

# Industrial USB - Bridging the Gap

## The Challenge of Industrial Disconnect

Finding a new computer today that will ship with the once standard DB-9 and DB-25 connections, and that will communicate with your RS-232 and RS-422/485 devices is a significant challenge.

As the high-speed Universal Serial Bus (USB) has progressively dominated the consumer market, these slower and more cumbersome connections have become obsolete to the masses. Following typical supply and demand procedures, PC manufacturers have simply stopped providing them as standard hardware, replacing them with USB components.

*USB technology has created a gap between current industrial equipment and today's computers.*

This shift in the marketplace represents somewhat of an obstacle for industrial players, as most of their current electronic equipment utilizes RS-232 and RS-422/485 interfaces to communicate with their computer systems.

Consequently, a major connectivity gap has emerged between industrial electronics and today's computers.

## Understanding How and Why USB Dominance Came to Be

USB was officially introduced to the world in 1995, although the concept had been in the works since before 1994. The concept was the brainchild of a consortium of seven companies that combined their resources to advance the ways computers connect to peripherals and other components.

The original consortium of seven companies, now called the USB Implementers Forum, Inc (USB-IF), has grown to include over 1000 members that help steer the promotion and development of USB technologies. Leading participants within the USB-IF include industry players such as Intel, Hewlett Packard, Microsoft, NEC and Phillips.

*Traditional peripheral swapping is costly and time consuming.*

It is little wonder that USB has so quickly obtained such a dominant market presence. Prior to USB technologies, adding and subtracting peripherals to your computer system or network required powering down the system, making the adjustment, rebooting the system and then installing necessary drivers. This process took time and consumed valuable human resources. Additionally, more often than not, additional internal components, such as PCI cards, were required to make the addition, further complicating installation procedures and expenditures.

USB technologies have radically changed this process. USB allows users to "hot swap" components – or add and subtract peripherals such as



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*Hot swap, extensive expansion capacities, and low-cost components and wiring have enabled the rapid rise of the USB connection.*

printers, cameras, scanners, and a wide range of Human Interface Devices (HID's) without rebooting. And while device drivers are still necessary, the installation process has been expedited and simplified, especially considering that drivers are only installed once when a device is first connected.

A final aspect of USB technologies that have made it so appealing is its expansion capacities. A standard DB-9 connection has little flexibility in controlling multiple external components and peripherals. One connection controls one piece of equipment. In stark contrast, when combined with USB hubs, adequate PC resources, and proper wiring, a single USB port can manage as many as 127 devices. This feature instantly frees up internal computer space, saves on buying additional hardware, eliminates the need for setting COM ports and IRQ's, and provides for almost instant installation of new peripherals.

## The Technical Capacities and Specifications of USB

### Supported Operating Systems

Windows 98 was the first OS to support USB connections right out of the box. Since then, virtually every OS on the market is USB enabled. Support for Windows 95 has since been added and third party solutions have been created for support in NT 4.0.

### Logos and Terms

There are various USB logos, each with different meanings and corresponding product specifications.

*Windows 98 and newer operating systems fully support USB connections.*



Standard USB Logo – Current logo that designates the existence of a USB connection. Can be USB 1.0, 1.1, or USB 2.0. Data transfer rates can vary from 1.5Mbps to 12 Mbps.



High-Speed USB Logo – Indicates the presence of USB 2.0 with transfer capacities of up to 480Mbps.



USB On-the-Go Logo – A unique version of USB technology, this allows certain types of peripherals, such as PDA's and cell phones to connect directly to each other, without a computer acting as host. Can be USB 1.0, 1.1, or 2.0 with speeds varying from 1.5Mbps to 12Mbps



USB On-the-Go High Speed Logo – Always USB 2.0 technology with transfer speeds of up to 480Mbps.



USB Wireless Logo – The latest in USB technology that allows peripherals and computers to communicate without a hard connection at distances of up to 30 meters and at speeds of up to 12Mbps.



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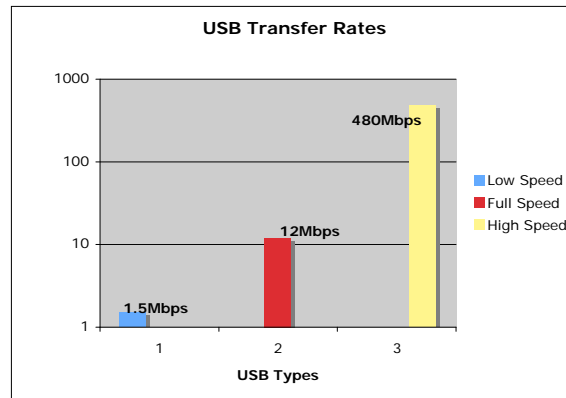
*High baud rates and automated backward compatibility provide for extreme ease of use and broad connection diversity.*

All version types are backward compatible and will support previous versions by slowing down transfer rates. Baud and version rates can co-exist on the same bus, but it is recommended that high-speed and low speed devices be separated for maximum performance.

### Data Transfer Rates and Terms

- Low or Normal Speed 1.5Mbps
- Full Speed 12Mbps
- High Speed 480Mbps (USB 2.0)

**Note:** Not all USB 2.0 devices are certified for High Speed transfer rates. Look for the USB High Speed Logo to ensure maximum capacity.



### Technical Specifications

*Attention: Not all USB 2.0 devices operate at High Speed baud rates. If rates above 12Mbps are needed ensure that both the device and the computer are certified High Speed.*

- Max wire length 5 meters  
Note: Can be extended to 30 meters by adding a series of hubs.
- Max number of hubs 5
- Max number of devices per USB port 127  
Note: Hubs count as a device
- Low power device 100mA
- High power device 500mA
- Wiring Configuration Star topology
- Signal Levels (volts) 0.0-0.3 (low)  
2.8-3.6 (high)
- Communication type Half-duplex

### Wiring Types

There are 4 types of wiring systems used with USB. All use Shielded Twisted Pair (STP) cabling.

#### USB Type A



USB-A Female  
(Chassis Mount)

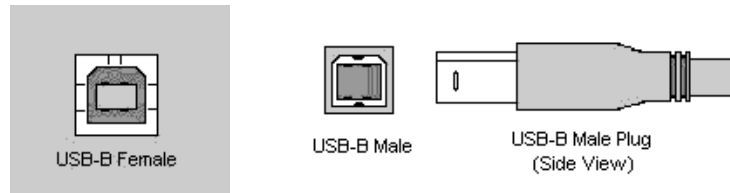


USB-A Male

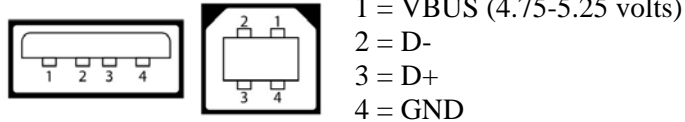


USB-A Male Plug  
(Side View)

## USB Type B



### Pin Numbers and Function



## Bridging the Gap - Connecting to USB

*USB converters give industrial companies the power to connect their current equipment to computers that do not support RS-232, and RS-422/485.*

The technology gap between existing industrial equipment and today's computers does create a challenge for many companies. Fortunately, it is an obstacle that is quickly and inexpensively solved.

The solution lies in the emergence of a wide range of USB converters. These converters give companies the freedom and flexibility to utilize the latest computer power and resources, while maintaining their fully operational, legacy peripherals and equipment.

### What To Look For

USB converters come in a wide variety of shapes and sizes. The challenge is that many connectors of the same pin configuration do not necessarily make the necessary conversions or meet the required baud rates.

For example, a USB to serial converter connecting a 9-pin DB9, will typically only have the capacity to connect to RS-232 devices. However, supported operating systems, baud rates, cable types, buffer rates, duplexing capabilities and a number of other factors can vary greatly. The same type of variables hold true with USB to RS-422 and RS-485 converters.

Because of these differences, it is essential that you know the exact specifications needed for the conversion process. Here are seven essential elements to consider:

*There are 7 essential questions that must be answered before you can select the right USB converter.*

1. Are you converting from RS-232, RS-422, RS-485 or do you have a need to move all of them through on USB host?
2. What transfer rates are required?
3. What duplex do you need for your RS-485 communications?
4. Are you dealing with DB9 or DB25 connectors? Male or female?
5. When making the conversion, do you need optical isolation to withstand harsh environments?



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6. What handshake requirements do you have and does the converter meet those needs?
7. Does the converter meet the voltage needs of your RS-232, 422, 485 device?

### **Installation**

Once these fundamental questions have been answered and the appropriate converter selected, bridging the gap is a very simply process. Simply plug in the converter to USB port on the computer and connect your peripheral to the other end. On the first connection, all necessary drivers will need to be installed, but after that you can freely hot swap elements and components as necessary.

## **An Overview of USB Converter Benefits & Features**

*Industrial companies can save valuable time, money and human resources by utilizing USB converters.*

- Is a low cost solution for connecting existing equipment to today's computer systems
- Frees up computer's internal hardware space
- Eliminates time consuming set up of confusing IRQ's, I/O addresses and COM Ports
- Allows hot swap so numerous peripherals can be added and/or subtracted instantly
- Up to 127 devices can be added and controlled by a single USB port. This minimizes costs and maximizes resources
- Automatic and seamless adjustments for various version types and baud rates
- Converters available for virtually every industrial situation and application.
- Readily converts RS-232, RS-422 and RS-485 to USB, regardless of connector pin configuration
- Peripherals can be up to 30 meters away from controlling computer system
- USB converters allow companies to save valuable resources of time, money, and human resources by avoiding costly hardware upgrades, and moving to a true "plug and play" hot swap environment



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