Choosing a Multiport Serial Board for Serial Communication

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Serial communication (RS-232/422/485) has been used in Industrial Automation (IA) for many years. Since computers come equipped with a limited number of serial ports, multiport serial boards (MSB) are needed to expand the number of ports to connect additional peripheral devices. Although choosing an MSB may seem like a simple task at first, you may encounter problems if you fail to take the type of chip, driver, hardware and application used into consideration.

The Chip

The UART chip is the primary component used in serial communication. Although an independent 2- to 8-channel UART chip is usually sufficient, a UART integrated with PCI or PCI Express interface reduces the number of components onboard and translates into better MTBF, lower RMA, and lower power consumption, all of which go a long way in protecting your investment. Also make sure the UART of your MSB supports functions specific to industrial automation (IA), such as on-chip flow control, RS-485 ADDC, and linear baudrate. Without these UART functions, your serial transmission will be susceptible to poor reliability.

For multiport serial products, Moxa offers the following UART chips that support IA specific functions: the MU150 1-channel UART, MU860 8-channel UART with PCI interface, and MUE-x50

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2- to 8-channel UART with PCIe interface (the world's first combined PCIe-UART solution).

The Driver

It is best to use a driver that is developed and maintained by the MSB manufacturer. Some MSB manufacturers use turnkey solutions obtained from the UART vendor and have no ability to maintain the drivers. If you need assistance with the driver, it will not be easy to get quick support from these vendors. Another problem is that these UART vendors generally develop drivers that only support major operating systems such as Windows and Linux. If you need drivers such as SCO OpenServer 5/6 or QNX, which is popular in some IA applications, you may end up waiting a long time for support because these vendors have no software team.

Even if you use a driver from the MSB manufacturer, you may still encounter quality problems because modern operating systems are more complicated than earlier ones, such as Windows and Linux designed for Multi-Core CPUs. OS-related problems with the driver are usually the result of poor programming. Therefore, it is best to use certified drivers such as WHQL for Windows to ensure optimum driver quality and user-friendliness.

Moxa's drivers not only support Windows and Linux, but also SCO OpenServer, SCO Unixware, FreeBSD, QNX, DOS, Windows CE and Windows XP Embedded. In addition, all Windows drivers are WHQL certified and all drivers are maintained by Moxa's driver team. Moxa has over 20 years experience in UART driver development and has developed the Serial Verification System (SVS) for different operating systems. The SVS can confirm Moxa driver quality and prevent recurring problems because all customer feedback is updated into this system.

As operating systems are constantly updated, Moxa's driver team constantly develops drivers to support the latest version as soon as possible.

The Hardware

When choosing an MSB, select a vendor that can provide a complete hardware solution including different numbers of channels, system bus interfaces (ISA, PCI, PCI-X, PCIe, etc.), RS-232/422/485 compatibility, isolation protection, and cable wiring. This way, you won't have to spend extra time finding separate solutions from different vendors to satisfy each requirement.

Quality is an important issue. If your system integrates an MSB with a high RMA rate, this will negatively influence your company's reputation. Moxa products also comply with safety standards, such as CE, FCC, UL, TUV, etc. With Moxa's quality control system, Moxa MSBs have a low RMA rate and that is the reason why customers continue to choose Moxa.

The Application

The application layer support used to control and monitor your peripheral devices is another important factor to consider when choosing a multiport serial board product. For example, good utilities and programming libraries can save system development time.
In addition, not all software engineers in industrial automation are familiar with C or C++ programming and require a quick and bug free way to code.

Moxa's software team also has good experience in serial communication programming and understands customer requirements. For the most popular Windows platforms, Moxa provides PComm Lite. PComm Lite comes equipped with a library that simplifies Win32 C and C++ programming and a Terminal/Diagnostic/Monitor utility that saves debugging time. Communication problems may be caused by the software or hardware. For hardware issues, you can use the Diagnostic utility to run a UART internal test to make sure there are no problems with the MSB. The Terminal utility allows you to do simple data transfers to make sure the cable wiring is correct.

Terminal can also open multiple windows for different COM ports. It can also control and detect modem signals, XModem/YModem/ZModem file transferring, sending and detecting of broken signals, data capturing, and VT100/ANSI emulation. If your serial program was developed by a third party, you can also use the Monitor utility to watch the serial status such as the Tx/Rx count, modem signal, and baud rate/parity/stop bits setting of your program. Monitor can also verify communication problems such as wrong settings or modem signal statuses without feedback from the device. With PComm Lite support, you can solve most of your communication problems in several minutes.

IA Specific Functions

On-chip Flow Control

Reliability is always a top priority in industrial automation. To prevent data loss in serial communication, flow control is required for slow/legacy devices as well as high data rate applications. Most vendors only implement flow control via the driver. The driver will turn off the RTS mechanism if the receive buffer reaches the high-water level and turn the RTS back on if the buffer drops below the low-water level. But this method is not reliable. If the system is busy, the driver can not process the flow control on time.

To solve this issue, the UART must support "on-chip" flow control including RTS/CTS and Xon/Xoff flow control. All the processes are automatically performed by the UART so the driver must also be compatible with the UART as well. Incompatibility between the UART and driver is why some MSBs with on-chip flow control still experience data loss.

All Moxa UPCI and PCIe products support on-chip RTS/CTS and Xon/Xoff flow control. The drivers are also designed to be compatible with the UART. Furthermore, all Moxa drivers and hardware are tested under high stress situations, 4 boards at 921.6 kbps for over 24 hours, and experienced no data loss.

RS-485 Support

RS-485 is a type of half-duplex communication that requires users to manually switch the direction of transmission. In the past, most engineers used RTS signals to perform this function but it was very time consuming because users had to make sure that all data are sent out before switching from "transmit" to "receive." Now, technology is available to automatically detect and switch the direction. It is best if your MSB's UART can support this function.

All Moxa UART solutions support this IA requirement. In addition, all Moxa RS-485 UPCI MSBs are equipped with our patented Auto Data Direction Control (ADDC), which means programmers no longer need to worry about manually controlling the transmission direction.

Linear Baudrate

Many applications use special baudrates such as 500 Kbps or 250 Kbps. The baudrate for most UARTs is controlled by a simple formula: $Divisor = Frequency/(16*Baudrate)$. The divisor is set in the UART register and the limitation must be an integer. All numerals following the decimal point are ignored. However, this formula limits the UART to a specific baudrate. Moxa's MU860 with linear baudrate solves this problem by using a special function that can support 8 times as many baudrates as a typical UART.

Conclusion

Choosing a multiport serial board can be trickier than it seems. Not only do users need to consider factors such as chips, drivers, hardware, and applications, but also whether or not the board can support industrial automation (IA) specific functions. Moxa has been a leading provider of serial communication consultation and multiport serial board products for over 20 years. From fundamental hardware components to high-level serial application programming, Moxa continue to be a trusted source of professional solutions and continues to develop new technologies to meet the ever-changing demands of industrial automation.