General
Wiring Notes

EASYLAB Controller TCU3

Last update
16.02.2024

Notes

The options contained in these wiring instructions can be activated and parameterized with the EasyConnect software. It is not possible to set the controller parameters individually at the factory.

Applicable documents

Leaflets and assembly instructions of

- EASYLAB Controller TCU3

- EASYLAB Expansion modules EM-TRF or EM-TRF-USV, EM-LON, EM-AUTOZERO, EM-LIGHT, EM-BAC-MOD-01, EM-IP

- Sensors/Transducers for fume cupboard control VS-TRD or DS-TRD-02

- EASYLAB Control panels BE-SEG-02, BE-LCD, CP-TOUCH

General safety instructions

Recognised codes of engineering practice, especially the safety requirements and accident prevention regulations must be observed when performing all assembly, wiring and commissioning procedures.

Only specially trained and qualified personnel are permitted to perform the assembly, wiring and commissioning.
The electrical installations must be implemented in compliance with the current valid EN / VDE / DIN and local electrical regulations.

Danger:

Electric shock by touching live parts.
Electrical devices may cause electrical hazards during operation

Before installation/assembly works begin:
**Disconnect all poles or switch off supply voltage of EASYLAB controller.
Protect power supply against unauthorised or unintended restart.**

All installation operations may only start after these safety operations.
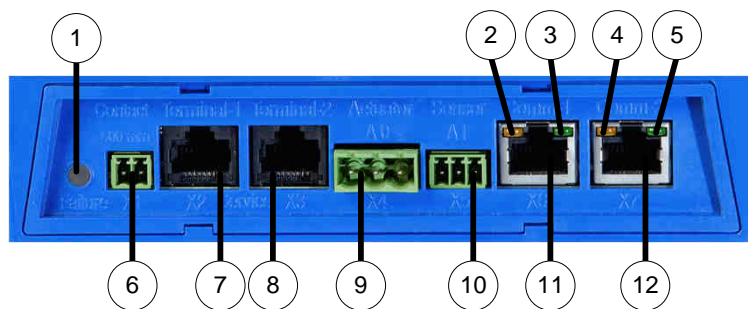
Contents

Exterior sockets / Indicators:

Left box side

Right box side
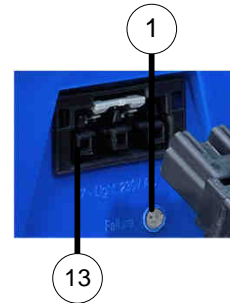
Interior sockets / Indicators:
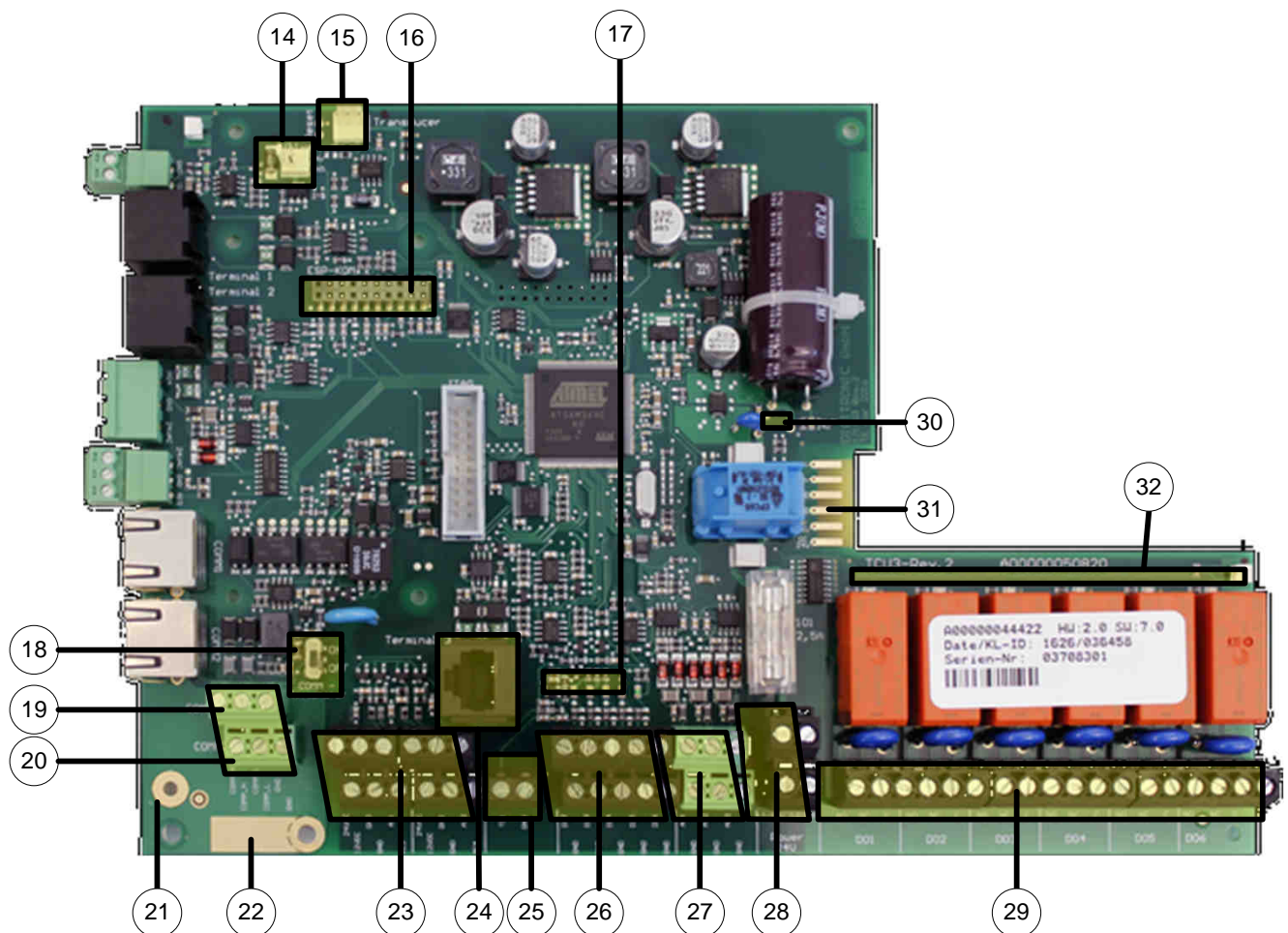
1 Red error indicator
2 Yellow indicator - Network termination activated
3 Green indicator (Reserved)
4 Yellow indicator CL-Network data received
5 Green indicator Controller operation (Heartbeat)
6 Socket X1 DI1 - Sash contact 500 mm
7 Socket X2 Control panel 1
8 Socket X3 Control panel 2
9 Socket X4 A04 Actuator
10 Socket X5 AI5 - Face velocity transducer
11 Socket X6 Communication line 1 - RJ45
12 Socket X7 Communication line 2 - RJ45

13 Socket Fume cupboard lights via connector from Wago Winsta Midi Series 770-113 (only with EM-LIGHT expansion module)
14 Socket Magnetic valve EM-AUTOZERO
15 Socket AI1 for internal volume flow transducer
16 Expansion slot for LonWorks®, BACnet, Modbus interface with EM-LON, EM-BAC-MOD-01 or EM-IP
17 Optical status indicators of digital inputs
18 Activation switch for CL network termination
19 Screw terminals for communication line 1
20 Screw terminals for communication line 2

21 PE connection
22 Clamp / Connection pad for cable shield
23 Screw terminals Analogue inputs AI1…AI4
24 connection digital actuator
25 Screw terminals temperature sensor PT1000 TI1
26 Screw terminals Digital inputs DI2…DI6
27 Screw terminals Analogue outputs AO1…AO3
28 Screw terminals Power supply 24 V AC / DC
29 Screw terminals Digital outputs DO1… D06
30 Green indicator 24 V ok
31 Connection pad for Expansion module mains supply
32 Optical indicators for switching state of digital outputs

Power supply

Optional expansion module

EM-TRF
Mains supply 230 V AC

EM-TRF-USV
Mains supply 230 V AC
with UPS function

230 V AC

24 V Power LED

EM-TRF
EM-TRF-USV
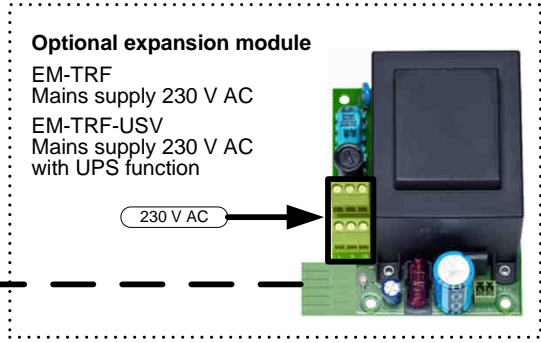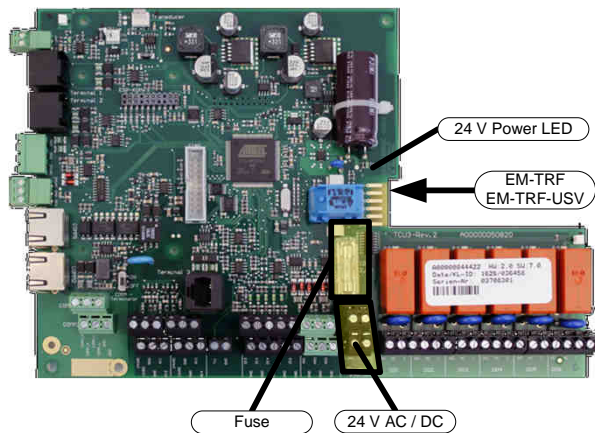
24 V Power LED: On = Supply voltage ok
                Off = Supply voltage not ok

Fuse

24 V AC / DC

Supply voltage 24 V AC / DC

Supply voltage

AC	DC
L1	+24 V
L2	GND

L1 / 24V   L2 / GND
Power 24V
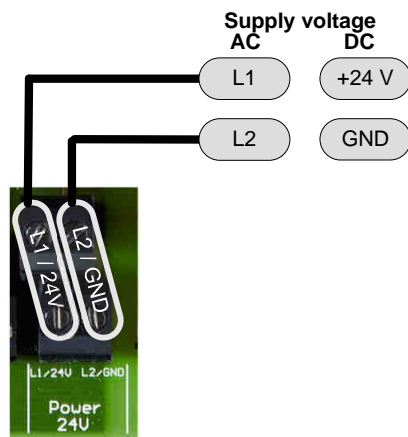
Technical data:

- Supply voltage 24 V AC ± 15% 50-60 Hz

- Supply voltage 24 V DC ± 15%

- Fuse 2,5 A slow, 250 V; glass tube fuse 5x20 mm

- Power consumption up to 40 VA (Maximum configuration)
  inrush current actuator: Imax 20 A for 5 ms
  Only TCU3 without additional configuration: ……………………………5 VA
  Maximum power consumption is determined by the individual controller configuration.
  Typical configurations will lead to following values:
  Fume cupboard controller with control panel …………………up to 35 VA
  Room controller with room control panel CP-TOUCH…………..   up to 33 VA
  Room controller without room control panel …………………. up to 29 VA
  Supply air/extract air controller without room control panel ….up to 29 VA

Important wiring instructions:

Observe polarity
Polarity of DC and AC supply voltage has to be strictly complied for all controllers during wiring.

Limited wiring in a row
Power supply wiring in a row (via double terminals) is only approved for a maximum of 5 EASYLAB controllers!

Supply voltage at analogue inputs for supply of sensor/transducer
Type of used controller power supply (AC/DC) will influence type of provided power supply at analogue inputs:
TCU3 Power supply 24 V AC → Provided sensor supply at AI1-AI5 is 24 V AC
TCU3 Power supply 24 V DC → Provided sensor supply at AI1-AI5 is 24 V DC

This may require attention for connected sensors

Mains supply voltage 230 V AC

Alternative power supply
(only with expansion module EM-TRF or EM-TRF-USV)

L	Phase
N	Neutral
PE	Protective conductor

L N PE
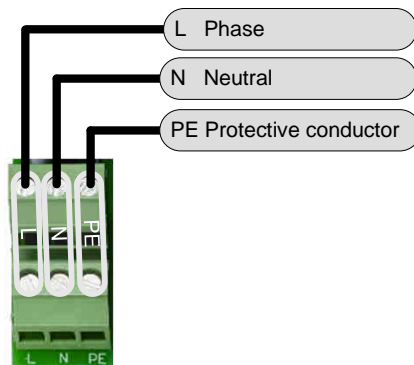
Technical data:

- Supply voltage 230 V AC ± 20% 50-60 Hz

- Fuse 500 mA slow, 250 V

- Power consumption up to 40 VA (Maximum configuration)

Important wiring instruction:

- Never connect 230 V and 24 V supply voltage simultaneous at one controller.

- Never connect 24 V supply voltage at controller with built in expansion module EM-TRF or EM-TRF-USV

Supply voltage at analogue inputs for supply of sensor/transducer
TCU3 Power suppy 230V AC → Provided sensor supply at AI1-AI5 is 24 V DC
(with EM-TRF, EM-TRF-USV)

This may require attention for connected sensors

Communication line (CL)

For Plug- & Play data exchange between the controllers within one EASYLAB system

Note:
Use always green patch cables for the communication line CL

Aim:
Simple determination of communication line cable (green) and control panel connecting cable (blue)

Technical data:

- Maximum device no. within one system: 24

- Maximum total length: 300 m

- Network cable type **SF-UTP** (braid + foil shield) according ISO IEC 11801 (2002)

  patch cable with RJ45 plug connectors on both sides or cable from a reel; e.g. Cat 5

- Activate termination resistor at the beginning and the end of the EASYLAB communication line CL.

- 5 m connectiion cable for communication line CL included in the delivery
  (only for fume cupboard controller with device function FH-xxx and TAM)

CL - Connection sockets and indicators

Terminiation CL	
Reserved	
Data reception CL	
Heartbeat	
RJ45 socket X6 Connection COMM-1	
RJ45 socket X7 Connection COMM-2	

Termination indicator
Yellow = Termination active   Off = Termination inactive

Data reception CL
Yellow / blinking = Data received

Heartbeat
Green slow blinking = Normal controller operation
Green off = Device not operable

Default socket communication line 1

Default socket communication line 2

CL - Termination resistor

Activation switch CL termination

Termination of communication line CL

For a correct data exchange of the controllers is a termination on both ends of the communication line required.

ON   = Termination activated
OFF = Termination deactivated

Communication line (CL)

CL - Screw terminals as an alternative wiring option:

For data exchange via network cable from a reel as an alternative to patch cables

Important wiring note:

For port COMM1 or COMM2 on one EASYLAB controller use either the RJ45 sockets with patch cable **or** the screw terminals with network cable from a reel to built up the communication line CL.

Technical data:

- Maximum device no. within one system: 24
- Maximum total length: 300 m
- Network cable type **SF-UTP** (braid + foil shield) according ISO IEC 11801 (2002) cable on a reel; e.g. Cat 5
- Activate termination resistor at the beginning and the end of the EASYLAB communication line CL.
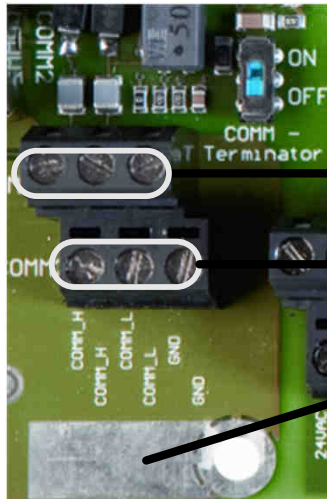
Screw terminals COMM1
COMM-H / COMM-L / GND   Replaces RJ45 socket X6 of COMM-1

Screw terminals COMM2
COMM-H / COMM-L / GND   Replaces RJ45 socket X7 of COMM-2

Shielding contact area
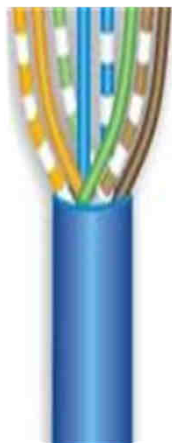
Wiring notes:

- Uses either screw terminals or RJ45 sockets of one EASYLAB controller.

- Use always two cores for each signal

- Use clamp to contact cable shielding with shielding contact area on the controller PCB

Wire assignment as follows:

Screw terminal TCU3	Cable core (Color coding according EIA/TIA568B)		
GND	blue	and	white/blue
COMM_H	white/orange	and	white/green
COMM_L	orange	and	green

Communication system - Communication line (CL) and it's termination

Important notes for system design

- Up to 24 EASYLAB controller can be connected together
  FH: Fume cupboard controller SC: Supply air controller EC: extract air controller   RS: Room supply air controller
  RE: Room extract air controller, PC: presssure controller, TAM: TROX Adaption module

- Any order of devices at communication line is allowed

- Only controller types (RS, RE, PC, TAM) of **one** system type can work within one EASYLAB communication system;
  that means either controller types of an extract air controller system (LAB Laboratory)
              or controller types of a supply air controlled system (CLR CleanRoom)

- Maximum length of the communication line CL: 300m.

- Use network cable type SF-UTP acc. ISO IEC 11801 (braid+foil shielded e.g. CAT 5)

- 5 m connection cable for communication line CL included in the delivery
  (only for fume cupboard controller with device function FH-xxx)

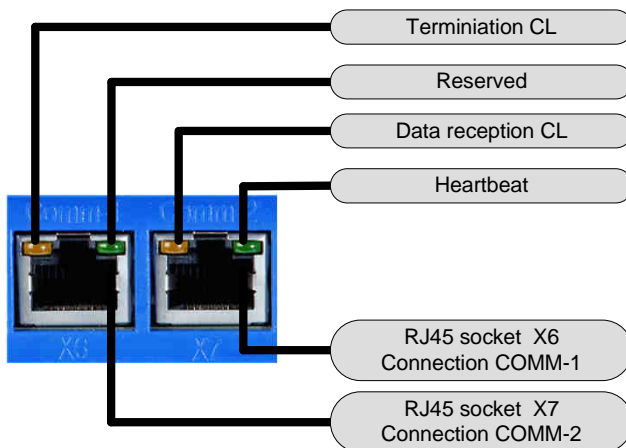- Communication line termination at the beginning and the end
  by activating the switch COMM-Terminator on the EASYLAB main board   (see examples below)

Termination switch on the pcb   Symbol activated / deactivated

Example 1: Two fume cupboard controller   or   two room controller

Example 2: Two fume cupboard controller and one room supply air controller
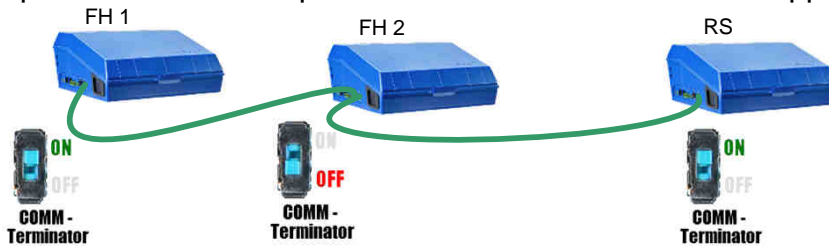
Example 3: Three fume cupboard controller and one room supply air controller

Example 4: Two fume cupboard controller, one extract air controller, two room supply air controller and one room extract air controller
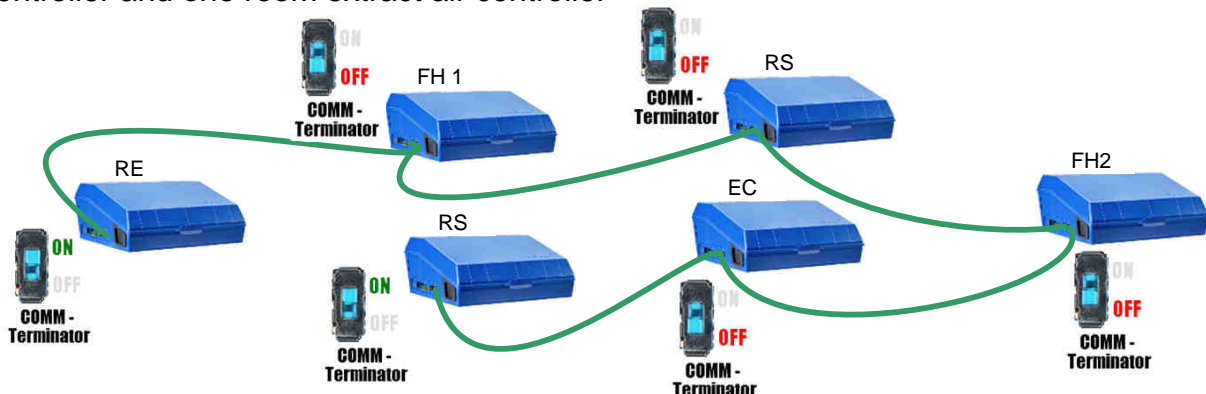
Room-Management-Function

The Room-Management-Function (RMF) is a software option to realize room based functions with the EASYLAB System:

- Centralized interchange point for wiring of room functions
- Connection of room control panels
- Centralized configuration of room parameters and functions
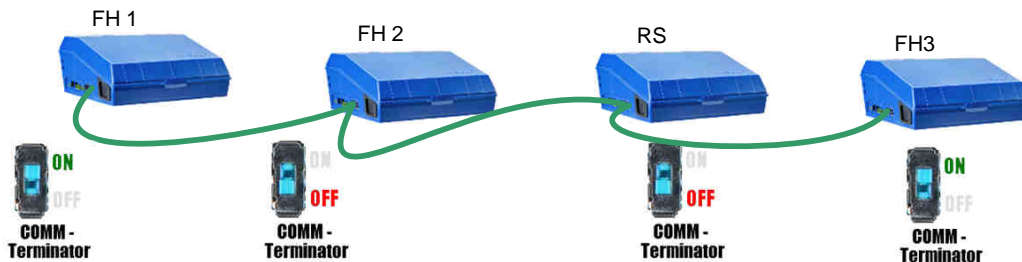- Monitioring of room functions

Technical data:

- RMF can be acitvated on any room controller (Supply or Extract air) or on a TROX Adaption module.
- RMF activation is only allowed on exactly one EASYLAB controller in a system of max. 24 controller.
- RMF can be activated with the EASYLAB configuration software EasyConnect.

Example 1:

FH 1 Fume cupboard controller	FH 2 Fume cupboard controller	FH 3 Fume cupboard controller	RS Room supply controller	RE Room extract controller

RMF

Example 2:

FH 1 Fume cupboard controller	FH x Fume cupboard controller	RE Room extract controller	RS 1 Room supply controller	RS 2 Room supply controller

RMF
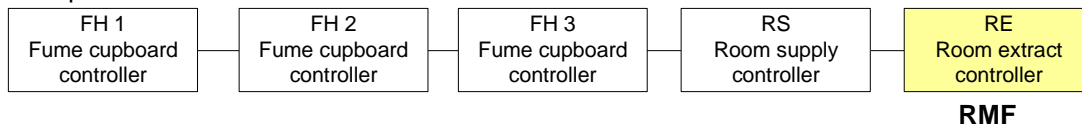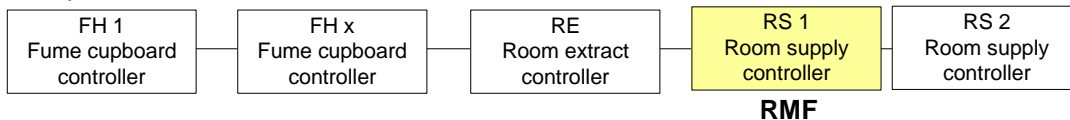
RMF relevance for wiring

The selection of the controller with RMF is relevant for the wiring of room based functions and signals. Following signals and the room control panel have to be connected at the controller with the RMF:

Room control panel
Room operation mode preset,
Displaying of current values and monitoring status,
Easy access point for service/configuration of controller with RMF

Room operation mode preset
Operation modes,
Priority (Blocking of hand mode)

Volumen flow shift
Temperature
External pressure control

Internal pressure control
Current pressure (Pressure transducer),
Door contact,
Selecting pressure setpoint

**LonWorks®, BACnet MS/TP, Modbus RTU
Room interface**
Operation mode preset and priority,
Volume flow shift (Extract-/Supply air)
Selecting pressure setpoint

RMF
Optionally:

LonWorks®
EM-LON

BACnet MS/TP /
Modbus RTU
EM-BAC-MOD-01

BACnet-IP /
Modbus-IP
EM-IP

Alarm
Configurable summary alarm, Pressure alarm

Current values
Total room extract air and room supply air,

**LonWorks®, BACnet MS/TP, Modbus RTU
BACnet-IP, Modbus-IP Room interface**
Current room operation mode,
Current values of room extract/supply air
Current pressure value,
Summary alarm, Pressure alarm,
Preevaluation of damper positions

Connection of control panels

RJ45 socket X3
Control panel #2

RJ45 socket X2
Control panel #1
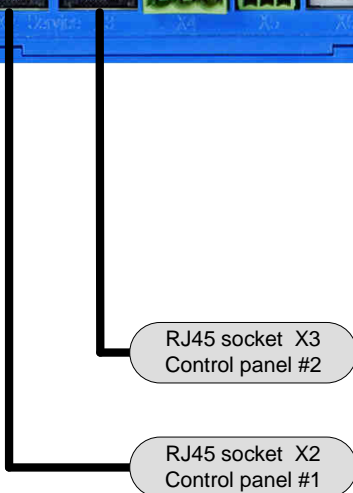
Note:

Use always blue patch cables for the control panels

Aim:
Simple determination of communication line cable (green) and control panel connecting cable (blue)

Control panel for fume cupboard controllers:

BE-SEG-02

CP-TOUCH

Technical data:

- Admitted are control panel types BE-SEG-01 and -02, BE-LCD and CP-TOUCH
- Up to two control panels can be connected to one controller
- 5 m connection cable blue included in the delivery
- Optionallly connection cable up to 40 m overall length useable: Network cable type **SF-UTP** acc. ISO IEC 11801 (braid+foil shielded) with RJ45 connectors on both sides, e.g. patch cable Cat 5
- Plug in connection cable on back side of control panel

Room control panel:

CP-TOUCH

Technical data:

- Useable only at room controllers with activated Room-Management-Function
- Admitted is only control panel type BE-LCD and CP-TOUCH
- Up to two control panels can be connected to one controller
- 5 m connection cable blue included in the delivery
- Optionallly connection cable up to 40 m overall length useable: Network cable type **SF-UTP** acc. ISO IEC 11801 (braid+foil shielded) with RJ45 connectors on both sides, e.g. patch cable Cat 5
- Plug in connection cable on back side of control panel

Note:
Room control panels can only be used at room controllers with activated Room-Management-Function (RMF).

Connection of TCU3 and PC for TROX EasyConnect-Software

EASYLAB Controller / Control panel

PC-Software TROX EasyConnect
- Configuration
- Diagnostics
- Maintenance

USB
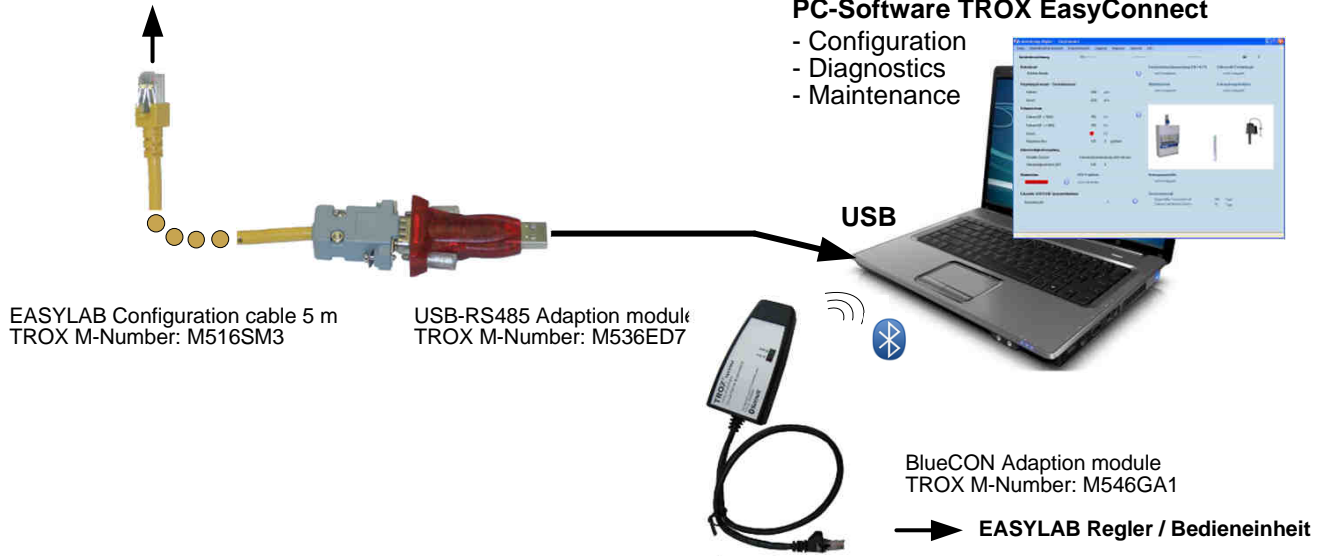
EASYLAB Configuration cable 5 m
TROX M-Number: M516SM3

USB-RS485 Adaption module
TROX M-Number: M536ED7

BlueCON Adaption module
TROX M-Number: M546GA1

EASYLAB Regler / Bedieneinheit

Complete package 1:
Order Code: EasyConnect-CAB

EasyConnect Software +
Configuration cable + USB-RS485 Adaption module +
programing adapter

TROX Number: B588NF4

Complete package 2:
Order Code: EasyConnect-BC
Alternatively you can use the Bluetooth Adaption module BlueCON for a wireless connection between TCU3 and PC with EasyConnect software. The BlueCON module replaces the USB-RS485 Adaption module and the cable.

EasyConnect Software + Bluetooth Adaption module BlueCON
+ programming adapter
TROX Number: B588NF5

Connection via control panels

BE-SEG-02

CP-TOUCH

Programming adapter
Trox number: A00000043797

Control panel of fume cupboard controller

Fume cupboard or room control panel

Connection directly at EASYLAB controller
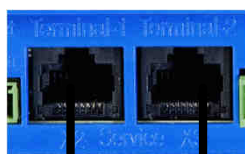
Use connection socket of control panels

RJ45 socket X3

RJ45 socket X2

Digital inputs (DI) / Digital outputs (DO)

DI1

DI2..DI6   DO1..DO6
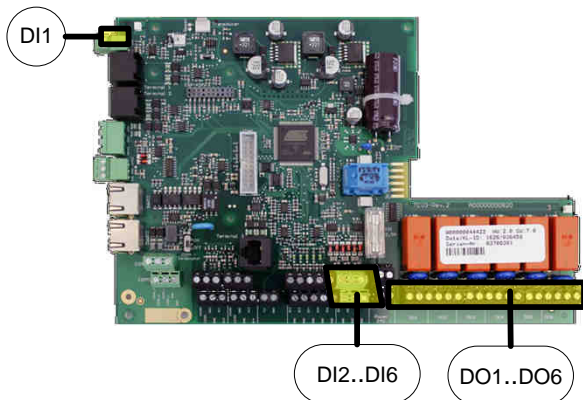
Digital inputs DI1 … DI6
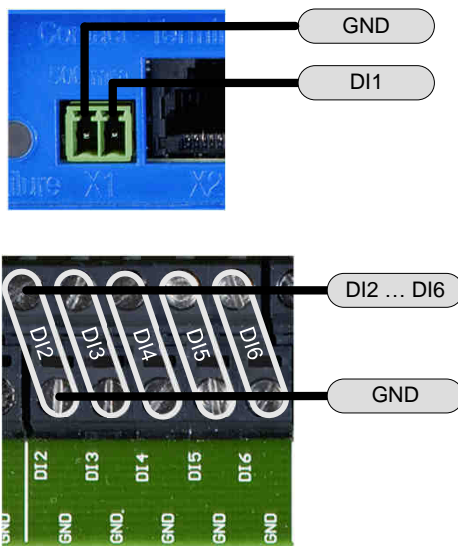
Typical applications: Reading of switch contacts

GND

DI1

DI   **Make contact**
GND

DI2 … DI6

GND

DI   **Brake contact**
GND
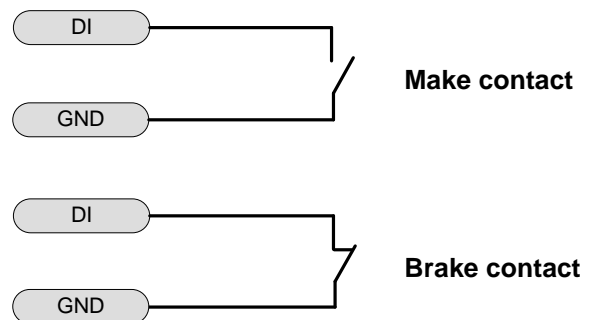
The contact effect (Make/Brake contact) can be configured within the EasyConnect software

Connector for DI1:
- Phoenix   MC   1,5/ 2-ST-3,5   Phoenix-No. 1840366 (included in the delivery)
                                    Trox material number: A00000040301
- Phoenix   MCVR 1,5/ 2-ST-3,5   Phoenix-No. 1863152 (by customer)
- Phoenix   MCVW 1,5/ 2-ST-3,5   Phoenix-No. 1862852 (by customer)

Digital outputs DO1 … DO6
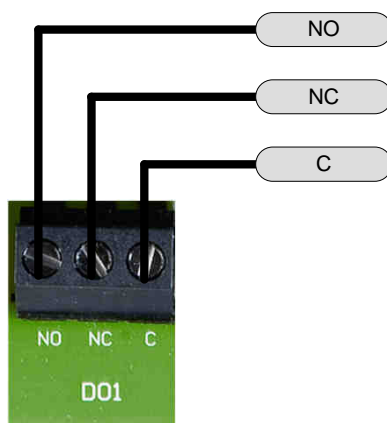
Typical application: Special functions / Alarm relay

NO

NC

C

TCU3

C   NC

NO
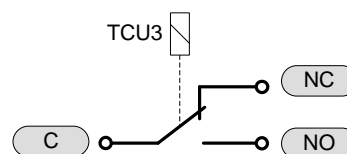
Technical data:

Electrical rating of contacts and pcb: 230 V AC max. 8 A

Additional note to alarm relay effect:

Alarm relay released   → Alarm state
Alarm relay activated   → No alarm state

Analogue inputs (AI) / Analogue outputs (AO) / Terminal 3

AO4
AI5
Terminal 3
AI1.. AI4
AO1 .. AO3

Analogue inputs AI1 … AI5

24V AC / GND / AI 1   24V AC / GND / AI 2

12V DC / GND / AI 3   12V DC / GND / AI 4
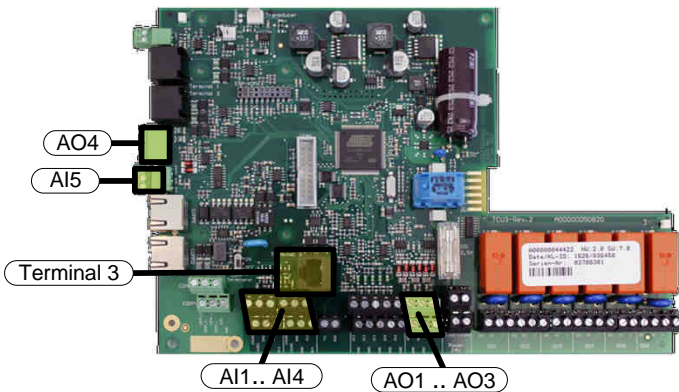
24V AC
GND
AI5
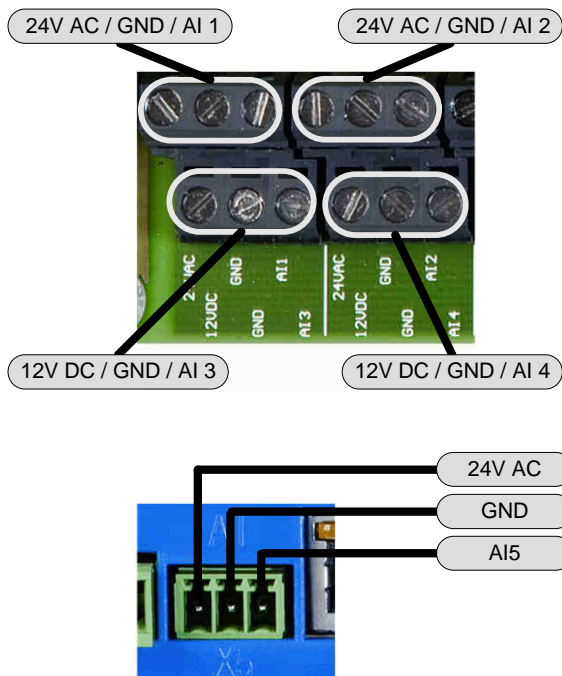
Typical application: Sensor/Transducer integration

AI

A_{output} Sensor / Transducer
Output signal

GND

V_{cc} Sensor / Transducer
Power supply

12 V DC
24 V AC
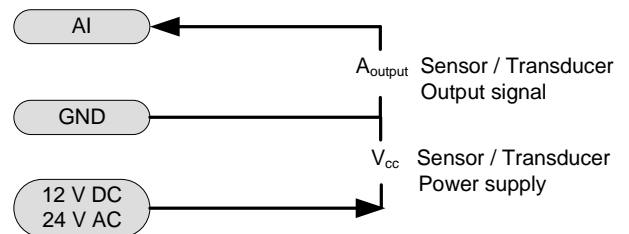
Typical application: Signal integration

AI

U_{Analog}

GND
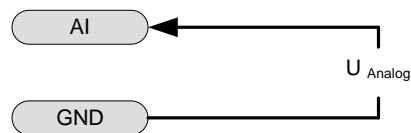
Technical data:
- Input voltage range 0-10 V DC
- Characteristic freely configurable
- Input resistance > 100kOhm

Connector for AI5:
- Phoenix MC   1,5/ 3-ST-3,5   Phoenix-No. 1701879 (included in the delivery)
                                   Trox material number: A00000040302
- Phoenix MCVR 1,5/ 3-ST-3,5   Phoenix-No. 1863165 (by customer)
- Phoenix MCVW 1,5/ 3-ST-3,5   Phoenix-No. 1862865 (by customer)

Analogue outputs AO1 … AO4
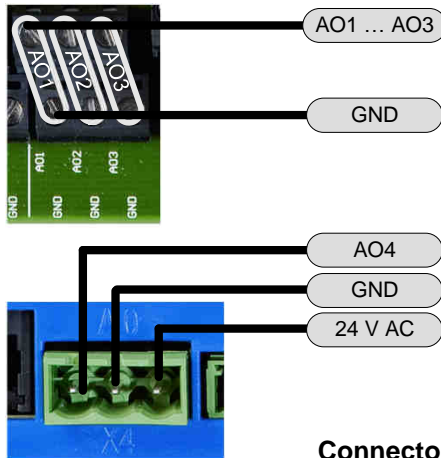
Typical application: Signal transmission output

AO1 … AO3

GND

AO

GND

$U_{Analogue}$

AO4

GND

24 V AC
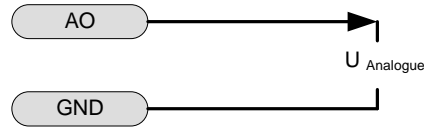
Technical data:
- Output voltage range 0-10 V DC
- Characteristic freely configurable
- Maximum output load 10 mA

Connector for AO4:
- Phoenix MVSTBR 2,5 /3-ST-5,08 Phoenix-No. 1792252 (included in the delivery)
  Trox material number: M516EE1

Terminal 3 (connection TROX HPD)

use: connection oft digital actuator TROX HPD

Important note:
Actuator TROX HPD may be connected only to terminal 3!

Sash distance sensor DS-TRD

AI4

GN (GN)

GND

WH (WS) 0 – 1750 mm; BN (BR) 350 – 2100 mm

12 V DC

BN (BR) 0 – 1750 mm; WH (WS) 350 – 2100 mm

0 mm

350 mm

2100 mm

1750 mm

2100 mm

① ② ③

Input / Output assigment - Fume cupboard controller (FH)

Digital inputs DI	
DI 1	Sash monitoring EN14175 *(only if configured; else **unused**)*
DI 2	Switch contact of 2/3-point control *(only if device function is FH-2P or FH-3P, else **unused**)*
DI 3	Switch contact of 3-point control *(only if device function is FH-3P, else **unused**)*
DI 4	Fume scrubber operation request *(only if fume scrubber function configured; else **unused**)*
DI 5	Support flow fan - Error *(only if supportive flow technology configured, else **unused**)*
DI 6	not used

Unused inputs can be configured with the EasyConnect software for the usage of following functions:
- Integration of switchable constant volume flows into room balance
- Integration of motion detector for special functions
- Smoke extraction function
- Operation mode preset High Mode, Low Mode, Shut off mode, Hand mode
  (only available for fume cupboard controllers which do not follow the room operation mode due to special configuration)
Operating mode changeover possible via control panel with configured keys
The state of the not used inputs could be transmitted by the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 4.x)

Digital outputs D0	
DO 1	Alarm relay (1)
DO 2	Fume scrubber – Enable (if configured, else **unused**)
DO 3	Supportive flow technology fan - On/Off (if configured, else **unused**)
DO 4	Automatic sash window closing - Open sash / Operation mode dependent switching e.g. fans (2) (if configured, else **unused**)
DO 5	Automatic sash window closing - Close sash / Operation mode dependent switching e.g. fans (2) (if configured, else **unused**)
DO 6	Fume cupboard interior light - On / Off (if configured, else **unused**)

(1) *Alarm state = Relay released*
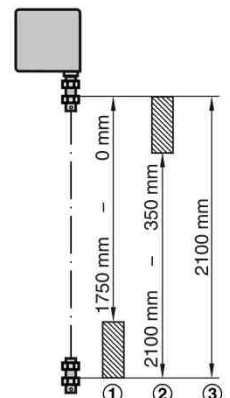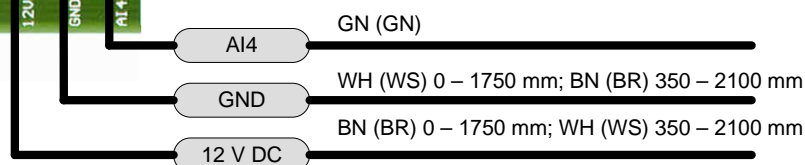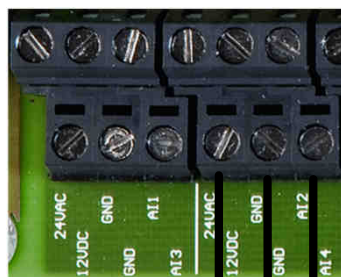(2) *From release 5.x : DO4 Standard, high, open, red. mode; b: DO4 Standard, high, open mode, DO5 red. mode*
Unused outputs relays could be energized via the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 5.x).

Analogue inputs AI	
AI 1	Internal volume flow transducer *(optionally external volume flow transducer)*
AI 2	Temperature sensor (2) *(if temperature alarm is activated, else **unused** (1))*
AI 3	**unused** (1)
AI 4	Sash distance sensor *(only if device function is FH-DS or FH-DV, else **unused**)*
AI 5	Face velocity transducer *(only if device function is FH-VS, else **unused**)*
TI1	Temperature sensor PT1000 (2) *(if temperature alarm is activated)*

Unused inputs can be configured with EasyConnect software for integration of variable volume flow into room balance
(1) from TCU V7.0 and EM-LON / EM-BAC-MOS-01 V4 or EM-IP V2 the voltage value could be transmitted via the communication card
(2) from TCU V8.0

Analogue outputs AO	
AO 1	Current volume flow of controller
AO 2	Total extract air room/Total supply air room/Set point supply air/voltage value via bus (1) *(configurable)*
AO 3	Damper position of controller
AO 4	Damper actuator

(1) from Version 7.0

Input / Output assigment – supply air / extract air control (SC/EC)

Digital inputs DI	
DI 1	not used, without function
DI 2	Switch contact of 2/3-point control *(only if device function is SC/EC-2P or SC/EC-3P, else without function)*
DI 3	Switch contact of 3-point control *(only if device function is SC/EC-3P, else without function)*
DI 4	Shut off mode *(configurable; else without function)*
DI 5	without function
DI 6	without function
The state of the inputs could be transmitted by the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 4.x).	

Digital outputs D0	
DO 1	Alarm relay (1)
DO 2	Alarm relay, time dependent (2) *(configurable; else without function)*
DO 3	without function
DO 4	without function
DO 5	without function
DO 6	without function
(1) *Alarm state = Relay released* (2) *Alarm relay time dependent: after release of an alarm the relay is energized for a setable time* *Outputs without function could be energized via the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 5.x).*	

Analogue inputs AI	
AI 1	Internal volume flow transducer *(optionally external volume flow transducer)*
AI 2	without function (1)
AI 3	without function (1)
AI 4	setpoint volume flow *(only if device function is SC/EC E0/E2, else not used, without function)*
AI 5	not used, without function
(1) *from TCU V7.0 and EM-LON / EM-BAC-MOS-01 V4 or EM-IP V2 the voltage value could be transmitted via the communication card*	

Analogue outputs AO	
AO 1	Current volume flow of controller
AO 2	Total extract air room/Total supply air room/Set point supply air/voltage value via bus (1) *(configurable)*
AO 3	Damper position of controller
AO 4	Damper actuator
(1) from Version 7.0	

Input / Output assigment - Room Controller (RS/RE/PC)

Note:
Some assignments are only available on room controllers with activated Room-Management-Function (RMF)

Digital inputs DI	
DI 1	**unused**
DI 2	**unused** *(Default at RMF: Room operation mode - Shut off mode)*
DI 3	**unused** *(Default at RMF: Room operation mode - Low mode)*
DI 4	**unused** *(Default at RMF: Room operation mode - High mode)*
DI 5	Pressure control - Door contact *(only at RMF, if internal pressure control is configured; else **unused**)*
DI 6	Pressure control - Changing setpoint *(only at RMF, if internal pressure control is configured; else **unused**)*

Unused inputs can be configured with the EasyConnect software for the usage of following functions:
- Integration of switchable constant volume flows into room balance
- Operation mode preset for the room: High Mode, Low Mode, Shut off mode, Hand mode (only at RMF)
The state of the not used inputs could be transmitted by the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 4.x).

Digital outputs D0	
DO 1	Alarm relay (1)
DO 2	Switchable output (On/Off) *(only at RMF; else **unused**)*
DO 3	Pressure alarm (1) *(only at RMF, if internal pressure control is configured; else **unused**)*
DO 4	Summary alarm (1) *(only at RMF; else **unused**)*
DO 5	Diffuser control / Sun blind – Open (2) / Room mode dependent (3) *(only at RMF, if configured; else **unused**)*
DO 6	Diffuser control / Sun blind – Close (2) / Room mode dependent (3) *(only at RMF, if configured; else **unused**)*

(1) Relevant for alarm relay DO1, DO3, DO4: Alarm state = Relay released.
(2) From release 3.x; (3) From release 5.x, relay individual selectable
***Unused** outputs relays could be energized via the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 5.x).*

Analogue inputs AI	
AI 1	Internal volume flow transducer *(optionally external volume flow transducer)*
AI 2	**unused** (1)
AI 3	Volume flow offset - Temperature (1) *(only at RMF, if function is configured; else **unused**)*
AI 4	Volume flow offset - Pressure *(only at RMF, if function is configured; else **unused**)*
AI 5	Press.Tranducer - Current pressure *(only at RMF, if internal pressure control is configured; else **unused**)*

Unused inputs can be configured with EasyConnect software for integration of variable volume flow into room balance
(1) from TCU V7.0 and EM-LON / EM-BAC-MOS-01 V4 or EM-IP V2 the voltage value could be transmitted via the communication card

Analogue outputs AO	
AO 1	Current volume flow of controller
AO 2	Total extract air room/Total supply air room/Set point supply air/voltage value via bus (1) *(configurable)*
AO 3	Damper position of controller
AO 4	Damper actuator

(1) from Version 7.0

Input / Output assignment - TROX Adaption Module (TAM)

Note:
Some assignments are only available on TAM's with activated Room-Management-Function (RMF)

Digital inputs DI	
DI 1	**unused**
DI 2	**unused** *(Default at RMF: Room operation mode - Shut off mode)*
DI 3	**unused** *(Default at RMF: Room operation mode - Low mode)*
DI 4	**Unused** *(Default at RMF: Room operation mode - Hi mode)*
DI 5	Pressure control - Door contact *(only at RMF, if internal pressure control is configured; else **unused**)*
DI 6	Pressure control - Changing setpoint *(only at RMF, if internal pressure control is configured; else **unused**)*

Unused *inputs can be configured with the EasyConnect software for the usage of following functions:*

- Integration of switchable constant volume flows into room balance

- Operation mode preset for the room: High Mode, Low Mode, Shut off mode, Hand mode (only at RMF)
The state of the not used inputs could be transmitted by the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 4.x).

Digital outputs D0	
DO 1	Alarm relay (1)
DO 2	Switchable output (On/Off) *(only at RMF, else **unused**)*
DO 3	Pressure alarm (1) *(only at RMF, if internal pressure control is configured, else **unused**)*
DO 4	Summary alarm (1) *(only at RMF, else **unused**)*
DO 5	Diffuser control / Sun blind – Open (2) / Room mode dependent (3) *(only at RMF, if configured; else **unused**)*
DO 6	Diffuser control / Sun blind – Close (2) / Room mode dependent (3) *(only at RMF, if configured; else **unused**)*

(1) Relevant for alarm relay DO1, DO3, DO4: Alarm state = Relay released.
(2) From release 3.x; (3) From release 5.x, relay individual selectable
Unused *outputs relays could be energized via the expansion module LON / BACnet / MODBUS (available from TCU3 Software Release 5.x).*

Analogue inputs AI	
AI 1	**unused**
AI 2	**unused** (1)
AI 3	Volume flow offset - Temperature (1) *(only at RMF, if function is configured; else **unused**)*
AI 4	Volume flow offset - Pressure *(only at RMF, if function is configured; else **unused**)*
AI 5	Press.Transducer - Current pressure *(only at RMF, if internal pressure control is configured; else **unused**)*

Unused inputs can be configured with EasyConnect software for integration of variable volume flow into room balance
(1) from TCU V7.0 and EM-LON / EM-BAC-MOS-01 V4 or EM-IP V2 the voltage value could be transmitted via the communication card

Analogue outputs AO	
AO 1	
AO 2	Total extract air room/Total supply air room/Set point supply air/voltage value via bus (1) *(configurable)*
AO 3	
AO 4	

(1) from Version 7.0

Fume cupboard controller with face velocity transducer

Device function FH-VS

Face velocity transducer
Type VS-TRD
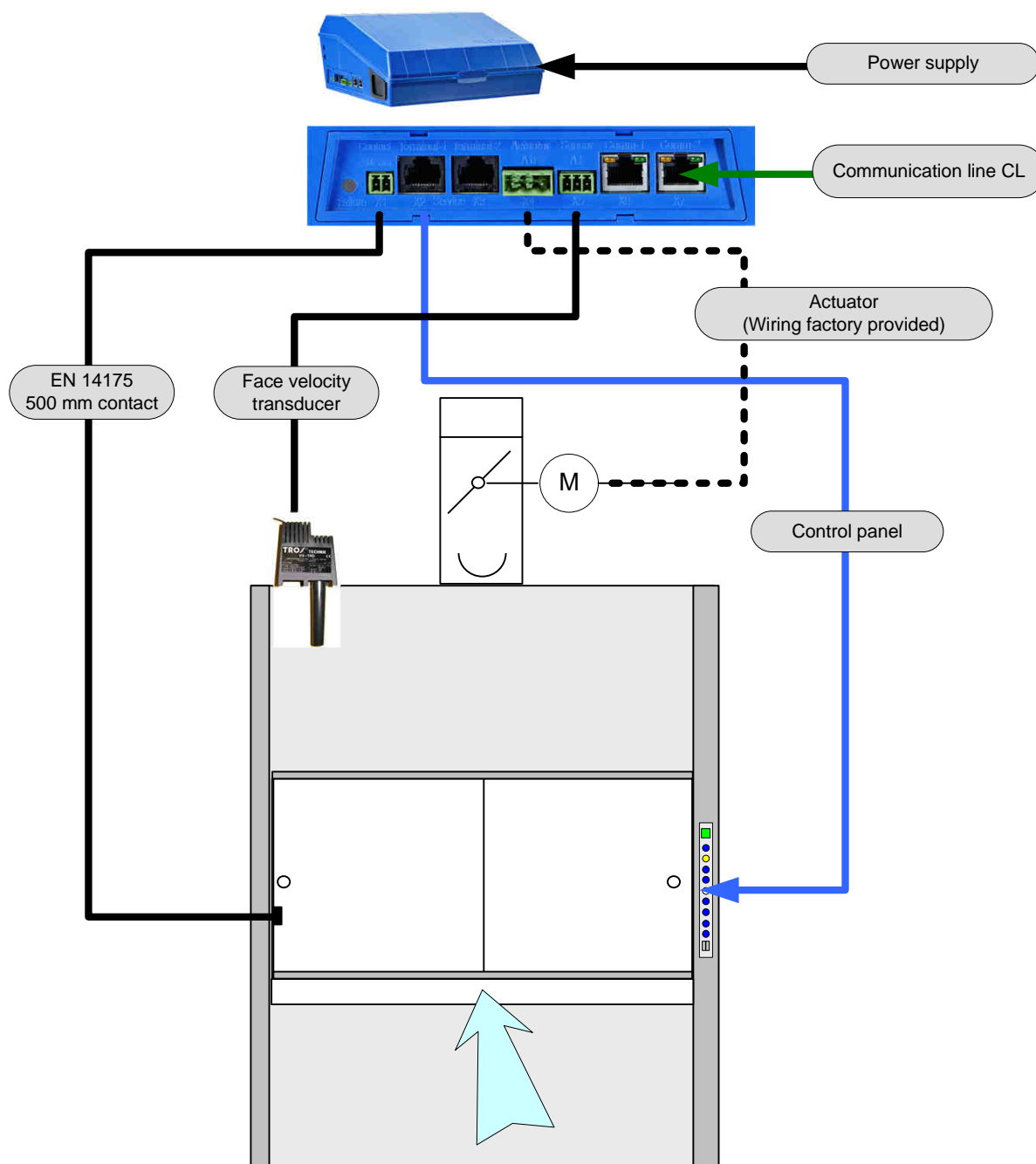
Technical data - transducer

- Supply voltage 24 V AC ±15% (via controller)
- Analogue output signal 2..10 V DC according to 0..1 m/s
- Connection cable approx. 3 m;
- Optionally, extension cable approx. 5 m; TROX Article-No. M536BA9

- Power supply
- Communication line CL
- Actuator (Wiring factory provided)
- EN 14175 500 mm contact
- Face velocity transducer
- Control panel
- M

EN14175 Sash monitoring:
Bistable switch contact must be provided on site.

Fume cupboard controller with sash distance sensor

Device function FH-DS or FH-DV

Technical data - sensor

- Supply voltage 12 V DC (via controller)
- Analogue output signal according to extension length up to 1750 mm
- Connection cable approx. 3 m

Sash distance sensor
Type DS-TRD-02

Detection of sash
position
Analogue input AI4

Power supply

Communication line CL

Actuator
(Wiring factory provided)

Sash distance
sensor

Control panel

M

EN14174 Sash monitoring
Monitoring of sash position
(500 mm) via sash distance
sensor.

Additional switch contact and
wiring not required!

Fume cupboard controller with face velocity transducer & sash distance sensor

Device function FH-VD

Technical data - transducer
- Supply voltage 24 V AC ±15% (via controller)
- Analogue output signal 2..10 V DC according to 0..1 m/s
- Connection cable approx. 3 m;
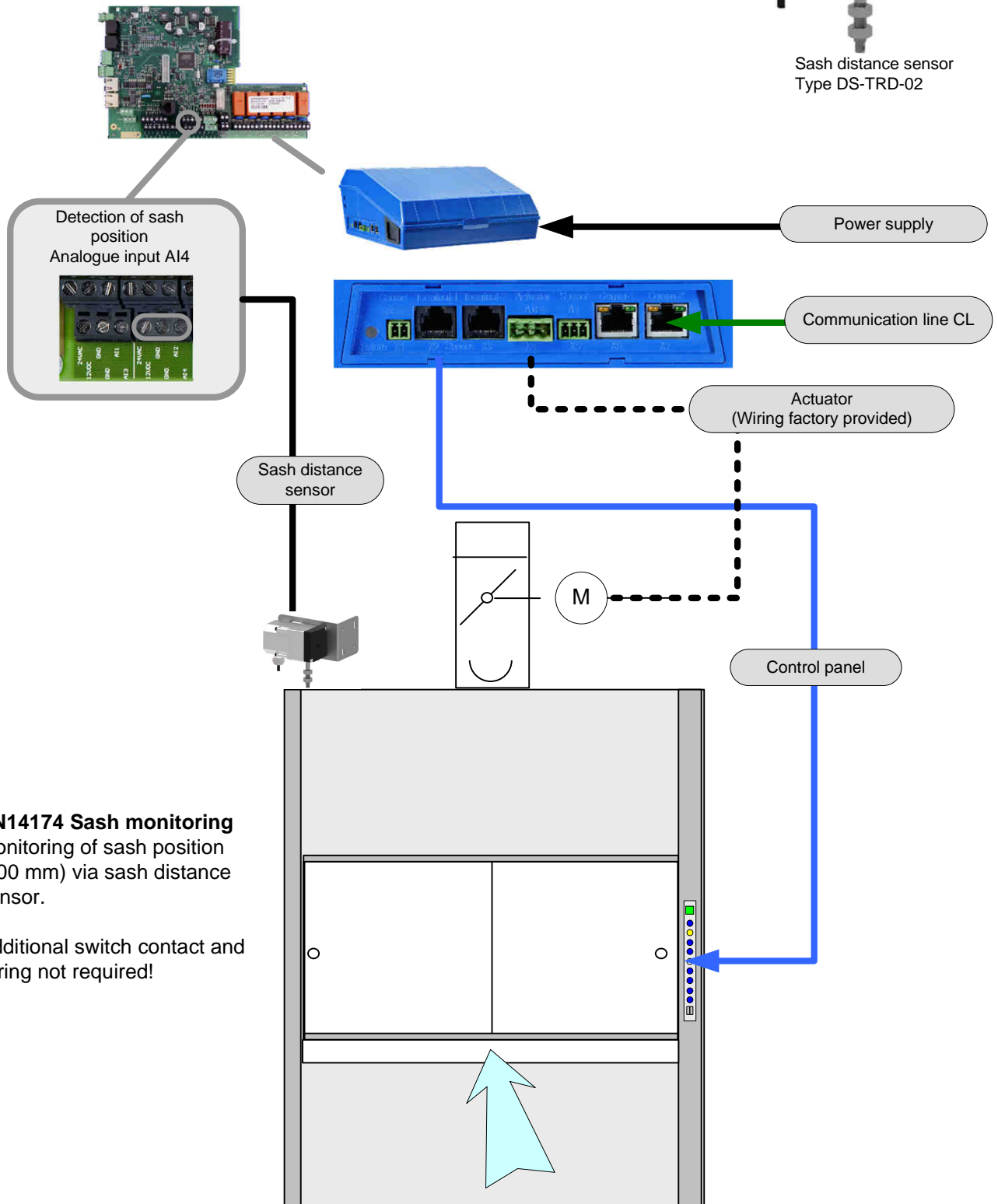- Optionally, extension cable approx. 5 m; TROX Article-No. M536BA9

Technical data - sensor
- Supply voltage 12 V DC (via controller)
- Analogue output signal according to extension length up to 1750 mm
- Connection cable approx. 3 m

Detection of sash position
Analogue input AI4

Power supply

Communication line CL

Sash distance sensor

Actuator
(Wiring factory provided)

Face velocity transducer

M

Control panel
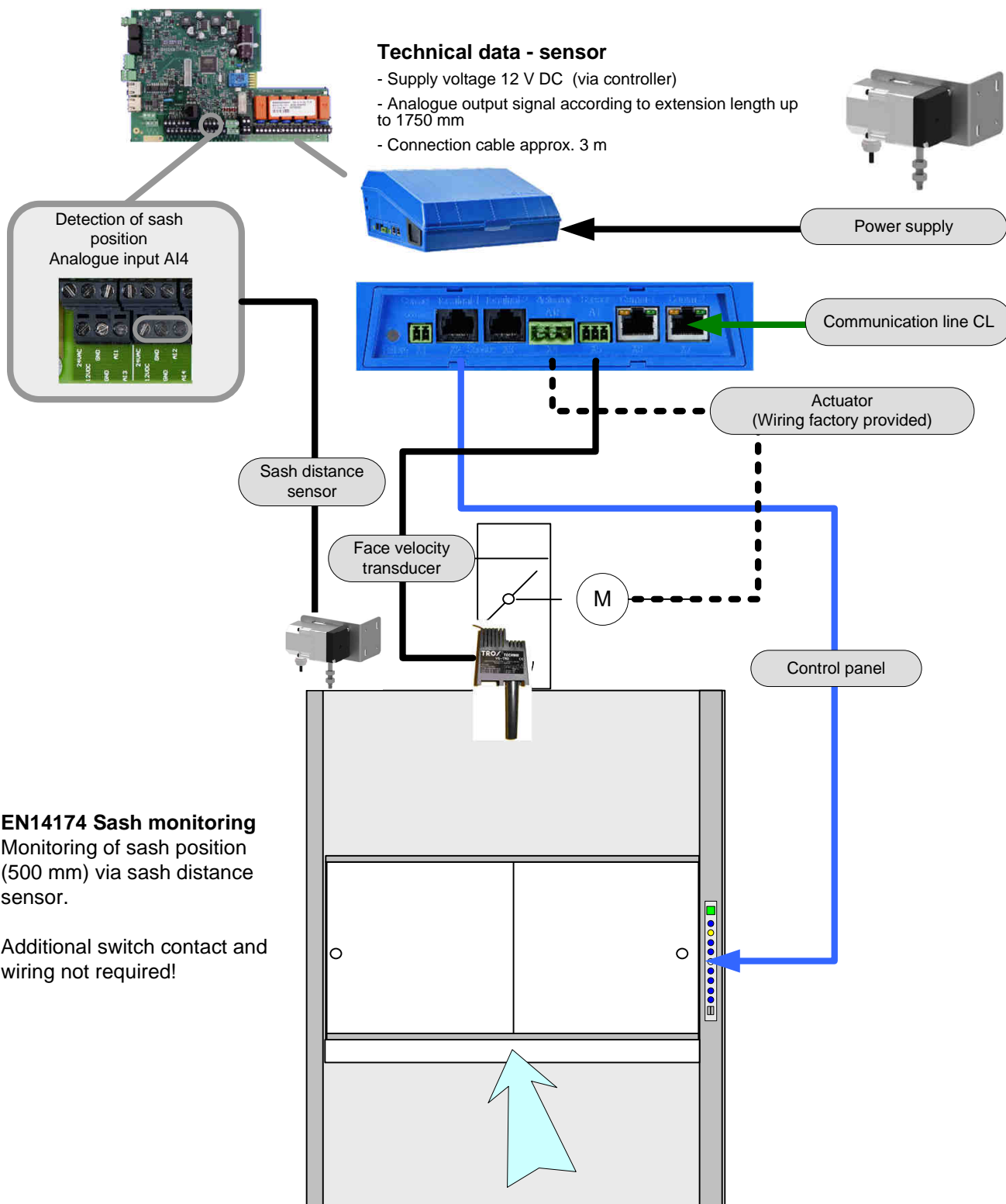
EN14174 Sash monitoring
Monitoring of sash position (500 mm) via sash distance sensor.

Additional switch contact and wiring not required!

Fume cupboard controller with 3 switching levels

Device function FH-3P
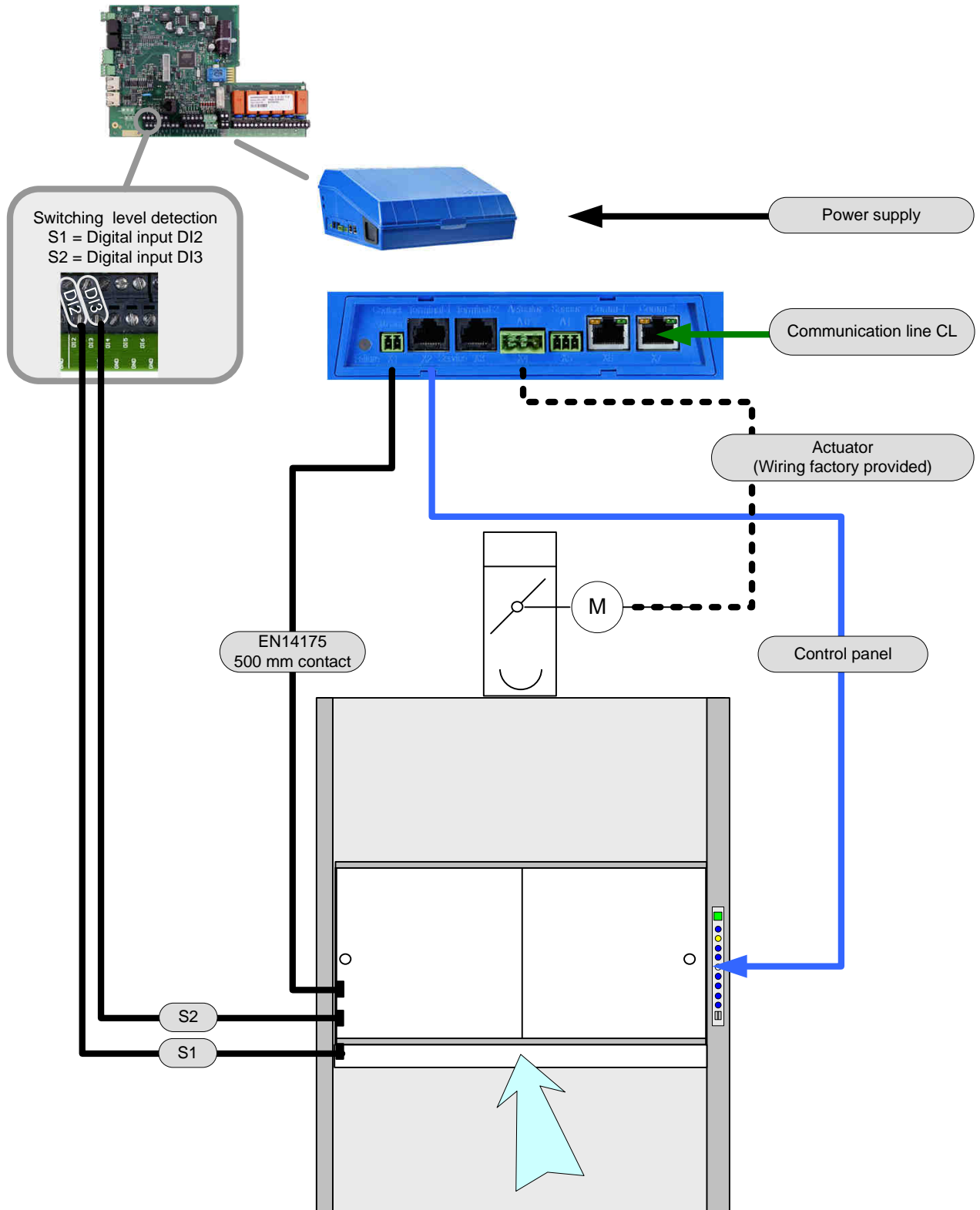
Switching level detection
S1 = Digital input DI2
S2 = Digital input DI3

Power supply

Communication line CL

Actuator
(Wiring factory provided)

EN14175
500 mm contact

Control panel

M

S2

S1

S1, S2 and EN14175 sash monitoring:
Bistable switch contacts must be provided on site.

Fume cupboard controller with 2 switching levels

Device function FH-2P

Power supply

Communication line CL

Switching level detection
S1 = Digital input DI2

Actuator
(Wiring factory provided)

EN14175
500 mm contact

Control panel

S1

M

S1, S2 and EN14175 sash monitoring:
Bistable switch contacts must be provided on site.

Fume cupboard controller with fixed value control

Device function FH-F

EN14175
500 mm contact
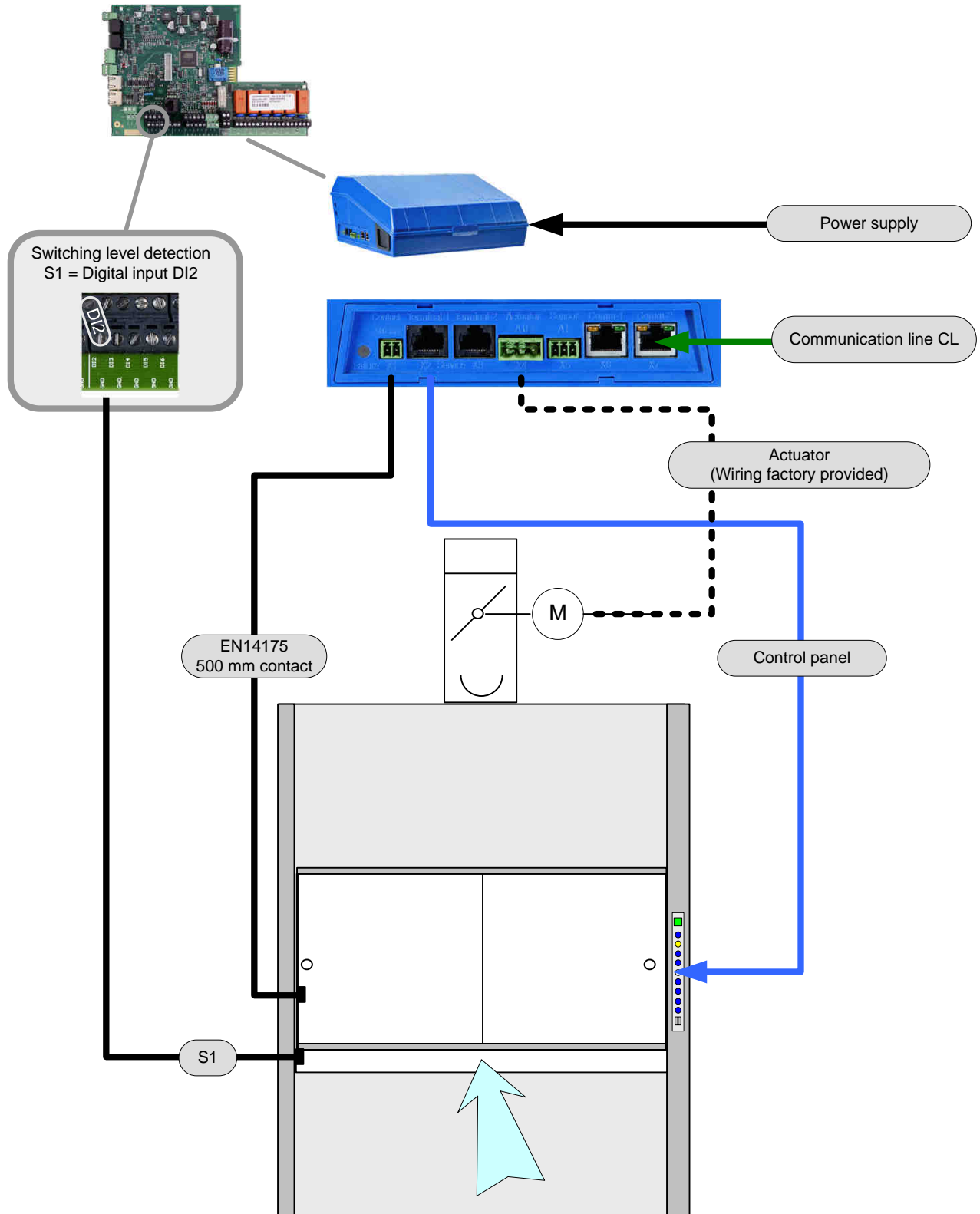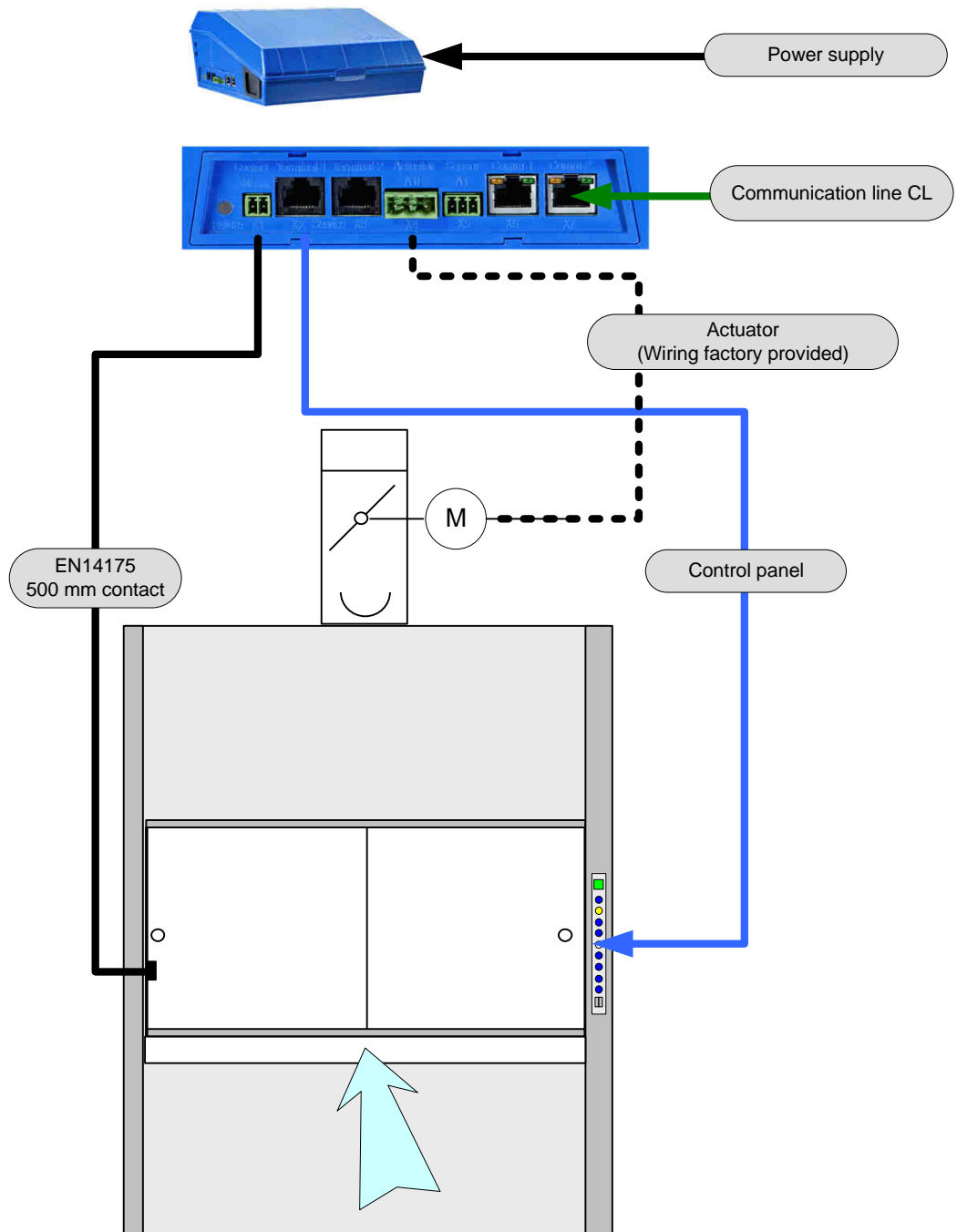
Power supply

Communication line CL

Actuator
(Wiring factory provided)

Control panel

EN14175 sash monitoring:
Bistable switch contact must be provided on site.

TROX ® TECHNIK

TROX GmbH   Heinrich-Trox-Platz   D-47504 Neukirchen-Vluyn

Special functions - Fume cupboard controller   Part 1

Sash window monitoring EN 14175

Activation of function with EasyConnect configuration software

DI1
X1 Contact 500 mm

GND

Switch contact at sash window
Bistable switch contact
Close = sash > 500 mm opend
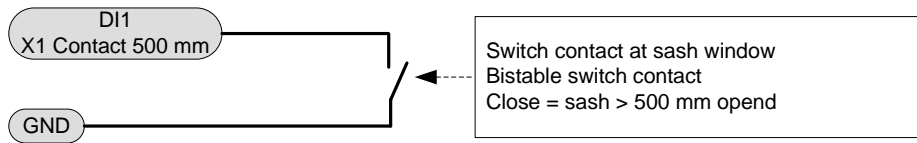
Activation of fume scrubber

Activation of function with EasyConnect configuration software

DI 4

GND

Fume scrubber operation - Demand
Potential free switch contact (Make or brake)

TCU3

DO 2   NC

C   NO

Fume scrubber activation
Controller has volume flow adapted
Enable fume scrubber operation
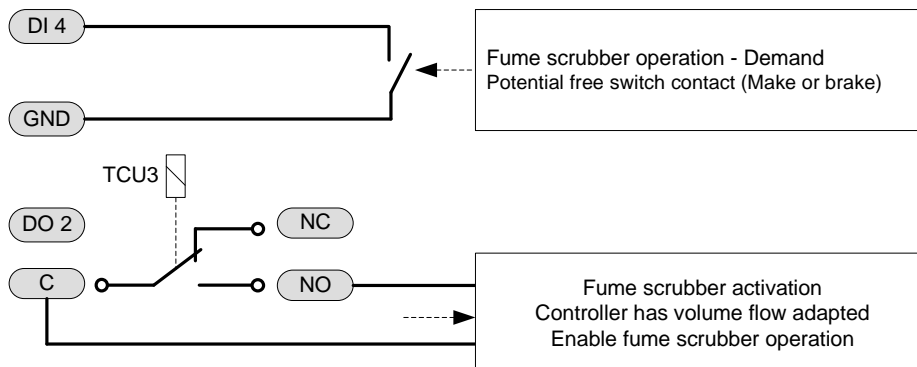
Control of supportive flow technology

Activation / configuration of function with EasyConnect configuration software

TCU3

DO 3   NC

C   NO

Activation of supportive flow fan

DI 5

GND

Fault monitoring of supportive flow fan

Potential free switch contact (Make or brake)
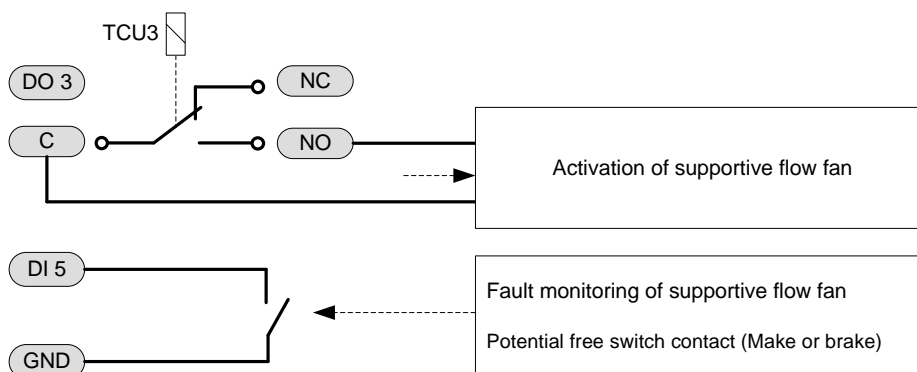
Control of automatic sash device

Activation of function with EasyConnect configuration software

Control panel

BE-SEG-xx
CP-Touch

TCU3

DO 4   NC

C   NO

Switch input
Open sash window

Automatic sash device
(Third party product)

TCU3

DO 5   NC

C   NO

Switch input
Close sash window
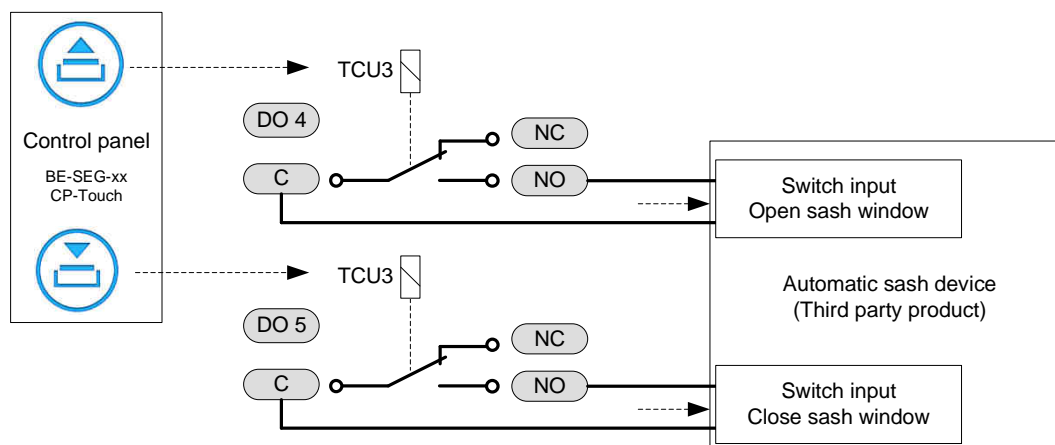
Special functions - Fume cupboard controller   Part 2

Operation mode dependent switching
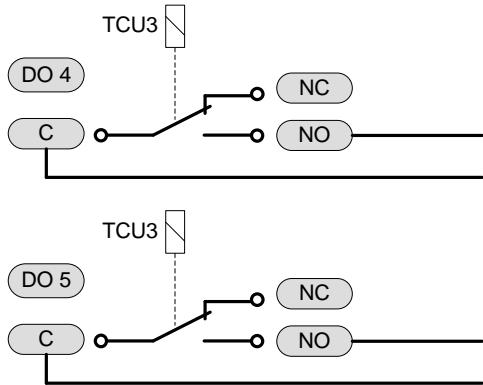
2 variants possible:
a:
DO4 switches by Standard mode, High mode, Open mode, Low mode
DO5 not used

b:
DO4 switches by Standard mode, High mode, Open mode
DO5 switches by Low mode

Control of fume cupboard lighting

Control panel
BE-SEG-xx
CP-Touch

Fume cupboard lighting
max. 500 watt
Max contact rating 8 A

Power supply
max. 230 V AC

For safety reasons the TCU3 casing must be locked in such a way that it can only be opened with a tool when a 230 V power supply is connected.

A safety latch with a sticker is available, which can be ordered under EM-TRF-Zubehoer (A00000055540).

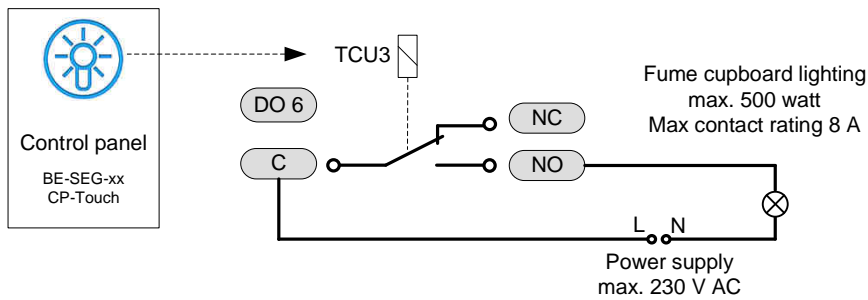*When delivered with transformer module EM-TRF or EM-TRF-USV, this is installed and is not required additionally.*

Notes: Activation of function with EasyConnect configuration software

Control of fume cupboard lighting with expansion module EM-LIGHT

Expansion module EM-LIGHT ready to plug in of a 230 V AC fume cupboard lighting (no external wiring needed if transformer module is installed)
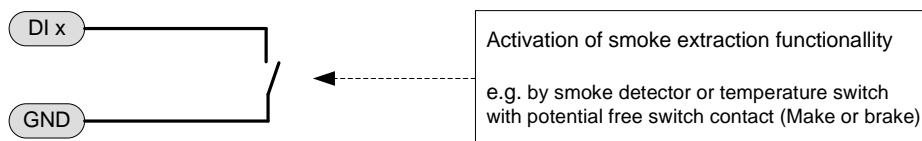

*Mating connector not in scope of delivery of EM-LIGHT
type: WAGO WINSTA MIDI 770-113
Can be ordered under EM-CPL*

Notes: Activation of function with EasyConnect configuration software. By delivered regulator with EM-LIGHT the function fume cupboard lighting is activated

Further details can be found in the installation and operating manual oft the EM-LIGHT expansion module.

Activation of smoke extraction function

Activation of smoke extraction functionallity

e.g. by smoke detector or temperature switch
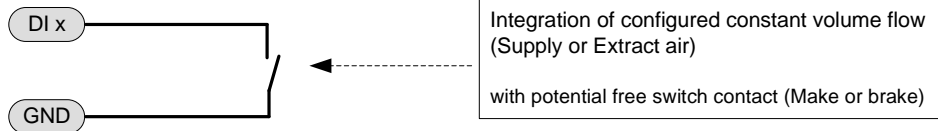with potential free switch contact (Make or brake)

*Notes: DIx: Function is available on all unused digital inputs DI1..DI6 by using Make or Brake switch contact.
Configuration of function with EasyConnect configuration software
Digital input, activation direction and EASYLAB Smoke extraction functionality (Damper open mode or damper shut off mode) must be configured*
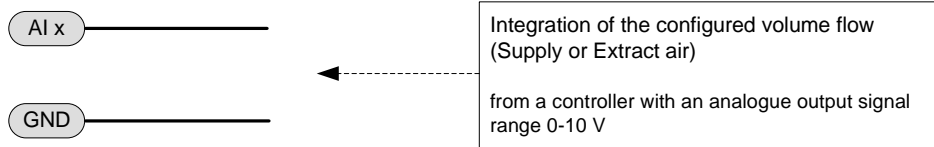
Special functions - Fume cupboard controller   Part 3

Integration of constant volume flows into room balance

DI x

GND

Integration of configured constant volume flow
(Supply or Extract air)

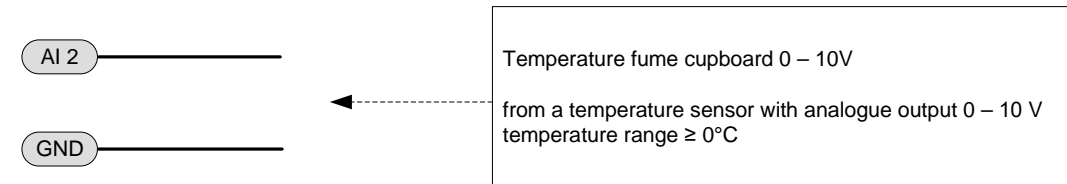with potential free switch contact (Make or brake)

Notes: DIx: Function is available on all unused digital inputs DI1..DI6 by using Make or Brake switch contact.
Configuration of function settings with EasyConnect configuration software
Digital input, activation direction and required volume flow which should be integrated into the room balance during contact activation must be configured.

Integration of variable volume flows into room balance

AI x

GND

Integration of the configured volume flow
(Supply or Extract air)

from a controller with an analogue output signal
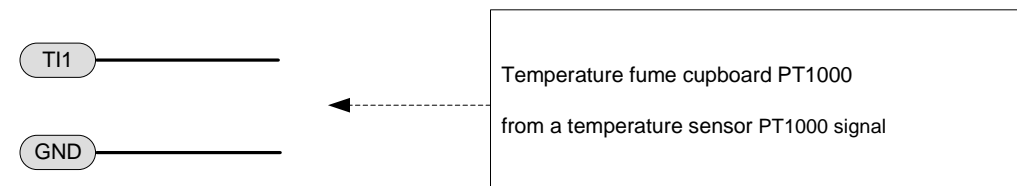range 0-10 V

Notes: AIx: Function is available on all unused analogue inputs AI by connecting an analogue signal with 0-10 V.
Configuration of function setting with EasyConnect configuration software
Analogue input, characteristic and required volume flow values (Extract or supply air) which should be integrated into the room balance must be configured .

Temperature alarm activ

AI 2

GND

Temperature fume cupboard 0 – 10V

from a temperature sensor with analogue output 0 – 10 V
temperature range ≥ 0°C

Temperature alarm passiv

TI1

GND

Temperature fume cupboard PT1000

from a temperature sensor PT1000 signal

note: The function could be parametrized with the configuration software EasyConnect alternativ as an activ or a passiv signal.
The temperature alarm ia available from Version 8.0 of EASYLAB

Activation of motion detector functions
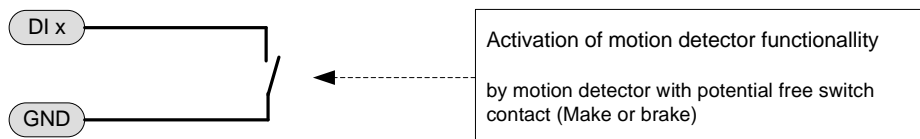
DI x

GND

Activation of motion detector functionallity

by motion detector with potential free switch
contact (Make or brake)

Notes: DIx: Function is available on all unused digital inputs DI1..DI6 by using Make or Brake switch contact.
Configuration of function with EasyConnect configuration software
Digital input, activation direction and EASYLAB Motion detector functionality with parameters must be configured

Supply air- / Extract air controller 0-10 V / 2-10 V
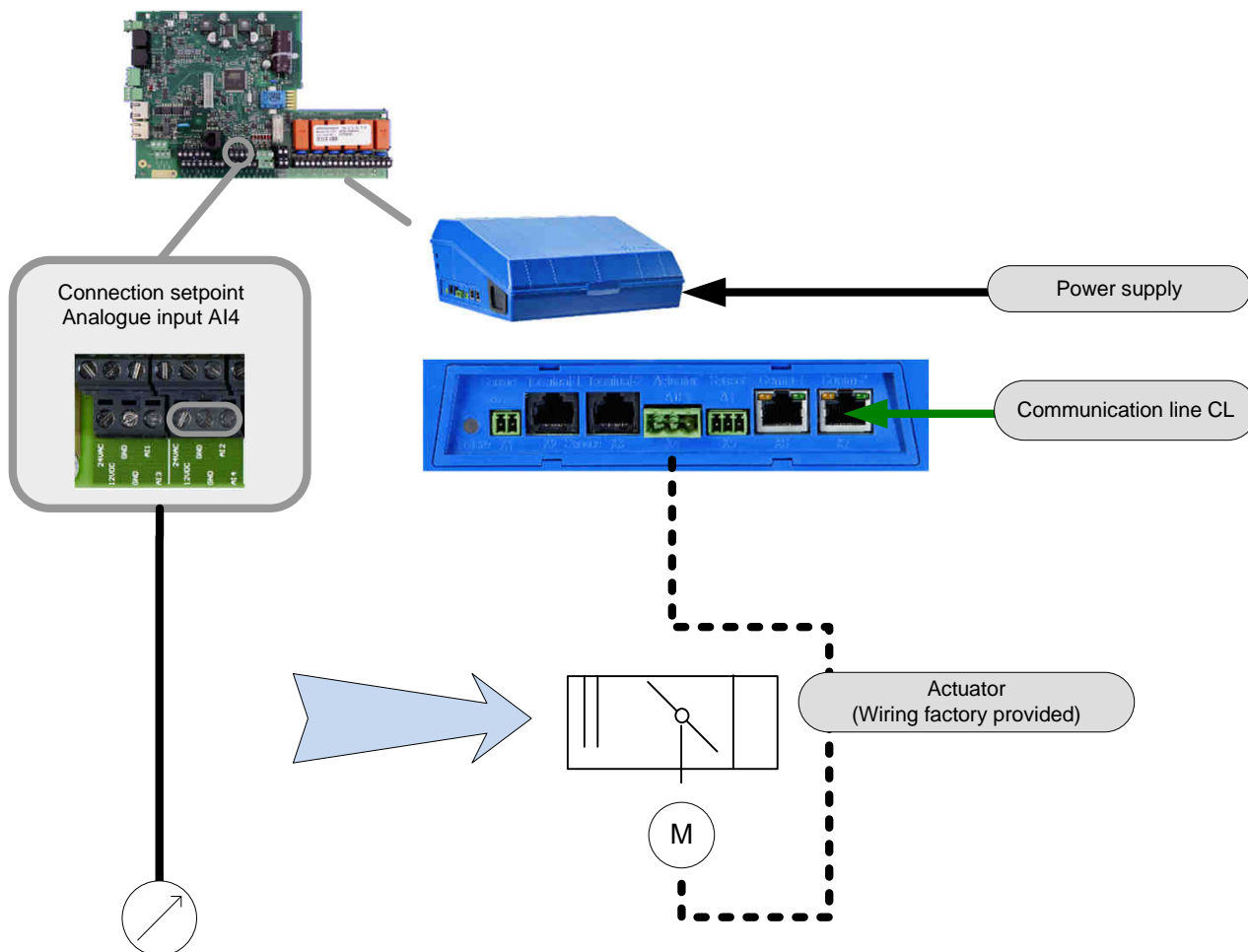
Device function SC-E0; SC-E2; EC-EO; EC-E2

Setpoint volumeflow via 0 – 10 V (E0) or 2 – 10 V (E2)

Difference SC / EC:
SC: actual volume flow as supply via CL to room regulation system
EC: actual volume flow as exhaust via CL to room regulation system

Connection setpoint
Analogue input AI4

Power supply

Communication line CL

Actuator
(Wiring factory provided)

M

Supply air- / Extract air controller 3-point-regulation -3P

Device function SC-3P; EC-3P

Setpoint volumeflow via 2 switch inputs, 3 setpoints

Difference SC / EC:
SC: actual volume flow as supply via CL to room regulation system
EC: actual volume flow as exhaust via CL to room regulation system

Switching detection
S1 = digital input DI2
S2 = digital input DI3

Power supply

Communication line CL

Actuator
(Wiring factory provided)

M

S2

S1

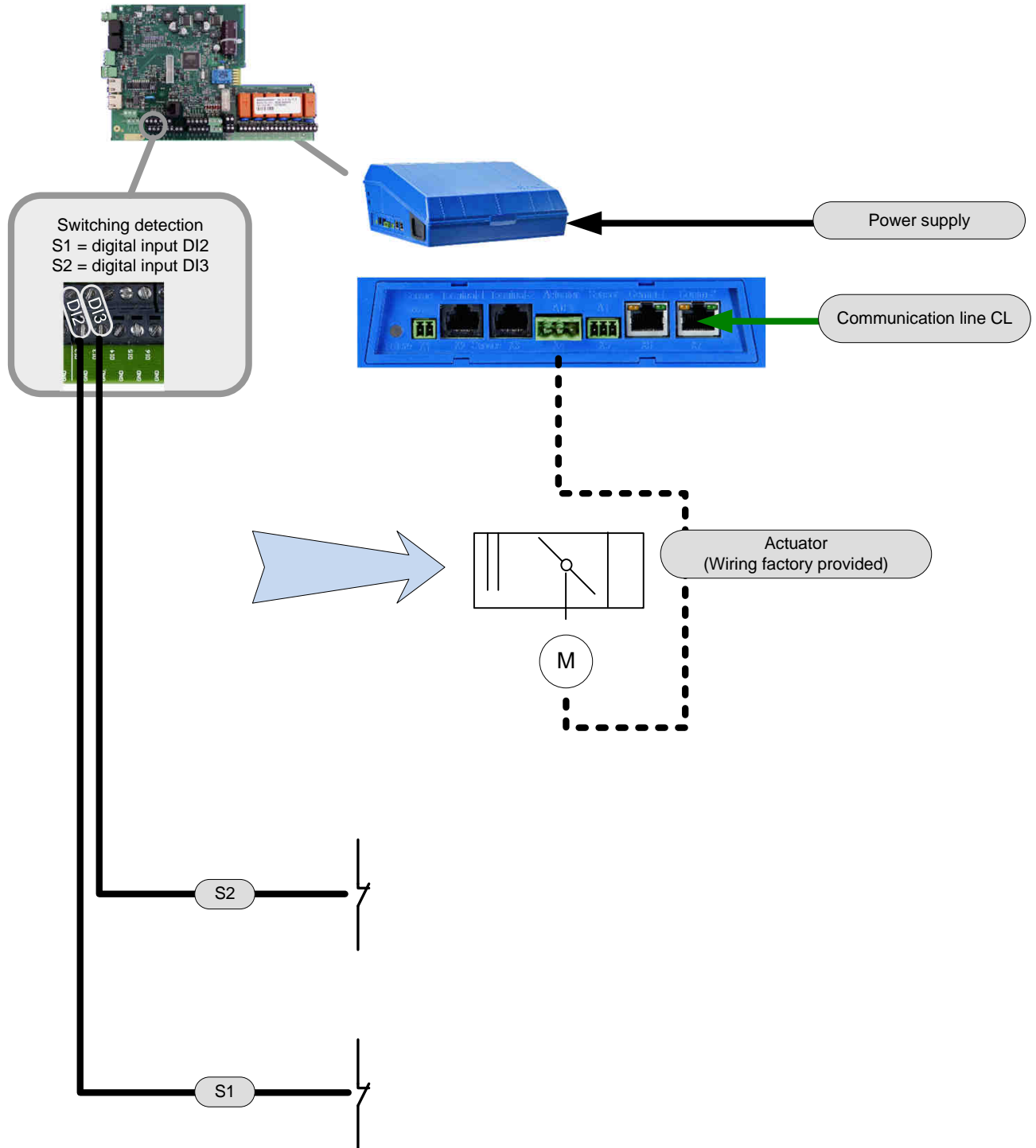## Supply air- / Extract air controller 2-point-regulation -2P

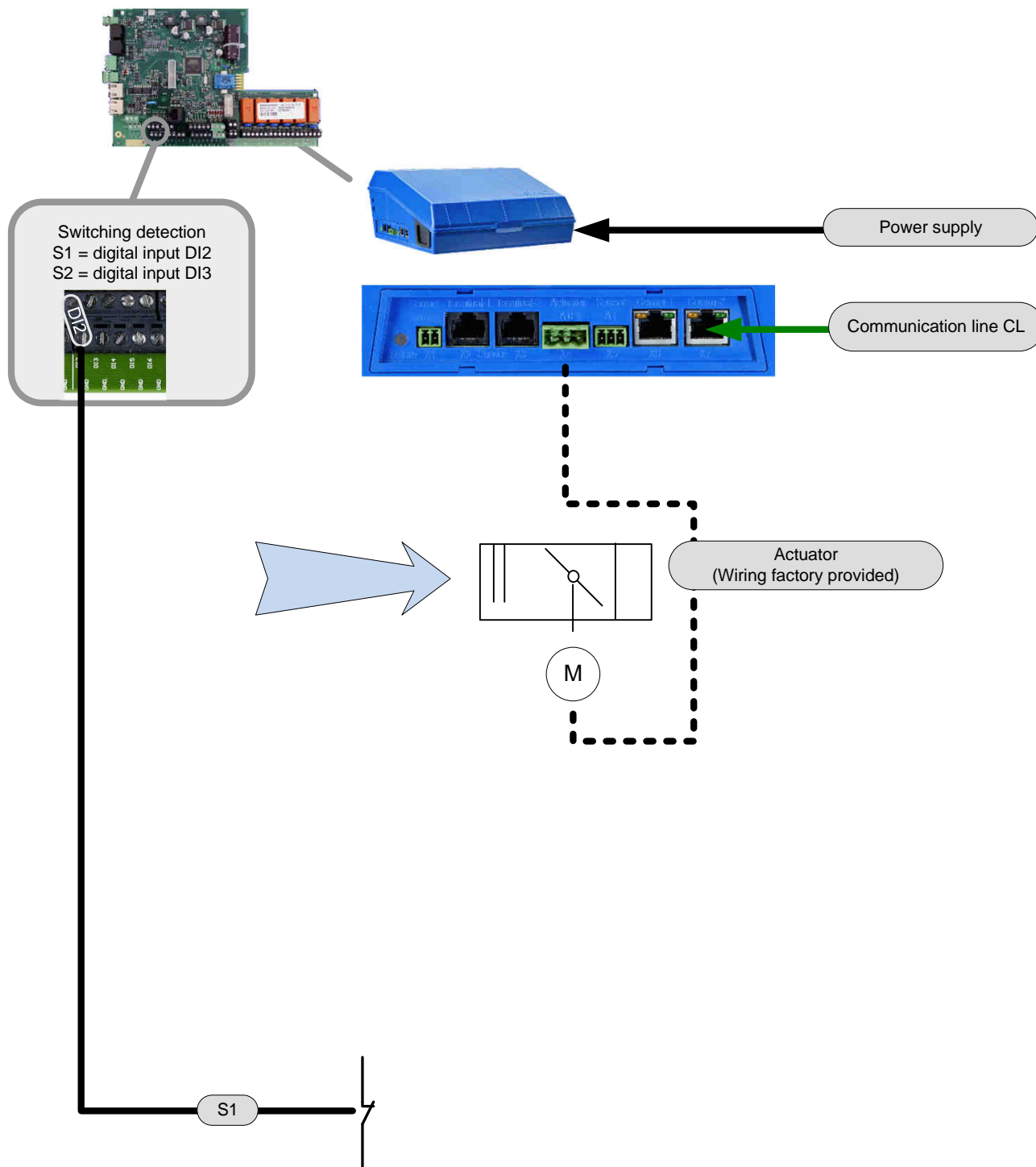Device function SC-2P; EC-2P

Setpoint volumeflow via 1 switch inputs, 2 setpoints

Difference SC / EC:
SC: actual volume flow as supply via CL to room regulation system
EC: actual volume flow as exhaust via CL to room regulation system

Switching detection
S1 = digital input DI2
S2 = digital input DI3

Power supply

Communication line CL

Actuator
(Wiring factory provided)

M

S1

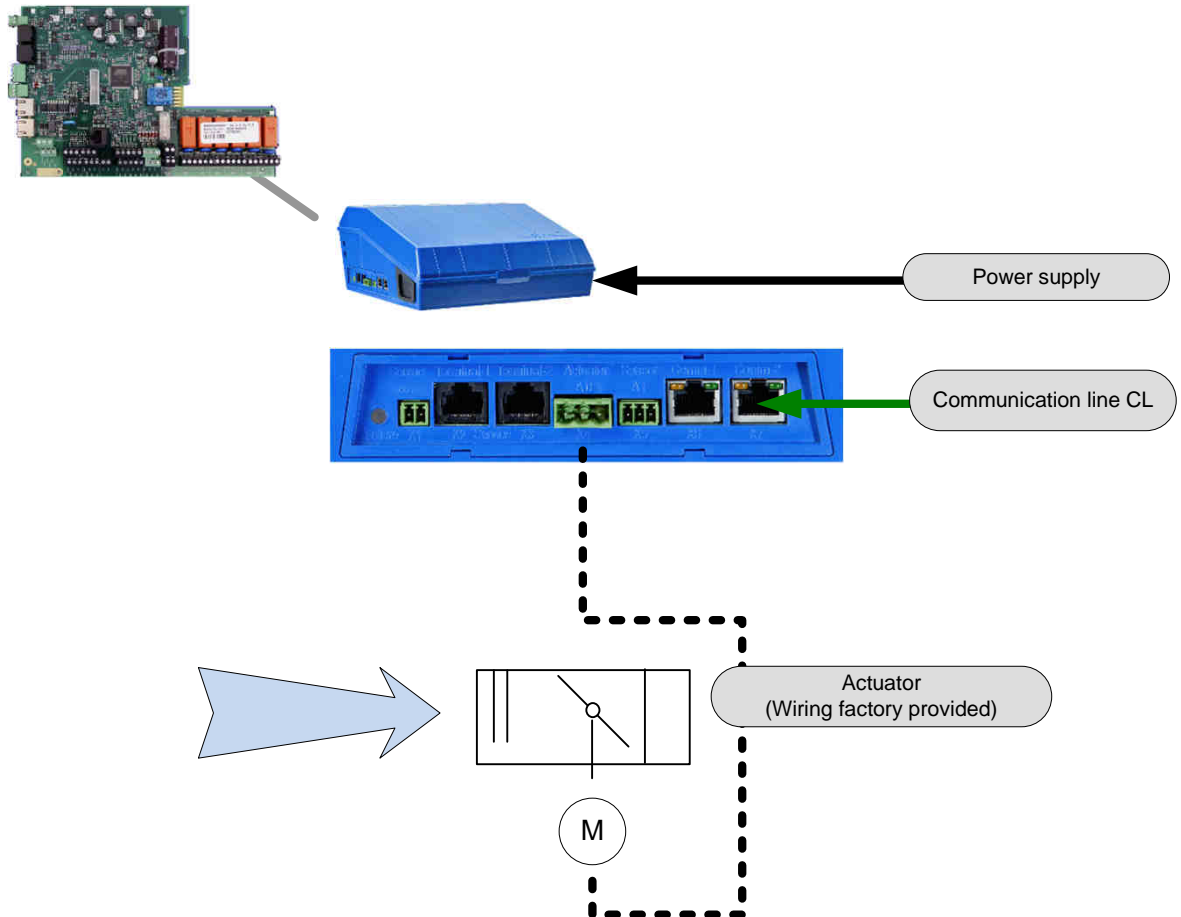## Supply air- / Extract air controller Fixed volume flow -F

Device function SC-F; EC-F

Setpoint volumeflow fix parameterized

Difference SC / EC:
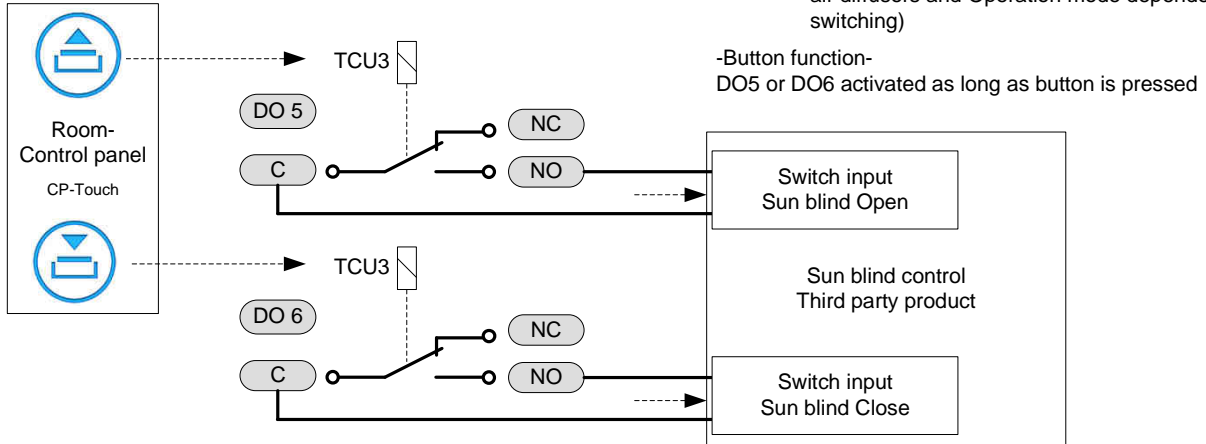**SC: actual volume flow as supply via CL to room regulation system**
EC: actual volume flow as exhaust via CL to room regulation system

Power supply

Communication line CL

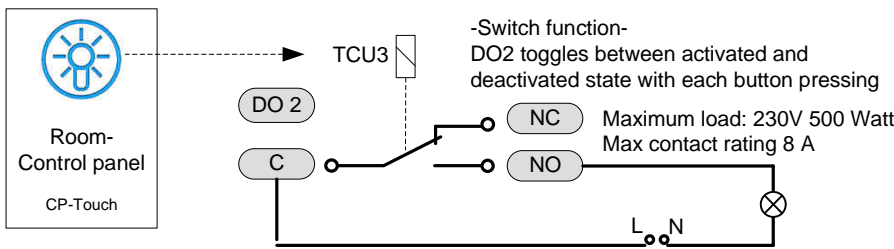Actuator
(Wiring factory provided)

M

Special functions – Room controller   Part 1

Control of on-site provided sun blind control device
(only at room controller with activated RMF and alternative to Activation/Deactivation of supply air diffusors and Operation mode dependent switching)

-Button function-
DO5 or DO6 activated as long as button is pressed

Room-Control panel
CP-Touch

TCU3

DO 5
C
NC
NO

Switch input
Sun blind Open

Sun blind control
Third party product

TCU3

DO 6
C
NC
NO

Switch input
Sun blind Close

Control of on-site provided lighting / device (only at room controller with activated RMF)

-Switch function-
DO2 toggles between activated and deactivated state with each button pressing

Maximum load: 230V 500 Watt
Max contact rating 8 A

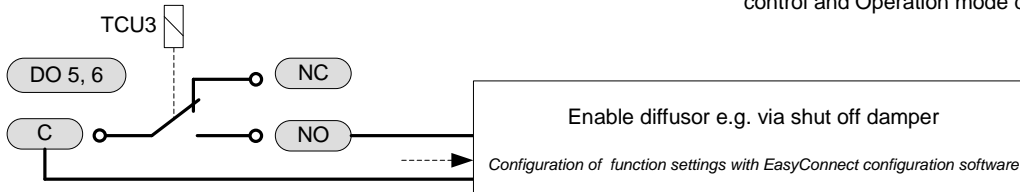Room-Control panel
CP-Touch

TCU3

DO 2
C
NC
NO

L   N

For safety reasons the TCU3 casing must be locked in such a way that it can only be opened with a tool when a 230 V power supply is connected.

A safety latch with a sticker is available, which can be ordered under EM-TRF-Zubehoer (A00000055540).
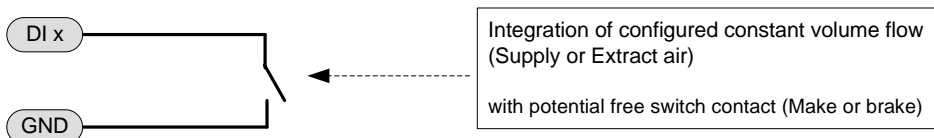
When delivered with transformer module EM-TRF or EM-TRF-USV, this is installed and is not required additionally.

Activation/Deactivation of supply air diffusors
(only at supply air controller and alternative to sun blind control and Operation mode dependent switching)
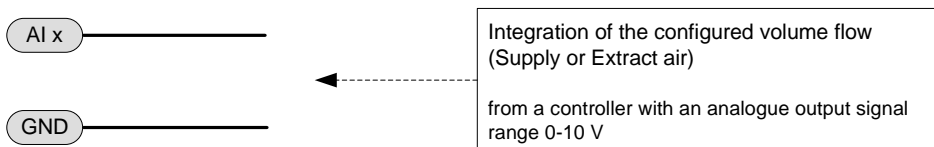
TCU3

DO 5, 6
C
NC
NO

Enable diffusor e.g. via shut off damper

Configuration of function settings with EasyConnect configuration software

Notes: Function is only available if sun blind control is not activated
Configuration of function settings with EasyConnect configuration software

Integration of constant volume flows into room balance

DI x
GND

Integration of configured constant volume flow
(Supply or Extract air)

with potential free switch contact (Make or brake)

Notes: Dix: Function is available on all unused digital inputs DI1..DI6 by using Make or Brake switch contact.
Configuration of function settings with EasyConnect configuration software
Digital input, activation direction and required volume flow which should be integrated into the room balance during contact activation must be configurated.

Integration of variable volume flows into room balance

AI x
GND

Integration of the configured volume flow
(Supply or Extract air)

from a controller with an analogue output signal range 0-10 V

Notes: Aix: Function is available on all unused analogue inputs AI by connecting an analogue signal with 0-10 V.
Configuration of function setting with EasyConnect configuration software
Analogue input, characteristic and required volume flow values (Extract or supply air) which should be integrated into the room balance must be configurated .

Special functions – Room controller   Part 2

Operation mode dependent switching   (alternative to sun blind control and Activation/Deactivation of supply air diffusors)

TCU3

DO 5

C

NC

NO

TCU3

DO 6

C

NC

NO
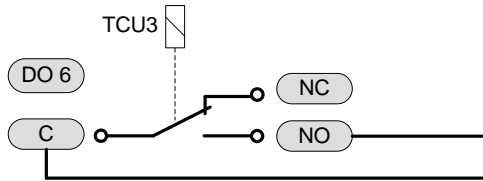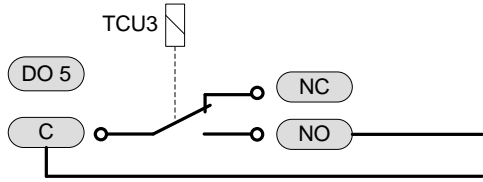
Individually adjustable for each relay
Relay switches in any given operating mode.
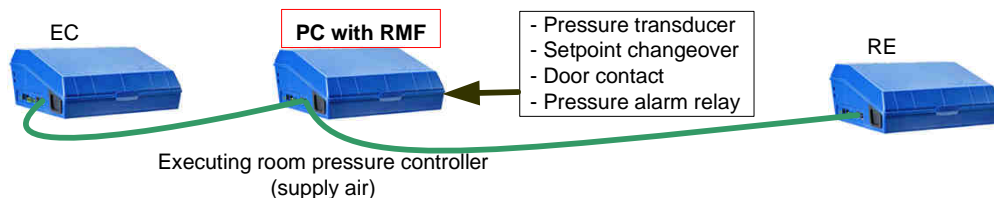Combinations are possible

Internal pressure control

- Pressure control via supply air controller; (Extract air controlled system - Laboratory)
- Preessure control via extract air controller (Supply air controlled system - Clean room)
  available as of TCU3 controller with Software Version 3.0
- Current pressure signal integrateable via analogue signal 0-10V; Characteristic configurable
- 2 independant setpoits with related parameters configurable
- Setpoint changeover via switch contact at DI6 configurable
  alternativly via Expansion Modul via LonWorks®, BACnet MS/TP, Modbus-RTU, BACnet IP, Modbus IP
- Special functions via door switch contact at DI5 configurable (Alarmhandling, Ccontrol behaviouren)
- All connections and settings for pressure control within controller with Room-Management-Function (RMF)
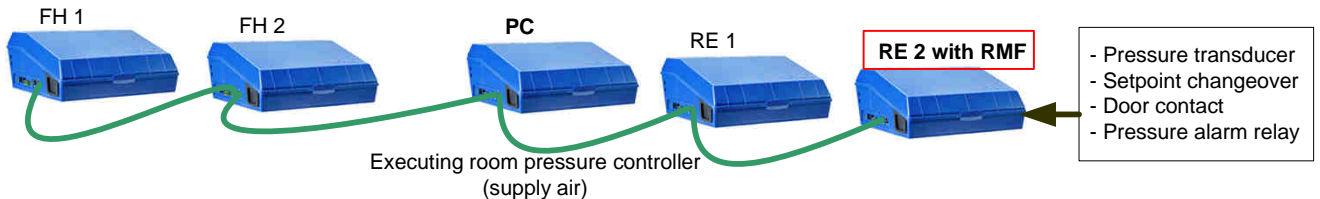- Seperate alarm output DO3 for pressure control loop

1. System design - Pressure control within extract air controlled room (e.g. Laboratory)

FH: Fume cupboard controller EC: extract air controller RE: Room extract air controller
PC: Executing pressure controller – Supply air

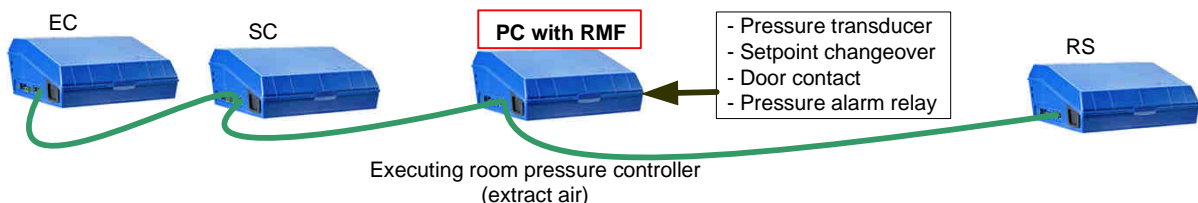Example 1.1: RMF-Function activated on executing pressure controller

EC   **PC with RMF**   - Pressure transducer   RE
                                      - Setpoint changeover
                                      - Door contact
                                      - Pressure alarm relay

Executing room pressure controller
(supply air)

Example 1.2: RMF-Function activated on other room controller (not recommended)

FH 1   FH 2   **PC**   RE 1   **RE 2 with RMF**   - Pressure transducer
                                                                - Setpoint changeover
                                                                - Door contact
                                                                - Pressure alarm relay

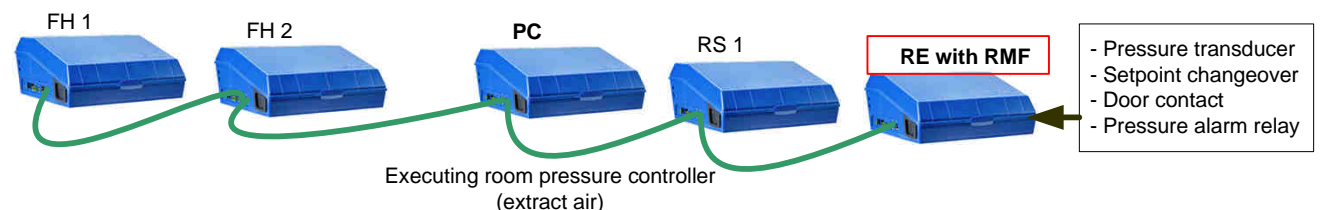Executing room pressure controller
(supply air)

2. System design - Pressure control within supply air controlled room (e.g. Clean room)

FH: Fume cupboard controller SC: Supply air controller   RS: Room supply air controller
PC: Executing pressure controller – Extract air

Example 2.1: RMF-Function activated on executing pressure controller

EC   SC   **PC with RMF**   - Pressure transducer   RS
                                                 - Setpoint changeover
                                                 - Door contact
                                                 - Pressure alarm relay

Executing room pressure controller
(extract air)

Example 2.2: RMF-Function activated on other room controller (not recommended)

FH 1   FH 2   **PC**   RS 1   **RE with RMF**   - Pressure transducer
                                                              - Setpoint changeover
                                                              - Door contact
                                                              - Pressure alarm relay

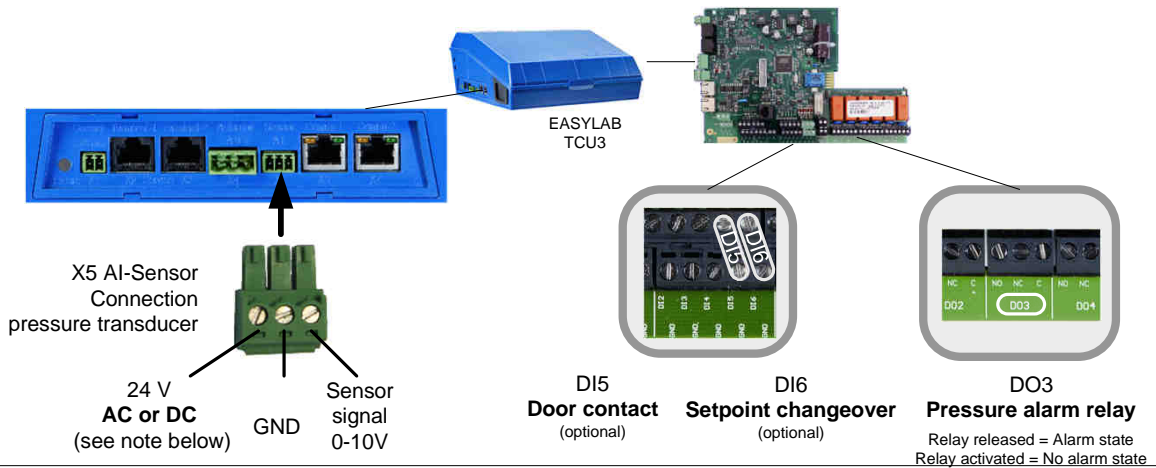Executing room pressure controller
(extract air)

Recommendation:
In tight rooms and for optimal use of the diagnostic functions, the room management function (RMF)
should be activated on the operating pressure controller (PC) .

Pressure control connections:

X5 AI-Sensor
Connection
pressure transducer

24 V
AC or DC
(see note below)   GND   Sensor
signal
0-10V

DI5
Door contact
(optional)

DI6
Setpoint changeover
(optional)

DO3
Pressure alarm relay
Relay released = Alarm state
Relay activated = No alarm state

Power supply for pressure transducer

The power supply of the pressure transducer **can** be provided by the EASYLAB TCU3 via 24V connector of analogue input X5 AI Sensor.

Important:

TCU3 supplied with 24 V AC → Connector 24V of X5 AI Sensor provides 24V AC
TCU3 supplied with 24 V DC → Connector 24V of X5 AI Sensor provides 24V DC
TCU3 supplied with 230V AC → Connector 24V of X5 AI Sensor provides 24V DC.

The above mentioned different supply voltage types must be observed depending on selected pressure transducer type.

## Huba Pressure transducer type 699

This transducer is approved for AC and DC power supply type.
Therefore no adaption is required.

Briem Pressure transducer type GB604 MF 0,75

This transducer is approved for AC and DC power supply type.
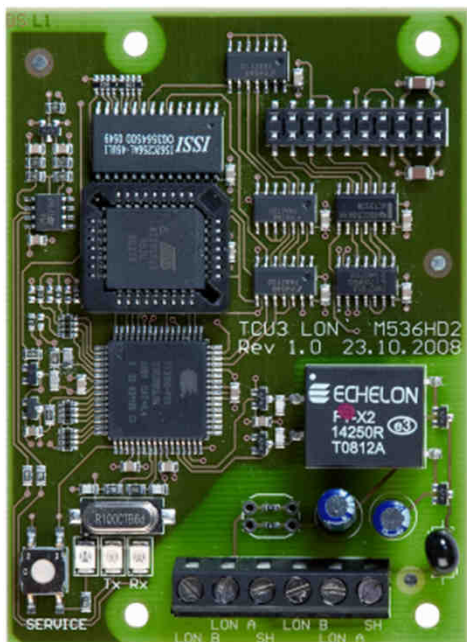Therefore no adaption is required.

Old Briem transducer must be manually adapted to the power supply type.
Default delivery setting ist AC supply.
Using a 230 V AC supply for the TCU3 via EM-TRF or EM-TRF-USV or 24 V DC supply implies a manual change of the supply to DC type.
Therefore change jumper setting from AC to DC within the Briem transducer casing.

Briem
GB 604 MF
0,75

Tubing

p   reference (Reference room)

Pressure to be rrgulated
(Room pressure)
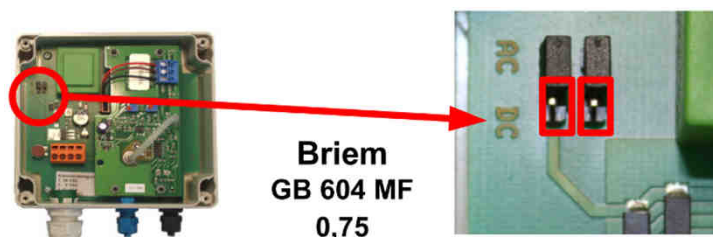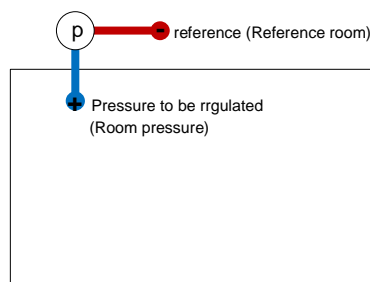
LonWorks®-Interface   (Expansion module EM-LON)


Technical data:

- LonWorks®-Interface FT10
- Network structure: Free Topology / Twisted Pair
- Simple network integration via internal connected double terminals
- Service-Key
- Status-LED for Service key, data transmission and data reception
- Mounting of expansion module within EASYLAB TCU3 controller box
- Supply voltage 5 V DC provided by EASYLAB controller TCU3
- Each network segment must be terminated with network terminator
- The maximum number of network devices is based on the LonWorks®
  specifications from Echelon. There are no additional restrictions by TROX.

Data interface: Standard Network Variable Types (SNVT)

- Different data points according to controller device type:
  Room controller / TAM with activated Room-Management-Function (RMF)
  or Fume cupboard controller / Room controller / TAM without RMF
  Usage on controller with activated RMF
    -> Access to datapoints of room
  Usage on controller without RMF
    -> Access to datapoints of single controller

Connection assignment:
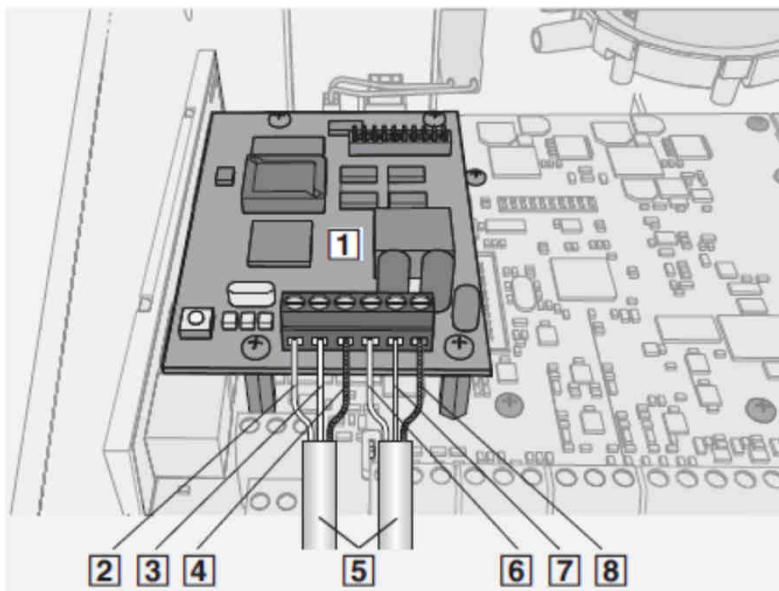
1 Expansion module EM-LON
2 LON-B
3 LON-A
4 Shielding
5 Network cables
6 LON-B
7 LON-A
8 Shielding

Expansion module built into EASYLAB TCU3 controller box

Network cable types:

Following cable types are recommended for LonWorks®-networks by Echelon:

TIA 568A Category 5
- 8471 oder 85102 (Belden)
- Level IV cable
- JY(St)Y 2x2x0,8 (use only twisted wire pairs for LON-A and LON-B)

For more details see assembly and operating instruction manual of EM-LON.

The EM-LON extension module is only available as a spare part since 2022 (note availability of goods).

BACnet MS/TP interface   (Expansion module EM-BAC-MOD-01)
Modbus RTU interface
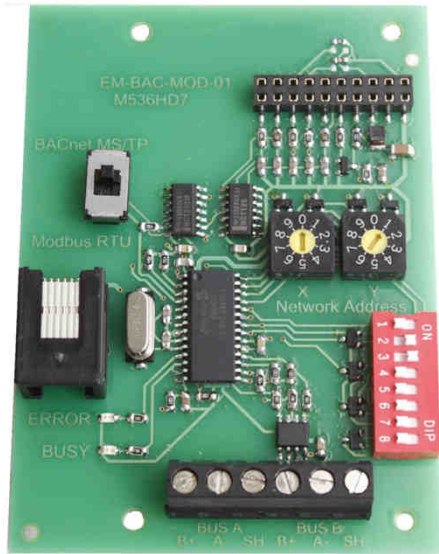
Technical data:

- BACnet MS/TP interface or Modbus RTU interface
  selectable via configuration switch

- Configurable network address and communication parameter

- Simple network integration via internal connected double terminals

- Status-LED for display of data transfer and communication error

- Mounting of expansion module within EASYLAB TCU3 controller box

- Supply voltage 5 V DC provided by EASYLAB controller TCU3

- Current regulations for network design and number of network device must
  be observed: BACnet Standard 135-2004   Modbus according EIA-485
  In particular this includes:
    - Network topology with simple line structure
    - Usage of twisted pair copper cables with shielding
    - Compliance of polarity A- and B+ for all network devices
    - 120 Ohm resistor for network termination at first and last network device
    - Network BIAS resistor for BACnet networks
    - Max. 32 network devices in each network segment
    - Configuration of individuell network address for each device

Data interface:

- BACnet objects according PICS documentation or Modbus data registers

- Different data points according to controller device type:
  Room controller / TAM with activated Room-Management-Function (RMF)
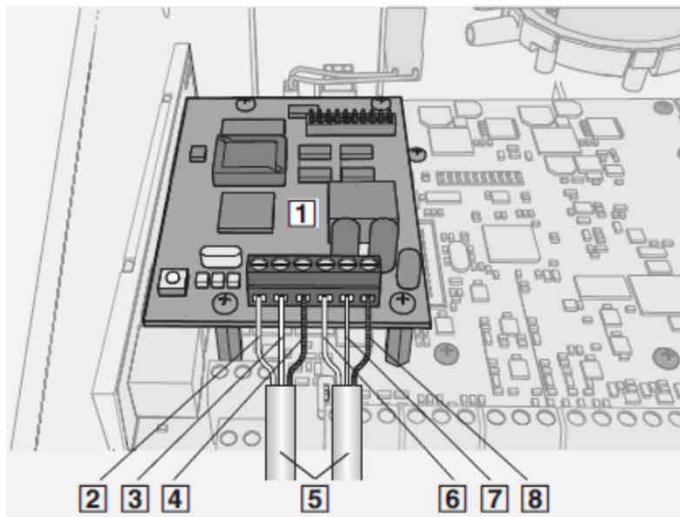 or Fume cupboard controller / Room controller / TAM without RMF
  Usage on controller with activated RMF
    -> Access to datapoints of room
  Usage on controller without RMF
    -> Access to datapoints of single controller

Connection assignment:

1 Expansion module EM-BAC-MOD-01
   PCB illustration differs a little from original;
   (Screw terminal representation is correct, see photo above)

2 B+   EIA-485

3 A-   EIA-485

4 Shielding

5 Network cables

6 B+   EIA-485

7 A-   EIA-485

8 Shielding

Expansion module built into EASYLAB TCU3 controller box

For more details see assembly and operating instruction manual of EM-BAC-MOD-01.

BACnet IP-interface   (Expansion module EM-IP)
## Modbus IP-interface

Technical data:

- BACnet interface Schnittstelle IP or Modbus interface IP,
  switcheable via integral webserver
- Configurable network address and transmission parameter
- Two RJ45 10/100 Mbit Ethernet connections
  (up to five EM-IP modules can be linked by a daisy chain)
- Status LED for indication of data transmission and errors
- Mounting of expansion module within EASYLAB TCU3 controller box
- Supply voltage 5 V DC provided by EASYLAB controller TCU3

  Data interface:

- BACnet objects according PICS documentation or Modbus data registers
- Different data points according to controller device type:
  Room controller / TAM with activated Room-Management-Function (RMF)
  or Fume cupboard controller / Room controller / TAM without RMF
  Usage on controller with activated RMF
  -> Access to datapoints of room
  Usage on controller without RMF
  -> Access to datapoints of single controller

Connection assignment:
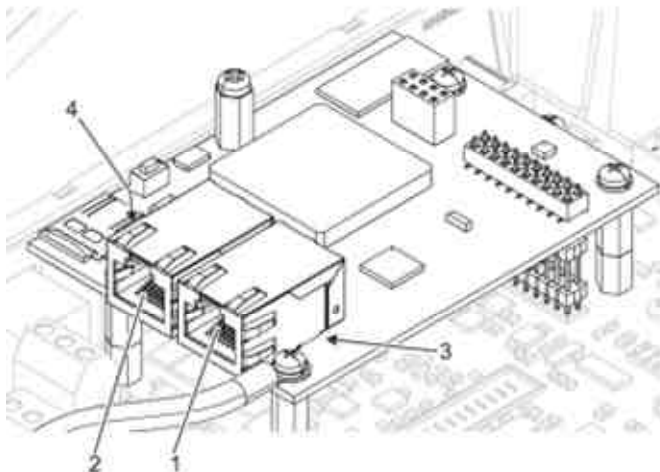
Expansion module EM-IP

1 Ethernet-socket LAN 1
2 Ethernet-socket LAN 2
3 LED-state indicator LAN 1
4 LED-state indicator LAN 2

Expansion module built into EASYLAB TCU3 controller box

For more details see assembly and operating instruction manual of EM-IP.