ifm electronic

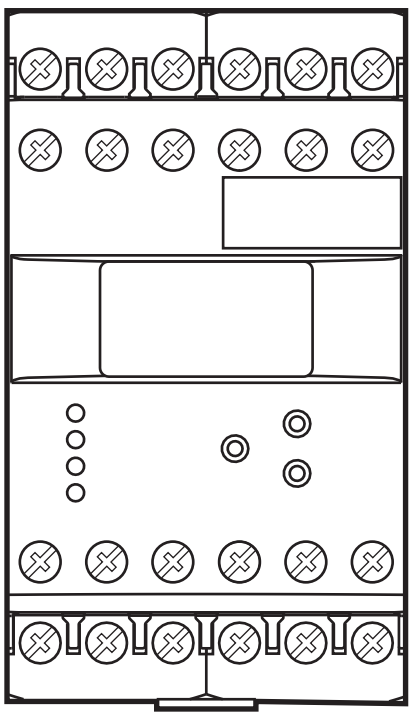
CE

Operating instructions

ecomat200®

UK

Monitor
FA-1



7390961 / 00 01 / 2013

Contents

This document is the original instructions.

1 Preliminary note

This document is part of the device and contains information about the correct handling of the product.

This document is intended for specialists. These specialists are people who are qualified by their training and their experience to see risks and to avoid possible hazards that may be caused during operation or maintenance of the device.

Read this document before use to familiarise yourself with operating conditions, installation and operation. Keep this document during the entire duration of use of the device.

Adhere to the warning notes and safety instructions.

1.1 Symbols used

▶ Instructions

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance can result in malfunction or interference.

Information
Supplementary note.

1.2 Warning signs used

⚠ WARNING

Warning of serious personal injury.
Death or serious irreversible injuries may result.

⚠ CAUTION

Warning of personal injury.
Slight reversible injuries may result.

NOTE

Warning of damage to property.

2 Safety instructions

2.1 General

Follow the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the device.

2.2 Target group

The device must only be installed, connected and put into operation by a qualified electrician.

2.3 Electrical connection

Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.

Make sure that the external voltage is generated and supplied according to the requirements for safe extra-low voltage (SELV) since this voltage is supplied without further measures near the operating elements and at the terminals for the supply of connected sensors.

The wiring of all signals in connection with the SELV circuit of the device must also comply with the SELV criteria (safety extra-low voltage, safe electrical isolation from other electric circuits).

If the externally supplied or internally generated SELV voltage is externally grounded, the responsibility lies with the user in accordance with the applicable national installation regulations. All statements in this manual refer to the unit the SELV voltage of which is not grounded.

It is not allowed to supply external voltage to the terminals for the pulse pick-up supply. The consumption of current which exceeds the value given in the technical data is not allowed.

An external main switch must be installed for the unit which can switch off the unit and all related circuits. This main switch must be clearly assigned to the unit.

2.4 Operation

Be careful when handling the unit once power is applied. This is only allowed by qualified personnel due to the protection rating IP 20.

The design of the unit corresponds to the protection class II except for the terminal blocks. Protection against accidental contact (finger protection to IP 20) for qualified personnel is only guaranteed if the terminal screw has been completely screwed in.

2.5 Installation location

For the correct operation the unit must be mounted in a housing (protection rating IP 40 or higher) which can only be opened using a tool or in a locked control cabinet.

The device has been tested for an impact energy of 1 joule according to EN 61010.

2.6 Housing temperature

As described in the technical specifications below the device can be operated in a wide ambient temperature range. Because of the additional internal heating the operating elements and the housing walls can have high perceptible temperatures when touched in hot environments.

2.7 Tampering with the device

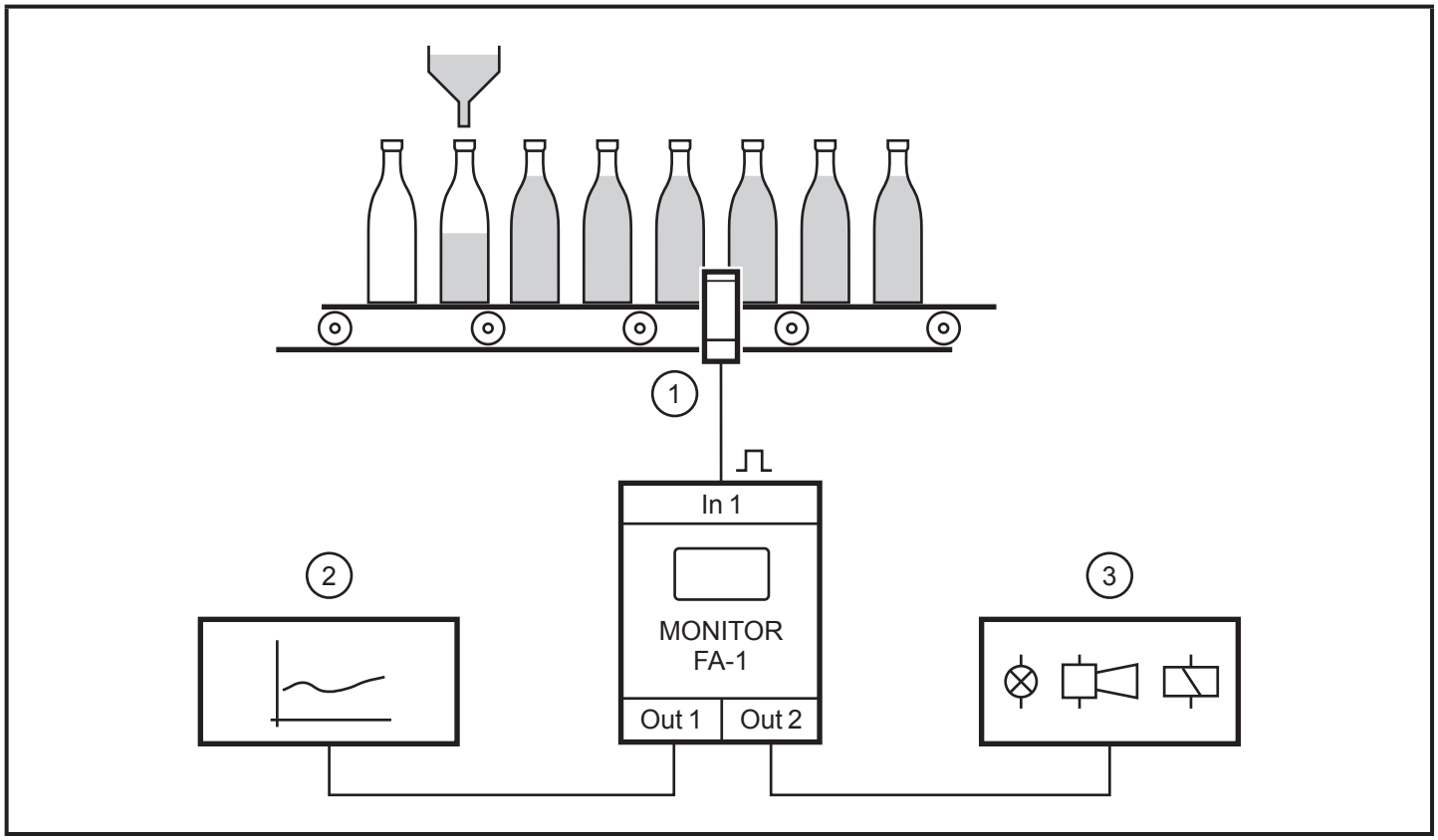
In case of malfunction of the unit or queries please contact the manufacturer. Any tampering with the device can seriously affect the safety of operators and machinery. This is not permitted and leads to the exclusion of any liability and warranty claims.

3 Functions and features

The FA-1 monitor is a programmable frequency-to-current converter.

It takes the pulses of external pulse pick-ups and determines the input frequency on the basis of the period measurement. It calculates the value of the analogue signal in 4...20 mA or 0...10 V on the basis of the set parameters.

It is used as a measurement converter, for example, as an infeed to analogue measuring or recording instruments and PLC input cards or it is used as speed input for frequency converters.



Example 1: detection of a quantity per time unit or conversion of the measured value into an analogue signal

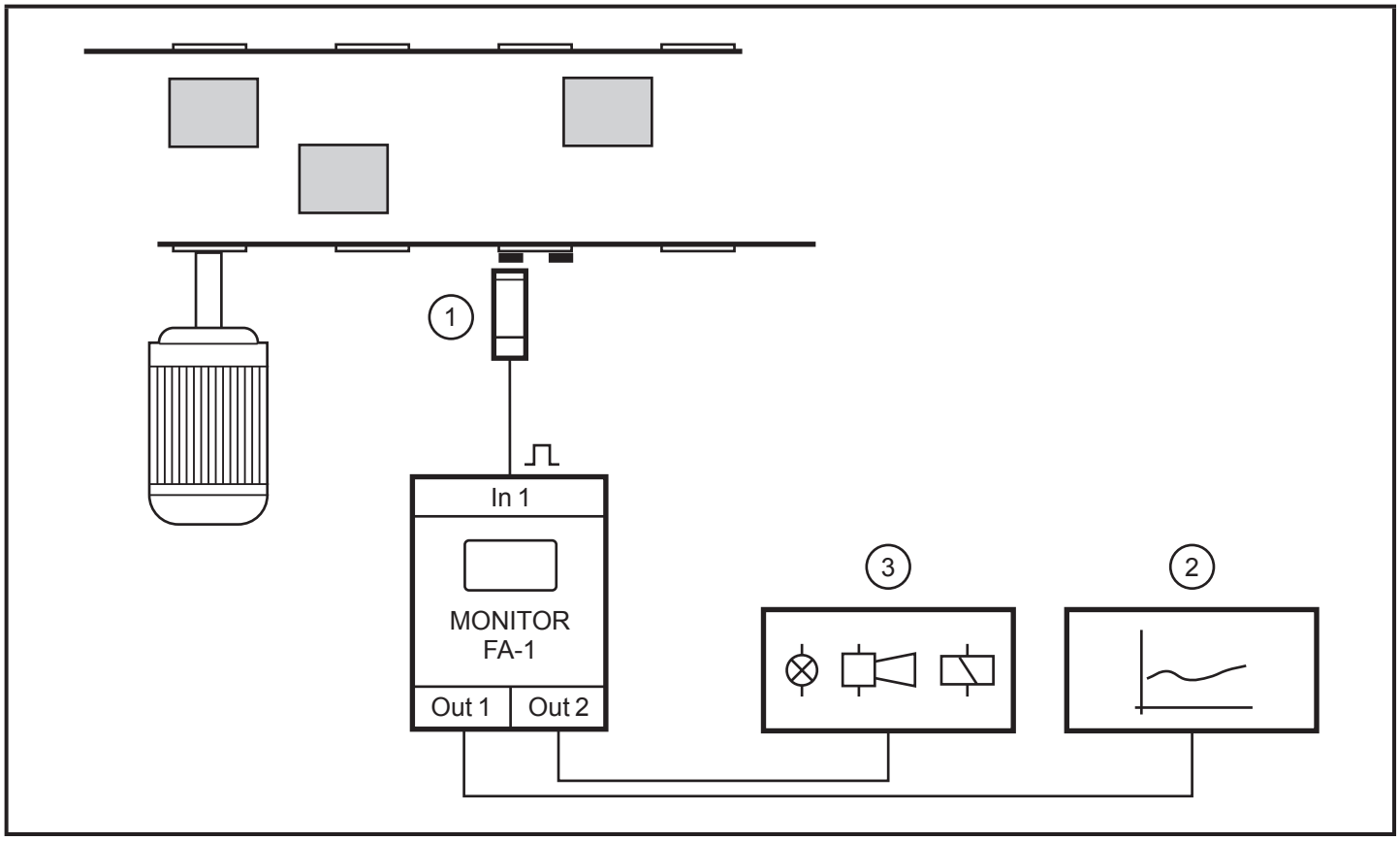
1: Pulse pick-up
2: Analogue output, here e.g. to indicate or record bottles/time unit
3: Switching output

Any frequency value can be assigned to the analogue initial or final value.

For example for the signal 4...20 mA:
4 mA = input frequency 200 Hz
20 mA = input frequency 1.2 kHz

The value of the output signal changes either in proportion or out of proportion with the value of the input frequency.

The monitor has a "teach" function which allows to measure current input frequencies and to assign them to the parameters for initial and final values (→ 8.3 Teach function).



Example 2: detection of a conveyor belt speed and monitoring of overspeed/underspeed (→ 8.4 Setting example)

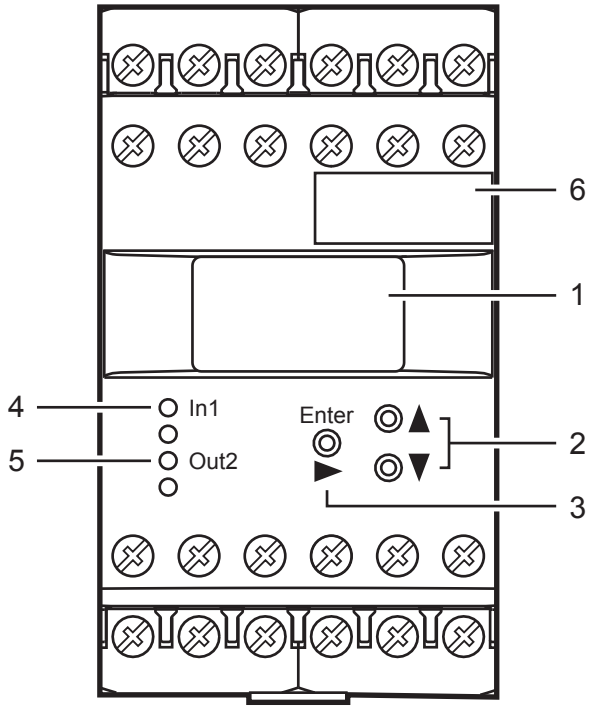
1: Pulse pick-up
2: Analogue output, here e.g. to record the conveyor belt speed
3: Switching output, here e.g. to indicate overspeed/underspeed

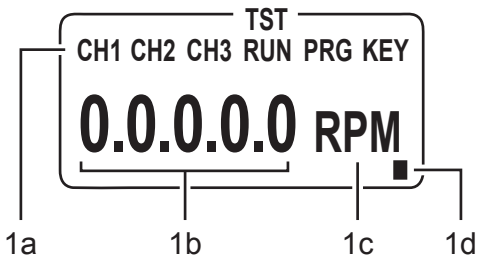
Moreover the FA-1 monitor monitors whether the input frequency is above or below a switching threshold and switches the output according to the parameters set. The switch point can also be set via a teach function.

⚠ WARNING

The device is not approved for safety-related tasks in the field of operator protection.
Using an electrical connection of the outputs of two or more units to achieve a redundant circuit, they can also be used for safety-related tasks. All applicable technical standards must be followed.

4 Operating and display elements





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1	OLED display	
1a	Indicators for input channels and operating modes	
	CH...	Input channels
	RUN	Run mode (normal operating mode)
	TST	Test mode (check the switching characteristics without pulse pick-up connected)
	PRG	Programming mode (setting of the parameter values)
	KEY	Locking
1b	Actual values and parameter values (5-digit, numerical)	
	Speed	0...99,999 RPM / 100.00...600.00 kPM For values > 99,999 RPM the unit changes from RPM to kRM [kilo revolutions per minute].
	Pulses	0.0...10,000 Hz
	Analogue signal	0.00...10.00 V / 0.00...20.00 mA
	Outside the value ranges the display shows "----".	
1c	Parameter abbreviation and units (3-digit, alphanumeric)	
1d	Display is in stand-by mode, no values visible (→ 4.1)	
2	[▲] and [▼] buttons	
	Selection of the actual value display, parameter selection, setting of the parameter values	

3	[Enter/▶] button	
	Selection of the operating mode, acknowledgement of the parameter value, front reset	
4	LEDs In1 (yellow)	Input pulses
5	LEDs Out2 (green)	Switching state of output 2
	Off	Output is not switched. (Relay de-energised, transistor blocked)
	On	Output is switched. (Relay energised, transistor switched)
	Flashing quickly	Output is kept latched. (Parameter SOx, Store Output)
	Flashing slowly	The delay time has an effect on the output. The output switches when the delay time has elapsed and the trigger event is still present (parameter DTx, delay time).
6	Panel for labelling	

4.1 Display stand-by mode

If no button is pressed for more than 10 minutes, the display changes to the stand-by mode. Values and units are no longer visible.
The stand-by mode can be identified by a flashing rectangle.

Even if no values and units are visible, the device continues its monitoring function on the basis of the set parameters and switches the relay and transistor outputs accordingly.

Press any button to switch the display on again.

5 Installation

5.1 Installation of the device

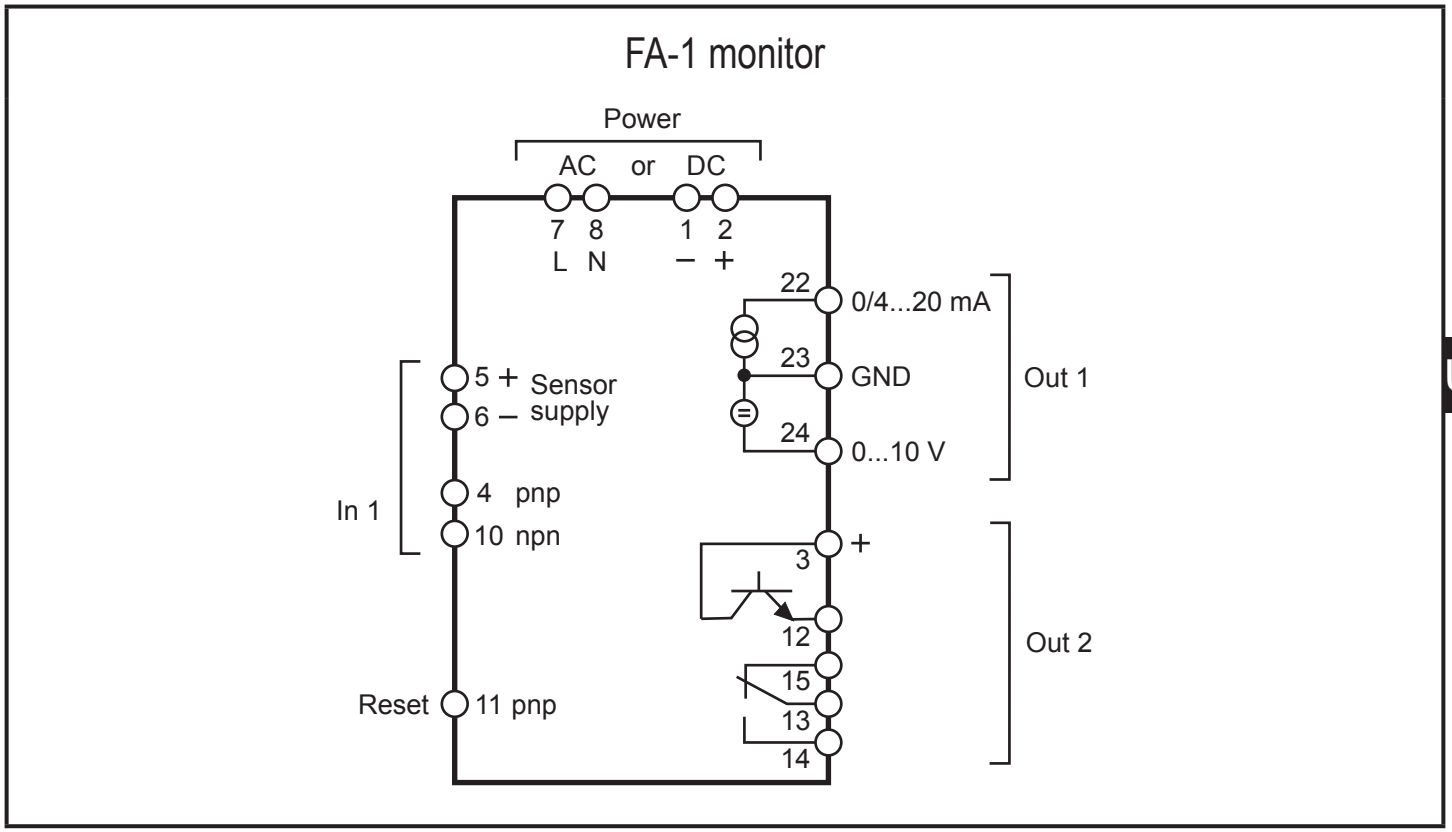
- ▶ Install the device on a 35 mm DIN rail.
- ▶ Leave enough space between the unit and the top and bottom of the control cabinet to enable air circulation and to avoid excessive heating.
- ▶ Take into account the internal heating of all units when mounting several units side by side. The environmental conditions must be observed for every unit.

5.2 Installation of the sensors

- ▶ Follow the manufacturer's installation instructions.

6 Electrical connection

6.1 Terminal connection



Terminal connection

⚠ WARNING

Do not use unconnected terminals such as terminal 9 as support point terminal.

6.2 Voltage supply (power)

- ▶ Voltage supply see type label.
- ▶ The device may only be operated using one of the possible voltage connections, i.e. either terminals 7/8 (AC) or terminals 1/2 (24 V DC).
- ▶ All supply and signal cables must be laid separately. Use a screened cable if required in the application.

6.2.1 AC supply

- ▶ The AC supply cable must be protected according to the cross-section used (max. 16 A).

If the unit is supplied on AC, the low voltage provided for the sensor supply meets the SELV criteria according to EN 61010, overvoltage category II, soiling degree 2.

6.2.2 DC supply

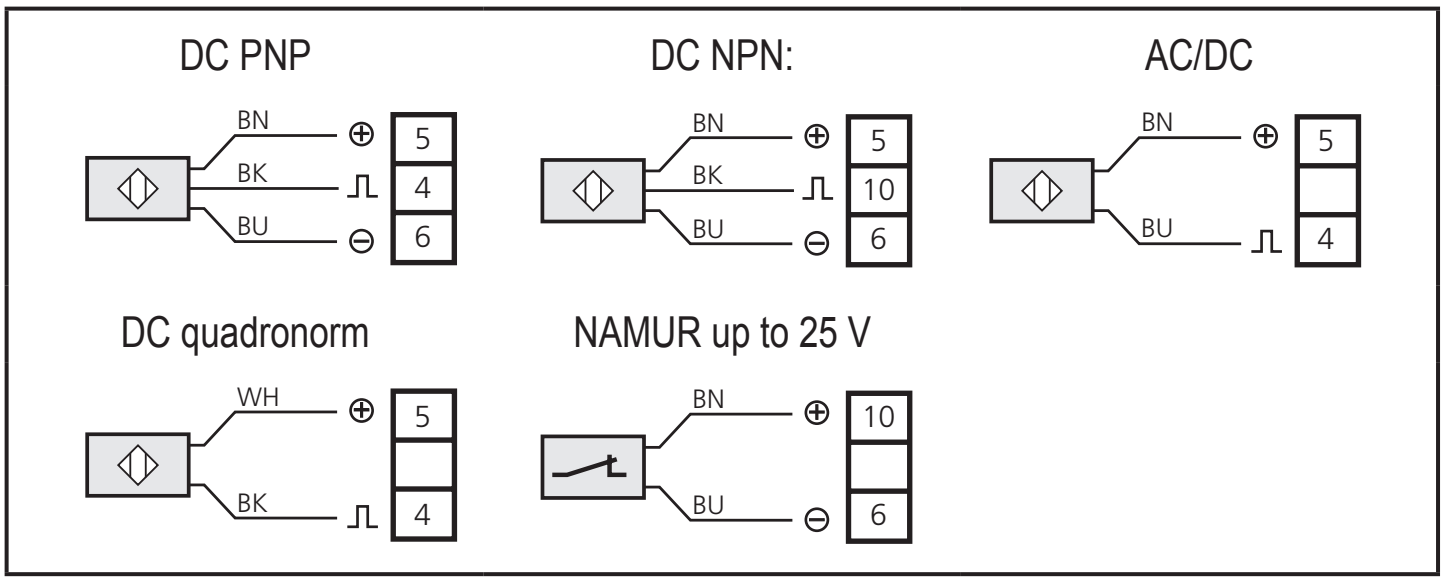
- ▶ The SELV criteria (safety extra-low voltage) must be met for the DC supply.

▶ The DC supply cable L+ (terminal 2) must be protected externally with a 315 mA time-lag fuse (5 x 20 mm or similar).

The DC supply terminals are directly connected to the sensor supply terminals.

6.3 Inputs

6.3.1 Connection of the sensors (In1)



Connection of the sensors

The connection of mechanical switch contacts is not recommended since they tend to bounce and produce faulty pulses.

The terminals 5/6 can be used for the sensor supply or for the reset inputs.

6.3.2 Reset input (reset)

Via the reset input (terminal 11) the start-up delay can be started or a saved error can be reset while the latching function is active (SO2 = 2).

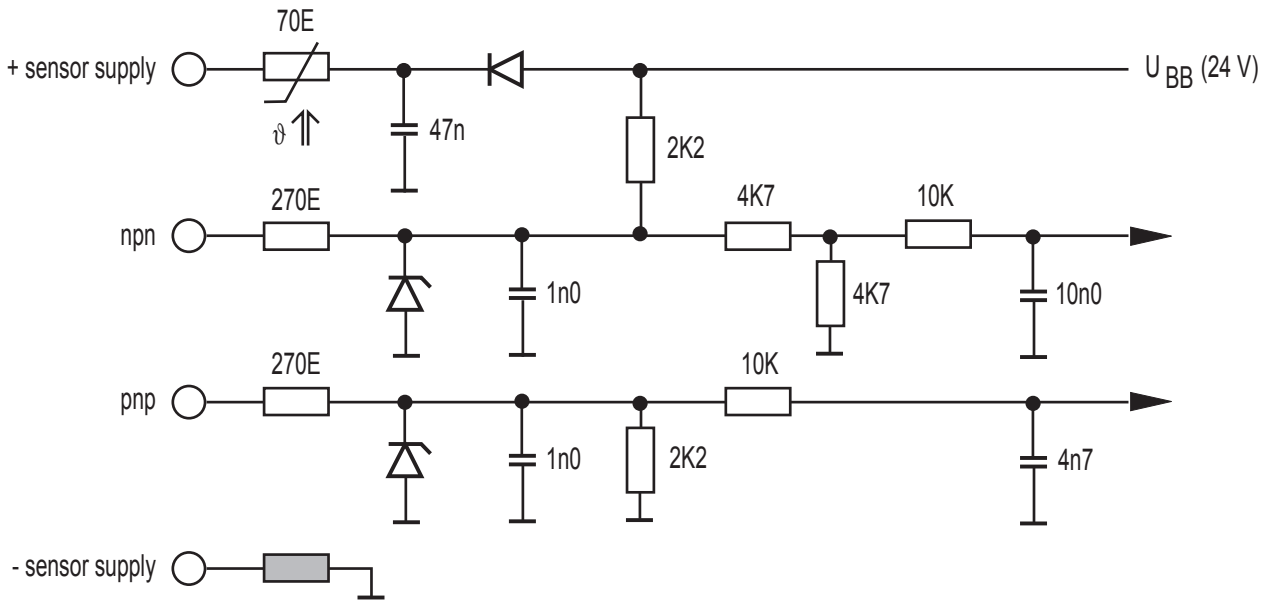
▶ The internal +24 V DC voltage (terminal 5) or an external +24 V DC voltage is connected to terminal 11 via a closing contact.
▶ If an external voltage is used, the negative reference point of this voltage must be connected to terminal 1 of the monitor.

When the contact is opened (+24 V DC no longer applied), the start-up delay starts.

When the contact is closed (+ 24 V DC applied) a saved error is reset.

A +24 V DC continuous signal leads to a permanent bridging of the monitoring, i.e. the same state as during the start-up delay is indicated. When the voltage is no longer applied and the set start-up delay has elapsed, monitoring starts.

6.3.3 Typical input circuit F...-x



6.4 Outputs

6.4.1 Analogue output (Out1)

The analogue output is electrically isolated from the pulse pick up supply and the 24 V DC supply voltage up to 500 V DC.
This electrical isolation is a simple electrical separation. It is not suitable for the isolation from mains circuits and SELV circuits.

No dangerous contact circuits must be connected to the analogue output.

6.4.2 Relay output (Out2)

▶ To prevent excessive wear and to comply with the EMC standards, interference suppression of the contacts is required for switching inductive loads.

⚠ WARNING

If the device is operated on an AC supply (terminals 7/8) this must use the same supply cable as the voltage supply to switch an AC voltage via the relay output.

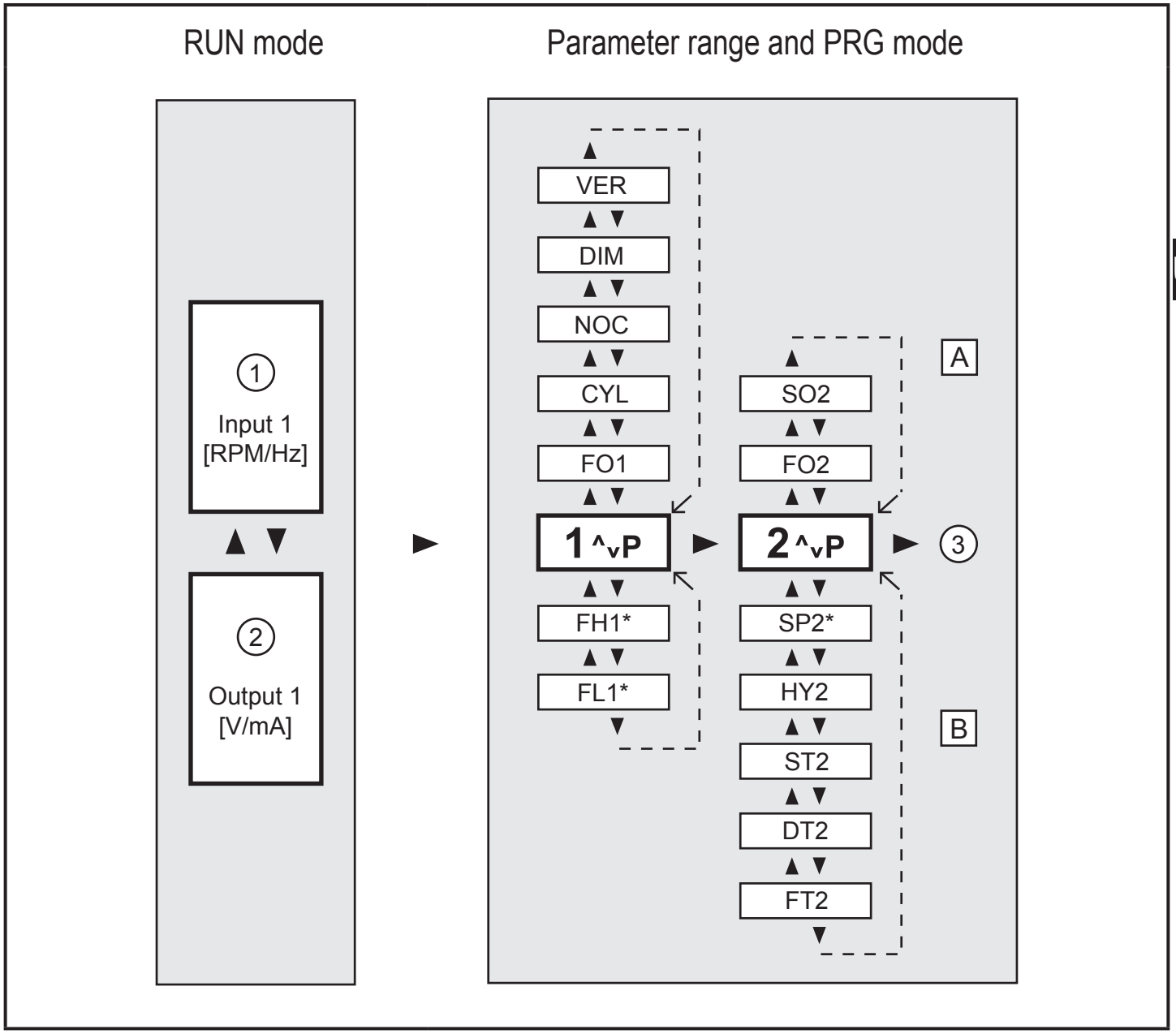
If the relay output is used to switch very small currents (e.g. PLC inputs), considerable contact resistance can arise. Use the transistor output for this purpose.

6.4.3 Transistor output (Out2)

▶ The transistor output needs an external +24 V DC supply on terminal 3.
▶ Connect the reference point (GND) of the external power supply to terminal 1 of the monitor. Otherwise no switching operation is possible.
▶ The SELV criteria (safety extra-low voltage) must be met for the DC supply of the transistor output.
▶ The DC supply cable L+ (terminal 3) must be protected externally with a 315 mA time-lag fuse (5 x 20 mm or similar).

7 Navigation and parameter overview

The buttons [▲] / [▼] and [Enter/►] are used for the navigation, entry of values and acknowledgement within the parameters arranged in columns.



1: Display: actual value speed/input frequency
2: Display: actual value analogue output
3: Back to the RUN mode

A: System parameters
B: Application parameters

*) Parameters with teach function (→ 8.3)

7.1 System parameters

7.1.1 FO1

Function of output 1 (output function of analogue output 1)

1	4...20 mA	Proportional output signals
2	0...20 mA	
3	0...10 V	
4	20...4 mA	Inversely proportional output signals
5	20...0 mA	
6	10...0 V	
Values		1...6
Default value		2 (0...20 mA)

7.1.2 CYL

Cycles (averaging)

Averaging of up to 16 measurements. Only influences frequency-to-current conversion!	
Values	1...16
Default value	1

7.1.3 NOC

Number of cams

Number of cams detected per revolution. On the basis of this value the monitor calculates the rotational speed (measured frequency ÷ NCx = displayed speed in RPM). For frequency measurements NCx = 1 should remain set.	
Values	1...999
Default value	1

7.1.4 DIM

Dimension (display format)

Indication in Hz or RPM (revolutions per minute). When a new unit is selected, the monitor converts all existing values into the new unit!	
Values	0 = RPM
	1 = Hz
Default value	0 = RPM

7.1.5 VER

Software version

The installed software version is displayed (5-digit number with abbreviation VCO).

7.1.6 FO2

Function of output 2 (switching function of output 2)

1	Relay energises (transistor output switched) when the current value is below the switch point SPx (signalled state: "minimum speed"/"blocked").
2	Relay de-energises (transistor output blocked) when the current value is below the switch point SPx (signalled fault: "underspeed "/"blocked").
3	Relay energises (transistor output switched) when the current value is above the switch point SPx (signalled state: "rotational speed reached").
4	Relay de-energises (transistor output blocked) when the current value is above the switch point SPx (signalled fault: "overspeed").
5	Relay is energised (transistor output switched) within the frequency range (acceptable range).
6	Relay is de-energised (transistor output blocked) within the frequency range. With the functions 5 and 6 a frequency range above and below the switch point SP2 is defined in combination with the parameter HY2 (hysteresis).
	$SP2 = (f_{max} + f_{min}) \div 2$
	$HY2 = ((SP2 - SP_{min}) \div SP2) \times 100\ [\%]$
Values	1...6
Default value	2

7.1.7 SO2

Store output 2 (latching function of output 2)

When this parameter is active the output does not switch back automatically but must be reset.	
Values	0 = inactive
	1 = front reset ([Enter/▶] > 3 s)
	2 = front reset and external reset
Default value	0 = (inactive)

7.2 Application parameters

7.2.1 FH1

Frequency high (final value of the frequency range)

Depending on FO1 the analogue minimum or maximum value is indicated. For 0...99,999 RPM the increment is 1 RPM. For values > 99,999 RPM the unit changes from RPM to kRM [kilo revolutions per minute] and the increment is 10 RPM.	
Note	Teach function (→ 8.3) The difference between initial and final value must be at least 5 % of the final value!
Values	0.0...10,000 Hz or 0...600,000 RPM
Default value	1000 (RPM)

7.2.2 FL1

Frequency low (initial value of the frequency range)

Depending on FO1 the analogue minimum or maximum value is indicated. For 0...99,999 RPM the increment is 1 RPM. For values > 99,999 RPM the unit changes from RPM to kRM [kilo revolutions per minute] and the increment is 10 RPM.	
Note	Teach function (→ 8.3) The difference between initial and final value must be at least 5 % of the final value!
Values	0.0...10,000 Hz or 0...600,000 RPM
Default value	0 (RPM)

7.2.3 SP2

Switch point of output 2

Value at which output 2 changes its switching state according to the switching function FO2.	
Note	Setting function (→ 8.3)
Values	0.1...10,000 Hz or 1...600,000 RPM (unit depends on DIM)
Default value	500 (RPM)

7.2.4 HY2

Hysteresis of output 2 (hysteresis for switch point SP2)

The hysteresis value determines the difference between the reset point and the switch point SP2. Prevents a possible chattering of the switching output. In combination with the switching functions 5 and 6 (FOx) an acceptable range or an error range can be defined.	
Values	0.0...1000.0 % of the value for SP2
Default value	5.0

7.2.5 ST2

Start-up delay time of output 2

Enables the suppression of error messages when a plant is started. When the device is switched on or when the 24 V signal is removed from the reset input, the output for the time set here is in the "good" state (= no fault).	
Values	0.0...1000.0 s
Default value	0.0 (no start-up delay)

7.2.6 DT2

Delay time of output 2

Enables a delayed switching of output 2. The output switches only if the current value is above or below the switch point for more than the time set here.	
Values	0.0...1000.0 s
Default value	0.0 (no delay time)

7.2.7 FT2

Fleeting time of output 2

If an event occurs, the output changes its state during the set time and then switches back to the initial state.	
Values	0.0...1000.0 s
Default value	0.0 (fleeting time not active)

8 Programming

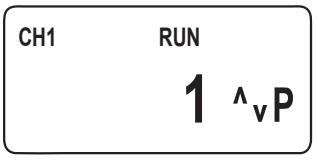
⚠ WARNING

If programming takes place during operation, dangerous contact voltage may occur. Therefore ensure that programming is done by a qualified electrician.

Parameter changes during operation, especially changes to the switching function and the switch points can lead to malfunction in the plant. Therefore disconnect it during the change and then check the function.

Programming consists of 6 steps:	
1. Change from the RUN mode to the parameter range 1 or 2	[Enter/►]
2. Selection of the requested parameter (FOx, SOx, NCx, etc.)	[▲] / [▼]
3. Change to the PRG mode	[Enter/►]
4. Setting or changing the parameter value	[▲] / [▼]
5. Acknowledgement of the set parameter value	[Enter/►] > 3 s
6. Return to the RUN mode	[Enter/►] > 3 s

8.1 Programming example DT1 (delay time, output 1)

Operation	Display
Change from the RUN mode to the parameter range (here 1)	
► Briefly press [Enter/►] once. > The 1st parameter range is displayed.	
Select the requested parameter (here DT1)	
► Press [▼] until the parameter DT1 is displayed with the currently set value (here default value 0.0).	
Change to the PRG mode	
► Briefly press [Enter/►] once. > The unit is in the programming mode. > PRG indicator visible, parameter abbreviation flashes.	

Set or change the parameter value	
▶ Press [▲] / [▼] until the requested parameter value is displayed (→ 8.2.3 Numerical entries).	
Acknowledge the set parameter value	
▶ Press [Enter/▶] until the parameter abbreviation no longer flashes and the indicator PRG has disappeared. > The new parameter value is indicated and effective.	
Return to the RUN mode	
▶ Press [Enter/▶] for about 3 s or wait for the time-out function (approx. 15 s). > The unit is again in the RUN mode, the current value is indicated.	

UK

8.2 Notes on programming

8.2.1 RUN mode

During programming the unit internally remains in the RUN mode (RUN indicator visible).
This means that until a new value is acknowledged with [Enter/▶], the unit carries out its monitoring function on the basis of the previously set parameters and switches the relay and transistor outputs accordingly.

The monitoring function of the monitor is deactivated by continuously pressing [Enter/▶] in the RUN mode. The deactivation is effective as long as the button is pressed.

8.2.2 Time-out function

If during programming no button is pressed for approx. 15 s, this is seen as a cancellation.
Parameter changes which are not acknowledged with [Enter/▶] are rejected. The previously set parameter value is restored and remains effective for the monitoring function.

8.2.3 Numerical entries

▶ Press [▲] or [▼] and hold the button.

The smallest decade becomes active and is counted up or down depending on the selected button (e.g. 1, 2, 3,...0). Then comes the next decade, etc.

As soon as the button is released, the active decade flashes. It is set by pressing [▲] or [▼] several times. The preceding decade then flashes and can be set.

8.2.4 Factory reset

The factory default values can be restored by pressing [▲] and [▼] simultaneously during power on. All previously entered parameter values are lost.

8.2.5 KEY function (locking)

The unit can be locked to prevent incorrect entries.
After locking, only the actual value indication can be changed with the [▲] and [▼] buttons. Parameter range and PRG mode can no longer be selected.

Locking	Unlocking
▶ Press [▲] and [▼] simultaneously and hold the buttons pressed. > The KEY indicator flashes. ▶ Release the buttons when the KEY indicator is continuously indicated.	▶ Press [▲] and [▼] simultaneously and hold the buttons pressed. > The KEY indicator flashes. ▶ Release the buttons when the KEY indicator is no longer indicated.

8.3 Teach function

In addition to the numerical entry 3 parameters can also be set via the teach function. In the programming mode this function enables to measure and display the current input frequency and assign it to the selected parameter.

- FH1 frequency high (final value of the frequency range)
- FL1 frequency Low (initial value of the frequency range)
- SP2 switch point of output 2

To teach the current measured value the same programming steps as for "normal" programming are carried out.

Programming with teach function	
1. Change from the RUN mode to the parameter range 1 or 2	[Enter/▶]
2. Select the requested parameter (FH1, FL1 or SP2)	[▲] / [▼]
3. Change to the PRG mode	[Enter/▶]
4. Display and set the current input frequency*	[▲] and [▼] > 3 s
5. Acknowledge the displayed and possibly changed value	[Enter/▶] > 3 s
6. Return to the RUN mode	[Enter/▶] > 3 s

*) The displayed value can be changed with [▲] / [▼], if necessary.

8.4 Setting example

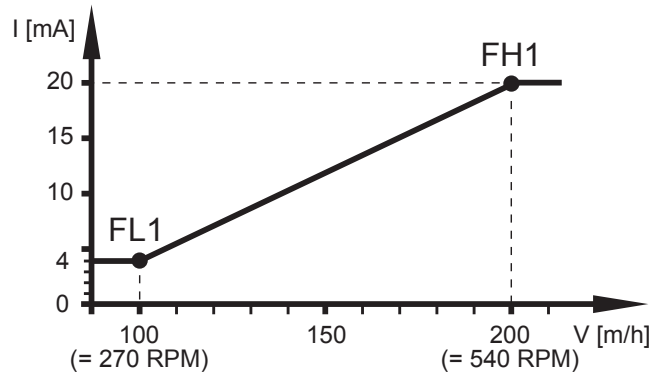
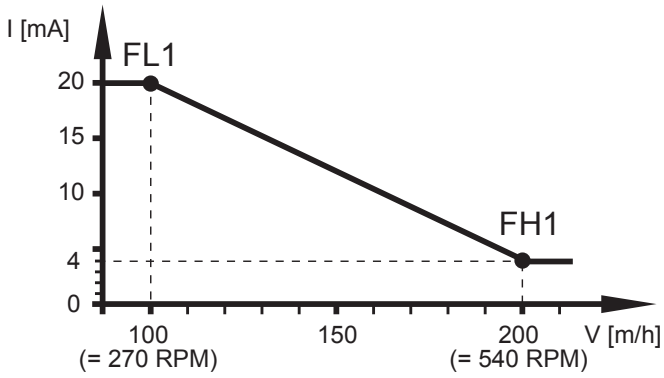
8.4.1 Detection of conveyor belt speed and error message

See example 2 (→ 3 Functions and features)

Task

The conveyor belt speed is to be detected between the minimum and maximum range and is to be converted into an analogue signal (4...20 mA).
A belt speed < 50 m/h is to be signalled as a fault state.
The output relay of the monitor is to remain in this switching state until a reset is started.

System parameters			
Belt speed		≤ 200 m/h ≥ 100 m/h	
Cams on the shaft		2 per revolution	
Analogue data recorder input		4...20 mA	
Parameter values			
FO1	Output function of analogue output 1	1	4...20 mA
NOC	Number of cams	2	Display of shaft speed in RPM
FO2	Switching function of output 2	2	Relay de-energises when the actual value is below the switch point SP2 (signalled fault: "underspeed"/"blocked").
SO2	Latching function of output 2	2	Reset with [Enter/▶] or external 24 V DC signal
FH1	Frequency high (final value of the frequency range)	540	Acquiring the input frequency via the teach function with a max. belt speed of 200 m/h (here e.g. shaft speed 540 RPM)
FL1	Frequency low (initial value of the frequency range)	270	Acquiring the input frequency via the teach function with a min. belt speed of 100 m/h (here e.g. shaft speed 270 RPM)
SP2	Switch point of output 2	135	Detection of the input frequency via the teach function with a belt speed of 50 m/h (here e.g. shaft speed 135 RPM) or numerical entry by conversion on the basis of the input values FH1 or FL1 detected before.

Analogue output	
Here FO1 = 1 (4...20 mA) Proportional	As an alternative FO1 = 4 (20...4 mA) Inversely proportional
	

9 Test mode

In the test mode the switching behaviour of the monitor can be checked, set and stored without any connected pulse pick-up. The monitor runs through a freely definable frequency range and switches the outputs according to the selected switching function and switch points.

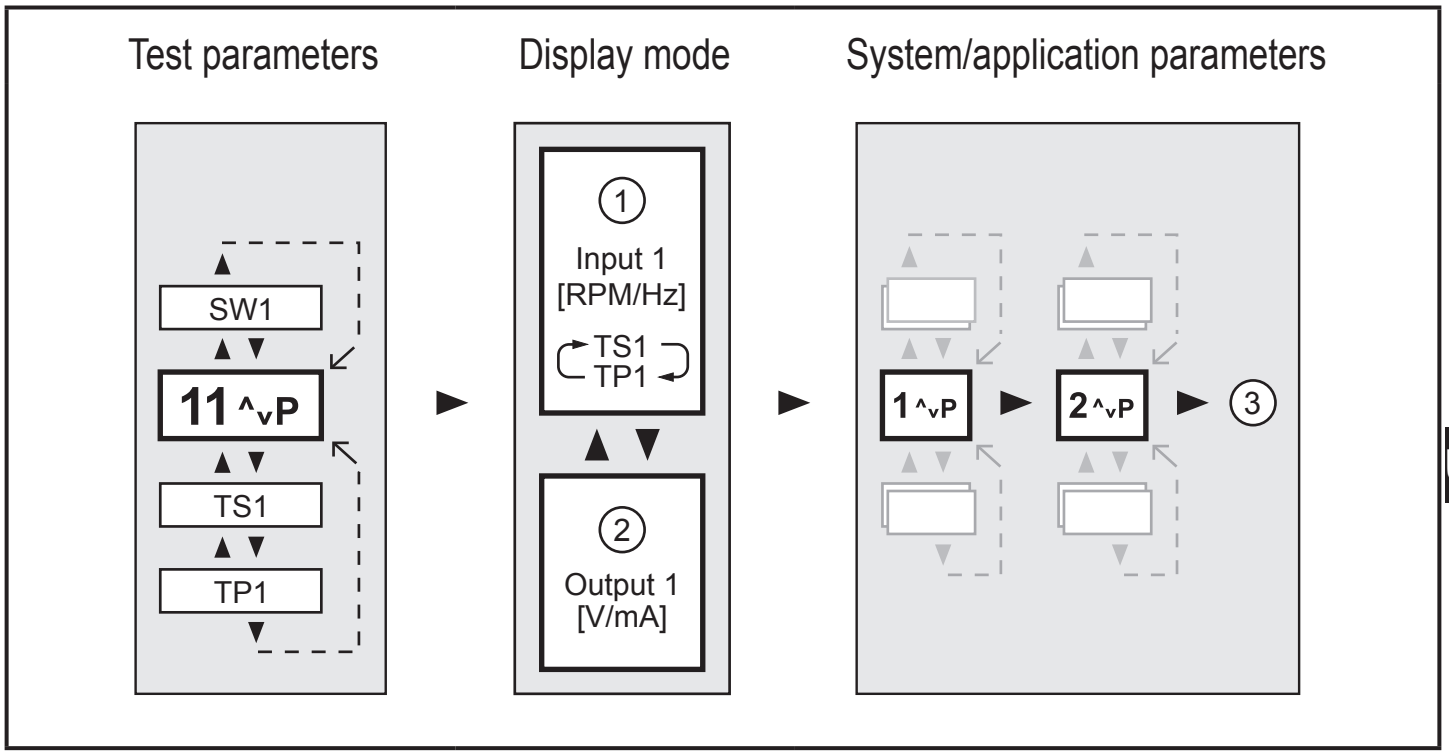
9.1 Activate the test mode

► Apply the operating voltage and press [Enter/►] simultaneously.
> The display indicates the parameter range 11 and "TST".
> In addition to the system and application parameters, parameters for the test frequencies are available.

9.2 Terminate the test mode

► Switch off the unit.

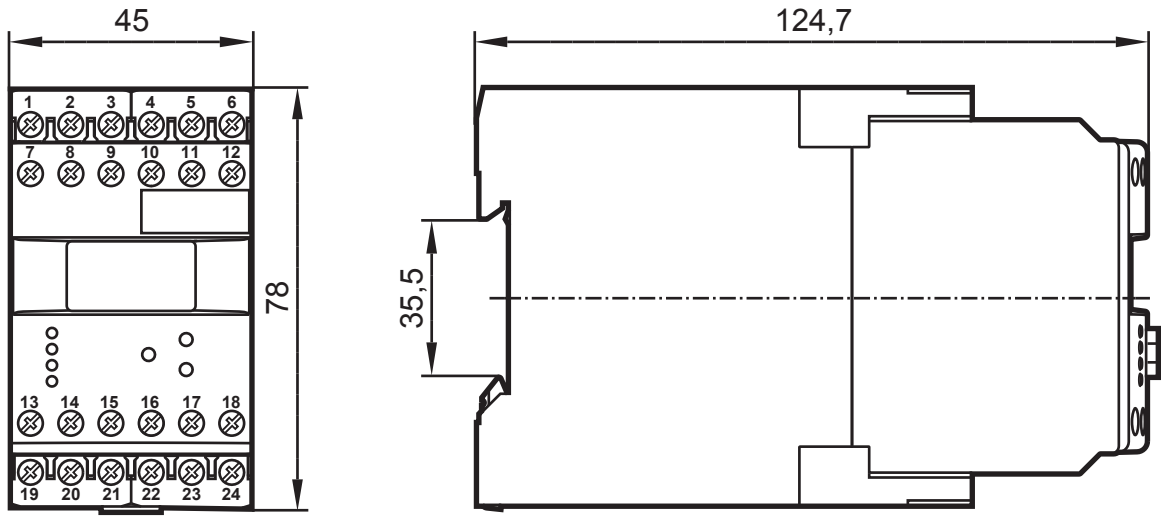
9.3 Test parameters



1: Test frequency input 1
2: Analogue value output 1
3: Back to the test parameters

SW1	Sweep on input 1	
	Change of speed of the test frequency	
	Values	1...5 (1 = fast, 5 = slow)
	Default value	1
TS1	Test start on input 1	
	Initial value of the test frequency	
	Values	1...600,000 RPM or 0.1...10,000 Hz
	Default value	50 RPM
TP1	Test stop on input 1	
	Final value of the test frequency	
	Values	1...600,000 RPM or 0.1...10,000 Hz
	Default value	1500 RPM

10 Scale drawing



11 Technical data

11.1 Overview

Article no.	DW2503
Monitor type	FA-1
Supply voltage Frequency range Power consumption	see type label
Sensor types	PNP/NPN; NAMUR
Sensor supply	24 V DC
Input frequency	≤ 15 kHz
Analogue output	0...10 V; 0/4...20 mA
Load (V/mA)	≥ 10 kOhm / ≤ 500 Ohm
Relay output	1 changeover contact, potential-free
Switching current	≤ 6 A
Switching voltage	≤ 250 V AC; B300, R300
Transistor output	PNP switched; externally supplied
Switching current	≤ 15 mA; short-circuit proof
Switching voltage	24 V DC (± 20 %)
Protection housing / terminals	IP 50 / IP 20
Ambient temperature	-40...60°C
Storage temperature	-40...85° C

Article no.	DW2503
Maximum relative air humidity	80 % (31 °C) linearly decreasing to 50 % (40 °C)
Maximum operating altitude	2000 m above sea level
Connection	17 dual-chamber terminals; 2 x 2.5 mm² (AWG 14)
cULus test conditions	Housing dimensions for temperature rise test: 200 x 200 x 150 mm

Data sheets are available at:
www.ifm.com → Data sheet search→ Article number

11.2 Approvals/standards

EC declarations of conformity, approvals etc. are available at:
www.ifm.com → Data sheet search → Article number → More information

12 Maintenance, repair, disposal

The unit is maintenance-free.

- ▶ Do not open the housing as the device does not contain any components which can be repaired by the user. The device must only be repaired by the manufacturer.
- ▶ Dispose of the device in accordance with the national environmental regulations.