Remote I/O®

ALLEN-BRADLEY® Remote I/O Indicator Interface for 520 and 920i™ Indicators

Installation and Programming Manual

ROCKWELL AUTOMATION ENCOMPASS™ THE AMERICAS

RICE LAKE WEIGHING SYSTEMS
Industrial Solutions on a Global Scale®

ISO 9001 REGISTERED

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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 card. The Remote I/O Interface allows *520* and *920i* indicators to communicate with PLC® and SLC™ controllers using the Allen-Bradley® Remote I/O network.[1] See the *520* or *920i* *Installation Manual* for additional installation information and detailed descriptions of indicator functions.

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

The Remote I/O Interface card is installed inside the indicator enclosure. Installation in NEMA 4X stainless steel enclosures permits use in washdown environments.

Warning *Some procedures described in this manual require work inside the indicator 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 from the *520* or *920i* indicator to the PLC controller. The Remote I/O Interface also provides the PLC programmer with limited control of indicator functions. Indicator configuration and calibration cannot be performed through the Remote I/O Interface.

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). Each pair of slots corresponds to a “module group”, one input and one output word. The Remote I/O Interface contains two module groups and therefore communicates two words of data.

The PLC controller sends commands to the indicator through the Remote I/O Interface by writing the commands to the output image table, and reads returned weight and status data from the input image table. These actions are referred to as discrete transfers. See Section 3.0 on page 6 for information about using discrete transfer commands.

Block transfers are accomplished by sending a block write command followed by a block read command. Separate data files are set up for block commands. The length of these files depends on the length of the data being read or written. See Section 4.0 on page 12 for information about using block transfer commands.

2.0 Installation

This section describes the procedures used to install the Remote I/O interface card into the *520* and *920i* 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

Use the following procedure to install the Remote I/O Interface card into *520* and *920i* indicators.

1. Disconnect indicator from power source.

Warning *Disconnect power before removing indicator backplate.*

The 520 and 920i have no on/off switch. Before opening the unit, ensure the power cord is disconnected from the power outlet.

2. Open indicator enclosure. For indicator models with backplates, place indicator face-down on an antistatic work mat and remove screws that hold the backplate to the enclosure body.

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

3. Carefully align the large option card connector with connector J5 or J6 on the *920i* CPU board or connector J2 on the *520* CPU board. Press down to seat the option card in the CPU board connector.
4. Use the screws provided in the option kit to secure the other end of the option card to the threaded standoffs on the CPU board (see Figures 2-1 and 2-2).

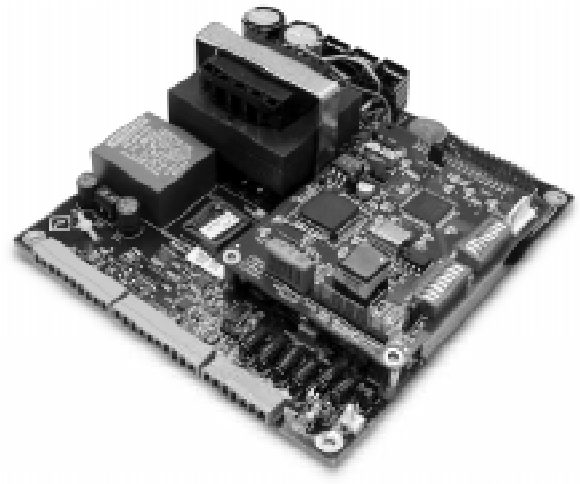


Figure 2-1. Option Card Installed on 520 CPU Board

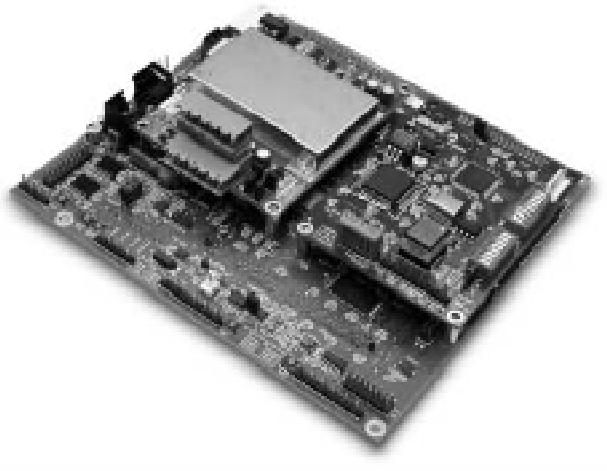


Figure 2-2. Option Card Installed on 920i CPU Board

5. Set termination resistance (jumper JMP4) as described in Section 2.1.1 on page 3.
6. Wire the card to the network as described in Section 2.1.2 on page 3.
7. Set DIP switches as described in Section 2.2 on page 4.
8. Use cable ties to secure loose cables inside the enclosure.
9. For indicator models that include a backplate, position the backplate over the enclosure and reinstall the backplate screws. For the *920i* desktop and universal models, 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).

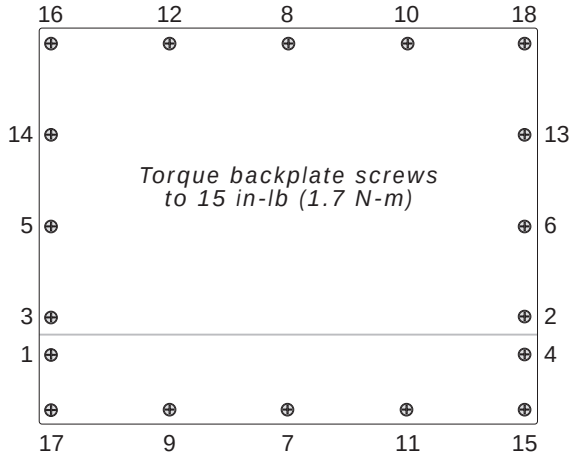


Figure 2-3. 920i Enclosure Backplate

10. Ensure no excess cable is left inside the enclosure and tighten cord grips.
11. Reconnect power to the indicator. The indicator automatically recognizes all installed option cards when the unit is powered on. No hardware-specific configuration is required to identify the newly-installed Remote I/O card to the system.

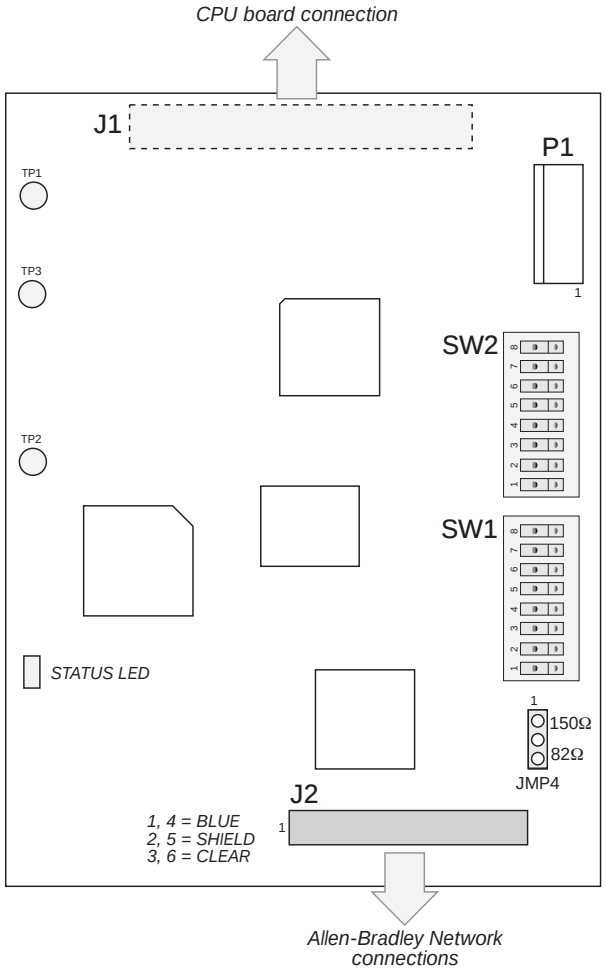


Figure 2-4. Remote I/O Interface Card

2.1.1 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 2-1 to determine the appropriate termination resistance value and JMP4 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 card.

Network Data Rate	Maximum Cable Length	Maximum Nodes	JMP4 Termination Resistance
57.6 Kbps	10 000 ft	16	150Ω
115.2 Kbps	5000 ft		
230.4 Kbps	2500 ft	32	82Ω

Table 2-1. JMP4 Jumper Positions and Termination Resistance Values

2.1.2 A-B Network Connections

Connections to the Allen-Bradley network are made at connector J2 on the Remote I/O Interface card (see Figure 2-4 on page 3). Connectors 4–6 are tied to connectors 1–3 to allow daisy-chaining through the Remote I/O Interface.

Feed Allen-Bradley network cable through cord grip. Allow enough cable for routing along inside of enclosure to J2 connector on the Remote I/O Interface card. Connect Allen-Bradley network cables into connector J2 on the Remote I/O Interface card, then use cable ties to secure network cables to the cable tie mounts.

2.1.3 LED Status Indicator

A single LED on the Remote I/O card provides status information for troubleshooting (see Figure 2-4). Table 2-2 summarizes the function of the LED.

LED	Function
OFF	Not initialized or not receiving valid frames
Pulsing (2Hz)	Communications established with Command 1's or timeout
ON	Valid communications established with Command 2's

Table 2-2. Remote I/O Interface Status LED

2.2 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 2-5 shows the switch assignments for SW1 and SW2.

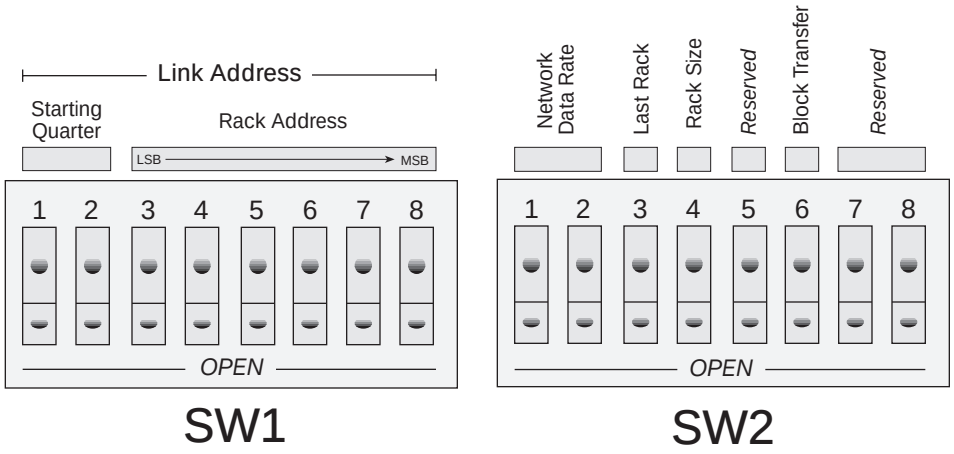


Figure 2-5. SW1 and SW2 DIP Switch Assignments

Starting Quarter

Switches SW1-1 and SW1-2 set the starting quarter (or group number) used by the Remote I/O Interface. Use Table 2-3 to select the correct switch settings.

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

Table 2-3. 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 5 to select the correct switch settings for the rack address. *Note that setting a switch OPEN acts as a logical "1" and that SW1-3 represents the least significant bit (LSB) of the rack address.*

Network Data Rate

SW2-1 and SW2-2 set the data rate of the Allen-Bradley network. Use Table 2-4 to select the correct switch settings for the network.

Remote I/O Data Rate	SW2 Switch Settings	
	1	2
57.6 Kbps	CLOSED	CLOSED
115.2 Kbps	OPEN	CLOSED
230.4 Kbps	CLOSED	OPEN
	OPEN	OPEN

Table 2-4. Network Data Rate

Last Rack

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

Rack Size

At this time only a quarter rack size is supported. This option has been included for possible future expansion to include half rack support. Switch 2-4 is ignored.

Block Transfer

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

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

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

2.3 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

Discrete commands are used by the PLC 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).

NOTE: Data returned by discrete transfer commands is not valid when the indicator is in setup mode.

3.1 Output Image Table Format

To perform a discrete command, the PLC places two 16-bit words in the PLC output image table, which is sent by the scanner to the node adapter of the Remote I/O Interface. The Remote I/O Interface provides the contents of the output image table to the indicator for command processing.

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	p07	p06	p05	p04	p03	p02	p01	p00	c07	c06	c05	c04	c03	c02	c01	c00

Table 3-1. Output Image Table Format

where:

v00–v15	16-bit unsigned integer value
p00–p07	Parameter value
c00–c07	Command number

These fields are described below:

Value

Word 0 of the output image table is used to pass 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 (12) is specified in bits 00 through 07 of word 1.

Values entered in this field are treated as unsigned integers. Possible values range from 0 to 65535.

Parameter value

To allow communication with a multi-scale indicator, the scale number is sent in the upper byte of word 1. A value of 0 represents the current scale. Certain commands require a parameter other than a scale number. These commands are noted in the table as requiring a slot number or other selection parameter.

Command Number

The number representing the indicator command is sent in the lower byte of word 1. Table 3-2 lists the remote commands that can be specified for *520* and *920i* indicators on discrete write commands.

NOTE: *A lockout feature that looks for any change in the image table data is incorporated into the indicator receive mechanism to prevent inundation by the same command. Repeated commands must be separated by any other valid command/parameter/value combination.*

Decimal	Hex	Binary	Command
0	0x00	0000 0000	Return Status and Weight
1	0x01	0000 0001	Display Channel
2	0x02	0000 0010	Display Gross Weight
3	0x03	0000 0011	Display Net Weight
4	0x04	0000 0100	Display Piece Count
9	0x09	0000 1001	Gross/Net key press (toggle mode)
10	0x0A	0000 1010	Zero
11	0x0B	0000 1011	Display Tare
12	0x0C	0000 1100	Enter Tare (integer)
13	0x0D	0000 1101	Acquire Tare

Table 3-2. 520 / 920i Remote Commands

Decimal	Hex	Binary	Command
14	0x0E	0000 1110	Clear Tare
16	0x10	0001 0000	Primary Units
17	0x11	0001 0001	Secondary Units
18	0x12	0001 0010	Tertiary Units
19	0x13	0001 0011	Units key press (toggle units)
20	0x14	0001 0100	Print Request
21	0x15	0001 0101	Display Accumulator
22	0x16	0001 0110	Clear Accumulator
23	0x17	0001 0111	Push Weight to Accumulator
32	0x20	0010 0000	Return Gross (integer)
33	0x21	0010 0001	Return Net (integer)
34	0x22	0010 0010	Return Tare (integer)
35	0x23	0010 0011	Return Piece Count
37	0x25	0010 0101	Return Current Display (integer)
38	0x26	0010 0110	Return Accumulator (integer)
39	0x27	0010 0111	Return Rate of Change (integer)
40	0x28	0010 1000	Return Peak (integer)
95	0x5F	0101 1111	Set Batching State
96	0x60	0110 0000	Batch Start
97	0x61	0110 0001	Batch Pause
98	0x62	0110 0010	Batch Reset
99	0x63	0110 0011	Batch Status
112	0x70	0110 0100	Lock Indicator Front Panel
113	0x71	0110 0101	Unlock Indicator Front Panel
114	0x72	0110 0110	Set Digital Input ON
115	0x73	0110 0111	Set Digital Input OFF
116	0x74	0110 1000	Read Digital Input Status
253	0xFD	1111 1101	No operation
254	0xFE	1111 1110	Reset Indicator

Table 3-2. 520 / 920i Remote Commands (Continued)

3.2 Input Image Table Format

In response to a discrete command, the Remote I/O Interface interface returns data and status information across the network as two 16-bit words. This information is read from the input image table by the PLC. The format of the input image table is shown in Table 3-3:

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	s11	s10	s09	s08	s07	s06	s05	s04	s03	s02	s01	s00	v19	v18	v17	v16

Table 3-3. Input Image Table Format

where:

v00–v19 20-bit unsigned integer
s00–s11 Status data

Value

Weight data is returned to the PLC using word 0 and bits 0 to 3 from word 1 of the input image table. The PLC can use just word 0 to read data in a 16-bit format, allowing unsigned values from 0 to 65,535 to be returned from the indicator. If larger numbers or greater precision is required, the PLC can piece together the additional four bits from word 1, resulting in a 20-bit unsigned value. This format allows the indicator to return values up to 1,048,575. Polarity is returned with status data. The weight data returned is the displayed weight after the command is executed unless the command specifies otherwise.

Status Data

Indicator status data is returned in bits 4–15 of word 1. Status data is listed in Table 3-4. Batch commands return batch status in place of bits 8–15 as listed in Table 3-5.

Channel Bits

Bits s01–s03 of the indicator status data (Table 3-4) are used to represent the lower three bits of the scale channel number. For example, if a value of ‘001’ is returned in these bits, the scale channel number is 1, 9, 17 or 25.

Word 1 Bit	Status Bit	Indicator Status Data	
		Value=0	Value=1
04	s00	Positive weight	Negative weight
05	s01	Lower three bits of scale number	
06	s02		
07	s03		
08	s04	Gross	Net
09	s05	No tare	Tare acquired
10	s06	Primary units	Secondary/ other units
11	s07	Standstill	In motion
12	s08	Weight invalid / Over-range	Weight OK
13	s09	Not zero	Center of zero
14	s10	Tare not entered	Tare entered
15	s11	Error	No error

Table 3-4. Indicator Status Data Format

Word 1 Bit	Status Bit	Batch Function Status Data	
		Value=0	Value=1
08	s04	Alarm OFF	Alarm ON
09	s05	Batch not stopped	Batch stopped
10	s06	Batch not running	Batch running
11	s07	Batch not paused	Batch paused
12	s08	Digital input 1 OFF	Digital input 1 ON
13	s09	Digital input 2 OFF	Digital input 2 ON
14	s10	Digital input 3 OFF	Digital input 3 ON
15	s11	Digital input 4 OFF (*520*) Error	Digital input 4 ON (*520*) No error

Table 3-5. Batch Function Status Data Format

3.3 Discrete Command Descriptions

NOTE: *For all commands that require a scale number, a value of 0 indicates the current scale. Unless otherwise specified, the indicator returns weight and status data for the specified scale.*

Return Status and Current Weight

Command: 0, 0x00

Parameter: Scale number

Command 0 returns the status and weight of the specified scale in integer format, without changing the display.

Display Channel

Command: 1, 0x01

Parameter: Scale number

Command 1 causes the weight of the specified scale to be displayed and returned in its current mode and format. This command is valid for the *920i* only.

Display Gross Weight

Command: 2, 0x02

Parameter: Scale number

Command 2 causes the gross weight of the specified scale to be displayed and returned.

Display Net Weight

Command: 3, 0x03

Parameter: Scale number

Command 3 causes the net weight of the specified scale to be displayed and returned.

Display Piece Count

Command: 4, 0x04

Parameter: Scale number

Command 4 causes the piece count on the specified scale to be displayed and returned. This command is valid only for the *520* indicator, and only if count mode is enabled.

Gross/Net Key Press (toggle mode)

Command: 9, 0x09

Parameter: Scale number

Command 9 toggles between gross and net mode (and count mode, if enabled). If a scale number other than 0 is specified, the action may not be evident until the specified scale is displayed.

Zero

Command: 10, 0x0A

Parameter: 0 (current scale)

Command 10 performs a zero action on the current scale.

Display Tare

Command: 11, 0x0B

Parameter: Scale number

Command 11 causes the tare weight on the specified scale to be displayed. If a scale number other than 0 is specified, the indicator first causes the specified scale to be displayed. The tare data continues being returned even if the display times out and returns to another mode, until another command is issued.

Enter Tare (integer)

Command: 12, 0x0C

Parameter: Scale number

Value: Tare weight

Command 12 enters a tare for the scale selected. Tare data must be in integer format. The indicator continues to return weight data in the current mode for the specified scale. This command is not valid if block transfer is enabled.

Acquire Tare (simulate tare key press)

Command: 13, 0x0D

Parameter: Scale number

Command 13 acquires a tare based on the weight currently on the specified scale. The indicator continues to return weight data in the current mode for the specified scale.

Clear Tare

Command: 14, 0x0E

Parameter: Scale number

Command 14 clears the tare for the specified scale. The indicator continues to return weight data in the current mode for the specified scale.

Primary Units

Command: 16, 0x10

Parameter: Scale number

Command 16 switches the current format of the specified scale to the primary units configured for that scale.

Secondary Units

Command: 17, 0x11

Parameter: Scale number

Command 17 switches the current format of the specified scale to the secondary units configured for that scale.

Tertiary Units

Command: 18, 0x12

Parameter: Scale number

Command 18 switches the current format of the specified scale to the tertiary units configured for that scale. This command is valid for the *920i* only.

Units Key Press (toggle units)

Command: 19, 0x13

Parameter: Scale number

Command 19 toggles the current format of the specified scale to the next units configured for that scale, as available.

Print Request

Command: 20, 0x14

Parameter: Scale number

Command 20 causes the indicator to execute a print request using the current scale.

Display Accumulator

Command: 21, 0x15

Parameter: Scale number

Command 21 causes the value of the accumulator for the specified scale to be displayed and returned. This command is only valid if the accumulator for the specified scale is enabled.

Clear Accumulator

Command: 22, 0x16

Parameter: Scale number

Command 22 clears the value of the accumulator for the specified scale. This command is only valid if the accumulator for the specified scale is enabled.

Push Weight to Accumulator

Command: 23, 0x17

Parameter: Scale number

Command 23 adds the net weight on the specified scale to the value of the accumulator for the specified scale. The scale must return to net zero between accumulations. The indicator returns the accumulated weight data for the specified scale. This command is only valid if the accumulator for the specified scale is enabled.

Return Gross as Integer

Command: 32, 0x20

Parameter: Scale number

Command 32 returns the gross weight value for the specified scale as an integer.

Return Net as Integer

Command: 33, 0x21

Parameter: Scale number

Command 33 returns the net weight value for the specified scale as an integer.

Return Tare as Integer

Command: 34, 0x22

Parameter: Scale number

Command 34 returns the tare weight value for the specified scale as an integer.

Return Piece Count

Command: 35, 0x23

Parameter: Scale number

Command 35 returns the piece count value for the specified scale. This command is valid only for the *520* indicator, and only if count mode is enabled.

Return Current Display as Integer

Command: 37, 0x25

Parameter: Scale number

Command 37 returns the weight value for the specified scale as currently displayed. This may include gross, net, tare, piece count, or accumulator values, as enabled. On the *920i*, the weight value is returned in the mode used to display a scale widget.

Return Accumulator as Integer

Command: 38, 0x26

Parameter: Scale number

Command 38 returns the accumulator value for the specified scale. This command is only valid if the accumulator for the specified scale is enabled.

Return Rate of Change as Integer

Command: 39, 0x27

Parameter: Scale number

Command 39 returns the current rate of change value for the specified scale. This command is valid only for the *920i*.

Return Peak as Integer

Command: 40, 0x28

Parameter: Scale number

Command 40 returns the net peak value for the specified scale. This command is valid only for the *520* indicator, and only if the peak hold function is enabled.

Set Batching State

Command: 95, 0x5F

Parameter: State (0 = off; 1 = auto; 2 = manual)

Command 95 sets the batching (BATCHNG) parameter. Indicator status is returned with the current weight for the last scale specified.

Batch Start

Command: 96, 0x60

Parameter: Scale number

Command 96 starts a batch program from the current step after a stop, pause or reset. Batch status is returned with the current weight for the specified scale.

Batch Pause

Command: 97, 0x61

Parameter: Scale number

Command 97 pauses a batch program at the current step. Batch status is returned with the current weight for the specified scale.

Batch Reset

Command: 98, 0x62

Parameter: Scale number

Command 98 stops a batch program and resets it to the first batch step. Batch status is returned with the current weight for the specified scale.

Batch Status

Command: 99, 0x63

Parameter: Scale number

Command 99 returns the status of a batch. Batch status is returned with the current weight for the specified scale.

Lock Front Panel of Indicator

Command: 112, 0x70

Parameter: Scale number

Command 112 disables all the keys on the front panel of the indicator. Indicator status is returned with the current weight for the specified scale.

Unlock Front Panel of Indicator

Command: 113, 0x71

Parameter: Scale number

Command 113 re-enables all the keys on the front panel of the indicator. Indicator status is returned with the current weight for the specified scale.

Set Digital Output ON

Command: 114, 0x72

Parameter: Slot number

Value: Bit number

Command 114 sets the specified digital output ON (active). Use slot number 0 for onboard digital outputs. Indicator status is returned with the current weight for the last scale specified. This command is not valid if block transfer is enabled.

Set Digital Output OFF

Command: 115, 0x73

Parameter: Slot number

Value: Bit number

Command 115 sets the specified digital output OFF (inactive). Use slot number 0 for onboard digital outputs. Indicator status is returned with the current weight for the last scale specified. This command is not valid if block transfer is enabled.

Read Digital I/O

Command: 116, 0x74

Parameter: Slot Number and Shift (1 = low; 2 = high)

Command 116 returns the status of all digital I/O (digital inputs only, for the *520*) for the slot specified in word 0.

Because word 0 only contains 16 bits, a shift is used to slide a "window" over the slot data to be returned. The high nibble of the parameter contains 1 to look at the low 16 bits of the slot (bits 1–16) or 2 to return the high 16 bits (bits 9–24). Use slot number 0 for onboard digital inputs. Indicator status is returned in the status area for the last scale specified.

No Operation

Command: 253, 0xFD

Parameter: Scale number

Command 253 provides a command to use between operations, as necessary, without causing the indicator to perform any action. Indicator status and weight data for the specified scale is still returned.

Reset Indicator

Command: 254, 0xFE

Parameter: None

Command 254 provides a command to remotely reset the indicator. No data is returned.

4.0 Block Transfer Commands

The Remote I/O Interface supports block transfer commands for the *520* and *920i* indicators. These commands allow the PLC controller to exchange larger blocks of data with the indicator, such as 32-bit floating-point values and partial setpoint configuration.

NOTE: Weight data returned by block transfer commands is not valid when the indicator is in setup mode.

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
Decimal	Hex			
268	0x10C	Set Tare Value	4	4
288	0x120	Read Gross Weight	2	4
289	0x121	Read Net Weight	2	4
290	0x122	Read Tare Weight	2	4
291	0x123	Read Piece Count	2	4
293	0x125	Read Current Display	2	4
294	0x126	Read Accumulator	2	4
295	0x127	Read Rate of Change	2	4
296	0x128	Read Peak Value	2	4
302	0x12E	Read Gross, Tare, Net	2	8
303	0x12F	Read Multiple Weights	4	4–62
304	0x130	Set Setpoint Value	4	2
305	0x131	Set Setpoint Hysteresis	4	2
306	0x132	Set Setpoint Bandwidth	4	2
307	0x133	Set Setpoint Preact	4	2
319	0x13F	Set Single Setpoint, All Values	10	2
320	0x140	Read Setpoint Value	2	4
321	0x141	Read Setpoint Hysteresis	2	4
322	0x142	Read Setpoint Bandwidth	2	4
323	0x143	Read Setpoint Preact	2	4
335	0x14F	Read Single Setpoint, All Values	2	10
336	0x150	Set Multiple Setpoint Values	4–62	2
337	0x151	Read Multiple Setpoint Values	2	4–62
NOTE: Command lengths expressed as number of words. Number of words required for variable length commands depends on number of setpoints or scales specified.				

Table 4-1. Block Transfer Commands

4.1 Block Write Command Format

The format for sending a block write command includes a minimum of two words. The first word always contains the command to be executed by the indicator. The second word contains one or more parameters necessary to execute the command, such as a scale number or setpoint number. If a command requires additional values, this data follows, generally as one or more 4-byte, single-precision floating-point numbers. Below is a general outline and example for setting up a data file for a block write command.

Word	Description	Sample Data	Description
0	Command number (hex)	0x010C	Set Tare command
1	Parameter data (hex)	0x0000	Current scale
2	Value, MSW	125.0	Tare value
3	Value, LSW		

Table 4-2. Block Write Command Format Example

4.2 Block Read Command Format

Block read commands have a similar format. The first word echoes the command number. If the command fails or is not recognized, the negative of the command number is returned to signal the error. The second word contains a status of the indicator for the scale selected, or a batch status for setpoint commands. Data being returned to the PLC follows, as required by the command, generally as one or more 4-byte, single-precision floating-point numbers. Below is a general outline and example for setting up a data file for a block read command.

Word	Description	Sample Data	Description
0	Command numbe	0x0151	Read Multiple Setpoints command
1	Status data	0x0B02	Batch status
2	First value, MSW	150.0	Setpoint 1 value
3	First value, LSW		
4	Second value, MSW	225.0	Setpoint 2 value
5	Second value, LSW		

Table 4-3. Block Read Command Format Example

Status Data

Block command status bit definitions are shown in Table 4-4. Setpoint commands return the setpoint number in the low byte, batch status in the high byte of the status word (see Table 4-5).

Word 1 Bit	Status Bit	Indicator Status Data	
		Value=0	Value=1
00	s00	Positive weight	Negative weight
01	s01	Reserved	
02	s02		
03	s03	Scale number *(NOTE: Value 0 represents scale #32)*	
04	s04		
05	s05		
06	s06		
07	s07		
08	s08	Gross	Net
09	s09	No tare	Tare acquired
10	s10	Primary units	Secondary/ other units
11	s11	Standstill	In motion
12	s12	Weight invalid / Over-range	Weight OK
13	s13	Not zero	Center of zero
14	s14	Tare not entered	Tare entered
15	s15	Error	No error

Table 4-4. Block Command Status Data Format

Word 1 Bit	Status Bit	Batch Function Status Data	
		Value=0	Value=1
00	s00	Setpoint number	
01	s01		
02	s02		
03	s03		
04	s04		
05	s05		
06	s06		
07	s07		
08	s08	Alarm OFF	Alarm ON
09	s09	Batch not stopped	Batch stopped
10	s10	Batch not running	Batch running
11	s11	Batch not paused	Batch paused
12	s12	Digital input 1 OFF	Digital input 1 ON
13	s13	Digital input 2 OFF	Digital input 2 ON
14	s14	Digital input 3 OFF	Digital input 3 ON
15	s15	Digital input 4 OFF (*520*) Error	Digital input 4 ON (*520*) No error

Table 4-5. Batch Function Status Data Format

4.3 Block Transfer Command Descriptions

NOTE: *For all commands that require a scale number, a value of 0 indicates the current scale. Unless otherwise specified, the indicator returns weight and status data for the specified scale.*

Set Tare Value

Command: 268, 0x10C
Block Write: 4 words
Parameter: Scale number
Value: Tare weight
Block Read: 4 words
Return Status: Selected scale
Return Value: Tare weight

Command 268 enters a tare for the scale selected in floating-point format. The indicator returns the tare weight as taken, or 0 for no tare.

Read Gross Weight

Command: 288, 0x120
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Gross weight

Command 288 returns the gross weight value for the specified scale in floating-point format.

Read Net Weight

Command: 289, 0x121
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Net weight

Command 289 returns the net weight value for the specified scale in floating-point format.

Read Tare Weight

Command: 290, 0x122
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Tare weight

Command 290 returns the tare weight value for the specified scale in floating-point format.

Read Piece Count

Command: 291, 0x123
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Count value

Command 291 returns the piece count value for the specified scale in floating-point format. This command is only valid for the *520*, and only if count mode is enabled.

Read Current Display

Command: 293, 0x125
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Currently displayed weight

Command 293 returns the weight value for the specified scale as currently displayed in floating-point format. This may include gross, net, tare, piece count, or accumulator values, as enabled. On the *920i*, the weight value is returned in the mode used to display a scale widget.

Read Accumulator

Command: 294, 0x126
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Accumulator value

Command 294 returns the accumulator value for the specified scale in floating-point format. This command is only valid if the accumulator for the specified scale is enabled.

Read Rate of Change

Command: 295, 0x127
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Rate of change value

Command 295 returns the current rate of change value for the specified scale in floating-point format. This command is only valid for the *920i*.

Read Peak Value

Command: 296, 0x128
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 4 words
Return Status: Selected scale
Return Value: Net peak weight

Command 296 returns the net peak value for the specified scale in floating-point format. This command is only valid for the *520*, and only if the peak hold function is enabled.

Read Gross, Tare, Net

Command: 302, 0x12E
Block Write: 2 words
Parameter: Scale number
Value: None
Block Read: 8 words
Return Status: Selected scale
Return Value: Gross, tare, and net weights

Command 302 returns the gross, tare, and net weights on a single command. The structure of the command is as follows:

Word 0:	Command number
Word 1:	Scale number
Words 2–3:	Gross weight
Words 4–5:	Tare weight
Words 6–7:	Net weight

Read Multiple Weights

Command: 303, 0x12F
Block Write: 4 words
Parameter: Weight type
Value: Bit-map of scales
Block Read: Variable, 4 words minimum
Return Status: Composite
Return Value: Weight for each scale requested

Command 303 returns the weights for up to 30 scales in floating-point format. The weights are returned in the mode specified by the parameter weight type, 0 for gross or 1 for net. Words 2 and 3 contain a bit map of the scales for which a weight should be returned; the least significant bit represents scale 1. Each 2-word value represents the weight for the next scale requested, if valid, beginning with scale 1. If a scale is not valid (scale does not exist), the bit is ignored. Status data returned is a composite of the scales requested, according to the following rules:

- Indicator status: If a bit is set for any of the scales requested, it is set in the composite.
- Scale number: The total number of scales in the composite is returned.

This command is valid only for the *920i*.

Set Setpoint Value

Command: 304, 0x130
Block Write: 4 words
Parameter: Setpoint number
Value: Target Value
Block Read: 2 words
Return Status: Batch
Return Value: None

Command 304 sets the target value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a target value.

Set Setpoint Hysteresis

Command: 305, 0x131
Block Write: 4 words
Parameter: Setpoint number
Value: Hysteresis value
Block Read: 2 words
Return Status: Batch
Return Value: None

Command 305 sets the hysteresis value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a hysteresis value.

Set Setpoint Bandwidth

Command: 306, 0x132
Block Write: 4 words
Parameter: Setpoint number
Value: Bandwidth value
Block Read: 2 words
Return Status: Batch
Return Value: None

Command 306 sets the bandwidth value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a bandwidth value.

Set Setpoint Preact

Command: 307, 0x133
Block Write: 4 words
Parameter: Setpoint number
Value: Preact Value
Block Read: 2 words
Return Status: Batch
Return Value: None

Command 307 sets the preact value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a preact value.

Set Single Setpoint, All Values

Command: 319, 0x13F
Block Write: 10 words
Parameter: Setpoint number
Value: Values as required
Block Read: 2 words
Return Status: Batch
Return Value: None

Command 319 sets the target, hysteresis/bandwidth and preact values for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a target value.

The structure of the block write command is as follows:

Word 0:	Command number
Word 1:	Setpoint number
Word 2:	Setpoint kind
Word 3:	*Reserved/not used*
Words 4–5:	Target value
Words 6–7:	Hysteresis or band value
Words 8–9:	Preact value

The value sent in words 6 and 7 is interpreted as hysteresis or band value based on the TRIP setting of the setpoint. If the setpoint requires neither a hysteresis nor a band value, this value is ignored and only the target value is set. The preact value is ignored if preact is not enabled for the setpoint.

Table 4-6 lists the values specified for the setpoint kind in word 2.

Value (Hex)	Setpoint Kind	Supported for Indicator	
		520	*920i*
0000	OFF	√	√
0001	GROSS	√	√
0002	NET	√	√
0003	–GROSS (Negative gross)	√	√
0004	–NET (Negative net)	√	√
0005	ACCUM (Accumulator)		√
0006	ROC (Rate of change)		√
0007	+REL (Postive relative)	√	√
0008	–REL (Negative relative)	√	√
0009	%REL (Percent relative)	√	√
000A	RESREL (Result relative)		√
000B	PAUSE	√	√
000C	DELAY	√	√
000D	WAITSS (Wait for standstill)	√	√
000E	COUNTER	√	√

Table 4-6. Setpoint Kind Values

Value (Hex)	Setpoint Kind	Supported for Indicator	
		520	*920i*
000F	AUTOJOG	√	√
0010	COZ (Center of zero)	√	√
0011	INMOTON (In motion)	√	√
0012	INRANGE (In range)	√	√
0013	BATCHPR (Batch process)	√	√
0014	TIMER	√	√
0015	CONCUR	√	√
0016	DIGIN (Digital input)		√
0017	AVG (Average)		√
0018	TOD (Time of day)		√
0019	DELTA (Delta weight)		√
001A	CHKWEI (Checkweigher)		√
001B	PLSCNT (Pulse counter)		√
001C	PLSRAT (Pulse rate)		√
001D	ALWAYS		√
001E	NEVER		√

Table 4-6. Setpoint Kind Values (Continued)

Read Setpoint Value

Command: 320, 0x140
Block Write: 2 words
Parameter: Setpoint number
Value: None
Block Read: 4 words
Return Status: Batch
Return Value: Target value

Command 320 returns the target value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a target value.

Read Setpoint Hysteresis

Command: 321, 0x141
Block Write: 2 words
Parameter: Setpoint number
Value: None
Block Read: 4 words
Return Status: Batch
Return Value: Hysteresis value

Command 321 returns the hysteresis value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a hysteresis value.

Read Setpoint Bandwidth

Command: 322, 0x142
Block Write: 2 words
Parameter: Setpoint number
Value: None
Block Read: 4 words
Return Status: Batch
Return Value: Bandwidth value

Command 322 returns the bandwidth value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a bandwidth value.

Read Setpoint Preact

Command: 323, 0x143
Block Write: 2 words
Parameter: Setpoint number
Value: None
Block Read: 4 words
Return Status: Batch
Return Value: Preact value

Command 323 returns the preact value for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a preact value.

Read Single Setpoint, All Values

Command: 335, 0x14F
Block Write: 2 words
Parameter: Setpoint number
Value: None
Block Read: 10 words
Return Status: Batch
Return Value: Values as available

Command 335 returns the target, hysteresis/bandwidth and preact values for the specified setpoint in floating-point format. This command is only valid if the setpoint is enabled and requires a target value.

The structure of the block read command is as follows:

Word 0:	Command number
Word 1:	Setpoint number
Word 2:	Setpoint kind
Word 3:	*Reserved/not used*
Words 4–5:	Target value
Words 6–7:	Hysteresis or band value
Words 8–9:	Preact value

The value returned in words 6 and 7 is either the hysteresis or band value, based on the TRIP setting of the setpoint. If the setpoint requires neither a hysteresis nor a band value, this value is set to 0. The preact value returned is set to 0 if preact is not enabled for the setpoint.

See Table 4-6 on page 17 for a list of the setpoint kind values returned in word 2.

Set Multiple Setpoint Values

Command: 336, 0x150
Block Write: Variable, 4 words minimum
Parameter: Setpoint range
Value: Values as required
Block Read: 2 words
Return Status: Batch
Return Value: None

Command 336 sets the target values for the specified range of setpoints in floating-point format. The first value sent is the target value for the setpoint number specified in the low byte of the parameter. The last value sent is the target value for the setpoint number specified in the high byte of the parameter. If a target value is not required for any setpoint, the value should be set to 0.0, but is actually ignored by the indicator. Up to 30 setpoints can be set at one time. The return status includes the setpoint number of the last setpoint set.

Read Multiple Setpoint Values

Command: 337, 0x151
Block Write: 2 words
Parameter: Setpoint range
Value: None
Block Read: Variable, 4 words minimum
Return Status: Batch
Return Value: Values as available

Command 337 returns the target values for the specified range of setpoints in floating-point format. The first value returned is the target value for the setpoint number specified in the low byte of the parameter. The last value returned is the target value for the setpoint number specified in the high byte of the parameter. If a target value is not required for any setpoint, the value returned is 0.0. Up to 30 setpoints can be requested at one time. The return status includes the setpoint number of the last setpoint read.

5.0 Operation

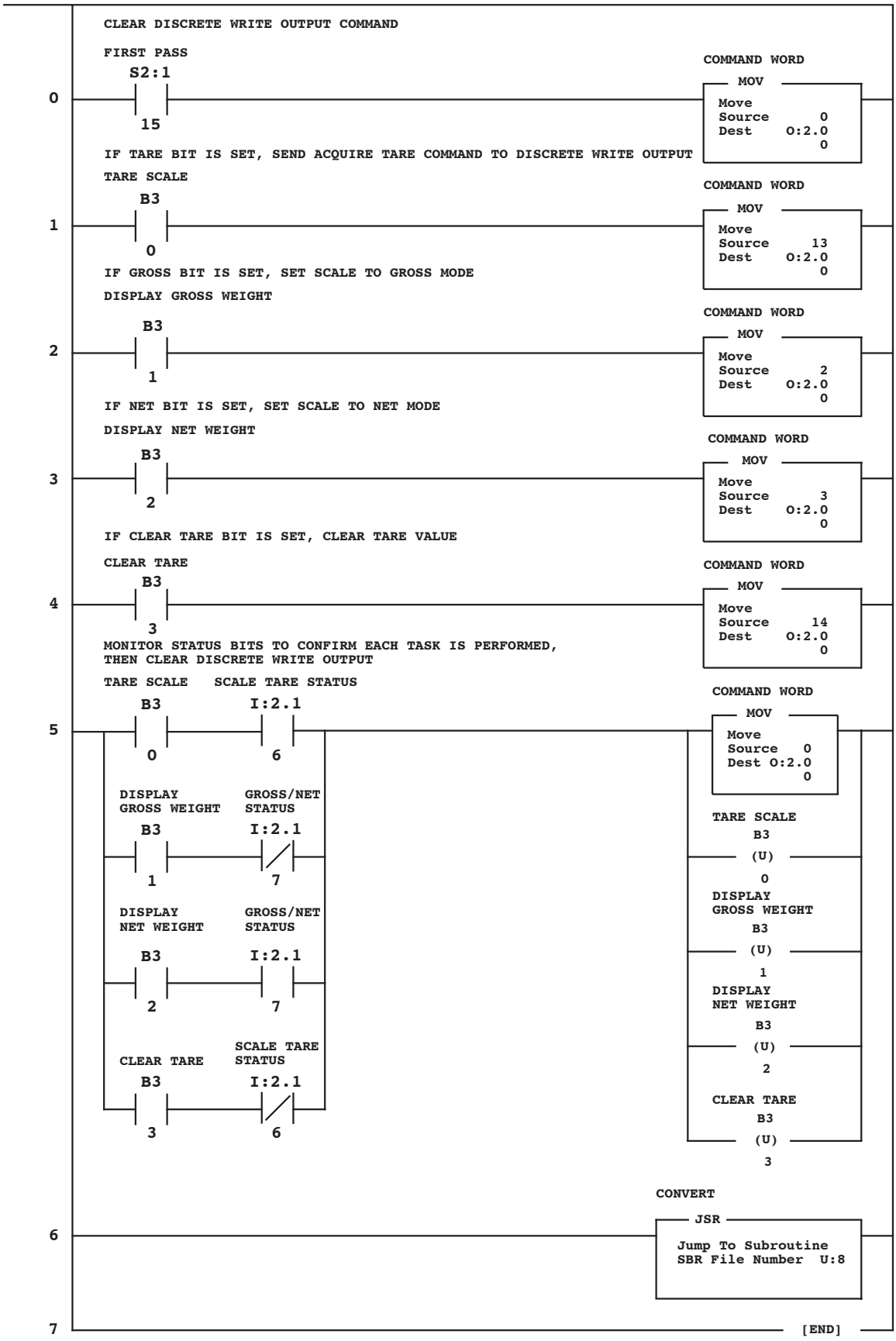
The examples on the following pages provide PLC programming examples for using the Remote I/O Interface.

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.

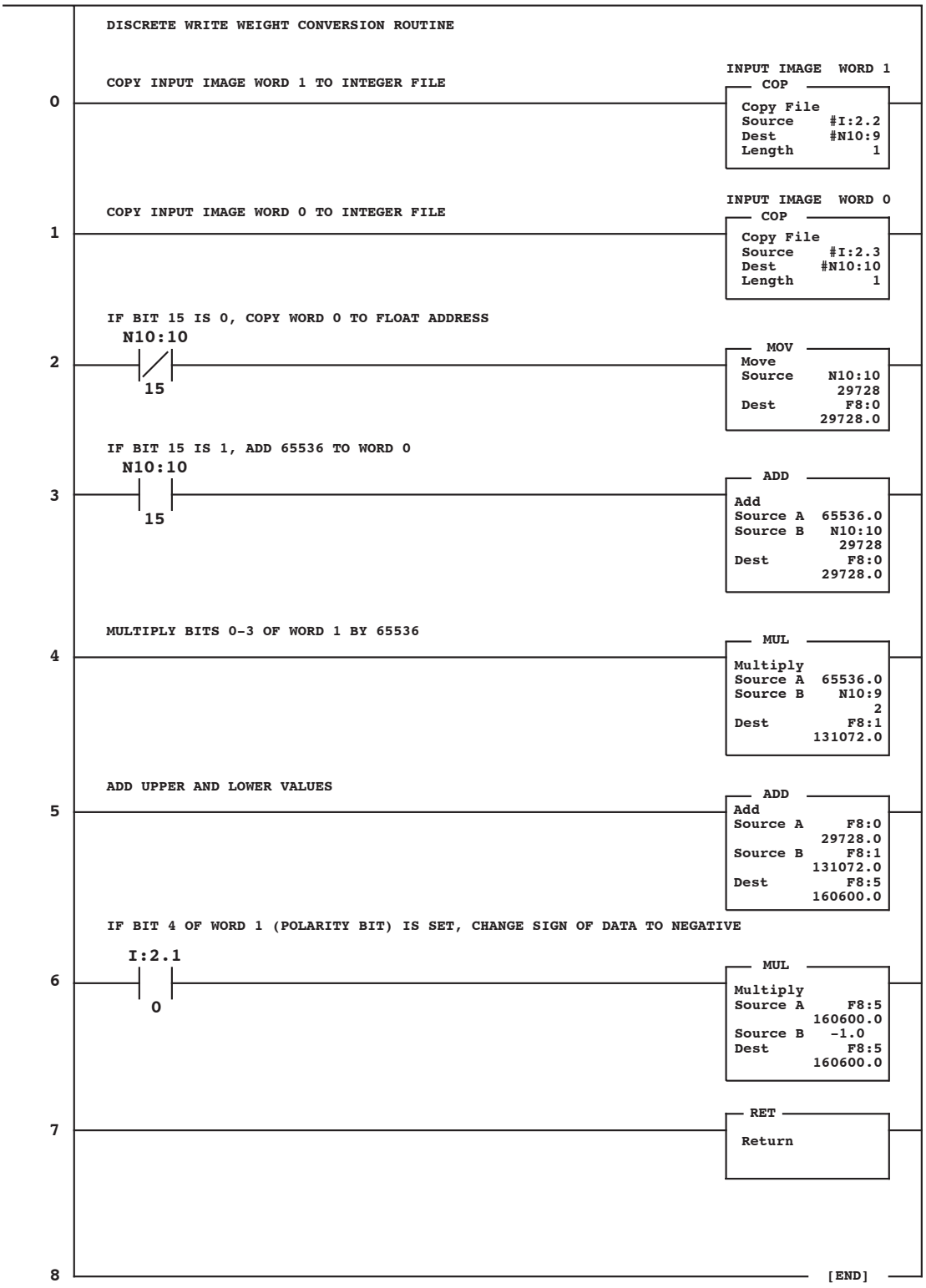
NOTES:

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
COMMAND WORD
MOV
Move
Source 0
Dest O:2.0
0
0
IF TARE BIT IS SET, SEND ACQUIRE TARE COMMAND TO DISCRETE WRITE OUTPUT
TARE SCALE
B3
0
1
COMMAND WORD
MOV
Move
Source 13
Dest O:2.0
0
IF GROSS BIT IS SET, SET SCALE TO GROSS MODE
DISPLAY GROSS WEIGHT
B3
1
2
COMMAND WORD
MOV
Move
Source 2
Dest O:2.0
0
IF NET BIT IS SET, SET SCALE TO NET MODE
DISPLAY NET WEIGHT
B3
2
3
COMMAND WORD
MOV
Move
Source 3
Dest O:2.0
0
IF CLEAR TARE BIT IS SET, CLEAR TARE VALUE
CLEAR TARE
B3
3
4
COMMAND WORD
MOV
Move
Source 14
Dest O:2.0
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
6
5
COMMAND WORD
MOV
Move
Source 0
Dest O:2.0
0
DISPLAY GROSS WEIGHT
B3
1
GROSS/NET STATUS
I:2.1
7
TARE SCALE
B3
(U)
0
DISPLAY NET WEIGHT
B3
2
GROSS/NET STATUS
I:2.1
7
DISPLAY GROSS WEIGHT
B3
(U)
1
CLEAR TARE
B3
3
SCALE TARE STATUS
I:2.1
6
DISPLAY NET WEIGHT
B3
(U)
2
CLEAR TARE
B3
(U)
3
CONVERT
JSR
Jump To Subroutine
SBR File Number U:8
6
7
[END]

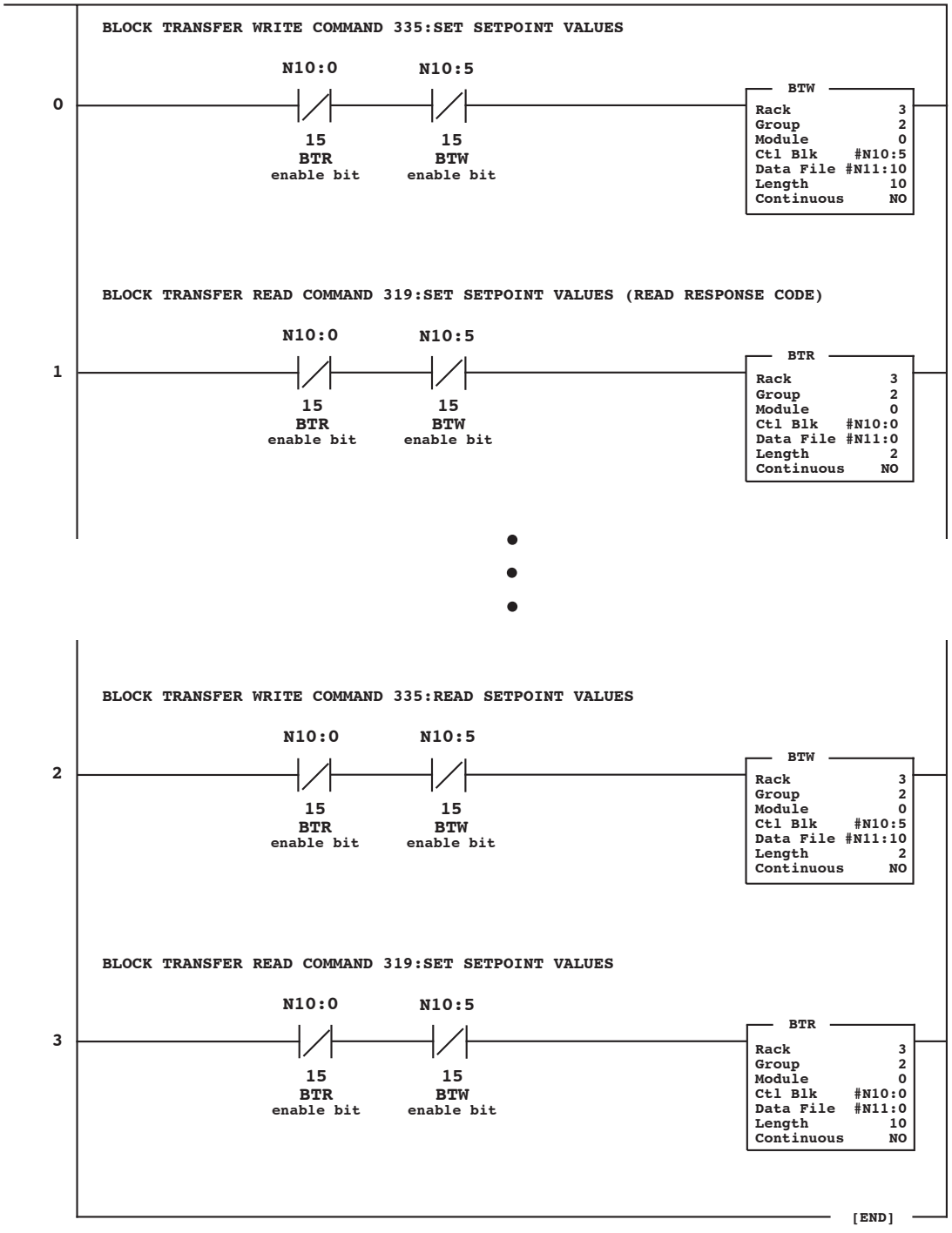
5.2 PLC Program for Converting 20-bit Values to Floating Integers

The following programming example converts a 32-bit value in the input image table to a floating integer value stored at location F8:5.

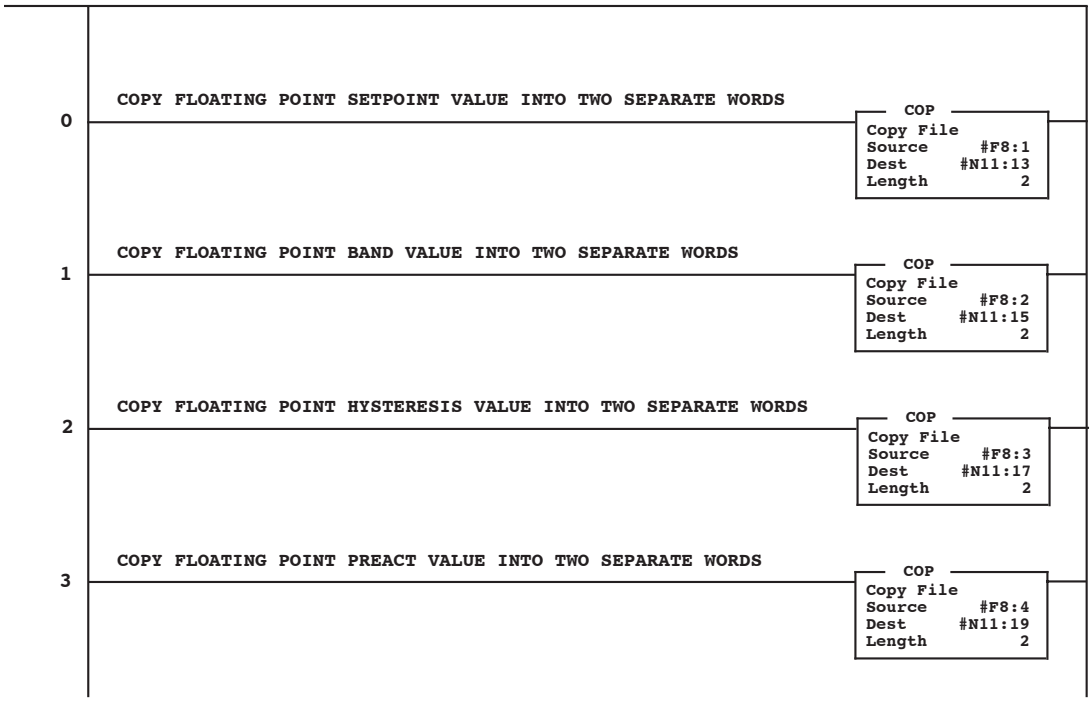


5.3 Using Block Transfer to Set and Read Setpoint Values

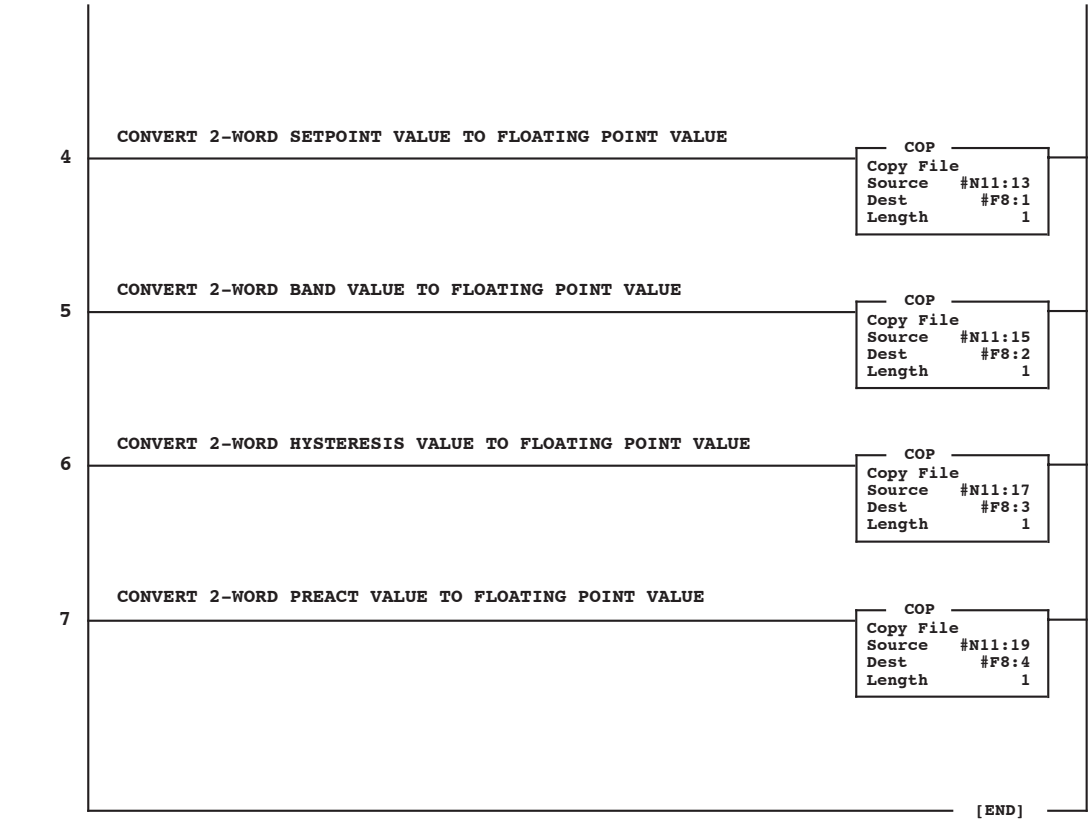
The following program example uses block transfer commands to write setpoint values to the *520* or *920i* indicator (block write/block read command 335), then read the values for the setpoint (block write/block read command 319). See Sections Section 4.0 on page 12 for more information about the Set and Read Setpoint Value 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.



(SET SETPOINT VALUES, READ SETPOINT VALUES BLOCK TRANSFER COMMANDS)



6.0 Remote I/O Interface Card Specifications

Power Requirements

Option Card, DC Power:

Supply voltage: 6 VDC, supplied by *520*/*920i* bus
Typical current draw: 137 mA
Power consumption: 126 mW

Indicators, Typical AC Load:

520	Power (TRMS):	2 W
	Current (TRMS):	65 mA
920i	Power (TRMS):	1.1 W
	Current (TRMS):	15 mA

Communications Specifications

Allen-Bradley Remote I/O Network Communications:

Twinaxial cable attachment to networks at 57.6, 115.2, or 230.4 Kbps

Update rate is dependent on the configured baud rate and the number of network nodes. Maximum update rates are:

520: up to 120 updates/sec
920i: up to 960 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.

THESE WARRANTIES EXCLUDE ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NEITHER RLWS NOR DISTRIBUTOR WILL, IN ANY EVENT, BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

RLWS AND BUYER AGREE THAT RLWS'S SOLE AND EXCLUSIVE LIABILITY HEREUNDER IS LIMITED TO REPAIR OR REPLACEMENT OF SUCH GOODS. IN ACCEPTING THIS WARRANTY, THE BUYER WAIVES ANY AND ALL OTHER CLAIMS TO WARRANTY.

SHOULD THE SELLER BE OTHER THAN RLWS, THE BUYER AGREES TO LOOK ONLY TO THE SELLER FOR WARRANTY CLAIMS.

NO TERMS, CONDITIONS, UNDERSTANDING, OR AGREEMENTS PURPORTING TO MODIFY THE TERMS OF THIS WARRANTY SHALL HAVE ANY LEGAL EFFECT UNLESS MADE IN WRITING AND SIGNED BY A CORPORATE OFFICER OF RLWS AND THE BUYER.

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