

GESTRA

Special

*Self-Monitoring Temperature
Limiters for Pressurized Hot-Water and Steam Plants*

- *From self-acting to BUS-capable
safety temperature limiters*

SPECTORbus - One System for All Requirements!

With the bus-capable safety (self-monitoring) temperature limiters of the SPECTOR family, GESTRA AG is already offering the fourth generation of components for safety equipment.

History of the development:

With the introduction of boiler monitoring, the temperature limiters that were initially developed and used in great numbers were of the self-acting (mechanical) type.

With the increasing modernization and automation of boiler systems as well as the development of new boiler plants, there were increased demands on the precision of the monitoring equipment. It had to be possible to control the working temperatures as closely as possible to the switch-off temperatures without the tolerances leading to switchpoint drift or shutting down of the boiler plant.

What developmental steps were taken?

1 Self-acting safety temperature limiter

The liquid filling of the capillary feeler expands with the rise in the temperature, thus operating the electronic switchgear.

Depending on the length of the capillary rod and the fluctuations in the environmental factors, the switchpoints of this system, referred to e.g. 22 °C, are influenced by approx. 0.22 % / K at around 160 °C, i.e. the units switch off sooner than intended.

With a fluid temperature of 160 °C and an ambient temperature of 80 °C, the switchpoint displacement is therefore approx. 9 K.

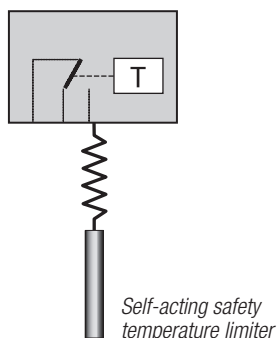
If the greatest equipment tolerance is considered, this yields a maximum calculated switch-off below the scale setting of:

- 5 % or 13 K in the upper third of the scale, and
- 10 % or 17 K at the bottom of the scale.

For this type of unit, the switchpoint accuracy corresponds to +0/-5 % of the limit range in the upper third. At the bottom of the scale, the tolerance increases to +0/-10 %.

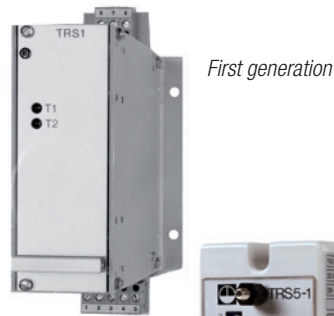
The switching hysteresis is about 10 K.

As a consequence of the above parameters, the working temperatures must be kept considerably below the limit values if unnecessary shutdowns are to be avoided.

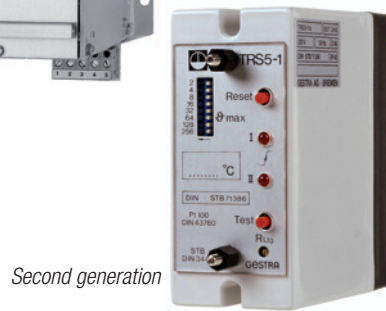


2 Electronic self-monitoring temperature limiters of the first and second generations

In order to compensate for the disadvantage of the capillary rod systems as far as possible, electronic self-monitoring temperature limiters were used from the end of the 1960s, with the benefit that they dispensed with the need for liquid fillings. These systems utilized the change in resistance exhibited by resistance thermometers, such as Pt100, for obtaining the measurement values.



First generation



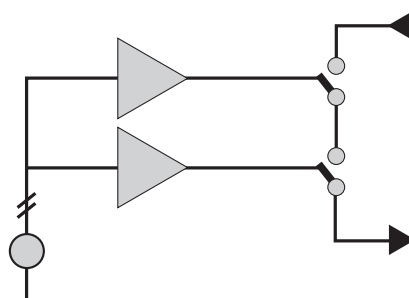
Second generation

With resistance thermometers, it was necessary to compensate for the effects of the resistance posed by the cable connecting the sensor to the evaluation unit. This was due to the fact that two-wire circuits were used in these systems.

The switchpoint accuracy of these units was better than -3 K; owing to their high precision and low drift, they were also used for the temperature control. The evaluation unit had two channels, thus complying with the requirements of DIN 3440, as units of "high-integrity design".

Depending on the temperature, the accuracy of these units was approx. 0.3 – 4.6 K (1000 °C). The switching hysteresis was limited to 5 K.

Whilst the temperatures for the first generation were set and lead-sealed at the factory, the second generation already permitted customized settings, thanks to the code switches arranged on the front panel under a sealable cover plate.



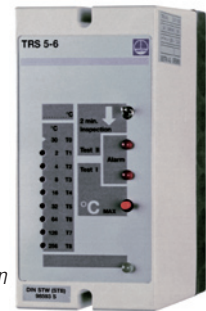
Electronic two-channel limiter

3 Electronic self-monitoring temperature limiter of the third generation with periodic self-testing for loss of redundancy in the evaluation unit as per EN 50156 (formerly VDE 0116)

Building up on the limiters of the second generation, the demands of the amended regulations and codes were realized in the new designs. Until now, the electronic evaluation unit had not been subject to automatic monitoring. Equipment of this design had to be, and still must be, examined every 6 months by qualified staff or, if used in 72-hour unmanned operation, by an external expert.

The test was conducted by approaching the actual switch-off point.

The firing equipment was shut down and locked out via the series-connected output contacts of the two-channel level controller.



Third generation

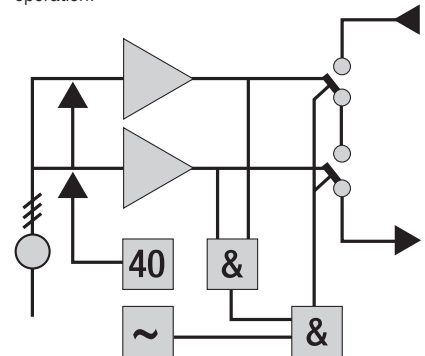
The main advancement of this new generation was the introduction of the periodic self-test in the evaluation unit.

Every 40 seconds, the electronics is automatically tested for the proper functioning of all evaluation channels and the energizing circuitry of the output relay contacts is checked. In parallel to this, an automatic check routine is executed to perform the periodic self-test.

Tests of this kind are conducted in the background mode of the electronics and are not noticeable from the outside.

At this time, the three-wire connection was introduced for automatic compensation of the resistances in the sensor line.

For such units, the inspection by an external expert is only required **once** a year for 72-hour unmanned operation.



Electronic two-channel limiter with periodic self-test

4 SPECTORbus – the future has already begun

With the latest product family, GESTRA is again blazing a new trail in boiler equipment, strengthening its position as a market leader.

In addition to the properties of the preceding systems described above, these newly developed systems are characterized by the following innovative solutions for increasing the level of plant reliability and reducing costs:

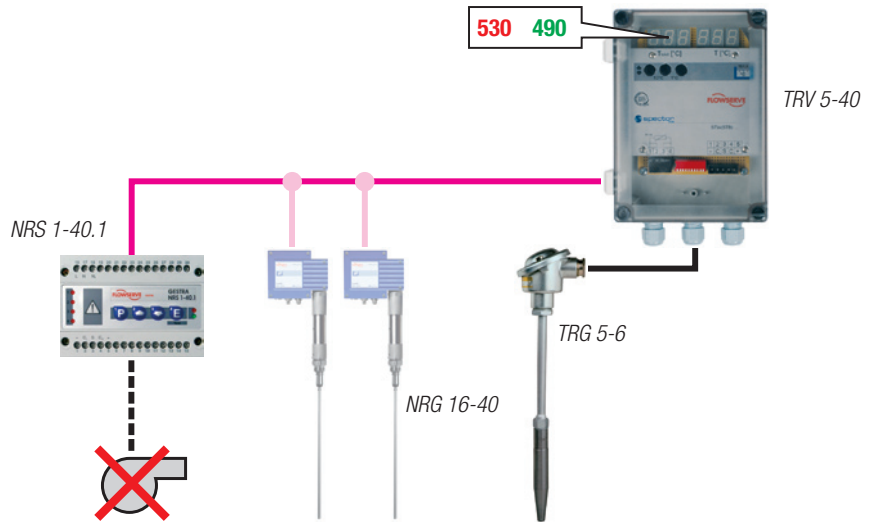
- ▶ Active autonomous monitoring of the cable connection between sensor and evaluation unit through the bus interface.
- ▶ Active monitoring of the relay output contacts. In the previous systems, the monitoring ended with the energizing circuits of the output relays. With the new solution, GESTRA has redefined the state of the art for safety circuits, since this test also detects fused relay contacts.
- ▶ Digital numerical display of **switch-off** and **actual temperature**.
- ▶ Integration of two more Pt100 sensors with transfer of the temperature data via the CANbus.

With this equipment, the term "GESTRA Boiler Safety System" was introduced for the first time. This system provides the possibility of being able to connect as many as four limiter functions to one NRS 1-40.1 control device. For example, the constellations 2 x LW, 1 x HW and 1 x STL for steam boilers with superheater, or 4 x STL for cascaded superheaters, are feasible – as are many others. Instead of having to set the switch-off temperatures with code switches, this can now be done conveniently by pushbuttons in the temperature preamplifier TRV 5-40.

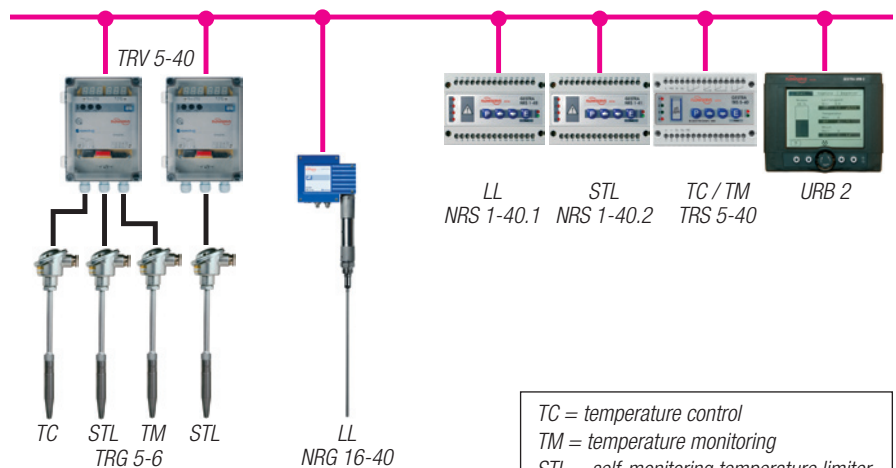
With the introduction of the SPECTOR family, the Pt100 sensors of accuracy class B were converted to class A – another contribution towards greater precision in measurement and, as a result, lower tolerances. The maximum temperature deviation is 1.5 K at 650 °C, as opposed to max. 3.6 K previously.

You too can benefit from the possibilities of modern and reliable boiler safety technology. Why settle for anything less?

GESTRA – with Energy into the Future

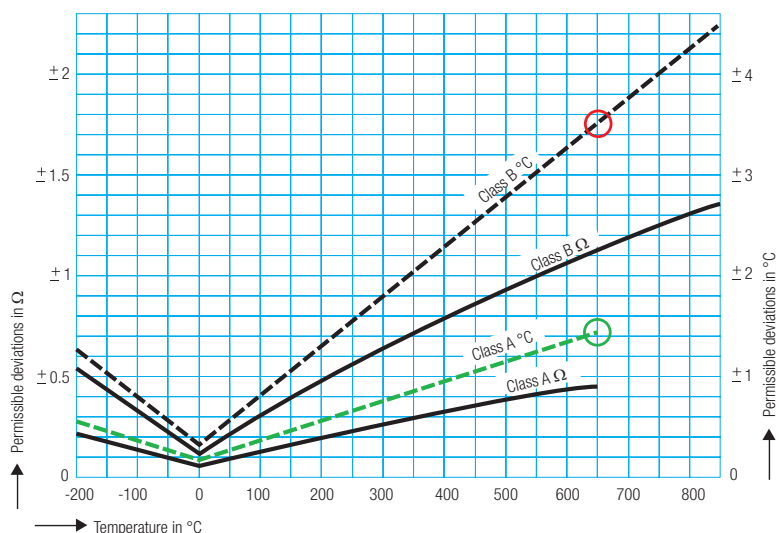


Self-monitoring temperature limitation with NRS 1-40.1
Example: Steam boiler with superheater



Example: Pressurized hot-water plant

TC = temperature control
TM = temperature monitoring
STL = self-monitoring temperature limiter
LL = level limiter





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