9113

Temperatur- / mA-konverter

No. 9113V103-UK
Product version: 9113-003

PR electronics A/S offers a wide range of analogue and digital signal conditioning modules for industrial automation. The product range includes Isolators, Displays, Ex Interfaces, Temperature Transmitters, and Universal Modules. You can trust our products in the most extreme environments with electrical noise, vibrations and temperature fluctuations, and all products comply with the most exacting international standards. »Signals the Best« is the epitome of our philosophy – and your guarantee for quality.

PR electronics A/S offre une large gamme de produits pour le traitement des signaux analogiques et numériques dans tous les domaines industriels. La gamme de produits s’étend des transmetteurs de température aux afficheurs, des isolateurs aux interfaces SI, jusqu’aux modules universels. Vous pouvez compter sur nos produits même dans les conditions d’utilisation sévères, p.ex. bruit électrique, vibrations et fluctuations de température. Tous nos produits sont conformes aux normes internationales les plus strictes. Notre devise »SIGNALS the BEST« c’est notre ligne de conduite - et pour vous l’assurance de la meilleure qualité.

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</table>
WARNING
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.

WARNING
Do not open the front plate of the device as this will cause damage to the connector for the display / programming front PR 4501. This device contains no DIP-switches or jumpers.

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.

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 according 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...1500 Volt DC, and 50...1000 Volt AC.
Technicians are qualified persons educated or trained to mount, operate, and also troubleshoot 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. The packing should always follow the device until this has been permanently mounted.
Check at the receipt of the device whether the type corresponds to the one ordered.

ENVIRONMENT
Avoid direct sunlight, dust, high temperatures, mechanical vibrations and shock, as well as 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.
The device is designed to be safe at least under an altitude up to 2 000 m.

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

The use of stranded wires is not permitted for mains wiring except when wires are fitted with cable ends.

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

The device is provided with field wiring terminals and shall be supplied from a Power Supply having double / reinforced insulation. A power switch shall be easily accessible and close to the device. The power switch shall be marked as the disconnecting device for the device.

For installation on Power Rail 9400 the power is supplied by Power Control module 9410.

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

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 device 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 9000

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

As manufacturer

PR electronics A/S
Lerbakken 10
DK-8410 Rønde

hereby declares that the following product:

Type: 9113
Name: Temperature / mA converter

is in conformity with the following directives and standards:
The EMC Directive 2004/108/EC and later amendments
   EN 61326-1 : 2006
   For specification of the acceptable EMC performance level, refer to the electrical specifications for the device.
The Low Voltage Directive 2006/95/EC and later amendments
   EN 61010-1 : 2001
The ATEX Directive 94/9/EC and later amendments
   EN 61241-0:2006, EN 61241-11:2006, EN 60079-0:2006,
   ATEX certificate: KEMA 07ATEX0148 X

No changes are required to enable compliance with the replacement standard:
   EN 60079-0 : 2009

Notified body

KEMA Quality B.V. (0344)
Utrechtseweg 310, 6812 AR Arnhem
P.O. Box 5185, 6802 ED Arnhem
The Netherlands

Rønde, 27 June 2012

Kim Rasmussen
Manufacturer’s signature
TEMPERATURE / mA CONVERTER

9113

• *Input for RTD, TC and mA*
• *Active / passive mA output*
• *1 or 2 channels*
• *Can be supplied separately or installed on power rail, PR type 9400*
• *SIL 2-certified via Full Assessment*

**Advanced features**

• Configuration and monitoring by way of detachable display front (PR 4501); process calibration and signal simulation.
• Copying of the configuration from one device to others of the same type via the display front.
• TC inputs can use either the internal CJC or a terminal with a built-in Pt100 sensor (PR 5910Ex, channel 1 / PR 5913Ex, channel 2) for higher accuracy.
• The device automatically detects whether it must supply an active or a passive current signal.
• Advanced monitoring of internal communication and stored data.
• SIL 2 functionality is optional and must be activated in a menu point.

**Application**

• The device can be mounted in the safe area and in zone 2 / div. 2 and receive signals from zone 0, 1, 2, 20, 21 and 22 / Class I/II/III, Div. 1, Gr. A-G.
• Conversion and scaling of temperature (Pt, Ni and TC) and active current signals.
• The 9113 has been designed, developed and certified for use in SIL 2 applications according to the requirements of IEC 61508.

**Technical characteristics**

• 1 green and 2 red front LEDs indicate operation status and malfunction.
• 2.6 kVAC galvanic isolation between input, output and supply.
Input signals:

Channel 1:
Current TC
RTD Connection, wires
*Order separately: CJC connector 5910Ex/5913Ex

Channel 2:
Current TC
RTD Connection, wires
*Order separately: CJC connector 5910Ex/5913Ex

Zone 0, 1, 2, 20, 21, 22 / Cl. I/II/III, div. 1 gr. A-G

Output signals:

Analogue, 0/4...20 mA

Ch. 2:
2-wire supply -

Ch. 1:
2-wire supply -

Power rail

Error signal
Rail, +24 VDC
Rail, Gnd.
No connection
No connection

Power connection:

Supply via power rail

Zone 2 / Cl. 1, div. 2, gr. A-D or safe area

Gnd.
Supply +19.2...31.2 VDC
Device status
Device status
N.C.
PR 4501 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 9113.
• Can be moved from one 9113 device to another and download the configuration of the first unit to subsequent units.
• When mounted in the process, the display shows process values and device status.

Technical characteristics
• LCD display with 4 lines; Line 1 (H=5.57 mm) shows input status, line 2 and 3 (H=3.33 mm) show analogue input / output value or TAG no. and units, and line 4 shows status for communication and whether the device is SIL-locked. Static dot = SIL-locked and flashing dot = not SIL-locked.
• 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 unauthorised modifications to the configuration.

Mounting / installation
• Click 4501 onto the front of 9113.
Order

9113BA = Temperature / mA converter, 1 channel  
9113BB = Temperature / mA converter, 2 channels  
4501 = Display / programming front  
5910Ex = CJC connector, channel 1  
5913Ex = CJC connector, channel 2  
9400 = Power rail

Electrical specifications
Specifications range ...................................... -20°C to +60°C  
Storage temperature .................................... -20°C to +85°C  

Common specifications:  
Supply voltage, DC ....................................... 19.2...31.2 VDC  
Max. consumption ........................................ ≤ 3.5 W (2 channels)  
Fuse ............................................................. 400 mA SB / 250 VAC  
Isolation voltage, test / operation:  
   Input / output / supply ......................... 2.6 kVAC / 250 VAC  
   Output 1 to output 2 ............................. 1.5 kVAC / 150 VAC reinforced  
   Status relay to supply ........................... 1.5 kVAC / 150 VAC reinforced  
Communications interface ....................... Programming front 4501  
Signal / noise ratio .................................. Min. 60 dB (0...100 kHz)  
Average response time incl. delay:  
   Temperature input ................................ ≤ 1 s  
   mA input ............................................... ≤ 0.4 s  
Calibration temperature ............................ 20..28°C  
Accuracy, the greater of the general and basic values:  

<table>
<thead>
<tr>
<th>Input type</th>
<th>Absolute accuracy</th>
<th>Temperature coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>≤ ±0.1% of span</td>
<td>≤ ±0.01% of span / °C</td>
</tr>
<tr>
<td>Basic values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input type</strong></td>
<td><strong>Basic accuracy</strong></td>
<td><strong>Temperature coefficient</strong></td>
</tr>
<tr>
<td>Volt</td>
<td>≤ ±20 µV</td>
<td>≤ ±2 µV / °C</td>
</tr>
<tr>
<td>Pt100, Pt200, Pt 1000</td>
<td>≤ ±0.2°C</td>
<td>≤ ±0.02°C / °C</td>
</tr>
<tr>
<td>Pt500, Ni100, Ni160, Ni 1000</td>
<td>≤ ±0.3°C</td>
<td>≤ ±0.03°C / °C</td>
</tr>
<tr>
<td>Pt50, Pt400, Ni50</td>
<td>≤ ±0.4°C</td>
<td>≤ ±0.04°C / °C</td>
</tr>
<tr>
<td>Pt250, Pt300</td>
<td>≤ ±0.6°C</td>
<td>≤ ±0.06°C / °C</td>
</tr>
<tr>
<td>Pt20</td>
<td>≤ ±0.8°C</td>
<td>≤ ±0.08°C / °C</td>
</tr>
<tr>
<td>Pt10</td>
<td>≤ ±1.4°C</td>
<td>≤ ±0.14°C / °C</td>
</tr>
<tr>
<td>TC type: E, J, K, L, N, T, U</td>
<td>≤ ±1°C</td>
<td>≤ ±0.1°C / °C</td>
</tr>
<tr>
<td>TC type: R, S, W3, W5, LR</td>
<td>≤ ±2°C</td>
<td>≤ ±0.2°C / °C</td>
</tr>
<tr>
<td>TC type: B 160...400°C</td>
<td>≤ ±4.5°C</td>
<td>≤ ±0.45°C / °C</td>
</tr>
<tr>
<td>TC type: B 400...1820°C</td>
<td>≤ ±2°C</td>
<td>≤ ±0.2°C / °C</td>
</tr>
</tbody>
</table>

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

Wire size (min...max.) .............................................. AWG 14...26 / 0.13...2.08 mm² stranded wire
Screw terminal torque ............................................. 0.5 Nm
Relative humidity .................................................. < 95% RH (non-cond.)
Dimen., without display front (HxBxD) .................. 109 x 23.5 x 104 mm
Dimensions, w. display front (HxBxD) .................. 109 x 23.5 x 116 mm
Protection degree .................................................. IP20
Weight ............................................................. 250 g / 265 g with 4501

**Isolation:**
Input to any ....................................................... 300 VAC double/reinforced isolation
Analogue output to supply ..................................... 300 VAC double/reinforced isolation
Status relay to supply .......................................... 150 VAC double/reinforced or
                                                      300 VAC basic isolation
**RTD input:**

<table>
<thead>
<tr>
<th>Input type</th>
<th>Min. value</th>
<th>Max. value</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100</td>
<td>-200°C</td>
<td>+850°C</td>
<td>IEC 60751</td>
</tr>
<tr>
<td>Ni100</td>
<td>-60°C</td>
<td>+250°C</td>
<td>DIN 43760</td>
</tr>
</tbody>
</table>

Input for RTD types:
Pt10*, Pt20*, Pt50*, Pt100, Pt200, Pt250, Pt300, Pt400, Pt500, Pt1000
Ni50, Ni100, Ni120, Ni1000

Cable resistance per wire (max.) ............... 50 Ω

Sensor current ........................................ Nom. 0.2 mA

Effect of sensor cable resistance
(3- / 4-wire) ........................................ < 0.002 Ω / Ω

Sensor error detection ............................... Programmable ON / OFF

Sensor error current:
when detecting ...................................... < 2 μA
else ......................................................... 0 μA

* No short circuit detection for Pt10, Pt20 and Pt50

**TC input:**

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

Cold junction compensation (CJC):
via external sensor in connector 5910
20...28°C ≤ ±1°C
-20...20°C and 28...70°C ≤ ±2°C

via internal CJC sensor ......................... ±(2.0°C + 0.4°C * Δt)

Δt = internal temperature - ambient temperature
Sensor error detection ........................................ Programmable ON or OFF
(only wire breakage)

Sensor error current:
when detecting ........................................... Nom. 2 μA
else .......................................................... 0 μA

**Current input:**
Measurement range ...................................... 0...20 mA
Programmable measurement ranges .................. 0...20 and 4...20 mA
Input resistance .......................................... Nom. 20 Ω + PTC 50 Ω
Sensor error detection .................................... Programmable ON / OFF
Only 4...20 mA (NAMUR)

**Current output:**
Signal range (span) ...................................... 0...20 mA
Programmable signal ranges .......................... 0...20 / 4...20 / 20...0 and 20...4 mA
Load (max.) .............................................. 20 mA / 600 Ω / 12 VDC
Load stability ........................................... ≤ 0.01% of span / 100 Ω
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 .............................................. ≤ 28 mA

**2-wire 4...20 mA output:**
Signal range ........................................... 4...20 mA
Load stability ....................................... ≤ 0.01% of span / 100 Ω
Load resistance ....................................... ≤ (V_{supply} -3.5)/0.023 A [Ω]
External 2-wire supply range ...................... 3.5...26 VDC
Effect of external 2-wire supply voltage variation .................................. < 0.005% of span / V

**Status relay in safe area:**
Max. voltage ........................................... 125 VAC / 110 VDC
Max. current ........................................... 0.5 AAC / 0.3 ADC
Max. AC power ........................................ 62.5 VA / 32 W

**Marine approval:**
Det Norske Veritas, Ships & Offshore .......... Stand. f. Certific. No. 2.4

**GOST R approval:**
VNIIFTRI, Cert No. ................................. See www.prelectronics.com

**SIL certification:**
exida, Cert No. ........................................ PREI 070902 P0002 C03.01
<table>
<thead>
<tr>
<th>Observed authority requirements:</th>
<th>Standard:</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC 2004/108/EC</td>
<td>EN 61326-1</td>
</tr>
<tr>
<td>LVD 2006/95/EC</td>
<td>EN 61010-1</td>
</tr>
<tr>
<td>ATEX 94/9/EC</td>
<td>EN 60079-0, -11, -15, -26 and EN 61241-0, -11</td>
</tr>
<tr>
<td>IECEx</td>
<td>IEC 60079-0, -11, -15 and -26 IEC 61241-0 and -11</td>
</tr>
<tr>
<td>c FM us</td>
<td>FM 3600, 3611, 3810 CSA E60079-0, -15 CSA 22.2 -25, -142, -213 ANSI/ISA-12.00.01 / 12.12.02</td>
</tr>
<tr>
<td>UL, Standard for Safety</td>
<td>UL 61010-1</td>
</tr>
<tr>
<td>SIL</td>
<td>IEC 61508</td>
</tr>
</tbody>
</table>

**of span** = of the currently selected measurement range
**Configuration of sensor error check**

<table>
<thead>
<tr>
<th>Device:</th>
<th>Sensor error check:</th>
</tr>
</thead>
<tbody>
<tr>
<td>9113</td>
<td>Configuration</td>
</tr>
<tr>
<td></td>
<td>OUT.ERR=None.</td>
</tr>
<tr>
<td>Else:</td>
<td>Sensor error detection:</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Visualisation in the 4501 of:**

**Input signal outside range**

**Outside range readout (IN. LO, IN. HI):**

If the valid range of the A/D converter or the polynomial is exceeded

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Readout</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURR</td>
<td>0...20 mA / 4...20 mA</td>
<td>IN. LO</td>
<td>&lt; -1.05 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN. HI</td>
<td>&gt; 25.05 mA</td>
</tr>
<tr>
<td>TEMP</td>
<td>TC / RTD</td>
<td>IN. LO</td>
<td>&lt; temperature range -2°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN. HI</td>
<td>&gt; temperature range +2°C</td>
</tr>
</tbody>
</table>

**Display readout below min. / above max. (-1999, 9999):**

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Readout</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All</td>
<td>-1999</td>
<td>Display readout &lt;-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9999</td>
<td>Display readout &gt;9999</td>
</tr>
</tbody>
</table>

**Sensor error detection**

**Sensor error detection (SE.BR, SE.SH):**

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Readout</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURR</td>
<td>Loop break (4...20 mA)</td>
<td>SE.BR</td>
<td>&lt;= 3.6 mA; &gt;= 20.75 mA</td>
</tr>
<tr>
<td>TEMP</td>
<td>TC</td>
<td>SE.BR</td>
<td>&gt; 10 kΩ...165 kΩ</td>
</tr>
<tr>
<td></td>
<td>For Pt10, Pt20, Pt50, Pt100, Pt200, Ni50 and Ni120</td>
<td>SE.BR</td>
<td>&gt; 900...1000 Ω (cable &gt; 50 Ω)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE.SH</td>
<td>&lt; app. 15 Ω</td>
</tr>
<tr>
<td></td>
<td>RTD: 2-, 3- and 4-wire for Pt250, Pt300, Pt400, Pt500, Pt1000 and Ni1000</td>
<td>SE.BR</td>
<td>&gt; 10...12 kΩ (cable &gt; 50 Ω)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE.SH</td>
<td>&lt; app. 15 Ω</td>
</tr>
</tbody>
</table>

**Error indications**

<table>
<thead>
<tr>
<th>Error search</th>
<th>Readout</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input underrange</td>
<td>IN. LO</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Input overrange</td>
<td>IN. HI</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Sensor wire breakage</td>
<td>SE.BR</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Sensor short circuit</td>
<td>SE.SH</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Test of internal CJC sensor</td>
<td>CJ.ER</td>
<td>Internal CJC sensor defect or CJC temperature out of range**</td>
</tr>
<tr>
<td>CJC connector error - check CJC-connector block</td>
<td>CJ.CE</td>
<td>Defect or missing CJC-connector, temperature out of allowed range</td>
</tr>
</tbody>
</table>

---

**Table dimensions:**

<table>
<thead>
<tr>
<th>Device</th>
<th>Sensor error check:</th>
</tr>
</thead>
<tbody>
<tr>
<td>9113</td>
<td>Configuration</td>
</tr>
<tr>
<td></td>
<td>OUT.ERR=None.</td>
</tr>
<tr>
<td>Else:</td>
<td>Sensor error detection:</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Table dimensions:**

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Readout</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURR</td>
<td>0...20 mA / 4...20 mA</td>
<td>IN. LO</td>
<td>&lt; -1.05 mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN. HI</td>
<td>&gt; 25.05 mA</td>
</tr>
<tr>
<td>TEMP</td>
<td>TC / RTD</td>
<td>IN. LO</td>
<td>&lt; temperature range -2°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IN. HI</td>
<td>&gt; temperature range +2°C</td>
</tr>
</tbody>
</table>

**Table dimensions:**

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Readout</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All</td>
<td>-1999</td>
<td>Display readout &lt;-1999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9999</td>
<td>Display readout &gt;9999</td>
</tr>
</tbody>
</table>

**Table dimensions:**

<table>
<thead>
<tr>
<th>Input</th>
<th>Range</th>
<th>Readout</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURR</td>
<td>Loop break (4...20 mA)</td>
<td>SE.BR</td>
<td>&lt;= 3.6 mA; &gt;= 20.75 mA</td>
</tr>
<tr>
<td>TEMP</td>
<td>TC</td>
<td>SE.BR</td>
<td>&gt; 10 kΩ...165 kΩ</td>
</tr>
<tr>
<td></td>
<td>For Pt10, Pt20, Pt50, Pt100, Pt200, Ni50 and Ni120</td>
<td>SE.BR</td>
<td>&gt; 900...1000 Ω (cable &gt; 50 Ω)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE.SH</td>
<td>&lt; app. 15 Ω</td>
</tr>
<tr>
<td></td>
<td>RTD: 2-, 3- and 4-wire for Pt250, Pt300, Pt400, Pt500, Pt1000 and Ni1000</td>
<td>SE.BR</td>
<td>&gt; 10...12 kΩ (cable &gt; 50 Ω)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SE.SH</td>
<td>&lt; app. 15 Ω</td>
</tr>
</tbody>
</table>

**Table dimensions:**

<table>
<thead>
<tr>
<th>Error search</th>
<th>Readout</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input underrange</td>
<td>IN. LO</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Input overrange</td>
<td>IN. HI</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Sensor wire breakage</td>
<td>SE.BR</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Sensor short circuit</td>
<td>SE.SH</td>
<td>See conditions above</td>
</tr>
<tr>
<td>Test of internal CJC sensor</td>
<td>CJ.ER</td>
<td>Internal CJC sensor defect or CJC temperature out of range**</td>
</tr>
<tr>
<td>CJC connector error - check CJC-connector block</td>
<td>CJ.CE</td>
<td>Defect or missing CJC-connector, temperature out of allowed range</td>
</tr>
<tr>
<td>Error search</td>
<td>Readout</td>
<td>Cause</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>Input error - check input connection and reset power</td>
<td>IN.ER</td>
<td>Signal levels on input beyond limits or connected to wrong terminals*</td>
</tr>
<tr>
<td>Output error - check output connections and reset power</td>
<td>AO.ER</td>
<td>Error in analogue output current (SIL mode only)*</td>
</tr>
<tr>
<td>No communication</td>
<td>NO.CO</td>
<td>No communication with (4501)</td>
</tr>
<tr>
<td>Flash memory error - check configuration</td>
<td>FL.ER</td>
<td>FLASH error (configuration invalid)***</td>
</tr>
<tr>
<td></td>
<td>CO.ER</td>
<td></td>
</tr>
<tr>
<td>Invalid configuration type or version</td>
<td>TY.ER</td>
<td>Configuration read from EEPROM has invalid type or rev. no.</td>
</tr>
<tr>
<td>Hardware error</td>
<td>RA.ER</td>
<td>RAM error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>IF.ER</td>
<td>Internal Flash error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>SW.ER</td>
<td>SW monitor error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>AD.ER</td>
<td>A/D converter error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>AO.SU</td>
<td>Analogue output supply error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>CA.ER</td>
<td>Factory calibration error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>CM.ER</td>
<td>Main CPU error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>II.ER</td>
<td>Initialisation check error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>RS.ER</td>
<td>Reset error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>IC.ER</td>
<td>Input communication error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>M1.ER</td>
<td>Main CPU to Ch.1 error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>M2.ER</td>
<td>Main CPU to Ch.2 error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>MC.ER</td>
<td>Main CPU config. error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>MF.ER</td>
<td>Main CPU Flash error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>MR.ER</td>
<td>Main CPU RAM error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>MS.ER</td>
<td>Main CPU supply error*</td>
</tr>
<tr>
<td>Hardware error</td>
<td>MP.ER</td>
<td>Main CPU ProgFlow error*</td>
</tr>
</tbody>
</table>

! All error indications in the display flash once per second. The help text explains the error.
* Error is acknowledged by either stepping through the basic setup, or by resetting the device power. Some types of errors can only be acknowledged by resetting the device power.
** Error is acknowledged by either stepping through the basic setup, or by resetting the device power. Error can be disregarded by selecting input type different than TC.
*** Error is acknowledged by stepping through the basic setup.
CONNECTIONS

Inputs

Channel 1
- RTD, 2-wire
  - 41 42 43 44

Channel 2
- RTD, 2-wire
  - 51 52 53 54

Current
- Channel 1
  - 41 42 43 44
- Channel 2
  - 51 52 53 54

Outputs

Channel 1
- Current (Active output)
  - 11 12 13 14
- Current (Passive output)
  - 11 12 13 14

Channel 2
- Current (Active output)
  - 11 12 13 14
- 2-wire transmitter (Passive output)
  - 11 12 13 14

NC = no connection

* Order separately: CJC connector 5910Ex (ch. 1) / 5913Ex (ch. 2).
Signal error and cable fault indications without display front

<table>
<thead>
<tr>
<th>Condition</th>
<th>Power rail signal status</th>
<th>Status relay, N.C.</th>
<th>Ch. 1: Red LED</th>
<th>Ch. 2: Red LED</th>
<th>Ch. 1 defective (ch. 2 OK)</th>
<th>Ch. 2 defective (ch. 1 OK)</th>
<th>Ch. 1, wire short / break</th>
<th>Ch. 2, wire short / break</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device OK</td>
<td>Energized</td>
<td>Energized</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>No supply</td>
<td>Closed</td>
<td>De-energized</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Device defective</td>
<td>De-energized</td>
<td>De-energized</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Channel 1, signal OK</td>
<td>Energized</td>
<td>Energized</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Channel 2, signal OK</td>
<td>Closed (if activated)</td>
<td>Closed</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Ch. 1, wire short / break</td>
<td>De-energized</td>
<td>De-energized</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Ch. 2, wire short / break</td>
<td>Closed (if activated)</td>
<td>Closed</td>
<td>OFF</td>
<td>OFF</td>
<td>Flashing</td>
<td>Flashing</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
CONFIGURATION / OPERATING THE FUNCTION KEYS

Documentation for routing diagram.

In general

When configuring the 9113, 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 accept 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

Password protection: Programming access can be blocked by assigning a password. The password is saved in the converter in order to ensure a high degree of protection against unauthorised modifications to the configuration. Default password 2008 allows access to all configuration menus.

Selection of units

By selection of temperature input you can choose which process units should be shown in the display (see table). The process value is always displayed in Celsius or Fahrenheit. This is selected in the menu point after selection of temperature input.

CJC

In the CJC menu you can choose between CJC connector and internal cold junction compensation. The CJC connector (PR 5910Ex/PR 5913Ex) must be ordered separately.
Signal and sensor error information via display front 4501

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 as text in line 2 for channel 1 and line 3 for channel 2 and at the same time the backlight flashes. Line 4 of the display is a status line which shows whether the device is SIL-locked (static dot = SIL-locked and flashing dot = not SIL-locked) as well as status for communication COM (running circle) indicating correct functioning of 4501.

Signal and sensor error indication without display front

Status of the unit can also be read from the 3 LEDs in the front of the device.
- Green flashing LED indicates normal operation.
- No light in the green LED indicates lack of supply voltage or error in the device.
- Steady red LED indicates fatal error.
- Flashing red LED indicates sensor error.

Advanced functions

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

Display setup: Here you can adjust the brightness contrast and the backlight.
- Setup of TAG numbers with 5 alphanumerics. Selection of functional readout in line 2 and 3 of the display - choose between readout of analogue input, analogue output or tag no or alternating display.

Two-point process calibration: 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. Then a high signal (not necessarily 100%) is applied and the actual value is entered. 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: 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 (no time-out). The simulation function exits automatically, if the 4501 is detached.
**Password:** Here you can choose a pass word between 0000 and 9999 in order to protect the device against unauthorised modifications to the configuration. The device is delivered default without password.

**Language:** In the menu "lang.setup” 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.

**Power rail:** In the menu ”RAIL” you can choose if sensor errors are transmitted to the central surveillance in the PR 9410 power control unit.

**Safety integrity level:** See Safety Manual for details.
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
- Accept the chosen value and proceed to the next menu

Hold Back to previous menu / return to menu 1.0 without saving

1.0 = Default state. Line 1 shows input status, line 2 and 3 show analogue input / output value or TAG No. and units, and line 4 shows status for communication and whether the device is SIL-locked. Static dot = SIL-locked and flashing dot = not SIL-locked.

1.1 = Only if password-protected.
1.2 = Not valid for 0...20 mA input signal.
1.3 = Only if input signal is temperature. Min. and max. acc. to selected sensor type.
1.4 = Only if the configuration is not protected by a password.

Red text signifies safety parameters in a SIL configuration. See safety manual for details.

Routing diagram ADV.SET

Continued on the page

Routing diagram ADV.SET
To default state 1.0

Configuration of CH2 identical to CH1

0.0
OUT.LO
Txt 14

150.0
OUT.HI
Txt 15

0
RESP.
Txt 35

999.9
-199.9

999.9
-199.9

0
60

1.3
1.3

1.0

To default state 1.0
In the submenu simulation (SIM) you must press \( \times \) to return to the default state 1.0.
SCROLLING HELP TEXTS IN DISPLAY LINE 3

[01] Set correct password
[02] Enter advanced setup menu?
[03] Select temperature input
  Select current input
[04] Select 0-20 mA input range
  Select 4-20 mA input range
[05] Select TC sensor type
  Select Ni sensor type
  Select Pt sensor type
[06] Select Pt10 sensor type
  Select Pt20 sensor type
  Select Pt50 sensor type
  Select Pt100 sensor type
[07] Select Ni50 sensor type
  Select Ni100 sensor type
  Select Ni120 sensor type
  Select Ni1000 sensor type
[08] Select TC-B sensor type
  Select TC-E sensor type
  Select TC-J sensor type
  Select TC-K sensor type
  Select TC-L sensor type
  Select TC-N sensor type
  Select TC-R sensor type
  Select TC-S sensor type
  Select TC-T sensor type
  Select TC-U sensor type
  Select TC-W3 sensor type
  Select TC-W5 sensor type
  Select TC-Lr sensor type
[09] Select 2-wire sensor connection
  Select 3-wire sensor connection
  Select 4-wire sensor connection
[10] Select Celsius as temperature unit
  Select Fahrenheit as temperature unit
[11] Select 0-20 mA output range
  Select 4-20 mA output range
  Select 20-0 mA output range
  Select 20-4 mA output range
[12] Select no error action - output undefined at error
  Select downscale at error
  Select NAMUR NE43 downscale at error
[13] Select NAMUR NE43 upscale at error
[14] Set temperature for analogue output low
[15] Set temperature for analogue output high
[16] Enable Rail status signal output?
[17] Enter SIL setup
  Enter simulation mode
  Enter RAIL setup
[18] Load saved configuration into 9113
  Save 9113 configuration in 4501
[19] Adjust LCD contrast
[20] Adjust LCD backlight
[21] Write a 5-character channel TAG
[22] Show analogue input value in display
  Show analogue output value in display
  Show TAG in display
  Alternate shown information in display
[23] Enable password protection?
[24] Set new password
[25] Select language
[26] Select channel to calibrate
[27] Calibrate input low to process value?
[28] Set value for low calibration point
[29] Calibrate input high to process value?
[30] Set value for high calibration point
[31] Use process calibration values?
[32] Select channel to simulate
[33] Set the input simulation value
[34] Enable SIL configuration lock?
  0-20 mA is not a valid output range for SIL operation
[35] Set Analog output response time in seconds
[36] Select internal temperature sensor
  Select CJC connector (accessory)
[37] ...is channel using process-compensated calibration data?
[38] Configuration SIL status (Open / Locked)
[39] Sensor wire breakage
[40] Select temperature input
[41] Sensor short circuit
[42] Input underrange
[43] Input overrange
[44] Input error - check input connections and reset power
[45] Output error - check connections and reset power
[46] Flash memory error - check configuration
[47] Invalid configuration type or version
[48] Hardware error
[49] CJC sensor error - check device temperature
[50] CJC error - check CJC connector block
[51] No communication
APPENDIX

IECEx Installation drawing
ATEX Installation drawing
FM Installation drawing
Safety manual
IECEx Installation drawing

9113

For safe installation of 9113B 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.

4501

For Installation in Zone 2 / Division 2 the following must be observed. The 4501 programming module is to be used solely with PR electronics modules. It is important that the module is undamaged and has not been altered or modified in any way. Only 4501 modules free of dust and moisture shall be installed.

IECEx Certificate: ..........................................................KEM 09.0052 X

Marking
Ex nA nC IIC T4 Gc
[Ex ia Ga] IIC/IIb/IIA
[Ex ia Da] IIIC

Standards

Hazardous area
Zone 0,1,2, 20, 21, 22

Non Hazardous area
or Zone 2

-20 ≤ Ta ≤ +60ºC

Power Rail

Revision date: 2009-11-27
Version Revision: V3 R0
Prepared by: PB
Page: 1/3
Installation notes:
For installation in Zone 2, the module must be installed in an outer enclosure having an IP protection of at least IP54 conforming to the requirements of IEC60079-15.
For installation on Power Rail in Zone 2, only Power Rail type 9400 supplied by Power Control Unit type 9410 is allowed.
In type of protection “intrinsic safety iD” the parameters for intrinsic safety for gas group IIB are applicable.
After the sensor circuits (Terminals 41..44, 51..54) have been installed in a type of protection, other than “intrinsic safety” the module shall not be re-installed in type of protection "intrinsic safety"
Do not separate connectors when energized and an explosive gas mixture is present.
Do not mount or remove modules from the Power Rail when an explosive gas mixture is present.
Hazardous area
Zone 0,1,2, 20, 21, 22
or Zone 2

Non Hazardous area

-20 ≤ Ta ≤ +60°C

Ex input

CH1 (terminal 43 +)
CH2 (terminal 52 -)

Uo: 17.4 V
Io: 18.4 mA
Po: 80 mW
Lo/Ro 445 μH/Ω

(terminal 11,12,13,14)
(terminal 31,32,33,34)
(terminal 91,92,93,94,95)
Uio: 253 V, max. 400 Hz

<table>
<thead>
<tr>
<th>IIC</th>
<th>IIB</th>
<th>IIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ce</td>
<td>0.3 μF</td>
<td>1.6 μF</td>
</tr>
<tr>
<td>Lo</td>
<td>80 mH</td>
<td>250 mH</td>
</tr>
</tbody>
</table>

Ui: 10 V
Ii: 30 mA
Ci: 15 nF
Li: 1.7 μH

Revision date: 2009-11-27
Version Revision: V3 R0
Prepared by: PB
Page: 3/3
ATEX Installation drawing

9113
For safe installation of 9113B 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.

4501
For Installation in Zone 2 / Division 2 the following must be observed. The 4501 programming module is to be used solely with PRelectronics modules. It is important that the module is undamaged and has not been altered or modified in any way. Only 4501 modules free of dust and moisture shall be installed.

ATEX Certificate: KEMA 07ATEX 0148 X

Marking: II 3 G Ex nA nC IICT4
II (1) G [Ex ia] IIC/IIB/IIA
II (1) D [Ex iaD]

Hazardous area
Zone 0, 1, 2, 20, 21, 22

Non Hazardous area
or Zone 2

-20 ≤ Ta ≤ +60°C

Power Rail

(terminal 11, 12, 13, 14)
(terminal 31, 32, 33, 34)
(terminal 91, 92, 93, 94, 95)

Um: 253 V, max. 400 Hz
Ex input
CH1 (terminal 41,42,43,44)
CH2 (terminal 51,52,53,54)

- $U_o$: 8.7 V
- $I_o$: 18.4 mA
- $P_o$: 40 mW
- $L_o/R_o$: 892 $\mu$H/$\Omega$

<table>
<thead>
<tr>
<th></th>
<th>IIC</th>
<th>IIB</th>
<th>IIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_o$:</td>
<td>5 $\mu$F</td>
<td>50 $\mu$F</td>
<td>1000 $\mu$F</td>
</tr>
<tr>
<td>$L_o$:</td>
<td>100 mH</td>
<td>300 mH</td>
<td>700 mH</td>
</tr>
</tbody>
</table>

$U_i$: 10 V
$I_i$: 30 mA
$C_i$: 30 nF
$L_i$: 820 nH

**Status Relay. terminal (33,34)**

- Voltage max.: 125 VAC / 110 VDC
- Power max.: 62.5 VA / 32 W
- Current max.: 0.5 A AC / 0.3 ADC

Zone 2 installation:
- Voltage max.: 32 VAC / 32 VDC
- Power max.: 16 VA / 32 W
- Current max.: 0.5 A AC / 1 ADC

**Installation notes:**

For installation in Zone 2, the module must be installed in an outer enclosure having an IP protection of at least IP54 conforming to the requirements of EN60079-15.

For installation on Power Rail in Zone 2, only Power Rail type 9400 supplied by Power Control Unit type 9410 (Type Examination Certificate KEMA 07ATEX0152 X) is allowed.

In type of protection "intrinsic safety iD" the parameters for intrinsic safety for gas group IIB are applicable.

After the sensor circuits (Terminals 41..44, 51..54) have been installed in a type of protection, other than "intrinsic safety" the module shall not be re-installed in type of protection "intrinsic safety"

Do not separate connectors when energized and an explosive gas mixture is present.

Do not mount or remove modules from the Power Rail when an explosive gas mixture is present.
Hazardous area
Zone 0,1,2, 20, 21, 22

Non Hazardous area
or Zone 2
-20 ≤ Ta ≤ +60°C

Ex input
CH1 (terminal 43)
CH2 (terminal 52)

Uo: 17.4 V
Io: 18.4 mA
Po: 80 mW
Lo/Ro: 445 \( \mu \text{H}/\Omega \)

<table>
<thead>
<tr>
<th></th>
<th>IIC</th>
<th>IIB</th>
<th>IIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co</td>
<td>0.3 ( \mu \text{F} )</td>
<td>1.6 ( \mu \text{F} )</td>
<td>8 ( \mu \text{F} )</td>
</tr>
<tr>
<td>Lo</td>
<td>80 mH</td>
<td>250 mH</td>
<td>600 mH</td>
</tr>
</tbody>
</table>

U_i: 10 V
I_i: 30 mA
C_i: 15 nF
L_i: 1.7 \( \mu \text{H} \)

U_m: 253 V, max. 400 Hz
FM Installation drawing

9113

For safe installation of 9113B 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.

4501

For Installation in Zone 2 / Division 2 the following must be observed.
The 4501 programming module is to be used solely with PR electronics modules. It is
important that the module is undamaged and has not been altered or modified in any way.
Only 4501 modules free of dust and moisture shall be installed.

FM Certificate: ..........................................................3038279

Hazardous area
Class I/II/III, Division 1, Group A,B,C,D,E,F,G
or Class I, Zone 0/1 Group IIC

Non Hazardous Area or
Class I, Division 2, Group A,B,C,D T4
or Class I, Zone 2 Group IIIC T4

Intrinsically safe apparatus
entity parameters:

Vmax (Ui) ≥ Vt (Uo)
Imax (Ii) ≥ It (Io)
Pi ≥ Po
Ca ≥ Ccable + Ci
La ≥ Lcable + Li
The sum of capacitance and
inductance of cable and
intrinsic safe equipment must
be less or equal to Ca and La

-20 ≤ Ta ≤ 60°C

Power Rail

9192 939495

31

32

33

34

41

42

43

44

11

12

13

14
Ex input
CH1 (terminal 41,42,43,44)
CH2 (terminal 51,52,53,54)
Vt (Uo): 8.7 V
It (Io): 18.4 mA
Po: 40 mW
Lo/Ro: 892 μH/Ω

<table>
<thead>
<tr>
<th></th>
<th>IIC / Group A,B</th>
<th>IIB / Group C,E,F</th>
<th>IIA / Group D,G</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₀ / C₀</td>
<td>5 μF</td>
<td>50 μF</td>
<td>1000 μF</td>
</tr>
<tr>
<td>L₀ / L₀</td>
<td>100 mH</td>
<td>300 mH</td>
<td>700 mH</td>
</tr>
</tbody>
</table>

Uᵢ: 10 V
Iᵢ: 30 mA
Cᵢ: 30 nF
Lᵢ: 820 nH

Status Relay. terminal (33,34)
Voltage max: 125 VAC / 110 VDC
Power max: 62.5 VA / 32 W
Current max: 0.5 A AC / 0.3 ADC

Zone 2 installation:
Voltage max: 32 VAC / 32 VDC
Power max: 16 VA / 32 W
Current max: 0.5 A AC / 1 ADC

Installation notes:
The installation and wiring shall be in accordance with the National Electrical Code NFPA 70, Article 500 or 505.
The module must be supplied from a Power Supply having double or reinforced insulation.
The use of stranded wires is not permitted for mains wiring except when wires are fitted with cable ends.
For installation on the 9400 Power Rail the power must be supplied from Power Control Module Unit 9410.
For installation in Zone 2 or Division 2, the module must be installed in a suitable outer enclosure having an IP protection of at least IP54.
The module is galvanically isolated and does not require grounding.
Install in pollution degree 2 or better.
Use 60 / 75 °C Copper Conductors with wire size AWG: (26-14).
Warning: Substitution of components may impair intrinsic safety.
Warning: To prevent ignition of the explosive atmospheres, disconnect power before servicing and do not separate connectors when energized and an explosive gas mixture is present.
Warning: Do not mount or remove modules from the Power Rail when an explosive gas mixture is present.
Hazardous area
Class I/II/III, Division 1, Group A,B,C,D,E,F,G or Class I, Zone 0/1 Group IIC

Non Hazardous Area or
Class I, Division 2, Group A,B,C,D T4 or Class I, Zone 2 Group IIC T4

Intrinsically safe apparatus
entity parameters:

\[ V_{\text{max}} (U_i) \geq V_{t} (U_o) \]
\[ I_{\text{max}} (I_i) \geq I_{t} (I_o) \]
\[ P_i \geq P_o \]
\[ C_a \geq C_{\text{cable}} + C_i \]
\[ L_a \geq L_{\text{cable}} + L_i \]
The sum of capacitance and inductance of cable and intrinsic safe equipment must be less or equal to \( C_a \) and \( L_a \)

Ex input
CH1 (terminal 42,43)
CH2 (terminal 52,53)

\[ V_{t} (U_o) : 17.4 \text{ V} \]
\[ I_{t} (I_o) : 18.4 \text{ mA} \]
\[ P_o : 80 \text{ mW} \]
\[ L_0/R_0 : 445 \mu \text{H/} \Omega \]

<table>
<thead>
<tr>
<th>Group</th>
<th>IIC</th>
<th>IIB</th>
<th>IIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,B</td>
<td>0.3 \mu F</td>
<td>1.6 \mu F</td>
<td>8 \mu F</td>
</tr>
<tr>
<td>C,C,F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D,G</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ U_i : 10 \text{ V} \]
\[ I_i : 30 \text{ mA} \]
\[ C_i : 15 \text{ nF} \]
\[ L_i : 1.7 \mu \text{H} \]
SAFETY MANUAL

TEMPERATURE / mA CONVERTER
9113

This safety manual is valid for the following product versions:
9113-003
9113-002
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<th>Description</th>
<th>Page</th>
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</tr>
</tbody>
</table>
1 Observed standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61508</td>
<td>Functional Safety of electrical / electronic / programmable electronic</td>
</tr>
<tr>
<td></td>
<td>safety-related systems</td>
</tr>
<tr>
<td></td>
<td>safety-related systems</td>
</tr>
<tr>
<td>IEC 61326-3-1:2008</td>
<td>Immunity requirements for safety-related systems</td>
</tr>
</tbody>
</table>

2 Acronyms and abbreviations

<table>
<thead>
<tr>
<th>Acronym / Abbreviation</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element</td>
<td></td>
<td>Term defined by IEC 61508 as “part of a subsystem comprising a single component or any group of components that performs one or more element safety functions”</td>
</tr>
<tr>
<td>PFD</td>
<td>Probability of Failure on Demand</td>
<td>This is the likelihood of dangerous safety function failures occurring on demand.</td>
</tr>
<tr>
<td>PFH</td>
<td>Probability of dangerous Failure per Hour</td>
<td>The term “Probability” is misleading, as IEC 61508 defines a Rate.</td>
</tr>
<tr>
<td>SFF</td>
<td>Safe Failure Fraction</td>
<td>Safe Failure Fraction summarises the fraction of failures which lead to a safe state and the fraction of failures which will be detected by diagnostic measures and lead to a defined safety action.</td>
</tr>
<tr>
<td>SIF</td>
<td>Safety Integrity Function</td>
<td>Function that provides fault detection (to ensure the necessary safety integrity for the safety functions)</td>
</tr>
<tr>
<td>SIL</td>
<td>Safety Integrity Level</td>
<td>The international standard IEC 61508 specifies four discrete safety integrity levels (SIL 1 to SIL 4). Each level corresponds to a specific probability range regarding the failure of a safety function.</td>
</tr>
</tbody>
</table>

3 Purpose of the product

Conversion and scaling of temperature (Pt, Ni and TC) and current signals from hazardous area.

The device can be mounted in the safe area and in zone 2 / div. 2 and receive signals from zone 0, 1, 2, 20, 21 and 22 / Class I/II/III, Div. 1, Gr. A-G.

Error events, including cable breakage, are monitored and signalled via the individual status relay and/or a collective electronic signal via the power rail.

The 9113 has been designed, developed and certified for use in SIL 2 applications according to the requirements of IEC 61508.
4 Assumptions and restrictions for use of the product

4.1 Basic safety specifications
Operational temperature range ................... -20...+60°C
Storage temperature range ......................... -20...+85°C
Power supply type, min. ......................... Double or reinforced
Supply voltage ........................................ 19.2...31.2 VDC
External loop supply voltage ..................... 5...26 VDC + external drop
Mounting area .......................................... Zone 2 / Division 2 or safe area
Mounting environment .............................. Pollution degree 2 or better

4.2 Safety accuracy
The analogue output corresponds to the applied input within the safety accuracy.
Safety accuracy ........................................ ±2%

4.2.1 Minimum span
For temperature measurements, the selected range (OUT.HI - OUT.LO) shall be larger or equal to the values below:

<table>
<thead>
<tr>
<th>Input type</th>
<th>Minimum span for safety accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100, Pt200, Pt1000</td>
<td>28°C</td>
</tr>
<tr>
<td>Pt500, Ni100, Ni120, Ni1000</td>
<td>43°C</td>
</tr>
<tr>
<td>Pt50, Pt400, Ni50</td>
<td>57°C</td>
</tr>
<tr>
<td>Pt250, Pt300</td>
<td>85°C</td>
</tr>
<tr>
<td>Pt20</td>
<td>142°C</td>
</tr>
<tr>
<td>Pt10</td>
<td>283°C</td>
</tr>
<tr>
<td>TC: E, J, K, L, N, T, U</td>
<td>91°C</td>
</tr>
</tbody>
</table>

4.2.2 Range limitations
TC type B shall not be used below +400°C

4.3 Associated equipment

4.3.1 RTD sensor wiring
If a 2-wire or a 3-wire connection for RTD is selected, the end user must ensure that the applied sensor wiring does not introduce failures exceeding the requirements for the safety application.
4.3.2 Sensor errors
If Sensor error detection is disabled, if current input range 0...20 mA is selected or if input type Pt10, Pt20, or Pt50 is selected, the end user must ensure that the applied sensor including wiring has a failure rate qualifying it for the safety application without sensor error detection enabled. For Pt10, Pt20 and Pt50 input types, this only relates to short-circuited sensor detection.

4.3.3 Process calibration
If a process calibration is taken into SIL-mode operation, it is mandatory that the accuracy of the device (and sensor, if applicable) are tested by the end user after SIL-mode is entered, in addition to the normal functional test. Refer to section 14 - Safe parameterisation - user responsibility.

4.3.4 Analogue output
The connected safety PLC shall be able to detect and handle the fault indications on the analogue output of the 9113 converter by having a NAMUR NE43-compliant current input.

4.4 Failure rates
The basic failure rates from the Siemens standard SN 29500 are used as the failure rate database.
Failure rates are constant, wear-out mechanisms are not included.
External power supply failure rates are not included.

4.5 Safe parameterisation
The user is responsible for verifying the correctness of the configuration parameters. (See section 14 Safe parameterisation - user responsibility).
Manual override may not be used for safety applications.

4.6 Installation in hazardous areas
The IECEx Installation drawing, ATEX Installation drawing and FM Installation drawing shall be followed if the products are installed in hazardous areas.

5 Functional specification of the safety function
Conversion of current signals (0...20 mA or 4...20 mA), RTD sensor signals or thermocouple sensor signals from hazardous areas to a 4...20 mA current output signal, in two separately configurable channels, within specified accuracy.
For RTD sensors, cable resistances of up to 50 Ω per wire can be compensated if 3- or 4-wire connection is configured.
For thermocouple sensors, cold junction temperature errors can be compensated, either by an internally mounted temperature sensor, or by an accessory connector with a built-in temperature sensor. The selection of CJC measurement must be done and verified by the end user.

6 Functional specification of the non-safety functions
The status relay (terminal 33 and 34), error signal on power rail (terminal 91) and LED outputs are not suitable for use in any Safety Instrumented Function.
7 Safety parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of dangerous Failure per Hour (PFH)</td>
<td>6.10E-08</td>
</tr>
<tr>
<td>Probability of failure on demand (PFD) - 1 year proof test interval</td>
<td>3.96E-04</td>
</tr>
<tr>
<td>Proof test interval (10% of loop PFD)</td>
<td>3 years</td>
</tr>
<tr>
<td>Safe Failure Fraction</td>
<td>90.7 %</td>
</tr>
<tr>
<td>Demand response time - Signal input: &lt; 0.5 seconds</td>
<td></td>
</tr>
<tr>
<td>Demand response time - Temperature input: &lt; 1.1 seconds</td>
<td></td>
</tr>
<tr>
<td>Demand mode</td>
<td>High</td>
</tr>
<tr>
<td>Demand rate</td>
<td>3000 seconds</td>
</tr>
<tr>
<td>Mean Time To Repair (MTTR)</td>
<td>24 hours</td>
</tr>
<tr>
<td>Diagnostic test interval</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Hardware Fault Tolerance (HFT)</td>
<td>0</td>
</tr>
<tr>
<td>Component Type</td>
<td>B</td>
</tr>
<tr>
<td>SIL capability</td>
<td>SIL 2</td>
</tr>
<tr>
<td>Description of the “Safe State” - Output ≤ 3.6 mA or output ≥ 21 mA</td>
<td></td>
</tr>
</tbody>
</table>

Note1: The 9113 contains no lifetime limiting components, therefore the PFH figures are valid for up to 12 years, according to IEC 61508.

8 Hardware and software configuration

All configurations of software and hardware versions are fixed from factory, and cannot be changed by end-user or reseller.

This manual only covers products labelled with the product version (or range of versions) specified on the front page.

9 Failure category

<table>
<thead>
<tr>
<th>Failure category</th>
<th>Failure rates (1/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail Safe Detected</td>
<td>0.000E-0</td>
</tr>
<tr>
<td>Fail Safe Undetected</td>
<td>2.34E-7</td>
</tr>
<tr>
<td>Fail Dangerous Detected</td>
<td>3.67E-7</td>
</tr>
<tr>
<td>Fail Dangerous Undetected</td>
<td>6.10E-8</td>
</tr>
</tbody>
</table>
10 Periodic proof test procedure

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bypass the safety PLC or take other appropriate action to avoid a false trip</td>
</tr>
<tr>
<td>2</td>
<td>Connect a simulator identical to the input setup</td>
</tr>
<tr>
<td>3</td>
<td>Apply input value corresponding to 0/100% output range to each channel</td>
</tr>
<tr>
<td>4</td>
<td>Observe whether the output channel acts as expected</td>
</tr>
<tr>
<td>5</td>
<td>Restore the input terminals to full operation</td>
</tr>
<tr>
<td>6</td>
<td>Remove the bypass from the safety PLC or otherwise restore normal operation</td>
</tr>
</tbody>
</table>

This test will detect approximately 95% of possible “du” (dangerous undetected) failures in the device. The proof test is equivalent to the functional test.

11 Procedures to repair or replace the product
Any failures that are detected and that compromise functional safety should be reported to the sales department at PR electronics A/S.
Repair of the device and replacement of circuit breakers must be done by PR electronics A/S only.

12 Maintenance
No maintenance required.

13 Documentation for routing diagram
The routing diagram is shown in section 16.2.

13.1 In general
When configuring the 9113, 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 accept 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.
13.2 Further explanations

13.2.1 Password protection
Access to the configuration can be blocked by assigning a password. The password is saved in the device in order to ensure a high degree of protection against unauthorised modifications to the configuration. Default password 2008 allows access to all configuration menus. Password protection is mandatory in SIL applications.

13.2.2 Sensor/cable fault information via display front 4501
When the function is enabled and supported by selected input type, sensor or cable faults are displayed as SE.BR (sensor break) or SE.SH (cable short-circuited). Sensor fault is shown independently for each channel. In case of sensor or cable fault the backlight flashes. This can be reset by pressing the \( \text{\(\square\)} \) key. When the sensor or cable fault has been remedied, the device will return to normal operation.

13.3 Advanced functions
The device gives access to a number of advanced functions which can be reached by answering “Yes” to the point “adv.set”.

13.3.1 Memory (MEM)
In the memory menu a non-SIL configuration can be either saved or loaded from the local memory of the 4501 display unit. Choose SAVE to store the current configuration in the 4501 memory. Press LOAD to read a previously stored configuration in the 4501 memory and store it in the device. It is only possible to load a configuration stored from the same type of device and from the same version, or earlier.

13.3.2 Display setup (DISP)
The brightness contrast and the backlight can be adjusted. Tag numbers with 5 alphanumerics can be entered for both channels. Functional readout in line 2 (ch.1) and 3 (Ch.2) of the display can be selected: choose between readout of input value, output current or tag no. When selecting "ALT" the readout alternates between input value, output current and tag no.

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

13.3.4 Language (LANG)
In this menu 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.
13.3.5 Process calibration (CAL)
A process calibration can be made by the end user. A known process signal must be applied for both low and high end of the input measurement range. The known input of the applied low end signal must be entered in the CAL.LO menu and confirmed by pressing OK before removing or changing the applied signal to the high end signal. The known input of the applied high end signal must be entered in the CAL.HI menu and confirmed by pressing OK before removing. It is possible to enable or disable the use of the latest process calibration.

13.3.6 Power rail (RAIL)
In this menu it can be chosen if errors in the device are transmitted to the central surveillance in the PR 9410 power control device.

13.3.7 Simulation (SIM)
It is possible to override the actual measured input signal by a simulated value. Only one channel can be simulated at a time. Leaving either of the simulation menus, or disconnecting the 4501 device, will disable the simulation mode and bring the output back to correspond to the actual measured value. Simulation is not possible in SIL-mode.

13.3.8 Safety integrity level (SIL)
See section 14 - Safe parameterisation - user responsibility
# 14 Safe parameterisation - user responsibility

## 14.1 Safety-related configuration parameters

### 14.1.1 Parameters related only to Channel 1

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
</table>
| CH1.TYP | Selected input type:  
TEMP = Temperature  
CURR = Current |
| I.RANGE | Selected fixed input range for current measurements (for CH1.TYP = CURR):  
0_20 = 0...20 mA (no sensor error detection!)  
4_20 = 4...20 mA |
| CONNEC  | Selected sensor connection type for RTD measurements (for SENSOR = Ni or Pt):  
2W = 2-wire  
3W = 3-wire  
4W = 4-wire  
If 2W or 3W is selected, the end user must ensure that the applied sensor wiring does not introduce failures exceeding the requirements for the safety application. |
| UNIT    | Selected temperature unit (for CH1.TYP = TEMP):  
°C = degrees Celsius  
°F = degrees Fahrenheit |
| SENSOR  | Selected temperature sensor type (for CH1.TYP = TEMP):  
TC = Thermocouple  
Ni = Ni RTD sensor  
Pt = Pt RTD sensor |
| Pt.TYPE | Pt sensor type (for SENSOR = Pt):  
10 = Pt10  
20 = Pt20  
50 = Pt50  
100 = Pt100  
200 = Pt200  
250 = Pt250  
300 = Pt300  
400 = Pt400  
500 = Pt500  
1000 = Pt1000 |
<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ni.TYPE</td>
<td>Ni sensor type (for SENSOR = Ni):</td>
</tr>
<tr>
<td></td>
<td>50 = Ni50</td>
</tr>
<tr>
<td></td>
<td>100 = Ni100</td>
</tr>
<tr>
<td></td>
<td>120 = Ni120</td>
</tr>
<tr>
<td></td>
<td>1000 = Ni1000</td>
</tr>
<tr>
<td>TC.TYPE</td>
<td>Thermocouple type (for SENSOR = TC):</td>
</tr>
<tr>
<td></td>
<td>TC.B = Thermocouple type B</td>
</tr>
<tr>
<td></td>
<td>TC.E = Thermocouple type E</td>
</tr>
<tr>
<td></td>
<td>TC.J = Thermocouple type J</td>
</tr>
<tr>
<td></td>
<td>TC.K = Thermocouple type K</td>
</tr>
<tr>
<td></td>
<td>TC.L = Thermocouple type L</td>
</tr>
<tr>
<td></td>
<td>TC.N = Thermocouple type N</td>
</tr>
<tr>
<td></td>
<td>TC.R = Thermocouple type R</td>
</tr>
<tr>
<td></td>
<td>TC.S = Thermocouple type S</td>
</tr>
<tr>
<td></td>
<td>TC.T = Thermocouple type T</td>
</tr>
<tr>
<td></td>
<td>TC.U = Thermocouple type U</td>
</tr>
<tr>
<td></td>
<td>TC.W3 = Thermocouple type W3</td>
</tr>
<tr>
<td></td>
<td>TC.W5 = Thermocouple type W5</td>
</tr>
<tr>
<td></td>
<td>TC.Lr = Thermocouple type Lr</td>
</tr>
<tr>
<td>CJC</td>
<td>CJC type for SENSOR = TC:</td>
</tr>
<tr>
<td></td>
<td>INT = Internal CJC sensor measurement</td>
</tr>
<tr>
<td></td>
<td>CONN = CJC connector measurement (accessory)</td>
</tr>
<tr>
<td>O.RANGE</td>
<td>Fixed output range for current output:</td>
</tr>
<tr>
<td></td>
<td>0-20 = 0...20 mA  Not valid when EN.SIL = YES (Safety applications)</td>
</tr>
<tr>
<td></td>
<td>4-20 = 4...20 mA</td>
</tr>
<tr>
<td></td>
<td>20-0 = 20...0 mA  Not valid when EN.SIL = YES (Safety applications)</td>
</tr>
<tr>
<td></td>
<td>20-4 = 20...4 mA</td>
</tr>
<tr>
<td>Name</td>
<td>Function</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>OUT.ERR</td>
<td>Fixed output value on detected sensor error: NONE = Sensor error detection NOT enabled, output at sensor error is undefined. The end user must ensure that the applied sensor including wiring has a failure rate qualifying it for the safety application without the detection enabled. 0 mA = Output is 0 mA at sensor error 3.5 mA = Output is 3.5 mA at sensor error (NE43 downscale) 23 mA = Output is 23 mA at sensor error (NE4 upscale)</td>
</tr>
<tr>
<td>OUT.LO</td>
<td>Selected temperature value for 0% output for CH1.TYP = TEMP in units defined by the UNIT parameter (°C or °F) Range is defined by the selected temperature sensor (SENSOR and TC.TYPE, Ni.TYPE or Pt.TYPE), but value must be less than OUT.HI - minimum span.</td>
</tr>
<tr>
<td>OUT.HI</td>
<td>Selected temperature value for 100% output for CH1.TYP = TEMP in units defined by the UNIT parameter (°C or °F). Range is defined by the selected temperature sensor (SENSOR and TC.TYPE, Ni.TYPE or Pt.TYPE), but must be larger than OUT.LO + minimum span.</td>
</tr>
<tr>
<td>RESP</td>
<td>Analogue output response time in seconds. Range is 0.0 to 60.0 seconds.</td>
</tr>
<tr>
<td>USE.CAL</td>
<td>Use the applied process calibration values: NO = The last performed process calibration on Channel1 is not used. The channel operates with accuracy as specified. YES = The last performed process calibration on Channel1 is in operation. The required accuracy must be verified by user. End user must verify by test that the applied process calibration does not introduce failures exceeding the requirements for the safety application.</td>
</tr>
</tbody>
</table>
14.1.2 Parameters related only to Channel 2 (only for type 9113BB)

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1.TYP</td>
<td>Functions as described for Channel 1 (14.1.1)</td>
</tr>
<tr>
<td>I.RANGE</td>
<td></td>
</tr>
<tr>
<td>CONNEC</td>
<td></td>
</tr>
<tr>
<td>UNIT</td>
<td></td>
</tr>
<tr>
<td>SENSOR</td>
<td></td>
</tr>
<tr>
<td>Pt.TYPE</td>
<td></td>
</tr>
<tr>
<td>Ni.TYPE</td>
<td></td>
</tr>
<tr>
<td>TC.TYPE</td>
<td></td>
</tr>
<tr>
<td>CJC</td>
<td></td>
</tr>
<tr>
<td>O.RANGE</td>
<td></td>
</tr>
<tr>
<td>OUT.ERR</td>
<td></td>
</tr>
<tr>
<td>OUT.LO</td>
<td></td>
</tr>
<tr>
<td>OUT.HI</td>
<td></td>
</tr>
<tr>
<td>RESP</td>
<td></td>
</tr>
<tr>
<td>USE.CAL</td>
<td></td>
</tr>
</tbody>
</table>

14.1.3 Parameters related to both channels

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW.PAS</td>
<td>Password for protection of the device configuration from un-authorized access. Range from 0 to 9999.</td>
</tr>
</tbody>
</table>

The above safety-related configuration parameters are marked in red text in the routing diagrams and must be verified by the user in a SIL configuration.

14.2 Verification procedure
The verification is done using the display / programming front PR 4501 and following the procedure described below.
### 14.2.1 If no password is set

<table>
<thead>
<tr>
<th>Action</th>
<th>Display shows</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Press OK</td>
<td>ADV.SET</td>
</tr>
<tr>
<td>2 Set (ADV.SET) to Yes and press OK</td>
<td>SETUP</td>
</tr>
<tr>
<td>3 Set SETUP to SIL and press OK</td>
<td>EN.SIL</td>
</tr>
<tr>
<td>4 Set EN.SIL to YES and press OK</td>
<td>NEW.PAS</td>
</tr>
<tr>
<td>5 Set password to a number between 0 and 9999 and press OK (At this time the device starts operating in SIL mode with the entered configuration parameters!)</td>
<td>CONFIG Verify OPEN-&gt;LOCK*</td>
</tr>
<tr>
<td>6 Press OK to confirm verification of the OPEN-&gt;LOCK in the display</td>
<td>CH1.TYP</td>
</tr>
<tr>
<td>7 Verify input type for Channel 1 and press OK</td>
<td>I.RANGE</td>
</tr>
<tr>
<td>8 Verify fixed input range and press OK (ONLY IF CH1.TYP = CURR)</td>
<td>CONNEC</td>
</tr>
<tr>
<td>9 Verify sensor connection type and press OK (ONLY IF SENSOR = Ni or Pt and CH1.TYP = TEMP)</td>
<td>UNIT</td>
</tr>
<tr>
<td>10 Verify temperature unit and press OK (ONLY IF CH1.TYP = TEMP)</td>
<td>SENSOR</td>
</tr>
<tr>
<td>11 Verify temperature sensor type and press OK (ONLY IF CH1.TYP = TEMP)</td>
<td>Pt.TYPE</td>
</tr>
<tr>
<td>12 Verify Pt sensor type and press OK (ONLY IF SENSOR = Pt and CH1.TYP = TEMP)</td>
<td>Ni.TYPE</td>
</tr>
<tr>
<td>13 Verify Ni sensor type and press OK (ONLY IF SENSOR = Ni and CH1.TYP = TEMP)</td>
<td>TC.TYPE</td>
</tr>
<tr>
<td>14 Verify Thermocouple type and press OK (ONLY IF SENSOR = TC and CH1.TYP = TEMP)</td>
<td>CJC</td>
</tr>
</tbody>
</table>

* Open is shown briefly in the display.
<table>
<thead>
<tr>
<th>Action</th>
<th>Display shows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify CJC type and press OK (ONLY IF SENSOR = TC and CH1.TYP = TEMP)</td>
<td>O.RANGE</td>
</tr>
<tr>
<td>Verify fixed output range and press OK</td>
<td>OUT.ERR</td>
</tr>
<tr>
<td>Verify fixed output value on detected sensor error and press OK (ONLY IF CH1.TYP = TEMP, or IF I.RANGE = 4-20 mA)</td>
<td>OUT.LO</td>
</tr>
<tr>
<td>Verify temperature for 0% output and press OK (ONLY IF CH1.TYP = TEMP)</td>
<td>OUT.HI</td>
</tr>
<tr>
<td>Verify temperature for 100% output and press OK (ONLY IF CH1.TYP = TEMP)</td>
<td>RESP</td>
</tr>
<tr>
<td>Verify analogue output response time and press OK</td>
<td>CH2.TYP</td>
</tr>
<tr>
<td>Verify input type for Channel 2 and press OK</td>
<td>I.RANGE</td>
</tr>
<tr>
<td>Verify fixed input range and press OK (ONLY IF CH2.TYP = CURR)</td>
<td>CONNEC</td>
</tr>
<tr>
<td>Verify sensor connection type and press OK (ONLY IF SENSOR = Ni or Pt and CH2.TYP = TEMP)</td>
<td>UNIT</td>
</tr>
<tr>
<td>Verify temperature unit and press OK (ONLY IF CH2.TYP = TEMP)</td>
<td>SENSOR</td>
</tr>
<tr>
<td>Verify temperature sensor type and press OK ( ONLY IF CH2.TYP = TEMP)</td>
<td>Pt.TYPE</td>
</tr>
<tr>
<td>Verify Pt sensor type and press OK (ONLY IF SENSOR = Pt and CH2.TYP = TEMP)</td>
<td>Ni.TYPE</td>
</tr>
<tr>
<td>Action</td>
<td>Display shows</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>27 Verify Ni sensor type and press OK (ONLY IF SENSOR = Ni and CH2.TYP = TEMP)</td>
<td>TC.TYPE</td>
</tr>
<tr>
<td>28 Verify Thermocouple type and press OK (ONLY IF SENSOR = TC and CH2.TYP = TEMP)</td>
<td>CJC</td>
</tr>
<tr>
<td>29 Verify CJC type and press OK (ONLY IF SENSOR = TC and CH2.TYP = TEMP)</td>
<td>O.RANGE</td>
</tr>
<tr>
<td>30 Verify fixed output range for current output</td>
<td>OUT. ERR</td>
</tr>
<tr>
<td>31 Verify fixed output value on detected sensor error and press OK (ONLY IF CH2.TYP = TEMP, or IF I.RANGE = 4-20 mA or 20-4 mA)</td>
<td>OUT. LO</td>
</tr>
<tr>
<td>32 Verify temperature for 0% output and press OK (ONLY IF CH2.TYP = TEMP)</td>
<td>OUT. HI</td>
</tr>
<tr>
<td>33 Verify temperature for 100% output and press OK (ONLY IF CH2.TYP = TEMP)</td>
<td>RESP</td>
</tr>
<tr>
<td>34 Verify analogue output response time and press OK</td>
<td>CH1. CAL</td>
</tr>
<tr>
<td>35 Verify the use of applied process calibration values for Channel 1 and press OK</td>
<td>CH2. CAL</td>
</tr>
<tr>
<td>36 Verify the use of applied process calibration values for Channel 2 and press OK</td>
<td>PASSW.</td>
</tr>
<tr>
<td>37 Verify password and press OK</td>
<td>SIL. OK</td>
</tr>
<tr>
<td>38 Verify SIL mode within 1 second</td>
<td></td>
</tr>
</tbody>
</table>
14.2.2 If password is set

<table>
<thead>
<tr>
<th>Action</th>
<th>Display shows</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Press OK</td>
<td>PASSW</td>
</tr>
<tr>
<td>2 Enter password and press OK</td>
<td>ADV.SET</td>
</tr>
<tr>
<td>3 Set ADV.SET to Yes and press OK</td>
<td>SETUP</td>
</tr>
<tr>
<td>4 Set SETUP to SIL and press OK</td>
<td>EN.SIL</td>
</tr>
<tr>
<td>5 Set EN.SIL to YES and press OK</td>
<td>CONFIG Verify</td>
</tr>
<tr>
<td>(At this time the device starts operating</td>
<td>OPEN-&gt;LOCK*</td>
</tr>
<tr>
<td>in SIL mode with the entered configuration</td>
<td></td>
</tr>
<tr>
<td>parameters!)</td>
<td></td>
</tr>
<tr>
<td>6 to 38</td>
<td>As step 6 to 38 for 14.2.1</td>
</tr>
</tbody>
</table>

* Open is shown briefly in the display

14.2.3 If any parameter is found to be incorrect during verification
Remove SIL-mode (by entering the password and selecting SIL-mode OFF).
Go through the setup menu and correct the parameter(s).
Repeat step 1 to 38 (with correct parameters).

14.3 Functional test
The user is responsible to make a functional test after verification of the safety parameters. The procedure for periodic proof test described in section 10 shall be used.
In addition, if a process calibration is taken into SIL-mode operation (refer to section 13.3 - Advanced functions), it is mandatory that the accuracy of the device (and sensor, if applicable) are tested.

15 Fault reaction and restart condition
When the 9113 detects a fault the output will go to Safe State, in which the output will go to “de-energised”.
If the fault is application-specific (cable error detection) the 9113 will restart when the fault has been corrected.
For device faults there are 2 ways of bringing the device out of Safe State.
1. Power cycle the device.
2. Bring the device out of SIL mode (choose “NO” in the menu point ”EN.SIL”), and set it back to SIL mode again (choose “YES” in the menu point “EN.SIL” and verify the configuration).
### 16 User interface

#### 16.1 Scrolling help texts in display line 3

<table>
<thead>
<tr>
<th>No.</th>
<th>Text</th>
<th>Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Set correct password</td>
<td>Enter SIL setup</td>
</tr>
<tr>
<td>02</td>
<td>Enter advanced setup menu?</td>
<td>Enter simulation mode</td>
</tr>
<tr>
<td>03</td>
<td>Select temperature input</td>
<td>Enter RAIL setup</td>
</tr>
<tr>
<td>04</td>
<td>Select 0-20 mA input range</td>
<td>Perform process calibration</td>
</tr>
<tr>
<td>05</td>
<td>Select TC sensor type</td>
<td>Enter language setup</td>
</tr>
<tr>
<td>06</td>
<td>Select Pt10 sensor type</td>
<td>Enter password setup</td>
</tr>
<tr>
<td>07</td>
<td>Select Ni50 sensor type</td>
<td>Enter display setup</td>
</tr>
<tr>
<td>08</td>
<td>Select TC-B sensor type</td>
<td>Perform memory operations</td>
</tr>
<tr>
<td>09</td>
<td>Select 3-wire sensor connection</td>
<td>Load saved configuration into 9113</td>
</tr>
<tr>
<td>10</td>
<td>Select Celsius as temperature unit</td>
<td>Save 9113 configuration in 4501</td>
</tr>
<tr>
<td>11</td>
<td>Select Fahrenheit as temperature unit</td>
<td>Adjust LCD contrast</td>
</tr>
<tr>
<td>12</td>
<td>Select 0-20 mA output range</td>
<td>Show a 5-character channel TAG</td>
</tr>
<tr>
<td>13</td>
<td>Select no error action - output undefined at error</td>
<td>Show analogue input value in display</td>
</tr>
<tr>
<td>14</td>
<td>Set temperature for analogue output low</td>
<td>Show TAG in display</td>
</tr>
<tr>
<td>15</td>
<td>Set temperature for analogue output high</td>
<td>Alternate shown information in display</td>
</tr>
<tr>
<td>16</td>
<td>Enable Rail status signal output?</td>
<td>Enable password protection?</td>
</tr>
<tr>
<td>17</td>
<td>Enter SIL setup</td>
<td>Set new password</td>
</tr>
<tr>
<td>18</td>
<td>Set 4-20 mA input range</td>
<td>Select language</td>
</tr>
<tr>
<td>19</td>
<td>Select Ni100 sensor type</td>
<td>Select channel to calibrate</td>
</tr>
<tr>
<td>20</td>
<td>Select Ni120 sensor type</td>
<td>Calibrate input low to process value?</td>
</tr>
<tr>
<td>21</td>
<td>Select Ni1000 sensor type</td>
<td>Set value for low calibration point</td>
</tr>
<tr>
<td>22</td>
<td>Select Pt20 sensor type</td>
<td>Calibrate input high to process value?</td>
</tr>
<tr>
<td>23</td>
<td>Select Pt50 sensor type</td>
<td>Set value for high calibration point</td>
</tr>
<tr>
<td>24</td>
<td>Select Pt100 sensor type</td>
<td>Use process calibration values?</td>
</tr>
<tr>
<td>25</td>
<td>Select Pt500 sensor type</td>
<td>Select channel to simulate</td>
</tr>
<tr>
<td>26</td>
<td>Select Pt1000 sensor type</td>
<td>Set the input simulation value</td>
</tr>
<tr>
<td>27</td>
<td>Select Pt200 sensor type</td>
<td>Enable SIL configuration lock?</td>
</tr>
<tr>
<td>28</td>
<td>Select Pt250 sensor type</td>
<td>0-20 mA is not a valid output range for SIL operation</td>
</tr>
<tr>
<td>29</td>
<td>Select Pt300 sensor type</td>
<td>Set Analog output response time in seconds</td>
</tr>
<tr>
<td>30</td>
<td>Select Pt300 sensor type</td>
<td>Select internal temperature sensor</td>
</tr>
<tr>
<td>31</td>
<td>Select Pt400 sensor type</td>
<td>Select CJC connector (accessory)</td>
</tr>
<tr>
<td>32</td>
<td>Select Pt500 sensor type</td>
<td>...is channel using process-compensated calibration data?</td>
</tr>
<tr>
<td>33</td>
<td>Select Pt1000 sensor type</td>
<td>Configuration SIL status (Open / Locked)</td>
</tr>
<tr>
<td>34</td>
<td>Select Pt5050 sensor type</td>
<td>Sensor wire breakage</td>
</tr>
<tr>
<td>35</td>
<td>Select 2-wire sensor connection</td>
<td>Sensor short circuit</td>
</tr>
<tr>
<td>36</td>
<td>Select 4-wire sensor connection</td>
<td>Input underrange</td>
</tr>
<tr>
<td>37</td>
<td>Select 3-wire sensor connection</td>
<td>Input overrange</td>
</tr>
<tr>
<td>38</td>
<td>Select 4-wire sensor connection</td>
<td>Input error - check input connections and reset power</td>
</tr>
<tr>
<td>39</td>
<td>Select 3-wire sensor connection</td>
<td>Input error - check connections and reset power</td>
</tr>
<tr>
<td>40</td>
<td>Select 4-wire sensor connection</td>
<td>Flash memory error - check configuration</td>
</tr>
<tr>
<td>41</td>
<td>Select 4-wire sensor connection</td>
<td>Invalid configuration type or version</td>
</tr>
<tr>
<td>42</td>
<td>Select 4-wire sensor connection</td>
<td>Hardware error</td>
</tr>
<tr>
<td>43</td>
<td>Select 4-wire sensor connection</td>
<td>CJC sensor error - check device temperature</td>
</tr>
<tr>
<td>44</td>
<td>Select 4-wire sensor connection</td>
<td>CJC error - check CJC connector block</td>
</tr>
<tr>
<td>45</td>
<td>Select 4-wire sensor connection</td>
<td>No communication</td>
</tr>
</tbody>
</table>
16.2 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
Accept the chosen value and proceed to the next menu
Hold Back to previous menu / return to menu 1.0 without saving

1.0 = Default state. Line 1 shows input status, line 2 and 3 show analogue input / output value or TAG No. and units, and line 4 shows status for communication and whether the device is SIL-locked. Static dot = SIL-locked and flashing dot = not SIL-locked.

1.1 = Only if password-protected.
1.2 = Not valid for 0...20 mA input signal.
1.3 = Only if input signal is temperature. Min. and max. acc. to selected sensor type.
1.4 = Only if the configuration is not protected by a password.

Red text signifies safety parameters in a SIL configuration.
Configuration of CH2 identical to CH1

To default state 1.0
2.0 In the submenu simulation (SIM) you must press \( \times \) to return to the default state 1.0.

Verification of SIL configuration
17 Connections diagram

**Inputs**

**Channel 1**
- RTD, 2-wire: 41 42 43 44
- RTD, 3- / 4-wire: 41 42 43 44
- Current: 41 42 43 44

**Channel 2**
- RTD, 2-wire: 51 52 53 54
- RTD, 3- / 4-wire: 51 52 53 54
- Current: 51 52 53 54

**Supply and status relay**
- Gnd. NC NC NC

**Outputs**

**Channel 1**
- Current: 11 12 13 14
- 2-wire transmitter: 11 12 13 14

**Channel 2**
- Current: 11 12 13 14
- 2-wire transmitter: 11 12 13 14

* TC, CJC connector

* Order separately: CJC connector 5910Ex (ch. 1) / 5913Ex (ch. 2).
**Displays**  Programmable displays with a wide selection of inputs and outputs for display of temperature, volume and weight, etc. Feature linearisation, scaling, and difference measurement functions for programming via PReset software.

**Ex interfaces**  Interfaces for analogue and digital signals as well as HART® signals between sensors / I/P converters / frequency signals and control systems in Ex zone 0, 1 & 2 and for some modules in zone 20, 21 & 22.

**Isolation**  Galvanic isolators for analogue and digital signals as well as HART® signals. A wide product range with both loop-powered and universal isolators featuring linearisation, inversion, and scaling of output signals.

**Temperature**  A wide selection of transmitters for DIN form B mounting and DIN rail modules with analogue and digital bus communication ranging from application-specific to universal transmitters.

**Universal**  PC or front programmable modules with universal options for input, output and supply. This range offers a number of advanced features such as process calibration, linearisation and auto-diagnosis.
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