Communication with ABB Controller

WARNING: This document is a draft based on technical documents from ABB. These notes have not been field tested and are subject to change.

Overview

This document explains how to set-up communications between the DVT 600 Series and the ABB S4C+ Controller. Some known confusion points and hardware problems are discussed and several solutions are presented. A very simple communications example is described to illustrate the necessary commands used in Rapid language and the steps required to configure DataLink. The purpose of this document is to address communication issues, for a more elaborate example involving vision and motion control the reader is referred to the documents under Motion Control Notes.

Hardware

The DVT 600 Series can communicate inspection results through a serial RS-422/485 connection or via Ethernet TCP/IP. The ABB controller communicates with external devices using a serial RS-422 or RS-232 connection. Therefore, serial communications needs to be established between the two systems. Both devices can send and receive data as ASCII characters without an additional serial protocol.

Confusion Point: System-specific communications must not be confused with data exchange communications.

The DVT 600 system commands are used to communicate from the Framework User Interface to the firmware in the SmartImage Sensor. These system commands are also ASCII characters and are preceded by a '# ' or a '*'. For instance, the command to trigger an inspection is '#YI'. For a complete list of commands refer to the FrameWork Command List or Appendix A of the FrameWork User guide. All DVT documentation is available for download at www.dvtsensors.com.

In the DVT 600, system commands and data can be sent over the serial port or over the Ethernet port. Since the same physical connection can be used for both types of information, a distinction is made by selecting the System driver or the DataLink driver under the **Image Sensor Communications** dialog box in the **Communications menu**. Figure 1 shows a schematic of the basic connections, the ports used are indicated as well as the type of data that flows over the different lines.

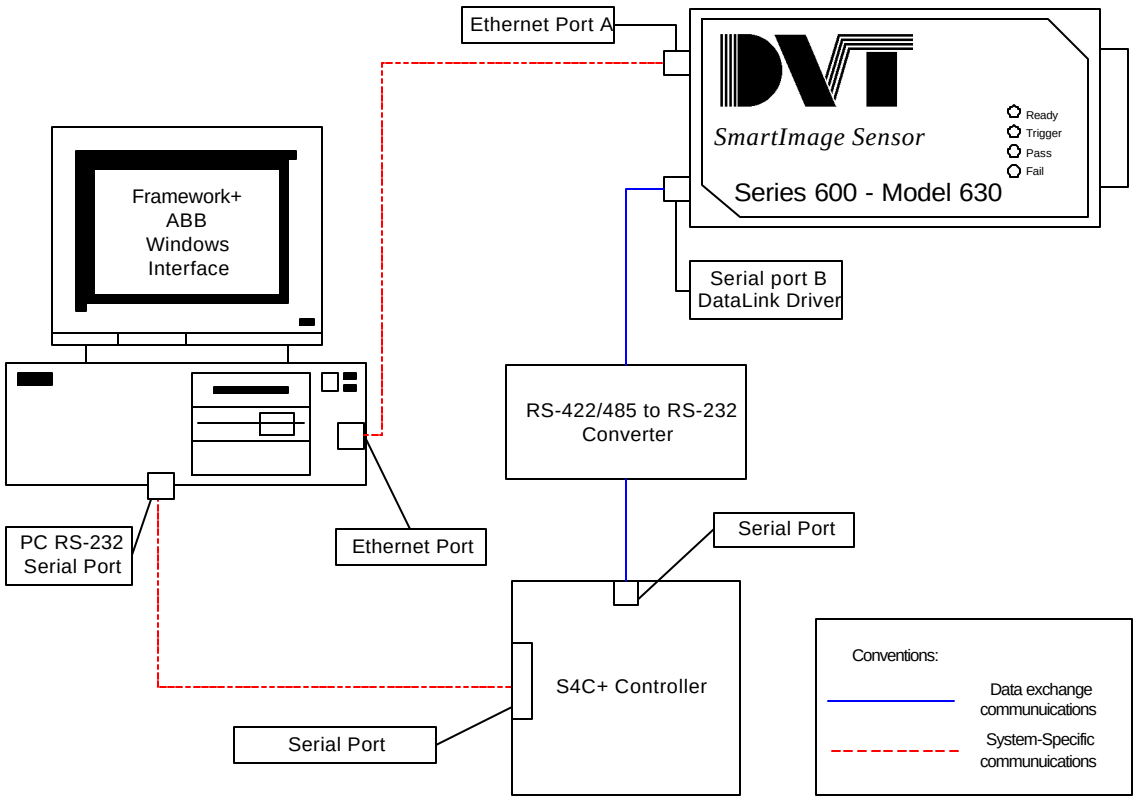


Figure 1: Schematic of Connections

The configuration shown above is useful for testing because it allows the user to simultaneously interface with the image sensor and with the controller using the corresponding Window's GUIs. Assuming that both system communications are running normally let us describe in detail the data exchange connection.

To go from the DVT system to the ABB controller, the converter block in figure 2 must perform two functions: change standards from RS-422/485 to RS-232 and provide the proper connectors to the S4C+ and DVT cables. The serial connection on the DVT 600 is an RS-422/485 port with a RJ-11 connector plug. A shielded RJ-11 cable is offered as an option with the DVT 600 system. The S4C+ has both an RS-232 and an RS-422 port. Some ABB equipment is designed to be used with the RS-422 port, so for the purposes of generality, the connection with the RS-232 port will be covered below. Both serial ports on the S4C+ controller use a DB-9 connector.

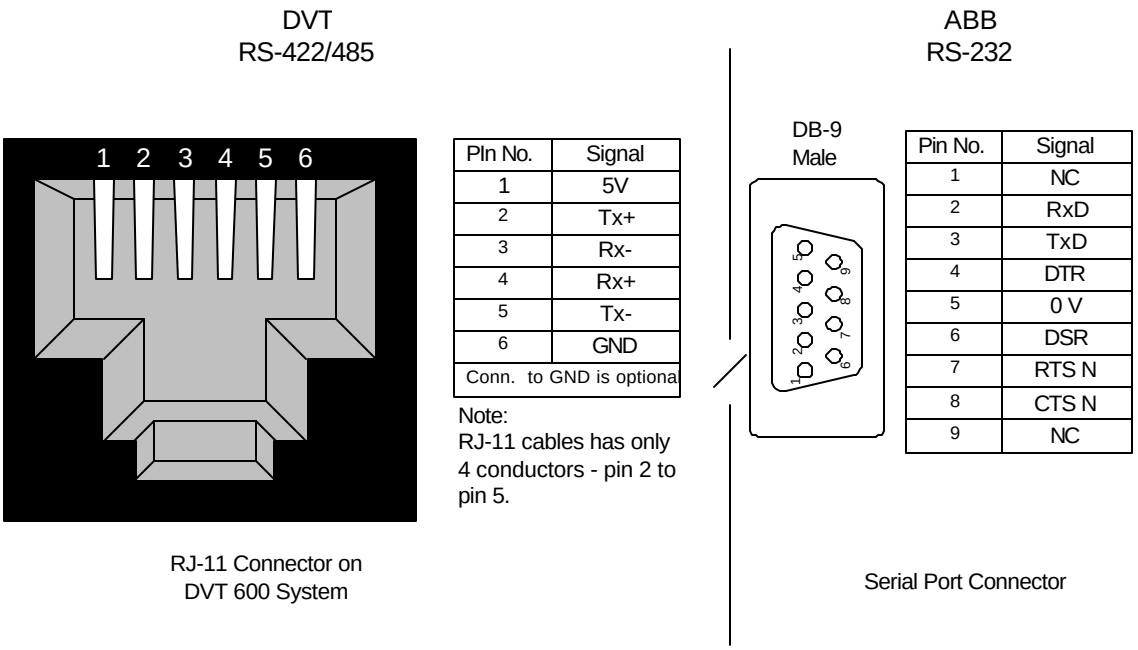


Figure 2 Serial Stds. and Connectors on Both Systems

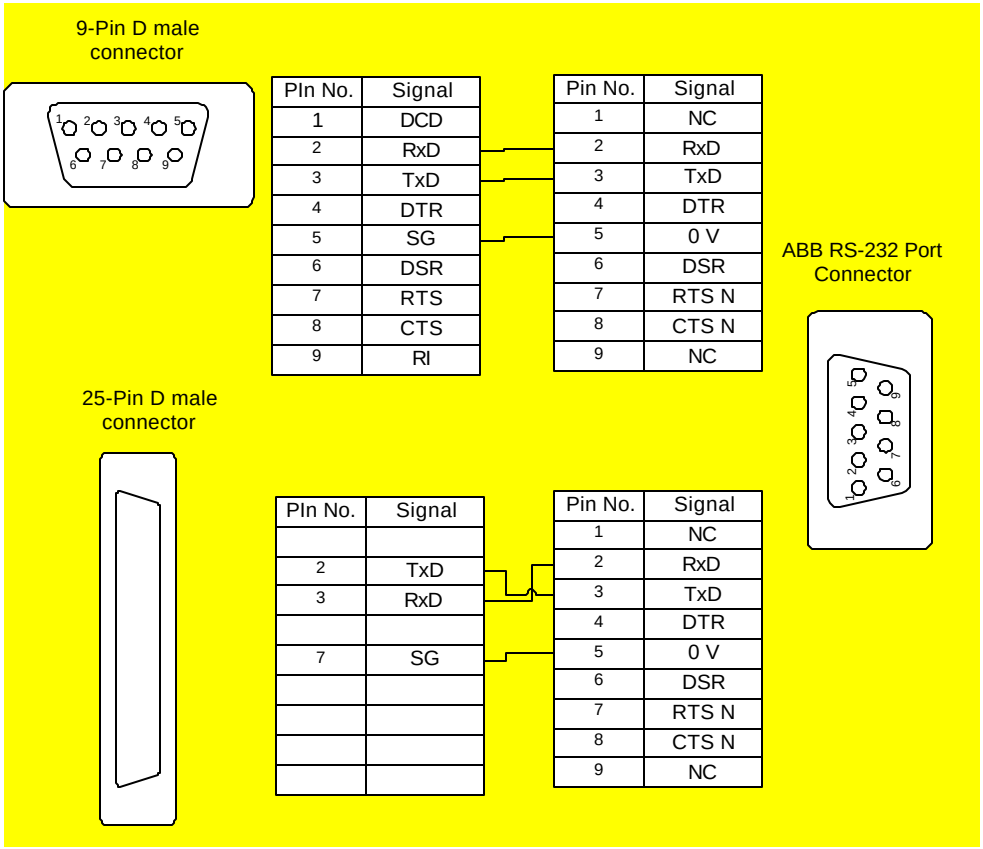


Figure 3 Straight-through DB9 and DB25 to ABB Cables

A BlackBox interface converter (DVT part # CON-4T2) is currently offered as an option to be shipped with 600 systems. This converter has a RJ-11 plug on the RS-422/485 side and a 9-pin female D connector on the RS-232 side (See Figure 4). It was chosen to interface with a PC RS-232 port. The converter obtains power from the RS-232 side of the connection. Specifically from either the DTR (pin 4), the RTS (pin 7) or RI (pin 9). When interfacing with a PC port, the converter sees these signals and can draw power from them. The ABB port provides does not provide power on the serial port so the BlackBox converter cannot draw power from the connection and communications are not possible.

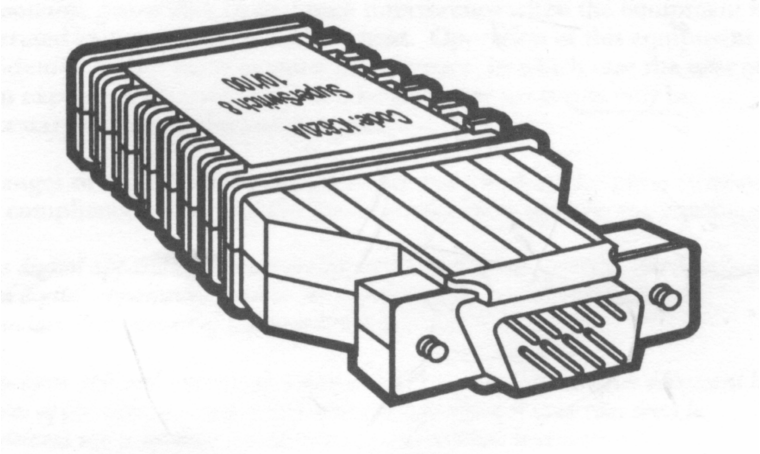


Figure 4: BlackBox Converter (Optional with DVT Systems)

Possible Known problem: Communication between a DVT 600 and the ABB controller using the converter provided as an option with DVT systems may not work. The converter needs 6-12 volts supplied to certain pins in order to obtain power.

Several solutions to this problem and the advantages and disadvantages of each will be discussed.

Solution #1

Use a different interface converter that is powered externally. Several options will be presented here. The prices vary depending on the type of isolation and complexity of the devices. BlackBox offers several converters that are powered by 115 VAC, 60 Hz. Although they provide extremely good isolation and configuration flexibility, the foot print of these converters is about 5 x 8 inches and they are priced higher.

RS-232-RS-422/485 Converter Plus : Part # IC108A List price : $259

RS-232-RS-422/485 Converter Plus w/Opto-Isolation:

Part # IC109A-R2 List price : $308

For information on other converters visit www.blackbox.com.

The connectors on the converters mentioned above are a 4 point terminal block on the RS-422/485 side and a 25-pin female D connector on the RS-232 side. The RJ-11 cable from DVT must be wired directly to the terminal block and an ABB-DB25 Male connector must be ordered or constructed as in figure 3 (simply connect transmit, receive and ground wires.) The converters can be configured as a DCE (Data Communications Equipment such as a PC) or DTE (Data Terminal Equipment, devices such as Bar code readers). The default configuration is DTE; so transmit and receive lines are crossed at the terminal block. See Figure 5.

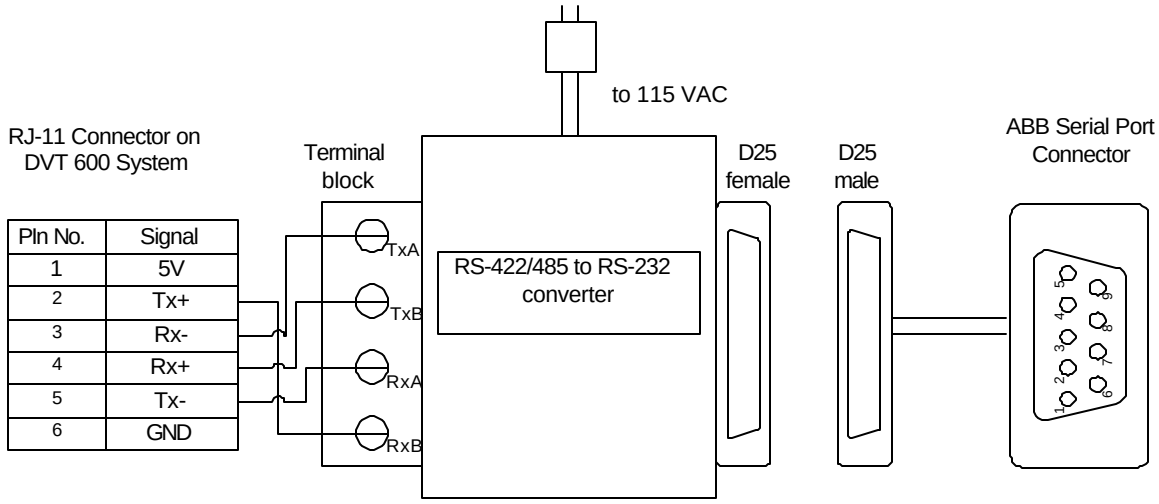


Figure 5: Connections with Externally Powered BlackBox Converter

B&B Electronics manufactures an externally powered converter with terminal block connectors on the RS-422 and DB9 or DB25 connectors on the RS-232 side. It comes with an optional 110VAC to 12V DC transformer that provides power to 2 terminals in order to enable the driver. The price of this converter is around $70 in a very small package; one drawback is that it does not provide opto-isolation. The part number is 422LPCOR . For more information visit www.bb-eec.com

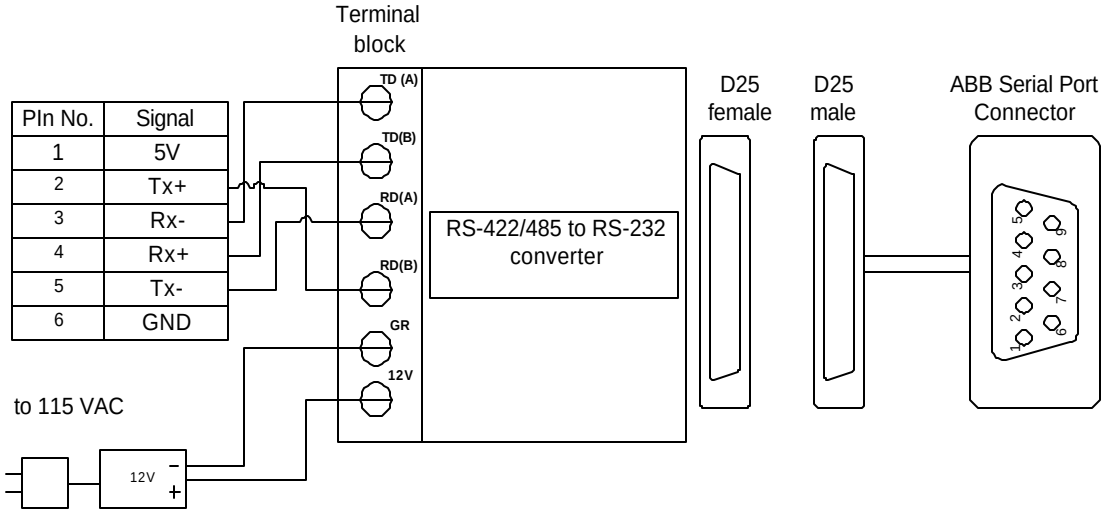


Figure 6: Wiring for B&B electronics converter.

Obtaining one of these externally powered converters constitutes the most robust solution to the problem without special restrictions on the distances of the wires. Some disadvantages of this solution may be the increased price of the converter and the need for an extra power line on the installation.

Solution #2

If the currently available converter is to be used then there must be power provided to it. A voltage of 6–12 volts with respect to SG (pin 5) can be applied to any of the following pins exclusively:

DTR: pin 4

RTS: pin 7

RI : pin 9

A terminal block with a 9 pin male connector will be ideal for this approach. The RS-232 side of the BlackBox converter plugs into the block and the TxD, RxD, and ground lines from the ABB serial cable are connected to the corresponding terminals. In addition a 12 V line should be connected to the terminal corresponding to pin 4 in order to power the converter. See Figure 7 for a schematic.

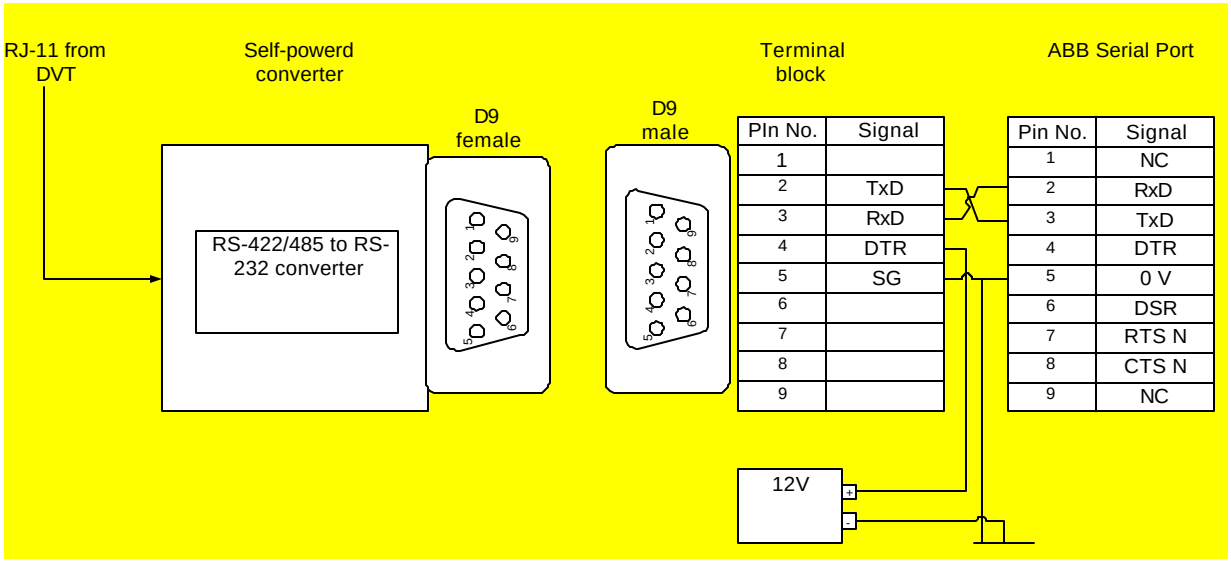


Figure 7: Connections with Current BlackBox Converter

This approach will provide a fast solution with the equipment currently available to DVT users. It carries almost no extra cost or space and has no special restrictions on the distance of the wires. A disadvantage of this solution is the need for an extra 12V line on the installation.

Solution #3

The final solution presented here consists of completely bypassing the converter. By wiring the TxD- and RxD- and ground wires from the RS-422 side to the TxD, RxD and ground from the RS-232 side. To implement this solution, a different cable must be used on the DVT side. Instead of using a RJ-11 cable which carries only four conductors, a RJ-12 cable (same plug connectors but carries 6 conductors) must be used so that a common ground exists. A simple terminal block can be used for this approach. For the wiring details see Figure 8Figure .

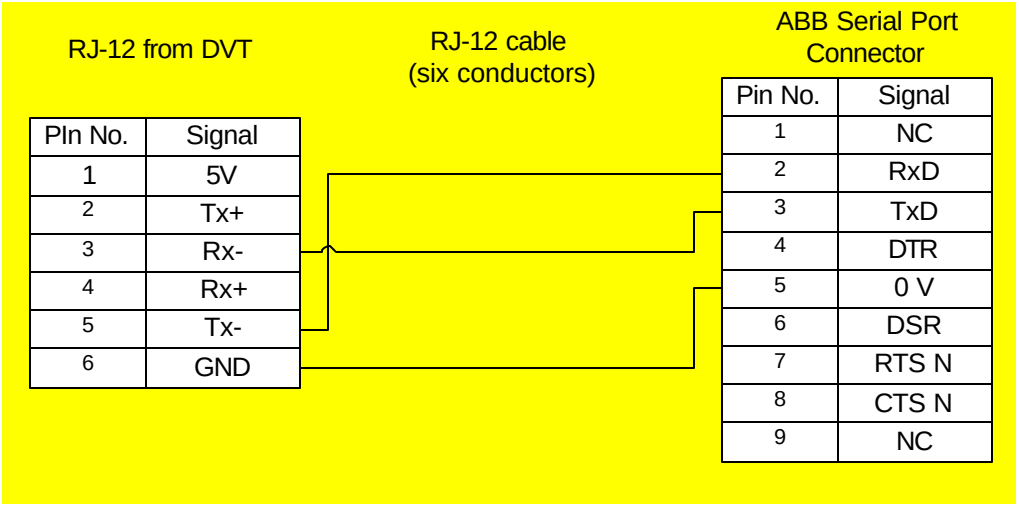


Figure 8: Direct Wiring w/o Converter

This solution is only applicable over very short distances (a few feet.) The RS-422/485 standard uses differential voltages to transmit data (allowing for greater distances), while the RS-232 standard uses absolute voltages. By performing the direct wiring explained above, the absolute signal levels produced in the RS-422/485 side and seen by the RS-232 side become close to the ±3V limit as the distance of the wires increases. In addition, this solution would make the system more vulnerable to noise. However, it has the advantage of not having to use a converter or an extra power line in the installation.

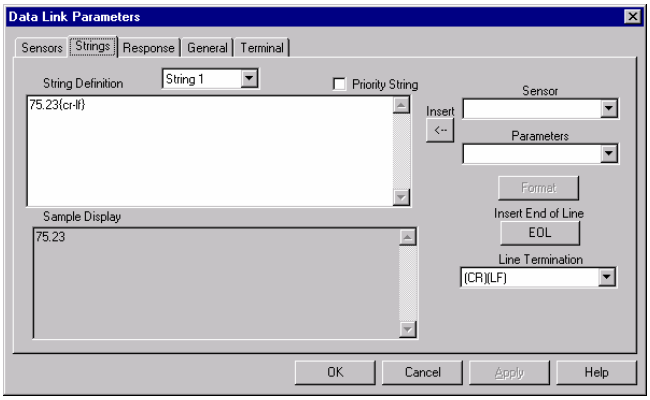
Software-Example

One of the solutions described in the hardware section should be implemented for the data exchange connection and the connections should follow the diagram in Figure 2.

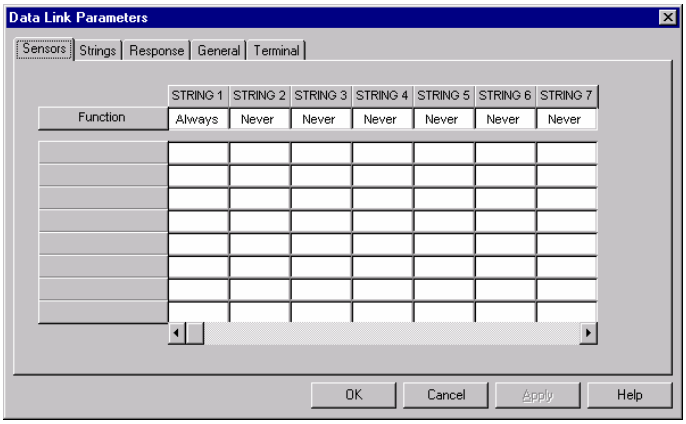
The best way to illustrate the necessary software steps is to go through a very simple example. A basic and common operation is to obtain the position of an object from the SmartImage sensor and feed it into a variable in the ABB controller. For the sake of simplicity this example will show how to send a single floating point number from the DVT system into the ABB controller (without regard for coordinate transformations). The steps necessary to accomplish this are:

On the DVT side:

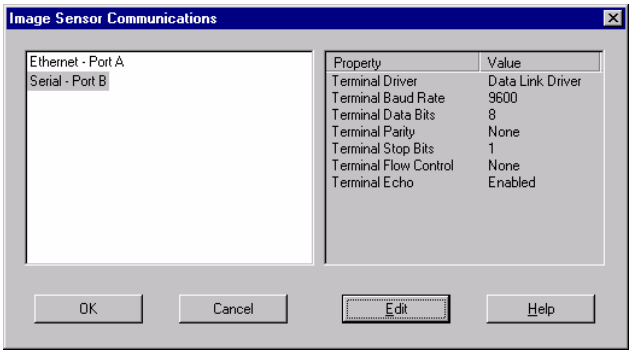
1. Set up DataLink to output a string with the desired format. This simulates a soft sensor outputting a position result from an actual inspection. Write a floating point number as a string and note the EOL characters (LF last).



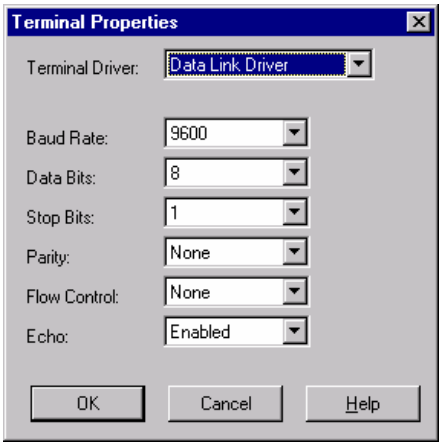
2. Output the string on every inspection



3. Configure the serial port B to the DataLink Driver and set connection parameters compatible with the ABB S4C+ requirements. It is important to use exactly these parameters or the connection will not work



The ABB port can be configured to receive data at 9600 Baud, 8 Data bits, 1 Stop bit, no parity check and no flow control. Some of these settings can be modified on the controller side. Simply make sure that they coincide with DVT settings.



4. Wait until the S4C+ controller is ready to receive the data and trigger and inspection to test the installation.

On the S4C+ side:

1. Write a simple program to read in the ASCII characters and place them in strings.

2. Convert the data to a floating point number and store it in a local variable.

3. Run the program and trigger a DVT inspection.

4. Check the variable to verify new addition.

The following ABB Rapid program accomplishes the tasks defined above.

```
VAR iodev channel2;
VAR string dvtData;
VAR num dvtValue;
Open “sio1:” channel2 \Bin;
dvtData := ReadStrBin(channel 2,5);
StrToVal(dvtData,dvtValue);
Close channel2;
```

Line 1: VAR iodev channel2

Declares an IO device and calls it channel 2 so it can be opened and read from.

Line 2: VAR string dvtData

Sets up a string called dvtData that will be used to store information from the serial port.

Line 3: VAR num dvtValue

Declares a numeric value that can be used in the robot program to represent a position or distance.

Line 4: Open “sio1:” channel2 \Bin

Opens the serial port to read binary data.

Line 5: dvtData := ReadStrBin(channel 2,5)

Reads 5 characters from the serial port and store them in dvtData.

Line 6: StrToVal(dvtData,dvtValue)

Converts the string in dvtData to a number and stores it in dvtValue.

Line 7: Close channel2

Closes the serial port.

Feedback on this note is appreciated at techsupport@dvtsensors.com.