DIO2 input frequency.
12.15	DIO2 F MIN	FW block: DIO2 (see above)
	Defines the minimum value for frequency input (when 12.02 DIO2 CONF is set to (2) FREQ INPUT).	
	3…32768 Hz	Minimum DIO2 input frequency.
12.16	DIO2 F MAX SCALE	FW block: DIO2 (see above)
	Defines the real value that corresponds to the maximum frequency input value defined by parameter 12.14 DIO2 F MAX.  	
	-32768…32768	Real value corresponding to value of parameter 12.14.
12.17	DIO2 F MIN SCALE	FW block: DIO2 (see above)
	Defines the real value that corresponds to the minimum frequency input value defined by parameter 12.15 DIO2 F MIN. See parameter 12.16 DIO2 F MAX SCALE.	
	-32768…32768	Real value corresponding to value of parameter 12.15.

Group 13 ANALOGUE INPUTS

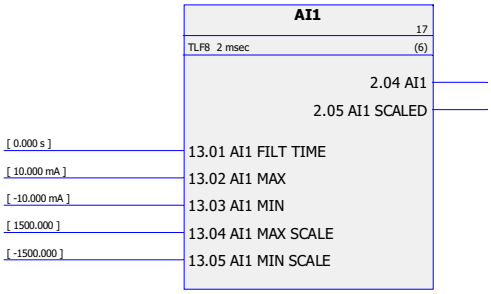
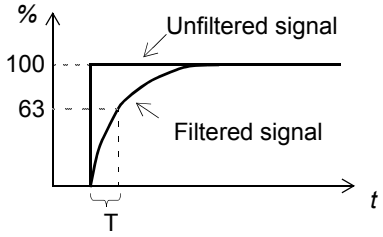
Settings for the analogue inputs.

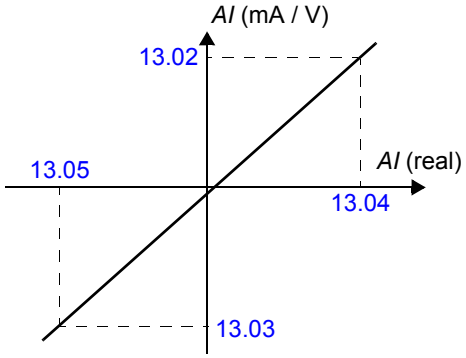
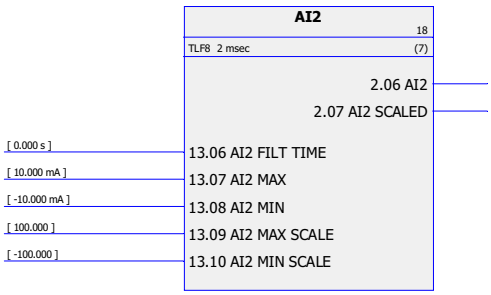
The regen supply module offers two programmable analogue inputs, AI1 and AI2. Both inputs can be used either as a voltage or a current input (-11…11 V or -22…22 mA). The input type is selected with jumpers J1 and J2 respectively on the JCU Control Unit.

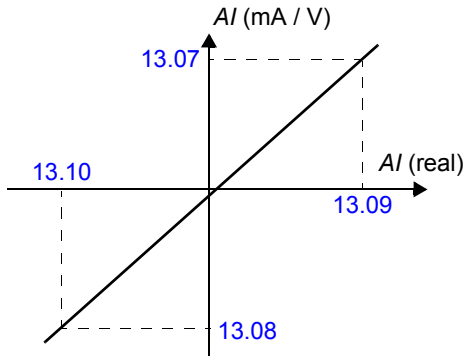
The inaccuracy of the analogue inputs is 1% of the full scale range and the resolution is 11 bits (+ sign). The hardware filter time constant is approximately 0.25 ms.

Analogue inputs can be used as the source for DC voltage/power and reactive power reference.

Analogue input supervision can be added with standard function blocks. See chapter Standard function blocks.

13 ANALOGUE INPUTS		
Firmware block: **AI1** (12) Filters and scales the analogue input AI1 signal and selects the AI1 supervision. Also shows the value of the input.		
Block outputs located in other parameter groups		2.04 AI1 (page 31) 2.05 AI1 SCALED (page 31)
13.01	AI1 FILT TIME	FW block: AI1 (see above)
	Defines the filter time constant for analogue input AI1.  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time T = filter time constant **Note:** The signal is also filtered due to the signal interface hardware (approximately 0.25 ms time constant). This cannot be changed by any parameter.	
	0…30 s	Filter time constant for AI1.
13.02	AI1 MAX	FW block: AI1 (see above)
	Defines the maximum value for analogue input AI1. The type is selected with jumper J1 on the JCU Control Unit.	
	-11…11 V / -22…22 mA	Maximum AI1 input value.

13.03	AI1 MIN	FW block: AI1 (see above)
	Defines the minimum value for analogue input AI1. The type is selected with jumper J1 on the JCU Control Unit.	
	-11…11 V / -22…22 mA	Minimum AI1 input value.
13.04	AI1 MAX SCALE	FW block: AI1 (see above)
	Defines the real value that corresponds to the maximum analogue input value defined by parameter 13.02 AI1 MAX.  	
	-32768…32768	Real value corresponding to value of parameter 13.02.
13.05	AI1 MIN SCALE	FW block: AI1 (see above)
	Defines the real value that corresponds to the minimum analogue input value defined by parameter 13.03 AI1 MIN. See parameter 13.04 AI1 MAX SCALE.	
	-32768…32768	Real value corresponding to value of parameter 13.03.
Firmware block: **AI2** (13) Filters and scales the analogue input AI2 signal and selects the AI2 supervision. Also shows the value of the input.		
Block outputs located in other parameter groups		2.06 AI2 (page 31) 2.07 AI2 SCALED (page 31)
13.06	AI2 FILT TIME	FW block: AI2 (see above)
	Defines the filter time constant for analogue input AI2. See parameter 13.01 AI1 FILT TIME.	
	0…30 s	Filter time constant for AI2.
13.07	AI2 MAX	FW block: AI2 (see above)
	Defines the maximum value for analogue input AI2. The type is selected with jumper J2 on the JCU Control Unit.	

	-11…11 V / -22…22 mA	Maximum AI2 input value.
13.08	AI2 MIN	FW block: AI2 (see above)
	Defines the minimum value for analogue input AI2. The type is selected with jumper J2 on the JCU Control Unit.	
	-11…11 V / -22…22 mA	Minimum AI2 input value.
13.09	AI2 MAX SCALE	FW block: AI2 (see above)
	Defines the real value that corresponds to the maximum analogue input value defined by parameter 13.07 AI2 MAX.  	
	-32768…32768	Real value corresponding to value of parameter 13.07.
13.10	AI2 MIN SCALE	FW block: AI2 (see above)
	Defines the real value that corresponds to the minimum analogue input value defined by parameter 13.08 AI2 MIN. See parameter 13.09 AI2 MAX SCALE.	
	-32768…32768	Real value corresponding to value of parameter 13.08.
13.11	AITUNE	FW block: None
	Triggers the AI tuning function. Connect the signal to the input and select the appropriate tuning function.	
	(0) NO ACTION	AI tune is not activated.
	(1) AI1 MIN TUNE	Current analogue input AI1 signal value is set as minimum value for AI1, parameter 13.03 AI1 MIN. The value reverts back to (0) NO ACTION automatically.
	(2) AI1 MAX TUNE	Current analogue input AI1 signal value is set as maximum value for AI1, parameter 13.02 AI1 MAX. The value reverts back to (0) NO ACTION automatically.
	(3) AI2 MIN TUNE	Current analogue input AI2 signal value is set as minimum value for AI2, parameter 13.08 AI2 MIN. The value reverts back to (0) NO ACTION automatically.
	(4) AI2 MAX TUNE	Current analogue input AI2 signal value is set as maximum value for AI2, parameter 13.07 AI2 MAX. The value reverts back to (0) NO ACTION automatically.

<table>
<tr><td>13.12</td><td>AI SUPERVISION</td><td>FW block: None</td></tr>
<tr><td></td><td colspan="2">Selects how the regen supply module reacts when analogue input signal limit is reached. The limit is selected by parameter 13.13 AI SUPERVIS ACT.</td></tr>
<tr><td></td><td>(0) NO</td><td>No action taken.</td></tr>
<tr><td></td><td>(1) FAULT</td><td>The regen supply module trips on fault AI SUPERVISION.</td></tr>
<tr><td>13.13</td><td>AI SUPERVIS ACT</td><td>FW block: None</td></tr>
<tr><td></td><td colspan="2">Selects the analogue input signal supervision limit.
<table>
<tr><th>Bit</th><th></th><th>Supervision selected by parameter 13.12 AI SUPERVISION is activated if</th></tr>
<tr><td>0</td><td>AI1<min</td><td>AI1 signal value falls below the value defined by equation:
par. 13.03 AI1 MIN - 0.5 mA or V</td></tr>
<tr><td>1</td><td>AI1>max</td><td>AI1 signal value exceeds the value defined by equation:
par. 13.02 AI1 MAX + 0.5 mA or V</td></tr>
<tr><td>2</td><td>AI2<min</td><td>AI2 signal value falls below the value defined by equation:
par. 13.08 AI2 MIN - 0.5 mA or V</td></tr>
<tr><td>3</td><td>AI2>min</td><td>AI2 signal value exceeds the value defined by equation:
par. 13.07 AI2 MAX + 0.5 mA or V</td></tr>
</table>
Example: If parameter value is set to 0010 (bin), bit 1 AI1>max is selected.</td></tr>
<tr><td></td><td>0b0000…0b1111</td><td>AI1/AI2 signal supervision selection.</td></tr>
</table>

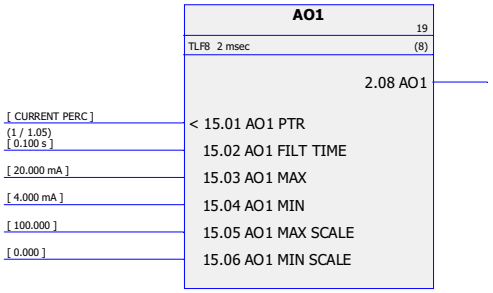
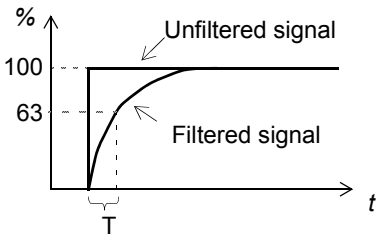
Group 15 ANALOGUE OUTPUTS

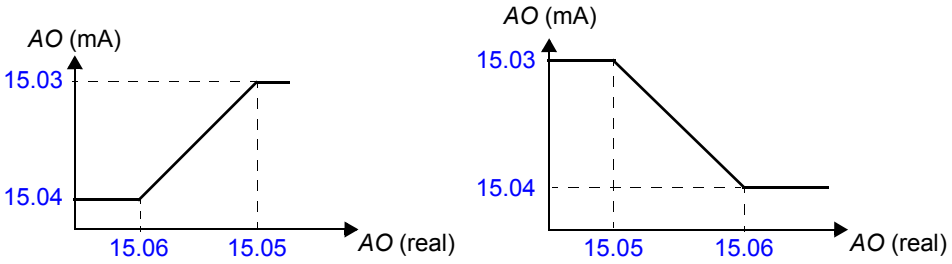
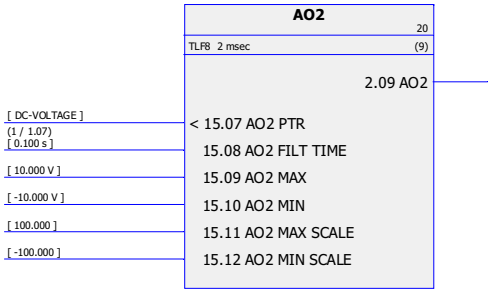
Settings for the analogue outputs.

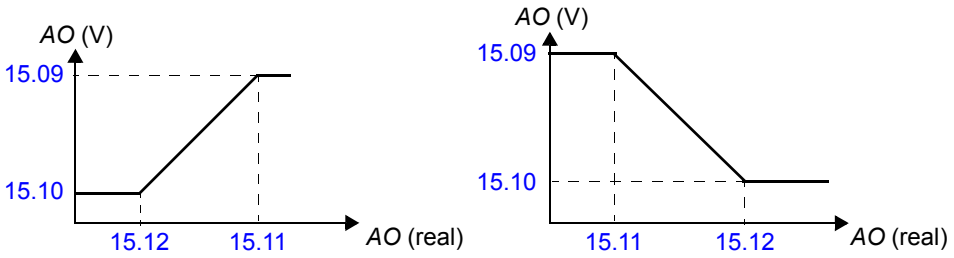
The regen supply module offers two programmable analogue outputs: one current output AO1 (0…20 mA) and one voltage output AO2 (-10…10 V).

The resolution of the analogue outputs is 11 bits (+ sign) and the inaccuracy is 2% of the full scale range.

The analogue output signals can be proportional to DC voltage, output frequency, output current, power, etc. It is possible to write a value to an analogue output through a serial communication link (e.g. fieldbus link).

15 ANALOGUE OUTPUTS		
Firmware block: **AO1** (14) Connects an actual signal to analogue output AO1, and filters and scales the output signal. Also shows the value of the output.		
Block outputs located in other parameter groups		2.08 AO1 (page 31)
15.01	AO1 PTR	FW block: AO1 (see above)
	Selects a regen supply module signal to be connected to analogue output AO1.	
	Value pointer: Group and index	
15.02	AO1 FILT TIME	FW block: AO1 (see above)
	Defines the filtering time constant for analogue output AO1.  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time T = filter time constant **Note:** The signal is also filtered due to the signal interface hardware (approximately 0.5 ms time constant). This cannot be changed by any parameter.	
	0…30 s	Filter time constant for AO1.
15.03	AO1 MAX	FW block: AO1 (see above)
	Defines the maximum value for analogue output AO1.	
	0…22.7 mA	Maximum AO1 output value.

15.04	AO1 MIN	FW block: AO1 (see above)
	Defines the minimum value for analogue output AO1.	
	0…22.7 mA	Minimum AO1 output value.
15.05	AO1 MAX SCALE	FW block: AO1 (see above)
	Defines the real value that corresponds to the maximum analogue output value defined by parameter 15.03 AO1 MAX. 	
	-32768…32767	Real value corresponding to value of parameter 15.03.
15.06	AO1 MIN SCALE	FW block: AO1 (see above)
	Defines the real value that corresponds to the minimum analogue output value defined by parameter 15.04 AO1 MIN. See parameter 15.05 AO1 MAX SCALE.	
	-32768…32767	Real value corresponding to value of parameter 15.04.
Firmware block: **AO2** (15) Connects an actual signal to analogue output AO2, and filters and scales the output signal. Also shows the value of the output.		
Block outputs located in other parameter groups		2.09 AO2 (page 31)
15.07	AO2 PTR	FW block: AO2 (see above)
	Selects a regen supply module signal to be connected to analogue output AO2.	
	Value pointer: Group and index	
15.08	AO2 FILT TIME	FW block: AO2 (see above)
	Defines the filtering time constant for analogue output AO2. See parameter 15.02 AO1 FILT TIME.	
	0…30 s	Filter time constant for AO2.

15.09	AO2 MAX	FW block: AO2 (see above)
	Defines the maximum value for analogue output AO2.	
	-10…10 V	Maximum AO2 output value.
15.10	AO2 MIN	FW block: AO2 (see above)
	Defines the minimum value for analogue output AO2.	
	-10…10 V	Minimum AO2 output value.
15.11	AO2 MAX SCALE	FW block: AO2 (see above)
	Defines the real value that corresponds to the maximum analogue output value defined by parameter 15.09 AO2 MAX. 	
	-32768…32767	Real value corresponding to value of parameter 15.09.
15.12	AO2 MIN SCALE	FW block: AO2 (see above)
	Defines the real value that corresponds to the minimum analogue output value defined by parameter 15.10 AO2 MIN. See parameter 15.11 AO2 MAX SCALE.	
	-32768…32767	Real value corresponding to value of parameter 15.10.

Group 16 SYSTEM

Local control and parameter access settings, restoration of default parameter values, save of parameters into permanent memory.

16 SYSTEM		
16.01	LOCAL LOCK	FW block: None
	Selects the source for disabling local control (Take/Release button on the PC tool, LOC/REM key of the panel). 1 = Local control disabled. 0 = Local control enabled. **WARNING!** Before activating, ensure that the control panel is not needed for stopping the regen supply module!	
	Bit pointer: Group, index and bit	
16.02	PARAMETER LOCK	FW block: None
	Selects the state of the parameter lock. The lock prevents parameter changing. **Note:** This parameter can only be adjusted after the correct pass code has been entered at parameter 16.03 PASS CODE.	
	(0) LOCKED	Locked. Parameter values cannot be changed from the control panel.
	(1) OPEN	The lock is open. Parameter values can be changed.
	(2) NOT SAVED	The lock is open. Parameter values can be changed, but the changes will not be stored at power switch off.
16.03	PASS CODE	FW block: None
	After entering 358 at this parameter, parameter 16.02 PARAMETER LOCK can be adjusted. The value reverts back to 0 automatically.	
16.04	PARAM RESTORE	FW block: None
	Restores the original settings of the application, i.e. parameter factory default values. **Note:** This parameter cannot be changed while the regen supply module is running.	
	(0) DONE	Restoration is completed.
	(1) RESTORE DEFS	All parameter values are restored to default values, except motor data, ID run results, and fieldbus, drive-to-drive link and encoder configuration data.
	(2) CLEAR ALL	All parameter values are restored to default values, including motor data, ID run results and fieldbus and encoder configuration data. PC tool communication is interrupted during the restoration. Regen supply module CPU is re-booted after the restoration is completed.
16.07	PARAM SAVE	FW block: None
	Saves the valid parameter values to the permanent memory. **Note:** A new parameter value is saved automatically when changed from the PC tool or panel but not when altered through a fieldbus connection.	

	(0) DONE	Save completed.
	(1) SAVE	Save in progress.
16.09	USER SET SEL	FW block: None
	Enables the save and restoration of up to four custom sets of parameter settings. The set that was in use before powering down the regen supply module is in use after the next power-up. **Note:** Any parameter changes made after loading a set are not automatically stored – they must be saved using this parameter.	
	(1) NO REQUEST	Load or save operation complete; normal operation.
	(2) LOAD SET 1	Load user parameter set 1.
	(3) LOAD SET 2	Load user parameter set 2.
	(4) LOAD SET 3	Load user parameter set 3.
	(5) LOAD SET 4	Load user parameter set 4.
	(6) SAVE SET 1	Save user parameter set 1.
	(7) SAVE SET 2	Save user parameter set 2.
	(8) SAVE SET 3	Save user parameter set 3.
	(9) SAVE SET 4	Save user parameter set 4.
	(10) IO MODE	Load user parameter set using parameters 16.11 and 16.12.
16.10	USER SET LOG	FW block: None
	Shows the status of the user parameter sets (see parameter 16.09 USER SET SEL). Read-only.	
	N/A	No user sets have been saved.
	(1) LOADING	A user set is being loaded.
	(2) SAVING	A user set is being saved.
	(4) FAULTED	Invalid or empty parameter set.
	(8) SET1 IO ACT	User parameter set 1 has been selected by parameters 16.11 and 16.12.
	(16) SET2 IO ACT	User parameter set 2 has been selected by parameters 16.11 and 16.12.
	(32) SET3 IO ACT	User parameter set 3 has been selected by parameters 16.11 and 16.12.
	(64) SET4 IO ACT	User parameter set 4 has been selected by parameters 16.11 and 16.12.
	(128) SET1 PAR ACT	User parameter set 1 has been loaded using parameter 16.09.
	(256) SET2 PAR ACT	User parameter set 2 has been loaded using parameter 16.09.

<table>
<tr><td></td><td>(512) SET3 PAR ACT</td><td>User parameter set 3 has been loaded using parameter 16.09.</td></tr>
<tr><td></td><td>(1024) SET4 PAR ACT</td><td>User parameter set 4 has been loaded using parameter 16.09.</td></tr>
<tr><td>16.11</td><td>USER IO SET LO</td><td>FW block: None</td></tr>
<tr><td></td><td colspan="2">Together with parameter 16.12 USER IO SET HI, selects the user parameter set when parameter 16.09 USER SET SEL is set to (10) IO MODE. The status of the source defined by this parameter and parameter 16.12 select the user parameter set as follows:
<table>
<tr><th>Status of source defined by par. 16.12 (hi)</th><th>Status of source defined by par. 16.11 (lo)</th><th>User parameter set selected</th></tr>
<tr><td>0</td><td>0</td><td>Set 1</td></tr>
<tr><td>0</td><td>1</td><td>Set 2</td></tr>
<tr><td>1</td><td>0</td><td>Set 3</td></tr>
<tr><td>1</td><td>1</td><td>Set 4</td></tr>
</table></td></tr>
<tr><td></td><td colspan="2">Bit pointer: Group, index and bit</td></tr>
<tr><td>16.12</td><td>USER IO SET HI</td><td>FW block: None</td></tr>
<tr><td></td><td colspan="2">See parameter 16.11 USER IO SET LO.</td></tr>
<tr><td></td><td colspan="2">Bit pointer: Group, index and bit</td></tr>
<tr><td>16.13</td><td>TIME SOURCE PRIO</td><td>FW block: None</td></tr>
<tr><td></td><td colspan="2">Selects which real-time clock source is adopted by the regen supply module as the master real-time clock. Some selections specify multiple sources that are in order of priority.</td></tr>
<tr><td></td><td>(0) FB_D2D_MMI</td><td>Fieldbus (highest priority); drive-to-drive link; man-machine interface (control panel or PC).</td></tr>
<tr><td></td><td>(1) D2D_FB_MMI</td><td>Drive-to-drive link (highest priority); fieldbus; man-machine interface (control panel or PC).</td></tr>
<tr><td></td><td>(2) FB_D2D</td><td>Fieldbus (highest priority); drive-to-drive link.</td></tr>
<tr><td></td><td>(3) D2D_FB</td><td>Drive-to-drive link (highest priority); fieldbus.</td></tr>
<tr><td></td><td>(4) FB ONLY</td><td>Fieldbus only.</td></tr>
<tr><td></td><td>(5) D2D ONLY</td><td>Drive-to-drive link only.</td></tr>
<tr><td></td><td>(6) MMI_FB_D2D</td><td>Man-machine interface (control panel or PC) (highest priority); fieldbus; drive-to-drive link.</td></tr>
<tr><td></td><td>(7) MMI ONLY</td><td>Man-machine interface (control panel or PC) only.</td></tr>
<tr><td></td><td>(8) INTERNAL</td><td>No external sources are used as master real-time clock.</td></tr>
</table>

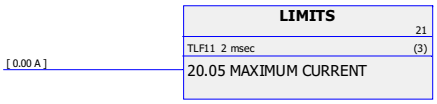
Group 17 PANEL DISPLAY

Selection of signals for panel display.

17 PANEL DISPLAY		
17.01	SIGNAL1 PARAM	FW block: None
	Selects the first signal to be displayed on the control panel. The default signal is 1.07 DC-VOLTAGE.	
	Value pointer: Group and index	
17.02	SIGNAL2 PARAM	FW block: None
	Selects the second signal to be displayed on the control panel. The default signal is 1.04 CURRENT.	
	Value pointer: Group and index	
17.03	SIGNAL3 PARAM	FW block: None
	Selects the third signal to be displayed on the control panel. The default signal is 1.22 INVERTER POWER.	
	Value pointer: Group and index	

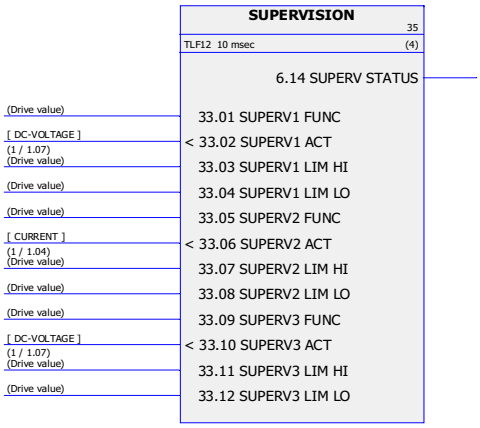
Group 20 LIMITS

Definition of regen supply module operation limit.

20 LIMITS		
Firmware block: **LIMITS** (20) Adjusts the regen supply module current limit.		
20.05	MAXIMUM CURRENT	FW block: LIMITS (see above).
	Defines the allowed maximum converter current.	
	0…30000 A	
20.08	THERM CURR LIM	FW block: None
	Enables the thermal current limitation. Thermal current limit is calculated by the inverter thermal protection function.	
	(0) ENABLE	The calculated thermal current value limits the converter output current.
	(1) DISABLE	The calculated thermal limit is not used. If the inverter output current is excessive, alarm IGBT OVERTEMP is generated and eventually the regen supply module trips on fault IGBT OVERTEMP.

Group 33 SUPERVISION

Configuration of signal supervision.

33 SUPERVISION		
Firmware block: **SUPERVISION** (17)		
Block outputs located in other parameter groups		6.13 SUPERV STATUS (page 39)
33.01	SUPERV1 FUNC	FW block: SUPERVISION (see above)
	Selects the mode of supervision 1.	
	(0) DISABLED	Supervision 1 not in use.
	(1) LOW	When the signal selected by parameter 33.02 SUPERV1 ACT falls below the value of parameter 33.04 SUPERV1 LIM LO, bit 0 of 6.13 SUPERV STATUS is activated. To clear the bit, the signal must exceed the value of parameter 33.03 SUPERV1 LIM HI.
	(2) HIGH	When the signal selected by parameter 33.02 SUPERV1 ACT exceeds the value of parameter 33.03 SUPERV1 LIM HI, bit 0 of 6.13 SUPERV STATUS is activated. To clear the bit, the signal must exceed the value of parameter 33.04 SUPERV1 LIM LO.
	(3) ABS LOW	When the absolute value of the signal selected by parameter 33.02 SUPERV1 ACT falls below the value of parameter 33.04 SUPERV1 LIM LO, bit 0 of 6.13 SUPERV STATUS is activated. To clear the bit, the absolute value of the signal must exceed the value of parameter 33.03 SUPERV1 LIM HI.
	(4) ABS HIGH	When the absolute value of the signal selected by parameter 33.02 SUPERV1 ACT exceeds the value of parameter 33.03 SUPERV1 LIM HI, bit 0 of 6.13 SUPERV STATUS is activated. To clear the bit, the absolute value of the signal must exceed the value of parameter 33.04 SUPERV1 LIM LO.
33.02	SUPERV1 ACT	FW block: SUPERVISION (see above)
	Selects the signal to be monitored by supervision 1. See parameter 33.01 SUPERV1 FUNC.	
	Value pointer: Group and index	

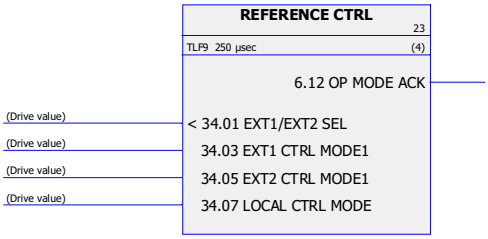
33.03	SUPERV1 LIM HI	FW block: SUPERVISION (see above)
	Sets the upper limit for supervision 1. See parameter 33.01 SUPERV1 FUNC.	
	-32768…32768	
33.04	SUPERV1 LIM LO	FW block: SUPERVISION (see above)
	Sets the lower limit for supervision 1. See parameter 33.01 SUPERV1 FUNC.	
	-32768…32768	
33.05	SUPERV2 FUNC	FW block: SUPERVISION (see above)
	Selects the mode of supervision 2.	
	(0) DISABLED	Supervision 2 not in use.
	(1) LOW	When the signal selected by parameter 33.06 SUPERV2 ACT falls below the value of parameter 33.08 SUPERV2 LIM LO, bit 1 of 6.13 SUPERV STATUS is activated. To clear the bit, the signal must exceed the value of parameter 33.07 SUPERV2 LIM HI.
	(2) HIGH	When the signal selected by parameter 33.06 SUPERV2 ACT exceeds the value of parameter 33.07 SUPERV2 LIM HI, bit 1 of 6.13 SUPERV STATUS is activated. To clear the bit, the signal must exceed the value of parameter 33.08 SUPERV2 LIM LO.
	(3) ABS LOW	When the absolute value of the signal selected by parameter 33.06 SUPERV2 ACT falls below the value of parameter 33.08 SUPERV2 LIM LO, bit 1 of 6.13 SUPERV STATUS is activated. To clear the bit, the absolute value of the signal must exceed the value of parameter 33.07 SUPERV2 LIM HI.
	(4) ABS HIGH	When the absolute value of the signal selected by parameter 33.06 SUPERV2 ACT exceeds the value of parameter 33.07 SUPERV2 LIM HI, bit 1 of 6.13 SUPERV STATUS is activated. To clear the bit, the absolute value of the signal must exceed the value of parameter 33.08 SUPERV2 LIM LO.
33.06	SUPERV2 ACT	FW block: SUPERVISION (see above)
	Selects the signal to be monitored by supervision 2. See parameter 33.05 SUPERV2 FUNC.	
	Value pointer: Group and index	
33.07	SUPERV2 LIM HI	FW block: SUPERVISION (see above)
	Sets the upper limit for supervision 2. See parameter 33.05 SUPERV2 FUNC.	
	-32768…32768	
33.08	SUPERV2 LIM LO	FW block: SUPERVISION (see above)
	Sets the lower limit for supervision 2. See parameter 33.05 SUPERV2 FUNC.	
	-32768…32768	

33.09	SUPERV3 FUNC	FW block: SUPERVISION (see above)
	Selects the mode of supervision 3.	
	(0) DISABLED	Supervision 3 not in use.
	(1) LOW	When the signal selected by parameter 33.10 SUPERV3 ACT falls below the value of parameter 33.12 SUPERV3 LIM LO, bit 2 of 6.13 SUPERV STATUS is activated. To clear the bit, the signal must exceed the value of parameter 33.11 SUPERV3 LIM HI.
	(2) HIGH	When the signal selected by parameter 33.10 SUPERV3 ACT exceeds the value of parameter 33.11 SUPERV3 LIM HI, bit 2 of 6.13 SUPERV STATUS is activated. To clear the bit, the signal must exceed the value of parameter 33.12 SUPERV3 LIM LO.
	(3) ABS LOW	When the absolute value of the signal selected by parameter 33.10 SUPERV3 ACT falls below the value of parameter 33.12 SUPERV3 LIM LO, bit 2 of 6.13 SUPERV STATUS is activated. To clear the bit, the absolute value of the signal must exceed the value of parameter 33.11 SUPERV3 LIM HI.
	(4) ABS HIGH	When the absolute value of the signal selected by parameter 33.10 SUPERV3 ACT exceeds the value of parameter 33.11 SUPERV3 LIM HI, bit 2 of 6.13 SUPERV STATUS is activated. To clear the bit, the absolute value of the signal must exceed the value of parameter 33.12 SUPERV3 LIM LO.
33.10	SUPERV3 ACT	FW block: SUPERVISION (see above)
	Selects the signal to be monitored by supervision 3. See parameter 33.09 SUPERV3 FUNC.	
	Value pointer: Group and index	
33.11	SUPERV3 LIM HI	FW block: SUPERVISION (see above)
	Sets the upper limit for supervision 3. See parameter 33.09 SUPERV3 FUNC.	
	-32768…32768	
33.12	SUPERV3 LIM LO	FW block: SUPERVISION (see above)
	Sets the lower limit for supervision 3. See parameter 33.09 SUPERV3 FUNC.	
	-32768…32768	

Group 34 REFERENCE CTRL

Control mode selection.

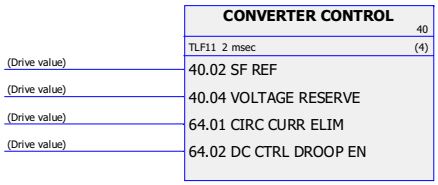
Using the parameters in this group, it is possible to select whether external control location EXT1 or EXT2 is used (either one is active at a time). These parameters also select the control mode (DC VOLTAGE/POWER).

34 REFERENCE CTRL		
Firmware block: **REFERENCE CTRL** (34) This block • defines the selection method between external control locations EXT1 and EXT2 • configures control mode (DC VOLTAGE/POWER) selection • shows the active operating mode.		
Block outputs located in other parameter groups		6.12 OP MODE ACK (page 39)
34.01	EXT1/EXT2 SEL	FW block: REFERENCE CTRL (see above)
	Selects the source for external control location EXT1/EXT2 selection. 0 = EXT1. 1 = EXT2.	
	Bit pointer: Group, index and bit	
34.03	EXT1 CTRL MODE1	FW block: REFERENCE CTRL (see above)
	Selects control mode 1 for external control location EXT1.	
	(1) DC VOLTAGE	
	(2) POWER	
34.05	EXT2 CTRL MODE1	FW block: REFERENCE CTRL (see above)
	Selects control mode for external control location EXT2. For selections, see parameter 34.03 EXT1 CTRL MODE1.	
34.07	LOCAL CTRL MODE	FW block: REFERENCE CTRL (see above)
	Selects the control mode for local control. **Note:** This parameter cannot be changed while the regen supply module is running.	
	(1) DC VOLTAGE	
	(2) POWER	

Group 40 CONVERTER CONTROL

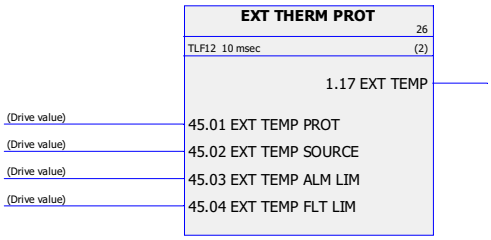
Converter control settings:

- switching frequency
- voltage reserve

40 CONVERTER CONTROL		
Firmware block: **CONVERTER CONTROL** (40) This block defines converter control settings such as • switching frequency • voltage reserve • circulating current elimination • drooping of the DC voltage controller		
Block outputs located in other parameter groups		64.01 CIRC CURR ELIM (page 93) 64.02 DC CTRL DROOP EN (page 93)
40.02	SF REF	FW block: CONVERTER CONTROL (see above)
	Defines the switching frequency of the regen supply module. The higher the switching frequency, the more losses it produces at power stage, the available current magnitude may be reduced.	
	3/4/5/8/16 kHz	Switching frequency.
40.04	VOLTAGE RESERVE	FW block: CONVERTER CONTROL (see above)
	Defines the minimum allowed DC voltage reference value. If the DC voltage is too low, it is increased internally so that the desired voltage reserve is maintained for control. The default value of 2% is suitable for most cases. **Note:** The parameter has no effect if circulating current elimination is activated by parameter 64.01.	
	-4…50 %	Minimum allowed voltage reserve.

Group 45 EXT THERM PROT

Settings for thermal protection of the regen supply.

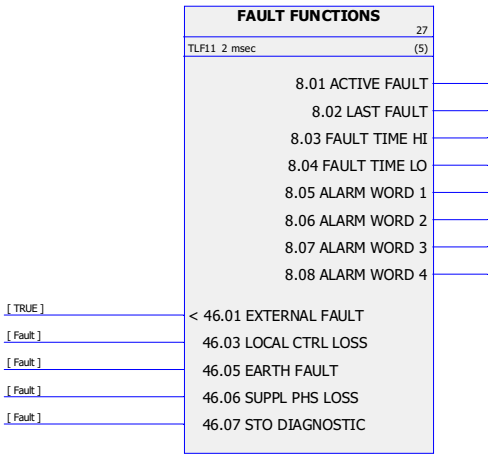
45 EXT THERM PROT		
Firmware block: **EXT TEMP PROT** (45) Configures overtemperature protection based on external temperature measurement.		
Block outputs located in other parameter groups		1.17 EXT TEMP (page 29)
45.01	EXT TEMP PROT	FW block: EXT TEMP PROT (see above)
	Selects how the regen supply module reacts when overtemperature is detected.	
	(0) NO	No reaction.
	(1) ALARM	The regen supply module generates warning EXT TEMPERATURE when overtemperature is detected.
	(2) FAULT	The regen supply module trips on fault EXT OVERTEMP when overtemperature is detected. **Note:** The warning EXT TEMPERATURE may be generated before fault trip. Warning/fault levels are defined by parameters 45.03 and 45.04, respectively.
45.02	EXT TEMP SOURCE	FW block: EXT TEMP PROT (see above)
	Selects the signal type and source for temperature supervision. When overtemperature is detected, the regen supply module reacts as defined by parameter 45.01 EXT TEMP PROT.	
	(0) NONE	No temperature measurement selected.
	(1) KTY JCU	The temperature is supervised using a KTY84 sensor connected to thermistor input TH on the control unit.
	(2) PTC JCU	The temperature is supervised using 1…3 PTC sensors connected to thermistor input TH on the control unit.

45.03	EXT TEMP ALM LIM	FW block: EXT TEMP PROT (see above)
	Defines the alarm limit for the overtemperature protection. Warning EXT TEMPERATURE is generated if temperature measured with KTY84 type sensor exceeds the limit when par. 45.01 EXT TEMP PROT = (1) ALARM/(2) FAULT. The parameter has no effect with PTC type thermistor(s) except when the PTC signal is connected to the JCU (i.e. parameter 45.02 = PTC JCU). In that case, the limit is defined in ohms and the warning is generated when the resistance of the TH input exceeds the limit.	
	0…10000 °C	Overtemperature alarm limit.
45.04	EXT TEMP FLT LIM	FW block: EXT TEMP PROT (see above)
	Defines the fault limit for the overtemperature protection. Fault EXT OVERTEMP is generated if temperature measured with KTY84 type sensor exceeds the limit and par. 45.01 EXT TEMP PROT = (2) FAULT. The parameter has no effect with PTC type thermistor(s) except when the PTC signal is connected to the JCU (i.e. parameter 45.02 = PTC JCU). In that case, the limit is defined in ohms and the fault is generated when the resistance of the TH input exceeds the limit.	
	0…10000 °C	Overtemperature fault limit.

Group 46 FAULT FUNCTIONS

Definition of drive behaviour upon a fault situation.

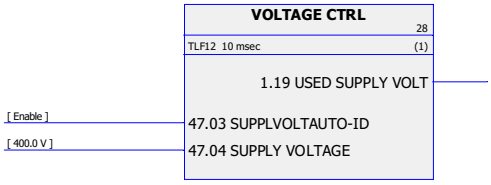
An alarm or a fault message indicates abnormal drive status. For the possible causes and remedies, see chapter *Fault tracing*.

46 FAULT FUNCTIONS		
Firmware block: **FAULT FUNCTIONS** (46) This block • configures supervision of external faults by defining the source (for example, a digital input) for external fault indication signal • selects the reaction of the regen supply module (warning; fault) upon situations like local control communication break, supply phase loss, earth fault, or Safe Torque Off function activation • shows the codes of the latest faults, the time at which the active fault occurred, and the alarm words.		
Block outputs located in other parameter groups		8.01 ACTIVE FAULT (page 40) 8.02 LAST FAULT (page 40) 8.03 FAULT TIME HI (page 40) 8.04 FAULT TIME LO (page 40) 8.05 ALARM WORD 1 (page 40) 8.06 ALARM WORD 2 (page 41) 8.07 ALARM WORD 3 (page 41) 8.08 ALARM WORD 4 (page 41)
46.01	EXTERNAL FAULT	FW block: FAULT FUNCTIONS (see above)
	Selects a source for an external fault signal. 0 = External fault trip. 1 = No external fault.	
	Bit pointer: Group, index and bit	
46.03	LOCAL CTRL LOSS	FW block: FAULT FUNCTIONS (see above)
	Selects how the regen supply module reacts to a control panel or PC tool communication break.	
	(0) NO	No action.
	(1) FAULT	Drive trips on LOCAL CTRL LOSS fault.
46.05	EARTH FAULT	FW block: FAULT FUNCTIONS (see above)
	Selects how the regen supply module reacts when an earth fault or current unbalance is detected in the supply or the supply cable. **Note:** Earth Fault must be disabled in parallel-connected regen supply modules.	

	(0) NO	No action.
	(1) WARNING	The regen supply module generates alarm EARTH FAULT.
	(2) FAULT	The regen supply module trips on EARTH FAULT.
46.06	SUPPL PHS LOSS	FW block: FAULT FUNCTIONS (see above)
	Selects how the regen supply module reacts when a supply phase loss is detected. **Note:** Missing supply phase is detected only during synchronization to supply network.	
	(0) NO	No reaction.
	(1) FAULT	Supply module trips on SUPPLY PHASE fault (default).
46.07	STO DIAGNOSTIC	FW block: FAULT FUNCTIONS (see above)
	Selects how the regen supply module reacts when the Safe Torque Off function is active while the regen supply module is not modulating. The Safe Torque Off function disables the control voltage of the power semiconductors of the output stage, thus preventing the regen supply module to re-generate power from DC bus to supply network. For Safe Torque Off wiring, see the Hardware Manual. **Note:** This parameter is only for supervision. The Safe Torque Off function can activate, even when this parameter selection is NO. **Note**: Fault STO 1 LOST / STO 2 LOST is activated if safety circuit signal 1/2 is lost when the regen supply module is at stopped state and this parameter is set to (2) ALARM or (3) NO. **WARNING!** The Safe Torque Off function does not prevent power flow from supply network to DC link.	
	(1) FAULT	Supply module trips on SAFE TORQUE OFF fault.
	(2) ALARM	Supply module generates SAFE TORQUE OFF warning.
	(3) NO	No reaction.

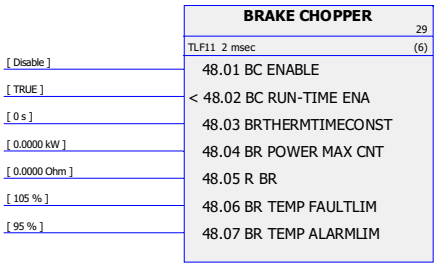
Group 47 VOLTAGE CTRL

Configures charging of the DC-link capacitors.

47 VOLTAGE CTRL		
Firmware block: **VOLTAGE CTRL** (47) This block • enables/disables automatic identification of supply voltage • provides a parameter for manual definition of supply voltage • shows the supply voltage value used in charging relay control.		
Block outputs located in other parameter groups		1.19 USED SUPPLY VOLT (page 29)
47.03	SUPPLVOLTAUTO-ID	FW block: VOLTAGE CTRL (see above)
	Enables the auto-identification of the supply voltage.	
	(0) DISABLE	Auto-identification of supply voltage disabled.
	(1) ENABLE	Auto-identification of supply voltage enabled.
47.04	SUPPLY VOLTAGE	FW block: VOLTAGE CTRL (see above)
	Defines the nominal supply voltage. Used if auto-identification of the supply voltage is not enabled by parameter 47.03 SUPPLVOLTAUTO-ID.	
	0…1000 V	Nominal supply voltage.

Group 48 BRAKE CHOPPER

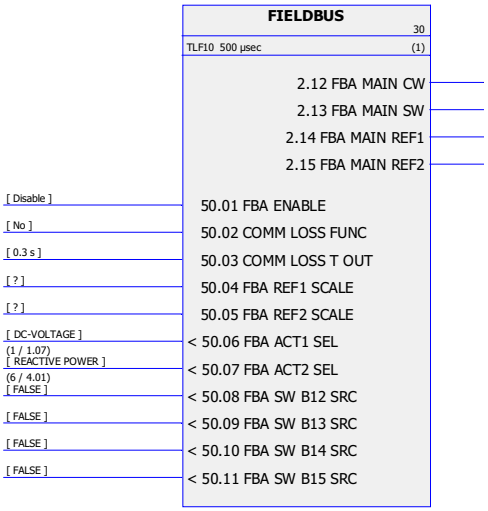
Configuration of internal brake chopper.

48 BRAKE CHOPPER		
Firmware block: **BRAKE CHOPPER** (48) This block configures the brake chopper control and supervision.		
48.01	BC ENABLE	FW block: BRAKE CHOPPER (see above)
	Enables the brake chopper control. **Note:** Before enabling brake chopper control, ensure the brake resistor is installed. The regen supply module has a built-in brake chopper.	
	(0) DISABLE	Brake chopper control disabled.
	(1) ENABLETHERM	Enable brake chopper control with resistor overload protection.
	(2) ENABLE	Enable brake chopper control without resistor overload protection. This setting can be used, for example, if the resistor is equipped with a thermal circuit breaker that is wired to stop the drive if the resistor overheats.
48.02	BC RUN-TIME ENA	FW block: BRAKE CHOPPER (see above)
	Selects the source for quick run-time brake chopper control. 0 = Brake chopper IGBT pulses are cut off. 1 = Normal brake chopper IGBT modulation. The overvoltage control is automatically switched off. This parameter can be used to program the chopper control to function only when the drive is operating in generating mode.	
	Bit pointer: Group, index and bit	
48.03	BRTHERMTIMECONST	FW block: BRAKE CHOPPER (see above)
	Defines the thermal time constant of the brake resistor for overload protection.	
	0…10000 s	Brake resistor thermal time constant.
48.04	BR POWER MAX CNT	FW block: BRAKE CHOPPER (see above)
	Defines the maximum continuous braking power which will raise the resistor temperature to the maximum allowed value. The value is used in the overload protection.	
	0…10000 kW	Maximum continuous braking power.

48.05	R BR	FW block: BRAKE CHOPPER (see above)
	Defines the resistance value of the brake resistor. The value is used for brake chopper protection.	
	0.1…1000 ohm	Resistance.
48.06	BR TEMP FAULTLIM	FW block: BRAKE CHOPPER (see above)
	Selects the fault limit for the brake resistor temperature supervision. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter 48.04 BR POWER MAX CNT. When the limit is exceeded the drive trips on fault BR OVERHEAT.	
	0…150%	Resistor temperature fault limit.
48.07	BR TEMP ALARMLIM	FW block: BRAKE CHOPPER (see above)
	Selects the alarm limit for the brake resistor temperature supervision. The value is given in percent of the temperature the resistor reaches when loaded with the power defined by parameter 48.04 BR POWER MAX CNT. When limit is exceeded the drive generates alarm BR OVERHEAT.	
	0…150%	Resistor temperature alarm limit.

Group 50 FIELDBUS

Basic settings for fieldbus communication. See also chapter *Appendix A – Fieldbus control* on page 137.

50 FIELDBUS		
Firmware block: **FIELDBUS** (50) This block • initialises the fieldbus communication • selects communication supervision method • defines scaling of the fieldbus references and actual values • selects sources for programmable status word bits • shows the fieldbus control and status words, and references.		
Block outputs located in other parameter groups		2.12 FBA MAIN CW (page 32) 2.13 FBA MAIN SW (page 33) 2.14 FBA MAIN REF1 (page 34) 2.15 FBA MAIN REF2 (page 34)
50.01	FBA ENABLE	FW block: FIELDBUS (see above)
	Enables communication between the drive and fieldbus adapter.	
	(0) DISABLE	No communication.
	(1) ENABLE	Communication between drive and fieldbus adapter enabled.
50.02	COMM LOSS FUNC	FW block: FIELDBUS (see above)
	Selects how the drive reacts in a fieldbus communication break. The time delay is defined by parameter 50.03 COMM LOSS T OUT.	
	(0) NO	Protection inactive.
	(1) FAULT	Protection active. The regen supply module trips on fault FIELDBUS COMM.
50.03	COMM LOSS T OUT	FW block: FIELDBUS (see above)
	Defines the time delay before the action defined by parameter 50.02 COMM LOSS FUNC is taken. Time count starts when the link fails to update the message.	
	0.3…6553.5 s	Delay for fieldbus communication loss function.

50.04	FBA REF1 SCALE	FW block: FIELDBUS (see above)
	Selects scaling of fieldbus reference FBA REF1. The same scale is also used for actual value FBA ACT1. Defines the correspondence of the internal real value and 16 bit signed integer value used with ABB Drives Profile.	
	(0) RAW DATA	No scaling (i.e. data is transmitted without scaling).
	(1) 100 = 1.00	Real value can be given with two decimals as an integer. For example, 10000 = 100.00 [SI unit]. Suitable e.g. for re-active/active powers in value range -327.68…+327.67 [kVAr/kW] according to the value range of signed 16 bit integers.
	(2) 10 = 1.0	Real value can be given with one decimal as an integer. For example, 20000 = 2000.0 [SI unit]. Value range -3276.8...+3276.7 is adequate e.g. for DC voltage.
50.05	FBA REF2 SCALE	FW block: FIELDBUS (see above)
	Selects scaling of fieldbus reference FBA REF2. The same scale is also used for actual value FBA ACT2. Defines the correspondence of the internal real value and 16 bit signed integer value used with ABB Drives Profile.	
	(0) RAW DATA	No scaling (i.e. data is transmitted without scaling).
	(1) 100 = 1.00	Real value can be given with two decimals as an integer. For example, 10000 = 100.00 [SI unit]. Suitable e.g. for re-active/active powers in value range -327.68…+327.67 [kVAr/kW] according to the value range of signed 16 bit integers.
	(2) 10 = 1.0	Real value can be given with one decimal as an integer. For example, 20000 = 2000.0 [SI unit]. Value range -3276.8...+3276.7 is adequate e.g. for DC voltage.
50.06	FBA ACT1 SEL	FW block: FIELDBUS (see above)
	Selects the actual value (FBA ACT1), which is sent to the fieldbus corresponding to FBA REF1. Scaling of FBA ACT1 is defined by parameter 50.04 FBA REF1 SCALE.	
	(1073742087) DC VOLTAGE	Signal 1.07 DC-VOLTAGE is sent to the fieldbus as an actual value 1. Select when DC voltage reference is written from the fieldbus as reference 1 i.e. 60.01 DC REF SEL = FBA REF1.
	(1073742849) REACT. POWER	Signal 4.01 REACTIVE POWER is sent to the fieldbus as an actual value 1. Select when reactive power reference is written from the fieldbus as reference 1 i.e. 61.01 Q POWER REF SEL = FBA REF1.
	(1073742102) ACTIVE POWER	Signal 1.22 INVERTER POWER is sent to the fieldbus as an actual value 1. Select when power reference is written from the fieldbus as reference 1 i.e. 62.01 POW REF SEL = FBA REF1.
50.07	FBA ACT2 SEL	FW block: FIELDBUS (see above)
	Selects the actual value (FBA ACT2), which is sent to the fieldbus corresponding to FBA REF2. Scaling of FBA ACT2 is defined by parameter 50.05 FBA REF2 SCALE.	
	(1073742087) DC VOLTAGE	Signal 1.07 DC-VOLTAGE is sent to the fieldbus as an actual value 2. Select when DC voltage reference is written from the fieldbus as reference 2, i.e. 60.01 DC REF SEL = FBA REF2.

	(1073742849) REACT. POWER	Signal 4.01 REACTIVE POWER is sent to the fieldbus as an actual value 2. Select when reactive power reference is written from the fieldbus as reference 2, i.e. 61.01 Q POWER REF SEL = FBA REF2.
	(1073742102) ACTIVE POWER	Signal 1.22 INVERTER POWER is sent to the fieldbus as an actual value 2. Select when power reference is written from the fieldbus as reference 2, i.e. 62.01 POW REF SEL = FBA REF2.
50.08	FBA SW B12 SRC	FW block: FIELDBUS (see above)
	Selects the source for freely programmable fieldbus status word bit 28 (2.13 FBA MAIN SW bit 28 SW B12).	
	Bit pointer: Group, index and bit	
50.09	FBA SW B13 SRC	FW block: FIELDBUS (see above)
	Selects the source for freely programmable fieldbus status word bit 29 (2.13 FBA MAIN SW bit 29 SW B13).	
	Bit pointer: Group, index and bit	
50.10	FBA SW B14 SRC	FW block: FIELDBUS (see above)
	Selects the source for freely programmable fieldbus status word bit 30 (2.13 FBA MAIN SW bit 30 SW B14).	
	Bit pointer: Group, index and bit	
50.11	FBA SW B15 SRC	FW block: FIELDBUS (see above)
	Selects the source for freely programmable fieldbus status word bit 31 (2.13 FBA MAIN SW bit 31 SW B15).	
	Bit pointer: Group, index and bit	

Group 51 FBA SETTINGS

Further fieldbus communication configuration. These parameters need to be set only if a fieldbus adapter module is installed. See also *Appendix A – Fieldbus control* on page 137.

Notes:

- This parameter group is presented in the *User's Manual* of the fieldbus adapter as parameter group 1 or A.
- The new settings will take effect when the drive is powered up the next time (before powering off the drive, wait at least 1 minute), or when parameter 51.27 FBA PAR REFRESH is activated.

51 FBA SETTINGS		
51.01	FBA TYPE	FW block: None
	Displays the type of the connected fieldbus adapter module.	
	(0) NOT DEFINED	Fieldbus adapter module not found (not properly connected, or disabled by parameter 50.01 FBA ENABLE).
	(1) PROFIBUS-DP	FPBA-xx PROFIBUS-DP adapter module
	(32) CANOpen	FCAN-xx CANopen adapter module
	(37) DEVICENET	FDNA-xx DeviceNet adapter module
	(128) ETHERNET	FENA Ethernet adapter module
	(485) RS-485 COMM	FSCA RS-485 adapter module
51.02	FBA PAR2	FW block: None
…	….	….
51.26	FBA PAR26	FW block: None
	Parameters 51.02…51.26 are adapter module-specific. For more information, see the *User's Manual* of the fieldbus adapter module. Note that not all of these parameters are necessarily visible.	
51.27	FBA PAR REFRESH	FW block: None
	Validates any changed adapter module configuration parameter settings. After refreshing, the value reverts automatically to (0) DONE. **Note:** This parameter cannot be changed while the drive is running.	
	(0) DONE	Refreshing done.
	(1) REFRESH	Refreshing.
51.28	PAR TABLE VER	FW block: None
	Displays the parameter table revision of the fieldbus adapter module mapping file stored in the memory of the drive. In format xyz, where x = major revision number; y = minor revision number; z = correction number.	

51.29	DRIVE TYPE CODE	FW block: None
	Displays the drive type code of the fieldbus adapter module mapping file stored in the memory of the drive. Example: 530 = ACSM1-204 Regen supply module.	
51.30	MAPPING FILE VER	FW block: None
	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive. In decimal format. Example: 1 = revision 1.	
51.31	D2FBA COMM STA	FW block: None
	Displays the status of the fieldbus adapter module communication.	
	(0) IDLE	Adapter not configured.
	(1) EXEC. INIT	Adapter initializing.
	(2) TIME OUT	A timeout has occurred in the communication between the adapter and the drive.
	(3) CONFIG ERROR	Adapter configuration error – the major or minor revision code of the common program revision in the fieldbus adapter module is not the revision required by the module (see par. 51.32 FBA COMM SW VER), or mapping file upload has failed more than three times.
	(4) OFF-LINE	Adapter is off-line.
	(5) ON-LINE	Adapter is on-line.
	(6) RESET	Adapter is performing a hardware reset.
51.32	FBA COMM SW VER	FW block: None
	Displays the common program revision of the adapter module. In format axyz, where a = major revision number, xy = minor revision numbers. z = correction letter. Example: 207B = revision 2.07B.	
51.33	FBA APPL SW VER	FW block: None
	Displays the application program revision of the adapter module. In format axyz, where: a = major revision number, xy = minor revision numbers, z = correction letter. Example: 202A = revision 2.02A.	

Group 52 FBA DATA IN

These parameters select the data to be sent by the drive to the fieldbus controller, and need to be set only if a fieldbus adapter module is installed. See also *Appendix A – Fieldbus control* on page 137.

Notes:

- This parameter group is presented in the *User's Manual* of the fieldbus adapter as parameter group 3 or C.
- The new settings will take effect when the drive is powered up the next time (before powering off the drive, wait at least 1 minute), or when parameter 51.27 FBA PAR REFRESH is activated.
- The maximum number of data words is protocol-dependent.
- If the selected data is 32 bits long, two parameters are reserved for the transmission.

52 FBA DATA IN		
52.01	FBA DATA IN1	FW block: None
	Selects data to be transferred from the drive to the fieldbus controller.	
	0	Not in use.
	4	Status Word (16 bits).
	5	Actual value 1 (16 bits).
	6	Actual value 2 (16 bits).
	14	Status Word (32 bits).
	15	Actual value 1 (32 bits).
	16	Actual value 2 (32 bits).
	101…9999	Parameter index.
52.02	FBA DATA IN2	FW block: None
…	…	
52.12	FBA DATA IN12	FW block: None
	See 52.01 FBA DATA IN1.	

Group 53 FBA DATA OUT

These parameters select the data to be sent by the fieldbus controller to the drive, and need to be set only if a fieldbus adapter module is installed. See also *Appendix A – Fieldbus control* on page 137.

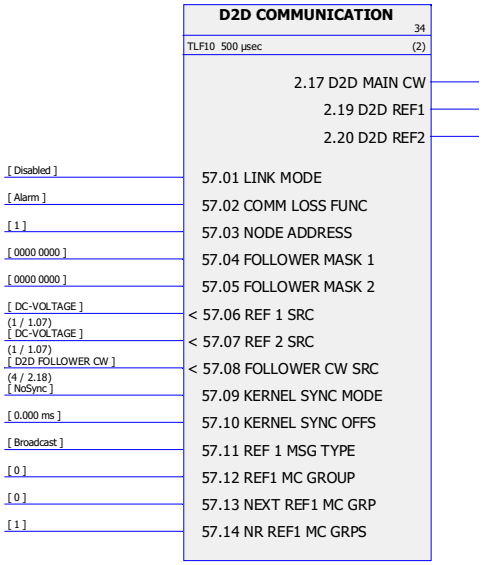
Notes:

- This parameter group is presented in the *User's Manual* of the fieldbus adapter as parameter group 2 or B.
- The new settings will take effect when the drive is powered up the next time (before powering off the drive, wait at least 1 minute), or when parameter 51.27 FBA PAR REFRESH is activated.
- The maximum number of data words is protocol-dependent.
- If the selected data is 32 bits long, two parameters are reserved for the transmission.

53 FBA DATA OUT		
53.01	FBA DATA OUT1	FW block: None
	Selects data to be transferred from the fieldbus controller to the drive.	
	0	Not in use.
	1	Control Word (16 bits).
	2	Reference REF1 (16 bits).
	3	Reference REF2 (16 bits).
	11	Control Word (32 bits).
	12	Reference REF1 (32 bits).
	13	Reference REF2 (32 bits).
	1001…9999	Parameter index.
53.02	FBA DATA OUT2	FW block: None
…		
53.12	FBA DATA OUT12	FW block: None
	See 53.01 FBA DATA OUT1.	

Group 57 D2D COMMUNICATION

Drive-to-drive communication settings. See *Appendix B – Drive-to-drive link* on page 145.

57 D2D COMMUNICATION		
Firmware block: **D2D COMMUNICATION** (57) This block sets up the drive-to-drive communication. It also shows the drive-to-drive control word and the two references received from the link.		
Block outputs located in other parameter groups		2.17 D2D MAIN CW (page 34) 2.19 D2D REF1 (page 34) 2.20 D2D REF2 (page 34)
57.01	LINK MODE	FW block: D2D COMMUNICATION (see above)
	Activates the drive-to-drive connection.	
	(0) DISABLED	Drive-to-drive connection disabled.
	(1) FOLLOWER	The regen supply module is a follower on the drive-to-drive link.
	(2) MASTER	The regen supply module is the master on the drive-to-drive link. Only one regen supply module/drive can be the master at a time.
57.02	COMM LOSS FUNC	FW block: D2D COMMUNICATION (see above)
	Selects how the regen supply module acts when an erroneous drive-to-drive configuration or a communication break is detected.	
	(0) NO	Supervision inactive.
	(1) ALARM	The regen supply module generates an alarm.
	(2) FAULT	The regen supply module trips on a fault.

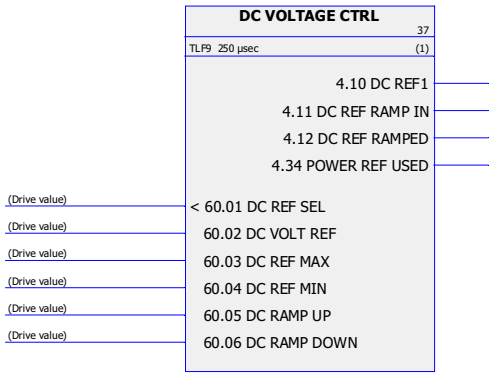
57.03	NODE ADDRESS	FW block: D2D COMMUNICATION (see above)
	Sets the node address for a follower regen supply module. Each follower must have a dedicated node address. **Note:** If the regen supply module is set to be the master on the drive-to-drive link, this parameter has no effect (the master is automatically assigned node address 0).	
	1…62	Node address.
57.04	FOLLOWER MASK 1	FW block: D2D COMMUNICATION (see above)
	On the master regen supply module, selects the followers to be polled. If no response is received from a polled follower, the action selected by parameter 57.02 COMM LOSS FUNC is taken. The least significant bit represents follower with node address 1, while the most significant bit represents follower 31. When a bit is set to 1, the corresponding node address is polled. For example, followers 1 and 2 are polled when this parameter is set to the value of 0x3.	
	0x00000000…0x7FFFFFFF	Follower mask 1.
57.05	FOLLOWER MASK 2	FW block: D2D COMMUNICATION (see above)
	On the master regen supply module, selects the followers to be polled. If no response is received from a polled follower, the action selected by parameter 57.02 COMM LOSS FUNC is taken. The least significant bit represents follower with node address 32, while the most significant bit represents follower 62. When a bit is set to 1, the corresponding node address is polled. For example, followers 32 and 33 are polled when this parameter is set to the value of 0x3.	
	0x00000000…0x7FFFFFFF	Follower mask 2.
57.06	REF 1 SRC	FW block: D2D COMMUNICATION (see above)
	Selects the source of D2D reference 1 sent to the followers. The parameter is effective on the master regen supply module, as well as submasters (57.03 NODE ADDRESS = 57.12 REF1 MC GROUP) in a multicast message chain (see parameter 57.11 REF 1 MSG TYPE). The default value is P.01.07, i.e. 1.07 DC-VOLTAGE.	
	Value pointer: Group and index.	
57.07	REF 2 SRC	FW block: D2D COMMUNICATION (see above)
	On the master regen supply module, selects the source of D2D reference 2 broadcast to all followers. The default value is P.01.07, i.e. 1.07 DC-VOLTAGE.	
	Value pointer: Group and index.	
57.08	FOLLOWER CW SRC	FW block: D2D COMMUNICATION (see above)
	Selects the source of the D2D control word sent to the followers. The parameter is effective on the master regen supply module, as well as submasters in a multicast message chain (see parameter 57.11 REF 1 MSG TYPE). The default value is P.02.18, i.e. 2.18 D2D FOLLOWER CW.	
	Value pointer: Group and index.	
57.09	KERNEL SYNC MODE	FW block: D2D COMMUNICATION (see above)
	Determines which signal the time levels of the regen supply module are synchronised with. An offset can be defined by parameter 57.10 KERNEL SYNC OFFS if desired.	

	(0) NO SYNC	No synchronisation.
	(1) D2DSYNC	If the regen supply module is the master on a drive-to-drive link, it broadcasts a synchronisation signal to the follower(s). If the regen supply module is a follower, it synchronises its firmware time levels to the signal received from the master.
	(2) FBSYNC	The regen supply module synchronises its firmware time levels to a synchronisation signal received through a fieldbus adapter.
	(3) FBTOD2DSYNC	If the regen supply module is the master on a drive-to-drive link, it synchronises its firmware time levels to a synchronisation signal received from a fieldbus adapter, and broadcasts the signal on the drive-to-drive link. If the regen supply module is a follower, this setting has no effect.
57.10	KERNEL SYNC OFFS	FW block: D2D COMMUNICATION (see above)
	Defines an offset between the synchronisation signal received and the time levels of the regen supply module. With a positive value, the regen supply module time levels will lag behind the synchronisation signal; with a negative value, the regen supply module time levels will lead.	
	-4.999…5.000 ms	Synchronisation offset.
57.11	REF 1 MSG TYPE	FW block: D2D COMMUNICATION (see above)
	By default, in drive-to-drive communication, the master broadcasts the drive-to-drive control word and references 1 and 2 to all followers. This parameter enables multicasting, i.e. sending the drive-to-drive control word and reference 1 to a certain drive/supply module or group of drives/supply modules. The message can then be further relayed to another group of drives/supply modules to form a multicast chain. In the master, as well as any submaster (i.e. follower relaying the message to other followers), the sources for the control word and reference 1 are selected by parameters 57.08 FOLLOWER CW SRC and 57.06 REF 1 SRC respectively. **Note:** Reference 2 is broadcast to all followers by the masters. For more information, see *Appendix B – Drive-to-drive link* on page 145.	
	(0) BROADCAST	The control word and reference 1 are sent by the master to all followers. If the master has this setting, the parameter has no effect in the followers.
	(1) REF1 MC GRPS	The drive-to-drive control word and reference 1 are only sent to the drives/supply modules in the multicast group specified by parameter 57.13 NEXT REF1 MC GRP. This setting can also used in submasters (i.e. followers whose parameters 57.03 and 57.12 have the same value) to form a multicast chain.
57.12	REF1 MC GROUP	FW block: D2D COMMUNICATION (see above)
	Selects the multicast group the regen supply module belongs to. See parameter 57.11 REF 1 MSG TYPE.	
	0…62	Multicast group (0 = none).

57.13	NEXT REF1 MC GRP	FW block: D2D COMMUNICATION (see above)
	Specifies the next multicast group of drives/supply modules the multicast message is relayed to. See parameter 57.11 REF 1 MSG TYPE. This parameter is effective only in the master or submasters (i.e. followers whose parameters 57.03 and 57.12 have the same value).	
	0…62	Next multicast group in message chain.
57.14	NR REF1 MC GRPS	FW block: D2D COMMUNICATION (see above)
	In the master drive, sets the total number of links (followers or groups of followers) in the multicast message chain. See parameter 57.11 REF 1 MSG TYPE. **Notes:** • This parameter has no effect if the regen supply module is a follower. • The master counts as a member of the chain if acknowledgement from the last regen supply module to the master is desired.	
	1…62	Total number of links in multicast message chain.
57.15	D2D COMM PORT	FW block: None
	Defines the hardware to which the drive-to-drive link is connected. In special cases (such as harsh operating conditions), the galvanic isolation provided by the RS-485 interface of the FMBA module may make for more robust communication than the standard drive-to-drive connection.	
	(0) ON-BOARD	Connector X5 on the JCU Control Unit is used.
	(1) SLOT 1	An FMBA module installed in JCU option slot 1 is used.
	(2) SLOT 2	An FMBA module installed in JCU option slot 2 is used.
	(3) SLOT 3	An FMBA module installed in JCU option slot 3 is used.

Group 60 DC REF SEL

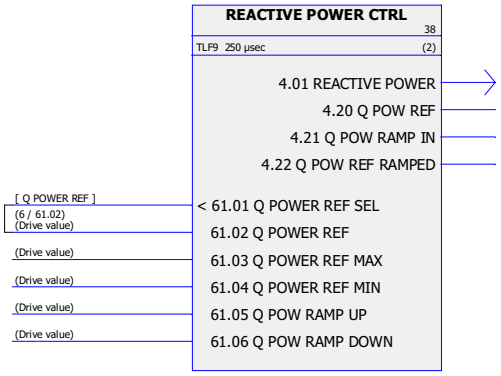
DC voltage reference settings.

60 DC REF SEL		
Firmware block: **DC VOLTAGE CTRL** (60) This block sets up DC voltage reference. It also shows reference values.		
Block outputs located in other parameter groups		4.10 DC REF1 (page 35) 4.11 DC REF RAMP IN (page 35) 4.12 DC REF RAMPED (page 35) 4.34 POW REF USED (page 35)
60.01	DC REF SEL	FW block: DC VOLTAGE CTRL (see above)
	Selects the source of DC voltage reference. The user can select the reference source freely with the value pointer parameter. A pre-defined selection list is provided. The default setting is (0) Internal. In local control mode (with DriveStudio or with control panel) the local reference overrides this selection (see "Local reference" in block diagram).	
	(0) Internal	Zero reference. DC voltage level is determined based on parameter 40.04 VOLTAGE RESERVE.
	(1073742341) AI1	Analogue input AI1 (2.05 AI1 SCALED).
	(1073742343) AI2	Analogue input AI2 (2.07 AI2 SCALED).
	(1073742350) FBA REF1	Fieldbus reference 1 (2.14 FBA MAIN REF1).
	(1073742351) FBA REF2	Fieldbus reference 2 (2.15 FBA MAIN REF2).
	(1073742355) D2D REF1	Drive-to-drive reference 1 (2.19 D2D REF1).
	(1073742356) D2D REF2	Drive-to-drive reference 2 (2.20 D2D REF2).
	(1073757186) P.60.02	Parameter 60.02 DC VOLT REF.
60.02	DC VOLT REF	FW block: DC VOLTAGE CTRL (see above)
	Defines the constant value for DC voltage reference.	
	0.0…2000 V	

60.03	DC REF MAX	FW block: DC VOLTAGE CTRL (see above)
	Defines the maximum allowed DC voltage.	
	0.0…2000.0 V	
60.04	DC REF MIN	FW block: DC VOLTAGE CTRL (see above)
	Defines the minimum allowed DC voltage.	
	0.0…2000.0 V	
60.05	DC RAMP UP	FW block: DC VOLTAGE CTRL (see above)
	Defines the DC voltage ramp time in milliseconds as the time required for the DC voltage reference to change by 100 V DC. The value is active when the reference is increasing i.e. changing away from zero.	
60.06	DC RAMP DOWN	FW block: DC VOLTAGE CTRL (see above)
	Defines the DC voltage ramp time in milliseconds as the time required for the DC voltage reference to change by 100 V DC. The value is active when the reference is decreasing i.e. changing towards zero.	

Group 61 REACTIVE POWER

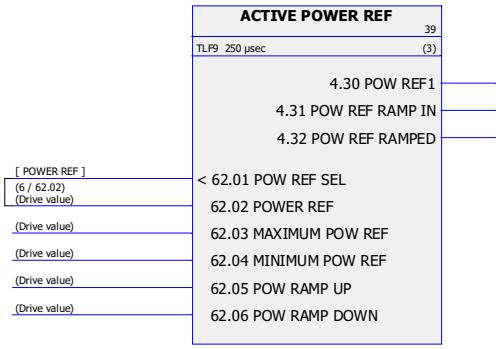
Reactive power reference settings.

61 REACTIVE POWER		
Firmware block: **REACTIVE POWER CTRL** (61) This block sets up reactive power control. It also shows reference values.		
Block outputs located in other parameter groups		4.01 REACTIVE POWER (page 35) 4.20 Q POW REF (page 35) 4.21 Q POW RAMP IN (page 35) 4.22 Q POW REF RAMPED (page 35)
61.01	Q POWER REF SEL	FW block: REACTIVE POWER CTRL (see above)
	Selects the source of reactive power reference. The user can select the reference source freely with the value pointer parameter. A pre-defined selection list is provided. The default setting is P.61.02.	
	(0) ZERO	Zero reference.
	(1073742341) AI1	Analogue input AI1 (2.05 AI1 SCALED).
	(1073742343) AI2	Analogue input AI2 (2.07 AI2 SCALED).
	(1073742350) FBA REF1	Fieldbus reference 1 (2.14 FBA MAIN REF1).
	(1073742351) FBA REF2	Fieldbus reference 2 (2.15 FBA MAIN REF2).
	(1073742355) D2D REF1	Drive-to-drive reference 1 (2.19 D2D REF1).
	(1073742356) D2D REF2	Drive-to-drive reference 2 (2.20 D2D REF2).
	(1073757442) P.61.02	Parameter 61.02 Q POWER REF.
61.02	Q POWER REF	FW block: REACTIVE POWER CTRL (see above)
	User can set a constant value for reactive power reference. As default this value is set to 0 kVAr.	
	-32768…32768	
61.03	Q POWER REF MAX	FW block: REACTIVE POWER CTRL (see above)
	Defines the maximum allowed reactive power in kVAr.	
	-32768…32768	

61.04	Q POWER REF MIN	FW block: REACTIVE POWER CTRL (see above)
	Defines the minimum allowed reactive power in kVAr.	
	-32768…32768	.
61.05	Q POW RAMP UP	FW block: REACTIVE POWER CTRL (see above)
	Defines the time in milliseconds required for the reactive power reference to change by 1000 kVAr. The value is active when the absolute value of the reference is increasing i.e. the reference is changing away from zero either on the positive side or on the negative side.	
	0…32768	
61.06	Q POW RAMP DOWN	FW block: REACTIVE POWER CTRL (see above)
	Defines the time in milliseconds required for the reactive power reference to change by 1000 kVAr. The value is active when the absolute value of the reference is decreasing i.e. the reference is changing towards zero either on the positive side or on the negative side.	
	0…32768	

Group 62 POWER REF

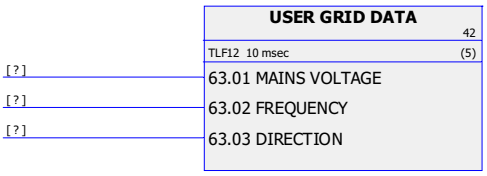
Active power reference settings.

62 POWER REF		
Firmware block: **ACTIVE POWER REF** (62) This block sets up active power reference. It also shows reference vales.		
Block outputs located in other parameter groups		4.30 POW REF1 (page 35) 4.31 POW REF RAMP IN (page 35) 4.31 POW REF RAMPED (page 35)
62.01	POW REF SEL	FW block: ACTIVE POWER REF (see above)
	Selects the source of active power reference. The user can select the reference source freely with the value pointer parameter. A pre-defined selection list is provided. The default setting is P.62.02.	
	(0) ZERO	Zero reference.
	(1073742341) AI1	Analogue input AI1 (2.05 AI1 SCALED).
	(1073742343) AI2	Analogue input AI2 (2.07 AI2 SCALED).
	(1073742350) FBA REF1	Fieldbus reference 1 (2.14 FBA MAIN REF1).
	(1073742351) FBA REF2	Fieldbus reference 2 (2.15 FBA MAIN REF2).
	(1073742355) D2D REF1	Drive-to-drive reference 1 (2.19 D2D REF1).
	(1073742356) D2D REF2	Drive-to-drive reference 2 (2.20 D2D REF2).
	(1073757698) P.62.02	Parameter 62.02 POWER REF.
62.02	POWER REF	FW block: ACTIVE POWER REF (see above)
	You can set a constant value for active power reference of power control mode. By default this value is set to 0 kW.	
	-32768…32768	
62.03	MAXIMUM POW REF	FW block: ACTIVE POWER REF (see above)
	Defines the maximum allowed active power in kW. This parameter affects both the power control mode and the DC voltage control mode.	
	-32768…32768	

62.04	MINIMUM POW REF	FW block: ACTIVE POWER REF (see above)
	Defines the minimum allowed active power in kW. This parameter affects both the power control mode and the DC voltage control mode.	
	-32768…32768	
62.05	POW RAMP UP	FW block: ACTIVE POWER REF (see above)
	Defines the time in milliseconds required for the active power reference to change by 1000 kW. The value is active when the absolute value of the reference is increasing i.e. the reference is changing away from zero either on the positive side or on the negative side.	
	0…32768	
62.06	POW RAMP DOWN	FW block: ACTIVE POWER REF (see above)
	Defines the time in milliseconds required for the active power reference to change by 1000 kW. The value is active when the absolute value of the reference is decreasing i.e. the reference is changing towards zero either on the positive side or on the negative side.	
	0…32768	

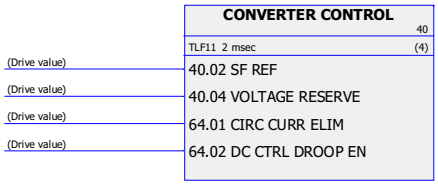
Group 63 USER DATA

If the automatic network synchronization is not working reliably, for example, because of network disturbances, you can manually enter network data in Group 63 USER DATA. If both frequency and direction are given, the 5…10 ms starting delay occurring in the first start after a power-up is eliminated.

63 USER DATA		
Firmware block: **USER GRID DATA** (63) This block defines mains voltage, network frequency and network direction.		
63.01	MAINS VOLTAGE	FW block: USER GRID DATA (see above)
	Network voltage in V. If the network is very distorted, the fundamental value should be given (e.g. analyzed with external measurement).	
	0…1000	
63.02	FREQUENCY	FW block: USER GRID DATA (see above)
	Network frequency in Hz.	
	0…1000	
63.03	DIRECTION	FW block: USER GRID DATA (see above)
	Network rotation direction.	
	(0) NOT GIVEN	
	(1) POSITIVE	
	(2) NEGATIVE	

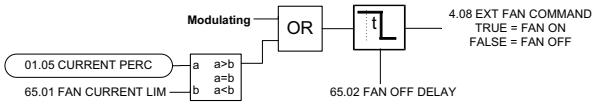
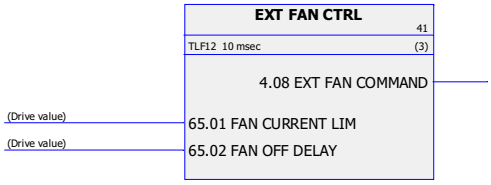
Group 64 PARALLEL UNITS

Settings for parallel connected regen supply modules.

64 PARALLEL UNITS		
Firmware block: **CONVERTER CONTROL** (64) This block sets up circulating current elimination and DC voltage controller drooping for parallel-connected units.		
Block outputs located in other parameter groups		40.02 SF REF (page 67) 40.04 VOLTAGE RESERVE (page 67)
64.01	CIRC CURR ELIM	FW block: CONVERTER CONTROL (see above)
	Activates the circulating current elimination. This parameter should be enabled if the supply units are connected in parallel without isolation transformers. Enabling this parameter increases the losses of the supply section.	
	(0) DISABLE	
	(1) ENABLE	
64.02	DC CTRL DROOP EN	FW block: CONVERTER CONTROL (see above)
	Enables the DC voltage controller drooping. This parameter should be enabled if more than one supply unit in DC voltage control mode are connected to the same DC bus. The drooping rate is 20 V per nominal power. The same DC voltage reference must be used in all supply units connected to the same DC bus. Do not use internal DC voltage reference. The DC voltage reference used should be sufficiently larger than the peak value of the line-to-line voltage. For example, in 400 V network the DC reference could be approximately 615 V (square root of 2 × 400 V + 50 V). **Note:** DC voltage measurement accuracy differences in parallel-connected units may result in slightly unbalanced currents between the units. This effect can be compensated by changing the DC voltage references. For example, if one of the parallel-connected units is measuring the DC bus voltage to be 1 V higher than the others, its DC voltage reference should be increased by 1 V.	
	(0) DISABLE	
	(1) ENABLE	

Group 65 FILTER FAN CTRL

Regen filter module fan control settings.

65 FILTER FAN CTRL		
Firmware block: **EXT FAN CTRL** (65) This block sets up the ON/OFF control of the cooling fan of the regen filter module:  The fan is always ON when the regen supply module is modulating. In the stopped state, the fan is ON if the current exceeds the limit defined by parameter 65.01 FAN CURRENT LIM. If both of these conditions cease to be met, the fan keeps running for a time defined by parameter 65.02 FAN OFF DELAY to avoid unnecessary stopping and starting of the fan. The fan is controlled via DIO1 by default (see parameters 12.01 DIO1 CONF and 12.04 DIO1 OUT PTR).		
Block outputs located in other parameter groups		4.08 EXT FAN COMMAND (page 35)
65.01	FAN CURRENT LIM	FW block: EXT FAN CTRL (see above)
	Fan current limit.	
	0.0…1000.0%	
65.02	FAN OFF DELAY	FW block: EXT FAN CTRL (see above)
	Fan minimum run time.	
	0…42949672 s	

Group 95 HW CONFIGURATION

Miscellaneous hardware-related settings.

95 HW CONFIGURATION		
95.01	CTRL UNIT SUPPLY	FW block: None
	Selects how the drive control unit is powered.	
	(0) INTERNAL 24V	The drive control unit is powered from the drive power unit it is mounted on.
	(1) EXTERNAL 24V	The drive control unit is powered from an external power supply.
95.03	TEMP INU AMBIENT	FW block: None
	Defines the maximum ambient temperature. The value is used by the regen supply module cooling diagnostics.	
	0…55 °C	

Group 99 START-UP DATA

Start-up settings: language and ID-run mode.

99 START-UP DATA		
99.01	LANGUAGE	FW block: None
	Selects the language.	
	(2057) ENGLISH	English.
	(1029) CZECH	Czech.
	(1030) DANSK	Danish.
	(1031) DEUTSCH	German.
	(1034) ESPAÑOL	Spanish.
	(1035) SUOMI	Finnish.
	(1036) FRANÇAIS	French.
	(1038) MAGYAR	Hungarian.
	(1040) ITALIANO	Italian.
	(1041) JAPANESE	Japanese.
	(1042) KOREAN	Korean.
	(1043) NEDERLANDS	Dutch.
	(1045) POLSKI	Polish.
	(1049) RUSSKI	Russian.
	(1053) SVENSKA	Swedish.
	(1055) TÜRKÇE	Turkish.
	(2052) CHINESE	Chinese.
	(2070) PORTUGUES	Portuguese.
99.13	IDRUN MODE	FW block: None
	ID-run is a way to get values for the user data parameters 63.01…63.03.	
	(0) NOT ACTIVE	No network ID run is requested.
	(1) NORMAL	Initiate ID-run. Supply section must be started for ID-run to start.
	(2) CLEAR RESULT	Clears parameters 63.01…63.03. Cancels initiated ID-run. The next start is in automatic mode. All parameters are identified which causes a 5…10 ms start delay.

Parameter data

What this chapter contains

This chapter lists the parameters of the drive with some additional data. For the parameter descriptions, see chapter Parameters and firmware blocks.

Terms

Term	Definition
Actual signal	Signal measured or calculated by the drive. Can be monitored by the user. No user setting is possible.
Def	Default value
enum	Enumerated list, i.e. selection list
FbEq	Fieldbus equivalent: The scaling between the value shown on the panel and the integer used in serial communication.
Page no.	Page number for more information
INT32	32-bit integer value (31 bits + sign)
Bit pointer	Bit pointer. A bit pointer points to a single bit in the value of another parameter.
Val pointer	Value pointer. A value pointer points to the value of another parameter.
Parameter	An operation instruction of the regen supply module that is often user-adjustable. Parameters that are signals measured or calculated by the supply module are called actual signals.
Pb	Packed boolean
PT	Parameter protection type. See WP, WPD and WP0.
REAL	16-bit value 16-bit value (31 bits + sign) = integer value = fractional value
REAL24	8-bit value 24-bit value (31 bits + sign) = integer value = fractional value
Save PF	Parameter is saved to flash memory at 1 minute intervals to prevent data loss if power supply to the drive control unit is lost.
Type	Data type: enum, INT32, Bit pointer, Val pointer, Pb, REAL, REAL24, UINT32.
UINT32	32-bit unsigned integer value
WP	Write protected parameter (i.e. read only)
WPD	Write protected parameter while drive is running
WP0	Write protected parameter, but it may be reset to zero.

Fieldbus equivalent

Serial communication data between fieldbus adapter and drive is transferred in integer format. Thus the drive actual and reference signal values must be scaled to 16/32-bit integer values. Fieldbus equivalent defines the scaling between the signal value and the integer used in serial communication.

All the read and sent values are limited to 16/32 bits.

Example: If 20.05 MAXIMUM CURRENT is set from external control system, an integer value of 100 corresponds to 1 A.

Fieldbus addresses

For FPBA-01 Profibus Adapter, FDNA-01 DeviceNet Adapter and FCAN-01 CANopen Adapter, see the User's Manual of the fieldbus adapter module.

Pointer parameter format in fieldbus communication

Value and bit pointer parameters are transferred between the fieldbus adapter and drive as 32-bit integer values.

32-bit integer value pointers

When value pointer parameter is connected to the value of another parameter or signal, the format is as follows:

	Bit			
	30…31	**16…29**	**8…15**	**0…7**
Name	Source type		Group	Index
Value	1	-	1…255	1…255
Description	Value pointer is connected to parameter/signal.	-	Group of source parameter	Index of source parameter

When value pointer parameter is connected to an application program, the format is as follows:

	Bit		
	30…31	**24…29**	**0…23**
Name	Source type	Not in use	Address
Value	2	-	$0…2^{23}$
Description	Value pointer is connected to application program.	-	Relative address of application program variable

Note: Value pointer parameters which are connected to an application program cannot be set via fieldbus (i.e. read access only).

32-bit integer bit pointers

When bit pointer parameter is connected to value 0 or 1, the format is as follows:

	Bit		
	30…31	**16…29**	**0**
Name	Source type	Not in use	Value
Value	0	-	0…1
Description	Bit pointer is connected to 0/1.	-	0 = False, 1 = True

When bit pointer is connected to a bit value of another signal, the format is as follows:

	Bit				
	30…31	**24…29**	**16…23**	**8…15**	**0…7**
Name	Source type	Not in use	Bit sel	Group	Index
Value	1	-	0…31	2…255	1…255
Description	Bit pointer is connected to signal bit value.	-	Bit selection	Group of source parameter	Index of source parameter

When bit pointer parameter is connected to an application program, the format is as follows:

	Bit		
	30…31	**24…29**	**0…23**
Name	Source type	Bit sel	Address
Value	2	0…31	$0…2^{23}$
Description	Bit pointer is connected to application program.	Bit selection	Relative address of application program variable

Note: Bit pointer parameters which are connected to an application program cannot be set via fieldbus (i.e. read access only).

Actual signals (Parameter groups 1…9)

Index	Name	Type	Range	Unit	FbEq	Update time	Data length	PT	Save PF	Page no.
01	ACTUAL VALUES									
1.03	FREQUENCY	REAL	-30000.00… 30000.00	Hz	1 = 100	2 ms	32	WP		29
1.04	CURRENT	REAL	0.00…30000.00	A	1 = 100	2 ms	32	WP		29
1.05	CURRENT PERC	REAL	0.0…1000.0	%	1 = 10	2 ms	32	WP		29
1.07	DC-VOLTAGE	REAL	0.0…2000.0	V	1 = 10	250 µs	16	WP		29
1.15	TEMP INVERTER	REAL24	-40.0…160.0	%	1 = 10	2 ms	16	WP		29
1.16	TEMP BC	REAL24	-40.0…160.0	%	1 = 10	2 ms	16	WP		29
1.17	EXT TEMP	REAL	-10.0…250.0	°C	1 = 10	10 ms	16	WP		29
1.19	USED SUPPLY VOLT	REAL	0.0…1000.0	V	1 = 10	-	16	WP		29
1.20	BRAKE RES LOAD	REAL24	0…1000	%	1 = 1	50 ms	16	WP		30
1.21	CPU USAGE	UINT32	0…100	%	1 = 1	-	16	WP		30
1.22	INVERTER POWER	REAL	-32786.00… 32768.00	kW	1 = 100	10 ms	32	WP		30
1.26	ON TIME COUNTER	INT32	0…2^{31} - 1	h	1 = 1 min	10 ms	32	WP0	x	30
1.27	RUN TIME COUNTER	INT32	0…2^{31} - 1	h	1 = 1 min	10 ms	32	WP0	x	30
1.28	FAN ON-TIME	INT32	0…2^{31} - 1	h	1 = 1 min	10 ms	32	WP0	x	30
02	I/O VALUES									
2.01	DI STATUS	Pb	0…2^{32} - 1	-	1 = 1	2 ms	16	WP		31
2.02	RO STATUS	Pb	0…2^{32} - 1	-	1 = 1	2 ms	16	WP		31
2.03	DIO STATUS	Pb	0…2^{32} - 1	-	1 = 1	2 ms	16	WP		31
2.04	AI1	REAL	-22.000 mA … 22.000 mA or -11.000 V … 11.000 V	mA or V	1 = 1000	2 ms	16	WP		31
2.05	AI1 SCALED	REAL	-32768.000… 32768.000	-	1 = 1000	2 ms	32	WP		31
2.06	AI2	REAL	-22.000 mA … 22.000 mA or -11.000 V… 11.000 V	mA or V	1 = 1000	2 ms	16	WP		31
2.07	AI2 SCALED	REAL	-32768.000… 32768.000	-	1 = 1000	2 ms	32	WP		31
2.08	AO1	REAL	0.000…22.700	mA	1 = 1000	2 ms	16	WP		31
2.09	AO2	REAL	-10.000…10.000	V	1 = 1000	2 ms	16	WP		31
2.10	DIO2 FREQ IN	REAL	-32768.000… 32768.000	-	1 = 1000	2 ms	32	WP		31
2.11	DIO3 FREQ OUT	REAL	-32768.000… 32768.000	Hz	1 = 1000	2 ms	32	WP		31
2.12	FBA MAIN CW	Pb	0…2^{32} - 1	-	1 = 1	500 µs	32	WP		32
2.13	FBA MAIN SW	Pb	0…2^{32} - 1	-	1 = 1	2 ms	32	WP		33
2.14	FBA MAIN REF1	INT32	-2^{31}…2^{31} - 1	-	1 = 1	500 µs	32	WP		34
2.15	FBA MAIN REF2	INT32	-2^{31}…2^{31} - 1	-	1 = 1	500 µs	32	WP		34
2.17	D2D MAIN CW	Pb	0…2^{32} - 1	-	1 = 1	500 µs	16	WP		34
2.18	D2D FOLLOWER CW	Pb	0…2^{32} - 1	-	1 = 1	2 ms	16	WP		34

Index	Name	Type	Range	Unit	FbEq	Update time	Data length	PT	Save PF	Page no.
2.19	D2D REF1	INT32	-2^{31}…2^{31} - 1	-	1 = 1	500 µs	32	WP		34
2.20	D2D REF2	INT32	-2^{31}…2^{31} - 1	-	1 = 1	2 ms	32	WP		34
04	LINE CONV SIGNALS									
4.01	REACTIVE POWER	REAL	-32768.000… 32768.000	kVAr	1 = 1000	2 ms	32	WP		35
4.08	EXT FAN COMMAND	Pb	0…1	-	1 = 1	10 ms	16	WP		35
4.10	DC REF1	REAL	0.0…2000.0	V	1 = 10	250 µs	16	WP		35
4.11	DC REF RAMP IN	REAL	0.0…2000.0	V	1 = 10	250 µs	16	WP		35
4.12	DC REF RAMPED	REAL	0.0…2000.0	V	1 = 10	250 µs	16	WP		35
4.20	Q POW REF	REAL	-32768.000… 32768.000	kVAr	1 = 1000	250 µs	32	WP		35
4.21	Q POW RAMP IN	REAL	-32768.000… 32768.000	kVAr	1 = 1000	250 µs	32	WP		35
4.22	Q POW REF RAMPED	REAL	-32768.000… 32768.000	kVAr	1 = 1000	250 µs	32	WP		35
4.30	POW REF1	REAL	-32768.000… 32768.000	kW	1 = 1000	250 µs	32	WP		35
4.31	POW REF RAMP IN	REAL	-32768.000… 32768.000	kW	1 = 1000	250 µs	32	WP		35
4.32	POW REF RAMPED	REAL	-32768.000… 32768.000	kW	1 = 1000	250 µs	32	WP		35
4.34	POWER REF USED	REAL	-32768.000… 32768.000	kW	1 = 1000	250 µs	32	WP		35
06	DRIVE STATUS									
6.01	STATUS WORD 1	Pb	0…2^{32} - 1	-	1 = 1	2 ms	32	WP		36
6.02	STATUS WORD 2	Pb	0…2^{32} - 1	-	1 = 1	2 ms	32	WP		37
6.05	LIMIT WORD 1	Pb	0…2^{32} - 1	-	1 = 1	250 µs	16	WP		38
6.07	LC LIM STATUS	Pb	0…2^{32} - 1	-	1 = 1	250 µs	16	WP		38
6.12	OP MODE ACK	enum	0…3	-	1 = 1	2 ms	16	WP		39
6.14	SUPERV STATUS	enum	0…2^{32} - 1	-	1 = 1	2 ms	16	WP		39
08	ALARMS & FAULTS									
8.01	ACTIVE FAULT	INT32	0…65535	-	1 = 1	-	16	WP		40
8.02	LAST FAULT	INT32	0…2^{31} - 1	-	1 = 1	-	16	WP0		40
8.03	FAULT TIME HI	INT32	0…2^{31} - 1	days	1 = 1	-	32	WP		40
8.04	FAULT TIME LO	INT32	0…2^{31} - 1	-	1 = 1	-	32	WP		40
8.05	ALARM WORD 1	UINT32	0…2^{32} - 1	-	1 = 1	2 ms	16	WP0		40
8.06	ALARM WORD 2	UINT32	0…2^{32} - 1	-	1 = 1	2 ms	16	WP0		41
8.07	ALARM WORD 3	UINT32	0…2^{32} - 1	-	1 = 1	2 ms	16	WP0		41
8.08	ALARM WORD 4	UINT32	0…2^{32} - 1	-	1 = 1	2 ms	16	WP0		41
09	SYSTEM INFO									
9.01	DRIVE TYPE	INT32	0…65535	-	1 = 1	-	16	WP		42
9.02	DRIVE RATING ID	INT32	0…65535	-	1 = 1	-	16	WP		42
9.03	FIRMWARE ID	Pb	0…2^{32} - 1	-	1 = 1	-	32	WP		42
9.04	FIRMWARE VER	Pb	0…2^{32} - 1	-	1 = 1	-	16	WP		42
9.05	FIRMWARE PATCH	Pb	0…2^{32} - 1	-	1 = 1	-	16	WP		42
9.10	INT LOGIC VER	Pb	0…2^{32} - 1	-	1 = 1	-	16	WP		42

Index	Name	Type	Range	Unit	FbEq	Update time	Data length	PT	Save PF	Page no.
9.20	OPTION SLOT 1	INT32	0…24	-	1 = 1	-	16	WP		42
9.21	OPTION SLOT 2	INT32	0…24	-	1 = 1	-	16	WP		42
9.22	OPTION SLOT 3	INT32	0…23	-	1 = 1	-	16	WP		42

Parameter groups 10…99

Index	Parameter	Type	Range	Unit	FbEq	Update time	Data len.	Def	PT	Save PF	Page no.
10	START/STOP										
10.01	EXT1 START FUNC	enum	0…4	-	1 = 1	2 ms	16	1	WPD		43
10.02	EXT1 START IN1	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.True	WPD		44
10.03	EXT1 START IN2	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.False	WPD		44
10.04	EXT2 START FUNC	enum	0…4	-	1 = 1	2 ms	16	1	WPD		44
10.05	EXT2 START IN1	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.01.00	WPD		45
10.06	EXT2 START IN2	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.False	WPD		45
10.08	FAULT RESET SEL	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.01.02			45
10.09	RUN ENABLE	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.True	WPD		45
10.12	START INHIBIT	enum	0…1	-	1 = 1	2 ms	32	0			45
10.13	FB CW USED	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.12	WPD		45
10.16	D2D CW USED	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.17			46
10.17	START ENABLE	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.True	WPD		46
10.18	FORCE STOP	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.01.03	WPD		
12	DIGITAL IO										
12.01	DIO1 CONF	enum	0…1	-	1 = 1	10 ms	16	0			47
12.02	DIO2 CONF	enum	0…2	-	1 = 1	10 ms	16	0			48
12.03	DIO3 CONF	enum	0…3	-	1 = 1	10 ms	16	0			48
12.04	DIO1 OUT PTR	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.04.08.00			48
12.05	DIO2 OUT PTR	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.06.02.03			48
12.06	DIO3 OUT PTR	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.06.01.10			48
12.07	DIO3 F OUT PTR	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.07			48
12.08	DIO3 F MAX	REAL	3…32768	Hz	1 = 1	10 ms	16	1000			48
12.09	DIO3 F MIN	REAL	3…32768	Hz	1 = 1	10 ms	16	3			49
12.10	DIO3 F MAX SCALE	REAL	0…32768	-	1 = 1	10 ms	16	1500			49
12.11	DIO3 F MIN SCALE	REAL	0…32768	-	1 = 1	10 ms	16	0			49
12.12	RO1 OUT PTR	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.01.00			49
12.13	DI INVERT MASK	UINT32	0…2^{32} - 1	-	1 = 1	2 ms	16	0			50
12.14	DIO2 F MAX	REAL	3…32768	Hz	1 = 1	10 ms	16	1000			50
12.15	DIO2 F MIN	REAL	3…32768	Hz	1 = 1	10 ms	16	3			50
12.16	DIO2 F MAX SCALE	REAL	-32768… 32768	-	1 = 1	10 ms	16	1500			50
12.17	DIO2 F MIN SCALE	REAL	-32768… 32768	-	1 = 1	10 ms	16	0			50
13	ANALOGUE INPUTS										
13.01	AI1 FILT TIME	REAL	0.000… 30.000	s	1 = 1000	10 ms	16	0			51
13.02	AI1 MAX	REAL	-22.000… 22.000	mA	1 = 1000	10 ms	16	10.000			51
13.03	AI1 MIN	REAL	-22.000… 22.000	mA	1 = 1000	10 ms	16	-10.000			52
13.04	AI1 MAX SCALE	REAL	-32768.000… 32768.000	-	1 = 1000	10 ms	32	1500.000			52

Index	Parameter	Type	Range	Unit	FbEq	Update time	Data len.	Def	PT	Save PF	Page no.
13.05	AI1 MIN SCALE	REAL	-32768.000… 32768.000	-	1 = 1000	10 ms	32	-1500.000			52
13.06	AI2 FILT TIME	REAL	0.000…30.000	s	1 = 1000	10 ms	16	0			52
13.07	AI2 MAX	REAL	-22.000… 22.000	mA	1 = 1000	10 ms	16	10.000			52
13.08	AI2 MIN	REAL	-22.000… 22.000	mA	1 = 1000	10 ms	16	-10.000			53
13.09	AI2 MAX SCALE	REAL	-32768.000… 32768.000	-	1 = 1000	10 ms	32	100.000			53
13.10	AI2 MIN SCALE	REAL	-32768.000… 32768.000	-	1 = 1000	10 ms	32	-100.000			53
13.11	AITUNE	enum	0…4	-	1 = 1	10 ms	16	-			53
13.12	AI SUPERVISION	enum	0…1	-	1 = 1	2 ms	16	0			54
13.13	AI SUPERVIS ACT	Pb	0…2^{32} - 1	-	1 = 1	2 ms	16	0			54
15	ANALOGUE OUTPUTS										
15.01	AO1 PTR	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.05			55
15.02	AO1 FILT TIME	REAL	0.000…30.000	s	1 = 1000	10 ms	16	0.100			55
15.03	AO1 MAX	REAL	0.000…22.700	mA	1 = 1000	10 ms	16	20.000			55
15.04	AO1 MIN	REAL	0.000…22.700	mA	1 = 1000	10 ms	16	4.000			56
15.05	AO1 MAX SCALE	REAL	-32768.000… 32767.000	-	1 = 1000	10 ms	32	100.000			56
15.06	AO1 MIN SCALE	REAL	-32768.000… 32767.000	-	1 = 1000	10 ms	32	0.000			56
15.07	AO2 PTR	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.07			56
15.08	AO2 FILT TIME	REAL	0.000…30.000	s	1 = 1000	10 ms	16	0.100			56
15.09	AO2 MAX	REAL	-10.000… 10.000	V	1 = 1000	10 ms	16	10.000			57
15.10	AO2 MIN	REAL	-10.000… 10.000	V	1 = 1000	10 ms	16	-10.000			57
15.11	AO2 MAX SCALE	REAL	-32768.000… 32767.000	-	1 = 1000	10 ms	32	100.000			57
15.12	AO2 MIN SCALE	REAL	-32768.000… 32767.000	-	1 = 1000	10 ms	32	-100.000			57
16	SYSTEM										
16.01	LOCAL LOCK	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.False			58
16.02	PARAMETER LOCK	enum	0…2	-	1 = 1	2 ms	32	1			58
16.03	PASS CODE	UINT32	0…2^{31} -1	-	1 = 1	-	32	0			58
16.04	PARAM RESTORE	enum	0…2	-	1 = 1	-	32	0	WPD		58
16.07	PARAM SAVE	enum	0…1	-	1 = 1	-	32	0			58
16.09	USER SET SEL	enum	1…10	-	1 = 1	-	32	1	WPD		59
16.10	USER SET LOG	Pb	0…2^{32} - 1	-	1 = 1	-	32	0	WP		59
16.11	USER IO SEL LO	Bit pointer	0…2^{32} - 1	-	1 = 1	-	32	C.False			60
16.12	USER IO SEL HI	Bit pointer	0…2^{32} - 1	-	1 = 1	-	32	C.False			60
16.13	TIME SOURCE PRIO	enum	0…8	-	1 = 1	-	16	0			60

Index	Parameter	Type	Range	Unit	FbEq	Update time	Data len.	Def	PT	Save PF	Page no.
17	PANEL DISPLAY										
17.01	SIGNAL1 PARAM	UINT32	00.00… 255.255	-	1 = 1	-	16	01.07			61
17.02	SIGNAL2 PARAM	UINT32	00.00… 255.255	-	1 = 1	-	16	01.04			61
17.03	SIGNAL3 PARAM	UINT32	00.00… 255.255	-	1 = 1	-	16	01.22			61
20	LIMITS										
20.05	MAXIMUM CURRENT	REAL	0…30000	A	1 = 100	10 ms	32	0.00			62
20.08	THERM CURR LIM	enum	0…1	-	1 = 1	-	16	1			62
33	SUPERVISION										
33.01	SUPERV1 FUNC	enum	0…4	-	1 = 1	2 ms	16	0			63
33.02	SUPERV1 ACT	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.07			63
33.03	SUPERV1 LIM HI	REAL	-32768.00… 32768.00	-	1 = 100	2 ms	32	0.00			64
33.04	SUPERV1 LIM LO	REAL	-32768.00… 32768.00	-	1 = 100	2 ms	32	0.00			64
33.05	SUPERV2 FUNC	enum	0…4	-	1 = 1	2 ms	16	0			64
33.06	SUPERV2 ACT	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.04			64
33.07	SUPERV2 LIM HI	REAL	-32768.00… 32768.00	-	1 = 100	2 ms	32	0.00			64
33.08	SUPERV2 LIM LO	REAL	-32768.00… 32768.00	-	1 = 100	2 ms	32	0.00			64
33.09	SUPERV3 FUNC	enum	0…4	-	1 = 1	2 ms	16	0			65
33.10	SUPERV3 ACT	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.07			65
33.11	SUPERV3 LIM HI	REAL	-32768… 32768	-	1 = 100	2 ms	32	0.00			65
33.12	SUPERV3 LIM LO	REAL	-32768… 32768	-	1 = 100	2 ms	32	0.00			65
34	REFERENCE CTRL										
34.01	EXT1/EXT2 SEL	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.02.01.01			66
34.03	EXT1 CTRL MODE1	enum	1…2	-	1 = 1	2 ms	16	1			66
34.05	EXT2 CTRL MODE1	enum	1…2	-	1 = 1	2 ms	16	1			66
34.07	LOCAL CTRL MODE	enum	1…6	-	1 = 1	2 ms	16	1	WPD		66
40	CONVERTER CONTROL										
40.02	SF REF	enum	0…16	kHz	1 = 1	-	16	3			67
40.04	VOLTAGE RESERVE	REAL24	-4…50	%	1 = 1	2 ms	32	2			67
45	EXT TEMP PROT										
45.01	EXT TEMP PROT	enum	0…2	-	1 = 1	10 ms	16	2			68
45.02	EXT TEMP SOURCE	enum	0…12	-	1 = 1	10 ms	16	2			68
45.03	EXT TEMP ALM LIM	REAL	0…10000	ohm or °C	1 = 1	10 ms	16	90			69
45.04	EXT TEMP FLT LIM	REAL	0…10000	ohm or °C	1 = 1	10 ms	16	110			69
46	FAULT FUNCTIONS										
46.01	EXTERNAL FAULT	Bit pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	C.True			70

Index	Parameter	Type	Range	Unit	FbEq	Update time	Data len.	Def	PT	Save PF	Page no.
46.03	LOCAL CTRL LOSS	enum	0…1	-	1 = 1	10 ms	32	1			70
46.05	EARTH FAULT	enum	0…2	-	1 = 1	-	16	2			70
46.06	SUPPL PHS LOSS	enum	0…1	-	1 = 1	2 ms	16	1			71
46.07	STO DIAGNOSTIC	enum	1…3	-	1 = 1	10 ms	16	1			71
47	VOLTAGE CTRL										
47.03	SUPPLVOLTAUTO-ID	enum	0…1	-	1 = 1	-	16	1			72
47.04	SUPPLY VOLTAGE	REAL	0.0…1000.0	V	1 = 10	-	16	400.0			72
48	BRAKE CHOPPER										
48.01	BC ENABLE	enum	0…2	-	1 = 1	250 µs	16	0			73
48.02	BC RUN-TIME ENA	Bit pointer	0…2^{32} - 1	-	1 = 1	250 µs	32	C.True			73
48.03	BRTHERMTIMECONST	REAL24	0…10000	s	1 = 1	-	32	0			73
48.04	BR POWER MAX CNT	REAL24	0.0…10000.0	kW	1 = 10	-	32	0.0			73
48.05	R BR	REAL24	1.0…1000.0	ohm	1 = 10	-	32	0.0			74
48.06	BR TEMP FAULTLIM	REAL24	0…150	%	1 = 1	-	16	105			74
48.07	BR TEMP ALARMLIM	REAL24	0…150	%	1 = 1	-	16	95			74
50	FIELDBUS										
50.01	FBA ENABLE	enum	0…1	-	1 = 1	-	16	0			75
50.02	COMM LOSS FUNC	enum	0…1	-	1 = 1	-	16	0			75
50.03	COMM LOSS T OUT	UINT32	0.3…6553.5	s	1 = 10	-	16	0.3			75
50.04	FBA REF1 SCALE	enum	0…2	-	1 = 1	10 ms	16	2			76
50.05	FBA REF2 SCALE	enum	0…2	-	1 = 1	10 ms	16	1			76
50.06	FBA ACT1 SEL	Val pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	P.01.07			76
50.07	FBA ACT2 SEL	Val pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	P.04.01			76
50.08	FBA SW B12 SRC	Bit pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	C.False			77
50.09	FBA SW B13 SRC	Bit pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	C.False			77
50.10	FBA SW B14 SRC	Bit pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	C.False			77
50.11	FBA SW B15 SRC	Bit pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	C.False			77
51	FBA SETTINGS										
51.01	FBA TYPE	UINT32	0…65536	-	1 = 1		16	0			78
51.02	FBA PAR2	UINT32	0…65536	-	1 = 1		16	0		x	78
…	…	…	…	…	…		….	…		…	
51.26	FBA PAR26	UINT32	0…65536	-	1 = 1		16	0		x	78
51.27	FBA PAR REFRESH	UINT32	0…1	-	1 = 1		16	0	WPD	x	78
51.28	PAR TABLE VER	UINT32	0…65536	-	1 = 1		16	0		x	78
51.29	DRIVE TYPE CODE	UINT32	0…65536	-	1 = 1		16	0		x	79
51.30	MAPPING FILE VER	UINT32	0…65536	-	1 = 1		16	0		x	79
51.31	D2FBA COMM STA	UINT32	0…6	-	1 = 1		16	0	WP	x	79
51.32	FBA COMM SW VER	UINT32	0…65536	-	1 = 1		16	0		x	79
51.33	FBA APPL SW VER	UINT32	0…65536	-	1 = 1		16	0		x	79
52	FBA DATA IN										
52.01	FBA DATA IN1	UINT32	0…9999	-	1 = 1		16	0		x	80
…	…	…	…	…	…		…	…		…	-
52.12	FBA DATA IN12	UINT32	0…9999	-	1 = 1		16	0		x	80

Index	Parameter	Type	Range	Unit	FbEq	Update time	Data len.	Def	PT	Save PF	Page no.
53	FBA DATA OUT										
53.01	FBA DATA OUT1	UINT32	0…9999	-	1 = 1		16	0		x	81
…	…	…	…	…	…		…	…		…	
53.12	FBA DATA OUT12	UINT32	0…9999	-	1 = 1		16	0		x	81
57	D2D COMMUNICATION										
57.01	LINK MODE	enum	0…2	-	1 = 1	-	16	0	WPD		82
57.02	COMM LOSS FUNC	enum	0…2	-	1 = 1	-	16	1			82
57.03	NODE ADDRESS	UINT32	1…62	-	1 = 1	-	16	1	WPD		83
57.04	FOLLOWER MASK 1	Pb	0…2^{32} - 1	-	1 = 1	-	32	0			83
57.05	FOLLOWER MASK 2	Pb	0…2^{32} - 1	-	1 = 1	-	32	0			83
57.06	REF 1 SRC	Val pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	P.01.07			83
57.07	REF 2 SRC	Val pointer	0…2^{32} - 1	-	1 = 1	2 ms	32	P.01.07			83
57.08	FOLLOWER CW SRC	Val pointer	0…2^{32} - 1	-	1 = 1	500 µs	32	P.02.18			83
57.09	KERNEL SYNC MODE	enum	0…3	-	1 = 1	10 ms	16	0	WPD		83
57.10	KERNEL SYNC OFFS	INT32	-4.999… 5.000	ms	1 = 1000	10 ms	32	-	WPD		84
57.11	REF 1 MSG TYPE	enum	0…1	-	1 = 1	-	16	0			84
57.12	REF1 MC GROUP	UINT32	0…62	-	1 = 1	-	16	0			84
57.13	NEXT REF1 MC GRP	UINT32	0…62	-	1 = 1	-	16	0			85
57.14	NR REF1 MC GRPS	UINT32	1…62	-	1 = 1	-	16	1			85
57.15	D2D COMM PORT	enum	0…3	-	1 = 1	-	16	0	WPD		85
60	DC VOLT REF										
60.01	DC REF SEL	Val pointer	0…2^{32} - 1	-	1 = 1	250 µs	32	0			86
60.02	DC VOLT REF	REAL	0.0…2000.0	V	1 = 10	-	16	580.0			86
60.03	DC REF MAX	REAL	0.0…2000.0	V	1 = 10	250 µs	16	770.0			87
60.04	DC REF MIN	REAL	0.0…2000.0	V	1 = 10	250 µs	16	0.0			87
60.05	DC RAMP UP	REAL	0.000… 32768.000	ms	1 = 1000	-	32	100.000			87
60.06	DC RAMP DOWN	REAL	0.000… 32768.000	ms	1 = 1000	-	32	100.000			87
61	REACTIVE POWER										
61.01	Q POWER REF SEL	Val pointer	0…2^{32} - 1	-	1 = 1	250 µs	32	P.61.02			88
61.02	Q POWER REF	REAL	-32768.000 …32768.000	kVAr	1 = 1000	-	32	0.000			88
61.03	Q POWER REF MAX	REAL	-32768.000 …32768.000	kVAr	1 = 1000	250 µs	32	32768.000			88
61.04	Q POWER REF MIN	REAL	-32768.000 …32768.000	kVAr	1 = 1000	250 µs	32	-32768.000			89
61.05	Q POW RAMP UP	REAL	0.000… 32768.000	ms	1 = 1000	-	32	1000.000			89
61.06	Q POW RAMP DOWN	REAL	0.000… 32768.000	ms	1 = 1000	-	32	1000.000			89
62	POWER REF										
62.01	POW REF SEL	Val pointer	0…2^{32} - 1	-	1 = 1	250 µs	32	P.62.02			90

Index	Parameter	Type	Range	Unit	FbEq	Update time	Data len.	Def	PT	Save PF	Page no.
62.02	POWER REF	REAL	-32768.000 …32768.000	kW	1 = 1000	-	32	0.000			90
62.03	MAXIMUM POW REF	REAL	-32768.000 …32768.000	kW	1 = 1000	250 µs	32	32768.000			90
62.04	MINIMUM POW REF	REAL	-32768.000 …32768.000	kW	1 = 1000	250 µs	32	-32768.000			91
62.05	POW RAMP UP	REAL	0.000… 32768.000	ms	1 = 1000	-	32	1000.000			91
62.06	POW RAMP DOWN	REAL	0.000… 32768.000	ms	1 = 1000	-	32	1000.000			91
63	USER DATA										
63.01	MAINS VOLTAGE	REAL	0…1000	V	1 = 1	-	32	0			92
63.02	FREQUENCY	REAL	0…1000	Hz	1 = 1	-	32	0			92
63.03	DIRECTION	enum	0…2	-	1 = 1	-	16	0			92
64	PARALLEL UNITS										
64.01	CIRC CURR ELIM	enum	0…1	-	1 = 1	-	16	0			93
64.02	DC CTRL DROOP EN	enum	0…1	-	1 = 1	10 ms	16	0			93
65	FILTER FAN CTRL										
65.01	FAN CURRENT LIM	REAL	0.0…1000.0	%	1 = 10	10 ms	16	10.0			94
65.02	FAN OFF DELAY	UINT32	0…2^{32} - 1	s	1 = 1	10 ms	32	120			94
95	HW CONFIGURATION										
95.01	CTRL UNIT SUPPLY	enum	0…1	-	1 = 1	2 ms	16	0			95
95.03	TEMP INU AMBIENT	REAL	0…55	°C	1 = 1	10 ms	16	40			95
99	START-UP DATA										
99.01	LANGUAGE	enum	0…65535	-	1 = 1	-	16	2057 (English)			96
99.13	IDRUN MODE	enum	0…2	-	1 = 1	-	16	0	WPD		96

Fault tracing

What this chapter contains

The chapter lists all alarm and fault messages including the possible cause and corrective actions.

Safety

WARNING! Only qualified electricians are allowed to maintain the drive. The *Safety Instructions* on the first pages of the appropriate hardware manual must be read before you start working with the drive.

Alarm and fault indications

An alarm or a fault message indicates abnormal drive status. Most alarm and fault causes can be identified and corrected using this information. If not, an ABB representative should be contacted.

The four-digit code number in brackets after the message is for the fieldbus communication.

The alarm/fault code is displayed on the 7-segment display of the drive. The following table describes the indications given by the 7-segment display.

Display	Meaning
“E-” followed by error code	System error. See appropriate drive hardware manual.
“A-” followed by error code	Alarm. See section *Alarm messages generated by the drive* on page 111.
“F-” followed by error code	Fault. See section *Fault messages generated by the drive* on page 115.

How to reset

The drive can be reset either by pressing the reset key on the PC tool ( ) or control panel (***RESET***) or switching the supply voltage off for a while. When the fault has been removed, the motor can be restarted.

A fault can also be reset from an external source by parameter 10.08 FAULT RESET SEL.

Fault history

When fault is detected, it is stored in the fault logger with a time stamp. The fault history stores information on the 16 latest faults of the drive. Three of the latest faults are stored at the beginning of a power switch off.

Signals 8.01 ACTIVE FAULT and 8.02 LAST FAULT store the fault codes of the most recent faults.

Alarms can be monitored via alarm words 8.05 ALARM WORD 1 … 8.08 ALARM WORD 4. Alarm information is lost at power switch off or fault reset.

Alarm messages generated by the drive

Code	Alarm (fieldbus code)	Cause	What to do
2003	SAFE TORQUE OFF (0xFF7A) Programmable fault: 46.07 STO DIAGNOSTIC	Safe Torque Off function is active, i.e. safety circuit signal(s) connected to connector X6 is lost while drive is stopped and parameter 46.07 STO DIAGNOSTIC is set to (2) ALARM.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
2004	STO MODE CHANGE (0xFF7A)	Error in changing Safe Torque Off supervision, i.e. parameter 46.07 STO DIAGNOSTIC setting could not be changed to value (2) ALARM.	Contact your local ABB representative.
2005	EXT TEMPERATURE (0x4310) Programmable fault: 45.01 EXT TEMP PROT	Measured temperature or resistance (selected by parameter 45.02 EXT TEMP SOURCE) has exceeded alarm limit defined by parameter 45.03 EXT TEMP ALM LIM.	Check that thermistor signal is connected to the input selected by parameter 45.02 EXT TEMP SOURCE. Check that thermistor type is the one selected by parameter 45.02 EXT TEMP SOURCE. Check the value of the alarm limit (45.03).
2006	EMERGENCY OFF (0xF083)	Drive has received emergency OFF2 command.	To restart drive, activate RUN ENABLE signal (source selected by parameter 10.09 RUN ENABLE) and start drive.
2007	RUN ENABLE (0xFF54)	No Run enable signal is received.	Check setting of parameter 10.09 RUN ENABLE. Switch signal on (e.g. in the fieldbus Control Word) or check wiring of selected source.
2008	ID-RUN (0xFF84)	Network identification is requested by parameter 99.13 IDRUN MODE = Normal.	Start the identification routine by pressing the Start button. The identification routine initializes parameters 63.01…63.03 and it lasts for a few seconds. Modulation stops and the warning disappears after the identification is completed. Select 99.13 IDRUN MODE = Clear Results to cancel a pending identification request.
2009	EMERGENCY STOP (0xF081)	Drive has received emergency stop command (OFF1/OFF3).	Check that it is safe to continue operation. Return emergency stop push button to normal position (or adjust the fieldbus Control Word accordingly). Restart drive.
2011	BR OVERHEAT (0x7112)	Brake resistor temperature has exceeded alarm limit defined by parameter 48.07 BR TEMP ALARMLIM.	Stop drive. Let resistor cool down. Check resistor overload protection function settings, parameters 48.01…48.05. Check alarm limit setting, parameter 48.07. Check that braking cycle meets allowed limits.

Code	Alarm (fieldbus code)	Cause	What to do
2012	BC OVERHEAT (0x7181)	Brake chopper IGBT temperature has exceeded internal alarm limit.	Let chopper cool down. Check resistor overload protection function settings, parameters 48.01…48.05. Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
2013	DEVICE OVERTEMP (0x4210)	Measured drive temperature has exceeded internal alarm limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
2014	INTBOARD OVERTEMP (0x7182)	Interface board (between power unit and control unit) temperature has exceeded internal alarm limit.	Let drive cool down.
2015	BC MOD OVERTEMP (0x7183)	Input bridge or brake chopper temperature has exceeded internal alarm limit.	Let drive cool down.
2016	IGBT OVERTEMP (0x7184)	Drive temperature based on thermal model has exceeded internal alarm limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
2017	FIELDBUS COMM (0x7510) Programmable fault: 50.02 COMM LOSS FUNC	Cyclical communication between drive and fieldbus adapter module or between PLC and fieldbus adapter module is lost.	Check status of fieldbus communication. See appropriate User's Manual of fieldbus adapter module. Check fieldbus parameter settings. See parameter group 50 FIELDBUS on page 75. Check cable connections. Check if communication master can communicate.
2018	LOCAL CTRL LOSS (0x5300) Programmable fault: 46.03 LOCAL CTRL LOSS	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Replace control panel in mounting platform.
2019	AI SUPERVISION (0x8110) Programmable fault: 13.12 AI SUPERVISION	Analogue input AI1 or AI2 signal has reached limit defined by parameter 13.13 AI SUPERVIS ACT.	Check analogue input AI1/2 source and connections. Check analogue input AI1/2 minimum and maximum limit settings, parameters 13.02 and 13.03 / 13.07 and 13.08.
2020	FB PAR CONF (0x6320)	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check fieldbus parameter settings. See parameter group 50 FIELDBUS on page 75.

Code	Alarm (fieldbus code)	Cause	What to do
2033	D2D COMMUNICATION (0x7520) Programmable fault: 57.02 COMM LOSS FUNC	On the master drive: The drive has not received a response from an activated follower for five consecutive polling cycles.	Check that all drives that are polled (parameters 57.04 and 57.05) on the drive-to-drive link are powered, properly connected to the link, and have the correct node address. Check the drive-to-drive link wiring.
		On a follower drive: The drive has not received new reference 1 and/or 2 for five consecutive reference handling cycles.	Check parameter settings to ensure that all followers in the multicast message chain (i.e. when parameter 57.11 REF 1 MSG TYPE = REF1 MC GRPS on the master) receive a reference 1 and command word. Check that the handling of reference 2 is not disabled (i.e. disabled by setting input pin 'Ref2 Cycle Sel' of the D2D_Conf block to negative) in the application program of the master drive. Check the drive-to-drive link wiring.
2034	D2D BUFFER OVERLOAD (0x7580) Programmable fault: 57.02 COMM LOSS FUNC	Transmission of drive-to-drive references failed because of message buffer overflow.	If an application program exists: Check the selected reference handling cycles from the D2D_Conf block in the application program to verify that a maximum of eight messages per millisecond is not exceeded. Check the number of D2D_SendMessage blocks, sum of active D2D_SendMessage blocks and that reference 2 message (if not disabled) is not above four. Check the drive-to-drive link wiring.
2035	PS COMM (0x5480)	Communication errors detected between the JCU Control Unit and the power unit of the drive.	Check the connections between the JCU Control Unit and the power unit.
2036	RESTORE (0x630D)	Restoration of backed-up parameters failed.	Contact your local ABB representative.
2039	EARTH FAULT (0x2330) Programmable fault: 46.05 EARTH FAULT	The regen supply module has detected that there is a too large current imbalance between measured phase currents.	If the supply modules are parallel-connected, disable earth fault supervision in the supply modules. Check that there is no earth fault in supply cables. If no earth fault can be detected, contact your local ABB representative.
2042	D2D CONFIG (0x7583)	The settings of drive-to-drive link configuration parameters (group 57) are incompatible.	Check the settings of the parameters in group 57 D2D COMMUNICATION. Parameter mismatch in master drive: 57.11 REF 1 MSG TYPE = REF1 MC GRPS but the 57.13 NEXT REF1 MC GRP = 0. Give the correct target node.
2050	IGBT OVERLOAD (0x5482)	Excessive IGBT junction to case temperature. This fault protects the IGBT(s) and can be activated by a short circuit in the motor cable.	Check motor cable.

Code	Alarm (fieldbus code)	Cause	What to do
2051	IGBT TEMP (0x4210)	Drive IGBT temperature is excessive. Fault trip limit is 100%.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
2052	COOLING (0x4290)	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C (104 °F), ensure that load current does not exceed derated load capacity of drive. See appropriate Hardware Manual. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
2072	DC NOT CHARGED (0x3250)	Starting has been attempted before charging of the intermediate circuit is finished.	Wait a moment for the DC voltage to rise. Check from parameter 1.07 DC-VOLTAGE that the supply voltage is high enough. Change 47.03 SUPPLVOLTAUTO-ID = Disable and set appropriate value to 47.04 SUPPLY VOLTAGE. If 47.03 SUPPLVOLTAUTO-ID = Disable, check that the value of 47.04 corresponds to the mains voltage of the supply network.

Fault messages generated by the drive

Code	Fault (fieldbus code)	Cause	What to do
0001	OVERCURRENT (0x2310)	Output current has exceeded internal fault limit.	Check motor load. Check supply voltage. Check that there are no power factor compensation capacitors in the supply. Check converter power semiconductors (IGBTs) and current transducers.
0002	DC OVERVOLTAGE (0x3210)	Excessive intermediate circuit DC voltage.	Check that overvoltage controller is on in the motor drives (if applicable). Check deceleration time of the motor drives. Check brake chopper and resistor (if used). Check mains for static or transient overvoltage.
0003	DEVICE OVERTEMP (0x4210)	Measured drive temperature has exceeded internal fault limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
0004	SHORT CIRCUIT (0x2340)	Fast overcurrent indicating short circuit fault.	See the OVERCURRENT fault. Measure resistances of converter power semiconductors (IGBTs). If faulty IGBTs are found, contact your local ABB representative.
0005	DC UNDERVOLTAGE (0x3220)	Intermediate circuit DC voltage is not sufficient due to missing mains phase, blown fuse or converter internal fault.	Check mains supply and fuses.
0006	EARTH FAULT (0x2330) Programmable fault: 46.05 EARTH FAULT	The regen supply module has detected that there is a too large current imbalance between measured phase currents.	If the supply modules are parallel-connected, earth fault supervision must be disabled. Check converter fuses. Check that there is no earth fault in supply cables. If no earth fault can be detected, contact your local ABB representative.
0007	FAN FAULT (0xFF83)	Fan is not able to rotate freely or fan is disconnected. Fan operation is monitored by measuring fan current.	Check fan operation and connection.
0008	IGBT OVERTEMP (0x7184)	Drive temperature based on thermal model has exceeded internal fault limit.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
0009	BC WIRING (0x7111)	Brake resistor short circuit or brake chopper control fault.	Check brake chopper and brake resistor connection. Ensure brake resistor is not damaged.

Code	Fault (fieldbus code)	Cause	What to do
0010	BC SHORT CIRCUIT (0x7113)	Short circuit in brake chopper IGBT.	Ensure brake resistor is connected and not damaged.
0011	BC OVERHEAT (0x7181)	Brake chopper IGBT temperature has exceeded internal fault limit.	Let chopper cool down. Check resistor overload protection function settings, parameters 48.03…48.05. Check that braking cycle meets allowed limits. Check that drive supply AC voltage is not excessive.
0012	BR OVERHEAT (0x7112)	Brake resistor temperature has exceeded fault limit defined by parameter 48.06 BR TEMP FAULTLIM.	Stop drive. Let resistor cool down. Check resistor overload protection function settings, parameters 48.01…48.05. Check fault limit setting, parameter 48.06. Check that braking cycle meets allowed limits.
0015	SUPPLY PHASE (0x3130) Programmable fault: 46.06 SUPPL PHS LOSS	Missing phase during synchronization.	Check supply fuses. Check supply for network imbalance.
0018	CURR U2 MEAS (0x3184)	Measured offset error of U2 output phase current measurement is too great. (Offset value is updated during current calibration.)	Contact your local ABB representative.
0019	CURR V2 MEAS (0x3185)	Measured offset error of V2 output phase current measurement is too great. (Offset value is updated during current calibration.)	Contact your local ABB representative.
0020	CURR W2 MEAS (0x3186)	Measured offset error of W2 output phase current measurement is too great. (Offset value is updated during current calibration.)	Contact your local ABB representative.
0021	STO1 LOST (0x8182)	Safe Torque Off function is active, i.e. safety circuit signal 1 connected between X6:1 and X6:3 is lost while drive is at stopped state and parameter 46.07 STO DIAGNOSTIC setting is (2) ALARM or (3) NO.	Check safety circuit connections. For more information, see appropriate drive hardware manual.

Code	Fault (fieldbus code)	Cause	What to do
0022	STO2 LOST (0x8183)	Safe Torque Off function is active, i.e. safety circuit signal 2 connected between X6:2 and X6:4 is lost while drive is at stopped state and parameter 46.07 STO DIAGNOSTIC setting is (2) ALARM or (3) NO.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
0023	STO MODE CHANGE (0xFF7A)	Error in changing Safe Torque Off supervision, i.e. parameter 46.07 STO DIAGNOSTIC setting could not be changed to value (1) FAULT.	Contact your local ABB representative.
0024	INTBOARD OVERTEMP (0x7182)	Interface board (between power unit and control unit) temperature has exceeded internal fault limit.	Let drive cool down.
0025	BC MOD OVERTEMP (0x7183)	Input bridge or brake chopper temperature has exceeded internal fault limit.	Let drive cool down.
0027	PU LOST (0x5400)	Connection between the JCU Control Unit and the power unit of the drive is lost. External 24 V supply connected to JCU without mains supply, but not configured with parameter.	Check the connections between the JCU Control Unit and the power unit. Check the setting of parameter 95.01 CTRL UNIT SUPPLY.
0028	PS COMM (0x5480)	Communication errors detected between the JCU Control Unit and the power unit of the drive.	Check the connections between the JCU Control Unit and the power unit.
0030	EXTERNAL (0x9000)	Fault in external device. (This information is configured through one of programmable digital inputs.)	Check external devices for faults. Check setting of parameter 46.01 EXTERNAL FAULT.
0031	SAFE TORQUE OFF (0xFF7A) Programmable fault: 46.07 STO DIAGNOSTIC	Safe Torque Off function is active, i.e. safety circuit signal(s) connected to connector X6 is lost - during drive start or drive run or - while drive is stopped and parameter 46.07 STO DIAGNOSTIC setting is (1) FAULT.	Check safety circuit connections. For more information, see appropriate drive hardware manual.
0036	LOCAL CTRL LOSS (0x5300) Programmable fault: 46.03 LOCAL CTRL LOSS	Control panel or PC tool selected as active control location for drive has ceased communicating.	Check PC tool or control panel connection. Check control panel connector. Replace control panel in mounting platform.

Code	Fault (fieldbus code)	Cause	What to do
0037	NVMEM CORRUPTED (0x6320)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0038	OPTION COMM LOSS (0x7000)	Communication to FIO-xx option(s) is lost.	Check that option modules are properly connected to Slot 1 and (or) Slot 2. Check that option modules or Slot 1/2 connectors are not damaged. To determine whether module or connector is damaged: Test each module individually in Slot 1 and Slot 2.
0045	FIELDBUS COMM (0x7510) Programmable fault: 50.02 COMM LOSS FUNC	Cyclical communication between drive and fieldbus adapter module or between PLC and fieldbus adapter module is lost.	Check status of fieldbus communication. See appropriate User's Manual of fieldbus adapter module. Check fieldbus parameter settings. See parameter group 50 FIELDBUS on page 75. Check cable connections. Check if communication master can communicate.
0046	FB MAPPING FILE (0x6306)	Drive internal fault	Contact your local ABB representative.
0047	EXT OVERTEMP (0x4310) Programmable fault: 45.01 EXT TEMP PROT	Measured temperature or resistance (selected by parameter 45.02) has exceeded the fault limit defined by parameter 45.04 EXT TEMP FLT LIM.	Check that thermistor signal is connected to the input selected by parameter 45.02 EXT TEMP SOURCE. Check that thermistor type is the one selected by parameter 45.02 EXT TEMP SOURCE. Check value of fault limit (45.04).
0049	AI SUPERVISION (0x8110) Programmable fault: 13.12 AI SUPERVISION	Analogue input AI1 or AI2 signal has reached limit defined by parameter 13.13 AI SUPERVIS ACT.	Check analogue input AI1/2 source and connections. Check analogue input AI1/2 minimum and maximum limit settings, parameters 13.02 and 13.03 / 13.07 and 13.08.
0052	D2D CONFIG (0x7583)	Configuration of the drive-to-drive link has failed for a reason other than those indicated by alarm 2042, for example start inhibition is requested but not granted.	Contact your local ABB representative.

Code	Fault (fieldbus code)	Cause	What to do
0053	D2D COMMUNICATION (0x7520) Programmable fault: 57.02 COMM LOSS FUNC	On the master drive: The drive has not received a response from an activated follower for five consecutive polling cycles.	Check that all drives that are polled (parameters 57.04 FOLLOWER MASK 1 and 57.05 FOLLOWER MASK 2) on the drive-to-drive link are powered, properly connected to the link, and have the correct node address. Check the drive-to-drive link wiring.
		On a follower drive: The drive has not received new reference 1 and/or 2 for five consecutive reference handling cycles.	Check parameter settings to ensure that all followers in the multicast message chain (i.e. when parameter 57.11 REF 1 MSG TYPE = REF1 MC GRPS on the master) receive a reference 1 and command word. Check that the handling of reference 2 is not disabled (i.e. disabled by setting input pin 'Ref2 Cycle Sel' of the D2D_Conf block to negative) in the application program of the master drive. Check the drive-to-drive link wiring.
0054	D2D BUFFER OVERLOAD (0x7580) Programmable fault: 57.02 COMM LOSS FUNC	Transmission of drive-to-drive references failed because of message buffer overflow.	If an application program exists: Check the selected reference handling cycles in D2D_Conf block in application program to verify that a maximum of eight messages in millisecond is not exceeded. Check the number of D2D_SendMessage blocks; sum of active D2D_SendMessage blocks and that reference 2 message (if not disabled) is not above four. Check the drive-to-drive link wiring.
0055	TECH LIB (0x6382)	Resettable fault generated by a technology library.	Refer to the documentation of the technology library.
0056	TECH LIB CRITICAL (0x6382)	Permanent fault generated by a technology library.	Refer to the documentation of the technology library.
0057	FORCED TRIP (0xFF90)	Generic Drive Communication Profile trip command.	Check PLC status.
0058	FIELDBUS PAR ERROR (0x6320)	The drive does not have a functionality requested by PLC, or requested functionality has not been activated.	Check PLC programming. Check fieldbus parameter settings. See parameter group 50 FIELDBUS on page 75.
0062	D2D SLOT COMM (0x7584)	Drive-to-drive link is set to use an FMBA module for communication, but no module is detected in specified slot.	Check the settings of parameters 57.01 LINK MODE and 57.15 D2D COMM PORT. Ensure that the FMBA module has been detected by checking parameters 9.20…9.22. Try installing the FMBA module into another slot. If the problem persists, contact your local ABB representative.

Code	Fault (fieldbus code)	Cause	What to do
0064	IGBT OVERLOAD (0x5482)	Excessive IGBT junction to case temperature. If the supply module is heavily loaded while ambient temperature and/or heatsink is cold, this fault may occur before IGBT TEMP fault.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check line current against converter current.
0065	IGBT TEMP (0x4210)	IGBT temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check line current against converter current.
0066	COOLING (0x4290)	Supply module temperature is excessive.	Check ambient temperature. If it exceeds 40 °C (104 °F), ensure that load current does not exceed derated load capacity of the regen supply module. See appropriate Hardware Manual. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.
0201	T2 OVERLOAD (0x6100)	Firmware time level 2 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0202	T3 OVERLOAD (0x6100)	Firmware time level 3 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0203	T4 OVERLOAD (0x6100)	Firmware time level 4 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0204	T5 OVERLOAD (0x6100)	Firmware time level 5 overload **Note:** This fault cannot be reset.	Contact your local ABB representative.
0205	A1 OVERLOAD (0x6100)	Application time level 1 fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0206	A2 OVERLOAD (0x6100)	Application time level 2 fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0207	A1 INIT FAULT (0x6100)	Application task creation fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0208	A2 INIT FAULT (0x6100)	Application task creation fault **Note:** This fault cannot be reset.	Contact your local ABB representative.

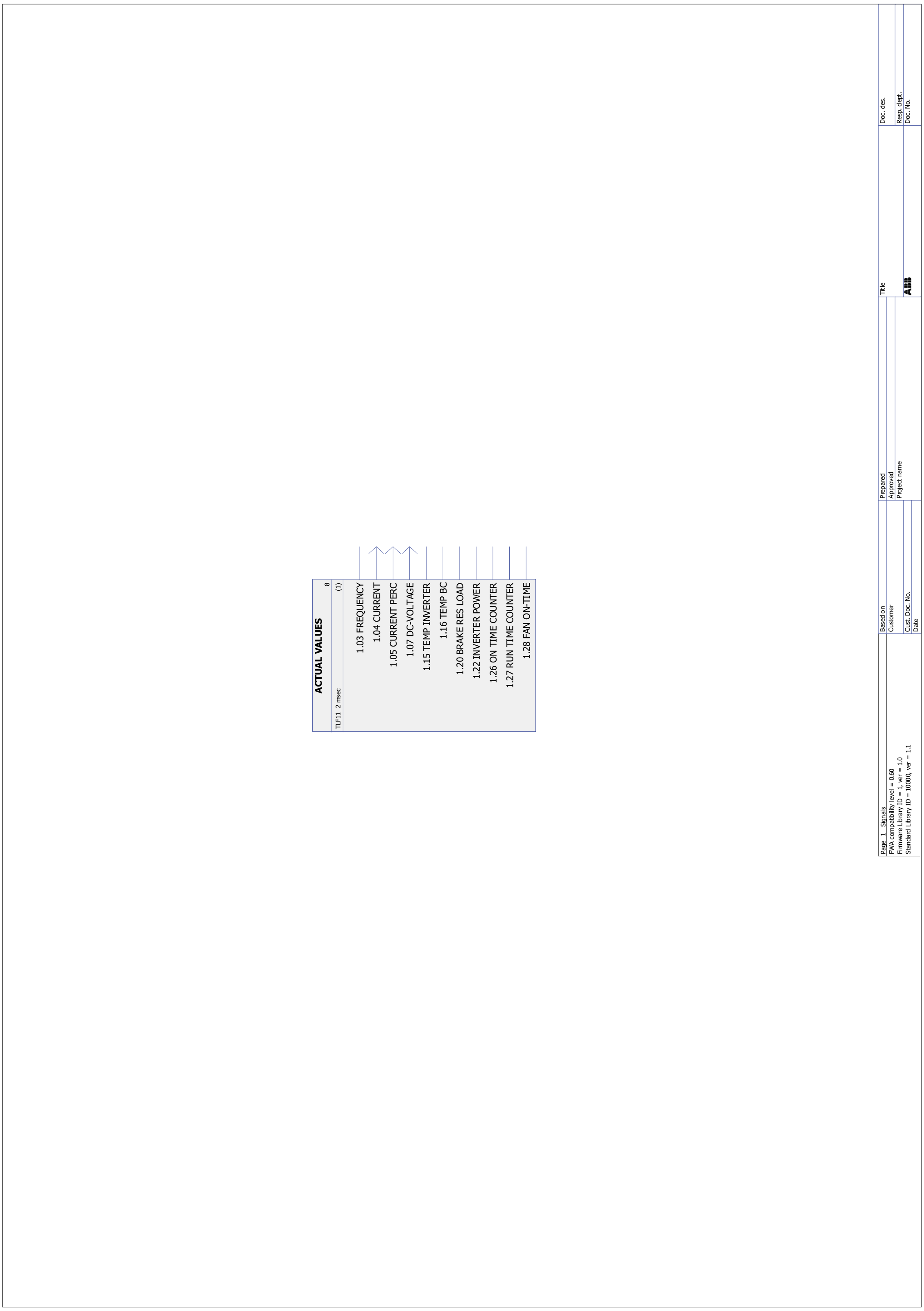
Code	Fault (fieldbus code)	Cause	What to do
0209	STACK ERROR (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0210	JMU MISSING (0xFF61)	JMU Memory Unit is missing or broken.	Ensure that JMU is in its place and properly connected. Replace broken JMU.
0301	UFF FILE READ (0x6300)	File read error **Note:** This fault cannot be reset.	Contact your local ABB representative.
0302	APPL DIR CREATION (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0303	FPGA CONFIG DIR (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0304	PU RATING ID (0x5483)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0305	RATING DATABASE (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0306	LICENSING (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0307	DEFAULT FILE (0x6100)	Drive internal fault **Note:** This fault cannot be reset.	Contact your local ABB representative.
0308	APPL FILE PAR CONF (0x6300)	Corrupted application file **Note:** This fault cannot be reset.	Reload application. If fault is still active, contact your local ABB representative.
0309	APPL LOADING (0x6300)	Corrupted application file **Note:** This fault cannot be reset.	Reload application. If fault is still active, contact your local ABB representative.
0310	USERSET LOAD (0xFF69)	Loading of user set is not successfully completed because: - requested user set does not exist - user set is not compatible with drive program - drive has been switched off during loading.	Reload.

Code	Fault (fieldbus code)	Cause	What to do
0311	USERSET SAVE (0xFF69)	User set is not saved because of memory corruption.	Check the setting of parameter 95.01 CTRL UNIT SUPPLY. If the fault still occurs, contact your local ABB representative.
0312	UFF OVERSIZE (0x6300)	UFF file is too big.	Contact your local ABB representative.
0313	UFF EOF (0x6300)	UFF file structure failure	Delete faulty file or contact your local ABB representative.
0314	TECH LIB INTERFACE (0x6100)	Incompatible firmware interface **Note:** This fault cannot be reset.	Contact your local ABB representative.
0315	RESTORE FILE (0x630D)	Restoration of backed-up parameters failed.	Contact your local ABB representative.
0316	DAPS MISMATCH (0x5484)	Mismatch between JCU Control Unit firmware and power unit logic versions.	Contact your local ABB representative.
0317	SOLUTION FAULT (0x6200)	Fault generated by function block SOLUTION_FAULT in the application program.	Check the usage of the SOLUTION_FAULT block in the application program.

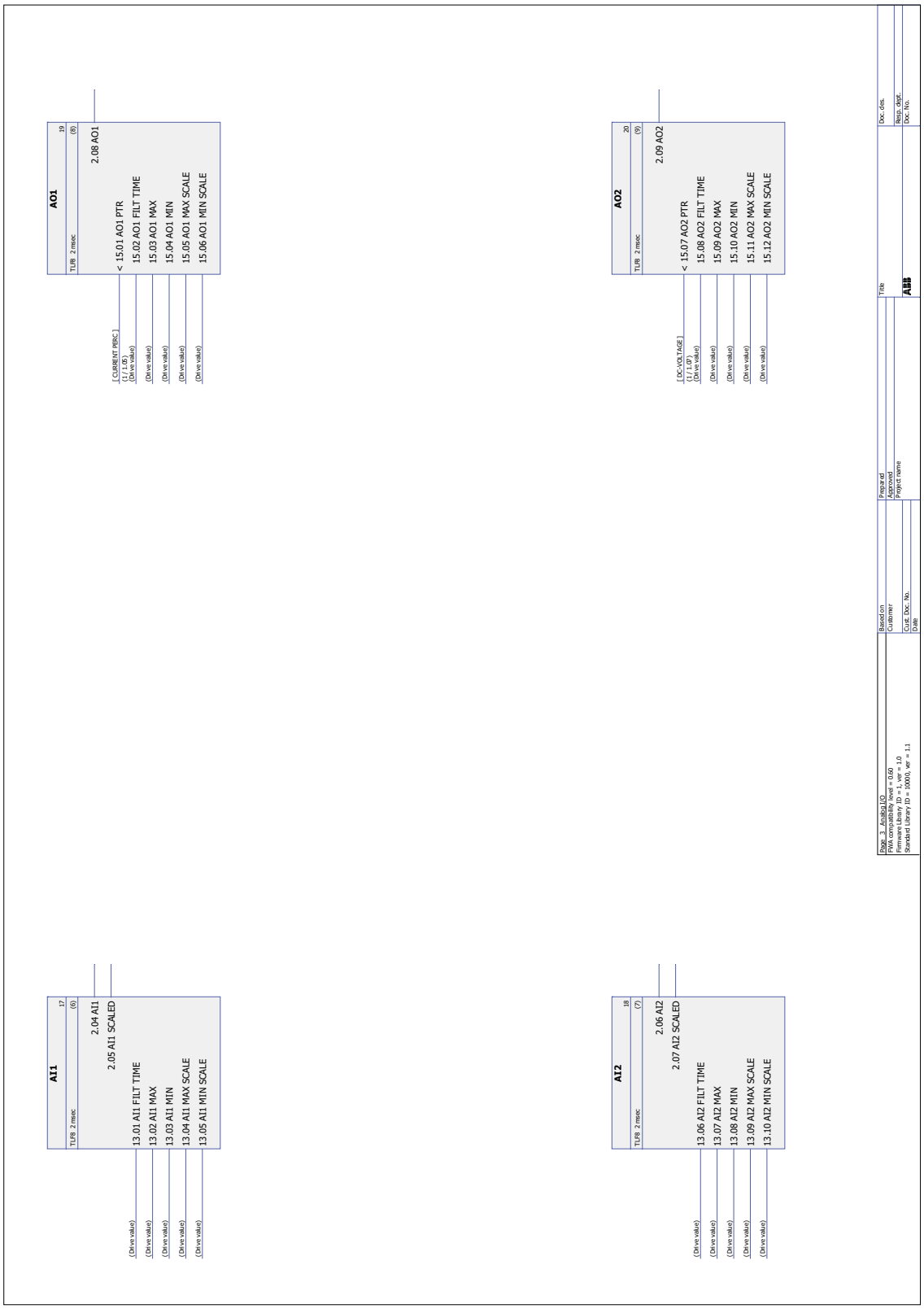
Application program template

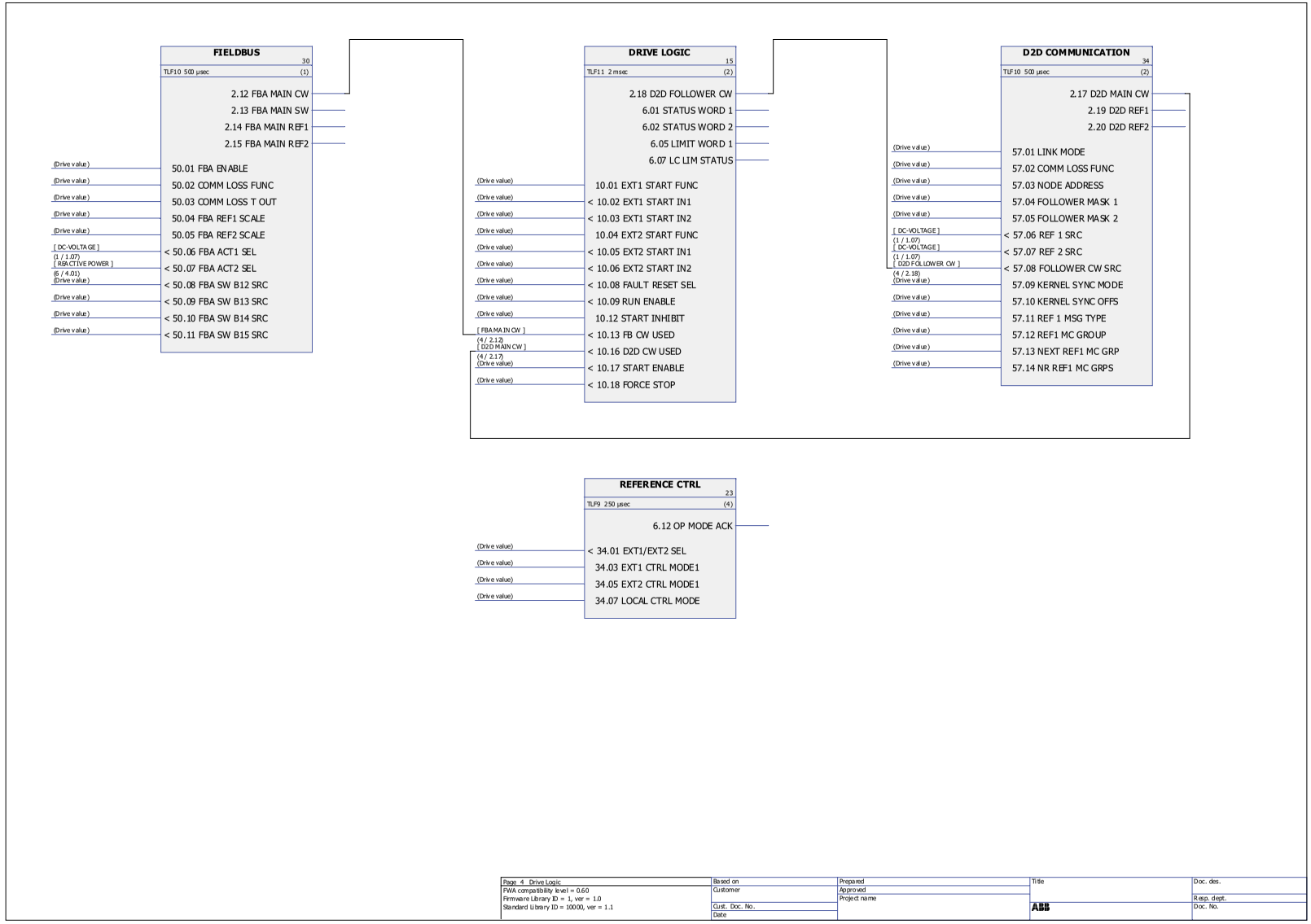
What this chapter contains

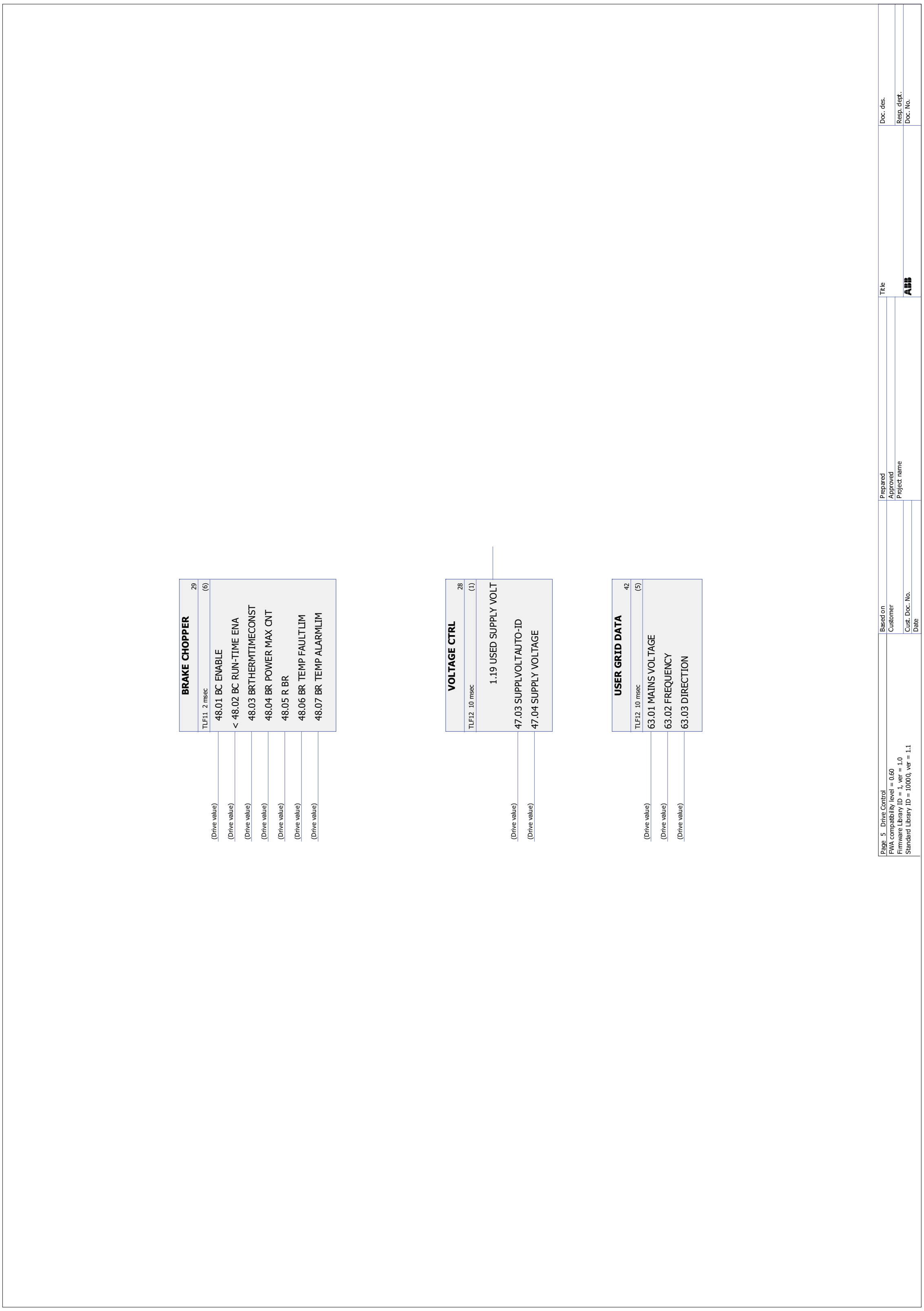
This chapter presents the application program template as displayed by the DriveSPC tool.

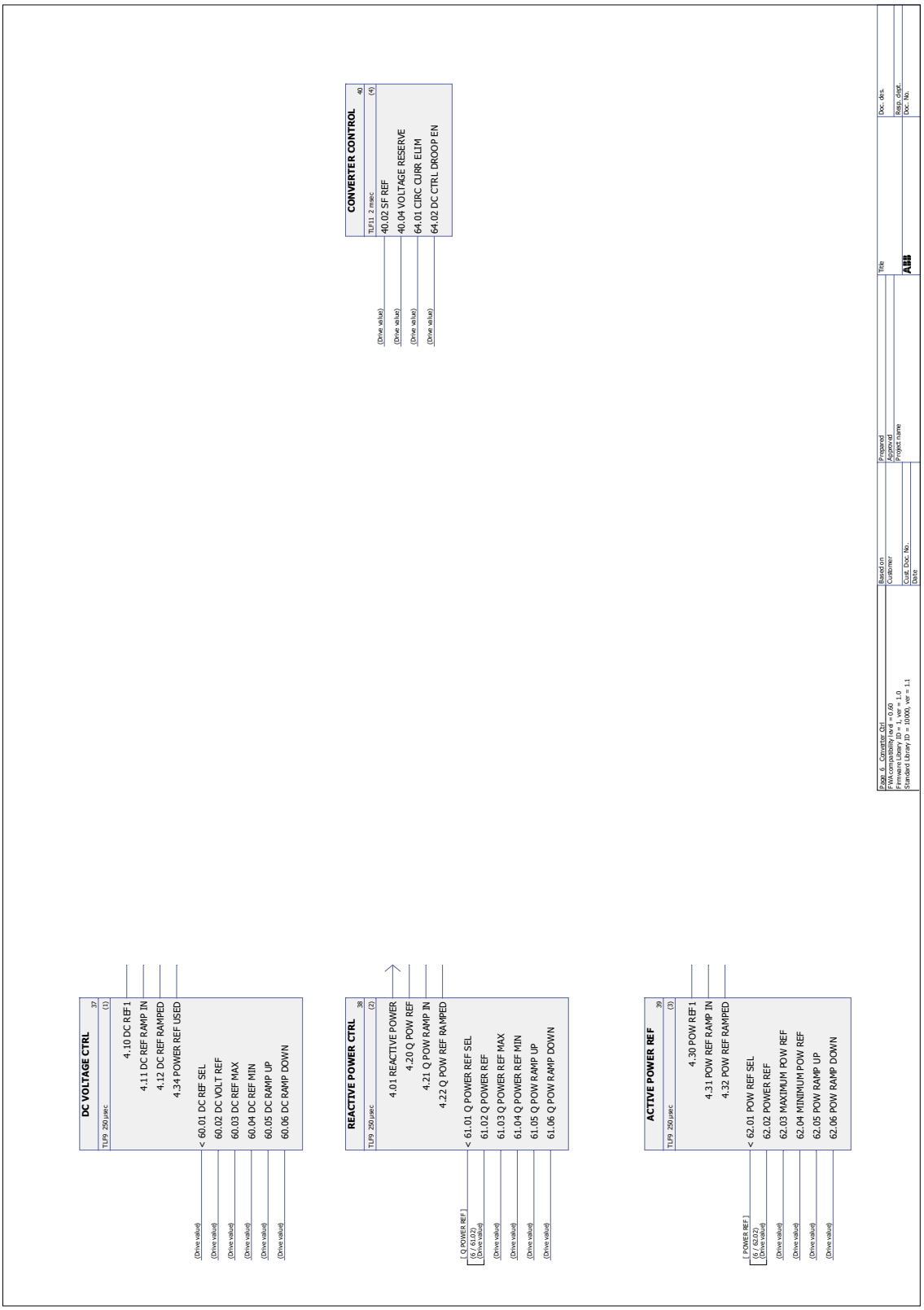

ACTUAL VALUES
8
TLF11 2 msec
(1)
1.03 FREQUENCY
1.04 CURRENT
1.05 CURRENT PERC
1.07 DC-VOLTAGE
1.15 TEMP INVERTER
1.16 TEMP BC
1.20 BRAKE RES LOAD
1.22 INVERTER POWER
1.26 ON TIME COUNTER
1.27 RUN TIME COUNTER
1.28 FAN ON-TIME
Page 1 Signals
FWA compatibility level = 0.60
Firmware Library ID = 1, ver = 1.0
Standard Library ID = 10000, ver = 1.1
Based on
Customer
Cust. Doc. No.
Date
Prepared
Approved
Project name
Title
ABB
Doc. des.
Resp. dept.
Doc. No.

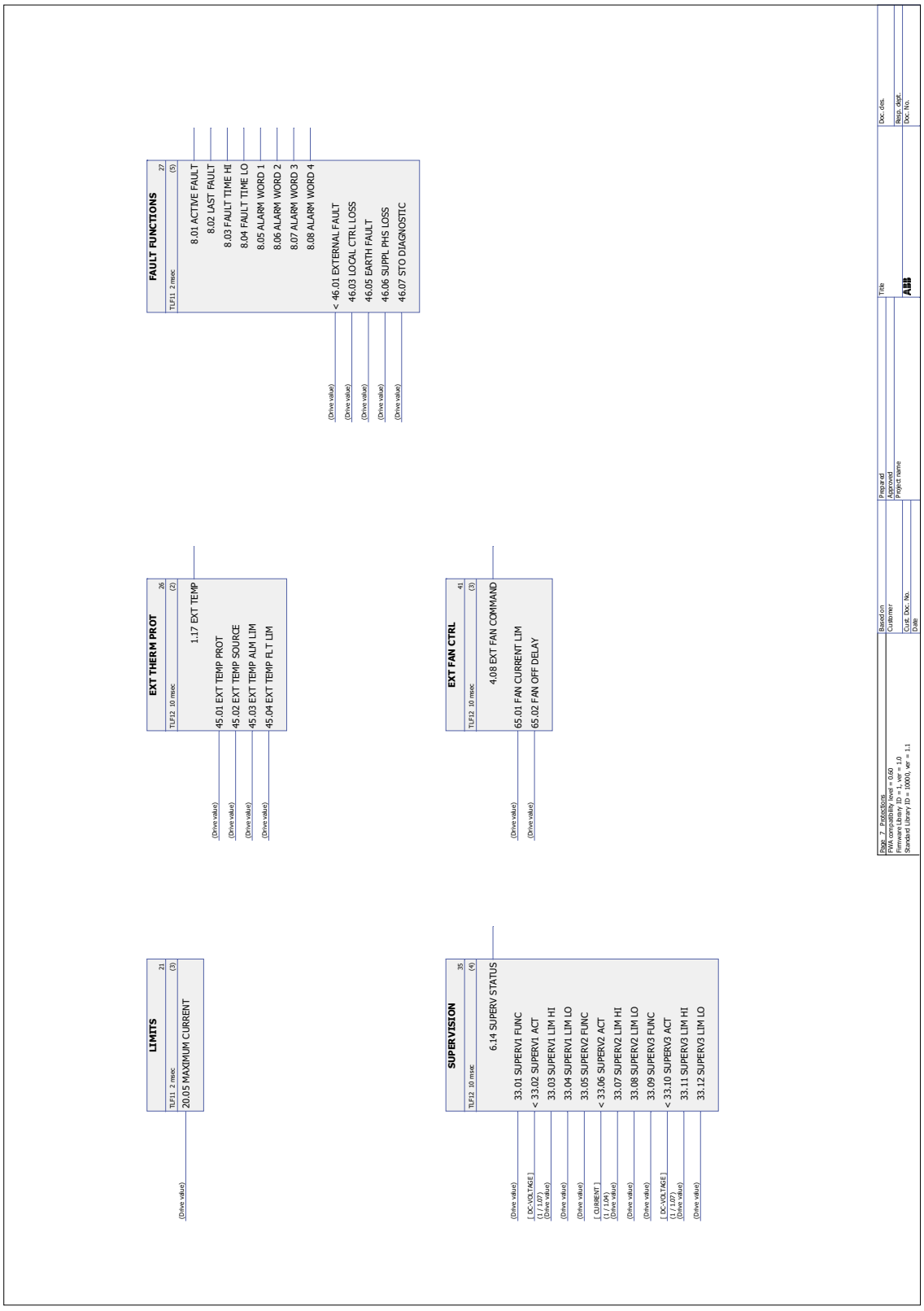

DIO1
12
(3)
TUF8 2 msec
2.03 DIO STATUS
12.01 DIO1 CONF
< 12.04 DIO1 OUT PTR
2.03 Bit 0
(Drive value)
(Drive value)
DIO2
13
(4)
TUF8 2 msec
2.03 DIO STATUS
2.10 DIO2 FREQ IN
12.02 DIO2 CONF
< 12.05 DIO2 OUT PTR
12.14 DIO2 F MAX
12.15 DIO2 F MIN
12.16 DIO2 F MAX SCALE
12.17 DIO2 F MIN SCALE
2.03 Bit 1
(Drive value)
(Drive value)
(Drive value)
(Drive value)
(Drive value)
(Drive value)
DIO3
14
(5)
TUF8 2 msec
2.03 DIO STATUS
2.11 DIO3 FREQ OUT
12.03 DIO3 CONF
< 12.06 DIO3 OUT PTR
< 12.07 DIO3 F OUT PTR
12.08 DIO3 F MAX
12.09 DIO3 F MIN
12.10 DIO3 F MAX SCALE
12.11 DIO3 F MIN SCALE
2.03 Bit 2
(Drive value)
(Drive value)
[DC-VOLTAGE]
(1 / 1.07)
(Drive value)
(Drive value)
(Drive value)
(Drive value)
RO
11
(2)
TUF8 2 msec
2.02 RO STATUS
< 12.12 RO1 OUT PTR
(Drive value)
DI
10
(1)
TUF8 2 msec
2.01 DI STATUS
12.13 DI INVERT MASK
(Drive value)
Page 2 - Digital I/O
Based on
Prepared
Title
Doc. des.
FWA compatibility level = 0.60
Customer
Approved
Revis. desc.
Firmware Library ID = 1xx = 1.0
Project name
Cust. Doc. No.
Doc. No.
Standard Library ID = 1000, ver = 1.1
Date
ABB


AO1
TURB 2 msec
2.08 AO1
< 15.01 AO1 PTR
15.02 AO1 FILT TIME
15.03 AO1 MAX
15.04 AO1 MIN
15.05 AO1 MAX SCALE
15.06 AO1 MIN SCALE
[CURRENT MIN]
(1 / 1.05)
(Drive value)
AO2
TURB 2 msec
2.09 AO2
< 15.07 AO2 PTR
15.08 AO2 FILT TIME
15.09 AO2 MAX
15.10 AO2 MIN
15.11 AO2 MAX SCALE
15.12 AO2 MIN SCALE
[DC-VOLTAGE]
(1 / 1.07)
AI1
TURB 2 msec
2.04 AI1
2.05 AI1 SCALED
13.01 AI1 FILT TIME
13.02 AI1 MAX
13.03 AI1 MIN
13.04 AI1 MAX SCALE
13.05 AI1 MIN SCALE
AI2
TURB 2 msec
2.06 AI2
2.07 AI2 SCALED
13.06 AI2 FILT TIME
13.07 AI2 MAX
13.08 AI2 MIN
13.09 AI2 MAX SCALE
13.10 AI2 MIN SCALE
Page 3 Analog I/O
Firmware library ID = 1, ver = 1.0
Standard Library ID = 10000, ver = 1.1
Based on
Customer
Cust. Doc. No.
Date
Prepared
Approved
Project name
Title
Doc. des.
Resp. dept.
Doc. No.
ABB


FIELDBUS
30
TLF10 500 µsec (1)
2.12 FBA MAIN CW
2.13 FBA MAIN SW
2.14 FBA MAIN REF1
2.15 FBA MAIN REF2
(Drive value) 50.01 FBA ENABLE
(Drive value) 50.02 COMM LOSS FUNC
(Drive value) 50.03 COMM LOSS T OUT
(Drive value) 50.04 FBA REF1 SCALE
(Drive value) 50.05 FBA REF2 SCALE
[DC-VOLTAGE] < 50.06 FBA ACT1 SEL
(1 / 1.07) [REACTIVE POWER] < 50.07 FBA ACT2 SEL
(6 / 4.01) (Drive value) < 50.08 FBA SW B12 SRC
(Drive value) < 50.09 FBA SW B13 SRC
(Drive value) < 50.10 FBA SW B14 SRC
(Drive value) < 50.11 FBA SW B15 SRC
DRIVE LOGIC
15
TLF11 2 msec (2)
2.18 D2D FOLLOWER CW
6.01 STATUS WORD 1
6.02 STATUS WORD 2
6.05 LIMIT WORD 1
6.07 LC LIM STATUS
(Drive value) 10.01 EXT1 START FUNC
(Drive value) < 10.02 EXT1 START IN1
(Drive value) < 10.03 EXT1 START IN2
(Drive value) 10.04 EXT2 START FUNC
(Drive value) < 10.05 EXT2 START IN1
(Drive value) < 10.06 EXT2 START IN2
(Drive value) < 10.08 FAULT RESET SEL
(Drive value) < 10.09 RUN ENABLE
(Drive value) 10.12 START INHIBIT
[FBA MAIN CW] < 10.13 FB CW USED
(4 / 2.12) [D2D MAIN CW] < 10.16 D2D CW USED
(4 / 2.17) (Drive value) < 10.17 START ENABLE
(Drive value) < 10.18 FORCE STOP
D2D COMMUNICATION
34
TLF10 500 µsec (2)
2.17 D2D MAIN CW
2.19 D2D REF1
2.20 D2D REF2
(Drive value) 57.01 LINK MODE
(Drive value) 57.02 COMM LOSS FUNC
(Drive value) 57.03 NODE ADDRESS
(Drive value) 57.04 FOLLOWER MASK 1
(Drive value) 57.05 FOLLOWER MASK 2
[DC-VOLTAGE] < 57.06 REF 1 SRC
(1 / 1.07) [DC-VOLTAGE] < 57.07 REF 2 SRC
(1 / 1.07) [D2D FOLLOWER CW] < 57.08 FOLLOWER CW SRC
(4 / 2.18) (Drive value) 57.09 KERNEL SYNC MODE
(Drive value) 57.10 KERNEL SYNC OFFS
(Drive value) 57.11 REF 1 MSG TYPE
(Drive value) 57.12 REF1 MC GROUP
(Drive value) 57.13 NEXT REF1 MC GRP
(Drive value) 57.14 NR REF1 MC GRPS
REFERENCE CTRL
23
TLF9 250 µsec (4)
6.12 OP MODE ACK
(Drive value) < 34.01 EXT1/EXT2 SEL
(Drive value) 34.03 EXT1 CTRL MODE1
(Drive value) 34.05 EXT2 CTRL MODE1
(Drive value) 34.07 LOCAL CTRL MODE
Page 4 Drive Logic
FWA compatibility level = 0.60
Firmware Library ID = 1, ver = 1.0
Standard Library ID = 10000, ver = 1.1
Based on
Customer
Cust. Doc. No.
Date
Prepared
Approved
Project name
Title
ABB
Doc. des.
Resp. dept.
Doc. No.


BRAKE CHOPPER
29
TLF11 2 msec
(6)
48.01 BC ENABLE
< 48.02 BC RUN-TIME ENA
48.03 BRTHERMTIMECONST
48.04 BR POWER MAX CNT
48.05 R BR
48.06 BR TEMP FAULTLIM
48.07 BR TEMP ALARMLIM
(Drive value)
(Drive value)
(Drive value)
(Drive value)
(Drive value)
(Drive value)
(Drive value)
VOLTAGE CTRL
28
TLF12 10 msec
(1)
1.19 USED SUPPLY VOLT
47.03 SUPPLVOLTAUTO-ID
47.04 SUPPLY VOLTAGE
(Drive value)
(Drive value)
USER GRID DATA
42
TLF12 10 msec
(5)
63.01 MAINS VOLTAGE
63.02 FREQUENCY
63.03 DIRECTION
(Drive value)
(Drive value)
(Drive value)
Page 5 Drive Control
FWA compatibility level = 0.60
Firmware Library ID = 1, ver = 1.0
Standard Library ID = 10000, ver = 1.1
Based on
Customer
Cust. Doc. No.
Date
Prepared
Approved
Project name
Title
ABB
Doc. des.
Resp. dept.
Doc. No.


DC VOLTAGE CTRL
TLF9 250 µsec
4.10 DC REF1
4.11 DC REF RAMP IN
4.12 DC REF RAMPED
4.34 POWER REF USED
60.01 DC REF SEL
60.02 DC VOLT REF
60.03 DC REF MAX
60.04 DC REF MIN
60.05 DC RAMP UP
60.06 DC RAMP DOWN
REACTIVE POWER CTRL
TLF9 250 µsec
4.01 REACTIVE POWER
4.20 Q POW REF
4.21 Q POW RAMP IN
4.22 Q POW REF RAMPED
61.01 Q POWER REF SEL
61.02 Q POWER REF
61.03 Q POWER REF MAX
61.04 Q POWER REF MIN
61.05 Q POW RAMP UP
61.06 Q POW RAMP DOWN
ACTIVE POWER REF
TLF9 250 µsec
4.30 POW REF1
4.31 POW REF RAMP IN
4.32 POW REF RAMPED
62.01 POW REF SEL
62.02 POWER REF
62.03 MAXIMUM POW REF
62.04 MINIMUM POW REF
62.05 POW RAMP UP
62.06 POW RAMP DOWN
CONVERTER CONTROL
TLF11 2 msec
40.02 SF REF
40.04 VOLTAGE RESERVE
64.01 CIRC CURR ELIM
64.02 DC CTRL DROOP EN
Page 6 Converter Ori
FWA compatibility rev# = 0.60
Firmware Library ID = xxxx ver = 1.0
Standard Library ID = 10000, ver = 1.1
Based on
Customer
Cust. Doc. No.
Date
Prepared
Approved
Project name
Title
Doc. des.
Doc No.

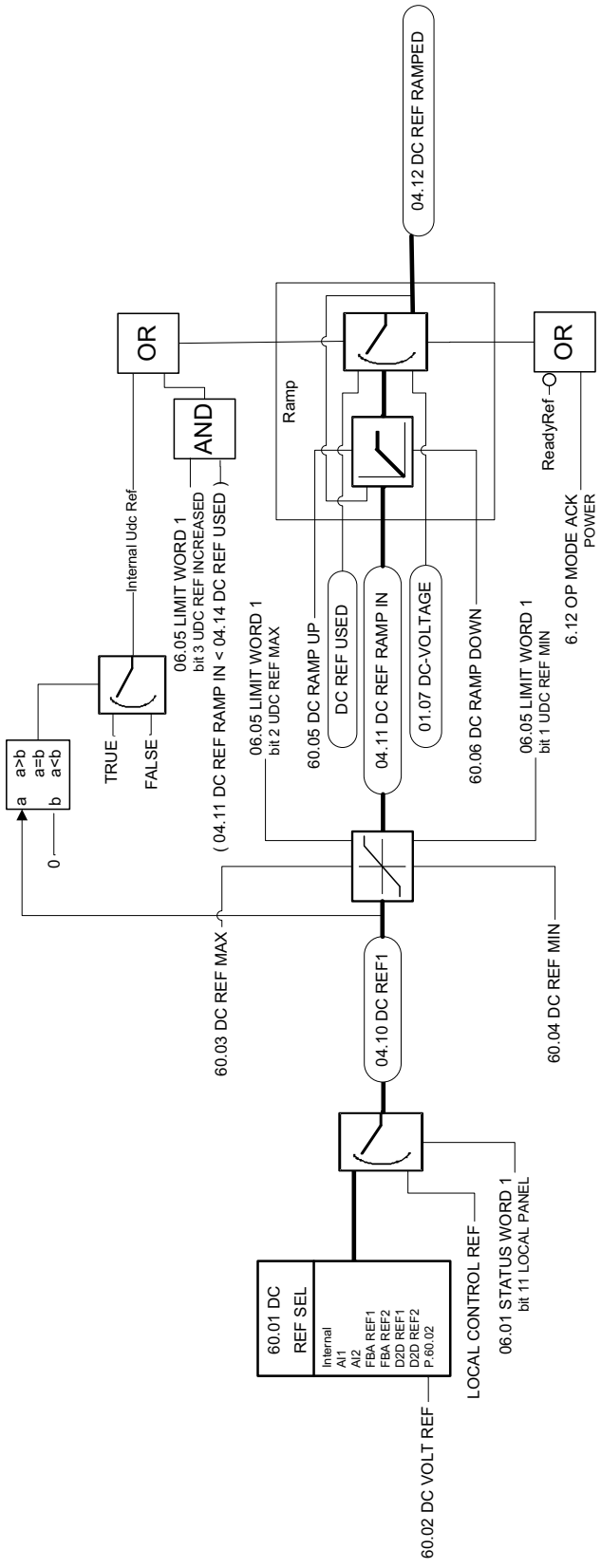

FAULT FUNCTIONS
TLF11 2 msec
8.01 ACTIVE FAULT
8.02 LAST FAULT
8.03 FAULT TIME HI
8.04 FAULT TIME LO
8.05 ALARM WORD 1
8.06 ALARM WORD 2
8.07 ALARM WORD 3
8.08 ALARM WORD 4
< 46.01 EXTERNAL FAULT
46.03 LOCAL CTRL LOSS
46.05 EARTH FAULT
46.06 SUPPL PHS LOSS
46.07 STO DIAGNOSTIC
EXT THERM PROT
TLF12 10 msec
1.17 EXT TEMP
45.01 EXT TEMP PROT
45.02 EXT TEMP SOURCE
45.03 EXT TEMP ALM LIM
45.04 EXT TEMP FLT LIM
EXT FAN CTRL
TLF12 10 msec
4.08 EXT FAN COMMAND
65.01 FAN CURRENT LIM
65.02 FAN OFF DELAY
LIMITS
TLF11 2 msec
20.05 MAXIMUM CURRENT
SUPERVISION
TLF12 10 msec
6.14 SUPERV STATUS
33.01 SUPERV1 FUNC
< 33.02 SUPERV1 ACT
33.03 SUPERV1 LIM HI
33.04 SUPERV1 LIM LO
33.05 SUPERV2 FUNC
< 33.06 SUPERV2 ACT
33.07 SUPERV2 LIM HI
33.08 SUPERV2 LIM LO
33.09 SUPERV3 FUNC
< 33.10 SUPERV3 ACT
33.11 SUPERV3 LIM HI
33.12 SUPERV3 LIM LO
Page nr 7 Protections
Parameter table version = 0.60
Firmware Library ID = 1, ver = 1.0
Standard Library ID = 10000, ver = 1.1
Based on
Customer
Cust. Doc. No.
Date
Prepared
Approved
Project name
Title
Doc. clas.
Resp. dept.
Doc. No.
ABB

Control chain block diagrams

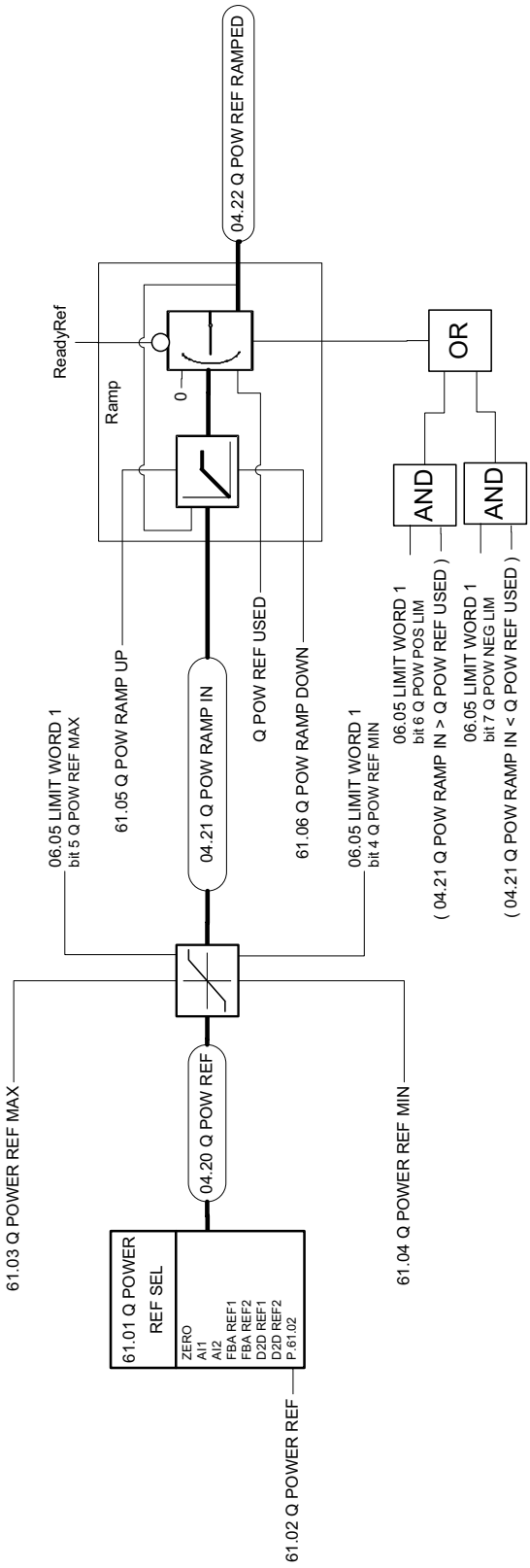
What this chapter contains

This chapter presents the drive control chain in different control modes.

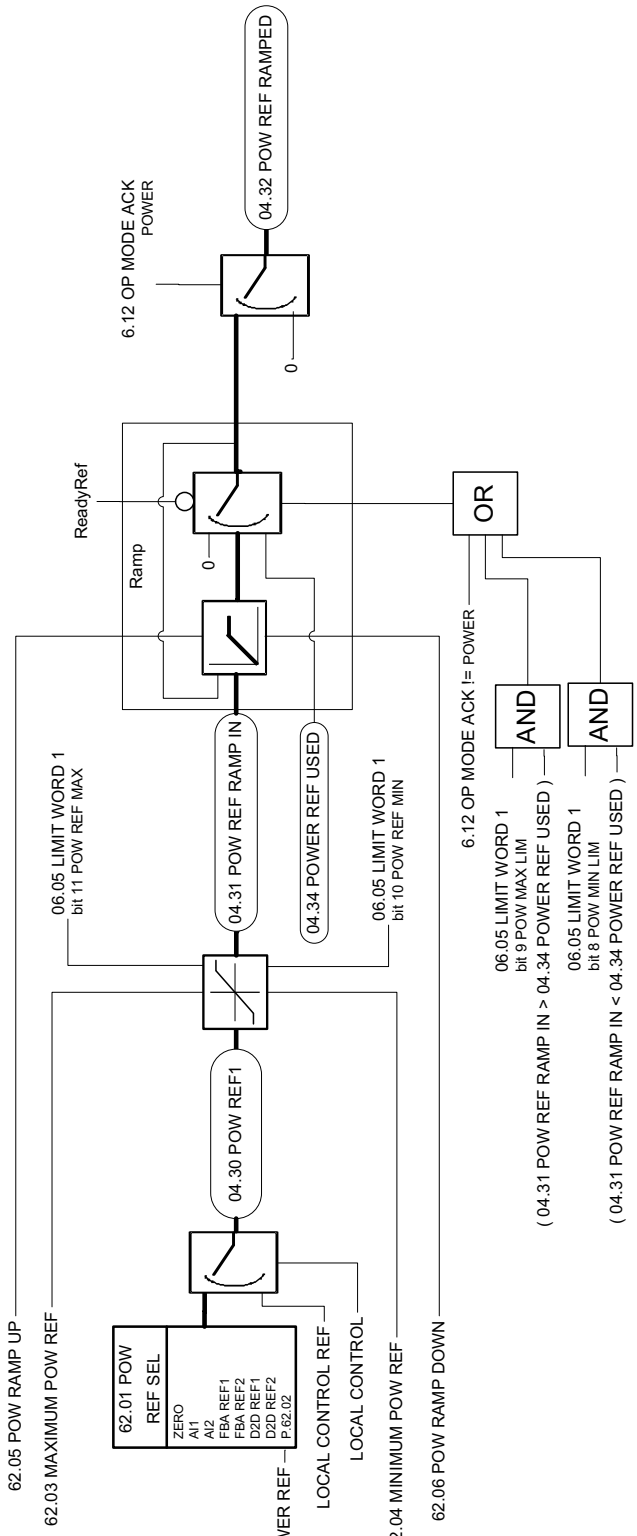
DC voltage reference



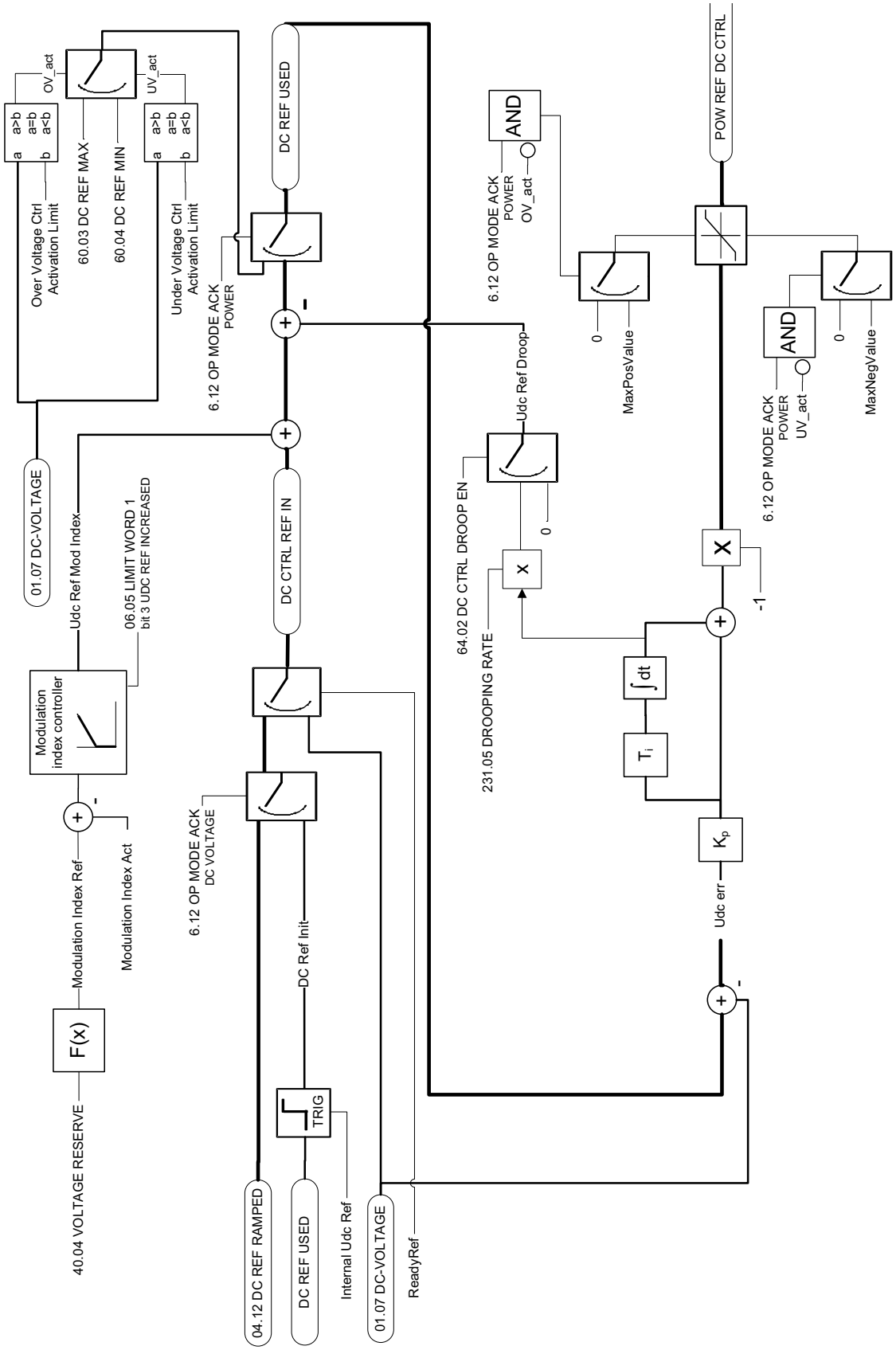
Reactive power reference



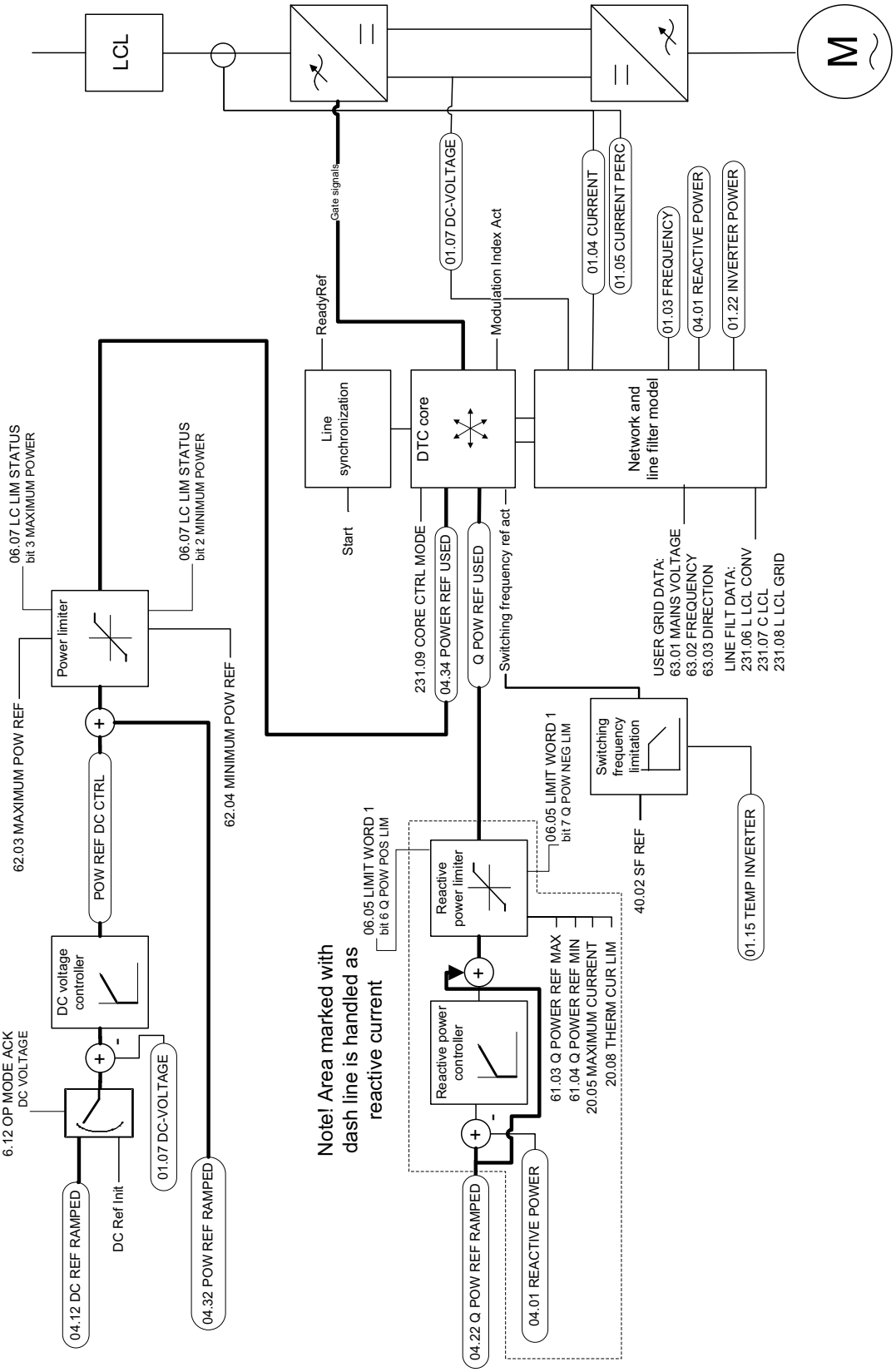
Power reference



DC voltage control



Regen supply control



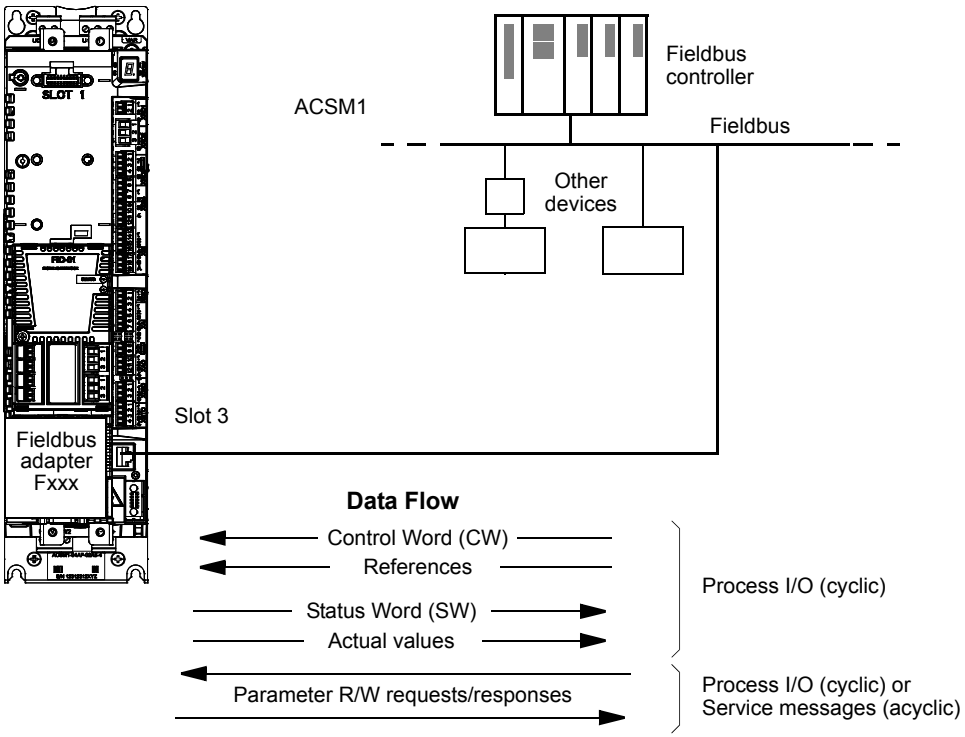
Appendix A – Fieldbus control

What this chapter contains

The chapter describes how the drive can be controlled by external devices over a communication network.

System overview

The drive can be connected to a fieldbus controller via a fieldbus adapter module. The adapter module is connected to drive Slot 3.



The drive can be set to receive all of its control information through the fieldbus interface, or the control can be distributed between the fieldbus interface and other available sources, for example digital and analogue inputs.

The drive can communicate with fieldbus controller via fieldbus adapter using one of the following serial communication protocols:

- PROFIBUS-DP® (FPBA-01 adapter)
- CANopen® (FCAN-01 adapter)
- DeviceNet® (FDNA-01 adapter)
- Modbus (FSCA-01 adapter).

Setting up communication through a fieldbus adapter module

Before configuring the drive for fieldbus control, the adapter module must be mechanically and electrically installed according to the instructions given in the User's Manual of the appropriate fieldbus adapter module.

The communication between the drive and the fieldbus adapter module is activated by setting parameter 50.01 FBA ENABLE to (1) ENABLE. The adapter-specific parameters must also be set. See the table below.

Parameter	Setting for fieldbus control	Function/Information
COMMUNICATION INITIALIZATION AND SUPERVISION		
50.01 FBA ENABLE	(1) ENABLE	Initializes communication between drive and fieldbus adapter module.
50.02 COMM LOSS FUNC	(0) NO (1) FAULT	Selects how the drive reacts in a fieldbus communication break.
50.03 COMM LOSS T OUT	0.3…6553.5 s	Defines the time between communication break detection and the action selected with parameter 50.02 COMM LOSS FUNC.
50.04 FBA REF1 SCALE and 50.05 FBA REF2 SCALE	(0) RAW DATA (1) 100 = 1.00 (2) 10 = 1.0	Defines the fieldbus reference and actual value scaling.
50.06 FBA ACT1 SEL and 50.07 FBA ACT2 SEL	(1073742087) DC VOLTAGE (1073742849) REACT. POWER (1073742102) ACTIVE POWER	Selects actual value signal.
ADAPTER MODULE CONFIGURATION		
51.01 FBA TYPE	–	Displays the type of the fieldbus adapter module.
51.02 FBA PAR2 • • • 51.26 FBA PAR26	These parameters are adapter module-specific. For more information, see the User's Manual of the fieldbus adapter module. Note that not all of these parameters are necessarily used.	
51.27 FBA PAR REFRESH	(0) DONE (1) REFRESH	Validates any changed adapter module configuration parameter settings.
51.28 PAR TABLE VER	–	Displays the parameter table revision of the fieldbus adapter module mapping file stored in the memory of the drive.
51.29 DRIVE TYPE CODE	–	Displays the drive type code of the fieldbus adapter module mapping file stored in the memory of the drive.
51.30 MAPPING FILE VER	–	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive.
51.31 D2FBA COMM STA	–	Displays the status of the fieldbus adapter module communication.
51.32 FBA COMM SW VER	–	Displays the common program revision of the adapter module.
51.33 FBA APPL SW VER	–	Displays the application program revision of the adapter module.
Note: In the User's Manual of the fieldbus adapter module, the parameter group number is 1 or A for parameters 51.01…51.26.		

Parameter	Setting for fieldbus control	Function/Information
TRANSMITTED DATA SELECTION		
52.01 FBA DATA IN1 … 52.12 FBA DATA IN12	0 4…6 14…16 101…9999	Defines the data transmitted from drive to fieldbus controller. **Note:** If the selected data is 32 bits long, two parameters are reserved for the transmission.
53.01 FBA DATA OUT1 … 53.12 FBA DATA OUT12	0 1…3 11…13 1001…9999	Defines the data transmitted from fieldbus controller to drive. **Note:** If the selected data is 32 bits long, two parameters are reserved for the transmission.
Note: In the User's Manual of the fieldbus adapter module, the parameter group number is 3 or C for parameters 52.01…52.12 and 2 or B for parameters 53.01…53.12.		

After the module configuration parameters have been set, the drive control parameters (see section Drive control parameters) must be checked and adjusted when necessary.

The new settings will take effect when the drive is powered up the next time (before powering off the drive, wait at least 1 minute), or when parameter 51.27 FBA PAR REFRESH is activated.

Drive control parameters

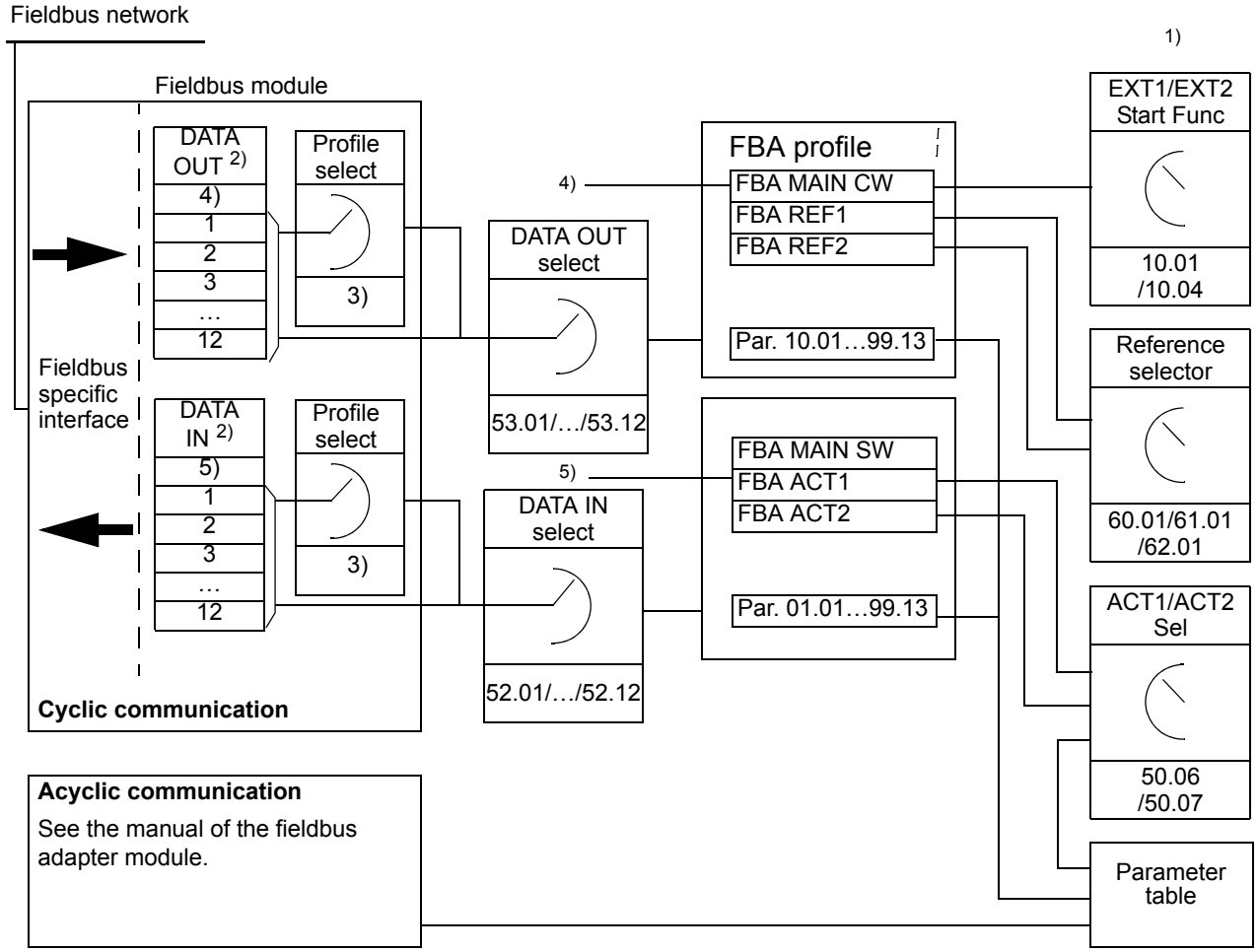
The Setting for fieldbus control column gives the value to use when the fieldbus interface is the desired source or destination for that particular signal. The Function/Information column gives a description of the parameter.

Parameter	Setting for fieldbus control	Function/Information
CONTROL COMMAND SOURCE SELECTION		
10.01 EXT1 START FUNC	(3) FBA	Selects fieldbus as the source for the start and stop commands when EXT1 is selected as the active control location.
10.04 EXT2 START FUNC	(3) FBA	Selects fieldbus as the source for the start and stop commands when EXT2 is selected as the active control location.
60.01 DC REF SEL	(1073742350) FBA REF1 (1073742351) FBA REF2	Fieldbus reference REF1 or REF 2 is used as DC voltage reference.
61.01 Q POWER REF SEL	(1073742350) FBA REF1 (1073742351) FBA REF2	Fieldbus reference REF1 or REF 2 is used as reactive power reference.
62.01 POW REF SEL	(1073742350) FBA REF1 (1073742351) FBA REF2	Fieldbus reference REF1 or REF 2 is used as active power reference.
SYSTEM CONTROL INPUTS		
16.07 PARAM SAVE	(0) DONE (1) SAVE	Saves parameter value changes (including those made through fieldbus control) to permanent memory.

The fieldbus control interface

The cyclic communication between a fieldbus system and the drive consists of 16/32-bit input and output data words. The drive supports at the maximum the use of 12 data words (16-bit) in each direction.

Data transmitted from the drive to the fieldbus controller is defined by parameters 52.01…52.12 (FBA DATA IN) and data transmitted from the fieldbus controller to the drive is defined by parameters 53.01…53.12 (FBA DATA OUT).



1) See also other parameters which can be controlled by the fieldbus.
2) The maximum number of used data words is protocol-dependent.
3) Profile/instance selection parameters. Fieldbus module specific parameters. For more information, see the User's Manual of the appropriate fieldbus adapter module.
4) With DeviceNet the control part is transmitted directly.
5) With DeviceNet the actual value part is transmitted directly.

The Control Word and the Status Word

The Control Word (CW) is the principal means of controlling the drive from a fieldbus system. The Control Word is sent by the fieldbus controller to the drive. The drive switches between its states according to the bit-coded instructions of the Control Word.

The Status Word (SW) is a word containing status information, sent by the drive to the fieldbus controller.

Actual values

Actual values (ACT) are 16/32-bit words containing information on selected operations of the drive.

FBA communication profile

The FBA communication profile is a state machine model which describes the general states and state transitions of the drive. The State diagram on page 143 presents the most important states (including the FBA profile state names). The FBA Control Word (2.12 FBA MAIN CW, page 32) commands the transitions between these states and the FBA Status Word (2.13 FBA MAIN SW, page 33) indicates the status of the drive.

Fieldbus adapter module profile (selected by adapter module parameter) defines how the control word and status word are transmitted in a system which consists of fieldbus controller, fieldbus adapter module and drive. With transparent modes, control word and status word are transmitted without any conversion between the fieldbus controller and the drive. With other profiles (e.g. PROFIdrive for FPBA-01, AC/DC drive for FDNA-01, DS-402 for FCAN-01 and ABB Drives profile for all fieldbus adapter modules) fieldbus adapter module converts the fieldbus-specific control word to the FBA communication profile and status word from FBA communication profile to the fieldbus-specific status word.

For descriptions of other profiles, see the *User's Manual* of the appropriate fieldbus adapter module.

Note: The regen supply module does not support any fieldbus protocol specific profiles because they are intended for either speed/torque controlled drives or motion controlled drives. Use 16/32 transparent mode or ABB Drives profile instead.

Fieldbus references

References and actual values are transmitted to/from the fieldbus controller as 16- or 32-bit integers depending on the selected profile. Internally, the firmware handles them as 32 signed integers (two's complement). Therefore, scaling from 16- to 32-bit integers (and vice versa) may be needed. An internal integer value is denoted as a real value consisting of a sign bit, 15-bit integer value and 16-bit fractional value.

Transparent 32 mode

Values are transmitted to/from the fieldbus controller directly in the 32-bit internal data format without any scaling. A positive reference value (as real number) is

multiplied by 65536 to get the corresponding 32-bit integer value. A negative reference is formed by calculating the two's complement from the corresponding positive reference value. Conversely, a 32-bit integer actual value must be divided by 65536 to get actual value as a real number.

For example, reference 1234.5 [SI unit] = 80904192 (= 1234.5 × 65536) as an integer and actual value 12345 (as integer) is approximately 0.18837 [SI unit] (= 12345 ÷ 65536).

Transparent 16 mode

Values are transmitted to/from the fieldbus controller as 16-bit integers. The fieldbus interface offers reference multiplier/actual value divisor for the transparent 16 mode as parameter T16 SCALE. Setting the scale to 65535 will provide practically exact approximation of 1 ~ 1.0 [SI unit]. Alternatively setting the scale to 6554 (accurate value would be 6553.6) will provide one decimal accuracy for a 16-bit integer.

Note: The value scaling works only with positive values. Correspondence between 16-bit and 32-bit negative values (two's complements) is not so straightforward that it could be handled with one constant multiplier/divisor. Therefore, the use of transparent 16 is in practice limited to DC voltage control because DC voltage can get only positive values.

For example, if T16 SCALE = 65535, DC voltage as integer 615 ~ 614.99 V (= 65535 ÷ 65536 × 615).

When T16 SCALE = 6554, integer value 6155 ~ 615.54 V (= 6554 ÷ 65536 × 6155).

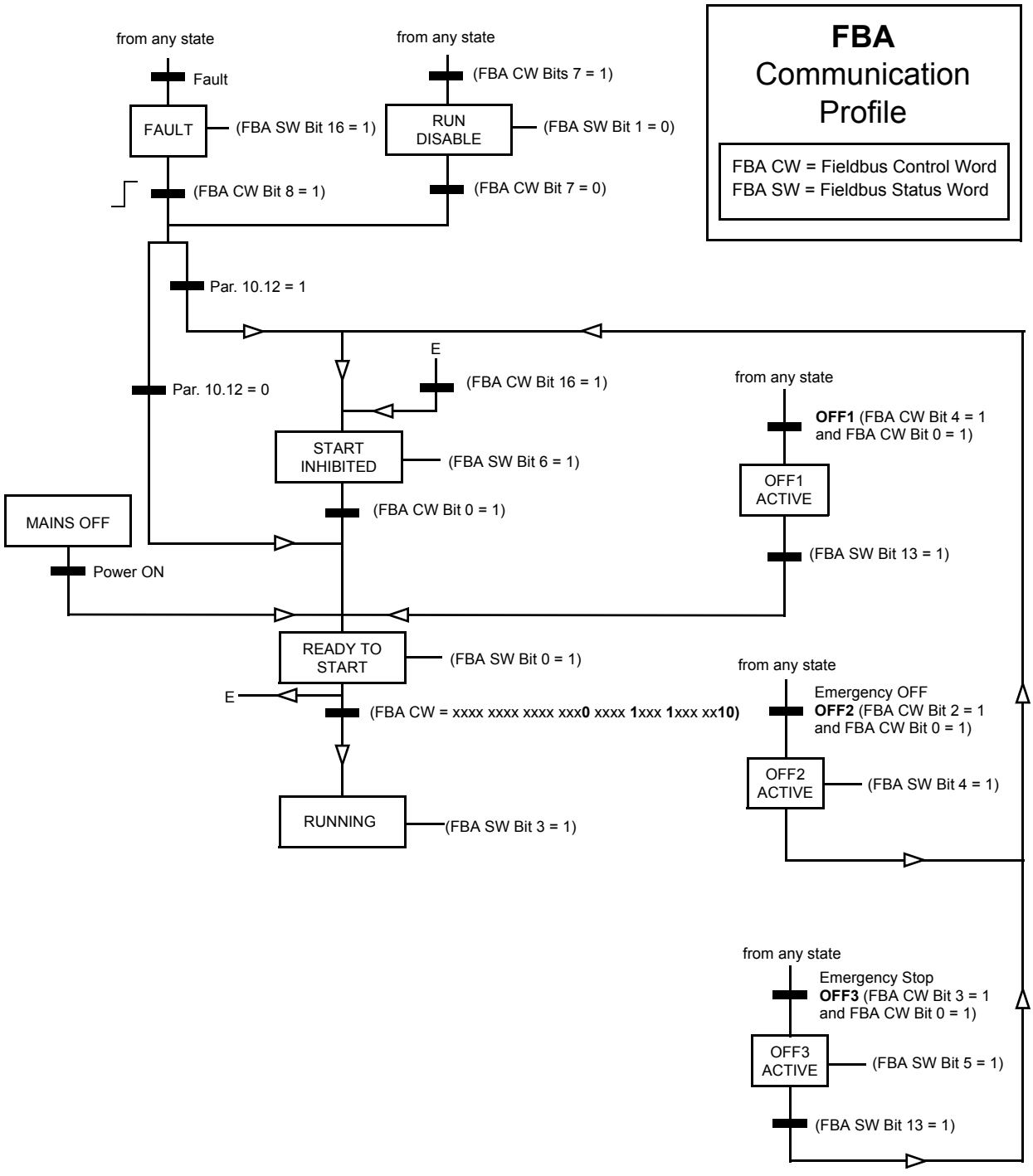
ABB Drives profile

The ABB Drives profile provides an easy way to transmit references and actual values as signed 16-bit integers via fieldbus. Basically, the ABB Drives profile is intended only for speed/torque controlled drives, but the same scaling principle normally used for speed/torque values can be used for any needed quantity (DC voltage [V], reactive power [kVAr] or active power [kW]).

Scaling is chosen with parameters 50.04 FBA REF1 SCALE and 50.05 FBA REF2 SCALE. They define whether the real value is given with one or two decimals' accuracy as an integer, i.e. 10 = 1.0 [SI unit] or 100 = 1.00 [SI unit]. Usable scaling depends on the needed value range. One decimal's accuracy provides value range -3276.8…+3276.7 [SI unit]. With two decimals, the value range is limited to -327.68…+327.67 [SI unit].

State diagram

The following presents the state diagram for the FBA communication profile. For other profiles, see the *User's Manual* of the appropriate fieldbus adapter module.



Appendix B – Drive-to-drive link

What this chapter contains

This chapter describes the wiring of, and available communication methods on the drive-to-drive link. Examples of using standard function blocks in the communication are also given starting on page 153.

General

The drive-to-drive link is a daisy-chained RS-485 transmission line, constructed by connecting the X5 terminal blocks of the JCU Control Units of several drives. It is also possible to use an FMBA Modbus extension module installed into an option slot on the JCU. The firmware supports up to 63 nodes on the link.

The link has one master drive; the rest of the drives are followers. By default, the master broadcasts control commands as well as selected references for all followers. The master can send 8 messages per millisecond at 100/150-microsecond intervals. Sending one message takes approximately 15 microseconds, which results in a theoretical link capacity of roughly 6 messages per 100 microseconds.

Multicasting the control data and reference 1 to a pre-defined group of drives is possible, as is chained multicast messaging. Reference 2 is always broadcast by the master to all followers. See parameters 57.11…57.14.

Wiring

Shielded twisted-pair cable (~100 ohm, e.g. PROFIBUS-compatible cable) must be used for the wiring. The maximum length of the link is 50 metres (164 ft).

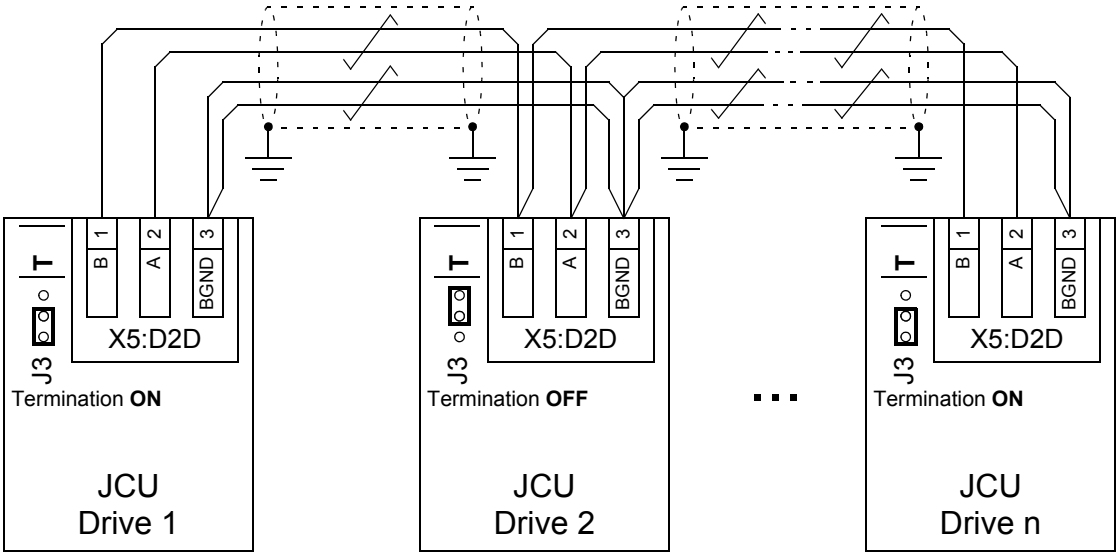
The JCU Control Unit has a jumper (J3, “T”) next to the X5 terminal block for bus termination. Termination must be ON on the drives at the ends of the drive-to-drive link; on intermediate drives, termination must be OFF.

Instead of the X5 connector, an FMBA Modbus extension module can be used.

For best immunity, high quality cable is recommended. The cable should be kept as short as possible. Unnecessary loops and running the cable near power cables (such as motor cables) must be avoided.

Note: The cable shields are to be grounded to the control cable clamp plate on the drive. Follow the instructions given in the *Hardware Manual* of the drive.

The following diagram shows the wiring of the drive-to-drive link.



Datasets

Drive-to-drive communication uses DDCS (Distributed Drives Communication System) messages and dataset tables for data transfer. Each drive has a dataset table of 256 datasets, numbered 0…255. Each dataset contains 48 data bits. By default, datasets 0…15 and 200…255 are reserved for the drive firmware; datasets 16…199 are available for the user application program.

The contents of the standard communication datasets (16-bit control word and two 32-bit references) can be configured freely with pointer parameters and/or application programming with the DriveSPC tool. Depending on the drive control mode, the followers can be configured to use the drive-to-drive commands and references with the following parameters:

Control data	Parameter	Setting for drive-to-drive communication
Start/Stop commands	10.01 EXT1 START FUNC 10.04 EXT2 START FUNC	(4) D2D
DC voltage reference	60.01 DC REF SEL	(1073742355) D2D REF1 or (1073742356) D2D REF2
Reactive power reference	61.01 Q POWER REF SEL	(1073742355) D2D REF1 or (1073742356) D2D REF2
Active power reference	62.01 POW REF SEL	(1073742355) D2D REF1 or (1073742356) D2D REF2

The communication status of the followers can be supervised by a periodic supervision message from the master to the individual followers (see parameters 57.04 FOLLOWER MASK 1 and 57.05 FOLLOWER MASK 2).

Drive-to-drive function blocks can be used in the DriveSPC tool to enable additional communication methods (such as follower-to-follower messaging) and to modify the use of datasets between the drives. See the function blocks in *ACSM1 Speed and Torque Control Program Firmware Manual* or *ACSM1 Motion Control Program Firmware Manual*.

Types of messaging

Each drive on the link has a unique node address allowing point-to-point communication between two drives. The node address 0 is automatically assigned to the master drive; on other drives, the node address is defined by parameter 57.03 NODE ADDRESS.

Multicast addressing is supported, allowing the composition of groups of drives. Data sent to a multicast address is received by all drives that have that address. A multicast group can consist of 1…62 drives.

In broadcast messaging, data can be sent to all drives (actually, all followers) on the link.

Both master-to-follower(s) and follower-to-follower(s) communication is supported. A follower can send one message to another follower (or a group of followers) after receiving a token message from the master.

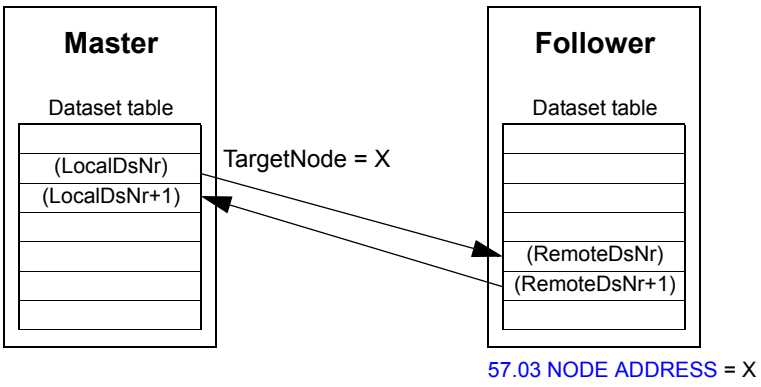
Type of messaging		**Note**
Point-to-point	Master point-to-point	Supported only at master
	Read remote	Supported only at master
	Follower point-to-point	Supported only at followers
Standard multicast		For both master and followers
Broadcast		For both master and followers
Token message for follower-to-follower communication		–
Chained multicast		Supported only for drive-to-drive reference 1 and command word.

Master point-to-point messaging (read and write)

In this type of messaging, the master sends one dataset (LocalDsNr) from its own dataset table to the follower's. TargetNode stands for the node address of the follower; RemoteDsNr specifies the target dataset number.

The follower responds by returning the contents of the next dataset. The response is stored into dataset LocalDsNr+1 in the master.

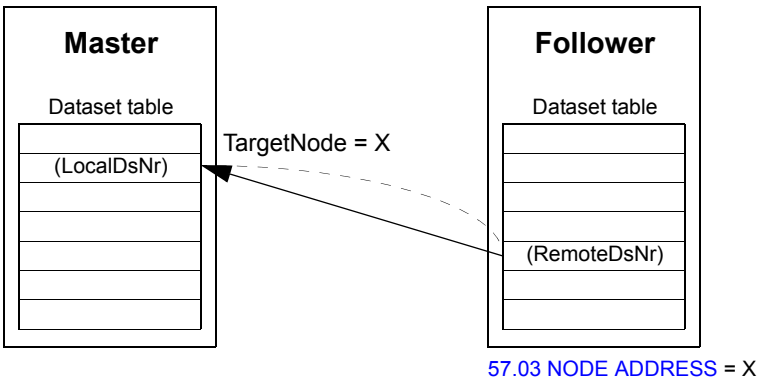
Note: Master point-to-point messaging is only supported at the master because the response is always sent to node address 0 (the master).



Read remote messaging (read only)

The master can read a dataset (RemoteDsNr) from a follower specified by TargetNode. The follower returns the contents of the requested dataset to the master. The response is stored at dataset LocalDsNr in the master.

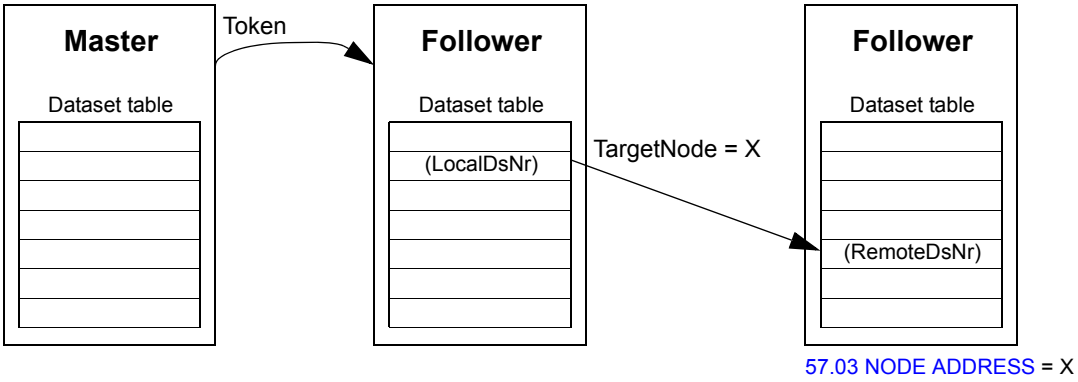
Note: Read remote messaging is only supported at the master because the response is always sent to node address 0 (the master).



Follower point-to-point messaging (write only)

This type of messaging is for point-to-point communication between followers. After receiving a token from the master, a follower can send one dataset to another follower with a follower point-to-point message. The target drive is specified using the node address.

Note: The data is not sent to the master.



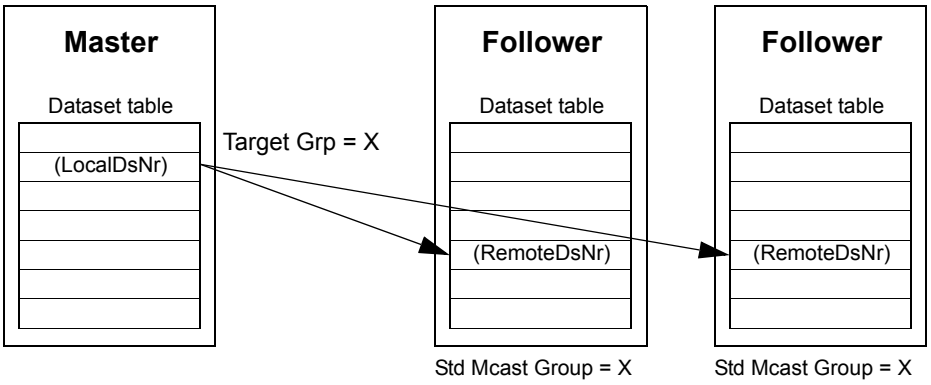
Standard multicast messaging (write only)

In standard multicast messaging, one dataset can be sent to a group of drives having the same standard multicast group address. The target group is defined by the D2D_Conf standard function block.

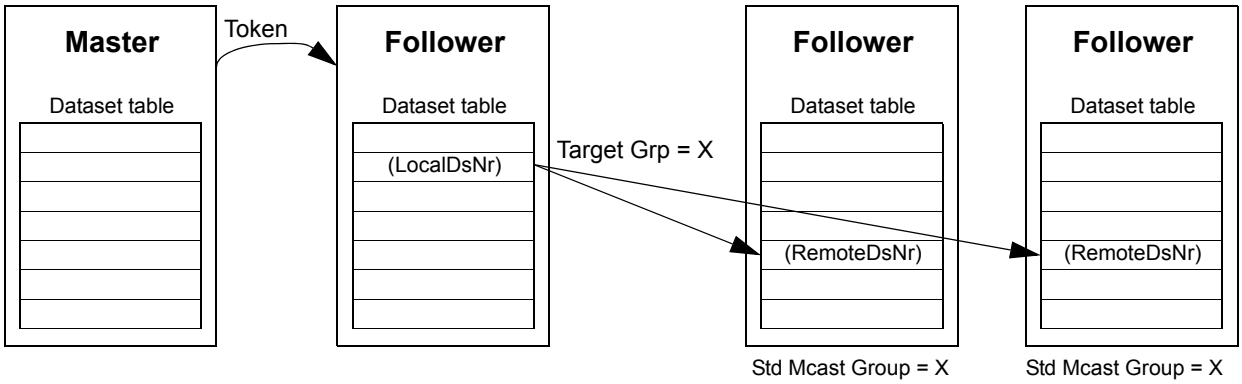
The sending drive can either be the master, or a follower after receiving a token from the master.

Note: The master does not receive the sent data even if it is a member of the target multicast group.

Master-to-follower(s) multicasting



Follower-to-follower(s) multicasting



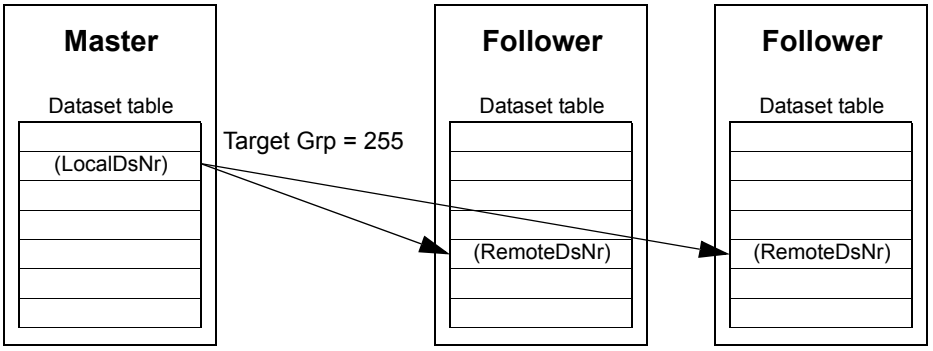
Broadcast messaging (write only)

In broadcasting, the master sends one dataset to all followers, or a follower sends one dataset to all other followers after receiving a token from the master.

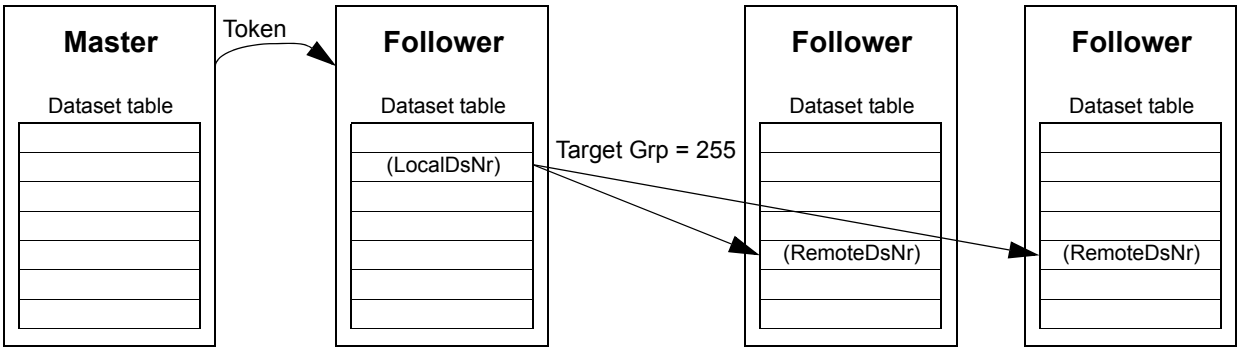
The target (Target Grp) is automatically set to 255 denoting all followers.

Note: The master does not receive any data broadcast by the followers.

Master-to-follower(s) broadcasting



Follower-to-follower(s) broadcasting



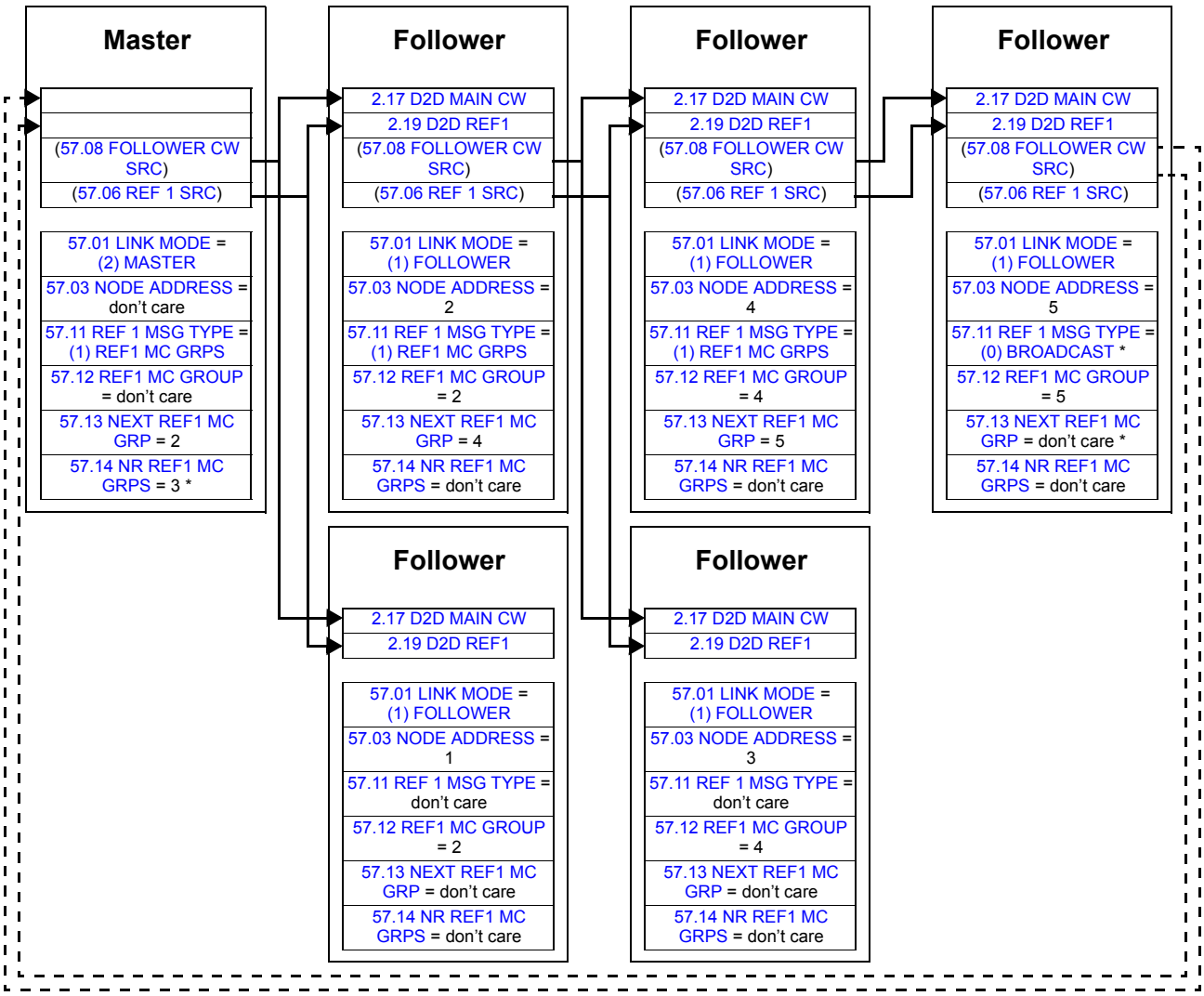
Chained multicast messaging

Chained multicasting is supported only for drive-to-drive reference 1 by the firmware.

The message chain is always started by the master. The target group is defined by parameter 57.13 NEXT REF1 MC GRP. The message is received by all followers that have parameter 57.12 REF1 MC GROUP set to the same value as parameter 57.13 NEXT REF1 MC GRP in the master.

If a follower have parameters 57.03 NODE ADDRESS and 57.12 REF1 MC GROUP set to the same value, it becomes a submaster. Immediately after a submaster receives the multicast message, it sends its own message to the next multicast group defined by parameter 57.13 NEXT REF1 MC GRP.

The duration of the entire message chain is approximately 15 microseconds multiplied by the number of links in the chain (defined by parameter 57.14 NR REF1 MC GRPS in the master).



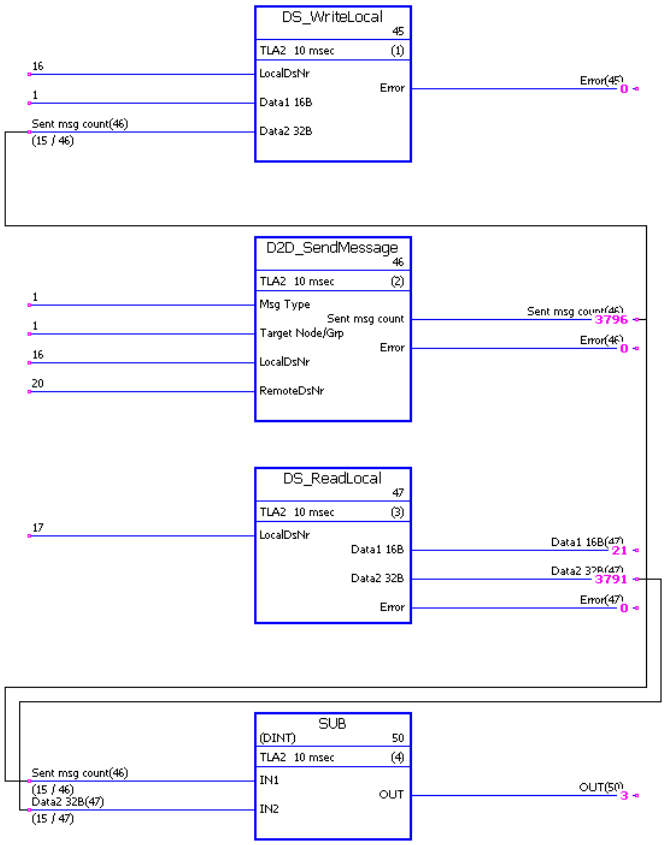
* If the last follower should send an acknowledgement to the master, the following changes would be required: In the master drive, par. 57.14 NR REF1 MC GRPS should be set to 4; in the last follower, par. 57.11 REF 1 MSG TYPE should be set to (1) REF1 MC GRPS and par. 57.13 NEXT REF1 MC GRP to 0. Note that, at the time of printing, the acknowledgement is not used in any way. In the example, sending the acknowledgement is prevented by setting par. 57.11 REF 1 MSG TYPE to (0) BROADCAST in the last follower. Alternatively, parameters 57.03 NODE ADDRESS and 57.12 REF1 MC GROUP could be set to non-equal values.

Examples of using standard function blocks in drive-to-drive communication

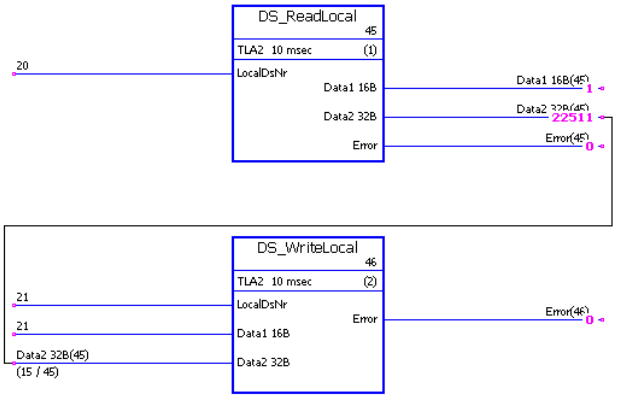
See also the descriptions of the drive-to-drive function blocks in *ACSM1 Speed and Torque Control Program Firmware Manual* or *ACSM1 Motion Control Program Firmware Manual*.

Example of master point-to-point messaging

Master



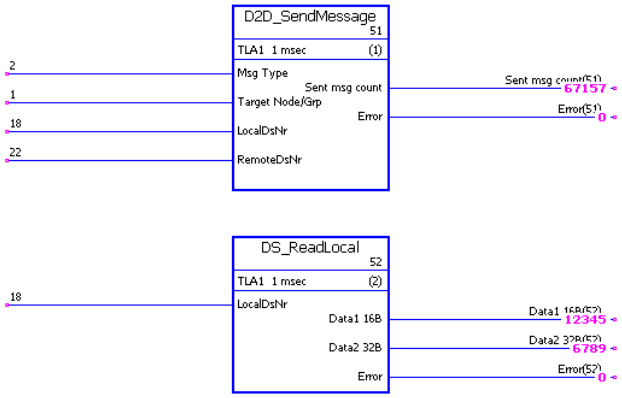
Follower (node 1)



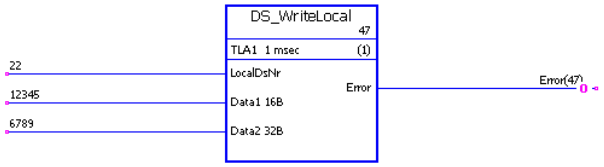
1. The master sends a constant (1) and the value of the message counter into follower dataset 20. Data is prepared to and sent from dataset 16.
2. The follower sends the received counter value and a constant (21) as a reply to the master.
3. The master calculates the difference of the latest message number and received data.

Example of read remote messaging

Master



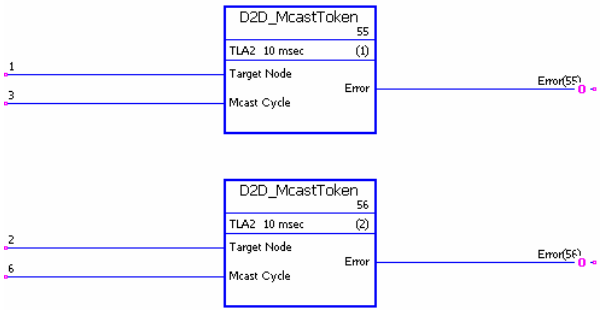
Follower (node 1)



1. The master reads the contents of the follower dataset 22 into its own dataset 18. Data is accessed using the DS_ReadLocal block.
2. In the follower, constant data is prepared into dataset 22.

Releasing tokens for follower-to-follower communication

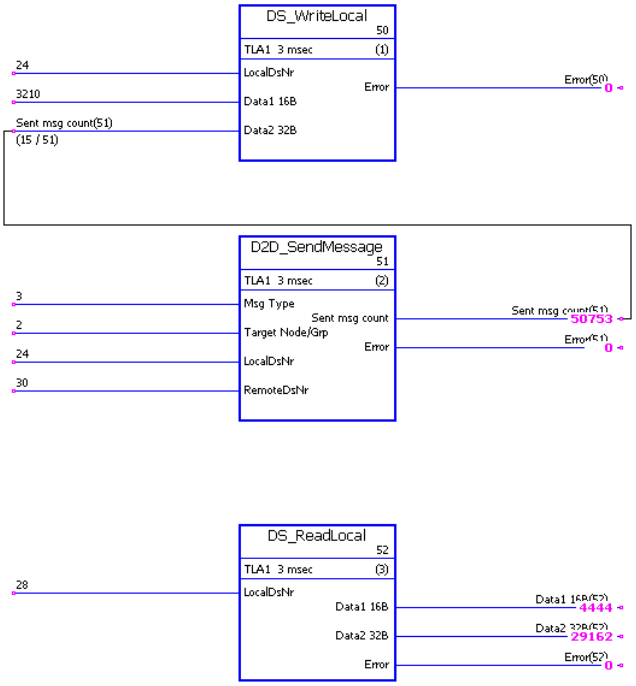
Master



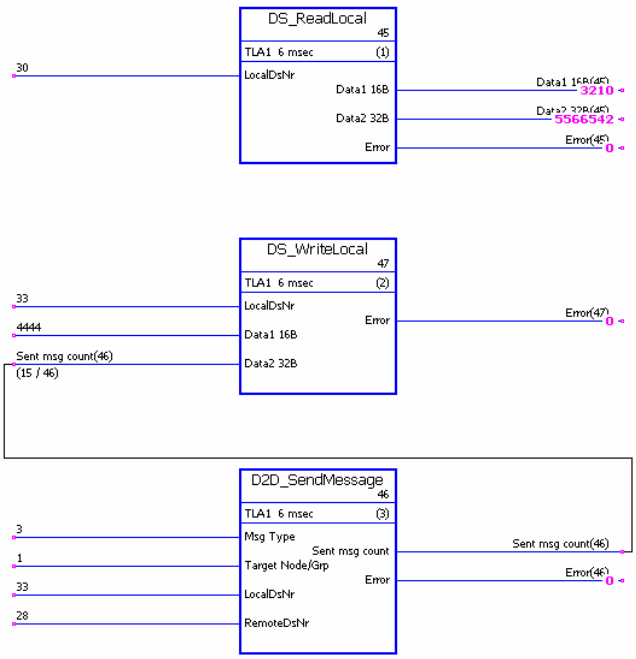
1. This drive-to-drive link consists of three drives (master and two followers).
2. The master operates as a “chairman”. Follower 1 (node 1) is allowed to send one message every 3 milliseconds. Follower 2 (node 2) is allowed to send one message every 6 milliseconds.

Example of follower point-to-point messaging

Follower 1



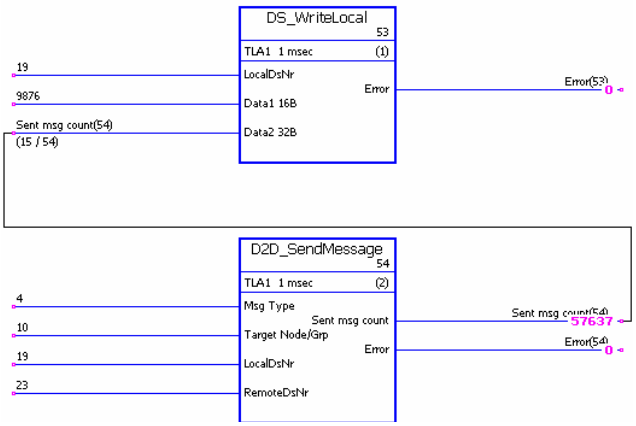
Follower 2



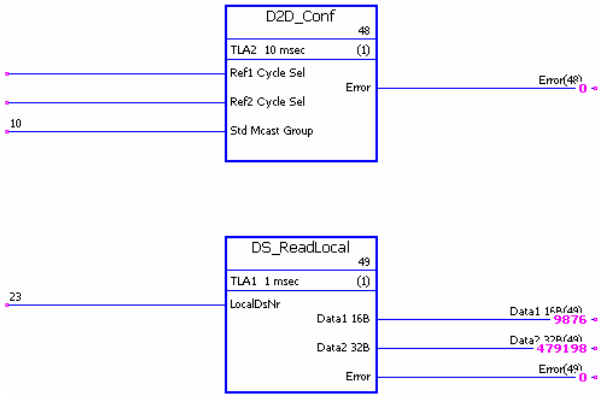
1. Follower 1 writes local dataset 24 to follower 2 dataset 30 (3 ms interval).
2. Follower 2 writes local dataset 33 to follower 1 dataset 28 (6 ms interval).
3. In addition, both followers read received data from local datasets.

Example of standard master-to-follower(s) multicast messaging

Master



Follower(s) in Std Mcast Group 10

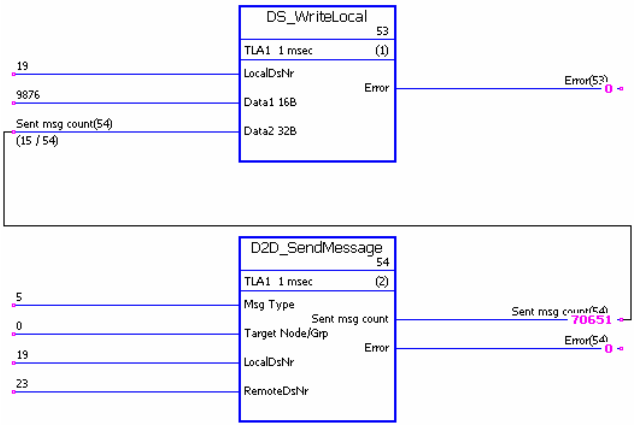


1. The master sends a constant (9876) and the value of the message counter to all followers in standard multicast group 10. The data is prepared into and sent from master dataset 19 to follower dataset 23.
2. Received data is read from dataset 23 of the receiving followers.

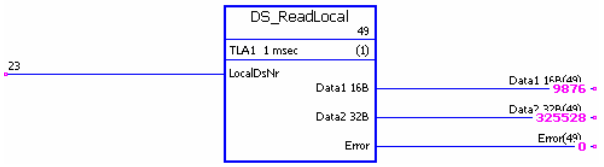
Note: The example application shown for Master above also applies to the sending follower in standard follower-to-follower multicasting.

Example of broadcast messaging

Master



Follower(s)



1. The master sends a constant (9876) and the value of the message counter to all followers. The data is prepared into and sent from master dataset 19 to follower dataset 23.
2. Received data is read from dataset 23 of the followers.

Note: The example application shown for Master above also applies to the sending follower in follower-to-follower broadcasting.

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