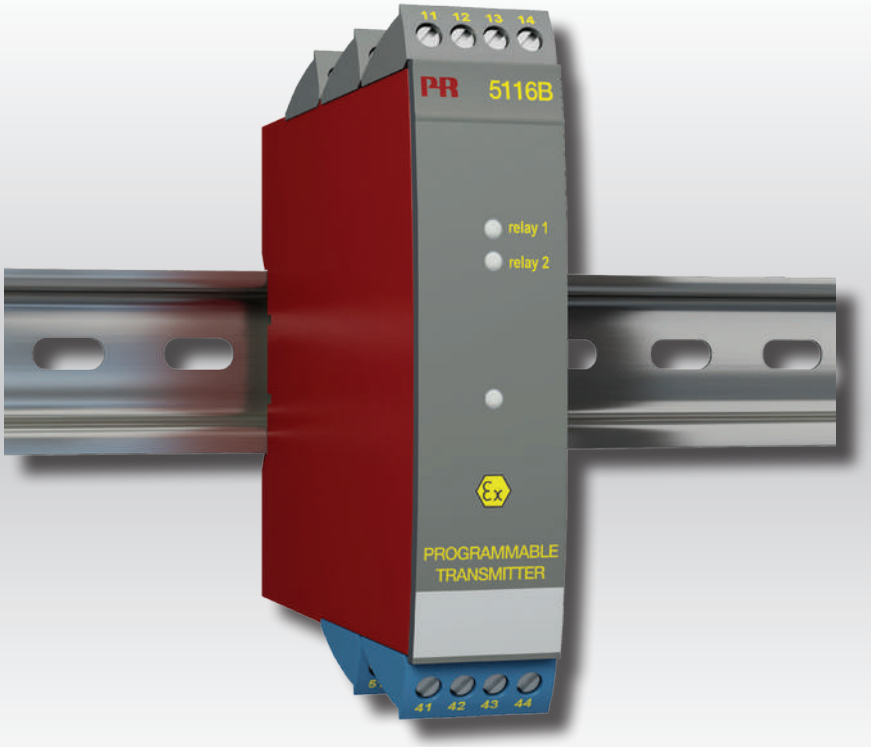
PERFORMANCE
MADE
SMARTER

Product manual
5116
Programmable transmitter



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

No. 5116V105-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. 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.

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.

UL installation requirements

Use 60/75°C copper conducters 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

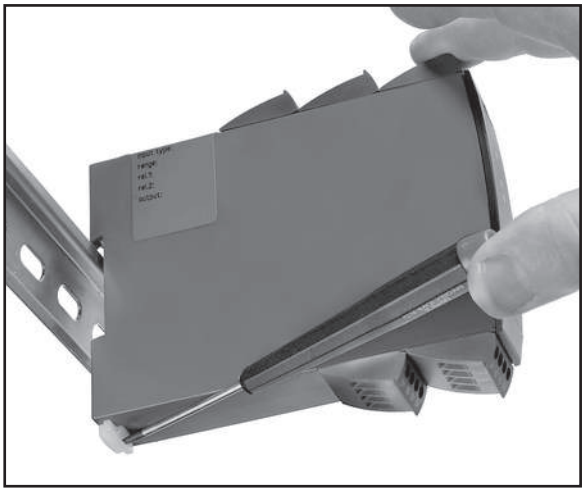
When disconnected, the device may be cleaned with a cloth moistened with distilled water.

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

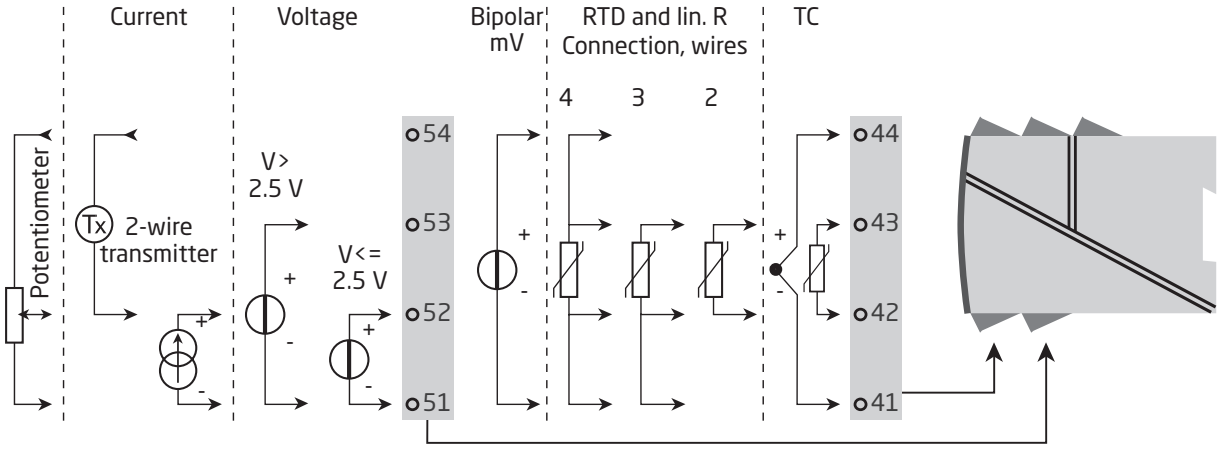
First, remember to demount the connectors with hazardous voltages.



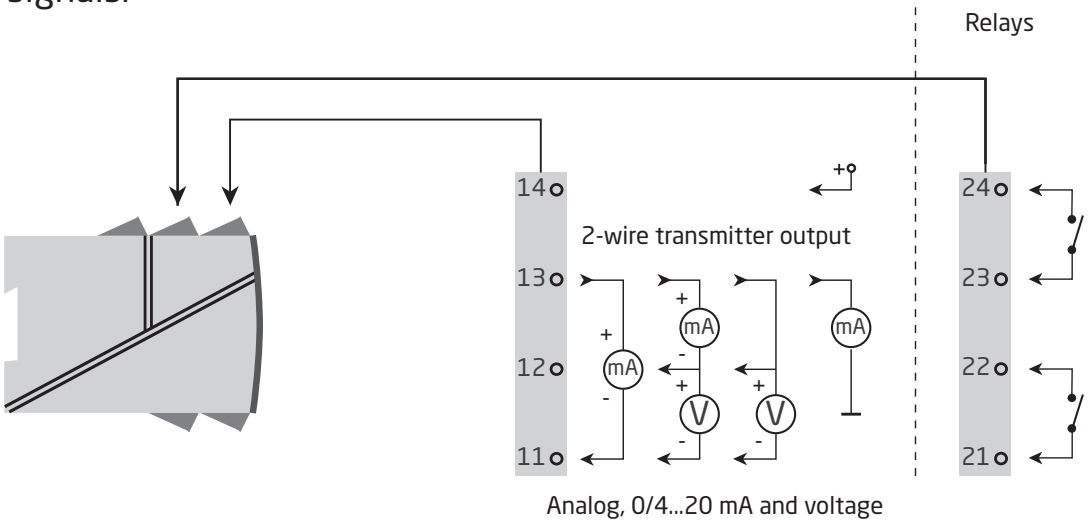
Picture 1:
By lifting the bottom lock, the device is detached from the DIN rail.

Applications

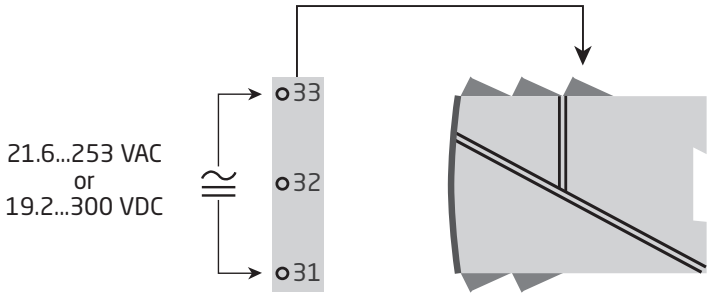
Input signals:



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 buttton.
- 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	≤ ±0.05% of span	≤ ±0.01% of span / °C

Basic values		
Input type	Basic accuracy	Temperature coefficient
mA	≤ ±4 µA	≤ ±0.4 µA / °C
Volt	≤ ±10 µV	≤ ±1 µV / °C
RTD	≤ ±0.2°C	≤ ±0.01°C / °C
Lin. R	≤ ±0.1°Ω	≤ ±10 mΩ / °C
TC type: E, J, K, L, N, T, U	≤ ±1°C	≤ ±0.05°C / °C
TC type: B, R, S, W3, W5, LR	≤ ±2°C	≤ ±0.2°C / °C

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

Auxiliary supplies:
Reference voltage . . . . . 2.5 VDC ±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 . . . . . < ±1°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 = ∞, VDROP < 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

Of span = of the currently selected measurement range

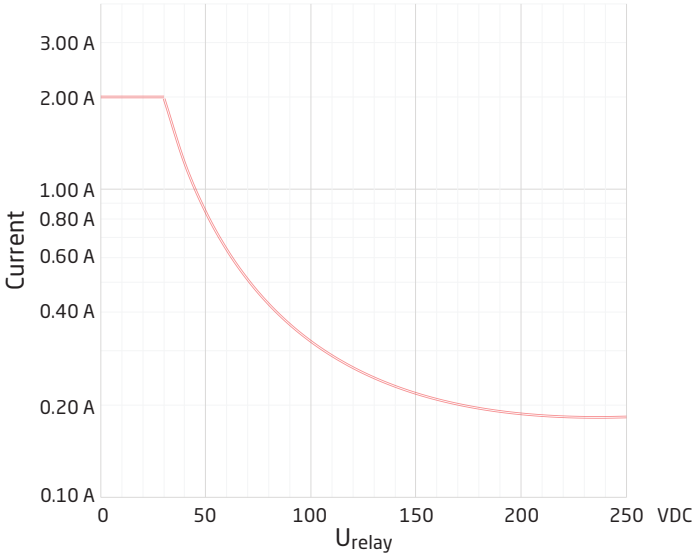
Sensor error detection and loop error on 4...20 mA

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_{relay} ≤ 30 VDC	2 ADC
@ U_{relay} >30 VDC	[1380 x U_{relay}^{-2} x $1.0085^{U_{relay}}$] ADC

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



Observed authority requirements:

EMC	2014/30/EU
LVD	2014/35/EU
ATEX	2014/34/EU
RoHS	2011/65/EU

Approvals

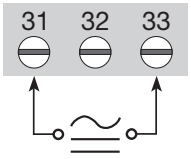
Det Norske Veritas, Ships & Offshore	Standard for Certification No. 2.4
UL, Standard for Safety	UL 508, CSA-C22.2 No. 14
EAC	TR-CU 020/2011

I.S. / Ex approvals

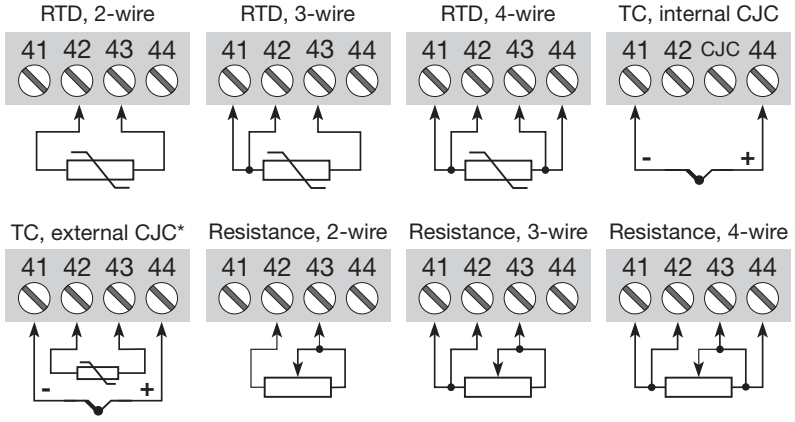
ATEX	KEMA 04ATEX1316 X
FM	3023092
EAC Ex TR-CU 012/2011	RU C-DK.GB08.V.00410

Connections

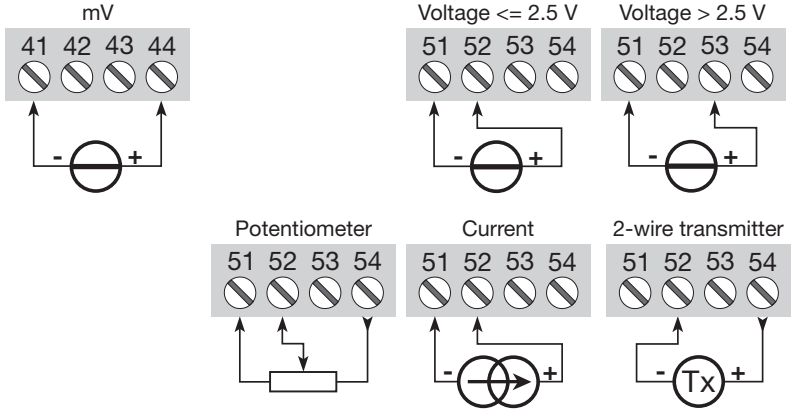
Supply:



Inputs:

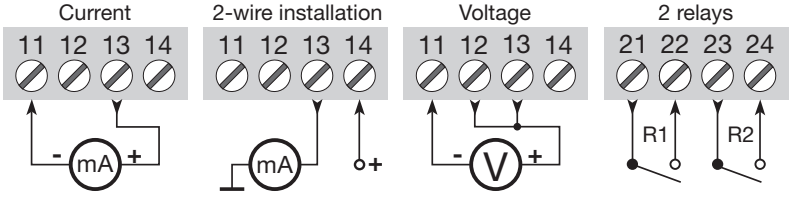


* If the device is reconfigured from temperature measurement with CJC connector to analogue measurement, the CJC connecter must be demounted.

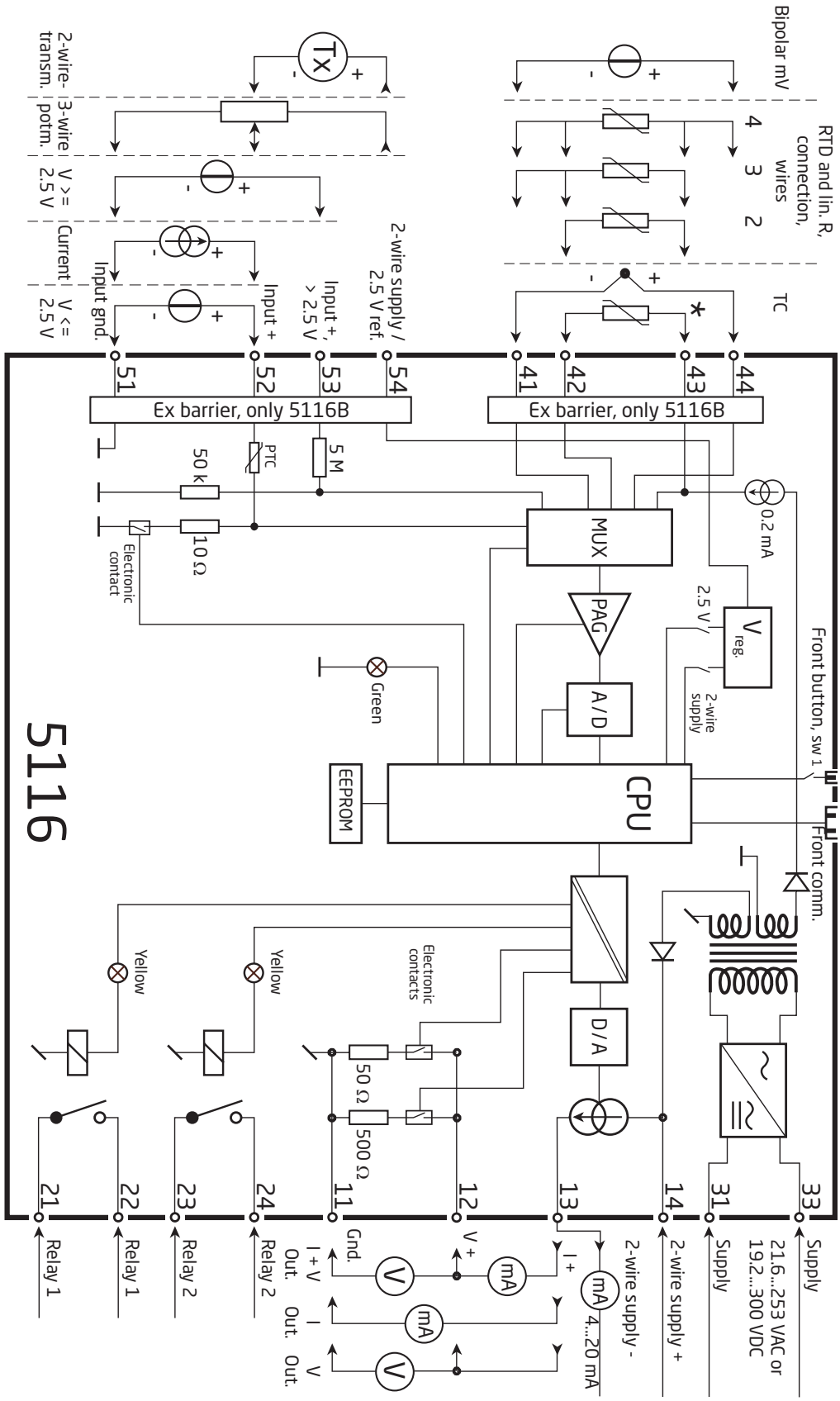


Connections

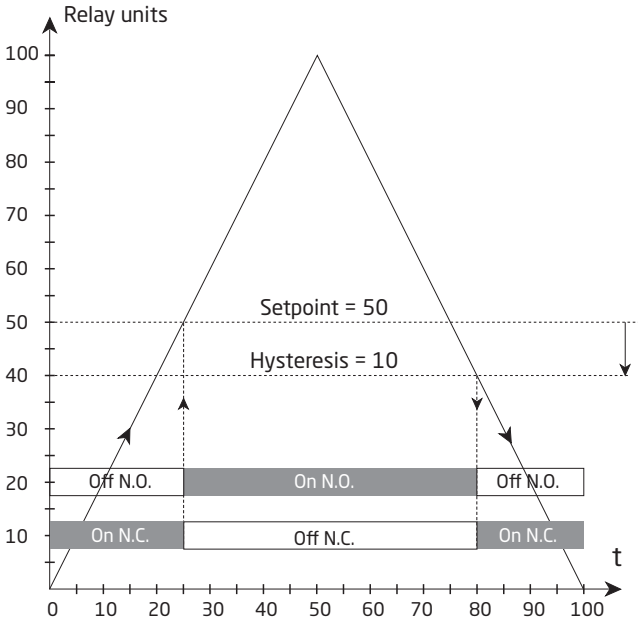
Outputs:



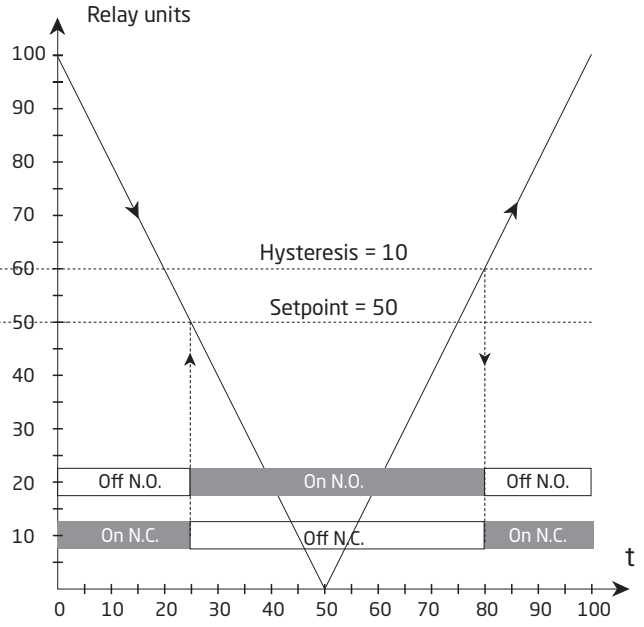
Block diagram



Graphic depiction of relay actions Increasing / Decreasing

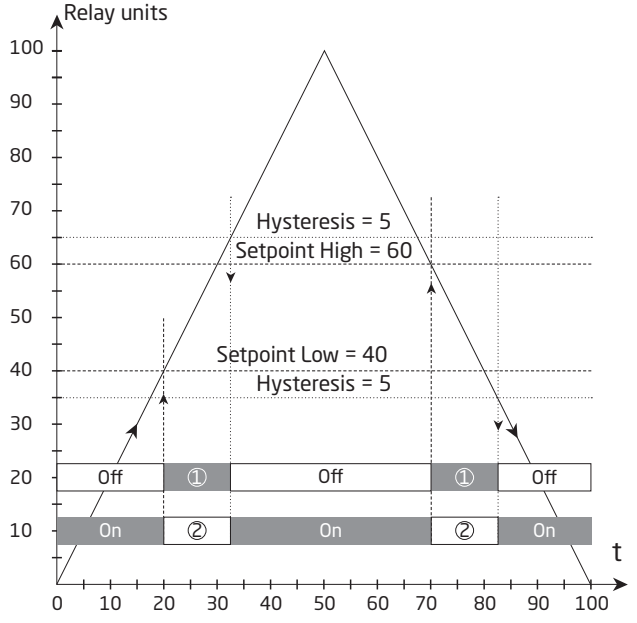


Relay action: Increasing

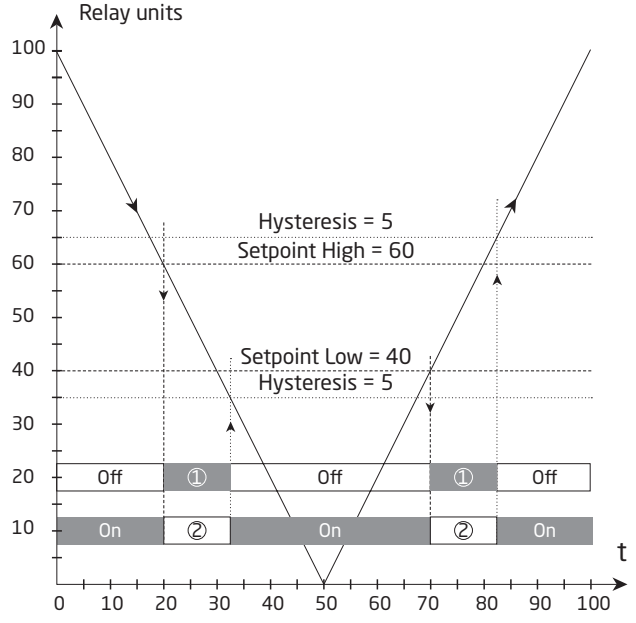


Relay action: Decreasing

Graphic depiction of relay action Window

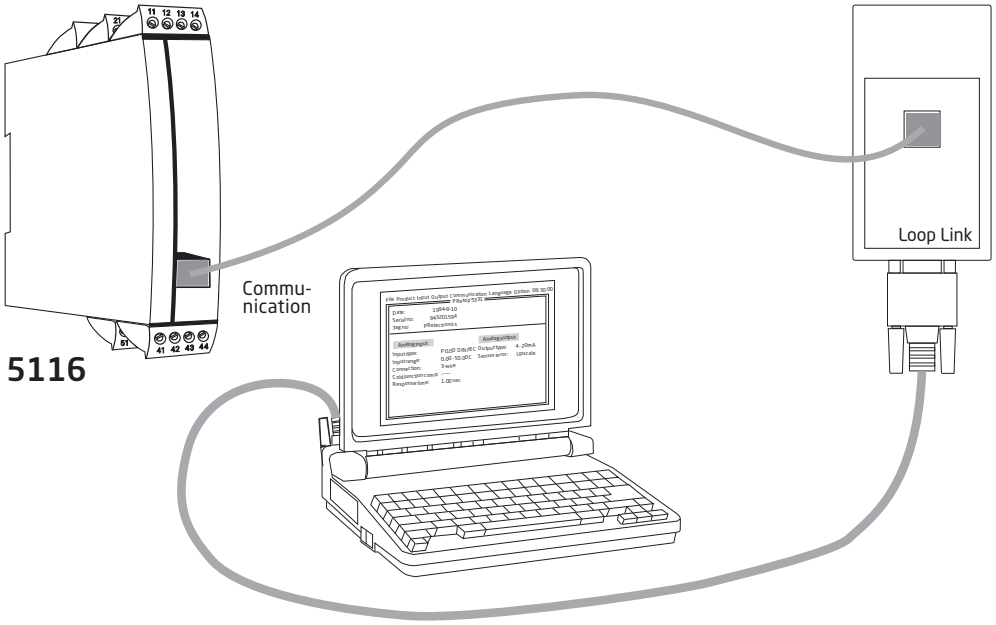


Relay action: Window (shown for increasing signal)
Contact: Closed inside window = ①
Contact: Open inside window = ②



Relay action: Window (shown for decreasing signal)
Contact: Closed inside window = ①
Contact: Open inside window = ②

5116 connection to Loop Link

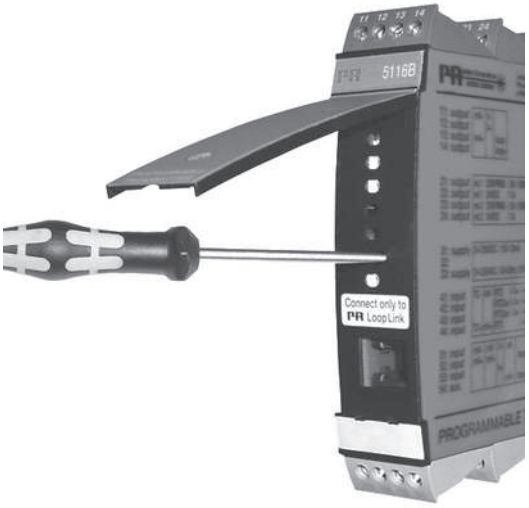


For connection of 5116B to Loop Link, please observe the instructions for instrinsically safe installation.

Activation of the process calibration button

Open the front cover and activate the switch with a pointed object, e.g. a small screwdriver.
The switch is placed a little to the right of the LEDs.

For further instructions see the description of the process calibration function on page 19.



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
Setpiont 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.

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ATEX Installation drawing

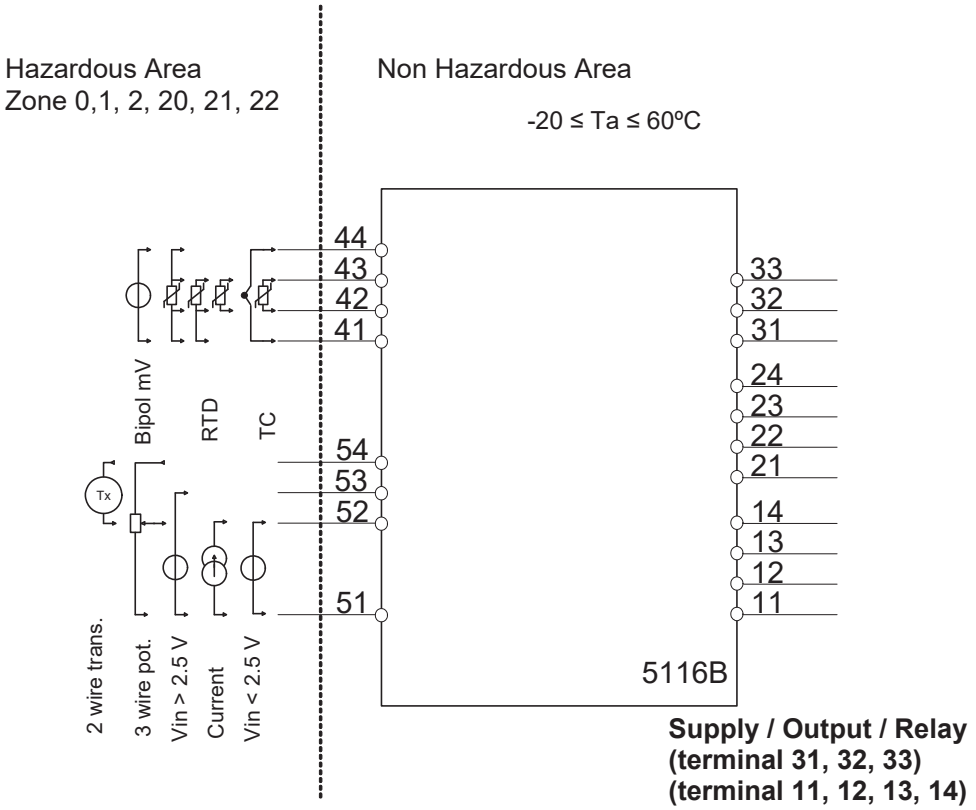
5116B
For safe installation of 5116B the following must be observed. The module shall only be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this area.
Year of manufacture can be taken from the first two digits in the serial number.

ATEX Certificate KEMA 04ATEX 1316X

Marking

II (1) G [Ex ia Ga] IIC/IIB/IIA
II (1) D [Ex ia Da] IIIC

Standards EN 60079-0 : 2012, A11:2013, EN 60079-11 : 2012



Supply / Output / Relay
(terminal 31, 32, 33)
(terminal 11, 12, 13, 14)
(terminal 21, 22, 23, 24)

U_m: 253 VAC

Terminal	Uo	Io	Po	Lo			Co		
				IIC	IIB	IIA	IIC	IIB	IIA
41, 42, 44, 43	7.5 V	2.2 mA	4.2 mW	1 H	1 H	1 H	6 µF	6 µF	6 µF
51, 52, 53	7.5 V	2.2 mA	4.2 mW	1 H	1 H	1 H	6 µF	6 µF	6 µF
51, 52, 53, 54	28 V	93 mA	650 mW	3 mH	16 mH	31 mH	75 nF	645 nF	2 µF

Terminal (31, 33)
Supply:

AC Voltage	21.6 – 253 VAC
DC Voltage	19.2 – 300 VDC
Power max.	3.0 W

Terminal (11, 12, 13, 14)
Analog output:

Current	0/4 – 20 mADC
Voltage	0 – 10 VDC

Terminal (21, 22) and (23, 24)
Relay 1 and 2:

Voltage max.	250 VAC / VDC
AC Power max.	500 VA
AC Current max.	2 AAC
DC Current @ ≤ 30VDC	2ADC
DC Current @ ≥ 30VDC	$1380 * U^{-2} * 1.0085^{U}$

Installation notes

The intrinsically safe circuits are galvanically connected to the communications interface unit.
The communications interface may only be connected temporally, 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.

In type of protection [Ex ia Da] the parameters for intrinsic safety for gas group IIB are applicable

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 EN60079-14.

Programming of the 5116B module is done by use of Loop Link 5909 outside hazardous area. If the module is installed in hazardous area, programming is allowed only if the area is known to be safe.

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

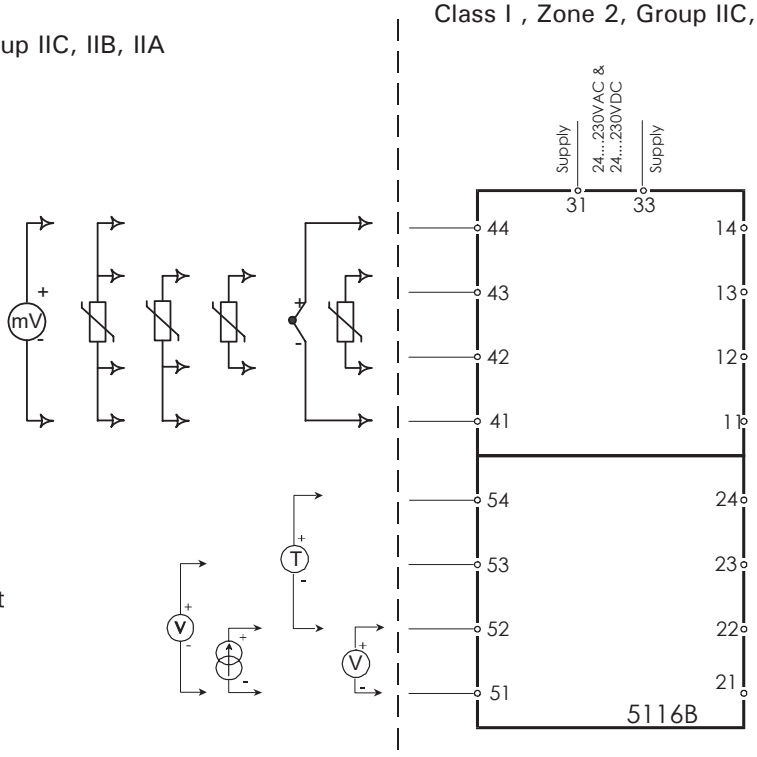
Unclassified Location
or
Hazardous (Classified) Location

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:

Vmax (Ui) ≥ Vt (Uo)
Imax (Ii) ≥ It (Io)
Pi ≥ Po
Ca ≥ C_{cable} + Ci
La ≥ L_{cable} + Li

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



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.

Rev. AA 2005-07-20

Document history

The following list provides notes concerning revisions of this document.

Rev. ID	Date	Notes
105	1901	ATEX installation drawing added

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