# Any question?

## Customers ask – We give the answer

**? Electrical motors of type of protection flameproof enclosure ‚d' are frequently designed with ‚thermistors for full protection' (e.g. in the case of static converter operation or switched-mode duty ). Why is this simple and effective protection option on motors of type of protection Increased safety ‚e' used very rarely?**

! On equipment of type of protection Flameproof enclosure ‚d', only the outer surface temperature of the enclosure is limited for compliance with explosion protection; thus, on motors of temperature class T4, a limiting temperature of 135 °C applies for instance (EN 50014, 5.1.2). Interior temperatures (e.g. on the rotor) are irrelevant to explosion protection.

Temperature sensors can be accommodated only in the stator winding with feasible technical effort. They can safely monitor the maximum external temperature (e.g. between the ribs halfway along the stator), if they are fitted accordingly (embedded in the winding overhang opposite the fan side) and at a rated response temperature determined by testing.

The limiting temperatures imposed by the temperature class also apply expressly to the surfaces of internal components, which could come into contact with explosive atmospheres on equipment, type of protection Increased safety ‚e' (EN 50019, 4.7.1) – they thus also apply to the rotor of an enclosed squirrel-cage motor for instance.

Owing to the fact that there is no direct, thermally conductive contact between thermistor and rotor, its temperature cannot be detected. If the squirrel cage temperature in continuous duty and / or with locked rotor is higher than the temperature of the stator winding, the motor is a machine with a ‚thermally critical rotor'.

Depending on design and make, this applies at a power limit of approx. 3...5.5 kW. Thus, theoretically, only the smaller motors of type of protection Increased safety ‚e' with 'thermally critical stator' can be equipped with ‚thermistors for full protection' – and this option is hardly used in practice.

**? The information on the supplemental label on a flameproof electrical motor includes the following:**
**What must be noted during installation?**

**Thermistors PTC DIN 44081/82-145**
**function tested relay ⟨Ex⟩ II (2) G**
**$t_A$ 28 s / 20 °C $U_N$ $I_A/I_N$ 5,0**

! In each individual case, it is the task of the motor manufacturer to make the importance of this information clear to the installer and operator in the operating instructions.

The following can be stated in general: temperature sensors (PTC thermistors) in accordance with DIN 44081 with a rated response temperature of 145 °C are embedded in the winding. They provide full protection. Current-dependent monitoring is not required or is ineffective (e.g. in static converter supply). The function of the tripping relay must be tested by a notified body. The 2 in brackets means the following: the relay must be installed in the safe area; its protection function acts into category 2 (Zone 1) in accordance with Directive 94/9/EC, Article 1 (2), and the Guidelines further to this Directive 11.2.1. The marking II (2) G replaces the PTB test mark which

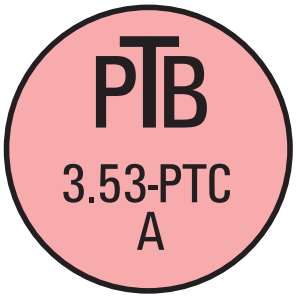


Figure 1: Test mark of the PTB for function-tested TMS tripping devices

was customary up until around the year 2002 in the scope of validity of the Directive (Figure 1). The response time $t_A$ refers to testing with locked rotor. It can be anticipated at rated voltage $U_N$ at an ambient temperature of 20 °C and with the specified, relative locked-rotor current. It is a measure of thermal coupling between sensor and winding. Unless there are special reasons, it is not necessary to practically test the function of the protective device during precommissioning inspection and/or during the periodical inspections (analogous interpretation of IEC/EN 60079-17, Inspection and maintenance of electrical installations in hazardous areas (other than mines) 5.2.1). However, after a new rewinding during the course of repair, a qualified person is obliged to check the thermal coupling with respect to the specified value ; a deviation of $t_A$ + 20% is permitted (PTB Test Regulations, (PTB-Prüfregeln); Section 10.2). →

**? Up to now, I assumed that the Profibus PA is the intrinsically safe field bus. Remote I/O is now talked about more and more frequently. What I. S. buses are used in this case?**

! Basically, almost any (field) bus can be operated intrinsically safe provided the corresponding technology is commercially available. This is because the voltages and currents required for data transmission are in the range of a few Volts and 10 to 100 mA and thus are precisely in the application range of intrinsic safety. Industrial application began in the late eighties when predecessors of today's remote I/O´s with an intrinsically safe serial transmission technology were marketed as ‚field multiplexers' and ‚field stations' in the I.S. sector. Point-to-point connections but also bus-capable systems such as RS 485 were used in this case. Work on the physical level for ‚the (international) field bus' (today IEC 61158-2) also began at the same time. The emphasis was on applications in process engineering so that the aspects of an intrinsically safe transmission level were also allowed for at an early point.

Nowadays, two field buses are based on the IEC 61158-2 technology: Profibus PA and the Foundation Fieldbus H1. They do not differ at the physical level and both have an intrinsically safe version and have correspondingly certified equipment. This type of field bus is referred to as ‚device level bus', which expresses that sensors and actuators are connected directly to such a bus. In addition, PA and H1 allow powering of the field units from the same wire pair provided the power demand does not exceed approx. 100–150 mW per device. Four to eight devices per bus segment are assumed owing to the restricted intrinsically safe power. The transmission speed, at 31.25 kbit/s, is rather low which also limits the number of connectable devices. By contrast, 20 to 70 field units are typically connected to Remote I/O and these units, such as solenoid valves, can also be supplied with high power. A fast ‚plant level bus' with a high transmission speed is suitable for communication with the automation systems (PLC, DCS or PC). The Profibus DP (RS 485) has positioned itself very well in this case. R. STAHL has developed the intrinsically safe version RS 485 Ex i for its ‚VOS 200' Remote I/O and, after slight modifications, it is now a Profibus Standard elaborated jointly by the manufacturers as RS 485-IS. Other approaches, e.g. by MTL for an intrinsically safe LonWorks topology, have not been able to establish themselves successfully on the market.

For the future, it can be seen that Ethernet with 10 and 100 Mbit/s will also make inroads into the field level of process engineering. Classic, ‚electrical intrinsic safety' will probably be replaced by 'optical intrinsic safety' in this process since large distances (i.e. > 100 m) need to be spanned with fibre optic cables.

However, a (field) bus in a hazardous area does not necessarily have to be intrinsically safe. Providing there is an EEx e connection system suitable for the data rate etc., any bus can be routed into the hazardous area. There are no restrictions as regards voltage or current and more power can be provided for field units. Products are now available for such applications as well. However, handling of such an Ex e bus, e.g. during maintenance or extension work, is, by far, not as elegant as it would be with an intrinsically safe solution.