

PERFORMANCE  
MADE  
SMARTER

# Product manual

# 4116

## *Universal transmitter*



TEMPERATURE | I.S. INTERFACES | COMMUNICATION INTERFACES | MULTIFUNCTIONAL | ISOLATION | DISPLAY

No. 4116V105-UK  
From serial no.: 121524001

**PR**  
electronics

# 6 Product Pillars

## *to meet your every need*

### Individually outstanding, unrivalled in combination

With our innovative, patented technologies, we make signal conditioning smarter and simpler. Our portfolio is composed of six product areas, where we offer a wide range of analog and digital devices covering over a thousand applications in industrial and factory automation. All our products comply with or surpass the highest industry standards, ensuring reliability in even the harshest of environments and have a 5-year warranty for greater peace of mind.



Temperature

Our range of temperature transmitters and sensors provides the highest level of signal integrity from the measurement point to your control system. You can convert industrial process temperature signals to analog, bus or digital communications using a highly reliable point-to-point solution with a fast response time, automatic self-calibration, sensor error detection, low drift, and top EMC performance in any environment.



I.S. Interface

We deliver the safest signals by validating our products against the toughest safety standards. Through our commitment to innovation, we have made pioneering achievements in developing I.S. interfaces with SIL 2 Full Assessment that are both efficient and cost-effective. Our comprehensive range of analog and digital intrinsically safe isolation barriers offers multifunctional inputs and outputs, making PR an easy-to-implement site standard. Our backplanes further simplify large installations and provide seamless integration to standard DCS systems.



Communication

We provide inexpensive, easy-to-use, future-ready communication interfaces that can access your PR installed base of products. All the interfaces are detachable, have a built-in display for readout of process values and diagnostics, and can be configured via push-buttons. Product specific functionality includes communication via Modbus and Bluetooth and remote access using our PR Process Supervisor (PPS) application, available for iOS and Android.



Multifunction

Our unique range of single devices covering multiple applications is easily deployable as your site standard. Having one variant that applies to a broad range of applications can reduce your installation time and training, and greatly simplify spare parts management at your facilities. Our devices are designed for long-term signal accuracy, low power consumption, immunity to electrical noise and simple programming.



Isolation

Our compact, fast, high-quality 6 mm isolators are based on microprocessor technology to provide exceptional performance and EMC-immunity for dedicated applications at a very low total cost of ownership. They can be stacked both vertically and horizontally with no air gap separation between units required.



Display

Our display range is characterized by its flexibility and stability. The devices meet nearly every demand for display readout of process signals, and have universal input and power supply capabilities. They provide a real-time measurement of your process value no matter the industry, and are engineered to provide a user-friendly and reliable relay of information, even in demanding environments.

# Universal transmitter 4116

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## Warning



**GENERAL**

This device is designed for connection to hazardous electric voltages. Ignoring this warning can result in severe personal injury or mechanical damage.

To avoid the risk of electric shock and fire, the safety instructions of this guide must be observed and the guidelines followed. The specifications must not be exceeded, and the device must only be applied as described in the following.

Prior to the commissioning of the device, this installation guide must be examined carefully.

Only qualified personnel (technicians) should install this device. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



**HAZARD-  
OUS  
VOLTAGE**

## Warning

Until the device is fixed, do not connect hazardous voltages to the device. The following operations should only be carried out on a disconnected device and under ESD safe conditions:

General mounting, connection and disconnection of wires.

Troubleshooting the device.

**Repair of the device and replacement of circuit breakers must be done by PR electronics A/S only.**



**CAUTION**

## Warning

To keep the safety distances, the relay contacts on the device must not be connected to both hazardous and non-hazardous voltages at the same time.



**INSTAL-  
LATION**

## Warning

Do not open the front plate of the device as this will cause damage to the connector for the display / programming front PR 45xx.

This device contains no DIP-switches or jumpers.

SYSTEM 4000 must be mounted on a DIN rail according to DIN EN 60715.



## Symbol identification



**Triangle with an exclamation mark:** Warning / demand. Potentially lethal situations. Read the manual before installation and commissioning of the device in order to avoid incidents that could lead to personal injury or mechanical damage.



**The CE mark** proves the compliance of the device with the essential requirements of the directives.



**The double insulation symbol** shows that the device is protected by double or reinforced insulation.

## Safety instructions

### Definitions

**Hazardous voltages** have been defined as the ranges: 75 to 1500 Volt DC, and 50 to 1000 Volt AC.

**Technicians** are qualified persons educated or trained to mount, operate, and also trouble-shoot technically correct and in accordance with safety regulations.

**Operators**, being familiar with the contents of this manual, adjust and operate the knobs or potentiometers during normal operation.

### Receipt and unpacking

Unpack the device without damaging it and check whether the device type corresponds to the one ordered. The packing should always follow the device until this has been permanently mounted.

### Environment

Avoid direct sun light, dust, high temperatures, mechanical vibrations and shock, and rain and heavy moisture. If necessary, heating in excess of the stated limits for ambient temperatures should be avoided by way of ventilation.

The device must be installed in pollution degree 2 or better.

### Mounting

Only technicians who are familiar with the technical terms, warnings, and instructions in the manual and who are able to follow these, should connect the device. Should there be any doubt as to the correct handling of the device, please contact your local distributor or, alternatively,

**PR electronics A/S**  
**[www.prelectronics.com](http://www.prelectronics.com)**

Mounting and connection of the device should comply with national legislation for mounting of electric materials, i.e. wire cross section, protective fuse, and location.

Descriptions of input / output and supply connections are shown in the block diagram and side label.

The following apply to fixed hazardous voltages-connected devices:

The max. size of the protective fuse is 10 A and, together with a power switch, it should be easily accessible and close to the device. The power switch should be marked with a label indicating that it will switch off the voltage to the device.

Year of manufacture can be taken from the first two digits in the serial number.

### UL installation requirements

Use 60/75°C copper conductors only

For use only in pollution degree 2 or better

Max. ambient temperature . . . . . 60°C

Max. wire size. . . . . AWG 26-14

UL file number . . . . . E231911

### Calibration and adjustment

During calibration and adjustment, the measuring and connection of external voltages must be carried out according to the specifications of this manual. The technician must use tools and instruments that are safe to use.

**Normal operation**

Operators are only allowed to adjust and operate devices that are safely fixed in panels, etc., thus avoiding the danger of personal injury and damage. This means there is no electrical shock hazard, and the device is easily accessible.

**Cleaning**

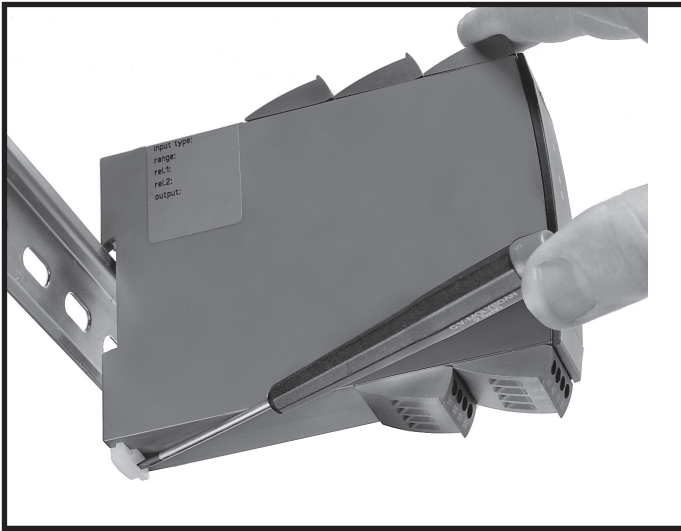
When disconnected, the device may be cleaned with a cloth moistened with distilled water.

**Liability**

To the extent the instructions in this manual are not strictly observed, the customer cannot advance a demand against PR electronics A/S that would otherwise exist according to the concluded sales agreement.

## How to demount system 4000

First, remember to demount the connectors with hazardous voltages.



**Picture 1:**

The device is detached from the DIN rail by moving the bottom lock down.

### When front LED lights red / display shows AO.ER

PR 4116 is designed as a SIL 2 device with a high safety level. Therefore, a continuous measurement of the outgoing current is carried out on a 4...20 mA and 20...4 mA output signal. If the current output signal is different from the internal calculated output value or the current output is 0 (due to e.g. an open circuit breakage), an error mode switches on the red front LED and disables the relays. This function is not a default option but must be actively selected via the programming menu (S4-20 & S20-4). The error mode can only be reset by switching off and then switching on the supply voltage to the device.

# Universal transmitter

## 4116

- Input for RTD, TC, Ohm, potentiometer, mA and V
- 2-wire supply > 16 V
- FM-approved for installation in Div. 2
- Output for current, voltage and 2 relays
- Universal AC or DC supply

### Application

- Linearized, electronic temperature measurement with RTD or TC sensor.
- Conversion of linear resistance variation to a standard analog current / voltage signal, i.e. from solenoids and butterfly valves or linear movements with attached potentiometer.
- Power supply and signal isolator for 2-wire transmitters.
- Process control with 2 pairs of potential-free relay contacts and analog output.
- Galvanic separation of analog signals and measurement of floating signals.
- The 4116 is designed according to strict safety requirements and is thus suitable for application in SIL 2 installations.
- Suitable for the use in systems up to Performance Level "d" according to ISO-13849.

### Technical characteristics

- When 4116 is used in combination with the 45xx display / programming units, all operational parameters can be modified to suit any application. As the 4116 is designed with electronic hardware switches, it is not necessary to open the device for setting of DIP-switches.
- A green / red front LED indicates normal operation and malfunction. A yellow LED is ON for each active output relay.
- Continuous check of vital stored data for safety reasons.
- 4-port 2.3 kVAC galvanic isolation.

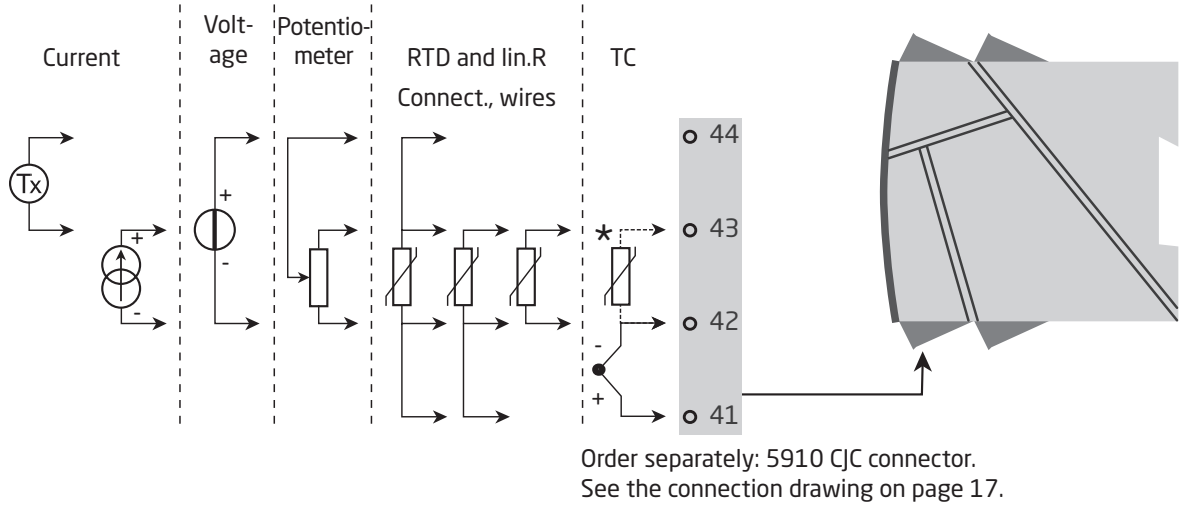
### Mounting / installation / programming

- Very low power consumption means units can be mounted side by side without an air gap - even at 60°C ambient temperature.
- Configuration, monitoring, 2-point process calibration and more are accomplished using PR's 45xx detachable displays.
- All programming can be password-protected.

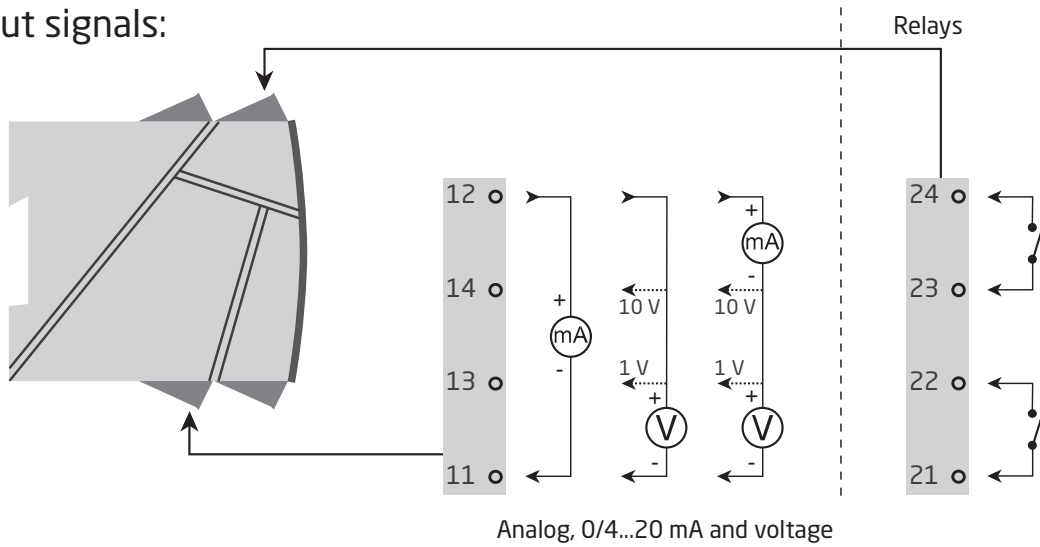


# Applications

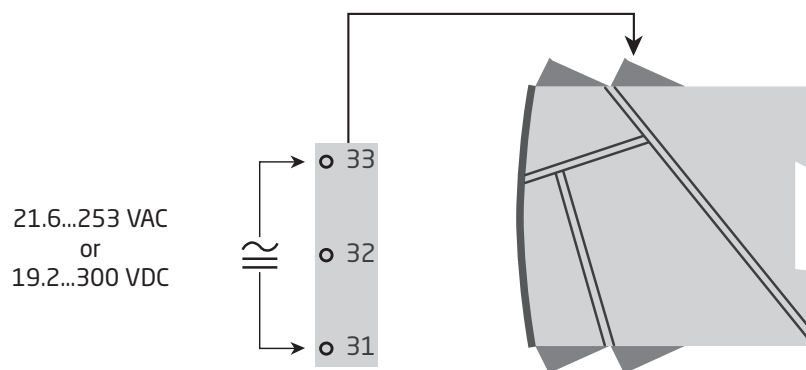
Input signals:



Output signals:



Supply:



## PR 45xx display / programming front



### Functionality

The simple and easily understandable menu structure and the explanatory help texts guide you effortlessly and automatically through the configuration steps, thus making the product very easy to use. Functions and configuration options are described in the section "Configuration / operating the function keys".

### Application

- Communications interface for modification of operational parameters in 4116.
- Can be moved from one 4116 device to another and download the configuration of the first unit to subsequent units.
- Fixed display for readout of process data and status.

### Technical characteristics

- LCD display with 4 lines:
  - Line 1 (H=5.57 mm) shows the input signal.
  - Line 2 (H=3.33 mm) shows the selected engineering unit.
  - Line 3 (H=3.33 mm) shows analog output or TAG no.
  - Line 4 shows status for communication and relays.
- Programming access can be blocked by assigning a password. The password is saved in the device in order to ensure a high degree of protection against unauthorized modifications to the configuration.

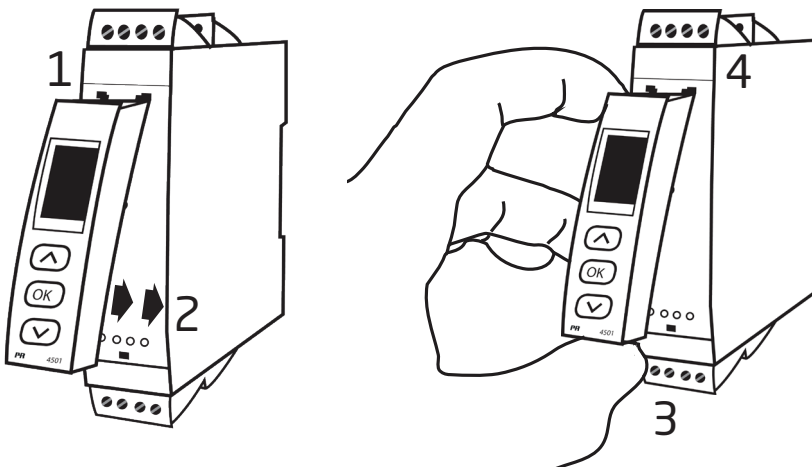


## Mounting / demounting the PR 45xx

- 1: Insert the tabs of the PR 45xx into the holes at the top of the device.
- 2: Hinge the PR 45xx down until it snaps into place.

### Demounting of the PR 45xx

- 3: Push the release button on the bottom of the PR 45xx and hinge the the PR 45xx out and up.
- 4: With the PR 45xx hinged up, remove from holes at the top of the device.



## Order

4116 = Universal transmitter

## Accessories

4501 = Display / programming front

4511 = Modbus communication enabler

4512 = Bluetooth communication enabler

5910 = CJC connector

## Electrical specifications

### Environmental conditions

Operating temperature . . . . .	-20°C to +60°C
Storage temperature . . . . .	-20°C to +85°C
Calibration temperature. . . . .	20...28°C
Relative humidity . . . . .	< 95% RH (non-cond.)
Protection degree . . . . .	IP20
Installation in pollution degree 2 & measurement / overvoltage category II.	

### Mechanical specifications

Dimensions (HxWxD) . . . . .	109 x 23.5 x 104 mm
Dimensions (HxWxD) w/ 4501 / 451x . . . . .	109 x 23.5 x 116 / 131 mm
Weight approx. . . . .	175 g
Weight incl. 4501 / 451x (approx.) . . . . .	190 g / 205 g
DIN rail type. . . . .	DIN EN 60715 - 35 mm
Wire size. . . . .	0.13...2.08 mm <sup>2</sup> / AWG 26...14 stranded wire
Screw terminal torque. . . . .	0.5 Nm
Vibration. . . . .	IEC 60068-2-6
2...13.2 Hz . . . . .	±1 mm
13.2...100 Hz. . . . .	±0.7 g

### Common electrical specifications

Supply voltage, universal. . . . .	21.6...253 VAC, 50...60 Hz or 19.2...300 VDC
Fuse . . . . .	400 mA SB / 250 VAC
Max. required power. . . . .	≤ 2.5 W
Max. power dissipation . . . . .	≤ 2.5 W
Isolation voltage - test . . . . .	2.3 kVAC
Isolation voltage - working . . . . .	250 VAC (reinforced) / 500 VAC (basic)
Programming . . . . .	PR 45xx
Signal dynamics, input / output . . . . .	24 bit / 16 bit
Signal / noise ratio. . . . .	> 60 dB (0...100 kHz)
Response time (0...90%, 100...10%):	
Temperature input. . . . .	≤ 1 s
mA / V input . . . . .	≤ 400 ms

### Auxiliary supplies

2-wire supply (terminal 44...43). . . . .	25...16 VDC / 0...20 mA
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Accuracy, the greater of general and basic values:

General values		
Input type	Absolute accuracy	Temperature coefficient
All	$\leq \pm 0.1\%$ of span	$\leq \pm 0.01\%$ of span / °C

Basic values		
Type	Basic accuracy	Temperature coefficient
mA	$\leq \pm 4 \mu\text{A}$	$\leq \pm 0.4 \mu\text{A} / ^\circ\text{C}$
Volt	$\leq \pm 20 \mu\text{V}$	$\leq \pm 2 \mu\text{V} / ^\circ\text{C}$
Pt100	$\leq \pm 0.2^\circ\text{C}$	$\leq \pm 0.01^\circ\text{C} / ^\circ\text{C}$
Linear resistance	$\leq \pm 0.1 \Omega$	$\leq \pm 0.01 \Omega / ^\circ\text{C}$
Potentiometer	$\leq \pm 0.1 \Omega$	$\leq \pm 0.01 \Omega / ^\circ\text{C}$
TC type: E, J, K, L, N, T, U	$\leq \pm 1^\circ\text{C}$	$\leq \pm 0.05^\circ\text{C} / ^\circ\text{C}$
TC type: R, S, W3, W5, LR	$\leq \pm 2^\circ\text{C}$	$\leq \pm 0.2^\circ\text{C} / ^\circ\text{C}$
TC type: B 85...200°C	$\leq \pm 4^\circ\text{C}$	$\leq \pm 0.4^\circ\text{C} / ^\circ\text{C}$
TC type: B 200...1820°C	$\leq \pm 2^\circ\text{C}$	$\leq \pm 0.2^\circ\text{C} / ^\circ\text{C}$

EMC - immunity influence. . . . .	$< \pm 0.5\%$ of span
Extended EMC immunity: NAMUR NE 21, A criterion, burst . . . . .	$< \pm 1\%$ of span

### Input specifications

#### RTD, linear resistance and potentiometer input

Input for RTD types:

Pt10, Pt20, Pt50, Pt100, Pt200, Pt250, Pt300, Pt400, Pt500, Pt1000

Ni50, Ni100, Ni120, Ni1000, Cu10, Cu20, Cu50, Cu100

Input type	Min. value	Max. value	Standard
Pt10...Pt1000	-200°C	+850°C	IEC 60751
Ni50...Ni1000	-60°C	+250°C	DIN 43760
Cu10...Cu100	-200°C	+260°C	$\alpha = 0.00427$
Lin. R	0 $\Omega$	10000 $\Omega$	-
Potentiometer	10 $\Omega$	100 k $\Omega$	-

Cable resistance per wire (max.), RTD . . . . . 50  $\Omega$   
 Sensor current, RTD . . . . . Nom. 0.2 mA  
 Effect of sensor cable resistance (3- / 4-wire), RTD . . . . .  $< 0.002 \Omega / \Omega$   
 Sensor error detection, RTD . . . . . Yes  
 Short circuit detection, RTD . . . . .  $< 15 \Omega$

## TC input

Type	Min. value	Max. value	Standard
B	0°C	+1820°C	IEC 60584-1
E	-100°C	+1000°C	IEC 60584-1
J	-100°C	+1200°C	IEC 60584-1
K	-180°C	+1372°C	IEC 60584-1
L	-200°C	+900°C	DIN 43710
N	-180°C	+1300°C	IEC 60584-1
R	-50°C	+1760°C	IEC 60584-1
S	-50°C	+1760°C	IEC 60584-1
T	-200°C	+400°C	IEC 60584-1
U	-200°C	+600°C	DIN 43710
W3	0°C	+2300°C	ASTM E988-90
W5	0°C	+2300°C	ASTM E988-90
LR	-200°C	+800°C	GOST 3044-84

### Cold junction compensation (CJC):

- via external sensor in connector 5910. . . . . 20...28°C  $\leq$   $\pm 1^\circ\text{C}$   
-20...20°C / 28...70°C  $\leq$   $\pm 2^\circ\text{C}$
- via internal CJC sensor . . . . .  $\pm(2.0^\circ\text{C} + 0.4^\circ\text{C} * \Delta t)$

$\Delta t$  = internal temperature - ambient temperature

Sensor error detection, all TC types. . . . . Yes

### Sensor error current:

- when detecting . . . . . Nom. 2  $\mu\text{A}$
- else. . . . . 0  $\mu\text{A}$

## Current input

- Measurement range . . . . . 0...23 mA
- Programmable measurement ranges . . . . . 0...20 and 4...20 mA
- Input resistance . . . . . Nom. 20  $\Omega$  + PTC 50  $\Omega$
- Sensor error detection:
  - Loop break 4...20 mA . . . . . Yes

## Voltage input

- Measurement range . . . . . 0...12 VDC
- Programmable measurement ranges . . . . . 0...1 / 0.2...1 / 0...5 / 1...5 / 0...10 and 2...10 VDC
- Input resistance, nom.. . . . . 10 M $\Omega$

## Output specifications

### Current output

- Signal range (span) . . . . . 0...23 mA
- Programmable signal ranges . . . . . 0...20 / 4...20 / 20...0 and 20...4 mA
- Load (max.) . . . . .  $\leq 800 \Omega$
- Load stability . . . . .  $\leq 0.01\%$  of span / 100  $\Omega$
- Sensor error detection . . . . . 0 / 3.5 / 23 mA / none
- NAMUR NE 43 Upscale / Downscale . . . . . 23 mA / 3.5 mA
- Output limitation:
  - on 4...20 and 20...4 mA signals . . . . . 3.8...20.5 mA
  - on 0...20 and 20...0 mA signals . . . . . 0...20.5 mA
- Current limit. . . . .  $\leq 28 \text{ mA}$

### Voltage output

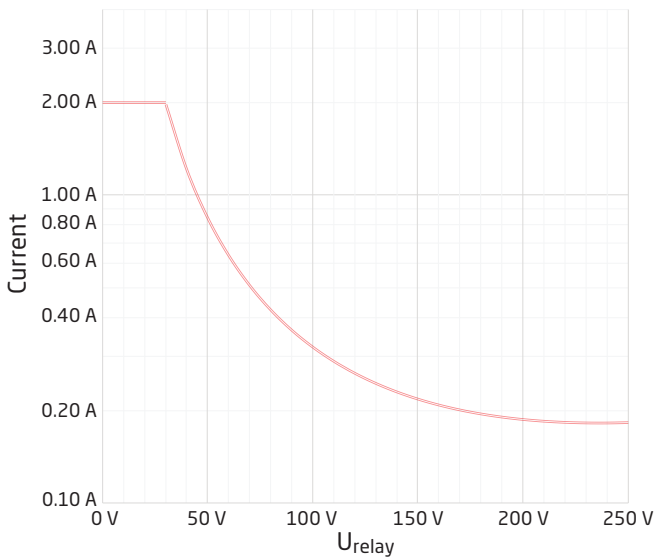
- Signal range. . . . . 0...10 VDC
- Programmable signal ranges . . . . . 0...1 / 0.2...1 / 0...10 / 0...5 / 1...5 / 2...10 / 1...0 /  
1...0.2 / 5...0 / 5...1 / 10...0 og 10...2 V
- Load (min.) . . . . . 500 k $\Omega$

of span = of the currently selected measurement range

## Relay outputs

Relay functions. . . . .	Setpoint, Window, Sensor error, Latch, Power and Off
Hysteresis. . . . .	0...100%
On and Off delay . . . . .	0...3600 s
Sensor error detection . . . . .	Break / Make / Hold
Max. voltage . . . . .	250 VAC / VDC
Max. AC current. . . . .	2 A
Max. AC power . . . . .	500 VA
Max. DC current, resistive load:	
@ $U_{\text{relay}} \leq 30 \text{ VDC}$ . . . . .	2 ADC
@ $U_{\text{relay}} > 30 \text{ VDC}$ . . . . .	$[1380 \times U_{\text{relay}}^{-2} \times 1.0085^{U_{\text{relay}}}] \text{ ADC}$

Graphic depiction of  $[1380 \times U_{\text{relay}}^{-2} \times 1.0085^{U_{\text{relay}}}]$ :



## Observed authority requirements

EMC. . . . .	2014/30/EU
LVD . . . . .	2014/35/EU
RoHS . . . . .	2011/65/EU
EAC . . . . .	TR-CU 020/2011

## Approvals:

c UL us, UL 508. . . . .	E231911
FM . . . . .	3025177
DNV-GL . . . . .	TAA0000101
EU RO Mutual Recognition Type Approval . . . . .	MRA000000Z

## Functional Safety:

Hardware assessed for use in SIL applications  
FMEDA report - [www.prelectronics.com](http://www.prelectronics.com)

## Visualisation in the 45xx of sensor error detection and input signal outside range

Sensor error check:		
Device	Configuration	Sensor error detection:
4116	R1, ERR.ACT=NONE - R2, ERR.ACT=NONE, OUT.ERR=NONE.	OFF
	Else:	ON

Outside range readout (IN.LO, IN.HI): If the valid range of the A/D converter or the polynomial is exceeded			
Input	Range	Readout	Limit
VOLT	0...1 V / 0.2...1 V	IN.LO	< -25 mV
		IN.HI	> 1.2 V
	0...10 V / 2...10 V	IN.LO	< -25 mV
		IN.HI	> 12 V
CURR	0...20 mA / 4...20 mA	IN.LO	< -1.05 mA
		IN.HI	> 25.05 mA
LIN.R	0...800 Ω	IN.LO	< 0 Ω
		IN.HI	> 1075 Ω
	0...10 kΩ	IN.LO	< 0 Ω
		IN.HI	< 110 kΩ
POTM	-	IN.LO	< -0.5 %
		IN.HI	> 100.5 %
TEMP	TC / RTD	IN.LO	< temperature range -2°C
		IN.HI	> temperature range +2°C


Display readout below min. / above max. (-1999, 9999):			
Input	Range	Readout	Limit
All	All	-1999	Display readout <-1999
		9999	Display readout >9999

### Sensor error detection limits

Sensor error detection (SE.BR, SE.SH):			
Input	Range	Readout	Limit
CURR	Loop break (4..20 mA)	SE.BR	<= 3.6 mA; > = 21 mA
POTM	All, SE.BR on all 3-wire	SE.BR	> ca. 126 kΩ
LIN.R	0...800 Ω	SE.BR	> ca. 875 Ω
	0...10 kΩ	SE.BR	> ca. 11 kΩ
TEMP	TC	SE.BR	> ca. 750 kΩ / (1.25 V)
	RTD, 2-, 3-, and 4-wire No SE.SH for Cuxx, Pt10, Pt20 and Pt50	SE.BR	> ca. 15 kΩ
		SE.SH	< ca. 15 Ω

## Error indications

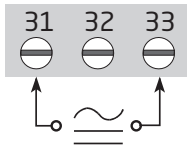
Readout at hardware error		
Error search	Readout	Cause
Test of internal CJC sensor	CJ.ER	CJC sensor defect or temperature outside range
Checksum test of the configuration in FLASH	FL.CO	Error in FLASH
Check measurement of analog output current	AO.ER	1) No load on the current output (only S4...20 / S20...4 mA)
Communications test 45xx / 4116	NO.CO	Connection error
Check that input signal matches input configuration	IN.ER	1) Error levels on input
Check that saved configuration in 45xx matches device	TY.ER	Configuration is not 4116

! All error indications in the display flash once per second. The help text explains the error. If the error is a sensor error, the display backlight flashes as well - this is acknowledged (stopped) by pushing the  button.
1) The error is reset by switching off and then switching on the supply voltage to the device.

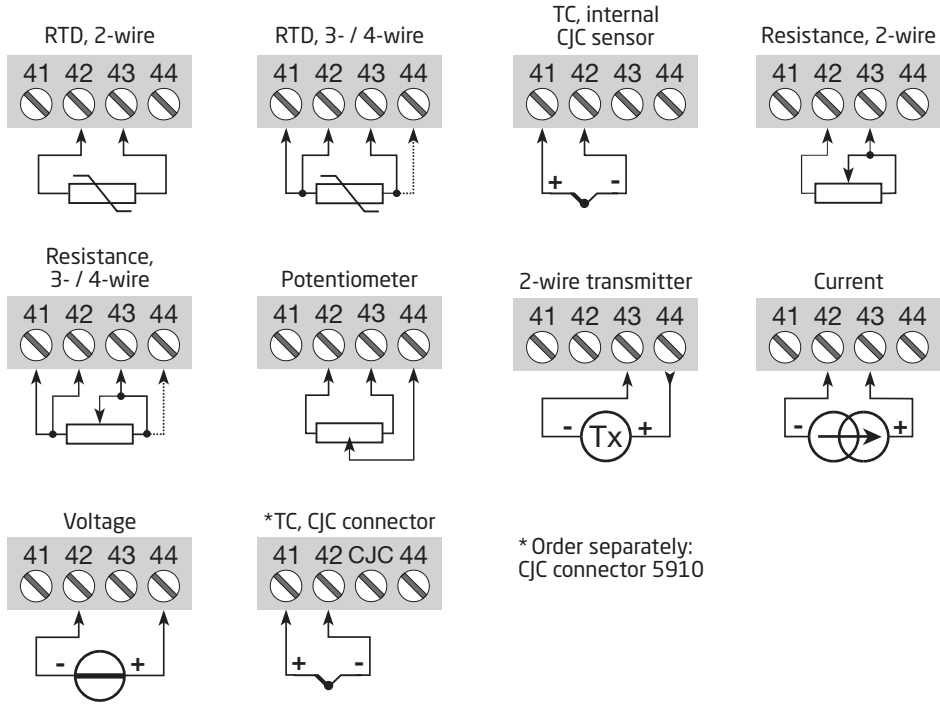


# Connections

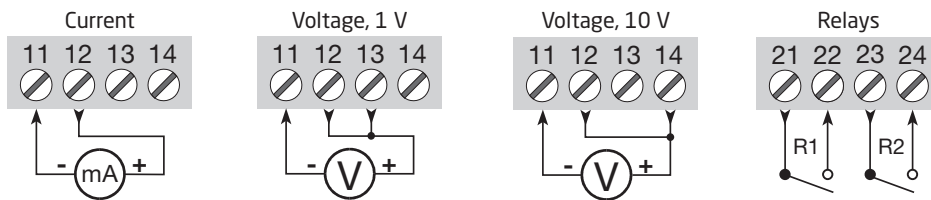
## Supply



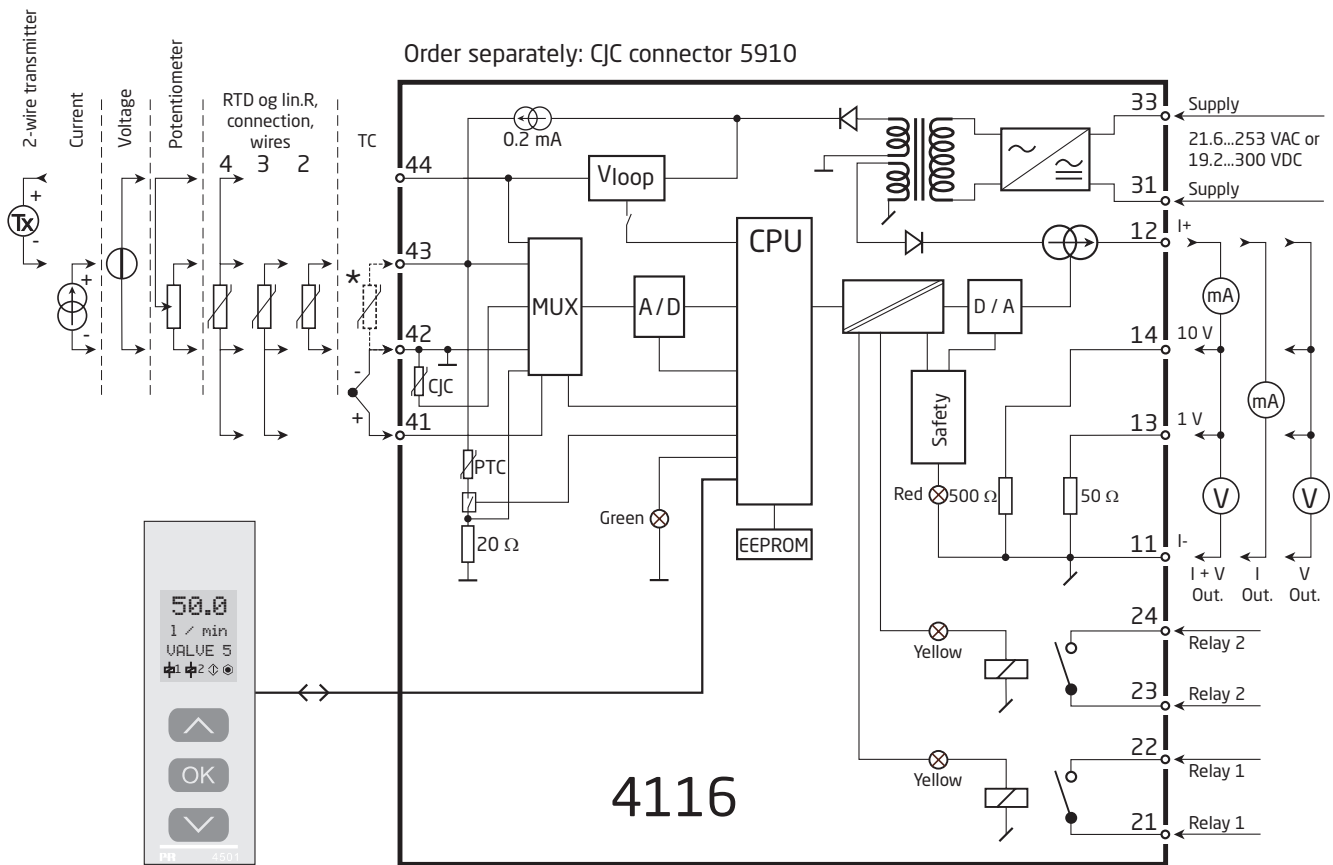
## Inputs:



## Outputs:



# Block diagram



# Configuration / operating the function keys

Documentation for routing diagram.

## In general

When configuring the 4116, you will be guided through all parameters and you can choose the settings which fit the application. For each menu there is a scrolling help text which is automatically shown in line 3 on the display.

Configuration is carried out by use of the 3 function keys:

- ⏪ will increase the numerical value or choose the next parameter
- ⏩ will decrease the numerical value or choose the previous parameter
- ⏹ will save the chosen value and proceed to the next menu

When configuration is completed, the display will return to the default state 1.0. Pressing and holding ⏹ will return to the previous menu or return to the default state (1.0) without saving the changed values or parameters.

If no key is activated for 1 minute, the display will return to the default state (1.0) without saving the changed values or parameters.

## Further explanations

**Fast setpoint adjustment and relay test:** These menus allow you to make a quick setpoint change and relay test when the FastSet menu is activated. This function can only be activated when the relays are set for setpoint function and are controlled by a setpoint.

Pressing ⏪ and ⏩ simultaneously will activate a relay test and change the state of the relay.

Pressing ⏹ will save the setpoint change.

Holding down ⏹ for more than 1 second will return the unit to the default state without saving the setpoint change.

**Password protection:** Programming access can be blocked by assigning a password. The password is saved in the device in order to ensure a high degree of protection against unauthorized modifications to the configuration.

If the configured password is not known, please contact PR electronics support - [www.prelectronics.com/contact](http://www.prelectronics.com/contact).

## Signal and sensor error info via display front 45xx

Sensor error (see limits in the table) is displayed as SE.BR (sensor break) or SE.SH (sensor short). Signals outside the selected range (not sensor error, see table for limits) are displayed as IN.LO indicating low input signal or IN.HI indicating high input signal. The error indication is displayed in line 3 as text and at the same time the backlight flashes. Line 4 of the display is a status line which displays status of relay 1 and relay 2, COM (flashing bullet) indicating correct functioning of 45xx and arrow up/down which indicates tendency readout of the input signal. If the figure 1 or figure 2 flashes, the unit has detected that the setpoint has been exceeded and that the relay is in "delay" mode. When the delay time has passed and the relay makes / breaks, the relay sign either displays or disappears.

## Signal and sensor error indication without display front

Status of the unit can also be read from the red / green LED in the front of the device.

Green flashing LED 13 Hz indicates normal operation.

Green flashing LED 1 Hz indicates sensor error.

Steady red LED indicates internal error.

## Relay functions

6 different settings of relay function can be selected.

**Setpoint:** The unit works as a single limit switch

**Window:** The relay has a window that is defined by a low and a high setpoint. On both sides of the window the relay has the same status.

**Error function:** The relay is activated by sensor error.

**Power:** The relay is activated as long as the power is on.

**Off:** The relay is deactivated.

**Latch:** The relay is latched. Only valid for setpoint and window function.

**Increasing/decreasing:** The relays can be set to activate at increasing or decreasing input signal.

**Delay:** An ON and an OFF delay can be set on both relays in the range 0...3600 s.

**Hysteresis:** 0.0...100.0%.

## Latch

When the setpoint is exceeded the relay outputs enters an alarm state. The latch function of the 4116 will hold the relays in this state until the function is deactivated manually. The latch function can be applied when the relay function setpoint or window is selected.

The latch function can be selected separately for each relay output. If the configuration is copied from one device to another by way of the 45xx, the latch function must be reconfigured.

The latch function activates and holds the relays when the input signal rises above or falls below the selected setpoints and the relay action has been selected as increasing or decreasing.

The window function is selected by choosing "window" in the menu and defining a high and a low setpoint. It can be selected for each relay contact whether the contact is open or closed inside the window. This selection is made in the menu R1.cont and R2.cont.

The setpoint function is selected by choosing "setpoint" in the menu and entering the desired limit. The device then works as a single limit switch.

An activated relay means that the contact is closed if the contact function "normally open" is selected, and the contact is open if the contact function "normally closed" is selected.

The delay time for activation and deactivation can be set independently of each other in the menus ON.DEL and OFF DEL respectively.

If the relay function "Error" is active, the relay will latch when a sensor error occurs and will not be deactivated automatically when the sensor error is rectified.

The relay can only be deactivated by an operator and only when the normal conditions for deactivation are met. If the input signal still has a value that will activate the relay, the relay will latch again.

See the graphic depiction of the setpoint and window functions on pages 30 and 31.

### Manual deactivation of the latch function

If the relay outputs are activated and thereby latched, it will be indicated in the display. The backlight flashes and the scrolling help text tells you how to deactivate the output. Manual deactivation is carried out by way of the front buttons on the 45x. Use  $\triangle$  and  $\nabla$  to navigate in the menu and  $\otimes$  to validate your selection. If the password protection has been activated, the password must be entered in order to access the deactivation menu. See the menu structure on page 27.

### Advanced functions

The unit gives access to a number of advanced functions which can be reached by answering "Yes" to the point "ADV.SET".

**Memory (MEM):** In the memory menu you can save the configuration of the device in the 45xx, and then move the 45xx onto another device of the same type and download the configuration in the new device.

**Display setup (DISP):** Here you can adjust the brightness contrast and the backlight. Setup of TAG numbers with 6 alphanumerics. Selection of functional readout in line 3 of the display - choose between readout of analog output or tag no.

**Two-point process calibration (CAL):** The device can be process-calibrated in 2 points to fit a given input signal . A low input signal (not necessarily 0%) is applied and the actual value is entered via 45xx. Then a high signal (not necessarily 100%) is applied and the actual value is entered via 45xx. If you accept to use the calibration, the device will work according to this new adjustment. If you later reject this menu point or choose another type of input signal the device will return to factory calibration.

**Process simulation function (SIM):** In the menu point "EN.SIM" it is possible to simulate an input signal by means of the arrow keys and thus control the output signal up or down. You must exit the menu by pressing  $\otimes$  (no time-out).

The following point allows you to activate relay 1 and relay 2 by means of the arrow-keys up/down. You must exit the menu by pressing  $\otimes$  (no time-out).

The simulation function exits automatically, if the 45xx is detached.

**Password (PASS):** Here you can choose a password between 0000 and 9999 in order to protect the unit against unauthorized modifications to the configuration. The unit is delivered default without password.

**Language (LANG):** In the menu "LANG" you can choose between 7 different language versions of help texts that will appear in the menu. You can choose between UK, DE, FR, IT, ES, SE and DK.

### **Auto diagnosis**

The device performs an advanced auto diagnosis of the internal circuits.

The following possible errors can be displayed in the front unit 45xx.

CJ.ER - CJC sensor defect or CJC temperature outside range

FL.ER - Flash error

AO.ER - No load on the current output (only for S4...20 mA / S20...4 mA)

NO.CO - Connection error

IN.ER - Error levels on input

TY.ER - Configuration in 45xx does not match this product type

### **Selection of units**

After choosing the input signal type you can choose which process units should be displayed in text line 2 (see table). By selection of temperature input the process value is always displayed in Celsius or Fahrenheit. This is selected in the menu point after selection of temperature input.

### **Safety readback & SIL operation**

When the device is delivered with default configuration, the SIL function is disabled. The safety readback function (loop surveillance) can be selected in the menu O.RANGE, thus enabling the device to run in SIL mode.

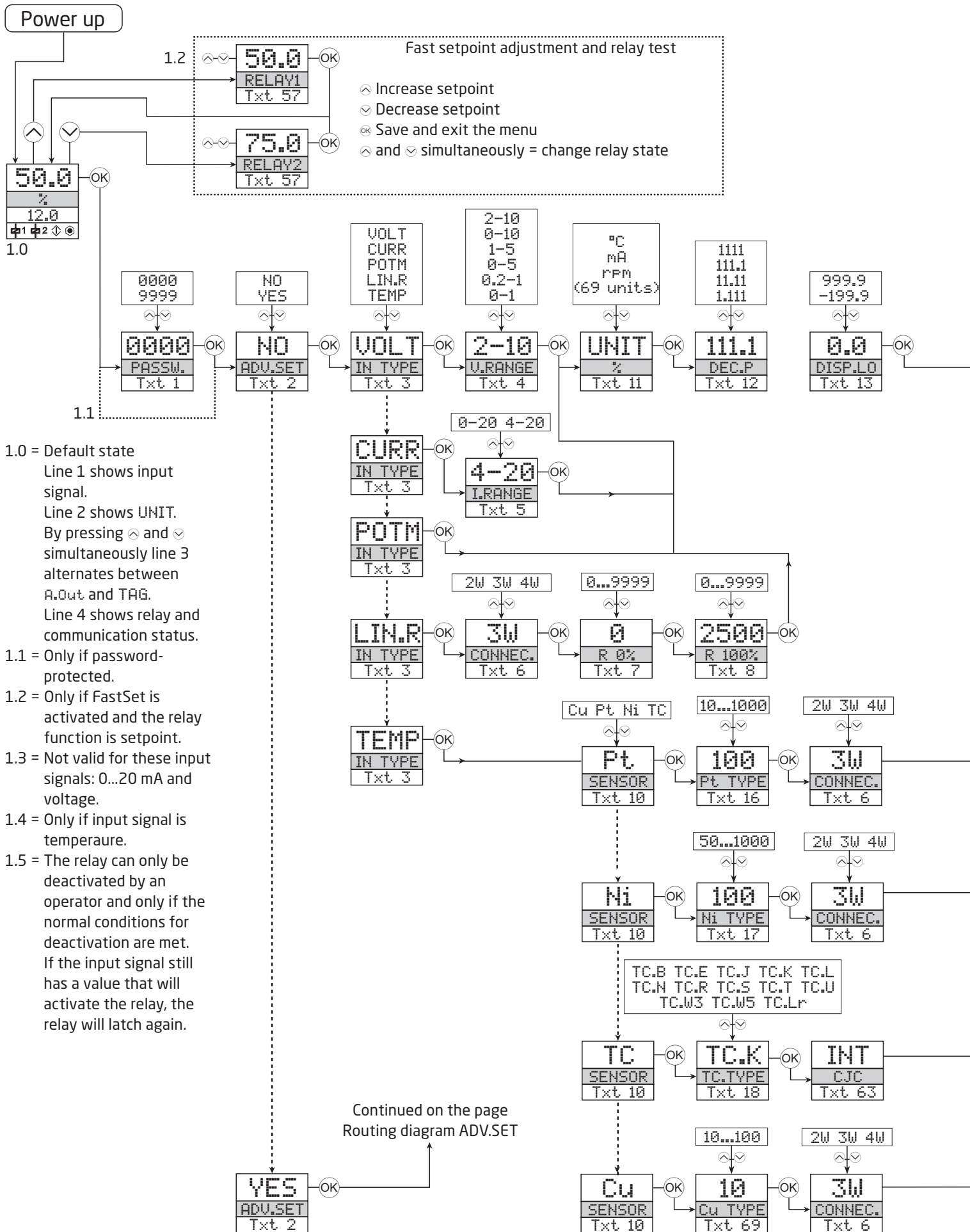
In order to enable the SIL functionality, the menu item S4...20 mA or S20...4 mA MUST be selected.

All other assumptions and restrictions contained in the FMEDA report must also be observed.

Please note, however, that when safety readback is enabled, a sensor error will be indicated as an error on the analog output signal.

### **CJC**

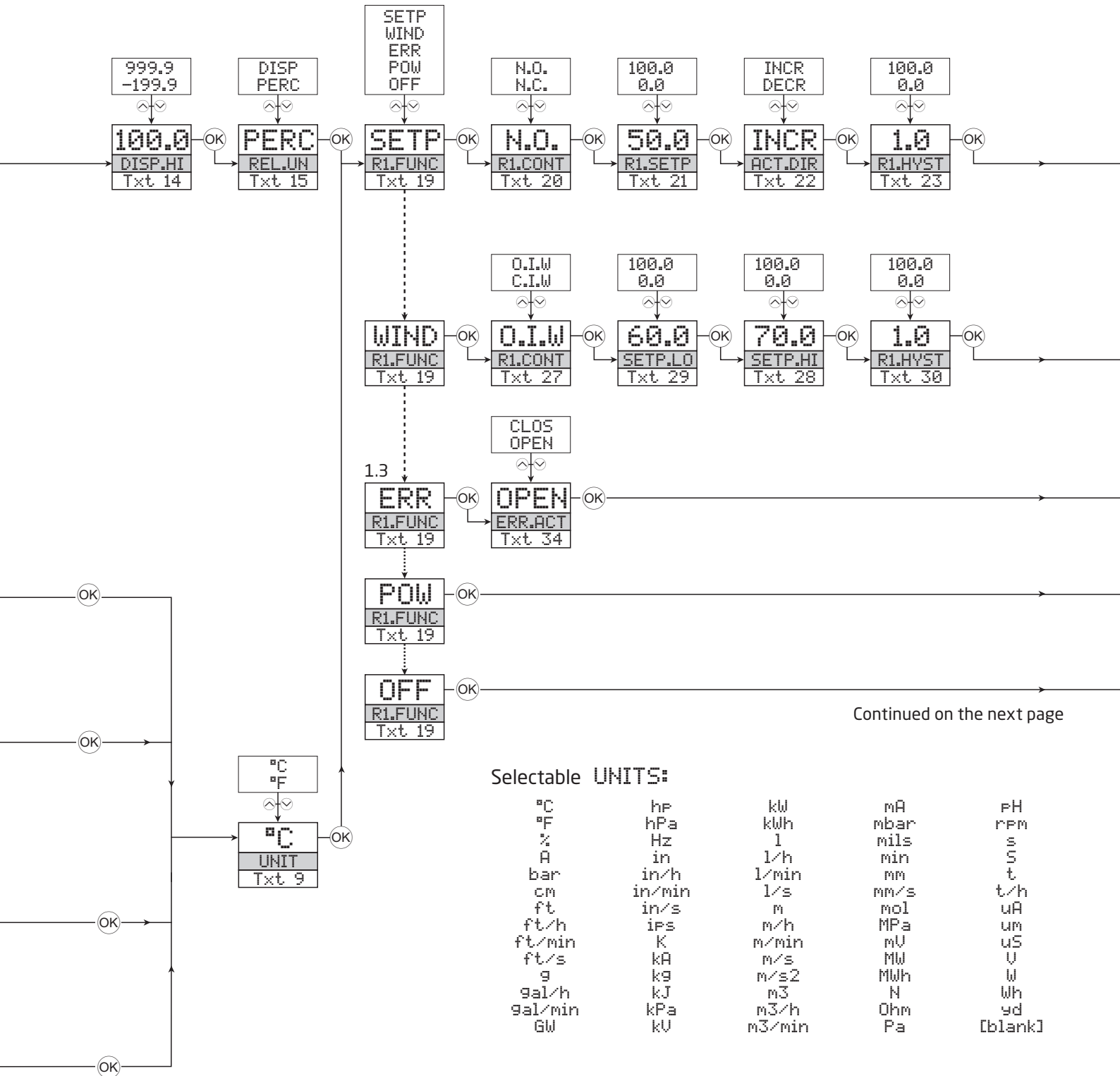
In the CJC menu you can choose between CJC connector and internal cold junction compensation. The CJC connector (PR 5910) must be ordered separately.



# Routing diagram

If no key is activated for 1 minute, the display will return to the default state 1.0 without saving configuration changes.

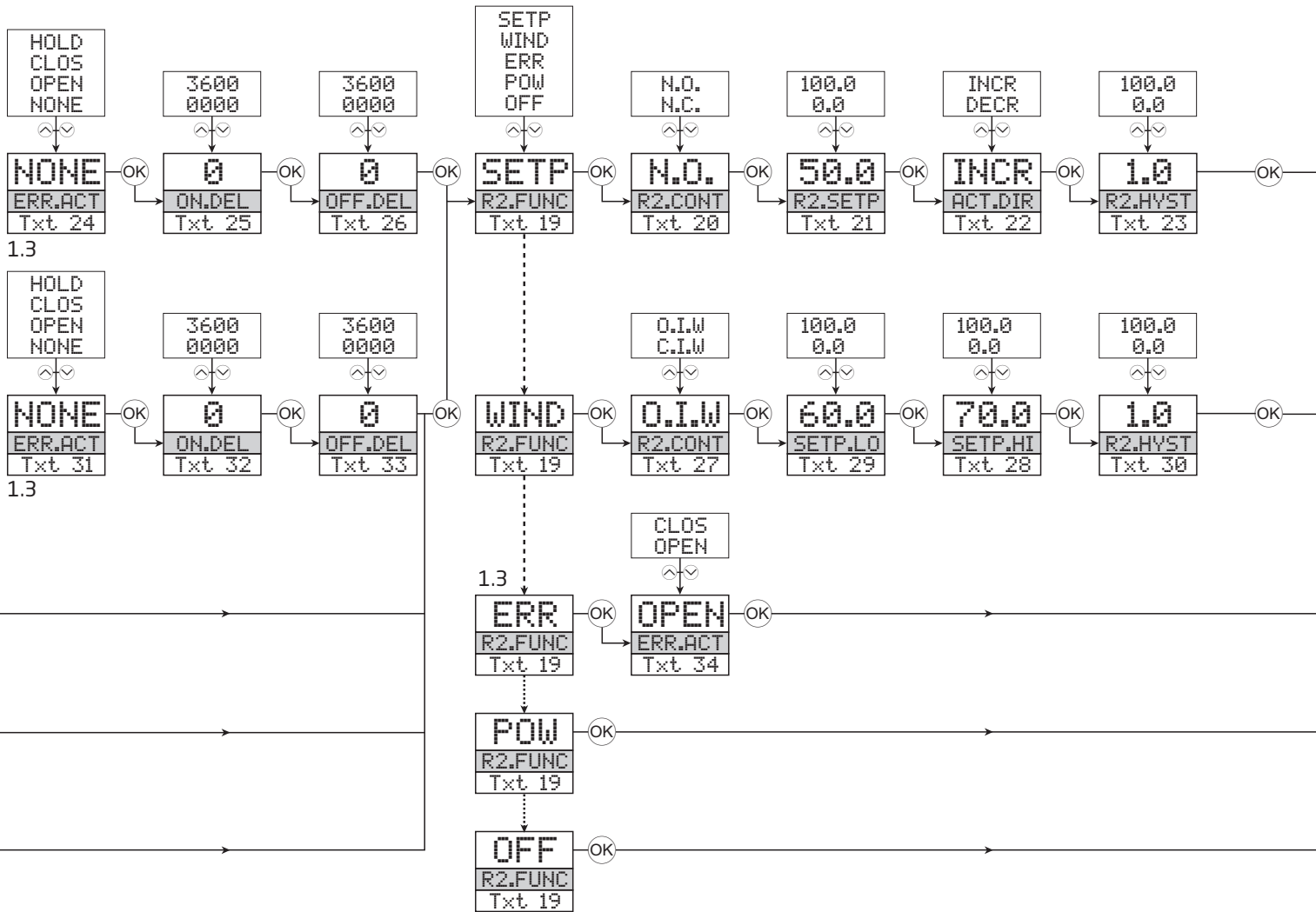
- ⬆ Increase value / choose next parameter
- ⬇ Decrease value / choose previous parameter
- ⊗ Save the chosen value and proceed to the next menu
- Hold ⊗ Back to previous menu / return to menu 1.0 without saving.



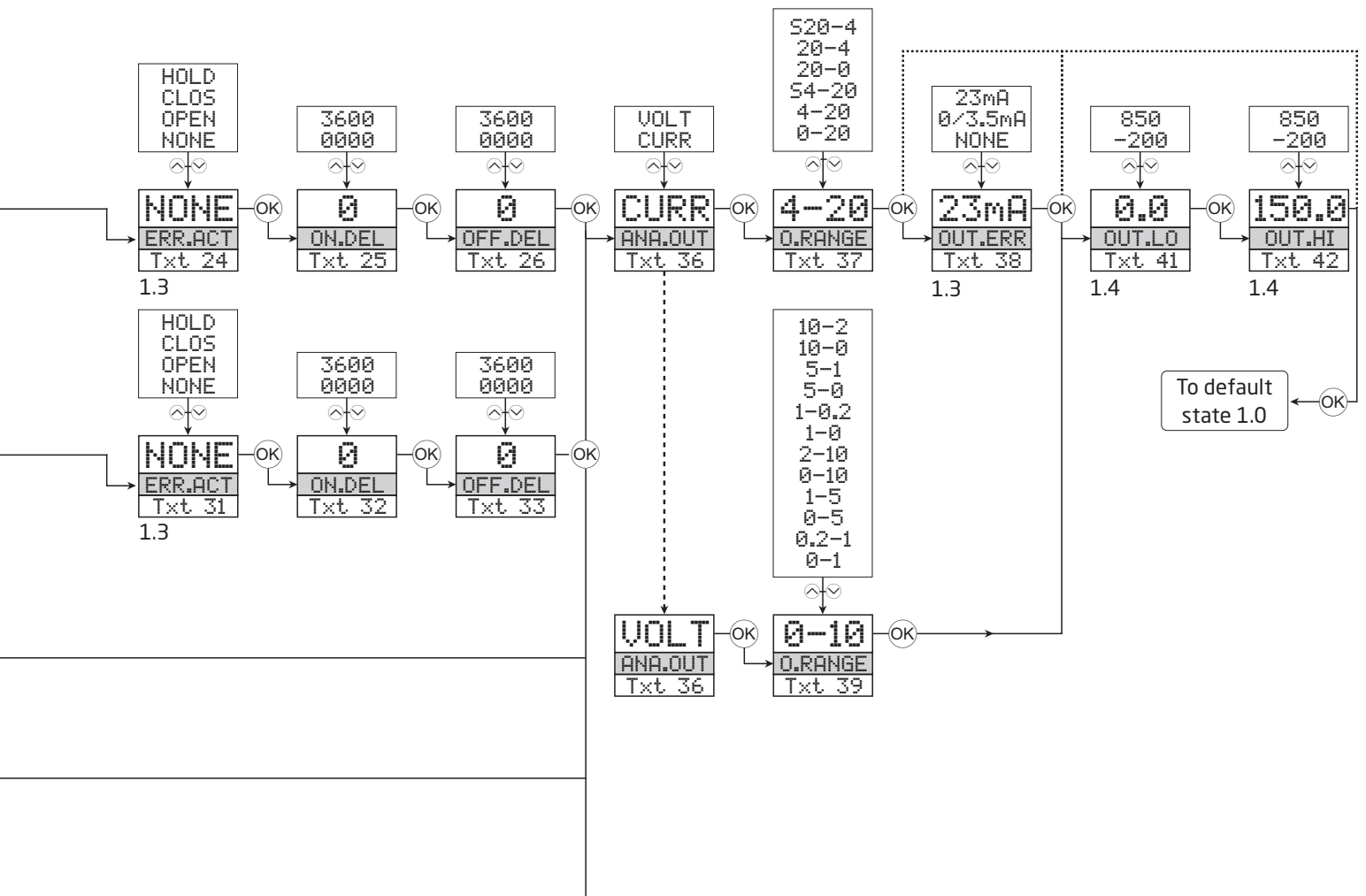
## Selectable UNITS:

°C	hPa	kW	mA	pH
°F	hPa	kWh	mbar	rpm
%	Hz	l	mils	s
A	in	l/h	min	S
bar	in/h	l/min	mm	t
cm	in/min	l/s	mm/s	t/h
ft	in/s	m	mol	uA
ft/h	ips	m/h	MPa	uM
ft/min	K	m/min	mV	uS
ft/s	kA	m/s	MW	V
g	kG	m/s <sup>2</sup>	MWh	W
gal/h	kJ	m <sup>3</sup>	N	Wh
gal/min	kPa	m <sup>3</sup> /h	Ohm	yd
GW	kV	m <sup>3</sup> /min	Pa	[blank]

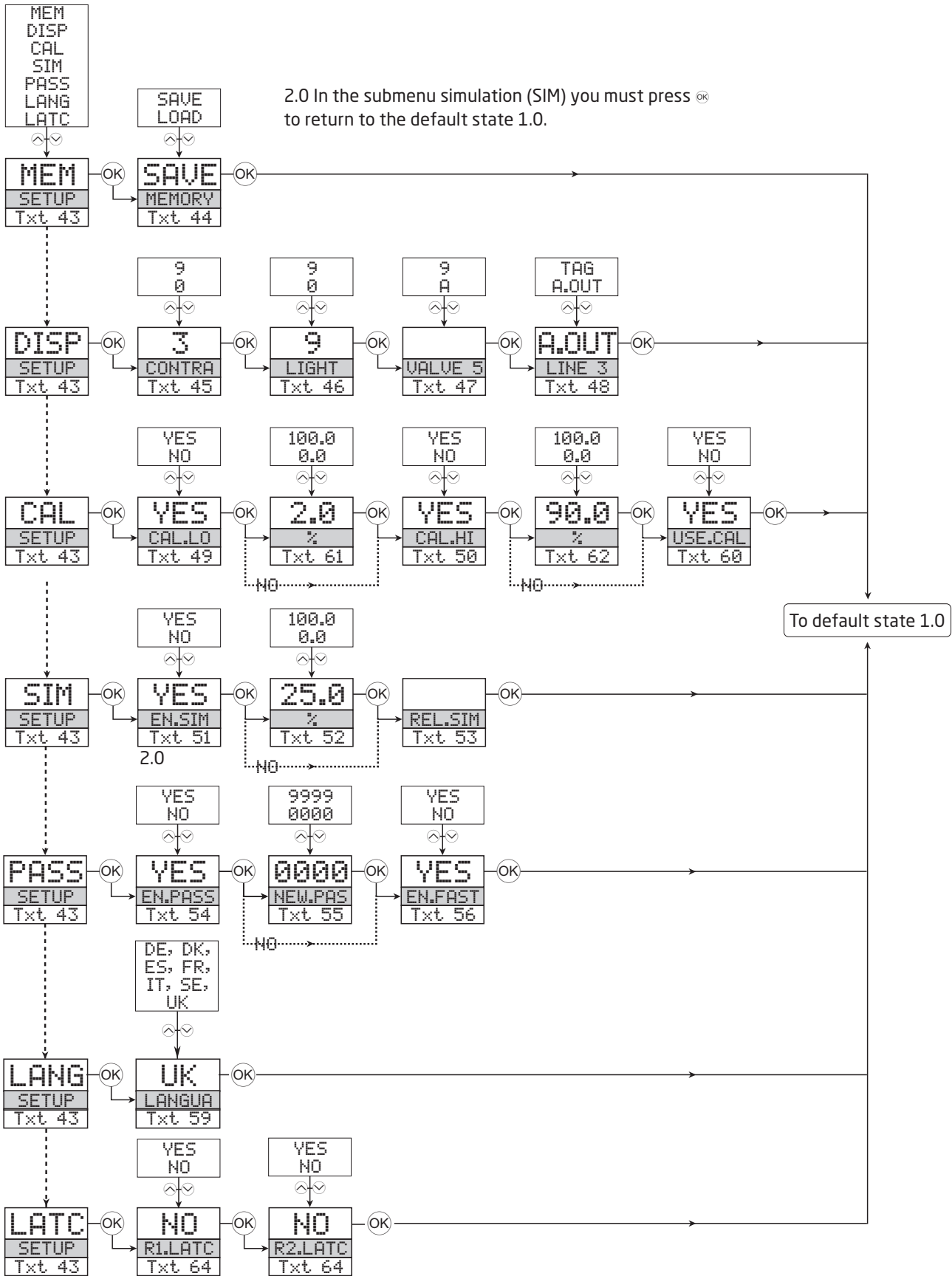
Continued on the next page



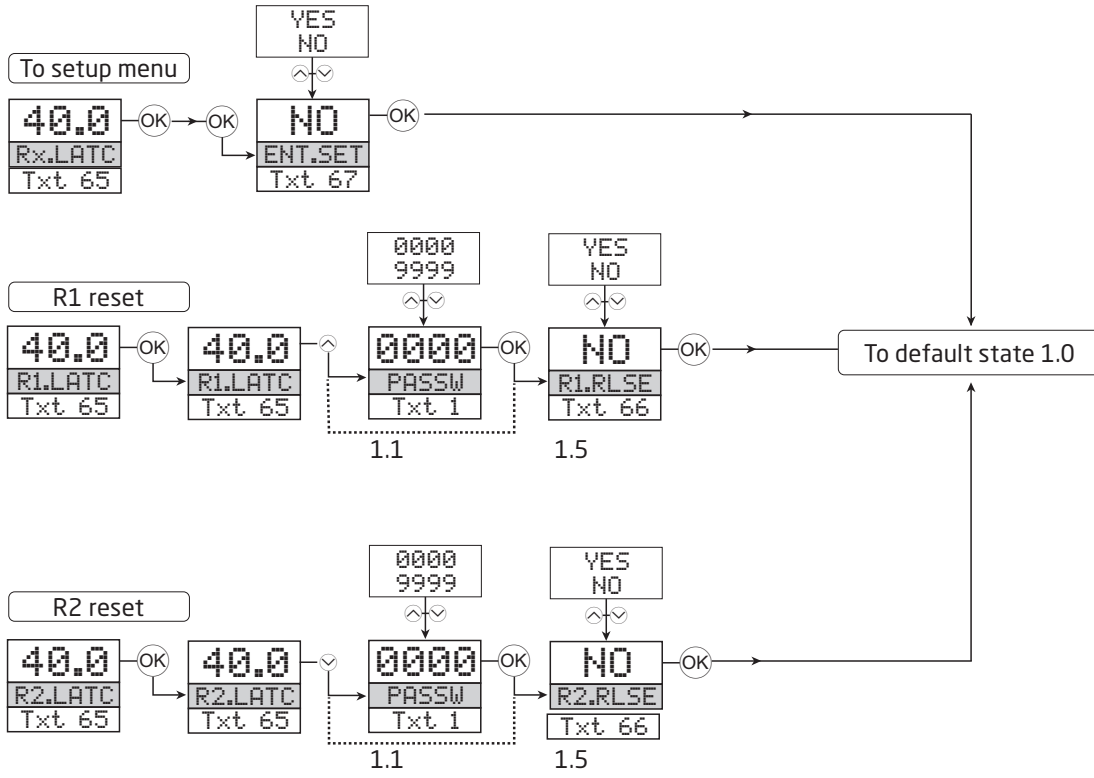




# Routing diagram, advanced settings (ADV.SET)



## Routing diagram, manual deactivation of the latch function

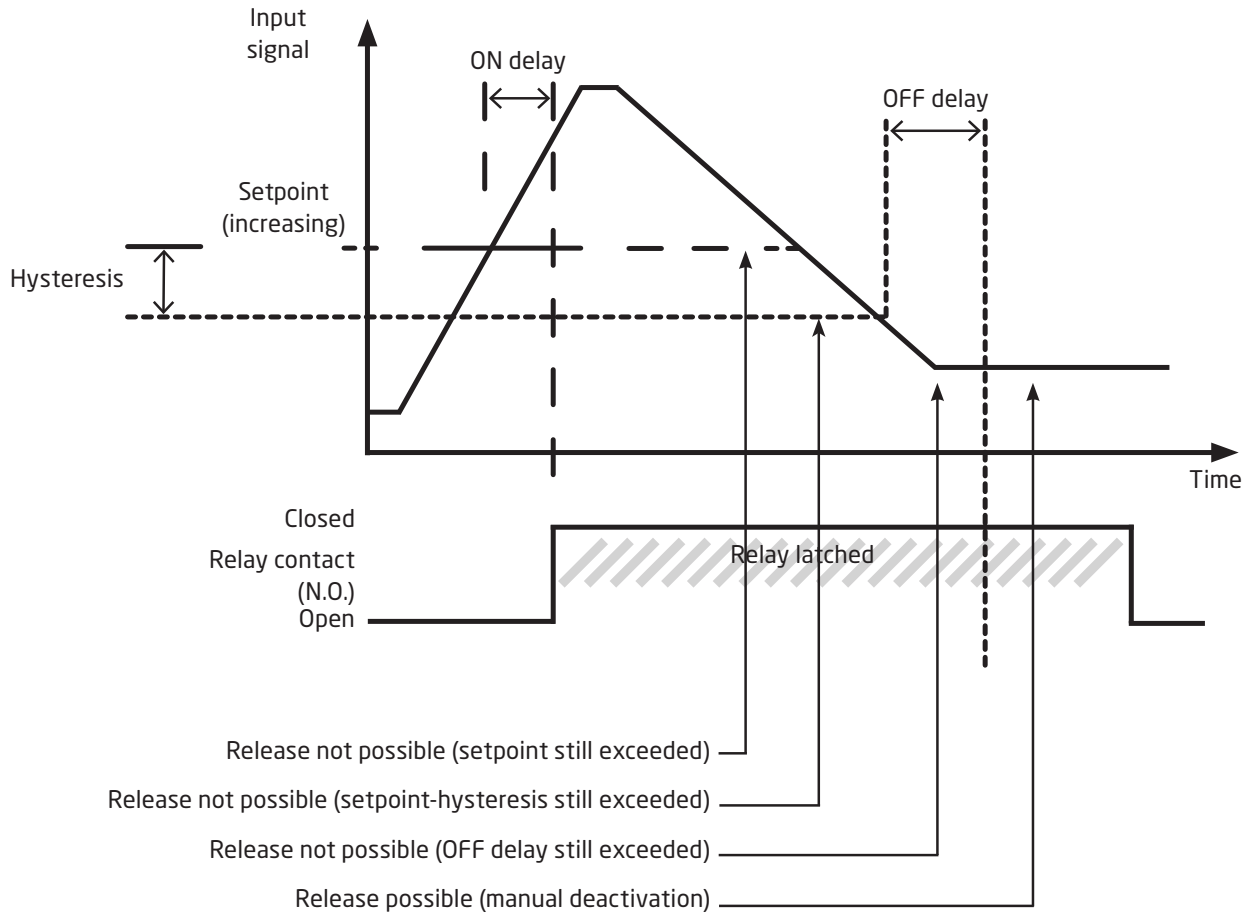


## Help text overview

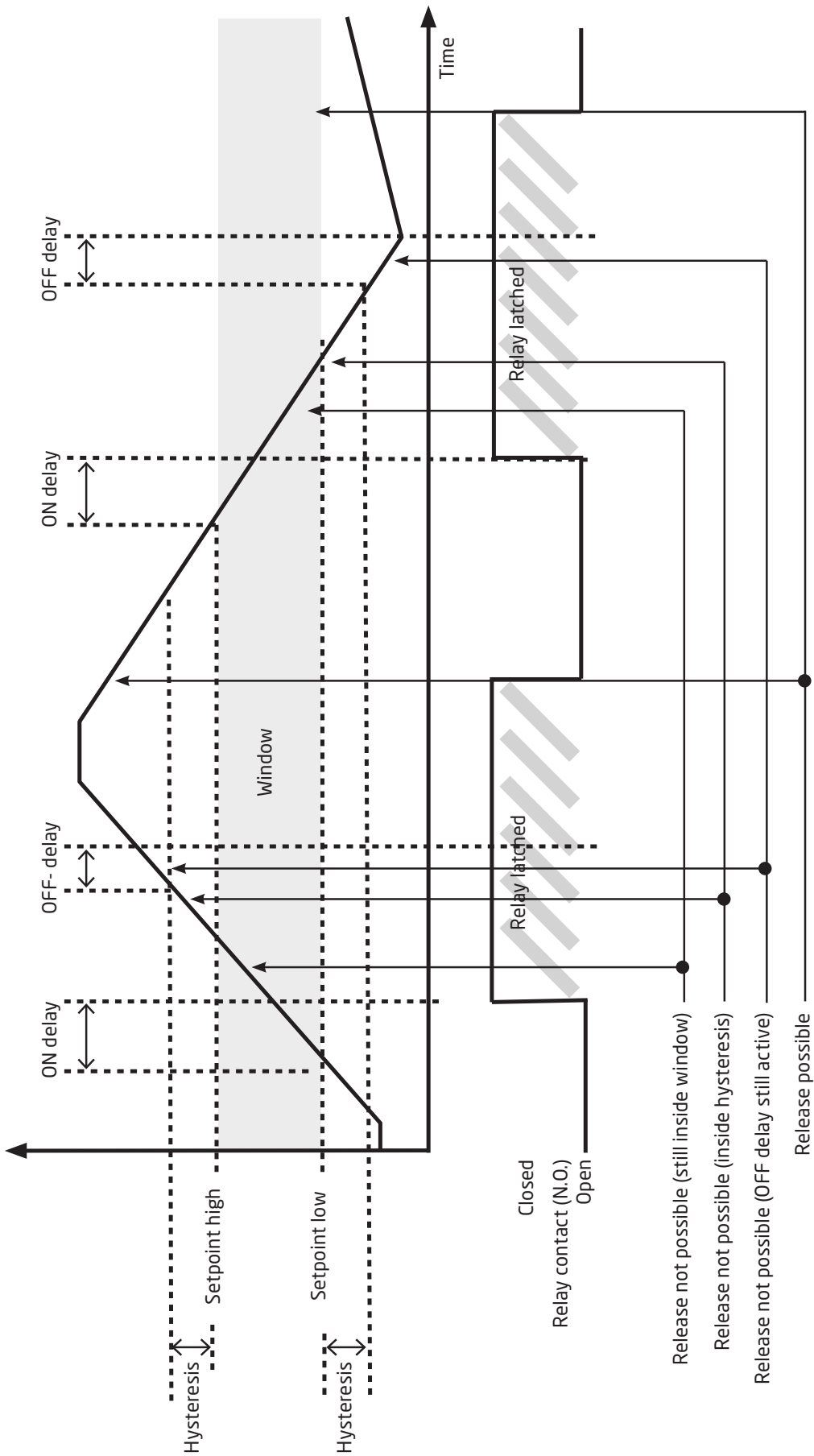
- [01] Set correct password
- [02] Enter advanced setup menu?
- [03] Select temperature input
  - Select potentiometer input
  - Select linear resistance input
  - Select current input
  - Select voltage input
- [04] Select 0.0-1 V input range
  - Select 0.2-1 V input range
  - Select 0-5 V input range
  - Select 1-5 V input range
  - Select 0-10 V input range
  - Select 2-10 V input range
- [05] Select 0-20 mA input range
  - Select 4-20 mA input range
- [06] Select 2-wire sensor connection
  - Select 3-wire sensor connection
  - Select 4-wire sensor connection
- [07] Set resistance value low
- [08] Set resistance value high
- [09] Select Celsius as temperature unit
  - Select Fahrenheit as temperature unit
- [10] Select TC sensor type
  - Select Ni sensor type
  - Select Pt sensor type
  - Select Cu sensor type
- [11] Select display unit
- [12] Select decimal point position
- [13] Set display range low
- [14] Set display range high
- [15] Set relays in % of input range
  - Select relays in display units
- [16] Select Pt10 as sensor type
  - Select Pt20 as sensor type
  - Select Pt50 as sensor type
  - Select Pt100 as sensor type
  - Select Pt200 as sensor type
  - Select Pt250 as sensor type
  - Select Pt300 as sensor type
  - Select Pt400 as sensor type
  - Select Pt500 as sensor type
  - Select Pt1000 as sensor type
- [17] Select Ni50 as sensor type
  - Select Ni100 as sensor type
  - Select Ni120 as sensor type
  - Select Ni1000 as sensor type
- [69] Select Cu10 as sensor type
  - Select Cu20 as sensor type
  - Select Cu50 as sensor type
  - Select Cu100 as sensor type
- [18] Select TC-B as sensor type
  - Select TC-E as sensor type
  - Select TC-J as sensor type
  - Select TC-K as sensor type
  - Select TC-L as sensor type
  - Select TC-N as sensor type
  - Select TC-R as sensor type
  - Select TC-S as sensor type
  - Select TC-T as sensor type
  - Select TC-U as sensor type
  - Select TC-W3 as sensor type
  - Select TC-W5 as sensor type
  - Select TC-Lr as sensor type
- [19] Select OFF function - relay is permanently off
  - Select POWER function - relay indicates power status OK
  - Select ERROR function - relay indicates sensor error only
  - Select WINDOW function - relay controlled by 2 setpoints
  - Select SETPOINT function - relay controlled by 1 setpoint
- [20] Select Normally Closed contact
  - Select Normally Open contact
- [21] Set relay setpoint
- [22] Activate relay on decreasing signal
  - Activate relay on increasing signal
- [23] Set relay hysteresis
- [24] No error action - undefined status at error
  - Open relay contact at error
  - Close relay contact at error
  - Hold relay status at error
- [25] Set relay ON delay in seconds
- [26] Set relay OFF delay in seconds
- [27] Relay contact is Closed Inside Window
  - Relay contact is Open Inside Window
- [28] Set relay window setpoint high
- [29] Set relay window setpoint low
- [30] Set relay window hysteresis
- [31] No error action - undefined status at error
  - Open relay contact at error
  - Close relay contact at error
  - Hold relay status at error
- [32] Set relay ON delay in seconds
- [33] Set relay OFF delay in seconds
- [34] Open relay contact at error
  - Close relay contact at error
- [36] Select current as analog output type
  - Select voltage as analog output type
- [37] Select 0-20 mA output range
  - Select 4-20 mA output range
  - Select S4-20 mA with safety readback
  - Select 20-0 mA output range
  - Select 20-4 mA output range
  - Select S20-4 mA with safety readback
- [38] Select no error action - output undefined at error
  - Select downscale at error
  - Select NAMUR NE43 downscale at error
  - Select NAMUR NE43 upscale at error
- [39] Select 0.0-1 V output range
  - Select 0.2-1 V output range
  - Select 0-5 V output range
  - Select 1-5 V output range
  - Select 0-10 V output range
  - Select 2-10 V output range
  - Select 1-0.0 V output range

- Select 1-0.2 V output range
- Select 5-0 V output range
- Select 5-1 V output range
- Select 10-0 V output range
- Select 10-2 V output range
- [41] Set temperature for analog output low
- [42] Set temperature for analog output high
- [43] Enter password setup
- Enter simulation mode
- Perform process calibration
- Enter display setup
- Perform memory operations
- Enter relay latch setup
- [44] Load saved configuration into 4116
- Save 4116 configuration in 45xx
- [45] Adjust LCD contrast
- [46] Adjust LCD backlight
- [47] Write a 6-character device TAG
- [48] Analog output value is shown in display line 3
- Device TAG is shown in display line 3
- [49] Calibrate input low to process value?
- [50] Calibrate input high to process value?
- [51] Enable simulation mode?
- [52] Set the input simulation value
- [53] Relay simulation - use ⏪ and ⏩ to toggle relay 1 and 2
- [54] Enable password protection?
- [55] Set new password
- [56] Enable Fastset functionality?
- [57] Relay setpoint - press ⏹ to save
- [58] Relay setpoint - Read only
- [59] Select language
- [60] Use process calibration values?
- [61] Set value for low calibration point
- [62] Set value for high calibration point
- [63] Select CJC connector (accessory)
- Select internal temperature sensor
- [64] Enable relay latch function?
- [65] Relay is latched - press ⏹ to acknowledge
- Relay 1 is latched - press ⏪ to release
- Relay 2 is latched - press ⏩ to release
- Relays are latched - press ⏪ or ⏩ to release relay 1 or relay 2
- [66] Release relay? (if conditions allow)
- [67] Enter setup menu? (latched relays may release!)

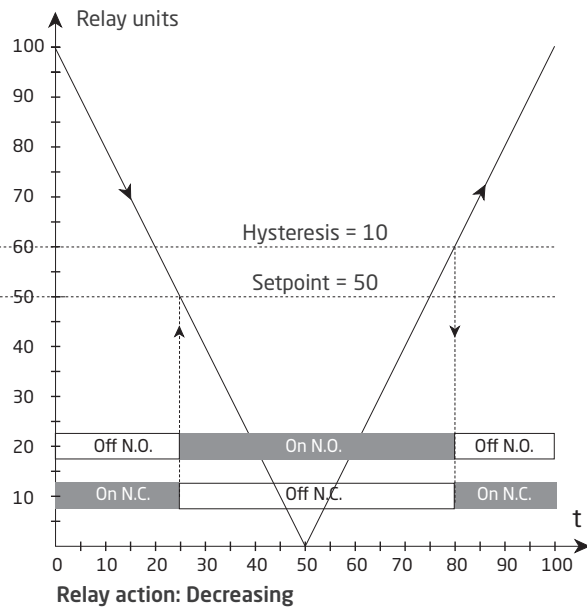
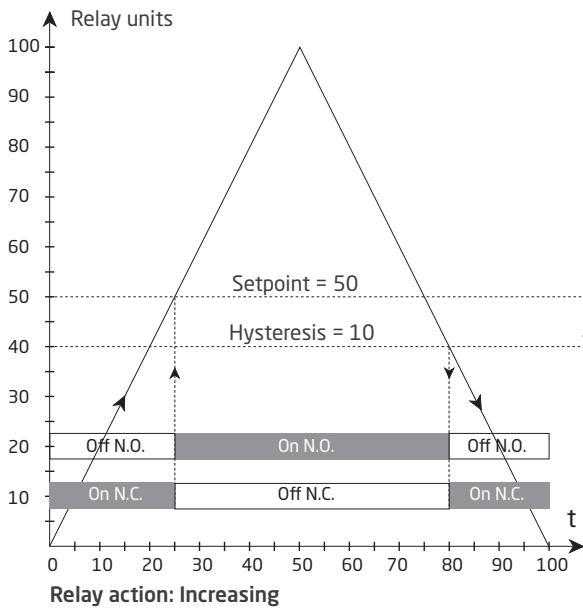
# Graphic depiction of latch function setpoint



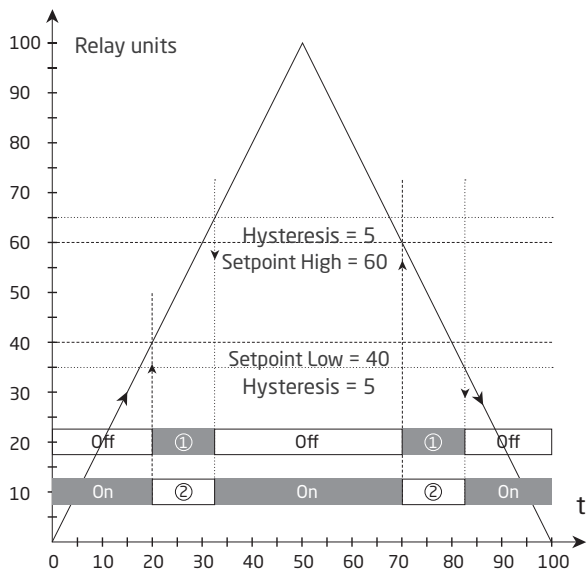
# Graphic depiction of latch function window



## Graphic depiction of relay action setpoint

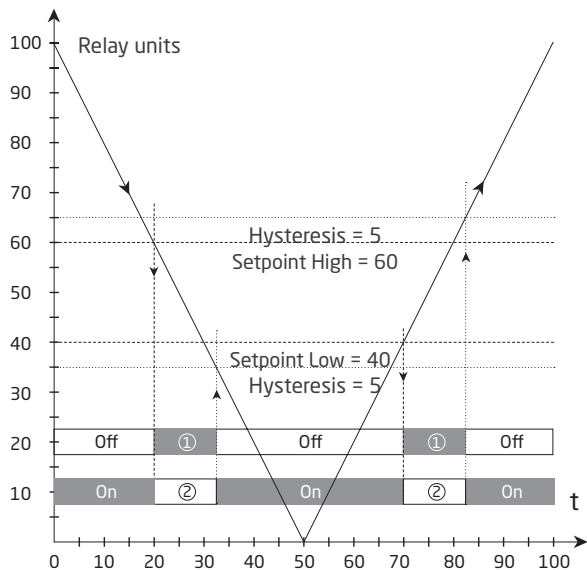


## Graphic depiction of relay action window



**Relay function: Window** (shown for increasing signal)

Contact: Closed inside window = ①  
Contact: Open inside window = ②



**Relay function: Window** (shown for decreasing signal)

Contact: Closed inside window = ①  
Contact: Open inside window = ②



## Document history

The following list provides notes concerning revisions of this document.

<b>Rev. ID</b>	<b>Date</b>	<b>Notes</b>
105	1948	Relay data updated, graph with resistive loads inserted. EU-RO marine approval added.

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