Pepperl+Fuchs GmbH – Lilienthalstrasse 200 – 68307 Mannheim – Germany

Please quote the following contact information when publishing:
Tel.: +49 621 776-2222, Fax: +49 621 776-27-2222, www.pepperl-fuchs.com, pa-info@de.pepperl-fuchs.com

Editorial contact: Christa Blas (extension: -1420, fax: -1108), cblas@de.pepperl-fuchs.com

Patented 2:1 technology

Two NAMUR sensors via one stand pair

Eliminating cables is always worthwhile. Not only are material, planning and installation costs reduced significantly, but systems are safer and simplier to maintain. The risk of incorrect connection increases disproportionately as the number of cables and terminals increases. The digital 2:1 transmission technology facilitates a 50% reduction in wiring.

In process automation, the amount of digital signals is nearly 50%, depending on plant structure. The IEC60947-compliant 2-wire sensors mostly used for digital input signals are powered with the current circuit and are resistant to short circuiting and overloading.

The sensor interface in accordance with IEC60947

Digital sensors with a sensor interface in accordance with IEC60947 are called NAMUR sensors. Via their 2-wire connection the sensor supply with low independent power (typically 0.8 mA) and the measured values are transmitted simultaneously. The current in the sensor circuit is influenced by the distance from a metal object. The switching points for what is an analog input signal up to this point are formed and evaluated in the connected interface modules. The fact that these switching points are specified in EN60947 (between 1.2 and 2.1 mA at, typically, 8 V) ensures cross-manufacturer compatibility of the sensors and interface modules. Because sensors of this type have a defined minimum and maximum current, it is easy to add two more values for lead breakages and short circuiting monitoring (below the minimum current and above the maximum current). Here too, IEC 60947 specifies the values (lead breakage in the control circuit is I < 0.1 mA, short-circuiting is I > 6 mA). Figure 1 shows the typical characteristic curve for a NAMUR sensor according to IEC 60947.

Evaluation of digital sensor signals in accordance with IEC 60947

The evaluation of digital NAMUR signals is performed with static signals in the switch amplifier. The signal currents are evaluated according to the standard and an output is given in the form of a switching signal and/or error statuses where applicable. The sensor is generally powered via 8 V direct current. Figure 2 shows a 2-channel signal evaluation via a 2-channel switch amplifier, as an example. Two NAMUR sensors are evaluated and corresponding outputs are given through switch contacts. Depending on output stage, higher frequencies can also be transmitted with this type of evaluation.

Evaluation using 2:1 technology

The field wiring illustrated in figure 2, shows much wiring is required. Each NAMUR sensor is connected separately with an evaluation unit via a 2-wire cable. With 2:1 technology, the signals from two NAMUR-compliant proximity switches can be transmitted to the control cabinet via one strand pair. The patented evaluation system from Pepperl+Fuchs is simple but effective: when connecting two 2-wire proximity switches with a polarity protection function anti-parallel to a cable pair, both types of information are transmitted simultaneously. The special evaluation electronics of the switch amplifier in the control cabinet differentiate between the signals on the basis of the polarity and divide them again into two separate output channels (figures 3 & 4). The polarity is switched with low frequency. Depending on polarity, sensor I or sensor II transmits its signal to the switch amplifier. All digital sensors with signal levels in accordance with IEC60947 can be used. Proximity switches are, as a rule, equipped with polarity protection diodes and can be connected directly; only anti-parallel connection must be observed. If a series diode is connected, the 2:1 technology also functions with mechanical contacts. Pepperl+Fuchs offers special terminals with integrated diodes for this purpose. Due to the cyclic reversal of polarity of the power supply, the system has limitations for applications with high frequencies.

2:1 Technology – ideal for multiple sensors: simple but effective

2:1 technology enables simple solutions with reduced wiring needs wherever several sensor signals are required in one place, and particularly for applications where digital signals occur in pairs immediately at one measuring point. Possible uses include positional feedback of valves and rotary drives, minimum/maximum manometers, magnetic submersible probes in level control technology and flow measurements with mono-stable inductive proximity sensors. A particularly important synergy is created with the combination of 2:1 sensors and Pepperl+Fuchs technology: one sensor and one cable supply two signals. Plant expansion is another ideal application for 2:1 technology, particularly in situations where additional signals have to be routed via existing and possibly fully-utilized field wiring. Where laying

further cables would be very difficult, additional signals can use the existing wiring via the 2:1 transmission technology.

Dual savings – cables and control cabinet space

The required installation time and space within the control cabinet are also reduced significantly. First, only half the number of terminals has to be connected and second, an ideal packing density can be achieved via four-channel switch amplifiers in the K-system housing, which is only 20 mm wide. The cables are monitored for short circuits and lead breakages as before. Service is not subject to extraordinary technical requirements or specialist knowledge. Correct functioning can be checked at any time using any multimeter and a series diode. The system is ideal for use anywhere cables can be eliminated without the need for complex fieldbus technology. It is a valuable product for both end customers and field device manufacturers and also for planning companies who need to limit the wiring requirements for large installations.

Key words: Pepperl+Fuchs, K-system, isolated barriers, switch amplifier, NAMUR sensors, double sensors, 2:1 technology

Author: Dipl.-Ing. Stefan Pflüger
Product Marketing Manager, Interface Technology
Division Process Automation

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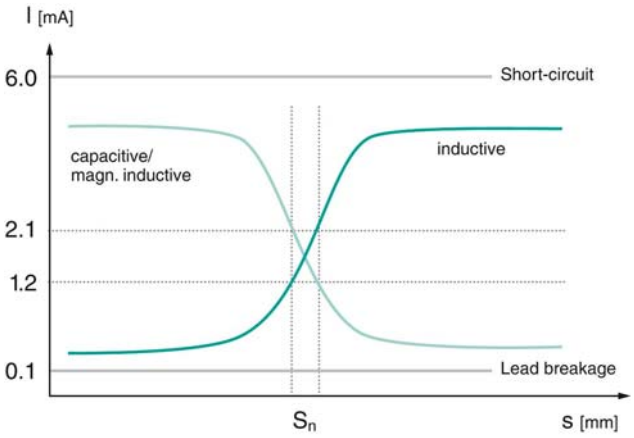

Fig. 1: Characteristics in accordance with IEC 60947

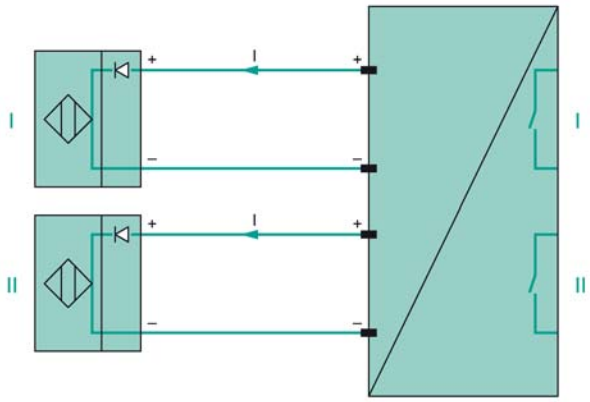

Fig. 2: Conventional wiring of a 2:1 sensor circuit

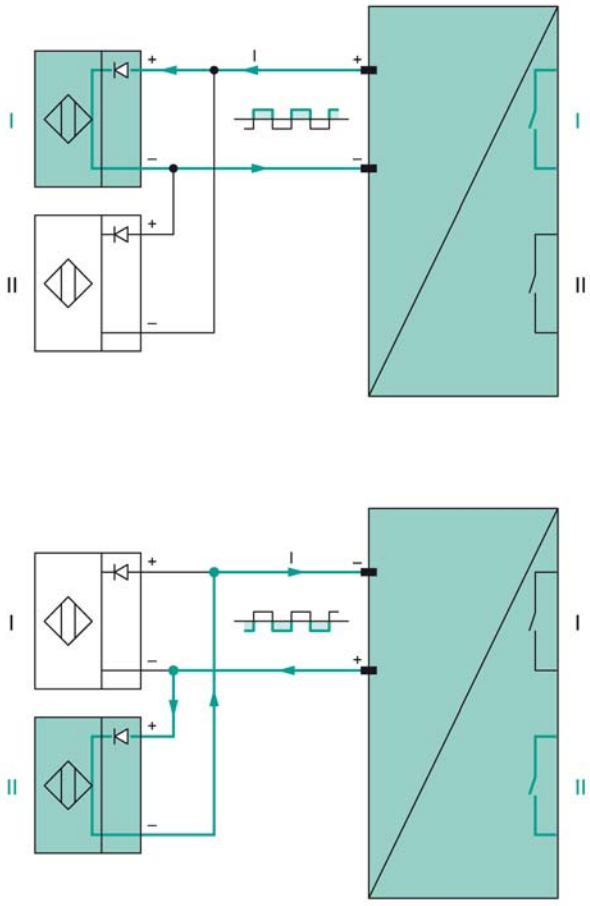

Fig. 3 and 4: Control of two sensors using 2:1 technology

Fig. 5: Two sensors in 2:1 technology

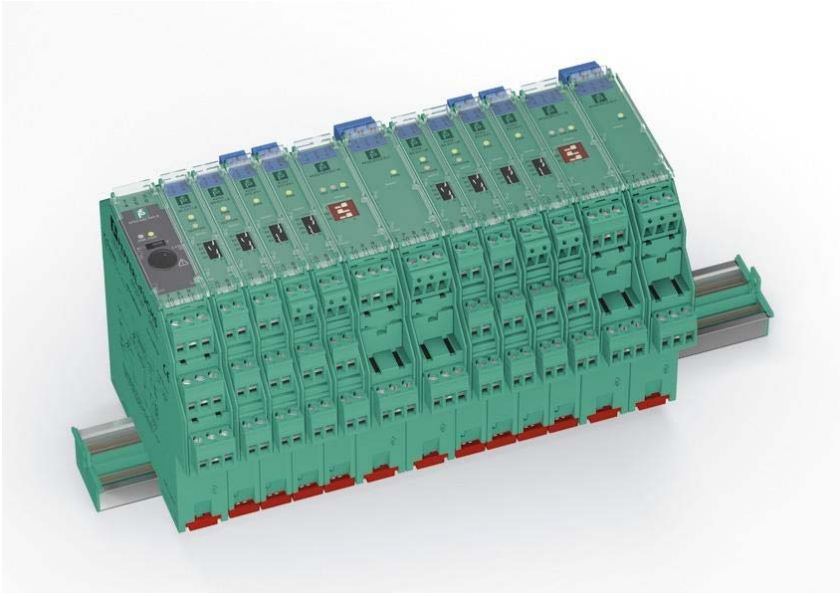

Fig. 6: Switch amplifier in K-system