I/O Error Monitoring in Industrial Machine Control

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Modern machine control units are increasingly decentralized in their assembly and have intelligent peripheries addressed by buses. Besides the control of the overall system the recognition of failures and states on input and output lines is of growing importance as the desire to minimize – or where possible totally avoid – costs for service and repairs increases.

This is a task which can be assigned to peripheral devices such as the high-side driver iC-JX, greatly simplifying the monitoring and handling of errors.

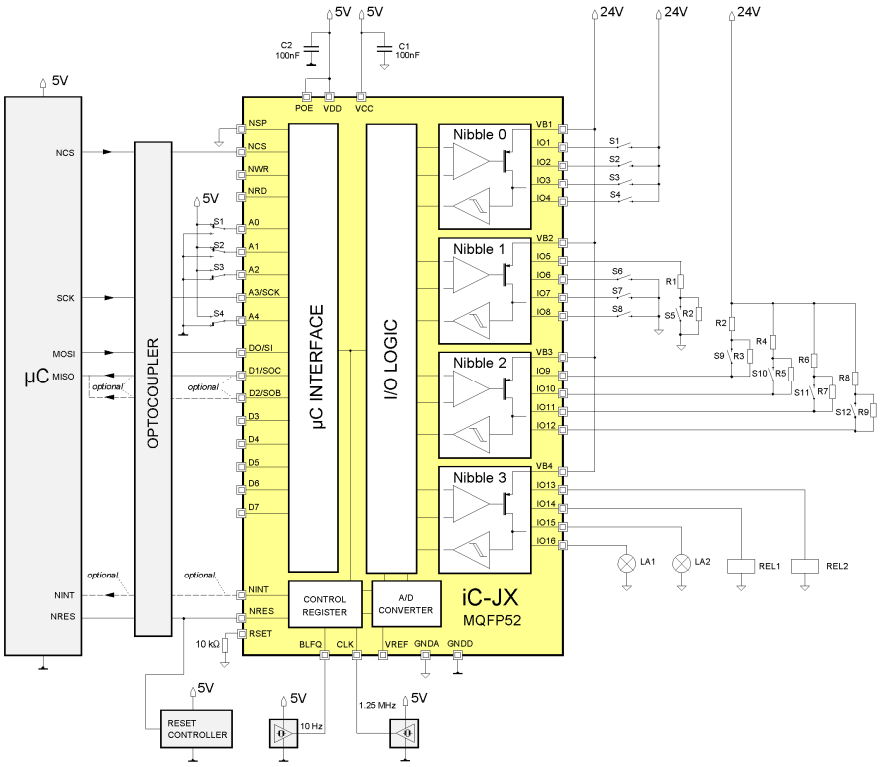

Figure 1: iC-JX in a typical application environment

Figure 1 shows iC-JX in a typical industrial application environment. Designed for use in industrial applications, such as machine control panels or 24V I/O modules, this device permits input and output functions to be completely programmed by the microcontroller control unit, enabling lamps or relays to be driven, switches and sensors to be read out and lines, drivers and sensors to be monitored.
Communication with the microcontroller is achieved by either an SPI (as shown in Fig. 1) or 8-bit parallel interface. In conjunction with an SPI an insolation for the entire I/O system is possible by using only six optocoupler as illustrated in Fig. 1, providing an inexpensive solution. Without the need for any further components up to four JX devices can be addressed via the SPI, making a total of 64 I/O channels available.

iC-JX has 4x4 I/O ports which can be configured in blocks as input or output channels. The bidirectional drivers record logic states from external sources or read back the output state. This enables an open wire or short circuit in the load to be recognized. The high-side short-circuit-proof output channels permit various loads of up to 150 mA dc (500 mA pulses) – including protection against flyback. Integrated control logic identifies input signal changes and generates an interrupt. Each I/O has an digital input filters for suppressing interference (such as contact bouncing, for example). By integrating previously discrete filter components the number of external devices is reduced, thus cutting down on costs.

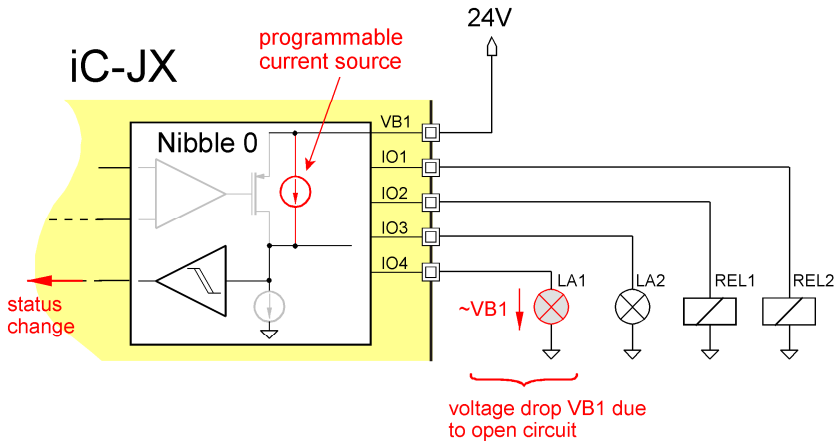

Figure 2: System diagnosis using programmed current sources

Each I/O port comes equipped with programmable current sources so that the presence or specified values of connected loads can be checked prior to activation (system check, Figure 2). In addition all ports have a common 10-bit A/D converter at their disposal for the evaluation of any sensors connected up to the device (Figure 3). This allows any failures to be recognized, such as cable fractures or changes in the characteristic curve of loads due to the effects of aging or excessive temperature.

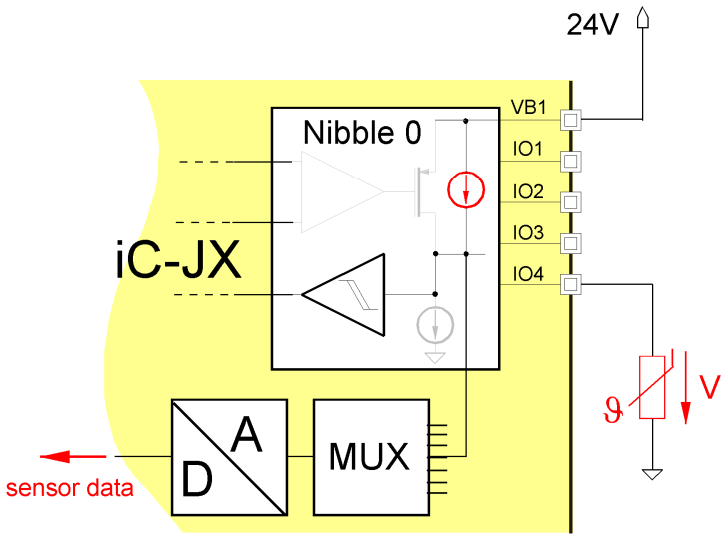

Figure 3: The use of the A/D converter for sensor evaluation

Further application-specific functions are the definition of interrupt sources, such as over-current, input levels and flash circuits, such as those used in control panel displays. The given interrupt sources can be modified by digital filters with variable filter times, allowing impulsive input signals caused by contact bouncing or high inrush currents with lamps and capacitive loads to be masked, thus not automatically triggering an interrupt. In return all inputs have a Schmitt trigger characteristic so that slow signals can also be processed reliably.

The device has internal protective circuitry governing the shutdown of drivers with under-voltage and excessive temperature, for example. Each driver stage has its own temperature sensor which is evaluated in two stages, putting the microcontroller in the position of being able to carefully shutdown the chip if excessive temperature occurs. A common inhibiting input permits all outputs to be shutdown externally, thus providing a security watchdog which is independent of the processor.

Thanks to its internal signal conditioning unit the use of iC-JX does away with the need for external filter components. By integrating a signal readback function the device also allows for a greater packaging density, at the same time providing improved reliability and flexibility.

Further information can be requested free of charge by mail or on the internet at www.ichaus.com.