Emotron FlowDrive
Dedicated drive

Software Instruction

English

Valid from software version 1.00

FlowDrive™

emotron
DEDICATED DRIVE
A CG Product

Emotron FlowDrive

Software instruction - ENGLISH

Valid from Software version 1.00

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Safety Instructions

Congratulations for choosing a product from CG Drives & Automation!

Following symbols can appear in this instruction or on the product itself. Always read these first before continuing.

NOTE: Additional information as an aid to avoid problems.

CAUTION!
Failure to follow these instructions can result in malfunction or damage to the AC drive.

Warning!
Failure to follow these instructions can result in serious injury to the user in addition to serious damage to the AC drive.

HOT SURFACE!
Failure to follow these instructions can result in injury to the user.

Handling the AC drive

Installation, commissioning, demounting, taking measurements, etc, of or on the AC drive may only be carried out by personnel technically qualified for the task. A number of national, regional and local regulations govern handling, storage and installation of the equipment. Always observe current rules and legislation.

Opening the AC drive

WARNING!
Always switch off the mains voltage before opening the AC drive and wait at least 7 minutes to allow the capacitors to discharge.

Always take adequate precautions before opening the AC drive. Although the connections for the control signals and the switches are isolated from the main voltage, do not touch the control board when the AC drive is switched on.

Precautions to be taken with a connected motor

If work must be carried out on a connected motor or on the driven machine, the mains voltage must always be disconnected from the AC drive first. Wait at least minutes before starting work.

Earthing

The AC drive must always be earthed via the mains safety earth connection.

Earth leakage current

CAUTION!
This AC drive has an earth leakage current which does exceed 3.5 mA AC. Therefore the minimum size of the protective earth conductor must comply with the local safety regulations for high leakage current equipment which means that according to the standard IEC61800-5-1 the protective earth connection must be assured by one of following conditions:
PE conductor cross-sectional area shall for phase cable size ≤ 16 mm^2 (6 AWG) be >10 mm^2 Cu (16 mm^2 Al) or use a second PE conductor with same area as original PE conductor.
For cable size above 16 mm^2 (6 AWG) but smaller or equal to 35mm^2(2 AWG) the PE conductor cross-sectional area shall be at least 16mm^2(6 AWG).
For cables >35 mm^2 (2 AWG) the PE conductor cross-sectional area should be at least 50 % of the used phase conductor.
When the PE conductor in the used cable type is not in accordance with the above mentioned cross-sectional area requirements, a separate PE conductor should be used to establish this.

Residual current device (RCD) compatibility

This product cause a DC current in the protective conductor. Where a residual current device (RCD) is used for protection in case of direct or indirect contact, only a Type B RCD is allowed on the supply side of this product. Use RCD of 300 mA minimum.

EMC Regulations

In order to comply with the EMC Directive, it is absolutely necessary to follow the installation instructions. All installation descriptions in this manual follow the EMC Directive.

Mains voltage selection

The AC drive may be ordered for use with the mains voltage range listed below.

FLD48: 230-480 V
FLD52: 440-525 V
FLD69: 500-690 V

Voltage tests (Megger)

Do not carry out voltage tests (Megger) on the motor, before all the motor cables have been disconnected from the AC drive.

Condensation

If the AC drive is moved from a cold (storage) room to a room where it will be installed, condensation can occur. This can result in sensitive components becoming damp. Do not connect the mains voltage until all visible dampness has evaporated.

Incorrect connection

The AC drive is not protected against incorrect connection of the mains voltage, and in particular against connection of the mains voltage to the motor outlets U, V and W. The AC drive can be damaged in this way.

Power factor capacitors for improving cosφ

Remove all capacitors from the motor and the motor outlet.

Precautions during Autoreset

When the automatic reset is active, the motor will restart automatically provided that the cause of the trip has been removed. If necessary take the appropriate precautions.

Transport

To avoid damage, keep the AC drive in its original packaging during transport. This packaging is specially designed to absorb shocks during transport.

IT Mains supply

The AC drives can be modified for an IT mains supply, (non-earthed neutral), please contact your supplier for details.

Alarms

Never disregard an alarm. Always check and remedy the cause of an alarm.

Heat warning

HOT SURFACE!
Be aware of specific parts on the AC drive having high temperature.

DC-link residual voltage

WARNING!
After switching off the mains supply, dangerous voltage can still be present in the AC drive. When opening the AC drive for installing and/or commissioning activities wait at least 7 minutes. In case of malfunction a qualified technician should check the DC-link or wait for one hour before dismantling the AC drive for repair.

Contents

1. Introduction

Emotron FlowDrive is an AC drive dedicated for controlling wastewater pumps with focus on continuous pumping with best economy (lowest cost).
FlowDrive can operate as a Standalone unit (1 AC drive) or in a Master-Follower configuration (2 AC drives).

Prerequisites

In order to utilize the FlowDrive, following is required:

- Analouge water level sensor for automatic level control, preferably 4-20mA
- In a Master-Follower configuration a cable between the units is required. For cable specification, see separate "Installation & Getting stared instruction".
- One external switch per AC drive: Auto- Off - Forced run (optional but highly recommended)
- Digital switch for redundant overflow detection (optional, can be disabled)
- 1 pump per AC drive (if dual pumps are used, equal pump performance is required)

Several options are available, listed in "Installation & Getting started instruction" that enable you to customize the AC drive for your specific needs.

Motors

The AC drive is suitable for use with standard 3-phase asynchronous motors. Under certain conditions it is possible to use other types of motors. Contact your supplier for details.

1.1 Using of the instruction manual

Within this instruction manual the abbreviation "AC drive" is used to indicate the complete variable speed drive as a single unit.

With help of the index and the table of contents it is easy to track individual functions and to find out how to use and set them.

1.2 Glossary

1.2.1 Abbreviations and symbols

In this manual the following abbreviations are used:

Table 1 Abbreviations

Abbreviation/ symbol	Description
AC drive	Frequency converter
FLD	FlowDrive
IGBT	Insulated Gate Bipolar Transistor
BEP	Best Efficiency Point
RTC	Real Time Clock (option)
CP	Control panel, the programming and presentation unit on the AC drive
HCP	Handheld control panel (option)
EInt	Communication format
UInt	Communication format (Unsigned integer)
Int	Communication format (Integer)
Long	Communication format
🔒	The function cannot be changed in run mode

1.2.2 Definitions

In this manual the following definitions for current, torque and frequency are used:

Table 2 Definitions

Name	Description	Quantity
I_{IN}	Nominal input current of AC drive	A_{RMS}
I_{NOM}	Nominal output current of AC drive	A_{RMS}
I_{MOT}	Nominal motor current	A_{RMS}
P_{NOM}	Nominal power of AC drive	kW
P_{MOT}	Nominal Motor power	kW
T_{NOM}	Nominal torque of motor	Nm
T_{MOT}	Motor torque	Nm
f_{OUT}	Output frequency of AC drive	Hz
f_{MOT}	Nominal frequency of motor	Hz
n_{MOT}	Nominal speed of motor	rpm
I_{CL}	Maximum output current	A_{RMS}
Speed	Actual motor speed	rpm
Torque	Actual motor torque	Nm
Sync speed	Synchronous speed of the motor	rpm

2. Main Features

This chapter contains descriptions of the main features of the Emotron FlowDrive.

Emotron FlowDrive is an AC drive dedicated for pumping wastewater. The integrated pump controller reduces the number of sensors and relays required to a minimum. It also eliminates the need for an external pump controller. FlowDrive AC drive can operate as a Standalone unit controlling one pump or in a Master-Follower configuration where two AC drives are used to control two pumps.

2.1 Introduction

Reservoir level control

The main feature of Emotron FlowDrive is the reservoir level control. This function controls the level in a pump sump based on input from an analogue level sensor, using one or two pumps.

AutoTune system

During commissioning, the user configures all motor data, sump geometry and levels. The self-learning AutoTune program then takes over, taking the measurements and calculating process data to enable optimal control. Features include load monitoring, best efficiency point and flow estimation.

Best efficiency point (BEP) algorithm

Initially, the AC drive operates in learn mode in order to establish the most efficient operating parameters for the BEP algorithm. By running the pump over a range of frequencies and measuring the volumes and energy consumptions, it defines the most energy efficient pumping frequency, and calibrates the related functions accordingly. Thereafter, the reservoir level control operates according to these defined values.

No flow sensor required

Once the initial commissioning program has been run, the FlowDrive can estimate in and outflow without the need for a costly external flow sensor. If more accurate flow measurements are required for other reasons, the FlowDrive does, however, support the use of an external sensor.

Random start level

To prevent residues accumulating at a single level, this feature generates a random start level. The residues spread are thus over a broader surface and major buildups prevented.

Alternating pumps

Selects if either run hours or number of starts shall be used to select which pump to run in a dual pump configuration.

Cleaning functions

Several cleaning functions are built-in to reduce maintenance requirements;

- Pump cleaning
- Pump sump cleaning
- Pipe cleaning

Single pump or two pump configuration

Emotron FlowDrive can work in three different modes:

- Stand alone - One single pump
- Master - Main unit in a two pump configuration
- Follower - Second pump in a two pump configuration

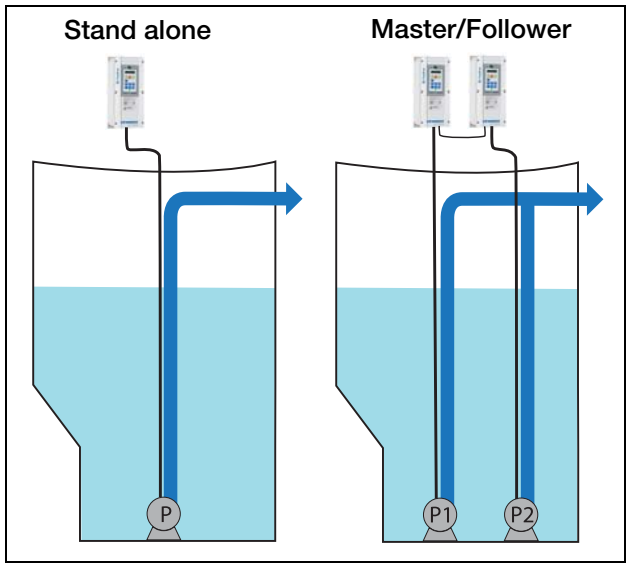


Fig. 1 Stand alone and Master/Follower configuration.

See next page for wiring examples of the different configurations.

2.1.1 Minimum wiring examples

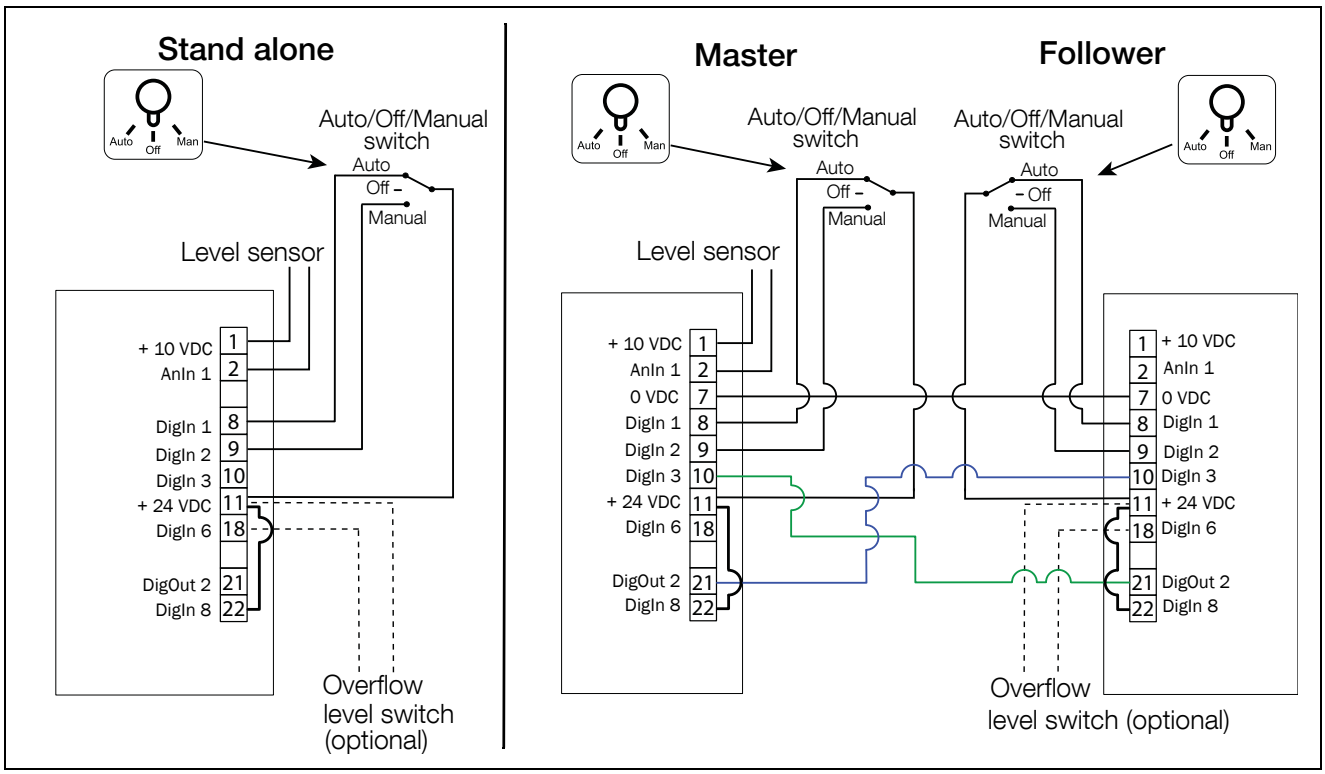


Fig. 2 General control I/O, minimum wiring.

Table 3 Terminals and description of functions.

Stand alone / Master			Follower			
Terminal	**Name**	**Description**	**Terminal**	**Name**	**Function**	**Menu**
Analogue inputs						
2	AnIn 1	Level sensor				511
Outputs						
1	+10V	+10V DC supply voltage				
7	0 VDC	Common	7	0 VDC	Common	
11	+24V	+24V DC supply voltage	11	+24V	+24V DC supply voltage	
Digital inputs						
8	DigIn 1	Auto (Auto run)	8	DigIn 1	Auto (Auto run)	522
9	DigIn 2	Manual (Forced run)	9	DigIn 2	Manual (Forced run)	521
10	DigIn 3	FlowLinkIn (Follower feedback)	10	DigIn 3	FlowLinkIn (Follower control)	523
18	DigIn 6	Overflow level switch (optional)	18	DigIn 6	Overflow level switch (optional)	526
22	DigIn 8	Reset	22	DigIn 8	Reset	528
Digital outputs						
21	DigOut 2	FlowLinkOut (Follower control)	21	DigOut 2	FlowLinkOut (Follower feedback)	542

2.1.2 Full wiring examples

FlowDrive Stand alone

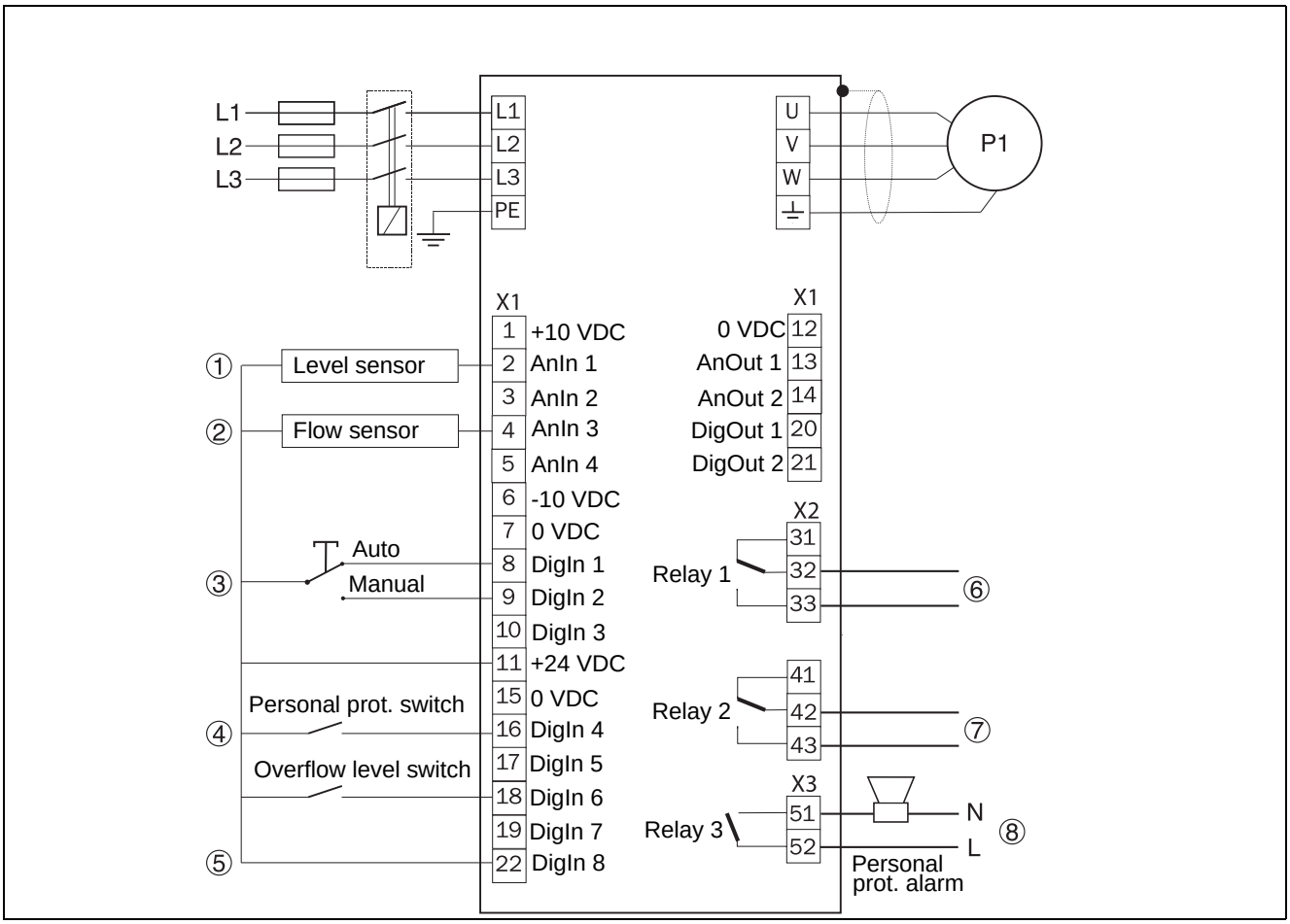


Fig. 3 FlowDrive standalone full wiring examples.

Pos. Nr	Function	Mandatory	Terminal	Description	Menu	Default setting	Customer setting
1	Level sensor	Yes	2	AnIn 1	511	Level sensor	
2	Flow sensor	No	4	AnIn 3	517	Off	Flow sensor
3	Auto/Off/Manual switch	No	8	DigIn 1	521	Flow ManRun	
		Yes	9	DigIn 2	522	Flow AutoRun	
4	Personal protection switch	No	16	DigIn 4	524	Off	PP Timer
5	Autoreset enabling	No	22	DigIn 8	528	Reset	
6	Trip relay output	No	32 - 33	Relay 1	551	Trip	
7	Operation relay output	No	42 - 43	Relay 2	552	Run	
8	Personal protection prealarm	No	51 - 52	Relay 3	553	Off	PP PreAlarm

FlowDrive Master / Follower

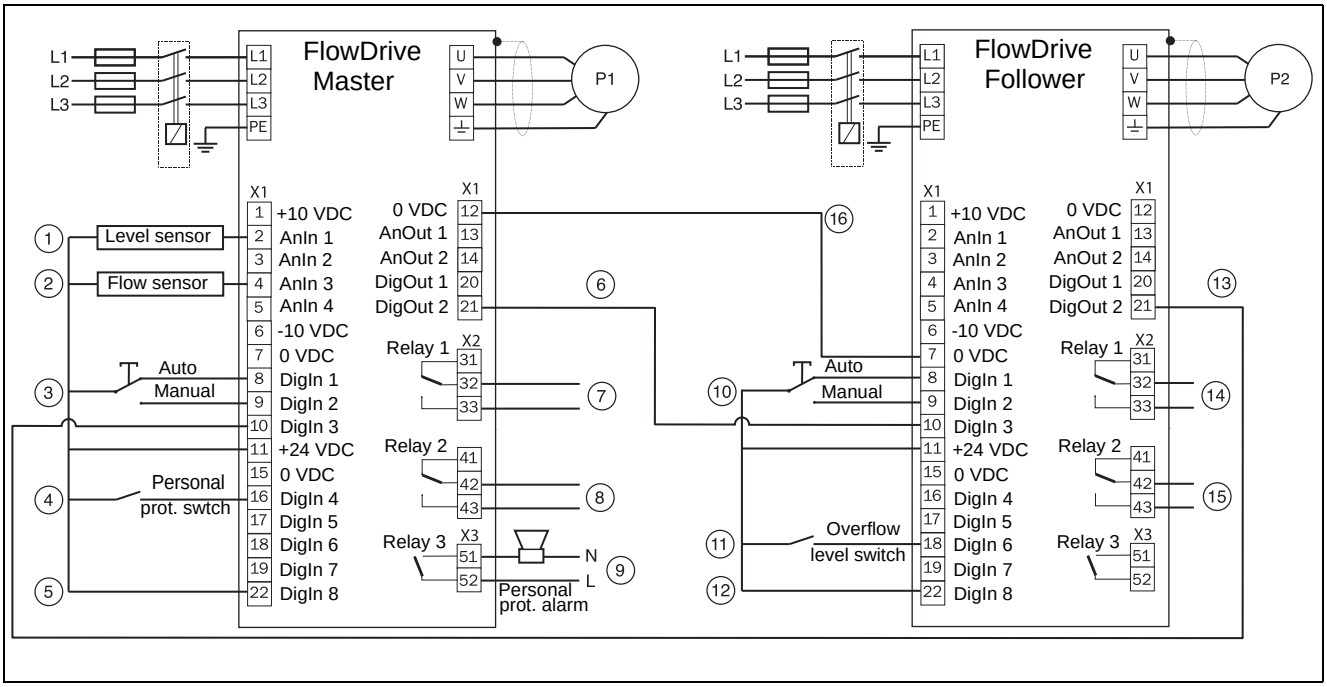


Fig. 4 FlowDrive Master/follower full wiring example.

Pos. Nr	Function	Man-datory	Unit	Terminal	Descrip-tion	Menu	Default setting	Customer setting
1	Level sensor	Yes	Master	2	AnIn 1	511	Level sensor	
2	Flow sensor	No	Master	4	AnIn 3	517	Off	Flow sensor
3	Auto/Off/Manual switch - Master	No	Master	8	DigIn 1	521	Flow ManRun	
		Yes	Master	9	DigIn 2	522	Flow AutoRun	
4	Personal protection switch	No	Master	16	DigIn 4	524	Off	PP Timer
5	Autoreset enabling	No	Master	22	DigIn 8	528	Reset	
6	Master/Follower communi-cation	Yes	Master	21	DigOut 2	542	FlowLinkOut	
		Yes	Follower	10	DigIn 3	523	FlowLinkIn	
7	Trip relay output	No	Master	32 - 33	Relay 1	551	Trip	
8	Operation relay output	No	Master	42 - 43	Relay 2	552	Run	
9	Personal protection pre-alarm	No	Master	51 - 52	Relay 3	553	Off	PP PreAlarm
10	Auto/Off/Manual switch - Follower	No	Follower	8	DigIn 1	521	FlowManRun	
		Yes	Follower	9	DigIn 2	522	FlowAutoRun	
11	Overflow level switch	No	Follower	18	DigIn 6	526	Lvl Overflow	
12	Autoreset enabling	No	Follower	22	DigIn 8	528	Reset	
13	Master/Follower communi-cation	Yes	Follower	21	DigOut 2	542	FlowLinkOut	
		Yes	Master	10	DigIn 3	523	FlowLinkIn	
14	Trip relay output	No	Follower	32 - 33	Relay 1	551	Trip	
15	Operation relayoutput	No	Follower	42 - 43	Relay 2	552	Run	
16	Common, signal ground	Yes	Master	12	0 VDC			
		Yes	Follower	7				

2.2 Reservoir Level Control

This function controls the level in a pump sump based on input from an analogue level sensor.
The main goal of level control is to control the level in the pump sump avoiding overflows. By analysing the sump level and with knowledge about the process, gained from the initial self-learning program, the level can be maintained using as little energy as possible.

To be able to do accurate measurements of flows, change pumps at natural stops, avoid residue buildup at a specific level, etc it has been chosen to strive for pumping down to stop level regularly. This is done by decreasing the level over time from pump start. Desired emptying time is configurable and can be set between 0 and 8 hours.

2.2.1 Levels

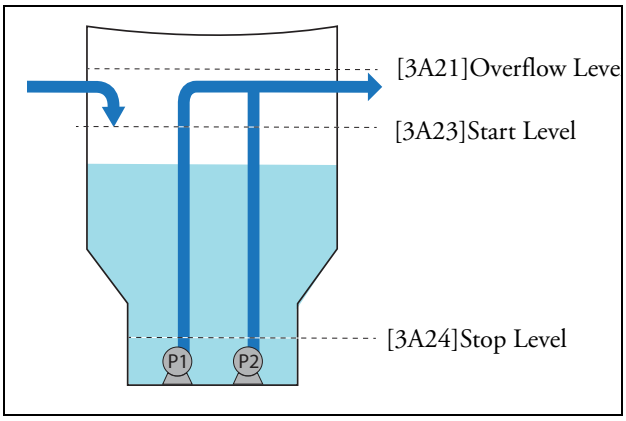


Fig. 5 Reservoir levels

Three levels exist: Stop, Start, and Overflow. See picture above. Levels can be set in centimeters from -100 to +100 meters in software and relates to the value given by the analogue level sensor. Levels must be configured so the following criterion is fulfilled:

Overflow > Start > Stop

The “Overflow” level can either be represented as a software configurable level or as a digital switch. Preferably it is represented as a digital switch connected to the follower drive for additional redundancy. By doing so overflow can be prevented in case of failure of the master drive or the analogue level sensor.

2.2.2 Level control, details

When “[3A23]Start Level” is reached one of the pumps will start. If “[3B1]Flush Start” is used the chosen pump will ramp up and run at full speed for a configurable amount of seconds (default 30 seconds). After flushing, or directly if flushing is not enabled, frequency will be adjusted to the most energy efficient one.

When a pump is running the aim is to empty the sump within “[3A13]Empty time” minutes (default 4 hours). “Empty time” is the desired maximum time to empty the sump.
To achieve emptying the sump within the desired time frame, speed of the pump is adjusted:

In most cases one pump running at its most efficient frequency will be enough to pump down the level faster than the desired “Empty time”. Reducing frequency further is not energy efficient and should be refrained from, hence time for emptying the sump might be shorter than “Empty time”.

In case inflow is higher than the generated outflow at the most efficient pump speed, the pump speed is increased.

In case inflow is higher than the generated outflow at full speed of one pump the second pump will be started. Initially the second pump will ramp up to a speed creating a higher flow than one pump at full speed. Speed will then continue to be controlled to achieve the desired “Empty time”.

In case two pumps are engaged and outflow required could be achieved with one pump FlowDrive will go back to running with one pump since this is more energy efficient.

2.2.3 Level control, example

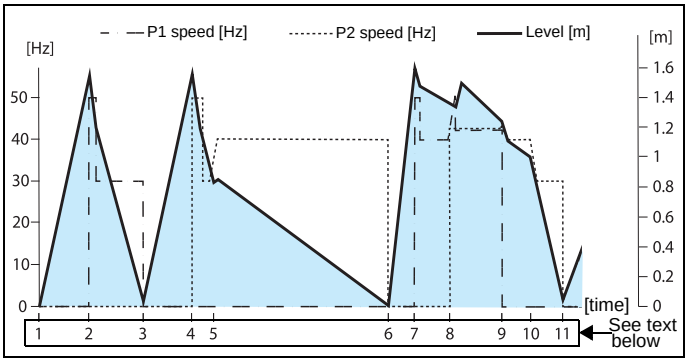


Fig. 6 Example of level and pump speeds.

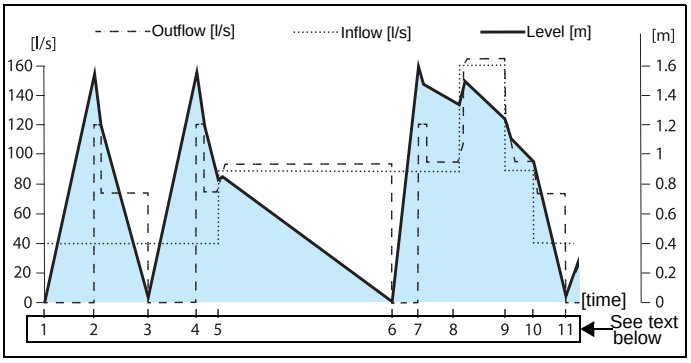


Fig. 7 Same example as in Fig. 6, but showing level, inflow and outflow.

1. Both pumps stand still, level is rising with inflow 40 l/s.
2. "[3A23]Start Level" is reached (1.5 m in this example) and pump 1 starts with flushing at 50 Hz. After flushing pump 1 ramp down to optimal frequency (30 Hz in this example). Sump level is decreasing. Since inflow in this case is low the sump will be emptied fast, faster than the desired "[3A13]Empty time", despite the pump running at a low frequency. However, emptying is done in the most energy efficient way. Going down further in frequency is neither good from an energy efficiency standpoint nor for minimum flow rate in the pipes.
3. "[3A24]Stop Level" is reached (0 m in this example) and pump is stopped. Sump level start rising caused by the net inflow and no outflow (since no pumps are running).
4. "[3A23]Start Level" is reached. Pump 2, due to alternating pumps, start flushing at full speed (50 Hz). After flushing is done pump 2 ramp down to optimal frequency. As before the sump level is sinking fast (same inflow/outflow conditions as before).
5. Level start rising, caused by an increased inflow (90 l/s). Pump 2 frequency is ramped up until sump level starts to decrease in a rate determined by the "[3A13]Empty time" parameter. In this example 40 Hz is needed. Sump level is decreasing in accordance with "[3A13] Empty-Time".
6. "[3A24]Stop Level" is reached (0 m in this example) and pump 2 stops. Sump level is rising caused by the inflow and no outflow (no pumps are running). The increased inflow can clearly be seen as the fill up time is shorter compared to the two previous fill up periods (1 and 3).
7. "[3A23]Start Level" is reached for the third time and pump 1 starts flushing at 50 Hz. After flushing is done pump ramp down to optimal frequency. At optimal frequency the created outflow is less than the inflow and hence sump level starts rising. Pump frequency is increased until level starts to decrease in a rate in accordance with "[3A13]Empty time".
8. Inflow increases again and level starts rising. Pump 1 frequency is increased all the way up to full speed (here 50 Hz) to meet the increased inflow. However, sump level is still rising; hence Pump 2 is also needed. Both pumps are controlled to a frequency producing more flow than one pump at full speed (in this example 42 Hz). Now sump level is decreasing in accordance with "[3A13]Empty time".
9. Inflow decreases to 90 l/s. Speed of both pumps are reduced. At 38 Hz Pump 1 is shut down and Pump 2 ramps up to 50 Hz.
   Pump 2 speed reduced down to 40 Hz to create a small net outflow.
10. Inflow falls to 40 l/s. Speed of Pump 2 is reduced down to BEP speed 30 Hz.
11. End of example.

Local manual control

Often it is required to manually being able force the pumps to either run or stop. In that case the Reservoir Level Control is overridden. If the Auto/Off Manual switch on one of the AC drives is set to manual control that AC drive will ramp up to full speed and the other AC drive will stop. If both AC drives are set to manual control both AC drives will be running at full speed regardless of the level read back by the level sensor.

2.3 AutoTune program

This self learning commissioning program should normally be started in the final stage of the FlowDrive commissioning when all motor data and levels are configured by the user. AutoTune program will do measurements needed for optimal control, while performing the reservoir level control. For example it will search for the most energy efficient frequency to pump at and do calibrations of other functions.

Energy efficiency theory

The figure below shows a typical curve describing the energy/volume to frequency for a pump connected to long or narrow pipes where dynamic pressure is a major part. Generally the pump runs at best close to 50Hz but at this speed the pipe back pressure, due to frictional losses, often is dominant. Reducing the frequency will reduce the flow and hence the amount of frictional losses in the pipe. However, the pump will also lose some efficiency but not as much as saved by the reduced flow. Going even lower in frequency will cause the pump to start losing efficiency quickly. Meanwhile the gain of reduced flow rate will not compensate pump losses at low frequencies. Hence, the energy consumed to pump a defined volume will start to increase again at low frequencies. Consequently, we will get a curve shaped as below where a BEP- Best Efficiency Point, can be identified.

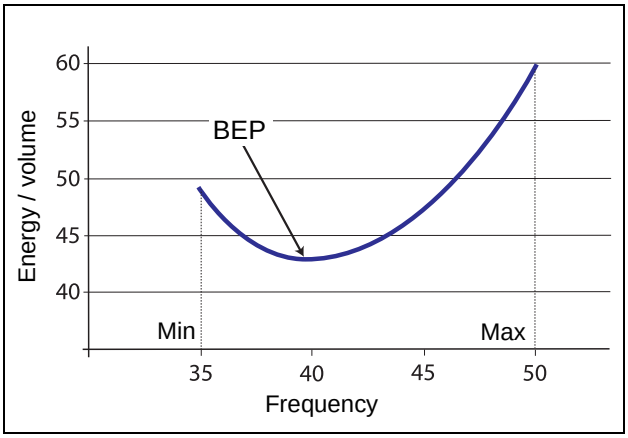


Fig. 8 Efficiency curve with BEP-Best Efficiency Point.

BEP find algorithm

The curve in Fig. 8 above is seldom known; hence FlowDrive must be able to derive it. Frequency and energy is known entities in the AC drive but the pumped volume is not. To derive this curve a flow meter could be used but since it is expensive and seldom mounted in pump sumps the FlowDrive must be able to estimate the pumped volume in some other way. To do this the pump sump is used and a lot of measurements are taken at different frequencies. When all desired measurements have been taken the efficiency curve can be obtained. Depending on inflow conditions and capacity of the pumps time for finalizing the self-learning commissioning program will vary.

Flow estimation calibration

While doing the BEP measurements outflow estimations for each frequency are calibrated. This requires that the user have entered area data for the pump sump.

Load monitor calibration

The load monitor is calibrated during the self-learning commissioning program to be able to detect blocking of the pump(s).

Finalizing the self-learning commissioning program

When all measurements are done the BEP frequency is calculated. In addition outflow capacities at different frequencies are now known. The self-learning commissioning program will finalize and hand over control to reservoir level control automatically. Reservoir level control will then use this data during normal operation.

2.4 Cleaning functions

To reduce maintenance the FlowDrive system has the following cleaning functions

2.4.1 Pump cleaning

When pumping waste water, that includes various materials, the pumps can get clogged. Problems either emerge from gradually buildup of small fibers on the impeller or bigger objects, like rugs, that get stuck in the pump. Often these objects can be cleaned from the pump by reversing it if done in time.

NOTE: Before turning this feature on, make sure that the installation can handle running the pump in reverse direction.
Not all pumps or all configurations can operate in the opposite direction. Please check with the pump manufacturer.

Pump cleaning is a function which reverses the motor speed for a short time in order to remove the dirt and obstacles in the pump. The function, if enabled, is triggered by a "PumpNotClean" warning, on a user request, periodically or on desired time and date (repetitive) if the AC drive is equipped with the Real Time Clock option. The function is enabled/disabled by [3B31].

When triggered, the function does following:

1. Motor runs in reverse direction at [3B34] Hz for [3B35] seconds.
2. The motor runs in forward direction at [343] Hz for the time defined by "[4172] MaxPreAlDel" *1,5.
   If "PumpNotClean" warning is no longer active, the motor returns to Reservoir level control operation.
   If "PumpNotClean" warning is still active, the cleaning procedure is repeated for max. 8 consecutive times. If the warning is still active, a "CleaningFailed" warning is triggered. The pump will continue to run. We recommend to stop the pump and check the reason and clean it manually if clogged.
   This alarm is reset when "PumpNotClean" warning is not active.

Pump cleaning is triggered from following sources:

1. "PumpNotClean" warning.
2. Menu "[3B32] ForcePumpCl".
3. Digital input.
4. Run-time.
5. Real Tme Clock - Option.
6. Load monitor tuning

Load monitor – automatic detection

The load monitor is used to automatically detect clogging of the pump to resolve the problem automatically without the need for costly manual maintenance. In addition it is often vital to detect clogging problems early; otherwise pump cleaning by reversing the pump will have little effect.

During the initial self-learning commissioning program the load monitor is calibrated. Then the load monitor will supervise the load of the pump trying to detect abnormal behaviour.

In the FlowDrive system with two pumps connected to the same pipe starting and stopping of the other pump will affect the load. To avoid false detections of over or under load, monitor is aware of what the other pump is doing.

In case of abnormal behaviour a "PumpNotClean" warning will be set and if enabled, pump cleaning will be performed. If problem persist after a finished cleaning the cleaning operation can be executed again up to 8 number of times before a "CleaningFailed" alarm is triggered.

Different ways a pump can get clogged

In the case of fibre buildup the initial sign of a partly clogged impeller is somewhat less power usage and a reduced amount of pumped water. In addition fluctuations in current might be present emerging from one or more clogged vanes. At this stage the dirt can often be flushed out of the pump by reversing the pump for a short while. If pump is not cleaned at this stage additional buildup will occur resulting in additional lost efficiency. In the final stage the pump will have accumulated so much dirt causing it to cease pumping anything and all energy will be consumed in internal frictional losses. Generally this requires even more energy than normal operation. At this stage the pump cannot be cleaned by reversing the direction; manual maintenance is required.

In case of a rug or other bigger object get stuck in the pump the load will increase significantly quite swiftly. Often the object will only be stuck in the pump for a short period of time and then flushed away without any action taken. Hence a time-out before action is available "[4172] MaxPreAlDel".

2.4.2 Sump cleaning

Pump sump cleaning run(s) the selected pump(s) below the normal stop level until free running (slurping air). This will help to get rid of accumulated residues in the bottom of the pump sump.

This feature can be requested to run from the control panel/ fieldbus or automatically by calendar time (require RTC) or run hours/starts.

NOTE 1: Running pumps below their normal stop level might cause the pump to overheat.
NOTE 2: Problems might emerge from sucking air into the pump/pipes in some installations.

2.4.3 Pipe cleaning

Sometimes it is desired to produce a high flow during an extended period of time. Pipe cleaning does this by letting the pump sump fill up to start level and then run all available pumps at full speed until stop level is reached. This produces the highest possible flow for as long as possible which will clean the pipes from loose sediments that might not be flushed away during normal operation.

Pipe cleaning can be programmed to execute every X pump down cycle or by clock time if the RTC option is present.

2.5 Other functions

2.5.1 Maintenance alarm

As a personal protection, when maintenance is ongoing an external switch is enabled by the service technician. This switch will start a countdown of maintenance time; configurable in the master drive. When 5 minutes remain a digital output will be enabled (to start a pre-warning light/ siren). If alarm is not reset within these five minutes the master drive will signal an alarm that can be seen by the telemetry system or other. See further information in chapter “Person Prot [430] nF)” on page 83.

2.5.2 Easy commissioning menu loop

To ease commissioning a pre programmed menu loop is set up when started for the first time. This will guide the user through the parameters that needs to be configured at commissioning. See further information in separate “Installation & Getting started instruction”.

2.5.3 Communication

Master drive can be equipped with RS-232/485 Modbus RTU communication or any of the numerous fieldbuses. All parameters can be configured remotely and logged information can be retrieved.

2.5.4 Overflow log

This feature is for logging overflow and keeping data that might be required by authorities.

- Last Duration Time [7371]- Calendar time and date if RTC is available otherwise online time
- Total Duration Time [7373] of overflow

2.5.5 Statistics

Following statistics can be read out:

Current sump level

- Sump level in meters [741], also displayed in [100]

Run hours

- Run Time total [7311]
- P1Run Time [7312]
- P2Run Time [7313]
- Run Time Daily [7314]
- P1 Run Time Daily [7315]
- P2 Run Time Daily [7316]

Energy consumption

- Energy total [7331]
- Energy P1 [7332]
- Energy P2 [7333]
- Energy Daily [7334]
- P1 Energy Daily [7335]
- P2 Energy Daily [7336]
- Savings compared to running at full speed [736]

Pump starts

- Pump starts total [7341]
- P1 starts [7342]
- P2 starts [7343]
- Pump starts Daily [7345]
- P1 starts Daily [7345]
- P2 starts Daily [7346]

Flow

- Estimated current inflow [742]
- Current (estimated) total outflow [7431]
- Outflow P1 [7432]
- Outflow P2 [7433]

Pumped volume

- Pumped volume Daily [7444]
- P1 volume Daily [7445]
- P2 volume Daily [7446]

2.5.6 Trips

See Chapter 6. page 145 for general information regarding Trips and Warnings.

Analogue sensor error

Triggered if:

- Does not give at least 4mA
- If digital overflow alarm is enabled and analogue level sensor is not at overflow level

Overflow trip

Triggered if level is above overflow level

User defined trips

Configurable alarms; where name and action can be set. E.g. to be used for:

- Temperature errors
- Water in pump oil

Clean fail trip

Set by load monitor that has detected a pump clean problem but couldn't resolve it.

2.5.7 Warnings

Pump not clean

Set by load monitor when pumps are not clean.

High level warning

If 10% from overflow.

Above start level but no pumps are running

Could happen if both pumps are manually set to off.

Communication error

Warning if communication between master and follower fails.

3. Getting Started

This chapter is a step by step guide that will show you the quickest way to get the pumps running.

We assume that the FlowDrive unit is mounted and connected according to the instructions in the separate "Installation & Getting started instruction" delivered together with the FlowDrive.

FlowDrive can operate as a Standalone unit (1 AC drive) or in a Master-Follower configuration (2 AC drives).

Sections

Chapter 3.1 - Describes how to use the function keys on the control panel.

Chapter 3.2 - Covers generic configuration like language and motor parameters.

Chapter 3.3 - Describes configuration of level control parameters related to the pump sump.

Chapter 3.4 - Describes how to start up the system and make sure everything is correctly configured.

Chapter 3.5 - Run the Auto Tune program.

Chapter 3.6 - Configuration of additional features.

3.1 Function keys

The function keys operate the menus and are also used for programming and read-outs of all the menu settings.

ENTER	step to lower menu level or confirm changed setting
ESC	step to higher menu level or ignore changed setting
NEXT	step to next menu on the same level
PREV	step to previous menu on the same level
+	increase value or change selection
−	decrease value or change selection
LOC/REM	- Toggle between menus in the toggle loop - Switching between local and remote control - Change the sign of a value

3.1.1 Using the function keys

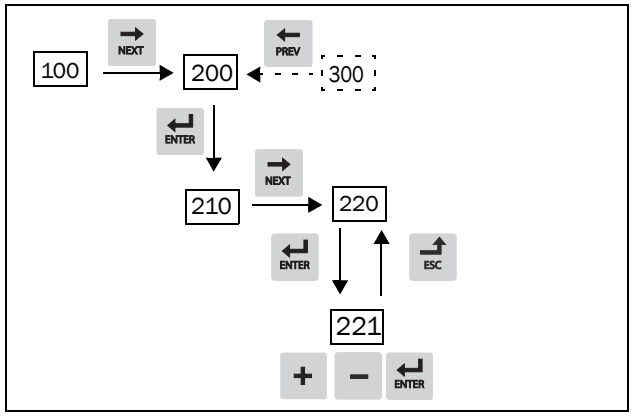


Fig. 9 Example of menu navigation when entering motor voltage

Example:

Setting Motor data.

Menu [100], "Preferred View" is displayed when started.

1. Press NEXT to display menu [200], "Main Setup".
2. Press ENTER and then NEXT two times to display menu [220], "Motor Data".
3. Press ENTER to display menu [221] and set motor voltage.
4. Change the value using the + and − keys. Confirm with ENTER.

3.1.2 Toggle loop

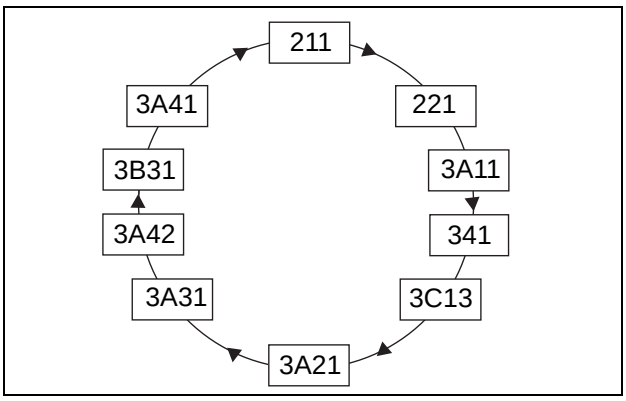


Fig. 10 Default toggle loop

To ease commissioning there is a pre-programmed default toggle loop that can be used to jump between the parameters described in this guide. Often other settings adjacent to these entry points should also be configured.

- [211] Language - Select language and supply voltage
- [221] Motor Volts - Motor configuration
- [3A11] Drive Conf .- Configuration of AC drive
- [341] Min speed - Speed configuration
- [3C13] Sensor min – Level sensor configuration
- [3A21] Overflow – Configurations of levels (where to start, stop pumping)
- [3A31] Level 1 – Reservoir configuration
- [3A42] LoadMonTune – Option to tune load monitor during Auto Tune program
- [3B31] Act.PumpCln - Option to clean pumps during Auto Tune program
- [3A41] Start AutoT – Start the Auto Tune program

3.2 Basic configuration (all AC drives)

This section is valid for all AC drive configurations, stand alone, master or follower.

3.2.1 Switch on the mains

Once the mains is switched on, the internal fan in the AC drive will run for 5 seconds (In frame size A3 the fan runs continuously). The control panel is lighted up and the AC drive can be configured.
To change settings use the keys on the control panel or remote access program such as EmoSoftCom. For further information about the control panel, EmoSoftCom and menu structure, see the software instruction

3.2.2 Language and supply voltage

Menu [100], “Preferred View” is displayed when started.

1. Navigate to menu [211] or press toggle button once and you will jump directly to menu [211].
   “[211] Language” – Set preferred language.
2. Now navigate to “Mains supply voltage [21B]” and set supply voltage according to the actual drive supply voltage used.

3.2.3 Set the Motor Data

Navigate to menu [221] or press toggle button once and you will jump directly to menu [221].
Enter correct motor data for the connected motor. Change settings using the keys on the control panel. For further information about the control panel and menu structure, see the software instruction.

1. Set motor voltage [221].
2. Set motor frequency [222].
3. Set motor power [223].
4. Set motor current [224].
5. Set motor speed [225].
6. Set power factor (cos φ) [227].
7. Press toggle button to continue.

3.2.4 Set FlowDrive configuration

The FlowDrive can work in two drive modes;
FlowDrive mode and Generic drive mode.
In FlowDrive mode the drive is configured for reservoir level control and in Generic drive mode it behaves just like a normal Emotron FDU drive.

By default the AC drive is configured in FlowDrive mode and the remaining quick start guide describes configuring this mode. In case you are interested in running the FlowDrive as a Generic drive, change parameter "[21C] Drive appl." to "Generic" and consult the instruction manual and parameter list for FDU in the download area (file archive) on www.emotron.com .

In FlowDrive mode the AC drive can operate as a Standalone unit (1 AC drive) or in a Master-Follower configuration (2 AC drives).
The following configurations should be done on all AC drives independent of drive mode (Standalone, Master, or Follower).

1. Press toggle button once more or navigate to menu "[3A11] FLD Config"
   Select whether the FlowDrive should be controlled as a
   - 'Standalone', Configuration for a single AC drive/ pump in
     pump sump.
   - 'Master' Configuration for the main AC drive in a dual AC drive/pump setup
   - 'Follower' Configuration for the secondary AC drive in a dual AC drive/pump setup.
2. Press toggle button again or navigate to menu
   " [341] Min frequency"
   Minimum frequency is by default set to nominal motor frequency and must be changed by the user. Generally 70% of nominal motor frequency is a good value to start with. I.e. 35Hz in case nominal motor frequency is 50Hz. This is low enough to be able to find the best efficiency point and high enough to ensure that the pump generates a sufficient flow. Adjust upwards if the default value is considered to be too low for keeping up with normal inflow.

For units configured as "Follower" in menu [3A11] this concludes the configuration. For other units continue with the next section.

3.3 Additional configuration for Standalone / Master AC drives

3.3.1 Level sensor configuration

The level sensor connected to the standalone or master unit needs to be configured based on its type and placement.
Navigate to menu [3C13] or press the toggle button.

1. "[3C13] Sensor min"
   This is configuration of which level, in meters, the min analogue signal from the sensor should represent. Generally this is 0 for a pressure sensor placed in the bottom of the sump. Press NEXT to continue.
2. "[3C14] Sensor max"
   This is configuration of which level, in meters, the max analogue signal from the sensor represents. This data is dependent on the sensor but often sensors with a range of 5 or 10 meters is used.

See also Fig. 11, page 20.

3.3.2 Set sump levels

Set the desired levels for actions to be taken (starting and stopping of the pumps), see Fig. 11, page 20.
Navigate to menu [3A21] or press the toggle button again and set following.

1. "[3A21] Overflow " Level where the overflow alarm is triggered. Press NEXT to continue.
2. "[3A23] Start level" Level where the pump is started, Press NEXT to continue.
3. "[3A25] Stop level" Level where the pump is stopped Press NEXT to continue.

Note: Overflow level has to be higher than Start level which has to be higher than Stop level.

3.3.3 Set reservoir geometry

The reservoir geometry settings are crucial for the Auto Tune program and flow estimations. Enter values as precisely as possible, failing to do so will result in inaccurate measurements.
Navigate to menu “[3A31] Level 1” or press toggle button.

Start from the bottom level (level 1) and set a corresponding area for each change of shape in the reservoir. It is possible to use 5 levels and areas. Use as many as required, unused levels/areas should be set to 0/Off.
Last level defined is extrapolated, hence in a uniformed sump only one level/area is required.

Level 1 [3A31]	Area 1 [3A32]
Level 2 [3A33]	Area 2 [3A34]
Level 3 [3A35]	Area 3 [3A36]
Level 4 [3A37]	Area 4 [3A38]
Level 5 [3A39]	Area 5 [3A3A]

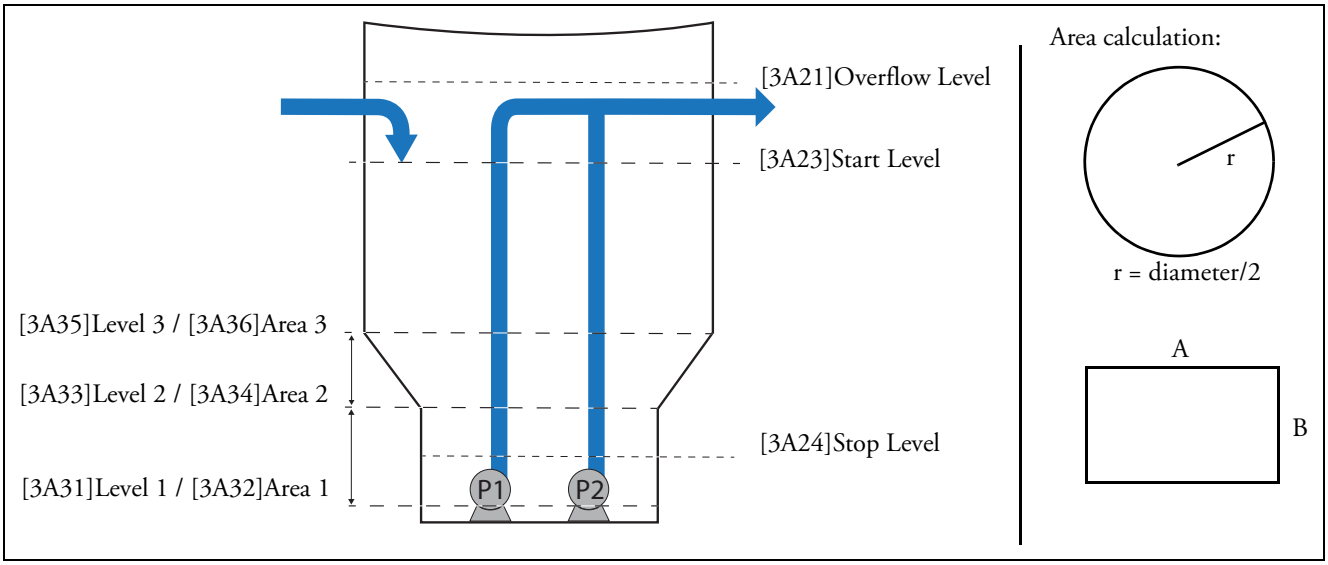


Fig. 11 Sump areas and levels, examples.

Example with round reservoir:

Level= X m,

Area = πr^2

Level 1 = 0 m
Area 1 = Radius is 0.60 m, area 1 is calculated:

$\pi\ 0.60^2 = 1.13 m^2$

Level 2 = 0.50 m,

Area 2 = Radius is 0.60 m, area 2 is calculated:
$\pi\ 0.60^2 = 1.13 m^2$

Level 3 = 0.60 m
Area 3 = Radius 0.90 m, area 3 is calculated:
$\pi\ 0.90^2 = 2.54\ m^2$

Example with rectangular reservoir:

Level= X m,

Area = A x B m^2

Level 1: 0 m
Area 1 : A= 1.20 m, B= 0.50 m, area 1 is calculated:
1.20 x 0.50 = 0.60 m^2

Level 2 = 0.50 m,

Area 2 : A= 1.20 m, B= 0.50 m, area 2 is calculated:
1.20 x 0.50 = 0.60 m^2

Level 3 = 0.60 m
Area 3 : A= 1.80 m, B= 0.50m, area 3 is calculated:
1.80 x 0.50 = 0.90 m^2

Examples of reservoir shapes and levels

Following are examples of different reservoir shapes and levels required.

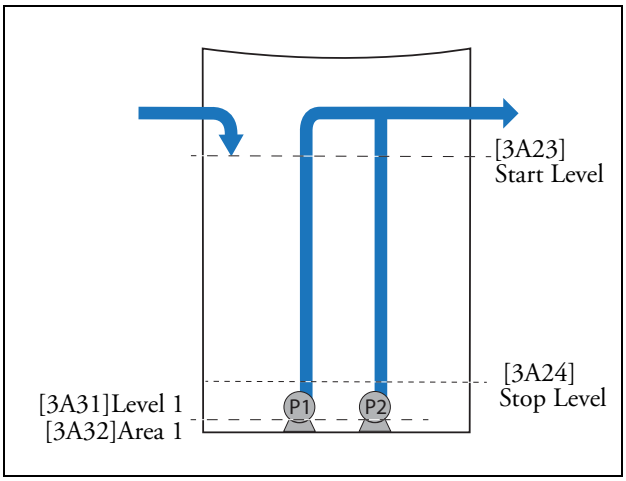


Fig. 12 With a uniform shape, only one level /area is required as the area is the same.

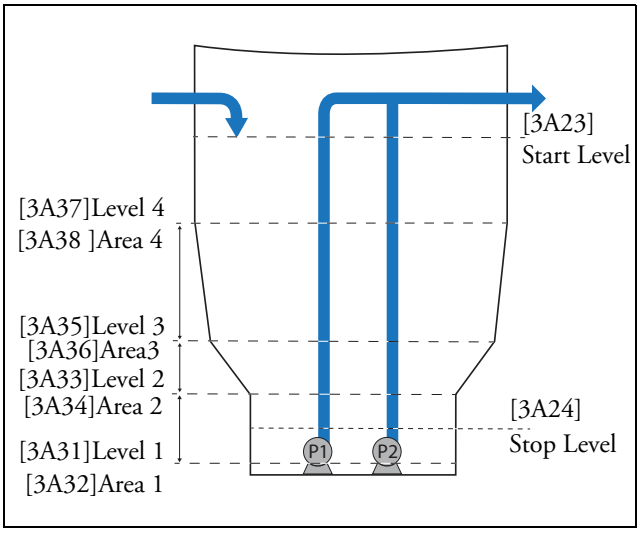


Fig. 13 With this shape, 4 levels and areas are required.

Note: User with 60Hz motors must change the values i menus:
"Flush speed [3B12]" &
"Rev speed [3B34]" from50 to 60 Hz.

3.4 Test run

Now the configuration is finished; time to test that everything works as expected

Sump level

By default the sump level is shown as first row in [100] menu. Make sure current sump water level displayed corresponds to actual level in the sump.

Auto/Off/Manual switches

Make sure the external Auto/Off/Manual switches are configured and conneced correctly as described in separate "Installation & Getting started instruction".

1. Set both switches in "Off" position.
2. Go to menu "[746] Pump mode" on the Master AC drive. In this menu the mode for the pumps are shown.
3. Make sure "Off" is shown for both pumps in this menu. In case not "Off" is shown for both pumps, make sure the switches are in correct position and connected correctly. Also inspect the configuration in menu "[52X] DigIn X" where X is the digital input number.
4. Turn the Auto/Off/Manual switch to Manual for one of the pumps. The corresponding pump should start and "[746] Pump mode" should change to "Manual" for the corresponding pump (the other pump should stay in "Off" state). Test both pumps. Switch both back to "Off".
5. Change both switches to Auto.
6. "[746] Pump mode" should change to "Auto" mode.

Verify "Auto mode" operation

In "Auto" pump mode the pump should start when actual Sump level (menu [100] or [741]) has reached "[3A23] Start level". Monitor how the level decreases and that the pump stops when "[3A25] Stop level" is reached.

3.5 Engage “Auto Tune” program to optimize energy consumption

When concluded that the FlowDrive appears to be running correctly in Auto mode as described earlier, the “Auto Tune” program can be started. It is designed to measure reference outflows and find the best efficiency point. In addition the Auto Tune program can configure the load monitor enabling detection of obstructed pumps.

Load monitor

Decide if load monitor should be configured during the Auto Tune program. The load monitor needs to be configured to detect over/under load of the pumps during normal operation; e.g. to detect that a rug has got stuck in the pump. The “LoadMonTune [3A42]” parameter configures if the various normal loads should be measured at the beginning of the "Auto Tune" program.
The Load Monitor configuration is done by measuring the normal load at different frequencies. This has no real impact on the calculation of flows or energy / volume, but must be done to detect if the pump load is increased during normal operation.

- Go to menu [3A42] or press the toggle button. “[3A42] LoadMonTune” – Set to “Yes” to configure the load monitor during Auto Tune program.

Clean pumps

It is not mandatory to run pump cleaning in the Auto Tune program but it will help getting accurate measurements.

NOTE: Pump cleaning will reverse the pumps. Check with the pump manufacturer that the connected pump can operate in the reverse direction.
Activating of pump cleaning is necessary for “Load monitor” to be able to clean the pump(s).

Decide if a pump cleaning shall be done prior to the Auto Tune program.

- Navigate to menu [3B31] or press the toggle button. “[3B31] Allowed” – Set to “Yes” to allow pump cleaning. If allowed the Auto Tune program will start with cleaning the pump(s).

Start Auto Tune

The Auto Tune program will do a lot of measurements and will take several hours, up to days, to complete. During AutoTune the FlowDrive will use a narrow start/stop interval located slightly below the normal start level. These levels are normally automatically set but can be seen (and changed) in "[3A24] BEP Start" and "[3A25] BEP Stop".

The AutoTune program will do "[3A43] BEP samples" of measurements at each frequency. However, if a sample measurement is considered faulty (e.g. when inflow is changed a lot or is too high) that measurement will be discharged and redone. The progress of the AutoTune program can be seen in menu "[7492] BEP progress" as a percentage. When successfully finalized "[7491] BEP State" will show "Finished". Under certain conditions (too many faulty measurements in a row) the AutoTune program will be aborted. In that case menu "[7491] BEP State" will show "Aborted".
After completion, or if aborted, the AC drive will automatically jump into normal running mode.

- Navigate to menu [3A41] or press toggle button. “[3A41] Start AutoT” – Set to “Start” to initiate the Auto Tune program

The progress can be seen in menu “[7492] BEP progres” as a percentage. When finished the result can be seen in the following parameters:
“[349] BEP Speed” – The frequency where it is most efficient to pump at.
“[94X] Flow log 1P” – Log of outflow and energy data for one pump at different frequencies.
“[95X] Flow log 2P” – Log of flows and energy data for two pumps at different frequencies.
“[41CX] Load Curve” – If load monitor was configured load data at different frequencies can be found here .

3.6 Configuration of additional features

Here is an overview of some of the additional features built into the FlowDrive, more detailed information can be found in chapter "Parameter description and functionality" on page 31.

Flush start

Function to always ramp up to full speed to get sludge and sediment moving. Flushing time and frequency can be configured in [3B1X] menus. By default this feature is turned on.

Random start level

To avoid building up residues at start level on the sump wall, it is possible to randomize where the pumps are started. By default randomized start level is turned off.

Activate this function by setting start level in "[3B2]Start lvl Δ ", by default this is set to off.

"[3B2] Start lvl Δ "– Set the desired variation in meters.

Example

Start level is set to: 1.5 meters
Start lvl Δ is set to: 0.4m
Actual start level will then be randomized between 1.1m-1.5m.

Pump cleaning

Pump cleaning runs the pump in a specific pattern in both forward and reverse direction to clean the pump from rugs and dirt buildup. By default this feature is turned off.

NOTE: Pump cleaning will reverse the pumps. Check with the pump manufacturer that the connected pump can operate in the reverse direction.

"[3B31] Act.PumpCln" – Set to 'Yes' to allow pump cleaning
"[3B32] ForcePumpCl" – Set to 'Master', 'Follower', or 'Both' to request a "one-off" pump cleaning right away

Sump cleaning

Pump sump cleaning empties the pump sump by running the selected pump(s) below the normal stop level until free running. This will help to get rid of accumulated residues in the bottom of the pump sump.

NOTE 1: Running pumps below their normal stop level might cause the pump to overheat.
NOTE 2: Problems might emerge from sucking air into the pump/pipes in some installations.

"[3B41] Act.SumpCln" – Activates and configures how to run sump cleaning.

"[3B42] ForceSumpCl" Activates a "one-off" run of sump cleaning if set to 'Yes' in accordance with "Run mode".

Pipe cleaning

Pipe cleaning function produce maximum flow for as long time as possible to clean the pipes from loose residues. Pipe cleaning can be activated at any time and will be performed as soon as the start level is reached (full sump).

"[3B51] ForcePipeC" – Activate a "one-off" run of pipe cleaning if set to 'Yes'. When the volume in the sump has reached start level, Pipe cleaning will be performed.

4. Operation via the Control Panel

This chapter describes how to use the control panel.

4.1 General

The control panel displays the status of the AC drive and is used to set all the parameters.

NOTE: The AC drive can run without the control panel being connected.

4.2 The control panel

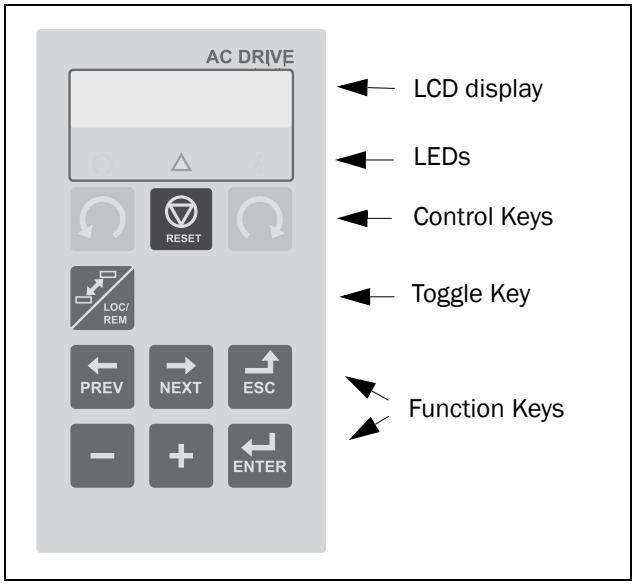


Fig. 14 Control panel display, LEDs and Keys.

4.2.1 The display

The display is back lit and consists of 2 rows, each with space for 16 characters. The display is divided into six areas.

The different areas in the display are described below:

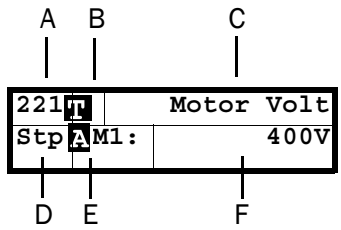


Fig. 15 The display

Area A: Shows the actual menu number (3 or 4 digits).

Area B Shows if the menu is in the toggle loop or the AC drive is set for Local operation.

Area C: Shows the heading of the active menu.

Area D *: Shows the status of the AC drive (3 digits). The following status indications are possible:

Digits	Description	Bit*
Stp	Motor is stopped	0
Run	Motor runs	1
Acc	Acceleration	2
Dec	Deceleration	3
Trp	Tripped	4
SST	Operating Safe Stop, is flashing when activated	5
VL	Operating at voltage limit	6
SL	Operating at speed limit	7
CL	Operating at current limit	8
TL	Operating at torque limit	9
OT	Operating at temperature limit	10
I^2t	Active I^2t protection	11
LV	Operating at low voltage	12
Sby	Operating from Standby power supply	13
LCL	Operating with low cooling liquid level	14
Slp	Sleep mode	15

*) The status shown in Area D on the control panel can be read via a fieldbus or serial communication, e.g. using Modbus address nr 30053.
It is also possible to read all status indications, not just the highest prioritized one, via a fieldbus or serial communication, e.g. using Modbus address nr 30180.
This information is also shown in EmoSoftCom PC-tool (optional) as menu “Status bits [72B]”.

Area E: Shows active parameter set and if it is a motor parameter.

Area F: Shows the setting or selection in the active menu. This area is empty at the 1st level and 2nd level menu. This area also shows warnings and alarm messages. In some situations this area could indicate “+++” or ” - - -” please see further information in Chapter 4.2.2 page 26

Fig. 16 Example 1st level menu

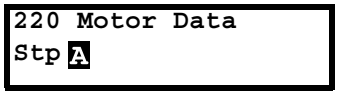


Fig. 17 Example 2nd level menu

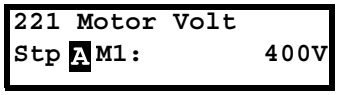


Fig. 18 Example 3d level menu

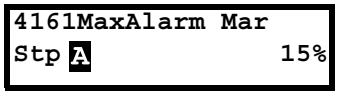


Fig. 19 Example 4th level menu

4.2.2 Indications on the display

The display can indicate "+++" or "- - -" if a parameter is out of range. In the AC drive there are parameters which are dependent on other parameters. For example, if the speed reference is 500 and the maximum speed value is set to a value below 500, this will be indicated with "+++" on the display. If the minimum speed value is set over 500, "- - -" is displayed.

4.2.3 LED indicators

The symbols on the control panel have the following functions:

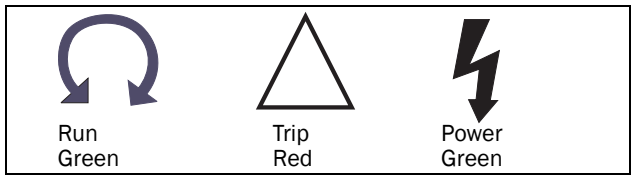


Fig. 20 LED indications

Table 4 LED indication

Symbol	Function		
	ON	FLASHING	OFF
POWER (green)	Power on	----------	Power off
TRIP (red)	AC drive tripped	Warning/Limit	No warning or trip
RUN (green)	Motor shaft rotates	Motor speed increase/ decrease	Motor stopped

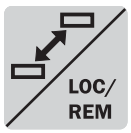
4.2.4 Control keys

In FlowDrive mode only the Stop/Reset button is used to reset the AC drive after a trip.
As default these keys are disabled and set to "Flow control" in menus "Ref Control [214]" and "Run/Stop Control [215]".

Table 5 Control keys

	RUN L:	gives a start with left rotation. Not used in FlowDrive
RESET	STOP/RESET:	Resets the AC drive after a trip
	RUN R:	gives a start with right rotation. Not used in FlowDrive

4.2.5 The Toggle and Loc/Rem Key



This key has normally two functions: Toggle and switching between Loc/Rem function. In FlowDrive mode the Loc/Rem function is disabled.

Press one second to use the toggle function. When editing values, the toggle key can be used to change the sign of the value, see section 4.5, page 29.

Toggle function

Using the toggle function makes it possible to easily step through selected menus in a loop. The toggle loop can contain a maximum of ten menus. As default the toggle loop contains the menus needed for Quick Setup. You can use the toggle loop to create a quick-menu for the parameters that are most importance to your specific application.

Add a menu to the toggle loop

1. Go to the menu you want to add to the loop.
2. Press the Toggle key and keep it pressed while pressing the + key.

Delete a menu from the toggle loop

1. Go to the menu you want to delete using the toggle key.
2. Press the Toggle key and keep it pressed while pressing the - key.

Delete all menus from the toggle loop

1. Press the Toggle key and keep it pressed while pressing the Esc key.
2. Confirm with Enter.

Default toggle loop

Fig. 21 shows the default toggle loop. This loop contains the necessary menus that need to be set before starting.
Example:
To access submenus to menu [221],
press Toggle to enter menu [221] then use the Next key to enter the sub menus [222] to [22H] and enter the parameters. When you press the Toggle key again, menu [3A11] is displayed.

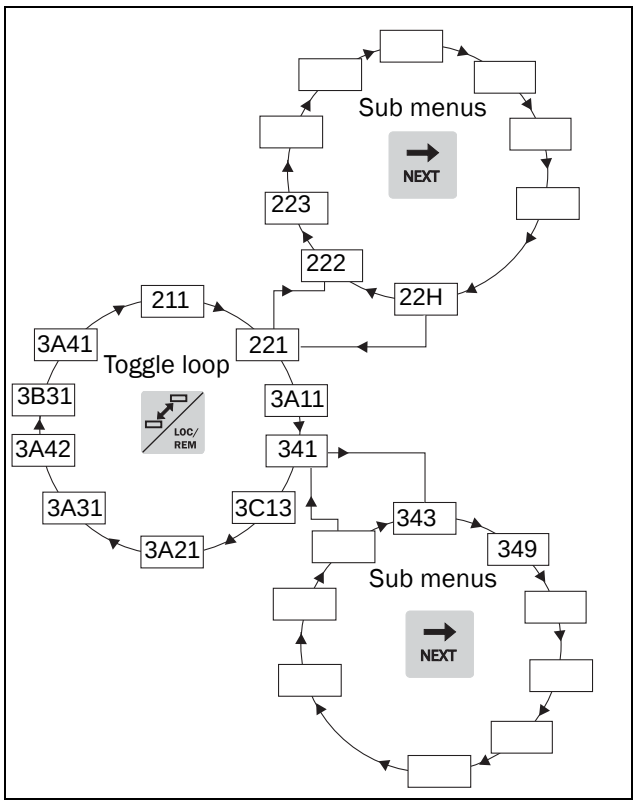


Fig. 21 Toggle loop example.

Indication of menus in toggle loop

Menus included in the toggle loop are indicated with a T in area B in the display.

4.2.6 Function keys

The function keys operate the menus and are also used for programming and read-outs of all the menu settings.

Table 6 Function keys

ENTER	ENTER key:	- step to a lower menu level - confirm a changed setting
ESC	ESCAPE key:	- step to a higher menu level - ignore a changed setting, without confirming
PREV	PREVIOUS key:	- step to a previous menu within the same level - go to more significant digit in edit mode
NEXT	NEXT key:	- step to a next menu within the same level - go to less significant digit in edit mode
−	- key:	- decrease a value - change a selection
+	+ key:	- increase a value - change a selection
LOC/ REM	TOGGLE and LOC/REM key:	- Toggle between menus in the toggle loop - Change the sign of a value

4.3 The menu structure

The menu structure consists of 4 levels:

Main Menu 1st level	The first character in the menu number.
2nd level	The second character in the menu number.
3rd level	The third character in the menu number.
4th level	The fourth character in the menu number.

This structure is consequently independent of the number of menus per level.

For instance, a menu can have two selectable menus (PreAlarm [431]), or it can have several selectable menus (User trips [440]).

NOTE: If there are more than 10 menus within one level, the numbering continues in alphabetic order.

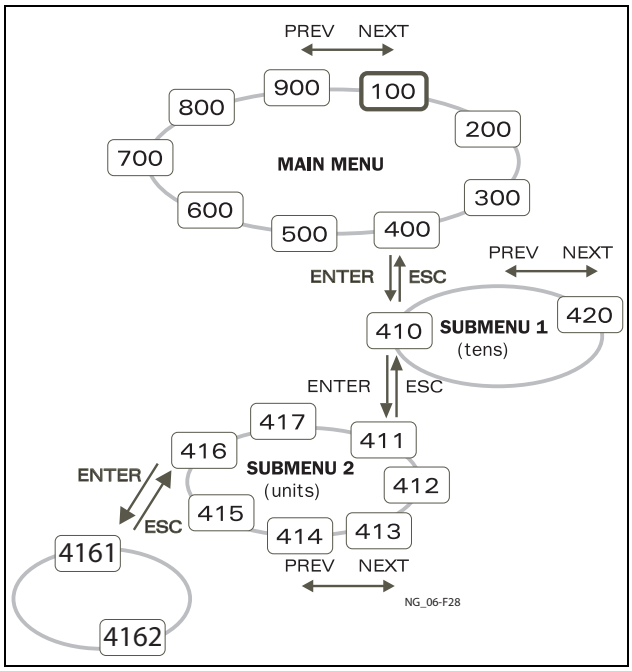


Fig. 22 Menu structure

4.3.1 The main menu

This section gives you a short description of the functions in the Main Menu.

100 Preferred View

Displayed at power-up. It displays the actual process value as default. Programmable for many other read-outs.

200 Main Setup

Main settings to get the AC drive operable. The motor data settings are the most important. Also option utility and settings.

300 Process and Application Parameters

Settings more relevant to the application such as Sump level, sump geometry, Reservoir level control, Autotuning, sensor configuration etc.

400 Load Monitor and Process Protection

Protection associated with the process and mains.
Load monitor settings.

500 Inputs/Outputs and Virtual Connections

All settings for inputs and outputs are entered here.

600 Logical Functions and Timers

All settings for conditional signals are entered here.

700 View Operation and Status

Viewing all the operational data like frequency, load, power, current, etc.

800 View Trip Log

Viewing the last 10 trips in the trip memory.

900 Service Information and AC drive Data

Electronic type label for viewing the software version and AC drive type. View result of Auto Tune program measurements. Reset of statistics.

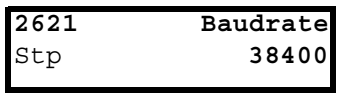
4.4 Programming during operation

Most of the parameters can be changed during operation without stopping the AC drive. Parameters that can not be changed are marked with a lock symbol in the display.

NOTE: If you try to change a function during operation that only can be changed when the motor is stopped, the message "Stop First" is displayed.

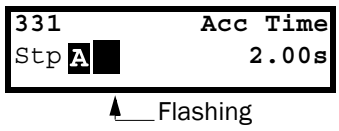
4.5 Editing values in a menu

Most values in the second row in a menu can be changed in two different ways. Enumerated values like the baud rate can only be changed with alternative 1.



Alternative 1

When you press the + or - keys to change a value, the cursor is flashing to the left in the display and the value is increased or decreased when you press the appropriate key. If you keep the + or - keys pressed, the value will increase or decrease continuously. When you keep the key pressed the change speed will increase. The Toggle key is used to change the sign of the entered value. The sign of the value will also change when zero is passed. Press Enter to confirm the value.

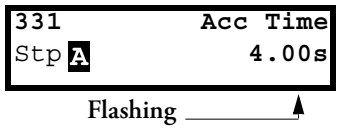


Alternative 2

Press the + or - key to enter edit mode. Then press the Prev or Next key to move the cursor to the right most position of the value that should be changed. The cursor will make the selected character flashes. Move the cursor using the Prev or Next keys. When you press the + or - keys, the character at the cursor position will increase or decrease. This alternative is suitable when you want to make large changes, i.e. from 2 s to 400 s.

To change the sign of the value, press the toggle key. This makes it possible to enter negative values (Only valid for certain parameters).

Example: When you press Next the 4 will flash.



Press Enter to save the setting and Esc to leave the edit mode.

4.6 Programming example

This example shows how to program a change of the Acc. Time set from 4.0 s to 2.0 s.

The flashing cursor indicates that a change has taken place but is not saved yet. If at this moment, the power fails, the change will not be saved.

Use the ESC, Prev, Next or the Toggle keys to proceed and to go to other menus.

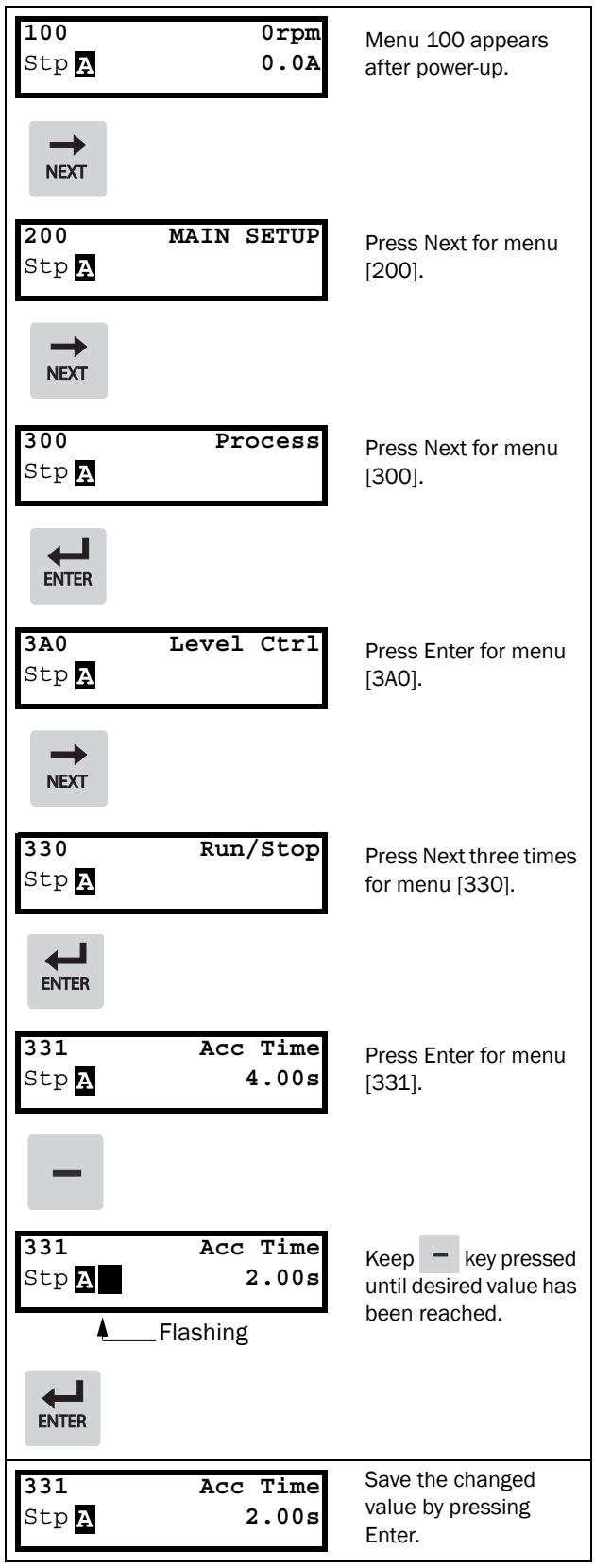


Fig. 23 Programming example

5. Parameter description and functionality

This chapter describes the menus and parameters in the software. You will find a short description of each function and information about default values, ranges, etc. There are also tables containing communication information. You will find the parameter numbers for all available fieldbus options as well as the enumeration for the data.
On our home page (www.emotron.com) in the download area (file archive), you could find a "Communication information" list and a list to note “Parameter set” information.

Function	Menu number	Description	See section
Preferred view	100	Menu display settings.	5.1, page 33
Operation setup	210	Basic settings for language, key functionality, control source.	5.2.1, page 34
Motor data	220	Setting of data for the used motor.	5.2.2, page 38
Motor protection	230	Motor and AC drive thermal protections.	5.2.3, page 42
Parameter set handling	240	Selection and configuration of parameter sets.	5.2.4, page 46
Autoreset	250	Automatic reset of active alarms and restart of the AC drive.	5.2.5, page 48
Serial communication	260	Serial communication settings for the data transfer.	5.2.6, page 55
Process settings	300	Process value settings for sump level, sump geometry, Autotuning, analogue signal start/stop functions.	5.3, page 59
Level control	3A0	Process parameters for waste water level control (FlowDrive).	5.3.1, page 59
Functions	3B0	Functions to be used together with level control.	5.3.2, page 64
Sensors	3C0	Process configuration of connected sensors.	5.3.3, page 70
Load monitor and Process protection	400	Protection associated with the process and mains. Load monitor settings.	5.4, page 76
I/O settings	500	Input and output settings for control and monitoring.	5.5, page 85
Analogue input	510		5.5.1, page 85
Digital inputs	520		5.5.2, page 92
Analogue output	530		5.5.3, page 93
Relays	550		5.5.5, page 99
Virtual I/Os	560		5.5.6, page 101
Logic and timers	600	Settings for logical functions and timers.	5.6, page 102
Operation status	700	View operation parameter values and status.	5.7, page 122
Stored values	730	View stored statistics.	5.7.3, page 128
Flow status	740	View actual FlowDrive status	5.7.4, page 132
Trip log	800	View trip messages and trip data.	5.8, page 136
System data	900	Wiew Emotron FlowDrive model, software and hardware version. Service information.	5.9, page 138
Clock (option)	930	View Actual time and date if you have the RTC-Real Time Clock option installed.	5.9.2, page 139
Flow log Pump 1	940	View result of Auto Tune program measurements for one pump.	5.9.3, page 140
Flow log Pump 2	950	View result of Auto Tune program measurements for two pumps.	5.9.4, page 142
Reset	990	Reset statistics counters	5.9.5, page 142

Emotron FlowDrive application

The Emotron FlowDrive is mainly intended as a dedicated waste water AC drive. However it can also be used as a Generic drive (such as Emotron FDU). You can do this selection in menu " Drive application [21C]" on page 38.

When using the FlowDrive in waste water mode some menus and sub menus that are normally visible in FDU, are Hidden and not to be used. These hidden menus are listed in Table 7.
If you prefer to use the AC drive as a Generic drive (as FDU), you can find the instruction manual and parameter list for FDU in the download area (file archive) on www.emotron.com.

NOTE: The communication numbers are not necessarily the same for FlowDrive in Generic mode as for Emotron FDU.

Table 7 Following menus are only visible in Generic mode.

Menu	Description	Menu	Description
310	Set/View reference	33I	Release trq
320	Process setting	342	Stp<MinSpd
333	Acc MotPot	344	SkipSpd 1 Lo
334	Dec MotPot	345	SkipSpd 1 Hi
33A	Spinstart	346	SkipSpd 1 Lo
33B	Stop mode	347	SkipSpd 2 Hi
33C	Brk Release	348	Jog Speed
33D	Release Spd	360	Preset Ref
33E	Brk Engage	380	ProcCtrl PID
33F	Brk Wait	390	Pump/Fan Ctl
33G	Vector Brake	723	Warning
33H	Brk Fault		

Description of menu table layout

Following two kinds of tables are used in this chapter.

① Read-only ②		③ 332 Dec Time StpA 10.00s
Default:		④
⑤	⑥	⑦

① Read-only ②	③ 222 Motor Freq StpA M1 50Hz
Default:	④
Resolution	⑦

1. Parameter cannot be changed during operation.
2. Parameter only for viewing.
3. Menu information as displayed on control panel. For explanation of display text and symbols, see Chapter 4.2 page 25.
4. Factory setting of parameter (also showed on display).
5. Available settings for the menu, listed selections.
6. Communication integer value for the selection. For use with communication bus interface (only if selection type parameters).
7. Description of selection alternative, setting or range (min - max value).

Menu mode explanation

Some menus are called “FlowDrive advanced” menus. Normally these menus are not required to be changed. FlowDrive advanced menu tables are marked with grey here in this chapter and also in the Menu list in Chapter 9. page 159, see example below.

3A24	BEP start	No		

There is also an “Adv)” after the menu name in the heading.

It is possible to access the advanced menus by pressing and buttons simultaneously for 3 seconds or in the menu “[21D] Menu Mode”.

Stand alone / Master / Follower

Furthermore, most of the menus are only visible in a Master drive/Standalone unit and thereby not visible in the Follower drive (if used/installed). These not visible menus are marked nF) (not Follower) after the menu name in the heading.

Resolution of settings

The resolution for all range settings described in this chapter is 3 significant digits. Exceptions are speed values which are presented with 4 significant digits. Table 8 shows the resolutions for 3 significant digits.

Table 8

3 Digit	Resolution
0.01-9.99	0.01
10.0-99.9	0.1
100-999	1
1000-9990	10
10000-99900	100

5.1 Preferred View [100]

This menu is displayed at every power-up. During operation, the menu [100] will automatically be displayed when the keyboard is not operated for 5 minutes. The automatic return function will be switched off when the Toggle and Stop key is pressed simultaneously. As default it displays the Sump level and motor frequency.

Menu “[100] Preferred View” displays the settings made in menu “[110], 1st line”, and “[120], 2nd line”. See Fig. 24.

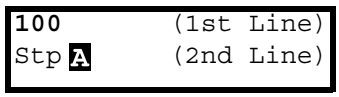


Fig. 24 Display functions

5.1.1 1st Line [110]

Sets the content of the upper row in the menu “[100] Preferred View.”

		110 1st Line Stp A Sump level
Default:		Sump level
Dependent on menu		
Process Val	0	Process value
Speed	1	Speed
Torque	2	Torque
Process Ref	3	Process reference
Shaft Power	4	Shaft power
El Power	5	Electrical power
Current	6	Current
Output volt	7	Output voltage
Frequency	8	Frequency
DC Voltage	9	DC voltage
Heatsink Tmp	10	Heatsink temperature
Motor Temp *	11	Motor temperature
AC drive Status	12	AC drive status
Run Time	13	Run Time
Energy	14	Energy
Mains Time	15	Mains time
Sump level	16	Sump level
Inflow	17	Inflow
Outflow	18	Outflow

* The “Motor temp” is only visible if you have the option PTC/PT100 card installed and a PT100 input is selected in menu[236].

Communication information

Modbus Instance no/DeviceNet no:	43001
Profibus slot/index	168/160
EtherCAT index (hex)	4bb9
Profinet IO index	19385
Fieldbus format	UInt
Modbus format	UInt

5.1.2 2nd Line [120]

Sets the content of the lower row in the menu “[100] Preferred View”. Same selection as in menu [110].

120 2nd Line Stp A Frequency	
Default:	Frequency

Communication information

Modbus Instance no/DeviceNet no:	43002
Profibus slot/index	168/161
EtherCAT index (hex)	4bba
Profinet IO index	19386
Fieldbus format	UInt
Modbus format	UInt

5.2 Main Setup [200]

The Main Setup menu contains the most important settings to get the AC drive operational and set up for the application. It includes different sub menus concerning the control of the unit, motor data and protection, utilities and automatic resetting of faults. This menu will instantaneously be adapted to build in options and show the required settings.

5.2.1 Operation [210]

Selections concerning the used motor, AC drive mode, control signals and serial communication are described in this submenu and is used to set the AC drive up for the application.

Language [211]

Select the language used on the LC Display. Once the language is set, this selection will not be affected by the Load Default command.

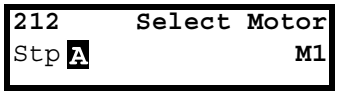
211 Language Stp A English		
Default:		English
English	0	English selected
Svenska	1	Swedish selected
Nederlands	2	Dutch selected
Deutsch	3	German selected
Español	4	Spanish selected

Communication information

Modbus Instance no/DeviceNet no:	43011
Profibus slot/index	168/170
EtherCAT index (hex)	4bc3
Profinet IO index	19395
Fieldbus format	UInt
Modbus format	UInt

Select Motor [212]

This menu is used if you have more than one motor in your application. Select the motor to define. It is possible to define up to four different motors, M1 to M4, in the AC drive. For parameter set handling including Motor sets M1 - M4 see Chapter 5.2.4 page 46.



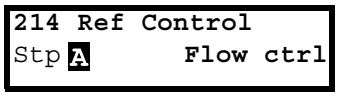
Default:		M1
M1	0	Motor Data is connected to selected motor.
M2	1	
M3	2	
M4	3	

Communication information

Modbus Instance no/DeviceNet no:	43012
Profibus slot/index	168/171
EtherCAT index (hex)	4bc4
Profinet IO index	19396
Fieldbus format	UInt
Modbus format	UInt

Reference control [214]

To control the speed of the motor, the AC drive needs a reference signal. By default this is set to Flow ctrl to obtain FlowDrive functionality and shall not be changed. Flow ctrl creates an internal set value.
For other applications this reference signal can be set to a remote source from the installation, the keyboard of the AC drive, or by serial or fieldbus communication.



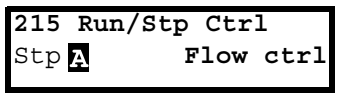
Default:		Flow ctrl
Remote	0	The reference signal comes from the analogue inputs of the terminal strip (terminals 1-22).
Keyboard	1	Reference is set with the + and - keys on the Control Panel. Can only be done in menu “Set/View reference [310]”.
Com	2	The reference is set via the serial communication (RS 485, Fieldbus.).
Flow ctrl	3	Internal FlowDrive control.

Communication information

Modbus Instance no/DeviceNet no:	43014
Profibus slot/index	168/173
EtherCAT index (hex)	4bc6
Profinet IO index	19398
Fieldbus format	UInt
Modbus format	UInt

Run/Stop Control [215]

This function is used to select the source for run and stop commands. By default this is set to Flow ctrl, to obtain FlowDrive functionality and shall not be changed.



Default:		Flow ctrl
Remote	0	The start/stop signal comes from the digital inputs of the terminal strip (terminals 1-22). For settings, see menu group [330] and [520].
Keyboard	1	Start and stop is set on the Control Panel.
Com	2	The start/stop is set via the serial communication (RS 485, Fieldbus.) See Fieldbus or RS232/485 option manual for details.
Flow ctrl	3	Internal FlowDrive control.

Communication information

Modbus Instance no/DeviceNet no:	43015
Profibus slot/index	168/174
EtherCAT index (hex)	4bc7
Profinet IO index	19399
Fieldbus format	UInt
Modbus format	UInt

Reset Control [216]

When the AC drive is stopped due to a failure, a reset command is required to make it possible to restart the AC drive. Use this function to select the source of the reset signal.

		216 Reset Ctrl Stp A Rem+Keyb+Com
Default:		Rem+Keyb+Com
Remote	0	The command comes from the inputs of the terminal strip (terminals 1-22).
Keyboard	1	The command comes from the command keys of the Control Panel.
Com	2	The command comes from the serial communication (RS 485, Fieldbus).
Remote + Keyb	3	The command comes from the inputs of the terminal strip (terminals 1-22) or the keyboard.
Com + Keyb	4	The command comes from the serial communication (RS485, Fieldbus) or the keyboard.
Rem+Keyb +Com	5	The command comes from the inputs of the terminal strip (terminals 1-22), the keyboard or the serial communication (RS485, Fieldbus).

Communication information

Modbus Instance no/DeviceNet no:	43016
Profibus slot/index	168/175
EtherCAT index (hex)	4bc8
Profinet IO index	19400
Fieldbus format	UInt
Modbus format	UInt

Lock Code? [218] Adv)

To prevent the keyboard being used or to change the setup of the AC drive and/or process control, the keyboard can be locked with a password. This menu, “Lock Code [218]”, is used to lock and unlock the keyboard. Enter the password “291” to lock/unlock the keyboard operation. If the keyboard is not locked (default) the selection “Lock Code?” will appear. If the keyboard is already locked, the selection “Unlock Code?” will appear.

When the keyboard is locked, parameters can be viewed but not changed. The reference value can be changed and the AC drive can be started, stopped and reversed if these functions are set to be controlled from the keyboard.

	218 Lock Code? Stp A 0
Default:	0
Range:	0–9999

Communication information

Modbus Instance no/DeviceNet no:	43018
Profibus slot/index	168/177
EtherCAT index (hex)	4bca
Profinet IO index	19402
Fieldbus format	UInt, 1=1
Modbus format	UInt

Rotation [219] Adv)

Overall limitation of motor rotation direction

This function limits the overall rotation, either to left or right or both directions. This limit is prior to all other selections, e.g.: if the rotation is limited to right, a Run-Left command will be ignored. To define left and right rotation we assume that the motor is connected U-U, V-V and W-W.

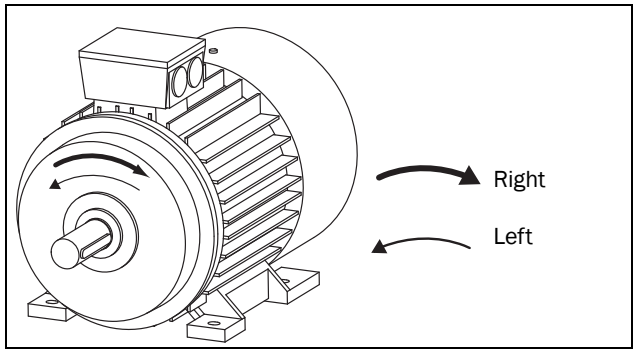


Fig. 25 Rotation

In this menu you set the general rotation for the motor.

		219 Rotation Stp A R+L
Default:		R + L
R	1	Speed direction is limited to right rotation. The input and key RunL are disabled.
L	2	Speed direction is limited to left rotation. The input and key RunR are disabled.
R+L	3	Both speed directions allowed.

Communication information

Modbus Instance no/DeviceNet no:	43019
Profibus slot/index	168/178
EtherCAT index (hex)	4bcb
Profinet IO index	19403
Fieldbus format	UInt
Modbus format	UInt

Remote Signal Level/Edge [21A] Adv)

In this menu you select the way to control the inputs for RunR, RunL and Reset that are operated via the digital inputs on the terminal strip. The inputs are default set for level-control, and will be active as long as the input is made and kept high. When edge-control is selected, the input will be activated by the low to high transition of the input.

		21A Level/Edge Stp **A** **Level**
Default:		Level
Level	0	The inputs are activated or deactivated by a continuous high or low signal. Is commonly used if, for example, a PLC is used to operate the AC drive.
Edge	1	The inputs are activated by a transition; for Run and Reset from “low” to “high” and for Stop from "high" to "low".

Communication information

Modbus Instance no/DeviceNet no:	43020
Profibus slot/index	168/179
EtherCAT index (hex)	4bcc
Profinet IO index	19404
Fieldbus format	UInt
Modbus format	UInt

CAUTION!
Level controlled inputs DO NOT comply with the Machine Directive if the inputs are directly used to start and stop the machine.

NOTE: Edge controlled inputs can comply with the Machine Directive (see the Chapter 8. page 157) if the inputs are directly used to start and stop the machine.

Mains supply voltage [21B]

WARNING!
This menu must be set according to the AC drive product label and the supply voltage used. Wrong setting might damage the AC drive.

In this menu the nominal mains supply voltage connected to the AC drive can be selected. The setting will be valid for all parameter sets. The default setting, Not defined, is never selectable and is only visible until a new value is selected.

Once the supply voltage is set, this selection will not be affected by the Load Default command [243].

Brake chopper activation level is adjusted using the setting of [21B] (Brake chopper is not available with FlowDrive) ..

NOTE: The setting is affected by the “Load from CP” command [245] and if loading parameter file via EmoSoftCom.

		21B Supply Volts Stp **A** **Not defined**
Default:		Not defined
Not Defined	0	Inverter default value used. Only valid if this parameter is never set.
220-240 V	1	Only valid for FLD48/52
380-415 V	3	Only valid for FLD48/52/69
440-480 V	4	Only valid for FLD48/52/69
500-525 V	5	Only valid for FLD52/69
550-600 V	6	Only valid for FLD69
660-690 V	7	Only valid for FLD69

Communication information

Modbus Instance no/DeviceNet no:	43381
Profibus slot/index	170/30
EtherCAT index (hex)	4d35
Profinet IO index	19765
Fieldbus format	UInt
Modbus format	UInt

Drive application [21C]

Configures the AC drive to be a FlowDrive or a normal drive (Emotron FDU).

	21C Drive Appl. Stp A Waste water	
Default:		Waste water
Waste water	0	Waste water reservoir level control.
Generic	1	Normal drive mode (as FDU).

Communication information

Modbus Instance no/DeviceNet no:	433832
Profibus slot/index	170/321
EtherCAT index (hex)	4d36
Profinet IO index	19766
Fieldbus format	UInt
Modbus format	UInt

Menu mode [21D]

Shows current menu mode. Here it is possible to select between showing basic menus or Basic + FLD Advanced menus.

	21D Menu Mode Stp A Basic	
Default:		Basic
Basic	0	Only Basic menus are shown
FLD Advanced	1	Basic + FLD Advanced menus shown

Communication information

Modbus Instance no/DeviceNet no:	43383
Profibus slot/index	170/32
EtherCAT index (hex)	4d37
Profinet IO index	19767
Fieldbus format	UInt
Modbus format	UInt

5.2.2 Motor Data [220]

In this menu you enter the motor data to adapt the AC drive to the connected motor. This will increase the control accuracy as well as different read-outs and analogue output signals.

Motor M1 is selected as default and motor data entered will be valid for motor M1. If you have more than one motor you need to select the correct motor in menu [212] before entering motor data.

NOTE 1: The parameters for motor data cannot be changed during run mode.

NOTE 2: The default settings are for a standard 4-pole motor according to the nominal power of the AC drive.

NOTE 3: Parameter set cannot be changed during run if the parameter set is set for different motors.

NOTE 4: Motor Data in the different sets M1 to M4 can be revert to default setting in menu "[243] Default>Set".

WARNING!
Enter the correct motor data to prevent dangerous situations and assure correct control.

Motor Voltage [221]

Set the nominal motor voltage.

221 Motor Volts Stp A M1: 400V	
Default:	400 V for FLD48 500 V for FLD52 690 V for FLD69
Range:	100-700 V
Resolution	1 V

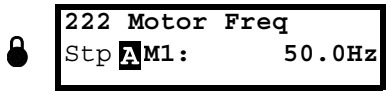
NOTE: The Motor Volts value will always be stored as a 3 digit value with a resolution of 1 V.

Communication information

Modbus Instance no/DeviceNet no:	43041
Profibus slot/index	168/200
EtherCAT index (hex)	4be1
Profinet IO index	19425
Fieldbus format	Long, 1=0.1 V
Modbus format	EInt

Motor Frequency [222]

Set the nominal motor frequency.



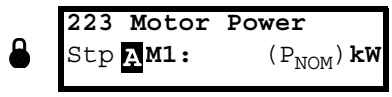
Default:	50 Hz
Range:	20.0 - 300.0 Hz
Resolution	0.1 Hz

Communication information

Modbus Instance no/DeviceNet no:	43060
Profibus slot/index	168/219
EtherCAT index (hex)	4bf4
Profinet IO index	19444
Fieldbus format	Long, 1=0.1 Hz
Modbus format	EInt

Motor Power [223]

Set the nominal motor power. If parallel motors, set the value as sum of motors power. The nominal motorpower must be within the range of 1 - 150% of the AC drives nominal power.



Default:	P_{NOM}AC drive
Range:	1-150 % x P_{NOM}
Resolution	3 significant digits

NOTE: The Motor Power value will always be stored as a 3 digit value in W up to 999 W and in kW for all higher powers.

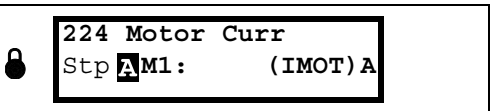
Communication information

Modbus Instance no/DeviceNet no:	43043
Profibus slot/index	168/202
EtherCAT index (hex)	4be3
Profinet IO index	19427
Fieldbus format	Long, 1=1 W
Modbus format	EInt

P_{NOM} is the nominal AC drive power.

Motor Current [224]

Set the nominal motor current. If parallel motors, set the value as sum of motors current.



Default:	I_{MOT} (see Note 2 page 38)
Range:	25 - 150% x I_{NOM}

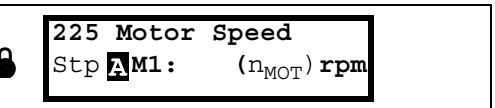
Communication information

Modbus Instance no/DeviceNet no:	43044
Profibus slot/index	168/203
EtherCAT index (hex)	4be4
Profinet IO index	19428
Fieldbus format	Long, 1=0.1 A
Modbus format	EInt

NOTE: The default settings are for a standard 4-pole motor according to the nominal power of the AC drive.

Motor Speed [225]

Set the nominal asynchronous motor speed.



Default:	n_{MOT} (see Note 2 page 38)
Range:	30 - 18000 rpm
Resolution	1 rpm, 4 sign digits

WARNING!
Do NOT enter a synchronous (no-load) motor speed.

NOTE: Entering a wrong, too low value can cause a dangerous situation for the driven application due to high speeds.

Communication information

Modbus Instance no/DeviceNet no:	43045
Profibus slot/index	168/204
EtherCAT index (hex)	4be5
Profinet IO index	19429
Fieldbus format	UInt. 1=1 rpm
Modbus format	UInt

Motor Poles [226]

When the nominal speed of the motor is ≤500 rpm, the additional menu for entering the number of poles, [226], appears automatically. In this menu the actual pole number can be set which will increase the control accuracy of the AC drive.

226 Motor Poles Stp AM1: 4	
Default:	4
Range:	2-144

Communication information

Modbus Instance no/DeviceNet no:	43046
Profibus slot/index	168/205
EtherCAT index (hex)	4be6
Profinet IO index	19430
Fieldbus format	Long, 1=1 pole
Modbus format	EInt

Motor Cos φ [227]

Set the nominal Motor cosphi (power factor).

227 Motor Cosφ Stp AM1: CosφNOM	
Default:	$Cos\varphi_{NOM}$ (see Note 2 page 38)
Range:	0.45 - 1.00

Communication information

Modbus Instance no/DeviceNet no:	43047
Profibus slot/index	168/206
EtherCAT index (hex)	4be7
Profinet IO index	19431
Fieldbus format	Long, 1=0.01
Modbus format	EInt

Motor ventilation [228]

Parameter for setting the type of motor ventilation. Affects the characteristics of the I^2t motor protection by lowering the actual overload current at lower speeds.

228 Motor Vent Stp AM1: Self		
Default:		Self
None	0	Limited I^2t overload curve.
Self	1	Normal I^2t overload curve. Means that the motor stands lower current at low speed.
Forced	2	Expanded I^2t overload curve. Means that the motor stands almost the whole current also at lower speed.

Communication information

Modbus Instance no/DeviceNet no:	43048
Profibus slot/index	168/207
EtherCAT index (hex)	4be8
Profinet IO index	19432
Fieldbus format	UInt
Modbus format	UInt

When the motor has no cooling fan, None is selected and the current level is limited to 55% of rated motor current.

With a motor with a shaft mounted fan, Self is selected and the current for overload is limited to 87% from 20% of synchronous speed. At lower speed, the overload current allowed will be smaller.

When the motor has an external cooling fan, Forced is selected and the overload current allowed starts at 90% from rated motor current at zero speed, up to nominal motor current at 70% of synchronous speed.

Fig. 26 shows the characteristics with respect for Nominal Current and Speed in relation to the motor ventilation type selected.

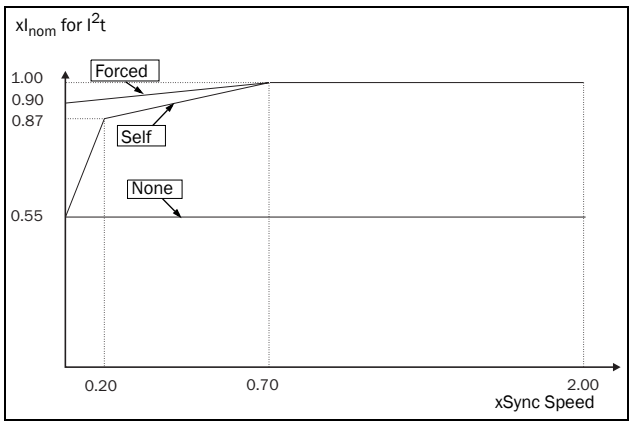


Fig. 26 I^2t curves

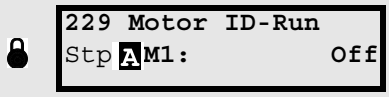
Motor Identification Run [229] Adv)

NOTE: This function is not required in FlowDrive mode.

This function is used when the AC drive is put into operation for the first time. To achieve an optimal control performance, fine tuning of the motor parameters using a motor ID run is needed. During the Test run the display shows "Test run" flashing.

To activate the Motor ID run, select "Short" and press Enter. Then press RunL or RunR on the control panel to start the ID run. If menu "[219] Rotation" is set to L the RunR key is inactive and vice versa. The ID run can be aborted by giving a Stop command via the control panel or Enable input. The parameter will automatically return to OFF when the test is completed. The message "Test run OK!" is displayed. Before the AC drive can be operated normally again, press the STOP/RESET key on the control panel.

During the Short ID run the motor shaft does not rotate. The AC drive measures the rotor and stator resistance.



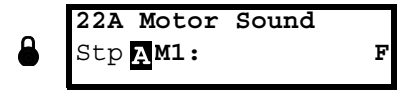
Default:		Off, see Note
Off	0	Not active
Short	1	Parameters are measured with injected DC current. No rotation of the shaft will occur.

Communication information

Modbus Instance no/DeviceNet no:	43049
Profibus slot/index	168/208
EtherCAT index (hex)	4be9
Profinet IO index	19433
Fieldbus format	UInt
Modbus format	UInt

Motor Sound [22A]

Sets the sound characteristic of the AC drive output stage by changing the switching frequency and/or pattern. Generally the motor noise will go down at higher switching frequencies.



Default:		F
E	0	Switching frequency 1.5 kHz
F	1	Switching frequency 3 kHz
G	2	Switching frequency 6 kHz
H	3	Switching frequency 6 kHz, random frequency (±750 Hz)
Advanced	4	Switching frequency and PWM mode setup via [22E]

Communication information

Modbus Instance no/DeviceNet no:	43050
Profibus slot/index	168/209
EtherCAT index (hex)	4bea
Profinet IO index	19434
Fieldbus format	UInt
Modbus format	UInt

NOTE: At switching frequencies >3 kHz derating may become necessary.

NOTE: If the heat sink temperature gets too high the switching frequency is decreased to avoid tripping. This is done automatically in the AC drive. The default switching frequency is 3 kHz.

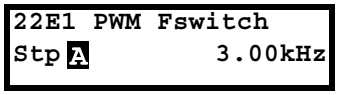
Motor PWM [22E]

Menus for advanced setup of motor modulation properties PWM = Pulse Width Modulation).

Note: Menus [22E1] - [22E3] are only visible if [22A] is set to "Advanced".

PWM Fswitch [22E1]

Set the PWM switching frequency of the AC drive

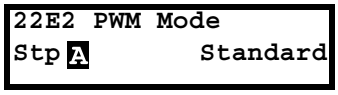


Default:	3.00 kHz
Range	1.50 - 6.00kHz
Resolution	0.01kHz

Communication information

Modbus Instance no/DeviceNet no:	43053
Profibus slot/index	168/212
EtherCAT index (hex)	4bed
Profinet IO index	19437
Fieldbus format	Long, 1=1Hz
Modbus format	EInt

PWM Mode [22E2]



Default:		Standard
Standard	0	Standard
Sine Filt	1	Sine Filter mode for use with output Sine Filters

NOTE: Switching frequency is fixed when "Sine Filt" is selected. This means that it is not possible to control the switching frequency based on temperature.

Communication information

Modbus Instance no/DeviceNet no:	43054
Profibus slot/index	168/213
EtherCAT index (hex)	4bee
Profinet IO index	19438
Fieldbus format	UInt
Modbus format	UInt

PWM Random [22E3]

	22E3 PWM Random Stp A Off	
Default:		Off
Off	0	Random modulation is Off.
On	1	Random modulation is active. Random frequency variation range is ± 1/8 of level set in [E22E1].

Communication information

Modbus Instance no/DeviceNet no:	43055
Profibus slot/index	168/214
EtherCAT index (hex)	4bef
Profinet IO index	19439
Fieldbus format	UInt
Modbus format	UInt

Phase order[22H] Adv)

Phase sequence for motor output. In this menu you can correct rotation direction on the motor by selecting "reverse" instead of switching the motor cables.

	22H Phase order Stp A	
Default:		Normal
Normal	0	Normal phase order (U,V,W)
Reverse	1	Reverse phase order (U, W, V)

Communication information

Modbus Instance no/DeviceNet no:	43058
Profibus slot/index	168/217
EtherCAT index (hex)	4bf2
Profinet IO index	19442
Fieldbus format	UInt
Modbus format	UInt

5.2.3 Motor Protection [230]

This function protects the motor against overload based on the standard IEC 60947-4-2.

Motor I^2t Type [231]

The motor protection function makes it possible to protect the motor from overload as published in the standard IEC 60947-4-2. It does this using "Motor I2t Current [232]" as a reference. The "Motor I2t Time [233]" is used to define the time behaviour of the function. The current set in [232] can be delivered infinite in time. If for instance in [233] a time of 1000 s is chosen the upper curve of Fig. 27 is valid. The value on the x-axis is the multiple of the current chosen in [232]. The time [233] is the time that an overloaded motor is switched off or is reduced in power at 1.2 times the current set in [232].

	231 Mot I^2t Type Stp A Trip	
Default:		Trip
Off	0	I^2t motor protection is not active.
Trip	1	When the I^2t time is exceeded, the AC drive will trip on "Motor I^2t".
Limit	2	This mode helps to keep the inverter running when the Motor I2t function is just before tripping the AC drive. The trip is replaced by current limiting with a maximum current level set by the value out of the menu [232]. In this way, if the reduced current can drive the load, the AC drive continues running. If there is no reduction in thermal load, the drive will trip.

Communication information

Modbus Instance no/DeviceNet no:	43061
Profibus slot/index	168/220
EtherCAT index (hex)	4bf5
Profinet IO index	19445
Fieldbus format	UInt
Modbus format	UInt

NOTE: When Mot I2t Type=Limit, the AC drive can control the speed < MinSpeed to reduce the motor current.

Motor I^2t Current [232]

Sets the current limit for the motor I^2t protection.

	232 Mot I²t Curr Stp A 100%
Default:	100% of I_{MOT}
Range:	0–150% of I_MOT (set in menu [224])

Communication information

Modbus Instance no/DeviceNet no:	43062
Profibus slot/index	168/221
EtherCAT index (hex)	4bf6
Profinet IO index	19446
Fieldbus format	Long, 1=1%
Modbus format	EInt

NOTE: When the selection Limit is set in menu [231], the value must be above the no-load current of the motor.

Motor I^2t Time [233]

Sets the time of the I^2t function. After this time the limit for the I^2t is reached if operating with 120% of the I^2t current value. Valid when start from 0 rpm.

NOTE: Not the time constant of the motor.

	233 Mot I²t Time Stp A 60s
Default:	60 s
Range:	60–1200 s

Communication information

Modbus Instance no/DeviceNet no:	43063
Profibus slot/index	168/222
EtherCAT index (hex)	4bf7
Profinet IO index	19447
Fieldbus format	Long, 1=1 s
Modbus format	EInt

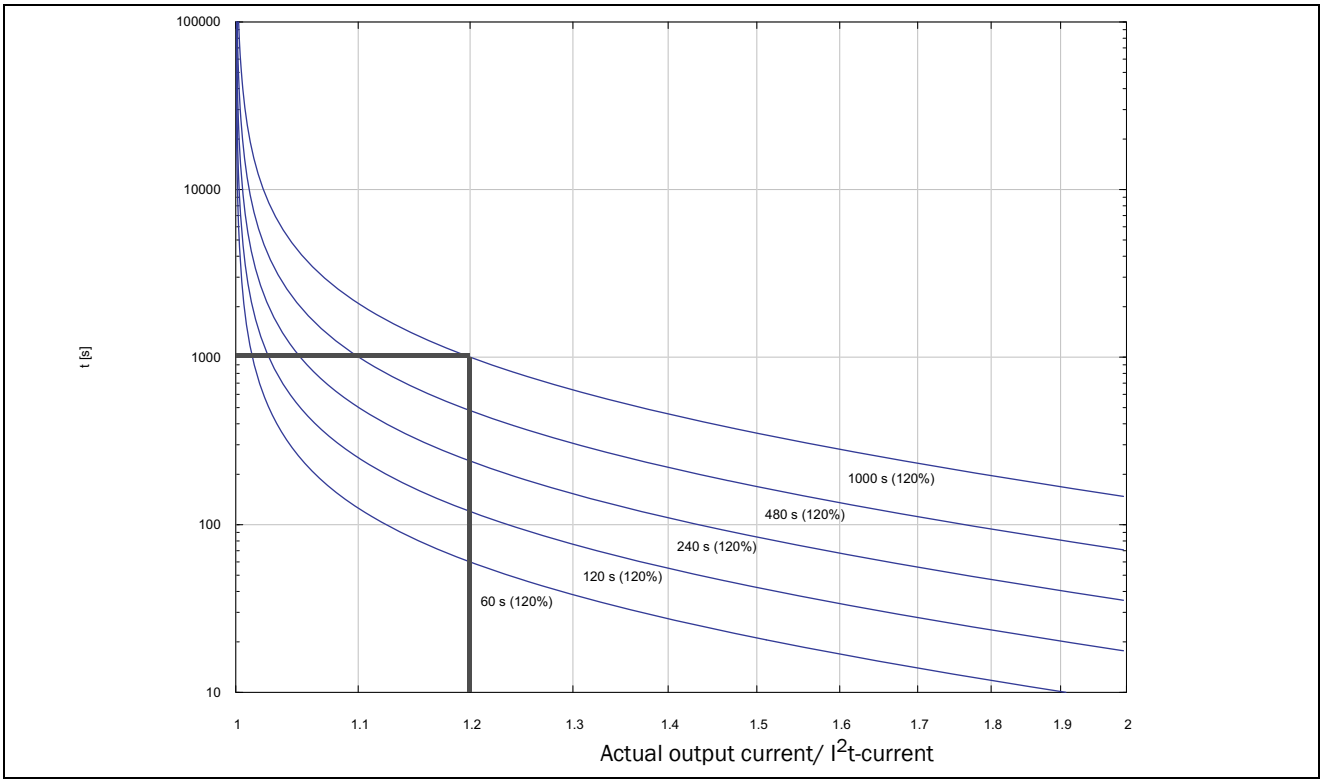


Fig. 27 I^2t function

Fig. 27 shows how the function integrates the square of the motor current according to the "Mot I^2t Curr [232]" and the "Mot I^2t Time [233]".

When the selection Trip is set in menu [231] the AC drive trips if this limit is exceeded.

When the selection Limit is set in menu [231] the AC drive reduces the torque if the integrated value is 95% or closer to the limit, so that the limit cannot be exceeded.

NOTE: If it is not possible to reduce the current, the AC drive will trip after exceeding 110% of the limit.

Example

In Fig. 27 the thick grey line shows the following example.

- Menu "[232] Mot I^2t Curr" is set to 100%. 1.2 x 100% = 120%
- Menu "[233] Mot I^2t Time" is set to 1000 s.

This means that the AC drive will trip or reduce after 1000 s if the current is 1.2 times of 100% nominal motor current.

Thermal Protection [234]

Only visible if the PTC/PT100 option board is installed. Set the PTC input for thermal protection of the motor. The motor thermistors (PTC) must comply with DIN 44081/ 44082. Please refer to the manual for the PTC/PT100 option board.

Menu [234] Thermal Prot" contains functions to enable or disable the PTC input. Here you can select and activate PTC and/or PT100.

		234 Thermal Prot Stp A Off
Default:		Off
Off	0	PTC and PT100 motor protection are disabled.
PTC	1	Enables the PTC protection of the motor via the insulated option board.
PT100	2	Enables the PT100 protection for the motor via the insulated option board.
PTC+PT100	3	Enables the PTC protection as well as the PT100 protection for the motor via the insulated option board.

Communication information

Modbus Instance no/DeviceNet no:	43064
Profibus slot/index	168/223
EtherCAT index (hex)	4bf8
Profinet IO index	19448
Fieldbus format	UInt
Modbus format	UInt

NOTE: PTC option and PT100 selections can only be selected in menu [234] if the option board is mounted.

NOTE: If you select the PTC option, the PT100 inputs as motor protection are ignored.

Motor Class [235]

Only visible if the PTC/PT100 option board is installed. Set the class of motor used. The trip levels for the PT100 sensor will automatically be set according to the setting in this menu.

		235 Mot Class Stp A F 140°C
Default:		F 140°C
A 100°C	0	
E 115°C	1	
B 120°C	2	
F 140°C	3	
F Nema 145°C	4	
H 165°C	5	

Communication information

Modbus Instance no/DeviceNet no:	43065
Profibus slot/index	168/224
EtherCAT index (hex)	4bf9
Profinet IO index	19449
Fieldbus format	UInt
Modbus format	UInt

NOTE: This menu is only valid for PT 100.

PT100 Inputs [236]

Sets which of PT100 inputs that should be used for thermal protection. Deselecting not used PT100 inputs on the PTC/ PT100 option board in order to ignore those inputs, i.e. extra external wiring is not needed if port is not used.

		236 PT100 Inputs Stp A PT100 1+2+3
Default:		PT100 1+2+3
Selection:		PT100 1, PT100 2, PT100 1+2, PT100 3, PT100 1+3, PT100 2+3, PT100 1+2+3
PT100 1	1	Channel 1 used for PT100 protection
PT100 2	2	Channel 2 used for PT100 protection
PT100 1+2	3	Channel 1+2 used for PT100 protection
PT100 3	4	Channel 3 used for PT100 protection
PT100 1+3	5	Channel 1+3 used for PT100 protection
PT100 2+3	6	Channel 2+3 used for PT100 protection
PT100 1+2+3	7	Channel 1+2+3 used for PT100 protection

Communication information

Modbus Instance no/DeviceNet no:	43066
Profibus slot/index	168/225
EtherCAT index (hex)	4bfa
Profinet IO index	19450
Fieldbus format	UInt
Modbus format	UInt

NOTE: This menu is only valid for PT 100 thermal protection if PT100 is enabled in menu [234].

Motor PTC [237]

For AC drive sizes B to D(FLD48/52-003-074) there is optional possibility to directly connect motor PTC (not to be mixed up with PTC/PT100 option board, see Chapter Option in separate "Getting started & Installation instruction".

In this menu the internal motor PTC hardware option is enabled. This PTC input complies with DIN 44081/44082. For electrical specification please refer to the separate manual for the PTC/PT100 option board, same data applies (could be found on www.emotron.com/www.cgglobal.com).

This menu is only visible if a PTC (or resistor <2 kOhm) is connected to terminals X1: 78–79. See separate "Installation & Getting started instruction".

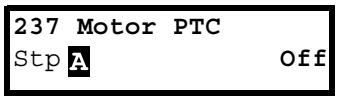
NOTE: This function is not related to PTC/PT100 option board.

To enable the function:

1. When Connect the thermistor wires to X1: 78–79 or for testing the input, connect a resistor to the terminals are connected.Use resistor value between 50 and 2000 ohm. Menu [237] will now appear.
2. Enable input by setting menu "[237] Motor PTC"=On.

If enabled and <50 ohm a sensor error trip will occur. The fault message "Motor PTC" is shown.

If the function is disabled and the PTC or resistor is removed, the menu will disappear after the next power on

		
Default:		Off
Off	0	Motor PTC protection is disabled
On	1	Motor PTC protection is enabled

Communication information

Modbus Instance no/DeviceNet no:	43067
Profibus slot/index	168/226
EtherCAT index (hex)	4bfb
Profinet IO index	19451
Fieldbus format	UInt
Modbus format	UInt

5.2.4 Parameter Set Handling [240]

NOTE: Multiple parameter sets must not be used in FlowDrive. This function is normally used in Generic mode.

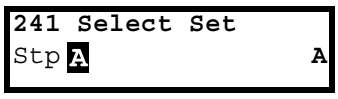
There are four different parameter sets available in the AC drive. These parameter sets can be used to set the AC drive up for different processes or applications such as different motors used and connected, activated PID controller, different ramp time settings, etc.

A parameter set consists of all parameters with the exception of the Global parameters. The Global parameters are only able to have one value for all parameter sets.
Following parameters are Global: [211] Language, [217] Local Remote, [218] Lock Code, [220] Motor Data, [241] Select Set, [260] Serial Communication and [21B]Mains Supply Voltage .

NOTE: Actual timers are common for all sets. When a set is changed the timer functionality will change according to the new set, but the timer value will stay unchanged.

Select Set [241]

Here you select the parameter set. Every menu included in the parameter sets is designated A, B, C or D depending on the active parameter set. Parameter sets can be selected from the keyboard, via the programmable digital inputs or via serial communication. Parameter sets can be changed during the run. If the sets are using different motors (M1 to M4) the set will be changed only when the motor is stopped.



Default:		A
Selection:		A, B, C, D, DigIn, Com, Option
A	0	Fixed selection of one of the 4 parameter sets A, B, C or D.
B	1	
C	2	
D	3	
DigIn	4	Parameter set is selected via a digital input. Define which digital input in menu “[520] Digital inputs”.
Com	5	Parameter set is selected via serial communication.
Option	6	The parameter set is set via an option. Only available if the option can control the selection.

Communication information

Modbus Instance no/DeviceNet no:	43022
Profibus slot/index	168/181
EtherCAT index (hex)	4bce
Profinet IO index	19406
Fieldbus format	UInt
Modbus format	UInt

The active set can be viewed with function [721] VSD status.

NOTE: Parameter set cannot be changed during run if the parameter set includes change of the motor set (M2-M4). In this case always stop the motor before changing parameter set.

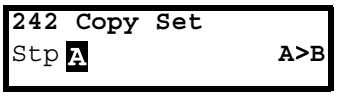
Prepare parameter Set when different Motor data M1 - M4:

1. Select desired parameter Set to be set in [241] A - D.
2. Select “Motor Set [212]” if other than the default Set M1.
3. Set relevant motor data in the Menu group [220].
4. Set other desired parameter settings to belong to this parameter Set.

To prepare a Set for another motor, repeat these steps.

Copy Set [242]

This function copies the content of a parameter set into another parameter set.



Default:		A>B
A>B	0	Copy set A to set B
A>C	1	Copy set A to set C
A>D	2	Copy set A to set D
B>A	3	Copy set B to set A
B>C	4	Copy set B to set C
B>D	5	Copy set B to set D
C>A	6	Copy set C to set A
C>B	7	Copy set C to set B
C>D	8	Copy set C to set D
D>A	9	Copy set D to set A
D>B	10	Copy set D to set B
D>C	11	Copy set D to set C

Communication information

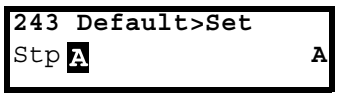
Modbus Instance no/DeviceNet no:	43021
Profibus slot/index	168/180
EtherCAT index (hex)	4bcd
Profinet IO index	19405
Fieldbus format	UInt
Modbus format	UInt

NOTE: The actual value of menu [310] will not be copied into the other set.

A>B means that the content of parameter set A is copied into parameter set B.

Load Default Values Into Set [243]

With this function three different levels (factory settings) can be selected for the four parameter sets. When loading the default settings, all changes made in the software are set to factory settings. This function also includes selections for loading default settings to the four different Motor Data Sets.



Default:		A
A	0	Only the selected parameter set will revert to its default settings.
B	1	
C	2	
D	3	
ABCD	4	All four parameter sets will revert to the default settings.
Factory	5	All settings, except [211], [221]-[228], [261], [3A1] and [923], will revert to the default settings.
M1	6	Only the selected motor set will revert to its default settings.
M2	7	
M3	8	
M4	9	
M1234	10	All four motor sets will revert to default settings.

Communication information

Modbus Instance no/DeviceNet no:	43023
Profibus slot/index	168/182
EtherCAT index (hex)	4bcf
Profinet IO index	19407
Fieldbus format	UInt
Modbus format	UInt

NOTE: Trip log hour counter and other VIEW ONLY menus are not regarded as settings and will be unaffected.

NOTE: If "Factory" is selected, the message "Sure?" is displayed. Press the + key to display "Yes" and then Enter to confirm.

NOTE: The parameters in menu "[220] Motor data", are not affected by loading defaults when restoring parameter sets A–D.

Copy All Settings to Control Panel [244]

All the settings can be copied into the control panel including the motor data. Start commands will be ignored during copying.

Default:		No Copy
No Copy	0	Nothing will be copied
Copy	1	Copy all settings

Communication information

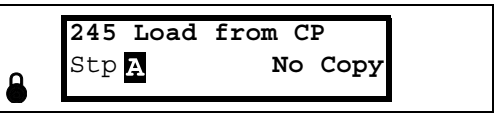
Modbus Instance no/DeviceNet no:	43024
Profibus slot/index	168/183
EtherCAT index (hex)	4bd0
Profinet IO index	19408
Fieldbus format	UInt
Modbus format	UInt

NOTE: The actual value of menu [310] will not be copied into control panel memory set.

Load Settings from Control Panel [245]

This function can load all four parameter sets from the control panel to the AC drive. Parameter sets from the source AC drive are copied to all parameter sets in the target AC drive, i.e. A to A, B to B, C to C and D to D.

Start commands will be ignored during loading.



Default:		No Copy
No Copy	0	Nothing will be loaded.
A	1	Data from parameter set A is loaded.
B	2	Data from parameter set B is loaded.
C	3	Data from parameter set C is loaded.
D	4	Data from parameter set D is loaded.
ABCD	5	Data from parameter sets A, B, C and D are loaded.
A+Mot	6	Parameter set A and Motor data are loaded.
B+Mot	7	Parameter set B and Motor data are loaded.
C+Mot	8	Parameter set C and Motor data are loaded.
D+Mot	9	Parameter set D and Motor data are loaded.
ABCD+Mot	10	Parameter sets A, B, C, D and Motor data are loaded.
M1	11	Data from motor 1 is loaded.
M2	12	Data from motor 2 is loaded.
M3	13	Data from motor 3 is loaded.
M4	14	Data from motor 4 is loaded.
M1M2M3 M4	15	Data from motor 1, 2, 3 and 4 are loaded.
All	16	All data is loaded from the control panel.

Communication information

Modbus Instance no/DeviceNet no:	43025
Profibus slot/index	168/184
EtherCAT index (hex)	4bd1
Profinet IO index	19409
Fieldbus format	UInt
Modbus format	UInt

NOTE: Loading from the control panel will not affect the value in menu [310].

5.2.5 Trip Autoreset/Trip Conditions [250]

The benefit of this feature is that occasional trips that do not affect the process will be automatically reset. Only when the failure keeps on coming back, recurring at defined times and therefore cannot be solved by the AC drive, will the unit give an alarm to inform the operator that attention is required.

For all trip functions that can be activated by the user you can select to control the motor down to zero speed according to set deceleration ramp to avoid water hammer.

Also see section 6.2, page 146.

Autoreset example:

In an application it is known that the main supply voltage sometimes disappears for a very short time, a so-called “dip”. That will cause the AC drive to trip an “Undervoltage alarm”. Using the Autoreset function, this trip will be acknowledged automatically.

- Enable the Autoreset function by making the reset input continuously high.
- Activate the Autoreset function in the menu [251], Number of trips.
- Select in menus [252] to [25N] the Trip condition that are allowed to be automatically reset by the Autoreset function after the set delay time has expired.

Number of Trips [251]

Any number set above 0 activates the Autoreset. This means that after a trip, the AC drive will restart automatically according to the number of attempts selected. No restart attempts will take place unless all conditions are normal.

If the Autoreset counter (not visible) contains more trips than the selected number of attempts, the Autoreset cycle will be interrupted. No Autoreset will then take place.

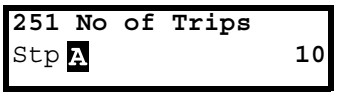
If there are no trips for more than 10 minutes, the Autoreset counter decreases by one.

If the maximum number of trips has been reached, the trip message hour counter is marked with an “A”.

If the Autoreset is full then the AC drive must be reset by a normal Reset.

Example:

- Number of allowed autoreset attempts [251]= 5.
- Within 10 minutes 6 trips occur.
- At the 6th trip there is no autoreset, because the autoreset counter is set to allow only 5 attempts to autoreset a trip.
- To reset the autoreset counter, give a new reset command (from one of the sources for reset control selected in menu [216]).
- The autoreset counter is now zeroed.

	
Default:	10
Range:	0–10 attempts

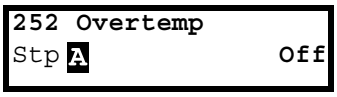
Communication information

Modbus Instance no/DeviceNet no:	43071
Profibus slot/index	168/230
EtherCAT index (hex)	4bff
Profinet IO index	19455
Fieldbus format	UInt, 1=1
Modbus format	UInt

NOTE: An auto reset is delayed by the remaining ramp time.

Over temperature [252]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

		
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

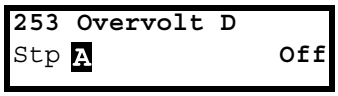
Communication information

Modbus Instance no/DeviceNet no:	43072
Profibus slot/index	168/231
EtherCAT index (hex)	4c00
Profinet IO index	19456
Fieldbus format	Long, 1=1 s
Modbus format	EInt

NOTE: An auto reset is delayed by the remaining ramp time.

Overvolt D [253]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active**.**

		
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

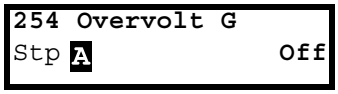
Communication information

Modbus Instance no/DeviceNet no:	43075
Profibus slot/index	168/234
EtherCAT index (hex)	4c03
Profinet IO index	19459
Fieldbus format	Long, 1=1 s
Modbus format	EInt

NOTE: An auto reset is delayed by the remaining ramp time.

Overvolt G [254]

Delay time starts counting when the fault is gone When the time delay has elapsed, the alarm will be reset if the function is active.

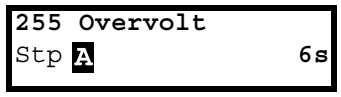
		
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43076
Profibus slot/index	168/235
EtherCAT index (hex)	4c04
Profinet IO index	19460
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Overvolt [255]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



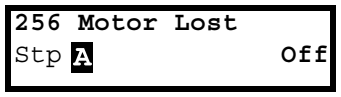
Default:		6s
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43077
Profibus slot/index	168/236
EtherCAT index (hex)	4c05
Profinet IO index	19461
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Motor Lost [256]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

NOTE: Only visible when Motor Lost is selected in menu [423].

Communication information

Modbus Instance no/DeviceNet no:	43083
Profibus slot/index	168/242
EtherCAT index (hex)	4c0b
Profinet IO index	19467
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Locked Rotor [257]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active**.**

Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43086
Profibus slot/index	168/245
EtherCAT index (hex)	4c0e
Profinet IO index	19470
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Power Fault [258]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active**.**

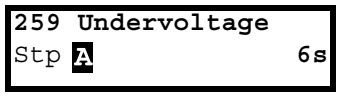
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43087
Profibus slot/index	168/246
EtherCAT index (hex)	4c0f
Profinet IO index	19471
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Undervoltage [259]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



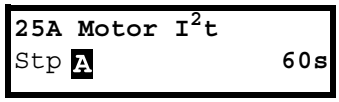
Default:		6s
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43088
Profibus slot/index	168/247
EtherCAT index (hex)	4c10
Profinet IO index	19472
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Motor I^2t [25A]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



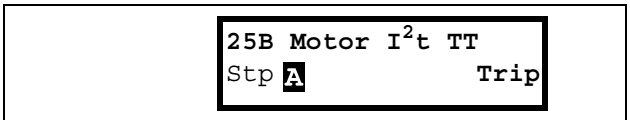
Default:		60s
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43073
Profibus slot/index	168/232
EtherCAT index (hex)	4c01
Profinet IO index	19457
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Motor I^2t Trip Type [25B]

Select the preferred way to react to a Motor I^2t trip.



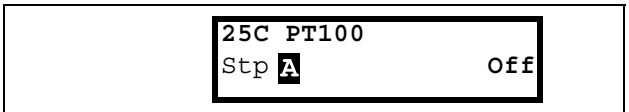
Default:		Trip
Trip	0	The motor will trip
Deceleration	1	The motor will decelerate

Communication information

Modbus Instance no/DeviceNet no:	43074
Profibus slot/index	168/233
EtherCAT index (hex)	4c02
Profinet IO index	19458
Fieldbus format	UInt
Modbus format	UInt

PT100 [25C]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43078
Profibus slot/index	168/237
EtherCAT index (hex)	4c06
Profinet IO index	19462
Fieldbus format	Long, 1=1 s
Modbus format	EInt

PT100 Trip Type [25D]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43079
Profibus slot/index	168/238
EtherCAT index (hex)	4c07
Profinet IO index	19463
Fieldbus format	Uint
Modbus format	UInt

PTC [25E]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

	25E PTC Stp A Off	
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43084
Profibus slot/index	168/243
EtherCAT index (hex)	4c0c
Profinet IO index	19468
Fieldbus format	Long, 1=1 s
Modbus format	EInt

PTC Trip Type [25F]

Select the preferred way to react to a PTC trip.

25F PTC TT Stp A Trip	
Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43085
Profibus slot/index	168/244
EtherCAT index (hex)	4c0d
Profinet IO index	19469
Fieldbus format	UInt
Modbus format	UInt

External Trip [25G]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

	25G Ext Trip Stp A Off	
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43080
Profibus slot/index	168/239
EtherCAT index (hex)	4c08
Profinet IO index	19464
Fieldbus format	Long, 1=1 s
Modbus format	EInt

External Trip Type [25H]

Select the preferred way to react to an alarm trip.

25H Ext Trip TT Stp A Trip	
Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43081
Profibus slot/index	168/240
EtherCAT index (hex)	4c09
Profinet IO index	19465
Fieldbus format	UInt
Modbus format	UInt

Communication Error [25I]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

	25I Com Error Stp A Off	
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43089
Profibus slot/index	168/248
EtherCAT index (hex)	4c11
Profinet IO index	19473
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Communication Error Trip Type [25J]

Select the preferred way to react to a communication trip.

25J Com Error TT Stp A Trip	
Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43090
Profibus slot/index	168/249
EtherCAT index (hex)	4c12
Profinet IO index	19474
Fieldbus format	UInt
Modbus format	UInt

Min Alarm [25K]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

25K Min Alarm Stp A Off		
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43091
Profibus slot/index	168/250
EtherCAT index (hex)	4c13
Profinet IO index	19475
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Min Alarm Trip Type [25L]

Select the preferred way to react to a min alarm trip.

25L Min Alarm TT Stp A Trip	
Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43092
Profibus slot/index	168/251
EtherCAT index (hex)	4c14
Profinet IO index	19476
Fieldbus format	UInt
Modbus format	UInt

Max Alarm [25M]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

25M Max Alarm Stp A Off		
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43093
Profibus slot/index	168/252
EtherCAT index (hex)	4c15
Profinet IO index	19477
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Max Alarm Trip Type [25N]

Select the preferred way to react to a max alarm trip.

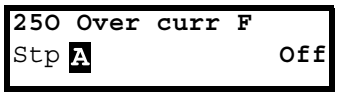
25N Max Alarm TT Stp A Trip	
Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43094
Profibus slot/index	168/253
EtherCAT index (hex)	4c16
Profinet IO index	19478
Fieldbus format	UInt
Modbus format	UInt

Over current F [25O]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43082
Profibus slot/index	168/241
EtherCAT index (hex)	4c0a
Profinet IO index	19466
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Pump [25P]

NOTE: This parameter has no impact on wastewater pump control.

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.

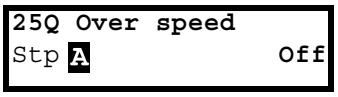
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43095
Profibus slot/index	168/254
EtherCAT index (hex)	4c17
Profinet IO index	19479
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Over Speed [25Q]

Delay time starts counting when the fault is gone. When the time delay has elapsed, the alarm will be reset if the function is active.



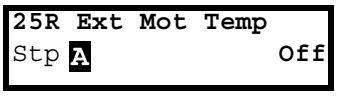
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43096
Profibus slot/index	169/0
EtherCAT index (hex)	4c18
Profinet IO index	19480
Fieldbus format	Long, 1=1 s
Modbus format	EInt

External Motor Temperature [25R]

Delay time starts counting when the fault disappears. When the time delay has elapsed, the alarm will be reset if the function is active.



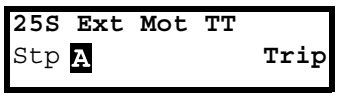
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43097
Profibus slot/index	168/239
EtherCAT index (hex)	4c19
Profinet IO index	19481
Fieldbus format	Long, 1=1 s
Modbus format	EInt

External Motor Trip Type [25S]

Select the preferred way to react to an alarm trip.



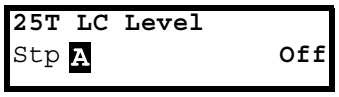
Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43098
Profibus slot/index	168/240
EtherCAT index (hex)	4c1a
Profinet IO index	19482
Fieldbus format	UInt
Modbus format	UInt

Liquid cooling low level [25T]

Delay time starts counting when the fault disappears. When the time delay has elapsed, the alarm will be reset if the function is active.



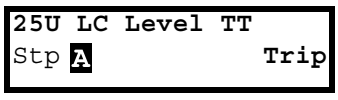
Default:		Off
Off	0	Off
1–3600	1–3600	1–3600 s

Communication information

Modbus Instance no/DeviceNet no:	43099
Profibus slot/index	169/3
EtherCAT index (hex)	4c1b
Profinet IO index	19483
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Liquid Cooling Low level Trip Type [25U]

Select the preferred way to react to an alarm trip.



Default:	Trip
Selection:	Same as menu [25B]

Communication information

Modbus Instance no/DeviceNet no:	43100
Profibus slot/index	169/4
EtherCAT index (hex)	4c1c
Profinet IO index	19484
Fieldbus format	UInt
Modbus format	UInt

5.2.6 Serial Communication [260]

This function is to define the communication parameters for serial communication. There are two types of options available for serial communication, RS232/485 (Modbus/RTU) and fieldbus modules (Profibus, DeviceNet, Modbus/TCP, Profinet IO, EtherCAT and EtherNet/IP). For more information see Chapter 7. page 153 and respective option manual.

Comm Type [261]

Select RS232/485 [262] or Fieldbus [263].

Default:		RS232/485
RS232/485	0	RS232/485 selected
Fieldbus	1	Fieldbus selected (Profibus, DeviceNet, Modbus/TCP, Profinet IO, EtherCAT or EtherNet/IP)

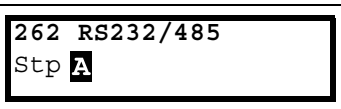
Communication information

Modbus Instance no/DeviceNet no:	43031
Profibus slot/index	168/190
EtherCAT index (hex)	4bd7
Profinet IO index	19415
Fieldbus format	UInt
Modbus format	UInt

NOTE: Toggling the setting in this menu will perform a soft reset (re-boot) of the Fieldbus module.

RS232/485 [262]

Press Enter to set up the parameters for RS232/485 (Modbus/RTU) communication.



Baud rate [2621]

Set the baud rate for the communication.

NOTE: This baud rate is only used for the isolated RS232/485 option.

		2621 Baudrate Stp A 38400
Default:		38400
2400	0	Selected baud rate
4800	1	
9600	2	
19200	3	
38400	4	

Communication information

Modbus Instance no/DeviceNet no:	43032
Profibus slot/index	168/191
EtherCAT index (hex)	4bd8
Profinet IO index	19416
Fieldbus format	UInt
Modbus format	UInt

Address [2622]

Enter the unit address for the AC drive.

NOTE: This address is only used for the isolated RS232/485 option.

	2622 Address Stp A 1
Default:	1
Selection:	1–247

Communication information

Modbus Instance no/DeviceNet no:	43033
Profibus slot/index	168/192
EtherCAT index (hex)	4bd9
Profinet IO index	19417
Fieldbus format	UInt, 1=1
Modbus format	UInt

Fieldbus [263]

Press Enter to set up the parameters for fieldbus communication.

Address [2631]

Enter/view the unit/node address of the AC drive. Read & write access for Profibus, DeviceNet. Read - only for EtherCAT.

	2631 Address Stp A 62
Default:	62
Range:	Profibus 0–126, DeviceNet 0–63
Node address valid for Profibus(RW), DeviceNet (RW) and EtherCAT (RO).	

Communication information

Modbus Instance no/DeviceNet no:	43034
Profibus slot/index	168/199
EtherCAT index (hex)	4bda
Profinet IO index	19418
Fieldbus format	UInt, 1=1
Modbus format	UInt

Process Data Mode [2632]

Enter the mode of process data (cyclic datAdv). For further information, see the Fieldbus option manual.

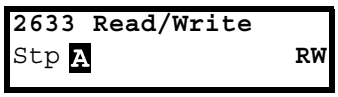
		2632 PrData Mode Stp A Basic
Default:		Basic
None	0	Control/status information is not used.
Basic	4	4 byte process data control/status information is used.
Extended	8	4 byte process data (same as Basic setting) + additional proprietary protocol for advanced users is used.

Communication information

Modbus Instance no/DeviceNet no:	43035
Profibus slot/index	168/194
EtherCAT index (hex)	4bdb
Profinet IO index	19419
Fieldbus format	UInt
Modbus format	UInt

Read/Write [2633]

Select read/write to control the inverter over a fieldbus network. For further information, see the Fieldbus option manual.



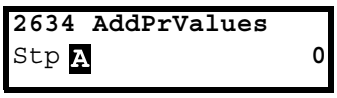
Default:		RW
RW	0	
Read	1	
Valid for process data. Select R (read only) for logging process without writing process data. Select RW in normal cases to control inverter.		

Communication information

Modbus Instance no/DeviceNet no:	43036
Profibus slot/index	168/195
EtherCAT index (hex)	4bdc
Profinet IO index	19420
Fieldbus format	UInt
Modbus format	UInt

Additional Process Values [2634]

Define the number of additional process values sent in cyclic messages.



Default:	0
Range:	0-8

Communication information

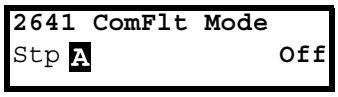
Modbus Instance no/DeviceNet no:	43039
Profibus slot/index	168/198
EtherCAT index (hex)	4bdf
Profinet IO index	19423
Fieldbus format	UInt, 1=1
Modbus format	UInt

Communication Fault [264]

Main menu for communication fault/warning settings. For further details please see the Fieldbus option manual.

Communication Fault Mode [2641]

Selects action if a communication fault is detected.



Default:		Off
Off	0	No communication supervision.
Trip	1	RS232/485 selected: The AC drive will trip if there is no communication for time set in parameter [2642]. Fieldbus selected: The AC drive will trip if: 1. The internal communication between the control board and fieldbus option is lost for time set in parameter [2642]. 2. If a serious network error has occurred.
Warning	2	RS232/485 selected: The AC drive will give a warning if there is no communication for time set in parameter [2642]. Fieldbus selected: The AC drive will give a warning if: 1. The internal communication between the control board and fieldbus option is lost for time set in parameter [2642]. 2. If a serious network error has occurred.

NOTE: Menu [214] and/or [215] must be set to COM to activate the communication fault function.

Communication information

Modbus Instance no/DeviceNet no:	43037
Profibus slot/index	168/196
EtherCAT index (hex)	4bdd
Profinet IO index	19421
Fieldbus format	UInt
Modbus format	UInt

Communication Fault Time [2642]

Defines the delay time for the trip/warning.

	2642 ComFlt Time Stp A 0.5s
Default:	0.5 s
Range:	0.1-15 s

Communication information

Modbus Instance no/DeviceNet no:	43038
Profibus slot/index	168/197
EtherCAT index (hex)	4bde
Profinet IO index	19422
Fieldbus format	Long, 1=0.1 s
Modbus format	EInt

Ethernet [265]

Settings for Ethernet module (Modbus/TCP, Profinet IO). For further information, see the Fieldbus option manual.

NOTE: The Ethernet module must be re-booted to activate the below settings. For example by toggling parameter [261]. Non-initialized settings indicated by flashing display text.

IP Address [2651]

	2651 IP Address 0. 0. 0. 0
Default:	0.0.0.0

Communication information

Modbus Instance no/DeviceNet no:	42701, 42702, 42703, 42704
Profibus slot/index	167/115, 167/116, 167/117, 167/118
EtherCAT index (hex)	4a8d, 4a8e, 4a8f, 4a90
Profinet IO index	19085, 19086, 19087, 19088
Fieldbus format	UInt, 1=1
Modbus format	UInt

MAC Address [2652]

	2652 MAC Address Stp A 000000000000
Default:	An unique number for the Ethernet module.

Communication information

Modbus Instance no/DeviceNet no:	42705, 42706, 42707, 42708, 42709, 42710
Profibus slot/index	167/119, 167/120, 167/121, 167/122, 167/123, 167/124
EtherCAT index (hex)	4a91, 4a92, 4a93, 4a94, 4a95, 4a96,
Profinet IO index	19089, 19090, 19091, 19092, 19093, 19094
Fieldbus format	UInt, 1=1
Modbus format	UInt

Subnet Mask [2653]

	2653 Subnet Mask 0. 0. 0. 0
Default:	0.0.0.0

Communication information

Modbus Instance no/DeviceNet no:	42711, 42712, 42713, 42714
Profibus slot/index	167/125, 167/126, 167/127, 167/128
EtherCAT index (hex)	4a97, 4a98, 4a99, 4a9a
Profinet IO index	19095, 19096, 19097, 19098
Fieldbus format	UInt, 1=1
Modbus format	UInt

Gateway [2654]

	2654 Gateway 0. 0. 0. 0
Default:	0.0.0.0

Communication information

Modbus Instance no/DeviceNet no:	42715, 42716, 42717, 42718
Profibus slot/index	167/129, 167/130, 167/131, 167/132
EtherCAT index (hex)	4a9b, 4a9c, 4a9e, 4a9f
Profinet IO index	19099, 19100, 19101, 19102
Fieldbus format	UInt, 1=1
Modbus formatPicknik	UInt

DHCP [2655]

	
Default:	Off
Selection:	On/Off

Communication information

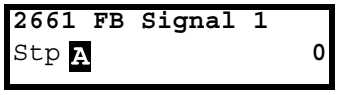
Modbus Instance no/DeviceNet no:	42719
Profibus slot/index	167/133
EtherCAT index (hex)	4a9f
Profinet IO index	19103
Fieldbus format	UInt
Modbus format	UInt

Fieldbus Signals [266]

Defines modbus mapping for additional process values. For further information, see the Fieldbus option manual.

FB Signal 1 - 16 [2661]-[266G]

Used to create a block of parameters which are read/written via communication. 1 to 8 read + 1 to 8 write parameters possible.

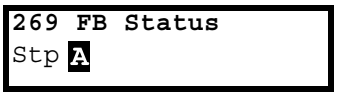
	
Default:	0
Range:	0-65535

Communication information

Modbus Instance no/DeviceNet no:	42801-42816
Profibus slot/index	167/215-167/230
EtherCAT index (hex)	4af1 - 4b00
Profinet IO index	19185 - 19200
Fieldbus format	UInt, 1=1
Modbus format	UInt

FB Status [269]

Sub menus showing status of fieldbus parameters. Please see the Fieldbus manual for detailed information.



5.3 Process and Application Parameters [300]

These parameters are mainly adjusted to obtain optimum process or machine performance.

5.3.1 Level Control [3A0]

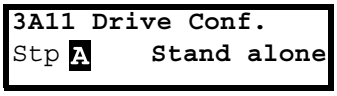
Process parameters for waste water level control (FlowDrive) see Chapter 2.2 page 11 for more information.

Mode configuration [3A1]

Configuration of Level Control mode.

Drive configuration[3A11]

Drive configuration in FlowDrive setup.

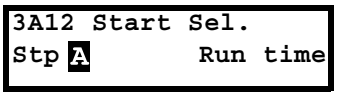
		
Default:		Stand alone
Stand alone	0	Only one drive
Master	1	This drive is the Master
Follower	2	This drive is the Follower

Communication information

Modbus Instance no/DeviceNet no:	43600
Profibus slot/index	170/249
EtherCAT index (hex)	44e10
Profinet IO index	19984
Fieldbus format	UInt, 1=1
Modbus format	UInt

Start select[3A12] nF)

Set how to select pump to start. Either by runtime or by starts. The drive with lowest number of starts or lowest runtime will be selected.

		
Default:		Run time
Run time	0	
No. Starts	1	

Communication information

Modbus Instance no/DeviceNet no:	43601
Profibus slot/index	170/250
EtherCAT index (hex)	4e11
Profinet IO index	19985
Fieldbus format	UInt
Modbus format	UInt

Empty time[3A13] Adv) nF)

Approximate empty time from when start pumping to stop. To be able to do accurate measurements of flows, change pumps at natural stops, avoid residue buildup at a specific level, etc it has been chosen to strive for emptying the pump sump regularly. This is done by decreasing the level over time from pump start. Desired emptying time is configurable in this menu.

3A13 Empty time Stp A 240min	
Default:	240min
Range:	0 - 480min

Communication information

Modbus Instance no/DeviceNet no:	43602
Profibus slot/index	170/251
EtherCAT index (hex)	4e12
Profinet IO index	19986
Fieldbus format	UInt, 1=1
Modbus format	UInt

Level configuration [3A2] nF)

General configuration of Level Control.

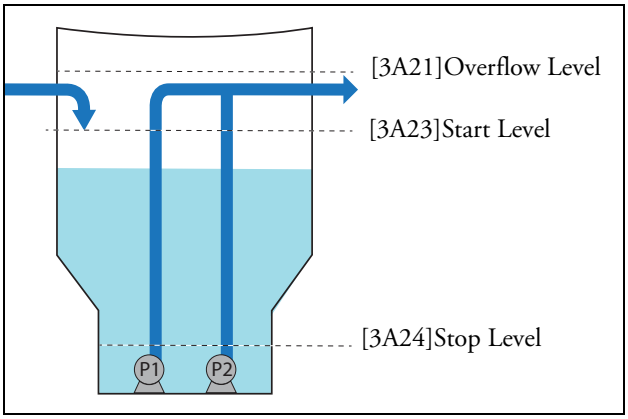


Fig. 28 Sump levels, examples.

Overflow[3A21] nF)

Set Overflow level.
The Overflow level shall be higher than level set in "[3A23] Start level".
If Overflow level is reached, an overflow warning is triggered. In menu [737] duration time for latest overflow is registered.

3A21 Overflow Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43603
Profibus slot/index	170/252
EtherCAT index (hex)	4e13
Profinet IO index	19987
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Start level[3A22] nF)

Level where to start pumping.

3A22 Start Level Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43604
Profibus slot/index	170/253
EtherCAT index (hex)	4e14
Profinet IO index	19988
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Stop level[3A23] nF)

Level where to stop pumping.

3A223 Stop level Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43605
Profibus slot/index	170/254
EtherCAT index (hex)	4e15
Profinet IO index	19989
Fieldbus format	Long, 1=0.001
Modbus format	EInt

BEP start [3A24] Adv) nF)

Start level for BEP algorithm, used during Autotune program, to determine the most efficient speed. Normally automatically set. If uncertainty in sump area it might be good to set BEP start and stop levels manually where the area is even and known. Uncertainties in volume calculation will result in poor AutoTune result.

3A24 BEP start Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43606
Profibus slot/index	171/0
EtherCAT index (hex)	4e16
Profinet IO index	19990
Fieldbus format	Long, 1=0.001
Modbus format	EInt

BEP Stop [3A25] Adv) nF)

Stop level for BEP algorithm. Normally automatically detected. Can be good to set manually to assure even sump area, see BEP start [3A24] Adv) nF).

3A25 BEP Stop Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43607
Profibus slot/index	171/1
EtherCAT index (hex)	4e17
Profinet IO index	19991
Fieldbus format	Long, 1=0.001
Modbus format	EInt

PreOverFlow [3A26] Adv) nF)

Automatically set between overflow level and start level to detect an imminent overflow. If PreOverflow level is reached, all pumps will start and run at full speed and PreOverFlow warning is triggered.

3A26 PreOverFlow Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43608
Profibus slot/index	171/2
EtherCAT index (hex)	4e18
Profinet IO index	19992
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Sump Geometry[3A3] nF)

The reservoir geometry settings are crucial for the auto tune program and flow estimations. Please enter values as precisely as possible, failing to do so will result in inaccurate measurements.

Up to 5 levels and areas can be set. Start from the bottom level (level 1) and set a corresponding area for each change of shape in the reservoir. Use as many as required, unused levels/areas should be set to 0/Off.

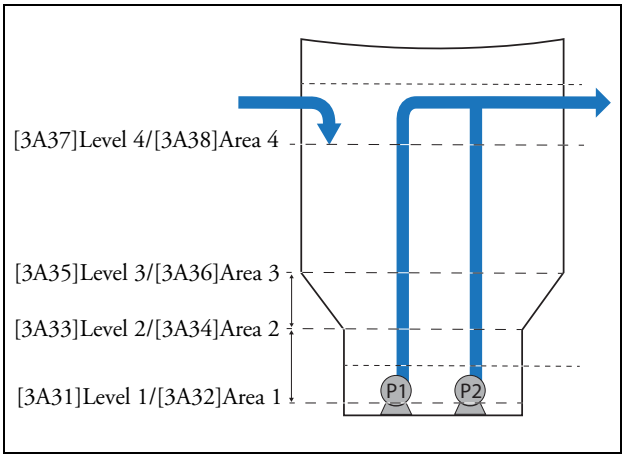


Fig. 29 Example of Sump areas and levels.

Level 1[3A31] nF)

Lowest level of sump in meter. Often 0.

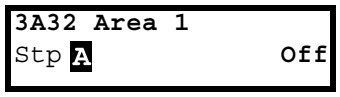
3A31 Level 1 Stp A 0.000m	
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43609
Profibus slot/index	171/3
EtherCAT index (hex)	4e19
Profinet IO index	19993
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Area 1[3A32] nF)

Area at lowest level.



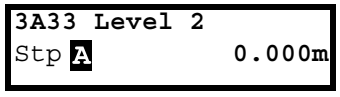
Default:	Off (m^2)

Communication information

Modbus Instance no/DeviceNet no:	43610
Profibus slot/index	171/4
EtherCAT index (hex)	4e1a
Profinet IO index	19994
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Level 2 [3A33] nF)

Second lowest level where the area is changed.



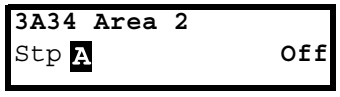
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43611
Profibus slot/index	171/5
EtherCAT index (hex)	4e1b
Profinet IO index	19995
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Area 2 [3A34] nF)

Area at level 2.



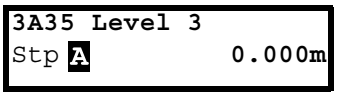
Default:	Off (m^2)

Communication information

Modbus Instance no/DeviceNet no:	43612
Profibus slot/index	171/6
EtherCAT index (hex)	4e1c
Profinet IO index	19996
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Level 3 [3A35] nF)

Third level where the area is changed again.



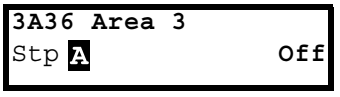
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43613
Profibus slot/index	171/7
EtherCAT index (hex)	4e1d
Profinet IO index	19997
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Area 3 [3A36] nF)

Area at level 3.



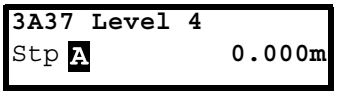
Default:	Off (m^2)

Communication information

Modbus Instance no/DeviceNet no:	43614
Profibus slot/index	171/8
EtherCAT index (hex)	4e1e
Profinet IO index	19998
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Level 4 [3A37] nF)

Fourth level where the area is changed again



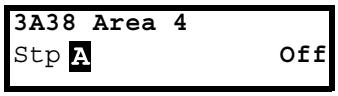
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43615
Profibus slot/index	171/9
EtherCAT index (hex)	4e1f
Profinet IO index	19999
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Area 4 [3A38] nF)

Area at level 4.



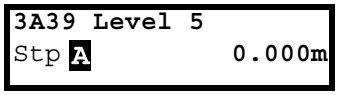
Default:	Off (m^2)

Communication information

Modbus Instance no/DeviceNet no:	43616
Profibus slot/index	171/10
EtherCAT index (hex)	4e20
Profinet IO index	20000
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Level 5 [3A39] nF)

Fifth level where the area is changed again.



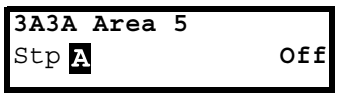
Default:	0.000m

Communication information

Modbus Instance no/DeviceNet no:	43617
Profibus slot/index	171/11
EtherCAT index (hex)	4e21
Profinet IO index	20001
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Area 5 [3A3A] nF)

Area at level 5.



Default:	Off (m^2)

Communication information

Modbus Instance no/DeviceNet no:	43618
Profibus slot/index	171/12
EtherCAT index (hex)	4e22
Profinet IO index	20002
Fieldbus format	Long, 1=0.1
Modbus format	EInt

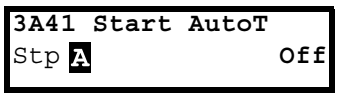
Auto Tune[3A4] nF)

Auto Tune program will do measurements and calculate process data needed for optimal control. For example it will search for the most energy efficient frequency to pump at and do calibrations of other functions.
See Chapter 2.3 page 13 for more information.

In following menus you can set Autotune parameters.

Start Auto Tune[3A41] nF)

In this menu you can start or deselect Auto tuning.
It is also possible to see actual status during Auto Tune.



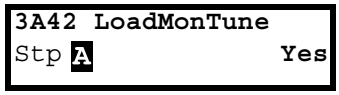
Default:		Off
Off	0	No auto tuning
Start	1	Start autotune
Resume	2	Resume autotune if Aborted.
Measuring	3	Status indications
Paused	4	
Aborted	5	
Finished	6	

Communication information

Modbus Instance no/DeviceNet no:	43619
Profibus slot/index	171/13
EtherCAT index (hex)	4e23
Profinet IO index	20003
Fieldbus format	UInt
Modbus format	UInt

LoadMonTune [3A42] nF)

Allow configuration of load monitor during Auto Tune program.



Default		Yes
No	0	No configuration of load monitoring
Yes	1	Configuration of load monitoring allowed.

Communication information

Modbus Instance no/DeviceNet no:	43620
Profibus slot/index	171/14
EtherCAT index (hex)	4e24
Profinet IO index	20004
Fieldbus format	UInt
Modbus format	UInt

BEP samples [3A43] Adv) nF)

Number of samples taken for each frequency in BEP. More gives better accuracy. Default 5. Less than 3 is not recommended.
In case of uneven inflow >7 is recommended.

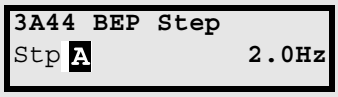
	
Default:	5
Range	Off - 30

Communication information

Modbus Instance no/DeviceNet no:	43621
Profibus slot/index	171/15
EtherCAT index (hex)	4e25
Profinet IO index	20005
Fieldbus format	UInt, 1=1
Modbus format	UInt

BEP Step [3A44] Adv) nF)

Step in Hz between measurement points, e.g. 2Hz will result in measurement series of 50, 48, 46…

	
Default:	2.0Hz
Range	1.0- 10.0Hz

Communication information

Modbus Instance no/DeviceNet no:	43622
Profibus slot/index	171/16
EtherCAT index (hex)	4e26
Profinet IO index	20006
Fieldbus format	UInt, 1=0.1
Modbus format	UInt

5.3.2 Functions[3B0] nF)

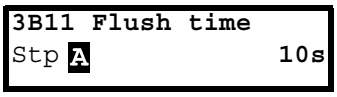
Functions to be used together with level control.

Flush start[3B1] nF)

Starts pump at full speed to create a flushing effect in the pipes to get everything moving.

Flush time[3B11] nF)

Time to flush until going back to more optimal drive speed.

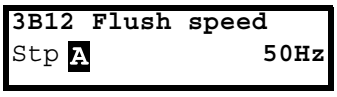
	
Default	10s
Range	Off - 120s

Communication information

Modbus Instance no/DeviceNet no:	43630
Profibus slot/index	171/24
EtherCAT index (hex)	4e2e
Profinet IO index	20014
Fieldbus format	UInt, 1=1
Modbus format	UInt

Flush speed [3B12] nF)

Frequency to flush at (normally use motor nominal speed; 50 or 60 Hz).

	
Default:	50Hz
Range	0.0 - 240Hz

Communication information

Modbus Instance no/DeviceNet no:	43631
Profibus slot/index	171/25
EtherCAT index (hex)	4e2f
Profinet IO index	20015
Fieldbus format	UInt, 1=0.1
Modbus format	UInt

Start lvl Δ [3B2] nF)

If enabled, start level will vary to avoid residue buildup at start level.
Randomizes start level between “Start level” and “Start level ./. Start level Δ “. This to not always start pumps at same level.

	3B2 Start lvl Δ Stp A Off
Default:	Off
Range	Off= Fixed start level = [3A22]. Max= Distance between start and stop level.

Communication information

Modbus Instance no/DeviceNet no:	43632
Profibus slot/index	171/26
EtherCAT index (hex)	4e30
Profinet IO index	20016
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Example

Start level is set to: 1.5 m
Start level Δ is set to: 0.4 m

Actual start level will be randomized between 1.1 - 1.5 m

PumpCleaning [3B3] nF)

Function for reversing the pumps to try removing tangled dirt and obstacles in the pump.
If this function is enabled, Pump cleaning is triggered by an alarm “PumpNotClean”, on user request, periodically or on desired time and date if RTC option is available.
“PumpNotClean” is detected by comparing actual load with normal load (if configured at “AutoTune”) see also “ Load monitor calibration” on page 13.
When triggered, the function does following:

1. Motor runs in reverse direction at [3B34] Hz for [3B35] s.
2. Speed reference is set to “[343] Max Speed”.
3. The motor runs in normal direction at [343] Hz for the time defined by [4172]*1,5.
   If “PumpNotClean” alarm is not active, the motor stops or continues running (according to “[747] Flow status”).
   If “PumpNotClean” alarm is active, the cleaning procedure is repeated for max. 8 consecutive times. If the alarm is still active, a “CleaningFailed” alarm is triggered. This alarm is reset when “PumpNotClean” alarm is not active.

Pump cleaning is triggered from following sources:

1. “PumpNotClean” alarm.
2. Menu “[3B32] ForcePumpCl”.
3. Digital input.
4. Run-time.
5. Real Time Clock - Option.
6. Load monitor tuning.

Activate pump cleaning [3B31] nF)

Set if cleaning is allowed or Disable/enable pump cleaning function.
Some pumps should not be reversed, check with pump manufacturer.

		3B31 Act.PumpCln Stp A No
Default		No
No	0	Pump cleaning not allowed.
Yes	1	Pump cleaning allowed

Communication information

Modbus Instance no/DeviceNet no:	43633
Profibus slot/index	171/27
EtherCAT index (hex)	4e31
Profinet IO index	20017
Fieldbus format	UInt
Modbus format	UInt

Force Pump Cleaning[3B32] nF)

Request cleaning of pump and presenting status (either all pumps or an individual pump). Will be done as soon as possible.

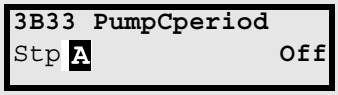
		3B32 ForcePumpCl Stp A Off
Default:		Off
Off	0	Pump cleaning is not active. Setting the value to Off, interrupts cleaning in process.
Master	1	Request Master pump to be cleaned.
Follower	2	Request Follower pump to be cleaned.
Both	3	Request both pumps to be cleaned.
Pending	4	Pump cleaning will be performed when the conditions are fulfilled. Value cannot be set by the user.
In progress	5	Pump cleaning procedure is in progress. Value cannot be set by the user.

Communication information

Modbus Instance no/DeviceNet no:	43634
Profibus slot/index	171/28
EtherCAT index (hex)	4e32
Profinet IO index	20018
Fieldbus format	UInt
Modbus format	UInt

Pump clean period [3B33] Adv) nF)

Periodic pump cleaning. Request cleaning when the pump runs for more than every X run hours. Cleaning will be performed when the stop level is reached, after the set period time is reached.

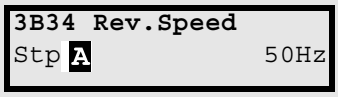
	
Default:	Off- Periodic pump cleaning is disabled
Range:	Off - 876h

Communication information

Modbus Instance no/DeviceNet no:	43635
Profibus slot/index	171/29
EtherCAT index (hex)	4e33
Profinet IO index	20019
Fieldbus format	UInt, 1=1
Modbus format	UInt

Reverse Speed[3B34] Adv) nF)

Motor speed during cleaning (reverse speed).
If this value is se to a lower value than value set in menu "[341] Min Speed", pump cleaning is disabled.

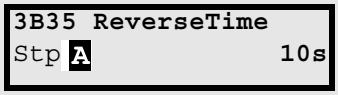
	
Default:	50Hz
Range	0.0 - 240Hz

Communication information

Modbus Instance no/DeviceNet no:	43636
Profibus slot/index	171/30
EtherCAT index (hex)	4e34
Profinet IO index	20020
Fieldbus format	UInt, 1=0.1
Modbus format	UInt

ReverseTime [3B35] Adv) nF)

Running time at Reverse speed.
If set to Off, pump cleaning is disabled.

	
Default	10s
Range	Off - 30s

Communication information

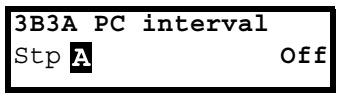
Modbus Instance no/DeviceNet no:	43637
Profibus slot/index	171/31
EtherCAT index (hex)	4e35
Profinet IO index	20021
Fieldbus format	UInt, 1=1
Modbus format	UInt

Pump Cleaning interval[3B3A] nF)

This menu is only visible with RTC-Real Time Clock option installed.

Here you can set the reoccurrence interval for scheduled pump cleaning.

Example:
If weekly start desired, set interval to 7,
every other week set interval to 14
and if once a year set 365.

	
Default	Off
Range	Off - 365

Communication information

Modbus Instance no/DeviceNet no:	43645
Profibus slot/index	171/39
EtherCAT index (hex)	4e3d
Profinet IO index	20029
Fieldbus format	Long, 1=1
Modbus format	EInt

Pump Cleaning start Date[3B3B] nF)

This menu is only visible with RTC-Real time clock option installed and menu "[3B3A] PC interval" set to 1 - 365.

Here you can set from which date pump cleaning shall be possible and from which date the interval set in "[3B3A] PC interval" shall reoccur.

	
Default	2015-01-01
Range	YYYY-MM-DD

Communication information

Modbus Instance no/DeviceNet no:	43646,43647, 43648 (Y,M,D)
Profibus slot/index	171/40, 171/41, 171/42
EtherCAT index (hex)	4e3e, 4e3f, 4e40
Profinet IO index	20030, 20031, 20032
Fieldbus format	Long, 1=1Y Long, 1=1M Long, 1=1D
Modbus format	EInt

Pump Cleaning startTime[3B3C] nF)

This menu is only visible with RTC-Real time clock option installed and menu "[3B3A] PC interval" set to 1 - 365.

Here you can set at which time pump cleaning shall be possible at the date set in menu "[3B3B] PCstartDate".

3B3C PCstartTime Stp A 00:00:00	
Default	00:00:00
Range	00:00:00 - 23:59:59

Communication information

Modbus Instance no/DeviceNet no:	43649, 43650, 43651 (h, m,s)
Profibus slot/index	171/43, 171/44, 171/45
EtherCAT index (hex)	4e41, 4e42, 4e43
Profinet IO index	20033, 20034, 20035
Fieldbus format	Long, 1=1h Long, 1=1m Long, 1=1s
Modbus format	EInt

Sump cleaning [3B4] nF)

Function for cleaning the pump sump by pumping the level down until pump slurps air.
Sump cleaning can be requested from control panel, periodically or on desired time and date if Real time clock (option) is available.

Activate Sump Cleaning [3B41] nF)

Allows sump cleaning and determines how to operate. Normally set to OFF to protect pumps not suitable for running this function.

3B41 Act.SumpCln Stp A Off		
Default:		Off
Off	0	No request.
Master	1	Request Master pump to run
Follower	2	Request Follower pump to run
Both	3	Request both pumps run

Communication information

Modbus Instance no/DeviceNet no:	43655
Profibus slot/index	171/49
EtherCAT index (hex)	4e47
Profinet IO index	20039
Fieldbus format	UInt
Modbus format	UInt

Force Sump Cleaning[3B42] nF)

Request a one off sump cleaning. Will start when normal stop level is reached next time.

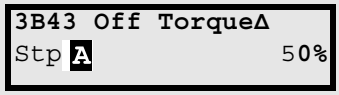
3B42 ForceSumpCl Stp A No		
Default		No
No	0	No request
Yes	1	Request sump cleaning to start next time stop level is reached.

Communication information

Modbus Instance no/DeviceNet no:	43656
Profibus slot/index	171/50
EtherCAT index (hex)	4e48
Profinet IO index	20040
Fieldbus format	UInt
Modbus format	UInt

Off TorqueΔ[3B43] Adv) nF)

Delta torque to detect slurping of air (pump running free). A load sample is taken when level passes the normal stop level. If "Off Torque delta" is set to 30%, the pump will shut down when torque is 70% of the sampled torque.



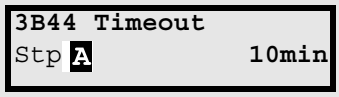
Default	50%
Range	0 - 99%

Communication information

Modbus Instance no/DeviceNet no:	43657
Profibus slot/index	171/51
EtherCAT index (hex)	4e49
Profinet IO index	20041
Fieldbus format	UInt
Modbus format	UInt

Timeout [3B44] Adv) nF)

Time-out from start of function (passing the stop level). This is a safety feature to not hurt the pumps running to long at low level (causing insufficient cooling).



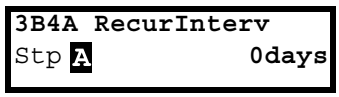
Default.	10min
Range	0 - 60min

Communication information

Modbus Instance no/DeviceNet no:	43658
Profibus slot/index	171/52
EtherCAT index (hex)	4e4a
Profinet IO index	20042
Fieldbus format	UInt
Modbus format	UInt

Recurrence Interval [3B4A] nF)

Set days between sump cleaning, see example in menu "Pump Cleaning interval[3B3A] nF)" on how to set.



Default	0days
Range	0 - 365days

Communication information

Modbus Instance no/DeviceNet no:	43665
Profibus slot/index	171/59
EtherCAT index (hex)	4e51
Profinet IO index	20049
Fieldbus format	Long, 1=1
Modbus format	Eint

Sump Cleaning startDate [3B4B] nF)

This menu is only visible with RTC-Real time clock option installed and menu [3B4A] set to 1 - 365.

Here you can set from which date sump cleaning shall be possible and from which date the interval set in "[3B4A] RecurInterval" shall reoccur.

Default.	2015-01-01
Range	YYYY-MM-DD

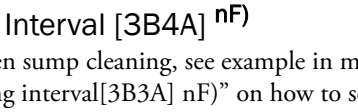
Communication information

Modbus Instance no/DeviceNet no:	43666, 43667, 43668 (Y, M, D)
Profibus slot/index	171/60, 171/61, 171/62
EtherCAT index (hex)	4e52, 4e53, 4e54
Profinet IO index	20050, 20051, 20052
Fieldbus format	Long, 1=1Y Long, 1=1M Long, 1=1D
Modbus format	Eint

Sump Cleaning startTime [3B4C] nF)

This menu is only visible with RTC-Real time clock option installed and menu [3B4A] set to 1 - 365.

Here you can set at which time sump cleaning shall be possible at the date set in menu "[3B4B] SCstartDate".



Default.	00:00:00
Range	00:00:00 - 23:59:59

Communication information

Modbus Instance no/DeviceNet no:	43669, 43670, 43671
Profibus slot/index	171/63, 171/64, 171/65
EtherCAT index (hex)	4e55, 4e56, 4e57
Profinet IO index	20053, 20054, 20055
Fieldbus format	Long, 1=1h Long, 1=1m Long, 1=1s
Modbus format	Eint

Pipe cleaning [3B5] nF)

Function for cleaning the pipes from accumulated dirt by producing as high flow as possible for as long time as possible.

Force Pipe Cleaning [3B51] nF)

Request pipe cleaning. Will start next time at start level (full sump).

	3B51 ForcePipeC Stp A No	
Default.		No
No	0	No request
Yes	1	Pipe cleaning requested

Communication information

Modbus Instance no/DeviceNet no:	43675
Profibus slot/index	171/69
EtherCAT index (hex)	4e5b
Profinet IO index	20059
Fieldbus format	UInt
Modbus format	UInt

Pipe Cleaning period [3B52] nF)

Set how often pipe cleaning shall be possible. Start pipe cleaning every X pump down cycle (one pump down cycle means complete pump down to stop level).

3B52 PipeCperiod Stp A Off	
Default	Off
Range	Off - 500

Communication information

Modbus Instance no/DeviceNet no:	43676
Profibus slot/index	171/70
EtherCAT index (hex)	4e5c
Profinet IO index	20060
Fieldbus format	UInt, 1=1
Modbus format	UInt

Load Monitor[3B6] Adv) nF)

Load monitor for abnormal pump load detection.
Load monitor is automatically tuned if allowed by "[3A42] Load MonTune" when FlowDrive Autotuning is activated. Pump cleaning is performed prior to load monitor tuning (if allowed).
Load monitor autotuning can be triggered manually by "[3B61] LoadMonTune".
All drives must be in Auto mode in order to perform the autotuning. If set to any other mode than Auto while autotuning is performed, the procedure is aborted.

Load monitor autotuning starts when the water level reaches "[3A24] BEP start level".
If the level drops below "[3A23] Stop level", the procedure is paused and repeated when the level increases to BEP start level.
If the drive is set to Full speed (Manual) mode while the autotuning is running, the procedure is paused and repeated when the conditions allow that.

When load monitor autotuning is finished, the values are verified for following conditions:

- torque at max. speed is not higher than 100%
- torque is increasing with increasing speed. This condition is checked for only if the frequency range (difference between min and max frequency) is set to 8 Hz or more.

If the above conditions are not fulfilled, the load monitor autotuning is repeated for maximal 8 times and aborted if the conditions are not fulfilled. Load monitor is then disabled by forcing "[411] Alarm Select" to Off.
If the load monitor autotuning is successful, the load monitor is enabled by forcing "[411] Alarm Select" to Min+Max with a torque margin of 20% (set in [4171] and [4181]).

Pressing the "Reset" key on the PPU while load monitor autotuning is performed aborts the procedure.

LoadMonitor Tune [3B61] Adv) nF)

State of load monitor.

Read only	3B61 LoadMonTune Stp A Not done	
Not done	0	Load monitor tuning is not performed
Start	1	Triggers the load monitor autotuning in all available drives. If more than 1 drive is available, the Master is tuned first, then the Follower.
Pending	2	Load monitor autotuning procedure is pending and it will be performed when all the conditions allow it. Value cannot be set by the user.
Cleaning	3	Pump cleaning procedure is performed prior to tuning the load monitor. Value cannot be set by the user.
Paused	4	Procedure is paused and it will be continued when the water level rises above BEP Start level. Value cannot be set by the user.
Master	5	Master drive load monitor autotuning is in progress. Value cannot be set by the user.
Follower	6	Follower drive load monitor autotuning is in progress.Value cannot be set by the user.
Failed	7	Procedure has failed. Load monitor is deactivated. It can be manually activated in menu [410]
Done	8	Procedure was performed successfully.

Communication information

Modbus Instance no/DeviceNet no:	43677
Profibus slot/index	171/71
EtherCAT index (hex)	4e5d
Profinet IO index	20061
Fieldbus format	UInt
Modbus format	UInt

5.3.3 Sensors [3C0] nF)

In following menus, process configuration for connected sensors can be done.

Sensor function (level sensor / flow sensor) and electrical properties are defined in“Chapter 5.5.1 page 85”.

Level sensor [3C1] nF)

Level in the pump sump is based on input from analogue level sensor. The following parameters determines how to interpret these electrical signals as a level.

In the examples below we presume using a pressure level sensor with a range of 5 meters. Hence the difference between Sensor min[3C13] and Sensor max[3C14] nF) setting should be 5.

Example 1:
Sensor is placed at bottom of pump sump. Hence sensor Min level = 0 and sensor Max Level = 5.

Example 2:
Sensor is placed slightly above the sump bottom, e.g. 0.2m. Hence sensor Min level = 0.2 and sensor Max Level = 5.2.

Example 3:
Another scenario is according to Fig. 30 below where the levels refer to the normal sea level. Sump bottom is here 8 meters below sea level. Consequently Sensor Min level = -8 and Sensor Max Level = -3.

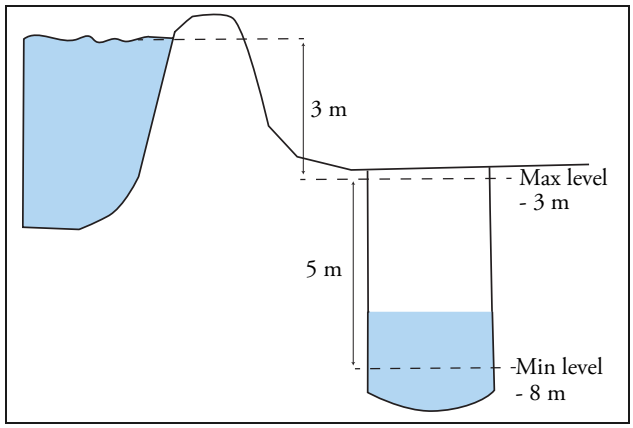


Fig. 30 Example of min- max levels in a pump sump

Level unit [3C11]Adv) nF)

Set desired unit for the level sensor to be used.

3C11 Level Unit Stp A m		
Default:		m
Off	0	Off = No level sensor connected
m	1	meter
%	3	percent
bar	4	pressure
Pa	5	pressure

Communication information

Modbus Instance no/DeviceNet no:	43700
Profibus slot/index	171/94
EtherCAT index (hex)	4e74
Profinet IO index	20084
Fieldbus format	UInt
Modbus format	UInt

Sensor min[3C13]

This is configuration of which level, in meters, the min analogue signal from the sensor should represent. Generally this is 0 for a pressure sensor placed in the bottom of the sump. The level can also be set as in the "Example 3" above Fig. 30, where the min level is set to -8.

3C13 Sensor min Stp A 0.000m	
Default:	0.000m
Range	-100 to 100

Communication information

Modbus Instance no/DeviceNet no:	43707
Profibus slot/index	171/101
EtherCAT index (hex)	4e7b
Profinet IO index	20091
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Sensor max[3C14] nF)

This is configuration of which level, in meters, the max analogue signal from the sensor represents. This data depends on both sensor properties as well as the sensor min value.

Example:
In case sensor with a range of 10 meters is used, this level should be 10 meters above "[3C13] Sensor min".

3C14 Sensor max Stp A 10m	
Default:	10m
Range	-100 to 100

Communication information

Modbus Instance no/DeviceNet no:	43708
Profibus slot/index	171/102
EtherCAT index (hex)	4e7c
Profinet IO index	20092
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Ratio [3C15] Adv) nF)

This function sets the ratio between the actual level and the read analogue value. The sensor characteristics is given by the sensor manufacturer. Linear ratio is by far the most commonly used.

3C15 Ratio Stp A Linear		
Default:		Linear
Linear	0	Ratio is linear
Quadratic	1	Ratio is quadratic

Communication information

Modbus Instance no/DeviceNet no:	43709
Profibus slot/index	171/103
EtherCAT index (hex)	4e7d
Profinet IO index	20093
Fieldbus format	UInt
Modbus format	UInt

Flow sensor [3C2] nF)

To improve measured flows, a flow sensor can be used on the outlet.

Flow unit[3C21] Adv) nF)

If you have a flow sensor connected, set desired unit for the sensor to be used. No sensor connected, set to Off.

	3C21 Flow Unit Stp A Lit/s	
Default:		Lit/s
Off	0	Off = No flow sensor connected
Lit/s	1	Litre per second
%	3	Percent
m^3/hour	4	Cubic meters per hour

Communication information

Modbus Instance no/DeviceNet no:	43710
Profibus slot/index	171/104
EtherCAT index (hex)	4e7e
Profinet IO index	20094
Fieldbus format	UInt
Modbus format	UInt

Flow min[3C23] nF)

This is configuration of which flow, in Lit/s, the min analogue signal from the sensor should represent. Generally this is 0.

3C23 Flow min Stp A 0	
Default:	0Lit/s
Range	0 - 1000

Communication information

Modbus Instance no/DeviceNet no:	43717
Profibus slot/index	171/111
EtherCAT index (hex)	4e85
Profinet IO index	20101
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Flow max[3C24] nF)

This is configuration of which flow the max analogue signal from the sensor represents.

3C24 Flow max Stp A 1000	
Default:	1000Lit/s
Range	0 - 1000

Communication information

Modbus Instance no/DeviceNet no:	43718
Profibus slot/index	171/112
EtherCAT index (hex)	4e86
Profinet IO index	20102
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Ratio [3C25] Adv) nF)

This function sets the ratio between the actual flow and the read analogue value. The sensor characteristics is given by the sensor manufacturer. Linear ratio is by far the most commonly used.

3C25 Ratio Stp A Linear	
Default:	Linear
Linear	Ratio is linear
Quadratic	Ratio is quadratic

Communication information

Modbus Instance no/DeviceNet no:	43719
Profibus slot/index	171/113
EtherCAT index (hex)	4e87
Profinet IO index	20103
Fieldbus format	UInt
Modbus format	UInt

5.3.4 Start/Stop settings [330]

Submenu with all the functions for acceleration, deceleration, starting, stopping, etc.

Acceleration Time [331]

The acceleration time is defined as the time it takes for the motor to accelerate from 0 rpm to nominal motor speed.

NOTE: If the Acc Time is too short, the motor is accelerated according to the Torque Limit. The actual Acceleration Time may then be longer than the value set.

331 Acc Time Stp A 4.0s	
Default:	4.0 s
Range:	0.5 – 3600 s

Communication information

Modbus Instance no/DeviceNet no:	43101
Profibus slot/index	169/5
EtherCAT index (hex)	4c1d
Profinet IO index	19485
Fieldbus format	Long, 1=0.01 s
Modbus format	EInt

Fig. 31 shows the relationship between nominal motor speed/max speed and the acceleration time. The same is valid for the deceleration time.

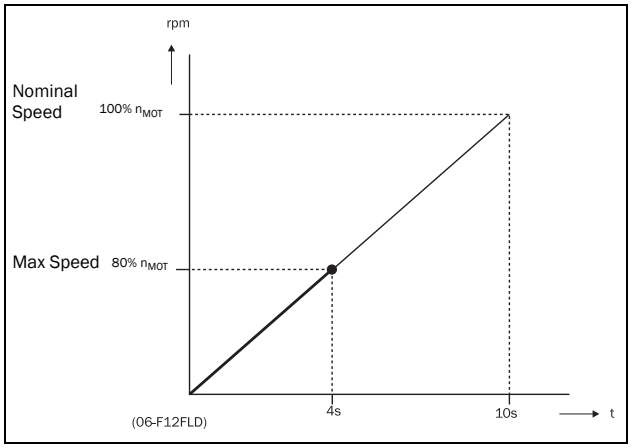


Fig. 31 Acceleration time and maximum speed

Fig. 32 shows the settings of the acceleration and deceleration times with respect to the nominal motor speed.

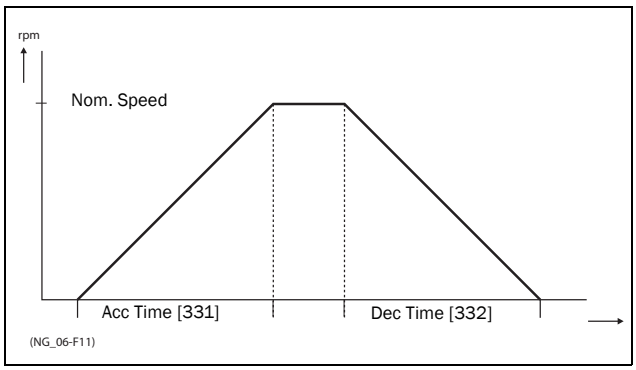


Fig. 32 Acceleration and deceleration times

Deceleration Time [332]

The deceleration time is defined as the time it takes for the motor to decelerate from nominal motor speed to 0 rpm.

332 Dec Time Stp A 4.0s	
Default:	4.0 s
Range:	0.5 – 3600 s

Communication information

Modbus Instance no/DeviceNet no:	43102
Profibus slot/index	169/6
EtherCAT index (hex)	4c1e
Profinet IO index	19486
Fieldbus format	Long, 1=0.01 s
Modbus format	EInt

NOTE: If the Dec Time is too short and the generator energy cannot be dissipated in a brake resistor, the motor is decelerated according to the overvoltage limit. The actual deceleration time may be longer than the value set.

Acceleration Time to Minimum Speed [335] Adv)

If minimum speed, [341]>0 Hz, is used in an application, the AC drive uses separate ramp times below this level. With "Acc>MinSpeed [335]" and "Dec<MinSpeed [336]" you can set the required ramp times. Short times can be used to prevent damage and excessive pump wear due too little lubrication at lower speeds. Longer times can be used to fill up a system smoothly and prevent water hammer due to rapidly exhausting air from the pipe system.

If a Minimum speed is programmed, this parameter will be used to select the acceleration time parameter [335] for speeds up to minimum speed at a run command. The ramp time is defined as the time it takes for the motor to accelerate from 0 rpm to nominal motor speed.

335 Acc>Min Spd Stp A 4.0s	
Default:	4.0 s
Range:	0.5 – 3600 s

Communication information

Modbus Instance no/DeviceNet no:	43105
Profibus slot/index	169/9
EtherCAT index (hex)	4c21
Profinet IO index	19489
Fieldbus format	Long, 1=0.01 s
Modbus format	EInt

Deceleration Time from Minimum Speed [336] Adv)

If a minimum speed is programmed, this parameter will be used to set the deceleration time from the minimum speed to 0 rpm at a stop command. The ramp time is defined as the time it takes for the motor to decelerate from the nominal motor speed to 0 rpm.

336 Dec<Min Spd Stp A 4.0s	
Default:	4.0 s
Range:	0.5 – 3600 s

Communication information

Modbus Instance no/DeviceNet no:	43106
Profibus slot/index	169/10
EtherCAT index (hex)	4c22
Profinet IO index	19490
Fieldbus format	Long, 1=0.01 s
Modbus format	EInt

Acceleration Ramp Type [337] Adv)

Sets the type of all the acceleration ramps in a parameter set. See Fig. 33. Depending on the acceleration and deceleration requirements for the application, the shape of both the ramps can be selected. For applications where speed changes need to be started and stopped smoothly, such as a conveyor belt with materials that can drop following a quick speed change, the ramp shape can be adapted to a S-shape and prevent speed change shocks. For applications that are not critical in this, the speed change can be fully linear over the complete range.

337 Acc Rmp Stp A Linear		
Default:		Linear
Linear	0	Linear acceleration ramp.
S-Curve	1	S-shape acceleration ramp.

NOTE: For S-curve ramps the ramp times, [331] and [332], defines the maximum acceleration and deceleration rated, i.e. linear part of S-curve, just as for the linear ramps. The S-curves are implemented so that for a speed step below sync speed the ramps are fully S-shaped while for larger steps the middle part will be linear. Therefore will a S-curve ramp from 0 –sync speed take 2 x Time while a step from 0–2 x sync speed will take 3 x Time (middle part 0.5sync speed – 1.5sync speed linear). Also valid for menu [338], Deceleration ramp type.

Communication information

Modbus Instance no/DeviceNet no:	43107
Profibus slot/index	169/11
EtherCAT index (hex)	4c23
Profinet IO index	19491
Fieldbus format	UInt
Modbus format	UInt

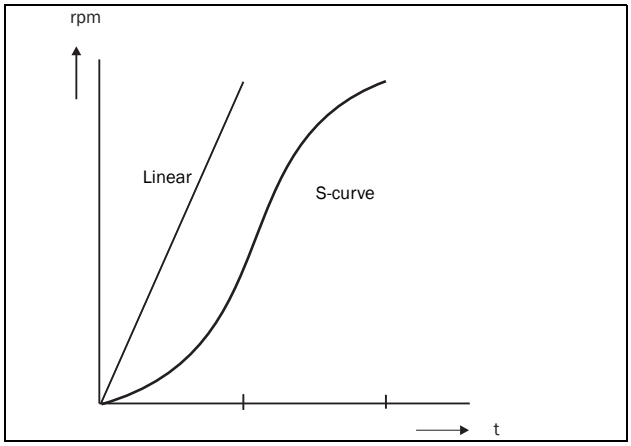


Fig. 33 Shape of acceleration ramp

Deceleration Ramp Type [338] Adv)

Sets the ramp type of all deceleration parameters in a parameter set Fig. 34.

338 Dec Rmp Stp A Linear	
Default:	Linear
Selection:	Same as menu [337]

Communication information

Modbus Instance no/DeviceNet no:	43108
Profibus slot/index	169/12
EtherCAT index (hex)	4c24
Profinet IO index	19492
Fieldbus format	UInt
Modbus format	UInt

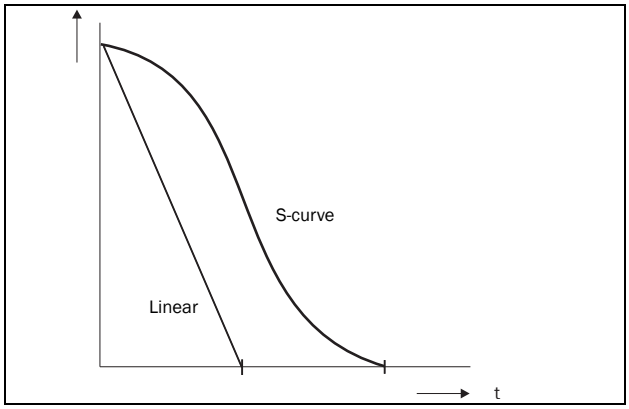


Fig. 34 Shape of deceleration ramp

Start Mode [339] Adv)

Sets the way of starting the motor when a run command is given.

339 Start Mode Stp A Fast		
Default:		Fast (fixed)
Fast	0	The motor flux increases gradually. The motor shaft starts rotating immediately once the Run command is given.

Communication information

Modbus Instance no/DeviceNet no:	43109
Profibus slot/index	169/13
EtherCAT index (hex)	4c25
Profinet IO index	19493
Fieldbus format	UInt
Modbus format	UInt

5.3.5 Speed [340]

Menu with all parameters for settings regarding to speeds, such as Min/Max speeds, Jog speeds, Skip speeds.

Minimum Speed [341]

Sets the minimum speed. The minimum frequency will operate as an absolute lower limit. Used to ensure the motor does not continuously run below a certain frequency and to maintain a certain performance.

In FlowDrive waste water applications, minimum frequency can generally be set to 70% of nominal motor frequency. I.e. 35Hz in case nominal motor frequency is 50Hz.

This parameter also affects the range where the Auto Tune program looks for the best efficiency point-BEP. In most cases this is low enough to be able to find the best efficiency point and high enough to ensure that the pump generates a sufficient flow. Adjust upwards if considered to be too low for keeping up with normal inflow (if set too low it will cause Auto tuning to take very long time or not to finish).

341 Min Speed Stp A 50Hz	
Default:	Same as “Motor Frequency [222]”
Range:	0 - Max Speed

NOTE: A lower speed value than the set minimum speed can be shown in the display due to motor slip.

Communication information

Modbus Instance no/DeviceNet no:	43730
Profibus slot/index	171/124
EtherCAT index (hex)	4e92
Profinet IO index	20114
Fieldbus format	UInt
Modbus format	UInt

Maximum Speed [343]

Sets the maximum speed. The maximum speed will operate as an absolute maximum limit. This parameter is used to prevent damage due to high speed.
The synchronous speed (Sync-spd) is determined by the parameter motor speed [225].

343 Max Speed Stp A Sync Speed		
Default:		Sync Speed
Sync Speed	0	Synchronous speed, i.e. no load speed, at nominal frequency.
1-24000rpm	1- 24000	Min Speed - 4 x Motor Sync Speed

Communication information

Modbus Instance no/DeviceNet no:	43731
Profibus slot/index	171/125
EtherCAT index (hex)	4e93
Profinet IO index	20115
Fieldbus format	UInt
Modbus format	UInt

NOTE: It is not possible to set the maximum speed lower than the minimum speed.

Note: Maximum speed [343] has priority over Min Speed [341], i.e. if [343] is set below [341] then the drive will run at [343] Max Speed with acceleration times given by [335] and [336] respectively.

BEP Speed [349] Adv)

This frequency is set automatically by the AutoTune program. see further in Chapter 2.3 page 13.

Read only	349 BEP Speed Stp A 0Hz
Default:	0 Hz
Range:	0 to max frequency

Communication information

Modbus Instance no/DeviceNet no:	43732
Profibus slot/index	171/126
EtherCAT index (hex)	4e94
Profinet IO index	20116
Fieldbus format	UInt
Modbus format	UInt

5.4 Load Monitor and Process Protection [400] Adv)

5.4.1 Load Monitor [410] Adv)

The load monitor function enables the AC drive to monitor the load, protecting machines and processes against mechanical overload and underload, e.g. a pump dry running or getting clogged.

In Waste water mode (set in [21C]) load monitor is used to detect clogging of the pump and automatically start pump cleaning if configured. Under normal circumstances, user does not need to do any configuration in menus [411] to [41C] as all settings are done during AutoTune program.

Alarm Select [411] Adv)

Selects the types of alarms that are active.

	411 Alarm Select Stp A Off	
Default:		Off
Off	0	No alarm functions active.
Min	1	Min Alarm active. The alarm output functions as an underload alarm.
Max	2	Max Alarm active. The alarm output functions as an overload alarm.
Max+Min	3	Both Max and Min alarm are active. The alarm outputs function as overload and underload alarms.

Communication information

Modbus Instance no/DeviceNet no:	43321
Profibus slot/index	169/225
EtherCAT index (hex)	4cf9
Profinet IO index	19705
Fieldbus format	UInt
Modbus format	UInt

Alarm Trip [412] Adv)

Selects which alarm must cause a trip to the AC drive.

412 Alarm trip Stp A Off	
Default:	Off
Selection:	Same as in menu [411]

Communication information

Modbus Instance no/DeviceNet no:	43322
Profibus slot/index	169/226
EtherCAT index (hex)	4cfa
Profinet IO index	19706
Fieldbus format	UInt
Modbus format	UInt

Ramp Alarm [413] Adv)

This function inhibits the (pre) alarm signals during acceleration/deceleration of the motor to avoid false alarms.

	413 Ramp Alarm Stp A Off	
Default:		Off
Off	0	(Pre) alarms are inhibited during acceleration/deceleration.
On	1	(Pre) alarms active during acceleration/ deceleration.

Communication information

Modbus Instance no/DeviceNet no:	43323
Profibus slot/index	169/227
EtherCAT index (hex)	4cfb
Profinet IO index	19707
Fieldbus format	UInt
Modbus format	UInt

Alarm Start Delay [414] Adv)

This parameter is used if, for example, you want to override an alarm during the start-up procedure.

Sets the delay time after a run command, after which the alarm may be given.

- If Ramp Alarm=On. The start delay begins after a RUN command.
- If Ramp Alarm=Off. The start delay begins after the acceleration ramp.

414 Start Delay Stp A 5s	
Default:	5 s
Range:	0-3600 s

Communication information

Modbus Instance no/DeviceNet no:	43324
Profibus slot/index	169/228
EtherCAT index (hex)	4cfc
Profinet IO index	19708
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Load Type [415] Adv)

In this menu you select monitor type according to the load characteristic of your application. By selecting the required monitor type, the overload and underload alarm function can be optimized according to the load characteristic.

When the application has a constant load over the whole speed range, i.e. extruder or screw compressor, the load type can be set to basic. This type uses a single value as a reference for the nominal load. This value is used for the complete speed range of the AC drive. The value can be set or automatically measured. See Autoset Alarm [41A] and "Normal Load [41B]" about setting the nominal load reference.

The load curve mode uses an interpolated curve with 9 load values at 8 equal speed intervals. This curve is populated by a Test run with a real load. This can be used with any smooth load curve including constant load.

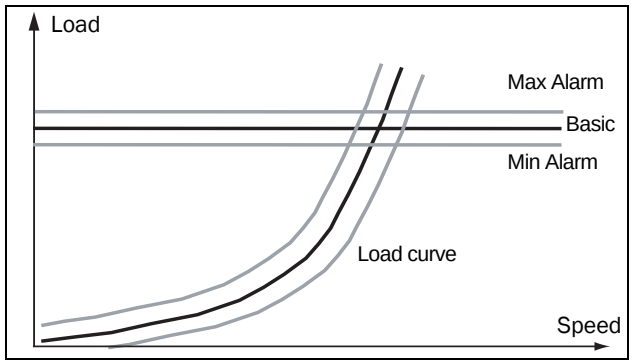


Fig. 35

	415 Load Type Stp A Load curve	
Default:		Load curve
Basic	0	Uses a fixed maximum and minimum load level over the full speed range. Can be used in situations where the torque is independent of the speed.
Load Curve	1	Uses the measured actual load characteristic of the process over the speed range.

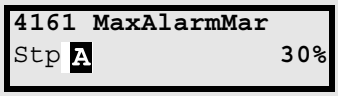
Communication information

Modbus Instance no/DeviceNet no:	43325
Profibus slot/index	169/229
EtherCAT index (hex)	4cfd
Profinet IO index	19709
Fieldbus format	UInt
Modbus format	UInt

Max Alarm [416] Adv)

Max Alarm Margin [4161] Adv)

With load type Basic, [415], used the Max Alarm Margin sets the band above the "Normal Load [41B]" menu that does not generate an alarm. With load type Load Curve [415], used the Max Alarm Margin sets the band above the Load Curve [41C], that does not generate an alarm. The Max Alarm Margin is a percentage of nominal motor torque.



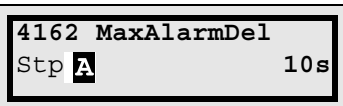
Default:	30%
Range:	0–400%

Communication information

Modbus Instance no/DeviceNet no:	43326
Profibus slot/index	169/230
EtherCAT index (hex)	4cfe
Profinet IO index	19710
Fieldbus format	Long, 1=1%
Modbus format	Eint

Max Alarm delay [4162] Adv)

When the load level without interruption exceeds the alarm level longer than set "Max Alarm delay" time, an alarm is activated.



Default:	10 s
Range:	0-90 s

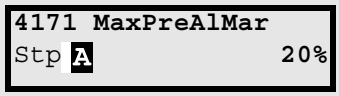
Communication information

Modbus Instance no/DeviceNet no:	43330
Profibus slot/index	169/234
EtherCAT index (hex)	4d02
Profinet IO index	19714
Fieldbus format	Long, 1=0.1 s
Modbus format	EInt

Max Pre Alarm [417] Adv)

Max Pre AlarmMargin [4171] Adv)

With load type Basic [415], used the Max Pre-Alarm Margin sets the band above the Normal Load, [41B], menu that does not generate a pre-alarm. With load type Load Curve, [415], used the Max Pre-Alarm Margin sets the band above the Load Curve, [41C], that does not generate a pre-alarm. The Max Pre-Alarm Margin is a percentage of nominal motor torque.



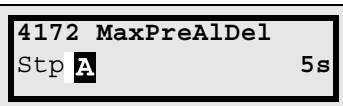
Default:	20%
Range:	0–400%

Communication information

Modbus Instance no/DeviceNet no:	43327
Profibus slot/index	169/231
EtherCAT index (hex)	4cff
Profinet IO index	19711
Fieldbus format	Long, 1=1%
Modbus format	EInt

Max Pre Alarm delay [4172] Adv)

When the load level without interruption exceeds the alarm level longer than set "Max PreAlarm delay" time, a warning is activated.



Default:	5 s
Range:	0–90 s

Communication information

Modbus Instance no/DeviceNet no:	43331
Profibus slot/index	169/235
EtherCAT index (hex)	4d03
Profinet IO index	19715
Fieldbus format	Long, 1=0.1 s
Modbus format	EInt

Min Pre Alarm [418] Adv)

Min Pre Alarm Margin [4181] Adv)

With load type Basic, [415], used the Min Pre-Alarm Margin sets the band under the Normal Load, [41B], menu that does not generate a pre-alarm. With load type Load Curve, [415], used the Min Pre-Alarm Margin sets the band under the Load Curve, [41C], that does not generate a

pre-alarm. The Min Pre-Alarm Margin is a percentage of nominal motor torque.

	4181 MinPreAlMar Stp A 20%
Default:	20%
Range:	0-400%

Communication information

Modbus Instance no/DeviceNet no:	43328
Profibus slot/index	169/232
EtherCAT index (hex)	4d00
Profinet IO index	19712
Fieldbus format	Long, 1=1%
Modbus format	EInt

Min Pre Alarm Response delay [4182] Adv)

When the load level without interruption is below the alarm level longer than set "Min PreAlarm delay" time, a warning is activated.

	4182 MinPreAlDel Stp A 5s
Default:	5 s
Range:	0-90 s

Communication information

Modbus Instance no/DeviceNet no:	43332
Profibus slot/index	169/236
EtherCAT index (hex)	4d04
Profinet IO index	19716
Fieldbus format	Long, 1=0.1 s
Modbus format	EInt

Min Alarm [419] Adv)

Min Alarm Margin [4191] Adv)

With load type Basic, [415], used the Min Alarm Margin sets the band under the "Normal Load [41B]", menu that does not generate an alarm. With load type "Load Curve [415]", used the Min Alarm Margin sets the band under the "Load Curve [41C]", that does not generate an alarm. The Max Alarm Margin is a percentage of nominal motor torque.

	4191 MinAlarmMar Stp A 30%
Default:	30%
Range:	0-400%

Communication information

Modbus Instance no/DeviceNet no:	43329
Profibus slot/index	169/233
EtherCAT index (hex)	4d01
Profinet IO index	19713
Fieldbus format	Long, 1=1%
Modbus format	EInt

Min Alarm Response delay [4192] Adv)

When the load level without interruption is below the alarm level longer than set "Min Alarm delay" time, an alarm is activated.

	4192 MinAlarmDel Stp A 10s
Default:	10 s
Range:	0-90 s

Communication information

Modbus Instance no/DeviceNet no:	43333
Profibus slot/index	169/237
EtherCAT index (hex)	4d05
Profinet IO index	19717
Fieldbus format	Long, 1=0.1 s
Modbus format	EInt

Autoset Alarm [41A] Adv)

The Autoset Alarm function can measure the nominal load that is used as reference for the alarm levels. If the selected "Load Type [415]" is Basic it copies the load the motor is running with to the menu "Normal Load [41B]". The motor must run on the speed that generates the load that needs to be recorded. If the selected "Load Type [415]" is Load Curve it performs a test-run and populates the "Load Curve [41C]" with the found load values.

WARNING!
When autoset does a Test run the motor and application/machine will ramp up to maximum speed.

NOTE: The motor must be running for the Autoset Alarm function to succeed. A not running motor generates a "Failed!" message.

		41A AutoSet Alrm Stp A No
Default:		No
No	0	
Yes	1	

Communication information

Modbus Instance no/DeviceNet no:	43334
Profibus slot/index	169/238
EtherCAT index (hex)	4d06
Profinet IO index	19718
Fieldbus format	UInt
Modbus format	UInt

The default set levels for the (pre)alarms are:

Overload	Max Alarm	menu [4161] + [41B]
	Max Pre Alarm	menu [4171] + [41B]
Underload	Min Pre Alarm	menu [41B] - [4181]
	Min Alarm	menu [41B] - [4191]

These default set levels can be manually changed in menus [416] to [419]. After execution the message "Autoset OK!" is displayed for 1s and the selection reverts to "No".

Normal Load [41B] Adv)

Set the level of the normal load. The alarm or pre alarm will be activated when the load is above/under normal load ± margin.

41B Normal Load Stp A 100%	
Default:	100%
Range:	0-400% of max torque

NOTE: 100% Torque means: I_{NOM}= I_{MOT}. The maximum depends on the motor current and AC drive max current settings, but the absolute maximum adjustment is 400%.

Communication information

Modbus Instance no/DeviceNet no:	43335
Profibus slot/index	169/239
EtherCAT index (hex)	4d07
Profinet IO index	19719
Fieldbus format	Long, 1=1%
Modbus format	EInt

Load Curve [41C] Adv)

The load curve function can be used with any smooth load curve. The curve can be populated with a test-run or the values can be entered or changed manually.

Load Curve 1-9 [41C1]-[41C9] Adv)

The measured load curve is based on 9 stored samples. The curve starts at minimum speed and ends at maximum speed, the range in between is divided into 8 equal steps. The measured values of each sample are displayed in [41C1] to [41C9] and can be adapted manually. The value of the 1st sampled value on the load curve is displayed.

41C1 Load Curve1 Stp A 0rpm 100%	
Default:	0rpm 100%
Range:	0–400% of max torque

Communication information

Modbus Instance no/DeviceNet no:	43336%, 43337 rpm, 43338 %, 43339 rpm, 43340 %, 43341 rpm, 43342 %, 43343 rpm, 43344 %, 43345 rpm, 43346 %, 43347 rpm, 43348 %, 43349 rpm, 43350 %, 43351 rpm, 43352 %, 43353 rpm
Profibus slot/index	169/240, 169/242, 169/244, 169/246, 169/248, 169/250, 169/252, 169/254, 170/1
EtherCAT index (hex)	4d08 %, 4d09 rpm, 4d0a %, 4d0b rpm, 4d0c %, 4d0d rpm, 4d0e %, 4d0f rpm, 4d10 %, 4d11 rpm, 4d12 %, 4d13 rpm, 4d14 %, 4d15 rpm, 4d16 %, 4d17 rpm, 4d18 %, 4d19 rpm
Profinet IO index	19720 %, 19721 rpm, 19722 %, 19723 rpm, 19724 %, 19725 rpm, 19726 %, 19727 rpm, 19728 %, 19729 rpm, 19730 %, 19731 rpm, 19732 %, 19733 rpm, 19734 %, 19735 rpm, 19736 %, 19738 rpm,
Fieldbus format	Long, 1= 1 %, Int 1=1 rpm
Modbus format	EInt

NOTE: The speed values depend on the Min- and Max Speed values. they are read only and cannot be changed.

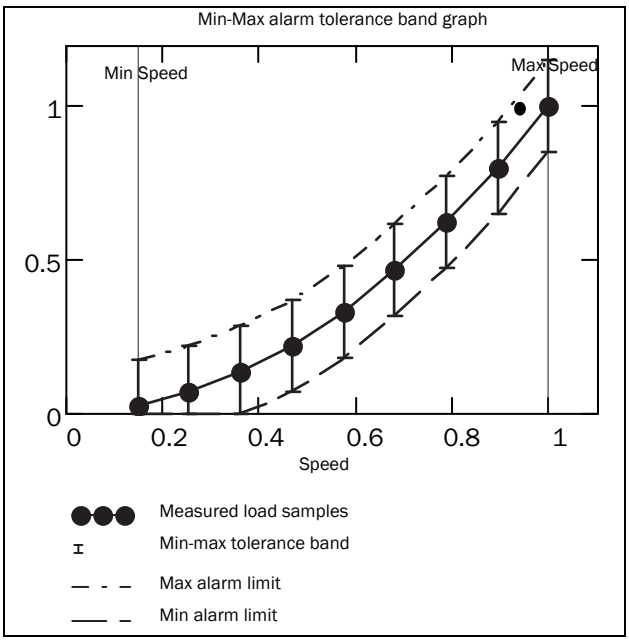


Fig. 36

5.4.2 Process Protection [420]

Submenu with settings regarding protection functions for the AC drive and the motor.

Low Voltage Override [421]

If a dip in the mains supply occurs and the low voltage override function is enabled, the AC drive will automatically decrease the motor speed to keep control of the application and prevent an under voltage trip until the input voltage rises again. Therefore the rotating energy in the motor/load is used to keep the DC link voltage level at the override level, for as long as possible or until the motor comes to a standstill. This is dependent on the inertia of the motor/load combination and the load of the motor at the time the dip occurs, see Fig. 37.

	421 Low Volt OR Stp **A** **On**	
Default:		On
Off	0	At a voltage dip the low voltage trip will protect.
On	1	At mains dip, AC drive ramps down until voltage rises.

Communication information

Modbus Instance no/DeviceNet no:	43361
Profibus slot/index	170/10
EtherCAT index (hex)	4d21
Profinet IO index	19745
Fieldbus format	UInt
Modbus format	UInt

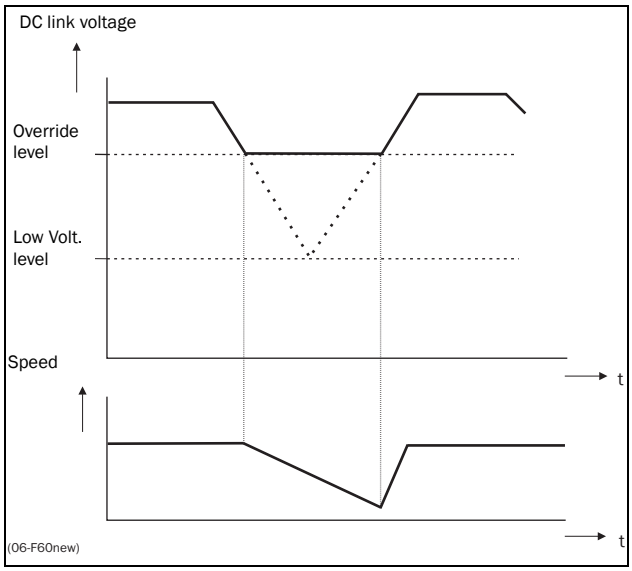
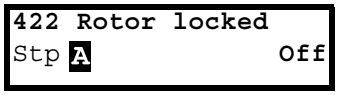


Fig. 37 Low voltage override

NOTE: During the low voltage override the LED trip/limit blinks.

Rotor locked [422]

With the rotor locked function enabled, the AC drive will protect the motor and application when this is stalled whilst increasing the motor speed from standstill. This protection will coast the motor to stop and indicate a fault when the Torque Limit has been active at very low speed for more than 5 seconds.



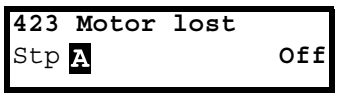
Default:		Off
Off	0	No detection
On	1	AC drive will trip when locked rotor is detected. Trip message “Locked Rotor”.

Communication information

Modbus Instance no/DeviceNet no:	43362
Profibus slot/index	170/11
EtherCAT index (hex)	4d22
Profinet IO index	19746
Fieldbus format	UInt
Modbus format	UInt

Motor lost [423]

With the motor lost function enabled, the AC drive is able to detect a fault in the motor circuit: motor, motor cable, thermal relay or output filter. Motor lost will cause a trip, and the motor will coast to standstill, when a missing motor phase is detected during a period of 500 ms. The detection time during DC-start is 50 ms and during Fast-start 10 ms.



Default:		Off
Off	0	Function switched off to be used if no motor or very small motor connected.
Trip	1	AC drive will trip when the motor is disconnected. Trip message “Motor Lost”.
Start	2	Test for disconnected motor will only be performed during start routine.

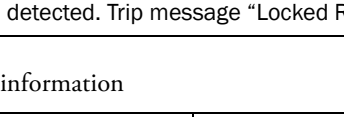
Communication information

Modbus Instance no/DeviceNet no:	43363
Profibus slot/index	170/12
EtherCAT index (hex)	4d23
Profinet IO index	19747
Fieldbus format	UInt
Modbus format	UInt

Overvolt control [424]

Used to switch off the overvoltage control function when only braking by brake chopper and resistor is required. The overvoltage control function, limits the braking torque so that the DC link voltage level is controlled at a high, but safe, level. This is achieved by limiting the actual deceleration rate during stopping. In case of a defect at the brake chopper or the brake resistor the AC drive will trip for “Overvoltage” to avoid a fall of the load e.g. in crane applications.

NOTE: Overvoltage control should not be activated if brake chopper is used. Brake chopper is not available with FlowDrive.



Default:		On
On	0	Overvoltage control activated
Off	1	Overvoltage control off

Communication information

Modbus Instance no/DeviceNet no:	43364
Profibus slot/index	170/13
EtherCAT index (hex)	4d24
Profinet IO index	19748
Fieldbus format	UInt
Modbus format	UInt

OverflowPolarity [425]

Select polarity of overflow digital switch.

Default:		High
High	0	Overflow is detected when input goes high.
Low	1	Overflow is detected when input goes low.

Communication information

Modbus Instance no/DeviceNet no:	43365
Profibus slot/index	170/14
EtherCAT index (hex)	4d25
Profinet IO index	19749
Fieldbus format	UInt
Modbus format	UInt

Sensor lost[426] nF)

Delay time before triggering sensor lost alarm.

	426 Sensor lost Stp A Off
Default:	Off
Range	Off - 60s

Communication information

Modbus Instance no/DeviceNet no:	43366
Profibus slot/index	170/15
EtherCAT index (hex)	4d26
Profinet IO index	19750
Fieldbus format	UInt, 1=1
Modbus format	UInt

5.4.3 Person Prot [430] nF)

Personal protection, here it is possible to activate a personal protection alarm via digital inputs. The intention is to make an remote operator aware of potential accident at the site. To function, this requires connection to ta remote SCADA (Supervisory Control And Data Acquisition) system.

The technician activates the "PreAlarm" counter when entering the pump station; e.g. by turning On the interior light. In this case we use a two pole light switch connected to the interior light as well as a digital input configured as "PP Timer".
If the technician does not reset the timer, by switching the light Off/On, before the time set in "[431] PreAlarm" a digital output signal "PP PreAlarm" is set. This is normally connected to a local Pre alarm device to notify that the time is out.

If PreAlarm is not reset within the time set in "[432] Alarm" a "Pers Protection warning" will be triggered. This warning will not have any impact on the pump operation, it is only to make the remote operator aware of the situation, that something has happened at the site.

In following wiring example we have used Relay 3 and DigIn 5 but also other connection points are possible if they are free.

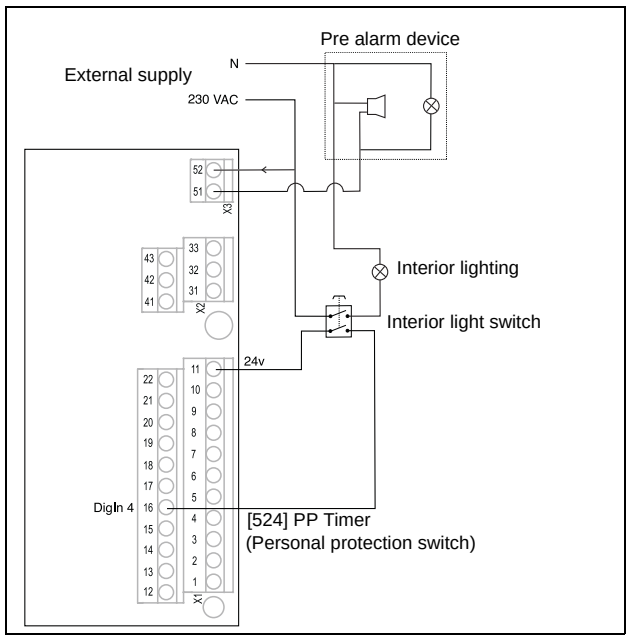


Fig. 38 Wiring example for Personal protection alarm

PreAlarm[431] nF)

Delay before personal protection PreAlarm is triggered**.**

	431 PreAlarm Stp A 30min
Default:	30min
Range	0 - 60min

Communication information

Modbus Instance no/DeviceNet no:	43367
Profibus slot/index	170/15
EtherCAT index (hex)	4d27
Profinet IO index	19751
Fieldbus format	UInt, 1=1
Modbus format	UInt

Alarm[432] nF)

Delay before personal protection warning is triggered.

	432 Alarm Stp A 5min
Default:	5min
Range	0 - 60min

Communication information

Modbus Instance no/DeviceNet no:	43368
Profibus slot/index	170/16
EtherCAT index (hex)	4d28
Profinet IO index	19752
Fieldbus format	UInt, 1=1
Modbus format	UInt

5.4.4 User trips[440] nF)

Here it is possible to configure up to four external triggered alarms with your own message and alarm behaviour. Configure DigitalIn as “User trip 1” to “User trip 4”.

User trips 1[441] nF)

Action 1 [4411] nF)

Select alarm action. See description of alarm actions in Chapter 6.1 page 145.

		4411 Action 1 Stp A No action
Default:		No action
No action	0	
Warning	1	
Log only	2	
Soft trip	3	
Hard trip	4	

Communication information

Modbus Instance no/DeviceNet no:	42313
Profibus slot/index	165/237
EtherCAT index (hex)	4909
Profinet IO index	18697
Fieldbus format	UInt
Modbus format	UInt

Delay 1[4412] nF)

Delay time before the alarm is triggered. Timer will be reset if alarm condition is interrupted.

4412 Delay 1 Stp A 0s	
Default:	0s
Range	0 - 3600s

Communication information

Modbus Instance no/DeviceNet no:	42314
Profibus slot/index	165/238
EtherCAT index (hex)	490a
Profinet IO index	18698
Fieldbus format	UInt
Modbus format	UInt

Active polarity 1[4413] nF)

Set if alarm shall be triggered active high or low.

		4413 Active pol 1 Stp A High
Default:		High
High	0	Alarm activated when signal is high
Low	1	Alarm activated when signal is low

Communication information

Modbus Instance no/DeviceNet no:	42315
Profibus slot/index	165/239
EtherCAT index (hex)	490b
Profinet IO index	18699
Fieldbus format	UInt, 1=1
Modbus format	UInt

Autoreset 1[4414] nF)

Select if alarm should be Autoreset. Set desired delay time to pass before a Autoreset. Requires that Autoreset is enabled in menu “ Number of Trips [251]” on page 48.

4414 Autoreset 1 Stp A Off	
Default:	Off
Range	Off - 3600s

Communication information

Modbus Instance no/DeviceNet no:	42316
Profibus slot/index	165/240
EtherCAT index (hex)	490c
Profinet IO index	18700
Fieldbus format	UInt, 1=1
Modbus format	UInt

Trip name 1[4415] nF)

Possibility to select between predefined trip names or define your own alarm name in menu “Trip text 1[4416] nF)” to be used.

		4415 Trip name 1 Stp A User defined
Default:		User defined
User defined	0	As defined in menu [4416]
Pump temp	1	Temperature in pump to high
WtrInPumpOil	2	Water in pump oil

Communication information

Modbus Instance no/DeviceNet no:	42317
Profibus slot/index	165/241
EtherCAT index (hex)	490d
Profinet IO index	18701
Fieldbus format	UInt
Modbus format	UInt

Trip text 1[4416] nF)

Here you can type your own alarm text.

4416 Trip text 1 Stp A User trip 1	
Default:	User trip 1

Communication information

Modbus Instance no/DeviceNet no:	42318 - 42329
Profibus slot/index	165/242 - 165/253
EtherCAT index (hex)	490e - 4919
Profinet IO index	18702 - 18713
Fieldbus format	UInt
Modbus format	UInt

User trips 2 - 4 [442] to [444] nF)

Same as menus [4411] to [4416]

Communication information

Modbus Instance no/ DeviceNet no:	42330 - 42335 42347 - 42352 42364 - 42369	User trip 2 3 4
Profibus slot/index	165/264 - 166/4 166/16 - 166/21 166/33 - 166/38	User trip 2 3 4
EtherCAT index (hex)	491a - 491f 492b - 4930 493c - 4941	User trip 2 3 4
Profinet IO index	18714 - 18719 18731 - 18736 18748 - 18753	User trip 2 3 4
Fieldbus format	UInt	
Modbus format	UInt	

5.5 I/Os and Virtual Connections [500]

Main menu with all the settings of the standard inputs and outputs of the AC drive.

5.5.1 Analogue Inputs [510]

Submenu with all settings for the analogue inputs.

AnIn1 Function [511]

Sets the function for Analogue input 1. Scale and range are defined by AnIn1 Advanced settings [513].

		511 AnIn1 Fc Stp A Level sensor
Default:		Level sensor
Off	0	Input is not active
Max Speed	1	The input acts as an upper speed limit.
Max Torque	2	The input acts as an upper torque limit.
Process Val	3	The input value equals the actual process value (feedback) and is compared to the reference signal (set point) by the PID controller, or can be used to display and view the actual process value.
Process Ref	4	Reference value is set for control in process units, see Process Source [321] and Process Unit [322].
Min Speed	5	The input acts as a lower speed limit.
Level sensor	6	Analogue level meter to determine the level in the sump.
Flow sensor	7	Analogue flow meter to determine the output flow.

Communication information

Modbus Instance no/DeviceNet no:	43201
Profibus slot/index	169/105
EtherCAT index (hex)	4c81
Profinet IO index	19585
Fieldbus format	UInt
Modbus format	UInt

NOTE: When AnInX Func=Off, the connected signal will still be available for Comparators [610].

AnIn1 Setup [512]

The analogue input setup is used to configure the analogue input in accordance with the signal used that will be connected to the analogue input. With this selection the input can be determined as current (4-20 mAdv) or voltage (0-10 V) controlled input. Other selections are available for using a threshold (live zero), a bipolar input function, or a user defined input range. With a bipolar input reference signal, it is possible to control the motor in two directions. See Fig. 39.

NOTE: The selection of voltage or current input is done with S1. When the switch is in voltage mode only the voltage menu items are selectable. With the switch in current mode only the current menu items are selectable.

		512 AnIn1 Setup Stp A 4-20mA
Default:		4-20 mA
Dependent on		Setting of switch S1
4–20mA	0	The current input has a fixed threshold (Live Zero) of 4 mA and controls the full range for the input signal. See Fig. 81.
0–20mA	1	Normal full current scale configuration of the input that controls the full range for the input signal. See Fig. 80.
User mA	2	The scale of the current controlled input, that controls the full range for the input signal. Can be defined by the advanced AnIn Min and AnIn Max menus.
User Bipol mA	3	Sets the input for a bipolar current input, where the scale controls the range for the input signal. Scale can be defined in advanced menu AnIn Bipol.
0–10V	4	Normal full voltage scale configuration of the input that controls the full range for the input signal. See Fig. 80.
2–10V	5	The voltage input has a fixed threshold (Live Zero) of 2 V and controls the full range for the input signal. See Fig. 81.
User V	6	The scale of the voltage controlled input, that controls the full range for the input signal. Can be defined by the advanced AnIn Min and AnIn Max menus.
User Bipol V	7	Sets the input for a bipolar voltage input, where the scale controls the range for the input signal. Scale can be defined in advanced menu AnIn Bipol.

NOTE: For bipol function, input RunR and RunL needs to be active and Rotation, [219] must be set to "R+L".

NOTE: Always check the needed set up when the setting of S1 is changed; selection will not adapt automatically.

Communication information

Modbus Instance no/DeviceNet no:	43202
Profibus slot/index	169/106
EtherCAT index (hex)	4c82
Profinet IO index	19586
Fieldbus format	UInt
Modbus format	UInt

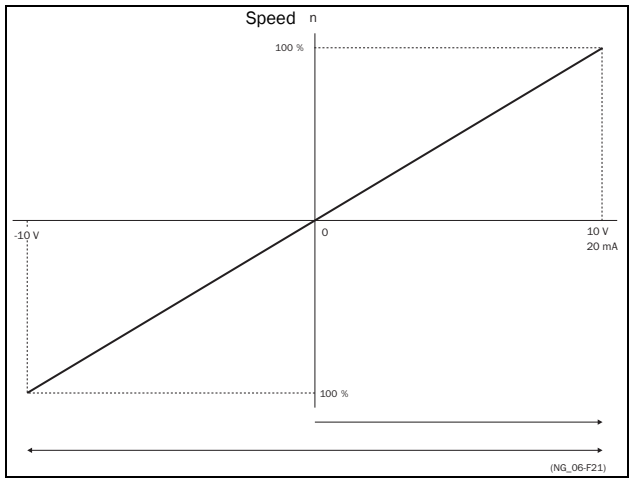


Fig. 39

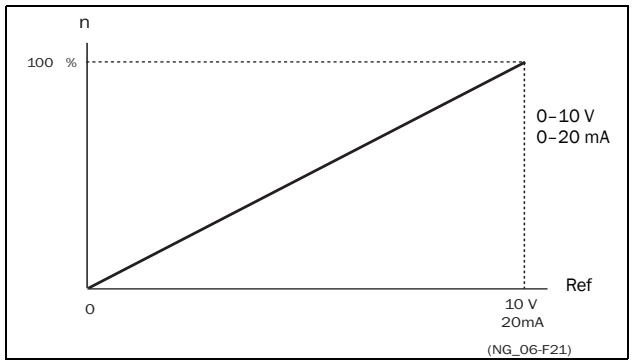


Fig. 40 Normal full-scale configuration

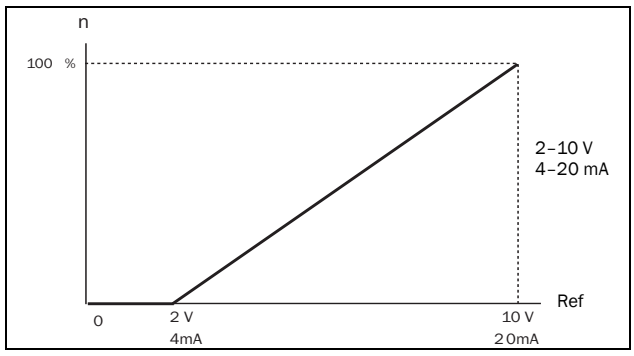


Fig. 41 2–10 V/4–20 mA (Live Zero)

AnIn1 Advanced [513]

NOTE: The different menus will automatically be set to either “mA” or “V”, based on the selection in AnIn 1 Setup [512].

```
513 AnIn1 Advan
Stp A
```

AnIn1 Min [5131]

Parameter to set the minimum value of the external reference signal. Only visible if [512] = User mA/V.

```
5131 AnIn1 Min
Stp A          4.00mA
```

Default:	4.00 mA
Range:	0.00–20.00 mA

Communication information

Modbus Instance no/DeviceNet no:	43203
Profibus slot/index	169/107
EtherCAT index (hex)	4c83
Profinet IO index	19587
Fieldbus format	Long, 1=0.01 mA, 0.01 V
Modbus format	EInt

AnIn1 Max [5132]

Parameter to set the maximum value of the external reference signal. Only visible if [512] = User mA/V.

```
5132 AnIn1 Max
Stp           20.00mA
```

Default:	20.00 mA
Range:	0.00–20.00 mA

Communication information

Modbus Instance no/DeviceNet no:	43204
Profibus slot/index	169/108
EtherCAT index (hex)	4c84
Profinet IO index	19588
Fieldbus format	Long, 1=0.01 mA, 0.01 V
Modbus format	EInt

Special function: Inverted reference signal

If the AnIn minimum value is higher than the AnIn maximum value, the input will act as an inverted reference input, see Fig. 42.

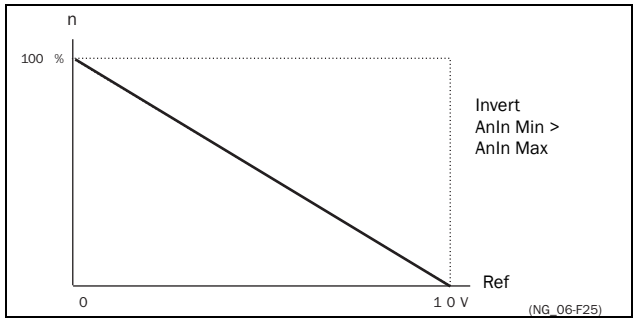


Fig. 42 Inverted reference

AnIn1 Bipol [5133]

This menu is automatically displayed if AnIn1 Setup is set to User Bipol mA or User Bipol V. The window will automatically show mA or V range according to selected function. The range is set by changing the positive maximum value; the negative value is automatically adapted accordingly. Only visible if [512] = User Bipol mA/V. The inputs RunR and RunL input need to be active, and “Rotation [219]”, must be set to “R+L”, to operate the bipolar function on the analogue input.

```
5133 AnIn1 Bipol
Stp A          20.00mA
```

Default:	20.00 mA
Range:	0.0–20.0 mA

Communication information

Modbus Instance no/DeviceNet no:	43205
Profibus slot/index	169/109
EtherCAT index (hex)	4c85
Profinet IO index	19589
Fieldbus format	Long, 1=0.01 mA, 0.01 V
Modbus format	EInt

AnIn1 Function Min [5134]

With AnIn1 Function Min the physical minimum value is scaled to selected process unit. The default scaling is dependent of the selected function of AnIn1 [511].

	5134 AnIn1 FcMin Stp A Min	
Default:		Min
Min	0	Min value
Max	1	Max value
User-defined	2	Define user value in menu [5135]

Table 9 shows corresponding values for the min and max selections depending on the function of the analogue input [511].

Table 9

AnIn Function	Min	Max
Speed	Min Speed [341]	Max Speed [343]
Torque	0%	Max Torque [351]
Process Ref	Process Min [324]	Process Max [325]
Process Value	Process Min [324]	Process Max [325]

Communication information

Modbus Instance no/DeviceNet no:	43206
Profibus slot/index	169/110
EtherCAT index (hex)	4c86
Profinet IO index	19590
Fieldbus format	UInt
Modbus format	UInt

AnIn1 Function Value Min [5135]

With AnIn1 Function ValMin you define a user-defined value for the signal. Only visible when user-defined is selected in menu [5134].

5135 AnIn1 VaMin Stp A 0.000	
Default:	0.000
Range:	-10000.000 – 10000.000

Communication information

Modbus Instance no/DeviceNet no:	43541
Profibus slot/index	170/190
EtherCAT index (hex)	4dd5
Profinet IO index	19925
Fieldbus format	Long, 1=1 rpm, 1 %, 1° or 0.001 if Process Value/ Process Ref using a [322] unit
Modbus format	EInt

AnIn1 Function Max [5136]

With AnIn1 Function Max the physical maximum value is scaled to selected process unit. The default scaling is dependent of the selected function of AnIn1 [511]. See Table 9.

	5136 AnIn1 FcMax Stp A Max	
Default:		Max
Min	0	Min value
Max	1	Max value
User-defined	2	Define user value in menu [5137]

Communication information

Modbus Instance no/DeviceNet no:	43207
Profibus slot/index	169/111
EtherCAT index (hex)	4c87
Profinet IO index	19591
Fieldbus format	UInt
Modbus format	UInt

AnIn1 Function Value Max [5137]

With AnIn1 Function VaMax you define a user-defined value for the signal. Only visible when user-defined is selected in menu [5136].

5137 AnIn1 VaMax Stp A 0.000	
Default:	0.000
Range:	-10000.000 – 10000.000

Communication information

Modbus Instance no/DeviceNet no:	43551
Profibus slot/index	170/200
EtherCAT index (hex)	4ddf
Profinet IO index	19935
Fieldbus format	Long, 1=1 rpm, 1 %, 1° or 0.001 if Process Value/ Process Ref using a [322] unit
Modbus format	EInt

NOTE: With AnIn Min, AnIn Max, AnIn Function Min and AnIn Function Max settings, loss of feedback signals (e.g. voltage drop due to long sensor wiring) can be compensated to ensure an accurate process control.

AnIn1 Operation [5138]

	5138 AnIn1 Oper Stp A Add+	
Default:		Add+
Add+	0	Analogue signal is added to selected function in menu [511].
Sub-	1	Analogue signal is subtracted from selected function in menu [511].

Communication information

Modbus Instance no/DeviceNet no:	43208
Profibus slot/index	169/112
EtherCAT index (hex)	4c88
Profinet IO index	19592
Fieldbus format	UInt
Modbus format	UInt

AnIn1 Filter [5139]

If the input signal is unstable (e.g. fluctuation reference value), the filter can be used to stabilize the signal. A change of the input signal will reach 63% on AnIn1 within the set AnIn1 Filter time. After 5 times the set time, AnIn1 will have reached 100% of the input change. See Fig. 43.

5139 AnIn1 Filt Stp A 0.1s	
Default:	0.1 s
Range:	0.001 – 10.0 s

Communication information

Modbus Instance no/DeviceNet no:	43209
Profibus slot/index	169/113
EtherCAT index (hex)	4c89
Profinet IO index	19593
Fieldbus format	Long, 1=0.001 s
Modbus format	EInt

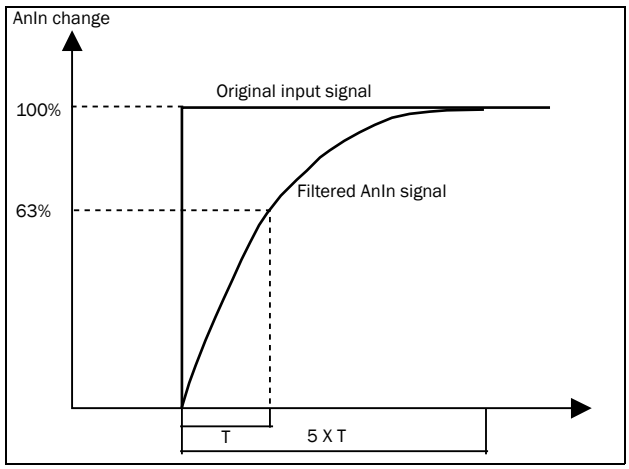


Fig. 43

AnIn1 Enable [513A]

Parameter for enable/disable analogue input selection via digital inputs (DigIn set to function AnIn Select).

	513A AnIn1 Enabl Stp A On	
Default:		On
On	0	AnIn1 is always active
!DigIn	1	AnIn1 is only active if the digital input is low.
DigIn	2	AnIn1 is only active if the digital input is high.

Communication information

Modbus Instance no/DeviceNet no:	43210
Profibus slot/index	169/114
EtherCAT index (hex)	4c8a
Profinet IO index	19594
Fieldbus format	UInt
Modbus format	UInt

AnIn2 Function [514]

Parameter for setting the function of Analogue Input 2.

Same function as “AnIn1 Fc [511]”.

514 AnIn2 Fc Stp A Off	
Default:	Off
Selection:	Same as in menu [511]

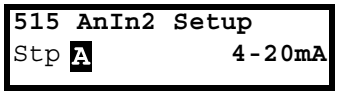
Communication information

Modbus Instance no/DeviceNet no:	43211
Profibus slot/index	169/115
EtherCAT index (hex)	4c8b
Profinet IO index	19595
Fieldbus format	UInt
Modbus format	UInt

AnIn2 Setup [515]

Parameter for setting the function of Analogue Input 2.

Same functions as “AnIn1 Setup [512]”.

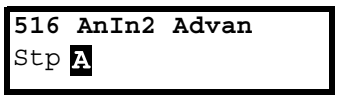
	
Default:	4 – 20 mA
Dependent on	Setting of switch S2
Selection:	Same as in menu [512].

Communication information

Modbus Instance no/DeviceNet no:	43212
Profibus slot/index	169/116
EtherCAT index (hex)	4c8c
Profinet IO index	19596
Fieldbus format	UInt
Modbus format	UInt

AnIn2 Advanced [516]

Same functions and submenus as under “AnIn1 Advan [513]”.



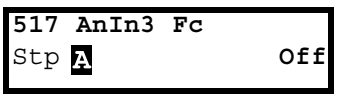
Communication information

Modbus Instance no/DeviceNet no:	43213–43220, 43542, 43552
Profibus slot/index	169/117–124, 170/191, 170/201
EtherCAT index (hex)	4c8d - 4c94, 4dd6, 4de0
Profinet IO index	19597-19604, 19926, 19936
Fieldbus format	See [5131] - [5137].
Modbus format	

AnIn3 Function [517]

Parameter for setting the function of Analogue Input 3.

Same function as “AnIn1 Fc [511]”.

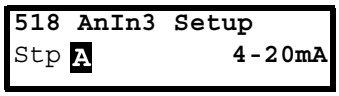
	
Default:	Off
Selection:	Same as in menu [511]

Communication information

Modbus Instance no/DeviceNet no:	43221
Profibus slot/index	169/125
EtherCAT index (hex)	4c95
Profinet IO index	19605
Fieldbus format	UInt
Modbus format	UInt

AnIn3 Setup [518]

Same functions as “AnIn1 Setup [512]”.

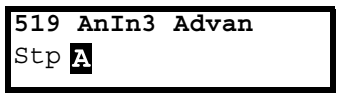
	
Default:	4–20 mA
Dependent on	Setting of switch S3
Selection:	Same as in menu [512].

Communication information

Modbus Instance no/DeviceNet no:	43222
Profibus slot/index	169/126
EtherCAT index (hex)	4c96
Profinet IO index	19606
Fieldbus format	UInt
Modbus format	UInt

AnIn3 Advanced [519]

Same functions and submenus as under “AnIn1 Advan [513]”.



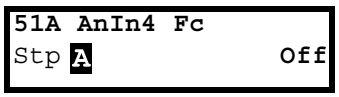
Communication information

Modbus Instance no/DeviceNet no:	43223–43230, 43543, 43553
Profibus slot/index	169/127–134, 170/192, 170/202
EtherCAT index (hex)	4c97 - 4c9e, 4dd7, 4de1
Profinet IO index	19607-19614, 19927, 19937
Fieldbus format	See [5131] - [5137].
Modbus format	

AnIn4 Function [51A]

Parameter for setting the function of Analogue Input 4.

Same function as “AnIn1 Fc [511].”



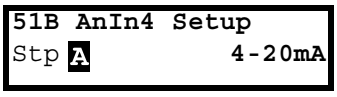
Default:	Off
Selection:	Same as in menu [511]

Communication information

Modbus Instance no/DeviceNet no:	43231
Profibus slot/index	169/135
EtherCAT index (hex)	4c9f
Profinet IO index	19615
Fieldbus format	UInt
Modbus format	UInt

AnIn4 Set-up [51B]

Same functions as “AnIn1 Setup [512]”.



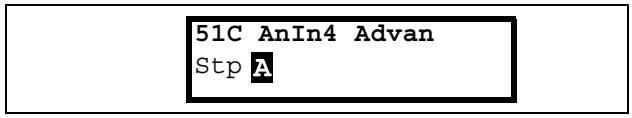
Default:	4-20 mA
Dependent on	Setting of switch S4
Selection:	Same as in menu [512].

Communication information

Modbus Instance no/DeviceNet no:	43232
Profibus slot/index	169/136
EtherCAT index (hex)	4ca0
Profinet IO index	19616
Fieldbus format	UInt
Modbus format	UInt

AnIn4 Advanced [51C]

Same functions and submenus as under “AnIn1 Advan[513]”.



Communication information

Modbus Instance no/DeviceNet no:	43233–43240, 43544, 43554
Profibus slot/index	169/137–144, 170/193, 170/203
EtherCAT index (hex)	4ca1 - 4ca8, 4dd8, 4de2
Profinet IO index	19617-19624, 19928, 19938
Fieldbus format	See [5131] - [5137].
Modbus format	

5.5.2 Digital Inputs [520]

Submenu with all the settings for the digital inputs.

NOTE: Additional inputs will become available when the I/O option boards are connected.

Digital Input 1 [521]

To select the function of the digital input.

On the standard control board there are eight digital inputs.

If the same function is programmed for more than one input that function will be activated according to "OR" logic if nothing else is stated..

		521 DigIn 1 Stp **A** **FlowManRun**
Default:		FlowManRun
Off	0	The input is not active.
Ext. Trip	3	Be aware that if there is nothing connected to the input, the AC drive will trip at "External trip" immediately. NOTE: The External Trip is active low. NOTE: Activated according to "AND" logic.
Enable	5	Enable command for the AC Drive. General start condition to run the AC drive. If made low during running the output of the AC drive is cut off immediately, causing the motor to coast to zero speed. **NOTE1:** In FlowDrive wastewater configuration this signal is not normally used. Instead the Flow ManRun and Flow AutoRun external signals are used to control the AC Drive operation. **NOTE2:** If none of the digital inputs are programmed to "Enable", the internal enable signal is active. **NOTE3:** Activated according to "AND" logic.
Reset	9	Reset command. To reset a Trip condition and to enable the Autoreset function.
Timer 1	21	Timer 1 Delay [643] will be activated on the rising edge of this signal.
Timer 2	22	Timer 2 Delay [653] will be activated on the rising edge of this signal.
Set Ctrl 1	23	Activates other parameter set. See Table 10 for selection possibilities.
Set Ctrl 2	24	Activates other parameter set. See Table 10 for selection possibilities.
Ext Mot Temp	27	Be aware that if there is nothing connected to the input, the AC drive will trip at "External Motor Temp" immediately. NOTE: The External Motor Temp is active low.
AnIn select	29	Activate/deactivate analogue inputs defined in [513A], [516A], [519A] and [51CA]
Lvl overflow	35	To set FlowDrive in overflow mode. Optional switch normally connected to the follower drive. Polarity is configured in menu "OverflowPolarity [425]".
Flow ManRun	36	Used in Waste water mode to force the drive to run at full speed.
Flow AutoRun	37	Used in Waste water mode to set the drive in Auto run mode hence it will control itself
Pump Clean	38	Activates Pump cleaning.
Sump Clean	39	Activates Sump cleaning as configured in menu " Activate Sump Cleaning [3B41] nF)" on page 67.
Pipe Clean	40	Activates Pipe cleaning.
Flow Autotune	41	Start Autotune program.
PP Timer	42	Starts Personal protection timer.
User trip 1	43	Activates User trip 1
User trip 2	44	Activates User trip 2
User trip 3	45	Activates User trip 3
User trip 4	46	Activates User trip 4
FlowLinkIn	47	Receive channel for communication link between Master and Follower.

Communication information

Modbus Instance no/DeviceNet no:	43241
Profibus slot/index	169/145
EtherCAT index (hex)	4ca9
Profinet IO index	19625
Fieldbus format	UInt
Modbus format	UInt

Table 10

Parameter Set	Set Ctrl 1	Set Ctrl 2
A	0	0
B	1	0
C	0	1
D	1	1

NOTE: To activate the parameter set selection, menu 241 must be set to DigIn.

Digital Input 2 [522] to Digital Input 8 [528]

Same function as “DigIn 1[521]”.
Default function for DigIn 3 is FlowLinkIn and default function for DigIn 6 is “Lvl overflow”.
For DigIn 4 to 7 the default function is Off.
For DigIn 8 the default function is Reset.

	522 DigIn 2 Stp A Flow AutoRun
Default:	Flow AutoRun
Selection:	Same as in menu [521]

Communication information

Modbus Instance no/DeviceNet no:	43242 – 43248
Profibus slot/index	169/146 – 169/152
EtherCAT index (hex)	4caa - 4cb0
Profinet IO index	19626 - 19632
Fieldbus format	UInt
Modbus format	UInt

Additional digital inputs [529] to [52H]

Additional digital inputs with I/O option board installed, “B1 DigIn 1 [529]” - “B3 DigIn 3 [52H]”. B stands for board and 1 to 3 is the number of the board which is related to the position of the I/O option board on the option mounting plate. The functions and selections are the same as “DigIn 1 [521]”.

Communication information

Modbus Instance no/DeviceNet no:	43501–43509
Profibus slot/index	170/150–170/158
EtherCAT index (hex)	4dad - 4db5
Profinet IO index	19885 - 19893
Fieldbus format	UInt
Modbus format	UInt

5.5.3 Analogue Outputs [530]

Submenu with all settings for the analogue outputs. Selections can be made from application and AC drive values, in order to visualize actual status. Analogue outputs can also be used as a mirror of the analogue input. Such a signal can be used as:

- a reference signal for the next AC drive in a Master/Follower configuration.
- a feedback acknowledgement of the received analogue reference value.

AnOut1 Function [531]

Sets the function for the Analogue Output 1. Scale and range are defined by AnOut1 Advanced settings [533].

		531 AnOut1 Fc Stp A Frequency
Default:		Frequency
Process Val	0	Actual process value according to Process feedback signal.
Speed	1	Actual speed.
Torque	2	Actual torque.
Process Ref	3	Actual process reference value.
Shaft Power	4	Actual shaft power.
Frequency	5	Actual frequency.
Current	6	Actual current.
El power	7	Actual electrical power.
Output volt	8	Actual output voltage.
DC-voltage	9	Actual DC link voltage.
AnIn1	10	Mirror of received signal value on AnIn1.
AnIn2	11	Mirror of received signal value on AnIn2.
AnIn3	12	Mirror of received signal value on AnIn3.
AnIn4	13	Mirror of received signal value on AnIn4.
Speed Ref	14	Actual internal speed reference Value after ramp and V/Hz.
Torque Ref	15	Actual torque reference value (=0 in V/Hz mode)

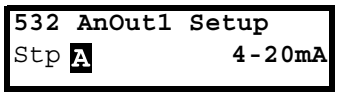
NOTE: When selections AnIn1, AnIn2 .... AnIn4 is selected, the setup of the AnOut (menu [532] or [535]) has to be set to 0-10V or 0-20mA. When the AnOut Setup is set to e.g. 4-20mA, the mirroring is not working correct.

Communication information

Modbus Instance no/DeviceNet no:	43251
Profibus slot/index	169/155
EtherCAT index (hex)	4cb3
Profinet IO index	19635
Fieldbus format	UInt
Modbus format	UInt

AnOut 1 Setup [532]

Preset scaling and offset of the output configuration.



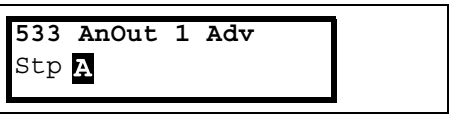
Default:		4-20mA
4–20mA	0	The current output has a fixed threshold (Live Zero) of 4 mA and controls the full range for the output signal. See Fig. 39, page 86.
0–20mA	1	Normal full current scale configuration of the output that controls the full range for the output signal. See Fig. 40, page 86.
User mA	2	The scale of the current controlled output that controls the full range for the output signal. Can be defined by the advanced AnOut Min and AnOut Max menus.
User Bipol mA	3	Sets the output for a bipolar current output, where the scale controls the range for the output signal. Scale can be defined in advanced menu AnOut Bipol.
0-10V	4	Normal full voltage scale configuration of the output that controls the full range for the output signal. See Fig. 40, page 86.
2–10V	5	The voltage output has a fixed threshold (Live Zero) of 2 V and controls the full range for the output signal. See Fig. 39, page 86.
User V	6	The scale of the voltage controlled output that controls the full range for the output signal. Can be defined by the advanced AnOut Min and AnOut Max menus.
User Bipol V	7	Sets the output for a bipolar voltage output, where the scale controls the range for the output signal. Scale can be defined in advanced menu AnOut Bipol.

Communication information

Modbus Instance no/DeviceNet no:	43252
Profibus slot/index	169/156
EtherCAT index (hex)	4cb4
Profinet IO index	19636
Fieldbus format	UInt
Modbus format	UInt

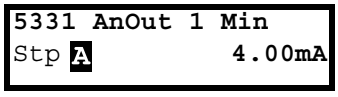
AnOut1 Advanced [533]

With the functions in the AnOut1 Advanced menu, the output can be completely defined according to the application needs. The menus will automatically be adapted to “mA” or “V”, according to the selection in “AnOut1 Setup [532]”.



AnOut1 Min [5331]

This parameter is automatically displayed if User mA or User V is selected in menu “AnOut 1 Setup [532]”. The menu will automatically adapt to current or voltage setting according to the selected setup. Only visible if [532] = User mA/V.



Default:	4.00 mA
Range:	0.00 – 20.00 mA, 0 – 10.00 V

Communication information

Modbus Instance no/DeviceNet no:	43253
Profibus slot/index	169/157
EtherCAT index (hex)	4cb5
Profinet IO index	19637
Fieldbus format	Long, 1=0.01 V, 0.01 mA
Modbus format	EInt

AnOut1 Max [5332]

This parameter is automatically displayed if User mA or User V is selected in menu "AnOut1 Setup [532]". The menu will automatically adapt to current or voltage setting a ccording to the selected setup. Only visible if [532] = User mA/V.

	5332 AnOut 1 Max Stp A 20.00mA
Default:	20.00 mA
Range:	0.00–20.00 mA, 0–10.00 V

Communication information

Modbus Instance no/DeviceNet no:	43254
Profibus slot/index	169/158
EtherCAT index (hex)	4cb6
Profinet IO index	19638
Fieldbus format	Long, 1=0.01 V, 0.01 mA
Modbus format	EInt

AnOut1 Bipol [5333]

Automatically displayed if User Bipol mA or User Bipol V is selected in menu AnOut1 Setup. The menu will automatically show mA or V range according to the selected function. The range is set by changing the positive maximum value; the negative value is automatically adapted accordingly. Only visible if [512] = User Bipol mA/V.

	5333 AnOut1Bipol Stp A 20.00mA
Default:	20.00mA
Range:	-10.00–10.00 V, -20.0–20.0 mA

Communication information

Modbus Instance no/DeviceNet no:	43255
Profibus slot/index	169/159
EtherCAT index (hex)	4cb7
Profinet IO index	19639
Fieldbus format	Long, 1=0.01 V, 0.01 mA
Modbus format	EInt

AnOut1 Function Min [5334]

With AnOut1 Function Min the physical minimum value is scaled to selected presentation. The default scaling is dependent of the selected function of "AnOut1 [531]".

		5334 AnOut1FCMin Stp A Min
Default:		Min
Min	0	Min value
Max	1	Max value
User-defined	2	Define user value in menu [5335]

Table 11 shows corresponding values for the min and max selections depending on the function of the analogue output [531].

Table 11

AnOut Function	Min Value	Max Value
Process Value	Process Min [324]	Process Max [325]
Speed	Min Speed [341]	Max Speed [343]
Torque	0%	Max Torque [351]
Process Ref	Process Min [324]	Process Max [325]
Shaft Power	0%	Motor Power [223]
Frequency	Fmin *	Motor Frequency [222]
Current	0 A	Motor Current [224]
El Power	0 W	Motor Power [223]
Output Voltage	0 V	Motor Voltage [221]
DC voltage	0 V	1000 V
AnIn1	AnIn1 Function Min	AnIn1 Function Max
AnIn2	AnIn2 Function Min	AnIn2 Function Max
AnIn3	AnIn3 Function Min	AnIn3 Function Max
AnIn4	AnIn4 Function Min	AnIn4 Function Max

*) Fmin is dependent on the set value in menu "Minimum Speed [341]".

Communication information

Modbus Instance no/DeviceNet no:	43256
Profibus slot/index	169/160
EtherCAT index (hex)	4cb8
Profinet IO index	19640
Fieldbus format	UInt
Modbus format	UInt

AnOut1 Function Value Min [5335]

With AnOut1 Function VaMin you define a user-defined value for the signal. Only visible when user-defined is selected in menu [5334].

5335 AnOut1VaMin Stp A 0.000	
Default:	0.000
Range:	-10000.000–10000.000

Communication information

Modbus Instance no/DeviceNet no:	43545
Profibus slot/index	170/194
EtherCAT index (hex)	4dd9
Profinet IO index	19929
Fieldbus format	Long, 1=1 rpm, 1 %, 1W, 0.1 Hz, 0.1 V, 0.1 A or 0.001 via process value [322]
Modbus format	EInt

AnOut1 Function Max [5336]

With AnOut1 Function Min the physical minimum value is scaled to selected presentation. The default scaling is dependent on the selected function of AnOut1 [531]. See Table 11.

5336 AnOut1FCMax Stp A Max		
Default:		Max
Min	0	Min value
Max	1	Max value
User defined	2	Define user value in menu [5337]

Communication information

Modbus Instance no/DeviceNet no:	43257
Profibus slot/index	169/161
EtherCAT index (hex)	4cb9
Profinet IO index	19641
Fieldbus format	UInt
Modbus format	UInt

NOTE: It is possible to set AnOut1 up as an inverted output signal by setting AnOut1 Min > AnOut1 Max. See Fig. 42, page 87.

AnOut1 Function Value Max [5337]

With AnOut1 Function VaMax you define a user-defined value for the signal. Only visible when user-defined is selected in menu [5334].

5337 AnOut1VaMax Stp A 0.000	
Default:	0.000
Range:	-10000.000–10000.000

Communication information

Modbus Instance no/DeviceNet no:	43555
Profibus slot/index	170/204
EtherCAT index (hex)	4de3
Profinet IO index	19939
Fieldbus format	Long, 1=1 rpm, 1 %, 1W, 0.1 Hz, 0.1 V, 0.1 A or 0.001 via process value [322]
Modbus format	EInt

AnOut2 Function [534]

Sets the function for the Analogue Output 2.

534 AnOut2 Fc Stp A Current	
Default:	Current
Selection:	Same as in menu [531]

Communication information

Modbus Instance no/DeviceNet no:	43261
Profibus slot/index	169/165
EtherCAT index (hex)	4cbd
Profinet IO index	19645
Fieldbus format	UInt
Modbus format	UInt

AnOut2 Setup [535]

Preset scaling and offset of the output configuration for analogue output 2.

	535 AnOut2 Setup Stp A 4-20mA
Default:	4-20mA
Selection:	Same as in menu [532]

Communication information

Modbus Instance no/DeviceNet no:	43262
Profibus slot/index	169/166
EtherCAT index (hex)	4cbe
Profinet IO index	19646
Fieldbus format	UInt
Modbus format	UInt

AnOut2 Advanced [536]

Same functions and submenus as under AnOut1 Advanced [533].

536 AnOut2 Advan Stp A

Communication information

Modbus Instance no/DeviceNet no:	43263–43567, 43546, 43556
Profibus slot/index	169/167–271, 170/195, 170/205
EtherCAT index (hex)	4cbf - 4cc3, 4dda, 4de4
Profinet IO index	19647-19651, 19930, 19940
Fieldbus format	See [5331] - [5337].
Modbus format	

5.5.4 Digital Outputs [540]

Submenu with all the settings for the digital outputs.

Digital Out 1 [541]

Sets the function for the digital output 1.

NOTE: The definitions described here are valid for the active output condition.

		541 DigOut 1 Stp A Ready
Default:		Ready
Off	0	Output is not active and constantly low.
On	1	Output is made constantly high, i.e. for checking circuits and trouble shooting.
Run	2	Running. The AC drive output is active = produces current for the motor.
Stop	3	The AC drive output is not active.
0Hz	4	The output frequency=0±0.1Hz when in Run condition.
Acc/Dec	5	The speed is increasing or decreasing along the acc. ramp dec. ramp.
At Process	6	The output = Reference.
At Max spd	7	The frequency is limited by the Maximum Speed.
No Trip	8	No Trip condition active.
Trip	9	A Trip condition is active.
AutoRst Trip	10	Autoreset trip condition active.
Limit	11	A Limit condition is active.
Warning	12	A Warning condition is active.
Ready	13	The AC drive is ready for operation and to accept a start command. This means that the AC drive is powered up and healthy.
T= T_{lim}	14	The torque is limited by the torque limit function.
I>I_{nom}	15	The output current is higher than the motor nominal current [224], reduced according to Motor ventilation [228], see Fig. 26, page 40.
Brake	16	The output is used to control a mechanical brake.(Brake is not available with FlowDrive)
SgnI<Offset	17	One of the AnIn input signals is lower than 75% of the threshold level.
Alarm	18	The max or min alarm level has been reached.
Pre-Alarm	19	The max or min pre alarm level has been reached.

Max Alarm	20	The max alarm level has been reached.
Max PreAlarm	21	The max pre alarm level has been reached.
Min Alarm	22	The min alarm level has been reached.
Min PreAlarm	23	The min pre alarm Level has been reached.
LY	24	Logic output Y.
!LY	25	Logic output Y inverted.
LZ	26	Logic output Z.
!LZ	27	Logic output Z inverted.
CA 1	28	Analogue comparator 1 output.
!A1	29	Analogue comp 1 inverted output.
CA 2	30	Analogue comparator 2 output.
!A2	31	Analogue comp 2 inverted output.
CD 1	32	Digital comparator 1 output.
!D1	33	Digital comp 1 inverted output.
CD 2	34	Digital comparator 2 output.
!D2	35	Digital comp 2 inverted output.
Operation	36	Run command is active or AC drive running. The signal can be used to control the mains contactor if the AC drive is equipped with Standby supply option.
T1Q	37	Timer1 output
!T1Q	38	Timer1 inverted output
T2Q	39	Timer2 output
!T2Q	40	Timer2 inverted output
Sleeping	41	Sleeping function activated
Loc/Rem	57	Local/Rem function is active
Standby	58	Standby supply option is active
PTC Trip	59	Trip when function is active
PT100 Trip	60	Trip when function is active
Overvolt	61	Overvoltage due to high main voltage
Acc	64	Acceleration along the acc. ramp
Dec	65	Deceleration along the dec. ramp
I^2t	66	I^2t limit protection active
V-Limit	67	Overvoltage limit function active
C-Limit	68	Overcurrent limit function active
Overtemp	69	Over temperature warning
Low voltage	70	Low voltage warning
DigIn 1	71	Digital input 1
DigIn 2	72	Digital input 2
DigIn 3	73	Digital input 3
DigIn 4	74	Digital input 4
DigIn 5	75	Digital input 5
DigIn 6	76	Digital input 6
DigIn 7	77	Digital input 7
DigIn 8	78	Digital input 8
ManRst Trip	79	Active trip that needs to be manually reset
Com Error	80	Serial communication lost
External Fan	81	The AC drive requires external cooling. Internal fans are active.
Run Right	85	Positive speed (>0.5%), i.e. forward/ clockwise direction.
Run Left	86	Negative speed (<0.5%), i.e. reverse counter clockwise direction.
Com Active	87	Fieldbus communication active.
CA3	91	Analogue comparator 3 output
!A3	92	Analogue comparator 3 inverted output
CA4	93	Analogue comparator 4 output
!A4	94	Analogue comparator 4 inverted output
CD3	95	Digital comparator 3 output
!D3	96	Digital comparator 3 inverted output
CD4	97	Digital comparator 4 output
!D4	98	Digital comparator 4 inverted output
C1Q	99	Counter 1 output
!C1Q	100	Counter 1 inverted output
C2Q	101	Counter 2 output
!C2Q	102	Counter 2 Inverted output
CLK1	104	Clock 1 output
!CLK1	105	Clock 1 inverted output
CLK2	106	Clock 2 output
!CLK2	107	Clock 2 inverted output
PP PreAlarm	108	Personal protection PreAlarm output
FlowLinkOut	109	Output channel for communication link between Master and Follower.

Communication information

Modbus Instance no/DeviceNet no:	43271
Profibus slot/index	169/175
EtherCAT index (hex)	4cc7
Profinet IO index	19655
Fieldbus format	UInt
Modbus format	UInt

Digital Out 2 [542]

NOTE: The definitions described here are valid for the active output condition.

Sets the function for the digital output 2.

	542 DigOut2 Stp A FlowLinkOut
Default:	FlowLinkOut
Selection:	Same as in menu [541]

Communication information

Modbus Instance no/DeviceNet no:	43272
Profibus slot/index	169/176
EtherCAT index (hex)	4cc8
Profinet IO index	19656
Fieldbus format	UInt
Modbus format	UInt

5.5.5 Relays [550]

Submenu with all the settings for the relay outputs. The relay mode selection makes it possible to establish a "fail safe" relay operation by using the normal closed contact to function as the normal open contact.

NOTE: Additional relays will become available when I/O option boards are connected. Maximum 3 boards with 3 relays each.

Relay 1 [551]

Sets the function for the relay output 1. Same function as digital output 1 [541] can be selected.

	551 Relay 1 Stp A Trip
Default:	Trip
Selection:	Same as in menu [541]

Communication information

Modbus Instance no/DeviceNet no:	43273
Profibus slot/index	169/177
EtherCAT index (hex)	4cc9
Profinet IO index	19657
Fieldbus format	UInt
Modbus format	UInt

Relay 2 [552]

NOTE: The definitions described here are valid for the active output condition.

Sets the function for the relay output 2.
Currently the run signal is active high also when the drives are in paused state. However, this will probably be changed in a future version of the software.

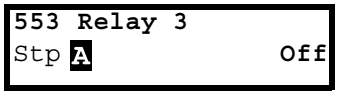
	552 Relay 2 Stp A Run
Default:	Run
Selection:	Same as in menu [541]

Communication information

Modbus Instance no/DeviceNet no:	43274
Profibus slot/index	169/178
EtherCAT index (hex)	4cca
Profinet IO index	19658
Fieldbus format	UInt
Modbus format	UInt

Relay 3 [553]

Sets the function for the relay output 3.



Default:	Off
Selection:	Same as in menu [541]

Communication information

Modbus Instance no/DeviceNet no:	43275
Profibus slot/index	169/179
EtherCAT index (hex)	4ccb
Profinet IO index	19659
Fieldbus format	UInt
Modbus format	UInt

Board Relay [554] to [55C]

These additional relays are only visible if an I/O option board is fitted in slot 1, 2, or 3. The outputs are named B1 Relay 1–3, B2 Relay 1–3 and B3 Relay 1–3. B stands for board and 1–3 is the number of the board which is related to the position of the I/O option board on the option mounting plate.

NOTE: Visible only if optional board is detected or if any input/output is activated.

Communication information

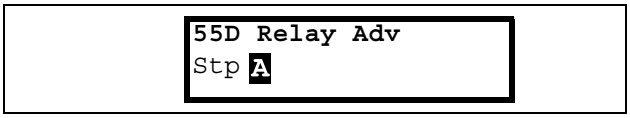
Modbus Instance no/DeviceNet no:	43511–43519
Profibus slot/index	170/160–170/168
EtherCAT index (hex)	4db7 - 4dbf
Profinet IO index	19895 - 19903
Fieldbus format	UInt
Modbus format	UInt

Relay Advanced [55D]

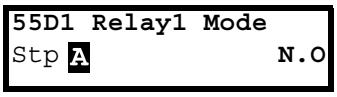
This function makes it possible to ensure that the relay will also be closed when the AC drive is malfunctioning or powered down.

Example

A process always requires a certain minimum flow. To control the required number of pumps by the relay mode NC, the e.g. the pumps can be controlled normally by the pump control, but are also activated when the AC drive is tripped or powered down.



Relay 1 Mode [55D1]



Default:		N.O
N.O	0	The normal open contact of the relay will be activated when the function is active.
N.C	1	The normally closed contact of the relay will act as a normal open contact. The contact will be opened when function is not active and closed when function is active.

Communication information

Modbus Instance no/DeviceNet no:	43276
Profibus slot/index	169/180
EtherCAT index (hex)	4ccc
Profinet IO index	19660
Fieldbus format	UInt
Modbus format	UInt

Relay Modes [55D2] to [55DC]

Same function as for "Relay 1 Mode [55D1]".

Communication information

Modbus Instance no/DeviceNet no:	43277, 43278, 43521–43529
Profibus slot/index	169/181, 169/182, 170/170–170/178
EtherCAT index (hex)	4ccd, 4cce, 4dc1 - 4dc9
Profinet IO index	19661, 19662, 19905 - 19913
Fieldbus format	UInt
Modbus format	UInt

5.5.6 Virtual Connections [560][Adv)]

Functions to enable eight internal connections of comparator, timer and digital signals, without occupying physical digital in/outputs. Virtual connections are used to wireless connection of a digital output function to a digital input function. Available signals and control functions can be used to create your own specific functions.

NOTE: When a digital input and a virtual destination are set to the same function, this function will act as an OR logic function.

Virtual Connection 1 Destination [561][Adv)]

With this function the destination of the virtual connection is established. When a function can be controlled by several sources, e.g. VC destination or Digital Input, the function will be controlled in conformity with "OR logic". See DigIn for descriptions of the different selections.

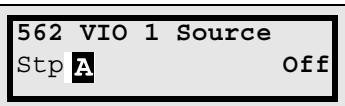
	
Default:	Off
Selection:	Same selections as for Digital Input 1, menu [521].

Communication information

Modbus Instance no/DeviceNet no:	43281
Profibus slot/index	169/185
EtherCAT index (hex)	4cd1
Profinet IO index	19665
Fieldbus format	UInt
Modbus format	UInt

Virtual Connection 1 Source [562][Adv)]

With this function the source of the virtual connection is defined. See DigOut 1 for description of the different selections.

	
Default:	Off
Selection:	Same as for menu [541].

Communication information

Modbus Instance no/DeviceNet no:	43282
Profibus slot/index	169/186
EtherCAT index (hex)	4cd2
Profinet IO index	19666
Fieldbus format	UInt
Modbus format	UInt

Virtual Connections 2-8 [563] to [56G][Adv)]

Same function as virtual connection 1 [561] and [562].

Communication information for virtual connections 2-8 Destination.

Modbus Instance no/DeviceNet no:	43283, 43285, 43287, 43289, 43291, 43293, 43295
Profibus slot/index	169/ 187, 189, 191, 193, 195, 197, 199
EtherCAT index (hex)	4cd3, 4cd5, 4cd17, 4cd9, 4cdb, 4cdd, 4cdf
Profinet IO index	19667, 19669, 19671, 19673, 19675, 19677, 19679
Fieldbus format	UInt
Modbus format	UInt

Communication information for virtual connections 2-8 Source.

Modbus Instance no/DeviceNet no:	43284, 43286, 43288, 43290, 43292, 43294, 43296
Profibus slot/index	169/ 188, 190, 192, 194, 196, 198, 200
EtherCAT index (hex)	4cd4, 4cd6, 4cd8, 4cda, 4cdc, 4cde, 4ce0
Profinet IO index	19668, 19670, 19672, 19674, 19676, 19678, 19680
Fieldbus format	UInt
Modbus format	UInt

5.6 Logical Functions and Timers [600] Adv)

With the Comparators, Logic Functions and Timers, conditional signals can be programmed for control or signalling features. This gives you the ability to compare different signals and values in order to generate monitoring/ controlling features.

5.6.1 Comparators [610] Adv)

The comparators available make it possible to monitor different internal signals and values, and visualize via digital relay outputs, when a specific value or status is reached or established.

Analogue comparators [611] - [614] Adv)

There are 4 analogue comparators that compare any available analogue value (including the analogue reference inputs) with two adjustable levels. The two levels available are Level HI and Level LO. There are two analogue comparator types selectable, an analogue comparator with hysteresis and an analogue window comparator.
The analogue hysteresis type comparator uses the two available levels to create a hysteresis for the comparator between setting and resetting the output. This function gives a clear difference in switching levels, which lets the process adapt until a certain action is started. With such a hysteresis, even an unstable analogue signal can be monitored without getting a nervous comparator output signal. Another feature is the possibility to get a fixed indication that a certain level has been passed. The comparator can latch by setting Level LO to a higher value than Level HI.

The analogue window comparator uses the two available levels to define the window in which the analogue value should be within for setting the comparator output.
The input analogue value of the comparator can also be selected as bipolar, i.e. treated as signed value or unipolar, i.e. treated as absolute value.

Refer to Fig. 47, page 106 where these functions are illustrated.

Digital comparators [615] Adv)

There are 4 digital comparators that compare any available digital signal.

The output signals of these comparators can be logically tied together to yield a logical output signal.

All the output signals can be programmed to the digital or relay outputs or used as a source for the virtual connections [560].

CA1 Setup [611] Adv)

Analogue comparator 1, parameter group.

Analogue Comparator 1, Value [6111]

Selection of the analogue value for Analogue Comparator 1 (CA1).

Analogue comparator 1 compares the selectable analogue value in menu [6111] with the constant Level HI in menu [6112] and constant Level LO in menu [6113]. If Bipolar type[6115] input signal is selected then the comparison is made with sign otherwise if unipolar selected then comparison is made with absolute values.

For Hysteresis comparator type [6114], when the value exceeds the upper limit level high, the output signal CA1 is set high and !A1 low, see Fig. 44. When the value decreases below the lower limit, the output signal CA1 is set low and !A1 high.

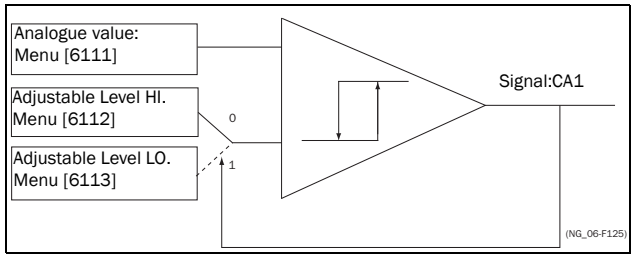


Fig. 44 Analogue comparator type Hysteresiss

For Window comparator type [6114], when the value is between the lower and upper levels, the output signal value CA1 is set high and !A1 low, see Fig. 46, page 104. When the value is outside the band of lower and upper levels, the output CA1 is set low and !A1 high.

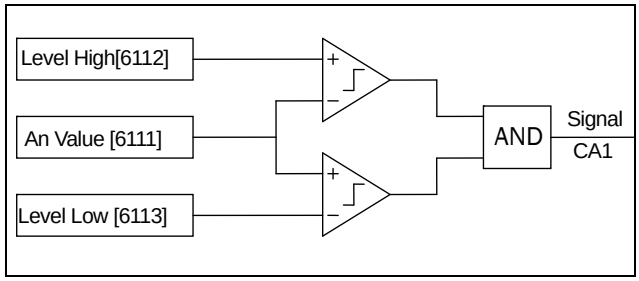


Fig. 45 Analogue comparator type "Window"

The output signal can be programmed as a virtual connection source and to the digital or relay outputs.

		6111 CA1 Value Stp A Speed
Default:		Speed
Process Val	0	Set by Process settings [321] and [322]
Speed	1	rpm
Torque	2	%
Shaft Power	3	kW
El Power	4	kW
Current	5	A
Output Volt	6	V
Frequency	7	Hz
DC Voltage	8	V
Heatsink Tmp	9	°C
PT100_1	10	°C
PT100_2	11	°C
PT100_3	12	°C
Energy	13	kWh
Run Time	14	h
Mains Time	15	h
AnIn1	16	%
AnIn2	17	%
AnIn3	18	%
AnIn4	19	%
Process Ref	20	Set by Process settings [321] and [322]
Process Err	21	

Communication information

Modbus Instance no/DeviceNet no:	43401
Profibus slot/index	170/50
EtherCAT index (hex)	4d49
Profinet IO index	19758
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 1, Level High [6112] **Adv)**

Sets the analogue comparator high level, with range according to the selected value in menu [6111].

	6112 CA1 Level HI Stp A 300rpm
Default:	300 rpm
Range:	See min/max in table below.

Min/Max setting range for menu [6112]

Mode	Min	Max	Decimals
Process Val	Set by Process settings [321] and [322]*		3
Speed, rpm	0	Max speed	0
Torque, %	0	Max torque	0
Shaft Power, kW	0	Motor P_nx4	0
El Power, kW	0	Motor P_nx4	0
Current, A	0	Motor I_nx4	1
Output volt, V	0	1000	1
Frequency, Hz	0	400	1
DC voltage, V	0	1250	1
Heatsink temp, °C	0	100	1
PT 100_1_2_3, °C	-100	300	1
Energy, kWh	0	1000000	0
Run time, h	0	65535	0
Mains time, h	0	65535	0
AnIn 1-4%	0	100	0
Process Ref	Set by Process settings [321] and [322]		3
Process Err	Set by Process settings [321] and [322]		3

NOTE: If Bipolar selected [6115] then Min value is equal to -Max in the table.

***) If Menu " Drive application [21C]" on page 38 set to "Waste water" then [321] and [322] are not visible since "Process Val" is internally handled.**

Communication information

Modbus Instance no/DeviceNet no:	43402
Profibus slot/index	170/51
EtherCAT index (hex)	4d4a
Profinet IO index	19786
Fieldbus format	Long, 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Example

This example describes, both for hysteresis and window type comparator, the normal use of the constant level high and low.

Menu	Function	Setting
343	Max Speed	1500
6111	CA1 Value	Speed
6112	CA1 Level HI	300 rpm
6113	CA1 Level LO	200 rpm
6114	CA1 Type	Hysteresis
561	VC1 Dest	Timer 1
562	VC1 Source	CA1

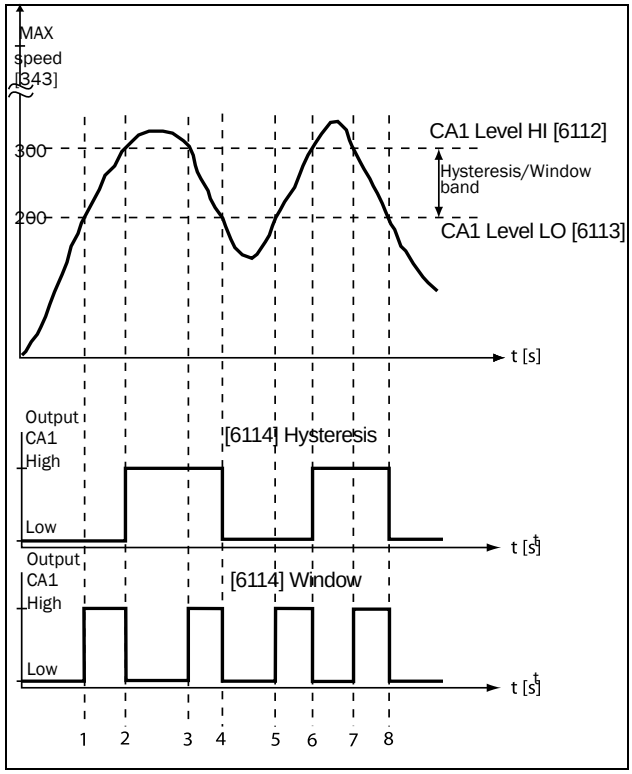


Fig. 46

Table 12 Comments to Fig. 46 regarding Hysteresis selection.

No.	Description	Hysteresis
1	The reference signal passes the Level LO value from below (positive edge), the comparator CA1 does not change, output stays low.	—
2	The reference signal passes the Level HI value from below (positive edge), the comparator CA1 output is set high.	↑
3	The reference signal passes the Level HI value from above (negative edge), the comparator CA1 does not change, output stays high.	—
4	The reference signal passes the Level LO value from above (negative edge), the comparator CA1 is reset, output is set low.	↓
5	The reference signal passes the Level LO value from below (positive edge), the comparator CA1 does not change, output stays low.	—
6	The reference signal passes the Level HI value from below (positive edge), the comparator CA1 output is set high.	↑
7	The reference signal passes the Level HI value from above (negative edge), the comparator CA1 does not change, output stays high.	—
8	The reference signal passes the Level LO value from above (negative edge), the comparator CA1 is reset, output is set low.	↓

Table 13 Comments to Fig. 46 regarding Window selection.

No.	Description	Window
1	The reference signal passes the Level LO value from below (signal inside Window band), the comparator CA1 output is set high.	↑
2	The reference signal passes the Level LO value from above (signal outside Window band), the comparator CA1 is reset, output is set low.	↓
3	The reference signal passes the Level HI value from above (signal inside Window band), the comparator CA1 output is set high.	↑
4	The reference signal passes the Level LO value from above (signal outside Window band), the comparator CA1 is reset, output is set low.	↓
5	The reference signal passes the Level LO value from below (signal inside Window band), the comparator CA1 output is set high.	↑
6	The reference signal passes the Level HI value from below (signal outside Window band),the comparator CA1 is reset, output is set low.	↓
7	The reference signal passes the Level HI value from above (signal inside Window band), the comparator CA1 output is set high.	↑
8	The reference signal passes the Level LO value from above (signal outside Window band), the comparator CA1 is reset, output is set low.	↓

Analogue Comparator 1, Level Low [6113] Adv)

Sets the analogue comparator low level, with unit and range according to the selected value in menu [6111].

6113 CA1 Level LO Stp A 200rpm	
Default:	200 rpm
Range:	Range as [6112].

Communication information

Modbus Instance no/DeviceNet no:	43403
Profibus slot/index	170/52
EtherCAT index (hex)	4d4b
Profinet IO index	19787
Fieldbus format	Long, 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator 1, Type [6114] Adv)

Selects the analogue comparator type, i.e. Hysteresis or Window type. See Fig. 47 and Fig. 48.

6114 CA1 Type Stp A Hysteresis		
Default:		Hysteresis
Hysteresis	0	Hysteresis type comparator
Window	1	Window type comparator

Communication information

Modbus Instance no/DeviceNet no:	43481
Profibus slot/index	170/130
EtherCAT index (hex)	4d99
Profinet IO index	19865
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 1, Polarity[6115] Adv)

Selects how the selected value in [6111] should be handled prior to the analogue comparator , i.e. as absolute value or handled with sign. See Fig. 47.

6115 CA1 Polar Stp A Unipolar		
Default:		Unipolar
Unipolar	0	Absolute value of [6111] used
Bipolar	1	Signed value of [6111] used

Communication information

Modbus Instance no/DeviceNet no:	43486
Profibus slot/index	170/135
EtherCAT index (hex)	4d9e
Profinet IO index	19870
Fieldbus format	UInt
Modbus format	UInt

Example

See Fig. 47 and Fig. 48 for different principle functionality of comparator features 6114 and 6115.

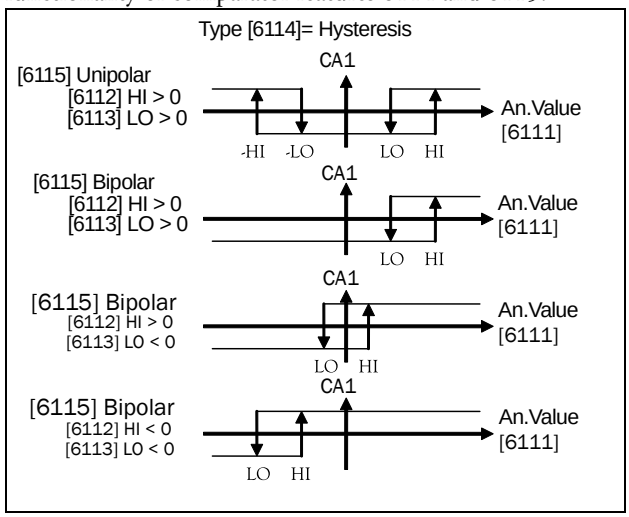


Fig. 47 Principle functionality of comparator features for "Type [6114] = Hysteresis " and "Polar [6115]".

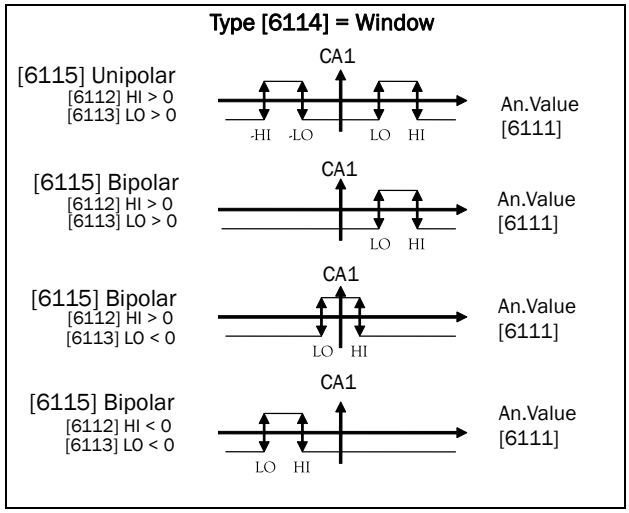


Fig. 48 Principle functionality of comparator features for "Type [6114] =Window " and "Polar [6115]".

NOTE: When "Unipolar " is selected, absolute value of signal is used.

NOTE: When "Bipolar" is selected in [6115] then:
1. Functionality is not symmetrical .
2. Ranges for high/low are bipolar

CA2 Setup [612] **Adv)**

Analogue comparator 2, parameter group.

Analogue Comparator 2, Value [6121] **Adv)**

Function is identical to analogue comparator 1, value [6111].

	6121 CA2 Value Stp A Torque
Default:	Torque
Selections:	Same as in menu [6111]

Communication information

Modbus Instance no/DeviceNet no:	43404
Profibus slot/index	170/53
EtherCAT index (hex)	4d4c
Profinet IO index	19788
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 2,Level High [6122] **Adv)**

Function is identical to analogue comparator 1, level high [6112].

	6122 CA2 Level HI Stp A 20%
Default:	20%
Range:	Enter a value for the high level.

Communication information

Modbus Instance no/DeviceNet no:	43405
Profibus slot/index	170/54
EtherCAT index (hex)	4d4d
Profinet IO index	19789
Fieldbus format	Long 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator 2, Level Low [6123] **Adv)**

Function is identical to analogue comparator 1, level low [6113].

	6123 CA2 Level LO Stp A 10%
Default:	10%
Range:	Enter a value for the low level.

Communication information

Modbus Instance no/DeviceNet no:	43406
Profibus slot/index	170/55
EtherCAT index (hex)	4d4e
Profinet IO index	19790
Fieldbus format	Long, 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator 2, Type [6124] **Adv)**

Function is identical to analogue comparator 1, Type [6114].

		6124 CA2 Type Stp A Hysteresis
Default:		Hysteresis
Hysteresis	0	Hysteresis type comparator
Window	1	Window type comparator

Communication information

Modbus Instance no/DeviceNet no:	43482
Profibus slot/index	170/131
EtherCAT index (hex)	4d9a
Profinet IO index	19866
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 2, Polar [6125] **Adv)**

Function is identical to analogue comparator 1, Polar [6115].

		6125 CA2 Polar Stp A Unipolar
Default:		Unipolar
Unipolar	0	Absolute value of [6111] used
Bipolar	1	Signed value of [6111] used

Communication information

Modbus Instance no/DeviceNet no:	43487
Profibus slot/index	170/136
EtherCAT index (hex)	4d9f
Profinet IO index	19871
Fieldbus format	UInt
Modbus format	UInt

CA3 Setup [613] Adv)

Analogue comparators 3, parameter group.

Analogue Comparator 3, Value [6131] Adv)

Function is identical to analogue comparator 1, value [6111].

	6131 CA3 Value Stp A Process Val
Default:	Process Value
Selections:	Same as in menu [6111]

Communication information

Modbus Instance no/DeviceNet no:	43471
Profibus slot/index	170/120
EtherCAT index (hex)	4d8f
Profinet IO index	19855
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 3, Level High [6132] Adv)

Function is identical to analogue comparator 1, level high [6112].

	6132 CA3 Level HI Stp A 30Hz
Default:	30Hz
Range:	Enter a value for the high level.

Communication information

Modbus Instance no/DeviceNet no:	43472
Profibus slot/index	170/121
EtherCAT index (hex)	4d90
Profinet IO index	19856
Fieldbus format	Long 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator 3, Level Low [6133] Adv)

Function is identical to analogue comparator 1, level low [6113].

	6133 CA3 Level LO Stp A 20Hz
Default:	20 Hz
Range:	Enter a value for the low level.

Communication information

Modbus Instance no/DeviceNet no:	43473
Profibus slot/index	170/122
EtherCAT index (hex)	4d91
Profinet IO index	19857
Fieldbus format	Long, 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator, 3 Type [6134] Adv)

Function is identical to analogue comparator 1, level Type [6114].

		6134 CA3 Type Stp A Hysteresis
Default:		Hysteresis
Hysteresis	0	Hysteresis type comparator
Window	1	Window type comparator

Communication information

Modbus Instance no/DeviceNet no:	43483
Profibus slot/index	170/132
EtherCAT index (hex)	4d9b
Profinet IO index	19867
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 3, Polar [6135] Adv)

Function is identical to analogue comparator 1, Polar [6115].

		6135 CA3 Polar Stp A Unipolar
Default:		Unipolar
Unipolar	0	Absolute value of [6111] used
Bipolar	1	Signed value of [6111] used

Communication information

Modbus Instance no/DeviceNet no:	43488
Profibus slot/index	170/137
EtherCAT index (hex)	4da0
Profinet IO index	19872
Fieldbus format	UInt
Modbus format	UInt

CA4 Setup [614] Adv)

Analogue comparators 4, parameter group.

Analogue Comparator 4, Value [6141] Adv)

Function is identical to analogue comparator 1, value [6111].

	6141 CA4 Value Stp A Process Err
Default:	Process Error
Selections:	Same as in menu [6111]

Communication information

Modbus Instance no/DeviceNet no:	43474
Profibus slot/index	170/123
EtherCAT index (hex)	4d92
Profinet IO index	19858
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 4, Level High [6142] Adv)

Function is identical to analogue comparator 1 level high [6112].

	6142 CA4 Level HI Stp A 10.0Hz
Default:	10.0Hz
Range:	Enter a value for the high level.

Communication information

Modbus Instance no/DeviceNet no:	43475
Profibus slot/index	170/124
EtherCAT index (hex)	4d93
Profinet IO index	19859
Fieldbus format	Long 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator 4, Level Low [6143] Adv)

Function is identical to analogue comparator 1, level low [6113].

	6143 CA4 Level LO Stp A -10.0Hz
Default:	-10.0 Hz
Range:	Enter a value for the low level.

Communication information

Modbus Instance no/DeviceNet no:	43476
Profibus slot/index	170/125
EtherCAT index (hex)	4d94
Profinet IO index	19860
Fieldbus format	Long, 1=1 W, 0.1 A, 0.1 V, 0.1 Hz, 0.1°C, 1 kWh, 1H, 1%, 1 rpm or 0.001 via process value
Modbus format	EInt

Analogue Comparator 4, Type [6144] Adv)

Function is identical to analogue comparator 1, level Type [6114]

		6144 CA4 Type Stp A Window
Default:		Window
Hysteresis	0	Hysteresis type comparator
Window	1	Window type comparator

Communication information

Modbus Instance no/DeviceNet no:	43484
Profibus slot/index	170/133
EtherCAT index (hex)	4d9c
Profinet IO index	19868
Fieldbus format	UInt
Modbus format	UInt

Analogue Comparator 4, Polar [6145] Adv)

Function is identical to analogue comparator 1, Polar [6115]

		6145 CA4 Polar Stp A Bipolar
Default:		Bipolar
Unipolar	0	Absolute value of [6111] used
Bipolar	1	Signed value of [6111] used

Communication information

Modbus Instance no/DeviceNet no:	43489
Profibus slot/index	170/138
EtherCAT index (hex)	4da1
Profinet IO index	19873
Fieldbus format	UInt
Modbus format	UInt

Digital comparator Setup [615] Adv)

Digital comparators, parameter group.

Digital Comparator 1 [6151] Adv)

Selection of the input signal for digital comparator 1 (CD1).

The output signal CD1 is set high if the selected input signal is active. See Fig. 49.

The output signal can be programmed to the digital or relay outputs or used as a source for the virtual connections [560].

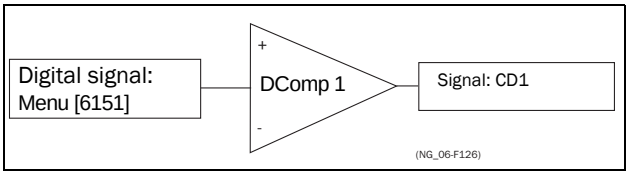


Fig. 49 Digital comparator

6151 CD1 Stp A Run	
Default:	Run
Selection:	Same selections as for “DigOut 1 [541]”.

Communication information

Modbus Instance no/DeviceNet no:	43407
Profibus slot/index	170/56
EtherCAT index (hex)	4d4f
Profinet IO index	19791
Fieldbus format	UInt
Modbus format	UInt

Digital Comparator 2 [6152] Adv)

Function is identical to digital comparator 1 [6151] Adv).

6152 CD 2 Stp A DigIn 1	
Default:	DigIn 1
Selection:	Same selections as for “DigOut 1 [541]”.

Communication information

Modbus Instance no/DeviceNet no:	43408
Profibus slot/index	170/57
EtherCAT index (hex)	4d50
Profinet IO index	19792
Fieldbus format	UInt
Modbus format	UInt

Digital Comparator 3 [6153] Adv)

Function is identical to digital comparator 1 [6151] Adv).

6153 CD 3 Stp A Trip	
Default:	Trip
Selection:	Same selections as for “DigOut 1 [541]”.

Communication information

Modbus Instance no/DeviceNet no:	43477
Profibus slot/index	170/126
EtherCAT index (hex)	4d95
Profinet IO index	19861
Fieldbus format	UInt
Modbus format	UInt

Digital Comparator 4 [6154] Adv)

Function is identical to digital comparator 1 [6151] Adv).

6154 CD 4 Stp A Ready	
Default:	Ready
Selection:	Same selections as for “DigOut 1 [541]”.

Communication information

Modbus Instance no/DeviceNet no:	43478
Profibus slot/index	170/127
EtherCAT index (hex)	4d96
Profinet IO index	19862
Fieldbus format	UInt
Modbus format	UInt

5.6.2 Logic Output Y [620] Adv)

By means of an expression editor, the comparator signals can be logically combined into the Logic Y function.

The expression editor has the following features:

- The following signals can be used:
  CA1, CA2, CD1, CD2 or LZ (or LY)
- The following signals can be inverted:
  !A1, !A2, !D1, !D2, or !LZ (or !LY)
- The following logical operators are available:
  "+" : OR operator
  "&" : AND operator
  "^" : EXOR operator

Expressions according to the following truth table can be made:

Input		Result		
A	B	& (AND)	+ (OR)	^(EXOR)
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0

The output signal can be programmed to the digital or relay outputs or used as a Virtual Connection Source [560].

```
620 LOGIC Y
Stp      CA1&!A2&CD1
```

The expression must be programmed by means of the menus [621] to [625].

Example:

Broken belt detection for Logic Y

This example describes the programming for a so-called "broken belt detection" for fan applications.

The comparator CA1 is set for frequency>10Hz.

The comparator !A2 is set for load < 20%.

The comparator CD1 is set for Run.

The 3 comparators are all AND-ed, given the "broken belt detection".

In menus [621]-[625] expression entered for Logic Y is visible.

Set menu [621] to CA1
Set menu [622] to &
Set menu [623] to !A2
Set menu [624] to &
Set menu [625] to CD1

Menu [620] now holds the expression for Logic Y:

CA1&!A2&CD1

which is to be read as:

(CA1&!A2)&CD1

NOTE: Set menu [624] to "." to finish the expression when only two comparators are required for Logic Y.

Y Comp 1 [621] Adv)

Selects the first comparator for the logic Y function.

```
621 Y Comp 1
Stp A              CA1
```

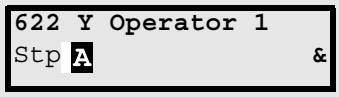
Default:		CA1
CA1	0	
!A1	1	
CA2	2	
!A2	3	
CD1	4	
!D1	5	
CD2	6	
!D2	7	
LZ/LY	8	
!LZ/!LY	9	
T1	10	
!T1	11	
T2	12	
!T2	13	
CA3	14	
!A3	15	
CA4	16	
!A4	17	
CD3	18	
!D3	19	
CD4	20	
!D4	21	
C1	22	
!C1	23	
C2	24	
!C2	25	

Communication information

Modbus Instance no/DeviceNet no:	43411
Profibus slot/index	170/60
EtherCAT index (hex)	4d53
Profinet IO index	19795
Fieldbus format	UInt
Modbus format	UInt

Y Operator 1 [622] Adv)

Selects the first operator for the logic Y function.



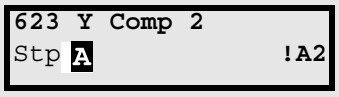
Default:		&
&	1	&=AND
+	2	+=OR
^	3	^=EXOR

Communication information

Modbus Instance no/DeviceNet no:	43412
Profibus slot/index	170/61
EtherCAT index (hex)	4d54
Profinet IO index	19796
Fieldbus format	UInt
Modbus format	UInt

Y Comp 2 [623] Adv)

Selects the second comparator for the logic Y function.



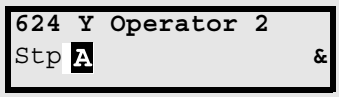
Default:	!A2
Selection:	Same as menu [621]

Communication information

Modbus Instance no/DeviceNet no:	43413
Profibus slot/index	170/62
EtherCAT index (hex)	4d55
Profinet IO index	19797
Fieldbus format	UInt
Modbus format	UInt

Y Operator 2 [624] Adv)

Selects the second operator for the logic Y function.



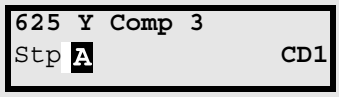
Default:		&
.	0	When · (dot) is selected, the Logic Y expression is finished (when only two expressions are tied together).
&	1	&=AND
+	2	+=OR
^	3	^=EXOR

Communication information

Modbus Instance no/DeviceNet no:	43414
Profibus slot/index	170/63
EtherCAT index (hex)	4d56
Profinet IO index	19798
Fieldbus format	UInt
Modbus format	UInt

Y Comp 3 [625] Adv)

Selects the third comparator for the logic Y function.

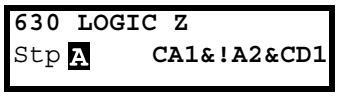


Default:	CD1
Selection:	Same as menu [621]

Communication information

Modbus Instance no/DeviceNet no:	43415
Profibus slot/index	170/64
EtherCAT index (hex)	4d57
Profinet IO index	19799
Fieldbus format	UInt
Modbus format	UInt

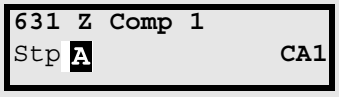
5.6.3 Logic Output Z [630] Adv)



The expression must be programmed by means of the menus [631] to [635].

Z Comp 1 [631] Adv)

Selects the first comparator for the logic Z function.



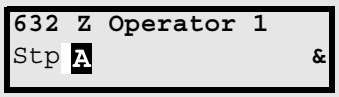
Default:	CA1
Selection:	Same as menu [621]

Communication information

Modbus Instance no/DeviceNet no:	43421
Profibus slot/index	170/70
EtherCAT index (hex)	4d5d
Profinet IO index	19805
Fieldbus format	UInt
Modbus format	UInt

Z Operator 1 [632] Adv)

Selects the first operator for the logic Z function.



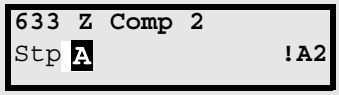
Default:	&
Selection:	Same as menu [622]

Communication information

Modbus Instance no/DeviceNet no:	43422
Profibus slot/index	170/71
EtherCAT index (hex)	4d5e
Profinet IO index	19806
Fieldbus format	UInt
Modbus format	UInt

Z Comp 2 [633] Adv)

Selects the second comparator for the logic Z function.



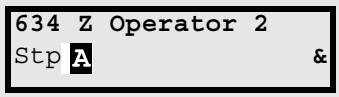
Default:	!A2
Selection:	Same as menu [621]

Communication information

Modbus Instance no/DeviceNet no:	43423
Profibus slot/index	170/72
EtherCAT index (hex)	4d5f
Profinet IO index	19807
Fieldbus format	UInt
Modbus format	UInt

Z Operator 2 [634] Adv)

Selects the second operator for the logic Z function.



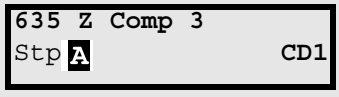
Default:	&
Selection:	Same as menu [624]

Communication information

Modbus Instance no/DeviceNet no:	43424
Profibus slot/index	170/73
EtherCAT index (hex)	4d60
Profinet IO index	19808
Fieldbus format	UInt
Modbus format	UInt

Z Comp 3 [635] Adv)

Selects the third comparator for the logic Z function.



Default:	CD1
Selection:	Same as menu [621]

Communication information

Modbus Instance no/DeviceNet no:	43425
Profibus slot/index	170/74
EtherCAT index (hex)	4d61
Profinet IO index	19809
Fieldbus format	UInt
Modbus format	UInt

5.6.4 Timer 1 [640] Adv)

The Timer functions can be used as a delay timer or as an interval with separate On and Off times (alternate mode). In delay mode, the output signal T1Q becomes high if the set delay time is expired. See Fig. 50.

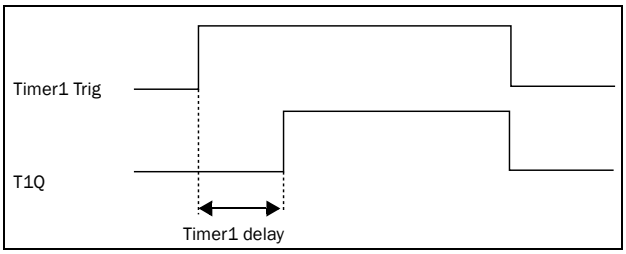


Fig. 50

In alternate mode, the output signal T1Q will switch automatically from high to low etc. according to the set interval times "Timer1 T1" and "Timer 1 T2". See Fig. 51.

The output signal can be programmed to the digital or relay outputs used in logic functions [620] and [630], or as a virtual connection source [560].

NOTE: The actual timers are common for all parameter sets. If the actual set is changed, the timer functionality [641] to [645] will change according set settings but the timer value will stay unchanged. So initialization of the timer might differ for a set change compared to normal triggering of a timer.

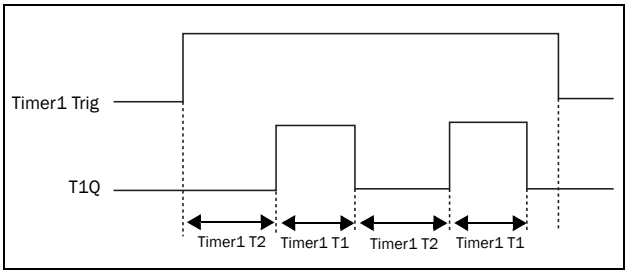


Fig. 51

Timer 1 Trig [641] Adv)

Selection of the Timer input trigger signal.

641 Timer1 Trig Stp A Off	
Default:	Off
Selection:	Same selections as Digital Output 1 menu [541].

Communication information

Modbus Instance no/DeviceNet no:	43431
Profibus slot/index	170/80
EtherCAT index (hex)	4d67
Profinet IO index	19815
Fieldbus format	UInt
Modbus format	UInt

Timer 1 Mode [642] Adv)

Selection of mode of operation for Timer.

642 Timer1 Mode Stp A Off		
Default:		Off
Off	0	
Delay	1	
Alternate	2	

Communication information

Modbus Instance no/DeviceNet no:	43432
Profibus slot/index	170/81
EtherCAT index (hex)	4d68
Profinet IO index	19816
Fieldbus format	UInt
Modbus format	UInt

Timer 1 Delay [643] Adv)

This menu is only visible when timer mode is set to delay.

This menu can only be edited as in alternative 2, see Chapter 4.5 page 29.

Timer 1 delay sets the time that will be used by the first timer after it is activated. Timer 1 can be activated by a high signal on a DigIn that is set to Timer 1 or via a virtual destination [560].

	643 Timer1Delay Stp A 0:00:00
Default:	0:00:00 (hr:min:sec)
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	43433 hours 43434 minutes 43435 seconds
Profibus slot/index	170/82, 170/83, 170/84
EtherCAT index (hex)	4d69, 4d6a, 4d6b
Profinet IO index	19817, 19818, 19819
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

Timer 1 T1 [644] Adv)

When timer mode is set to Alternate and Timer 1 is enabled, this timer will automatically keep on switching according to the independently programmable on and off times. The Timer 1 in Alternate mode can be enabled by a digital input or via a virtual connection. See Fig. 51. Timer 1 T1 sets the on time in the alternate mode.

	644 Timer 1 T1 Stp A 0:00:00
Default:	0:00:00 (hr:min:sec)
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	43436 hours 43437 minutes 43438 seconds
Profibus slot/index	170/85, 170/86, 170/87
EtherCAT index (hex)	4d6c, 4d6d, 4d6e
Profinet IO index	19820, 19821, 19822
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

Timer 1 T2 [645] Adv)

Timer 1 T2 sets the off time in the alternate mode.

	645 Timer1 T2 Stp A 0:00:00
Default:	0:00:00, hr:min:sec
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	43439 hours 43440 minutes 43441 seconds
Profibus slot/index	170/88, 170/89, 170/90
EtherCAT index (hex)	4d6f, 4d70, 4d71
Profinet IO index	19823, 19824, 19825
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

NOTE: "Timer 1 T1 [644]" and "Timer 1 T2 [645]" are only visible when Timer Mode is set to Alternate.

Timer 1 Value [649] Adv)

Timer 1 Value shows actual value of the timer.

	649 Timer1 Value Stp A 0:00:00
Default:	0:00:00, hr:min:sec
Range:	0:00:00–9:59:59

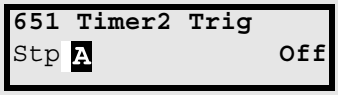
Communication information

Modbus Instance no/DeviceNet no:	42921 hours 42922 minutes 42923 seconds
Profibus slot/index	168/80, 168/81, 168/82
EtherCAT index (hex)	4b69, 4b6a, 4b6b
Profinet IO index	19305, 19306, 19307
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

5.6.5 Timer 2 [650] Adv)

Refer to the descriptions for Timer1.

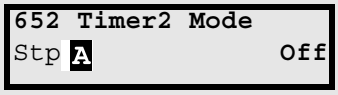
Timer 2 Trig [651] Adv)

	
Default:	Off
Selection:	Same selections as Digital Output 1 menu [541].

Communication information

Modbus Instance no/DeviceNet no:	43451
Profibus slot/index	170/100
EtherCAT index (hex)	4d7b
Profinet IO index	19835
Fieldbus format	UInt
Modbus format	UInt

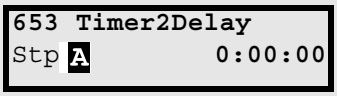
Timer 2 Mode [652] Adv)

	
Default:	Off
Selection:	Same as in menu [642]

Communication information

Modbus Instance no/DeviceNet no:	43452
Profibus slot/index	170/101
EtherCAT index (hex)	4d7c
Profinet IO index	19836
Fieldbus format	UInt
Modbus format	UInt

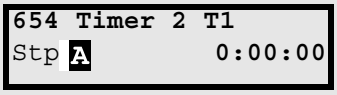
Timer 2 Delay [653] Adv)

	
Default:	0:00:00, hr:min:sec
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	43453 hours 43454 minutes 43455 seconds
Profibus slot/index	170/102, 170/103, 170/104
EtherCAT index (hex)	4d7d, 4d7e, 4d7f
Profinet IO index	19837, 19838, 19839
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

Timer 2 T1 [654] Adv)

	
Default:	0:00:00, hr:min:sec
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	43456 hours 43457 minutes 43458 seconds
Profibus slot/index	170/105, 170/106, 170/107
EtherCAT index (hex)	4d80, 4d81, 4d82
Profinet IO index	19840, 19841, 19842
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

Timer 2 T2 [655] Adv)

655 Timer 2 T2 Stp A 0:00:00	
Default:	0:00:00, hr:min:sec
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	43459 hours 43460 minutes 43461 seconds
Profibus slot/index	170/108, 170/109, 170/110
EtherCAT index (hex)	4d83, 4d84, 4d85
Profinet IO index	19843, 19844, 19845
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

Timer 2 Value [659] Adv)

Timer 2 Value shows actual value of the timer.

659 Timer2 Value Stp A 0:00:00	
Default:	0:00:00, hr:min:sec
Range:	0:00:00–9:59:59

Communication information

Modbus Instance no/DeviceNet no:	42924 hours 42925 minutes 42926 seconds
Profibus slot/index	168/83, 168/84, 168/84
EtherCAT index (hex)	4b6c, 4b6d, 4b6f
Profinet IO index	19308, 19309, 19310
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	UInt, 1=1 h/m/s

5.6.6 Counters [660] Adv)

Counter functions for counting pulses and signalling on digital output when counter reaches specified high and low limit levels.
The counter is counting up on positive flanks on the triggered signal, the counter is cleared as long as the Reset signal is active.
The counter can be automatically decremented with specified decrement time, if no new trigger signal has occurred within the decrement time.
The counter value is clamped to the high limit value and the digital output function (C1Q or C2Q) is active when counter value equals high limit value.
See Fig. 52 for more information of the counters.

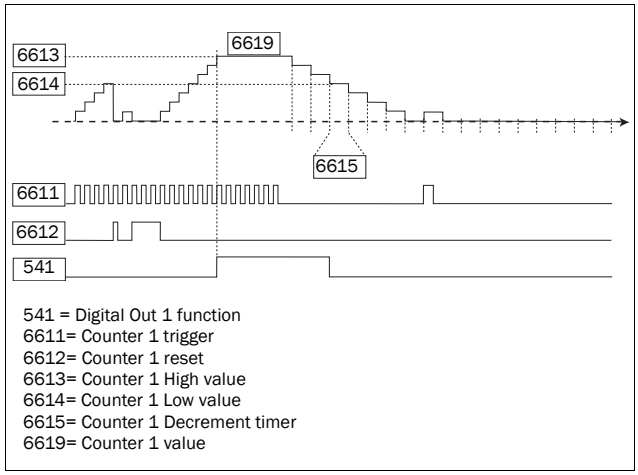


Fig. 52 Counters, operating principle.

Counter 1 [661] Adv)

Counter 1 parameter group.

Counter 1 Trigger [6611] Adv)

Selection of the digital output signal used as trigger signal for counter 1. Counter 1 is incremented by 1 on every positive flank on the trigger signal.

NOTE: Maximum counting frequency is 8 Hz.

6611 C1 Trig Stp A Off	
Default:	Off
Selection:	Same selections as “Digital Out 1 [541]”.

Communication information

Modbus Instance no/DeviceNet no:	43571
Profibus slot/index	170/220
EtherCAT index (hex)	4df3
Profinet IO index	19955
Fieldbus format	UInt
Modbus format	UInt

Counter 1 Reset [6612] Adv)

Selection of the digital signal used as reset signal for counter 1. Counter 1 is cleared to 0 and held to 0 as long as reset input is active (high).

NOTE: Reset input has top priority.

6612 C1 Reset Stp A Off	
Default:	Off
Selection:	Same selections as “Digital Out 1 [541]”.

Communication information

Modbus Instance no/DeviceNet no:	43572
Profibus slot/index	170/221
EtherCAT index (hex)	4df4
Profinet IO index	19956
Fieldbus format	UInt
Modbus format	UInt

Counter 1 High value [6613] Adv)

Sets counter 1 high limit value. Counter 1 value is clamped to selected high limit value and the counter 1 output (C1Q) is active (high) when the counter value equals the high value.

NOTE: Value 0 means that counter output is always true (high).

6613 C1 High Val Stp A 0	
Default:	0
Range:	0 - 10000

Communication information

Modbus Instance no/DeviceNet no:	43573
Profibus slot/index	170/222
EtherCAT index (hex)	4df5
Profinet IO index	19957
Fieldbus format	Long, 1=1
Modbus format	EInt

Counter 1 Low value [6614] Adv)

Sets counter 1 low limit value. Counter 1 output (C1Q) is de-activated (low) when the counter value is equal or smaller than the low value.

NOTE: Counter high value has priority so if high and low values are equal then the counter output is de-activated when the value is smaller than the low value.

6614 C1 Low Val Stp A 0	
Default:	0
Range:	0 - 10000

Communication information

Modbus Instance no/DeviceNet no:	43574
Profibus slot/index	170/223
EtherCAT index (hex)	4df6
Profinet IO index	19958
Fieldbus format	Long, 1=1
Modbus format	EInt

Counter 1 Decrement timer [6615] Adv)

Sets counter 1 automatic decrement timer value. The counter 1 is decremented by 1 after elapsed decrement time and if no new trigger has happened within the decrement time. The decrement timer is reset to 0 at every counter 1 trig pulse

6615 C1 DecTimer Stp A Off		
Default:		Off
Off	0	Off
1 - 3600	1 - 3600	1 - 3600 s

Communication information

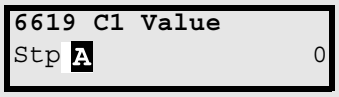
Modbus Instance no/DeviceNet no:	43575
Profibus slot/index	170/224
EtherCAT index (hex)	4df7
Profinet IO index	19959
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Counter 1 Value [6619] Adv)

Parameter shows the actual value of counter 1.

NOTE: Counter 1 value is common for all parameter sets.

NOTE: The value is volatile and lost at power down.

	
Default:	0
Range:	0 - 10000

Communication information

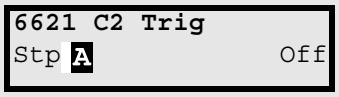
Modbus Instance no/DeviceNet no:	42927
Profibus slot/index	168/86
EtherCAT index (hex)	4b6f
Profinet IO index	19311
Fieldbus format	UInt, 1=1
Modbus format	UInt

Counter 2 [662] Adv)

Refer to description for Counter 1 [661] Adv).

Counter 2 Trigger [6621] Adv)

Function is identical to Counter 1 Trigger [6611].

	
Default:	Off
Selection:	Same selections as Digital Out 1 [541].

Communication information

Modbus Instance no/DeviceNet no:	43581
Profibus slot/index	170/230
EtherCAT index (hex)	4dfd
Profinet IO index	19965
Fieldbus format	UInt
Modbus format	UInt

Counter 2 Reset [6622] Adv)

Function is identical to Counter 1 Reset [6612].

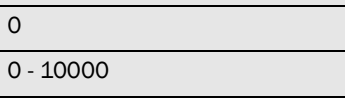
	
Default:	Off
Selection:	Same selections as Digital Out 1 [541].

Communication information

Modbus Instance no/DeviceNet no:	43582
Profibus slot/index	170/231
EtherCAT index (hex)	4dfe
Profinet IO index	19966
Fieldbus format	UInt
Modbus format	UInt

Counter 2 High value [6623] Adv)

Function is identical to Counter 1 High value [6613].

	
Default:	0
Range:	0 - 10000

Communication information

Modbus Instance no/DeviceNet no:	43583
Profibus slot/index	170/232
EtherCAT index (hex)	4dff
Profinet IO index	19967
Fieldbus format	Long, 1=1
Modbus format	EInt

Counter 2 Low value [6624] Adv)

Function is identical to Counter 1 Low value [6614].

Default:	0
Range:	0 - 10000

Communication information

Modbus Instance no/DeviceNet no:	43584
Profibus slot/index	170/233
EtherCAT index (hex)	4e00
Profinet IO index	19968
Fieldbus format	Long, 1=1
Modbus format	EInt

Counter 2 Decrement timer [6625] Adv)

Function is identical to Counter 1 Decrement timer [6615].

Default:		Off
Off	0	Off
1 - 3600	1 - 3600	1 - 3600 s

Communication information

Modbus Instance no/DeviceNet no:	43585
Profibus slot/index	170/234
EtherCAT index (hex)	4e01
Profinet IO index	19969
Fieldbus format	Long, 1=1 s
Modbus format	EInt

Counter 2 Value [6629] Adv)

Parameter shows the actual value of counter 2.

NOTE: Counter 2 value is common for all parameter sets.

NOTE: The value is volatile and lost at power down.

	6629 C2 Value Stp A 0
Default:	0
Range:	0 - 10000

Communication information

Modbus Instance no/DeviceNet no:	42928
Profibus slot/index	168/87
EtherCAT index (hex)	4b70
Profinet IO index	19312
Fieldbus format	UInt, 1=1
Modbus format	UInt

5.6.7 Clock Logic [670] Adv)

This function requires the option board RTC.
There are two Clock functions, Clock 1 and Clock 2. Each clock with separate settings for Time On, Time Off, Date On, Date Off and Weekday. These clocks can be used for activating/deactivating desired functions via Relay, digital output or Virtual I/O (For example creating start and stop commands).

Clock 1 [671] Adv)

The time, date and weekday for clock 1 are set in these submenus.

Read-only	671 Clock 1 Stp A

Clock 1 Time On [6711] Adv)

Time when the clock 1 output signal (CLK1) is activated.

	6711 Clk1TimeOn Stp A 00:00:00
Default:	00:00:00 (hours:minutes:seconds)
Range:	00:00:00–23:59:59

Communication information

Modbus Instance no/DeviceNet no:	43800, 43801, 43802 (h,m,s)
Profibus slot/index	171/194, 171/195, 171/196
EtherCAT index (hex)	4ed8, 4ed9, 4eda
Profinet IO index	20184, 20184, 20186
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	EInt

Clock 1 Time Off [6712] Adv)

Time when the clock 1output signal (CLK1) is deactivated.

	6612 Clk1TimeOff Stp A 00:00:00
Default:	00:00:00 (hours:minutes:seconds)
Range:	00:00:00–23:59:59

Communication information

Modbus Instance no/DeviceNet no:	43803, 43804, 43805 (h,m,s)
Profibus slot/index	171/197, 171/198, 171/199
EtherCAT index (hex)	4edb, 4edc, 4edd
Profinet IO index	20187, 20188, 20189
Fieldbus format	UInt, 1=1 h/m/s
Modbus format	EInt

Clock 1 Date On [6713] Adv)

Date when the clock 1 output signal (CLK1) is activated.

6713 Clk1DateOn Stp A 2013-01-01	
Default:	2013-01-01
Range:	YYYY-MM-DD

Communication information

Modbus Instance no/DeviceNet no:	43806, 43807, 43808 (Y,M,D)
Profibus slot/index	171/200, 171/201, 171/202
EtherCAT index (hex)	4ede,4edf, 4ee0
Profinet IO index	20190, 20191, 20192
Fieldbus format	Long, 1=1 Y/M/D
Modbus format	EInt

Clock 1 Date Off [6714] Adv)

Date when the clock output signal (CLK1) is deactivated. Note that if "Clk1DateOff" is set to an earlier date than "Clk1DateOn", the result will be that the clock is not deactivated at the set date.

6714 Clk1DateOff Stp A 2013-01-01	
Default:	2013-01-01
Range:	YYYY-MM-DD

Communication information

Modbus Instance no/DeviceNet no:	43809, 43810, 43811 (Y,M,D)
Profibus slot/index	171/203,171/204, 171/205
EtherCAT index (hex)	4ee1, 4ee2, 4ee3
Profinet IO index	20193, 20194, 20195
Fieldbus format	Long, 1=1 Y/M/D
Modbus format	EInt

Clock 1 Weekday [6715] Adv)

Weekdays when the clock function is active. Having entered the editing mode, select or deselect the desired weekdays with the cursor using the PREV and NEXT keys on the control panel. The deactivated weekdays are replaced by a dash mark "-" (e.g. "MTWTF - -"). Confirm by pressing ENTER. Exit the editing mode and the activated weekdays will be viewed in the menu display. .

6715 Clk1Weekday Stp A MTWTFSS	
Default:	MTWTFSS (all activated)
Range:	Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday.

Communication information

Modbus Instance no/DeviceNet no:	43812
Profibus slot/index	171/206
EtherCAT index (hex)	4ee4
Profinet IO index	20196
Fieldbus format	UInt, 1=1
Modbus format	UInt

NOTE: Please make sure that the correct time and date settings are done for the real time clock, menu group "5.9.2 Clock [930]" on page 139.

Example 1:
The output CLK1 shall be active Mondays to Fridays on working hours, e.g. 08:00-17:00. This signal is used to start e.g. a pump with virtual I/O.

Menu	Text	Setting
6711	Clk1TimeOn	08:00
6712	Clk1TimeOff	17:00
6713	Clk1DateOn	2013-02-01 (date in the past)
6714	Clk1DateOff	2099-12-31 (Date in the future)
6715	Clk1Weekday	MTWTF- -
561	VIO 1 Dest	Run FWD
562	VIO 1 Source	Clk1

Example 2:
The output CLK1 shall be active on weekends, all day.

Menu	Text	Setting
6711	Clk1TimeOn	0:00:00
6712	Clk1TimeOff	23:59:59
6713	Clk1DateOn	2013-02-01 (date in the past)
6714	Clk1DateOff	2099-12-31 (Date in the future)
6715	Clk1Weekday	- - - - - SS
561	VIO 1 Dest	Run FWD
562	VIO 1 Source	Clk1

Clock 2 [672] Adv)

Refer to the description for Clock 1 [671].

5.7 View Operation/Status [700]

Menu with parameters for viewing all actual operational data, such as speed, torque, power, etc.

5.7.1 Operation [710]

Process Value [711]

The process value is showing the process actual value, depending on selection done in chapter, Process Source [321].

	711 Process Val Stp
Unit	Depends on selected Process source [321] and Process Unit [322].
Resolution	Speed: 1 rpm, 4 digits Other units: 3 digits

Communication information

Modbus Instance no/DeviceNet no:	31001
Profibus slot/index	121/145
EtherCAT index (hex)	23e9
Profinet IO index	1001
Fieldbus format	Long, 1=1rpm, 1%, 1 °C or 0.001 if Process Value/ Process Ref using a [322] unit
Modbus format	EInt

Speed [712]

Displays the actual shaft speed.

Read only	712 Speed Stp rpm
Unit:	rpm
Resolution:	1 rpm, 4 digits

Communication information

Modbus Instance no/DeviceNet no:	31002
Profibus slot/index	121/146
EtherCAT index (hex)	23ea
Profinet IO index	1002
Fieldbus format	Int, 1=1 rpm
Modbus format	Int, 1=1 rpm

Torque [713]

Displays the actual shaft torque.

Read only	713 Torque Stp 0% 0.0Nm
Unit:	%, Nm
Resolution:	1 %, 0.1 Nm

Communication information

Modbus Instance no/DeviceNet no:	31003 Nm 31004 %
Profibus slot/index	121/147 121/148
EtherCAT index (hex)	23eb Nm 23ec %
Profinet IO index	1003 Nm 1004 %
Fieldbus format	Long, 1=0.1 Nm Long, 1=1 %
Modbus format	EInt

Shaft power [714]

Displays the actual shaft power.

Read only	714 Shaft Power Stp W
Unit:	W
Resolution:	1W

Communication information

Modbus Instance no/DeviceNet no:	31005
Profibus slot/index	121/149
EtherCAT index (hex)	23ed
Profinet IO index	1005
Fieldbus format	Long, 1=1W
Modbus format	EInt

Electrical Power [715]

Displays the actual electrical output power.

Read only	715 El Power Stp kW
Unit:	kW
Resolution:	1 W

Communication information

Modbus Instance no/DeviceNet no:	31006
Profibus slot/index	121/150
EtherCAT index (hex)	23ee
Profinet IO index	1006
Fieldbus format	Long, 1=1W
Modbus format	EInt

Current [716]

Displays the actual output current.

Read only	716 Current Stp A
Unit:	A
Resolution:	0.1 A

Communication information

Modbus Instance no/DeviceNet no:	31007
Profibus slot/index	121/151
EtherCAT index (hex)	23ef
Profinet IO index	1007
Fieldbus format	Long, 1=0.1 A
Modbus format	EInt

Output Voltage [717]

Displays the actual output voltage.

Read only	717 Output Volt Stp V
Unit:	V
Resolution:	0.1 V

Communication information

Modbus Instance no/DeviceNet no:	31008
Profibus slot/index	121/152
EtherCAT index (hex)	23f0
Profinet IO index	1008
Fieldbus format	Long, 1=0.1 V
Modbus format	EInt

Frequency [718]

Displays the actual output frequency.

Read only	718 Frequency Stp Hz
Unit:	Hz
Resolution:	0.1 Hz

Communication information

Modbus Instance no/DeviceNet no:	31009
Profibus slot/index	121/153
EtherCAT index (hex)	23f1
Profinet IO index	1009
Fieldbus format	Long, 1=0.1 Hz
Modbus format	EInt

DC Link Voltage [719]

Displays the actual DC link voltage.

Read only	719 DC Voltage Stp V
Unit:	V
Resolution:	0.1 V

Communication information

Modbus Instance no/DeviceNet no:	31010
Profibus slot/index	121/154
EtherCAT index (hex)	23f2
Profinet IO index	1010
Fieldbus format	Long, 1=0.1 V
Modbus format	EInt

Heatsink Temperature [71A]

Displays the actual heatsink temperature, measured. The signal is generated by a sensor in the IGBT module.

Read only	71A Heatsink Tmp Stp °C
Unit:	°C
Resolution:	0.1 °C

Communication information

Modbus Instance no/DeviceNet no:	31011
Profibus slot/index	121/155
EtherCAT index (hex)	23f3
Profinet IO index	1011
Fieldbus format	Long, 1=0.1 °C
Modbus format	EInt

PT100_1_2_3 Temp [71B]

Displays the actual PT100 temperature if PT100 option boar is installed.

Read only	71B PT100 1,2,3 Stp °C
Unit:	°C
Resolution:	1°C

Communication information

Modbus Instance no/DeviceNet no:	31012, 31013, 31014
Profibus slot/index	121/156 121/157 121/158
EtherCAT index (hex)	23f4, 23f5, 23f6
Profinet IO index	1012, 1013, 1014
Fieldbus format	Long, 1=1 °C
Modbus format	EInt

5.7.2 Status [720]

VSD Status [721]

Indicates the overall status of the AC drive.

```
721 VSD Status
Stp 1/222/333/44
```

Fig. 53 AC drive status

Display position	Function	Status value
1	Parameter Set	A,B,C,D
222	Source of reference value	-Rem (remote) -Key (keyboard) -Com (Serial comm.) -Opt (option)
333	Source of Run/Stop command	-Rem (remote) -Key (keyboard) -Com (Serial comm.) -Opt (option)
44	Limit functions	- - - -No limit active -VL (Voltage Limit) -SL (Speed Limit) -CL (Current Limit) -TL (Torque Limit)

Example: “A/Key/Rem/TL”

This means:

A: Parameter Set A is active.

Key: Reference value comes from the keyboard (CP).

Rem: Run/Stop commands come from terminals 1-22.

TL: Torque Limit active.

Communication information

Modbus Instance no/DeviceNet no:	31015
Profibus slot/index	121/159
EtherCAT index (hex)	23f7
Profinet IO index	1015
Fieldbus format	UInt
Modbus format	UInt

Description of communication format

Integer values and bits used

Bit	Integer representation
1 - 0	Active Parameter set, where 0=A, 1=B, 2=C, 3=D
4 - 2	Source of Reference control value, where 0=Rem, 1=Key, 2=Com, 3=Option
7 - 5	Source of Run/Stop/Reset command, where 0=Rem, 1=Key, 2=Com, 3=Option
13 - 8	Active limit functions, where 0=No limit, 1=VL, 2=SL, 3=CL, 4=TL
14	Inverter is in warning (A warning condition is active)
15	Inverter is tripped (A Trip condition is active)

Example:
Previous example “A/Key/Rem/TL”
is interpreted “ 0/1/0/4”
In bit format this is presented as

Bit	Interpretation	Integer representation	
0 LSB	0	A(0)	Parameter set
1	0		
2	1	Key (1)	Source of control
3	0		
4	0		
5	0	Rem (0)	Source of command
6	0		
7	0		
8	0	TL (4)	Limit functions
9	0		
10	1		
11	0		
12	0		
13	0		
14	0		Warning condition
15 MSB	0		Trip condition

In the example above it is assumed that we have no trip or warning condition (the alarm LED on the control panel is off).

Warning [722]

Display the actual or last warning condition. A warning occurs if the AC drive is close to a trip condition but still in operation. During a warning condition the red trip LED will start to blink as long as the warning is active.

```
722          Warnings
Stp          warn.msg
```

The active warning message is displayed in menu [722]. If no warning is active the message “No Error” is displayed.

The following warnings are possible:

Communi-cation integer value	Warning message
0	No Error
1	Motor I²t
2	PTC
3	Motor lost
4	Locked rotor
5	Ext trip
6	Mon MaxAlarm
7	Mon MinAlarm
8	Comm error
9	PT100
10	Deviation
11	Pump
12	Ext Mot Temp
13	LC Level
14	Brake
15	Option
16	Over temp
17	Over curr F
18	Over volt D
19	Over volt G
20	Over volt
21	Over speed
22	Under voltag
23	Power fault
24	Desat
25	DClink error
26	Int error
27	Ovolt m cut
28	Over voltage
29	Not used
30	CRIO Comm
31	Encoder
32	AnalougeIn1
33	AnalougeIn2
34	AnalougeIn3
35	AnalougeIn4
36	Pump 2
37	Pers Protect
38	User trip 1
39	User trip 2

Communi-cation integer value	Warning message
40	User trip 3
41	User trip 4
42	OverTempPump
43	CleaningFail
44	FullspeedT
45	PumpNotClean
46	Overflow
47	SrtLvlNoPump
48	RTC lost
49	P2 Comm Err

Communication information

Modbus Instance no/DeviceNet no:	31016
Profibus slot/index	121/160
EtherCAT index (hex)	23f8
Profinet IO index	1016
Fieldbus format	UInt
Modbus format	UInt

See also in chapter “6. Troubleshooting, Diagnoses and Maintenance” on page 145.

Warning Pump 2[723]

Display the actual or last warning condition for Pump 2. Same conditions and warning as menu [722].

Read only	723 Warning P2 Stp

Communication information

Modbus Instance no/DeviceNet no:	30877
Profibus slot/index	121/21
EtherCAT index (hex)	236d
Profinet IO index	877
Fieldbus format	UInt
Modbus format	UInt

Digital Input Status [724]

Indicates the status of the digital inputs. See Fig. 54.

1 DigIn 1
2 DigIn 2
3 DigIn 3
4 DigIn 4
5 DigIn 5
6 DigIn 6
7 DigIn 7
8 DigIn 8

The positions one to eight (read from left to right) indicate the status of the associated input:

1 High

0 Low

The example in Fig. 54 indicates that DigIn 1, DigIn 3 and DigIn 6 are active at this moment.

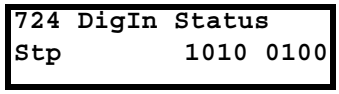


Fig. 54 Digital input status example

Communication information

Modbus Instance no/DeviceNet no:	30878
Profibus slot/index	121/22
EtherCAT index (hex)	236e
Profinet IO index	878
Fieldbus format	UInt, 1=1
Modbus format	UInt

Digital Output Status [725]

Indicates the status of the digital outputs and relays. See Fig. 55.

RE indicate the status of the relays on position:

1 Relay1
2 Relay2
3 Relay3

DO indicate the status of the digital outputs on position:

1 DigOut1
2 DigOut2

The status of the associated output is shown.

1 High
0 Low

The example in Fig. 55indicates that DigOut1 is active and Digital Out 2 is not active. Relay 1 is active, relay 2 and 3 are not active.

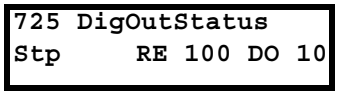


Fig. 55 Digital output status example

Communication information

Modbus Instance no/DeviceNet no:	30879
Profibus slot/index	121/23
EtherCAT index (hex)	236f
Profinet IO index	879
Fieldbus format	UInt, 1=1
Modbus format	UInt

Analogue Input Status [726]

Indicates the status of the analogue inputs 1 and 2.

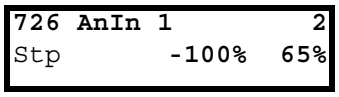


Fig. 56 Analogue input status

Communication information

Modbus Instance no/DeviceNet no:	30880, 30881
Profibus slot/index	121/24, 121/25
EtherCAT index (hex)	2370, 2371
Profinet IO index	880, 881
Fieldbus format	Long, 1=1%
Modbus format	EInt

The first row indicates the analogue inputs.

1 AnIn 1
2 AnIn 2

Reading downwards from the first row to the second row the status of the belonging input is shown in %:

-100% AnIn1 has a negative 100% input value
65% AnIn2 has a 65% input value

So the example in Fig. 57 indicates that both the Analogue inputs are active.

NOTE: The shown percentages are absolute values based on the full range/scale of the in- or output; so related to either 0–10 V or 0–20 mA.

Analogue Input Status [727]

Indicates the status of the analogue inputs 3 and 4.

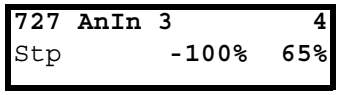


Fig. 57 Analogue input status

Communication information

Modbus Instance no/DeviceNet no:	30882, 30883
Profibus slot/index	121/26, 121/27
EtherCAT index (hex)	2372, 2373
Profinet IO index	882, 883
Fieldbus format	Long, 1=1%
Modbus format	EInt

Analogue Output Status [728]

Indicates the status of the analogue outputs. Fig. 58. E.g. if 4-20 mA output is used, the value 20% equals to 4 mA.

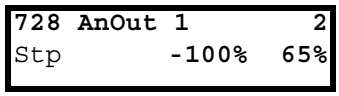


Fig. 58 Analogue output status

Communication information

Modbus Instance no/DeviceNet no:	30884, 30885
Profibus slot/index	121/28, 121/29
EtherCAT index (hex)	2374, 2375
Profinet IO index	884, 885
Fieldbus format	Long, 1=1%
Modbus format	EInt

The first row indicates the Analogue outputs.

1 AnOut 1
2 AnOut 2

Reading downwards from the first row to the second row the status of the belonging output is shown in %:

-100%AnOut1 has a negative 100% output value
65%AnOut2 has a 65% output value

The example in Fig. 58 indicates that both the Analogue outputs are active.

NOTE: The shown percentages are absolute values based on the full range/scale of the in- or output; so related to either 0–10 V or 0–20 mA.

I/O board Status [729] - [72B]

Indicates the status for the additional I/O on option boards 1 (B1), 2 (B2) and 3 (B3).

```
729 IO B1
Stp     RE 000 DI100
```

Communication information

Modbus Instance no/DeviceNet no:	30886 - 30888
Profibus slot/index	121/30 - 121/32
EtherCAT index (hex)	2376 - 2378
Profinet IO index	886 - 888
Fieldbus format	UInt,
Modbus format	bit 0=DigIn1 bit 1=DigIn2 bit 2=DigIn3 bit 8=Relay1 bit 9=Relay2 bit 10=Relay3

Status bits [72C]

This menu is not visible in the control panel display. It is used in EmoSoftCom PC-tool (optional) and can be read via fieldbus or serial communication, see also in Chapter 4.2.1 page 25.

Communication information

Modbus Instance no/DeviceNet no:	30889
Profibus slot/index	121/33
EtherCAT index (hex)	2379
Profinet IO index	889
Fieldbus format	UInt, 1=1
Modbus format	UInt

5.7.3 Stored values [730]

The shown values are the actual values built up over time. Values are stored at power down and updated again at power up.

Daily values are not preserved at power down and are reset every 24 hours, reset counter starts when drive is powered up. Resetting daily statistics in menu “Daily Reset [995]” will also reset the counter. Hence reset will occur every 24 hours from the moment of reset.

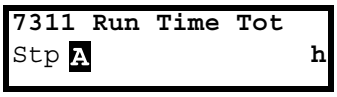
If an RTC is present, reset occurs automatically at midnight.

Run Time [731]

Displays the runtimes for the AC drive/s.

Run Time Total [7311]

Displays the total time all AC drives has been in Run Mode.

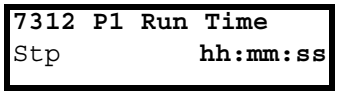
Read only		
Unit:		h: total runtime

Communication information

Modbus Instance no/DeviceNet no:	30892
Profibus slot/index	121/36
EtherCAT index (hex)	237c
Profinet IO index	892
Fieldbus format	UInt, 1=1
Modbus format	UInt,

Pump 1 Run Time [7312]

Displays the total time that pump 1 has been in Run Mode.

Read only	
Unit:	hh: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30893:30894:30895 (hr:min:sec)
Profibus slot/index	121/37, 121/38, 121/39
EtherCAT index (hex)	237d, 237e, 237f
Profinet IO index	893, 894, 895
Fieldbus format	Long, 1=1h:m:s
Modbus format	Eint

Pump 2 Run Time [7313]

Displays the total time that pump 2 has been in Run Mode.

Read only	7313 P2 Run Time Stp hh:mm:ss
Unit:	h: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30896:30897:30898 (hr:min:sec)
Profibus slot/index	121/40, 121/41, 121/42
EtherCAT index (hex)	2380, 2381, 2382
Profinet IO index	896, 897, 898
Fieldbus format	Long, 1=1h:m:s
Modbus format	Eint

Run time daily [7314]

Displays the total daily run time for all pumps.

Read only	7314 Run Time Day Stp h
Unit:	h: total runtime

Communication information

Modbus Instance no/DeviceNet no:	30899
Profibus slot/index	121/43
EtherCAT index (hex)	2383
Profinet IO index	899
Fieldbus format	UInt, 1=1
Modbus format	UInt

Pump 1 Run Time Daily [7315]

Displays the daily time that the Pump 1 has been in Run Mode.

Read only	7315 P1 RunT Day Stp hh:mm:ss
Unit:	hh: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30900:30901:30902 (hr:min:sec)
Profibus slot/index	121/44, 121/45, 121/46
EtherCAT index (hex)	2384, 2385, 2386
Profinet IO index	900,901, 902
Fieldbus format	Long, 1=1h:m:s
Modbus format	EInt

Pump 2 Run Time Daily [7316]

Displays the daily time that the Pump 2 has been in Run Mode.

	7316 P2 RunT Day Stp hh:mm:ss
Unit:	hh: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30903, 30904, 30905 (hr:min:sec)
Profibus slot/index	121/47, 121/48, 121/49
EtherCAT index (hex)	2387, 2388, 2389
Profinet IO index	903, 904, 905
Fieldbus format	Long, 1=1h:m:s
Modbus format	Eint

Mains time [732]

Displays the total time that the AC drive has been connected to the mains supply. This timer cannot be reset.

Read only	732 Mains Time Stp h:mm:ss
Unit:	h: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30906:30907:30908 (hr:min:sec)
Profibus slot/index	121/53, 121/54, 121/55
EtherCAT index (hex)	238b, 238b, 238c
Profinet IO index	906, 907, 908
Fieldbus format	Long, 1=1h:m:s
Modbus format	Eint

Energy [733]

Displays the energy consumption.

Energy total [7331]

Displays the total energy consumption of all pumps since the last energy reset in menu “Energy Reset [991]” took place.

Read only	7331 Energy tot Stp A kWh
Unit:	Wh (shows Wh, kWh, MWh or GWh)
Range:	0.0–1 GWh, counter will restart from 0 after 1 GWh.

Communication information

Modbus Instance no/DeviceNet no:	30909
Profibus slot/index	121/53
EtherCAT index (hex)	238d
Profinet IO index	909
Fieldbus format	Long, 1=1
Modbus format	EInt

Energy Pump 1 [7332]

Energy consumed by Pump 1 since the last energy reset.

Read only	7332 Energy P1 Stp A kWh
Unit:	Wh (shows Wh, kWh, MWh or GWh)
Range:	0.0–1 GWh, counter will restart from 0 after 1 GWh.

Communication information

Modbus Instance no/DeviceNet no:	30910
Profibus slot/index	121/178
EtherCAT index (hex)	240a
Profinet IO index	1034
Fieldbus format	Long, 1=1
Modbus format	EInt

Energy Pump 2 [7333]

Energy consumed by Pump 2 since the last energy reset.

Read only	7333 Energy P2 Stp A kWh
Unit:	Wh (shows Wh, kWh, MWh or GWh)
Range:	0.0–1 GWh, counter will restart from 0 after 1 GWh.

Communication information

Modbus Instance no/DeviceNet no:	30911
Profibus slot/index	121/55
EtherCAT index (hex)	238f
Profinet IO index	911
Fieldbus format	Long, 1=1
Modbus format	EInt

Energy Daily [7334]

Total daily energy consumed by all pumps.

Read only	7334 Energy Day Stp A kWh
Unit:	Wh (shows Wh, kWh, MWh or GWh)
Range:	0.0–1 GWh, counter will restart from 0 after 1 GWh.

Communication information

Modbus Instance no/DeviceNet no:	30912
Profibus slot/index	121/56
EtherCAT index (hex)	2390
Profinet IO index	912
Fieldbus format	Long, 1=1
Modbus format	EInt

Energy Daily Pump 1 [7335]

Daily energy consumed by pump 1.

Read only	7335 P1EnergyDay Stp A kWh
Unit:	Wh (shows Wh, kWh, MWh or GWh)
Range:	0.0–1 GWh, counter will restart from 0 after 1 GWh.

Communication information

Modbus Instance no/DeviceNet no:	30913
Profibus slot/index	121/57
EtherCAT index (hex)	2391
Profinet IO index	913
Fieldbus format	Long, 1=1
Modbus format	EInt

Energy Daily Pump 2 [7336]

Daily energy consumed by pump 2.

Read only	7336 P2EnergyDay Stp A kWh
Unit:	Wh (shows Wh, kWh, MWh or GWh)
Range:	0.0–1 GWh, counter will restart from 0 after 1 GWh.

Communication information

Modbus Instance no/DeviceNet no:	30914
Profibus slot/index	121/58
EtherCAT index (hex)	2392
Profinet IO index	914
Fieldbus format	Long, 1=1
Modbus format	EInt

Pump Starts [734]

Displays number of pump starts.

Total Pump starts [7341]

Displays the total number of starts since the last reset in menu “Reset starts[994]” took places

Read only	7341 Pstarts tot Stp A 0

Communication information

Modbus Instance no/DeviceNet no:	30915
Profibus slot/index	121/59
EtherCAT index (hex)	2393
Profinet IO index	915
Fieldbus format	Long, 1=1
Modbus format	EInt

Pump 1 starts [7342]

Displays the total number of starts for pump 1.

Read only	7342 P1 starts Stp A 0

Communication information

Modbus Instance no/DeviceNet no:	30916
Profibus slot/index	121/60
EtherCAT index (hex)	2394
Profinet IO index	916
Fieldbus format	Long, 1=1
Modbus format	EInt

Pump 2 starts [7343]

Displays the total number of starts for pump 2.

Read only	7343 P2 starts Stp A 0

Communication information

Modbus Instance no/DeviceNet no:	30917
Profibus slot/index	121/61
EtherCAT index (hex)	2395
Profinet IO index	917
Fieldbus format	Long, 1=1
Modbus format	EInt

Pump starts Daily [7344]

Total number of starts by all pumps daily.

Read only	7344 Pstarts Day Stp A 0

Communication information

Modbus Instance no/DeviceNet no:	30918
Profibus slot/index	121/62
EtherCAT index (hex)	2396
Profinet IO index	918
Fieldbus format	UInt, 1=1
Modbus format	UInt

Pump 1 starts Daily [7345]

Total number of starts by pump1 daily.

Read only	7345 P1StartsDay Stp A 0

Communication information

Modbus Instance no/DeviceNet no:	30919
Profibus slot/index	121/63
EtherCAT index (hex)	2397
Profinet IO index	919
Fieldbus format	UInt, 1=1
Modbus format	UInt

Pump 2 startsDaily[7346]

Total number of starts by pump2 daily.

Read only	7346 P2StartsDay Stp A 0

Communication information

Modbus Instance no/DeviceNet no:	30920
Profibus slot/index	121/64
EtherCAT index (hex)	2398
Profinet IO index	920
Fieldbus format	UInt, 1=1
Modbus format	UInt

EnergySaving [736]

Shows energy savings for the installation compared with standard On/Off control in %..

Read only	736 EnergySaving Stp 0%
Unit:	0%
Range:	0 - 100%

Communication information

Modbus Instance no/DeviceNet no:	30921
Profibus slot/index	121/65
EtherCAT index (hex)	2399
Profinet IO index	921
Fieldbus format	Int, 1=1
Modbus format	Int

Overflow [737]

Shows information of last overflow.

Last duration time [7371]

Shows for how long time Last Overflow has occurred.

Read only	7371 LastDurTime Stp 00:00:00
Unit:	h: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30923, 30924, 30925 (h,m,s)
Profibus slot/index	121/67, 121/68, 121/69
EtherCAT index (hex)	239b, 239c, 239d
Profinet IO index	923, 924, 925
Fieldbus format	Long, 1=1h,m,s
Modbus format	EInt

Total duration time [7373]

Shows total time for all Overflow.

Read only	7373 TotDurTime Stp 00:00:00
Unit:	h: mm:ss (hours: minutes: seconds)
Range:	00: 00: 00–262143: 59: 59

Communication information

Modbus Instance no/DeviceNet no:	30932, 30933, 30934 (h,m,s)
Profibus slot/index	121/76, 121/77, 121/78
EtherCAT index (hex)	23a4, 23a5, 23a6
Profinet IO index	932, 933, 934
Fieldbus format	Long, 1=1h,m,s
Modbus format	EInt

5.7.4 Flow status [740]

Following menus shows FlowDrive statistics.

Sump level [741]

Shows actual level in the pump sump.

Read only	741 Sump level Stp m
Unit:	m

Communication information

Modbus Instance no/DeviceNet no:	30940
Profibus slot/index	121/84
EtherCAT index (hex)	23ac
Profinet IO index	940
Fieldbus format	Long, 1=0.001
Modbus format	EInt

Inflow [742]

Shows estimated inflow to the sump.

Read only	742 Inflow Stp lit/s
Unit:	lit/s

Communication information

Modbus Instance no/DeviceNet no:	30941
Profibus slot/index	121/85
EtherCAT index (hex)	23ad
Profinet IO index	941
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Outflow [743]

Shows the current outflow statistics.

Outflow Tot [7431]

Shows the current outflow of all pumps. If a flowmeter is connected this value is obtained from the flowmeter, otherwise this value is estimated as a result from the Autotune program.

Read only	7431 Outflow Tot Stp A lit/s
Unit:	lit/s

Communication information

Modbus Instance no/DeviceNet no:	30942
Profibus slot/index	121/86
EtherCAT index (hex)	23ae
Profinet IO index	942
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Outflow Pump 1 [7432]

Current outflow produced by pump 1.

Read only	7432 Outflow P1 Stp A lit/s
Unit:	lit/s

Communication information

Modbus Instance no/DeviceNet no:	30943
Profibus slot/index	121/87
EtherCAT index (hex)	23af
Profinet IO index	943
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Outflow Pump 2 [7433]

Current outflow produced by pump 2.

Read only	7433 Outflow P2 Stp A lit/s
Unit:	lit/s

Communication information

Modbus Instance no/DeviceNet no:	30944
Profibus slot/index	121/88
EtherCAT index (hex)	23b0
Profinet IO index	944
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Pumped volume [744]

Accumulated pumped volume.

Volume pumped[7441]

Total accumulated pumped volume for all pumps.

Read only	7441 Vol pumped Stp A 0m3
Unit:	m3

Communication information

Modbus Instance no/DeviceNet no:	30945
Profibus slot/index	121/89
EtherCAT index (hex)	23b1
Profinet IO index	945
Fieldbus format	Long, 1=1
Modbus format	EInt

Volume Pump1 [7442]

Accumulated pumped volume for pump 1.

Read only	7442 P1 Volume Stp A 0m3
Unit:	m3

Communication information

Modbus Instance no/DeviceNet no:	30946
Profibus slot/index	121/90
EtherCAT index (hex)	23b2
Profinet IO index	946
Fieldbus format	Long, 1=1
Modbus format	EInt

Volume Pump 2 [7443]

Accumulated pumped volume for pump 2.

Read only	7443 P2 Volume Stp A 0m3
Unit:	m3

Communication information

Modbus Instance no/DeviceNet no:	30947
Profibus slot/index	121/91
EtherCAT index (hex)	23b3
Profinet IO index	947
Fieldbus format	Long, 1=1
Modbus format	EInt

VolumeDaily [7444]

Total daily accumulated pumped volume for all pumps.

Read only	7444 VolumeDaily Stp A 0m3
Unit:	m3

Communication information

Modbus Instance no/DeviceNet no:	30948
Profibus slot/index	121/92
EtherCAT index (hex)	23b4
Profinet IO index	948
Fieldbus format	UInt, 1=1
Modbus format	UInt

Pump 1 volume daily[7445]

Daily accumulated pumped volume for pump 1.

Read only	7445 P1Vol Daily Stp A 0m3
Unit:	m3

Communication information

Modbus Instance no/DeviceNet no:	30949
Profibus slot/index	121/93
EtherCAT index (hex)	23b5
Profinet IO index	949
Fieldbus format	UInt, 1=1
Modbus format	UInt

Pump 2 volume daily [7446]

Daily accumulated pumped volume for pump 2.

Read only	7446 P2Vol Daily Stp A 0m3
Unit:	m3

Communication information

Modbus Instance no/DeviceNet no:	30950
Profibus slot/index	121/94
EtherCAT index (hex)	23b6
Profinet IO index	950
Fieldbus format	UInt, 1=1
Modbus format	UInt

Frequency Pump 1 and Pump 2 [745]

Current frequency for pump1 and pump2.

Read only	745 Frequency Stp 0.0Hz 0.0Hz
Unit:	Hz

Communication information

Modbus Instance no/DeviceNet no:	30951, 30952
Profibus slot/index	121/94, 121/95
EtherCAT index (hex)	23b7, 23b8
Profinet IO index	951, 952
Fieldbus format	Long, 1=0.1
Modbus format	Eint

Pump mode Pump 1 and Pump 2 [746]

Indicate actual run mode for each pump.

Read only	746 Pump mode Stp Off Off
Off	Pump not allowed to run.
Manual	Pump manually controlled to full speed.
Auto	Pump automatically controlled (normal run mode)

Communication information

Modbus Instance no/DeviceNet no:	30953, 30954
Profibus slot/index	121/96, 121/97
EtherCAT index (hex)	23b9, 23ba
Profinet IO index	953, 954
Fieldbus format	UInt
Modbus format	UInt

Flow status [747]

Indicates the current state of the FlowDrive.

Read only		747 Flow state Stp Off
Off	0	Flow control not enabled.
BEP Standby	1	Waiting for the sump to fill up during BEP search.
Standby	2	Pump not running.
Flushing	3	Start the pump cycle with flushing the pipes.
Running	4	Pump running at desired speed.
Full speed	5	running at max. speed
Pump Clean	6	Running at cleaning speed in reverse direction.
BEP Running	7	Performing a BEP run.
LoadMonMeas	8	load monitor autotuning
Sump Clean	9	Clean sump by pumping down to slurping.
Pipe Clean	10	Clean pipes by producing as much flow as possible.

Communication information

Modbus Instance no/DeviceNet no:	30955
Profibus slot/index	121/99
EtherCAT index (hex)	23bb
Profinet IO index	955
Fieldbus format	UInt, 1=1
Modbus format	UInt

Actual start Level [748]

Indicates next start level. Will vary if using "Start lvl delta [3B2] nF)" otherwise always same as "Start level[3A22] nF)".

Read only		748 Act startLvl Stp 0m
Unit:	m	

Communication information

Modbus Instance no/DeviceNet no:	30956
Profibus slot/index	121/100
EtherCAT index (hex)	23bc
Profinet IO index	956
Fieldbus format	Long, 1=0.001
Modbus format	EInt

BEP [749]

Indicates BEP status (Autotune program mainly consists of the BEP algorithm).

BEP state [7491]

Indicates the current state.

Read only		7491 BEP state Stp Off
Off	0	Off
StartMeasure	1	Initial state, beginning measuring BEP
Resume	2	BEP algorithm resumed.
Measuring	3	BEP algorithm running.
Paused	4	BEP algorithm paused, will resume automatically.
Aborted	5	BEP algorithm aborted, will not resume.
Finished	6	BEP algorithm finalized.

Communication information

Modbus Instance no/DeviceNet no:	30957
Profibus slot/index	121/101
EtherCAT index (hex)	23BD
Profinet IO index	957
Fieldbus format	UInt, 1=1
Modbus format	uInt

BEP progress[7492]

Indicates progress of the BEP finding algorithm.
During AutoTune program this is continuously showing the state, when finished this will show 100%. Will be reset when running a new AutoTune.

Read only	7492 BEP progres Stp %
Unit:	%

Communication information

Modbus Instance no/DeviceNet no:	30958
Profibus slot/index	121/102
EtherCAT index (hex)	23BE
Profinet IO index	958
Fieldbus format	UInt, 1=1
Modbus format	uInt

5.8 View Trip Log [800]

Main menu with parameters for viewing all the logged trip data. In total the AC drive saves the last 10 trips in the trip memory. The trip memory refreshes on the FIFO principle (First In, First Out). Every trip in the memory is logged on the time of the "Run Time [731]" counter. At every trip, the actual values of several parameter are stored and available for troubleshooting.

5.8.1 Trip Message log [810]

Display the cause of the trip and what time that it occurred. When a trip occurs the status menus are copied to the trip message log. There are nine trip message logs [810]–[890]. When the tenth trip occurs the oldest trip will disappear.

After reset of occurred trip, the trip message will be removed and menu [100] will be indicated.

Read only	8x0 Trip message Stp h:mm:ss
Unit:	h: m (hours: minutes)
Range:	0h: 0m–65355h: 59m

```
810 Ext Trip
Stp        132:12:14
```

For fieldbus integer value of trip message, see message table for warnings, [722].

NOTE: Bits 0–5 used for trip message value. Bits 6–15 for internal use.

Communication information

Modbus Instance no/DeviceNet no:	31101
Profibus slot/index	121/245
EtherCAT index (hex)	244d
Profinet IO index	1101
Fieldbus format	UInt, 1=1
Modbus format	UInt

Trip message [811]-[8144]

The information from the status menus are copied to the trip message log when a trip occurs.

Trip menu	Copied from	Description
811		**Operation**
8111	711	Process Value
8112	712	Speed
8113	713	Torque
8114	714	Shaft Power
8115	715	Electrical Power
8116	716	Current
8117	717	Output voltage
8118	718	Frequency
8119	719	DC Link voltage
811A	71A	Heatsink Temperature
811B	71B	PT100_1, 2, 3
812		**Status**
8121	721	AC drive Status
8123	723	Warning pump 2
8124	724	Digital input status
8125	725	Digital output status
8126	726	Analogue input status 1-2
8127	727	Analogue input status 3-4
8128	728	Analogue output status 1-2
8129	729	I/O status option board 1
812A	72A	I/O status option board 2
812B	72B	I/O status option board 3 (not valid for IP2Y drives)
813		**Stored Val**
8131	7312	P1 Run Time
8132	732	Mains Time
8133	7332	Energy P1
8134	7341	Pstarts tot
8135	7342	P1 starts
8136	8236	Time
8137	8237	Date
814		**Flow Status**
8141	8241	Sump level
8142	8242	Pump mode
8143	8243	Flow state
8144	8244	BEP state

Communication information

Modbus Instance no/DeviceNet no:	31102 - 31139
Profibus slot/index	121/246 - 254, 122/0 - 28
EtherCAT index (hex)	244e - 2473
Profinet IO index	1102 - 1139
Fieldbus format	Depends on parameter, see respective parameter.
Modbus format	Depends on parameter, see respective parameter.

Example:

Fig. 59 shows the third trip memory menu [830]: Over temperature trip occurred after 1396 hours and 13 minutes in Run time.

```
830 Over temp
Stp          1396h:13m
```

Fig. 59 Trip 3

5.8.2 Trip Messages [820] - [890]

Same information as for menu [810].

Communication information

Modbus Instance no/ DeviceNet no:	31151–31185 31201–31235 31251–31285 31301–31335 31351–31385 31401–31435 31451–31485 31501–31535	Trip log list 2 3 4 5 6 7 8 9
Profibus slot/index	122/40–122/74 122/90–122/124 122/140–122/174 122/190–122/224 122/240–123/18 123/35 - 123/68 123/85–123/118 123/135–123/168	Trip log list 2 3 4 5 6 7 8 9
EtherCAT index (hex)	247e - 24b0 24b1 - 24e2 24e3 - 2514 2515 - 2546 2547 - 2578 2579 - 25aa 25ab - 25dc 25dd - 260e	Trip log list 2 3 4 5 6 7 8 9
Profinet IO index	1151 - 1185 1201 - 1235 1251 - 1285 1301 - 1335 1351 - 1385 1401 - 1435 1451 - 1485 1501 - 1535	Trip log list 2 3 4 5 6 7 8 9
Fieldbus format	See Trip 811 - 810	
Modbus format		

All nine alarm lists contain the same type of data. For example DeviceNet parameter 31101 in alarm list 1 contains the same data information as 31151 in alarm list 2.

5.8.3 Reset Trip Log [8A0]

Resets the content of the 10 trip memories.

	8A0 Reset Trip L Stp No	
Default:		No
No	0	
Yes	1	

Communication information

Modbus Instance no/DeviceNet no:	8
Profibus slot/index	0/7
EtherCAT index (hex)	2008
Profinet IO index	8
Fieldbus format	UInt
Modbus format	UInt

NOTE: After the reset the setting goes automatically back to "NO". The message "OK" is displayed for 2 sec.

5.9 System Data [900]

Main menu for viewing all the AC drive system data.

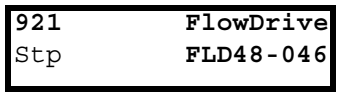
5.9.1 VSD Data [920]

VSD Type [921]

Shows the AC drive type according to the type number.

The options are indicated on the type plate of the AC drive.

NOTE: If the control board is not configured, then type type shown is FLD40-XXX.



Example of type

Communication information

Modbus Instance no/DeviceNet no:	31037
Profibus slot/index	121/181
EtherCAT index (hex)	240d
Profinet IO index	1037
Fieldbus format	UInt, 1=1
Modbus format	UInt

Examples:

FLD48-046, AC drive-series suited for 380-480 volt mains supply, and a rated output current of 46 A.

Software [922]

Shows the software version number of the AC drive.

Fig. 60 gives an example of the version number.

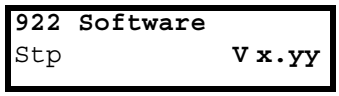


Fig. 60 Example of software version

V x.yy = Software version (example V 1.00)

x = (major) special software variant number

yy= (minor) revision of this special software

Communication information

Modbus Instance no/DeviceNet no:	31038 software version 31039 option version
Profibus slot/index	121/182-183
EtherCAT index (hex)	240e, 240f
Profinet IO index	1038, 1039
Fieldbus format	UInt
Modbus format	UInt

Table 14 Information for Modbus and Profibus number, software version

Bit	Example	Description
7–0	32	minor
13–8	4	major
15–14		release 00: V, release version 01: P, pre-release version 10: β, Beta version 11: α, Alpha version

Table 15 Information for Modbus and Profibus number, option version

Bit	Example	Description
7–0	07	Minor option version
15–8	03	Major option version

NOTE: It is important that the software version displayed in menu [922] is the same software version number as the software version number written on the title page of this instruction manual. If not, the functionality as described in this manual may differ from the functionality of the AC drive.

Build Info [9221]

Software version created, Date and time.

9221 Build Info Stp	
Default:	YY:MM:DD:HH:MM:SS

Build ID [9222]

Software identification code.

9222 Build ID Stp 0E1B7F9E	
Example:	0E1B7F9E

Unit name [923]

Option to enter a name of the unit for service use or customer identity. The function enables the user to define a name with max 12 characters. Use the Prev and Next key to move the cursor to the required position. Then use the + and - keys to scroll in the character list. Confirm the character by moving the cursor to the next position by pressing the Next key. See section User-defined Unit [323].

Example

Create user name USER 15.

1. When in the menu [923] press Next to move the cursor to the right most position.
2. Press the + key until the character U is displayed.
3. Press Next.
4. Then press the + key until S is displayed and confirm with Next.
5. Repeat until you have entered USER15.

923 USER 15 Stp	
Default:	No characters shown

Communication information

Modbus Instance no/DeviceNet no:	42301–42312
Profibus slot/index	165/225–236
EtherCAT index (hex)	48fd - 4908
Profinet IO index	18685 - 18696
Fieldbus format	UInt
Modbus format	UInt

When sending a unit name you send one character at a time starting at the right most position.

5.9.2 Clock [930]

This menu group displays actual time and date if you have the RTC-Real Time Clock option installed, see “Chapter Options in Installation & Getting started instruction”.

Time [931]

Actual time, displayed as HH:MM:SS. Adjustable setting.

931 Time Stp 00:00:00	
Default:	00:00:00

Communication information

Modbus Instance no/DeviceNet no:	42601, 42602, 42603 (h,m,s)
Profibus slot/index	167/15, 167/16, 167/17
EtherCAT index (hex)	4a29, 4a2a, 4a2b
Profinet IO index	18985, 18986, 18987
Fieldbus format	Long, 1=1 h/m/s
Modbus format	EInt

Date [932]

Actual date, displayed as YYYY-MM-DD. Adjustable setting.

```
932 Date
Stp        2013-01-01
```

Default:	2013-01-01

Communication information

Modbus Instance no/DeviceNet no:	42604, 42605, 42606 (Y,M,D)
Profibus slot/index	167/18,167/19, 167/20
EtherCAT index (hex)	4a2c, 4a2d, 4a2e
Profinet IO index	18988, 18989, 18990
Fieldbus format	Long, 1=1 Y/M/D
Modbus format	EInt

Weekday [933]

Display of actual weekday.

```
933 Weekday
Stp              Monday
```

Default:		Monday
Monday	0	
Tuesday	1	
Wednesday	2	
Thursday	3	
Friday	4	
Saturday	5	
Sunday	6	

Communication information

Modbus Instance no/DeviceNet no:	42607
Profibus slot/index	167/21
EtherCAT index (hex)	4a2f
Profinet IO index	18991
Fieldbus format	Long
Modbus format	EInt

5.9.3 Flow log 1P [940] Adv)

Auto Tune program measurements result for one pump.

Valid points [941] Adv)

Number of measuring points.

Read only

```
941 Valid points
Stp                    0
```

Communication information

Modbus Instance no/DeviceNet no:	37791
Profibus slot/index	148/50
EtherCAT index (hex)	3e6f
Profinet IO index	7791
Fieldbus format	UInt, 1=1
Modbus format	UInt

Freq:XX.xHz [942] Adv)

This menu is dynamic where XX.x is the frequency for which the data in following sub menus are measured.

Read only

```
942 Freq:50.0Hz
Stp
```

Communication information

Modbus Instance no/DeviceNet no:	47801
Profibus slot/index	187/115
EtherCAT index (hex)	5e79
Profinet IO index	24185
Fieldbus format	UInt, 1=0.1
Modbus format	UInt

Outflow [9421] **Adv)**

Measured outflow for one pump at frequency shown in parent menu [942].

Read only	9421 Outflow Stp 0Lit/s
Unit:	Lit/s

Communication information

Modbus Instance no/DeviceNet no:	47802
Profibus slot/index	187/116
EtherCAT index (hex)	5e7a
Profinet IO index	24186
Fieldbus format	Long, 1=0.1
Modbus format	EInt

Flow energy [9422] **Adv)**

Calculated relative energy for one pump at frequency shown in parent menu. Is compared to flow energy points for other frequencies at the end of the Auto Tune program to determine " BEP Speed [349] Adv)" on page 76. A lower value is more energy efficient than a high.

Read only	9422 Flow energy Stp 0Wh
Unit:	Wh

Communication information

Modbus Instance no/DeviceNet no:	47803
Profibus slot/index	187/117
EtherCAT index (hex)	5e7b
Profinet IO index	24187
Fieldbus format	Long, 1=0.01
Modbus format	EInt

Measured [9423] **Adv)**

Show if the measuring point is finalized.

Read only	9423 DataMeasured Stp 0
Default:	0
0	Not measured
1	Measured

Communication information

Modbus Instance no/DeviceNet no:	47804
Profibus slot/index	187/118
EtherCAT index (hex)	5e7c
Profinet IO index	24188
Fieldbus format	UInt, 1=1
Modbus format	UInt

Freq:XX.xHz [943] to [94K]**Adv)**

Same as for menu [942]. Gives up to18 values.

Communication information

Modbus Instance no/DeviceNet no:	47805-47876
Profibus slot/index	187/118 _ 187/190
EtherCAT index (hex)	5e7c - 5ec4
Profinet IO index	24188 - 24260
Fieldbus format	See menu [942] - [9423]
Modbus format	

5.9.4 Flow log 2P [950] Adv)

Auto Tune program measurements result for two pumps.

Valid points [951] Adv)

Same as menu [941] but for two pumps.

Read only	951 Valid points Stp 0

Communication information

Modbus Instance no/DeviceNet no:	37792
Profibus slot/index	148/51
EtherCAT index (hex)	3e70
Profinet IO index	7792
Fieldbus format	UInt, 1=1
Modbus format	UInt

Freq:XX.x for Pump 2Hz [952] to [95K] Adv)

Same as menu [942] but for two pumps.

Communication information

Modbus Instance no/DeviceNet no:	47901-47976
Profibus slot/index	187/215 _ 188/35
EtherCAT index (hex)	5edd - 5e28
Profinet IO index	24285 - 24360
Fieldbus format	See menu [942] - [9423]
Modbus format	

5.9.5 Reset [990]

In following menus various statistical data can be reset. This statistical data is generally found in the menus in chapter "5.7 View Operation/Status [700]" on page 122

A reset will reset the selected data in both Master and Follower unit, if connected.

Energy Reset [991]

A reset in this menu will reset data in menus [7331], [7332] and [7333].

	991 Reset Energy Stp No
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	53
Profibus slot/index	0/52
EtherCAT index (hex)	2035
Profinet IO index	53
Fieldbus format	UInt
Modbus format	UInt

Savings [992]

A reset in this menu will reset data in menu [736].

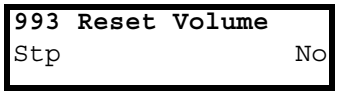
	992 Savings Stp No
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	55
Profibus slot/index	0/54
EtherCAT index (hex)	2037
Profinet IO index	55
Fieldbus format	UInt
Modbus format	UInt

Reset Volume[993]

A reset in this menu will reset data in menus [7441], [7442] and [7443].



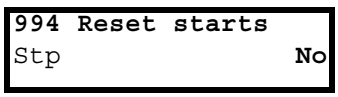
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	52
Profibus slot/index	0/51
EtherCAT index (hex)	2034
Profinet IO index	52
Fieldbus format	UInt
Modbus format	UInt

Reset starts[994]

A reset in this menu will reset data in menus [7341], [7342] and [7343].



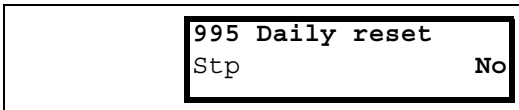
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	51
Profibus slot/index	0/520
EtherCAT index (hex)	2033
Profinet IO index	51
Fieldbus format	UInt
Modbus format	UInt

Daily Reset [995]

A reset in this menu will reset data in all daily menus:
[7314], [7315] and [7316]
[7334], [7335] and [7336]
[7344], [7345] and [7346]
[7444], [7445] and [7446].



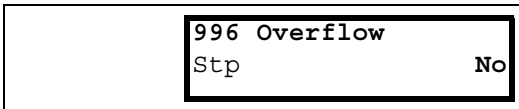
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	54
Profibus slot/index	0/53
EtherCAT index (hex)	2036
Profinet IO index	54
Fieldbus format	UInt
Modbus format	UInt

Overflow [996]

A reset in this menu will reset data in menus “Last duration time [7371]” and “Total duration time [7373]”.



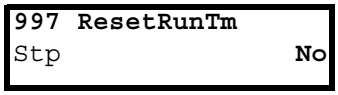
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	50
Profibus slot/index	0/49
EtherCAT index (hex)	2032
Profinet IO index	50
Fieldbus format	UInt
Modbus format	UInt

Reset run time[997]

A reset in this menu will reset data in menus [7311], [7312] and [7313] .

	
Default:	No
No	
Yes	

Communication information

Modbus Instance no/DeviceNet no:	56
Profibus slot/index	0/55
EtherCAT index (hex)	2038
Profinet IO index	56
Fieldbus format	UInt
Modbus format	UInt

6. Troubleshooting, Diagnoses and Maintenance

6.1 Trips, warnings and limits

In order to protect the AC drive the principal operating variables are continuously monitored by the system. If one of these variables exceeds the safety limit an error/warning message is displayed. In order to avoid any possibly dangerous situations, the inverter sets itself into a stop Mode called Trip and the cause of the trip is shown in the display.

Trips will always stop the AC drive. Trips can be divided into normal and soft trips, depending on the setup Trip Type, see menu "[250] Autoreset". Normal trips are default. For normal trips the AC drive stops immediately, i.e. the motor coasts naturally to a standstill. For soft trips the AC drive stops by ramping down the speed, i.e. the motor decelerates to a standstill.

"Normal Trip"

- The AC drive stops immediately, the motor coasts to a standstill.
- The Trip relay or output is active (if selected).
- The Trip LED is on.
- The accompanying trip message is displayed.
- The "TRP" status indication is displayed (area D of the display).
- After reset command, the trip message will disappear and menu [100] will be indicated.

"Soft Trip"

- the AC drive stops by decelerating to a standstill.

During the deceleration.

- The accompanying trip message is displayed, including an additional soft trip indicator "S" before the trip time.
- The Trip LED is flashing.
- The Warning relay or output is active (if selected).

After standstill is reached.

- The Trip LED is on.
- The Trip relay or output is active (if selected).
- The "TRP" status indication is displayed (area D of the display).
- After reset command, the trip message will disappear and menu [100] will be indicated.

Apart from the TRIP indicators there are two more indicators to show that the inverter is in an "abnormal" situation.

"Warning"

- The inverter is close to a trip limit.
- The Warning relay or output is active (if selected).
- The Trip LED is flashing.
- The accompanying warning message is displayed in window "[722] Warning".
- One of the warning indications is displayed (area F of the display).

"Warning/Log"

- Same as "Warning"
- Message is displayed in "Trip message log [810]"

"Limits"

- The inverter is limiting torque and/or frequency to avoid a trip.
- The Limit relay or output is active (if selected).
- The Trip LED is flashing.
- One of the Limit status indications is displayed (area D of the display).

Table 16 List of trips and warnings

Trip/Warning messages	Selections	Trip (Normal/ Soft)	Warning indicators (Area D)
Cleaning failed	Warning		
Comm error	Trip/Off/Warn	Normal/Soft	
Desat ### *	On	Normal	
DClink error	On	Normal	
Ext trip	Via DigIn	Normal/Soft	
Ext Mot Temp	Via DigIn	Normal/Soft	
Int error	Trip		
LC Level	Trip/Off/Warn Via DigIn	Normal/Soft	LCL
Locked rotor	Trip/Off	Normal	
Mon MaxAlarm	Trip/Off/Warn	Normal/Soft	
Mon MinAlarm	Trip/Off/Warn	Normal/Soft	
Motor I^2t	Trip/Off/Limit	Normal/Soft	I^2t
Motor lost	Trip/Off	Normal	
Motor PTC	On	Normal	
OPTION	On	Normal	
Over curr F	On	Normal	
Overflow	Warning/Log		
Over volt	On	Normal	
Over volt D	On	Normal	
Over volt G	On	Normal	
Ovolt m cut	On	Normal	
Over voltage	Warning		VL
Over temp	On	Normal	OT
Over speed			
Pers Protect	Warning/Log Via DigIn		
Power Fault PF #### *	On	Normal	
PT100	Trip/Off	Normal/Soft	
PTC	Trip/Off	Normal/Soft	
PumpNotClean	Warning		
P2 Comm Err	Warning/Log Via DigIn		
RTC lost	Warning		
Under voltage	On	Normal	LV
User trip 1 - 4	Trip/Off/Warn	Normal/Soft	

*) Refer to table Table 17 regarding which Desat or Power Fault is triggered.

6.2 Trip conditions, causes and remedial action

The table later on in this section must be seen as a basic aid to find the cause of a system failure and to how to solve any problems that arise. An AC drive is mostly just a small part of a complete AC drive system. Sometimes it is difficult to determine the cause of the failure, although the AC drive gives a certain trip message it is not always easy to find the right cause of the failure. Good knowledge of the complete drive system is therefore necessary. Contact your supplier if you have any questions.

The AC drive is designed in such a way that it tries to avoid trips by limiting torque, overvolt etc.

Failures occurring during commissioning or shortly after commissioning are most likely to be caused by incorrect settings or even bad connections.

Failures or problems occurring after a reasonable period of failure-free operation can be caused by changes in the system or in its environment (e.g. wear).

Failures that occur regularly for no obvious reasons are generally caused by Electro Magnetic Interference. Be sure that the installation fulfils the demands for installation stipulated in the EMC directives. See “8. EMC and standards” on page 157.

Sometimes the so-called “Trial and error” method is a quicker way to determine the cause of the failure. This can be done at any level, from changing settings and functions to disconnecting single control cables or replacing entire drives.

The Trip Log can be useful for determining whether certain trips occur at certain moments. The Trip Log also records the time of the trip in relation to the run time counter.

WARNING!
If it is necessary to open the AC drive or any part of the system (motor cable housing, conduits, electrical panels, cabinets, etc.) to inspect or take measure-ments as suggested in this instruction manual, it is absolutely necessary to read and follow the safety instructions in the manual.

6.2.1 Technically qualified personnel

Installation, commissioning, demounting, making measurements, etc., of or at the AC drive may only be carried out by personnel technically qualified for the task.

6.2.2 Opening the AC drive

WARNING!
Always switch the mains voltage off if it is necessary to open the AC drive and wait at least 7 minutes to allow the capacitors to discharge.

WARNING!
In case of malfunctioning always check the DC-link voltage, or wait one hour after the mains voltage has been switched off, before dismantling the AC drive for repair.

The connections for the control signals and the switches are isolated from the mains voltage. Always take adequate precautions before opening the AC drive.

6.2.3 Precautions to take with a connected motor

If work must be carried out on a connected motor or on the driven machine, the mains voltage must always first be disconnected from the AC drive. Wait at least 7 minutes before continuing.

6.2.4 Autoreset Trip

If the maximum number of Trips during Autoreset has been reached, the trip message hour counter is marked with an "A".

```
830 OVERVOLT G
Trp A 345:45:12
```

Fig. 61 Autoreset trip

Fig. 61 shows the 3rd trip memory menu [830]: Overvoltage G trip after the maximum Autoreset attempts took place after 345 hours, 45 minutes and 12 seconds of run time.

Table 17 Trip condition, their possible causes and remedial action

Trip condition	Possible Cause	Remedy
Cleaning failed	If “Pump Not Clean” warning is still active after repeated Pump Cleanings, “Cleaning Failed” is triggered. No more automatic cleaning attempts will be performed.	- Check why the pumps are sluggish, if they are clogged, clean the pump manually. - To remove the warning, run Pump Cleaning via menu “[3B32] ForcePumpCl” or via Digital in.
Comm error	Error on serial communication (option)	- Check cables and connection of the serial communication. - Check all settings with regard to the serial communication - Restart the equipment including the AC drive
Desat	Failure in output stage, - desaturation of IGBTs - Hard short circuit between phases or phase to earth - Earth fault	- Check on bad motor cable connections - Check on bad earth cable connections - Check on water and moisture in the motor housing and cable connections - Check that the rating plate data of the motor is correctly entered.
DC link error	DC link voltage ripple exceeds maximum level	- Make sure all three phases are properly connected and that the terminal screws are tightened. - Check that the mains supply voltage is within the limits of the AC drive. - Try to use other mains supply lines if dip is caused by other machinery.
Ext trip	External input (DigIn 1-8) active: - active low function on the input.	- Check the equipment that initiates the external input - Check the programming of the digital inputs DigIn 1-8
Ext Mot Temp	External input (DigIn 1-8) active: - active low function on the input.	- Check the equipment that initiates the external input - Check the programming of the digital inputs DigIn 1-8
Int error	Internal alarm	- Contact service.
LC Level	Low liquid cooling level in external reservoir. External input (DigIn 1-8) active: - active low function on the input. **NOTE:** Only valid for AC drive types with Liquid Cooling option.	- Check liquid cooling - Check the equipment and wiring that initiates the external input - Check the programming of the digital inputs DigIn 1-8
Locked rotor	Torque limit at motor standstill: - Mechanical blocking of the rotor.	- Check for mechanical problems at the motor or the machinery connected to the motor - Set locked rotor alarm to OFF.
Mon MaxAlarm	Max alarm level (overload) has been reached.	- Check the load condition of the machine - Check the monitor setting in section 5.4.1, page 76.
Mon MinAlarm	Min alarm level (underload) has been reached.	- Check the load condition of the machine - Check the monitor setting in section 5.4.1, page 76.
Motor I^2t “I^2t”	I^2t value is exceeded. - Overload on the motor according to the programmed I^2t settings.	- Check on mechanical overload on the motor or the machinery bearings, gearboxes, chains, belts, etc.) - Change the Motor I^2t Current setting in menu group [230]
Motor lost	Phase loss or too great imbalance on the motor phases	- Check the motor voltage on all phases. - Check for loose or poor motor cable connections If all connections are OK, contact your supplier - Set motor lost alarm to OFF.
Motor PTC	Motor thermistor (PTC) exceeds maximum level. **NOTE: Only valid if [237] is enabled.**	- Check on mechanical overload on the motor or the machinery (bearings, gearboxes, chains, belts, etc.) - Check the motor cooling system. - Self-cooled motor at low speed, too high load. - Set PTC, menu [237] to OFF
OPTION	If an Option specific trip occurs	- Check the description of the specific option

Table 17 Trip condition, their possible causes and remedial action

Trip condition	Possible Cause	Remedy
Over temp	Heatsink temperature too high: - Too high ambient temperature of the AC drive - Insufficient cooling - Too high current - Blocked or stuffed fans	- Check the cooling of the AC drive cabinet. - Check the functionality of the built-in fans. The fans must switch on automatically if the heatsink temperature gets too high. At power up the fans are briefly switched on. - Check AC drive and motor rating - Clean fans
Over curr F	Motor current exceeds the peak AC drive current: - Too short acceleration time. - Too high motor load - Excessive load change - Soft short-circuit between phases or phase to earth - Poor or loose motor cable connections - Too high IxR Compensation level	- Check the acceleration time settings and make them longer if necessary. - Check the motor load. - Check on bad motor cable connections - Check on bad earth cable connection - Check on water or moisture in the motor housing and cable connections. - Lower the level of IxR Compensation [352]
Overflow	Level in pump sump exceeds the configured overflow level or digital overflow switch is activated.	If actual level is as high as indicated. - Check if pumps are running. - Check if inflow is too high. - Check if pumps are not clean or in some other way obstructed. If actual level is not as high as indicated. - Check if levels are correctly configured, see “ Level configuration [3A2] nF)” on page 60. - Check actual level reported by the analogue level sensor, see “ Sump level [741]” on page 132. - Check digital overflow switch.
Over volt D(eceleration) Over volt G(eneration)	Too high DC Link voltage: - Too short deceleration time with respect to motor/machine inertia. - Too small brake resistor malfunctioning Brake chopper (Brake chopper is not available with FlowDrive)	- Check the deceleration time settings and make them longer if necessary. - Check the dimensions of the brake resistor and the functionality of the Brake chopper (if used)
Over volt (Mains) O(ver) volt M(ains) cut	Too high DC Link voltage, due to too high mains voltage	- Check the main supply voltage - Try to take away the interference cause or use other main supply lines.
Over speed	Motor speed measurement exceeds maximum level. 110% of max speed (all parameter sets).	- Check encoder cables, wiring and setup - Check motor data setup [22x] - Perform short ID-run
Pers Protect	External switch not reset in time. See Chapter 5.4.3 page 83	- Check pump station and why the technician not has reset the local alarm that is triggered before this alarm.
PF Comm Err	Internal communication error	- Contact service
PF Int Temp	Internal temperature too high	- Check internal fans
PF Temp Err	Malfunction in temperature sensor	- Contact service
PF Sup Err	Mains supply fault	- Check mains supply voltage - Check fuses and line connections.
Power Fault	One of the 10 PF (Power Fault) trips below has occured, but could not be determined.	- Check the PF errors and try to determine the cause. The trip history can be helpful.
PT100	Motor PT100 elements exceeds maximum level. **NOTE: Only valid if option board PTC/ PT100 is used.**	- Check on mechanical overload on the motor or the machinery (bearings, gearboxes, chains, belts, etc.) - Check the motor cooling system. - Self-cooled motor at low speed, too high load. - Set PT100 to OFF, menu [234]
PTC	Motor thermistor (PTC) exceeds maximum level. **NOTE: Only valid if option board PTC/ PT100 is used.**	- Check on mechanical overload on the motor or the machinery (bearings, gearboxes, chains, belts, etc.) - Check the motor cooling system. - Self-cooled motor at low speed, too high load. - Set PTC, menu [234] to OFF

Table 17 Trip condition, their possible causes and remedial action

Trip condition	Possible Cause	Remedy
PumpNotClean	Pumps are clogged.	- Activate Pumpcleaning in menu [3B31] - Run PumpCleaning via "[3B32] ForcePumpCl" - If Pump Not Clean warning is still active after Pump Cleaning, the pumps has to be manually cleaned.
P2 Comm Err	Communication with Follower unit is lost.	- Check wiring and configuration of the digital I/O pins used. - Check "Mode configuration [3A1]" on both drives; one drive should be Master and the other Follower.
RTC lost	RTC was detected at start up but communication is lost.	- Check internal cables to the RTC option board.
Under voltage	Too low DC Link voltage: - Too low or no supply voltage - Mains voltage dip due to starting other major power consuming machines on the same line.	- Make sure all three phases are properly connected and that the terminal screws are tightened. - Check that the mains supply voltage is within the limits of the AC drive. - Try to use other mains supply lines if dip is caused by other machinery - Use the function low voltage override [421]
User trip 1 - 4	Alarm turned on and the assigned digital input triggered the alarm.	- Check digital input polarity. - Check source of digital input.

6.3 Maintenance

The AC drive is designed to require minimum of servicing and maintenance. There are however some things which must be checked regularly in order to optimise product life time.

- Keep the AC drive unit clean and cooling efficient (clean air inlets, heatsink profile, parts, components, etc)
- There is an internal fan that should be inspected and cleaned from dust if necessary.
- If AC drives are built into cabinets, also check and clean the dust filters of the cabinets regularly.
- Check external wiring, connections and control signals.
- Check tightening of all terminal screws regularly, especially important are power and motor cable connections

Preventive maintenance can optimise the product life time and secure trouble free operation without interruptions.

For more information on maintenance, please contact your CG Drives & Automation service partner.

Precautions to take with a connected motor

NOTE: Refer to motor manufacturers instruction manual for motor maintenance requirements.

If work must be carried out on a connected motor or on the driven machine, the mains voltage must always first be disconnected from the drive unit.

7. Serial communication

The AC drive provides possibility for different types of serial communication.

- Modbus RTU via RS232/485
- Fieldbuses as Profibus DP and DeviceNet
- Industrial Ethernet as Modbus/TCP, Profinet IO, EtherCAT and EtherNet/IP

7.1 Modbus RTU

The AC drive has an asynchronous serial communication interface behind the control panel. It is also possible to use the isolated RS232/485 option board (if installed).
The protocol used for data exchange is based on the Modbus RTU protocol, originally developed by Modicon. The physical connection is RS232. The AC drive acts as a Follower with address 1 in a master-follower configuration. The
communication is half-duplex. It has a standard non return zero (NRZ) format.

The baud rate is fixed to 9600 (Control panel RS232 port).

The character frame format (always 11 bits) has:

- one start bit
- eight data bits
- two stop bits
- no parity

It is possible to temporarily connect a personal computer with for example the software EmoSoftCom (programming and monitoring software) to the RS232 connector on the control panel. This can be useful when copying parameters between AC drives etc. For permanent connection of a personal computer you have to use one of the communication option boards.

NOTE: This RS232 port is not isolated.

WARNING!
Correct and safe use of a RS232 connection depends on the ground pins of both ports being the same potential. Problems can occur when connecting two ports of e.g. machinery and computers where both ground pins are not the same potential. This may cause hazardous ground loops that can destroy the RS232 ports.

The RS232 connection behind the control panel is not galvanically isolated.

The RS232/485 option board from CG Drives & Automation is galvanically isolated.

Note that the control panel RS232 connection can safely be used in combination with commercial available isolated USB to RS232 converters.

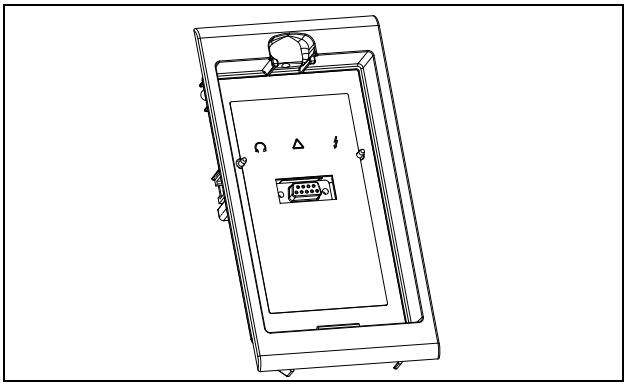


Fig. 62 RS232 connector behind the control panel

7.2 Parameter sets

Communication information for the different parameter sets.

The different parameter sets in the AC drive have the following DeviceNet instance numbers, Profibus slot/index numbers, Profinet IO index and EtherCAT index numbers:

Param. set	Modbus/ DeviceNet Instance number	Profibus Slot/Index	Profinet IO index	EtherCAT index (hex)
A	43001–43899	168/160 to 172/38	19385 - 20283	4bb9 - 4f3b
B	44001–44899	172/140 to 176/18	20385 - 21283	4fa1 - 5323
C	45001–45899	176/120 to 179/253	21385 - 22283	5389 - 5706
D	46001–46899	180/100 to 183/233	22385 - 23283	5771 - 5af3

Parameter set A contains parameters 43001 to 43899. The parameter sets B, C and D contains the same type of information. For example parameter 43123 in parameter set A contain the same type of information as 44123 in parameter set B.

7.3 Motor data

Communication information for the different motors.

Motor	Modbus/ DeviceNet Instance number	Profibus Slot/ Index	Profinet IO index	EtherCAT index (hex)
M1	43041–43048	168/200 to 168/207	19425 - 19432	4be1 - 4be8
M2	44041–44048	172/180 to 174/187	20425 - 20432	4fc9 - 4fd0
M3	45041–45048	176/160 to 176/167	21425 - 21432	53b1 - 53b8
M4	46041–46048	180/140 to 180/147	22425 - 22432	5799 - 57a0

M1 contains parameters 43041 to 43048. The M2, M3, and M4 contains the same type of information. For example parameter 43043 in motor M1 contain the same type of information as 44043 in M2.

7.4 Description of the EInt formats

A parameter with Eint format can be represented in two different formats (F). Either as a 15 bit unsigned integer format (F= 0) or a Emotron floating point format (F=1). The most significant bit (B15) indicates the format used. See detailed description below.
All parameters written to a register may be rounded to the number of significant digits used in the internal system.

The matrix below describes the contents of the 16-bit word for the two different EInt formats:

```
B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
F=1 e3  e2  e1  e0  m10 m9 m8 m7 m6 m5 m4 m3 m2 m1 m0
F=0 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
```

If the format bit (B15) is 0, then all bits may be treated as a standard unsigned integer (UInt)

If the format bit is 1, then is the number interpreted as this:

Value = M * 10^E, where M=m10..m0 represents a two- complement signed mantissa and E= e3..e0 represents a two- complement signed exponent.

NOTE: Parameters with EInt format may return values both as 15 bit unsigned int (F=0) or in Emotron floating point (F=1).

Example, resolution

If you write the value 1004 to a register and this register has 3 significant digits, it will be stored as 1000.

In the Emotron floating point format (F=1), one 16-bit word is used to represent large (or very small numbers) with 3 significant digits.

If data is read or written as a fixed point (i.e. no decimals) number between 0-32767, the 15 bit Unsigned integer format (F=0) may be used.

Detailed description of Emotron floating point format

```
e3-e0 4-bit signed exponent. Gives a value
range:
-8..+7 (binary 1000 .. 0111)
m10-m0 11-bit signed mantissa.Gives a value
range:
-1024..+1023 (binary
10000000000..01111111111)
```

A signed number should be represented as a two complement binary number, like below:

Value Binary

```
-8 1000
-7 1001
..
-2 1110
-1 1111
0 0000
1 0001
2 0010
..
6 0110
7 0111
```

The value represented by the Emotron floating point format is m·10e.

To convert a value from the Emotron floating point format to a floating point value, use the formula above.

To convert a floating point value to the Emotron floating point format, see the C-code example below.

Example, floating point format

The number 1.23 would be represented by this in Emotron floating point format,

```
F EEEE MMMMMMMMMMM
1 1110 00001111011
F=1 -> floating point format used
E=-2
M=123
```

The value is then $123x10^{-2} = 1.23$

Example 15bit unsigned int format

The value 72.0 can be represented as the fixed point number 72. It is within the range 0-32767, which means that the 15-bit fixed point format may be used.

The value will then be represented as:

```
B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0   0   0   0   0   0   0  0  0  1  0  0  1  0  0  0
```

Where bit 15 indicates that we are using the fixed point format (F=0).

Programming example:

```
typedef struct
{
  int m:11; // mantissa, -1024..1023
  int e: 4; // exponent -8..7
  unsigned int f: 1; // format, 1->special emoint format
}    eint16;
//---------------------------------------------------------------------------
unsigned short int float_to_eint16(float value)
{
  eint16 etmp;
  int dec=0;

  while (floor(value) != value && dec<16)
  {
     dec++; value*=10;
  }
  if (value>=0 && value<=32767 && dec==0)
     *(short int *)&etmp=(short int)value;
  else if (value>=-1000 && value<0 && dec==0)
  {
     etmp.e=0;
     etmp.f=1;
     etmp.m=(short int)value;
  }
  else
  {
     etmp.m=0;
     etmp.f=1;
     etmp.e=-dec;
     if (value>=0)
        etmp.m=1; // Set sign
     else
        etmp.m=-1; // Set sign
     value=fabs(value);
     while (value>1000)
     {
        etmp.e++; // increase exponent
        value=value/10;
     }
     value+=0.5; // round
     etmp.m=etmp.m*value; // make signed
  }
 return (*(unsigned short int *)&etmp);
}
//---------------------------------------------------------------------------
float eint16_to_float(unsigned short int value)
{
  float f;
  eint16 evalue;

  evalue=*(eint16 *)&value;
  if (evalue.f)
  {
     if (evalue.e>=0)
        f=(int)evalue.m*pow10(evalue.e);
     else
        f=(int)evalue.m/pow10(abs(evalue.e));
  }
  else
     f=value;

  return f;
}
//---------------------------------------------------------------------------
```

8. EMC and standards

8.1 EMC standards

The AC drive complies with the following standards:

EN(IEC)61800-3:2004 Adjustable speed electronic power drive systems, part 3, EMC product standards:

Standard: category C3, for systems of rated supply voltage< 1000 VAC, intended for use in the second environment.

Optional: Category C2 for systems of rated supply voltage <1.000 V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by experienced person with the necessary skills in installing and/or commissioning AC drives including their EMC aspects.

8.2 Stop categories and emergency stop

The following information is important if emergency stop circuits are used or needed in the installation where a AC drive is used. EN 60204-1 defines 3 stop categories:

Category 0: Uncontrolled STOP:

Stopping by switching off the supply voltage. A mechanical stop must be activated. This STOP may not be implemented with the help of a AC drive or its input/output signals.

Category 1: Controlled STOP:

Stopping until the motor has come to rest, after which the mains supply is switched off. This STOP may not be implemented with the help of a AC drive or its input/output signals.

Category 2: Controlled STOP:

Stopping while the supply voltage is still present. This STOP can be implemented with each of the AC drives STOP command.

WARNING!
EN 60204-1 specifies that every machine must be provided with a category 0 stop. If the application prevents this from being implemented, this must be explicitly stated. Furthermore, every machine must be provided with an Emergency Stop function. This emergency stop must ensure that the voltage at the machine contacts, which could be dangerous, is removed as quickly as possible, without resulting in any other danger. In such an Emergency Stop situation, a category 0 or 1 stop may be used. The choice will be decided on the basis of the possible risks to the machine.

NOTE: With option Safe Stop, a "Safe Torque Off (STO)" stop according EN-IEC 62061:2005 SIL 3 & EN-ISO 13849-1:2006, can be achieved.
See chapter, Safe Stop option

9. Menu List

On our home page in the download area, you could find a "Communication information" list and a list to note Parameter set information.

Some menus are marked with grey, see below, these menus are so called “Advanced menus”:

3A24	BEP start	No		

To access the advanced menus, press  and  buttons simultaneously for 3 seconds. It is also possible to go to menu “[21D] MenuMode” and select FLD Advanced.

						Factory setting	Customer	Page
100	Preferred View							33
	110	1st Line				Sump level		
	120	2nd Line				Frequency		
200	Main Setup							
	210	Operation						34
		211	Language			English		
		212	Select Motor			M1		
		214	Ref Control			Flow ctrl		
		215	Run/Stp Ctrl			Flow ctrl		
		216	Reset Ctrl			Rem+Keyb+Com		
		218	Lock Code?			0		
		219	Rotation			R+L		
		21A	Level/Edge			Level		
		21B	Supply Volts			Not Defined		
		21C	Drive Appl.			Waste water		
		21D	MenuMode			Basic		
	220	Motor Data						38
		221	Motor Volts			U_{NOM} V		
		222	Motor Freq			50Hz		
		223	Motor Power			(P_{NOM}) kW		
		224	Motor Curr			(I_{MOT}) A		
		225	Motor Speed			(n_{MOT}) rpm		
		226	Motor Poles			4		
		227	Motor Cosφ			$Cos\varphi_{NOM}$		
		228	Motor Vent			Self		
		229	Motor ID-Run			Off		
		22A	Motor Sound			F		
		22E	Motor PWM					
			22E1	PWM Fswitch		3.00 kHz		
			22E2	PWM Mode		Standard		
			22E3	PWM Random		Off		
		22H	Phase order			Normal		
	230	Mot Protect						42
		231	Mot I^2t Type			Trip		
		232	Mot I^2t Curr			100%		
		233	Mot I^2t Time			60s		
		234	Thermal Prot			Off		
		235	Motor Class			F 140°C		
		236	PT100 Inputs			PT100 1+2+3		
		237	Motor PTC			Off		

						Factory setting	Customer	Page
240	Set Handling							46
	241	Select Set				A		
	242	Copy Set				A>B		
	243	Default>Set				A		
	244	Copy to CP				No Copy		
	245	Load from CP				No Copy		
250	Autoreset							48
	251	No of Trips				10		
	252	Overtemp				Off		
	253	Overvolt D				Off		
	254	Overvolt G				Off		
	255	Overvolt				6s		
	256	Motor Lost				Off		
	257	Locked Rotor				Off		
	258	Power Fault				Off		
	259	Undervoltage				6s		
	25A	Motor I^2t				60s		
	25B	Motor I^2t TT				Trip		
	25C	PT100				Off		
	25D	PT100 TT				Trip		
	25E	PTC				Off		
	25F	PTC TT				Trip		
	25G	Ext Trip				Off		
	25H	Ext Trip TT				Trip		
	25I	Com Error				Off		
	25J	Com Error TT				Trip		
	25K	Min Alarm				Off		
	25L	Min Alarm TT				Trip		
	25M	Max Alarm				Off		
	25N	Max Alarm TT				Trip		
	25O	Over curr F				Off		
	25P	Pump				Off		
	25Q	Over speed				Off		
	25R	Ext Mot Temp				Off		
	25S	Ext Mot TT				Trip		
	25T	LC Level				Off		
	25U	LC Level TT				Trip		
260	Serial Com							55
	261	Com Type				RS232/485		
	262	RS232/485						55
		2621	Baudrate			38400		
		2622	Address			1		
	263	Fieldbus						56
		2631	Address			62		
		2632	PrData Mode			Basic		
		2633	Read/Write			RW		
		2634	AddPrValues			0		
	264	Comm Fault						57
		2641	ComFlt Mode			Off		
		2642	ComFlt Time			0.5 s		
	265	Ethernet						58
		2651	IP Address			0.0.0.0		
		2652	MAC Address			000000000000		
		2653	Subnet Mask			0.0.0.0		
		2654	Gateway			0.0.0.0		
		2655	DHCP			Off		
	266	FB Signal						59
		2661	FB Signal 1			0		

					Factory setting	Customer	Page
			2662	FB Signal 2	0		
			2663	FB Signal 3	0		
			2664	FB Signal 4	0		
			2665	FB Signal 5	0		
			2666	FB Signal 6	0		
			2667	FB Signal 7	0		
			2668	FB Signal 8	0		
			2669	FB Signal 9	0		
			266A	FB Signal 10	0		
			266B	FB Signal 11	0		
			266C	FB Signal 12	0		
			266D	FB Signal 13	0		
			266E	FB Signal 14	0		
			266F	FB Signal 15	0		
			266G	FB Signal 16	0		
		269	FB Status				
300	Process						59
	3A0	Level Ctrl					
		3A1	Mode config				59
			3A11	Drive conf.	Stand alone		
			3A12	Start Sel.	Run time		
			3A13	Empty time	240min		
		3A2	Level config				60
			3A21	Overflow	0		
			3A22	Start Level	0		
			3A23	Stop Level	0		
			3A24	BEP start	0		
			3A25	BEP stop	0		
			3A26	PreOverFlow	0		
		3A3	Sump Geometry				61
			3A31	Level 1	0		
			3A32	Area 1	Off		
			3A33	Level 2	0		
			3A34	Area 2	Off		
			3A35	Level 3	0		
			3A36	Area 3	Off		
			3A37	Level 4	0		
			3A38	Area 4	Off		
			3A39	Level 5	0		
			3A3A	Area 5	Off		
		3A4	Autotune				63
			3A41	Start AutoT	Off		
			3A42	LoadMonTune	Yes		
			3A43	BEP samples	5		
			3A44	BEP step	2Hz		
	3B0	Functions					64
		3B1		Flush start			
			3B11	Flush time	10s		
			3B12	Flush speed	50Hz		
		3B2	Start lvl △		Off		65
		3B3	PumpCleaning				65
			3B31	Act.PumpCln	No		
			3B32	ForcePumpCl	Off		
			3B33	PumpCperiod	Off		
			3B34	Rev. speed	50Hz		
			3B35	ReverseTime	10s		
			3B3A	PC interval	Off		
			3B3B	PCstartDate	2015-01-01		
			3B3C	PCstartTime	Off		
		3B4	SumpCleaning				67
			3B41	Act.SumpCln	Off		
			3B42	ForceSumpCl	No		
			3B43	Off Torque △	50%		
			3B44	Timeout	10min		
			3B4A	RecurInterv	0days		
			3B4B	SCstartDate	2015-01-01		
			3B4C	SCstartTime	00:00:00		
		3B5	PipeCleaning				69
			3B51	ForcePipeC	No		
			3B52	PipeCperiod	Off		
		3B6	LoadMonitor				
			3B61	LoadMonTune	Not Done		
	3C0	Sensors					70
		3C1	Level sensor				70
			3C11	Level Unit	m		
			3C13	Sensor min	0		
			3C14	Sensor max	10		
			3C15	Ratio	Linear		
		3C2	Flow sensor				72
			3C21	Flow Unit	Lit/s		
			3C23	Flow Min	0		
			3C24	Flow Max	1000		
			3C25	Ratio	Linear		
	330	Start/Stop					73
		331	Acc Time		4s		
		332	Dec Time		4s		
		335	Acc>Min Spd		4s		
		336	Dec<Min Spd		4s		
		337	Acc Rmp		Linear		
		338	Dec Rmp		Linear		
		339	Start Mode		Fast		
	340	Speed					75
		341	Min speed		50Hz		
		343	Max speed		Sync		
		349	BEP Speed		0Hz		
400	Monitor/Prot						76
	410	Load Monitor					76
		411	Alarm Select		Off		
		412	Alarm trip		Off		
		413	Ramp Alarm		Off		
		414	Start Delay		5s		
		415	Load Type		Load Curve		
		416	Max Alarm				78
			4161	MaxAlarmMar	30%		
			4162	MaxAlarmDel	10s		
		417	Max Pre alarm				78
			4171	MaxPreAlMar	20%		
			4172	MaxPreAlDel	5s		
		418	Min Pre Alarm				78
			4181	MinPreAlMar	20%		
			4182	MinPreAlDel	5s		
		419	Min Alarm				79
			4191	MinAlarmMar	30%		
			4192	MinAlarmDel	10s		
		41A	Autoset Alrm		No		
		41B	Normal Load		100%		

					Factory setting	Customer	Page
	41C	Load Curve					80
		41C1	Load Curve 1	0 rpm 100%			
		41C2	Load Curve 2	0 rpm 100%			
		41C3	Load Curve 3	0 rpm 100%			
		41C4	Load Curve 4	0 rpm 100%			
		41C5	Load Curve 5	0 rpm 100%			
		41C6	Load Curve 6	0 rpm 100%			
		41C7	Load Curve 7	0 rpm 100%			
		41C8	Load Curve 8	0 rpm 100%			
		41C9	Load Curve 9	0 rpm 100%			
	420	Process Prot					81
		421	Low Volt OR		On		
		422	Rotor Locked		Off		
		423	Motor Lost		Off		
		424	OverVolt Ctl		On		
		425	OverflowPol		High		
		426	Sensor lost		Off		
	430	Person Prot					83
		431	PreAlarm		30min		
		432	Alarm		5min		
	440	User trips					84
		441	User trip 1				
			4411	Action	No action		
			4412	Delay	0s		
			4413	Active pol	High		
			4414	Autoreset	Off		
			4415	Trip name	User defined		
			4416	Trip text	User trip 1		
		442	User trip 2				85
			4421	Action	No action		
			4422	Delay	0s		
			4423	Active pol	High		
			4424	Autoreset	Off		
			4425	Trip name	User defined		
			4426	Trip text	User trip 2		
		443	User trip 3				
			4431	Action	No action		
			4432	Delay	0s		
			4433	Active pol	High		
			4434	Autoreset	Off		
			4435	Trip name	User defined		
			4436	Trip text	User trip 3		
		444	User trip 4				
			4441	Action	No action		
			4442	Delay	0s		
			4443	Active pol	High		
			4444	Autoreset	Off		
			4445	Trip name	User defined		
			4446	Trip text	User trip 4		
500	I/Os						102
	510	An Inputs					
		511	AnIn1 Fc		Level sensor		
		512	AnIn1 Setup		4-20mA		
		513	AnIn1 Advn				
			5131	AnIn1 Min	4mA		
			5132	AnIn1 Max	20.00mA		
			5133	AnIn1 Bipol	20.00mA		
			5134	AnIn1 FcMin	Min		

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		5135	AnIn1 VaMin	0		
		5136	AnIn1 FcMax	Max		
		5137	AnIn1 VaMax	0		
		5138	AnIn1 Oper	Add+		
		5139	AnIn1 Filt	0.1s		
		513A	AnIn1 Enabl	On		
	514	AnIn2 Fc		Off		89
	515	AnIn2 Setup		4-20mA		
	516	AnIn2 Advan				90
		5161	AnIn2 Min	4mA		
		5162	AnIn2 Max	20.00mA		
		5163	AnIn2 Bipol	20.00mA		
		5164	AnIn2 FcMin	Min		
		5165	AnIn2 VaMin	0		
		5166	AnIn2 FcMax	Max		
		5167	AnIn2 VaMax	0		
		5168	AnIn2 Oper	Add+		
		5169	AnIn2 Filt	0.1s		
		516A	AnIn2 Enabl	On		
	517	AnIn3 Fc		Off		90
	518	AnIn3 Setup		4-20mA		
	519	AnIn3 Advan				
		5191	AnIn3 Min	4mA		
		5192	AnIn3 Max	20.00mA		
		5193	AnIn3 Bipol	20.00mA		
		5194	AnIn3 FcMin	Min		
		5195	AnIn3 VaMin	0		
		5196	AnIn3 FcMax	Max		
		5197	AnIn3 VaMax	0		
		5198	AnIn3 Oper	Add+		
		5199	AnIn3 Filt	0.1s		
		519A	AnIn3 Enabl	On		
	51A	AnIn4 Fc		Off		91
	51B	AnIn4 Setup		4-20mA		
	51C	AnIn4 Advan				91
		51C1	AnIn4 Min	4mA		
		51C2	AnIn4 Max	20.00mA		
		51C3	AnIn4 Bipol	20.00mA		
		51C4	AnIn4 FcMin	Min		
		51C5	AnIn4 VaMin	0		
		51C6	AnIn4 FcMax	Max		
		51C7	AnIn4 VaMax	0		
		51C8	AnIn4 Oper	Add+		
		51C9	AnIn4 Filt	0.1s		
		51CA	AnIn4 Enabl	On		
520	Dig Inputs					92
	521	DigIn 1		Flow ManRun		
	522	DigIn 2		Flow AutoRun		
	523	DigIn 3		FlowLink In		
	524	DigIn 4		Off		
	525	DigIn 5		Off		
	526	DigIn 6		Lvl overflow		
	527	DigIn 7		Off		
	528	DigIn 8		Reset		
	529	B(oard)1 DigIn 1		Off		
	52A	B(oard)1 DigIn 2		Off		
	52B	B(oard)1 DigIn 3		Off		
	52C	B(oard)2 DigIn 1		Off		

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	52D	B(oard)2 DigIn 2		Off		
	52E	B(oard)2 DigIn 3		Off		
	52F	B(oard)3 DigIn 1		Off		
	52G	B(oard)3 DigIn 2		Off		
	52H	B(oard)3 DigIn 3		Off		
530	An Outputs					93
	531	AnOut1 Fc		Frequency		
	532	AnOut1 Setup		4-20mA		
	533	AnOut1 Advan				
		5331	AnOut 1 Min	4mA		
		5332	AnOut 1 Max	20.0mA		
		5333	AnOut1Bipol	20.0mA		
		5334	AnOut1 FcMin	Min		
		5335	AnOut1 VaMin	0		
		5336	AnOut1 FcMax	Max		
		5337	AnOut1 VaMax	0		
	534	AnOut2 FC		Current		
	535	AnOut2 Setup		4-20mA		
	536	AnOut2 Advan				
		5361	AnOut 2 Min	4mA		
		5362	AnOut 2 Max	20.0mA		
		5363	AnOut2Bipol	20.0mA		
		5364	AnOut2 FcMin	Min		
		5365	AnOut2 VaMin	0		
		5366	AnOut2 FcMax	Max		
		5367	AnOut2 VaMax	0		
540	Dig Outputs					97
	541	DigOut 1		Ready		
	542	DigOut 2		FlowLinkOut		
550	Relays					99
	551	Relay 1		Trip		
	552	Relay 2		Run		
	553	Relay 3		Off		
	554	B(oard)1 Relay 1		Off		
	555	B1 Relay 2		Off		
	556	B1 Relay 3		Off		
	557	B2 Relay 1		Off		
	558	B2 Relay 2		Off		
	559	B2 Relay 3		Off		
	55A	B3 Relay 1		Off		
	55B	B3 Relay 2		Off		
	55C	B3 Relay 3		Off		
	55D	Relay Advan				
		55D1	Relay 1 Mode	N.O		
		55D2	Relay 2 Mode	N.O		
		55D3	Relay 3 Mode	N.O		
		55D4	B1R1 Mode	N.O		
		55D5	B1R2 Mode	N.O		
		55D6	B1R3 Mode	N.O		
		55D7	B2R1 Mode	N.O		
		55D8	B2R2 Mode	N.O		
		55D9	B2R3 Mode	N.O		
		55DA	B3R1 Mode	N.O		
		55DB	B3R2 Mode	N.O		
		55DC	B3R3 Mode	N.O		
560	Virtual I/Os					101
	561	VIO 1 Dest		Off		
	562	VIO 1 Source		Off		
	563	VIO 2 Dest		Off		
	564	VIO 2 Source		Off		
	565	VIO 3 Dest		Off		
	566	VIO 3 Source		Off		
	567	VIO 4 Dest		Off		
	568	VIO 4 Source		Off		
	569	VIO 5 Dest		Off		
	56A	VIO 5 Source		Off		
	56B	VIO 6 Dest		Off		
	56C	VIO 6 Source		Off		
	56D	VIO 7 Dest		Off		
	56E	VIO 7 Source		Off		
	56F	VIO 8 Dest		Off		
	56G	VIO 8 Source		Off		
600	Logical&Timers					102
610	Comparators					
	611	CA1 Setup				
		6111	CA1 Value	Speed		
		6112	CA1 Level HI	300		
		6113	CA1 Level LO	200		
		6114	CA1 Type	Hysteresis		
		6115	CA1 Polar	Unipolar		
	612	CA2 Setup				107
		6121	CA2 Value	Torque		
		6122	CA2 LevelHI	20		
		6123	CA2 LevelLO	10		
		6124	CA2 Type	Hysteresis		
		6125	CA2 Polar	Unipolar		
	613	CA3 Setup				108
		6131	CA3 Value	Process Val		
		6132	CA3 LevelHI	30		
		6133	CA3 LevelLO	20		
		6134	CA3 Type	Hysteresis		
		6135	CA3 Polar	Unipolar		
	614	CA4 Setup				109
		6141	CA4 Value	Process Err		
		6142	CA4 LevelHI	10		
		6143	CA4 LevelLO	- 10		
		6144	CA4 Type	Window		
		6145	CA4 Polar	Bipolar		
	615	CD Setup				110
		6151	CD1	Run		
		6152	CD2	DigIn 1		
		6153	CD3	Trip		
		6154	CD4	Ready		
620	Logic Y					111
		621	Y Comp 1	CA1		
		622	Y Operator 1	&		
		623	Y Comp 2	!A2		
		624	Y Operator 2	&		
		625	Y Comp 3	CD1		
630	Logic Z					113
		631	Z Comp 1	CA1		
		632	Z Operator 1	&		
		633	Z Comp2	!A2		
		634	Z Operator 2	&		
		635	Z Comp 3	CD1		
640	Timer1					114

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	641	Timer1 Trig		Off		
	642	Timer1 Mode		Off		
	643	Timer1 Delay		00:00:00		
	644	Timer 1 T1		00:00:00		
	645	Timer1 T2		00:00:00		
	649	Timer1 Value		00:00:00		
650	Timer2					116
	651	Timer2 Trig		Off		
	652	Timer2 Mode		Off		
	653	Timer2 Delay		00:00:00		
	654	Timer 2 T1		00:00:00		
	655	Timer2 T2		00:00:00		
	659	Tmer2 Value		00:00:00		
660	Counters					117
	661	Counter 1				
		6611	C1 Trig	Off		
		6612	C1 Reset	Off		
		6613	C1 High Val	0		
		6614	C1 Low Val	0		
		6615	C1 DecTimer	Off		
		6619	C1 Value	0		
	662	Counter 2				
		6621	C2 Trig	Off		
		6622	C2 Reset	Off		
		6623	C2 High Val	0		
		6624	C2 Low Val	0		
		6625	C2 DecTimer	Off		
		6629	C2 Value	0		
670	Clock logic					120
	671	Clock 1				
		6711	Clk 1 TimeOn	00:00:00		
		6712	Clk 1 TimeOff	00:00:00		
		6713	Clk 1 DateOn	2013-01-01		
		6714	Clk 1 DateOff	2013-01-01		
		6715	Clk 1 Weekday	MTWTFSS		
	672	Clock 2				
		6721	Clk 2 TimeOn	00:00:00		
		6722	Clk 2 TimeOff	00:00:00		
		6723	Clk 2 DateOn	2013-01-01		
		6724	Clk 2 DateOff	2013-01-01		
		6725	Clk 2 Weekday	MTWTFSS		
700	Oper/Status					122
	710	Operation				
		711	Process Val			
		712	Speed			
		713	Torque			
		714	Shaft Power			
		715	El Power			
		716	Current			
		717	Output volt			
		718	Frequency			
		719	DC Voltage			
		71A	Heatsink Tmp			
		71B	PT100_1_2_3			
	720	Status				124
		721	AC drive Status			
		722	Warning			
		723	Warning P2			

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	725	DigOutStatus				
	726	AnIn 1 2				
	727	AnIn 3 4				
	728	AnOut 1 2				
	729	IO Status B1				
	72A	IO Status B2				
	72B	IO Status B3				
	72C	Status bits				
730	Stored Val					128
	731	Run Time				
		7311	RunTime Tot			
		7312	P1 Run Time	00:00:00		
		7313	P2 Run Time	00:00:00		
		7314	RunTime Day			
		7315	P1 RunT Day	00:00:00		
		7316	P2 RunT Day	00:00:00		
		7317	Reset RunTm	No		
	732	Mains Time		00:00:00		
	733	Energy				129
		7331	Energy tot	...kWh		
		7332	Energy P1	...kWh		
		7333	Energy P2	...kWh		
		7334	Energy Day			
		7335	P1EnergyDay			
		7336	P2EnergyDay			
	734	Pump starts				131
		7341	Pstarts tot			
		7342	P1 starts			
		7343	P2 starts			
		7344	Pstarts Day			
		7345	P1StartsDay			
		7346	P2StartsDay			
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	992	Savings			No		
	993	Reset Volume			No		
	994	Reset starts			No		
	995	Daily Reset			No		
	996	Overflow			No		
	997	Reset runtime			No		

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