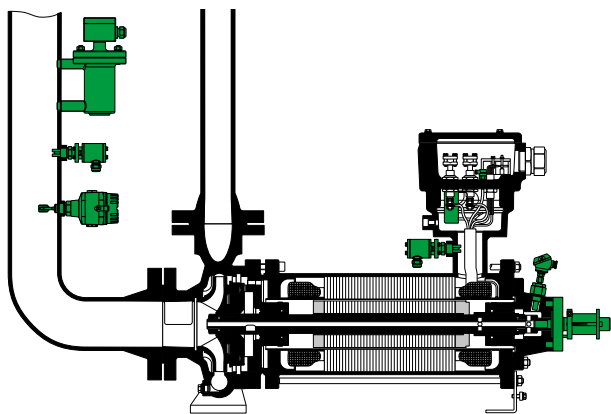


PRODUCT INFORMATION



Monitoring equipment
for hermetically sealed
centrifugal pumps
with canned motor

General

When used as intended, hermetically sealed centrifugal pumps with canned motor are hydrodynamically (radially) and hydraulically (axially) balanced and absolutely free from wear. However, the proper function can be disturbed by an inadmissible operating method or an unpredictable or unconsidered incidence.

Efficient monitoring equipment should play an important role in ensuring that failures are detected at an early stage, before they become a safety risk for persons and the environment. A reliable monitoring system prevents costly damage to the pump and a possibly long shutdown of the production plant. In case of safety-related failures, the monitoring equipment has to ensure the shutdown of the pump.

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1 Complete overview of the safety- and function-related monitoring equipment

In order to ensure the proper function of a hermetically sealed centrifugal pump with canned motor, HERMETIC provides the following monitoring equipment:



Level monitoring of the pumped liquid for detecting and avoiding dry run

The pump's interior and rotor chamber must be always filled with the pumped liquid for reasons of safety. HERMETIC provides suitable level monitoring equipment for each pump complying with the explosion protection requirements according to directive 94/9/EC. Level monitoring can be recommended principally for application cases which do not mandatory comply with explosion protection requirements. Level monitoring prevents the pump from running dry and to be affected by major damages such as by destruction of the slide bearings or by exceeding inadmissible high temperatures caused by missing cooling and lubricating flow. In addition the pump can be prevented from cavitation damages by means of level monitoring equipment which are caused by evaporation of boiling liquids in the suction pipe.



Temperature monitoring for detecting and avoiding inadmissible high temperatures in the pump and the motor

Temperature monitoring ensures that the pump is switched off when achieving inadmissible high temperatures. HERMETIC provides suitable temperature monitoring equipment for each pump complying with explosion protection requirements according to directive 94/9/EC. Monitoring of the liquid temperature allows a reliable control to ensure the operation of the pump within the admissible range and to ensure the internal motor cooling of a canned motor pump. For liquids with a pour point that is higher than the ambient temperature, the liquid temperature monitoring can also be used to prevent the start-up of the pump as long as the maximum admissible viscosity of the liquid is reached.

In order to protect canned motors against inadmissible high temperatures, the winding is equipped either with PTC thermistors or Pt100 resistance thermometers.



Rotor position monitoring for detecting and avoiding axial wear

Axial thrust balancing is mainly influenced by the operating method of the pump, plant conditions and various physical properties of the pumped liquid. For an early detection of an imminent malfunction it is recommended to install a rotor position monitoring device. This electronic protection equipment monitors the axial shaft position of the rotor during operation in a hermetically sealed and contact-free way. Combined with the level and temperature monitoring an efficient detection of imminent failures is possible.



Rotation monitoring for detecting and avoiding incorrect phase sequence

The correct rotating direction of hermetically sealed centrifugal pumps with canned motor cannot be checked visually from the outside. Due to a wrong phase sequence in the power line the pump is operated with an incorrect rotating direction without being noticed what might result in considerable damages to the pump. By default, hermetically sealed centrifugal pumps with canned motor are equipped with an electronic rotation monitor in the form of a phase sequence relay.



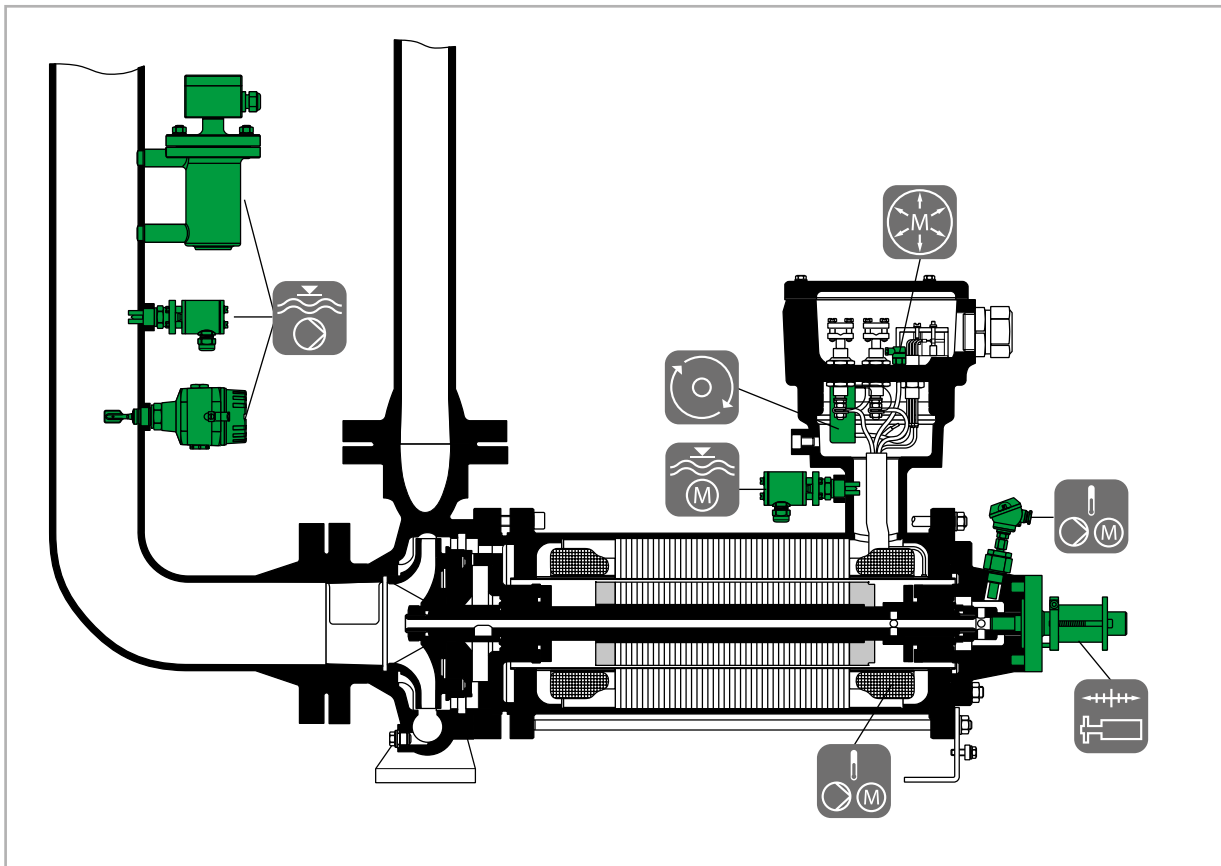
Pressure monitoring for detecting a damaged and leaking stator liner

During normal operation, the hermetically sealed stator liner prevents the intrusion of the pumped liquid out of the pressurised rotor chamber into the stator chamber. If, in case of a failure, the stator liner gets damaged, then any leakage that may subsequently occur can be detected due to the pressure increase in the stator chamber by means of an appropriate monitoring equipment. For canned motors of type of protection oil immersion, the pressure monitoring of the stator chamber is mandatory.



Level monitoring of the motor protective liquid used in hermetically sealed centrifugal pumps with canned motor of type of protection oil immersion

For canned motors of type of protection oil immersion, the motor winding is completely surrounded by a protective liquid to eliminate the possibility of an ignition source. In order to ensure that the winding is sufficiently immersed, level monitoring of the motor protection liquid is required. HERMETIC provides suitable level monitoring equipment of the motor protective liquid for each pump with canned motor of type of protection oil immersion complying with the explosion protection requirements according to directive 94/9/EC.



2 Monitoring equipment for the safe operation of hermetically sealed centrifugal pumps with canned motor in potentially explosive atmospheres

2.1 Requirements to ensure the explosion protection of hermetically sealed centrifugal pumps with canned motor of type of protection flameproof enclosure

Hermetically sealed centrifugal pumps are principally manufactured for use in potentially explosive atmospheres. For this reason the pumps comply with electrical as well as non-electrical explosion protection requirements.

Electrical explosion protection

Both the canned motor and the terminal box as electrical equipment comply with the electrical explosion protection requirements according to EN 60079.

The canned motor is designed in type of protection flameproof enclosure "d" according to EN 60079-1. For this type of protection, all parts which are capable of igniting an explosive atmosphere due to sparks and electric arcs are placed inside an enclosure that is capable of withstanding the pressure of an internal explosion and also preventing the explosion from being transmitted to the atmosphere surrounding the enclosure.

The terminal box of the canned motor is designed in type of protection increased safety "e" according to EN 60079-7. Larger clearances and creepage distances, along with the implementation of additional measures, ensures the prevention of sparks and electric arcs inside the terminal box, as well as excessive temperatures during normal operation.

Non-electrical explosion protection

The hydraulic part of the pump and the rotor chamber as non-electrical equipment are designed in type of protection constructional safety "c" according to EN 13463-5. Provided that the pump as part of the process system is permanently filled with liquid, the formation of an explosive atmosphere in the wetted inner chamber of the pump is impossible. A risk of ignition inside the pump can be ruled out in this case. If the permanent filling with liquid cannot be guaranteed during operation, then appropriate monitoring equipment with an ignition protection level IPL 1 according to EN 13463-6 is required. Since, as a result of its design, all rotating parts are located inside the pump, the risk of igniting the atmosphere outside can only be caused by hot surfaces.

Hot surfaces

As well as the mechanical and electrical ignition sources inside the pump, there is also a risk of ignition from hot surfaces. The surface temperature of the pump to the surrounding atmosphere is dependent on the temperature of the liquid to be pumped as well as the self-heating of the pump, e.g. due to friction, eddy currents or motor losses.

In order to ensure the explosion protection, the maximum surface temperature needs to be below the ignition temperature of the gas/air mixture, in which the pump is applied, at all times.

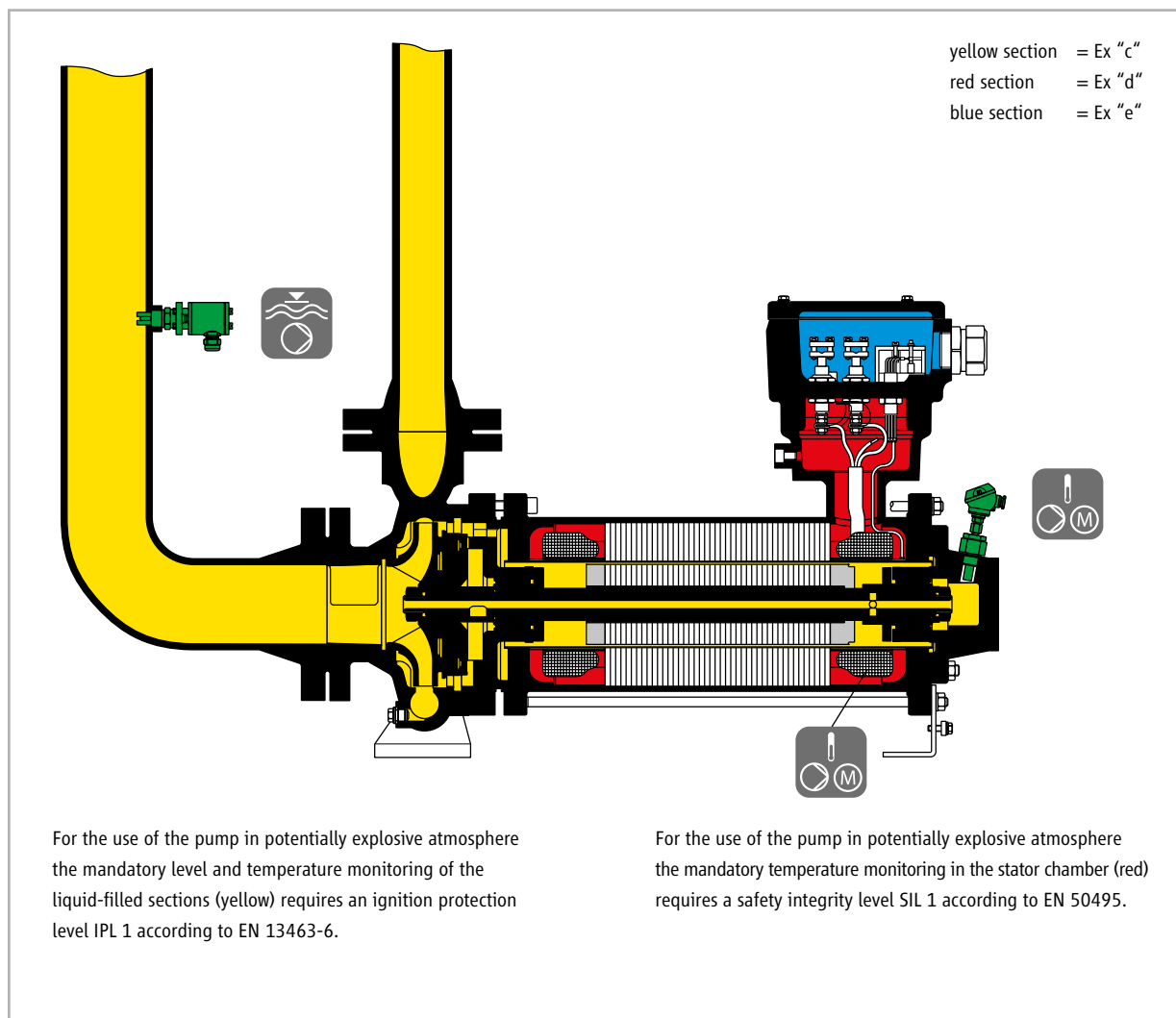
- 2 Monitoring equipment for the safe operation of hermetically sealed centrifugal pumps with canned motor in potentially explosive atmospheres
- 2.1 Requirements to ensure the explosion protection of hermetically sealed centrifugal pumps with canned motor of type of protection flameproof enclosure

In order to prevent the maximum permissible surface temperature from being exceeded, and thereby to continue to meet the conditions of the required temperature class, the temperature has to be monitored at the pump.

For hermetically sealed centrifugal pumps with canned motor, two temperature monitoring methods are possible:

1. Monitoring of the pumped liquid temperature: In this case, monitoring equipment with an ignition protection level IPL 1 according to EN 13463-6 is required.
This type of monitoring enables a more precise control of the proper function of the pump, due to the temperature of the heated motor cooling flow being measured.
2. Monitoring of the motor winding temperature: In this case, monitoring equipment with a safety integrity level SIL 1 according to EN 50495 is required. Alternatively, thermal monitoring equipment can be used, that has been approved according to directive 94/9/EC by a notified body for use as monitoring equipment and that has been marked accordingly. For this type of monitoring, the pump may also be operated in combination with a frequency converter.

For canned motors of type of protection flameproof enclosure, either one of the monitoring methods, or a combination of both, can be used. When selecting the temperature monitoring equipment, attention needs to be paid to the application and pump specific requirements concerning the explosion protection.



2.2 Additional requirements to ensure the explosion protection of hermetically sealed centrifugal pumps with canned motor of type of protection oil immersion

For hermetically sealed centrifugal pumps with canned motor of type of protection oil immersion, the same requirements as described in Section 2.1 apply, apart from a few exceptions:

Electrical explosion protection

The canned motor is designed in type of protection oil immersion “o” according to EN 60079-6. For this type of protection, all parts which are capable of igniting an explosive atmosphere due to sparks and electric arcs are immersed in a protective liquid, so that the formation of an explosive atmosphere is impossible. Therefore it has to be ensured that the winding is sufficiently immersed. For the purpose of level monitoring, only a screw-mounted, pressure- and temperature-resistant sight glass is provided by default. Alternatively, an electronic level monitoring equipment, that is suitable for the application conditions, can be used. The level monitoring also requires a safety integrity level SIL 1 according to EN 50495.

An additional pressure monitoring equipment is required for the following reasons:

- Detection and avoidance of excessive pressures in the stator chamber due to the thermal expansion of the motor protection liquid.
- Detection of pumped liquid entering the stator chamber as a consequence of a damaged stator liner.

By default, a pressure switch is installed in the motor terminal box for this purpose, and has to be connected to an intrinsically safe circuit. The pressure switch also acts as a pressure relief device according to EN 60079-6, clause 4.4.

Hot surfaces

For hermetically sealed centrifugal pumps with canned motor of type of protection oil immersion, both of the temperature monitoring methods described in section 2.1 are mandatory, i.e. the temperature monitoring of the pumped liquid as well as the temperature monitoring of the motor winding.

-
- For the use of the pump in potentially explosive atmosphere the optional level monitoring for the motor protection liquid in the stator chamber (brown) requires a safety integrity level SIL 1 according to EN 50495.

3 Detailed description of the monitoring equipment

3.1 Level monitoring

3.1.1 KSR magnetic float switch

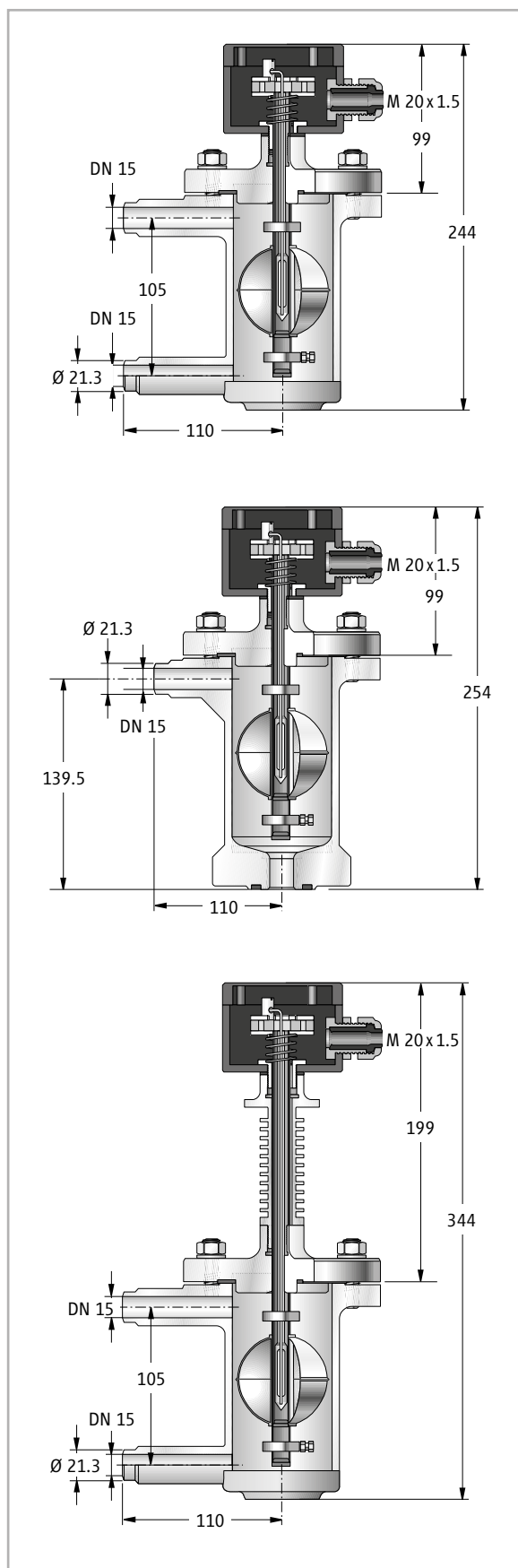
Function

Within the KSR magnetic float switch, a float equipped with a magnet moves on a guide tube which has an inert gas contact (reed contact) inside it. If the liquid level rises or falls, the installed reed contact is activated via the magnet. The correct functioning of the installed contact circuit can be checked by means of a movable contact insert.

Model / Type

Manufacturer: KSR KUEBLER Niveau-Messtechnik AG

- KSR magnetic float switch of type 60-AFV HP-VS/CF-L110-V62A-AS-EX, mat. no. 266211008 (standard design)
- KSR magnetic float switch of type 60-AFV HP-VS/CF-L110-V62A-AU-EX, mat. no. 266211009 (for pumps with heat exchangers)
- KSR magnetic float switch of type 60-AFV HP-VS/HHT-CF-L110-V62A-AS-EX, mat. no. 266211010 (for hot pumped liquids)



Explosion protection according to Directive 94/9/EC

EC-type-examination certificate KEMA 01 ATEX 1053 X

EN 60079-0: 2006, EN 60079-11: 2007, EN 60079-26: 2007, EN 61241-0: 2006, EN 61241-11: 2006

Design

Float enclosure with welding stud and housing lid made of stainless steel (1.4581); stainless steel (1.4571) float; stainless steel (1.4571) guide tube; aluminium connection head; special materials upon request (e.g. Hastelloy alloys, PVDF); protection rating: IP 65

Application conditions

| | |
|---|---|
| KSR magnetic float switch of type 60-AFV HP-VS/CF-L110-V62A-AS-EX: | for temperatures ranging from -70°C to $+100^{\circ}\text{C}$ |
| KSR magnetic float switch of type 60-AFV HP-VS/CF-L110-V62A-AU-EX: | for temperatures ranging from -70°C to $+100^{\circ}\text{C}$ |
| KSR magnetic float switch of type 60-AFV HP-VS/HHT-CFL110-V62A-AS-EX: | for temperatures ranging from -10°C to $+350^{\circ}\text{C}$ |
| Ambient temperature range: | -50°C to $+60^{\circ}\text{C}$ |

Normal design

For densities $\geq 625 \text{ kg/m}^3$
Pressure rating: PN 25 (EN 764-1), stainless steel (1.4571) float

Special design

For densities $\geq 480 \text{ kg/m}^3$, pressure rating PN 25, titanium float
For densities $\geq 625 \text{ kg/m}^3$, pressure rating PN 40, stainless steel (1.4571) float

- Float made of Hastelloy
- With flange connection piece DN 15

Electrical data

Power supply circuit of the reed contacts: type of protection intrinsic safety Ex ia IIC, only to be connected to a certified intrinsically safe circuit with the following associated maximum values: $U_i = 36 \text{ V}$; $I_i = 100 \text{ mA}$; $C_i = 0 \text{ nF}$; $L_i = 0 \text{ }\mu\text{H}$

Installation

The KSR magnetic float switch can be directly welded onto the pipe using 2 welding studs. It is beneficial to install the KSR magnetic float switch within a vertical section of the pipe on the suction side. The float enclosure must be at least as high as the discharge nozzle of the pump, and there must be no shut-off device between the float and the suction nozzle. If such an installation is not possible, the KSR magnetic float switch can alternatively be installed on the discharge side of the pipe.

Switching amplifier for KSR magnetic float switch

A switching amplifier of type 9170/10-12-X1s, produced by R. STAHL, is a suitable trigger device for the KSR magnetic float switch.

Modell / Type

Manufacturer: R. STAHL AG

- Switching amplifier of type 9170/10-12-21s, 120 V AC to 230 V AC (96 V to 253 V), 1.8 VA, mat. no. 265930901
- Switching amplifier of type 9170/10-12-11s, 24 V DC (18 V to 31.2 V), approx. 0.8 W, mat. no. 265931001

Explosion protection according to Directive 94/9/EC

EC-type-examination certificate DMT 02 ATEX E 195 X

IEC 60079-0: 2007, EN 60079-11: 2007, EN 60079-15: 2005, EN 60079-26: 2007, EN 50303: 2000,
 EN 61241-0: 2006, EN 61241-11: 2006

Intrinsic safety "i"

The switching amplifiers have intrinsically-safe control inputs with [Ex ia] IIC protection. Activation can be achieved via isolated contacts, two-wire proximity switches according to EN 60947-5-6 (NAMUR) or other resistance-change devices.

Installation

The device must be installed outside the hazardous area, since only the control circuit is intrinsically safe. The only action required is to connect a two-wire signal line to the switching amplifier.

Electrical data

Control circuit (connections 10,11): type of protection intrinsic safety [Ex ia] IIC
 maximum values: $U_o = 10.6 \text{ V}$, $I_o = 24 \text{ mA}$, $P_o = 64 \text{ mW}$

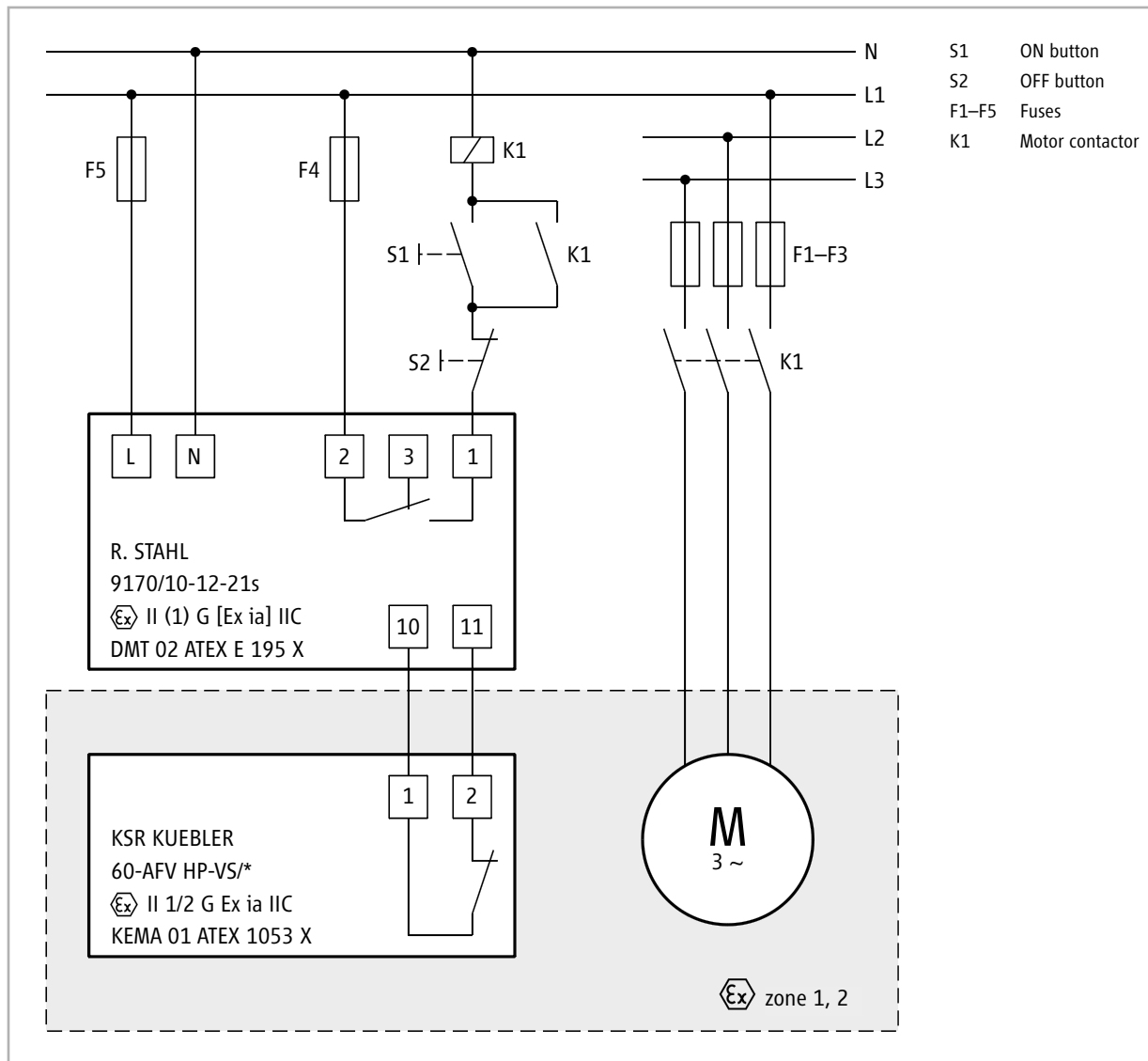
Output circuit (connections 1, 2, 3) – power relay

Maximum DC load: 250 V / 2 A
 Maximum AC load: 250 V / 4 A
 Maximum switching capacity: 50 W / 1000 VA

Mechanical data

Dimensions: 18 x 108 x 115 mm
 Fastening: Attached to DIN-rail according to EN 50022
 Weight: Approx. 160 g
 Orientation: Vertical or horizontal
 Place of installation: Outside the potentially explosive area
 Connecting terminals Single-wired: 0.2 mm² to 2.5 mm² (rigid)
 (Screw-type terminals) 0.2 mm² to 2.5 mm² (flexible)
 0.25 mm² to 2.5 mm² (flexible with ferrules fitted)
 Two-wired: 0.2 mm² to 1.0 mm² (rigid)
 0.2 mm² to 1.5 mm² (flexible)
 0.25 mm² to 1.0 mm² (flexible with ferrules fitted)
 Protection rating for housing: IP 30
 Protection rating for terminals: IP 20
 Ambient temperature range: -20 °C to +70 °C
 Storage temperature range: -40 °C to +80 °C
 Relative humidity: ≤ 95 % (no condensation)

Circuit diagram



Example of connecting the KSR magnetic float switch

3.1.2 Optoelectronic liquid level limit transducer

Function

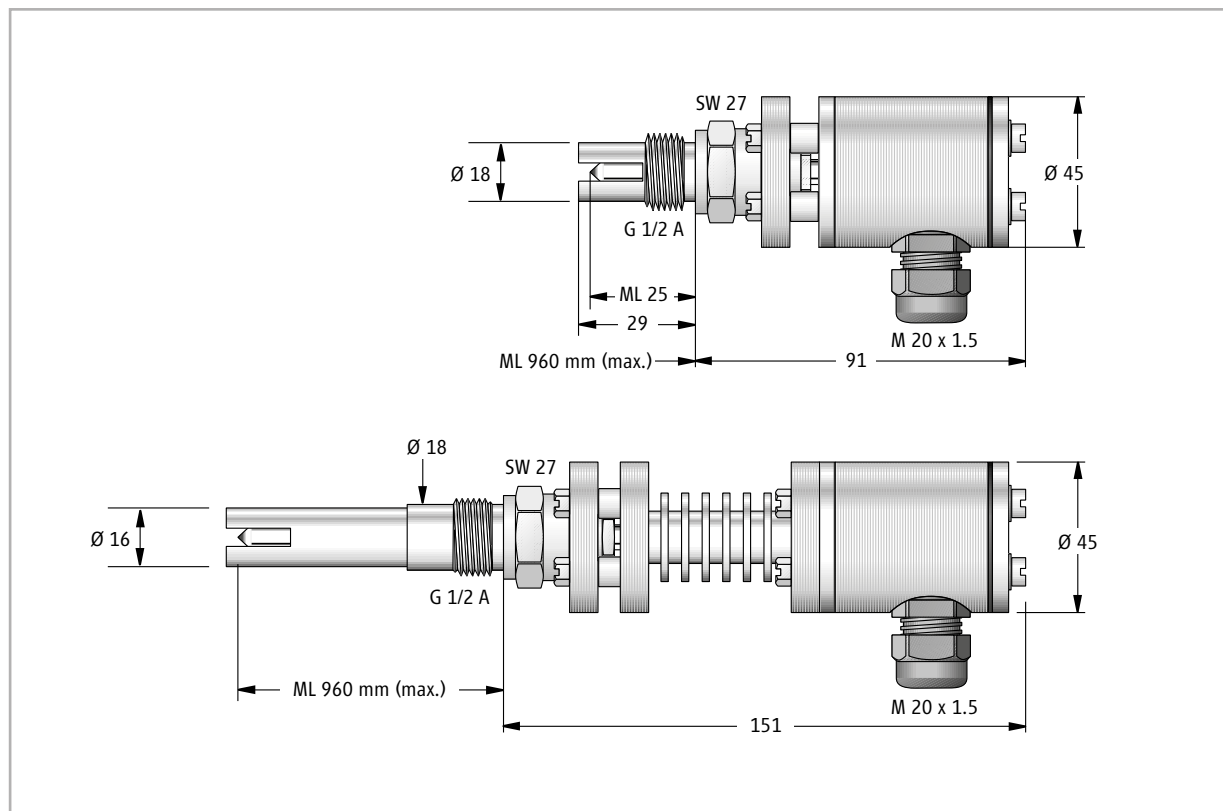
The optoelectronic liquid level limit transducer uses the different refractive properties of gases and liquids to optically determine the fill level. Light from an infrared LED is directed through a glass rod with a tapered end. For the medium gas, the light is almost totally reflected and directed back to a phototransistor. If liquid surrounds the sensor surface, then the light is fully redirected into the liquid. The phototransistor consequently receives no more light. The different signals thus generated are simply evaluated as "WET" and "DRY" signals and the resulting voltage is transferred to the controller.

In combination with the controller the optoelectronic liquid level limit transducer can also be used to ensure that the motor winding is sufficiently immersed with protective liquid, regarding canned motors of type of protection oil immersion.

Model / Type

Manufacturer: KSR KUEBLER Niveau-Messtechnik AG

- Optoelectronic liquid level limit transducer of type KSR-OPTO.211 300 000.0660, mat. no. 266290010 (standard design)
- Optoelectronic liquid level limit transducer of type KSR-OPTO.211 300 000.0669, mat. no. 266290020 (with cooling fins for hot and extremely cold liquids)



Explosion protection according to Directive 94/9/EC

EC-type-examination certificate ZELM 06 ATEX 0299

EN 60079-0: 2009, EN 60079-11: 2007, EN 60079-26: 2007, EN 60079-28: 2007

Design

Sensor with stainless steel (1.4571) connecting thread (G 1/2"); glass sensor with stainless steel connection head; special materials upon request (e.g. Hastelloy alloys, titanium); protection type: Ex ib op is IIC T6 (sensor: zone 0); protection rating: IP 65; design characteristic: NO contact for rising level

Application conditions

Optoelectronic liquid level limit transducer of type KSR-OPTO.211 300 000.0660: for temperatures ranging from -65°C to $+250^{\circ}\text{C}$

Optoelectronic liquid level limit transducer of type KSR-OPTO.211 300 000.0669: for temperatures ranging from -160°C to $+400^{\circ}\text{C}$

Ambient temperature range: -40°C to $+75^{\circ}\text{C}$

Normal design

Range of densities No restrictions

Pressure rating: PN 250 (EN 764-1)

Special designs

Special materials such as Hastelloy

Flange connection included (DN 20 or higher)

Sealing weld

Electrical data

Signal circuit of type of protection intrinsic safety Ex ib IIC. Only to be connected to a certified intrinsically safe input circuit with the following associated maximum values: $U_i = 9.7\text{ V DC}$, $I_i = 149\text{ mA}$, $P_i = 1\text{ W}$

Installation

The optoelectronic liquid level limit transducer can be installed directly in the pipe. If the optoelectronic liquid level limit transducer is installed in a vertical section of the pipe on the suction side, it must be at least as high as the discharge nozzle of the pump, and there must be no shut-off device between the float and the suction nozzle. If such an installation is not possible, the optoelectronic liquid level limit transducer can alternatively be installed on the discharge side of the pipe. The sensor tip should extend into the cross-sectional plane of the pipe by at least 10 mm, but should not be more than 15 mm from the opposite wall of the pipe.

Controller and power supply for Optoelectronic Transducers

A controller of type KSR-OPTO.2502.XX, produced by KSR KUEBLER Niveau-Messtechnik AG, is a suitable trigger device for the optoelectronic liquid level limit transducer.

Model / Type

Manufacturer: KSR KUEBLER Niveau-Messtechnik AG

- Controller of type KSR-OPTO.2502.11, 230 VAC \pm 10 %, 2.8 VA, mat. no. 265930840
- Controller of type KSR-OPTO.2502.41, 24 VDC \pm 25 %, 3.0 W, 48 Hz to 68 Hz, mat. no. 265930850

Explosion protection according to Directive 94/9/EC

EC-type-examination certificate ZELM 06 ATEX 0300

EN 60079-0: 2009, EN 60079-11: 2007

Intrinsic safety "i"

The controllers have intrinsically-safe control inputs of type of protection [Ex ib] IIC.

Installation

The device must be installed outside the hazardous area, since only the control circuit is intrinsically safe. The only action required is to connect a two-wire signal line to the controller.

Electrical data

Control circuit (connections WS, BR, GN): type of protection intrinsic safety [Ex ib] IIC

maximum values: $U_o = 9.6 \text{ V}$, $I_o = 149 \text{ mA}$, $P_o = 1 \text{ W}$

1 changeover switch signal / 1 changeover switch failure

Max. cable length

600 m for cross-sectional area of 1.5 mm²

Output circuit (connections 1, 2, 3) – signal relay

Maximum DC load: 40 V / 2 A

Maximum AC load: 250 V / 3 A

Maximum switching capacity: 100 VA

Output circuit (connections 4, 5, 6) – failure relay

Maximum DC load: 40 V / 2 A

Maximum AC load: 250 V / 3 A

Maximum switching capacity: 100 VA

Mechanical data

Dimensions: 200 x 120 x 75 mm

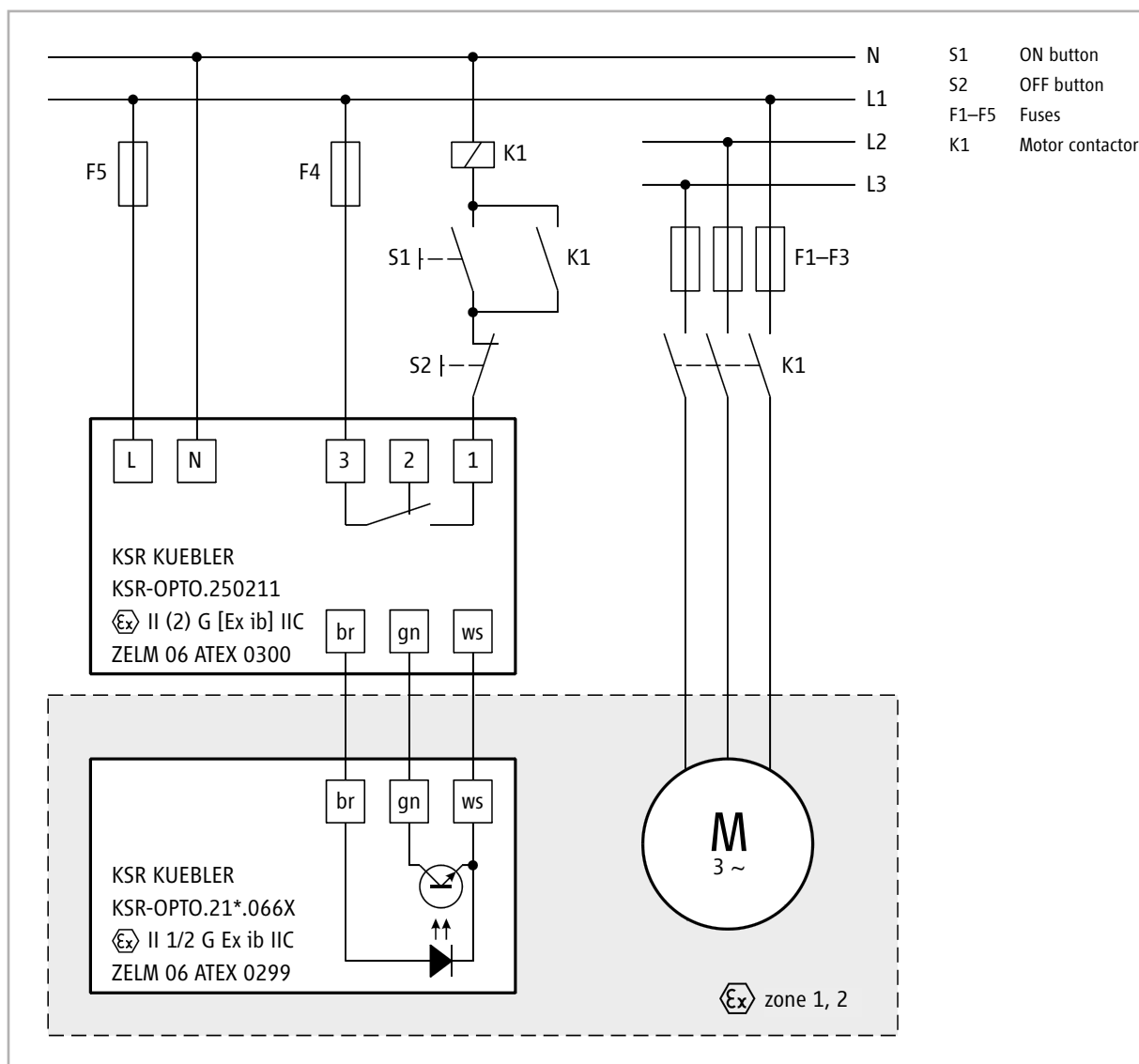
Weight: Approx. 730 g

Place of installation: Outside the potentially explosive area

Ambient temperature range for Macrodon housing: -40°C to $+40^\circ\text{C}$

Macrodon housing protection rating: IP 65

Circuit diagram



Example of connecting the optoelectronic liquid level limit transducer

3.1.3 Vibration limit switch

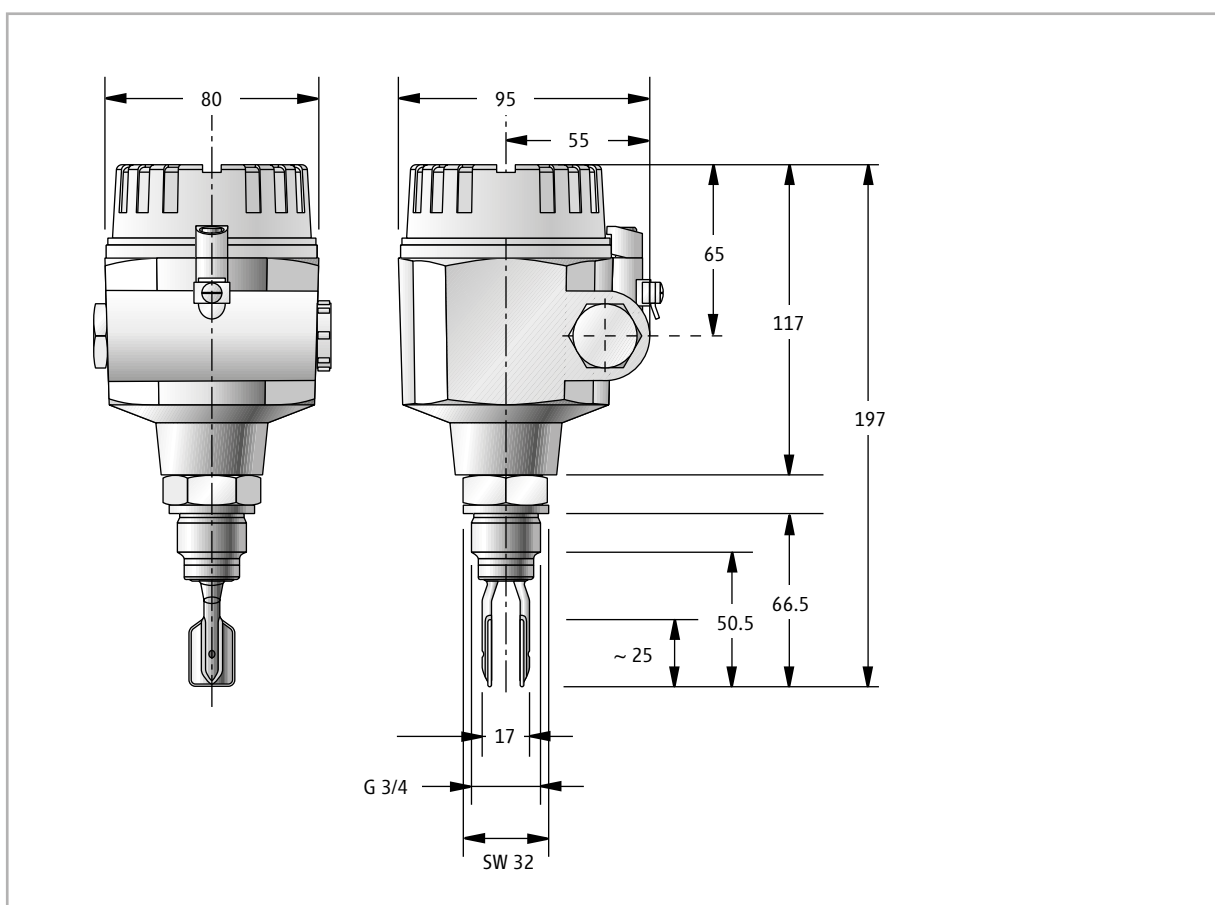
Function

The tuning fork of the sensor oscillates at a natural frequency. If it is covered with liquid, the oscillatory frequency is reduced. This change in frequency activates the limit switch. The functioning of the switch is not affected by flows, turbulence, gas bubbles, vibration, solid matter or deposit.

Model / Type

Manufacturer: Endress+Hauser Messtechnik GmbH+Co. KG

Vibration limit switch of type FTL50-GAF2AA5G5C (Liquiphant) with electronic module of type FEL55; can be connected directly to a PLC (programmable logic controller).



Explosion protection according to Directive 94/9/EC

EC-type-examination certificate KEMA 99 ATEX 5172 X

EN 60079-0: 2009, EN 60079-11: 2007, EN 60079-26: 2007, EN 60079-27: 2008

Design

| | |
|------------------------------|--|
| Design version: | FTL50 |
| Structural form: | compact |
| Certification: | ATEX II 1/2GD Ex ia IIC T6/IECEx zone0/1 |
| Process fitting: | 2", 300 lbs, RF 316/316L, flanged (ANSI B16.5) |
| Probe length: | AA compact |
| Output info (electronics): | FEL55, 8/16 mA, 11 to 36 V DC |
| Cable inlet (housing): | F13 aluminium, IP66/68; M20 threaded fitting |
| Acceptance test certificate: | EN 10204 - 3.1 Materials (316L, contact with medium) |

Application conditions

The Liquiphant FTL50GAF2AA5G5C with electronic module FEL55 is a limit switch that can be used in all liquids

- for process temperatures ranging from $-50\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$
- for ambient temperatures at the electronics housing ranging from $-50\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$
- for pressures of up to 100 bar
- for viscosities of up to $10000\text{ mm}^2/\text{s}$
- for densities $\geq 0.5\text{ g/cm}^3$ or $\geq 0.7\text{ g/cm}^3$

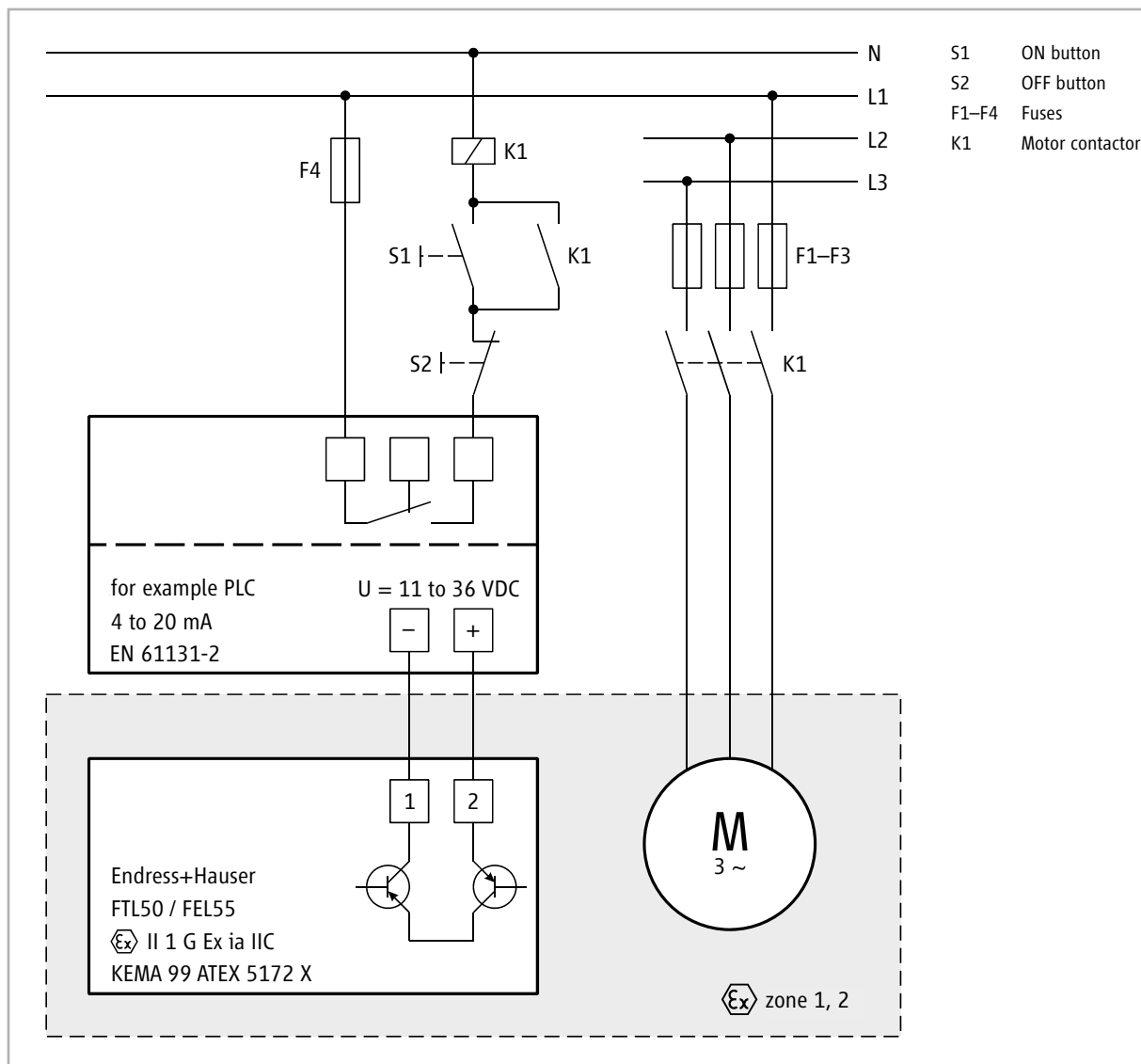
Electrical data for the electronic module of type FEL55

Power supply and output circuits (terminals 1 and 2): type of protection intrinsic safety Ex ia IIC, only to be connected to a certified intrinsically safe circuit with the following associated maximum values: $U_i = 36\text{ V}$; $I_i = 100\text{ mA}$; $P_i = 1\text{ W}$; $C_i = 0\text{ nF}$; $L_i = 0\text{ mH}$

Installation

The vibration limit switch is directly flanged-mounted on the pipe. It is beneficial to install the vibration limit switch within a vertical section of the pipe on the suction side. It must be at least as high as the discharge nozzle of the pump, and there must be no shut-off device between it and the suction nozzle. If such an installation is not possible, the vibration limit switch can alternatively be installed on the discharge side of the pipe.

Circuit diagram



Example of connecting the FTL50 / FEL55



3.2 Temperature monitoring

3.2.1 Liquid temperature

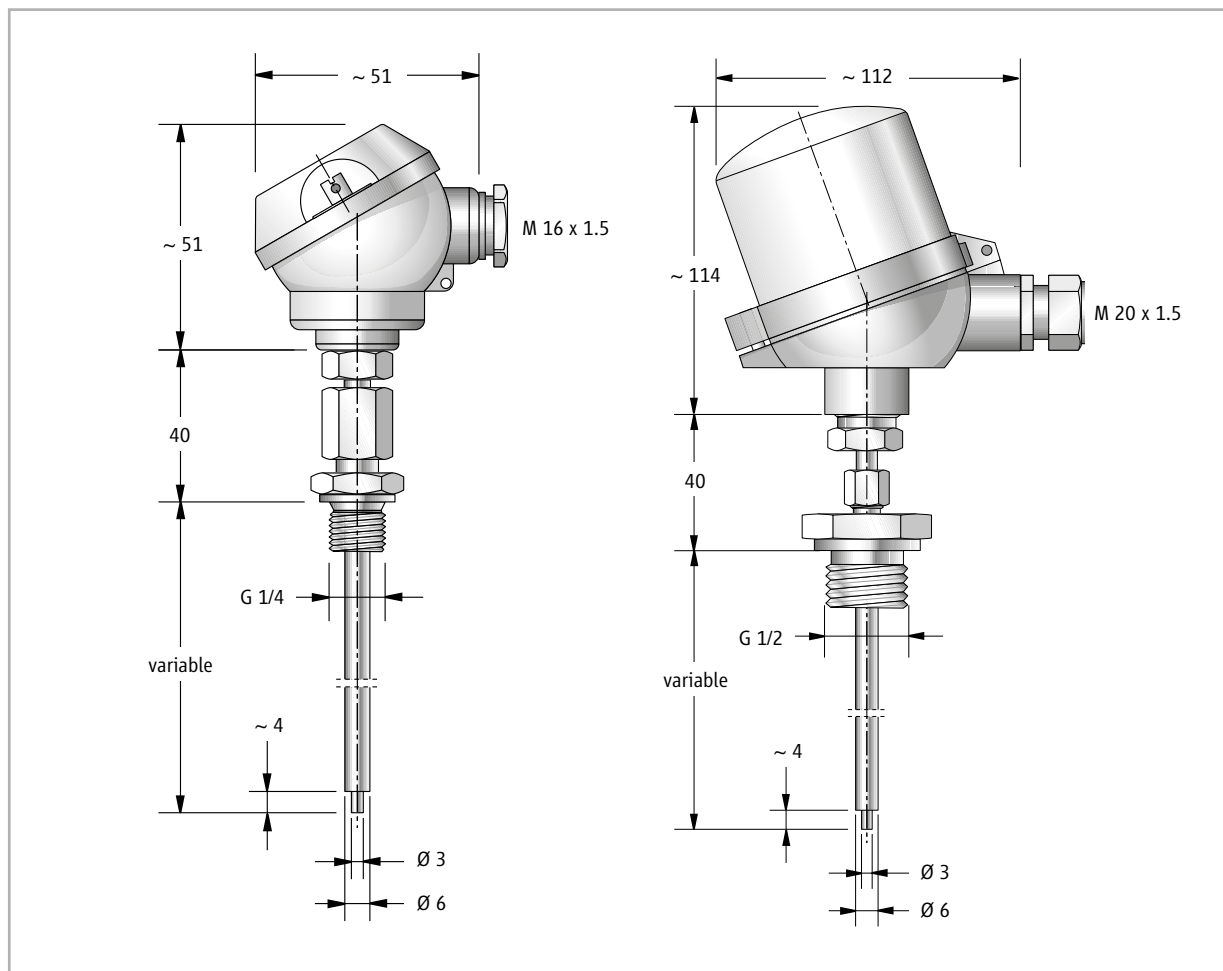
Function

The Pt100 resistance thermometer of type TR55 has been optimally designed for measuring surface temperatures with dry ambient conditions at the measuring tip. The spring-loaded, flat design of the measuring tip ensures a uniform contact pressure from the thermometer. The optimal insertion depth can be set via a threaded clamp. Optionally installed transmitters in the connection head (analogue or digital) are capable of providing a diverse range of output signals, e.g. 4 to 20 mA, HART® protocol, PROFIBUS® PA or FOUNDATION™ Fieldbus.

Model / Type

Manufacturer: WIKA Alexander Wiegand SE & Co.KG

■ TR55 resistance thermometer with spring-loaded measuring tip, mat. no. 266240XXX



Explosion protection according to Directive 94/9/EC

EC-type-examination certificate TÜV 10 ATEX 555793 X

EN 60079-0: 20096, EN 60079-11: 2007, EN 60079-26: 2007, EN 61241-11: 2006

Design

| | |
|--|--|
| Connection head: | JS, aluminium, miniature design |
| Cable outlet of the connection head: | M16 x 1.5 |
| Inner thread at the connection head: | M10 x 1.0 |
| Output signal: | Pt100 |
| Process fitting: | G 1/2 B threaded clamp, CrNi steel clamping ring |
| Thread material: | CrNi steel, 1.4571 (316 Ti) |
| Diameter of retaining pipe / sensor tip: | 6 mm / 3 mm, spring deflection of approx. 3-4 mm |
| Retaining pipe material: | CrNi steel, 1.4571 (316 Ti) |
| Casing/Pipe material: | CrNi steel, 1.4571 (316 Ti) |
| Measuring element: | Pt100, class B (IEC 60751) |
| Circuit type: | 1 x 3-conductor |

Application conditions

| | |
|--------------------|--------------------|
| Temperature range: | -200 °C to +450 °C |
|--------------------|--------------------|

Electrical data without transmitter

Type of protection intrinsic safety Ex ia IIC or ib IIC, only to be connected to a certified intrinsically safe circuit with the following associated maximum values: $U_i = \text{DC } 30 \text{ V}$; $I_i = 550 \text{ mA}$; $P_i = 1.5 \text{ W}$

Installation

The TR55 resistance thermometer is fitted to the bearing cover of the pump using an appropriate connecting piece.

Option

The TR55 resistance thermometer is optionally available with a digital temperature transmitter with HART® protocol (for mounting at head).

Model / Type

- T32.15

Explosion protection according to Directive 94/9/EC

EC-type-examination certificate BVS 08 ATEX E 019 X

EN 60079-0: 2006, EN 60079-11: 2007, EN 60079-26: 2004, EN 61241-0: 2006, EN 61241-11: 2004

Design

- Output signal: 4 to 20 mA
- Signalling according to NAMUR requirements (NE 43, NE 89)
- Rated insulation voltage of AC 1200 V between sensor and current loop
- TÜV-certified SIL version for protective devices
- developed according to IEC 61508

Electrical data

Type of protection intrinsic safety Ex ia IIC, only to be connected to a certified intrinsically safe circuit with the following associated maximum values: $U_i = \text{DC } 30 \text{ V}$; $I_i = 130 \text{ mA}$; $P_i = 800 \text{ mW}$

Trigger device for TR55 resistance thermometer

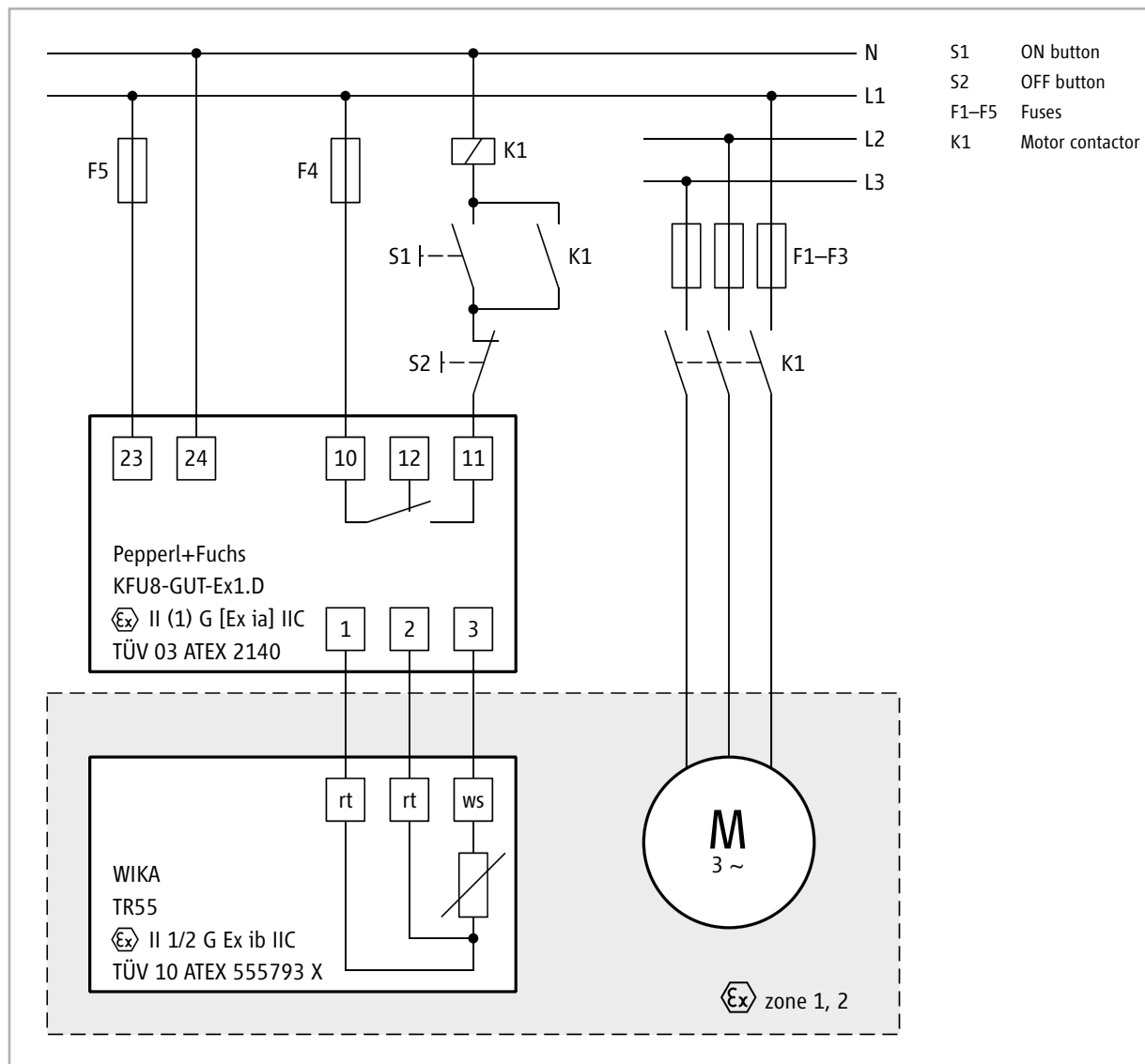
Temperature converter with trip values

Recommendation:

KFU8-GUT-Ex1.D [AC/DC wide range supply], manufacturer: Pepperl+Fuchs GmbH

KFD2-GUT-Ex1.D [24 V DC supply (Power Rail)], manufacturer: Pepperl+Fuchs GmbH

Circuit diagram



Example of connecting the TR55 resistance thermometer

3.2.2 Thermal motor protection

Function

The thermal motor protection protects the canned motor from excessive winding temperatures caused by mechanical overloading or by the failure of one or two phases. For this purpose, temperature sensors are fitted in the motor winding that have to be analysed accordingly. Either Pt100 resistance thermometers or PTC thermistors, with a nominal response temperature of 180 °C for motors of insulation class H or 210 °C for motors of insulation class C-220, are available as winding temperature sensors for canned motors. Since the temperature of the motor winding is directly monitored, this protective device is independent of the type of current and connection. Hence, along with the utilisation of the thermal motor protection, the operation of the canned motor pump in combination with a frequency converter as well as the connection to a motor stop period heater in potentially explosive atmospheres are also permissible.

Trigger device for PTC thermistors

Model / Type

Manufacturer: ZIEHL industrie-elektronik GmbH+Co KG

- PTC resistor relay of type MS 220 KA, AC 220 -240 V \pm 10 %, 50/60 Hz \leq 2 VA, mat. no. 265940700

Explosion protection according to Directive 94/9/EC

EC-type-examination certificate PTB 02 ATEX 3058

EN 61000-6-4: 2007, EN 61000-6-2: 2005, EN 60947-5-1: 2004, EN 60947-8: 2003, EN 60079-14: 2003

Installation

The device must be installed outside the hazardous area. The only action required is to connect a two-wire signal line to the PTC resistor relay.

Electrical data

| | |
|-------------------------|---------------------|
| Contact type: | 1 changeover switch |
| Max. switching voltage: | AC 415 V |
| Max. switching current: | 6 A |

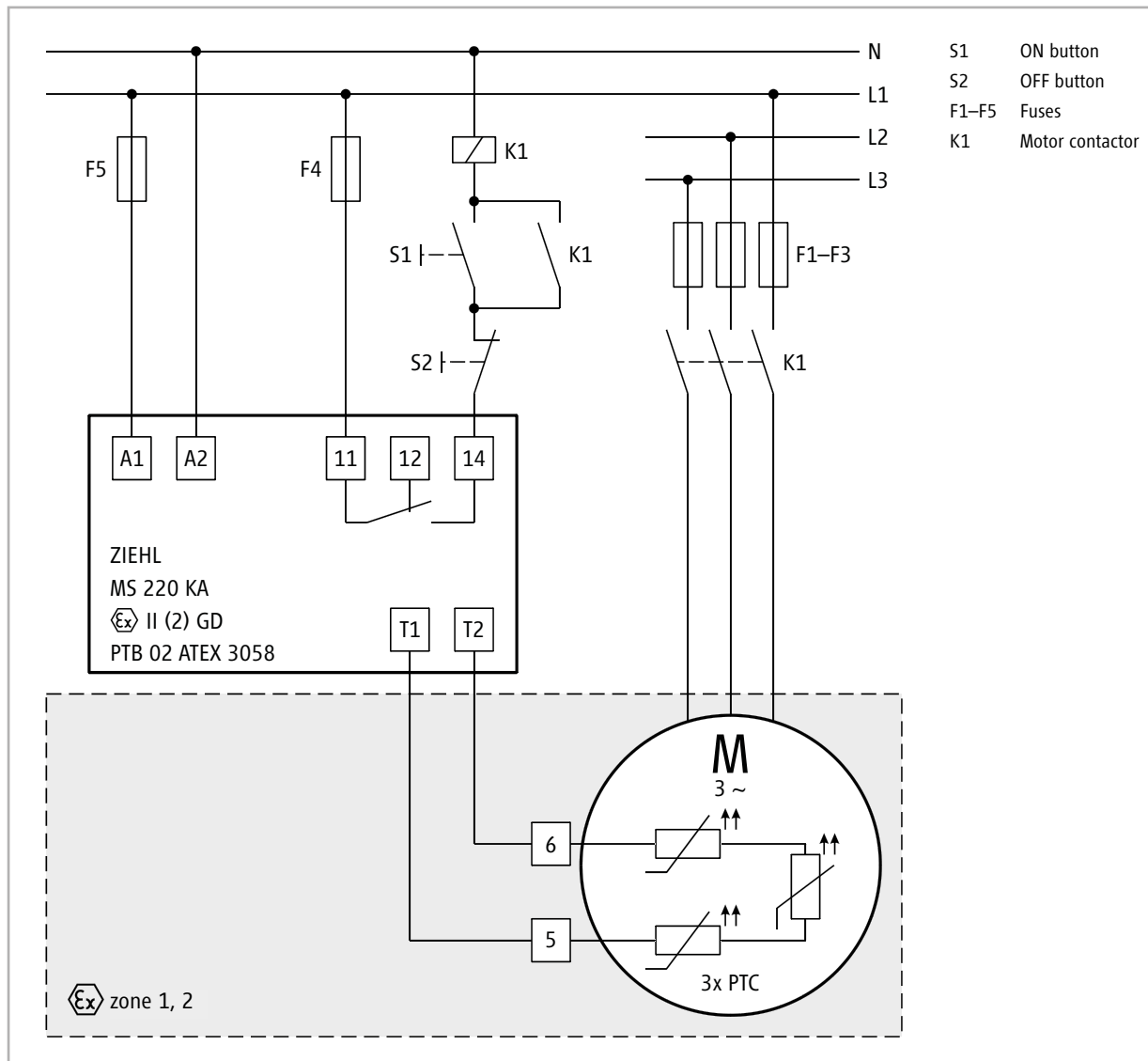
Max. cable length

1000 m for cross-sectional area of 2.5 mm²

Mechanical data

| | |
|--|---|
| Dimensions: | 75 x 22.5 x 110 mm |
| Fastening: | Attached to 35-mm standard rail in accordance with EN 50 022 or via M4 screws |
| Weight: | Approx. 150 g |
| Fitting position: | Any |
| Permissible ambient temperature range: | -20 °C to +55 °C |
| Protection rating of housing: | IP 30 |
| Protection rating of terminals: | IP 20 |

Circuit diagram



Example of connecting a triple PTC thermistor

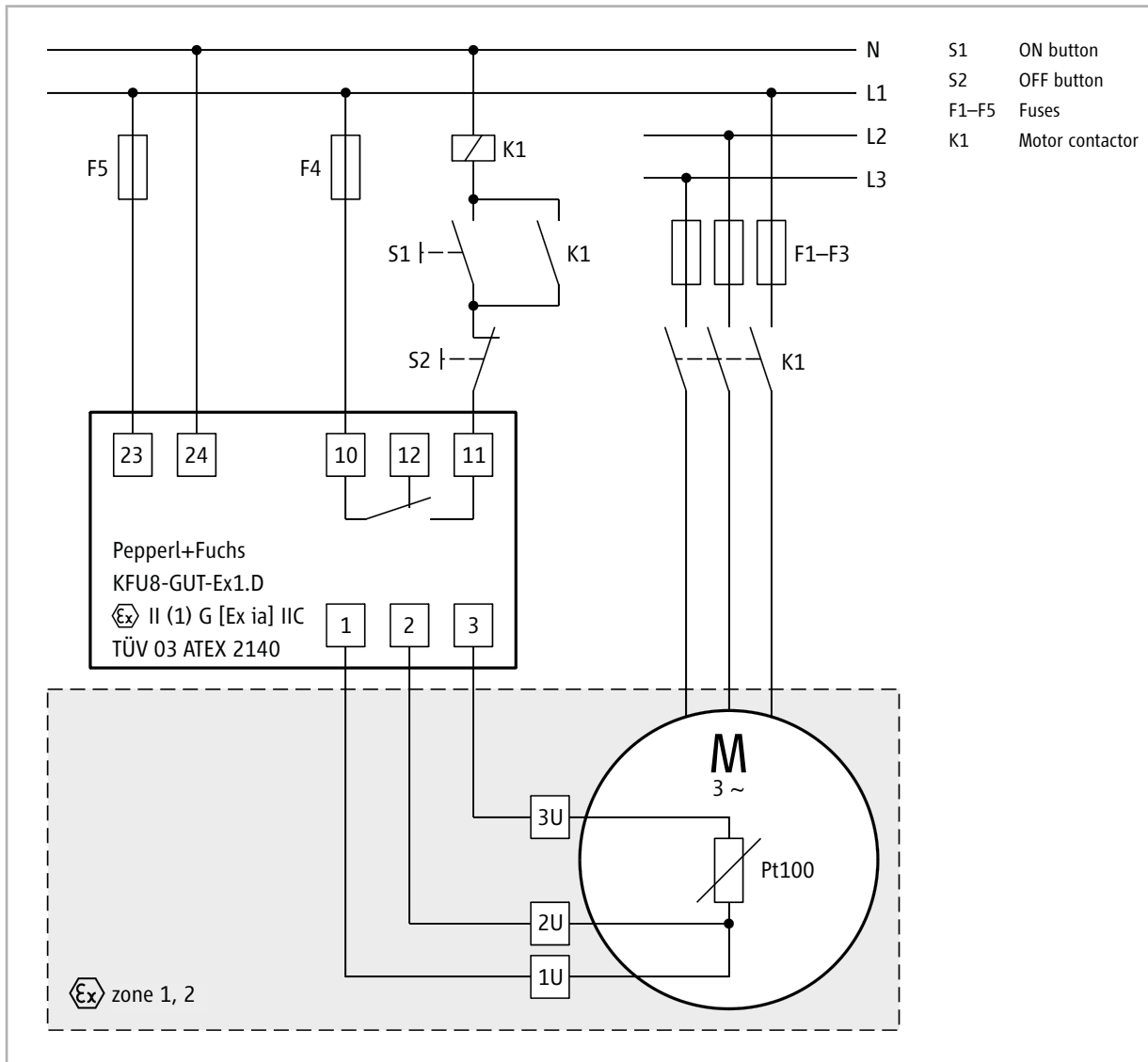
Trigger device for Pt100 resistance thermometer

Temperature converter with trip values

Recommendation:

KFU8-GUT-Ex1.D [AC/DC wide range supply], manufacturer: Pepperl+Fuchs GmbH

KFD2-GUT-Ex1.D [24 V DC supply (Power Rail)], manufacturer: Pepperl+Fuchs GmbH

Circuit diagram

Example of connecting a 3-wire Pt100 resistance thermometer (winding strand U)

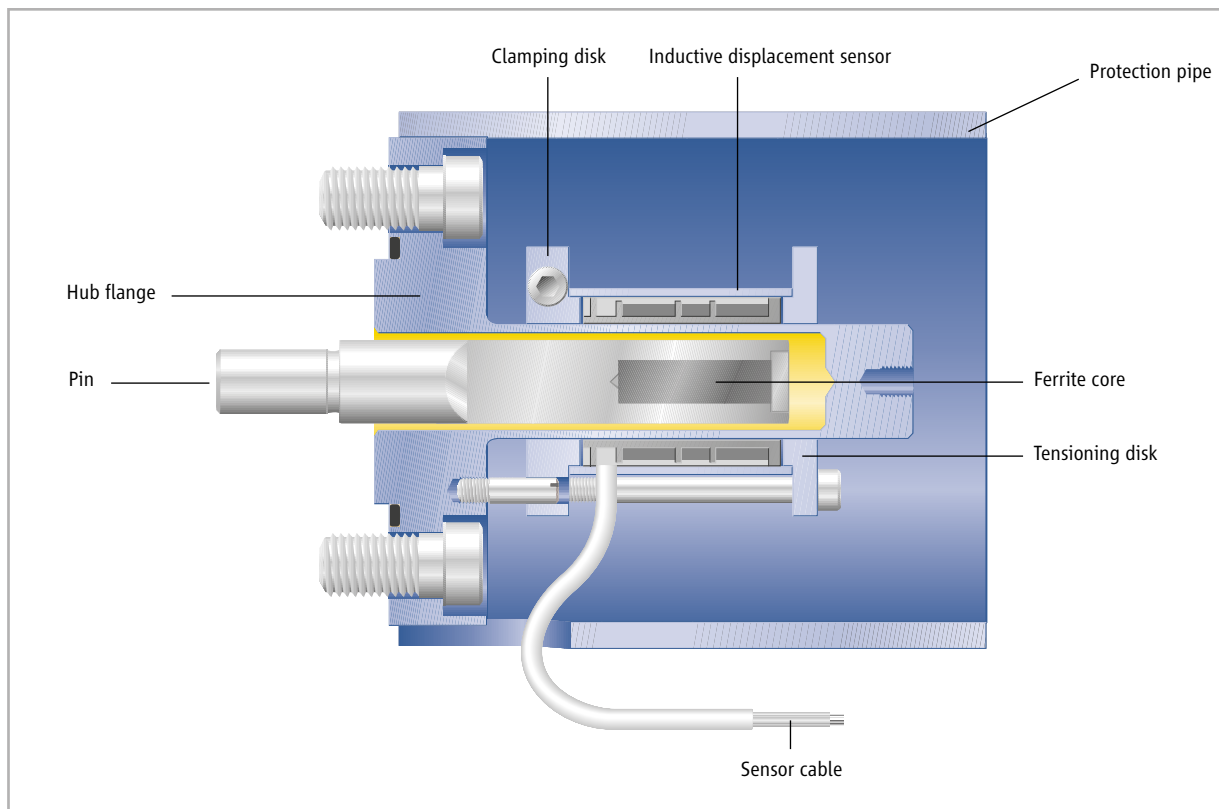
3.3 Rotor position monitoring

Function

The Monitor for Axial Position (MAP) is a contact free measuring device based on the LVDT principle for monitoring the axial shaft position of a HERMETIC pump. The MAP consists of a sensor assembly with a permanently attached sensor cable and a separate controller unit mounted in a Fibreglas reinforced polyester casing of protection type IP65. A chemically resistant pin is mounted to the shaft end of the pump rotor. The pin contains a ferromagnetic core which is hermetically enclosed by seal welding. The installed and rotating pin extends at the back end of the pump. A modified cover (hub flange) is flanged to the pump and seals the pin from the atmosphere. The sensor is mounted to this cover. This arrangement allows the contact free measurement of the axial displacement of the pump shaft to ensure that the unit remains hermetically sealed. The sensor signal is analyzed by a separate controller which is located up to 5 m (16ft) away from the pump. With the ferromagnetic core of the pin located in the center of the sensor, the MAP will have an output signal of 12 mA. The signal sensitivity is typically adjusted to 2 mA for each mm of movement. The controller contains trim pots and LEDs to adjust the output signal.

The system is characterised by the following features:

- Based on the reliable LVDT (Linear Variable Differential Transformer) displacement measuring system
- Independent of rotational speed, i.e. the device can be calibrated when pump is switched-off
- Suitable for frequency converter
- No permanent magnet that attracts ferritic particles
- Sensor and controller are separated. This allows the operation in a wider temperature range
- Easy to install and to calibrate
- Approval for use in potentially explosive atmospheres
- Materials of wetted parts: Stainless steel 1.4571 or Hastelloy C-4 2.4610
- Operating range -40°C to $+130^{\circ}\text{C}$; other temperatures possible on request



Technical data

Sensor DTA-3D-5-CR5-G-HP

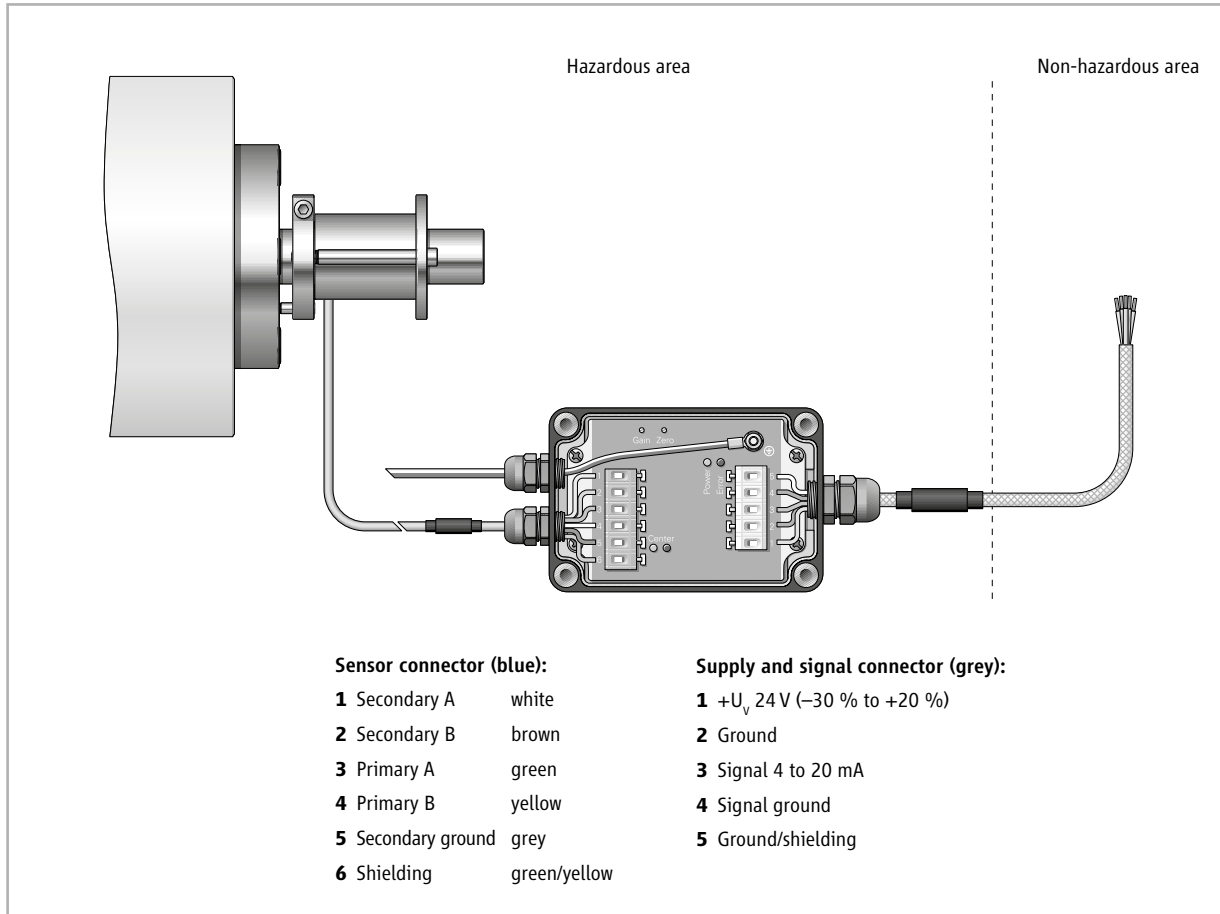
| | |
|--|--|
| Power supply ¹ : | approx. 5 m (16ft) Teflon cable 5xAWG22/7 braided wire ends with end sleeves |
| Operating temperature: | −40 °C to +130 °C (−40 °F to +266 °F) |
| Storage temperature: | −40 °C to +130 °C (−40 °F to +266 °F) |
| Humidity: | 5 - 95% (non-condensing) |
| Ambient pressure: | atmospheric pressure |
| Input voltage: | up to 10 V _{eff} |
| Frequency: | 0.2 kHz to 20 kHz |
| Resistance / Inductance (Pin in center position): | primary: 50 Ω / 7.8 mH secondary: 2 x 90 Ω / 21 mH |
| Linearity: | < 0,5 % of the measuring range at 0.5 V _{eff} / 1 kHz |
| Degree of protection: | IP 66 (DIN 40 050 / IEC 60 529) |
| Explosion protection marking: | II 2G Ex ib IIC T6 ZELM 09 ATEX 0413 X only valid in combination with appropriate MAP controller, Mat.: 266900202 |

MAP controller

| | |
|--|---|
| Measuring range: | ±3.0 mm |
| Operating temperature: | −30 °C to +70 °C (−22 °F to +158 °F) |
| Storage temperature: | −40 °C to +85 °C (−40 °F to +185 °F) |
| Humidity: | 5 - 95% (non-condensing) |
| Ambient pressure: | atmospheric pressure |
| Power supply: | DC 24 V −30% to +20% (16.8 to 28.8V) < 80 mA |
| Output signal: | 4 to 20 mA; load resistor max. 500 Ω |
| Sensor signal: | 0.5 to 0.6 V _{eff} ; 0.9 to 1.2 kHz |
| Linearity: | < 0,5% of the measuring range at 0.5 V _{eff} / 1 kHz |
| Sensor connection ¹ : | allowed ø 3.5 to 6 mm; 0.08 to 2.5 mm ² ; cage clamps |
| Grounding connection: | allowed ø 3.5 to 6 mm; 4 mm ² ; cable lug |
| Power supply and signal output connection: | allowed ø 5 to 8 mm; 0.5 to 2.5 mm ² ; cage clamps |
| Adjustment and signal components: | 2 trim pots; 4 LEDs in enclosure |
| Degree of protection: | IP 65 (DIN 40 050 / IEC 60 529) |
| Explosion protection marking: | II 2G Ex e mb [ib] IIC T6 ZELM 09 ATEX 0413 X only valid in combination with appropriate sensor DTA-3D-5-CR5-G-HP, Mat.: 264000026202 |

¹ It's not allowed to lengthen or to shorten the sensor cable.

Pin assignment



Function and warning indicators

LEDs at sensor (blue)

| | |
|------------------------|--|
| ■ green | signal below 12 mA |
| ■ red | signal above 12 mA |
| ■ red/green changeover | pin in mechanical center position (hysteresis approx. 0.06 mA) |

LEDs at supply connector (grey)

| | |
|-----------------|---|
| ■ green (Power) | supply voltage is OK |
| ■ red (Error) | supply voltage is too low or load resistor in signal circuit is too large |

Special accessories

Calibration device: For easy calibration of the MAP

Power supply unit for MAP

Model / Type

Manufacturer: PHOENIX CONTACT Deutschland GmbH

- DIN-rail power supply unit: 24 V DC; type STEP-PS/ 1AC/24DC/0.5; primary-switched; single-phase; mat. no.: 262000012

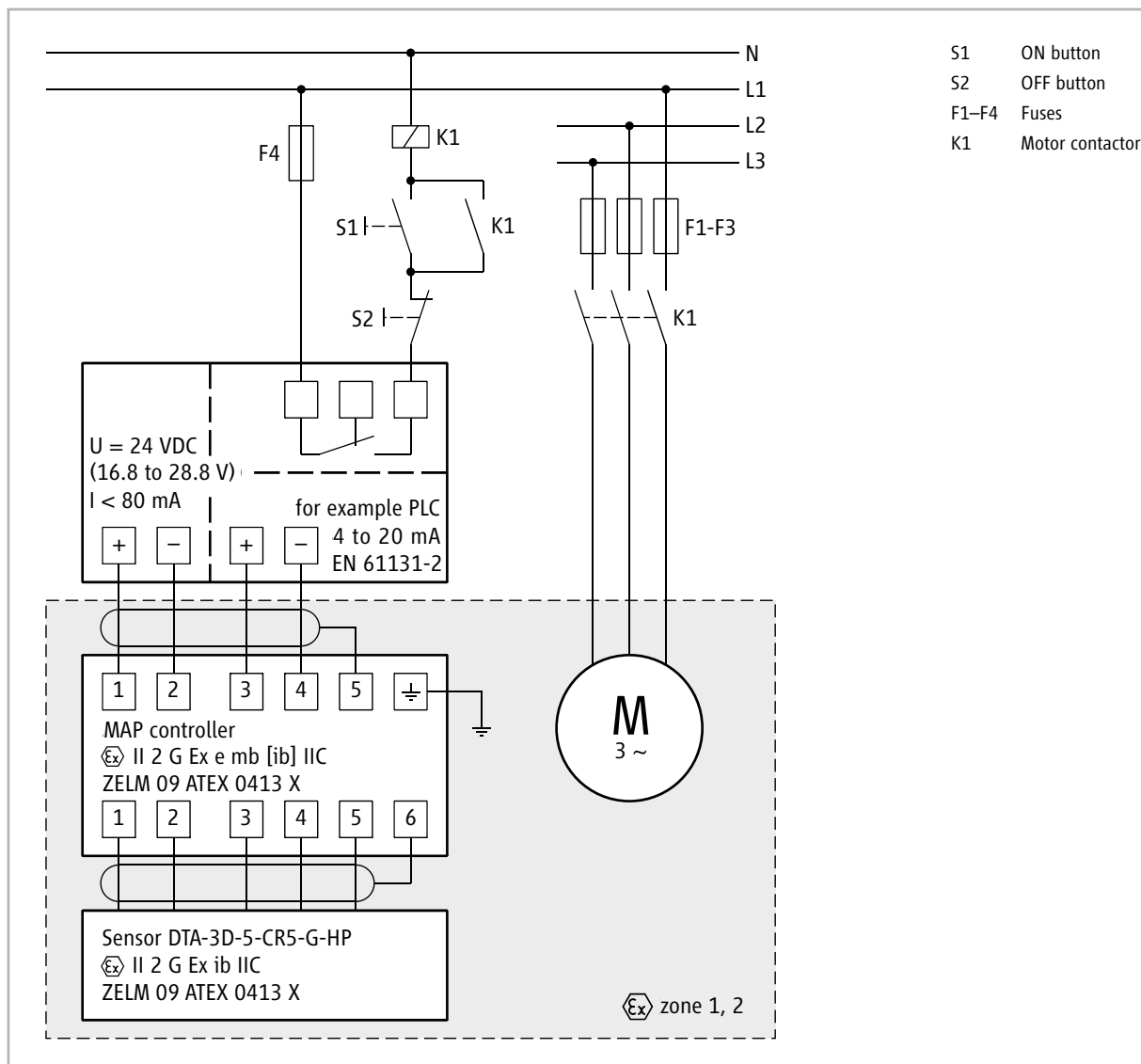
Installation

The device must be installed outside the hazardous area.

Electrical data

| | |
|----------------------|--|
| Input voltage: | 100 to 240 V AC; 50 to 60 Hz |
| Current consumption: | Approx. 0.28 A (120 V AC); approx. 0.13 A (230 V AC) |
| Output voltage: | 24 V DC $\pm 1\%$ |
| Output current: | 0.5 A; max 1 A |

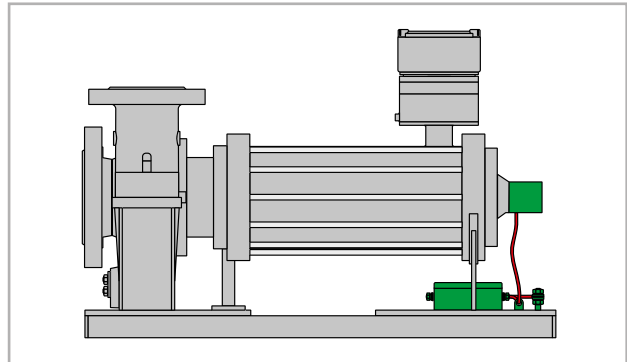
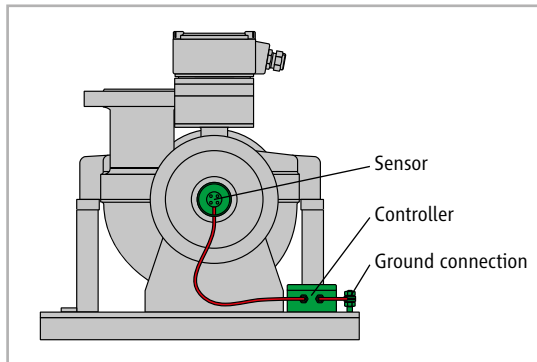
Circuit diagram



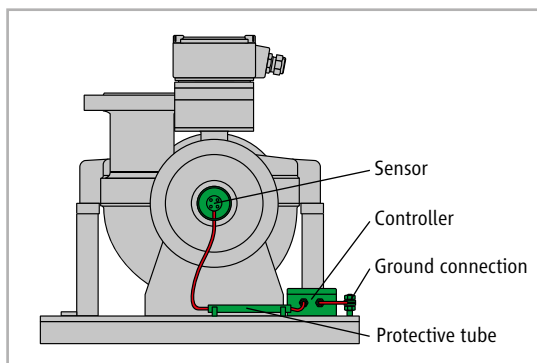
Example of connecting the MAP

Design variants in respect of MAP wiring (extra costs)

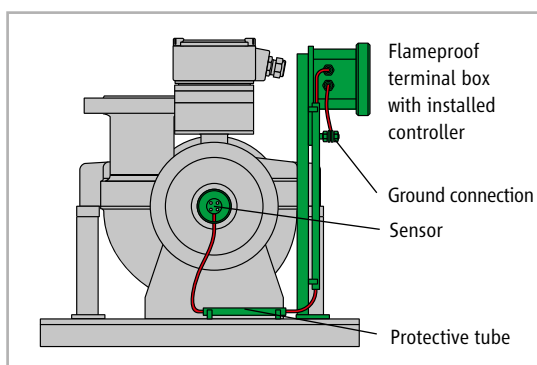
1. MAP mounted and connected to base plate (standard design)



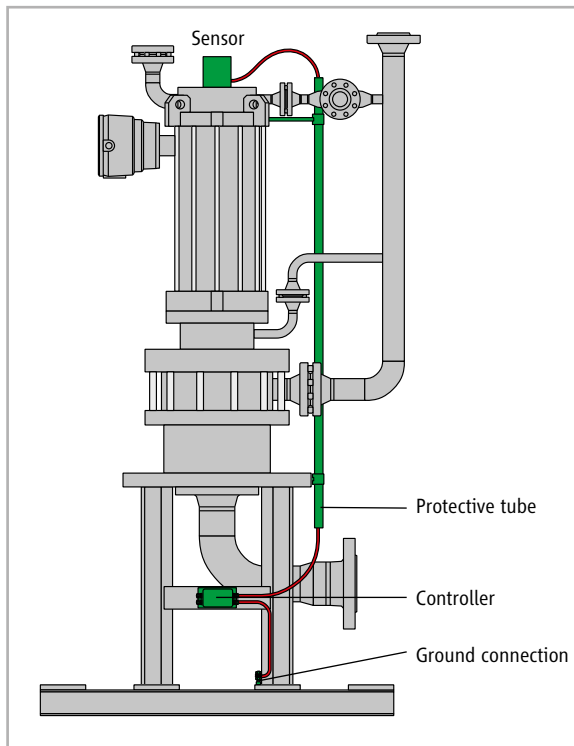
1. MAP mounted and connected to base plate with protective tube included



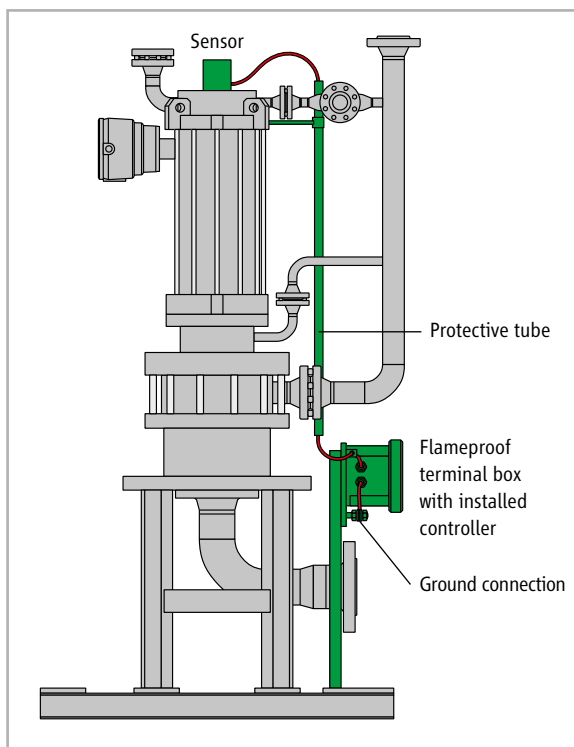
3. MAP mounted and connected in flameproof terminal box with protective tube included



4. MAP for vertical pumps mounted and connected to base frame with protective tube included



5. MAP for vertical pumps mounted and connected in flameproof terminal box with protective tube included



3.4 Rotation monitoring

There are two different versions of the device according to motor type and application conditions:

- Rotation monitor ROMi (integrated): potted module for installation in the stator chamber below the terminal box
- Rotation monitor ROME (external): DIN-rail model for installation in control cabinet

With the relay output integrated in the monitoring circuit of the pump, an immediate shut-off of the power supply is guaranteed in case of an incorrect phase sequence due to the short response time of the device.

Rotation monitor ROME, mat. no. 262000010

Rotation monitor ROME, mat. no. 262000011

- According to DIN EN 60255
- Detection of incorrect phase sequence
- No separately auxiliary voltage necessary
- Nominal voltage range 3 AC 380 to 690 V
- Suitable for frequency converter ($f = 40$ to 80 Hz)
- Output: NC contact (open at incorrect phase sequence)
- Extended temperature range
- ROMi: potted module with stranded wire connection suitable for mounting in terminal box
- Width ROME: 35 mm (1.4 in)



Technical data

Input (L1-L2-L3) (ROMi: stranded wire red-blue-grey)

| | |
|-------------------------|--|
| Nominal voltage U_N : | 3 AC 380 to 690 V |
| Voltage range: | 0.85 to 1.1 U_N (3 AC 320 to 760 V) |
| Nominal consumption: | approx. 3 VA |
| Frequency range: | 40 to 80 Hz (main frequency); suitable for frequency converter |

Output (7-8) (ROMi: stranded wire yellow-green)

| | | |
|----------------------------------|---|-------------------|
| Contact: | 1 NC contact | |
| Reaction time: | after connection of all 3 phases with wrong phase sequence until NC contact opens: approx. 100 ms | |
| Thermal current, I _{th} | | |
| ROMi: | 2 A | |
| ROME: | 5 A | |
| Switching capacity of ROMi | | |
| acc AC 15: | 1 A / AC 230 V | IEC/EN 60 947-5-1 |
| acc DC 13: | 1 A / DC 24 V | IEC/EN 60 947-5-1 |
| Switching capacity ROME | | |
| acc AC 15: | 2 A / AC 230 V | IEC/EN 60 947-5-1 |
| acc DC 13: | 2 A / DC 24 V | IEC/EN 60 947-5-1 |
| Electrical life time: | 1.5 x 10 ⁵ switching cycles | |
| Short circuit strenght | | |
| max. fuse rating | | |
| ROMi: | 2 A gL | IEC/EN 60 947-5-1 |
| ROME: | 4 A gL | IEC/EN 60 947-5-1 |
| Mechanical life time: | ≥ 30 x 10 ⁶ switching cycles | |

General data

| | | |
|---|--|-------------------|
| Operating mode: | Continuous operation | |
| Temperature range | | |
| ROMi: | −30 °C to +75 °C (−22 °F to +167 °F) | |
| ROME: | −30 °C to +70 °C (−22 °F to +158 °F) | |
| Clearance and creepage distances | | |
| Rated impulse voltage / pollution degree; | | |
| output to input: | 6 kV / 3 | IEC 60 664-1 |
| EMC | | |
| Fast transients: | 2 kV | IEC/EN 61 000-4-4 |
| Surge voltages: | 2 kV | IEC/EN 61 000-4-5 |
| Interference suppression: | Limit value, class B | EN 55 011 |
| Degree of protection | | |
| ROMi: | Potted module | |
| ROME: | Enclosure: IP 40 | EN 60 529 |
| | Terminals: IP 20 | EN 60 529 |
| Housing | | |
| ROMi: | Pottant with UL approval | |
| ROME: | Thermoplastic with V0 behaviour according to UL subject 94 | |
| Vibration resistance: | Amplitude 0.35 mm, frequency 10 Hz to 55 Hz | IEC/EN 60 068-2-6 |
| Climatic resistance: | | |
| ROMi: | 30 / 075 / 04 | IEC/EN 60 068-1 |
| ROME: | 30 / 070 / 04 | IEC/EN 60 068-1 |

Wire connection:

| | | | |
|-------|--------------------------|---|--------------------|
| ROMi: | L1; stranded wire red: | 0.5 mm ² , double insulation | |
| | L2; stranded wire blue: | 0.5 mm ² , double insulation | |
| | L3; stranded wire grey: | 0.5 mm ² , double insulation | |
| | 7; stranded wire yellow: | 0.25 mm ² , double insulation | |
| | 8; stranded wire green: | 0.25 mm ² , double insulation | |
| ROME: | | 2 x 2.5 mm ² solid | DIN 46 228 |
| | | 2 x 1.5 mm ² stranded wire with sleeve | DIN 46 228-1/-2/-3 |

Wire fixing ROME:

Flat terminals with self-lifting clamping piece

EN 60 999

Mounting ROME:

DIN-rail

IEC/EN 60 715

Weight

| | |
|-------|-------|
| ROMi: | 180 g |
| ROME: | 220 g |

Dimensions (width x height x depth)

| | |
|-------|--------------------------------------|
| ROMi: | 62 x 62 x 28 mm (2.5 x 2.5 x 1.1 in) |
| ROME: | 35 x 90 x 59 mm (1.4 x 3.5 x 2.3 in) |

Standard types

Rotation monitor ROMi (internal)

Material number: 262000010

- Output: 1 NC contact
- Nominal voltage U_N : 3 AC 380 to 690 V
- Frequency range: 40 to 80 Hz
- Width: 62 mm (2.5 in)

Rotation monitor ROME (external)

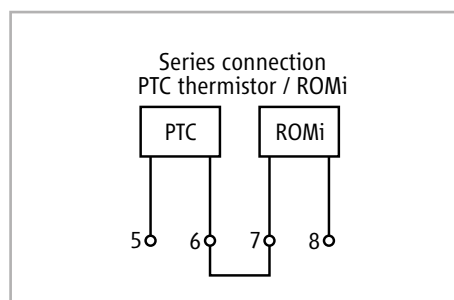
Material number: 262000011

- Output: 1 NC contact
- Nominal voltage U_N : 3 AC 380 to 690 V
- Frequency range: 40 to 80 Hz
- Width: 35 mm (1.4 in)

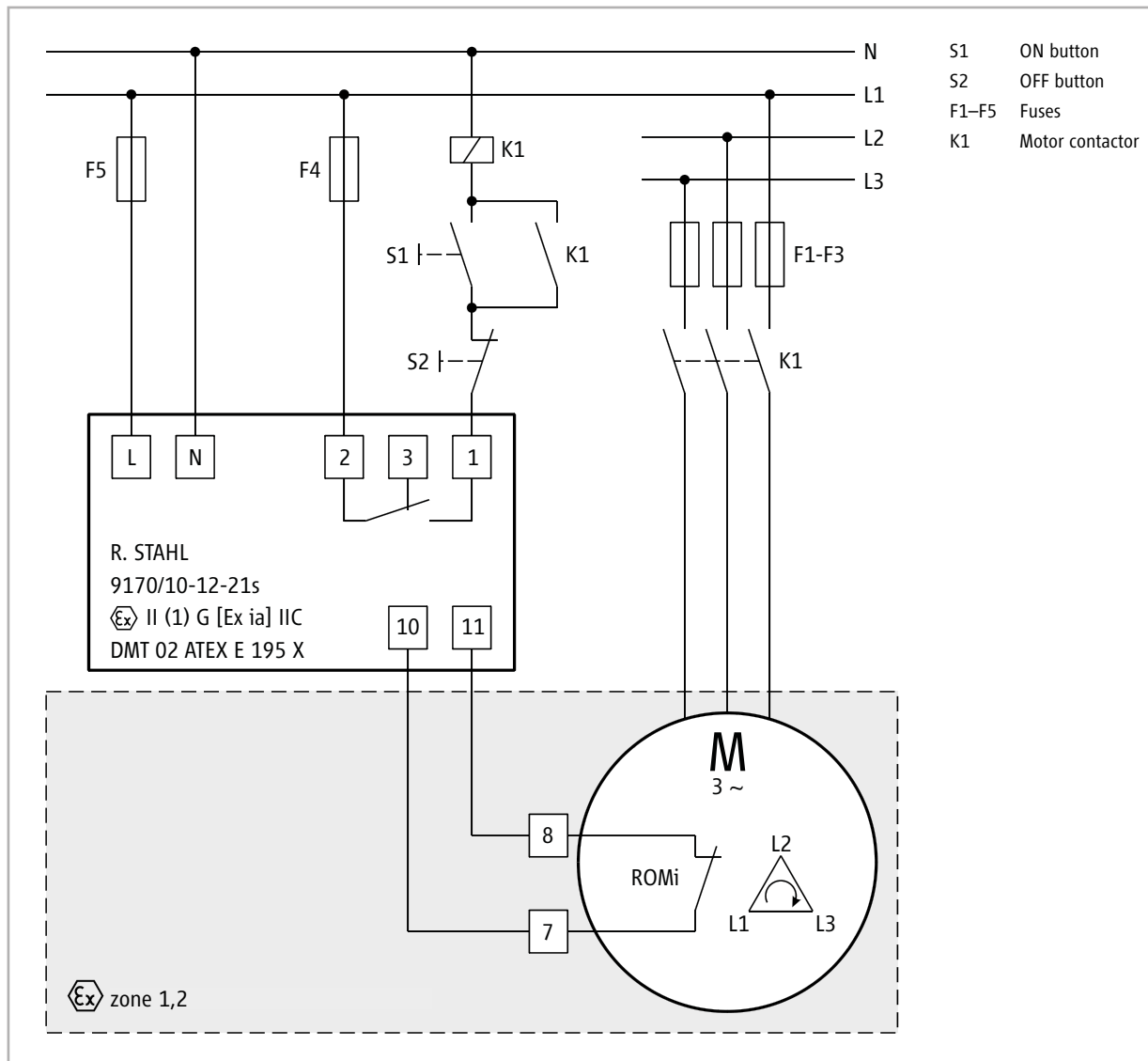
Additional information

The rotation monitor ROMi / ROME may detect a wrong sense of rotation while using a soft starter. In this case it can be necessary to bypass the output circuit (7-8) during the start up procedure of the pump.

In case the motor is additionally equipped with a PTC thermistor, the rotation monitor ROMi may be monitored separately (7-8) as well as in series with the PTC thermistor (5-8):

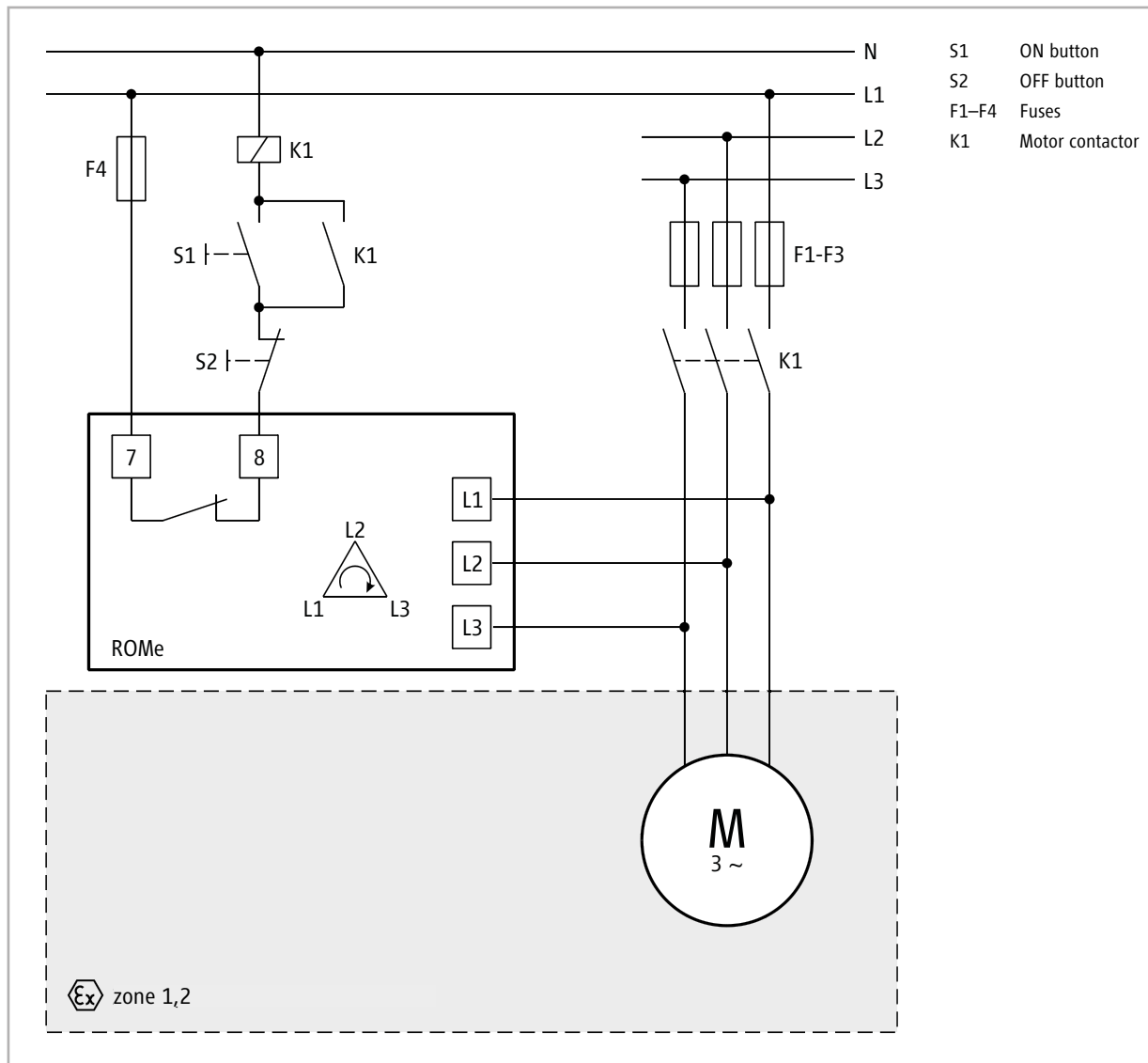


Circuit diagram



Example of connecting the ROMi

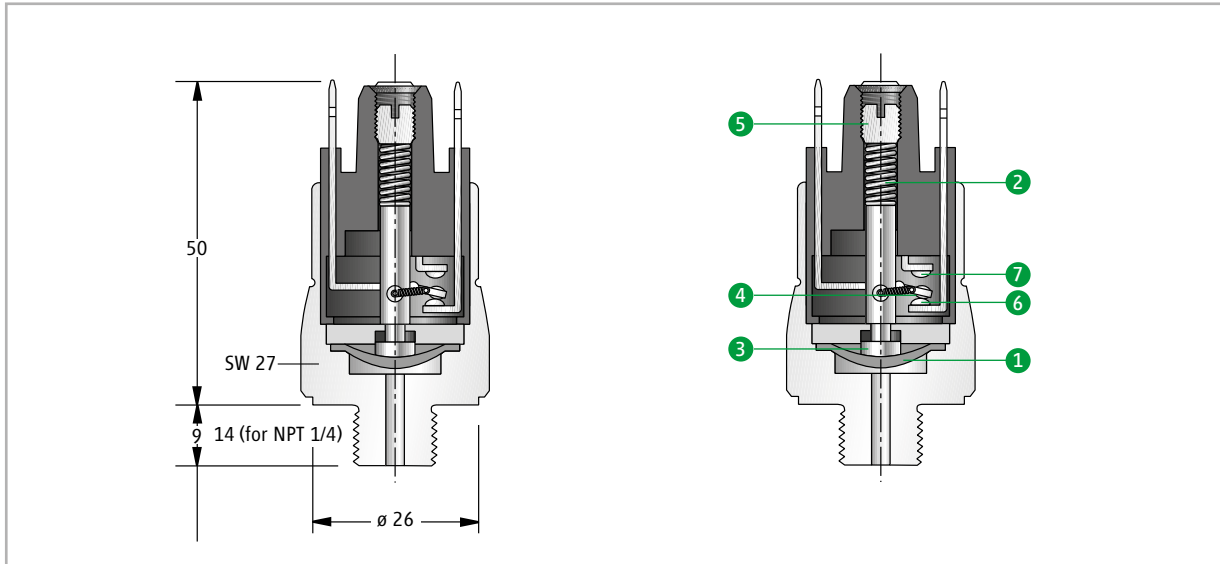
Circuit diagram



Example of connecting the ROME

3.5 Pressure monitoring

Function



If pumped liquid enters the stator chamber due to a damaged stator liner, the pressure acts on the diaphragm (1) of the installed pressure switch. If the force resulting from this pressure is greater than the force exerted by the preloaded compression spring (2), the swivel contact (4) is operated by the plunger (3). By turning the set screw (5), the pressure switch can be adjusted within its pressure range. In a depressurised state, the circuit is closed via the NC contact (6). If the applied pressure exceeds the set switching pressure, the swivel contact is flipped and the circuit closed via the NO contact (7).

Model / Type

Manufacturer: SUCO Robert Scheuffele GmbH & Co. KG

■ Diaphragm pressure switch, SW 27, 24 V DC; type: 0190-458 03-X-XXX

Technical data

| | |
|------------------------|--|
| Setting range: | 1 to 10 bar |
| Tolerance: | 0.5 bar |
| p_{max} : | 300 bar |
| Thread: | G 1/4 |
| Material: | Zinc-plated steel |
| Diaphragm: | EPDM or silicone |
| Operating temperature: | -30 °C to +120 °C (EPDM) or -40 °C to +120 °C (silicone) |
| Degree of protection: | IP65 |
| Switch: | Pressure- and vacuum-tight |
| Voltage: | 24 V DC |
| Max. current: | 50 mA |
| Contact configuration: | Changeover switch; connected as NC contact by default |

Convincing service.

Important features are readiness, mobility, flexibility, availability and reliability. Our aim is to guarantee the maximum availability and performance of your pump.

Installation and commissioning

- service effected on site by own service technicians

Spare part servicing

- prompt and longstanding availability
- consulting service on customized spare part stockkeeping

Repair and maintenance

- professional repairs including test run executed in our headquarter
- or executed by one of our service centers worldwide

Retrofit

- retrofit of your centrifugal pumps by installing a canned motor to comply with the requirements of the IPPC Directive

Maintenance and service agreement

- individually developed concepts to increase the availability of your production facilities

Training and workshops

- Additional qualification of your staff to ensure your production

Among others, our products comply with:

- Directive 2006/42/EC (Machinery Directive)
- Explosion protection acc. to Directive 94/9/EC (ATEX); UL; KOSHA; NEPSI; CQST; CSA; GOST; GOST R
- Directive 96/61/EC (IPPC Directive)
- Directive 1999/13/EC (VOC Directive)
- TA-Luft
- RCC-M, Niveau 1, 2, 3

HERMETIC-Pumpen GmbH

is certified acc. to:

- ISO 9001:2008
- Directive 94/9/EC
- GOST R; Rostekhnadzor
- AD 2000 HP 0; Directive 97/23/EC
- DIN EN ISO 3834-2
- KTA 1401; AVS D 100 / 50; IAEA 50-C-Q
- Certified company acc. to § 19 I WH