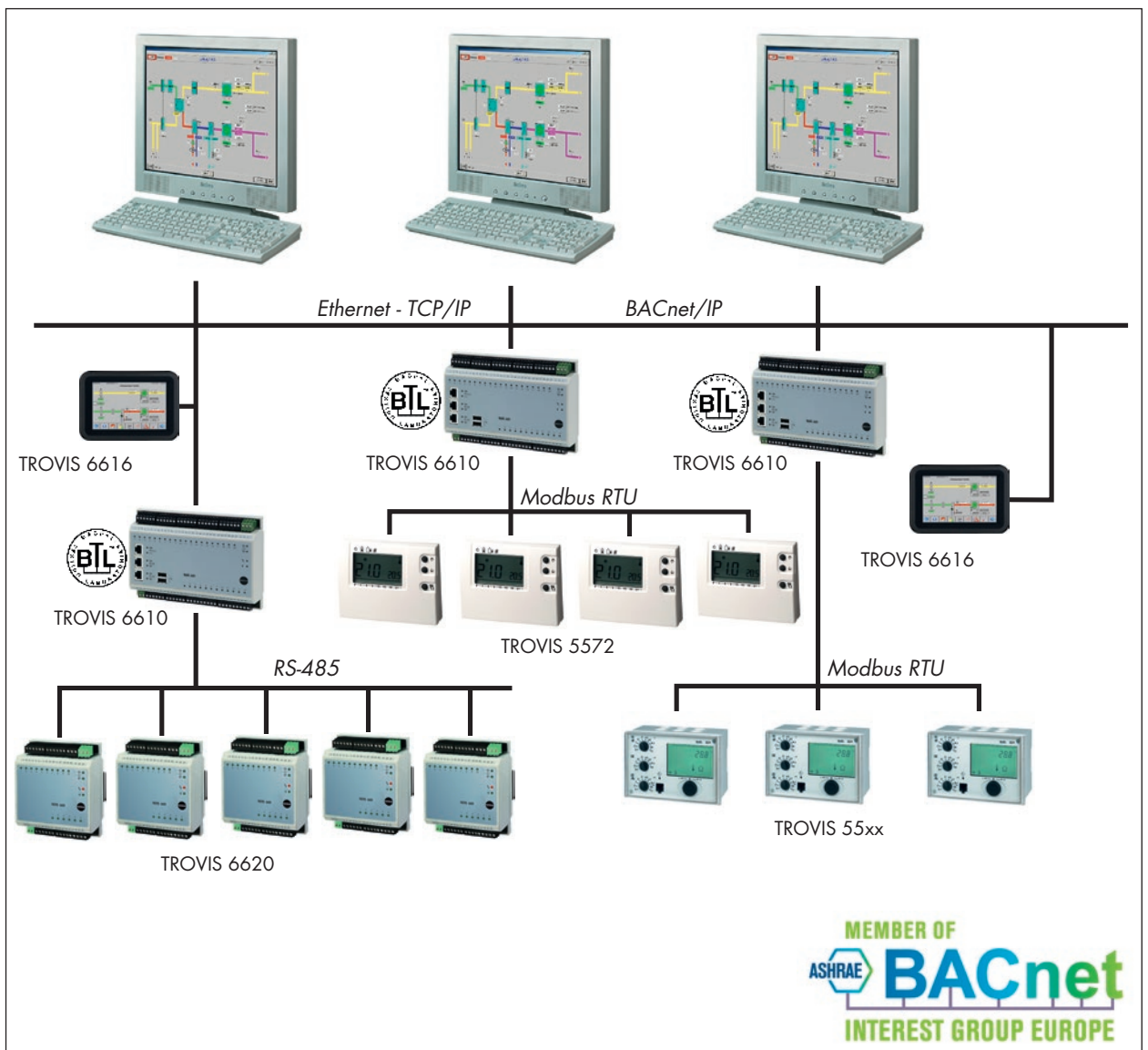# System Integration Guidelines

for electrical technicians

These system integration guidelines give an insight into the most important points concerning the installation and commissioning of SAMSON's TROVIS 6600 Automation System.

Inhalt

1   System design and properties

The TROVIS 6600 Automation System consists of self-contained automation stations consisting of a TROVIS 6610 CPU Module, TROVIS 6620 I/O Modules, TROVIS 6625 Input Modules, TROVIS 6630 AO Moduls, TROVIS 6640 AI Modules and optional TROVIS 6616 Web Terminals. The visualization software usually runs under Microsoft Windows® operating system.

A maximum of 20,000 physical data points can be processed by an entire system. The TROVIS 6620 I/O Modules TROVIS 6625 Input Modules, TROVIS 6630 AO Modules and TROVIS 6640 AI Modules are peripheral devices which communicate with the TROVIS 6610 CPU Module over RS-485. The TROVIS 6610 CPU Modules communicate with each other as well as with the control station over Ethernet (BACnet/IP, BACnet PTP, TCP/IP or Modbus).

The highly flexible modules are suitable for implementing cost-effective solutions. DDC concepts with a high degree of distribution within a network are easy to implement.

Components in the system

- Control station   TROVIS-LS
- Operating stations   TROVIS-BS
- CPU module   TROVIS 6610*
- I/O module   TROVIS 6620*
- Input module   TROVIS 6625
- AO module   TROVIS 6630
- AI module   TROVIS 6640
- Web terminal   TROVIS 6616
                             * various models

Associated software

- Operating system   Usually Windows®
- Process visualization   e.g. Wonderware InTouch
- Graphical project management tool   TROVIS 6690
- DA-Server 6600   TROVIS 6691
- OPC-Server 6600   TROVIS 6692

Accessories

- End-of-line termination for I/O bus
  (2 pcs. included in the scope
  of delivery of TROVIS 6610)   1400-9561
- 1-port bus hub   1400-6169
- 4-port bus hub   1400-7140
- Modbus master cable incl.
  four terminating resistors   1400-9748
- Modbus slave cable   1400-9749
- Serial connecting cable   1400-9750

- Cable converter for two-wire circuit   1400-8800
- Cable converter for four-wire circuit   1400-7308
- Terminal block for TROVIS 6610   1991-0133
- Terminal block for TROVIS 6620   1991-0134
- Terminal block for TROVIS 6630   1992-4304
- Terminal block for TROVIS 6640   1992-4305

2   Quick introduction

2.1 Max. number of units

32   TROVIS 6610 CPU Modules per system

32   TROVIS 6620/TROVIS 6625/TROVIS 6630/TROVIS 6640 Modules
     per CPU module

TROVIS 6610 CPU Module

40   physical data points including:

   20   universal inputs, which are set individually for each input:

      • Analog input: Pt 1000 (–40 to 160 °C)
                        0 to 2000 Ω
        also 0 to 10 V for TROVIS 6610-0001 and higher

      • Binary input including
        channel 1 and 2 as counter inputs up to 1 kHz (1:1)

   12   binary outputs · 2 A, 250 V AC (inductive)

    8   analog outputs · 0 to 10 V

TROVIS 6620 I/O Module

20   physical data points including:

   10   universal inputs, which are set individually for each input:

      • Analog input: Pt 1000 (–40 to 160 °C)
                        0 to 2000 Ω
        also 0 to 10 V for TROVIS 6620-0001 and higher

      • Binary input including
        channel 1 and 2 as counter inputs up to 1 kHz (1:1)

   6   binary outputs · 2 A, 250 V AC (inductive)

    4   analog outputs · 0 to 10 V

TROVIS 6625 Input Module

20   binary inputs optionally internally or externally powered
     (max. 24 V DC)

TROVIS 6630 AO Module

 8   analog outputs, optionally current or voltage

   – 0 to 20 mA/4 to 20 mA
   – 0 to 10 V/2 to 10 V

TROVIS 6640 AI Module

8   analog inputs, optionally current (transmitter supply) or voltage, Pt 100
    (two/three-wire), Pt 1000 (two/three-wire), resistance

   – 0 to 20 mA/4 to 20 mA
   – 0 to 10 V/2 to 10 V
   – Pt 100, two/three-wire (–50 to 250 °C)
   – Pt 1000, two/three-wire (–50 to 250 °C)
   – 0 to 2000 Ω

2.2 Network expansion (without repeaters, hubs etc.)

Ethernet   100BaseT   typ. LAN
I/O bus   1200 m

2.3 Cable recommendation

24 V AC   1.5 mm² stranded wire
Ethernet   min. Cat 5 cable, shielded (STP)
I/O bus   JY(ST)Y 2 x 2 x 0.8

2.4 Power supply

24 V AC, max. 280 VA for one TROVIS 6610 CPU Module and a total of 32 TROVIS 6620, TROVIS 6625, TROVIS 6630 and/or TROVIS 6640 Modules

2.5 Important instructions

- In **TROVIS 6610-0001** CPU Modules and **TROVIS 6620-0001** I/O Modules, the DIP switches are used to determine how a universal input is to be used. The DIP switches allow the input to be set either as a binary, sensor or resistance input or as a voltage input.

  The DIP switches for module configuration are located at the back of the module. **Therefore, the module must be configured first before installation.** The following switch positions apply:

  ON   Configuration of the universal input as a binary, sensor or resistance input

  OFF   Configuration of the universal input as a voltage input

Back of module
(TROVIS 6610-0001
and
TROVIS 6620-0001)

TROVIS 6610 CPU Module   TROVIS 6620 I/O Module
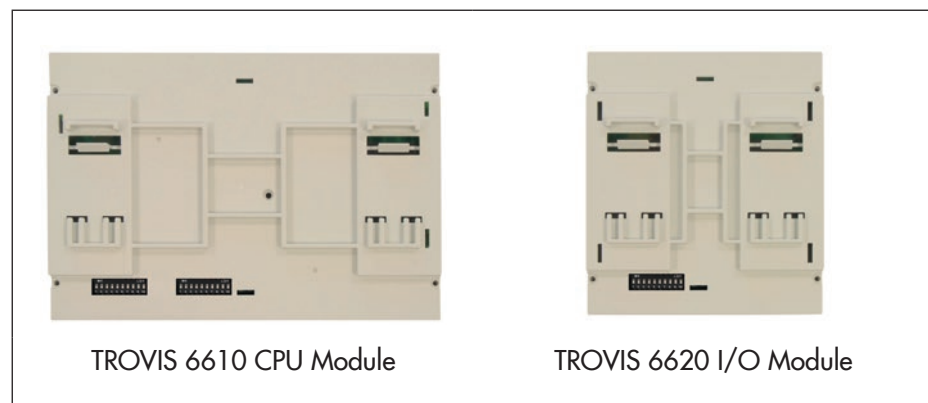
In **older models**, the universal input cannot be configured as a voltage input. Therefore, configuration is not required. In **TROVIS 6610-0002** and **TROVIS 6620-0002** and higher, the universal inputs are configured in the TROVIS 6690 Graphical Project Management Tool.

- Required distance of at least 30 mm between cable duct and TROVIS 6610 CPU Module as well as the TROVIS 6620, TROVIS 6625, TROVIS 6630 and TROVIS 6640 Modules.
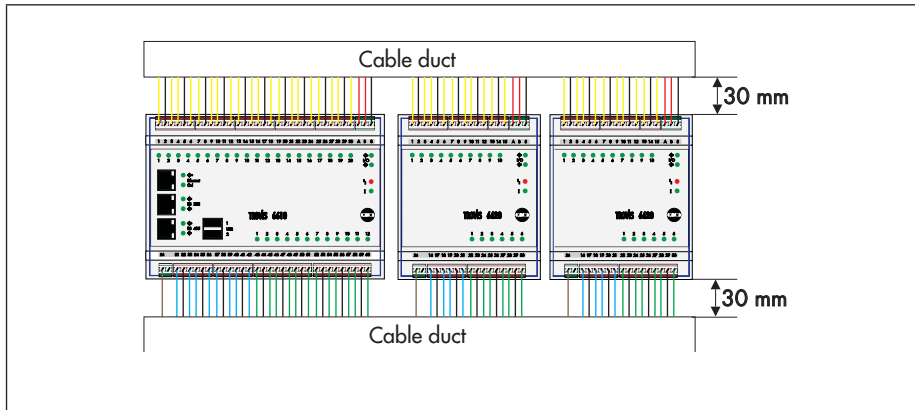
Minimum distance to be kept between modules and cable duct

- Two-core wire-end ferrules are used for the voltage supply wiring to ensure that the other modules remain connected when a module is disconnected from the power supply.
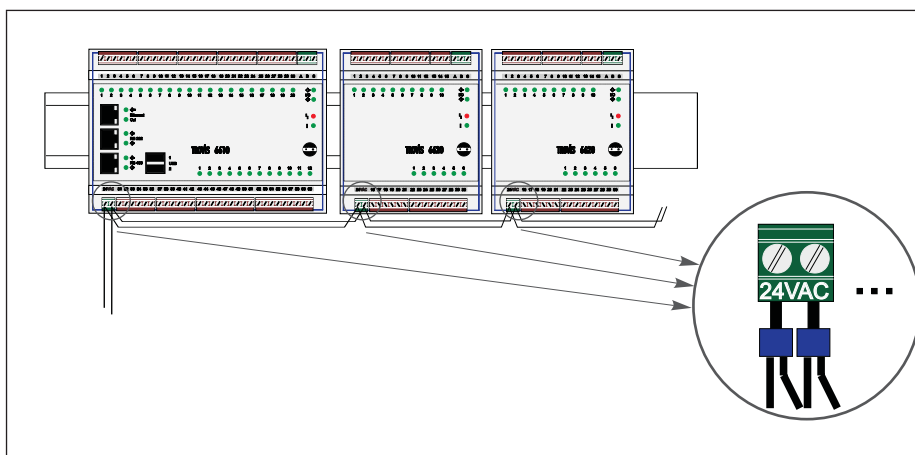
Wiring with two-core wire-end ferrules

- Two-core wire-end ferrules are used for the wiring of the I/O bus to guarantee communication between the other modules with the TROVIS 6610 CPU Module when a module is disconnected.

2.6 Installation

- Write down the IP address of the TROVIS 6610 CPU Module before installing it as the IP address will be needed later on during the system integration.

- Before installation, perform the configuration of the modules (TROVIS 66x0-0001 or higher).

- As a rule, the modules are installed in a separate instrumentation cabinet.

- Installation directly in the power unit is also possible, provided sufficient shielding is ensured by using a separating metal plate.

- All modules are equipped with a fixture base for rail mounting TS 35.

- Keep a minimum distance of 30 mm between the module terminals and the cable duct on wiring the modules!

Nameplate of TROVIS 6610 CPU Module with IP address

```
SAMSON  TROVIS  6610
CPU Module
Model no.      6610-000x
Serial no.     XXXXXXXX
Var.-ID        XXXXXXX
MAC address    XX:XX:XX:XX:XX:XX
IP address     XXX.XXX.XXX.XXX
IO address     XX:XX:XX:XX
Power supply:  24 V AC 50 Hz 15 VA          Made in Germany

                                            DMC

                                            variable
```

Nameplate of TROVIS 6620 I/O Module
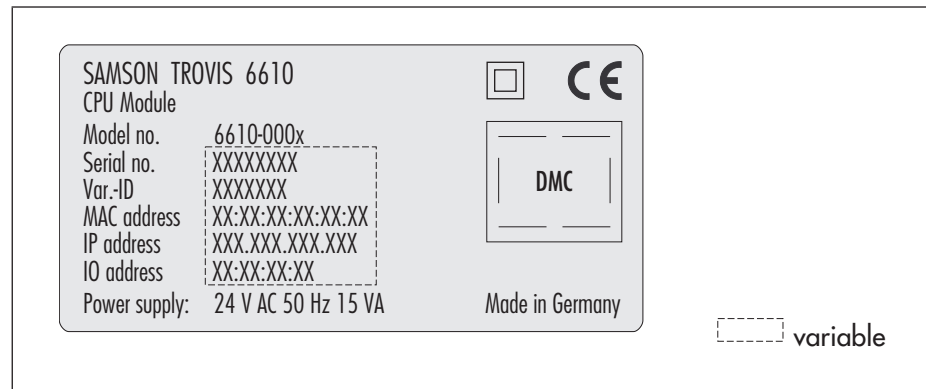
```
SAMSON  TROVIS  6620
IO Module

Model no.      6620-000x
Serial no.     XXXXXXXX
Var.-ID        XXXXXXX
IO address     XX:XX:XX:XX
Power supply:  24 V AC 50 Hz 6 VA     Made in Germany

                                      DMC

                                      variable
```
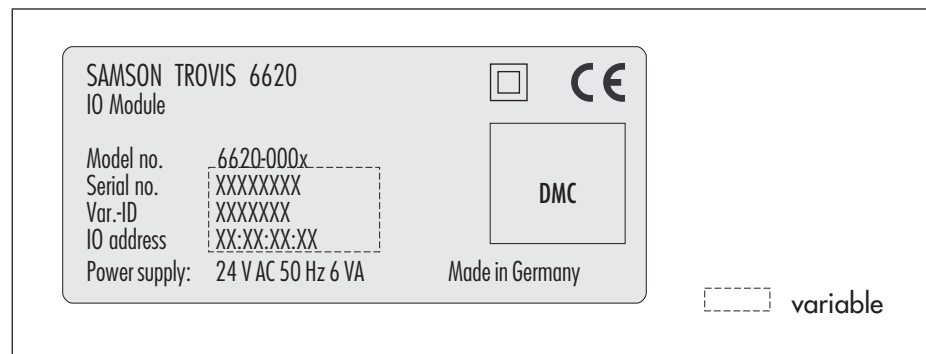
2.7 RJ connector pinout

The RJ connector pinout is not standardized. The following pinout applies to these guidelines and the TROVIS 6610 CPU Module:

RJ-45
8-pole

RJ-12
6-pole
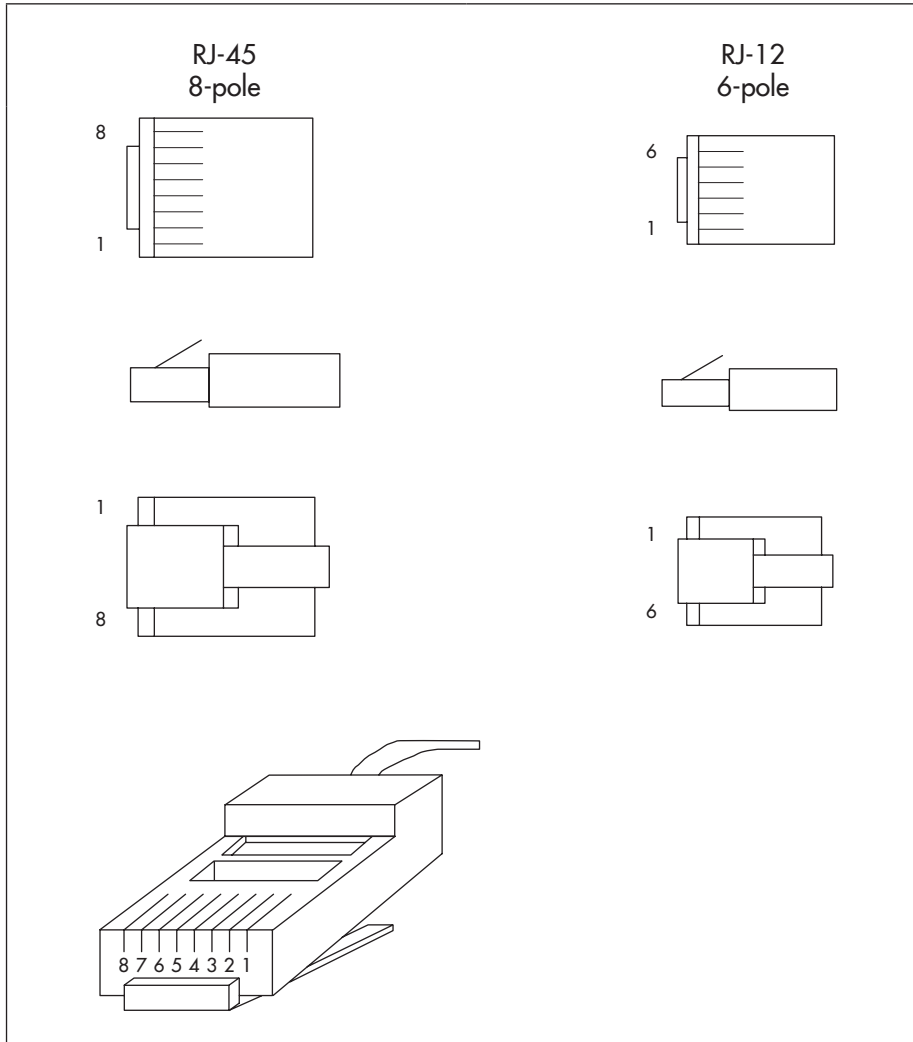
RJ connector

3   Technical data

3.1 TROVIS 6610 CPU Module

TROVIS 6610 CPU Module

Technical data of TROVIS 6610 CPU Module	
Power supply	
Power supply	24 V AC (20.4 to 27.6 V AC)
Frequency range	48 to 62 Hz
Power consumption	15 VA
Connection	2-pin screw clamp terminal (green) Max. 2.5 mm² wire cross-section
Temperature range	
Operation	0 to 55 °C
Transportation and storage	−20 to 70 °C
Relative humidity	Normal, no dew formation
Electromagnetic compatibility	
Noise emission	According to EN 61000-6-3
Noise immunity	According to EN 61000-6-2
Device safety	
Class of protection	II according to EN 61140: 2003
Overvoltage category	II according to EN 60664-1
Degree of contamination	2 according to EN 60664-1
Degree of protection	IP 20 according to IEC 60529
Installation	
Dimensions including terminals	Width x height x depth: 185 x 130 x 60 (in mm)
Weight	Approx. 0.7 kg
Installation	On rails (all DIN and EN types)
I/O connections	Screw clamp terminals Max. 2.5 mm² wire cross-section

Technical data of TROVIS 6610 CPU Module	
20 universal inputs including two counter inputs (channels 1 and 2)	
Note: There is no galvanic isolation between inputs and to the analog outputs!	
When used as binary inputs	
Power supply to binary inputs	Internally powered/approx. 10 V DC
Measuring current in short circuit	500 µA
Input load	Max. 100 Ω
Minimum pulse length (1:1) (channels 1 and 2)	> 0.5 ms (< 1 kHz) > 500 ms (TROVIS 6610-0001 only)
Counter pulse	Positive edge triggered
Minimum pulse length (channels 3 to 20)	1 s
LED on the module for counter inputs	ON = Contact made or < 0.4 V OFF = Contact open or > 4 V
LED on the module for binary inputs	ON = Contact made or < 0.05 V OFF = Contact open or > 1 V
When used as analog inputs	
Sensor	
Type of sensor	Pt 1000 in two-wire connection
Input range	−40 to 160 °C
Resolution	10 bit
Accuracy	< 0.5 % of measuring range
Temperature influence	< 0.1 % of measuring range per 10 K
Measuring current	500 µA
Resistor	
Input range	0 to 2000 Ω · Two-wire connection
Resolution	10 bit
Accuracy	< 0.1 % of measuring range
Temperature influence	< 0.05 % of measuring range per 10 K
Measuring current	500 µA
Voltage (TROVIS 6610-0001 and higher)	
Input range	0 to 10 V DC
Resolution	10 bit
Accuracy	< 0.5 % of measuring range
Temperature influence	< 0.04 % of measuring range per 10 K
Input resistance	10 kΩ
12 binary outputs	
Load of relay	250 V AC, 2 A inductive load 250 V AC, 3 A resistive load

Technical data of TROVIS 6610 CPU Module	
8 analog outputs	
Output range	0 to 10 V DC
Resolution	10 bit
Accuracy	< 0.5 % of measuring range
Temperature influence	< 0.03 % of measuring range per 10 K
Permissible load	> 3.3 kΩ
Short-circuit current	5.5 mA
Indicators	
LED status indication	Binary input and output CPU operation and malfunction Communication (Rx/Tx) for each interface
Interfaces	
Supervisory level/CPU modules	
Specification	According to IEEE 802.3
Transmission rate	10/100 Mbit/s
Protocol	TCP/IP
Connection	RJ-45 · 8-pole
I/O bus	
Specification	RS-485 Two-wire, polarity insensitive
Galvanic isolation	Yes
Transmission rate (kBit/s)	9.6, 19.2, 38.4, 57.6, 115.2
Protocol	SAMSON
Connection	3-pin screw clamp terminal (green) Max. 2.5 mm² wire cross-section
RS-232	
Specification	RS-232 with RTS/CTS control lines
Galvanic isolation	No
Transmission rate (kBit/s)	9.6, 19.2, 38.4, 57.6, 115.2
Connection	RJ-45 · 8-pole
Modbus	
Specification	RS-485 · Four-wire Two-wire over external jumper
Galvanic isolation	Yes
Transmission rate (kBit/s)	9.6, 19.2, 38.4, 57.6, 115.2
Protocol	Modbus RTU master or slave
Connection	RJ-45 · 8-pole

Technical data of TROVIS 6610 CPU Module	
USB	
Specification	2 x USB 2.0 full speed 12 Mbit/s Memory pen, modem (USB mass storage, USB CDC/ACM)

State of delivery

The TROVIS 6610 CPU Module is delivered without any plant operating software. The MAC address as well as the IP address are written on the left-hand side of the nameplate.

The subnet mask is 255.255.0.0. A gateway has not been entered.

Accessories (included in the scope of delivery)

Item	Qty.	Designation	Type	Item number
1	2	End-of-line termination	200 Ω	1400-9561

Terminating resistors

200 Ω   200 Ω
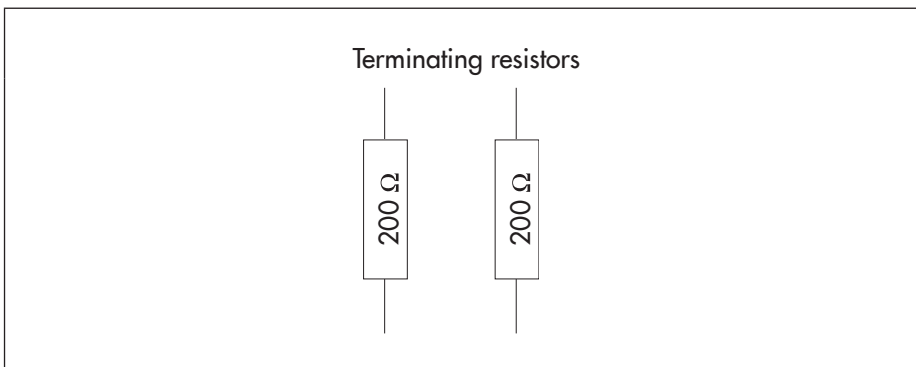
End-of-line termination (1400-9561)

3.2 TROVIS 6620 I/O Module

**TROVIS 6620
I/O Module**

Technical data of TROVIS 6620 I/O Module	
Power supply	
Power supply	24 V AC (20.4 to 27.7 V AC)
Frequency range	48 to 62 Hz
Power consumption	6 VA
Connection	2-pin screw clamp terminal (green) Max. 2.5 mm² wire cross-section
Temperature range	
Operation	0 to 55 °C
Storage and transportation	−20 to 70 °C
Humidity rating	Normal, no dew formation
Electromagnetic compatibility	
Noise emission	According to EN 61000-6-3
Noise immunity	According to EN 61000-6-2
Device safety	
Class of protection	II according to EN 61140: 2003
Overvoltage category	II according to EN 60664-1
Degree of contamination	2 according to EN 60664-1
Degree of protection	IP 20 according to IEC 60529
Installation	
Dimensions including terminals	Width x height x depth: 110 x 130 x 60 (in mm)
Weight	Approx. 0.5 kg
Installation	On rails (all DIN and EN types)
I/O connections	Screw clamp terminals Max. 2.5 mm² wire cross-section

Technical data of TROVIS 6620 I/O Module	
10 universal inputs including two counter inputs (channels 1 and 2)	
Note: There is no galvanic isolation between inputs and to the analog outputs!	
When used as binary inputs	
Power supply to binary inputs	Internally powered/approx. 10 V DC
Measuring current in short circuit	500 μA
Input load	Max. 100 Ω
Minimum pulse length (1:1) (channels 1 and 2)	> 0.5 ms (< 1 kHz) > 500 ms (TROVIS 6620-0001 only)
Counter pulse	Positive edge triggered
Minimum pulse length (channels 3 to 20)	1 s
LED on the module for counter inputs	ON = Contact made or < 0.4 V OFF = Contact open or > 4 V
LED on the module for binary inputs	ON = Contact made or < 0.05 V OFF = Contact open or > 1 V
When used as analog inputs	
Sensor	
Type of sensor	Pt 1000 in two-wire connection
Input range	−40 to 160 °C
Resolution	10 bit
Accuracy	< 0.5 % of measuring range
Temperature influence	< 0.1 % of measuring range per 10 K
Measuring current	500 μA
Resistor	
Input range	0 to 2000 Ω · Two-wire connection
Resolution	10 bit
Accuracy	< 0.1 % of measuring range
Temperature influence	< 0.05 % of measuring range per 10 K
Measuring current	500 μA
Voltage (TROVIS 6620-0001 and higher)	
Input range	0 to 10 V DC
Resolution	10 bit
Accuracy	< 0.5 % of measuring range
Temperature influence	< 0.04 % of measuring range per 10 K
Input resistance	10 kΩ

Technical data of TROVIS 6620 I/O Module	
6 binary outputs	
Load of relay	250 V AC, 2 A inductive load 250 V AC, 3 A resistive load TROVIS 6620-0000/-0001: 250 V AC, 3 A inductive load 250 V AC, 8 A resistive load
4 analog outputs	
Output range	0 to 10 V DC
Resolution	10 bit
Accuracy	< 0.5 % of measuring range
Temperature influence	< 0.03 % of measuring range per 10 K
Permissible load	> 3.3 kΩ
Short-circuit current	5.5 mA
Indicators	
LED status indication	Binary input and output Module operation and malfunction Communication (Rx/Tx)
Interfaces	
I/O bus	
Specification	RS-485 · Two-wire, polarity insensitive
Galvanic isolation	Yes
Transmission rate (kBit/s)	9.6, 19.2, 38.4, 57.6, 115.2 (automatic adaptation to Baud rate in CPU module)
Protocol	SAMSON
Connection	3-pin screw clamp terminal (green) Max. 2.5 mm² wire cross-section

3.3 TROVIS 6625 Input Module

**TROVIS 6625
Input Module**

Technical data of TROVIS 6625 Input Module	
Power supply	
Power supply	24 V AC (20.4 to 27.7 V AC)
Frequency range	48 to 62 Hz
Power consumption	8 VA
Connection	2-pin screw clamp terminal (green) Max. 2.5 mm² wire cross-section
Temperature range	
Operation	0 to 55 °C
Storage and transportation	−20 to 70 °C
Humidity rating	Normal, no dew formation
Electromagnetic compatibility	
Noise emission	According to EN 61000-6-3
Noise immunity	According to EN 61000-6-2
Device safety	
Class of protection	II according to EN 61140: 2003
Overvoltage category	II according to EN 60664-1
Degree of contamination	2 according to EN 60664-1
Degree of protection	IP 20 according to IEC 60529
Installation	
Dimensions including terminals	Width x height x depth: 110 x 130 x 60 (in mm)
Weight	Approx. 0.5 kg
Installation	On rails (all DIN and EN types)
I/O connections	Screw clamp terminals Max. 2.5 mm² wire cross-section

Technical data of TROVIS 6625 Input Module	
20 binary inputs	
Note: There is no galvanic isolation between inputs!	
When used as internally powered binary inputs	
Power supply to binary inputs	Internally powered/18 to 33 V DC
LED on the module	LED on when RS < 50 Ω LED off when RS > 10 kΩ
When used as externally powered binary inputs	
Power supply to binary inputs	Max. 24 V DC (+15 %)
Input resistance	Approx. 8 kΩ
LED on the module	LED on when > 20 V DC LED off when < 8 V DC
Indicators	
LED status indication	Binary input Module operation and malfunction Communication (Rx/Tx)
Interfaces	
I/O bus	
Specification	RS-485 · Two-wire, polarity insensitive
Galvanic isolation	Yes
Transmission rate (kBit/s)	9.6, 19.2, 38.4, 57.6, 115.2 (automatic adaptation to Baud rate in CPU module)
Protocol	SAMSON
Connection	3-pin screw clamp terminal (green) Max. 2.5 mm² wire cross-section

3.4 TROVIS 6630 AO Module

TROVIS 6630
AO Module

Technical data of TROVIS 6630 AO Module	
Power supply	
Power supply	24 V AC (20.4 to 27.7 V AC)
Frequency range	48 to 62 Hz
Power consumption	Max. 8 VA
Power supply	24 V DC
Power consumption	Max. 7 W
Temperature range	
Operation	0 to 55 °C
Storage and transportation	−20 to 70 °C
Humidity rating	Max. 95 %, non-condensing
Electromagnetic compatibility	
Noise emission	According to EN 61000-6-3
Noise immunity	According to EN 61000-6-2
Device safety	
Class of protection	II according to EN 61140: 2003
Overvoltage category	II according to EN 60664-1
Degree of contamination	2 according to EN 60664-1
Degree of protection	IP 20 according to IEC 60529
Installation	
Dimensions including terminals	Width x height x depth: 110 x 130 x 60 (in mm)
Weight	Approx. 0.4 kg
Installation	On rails (all DIN and EN types)
I/O connections	Screw clamp terminals Max. 2.5 mm² wire cross-section

Technical data of TROVIS 6630 AO Module	
8 analog outputs	
When used as a voltage output	
Output ranges	0 to 10 V/2 to 10 V Adjustable overdrive (max. 12 V)
Resolution	< 0.001 V
Accuracy	< 0.1 %/< 0.13 % of measuring range
Temperature influence	< 0.0029 %/10 K of measuring range
Load resistance	> 1600 Ω
When used as a current output	
Output ranges	0 to 20 mA/4 to 20 mA Adjustable overdrive (max. 24 mA)
Resolution	< 0.001 mA
Accuracy	< 0.1 %/< 0.13 % of measuring range
Temperature influence	< 0.0045 % of measuring range/10 K
Load	< 800 Ω at 20 mA

3.5 TROVIS 6640 AI Module

TROVIS 6640
AI Module

Technical data of TROVIS 6640 AI Module	
Power supply	
Power supply	24 V AC (20.4 to 27.7 V AC)
Frequency range	48 to 62 Hz
Power consumption	8 VA
Power supply	24 V DC
Power consumption	8 W
Temperature range	
Operation	0 to 55 °C
Storage and transportation	−20 to 70 °C
Humidity rating	Normal, no dew formation
Electromagnetic compatibility	
Noise emission	According to EN 61000-6-3
Noise immunity	According to EN 61000-6-2
Device safety	
Class of protection	II according to EN 61140: 2003
Overvoltage category	II according to EN 60664-1
Degree of contamination	2 according to EN 60664-1
Degree of protection	IP 20 according to IEC 60529
Installation	
Dimensions including terminals	Width x height x depth: 110 x 130 x 60 (in mm)
Weight	Approx. 0.4 kg
Installation	On rails (all DIN and EN types)
I/O connections	Screw clamp terminals Max. 2.5 mm² wire cross-section

Technical data of TROVIS 6640 AI Module	
8 analog inputs	
When used as a voltage input	
Input ranges	0 to 10 V DC/2 to 10 V DC
Resolution	< 2.5 mV
Accuracy	< 0.1 %/< 0.13 % of measuring range
Temperature influence	< 0.0043 % of measuring range/10 K
Static destruction limit	−4 to 15 V
Load resistance	100 kΩ
When used as a current input	
Input ranges	0 to 20 mA/4 to 20 mA
Resolution	< 6 µA
Accuracy	< 0.15 %/< 0.13 % of measuring range
Temperature influence	< 0.0029 % of measuring range/10 K
Static destruction limit	± 50 mA
Load	500 Ω
Two-wire transmitter supply	24 V DC (max. 30 mA/channel), short-circuit protection, electronic current limiter
When used as a Pt 100 input (two-wire)	
Input range	−50 to 250 °C
Type of sensor	Pt 100 (two-wire)
Resolution	< 0.21 °C
Accuracy	< 0.4 % of measuring range
Temperature influence	< 0.1 % of measuring range/10 K
Measuring current	0.5 mA
When used as a Pt 100 input (three-wire)	
Input range	−50 to 250 °C
Type of sensor	Pt 100 (three-wire)
Resolution	< 0.08 °C
Accuracy	< 0.23 % of measuring range
Temperature influence	< 0.05 % of measuring range/10 K
Measuring current	0.5 mA

Technical data of TROVIS 6640 AI Module	
When used as a Pt 1000 input (two-wire)	
Input range	−50 to 250 °C
Type of sensor	Pt 1000 (two-wire)
Resolution	< 0.14 °C
Accuracy	< 0.14 % of measuring range
Temperature influence	< 0.03 % of measuring range/10 K
Measuring current	0.5 mA
When used as a Pt 1000 input (three-wire)	
Input range	−50 to 250 °C
Type of sensor	Pt 1000 (three-wire)
Resolution	< 0.13 °C
Accuracy	< 0.49 % of measuring range
Temperature influence	< 0.072 % of measuring range/10 K
Measuring current	0.5 mA
When used as a resistance input	
Input range	0 to 2000 Ω
Resolution	< 0.53 Ω
Accuracy	< 0.1 % of measuring range
Temperature influence	< 0.015 % of measuring range/10 K
Load	0.5 mA

3.6 TROVIS 6616 Web Terminal

TROVIS 6616 Web Terminal

Technical data of TROVIS 6616 Web Terminal	
Power supply	
Power supply	24 V AC or Power over Ethernet (PoE)
Power consumption	7.4 W
Grounding conductor PE	a) Wire cross-section stranded with ferrule without plastic sleeve, max. 1.5 mm² b) Wire cross-section stranded with ferrule with plastic sleeve, max. 0.5 mm²
Temperature range	
Operation	0 to 50 °C
Transportation and storage	0 to 70 °C
Relative humidity	10 to 90 %, non-condensing
Electromagnetic compatibility	
Noise emission	According to EN 61000-6-3
Noise immunity	According to EN 61000-6-2
Device safety	
Class of protection	II according to EN 61140: 2003
Overvoltage category	II according to EN 60664-1
Degree of contamination	2 according to EN 60664-1
Degree of protection	IP 65 at the front, IP 20 at the back
CE certification	EN 55022: 2010 Class B EN 55024: 2010 EN 61000-6-2: 2005
Performance	
CPU	Cortex A8 processor with ultra low voltage, 1 GHz
RAM	512 MB LPDDR RAM
Display	7" widescreen LED-TFT monitor, projected capacitive touch screen

| Technical data of TROVIS 6616 Web Terminal	
Resolution	800 x 480 pixels, can be used for micro-browser with 758 x 480 pixels
RS-232	1 x 9-pole
Ethernet 10/100 Mbit/s	1 x RJ-45
Interfaces	
USB	2x USB 2.0 A, 1x mini USB
Ethernet 10/100 with 802.3af PoE (Power over Ethernet)	1 x RJ-45
Dimensions	
Front dimensions	208 x 144 mm
Panel cut-out	186 x 123 mm

4   Attachment

To mount the modules, first hook the module on the top (1) of the rail and press down (2).

To detach it from the rail (4), use a screwdriver to lever the latching (3) downwards located underneath the module.

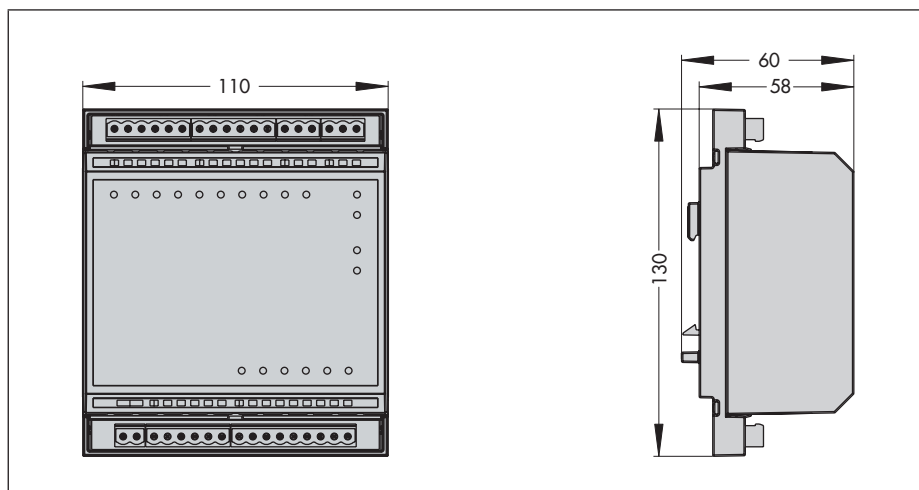The module is detached in this way from the rail (4).

4.1 TROVIS 6610 CPU Module

**Dimensions
TROVIS 6610
CPU Module**
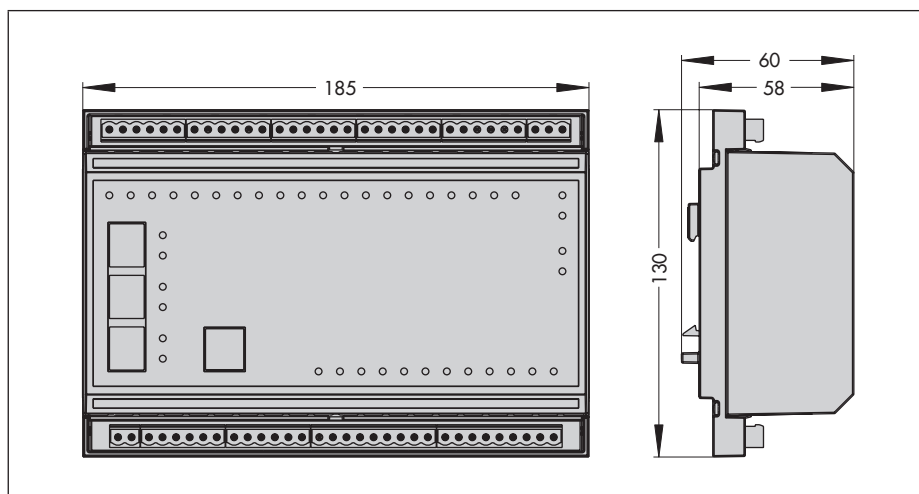
4.2 TROVIS 6620 I/O Module, TROVIS 6625 Input Module, TROVIS 6630 AO Module and TROVIS 6640 AI Module

**Dimensions
TROVIS 6620
I/O Module
TROVIS 6625
Input Module
TROVIS 6630
AO Module
TROVIS 6640
AI Module**

4.3 TROVIS 6616 Web Terminal

The TROVIS 6616 Web Terminal is designed for panel mounting with the front dimensions 208 x 144 mm.

Install as follows:

• Make panel cut-out with the dimensions 186 x 123 mm.

• Push the TROVIS 6616 Web Terminal from the front with the ventilation slots facing upward into the panel cut-out.

• Clamp the web terminal from the back against the control panel using the four supplied clips.
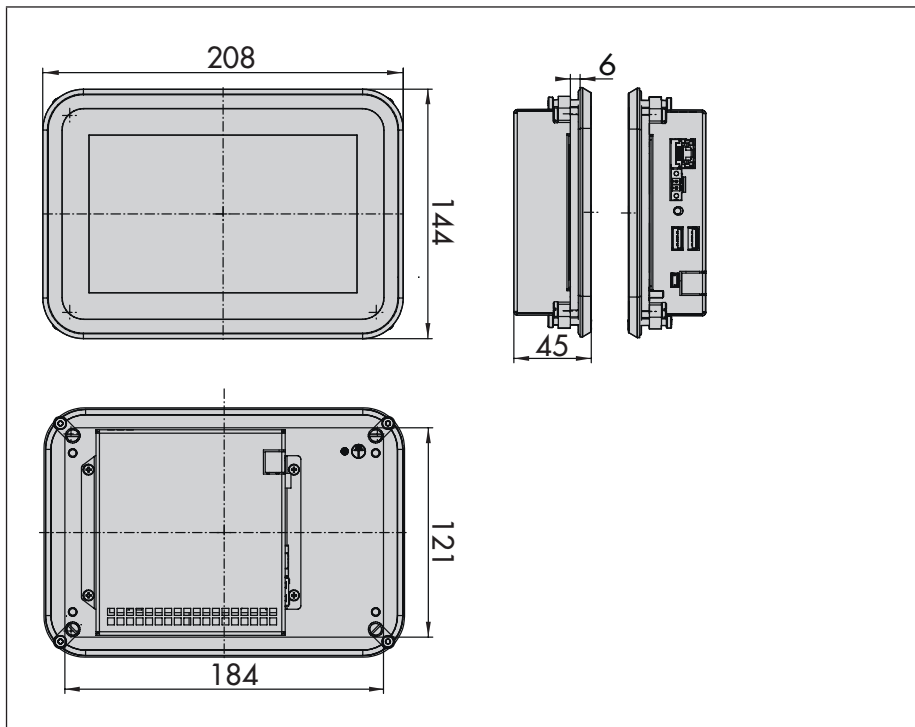
**Dimensions
TROVIS 6616
Web Terminal**

5   Sizing of the power transformer

A maximum of 32 TROVIS 6620, TROVIS 6625, TROVIS 6630 and/or TROVIS 6640 modules can be connected to a TROVIS 6610 CPU module. The voltage supply of all modules is 24 V AC.

5.1 Power consumption of the modules

Module	Voltage	Power consumption
TROVIS 6610 CPU Module	24 V AC	15 VA
TROVIS 6620 I/O Module	24 V AC	6 VA
TROVIS 6625 Input Module	24 V AC	8 VA
TROVIS 6630 AO Module	24 V AC	8 VA
TROVIS 6640 AI Module	24 V AC	8 VA

5.2 Total power consumption of a system

Type	Quantity	Power consumption	Total power consumption
TROVIS 6610 CPU Module	…	15 VA	… VA
TROVIS 6620 I/O Module	…	6 VA	… VA
TROVIS 6625 Input Module	…	8 VA	… VA
TROVIS 6630 AO Module	…	8 VA	… VA
TROVIS 6640 AI Module	…	8 VA	… VA
		Subtotal	… VA
		10 % reserve	… VA
		Total	… VA

5.3 Protection of the power supply (operating voltage)

Protect the feeding transformer for the operating voltage on the primary side (S 1). On the secondary side (S 2) the transformer is to be sized and protected taking into account the effective load of the connected components.

5.4 Voltage drop in the supply line

The larger the reduced power from the power transformer (NT 1) is, the larger the drop in voltage or power on the lines.

The voltage drop is calculated as follows:

$$U_{RL} = \frac{2 \times L \times P}{\kappa \times A \times U_S}$$

U_{RL} = Voltage drop in a two-way circuit [V]
L   = One-way circuit length of the supply line [m]
P   = Power drawn from the power transformer (NT 1) [VA]
κ = Material constant (kappa); for copper 57 [m/Ω x mm²]
A   = Wire cross-section [mm²]
U_S = Power supply of the system; in this example 24 V

Voltage drop for a system consisting of one CPU module and 12 I/O modules   **Example**

Type	Quantity	Power consumption	Total power consumption
TROVIS 6610 CPU Module	1	15 VA	15 VA
TROVIS 6620 I/O Module	12	6 VA	72 VA
TROVIS 6630 AO Module	1	8 VA	8 VA
TROVIS 6640 AI Module	1	8 VA	8 VA
Actuator	–	–	–
Other	–	–	–
		Subtotal	103 VA
		10 % reserve	10.3 VA
		Total	113 VA

Including a power reserve of 10 %, a capacity of 113 VA is required.
The voltage drop is to be determined for a one-way line length of 70 m and a wire cross-section of 1.5 mm².

$$U_{RL} = \frac{2 \times L \times P}{\kappa \times A \times U_S} = \frac{2 \times 70\ m \times 113\ VA}{57\ m/\Omega\ mm^2 \times 1.5\ mm^2 \times 24\ V} = \underline{7.7\ V}$$

The voltage drop in this example is 7.7 V.
It clearly demonstrates that the line length should not be underestimated.
Otherwise, the consuming device would have insufficient voltage in this case:

$$U_{consumer} = 24\ V - 7.7\ V = \textbf{16.3 V}!$$

5.5 Recommended power line length for high performances

In order to guarantee the power supply of the system, the lower tolerance limit of the transformer as well as the lower tolerance limit of the system must be taken into account.

$$L_{max} = \frac{U_{RL} \times \kappa \times A \times U_{transformer}}{2 \times P}$$

L_{max} =   Maximum permissible line length (one-way)
U_{RL} =   Permissible voltage drop (in this example 3.6 V)
κ =   Material constant (kappa); for copper 57 [m/Ω x mm²]
A   =   Wire cross-section [mm²]

$U_{transformer}$ =   Secondary voltage of the transformer (24 V AC)
P   =   System's required power (consuming device)

Example   Recommended power line length for for 210 VA

This corresponds to a maximum power requirement for one CPU module and 32 I/O modules.

1.0 mm^2 = max. 12 m
1.5 mm^2 = max. 18 m
2.5 mm^2 = max. 30 m

5.5.1 Power supply in a loop

If the power supply line is a four-wire line, it is possible to wire the last module to the first module (power supply in a loop).

As a result, the cross section is doubled which leads to the parasitic voltage drop being halved or the maximum permissible line length can be doubled.

A sensible alternative is provided in the form of a distributed supply of modules, i.e. modules installed further away are supplied with power over separate transformers (230/24 V AC) with corresponding power.

Power supply in a loop
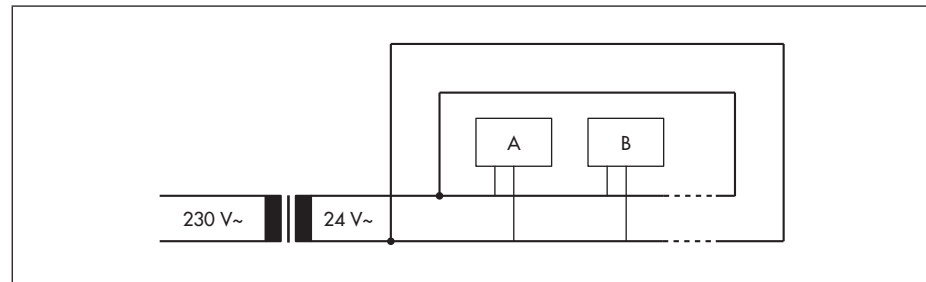
6 Wiring installation

6.1 TROVIS 6610 CPU Module

All the electrical connections of the CPU module are designed as screw terminals.

**TROVIS 6610
CPU Module**

Terminal assignment of TROVIS 6610 CPU Module		
Terminal	**Channel**	**Connections of the TROVIS 6610 CPU Module**
1	1	UE1/ZE1
2		GND
3	2	UE2/ZE2
4	3	UE3
5		GND
6	4	UE4
7	5	UE5
8		GND
9	6	UE6
10	7	UE7
11		GND
12	8	UE8
13	9	UE9
14		GND
15	10	UE10
16	11	UE11
17		GND
18	12	UE12
19	13	UE13
20		GND

Terminal assignment of TROVIS 6610 CPU Module		
Terminal	**Channel**	**Connections of the TROVIS 6610 CPU Module**
21	14	UE14
22	15	UE15
23		GND
24	16	UE16
25	17	UE17
26		GND
27	18	UE18
28	19	UE19
29		GND
30	20	UE20
A		RX/TX A
B		RX/TX B
S		Shielding
24 V AC	24 V AC 15 VA	Power supply
31	21	AA1
32		GND
33	22	AA2
34	23	AA3
35		GND
36	24	AA4
37	25	AA5
38		GND
39	26	AA6
40	27	AA7
41		GND
42	28	AA8
43	29	BA1
44		Supply of channels 29 and 30
45	30	BA2
46	31	BA3
47		Supply of channels 31 and 32
48	32	BA4

Terminal assignment of TROVIS 6610 CPU Module		
Terminal	**Channel**	**Connections of the TROVIS 6610 CPU Module**
49	33	BA5
50		Supply of channels 35 and 36
51	34	BA6
52	35	BA7
53		Supply of channels 35 and 36
54	36	BA8
55	37	BA9
56		Supply of channels 37 and 38
57	38	BA10
58	39	BA11
59		Supply of channels 39 and 40
60	40	BA12

UE   Universal input, i.e. binary input, 0 to 10 V, 0 to 2000 Ω, Pt 1000
ZE   Counter input up to 1 kHz
AA   Analog output 0 to 10 V
BA   Binary output, 250 V AC, 2 A (inductive), 3 A (resistive)

6.2 TROVIS 6620 I/O Module

All the electrical connections of the I/O module are designed as screw terminals.

**TROVIS 6620
I/O Module**

Terminal assignment of TROVIS 6620 I/O Module		
Terminal	**Channel**	**Connections of the TROVIS 6620 I/O Module**
1	1	UE/ZE1
2		GND
3	2	UE/ZE2
4	3	UE
5		GND
6	4	UE
7	5	UE
8		GND
9	6	UE
10	7	UE
11		GND
12	8	UE
13	9	UE
14		GND
15	10	UE
A		RX/TX A
B		RX/TX B
S		Shielding
24 V AC	24 V AC 6 VA	Power supply
16	11	AA
17		GND

Terminal assignment of TROVIS 6620 I/O Module		
Terminal	**Channel**	**Connections of the TROVIS 6620 I/O Module**
18	12	AA
19	13	AA
20		GND
21	14	AA
22	15	BA
23		Supply of channels 15 and 16
24	16	BA
25	17	BA
26		Supply of channels 17 and 18
27	18	BA
28	19	BA
29		Supply of channels 19 and 20
30	20	BA

UE   Universal input, i.e. binary input, 0 to 10 V, 0 to 2000 Ω, Pt 1000
ZE   Counter input up to 1 kHz
AA   Analog output 0 to 10 V
BA   Binary output,
        TROVIS 6620-0000/-0001: 250 V AC, 3 A (inductive), 8 A (resistive)
        TROVIS 6620-0002: 250 V AC, 2 A (inductive), 3 A (resistive)
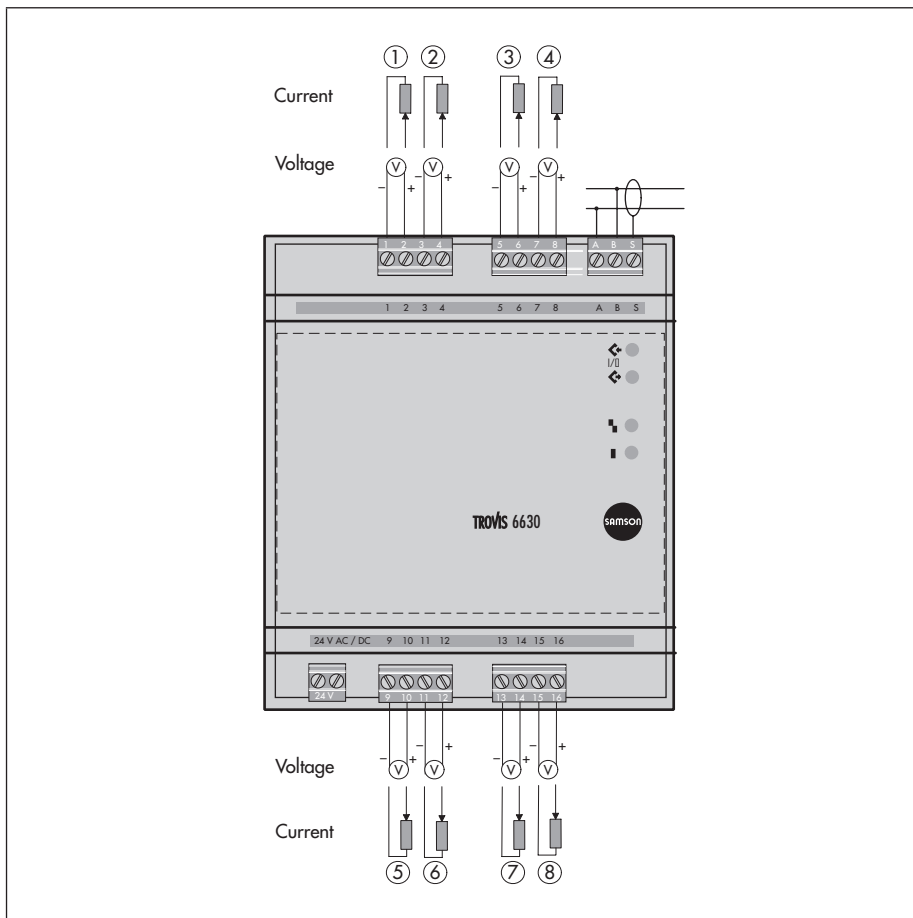
6.3 TROVIS 6625 Input Module

All the electrical connections of the input module are designed as screw terminals.

**TROVIS 6625
Input Module**

Terminal assignment of TROVIS 6625 Input Module		
Terminal	**Channel**	**Connections of the TROVIS 6625 Input Module**
1	1	BE01
2		GND
3	2	BE02
4	3	BE03
5		GND
6	4	BE04
7	5	BE05
8		GND
9	6	BE06
10	7	BE07
11		GND
12	8	BE08
13	9	BE09
14		GND
15	10	BE10
A		RX/TX A
B		RX/TX B
S		Shielding
24 V AC	24 V AC 6 VA	Power supply
16	11	BE11

Terminal assignment of TROVIS 6625 Input Module		
Terminal	**Channel**	**Connections of the TROVIS 6625 Input Module**
17		GND
18	12	BE12
19	13	BE13
20		GND
21	14	BE14
22	15	BE15
23		GND
24	16	BE16
25	17	BE17
26		GND
27	18	BE18
28	19	BE19
29		GND
30	20	BE20

BE   Binary input

6.4 TROVIS 6630 AO Module

All the electrical connections of the AO module are designed as screw terminals.

**TROVIS 6630
AO Module**

Terminal assignment of TROVIS 6630 AO Module		
Terminal	**Channel**	**Connections of the TROVIS 6630 AO Module**
1		GND
2	1	Voltage/current
3		GND
4	2	Voltage/current
5		GND
6	3	Voltage/current
7		GND
8	4	Voltage/current
A		RX/TX A
B		RX/TX B
S		Shielding
24 V AC/DC		Power supply
24 V AC/DC		Power supply
9		GND
10	5	Voltage/current
11		GND
12	6	Voltage/current
13		GND
14	7	Voltage/current
15		GND
16	8	Voltage/current

**Electrical connection
TROVIS 6630
AO Module**

6.5 TROVIS 6640 AI Module

All the electrical connections of the AI module are designed as screw terminals.

**TROVIS 6640
AI Module**

Terminal assignment of TROVIS 6640 AI Module		
Terminal	**Channel**	**Connections of the TROVIS 6640 AI Module**
1		GND
2	1	Voltage/current/resistance
3		Three-wire
4		+ 24 V
5		GND
6	2	Voltage/current/resistance
7		Three-wire
8		+24 V
9		GND
10	3	Voltage/current/resistance
11		Three-wire
12		+24 V
13		GND
14	4	Voltage/current/resistance
15		Three-wire
16		+24 V
A		RX/TX A
B		RX/TX B
S		Shielding
24 V AC/DC		Power supply
24 V AC/DC		Power supply
17		GND
18	5	Voltage/current/resistance

Terminal assignment of TROVIS 6640 AI Module		
Terminal	**Channel**	**Connections of the TROVIS 6640 AI Module**
19		Three-wire
20		+24 V
21		GND
22	6	Voltage/current/resistance
23		Three-wire
24		+24 V
25		GND
26	7	Voltage/current/resistance
27		Three-wire
28		+24 V
29		GND
30	8	Voltage/current/resistance
31		Three-wire
32		+24 V
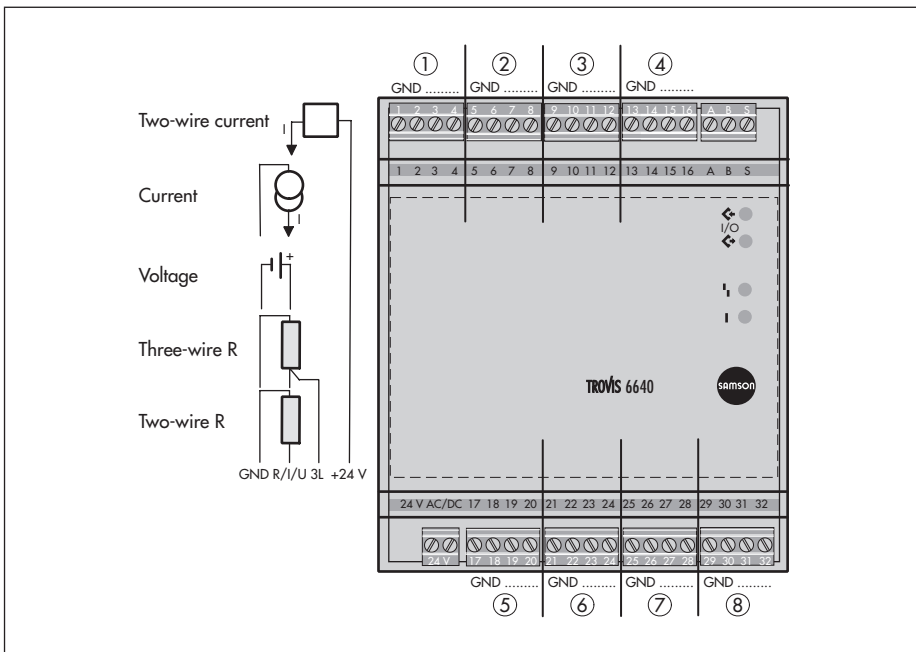
Electrical connection TROVIS 6640 AI Module

6.6 Universal bus unit CoRe01

The unit can be used as a converter (RS-232 to RS-485) or as a repeater for RS-485 buses in two-wire or four-wire technology. Slide switches accessible from the outside allow operators to select the operating mode, transmission rate, termination and bus bias voltage.

In two-wire operation, the polarity of the two wires does not need to be observed, provided this applies to all other devices on the bus as well.

Both interfaces are isolated against the microcontroller (signal processing unit) located in between them. The interfaces do not need to be used in the same operating mode, e.g. one interface can be operated in two-wire connection with 19200 Baud and the other in four-wire connection with 9600 Baud. Despite connecting several repeaters in succession, the signal does not increasingly degenerate.

A safety mechanism (transmission time monitoring) prevents the bus line from being permanently blocked.

**Universal bus unit
CoRe01
(order no. 1400-9670)**
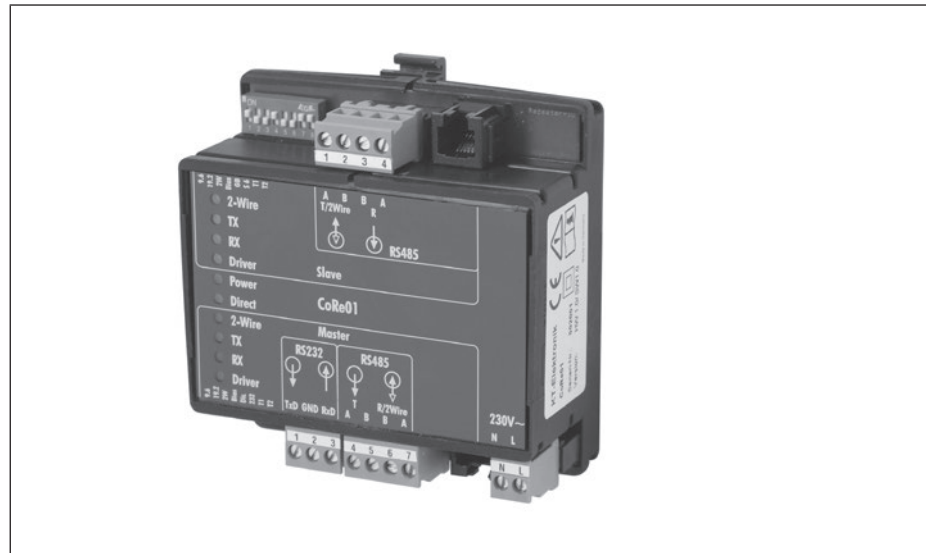
6.7 Power line

The TROVIS 6600 Automation System is supplied with a 24 VAC power supply.

Size the power transformer to match the power consumption of all the connected modules (see section 5).

Route the secondary voltage using two-core wire-end ferrules to the TROVIS 6610 CPU Module (terminals 24 V AC) as well as the TROVIS 6620, TROVIS 6625, TROVIS 6630 and TROVIS 6640 Modules (terminals 24 V AC). This guarantees that the power supply continues to reach all the other modules when the bottom connector on the TROVIS 6610 CPU Module is disconnected or while a module is being replaced.

Note

- Take into account the power consumption required by the entire system on selecting the power transformer.
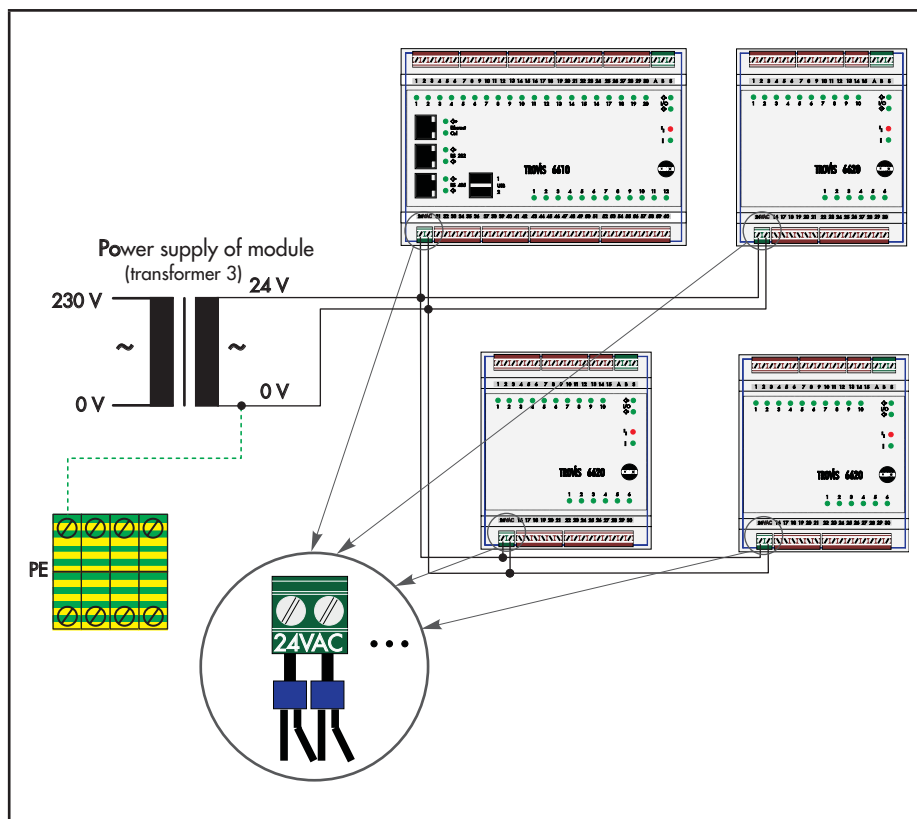
Wiring of the power line of the modules

The following instruments, for example, can be used:

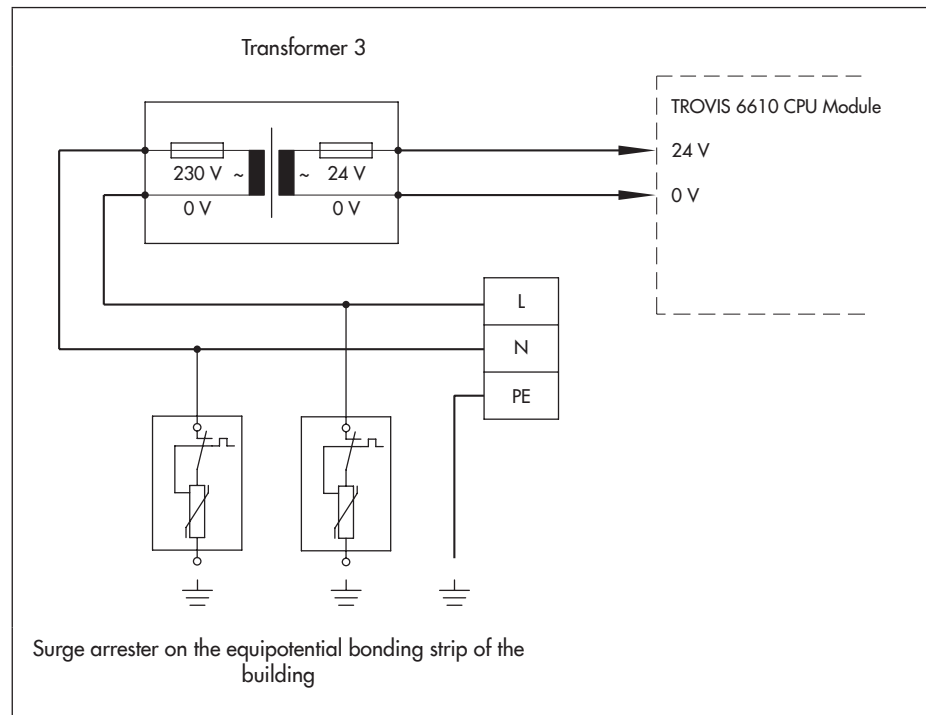| RINCK ELECTRONIC GMBH		http://www.rinck-electronic.de
Power transformer 230 V AC/24 V AC	**Power**	**Order no.**
	30 VA	A102
	60 VA	A103
	100 VA	A104

6.8 Surge arresters

To prevent damage from excess voltage, we recommend using surge arresters.

The system is grounded to the equipotential bonding strip of the building.

Read the manufacturer's instructions!

Surge arrester for power transformer

Transformer 3

TROVIS 6610 CPU Module

24 V

230 V ~   ~ 24 V

0 V   0 V

24 V

0 V

L

N

PE

Surge arrester on the equipotential bonding strip of the building

The following instruments, for example, can be used:

DEHN + SÖHNE GmbH + Co. KG		http://www.dehn.de
Surge arresters	**Type**	**Order no.**
	DG S 275 FM	952090
	DG M TNC 275 FM	952305
	DG M TNS 275 FM	952405

6.9 Connecting passive and active sensors as well as final control elements

Grounding (GND) is bridged within the TROVIS 6610, TROVIS 6620, TROVIS 6625, TROVIS 6630 and TROVIS 6640 Modules and routed out at the following terminals:

TROVIS 6610 CPU Module: 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41

TROVIS 6620 I/O Module: 2, 5, 8, 11, 14, 17, 20

TROVIS 6625 Input Module: 2, 5, 8, 11, 14, 17, 20, 23, 26, 29

TROVIS 6630 AO Module: 1, 3, 5, 7, 9, 11, 13, 15

TROVIS 6640 AI Module: 1, 5, 9, 13, 17, 21, 25, 29

Only one ground connection from one of the above specified module terminals to the collective GND terminal is required per module. The cross-section of the GND connection must be 1 mm^2 or larger. This connection forms the ground for analog and binary inputs as well as for analog outputs. The associated "signal plus" line is wired to the respective input or output.
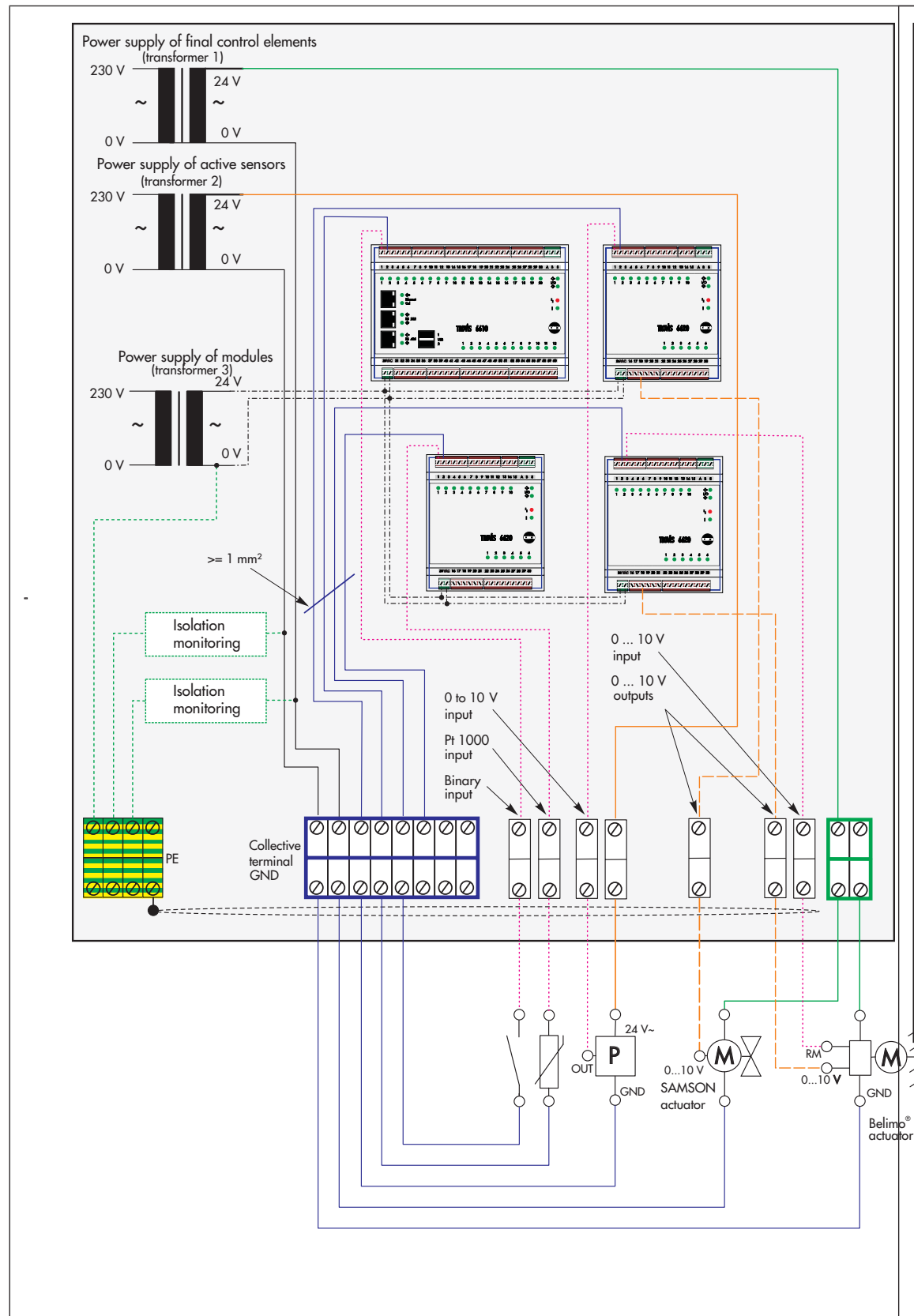
To prevent potential shifts for active sensors and final control elements, separate transformers must be used to supply the CPU module and TROVIS 6620, TROVIS 6625, TROVIS 6630 and TROVIS 6640 Modules (wiring example 1). It is important that the transformers have a reference even for alternating voltages (marked 0 V in the example). Therefore, make sure on wiring that the lines are not interchanged by mistake.

In **wiring example 2** (not recommended) operation with just one transformer is illustrated.
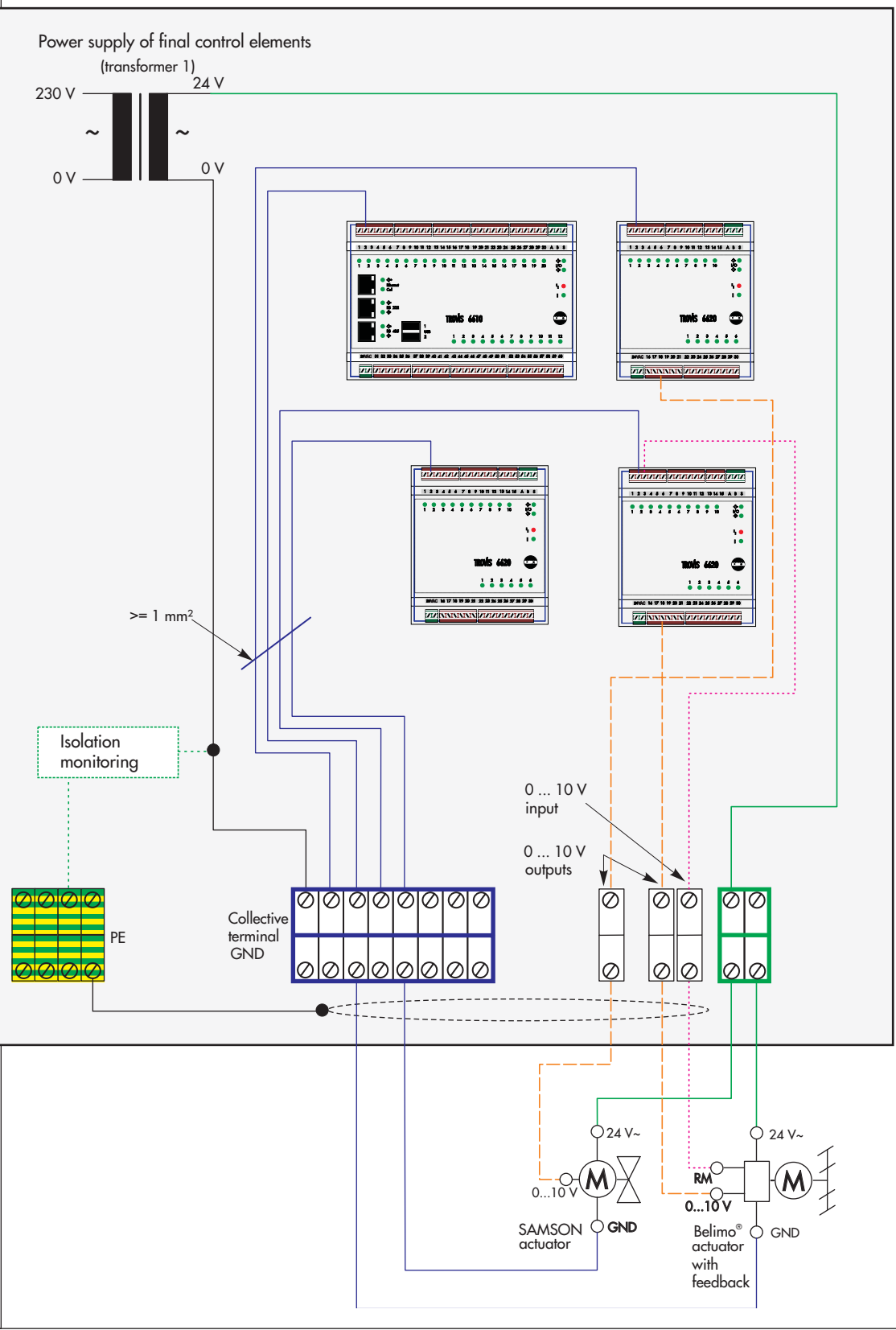
NOTICE

- There is no galvanic isolation between TROVIS 6610 CPU Module and the TROVIS 6620, TROVIS 6625, TROVIS 6630 and TROVIS 6640 Modules.

- Sensors with bridge rectifiers may cause a faulty sensor or lead to the transformer short-circuiting over the bridge rectifier.

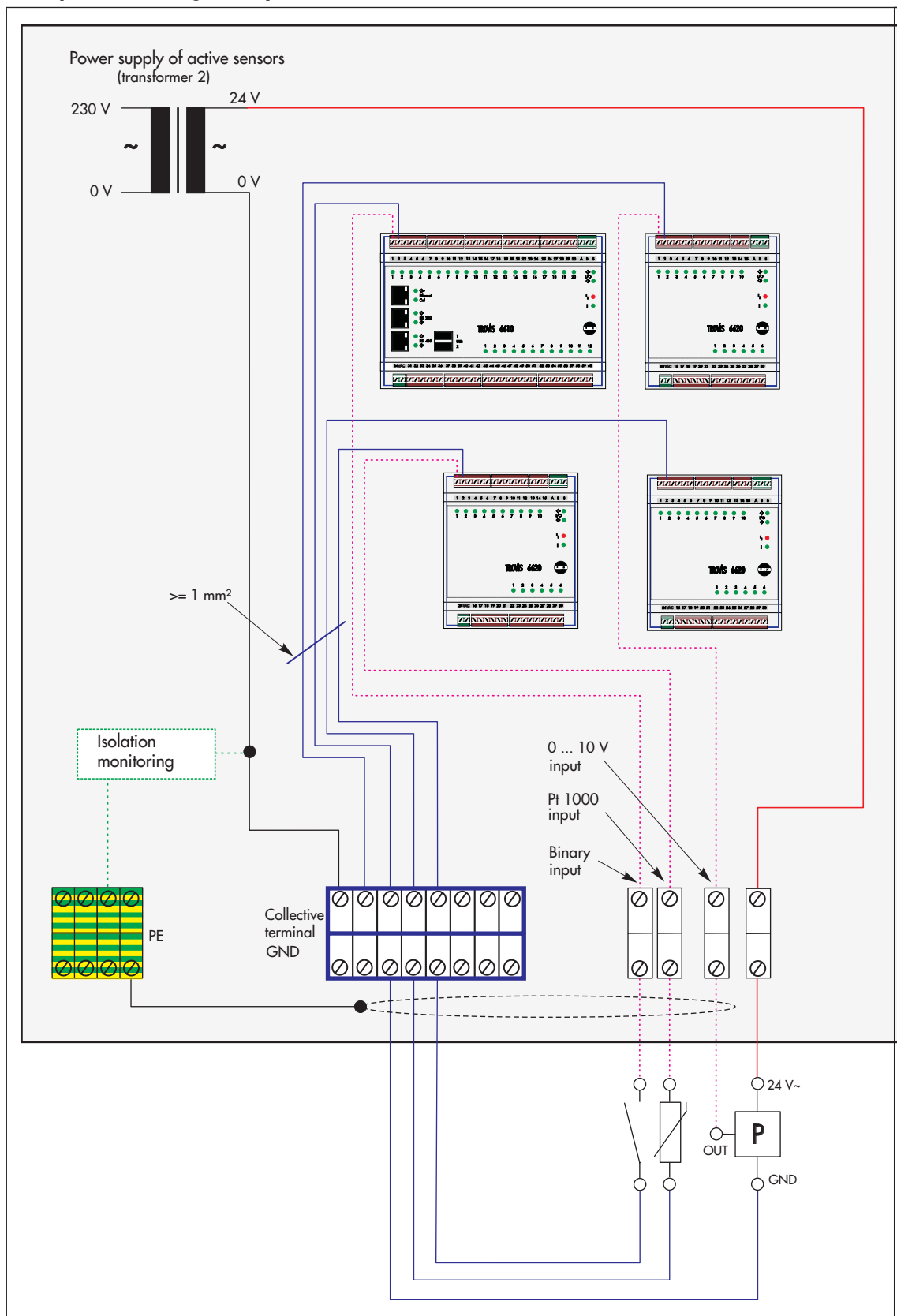**Wiring example 1**: Passive and active sensors as well as final control elements
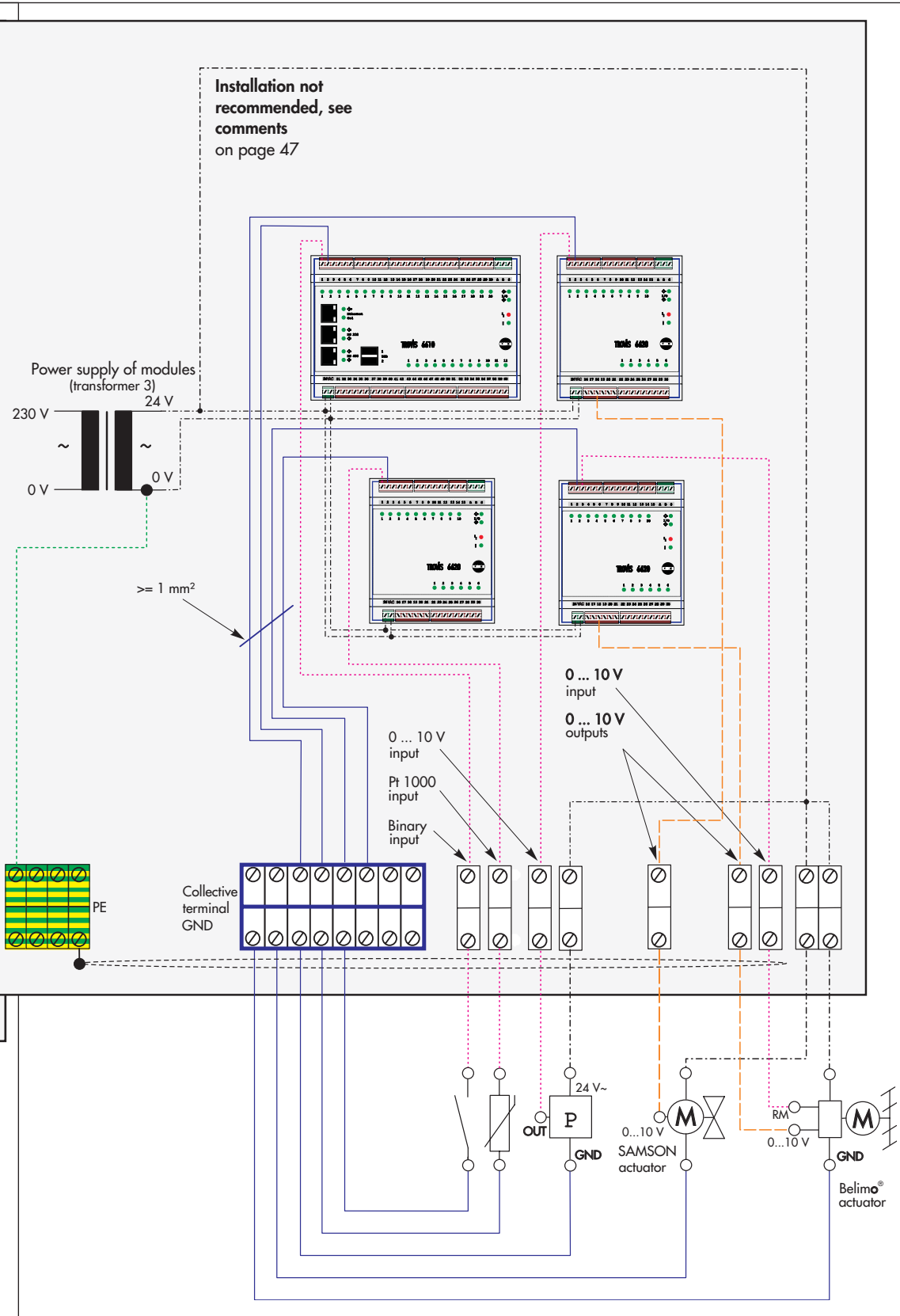
Excerpt from wiring example 1: Connecting final control elements

Power supply of final control elements
(transformer 1)

230 V

24 V

0 V

0 V

~   ~

>= 1 mm²

Isolation
monitoring

PE

Collective
terminal
GND

0 ... 10 V
input

0 ... 10 V
outputs

24 V~   24 V~

RM

0...10 V   0...10 V

SAMSON   GND   Belimo®   GND
actuator   actuator
                         with
                         feedback

Excerpt from wiring example 1: Passive and active sensors

Power supply of active sensors
(transformer 2)

230 V   24 V

0 V   0 V

>= 1 mm²

Isolation
monitoring

PE

Collective
terminal
GND

0 ... 10 V
input

Pt 1000
input

Binary
input

24 V~

OUT   P

GND

Wiring example 2: Passive and active sensors as well as final control elements

Installation not recommended, see comments on page 47

Power supply of modules (transformer 3)

230 V

0 V

24 V

0 V

>= 1 mm²

0 ... 10 V input

0 ... 10 V outputs

0 ... 10 V input

Pt 1000 input

Binary input

PE

Collective terminal GND

24 V~

OUT P GND

0...10 V SAMSON actuator

RM 0...10 V GND

Belimo® actuator

7   Interfaces of TROVIS 6610 CPU Module

7.1 Ethernet

Ethernet jack pinout

		Signal assignment
	8	R4 (not used)
	7	T4 (not used)
	6	R3 (twisted pair Receive Pair)
	5	T1 (not used)
	4	R1 (not used)
	3	T3 (twisted pair Receive Pair)
	2	R2 (twisted pair Transmit Pair)
	1	T2 (twisted pair Transmit Pair)

7.1.1 TROVIS 6616 Web Terminal

A TROVIS 6616 Web Terminal can be connected to the TROVIS 6610 CPU Module at the Ethernet port.

The web terminal allows the user to display selected data points in text or graphical format and to change them. A software configuration is not required to commission the web terminal. It just needs to be connected to the power supply and to the network to the TROVIS 6610 CPU Module.

The system integratopm and the data points displayed on the web terminal are not described here. Read the special documentation.

Connecting jack for TROVIS 6616 Web Terminal

7.1.2 Wiring over Ethernet

The visualization station is connected to the TROVIS 6610 CPU Module as well as the CPU modules to each other over Ethernet, which is standardized as IEEE Std 802.3.

The TROVIS 6610 CPU Module can be integrated into a network over 10/100BaseT (using twisted-pair cable, star topology).

Connecting jack for 10/100BaseT

7.1.2.1 Laying installation cables

In the control cabinet the installation cable can be connected to a connection unit with RJ-45 connector using components by BTR NETCOM GmbH.

Read the manufacturer's instructions.

**E-DAT module
REG 8(8)
IP 20**

BTR NETCOM GmbH	http://www.btr-netcom.com
Rail module Cat.6A 10 GBit	E-DAT module REG 8(8) IP 20

7.1.2.2 10/100BaseT / twisted-pair wiring / star topology

Twisted-pair cabling is flexible and modern since high transmission rates are achieved by using at least Cat-5 cables which represent the current industrial standard in cabling.

In cases where the network participants are arranged close together, twisted-pair cabling (10/100) is always a suitable option.

The twisted-pair cabling is based on a star topology with a maximum segment length of 100 m, which are usually implemented by hubs/switches.

The simplest form of this network is represented in this case by a TROVIS 6610 CPU Module and a computer with NIC (network interface adapter). A commercially available crossover patch cable is required.

Pinout: Crossover patch cable						
Signal	Cable color	Ethernet	PIN	Cable	Pin	RJ-45 jack
T2	White/orange	Used	3		1	Used
R2	Orange/white	Used	6		2	Used
T3	White/green	Used	1		3	Used
R1	Blue/white	—-	7	—-	4	—-
T1	White/blue	—-	8	—-	5	—-
R3	Green/white	Used	2		6	Used
T4	White/brown	—-	4	—-	7	—-
R4	Brown/white	—-	5	—-	8	—-
The shielding is crimped underneath the metal housing of the connector.						
Abbreviations: T - Tip; R - Ring; 1 … 4 - Twisted-pair cable The + side of each pair is called tip, whereas the − side is called ring. These terms originate from the telephone operators' phone plug in the early days of telephony.						

Network with TROVIS 6610 CPU Module and computer

Crossover patch cable
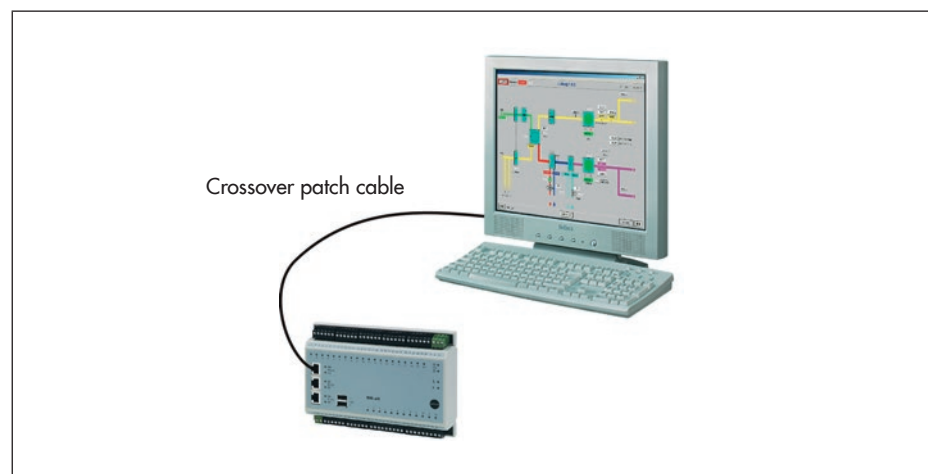
It is not possible to add a further network participant to the network constellation shown, which consists of the TROVIS 6610 CPU Module and computer.

The network can only be extended using auxiliary equipment, e.g. a network switch.

Auxiliary equipment is always used to extend the network when a new participant has been added or the network route is to be lengthened.

Adding and disconnecting participants does not cause any problems. Defective segments are automatically separated by the network switch to prevent a participant's failure from affecting the other participants. A commercially available straight patch cable is required.

Segment length	Max. 100 meter
Quantity of nodes/segment	Max. 2 (without auxiliary equipment)
Transmission rate	10/100 Mbit/s
Terminator	Not required
Cable type	Recommendation: At least Cat-5 Twisted pairs as well as cable are shielded separately. A four-wire cable is sufficient for 10/100BaseT.
Grounding	Not required

| **Pinout: Straight patch cable**						
Signal	Cable color	Ethernet	Pin	Cable	Pin	RJ-45 jack
T2	White/orange	Used	1	<->	1	Used
R2	Orange/white	Used	2	<->	2	Used
T3	White/green	Used	3	<->	3	Used
R1	Blue/white	—-	4	—-	4	—-
T1	White/blue	—-	5	—-	5	—-
R3	Green/white	Used	6	<->	6	Used
T4	White/brown	—-	7	—-	7	—-
R4	Brown/white	—-	8	—-	8	—-
The shielding is crimped underneath the metal housing of the connector.						
Abbreviations for signal line: T - Tip; R - Ring; 1 … 4 - Twisted-pair cable The + side of each pair is called tip, whereas the – side is called ring. These terms originate from the telephone operators' phone plug in the early days of telephony.						

Example 1   Network consisting of three TROVIS 6610 CPU Modules and computer, segments 1 to 4

Network consisting of three TROVIS 6610 CPU Modules and computer, segments 1 to 4
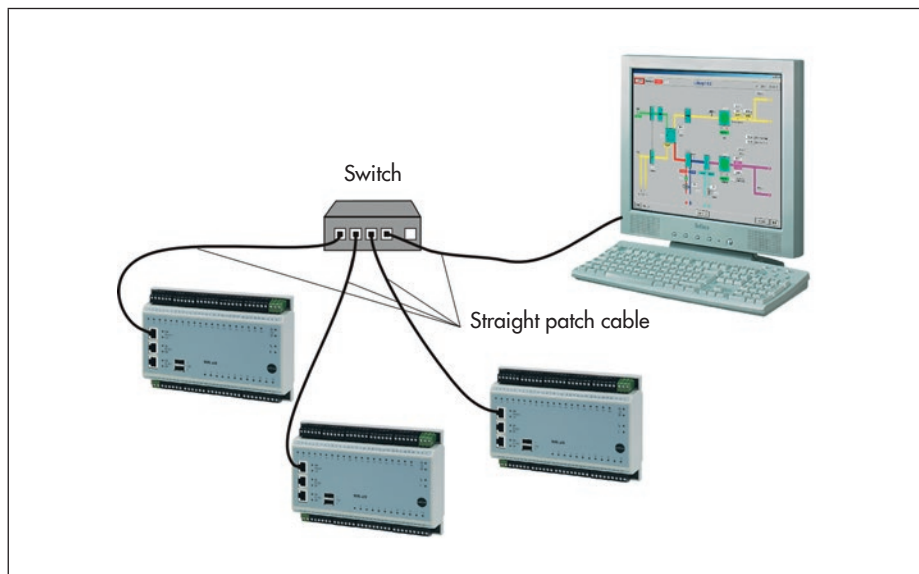
Example 2   Network consisting of three TROVIS 6610 CPU Modules and computer, segments 1 to 3

**Network consisting of three TROVIS 6610 CPU Modules and computer, segments 1 to 3**
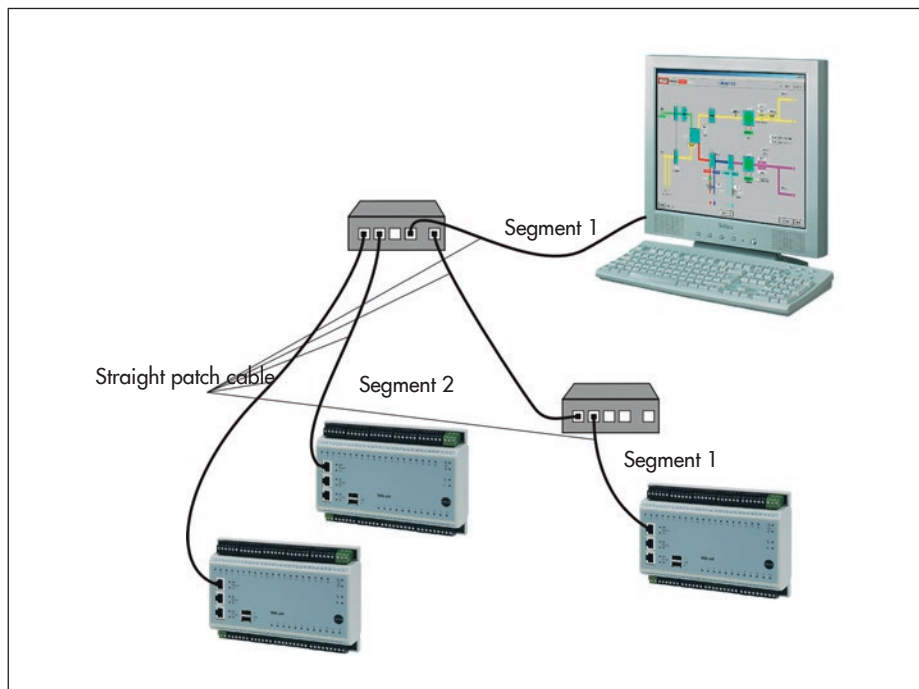
7.1.2.3 10/100BaseT network surge protection

Large networks with branched lines over long distances can be set up with the help of active components in floor distributors. As a result, these can serve as large aerials which can induce high voltage in the event of lightning striking.

The network components, e.g. switch or network card, can usually not withstand the resulting common mode voltage surge between the cable shielding and wire. Therefore, appropriate countermeasures need to be taken both at the switch and at the end device connection.

Read the manufacturer's instructions.

The following instruments, for example, can be used:

DEHN + SÖHNE GmbH + Co. KG	http://www.dehn.de
Surge arresters	DPA M CAT6 RJ45S 48 Article no.: 929 100

American Power Conversion Corp.	http://www.apc.com
Protect Net® surge protector for data lines	PNET1GB
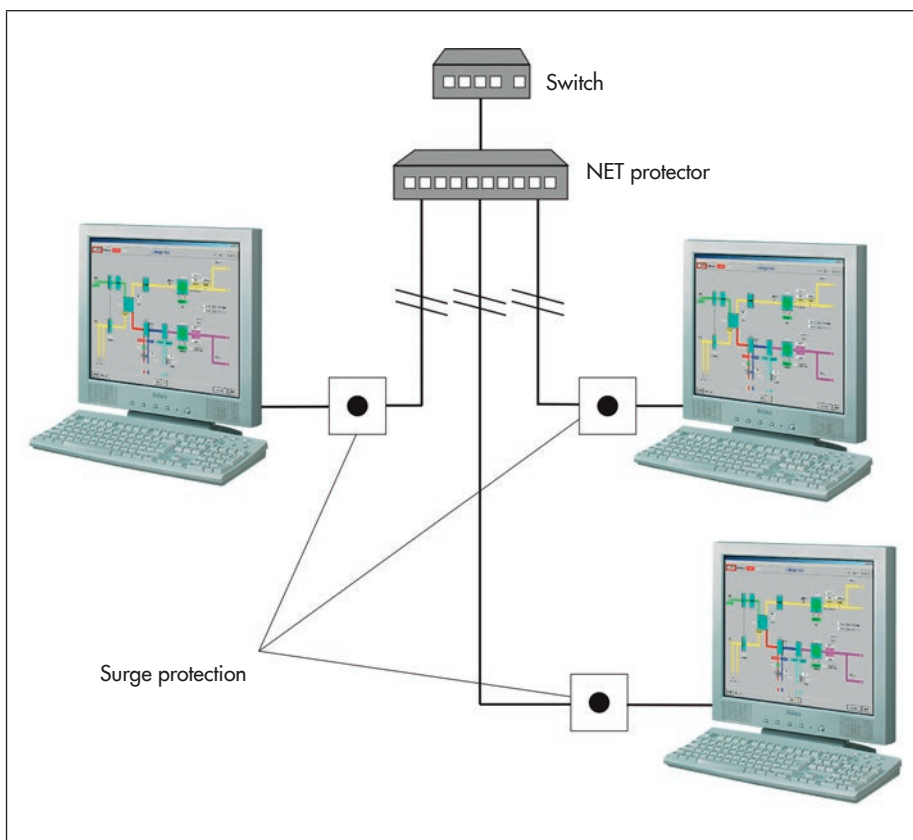
Maximum protection for twisted-pair cabling

7.1.3 Wiring over long distances using Ethernet extenders

On installing and wiring an Ethernet network, the wiring guidelines must be strictly observed. For example, you require cables that conform to the standards and while keeping the permissible line lengths. For twisted-pair cabling, the maximum cable length is 100 m per segment when CatX cables are used.

If the lengths stipulated must be exceeded, Ethernet extenders can be used for dedicated lines.

xDSL extenders

A DSL connection always consist of two DSL modems (modem 1 at the provider and modem 2 at the participant). These modems normally work in transparent bridging or as routers and usually must not be configured. Varying line lengths are bridged at various transmissions rate depending on the DSL technology.

Summary of xDSL technologies

(Device specifications may vary considerably due to constantly new innovations)

Technology	Theoretical max. downstream rate	Theoretical max. upstream rate	Maximum line length
ADSL	8 Mbit/s	1 Mbit/s	6 km
HDSL	2 Mbit/s	2 Mbit/s	5 km
SDSL	2.3 Mbit/s	2.3 Mbit/s	3.5 km
SHDSL	2.3 Mbit/s	2.3 Mbit/s	6 km
VDSL	52 Mbit/s (1.3)	2.3 Mbit/s (0.64)	0.3 km (1.3 km)

Example 1
VDSL bridge
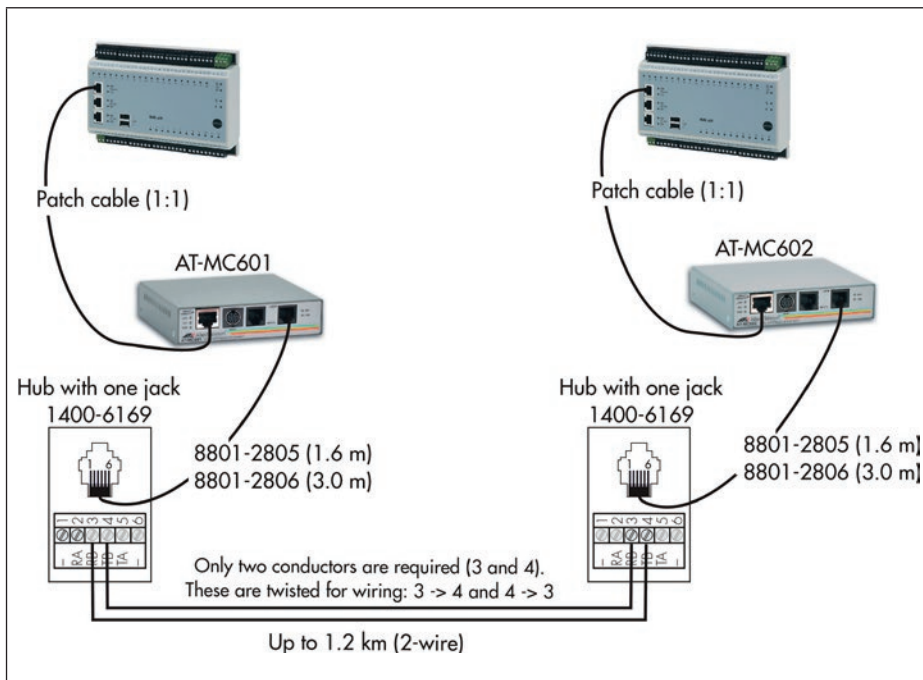
VDSL bridge to bridge 12000 m at approx. 11 Mbit/s symmetric data transfer of twisted-pair cabling.

Subscriber/provider unit
AT-MC 605
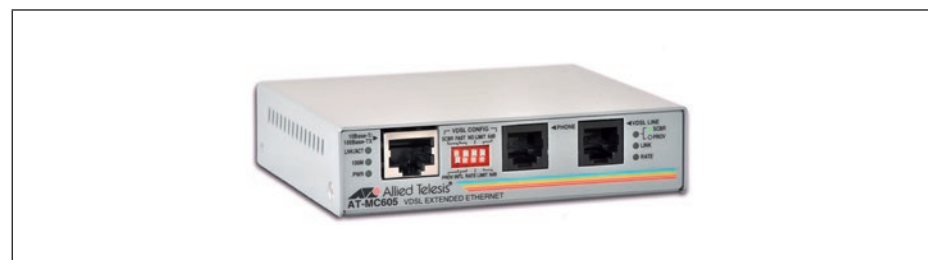
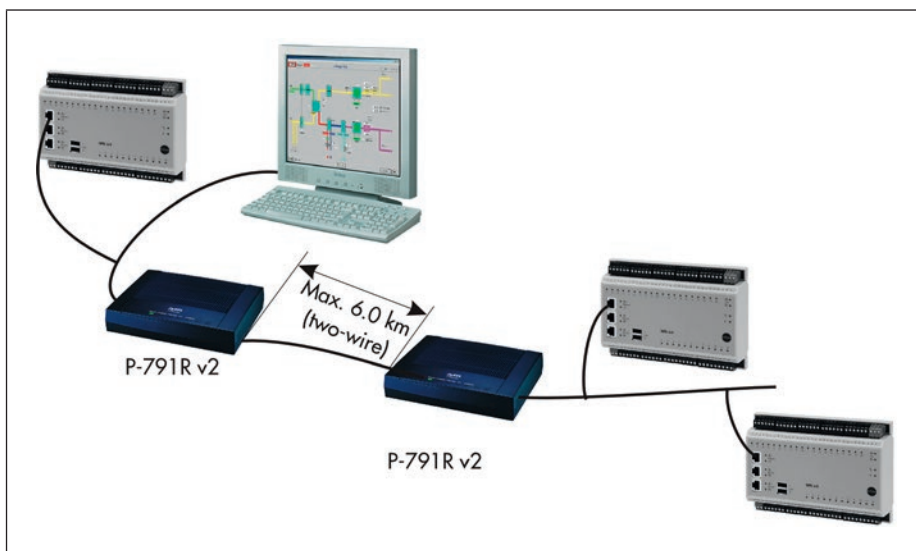| Allied Telesis International GmbH	http://www.alliedtelesis.com
Subscriber/provider unit	AT-MC605

Dedicated line with VDSL bridge

G.SHDL bridge modem to bridge 6000 m at approx. 5 Mbit/s symmetric data transfer of twisted-pair cabling.

Example 2

G.SHDSL bridge P-791R v2

ZyXEL Deutschland GmbH		http://www.zyxel.de
G.SHDSL.bis router	P-791R v2	

Dedicated line with G.SHDSL bridge

7.1.4 Lightning arresters

DEHNlink fine surge protection module

DEHN + SÖHNE GmbH + Co. KG	http://www.dehn.de
Surge arresters	DEHNlink DLI ISDN I, Article no.: 929 024 Fine surge protection only!
American Power Conversion Corp.	http://www.apc.com
Protect Net® surge protector for data lines	Pdigitel Fine surge protection only!

7.2 I/O bus

The interface from the TROVIS 6610 CPU Module to the TROVIS 6620 I/O Modules forms the I/O bus. This setup can minimize the reliance on a central control system and instead distributed individual components are equipped with their own intelligence. Ideally, TROVIS 6620 I/O Modules are distributed directly in the field to record and issue physical information.

Physical	RS-485, galvanically isolated
Cable length	Max. 1200 m, stubs smaller than 3 m
Cable recommendation	JY(ST)Y 2 x 2 x 0.8
End-of-line termination	At the physically furthest points on both ends 200 Ω between A and B
Polarity	Polarity insensitive
Transmission rate	9600 Bit/s to 115 kBit/s
Connection	3-pin screw clamp terminal, max. 2.5 mm²

An RS-485 interface is used to implement the I/O bus. It is designed in the TROVIS 6610 CPU Module with galvanic isolation. RS-485 is a two-wire, half-duplex, multi-drop network in which several participants can be connected with each other, and send and receive data.

7.2.1 Topology

RS-485 in a simple setup allows bidirectional bus communication of a maximum of 32 participants (including TROVIS 6610 CPU Module) in line topology. Stubs must not be longer than 3 m.

7.2.2 Line lengths

The permissible line length falls as the transmission rate rises. This is because the capacitive and inductive effects change the line resistance as the frequency rises.

Permissible line lengths	
9600 bit/s	Max. 1200 m
115 kBit/s	Max. 1000 m

7.2.3 Terminating resistors

The lines must be terminated regardless of the data transmission rate. The end-of-the-line terminations must be installed at the physically furthest points of both ends. A 200 Ω resistor is used to terminate the wire by clamping it between conductor A and B at both ends (included in the scope of delivery for TROVIS 6610 CPU Module).

The TROVIS 6620 I/O Modules are connected at the green 3-pin screw terminal block labeled ABS.

The LED located below the ABS terminal block indicate communication with other participants.
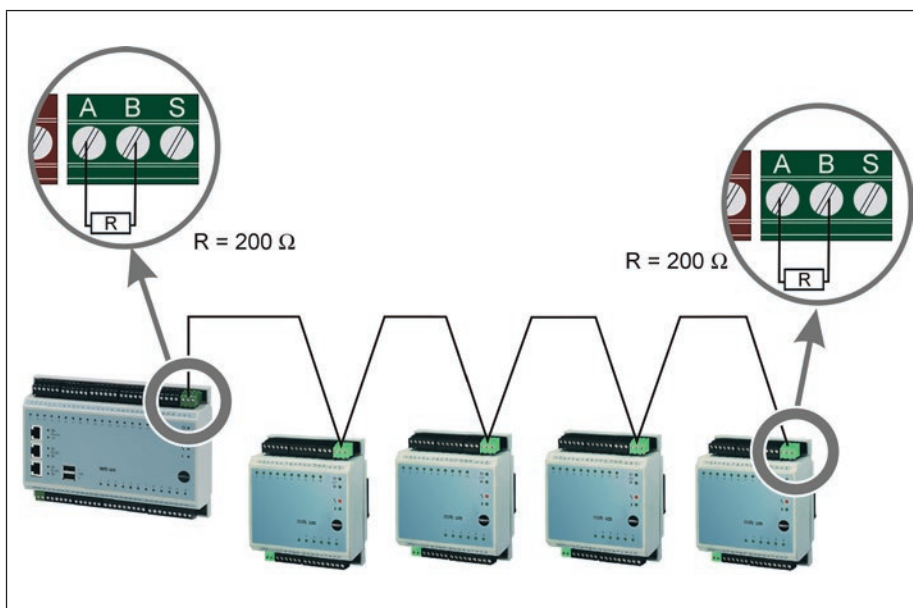
3-pin screw clamp terminal

Read the following recommendations which usually apply to all control and bus lines:

- Separate line routing

  Lines should not be run directly next to power lines. This helps to avoid interference, resulting from switching operations, from being coupled.

- Avoid installation loops

  The most frequent source for EMC interference in the event of lightning striking is the formation of induction loops. Induction loops arise from two independent networks which are connected to the same device, for example, the LON data line and the 230 V power line.

  This is the reason why all lines which run to one device should be run separately.

- Separating lines afflicted by surges and protected lines

  To avoid interference, protected and unprotected lines must be run separately from one another. Special care needs to be taken on wiring the distributor.

  The line must be laid as far away as possible from the lightning protection system, a stainless steel chimney or the grounding of a roof aerial.

- Connection to an equipotential bonding system

  The low-impedance connection of an arrester for the bus must be implemented by a 6 mm² copper connection with maximum 50 cm.

- Shielding and its grounding

  As a rule, the use of shielded lines is recommended. This ensures that a partial amount of capacitive and inductive coupling of interference energy is bled off over the shielding before reaching the bus wires.

  To minimize the effect of interference, it is advisable to ground the shielding at both ends using low-impedance capacitors.

  Observe the regulations concerning shielding stipulated in VDE 0160 and DIN 57800/VDE 0800 or your national regulations.

7.2.4 Fine and coarse surge protection for the I/O bus

For lines routed between buildings, lightning current arresters should be used at the point where the line enters the building.

Lightning current arresters are able to divert 5 kA surges of the waveform (10/350 µs) several times without being destroyed.

The shielding must be included in the equipotential bonding.

If equalizing currents over the cable shielding are to be expected due to the various building potentials, ground the shielding indirectly at one end over a gas-filled surge arrester. In this case, it is absolutely necessary to make sure that the power supply for the distribution equipment is also protected against high voltage by using the corresponding lightning current and surge arresters.

In-house installations require surge arresters that can divert the high surges of up to 5 kA of the waveform (8/20 µs) without being destroyed.

Read the manufacturer's instructions.

The following products, for example, can be used: **Example**

DEHN + SÖHNE GmbH + Co. KG	http://www.dehn.de
Gas-filled lightning current arrester with EMC terminal (building-to-building)	BLITZDUCTOR BXT ML2 BD S5 Article no. 920240 Base article no. 920300
Surge conductor (in-house)	BLITZDUCTOR BXT ML2 BD S5 Article no. 920240 Base article no. 920300
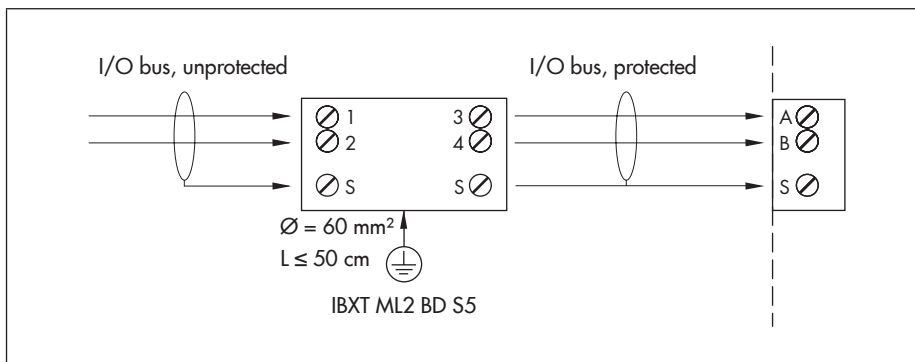
Connection of the surge arrestor BXT ML2 BD S5

7.3 Modbus RTU (master or slave)

Modbus is an open serial communications protocol based on the master/slave architecture. Since it is easy to implement on all kinds of serial interfaces, it has gained wide acceptance.

The bus consists of a master station and a number of slave stations. The communication is controlled entirely by the master.

Modbus has two basic communication mechanisms:

- Query/reply (polling):

  The master sends a query telegram to any one of the stations and waits for the query telegram.

- Broadcast:

  The master sends a command to all the stations on the network. These stations execute the command without providing feedback, e.g. setting the time.

The telegrams allow process data (input/output data) to be written and read. The data are packed in RTU format.

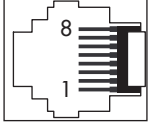| Physical	RS-485, galvanically isolated
Cable length	Max. 1200 m, stubs smaller than 3 m
Cable recommendation	JY(ST)Y 2 x 2 x 0.8
End-of-line termination	At the physically furthest points on both ends 200 Ω between A and B
Polarity	Polarity sensitive
Transmission rate	9600 Bit/s to 115 kBit/s
Connection	RJ-45 · 8-pole

An RS-485 interface is used in this case to implement the I/O bus. It is designed in the TROVIS 6610 CPU Module with galvanic isolation. RS-485 is a four-wire, full-duplex, network in which several participants can be connected with each other, and send and receive data.

Modbus connection

RS-485 jack pinout

		Designation	Comment
	8	NC	
	7	NC	
	6	TA	Output
	5	TB	Output
	4	RB	Input
	3	RA	Input
	2	NC	
	1	NC	

7.3.1 Topology

RS-485 in a simple setup allows bidirectional bus communication of a maximum of 32 participants (including TROVIS 6610 CPU Module) in line topology. Stubs must not be longer than 3 m.

7.3.2 Line lengths

The permissible line length falls as the transmission rate rises. This is because the capacitive and inductive effects change the line resistance as the frequency rises.

Permissible line lengths	
9600 bit/s	Max. 1200 m
115 kBit/s	Max. 1000 m

Hubs with 4 jacks
(1400-7140)

7.3.3 Terminating resistors

The lines must be terminated regardless of the data transmission rate. The end-of-the-line terminations must be installed at the physically furthest points of both ends. A 200 Ω resistor is used to terminate the wire by clamping it between conductor A and B at both ends.
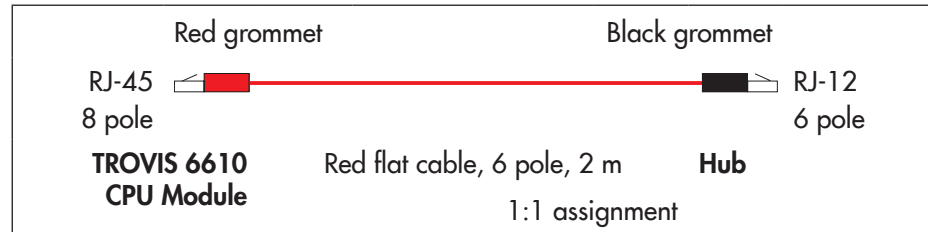
The Modbus devices are connected at the front RJ 45 jack labeled RS-485.

The LEDs next to the jack indicate communication with other participants.

Red
(1400-9748)

7.3.4 Connecting TROVIS 6610 CPU Module as the Modbus master

The connecting cable (order no. 1400-9748) is required when the CPU module is to be used as a Modbus master.

Series TROVIS 55xx controllers are connected over the cable converter (order no. 1400-7308).

Master connecting cable (1400-9748)

Red grommet · Black grommet

RJ-45
8 pole
TROVIS 6610 CPU Module

Red flat cable, 6 pole, 2 m
1:1 assignment

RJ-12
6 pole
Hub

Connector	Design.	Comment		Connector	Design.	Comment
8	NC					
7	NC		……	6	NC	
6	TA	Output	……	5	TA	Output
5	TB	Output	……	4	TB	Output
4	RB	Input	……	3	RB	Input
3	RA	Input	……	2	RA	Input
2	NC		……	1	NC	
1	NC					

Example 1   Modbus master function with SAMSON TROVIS 5576/5578 Controller as a slave.

Terminating resistor
200 Ω

- Every RS-485 bus must be terminated at the furthest points by a 200 Ω resistor at each

Red
(1400-9748)
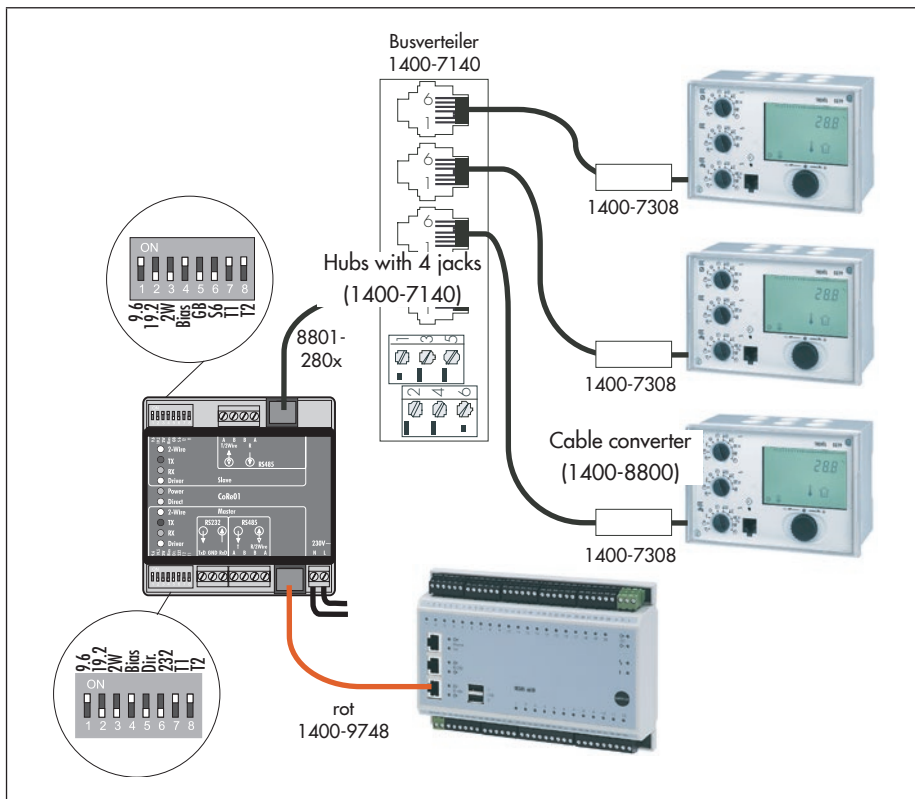
Connection as Modbus master with Series TROVIS 55xx Controller as slaves
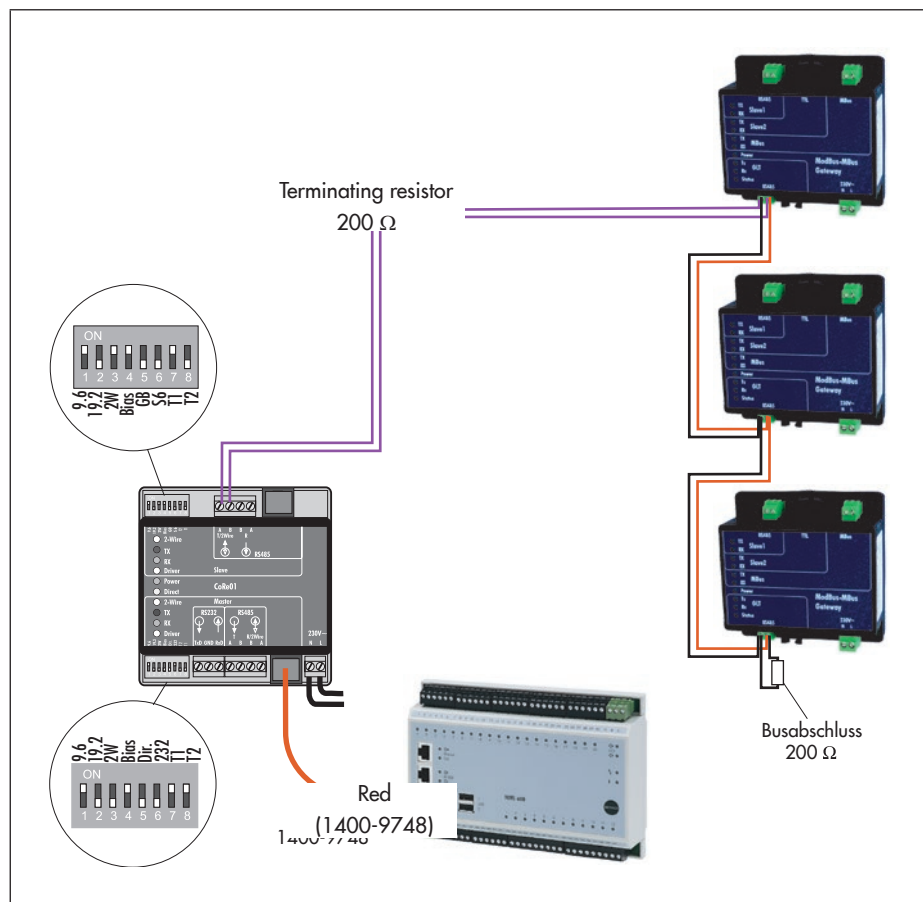
Modbus master function with meter bus/Modbus gateway

Example 2

In this example, a jumper must b͟e ͟ ͟ ͟ ͟tween RA/TA and RB/TB at the hub with one single jack.

Red
(1400-9748)

- Every RS-485 bus must be terminated at the furthest points by a 200 Ω resistor at each end.
- Configure TROVIS 6610 for four-wire operation.

Connection as Modbus master with meter bus/ Modbus gateway

Terminating resistor 200 Ω

Busabschluss 200 Ω

Red (1400-9748)

Modbus master function with meter bus/Modbus gateway and SAMSON TROVIS 5576/5579 Controller as a slave.

Example 3

- Every RS-485 bus must be terminated at the furthest points by a 200 Ω resistor at each end.
- Configure TROVIS 6610 for four-wire operation.
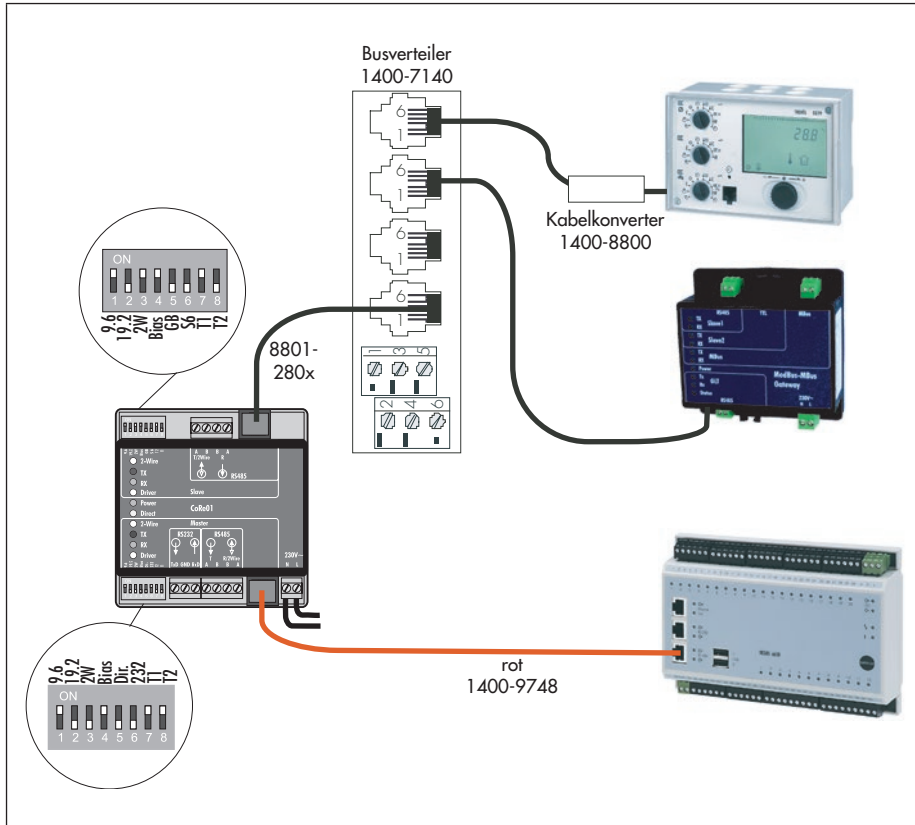
Connection as Modbus master with meter bus/Modbus gateway and SAMSON TROVIS 5576/5579 Controller
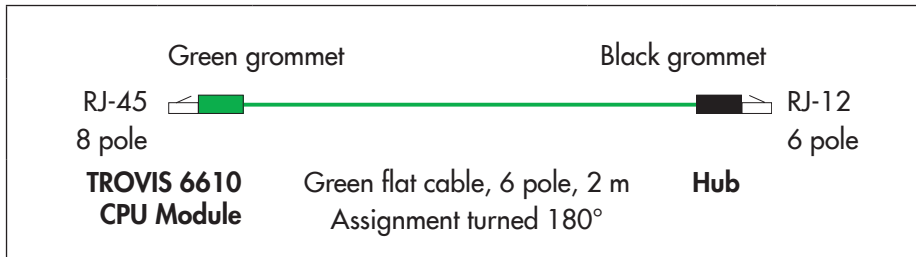
Example 4   Modbus master function with the BZK1000MOD module by Romutec®

In this example, a jumper must be installed between RA/TA and RB/TB at the hub with one single jack.

Connection as Modbus master
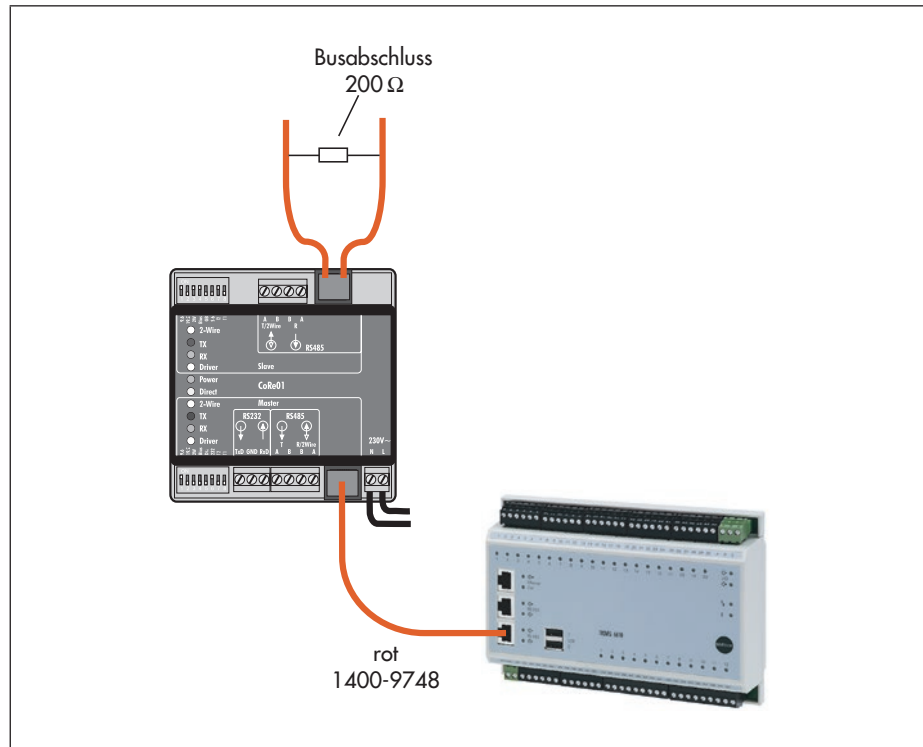
7.3.5 Connecting the TROVIS 6610 CPU Module as Modbus slave

The connecting cable (order no. 1400-9749) is required when the CPU module is to be used as a Modbus slave.
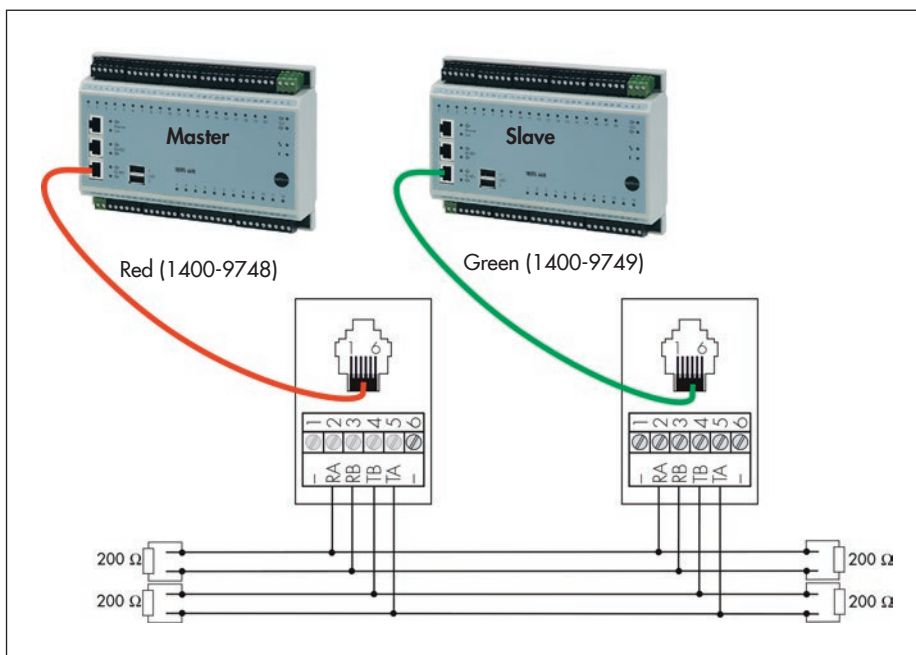

Green grommet   Black grommet

RJ-45   RJ-12
8 pole   6 pole

TROVIS 6610 CPU Module   Green flat cable, 6 pole, 2 m   **Hub**
Assignment turned 180°

Slave connecting cable (1400-9749)

Connector	Design.	Comment
8	NC	
7	NC	
6	TA	Output
5	TB	Output
4	RB	Input
3	RA	Input
2	NC	
1	NC	

Connector	Design.	Comment
6	NC	
5	RA	Input
4	RB	Input
3	TB	Output
2	TA	Output
1	NC	

Modbus master function with one TROVIS 6610 CPU Module as slave and one as master in a four-wire circuit.

Example 5

• Every RS-485 bus must be connected correctly.

Master   Slave

Red (1400-9748)   Green (1400-9749)

200 Ω   200 Ω
200 Ω   200 Ω

Modbus master function

Four-wire circuit

Slave: TROVIS 6610 CPU Module

Master: TROVIS 6610 CPU Module

Example 6   Modbus master function with a TROVIS 6610 CPU Module and a TRO-VIS 55xx Controller as slaves as well as a TROVIS 6610 CPU Module as a master in a two-wire circuit.
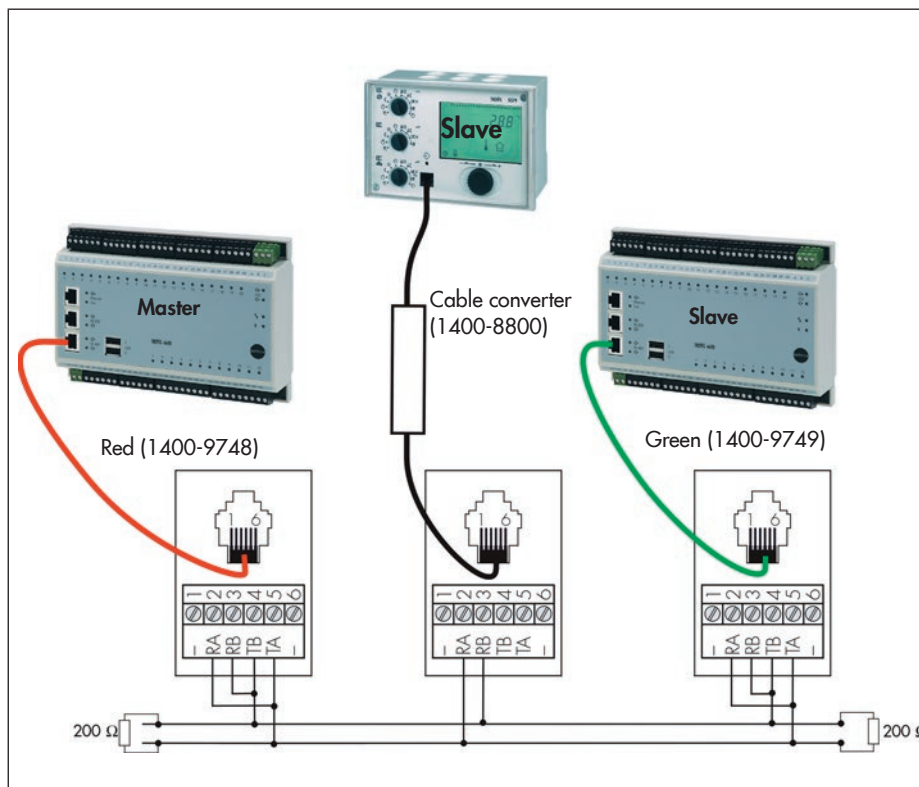
- Every RS-485 bus must be connected correctly.

Modbus master function

Two-wire circuit

Slave: TROVIS 6610 CPU Module and TRO-VIS 55xx Controller
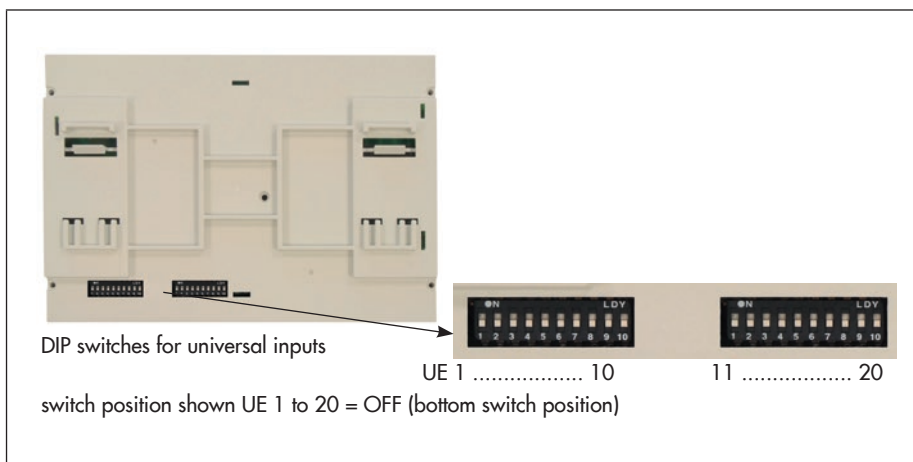
Master: TROVIS 6610 CPU Module

8   Integrating modules into the system

8.1 Module configuration

The TROVIS 6610 CPU Module and the TROVIS 6620 I/O Module have universal inputs. In addition to software configuration using the TROVIS 6690 Graphic Project Management Tool, all active inputs need to be configured over the DIP switches on the back of the module (for TROVIS 6610-0001 and TROVIS 6620-0001 and higher):
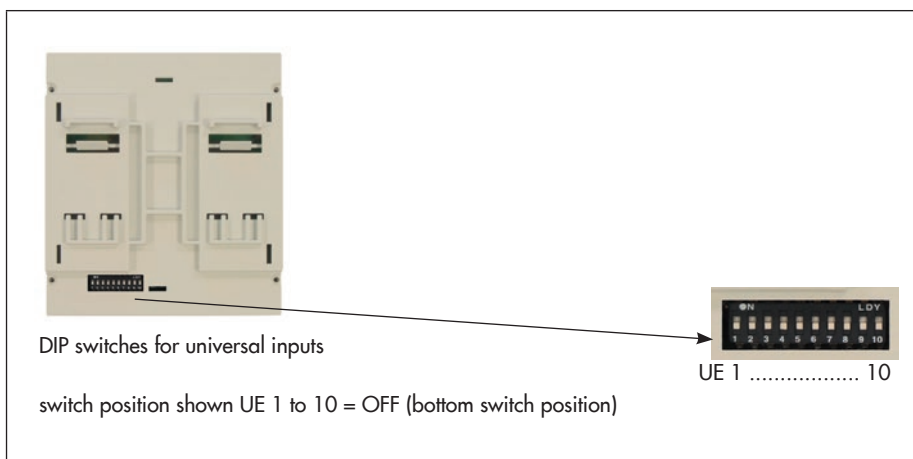
ON   for   Pt 1000, 0 to 2000 Ω, binary input

OFF   for   0 to 10 V

DIP switches for universal inputs

UE 1 10   11 20

switch position shown UE 1 to 20 = OFF (bottom switch position)

DIP switches on TRO-VIS 6610 CPU Module

(TROVIS 6610-0001)

DIP switches for universal inputs

UE 1 10

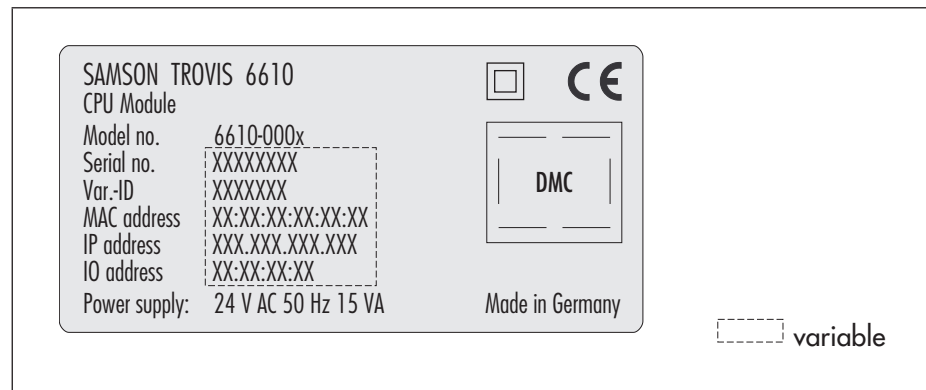switch position shown UE 1 to 10 = OFF (bottom switch position)

DIP switches on TRO-VIS 6620 I/O Module

(TROVIS 6620-0001)

8.2 Changing the network settings

Every participant in a bus system or network requires a clear identification or address. In a TCP/IP network, an IP address is assigned to every TROVIS 6610 CPU Module. This module is delivered with the TCP/IP address printed on the nameplate and with the subnet mask 255.255.0.0. The entry for the gateway is left empty. You can changes these settings to adapt them to an existing computer structure.

**Nameplate of
TROVIS 6610 CPU
Module with IP address**

SAMSON TROVIS 6610
CPU Module
Model no.   6610-000x
Serial no.   XXXXXXXX
Var.-ID   XXXXXXX
MAC address XX:XX:XX:XX:XX:XX
IP address   XXX.XXX.XXX.XXX
IO address   XX:XX:XX:XX
Power supply: 24 V AC 50 Hz 15 VA   Made in Germany

□ C€

DMC

┌------┐
└------┘ variable

To allow a connected computer/notebook/web terminal to communicate with
the CPU module(s), they must be in the same address range.

**Properties of the inter-
net protocol (TCP/IP)**

from:

Windows® XP Professional
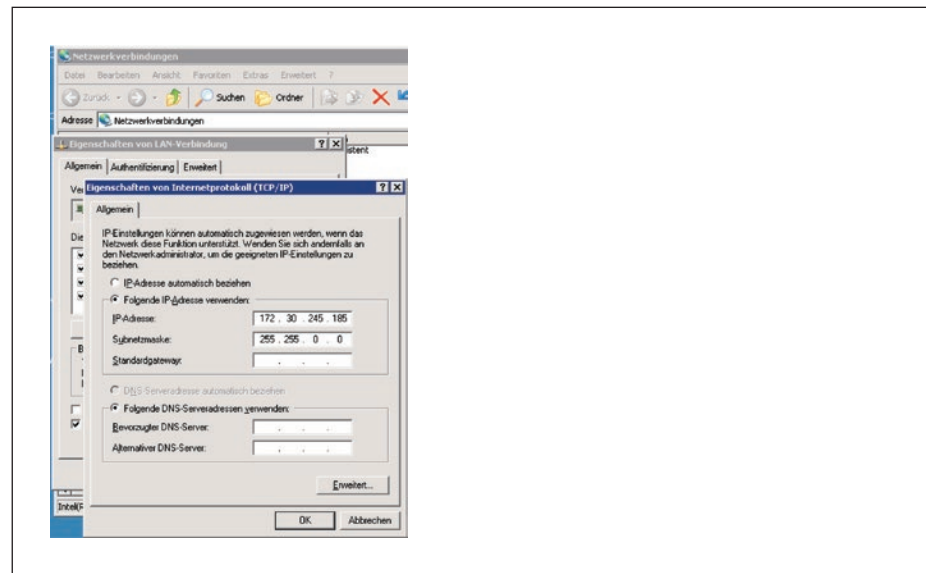
A TROVIS 6610 CPU Module has the following settings in the state of de-
livery:

IP address: 172.30.245.57

Subnet mask: 255.255.0.0

Gateway: No entry

A connected computer must be in the address range 172.30.XXX.XXX and
subnet mask 255.255.0.0.

A ping tool can be used to check communication with a participant. (start/
execute → CMD).

C:\>ping 172.30.245.55 (example)

To exit tool, write the EXIT command.

Ping tool

```
C:\WINDOWS\system32\cmd.exe

C:\>ping 172.30.245.55

Ping wird ausgeführt für 172.30.245.55 mit 32 Bytes Daten:

Antwort von 172.30.245.55: Bytes=32 Zeit<1ms TTL=64
Antwort von 172.30.245.55: Bytes=32 Zeit<1ms TTL=64
Antwort von 172.30.245.55: Bytes=32 Zeit<1ms TTL=64
Antwort von 172.30.245.55: Bytes=32 Zeit<1ms TTL=64

Ping-Statistik für 172.30.245.55:
    Pakete: Gesendet = 4, Empfangen = 4, Verloren = 0 (0% Verlust),
Ca. Zeitangaben in Millisek.:
    Minimum = 0ms, Maximum = 0ms, Mittelwert = 0ms

C:\>
```

The network settings can be adapted over the network protocol Telnet. They can be adapted over a browser, TROVIS 6616 Web Terminal, Telnet or the RS-232 serial port.

Serial port (RS-232) of a computer/notebook

Using a computer communications software such as Hyperterminal, you can change the networks settings.

Communication parameters (port settings):

Bits per second: 115 200

Data bits: 8

Parity: None

Stop bits: 1

Flow control: Hardware

Required cable: Item no. 0450-2284
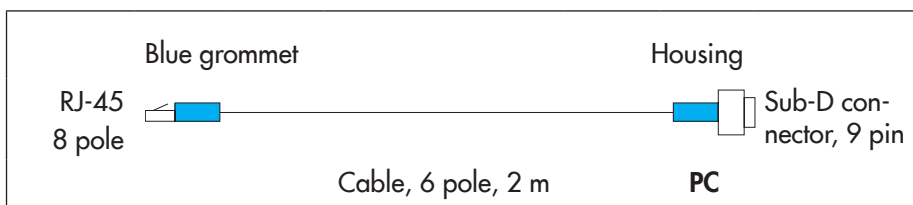
Connecting TROVIS 6610 CPU Module to a computer/notebook

| RJ-45	Designation	Comment		Sub-D 9 pin	Designation	Comment
8	NC					
7	GND					
6	RX	Input	……	3	TX	Output
5	CTS	Input	……	7	RTS	Output
4	RTS	Output	……	8	CTS	Input
3	TX	Output	……	2	RX	Input
2	GND	GND	……	5	GND	GND
1	NC					

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8.3 Addressing mode of the modules

Requirements for addressing mode
- The TROVIS 6610 CPU Modules must be reachable using the Ping tool (see above).
- **TROVIS 6690 Graphical Project Management Tool** must be installed on the computer.
- A hardware configuration must exist in **TROVIS 6690 Graphical Project Management Tool** or it must be created (see Manual H 6690 EN).

The addressing mode of the modules is performed in Hardware Model of **TROVIS 6690 Graphical Project Management Tool**. The Hardware Model is activated by selecting *Show Hardware Model* from the *View* menu.
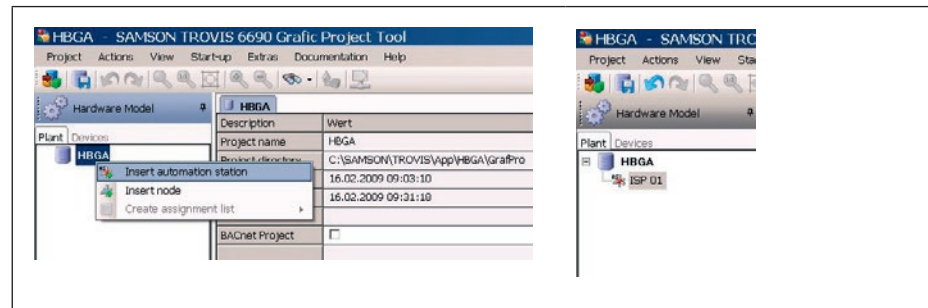
Activating the Hardware Model
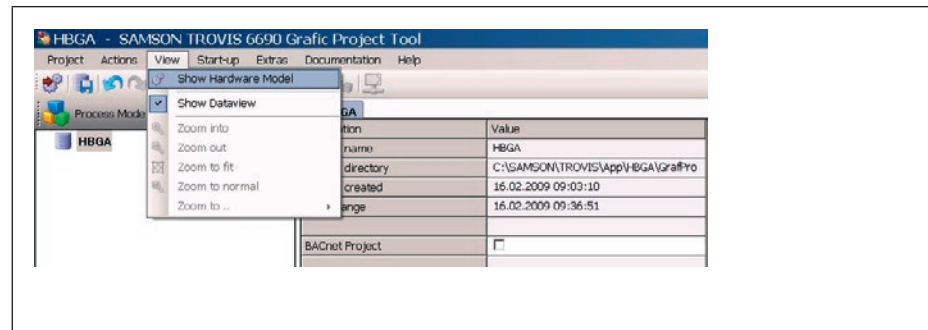
The Hardware Model portraits an image of the hardware installed in the building. The tree allows a logical structure to be built up which facilitates work during commissioning.
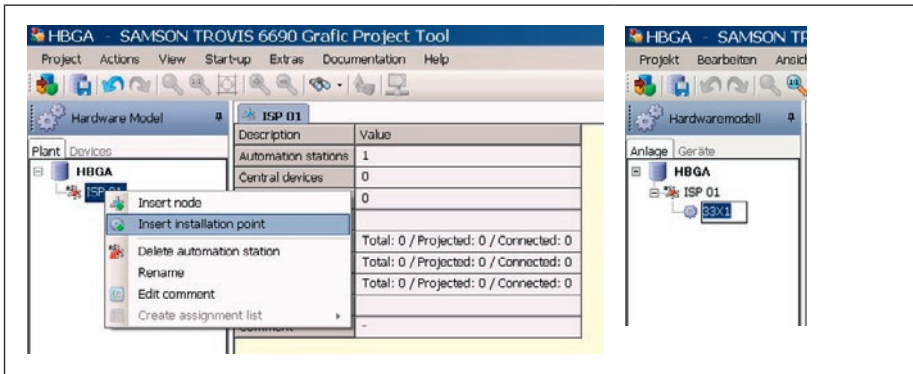
To set up the Hardware Model, a location in which the devices can be located must be created.

Hardware Model: Insert automation station

To do this, create a new automation station, in this example e.g. ISP 01 (set of controllers 01).
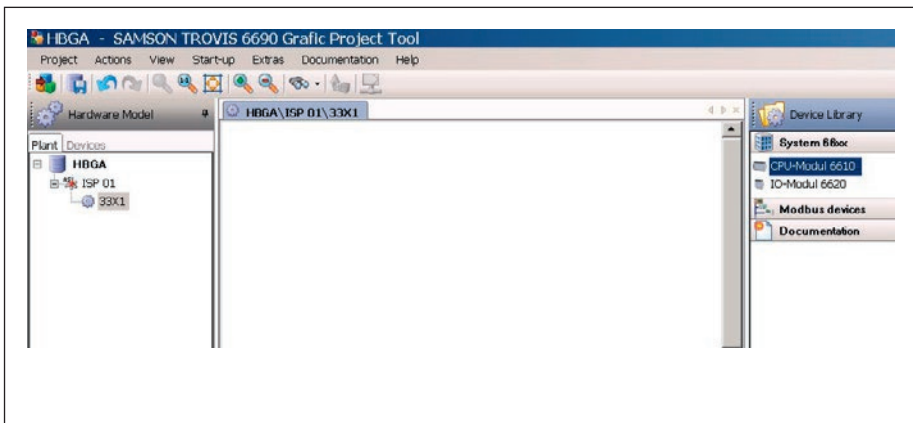
The installation point "33X1" is determined under the automation station.

**Hardware Model:
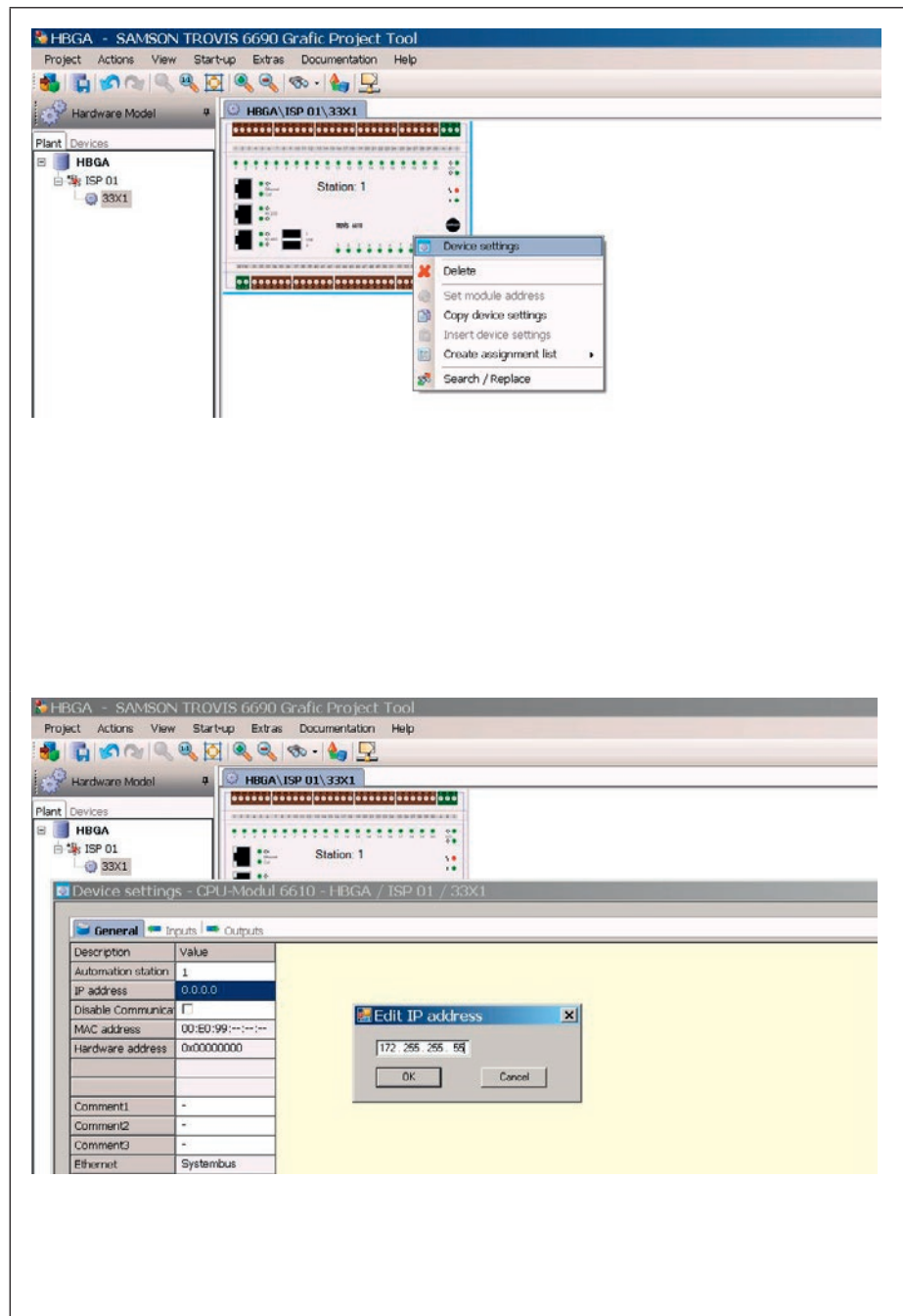Insert installation point**

**Hardware Model:
Add module**

The corresponding modules are selected from the hardware library and drag and dropped onto the plan.

In the context-sensitive menu of TROVIS 6610 CPU Module, at least the TCP/IP address must be entered and saved.

Hardware Model: Edit IP address

When the TROVIS 6610 CPU Module with specified IP address is found, the connected modules are listed on the right-hand side of the window. In this example, the modules integrated into the system (placed in the installation location as previously described) are shown and the physically existing modules are listed on the right with their hardware address.

To find the actual modules easier, it is possible to let the modules themselves be known. This state is activated by checking the box.

The LEDs on the inlet side of the corresponding module then light up one after the other in quick succession, making a chase pattern. The user can assign the module integrated into the system to the physically existing module in the TROVIS 6690 Graphical Project Management Tool.
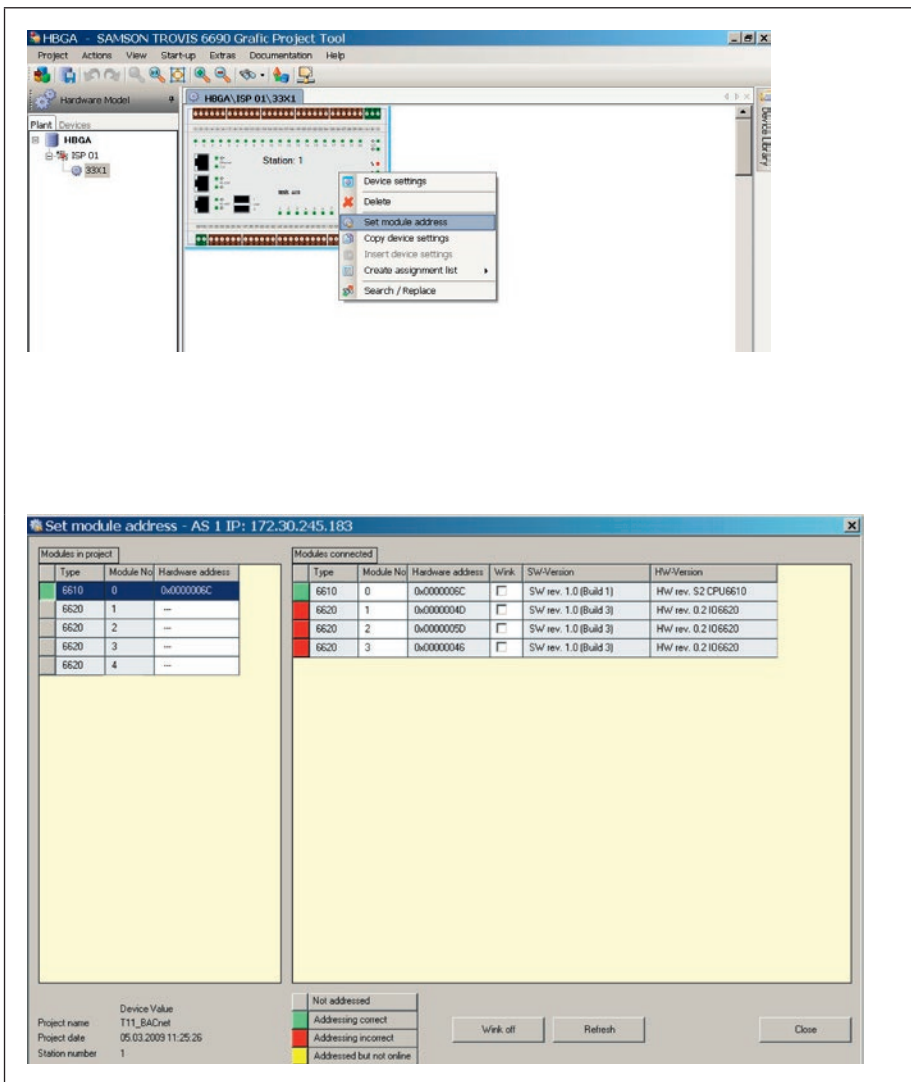
Hardware Model: Module integrated into the system and physically existing module

9   Licenses

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the right to use the BTL mark for BACnet
conformance tested products for the BACnet conformance of

TROVIS
6610

with
Firmware revision: SAMSON BACstack 1.6
BACnet protocol revision: 4
Device profile: B-BC

The right is granted according to the listing rules of the BACnet Interest
Group Europe based on the test report no. 08.61.SAM.001.1 issued by WSPLab.

The right granted here to use the BTL mark is limited to the above
mentioned product and firmware revision and may only be used on the
product itself and product related documentation.

Dortmund, April 6th, 2008
The Executive Board of the BIG-EU

Volker Röhl   William O. Swan   Roger Braun   Gijs de Koning

BACnet® is a registered trademark of ASHRAE. BTL® is a registered trademark of the BACnet International.

WSPCert

Certificate

No. BAC-0105-03

WSPCert attests the conformance of the following BACnet implementation to the BACnet standard ISO 16484-5:2012. The attested conformance refers to the BACnet Interoperability Building Blocks (BIBBs) listed in the annex of this certificate.

The BACnet Building Controller (B-BC)

**TROVIS 6610 Automation Station
6610-0002**

with the software version:

SAMSON BACstack 2.0

of

SAMSON AG
Postfach 10 19 01, 60019 Frankfurt a.M., Germany

has fulfilled the requirements according to the test standard ISO 16484-6, the BTL Test Plan 12.0 and the Certification Rules of the BACnet Interest Group Europe, see **MBS Test Report No. VG 2012_7573.**

The certificate is valid
until 2017/04/01

Date of renewal
2016/03/31

2013/11/04

C.C

Date of initial certification

Dipl.-Ing. G. Weinmann
Head of Certification Body

Empowered by

ASHRAE **BACnet**
INTEREST GROUP EUROPE

WSPCert Dr.-Ing. Frank Bitter
Kapuzinerweg 7, 70374 Stuttgart, Germany,
phone: +49 (0)711 9539220, email: info@wspcert.de

Certification body accredited
by the DAkkS according to
EN ISO/IEC 17065.

DAkkS
Deutsche
Akkreditierungsstelle
D-ZE-11156-01-00

WSPCert

Annex to Certificate No. BAC-0105-03

The certification of the BACnet Implementation
TROVIS 6610-0002 Automation Station
of **SAMSON AG**

refers to the BACnet Interoperability Building Blocks (BIBBs)
listed below. BIBBs other than listed are not part of the cer-
tification.

BACnet Interoperability Building Blocks	
DS-RP-A	Data Sharing – Read Property – A
DS-RP-B	Data Sharing – Read Property – B
DS-RPM-A	Data Sharing – Read Property Multiple – A
DS-RPM-B	Data Sharing – Read Property Multiple – B
DS-WP-A	Data Sharing – Write Property – A
DS-WP-B	Data Sharing – Write Property – B
DS-WPM-B	Data Sharing – Write Property Multiple – B
DS-COV-A	Data Sharing – COV – A
DS-COV-B	Data Sharing – COV – B
AE-N-I-B	Alarm and Event – Notification Internal – B
AE-N-E-B	Alarm and Event – Notification External – B
AE-ACK-B	Alarm and Event – Acknowledge Alarm – B
AE-ASUM-B	Alarm and Event – Alarm Summary – B
AE-ESUM-B	Alarm and Event Management – Event-Enrollment Summary – B
AE-INFO-B	Alarm and Event – Information – B
SCHED-I-B	Scheduling – Internal – B
SCHED-E-B	Scheduling – External – B
T-VMT-I-B	Trending – Viewing and Modifying Trends Internal – B
T-VMT-E-B	Trending – Viewing and Modifying Trends External – B
T-ATR-B	Trending – Automated Trend Retrieval – B
DM-DDB-A	Device Management – Dynamic Device Binding – A
DM-DDB-B	Device Management – Dynamic Device Binding – B
DM-DOB-B	Device Management – Dynamic Object Binding – B
DM-DCC-B	Device Management – Device Communication Control – B
DM-ATS-A	Device Management – Automatic Time Synchronization – A
DM-TS-A	Device Management – Time Synchronization – A
DM-TS-B	Device Management – Time Synchronization – B
DM-UTC-A	Device Management – UTC Time Synchronization – A
DM-UTC-B	Device Management – UTC Time Synchronization – B
DM-RD-B	Device Management – Reinitialize Device – B
DM-BR-B	Device Management – Backup and Restore – B
DM-R-B	Device Management – Restart– B
DM-LM-B	Device Management – List Manipulation– B
DM-OCD-B	Device Management – Object Creation and Deletion – B

AMEV

Mechanical and Electrical Engineering Working
Party of National, Regional and Local Authorities

WSPCert

BACnet CERTIFICATION BODY

AMEV attestation for certified BACnet devices

1. The following BACnet device is certified as per DIN EN ISO 16484-5:

Supplier	SAMSON AG		
Product name	TROVIS 6610 Automationsstation		
Product model number	6610-0002		
Standard device profile	B-BC	BACnet protocol vers. / rev.	1.12
Firmware revision	SAMSON BACstack 2.0		

Data Link Layer options	☒ BACnet IP (Annex J)	☐ BACnet over LonTalk
	☐ BACnet MS/TP master	☐ BACnet MS/TP slave
	☐ MS/TP baud rates: ……………………………………………	
	☐ ……………………………………………………………………	
Static address binding	☐ Yes (for MS/TP only)	
Network options	☒ BBMD	☒ Reg. by foreign devices
	☐ Router, medium:	
Character sets	☒ UTF-8	☒ ANSI X3.4
Reporting options	☒ Intrinsic reporting	☒ Algorithmic reporting

2. The device supports BACnet functions as per AMEV profile:

☐ **AMEV profile AS-A** (Automation station, base version)	**As of:**	
☒ **AMEV profile AS-B** (Automation station, extended version)	**As of:** V1.1 21.08.2012	
☐ **AMEV profile** ………………………………………………………..	**As of:**	
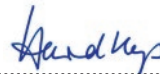
3. Basis for AMEV attestation:

☒ **Test report** of test lab MBS dated 07.11.2013   number VG 2012_7573
☒ **AMEV recommendation BACnet 2011 V1.1 As of:** 21.08.2012 (see www.amev-online.de)

4. The AMEV attestation is only valid in combination with the certificate:

☒ **Certificate number** BAC-0105 (see http://www.big-eu.org/conformance/eu/index.php)

(location, date)
 Düsseldorf, 28.11.2013

………………………………….
   (AMEV chairman BACnet)

WSPCert
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Telefax +49 711 953922-66

……………………………………
      (BACnet certification body)