D-mas Ex and non-Ex versions Operating Manual

English original

IMPORTANT
Read carefully prior to use.
Keep for future reference.

Version 5.20

1 Contents

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2 Notes on this document

2.1 Amendments

Rev.	Date	Amendment
1	03/2016	First release.
2	03/2016	Correction of a naming.
3	04/2016	Power cycle text add-on. Format optimizations.
4	05/2016	Polarity correction.
5	05/2016	Pinout correction.
6	05/2018	Information on non-Ex devices and process adaptation added. Warnings added.
7	05/2018	Optimized title page.

Tab. 1 Amendments

2.2 Validity

This document is valid for the following devices:

- Dmas_AF/❑/❑/❑/❑/❑/❑/❑/❑/Ex1-21
- Dmas_DF/❑/❑/❑/❑/❑/❑/❑/❑/Ex1-21
- Dmas_AF/❑/❑/❑/❑/❑/❑/❑/❑
- Dmas_DF/❑/❑/❑/❑/❑/❑/❑/❑

❑ is a placeholder for any characters.

In the following, these devices are also referred to as "sensors".

Devices with the suffix "Ex1-21" are intended for use in hazardous areas. All text parts are relevant when used in the potentially explosive area. Text parts marked with the Ex symbol (see section 2.3) must be strictly observed.

Device versions without the suffix "Ex1-21" must not be used in explosive areas. In this case, text parts that are marked with the explosive symbol (Ex) are irrelevant and can be ignored.

2.3 Representation

In our operating manuals, we use symbols that indicate special dangers and topics:

	General warning		High voltage warning
	Nuclear radiation warning		Hand injuries warning
	Reference to an explosion-relevant topic		Wear foot protection
	Instruction for optimum and safe functioning		Wear protective helmet

Tab. 2 Warning symbols overview

In our operating manuals, we use a multi-stage system for the warning symbols:

CAUTION
Hazard with a low level of risk which, if not avoided, may result in minor or moderate injury.

WARNING
Hazard with a medium level of risk which, if not avoided, may result in death or serious injury.

DANGER
Hazard with a high level of risk which, if not avoided, may result in death or serious injury.

2.4 Safety instructions

Read the operating manual carefully before starting any work!

- Devices may only be installed, connected, commissioned and serviced by qualified and authorised personnel in strict compliance with this operating manual, any relevant standards, legal requirements and certificates (depending on application). The operating manual assumes that you have the required training and skills for the necessary mechanical and electrical work. Otherwise, obtain support from trained personnel.
- Strictly follow the work instructions and proceed with care. Safety risks arise when departing from the manners of usage and work procedures presented in this manual. In certain cases, the approval, warranty and the manufacturer's responsibility will be invalidated.

- Only devices with Ex1-21 design (see nameplate) may be used in ATEX Zone 1 or 21.
- Alterations to the installation and/or parameter settings may only be made in accordance with this operating manual and with detailed knowledge of the behaviour of a connected controller and the possible influences on the operation processes to be controlled.

- Before opening the housing, make sure the device is dead/voltage-free in order to avoid contact with live parts and sparking.
- Electrostatic charges must be avoided. The device must be operated when electrostatically grounded.

3 Device description

3.1 Area of application

This device has been developed for mass flow measurement of solids transported in gas in pipes. The sensor pipe is inserted into the transport route. The evaluation electronics are located in the electronic unit outside the transport route.

This device is only intended for use in industrial environments.

The device is approved for use in explosive areas of Zones 1 or 21. Before use, you must check whether the detailed approval of the device (Ex marking on the nameplate) is correct for the planned area of application. For information on Ex marking see section 11.

During operation, the device must be closed and properly earthed (see section 6.1) and the flanges must be screwed to the pipeline with the specified torques.

The devices are intended for use in areas where no transients outside the EMC standards (see section 14) occur.

Dust deposits of more than 5 mm thickness on the outer housing are not permitted.

The device is certified as follows and may only be used in suitable environments:

ATEX	Gas	II 2G Ex d e IIC T4 Gb
	Particulate matter	II 2D Ex tb IIIC T130° Db IP68
IECEx	Gas	Ex d e IIC T4 Gb
	Particulate matter	Ex tb IIIC T130° Db IP68

Tab. 3 Certifications

No explosive hybrid mixtures may be fed inside the pipelines.

Any other use is prohibited. Any other use is prohibited. The use for liquids in particular is neither possible nor permitted.

3.2 Functionality

The device measures the average velocity and concentration of gas-bearing or falling solids without contact, integrally across the cross-section of the transport channel.

The measurement is capacitive.

For a reliable measurement, no electrically conductive layer must form on the inner wall, for example due to abrasion or moisture.

The sensor surface is arranged in the sensor mechanics outside an electrically insulating pipe (e.g. GRP).

A noise signal is generated due to statistical fluctuations in the particle flow. This signal appears in a similar form on two sensor surfaces with a time offset. This time offset depends linearly on the particle velocity.

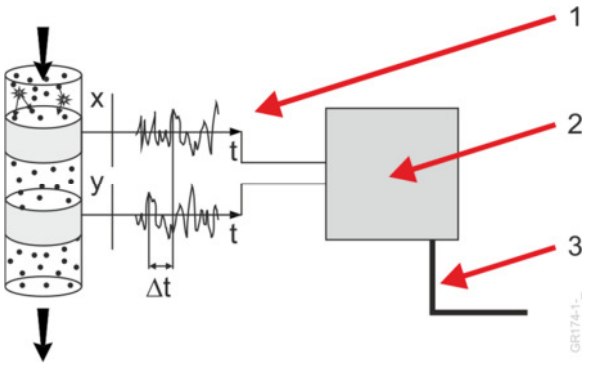


Fig. 1 Measuring principle

1 Incoming signals
2 Sensor
3 CAN bus

In the sensor mechanics, the two signals are recorded and transmitted to the sensor electronics. Together with the sensor distance, this results in the solid velocity. For the concentration measurement, the signals are added and evaluated by calibration.

The measured values, error messages or a stimulation signal are transferred to the CAN bus and are available to all connected components for further processing.

For velocity measurement, only moving particles contribute to signal generation. Solid deposits are not detected. In concentration measurement, however, deposits always lead to measurement errors (offset).

The level of the voltage signals from the sensor mechanics depends on the mass flow rate and the product properties. An automatic system monitors the height of these analogue signals and adjusts them via digitally adjustable amplifiers.

An analogue/digital converter feeds these signals to the correlation calculation in blocks of a certain length. The resulting correlation function is stored in an internal memory.

Due to the statistically fluctuating nature of the measurement signals, the calculated measured values are guided by software via an adjustable attenuation filter. This is designed in such a way that when a new measured velocity value is fed into an averaging memory, the oldest value is deleted (floating averaging). The damping behaviour is influenced by the "Damping Time" setting. A small value leads to a faster response but also to stronger fluctuating measured values. The velocity to be displayed is calculated from these measured values.

The resulting measurement results, error messages or a simulation signal are transmitted to the CAN bus via an optocoupler.

This information is available to all connected components for further processing and is displayed in the communication unit.

In the opposite direction, settings are transmitted via the CAN bus line which allow adjustment to the respective conveying process and the sensor mechanism used (e.g. distance of the sensor rings).

The microprocessor-based electronics equipment serves three main tasks:

- Processing of the signals coming from the sensors.
- Calculation of solid velocity and concentration.
- Digital output of measurements to the CAN bus and communication with other connected components

The measuring system consists of the following modular components, which communicate with each other via the CAN bus cable:

- Sensor:
  Measurement of solid velocity and solid concentration.
- DYNAcon communication unit:
  Configuration
  Calculation of the mass flow rate
  Measurement display
  Analogue value output (velocity, concentration or mass flow rate)
  Threshold monitoring with two relay outputs
  Alarm relay output

The CAN bus allows for the connection of a Dcon device and a sensor.

Dcon devices may only be installed outside the explosive area.

The exchange of messages between distributed I/O devices via the CAN bus not only ensures high data security, but also an easy exchange of individual components and a low-cost expansion of existing systems.

The installation requires:

- Single cable connection between the sensor and the communication unit
- Termination of the CAN bus (120 Ω) at both ends.

By its very nature, this bus system allows for the connection of two or more participants. Here, too, both bus ends must be terminated:

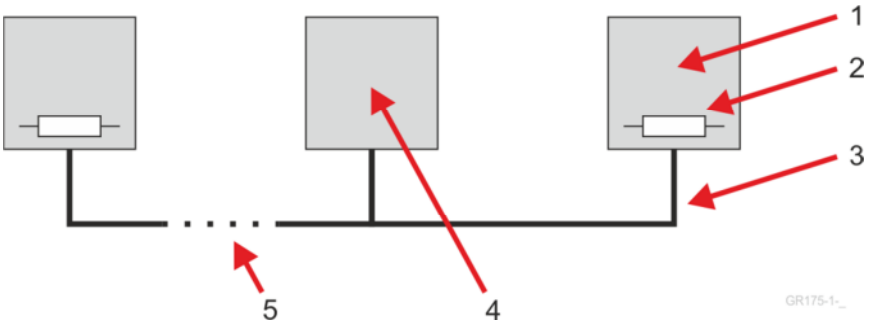


Fig. 2 CAN bus wiring principles

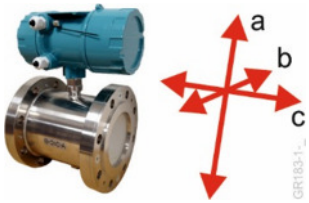
1 Participants with termination (end position)
2 Termination
3 CAN bus
4 Participants without termination
5 Possibly other participants

3.3 Technical data

Parameter	Value
Power supply	19 … 31 V_{DC}
Supply current	Max. 300 mA
Fuse	3.15 A slow-blow, cannot be replaced by the customer
Voltage on the 20 mA signal output	Max. 26 V_{DC}
Current on the 20 mA signal output	Max. 21 mA
Voltage on the CAN bus	Max. 5 V

Current on the CAN bus	Max. 100 mA
Permissible ambient temperature of the electronic unit during operation	-40 °C … +60 °C
Measurable transport velocity	0.2 … 100 m/s
Measurable product density	Dependent on material
Measurement accuracy	±1 %, depending on the uniformity of the product flow
Damping	1 to 30 s; quick changeover in the event of a sudden change in the mass flow
Permissible media in the sensor pipe	Gases and solids that do not have a corrosive or reactive effect on the inner pipe of the sensor.
Permissible process temperature	-40 °C … +130 °C
Permissible pressure in the sensor pipe	See device name (nameplate) and section 11 part C.
Material of sensor housing	See device name (nameplate) and section 11 part F.
Inner sensor pipe material	See device name (nameplate) and section 11 part G.
Seal material	See device name (nameplate) and section 11 part H.
Electronic unit housing material	Die-cast aluminium
Cables required for the cable glands	10 to 14 mm diameter
International Protection Rating	IP68 (Protection against water tested at 1 m depth, 24 h)
Weight	See Tab. 5.
Dimensions	See Tab. 5.

Tab. 4 Technical specifications (general)

Nominal diameter (see device name (nameplate) and section 11 part E)	Dimensions a x b x c 	Weight
AF DN2,5	350 x 190 x 270 mm	19 kg
DF DN25	300 x 170 x 270 mm	12.5 kg
DF DN50	350 x 190 x 270 mm	19 kg
DF DN100	360 x 220 x 270 mm	20 kg
DF DN125	420 x 250 x 270 mm	28 kg

Tab. 5 Technical data (dimensions and weight)

3.4 Mechanical design

The device consists of two main components, the sensor unit and the electronic unit:

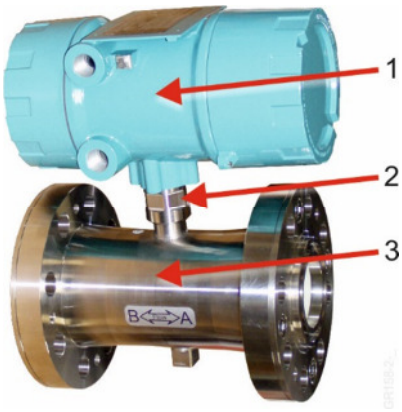


Fig. 3 Main components

1 Electronic unit
2 Connector with lock nut
3 Sensor unit

WARNING

Risk of explosion from loss of the explosion protection.

If the screw connection is loosened, ignition may occur that may lead to an explosion.

Never loosen the lock nut.

3.4.1 The sensor unit

The sensor surface for signal reception is located outside a pipe of electrically insulating material through which the product flows.

The sensor operates without contact, integrally across the pipe cross-section, without fittings in the conveyor section.

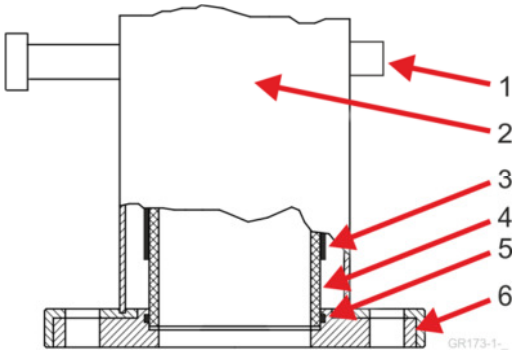


Fig. 4 Structure of the sensor unit

1 Connection for equipotential bonding
2 Housing
3 Sensitive surface
4 Sensor pipe
5 Gasket
6 Flange

Fig. 5 Connection for equipotential bonding on the sensor pipe

3.4.2 The electronic unit

All cables are routed to the middle section of the electronic unit:

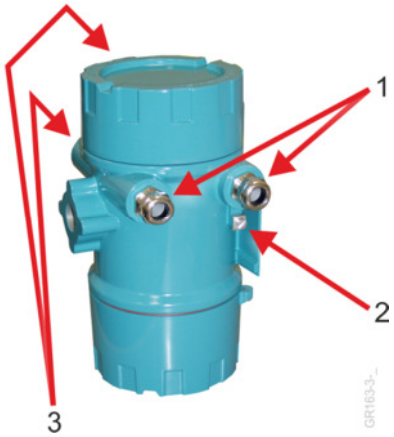


Fig. 6 Cable entries to the electronic unit

1 Cable glands
2 Equipotential bonding screw
3 Cable glands (opposite (1))

The electronic unit contains a terminal compartment and an electronics compartment:

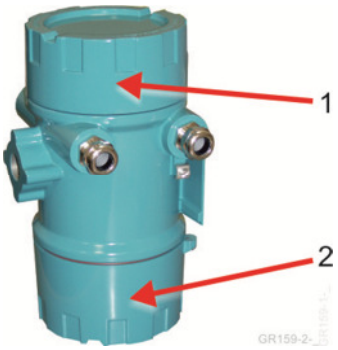


Fig. 7 Electronic unit compartments

1 Terminal compartment
2 Electronics compartment

Each compartment lies under a cover that is screwed to the middle section. There is a grub screw in the lids which prevents the lids from unintentionally loosening:

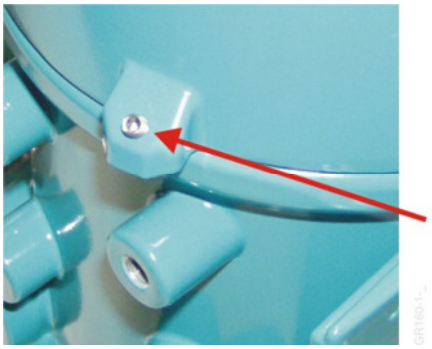


Fig. 8 Grub screw

3.4.2.1 The terminal compartment

The terminals for the electrical connections to external devices are located in the terminal compartment. The cables must be routed through the cable ducts in the middle section.

The connection board is accessible as soon as the cover has been removed:

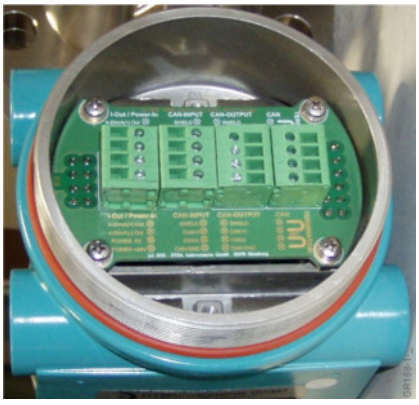


Fig. 9 Connection terminals in the terminal compartment

Observe the information on the connection board when installing the cabling:

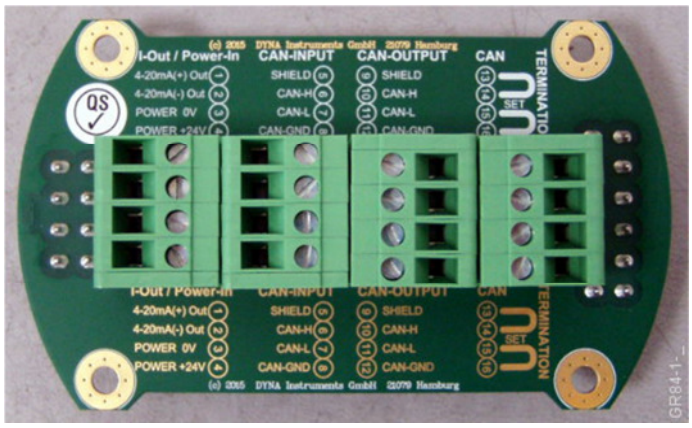


Fig. 10 Wiring information on the connection board:

The device is supplied with CAN bus termination. Termination is carried out via short-circuit jumpers in the corresponding terminals. Both jumpers must be fitted for termination.

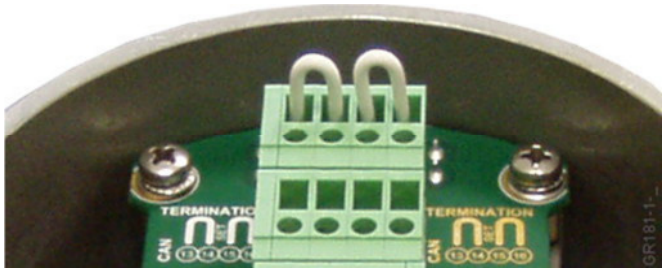


Fig. 11 Fitted CAN bus jumpers

The termination is controlled by a switch on the Dcon device. Please refer to the related operating manual.

3.4.2.2 The electronics compartment

The electronics compartment must remain closed except when servicing is required. There are five circuit boards in the electronics compartment. Three of these boards are accessible as soon as the cover is removed:

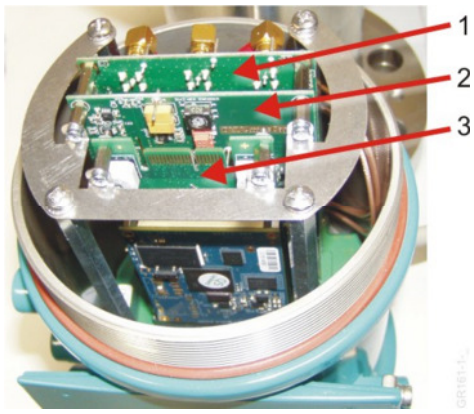


Fig. 12 Boards in the electronics compartment:

1 Analog board
2 Controller board
3 ECO carrier board with ECO module

3.4.2.3 The analog board

This board is responsible for amplifying the sensor signals.

The connection between the sensor surfaces and this board is made via coaxial cables with plug-in contacts.

3.4.2.4 The controller board

This board controls the functions of the analogue board.

3.4.2.5 The ECO carrier board with ECO module

This board controls the entire device and provides all communication channels with external devices. The following components of this board are accessible for service work.

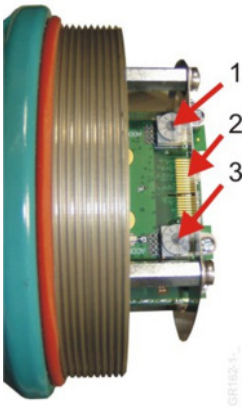


Fig. 13 Components of the ECO carrier board

1 ADDR2 rotary switch
2 Service connection
3 ADDR1 rotary switch

3.4.2.5.1 Working on the ECO carrier board

ADDR1 rotary switch

Reserved for future applications. Leave in factory setting. Set to 0 on delivery.

ADDR2 rotary switch

Set the CAN group with this rotary switch. The correct setting of the CAN group is necessary for communication with a DYNAcon device. CAN group is set to 0 on delivery.

Service connection

Service devices can be connected to the device via this connection. Do not connect anything to this terminal unless instructed to do so by an operating manual or service personnel.

4 System set-up

The measuring system comprises a sensor and a Dcon device:

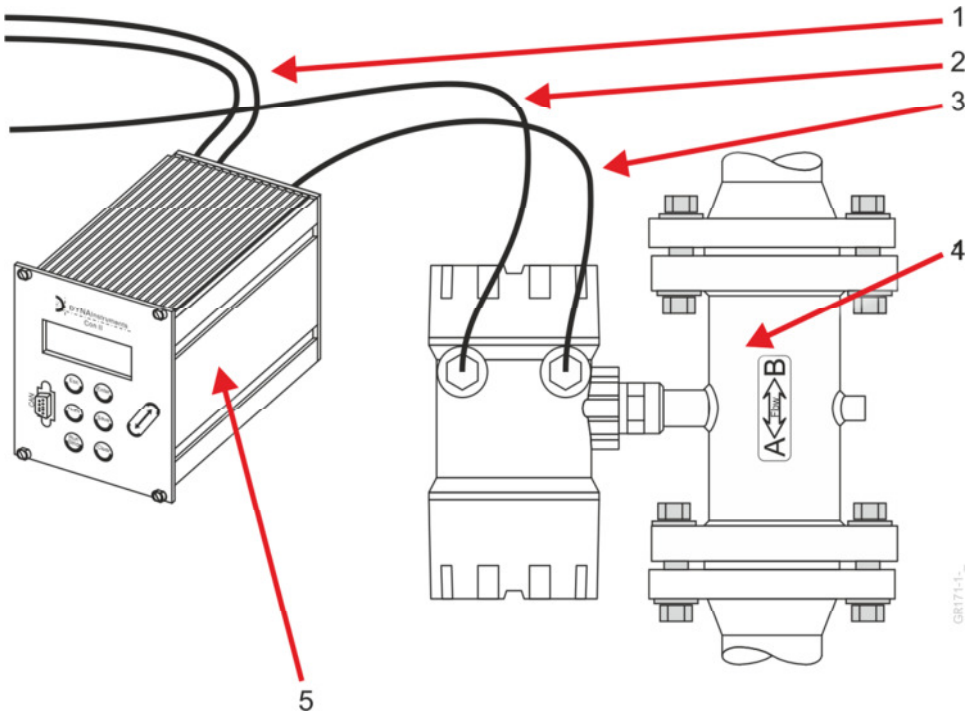


Fig. 14 Wiring principle of the measuring system

1 Two 20 mA outputs for velocity and concentration
2 Power supply cables 24V DC
3 CAN bus cable:
- to the sensor: configuration
- from the sensor: measurements, simulation values, error messages
4 Sensor
5 Dcon communication unit

5 Transport and storage

CAUTION

The device is very heavy.

If you lose control of the device while handling it, it can result in bruising and bone fractures.

Handle the device with care. Get help if you need to transport it. Wear safety shoes and a safety helmet. Use only tested means of transport with sufficient load capacity. Keep a safe distance. Never step under the suspended load.

All system components must be transported, stored, and operated in a non-corrosive environment.

Transport the product in its original packaging.

Protect the flanges during storage with the protective caps supplied.

6 Commissioning

6.1 Installation

WARNING

Danger of product leakage (or pressurisation).

Leaking product may result in injury to any unprotected body parts.

Depressurise the conveyor pipe before installation

WARNING

Risk of explosion due to chemical reaction.

A chemical reaction of the substances in the pipe with the material of the sensor pipe can cause an explosion that can injure you.

Make sure that the material of the sensor pipe (see section 11) is chemically suitable for the substances in the pipe.

WARNING

Risk of explosion due to chemical reaction.

A chemical reaction of the substances in the pipe with any lubricants used may cause an explosion that can injure you.

For lubricants in product contact, only use types that are chemically suitable for the substances in the pipe.

WARNING

Risk of explosion from loss of the explosion protection.

If a thread is damaged or if the housing has received a mechanical shock, an ignition may occur that may lead to an explosion. If damaged, use in the explosive area is no longer allowed and the device must be sent in for inspection.

Prevent damage to the thread of the housing cover and cable glands.

WARNING

Risk of explosion from loss of the explosion protection.

If the screw connection is loosened, ignition may occur that may lead to an explosion. Use in explosive areas is no longer permitted in the event of damage.

Never loosen the lock nut.

CAUTION

The pipe system can be under mechanical stress.

Pipe ends can move surprisingly. This can result in bruises and broken bones.

Wear a safety helmet. If possible, secure pipe ends against uncontrolled movements.

CAUTION

The device is very heavy.

If you lose control of the device while handling it, it can result in bruising and bone fractures.

Handle the device with care. Get help if you need to transport it. Wear safety shoes and a safety helmet. Use only tested means of transport with sufficient load capacity. Keep a safe distance. Never step under the suspended load.

The covers of the electronic unit are not secured. When loosening, make sure that they do not fall off.

Lightning strikes must not endanger either persons or equipment through flash voltages and compensating currents. Cabling between buildings must therefore be carried out with great care and in compliance with the installation regulations. Such cabling work must not be carried out during thunderstorms.

Only devices with the Ex1-21 design (see nameplate) may be installed within the explosive area in Zones 1 or 21, taking into account the installation regulations.

The type examination certificate and the special provisions contained therein must be observed. Devices may be used only as intended. The interconnection with external electrical equipment must be checked for compliance with the technical regulations.

The inner non-conductive surfaces of the sensor must be evaluated by the operator prior to installation in the Zone 1 according to the engineering rules for its application.

Protect the unit from excessive dust and water (e.g. for outdoor use).

Depending on the version, the device weighs several tens of kg. The load capacity of the pipeline into which the device is to be installed must be sufficient for installation. Otherwise, system parts may fall and cause serious and fatal injuries. Ensure that the mechanical stability of the fastening devices is sufficient for the weight of the device.

At process temperatures above 80°C, the sensor electronics must be thermally isolated from the process in such a way that the permissible ambient temperature (see section 3.3) is maintained. Thermal insulation may not enclose the electronics housing as this may lead to an overheating of the electronics and thus to malfunction or destruction of the electronics.

Vibrations of the conveyor pipe should be avoided at the site of installation.

In general, the measuring principle allows for installation in any position (horizontal, vertical, oblique). The measuring results show smaller fluctuations over time if the material flows through the sensor as uniformly as possible. The preferred installation (especially for highly concentrated flows with low transport velocities) is therefore one where the product flows vertically downward through the sensor. If possible, provide the following stabilising sections:

- Inlet section 20x inner diameter.
- Output section 10x inner diameter.

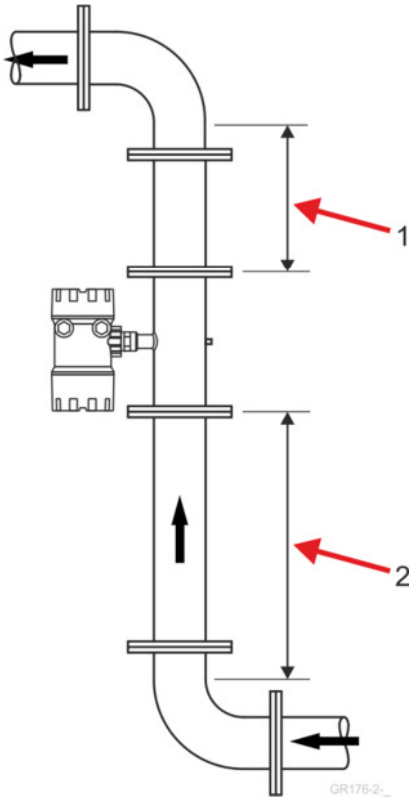


Fig. 15 Inlet and output sections

1 Output section
2 Inlet section

The device is supplied with flanges suitable for your system. The protective caps on the process connections protect the sealing surfaces. Do not remove these protective caps until just before installation.

Welded seams can cause turbulences that have a negative effect on the measured values. Therefore, after welding the weld neck flanges to the conveyor pipe, the internal weld seam should be ground flat if the flow tends to be turbulent.

The installation of the circuits must be carried out in accordance with the applicable installation regulations (verify the installer's expertise, protected installation, etc.).

The housing and connection may only be opened when it is in a voltage-free state. The PA connection must be attached in a low inductance fashion with the system PA according to local regulations. The connecting lines must be permanently installed outside of the operating equipment. All cable and wire entries must be closed according to the manufacturer's instructions.

If the outer diameter of the cable does not match the diameter range of the cable bushing (see section 3.2) or the wire cross-section is too large for the terminals, a terminal box is required (see section 6.2).

The special transmission technology of the CAN bus and the voltage input filter ensure interference suppression. Nevertheless, the cable must not be routed together with power lines. The CAN bus shield must not be grounded.

Prevent electrostatic charging. The appliance must be earthed.

Ensure proper installation to maintain the IP classification.

Use contact grease for a high longevity and good contact between the electrical connections.

During the installation, the regulations from the country of use as well as the standard EN 60079-14 are to be observed.

Procedure:

1. Check the flawless earthing of the pipeline and all relevant components.
2. Provide cable:
   - Power supply: 2-wire, outer diameter see section 3.3, conductor cross-section 1 mm² (up to 250 m), 2 mm² (up to 500 m), 4 mm² (up to 1000 m).
   - CAN bus: According to ISO 11898 2x2, twisted in pairs, outer diameter see section 3.2, minimum conductor cross-section 0.34 mm² required for 1000 m transmission distance.
   - Permitted diameters of the cables that are screwed into the terminals in the device (if a terminal box is used, this may differ from the above cables):
     wire 0.2 to 2.5 mm², stranded wire 0.2 to 2.5 mm², strand with ferrule without plastic collar 0.25 to 1.5 mm², strand with ferrule with plastic collar 0.25 to 1.0 mm²
   - Equipotential bonding: Conductor cross-section at least 6 mm².
3. Cut the pipeline and attach the flanges.
4. Fit flange seals.
   If flat seals are used, make sure that they do not protrude into the pipe cross-section.
   O-ring seals are required for devices with an O-ring groove in the sealing surface. The specifications can be found in the separate dimension sheets. Only use the O-rings specified here. Please contact DYNA Instruments if necessary.
5. Position the unit between the flanges and screw it together only slightly for the time being:

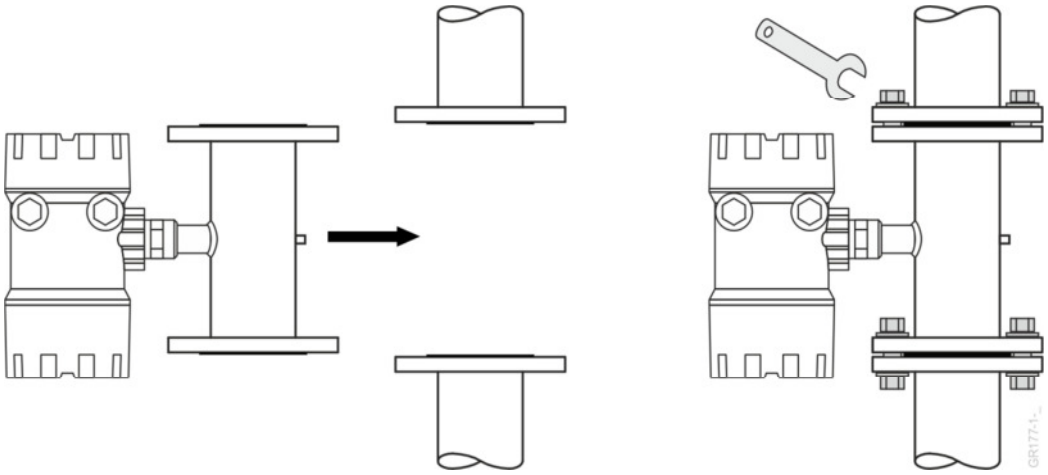


Fig. 16 Installation of the device in the pipe

6. Check that the pipe and device are not wedged and are not under mechanical stress. Ensure a centred installation as well as clean transitions between the process pipe flanges and the process connections of the device in order to avoid turbulence in the sensor range. This increases both the accuracy of measurements as well as the service life of the device.
7. Determine the torque for the flanges. The tightening torques listed below apply only to lubricated threads and to pipes that are free of tensile stresses:

DN	**PN16**	**PN25**	**PN40**	**PN64**
25	40 Nm	40 Nm	40 Nm	40 Nm
32	60 Nm	60 Nm	60 Nm	120 Nm
40	60 Nm	60 Nm	60 Nm	120 Nm
50	60 Nm	60 Nm	60 Nm	120 Nm
65	60 Nm	60 Nm	60 Nm	120 Nm
80	60 Nm	60 Nm	60 Nm	120 Nm
100	60 Nm	120 Nm	120 Nm	140 Nm
125	60 Nm	140 Nm	140 Nm	170 Nm

150	120 Nm	140 Nm	140 Nm	200 Nm
200	120 Nm	140 Nm	170 Nm	340 Nm

Tab. 6 Torques for DIN DF flanges

	150 lbs	**300 lbs**	**400 lbs**	**600 lbs**	**900 lbs**
1"	40 Nm	60 Nm	60 Nm	60 Nm	140 Nm
1 1/4"	40 Nm	60 Nm	60 Nm	60 Nm	140 Nm
1 1/2"	40 Nm	120 Nm	120 Nm	120 Nm	170 Nm
2"	60 Nm	60 Nm	60 Nm	60 Nm	140 Nm
2 1/2"	60 Nm	120 Nm	120 Nm	120 Nm	170 Nm
3"	60 Nm	120 Nm	120 Nm	120 Nm	140 Nm
3 1/2"	60 Nm	120 Nm	140 Nm	140 Nm	---
4"	60 Nm	120 Nm	140 Nm	140 Nm	200 Nm
5"	120 Nm	120 Nm	140 Nm	170 Nm	340 Nm
6"	120 Nm	120 Nm	140 Nm	170 Nm	200 Nm
8"	120 Nm	140 Nm	170 Nm	200 Nm	500 Nm

Tab. 7 Torques for ANSI AF flanges

8. Screw flanges together crosswise with the prescribed torque. Screws that are too tight will deform the sealing surface or damage the sensor housing.
9. Slightly loosen the grub screw of the connection chamber and unscrew the cover.
10. If the device is not at the end of the CAN bus, remove the jumpers from the terminals.
11. Loosen the cap nuts of the cable glands of the device.
    The cable glands are of type M20 x 1.5. When using other cable glands, it is essential to observe:
    - Matching thread.
    - For use in potentially explosive areas: Ex e or Ex d approval.
12. Pass a single cable with the correct diameter through the pre-assembled Ex-approved cable gland. Screw the cable into the terminals to 0.4 to 0.5 Nm according to the connection diagram (see section 13). Never connect more than one wire per terminal. Never replace the cable glands with non-Ex-approved types.

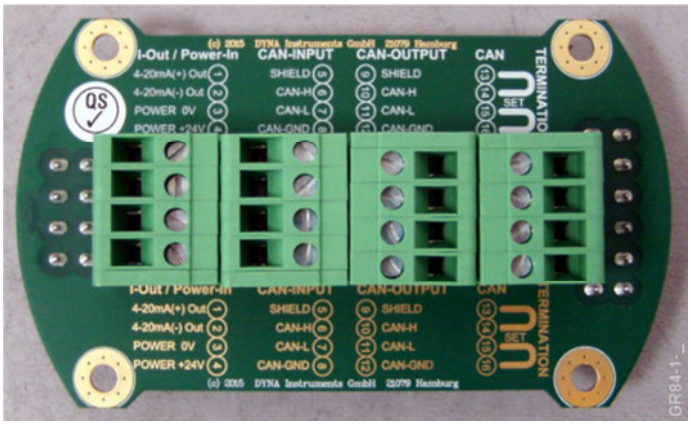


Fig. 17 Terminals.

13. Ensure that the shielding of the CAN bus is **not** grounded.
14. Check cable entry area for contamination, clean if necessary.

15. Tighten the cable glands again:
    - Tighten the bushing to 7 Nm (if loosened).
    - Tighten cap nut to 5 Nm.
    - Check tensile strength and tightness.
16. Unused cable bushings must be fitted with Ex e approved blanking plugs for the operating temperature range (included in delivery) and tightened to a torque of 5 Nm. Ensure that the cable diameter matches the cross-section of the cable glands (see section 9).
17. Screw the cover back on tightly to ensure IP protection and tighten the grub screw.
18. Connect the equipotential bonding screw of the device (see Fig. 4) to the equipotential bonding of the system using a cable at least 6 mm^2 thickness.
19. Measure the equipotential bonding:

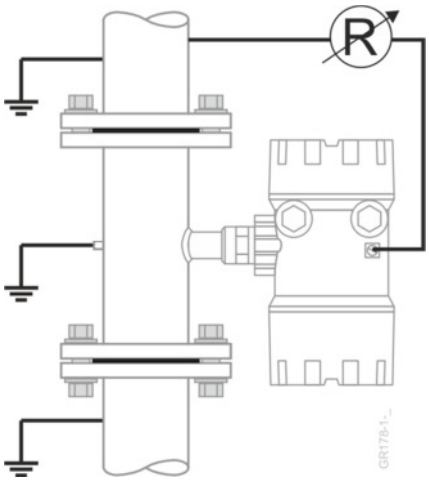


Fig. 18 Equipotential bonding test

20. Ensure that the resistance is less than 0.1 Ohm.

6.2 Connect via a terminal box

If a terminal box is required (see section 6.1), it must meet the following specifications:

- Shielding: Yes (terminal box must be made of metal).
- Potential equalisation: Yes, using a cable of at least 6 mm^2.
- Dimensions: Depending on cable dimensions and number of cables.
- Connection terminals: No ground contact.

6.3 Change CAN bus termination of the device

The device is supplied with a terminated CAN bus. Remove the CAN bus jumpers (see Fig. 11) if the device is not connected at the end of the bus.

6.4 Switching on the sensor for the first time

1. Ensure that all cable connections have been made correctly.
2. Check for correct operating voltage.
3. Apply the operating voltage.
4. Make sure that the display of the connected Dcon device no longer shows an address error after approx. 45 seconds.

6.5 Adapting to the process

A basic calibration has been carried out on all devices during production. During commissioning on site, the device must also be adapted to the process. This enables a correct conversion of the measured physical raw values to measured values for display or further processing.

The measurement system is adapted via the Dcon device. You will find relevant information in its operating instructions.

If you want to use the full pipe method shown there, it is necessary to fill the sensor completely with product in one work step:

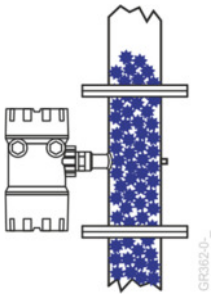


Fig. 19 Sensor completely filled with product

This can be done in the system or in a dismantled sensor. Choose a method that is easy to implement.

7 Operation

WARNING

Risk of explosion. The paint finish of the housing is not a protective insulation. Live cables may cause sparking on the housing.

In an explosive atmosphere, this may cause an explosion that could injure you.

Do not handle live cables in the vicinity of the device.

CAUTION

The housing of the device can be hot. This applies in particular if the processing temperatures are high.

This may result in burns.

Do not touch the device during operation unless strictly necessary. Check the temperature with a thermometer.

The device has no operating elements. It is operated exclusively via a Dcon device connected via the CAN bus. Please refer to the related operating manual.

The sensor can and should be used in continuous operation. If you disconnect the operating voltage, wait at least ten seconds before connecting it again. Otherwise, the built-in operating system assumes a brownout and starts an integrity check that can take a few minutes.

If you have changed parameters, wait 30 seconds for any intended switch-off of the sensor. Otherwise, the new setting may not be saved permanently.

8 Maintenance

WARNING

Risk of explosion from loss of the explosion protection.

Incorrectly performed maintenance work may lead to a condition that no longer ensures explosion protection.

Maintenance may only be carried out by qualified and authorised personnel.

Do not use cleaning agents that corrosively affect the material of the unit during cleaning. Refer to the data sheet of the cleaning agent and material of the device (see section 11).

The functionality of the device is stable over long periods and regular adjustments, etc. are thus not necessary. Therefore, the device is largely maintenance-free. However, the following activities should be performed:

Activity	**Frequency**
The inside of the sensor pipe is subject to wear. Therefore, this part must be checked regularly for damage and diameter. The inside diameter must not be more than 3 mm larger than the diameter on delivery (see nameplate). If this is exceeded, the part must be replaced. If not replaced, pressure safety is no longer guaranteed. In this case, explosion protection is also no longer guaranteed.	Annually; more frequently in the case of abrasive materials and/or high conveying velocities.
Remove dust from the outside of the electronic unit. Please see section 3.1.	Yearly; at shorter intervals if operating in very dusty environments.

Tab. 8 Maintenance work

9 Troubleshooting and repair

No modifications may be made to devices that are operated in potentially explosive areas. Repairs to the device may only be performed by specially trained and authorised personnel. Repairs that could impair the ignition protection type may only be carried out by DYNA Instruments.

Keep the electronics compartment locked. In particular, do not touch the components there. These are sensitive to static electricity and can be hot.

The covers of the electronic unit are not secured. When loosening, make sure that they do not fall off.

As soon as the device fault is reported, verify the following points:

- Has regular maintenance been performed?
- Is the installation perfect otherwise (fixed installation, correct and undamaged cabling)?
- Is the configuration unchanged?

If you have opened the device, for example to check the wiring, close it again as described in the installation instructions (see section 6.1).

Customers may not carry out maintenance work on internal parts. Repairs of such nature usually require a return of the device to the factory. Please contact DYNA Instruments for further details on the return procedure.

The sensor generates error messages in the display of the DYNAcon communication unit if required. Information on these error messages can be found in the section "Troubleshooting and repair" of the operating manual of the DYNAcon communication unit.

10 Decommissioning

10.1 Dismantling

After the unit has been installed and put into operation, do not change the orientation of the unit. Make a note of the orientation before dismantling.

When re-installing, pay attention to the direction of flow and orientation of the flanges so that the device is not installed in the wrong direction.

WARNING

Danger of product leakage (or pressurisation).

Leaking product may result in injury to any unprotected body parts.

Depressurise the conveyor pipe before disassembly.

CAUTION

The pipe system can be under mechanical stress.

Pipe ends can move surprisingly. This can result in bruises and broken bones.

Wear a safety helmet. If possible, secure pipe ends against uncontrolled movements.

CAUTION

The device is very heavy.

If you lose control of the device while handling it, it can result in bruising and bone fractures.

Handle the device with care. Get help if you need to transport it. Wear safety shoes and a safety helmet. Use only tested means of transport with sufficient load capacity. Keep a safe distance. Never step under the suspended load.

The covers of the electronic unit are not secured. When loosening, make sure that they do not fall off.

1. Disconnect the power supply.
2. Loosen and remove cables (see Installation).
3. If the cables are to be used for another device, electrically insulate the ends of the cables and store them safely until they are reused.
4. Loosen the flanges
5. Remove the device.

10.2 Disposal

Dispose of packaging according to local regulations.

CAUTION

The device is very heavy.

If you lose control of the device while handling it, it can result in bruising and bone fractures.

Handle the device with care. Get help if you need to transport it. Wear safety shoes and a safety helmet. Use only tested means of transport with sufficient load capacity. Keep a safe distance. Never step under the suspended load.

Device disposal:

1. If there are residues of hazardous substances in the sensor pipe, clean the sensor pipe.
2. Dispose of the device according to local regulations. If you send the device to GTS free of charge, proper disposal is ensured.

11 Certification

The devices are designed and tested for operational safety according to state-of-the-art technology and have left the factory in perfect condition. The devices comply with the relevant standards and regulations (see section 12).

The measuring system described in this operating manual therefore meets the legal requirements of the EC directives. By affixing the CE mark, GTS confirms that the device has been successfully tested.

Layout of the nameplate

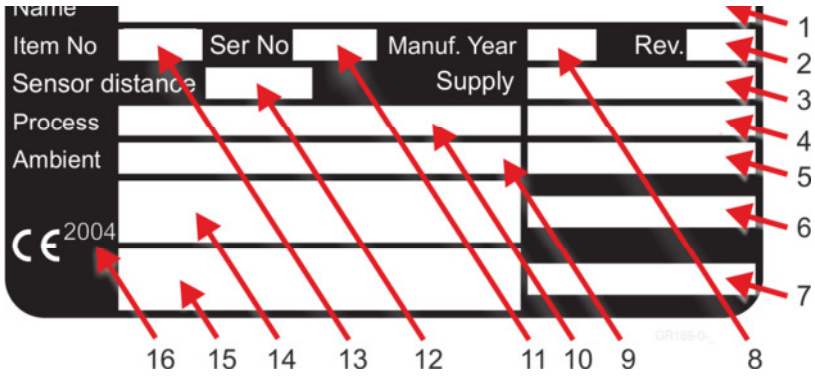


Fig. 20 Layout of the nameplate

1 Device name
2 Revision
3 Electric power supply
4 Maximum pressure in the sensor pipe
5 International Protection Rating
6 Number of the ATEX EC type-examination certificate
7 Number of the IECEx certificate
8 Year of manufacture
9 Ambient temperature range
10 Temperature range of the medium to be measured
11 Serial number
12 Sensor measuring distance
13 Article number
14 ATEX marking of the device
15 IECEx marking of the device
16 Number of inspection body

Structure of the device name

The device name follows this format:

Dmas_A/B/C/D/E/F/G/H/Ex1-21 A:

flange standard
DF DIN
AF ANSI

B: flange shape
1 Male and female face joints
2 Both sides with male face and O-ring
3 Female face on both sides
5 Male face on both sides

C: nominal pressure PN
DF flange shape: pressure in bar
AF flange shape: pressure in lbs

D: nominal size DN
DF flange shape: in millimetres
AF flange shape: in inches

E: Inside diameter DI
Specified in millimetres

F: housing material
00 Galvanised steel, chromated, painted
10 Stainless steel 1.4307 / AISI 304L
12 Housing: 1.4307 / AISI 304L
Cover: 1.471 / AISI 316Ti
13 Housing: normal steel, galvanised, chromated, painted
Sensor flanges: 1.4307 (stainless steel)

G: sensor pipe material
01 EP-GRP (glass fibre reinforced epoxy resin)
20 Teflon
30 PEEK
40 Ceramic
51 PA
56 POM

H: seal material
00 Nitrile butadiene rubber (NBR)
10 Fluorocarbon rubber (FPM/FKM)
20 Silicone (MH)

Structure of the explosion identification (example)

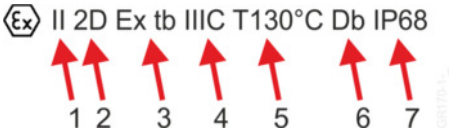


Fig. 21 Structure of the explosion identification using an example

1 Device group
2 Device category
3 Ignition protection type
4 Explosion group
5 Temperature class
6 Equipment protection level
7 International Protection Rating

You will find the explosion certification of our products in section 3.1. For more information about the identification, see DIN EN 60079-0.

12 Flange overview

DIN flange DF

DN	L	ØV	ØR	f1	f2	PN 16				PN 25				PN 40				PN 64			
						ØD	Ød1	Ød2	Number	ØD	Ød1	Ød2	Number	ØD	Ød1	Ød2	Number	ØD	Ød1	Ød2	Number
25	250	59,9	60	4	3	115	85	14	4	115	85	14	4	115	85	14	4	140	100	18	4
32	250	63,9	64	4	3	140	100	18	4	140	100	18	4	140	100	18	4	155	110	22	4
40	250	75,9	76	4	3	150	110	18	4	150	110	18	4	150	110	18	4	170	125	22	4
50	250	87,9	88	4	3	165	125	18	4	165	125	18	4	165	125	18	4	180	135	22	4
65	250	109,9	110	4	3	185	145	18	4	185	145	18	8	185	145	18	8	205	160	22	8
80	250	120,8	121	4	3	200	160	18	8	200	160	18	8	200	160	18	8	215	170	22	8
100	250	149,8	150	4,5	3,5	220	180	18	8	235	190	22	8	235	190	22	8	250	200	26	8
125	250	175,8	176	4,5	3,5	250	210	18		270	220	26	8	270	220	26	8	295	240	30	8
150	300	203,7	204	4,5	3,5	285	240	22		300	250	26	8	300	250	26	8	345	280	33	8
200	350	259,7	260	4,5	3,5	340	295	22		360	310	26	12	375	320	30	12	415	345	36	12

ANSI flange AF

DN	L	ØV	ØR	f1	f2	PN 150lbs				PN 300lbs			
						ØD	Ød1	Ød2	Number	ØD	Ød1	Ød2	Number
1"	250	52,3	52,4	6,35	4,8	107,9	79,4	15,9	4	123,8	88,9	19	4
1 1/4"	250	65,0	65,1	6,35	4,8	117,5	88,9	15,9	4	133,3	98,4	19	4
1 1/2"	250	74,5	74,6	6,35	4,8	127	98,4	15,9	4	155,6	114,3	22,2	4
2"	250	93,6	93,7	6,35	4,8	152,4	120,6	19	4	165,1	127	19	8
2 1/2"	250	106,3	106,4	6,35	4,8	177,8	139,7	19	4	190,5	149,2	22,2	8
3"	250	128,4	128,6	6,35	4,8	190,5	152,4	19	4	209,5	168,3	22,2	8
3 1/2"	250	141,1	141,3	6,35	4,8	215,9	177,8	19	8	228,6	184,1	22,2	8
4"	250	158,6	158,8	6,35	4,8	228,6	190,5	19	8	254	200	22,2	8
5"	250	187,1	187,3	6,35	4,8	254	215,9	22,2	8	279,4	234,9	22,2	8
6"	300	217,2	217,5	6,35	4,8	279,4	241,3	22,2	8	317,5	269,9	22,2	12
8"	350	271,2	271,5	6,35	4,8	342,9	298,4	22,2	8	381	330,2	25,4	12

all specifications in mm

ANSI flange AF

DN	L	ØV	ØR	f1	f2	PN 400lbs				PN 600lbs				PN 900lbs			
						ØD	Ød1	Ød2	Number	ØD	Ød1	Ød2	Number	ØD	Ød1	Ød2	Number
1"	250	52,3	52,4	6,35	4,8	123,8	88,9	19	4	123,8	88,9	19	4	149,2	101,6	25,4	4
1 1/4"	250	65,0	65,1	6,35	4,8	133,3	98,4	19	4	133,3	98,4	19	4	158,7	111,1	25,4	4
1 1/2"	250	74,5	74,6	6,35	4,8	155,6	114,3	22,2	4	155,6	114,3	22,2	4	177,8	123,8	28,6	4
2"	250	93,6	93,7	6,35	4,8	165,1	127	19	8	165,1	127	19	8	215,9	165,1	25,4	8
2 1/2"	250	106,2	106,4	6,35	4,8	190,5	149,2	22,2	8	190,5	149,2	22,2	8	244,5	190,5	28,6	8
3"	280	128,4	128,6	6,35	4,8	209,5	168,3	22,2	8	209,5	168,3	22,2	8	241,3	190,5	25,4	8
3 1/2"	280	141,1	141,3	6,35	4,8	228,6	184,1	25,4	8	228,6	184,1	25,4	8	---	---	---	---
4"	300	158,6	158,8	6,35	4,8	254	200	25,4	8	273	215,9	25,4	8	292,1	234,9	31,7	8
5"	350	187,1	187,3	6,35	4,8	279,4	234,9	25,4	8	330,2	266,7	28,6	8	349,2	279,4	34,9	8
6"	400	217,2	217,5	6,35	4,8	317,5	269,9	25,4	12	355,6	292,1	28,6	12	381	317,5	31,7	12
8"	450	271,2	271,5	6,35	4,8	381	330,2	28,6	12	419,1	349,2	31,7	12	469,9	393,7	38,1	12

Dimensions (example)

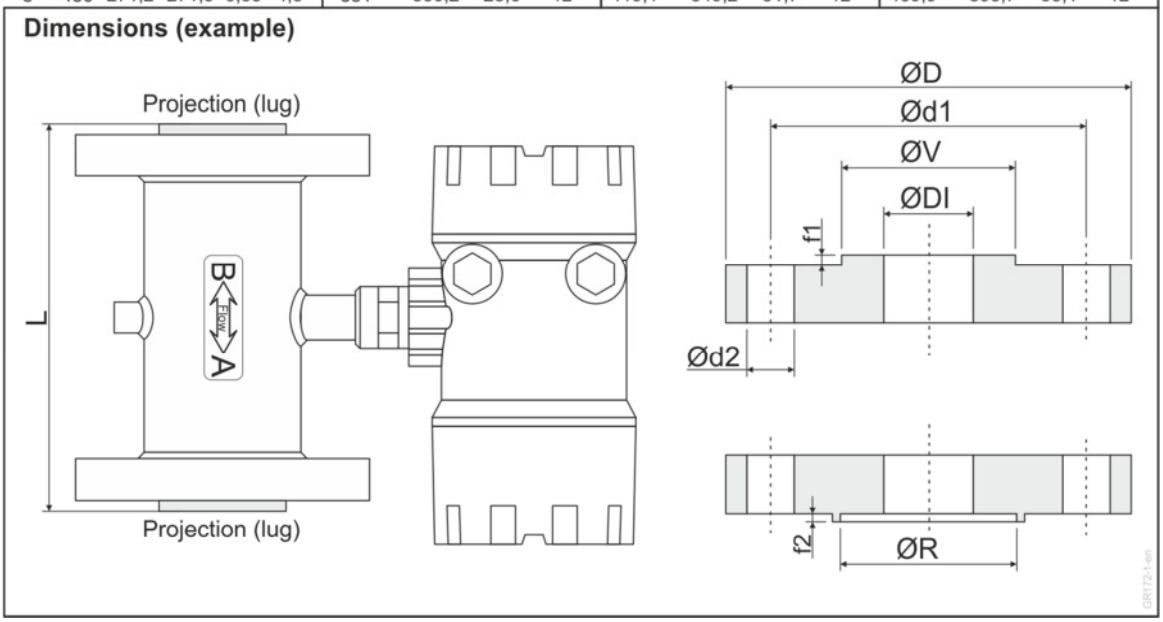


Fig. 22 Flange overview

13 Wiring diagrams

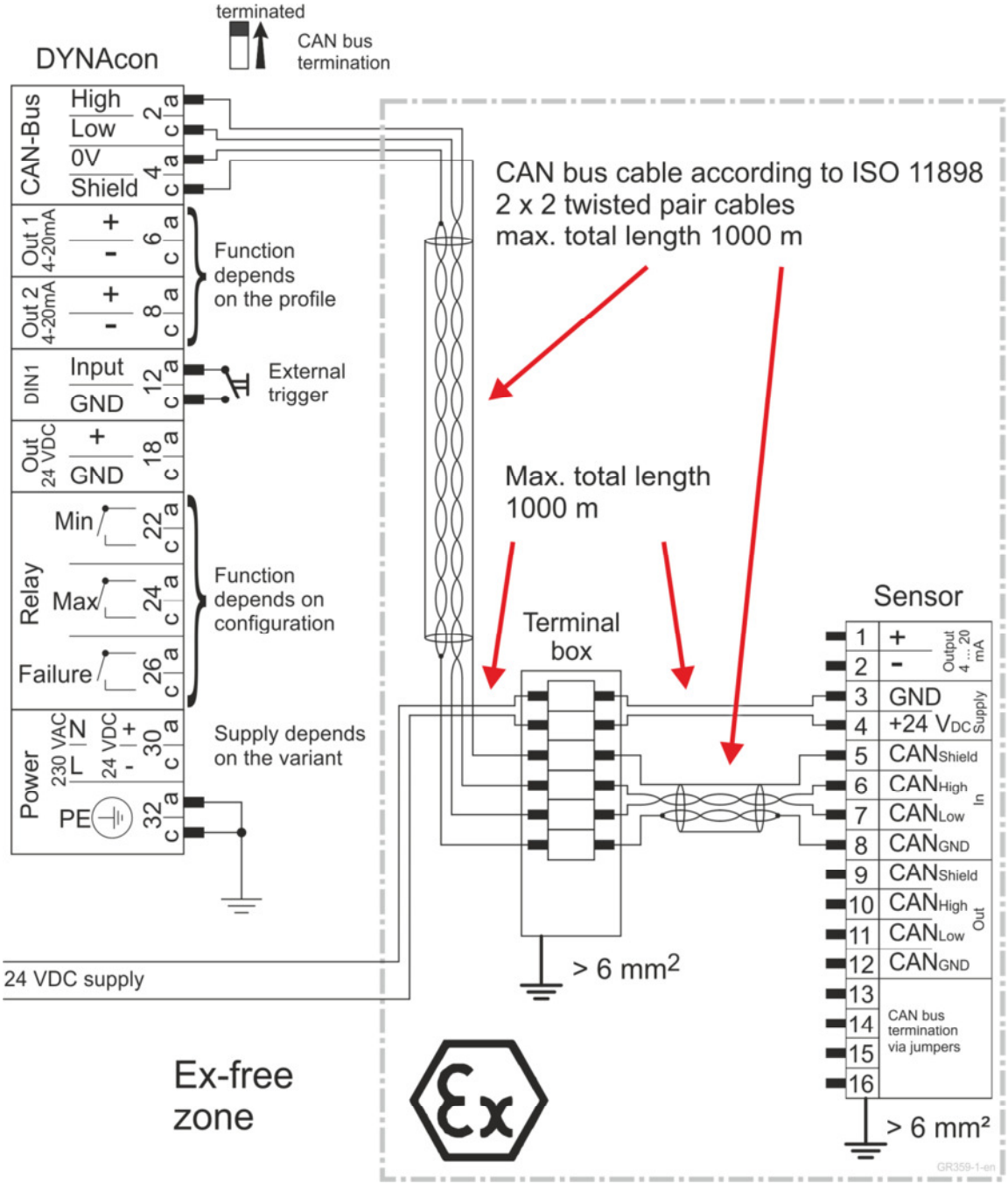


Fig. 23 Wiring diagram with terminal box

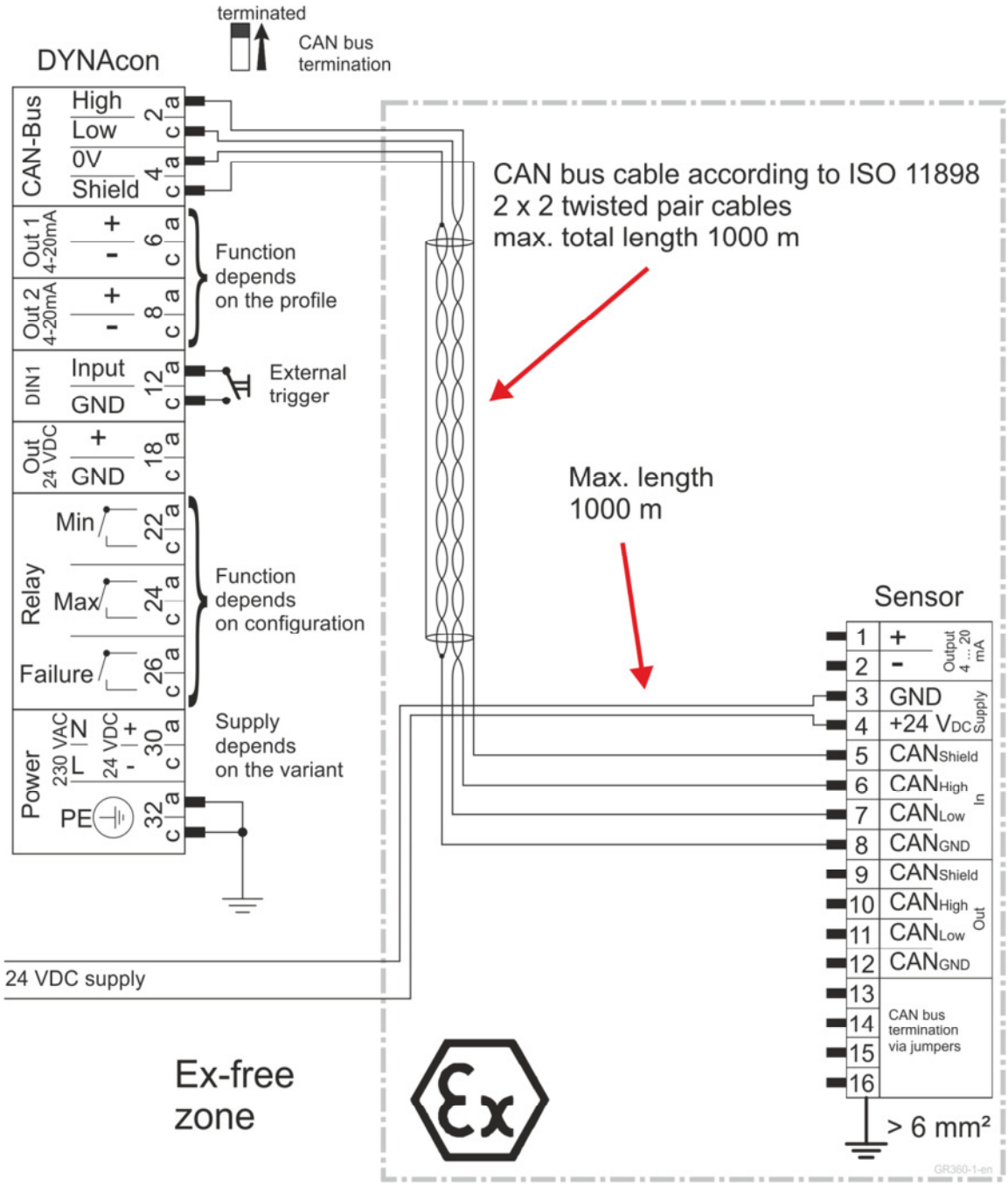


Fig. 24 Wiring diagram without terminal box

14 Applied standards and regulations

Area	Standard
Device	DIN EN 60079-0:2012 (Ex general) DIN EN 60079-1:2007 (Ex flameproof enclosure "d") DIN EN 60079-7:2007 (Ex increased safety "e") DIN EN 60079-31:2009 (Ex dust protection housing "t") 2014/30/EU (EMV) DIN EN 61326-1:2013 (EMC measuring instruments) DIN EN 61010-1:2010 (Safety measuring instruments)
Documentation	DIN EN 82079-1:2013-06
Production processes and quality assurance	ISO 9001:2008 (General processes) DIN EN ISO/IEC 80079-34:2011 (Ex)

Tab. 9 Applied standards

15 Configured parameters

Please fill out the tables with your configuration. This recording is useful when replacing a device or for multiple identical installations.

Date: _____ Tag no.

Item name Dmas_____ Serial number: _____

Ddens configuration:

1	Measuring Range		
	1.1 Range Limits		
	1.1.1 S max		kg/m3
	1.1.2 S min		kg/m3
	1.2 Range Units		
	1.2.1 Display Unit		
	1.2.2 Decimal places		
2	Upper Threshold		
	2.1 Upper threshold		
	2.2 S1		kg/m3
	2.3 H1		kg/m3
3	Lower Threshold		
	3.1 Lower threshold		
	3.2 S2		kg/m3
	3.3 H2		kg/m3
4	Analogue Output		
	4.1 Output Scaling		
	4.1.1 20mA =>		kg/m3
	4.2 Adjust 4mA		
	4.2.1 Calibr. 4 mA Output		
	4.3 Adjust 20mA		
	4.3.1 Calibr. 20 mA Output		
5	Simulation		
	5.1 Simulation		
	5.2 Value		kg/m3
	5.3 Alarm Relay		
6	Damping		
	6.1 Damping		
	6.1.1 Damping time		s
	6.2 Rapid Reaction		
	6.2.1 Reaction		
	6.2.2 Trigger Step		
	6.2.3 Damping cut-off		
7	Fault		
	7.1 Accepted Limit		s

	7.2 Output Value		
	7.3 Alarm Relay		
8	Analogue Input		
	8.1 Input Scaling		
	8.1.1 Input Type		
	8.1.2 Full Scl		kg/m3
	8.1.3 Gain		dB
	8.2 Cal. Setting		
	8.2.1 DAQ cal 4mA		
	8.2.2 DAQ cal 20mA		
	8.2.3 Input		mA
	8.3 HW Mode [restricted]		
9	Periods		
	9.1 DAQ Block		
	9.2 DAQ Period		µs
	9.3 Transmission		s
10	System		
	10.1 Language		
	10.1.1 Language		
	10.2 Date Time		
	10.2.1 Date		
	10.2.2 Time		
	10.3 CAN Group Address		
	10.3.1 Show CAN Group		
	10.3.2 I/O CAN Group		
	10.4 DYNAcon profiles [restricted]		

Dvel configuration:

1	Measuring Range		
	1.1 S max		m/s
	1.2 S min		m/s
2	Upper Threshold		
	2.1 Upper threshold		
	2.2 S1		m/s
	2.3 H1		m/s
3	Lower Threshold		
	3.1 Lower threshold		
	3.2 S2		m/s
	3.3 H2		m/s
4	Analogue Output		
	4.1 Analogue Output		
	4.1.1 20mA =>		m/s
	4.2 Adjust 4mA		
	4.2.1 Calibr. 4 mA Output		
	4.3 Adjust 20mA		
	4.3.1 Calibr. 20 mA Output		
5	Simulation		
	5.1 Simulation		
	5.2 Value		m/s
	5.3 Alarm Relay		
6	Damping		
	6.1 Damping		
	6.1.1 Damping time		s
	6.2 Rapid Reaction		
	6.2.1 Reaction		
	6.2.2 Trigger Step		
	6.2.3 Damping cut-off		
7	Adaption		
	7.1 Gain		
	7.1.1 Automatic		
	7.1.2 fix Gain		X
	7.1.3 Live Gain		X
	7.1.4 Gain Factor		X
	7.2 Adjustment		
	7.2.1 Umax		V
	7.2.2 Umin		V
	7.2.3 Limit		
	7.3 Analogue Circuit		
	7.3.1 Preamp Gain		

8	Fault		
	8.1 Accepted Limit		s
	8.2 Output Value		
	8.3 Alarm Relay		
9	Correlation		
	9.1 Parameter		
	9.1.1 DAQ Period		µs
	9.1.2 Distance		
	9.1.3 Flow		
	9.2 CCF Limit		
	9.2.1 CCF Limit		
	9.2.2 Actual CCF		
	9.2.3 Averaged CCF		
10	Periods		
	10.1 DAQ Block		
	10.2 DAQ Period		µs
	10.3 Transmission		s
11	System		
	11.1 Language		
	11.1.1 Language		
	11.2 Date Time		
	11.2.1 Date		
	11.2.2 Time		
	11.3 CAN Group Address		
	11.3.1 Show CAN Group		
	11.3.2 I/O CAN Group		
	11.4 DYNAcon profiles [restricted]		

Dpres configuration:

1	Measuring Range		
	1.1 Range Limits		
	1.1.1 S max		kPa
	1.1.2 S min		kPa
	1.2 Range Units		
	1.2.1 Display Unit		
	1.2.2 Decimal places		
2	Upper Threshold		
	2.1 Upper threshold		
	2.2 S1		kPa
	2.3 H1		kPa
3	Lower Threshold		
	3.1 Lower threshold		
	3.2 S2		kPa
	3.3 H2		kPa
4	Simulation		
	4.1 Simulation		
	4.2 Value		kPa
	4.3 Alarm Relay		
5	Damping		
	5.1 Damping		
	5.1.1 Damping time		s
	5.2 Rapid Reaction		
	5.2.1 Reaction		
	5.2.2 Trigger Step		
	5.2.3 Damping cut-off		
6	Fault		
	6.1 Accepted Limit		s
	6.2 Output Value		
	6.3 Alarm Relay		
7	Periods		
	7.1 Transmission		s
8	System		
	8.1 Language		
	8.1.1 Language		
	8.2 Date Time		
	8.2.1 Date		
	8.2.2 Time		
	8.3 CAN Group Address		
	8.3.1 Show CAN Group		

	8.3.2 I/O CAN Group		
8.4	DYNAcon profiles [restricted]		

Dvccf configuration:

1	Measuring Range		
	1.1 S max		
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