B&B Converters for the Industrial Bus World

What is an industrial bus? Traditionally, the industrial bus has been used to allow a central computer to communicate with a field device. The central computer was a mainframe or a mini (PDP11) and the field device could be a discreet device such as a flow meter, or temperature transmitter or a complex device such as a CNC cell or robot. As the cost of computing power came down, the industrial bus allowed computers to communicate with each other to coordinate industrial production.

INTERBUS-S
Modbus
BITBUS/IEEE1118
PROFIBUS
Optomux
Data Highway, DH
P-NET
DMX512
Series 90, SNP and SNPx
SUCOnet-K1
Measurement Bus/DIN 66348

As with human languages, many ways were devised to allow the computers and devices to communicate and, as with their human counterpart, most of the communication is incompatible with any of the other systems. The incompatibility can be broken into two categories: the physical layer and the protocol layer.

The physical layer and the protocol layer can be defined using the phone system as an example. Any spoken language can be carried over a phone line. As long as both the speaker and the listener(s) understand the language, communication is possible. The phone line is not concerned with the meaning of the signal that it carries, it is merely moving those signals from one point to another physically. This is the physical layer, the conduit in which communications pass from one point to another. On the other hand, the speaker and listener(s) are concerned with what is transported over the phone line. If the speaker is talking in Spanish and the listener(s) are only fluent in English, communication is not possible. Although the physical layer is working, the language or "protocol" is not correct, and communications cannot exist.

The industrial world has developed a variety of different physical and protocol communications standards. A list of all of them would fill the rest of this article, so we will limit this discussion to industrial busses using the RS-232 and RS-422/485 standards for their physical layer.

The greatest difference between RS-232 and RS-422/485 is the way information is transmitted.[1] RS-232 uses a single-ended, bipolar voltage to move data between two points. RS-422/485 uses a balance differential pair to accomplish this same task. The advantage of using RS-422/485 in an industrial environment is greater noise immunity. This allows a greater distance between the transmitter and receiver. There is a downside to the greater distances provided by RS-422/485- the "difference of potential" between end points.

Industrial busses cover a large area. Often different areas of the network are supplied by different power sources. Even though all of the sources are grounded, a voltage difference can exist between the grounds of these voltage sources. This voltage difference can upset the data line in an RS-422/485 bus by pushing the signal voltage out of range and, in some cases, an excess voltage can damage equipment. Another source of excess voltage potential can be caused by intermittent sources. Power line surges and lightning are causes of this type of disturbance, but other causes, such as large electric motors starting and stopping, can temporarily affect the ground reference voltage. The solution to this problem is to employ RS-422/485 devices that provide isolation between different parts of the network.[2] Additional protection can be achieved by using a fiber optic link between the network and areas known for voltage problems such as a power house or a water treatment plant.

Two popular industrial busses that use the RS-232 and RS-422/485 standards are Modbus and Data Highway. Modbus was developed by Modicon for its line of PLC's, up to and including the 984 line of controllers. Modbus can be configured for either RS-232 or RS-485 in a 4-wire mode. (Note: Modbus Plus is not RS-232 or RS-485 compatible). Data Highway is the name of the industrial bus produced by Allen-Bradley and is used on some SLC 500 controllers. An RS-485 port is also available on some PLC-2, 3 and 5 controllers. Consult the manual provided with your controller to be certain of the type of bus supported. The industrial busses that adhere to the RS-232 and RS-422/485 standard are listed below and on B&B's web page, www.bb-elec.com/bus-chart.asp, along with products that are compatible with various industrial busses. B&B products support these busses at the physical layer only and are mainly used as repeaters, line extenders and isolators. B&B also offers a custom design service to solve particular problems that arise from industrial busses.

(continued from page 1)

More information on industrial busses:

[1] See Technical Article #9 for details on the RS-232 and RS-422/485 standards, www.bb-elec.com/techlibr.asp

[2] See Technical Article #10 for details on data isolation, www.bb-elec.com/techlibr.asp

RS-422/485 Application Note, www.bb-elec.com/techlibr.asp

IndustrialBus Name	Manufacturer	B&B Product Compatability	Recommended Converter RS-232/485	Recommended Repeater/ Isolator	Protocol
B&B Product Compatability with Industrial Busses					
INTERBUS-S		Remote Bus ONLY (Local bus is NOT compatible)		485OP 485OPDR	Remote Bus is RS-485 Baud=500 kbps Full duplex
Modbus	Modicon	Modbus (Modbus+ is NOT compatible)	485OTLED* 485LDRC*	485OP 232SPHI4 485OPDR	Modbus can be configured for RS-485(4-wire) or RS-232 Baud=50 to 19200 bps Parity: even, odd, none
BITBUS/ IEEE1118		BITBUS/IEEE1118	485OTLED* 485LDRC*	485OP 485OPDR	BITBUS is RS-485 Baud(kbps)=375, 62.5
PROFIBUS		PROFIBUS-DP, PROFIBUS-FMS (PROFIBUS-PA is NOT compatible)	485OTLED* 485LDRC*	485OP 485OPDR	PROFIBUS-DP, FMS is RS-485 Baud (kbps) = 9.6, 19.2, 93.75, 187.5, 500 2-wire
Optomux	Opto 22	Optomux	485OTLED 485LDRC	485OP 485OPDR	Optomux is RS-422/485 Baud=38.4 kbps 4-wire
Data Highway, DH	Allen-Bradley	Data Highway, DH	485OTLED* 485LDRC*	485OP 485OPDR	Data Highway, DH, are RS-485 Baud(kbps)=57.6, 115, 230.4 2-wire
P-NET		P-NET	485OTLED 485LDRC	485OP 485OPDR	P-NET is RS-485 Baud=76.8 kbps
DMX512	USITT	DMX512 (AMX192 is NOT compatible)		485OP 485OPDR	DMX512 is RS-485 Baud=250 kbps
Series 90 (SNP) and (SNPx)	GE Fanuc	Series 90 (SNP) (SNPx)	485OTLED 485LDRC	485OP 485OPDR	Series 90 uses RS-232, RS-422, RS-485
SUCOnet-K1	Moeller	SUCOnet-K1		485OP 485OPDR	SUCOnet-K1 is RS-485 2-wire Baud=187.5 kbps
Measurement Bus DIN 66348		Measurement Bus	485OTLED* 485LDRC*	485OP 232SPHI4 485OPDR	Measurement Bus RS-485 and RS-232 Baud=110 bit/s to 1Mbit/s 4-wire

The 485OTLED and 485LDRC are rated to 115.2 kbps.
B&B offers a Fiber Optic Modem (FOSTC) and a DIN rail version (FOSTCDR) to extend a network or single drop to over 2.5 miles.
If you have a serial interface problem B&B can help with a custom product to meet your requirements. In-house engineering and manufacturing allows B&B to develop a custom product quickly and at a cost that may pleasantly surprise you.