Flexible connection of easy-to-program pressure and temperature sensors to the process

Pressure and temperature are frequently used measuring variables, for which great importance is placed on the interfaces to the process and the operator, as well as accuracy and reproducibility. The sensor must be positioned as “close to the action” as possible, and this can only be achieved with the right process connection. The electrical outputs of the interfaces for the operator in the field and to higher-level systems must be flexible, and operation must be kept as simple as possible.

Pressures and temperatures are essential parameters for the operation of a large number machines and plants. Whilst the measured values in process automation are normally transferred to the controller as analog signals, in machine building, it is often required for overshoot values to be indicated as well.
For example, the clamping pressure on machine tools must be monitored in order to ensure that the workpiece is seated correctly. Temperature sensors are frequently used for monitoring cooling and hydraulic fluid circuits.

Requirements of fluid sensors

The wide range of possible installation options in different applications requires the process connections of these devices to be highly flexible. Installation has to be simple, fast and if possible without the need for any additional mounting adapters. In this case, variable devices are ideal since they can be read from the front and from above according to the installation position in the machine.

When visibility is often difficult, it is important to have a display that enables measured values and displayed information to be read, even from several metres. State-of-the-art sensors come with a number of additional functions for optimum adaption to the application at hand. These requirements call for the development of simple and intuitive operation, if possible without tools, so that there is no possibility of operating errors occurring despite the large number of parameters involved.

All these requirements are met by Turck's new PS400/PS500 pressure sensors and TS400/TS500 temperature sensors. The company presented the PS400/PS500 pressure sensors at the Hannover Fair 2005. The successful philosophy behind this series naturally formed the basis for a further development in temperature sensors: The housing design, the operating concept and the output variations were used as the platform for the development of the new TS400/500 series of temperature sensors.

Like the pressure sensor, the TS400 is the fixed version and the TS500 the rotatable version. The temperature sensor is provided with a 4-pole M12 terminal for connecting the probes, thus ensuring a high degree of flexibility.

Measuring ranges, speed, outputs

The pressure sensors of the PS400/PS500 series cover all the pressure ranges important in machine building from -1 ... 0 bar to 0 ... 400 bar. If required, the pressure can be programmed and displayed in bar, psi, kPa, MPa or in a unit defined by the user. A patented medium stop system seals the sensor in the event that the pressure cell is damaged by high overpressure and thus reliably prevents a leakage into the machine.

The switch point accuracy of the devices is 0.5% of the full scale. If a sensor is used at up to only half of its rated pressure, it operates at an accuracy required for machine building of 1 % in relation to the used range. In this way, the number of different types required can be reduced considerably. A standard M12 connector (4-pole) on the TS400/TS500 provides the interface to the temperature probes.

These can either be connected directly or via a cable. The maximum measuring range of -50° to 500°C covers the most typical applications in machine building. The measured value can be displayed in °C, °F, K and Ω. A choice of Pt100 class A elements are available that allow a switch point accuracy of 0.2K.
As both sensor types come from the same product family, they provide either two transistor switch outputs or one switch and one analogue output. The standard current or voltage signals are available for the analogue output. Versions with a programmable output function and switch logic are also on offer.

Optimum programming convenience

One of the most important requirements when selecting an intelligent sensor is a high level of operating convenience for programming. A clear menu structure enables you in just a few steps to change the values for switch and reset points, output function, analogue ranges and a number of special functions such as switch delays, rotation of display direction or peak value memory.

Additional external devices such as a laptop or a special programming device are not required since the sensors of the PS400/PS500 and TS400/500 series are provided with three pushbuttons for this purpose. The two „Mode" and „Set" buttons for selecting and setting different parameters can be operated manually without any tools required. The values can be scrolled up or down for more convenient operation.

The "Enter" button must be pressed once the set value is stored, thus changing the programming. This is recessed and can only be pressed with a simple tool such as a ball-point pen. As long as a tool is not being used, the user can easily view all values and also change them after opening a time lock without any fear of changing the programming by accident. Only when the tool is used, can the user permanently modify the sensor settings. The sensors can be locked by means of a button combination.

Display supports users

The sensors of the PS400/PS500 and TS400/500 series come with a four-digit, 7-segment display that shows the measured value during normal operation and supports the user during programming. The large and clearly visible LED display can still be read accurately from long distances even in poor light conditions. When the sensor is installed horizontally, the reading direction of the display can be rotated by 180° via the software.

A row of LEDs above the 7-segment display permanently indicate the selected unit of measure as well as the status of the switch outputs. The sensors offer an outstandingly high EMC immunity and meet the requirements of IP 67 protection. The housing is manufactured entirely from stainless steel, the electrical connections are likewise metal sheathed and offer a high level of mechanical stability. In this way, a high level of operational reliability can be ensured.

Fast and simple installation

With a diameter of only 34 mm, these compact devices can be fitted in the standard 40mm grid dimensions (centre-centre) for machine tool construction. The display angle of 45° enables the sensor to be installed from above or from the front.

In order for the customer to read the display from a defined direction, mounting aids are normally required that enable the sensor to be aligned before fixing. With the PS500 and TS500 series this function is integrated in the sensor. After installation, the devices can be rotated to the required position to achieve optimum readability. The sensor is then fixed by means of a second nut.

Flexibility in the process

Different applications require different connections to the process. The pressure sensors of the PS400/500 series offer the terminals commonly used in machine building as standard features.

If required, additional terminals can be implemented without the need for additional adapters, as well as flush mounted solutions. Temperature sensors are available with different probe lengths and diameters. A protective tube enables the temperature sensor to be adapted to requirements very simply, even with critical applications.

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