Operating / Installation Instructions

mag - safe

No. 84.SE.011/E6.02.17

Valid as from serial no.: MS 14053
Transmitter: Baumer Flex Top 2211

Original Manual

DICKOW PUMPEN

LLOYD'S REGISTER · LRQA
ISO 9001
UKAS MANAGEMENT SYSTEMS
001

CONTENTS

1. SAFETY

1.1 General

The mag-safe is manufactured according to the state-of-the-art-technology, and is safe to operate. The mag-safe has been tested and left the factory in safe condition. In order to maintain this condition for the period of operation, the operating manual, the applicable documentation and certificates must be observed.

The general safety regulations must be strictly complied with when operating the mag-safe.

Only consideration of all safety instructions allows optimal protection of personnel and the environment from harm and assures safe, trouble-free operation of the mag-safe.

1.2 Application range

The mag-safe can safely be used in explosive zones 1 and 2 as a component of intrinsically safe circuits.

1.3 Technical limit values

The mag-safe is specified for use exclusively within the values stipulated on the type plate and in the technical data. These must be maintained accordingly, e.g.:

- The operating temperature must not exceed allowable limits.
- The ambient temperature must not exceed allowable limits.
- The casing protection class must be conform to the specific use.
- The technical data relating to explosion protection must be observed.

1.4 Warranty

Use other than for the intended purpose, failure to observe these instructions, assignment of unqualified personnel, or any unauthorised modification, will exclude the manufacturer's liability for resultant claims. The manufacturer's warranty will thereby be voided.

1.5 Explanation of symbols and notices

This symbol will be found in this manual adjacent to all notices concerning operational safety, where risks to the health and life of personnel may be posed.

Attention !

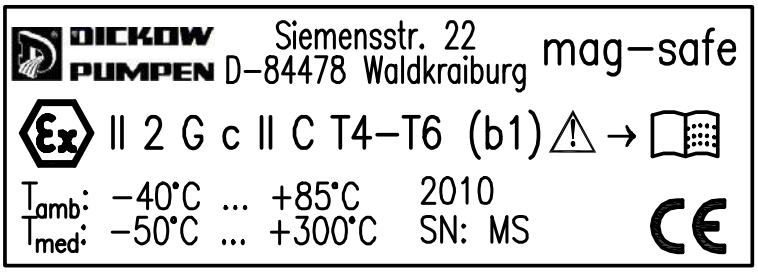
Points marked with ATTENTION must be followed in order to avoid damage and destruction of this device.

This symbol will be found in this manual adjacent to all notices concerning explosion protection.

1.6 Name tag

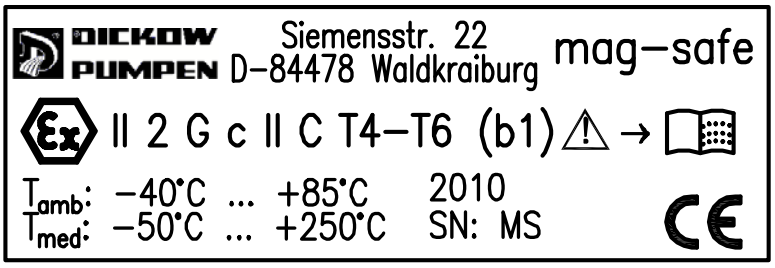
The name tag is printed on a base film with a protective laminate. The durability of the labelling has been tested according to EN 61010-1.

1.6.1 Standard



Consider the impact of ambient temperature on the temperature class as per chapter 9.1 !

1.6.2 Hybrid



Consider the impact of ambient temperature on the temperature class as per chapter 9.1 !

1.7 Duties of the operator

The operator must observe the national regulations regarding installation, functional testing, repair and maintenance of electrical equipment.

1.8 Personnel qualification

Installation, commissioning and servicing of the mag-safe must be performed only by trained staff authorised by the plant operator. The trained staff must have read and understood this manual, and strictly follow its instructions.

1.9 Return

When returning the mag-safe for repair, use the original packing or a suitable box safe for transport.

According to the EU Hazardous Substances Directive, the owners of special waste items are responsible for their disposal. They must ensure that all units returned to Dickow Pumpen KG are cleaned of any hazardous substances such as acids, caustics, solvents, etc.

1.10 Safety instructions for transportation

- The mag-safe must not be exposed to any moisture during transportation, and should be packed accordingly.
- The mag-safe should be suitably packed, such as in bubble-wrap, to protect it from shock impact during transportation.

Inspect the mag-safe prior to installation for possible damage caused by improper handling. Note any damage on the shipping documents. File any claims with the transport company immediately, and prior to installation.

1.11 Safety instructions for electrical installation

Electrical connections must be made only by authorised staff, according to the wiring diagram.

The instructions in this manual concerning electrical connection must be observed, otherwise the electrical protection rating may be impaired.

Safe isolation of circuits at risk of touch contact can only be guaranteed if the connected devices fulfil the requirements of VDE 0106 part 101 (Basic requirements for safe isolation).

To ensure safe isolation, lay the supply line separately from circuits at risk of touch contact, or provide additional insulation of it.

1.12 Safety instructions for operation

Before switching on, make sure the ambient conditions specified in the "Technical data" chapter are met, and that the power supply voltage matches the voltage of the transmitter.

If it is to be assumed that safe operation is no longer ensured, switch off the mag-safe and secure it against unintentional restarting.

1.13 Safety instructions for inspection and maintenance

When the casing cover is open, protection against electromagnetic interference and touch contact is disabled. Circuits at risk of touch contact are located inside the casing.
So the auxiliary energy must be switched off before opening the casing cover.

Repair work must be performed only by trained personnel.

1.14 Functional safety

The transmitter used has no Safety Integrity Level. The following parameters have been calculated:

- MTBF = 302 years; annual failure rate = 0.3307 %
- MTTF = 66 years

A feasible way to measure the quality of execution of shutdown is the classification of the monitoring system to avoid an ignition source according to TRGS 725 table 8 (zone 1; expected failure). The monitoring requirement is defined as classification level K1. Based on table 10 of TRGS 725, this dictates a Safety Integrity Level SIL1. The circuit and control system must be equipped accordingly.

To calculate the PFD values of the overall arrangement, the sensor must be exempted and the typical parameter of 25% of the target PFD value suggested by EN 61511 assigned to it.
To maintain the classification level, an annual recurrent test according to chapters 7.2.1 and 7.2.2 is required. The pre-set switch-off temperature must be checked according to chapter 6.3.

2. APPLICATION IN EXPLOSION-PROOF AREAS

Attention! Installation must be performed according to the manufacturer's instructions and the applicable standards and rules.
Commissioning and operation must be in compliance with EU Directive 99/92/EC and with BetrSichV (German plant safety regulations) and EN60079-14 (Electrical apparatus for explosive gas atmospheres – Electrical installations in hazardous areas).

2.1 Degree of protection

The connecting parts of the mag-safe must be installed such that at least the degree of protection of the applied ignition protection class is reached.

2.2 Electrostatic charge

In applications in explosive areas, it must be ensured that impermissible electrostatic charging of the mag-safe is avoided.

2.3 Earthing

The mag-safe is earthed by its positive pole via the pump casing. No separate earthing is required.

2.4 Interconnection

If the mag-safe is operated in an intrinsically safe circuit, proof of the intrinsic safety of the interconnection must be provided according to DIN VDE 0165/08.98 (= EN 60 079-14/1997 as well as IEC 60 079-14/1996) Intrinsically safe circuits fundamentally require verification of interconnection.

3. FUNCTION AND DESIGN

3.1 Function

The mag-safe is a monitoring system developed for magnetic pumps with metal containment shells. Malfunctions and operating errors causing a temperature rise on the containment shell surface will be detected promptly, and consequential damage will be avoided.

The mag-safe is sufficient as a stand-alone monitor for all pump problems and conditions set out in the table below, and also provides run-dry protection of unprimed pumps.

Refer to the table below:

PROBLEM	SYMPTOMS	EFFECTS	Protection by mag-safe
Running dry	Temperature rise, hot containment shell surface	Damage to sleeve bearings, demagnetisation of magnetic coupling	Alarm and immediate shut-off if the allowable temperature limit is exceeded (see chapter 6.2)
Closed discharge valve, clogged circulation channels, operation below minimum flow		Volatile media: Vaporisation of medium in sleeve bearing area, failure of bearings due to running dry Non-volatile media: Demagnetisation of magnets due to overheating	
Decoupled magnets			
Running dry due to exceeding boiling point in containment shell area		Vaporisation of medium in sleeve bearing area, failure of bearings due to running dry	
Solids deposits between rotor and containment shell		Destruction of the containment shell, leakage	
Ejected anti-friction bearings	Increased vibration and noise	Destruction of the containment shell due to contact of the drive rotor	Shut-off by destroying connection wire

The mag-safe is particularly recommended for handling boiling media, for media which tend to polymerise if a certain temperature is exceeded, and for applications with no continuous monitoring of anti-friction bearings.

Attention! The mag-safe is not a standardised thermocouple.

The transmitter converts the voltage signal coming from the measuring element into a 4 … 20 mA current signal, which is evaluated in the safe area for monitoring purposes.

3.2 Temperature/voltage output signal

3.2.1 Standard

Temperature [°C]	Input [mV] *	Output [mA]	Temperature [°C]	Input [mV] *	Output [mA]
-50	-3.150	4.00	160	6.300	13.60
-40	-2.700	4.46	170	6.750	14.06
-30	-2.250	4.91	180	7.200	14.52
-20	-1.800	5.37	190	7.650	14.97
-10	-1.350	5.83	200	8.100	15.43
0	-0.900	6.29	210	8.550	15.89
10	-0.450	6.74	220	9.000	16.34
20	0.000	7.20	230	9.450	16.80
30	0.450	7.66	240	9.900	17.26
40	0.900	8.12	250	10.350	17.72
50	1.350	8.57	260	10.800	18.17
60	1.800	9.03	270	11.250	18.63
70	2.250	9.49	280	11.700	19.09
80	2.700	9.94	290	12.150	19.54
90	3.150	10.40	300	12.600	20.00
100	3.600	10.86	260	10.800	18.17
110	4.050	11.32	270	11.250	18.63
120	4.500	11.77	280	11.700	19.09
130	4.950	12.23	290	12.150	19.54
140	5.400	12.69	300	12.600	20.00
150	5.850	13.14			

* At 20°C on the transmitter terminals

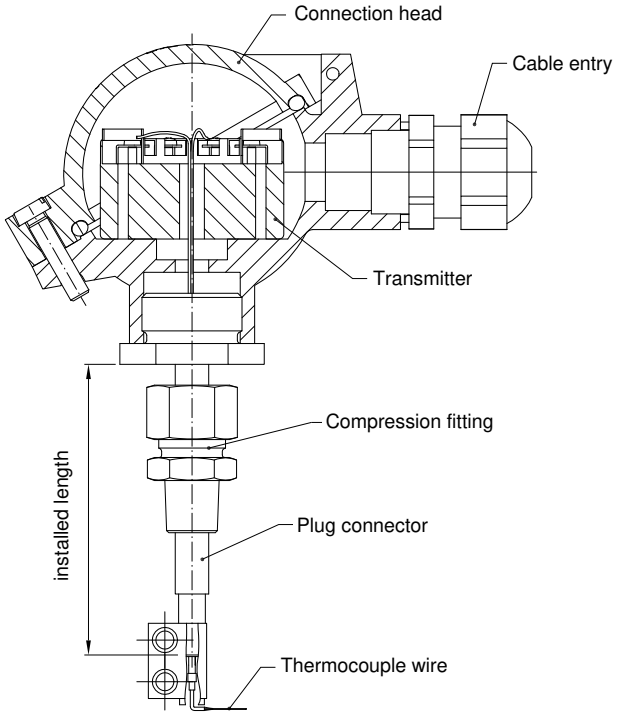
3.2.2 Hybrid

Temperature [°C]	Input [mV] *	Output [mA]	Temperature [°C]	Input [mV] *	Output [mA]
-50	-1.603	4.00	100	1.832	12.00
-40	-1.374	4.53	110	2.061	12.53
-30	-1.145	5.07	120	2.29	13.07
-20	-0.916	5.60	130	2.519	13.60
-10	-0.687	6.13	140	2.748	14.13
0	-0.458	6.67	150	2.977	14.67
10	-0.229	7.20	160	3.206	15.20
20	0	7.73	170	3.435	15.73
30	0.229	8.27	180	3.664	16.27
40	0.458	8.80	190	3.893	16.80
50	0.687	9.33	200	4.122	17.33
60	0.916	9.87	210	4.351	17.87
70	1.145	10.40	220	4.58	18.40
80	1.374	10.93	230	4.809	18.93
90	1.603	11.47	240	5.038	19.47
			250	5.267	20.00

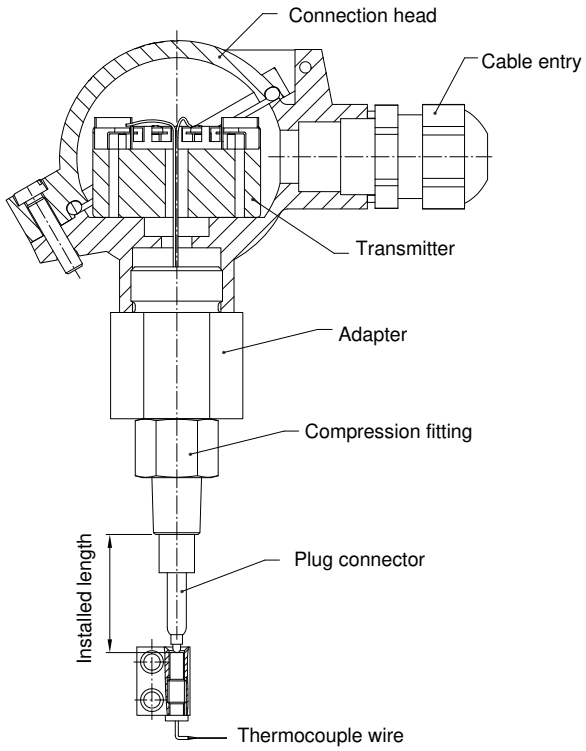
3.3 Design

3.3.1 mag-safe

Standard



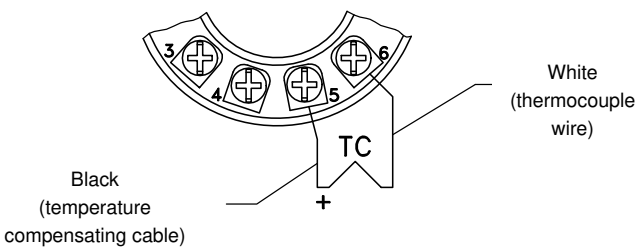
Hybrid



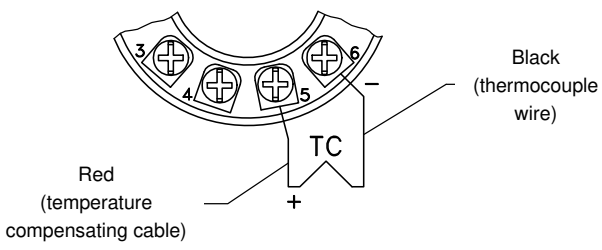
The hybrid design is intended to replace existing mag-safe units delivered before 2010, and for pumps prepared with mag-safe connections at that time.
The two designs are not interchangeable because the plug connectors and thermocouple wires are different.
The standard connection head is connected to the hybrid design by an additional adapter.

3.3.2 Connection of thermocouple

Standard



Hybrid



The thermocouple is wired at the factory, and shipped fully functional.

Attention! Red coloured seals ensure protection against unauthorised release.

3.4 Connection variants

3.4.1 Standard

mag-safe variant	Bearing support	Installed length [mm]	NPT connection
1V	0 / I / II	70	¼
2V	III / IV	135	¼
3V	200 / 500	200	¼

3.4.2 Hybrid

mag-safe hybrid variant	Bearing support	Installed length [mm] from bottom edge of NPT thread	NPT connection
1V	0 / I / II	45	¼
1V/V*	26/210 heated	45	¼
2V	III / IV	55	¼
2V/V*	III / IV impeller Ø > 320	55	¼

* With extension

4. MOUNTING ON THE PUMP

4.1 General

Attention!

Damage to components such as casings, threads, cable glands or seals will disable the IP protection rating of the mag-safe!
Install current signal lines and connection points correctly. When changing cable glands, pay attention to the relevant IP protection class and Ex approval.

Standard:

- Screw the bottom part of the compression fitting into the pump casing. Torque = 20 Nm.
- Lock the plug connector into the connecting block at the containment shell flange.
- Fasten the clamping ring. Torque = 25 Nm.

Hybrid:

- Fit the plug connector into the connecting block at the containment shell flange.
- Screw the mag-safe hybrid into the pump casing.
  Torque = 20 Nm.
  Use a size 19 open-end wrench.

4.2 Installation in explosive areas

Temperature rise caused by heat supply or heat accumulation must be avoided, such as by ensuring sufficient clearance from hot plant components and by thermal insulation. Heat dissipation must be ensured by unhindered air circulation.

Assembly and disassembly may only be performed by trained personnel having knowledge about the concept of the respective ignition protection classes. Appropriate measures must be provided to maintain the Ex temperature classes.

The EC type examination certificates applicable for the individual components are part of this manual, and must be stringently observed.

The mag-safe must be earthed via the pump casing.

4.3 Disassembly

- Comply with the relevant health and safety and accident prevention regulations.
- The current signal lines must be disconnected for disassembly. Appropriate measures must be taken to prevent unintentional restarting when the mag-safe is open.

Attention!
- No components must be damaged during disassembly. Damaged parts must be replaced.

The cover may be opened only when the power supply is disconnected.

Depending on the installed electrical components and on the operating situation (malfunctions etc.), an adequate time for electrical discharge and cooling must be waited before opening the cover.

5. ELECTRICAL CONNECTION

5.1 General

Electrical installation must comply with the relevant standards and regulations. Connections may be made only when the power supply is disconnected!

Attention!
- Electrical connection is carried out when the mag-safe is installed.
  The wires of the current signal line should be fitted with ferrules.
- Since the mag-safe has no switch-off device, overcurrent protectors, a lightning arrestor and mains power disconnect facilities must be provided on the plant.
- The diameter of the current signal line must match the cable entry at the connection head. Clamping range 6 … 13 mm. The torque for the cap nut is 5 Nm.
- The maximum wire cross-section for connections is 1.5 mm^2 (AWG14). The combination Phillips screws of the connecting terminals at the transmitter are tightened with a torque of 1.2 Nm.
- Comply with the specified switching mode (refer to chapter 9).

5.2 Cables and wires

- Use only insulated cables and wires with a minimum phase-to-earth, cable-to-screen and screen-to-earth test voltage of 500 V AC.
- Thin wires should be fitted with ferrules.
- The cables used must meet the requirements for the particular application in terms of withstand capability and temperature.
- The electrical wiring must be laid so as to rule out the possibility of mechanical damage.
- The cables must be suitable for use in Exi circuits according to EN 60079-14.
- Comply with the maximum cable length according to the transmitter operating manual.

The maximum cable length is dictated by the resistance, inductance and capacitance of the cable. The total capacitance and inductance of the cable must be within the limits set out in the EC type examination certificate.

5.3 Electrical connection in explosive areas

Electrical connection may only be performed by trained personnel having knowledge about the concept of the respective Ex ignition protection classes. Appropriate measures must be provided to maintain the Ex temperature classes.

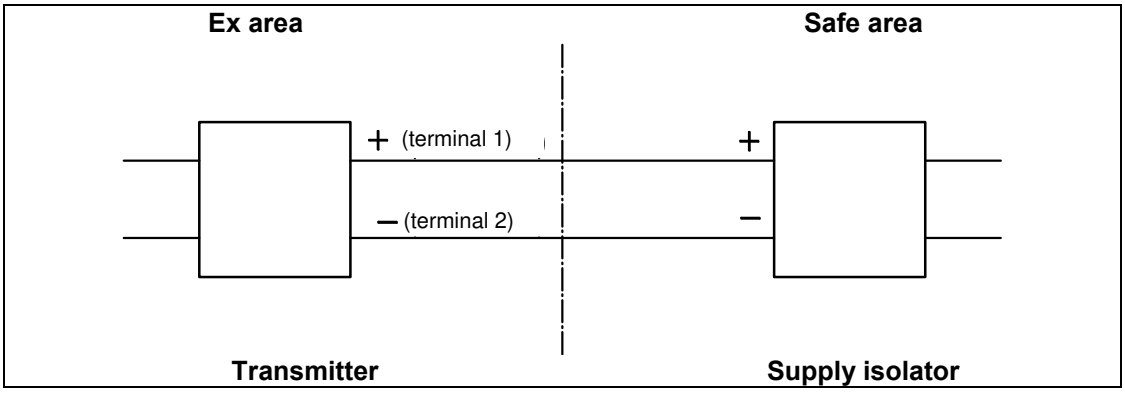
The EC type examination certificates applicable for the individual devices are part of this manual, and must be stringently observed.

The mag-safe must be earthed via the pump casing.

5.4 Electrical interconnection in explosive areas

The supply isolators must have adequate input circuits in order to rule out hazards (sparking). An analysis of the interconnection configuration must be carried out. Proof of intrinsic safety must be based on the electrical limit values stated in the type examination certificates of the individual devices, including the capacitance and inductance values of the wiring. Intrinsic safety is proven when a comparison of the limit values of the devices fulfils the following conditions:

Transmitter (intrinsically safe device)		**Supply isolator (associated device)**
U_i	≥	U_o
I_i	≥	I_o
P_i	≥	P_o
$L_i + L_c$ (wire)	≤	L_o
$C_i + C_c$ (wire)	≤	C_o



5.5 EMC wiring

The transmitter is powered via the current signal line. Screened cables are not imperative for analogue transmitters, but screened and twisted cables provide the best results. Unscreened cables must not be laid near strong fields.
The system must be earthed at one point.

5.6 Terminal connection

1. The power supply must be disconnected when making electrical connections.
2. Open the connection head.

Do not open the connection head in explosive areas when the power is connected. Wait the cooling time.

3. Connect the positive wire to terminal 1 on the transmitter (+) and the negative wire to terminal 2 (-).
4. Tighten the screws with a torque of 1.2 Nm.
5. After connecting, fasten the cheese-head screw of the connection head using a suitable tool. The O-ring and the sealing surface must be clean and undamaged.
6. Screw the cable gland to the connection head with a torque of 8 Nm. Feed the cable through the cap nut and fitting. Close the cable entry and tighten the cap nut with a torque of 8 Nm.

Refer to the supplied operating instructions for the cable entry.

5.7 Switching mode

Attention! The sum of applied voltage must not exceed 30 V. The sum of applied currents must not exceed 32 mA.

5.8 Potential equalisation

The mag-safe must be earthed via the pump casing, giving due consideration to the pump location.

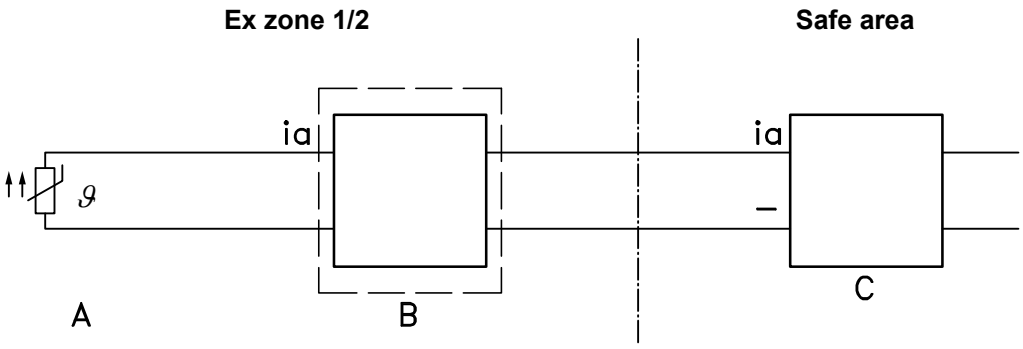
5.9 Interconnection

For interconnection of the transmitter and supply isolator, refer to the relevant operating manuals of those devices.

Attention! Refer to chapters 8.1, 8.6 and 9 !!

5.9.1 Intrinsic safety

For this instrumentation, it must be assured that power is only supplied via an approved intrinsically safe circuit. The electrical and technical parameters must not be exceeded. Refer to chapter 9.



A Temperature probe
B Exia transmitter in connection head
C Exia supply isolator

6. START-UP

6.1 General

The following must be checked prior to start-up:

- Compliance of the electrical data with the specified Ex-related values.
- Electrical connection and assembly must have been performed according to the "Installation" and "Electrical connection" chapters.

Comply with the relevant health and safety and accident prevention regulations.

- For operation of the transmitter observe the supplied technical documentation.

6.2 Determination of switch-off temperature

As a rule the switch-off temperature is calculated as follows:

$$T_{ab} = T_M + \Delta T_{sp} + \Delta T_s$$

T_{ab} = Switch-off temperature
T_M = Medium temperature
ΔT_{sp} = Calculated temperature rise in the containment shell area according to the pump manual
ΔT_s = Safety margin (≈ 10-40°C)

The safety margin ΔT_s depends on the magnet length and the diameter of the magnetic coupling, on the speed and on the pumped medium. If necessary, consult DICKOW.

In explosive areas, the switch-off temperatures dependent on temperature class for pumps of group II, category 2G must be observed according to the following table:

Temperature class	Max. surface temperature [°C]	Max. mag-safe switch-off temp. [°C]
T1	450	300 *
T2	300	290
T3	200	195
T4	135	130
T5	100	95
T6	85	80

* Maximum switch-off temperature

6.3 Testing before start-up

Prior to initial start-up, the entire measurement chain must be tested with regard to its efficiency.
The switch-off temperature is simulated via a suitable voltage source. For the purpose, an adjustable voltage supply must be applied to the contact points of the mag-safe plug and compared with the values specified in chapter 3.2 for an ambient temperature of +20°C.

Limit the voltage supply to max. ± 1 V.

If the ambient temperature deviates, a zero offset occurs that is balanced by the internal temperature compensation. The switch-off temperature set via the adjustable voltage supply must be corrected by a correction value according to the following formula:

Standard

$$K\,[mV] = (T_{ab} - T_{amb})\; x\; 0{,}045$$

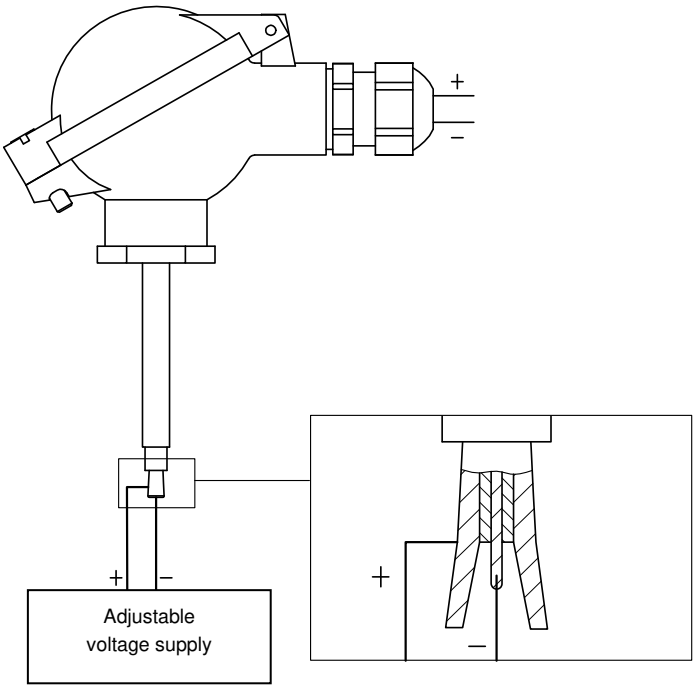
Hybrid

$$K\,[mV] = (T_{ab} - T_{amb})\; x\; 0{,}023$$

T_{amb} = ambient temperature

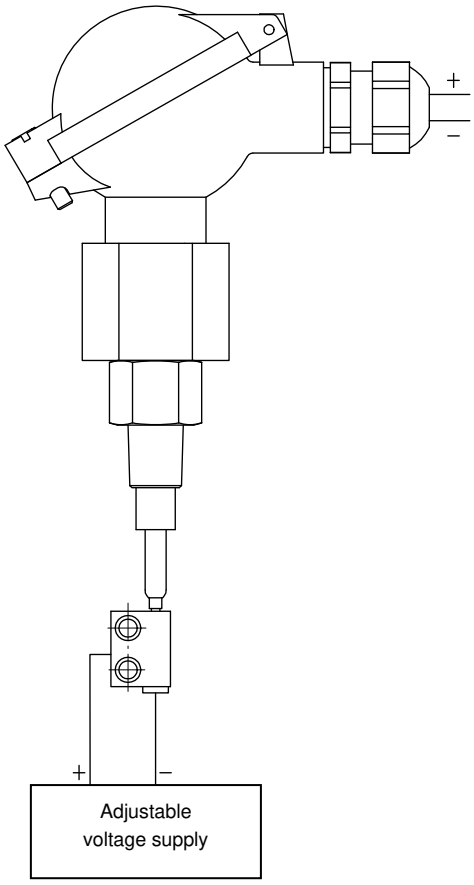
Example - Standard design:

- T_{amb} = -10°C ; T_{ab} = 50°C → K = (50°C - (-10°C)) x 0.045 = 2.7 mV
- T_{amb} = 40°C ; T_{ab} = 50°C → K = (50°C - (+40°C)) x 0.045 = 0.45 mV



Example - Hybrid design:

- T_{amb} = -10°C ; T_{ab} = 50°C → K = (50°C - (-10°C)) x 0.023 = 1.38 mV
- T_{amb} = 40°C ; T_{ab} = 50°C → K = (50°C - (+40°C)) x 0.023 = 0.23 mV



7. ERROR SIGNALLING

7.1 General

The transmitter is equipped with an LED indicator. If the display does not light up or if it flashes, an error has occurred. Please refer to the table below.
The error source can be determined based on the measurements described in chapter 7.2.

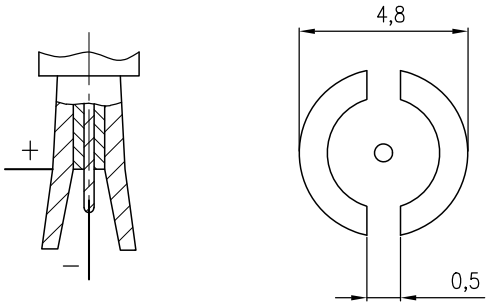
Problem	Possible cause	Remedy
Switch-off during operation. None of the problems described in chapter 3.1 exists. Temperature rises to the set limit value.	Wrong setting of limit value.	Correct calculation of limit value. Refer to chapter 6.1. Consult Dickow if necessary.
	Clogged internal circulation channels	Disassemble pump, check internal circulation. Clean if necessary.
	Decoupled magnets	Check torque. Can pump be rotated?
Sudden temperature rise up to max. 300°C or 20 mA when starting the pump, sudden temperature drop as pump runs down	Contact loss of the plug connection or compensating line	Check resistances. See chapter 7.2
		Check electrical wiring for proper contact.
		Vibration must be within the allowed limits. Refer to pump manual.
Widely fluctuating temperature (> 10K) or mA signal.	Contact loss	See above
	Electrical or magnetic interference	Sufficient distance between parallel cables.
		Avoid crossing measuring and load lines.
		Use screened signal line. See chapter 5.5
	Speed < 300 rpm	See description in chapter 7.1.
	Earth loops	Ensure a potential-free connection. See chapter 2.3, 4.2 and 5.8.
Constant temperature < -50°C (< 4 mA)	Current loop wire break	Check cables.
	Power supply defective	Check power supply, see chapter 7.1.4.
	Polarity	Check.
Constant temperature > 300°C (> 20 mA)	Thermocouple wire break	Localise error as per chapter 7.2.1.
		Change plug connector/containment shell
Dropping temperature indicated despite rising containment shell temperature.	Reverse polarity of thermocouple compensating line	Check connection, see chapter 3.3.2

Voltages are induced from the magnetic field of the rotating magnet coupling. At very low speed (< 300 rpm) these voltages lead to problems on the mag-safe due to uncontrolled swings and associated error messages.
Remedy: The reaction time of the switching device must be adjusted to 5 seconds in order to bridge the time, e.g. during run-down of the pump.

We recommend this tripping delay also to prevent false alarms resulting from electromagnetic interference.

To ensure a perfect contact between the plug connector and connecting block, the inner contact pin (-) must be centred. The maximum deviation is 0.5 mm. The outer contact clip (+) must have a defined pre-tension. The maximum deviation is +0.5 mm. A negative tolerance is not permitted.

Otherwise, the contacts must be readjusted.

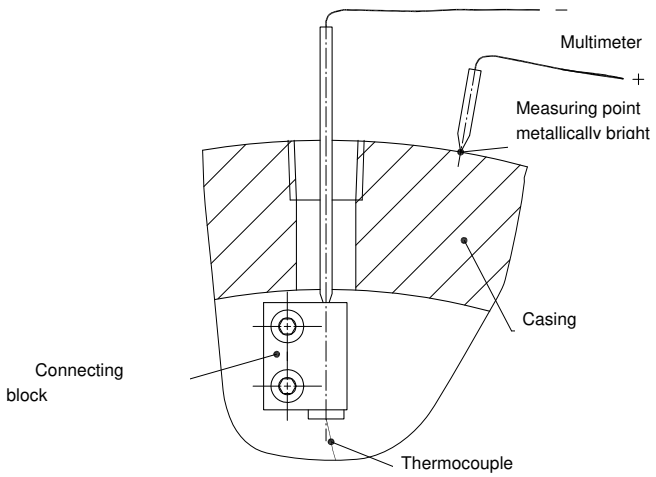


7.2 Required measurements

7.2.1 Measuring circuit 1: Plug – sensor tip – containment shell

Disconnect current signal lines from the transmitter and connect them to a multimeter. Black +, white -. The mag-safe remains screwed to the pump.

7.2.2 Measuring circuit 2: Plug – containment shell – pump casing



Remove the mag-safe and connect the multimeter to the female plug socket and pump casing according to the drawing.

7.2.3 Evaluation

The resistance in measuring circuit 1 (chapter 7.2.1) must not exceed 3 Ω, and the resistance in measuring circuit 2 (chapter 7.2.2) must not exceed 1.5 Ω.

- Measuring circuit 1 > 3 Ω → Contact problems.
  Remedy: Check the centring of the connecting block.
  Sensor tip must be free of corrosion and moisture.

- Measuring circuit 1 > 3 Ω
  and → Wire break. Remedy: change containment shell
  measuring circuit 2 > 1.5 Ω

7.2.4 Supply voltage

The supply voltage must be between 9-30 VDC.

Fluctuations in the voltage may have a negative effect on the measurement result.

7.2.5 Current signal

Comparison of the results with the table in chapter 3.2.

Perform the measurement where appropriate with a separate voltage supply to limit errors in the measurement chain.

8. MAINTENANCE

Besides a general visual check, the following test procedures must be carried out at least once a year:

- Check measuring circuits 1 and 2 as per chapters 7.2.1 and 7.2.2.
- Check the switch-off temperature according to chapter 6.3.

To maintain the classification level for functional safety (chapter 1.14), the described checks must be repeated at yearly intervals.

9. COMPONENTS / TECHNICAL DATA

In accordance with DIN EN 50020 chapter 5.4, the mag-safe is simple electrical equipment, and is not subject to EU Directive 94/9/EC.

Measuring range:	Standard	-50°C to +300°C
	Hybrid	-50°C to + 250°C
Pump minimum speed:	> 300 rpm; lower speeds will lead to widely fluctuating temperature indications (> 10K) and mA signals.	

The transmitter, cable entry, connection head, thermocouple and plug connector are included in the supply. The switch amplifier is not included however.

9.1 Transmitter

The mag-safe is equipped with a specially configured transmitter, Flex Top 2211 (manufacturer: Baumer), with galvanic isolation between the input and output. The transmitter is configured exclusively by DICKOW. The programming is password-protected.
A built-in temperature sensor is used for reference point compensation.

Classification:	Exia IIC T5 / T6 , ATEX II 1G
Type examination certificate:	TÜV 07 ATEX 347151 X

For electrical connection of the mag-safe refer to the operating manual and type examination certificate of the transmitter, as well as chapter 5.

Ambient temperature:	-40°C … +60°C (=T6); +85°C (=T5)
Transmitter entity parameters (terminals + to -):	L_i < 15 µH ; C_i < 5 nF
Sensor circuit parameters (terminals 3 to 6):	V_{DC} ≤ 6,6 V I_{DC} ≤ 17 mA P_{out} ≤ 30 mW C_a < 3 µF L_a < 99 mH

9.2 Cable entry

A metal cable gland with a M20 x 1.5 screw-in thread is used as standard.

Material:	Nickel-plated brass; seal EPDM, clamp cage polyamide
Ambient temperature:	- 40°C … + 75°C
Protection class:	max. IP68 (5 bar, 30 min)
Classification:	Ex II 2G Exe II
Type examination certificate:	PTB 04 ATEX 1112 X

9.3 Connection head

The connection head of type BUZ is similar to DIN 43729, type B.

Material:	Die-cast aluminium; magnesium content ≤ 3%
Protection class:	IP65
Ambient temperature:	- 40°C … 100°C

An Ex-proof connection head can also be mounted. Consultation with DICKOW is required in this case.

9.4 Thermocouple

The thermocouple on which the measurement is based consists of containment shell material 1.4571 or 2.4610 and standard alloyed nickel/ copper wire or 99.6 Ni (= hybrid).
The difference between the two containment shell materials is compensated by averaging the temperature/voltage characteristic.

Attention! The mag-safe is not a standardised thermocouple.

9.5 Plug connection

The standard connection is liquid-tight up to 40 bar.

The hybrid connection is not liquid-tight!

Temperature-stable up to 250°C.

9.6 Switch amplifier

An isolation barrier certified according to Exia with the entity parameters
V_{max} ≤ 30 V_{Dc} ; I_{max} ≤ 0.1 A and P_{max} ≤ 0.75 W must be used.

10. DOCUMENTATION

The standard documentation consists of the following:

- mag-safe operating manual
- mag-safe test report
- Transmitter operating manual and certificate of conformity
- Cable gland operating manual and certificate of conformity