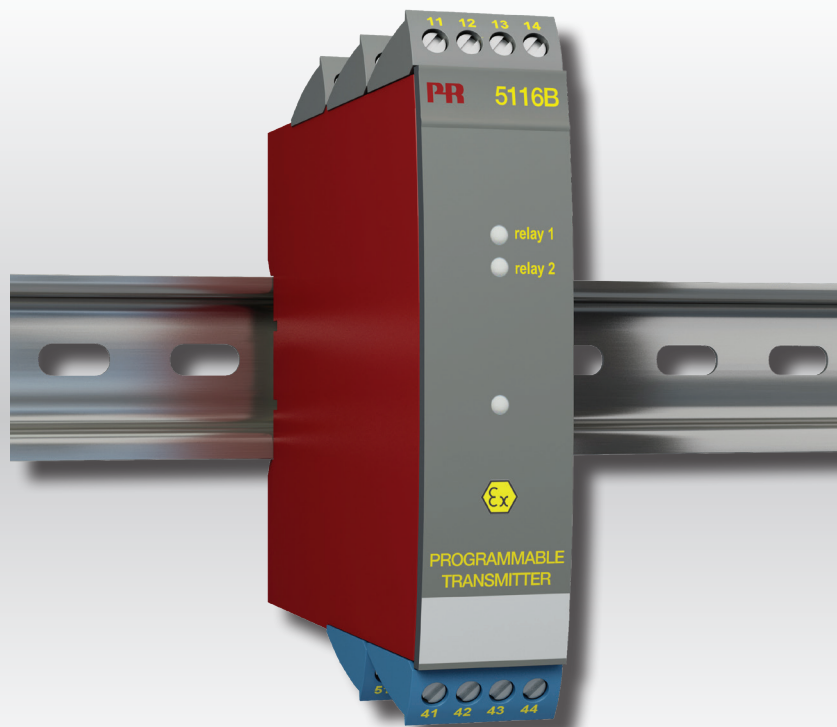


PERFORMANCE
MADE
SMARTER

Product Manual **5116**

Programmable transmitter



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

No. 5116V104-UK
From serial no. 181570001

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. The detachable 4501 Local Operator Interface (LOI) allows for local monitoring of process values, device configuration, error detection and signal simulation. The next generation, our 4511 Remote Operator Interface (ROI) does all that and more, adding remote digital communications via Modbus/RTU, while the analog output signals are still available for redundancy.

With the 4511 you can further expand connectivity with a PR gateway, which connects via industrial Ethernet, wirelessly through a Wi-Fi router or directly with the devices using our Portable Plant Supervisor (PPS) application. The PPS app is available for iOS, Android and Windows.



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.

Programmable transmitter

5116

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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 manual 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 manual 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.

Warning



**HAZARD-
OUS
VOLTAGE**

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, wire connection and disconnection.
- Troubleshooting the device.

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

Warning



**INSTAL-
LATION**

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. SYSTEM 5000 must be mounted on a DIN rail according to DIN 46277. The communication connector of SYSTEM 5000 is connected to the input terminals on which dangerous voltages can occur, and it must only be connected to the programming unit Loop Link by way of the enclosed cable.

Symbol identification



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



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.



Ex devices have been approved acc. to the ATEX directive for use in connection with installations in explosive areas.

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.

All devices fall under Installation Category II, Pollution Degree 2, and Insulation Class II.

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

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 telling it will switch off the voltage to the device.

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

Instructions for intrinsically safe installation of 5116B

The intrinsically safe circuits are galvanically connected to the communications interface unit.

The communications interface may only be connected temporarily, under the condition that the connectors with terminal numbers 41...44 and 51...54 are disconnected on the 5116B.

When a higher ingress protection than IP20 is required, this has to be achieved by an additional enclosure which is suitable for the applicable environmental conditions.

When two or more units are placed next to each other it has to be assured that all the terminal numbers 41...44 and 51...54 are placed on the same side and are separated from the non-intrinsically safe circuits of the units which could be mounted above or below it.

Each combination of circuits (to terminations 41...44 or to terminations 51...53 or to terminations 51...54) shall be connected via separated cables or if the combinations are in one cable shall be type A or B in accordance with EN 60079-14 Clause 12.2.2.8.

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

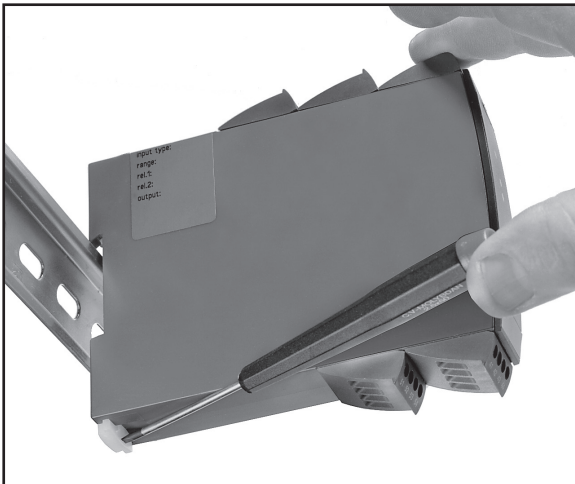
When disconnected, the device may be cleaned with a cloth moistened with distilled water.

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 5000

First, remember to demount the connectors with hazardous voltages.

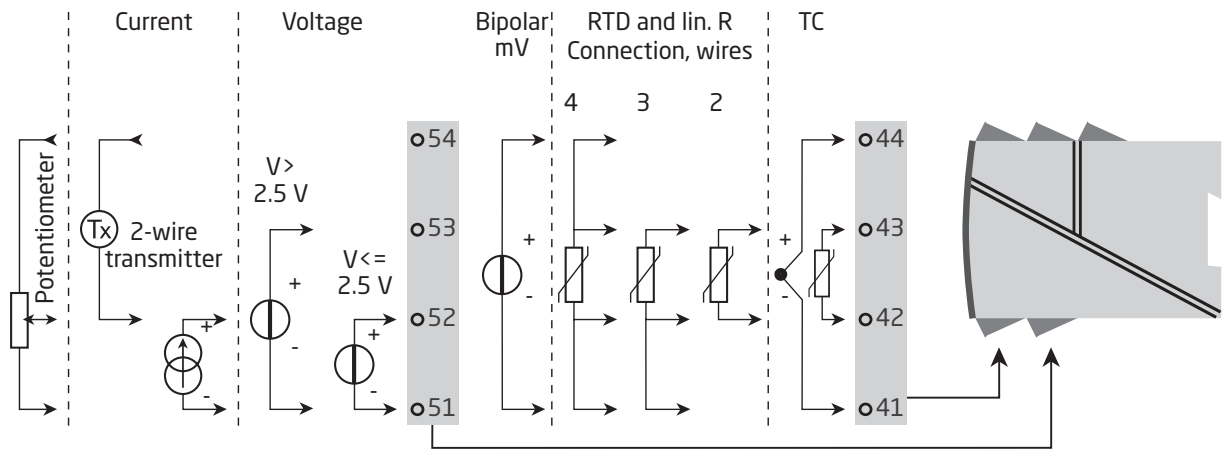


Picture 1:

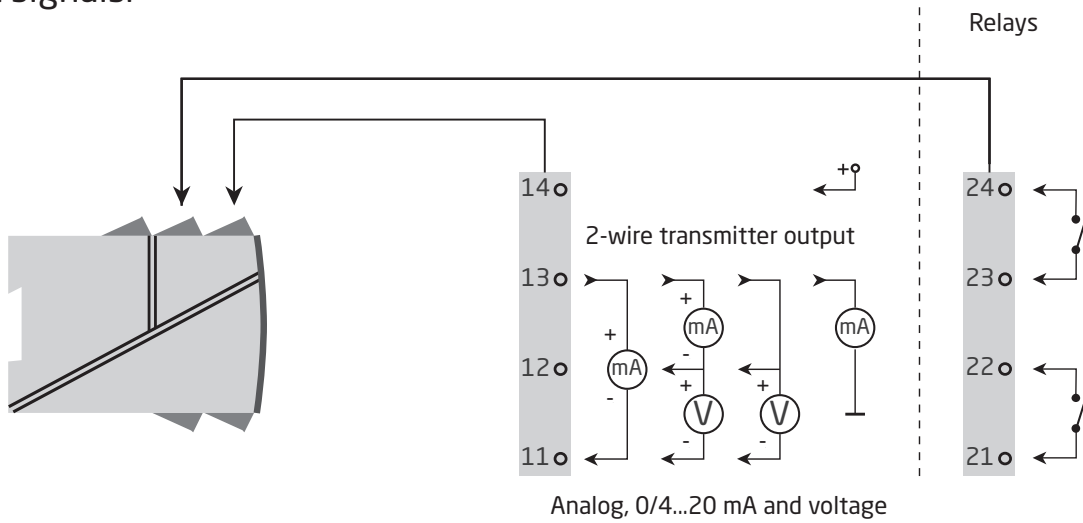
By lifting the bottom lock, the device is detached from the DIN rail.

Applications

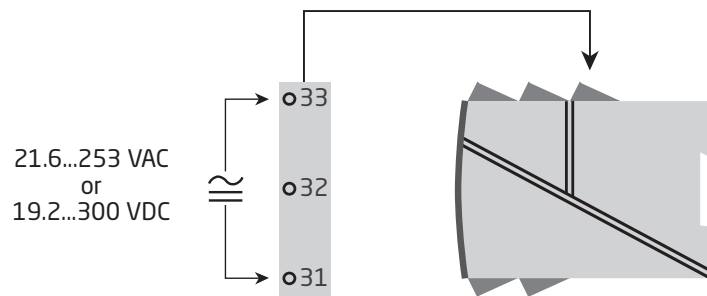
Input signals:



Output signals:



Supply:



Programmable transmitter

5116

- Input for RTD, TC, mV, Ohm, potmeter, mA and V
- 2-wire supply > 16.5 V
- Bipolar voltage input
- Output for current, voltage and 2 relays
- Universal AC or DC supply

Application

- Linearised, 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 potential-free relay contacts which can be configured for advanced functions.
- Galvanic separation of analog signals and measurement of floating signals.

Technical characteristics

- Within a few seconds the user can program PR5116 to suit the specific application.
- By way of the front push-button the input can be calibrated to the exact span of the process. Zero drift on the process signal can be adjusted by a single press of the front button.
- Continuous check of vital stored data for safety reasons.
- 3-port 3.75 kVAC galvanic isolation.

Mounting / installation

- Mounted vertically or horizontally on a DIN rail. As the devices can be mounted without any distance between neighbouring units, up to 42 devices can be mounted per metre.

Order

Type	Version
5116	Standard : A
	ATEX Ex and FM : B

Example: 5116B

NB! Please remember to order CJC connectors
type 5910/5910Ex for TC inputs with internal CJC.

Electrical specifications

Environmental conditions:

Operating temperature	-20°C to +60°C
Calibration temperature.	20...28°C
Relative humidity	< 95% RH (non-cond.)
Protection degree	IP20

Mechanical specifications:

Dimensions (HxWxD)	109 x 23.5 x 130 mm
Weight approx.	235 g
DIN rail type.	DIN 46277
Wire size (min....max.)	0.13...2.08 mm ² 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	21.6...253 VAC, 50...60 Hz or 19.2...300 VDCC
Fuse	400 mA SB / 250 VAC
Max. required power.	2.4 W
Max. power dissipation	2.0 W

Max. required power is the maximum power needed at terminals 31 and 33.

Max. power dissipation is the maximum power dissipated by the device.

Isolation voltage, test / operation.	3.75 kVAC / 250 VAC
PELV/SELV.	IEC 61140
Communications interface	Loop Link
Signal / noise ratio.	Min. 60 dB (0...100 kHz)
Updating time:	
Temperature / ±mV input.	115 ms
mA / V / mV input	75 ms
Response time (0...90%, 100...10%), programmable:	
Temperature / ± mV input	400 ms to 60 s
mA / V / mV input	250 ms to 60 s
Signal dynamics, input	22 bit
Signal dynamics, output	16 bit

Accuracy, the greater of the general and basic values:

General values		
Input type	Absolute accuracy	Temperature coefficient
All	$\leq \pm 0.05\%$ of span	$\leq \pm 0.01\%$ of span / °C

Basic values		
Input type	Basic accuracy	Temperature coefficient
mA	$\leq \pm 4 \mu\text{A}$	$\leq \pm 0.4 \mu\text{A} / ^\circ\text{C}$
Volt	$\leq \pm 10 \mu\text{V}$	$\leq \pm 1 \mu\text{V} / ^\circ\text{C}$
RTD	$\leq \pm 0.2^\circ\text{C}$	$\leq \pm 0.01^\circ\text{C} / ^\circ\text{C}$
Lin. R	$\leq \pm 0.1^\circ\Omega$	$\leq \pm 10 \text{m}\Omega / ^\circ\text{C}$
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: B, R, S, W3, W5, LR	$\leq \pm 2^\circ\text{C}$	$\leq \pm 0.2^\circ\text{C} / ^\circ\text{C}$

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

Auxiliary supplies:

Reference voltage 2.5 VDC $\pm 0.5\%$ / 15 mA
 2-wire supply (pin 54...52). 28...16.5 VDC / 0...20 mA

**Electrical specifications, temperature input,
terminal 41, 42, 43 and 44**

Max. offset 50% of selected max. value

TC input:

Type	Min. value	Max. value	Min. span	Standard
B	+400°C	+1820°C	200°C	IEC 60584-1
E	-100°C	+1000°C	50°C	IEC 60584-1
J	-100°C	+1200°C	50°C	IEC 60584-1
K	-180°C	+1372°C	50°C	IEC 60584-1
L	-100°C	+900°C	50°C	DIN 43710
N	-180°C	+1300°C	100°C	IEC 60584-1
R	-50°C	+1760°C	200°C	IEC 60584-1
S	-50°C	+1760°C	200°C	IEC 60584-1
T	-200°C	+400°C	50°C	IEC 60584-1
U	-200°C	+600°C	75°C	DIN 43710
W3	0°C	+2300°C	200°C	ASTM E988-90
W5	0°C	+2300°C	200°C	ASTM E988-90
LR	-200°C	+800°C	50°C	GOST 3044-84

Sensor error current Nom. 30 μA

CJC $< \pm 1^\circ\text{C}$

Sensor error detection Yes

RTD and linear resistance input

Input type	Min. value	Max. value	Min. span	Standard
Pt100	-200°C	+850°C	25°C	IEC 60751
Ni100	-60°C	+250°C	25°C	DIN 43760
Linear resist.	0 Ω	5000 Ω	30 Ω	-

Cable resistance per wire 10 Ω
(max. 50 Ω with less accuracy)
Sensor current Nom. 0.2 mA
Effect of sensor cable resistance (3- / 4-wire) < 0.002 Ω / Ω
Sensor error detection Yes

mV input:

Measurement range -2500...+2500 mV
Min. measurement range (span) 5 mV
Input resistance > 5 MΩ

Electrical specifications, mA / V input, terminal 51, 52, 53 and 54

Max. offset 50% of selected max. value

Current input:

Measurement range 0...100 mA
Min. measurement range (span) 4 mA
Input resistance:
Supplied unit Nom. 10 Ω + PTC 10 Ω
Non-supplied unit RSHUNT = ∞, VDROPP < 6 V
Sensor error detection:
loop error on 4...20 mA signals Yes

Voltage input

Measurement range 0...250 VDC
Min. measurement range (span) 5 mVDC
Input resistance ≤ 2.5 VDC Nom. 10 MΩ
> 2.5 VDC Nom. 5 MΩ

Potentiometer input via 2.5 V ref.

Potentiometer min. 170 Ω

Electrical specifications - output

Max. offset 50% of selected max. value

Current output

Signal range 0...23 mA
Min. signal range (span) 10 mA
Load (max.) ≤ 600 Ω
Load stability ≤ 0.01% of span / 100 Ω
Current limit ≤ 28 mA

Voltage output

Signal range 0...10 VDC
Min. signal range (span) 500 mV
Load (min.) 500 kΩ

2-wire 4...20 mA output

Signal range 4...20 mA
Load stability ≤ 0.01% of span / 100 Ω
Load resistance ≤ (Vsupply-3.5) / 0.023 A [Ω]
Max. external 2-wire supply 29 VDC
Effect of external 2-wire supply voltage variation < 0.005% of span / V

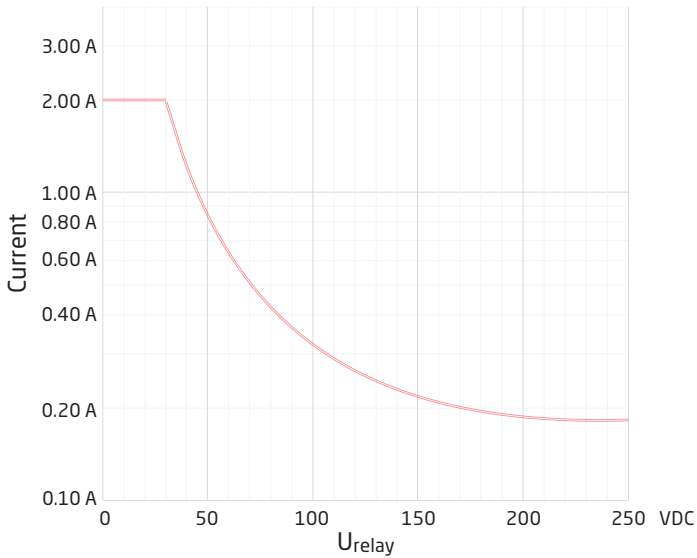
Sensor error detection and loop error on 4...20 mA

Programmable	0...23 mA
NAMUR NE43 Upscale	23 mA
NAMUR NE43 Downscale.	3.5 mA

Relay outputs

Sensor error detection	Break / Make / Hold / None
Max. voltage	250 VAC / VDC
Max. AC current.	2 A
Max. AC power	500 VA
Max. DC current, resistive load:	
@ $U_{\text{relay}} \leq 30$ VDC	2 ADC
@ $U_{\text{relay}} > 30$ VDC.	$[1380 \times U_{\text{relay}}^{-2} \times 1.0085^{U_{\text{relay}}}]$ ADC

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



Ex / I.S. approval - 5116B

KEMA 04ATEX1316 X.	II (1) G [Ex ia Ga] IIC/IIB/IIA or II (1) D [Ex ia Da] IIIC
----------------------------	---

Applicable for zone 0, 1, 2, 20, 21 or 22

Ex / I.S. data for 5116B

U_m	: 253 VDC
U_m , Loop Link.	: 60 VDC

Ex / I.S. data for temperature / bipolar mV input

Terminal 41, 42, 44 and 43

U_o	: 7.5 V
I_o	: 2.2 mA
P_o	: 4.2 mW
C_o	: 6 μ F
L_o	: 1.0 H

Ex / I.S. data for unipolar mA / V input:

Terminal 51, 52 and 53

U_o	: 7.5 V
I_o	: 2.2 mA
P_o	: 4.2 mW
C_o	: 6 μ F
L_o	: 1.0 H

Ex / I.S. data when using 2-wire supply / reference voltage

Terminal 51, 52, 53 and 54

U₀ : 28 V
 I₀ : 93 mA
 P₀ : 650 mW

	IIC	IIB / IIIC	IIA
C ₀ :	75 nF	645 nF	2 μF
L ₀ :	3 mH	16 mH	31 mH

Observed authority requirements:

EMC 2014/30/EU
 LVD 2014/35/EU
 RoHS 2011/65/EU

Approvals

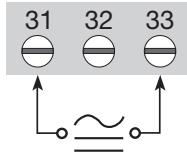
Det Norske Veritas, Ships & Offshore Standard for Certification No. 2.4
 UL, Standard for Safety UL 508
 EAC TR-CU 020/2011

I.S. / Ex

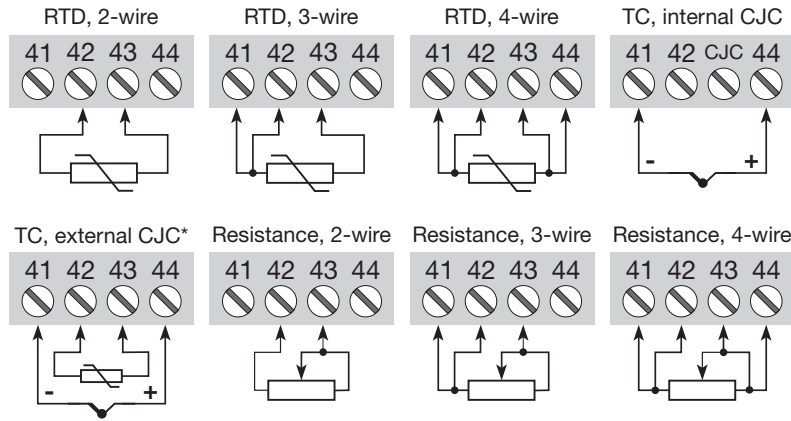
ATEX 2014/34/EU KEMA 04ATEX1316 X
 FM 3023092
 EAC Ex TR-CU 012/2011 RU C-DK.GB08.V.00410

Connections

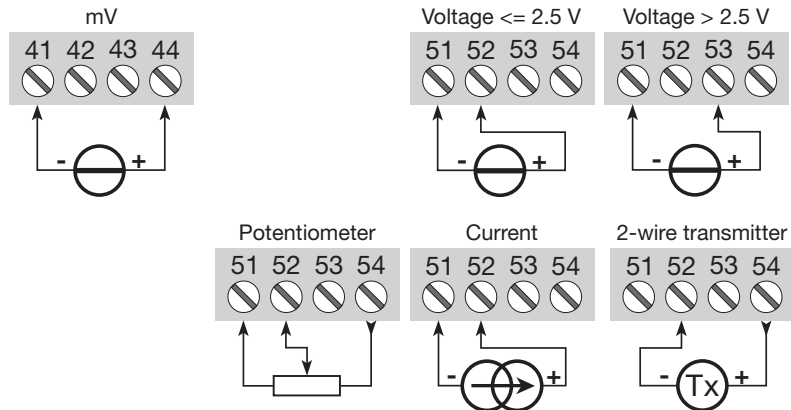
Supply:



Inputs:

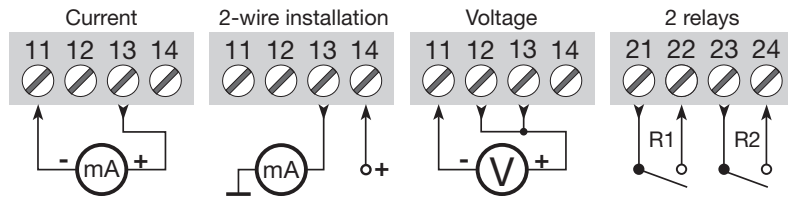


* If the device is reconfigured from temperature measurement with CJC connector to analogue measurement, the CJC connector must be demounted.

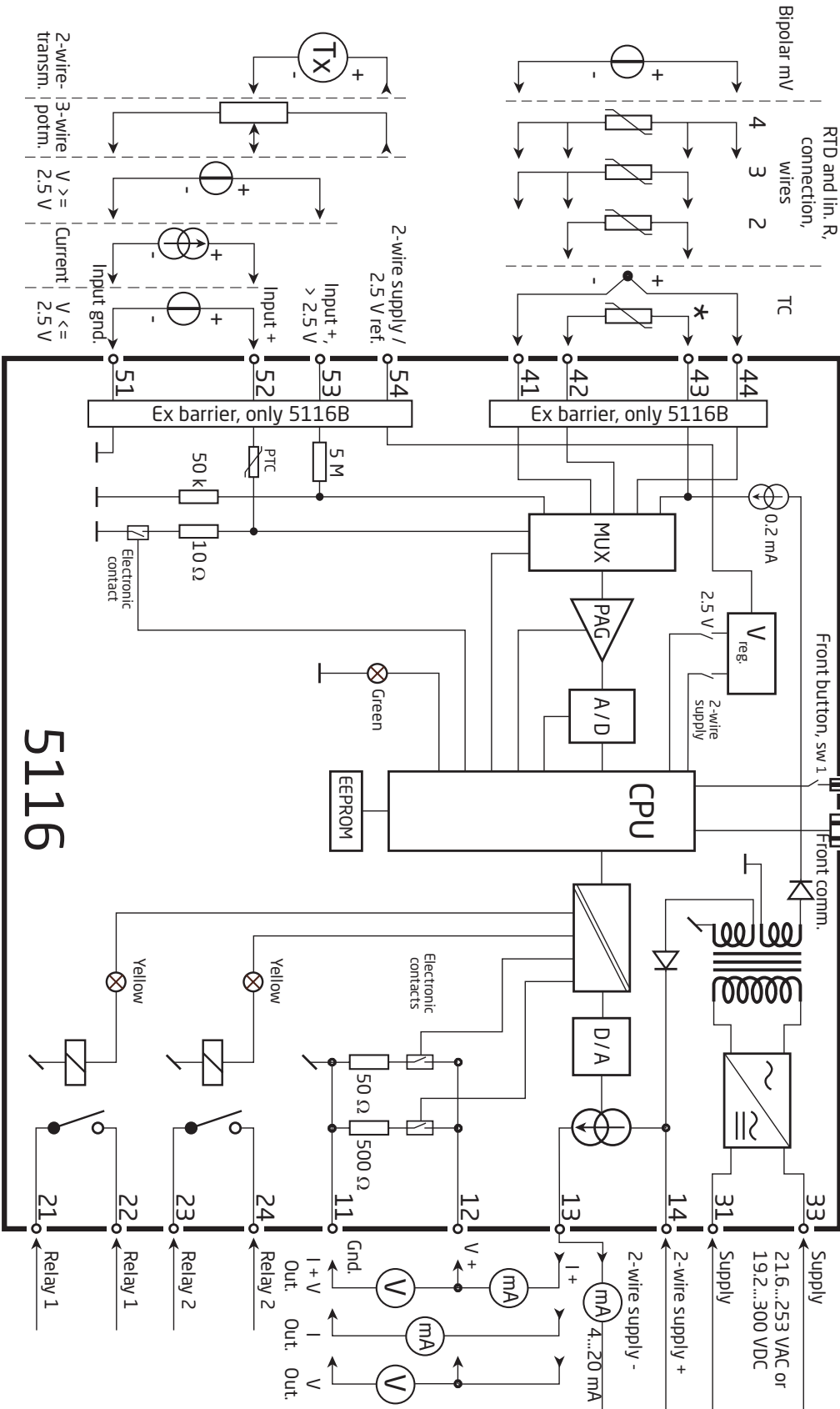


Connections

Outputs:

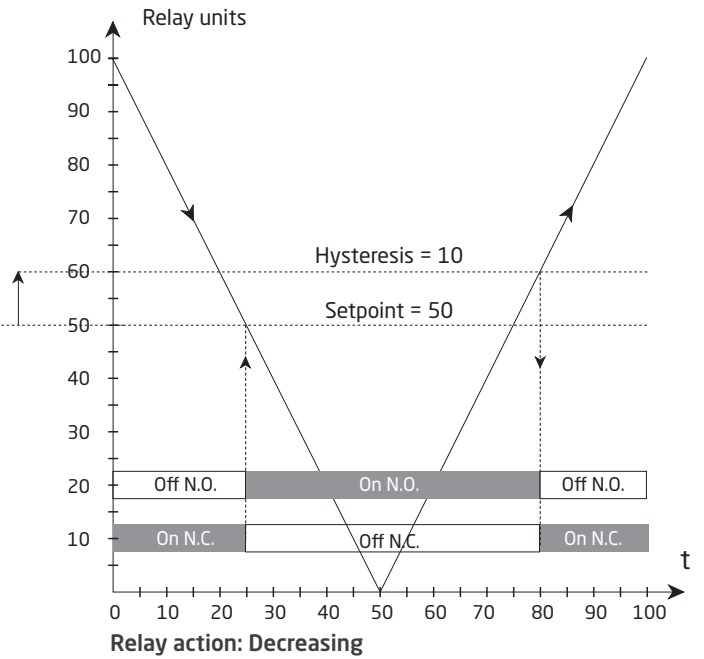
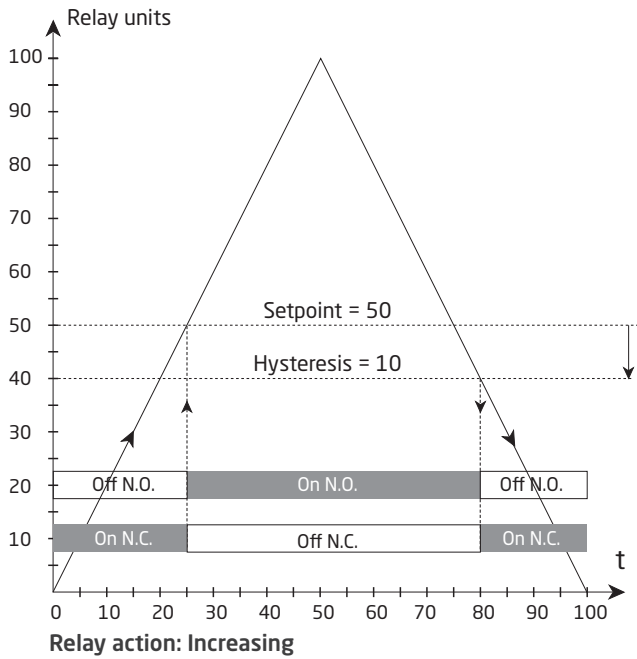


Block diagram

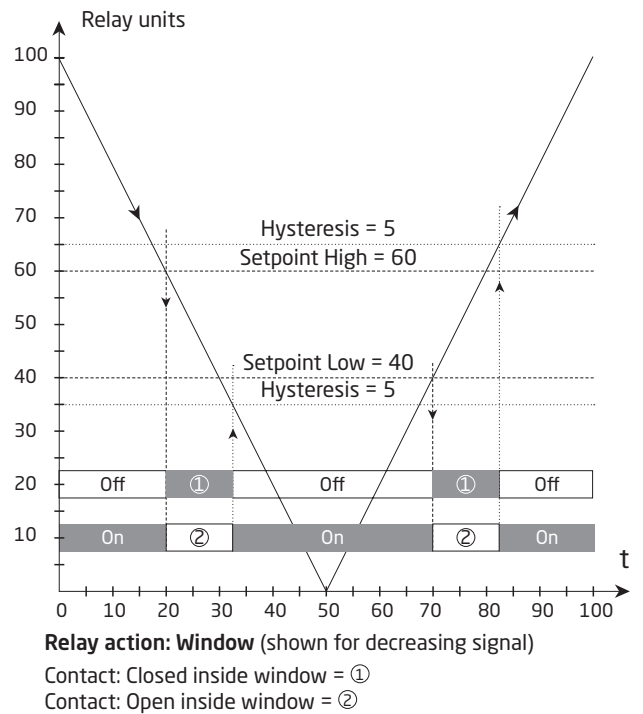
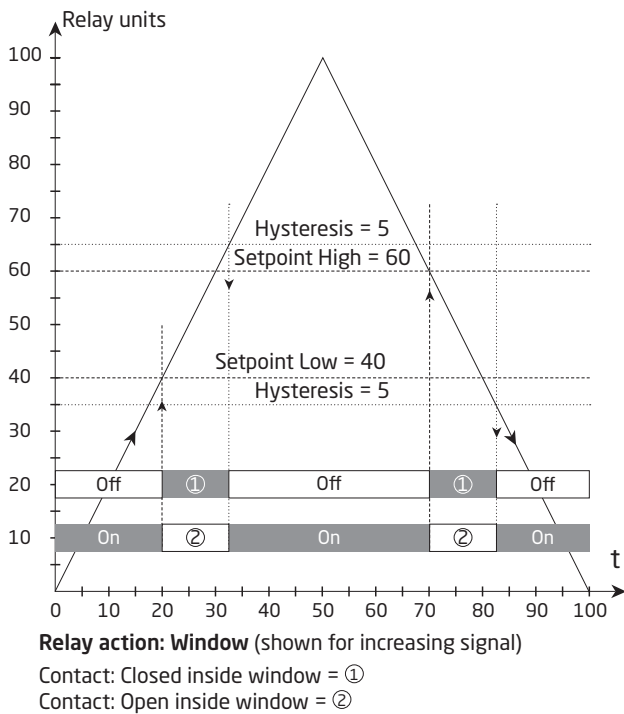


* Accessories: QIC connectors type 5910 / 5910 EX

Graphic depiction of relay actions Increasing / Decreasing



Graphic depiction of relay action Window



Configuration of relay 1 & 2 in PReset		
Parameter	Value	Description
Type	Off	No relay function
	Setpoint	Relay changes state at a limit on the span
	Setpoint window	Relay changes state inside a range of the span
	Sensor error indication	Only works for sensor error
	Power indication	Relay is active when power is on
Relay units for Relay 1 and Relay 2	% of input span	0...100% of input span
	Input units	E.g. °C, mV and mA
	% of output span	0...100% of output span
	Output units	mA and V
Setpoint	From min. to max. of relay units	Setpoint limit
Setpoint LOW (setpoint window only)	From min. to max. of relay units	Lower setpoint in setpoint window
Setpoint HIGH (setpoint window only)	From min. to max. of relay units	Higher setpoint in setpoint window
Hysteresis	From 0.1...99.9% of relay units	Difference between setpoint value and reset value. At setpoint window the hysteresis is outside the window.
On-delay	0..3600 s	Time from the signal crosses the setpoint threshold until the relay activates. Time is reset at setpoint crossing.
Off-delay	0..3600 s	Time from the signal crosses the hysteresis threshold until the relay deactivates. Time is reset at hysteresis crossing.
Action	Increasing	Activates at increasing signal
	Decreasing	Activates at decreasing signal
Contact	Normally open (N.O.)	Contact state before limit is reached
	Normally closed (N.C.)	Contact state before limit is reached
	Open inside window Energized	Relay deactivated inside setpoint window
	Closed inside window	Relay activated inside setpoint window
Sensor error detection	Contact open	Relay deactivated
	Contact closed	Relay activated
	Hold	Relay state as before sensor error occurred
	Off	No relay function

Process calibration 0% and 100% or only 0%

(not for RTD and TC input)

When the option "0% and 100% calibration" is actively configured in PReset it is possible to make the following process calibrations. Please note: Input 0% and 100% should be chosen higher than the process-calibrated span.

Process calibration 0% and 100%

1. Apply the actual 0% value.
2. Open the front cover, activate sw. 1 and wait until the green LED lights constantly.
3. Apply the actual 100% value.
4. Activate sw. 1. The LED will start flashing again.

The input on 5116 has now been scaled according to the actual process values.

When the option "0% calibration" is actively configured in PReset it is possible to make the following process calibration.

0% process calibration

1. Apply the actual 0% value.
2. Open the front cover and activate sw. 1.

The input on 5116 has now been scaled according to the actual process values.

Error functions

Error reason	Hardware error indication		
	Value on analog output	Relay contacts / Yellow LEDs	Green LED
No power supply	0 mA / 0 V	Contacts open / LEDs Off	Constantly Off
Sensor error	As configured	As configured	Blinking at 1...2 Hz
RAM checksum check failed *)	0 mA / 0 V	Contacts open / LEDs Off	Constantly On
EEPROM checksum check failed	0 mA / 0 V	Contacts open / LEDs Off	Constantly On
Main program stopped	0 mA / 0 V	Contacts open / LEDs Off	Constantly On
DAC / relay program stopped	0 mA / 0 V	Contacts open / LEDs Off	Depends on input **)

*) Error can be reset by power cycling the device or sending a new configuration.
 **) The green LED is controlled by the main processor.

Appendix

FM control drawing no. 5116QF01

Control Drawing 5116QF01

Hazardous (Classified) Location

Class I, Division 1, Group A,B,C,D
 Class II, Division 1 Group E, F, G
 Class III, Division 1
 Class I, Zone 0 and 1, Group IIC, IIB, IIA
 Class II, Zone 20 and 21

Unclassified Location
 or

Hazardous (Classified) Location
 Class I, Division 2, Group A,B,C,D
 Class I, Zone 2, Group IIC, IIB, IIA

Simple Apparatus or
 Intrinsically safe apparatus
 with entity parameters:

$$V_{max} (U_i) \geq V_t (U_o)$$

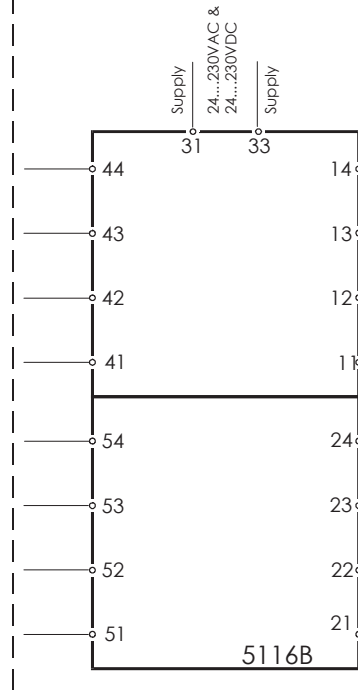
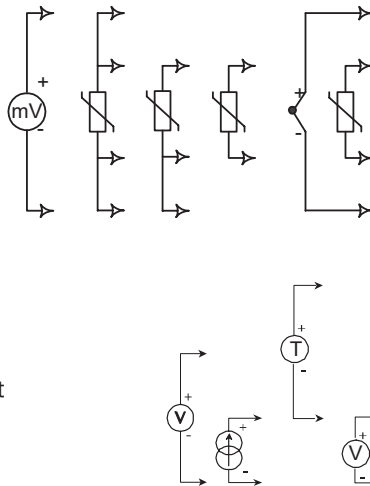
$$I_{max} (I_i) \geq I_t (I_o)$$

$$P_i \geq P_o$$

$$C_a \geq C_{cable} + C_i$$

$$L_a \geq L_{cable} + L_i$$

The sum of capacitance and
 inductance of cable and
 intrinsic safe equipment must
 be less or equal to C_a and L_a



Terminal	Voc (V)	Isc (mA)	Po (mW)	La (mH)			Ca (μF)		
				A,B	C,E	D,F,G	A,B	C,E	D,F,G
				IIC	IIB	IIA	IIC	IIB	IIA
41,42,43,44	7.5	2.2	4.2	1000	1000	1000	6	36	445
51,52,53	7.5	2.2	4.2	1000	1000	1000	6	36	445
51,52,53,54	28	93.0	650	3	16	31	0.075	0.645	2

Installation notes:

- 1) The maximum non hazardous location voltage is 250Vac/dc.
- 2) The installation shall be in accordance with the National Electrical Code NFPA 70, Articles 504 and 505.
- 3) 5116B is galvanic isolated and does not require grounding
- 4) For Installation in Div 2 or Zone 2 the 5116B must be installed in an enclosure according to ANSI/ISA S82.
- 5) Install in Pollution degree 2 or better
- 6) Use 60 / 75 °C Copper Conductors with Wire Size AWG: (26 – 14).
- 7) Warning: Substitution of components may impair intrinsic safety.

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All our devices are backed by expert service and a 5-year warranty. With each product you purchase, you receive personal technical support and guidance, day-to-day delivery, repair without charge within the warranty period and easily accessible documentation.

We are headquartered in Denmark, and have offices and authorized partners the world over. We are a local

business with a global reach. This means that we are always nearby and know your local markets well. We are committed to your satisfaction and provide PERFORMANCE MADE SMARTER all around the world.

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