

# Operating Manual



CULO-L

Ex ia  
Ex nR

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## ● 1 General

### 1.1 Information

Read this operating manual before mounting and start-up of the current loop display. Please keep this manual at a place accessible for all users and on-site. The following mounting and operating instructions have been compiled with great care, but it is not feasible to take all possible applications into consideration. If you have questions regarding a specific application, please contact the supplier of the device.

With special models please note special product information, e.g. in the delivery note.

If the serial number on the product label becomes illegible (e.g. through mechanical damage), traceability can not be ensured.

The current loop displays described in this operating manual, are carefully designed and manufactured using state-of-the-art technology. Every component undergoes strict quality inspection in all stages of manufacture.

### Intended Use

Use this current loop display as described in this operating manual and not any other way.

### Required Qualifications

For mounting and start-up of the display, qualified personnel has to be familiar with country-specific norms and regulations, including possessing required knowledge and qualifications. Qualified personnel must have required knowledge of measurement and control technology. As the display is an “electrical equipment” as per EN 50178, personnel also has to be familiar with electrical circuits. Depending on the operating conditions, other knowledge may also be required, e.g. of corrosive media.

### Overview

Important product and safety information is contained in the following chapters: *Signs, Abbreviations* (page 3), *Transport, Packaging, Storage* (page 3), *Safety Instructions* (pages 4-5), *Start-up and Operation* (page 6) and *Maintenance, Dismounting, Return, Cleaning, Disposal* (page 13). **Please comply with these instructions.**

### 1.2 Signs, Abbreviations



#### Warning!

Non-compliance can cause injuries to persons and/or the demolition of the device. There can be a danger to life.



#### Attention!

Noncompliance can cause faulty device operation or lead to property damage.



#### Information!

Non-compliance can influence device operation or cause unintentional device reactions.



#### Danger!

Danger to life by loss of explosion protection.

Non-compliance with these instructions can lead to a loss of explosion protection.

## ● 2 Transport, Packaging, Storage

### 2.1 Transport

Check the device for any damage that may have been caused during transportation. Report obvious damage at once.

### 2.2 Packaging

Do not remove packaging until just before mounting. Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, returns).

### 2.3 Storage

For long-term storage, please avoid the following influences:

- Direct sunlight or proximity to hot objects
- Mechanical vibration, mechanical shock (rough mounting)
- Soot, steam, dust and corrosive gases

If possible, store the device inside its original packaging or equivalent

### ● 3 Safety Instructions



- Select the appropriate current loop display with regard to version and application requirements before mounting or start-up.
- Comply with the relevant national regulations (e. g. standards) and comply with the applicable standards and directives for special applications (e. g. with dangerous media such as acetylene, flammable gases or liquids and toxic gases or liquids, or with refrigerating systems and compressors).

**Non-compliance with the relevant regulations can cause serious injuries and property damage!**

- **Never connect directly to a voltage supply (e.g. 24 V), or the display will be destroyed.**
- Please comply with the operating conditions outlined in chapter *Technical Data* (page 14).
- Ensure that the display is only operated as per its intended use i. e. as described in the following instructions.
- Do not carry out changes or procedures on the display that are not described in this operating manual.
- If the display becomes damaged or unsafe for operation, remove the device from service and mark it to prevent it from being used again on accident.
- Have repairs performed by the manufacturer only.

### ● 4 Ex ia Safety Instructions



#### **Gefahr!**

Danger to life by loss of explosion protection.  
Non-compliance with these instructions can lead to a loss of explosion protection.



#### **ATEX**

European explosion protection directive (Atmosphere=AT, Explosion=EX). The product complies with the requirements of the European directive 2014/34/EU (ATEX) for explosion protection.

#### 4.1 Notes on Use

- **Repairs are strictly forbidden.**
- Do not use displays with visible damage.
- Do not change or modify the display.
- Please comply with notes to mounting and operation, including the safety instructions for operation of devices in hazardous areas.
- **Mount the display in a casing of at least protection class IP20.**
- In addition to this operating manual, please comply with the EU type examination certificate included in the scope of delivery.
- Only use intrinsic safe equipment with the display complying with the following conditions:
  - The equipment must include a separate EU type examination certificate
  - The equipment does not exceed the valid electrical limit values when operated with the display

#### 4.2 Safety Parameters

Maximum terminal voltage:	$U_i = 30 \text{ VDC}$
Maximum current:	$I_i = 100 \text{ mA}$
Maximum power:	$P_i = 1 \text{ W}$
Approval:	II 2G Ex ia IIC T6
EU type examination certificate:	ZELM 05 ATEX 0252 X
Valid for types:	CL1..., CL6... / CM1...*

**\*Note:** For information about type CM1, see data sheet and manual CULO-M.

## ● 5 Ex nR Safety Instructions



### Danger!

Danger to life by loss of explosion protection.

Non-compliance with these instructions can lead to a loss of explosion protection.



### ATEX

European explosion protection directive (Atmosphere=AT, Explosion=EX). The product complies with the requirements of the European directive 2014/34/EU (ATEX) for explosion protection.

## 5.1 Notes on Use

### - Repairs are strictly forbidden.

- Do not use displays with visible damage.

- Do not change or modify the display.

- Please comply with notes to mounting and operation, including the safety instructions for operation of devices in hazardous areas.

### - Mount the display in a casing of at least protection class IP54.

- In addition to this operating manual, please comply with the EU type examination certificate included in the scope of delivery.

- Only use intrinsic safe equipment with the display complying with the following conditions:

- The equipment must include a separate EU type examination certificate

- The equipment does not exceed the valid electrical limit values when operated with the display

## 5.2 Safety Parameters

Maximum terminal voltage:

$U_i = 30 \text{ VDC}$

Maximum current:

$I_i = 100 \text{ mA}$

Maximum power:

$P_i = 1 \text{ W}$

Approval:

II 3 G Ex nR II T6

Declaration of conformity:

ZELM 05 ATEX 3275X

Valid for types:

CL2...



### Note:

Type CL2... is also available without a casing. A type CL2... without a casing will be delivered with a sealing ring.

Please mount a CL2... into a casing with at least protection class IP54, and seal it using the sealing ring. **An incorrectly sealed casing has no explosion protection!**

## ● 6 Start-Up, Operation

### 6.1 Function

The current loop display receives electrical signals, e.g. from a connected transmitter, and reproduces them on the display indicator.

### 6.2 Before Mounting



- Check if the CULO-L display was delivered in complete assembly.
- Inspect the display for possible damage during transportation. Should there be any obvious damage, inform the transport company and supplier immediately.
- Keep the packaging, as it offers optimal protection during transportation.
- Ensure the connecting contacts are protected from damage.

### 6.3 Mounting Process Connection

#### 6.3.1 Mounting / Operating Instructions Type CL1... / CL6...(Ex-ia Versions)



The current loop display is intended for mounting in suitable connecting heads or wall-mounted casings. When fully mounted, it can be used as an on-site display. The casings and the mounting of the display inside of them are not part of the EU type examination certificate. The casings shown and listed in chapter *Dimensions* (page 15) represent suggestions for possible applications.



The environmental temperature of the current loop display may change due to additional components. Additional components can cause temperature changes e.g. by heat emission inside the casing, especially due to transmitters mounted inside the same casing or when mounted inside a temperature sensor connecting head, due to heat radiated by the measured medium. In case of failure, the display operator has to ensure the maximum valid environmental temperature of 60 °C is not exceeded.

#### 6.3.2 Mounting / Operating Instructions Type CL2 (Ex-nR Version)



The current loop display is intended for mounting in suitable connecting heads or wall-mounted casings. When fully mounted, it can be used as an on-site display. The casings and the mounting of the display inside of them are not part of the EC declaration of conformity. The casings shown and listed in chapter *Dimensions* (page 15) represent suggestions for possible applications.



**Fitting the sealing ring wrong or mounting the display inside a casing with less than protection class IP54 causes loss of explosion protection.**

The environmental temperature of the current loop display may change due to additional components. Additional components can cause temperature changes e.g. by heat emission inside the casing, especially due to transmitters mounted inside the same casing or when mounted inside a temperature sensor connecting head, due to heat radiated by the measured medium. In case of failure, the display operator has to ensure the maximum valid environmental temperature of 60 °C is not exceeded.

#### 6.3.3 Mounting / Operating Instructions (All Versions)



**The programming set for programming the factory setting has no ATEX-approval. When using the programming set with a CULO-L Ex-version, the explosion protection is lost! Only the manufacturer is allowed to use the programming set.**

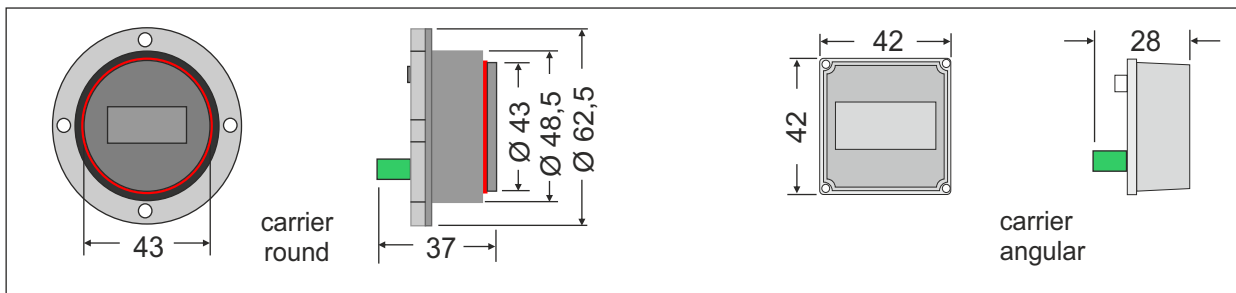


Display versions with explosion protection are only programmed via the three keys on the backside of the display!

## ● 6 Start-Up, Operation (Continued)

### 6.3 Mounting Process Connection (Continued)

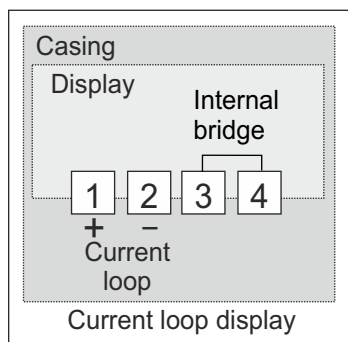
#### 6.3.4 Display Dimensions (Carrier)



### 6.4 Electrical Connection

#### 6.4.1 Electrical Connection General

##### Plug-In Terminal Strip Connection



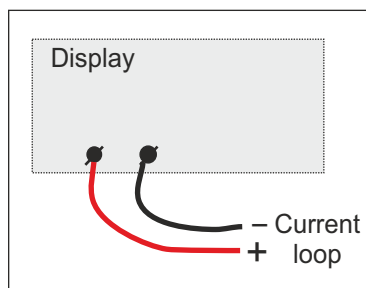
The 4-pole plug-in terminal strip for connecting the current loop display is located on the backside of the display and is only accessible after the casing is opened.

Wiring terminal 1: Positive pole of the current loop

Wiring terminal 2: Negative pole of the current loop

Wiring terminals 3 and 4 are bridged on the PCV and serve for the easy connection of a transmitter mounted inside the casing.

##### Open Strand Ends Connection



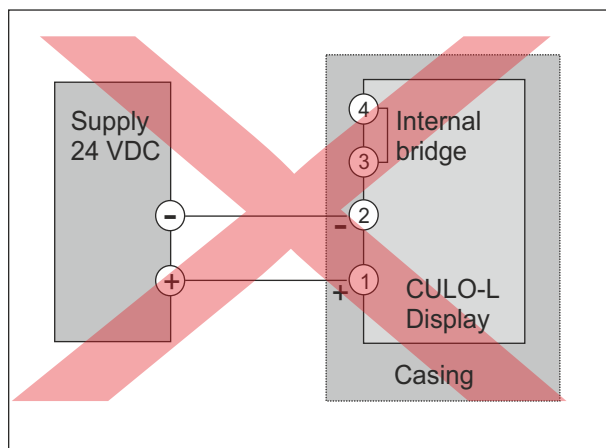
The open strand ends of the wire for connecting the current loop display are at the back of the display.

**Red wire:** Positive pole of the current loop

**Black wire:** Negative pole of the current loop

Shorten the open strand ends as needed and connect them properly (e.g. inside of the casing or inside an operator panel).

##### Notes to Current Loop Operation



The display can only operate in a current loop of 4...20 mA.

**A direct connection to a voltage supply (e.g. 24 VDC) will cause device destruction and loss of warranty.**

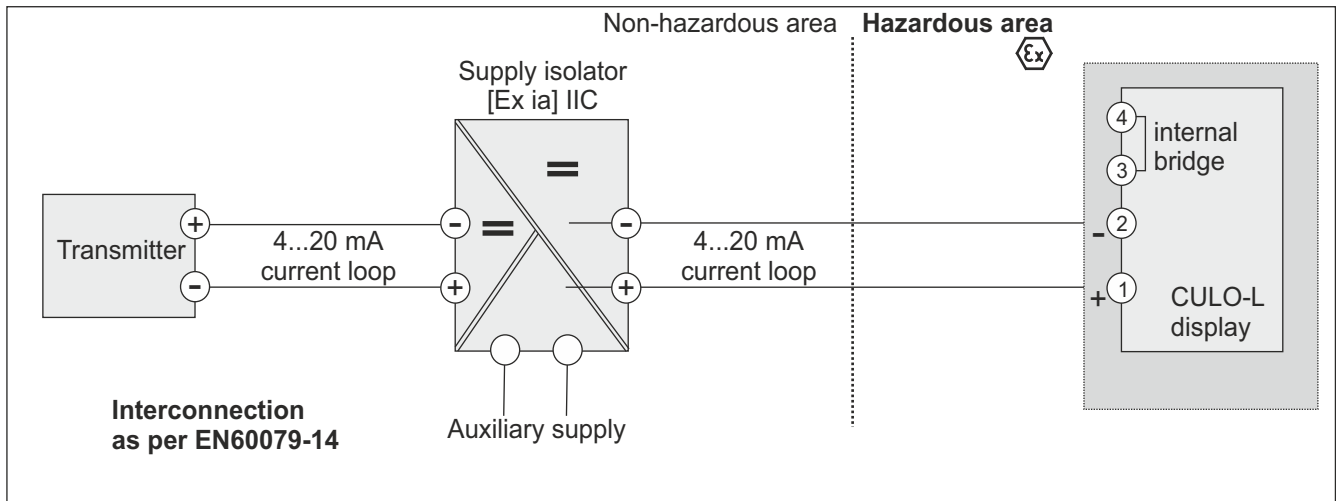
For an operational test the display has to be supplied from a current supply of 4...20 mA (e.g. mA source / calibration instrument).

In normal operation the display is connected in series with a transmitter (4...20 mA) or an 4...20 mA analog device output.

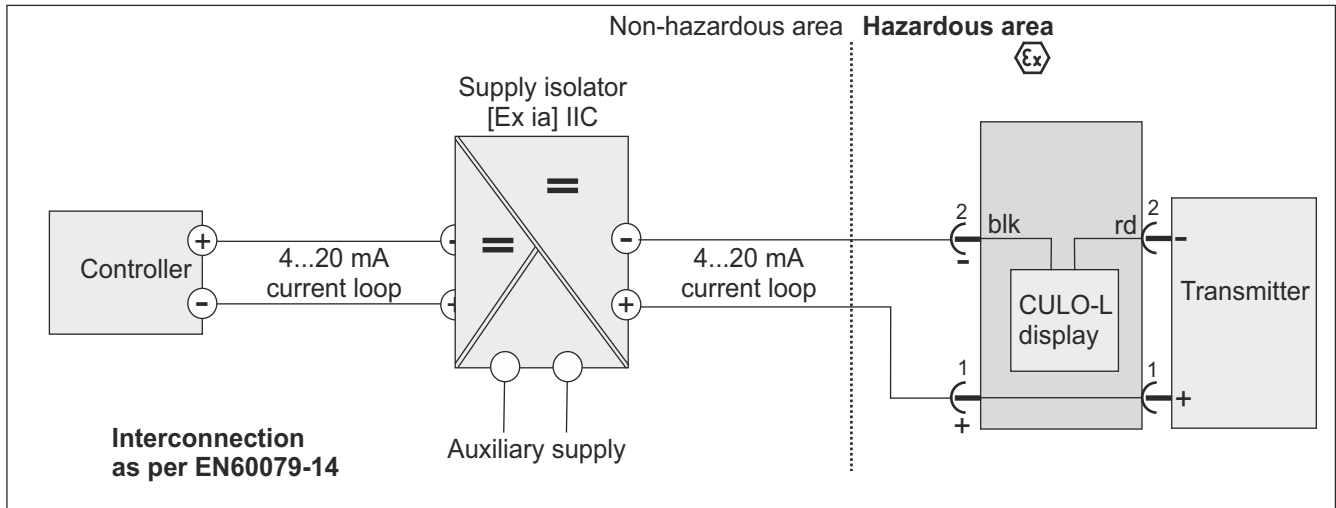
## 6.4 Electrical Connection (Continued)

### 6.4.2 Electrical Connection (Examples)

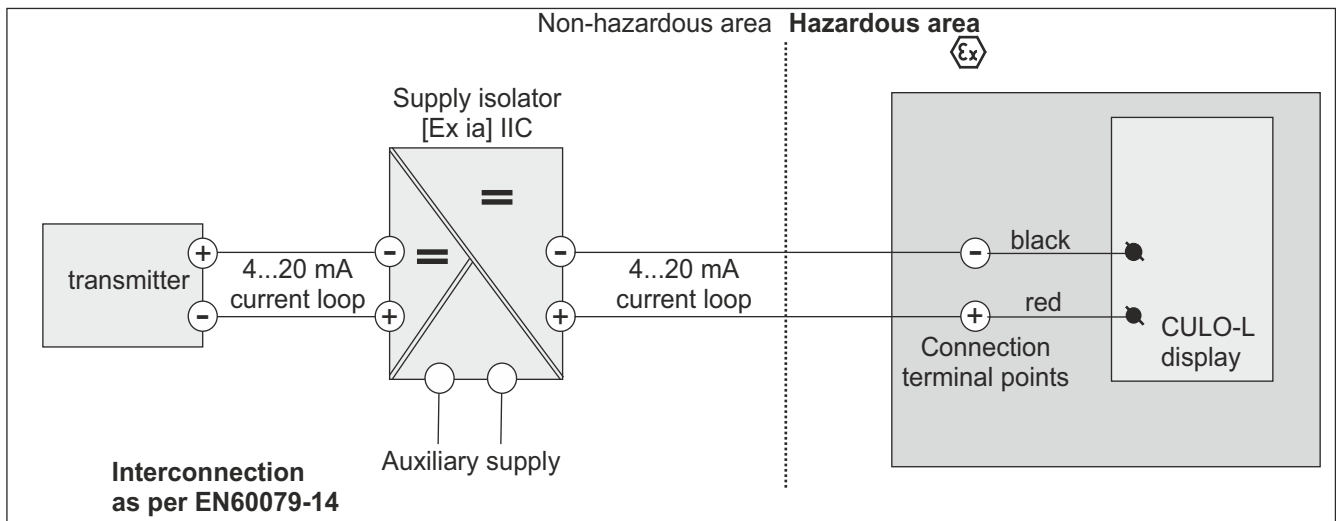
#### Connection Type CL1... (Ex-Version)



#### Connection Type CL6... in Plug-On Casing (Ex-Version)



#### Connection Type CL6... in Plug-On Casing (Ex-Version)





## ● 6 Start-Up, Operation (Continued)

### 6.4 Electrical Connection (Continued)

#### 6.4.3 Electrical Connection Special Version nR

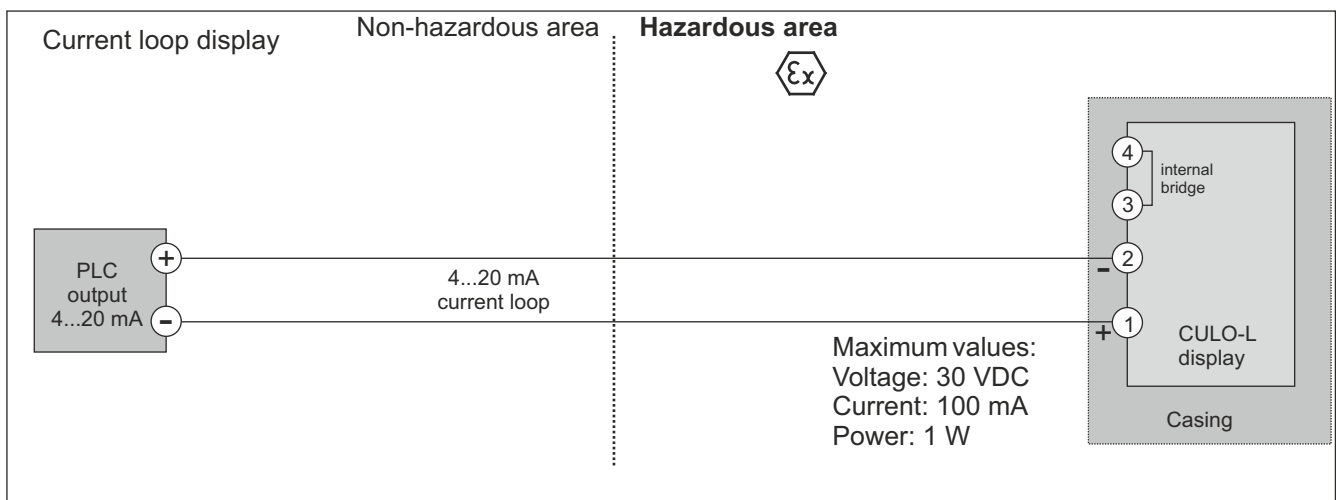
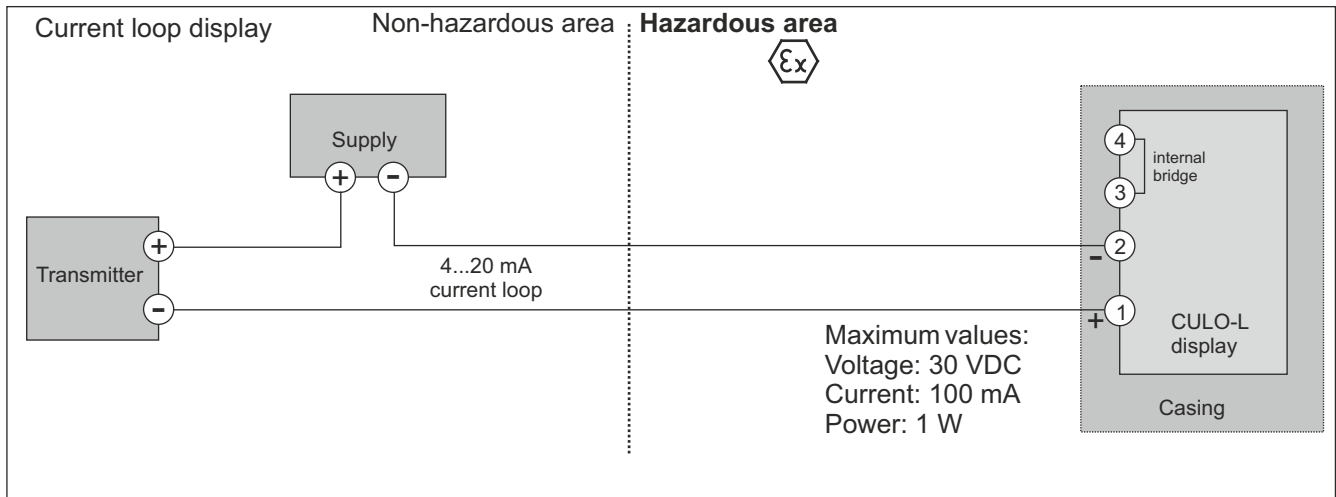


Please confirm that no foreign body (e.g. connection cable) is preventing the cover seal from working correctly when closing the casing. Only use connection cables approved for threaded connections. **Non-compliance will result in loss of explosion protection!**



Terminal area of the der separately approved threaded connections: M16x1,5: 3,5...6 mm.

#### Connection Type CL2... to Transmitter (Ex-Version)



## 7 Configuration



The programming set for programming the factory setting has no ATEX-approval. When using the programming set with a CULO-L Ex-version, the explosion protection is lost! Only the manufacturer is allowed to use the programming set.



Display versions with explosion protection are only programmed via the three keys on the backside of the display!

### 7.1 Display Overview



### 7.2 Display Underflow/Overflow

Range: 4,00...20 mA / displayed range: 3,90...20,10 mA / usable range: 3,60...21,50 mA  
warning underflow: 3,60...<3,9 mA / warning overflow: >20,10...21,50 mA  
display underflow: <3,60 mA / display overflow: >21,50 mA

Warning: Display flashes (normal display indication is changing with bars).

Values below 3,60 mA: a bar is changing with indication **undr**.

### 7.3 Display Programming

1. Connect the device as per wiring diagram
2. Switch the current loop supply on (current between 4...20 mA). This launches a start-up sequence and a segment test. Afterwards the display will show **CULO**, followed by the firmware version number (e.g. **F1.16**). Subsequently, the display will switch to operation mode.
3. Press key **P** to show the program number **P 0**.
4. Change the program number by pressing **P** and **▲** or **P** and **▼**.
5. Change to the stored value under the selected program number by pressing **P**.
6. Change the digit by short pressing the **P**-key. Change the value of the selected digit by pressing **▲** or **▼**.
7. Store the new settings by pressing **P** for at least 2 seconds. The new settings are saved when the display shows a horizontal bar.
8. After approx. 7 seconds without a key being pressed, the device will switch back to operation mode.

#### Additional functions for storage retrieval of min/max values during standard operation

The **▲**-key, when pressed, will show the value of the max-storage on display for a few seconds

The **▼**-key, when pressed, will show the value of the min-storage on display for a few seconds

Pressing both **▲** and **▼** at the same time will delete both min and max values

## 7 Configuration (Continued)



The programming set for programming the factory setting has no ATEX-approval. When using the programming set with a CULO-L Ex-version, the explosion protection is lost! Only the manufacturer is allowed to use the programming set.



Display versions with explosion protection are only programmed via the three keys on the backside of the display!

### 7.4 Programming Table for Display Programming

PN	Description	Range	Delivered state*
0	Calibration mode 0 = sensor calibration (with applied signal, for factory settings only) 1 = programming of indication (indicated value at 4/20 mA)	0/1	1
1	Final value (Programming the value at 20 mA, eg 600)	-999...9999	250
2	Initial value ( Programming the value at 4 mA, eg 100)	-999...9999	0
3	Selection of decimal point or unit (Programming a unit the indication shifts to the left)	0 / 0.0 / 0.00 0.000 / °F / °C	°C
4	Time of average / refresh of display (in 1/10 seconds)	5...100	10
5**	Stabilisation zero (the +/- range where 0000 is indicated)	0...100	2
50***	Definition PIN-code for program lock (value >0000)	0000...9999	0000
51***	Authentication with PIN-code (removal of program lock)	0000...9999	0000
100**	Number of calibration setpoints (calibration points for sensor calibration only, calibration points reduce the measuring rate)	0...30	0
101...130**	Calibration points (number according PN100)	-999...9999	0
200	TAG number	0000....9999	0

\*with factory configuration

\*\* when programming a value >1 a hysteresis of 0,1% is activated. This avoids a jumping indication.

\*\*\*optionally (if a PIN-code is not defined, PN50 and PN51 are hidden) The first time a PIN-code can be programmed only via interface during factory settings. If there is a PIN-code defined (indication of **Pin** during segment test), the programming interlock of PN51 has to be removed by inputting the defined PIN-code under PN50. Without removing the program lock, all changes under all other PN cannot be stored. To activate the PIN-code of PN50 again after programming, the programming mode has to be left by inputting 0000 under PN50, optionally, interrupt the current loop supply for a short time.

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## ● 8 Fault Recovery



### **Danger!** **Danger to life caused by explosion**

Working in flammable atmospheres can cause danger to life by explosion hazards.

- Only conduct fault repairs in non-flammable atmospheres!



### **Caution!** **Physical injuries, property- and environmental damage**

If faults can't be eliminated using the following actions, take the device out of operation immediately!

- Please make sure there is no more signal present and protect the device against accidental operation.
- Contact the manufacturer
- Only the manufacturer is allowed to conduct repairs!
- Please note the advice under chapter 9, page 13 and add a short error description to the current loop display.
- The error description should include details to environmental conditions, duration time of operation and error incidents.



- Do not use any pointed or hard objects for cleaning to prevent damage to the electrical contacts.
- Verify in advance if the right voltage supply and the right type of wiring has been chosen.
- For contact data, see cover/backside.

Note: In case of unjustified reclamation an additional charge is possible.

Make sure the unit is working properly after every setting change. In case the error persists, send the device in for repair (or replace the unit).

Returned goods: Clean dismounted devices. See also chapter 9 for more details.

## ● 9 Maintenance, Dismounting, Return, Cleaning, Disposal

### 9.1 Maintenance



- The CULO-L display are maintenance-free.
- Only the manufacturer is allowed to conduct repairs.
- The electronics are completely potted. They do not contain any repairable or replaceable parts.

### 9.2 Dismounting

Create dead voltage condition on device. Disconnect electrical connections. Please comply with operating notes in chapter 6.3.

### 9.3 Return



Warning

Before returning the device, follow the instructions in chapter 9.4.

To return a device, use the original packaging or something comparable.

To protect against damages, use anti-static foil, insulating material or identification as sensitive measurement equipment.

If possible, please add a bag with drying mass.

### 9.4 Cleaning

Clean the device regularly to keep it free of hazardous materials. Please keep the electrical contacts dry and clean!



Property damage!

Abrasive cleaners or corrosive solvents can damage the contacts.

- Power down and create dead voltage condition on the device before cleaning.
- Before returning the device needs to be free of hazardous materials like acids, brines, solvents, etc.!

### 9.5 Disposal



Dispose device components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the CULO-L current loop display is supplied.

Collect electrical and electronic parts separately. Separate metals and plastics. Dispose of printed circuit board assemblies professionally.

## ● 10 Technical Data

### Input

Current loop:	4...20 mA
Input resistance:	Ri <160 Ohm (U= <3,2 V)

### Accuracy

Resolution:	-999...9999 Digit
Error in measurement:	±0,2% of measurement range, ±1 digit
Temperature drift:	100 ppm/K

### Indication

Display:	7 segments, 8 mm, red, 4 digits
Overflow/Underflow:	as per HI / as per LO
Display time:	0,1 s - 1 s - 10 s (adjustable)

### Environmental Conditions

Operating temperature:	Standard:	0...+80°C / Ex-Type: 0...+60°C
Storage temperature:	-20...+80°C	

### Programmable Features

Indicating range / Display time / Decimal point / Unit (°C/°F) / Zero-point smoothing / Program lock / Anchor points / TAG-number

### Approval

EU type examination certificate:	ZELM 05 ATEX 0252 X
Declaration of conformity:	ZELM 05 ATEX 3175 X

### Mechanics

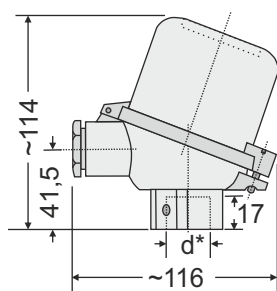
Casing material:	Macrolon	
Protection class:	Front: IP67	Connection: IP20
Connection:	Open cable ends	Plug-in terminal strip, up to 1,5 mm²
Carrier, round:	Dimensions:	Ø 43/48,5/62,5 mm x 37mm
	Mounting:	4 mounting holes for M4
	Weight:	approx. 55 g
Carrier, angular:	Dimensions:	42 x 42 x 28 mm
	Mounting:	4 mounting holes for 2 mm screws
	Weight:	approx. 45 g

### Accessories (Casing for display mounting)

Type variants:	Special casing for wall or pipe mounting (for more details, see chapter 11, <i>Dimensions</i> )
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## ● 11 Dimensions

### 11.1 Special Casing DIN BUZ-H

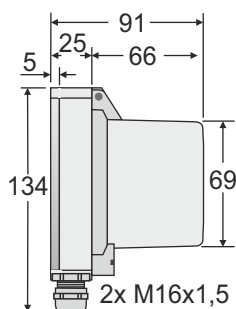
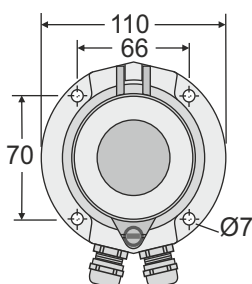


\*d: M24x1,5  
Ø15,3  
Ø22,5



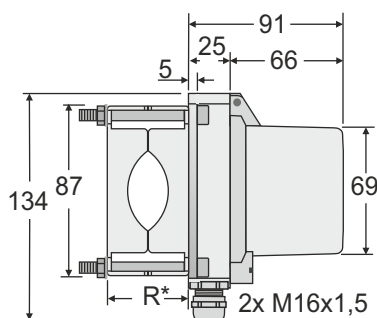
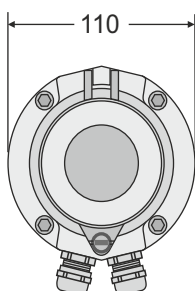
Special model  
Process connection: M24x1,5  
Ø15,3 mm  
Ø22,5 mm  
Material: Powder-coated  
diecast aluminum.  
Cable glands: 1x M20x1,5  
Protection class: IP67  
Weight: approx. 350 g  
Approvals: II 2G Ex ia IIC T6  
II 3G Ex nR T6

### 11.2 Wall-Mounted Casing, Surface-Mounted Casing with Magnetic Support



BUZ-H top special model  
Material: Powder-coated  
diecast aluminum  
Lower part: Powder-coated  
aluminum  
Magnetic support: embedded foil  
Cable gland: 2x M16x1,5  
Protection class: IP67  
Weight: approx. 500 g  
Approvals: II 2G Ex ia IIC T6  
II 3G Ex nR T6

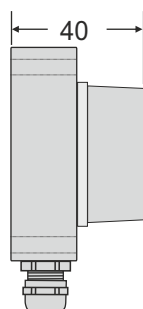
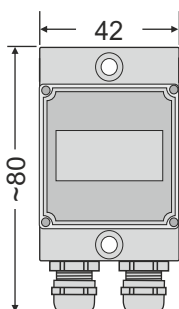
### 11.3 Pipe Support Casing



\*R = Pipe diameter outside = 42...60 mm

BUZ-H top special model  
Material: Powder-coated  
diecast aluminum  
Lower part: Powder-coated  
aluminum  
Pipe support: Tin-coated sheet  
steel mirror finished  
Pipe diameter: 42...60 mm  
Cable gland: 2x M16x1,5  
Protection class: IP67  
Weight: approx. 950 g  
Approvals: II 2G Ex ia IIC T6  
II 3G Ex nR T6

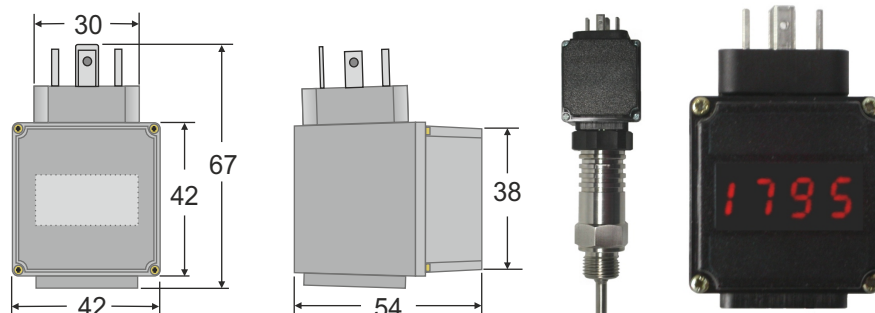
### 11.4 Surface-Mounted Casing



Dimensions: 80x42x40 mm  
Material: Anodized  
aluminum (natural)  
Mounting: 2 mounting holes for M4  
Cable gland: 2x M12x1,5  
Protection class: IP63  
Weight: approx. 120 g  
Approvals: II 2G Ex ia IIC T6

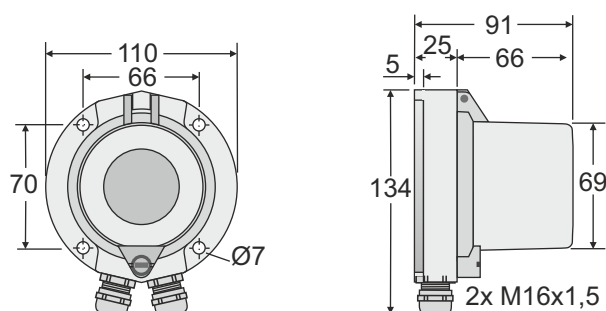
## ● 11 Dimensions (Continued)

### 11.5 Plug-On Casing



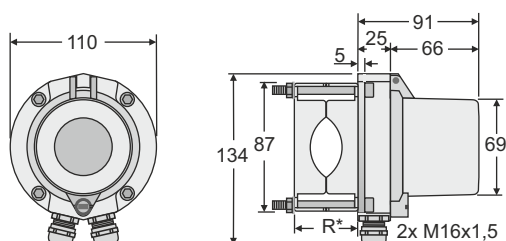
Dimensions: 43x46x54 mm (without plug-in components)  
 Casing pluggable with:  
 EN 175301-803 (Ventil)  
 M12x1  
 Material: Macrolon  
 Protection class: IP62  
 Weight: approx. 110 g  
 Approvals: II 2G Ex ia IIC T6

### 11.6 Ex-nR Wall-Mounted Casing



BUZ-H top special model  
 Material: Powder-coated diecast aluminum  
 Lower part: Powder-coated aluminum  
 Magnetic support: embedded foil  
 Cable gland: 2x M16x1,5  
 Protection class: IP67  
 Weight: approx. 500 g  
 Approvals: II 3G Ex nR T6

### 11.7 Ex-nR Casing with Pipe Support



BUZ-H top special model  
 Material: Powder-coated diecast aluminum  
 Lower part: Powder-coated aluminum  
 Pipe support: Tin-coated sheet steel mirror finished  
 Pipe diameter: 42...60 mm  
 Cable gland: 2x M16x1,5  
 Protection class: IP67  
 Weight: approx. 950 g  
 Approvals: II 3G Ex nR T6

\*R = Pipe diameter outside = 42...60 mm

### 11.8 nR without Casing



The current loop display is intended for mounting in suitable sealed connecting heads or wall-mounted casings. When fully mounted, it can be used as an on-site display. The casings and the mounting of the display inside of them are not part of the EG declaration of conformity. The casings shown and listed in chapter 11 *Dimensions* (pages 15-16) represent suggestions for possible applications. **Fitting the seal wrong or mounting the display inside a casing with less than protection class IP54 causes loss of explosion protection.**

**A sealing ring is part of the scope of delivery.**