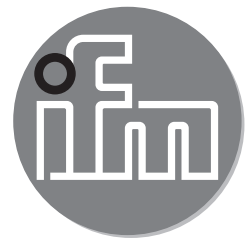


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Operating instructions

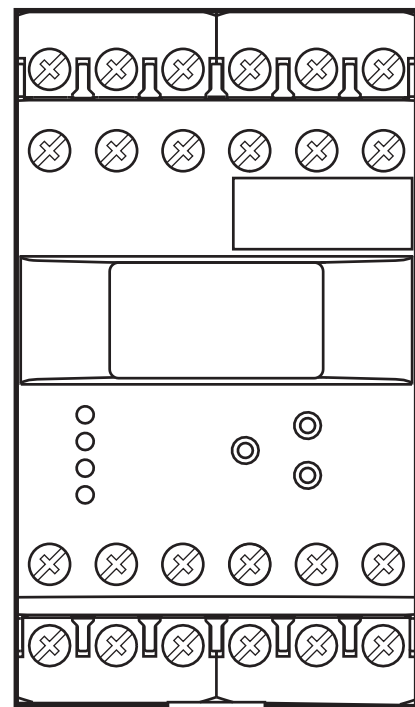
**ecomat200**

Monitor

FS-2 / FS-2N

UK

7390959 / 00 01 / 2013



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# 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 pushbuttons, 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.

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### 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 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 EN61010.

## **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**

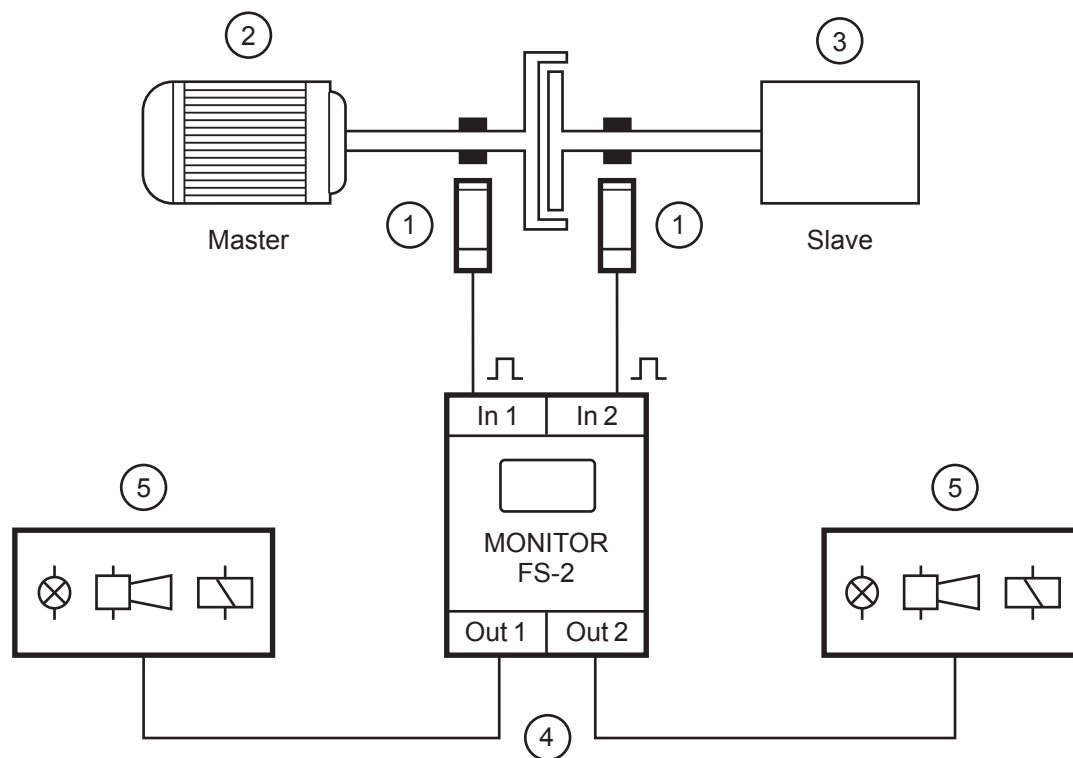
In case of malfunction of the unit or queries please contact the manufacturer. Any tampering with the device can seriously affect the safety of operators and machinery. This is not permitted and leads to the exclusion of any liability and warranty claims.

# **3 Functions and features**

The monitor FS-2/FS-2N is a pulse evaluation system. It is mainly used for slip monitoring of clutches, belt conveyors and other applications where rotational speed differences must be evaluated.


It takes the rotational speed proportional pulse sequences from the drive and power take-off sides at 2 separate inputs, supplies them to two internal counters and monitors the difference between the two counter values.

The monitor switches if the set number of the differential pulses is reached within a set reset time.



Example: slip monitoring on a clutch

- 1: pulse pick-ups
- 2: drive (master)
- 3: power take-off (slave)
- 4: switching outputs
- 5: signals depending on the selected switching functions

 The pulses can be freely assigned to the input channels. The differential pulses  $IN1 > IN2$  or  $IN2 > IN1$  can be evaluated.

Differential pulses are generated by blocking or overload.

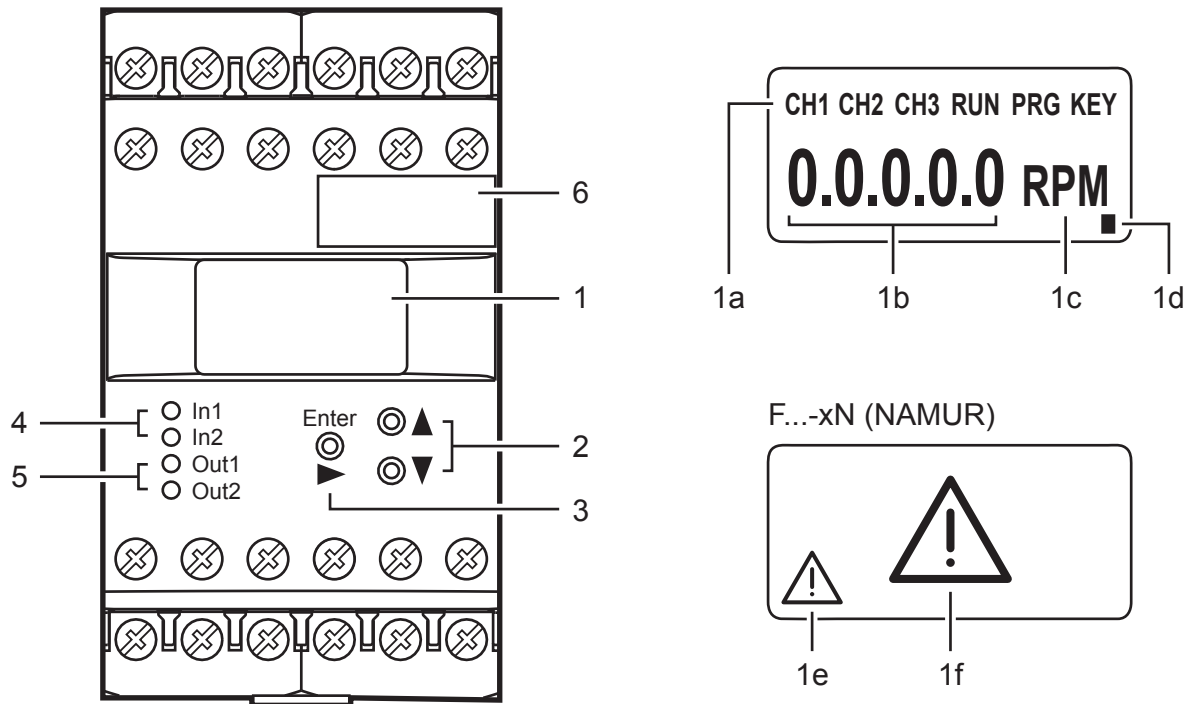
- Blocking = maximum rotational speed difference in few ms
- Overload = small rotational speed difference over a longer period

## WARNING

The device is not approved for safety-related tasks in the field of operator protection.

Using an electrical connection of the outputs from 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



1	OLED display	
1a	Indicators for input channels and operating modes	
	CH...	Input channels
	RUN	Run mode (normal operating mode)
	PRG	Programming mode (setting of the parameter values)
	KEY	Locking
1b	Actual values and parameter values (5-digit, numerical)	
	Rotational speed	0...60,000 RPM
	Pulses	0.1...1,000.0 Hz
	Differential pulses	0...999
	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)	
1e	Display in display mode Symbol for wire break / short circuit on the cable of the pulse pick-up (only F...-xN)	
1f	Display in standby mode Symbol for wire break / short circuit on the cable of the pulse pick-up (only F...-xN)	



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 In1/2 (yellow)	Input pulses
5	LEDs Out1/2 (green)	Switching status of the outputs 1 and 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	

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F...-xN = device with NAMUR input

## 4.1 Display stand-by mode

If no button is pressed for more than 10 minutes, the device 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

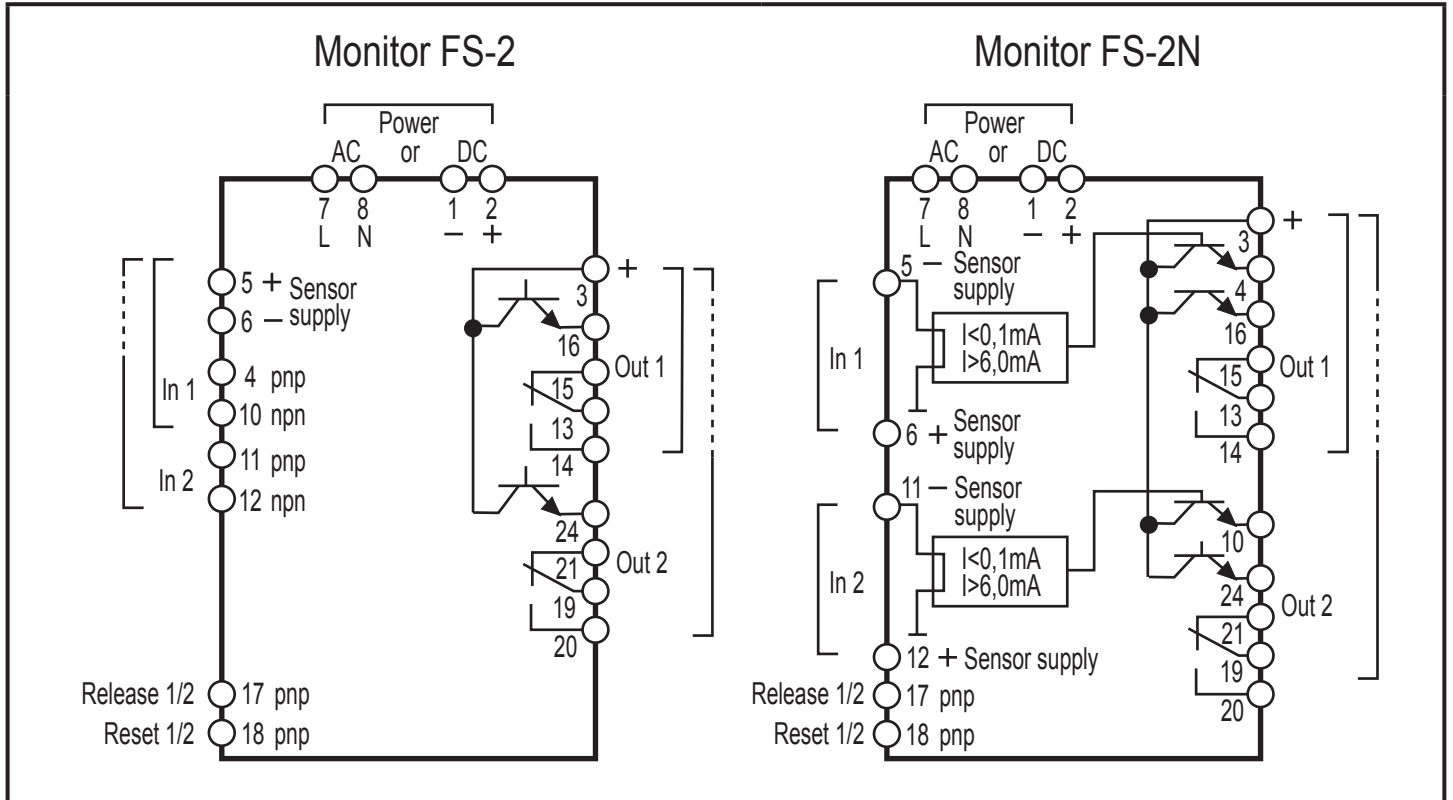
- Install the device on a 35 mm DIN rail.
- Leave enough space between the unit and the top and bottom of the control cabinet to enable air circulation and to avoid excessive heating.
- Take into account the internal heating of all units when mounting several units side by side. The environmental conditions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

## 5.2 Mounting 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.

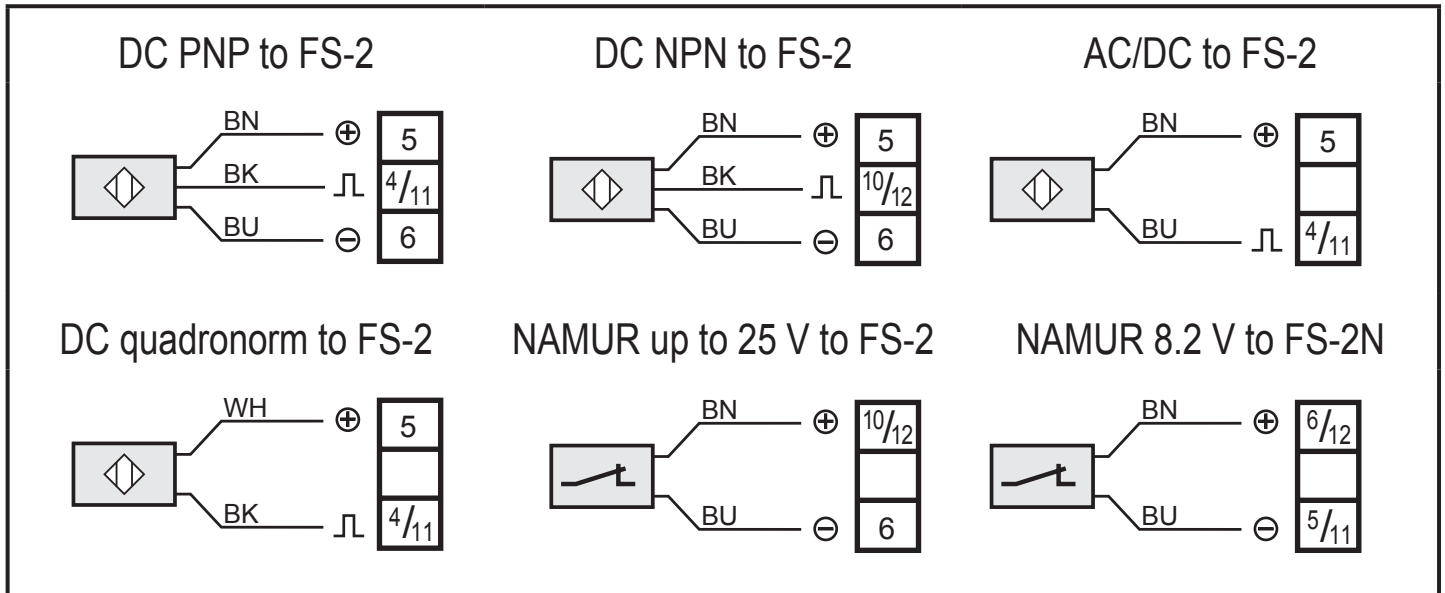
## 6.2.2 DC supply

- 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 T 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, 2)



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 release/reset inputs (only F...-x).

### 6.3.2 Release input (release 1 and 2)

By means of the release input (terminal 17), a preset start-up delay can be started.

- The internal +24 V DC voltage (terminal 5) or an external +24 V DC voltage is connected with terminal 17 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 set start-up delay starts for both outputs.

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In case of a stored fault the +24 V DC signal on terminal 17 is only effective after a reset has been made.

A +24 V DC continuous signal on terminal 17 keeps outputs 1 and 2 in the same state as with the active start-up delay.

### 6.3.3 Reset input (reset 1 and 2)

A saved error can be reset via the reset input (terminal 18).

- The internal +24 V DC voltage (terminal 5) or an external +24 V DC voltage is connected with terminal 18 via a closing contact.

Reset for output 1 and 2 = terminal 18

- 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 memory of both outputs is reset.

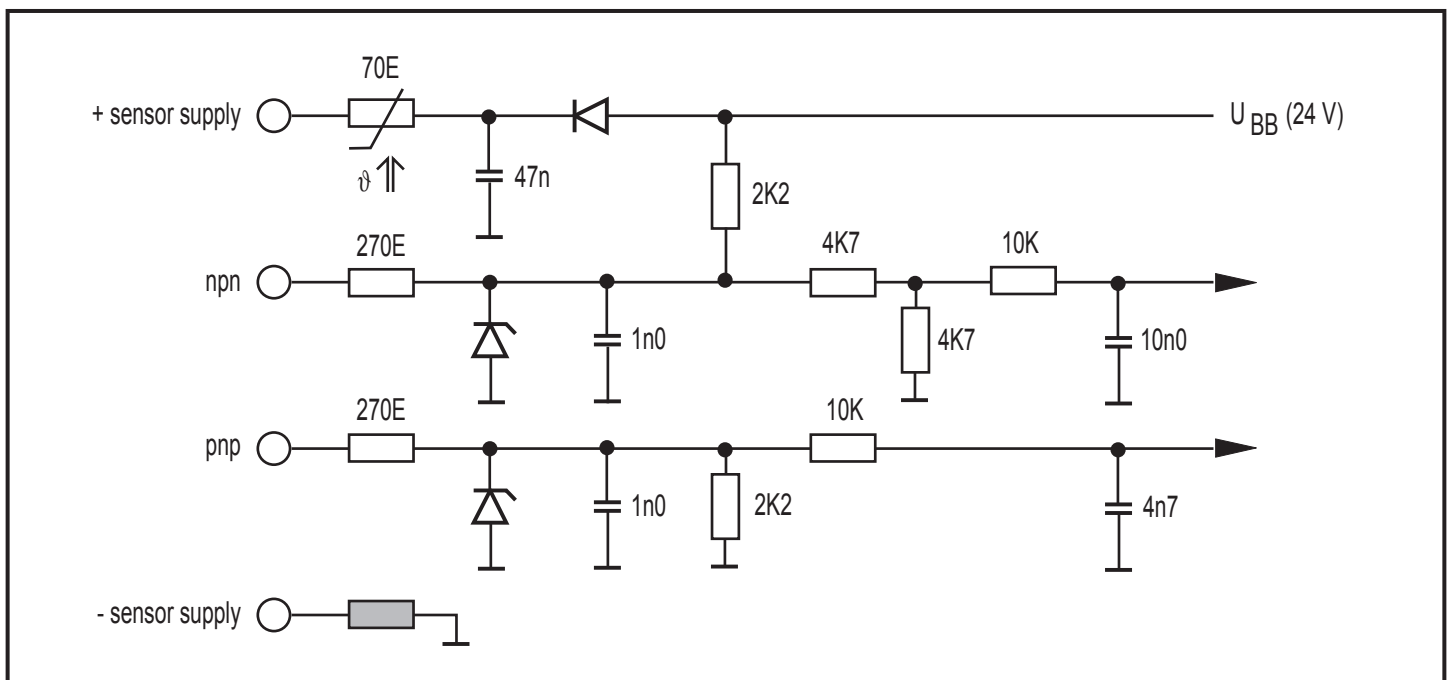


A +24 V DC continuous signal has no effect on the monitoring function.

Note on F...-xN:

The +24 V DC signal voltage required for the release/reset inputs is not available to the F...-xN. This must be taken from an external voltage source. The reference point (GND) of the external power supply must be connected to terminal 1 of the monitor; otherwise no switching operation is possible.

### 6.3.4 Typical input circuit F...-x



## 6.4 Outputs

### 6.4.1 Relay outputs (Out1, 2)

- ▶ 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 outputs.



If the relay outputs are used for switching very small currents (e.g. PLC inputs), considerable contact resistance can arise. In this case use the transistor outputs.

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### 6.4.2 Transistor outputs (Out1, 2)

- ▶ The transistor outputs need an external voltage of +24 V DC 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 outputs.
- ▶ The DC supply cable L+ (terminal 3) must be protected externally with a 315 mA T fuse (5 x 20 mm or similar).

## 6.5 Additional outputs for NAMUR devices (F...-xN)

### 6.5.1 Fault outputs

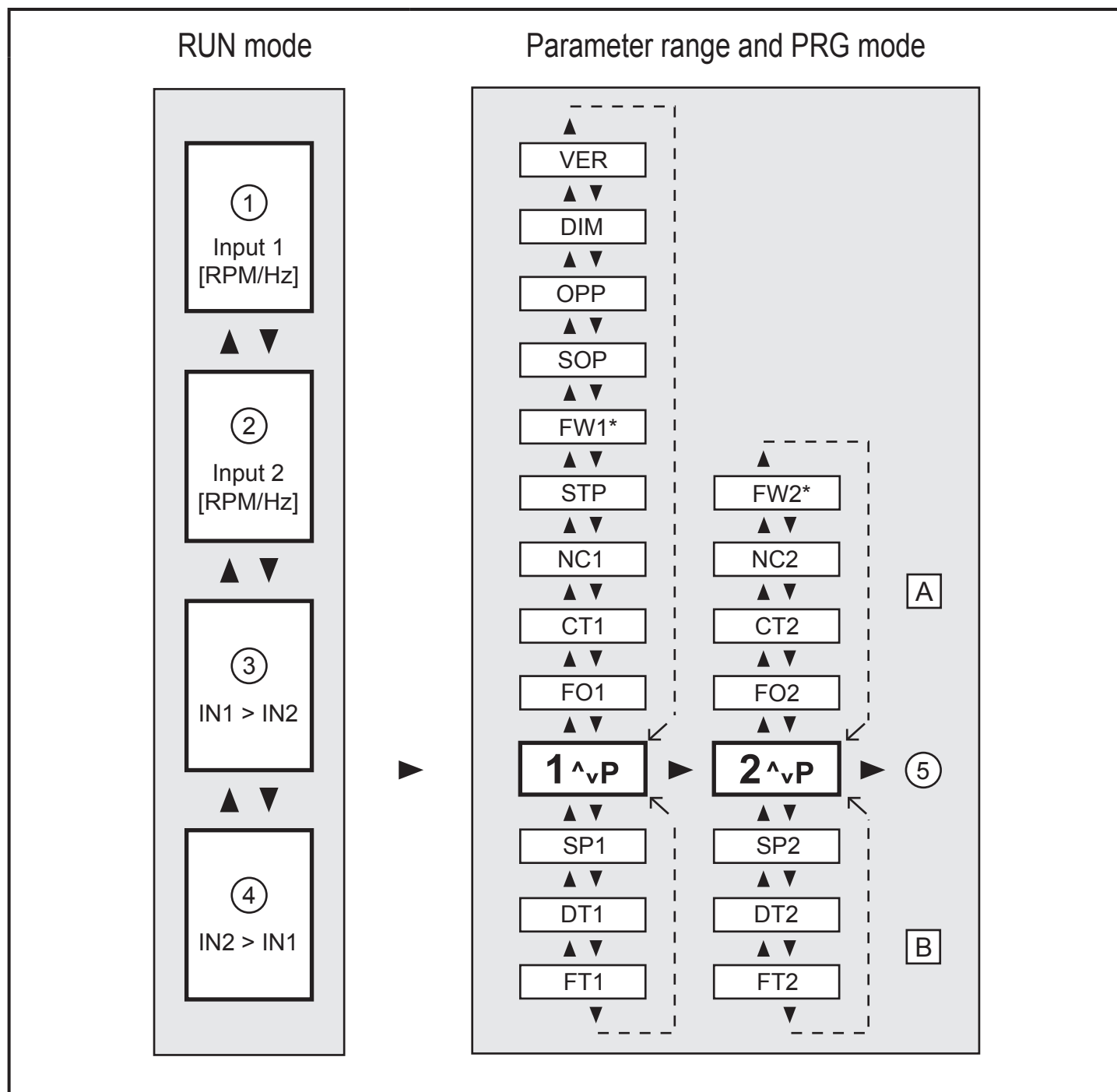
The fault outputs (terminals 4/10) indicate a wire fault between the monitor and the respective pulse pick-up (wire break/short circuit). In case of a fault the respective output is blocked.

Wire fault input 1 = terminal 4

Wire fault input 2 = terminal 10

## 7 Navigation and parameter overview

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



- 1: Display: actual value input 1
- 2: Display: actual value input 2
- 3: Display: differential pulses IN1 > IN2
- 4: Display: differential pulses IN2 > IN1
- 5: Back to the RUN mode

A: System parameters

B: Application parameters

\*) only F...-xN

## 7.1 System parameters

### 7.1.1 FOx

Function Output (switching function of the outputs 1/2)

1	The relay is de-energised in case of slip and during the start-up delay STP. (+24 V DC signal on terminal 17 = relay energised)
2	The relay is energised in case of slip and during the start-up delay STP. (+24 V DC signal on terminal 17 = relay de-energised)
3	The relay is de-energised in case of synchronous running and during the start-up delay STP. (+24 V DC signal on terminal 17 = relay de-energised)
4	The relay is energised in case of synchronous running and during the start-up delay STP. The relay is de-energised in case of slip (i.e. when number of differential pulses > SPx) (+24 V DC signal on terminal 17 = relay energised)
Values	1...4
Default values	4

4 = recommended setting for slip monitoring

### 7.1.2 CTx

Cycle Time (reset time)

<p>Time after which the corresponding differential pulse counter is reset. The time starts on the first pulse edge at In1 or In2. Operating principle: To avoid the differential pulses adding up to the limit value/switch point if an uncritical slip occurs several times over a long period they are regularly reset by the adjustable reset time. Only in case of critical slip or blocking is the allowed number of differential pulses exceeded within the reset time and the monitor switches. In principle it can be said: The monitoring sensitivity increases when the reset time is prolonged for an identical number of differential pulses. The length of the reset time also depends on the allowed rotational speed difference and the data of the clutch.</p>	
Values	0.0...1000.0 s
Default values	0.0

Setting example (→ 8.3)

### 7.1.3 NCx

#### Number of Cams (on inputs 1/2)

Allows the indication of the rotational speed in RPM if there is more than one switching cam per revolution. It is also possible to compensate for a different number of cams between the pulse pick-ups (drive/power take-off).	
Values	1...999
Default values	1

1 = highest setting sensitivity even if there are several cams.  
Displayed value shows pulses/min. instead of RPM or Hz.

### 7.1.4 STP

#### Start-up Delay Time Parallel (start-up delay outputs 1/2)

Normally the output relays are energised after power on of the monitor until the drive is switched on. The outputs then switch depending on the switching function and state of the plant. The parameter applies to both outputs. It can be used to compensate for a slipping start of the plant until synchronous running is achieved. Monitoring starts on the first pulse edge after this time has elapsed. The start-up delay can also be released externally while the monitor remains connected. (→ 6.3.2).	
Values	0.0...1000.0 s (min. setting = 0.1 s)
Default value	0.0

### 7.1.5 FWx

#### Function Wire Break Monitoring (only FS-2N)

Relay action in case of a wire fault		
If	FWx = inactive (0)	FWx = active (1)
FOx = 1	relay remains energised	relay de-energised
FOx = 2/3	relay remains de-energised	
FOx = 4 (default value)	relay remains energised	relay de-energised
Values	0 = inactive	
	1 = active	
Default values	0 = (inactive)	



## 7.1.6 SOP

Store Output Parallel (latching function outputs 1/2)

If the parameter is active, the outputs do not switch back automatically in case of a fault. They must be reset internally or externally. The function is simultaneously activated for both outputs. The reset function is also effective for both outputs.	
Values	0 = inactive
	1 = active front reset
	2 = front reset and external reset
Default value	0 = (inactive)

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## 7.1.7 OPP

Output Parallel (simultaneous switching of the outputs 1/2)

Determines whether the outputs switch simultaneously in case of a fault. Independent of whether the number of differential pulses SP1 or SP2 was exceeded.	
Values	0 = inactive
	1 = active (only effective if SOP = active (1 or 2) and FOx = 4)
Default value	0 = (inactive)

## 7.1.8 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

## 7.1.9 VER

Software version

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

## 7.2 Application parameters

### 7.2.1 SPx

Switch Point (max. number of differential pulses)

Number of differential pulses which must not be reached within the reset time (e.g. SPx = 5, the relay de-energises when the 5th differential pulse is reached).

The hysteresis (low switch point) is fixed to 2 differential pulses.

It can only become effective if the reset time CTx = 0.0 s.

Values	1...999
Default values	1

Setting example (→ 8.3)

### 7.2.2 DTx

Delay Time (for output 1/2)

Enables a delayed switching of the outputs 1/2.

In case of a value greater than 0.0 the outputs only switch if the state of being above or below the switch point is longer than the time set.

If e.g. for DTx = 5 s the allowed number of differential pulses is exceeded but is already below this value after 3 s, the output does not switch.

Values	0.0...1000.0 s (only effective if SOP inactive; 0)
Default values	0.0 (no delay time)

### 7.2.3 FTx

Fleeting Time (for outputs 1/2)

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 values	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.


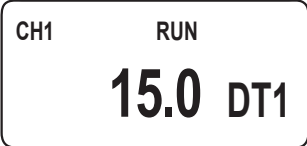

Therefore disconnect it during the change and then check the function.

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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, 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
<b>Change from the RUN mode to the parameter range (here 1)</b>	
<div><div>▶ Briefly press [Enter/▶] once.</div><div>&gt; The 1st parameter range is displayed.</div></div>	<div><div>CH1</div><div>RUN</div><div>1 ^vP</div></div>
<b>Selection of the requested parameter (here DT1)</b>	
<div><div>▶ Press the [▼] button until the parameter DT1 is displayed with the currently set value (here default value 0.0).</div></div>	<div><div>CH1</div><div>RUN</div><div>0.0 DT1</div></div>
<b>Change to the PRG mode</b>	
<div><div>▶ Briefly press [Enter/▶] once.</div><div>&gt; The unit is in the programming mode.</div><div>&gt; PRG indicator visible, parameter abbreviation flashes.</div></div>	<div><div>CH1</div><div>RUN PRG</div><div>0.0 DT1</div></div>

<b>Setting or changing the parameter value</b>	
<ul style="list-style-type: none"> <li>▶ Press [▲] / [▼] until the requested parameter value is displayed (→ 8.2.3 Numerical entries).</li> </ul>	
<b>Acknowledgement of the set parameter value</b>	
<ul style="list-style-type: none"> <li>▶ Press [Enter/▶] until the parameter abbreviation no longer flashes and the indicator PRG has disappeared.</li> <li>&gt; The new parameter value is indicated and effective.</li> </ul>	
<b>Return to the RUN mode</b>	
<ul style="list-style-type: none"> <li>▶ Press [Enter/▶] for about 3 s or wait for the time-out function (approx. 15 s).</li> <li>&gt; The unit is again in the RUN mode, the current value is indicated.</li> </ul>	

## 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 pushbutton 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 functions.

### 8.2.3 Numerical entries

▶ Press [▲] or [▼] and hold it.

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

As soon as the pushbutton 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 switched with the [▲] and [▼] buttons. Parameter range and PRG mode can no longer be selected. UK

Locking	Unlocking
<ul style="list-style-type: none"> <li>▶ Press [▲] and [▼] simultaneously and hold them pressed.</li> <li>&gt; The KEY indicator flashes.</li> <li>▶ Release the pushbuttons when the KEY indicator is continuously indicated.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Press [▲] and [▼] simultaneously and hold them pressed.</li> <li>&gt; The KEY indicator flashes.</li> <li>▶ Release the pushbuttons when the KEY indicator is no longer indicated.</li> </ul>

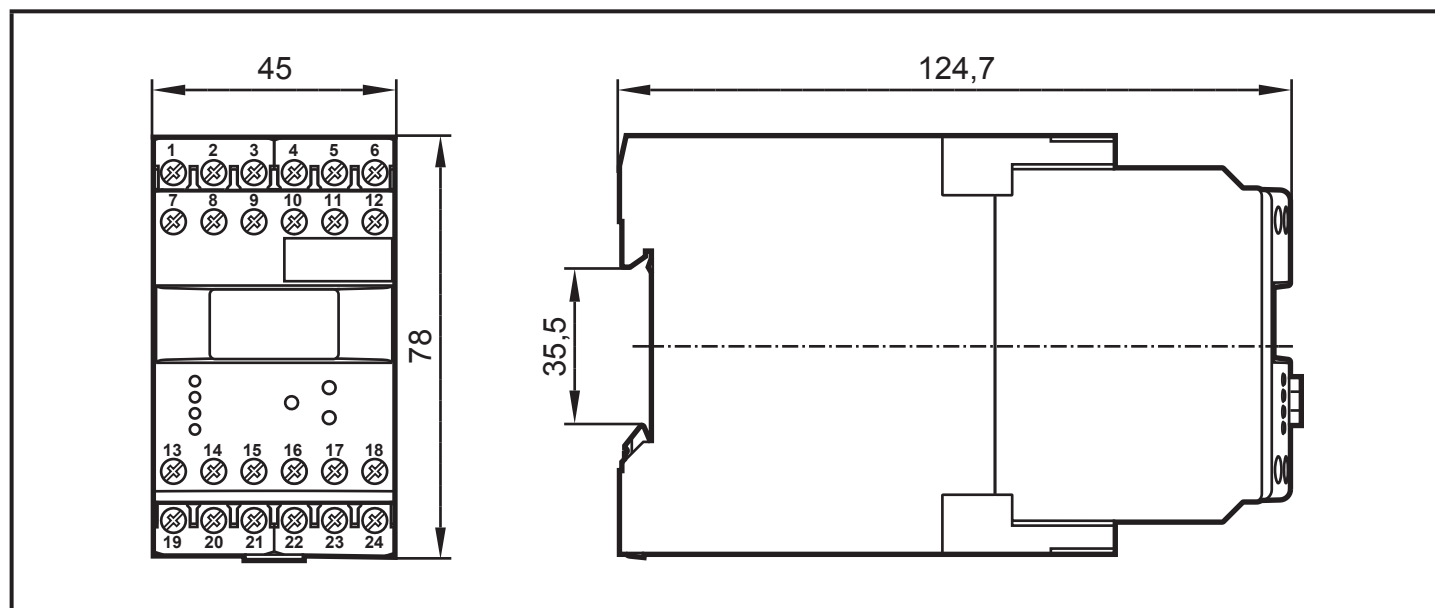
## 8.3 Setting example for overload

Switch Point (SPx) and Cycle Time (CTx)

System parameters for synchronous running	
Rotational speed of the drive Cams (NCx)	1500 = RPM 2 per revolution on the drive and power take-off side
Pulses for synchronous running	3000 pulses/min at both inputs (= 50 pulses/s)
Differential pulses	0 pulses/min
Drive side overload	
Rotational speed of the drive	1500 = RPM
Rotational speed of the power take-off side	1440 = RPM
Rotational speed difference	60 = RPM
Differential pulses	120 pulses/min (= 2 pulses/s)
Parameter values for overload	
Max. differential pulses (SPx)	2 pulses/s *)
Cycle time (CTx)	1.0 s *)

\*) or a multiple, e.g. 6 differential pulses in 3.0 s

## 9 Scale drawing



## 10 Technical data

### 10.1 Overview

Art. no.	DS2505	DS2605
Monitor type	FS-2	FS-2N
Supply voltage	see type label	
Frequency range		
Power consumption		
Sensor types	PNP/NPN; NAMUR	NAMUR (to EN 50227)
Sensor supply	24 V DC	8.2 V DC
Input frequency	≤ 5 kHz	≤ 5 kHz
Relay outputs	2 changeover contacts; potential free	
Switching current	≤ 6 A	≤ 6 A
Switching voltage	≤ 250 V AC; B300, R300	
Transistor outputs	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	-40...60 °C
Storage temperature	-40...85 °C	-40...85 °C

Art. no.	DS2505	DS2605
Max. relative air humidity	80 % (31 °C) linearly decreasing to 50 % (40 °C)	
Maximum operating altitude	2000 m above sea level	
Connection	21 dual-chamber terminals; 2 x 2.5 mm <sup>2</sup> (AWG 14)	
cULus test conditions	housing dimensions for temperature rise test: 200 x 200 x 150 mm	

Data sheets can be found at:

[www.ifm.com](http://www.ifm.com) → Data sheet search → article number

UK

## 10.2 Approvals / standards

EC declarations of conformity, approvals etc. can be downloaded at:

[www.ifm.com](http://www.ifm.com) → Data sheet search → Article number → More information

## 11 Maintenance, repair, disposal

The device 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.