SAFETY MANUAL

TEMPERATURE / mA CONVERTER
9113

This safety manual is valid for the following product versions:
9113-004
9113-003
9113-002
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1 Observed standards

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<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>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>
<td></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>Safety 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</td>
<td>Signal input: &lt; 0.5 seconds, Temperature input: &lt; 1.1 seconds</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”</td>
<td>Output ≤ 3.6 mA or output ≥ 21 mA</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 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            
|          | (No short circuit detection!)  
|          | 50 = Pt50            
|          | 100 = Pt100          
|          | 200 = Pt200          
|          | 250 = Pt250          
|          | 300 = Pt300          
|          | 400 = Pt400          
|          | 500 = Pt500          
<p>|          | 1000 = Pt1000        |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
</table>
| Ni.TYPE | Ni sensor type (for SENSOR = Ni):  
|        | 50 = Ni50  
|        | 100 = Ni100  
|        | 120 = Ni120  
|        | 1000 = Ni1000  |
| TC.TYPE | Thermocouple type (for SENSOR = TC):  
|        | TC.B = Thermocouple type B  
|        | TC.E = Thermocouple type E  
|        | TC.J = Thermocouple type J  
|        | TC.K = Thermocouple type K  
|        | TC.L = Thermocouple type L  
|        | TC.N = Thermocouple type N  
|        | TC.R = Thermocouple type R  
|        | TC.S = Thermocouple type S  
|        | TC.T = Thermocouple type T  
|        | TC.U = Thermocouple type U  
|        | TC.W3 = Thermocouple type W3  
|        | TC.W5 = Thermocouple type W5  
|        | TC.Lr = Thermocouple type Lr  |
| CJC    | CJC type for SENSOR = TC:  
|        | INT = Internal CJC sensor measurement  
|        | CONN = CJC connector measurement (accessory)  |
| O.RANGE | Fixed output range for current output:  
|        | 0-20 = 0...20 mA  Not valid when EN.SIL = YES (Safety applications)  
|        | 4-20 = 4...20 mA  
|        | 20-0 = 20...0 mA  Not valid when EN.SIL = YES (Safety applications)  
<p>|        | 20-4 = 20...4 mA  |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<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</td>
<td>CONFIG Verify OPEN-&gt;LOCK*</td>
</tr>
<tr>
<td>(At this time the device starts operating in SIL mode with the entered configuration parameters!)</td>
<td></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</td>
<td>CONNEC</td>
</tr>
<tr>
<td>(ONLY IF CH1.TYP = CURR)</td>
<td></td>
</tr>
<tr>
<td>9 Verify sensor connection type and press OK</td>
<td>UNIT</td>
</tr>
<tr>
<td>(ONLY IF SENSOR = Ni or Pt and CH1.TYP = TEMP)</td>
<td></td>
</tr>
<tr>
<td>10 Verify temperature unit and press OK</td>
<td>SENSOR</td>
</tr>
<tr>
<td>(ONLY IF CH1.TYP = TEMP)</td>
<td></td>
</tr>
<tr>
<td>11 Verify temperature sensor type and press OK</td>
<td>Pt.TYPE</td>
</tr>
<tr>
<td>(ONLY IF CH1.TYP = TEMP)</td>
<td></td>
</tr>
<tr>
<td>12 Verify Pt sensor type and press OK</td>
<td>Ni.TYPE</td>
</tr>
<tr>
<td>(ONLY IF SENSOR = Pt and CH1.TYP = TEMP)</td>
<td></td>
</tr>
<tr>
<td>13 Verify Ni sensor type and press OK</td>
<td>TC.TYPE</td>
</tr>
<tr>
<td>(ONLY IF SENSOR = Ni and CH1.TYP = TEMP)</td>
<td></td>
</tr>
<tr>
<td>14 Verify Thermocouple type and press OK</td>
<td>CJC</td>
</tr>
<tr>
<td>(ONLY IF SENSOR = TC and CH1.TYP = TEMP)</td>
<td></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>15 Verify CJC type and press OK (ONLY IF SENSOR = TC and CH1.TYP = TEMP)</td>
<td>O.RANGE</td>
</tr>
<tr>
<td>16 Verify fixed output range and press OK</td>
<td>OUT.ERR</td>
</tr>
<tr>
<td>17 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>18 Verify temperature for 0% output and press OK (ONLY IF CH1.TYP = TEMP)</td>
<td>OUT.HI</td>
</tr>
<tr>
<td>19 Verify temperature for 100% output and press OK (ONLY IF CH1.TYP = TEMP)</td>
<td>RESP</td>
</tr>
<tr>
<td>20 Verify analogue output response time and press OK</td>
<td>CH2.TYP</td>
</tr>
<tr>
<td>21 Verify input type for Channel 2 and press OK</td>
<td>I.RANGE</td>
</tr>
<tr>
<td>22 Verify fixed input range and press OK (ONLY IF CH2.TYP = CURR)</td>
<td>CONNEC</td>
</tr>
<tr>
<td>23 Verify sensor connection type and press OK (ONLY IF SENSOR = Ni or Pt and CH2.TYP = TEMP)</td>
<td>UNIT</td>
</tr>
<tr>
<td>24 Verify temperature unit and press OK (ONLY IF CH2.TYP = TEMP)</td>
<td>SENSOR</td>
</tr>
<tr>
<td>25 Verify temperature sensor type and press OK (ONLY IF CH2.TYP = TEMP)</td>
<td>Pt.TYPE</td>
</tr>
<tr>
<td>26 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</td>
<td>Press OK</td>
</tr>
<tr>
<td>2</td>
<td>Enter password and press OK</td>
</tr>
<tr>
<td>3</td>
<td>Set ADV.SEL to Yes and press OK</td>
</tr>
<tr>
<td>4</td>
<td>Set SETUP to SIL and press OK</td>
</tr>
<tr>
<td>5</td>
<td>Set EN.SIL to YES and press OK</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

- Set correct password
- Enter advanced setup menu?
- Select temperature input
- Select current input
- Select 0-20 mA input range
- Select 4-20 mA input range
- Select TC sensor type
- Select Ni sensor type
- Select Pt sensor type
- Select Pt10 sensor type
- Select Pt20 sensor type
- Select Pt50 sensor type
- Select Pt100 sensor type
- Select Pt200 sensor type
- Select Pt250 sensor type
- Select Pt300 sensor type
- Select Pt400 sensor type
- Select Pt500 sensor type
- Select Pt1000 sensor type
- Select Ni50 sensor type
- Select Ni100 sensor type
- Select Ni120 sensor type
- Select Ni1000 sensor type
- 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
- Select 2-wire sensor connection
- Select 3-wire sensor connection
- Select 4-wire sensor connection
- Select Celsius as temperature unit
- Select Fahrenheit as temperature unit
- Select 0-20 mA output range
- Select 4-20 mA output range
- Select 20-0 mA output range
- Select 20-4 mA output range
- Select no error action - output undefined at error
- Select downscale at error
- Select NAMUR NE43 downscale at error
- Select NAMUR NE43 upscale at error
- Select temperature for analogue output low
- Select temperature for analogue output high
- Enable Rail status signal output?

- Enter SIL setup
- Enter simulation mode
- Enter RAIL setup
- Perform memory operations
- Enter language setup
- Enter password setup
- Enter display setup

- Load saved configuration into 9113
- Save 9113 configuration in 4501

- Adjust LCD contrast
- Adjust LCD backlight

- Write a 5-character channel TAG

- Show analogue input value in display
- Show analogue output value in display
- Show TAG in display
- Alternate shown information in display

- Enable password protection?

- Set new password
- Select language

- Select channel to calibrate

- Calibrate input low to process value?
- Calibrate input high to process value?
- Set value for low calibration point
- Set value for high calibration point

- Use process calibration values?
- Select channel to simulate

- Set the input simulation value

- Enable SIL configuration lock?

- 0-20 mA is not a valid output range for SIL operation

- Set Analog output response time in seconds
- Select internal temperature sensor

- Select CJC connector (accessory)

- ...is channel using process-compensated calibration data?

- Configuration SIL status (Open / Locked)
- Sensor wire breakage
- Sensor short circuit

- Input underrange

- Input overrange

- Input error - check input connections and reset power

- Output error - check connections and reset power

- Flash memory error - check configuration

- Invalid configuration type or version

- Hardware error

- CJC sensor error - check device temperature

- CJC error - check CJC connector block

- No communication
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.
To default state 1.0
16.3  Routing diagram - Advanced settings (ADV.SET)

---

**MEM, DISP, CAL, SIM, PASS, LANG, RAIL, SIL**

**MEM**
- **SETUP**
  - **txt 17**
  - **SAVE**
    - **MEMORY**
      - **txt 18**
      - **OK**

**DISP**
- **SETUP**
  - **txt 17**
  - **CONTR**
    - **txt 19**
    - **YES**
      - **9**
    - **NO**
      - **0**

**PASS**
- **SETUP**
  - **txt 17**
  - **ENPASS**
    - **txt 25**
    - **OK**
  - **NO**
    - **0000**
    - **NEWPAR**
      - **txt 24**

**LANG**
- **SETUP**
  - **txt 17**
  - **LANGUN**
    - **txt 25**
    - **OK**

**CAL**
- **SETUP**
  - **txt 17**
  - **CH.1**
    - **YES**
      - **20.0**
    - **NO**
  - **CH.2**
    - **YES**
      - **-200**
    - **NO**
  - **CALLO**
    - **txt 27**

**RAIL**
- **SETUP**
  - **txt 17**
  - **YES**
    - **OK**

**SIM**
- **SETUP**
  - **txt 17**
  - **CH.1**
    - **25.0**
    - **txt 32**
  - **NO**
    - **-200**
    - **850**

**SIL**
- **SETUP**
  - **txt 17**
  - **NO**
    - **0000**
    - **9999**
    - **NEWPAR**
      - **txt 34**
  - **OK**
  - **1.4**

---

To default state 1.0

2.0 In the submenu simulation (SIM) you must press **OK** to return to the default state 1.0.

Verification of SIL configuration

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Version No. V6R0 21
17 Connections diagram

Power Rail connections

Supply and status relay

Error signal +24 V

NC = no connection

Inputs

RTD, 2-wire

RTD, 3- / 4-wire

TC, internal CJC sensor

*CJC connector

Current

Current

*C Order separately: CJC connector 5910Ex (ch. 1) / 5913Ex (ch. 2).

Outputs

Current 2-wire transmitter

Current 2-wire transmitter