Operating instructions

fimotec – fischer
Montagetechnik

Frequency control unit FSM-237 for three-phase motors

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CE

In your own interest:
Please read these instructions and keep them in a safe place.
Please observe and follow the safety information.

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1 General

In this manual, you will find all important information regarding the mounting, connection, setting and operation of your FSM 237 device.
In addition, you will find information as well as important warnings for your safety.
Please observe:
Devices of the FSM 237 series are specially adapted frequency converters for the actuation of three-phase asynchronous motors, particularly for belt drives. The devices generate a mains-independent output frequency for the motor. The motor has smooth running behaviour due to the sinusoidal output current.

1.1 The product

- Frequency converter with output voltage stabilization
- Mains frequency-independent, adjustable output frequency (speed)
- Can be used for mains voltages from 95 - 253 V~ 50 or 60 Hz
- Adjustable current limit for maximum motor current
- Soft start / soft stop can be adjusted separately
- Analog setpoint setting
- Cycling for motor output
- Backup copy of work parameters and factory settings can be called up
- Switchable via control signal of PLC or with a sensor or potential-free contact
- Temperature monitoring of power output stage
- Display of all values in original units V~; A~; T°C; Hz; V-; mA-; Time s
- 3 control inputs and two 24V= outputs are available

1.2 Guide for these instructions

Used signal words and symbols

Symbol	Signal word	Meaning
	Danger	Warning of potentially serious to fatal injuries The lightning symbol warns against dangers due to electrical current.
	Warning	Warning of potentially minor injuries or potential damage to property
	Caution	Warning of potential defects / destruction of the device
	Important note **Important tip**	Here, important information or a tip is given concerning the function.

1.3 Safety-related information for the user

These instructions contain the required information for the intended use of the device described herein. They are directed toward technically qualified personnel.

Qualified personnel are people who have been authorized by persons responsible for the safety of the system to execute the required activities and are able to recognize potential dangers and avoid them based on their training, experience and instruction, as well as their knowledge of relevant standards, regulations, accident prevention regulations and operating conditions (definition of skilled personnel according to IEC 364).

Caution: Danger due to electric voltage.
Nonobservance can lead to death, serious bodily injury, or property damage.

The following safety information is for your protection, the protection of third parties as well as the protection of the device. You should therefore observe it under all circumstances.

- Disconnect the power supply before installation or dismantling work, as well as when changing a fuse or making changes to the setup.
- Observe the valid accident prevention and safety regulations for your specific application.
- Before commissioning, check whether the nominal voltage of the device agrees with the local mains voltage.
- Emergency Stop mechanisms must remain active in all operating modes. Unlocking the Emergency Stop mechanisms must not result in uncontrolled reactivation.
- The electrical connections must be covered.
- Protective conductor connections must be checked for perfect function after installation.

Operating environment

- The device must not come into direct contact with water.
- When changing from cold to warm environments, allow the device to temper for a few hours before putting it into operation; otherwise, damage could occur due to condensation water.
- Do not install the control device near devices which generate strong electromagnetic fields. The function could be disturbed as a result.
- Also avoid environments which are very hot, cold or wet.

Power supply

- Only connect the device to a grounded mains socket with a mains voltage of 95-253 V~/50 Hz or 95-253 V~/60 Hz.
- If you notice malfunctions, disconnect the device from the mains. Have the device checked by qualified, skilled personnel, and repaired if necessary.

The device

- For safety and licensing reasons (CE), it is not permitted to convert and/or modify the device.
- The device meets the valid low-voltage and EMC directive.

Operation

- The device only functions correctly when it is correctly installed and operated. In the event of malfunctions or unclear operating states, you should check the device and remedy the malfunction (see chap. "Error list") or have it remedied.
- To avoid the risk of injury, do not allow uninstructed personnel or other vulnerable or endangered personnel to operate the device without supervision.

Warning:

For applications requiring constant switching ON and OFF of the motor (e.g., cycle operation, etc.), the control input provided for this or the integrated cycle function must be used. If the load current circuit is interrupted via a switch or relay, the device could be damaged.

If the device is switched on, the device plug on the operated motor must never be plugged in or unplugged. The device could be damaged by doing this.

- Parameters which are in the menu structure but are not described in these instructions represent spaceholders which either have no function or are, in the current version, not yet meant for use. Therefore, avoid activating these menu items or contact Support.

1.4 Intended use

The device described here is an electrical piece of equipment for use in industrial systems.
It is designed to control three-phase asynchronous motors.
A use other than the one described above is improper and can result in injuries as well as property damage.

(Further information about this topic can be found in the "Safety information" chapter).

2 Application

The electronic frequency converter FSM 237 is used for the infinitely variable speed control of three-phase asynchronous motors, particularly for belt drives.

The device works according to the pulse width modulation principle within the half-waves with adjustable period, 10 - 60 Hz; the speed is adjusted by setting via the foil keyboard embedded in the housing cover or can alternatively be selected via 0-10 V DC, 4-20 mA or an external 10 kOhm potentiometer.

After switching on the mains voltage, the integrated, adjustable soft start is started and ensures the speed starts up jerk-free up to the set frequency. A limiter stage limits the load current of the capacitors to 6 A in the moment of switch-on. Possible switch-on peaks are minimized this way. Furthermore, both the soft start as well as the soft stop are activated via the control input when the load output is switched on/off. Both times can be adjusted separately.

The control inputs allow the device to be switched on and off by another system (PLC, initiator, sensors, etc.). The control device therefore provides its own supply voltage of +24 V DC. Switching on or off via an external voltage of + 24 V DC is also possible.

Via the additionally integrated 24V= outputs, external devices can be operated of controlled, depending on the logic specification.

The motor can be run in cycle operation via adjustable switch-on and -off times (cycle times).

Note

By determining the mains voltage and output current, changes to these are registered immediately and compensated for by a controller stage, i.e. the speed remains stable. This way, smooth running is guaranteed.

3 Installation

There are 2 bores and 2 elongated holes accessible from the outside for fastening the device. These are separated from the housing interior.

Important note

Fasten the device to a vibration-free surface.

Caution:

Please make sure that the ribbon cable and control cable are not pinched against the housing in the interior. Pinching can cause short circuits and the destruction of the device.

Important note
Connection lines must be shielded!

Warning:

Procedure for high voltage test:

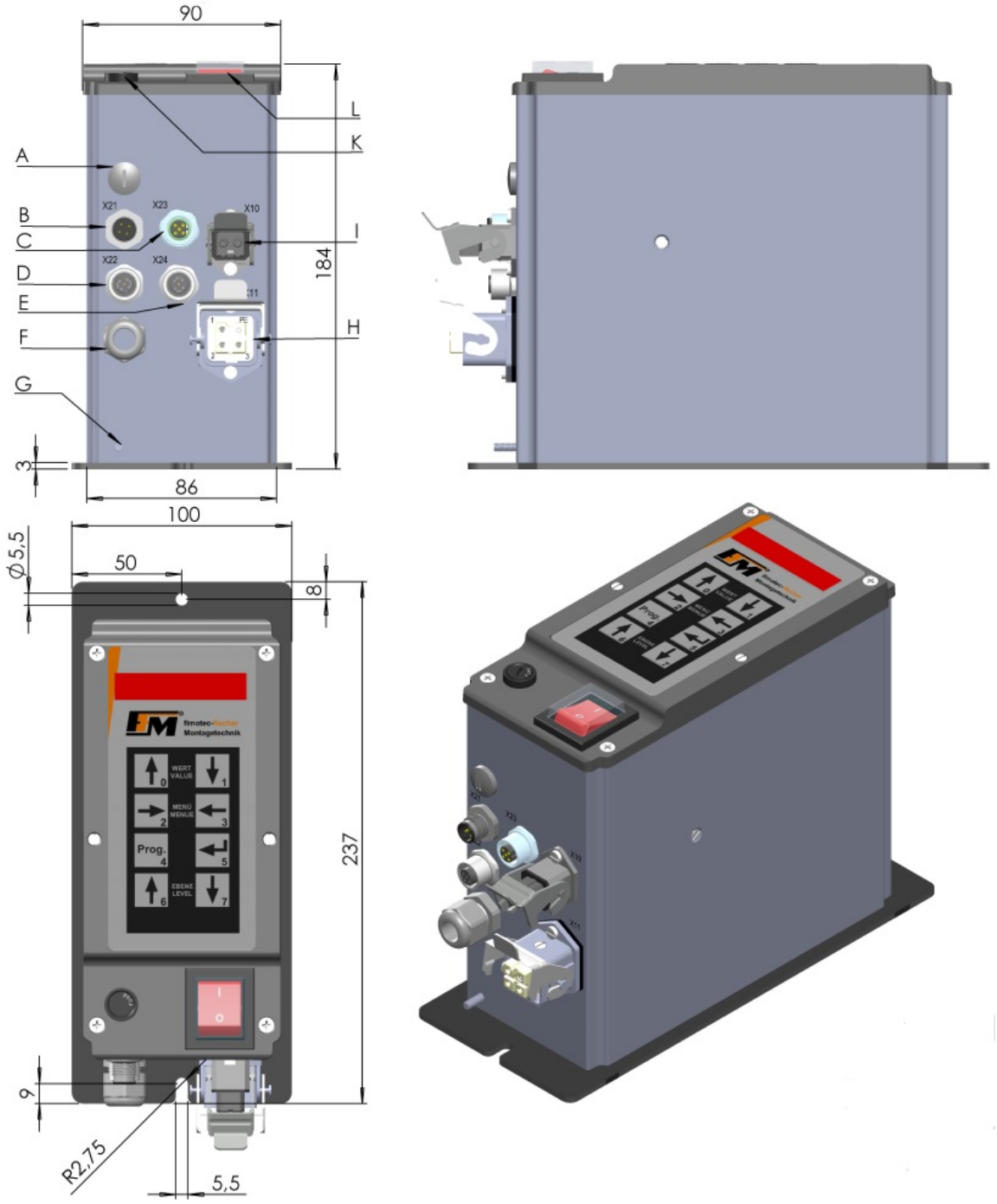
- **L and N must be connected with each other.**
- **Test voltage may not be higher than 1000 V AC**
- **Every device must be tested separately**

If the above criteria are not complied with, the device could be damaged and the warranty will be void.

Caution:

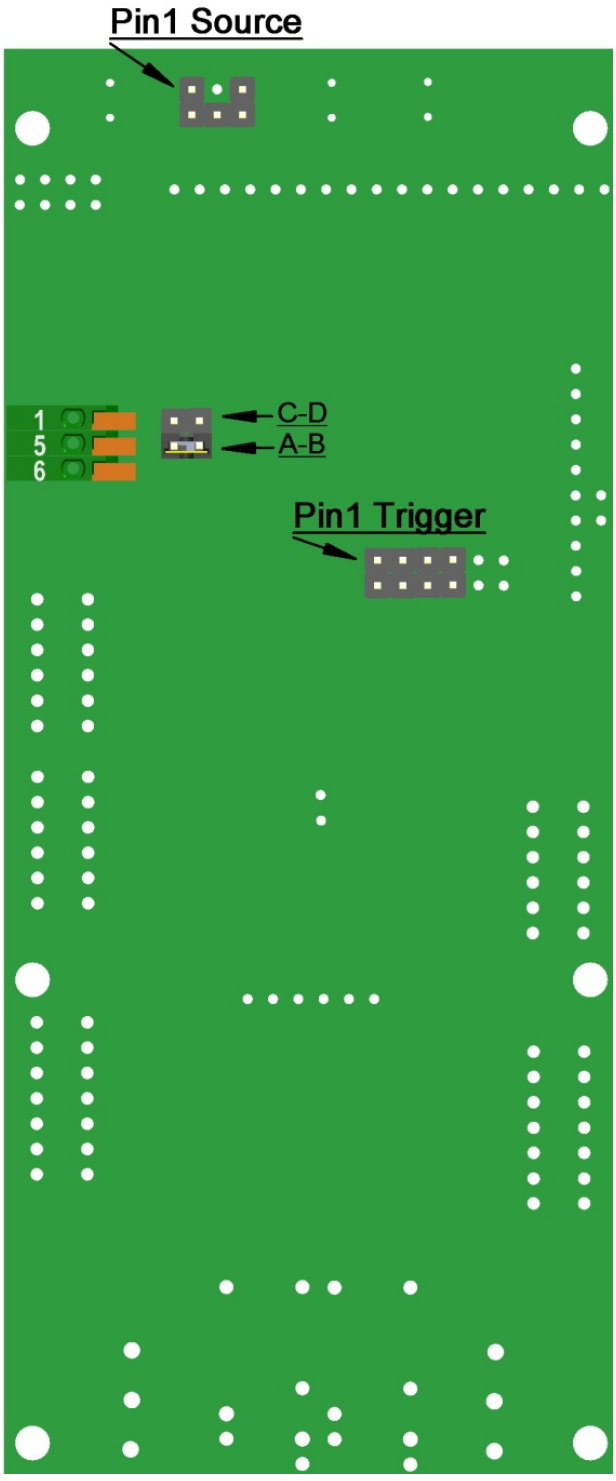
The cover of the device is made of plastic. Screwing on the cover with the 6 countersunk screws must not be done with force, since otherwise there is a risk of the plastic cracking.
Screw in screws with a commercially available screwdriver by hand until the screw is flush with the recess and the cover lies on the profile.

3.1 Overview and dimensions



A - M12x1.5 Blind plug
B - M12 plug, 4-pin, for enable input connection (E1) – X21
C - M12 socket, 4-pin, b-coded, for status output connection (T1) – X23
D - M12 socket, 4-pin, for sensor input connections (E2+E3) – X22
S - M12 socket, 4-pin, for valve connection (T2) – X24
F - Mains supply line
G - Grounding bolt
H - Motor connection 3+PE – X11
I - Mains voltage connection via STAKEI20 – X10
K - Mains fuse
L - Mains switch

3.2 Connections / operating elements of control boards



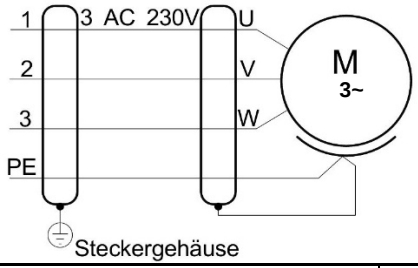
3.3 Housing connections

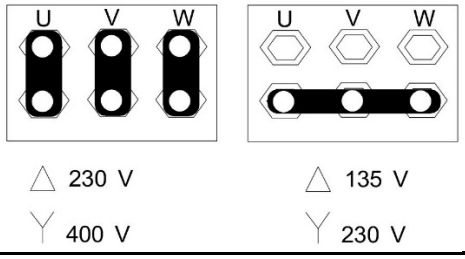
Motor output socket connection

Pin 1 - Motor
Pin 2 - Motor
Pin 3 - Motor

PE - Protective conductor

The output voltage of the device is 3 x 230 V~; the motor windings must be connected according to the used motor.





Mains voltage connection

Pin 1 - L
Pin 2 - N

PE - Protective conductor

X21

Control input connection E1
Pin 1 - 24V=
Pin 2 - Not Connected
Pin 3 - GND
Pin 4 - Enable input (menu: E1)

X23

Status output connection T1 (b-coded)
Pin 1 - Not Connected
Pin 2 - Not Connected
Pin 3 - GND
Pin 4 - Output (menu: A1)

X22

Sensor input connection E2+E3
Pin 1 - +24 V=
Pin 2 – Sensor input 2 (menu: E3)
Pin 3 - GND
Pin 4 - Sensor input 1 (menu: E2)

X24

Valve output connection T2
Pin 1 - +24 V=
Pin 2 - Valve output (menu: A2)
Pin 3 - GND
Pin 4 - Not connected

The +24V= supply is isolated from the mains voltage.

4 Commissioning

Before connecting the device, the mains voltage and frequency must be determined. The data must lie in the range of permissible values for the device.

- Check and set the jumpers according to the control type.
- Connect the motor and control cable to the device.
- Stick the mains plug of the device in the socket.
- Switch on the device
- Enter the characteristic data of the motor via the keyboard.
- Via the keypad for the soft start and soft stop, define the characteristics for switching the control input on and off.

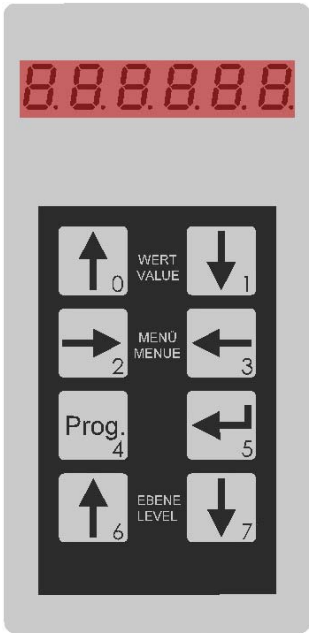
Operating note
Before switching on, check to make sure the plug connections are correct.
Switch on the device with the mains switch.
Set the speed via the keypad in the cover until the motor reaches the desired speed.

Warning:

All parts of the motor must be grounded.

4.1 Control panel

The device is operated/set via 8 keys which are located on a control panel on the cover, together with a 6 x7-segment LED display.
All operating mode settings as well as the settable parameters can be made via this control panel.

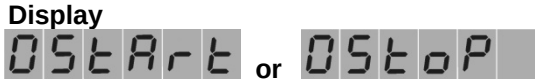


VALUE KEYS 0 and 1
MENU KEYS 2 and 3
PROGRAMMING KEY 4
SAVE KEY 5
LEVEL KEYS 6 and 7

Operating note: Power output ON/OFF

By simultaneously pressing the 6 and 7 keys, the device can be switched on/off, whereby, however, there is no disconnection from the mains; only the power semiconductors are shut off.

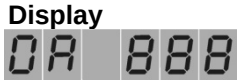
Display



Operating note: Jump to amplitude display

By simultaneously pressing the 2 and 3 keys, the "Amplitude" root display is called up.

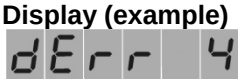
Display



Operating note: Error status query

If an error is registered, the display starts to flash. By pressing the 0 or 1 key, the error is displayed.

Display (example)



Operating note: Show software version and revision

By simultaneously pressing the 4 and 5 keys and keeping them pressed, the software number and revision date will be displayed in succession.

Display (example)

Keypad explanation

The parameters are set by means of a menu structure and by entering an operator code.
In the "Setting instructions", the menu structure and the setting ranges of the parameters, as well as the function programming, will be explained.

By briefly pressing the arrow key 0 (increase/change) or 1 (decrease/change), the value in the selected parameter is increased/reduced or changed by one position (ones, tenths or mode). If the one or other key is kept pressed, it switches to fast mode, and after approx. 1 s to 2x fast mode.

If arrow keys 2 (clockwise rotation) and 3 (counterclockwise rotation) are briefly pressed, it switches from one parameter to the next. If the one or other key is kept pressed, the parameters are rolled through.

By briefly pressing the arrow keys 6 (increase) and 7 (decrease), the level structure is changed from one level to the other. If the one or other key is kept pressed, the levels are rolled through.

When the 4 key is pressed in the "Amplitude" root display, programming mode is switched to without entering an operator code. The amplitude can now be changed with the 0 and 1 keys.

If the 4 key is pressed in all other parameters, the entry of an operator code is expected.

After entering the code, this must be confirmed with the 5 key. If the code is correct, programming mode is switched to. Depending on the access authorization (different codes are available for this; see the "Operator codes" chapter), the corresponding parameter items can be changed.

After completing the changes, these must be stored with the 5 key.

appears briefly.

Changes are discarded after approx. 1 minute (timeout) after the last key was pressed without pressing the '5' key; the values before changing to programming mode are restored.
Exiting programming mode due to the timeout is announced by the flashing of the programming dot in the second LED from the left. The dot flashes 3x before programming mode is exited.

Programming mode can be exited sooner by pressing the 4 key again without saving.

Programming mode is indicated by the dot in the second LED from the left.

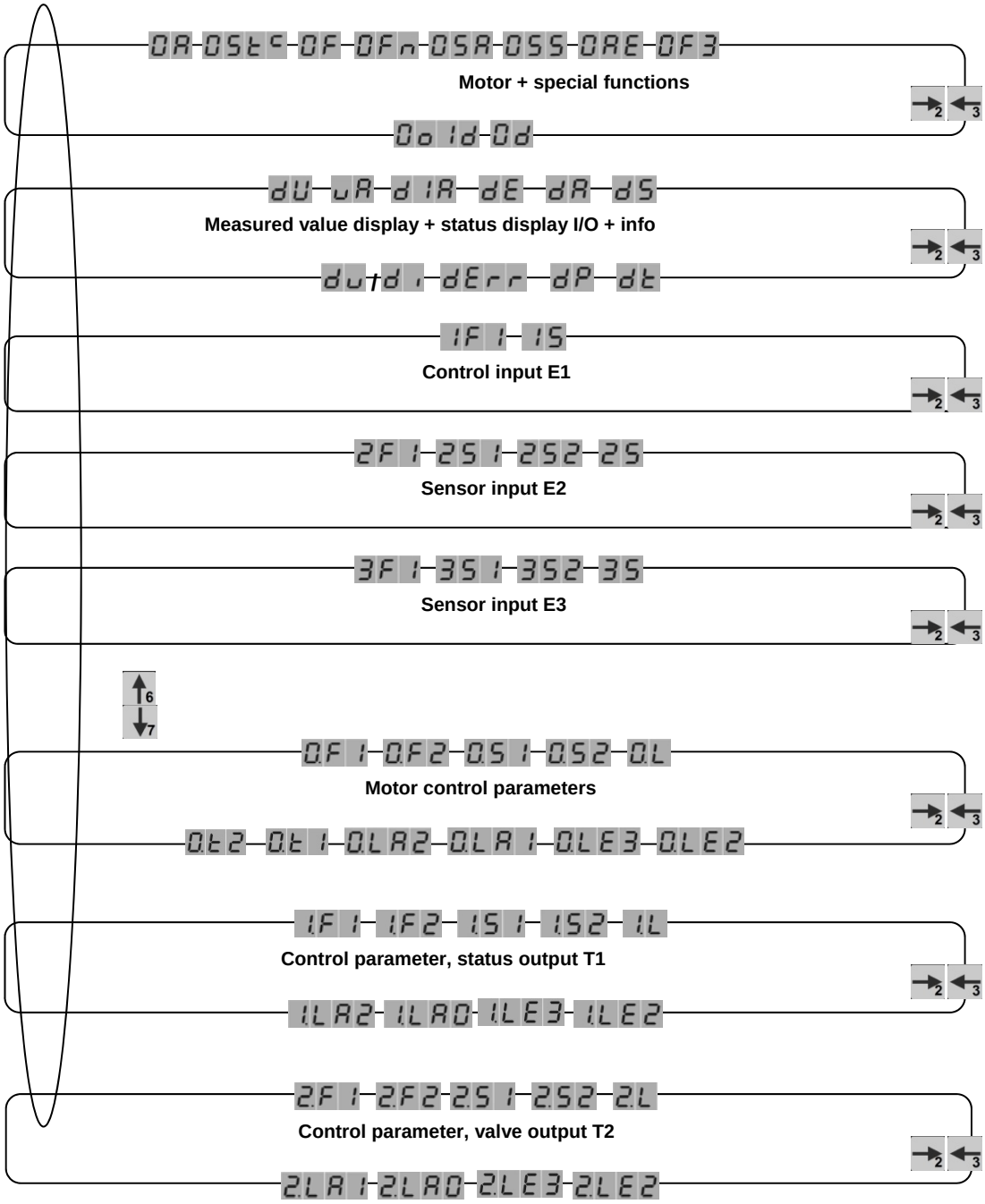
Security query
For some parameters, before executing the function "Read" or "Save", there is a security query

To confirm, the 5 key must be pressed again. To exit without executing the function, the keys 0 - 1 - 2 - 3 - 4 - 6 - 7 can be pressed.

Procedure example:

Select level via 6 and 7 keys.
Select parameter via 2 and 3 keys.
Press the 4 key to get into programming mode.
Enter the operator code (except for the "Amplitude" parameter), A or B.
Press the 5 key to confirm the code.
Change the parameter value with the 0 and 1 keys.
Save the value with the 5 key.
Alternatively, exit programming mode without saving by pressing the 4 key.

4.2 Menu structure



4.3 LEVEL 0 - Motor performance parameters

After power ON, the display switches to the "Frequency" root display. Depending on this, the 2 and 3 keys can be used to roll to every individual parameter on this level. The following parameters are available:

Code B
Visible after entering code

Parameter: Voltage characteristic value [V~], motor (*here, the connection* voltage of the used motor must be entered)
Value can be set from 1 - 230 max.
Increment 1 V~
Max. voltage depends on mains voltage range.

Code B
Visible after entering code

Parameter: Current limitation [A~] for the motor
Value can be set from 0.1 - 6.0
Increment 0.1 A~
Value is set to protect the motor at the max. permissible current.

Code A and B

Parameter: Frequency [Hz]
Value can be set from 10.0 - 60.0
Increment 0.1 Hz

Code B
Visible according to code input

Parameter: Frequency characteristic value [Hz], motor (*here, the operating* frequency of the used motor must be entered)
Settable value 10.0 - 60.0
Increment 0.1 Hz

Code A and B

Parameter: Soft start [s]
Value can be set from 0.1 - 5.0
Increment 0.1 s
Speed from 0 to set amplitude within set time.

Code A and B

Parameter: Soft stop [s]
Value can be set from 0.1 - 5.0
Increment 0.1 s
Set speed to 0 within set time.

Code A and B

Parameter: Setpoint specification [function]
Value can be set to F, I, P, U
F - Setpoint specified via membrane keypad
I Setpoint specified via analog current 4 - 20mA=
U - Setpoint specified via analog voltage 0 - 10 V=
P - Setpoint specified via potentiometer 10K

Codes A and B

Parameter: Direction of rotation selection [function]
Settable values r, L
r - clockwise rotation
L - counterclockwise rotation

Code A and B

Parameter: Control selection [function]
Value can be set to 0, 1, E
0 - Drive permanently OFF
1 - Driver permanently ON
E - Drive is controlled via logic level 0.

Code A and B

Parameter: Parameter backup [function]
Value can be set to 0, bs, br, rE
0 - No function
rE - Load factory settings
br - Load backup parameters
bs - Save backup parameters

4.4 LEVEL d - Information output (display only)

After power ON, the display switches to the "Frequency" root display. From here, the 6 key can be used to change to level d. The following values and status displays are available:

Value: Mains voltage [V~]
The currently applied mains voltage is displayed.

Value: Output voltage [V~]
The voltage currently applied to the motor is displayed.

Value: Output current [A~]
The currently flowing motor current is displayed.

Status display: Inputs E1 - E6, depending on availability.
The upper row of line segments outputs the physical status, i.e. if there is a signal applied to the corresponding input, a line segment is output.
24V= at E2 - Line appears in upper row, pos. 2 from left

The lower row of line segments outputs the logical status, i.e. after processing of inversion and times.
0V= on E1 and F1=S - Line segment appears in lower row, pos. 1 from the left.

Status display: Outputs A0 - A7, depending on availability.
The upper row of line segments outputs the physical status, i.e. if there is a signal applied to the corresponding input, a line segment is output.
24V= at A1 - Line appears in upper row, pos. 2 from the left

The lower row of line segments outputs the logical status, i.e. according to the logical input and output links and after processing of inversion and times.
24V= at A2 and F2=S - Line appears in lower row, pos. 3 from the left

Status display: Inputs and outputs, depending on availability.
The upper row of line segments outputs the physical status of the inputs, i.e., if a signal is applied at the corresponding input, a line segment is output.
The lower row of line segments outputs the physical status of the outputs, i.e., if a signal is applied at the corresponding output, a line segment is output.

Value: Temperature [°C]
The temperature on the power output stage is output.
Values up to 110 are permissible.

Display of the program version

Error number is displayed

Value of applied analog voltage [V=]

or

Value of applied analog current [mA=]

Depending on the programmed setpoint specification (parameter AE), the applied analog value is displayed here.

4.5 LEVEL 1 - Control input E1

After power ON, the display switches to the "Frequency" root display. From here, the 6 key (press 2x) can be used to change to level 1. The following parameters are available:

A logical 1 causes a reaction
A logical 0 causes no reaction.

Code A and B

Parameter: F1 [function]
Value can be set to O, S
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: Debouncing time S [ms]
Value can be set from 0.1 - 99.9
Increment 0.1 ms
If level changes are occurring very quickly in succession, double pulses can be hidden via the debouncing time.

Via input E1, all outputs are switched off / enabled with priority over the programmed Logic in the outputs.

4.6 LEVEL 2 - Sensor input E2

After power ON, the display changes to the "Frequency" root display.
From here, the 6 key (press 3x) can be used to change to level 2. The following parameters are available:

A logical 1 causes a reaction
A logical 0 causes no reaction.

Code A and B

Parameter: F1 [function]
Value can be set to O, S
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: Dropout delay S1 [s]
Value can be set from 0.0 - 99.9
Increment 0.1 s
There is a logical result, depending on the inversion.
If the logical result is 1, the output is switched off with a delay by the time S1.

Code A and B

Parameter: Pick-up delay S2 [s]
Value can be set from 0.0 - 99.9
Increment 0.1 s
There is a logical result, depending on the inversion.
If the logical result is 0, the output is switched on with a delay by the time S2.

4.7 LEVEL 3 - Sensor input E3

After power ON, the display changes to the "Frequency" root display.
From here, the 6 key (press 4x) can be used to change to level 3. The following parameters are available:

A logical 1 causes a reaction
A logical 0 causes no reaction.

Code A and B

Parameter: F1 [function]
Value can be set to O, S
O - Applied HI signal is not inverted and is further processed as logical 1. Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0. Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: Dropout delay S1 [s]
Value can be set from 0.0 - 99.9
Increment 0.1 s
There is a logical result, depending on the inversion.
If the logical result is 1, the output is switched off with a delay by the time S1.

Code A and B

Parameter: Pick-up delay S2 [s]
Value can be set from 0.0 - 99.9
Increment 0.1 s
There is a logical result, depending on the inversion.
If the logical result is 0, the output is switched on with a delay by the time S2.

4.8 LEVEL 0. - Motor logic / hopper cycle

After power ON, the display switches to the "Frequency" root display.
From here, the 6 key (press 5x) can be used to change to level 0.

On level 0, the motor control (physical), the cycle times and the feedback of the motor status (logical) are set. The feedback is available as a processable signal (comparable to an external control signal) for other logical links (other functions can be easily realized with this).

The following parameters are available:

A logical 1 causes a reaction
A logical 0 causes no reaction.

Code A and B

Parameter: F1 [function]
Value can be set to O, S
Function has a direct influence on the physical state of the motor (status inversion)
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: F2 [function]
Value can be set to O, S
The function has a direct influence on the logical (further processable) status of the motor (inversion of the logical status)
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: Dropout delay S1 [s]
Value can be set from 0.0 - 9.9
Increment 0.1 s
Depending on the physical state of the motor and the inversion by F2, a logical result is output.
If the logical result is 1, the (further processable) status (feedback) is passed on as 1, delayed by the time S1.
Otherwise, the state remains as is.

Code A and B

Parameter: Pick-up delay S2 [s]
Value can be set from 0.0 - 9.9
Increment 0.1 s
Depending on the physical state of the motor and the inversion by F2, a logical result is output.
If the logical result is 0, the (further processable) status (feedback) is passed on as 0, delayed by the time S2.
Otherwise, the state remains as is.

Code A and B

Parameter: Logic [function]
Value can be set to O, U, S
Result = physical state of the motor before the function F1.
O - OR operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

U - AND operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

S - ACCUMULATION operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

AND operation to switch off
OR operation to switch on again

Code A and B

Parameter: Input E2 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input E3 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Output A1 [function]
Value can be set to 0 or 1
0 - Output switched to inactive (not considered in the logic)
1 - Output switched to active (considered in the logic)

Code A and B

Parameter: Output A2 [function]
Value can be set to 0 or 1
0 - Output switched to inactive (not considered in the logic)
1 - Output switched to active (considered in the logic)

Code A and B

Parameter: Cycle operation switch-on time t1 [s]
Value can be set from 0.0 - 9.9 / 10 - 99
Increment 0.1 s / 1 s
While the motor is enabled via the control, the
HI phase of the cycle operation can be set via switch-on time t1.

Code A and B

Parameter: Cycle operation switch-off time t2 [s]
Value can be set from 0.0 - 9.9 / 10 - 99
Increment 0.1 s / 1 s
While the motor is enabled via the control, the
LO phase of the cycle operation can be set via switch-off time t2.

Function example:

Motor is switched via sensor inputs E2 and E3

-> Activation (1) of parameters 0.LE2 and 0.LE3

4.9 LEVEL 1. - Logic, transistor output

After power ON, the display switches to the "Frequency" root display.
From here, the 6 key (press 6x) can be used to change to level 1.

On level 1, the control of a transistor output (physical) and the feedback of the transistor output status (logical) are set. The feedback is available as a processable signal (comparable to an external control signal) for other logical links (more complex control functions can be easily realized with this).

The following parameters are available:

A logical 1 causes a reaction
A logical 0 causes no reaction.

Code A and B

Parameter: F1 [function]
Value can be set to O, S
Function has a direct influence on the physical state of the transistor output (inversion of the state)
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: F2 [function]
Value can be set to O, S
Function has a direct influence on the logical, (further processable) status of the transistor output (inversion of the logical status)
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: Dropout delay S1 [s]
Value can be set from 0.0 - 9.9
Increment 0.1 s
Depending on the physical state of the transistor output and the inversion by F2, a logical result is output.
If the logical result is 1, the (further processable) status (feedback) is passed on as 1, delayed by the time S1. Otherwise, the status remains unchanged.

Code A and B

Parameter: Pick-up delay S2 [s]
Value can be set from 0.0 - 9.9
Increment 0.1 s
Depending on the physical state of the transistor output and the inversion by F2, a logical result is output.
If the logical result is 0, the (further processable) status (feedback) is passed on as 0, delayed by the time S2. Otherwise, the status remains unchanged.

Code A and B

Parameter: Logic [function]
Value can be set to O, U, S
Result = physical state of the transistor output before function F1.
O - OR operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

U - AND operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

S - ACCUMULATION operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

AND operation to switch off
OR operation to switch on again

Code A and B

Parameter: Input E2 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input E3 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input A0 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input A2 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

4.10 LEVEL 2 - Valve output logic

After power ON, the display switches to the "Frequency" root display. From here, the 6 key (press 7x) can be used to change to level 2.

On level 2, the control of a transistor output (physical) and the feedback of the transistor output status (logical) are set. The feedback is available as a processable signal (comparable to an external control signal) for other logical links (more complex control functions can be easily realized with this).

The following parameters are available:

A logical 1 causes a reaction
A logical 0 causes no reaction.

Code A and B

Parameter: F1 [function]
Value can be set to O, S
Function has a direct influence on the physical state of the transistor output (inversion of the state)
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: F2 [function]
Value can be set to O, S
Function has a direct influence on the logically further processable state of the transistor output (inversion of the logical state).
O - Applied HI signal is not inverted and is further processed as logical 1. Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0. Applied LO signal is inverted and is further processed as logical 1.

Code A and B

Parameter: Dropout delay S1 [s]
Value can be set from 0.0 - 9.9
Increment 0.1 s
Depending on the physical state of the transistor output and the inversion by F2, a logical result is output.
If the logical result is 1, the (further processable) status (feedback) is passed on as 1, delayed by the time S1. Otherwise, the status remains unchanged.

Code A and B

Parameter: Pick-up delay S2 [s]
Value can be set from 0.0 - 9.9
Increment 0.1 s
Depending on the physical state of the transistor output and the inversion by F2, a logical result is output.
If the logical result is 0, the (further processable) status (feedback) is passed on as 0, delayed by the time S2. Otherwise, the status remains unchanged.

Code A and B

Parameter: Logic [function]
Value can be set to O, U, S
Result = physical state of the transistor output before function F1.
O - OR operation of all available and active (value entry 0.LEX=1) Inputs and active (0.LAX=1) outputs (feedback)

U - AND operation of all available and active (value entry 0.LEX=1) Inputs and active (0.LAX=1) outputs (feedback)

S - ACCUMULATION operation of all available and active (value entry 0.LEX=1) inputs and active (0.LAX=1) outputs (feedback)

AND operation to switch off
OR operation to switch on again

Code A and B

Parameter: Input E2 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input E3 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input A0 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

Code A and B

Parameter: Input A1 [function]
Value can be set to 0 or 1
0 - Input switched to inactive (not considered in the logic)
1 - Input switched to active (considered in the logic)

4.11 Setting the speed

After power ON, the display switches to the "Frequency" root display.

Programming mode is switched to by pressing the '4' key and code input. Dot appears in LED 2 from the left.
Set the desired speed and save the result with the '5' key. SAVE appears briefly.

10 – 60 Hz

If the setpoint specification should not be set to F, but to the value U, I, or P, it is not possible to change the speed, although the dot for programming mode is displayed.

4.12 Safely setting up the motor

First the following connection values of the motor must be determined:

Characteristic value: permissible voltage [V~]
Maximum permissible current consumption [A~]
Operating frequency [Hz] of the used motor

Based on the determined values, the permissible characteristic values are now set without the connected motor.

Start in "Frequency" root display.

Set the value to the permissible motor voltage by first changing to programming mode (see the control panel and operator code).

1 - 115/230V~

Then switch to the next menu item Current limit

0.1 - 6.0A~

Set the maximum permissible motor current here.

The operating frequency must now be defined as an additional step.

10 – 60 Hz

After the characteristic values of the motor are set, they should be intermediately saved.

4.13 Setting up the enable/sensor input

**Connect the enable/sensor input directly to the socket on the housing;
use a matching mating connector for this:**

X21	**Connection for enable input E1** **Pin 1 - 24V=** **Pin 2 - Not Connected** **Pin 3 - GND** **Pin 4 - Enable input (menu: E1)**
X22	**Sensor input connection E2+E3** **Pin 1 - +24 V=** **Pin 2 - Sensor input 2 (menu: E3)** **Pin 3 - GND** **Pin 4 - Sensor input 1 (menu: E2)**
	The +24V= supply is isolated from the 230V~ mains voltage.

Parametrize the menu item F1 on levels 1 - 3 with the desired function value via the control panel by changing to programming mode in menu item F1 first (see control panel and operator code):

Start in "Frequency" root display.

Parameter: F1 [function]
Value can be set to O, S
O - Applied HI signal is not inverted and is further processed as logical 1.
Applied LO signal is not inverted and is further processed as logical 0.

S - Applied HI signal is inverted and is further processed as logical 0.
Applied LO signal is inverted and is further processed as logical 1.

If F1 is set to O on level 0 and E2 is switched to active, the output 0 (motor) is switched off with logical 1 and switched on with logical 0.
Inversion of the sensor input!
Applies to inputs 2 and 3.

If F1 is set to O in level 1, all outputs are switched off with logical 1 and enabled with logical 0.
Inversion of the control input!

After changing the value, do not forget to save!

4.14 Factory settings / read/save user backup

Via the control panel, activate the menu item 0old on level 0. Change to programming mode (see the control panel and operator code):

Start in "Amplitude" root display

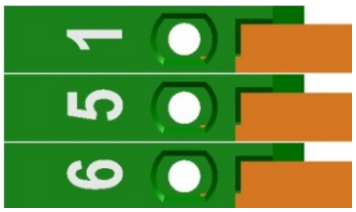
To load the factory settings, select the menu item "re". Proceed analogously to saving.
Your operator code-specific parameters will be reset to the factory settings.

To restore your backed-up data, select the menu item "br". Proceed analogously to saving.
Your operator code-specific parameters will be loaded.

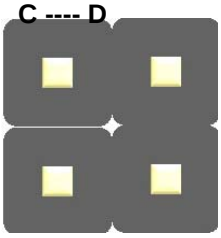
To back up your settings, select the menu item "bs" and press the 5 key. The security query "sure" appears. Press the 5 key again to save. "Save" appears and immediately the selected parameter again.
Your operator code-specific parameters will be backed up.

4.15 Setting up external setpoint specification

Connect the external setpoint to the available connection terminal on the control board via the available bore:

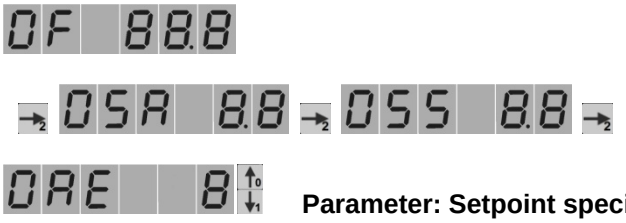
	**Terminal 6 - +5 V= analogous for external potentiometer** **Terminal 5 - Voltage input 0-10 V=** **or external potentiometer** **or current input 4-20 mA=** **Terminal 1 - GND analog for** **current input** **voltage input** **external potentiometer**

Use the jumpers on the control board to select the type of external setpoint:

C ---- D  **A ---- B**	**Bridge between C-D -> 4-20 mA=** **Bridge between A-B -> 0-10 V =** **or** **Potentiometer**

Parametrize the menu item AE on level 0 with the desired setpoint value via the control panel by changing to programming mode in menu item AE first (see control panel and operator code):

Start in "Amplitude" root display



Parameter: Setpoint specification [function]

Value can be set to F, I, P, U
F - Setpoint specified via membrane keypad
I Setpoint specified via analog current 4 - 20mA=
U - Setpoint specified via analog voltage 0 - 10 V=
P - Setpoint specified via potentiometer 10K

After changing the value, do not forget to save.

4.16 Connecting status/valve output

There are two 24V= transistor outputs available for control tasks. Connect the outputs (depending on the application) to the available connection sockets. Use a matching mating connector for this.

X23	**Status output connection T1 (b-coded)** **Pin 1 - Not Connected** **Pin 2 - Not Connected** **Pin 3 - GND** **Pin 4 - Output (menu: A1)**
X24	**Valve output connection T2** **Pin 1 - +24 V=** **Pin 2 - Valve output (menu: A2)** **Pin 3 - GND** **Pin 4 - Not connected** **The +24V= supply is isolated from the 230V~ mains voltage.**

Program the required parameters on LEVELS 1 - 2:

Transistor switches depending on input 2 and its delay times
-> 1.LE2 =1
(Parallel connection to motor, if motor is also switched via E2, motor status output)

Transistor switches depending on output 0 and its delay times
-> 1.LA0 =1
Inversion and delay times for this must be set under 0.F2; 0.S1; 0.S2.
(Delayed switching relative to motor depending on this is possible)

Other logical operations are also possible with the inputs E2, A0 - A2.

Applies to outputs 1. to 2.

In the case of complex control tasks, please contact your supplier.

5 Technical data

Mains connection, wide range	95 - 253 V~	
Voltage ranges	Automatic switching between 1 - 230 V~ and 1 - 115 V~	
Mains frequency	50 Hz	60 Hz
Variable output frequency	10.0 – 60.0 Hz	
Output current	0.1 - 2 A~	
Protection class	**IP 54 for suspended mounting** (screw connections point to the floor)	
Fuse	6.3 A F	
Mains connection, mechanical	2 m with moulded Schuko angle plug	
Mains connection, loop	STAKEI20 (active independent of power switch)	
Motor connection	HA3-BS series, 4-pin in axial sleeve housing	
Input E1	M12 plug, 4-pin +24V= / max. 50 mA / PNP Switching level HI : 6 - 24V=- Switching level LO: 0 - 4 V=	
Input E2+E3	M12 socket, 4-pin +24V= / max. 50 mA / PNP Switching level HI : 6 - 24V=- Switching level LO: 0 - 4 V=	
Status output T1	M12 socket, 4-pin 24V= / 100 mA max.	
Valve output T2	M12 socket, 4-pin, b-coded 24V= / 200 mA max.	
Output stabilization	Max. voltage change of 1V~	
Housing	Aluminium base plate + aluminum extruded section + plastic cover	
Dimensions	237 x 100 x 184mm	
Operating temperature	0...40° C	
Storage temperature	-10...+80° C	
Installation height	1000 m, 0.5% nominal current reduction per additional 100 m	

5.1 Setting values via keypad

Parameter			Factory settings
Motor level 0			
Voltage characteristic value	0A	1...230 V~	230 V~
Current limit	0St	0.1...6 A~	2 A~
Speed	0F	10.0...60.0 Hz	50.0 Hz
Frequency characteristic value	0Fn	10.0...60.0 Hz	50.0 Hz
Soft start ramp	0SA	0.1...5 seconds	1.0 s
Soft stop ramp	0SS	0.1...5 seconds	1.0 s
Nominal value selection	0AE	F - Keypad I - Current 4..20 mA U - Voltage 0..10 V DC P - External potentiometer	F
Direction of rotation	0F3	r - clockwise rotation or L - counterclockwise rotation	r
Working mode	0d	0 - Off E - Control 1 - Continuous operation	S
Backups	0old	0 - Work parameters re - Factory settings br - Read backup bs - Save backup	0

Control level 1			
Invert input	1F1	PNP (O) PNP inverted (S)	O
Debouncing time	1S	0.1...99.9 ms	0.1 ms
Control level 2			
Invert input	2F1	PNP (O) PNP inverted (S)	O
Pick-up delay	2S1	0.0...9.9 s	2.0 s
Dropout delay	2S2	0.0...9.9 s	2.0 s
Debouncing time	2S	0.1...99.9 ms	0.1 ms
Control level 3			
Invert input	3F1	PNP (O) PNP inverted (S)	O
Pick-up delay	3S1	0.0...9.9 s	0.0 s
Dropout delay	3S2	0.0...9.9 s	0.0 s
Debouncing time	3S	0.1...99.9 ms	0.1 ms
Logic level 0.			
Invert output	0.F1	Not inverted (O) Inverted (S)	O
Invert logical state of output	0.F2	Not inverted (O) Inverted (S)	O
Pick-up delay	0.S1	0.0...9.9 s	4.0 s
Dropout delay	0.S2	0.0...9.9 s	0.0 s
Logic operation	0.L	O - OR U - AND S - ACCUMULATION	O
For input which can be activated with logic	0.LE2	Inactive (0) / active (1)	1
For input which can be activated with logic	0.LE3	Inactive (0) / active (1)	0
For input which can be activated with logic	0.LA1	Inactive (0) / active (1)	0

For input which can be activated with logic	0.LA2	Inactive (0) / active (1)	0
Cycling, switch-on time	0.t1	0.0...99 s	0.0 s
Cycling, switch-off time	0.t2	0.0...99 s	0.0 s
Logic level 1.			
Invert output	1.F1	Not inverted (O) Inverted (S)	O
Invert logical state of output	1.F2	Not inverted (O) Inverted (S)	O
Pick-up delay	1.S1	0.0...9.9 s	0.0 s
Dropout delay	1.S2	0.0...9.9 s	0.0 s
Logic operation	1.L	O - OR U - AND S - ACCUMULATION	O
For input which can be activated with logic	1.LE2	Inactive (0) / active (1)	0
For input which can be activated with logic	1.LE3	Inactive (0) / active (1)	0
For input which can be activated with logic	1.LA0	Inactive (0) / active (1)	1
For input which can be activated with logic	1.LA2	Inactive (0) / active (1)	0
Logic level 2.			
Invert output	2.F1	Not inverted (O) Inverted (S)	O
Invert logical state of output	2.F2	Not inverted (O) Inverted (S)	O
Pick-up delay	2.S1	0.0...9.9 s	0.0 s
Dropout delay	2.S2	0.0...9.9 s	0.0 s
Logic operation	2.L	O - OR U - AND S - ACCUMULATION	O
For input which can be activated with logic	2.LE2	Inactive (0) / active (1)	0
For input which can be activated with logic	2.LE3	Inactive (0) / active (1)	0
For input which can be activated with logic	2.LA0	Inactive (0) / active (1)	1
For input which can be activated with logic	2.LA1	Inactive (0) / active (1)	0

6 Error list

Danger:
Life-threatening danger due to electric current! Have repairs on the 230V power network only performed by a qualified professional.

Problem/error	Possible cause(s)	Remedy
Device does not work	Power failure or defective fuse The 230V mains socket is defective. The device is defective. Control input inverted	➢ Check the fuses. ➢ Have the mains socket repaired by qualified, skilled personnel. ➢ Have the device checked by a qualified professional. ➢ Check whether the control input is correctly set.
Motor gets hot	Motor is operated with impermissible parameters.	➢ Have the characteristic values checked by qualified, skilled personnel.
Control input does not work	Control voltage is not in correct range Control input deactivated	➢ Have the voltage checked by qualified, skilled personnel. ➢ Check the settings
Important: **Malfunctions might occur in an unfavourable electromagnetic environment.**		

Caution:

Danger due to improper interventions. Do not manipulate the device. Otherwise, this can result in function failures and device defects.

6.1 Error messages / ERROR

If the complete display is flashing, an error occurred.
The error code can be queried on level d under the parameter Err.

The following error codes are possible:

Not defined

Overload shutdown
Output power exceeded
e.g. incorrect motor data or frequency setting

Critical temperature exceeded on the power output stage

Mains voltage lies outside of the standard
voltage ranges 90-130V~ and 190-253V~

Nominal control value cannot be reached

Short-circuit shutdown
(defective motor, ground fault, defective cable)

Data loss in the EEPROM

Processor communication error

Special error:

Keypad query error

In the case of frequently occurring error messages not described in this section, please contact the manufacturer.

7 Maintenance and cleaning

The control device works maintenance-free.
The safety inspection in acc. with DIN VDE 0701-0702 is to be performed annually.

Pull out the mains plug before cleaning the housing of the device with liquids.

8 Disposal

The control device must not be disposed of in the normal household waste.

Users are obligated to drop off old devices at a disposal point for old electrical and electronic devices. The separate collection and proper disposal of your old devices helps to conserve natural resources and ensures recycling, which protects human health and the environment. Information about where you can find disposal points for your old devices can be obtained from your city administration or local waste disposal facility.

9 EU conformity

The motor control FSM237 is marked with the CE marking and therefore meets the relevant European directives.
The company fimotec-fischer GmbH & Co. KG herewith confirms that this device meets the following directives:
Low-voltage directive 2014/35/EU
EMC directive 2014/30/EU
Standards EN 61000-6-4 and EN 61000-6-2

The declaration of conformity is archived at the manufacturer.

10 Service

If you have any questions or problems, please contact the supplier directly.

Manufacturer: fimotec-fischer GmbH & Co.KG:
Tel.: 0049 7424 884 0

Note

Please keep the following information ready, since otherwise service cannot be provided:

- Your company with address
- Your name and contact data, such as telephone number and e-mail address
- Complete designation of the device
- Serial number
- The direct supplier of your device or machine in which the device is integrated.

10.1 Operator codes

The following codes are available:

Without code	**Operator**
	System operator (code A)
	System setter (code B)

It is up to the system supplier to pass on the operator codes or to reserve them for his service personnel.

Via the system setter operator code, parameters are enabled which may only be changed by skilled, trained personnel, since the function and limit values of the conveyor devices are influenced with these settings.

11 Accessories (not included in the scope of delivery)

Designation	Use	Article number
Sleeve housing	for X11, drive on FS-26 / FSM-237	91.2130.20
Screw connection	for X11, drive on FS-26 / FSM-237	91.2130.50
Pin insert	for X11, drive on FS-26 / FSM-237	91.2130.60
Cable plug	for X10, 230V output	91.3300.20
Cable socket M12A	for X21, disable/enable input	91.3211.01
Power plug M12A	for X22, filling level sensor input	91.3311.01
Power plug M12A	for X24, 24V sorting air valve	91.3311.01
Power plug M12B	for X23, status relay output	91.3311.05
Connection cable	Filling level M8-3p, 3m straight St. M12	91.4214.00
Connection cable	Filling level M8-3p, 3m angled St. M12	91.4214.01
Connection cable	Filling level M8-3p, 5m straight St. M12	91.4214.02
Connection cable	Filling level M8-3p, 5m angled St. M12	91.4214.03
Connection cable	Filling level M8-4p, 3m straight St. M12	91.4214.04
Connection cable	Filling level M8-4p, 3m angled St. M12	91.4214.05
Connection cable	Filling level M8-4p, 5m straight St. M12	91.4214.06
Connection cable	Filling level M8-4p, 5m angled St. M12	91.4214.07
Connection cable	Filling level M12, 3m straight St. M12	91.4214.08
Connection cable	Filling level M12, 3m angled St. M12	91.4214.09
Connection cable	Filling level M12, 5m straight St. M12	91.4214.10
Connection cable	Filling level M12, 5m angled St. M12	91.4214.11
Connection cable	Disable betw. control devices 0.4 m	91.4214.90
Connection cable	Disable betw. control devices 3.0 m	91.4214.91
Connection cable	Disable betw. control devices 5.0 m	91.4214.92
Connection cable	Gear motor on FSM-237	91.4291.02