# Machine Tool Communications

The basics of machine tool communication are sending or receiving an NC program to or from a computer and a machine. This is done from the com port (RS-232) of the computer and the com port (RS-232) of the machine.

A cable is used to connect the com port of the computer to the com port of the machine. The cable has a connector at each end. The connector will be 9 or 25 pin depending on the connector port configuration.

Each of the pins in a connector port has a different function. The pins are numbered to distinguish one from the other. For example one pin is used for transmission, another is used to receive data, and another is used for a ground. These are the three pins that are needed for machine tool communications.

A pin-out description is usually supplied for each machine. This pin-out description will determine the function for each pin. Fortunately the pin-out for most controls is standard for all controls. Typically there will be a 9 pin connector on a computer and a 25 pin connector on a machine's control.

Cable

1) Determine the connector plugs needed for the machine side and the computer side (9 or 25).
2) Use the pin-out chart (see fig. 1) to determine which pins need to be connected in the connector plug.
3) Determine the proper jumpers required in each connector plug.
4) The cable being made is called a "Null Modem". It is null because the transmit pin from one end is being connected to the receive pin on the other side. And the ground pin from one side is being connected to the ground on the other side.
5) Check for continuity after soldering the wires and jumpers in the plug.
6) Null Modem adapters can be purchased with the appropriate pin-out from local electronic stores. If these are purchased, "straight cable" needs to be purchased to complete the cable from the computer to the machine tool.

Cable notes:

1) Keep the cable as short as possible. The longer the cable the possibility of data corruption is higher. This is because the resistance in the wire increases with the length of the cable and the voltage reduces in this length. The voltage should be between 9 and 12 volts AC between the ground pin and the transmission pin.
2) The voltage in the wire affects the baud rate and data corruption. The higher the voltage the higher the baud rate can be. Data transmission can be corrupted when the baud rate is too high for the amount of voltage in the line. Use low baud rates when the voltage is low.
3) Do not wrap the cable in a coil. This will cause RF (radio frequency) noise which will cause data corruption.

4) Do not attach the cable alone electrical conduit. This will cause RF (radio frequency) noise which will cause data corruption.
5) Do not lay the cable over florescent lights. This will cause RF (radio frequency) noise which will cause data corruption.
6) Confirm that the machine is grounded properly with a single not spliced wire from the machines buss bar to the buildings buss bar in the sub panel. If not done properly, this will cause RF (radio frequency) noise which will cause data corruption.
7) Data corruption can stop transmission, or it can change the data being sent. This is the most dangerous type of data corruption. The position values can change from what was needed.

Com Ports

1) The transmit circuit is separate from the receive circuit. One or both might be functioning. This result in being able to send to the machine but not receive from the machine.
2) The voltmeter test can be used to determine which device is functioning or not. Place the voltmeter in 0 to 20 volts AC, and put the black lead on the ground pin, and the red lead on the transmit pin. Transmit a file from the device being tested and the reading should be between 9 and 12 volts. If it is lower than 9 volts, this will cause data corruption. One of the ways for a computer builder to save money is to put a 3 volt com port in the computer. Most computer builders are not thinking about machine tool communications when they build the computer.
3) If the voltage is lower than 9 volts and higher quality com port should be installed in the computer. Digi International (www.digi.com) is an example of a com port board manufacturer that can be installed into a computer to get higher voltage in the com line.
4) If the transmit circuit is tested to function on both the computer and machine side, and the cable is good, the receive circuit on either the computer or machine side can be non functional. This would prevent receiving a file.

Communication Parameters

1) The communication parameters in both the machine and the computer need to be matched.
2) Usually the parameters can be changed on both sides. They just need to be the same.
3) The parameters are the baud rate, data bits, parity, and stop bits. The information for communication parameters can be found in the user's or operator's manual of the machine tool. Change or set the communication parameters in BobCad to match the requirements of the machine tool.
4) Sometimes a delay is needed during transmission. This is usually needed when the computer's clock rate is much higher than the machine's clock rate. This usually happens when the computer is of a much newer vintage than the machine.
5) The handshake parameter between a machine and a computer is usually Xon/Xoff. The other handshake options would be used for other devices that require a specialized communications protocol.

6) Beginning and End codes are needed in the program to denote the beginning and end of NC program data. The correct beginning and end code information is given in the user's or operator's manual of the machine tool. For example, commonly the % code is used as the beginning and end code.
   (Beginning of Program)
   %
   N1 O1 (PN 1234)
   N2 G90 G0 G40

   (End of Program)
   N100 M30
   %

7) All controls have an End of Block (EOB) requirement. This is the block of code that represents the end of each line of program coding. Commonly these would be a carriage return + line feed. These would be an ASII 10 and 13 codes. Sometimes the code that is displayed on the machines screen is a ";" or nothing. The carriage return and the line feed are non displayable codes. The correct EOB information is given in the user's or operator's manual of the machine tool.

Ready to transmit

1) Always get the receiving device ready to receive first. For example, set the machine in the receive mode first, then go to BobCad and press the OK button in the Send menu.

Ready to receive

1) Always get the receiving device ready to receive first. For example, from the receive menu in BobCad press the OK button, then go to the machine and use the send function at the machine.

Direct Numerical Control (DNC)

Direct Numerical Control is a form of machine tool communication not supported in BobCad. DNC is used when the length of the program exceeds the memory capacity of the machine. Another term for DNC is "Drip Feed". DNC requires the best communication system consisting of all the subjects discussed above. This is because data integrity is paramount during a DNC session. Any corrupt data can cause the machine to move in a path not expected by the programmer. Specialized software is required for DNC transmission. This software should be able to accomplish mid-program starts. Additionally, this software should be able to insure data integrity by using X-modem or other similar style communications protocol. X-modem style protocol uses a check-sum to insure data transmission.

## DNC Solutions

Call BobCad Technical Support for help with DNC solutions.

Simple Solutions:
Item # 121050 Predator CNC Editor Bundle for 1 Machine $850

Item # 121100 Predator CNC Editor Bundle for 2 Machines $925

These packages include, the Predator CNC editor, 25 feet of custom cable, an RS-232 card for a desktop or a PCMIA card for a laptop computer.

Add $1.50 per foot for every foot beyond 25 feet.

Some machines need special shaped adapters for the cable plugs. These are available. Please indicate the type of machine you are connecting to with your order.

Advanced solutions:
Predator offers advanced DNC solutions. Discuss your DNC needs with your BobCad Service Technician and we will provide your company with a custom quote.

Other Solutions:
Job Traveler system, Program Verification System, Remote Machine Monitoring, Paperless shop, and Shop organization are some of the things we offer.

Use the Behind the Tape Reader board to replace tape reader devices on older machines.

**Disabling the FIFO Buffer Settings and setting Communication Parameters**

Go to the **Device Manager;**

*For **Windows 98SE** and **ME:***

Click on **START** / **SETTINGS** / **CONTROL PANEL**, then double-click on **SYSTEM**, and then **DEVICE MANAGER**.

*For **Windows 2000:***

Click on **START** / **SETTINGS** / **CONTROL PANEL**, then double-click on **SYSTEM**, and then **HARDWARE**, and then **DEVICE MANAGER**.

*For **Windows XP:***

Click on **START** / **CONTROL PANEL**, then double-click on **SYSTEM** then **HARDWARE**, and then **DEVICE MANAGER**.

*Then, For all **Windows:***

Look for the **PORTS (COM & LPT)** section and click the plus sign, **" + "** to expand the section. Double-click on the communications port entry you are using to bring up the **Port Properties Window**. You will see some tabs along the top of the window. Select the **PORT SETTINGS** tab.

Select the **Port Settings Tab**. Here you can set the Baud rate, Parity, Data bits, Stop bits, and Flow control. These settings should be the same as your machine settings.

Toward the bottom of the **PORT SETTINGS** window, select the **ADVANCED** button. You'll be presented with check boxes that can be unchecked to disable the **FIFO buffers**. Once disabled, try your transfer again.

**Windows ME** has **High** / **Medium** / **Low**. Reduce them as far as possible and try your transfer again.

These are the common pin-outs for nearly all CNC controls