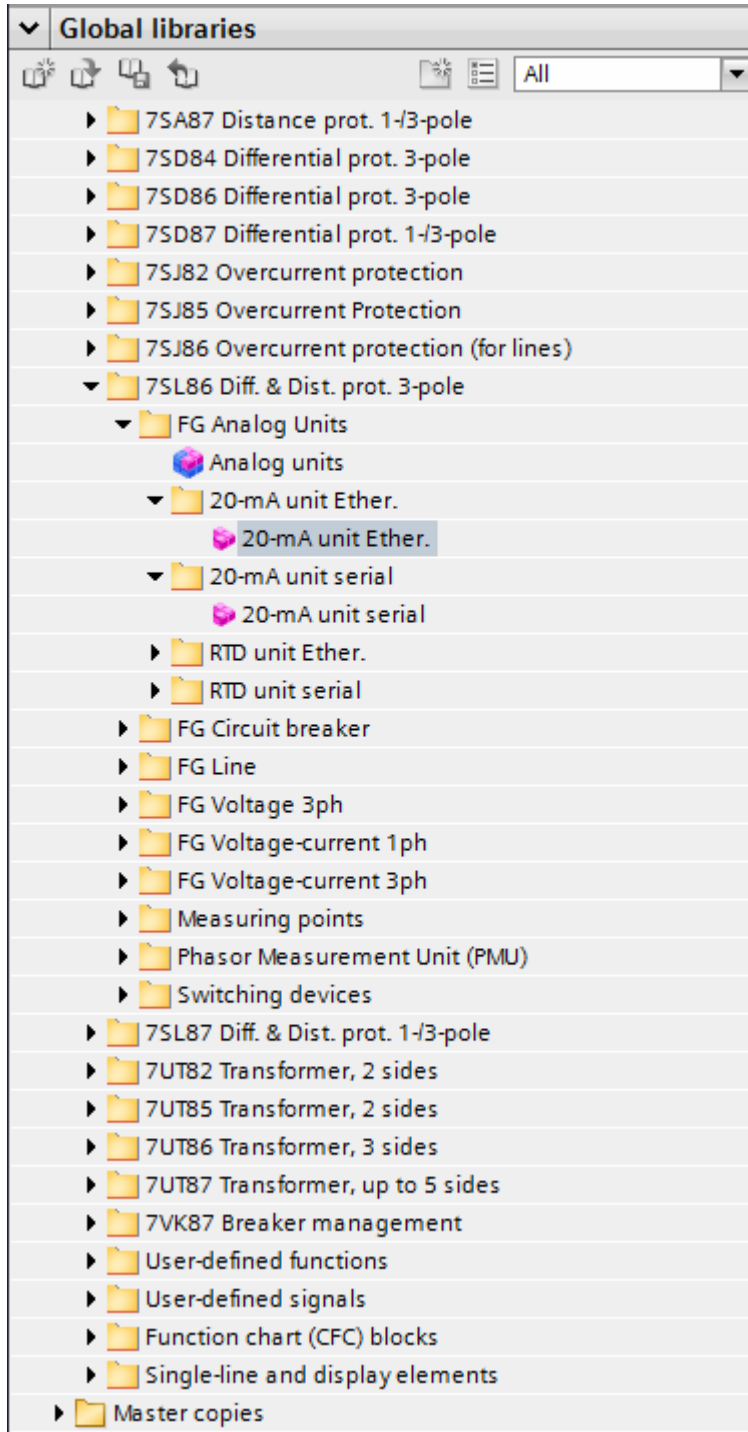## 5.9 Function-Group Type Analog Units

5.9.1 Overview

The **Analog units** function group is used to map analog units and communicate with them. Analog units are external devices, such as RTD units, or analog plug-in modules, such as measuring-transducer modules. You will find the **Analog units** function group for many device types in the Global DIGSI 5 library.


[sc20maee-190214-01, 1, en_US]

Figure 5-81   Analog Unit Function Group in DIGSI

5.9.2 Structure of the Function Group

If the device has a measuring transducer, it is automatically mapped in the **Analog units** function group. If one or more RTD units are connected to the device, you have to load one or more **RTD unit Ether.** or **RTD unit serial** functions from the Global DIGSI library in order to map the RTD units.

The following figure shows the structure of the function group.
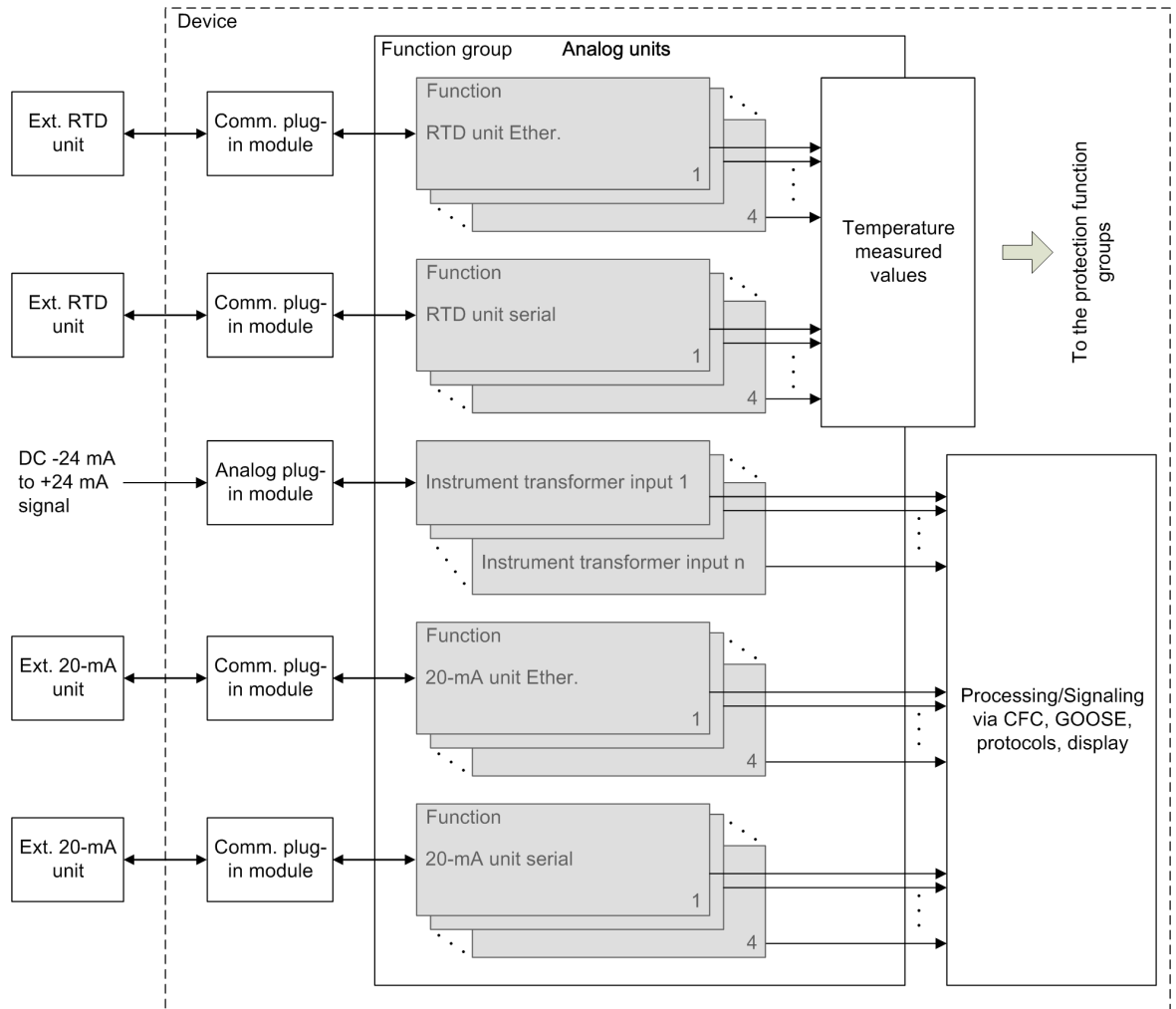
[dwstrthe-290113-01.tif, 1, en_US]

Figure 5-82   Structure of the Analog Unit Function Group

(1)   Gray: Wired optionally, available optionally

(2)   White: Wired always, available always

The **Analog units** function group has interfaces to protection function groups. The **Analog units** function group provides measured temperature values that come from an external RTD unit. These measured temperature values are available for all protection function groups in which a temperature monitoring function works.

The **RTD unit Ether.** function is not preconfigured by the manufacturer. A maximum of 4 function instances can work simultaneously.

The **RTD unit serial** function is set up structurally exactly in the same manner as the **RTD unit Ether.** function.
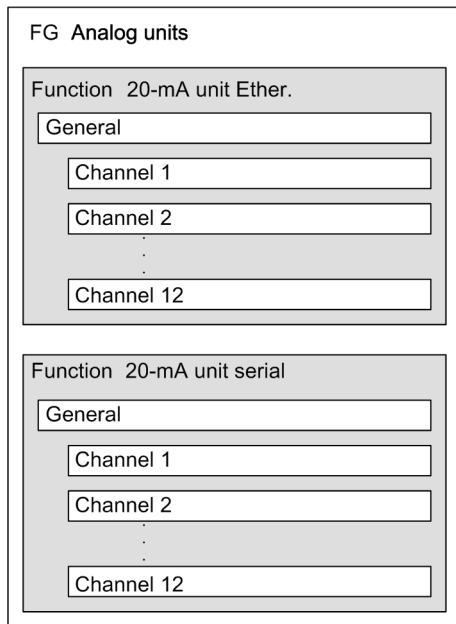
5.9.3　20-mA Unit Ethernet

5.9.3.1　Overview

The function **20-mA unit Ether.**:

- Communicates in series with a 20-mA unit via the Slave Unit Protocol (SUP) and records the values measured by the 20-mA unit

- Transforms the measured 20-mA values into slowly changing process tags such as temperature or gas pressure

- Makes the recorded process tags available to CFC, GOOSE, protocols and the device display

- Monitors communication with the 20-mA unit

5.9.3.2　Structure of the Function

The function **20-mA unit Ether.** can work only in the function group **Analog units**. A maximum of 4 function instances can work simultaneously. Each instance contains 12 preconfigured channel function blocks.

The function **20-mA unit Ether.** contains input and output channels which can be configured independently of one another.
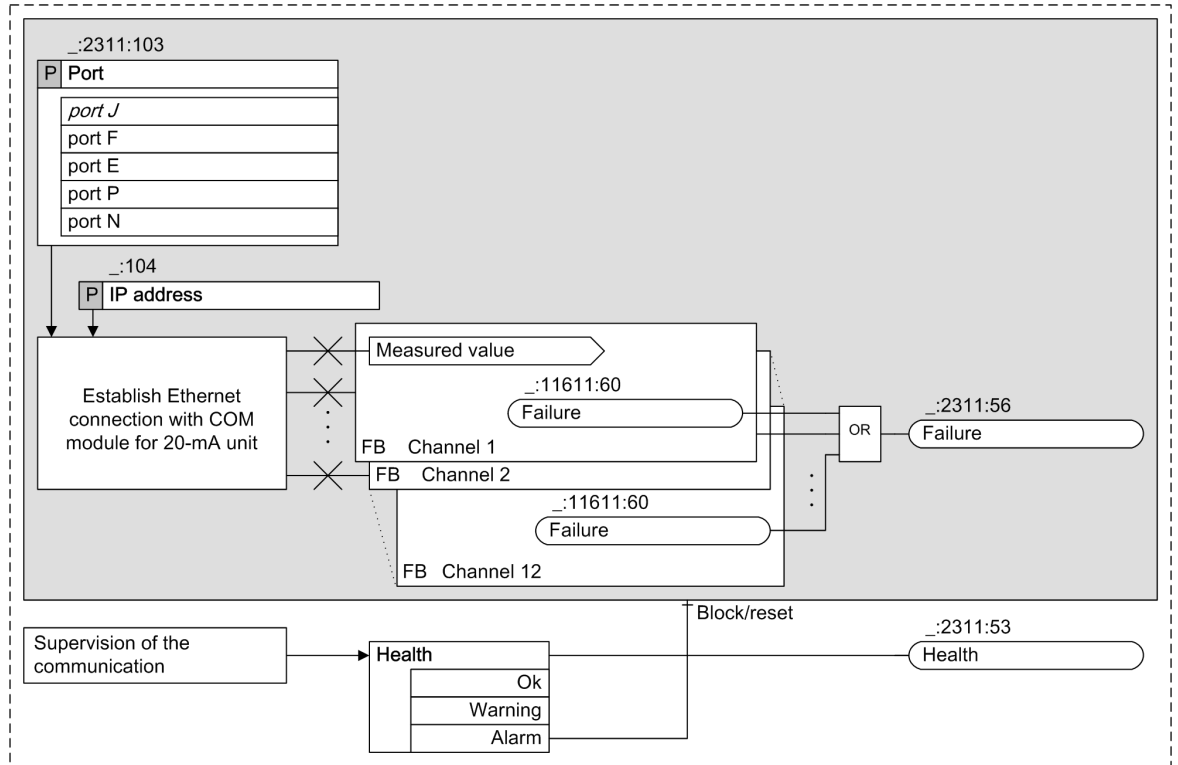

[dwstrfn2-150113-01.tif, 1, en_US]

Figure 5-83　　Structure/Embedding of the Function

5.9.3.3 Communication with 20-mA Unit Ethernet

Logic

[lo20mtcp-150113-01.tif, 1, en_US]

Figure 5-84   Logic of the Function 20-mA Unit Ethernet

Communication with 20-mA Unit

The function is used to communicate with a 20-mA unit connected via an Ethernet connection. When a connection of the function to an external 20-mA unit via an Ethernet interface has successfully been established, the 20-mA unit sends the measured values of all connected channels to the function **20-mA unit. Ether.**. For the connection to be established successfully, specific communication settings must be specified.

You can find more detailed information in Chapter *5.9.3.4 Application and Setting Notes* .

The 20-mA measurement unit **7XV5674** is supported.

Error Responses

The following table lists the conditions under which the *Health* status transitions to the Alarm or Warning state.

Table 5-19   Error Responses

Error Description	Status Health
The function **20-mA unit Ether.** cannot establish a connection with a communication module.	Alarm
The function **20-mA unit Ether.** sends TCP settings to the communication module, which evidently would like to connect to the 20-mA unit via a serial protocol. This communication module does not establish a connection to the 20-mA unit.	Alarm
The connection between the communication module and the 20-mA unit causes a time-out indication.	Warning

Error Description	Status Health
A communication module has not received any more data from the 20-mA unit for 9 sec.	Warning

The *Failure* signal is set as soon as one of the channel function blocks reports a failure.

5.9.3.4 Application and Setting Notes

Parameter: Port

- Default setting **(_:2311:103) Port** = *port J*

Use the **Port** setting to define the port connecting the 20-mA unit to the SIPROTEC 5 device.

Parameter: IP address

- Default setting **(_:2311:104) IP address** = *10.16.60.1*

With the **IP address** settings, you set the IP address of the 20-mA unit connected to the communication module via the TCP protocol. You must assign each 20-mA unit an unambiguous IP address. The IP address to be set depends on your network configuration. You can set any valid IPv4 address that does not cause conflicts with other IP addresses in the network. First set an IP address for the **7XV5674 20-mA unit** . Then specify the **IP address** settings for the communication module to the same address.

Settings on the 20-mA Unit

The **7XV5674 20-mA unit** is set with a web browser on the laptop computer via the latter's Ethernet interface. Detailed notes on the settings can be found in the 7XV5674 manual that accompanies the 20-mA unit. The documents are also available in the SIPROTEC download area (http://www.siprotec.de).

5.9.3.5 20-mA Channel

Logic
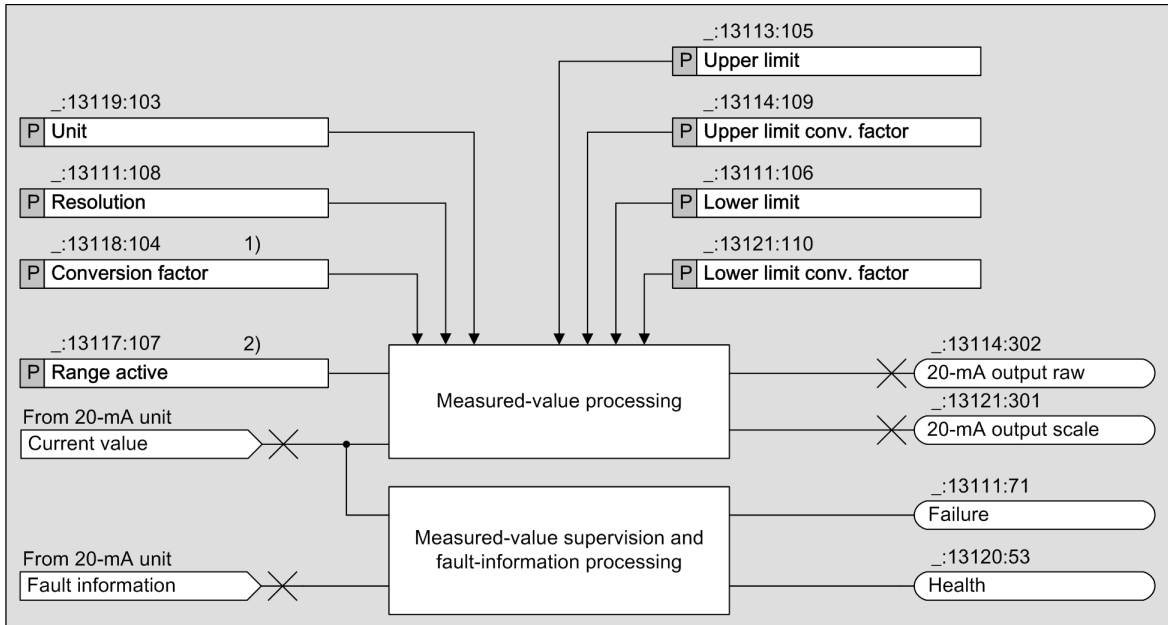
[lo20mcha-160113-01.tif, 1, en_US]

Figure 5-85   Logic Diagram of the Function 20-mA Channel

(1)   If the setting **Range active** is set to *test* , the setting **Transformation ratio** is not displayed.

(2)   If the setting **Range active** is set to *false*, the settings **Upper limit**, **Transformation ratio upper limit**, **Lower limit** and **Transformation ratio** are not displayed.

Measured-Value Calculation

The function **20-mA channel** processes a single 20-mA current signal supplied by the 20-mA unit of the corresponding channel. The 20-mA current measured value is converted into the correct physical quantities such as temperature or pressure. In each 20-mA functional unit (Ether. and serial) there are always 12 of the 20-mA channel function blocks, even if fewer channels are connected with the 20-mA unit. The calculated values are available for further processing via CFC, GOOSE, protocols, and the display image.

Measured-Value Processing

The 20-mA unit typically transmits a value which represents a physical quantity, such as a temperature or a pressure. Therefore, the device must contain a characteristic curve that maps the physical quantity to the 20-mA value. If you do not activate the **Range active** setting (no x in the check box), the function operates over the range 0 mA to 20 mA. If a value smaller than 0 mA or greater than 20 mA is active at the input of the 20-mA unit, the measured value is identified as invalid. The setting of the range for the scaled value goes from a usable range of 0 mA to 20 mA. The following figure shows an example.
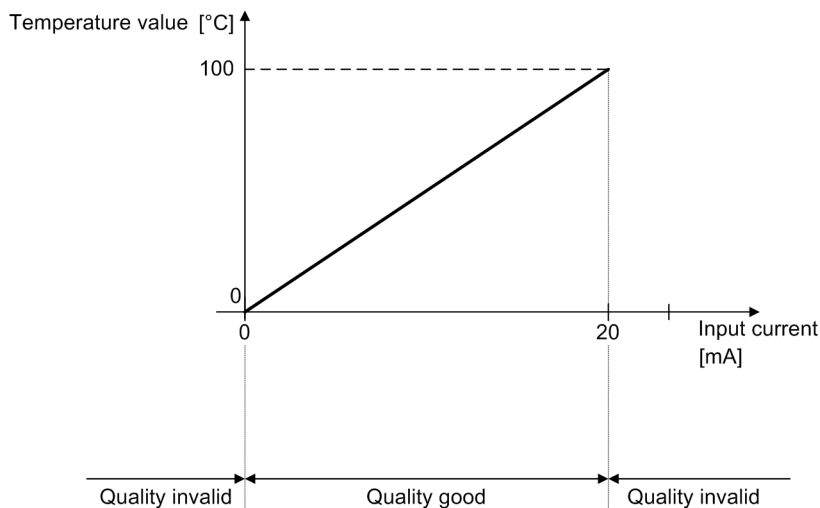

[sckanumw-190214-01, 1, en_US]

Figure 5-86   Settings for Example 1

In this example, the measured value 0 mA means a temperature of 0 °C and the measured value 20 mA means a temperature of 100 °C. So enter as **Unit** = *°C* and **Conversion factor** = *100*. The resolution (decimal place) of the temperature value can be chosen; for a decimal place, select **Resolution** = *0.1*.
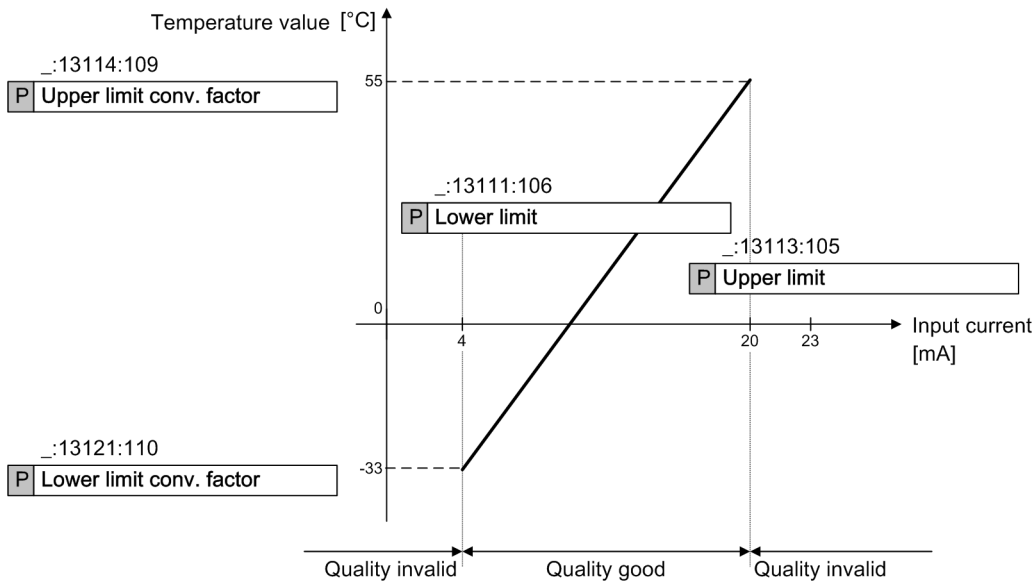

[dwknges3-020513-01.tif, 1, en_US]

Figure 5-87   Characteristic Curve of a 20-mA Input (Example 1)

If you activate the `Range active` setting, then 4 additional parameters `Upper limit`, `Lower limit`, `Upper limit conv. factor`, and `Lower limit conv. factor` appear. The parameters `Upper limit` and `Lower limit` indicate the range of the input current in mA. The setting `Upper limit conv. factor` is the calculated measured value if the input current corresponds to the value in the `Upper limit` setting. The setting `Lower limit conv. factor` is the calculated measured value if the input current corresponds to the value in the `Lower limit` setting. The setting of the range for the scaled value corresponds to the useable range between `Lower limit` and `Upper limit` (see following figure).

[sckanumf-190214-01, 1, en_US]

Figure 5-88   Settings for Example 2

[dwknges2-020513-01.tif, 1, en_US]

Figure 5-89   Characteristic Curve of a 20-mA Unit (Example 2)

In this example, the `Range active` setting is selected. The setting `Upper limit` is at 20 mA, the setting `Lower limit` is at 4 mA. The setting `Upper limit conv. factor` is at 55 and the setting `Lower limit conv. factor` is at -33. If the input current is smaller than -33 mA or greater than 55 mA, the quality of the scaled measured value in this example is invalid.

Each 20-mA channel makes available the scaled measured value in the information routing (these are the temperature values in the examples) and the original current measured value in mA for further processing.

The 20-mA values can be displayed in the display image and processed with CFC charts.

Error Responses

If the current input value is determined to be incorrect, the quality attribute of the output value is set to *invalid* That status for *Health* and the defect status assume the states displayed in the table.

Table 5-20   Error Responses

Error Description	Status *Health*	Error Status
Error Status 20-mA value lies outside the given limits	OK	Yes
Channel not connected	OK	No

5.9.3.6   Application and Setting Notes

Parameter: Unit

- Default setting (_:13111:103) `Unit` = *°C*

You use the setting `Unit` to specify which physical unit of measurement the measured values represent. The possible setting values are listed in the settings table.

Parameter: Conversion factor

- Default setting (_:13111:104) `Conversion factor` = *100*

The `Conversion factor` setting allows you to set the conversion factor for the measuring transducer.

Parameter: Resolution

- Default setting (_:13111:108) `Resolution` = *0.1*

The `Resolution` setting is used to specify the measured value resolution.

Parameter: Range active

- Default setting (_:13111:107) `Range active` = *false*

If you do not activate the `Range active` setting (no x in the check box), the function operates over the range -24 mA to +24 mA. The setting of the range for the scaled value goes from a usable range of -20 mA to +20 mA.

If you activate the `Range active` setting, then 4 additional settings `Upper limit`, `Upper limit conv. factor`, `Lower limit`, and `Lower limit conv. factor` appear.

Parameter: Upper limit, Lower limit, Upper limit conv. factor and Lower limit conv. factor

- Default setting(_:13111:105) `Upper limit` = *20000 mA*

- Default setting (_:13111:109) `Upper limit conv. factor` = *100*

- Default setting(_:13111:106) `Lower limit` = *4000 mA*

- Default setting (_:13111:110) `Lower limit conv. factor` = *100*

If you activate the `Range active` setting, then 4 additional settings `Upper limit`, `Lower limit`, `Upper limit conv. factor`, and `Lower limit conv. factor` appear. The setting `Upper limit conv. factor` is the calculated measured value if the input current corresponds to the value in the `Upper limit` setting. The setting `Lower limit conv. factor` is the calculated measured value if the input current corresponds to the value in the `Lower limit` setting.

The following settings and information table shows only 1 of the 12 channels, as the setting possibilities of the 12 channels do not differ.

5.9.3.7   Settings

Addr.	Parameter	C	Setting Options	Default Setting
General				
_:2311:103	General:Port		• port E • port F • port J • port N • port P	port J
Channel 1				
_:13111:103	Channel 1:Unit		• % • ° • °C • °F • Ω • Ω/km • Ω/mi • 1/s • A • As • cos φ • cycles • dB • F/km • F/mi • h • Hz • Hz/s • in • J • J/Wh • K • l/s • m • mi • min • p.u. • Pa • periods • rad • rad/s • s • V • V/Hz • VA • VAh • VAr • VArh • Vs • W • W/s • Wh	m
_:13111:108	Channel 1:Resolution		• 1 • 0.1 • 0.01 • 0.001	0.1

Addr.	Parameter	C	Setting Options	Default Setting
_:13111:107	Channel 1:Range active		• 0 • 1	false
_:13111:104	Channel 1:Conversion factor		1 to 10000	100
_:13111:105	Channel 1:Upper limit		0.00 mA to 20.00 mA	20.00 mA
_:13111:109	Channel 1:Upper limit conv. factor		-10000 to 10000	100
_:13111:106	Channel 1:Lower limit		0.00 mA to 20.00 mA	4.00 mA
_:13111:110	Channel 1:Lower limit conv. factor		-10000 to 10000	100

5.9.3.8 Information List

No.	Information	Data Class (Type)	Type
General			
_:2311:53	General:Health	ENS	O
_:2311:56	General:Failure	SPS	O
Channel 1			
_:13111:53	Channel 1:Health	ENS	O
_:13111:71	Channel 1:Failure	SPS	O
_:13111:301	Channel 1:20-mA output scale	MV	O
_:13111:302	Channel 1:20-mA output raw	MV	O

5.9.4 20-mA Einheit Seriell

5.9.4.1 Overview

The function **20-mA unit Serial**:

- Provides serial communications with a 20-mA unit via the Modbus protocol and records the values measured by the 20-mA unit

- Transforms the measured 20-mA values into slowly changing process variables such as temperature or gas pressure

- Makes the recorded process tags available to CFC, GOOSE, protocols and the device display

- Monitors communication with the 20-mA unit

The function **20-mA unit Serial** is structured in the same way as the function **20-mA Unit Ether.**. The mode of operation is also identical. The only difference is that the measured values are transferred to the communication module via a serial connection instead of an Ethernet connection.

You can find more information in Chapter *5.9.3.2 Structure of the Function* .

5.9.4.2 Application and Setting Notes

Parameter: Port

- Default setting **(_:2311:103) Port** = *Port J*

With the **Port** setting, you specify the slot for the communication module that will be used for the connection with an external 20-mA unit.

Parameter: Channel number

- Default setting **(_:2311:105) Channel number** = *1*

A serial communication module optionally uses 2 channels. With the `Channel number` setting, you specify the channel number (1 or 2) used to connect the 20-mA unit to the device. The communication module inputs are labeled with the channel numbers.

Parameter: Slave address

- Default setting `(_:2311:106)` `Slave address` = *1*

Use the `slave address` setting to define the device address of the 20-mA unit. If only one 20-mA unit is connected to the serial bus, the default value *1* can be used. Set the same device address as used with the 20-mA unit. The device address is important for distinguishing several 20-mA units that are connected to a serial bus. Set an unambiguous device address on every 20-mA unit, for example, 1, 2 and 3 when connecting 3 of the 20-mA units. On every 20-mA unit, set for the `slave address` setting in the 3 functions **20-mA Unit Serial** the same device address for each.

Parameter: Unit

- Default setting `(_:13111:103)` `Unit` = *°C*

You use the setting `Unit` to specify which physical unit of measurement the measured values represent. The possible setting values are listed in the settings table.

Parameter: Conversion factor

- Default setting `(_:13111:104)` `Conversion factor` = *100*

The `Conversion factor` setting allows you to set the conversion factor for the measuring transducer.

Parameter: Resolution

- Default setting `(_:13111:108)` `Resolution` = *0.1*

The `Resolution` setting is used to specify the measured value resolution.

Parameter: Range active

- Default setting `(_:13111:107)` `Range active` = *false*

If you do not activate the `Range active` setting (no x in the check box), the function operates over the range 0 mA to 20 mA. The setting of the range for the scaled value goes from a usable range of 0 mA to 20 mA.

If you activate the `Range active` setting, then 4 additional settings `Upper limit`, `Upper limit conv. factor`, `Lower limit`, and `Lower limit conv. factor` appear.

Parameter: Upper limit, Lower limit, Upper limit conv. factor and Lower limit conv. factor

- Default setting`(_:13111:105)` `Upper limit` = *20000 mA*

- Default setting `(_:13111:109)` `Upper limit conv. factor` = *100*

- Default setting`(_:13111:106)` `Lower limit` = *4000 mA*

- Default setting `(_:13111:110)` `Lower limit conv. factor` = *100*

If you activate the `Range active` setting, then 4 additional settings `Upper limit`, `Lower limit`, `Upper limit conv. factor`, and `Lower limit conv. factor` appear. The setting `Upper limit conv. factor` is the calculated measured value if the input current corresponds to the value in the `Upper limit` setting. The setting `Lower limit conv. factor` is the calculated measured value if the input current corresponds to the value in the `Lower limit` setting.

The following settings and information table shows only 1 of the 12 channels, as the setting possibilities of the 12 channels do not differ.

5.9.4.3 Settings

Addr.	Parameter	C	Setting Options	Default Setting
General				
_:2311:103	General:Port		• port E • port F • port J • port N • port P	port J
_:2311:105	General:Channel number		1 to 2	1
_:2311:106	General:Slave address		1 to 247	1
Channel 1				
_:13111:103	Channel 1:Unit		• % • ° • °C • °F • Ω • Ω/km • Ω/mi • 1/s • A • As • cos φ • cycles • dB • F/km • F/mi • h • Hz • Hz/s • in • J • J/Wh • K • l/s • m • mi • min • p.u. • Pa • periods • rad • rad/s • s • V • V/Hz • VA • VAh • VAr • VArh • Vs • W • W/s • Wh	m

Addr.	Parameter	C	Setting Options	Default Setting
_:13111:108	Channel 1:Resolution		• 1 • 0.1 • 0.01 • 0.001	0.1
_:13111:107	Channel 1:Range active		• 0 • 1	false
_:13111:104	Channel 1:Conversion factor		1 to 10000	100
_:13111:105	Channel 1:Upper limit		0.00 mA to 20.00 mA	20.00 mA
_:13111:109	Channel 1:Upper limit conv. factor		-10000 to 10000	100
_:13111:106	Channel 1:Lower limit		0.00 mA to 20.00 mA	4.00 mA
_:13111:110	Channel 1:Lower limit conv. factor		-10000 to 10000	100

5.9.4.4 Information List

No.	Information	Data Class (Type)	Type
General			
_:2311:53	General:Health	ENS	O
_:2311:56	General:Failure	SPS	O
Channel 1			
_:13111:53	Channel 1:Health	ENS	O
_:13111:71	Channel 1:Failure	SPS	O
_:13111:301	Channel 1:20-mA output scale	MV	O
_:13111:302	Channel 1:20-mA output raw	MV	O

5.9.5 Communication with 20-mA Unit

5.9.5.1 Integration of a Serial 20-mA Unit

Connection of the Communication Lines

Figure 5-90 shows how to connect the 20-mA unit to the SIPROTEC 5 device. Note that Pin 1 of the RJ45 plug is connected to RTD-B and Pin 2 is connected to RTD-A.
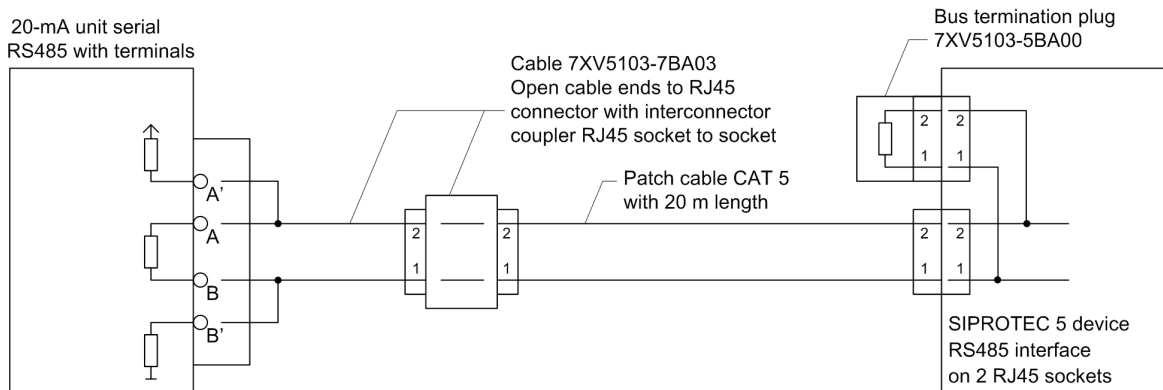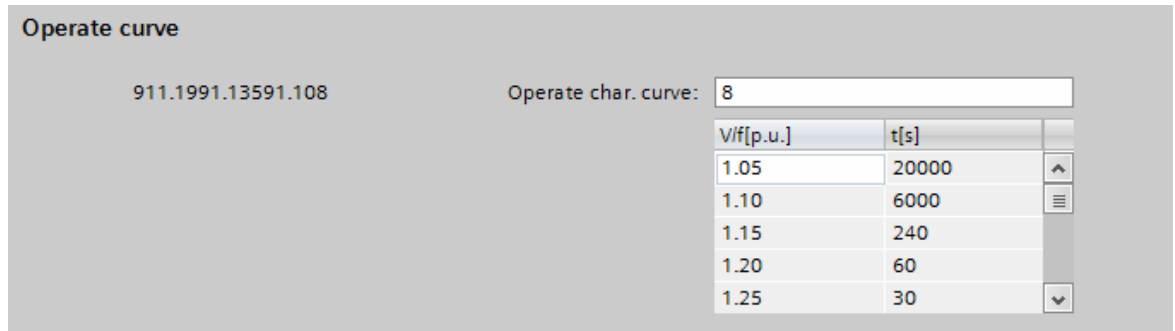

[dwve20au-150213-01.tif, 1, en_US]

Figure 5-90   Connection of the 20-mA Unit to the SIPROTEC 5 Device

Adding a USART Module

Add a USART-AB-1EL or a USART-AC-2EL USART module in DIGSI to the device. The USART module must be inserted at one of the plug-in positions for communication modules in the base module or in the CB202 expansion module (refer to the following figure).
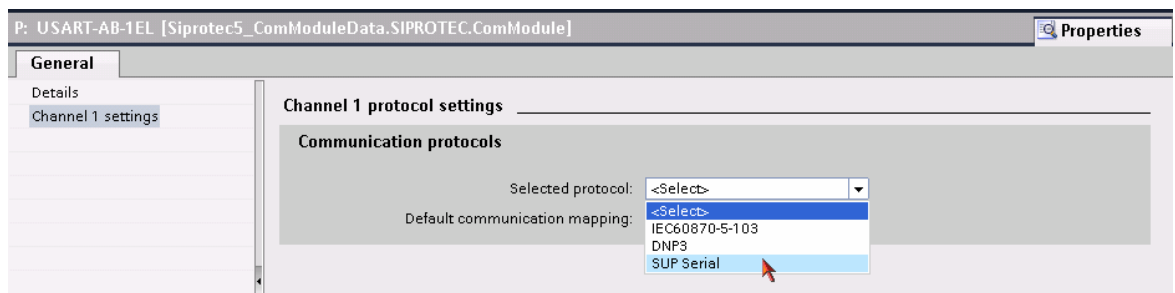

[sc20ser3-220114-01-DE, 1, en_US]

Figure 5-91   Insertion Position for a USART Module

Selecting the SUP Protocol

Select the Slave Unit Protocol (SUP). This protocol is responsible for the communication between the SIPROTEC 5 device and the 20-mA unit.

[scauser4-220114-01-DE, 1, en_US]

Figure 5-92   Selecting the SUP Protocol

Communication Settings

Make the communications settings for the relevant serial channels. For this, use the default settings specified by the 20-mA unit. Normally, you must adapt only the parameterization of the SIPROTEC 5 device to the settings of the 20-mA unit. Make sure that the setting values in both devices are the same. The settings of the **Non-flickering light (on/off):** is not relevant for the RS485 interface.

> **NOTE**
>
> The driver for the USART module for the SUP protocol is not preinstalled as standard for the initial use of this interface (following the firmware update).

[scauser5-220114-01-DE, 1, en_US]

Figure 5-93   Making the Communication Settings

With the selection of the SUP protocol for the 20-mA unit DIGSI automatically adds the function group **Analog units** to your device configuration. You can now instantiate the function **20-mA unit serial 1** (see following figure).
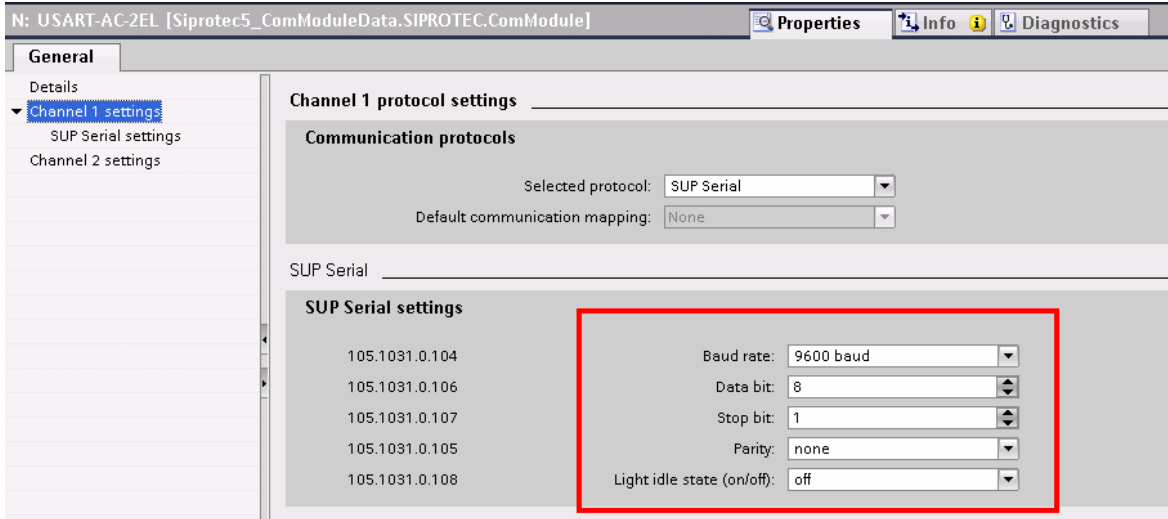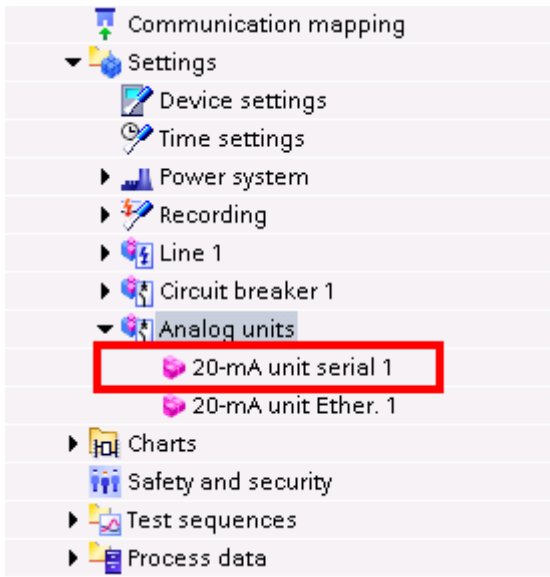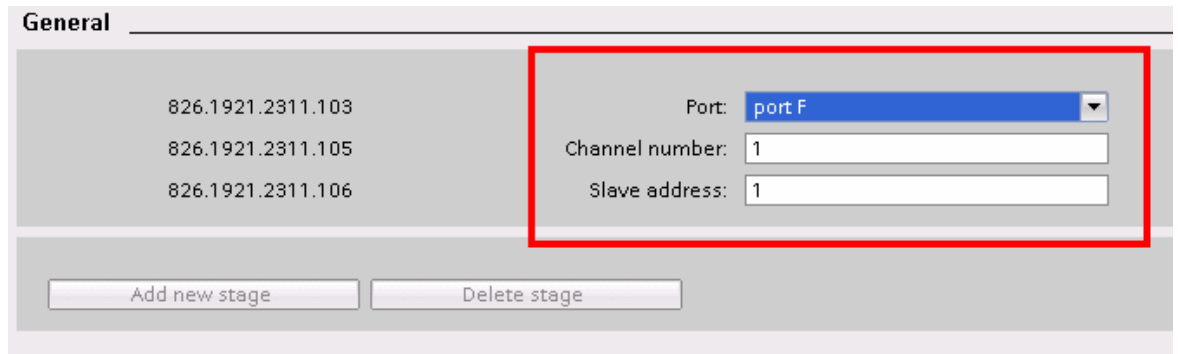

[sc20ser6-220114-01-DE, 1, en_US]

Figure 5-94   Insertion of the Function 20-mA Unit Serial 1

Now, set the channel number over which the SUP protocol runs. In addition, set the slave address of the 20-mA unit. This address must be set with the same value in the 20-mA unit (refer to the following figure).

For the first use of the 20-mA unit, the following device configuration must be set on the 20-mA unit:

- Bus protocol: mod

- Device address: 1

- Baud rate: 9600

- Parity: no

[scauser7-220114-01-DE, 1, en_US]

Figure 5-95   Setting the Port, Channel Number, and Device Address

Finally, load the configuration in the device.

5.9.5.2   Integration of a 20-mA Unit Ethernet

Device Configuration

In DIGSI, insert an Ethernet module into the provided slot, thus, adding the module to the device configuration. *Figure 5-96* displays the available slots in the base module or on the expansion module CB 202. Alternatively, you can also use the integrated Ethernet interface Port J.
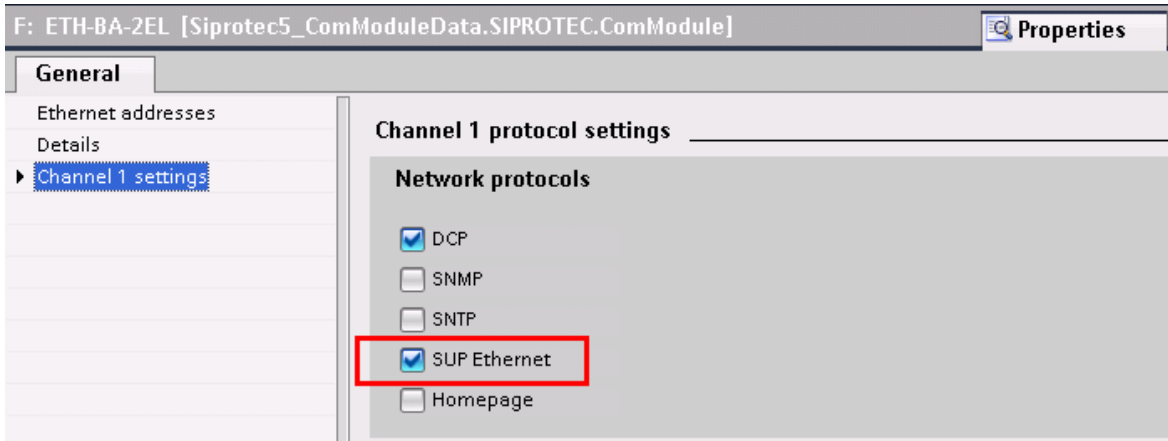

[scautcp1-220114-01-DE, 1, en_US]

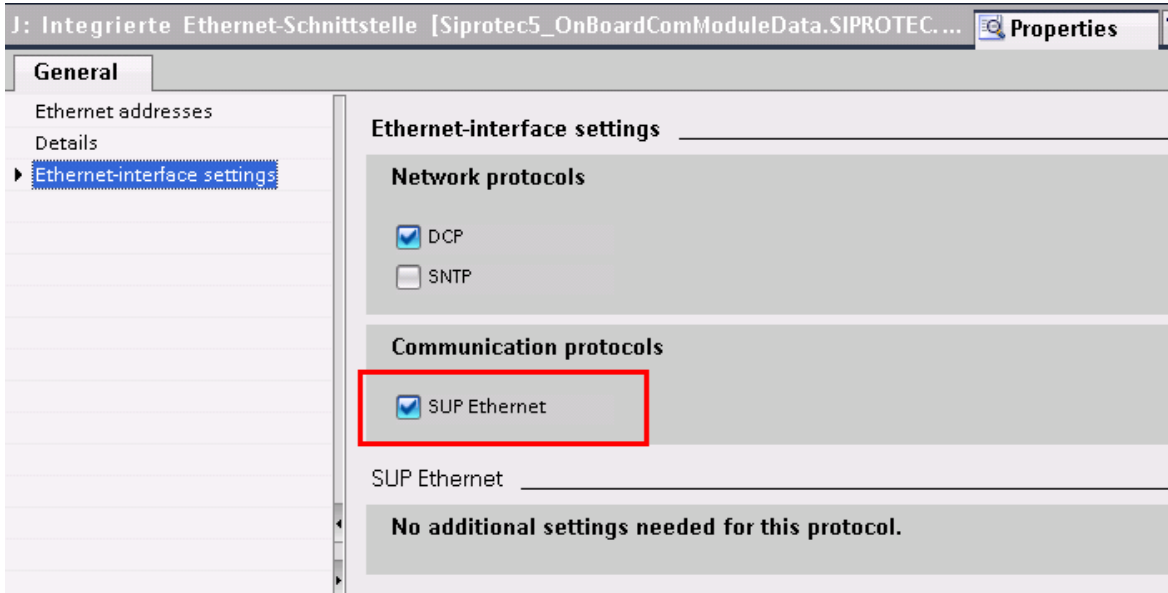Figure 5-96   Inserting an Ethernet Module

Communication Settings

Activate the SUP Ethernet protocol for the Ethernet module.

[scautcp2-220114-01-DE, 1, en_US]

Figure 5-97   Activation of the protocol

This protocol is also available for Port J of the integrated Ethernet interface of the base module (refer to following figure).

[scautcp3-220114-01-DE, 1, en_US]

Figure 5-98   Selection of the Protocol

With the selection of the SUP protocol for the 20-mA unit, DIGSI automatically adds the **Analog units** function group and the **20-mA unit Ether.** function to your device configuration (refer to the following figure).
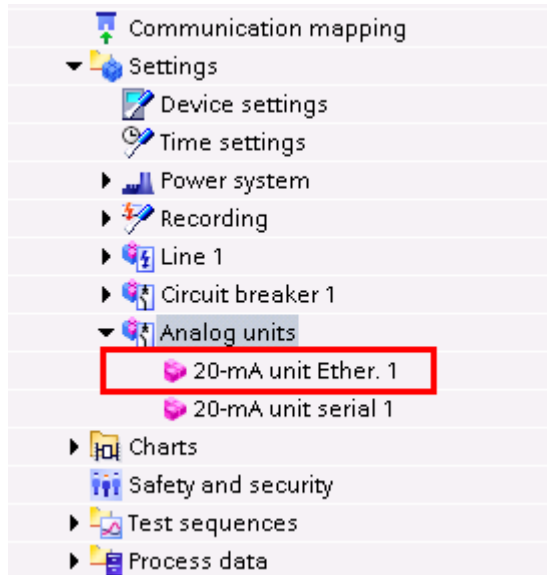
[sc20tcp4-220114-01-DE, 1, en_US]

Figure 5-99　　Insertion of the Function 20-mA Unit Ether. 1

Now, set the port over which the SUP protocol runs. In addition, set the IP address of the 20-mA unit (refer to the following figure). This address must be set with the same value in the 20-mA unit.
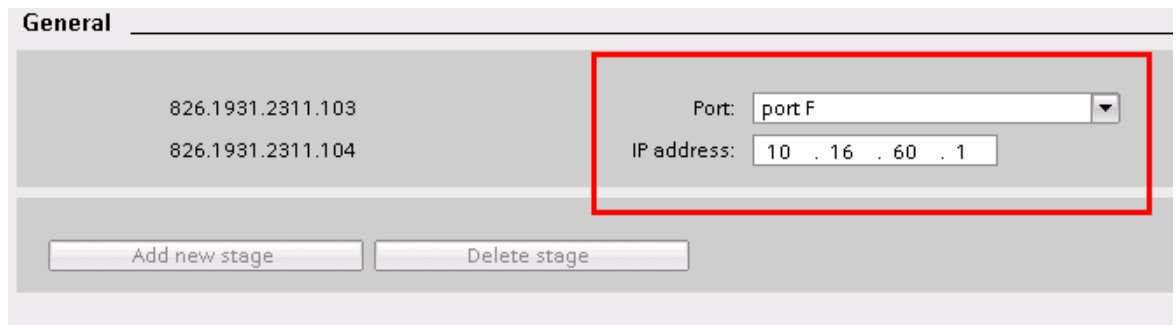
[scautcp5-220114-01-DE, 1, en_US]

Figure 5-100　　Setting the Port and IP Address

Finally, load the configuration in the device.
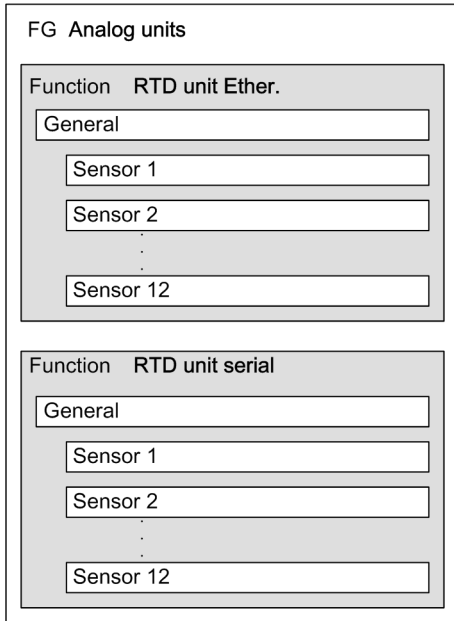
5.9.6　RTD Unit Ethernet

5.9.6.1　Overview

The **RTD unit Ether.** function:
- Communicates with an external RTD unit via the Slave Unit Protocol (SUP) and records the measured temperatures from the RTD unit
- Provides the captured temperatures to the temperature monitoring function
- Monitors communication with the RTD unit

5.9.6.2　Structure of the Function

The **RTD unit Ether.** function can only work in the **Analog units** function group. A maximum of 4 function instances can work simultaneously. Each instance contains 12 preconfigured sensor function blocks.
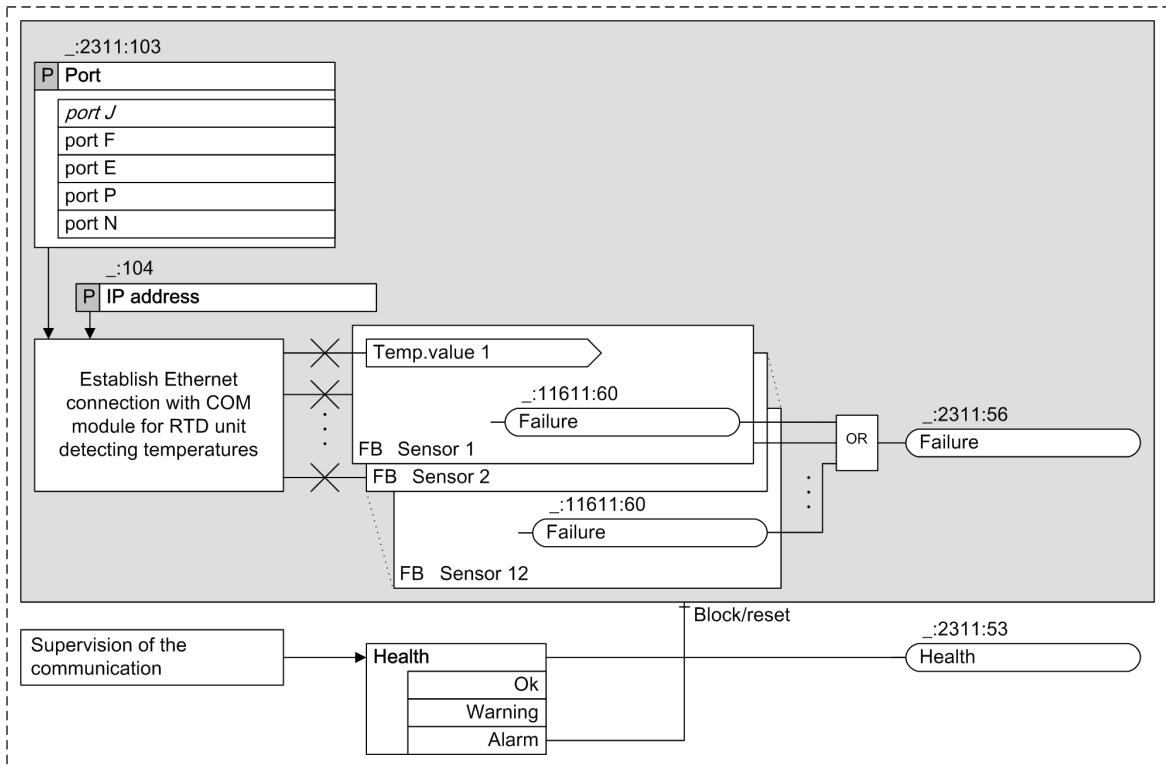
[dwstrfnc-291112-01.tif, 1, en_US]

Figure 5-101   Structure/Embedding of the Function

5.9.6.3   Communication with an RTD Unit

Logic

[lortdtcp-311012-01.tif, 1, en_US]

Figure 5-102   Logic of the RTD Unit Ether. Function

Communication with an RTD Unit

The function is used to communicate with an RTD box connected via an Ethernet connection. If the connection of the function is successfully established to the external RTD box via the Ethernet interface, the RTD box transmits the temperatures of all connected sensors to the **RTD box Ether.** function. For the connection to be established successfully, specific communication settings must be set, see chapter *5.9.6.4 Application and Setting Notes* .

The RTD box **Ziehl TR1200 IP** supports only an Ethernet connection of 10 MBit/s. A direct connection to a 100-Mbit communication module is therefore not possible. For this reason, you must connect the RTD box to the communication module via a 10/100 MBit/s autosensing switch which automatically recognizes the transmission rates and adapts them accordingly. Further information can be found in the Application and setting notes, see chapter *5.9.6.4 Application and Setting Notes* .

Error Responses

The following table lists the conditions under which the *Health* status transitions to the Alarm or Warning state.

Table 5-21   Error Responses

Error Description	Status Health
The **RTD unit Ether.** function cannot establish a connection with a communication module.	Alarm
The connection between the communication module and the RTD unit causes a time-out.	Warning
A communication module has not received any more data from the RTD unit for 9 sec.	Warning

The *Failure* signal is set as soon as one of the sensor function blocks reports a failure.

5.9.6.4   Application and Setting Notes

Parameter: Port

- Default setting **(_:2311:103) Port** = *port J*

Use the **Port** parameter to define over which port the external RTD-Unit is connected to the SIPROTEC 5 device.

If you want to connect the external RTD box to the integrated Ethernet interface, set the parameter **Port** = *Port J*. If you want to connect the external RTD box to an Ethernet plug-in module, set the parameter **Port** = *Port F* , *Port E*, *Port P*, or *plug-in module position*.

You can connect directly the RTD-Unit to the device via the internal 10-Mbit Ethernet port J. If you operate the RTD-Unit on another port via a 100-Mbit communication module, you need an interconnected 10/100-Mbit autosensing switch, which adapts transmission rates accordingly.

Parameter: IP address

- Default setting **(_:2311:104) IP address** = *10.16.60.1*

With the **IP address** settings, you set the IP address of the RTD-Unit connected to the communication module via the SUP protocol. Every RTD-Unit has to be assigned a unique IP address. The IP address to be set depends on your network configuration. You can set any valid IPv4 address that does not cause conflicts with other IP addresses in the network. Set an appropriate IP address first at the **Ziehl TR1200 IP** RTD-Unit. Then specify the **IP address** settings for the communication module to the same address.

Settings on the RTD Unit

The **Ziehl TR1200 IP** RTD-Unit is set with the front keys or in a Web browser on a laptop computer via its Ethernet interface. Set the connection type of the sensors (3-wire connection or resistance value for 2-wire connection), the idle state of the fault-indication relay, as well as the IP interface setting.

The code lock has to be switched off for parameterization. This is only possible using the front keys of the RTD-Unit. The code lock is **off** (switched off) in as-delivered condition and has pin **504**.

For detailed information on the settings, refer to the TR1200 IP manual that comes with the RTD-Unit. The documents are also available in the SIPROTEC download area (http://www.siprotec.de) under **Accessories -> 7XV5662-xAD**.

5.9.6.5 Temperature Sensor

Logic
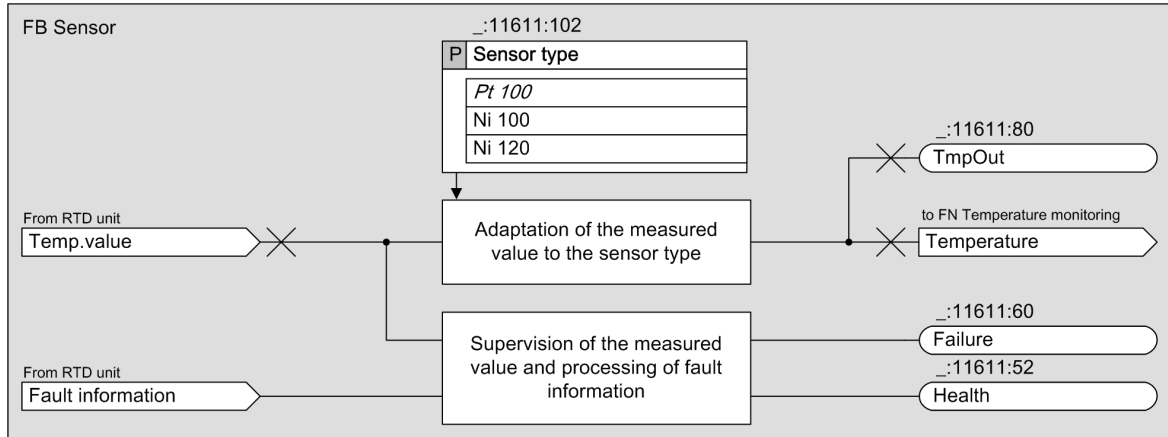
[lotmpval-311012-01.tif, 1, en_US]

Figure 5-103   Logic Diagram of the Temperature Sensor Function Block

Measured Temperature Value

The **Temperature sensor** function block processes one single measured temperature value delivered from the RTD box for the assigned sensor. 12 temperature sensor function blocks are always available in each RTD box function (both via Ethernet and serial), even if fewer sensors are connected to the RTD box.

Various temperature sensor types are supported: Pt100, Ni100, and Ni120 sensors. The function block is notified regarding the selection of connected type via the `sensor type` setting.

The function block delivers a measured temperature value in °C or °F as an output variable. The measured temperature value is available as an operational measured value and can be monitored by the **Temperature supervision** function.

Related Topics

Temperature supervision function, chapter *6.35.3 Function Description*

Error Responses

If the measured input value is determined to be incorrect, the quality attribute of the output measured temperature value is set to *invalid*. The statuses for Health and Error take the statuses in accordance with the following table:

Table 5-22   Error response

Error Description	Health Status	Error Status
Sensor or line short circuited	Alarm	Yes
Sensor or line interrupted	Alarm	Yes

Error Description	Health Status	Error Status
Measured temperature value outside the valid measuring range specified in the technical data. The valid measuring range depends on the sensor type.	Alarm	Yes
Sensor not connected	OK	No

5.9.6.6   Application and Setting Notes

Parameter: Sensor type

- Default setting (_:11611:102) **Sensor type** = *Pt 100*

The **Sensor type** parameter is used to set the sensor element used. You can select between *Pt 100*, *Ni 100* and *Ni 120*.

Parameter: Temperature unit

To change the display and evaluation of measured temperature values from °C to °F, adapt the DIGSI user default settings accordingly.

Proceed as follows:

- In DIGSI select the menu item **Extras** --> **Settings**.

- In the **Settings** view select the menu item **DIGSI 5 User preferences**.

- Under **Standard unit system** change the setting value of the unit system used from *SI units* to *US units*.
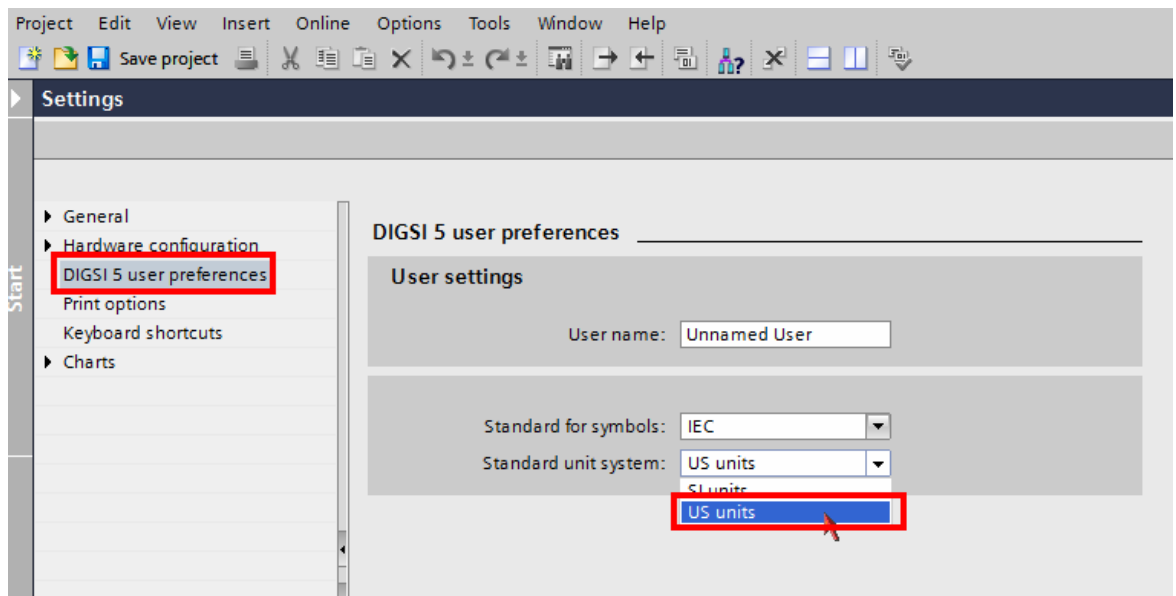
[scfahrht-190214-01, 1, en_US]

Figure 5-104   Change of the Display Between °C and °F

The following settings and information table shows only 1 of the 12 sensors, as the setting possibilities of the 12 sensors do not differ.

5.9.6.7 Settings

Addr.	Parameter	C	Setting Options	Default Setting
General				
_:2311:103	General:Port		• port E • port F • port J • port N • port P	port J
Sensor 1				
_:11611:102	Sensor 1:Sensor type		• Pt 100 • Ni 100 • Ni 120	Pt 100

5.9.6.8 Information List

No.	Information	Data Class (Type)	Type
General			
_:2311:53	General:Health	ENS	O
_:2311:56	General:Failure	SPS	O
Sensor 1			
_:11611:52	Sensor 1:Health	ENS	O
_:11611:60	Sensor 1:Failure	SPS	O
_:11611:80	Sensor 1:TmpOut	MV	O

5.9.7 RTD Unit Serial

5.9.7.1 Overview

The **RTD unit serial** function:

- Communicates with an external RTD unit serial via the Slave Unit Protocol (SUP) and records the measured temperatures from the RTD unit

- Provides the captured temperatures to the temperature supervision function

- Monitors communication with the RTD unit

The **RTD unit Serial** function is set up structurally in the same manner as the **RTD unit Ether.** function. The mode of operation is also identical (see *5.9.6.3 Communication with an RTD Unit*).

5.9.7.2 Application and Setting Notes

Parameter: Port

- Default setting **(_:2311:103)** **Port** = *F*

With the **Port** parameter, you set the slot for the communication module that will be used for the connection with an external RTD unit.
If you want to connect the external RTD box to an Ethernet plug-in module, set the parameter **Port** = *Port F* , *Port E*, *Port P*, or *plug-in module position*.

Parameter: Channel number

- Default setting **(_:2311:105)** **Channel number** = *1*

A serial communication module optionally uses 2 channels. With the **Channel number** settings, you set the channel number (1 or 2) through which the RTD unit is connected to the device. The communication module inputs are labeled with the channel numbers.

Parameter: Slave address

- Default setting **(_:2311:106)** `Slave address` = *1*

Use the `slave address` parameter to define the device address of the RTD unit. If only one RTD unit is connected to the serial bus, the default value *1* can be used. The same device address has to be set on the RTD unit. The device address is important for distinguishing among several RTD units connected to a serial bus. Set a unique device address (for example 1, 2 and 3 when connecting 3 RTD units) for each RTD unit and the same device address for the parameter `slave address` in the 3 **RTD unit serial** functions.

The following settings and information table shows only 1 of the 12 sensors, as the setting possibilities of the 12 sensors do not differ.

5.9.7.3 Settings

Addr.	Parameter	C	Setting Options	Default Setting
General				
_:2311:103	General:Port		• port E • port F • port J • port N • port P	port J
_:2311:105	General:Channel number		1 to 2	1
_:2311:106	General:Slave address		1 to 247	1
Sensor 1				
_:11611:102	Sensor 1:Sensor type		• Pt 100 • Ni 100 • Ni 120	Pt 100

5.9.7.4 Information List

No.	Information	Data Class (Type)	Type
General			
_:2311:53	General:Health	ENS	O
_:2311:56	General:Failure	SPS	O
Sensor 1			
_:11611:52	Sensor 1:Health	ENS	O
_:11611:60	Sensor 1:Failure	SPS	O
_:11611:80	Sensor 1:TmpOut	MV	O

5.9.8 Communication with RTD Unit

5.9.8.1 Integration of a Serial RTD Unit (Ziehl TR1200)

Connection of the Communication Lines

Figure 5-105 shows how you connect the RTD box to the SIPROTEC 5 device. Note that Pin 1 of the RJ45 plug is connected to RTD-B and Pin 2 is connected to RTD-A.
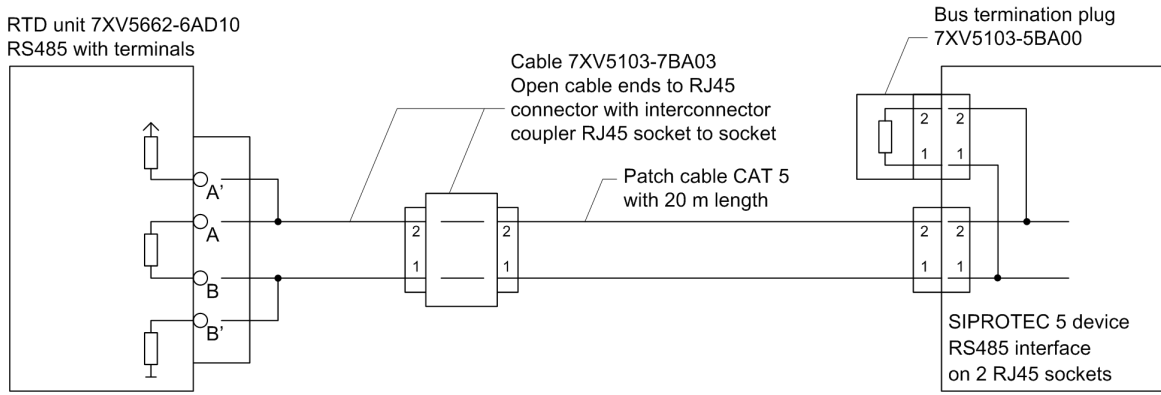
[dwverbau-201112-01.tif, 1, en_US]

Figure 5-105   Connection of the RTD Unit to the SIPROTEC 5 Device

Adding a USART Module

Add a USART-AB-1EL or a USART-AC-2EL USART module in DIGSI to the device. The USART module must be inserted at one of the plug-in positions for communication modules in the base module or in the CB202 expansion module (refer to the following figure).
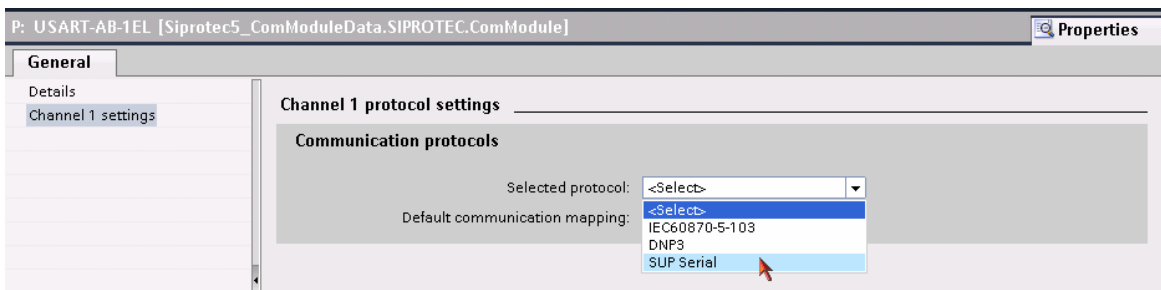

[scauser3-190214-01, 1, en_US]

Figure 5-106   Insertion Position for a USART Module

Selecting the SUP Protocol

Select the Slave Unit Protocol (SUP). This protocol is responsible for the communication between the SIPROTEC 5 device and the RTD Unit.

[scauser4-220114-01-DE, 1, en_US]

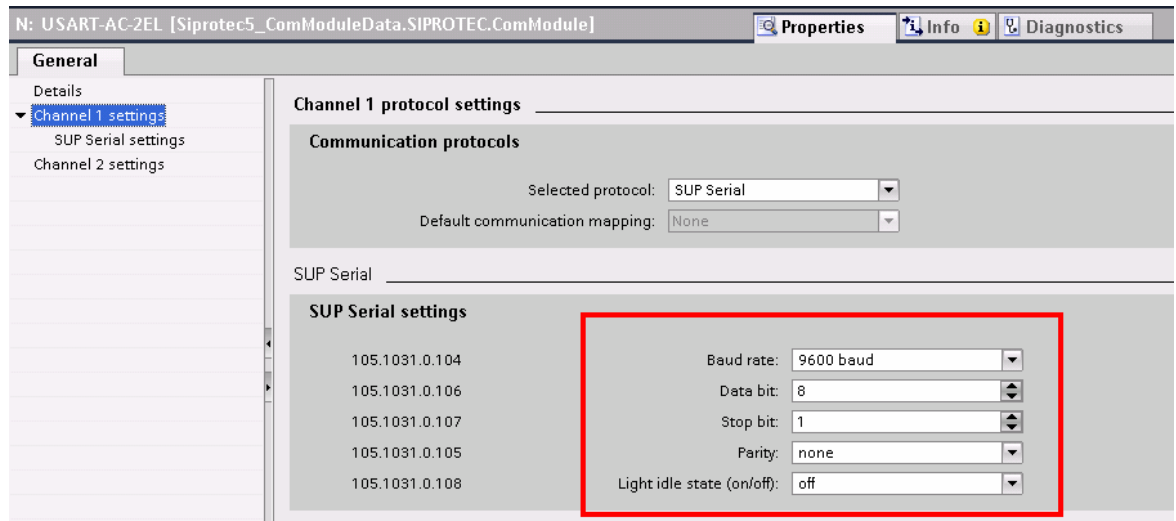Figure 5-107   Selecting the SUP Protocol

Communication Settings

Make the communications settings for the relevant serial channels. For this, use the default settings specified by the RTD box. Normally, you must adapt only the parameterization of the SIPROTEC 5 device to the settings of the RTD box. Make sure that the setting values in both devices are the same. The settings of the `Non-flickering light (on/off):` is not relevant for the RS485 interface.


> **NOTE**
>
> The driver for the USART module for the SUP protocol is not preinstalled as standard for the initial use of this interface (following the firmware update).

[scauser5-220114-01-DE, 1, en_US]

Figure 5-108   Making the Communication Settings

With the selection of the SUP protocol for the RTD box DIGSI automatically adds the function group **Analog units** to your device configuration. You can now instantiate the function **RTD box serial 1** (refer to the following figure).
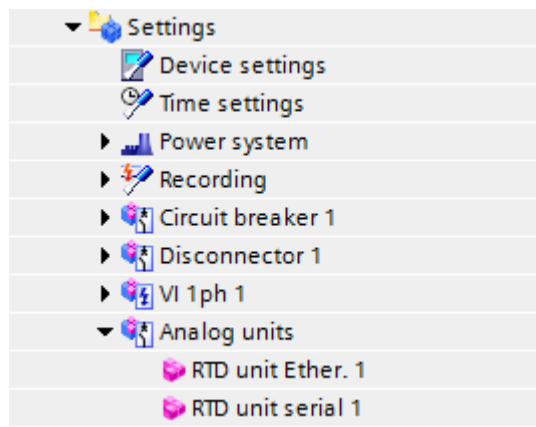

[scauser6-190214-01, 1, en_US]

Figure 5-109   Analog-Unit Instance

Now, set the channel number over which the SUP protocol runs. In addition, set the slave address of the RTD box. This address must be set with the same value in the RTD box (refer to the following figure).

The following device configuration must be set on the TR1200 RTD unit when the RTD unit is used for the first time:

- Bus protocol: mod

- Device address: 1

- Baud rate: 9600

- Parity: no
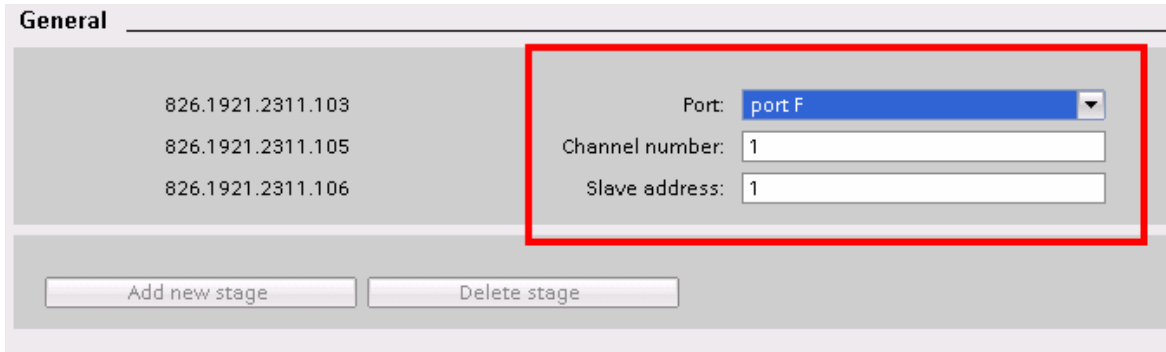
[scauser7-220114-01-DE, 1, en_US]

Figure 5-110   Setting the Port, Channel Number, and Slave Address

Finally, load the configuration in the device.

5.9.8.2 Integration of an RTD-Unit Ether. (TR1200 IP)

Device Configuration

In the DIGSI, insert an Ethernet module into the provided slot, thus, adding the module to the device configuration. *Figure 5-111* displays the available slots in the base module or on the expansion module CB 202. Alternatively, you can also use the integrated Ethernet interface Port J.
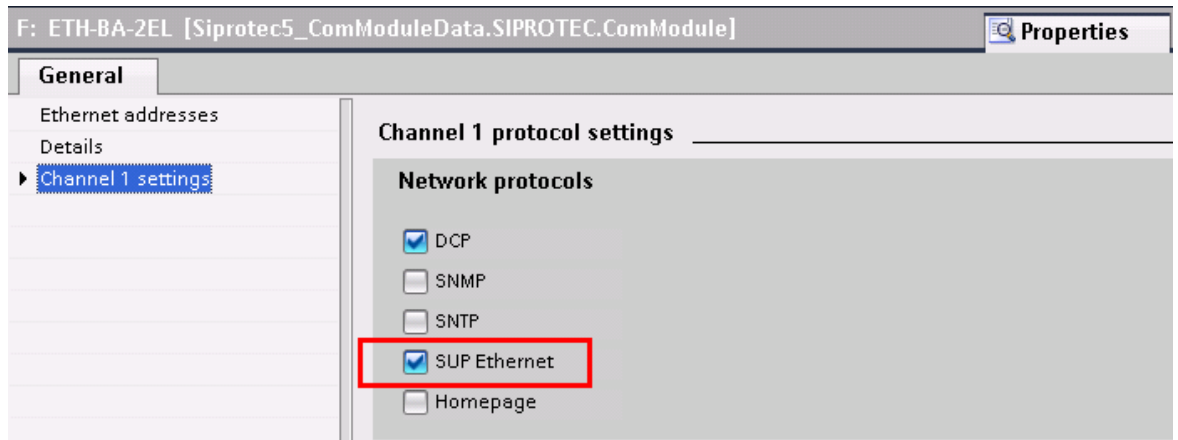

[scautcp1-220114-01-DE, 1, en_US]

Figure 5-111   Inserting an Ethernet Module
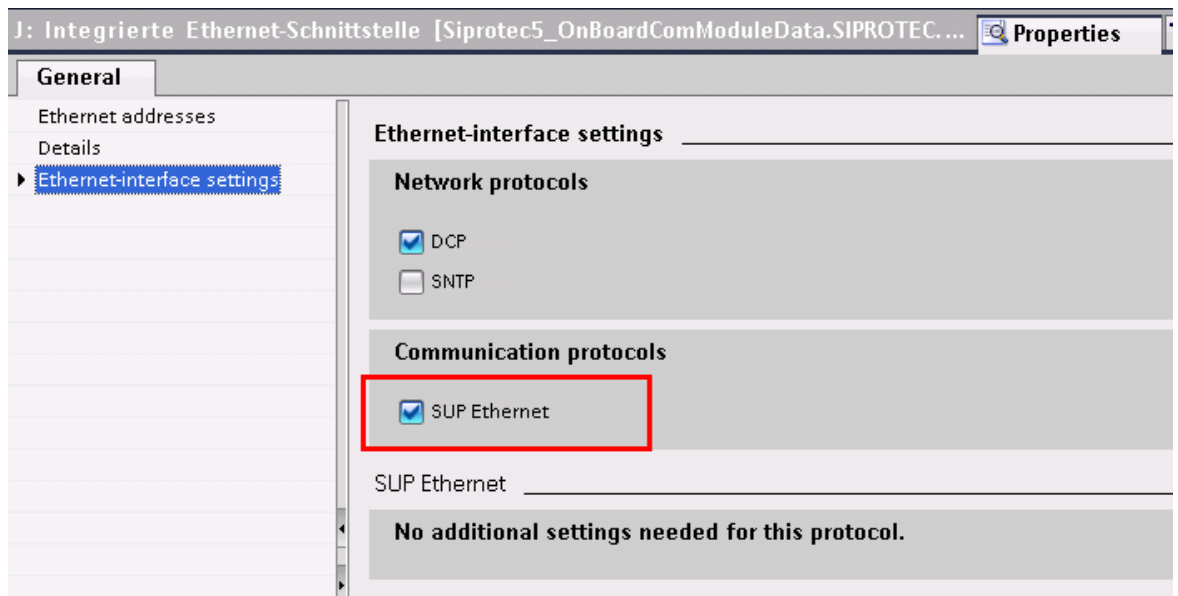
Communication Settings

Activate the SUP Ethernet protocol for the Ethernet module.

[scautcp2-220114-01-DE, 1, en_US]

Figure 5-112   SUP Ethernet Protocol Activation

This protocol is also available for Port J of the integrated Ethernet interface of the base module (refer to following figure).

[scautcp3-220114-01-DE, 1, en_US]

Figure 5-113   SUP Ethernet Protocol Activation (base module)

With the selection of the SUP protocol for the RTD unit, DIGSI automatically adds the **Analog units** function group and the **RTD unit Ether.** function to your device configuration (refer to the following figure).
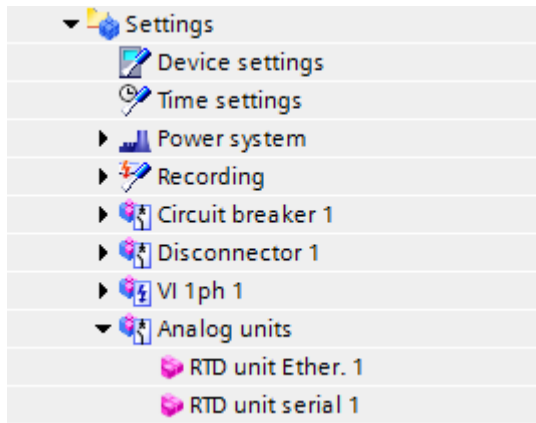
[scauser6-190214-01, 1, en_US]

Figure 5-114   Analog Unit Instance

Now, set the port over which the SUP protocol runs. In addition, set the IP address of the RTD box (refer to the following figure). This address must be set with the same value in the RTD box.
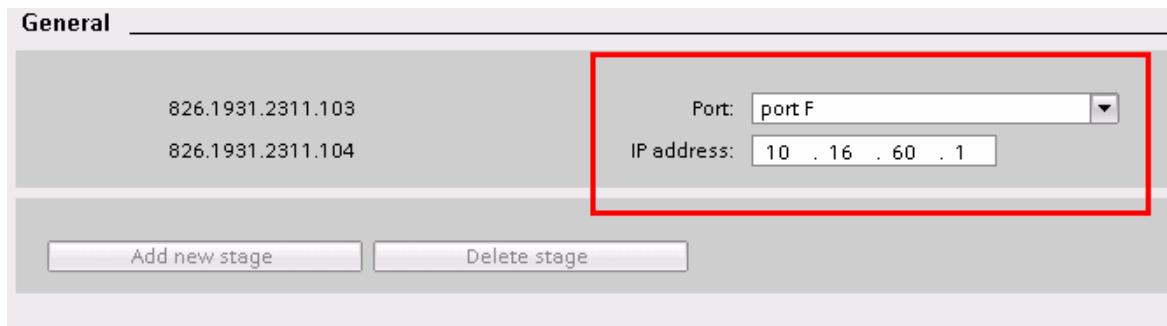
[scautcp5-220114-01-DE, 1, en_US]

Figure 5-115   Setting the Port and IP Address

Finally, load the configuration in the device.

5.9.8.3   Temperature Simulation without Sensors

Connect a resistor on the sensor terminals of the RTD unit. Using this resistor, simulate a constant temperature. The resistance value should be around 50 Ω to 200 Ω.

If you want to simulate a changeable temperature, connect an adjustable resistor of maximum 470 Ω instead of a fixed resistor.