VOLUME 4, JANUARY, 1993

Tech TALK

A TECHNICAL PRODUCT PUBLICATION

SP2000 Printer - IQ plus™ 310 Interfaces

In this issue, we'll discuss many of the more common serial interfaces for connecting the versatile SP2000 Printer to the popular IQ plus 310 Digital Indicator. Customer needs for industrial printing vary widely, and both machines have many features to accommodate these varying needs. There are numerous possible combinations—the printer has three operating modes and two serial formats, while the indicator has two operating modes transmitting a choice of two serial formats through two serial ports. We'll give the general principles needed to set up the machines for virtually any application and we'll cover the more common ones in detail.

Choosing the correct interface involves tracking a path through an elimination process. Your guide in that process should be a series of questions which you should be asking about your customer's needs. The questions are grouped around three main concepts: Where? What? and How?

WHERE DOES THE CUSTOMER WANT TO INITIATE THE PRINT COMMAND FROM?

The PRINT command can come from several locations: 1) the indicator, 2) the printer, 3) a remote switch, or 4) the keyboard of an interconnected computer.

1) Indicator: an operator at the indicator presses the PRINT button on the IQ plus 310 and the SP2000 prints out a single weight ticket. Data is transmitted through the IQ plus 310's Printer Port which must be set for DEMAND mode.

2) Printer: an operator at the printer presses the PRINT button on the SP2000 to initiate a print out. Either serial port of the IQ plus 310 may be used to transmit data, but the chosen port must be set to transmit in the CONTINUOUS mode.

3) Remote Switch: the operator presses a remote switch which feeds into one of the indicator's digital inputs. The digital input is configured to duplicate the function of the PRINT button. As in #1 above, data is transmitted through the IQ plus 310's Printer Port which must be set for DEMAND mode.

4) Computer: a computer keyboard can be connected to the Electronic Data Processing (EDP) port of the indicator. An operator at the keyboard can key in a two-letter print command (PR) and a carriage return to initiate a print command. Though the command travels though the EDP port, the actual weight data will be transmitted to the SP2000 through the Printer Port, which must be set for DEMAND mode.

WHAT INFORMATION DOES THE CUSTOMER WANT ON THE PRINT TICKET, AND IN WHAT FORMAT SHOULD THE SP2000 PRINT IT?

The SP2000 Printer has three operating modes which determine the information printed on the ticket—Standard Input Mode, Enhanced Output Mode, and Weight Extraction Mode. A complete discussion of those three modes is found in Sections 4.5, 4.6, and 4.7 of the SP2000 manual.

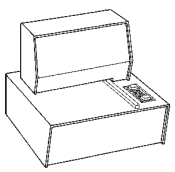
In a nutshell, the Standard Input Mode allows the SP2000 to receive ASCII data directly from the indicator and print that data out exactly as requested by the host indicator. The printer is functioning passively as a "dumb" printer, and the indicator must initiate the print command and be set in DEMAND mode.

The Enhanced Output Mode is similar to the Standard Input Mode, but allows time, date, and ID information to appear at the beginning or end of the printed data. The IQ plus 310 must initiate the print command and must be set for DEMAND mode.

The Weight Extraction Mode is the most versatile mode for scale applications. Here the printer extracts the weight information from an indicator's serial output string, reformats it, and sends it to its buffer for printing. Further choices allow the printer to place time, date, ID, and status data in various positions in the printout. If the indicator is sending in Continuous mode, the SP2000 PRINT button is used to initiate the print command. If data is sent in DEMAND mode, the IQ plus 310 PRINT button must initiate printing.

The operating mode is chosen by positioning SW3-1 and SW3-2 on the rear of the printer case. The mode chosen controls the meaning and function of the remaining switches on SW3 and all the switches on SW1 which allow various printing options to be selected. See Appendix B in the SP2000 manual for a complete list of the SW1 and SW3 options available in the various operating modes.

OPERATING MODE	SW3-1	SW3-2
Standard Input	OFF	OFF
Enhanced Output	ON	OFF
Weight Extraction	OFF	ON
(Self-Test Mode)	ON	ON

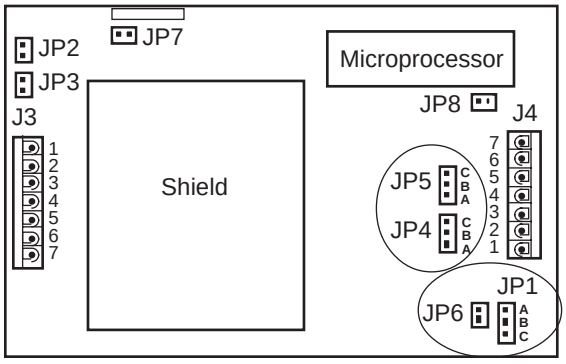


HOW WILL THE INDICATOR AND PRINTER COMMUNICATE WITH EACH OTHER?

Both machines offer RS-232 as the standard serial communication format. 20 mA Current Loop is also standard on the IQ plus 310, and available as an option with the SP2000. As a general guideline, RS-232 can be used with cables up to 50 ft. long. Beyond this length, and especially at higher baud rates, 20 mA Current Loop is recommended to prevent signal distortion.

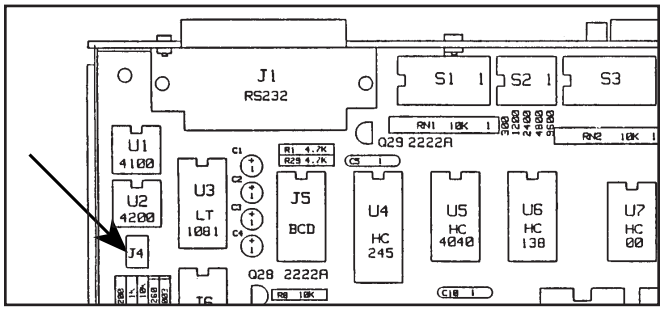
BCD communication options are available for both the indicator and printer. If the BCD format is used, the printer must be set for the Standard Input operating mode. Interfaces using the BCD format are detailed in both the SP2000 manual and the BCD installation manual for the IQplus 310. See those publications for more information.

The IQ plus 310 has two serial communication ports, a simplex, output-only Printer port, and a duplex, two-way EDP port. Either can communicate in RS-232 or 20 mA CL. The indicator uses three jumpers as shown below—JP1 and JP4 for the EDP port, and JP5 for the Printer port—to select RS-232 or 20 mA CL formats. When the jumpers are in the AB position, RS-232 format is selected. When in the BC position, 20 mA CL is selected. An additional jumper, JP6, is placed IN for Active 20 mA CL, and pulled OUT for Passive 20 mA CL. JP6 only affects the RXD channel of the EDP port.



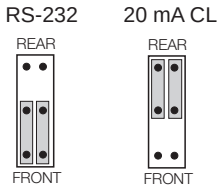
Serial Format Jumpers on IQplus 310 Main Board

The SP2000 has a single jumper switch, J4, to enable either RS-232 or 20 mA CL format. Shown in the diagram below, the jumper is located near the left rear corner of the SP2000 Main Board. This jumper has two parallel rows of three pins each. Each row has a separate 2-pin jumper.



J4 Serial Format Jumper on SP2000 Main Board

RS-232 is enabled when the front and center pins of each row are jumpered. 20 mA CL is enabled when the two jumpers are moved to connect the rear and center pins of each row. Note that 20 mA CL operation also requires that the optional chips U1 and U2 have been installed.

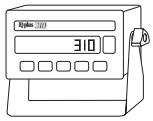


SP2000 Jumper J4

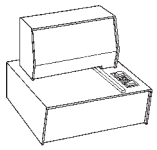
ONCE THE INTERFACE CHOICES ARE MADE, WHICH PIN CONNECTIONS ON THE TWO MACHINES ARE USED?

The table below will summarize many of the possible interface combinations. Detailed wiring diagrams for several common interfaces follow the table.

SP2000 Operating Mode	Print Command from IQ plus 310	Print Command from SP2000	
	Printer Port Demand Mode	Printer Port Continuous	EDP Port Continuous
Standard Input	20mA, RS-232	-----	-----
Enhanced Output	20mA, RS-232	-----	-----
Weight Extraction	20mA, RS-232	20mA, RS-232	20mA, RS-232



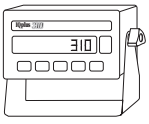
RS-232 through IQ plus 310's Printer Port-Continuous Mode. Print by SP2000 PRINT key



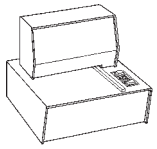
Connector J4	*Connector CJ5*
2 Ground	7 Ground
5 Printer Port TXD	3 RXD
	Jumper pins 4,5

Jumper-Position	*Jumper-Position*
JP5-AB	J4-Front/center

SP2000 must be set in Weight Extraction operating mode



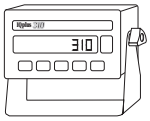
20 mA CL through IQ plus 310's Printer Port-Continuous Mode Print by SP2000 PRINT key



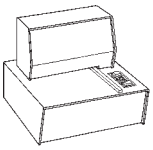
Connector J4	*Connector CJ5*
2 Ground	10 20 mA TXD -
5 Printer Port TXD	9 20 mA TXD +
	Jumper pins 4,5

Jumper-Position	*Jumper-Position*
JP5-BC	J4-Center/rear

SP2000 must be set in Weight Extraction operating mode



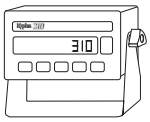
RS-232 through IQ plus 310's
EDP Port-Continuous Mode
Print by SP2000 PRINT key



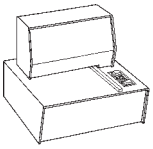
Connector J4		*Connector CJ5*
1 EDP TXD	———	3 RXD
2 Ground	———	7 Ground

Jumper-Position	*Jumper-Position*
JP4-AB	J4-Front/center

SP2000 must be set in Weight Extraction operating mode



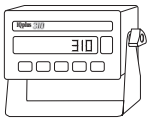
20 mA CL through IQ plus 310's
EDP Port-Continuous Mode
Print by SP2000 PRINT key



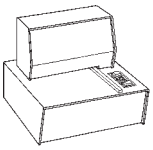
Connector J4		*Connector CJ5*
1 EDP TXD	———	9 20 mA TXD +
2 Ground	———	10 20 mA TXD -

Jumper-Position	*Jumper-Position*
JP4-BC	J4-Center/rear

SP2000 must be set in Weight Extraction operating mode

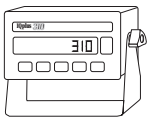


RS-232 through IQ plus 310's
Printer Port-Demand Mode
Print by IQ plus 310 PRINT key

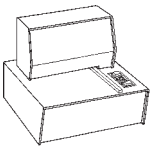


Connector J4		*Connector CJ5*
2 Ground	———	7 Ground
5 Printer Port TXD	———	3 RXD

Jumper-Position	*Jumper-Position*
JP5-AB	J4-Front/center

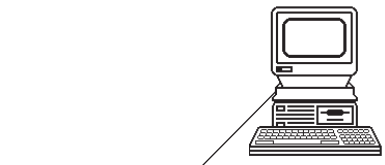


20 mA CL through IQ plus 310's
Printer Port-Demand Mode
Print by IQ plus 310 PRINT key

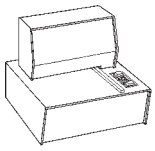


Connector J4		*Connector CJ5*
2 Ground	———	10 20 mA TXD -
5 Printer Port TXD	———	9 20 mA TXD +

Jumper-Position	*Jumper-Position*
JP5-BC	J4-Center/rear



RS-232, Computer data in through
EDP Port-Demand Mode
Data out Printer Port-Demand Mode
Print by keyed command PR <CR>

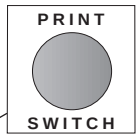


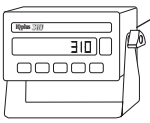
Connector J4		*Connector CJ5*
5 Printer TXD	———	3 RXD
2 Ground	———	7 Ground
3 EDP RXD		
1 EDP TXD		

Computer
Ground
RS-232 TXD
RS-232 RXD

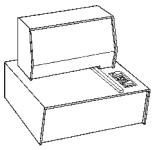
Jumper-Position	*Jumper-Position*
JP4-AB	J4-Front/center

In order for print command to be successful, the indicator must be in Demand mode, the scale must not be in motion, and the Gross Weight reading must not be negative. If the print command is not successful, the computer screen will display "??".
If print command was successful, the screen will display "OK".





RS-232 through IQ plus 310's
Printer Port-Demand Mode
Print by remote switch



Connector J4		*Connector CJ5*
5 Printer Port TXD	———	3 RXD
2 Ground	———	7 Ground
7 Digital In 1		

Push-Button SPST Switch

Jumper-Position	*Jumper-Position*
JP5-AB	J4-Front/center

The IQ plus 310's Digital Input 1 must be configured to PRINT

The examples on the previous pages should be representative of most applications you may encounter in the field. However, if a customer need arises for an application using an IQ plus 310 and SP2000 which is not covered on the previous pages, it is possible to design unique interfaces to handle those special cases.

To assist you with special designs, the following charts will be helpful. The first chart details the functions of the pins from the SP2000's serial communications terminal. Please note that pins 9, 10, 18, and 19 are only enabled when the 20 mA Current Loop communication option is installed in the SP2000 printer.

PIN	FUNCTION
1	CHASSIS GROUND
2	TXD RS-232
3	RXD RS-232
4	+ 5V (4.7K RESISTOR)
5	CLEAR TO SEND RS-232
7	GROUND
9	20 mA IN* (+)
10	20 mA IN* (-)
11	PRINT — ACTIVE LOW, OPEN COLLECTOR OUTPUT
13	GROUND
14	+ 5V
18	20 mA OUT* (+)
19	20 mA OUT* (-)
20	BUSY OUT (RS-232, -9V = BUSY)

* Requires installation of 20 mA option

SP2000 COMMUNICATIONS TERMINAL CONNECTIONS

The second chart details the IQ plus 310's serial communications terminal. This terminal is labeled as J4 on the indicator's main board. Note that most of the pins show different functions when the indicator is set up for RS-232 than when set up for 20 mA Current Loop format. A system of jumpers on the indicator's main board can be moved to select either the RS-232 or the 20 mA CL format. Those jumpers, and their positions are detailed in the third chart.

J4	RS 232 Format*	20 mA CL Format*
1	EDP TXD	EDP TXD 20mA +
2	COMM GRD	PRINT TXD 20 mA - EDP TXD 20mA -
3	EDP RXD	EDP RXD 20mA -
4	NOT USED	EDP RXD 20mA +
5	PRINT TXD	PRINT TXD 20mA +
6	DIGITAL IN 2	DIGITAL INPUT 2
7	DIGITAL IN 1	DIGITAL INPUT 1

*Dependent on jumper positions. See chart below for jumper positions.

IQ plus 310 COMMUNICATIONS TERMINAL CONNECTIONS

JP	Function	Position: Selection
JP1	EDP RXD	A-B: RS-232, B-C: 20 mA
JP4	EDP TXD	A-B: RS-232, B-C: 20 mA
JP5	Print TXD	A-B: RS-232, B-C: 20 mA
JP6	EDP RXD 20 mA	IN: Active, OUT: Passive

IQ plus 310 COMMUNICATIONS JUMPER POSITIONS

This Tech Talk bulletin addresses the majority of the issues related to IQ plus 310/SP2000 interfaces. If we have overlooked areas of particular interest to your application, please let us know.