Instruction Manual

optek- Converter C2000

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OEM Converter for use with

Inline Sensors **AF16, AF56, AF26, AF45, TF16**
Insertion probes **AS16, AS56**

Preface

This instruction manual is written to assist the user in proper procedures for trouble-free operation.

It is explicitly pointed out that optek-Danulat GmbH assumes no responsibility for loss or damage caused due to improper use of this instruction manual or products described herein.

On request, this manual is available in other languages as well as in digital format (Acrobat® Reader 7.0 required).

Our products are being continuously improved. Technical data is subject to change without notice.

Essen, January 2018

Content

Preface

1 Using this instruction manual

1.1 Validity of this instruction manual

Follow the instruction manual for every operation. If the converter is not used as described in this instruction manual, your safety and the converter function may be affected.

To maintain reliability of the product, enhance its life cycle, and avoid down times, follow the instructions given in this manual.

Furthermore, please follow local accident prevention and environmental protection instructions, as well as recognized technical regulations for safe and professional operation.

1.2 Pictograms and signal words

Important information in this instruction manual is marked with the following pictograms:

Danger!
This pictogram indicates immediate danger to life and health of persons.
The text next to the symbol gives information on how to avoid bodily injuries.

If the possible cause of risk can be specified, the corresponding pictogram precedes instructions:

Danger!
Electrical voltage.
This pictogram indicates danger due to electrical voltage.

Caution!
This pictogram indicates information on how to avoid material damage.

Note!
This pictogram indicates instructional or general advice.

2 Returns and disposal

2.1 Declaration of decontamination

For the safety of our employees and because of legal regulations we need a signed “declaration of decontamination” before your return can be handled.
This signed declaration must be included with the shipping documents on the outside of the packaging.
Any returns which were exposed to hazardous substances and were not professionally decontaminated are not accepted and will be sent back on your cost.

optek’s declaration of decontamination and contact information can be found on our website www.optek.com.

2.2 Disposal

Special legal regulations apply to the return and disposal of industrial waste equipment. However, manufacturer and user can contractually agree on which party is to fulfill these legal obligations.

Observe current national disposal regulations.
To dispose packaging material, please separate materials into the following groups:

- Paper / paperboard
- Plastic

For disposal, disassemble the system components and separate them according to different material groups.

Dispose of materials according to national and local regulations.

If no agreement has been made, products may be shipped to optek for disposal.

3 Intended use

The converter is to be used exclusively for optek-sensors according to the technical data. In combination with inline sensors for turbidity, concentration, color and UV absorbance, the converter is used processing measuring results.

The converter may only be interfaced with sensors listed in the "Technical data" of this manual found on page 9.

This converter is not intended for use in explosion-proof areas.

Tampering or unauthorized substitution of parts or changes of the converter or its software may affect the performance and result in unsafe operation.

The manufacturer is not liable for damage resulting from use contrary to the intended use.

Following this instruction manual is part of the intended use.

4 Description of the converter

The converter is designed for process monitoring and control using optek-sensors AF16, AF56, AF26, AF45, TF16 or optek probes AS16 or AS56.

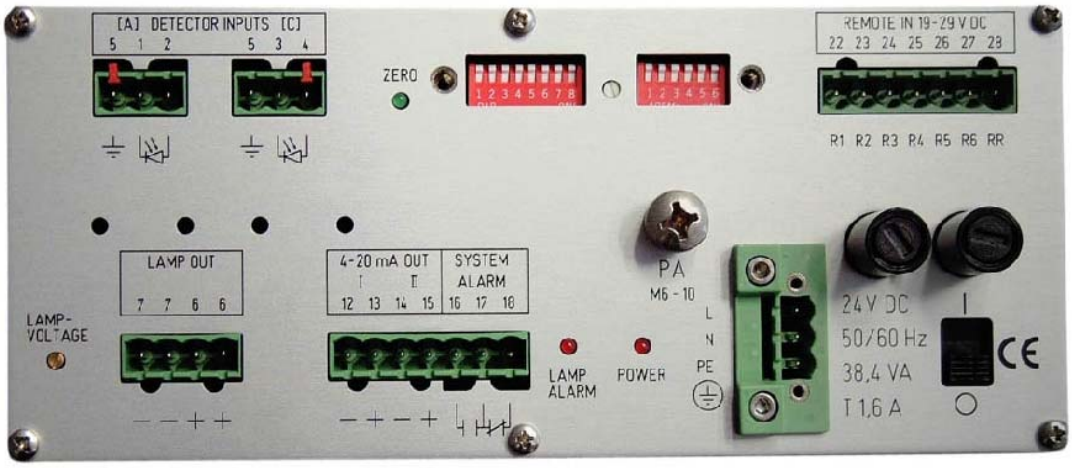
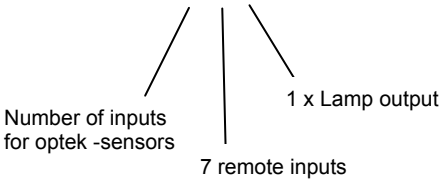


Fig. 1 Surface Control 2000

The converter is available in two versions: C2221 and C2121, both in 24 V DC. So model number is set up as follows:

Model number: C2_ 2 1



Changing the measuring range can be done either manually or remotely.
Two mA-outputs are available to get the values to your Control System (PLC / DCS).

4.1 *Front view converter C2000*

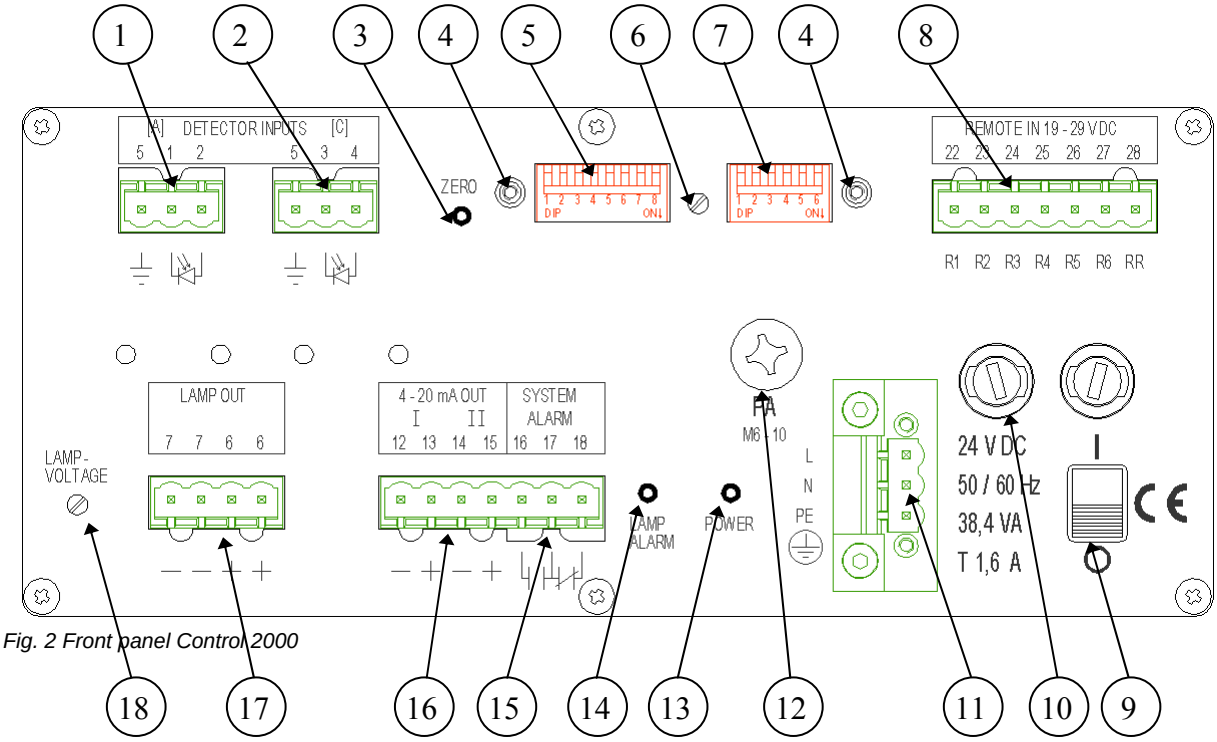


Fig. 2 Front panel Control 2000

Numbers stand for:

1 Detector input [A] (only for optek-sensors)
2 Detector input [C] (only for optek-sensors)
3 LED (green), Zero point indicator
4 M2.5 threads for cover attachment.
5 L-Switches for system adjustments, 8-position DIP
6 Digital potentiometer for adjustments in varius service
7 R-Switches for service adjustments, 6-position DIP
8 REMOTE IN
9 ON / OFF switch
10 T1.6 A fuses (5 x 20 mm)
11 Power supply (fixed), 24 V AC / DC
12 Potential equalization M6 x 10 (only for use with explosion protection or extreme EMC)
13 LED (red), power ON indikator
14 LED (flashes red), indicates lamp failure or system failure
15 System relay (active)
16 mA-output 1, mA-output 2
17 Lamp output (only for optek-sensors)
18 Potentiometer for lamp voltage adjustment

4.2 *L-Switches for system adjustments, 8-position DIP*

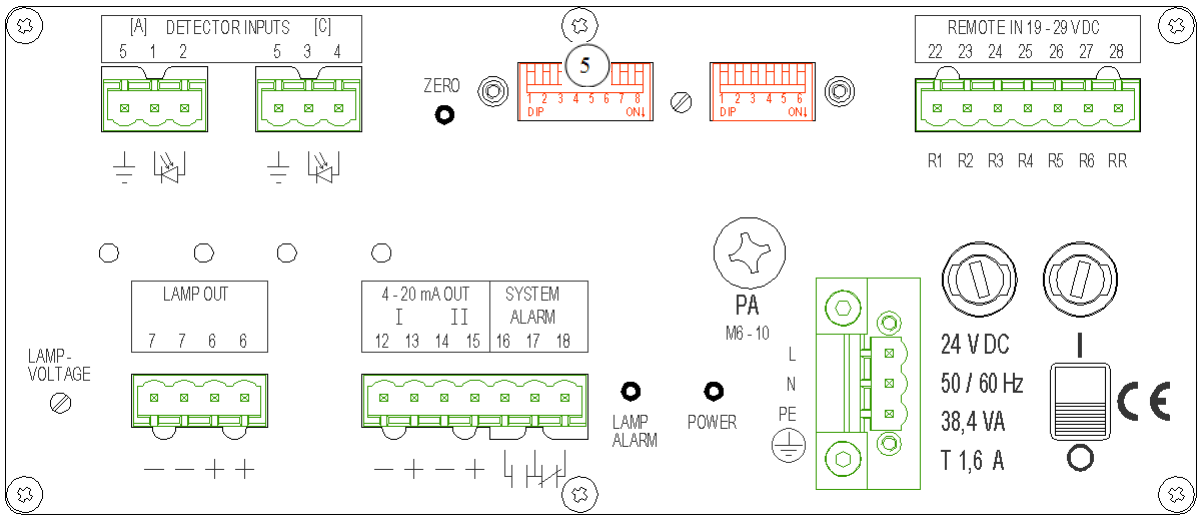


Fig. 3 L-Switches for system adjustments

The 8-position DIP- switches L (5) for system adjustments is behind the cover (here already removed), to avoid inadvertent operation.
The 8-position DIP- switches L (5) have the following functions:

- **DIP-1 to -3 Choose measuring range**
- **DIP-4 = ON activate manually change of measuring range**
- **DIP-5 = ON activate sensor adjustment for mA-1**
- **DIP-6= ON activate sensor adjustment for mA-2**
- **DIP-7 = ON activate damping for outputs (SLOW)**
- **DIP-8 = ON activate numbers of sensors 2 on lamp output (by connection 2 x AS56)**

Note!
- In case of 2 x AS56: When a lamp failure of one sensor occurs, switch DIP-8 switch to OFF, to be able to measure with the other sensor further on.
- Activating damping (DIP-7 = ON) means that the symmetric damping (1 sec.) is switched to asymmetric damping. Doing that increasing currents will be damped tenfold weaker. In 10 seconds, approximately 95% of the final value is reached.

4.3 *R-Switches for service adjustments, 6-position DIP*

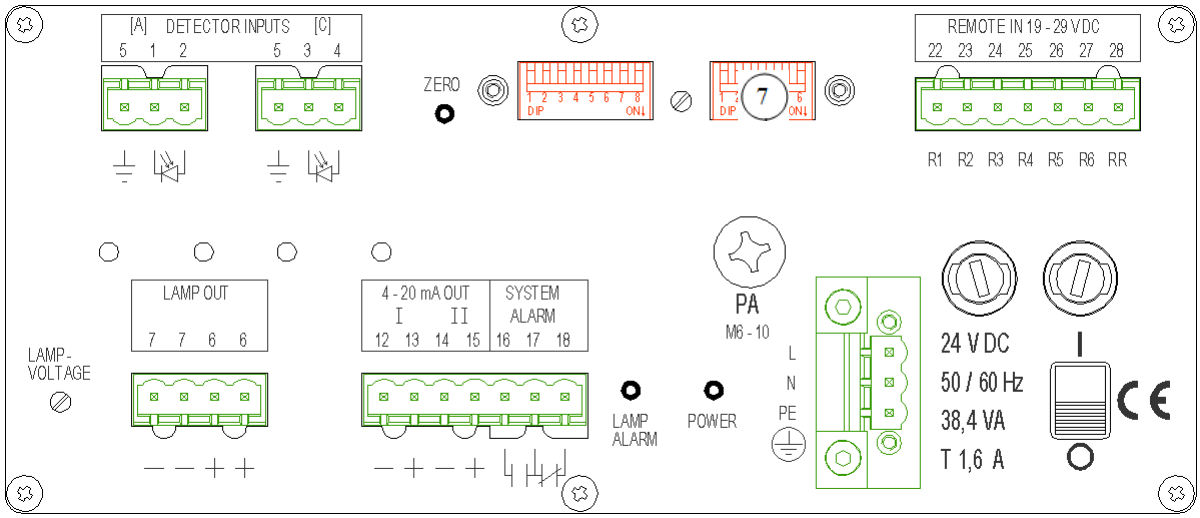


Fig. 4 R-Switches for service adjustments

The 6-position DIP- switches R (7) for service adjustments is behind the cover (here already removed), to avoid inadvertent operation.
The 6-position DIP- switches R (7) have the following functions:

- **DIP-1 to DIP-4** **Selection of parameter (e.g. Offset and Slope)**
- **DIP-5 = ON** **activate the current adjustment of the outputs**
- **DIP-6 = ON** **activate the sensor adjustment for the measuring function**
- **DIP-5 und -6 = ON** **activate zeroing for channel [A] and [C], Selection DIP-1 to DIP-4**

5 Technical Data

*Table 1 Technical data**

Technical Data	C2000
Housing	general purpose NEMA Type 12, for DIN-rail mounting to EN 50 022 (35 x 7.5 mm) rail - dimensions: W 202.0 mm (7.95 in.) H 86.0 mm (3.39 in.) D 92.0 mm (3.62 in.)
Operation	dip switches, potentiometer
LED	1 LED (green): power on 1 LED (green): zero 1 LED (red-flashing): lamp or system failure
Sensor-inputs	1 or optional 2 for optek photometric sensors
Remote-inputs	5 x 24 V (19 ... 29 V DC), typically 6.0 mA for remote range setting, remote zero, remote hold
Sensor lamp-outputs	1 lamp supply for optek photometric sensors 4.5 ... 8.5 V DC
mA-outputs	2 x 0/4 - 20 mA (NAMUR) functionally galvanically isolated (min. 500 V DC) for connection to PELV - accuracy: < 1.5 % - resolution: < 0.1 % - load: < 600 Ohm
Failsafe-output	1 SPDT contact to alarm in case of lamp or system failure (active) 0 - 50 V AC, 0 - 75 V DC, 0 - 2 A
Cable lenghts (sensor)	2, 3, 5, 10, 15, 20, 30 ... 100 m (7, 10, 16, 33, 49, 66, 98 ... 328 ft) cable length > 100 m on request sensors: AS56 / AS16: max: 50 m
Power supply (Fixed, secured against accidental touching)	24 V AC / DC (AC: 20.4 - 26.4 V AC, 47 - 64 Hz; DC: 20.4 - 28.8 V DC) (SELV / PELV) consider an external release device - power consumption: < 50 VA
Ambient conditions	temperature during operation (no direct sunlight): -10 - 40 °C (14 - 104 °F) temperature during transport (no direct sunlight) : -20 - 70 °C (-4 - 158 °F)
Internal operating temperature	-20 - 55 °C (-4 - 131 °F)
Weights	1.25 kg
Responding behavior	optek-detector inputs: 1 mA to 500 pA Linearity (converter): typically < 0.1 %, max. 0.5 % Accuracy (converter): typically < 0.3 %, max. 0.5 %
Certificates	ISO 9001:2008, GS, CE

*Data given are subject to changes without prior notice.

5.1 Possible sensors

The following optek-sensors can be connected to the converter:

Table 2 Connectable sensors

Sensor Options	AF16-F/N	AF26	AF45	AF56	TF16-N	AS16-F/N	AS16-BT-N	AS56-F/N
HT	X	X	X		X			
VA	X	X						
HT-VA	X	X						
VB	X	X	X			X	X	
HT-VB	X	X	X					
PV	X	X	X		X			
HT-PV	X	X			X			
VA-PV	X	X						
HT-VA-PV	X	X						
VB-PV	X	X	X					
HT-VB-PV	X	X						

A detailed sensor description can be found in the appropriate sensor manual.

5.2 Dimensions Control 2000

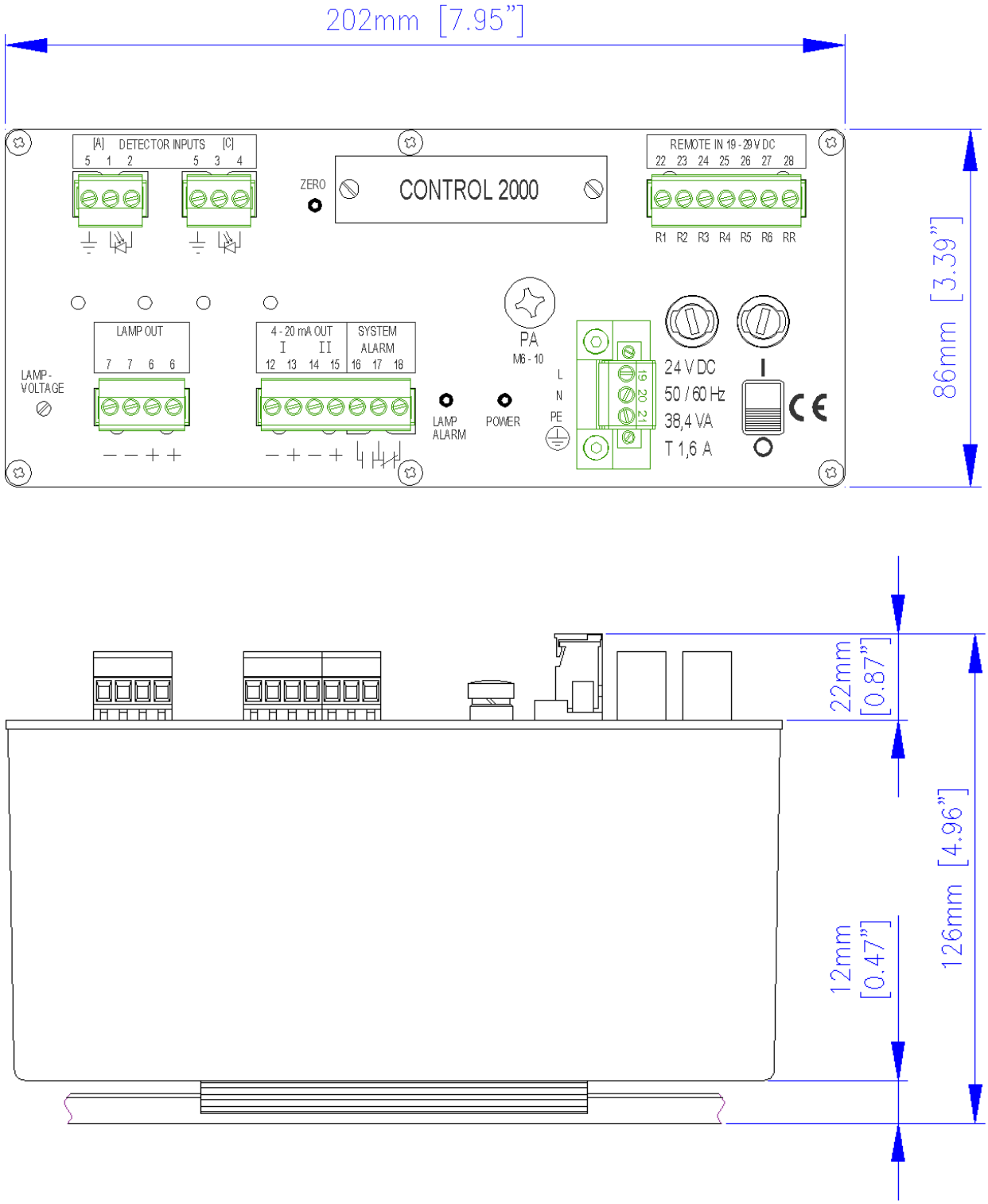


Fig. 5 Dimensions Control 2000

6 Installation

The C2000 series converters are designed for compact DIN rail mounting to EN 50 022 (35 x 7.5 mm) rail using the attached mounting adapter on the back of the converter. The converter is attached to the DIN-rail from the top and is secured when it is snapped in. To detach the converter from the DIN-rail, tilt the converter face up while pushing down on the top.

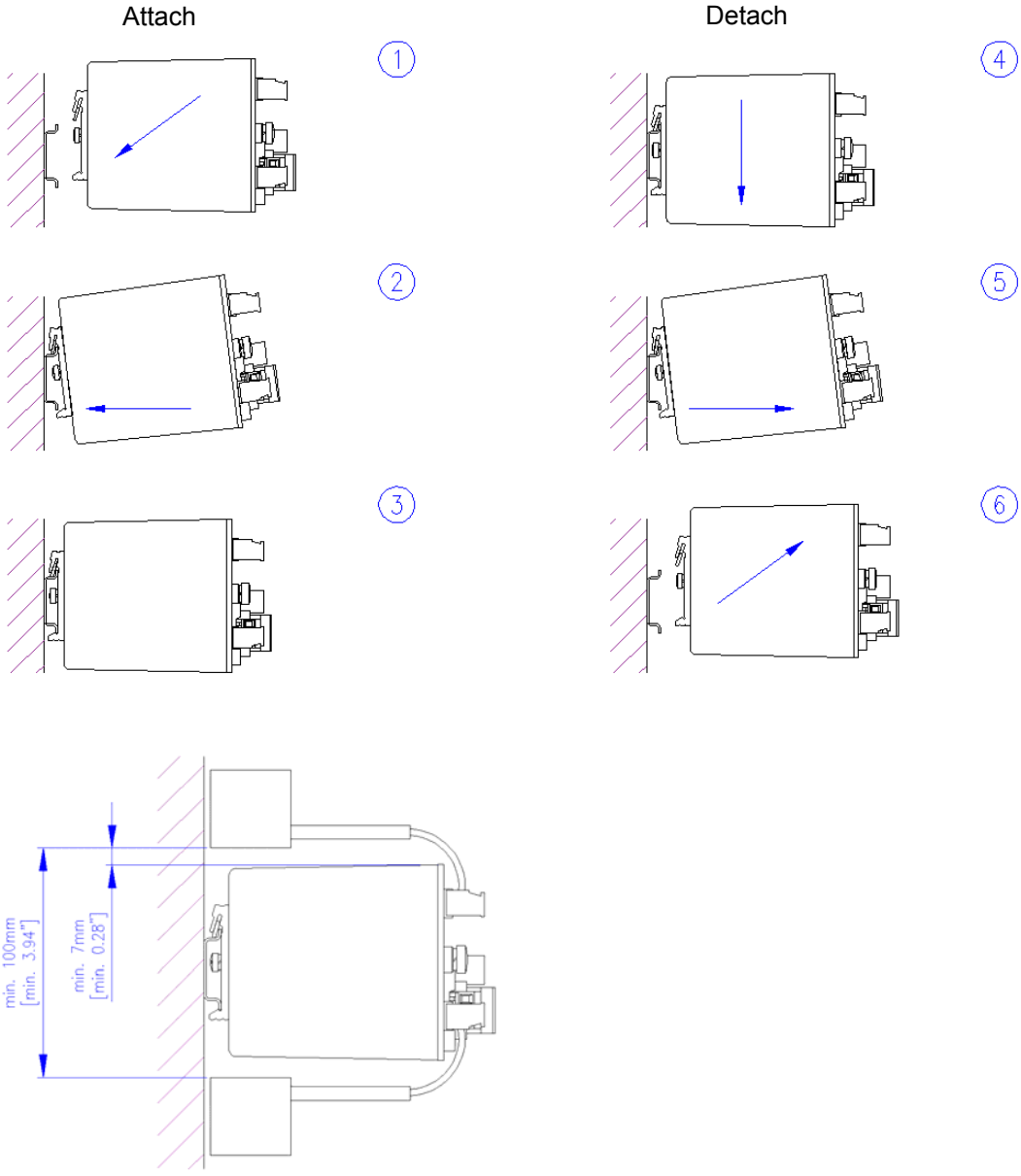


Fig. 6 Converter installation

The internal retaining spring allows quick attachment (1-3) and detachment (4-6) from standard DIN rails. No special tools are required. Allow for additional space of at least 7 mm (0.28”) above and below the transmitter and at least 120 mm (4.7”) cable length to the 24 V DC/AC power supply for easy mounting.

7 Wiring

7.1 General advice on wiring

Danger!
Electrical voltage.
Before connecting, switch the converter power switch to O (OFF) position.
Install electrical connections only by qualified electricians.

- All wiring terminals and switches are located on the front panel of the converter.
- The converter is designed for continuous operation and has only to be switched voltage-free for maintenance purposes.

7.2 Connection to power supply

Danger!
Electrical voltage.
Before connecting, switch the converter power switch to O (OFF) position.
Install electrical connections only by qualified electricians.

1. Connect the power supply to the power supply socket.

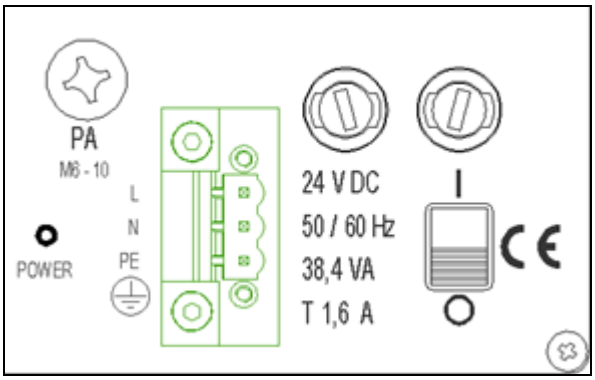


Fig. 7 Connecting the power supply 24 V AC / DC

L- Line = 19
N-Neutral = 20
PE Ground = 21

7.3 Connecting the sensors

Danger!
Electrical voltage.
Before connecting, switch the converter power switch to O (OFF) position.
Install electrical connections only by qualified electricians.

The following connections (1, 2, 17) are on the front of the converter:

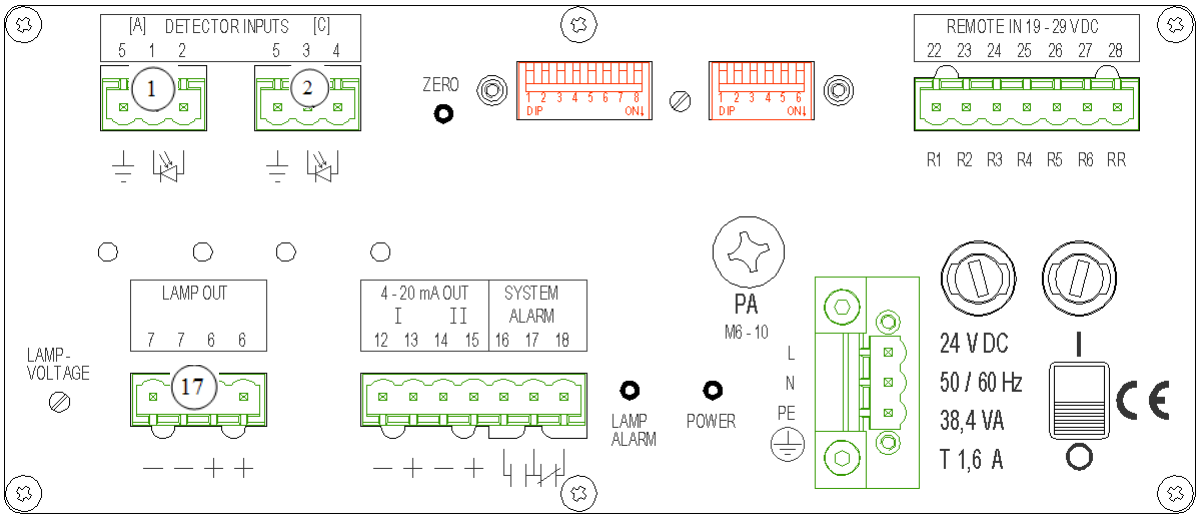


Fig. 8 Detector inputs and lamp output

To be able to allocate the end splices unequivocally to the clamps of the converter, each end splice is marked with the number of the correct clamp:

Detector cable to sensor

1 = white (A1) 2 = brown (A2) 5 = black (A5)
3 = white (C3) 4 = brown (C4) 5 = grey or black (C5)

Lamp cable to sensor

6 = white or blue (6) 7 = brown (7)

Table 3 Color code table

Color Code	
BK	Black
WH	White
BN	Brown
GY	Grey
BU	Blue

Caution!
Lamp voltage must be adjusted to the cable length in order to compensate voltage loss in the cable. Too low lamp voltage can lead to wrong measuring results. Too high lamp voltage reduces the life of the lamp module considerably.

7.3.1 Wiring plan AF16 to C2121 (also applies to C2221)

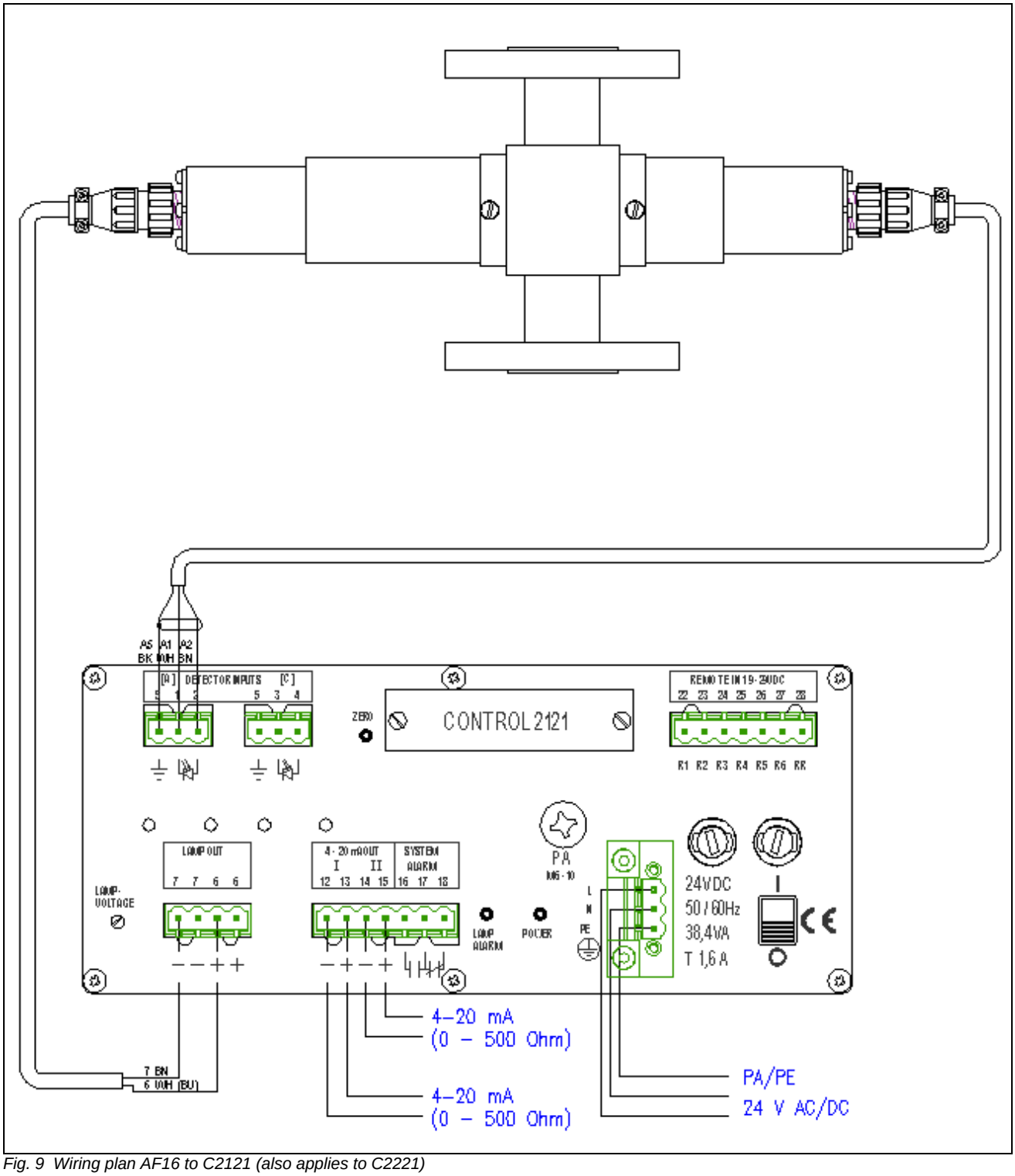


Fig. 9 Wiring plan AF16 to C2121 (also applies to C2221)

7.3.2 Wiring plan AS16 to C2121 (also applies to C2221)

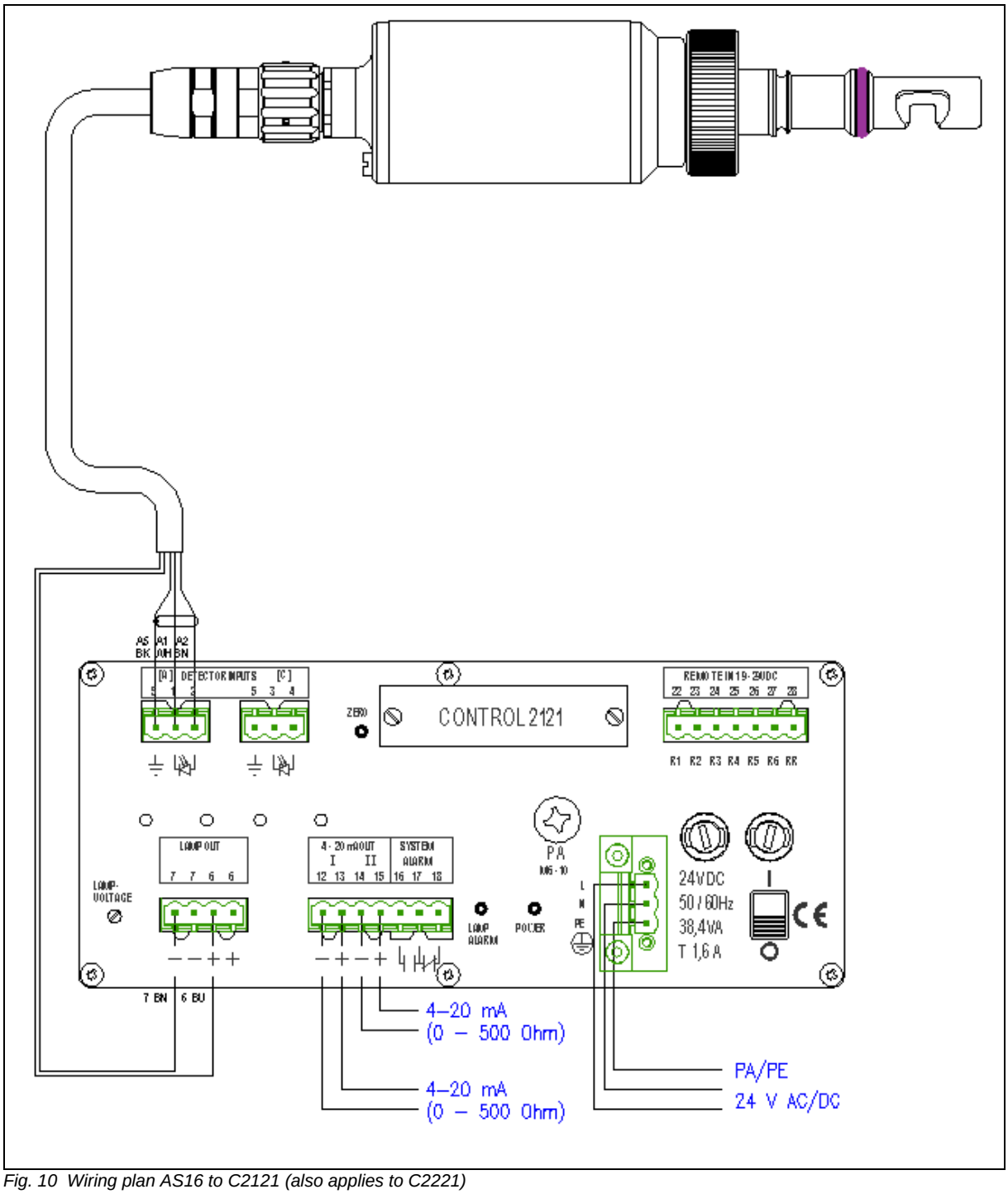


Fig. 10 Wiring plan AS16 to C2121 (also applies to C2221)

7.3.3 Wiring plan AS56 to C2121 (also applies to C2221)

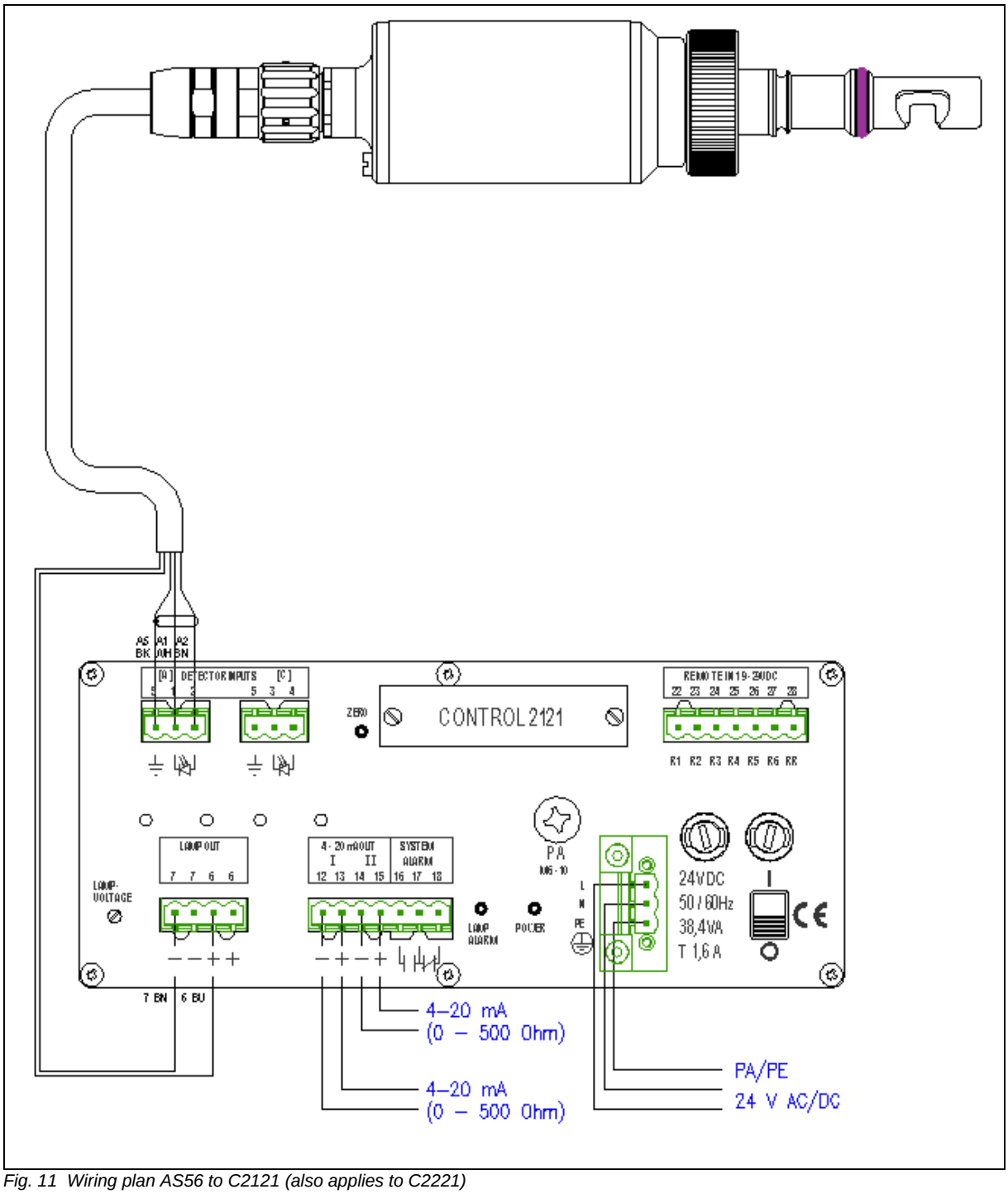


Fig. 11 Wiring plan AS56 to C2121 (also applies to C2221)

7.3.4 Wiring plan 2 x AS56 to C2221

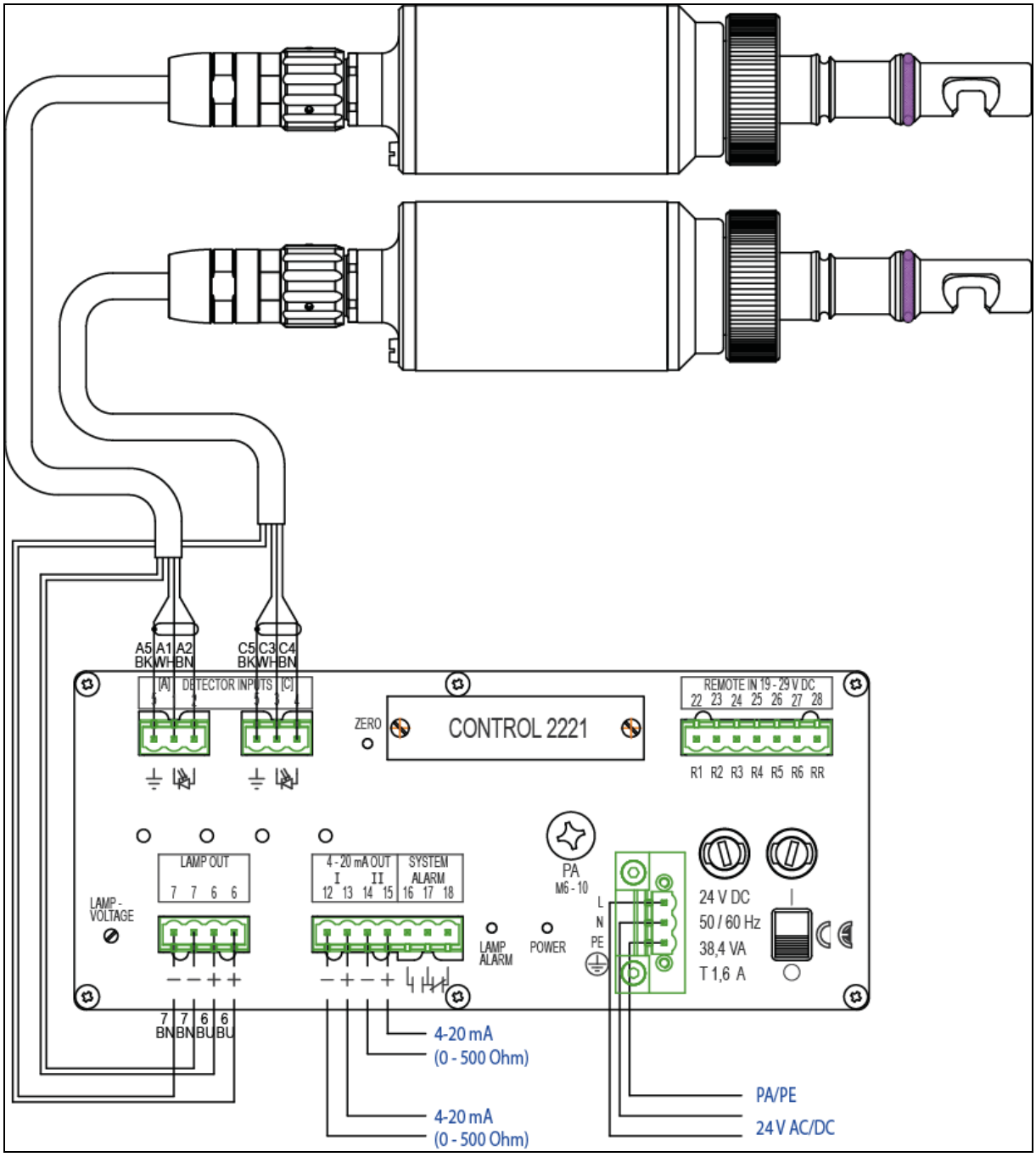


Fig. 12 Wiring plan 2x AS56 to C2221

7.3.5 Wiring plan AF56 to C2121 (also applies to C2221)

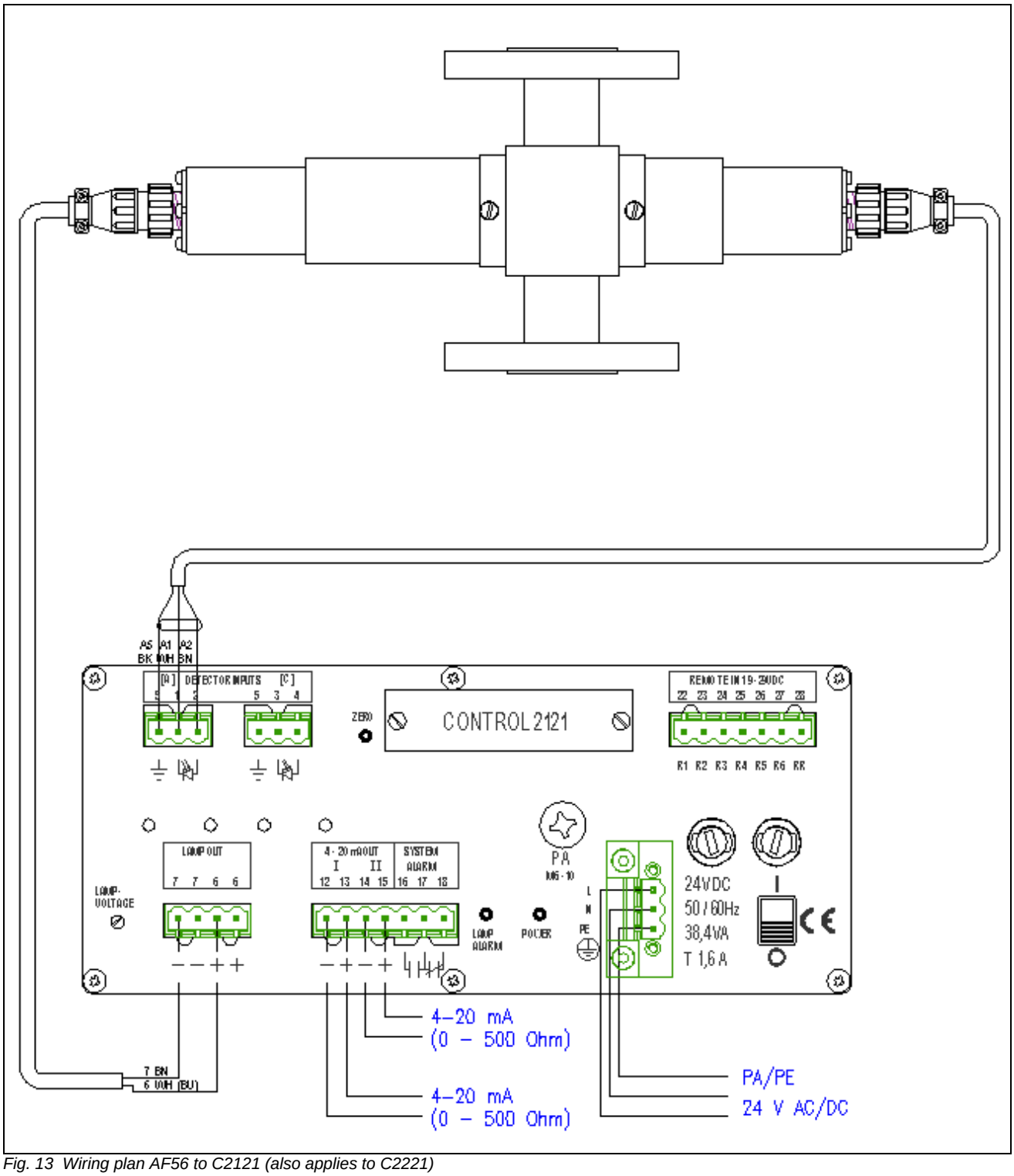


Fig. 13 Wiring plan AF56 to C2121 (also applies to C2221)

7.3.6 Wiring plan AF26 to C2221

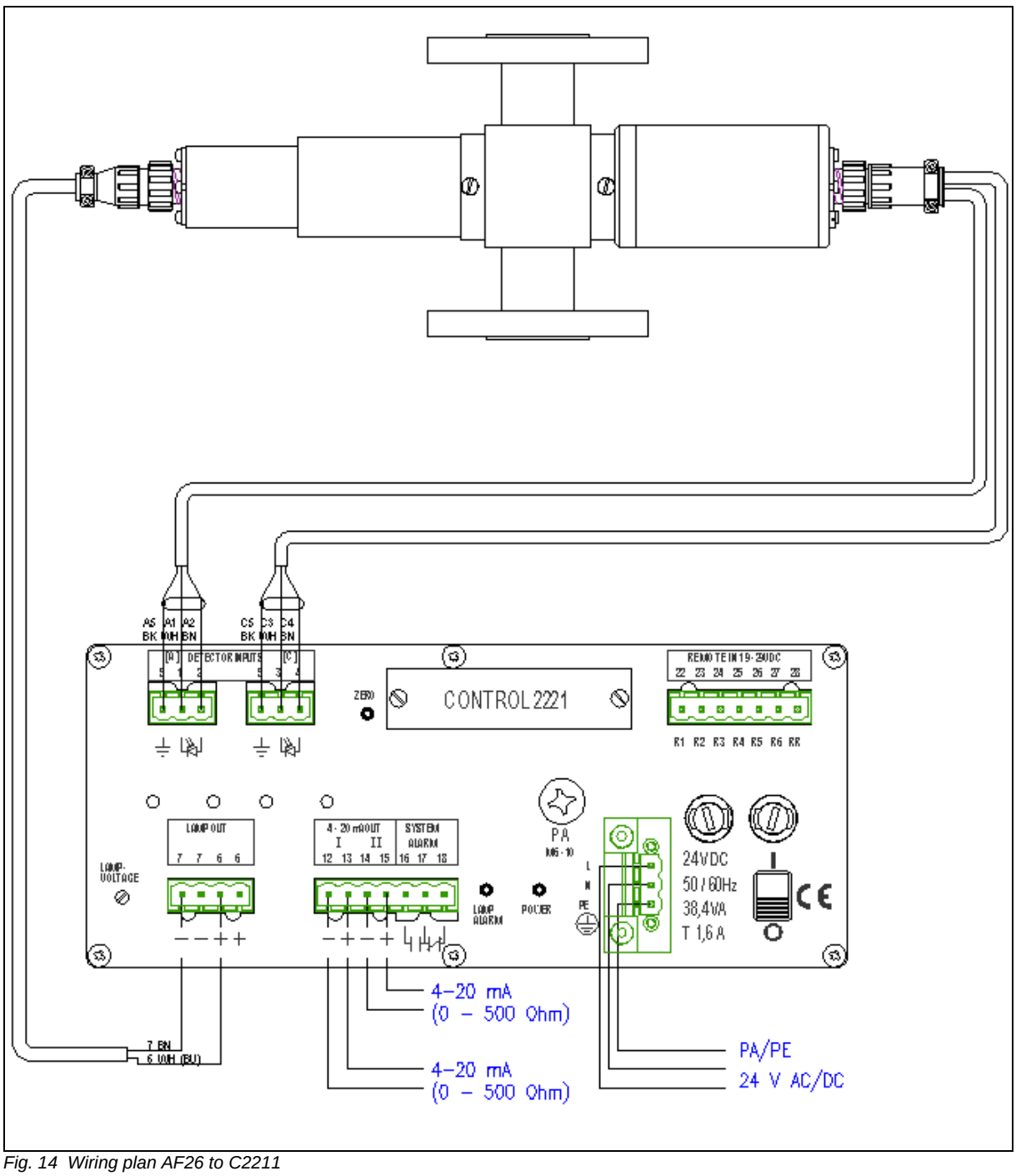


Fig. 14 Wiring plan AF26 to C2211

7.3.7 Wiring plan AF45 to C2221

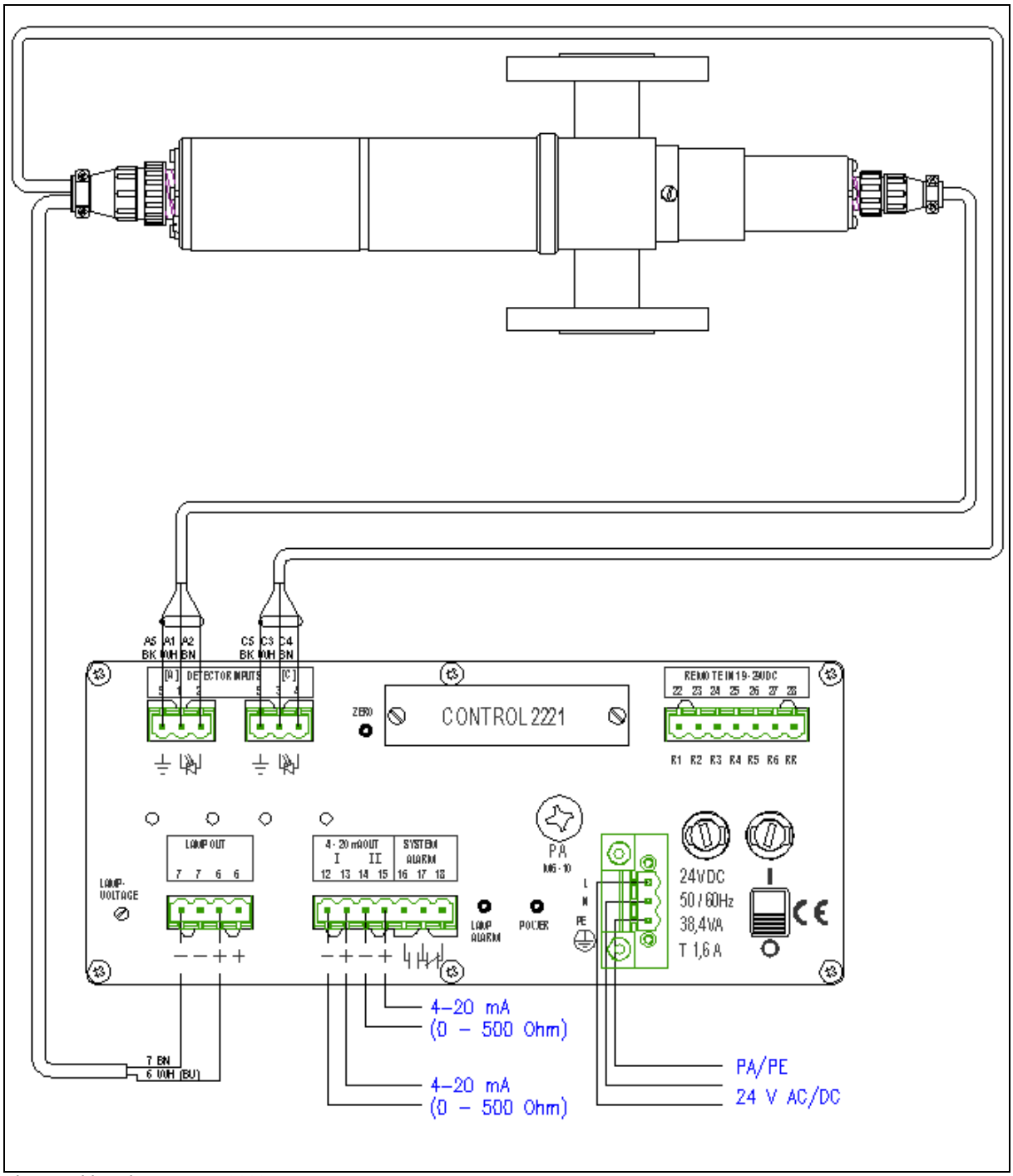


Fig. 15 Wiring plan AF45 to C2221

7.3.8 Wiring plan TF16 to C2221

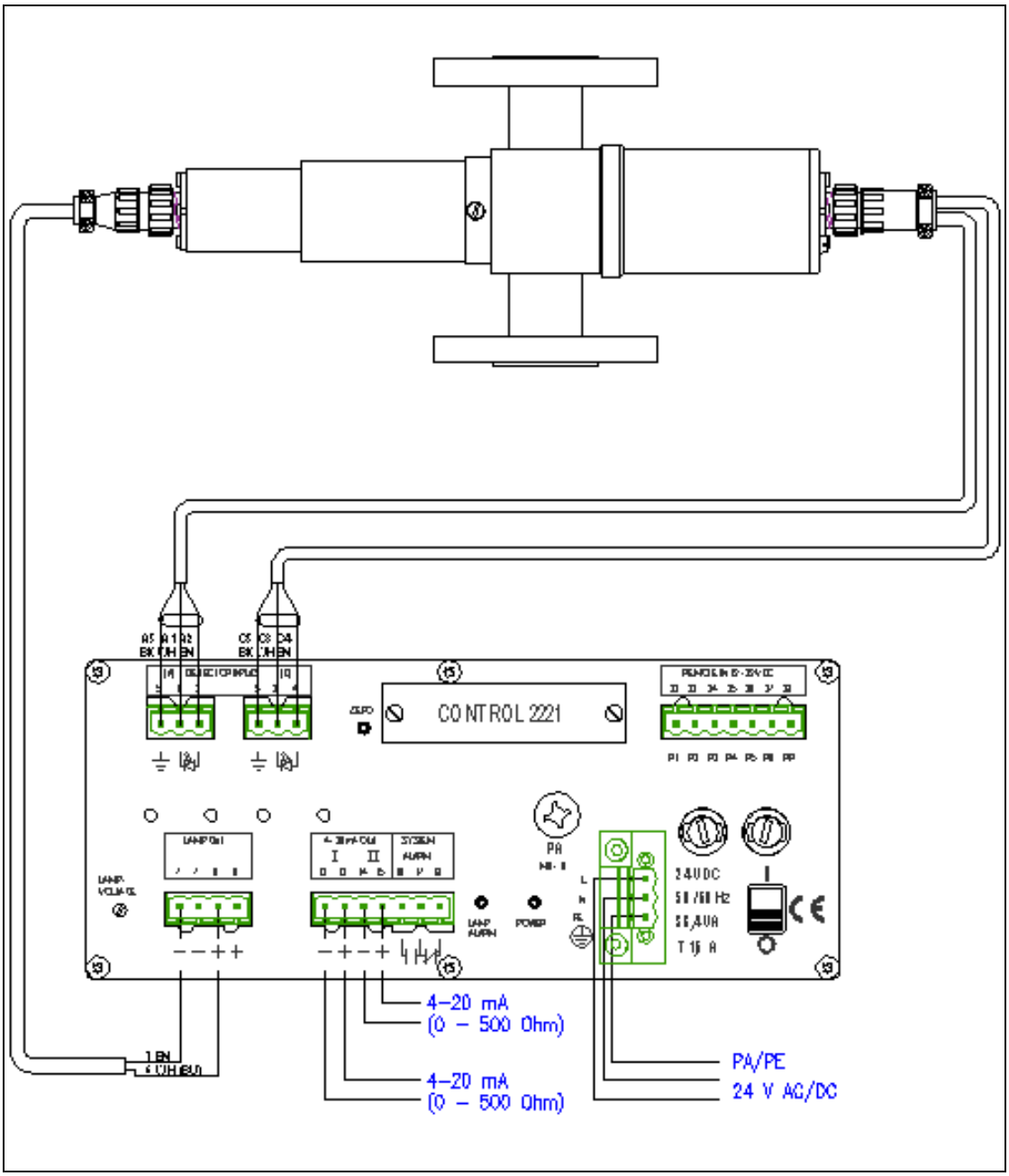


Fig. 16 Wiring plan TF16 to C2221

7.4 Connecting the system relay

Danger!
Electrical voltage.
Before connecting, switch the converter power switch to O (OFF) position.
Install electrical connections only by qualified electricians.

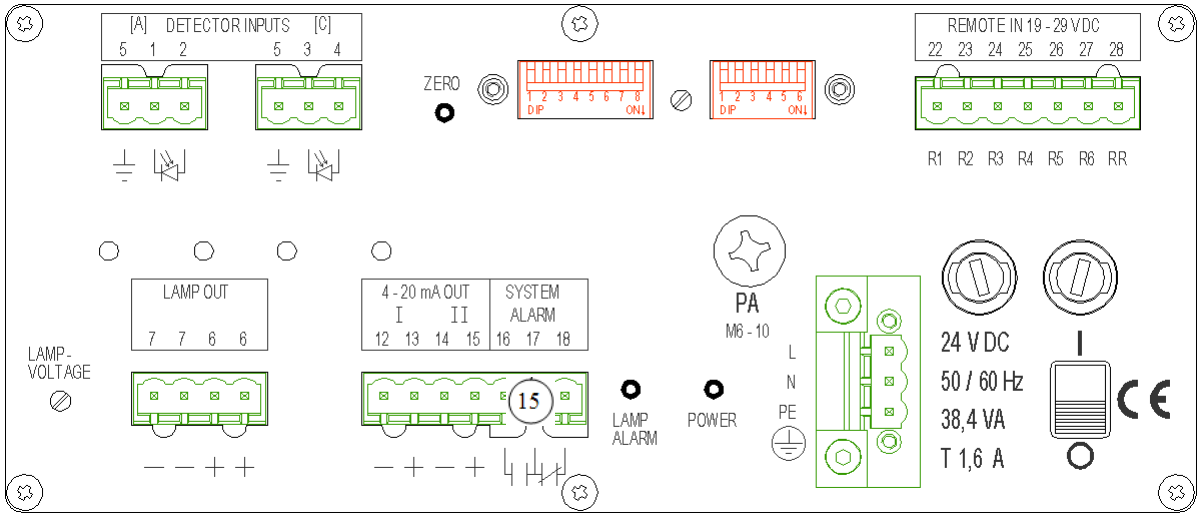


Fig. 17 System-Relay

The converter is equipped with a system relay (15).

System relay: 16 / 17 / 18 (active)

Switching the Control 2000 on the relay switches (active) and changes from the normal switching state

- System Okay (16-17 open, 17-18 closed)

to switching state

- System Error (16-17 closed, 17-18 open)

  Such as:
  - no voltage supply
  - hardware defect
  - lamp failure

Note!
The red LED LAMP ALARM flashes additionally having a lamp failure.
Observe the admissible relay output loads (see „Technical data“, chapter 5, page 9).

7.5 Connecting the mA-outputs

Danger!
Electrical voltage.
Before connecting, switch the converter power switch to O (OFF) position.
Install electrical connections only by qualified electricians.

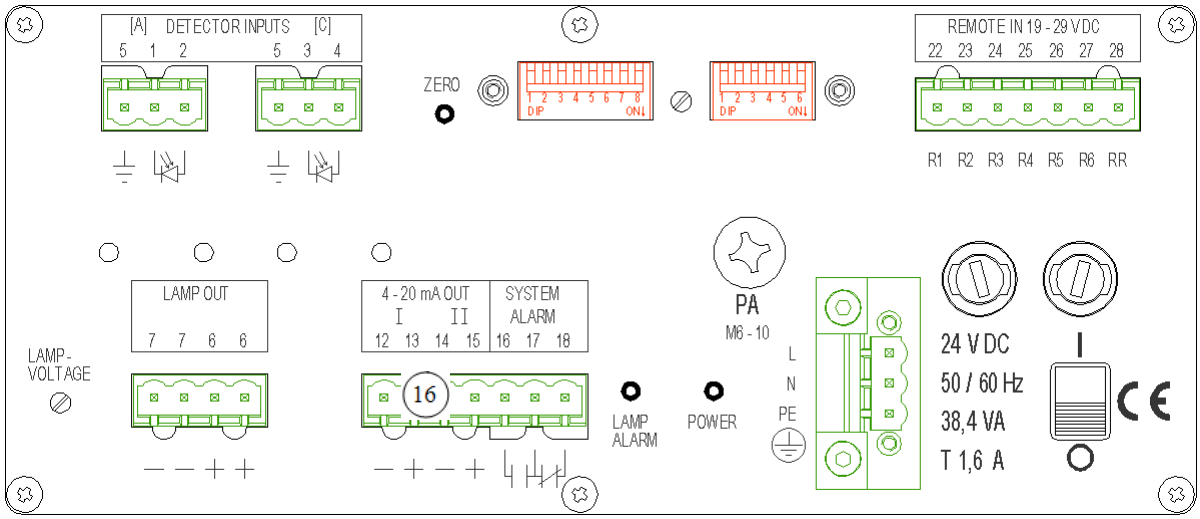


Fig. 18 mA-outputs

The Control 2000 is equipped with two 4-20 mA-outputs (16).

- mA-output 1 clamps 13+ / 12-
- mA-output 2 clamps 15+ / 14-

7.6 Connecting Remote In

Danger!
Electrical voltage.
Before connecting, switch the converter power switch to O (OFF) position.
Install electrical connections only by qualified electricians.

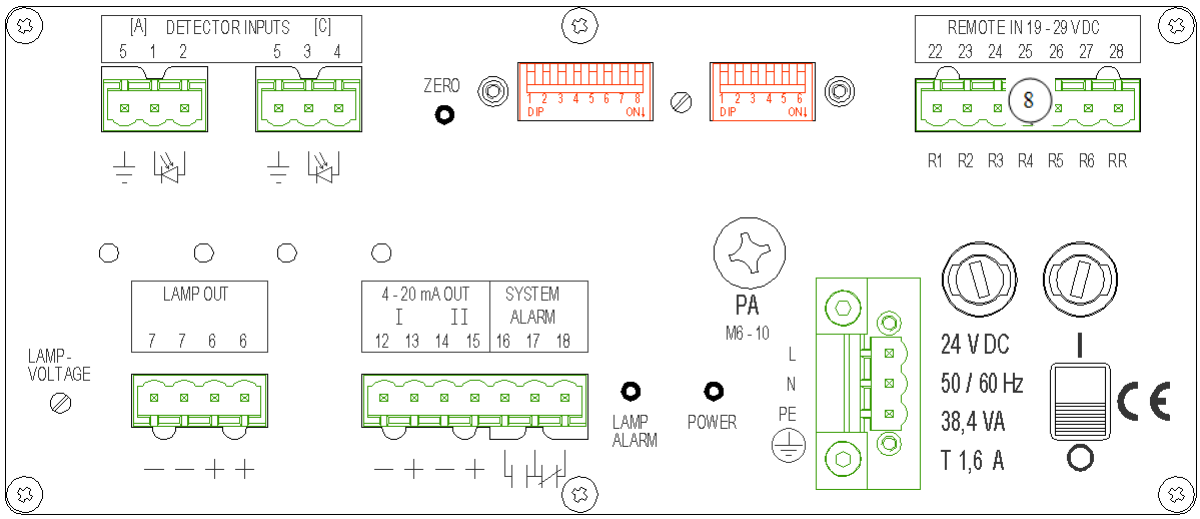


Fig. 19 Remote IN

The converter is equipped with remote control capabilities (8). 24 V DC control cables connected to the applicable remote input clamps are used to activate different converter functions (e.g. using PLC; change of measuring range, system zero point, hold).

R1	clamp 22	R2	clamp 23
R3	clamp 24	R4	clamp 25
R5	clamp 26	R6	clamp 27
RR	clamp 28		

First the level of inputs R1- R5 is set. Before a command execution always a confirmation signal (R6 = VALID) is expected, which must be constant at least 0.5 seconds before it is accepted by the system.

Voltages of 19 - 29 VDC are detected as HIGH and voltages of 0 VDC as LOW.

Note!
Please observe information in chapter 8.4, 8.5 and 8.6

8 Commissioning

8.1 Requirements for commissioning

Before commissioning the converter or the whole measuring system, carry out the following activities:

- Install the armature (see instruction manual of armature).
- Check the pipeline with the armature for leaks.
- Check armature windows for any visible dirt or damage.
- Install the sensor (see instruction manual of the sensor).
- Ensure that the converter is mounted correctly.
- Verify correct wiring of the converter (see chapter 7).

8.2 Switching the converter on

1. Flip the converter power switch (9) to I (ON) position.

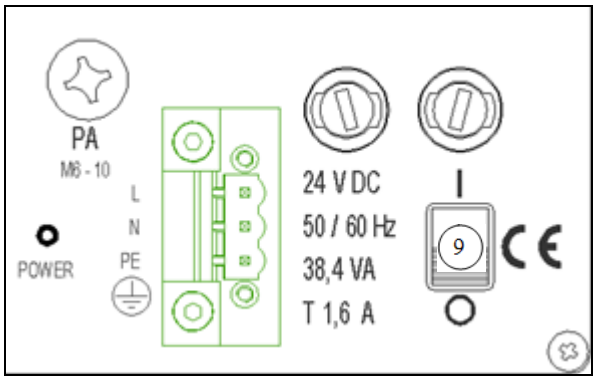


Fig. 20 Converter power switch

2. Switch on the external release device.
3. Wait for approx. 15 minutes, until the system has reached the operating temperature.

8.3 Adjusting lamp voltage

Lamp voltage must be adjusted to the cable length in order to compensate voltage loss in the cable. A lamp voltage, which is too low can lead to wrong measuring results. A lamp voltage, which is too high reduces the life span of the lamp module considerably.
Use the potentiometer (18) LAMP VOLTAGE on the front panel of the C2000 for lamp voltage adjustment.

1. Let the lamp module of the sensor operate for at least 3 minutes. During this time the voltage at the lamp output clamps of the converter adjusts depending on the load.

Caution!
The lamp voltage at the converter must not exceed 8.5 V DC or the system will overheat.

Lamp voltage depends on cable length and sensor type. During operation, lamp voltage at the lamp module has to be constant at 4.8 V (or 7.0 V when using AF45 or AF46). The values in the following table apply to original cable sets only.

Table 4 Lamp voltage depending on cable length

Cable set lengths standard*		Lamp voltage [V] depending on connected sensor and cable cross section				
		AF16, AF26, AF56, TF16-N	AS16, AS16-BT	AS56	AF45	
m	ft.	1.5 mm²	1.5 mm²	1.5 mm²	1.5 mm²	2.5 mm²
0	0	4.80	4.80	4.80	7.00	
2	7	4.84	4.84	4.82	7.04	
3	10	4.86	4.86	4.83	7.06	
5	16	4.90	4.90	4.86	7.11	
10	33	4.99	4.99	4.91	7.22	
15	49	5.09	5.09	4.97	7.33	
20	66	5.18	5.18	5.02	7.44	
25	82	5.28	5.28	5.08	7.55	
30	98	5.38	5.38	5.13	7.66	
35	115	5.47	5.47	5.19	7.77	
40	131	5.57	5.57	5.24	7.88	
45	148	5.66	5.66	5.30	7.99	
50	164	5.76	5.76	5.35	8.10	
60	197	5.95				7.74
70	230	6.14				7.87
80	262	6.34				7.99
90	295	6.53				8.11
100	328	6.72				8.24
Lamp-voltage =		4.80 + 0.0192 /m	4.80 + 0.0192 /m	4.80 + 0.011 /m	7.00 + 0.0192 /m	7.00 + 0.0108 /m
Resistance =		12.8 ohms / 1000 m	12.8 ohms / 1000 m	12.8 ohms / 1000 m	12.8 ohms / 1000 m	7.2 ohms / 1000 m

**. Cable sets length > 100 m (328 ft.) on request.*

Standard cross section for lamp cables is 1.5 mm². With longer cable sets, the following lamp cables are used to minimize voltage losses:

- AF16, AF26, TF16-N > 150 m (492 ft.): 2.5 mm²
  (Lamp voltage = 4.80 + 0.0108 / m; Resistance = 7.2 Ohm / 1000 m)
- AF45 > 50 m (164 ft.): 2.5 mm²

Caution!
When cable sets are later shortened, prior to connecting the lamp module, lamp voltage has to be reduced to the corresponding value to avoid overload.

8.4 Measuring Range Selection

8.4.1 Measuring Range Selection - Remote

Table 5 Measuring Range Selection - Remote

Funtion	R1	R2	R3	R4*	R5*	R6
Change to measuring range M01	LOW	LOW	LOW	LOW	LOW	**HIGH**
Change to measuring range M02	LOW	LOW	**HIGH**	LOW	LOW	**HIGH**
Change to measuring range M03	LOW	**HIGH**	LOW	LOW	LOW	**HIGH**
Change to measuring range M04	LOW	**HIGH**	**HIGH**	LOW	LOW	**HIGH**
Change to measuring range M05	**HIGH**	LOW	LOW	LOW	LOW	**HIGH**
Change to measuring range M06	**HIGH**	LOW	**HIGH**	LOW	LOW	**HIGH**
Change to measuring range M07	**HIGH**	**HIGH**	LOW	LOW	LOW	**HIGH**
Change to measuring range M08	**HIGH**	**HIGH**	**HIGH**	LOW	LOW	**HIGH**

*. *In case of 2 x AS56: LOW for measuring range selection mA output I (Sensor 1).*
HIGH for measuring range selection mA output II (Sensor 2).

The signals should there for at least 0.5 seconds before the valid signal is set. During the measuring range selection the system is not operational for about 1 to 2 seconds, as new parameters are loaded.

In the appendix you will find available measuring ranges for your parameter sets.

Note!
Voltages of 19 - 29 VDC are detected as HIGH and voltages of 0 VDC as LOW.

8.4.2 Measuring Range Selection - Manual

Table 6 Measuring Range Selection - Manual

DIP- 1	DIP- 2	DIP- 3	DIP- 4 OFF	DIP- 4 ON
OFF	OFF	OFF	**Deactivated**	Change to measuring range M01
OFF	OFF	**ON**	**Deactivated**	Change to measuring range M02
OFF	**ON**	OFF	**Deactivated**	Change to measuring range M03
OFF	**ON**	**ON**	**Deactivated**	Change to measuring range M04
ON	OFF	OFF	**Deactivated**	Change to measuring range M05
ON	OFF	**ON**	**Deactivated**	Change to measuring range M06
ON	**ON**	OFF	**Deactivated**	Change to measuring range M07
ON	**ON**	**ON**	**Deactivated**	Change to measuring range M08

The manual measuring selection for mA-output mA-1 and mA-2 is done using the L-Switches for system adjustments. This L-Switch can be found under the cover attachment with the device name, on the left side from the digital potentiometer. The DIP-switches 1-3 correspond to the Remote Inputs R1-R3, the DIP-switch 4 (de)activate the measuring range selection for both mA-outputs.
When DIP-4 is switched Off, the last measuring range persist, as long as no change is done by Remote.

In the appendix you will find available measuring ranges for your parameter sets.

8.5 Zero point adjustment

During commissioning, and routine checks, after lamp change or maintenance, always check the system zero point. To check or set the system zero point correctly, proceed as follows:

- Clean the windows of the armature or the probe.
- Fill the armature with clean particle-free water.
- Remove any gas bubbles in the medium.
- Cover the armature to prevent straight light.
- Let the system work for at least 15 minutes before checking the system zero point.

Note!
After correct zeroing the ZERO-LED (5) is lit as long as the measuring value is with in a range of + / - 1 % of the measuring range from zero.

The ZERO-LED (5) is not lit, if e.g. a too high zero point offset in set in sensor adaptation.

The ZERO-LED (5) will flash if the zero point adjustment could not be carried out.

During a zero point adjustment the system is not operational for about 1 to 2 seconds, as new data are stored and new measuring values are calculated.

The zeroing is repeated as long as the switches are set.

8.5.1 Zero point adjustment - Remote

Note!
Voltages of 19 - 29 VDC are detected as HIGH and voltages of 0 VDC as LOW.

Zero point adjustment if **one** sensor AF16, AF56, AF26, AF45, TF16, AS16 or AS56 is connected to the C2000:

Table 7 Zero point adjustment - Remote (only one sensor is connected)

	R1	R2	R3	R4	R5	R6
Activate Zero point for Input [A] or [A] and [C]	LOW	LOW	LOW	**HIGH**	LOW	**HIGH**

Zero point adjustment if **2 x AS56** sensors are connected to the C2000:

Table 8 Zero point adjustment - Remote (2 x AS56 sensors are connected)

	R1	R2	R3	R4	R5	R6
Activate Zero point for Input [A]	LOW	LOW	**HIGH**	**HIGH**	LOW	**HIGH**
Activate Zero point for Input [C]	LOW	**HIGH**	LOW	**HIGH**	LOW	**HIGH**
Activate Zero point for Input [A] and [C]	LOW	**HIGH**	**HIGH**	**HIGH**	LOW	**HIGH**

8.5.2 Zero point adjustment - Manual

Remove C2000 cover attachment to access to R-Switches (7).

Zero point adjustment if **one** sensor AF16, AF56, AF26, AF45, TF16, AS16 or AS56 is connected to the C2000:

Table 9 Zero point adjustment - Manual (only one sensor is connected)

DIP- 1	DIP- 2	DIP- 3	DIP- 4		DIP- 5	DIP- 6
ON	**ON**	**OFF**	**OFF**	Activate Zero point for Input [A] or [A] and [C]	**ON**	**ON**

Follow the steps in the order listed below:

1. Check, if the current measuring value at mA-output is correct.
2. Make sure all R-DIP switches are in OFF position.
3. Turn R-DIP switches 5 and 6 ON to activate manual zero adjustment.
4. Switch DIP-1 and DIP-2 to ON, to zero input [A] and input [C]. The current zero point is saved temporary.
5. Switch DIP-1 and DIP-2 to OFF. The new zero point for both inputs is saved permanent for all measuring functions.
6. Switch DIP-5 and DIP-6 to OFF. The converter returns to normal operation.

Note!
With DIP-5 and DIP-6 switches ON the system relay is drop out.

Zero point adjustment if **2 x AS56** sensors are connected to the C2000:

Table 10 Zero point adjustment - Manual (2 x AS56 sensors are connected)

DIP- 1	DIP- 2	DIP- 3	DIP- 4		DIP- 5	DIP- 6
ON	**ON**	**OFF**	**OFF**	Activate Zero point for Input [A]	**ON**	**ON**
OFF	**OFF**	**ON**	**ON**	Activate Zero point for Input [C]	**ON**	**ON**
ON	**ON**	**ON**	**ON**	Activate Zero point for Input [A] and [C]	**ON**	**ON**

Follow the steps in the order listed below:

1. Check, if the current measuring value at mA-output is correct.
2. Make sure all R-DIP switches are in OFF position.
3. Turn R-DIP switches 5 and 6 ON to activate manual zero adjustment.
4. Switch DIP-1 and DIP-2 to ON, to zero input [A]. The current zero point is saved temporary.
5. Switch DIP-1 and DIP-2 to OFF. The new zero point for input [A] is saved permanent for all measuring functions.
6. Switch DIP-3 and DIP-4 to ON, to zero input [C]. The current zero point is saved temporary.
7. Switch DIP-3 and DIP-4 to OFF. The new zero point for input [C] is saved permanent for all measuring functions.
8. Switch DIP-5 and DIP-6 to OFF. The converter returns to normal operation.

Note!
With DIP-5 and DIP-6 switches ON the system relay is drop out.

8.6 *Hold adjustment*

Note!
Hold adjustment can only be done by Remote.

8.6.1 Hold adjustment - Remote

Note!
Voltages of 19 - 29 VDC are detected as HIGH and voltages of 0 VDC as LOW.

Table 11 Holdt adjustment - Remote

	R1	**R2**	**R3**	**R4**	**R5**	**R6**
Activate HOLD-function for Input [C] and deactivate HOLD-function for Input [A]	LOW	**HIGH**	LOW	LOW	**HIGH**	**HIGH**
Activate HOLD-function for Input [A] and deactivate HOLD-function for Input [C]	LOW	LOW	**HIGH**	LOW	**HIGH**	**HIGH**
Activate HOLD-function for Input [A] and [C]	LOW	**HIGH**	**HIGH**	LOW	**HIGH**	**HIGH**
Deactivate HOLD-function for Input [A] and [C]	LOW	LOW	LOW	LOW	**HIGH**	**HIGH**

8.7 Calibration mA-Output

This feature allows you to adjust the output current by a factor and an offset.
The mA-adjustment can be set separately for both mA-outputs.

The settings for the mA-adjustment is the same for both mA-outputs.

Table 12 Setting range mA-adjustment

Output 0-100%	Offset	Resolution	Slope	Resolution
4 – 20 mA	+3,0 to + 5,0 mA	0,06 mA	14,4 to + 17,6 mA	0,06 mA

The following settings are possible using the R-Switch (7):

Table 13 Calibration mA-outputs

DIP- 1	DIP- 2	DIP- 3	DIP- 4	Adjustment with Digital-Potentiometer (6)	DIP- 5	DIP- 6
ON	OFF	OFF	OFF	Offset for Output mA-1	**ON**	OFF
OFF	**ON**	OFF	OFF	Slope for Output mA-1	**ON**	OFF
OFF	OFF	**ON**	OFF	Offset for Output mA-2	**ON**	OFF
OFF	OFF	OFF	**ON**	Slope for Output mA-2	**ON**	OFF

Note!
Only currents greater than zero are shown.
If the mA-output at low measuring values shows correct current values and at high measuring values low current values, the connected load is probably greater than 600 Ohm.

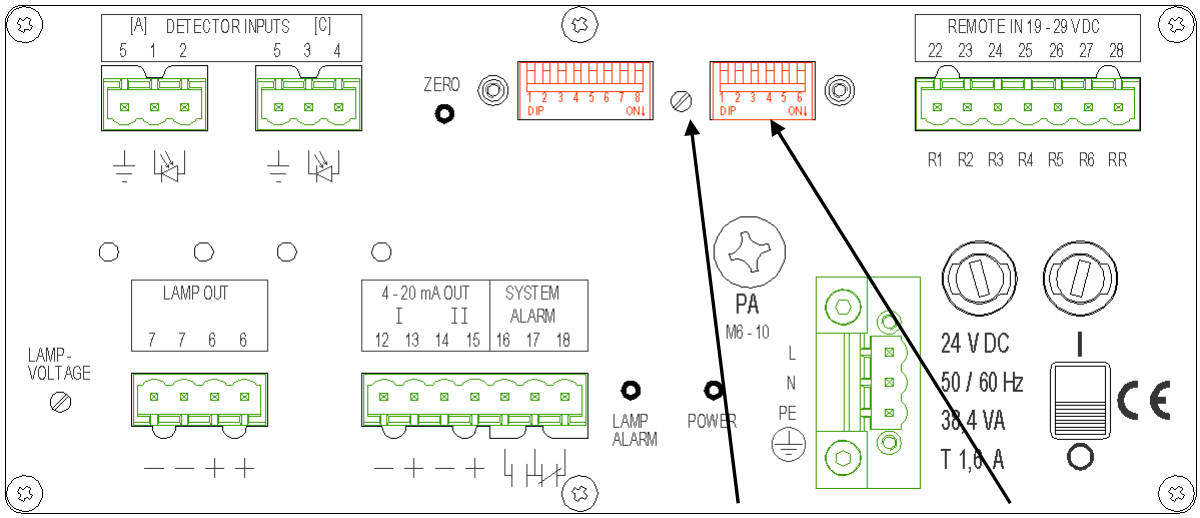


Fig. 21 Calibration mA-outputs **D**igital-**P**otentiometer (6) Switch R(7)

Follow the steps in the order listed below:

Connect Multimeter to Output mA-1 (Clamp 12-, Clamp 13+).

1. Check, if the current measuring value at mA-output mA-1 is correct.
2. Turn **DIP-1 to DIP-6 to OFF**.
3. Turn **DIP-5 to ON** to activate mA-adjustment.
4. Turn **DIP-1 to ON** to adjust offset of output mA-1
   (The output goes to 0% according to set value 4.00 mA)
5. Use the Digital-Potentiometer to adjust reading to desired value for output mA-1.
6. Turn **DIP-1 to OFF.**
   The offset is temporary saved in the C2000.
7. Turn **DIP-2 to ON** to adjust slope of output mA-1.
   (The output goes to 80% according to set value 16,80 mA)
8. Use the Digital-Potentiometer to adjust reading to desired value for output mA-1.
9. Turn **DIP-2 to OFF.**
   The slope is temporary saved in the C2000.

Connect Multimeter to Output mA-2 (Clamp 14-, Clamp 15+).

10. Turn **DIP-3 to ON** to adjust offset of output mA-2.
    (The output goes to 0% according to set value 4.00 mA)
11. Use the Digital-Potentiometer to adjust reading to desired value for output mA-2.
12. Turn **DIP-3 to OFF.**
    The offset is temporary saved in the C2000.
13. Turn **DIP-4 to ON** to adjust slope of output mA-2,
    (The output goes to 80% according to set value 16,80 mA)
14. Use the Digital-Potentiometer to adjust reading to desired value for output mA-2.
15. Turn **DIP-4 to OFF.**
    The slope is temporary saved in the C2000.
16. Turn **DIP-5 to OFF.**
    The settings for offset and slope are saved permanent in the C2000.

Note!
Adjust Offset first, than slope.

8.8 Sensor Adaptation and Zero Point Offset

This feature allows you to adjust the measuring value by a factor and a zero point offset. The sensor adaptation take effect always for the current measuring range used measuring function. If for the measuring ranges of both mA-outputs the same measuring function is used, then both measuring values will be calculated with the same sensor adaptation.

Measuring result without sensor adaptation:

mA-output = measuring value x 1 + 0

Measuring result with sensor adaptation:

mA-output = measuring value x factor + zero point offset

Note!
After zeroing the zero point offset remain as offset.
The adjustment of the zero point offset depends on the measuring function.
Zero point for measuring function TRANS is 100%T.
The adjustment of the factor is independent of the measuring function.
The adjustment occurs always for the measuring function of the selected measuring range.

The following settings are possible using the R-Switch (7):

Table 14 Sensor Adaptation and Zero Point Offset

DIP- 1	DIP- 2	DIP- 3	DIP- 4	Adjustment with Digital-Potentiometer (6)	DIP- 5	DIP- 6
ON	OFF	OFF	OFF	Zero Point Offset for measuring function of output mA-1	OFF	**ON**
OFF	**ON**	OFF	OFF	Factor for measuring function of output mA-1	OFF	**ON**
OFF	OFF	**ON**	OFF	Zero Point Offset for measuring function of output mA-2	OFF	**ON**
OFF	OFF	OFF	**ON**	Factor for measuring function of output mA-2	OFF	**ON**

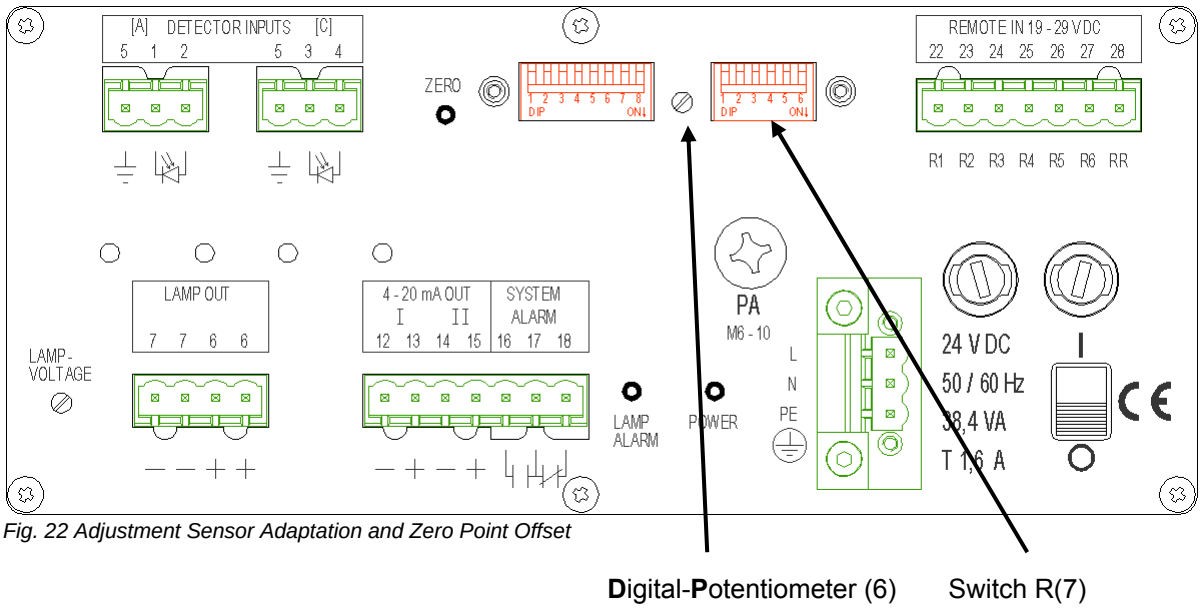


Fig. 22 Adjustment Sensor Adaptation and Zero Point Offset

Follow the steps in the order listed below:

Output mA-1:

1. Set the desired measuring range for output mA-1.
2. Check, if the current measuring value at mA-output mA-1 is correct.
3. Turn **DIP-1 to DIP-6 to OFF**.
4. Turn **DIP-6 to ON** to activate sensor adaptation
5. Turn **DIP-1 to ON** to adjust the zero point offset.
   (The current measuring value will be used for following setting when switching DIP-1)
6. Use the Digital-Potentiometer (6) to adjust the desired measuring value for output mA-1.
7. Turn **DIP-1 to OFF.**
   (The zero point offset is temporary saved in the C2000.)
8. Turn **DIP-6 to OFF**, the setting for zero point offset is saved permanent in the C2000.
9. Turn **DIP-6 to ON** to activate sensor adaptation.
10. Turn **DIP-2 to ON** to adjust the factor.
11. Use the Digital-Potentiometer (6) to adjust the desired measuring value for output mA-1.
12. Turn **DIP-2 to OFF.**
    (The factor is temporary saved in the C2000.)
13. Turn **DIP-6 to OFF**, the setting for factor is saved permanent in the C2000.

Output mA-2:

1. Set the desired measuring range for output mA-2.
2. Check, if the current measuring value at mA-output mA-2 is correct.
3. Turn **DIP-1 to DIP-6 to OFF**.
4. Turn **DIP-6 to ON** to activate sensor adaptation
5. Turn **DIP-1 to ON** to adjust the zero point offset.
   (The current measuring value will be used for following setting when switching DIP-1)
6. Use the Digital-Potentiometer (6) to adjust the desired measuring value for output mA-2.
7. Turn **DIP-1 to OFF.**
   (The zero point offset is temporary saved in the C2000.)
8. Turn **DIP-6 to OFF**, the setting for zero point offset is saved permanent in the C2000.
9. Turn **DIP-6 to ON** to activate sensor adaptation.
10. Turn **DIP-2 to ON** to adjust the factor.
11. Use the Digital-Potentiometer (6) to adjust the desired measuring value for output mA-2.
12. Turn **DIP-2 to OFF.**
    (The factor is temporary saved in the C2000.)
13. Turn **DIP-6 to OFF**, the setting for factor is saved permanent in the C2000.

Check the result of your settings by (de)activating of the sensor adaptation in the system adjustment. (see chapter 4.2, page 7).

Note!
Zero point offset or factor can be adjusted separately.
Adjust zero point offset first, than factor.

9 Faults

Try to clear the fault using the following table. Should you have any difficulty clearing the fault, feel free to contact our customer service.

Table 15 Possible faults and remedies

Possible fault	Possible remarks	Cause	Remedy
Failure of lamp module	- LED LAMP ALARM of converter flashes	Lamp cable between sensor and converter defective	- Continuity test of lamp cable - Exchange lamp module
		Lamp module defective	Exchange lamp module.
Detector failure	-	- Detector cable between sensor and converter defective - Detector defective	- Continuity test of detector cable - Exchange detector cable for new one. - Exchange detector
Condensate formation	Unrealistic, random measuring results	Humidity gets into optical housing and forms condensation deposits on windows.	Use air purge.
		O-Ring missing or defective	Disassemble sensor assemblies and check O-Rings, exchange if necessary.
Wrong results	Results are fluctuating. Zero point is drifting.	- Armature windows are dirty. -Armature windows are corroded. - Lamp modul near failure, Lamp module near the end of its operating life	- Clean armature window - Exchange armature window for sapphire window. - Exchange lamp module.
Connection error	- No function	Detector cable between sensor and converter defective	-Continuity test of detector cable - Exchange detector cable for new one.
		Sensor cable incorrectly connected to converter	Check and revise connections..
mA-signal (output)	mA-output delivers correct current results if measuring results are low and too low current results if measuring results are high.	Connected load > 600 ohms	- Check resistance of wiring. - Use appropriate mA-input
	Small deviations given in %	Poor calibration of the receiving mA-input.	Compensation by adjusting calibration of the sending mA-output.
Converter defect	None of the above mentioned errors can be detected.	-	Send system (converter and sensor) to optek for checking purposes. If necessary, the sensor body can remain in the pipeline so that only the optical arms and the converter have to be sent.

10 Appendix

10.1 Measuring range selection of Parameter sets (PS)

Note!

Voltages of 19 - 29 VDC are detected as HIGH and voltages of 0 VDC as LOW. For all following parameter sets signal loss will trigger system alarm and the failsafe level is set on 110 % with the exception of parameter set 16.

10.1.1 PS10 for 1-Channel sensors: AF16, AS16, AF56, AS56

Table 16 Measuring range PS 10

mA Output I (12, 13)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A)	M01: 0 - 6.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 5.0	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 4.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 2.0	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 1.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 0.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07: 0 - 0.2	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
	M08: 0 - 0.1	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.2 PS11 for 2-Channel sensors: AF45, AF26

Table 17 Measuring range PS 11

mA Output I (12, 13), II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A-C)	M01: 0 - 3.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 2.5	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 2.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 1.0	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 0.5	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 0.2	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07 0 - 0.1	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
% Transmission (A/C)	M08: 0 - 100.0	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.3 PS21 for 2-Channel sensors: AF45, AF26

Table 18 Measuring range PS 21

mA Output I (12, 13), II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A-C)	M01: 0 - 2.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 1.5	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 1.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 0.5	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
ABS-CU (C)	M05: 0 - 2.5	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 1.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
ABS-CU (A)	M07: 0 - 2.5	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
	M08: 0 - 1.5	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.4 PS22 for 2-Channel sensors: AF45, AF26

Table 19 Measuring range PS 22

mA Output I (12, 13)		Remote Inputs			
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)
ABS-CU (A-C)	M01: 0 - 3.0	LOW	LOW	LOW	HIGH
	M02: 0 - 2.5	LOW	LOW	HIGH	HIGH
	M03: 0 - 2.0	LOW	HIGH	LOW	HIGH
	M04: 0 - 1.0	LOW	HIGH	HIGH	HIGH
	M05: 0 - 0.5	HIGH	LOW	LOW	HIGH
	M06: 0 - 0.2	HIGH	LOW	HIGH	HIGH
	M07: 0 - 0.1	HIGH	HIGH	LOW	HIGH
% Transmission (A/C)	M08: 0 - 100	HIGH	HIGH	HIGH	HIGH

mA Output II (14, 15)	
Measuring function	Measuring range
ABS-CU (A-C)	M01: 0 - 3.0
	M02: 0 - 2.5
	M03: 0 - 2.0
	M04: 0 - 1.0
	M05: 0 - 0.5
	M06: 0 - 0.2
	M07: 0 - 0.1
% Transmission (A/C)	M08: 0 - 100

Manual: L-DIP switch			
L-1	L-2	L-3	L-4
OFF	OFF	OFF	ON
OFF	OFF	ON	ON
OFF	ON	OFF	ON
OFF	ON	ON	ON
ON	OFF	OFF	ON
ON	OFF	ON	ON
ON	ON	OFF	ON
ON	ON	ON	ON

Note!
Changes to the measuring ranges on mA-output I can only be done by Remote.
Changes to the measuring ranges on mA-output II can only be done manually.

10.1.5 PS23 for 2-Channel sensors: AF45, AF26

Table 20 Measuring range PS 23

mA Output I (12, 13)		mA Output II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A-C)	M01: 0 - 3.0	ABS-CU (C)	M01: 0 - 3.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 2.5		M02: 0 - 2.5	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 2.0		M03: 0 - 2.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 1.5		M04: 0 - 1.5	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 1.0		M05: 0 - 1.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 0.5		M06: 0 - 0.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07: 0 - 0.2		M07: 0 - 0.2	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
% Transmission (A/C)	M08: 0 - 100	% Transmission (A/C)	M08: 0 - 100	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.6 PS24 for 2-Channel sensors: AF45, AF26

Table 21 Measuring range PS 24

mA Output I (12, 13)		mA Output II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A)	M01: 0 - 3.0	ABS-CU (C)	M01: 0 - 3.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 2.5		M02: 0 - 2.5	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 2.0		M03: 0 - 2.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 1.5		M04: 0 - 1.5	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05 0 - 1.0		M05: 0 - 1.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 0.5		M06: 0 - 0.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07: 0 - 0.2		M07: 0 - 0.2	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
% Transmission (A/C)	M08: 0 - 100	% Transmission (A/C)	M08: 0 - 100	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.7 PS25 for 2-Channel sensors: AF45, AF26

Table 22 Measuring range PS 25

mA Output I (12, 13)		mA Output II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A-C)	M01: 0 - 3.0	ABS-CU (C)	M01: 0 - 3.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
ABS-CU (A)	M02: 0 - 3.0	ABS-CU (C)	M02: 0 - 3.0	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
ABS-CU (A-C)	M03: 0 - 2.0	ABS-CU (C)	M03: 0 - 2.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
ABS-CU (A)	M04: 0 - 2.0	ABS-CU (C)	M04: 0 - 2.0	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
ABS-CU (A-C)	M05: 0 - 1.0	ABS-CU (C)	M05: 0 - 1.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
ABS-CU (A)	M06: 0 - 1.0	ABS-CU (C)	M06: 0 - 1.0	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
ABS-CU (A-C)	M07: 0 - 0.5	ABS-CU (C)	M07: 0 - 0.5	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
% Transmission (A/C)	M08: 0 - 100	% Transmission (A/C)	M08: 0 - 100	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.8 PS12 for 2-Channel turbidity sensors TF16

Table 23 Measuring range PS 12

mA Output I (12, 13)		mA Output II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
TURB-PPM (A/C)	M01: 0 - 500.0	ABS-CU (C)	M01: 0 -5.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 200.0		M02: 0 - 4.0	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 100.0		M03: 0 - 3.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 50.0		M04: 0 - 2.5	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 20.0		M05: 0 - 2.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 10.0		M06: 0 - 1.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07: 0 - 5.0		M07: 0 - 1.0	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
	M08: 0 - 2.0		M08: 0 - 0.5	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.9 PS13 for 2-Channel turbidity sensor TF16

Table 24 Measuring range PS 13

mA Output I (12, 13)		mA Output II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
TURB-FTU (A/C)	M01: 0 - 200.0	ABS-CU (C)	M01: 0 -5.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 100.0		M02: 0 - 4.0	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 50.0		M03: 0 - 3.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 30.0		M04: 0 - 2.5	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 20.0		M05: 0 - 2.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 10.0		M06: 0 - 1.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07: 0 - 5.0		M07: 0 - 1.0	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
	M08: 0 - 2.0		M08: 0 - 0.5	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.10 PS14 for 2-Channel turbidity sensor TF16

Table 25 Measuring range PS 14

mA Output I (12, 13)		mA Output II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
TURB-EBC (A/C)	M01: 0 - 50.0	ABS-CU (C)	M01: 0 -5.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 25.0		M02: 0 - 4.0	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 20.0		M03: 0 - 3.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 10.0		M04: 0 - 2.5	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 5.0		M05: 0 - 2.0	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 3.0		M06: 0 - 1.5	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07: 0 - 2.0		M07: 0 - 1.0	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
	M08: 0 - 1.0		M08: 0 - 0.5	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

10.1.11 PS15 for 2 x 1-Channel sensors: 2 x AS56

mA Output I (12, 13)		Remote Inputs					
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R4 (25)	R5 (26)	R6 (27)
ABS-CU (A)	M01: 0 - 6.0	LOW	LOW	LOW	LOW	LOW	HIGH
	M02: 0 - 5.0	LOW	LOW	HIGH	LOW	LOW	HIGH
	M03: 0 - 4.0	LOW	HIGH	LOW	LOW	LOW	HIGH
	M04: 0 - 2.0	LOW	HIGH	HIGH	LOW	LOW	HIGH
	M05: 0 - 1.0	HIGH	LOW	LOW	LOW	LOW	HIGH
	M06: 0 - 0.5	HIGH	LOW	HIGH	LOW	LOW	HIGH
	M07: 0 - 0.2	HIGH	HIGH	LOW	LOW	LOW	HIGH
	M08: 0 - 0.1	HIGH	HIGH	HIGH	LOW	LOW	HIGH

mA Output II (14, 15)		Remote Inputs					
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R4 (25)	R5 (26)	R6 (27)
ABS-CU (C)	M01: 0 - 6.0	LOW	LOW	LOW	HIGH	HIGH	HIGH
	M02: 0 - 5.0	LOW	LOW	HIGH	HIGH	HIGH	HIGH
	M03: 0 - 4.0	LOW	HIGH	LOW	HIGH	HIGH	HIGH
	M04: 0 - 2.0	LOW	HIGH	HIGH	HIGH	HIGH	HIGH
	M05: 0 - 1.0	HIGH	LOW	LOW	HIGH	HIGH	HIGH
	M06: 0 - 0.5	HIGH	LOW	HIGH	HIGH	HIGH	HIGH
	M07: 0 - 0.2	HIGH	HIGH	LOW	HIGH	HIGH	HIGH
	M08: 0 - 0.1	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH

mA Output I (12, 13)		mA Output II (14, 15)		Manual: L-DIP switch			
Measuring function	Measuring range	Measuring function	Measuring range	L-1	L-2	L-3	L-4
ABS-CU (A)	M01: 0 - 6.0	ABS-CU (C)	M01: 0 - 6.0	OFF	OFF	OFF	ON
	M02: 0 - 5.0		M02: 0 - 5.0	OFF	OFF	ON	ON
	M03: 0 - 4.0		M03: 0 - 4.0	OFF	ON	OFF	ON
	M04: 0 - 2.0		M04: 0 - 2.0	OFF	ON	ON	ON
	M05: 0 - 1.0		M05: 0 - 1.0	ON	OFF	OFF	ON
	M06: 0 - 0.5		M06: 0 - 0.5	ON	OFF	ON	ON
	M07: 0 - 0.2		M07: 0 - 0.2	ON	ON	OFF	ON
	M08: 0 - 0.1		M08: 0 - 0.1	ON	ON	ON	ON

Note!
Changes to the measuring ranges on mA-output I and II separately can only be done by Remote!

10.1.12 PS16 for 2-Channel sensors: AF45, AF26

Table 26 Measuring range PS 16

mA Output I (12, 13), II (14, 15)		Remote Inputs				Manual: L-DIP switch			
Measuring function	Measuring range	R1 (22)	R2 (23)	R3 (24)	R6 (27)	L-1	L-2	L-3	L-4
ABS-CU (A-C)	M01: 0 - 3.0	LOW	LOW	LOW	HIGH	OFF	OFF	OFF	ON
	M02: 0 - 2.5	LOW	LOW	HIGH	HIGH	OFF	OFF	ON	ON
	M03: 0 - 2.0	LOW	HIGH	LOW	HIGH	OFF	ON	OFF	ON
	M04: 0 - 1.0	LOW	HIGH	HIGH	HIGH	OFF	ON	ON	ON
	M05: 0 - 0.5	HIGH	LOW	LOW	HIGH	ON	OFF	OFF	ON
	M06: 0 - 0.2	HIGH	LOW	HIGH	HIGH	ON	OFF	ON	ON
	M07 0 - 0.1	HIGH	HIGH	LOW	HIGH	ON	ON	OFF	ON
% Transmission (A/C)	M08: 0 - 100.0	HIGH	HIGH	HIGH	HIGH	ON	ON	ON	ON

Note!
Signal loss will not trigger system alarm!
Failsafe level is set on 103.1 %.

11 EU declaration of conformity

Herewith we

optek-Danulat GmbH, Emscherbruchallee 2, 45356 Essen, Germany,

declare under our sole responsibility, that the following measuring systems

each comprising of one converter

C2221 or C2121

and one sensor of the series

AF16, AF26, AF45, TF16, AS16, AS56, AF56

has been developed, constructed and manufactured in conformity with the requirements of the EU directives 2014/30/EU and 2014/35/EU published in L96 from 29.03.2014 and 2011/65/EU (published in L174 of 01.07.2011).

The assessment is based on the application of the standards:

EN 61326-1:2013
EN 61326-2-3:2013
EN 61010-1:2010
EN 50581:2012

Essen, 2017/07/22

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