Technology for Process Diagnostics

When faults occur in a system, identifying their cause is the most important requirement for implementing measures to prevent the possibility of them occurring in the future. However, the causes of system faults are often very difficult to determine. Suitable tools are now available thanks to the new functions provided in interface devices.

Device integrated data archiving can also be useful for centrally controlled systems, for example, with system faults that are accompanied by a fault in communication. Data that was generated before the fault was detected and rectified is irretrievably lost. Autonomous systems in particular are not provided with a convenient data archiving facility, which would otherwise considerably simplify the search for the cause of the system fault.

This is where the technology of the new Turck interface modules is particularly useful. An integrated data memory is continuously overwritten and also retains the data in the non-volatile memory in the event of a power failure. In this way, an interface device is turned into a transient recorder, in which the recorded signal trace can be read at any time with the FDT/DTM technology. The PC can then be used to display and further process the time trace. The continuous recording of process variables enables an existing system to be analysed.

The evaluation of the recorded data helps the planning engineer to optimise the existing system and estimate the effects of system expansions. Weak points can be localised and the effect of improvements made can be logged and verified. This therefore increases the transparency of the system function and thus an understanding of the causal interrelationships involved.

For this, the process variables are stored in a ring memory with the measuring cycle time of the device. The pointer moves continuously forward. The oldest data is overwritten every time the end of the memory is reached. The memory always contains the most recently recorded signal trace.
The sequence of measured values around the trigger event to be saved is determined by the pretrigger and the post-trigger settings which can be defined as required in the range between 0 and 100%. In the event that a previously defined trigger condition is present, recording is stopped after the post-trigger time has elapsed.

This transient can then be read out and analysed at a later time using the DTM.
The actual function of the interface module, i.e. the detection of input signals and the output to the analog and digital outputs continues in the background and is not affected by the data archiving process. The individual selection of the trigger position in the recorded transient allows the settings to be made as required, irrespective of the cause of the error or whether a critical state was exceeded.

The occurrence of a previously defined event is called a trigger. The trigger can be activated locally at the device by means of pushbuttons/display or also using the DTM interface on the PC. The absolute duration of the signal trace to be stored may vary according to the different requirements of the process concerned. The time periods required may range from a few minutes up to several months. Both the pretrigger time and the post-trigger time can therefore be set within a large time period by means of buttons and the display, or also by means of the DTM. In this way, an optimum display of the critical range is ensured. The following trigger conditions are possible:

• Undershoot/overshoot of a limit value: the measured value is continuously compared with the defined limit value. The trigger is activated as soon as an undershoot or overshoot is detected. Measuring is stopped after the post-trigger time has elapsed. The data is retained until the system is reactivated.
• Out-of-range values: The measured value, such as the speed of a motor, must not go outside of a specified speed range. In this case, the trigger will be activated.

• Faults in the input circuit: With temperature transducers, the fault may be caused by a wire-break or short-circuit in the temperature sensor. Implausible measured values that are outside of the characteristics of the selected sensor may also activate the trigger signal. With rotational speed monitors with a Namur input, a wire-break or short-circuit at the sensor or sensor cable may cause the trigger signal.
• Manual triggering by actuating a button combination on the device.

• External triggering by means of an additional digital input on the device.
• Power down: Recording is stopped in the event of a power failure. After the power supply is restored, further recording in the ring memory can be prevented so that the trace of measured values recorded before the power failure is retained in the memory.

State-of-the-art and powerful memory technology

Turck interface devices use memory modules with the new FRAM technology for storing measured values. The memory function of FRAM (ferroelectric random access memory) modules is based on the ferroelectric effect of a special material that stores the information in the electrical polarisation of its crystal structure. The polarisation of the material, and thus also the information is permanently retained for several years after an external electrical field has been switched off. The FRAM memory cell is also very similar to the cell of a dynamic memory and also boasts the same properties in terms of speed and virtually unlimited number of possible write/read cycles.

The new technology therefore closes the gap between the volatile and non-volatile memories. The pin compatibility with widely used serial EEPROMs and considerably lower energy requirements make FRAMs the ideal solution for fast data storage in “embedded systems”. The strengths of these memories are fully utilised as integral components of Turck interface devices, particularly for fault diagnostics in sensitive areas, and offer the user a wide range of benefits compared to conventional memory technologies.

Interface devices are currently provided with a 32 KByte measured value memory. The time range that can be stored with this size depends on the scan rate and the internal representation of the measured values. A temperature measuring transducer with a slow measuring cycle time can store several hours in the ring memory.

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