VATECH

ELIN EBG Elektronik

Operating instructions

MX basic

The Power Drives Company

ELIN EBG Elektronik

Safety Instructions

The following symbols should assist you in handling the instructions:

General information, note exactly!

Dangerous voltages! Danger of life!

Advice, tip!

The requirements for successful commissioning are correct selection of the unit, proper projection and mounting. If you have any further questions, please contact the supplier or call the manufacturer of the unit directly.

Capacitor Discharge!

Before performing any work on or in the unit, disconnect from the mains and wait at least 5 minutes until the D.C. link capacitors have been fully discharged, to make sure that the device is no longer live.

Automatic Restart!

With certain parameter settings it may happen that the frequency inverter starts up automatically when the mains supply returns after a power failure. Make sure that no persons and no other equipment is in danger.

Commissioning and Service!

Work on or in the unit must be done only by duly qualified staff and in full compliance with the appropriate instructions and pertinent regulations. Note that a fault may cause potential-free contacts and/or PCBs to carry mains potential. To avoid any risk to humans, obey the regulations concerning "Work on Live Equipment" explicitly.

Terms of delivery:

Our deliveries and services are based on the "General Terms of Delivery of the Austrian Electrical Industries" in the latest edition.

Specifications in this instruction:

We are constantly striving to improve our products and adapt them to the latest state of technical development. Therefore, we reserve the right to modify the specifications given in this instruction at any time, particular those referring to measures and dimensions. All planning recommendations and connection examples are non-binding suggestions for which we cannot accept any liability, particularly since the regulations to be complied with depend on the type and location of the plant and on the use of instruments.

Regulations:

It is the user's responsibility to ensure that the instrument and its component parts are used in compliance with applicable regulations. It is not permitted to use these instruments in residential areas without special measures to suppress radio frequency interference.

Patents and trademarks:

Please note that we do not guarantee any connections, instruments or processes described herein to be free from patent or trademark rights of third parties.

Keep this instruction at hand near the unit!

1 Inspect power wiring

POWER CABLE – FUSES – DISTANCES

- The mains lines must be connected to the terminals L1 / L2 / L3 (usually on the left).
- Check the capacity of the mains fuses according to the table in the Mounting Instructions.
- A (pre-mating) auxiliary contact should act on the digital input "pulse enable" if the motor line (terminals U / V / W) has a control element (contactor or service switch).
- Check if the length of the motor cable complies with the permissible limits, and if the AMF (Output Motor Filter) is integrated (if necessary).

2 Inspect EMC measures

RFI FILTER – GROUNDING – SCREENING

- Does the mains supply contain a filter that is suitable for this application?
- The motor cable screen must be connected with the filter (filter casing or PE terminal) extensively.
- The screen must be connected with the motor casing on the motor side.
- All low-level control lines (including digital inputs) require screening and must not be laid together with the motor lines.
- The frequency inverter (cubicle) requires extensive grounding in order not to exceed trip limits.

3 Inspect mechanics

ENGINE – MOTOR – INVERTER

- Check all components for damage during transport. All transport safety devices (e.g. at the motor) must be removed.
- Transport components must be mounted tidy.
- Check if there is enough cooling (for the motor as well as for the inverter).
- Check the mechanic connection between motor and machine.
- Is the whole drive ready to switch on ?

Release given from: .....

4 Switch on mains voltage and carry out tests

MAINS VOLTAGE – TESTS – AUXILIARY VOLTAGE

- Check the 24 V DC buffer voltage (if used) and switch it on.
- Are the three phase voltages given and are they symmetrical ? (See instructions in “Working with live lines” !)
- The mains voltage has to be 400V ±15%, 50/60Hz ±5%.

Select a suitable application macro

APPLICATION MACRO – PUMPS – FANS

➨ The inverter has pre-settings (macros) for three typical drive modes.

Macro 2 is especillay designed for pump and fan drives.

This settings contain:

- Adaptation on square load torque
- High continuous load at low overload
- Switching between manual reference value (0...10V) and automatic reference value (4...20mA)
- Locking reverse rotation and 5 Hz minimum frequency
- Digital inputs for Start, switch-over of reference values, external fault and external reset

➨ Macro M1 is the default setting (for drives which require a constant torque, e.g. conveyors).

➨ Select the desired macro with parameter B2.03 "Macro selection".

B2.03 Macro Selection	0...Conveyor → e.g.: 2...Centrif. pump	.....

Possible settings:	0...Conveyor	–
	1...Piston pump	–
	2...Centrifugal pump	Macro 2
	3...Coiler	–
	4...Test bench	–
	5...Pump with PID	–
	6...Exhaust fan	Macro 2
	7...Fan	Macro 2
	8...Separator	–

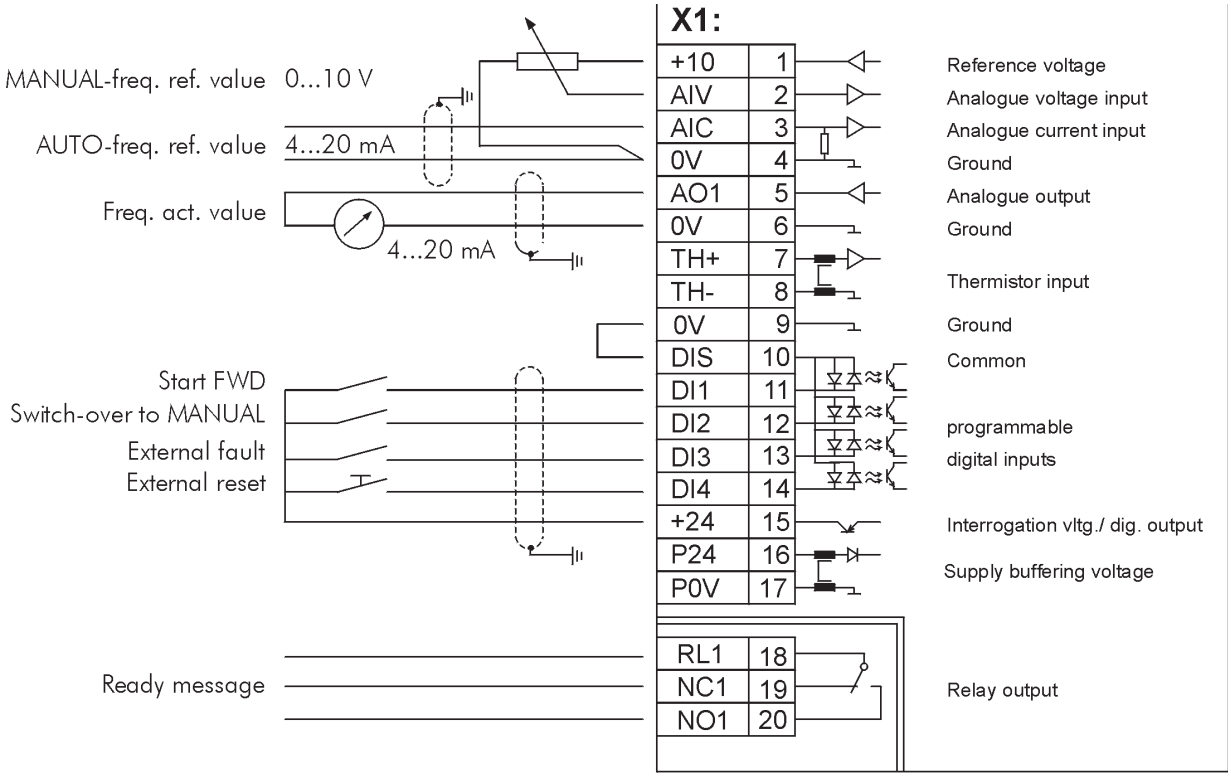
6 The “key” parameters

SHORT MENU – PARAMETERS – MATRIX FIELD B5

- Chapter B5 “Short menu” lists the “key” parameters and the configuration of the control terminals for each application.
- All parameter modifications are automatically included into the list of the “Short menu” and are deleted again, whenever the factory default is reset.

  Thus, the short menu provides a clear overview of all parameter settings.
- All parameter modifications are safely stored automatically after 5 minutes or by switching to matrix field A1 “Home” (or set parameter A1.00 “Save backup” to “1 Store” and then back to “0”, if you use the program MatriX).

Parameter	Pre-settings Macro 2	Selected adjustment
D1.00 AIV selection	freq. ref. manual	.....
D1.01 AIV value 0%	0,00 Hz	.....
D1.02 AIV value 100%	50,00 Hz	.....
D1.04 AIC selection	freq. ref. manual	.....
D1.06 AIC value 0%	0,00 Hz	.....
D1.07 AIC value 100%	50,00 Hz	.....
D2.00 DI1 selection	Start FWD	.....
D2.01 DI2 selection	Manual (Auto)	.....
D2.02 DI3 selection	Ext. fault	.....
D2.03 DI4 selection	Ext. reset	.....
D3.00 AO1 selection	frequency output	.....
D4.01 Relay output 1	Ready + Run	.....



7 Enter motor data

NOMINAL POWER – NOMINAL SPEED – NOMINAL CURRENT

➽ Enter the values for nominal power, nominal current, nominal voltage, nominal frequency and nominal speed from the motor output plate in matrix field B3.
Adjust the sum of P and I for parallel motors.

B3.00 Nom. power	..... kW
B3.01 Nom. current	..... A
B3.02 Nom. voltage	 V
B3.03 Nom. frequency	..... Hz
B3.04 Nom. speed	..... rpm

➽ All parameter modifications are safely stored automatically after 5 minutes or by switching to matrix field A1 “Home” (or set parameter A1.00 “Save backup” to “1 Store” and then back to “0”, if you use the program MatriX).

8 Start autotuning (self-adaptation)

MOTOR VALUES – CABLE RESISTOR – AUTOTUNING

➡ Use parameter B4.00 to start automatic tuning of the motor.
(the motor does not start turning !)

! Motor(s) must be connected !

! Pulse enable signal must exist !

! The motor must not rotate !

The individual measuring cycles can be observed on the display.
(period of 1 to 4 minutes, depending on motor size)

B4.00 Start tuning	Start the routine with "1"	Autotuning finished	☐ yes	☐ no

9 Start the drive in local mode

LOCAL MODE – START/STOP – DISPLAY

➡ Press the "Local/Remote" key in order to activate the display "Local" (bottom left).
Press the "Start" key and slowly increase the frequency setting by pressing the "Arrow up" key.

➡ Check the direction of motor rotation. If the motor rotates in the wrong direction, it is not necessary to reconnect the motor cables. With parameter C3.03 the rotary field can be inverted.

C3.03 Rotary field	U-V-W	Rotary field inverted	☐ yes	☐ no

Try different speeds during checking the charge of the drive in matrix field A2.

A2.02 Motor load (%)	Shows the load of the motor in percent of the motor nominal current
A2.03 Motor current (A)	Shows the actual motor current in ampere

➽ The three analogue monitors of the display can be adjusted with parameters A6.00 to A6.02.

A6.00 Select. zone 1	0...Output frequency	.....
A6.01 Select. zone 2	11...Speed reference	.....
A6.02 Select. zone 3	5...Motor current	.....

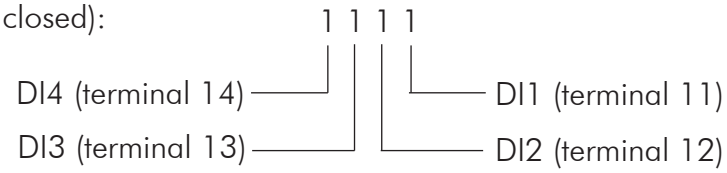
10 Remote mode

REMOTE MODE – CONTROL COMMANDS – ACTUAL VALUES

➽ Check the active reference values and control commands using parameters A4.00 to A4.22 before switching back to remote control mode.

A4.01 AIV scaled (Hz)	Shows the scaled reference value of AIV (0-10V)
A4.03 AIC scaled (Hz)	Shows the scaled reference value of AIC (4-20mA)
A4.14 Digital input X1	Shows the state of the digital inputs at terminal X1 in 4 bits

Display A4.14 (1...terminal closed):



➽ Activate "Test min. value" or "Test max. value" for the analogue outputs in order to check the actual value feedback sent to the control unit. The relay outputs can also be set to "ON" for testing purposes.

D3.00 AO1 selection	act. value → 20...Test min. val. → 21...Test max. val. → act. value
D4.01 Relay output 1	act. value → 0...not used → 25...ON (+24V) → act. value

Switch back to remote control mode, check the power parameters and the reactions to the control commands again.

11 Data storage and protocols

CODE LOCK – PARAMETER LIST – DATA STORAGE

➡ Adjust parameters which block unauthorized operating modes:

E4.00 and E4.01 lock in position "2 Remote only" the switch over to local mode.

E4.00 Loc./Rem. ref.	0...Local/Remote	.....
E4.01 Control comands	0...Local/Remote	.....

➡ The code lock has to be lifted before parameters can be adjusted, if a value between 1 and 9999 is selected for F6.01.

F6.01 Code value	0	.....

➡ Use B2.01 "Store User-M1" in order to save all parameter values (including motor data) in User Macro 1.

B2.01 Store User-M1	Storage of UM1 with "1"	User-Macro stored	☐ yes	☐ no

➡ Manual transfer of all settings from the “Short Menu” B5 (+autotuning data B4.01 to B4.04) to the start-up log (appendix C of this manual).

With the PC program “MatriX” all parameters can be read-out in doc-mode. Also the whole list can be printed (see instructions in appendix A !).

Operating the Frequency inverter

>*pDRIVE*< *MX basic*

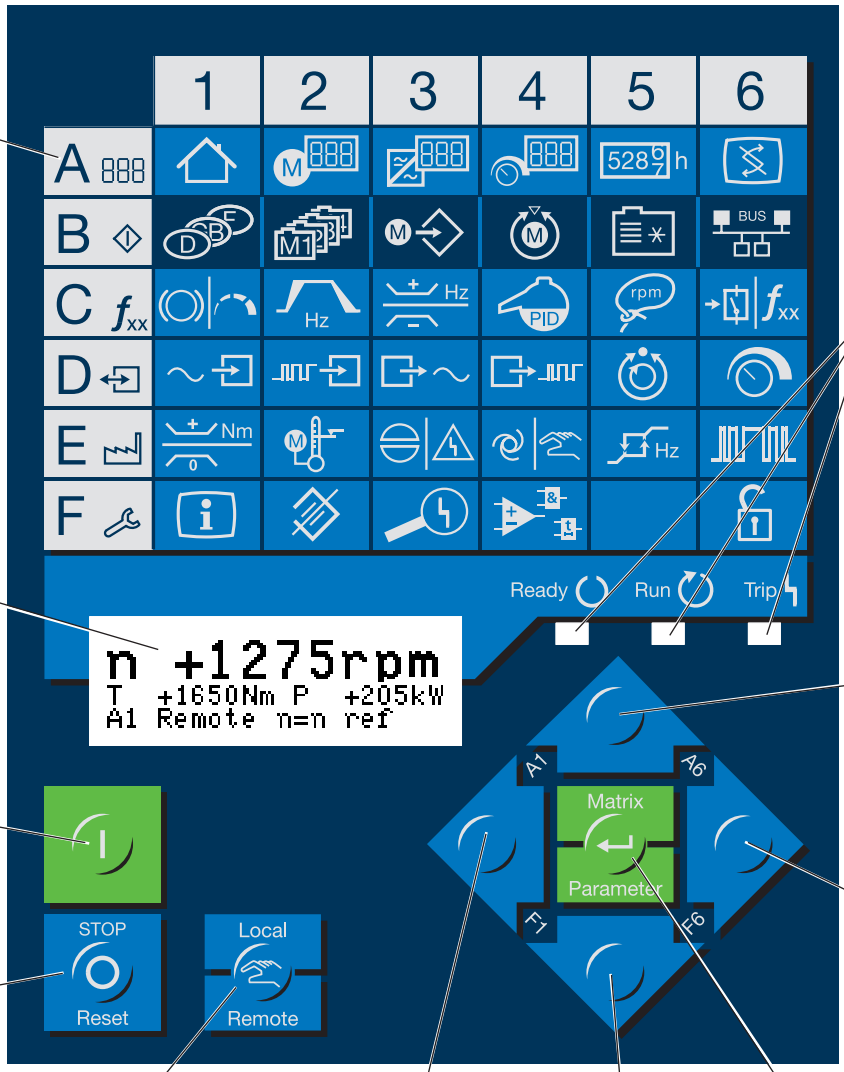
These Operating Instructions describe the functions of the following software:
PBA5 version 8 782 581.00 and higher

This manual covers the topics operation & parametrization. Detailed information about the topics planning, assembly and connection can be found in the Mounting Instructions, information about the Profibus connection is provided in the PBO1 Manual.

Please inform your supplier or insurance company in the case of damage or incomplete delivery. The manufacturer shall not accept responsibility for damage caused during shipment or unpacking.

The Keypad

Overview of all matrix fields listed according to their functions



Configurable, large-format LCD graphic display

"ON" key for: Start command in local mode

"OFF" key for: Stop command in local or remote mode, selectable reset function

"Local/Remote" key for: mode switch-over: keypad / terminal strip or field bus

"Left" key for: moving on the matrix level, moving the cursor to the left; definition of the reverse rotation field in local mode

"Down" key for: moving on the matrix level, scrolling parameters within a matrix field, decreasing numerical values; decreasing the reference value in local mode

"Matrix/Param." key for: switching between basic display and matrix level, and between matrix level and parameter group; accepting parameter values

"Right" key for: moving on the matrix level, moving the cursor to the right; definition of forward rotation in local mode

"Up" key for: moving on the matrix level, scrolling parameters within a matrix field, increasing numerical values; increasing the reference value in local mode.

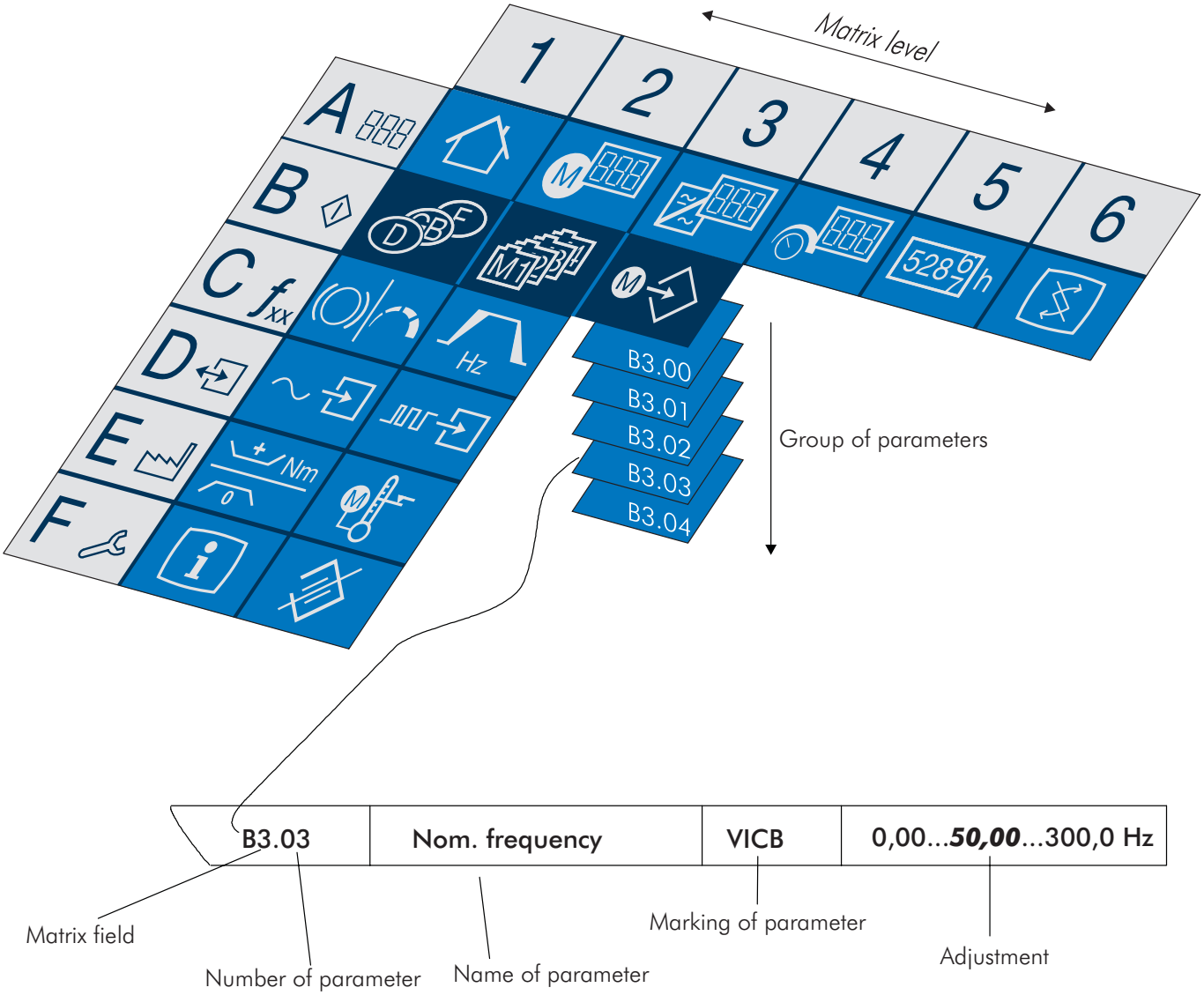
LED status indicators for: ready, run and trip

The software type and version are shown using parameters A3.08 and A3.09.

When the front cover is removed, the membrane keyboard can easily be removed, rotated by 90° and fixed again. Pay attention to the flat strip cable!

The Matrix Philosophy

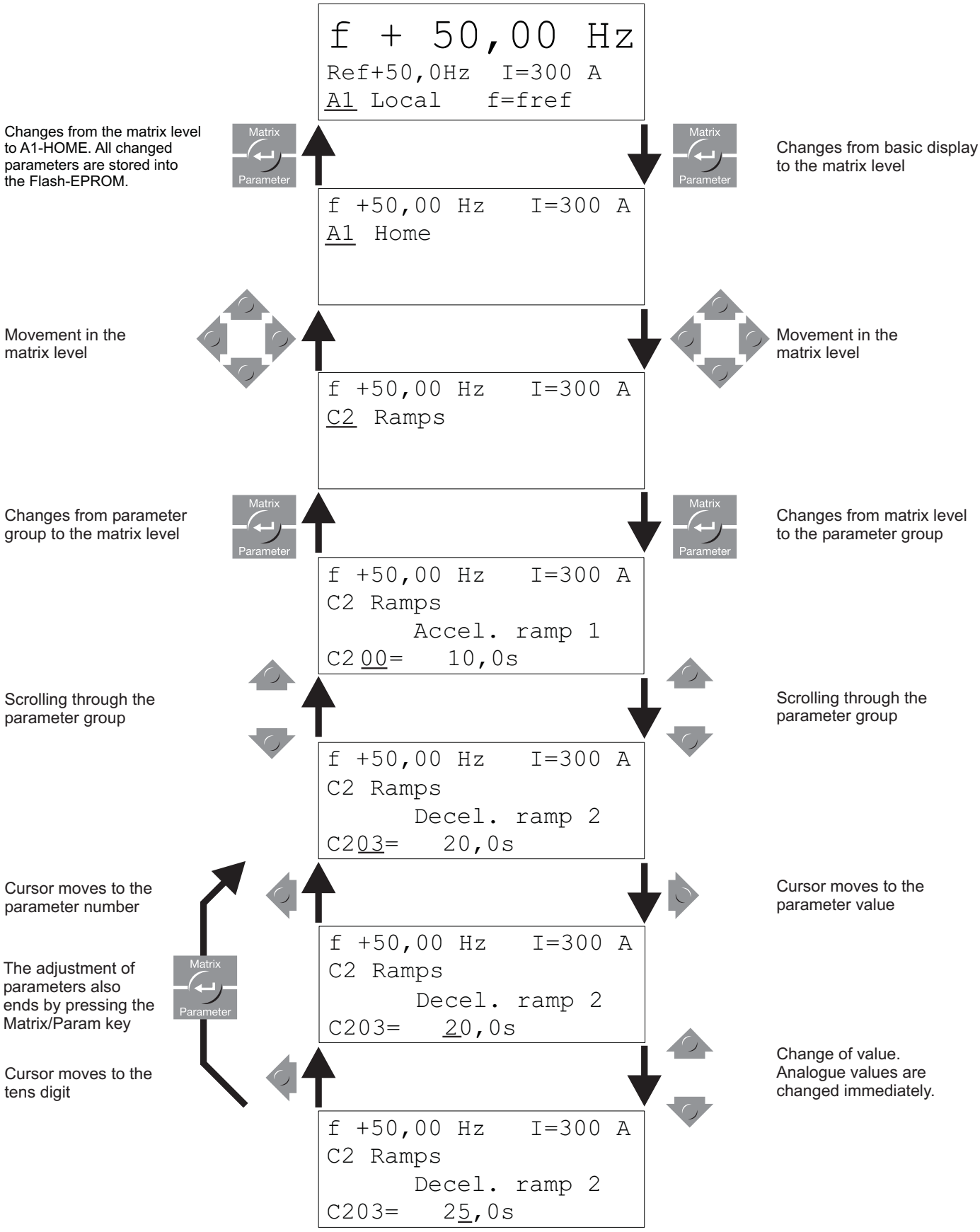
The arrangement of parameters in a matrix system provides the possibility to summarize parameters clearly by using a three dimensional approach.



- ❑ Press the key "Matrix/Parameter" to switch from the matrix level to a parameter group and vice versa.
- ❑ The matrix field A1-Home has a special function:
  It contains the basic display for the device and parameters which are only accessible with the applications software "MATRIX". All modifications are automatically saved when you switch back to the basic display.
- ❑ On the matrix level you can select any matrix field by pressing the up, down, left or right arrow keys.

All changes are stored in the FLASH-ROM when you leave the matrix level and switch back to the basic display (A1-HOME) or 5 minutes after modifying a parameter.

Parametrization



Shortcuts

You can move quickly on the matrix level by using the following shortcuts:

To move to the top left (A1 - HOME)	Simultaneously press keys ◀ + ▲
To move to the top right (A6 - DISPLAY CONFIG.)	Simultaneously press keys ▶ + ▲
To move to the bottom left (F1 - TEST-HELP)	Simultaneously press keys ◀ + ▼
To move to the bottom right (F6 - CODE)	Simultaneously press keys ▶ + ▼

In this way you can switch from the matrix level to a parameter group at the same time.

Local Mode

Activate the "LOCAL" mode to operate the frequency inverter using the integrated keypad. To do so, go to the basic display and press the key "LOCAL/REMOTE".
In LOCAL mode, the keys have the following functions:

Key	Basic Display	Matrix level	Parameter group
I	Start	—	—
STOP Reset	Stop / Reset	Stop / Reset	Stop / Reset
▲	Increase ref. value	Navigating on the matrix level	Scroll parameters or increase parameter values
▼	Reduce ref. value	Navigating on the matrix level	Scroll parameters or decrease parameter values
◀	Reverse	Navigating on the matrix level	Cursor left
▶	Forward	Navigating on the matrix level	Cursor right

The system is automatically restarted after the removal or confirmation of a trip due to a steady Start FWD or Start REV signal on the terminal strip.

Local mode can be blocked with parameters E4.00, E4.01 and E4.03!

If you use option card IO1, you have to activate the pulse enable using digital input DI5 in order to start the frequency inverter!

The functions of the keys can be connected to the terminal strip with parameter E4.03. As a result, the keys of the keypad have no functions for local mode (Exception: "Stop" key, if parameter E4.04 was set to "1 always active").

Start-up

Follow the steps listed below in order to start up the inverter:

B		**Setup**

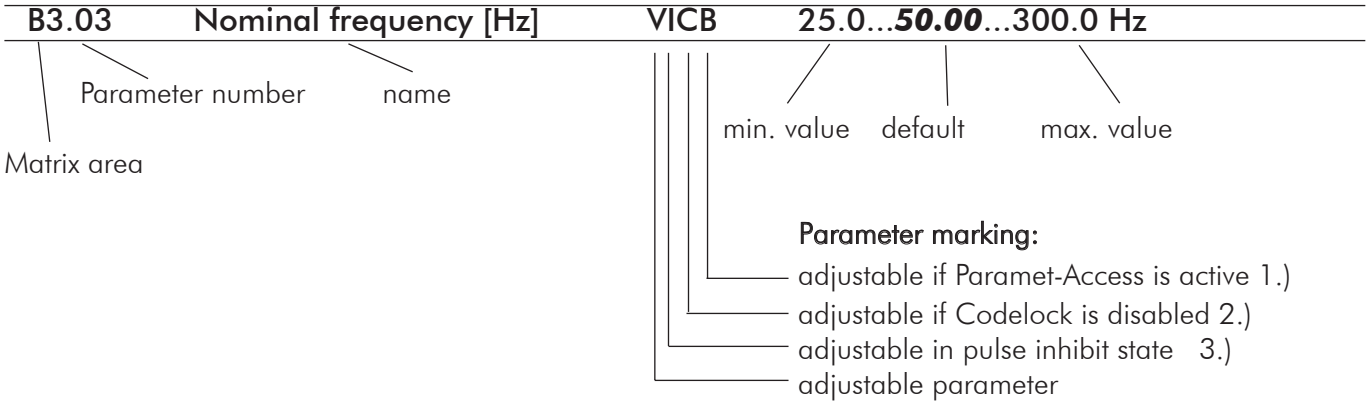
B1		Language selection	Select the operating language
B2		Macro configuration	The selection of an application macro configures the terminal strip and creates a suitable short menu.
B3		Motor data	Dual rating is adjusted with the motor data: Version C - high overload Version P - high continuous load
B4		Auto tune	A routine is started in order to tune the motor exactly with the inverter.
B5		Short menu	Adjustment of the parameters in the short menu.

Matrix	If additional parameters that are not included in the short menu are required to optimize the system, go to the matrix fields and set the necessary parameters accordingly. They are automatically transferred into the short menu.

B2		Macro configuration	After starting up the inverter, you can transfer the set parameters to the USER Macro by using parameters B2.01 and B2.02.

During the start-up phase, it might be helpful to supply the frequency inverter with an external 24 V buffer voltage. This allows you to make adjustments without power supply from the mains (exception: autotuning and default motor data).
The user interface is fully functional when an auxiliary voltage is applied.
Please use the start-up log in the appendix to record the inverter settings.
You should only transfer those parameters to the list that are shown in the short menu. All parameters that are not displayed are still set to the factory defaults.

Description of parameters



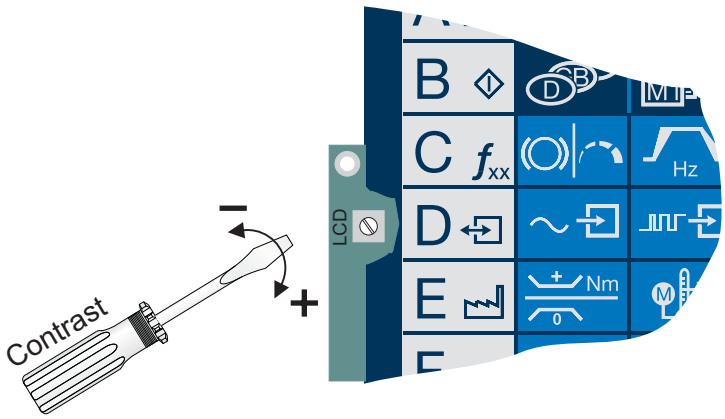
1.) See parameter F6.02

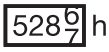
2.) See parameters F6.00 and F6.01

3.) No ON commands are accepted while these parameters are being set.
Key commands are suppressed and steady commands ignored as long as the cursor is positioned right of the "=" sign.

LCD display contrast regulation:

There is a potentiometer for regulating the contrast of the LCD display in the top left corner of the PCB (user interface - UI).



A	888	Display		
A1		Home	Basic Display	Page 9
A2		Motor values	Speed, torque, motor load, motor current, shaft power, apparent power, motor voltage, slip frequency, process and machine speed, process and machine scaling	Page 11
A3		Inverter values	Output frequency, inverter load, DC bus-voltage, heatsink temperature, actual switching frequency, drive reference, nominal current, hardware version, software type, software version, serial number, drive status	Page 12
A4		Reference values	Voltage reference value, current ref. value, pre-set ref. value, local and remote values, ramp values, torque limitation, digital inputs and bus ref. values	Page 13
A5		Time/kWh	Operating hours motor and inverter, kWh-meter	Page 14
A6		Display con.	Configuration of the basic display A1	Page 15

A — Display

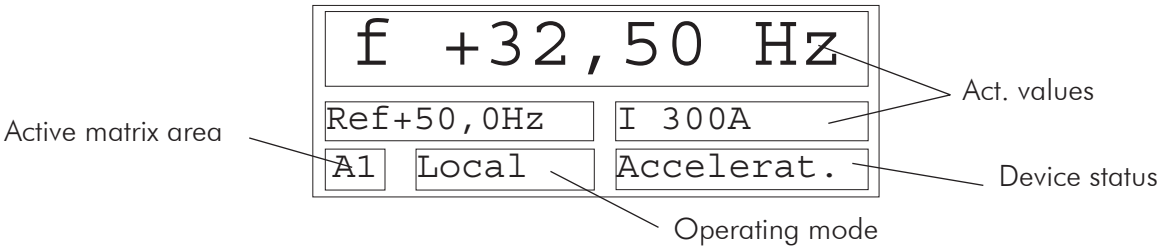
Display of ref. and actual values
Configuration of the LCD display

A1 — Home

Any modifications are stored in the FLASH-ROM:

1.) when leaving the matrix level and switching back to the basic display (A1-HOME) or
2.) five minutes after modifying a parameter.

This matrix area shows the basic display of the frequency inverter. Three actual values are displayed: operating mode, device status and active matrix field.



All analogue values displayed can be configured freely in matrix field A6 (Display configuration).
Any parameter changes are transferred to the memory as soon as the function HOME is activated again.

Operating modes	Meaning
Disabled	The inverter is blocked (does not emit voltage) because there is no enable signal at the terminal strip (digital input DI5_2 or a programmed input) or because the device states "19 Lock switching on" or "0 Not ready to switch on" are activated for bus control. If parameter C1.02 is set to "0 free wheel", the state "Lock" will also be displayed after a Stop command.
Stop	The inverter is enabled but there has not been a "START" command.
Not enabled	The internal command "Operation release" is missing (only for BUS control).
Trip	The inverter has been switched off due to a trip and the reason is displayed in the device status field.
Loading	If the function Contactor CTRL is activated, this command shows that the contactor has been activated but the necessary DC-voltage has not been reached yet.
Mains off	The inverter input terminals L1, L2, L3 have been enabled by a contactor using the function "Contactor CTRL" (C6.00).
Mains missing	"Mains missing" is displayed if the mains supply fails during operation and the undervoltage trip has been delayed.
Mains disconnected	The digital command "Mains ON/OFF" triggers a safety trip.
Locked	Inverter electronics have been blocked for remote operation with the command "Cut-off". Local mode using the keypad (or terminal strip "Local") is still possible.
AT running	The function "Auto tune" has been activated.

Displays during operation	
Acceleration	• The drive accelerates according to the settings for the acceleration ramp. The reference frequency has not been reached yet ($f_{REF} > f_{ACT}$). • An active limitation (thermal motor model, overload of the frequency inverter, etc.) during motor operation decreases the frequency ($f_{REF} > f_{ACT}$). • During motor operation with torque limitation ($f_{REF} > f_{ACT}$).
Deceleration	• The drive decelerates according to the setting for the deceleration ramp. The ref. frequency is not reached yet ($f_{REF} < f_{ACT}$). • An active limitation (thermal motor model, overload of the frequency inverter, etc.) during generator operation increases the frequency ($f_{REF} < f_{ACT}$). • During generator operation with torque limitation ($f_{REF} < f_{ACT}$).
$n = n_{REF}$	The actual frequency (speed) equals the reference frequency (speed). Hysteresis and delay time can be adjusted using parameter D4.08.
Param1 (UM1)	Parameter set1 = User Macro1 As soon as the setting "Parameter set2" has been activated with parameter B2.04, parameter set 1 or 2 is loaded depending on the digital input.
Param2 (UM2)	Parameter set2 = User Macro2 If there is a "1"-signal at the respective digital input, the 2nd parameter set (= User Macro 2) is loaded and "Parameter set 2 (UM2)" is displayed.
Warnings and limitations	See Appendix B (only if A6.03 = 1).
Displays during parametrization	
Code lock	You are trying to modify a parameter that is subject to Codelock. Remedy: disable Codelock F6!
Para locked	1. You are trying to modify a parameter that is subject to parameter lock. Remedy: Digital input "Paramet-lock" → break contact 2. You are trying to modify a parameter while the switch-over between 2 parameter sets using B2.04 "Multi-config." is active. Remedy: Change B2.04 to "0 not active".
Pulse release	You are trying to change a parameter that can only be changed if pulse inhibit is activated. Remedy: Stop command
No access	You are trying to modify a parameter via an unauthorized user terminal. Remedy: Activate "Paramet.-access" for the respective user terminal (F6.02).
Read only	You are trying to change an actual value (display) parameter.

A2 M Motor values

Display of motor-dependent and system-dependent actual values

A2.00	Speed [rpm]	read only	1.)
	Shows the actual motor speed in revolutions per minute. This is also displayed with pulse inhibit, i.e. when the motor is running out freely. Negative values indicate reverse rotation.		
A2.01	Torque [Nm]	read only	
	The display is "quadrantal". Display tolerance: 5% with reference to the nominal torque (friction, iron losses and ventilation losses are not included) In drives without encoder, the tolerance is higher in frequency ranges up to 2 Hz.		
A2.02	Motor load [%]	read only	
	100% correspond to the nominal current of the motor. Display tolerance: ±1.5%		
A2.03	Motor current [A]	read only	
	Apparent current of the motor in Ampere. Display tolerance: ±1.5% with reference to I_{NC} (effective value of the fundamental oscillation)		
A2.04	Shaft power [kW]	read only	
	Display tolerance: ±5% with reference to nominal power (calculated from T and n)		
A2.05	Apparent power [kVA]	read only	
	Display tolerance: ±3% with reference to nominal power (calculated from U and I)		
A2.06	Motor voltage [V]	read only	
	Display tolerance: ±2% with reference to nominal voltage (effective value of fundamental oscillation)		
A2.07	Slip frequency [Hz]	read only	
	Displays the slip frequency calculated from the nominal data of the motor and the actual load (calculated from the torque and the flow).		
A2.08	Process speed [m/min]	read only	1.)
	Possibility to display the process speed in m/min. The necessary conversion factor can be adjusted with parameter A2.10. A2.08 = A2.00 x A2.10.		
A2.09	Machine speed [rpm]	read only	1.)
	Possibility to display the machine speed in revolutions per minute. The gearing factor can be adjusted with parameter A2.11. A2.09 = A2.00 x A2.11.		
A2.10	Process scaling	VCB	-10.00...***1.000***...10.00
A2.11	Machine scaling	VCB	-10.00...***1.000***...10.00

1.) If the power part has no voltage supply ("Mains off" or "Mains missing" is displayed), these actual values are set to 0.

A3 Inverter values

Display of inverterspecific actual values

A3.00	Output frequency [Hz]	read only	
	Resolution: 0.01 Hz		
A3.01	Inverter load [%]	read only	
	100% correspond to the nominal current of the inverter (Version "C"). Display tolerance: ±1.5%		
A3.02	DC bus-voltage [VDC]	read only	1.)
	Displays the actual DC voltage. Display tolerance: ±2% with reference to the max. DC voltage. If the mains voltage is 400 V, the DC voltage ranges between 540 and 565 V DC.		
A3.03	Heatsink temperature [°C]	read only	1.)
	Display tolerance: ±5% (max. heatsink temperature: 81°C...95°C, depending on size) Exceeding the limits leads to: 1.) reduction of the switching frequency (see E6) 2.) reduction of the motor current 3.) overtemperature trip.		
A3.04	Act. switching frequency [kHz]	read only	
A3.05	Drive reference	read only	
A3.06	Nom. current "C" [A]	read only	
A3.07	Hardware version	read only	
	Displays the modification index of the integrated power part.		
A3.08	Software type	read only	
A3.09	Software version	read only	
A3.10	Serial number	read only	
A3.11	Drive status	read only	

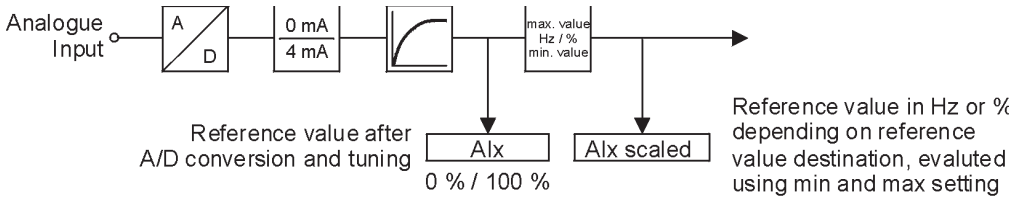
The drive states are displayed according to the MX status machine.
See also documentation "Profibus Option" (identical with parameter B6.48).

0 . . . . Not ready to switch on
1 . . . . Ready to switch on
2 . . . . Charge DC-bus
3 . . . . Ready to run
4 . . . . Operation release
5 . . . . Ramp output release
6 . . . . Ramp release
7 . . . . Run
8 . . . . Motor fluxing
9 . . . . release brake 1
10 . . . Crane active
11 . . . Jog1 active
12 . . . Jog 1 break
13 . . . OFF1 (deceleration) active
14 . . . OFF3 (quickstop) active
15 . . . Close brake
16 . . . DC-brake 1
17 . . . DC-brake 2
18 . . . OFF2 (pulse inhibit) active
19 . . . Lock switching on
20 . . . Fault
21 . . . Autotuning in progress
22 . . . Power part test in progress
23 . . . Release brake 2
24 . . . Release brake 3

1.) If the power part has no voltage supply ("Mains off" or "Mains missing" is displayed), these actual values are set to 0.

A4 Reference values

Display of reference values



A4.00	AIV 0...10 V [%]	read only
	Reference value at the analogue input terminal AIV (0 V...10 V corresp. to 0% ... 100 %).	
A4.01	AIV scaled [Hz] ([%])	read only
	Scaled reference value of AIV.	
A4.02	AIC 0(4)...20 mA [%]	read only
	Reference value at the analogue input terminal AIC (0(4) mA ... 20 mA / 0% ... 100 %).	
A4.03	AIC scaled [Hz] ([%])	read only
	Scaled reference value of AIC.	
A4.04	AI_2 0(4)...20 mA [%]	read only
	Reference value at the analogue input terminals (AI+ , AI-) of IO1 at the option slot X2. (0(4) mA ... 20 mA / 0% ... 100 %)	
A4.05	AI_2 scaled [Hz] ([%])	read only
	Scaled reference value of AI_2.	
A4.06	AI_3 0(4)...20 mA [%]	read only
	Reference value at the analogue input terminals (AI+ , AI-) of IO1at the option slot X3. (0(4) mA ... 20 mA / 0% ... 100 %)	
A4.07	AI_3 scaled [Hz] ([%])	read only
	Scaled reference value of AI_3.	
A4.08	Pre-set ref. [Hz] ([%])	read only
	Pre-set reference value.	
A4.09	Local reference [Hz] ([%])	read only
	Ref. value of local motorpotentiometer (keys UP, DOWN on keypad or digital commands on terminal strip)	
A4.10	Remote reference [Hz] ([%])	read only
	Ref. value of remote motorpotentiometer (digital inputs +speed remote, -speed remote)	
A4.11	Ref. value before ramp	read only
	Currently used frequency reference value before the acceleration integrator.	
A4.12	Ref. value after ramp	read only
	Currently used frequency reference value after the acceleration integrator.	

A4.13	Torque limit [%]	read only	

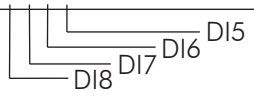
Currently used reference value for torque limitation.

A4.14	Digital input X1	read only	1111

This parameter shows the current state ("0" or "1"; in 4 bits) of the digital inputs on the basic card X1: terminals 11 to 14, DI1 to DI4 (from the right to the left).

A4.15	Digital input X2	read only	1111

State of the digital inputs at the 1st option card IO1
X2: terminals 26 to 29, DI5_2 to DI8_2 (from the right to the left).



NOTE: DI5_2 will always be set to "1" if there is no option card! → Display: "_ _ _ 1"

A4.16	Digital input X3	read only	1111

State of the digital inputs at the 1st option card IO1
X3: terminals 26 to 29, DI5_3 to DI8_3 (from the right to the left).

A4.17	Drive control word	read only

This parameter displays the internal control word of the drive. With the control word the MX Status machine is controlled. Hexadecimal presentation is used for the display.
Further instructions are included in the Profibus Option Manual (PBO1), parameter B6.47.

A4.18	Bus-ref1 scale	read only
A4.19	Bus-ref2 scale	read only
A4.20	Bus-ref3 scale	read only
A4.21	Bus-ref4 scale	read only
A4.22	Bus-ref5 scale	read only

Parameters A4.18 to A4.22 display the BUS reference values (PZD2 to PZD6) as standardized values that are created by reference value destinations. Further instructions are given in the Profibus Option Manual (PBO1).

A5 — 528 9/7 h — Time/kWh

Operating hours meter kWh-meter

A5.00	Operating hours motor [h]	read only

The operating hours meter "Motor" records the time during which the frequency inverter is in the operating mode "Pulse release"; i. e. voltage is applied to the motor. Decimal presentation is used for the display.
(Monitor display is possible by selecting A6.00 to 02!)

A5.01	Operating hours inverter [h]	read only

The operating hours meter "Inverter (FI)" records the time during which the frequency inverter is supplied with voltage (including 24V buffer voltage).

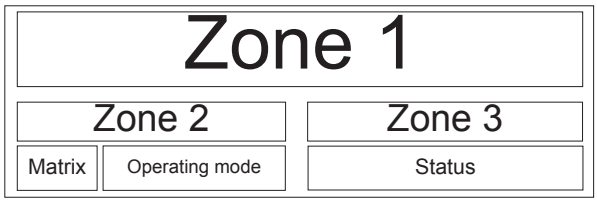
A5.02	kWh-meter [MWh]	read only

The kWh-meter records how much active energy has been consumed by the motor.
Display tolerance: ±3%; Only motor power is recorded.
(Monitor display is possible by selecting A6.00 to 02!)

Operating hours meter and kWh-meter cannot be reset by parametrization!

A6 Display configuration

Configuration of the basic display A1



You can assign an analogue reference or actual value to each zone (1, 2 and 3) by using the following selection table.

Zone 2 is not displayed during parametrization and zone 1 is minimized!

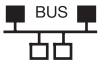
A6.00	Select. zone 1	VCB	Output frequency
A6.01	Select. zone 2	VCB	Speed reference
A6.02	Select. zone 3	VCB	Motor current

0 . . . Output frequency	*Hz •*	*corr. to A3.00*
1 . . . Drive load	*% of nominal inverter current "C"*	*corr. to A3.01*
2 . . . Motor load	*% of nominal motor current*	*corr. to A2.02*
3 . . . Torque	*Nm*	*corr. to A2.01*
4 . . . Motor voltage	*V*	*corr. to A2.06*
5 . . . Motor current	*A •*	*corr. to A2.03*
6 . . . Shaft power	*kW*	*corr. to A2.04*
7 . . . Apparent power	*kVA*	*corr. to A2.05*
8 . . . Motor speed	*rpm*	*corr. to A2.00*
9 . . . Linear speed	*m/min*	*corr. to A2.08*
10 . . Rotary speed	*rpm*	*corr. to A2.09*
11 . . Speed reference	*Hz •*	*corr. to A4.11*
12. . Torque reference	*%*	*corr. to A4.13*
13 . . PID-reference value	*%*	*corr. to C4.00*
14 . . PID feedback	*%*	*corr. to C4.01*
15 . . PID error	*%*	*corr. to C4.02*
16 . . DC-voltage	*V*	*corr. to A3.02*
17 . . Operating hours motor	*h*	*corr. to A5.00*
18 . . kWh meter	*MWh*	*corr. to A5.02*
19 . . Autotuning current	*A (not for A6.01)*	*corr. to B4.05*

A6.03	View limitation	VCB	not visible

0 . . . not visible •
1 . . . visible

If this parameter is set to 1, limitation interventions like "Current limitation", etc. (see Appendix B) are displayed in the status field. The display lasts as long as the intervention is ongoing, but at least 1.5 seconds.
This display is especially useful when starting up the inverter and during maintenance.

B		Setup		
B1		Language selection	Selection of the language	Page 17
B2		Macro configurat.	Display of macro, store USER-Macro 1 and 2, selection, enable 2. para. set	Page 17
B3		Motor data	Nominal power, nom. current, nom. voltage, nom. frequency, nominal speed, line voltage	Page 19
B4		Auto tune	Start tune, rotor coefficient, rotor time constant, stator resistor, fluxing current, autotuning current	Page 20
B5		Short menu	Adjustment of parameters in the short menu, macros 1 to 3	Page 21
B6		Comm. menu	See Manual "Profibus Option PB01", No. 8 074 575	Page 35

B Setup

Selection of language, macros, motor data using autotuning, parameters in the short menu

B1 Language selection

Country language selection

B1.00	Select language	VCB	German

	Software PBA5_A1:	*Software PBA5_A2:*
0 . . . German •	*German*	*German*
1 . . . English	*English*	*English*
2 . . . French	*French*	*French*
3 . . . language 4	*Dutch*	*Polish*
4 . . . language 5	*Spanish*	*Czech*

This parameter is not adjusted in the case of factory default!

B2 Macro configuration

Selection of application macros

B2.00	Macro selected	read only

This parameter displays which macro was selected last.
In the case of user macros, the display also indicates from which factory macro they were derived.

B2.01	Store USER-M1	VCB	Routine
B2.02	Store USER-M2	VCB	Routine

0 . . .Start
1 . . .Store
2 . . .Stored

The storage routine is activated by changing to line 1.

All parameter adjustments can be transferred to the customer-specific "USER macro" by using this storage process (user-programmable default values). Often it can be useful to store parameter adjustments in several steps and thus to make the process of starting up the drive or the whole system easier.

The motor data (Areas B3 and B4) are also stored!

SAFETY NOTE:
After successful start-up of the drive, all parameters should be stored in user macro 1 or 2. This allows you to restore all parameters with B2.03 (including the motor data and autotuning values) in the event of a replacement of the power part.

B2.03 Macro selection VICB Conveyor

0 . . . Conveyor • *Macro M1 (Page 22)*
1 . . . Piston pump *Macro M1 (Page 22)*
2 . . . Centrif.pump *Macro M2 (Page 25)*
3 . . . Coiler
4 . . . Test bench
5 . . . Pump+PID *Macro M3 (Page 29)*
6 . . . Exhaust fan *Macro M2 (Page 25)*
7 . . . Fan *Macro M2 (Page 25)*
8 . . . Separator *Macro M1 (Page 22)*

The existing parameter settings (<u>but not the motor data</u>) are overwritten with the respective pre-settings.

9 . . . USER-Macro1 *The existing parameter settings (incl. motor data B3 and B4) are*
10 . . USER macro2 *overwritten with the values from storage location (UM 1 and UM2).*
11 . . no change *Exits the parameter without modifications*

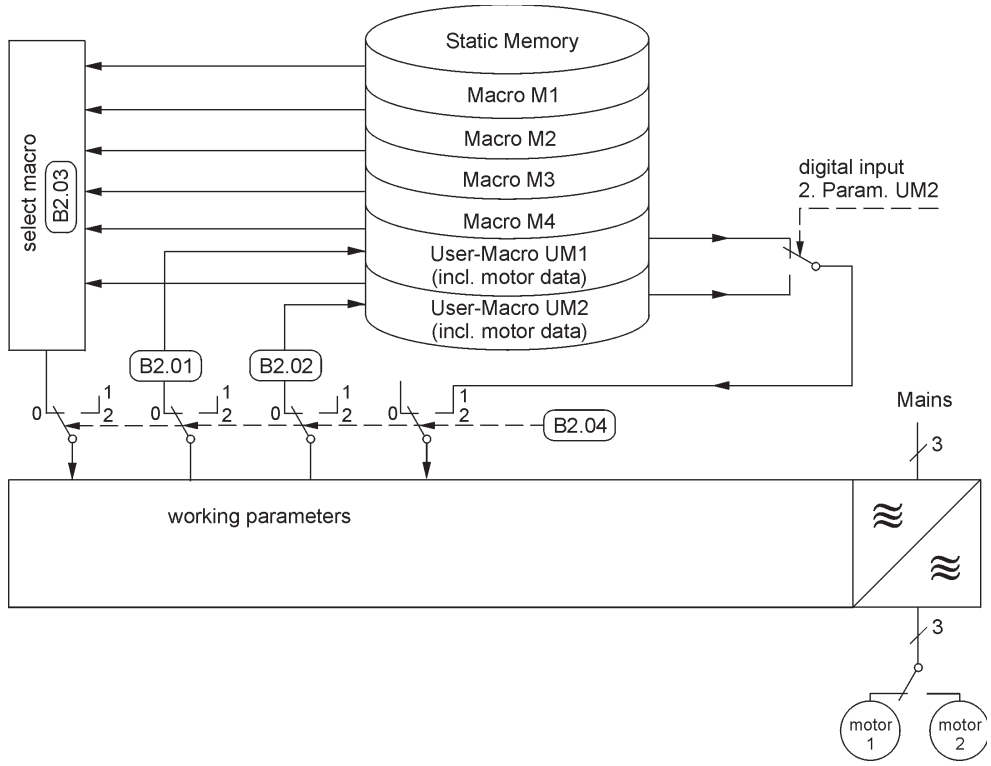
To make adaptation of the frequency inverter to the respective application as simple as possible, the library contains a number of application macros. Selecting a macro automatically activates the suitable functions, optimizes parameters and configures the terminal strip. At the same time a "Short menu" is created; it contains only those parameters that are important for the selected application. For comprehensive descriptions of the macros, see "B5-Short menu".

CAUTION:
The factory defaults of User Macros 1and 2 (state of delivery) <u>do not</u> contain any motor data! Use F2.01 to load the factory motor data, make adjustments and start autotuning!

B2.04 Multi-configuration VCB not active

0 . . . not active •
1 . . . Parameter set 1/2 (1 motor) *Application with one motor (thermal motor protection)*
2 . . . Parameter set 1/2 (2 motors) *A separate motor protection model is provided for each motor (thermal motor protection).*

Depending on the position of the digital input (parametrization: "20 User Macro 2"), the parameters are loaded from User Macros 1 or 2.



1.) Load the desired macro for the first motor, adjust the motor data, start autotuning and make all desired parameter adjustments.
2.) Parametrize a digital input (parameter D2.00 to 10) for the position "20 User Macro 2".
3.) Use B2.01 to store the new settings in User macro 1.
4.) Connect the second motor, adjust the motor data, start autotuning and make all desired parameter adjustments.
5.) The same input must be parametrized for the function "20 User Macro 2"!
6.) Use B2.02 to store the new settings in User macro 2.
7.) Set parameter B2.04 to "1 Parameter set 1/2 (1 motor)" or "2 Parameter set 1/2 (2 motors)" and change to the basic display (A1 - Home).
8.) Depending on the signal at the digital input, the respective parameter set is copied into the block "working parameter" in the case of pulse inhibit (Stop, Mains off or Disabled). The current parameter set is displayed.
Digital input Low = User-Macro 1 Display: "Macro 1 (UM1)"
Digital input High = User-Macro 2 Display: "Macro 2 (UM2)"
9.) Set parameter B2.04 to "0" if you want to adjust further parameters in a particular parameter set; make the desired adjustments and store them with B2.01 and B2.02. Then parametrize B2.04 again as "1" or "2".

As soon as B2.04 has the setting 1 or 2, the function "Para locked" will be active, i.e. parameters can no longer be changed!

B3 Motor data

Input of motor data according to the rating plate

B3.00	Nominal power [kW]	VICB	0...***Default***...2500 kW
B3.01	Nominal current [A]	VICB	0...***Default***...2500 A
B3.02	Nominal voltage [V]	VICB	0...***Default***...1000 V
B3.03	Nominal frequency [Hz]	VICB	25...***Default***...300 Hz
B3.04	Nominal speed [rpm]	VICB	0...***Default***...18000 rpm

By default, the settings for these parameters correspond to a four-pole standard motor for 400 V with the same output as the inverter. If you use a motor with different electrical data, please adjust the parameters (e. g. use of the device as version "C" - high overload).
E.g. for a motor (230/400 V, 22 kW, 50 Hz) in Δ with a constant torque of up to 87 Hz, the parameters have to be adjusted as follows:

B3.00 = $P_{N,Motor} \cdot \sqrt{3}$ = 22 kW · $\sqrt{3}$ = 38.1 kW
B3.01 = $I_{N\Delta\ (230\ V)}$ = 80 A
B3.02 = U_{NY} = 400 V
B3.03 = $f_N \cdot \sqrt{3}$ = 50 Hz · $\sqrt{3}$ = 87 Hz
B3.04 = $n_N \cdot \sqrt{3}$ = 1460 rpm · $\sqrt{3}$ = 2530 rpm

The nominal speed entered must be smaller than (or equal to) the synchronous speed! Otherwise, the inverter will calculate the wrong number of pairs of poles and the value displayed as actual speed will be incorrect.

B3.05	Line voltage	VICB	400 V; 50 Hz

0 . . 400 V; 50/60 Hz • 3 AC 400V (380...415V ±10%), 50/60Hz ±5%

For *>pDRIVE< MX basic* always setting 0 is displayed.

B4.00	Start tuning	VICB Routine
	0 . . . Start 0 → 1	*Starts tuning by selecting line "1".*
	1 . . . Autotuning	*Autotuning starts and is carried out automatically.*
	2 . . . Rotor coefficient	*The rotor coefficient is calculated.*
	3 . . . Rotor constant	*The rotor-time constant is calculated.*
	4 . . . Stator resistor	*The resistor of motor and motor cable is measured.*
	5 . . . I-flux 1	*The necessary fluxing current (open-circuit current)*
	6 . . . I-flux 2	*is calculated in five steps.*
	7 . . . I-flux 3	
	8 . . . I-flux 4	
	9 . . . I-flux 5	
	10 . . O.K.	*Autotuning is finished and the calculated values and measurements have been transferred to parameters B4.01 to B4.04.*
	11 . . Cancel	*Press the "Stop" key if you want to stop autotuning although the process has not finished yet.*

The motor is loaded with different voltages and currents on activation of the autotuning routine, but it does not start.
Thereby, specific motor measurements are carried out, and the results are stored in parameters B4.01 to B4.04.
The entire autotuning process takes 1 to 4 minutes. For autotuning the motor has to be cold.

1.) The tuning requires pulse enable for the inverter; i. e. "Stop" or "Mains off" must be displayed!
2.) The motor must not rotate during the autotuning process!

The most accurate measurement results are achieved if the electronic system has operating temperature, i.e. mains voltage should be applied to the inverter for at least 2 minutes prior to autotuning.

There are several reasons for error messages that are issued after the autotuning process:

Message "12 Error: rotor coeff.":
possible cause: - no enable signal at the terminal strip (e.g. digital input DI5) or via the bus
- no motor connected

Message "13 Error: rotor f":
possible cause: - motor is too big

Message "14 Error: stator R":
possible cause: - no motor connected

Message "15 Error: I-flux":
possible cause: - motor parameters (B3.00 to 04) have not been entered correctly
- motor rotates

If you cannot operate the motor satisfactorily (e. g. very small motors or special machines), you can reset the factory defaults for the autotuning data:

Use F2.01 "Reset motor parameters" in order to reset the factory defaults in areas B3 and B4. All the other parameter adjustments and the user macros remain unchanged.

The autotuning values must be stored in the user macro again!

B4.01	Rotor coefficient	VICB	0...***Default***...999999
B4.02	Rotor-time constant	VICB	0.000...***Default***...4.000 s
B4.03	Stator resistor	VICB	0.00...***Default***...50000.00 mOhm
B4.04	Fluxing current	VICB	0.0...***Default***...2500 A

After delivery (or after using F2.01 for resetting the factory defaults), the parameters display typical values for a motor according to the "P" power of the inverter. These values are replaced by the new data as soon as the autotuning process has finished.
You can also correct the values → see Service Manual.

B4.05	Autotuning current [A]	read only

You can display the current supply during autotuning for inspection purposes.
→ see also parameters A6.00 to A6.02.

B5 Short Menu

Parameter adjustment in the Short menu

A selection of those parameters which are important for the chosen application is displayed in this matrix area depending on the macro you have selected.

For many applications, parametrization of the drive will be finished as soon as the parameters displayed in the short menu have been set or adjusted.
You can make further optimizations, e.g. use option cards or different additional inverter functions, by selecting and adjusting the necessary parameters on the matrix level. These modified parameters will also be transferred into the short menu.
The automatic enlargement of the short menu gives you a clear and precise summary of all parameter settings. All parameters that are not listed in the short menu are stored as factory defaults.

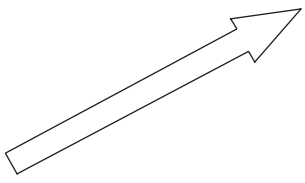
B5 . Short menu
C1.00 Incr. start tor...
C1.14 Economy...
C2.00 Accel. ramp1
C2.01 Decel. ramp1
C3.00 Min. freq...

e.g. changing parameter C1.02

C1.02 Stop mode	Decel. ramp

⇨ 0 free wheel
1 deceleration ramp
2 fast-stop

leads to the following changes compared with the default:



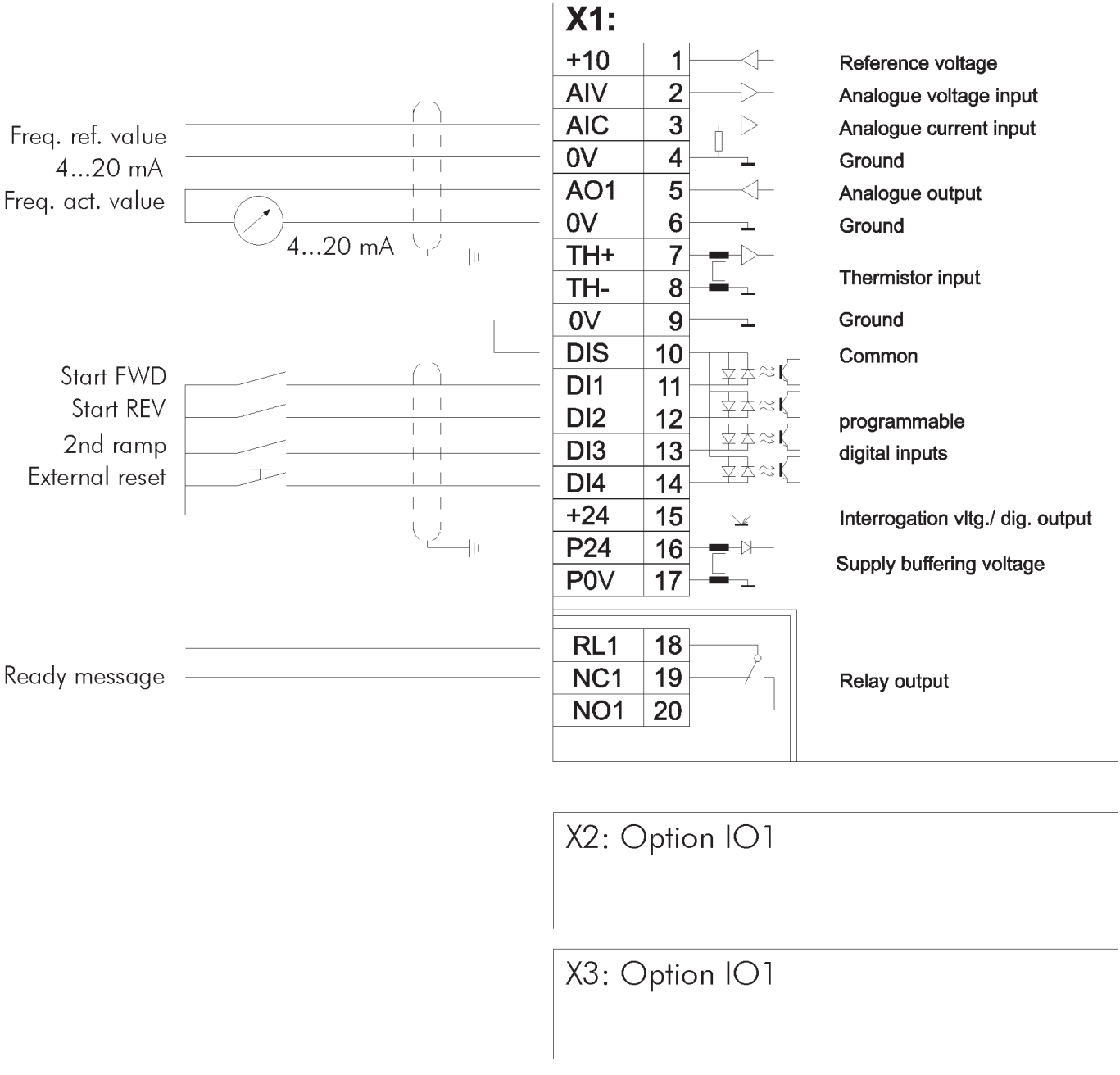
B5 . Short menu
C1.00 Incr. start tor...
C1.02 Stop mode
C1.14 Economy...
C2.00 Accel. ramp1
C2.01 Decel. ramp1
C3.00 Min. freq...

Macro M1 - Drives with high overload (factory setting)

Conveyors
piston pumps
separators, etc.

The start torque can be increased to a maximum of 180% for heavy starts (parameter C1.00 "Increase start torque").
The reference value of 4-20 mA is remote controlled, local mode is operated using the keypad.
Two switches (Start FWD and Start REV) are used for device control; in addition, the terminal strip functions "2. ramp" and "external reset" are programmed.
If you want to make further device-specific adjustments, use the parameter description and make adjustments in the matrix area.
The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M1

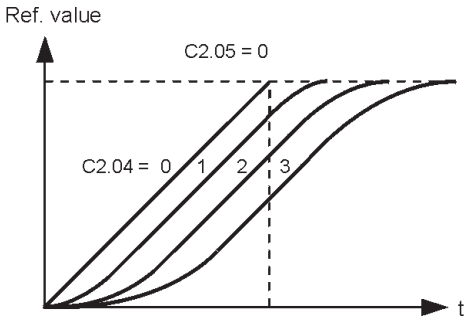
Parameter number	Name	Setting	Notes
B2.03	Macro selection	Conveyor	or: piston pump, separator
C1.00	Increase start torque	0...**1**...30 %	Setting for 150% start torque
C2.00	Acceleration ramp 1	0.0...**5.0**...3200 s	Setting in s/nom. motor frequency
C2.01	Deceleration ramp 1	0.0...**5.0**...3200 s	Setting in s/nom. motor frequency
C3.01	Maximum frequency	25.00...**50.00**...300 Hz	Setting of the upper frequency limit
C3.02	Direction enable	Enable FWD/REV	Enables forward and reverse rotation
D1.04	AIC selection	f-ref Auto	Frequency ref. value at ref-input AIC (mA)
D1.06	AIC value 0%	-300.0...**0.00**...300.0 Hz	Defines the frequency range for the
D1.07	AIC value 100%	-300.0...**50.00**...300.0 Hz	analogue signal 4-20 mA
D2.00	DI1 selection	Start FWD	Start/Stop forward (steady contact)
D2.01	DI2 selection	Start REV	Start/Stop reverse rotation (steady contact)
D2.02	DI3 selection	2.ramp	Changes to 2. accel./decel ramp set
D2.03	DI4 selection	Ext. Reset	Integration of an external reset
D3.00	AO1 selection	f-output	Analogue output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D4.01	Relay output 1	Ready + Run	Ready message at digital output RL1
E2.00	Thermistor input	not active	
E2.02	I_{MAX} at 0 Hz	0...**50**...150 %	Definition of the motor protection.
E2.03	I_{MAX} at f_{NOM}	0...**100**...150 %	Currents in % with ref. to $I_{NOM,MOTOR}$
E2.05	Motor-time constant	0...**5**...3200 min	>5 min: 24V buffering necessary!

All motor data B3.00 to B3.04 are displayed in the short menu!

For the >*pDRIVE*< *MX basic*, the short menu also lists parameter B3.05 "Line voltage".

Supplement to macro M1

S-ramp for acceleration and deceleration



You can activate an s-ramp in order to ensure a smooth transition from the standstill of the drive to the acceleration or deceleration phase and from the acceleration/deceleration phase to a steady-state speed.

In addition to macro M1, you have to make the following parameter adjustments:

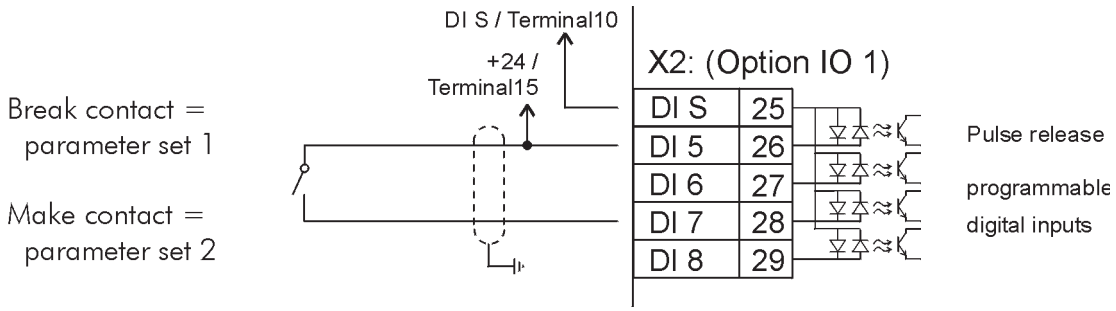
Parameter	Name	Setting	Notes
C2.04 C2.05	S-ramp S-ramp mode	S-ramp step 1, 2 or 3 Begin + End	Make adjustments as required. You can also select "Begin only".

Switching to parameter set 2

A special feature of the *>pDRIVE< MX* inverter is that you can have two different settings for every parameter. The set motor values, the measured autotuning values and the optimized parameter values are stored at the locations "User Macro 1" and "User Macro 2". Depending on the digital input, the inverter will operate with parameter set 1 or 2.

Applications:

- The inverter is alternately used for two motors.
- Parametrization for two different working processes with one motor.
- Alternate operation with and without speedometer feedback.



Parameter	Name	Setting	Notes
D2.05	DI7_2 selection	User Macro 2	Assignment of the function to DI7_2
B2.01	Store User-M1	Start routine with 1	Select line 1 to initiate the storage process
B2.02	Store User-M2	Start routine with 1	or
B2.04 *)	Mulit-configuration	Para.Set 1/2 (1 motor)	Para-Set 1/2 (2 motors)

*) Parameter adjustments are blocked as soon as the parameter is in position 1 or 2.

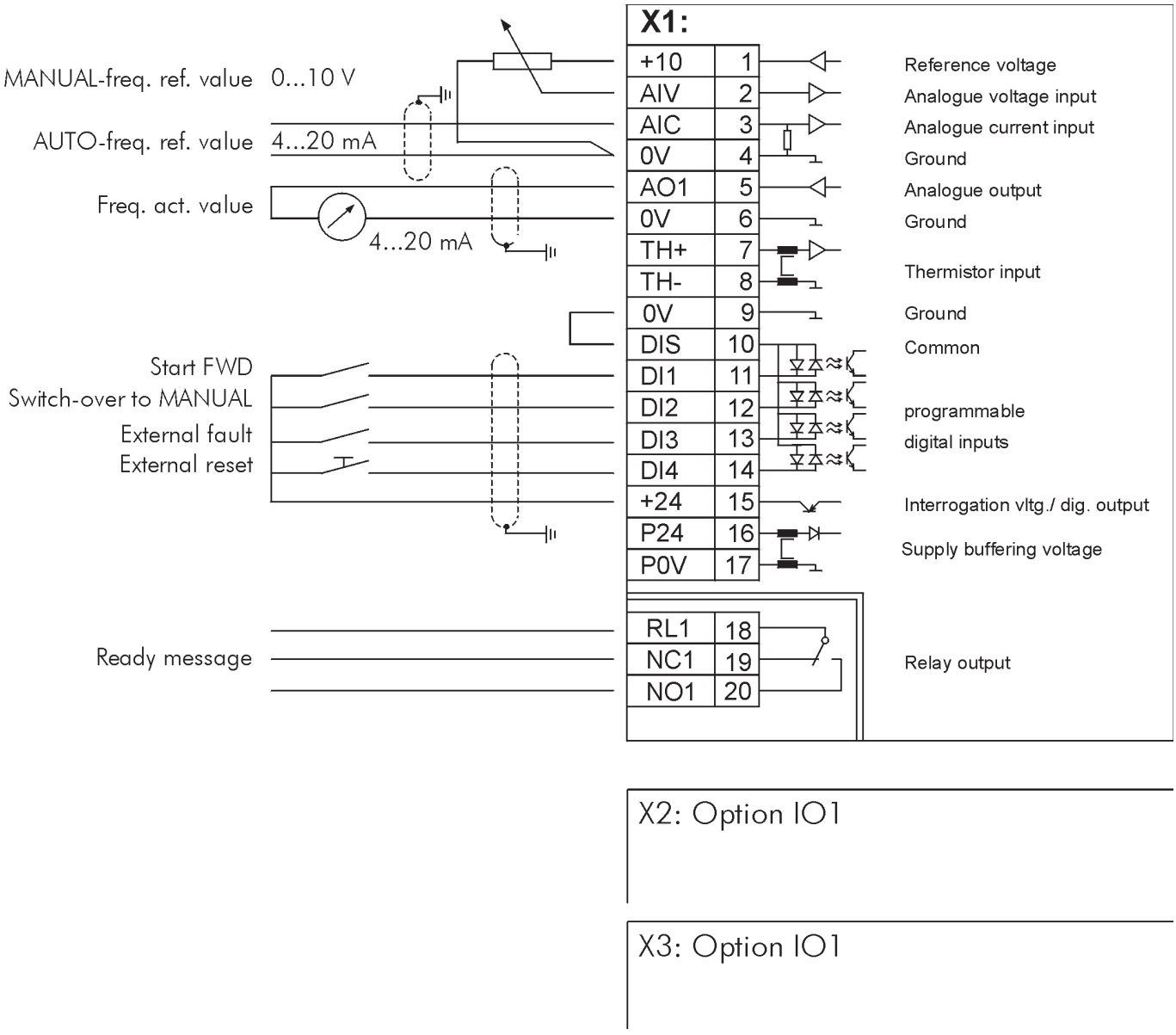
For instructions on the correct setting process, see parameter B2.04.

Macro M2 - Drives with high steady load (n^2 - load moment)

Centrifugal pumps
exhaust fans
fans, etc.

You can change to the higher rated motor power "P" by adjusting the respective motor data in parameters B3.00 to B3.01.
The energy saving function "Economy mode" is activated at level 1. The frequency reference value is set using 2 analogue inputs. The 0-10 V input is active, if the switch "Manual (Auto)" is closed. Otherwise, the default values are transmitted via the current reference value input AIC.
The devices are controlled with Start FWD, reverse rotation is blocked. In addition, the terminal strip functions "external fault" and "external reset" are programmed.
If further device-specific adjustments are necessary, please use the parameter description and adjust the parameters via the matrix area. The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M2

Parameter number	Name	Setting	Notes
B2.03	Macro selection	Centrifugal pump	or: exhaust fan, fan
C1.14	Economy mode	Step 1	Energy saving mode, step 1
C2.00	Acceleration ramp 1	0.0...**10.0**...3200 s	Setting in s/nom. motor frequency
C2.01	Deceleration ramp 1	0.00...**10.0**...3200 s	Setting in s/nom. motor frequency
C3.00	Minimum frequency	0.00...**5.00**...300 Hz	Setting of the lower frequency limit
C3.01	Maximum frequency	25.00...**50.00**...300 Hz	Setting of the upper frequency limit
D1.00	AIV selection	freq. ref Manual	Manual frequency reference value as 0-10 V signal at analogue input AIV
D1.01	AIV value 0 %	0.00...**0.00**...300.0 Hz	Defines the frequency range for the
D1.02	AIV value 100%	0.00...**50.00**...300.0 Hz	analogue signal 0-10 V
D1.04	AIC selection	freq. ref Auto	Automatic frequency ref. value as 4-20 mA signal at analogue input AIC
D1.06	AIC value 0%	-300.0...**0.00**...300.0 Hz	Defines the frequency range for the
D1.07	AIC value 100 %	-300.0...**50.00**...300.0 Hz	analogue signal 4-20 mA
D2.00	DI1 selection	Start FWD	Start/Stop (forward only - steady contact)
D2.01	DI2 selection	Manual (Auto)	Change to manual f-ref. value
D2.02	DI3 selection	Ext. fault	Integration of an external fault
D2.03	DI4 selection	Ext. Reset	Integration of an external reset
D3.00	AO1 selection	f-output	Analogue output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D4.01	Relay output 1	Ready + Run	Ready message at digital output RL1
E1.00	Current max. value	**125 %**	I_{MAX} - limitation with reference to $I_{N"C"}$
E2.00	Thermistor input	not active	
E2.03	I_{MAX} at f_{NOM}	0...**100**...150 %	Definition of the motor protection. Currents in % with ref. to $I_{NOM,MOTOR}$
E2.05	Motor-time constant	0...**5**...3200 min	>5 min: 24 V buffering necessary!
E3.02	External fault	N.O. Ready + Run	Ext. fault is integrated by means of a make contact and monitored in ready + run mode


All motor data B3.00 to B3.04 are displayed in the short menu!

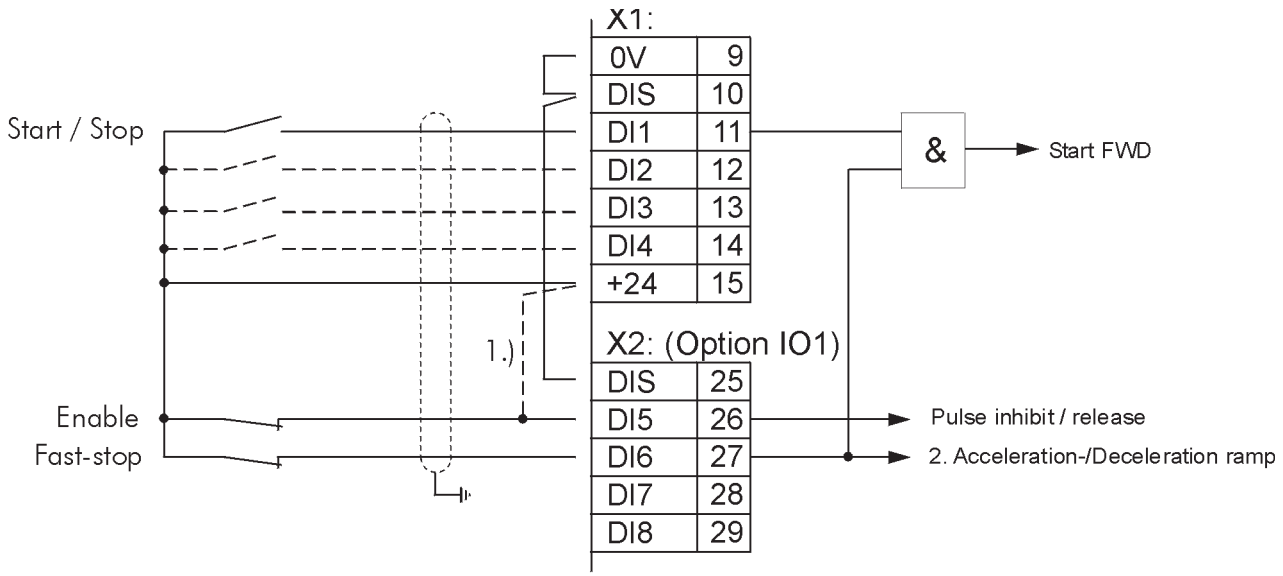

For the >*pDRIVE*< *MX basic*, the short menu also lists parameter B3.05 "Line voltage".

Supplement to macro M2

Fast-Stop with motor brake

Fans often require a fast-stop mechanism for special operating situations. The new motor brake function of the *>pDRIVE< MX* is able to reduce the deceleration time to 10...20%.
Three digital inputs regulate the behavior if the "OFF" command is activated:

DI1	Start FWD at acceleration ramp 2 / OFF 1	Deceleration at deceleration ramp 2
DI5_2	Start FWD at acceleration ramp 2 / OFF 2	Pulse inhibit = free wheel
DI6_2	Start FWD at acceleration ramp 2 / OFF 3	Fast-stop at deceleration ramp 1

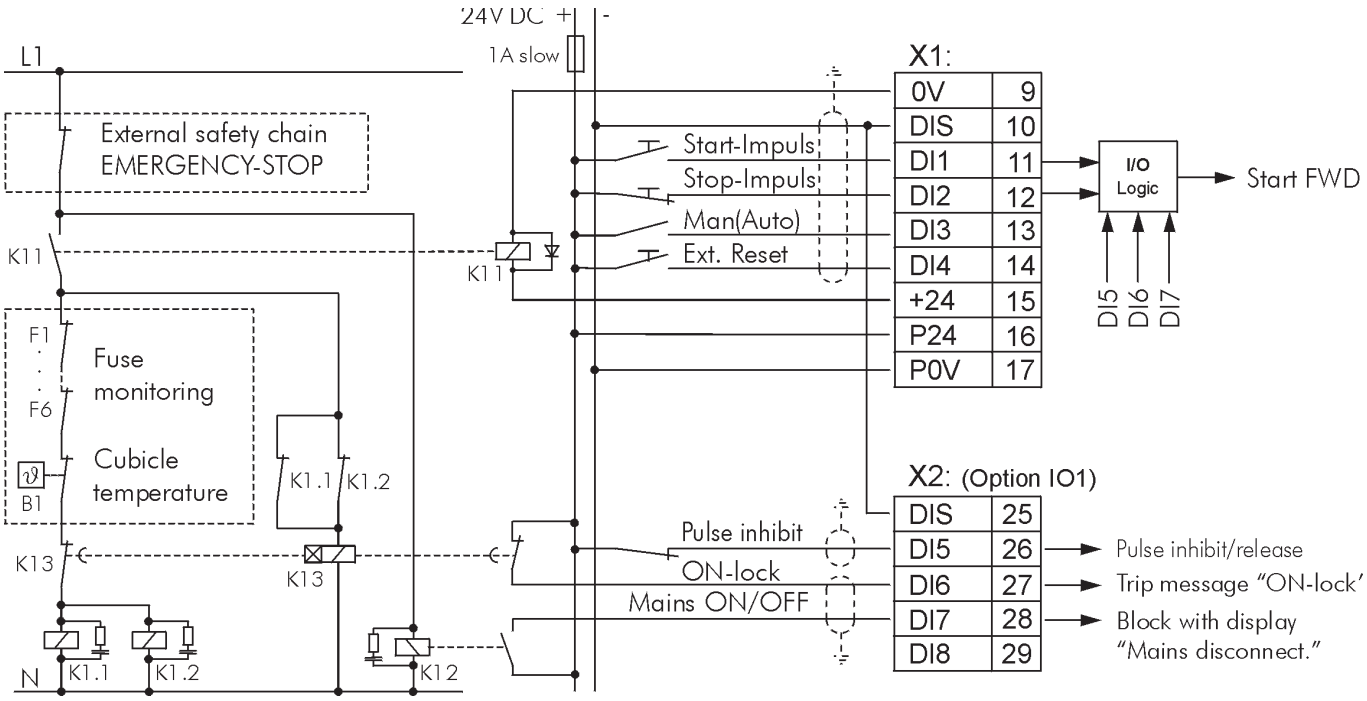


1.) Jumper, if no pulse inhibit/release signal is required.

Parameter	Name	Setting	Notes
C1.03	Braking mode	Motor brake A	Depending on the motor use A, B or C.
C2.00	Acceleration ramp 1	0.0...10.0...3200 s	Without function!
C2.01	Deceleration ramp 1	0.0...0.1...3200 s	Deceleration is adjusted according to the existing mass and the braking effect.
C2.02	Acceleration ramp 2	0.0...10.0...3200 s	Acceleration takes place at the current limitation if the working load is too big.
C2.03	Deceleration ramp 2	0.0...10.0...3200 s	Avoid motor overload by selecting a value that guarantees that the motor brake does not work during normal operation.
D2.00	DI1 selection	not used	Is only required by the logic module.
D2.04	DI6_2 selection	2. ramp	Is additionally required by the logic module.
F4.44	L5 signal to D1	DI1	Required from digital input DI1.
F4.45	L5 signal to D2	DI6_2	Required from digital input DI6_2.
F4.46	L5 logic function	AND	The drive only starts if the contacts for "Start FWD" and "Fast-stop" are closed.
F4.49	L5 selection	Start FWD	Internal wiring.

Contactor control with integration of monitoring units in the cubicle (ON lock):

If you use contactor control, the mains voltage will only be switched on as long as a Start command is active. Thus, the "standby losses" of the inverter are minimized and the lifetime of the fans is increased (see also parameter C6.00!). The control electronics are supplied permanently with a 24 V buffer voltage.



24V DC Auxiliary voltage for supplying the control electronics during "Mains OFF"

K11 Auxiliary relay (max. 100mA, 24V) that is activated via the digital output +24, parametrization "Mains ON" for activation of the contactor(s).

K12 Auxiliary relay (230V AC) for confirmation from the external safety chain (Emergency OFF). A renewed start pulse is necessary for restart. The inverter cannot be started while the safety chain is open.

K13 Time relay (time delay 0.5s; 230V AC) for confirmation from the safety chain (mains fuse blown, cubicle temperature >, contactor defect, ...). The lock is cancelled by using K11, the error message is stored by the inverter and a sum error message is displayed.

K1.1 Contactor for connection to mains supply. It opens after each deceleration, in the case of pulse inhibit, trip, and "Mains OFF".

K1.2 Both contactors have to work in parallel mode if MX size 5 is used.

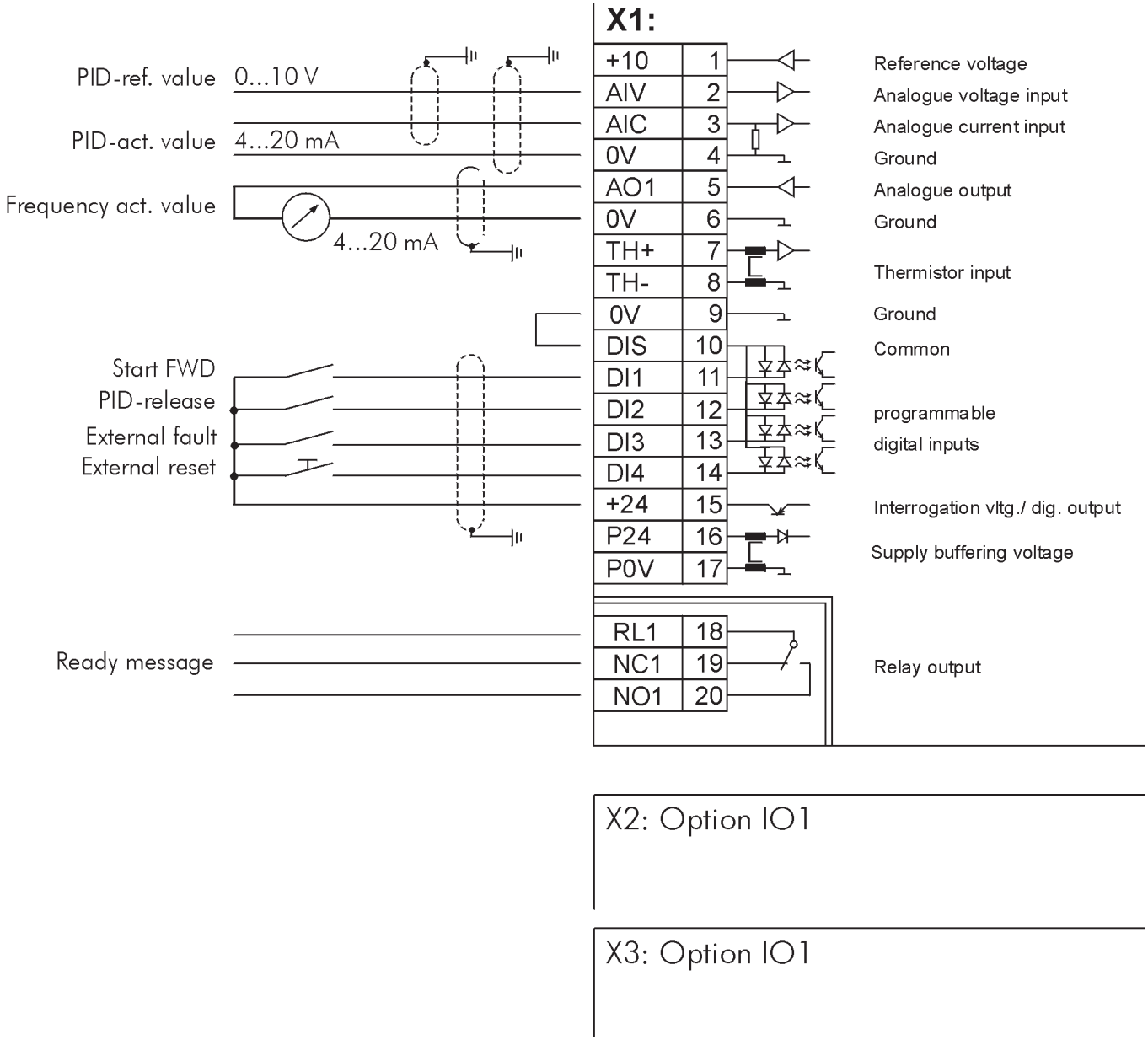
Parameter	Name	Setting	Notes
C6.00	Contactor control	active	
D2.00	DI1 selection	Start FWD impulse	parametrized for caliper control
D2.01	DI2 selection	Stop Impulse	
D2.02	DI3 selection	Manual (Auto)	
D2.03	DI4 selection	Ext. Reset	
D2.04	DI6_2 selection	ON lock	confirmation from the fuse monitor, etc.
D2.05	DI7_2 selection	Supply ON (OFF)	confirmation from the external safety chain
D4.00	+24 digital output	Line ON	output to contactor control

Macro M3 - drives with n² load moment and process control

Pressure, level and volume control, etc.

You can change to the higher rated motor power "P" by adjusting the respective motor data in parameters B3.00 to B3.01.
The energy saving function "Economy mode" is activated at step 1. The process reference value is defined via a voltage signal 0-10 V on AIV, the actual value is reported as a 4-20 mA signal on AIC. The devices are controlled with Start FWD, reverse rotation is blocked. In addition, the terminal strip functions "external fault" and "external reset" are programmed.
If further device-specific adjustments are necessary, please use the parameter description and adjust the parameters via the matrix area. The modified parameter settings can be stored in the user macro. All parameter modifications are automatically transferred to the short menu and are clearly summarized there.

Wiring diagram



Short menu for macro M3

Parameter number	Name	Setting	Notes
B2.03	Macro selection	Pump + PID	
C1.14	Economy mode	Step 1	Energy saving mode, step 1
C3.00	Minimum frequency	0.00...**5.00**...300 Hz	Setting of the lower frequency limit
C3.01	Maximum frequency	25.00...**50.00**...300 Hz	Setting of the upper frequency limit
C4.04	PID-controller enable	Yes	Activates the PID controller
C4.05	Prop. gain (kp)	0,0...**20.0**...3200 %	Controller setting: amplification
C4.06	Integr. time (Tn)	0.00...**10.00**...320.0 s	Controller setting: integration time
C4.08	Ref. accel. ramp	0.0...**10.0**...3200 s	Setting in s / 100%
C4.09	Ref. decel. ramp	0.0...**10.0**...3200 s	Setting in s / 100%
C4.10	Output scaling -	-300...**+10.00**...+300 Hz	Minimal limit of controller output
C4.11	Output scaling +	-300...**+50.00**...+300 Hz	Maximum limit of controller output
D1.00	AIV selection	PID-reference value	Reference value as voltage signal 0-10 V
D1.01	AIV value 0 %	0...**0**...200 %	Used for reference value
D1.02	AIV value 100%	0...**100**...200 %	adjustment
D1.04	AIC selection	PID-actual value	Actual value > current signal 4-20 mA
D1.06	AIC value 0%	0...**0**...200 %	Used for actual value
D1.07	AIC value 100 %	0...**100**...200 %	adjustment
D2.00	DI1 selection	Start FWD	Start/Stop (only forward - steady contact)
D2.01	DI2 selection	PID-enable	PID enable signal
D2.02	DI3 selection	Ext. fault	Integration of an external fault
D2.03	DI4 selection	Ext. Reset	Integration of an external reset
D3.00	AO1 selection	f-output	Analogue output 1 - frequency actual value (4-20 mA = 0 - f_{MAX})
D4.01	Relay output 1	Ready + Run	Ready message at digital output RL1
E1.00	Current max. value	**125 %**	I_{MAX} - limitation with reference to $I_{N"C"}$
E2.00	Thermistor input	not active	
E2.03	I_{MAX} at f_{NOM}	0...**100**...150 %	Definition of the motor protection. Currents in % with ref. to $I_{NOM,MOTOR}$
E2.05	Motor-time constant	0...**5**...3200 min	>5 min: 24 V buffer necessary!
E3.02	External fault	N.O. Ready + Run	Ext. fault is integrated by means of a make contact and monitored in ready + run mode

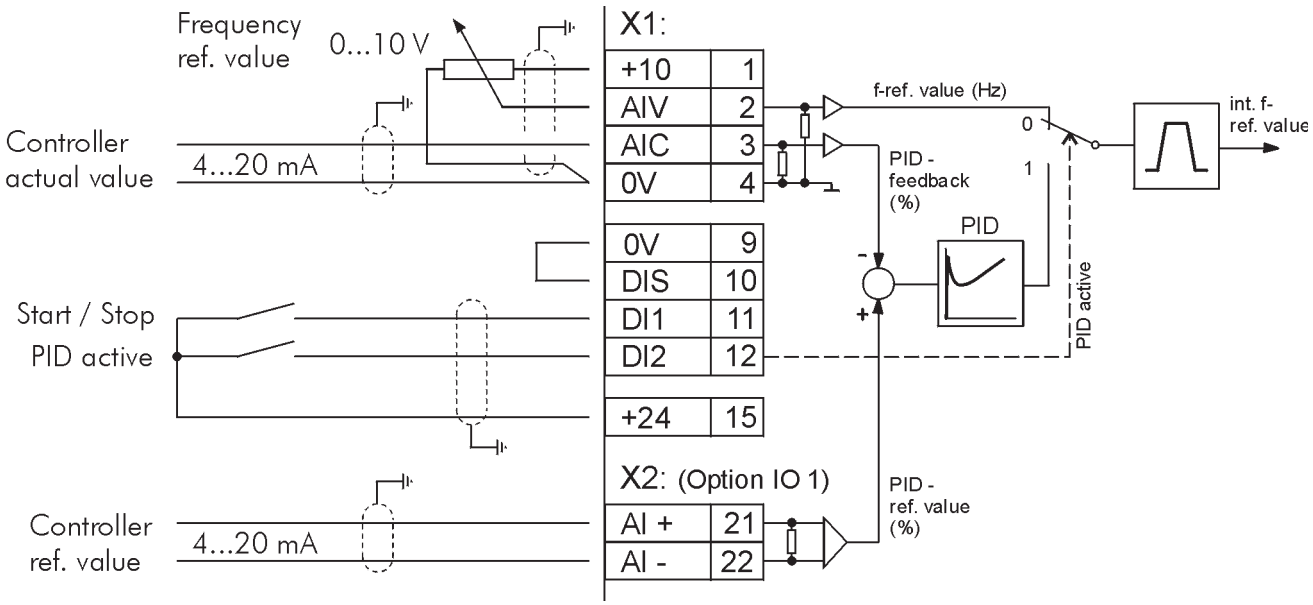

All motor data B3.00 to B3.04 are displayed in the short menu!


For the >*pDRIVE*< *MX basic*, the short menu also lists parameter B3.05 "Line voltage".

Supplement to Macro M3

Switch-over PID control mode / frequency default

The digital input "PID-enable" explained in macro M3 merely freezes the controller output at the last value or releases it.
The digital input function "PID active", however, allows you to switch from controller mode to direct frequency (speed) control and vice versa. In the following example, the direct frequency control is provided by a local potentiometer and the controller reference default with a 4...20mA signal (this requires the option card IO1).



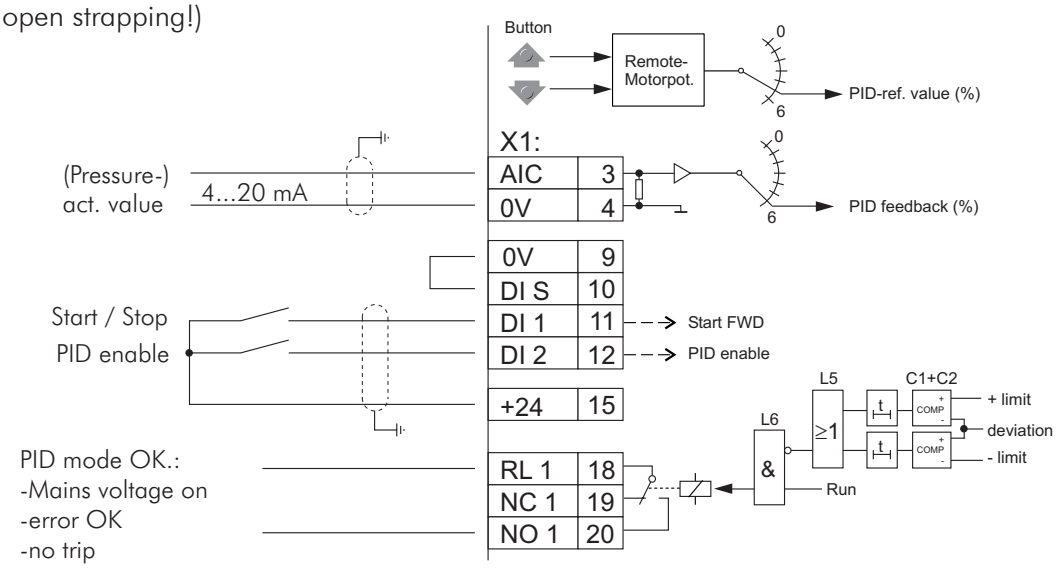
Parameter settings based on macro M3:

Parameter	Name	Setting	Notes
A6.00	Select. zone 1	PID error	Adjustment of the display for
A6.01	Select. zone 2	PID-reference value	PID-controller mode with switch-over
A6.02	Select. zone 3	Motor speed	to frequency control
C4.04	PID enable	terminals	Switch-over according to digital input
D1.00	AIV selection	freq. ref Auto	Voltage ref. value for frequency control
D1.01	AIV value 0%	-300...e.g.10.00...+300 Hz	with minimum and
D1.02	AIV value 100%	-300...e.g.50.00...+300 Hz	maximum limit
D1.09	AI_2 selection	PID-reference value	Controller ref. value as 4...20mA signal
D1.10	AI_2 signal type	4...20mA	
D1.11	AI_2 value 0%	-200...0.00...+200 %	
D1.12	AI_2 value 100%	-200...100.00...+200%	
D2.01	DI2 selection	PID active	Making contact switches over to controller mode

Through permanent feedback from the PID controller output, a smooth switch back to controller mode is possible.

PID process controller with reference value default on the keypad

The inverter works in controller mode without an external caliper and potentiometer, by setting the required reference value directly on the inverter keypad. Only the actual value signal (e.g. actual pressure value 4...20 mA) is connected to terminals 3 and 4 on the terminal strip.
Due to jumpers between terminals 9 and 10, as well as 11 and 15, controller mode starts as soon as the mains voltage is switched on (→ for parametrization of locked (VICB) parameters, switch to local mode and press Stop key or open strapping!)



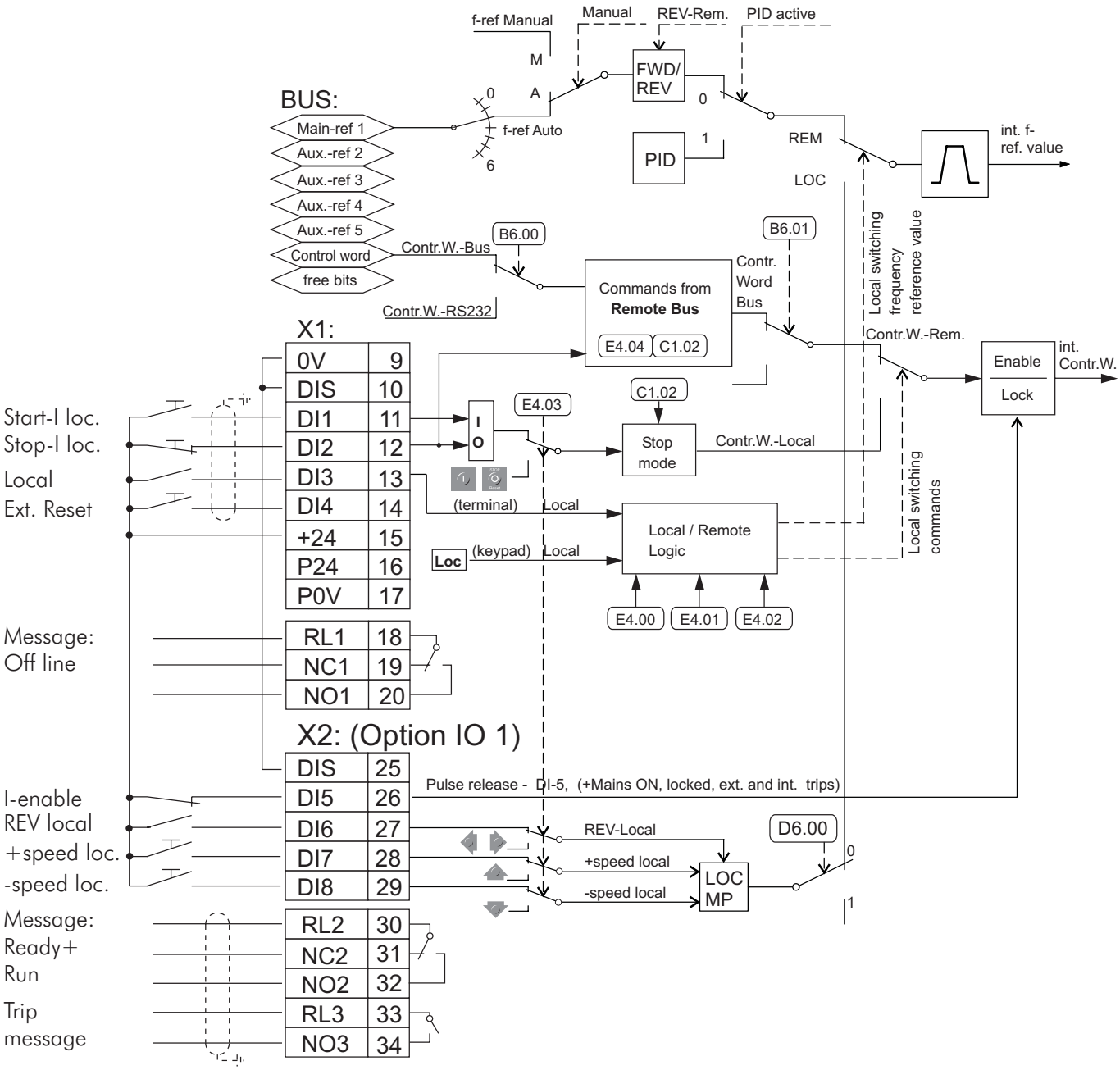
Parameter settings based on macro M3:

Parameter	Name	Setting	Notes
A6.00	Select. zone 1	PID error W-X	Adjustment of the display for
A6.01	Select. zone 2	PID-ref. value W	PID control mode
A6.02	Select. zone 3	PID-act. value X	
D1.00	AIV selection	not used	After resetting to factory default, the
D1.01	AIV value 0%	0.0...**0.01**...300 Hz	parameters do not longer appear in the
D1.02	AIV value 100%	0.0...**50.01**...300 Hz	short menu
D4.01	Relay output 1	Output logic L6	Message "PID mode OK"
D6.06	Rem. MP seledtion	PID-reference value	Remote motorpot. for PID-ref. value default
D6.07	Rem. MP min. value	-200...**0.00**...+200 %	Lower limit for PID-ref. value
D6.08	Rem. MP max. value	-200...**100.00**...+200 %	Upper limit for PID-ref. value
D6.11	Rem./MP control	Keypad	Keys on keypad for PID-ref. value
D6.12	Rem. ref. storage	active	Last ref. value is reactivated after Mains ON
F4.00	C1 Signal to E1	PID error	Monitoring of positive control deviation
F4.02	C1 reference	-200...e.g.**+50**...+200%	With time delay to span from
F4.03	C1 function	E1 > E2	start time until +error is OK.
F4.04	C1 Hysteresis/Band	0,0...**2,0**...100,0 %	
F4.06	C1 Time set	0.0...e.g.**30.0**...3200 s	
F4.08	C2 Signal to E1	PID error	Monitoring of negative control deviation with
F4.10	C2 reference	-200...e.g.**-5.0**...+200%	delayed feedback if not OK.
F4.11	C2 function	E1 < E2	
F4.12	C2 Hysteresis/Band	0.0...**2.0**...100.0 %	
F4.14	C2 time set	0.0...e.g.**10.0**...3200 s	
F4.44	L5 signal to D1	Output comp. C1	Link between the two monitoring modules
F4.45	L5 signal to D2	Output comp. C2	for error
F4.46	L5 logic function	OR	
F4.50	L6 signal to D1	Ready + Run	Link with Ready and Run feedback
F4.51	L6 signal to D2	Output logic L5	
F4.52	L6 logic function	AND-neg. (D2)	

Supplements to macros M1 to M3

Switching over to "local control" with local keys

The figures "Configuration of Analogue Inputs" in Chapter D1 and "Overview of Control Commands" in Chapter D2 show the various possibilities for switching between the operating modes.
The switch-over from remote mode (bus control or terminal control) to local mode (on the keypad or locally via digital inputs) is absolutely smooth.
The switching example describes the switch-over between Profibus control and local control of the motor. Thereby, both the reference value default and the digital control commands are switched over. In local mode, the keys of the keypad are replaced by local keys that are integrated via the terminal strip.



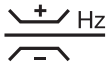
Parameter settings based on macro M1:

Parameter	Name	Setting	Notes
B6.00	Select bus	PROFIBUS DP	Parametrization of Profibus DP and
B6.01	Select remote	Bus	definition of the address
B6.02	Slave address	0...Address...126	
B6.03	Stop mode T.out	Fault	Behavior at trip of bus with adjustable
B6.04	Time OUT	0.0...e.g. 10.0...3200 s	delay time.
B6.06	Main reference 1	freq. ref Auto	Frequency ref. default in remote mode
D1.04	AIC selection	not used	
D2.00	DI1 selection	Start impulse local	Key command Start (make contact)
D2.01	DI2 selection	Stop impulse local	Key command Stop (break contact)
D2.02	DI3 selection	Local (Rem)	Making contact = local mode
D2.03	DI4 selection	Ext. Reset	Key command trip confirmation
D2.04	DI6_2 selection	REV local	Making contact = reverse
D2.05	DI7_2 selection	+speed local	Key command faster (break contact)
D2.06	DI8_2 selection	-speed local	Key command slower (break contact)
D4.01	Relay output 1	Local operation	Relay closed in local mode
D4.02	Relay output 2_2	Ready + Run	Relay closed for Ready + Run
D4.03	Relay output 3_2	Trip	Relay closed for trip
E4.02	Loc/Rem-switch	Terminals	Switch-over to local mode via terminal strip
E4.03	Ctrl. mode local	Terminals	Keys on keypad replaced by digital inputs

Bit 10, "Control OK" of the bus control word must be set in order to be able to switch back to remote (bus) mode !

Configuration and diagnosis of the serial port

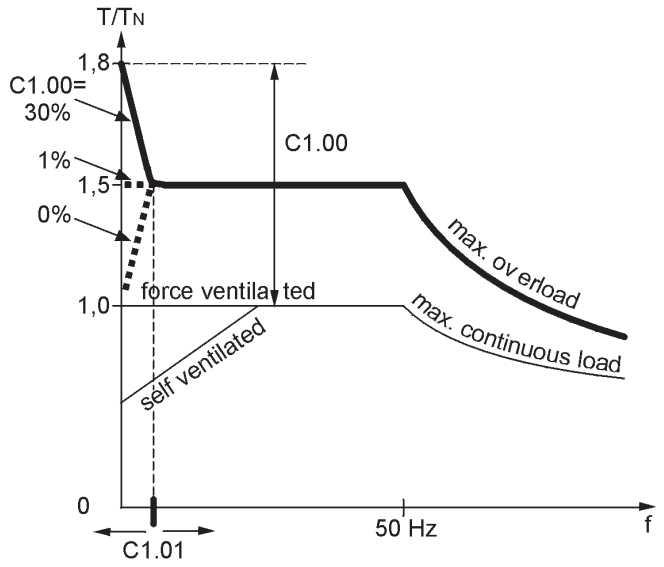
All parameters concerning connection of the Profibus to the frequency inverter can be found in the manual "Profibus Option PB01", No. 8 074 575!

C	f_{xx}	Settings	
C1		General functions	Increase start torque, increase steady torque, stop mode, braking mode, pre-set reference, jog frequency, economy mode Page 37
C2		Ramps	Acceleration and deceleration ramps, S-ramp, S-ramp mode Page 40
C3		Speed range	Minimum and maximum frequency, Direction enable, rotary field Page 41
C4		PID configurat.	General, reference and feedback monitoring, error, PID output, activation, prop gain, integration time, derive time, reference ramps, output scaling Page 42
C5		Catch on the fly	detection level Page 44
C6		Special functions	Contactor control Page 45

C1 General functions

Stop mode, braking mode, pre-set reference values, jog frequency, economy mode

C1.00	Increase start torque	VCB	0...***1***...30 %	see Macro
C1.01	Increase steady torque	VCB	5...***10***...45 Hz	



For applications requiring a high start torque, the start torque (100% or 150% T_N) can be increased to 180% T_N.

For pumps and fans, the setting 0% (T_A = approx. 100% T_N) is usually sufficient.

e.g. C1.00 = 0% corr. to approx. 100% $T_{N"C"}$
C1.00 = 1% corr. to approx. 150% $T_{N"C"}$
C1.00 = 30% corr. to approx. 180% $T_{N"C"}$

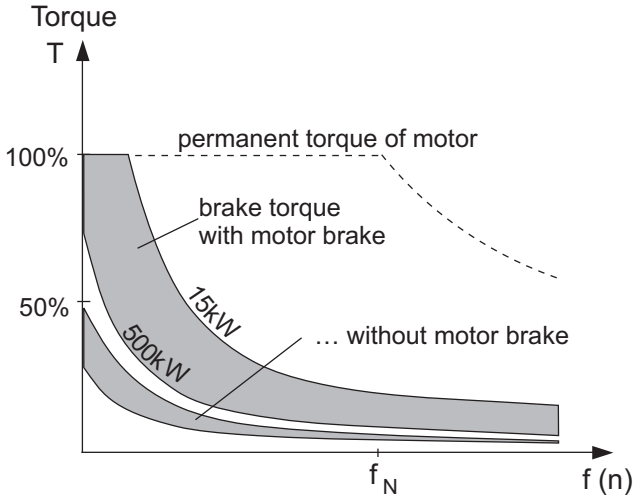
The range, in which this increase is effective, can be set using paramete C1.01.

The setting of the parameter has no effects on the function and the result of autotuning.

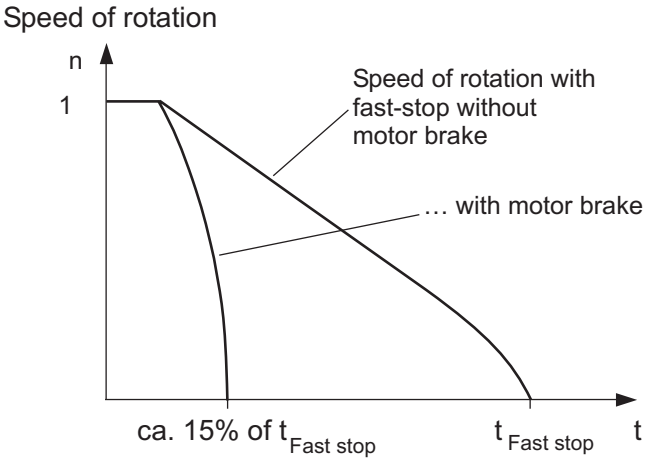
C1.02	Stop mode	VCB	deceleration ramp
	0 . . . free wheel (OFF 2)		A Stop command is followed by immediate pulse inhibit. The motor runs out freely. With this setting, "Disabled" is displayed instead of "Stop".
	1 . . . Decel. ramp (OFF 1) •		A stop command is followed by slowing down of the motor (if possible) according to the set deceleration ramp. On reaching 0 Hz, a pulse inhibit is issued.
	2 . . . Fast-stop (OFF 3)		A Stop command is followed by braking of the motor within the shortest possible time. On reaching 0 Hz, a pulse inhibit is issued (useful in connection with an external braking unit, an active mains unit or activated motor brake with parameter C1.03).

Stop command means the Off command from remote or local mode.

C1.03	Braking mode	VICB no braking function
	0 . . .No braking function •	(no brake, DC voltage limitation extends the deceleration ramp as required)
	1 . . .Ext. Braking unit	(for *>pDRIVE< MX basic* the option DC-connection is not available)
	2 . . .Motor brake A *3 . . .Motor brake B* *4 . . .Motor brake C*	(motor brake active, the braking energy is transformed into heat in the motor, motor cable and inverter. Depending on the unit size and motor type, the best braking effect is obtained with setting A, B or C.)
	5 . . . Int. braking unit	(not available)



Available brake torque with motor brake



Time to stop of a drive with motor brake

The "motor brake" is an extremely economic alternative to the external braking unit with resistor. The fast-stop of a 250 kW drive with 2..3-fold motor mass, for example, is possible within less than 4 seconds.
The motor noise is louder while the motor brake is working.

Most of the braking energy is transformed into heat in the motor.

C1.04	Pre-set reference	VICB not used
	0 . . .not used • *Hz* *1 . . .f-ref Manual Hz* *2 . . .f-ref Auto Hz* *3 . . .f-correction Hz* *4 . . .T-limitation %* *5 . . .PID reference %*	**Individual settings that cannot be selected have already been assigned one of the other reference value sources D1.00, D1.04, D1.09, D1.14, D6.06 or a bus reference value!**

The pre-set ref. values can be used as a source for various ref. value defaults.

See figure "Analogue ref. values" in section D1 - Analogue Inputs.

C1.05	Pre-set ref. 1	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.06	Pre-set ref. 2	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.07	Pre-set ref. 3	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.08	Pre-set ref. 4	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.09	Pre-set ref. 5	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.10	Pre-set ref. 6	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.11	Pre-set ref. 7	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00 %
C1.12	Pre-set ref. 8	VCB	-300.00...***0.00***...300.00 Hz -200.00...***0.00***...200.00%

The pre-set ref. values are selected using the digital commands Pre-set A, B and C, which must be programmed for 0...3 digital inputs depending on the required number of pre-set ref. values. See D2 – Digital Inputs.

DIx param. at Preset A	DIx param. at Pre-set B	DIx param. at Pre-set C	Selected value
0	0	0	Pre-set ref. 1
1	0	0	Pre-set ref. 2
0	1	0	Pre-set ref. 3
1	1	0	Pre-set ref. 4
0	0	1	Pre-set ref. 5
1	0	1	Pre-set ref. 6
0	1	1	Pre-set ref. 7
1	1	1	Pre-set ref. 8

→ A digital input does not need to be programmed for this reference value !!

The pre-set ref. values are pure reference values and do not include any Start commands!

C1.13	Jog frequency	VCB	-10.00...***0.00***...10.00 Hz

The jog function is used for inspection, setting or adjustment purposes. For this purpose, the digital command "Jog" (see D2 – Digital Inputs) is available. If this function is activated, the output frequency will accelerate to the jog frequency without acceleration/deceleration times. An additional ON/OFF command is not required. Jog mode is only possible when the unit is stopped!

C1.14	Economy mode	VCB	not active	see Macro

0 . . . not active •

1 . . . Step 1 *(= slight reduction)*

2 . . . Step 2 *(= medium reduction)*

3 . . . Step 3 *(= strong reduction)*

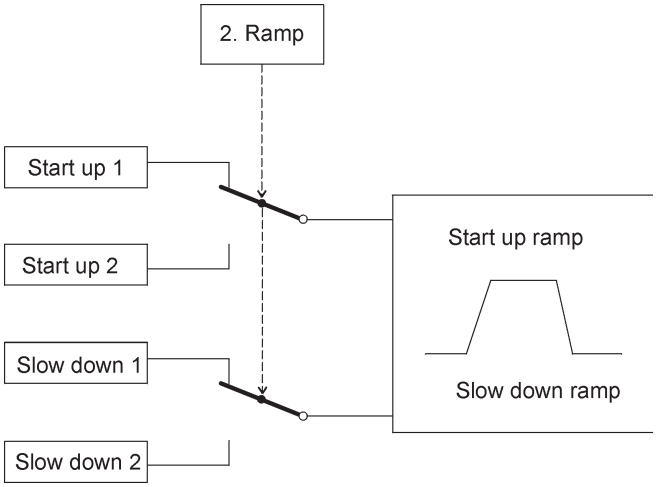
4 . . . Step 4 *(= very strong reduction)*

In applications with a square load moment curve (e.g. centrifugal pumps or fans), the magnetization current in the motor can be reduced with decreasing speed. This leads to a lower power uptake, thus saving energy.

Acceleration and deceleration ramps, S-ramp

C2.00	Acceleration ramp 1	VCB	0.0...***0.0***...3200 s	see Macro
C2.01	Deceleration ramp 1	VCB	0.0...***0.0***...3200 s	see Macro
C2.02	Acceleration ramp 2	VCB	0.0...***20.0***...3200 s	
C2.03	Deceleration ramp 2	VCB	0.0...***20.0***...3200 s	

There are 2 accel./decel. ramp sets available. The digital command "2.Ramp" (see D2 – Digital Inputs) switches between these sets. This switch-over is used primarily with Emergency OFF functions and accel./decel. times that depend on the speed.
The set accel./decel. time is with reference to the nominal motor frequency B3.03.



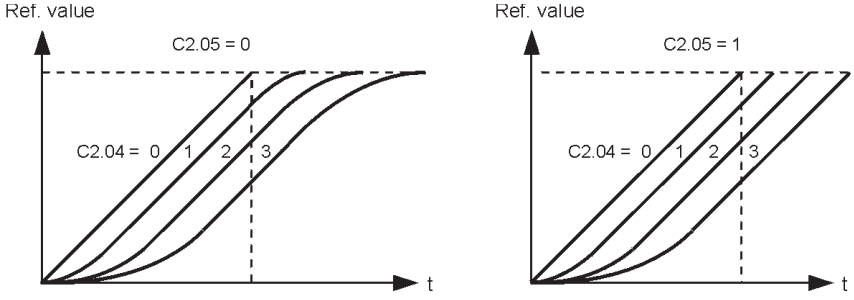
C2.04	S-ramp	VCB	no S-ramp

0 . . . no S-ramp •
1 . . . S-ramp step 1 (thereby, the ramp times are 10% [5%] longer)
2 . . . *S-ramp step 2* (thereby, the ramp times are 25% [12%] longer)
3 . . . *S-ramp step 3* (thereby, the ramp times are 50% [25%] longer)
(longer ramp time with C2.05 = 0 [C2.05 = 1])

With this parameter, a gentle start and/or gentle start-up of the reference frequency is possible. Typical applications are crane drives, conveyors, etc.

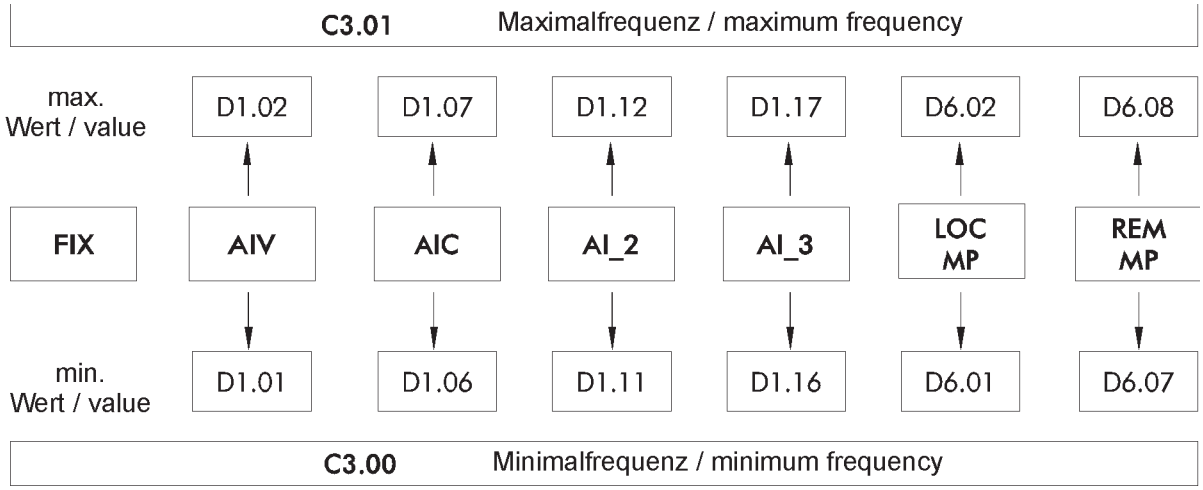
C2.05	S-ramp mode	VCB	Begin + End

0 . . . Begin + End •
1 . . . Begin only



Frequency range and direction

C3.00	Minimum frequency	VCB	0.00...***0.00***...300.00 Hz
C3.01	Maximum frequency	VCB	25.00...***50.00***...300.00 Hz



One min. and one max. value can be assigned individually to each ref. value source.
In addition, a min./max. limit, effective for all ref. value sources, can be set using parameters C3.00 and C3.01.

If both directions of rotation are enabled with parameter C3.02 (setting: "Enable FWD/REV"), the minimum limitation C3.00 is not effective.

If necessary, the respective minimum limitations of the reference value sources can be used.

C3.02	Direction enable	VICB	Disable REV	see Macro

0 . . .Disable REV • — *Reverse direction blocked in all operating modes*

1 . . .Disable FWD — *Forward direction blocked in all operating modes*

2 . . .Enable FWD/REV — *Both directions of rotation are possible*

By disabling the direction, interception mode is also disabled in this range. Therefore, a free-wheeling drive in reverse is also slowed down at the current limit with setting "0".
The same applies to forward rotation with setting "1".

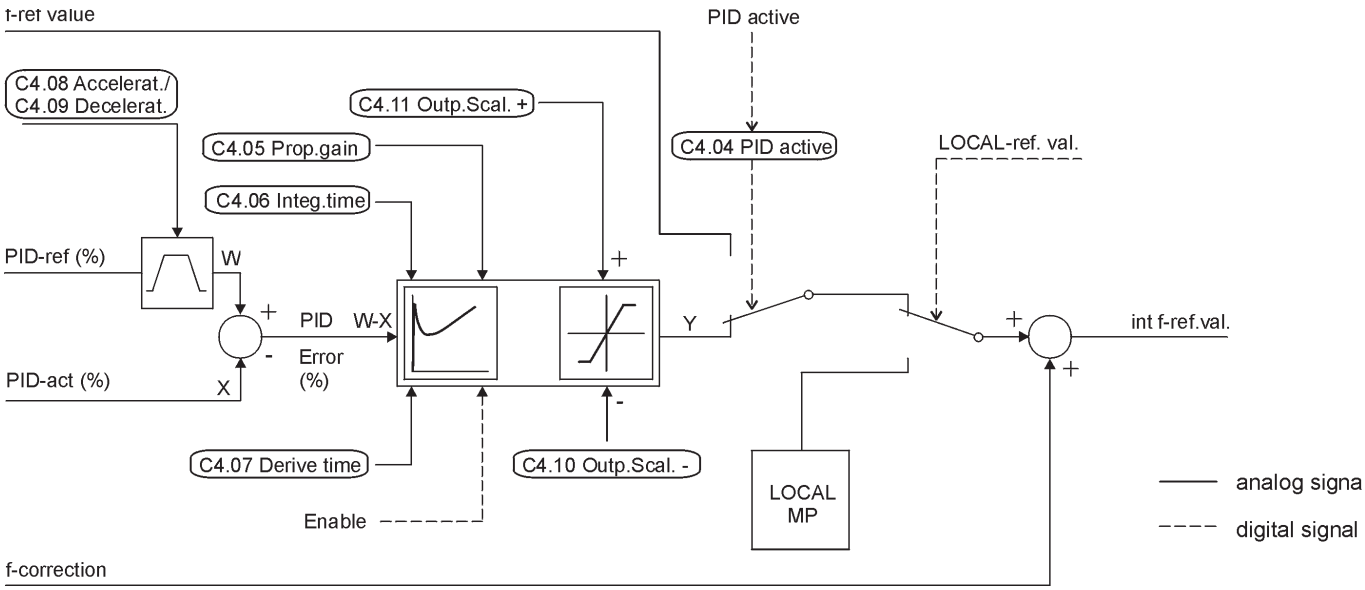
C3.03	Rotary field	VICB	U-V-W

0 . . .U - V - W • — *normal forward rotation*

1 . . .U - W - V — *inverted rotary field*

This parameter inverts the rotary field, thus making frequent reconnection of the motor cable unnecessary.

PID Process Controller



PID-reference value:

The following values can be used as a reference value source:

- External motor potentiometer	Parameter D6.06
- Pre-set reference values	Parameter C1.04
- Analogue input AIV: 0-10 V	Parameter D1.00
- Analogue input AIC: 0(4)-20 mA	Parameter D1.04
- Analogue input AI_2: 0(4)-20 mA	Parameter D1.09
- Analogue input AI_3: 0(4)-20 mA	Parameter D1.14
- Bus reference value	Parameter B6.06 to B6.10

In order to optimize the behavior of the controller, it is recommended that the acceleration and deceleration ramps (parameter group C2) have short settings. A separate ramp time can be set for the reference value (PID-ref) using parameter C4.08, C4.09.

Actual value:

Any analogue inputs (AIV, AIC, AI_2, AI_3 and bus) can be used as actual value inputs. The two values PID-ref. and actual are standardized in % and must be scaled at the respective reference value source.

Displays:

All controller-specific values such as reference value, actual value, error and controller output are also available as actual value displays in the basic display.

Error:

The error corresponds to the difference between the PID-ref. value after the accel./decel. ramp and the actual value. The difference is created independent of the controller destination (C4.04) and the operating state. Therefore, it can also be processed by the logic blocks (F4).

Controller

The PID-controller is designed as a process controller with the controller output "Frequency [Hz]". Prop. gain (kp), Integration time (Tn) and Derive time (Tv) can be adjusted individually. In addition, an external controller enable can be configured via the terminal strip (see D2).

Output scaling:
The controller output is limited by C4.10 and C4.11. The PID output is always standardized in Hz, and is applied as internal ref. frequency after the effective limitation.

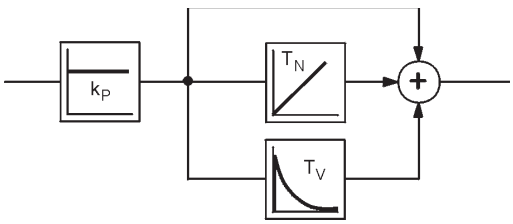
PID-controller active:
The PID-controller is activated using parameter C4.04 (position 1 or 2 and 24 V at the assigned digital input). The switch-over (from operating mode to control mode) is smooth, since the controller output is adjusted to the current reference value if "PID-controller not active". For W-X K 0, however, the kp share is effective immediately after switch-over.

Enable/disable:
If one of the digital inputs (field D2) is parametrized for the function "PID-enable", the controller is only enabled in run state. If the controller is locked, the output will remain at the last value.

Change of motor direction during controller mode:
- With parameter C3.03, the rotary field can be inverted → parametrization does not need to be modified
- or by changing parameters (negative settings for limitations, negative settings for ref. and actual value standardization, "Start REV" set when switching over to operating mode).

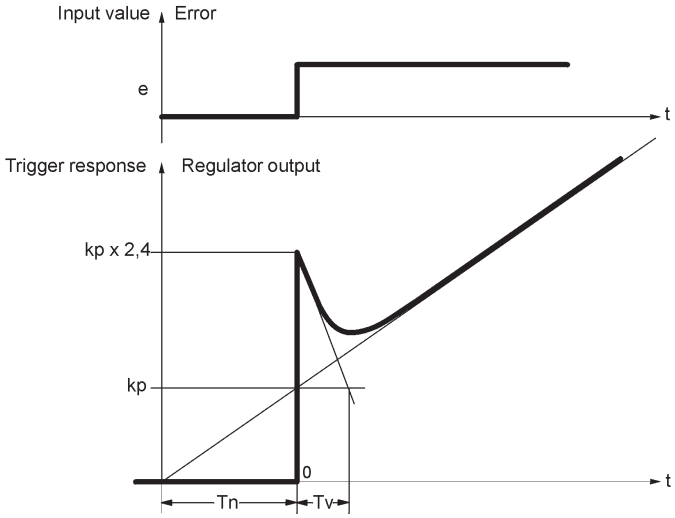
Switch-over to LOCAL:
When switching from remote controller mode to local (keypad or terminals), the controller output frequency [Hz] is defaulted directly by the local motor potentiometer on the keypad. The switch-over to the downstream motor potentiometer value or controller output and back is smooth.
→ see "Supplements to macro M3"

C4.00	Reference monitoring [%]	read only		
	Ref. value before acceleration integrator.			
C4.01	Feedback monitoring [%]	read only		
C4.02	Error [%]	read only		
C4.03	PID output [Hz]	read only		
	100% output corresponds to 163.84 Hz.			
C4.04	PID-controller active	VICB	no	see Macro
	0 . . . no • *1 . . . yes* *2 . . . Terminals*	(release via digital input → assignment of an input in field D2 necessary)		
C4.05	Prop. gain(kp)	VCB	0.0...***20.0***...3200%	see Macro
C4.06	Integration time (Tn)	VCB	0.00...***10.00***...320.0 s	see Macro
	Setting T_n=0 deactivates the integration time of the controller.			
C4.07	Derive time (Tv)	VCB	0.00...***0.00***...320.0 s	

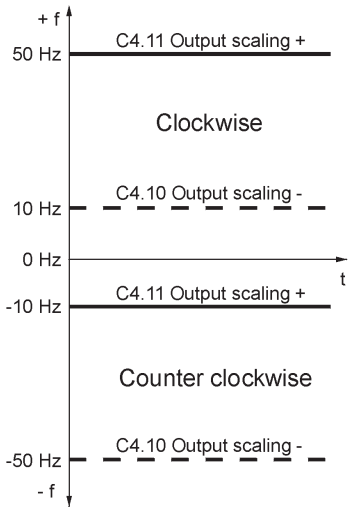


The effect of the integration time and derive time depends on k_p.

Control system behaviour:



Limitation of regulating value:



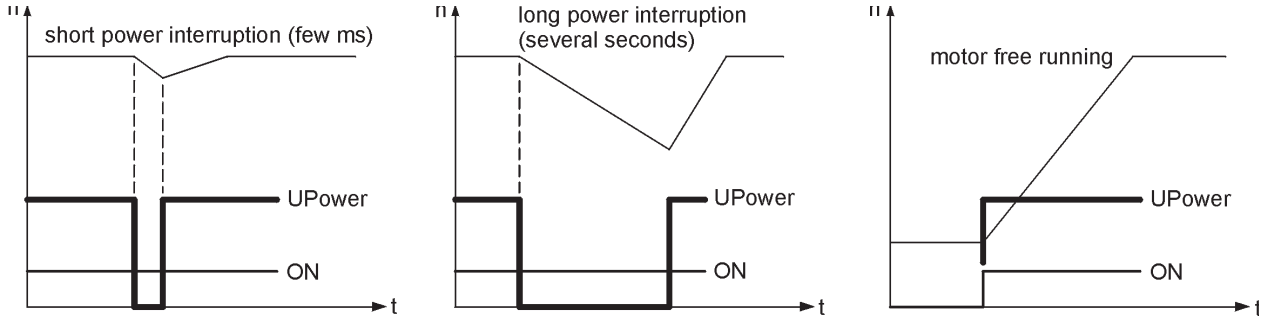
C4.08	Ref. acceleration ramp	VCB	0.0...***10.0***...3200 s	see Macro
C4.09	Ref. deceleration ramp	VCB	0.0...***10.0***...3200 s	see Macro
C4.10	Output scaling -	VCB	-300...+***10.00***...+300.0 Hz	see Macro
C4.11	Output scaling +	VCB	-300...+**50.00**...+300.0 Hz	see Macro

C5 rpm Catch on the fly

Catch on the fly

Due to the innovative control concept AVC (Auto Vector Control) in conjunction with the modulation process FMC (Flux Mode Control), the frequency inverter is able to pick up to a phase and speed synchronous free-wheeling motor in less than 0.1 s. However, this is only possible if a connection between the inverter and the motor exists.
Regardless of the duration of the power failure (e.g. some 100 ms to several seconds), this intercept function guarantees a safe and immediate start even during free-wheeling motor operation, starting from the current motor speed.

For motors not switched onto the inverter output yet, the Start command (intercept function) must be activated approx. 3...5 seconds later!
If the Start command is issued earlier, the inverter will brake a running motor down to approx. 0 Hz and then accelerate it to the set reference value.



C5.00	Detection level	VCB	0.6...***0.6***...15.0%

This parameter represents the sensitivity of the speed detection.

C6.00	Contactor control	VICB	not active

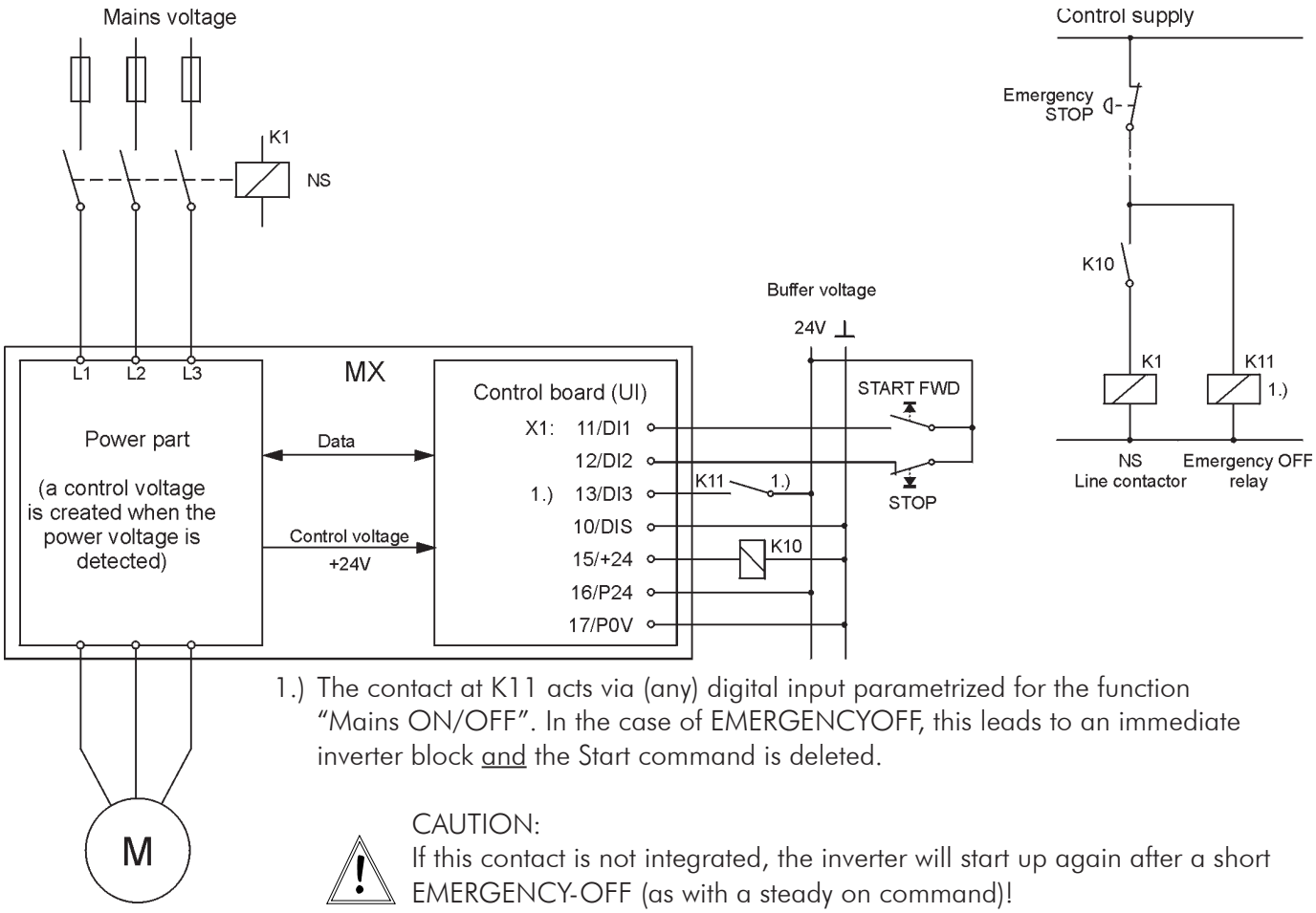
0 . . . not active •

1 . . . active

If the inverter electronics are supplied by an external 24 V buffer voltage, it is possible to activate the special function "Contactor control". Thereby, a selectable digital output (see D4) is activated with every Start command (via keypad, terminals or bus), which can be controlled via the mains protection switch. The "Ready" message is issued as soon as the control voltage (24 V) is applied.
If the mains voltage (intermediate circuit voltage) does not reach its nominal value within 3 sec., a trip follows with the message "Undervoltage 2". Possible causes are:

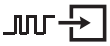
- Digital output is not parametrized correctly
- Mains protection switch does not close
- Mains fuses are defect or
- Inverter load wiring is defect

Every time the pulse inhibit state occurs (OFF command after deceleration or trip), the current to the inverter power part is switched off by the mains protection.
"Mains OFF" is displayed in the matrix area HOME (A1).



1.) The contact at K11 acts via (any) digital input parametrized for the function "Mains ON/OFF". In the case of EMERGENCYOFF, this leads to an immediate inverter block and the Start command is deleted.

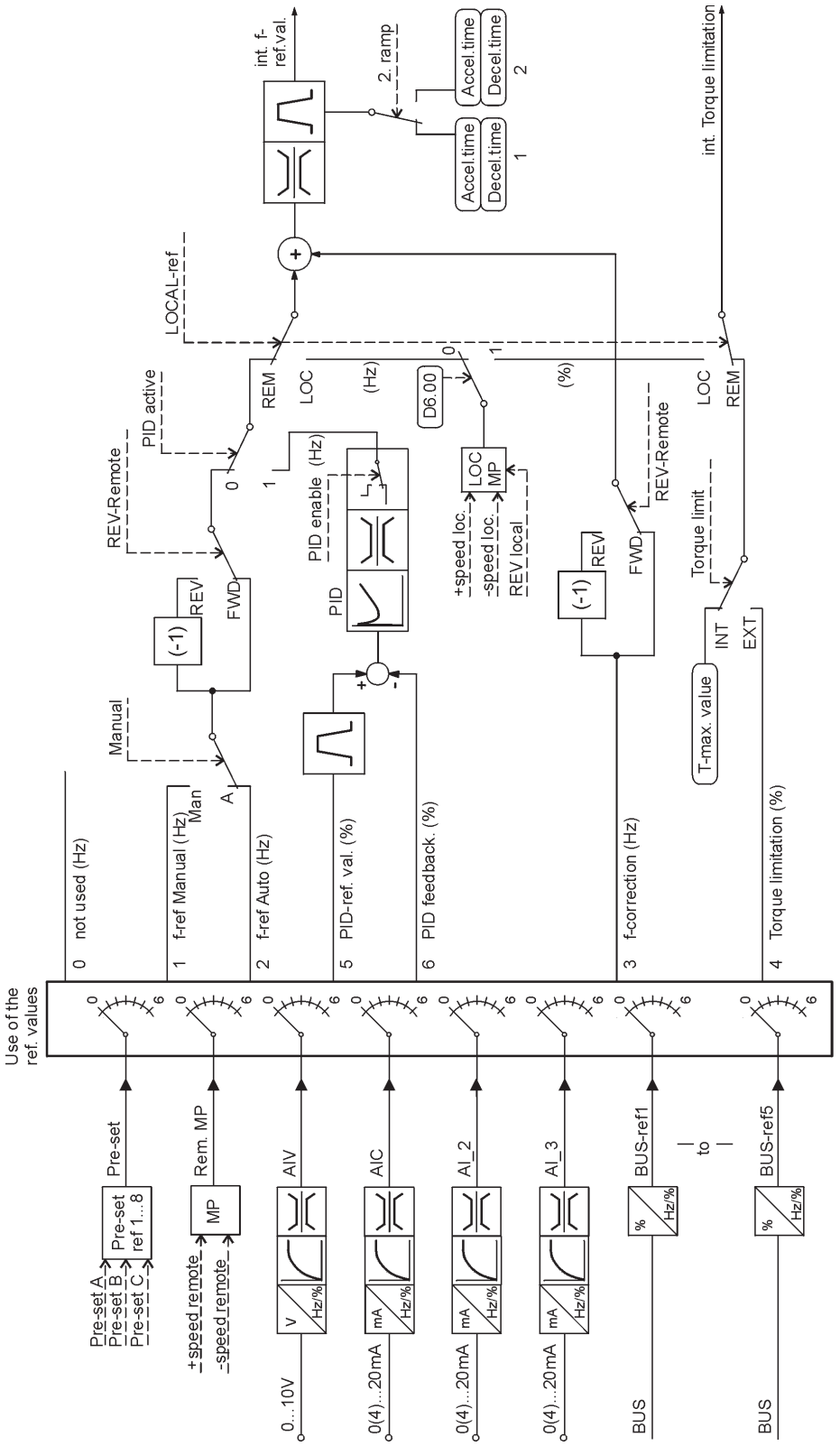
CAUTION:
If this contact is not integrated, the inverter will start up again after a short EMERGENCY-OFF (as with a steady on command)!

D		Inputs / Outputs	
D1		Analogue inputs	AIV selection, value, filter time, AIC selection, signal, value, filter time, AI_2 selection, signal, value, filter time, AI_3 selection, signal, value, filter time, Page 47
D2		Logic inputs	Configuration, DI destination Page 50
D3		Analogue outputs	AO1 selection, signal, min. and max. value, AO2_2 selection, AO2_3 selection Page 57
D4		Logic outputs	Configuration, 24 V output, relay outputs, Frequency level, hysteresis Page 59
D5		Encoder configurat.	Slip compensation, dynamic of slip compensation Page 61
D6		Electronic Potentiom.	local motorpotentiometer, Remote motorpotentiometer Page 62

D1 Analogue inputs

Configuration of analogue inputs

Overview "Analogue reference values"



D In/outputs

D1.00	AIV selection	VICB	not used	see Macro

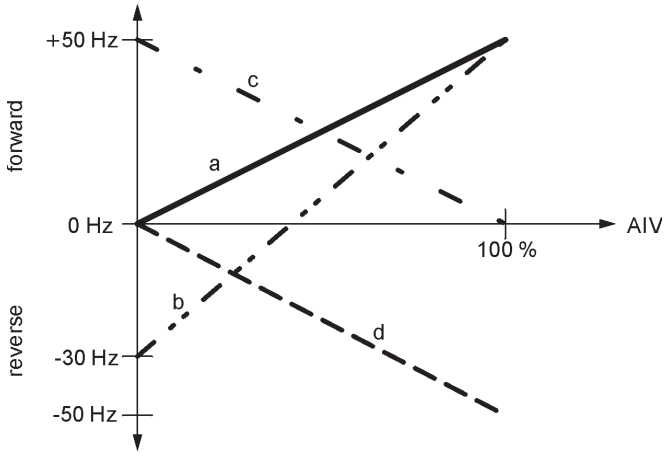
0 . . . not used • *Hz*
1 . . . f-ref Manual *Hz*
2 . . . f-ref Auto *Hz*
3 . . . f-correction *Hz*
4 . . . Torque limit *%*
5 . . . PID-reference value *%*
6 . . . PID feedback *%*

If individual settings cannot be selected, they have already been assigned one of the other reference value sources or a bus reference value!

As shown in the figure overleaf, the analogue ref. value AIV (0-10 V) serves as a source for various reference values. The relevant function is assigned to the analogue input using parameter D1.00.

D1.01	AIV value 0 %	VCB	-300.0...***0.01***...300.0 Hz -200.0...***0.01***...200.0%	see Macro
D1.02	AIV value 100%	VCB	-300.0...***50.01***...300.0 Hz -200.0...***30.52***...200.0 %	see Macro

With the AIV level, a frequency range is assigned to the analogue input signal (0...10V). Negative frequencies correspond with reverse on the frequency inverter output.



a ... 0-100% corresponds with 0 to 50 Hz

b ... 0-100% corresponds with -30 to 50 Hz

c ... 0-100% corresponds with 50 to 0 Hz

d ... 0-100% corresponds with 0 to -50 Hz

D1.03	AIV filter time	VCB	0.00...***0.05***...10.0 s

In order to suppress undesired interference or radio frequency interference, the digital ref. value filter can be programmed.

D1.04	AIC selection	VICB	f-ref Auto	see Macro

0 . . . not used • *Hz*
1 . . . f-ref Manual *Hz*
2 . . . f-ref Auto • *Hz*
3 . . . f-correction *Hz*
4 . . . T-limitation *%*
5 . . . PID-reference value *%*
6 . . . PID-actual value *%*

If individual settings cannot be selected, they have already been assigned one of the other reference value sources or a bus reference value!

The function of the analogue ref. value AIC corresponds with the ref. value AIV, except that it is a current signal 0(4)-20 mA.

D1.05	AIC signal	VCB	4-20 mA

0 *0-20 mA*
1 *4-20 mA •*

To monitor the 4-20 mA "LiveZero" signal for wire breakage, parameter E3.01 must be set accordingly!

D1.06	AIC value 0%	VCB	-300.0...***0.01***...300.00 Hz	see Macro
		VCB	-200.0...***0.01***...200.0%	
D1.07	AIC value 100 %	VCB	-300.0...***50.01***...300.00 Hz	see Macro
		VCB	-200.0...***30.52***...200.0 %	
D1.08	AIC filter time	VCB	0.00...***0.05***...10.0 s	

The function of the parameters D1.04...D1.08 is identical with the function of parameters D1.00...D1.03 and is described there.

D1.09	AI_2 selection	VICB	not used	see Macro

0 . . . not used •
1 . . . f-ref Manual
2 . . . f-ref Auto
3 . . . f-correction
4 . . . Torque limit
5 . . . PID-reference value
6 . . . PID feedback

Hz
Hz
Hz
Hz
%
%
%

If individual settings cannot be selected, they have already been assigned one of the other reference value sources or a bus reference value!

The analogue ref. value AI_2 corresponds with the 0(4)...20 mA ref. value on the differential amplifier input of the option card IO1 in slot X2. It has the same function as the ref. value AIC.

D1.10	AI_2 signal type	VCB	0-20 mA

0 . . . 0-20 mA •
1 . . . 4-20 mA

To monitor the 4-20 mA "LiveZero" signal for wire breakage, parameter E3.01 must be set accordingly!

D1.11	AI_2 value 0%	VCB	-300.0...***0.01***...300.00 Hz	see Macro
		VCB	-200.0...***0.01***...200.0 %	
D1.12	AI_2 value 100 %	VCB	-300.0...***50.01***...300.00 Hz	see Macro
		VCB	-200.0...***30.52***...200.0 %	
D1.13	AI_2 filter time	VCB	0.00...***0.05***...10.0 s	

The function of the parameters D1.09...D1.13 is identical with the function of parameters D1.00...D1.03 and is described there.

D1.14	AI_3 selection	VICB	not used

0 . . . not used •
1 . . . f-ref Manual
2 . . . f-ref Auto
3 . . . f-correction
4 . . . Torque limit
5 . . . PID-reference value
6 . . . PID feedback

Hz
Hz
Hz
Hz
%
%
%

If individual settings cannot be selected, they have already been assigned one of the other reference value sources or a bus reference value!

The analogue ref. value AI_3 corresponds with the 0(4)...20 mA ref. value on the differential amplifier input of the option card IO1 in slot X3. It has the same function as the ref. value AIC.

D1.15	AI_3 signal type	VCB	0-20 mA

0 . . . 0-20 mA •
1 . . . 4-20 mA

To monitor the 4-20 mA "LiveZero" signal for wire breakage, parameter E3.01 must be set accordingly!

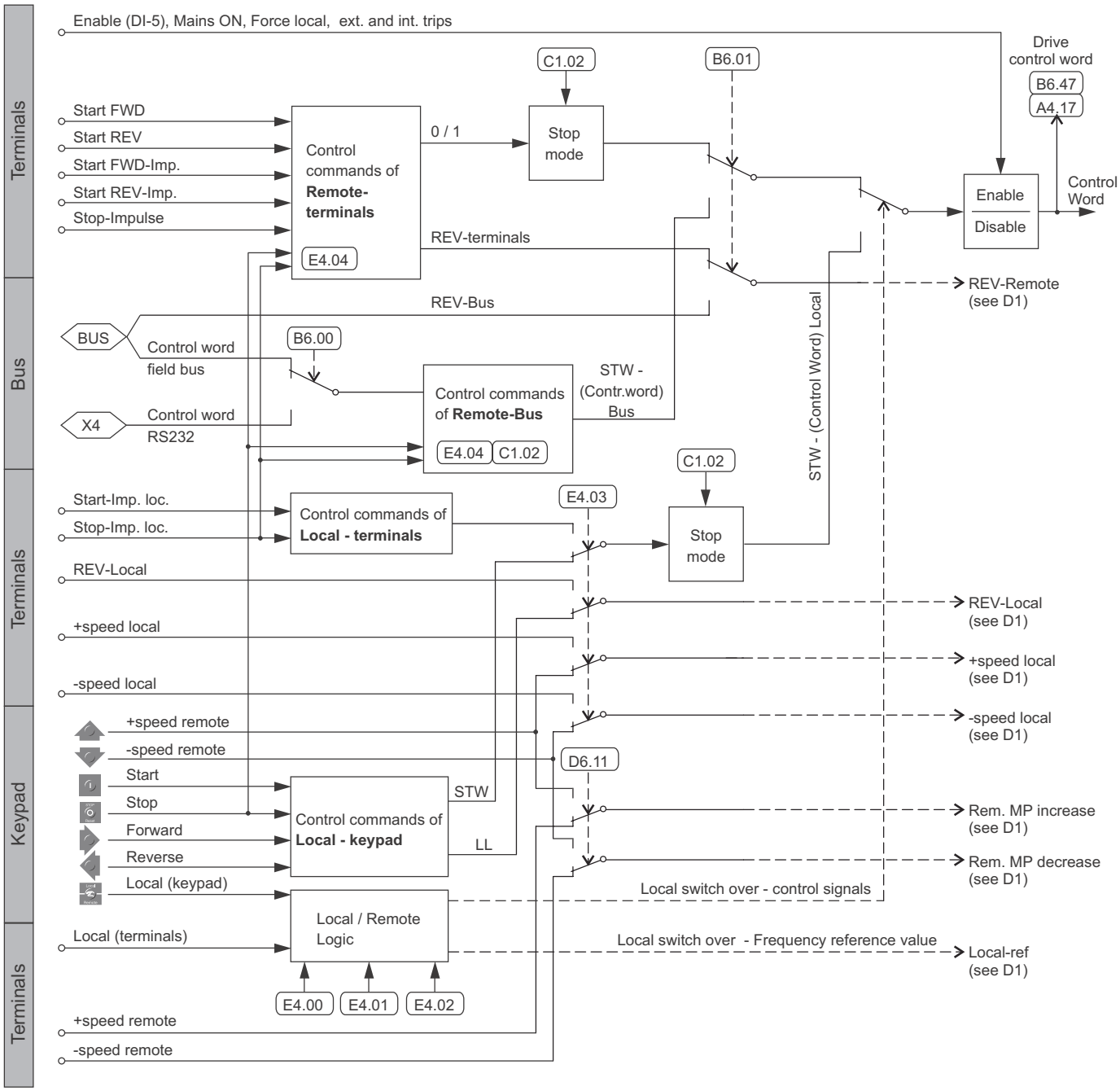
D1.16	AI_3 value 0%	VCB	-300.0...***0.01***...300.00 Hz
		VCB	-200.0...***0.01***...200.0 %
D1.17	AI_3 value 100 %	VCB	-300.0...***50.01***...300.00 Hz
		VCB	-200.0...***30.52***...200.0 %
D1.18	AI_3 filter time	VCB	0.00...***0.05***...10.0 s

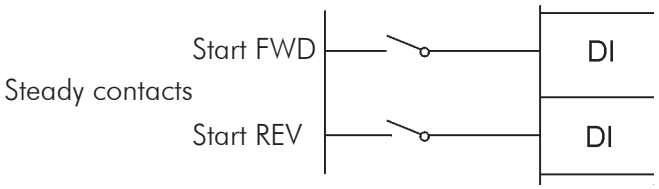
The function of the parameters D1.14...D1.18 is identical to that of parameters D1.00...D1.03 and is described there.

D2 Logic inputs

Configuration of digital inputs

Overview "Control Commands"

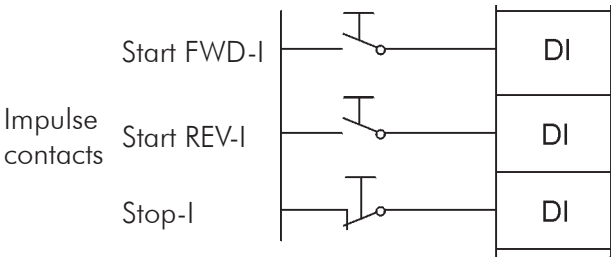




Start/Stop using steady contacts:

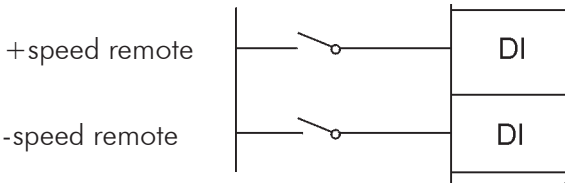
Making contact activates the Start command in the desired direction, breaking contact means Stop. The simultaneous making of Start FWD and Start REV also stops the motor.

An active Start command is not influenced internally ⇨ restart after reset.



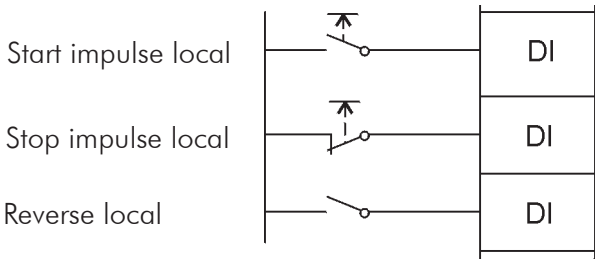
Start/Stop using impulse contacts:

An impulse signal (make contact) activates the Start command in the desired direction. An impulse signal (break contact) activates the Stop command. When pulse enable is switched off in the event of a trip shutdown, and after continued undervoltage (time can be set using parameter E3.07), the ON command is deleted automatically. A new Start impulse is required.



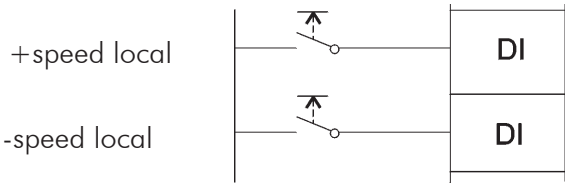
Remote motorpotentiometer:

Reference standardization via the remote motor potentiometer is achieved using the switch signals "+speed remote" and "-speed remote". Thereby, the reference value is raised or lowered according to the set acceleration/deceleration ramp as long as the command is active. The motor potentiometer can be configured in matrix area D6.



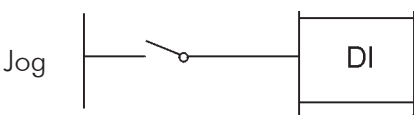
Start / Stop local control:

The digital signals replace keys I, O, ← and → on the keypad local ⇨ operation via the terminal strip. In addition to parametrization of the digital inputs (2 or 3), please note the settings for parameters E4.00 to E4.03.



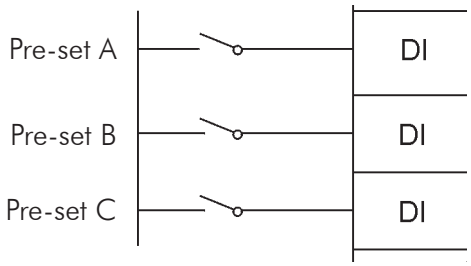
Local motor potentiometer:

The digital signals replace the function of the ↑↓ keys on the keypad.
Configuration of the local motorpot: see D6.00 to D6.04 and E4.00, 01 and 03.



Jog mode:

If the jog command is active, the inverter accelerates the motor with the fastest possible acceleration time to the set jog frequency C1.13. The jog function is only possible during stopped state.



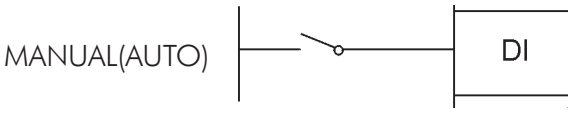
How many digital inputs have to be programmed depends on the required number of pre-set ref. values. They are programmed in matrix area C1. The pre-set ref. values are pure ref. values and do not contain any Start/Stop commands.

Pre-set values:

The max. 8 pre-set ref. values are selected with the signals Pre-set A...C as shown in the following table:

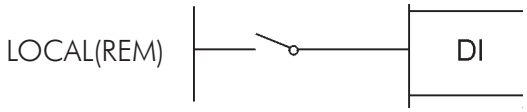
A	B	C	Ref. value
0	0	0	1 (C1.05)
1	0	0	2 (C1.06)
0	1	0	3 (C1.07)
1	1	0	4 (C1.08)
0	0	1	5 (C1.09)
1	0	1	6 (C1.10)
0	1	1	7 (C1.11)
1	1	1	8 (C1.12)

The digital inputs are also active in bus control mode.



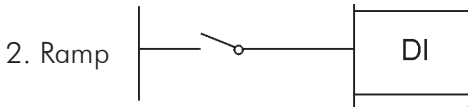
MANUAL(AUTO) switch-over:

The command MANUAL(AUTO) switches between the two ref. value sources "f-ref Manual" and "f-ref Auto". Break contact or command not used: AUTO, make contact: MANUAL.
The digital input is also active in bus control mode.



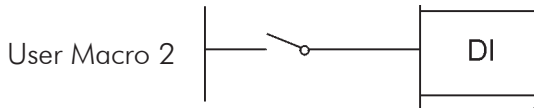
LOCAL(REM) switch-over:

The LOCAL(REM) switch defines whether the unit is controlled using the keypad (or digital command "Local"), or the terminals (or bus). By default, the switch-over is performed using the LOC/REM key on the keypad. If "terminals" is selected for parameter E4.02, the switch-over is only possible using a digital input (e.g. using a key-operated switch).
Break contact or command not used: REM,
make contact: LOC.
The digital input is also active in bus control mode.



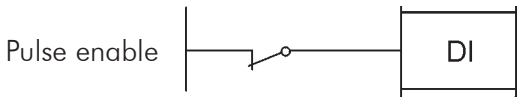
Ramp switch-over:

2 sets of acceleration/deceleration ramps are available. The signal "2.Ramp" is used to switch between these sets of ramps. The values for the acceleration and deceleration times are set in matrix area C2.
Make contact: Ramp 2.
The digital input is also active in bus control mode.



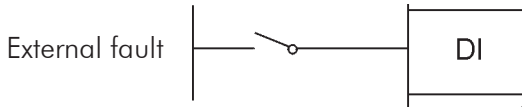
2. Parameter Set = User Macro2:

If parameter B2.04 is set to "1" or "2" depending on the DI, this input at LOW (0 V) means that the parameter values of User Macro1 and at HIGH (24 V) the parameter values of User Macro2 are loaded.
The parameters are only accepted with pulse inhibit!
The digital input is also active in bus control mode.



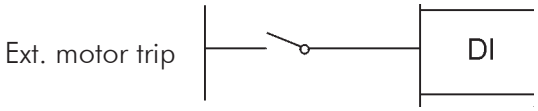
Enable:

Opening the switch "Enable" via the programmable terminal or via the hardware input DI5_2 leads to an immediate pulse inhibit in the power part of the motor. Any ON command stored via impulse contacts is deleted. The display shows: Disabled.
Function not parametrized or make contact: Enable.
The digital input is also active in bus control mode.



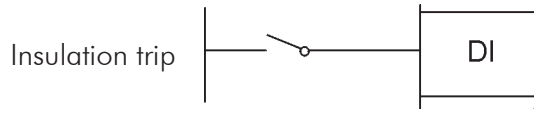
External fault:

An active command leads to trip shutdown with the error code "External fault". The reaction time is adjustable. Errors in the system can be integrated in the frequency converter controls using this input.
The trip message can be realized by means of break or make contacts (selected using E3.02 and E3.03).
The digital input is also active in bus control mode.



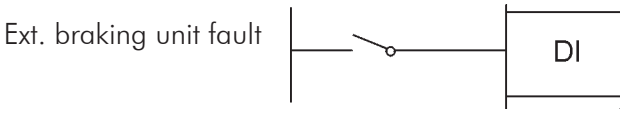
Motor trip:

The mode of action is the same as for an external trip, but the trip code indicates a motor trip. This command is used for bearing temperature monitoring, vibration monitoring devices, or motor temperature monitoring with Click-Therm. The reaction time of the trip message is adjustable and can be realized by break or make contacts (selected using E2.11 and E2.12).
The digital input is also active in bus control mode.



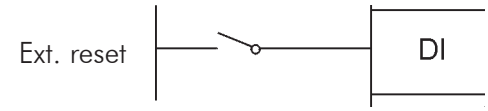
Insulation trip:

An active command leads to immediate shutdown with the trip code "Insulation fault". The reaction time is adjustable up to 160 s. Using this input, an external trip voltage monitor (for ungrounded mains) or the comparator output using the option "Earth protection 1 and 2" can be integrated.
The digital input is also active in bus control mode.



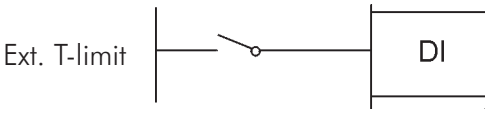
External braking unit fault:

Same mode of action as "Ext. fault", but with the display "Ext. BU fault" to integrate a braking unit trip in the inverter (see parameters E3.06 and 07).
The digital input is also active in bus control mode.



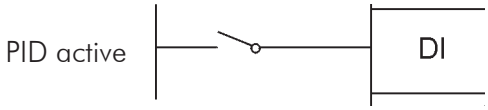
External reset:

Allows confirmation of a trip via the terminals.
Reset for ON flank: no effect on an inverter that is running.
The digital input is also active in bus control mode.



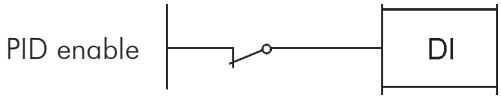
External torque limitation:

When this function is activated, the maximum torque is limited to an externally defined value. The value is defined by a separate ref. value source (see D1). If the torque exceeds the set limit, the drive will react with a speed deviation.
Break contact or command not used: T-max. value (E1.01) active, break contact: ext. T-limit activated.
The digital input is also active in bus control mode.



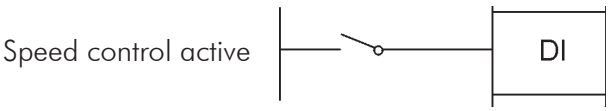
PID active:

This input allows a controlled switch-over between frequency control and PID control.
Break contact: switch-over from PID control to frequency control
Make contact (or input not used): PID controller active, the switch-over is vibrationless
The digital input is also active in bus control mode.



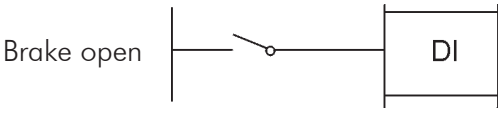
PID controller enable:

This function allows the internal process controller to be enabled via the terminals. Break contact: PID controller output is frozen at the last value. Make contact or not used: PID enabled.
The digital input is also active in bus control mode.



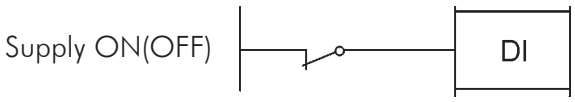
Speed controller active:

For *>pDRIVE< MX basic* the option SFB is not available.



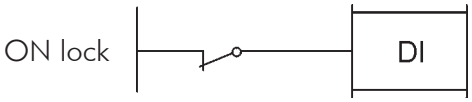
Brake open:

For *>pDRIVE< MX basic* the option crane control is not available.



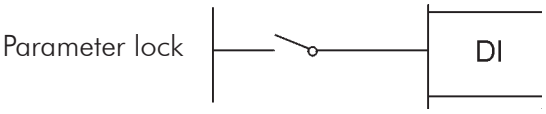
Supply ON(OFF):

Leads to an immediate pulse inhibit and thus to mains disconnection. Used for EMERGENCY OFF and mains disconnection signals.
Break contact: immediate pulse inhibit and subsequent mains disconnection, display shows: "Mains disc.".
The digital input is also active in bus control mode.



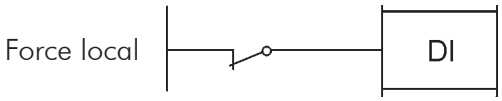
ON lock:

This input is used to integrate monitoring units in the cubicle (mains fuses, contactor, load switching monitor, fan monitor, etc.)
Make contact (or input not used): no trip
Break contact: trip message, shutdown and "ON lock" appears in the display.
The digital input is also active in bus control mode.



Parameter lock:

This function allows an additional lock for parametrization via the terminals. Thus, it is possible e.g. to lock parametrization via an external key-operated switch.
Break contact: parametrization enabled
Make contact: parametrization locked
The digital input is also active in bus control mode.



Force local:

This function allows cut-off for operation of the frequency inverter during remote mode.
Break contact: operation possible only in local mode (remote → pulse inhibit and message on display: "Locked").
Make contact: operation possible in both modes (local and remote).
The digital input is also active in bus control mode.

D2.00	DI1 selection	VICB	not used	see Macro
D2.01	DI2 selection	VICB	not used	see Macro
D2.02	DI3 selection	VICB	not used	see Macro
D2.03	DI4 selection	VICB	not used	see Macro
D2.04	DI6_2 selection	VICB	not used	see Macro
D2.05	DI7_2 selection	VICB	not used	see Macro
D2.06	DI8_2 selection	VICB	not used	see Macro
D2.07	DI5_3 selection	VICB	not used	
D2.08	DI6_3 selection	VICB	not used	
D2.09	DI7_3 selection	VICB	not used	
D2.10	DI8_3 selection	VICB	not used	

0 . . . .not used •
1 . . . .Start FWD
2 . . . .Start REV
3 . . . .Start FWD-Impulse
4 . . . .Start REV-Impulse
5 . . . .Stop-Impulse
6 . . . .+speed remote
7 . . . .-speed remote
8 . . . .Start Impulse local
9 . . . .Stop Impulse local
10 . . .REV local — *make contact = REV in local mode*
11 . . .+speed local
12 . . .-speed local
13 . . .Jog
14 . . .Pre-set A
15 . . .Pre-set B
16 . . .Pre-set C
17 . . .Manual (Auto) — *make contact = f-ref MAN*
18 . . .Local (Rem) — *break contact = local control (E4.00 to 03)*
19 . . .2.ramp — *make contact = accel./decel. ramp 2 selected*
20 . . .User Macro 2 — *make contact = user macro 2*
21 . . .Enable — *break contact = lock – free wheel*
22 . . .EXT-fault — *parametrize additionally using E3.02*
23 . . .EXT-motor fault — *parametrize additionally using E2.11*
24 . . .Insulation fault — *parametrize additionally using E3.04*
25 . . .Ext. BU-fault — *parametrize additionally using E3.06*
26 . . .EXT-Reset
27 . . .EXT-T limitation — *make contact = ext. torque limitation active*
28 . . .PID active — *break contact = PID controller active*
29 . . .PID-enable — *make contact = PID controller output enabled*
30 . . .Speed control active — *function not active*
31 . . .Brake open — *function not active*
32 . . .Supply ON/OFF
33 . . .ON lock — *break contact = switch-off with "ON lock"*
34 . . .Force local
35 . . .Paramet-locked — *in addition to F6.00*

1.) Each function can only be selected once. **"Double assignments are not possible!"**
2.) The outputs of the comparator/logic modules (parameters F4.xx) can also be linked with these functions.
3.) If a digital input is to perform 2 functions, this is possible via the comparator/logic modules.
4.) Inversion of a digital input is also possible via the comparator/logic modules.

Configuration of analogue outputs

D3.00	AO1 selection	VCB	not used	see Macro

0 . . . not used •		
1 . . . f-output signal	*100 % = fMAX (C3.01)*	
2 . . . f-output	*100 % = fMAX (C3.01)*	
3 . . . Output current	*100 % = Nom. motor current (B3.01)*	
4 . . . Torque signal	*100 % = Nom. motor torque (B3.00, B3.04)*	
5 . . . Torque	*100 % = Nom. motor torque (B3.00, B3.04)*	
6 . . . Power	*100 % = Nom. motor power (B3.00)*	
7 . . . Motor voltage	*100 % = nominal motor voltage (B3.02)*	
8 . . . n-output signal	*100 % = fMAX in rpm (C3.01 x 60 / 2p)*	
9 . . . n-output	*100 % = fMAX in rpm (C3.01 x 60 / 2p)*	
10 . . int. f-reference	*100 % = fMAX (C3.01), before accel., before fs compensation*	
11 . . int T-ref	*100 % = Nom. motor torque (B3.00, B3.04)*	
12 . . PID reference value	*100 % = 100 % (C4.00)*	
13 . . PID feedback	*100 % = 100 % (C4.01)*	
14 . . PID error	*100 % = 100 % (C4.02)*	
15 . . Bus ref1	*100 % = 4000 hex*	
16 . . Bus ref2	*100 % = 4000 hex*	
17 . . Bus ref3	*100 % = 4000 hex*	
18 . . Bus ref4	*100 % = 4000 hex*	
19 . . Bus ref5	*100 % = 4000 hex*	
20 . . Test min. value	*corresponds to AO min. value 0 or 4 mA*	
21 . . Test max. value	corresponds to 20 mA	

Multiple assignments are possible!
This means that an analogue value can be assigned to more than one output.

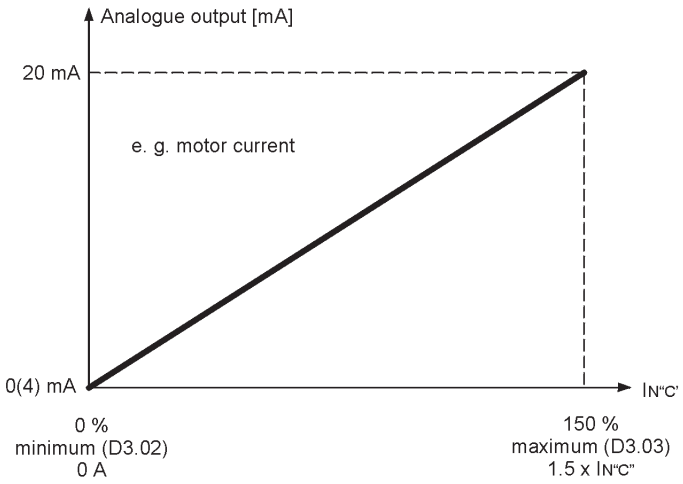
D3.01	AO1 signal	VCB	4-20 mA

0 . . . 0-20 mA
1 . . . 4-20 mA •

D3.02	AO1 min. value	VCB	-200.0...***0.0***...200.0 %
D3.03	AO1 max. value	VCB	-200.0...***100.0***...200.0 %

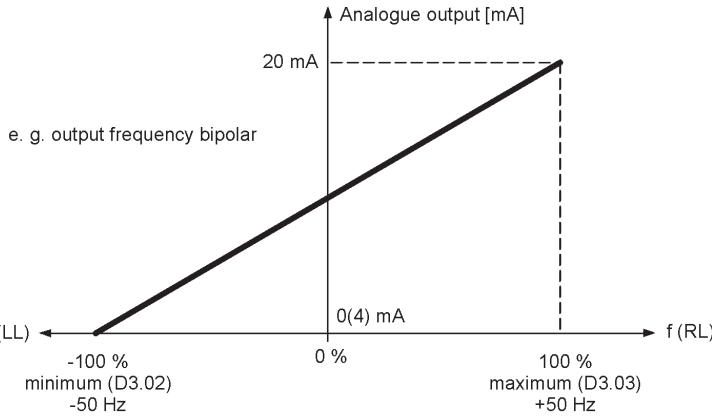
The analogue output is configured using these parameters. The value selected for D3.00 (please note the relevant standardization) is available as 0(4)-20 mA signal for external display. The analogue output is tuned using the parameters D3.02 = 0(4) mA and D3.03 = 20 mA.

Typical setting for: 2; 3; 5, 7; 9; 11



100 % = fMAX =e. g. 50 Hz
minimum = 0(4) mA ≙ 0 % (0 % x IN)
maximum = 20 mA ≙ 150 % (150 % x IN)

Typical setting for: 1; 4; 6; 8; 10; 12-19



100 % = fMAX = e. g. 50 Hz
minimum = 0(4) mA ≙ -100 % (-50 Hz)
maximum = 20 mA ≙ 100 % (+50 Hz)

D3.04	AO2_2 selection	VCB	not used see Macro

Possible settings, see D3.00. Analogue output for option card IO1 at slot X2.

D3.05	AO2_2 signal	VCB	4-20 mA

Possible settings, see D3.01.

D3.06	AO2_2 min. value	VCB	-200.0...***0.0***...200.0 %
D3.07	AO2_2 max. value	VCB	-200.0...***100.0***...200.0 %

Possible settings, see D3.02 and D3.03.

D3.08	AO2_3 selection	VCB	not used

Possible settings, see D3.00. Analogue output for option card IO1 at slot X3.

D3.09	AO2_3 signal	VCB	4-20 mA

Possible settings, see D3.01.

D3.10	AO2_3 min. value	VCB	-200.0...***0.0***...200.0 %
D3.11	AO2_3 max. value	VCB	-200.0...***100.0***...200.0 %

Possible settings, see D3.02 and D3.03.

Configuration of digital outputs

Available digital outputs:

1 x 24 V voltage output, max. 150 mA
1 x relay output ""change-over"
2 x relay output ""change-over" (Option Card IO1 in Slot X2)
2 x relay output "make contact" (Option Card IO1 in Slot X3)

The following states can be assigned to all digital outputs:

State	Relay picks up...
Ready	... if there is no trip and the drive is not running. if the control voltage is applied with activated mains contactor control C6.00.
Run	... on accepted Start command or guided deceleration.
Trip	... on trip, until confirmed.
Ready and Run	... if a ready or run state exists.
Alarm	... during a programmed warning situation (E2.01, E2.09, E3.08).
Bus alarm	... while bus communication is interrupted.
Generator operation	... if the motor is in generator state.
Line ON	... on switch-over to Line ON state with activated contactor control C6.00.
Local operat.	... as long as the drive is in LOCAL mode.
f(n)=fREF	... if the frequency act. value corresponds to the reference value (D4.08). if speed control is activated, the actual speed is compared.
f>fLEVEL	... if f > "f-Level ON" D4.06, and drops off again when f < "f-Level OFF" D4.07.
Lift brake	This function is not active.
Output C1	... if conditions in comparator block C1 are met (F4.00 to F4.07).
Output C2	... if conditions in comparator block C2 are met (F4.08 to F4.15).
Output C3	... if conditions in comparator block C3 are met (F4.16 to F4.29).
Output C4	... if conditions in comparator block C4 are met (F4.30 to F4.43).
Output L5	... if conditions in logic module L5 are met (F4.44 to F4.49).
Output L6	... if conditions in logic module L6 are met (F4.50 to F4.55).
Thyristor-ON	... if charging of the DC link is completed. (for control of an external charging connection or feedback unit)
BUS Cont. 11	... if the free bit 11 in the bus control word is 1.
BUS Cont. 12	... if the free bit 12 in the bus control word is 1.
BUS Cont. 13	... if the free bit 13 in the bus control word is 1.
BUS Cont. 14	... if the free bit 14 in the bus control word is 1.
BUS Cont. 15	... if the free bit 15 in the bus control word is 1.
ON (+24V)	... as soon as control voltage is available (+24V interrogation voltage for digital inputs).
Man.operation	... if the drive is in manual mode (D1, D2).
2.Param.act.	... on switch-over to parameter set 2 using a digital input (B2.04).
Ext.T-limit. act.	... if an external torque limitation is activated (E1.01).
PID active	... if the PID controller is active (C4.04).
PID enabled	... if the output of the PID controller is active (C4).
Speed ctrl. act.	This function is not active.
Trip inv.	... if there is no trip.

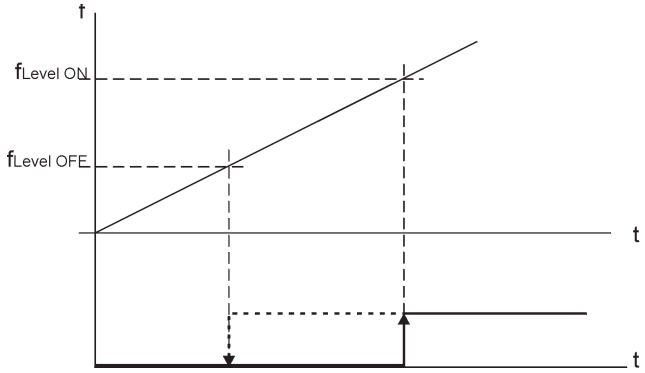
D4.00	+24 Dig. Output	VC	ON (24 V)	
D4.01	Relay output 1	VCB	Ready + Run	see Macro
D4.02	Relay output 2_2	VCB	not used	see Macro
D4.03	Relay output 3_2	VCB	not used	see Macro
D4.04	Relay output 2_3	VCB	not used	
D4.05	Relay output 3_3	VCB	not used	

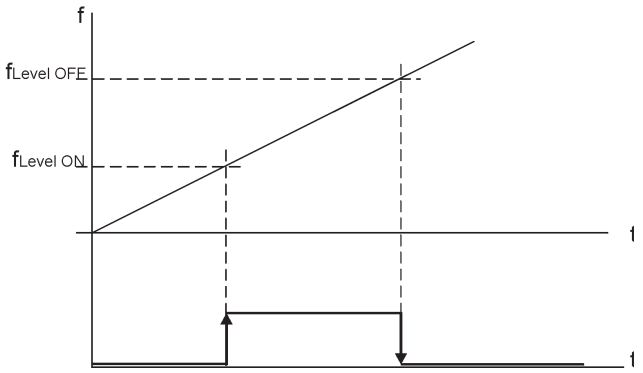
0 . . . not used •
1 . . . READY
2 . . . RUN
3 . . . Trip
4 . . . Ready and Run
5 . . . Alarm
6 . . . Bus alarm
7 . . . Generator operation
8 . . . Line ON
9 . . . Local operation
10 . . f(n) = fREF
11 . . f>fLevel
12 . . Lift brake *function not active*
13 . . Output Comparator C1
14 . . Output Comparator C2
15 . . Output Comparator C3
16 . . Output Comparator C4
17 . . Output logic L5
18 . . Output logic L6
19 . . Thyristor ON
20 . . BUS Control Word 11
21 . . BUS Control Word 12
22 . . BUS Control Word 13
23 . . BUS Control Word 14
24 . . BUS Control Word 15
25 . . ON (24 V) •
26 . . Manual operation
27 . . 2. Param. active
28 . . Ext. T-limitation active
29 . . PID active
30 . . PID enabled
31 . . Speed controller active *function not active*
32 . . Trip inverted

Multiple assignments are possible!
I.e., more than one relay output can indicate the same state!

D4.06	f-Level ON	VCB	0.00...***5.01***...300.00 Hz
D4.07	f-Level OFF	VCB	0.00...***2.01***...300.00 Hz

The limits for the digital signal ″>fLevel″ are set using these two parameters.





D4.08	Hyst. f=fref	VCB	0.1...***0.5***...10.0 Hz

Hysteresis for the digital signal f = fREF is set using this parameter. At the same time, the filter time for the signal is prolonged.

e.g. 0.5 Hz means ± 0.5 Hz hysteresis and 0.5 sec. delay time

The signal f = fREF is available at the relay outputs, the bus state word, the comparator interrogation, and in the status bar of the display.

D5 Encoder configuration

Settings for slip compensation

D5.00	Encoder/slip compensation	VICB	no encoder

0 . . . no encoder • — *standard applications (AVC mode works with calculated speed values)*

1 . . . Slip compensation — *precise speed (automatic slip compensation without encoder)*

2 . . . Encoder — *For >pDRIVE MX basic the option SFB is not available.*

In position ″0″, the speed display is calculated from the actual frequency and the current slip compensation (″Sensorless Vector Control″).
In position ″1″, the calculated slip frequency is added to the frequency reference value and the load-dependent revving down of the asynchronous motor is thus compensated. This produces a high static speed precision. The dynamics of this control circuit can be adjusted in rough increments using parameter D5.01 ″Dynamic of slip compensation″.

D5.01	Dynamic of slip compensation	VCB	low

0 . . . low •
1 . . . medium
2 . . . high

LOCAL and REMOTE motor potentiometer

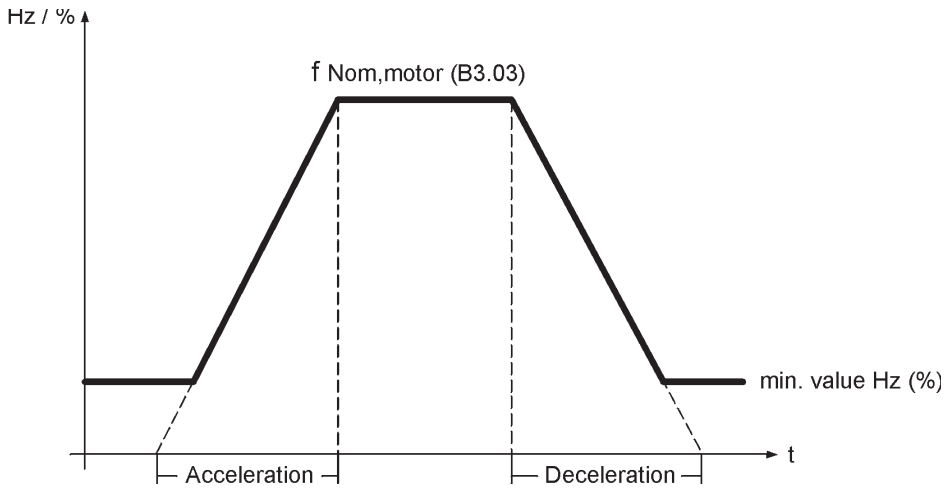
Basically, there is a distinction between the LOCAL motor potentiometer on the keypad and the REMOTE motor potentiometer at the terminal strip.

D6.00	Loc.MP selection	VICB	frequency reference

0 . . . frequency reference • *Hz*
1 . . . Torque reference *%*

The local motor potentiometer can be used as a source for the frequency ref. value or as ref. value for torque limitation. Depending on the use, the unit is changed automatically (f-ref in Hz, T-ref in %).

D6.01	Loc.MP min value	VCB	0.00...***0.00***...300.0 Hz 0.00...***0.00***...200.0 %
D6.02	Loc.MP max value	VCB	0.00...***50.00***...300.00 Hz 0.00...***30.52***...200.0 %
D6.03	Loc.MP accel. time	VCB	0.0...***10.0***...3200 s
D6.04	Loc.MP decel. time	VCB	0.0...***10.0***...3200 s



The motor potentiometer (MP) accel. and decel. time is the time (s) required by the motor potentiometer to change the frequency ref. value from 0 Hz to $f_{NOM,MOTOR}$ (B3.03) (with setting D6.00 = 1 - 0...100 % T_N) is defined.

The resolution (step by pressing the key) depends on the adjusted acceleration and deceleration time. e.g.: 10 s → step of 0.5 Hz
20 s → step of 0.25 Hz

D6.05	Loc. ref. storage	VCB	not active

0 . . . not active •
1 . . . active

If "reference-storage active" is selected, the set reference value is stored after a Stop command, or after mains disconnection. As a result, the drive goes to the stored ref. value again when a new Start command is issued.

D6.06	Rem.MP selection	VICB	not used

0 . . .not used • *Hz*
1 . . .f-ref Manual *Hz*
2 . . .f-ref Auto *Hz*
3 . . .f-correction *Hz*
4 . . .Torque limit *%*
5 . . .PID-reference value *%*

If individual settings cannot be selected, they have already been assigned one of the other reference value sources or a bus reference value!

The remote motor potentiometer is used as the source for various ref. value defaults. A function is assigned to the motor potentiometer using parameter D6.06. For control, 2 digital inputs must be set to the functions "+speed remote" and "-speed remote" (D2.00 – D2.10). The remote motor potentiometer can be used as a source for the frequency ref. value, the correction ref. value, the torque limitation ref. value or the PID ref. value. The unit is changed automatically, depending on the use (f-ref, f-correction in Hz / T-ref, PID-ref. value in %).

With pulse inhibit, only the function "-speed remote" is enabled!

D6.07	Rem.MP min value	VCB	-300.00...***0.01***...+300.00 Hz -200.00...***0.01***...+200.00 %
D6.08	Rem.MP max value	VCB	-300.00...***50.01***...+300.00 Hz -200.00...***30.52***...+200.00 %
D6.09	Rem.MP accel. time	VCB	0.0...***10.0***...3200 s
D6.10	Rem.MP decel. time	VCB	0.0...***10.0***...3200 s

Same function as D6.03 / D6.04.
See figure "Analogue ref. values", D1.

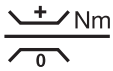
D6.11	Rem MP control	VCB	terminals

0 . . . keypad
1 . . . terminals •

By switching over to "0 keypad", the required motorpot value is defined using the up/down keys on the keypad.
If PID-controller function is used, an external ref. value setting is not necessary. Required ref. value adjustments can be made directly on the device at any time.

D6.12	Rem. ref. storage	VCB	not active

Same function as D6.05.

E		Drive	
E1		Drive overload	Max. overload Page 65
E2		Motor protection	Thermistor input, thermistor protection, max. current, therm. f-limit, motor-time constant, stalling time, frequency and current, >> protection, max. speed, Ext. motor trip, delay of switching-off Page 66
E3		Fault configurat.	Autorestart, loss of 4-20 mA, external fault, delay of switching-off, insulation fault, braking unit fault, braking unit fault, undervoltage, local reset, braking resistor overload and switch-on time Page 68
E4		Control configurat.	Local/remote reference, control and switch, control mode local, local STOP-key Page 70
E5		Skip frequ.	Skip frequency, hysteresis Page 72
E6		Switching frequency	Min. switching frequency, max. switching frequency Page 73

E — Drive

Adapting the inverter to the general unit concept

E1 — Drive overload

Maximum overload of inverter

E1.00	Current max. value	VCB	10...***150***...150 %	see Macro

This parameter defines the maximum current overload capacity in percent of the inverter current version C (high overload). At maximum heatsink temperature, 150% of the nominal unit current is available for 1 min in 10 min in the frequency range > 10 Hz. As soon as the time is elapsed, the current is reduced to 120 % $I_{N"C"}$ (at 2.5 kHz) without shutdown, in order to protect the inverter. If the maximum value (E1.00) is set to less than 120 % $I_{N"C"}$, there is no further time limitation for the load current.
→ Power reduction depending on switching frequency, see Mounting Instructions!

E1.01	Torque max. value	VCB	10...***200***...200 %

This parameter limits the motor torque. The setting 100% corresponds to the nominal motor torque. If exceeded, the frequency is reduced.
If an analogue input (terminal strip or bus) is set to "4 torque limit", this function takes over the torque limitation. In addition, it is possible to switch over between the two limitation standards using a digital input. If the digital input (or comparator output) is parametrized for the function "26 Ext. T-limitation" and High (contact made), the unit switches over to external T-limitation.

Analogue input / Digital input	not selected	selected
not selected	TLIM=parameter E1.01	TLIM=analogue signal
selected and = 0	TLIM=parameter E1.01	TLIM=parameter E1.01
selected and = 1	TLIM=parameter E1.01	TLIM=analogue signal

At low speed (≤ 2 Hz), accurate torque adjustment is not possible when working without an encoder!

Motor-specific protection measures

E2.00	Thermistor input	VCB	not active

0 . . . not active • — *No thermistor input used.*
1 . . . always active — *Thermistor is connected and errors are reported.*
2 . . . Ready / Run — *An error is reported only during Ready and Run state.*
3 . . . Run — *An error is reported only during Run state.*

For more information about the resistor specifications, see Mounting Instructions.

E2.01	Thermistor protection	VCB	Trip

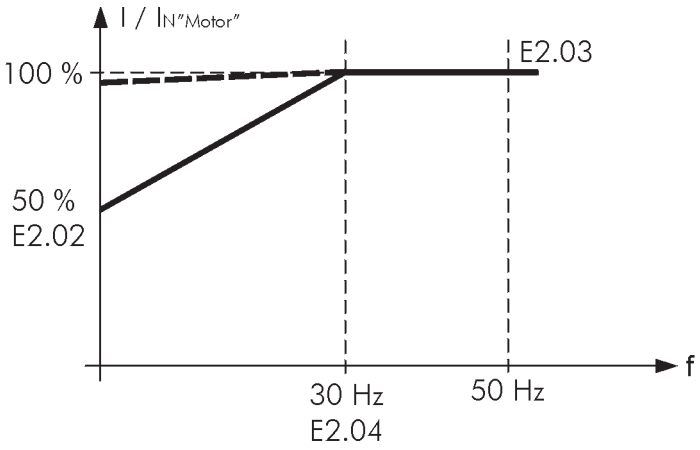
0 . . . Trip •
1 . . . Alarm

Motor temperature monitoring using thermistors can be evaluated as a trip or as an alarm. Unlike the trip message, alarm does not lead to shutdown of the inverter. The digital input must be parametrized for "Alarm" and the information must be processed externally.

Motor protection - thermal motor model with current limitation function

Unlike the overload limitation (parameter E1.00), which provides an overload protection for the inverter, the thermal motor model calculates the temperature rise in the motor based on the maximum steady currents at the nominal operating point and at the speed zero, taking into account the thermal time response and the respective speed (cooling conditions). In case of overload, the motor current is reduced to the set DC curve (E2.02 and E2.03). This leads to a speed reduction, leading to a stable operating point in case of loads with a square load moment (e.g. pumps and fans). If this does not succeed, e.g. in constant moment drives, the output frequency is reduced to 0 Hz. If this state persists for longer than the stalling time set with parameter E2.06 (with a frequency lower than the set stalling frequency E2.07), the result is a trip with the message "Motor overload".

Current/speed characteristics



Reduced cooling in self-ventilated motors !!

typical adjustment for
— self ventilated
– – force ventilated

E2.02	I max at 0 Hz	VCB	0...***31***...150 %	see Macro
E2.03	I max at f nom	VCB	30...***100***...150 %	

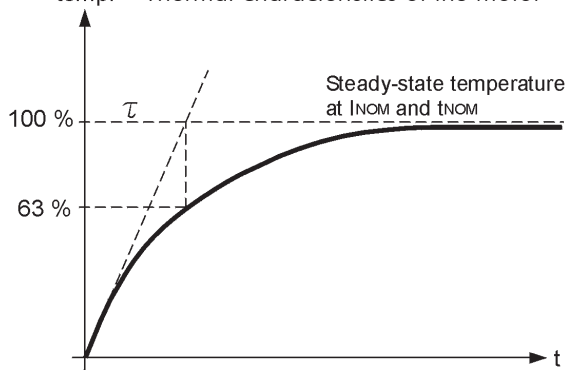
100% correspond to nominal motor current (see B3.01).

E2.04	Therm. f-limit	VCB	0...***30***...300 Hz

E2.05	Motor time constant (t)	VCB	1...***5***...3200 min

The motor-time constant τ describes the heat accumulation response of the motor. The steady-state temperature is reached within approx. 4...5 time constants at nominal operation (I_N and f_N). The default setting for the time constant of 5 min is very low in order to maintain sufficient motor protection even in the case of repeated mains shutdown. If required, the precise value can be found out from the motor supplier, and guideline values are shown in the following table (reset to factory default using parameter F2.01 "Return fact. motor").

temp. Thermal characteristics of the motor



Motor capacity / Number of poles	160 - 200	225 - 280	315 - 400
2, 4-pole	45 min	50 min	60 min
6, 8-pole	60 min	80 min	100 min

The electronic motor protection is reset to a "cold motor" by switching off the mains supply.

If the setting for parameter E2.05 is increased, it is imperative that the inverter is supplied using a fail-safe 24V buffer voltage via the terminals P24 and P0V.

E2.06	Stalling time	VCB	0...***60***...160 s
E2.07	Stalling frequency	VCB	0...***5***...20 Hz
E2.08	Stalling current	VCB	0...***80***...150%

100% corresponds to nominal motor current (see B3.01).

A blocked or highly overloaded motor during start-up is identified if it is operated at an output frequency lower than the stalling frequency, with a current greater than the stalling current, and for a time longer than the stalling time. The inverter is switched off with the trip message "Stall protection".

E2.09	n>> protection	VCB	Trip

0 . . . not active
1 . . . trip •
2 . . . warning

The overspeed protection can be evaluated both as a trip and as a warning. The motor speed is also monitored in pulse inhibit state (message in case of actively driving load states).
The warning has a release hysteresis of 100 rpm.

E2.10	n max motor	VCB	200...***3200***...18000 rpm

Maximum speed in rotations per minute. The default setting of 3200 rpm allows the operation of a 2-pole motor up to 50 Hz. For other pole numbers of a higher output frequency, the value must be changed accordingly !

E2.11	Ext. Motor trip	VCB	not active

0 . . . not active •
1 . . . N.O. active
2 . . . N.O. Ready + Run
3 . . . N.O. Run
4 . . . N.C. active
5 . . . N.C. Ready + Run
6 . . . N.C. Run

As external motor trips, e.g. bearing temperature monitors or vibrations monitors can be integrated using break (N.C.) or make contacts (N.O.).
If "Ready + Run" is selected, the trip message is issued in Ready or Run state, if "Run" is selected, the message is issued only in Run mode.

E2.12	Delay for E2.11	VCB	0.0...***1.0***...160 s

The safety shutdown "Motor trip" is only triggered if the signal "Ext. motor fault" is applied for longer than the set time.

E3 Fault configuration

Various reset functions, drive protection

E3.00	Autorestart	VCB	not active

0 . . . not active •
1 . . . active

If Autorestart is activated, the inverter tries to restart with an automatic reset after a trip.
This process is repeated 3x within 5 min, before final shutdown.

If a Start command and Auto-Restart are active in the case of a "transient" error, there is an automatic restart!

E3.01	Loss of 4-20 mA	VCB	not active

0 . . . not active •
1 . . . always active
2 . . . Ready + Run
3 . . . at 'Run'

Even unused analogue inputs are monitored with the setting 4...20 mA!

All analogue reference values are monitored for values below 3mA with the setting "4...20 mA". Depending on the setting, monitoring is provided either in Ready and Run state or in Run state only.

E3.02	External fault	VCB	not active	see Macro

0 . . . not active •
1 . . . N.O. active
2 . . . N.O. Ready + Run
3 . . . N.O. Run
4 . . . N.C. active
5 . . . N.C. Ready + Run
6 . . . N.C. Run

Trips registered by the device (e.g. overpressure, ...) can be integrated as an external fault using a break (N.C.) or make contact (N.O.). If "Ready + Run" is selected, monitoring is performed in Ready or Run state, if "Run" is selected, it is performed only in Run mode.

E3.03	Delay for E3.02	VCB	0.0...***0.0***...160 s

The message "Ext. fault" is only issued if the signal is applied for longer than the set time (for N.C. contacts: not applied).

E3.04	Insulation fault	VCB	not active

0 . . . not active •
1 . . . N.O. active
2 . . . N.O. Ready + Run
3 . . . N.O. Run
4 . . . N.C. active
5 . . . N.C. Ready + Run
6 . . . N.C. Run

The input works the same way as "Ext. fault", but "Insulation fault" is displayed on the monitor and in the fault memory. It is used specifically for integration of ground contact monitoring in non-grounded mains.

E3.05	Delay for E3.04	VCB	0.0...***10.0***...160 s

The message "Insulation fault" is only issued if the signal is applied for longer than the set time (for N.C. contacts: not applied).

E3.06	Braking unit fault	VCB	N.O. Ready + Run

0 . . . not active
1 . . . N.O. active
2 . . . N.O. Ready + Run •
3 . . . N.O. Run
4 . . . N.C. active
5 . . . N.C. Ready + Run
6 . . . N.C. Run

Input for switching off the device in the event of a defect in the external braking unit, with the display "Ext. BU error".

E3.07	Delay for E3.06	VCB	0.0...***5.0***...160 s

Start delay time (after Mains-ON) for "Ext. braking unit fault".

E3.08	Undervoltage	VCB	no fault

0 . . . no fault •
1 . . . Fault
2 . . . Alarm

By default, an undervoltage is not stored as a fault; i.e. on return and with an active Start command the drive continues to run automatically. If "undervoltage means fault" is selected, any undervoltage that persists for longer than the set time (E3.09) and occurs during operation of the device is treated as a fault (undervoltage 1) and must be confirmed as soon as the voltage returns to normal. Used for drives that must not restart automatically (personal safety).

Autorestart must not be activated !

E3.09	Delay for E3.08	VCB	0.0...***2.0***...20.0 s

Setting of the permissible undervoltage time for automatic restart or for the trip message "Undervoltage 1" (if E3.08 is set to "1 Fault").

A setting > 2 s is only useful if the control electronics are permanently supplied with a 24 V buffer voltage !

E3.10	Local Reset	VCB	active

0 . . . not active
1 . . . active •

This parameter defines whether an error can be confirmed with the key "O/Stop/Reset" on the keypad. By default, the local confirmation option is activated.

Definition of operating modes

E4.00 Loc./Rem. reference VICB Local / Remote

0 . . . Local / Remote • *Ref. value from keypad or terminals (or bus)*
1 . . . Local only *Ref. value from keypad (or terminal strip "Local functions") only*
2 . . . Remote only *Ref. value from terminal strip (or bus) only*

This parameter enables the possible sources for the frequency reference value:

LOCAL E4.03 = "0 keypad": The keys "Increase" / "Decrease" / "Reverse" / "Forward" are active.
E4.03 = "1 terminals": The digital inputs "+speed local" / "-speed local" and the function "REV local" are active.

REMOTE Frequency default via "f-ref MAN" or "f-ref Auto" or from PID-controller. Possible ref. value sources: analogue inputs AIV, AIC, AI_2, AI_3, pre-set ref. values, remote motorpot or one of the 5 bus ref. values.

E4.01 Control commands VICB Local / Remote

0 . . . Local / Remote • *Control commands from keypad or terminals (or bus)*
1 . . . Local only *Control commands from keypad (or terminal strip "Local functions") only*
2 . . . Remote only *Control commands from terminal strip (or bus) only*

This parameter enables the possible sources for the control commands:

LOCAL E4.03 = "0 keypad": The keys "I" / "O (Reset)" are active.
E4.03 = "1 terminals": The digital inputs "Start-I local" / "REV local" / "Stop-I local" are active.

REMOTE B6.01 = "0 terminals": The Start/Stop via the terminal strip "Start FWD" / "Start REV" and "Start FWD impulse" / "Start REV impulse" / "Stop impulse" are active.
B6.01 = "1 Bus": The Start/Stop commands of the bus control word (bits 0 to 10) are active.

The following options can be realized by combining the parameters "Loc./Rem. reference" and "Loc./Rem. control":

Operating mode	Parameter setting E4.00 & 01		Switch-over
	Loc./Rem. ref.	Loc./Rem. control	Loc/Rem
Local and remote mode	Loc/Rem	Loc/Rem	active
f-ref. value reversible	Loc/Rem	Local only	active for f-ref.
f-ref. value reversible	Loc/Rem	Remote only	active for f-ref.
I/O commands reversible	Local only	Loc/Rem	active for I/O
I/O commands reversible	Remote only	Loc/Rem	active for I/O
Remote mode only	Remote only	Remote only	no effect
Local mode only	Local only	Local only	no effect
Mixed mode	Local only	Remote only	no effect *)
Mixed mode	Remote only	Local only	no effect *)

*) In these modes, the change in direction is assigned to the control source !!

E4.02 Loc/Rem-switch VICB Keypad

0 . . . Keypad •
1 . . . terminals

If "Loc/Rem switch = terminals" is selected, the Loc/Rem key on the keypad is blocked. A terminal strip command is used to switch over (see D2).

E4.03 Control mode local VICB Keypad

0 . . . Keypad •
1 . . . terminals

This parameter defines where the Start/Stop commands and the control commands for the local motor potentiometer are derived from in local mode - from the keys on the keypad or from the digital inputs "Start impulse local" / "Stop impulse local" / "REV local" / "+speed local" / "-speed local".

E4.04 Local STOP-key VCB Local active only

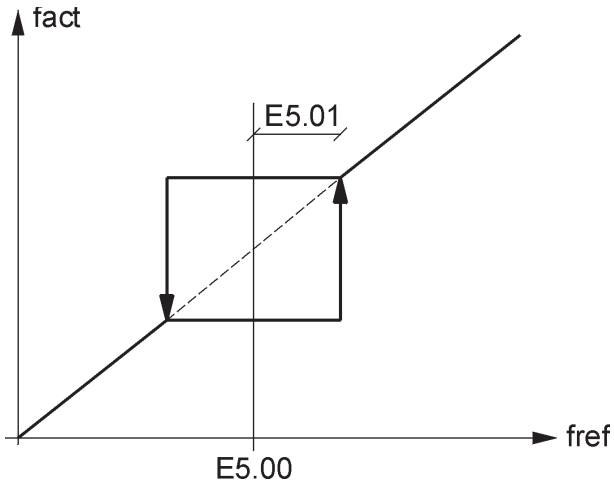
0 . . . Local active only •
1 . . . always active

If "Stop key always active" is selected, the STOP command can be issued using the STOP key on the keypad or the relevant digital input "Stop impulse local" in any mode. Depending on the setting for parameter C1.02 "Stop mode", the drive is stopped. With impulse contacts and BUS control, a renewed On command is required for acceleration. If the steady commands "Start FWD" or "Start REV" are applied to the terminal strip, the drive accelerates again immediately!!!

See setting example "Switch-over to local control with local keys" in Chapter B5, "Short menu - Supplements to macros M1 to M3".

E5.00	Skip frequency	VCB	5.00...***5.00***...300.0 Hz
E5.01	Hysteresis	VCB	0.00...***0.00***...4.00 Hz

The skip frequency defines the frequency at which the drive should not be operated in steady-state. The set hysteresis value defines the masked frequency range and acts symmetrically to the masking frequency.



If the frequency skip is activated, the limitation message "f-skip" is displayed.

Adjustment of the automatic switching frequency

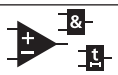
E6.00	Min. switching frequency	VCB	2.5 kHz

0 . . .2.5 kHz •
1 . . .5.0 kHz
2 . . .10.0 kHz

E6.01	Max. switching frequency	VCB	2.5 kHz

0 . . .2.5 kHz •
1 . . .5.0 kHz
2 . . .10.0 kHz

The inverter is equipped with a self-adjusting automatic pulse frequency.
Depending on the measured heatsink temperature, the switching frequency is set in such a way that the switching frequency is gradually reduced from the maximum value (E6.01) to the minimum value (E6.00) in the event of high load and simultaneous high cooler temperature. As a result, the device operates in an entirely fail-safe manner. The motor noise increases with decreasing switching frequency, however. The available switching frequency range can be limited or the automatic system can be switched off by using parameters E6.00 and E6.01. In order to keep the interference at the motor cable and the thermal load of the optional CE filters and AMFs as low as possible, the device is always operated with the minimum switching frequency at the factory default setting.

F		Debug		
F1		Test-Help	Test power part, test control part, description of fault causes	Page 75
F2		Factory settings	Activation	Page 76
F3		Fault memory	Fault code, review	Page 77
F4		Funct. blocks	Freely configurable comparators and logic modules	Page 78
F6			Adjustment of the current inverter offset at various switching frequencies	Page 86

F		Debug	Default settings, error memory, tuning, code lock

F1		Test-Help	Help in case of errors

F1.00 Test power part VICB Routine

0 . . . Start • *Start routine by changing to line 1 with the "Increase" key*
1 . . . Test Lower
2 . . . Test Upper
3 . . . No earth fault
4 . . . Earth fault !!
5 . . . Test not possible *→ no pulse enable!*

The function "Test power part" is used to register ground contacts on the motor side of the frequency inverter. When the routine is activated, all 3 IGBTs of a half bridge on the motor side are activated for a short time. If an overload occurs during this phase, the message "earth fault" is displayed. If the contactor control is activated, the contactor is addressed for the test time.

F1.01 Test control part VICB Routine

0 . . . Start • *Start routine by changing to line 1 with the "Increase" key*
1 . . . testing *The control electronics carry out a software-hardware test and*
2 . . . fault ! *then return to the initial screen.*
3 . . . no fault

The routine "Test control part" triggers a self-test of the inverter electronics with a subsequent boot function. During this time, data are transferred from the drive control to the user interface in devices with a loaded intermediate circuit. Data are also transferred from the user interface to the option card PBO1 (profibus connection).

F1.02 to F1.29

Parameters F1.02 to F1.29 contain descriptions and troubleshooting measures for the individual error messages. A list of the error messages can be found in the table in Appendix B.

Resetting the factory settings

F2.00	Return factory appli.	VICB	Routine

0 . . . Start • *Start routine by changing to line 1 with the "Increase" key.*
1 . . . Return factory
2 . . . O.K.

This routine resets the parameter settings (but not the motor data) to the factory default (Macro 1 "Conveyor") of the device, whereby all customer-specific entries are deleted!

The USER macros UM1 and UM2, the fault memory, the operating hours, the kWh meter and the language setting are excepted from the reset with F2.00 and 01!

F2.01	Return fact. motor	VICB	Routine

0 . . . Start • *Start routine by changing to line 1 with the "Increase" key.*
1 . . . Return factory
2 . . . O.K.

This routine replaces all motor data with the factory default data. The customer-specific settings are deleted (B3.00 to 04 and B4.01 to 04 are reset).

If there is no mains voltage (e.g. active contactor control C6.00), the motor data and autotuning data are not reset !!

This routine has no influence on the motor data stored in the User Macros UM1 and UM2!

F3 Fault memory

Display of the last 16 errors and the respective diagnostic values

F3.00	Fault code	read only	"Error counter"
F3.01	Review	VB	0...**0**...15

F3 Fault memory

			last entry in memory			
F3.00	Fault code				15	1.)
F3.01	Review			2 Event -2	1 Event -1	0 newest event
F3.02	Trip number			13	14	15
F3.03	Fault			61 Stall protect.	58 Mot.Temp.>	54 ext. trip	1.)
F3.04	Operating hours FI	(A5.01)		362,37 h	438,84 h	817,73 h	2.)
F3.05	Output frequency	(A3.00)		+0,6 Hz	+23,0 Hz	+43,4 Hz	2.)
F3.06	Speed	(A2.00)		+3 rpm	+649 rpm	+1260 rpm	2.)
F3.07	Motor current	(A2.03)		602 A	478 A	342 A	2.)
F3.08	DC-voltage	(A3.02)		533 V	541 V	545 V	2.)
F3.09	Heatsink temperature	(A3.03)		+25 °C	+71 °C	+63 °C	2.)
F3.10	Frequ. after ramp	(A4.12)		+50,0 Hz	+23,0 Hz	+43,4 Hz	2.)
F3.11	Operate-mode	(A1.02)		0 Remote	0 Remote	0 Remote	2.)
F3.12	Device status	(A3.11)		7 Run	7 Run	7 Run	2.)
F3.13	Drive control word	(A4.17)		047F hex	047F hex	047F hex	2.)3.)
F3.14	Drive status	(A1.03)		2 Acceleration	1 n=nref	1 n=nref	2.)
F3.15	Fault AR			0000 hex	0000 hex	0000 hex	2.) 3.)

1.) With every mains (or 24 V voltage) shutdown, an error message "+24V off" is entered. As long as parameter E3.08 "Undervoltage" is set to "0 no fault" or "2 alarm", however, it is overwritten every time. To do this the current number is set back by 1.

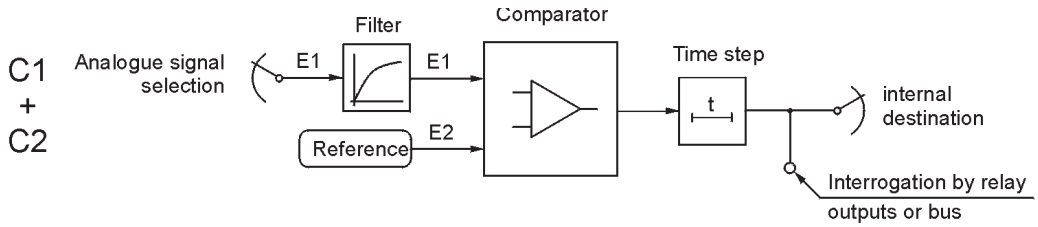
2.) All diagnostic values correspond to the actual values 10 msec before the trip.

3.) Drive control word and error message(s) in hex code: see Manual "Option Profibus PBO1" and Service Manual.

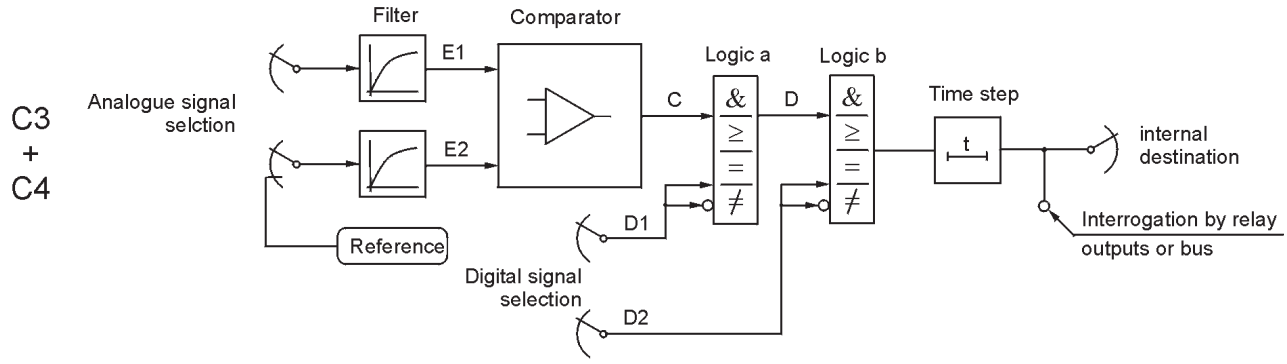
Comparators and logic modules

The inverter includes 4 comparators for monitoring various analogue signals.
The produced signal can either be issued via the relay outputs with an adjustable time increment and/or used internally as a control signal.
Two of this blocks are designed as analogue comparator levels with subsequent digital linking functions.
L5 and L6 are freely configurable logic modules.

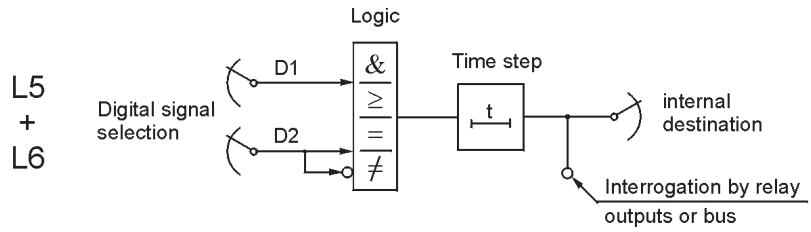
Schematic structure:



Comparator 1: Parameters F4.00 to F4.07
Comparator 2: Parameters F4.08 to F4.15



Comparator 3: Parameters F4.16 to F4.29
Comparator 4: Parameters F4.30 to F4.43



Logic module 5: Parameters F4.44 to F4.49
Logic module 6: Parameters F4.50 to F4.55

F4.00	C1 signal to E1	VCB	0.0 %
F4.08	C2 signal to E1	VCB	0.0 %
F4.16	C3 signal to E1	VCB	0.0 %
F4.30	C4 signal to E1	VCB	0.0 %

0 . . . 0.0% •	
1 . . . f-output sig.	*100% = fMAX (C3.01)*
2 . . . f-output	*100% = fMAX (C3.01)*
3 . . . Output current	*100% = Nom. motor current (B3.01)*
4 . . . Torque sig.	*100% = Nom. motor torque (B3.00, B3.04)*
5 . . . Torque	*100% = Nom. motor torque (B3.00, B3.04)*
6 . . . Power	*100% = Nom. motor power (B3.00)*
7 . . . Heatsink temperature	*100% = 100 °C*
8 . . . Switching frequency	*100% = 10 kHz*
9 . . . Speed signal	*100% = fMAX in rpm (C3.01 x 60 / 2p)*
10 . . Speed	*100% = fMAX in rpm (C3.01 x 60 / 2p)*
11 . . PID error	*100% = 100 %*
12 . . int. f-reference sig.	*100% = fMAX (C3.01), after accel., before fs compensation*
13 . . int. f-ref	*100% = fMAX (C3.01), after accel., before fs compensation*
14 . . int T-ref	*100% = Nom. motor torque (B3.00, B3.04)*
15 . . AIV	*100% = 10 V (A4.00)*
16 . . AIC	*100% = 20 mA (A4.02)*
17 . . AI_2	*100% = 20 mA (A4.04)*
18 . . AI_3	*100% = 20 mA (A4.06)*
19 . . DC-voltage	*100% = 813 V*

F4.18	C3 signal to E2	VCB	Ref. value
F4.32	C4 signal to E2	VCB	Ref. value

0 . . . Reference value (%) •	*to be set using F4.02*
1 . . . AIV	*100% = 10 V (A4.00)*
2 . . . AIC	*100% = 20 mA (A4.02)*
3 . . . AI_2	*100% = 20 mA (A4.04)*
4 . . . AI_3	*100% = 20 mA (A4.06)*
5 . . . Pre-set reference val.	*100% = 100% or 100% = 163.84 Hz (A4.08)*
6 . . . REM-MP ref.	*100% = 100% or 100% = 163.84 Hz (A4.10)*

F4.01	C1 filter for E1	VCB	0.0...***0.2***...160s
F4.09	C2 filter for E1	VCB	0.0...***0.2***...160s
F4.17	C3 filter for E1	VCB	0.0...***0.2***...160s
F4.31	C4 filter for E1	VCB	0.0...***0.2***...160s

PT1 filter for the analogue signal selected using E1.

F4.19	C3 filter for E2	VCB	0.0...***0.2***...160s
F4.33	C4 filter for E2	VCB	0.0...***0.2***...160s

PT1 filter for the analogue signal selected using E2.

F4.02	C1 reference	VCB	-200.0...***0.0***...+200.0 %
F4.10	C2 reference	VCB	-200.0...***0.0***...+200.0 %
F4.20	C3 Reference	VCB	-200.0...***0.0***...+200.0 %
F4.34	C4 Reference	VCB	-200.0...***0.0***...+200.0 %

Provides a programmable reference value for comparator E2.

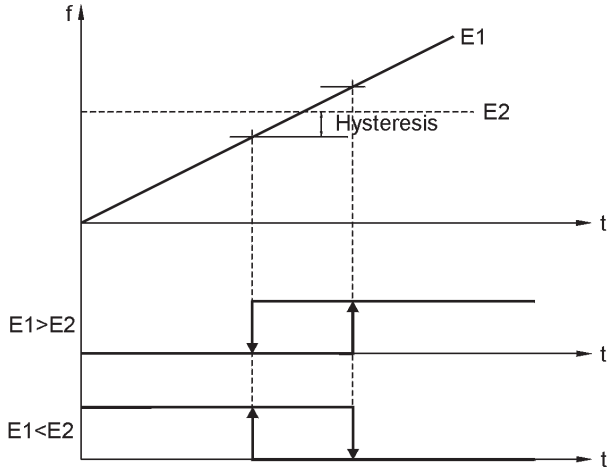
F4.03	C1 Comp. function	VCB	E1 > E2
F4.11	C2 Comp. function	VCB	E1 > E2
F4.21	C3 Comp. Function	VCB	E1 > E2
F4.35	C4 Comp. Function	VCB	E1 > E2

0 . . . E1 > E2 •
1 . . . E1 < E2
2 . . . E1 = E2
3 . . . E1 ≠ E2

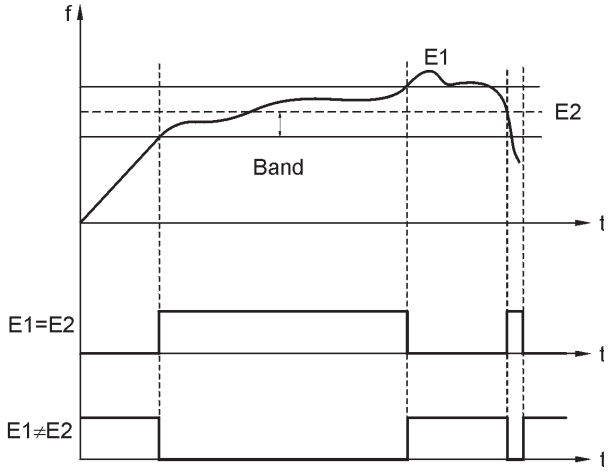
F4.04	C1 Comp. Hyst/Band	VCB	0.0...***5.0***...100.0 %
F4.12	C2 Comp. Hyst/Band	VCB	0.0...***5.0***...100.0 %
F4.22	C3 Comp. Hyst/Band	VCB	0.0...***5.0***...100.0 %
F4.36	C4 Comp. Hyst/Band	VCB	0.0...***5.0***...100.0 %

The comparator function defines the comparison criterion for the two analogue input values (E1, E2). Using the symmetrically functioning hysteresis/bandwidth, the following output states are obtained:

Reaction with function:
E1 > E2 and E1 < E2



Reaction with function:
E1 = E2 and E1 ≠ E2



F4.23	C3 Input D1	VCB	State ZERO
F4.24	C3 Input D2	VCB	State ZERO
F4.37	C4 Input D1	VCB	State ZERO
F4.38	C4 Input D2	VCB	State ZERO
F4.44	L5 signal to D1	VCB	State ZERO
F4.45	L5 signal to D2	VCB	State ZERO
F4.50	L6 signal to D1	VCB	State ZERO
F4.51	L6 signal to D2	VCB	State ZERO

	State 1 for:
0 . . . State ZERO •	*never*
1 . . . Ready	*Ready state*
2 . . . Run	*Run state*
3 . . . Fault	*Fault*
4 . . . Ready + Run	*Ready or Run state*
5 . . . Alarm	*Alarm (sum warning)*
6 . . . Bus-alarm	*bus communication is interrupted*
7 . . . Generator operation	*generator operation of motor*
8 . . . Local operation	*selected local operation*
9 . . . f = fref	*reference frequency is reached*
10 . . f > fLevel	*see D4.06, D4.07*
11 . . Start impulse	*4-second impulse following Start command*
12 . . DI1	*addressed DI1*
13 . . DI2	*addressed DI2*
14 . . DI3	*addressed DI3*
15 . . DI4	*addressed DI4*
16 . . DI5_2	*addressed DI5_2*
17 . . DI6_2	*addressed DI6_2*
18 . . DI7_2	*addressed DI7_2*
19 . . DI8_2	*addressed DI8_2*
20 . . DI5_3	*addressed DI5_3*
21 . . DI6_3	*addressed DI6_3*
22 . . DI7_3	*addressed DI7_3*
23 . . DI8_3	*addressed DI8_3*
24 . . State 1	*always*
25 . . Lift brake	*function not active*
26 . . Thyristor-ON	*intermediate circuit loaded*
27 . . Limit I>	*current limitation active *) or heatsink temp.>*
28 . . Limit V>	*voltage limitation active *)*
29 . . Limit Temp>	*motor protection (thermal motor model) active*
30 . . Limitations	*sum message for all limitations*
31 . . reserved	
32 . . reserved	
33 . . Output of comparator C1	
34 . . Output of comparator C2	
35 . . Output of comparator C3	
36 . . Output of comparator C4	
37 . . Output of logic module L5	
38 . . Output of logic module L6	
39 . . reserved	
40 . . reserved	
41 . . Bus control word 11	
42 . . Bus control word 12	
43 . . Bus control word 13	
44 . . Bus control word 14	
45 . . Bus control word 15	

**) The message for this limitation is currently not in function!*

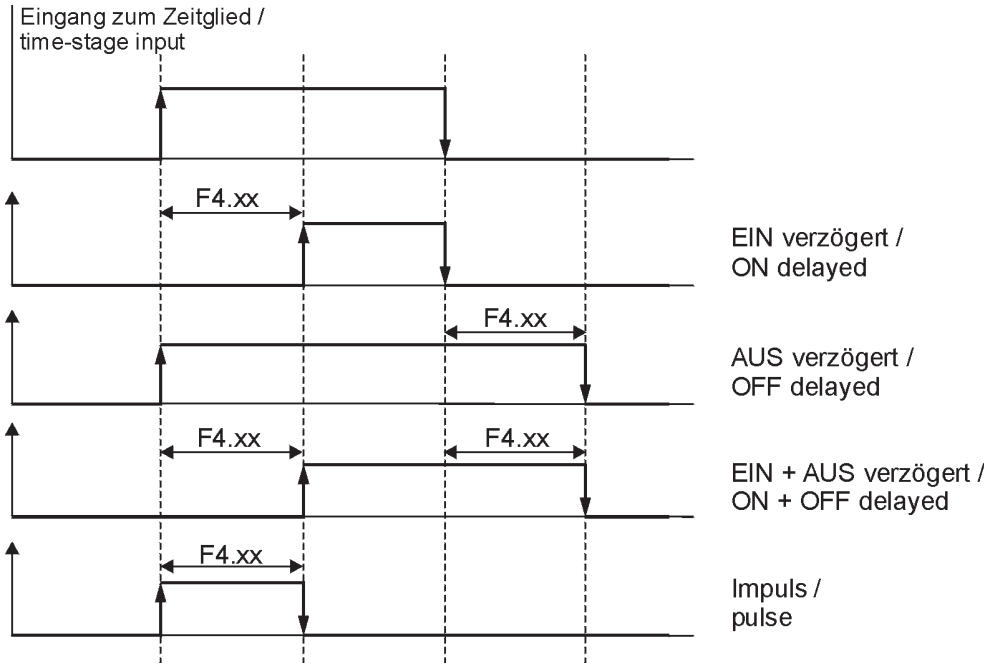
F4.25	C3 logic 'a' function	VCB	OR
F4.26	C3 logic 'b' function	VCB	OR
F4.39	C4 logic 'a' function	VCB	OR
F4.40	C4 logic 'b' function	VCB	OR
F4.46	L5 logic function	VCB	OR
F4.52	L6 logic function	VCB	OR

0 . . . AND
1 . . . OR •
2 . . . EQUAL
3 . . . UNEQUAL
4 . . . AND - negated *input D1 (D2) negated !*
5 . . . OR - negated *input D1 (D2) negated !*
6 . . . EQUAL - negated *input D1 (D2) negated !*
7 . . . UNEQUAL - negated *input D1 (D2) negated !*

F4.05	C1 time function	VCB	ON-delay
F4.13	C2 time-function	VCB	ON-delay
F4.27	C3 time-function	VCB	ON-delay
F4.41	C4 time-function	VCB	ON-delay
F4.47	L5 time-function	VCB	ON-delay
F4.53	L6 time-function	VCB	ON-delay

0 . . . ON - delay •
1 . . . OFF - delay
2 . . . ON + OFF - delay
3 . . . Impulse

F4.06	C1 time set	VCB	0.0...***0.0***...3200 s
F4.14	C2 time set	VCB	0.0...***0.0***...3200 s
F4.28	C3 time-set	VCB	0.0...***0.0***...3200 s
F4.42	C4 time-set	VCB	0.0...***0.0***...3200 s
F4.48	L5 time-set	VCB	0.0...***0.0***...3200 s
F4.54	L6 time-set	VCB	0.0...***0.0***...3200 s



F4.07	C1 selection	VCB	not used
F4.15	C2 selection	VCB	not used
F4.29	C3 selection	VCB	not used
F4.43	C4 selection	VCB	not used
F4.49	L5 selection	VCB	not used
F4.55	L6 selection	VCB	not used

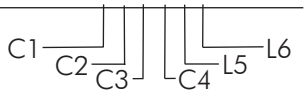
0 . . .not used •
1 . . .Start FWD
2 . . .Start REV
3 . . .Start FWD-Impulse
4 . . .Start REV-Impulse
5 . . .Stop-Impulse
6 . . .+speed remote
7 . . .-speed remote
8 . . .Start Impulse local
9 . . .Stop Impulse local
10 . .REV local
11 . .+speed local
12 . .-speed local
13 . .Jog
14 . .Pre-set A
15 . .Pre-set B
16 . .Pre-set C
17 . .Manual (Auto) — *make contact = f-ref MAN*
18 . .Local (Rem) — *break contact = local control (E4.00 to 03)*
19 . .2.Ramp
20 . .User Macro 2 — *make contact = user macro 2*
21 . .Enable
22 . .EXT-fault — *parametrize additionally using E3.02*
23 . .EXT-motor fault — *parametrize additionally using E2.11*
24 . .Insulation fault — *parametrize additionally using E3.04*
25 . .Ext. BU-fault — *parametrize additionally using E3.06*
26 . .EXT-Reset
27 . .EXT-T limitation
28 . .PID active
29 . .PID enable
30 . .Speed controller active — *function not active*
31 . .Brake open — *function not active*
32 . .Supply ON/OFF — *only with activated contactor control*
33 . .Force local

Using the parameters "selection", the respective comparator/logic module output can be assigned directly and internally (without detour via a relay output and digital input).

Each function can only be selected 1x. "Double assignments are not possible!"
Settings that have already been selected using one of the digital inputs D2 or another comparator/logic module cannot be set again.

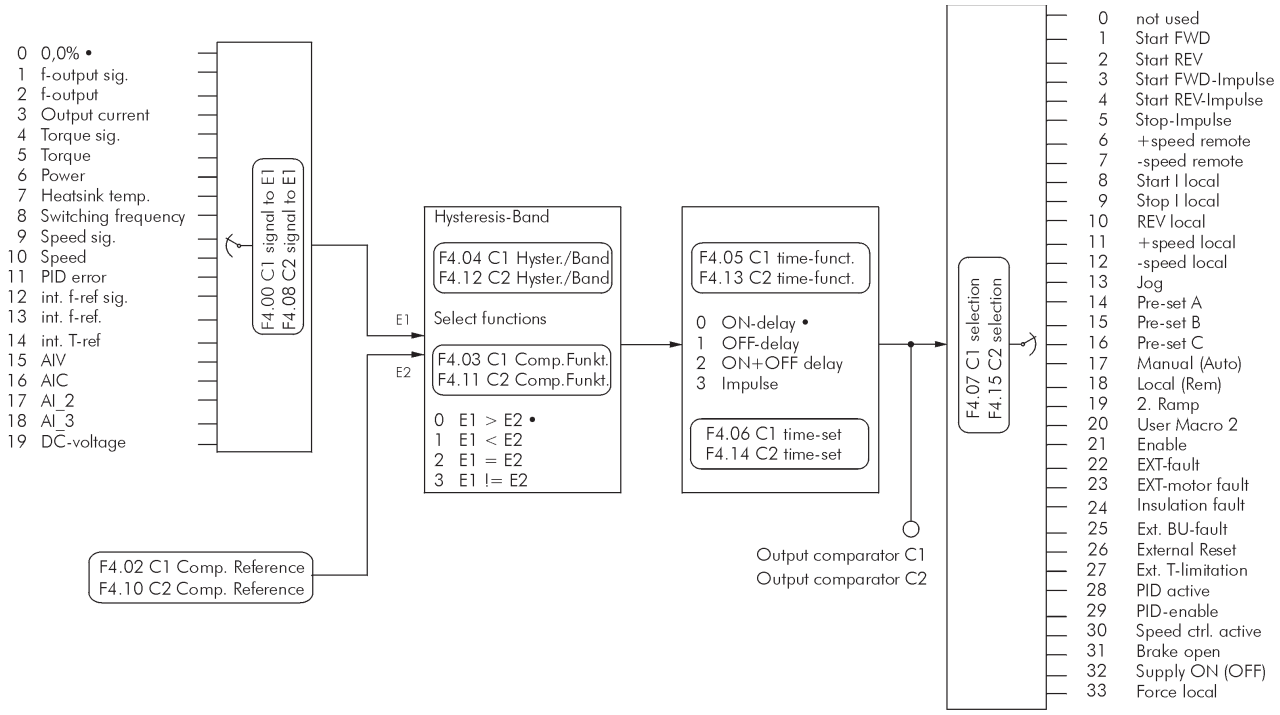
F4.56	C1-L6 status	read only	111111

This parameter shows the output state of the comparator logic modules C1 to L6 (from left to right). Leading zeros are suppressed.

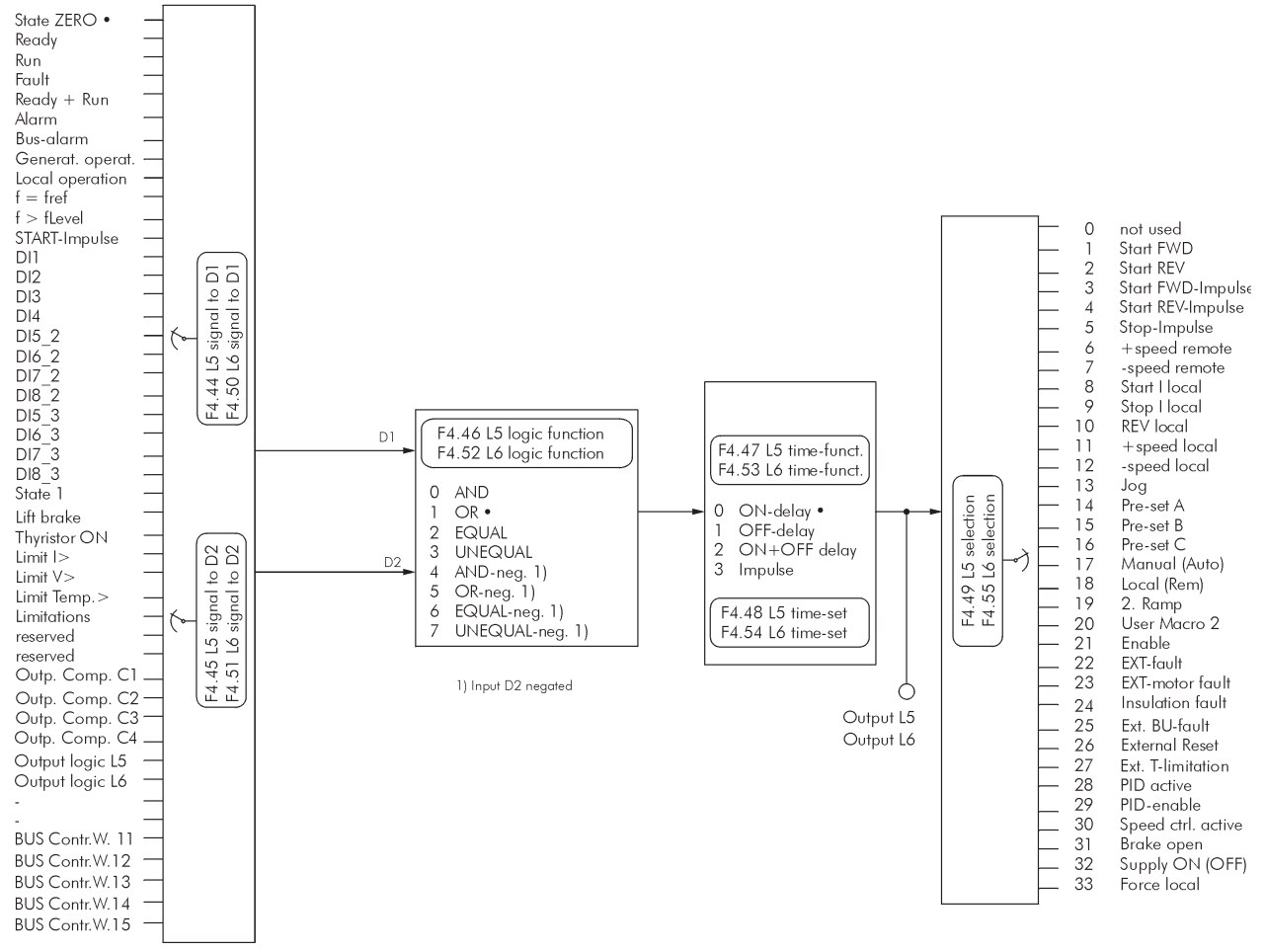


F Service

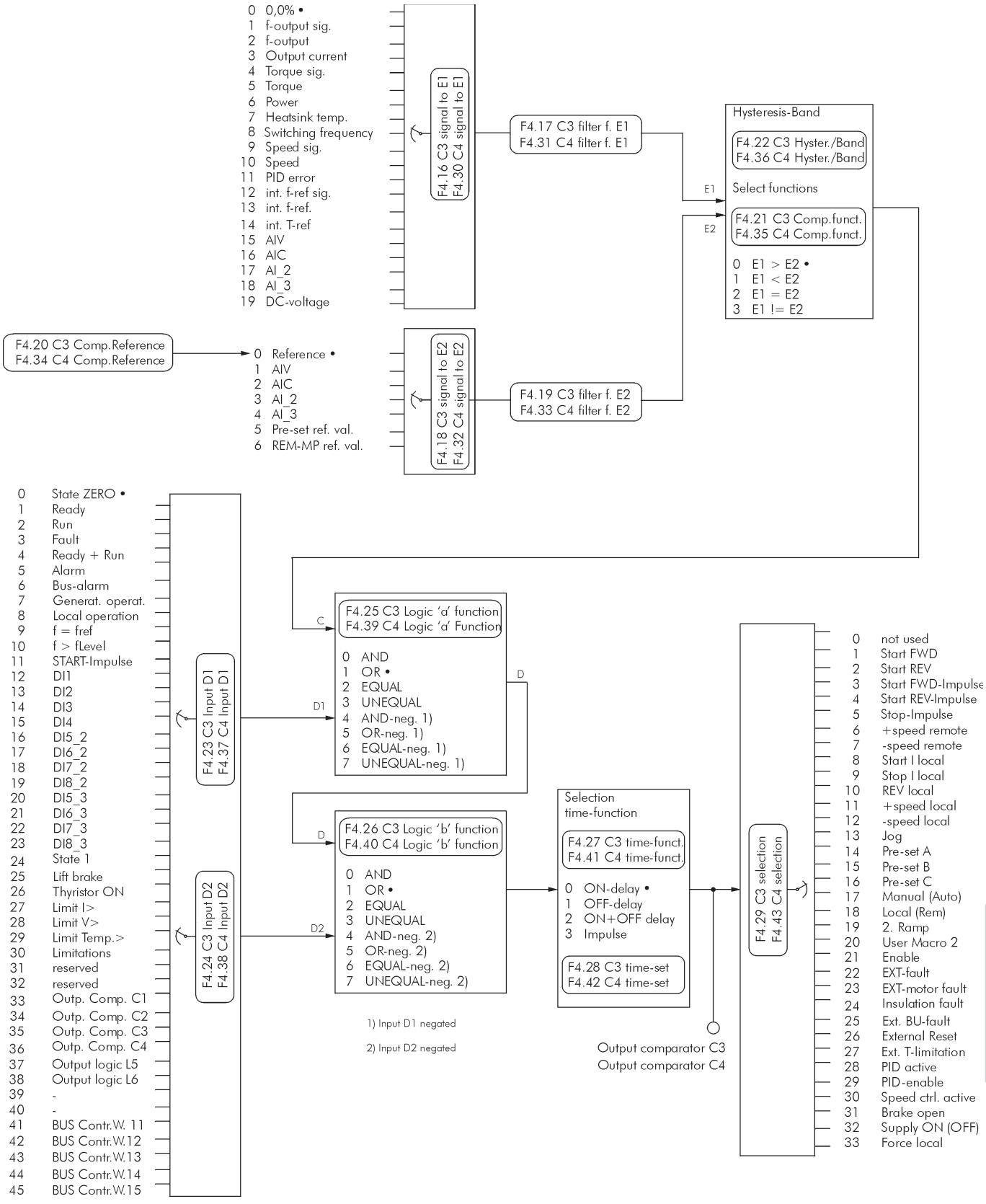
Functional diagram of comparator C1 and C2



Functional diagram of logic module L5 and L6



Functional diagram of comparator with logic block C3 and C4



F6 Code lock — Codelock

F6.00	Code	VB	0...***0***...9999
F6.01	Code value	VB	0...***0***...9999

The code lock is opened if the code value corresponds with the set number of the code. With every "Mains on", F6.00 - Code automatically resets to 0.

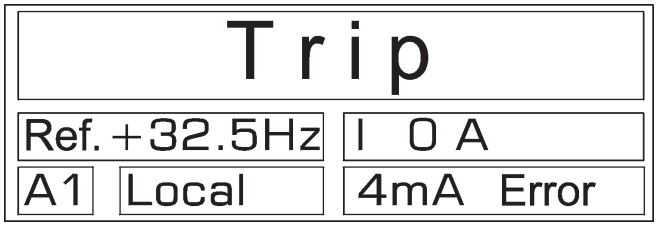
F6.02	Paramet.-Access	V	Keypad

0 . . . Keypad •
1 . . . Fieldbus
2 . . . RS232

F6.03	Pulse inhibit	VCB	No

0 . . . No • *inhibit not active, the inverter is enabled*
1 . . . Yes *The inverter is disabled and can be only enabled by resetting the parameter.*

This parameter is able to lock the software of the inverter. "Disabled" is displayed.
The PC tool Matrix sets the parameter to "1 yes" during transmission of parameters. So a start-up of the drive is prevented.



Trip Messages

In the event of a trip, the inverter switches off by means of pulse inhibit. A stored Start command (local control or start impulse contact) is deleted. The error message is issued as an entry in the status field.

More information about the cause of the trip and possible troubleshooting measures for each trip message can be found in matrix area F1-Help.

Confirmation of errors

An error can be confirmed in one of the following 5 ways:

- By pressing the O/Reset key on the keypad
- By switching off the mains supply and 24 V buffer voltage if provided
- By using a digital input to reset (see D2.00 to D2.10)
- With the activated Autorestart function (see E3.00)
- With a reset signal on the bus (e.g. Profibus)

In the case of active steady signals Start FWD or Start REV, the remedy and resetting of a trip is followed by an automatic restart!

MATRIX Software

INSTALLATION AND USE

1. Required devices

In addition to your computer, you will need the serial cable marked CABLE PC-MX.
This cable connects one of the parallel ports on your computer with the RJ45 port beneath the keypad on the user interface.

2. Hardware requirements

Minimum: 80486 or pentium PC, Windows 3.x or Windows 95, 8 MB RAM and sufficient hard disk space for the program and the created files

Recommended: Pentium PC, Windows 95, Windows 98 or Windows NT; 16 MB RAM and sufficient hard disk space for the program and the created files

In addition to the mouse port, a second free serial port is required!

3. Software installation

The software can be used both with WINDOWS 3.1 and with WINDOWS 95. To install the software, insert disk no. 1 in your floppy drive (in the following instructions, it is assumed that your floppy drive is drive A:).

Installation under WINDOWS 3.1:

In the Program Manager, select the option File/Run.
Click on Search and enter A:\ setup.

Click on OK to start installation.

You can define the directory and path, in which you want to install the MATRIX-Software. The default setting is C:\ MATRIX. The installation program will ask you to insert the other disks in the disk drive when required.

Installation under WINDOWS 95:
Installation under WINDOWS 98:
Installation under WINDOWS NT:

Click on the Start button and select Settings/System setup in the menu. Double-click on the symbol for software, then on “Install”.
The program will ask you to insert the installation disk in your disk drive.
Click on Continue.

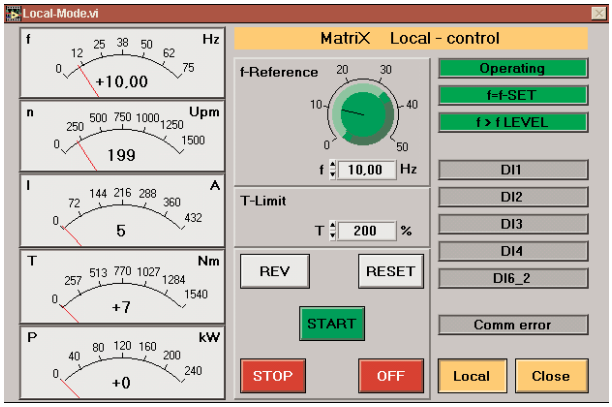
A:\ SETUP.EXE is displayed in the next window. Click on Continue to start the installation.

You can choose the directory and path in which you want to install the MATRIX-Software. The default setting is C:\ MATRIX.
The program will ask you to insert the remaining disks in the disk drive when required.

If you have downloaded the contents of the installation disks from the Internet, you can start the installation from any directory on your hard disk. Simply click on setup.exe in the directory, in which the data are located, then continue as above.

4. Program features

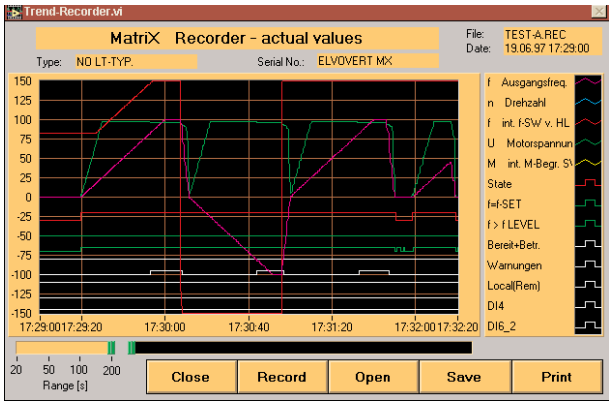
The MATRIX program offers the following functions:



a. Local control

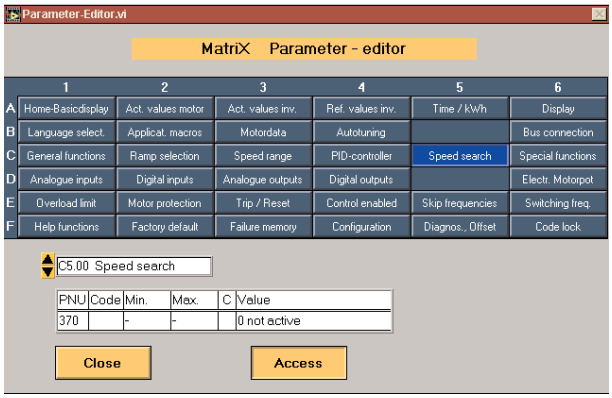
Used for observation and on-line control of a frequency inverter. Use the "Local" key to switch between observation mode and control mode.

The contents of the analogue display instruments and some digital display fields can be changed using the parameter editor (matrix area B6 "Comm. Menu", parameter group B6.11, B6.13, B6.15, B6.17, B6.19 and B6.26 to B6.30), if necessary.



b. Actual value plotter

Allows you to plot 5 analogue and 8 digital states during operation. The actual analogue values and some actual digital values that are to be plotted can be changed using the parameter editor (matrix area B6 "Comm. Menu", parameter group B6.11, B6.13, B6.15, B6.17, B6.19 and B6.26 to B6.30), if necessary.
Plotting is started and ended by pressing the key "Record" (maximum plotting time 200s). The size of the printout depends on the current zoom window.



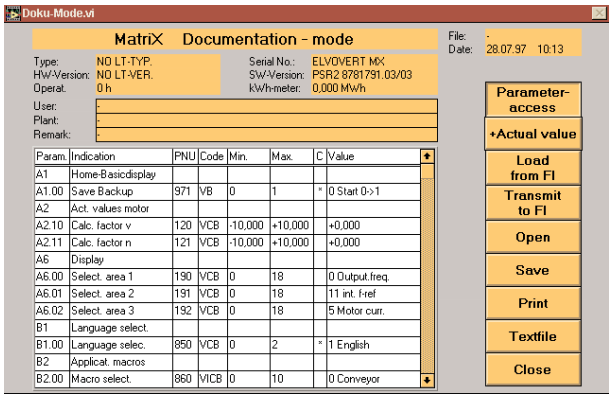
c. Parameter editor

With the displayed matrix, all parameters can be queried on-line and changed, if necessary. In order to be able not only to display but also to modify the parameters using the parameter editor, it is necessary to have user control (select the "User Control" button). After performing the routines:

A1.00 Home-Field "Save Backup"
B2.01 Applicat. Macros "Store USER-M1"
B4.00 Autotuning "Start tuning"
F1.00 Help functions "Test power part"
F2.00 Factory default "Return factory application" and
F2.01 Factory default "Return factory motor"

the respective line 0 must always be sent.

!! All modified parameters must be stored fail-safe by selecting A1.00 "Save backup", before the mains supply is disconnected!



d. Docu mode

Is used for archiving (storing on hard disk or floppy disk) the current parameter settings. In addition, stored parameter data can be transferred to any number of other inverters.

A complete list of parameters is printed by selecting "Print" (including actual values, if desired).

⇒ In Windows 95, 98 and NT, the program WordPad is opened. All formatting is saved, if the parameter list is saved in WordPad and then opened as a text file, e.g. in Microsoft Word, and then printed.

CAUTION:
The program transfers the current working parameters (incl. the current actual values), but not the contents of the user macros. In order to transfer these, the relevant user macro must first be opened with the parameter B2.03!

e. Error memory

Currently not available.

f. MATRIX Server

The server is a separate program that is automatically opened when the MATRIX software is started.
Press the "CON" key and then select the COM port and the bit rate (preferably COM1 and 19200 bit/s).

5. Operation

The MATRIX software package can only be used with the frequency inverter software version PSR2.02 or higher! If your inverter is still using an older software version, you can update using the program "FLASHcopy". However, all the parameters set in the inverter are deleted thereby, and the "Autotuning" function must be repeated.

To ensure proper operation, we recommend that you disable any screen savers.

Whenever more than one window is open, the reaction time of the program is increased. Therefore, we recommend that you close any windows that are not needed.

6. Deinstallation

De-installation under WINDOWS 3.1: Delete the program group MATRIX containing this software from your Windows interface.
Then delete all the files in the directory that you have selected, as well as all the files in the subdirectories PRIVAT and PUBLIC.
This removes all the files created during installation from your computer.

De-installation under WINDOWS 95: Click on the Start button and select Settings/System setup in the menu. Double-click on the symbol for software and follow the instructions on the next screen to uninstall MATRIX.

The following parameters can only be read out or modified on the PC using the MATRIX software. All these parameters are assigned to MATRIX area A1, which is reserved for the local keypad of the basic display (Home).

A1.00	Save backup	VB	Routine

0 . . . Start 0 ⇨ 1
1 . . . Store backup
2 . . . Stored

Unlike local mode on the keypad, the Save command is not issued automatically when you switch to the basic display (Home area). When parametrizing with the software program Matrix, the parameter A1.00 is used for saving.

Procedure:
1. Send line 1 *"Store backup"*
2. Wait for feedback 2 *"Stored"*
3. Send line 0 *"Start - 0 ⇨ 1"*

A1.01	Device-Mode	read only

0 . . . " "
1 . . . Mains disconnected
2 . . . Locked
3 . . . Mains off
4 . . . Disabled
5 . . . Stop
6 . . . Loading
7 . . . not enabled
8 . . . Mains missing
9 . . . Trip
10 . . Autotuning running
11 . . Test power part

The device mode corresponds to the display in field 1 of the basic display (Home).

A1.02	Operate-Mode	read only

0 . . . Remote
1 . . . Rem Loc
2 . . . Loc Rem
3 . . . Local
4 . . . Line
5 . . . Line Loc
6 . . . Loc Bus
7 . . . Local

The operate mode corresponds to the display in the field "Operate-Mode" of the basic display.

A1.03	Device status	read only

This parameter displays the current device state with the priorities:

- Display operating situation (lowest priority)
- Display selected parameter set
- Display limitation action
- Display warning
- Display trip (highest priority)

A1.04	LED-state	read only

0 . . . Not READY
1 . . . READY
2 . . . RUN
3 . . . TRIP

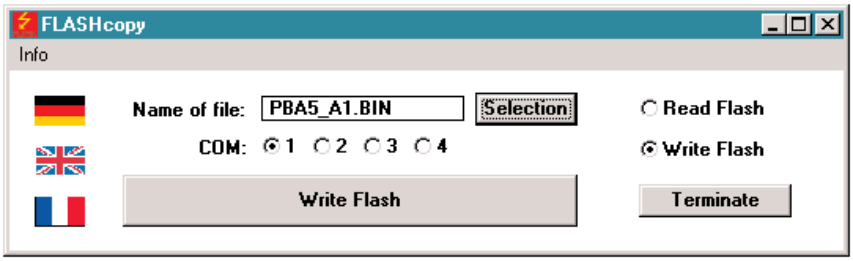
The LED state corresponds to the device state, which is displayed on one of the 3 colored LEDs on the keypad. If no LED is lit up, this corresponds to the state "Not READY".

FLASH-COPY

1. Installation

System requirements, installation and de-installation are the same as for the MatriX software.

2. Program features



The program FLASHcopy is used to read and write to the FLASH memory on the USER INTERFACE, which contains the inverter program.
The main application of "FLASHcopy" is the updating of your inverter software version. However, all the parameters set in the inverter are deleted thereby, and the "Autotuning" function must be repeated.

Moreover, you can read out all the current software stored on this chip, and save it to a file. This makes the duplication of user-specific settings for the operation of several inverters with the same configuration much easier.

First, select the correct COM port. If you have selected the wrong COM port, a timeout will be reported later, when you read or write to the chip.
Select whether you want to read or write to the FLASH chip.

The last step is naming the file.
If you are writing to the chip, you can select a bin-file from the subdirectory \PUBLIC. If you are reading, you can enter any filename you like.
Make sure that you do not overwrite one of your bin-files by mistake.

Files containing FLASH programs must have the file extension .bin. All *.bin files are stored in the subdirectory \PUBLIC. Other *.bin files can also be copied into this directory manually, if required.

In the event of an interruption during the data transfer to the inverter, switch off the inverter, press and hold the key "Matrix/Para" when you switch it on again. The yellow Ready-LED flashes. Now the *>pDRIVE< MX* is ready for a renewed data transfer.

Limitation Displays:

Message	Description, possible causes
delta Ud>	Pulse inhibit (charging connection open) due to dynamic undervoltage (limitation sum message)
U-Motor >	Pulse inhibit because motor current greater than thyristor current (limitation sum message)
U-DC limitation *)	Generator load (rapid deceleration) leads to increase in output frequency (to prolong deceleration time). (limitation U > +sum message)
I-limitation motor.*)	Motor current limitation is active and reduces the output frequency (limitation I > +sum message)
I-limitation generator *)	Generator current limitation is active and increases the output (limitation I > +sum message)
f-skip	The set frequency range masking is active (limitation sum message)
Motor temperature >	The motor protection model set with parameters E2.02 to E2.05 limits the output current. (limitation I > +sum message)
Drive temp. >	Excess temperature at the heatsink leads to a reduction of output current current. (limitation I > +sum message)

*) The display of this limitation is currently not in function.

Warnings:

Message	Description, possible causes
Memory fail	The error memory has only one valid block left (15 records already marked "invalid") → replace flash (warning: sum message).
DSP program Language 1 to Language 5 Font Bitmap	Program error in the respective segment → replace flash. (warning: sum message)
Bus Comm2	Communication error at bus (Profibus or RS232; bit 10: control OK=0) (warning: bus warning)
Undervoltage 1	Undervoltage parametrized for warning with E3.08
Motor temperature > Therm. SC	This motor thermistor evaluation is parametrized for warning with E2.01 (warning: sum message).
Overspeed	Motor speed monitoring is parametrized for warning with E2.09 (warning: sum message).

Trip Messages:

(Priority) Error message	Help-F1 Parameter	Description, possible causes
(34) Overvoltage	F1.02	Overvoltage in thyristor Decel. time too short ? or mains voltage too high ? Failure of mains phase during operation ?
(51) Undervoltage 1 (52) Undervoltage 2	F1.03	Undervoltage in thyristor Mains voltage available ? All phases available ? Mains fuses OK ? The inverter distinguishes two types: Underv. 1: U<< in operation, longer than permissible with parameter E3.09 Underv. 2: no mains voltage despite ON command from contactor control (after 2 sec)
(33) Overcurrent 1 (40) Overcurrent 2	F1.04	Overcurrent at inverter output Activate power part test! Short ? or earth fault ? The inverter distinguishes two types: Overcur. I>>, Overcur. Difference I>> (sizes 5 only)
(54) Ext. fault	F1.05	External Trip An external trip is reported by a terminal strip function Proper setting for parameter E3.02 ?
(57) 4 mA Error	F1.06	4 mA- fault A 4-20 mA ref. value is < 3 mA ->Wire break ? E3.01 ?
(58) Mot. Temp>	F1.07	Motor thermistor has picked up Motor overloaded ? External ventilator OK ?
(59) Thermistor SC	F1.08	Therm. SC Check thermistor wiring
(55) Mot. Trip	F1.09	Motor trip An external motor trip is reported by a terminal strip function Proper setting for parameter E2.11 ?
(60) Mot. Overload	F1.10	Motor overload ! The thermal motor model has performed an overload trip. See parameters E2.02 to E2.07
(61) Stall protection	F1.11	Stall protection The motor does not start, is mechanically blocked or very overloaded.
(56) Insul. Trip	F1.12	Insulation trip Ground contact in motor or motor cable

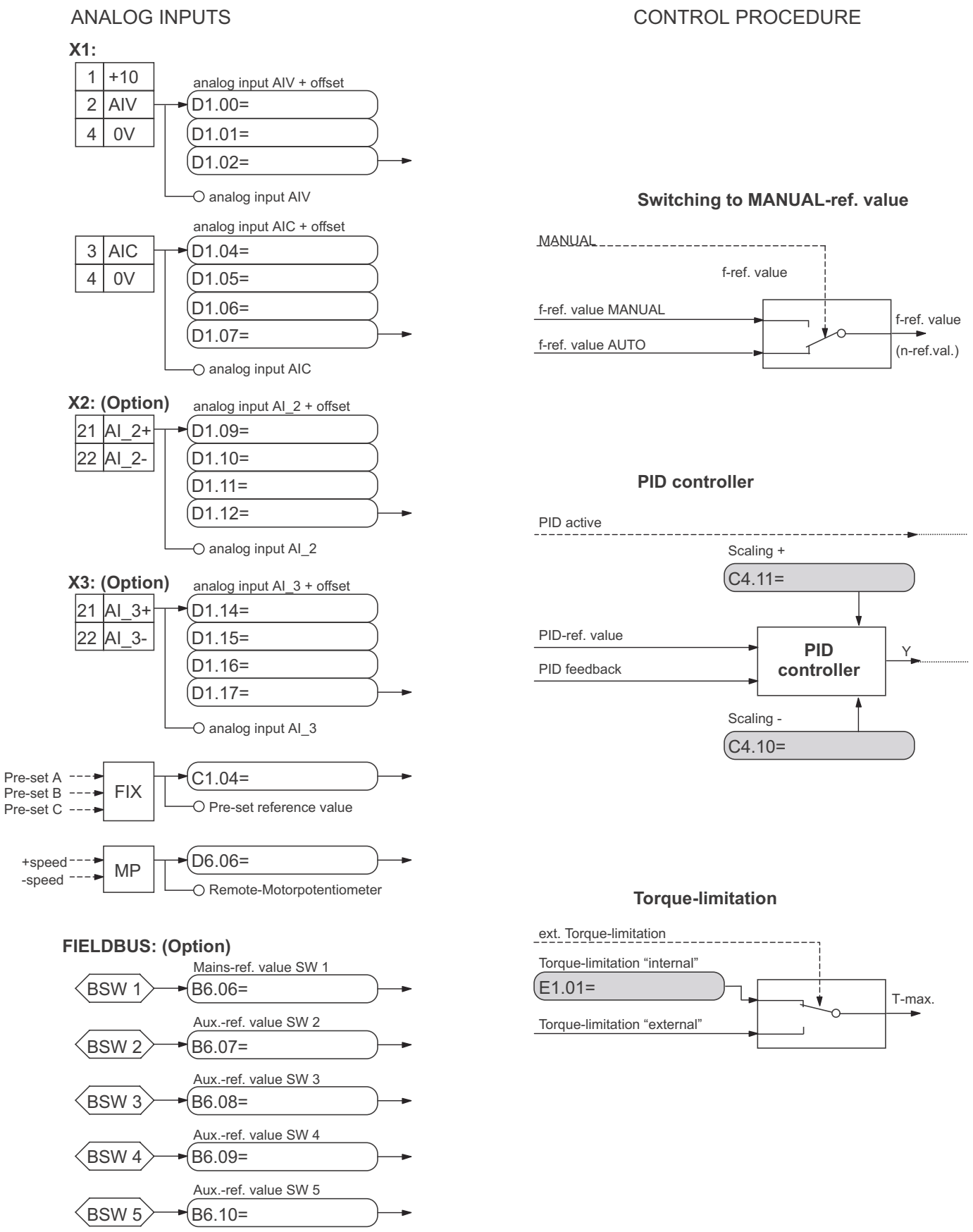
(Priority) Error message	Help-F1 Parameter	Description, possible causes
(64) BR unit error	F1.13	Trip of external braking unit
(62) Overspeed	F1.14	Overspeed The speed is greater than the maximum value set with parameter E2.10.
(49) Overtemp. 1 (47) Overtemp. 2	F1.16	Temperature at heatsink Check device fan cubicle ventilation, and possible air filter Ambient temperature too high ? The inverter distinguishes two types: Overtemp. 1: cooler temperature too high Overtemp. 2: A3.03 > 100°C: overtemp. or Temperature sensor KS A3.03 < -25°C: temperature sensor wire break
(41) ZB Temp>	F1.17	Overtemperature in central component Temperature in control part too high. Fan OK ? Check cabinet ventilation
(36) PoCi-Fault	F1.18	Defect in power circuit Replace respective components.
(35) AR-Fault 1.0	F1.19	Error on print "Drive control"
(48) AR-Fault 2.0 (10) AR-Fault 3.0 (11) AR-Fault 3.1 (23) AR-Fault 3.2		Replace component The inverter distinguishes three types: AR-Fault: 1: ref. voltage error, ext. 24 V buffer voltage too low AR-Fault: 2: ASIC error AR-Fault: 3.x: error in EEPROM (replace)
(15-18,20) Int. Comm. 1.0 to 1.4 (19) Int. Comm. 2.0 (37) Int. Comm. 3.0	F1.20	Error in internal communication Reset ? Replace electronics The inverter distinguishes three types: Int. Comm. 1.0 to 1.4: Control-Link error -> no communication Int. Comm. 2: AR program wrong or incorrectly transferred Int. Comm. 3: Enable error -> screen input DI5 !!
(1) UI Fault 1.0 (2) UI-Fault 2.0 (3) UI-Fault 2.1 (4-6) UI-Fault 3.0 to 3.2 (7-9) UI-Fault 4.0 to 4.2 (12) UI-Fault 5.0 (13) UI-Fault 6.0 (14) UI-Fault 7.0	F1.21	Defect on control print user interface (UI) Perform control circuit test Replace component The inverter distinguishes eight types: UI-Fault 1: Processor error (replace UI) UI-Fault 2.0: Code error (replace flash) UI-Fault 2.1: Code error (replace flash) UI-Fault 3: Task overflow (replace UI+ flash) UI-Fault 4: Backup error (replace flash) UI-Fault 5: LCD error (replace UI) UI-Fault 6: FLASH error (replace flash) UI-Fault 7: error in shift register (replace UI)

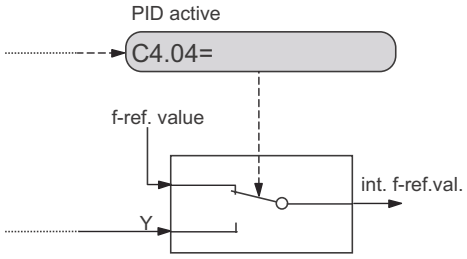
(Priority) Error message	Help-F1 Parameter	Description, possible causes
(22) BUS-Com.1	F1.23	Watch-Dog: Error during serial data transfer between DP master and PB01 The inverter did not receive data from the SPS (DP master) for longer than the set Watch-Dog time - bus wire interrupted or SPS error.
(50) BUS-Com.2	F1.24	Profibus DP master does not send "Guide OK" in control word Bit 10 is set to 0 during bus control - error in SPS or in bus module
(21) Com. card-fault	F1.25	PB01 cannot be initialized properly PB01 defect or installed incorrectly
(65) Charge Protect.	F1.26	Charge resistance monitor: Mains switched on/off too often or charging connection defect (the error lasts approx. 5 minutes !)
(66) ON Lock	F1.27	ONlock: Due to failure of mains fuses, contactor, cabinet overtemp., charging connection defect or ventilator protection switch
(0) +24V off	F1.28	no trip - 24V control voltage was switched off (mains voltage and 24V buffer voltage)
(32) Invalid entry	F1.29	Invalid entry in error memory Error memory has no entries yet or is defect (replace flash)

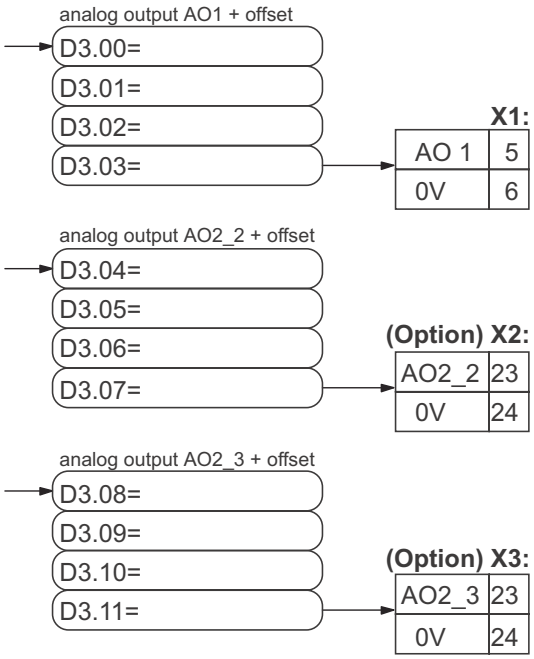
See Service Manual for more detailed information about service problems, such as error diagnosis, troubleshooting, spare parts storage etc.

Notes:

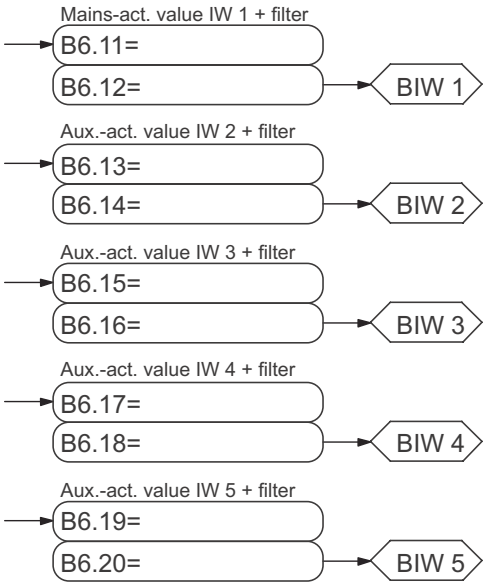
Schematic diagram 1:

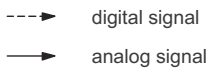




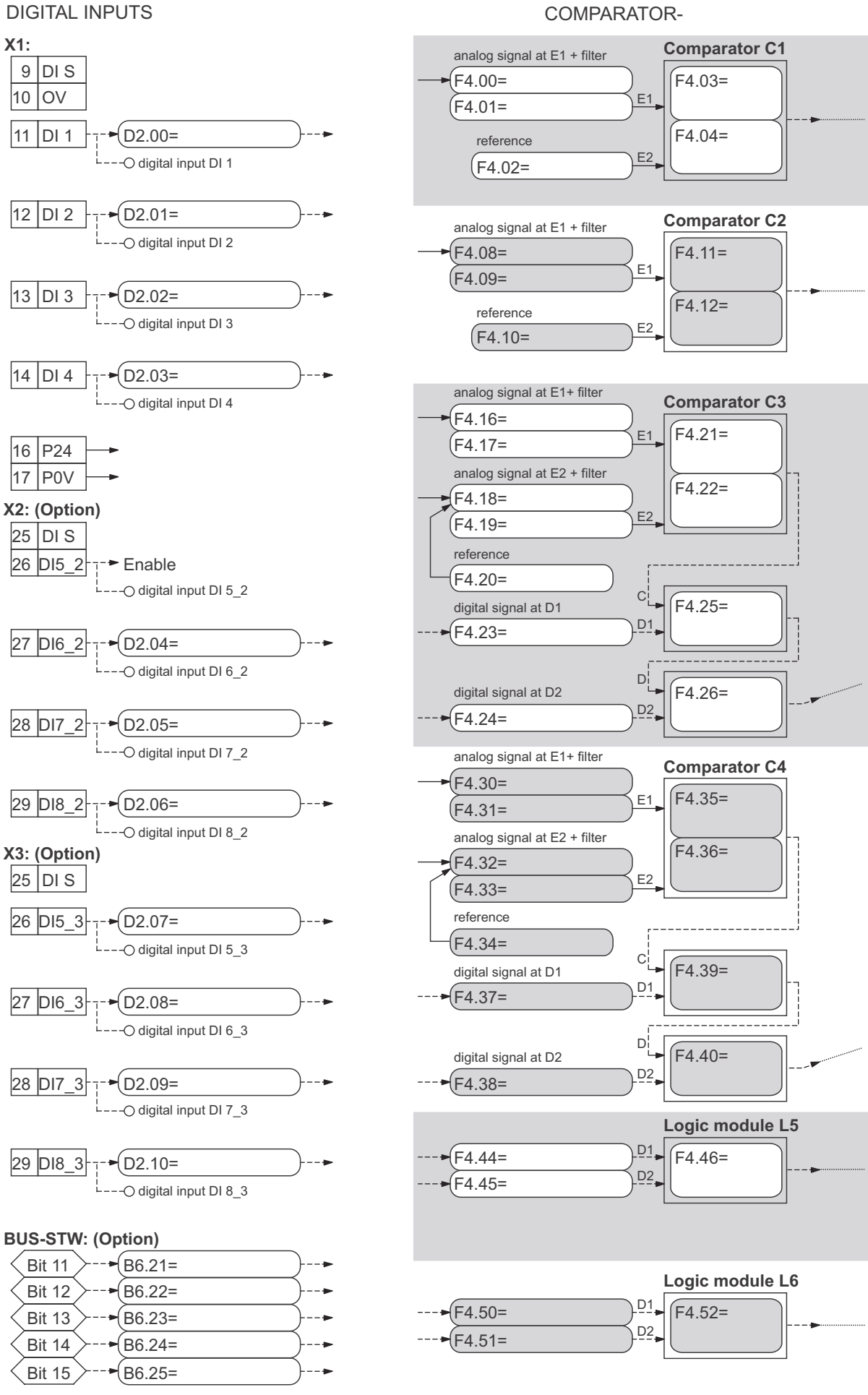


(Option) FIELDBUS:

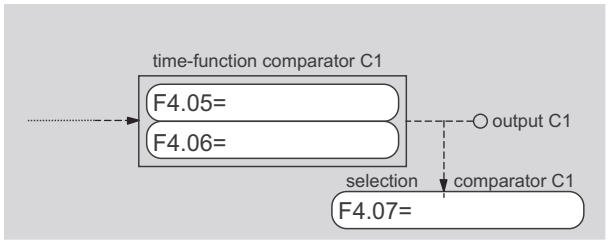


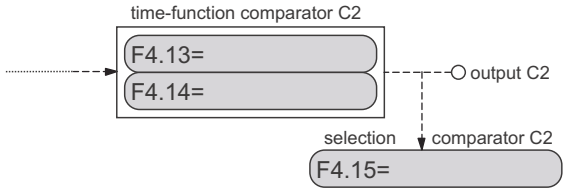


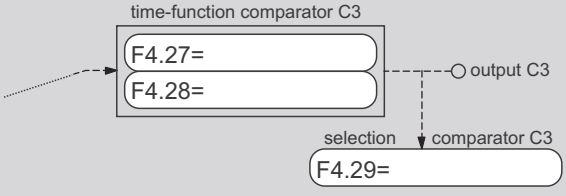
Schematic diagram 2:

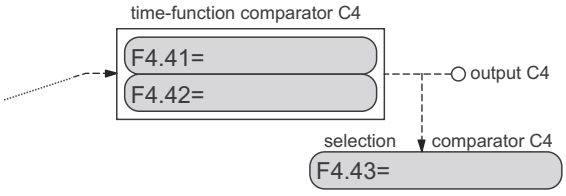


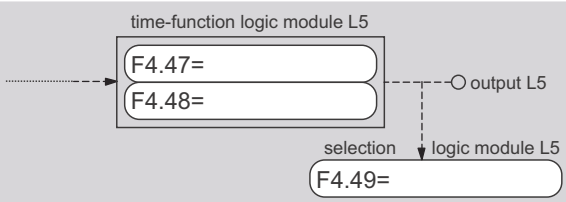
LOGIC MODULES

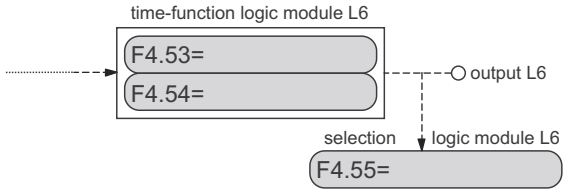




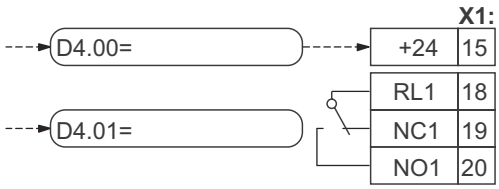


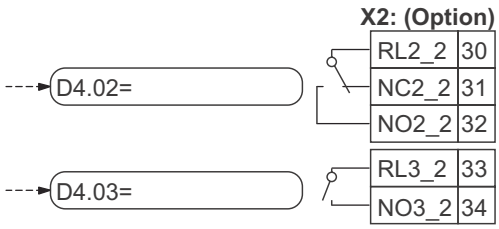


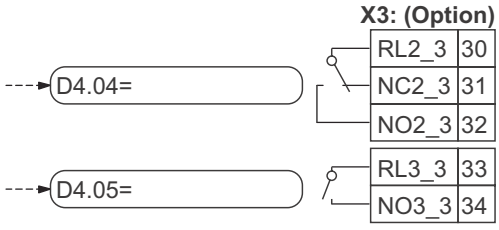


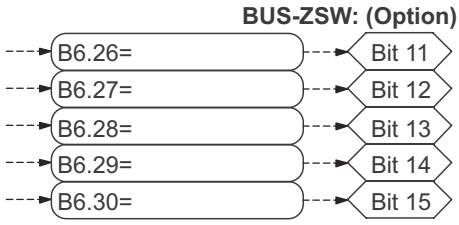


DIGITAL OUTPUTS









digital signal

analog signal

Notes:

>pDRIVE< MX basic Frequency inverter
Start-up log

Spg.:	❑ 400 V						
Type:	❑ 15/18	❑ 18/22	❑ 22/30	❑ 30/37	❑ 37/45	❑ 45/55	❑ 55/75
	❑ 75/90	❑ 90/110	❑ 110/132	❑ 132/160	❑ 160/200	❑ 200/250	❑ 250/315
	❑ 315/400	❑ 400/500	❑ 500/630				

Serial number:	Code:
Customer / Company:	Supplier / Company:
Delivery date:	Start-up date:

Parameter settings

Para.No.	Name	Macro M1 Conveyor, piston pump separator	Macro M2 Centrifugal pump, exhaust fan fan	Macro M3 Pump with PID controller	User Macro 1	User Macro 2
A 2	**Motor values**					
A 2.10	Process scaling	1.000	1.000	1.000		
A 2.11	Machine scaling	1.000	1.000	1.000		
A 3	**Inverter values**					
A 3.05	Drive reference	text	text	text		
A 3.06	Nominal current “C”	text	text	text		
A 3.07	Hardware version	text	text	text		
A 3.08	Software type	text	text	text		
A 3.09	Software version	text	text	text		
A 3.10	Serial number	text	text	text		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
A 6	**Display configuration**					
A 6.00	Selection zone 1	output frequency	output frequency	output frequency		
A 6.01	Selection zone 2	speed ref.	speed ref.	speed ref.		
A 6.02	Selection zone 3	motor current	motor current	motor current		
A 6.03	View limitation	not visible	not visible	not visible		
B 1	**Language selection**					
B 1.00	Language selection	German	German	German		
B 2	**Macro configuration**					
B 2.01	Store user macro 1	start	start	start		
B 2.02	Store user macro 2	start	start	start		
B 2.03	Macro selection	**conveyor**	**centrif. pump**	**pump + PID**		
B 2.04	Mulit-configuration	not active	not active	not active		
B 3	**Motor data**					
B 3.00	Nominal power	default value	default value	default value		
B 3.01	Nominal current	default value	default value	default value		
B 3.02	Nominal voltage	default value	default value	default value		
B 3.03	Nominal frequency	default value	default value	default value		
B 3.04	Nominal speed	default value	default value	default value		
B 3.05	Mains voltage	default value	default value	default value		
B 4	**Auto tune**					
B 4.00	Start tuning	Start 0 → 1	Start 0 → 1	Start 0 → 1		
B 4.01	Rotor coefficient	default value	default value	default value		
B 4.02	Rotor-time constant	default value	default value	default value		
B 4.03	Stator resistor	default value	default value	default value		
B 4.04	Fluxing current	default value	default value	default value		
B 6	**Comm. menu**					
B 6.00	Select bus	no bus	no bus	no bus		
B 6.01	Selection remote	terminals	terminals	terminals		
B 6.02	Slave address	0	0	0		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
B 6.03	Stop Mode T. out	alarm only	alarm only	alarm only		
B 6.04	Time OUT	0.0 s	0.0 s	0.0 s		
B 6.05	On after OFF 1, 3	not possible	not possible	not possible		
B 6.06	Main-reference 1	not used	not used	not used		
B 6.07	Aux. reference 2	not used	not used	not used		
B 6.08	Aux. reference 3	not used	not used	not used		
B 6.09	Aux. reference 4	not used	not used	not used		
B 6.10	Aux. reference 5	not used	not used	not used		
B 6.11	Actual value 1	f-output sig.	f-output sig.	f-output sig.		
B 6.12	Act. val. 1 filter time	0.10 s	0.10 s	0.10 s		
B 6.13	Aux. act. value 2	n-output sig.	n-output sig.	n-output sig.		
B 6.14	Act. val. 2 filter time	0.10 s	0.10 s	0.10 s		
B 6.15	Aux. act. value 3	output current	output current	output current		
B 6.16	Act. val. 3 filter time	0.10 s	0.10 s	0.10 s		
B 6.17	Aux. act. value 4	torque sig.	torque sig.	torque sig.		
B 6.18	Act. val. 4 filter time	0.10 s	0.10 s	0.10 s		
B 6.19	Aux. act. value 5	power	power	power		
B 6.20	Act. val. 5 filter time	0.10 s	0.10 s	0.10 s		
B 6.21	Bit 11 control word	not used	not used	not used		
B 6.22	Bit 12 control word	not used	not used	not used		
B 6.23	Bit 13 control word	not used	not used	not used		
B 6.24	Bit 14 control word	not used	not used	not used		
B 6.25	Bit 15 control word	not used	not used	not used		
B 6.26	Bit 11 status word	DI1	DI1	DI1		
B 6.27	Bit 12 status word	DI2	DI2	DI2		
B 6.28	Bit 13 status word	DI3	DI3	DI3		
B 6.29	Bit 14 status word	DI4	DI4	DI4		
B 6.30	Bit 15 status word	DI6_2	DI6_2	DI6_2		
B 6.34	Com. PPO Type	type 2	type 2	type 2		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
C 1	**General functions**					
C 1.00	Increase start torque	**1%**	0%	0%		
C 1.01	Increase steady torque	10 Hz	10 Hz	10 Hz		
C 1.02	Stop mode	decel. ramp	decel. ramp	decel. ramp		
C 1.03	Braking mode	no brak. function	no brak. function	no brak. function		
C 1.04	Pre-set reference	not used	not used	not used		
C 1.05	Pre-set ref. 1	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.06	Pre-set ref. 2	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.07	Pre-set ref. 3	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.08	Pre-set ref. 4	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.09	Pre-set ref. 5	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.10	Pre-set ref. 6	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.11	Pre-set ref. 7	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.12	Pre-set ref. 8	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.13	Jog frequency	0.00 Hz	0.00 Hz	0.00 Hz		
C 1.14	Economy mode	not active	**step 1**	**step 1**		
C 2	**Ramps**					
C 2.00	Acceleration ramp 1	**5.0 s**	**10.0 s**	0.0 s		
C 2.01	Deceleration ramp 1	**5.0 s**	**10.0 s**	0.0 s		
C 2.02	Acceleration ramp 2	20.1 s	20.1 s	20.1 s		
C 2.03	Deceleration ramp 2	20.1 s	20.1 s	20.1 s		
C 2.04	S-ramp	no S-ramp	no S-ramp	no S-ramp		
C 2.05	S-ramp mode	Begin + End	Begin + End	Begin + End		
C 3	**Speed range**					
C 3.00	Minimum frequency	0.00 Hz	**5.00 Hz**	**5.00 Hz**		
C 3.01	Maximum frequency	**50.0 Hz**	**50.0 Hz**	**50.0 Hz**		
C 3.02	Direction enable	**enable FW/RV**	disable RV	disable RV		
C 3.03	Rotary field	U – V – W	U – V – W	U – V – W		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
C 4	**PID configuration**					
C 4.04	PID active	no	no	**yes**		
C 4.05	Prop. gain(kp)	0.0%	0.0%	**20.0%**		
C 4.06	Integration time (Tn)	0.00 s	0.00 s	**10.00 s**		
C 4.07	Derive time (Tv)	0.00 s	0.00 s	**0.00 s**		
C 4.08	Ref. acceleration ramp	0.0 s	0.0 s	**10.0 s**		
C 4.09	Ref. deceleration ramp	0.0s	0.0 s	**10.0 s**		
C 4.10	Output scaling -	0.00 Hz	0.00 Hz	**10.00 Hz**		
C 4.11	Output scaling +	0.00 Hz	0.00 Hz	**50.0 Hz**		
C 6	**Special functions**					
C 6.00	Contactor control	not active	not active	not active		
D 1	**Analogue inputs**					
D 1.00	AIV selection	not used	**f-ref. manual**	**PID-ref.**		
D 1.01	AIV value 0%	0.01 Hz	**0.00 Hz**	**0,00%**		
D 1.02	AIV value 100%	50.01 Hz	**50.0 Hz**	**100.0%**		
D 1.03	AIV filter time	0.05 s	0.05 s	0.05 s		
D 1.04	AIC selection	**f-ref AUTO**	**f-ref AUTO**	**PID feedback**		
D 1.05	AIC signal	4-20 mA	4-20 mA	4-20 mA		
D 1.06	AIC value 0%	**0.00 Hz**	**0.00 Hz**	**0,00%**		
D 1.07	AIC value 100%	**50.0 Hz**	**50.0 Hz**	**100,00%**		
D 1.08	AIC filter time	0.05 s	0.05 s	0.05 s		
D 1.09	AI_2 selection	not used	not used	not used		
D 1.10	AI_2 signal type	0-20 mA	0-20 mA	0-20 mA		
D 1.11	AI_2 value 0%	0.01 Hz	0.01 Hz	0.01 Hz		
D 1.12	AI_2 value 100%	50.01 Hz	50.01 Hz	50.01 Hz		
D 1.13	AI_2 filter time	0.05 s	0.05 s	0.05 s		
D 1.14	AI_3 selection	not used	not used	not used		
D 1.15	AI_3 signal type	0-20 mA	0-20 mA	0-20 mA		
D 1.16	AI_3 value 0%	0.01 Hz	0.01 Hz	0.01 Hz		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
D 1.17	AI_3 value 100%	50.01 Hz	50.01 Hz	50.01 Hz		
D 1.18	AI_3 filter time	0.05 s	0.05 s	0.05 s		
D 2	**Logic inputs**					
D 2.00	DI1 selection	**start FWD**	**start FWD**	**start FWD**		
D 2.01	DI2 selection	**start REV**	**manual (auto)**	**PID-enable**		
D 2.02	DI3 selection	**2.ramp**	**EXT-fault**	**EXT-fault**		
D 2.03	DI4 selection	**EXT-reset**	**EXT-reset**	**EXT-reset**		
D 2.04	DI6_2 selection	not used	not used	not used		
D 2.05	DI7_2 selection	not used	not used	not used		
D 2.06	DI8_2 selection	not used	not used	not used		
D 2.07	DI5_3 selection	not used	not used	not used		
D 2.08	DI6_3 selection	not used	not used	not used		
D 2.09	DI7_3 selection	not used	not used	not used		
D 2.10	DI8_3 selection	not used	not used	not used		
D 3	**Analogue outputs**					
D 3.00	AO1 selection	**f-output**	**f-output**	**f-output**		
D 3.01	AO1 signal	4-20 mA	4-20 mA	4-20 mA		
D 3.02	AO1 min. value	0%	0%	0%		
D 3.03	AO1 max. value	100%	100%	100%		
D 3.04	AO2_2 selection	not used	not used	not used		
D 3.05	AO2_2 signal	4-20 mA	4-20 mA	4-20 mA		
D 3.06	AO2_2 min. value	0%	0%	0%		
D 3.07	AO2_2 max. value	100%	100%	100%		
D 3.08	AO2_3 selection	not used	not used	not used		
D 3.09	AO2_3 signal	4-20 mA	4-20 mA	4-20 mA		
D 3.10	AO2_3 min. value	0%	0%	0%		
D 3.11	AO2_3 max. value	100%	100%	100%		
D 4	**Logic outputs**					
D 4.00	+24 digital output	ON (24V)	ON (24V)	ON (24V)		
D 4.01	Relay output 1	**ready+run**	**ready+run**	**ready+run**		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
D 4.02	Relay output 2_2	not used	not used	not used		
D 4.03	Relay output 3_2	not used	not used	not used		
D 4.04	Relay output 2_3	not used	not used	not used		
D 4.05	Relay output 3_3	not used	not used	not used		
D 4.06	f-Level ON	5.01 Hz	5.01 Hz	5.01 Hz		
D 4.07	f-Level OFF	2.01 Hz	2.01 Hz	2.01 Hz		
D 4.08	Hyst. f = fREF	0.5 Hz	0.5 Hz	0.5 Hz		
D 5	**Catch on the fly**					
D 5.00	Encoder/slip compens.	no encoder	no encoder	no encoder		
D 5.01	Dyn. slip compensation	low	low	low		
D 6	**Electric Potentiom.**					
D 6.00	Local MP selection	frequency ref.	frequency ref.	frequency ref.		
D 6.01	Loc/MP min. value	0.00 Hz	0.00 Hz	0.00 Hz		
D 6.02	Loc/MP max. value	50.0 Hz	50.0 Hz	50.0 Hz		
D 6.03	Loc/MP accel. time	10.0 s	10.0 s	10.0 s		
D 6.04	Loc/MP decel. time	10.0 s	10.0 s	10.0 s		
D 6.05	Local ref. storage	not active	not active	not active		
D 6.06	Rem. MP selection	not used	not used	not used		
D 6.07	Rem. MP min. value	0.01 Hz	0.01 Hz	0.01 Hz		
D 6.08	Rem. MP max. value	50.01 Hz	50.01 Hz	50.01 Hz		
D 6.09	Rem. MP accel. time	10.0 s	10.0 s	10.0 s		
D 6.10	Rem. MP decel. time	10.0 s	10.0 s	10.0 s		
D 6.11	Rem. MP commands	terminals	terminals	terminals		
D 6.12	Rem ref. storage	not active	not active	not active		
E 1	**Drive overload**					
E 1.00	Current max. value	150%	**125%**	**125%**		
E 1.01	Torque max. value	200%	200%	200%		
E 2	**Motor protection**					
E 2.00	Thermistor input	**not active**	**not active**	**not active**		
E 2.01	Thermistor protection	trip	trip	trip		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
E 2.02	I max at 0 Hz	**50%**	31%	31%		
E 2.03	I max at fnom	**100%**	**100%**	**100%**		
E 2.04	Therm. f-limit	30 Hz	30 Hz	30 Hz		
E 2.05	Motor-time constant	**5 min**	**5 min**	**5 min**		
E 2.06	Stalling time	60 s	60 s	60 s		
E 2.07	Stalling frequency	5 Hz	5 Hz	5 Hz		
E 2.08	Stalling current	80%	80%	80%		
E 2.09	n>> protection	trip	trip	trip		
E 2.10	n max motor	3200 rpm	3200 rpm	3200 rpm		
E 2.11	Ext. motor trip	not active	not active	not active		
E 2.12	Delay for E2.11	1.0 s	1.0 s	1.0 s		
E 3	**Fault configuration**					
E 3.00	Autorestart	not active	not active	not active		
E 3.01	Loss of 4-20 mA	not active	not active	not active		
E 3.02	External fault	not active	**N.O. ready+r**	**N.O. ready+r**		
E 3.03	Delay for E3.02	0.0 s	0.0 s	0.0 s		
E 3.04	Insulation fault	not active	not active	not active		
E 3.05	Delay for E3.04	10.0 s	10.0 s	10.0 s		
E 3.06	Braking fault	N.O. ready+run	N.O. ready+run	N.O. ready+run		
E 3.07	Delay for E3.06	5.0 s	5.0 s	5.0 s		
E 3.08	Undervoltage	no fault	no fault	no fault		
E 3.09	Delay for E3.06	2.0 s	2.0 s	2.0 s		
E 3.10	Local reset	active	active	active		
E 4	**Control configuration**					
E 4.00	Loc/Rem ref.	local/remote	local/remote	local/remote		
E 4.01	Loc/Rem control	local/remote	local/remote	local/remote		
E 4.02	Loc/Rem-switch	keypad	keypad	keypad		
E 4.03	Control mode local	keypad	keypad	keypad		
E 4.04	Local STOP-key	local active only	local active only	local active only		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
E 5	**Skip frequency**					
E 5.00	Skip frequency	5.00 Hz	5.00 Hz	5.00 Hz		
E 5.01	Hysteresis	0.00Hz	0.00 Hz	0.00 Hz		
E 6	**Switching frequency**					
E 6.00	Min. switching frequency	2.5 kHz	2.5 kHz	2.5 kHz		
E 6.01	Max. switching frequency	2.5 kHz	2.5 kHz	2.5 kHz		
F 1	**Text-Help**					
F 1.00	Test power part	start	start	start		
F 1.01	Test control part	start	start	start		
F 2	**Factory settings**					
F 2.00	Return fact. application	start	start	start		
F 2.01	Return fact. motor	start	start	start		
F 4	**Function blocks**					
F 4.00	C1 signal to E1	0.0%	0.0%	0.0%		
F 4.01	C1 filter for E1	0.1 s	0.1 s	0.1 s		
F 4.02	C1 reference	0.0%	0.0%	0.0%		
F 4.03	C1 function	E1 > E2	E1 > E2	E1 > E2		
F 4.04	C1 hysteresis/Band	5.0%	5.0%	5.0%		
F 4.05	C1 time function	ON-delay	ON-delay	ON-delay		
F 4.06	C1 time set	0.0 s	0.0 s	0.0 s		
F 4.07	C1 selection	not used	not used	not used		
F 4.08	C2 signal to E1	0.0%	0.0%	0.0%		
F 4.09	C2 filter for E1	0.1 s	0.1 s	0.1 s		
F 4.10	C2 reference	0.0%	0.0%	0.0%		
F 4.11	C2 function	E1 > E2	E1 > E2	E1 > E2		
F 4.12	C2 hysteresis/band	5.0%	5.0%	5.0%		
F 4.13	C2 time-function	ON-delay	ON-delay	ON-delay		
F 4.14	C2 time set	0.0 s	0.0 s	0.0 s		
F 4.15	C2 selection	not used	not used	not used		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro	
F 4.16	C3 signal to E1	0.0%	0.0%	0.0%		
F 4.17	C3 filter for E1	0.1 s	0.1 s	0.1 s		
F 4.18	C3 signal to E2	Ref. value	Ref. value	Ref. value		
F 4.19	C3 filter for E2	0.1 s	0.1 s	0.1 s		
F 4.20	C3 reference	0.0%	0.0%	0.0%		
F 4.21	C3 function	E1 > E2	E1 > E2	E1 > E2		
F 4.22	C3 hysteresis/Band	5.0%	5.0%	5.0%		
F 4.23	C3 Input D1	State ZERO	State ZERO	State ZERO		
F 4.24	C3 Input D2	State ZERO	State ZERO	State ZERO		
F 4.25	C3 logic 'a' function	OR	OR	OR		
F 4.26	C3 logic 'b' function	OR	OR	OR		
F 4.27	C3 time-function	ON-delay	ON-delay	ON-delay		
F 4.28	C3 time-set	0.0 s	0.0 s	0.0 s		
F 4.29	C3 selection	not used	not used	not used		
F 4.30	C4 signal to E1	0.0%	0.0%	0.0%		
F 4.31	C4 filter for E1	0.1 s	0.1 s	0.1 s		
F 4.32	C4 signal to E2	Ref. value	Ref. value	Ref. value		
F 4.33	C4 filter for E2	0.1 s	0.1 s	0.1 s		
F 4.34	C4 reference	0.0%	0.0%	0.0%		
F 4.35	C4 function	E1 > E2	E1 > E2	E1 > E2		
F 4.36	C4 hysteresis/Band	5.0%	5.0%	5.0%		
F 4.37	C4 Input D1	State ZERO	State ZERO	State ZERO		
F 4.38	C4 Input D2	State ZERO	State ZERO	State ZERO		
F 4.39	C4 logic 'a' function	OR	OR	OR		
F 4.40	C4 logic 'b' function	OR	OR	OR		
F 4.41	C4 time-function	ON-delay	ON-delay	ON-delay		
F 4.42	C4 time-set	0.0 s	0.0 s	0.0 s		
F 4.43	C4 selection	not used	not used	not used		
F 4.44	L5 signal to D1	State ZERO	State ZERO	State ZERO		

Para.No.	Name	Macro M1	Macro M2	Macro M3	User Macro 1	User Macro 2
F 4.45	L5 signal to D2	State ZERO	State ZERO	State ZERO		
F 4.46	L5 logic function	OR	OR	OR		
F 4.47	L5 time-function	ON-delay	ON-delay	ON-delay		
F 4.48	L5 time-set	0.0 s	0.0 s	0.0 s		
F 4.49	L5 selection	not used	not used	not used		
F 4.50	L6 signal to D1	State ZERO	State ZERO	State ZERO		
F 4.51	L6 signal to D2	State ZERO	State ZERO	State ZERO		
F 4.52	L6 logic function	OR	OR	OR		
F 4.53	L6 time-function	ON-delay	ON-delay	ON-delay		
F 4.54	L6 time-set	0.0 s	0.0 s	0.0 s		
F 4.55	L6 selection	not used	not used	not used		
F 6	**Code lock**					
F 6.00	Code	0	0	0		
F 6.01	Code value	0	0	0		
F 6.02	Paramet-Access	RS 232	RS 232	RS 232		
F 6.03	Pulse inhibit	No	No	No		

Data stored into the USER macro ?

❑ yes

❑ no

Commissioned by: _____

Date: _____

Signature: _____

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ELIN EBG Elektronik GmbH
Power Drive Serices Ltd.
Unit 1, Victoria St. Ind. Est. Leigh,
Lancs WN7 5SE, UK.
Tel. +44 (0)1942 260206, Fax +44(0) 1942 260525
www.inverter.co.uk