Remote I/O

ALLEN-BRADLEY® Remote I/O Interface

for IQ plus® 510 and IQ plus® 710 Indicators

Version 2.04

Installation and Programming Manual

ROCKWELL AUTOMATION ENCOMPASS™ THE AMERICAS

RICE LAKE WEIGHING SYSTEMS
Industrial Solutions on a Global Scale®

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Contents

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About This Manual

This manual provides information needed to install and use the Rice Lake Weighing Systems Remote I/O Interface. The Remote I/O Interface allows IQ plus® 510 and 710 indicators to communicate with PLC® and SLC™ controllers using the Allen-Bradley® Remote I/O network.[1]

The Remote I/O Interface is installed inside the indicator's NEMA 4X stainless steel enclosure to permit use in washdown environments.

1. Allen-Bradley®, PLC®, and SLC™ are trademarks of Allen-Bradley Company, Inc., a Rockwell International company.

This manual applies to the following software versions:

- Remote I/O Interface, Version 2.04
- IQ plus 510/710, Version 1.4

Warning *Some procedures described in this manual require work inside the Remote I/O enclosure. These procedures are to be performed by qualified service personnel only.*

Authorized distributors and their employees can view or download this manual from the Rice Lake Weighing Systems distributor site at www.rlws.com.

1.0 Introduction

The Remote I/O Interface returns weight and status information streamed from the IQ plus 510 or 710 indicator to the PLC controller. The Remote I/O Interface provides full control of indicator functions to the PLC programmer. Indicator configuration and calibration must be done at the indicator front panel.

The Remote I/O Interface behaves as a node adapter device to the master PLC, appearing as a quarter rack of I/O. The PLC controller and Remote I/O Interface communicate using a quarter rack of data slots (4 slots with 8 bits of input, 8 bits of output per slot).

The PLC controller sends commands to the indicator through the Remote I/O Interface by writing the commands to the output image table, then reads weight and status data returned through the Remote I/O Interface in the input image table. These actions are referred to as discrete reads and discrete writes. See Section 3.0 on page 11 for information about using discrete transfer commands.

Weight Data Formats

Depending on the expected magnitude and required precision of the weight data returned from the indicator, the PLC controller can request weight data in various formats. The discrete write command can specify weight data be returned to the input image table using either 16-bit signed or 20-bit unsigned values, with optional bit shifting.

Weight data formats supported by the Remote I/O Interface allow values of –16,777,215 through +16,777,215 to be returned to the PLC controller using discrete transfer commands. The maximum displayable value for the supported indicators is 9,999,999.

See Section 3.3 on page 15 for detailed information about bit shifting and maximum returned values.

2.0 Installation

The section describes the procedures used to install the Remote I/O interface board into IQ plus 510/710 indicators, connect communications cables, select the termination resistance, and set the configuration DIP switches for the Remote I/O interface.

2.1 Installing the Remote I/O Interface

To install the Remote I/O Interface board into the IQ plus 510/710 indicators, do the following:

2.1.1 Replace Backplate

1. Ensure power to the indicator is disconnected, then place the indicator face-down on an antistatic work mat. Remove the screws that hold the backplate to the enclosure body. Loosen cord grips then lift the backplate away from the enclosure and set it aside.

Caution *Use a wrist strap to ground yourself and protect components from electrostatic discharge (ESD) when working inside the indicator enclosure.*

2. Disconnect and remove any load cell, serial communications, and digital I/O cabling through the indicator backplate.
3. Disconnect power cord ground wire from enclosure ground stud, then disconnect ground wire from backplate. Cut cable tie that secures the line filter input wires to the inside of the indicator enclosure and remove power cord.
4. Remove cord grips from original backplate and reinstall in Remote I/O backplate.
5. Route power cord, load cell, digital I/O, and communications cables through cord grips in Remote I/O backplate.
6. Reconnect power cord wires to the line filter. Use a cable tie to secure the line filter wires to the cable tie mount. Reconnect backplate and power cord ground wires to enclosure ground stud.
7. Reconnect load cell, digital I/O, and communications cables to the appropriate connectors on the indicator CPU board.

2.1.2 Install Remote I/O Interface Board

8. Use the four 6-32NC kep nuts supplied to mount the three brackets as shown in Figure 2-4 on page 4.
9. Attach three cable tie mounts to the inside of the indicator enclosure as shown in Figure 2-4.
10. Use cable ties to secure cable from the backplate LED annunciators to the Remote I/O Interface board. Allow enough slack in the wires to reach the location of connector J3 (see Figure 2-4).
11. Remove connector J4 from the header on the indicator CPU board. Connect the black, red, and green wires to the connector as shown in Table 2-1 and in Figure 2-4, then reinstall J4 on the indicator board.
12. Plug 10-pin ribbon cable into connector J15 on the indicator CPU board as shown in Figure 2-4. Ensure connector is oriented as shown in the drawing, with red wire of ribbon cable toward center of board.
13. Use the four 6-32NC x 1/4 machine screws supplied to mount the Remote I/O Interface board on the brackets as shown in Figure 2-4.

2.1.3 Connect Cables to Remote I/O Interface

14. Connect black, red, and green wires from the indicator J4 serial connector to the J4 connector on the Remote I/O Interface board.

Indicator J4 Pin	RS-232 Signal	Wire Color	RS-232 Signal	Remote I/O J4 Pin
2	GND	Black	GND	6
1	TxD	Red	RxD	7
3	RxD	Green	TxD	8

Table 2-1. Indicator-to-Remote I/O Serial Port Pin Assignments

15. Plug ribbon cable connector from J15 on the indicator CPU board into connector J1 on the Remote I/O Interface board. Ensure cable is oriented as shown in Figure 2-4, with red wire of ribbon cable attached at pin 1 on both connectors.

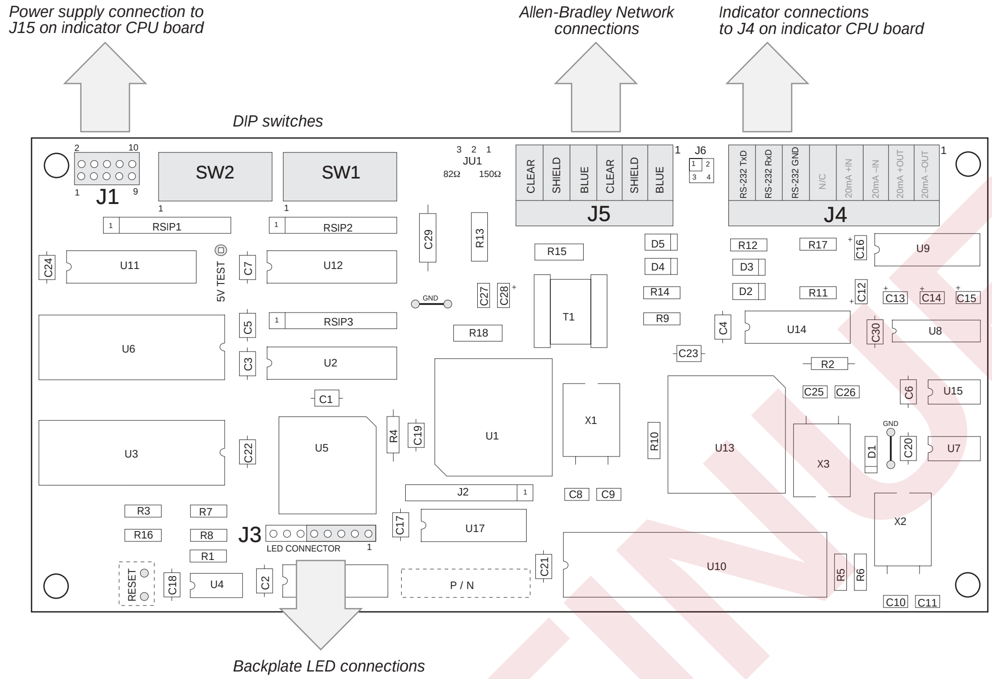


Figure 2-1. Remote I/O Interface Board

16. Plug LED annunciator cable plug into connector J3 on the Remote I/O Interface board. Ensure the black wire of the 5-pin cable plug is attached to pin 1 on the J3 connector (see Figure 2-2).

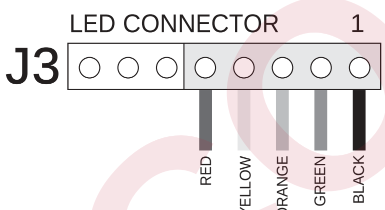


Figure 2-2. LED Cable Plug on J3 Connector

17. Feed Allen-Bradley network cable through cord grip. Allow enough cable for routing along inside of enclosure to J5 connector on the Remote I/O Interface board. Connect Allen-Bradley network cables into connector J5 on the Remote I/O Interface board as described in Section 2.2.4 on page 6.
18. Use three cable ties to secure the LED and Allen-Bradley network cables to the cable tie mounts attached in step 9.
19. Set termination resistance (jumper JU-1) as described in Section 2.2.2 on page 6.
20. Set DIP switches as described in Section 2.3 on page 7.

2.1.4 Reassemble Enclosure

21. Position the backplate over the enclosure and reinstall the backplate screws. Use the torque pattern shown in Figure 2-3 to prevent distorting the backplate gasket. Torque screws to 15 in-lb (1.7 N-m).

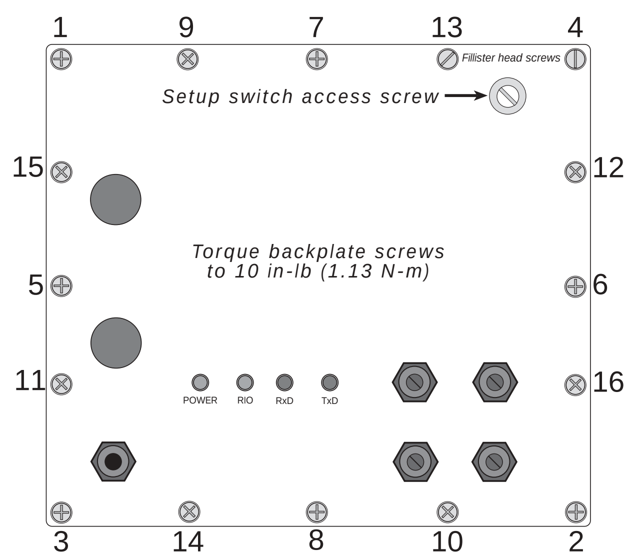


Figure 2-3. IQ plus 510/710/Remote I/O Backplate

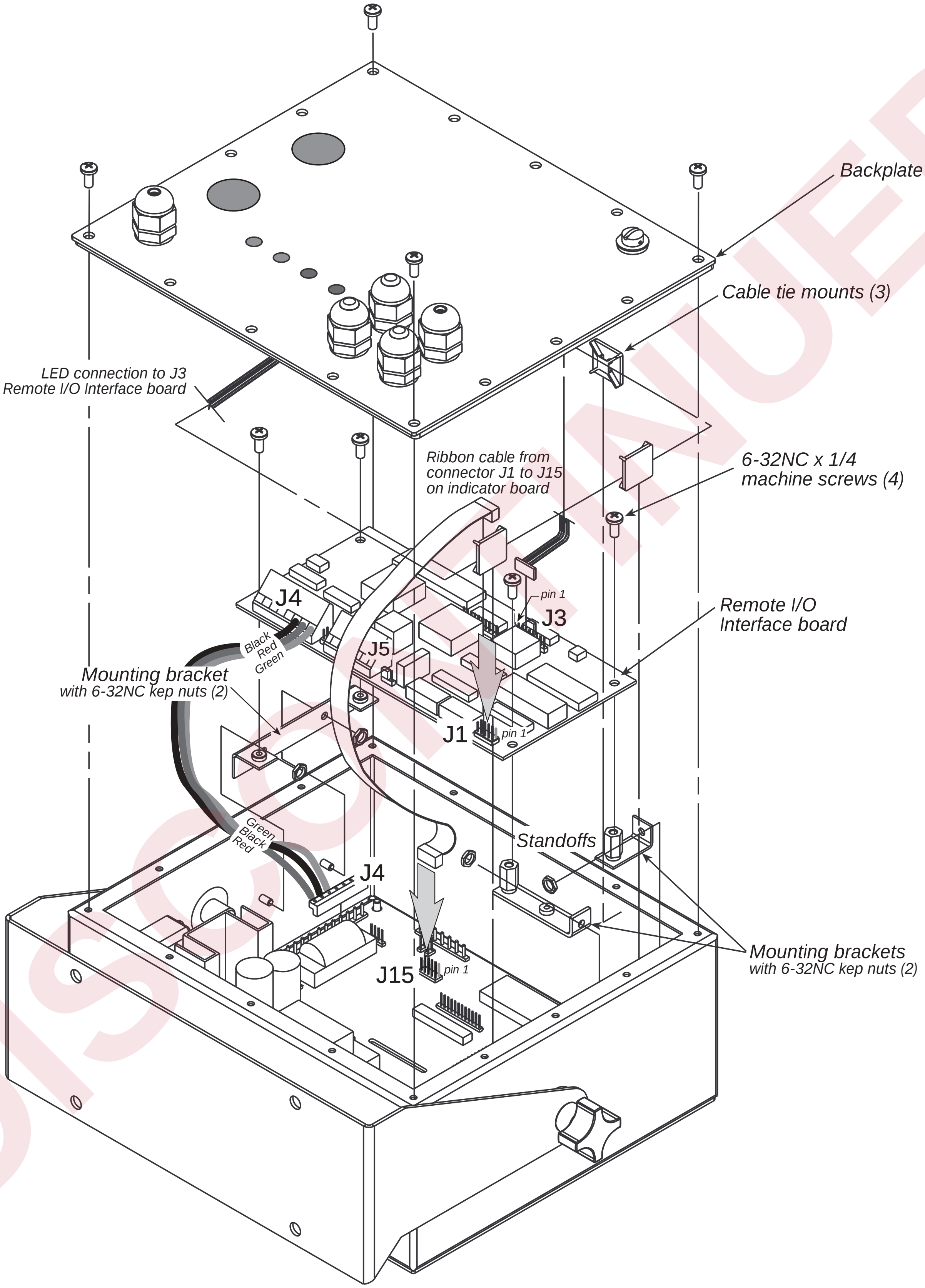


Figure 2-4. Remote I/O Interface Board Installation and Wiring

2.2 Physical Connections for Installed Boards

The indicator enclosure must be opened to connect cables and set DIP switches for the Remote I/O interface. Ensure power to the indicator is disconnected, then place the indicator face-down on an antistatic work mat. Remove the screws that hold the backplate to the enclosure body, then lift the backplate away from the enclosure and set it aside.

Caution *Use a wrist strap to ground yourself and protect components from electrostatic discharge (ESD) when working inside the indicator enclosure.*

The Remote I/O interface board (see Figure 2-1) is mounted on brackets above the indicator CPU board. Connections between the two boards are as follows:

- Ribbon cable from connector J15 on the indicator CPU/power supply board (see Figure 2-5 on page 5) to connector J1 on the Remote I/O board.
- Serial communications wiring from the indicator EDP port on connector J4 to connector J4 on the Remote I/O board.

Once wiring and DIP switch configuration (see Section 2.3) are complete, position the backplate over the indicator enclosure and reinstall the backplate screws. Use the torque pattern shown in Figure 2-3 on page 3 to prevent distorting the backplate gasket. Torque screws to 10 in-lb (1.13 N-m).

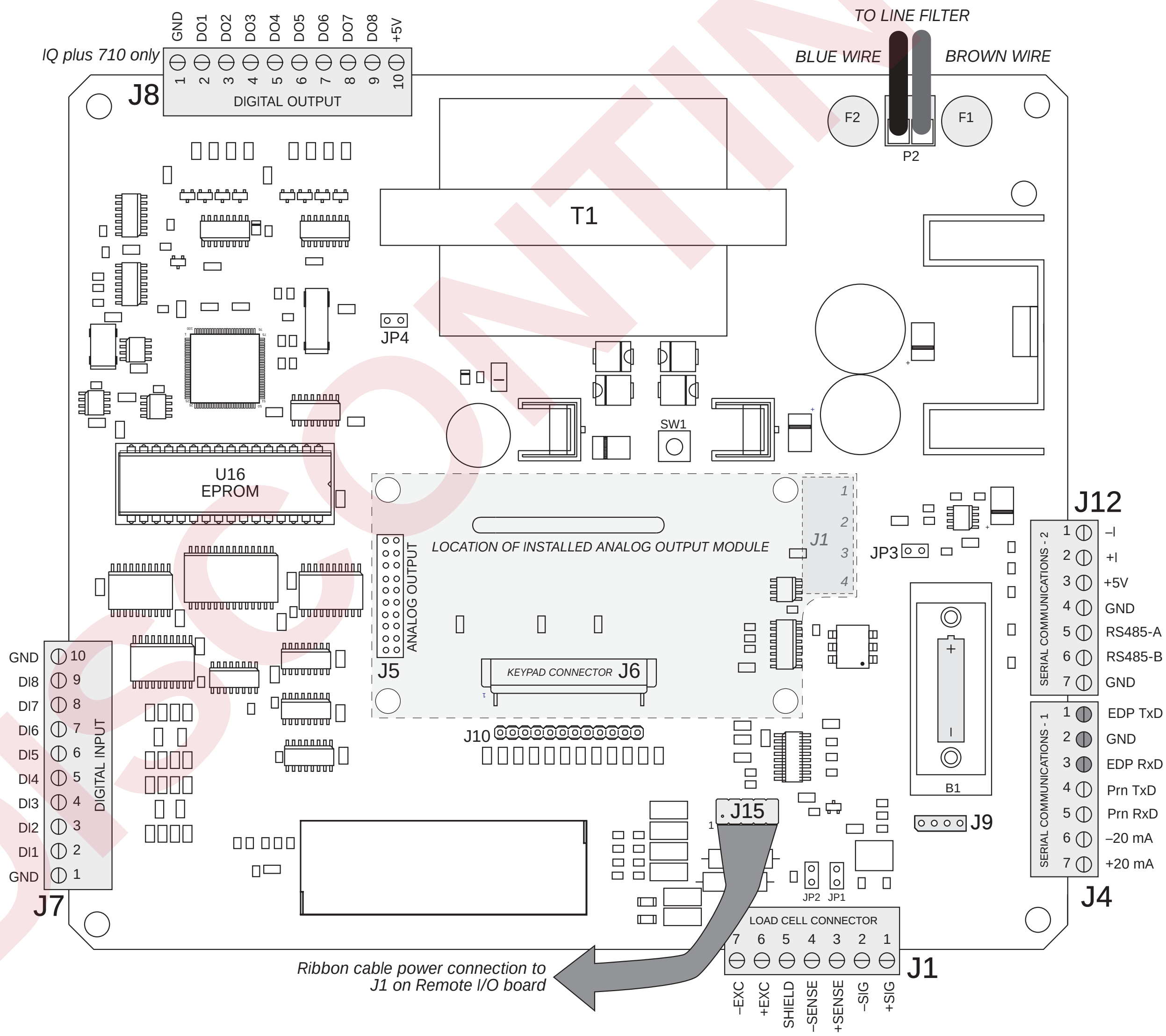


Figure 2-5. IQ plus 510/710 CPU and Power Supply Board

2.2.1 Power Connections

Power to the Remote I/O Interface is supplied by the indicator, using a ribbon cable attached from connector J15 on the indicator to connector J1 on the Remote I/O board. Note that the red wire strand of the ribbon cable must connect the 1 pins at each connector.

2.2.2 Termination Resistance

If the Remote I/O Interface is the last, or only, device attached to the PLC, the interface must provide a termination resistance. Use Table 2-2 to determine the appropriate termination resistance value and JU1 jumper position for the network. If the Remote I/O Interface is not the last device in a chain, position the jumper on one pin only. Resistance values for the jumper positions are marked on the Remote I/O Interface logic board.

Network Data Rate	Maximum Cable Length	Maximum Nodes	Termination Resistance	JU1 Jumper Position
57.6 Kbps	10 000 ft	16	150Ω	1–2
115.2 Kbps	5000 ft			
230.4 Kbps	2500 ft	32	82Ω	2–3

Table 2-2. JU1 Jumper Positions and Termination Resistance Values

2.2.3 Serial Connections

Connections to the indicator are made at connector J4 on the Remote I/O Interface controller board (see Figure 2-1 on page 3 for board location of J4). Figure 2-6 shows the J4 connector layout for the Remote I/O Interface. Table 2-1 on page 2 shows connections between the Remote I/O Interface and the IQ plus 510/710 indicators for RS-232 communications.

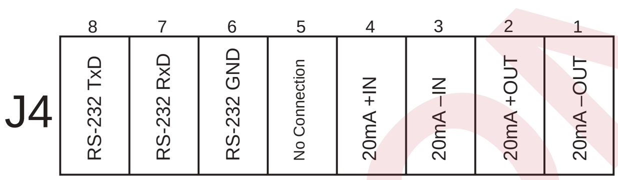


Figure 2-6. J4 Indicator Connections

2.2.4 A-B Network Connections

Connections to the Allen-Bradley network are made at connector J5 on the Remote I/O Interface controller board (see Figure 2-1 on page 3 for board location of J5). Figure 2-7 shows the connector layout for network connections. Connectors 4–6 are tied to connectors 1–3 to allow daisy-chaining through the Remote I/O Interface.

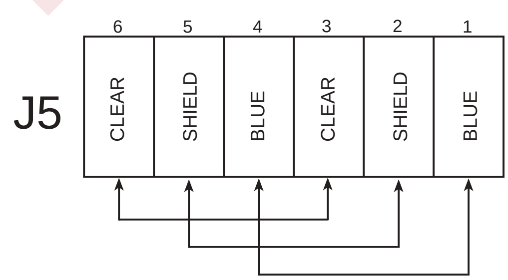


Figure 2-7. J5 Network Connections

2.3 DIP Switch Configuration

Two banks of DIP switches, SW1 and SW2, are used to configure the Remote I/O Interface for communication with the indicator and the network. Figure 2-8 shows the switch assignments for SW1 and SW2.

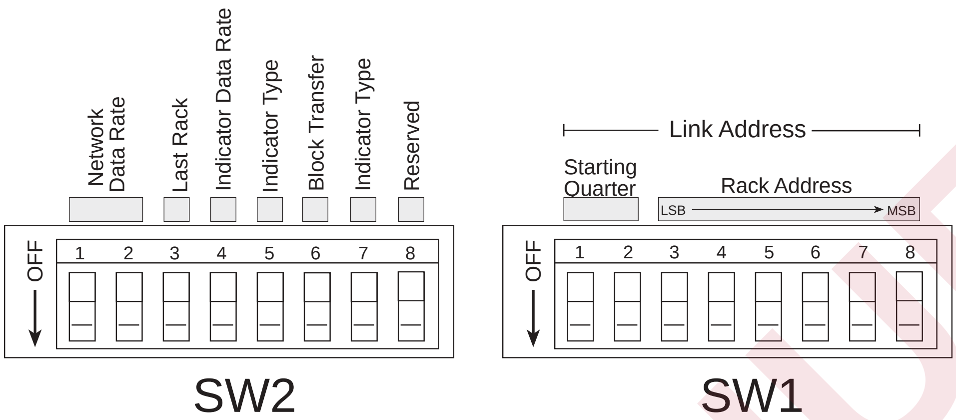


Figure 2-8. SW1 and SW2 DIP Switch Assignments

Network Data Rate

SW2-1 and SW2-2 set the data rate of the Allen-Bradley network. Use Table 2-3 to select the correct switch settings for the network.

Remote I/O Data Rate	SW2 Switch Settings	
	1	2
57.6 Kbps	ON	ON
115.2 Kbps	OFF	ON
230.4 Kbps	ON	OFF
	OFF	OFF

Table 2-3. Network Data Rate

Last Rack

Set SW2-3 ON if the Remote I/O Interface link address includes the highest module group in this rack address.

Indicator Data Rate

SW2-4 sets the data rate used to communicate with the attached indicator. Set this switch OFF for 9600 bps, ON for 19.2 Kbps.

Indicator Type

Switches SW2-5 and SW2-7 select the type of indicator attached to the Remote I/O logic board. For IQ plus 510 and 710 indicators, set SW2-5 OFF and SW2-7 ON.

Block Transfer

Set SW2-6 ON to enable or OFF to disable block transfer to the Remote I/O Interface. Setting this switch OFF causes the Remote I/O Interface to ignore unsolicited block transfer requests from the PLC.

NOTE: Switch SW2-8 should be set OFF. If the Remote I/O Interface returns incrementing values rather than weights to the PLC controller, verify that SW2-8 is set OFF.

Starting Quarter

Switches SW1-1 and SW1-2 set the starting quarter (or group number) used by the Remote I/O Interface. Use Table 2-4 to select the correct switch settings.

Starting Quarter	Group Number	SW1 Switch Settings	
		1	2
1st	0	ON	ON
2nd	2	OFF	ON
3rd	4	ON	OFF
4th	6	OFF	OFF

Table 2-4. Starting Quarter

Rack Address

Switches SW1-3 through SW1-8 are used to set the rack address of the Remote I/O Interface. Use Table 2-5 on page 8 to select the correct switch settings for the rack address. Note that setting a switch OFF acts as a logical "1" and that SW1-3 represents the least significant bit (LSB) of the rack address.

Rack Address		SW1 Switch Settings						Rack Address		SW1 Switch Settings					
Decimal	Octal	3	4	5	6	7	8	Decimal	Octal	3	4	5	6	7	8
00	00	ON	ON	ON	ON	ON	ON	32	40	ON	ON	ON	ON	ON	OFF
01	01	OFF	ON	ON	ON	ON	ON	33	41	OFF	ON	ON	ON	ON	OFF
02	02	ON	OFF	ON	ON	ON	ON	34	42	ON	OFF	ON	ON	ON	OFF
03	03	OFF	OFF	ON	ON	ON	ON	35	43	OFF	OFF	ON	ON	ON	OFF
04	04	ON	ON	OFF	ON	ON	ON	36	44	ON	ON	OFF	ON	ON	OFF
05	05	OFF	ON	OFF	ON	ON	ON	37	45	OFF	ON	OFF	ON	ON	OFF
06	06	ON	OFF	OFF	ON	ON	ON	38	46	ON	OFF	OFF	ON	ON	OFF
07	07	OFF	OFF	OFF	ON	ON	ON	39	47	OFF	OFF	OFF	ON	ON	OFF
08	10	ON	ON	ON	OFF	ON	ON	40	50	ON	ON	ON	OFF	ON	OFF
09	11	OFF	ON	ON	OFF	ON	ON	41	51	OFF	ON	ON	OFF	ON	OFF
10	12	ON	OFF	ON	OFF	ON	ON	42	52	ON	OFF	ON	OFF	ON	OFF
11	13	OFF	OFF	ON	OFF	ON	ON	43	53	OFF	OFF	ON	OFF	ON	OFF
12	14	ON	ON	OFF	OFF	ON	ON	44	54	ON	ON	OFF	OFF	ON	OFF
13	15	OFF	ON	OFF	OFF	ON	ON	45	55	OFF	ON	OFF	OFF	ON	OFF
14	16	ON	OFF	OFF	OFF	ON	ON	46	56	ON	OFF	OFF	OFF	ON	OFF
15	17	Reserved						47	57	OFF	OFF	OFF	OFF	ON	OFF
16	20	ON	ON	ON	ON	OFF	ON	48	60	ON	ON	ON	ON	OFF	OFF
17	21	OFF	ON	ON	ON	OFF	ON	49	61	OFF	ON	ON	ON	OFF	OFF
18	22	ON	OFF	ON	ON	OFF	ON	50	62	ON	OFF	ON	ON	OFF	OFF
19	23	OFF	OFF	ON	ON	OFF	ON	51	63	OFF	OFF	ON	ON	OFF	OFF
20	24	ON	ON	OFF	ON	OFF	ON	52	64	ON	ON	OFF	ON	OFF	OFF
21	25	OFF	ON	OFF	ON	OFF	ON	53	65	OFF	ON	OFF	ON	OFF	OFF
22	26	ON	OFF	OFF	ON	OFF	ON	54	66	ON	OFF	OFF	ON	OFF	OFF
23	27	OFF	OFF	OFF	ON	OFF	ON	55	67	OFF	OFF	OFF	ON	OFF	OFF
24	30	ON	ON	ON	OFF	OFF	ON	56	70	ON	ON	ON	OFF	OFF	OFF
25	31	OFF	ON	ON	OFF	OFF	ON	57	71	OFF	ON	ON	OFF	OFF	OFF
26	32	ON	OFF	ON	OFF	OFF	ON	58	72	ON	OFF	ON	OFF	OFF	OFF
27	33	OFF	OFF	ON	OFF	OFF	ON	59	73	OFF	OFF	ON	OFF	OFF	OFF
28	34	ON	ON	OFF	OFF	OFF	ON	60	74	ON	ON	OFF	OFF	OFF	OFF
29	35	OFF	ON	OFF	OFF	OFF	ON	61	75	OFF	ON	OFF	OFF	OFF	OFF
30	36	ON	OFF	OFF	OFF	OFF	ON	62	76	ON	OFF	OFF	OFF	OFF	OFF
31	37	OFF	OFF	OFF	OFF	OFF	ON	63	77	OFF	OFF	OFF	OFF	OFF	OFF

Table 2-5. SW1 Switch Settings for Remote I/O Interface Link Address

2.4 LED Indicators

Four LEDs on the IQ plus 510/710 backplate provide status information for the operator (see Figure 2-3 on page 3). Table 2-6 summarizes the function of the LEDs. See Section 6.0 on page 33 for more troubleshooting information.

LED	Color	Function	
Power	Green	On when external power applied; blinks if microprocessor is not executing	
RIO	Green	On steady when communicating with the PLC	
		Blinks if node adapter is receiving only RESET commands from PLC	Check if PLC is in program mode
		Off indicates no connection to the network	Check that baud rates configured for Remote I/O Interface and PLC match Check wiring at J5 connector
RxD	Red	Blinks with every character received from the indicator	May appear to be on steady when indicator is streaming data
TxD	Red	Blinks with every character sent to the indicator	

Table 2-6. Remote I/O Interface LED indicators

2.5 Indicator Setup

The IQ plus 510/710 indicators communicate with the Remote I/O Interface board using RS-232 communications with the indicator EDP port.

Table 2-7 shows the SERIAL menu configuration parameters recommended for the IQ plus 510 and 710 indicators to communicate with the Remote I/O Interface. See the indicator *Installation Manual* for detailed configuration information.

Indicator Configuration Settings			Notes
EDP	BAUD	9600 or 19200	Must match DIP switch selection on Remote I/O Interface
	BITS	8 NONE	Required
	TERMIN	CR	
	EOL DLY	0	
	HANDSHK	OFF	
	ADDRESS	0	
	BUS	ON	
	STREAM	ON/OFF	Set ON for some applications. To block transfer commands 3 and 12 (used for reading setpoint values), set STREAM to OFF. See Section 4.0 on page 16.

Table 2-7. IQ plus 510/710 Configuration Settings

2.6 Allen-Bradley Serial Stream

Figure 2-9 shows the format of the Allen-Bradley serial stream format. This format is output from the indicator when the EDP port AB-RIO and STREAM parameters are set ON.

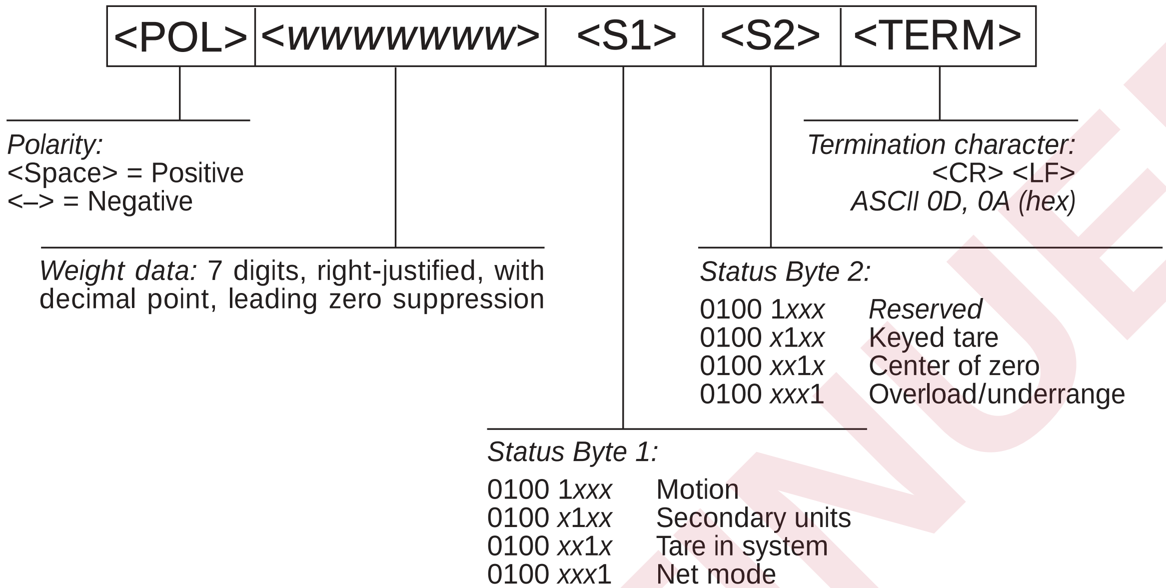


Figure 2-9. Allen-Bradley Serial Stream (ABSTRM) Format

2.7 Decimal Point Handling

Discrete Transfer

Discrete transfer commands return no decimal point information to the PLC. For example, a value of 750.1 displayed on the indicator is returned to the PLC as 7501.

Block Transfer

Block transfer commands support decimal point information with no special handling.

3.0 Discrete Transfer Commands

The PLC controller uses discrete write and discrete read commands to send and receive data from the Remote I/O Interface. The PLC controller and Remote I/O Interface share a quarter rack of slot space, resulting in two 16-bit words for the output image table (used to write commands to the indicator) and two 16-bit words for the input image table (used to read data from the indicator).

3.1 Output Image Table Format

The PLC places two 16-bit words in the PLC output image table which are read by the Remote I/O Interface node adapter. A discrete write command is performed when the PLC controller writes data to the output image table. The Remote I/O Interface reads the contents of the output image table, translates the command to a form that can be used by the indicator, and sends the command to the indicator.

The format of the output image table is shown in Table 3-1.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 0	v15	v14	v13	v12	v11	v10	v09	v08	v07	v06	v05	v04	v03	v02	v01	v00
Word 1	R	s	s	s	w	b	b	b	c	c	c	c	c	c	c	c

Table 3-1. Output Image Table Format

where:

v00–v15	16-bit signed integer value
R	Reserved
sss	Status data format
w	Weight format
bbb	Bit shift
cccc cccc	Command number

These fields are described below:

Value

Word 0 of the output image table is used for passing value data on certain commands. This field should be used only when block transfer is disabled. For example, to enter a tare value, use word 0 to specify the tare value; the Enter Tare command number (44) is specified in bits 00 through 07 of word 1.

Values entered in this field are treated as 16-bit signed integers. Possible values range from –32,768 to 32,767.

Status Data Format

The status data format bits specify the format of status data returned to the PLC.

000	Remote function status data
001	Batch function status data (valid only for Command 42, Batch Status)
010–111	Not defined

The IQ plus 510/710 indicators currently support only remote function status data (000). Remote function status data bits are described in Section 3.2.

Weight Format

Specifies the format of the weight data returned to the PLC controller:

0	16-bit signed integer (negative values are formatted as 2's complement)
1	20-bit unsigned integer

The 16-bit signed integer format should be used when the returned weight value is expected to be less than 32,767 (or 1,048,575, if using 5-bit bit shifting). This format allows the PLC controller to make a direct conversion of the value.

The 20-bit unsigned integer format is provided for large numbers requiring greater precision than the 16-bit format can provide. This format can be used for values up to 1 048 575 (or 16 777 215, if using 4-bit bit shifting). The 20-bit format requires the PLC program to piece together the additional four bits from word 0 in the input image table (see PLC programming example in Section 5.2 on page 30).

Bit Shift

The bit shift field specifies how many digits the weight value is to be shifted to the right before it is returned in the input image table. Bit shifting (discarding of the least significant digits) is done only if required. Bit shift field values are shown in Table 3-2 on page 12.

NOTE: If bit shifting is necessary, the bit shift bit in the remote function status information is set on (see Section 3.2). If bit shifting is used, the PLC program must check this status bit to determine if shifting was necessary and provide the appropriate conversion for the shifted value.

bbb	Bits shifted	Multiplier
000	None	1
001	1	2
010	2	4
011	3	8
100	4	16
101	5	32
110	6	64
111	7	128

Table 3-2. Bit Shift Field Values

Command Number

The number representing the indicator command is sent in the lower byte of word 1 (bits 0–7). This byte is interpreted as a decimal number. Table 3-3 lists the remote commands that can be specified for IQ plus 510 and 710 indicators on discrete write commands.

Decimal	Binary	Command	IQ plus 510/710
0	0000 0000	Return Status and Weight	N/A
6	0000 0110	Display Gross Weight	KGROSS<cr>
7	0000 0111	Display Net Weight	KNET<cr>
9	0000 1001	Acquire Tare	KTARE<cr>
10	0000 1010	Primary Units	KPRIM<cr>
11	0000 1011	Secondary Units	KSEC<cr>
14	0000 1110	Print Request	KPRINT<cr>
15	0000 1111	Clear	KCLR<cr>
17	0001 0000	Clear Accumulator	KDISPACCUM<cr>KCLR<cr>KCLR<cr> *(IQ plus 710 only)*
21	0001 0101	Clear Tare	KDISPTARE<cr>KCLR<cr>KCLR<cr> *(IQ plus 710 only)* For IQ plus 510 indicators, remove weight from the scale and use the KZERO command (command 43) to clear the tare.
23	0001 0111	Return Gross	XG<cr>
28	0001 1100	Return Net	XN<cr>
33	0010 0001	Return Tare	XT<cr>
37	0010 0101	Return Currrent Display	P<cr>
43	0010 1011	Zero	KZERO<cr>
44	0010 1100	Enter Tare	K*n*<cr>…K*n*<cr>KTARE<cr>
45	0010 1101	No Operation	None
47	0010 1111	Return Accumulator	XA<cr> *(IQ plus 710 only)*
66	0100 0010	Lock indicator front panel	LOCKON<cr>
67	0100 0011	Unlock indicator front panel	LOCKOFF<cr>
70–127	0100 0110 0111 1111	Reserved	
Notes:	Commands shown with shading in the command number column (6–21, 43–44) do not update weight data in the PLC. Use command 0, 23, 28, 33, and 37 to return weight data to the PLC. Data written to the input image table by command 14 is not changed by repeating the command. Successive execution of this command with no other command between executions (command 14 followed by another command 14) has no effect.		

Table 3-3. IQ plus 510/710 Remote Commands

Using the Output Image Table

The output image table can be thought of as storage for two integers, with each integer one word long. Setting the bit pattern required for a discrete write command can be accomplished by adding the decimal values of those bits that are set to 1, then placing the binary sum in the output image table.

Table 3-4 shows the format of word 1 of the output image table, which includes the command number, bit shift value, weight format, and status data format specifications. Note that the values of bits 13–15 are always 0: bit 15 is reserved; no status data formats are defined for values using bits 13 and 14.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Decimal Value of 1	N/A	N/A	N/A	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
Bit Definition	R	Status Data Format			Wt	Bit Shift			Command							

Table 3-4. Output Image Table Format (Word 1), Showing Decimal Values for Bits Set to 1

Table 3-5 shows an example of word 1 of the output image table. In the example, bits are set to send the following information on the discrete write command:

- Display Gross Weight command (bits 0–7 = 00000110, 6 decimal)
- No bit shifting (bits 8–10 = 000)
- 20-bit weight format (bit 11 = 1)
- Remote function status data format (bits 12–14 = 000)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Decimal Value of 1	0	0	0	0	2048	0	0	0	0	0	0	0	0	4	2	0
Bit Definition	R	Status Data Format			Wt	Bit Shift			Command							

Table 3-5. Example of Output Image Table Format (Word 1)

The integer value of the bits set in the example above are the sum of:

Command number (6) + Bit shift (0) + Weight format (2048) + Status Data Format (0) = 2054

Use Table 3-6 to determine the decimal value of word 1 of the output image table for any discrete write command.

Command	+	Bit Shift		+	Weight Format		+	Status Data Format		=	Total Value in Output Image Table
Number		0	0		16-bit	0		Remote Function	0		
		1	256		20-bit	2048					
		2	512								
		3	768								
		4	1024								
		5	1280								
		6	1536								
		7	1792								

Table 3-6. Chart for Finding Decimal Value of Output Image Table (Word 1)

3.2 Input Image Table Format

The Remote I/O Interface places two 16-bit words in the PLC input image table which are read by the PLC controller. The Remote I/O Interface receives data from the indicator, then writes data and status information to the input image table based on parameters specified on the previous discrete write command. A discrete read command is performed when the PLC controller reads the data from the input image table.

The format of the input image table is shown in Table 3-7:

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word 0	v15	v14	v13	v12	v11	v10	v09	v08	v07	v06	v05	v04	v03	v02	v01	v00
Word 1	s10	s09	s08	s07	s06	s05	s04	s03	s02	s01	s00	p	v19	v18	v17	v16

Table 3-7. Input Image Table Format

where:

- v00–v15 16-bit signed integer value (v15 is the sign bit)
- v16–v19 4 high-order bits of 20-bit unsigned integer
- p Polarity bit for 20-bit integer (0 = positive; 1 = negative). Not valid for 16-bit integers.
- s00–s10 Status data

Value

Word 0 of the input image table is used to return weight data to the PLC controller. For values returned in 16-bit format, bit v15 serves as the sign bit. Values returned in 20-bit format use word 0 and bits v16–v19 of word 1, with a polarity bit (word 1, bit 4) to indicate the sign.

See Section 3.3 on page 15 for information about interpreting bit shifted values in the input image table.

Polarity

The polarity bit is used to indicate the sign of values returned in 20-bit format. This bit is not used for 16-bit values.

Status Data

Status data returned on a discrete read command can be either remote function status data or batch function status data, depending on the format specified on the write command.

Caution *Status bits should be routinely checked to ensure that incoming weight data is valid and that communication with the indicator is active.*

For example, if communication with the indicator is lost, the weight OK/weight invalid bit (status bit s12) is set. Failure to monitor this bit can cause overflows or accidents if conditional filling operations are based on old data.

Table 3-8 shows the remote function status data format.

Word 1 Bit	Status Bit	Remote Function Status Data	
		Value=0	Value=1
05	s00	No bit shift	Bits shifted
06	s01	Reserved	
07	s02		
08	s03	Gross	Net
09	s04	No tare	Tare acquired
10	s05	Primary (LB)	Secondary (KG)
11	s06	Standstill	In motion
12	s07	Weight OK	Weight invalid / Over-range
13	s08	Not zero	Center of zero
14	s09	Tare not entered	Tare entered
15	s10	Reserved	

Table 3-8. Remote Function Status Data Format

3.3 Bit Shifting

The Remote I/O Interface supports bit shifting of up to 7 bits for values returned in signed 16-bit format, or 4 bits for values returned in the unsigned 20-bit format. Maximum values are limited by the 7-digit capacity of the indicators.

Table 3-9 shows an example of a 20-bit value with 4-bit bit shifting. The maximum possible value of the 20-bit number is increased from 1,048,575 without shifting to 16,777,200 with 4-bit bit shifting. The number shown above each bit position represents the value of that bit if the bit is set to 1. The maximum value that can be returned in a given number of bits, *n*, is the sum of these values, or $2^n - 1$.

8 388 608	4 194 304	2 097 152	1 048 576	524 288	262 144	131 072	65 536	32 768	16 384	8 192	4 096	2 048	1024	512	256	128	64	32	16	8	4	2	1
				19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				
																				<<<< Bit Shift = 4			

Table 3-9. 20-bit Value with 4-bit Bit Shift

Table 3-10 shows the maximum values and resolutions possible for signed 16-bit and unsigned 20-bit values. Maximum resolved values compensate for the discarded low order (shifted-out) bits.

For example, a signed 16-bit value contains 15 data bits (the 16th bit is used as a sign bit). The maximum value that can be returned in 15 bits is $2^{15} - 1$, or 32,767.

With bit shifting, the maximum value that can be returned is increased to $(2^{n+b} - 1) - (2^b - 1)$, where *n* is the number of data bits (15 or 20) and *b* is the number of bits shifted. For 4-bit bit shifting using 16-bit format, the maximum value that can be returned is $(2^{15+4} - 1) - (2^4 - 1)$, or 524,272.

Format	Bit Shift	Maximum Shifted Value (±)	Resolution	Maximum Resolved Value (±)
16-bit (includes sign bit)	0	N/A	1	32 767
	1	65 535	2	65 534
	2	131 071	4	131 068
	3	262 143	8	262 136
	4	524 287	16	524 272
	5	1 048 575	32	1 048 544
	6	2 097 151	64	2 097 088
	7	4 194 303	128	4 194 176
20-bit	0	N/A	1	1 048 575
	1	2 097 151	2	2 097 150
	2	4 194 303	4	4 194 300
	3	8 388 607	8	8 388 600
	4	16 777 215	16	16 777 200

Table 3-10. Maximum Values for 16- and 20-bit Format Values Using Bit Shifting

4.0 Block Transfer Commands

The Remote I/O Interface supports block transfer commands for the IQ plus 510 and IQ plus 710 indicators. These commands allow the PLC controller to exchange larger blocks of data with the indicator, including gross, net, tare, and accumulator values, and partial setpoint configuration. Some commands are not supported for the IQ plus 510 indicator.

Supported Commands

Table 4-1 shows the block write and block read commands supported by the Remote I/O Interface.

Command Number	Command Name	Block Write Command Length**	Block Read Command Length*	Valid for IQ plus 510
1	Set Tare Value	4	2	Yes
2	Set Setpoint Values	11	2	—
3 *	Read Setpoint Values	2	11	—
4	Read Accumulator Value	2	4	—
7	Read Tare Value	2	4	Yes
8	Read Gross Value	2	4	Yes
9	Read Net Value	2	4	Yes
11	Set Multiple Setpoint Values	4 – 18***	2	—
12 *	Read Multiple Setpoint Values	2	4 – 18***	—
13	Set Batching State	2	2	—
* Indicator EDP port streaming must be turned off for commands 3 and 12 (EDP/STREAM parameter on SERIAL menu)				
** Command lengths expressed as number of words				
*** Length of command depends on number of setpoints specified				

Table 4-1. Supported Block Transfer Commands

Using Block Transfer Commands

When using block transfer commands, each action is accomplished by sending a block write command followed by a block read command.

For example, to set a tare value, a Block Write Command 1 (Set Tare Value) consisting of the command number (1), indicator channel number, and the tare value itself is sent to the Remote I/O Interface. Next, a Block Read Command 1 is issued by the PLC controller. The two words of data returned to the PLC contain the number of the previous block write command (1) and a response code indicating whether or not the block write command was successful. If the command failed, the command number returned in the block read is set negative (using 2’s complement).

The following sections provide detailed descriptions of the block transfer commands. Each section shows the format used by the block write command, followed by that of the block read command. See Section 5.3 on page 31 for an example of using block transfer to set and read setpoint values.

4.1 Set Tare Value

The Set Tare Value block write command is used to write a tare value to the indicator. Table 4-2 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Command Number (1)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)
2	v31							Tare Value								v16	Tare Value (MSW)
3	v15															v00	Tare Value (LSW)

Table 4-2. Block Write Command 1: Set Tare Value

Command Number
Specifies the Set Tare Value command number, 1.

Channel Number
Specifies the channel number for the tare value being set. Specify channel 1 for IQ plus 510/710 indicators.

Tare Value
Specifies the tare value being set.

Block read command 1 returns a response code to the PLC controller, indicating whether or not the Set Tare Value block write command was successful. Possible values for the response code field are:

0 00 Command successful
1 01 Command failed
2 10 Block write command format not valid

If the block write command failed, the command number returned in word 0 is set negative (-1). Table 4-3 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Command Number (1)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r1	r0	Response Code (0–2)

Table 4-3. Block Read Command 1: Set Tare Value (Read Response Code)

4.2 Set Setpoint Values

The Set Setpoint Values block write command is used to write setpoint information to the indicator. Table 4-4 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	Command Number (2)
1	0	0	0	0	0	0	0	0	0	0	0	0	n3	n2	n1	n0	Setpoint Number (1–8)
2	0	0	0	0	0	0	0	0	0	0	0	k4	k3	k2	k1	k0	Setpoint Kind (0–18)
3	v31							Setpoint Value								v16	Setpoint Value (MSW)
4	v15															v00	Setpoint Value (LSW)
5	b31							Band Value								b16	Band Value (MSW)
6	b15															b00	Band Value (LSW)
7	h31							Hysteresis Value								h16	Hysteresis Value (MSW)
8	h15															h00	Hysteresis Value (LSW)
9	p31							Preact Value								p16	Preact Value (MSW)
10	p15															p00	Preact Value (LSW)

Table 4-4. Block Write Command 2: Set Setpoint Values

Command Number

Specifies the Set Setpoint Values command number, 2.

Setpoint Number

Specifies the setpoint number being configured. Valid values are 1 through 8, decimal.

Setpoint Kind

Specifies the kind of setpoint being configured. Table 4-5 shows the kinds of setpoints that can be specified on this parameter:

Value	Kind	Description
0	OFF	Setpoint turned off/ignored.
1	GROSSSP	Gross setpoint. Trips when the current gross weight matches this value.
2	NETSP	Net setpoint. Trips when the current net weight matches this value.
4	–RELSP	Negative relative setpoint. Trips at a specific value below the referenced setpoint.
6	PAUSE	Pauses the batch sequence indefinitely. Operator must activate the START digital input to continue processing.
7	DELAY	Delays the batch sequence for a specified time. The length of the delay (in tenths of a second) is specified on the Value parameter.
8	WAITSS	Wait for standstill. Pauses the batch sequence until the scale is at standstill.
17	TIMER	Tracks the progress of a batch sequence based on a timer. The timer value, specified in tenths of a second on the Value parameter, determines the length of time allowed between start and end setpoints. The indicator Start and End parameters are used to specify the start and end setpoints. If the End setpoint is not reached before the timer expires, the digital output associated with this setpoint is activated.

Table 4-5. Setpoint Kind Values

Value	Kind	Description
18	CONCUR	Allows a digital output to remain active over a specified portion of the batch sequence. Two types of Concur setpoints can be configured: Type 1: The digital output associated with this setpoint becomes active when the Start setpoint becomes the current batch step and remains active until the End setpoint becomes the current batch step. Type 2: The digital output associated with this setpoint becomes active when the Start setpoint becomes the current batch step and remains active until a timer expires. The indicator Start and End parameters are used to specify start and end setpoints. The timer value is specified in tenths of a second on the Value parameter.

Table 4-5. Setpoint Kind Values (Continued)

Table 4-6 lists the values that can be specified for the Setpoint Kind parameter. Shaded areas in the right columns indicate that the setpoint type can be used as a continuous or batch step setpoint.

- Continuous setpoints are free-running, becoming active based on a specified condition or weight value.
- Batch setpoints run sequentially, one at a time, for control of batch processing operations.

Decimal Value	Bit Number					Kind	Continuous or Batch Step	
	k4	k3	k2	k1	k0		Cont	Batch
0	0	0	0	0	0	OFF		
1	0	0	0	0	1	GROSSSP		
2	0	0	0	1	0	NETSP		
4	0	0	1	0	0	–RELSP		
6	0	0	1	1	0	PAUSE		
7	0	0	1	1	1	DELAY		
8	0	1	0	0	0	WAITSS		
17	1	0	0	0	1	TIMER		
18	1	0	0	1	0	CONCUR		

Table 4-6. Setpoint Kind Values

Setpoint Value

Specifies the value used as input for several setpoint types. Values specified can represent weight, time (in tenths of a second), or the number of repetitions used by counter setpoints.

Band Value

Specifies the bandwidth value used when the TRIP parameter is set to INBAND or OUTBAND. The bandwidth value is set to fall equally on either side of the setpoint value.

Hysteresis

Specifies a band on either side of the setpoint value that must be exceeded before a continuous setpoint will trip on again once it has shut off.

Preact Value

Specifies the amount of adjustment used by the PREACT parameter. This parameter is used only if PREACT is set to ON or LEARN.

See the *IQ plus 710 Installation Manual* for more information about setpoint configuration.

Block read command 2 returns a response code to the PLC controller, indicating whether or not the Set Setpoint Values block write command was successful. Possible values for the response code field are:

0	00	Command successful
1	01	Command failed
2	10	Block write command format not valid

If the block write command failed, the command number returned in word 0 is set negative (-2). Table 4-7 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	Command Number (2)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r1	r0	Response Code (0–2)

Table 4-7. Block Read Command 2: Set Setpoint Values (Read Response Code)

4.3 Read Setpoint Values

The Read Setpoint Values block write command is used to read setpoint values from the indicator. Table 4-8 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	Command Number (3)
1	0	0	0	0	0	0	0	0	0	0	0	0	n3	n2	n1	n0	Setpoint Number (1–8)

Table 4-8. Block Write Command 3: Read Setpoint Values

Command Number

Specifies the Read Setpoint Values command number, 3.

Setpoint Number

Specifies the number of the setpoint being read. Valid values are 1 through 8.

Block read command 3 returns an 11-word block of setpoint values to the PLC controller. If the block write command failed, the command number returned in word 0 is set negative (-3). Table 4-9 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	Command Number (3)
1	0	0	0	0	0	0	0	0	0	0	0	0	n3	n2	n1	n0	Setpoint Number (1–8)
2	0	0	0	0	0	0	0	0	0	0	0	k4	k3	k2	k1	k0	Setpoint Kind (0–18)
3	v31							Setpoint Value								v16	Setpoint Value (MSW)
4	v15															v00	Setpoint Value (LSW)
5	b31							Band Value								b16	Band Value (MSW)
6	b15															b00	Band Value (LSW)
7	h31							Hysteresis Value								h16	Hysteresis Value (MSW)
8	h15															h00	Hysteresis Value (LSW)
9	p31							Preact Value								p16	Preact Value (MSW)
10	p15															p00	Preact Value (LSW)

Table 4-9. Block Read Command 3: Read Setpoint Values

4.4 Read Accumulator Value

The Read Accumulator Value block write command is used to read accumulator values from the indicator. Table 4-10 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	Command Number (4)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Accumulator Number (1)

Table 4-10. Block Write Command 4: Read Accumulator Value

Command Number
Specifies the Read Accumulator Value command number, 4.

Accumulator Number
Specifies the number of the accumulator being read. Specify channel 1 for IQ plus 710 indicators.

Block read command 4 returns a 2-word accumulator value to the PLC controller. If the block write command failed, the command number returned in word 0 is set negative (-4). Table 4-11 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	Command Number (4)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Accumulator Number (1)
2	v31							Accumulator Value								v16	Accumulator Value (MSW)
3	v15															v00	Accumulator Value (LSW)

Table 4-11. Block Read Command 4: Read Accumulator Value

4.5 Read Tare Value

The Read Tare Value block write command is used to read a tare value from the indicator. Table 4-12 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	Command Number (7)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)

Table 4-12. Block Write Command 7: Read Tare Value

Command Number
Specifies the Set Tare Value command number, 7.

Channel Number
Specifies the channel number for the tare value being read. Specify channel 1 for IQ plus 510/710 indicators.

Block read command 7 returns a 2-word tare value to the PLC controller. If the block write command failed, the command number returned in word 0 is set negative (-7). Table 4-13 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	Command Number (7)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)
2	v31							Tare Value								v16	Tare Value (MSW)
3	v15															v00	Tare Value (LSW)

Table 4-13. Block Read Command 7: Read Tare Value

4.6 Read Gross Value

The Read Gross Value block write command is used to read a gross value from the indicator. Table 4-14 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	Command Number (8)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)

Table 4-14. Block Write Command 8: Read Gross Value

Command Number

Specifies the Read Gross Value command number, 8.

Channel Number

Specifies the channel number for the gross value being read. Specify channel 1 for IQ plus 510/710 indicators.

Block read command 8 returns a 2-word gross value to the PLC controller. If the block write command failed, the command number returned in word 0 is set negative (-8). Table 4-15 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	Command Number (8)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)
2	v31							Gross Value								v16	Gross Value (MSW)
3	v15															v00	Gross Value (LSW)

Table 4-15. Block Read Command 8: Read Gross Value

4.7 Read Net Value

The Read Net Value block write command is used to read a net value from the indicator. Table 4-16 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	Command Number (9)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)

Table 4-16. Block Write Command 9: Read Net Value

Command Number

Specifies the Read Net Value command number, 9.

Channel Number

Specifies the channel number for the net value being read. Specify channel 1 for IQ plus 510/710 indicators.

Block read command 9 returns a 2-word net value to the PLC controller. If the block write command failed, the command number returned in word 0 is set negative (-9). Table 4-17 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	Command Number (9)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Channel Number (1)
2	v31							Net Value								v16	Net Value (MSW)
3	v15															v00	Net Value (LSW)

Table 4-17. Block Read Command 9: Read Net Value

4.8 Set Multiple Setpoint Values

The Set Multiple Setpoint Values block write command is used to set the setpoint value for one or more setpoints. Depending on the number of setpoint values set, the command length can vary from 4 to 18 words. Table 4-18 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	Command Number (11)
1	0	0	0	0	0	0	0	0	0	0	0	0	n3	n2	n1	n0	Set Through Setpoint Number (1–8)
2	v31							Setpoint 1 Value								v16	Setpoint 1 Value (MSW)
3	v15															v00	Setpoint 1 Value (LSW)
4	v31							Setpoint 2 Value								v16	Setpoint 2 Value
5	v15															v00	
6	v31							Setpoint 3 Value								v16	Setpoint 3 Value
7	v15															v00	
8	v31							Setpoint 4 Value								v16	Setpoint 4 Value
9	v15															v00	
10	v31							Setpoint 5 Value								v16	Setpoint 5Value
11	v15															v00	
12	v31							Setpoint 6 Value								v16	Setpoint 6 Value
13	v15															v00	
14	v31							Setpoint 7 Value								v16	Setpoint 7 Value
15	v15															v00	
16	v31							Setpoint 8 Value								v16	Setpoint 8 Value
17	v15															v00	

Table 4-18. Block Write Command 11: Set Multiple Setpoint Values

Command Number

Specifies the Set Multiple Setpoint Values command number, 11.

Set Through Setpoint Number

Specifies the setpoints for which setpoint values are set. Valid values are 1 through 8. Setpoint values are set for all setpoints less than or equal to the number specified. For example, if the Set Through Setpoint Number is 4, setpoint values are entered for setpoints 1–4, using words 2–9.

Block read command 11 returns a response code to the PLC controller, indicating whether or not the Set Multiple Setpoint Values block write command was successful. Possible values for the response code field are:

0 00 Command successful
1 01 Command failed
2 10 Block write command format not valid

If the block write command failed, the command number returned in word 0 is set negative (-11). Table 4-19 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	Command Number (11)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r1	r0	Response Code (0–2)

Table 4-19. Block Read Command 12: Set Multiple Setpoint Values

4.9 Read Multiple Setpoint Values

The Read Multiple Setpoint Values block write command is used to read the setpoint value for one or more setpoints from the indicator. Table 4-20 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	Command Number (12)
1	0	0	0	0	0	0	0	0	0	0	0	0	n3	n2	n1	n0	Read Through Setpoint Number (1–8)

Table 4-20. Block Write Command 12: Read Multiple Setpoint Values

Command Number

Specifies the Read Multiple Setpoint Values command number, 12.

Read Through Setpoint Number

Specifies the setpoints for which setpoint values are read. Valid values are 1 through 8. Setpoint values are retrieved for all setpoints less than or equal to the number specified. For example, if the Read Through Setpoint Number is 6, setpoint values for setpoints 1 through 6 will be returned by the block read command.

The Read Multiple Setpoint Values block read command returns the requested setpoint values and a response code to the PLC controller. Depending on the number of setpoint values requested, the command length can vary from 4 to 18 words. Table 4-21 shows the format of the command if the values of all 8 setpoints are read.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	Command Number (12)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r1	r0	Response Code (0–2)
2	v31							Setpoint 1 Value								v16	Setpoint 1 Value (MSW)
3	v15															v00	Setpoint 1 Value (LSW)
4	v31							Setpoint 2 Value								v16	Setpoint 2 Value
5	v15															v00	
6	v31							Setpoint 3 Value								v16	Setpoint 3 Value
7	v15															v00	
8	v31							Setpoint 4 Value								v16	Setpoint 4 Value
9	v15															v00	
10	v31							Setpoint 5 Value								v16	Setpoint 5Value
11	v15															v00	
12	v31							Setpoint 6 Value								v16	Setpoint 6 Value
13	v15															v00	
14	v31							Setpoint 7 Value								v16	Setpoint 7 Value
15	v15															v00	
16	v31							Setpoint 8 Value								v16	Setpoint 8 Value
17	v15															v00	

Table 4-21. Block Read Command 12: Read Multiple Setpoint Values

The response code indicates whether or not the Read Multiple Setpoint Values block write command was successful. Possible values for the response code field are:

0 00 Command successful
1 01 Command failed
2 10 Block write command format not valid

If the block write command failed, the command number returned in word 0 is set negative (-12).

4.10 Set Batching State

The Set Batching State block write command is used to set the batching (BATCHNG) parameter to OFF, AUTO, or MANUAL. Table 4-22 shows the format of the command:

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	Command Number (13)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	s1	s0	Batching State (0–2)

Table 4-22. Block Write Command 13: Set Batching State

Command Number

Specifies the Set Batching State command number, 13.

Batching State

Specifies the type of batching enabled for the indicator. Possible values are:

0 00 Off
1 01 Automatic
2 10 Manual

The block read command returns a response code to the PLC controller, indicating whether or not the Set Batching State block write command was successful. Possible values for the response code field are:

0 00 Command successful
1 01 Command failed
2 10 Block write command format not valid

If the block write command failed, the command number returned in word 0 is set negative (–13). Table 4-23 shows the format of the block read command.

Word	Bit Number																Word Contents
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	Command Number (13)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	r1	r0	Response Code (0–2)

Table 4-23. Block Read Command 13: Set Batching State

5.0 Operation

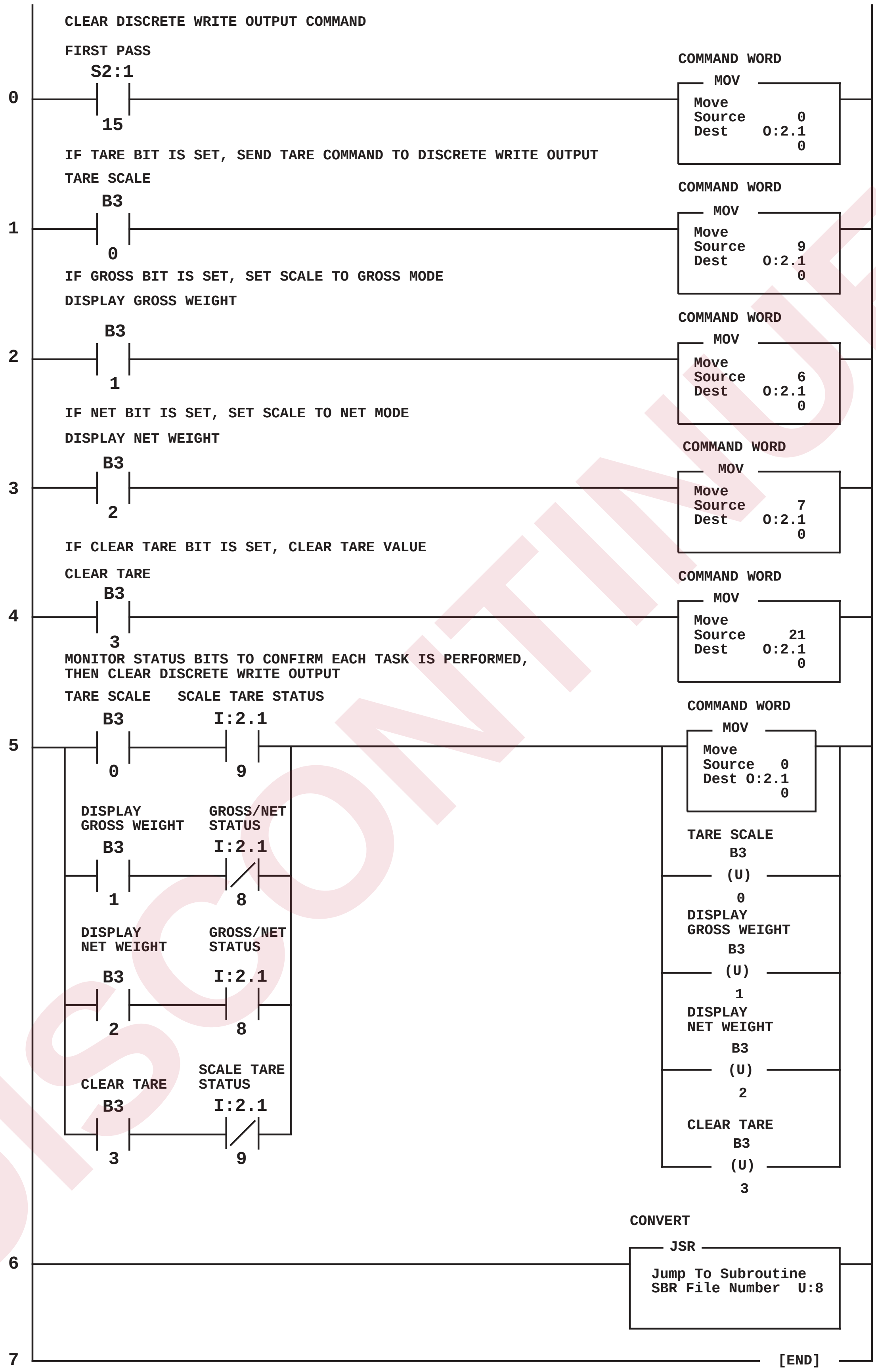
The examples on the following pages provide PLC programming examples for using the Remote I/O Interface.

5.1 Test Program for Verifying Remote I/O Interface Operation

The programming example shown on the next page writes a series of discrete commands to the Remote I/O Interface and checks the status bits returned in the input image table to confirm completion of each command. This example assumes the Remote I/O scanner to be in slot #2, with the Remote I/O Interface at rack address 0, quarter 0.

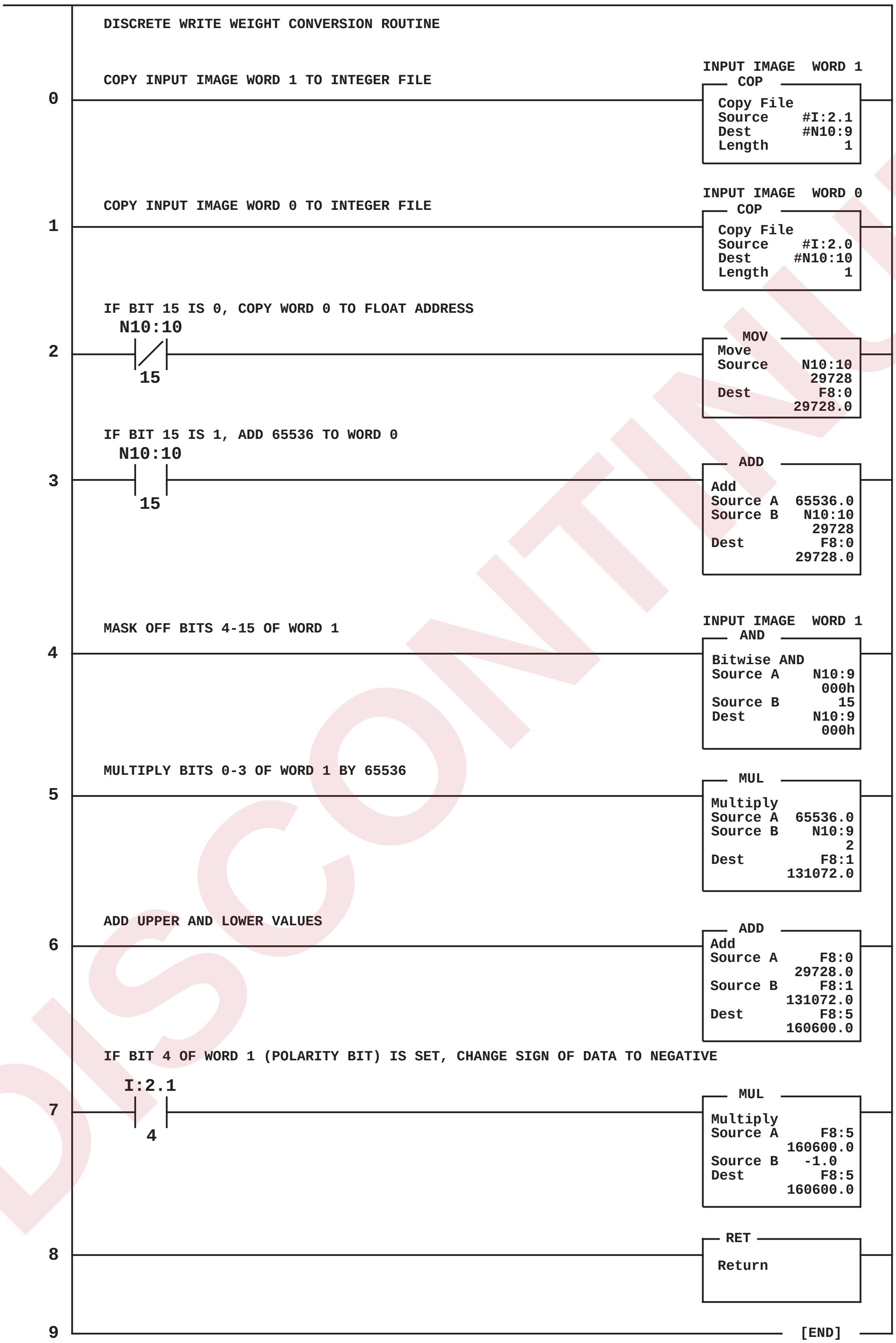
NOTES:

1. This program can be edited and used to test communications between the PLC and the Remote I/O Interface.
2. The COMMAND WORD must be zeroed after checking the status bits to confirm that the command has been executed.


CLEAR DISCRETE WRITE OUTPUT COMMAND
FIRST PASS
S2:1
15
0
COMMAND WORD
MOV
Move
Source 0
Dest O:2.1
0
IF TARE BIT IS SET, SEND TARE COMMAND TO DISCRETE WRITE OUTPUT
TARE SCALE
B3
0
1
COMMAND WORD
MOV
Move
Source 9
Dest O:2.1
0
IF GROSS BIT IS SET, SET SCALE TO GROSS MODE
DISPLAY GROSS WEIGHT
B3
1
2
COMMAND WORD
MOV
Move
Source 6
Dest O:2.1
0
IF NET BIT IS SET, SET SCALE TO NET MODE
DISPLAY NET WEIGHT
B3
2
3
COMMAND WORD
MOV
Move
Source 7
Dest O:2.1
0
IF CLEAR TARE BIT IS SET, CLEAR TARE VALUE
CLEAR TARE
B3
3
4
COMMAND WORD
MOV
Move
Source 21
Dest O:2.1
0
MONITOR STATUS BITS TO CONFIRM EACH TASK IS PERFORMED,
THEN CLEAR DISCRETE WRITE OUTPUT
TARE SCALE
B3
0
SCALE TARE STATUS
I:2.1
9
5
DISPLAY
GROSS WEIGHT
B3
1
GROSS/NET
STATUS
I:2.1
8
DISPLAY
NET WEIGHT
B3
2
GROSS/NET
STATUS
I:2.1
8
CLEAR TARE
B3
3
SCALE TARE
STATUS
I:2.1
9
COMMAND WORD
MOV
Move
Source 0
Dest O:2.1
0
TARE SCALE
B3
(U)
0
DISPLAY
GROSS WEIGHT
B3
(U)
1
DISPLAY
NET WEIGHT
B3
(U)
2
CLEAR TARE
B3
(U)
3
CONVERT
JSR
Jump To Subroutine
SBR File Number U:8
6
7
[END]

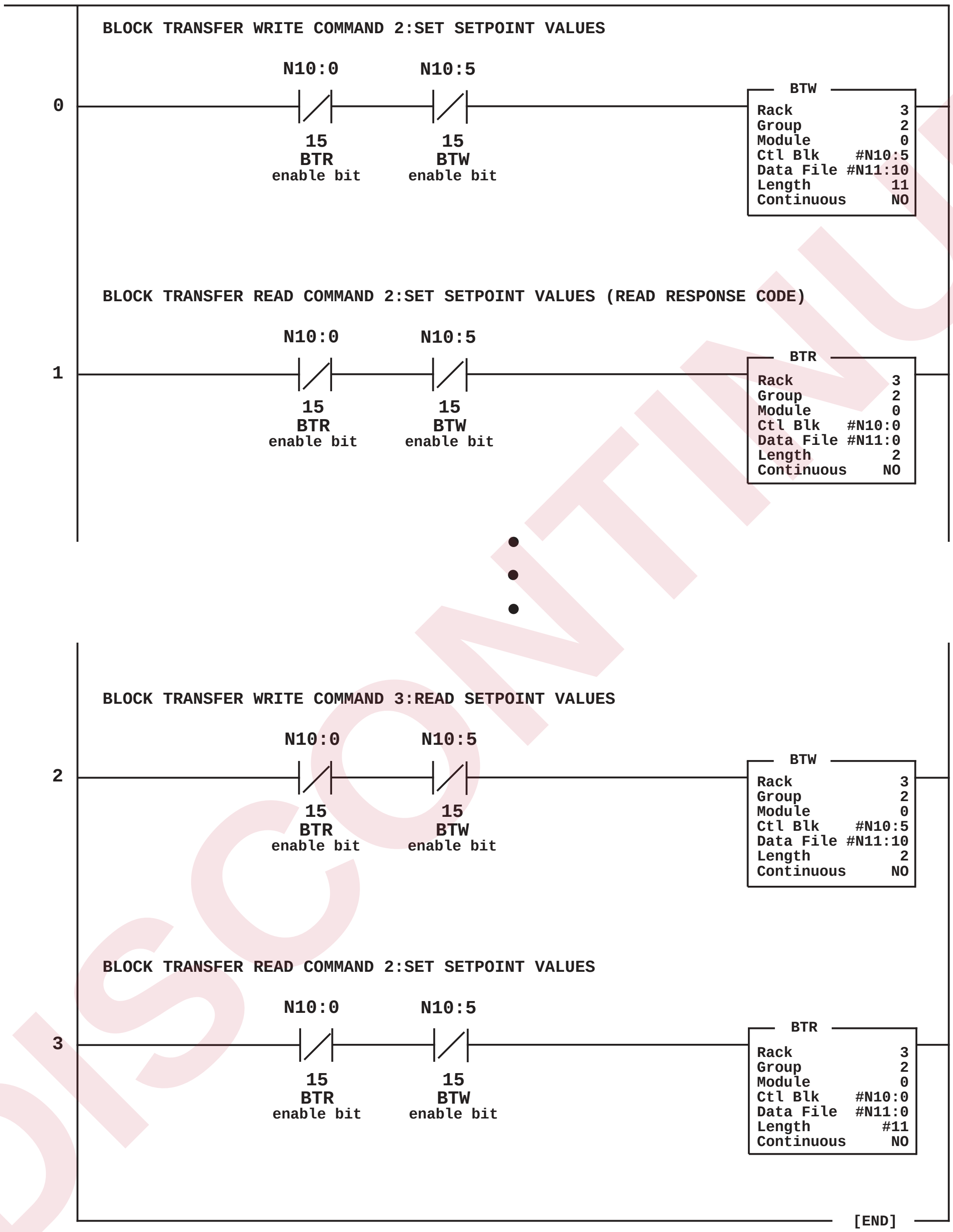
5.2 PLC Program for Converting 20-bit Values to Floating Integers

The following programming example converts a 20-bit value in the input image table to a floating integer value stored at location F8:5.

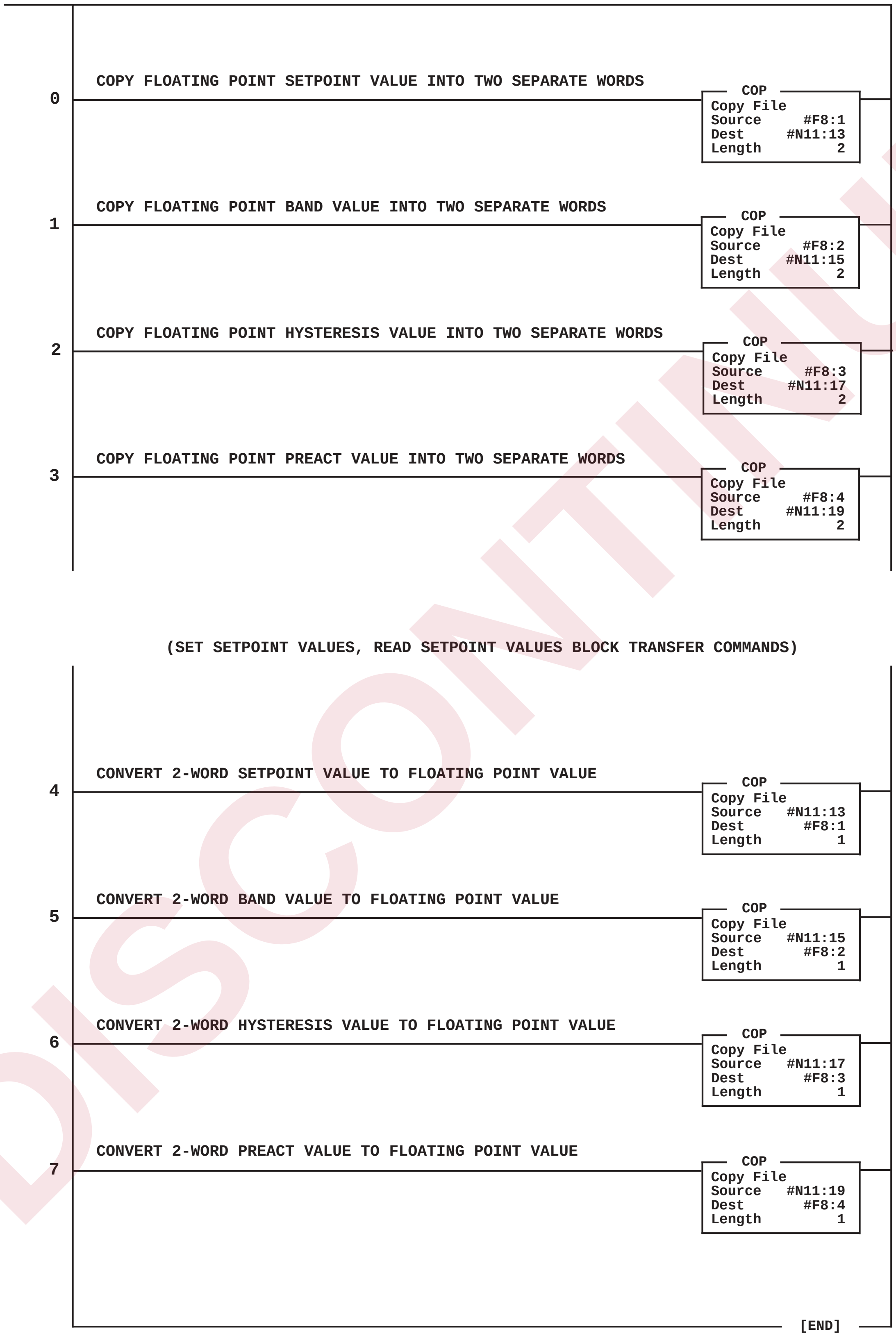


5.3 Using Block Transfer to Set and Read Setpoint Values

The following program example uses block transfer commands to write setpoint values to the IQ plus 510/710 indicator (block write/block read command 2), then read the values for the setpoint (block write/block read command 3). See Sections 4.2 and 4.3 for detailed descriptions of the Set and Read Setpoint Values block transfer commands.



Floating point values used for the Set Setpoint Values parameters must be copied into separate words before issuing the command. Values returned on the Read Setpoint Values block read command must be converted back to floating point values. The following example shows these conversions for all four parameters on the Set and Read Setpoint Values commands.

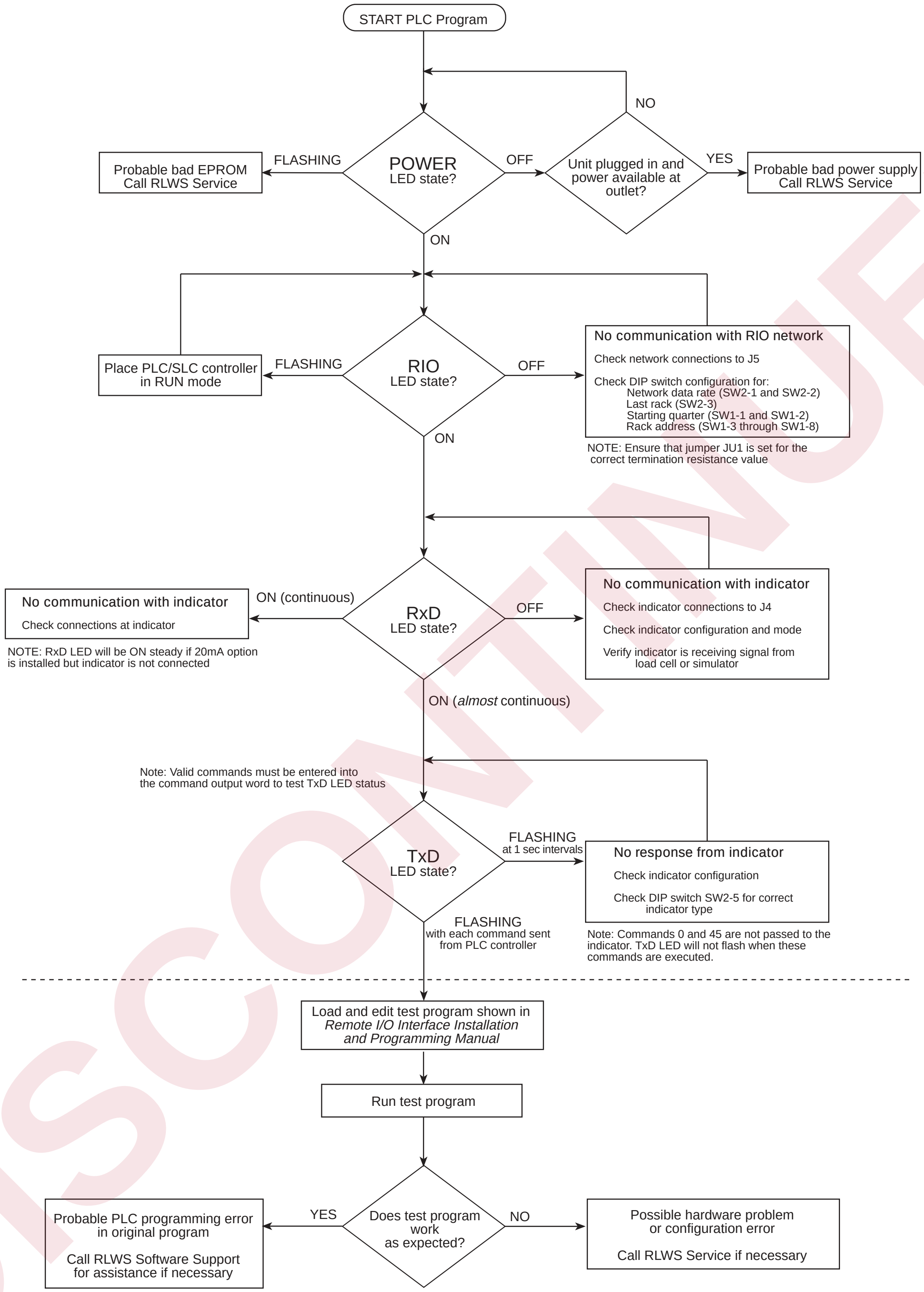


6.0 Troubleshooting

The LED indicators on the indicator backplate can be used to isolate hardware and configuration problems. The LEDs show whether the problem exists in the connection to the indicator, the connection to the PLC controller, or the Remote I/O Interface itself.

The flowchart on the following page provides a diagnostic procedure for troubleshooting the Remote I/O Interface using the unit's LED indicators.

If all LEDs appear to be responding correctly, edit the program shown in Section 5.1 on page 28 for your installation and use it to test the Remote I/O Interface.


START PLC Program
POWER LED state?
FLASHING
Probable bad EPROM Call RLWS Service
OFF
Unit plugged in and power available at outlet?
NO
YES
Probable bad power supply Call RLWS Service
ON
RIO LED state?
FLASHING
Place PLC/SLC controller in RUN mode
OFF
No communication with RIO network
Check network connections to J5
Check DIP switch configuration for:
Network data rate (SW2-1 and SW2-2)
Last rack (SW2-3)
Starting quarter (SW1-1 and SW1-2)
Rack address (SW1-3 through SW1-8)
NOTE: Ensure that jumper JU1 is set for the correct termination resistance value
ON
RxD LED state?
ON (continuous)
No communication with indicator
Check connections at indicator
NOTE: RxD LED will be ON steady if 20mA option is installed but indicator is not connected
OFF
No communication with indicator
Check indicator connections to J4
Check indicator configuration and mode
Verify indicator is receiving signal from load cell or simulator
ON (almost continuous)
Note: Valid commands must be entered into the command output word to test TxD LED status
TxD LED state?
FLASHING at 1 sec intervals
No response from indicator
Check indicator configuration
Check DIP switch SW2-5 for correct indicator type
Note: Commands 0 and 45 are not passed to the indicator. TxD LED will not flash when these commands are executed.
FLASHING with each command sent from PLC controller
Load and edit test program shown in Remote I/O Interface Installation and Programming Manual
Run test program
Does test program work as expected?
YES
Probable PLC programming error in original program
Call RLWS Software Support for assistance if necessary
NO
Possible hardware problem or configuration error
Call RLWS Service if necessary

7.0 Remote I/O Interface Specifications

Power Requirement

5 VDC, 250 mA

Communications Specifications

Allen-Bradley Remote I/O Network Communications:

Twinaxial cable attachment to networks at 56.6, 115.2, or 230.4 Kbps

Serial Communications:

Interface: RS-232C, 20mA current loop (optional)
Data rate: 9600 or 19.2 Kbps
ASCII encoding: 1 start bit, 8 data bits, 1 stop bit

Update Rate: 60 updates/sec

Environmental Specifications

Temperature: –10° to +40° C (14° to 104° F)

Remote I/O Interface Limited Warranty

Rice Lake Weighing Systems (RLWS) warrants that all RLWS equipment and systems properly installed by a Distributor or Original Equipment Manufacturer (OEM) will operate per written specifications as confirmed by the Distributor/OEM and accepted by RLWS. All systems and components are warranted against defects in materials and workmanship for one year.

RLWS warrants that the equipment sold hereunder will conform to the current written specifications authorized by RLWS. RLWS warrants the equipment against faulty workmanship and defective materials. If any equipment fails to conform to these warranties, RLWS will, at its option, repair or replace such goods returned within the warranty period subject to the following conditions:

- Upon discovery by Buyer of such nonconformity, RLWS will be given prompt written notice with a detailed explanation of the alleged deficiencies.
- Individual electronic components returned to RLWS for warranty purposes must be packaged to prevent electrostatic discharge (ESD) damage in shipment. Packaging requirements are listed in a publication, "Protecting Your Components From Static Damage in Shipment," available from RLWS Equipment Return Department.
- Examination of such equipment by RLWS confirms that the nonconformity actually exists, and was not caused by accident, misuse, neglect, alteration, improper installation, improper repair or improper testing; RLWS shall be the sole judge of all alleged non-conformities.
- Such equipment has not been modified, altered, or changed by any person other than RLWS or its duly authorized repair agents.
- RLWS will have a reasonable time to repair or replace the defective equipment. Buyer is responsible for shipping charges both ways.
- In no event will RLWS be responsible for travel time or on-location repairs, including assembly or disassembly of equipment, nor will RLWS be liable for the cost of any repairs made by others.

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