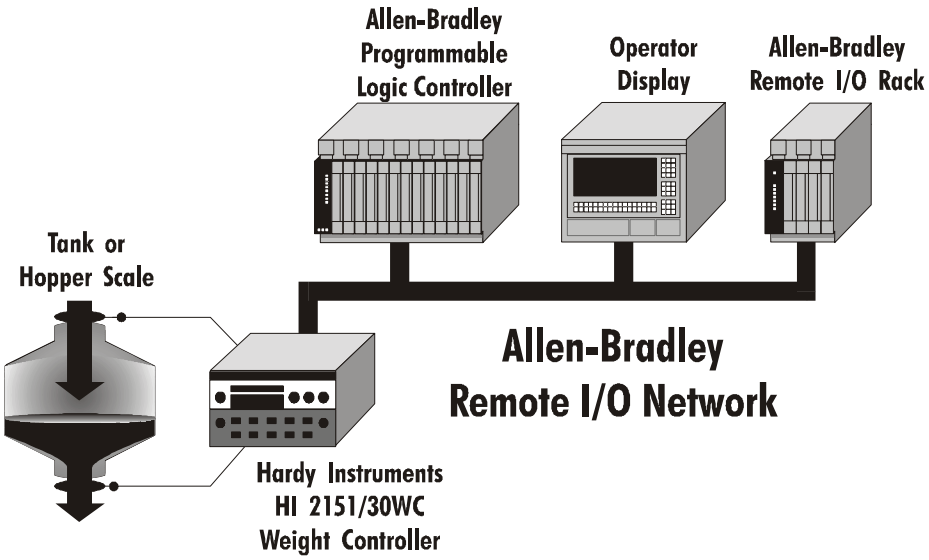
HI 2151 SERIES WEIGHT CONTROLLERS
REMOTE I/O OPTION

OPERATION AND INSTALLATION MANUAL



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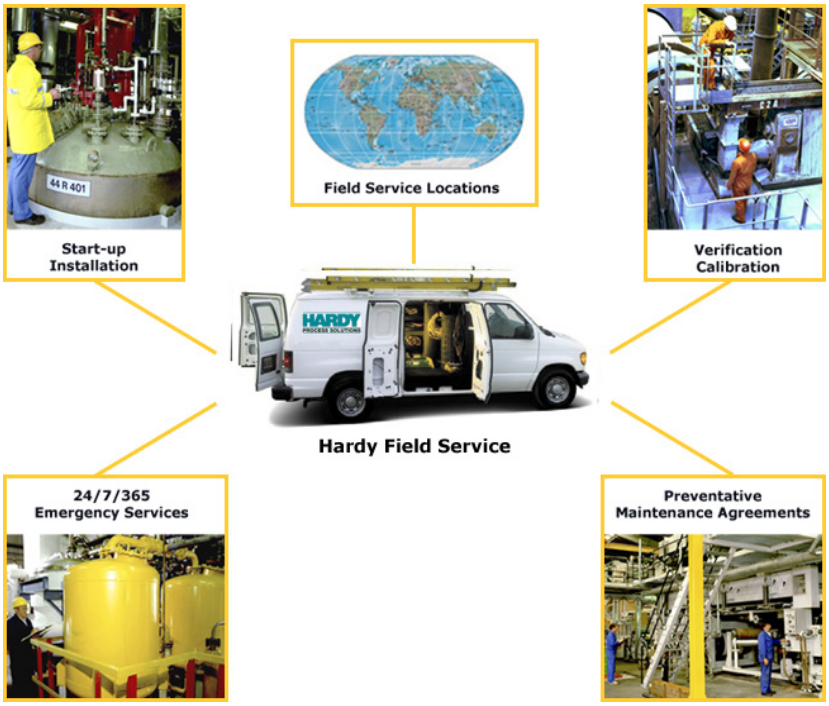

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CHAPTER 1 - OVERVIEW

Allen-Bradley License

Under license from The Allen-Bradley Corporation, Hardy Process Solutions Inc. has developed a Remote I/O Interface for the HI 2151 Weight Controller. The HI 2151WC is a general purpose industrial and process weighing instrument for use in a wide variety of applications including filling, dispensing, batching, and monitoring rate of flow by weight. The instrument includes numerous features and technologies including up to eight setpoint relays, 1,000,000 counts of resolution, Secure Memory Module for backup of critical calibration data, and WAVERSAVER®, the ability to ignore plant and process mechanical noise to quickly arrive at stable weight readings.

Hardy Process Solutions worked with substantial customer input and Allen-Bradley to identify that the remote I/O communications network best matched the needs of system integrators and end users for industrial and process applications. The interface is fast, field proven, requires minimal wiring, requires no special software drivers, and is standard on many Allen-Bradley programmable controllers. Setting each address and baud rate in the instrument, connecting three wires, and writing some ladder logic is all that is needed to begin communicating weighing parameters to and from an HI 2151WC controller.

Each Hardy HI 2151WC represents a quarter (1/4) rack of discrete I/O (32 bits in the PLC Output and Input image files) to the scanning PLC and supports both discrete and block transfers. The PLC continually exchanges 32 bits of its PLC Input Image Table and 32 bits of its Output Image Table with each 1/4 rack device. In a 1771 I/O Rack, these bits would normally be transferred from and to discrete input and output modules. For the weight controller, the Output Image bits are used to send commands to the weight controller and the Input Image bits return weight data and scale status bits. These actions are referred to as “discrete writes and “discrete reads”. The user is also able to exchange blocks of data with a 1/4 rack device via Block Transfer instructions in the PLC ladder logic program. These commands are referred to as “block writes” and “block reads”.

The host programmable controller can access all configuration and weighing parameters in the HI 2151WC, including performing scale calibration. The HI 2151WC can be used as a local display and keyboard for weighing parameters, or function as a blind controller properly digitizing the load cell signal and providing responsive setpoint control.

Using the Remote I/O interface shortens development time and provides the most functional weighing interface available for your Allen-Bradley programmable controller. Before starting system design, you

should also read the Installation and Operation manual of the HI 2151WCs.

Information contained in this manual is subject to change. Always check the latest version of this manual at our web site (http://www.hardysolutions.com) before beginning system design. This product incorporates technology which is licensed by Allen-Bradley Company Inc. Allen-Bradley does not technically approve, warrant or support this product. All warranty and support for this product is provided by Hardy Process Solutions Inc. PLC®, PLC-2®, PLC-3®, PLC-5®, SLC500® Series are registered trademarks of the Allen-Bradley Company, Inc.

Common Applications

The HI 2151WC series can be used in conjunction with Allen-Bradley programmable controllers to tackle a variety of process control needs. The most basic use of the interface is to simply allow the programmable controller to read weight data from one or more HI 2151WC series weight controllers. In addition to reading weight some other applications are:

- Filling
- Dispensing
- Batch Weighing Control
- Monitoring Rate of Flow
- Evaluating Totalized Weight
- Check Weighing
- Weight Level Alarming

NOTE: *There are two standard and six optional setpoint relays which provide control of ingredient weighments and weight level alarming.*

Monitoring Weighing Parameters

The HI 2151WC series weight controllers are capable of calculating five types of weight data, including the standard Gross and Net weights. In addition to the standard Gross and Net weights there are three options such as Peak Force, Totalized Weight (block transfer only), and Rate-of-Change or mass flow rate entering or leaving a vessel.

Short Glossary of Terms

1. Gross Weight - is used to describe the total weight of the container and the contents.
2. Net Weight - is the weight of the contents of the container only.
3. Tare Value - The action of adjusting out the known weight of the container from the total indicated weight, so that the indicator reads weight directly.
4. Dead Load - The weight of the vessel and other equipment which will be ignored during zero calibration.

Tare Value

Current Gross Weights becomes the Tare value by pushing the Tare Push Button on the front panel of the HI 2151WC, remote functions contact closure, discrete write or block transfer command by the PLC,

or can be entered as a numeric value via the keypad on the front panel of the HI 2151WC. This new tare value is the reference point for Net Weight.

TV = G - N

TV = Tare Value (weight)
G = Gross Weight
N = Net Weight

CHAPTER 2 - INSTALLATION

Remote I/O Board Cable Termination Dip Switch Configuration

About Cable Termination

Weight controllers are connected to a cable in daisy-chain fashion and are referred to as “nodes”. A Daisy Chain is a hardware configuration in which devices are connected one to another in a series. The end nodes on the daisy chain require termination resistors. The Remote I/O board provides the S1 Dip Switches which are used for cable termination based on the baud rate. (See Table 2-1) The S1 Dip Switches are only used on the last device in the daisy chain. For all other devices on the daisy chain both dip switches should be set to OFF. (See Fig. 2)

BAUD	TERMINATION	MAX NODES	MAX LENGTH	SWITCH 1	SWITCH 2
57.6 K	150 Ohms	16	10,000 Feet	ON	OFF
115.2 K	150 Ohms	16	5,000 Feet	ON	OFF
230.4 K	82 Ohms	32	2,500 Feet	OFF	ON

TABLE 2-1: CABLE TERMINATION REQUIREMENTS

NOTE: *Refer to your Allen-Bradley PLC-2, PLC-3, PLC-5 and SLC 500 manuals for the maximum number of nodes available.*

Setting the Cable Termination Dip Switches

Step 1. For all RIO board options (except for the last device) make sure the dip switches are set to the OFF position. (See Fig. 2-1)

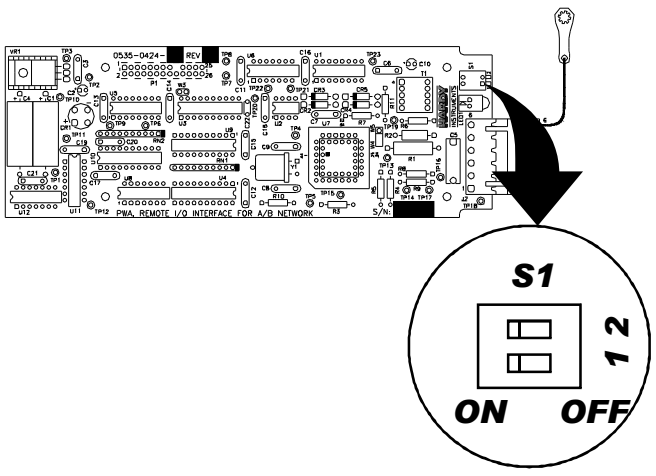


FIG. 2-1 REMOTE I/O S1 DIP SWITCH SETTINGS (DEFAULT)

NOTE: *The factory default setting is for both switches to be turned OFF. Also note that the dip switches in Figure 2-1 have been rotated for illustration purposes.*

Step 2. On the last RIO board in the daisy chain, select the desired switch settings in Table 2-1 for Baud Rate.

NOTE: *The cable lengths used in Table 2-1 are maximum lengths that can be used in the daisy chain.*

Installing the RIO Option Board

Step 1. With the 26 pins facing down, align the RIO Option Board over the connector on the A/D board. In either option slot.

Step 2. Gently slide the pins into the connector until it stops.

Step 3. Attach the board to the standoffs by installing the four screws to the standoffs.

Step 4. Connect the cable to the 6 pin connector on the RIO board. The 6 pin connector on the RIO option board is used for all Remote I/O connections. Pin definitions:

Pin 1	BLUE (1/2 of twisted pair)
Pin 2	SHIELD (outer braided shield)
Pin 3	Clear (1/2 of twisted pair)
Pin 6	Ground (Case)

CHAPTER 3 - SETUP

Remote I/O Setup

Bargraph LEDS Secondary Functions (HI 2151/ 20WC only)

While the RIO menu is displayed, the Bargraph LEDs have the following secondary functions.

A. The Zero Track LED displays the status of the "Green LED" on the RIO.

- On = Run
- Off = Off Line
- Flashing indicates either program mode or frequent retries.

B. The Motion LED indicates Self-Test. Self-Test is executed when the instrument powers up. The Motion LED flashes continuously if the Self-Test fails.

C. The Ctr Zero LED illuminates if communications fail. This failure can be caused by improper cabling, incorrect selection or improper use of termination resistors.

D. The Total LED is used for factory testing and illuminates when the status byte is set to 7.

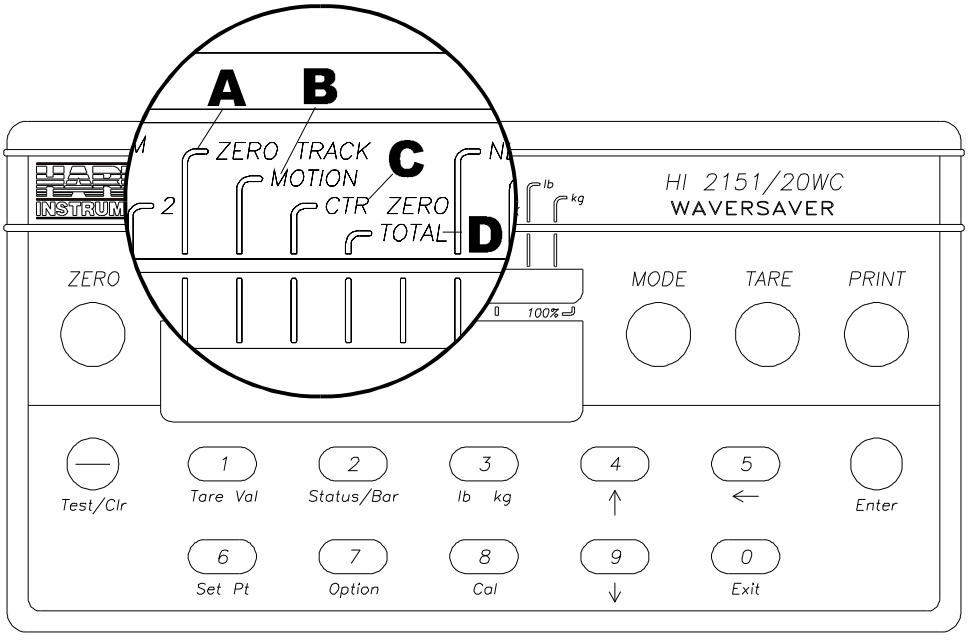


FIG. 3-1 FRONT PANEL/HI 2151/20WC

NOTE: *The bargraph LED Secondary functions above are for the HI 2151/20 only. The setup procedures in the remainder of this chapter are for both the HI 2151/20 and the HI 2151/30.*

Setup Procedures

Step 1. Enter the Option Menu by pressing the 7/Option button. (Display shows the first option available)
Step 2. Press the up arrow until RIO is displayed on the screen.
Step 3. Press the Enter button two times. (Display shows the currently selected Baud Rate value)
Step 4. Use the up or down arrow to select a baud rate 57600, 115200 or 230400. (Display shows the currently selected value)
Step 5. Press the Enter button two times.
Step 6. If a change is necessary, press the Test/Clr button.
Step 7. Use the numeric buttons and enter the PLC rack number. (Maximum 63)

NOTE: *The rack number is displayed in decimal on the weight controller, and octal in the PLC. You cannot use 0 for the PLC rack number.*

Step 8. Press the Enter button.
Step 9. Press the Enter button to see the quarter number. (Display shows the currently selected value)
Step 10. If a change is necessary, press the Test/Clr button.
Step 11. Use the numeric buttons and enter the PLC quarter number (maximum 3).

NOTE: *The quarter rack number in the PLC is displayed in decimal. Qtr 0 = PLC Group 0, Qtr 1 = PLC Group 2, Qtr 2 = PLC Group 4, Qtr 3 = PLC Group 6.*

Step 12. Press the Enter button.
Step 13. Press the Enter button to view last quarter status.
Step 14. Use the up or down arrow buttons to select Yes or No to indicate whether or not this is the last quarter of this rack currently in use.
Step 15. Press the Enter button.
Step 16. Press the Exit button.
Step 17. Press the Exit button.

NOTE: *If any data was changed a Reboot is required.*

Step 18. Now power-down the instrument and re-apply power to have new menu selections activated. In addition, you must perform a manual or auto configuration of the PLC.

Display Error Codes

These display error codes are in addition to those listed in the HI 2151WC manual.

ERR 33	Invalid quarter number entered. Select a value from 0 - 3.
ERR 34	Invalid rack number entered. Select a value from 1 - 63.
ERR 52	Too many serial ports are installed.

Blind Unit Operation Setup

About Blind Units

An HI 2151WC Weight Controller that cannot be programmed or configured from the front panel is a blind unit. In a blind unit, the Remote I/O parameters are configured using both the interior and exterior dip switches. (See Tables below)

NOTE: *You must power-down and power up the instrument to have new switch positions activated. You must also perform a manual or auto configuration of the PLC.*

Blind Unit Configuration

Step 1. Disconnect the power cord from the instrument.
Step 2. Set the Interior Dip Switches. (See Table 3-1)

INTERIOR DIP SWITCHES	
Switch Position - S2 which is located on the Power/Relay board	
1	n/u
2	n/u
3	n/u
4	n/u
5	last quarter in rack ON = Yes OFF = No
6	Blind Unit ON = Yes OFF = No
7	A1 (See Binary Baud Rate Table 3-1)
8	A0 (See Binary Baud Rate Table 3-2)

TABLE 3-1: INTERIOR DIP SWITCHES

BINARY BAUD RATE		
A1	A0	BAUD
0	0	57.6K
0	1	115.2K
1	0	230.4K

TABLE 3-2:

ON = 1
OFF = 0

NOTE: *Remember to select the appropriate jumper positions on the Remote I/O Option Board.*

Step 3. Set the Exterior Dip Switches. (See Table 3-3)

EXTERIOR DIP SWITCHES	
Switch Position - S3 which is located on the Rear Panel	
1	B5 (32)
2	B4 (16)
3	B3 (8)
4	B2 (4)
5	B1 (2)
6	B0 (1)
7	C1
8	C0

TABLE 3-3: EXTERIOR DIP SWITCHES

NOTE: *B0 through B5 represent a binary value for rack # from 1 to 63.*

BINARY QUARTER #		
C1	C0	Quarter #
0	0	0
0	1	1
1	0	2
1	1	3

TABLE 3-4: BINARY QUARTER NUMBER

ON = 1
OFF = 0

CHAPTER 4 - DISCRETE TRANSFERS

Discrete Writes

The PLC places two sixteen bit words in the Output Image Table which are read by the HI 2151WC weight controller. The second word defines which weight data the HI 2151WC should place in the Input Image Table for the PLC to read. The first word is reserved for future use. Programs should send all zeros for the first word to avoid conflict with future revisions of the command set.

Structure of the Two Words in the PLC Output Image Table

	bits: 15-12	bits: 11-8	bits: 7-4	bits: 3-0
First Word of the Quarter	reserved for future use	reserved for future use	reserved for future use	reserved for future use
Second Word of the Quarter	bit shift	weight parameter	1st status byte	2nd status byte

TABLE 4-1: DISCRETE WRITE - 2 WORDS (16 BITS EACH)

Bit Shift

A number from 0 to 4 specifies the number of bits to shift the 16 bit window from the right of the internal 20 bit value. This sixteen bit window is the weight value that will be placed in the PLC Input Image Table. See the section on resolution for additional information. Once the sixteen bit value is read by the PLC, it can be multiplied by the factor shown below to yield the actual weight value.

0 = No shift, the lowest 16 bits are transferred.
1 = Shift one digit, multiply by 2 to achieve actual weight value
2 = Shift two digits, multiply by 4 to achieve actual weight value
3 = Shift three digits, multiply by 8 to achieve actual weight value
4 = Shift four digits, multiply by 16 to achieve actual weight value

Weight Parameter

Select either Gross weight, Net weight, Rate-of-Change (mass flow), peak force (or peak weight), or Test weight to be placed in the PLC Input Image Table.

NOTE: *All weight parameters are in the units (lbs., kgs.) used during calibration.*

0 = Gross Weight (Standard)
1 = Net Weight (Standard)
2 = Rate-Of-Change (mass flow) (Optional)
3 = Peak weight or force (Optional)
4 = Test weight (an arbitrary incrementing value)

Status Byte

Select two of the status bytes below to be placed in the PLC Output Image Table. Definitions of the status bits contained in each status byte:

0 = Relay Status Byte
1 = Remote Function Status Byte
2 = Indicator Group 2 Status Byte
3 = Indicator Group 1 Status Byte
4 = Dipswitch Settings (exterior) Status Byte
5 = Dipswitch Settings (interior) Status Byte
6 = Acquire Tare (Set tare value = current gross weight)
7 = Lights test LED (see RIO Setup menu)
8 = MSB of 24 Bit Weight Value
    0-3 = 4 bits of weight data (16-19)
    4-7 = Sign Bits (20-23)
9 = Sync Pulse
    0-7 = This byte increments every 50 milliseconds

Example

Placing a 0000 (Hex) for the first word and a 0123 (Hex) for the second word in the PLC Output Image Table will cause the HI 2151WC to place the least significant sixteen bits of the internal 20 bit net weight value and Indicator Groups 1 and 2 Status Bytes in the PLC Input Image Table.

Discrete Reads

the HI 2151WC places the weight and status information, specified in the last discrete write command, in the PLC Input Image Table. The data is arranged as shown in Table 3-2.

bits:	**15-8**	**7-0**
First Word of the Quarter	MSB of weight parameter	LSB of weight parameter
Second Word of the Quarter	1st Status Byte	2nd Status Byte

TABLE 4-2: DISCRETE READ - 2 WORDS (16 BITS EACH)

NOTE: *Negative values are sent in "two's complement form".*

0 = Relay Status Byte

bit 0 Relay #8 status (on/off)
bit 1 Relay #7 status (on/off)
bit 2 Relay #6 status (on/off)
bit 3 Relay #5 status (on/off)
bit 4 Relay #4 status (on/off)
bit 5 Relay #3 status (on/off)
bit 6 Relay #1 status (on/off - Notice relays 1 and 2 are not in numerical sequence)
bit 7 Relay #2 status (on/off - Notice relays 1 and 2 are not in numerical sequence)

1 = Remote Function Status Byte	bit 0	Force display to Rate-of-Change mode
	bit 1	Add current net weight to total
	bit 2	Hold value on display
	bit 3	Hold option card updates
	bit 4	Force display to Net Weight mode
	bit 5	Toggle lbs/kg
	bit 6	Acquire Tare
	bit 7	Print Request (RS232 and BCD ports)
2 = Indicator Group 2 Status Byte	bit 0	Weight currently displayed in pounds units
	bit 1	Zero Track feature enabled
	bit 2	Reserved for future use
	bit 3	Current Gross Weight = 0
	bit 4	Weight in motion, i.e. changing
	bit 5	Gross Weight currently displayed
	bit 6	Net Weight currently displayed
	bit 7	Weight currently displayed in kilogram units
3 = Indicator Group 1 Status Byte	bit 0	Rate-of-Change currently displayed
	bit 1	Setpoint Relay #2 active
	bit 2	Setpoint Relay #1 active
	bit 3	Peak Force (weight) currently displayed
	bit 4	Totalized weight currently displayed
	bit 5	Reserved
	bit 6	Excitation Monitor Error
	bit 7	Reserved
4 = Dipswitch Settings (exterior) Status Byte	bit 0	RE-calibrate toggle
	bit 1	Option menu keypad lockout
	bit 2	Setpoint menu keypad lockout
	bit 3	Lb/Kg, Net/Gr, Tare, Zero keypad lockout
	bit 4	Zero tracking enable
	bit 5	Reserved for future use
	bit 6	RS232 command lockout
	bit 7	Multi-Drop enable

NOTE: *If Blind Mode dip switches status not visible.*

NOTE: *The PLC will receive both words with each discrete read, but it is not guaranteed that both words will be transferred as a unit. Both words will get transferred, but there may be some delay between the two.*

NOTE: *For the PLC-2®* series, you must use a 1772-SD2 scanner and the *PLC-2®* system to allow communication with the HI 2151WC via block transfer. Use block transfers only.

NOTE: *For the SLC 5/02® or above processors, you must use a 1747-SN to allow communication with the HI 2151WC via discrete transfer. The 1747-SN does not support block transfer.*

5 = Dipswitch Settings (interior) Status Byte	bit 0	Reserved for future use
	bit 1	Enables gross weight output on RS232 port once per second
	bit 2	Calibration lockout for NTEP (Legal for Trade) mode
	bit 3	Ignore incoming serial checksums (RS232 port)
	bit 4	Peak force is result of averaged gross weight
	bit 5	NTEP (Legal for Trade) mode enable
	bit 6	Eliminate ">" on print out (RS232 port)
	bit 7	Designates instrument to be in "Blind" configuration
8 = MSB of 24 Bit Weight Value	bit 0	bit 16 of weight data
	bit 1	bit 17 of weight data
	bit 2	bit 18 of weight data
	bit 3	bit 19 of weight data
	bit 4	sign bit 20
	bit 5	sign bit 21
	bit 6	sign bit 22
	bit 7	sign bit 23
9 = Sync Pulse	0-7	This byte increments every 50 milliseconds (new data available)

Example of Screen Printout

ADDRESS	17			0	ADDRESS	17			0
I:000	0000	0000	0000	0000	I:020	0100	0010	0011	1001
I:001	0000	0000	0000	0000	I:021	0000	0110	0000	0110
I:002	0000	0000	0000	0000	I:022	0000	0000	0000	0000
I:003	0000	0000	0000	0000	I:023	0000	0000	0000	0000
I:004	0000	0000	0000	0000	I:024	0000	0000	0000	0000
I:005	0000	0000	0000	0000	I:025	0000	0000	0000	0000
I:006	0000	0000	0000	0000	I:026	0000	0000	0000	0000
I:007	0000	0000	0000	0000	I:027	0000	0000	0000	0000
I:010	0000	0000	0000	0000	I:030	0000	0000	0000	0000
I:011	0000	0000	0000	0000	I:031	0000	0000	0000	0000
I:012	0000	0000	0000	0000	I:032	0000	0000	0000	0000
I:013	0000	0000	0000	0000	I:033	0000	0000	0000	0000
I:014	0000	0000	0000	0000	I:034	0000	0000	0000	0000
I:015	0000	0000	0000	0000	I:035	0000	0000	0000	0000
I:016	0000	0000	0000	0000	I:036	0000	0000	0000	0000
I:017	0000	0000	0000	0000	I:037	0000	0000	0000	0000

CHANGE RADIX			SPECIFY ADDRESS		NEXT FILE	PREV FILE	FORCE MONITOR	
F1			F5	F8	F9			

NOTE: *The addresses begin with the letter I not the number I.*

CHAPTER 5 - BLOCK TRANSFERS

About Block Transfers

The ladder logic programmer is able to exchange blocks of data with a 1/4 rack device via Block Transfer instructions in the ladder logic program. A Write Block Transfer is used to send commands and data to the Weight Controller, and a Read Block Transfer is used to collect acknowledgments and data from the Weight Controller. It is recommended that those front panel functions to be controlled via the Remote I/O network be locked from front panel control. Consult the HI 2151WC manuals for more information.

To utilize 20 bit resolution, the Ladder Logic program must synchronize the use of Block Transfer data to insure block integrity. Synchronization is accomplished by not using block data between the time block transfer is enabled and done (EN and DN bits). Of course, data can be moved to another buffer where it can be accessed while the next block transfer is in progress. The structure of the four byte numeric format for all weight parameters except totalized weight is as follows:

BYTE 1	BYTE 0 upper 4 bits	Byte 0 lower 4 bits	BYTE 3	BYTE 2
Sign bits	Sign bits (all 1's or 0's)	Weight bits 19-16	Weight bits 15-8	Weight bits 7-0

TABLE 5-1: FOUR BYTE NUMERIC FORMAT FOR WEIGHT PARAMETERS

NOTE: *The most significant word is located before the least significant word in the block I/O transfer.*

NOTE: *Negative values are sent in "two's complement" form.*

NOTE: *The maximum block size is 51 words.*

NOTE: *Block writes cannot be performed while the instrument is in the calibration mode. The calibration must be sealed by pressing enter at Endcal.*

Totalized weight uses all 32 bits available in the two words to represent unsigned data. the block transfer commands and formats are listed in the following tables. The Block Read commands are followed by the Block Write commands. When writing information to the weight controller be sure to send zeros (0's) to all words and bits marked as "reserved for future use". This will aid in achieving upward compatibility to future enhancements to the command set. For additional information on the function of each parameter in the tables below, consult the HI 2151 Installation and Operation manuals.

Block Read Commands

All block read commands are initiated by the ladder logic program performing a block write to the weight controller with the desired block command number in the first byte position of the block. the PLC then performs a block read and the weight controller will return the desired

information with the read command number repeated in the first byte of the block returned. If a data error is detected, an error code "99" is in the first byte of the returned block.

NOTE: *All block reads are initiated by performing a block write.*

NOTE: *A returned value of "99" (decimal) indicates an error.*

Block Read Command Number 1: Full Status and Weight Data

BLOCK READ COMMAND NUMBER 1: Full status and weight data WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 1 (decimal) bit 0 1 bit 1 0 bit 2 0 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 Indicator Group 1 Status bit 8 Rate-of-Change currently displayed bit 9 Setpoint RElay #2 active bit 10 Setpoint Relay #1 active bit 11 Peak Force (weight) currently displayed bit 12 Totalized weight currently displayed bit 13 Reserved for future use bit 14 Reserved for future use bit 15 Reserved for future use	1	0
Indicator Group 2 Status bit 0 Weight currently displayed in pounds units bit 1 Zero Track feature enabled bit 2 Reserved for future use bit 3 Current gross weight = 0 bit 4 Weight in motion, i.e. changing bit 5 Gross weight currently displayed bit 6 Net weight currently displayed bit 7 Weight currently displayed in Kilogram units Dipswitch Settings (exterior) Status bit 8 Re-calibrate toggle bit 9 Option menu keypad lockout bit 10 Setpoint menu keypad lockout bit 11 Lb/Kg, Net/Gross, Tare, Zero keypad lockout bit 12 Zero tracking enable bit 13 Reserved for future use bit 14 RS232 command lockout bit 15 Multi-Drop enable (RS-422 only) *Note: When the HI 2151WC is configured as a blind unit, the status of the dipswitches are not visible. See section on blind operation for more information.*	1	1

TABLE 5-2: BLOCK READ COMMAND NUMBER 1: FULL STATUS AND WEIGHT DATA

BLOCK READ COMMAND NUMBER 1: Full status and weight data WORD DEFINITIONS:	#WORDS	START WORD
Dipswitch Settings (interior) Status bit 0 Reserved for future use bit 1 Enables gross weight output on RS232 port once per second bit 2 Calibration lockout for NTEP (Legal for Trade) mode bit 3 Ignore incoming serial checksums (RS232 port) bit 4 Peak force is result of averaged gross weight bit 5 NTEP (Legal for Trade) mode enable bit 6 Eliminate “>” on print out (RS232 port) bit 7 Reserved for blind unit toggle Remote Function Status bit 8 Force display to Rate-of-Change mode bit 9 Add current net weight to total bit 10 Hold value on display bit 11 Hold option card updates bit 12 Force display to Net weight mode bit 13 Toggle lbs/kg bit 14 Acquire Tare bit 15 Print request (RS232 and BCD ports) *Note: When the HI 2151WC is configured as a blind unit, the status of the dipswitches are not visible. See section on blind operation for more information.*	1	2
Rate-of-Change Peak force of weight Total weight in accumulator Gross Weight Net Weight Tare Value *Note: All weight data is in the units (lbs., kgs.) which were used at the time of calibration.*	2 2 2 2 2 2	3 5 7 9 11 13
TOTAL NUMBER OF WORDS	15	

TABLE 5-2: BLOCK READ COMMAND NUMBER 1: FULL STATUS AND WEIGHT DATA

Block Read Command Number 2: Setpoint Relay Parameter

BLOCK READ COMMAND NUMBER 2: Setpoint Relay Parameters WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 2 (decimal) bit 0 0 bit 1 1 bit 2 0 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 Indicator Group 2 Status bit 8 Weight currently displayed in pounds units bit 9 Zero Track feature enabled bit 10 Reserved for future use bit 11 Current gross weight = 0 bit 12 Weight in motion, i.e. changing bit 13 Gross weight currently displayed bit 14 Net weight currently displayed bit 15 Weight currently displayed in kilogram units Note: A returned value of “99” (decimal) indicates an error.	1	0
Relay Status bit 0 Relay #8 status (on/off) bit 1 Relay #7 status (on/off) bit 2 Relay #6 status (on/off) bit 3 Relay #5 status (on/off) bit 4 Relay #4 status (on/off) bit 5 Relay #3 status (on/off) bit 6 Relay #1 status (on/off) bit 7 Relay #2 status (on/off) bit 8 - 15 Setpoint description byte A (See Table 5-4 & 5-5)	1	1
bits 0-7 Setpoint description byte B (See Table 5-4 & 5-5) bits 8-15 Setpoint description byte C (See Table 5-4 & 5-5)	1	2
Deadband value for setpoint #1	2	3
Deadband value for setpoint #2	2	5
Deadband value for setpoint #3	2	7
Deadband value for setpoint #4	2	9
Deadband value for setpoint #5	2	11
Deadband value for setpoint #6	2	13
Deadband value for setpoint #7	2	15
Deadband value for setpoint #8	2	17
Preact value for setpoint #1	2	19
Preact value for setpoint #2	2	21
Preact value for setpoint #3	2	23
Preact value for setpoint #4	2	25
Preact value for setpoint #5	2	27
Preact value for setpoint #6	2	29
Preact value for setpoint #7	2	31
Preact value for setpoint #8	2	33

BLOCK READ COMMAND NUMBER 2: Setpoint Relay Parameters WORD DEFINITIONS:	#WORDS	START WORD
Setpoint value for setpoint #1	2	35
Setpoint value for setpoint #2	2	37
Setpoint value for setpoint #3	2	39
Setpoint value for setpoint #4	2	41
Setpoint value for setpoint #5	2	43
Setpoint value for setpoint #6	2	45
Setpoint value for setpoint #7	2	47
Setpoint value for setpoint #8	2	49
TOTAL NUMBER OF WORDS	51	

TABLE 5-3: BLOCK READ COMMAND NUMBER 2: SETPOINT RELAY PARAMETERS

	Peak Force	Net Weight	Gross Weight	Rate-of-Change	Totalizer
Word 1, bits 8 - 15	0	0	0	0	1
Word 2, bits 0 - 7	0	0	1	1	0
Word 2, bits 8 - 15	0	1	0	1	0

TABLE 5-4: SETPOINT DESCRIPTION BYTES

The three setpoint description bytes are constructed by first reading the table above to determine the 1 and 0 pattern representing the weighing parameter you would like the setpoint to monitor, then writing that pattern below under the appropriate relay number. When patterns have been written for all desired relays then read bytes A, B, and C across from left to right.

SETPOINT DESCRIPTION BYTES								
	Relay 8	Relay 7	Relay 6	Relay 5	Relay 4	Relay 3	Relay 2	Relay 1
Word 1, bits 8-15								
Word 2, bits 0-7								
Word 2, bits 8-15								

TABLE 5-5: SETPOIINT DESCRIPTION BYTES

Example of Proper Setpoint Description Bytes

The proper setpoint description bytes for the following desired Relay types are as follows:

Relay 1 = Gross
Relay 2 = Net
Relay 3 = Rate-of-Change
Relay 4 = Peak
Relay 5 = Totalizer
Relay 6 = Gross
Relay 7 = Gross
Relay 8 = Gross

Word 1, bits 8 - 15 = 0001 0000 = 10 (hex)
Word 2, bits 0 - 7 = 1110 0101 = E5 (hex)
Word 2, bits 8 - 15 = 0000 0110 = 06 (hex)

Block Read Command Number 3: Instrument Identification and Diagnostics

BLOCK READ COMMAND NUMBER 3: Instrument Identification and Diagnostics WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 3 (decimal) bit 0 1 bit 1 1 bit 2 0 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 Instrument type by model number bit 8 A value of 1, if set for the HI 2151 bit 9-15 Reserved for future use	1	0
Firmware revision level: (ASCII format, i.e. 65 = A)	1	1
Zero calibration analog to digital converter raw counts:	2	2
Span calibration analog to digital converter raw counts:	2	4
TOTAL NUMBER OF WORDS	6	

TABLE 5-6: BLOCK READ COMMAND NUMBER 3: INSTRUMENT IDENTIFICATION AND DIAGNOSTICS

Block Read Command Number 4: Read Tare Value

BLOCK READ COMMAND NUMBER 4: Read Tare Value WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 4 (decimal) bit 0 0 bit 1 0 bit 2 1 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Tare Value	2	1
TOTAL NUMBER OF WORDS	3	

TABLE 5-7: BLOCK READ COMMAND NUMBER 4: READ TARE VALUE

Block Read Command Number 5: Calibration Parameters

BLOCK READ COMMAND NUMBER 5:Calibration Parameters WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 5 (decimal) bit 0 1 bit 1 0 bit 2 1 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Units of Measure bits 0 - 7 A value of 0 for pounds, or 1 for kilograms Decimal point position (places to the right of the decimal) bits 8 - 15 A value from 0 to 5	1	1
Totalizer decimal point position (places to the right of the decimal) bis 0 - 7 A value from 0 to 5 C2™, Second Generation Calibration bits 8 - 15 Load Cell Count	1	2
Display Graduation size (‘count by): A value of 1,2,5,10,20,50,100,200, or 500	1	3

BLOCK READ COMMAND NUMBER 5:Calibration Parameters WORD DEFINITIONS:	#WORDS	START WORD
Motion Tolerance: A sixteen bit value representing the low 16 bits of the 20 bit internal weighing range	1	4
Zero Tolerance: A sixteen bit value representing the low 16 bits of the 20 bit internal weighing range	1	5
Number of readings averaged: A value from 1 to 200 Note: Number of averages will temporarily read 200 if the instrument was in the CAL menu while this block read occurred.	1	6
Span weight value or C2®, Second Generation reference point value“	2	7
Scale Capacity (Full limit of scale): A 20 bit number in proper integer format	2	9
Mid-point Linearity Calibration Value: A 20 bit number in proper integer format	2	11
TOTAL NUMBER OF WORDS	13	

TABLE 5-8: BLOCK READ COMMAND NUMBER 5: CALIBRATION PARAMETERS

Block Read Command Number 6: Configuration of Rate-of-Change

BLOCK READ COMMAND NUMBER 6: Configuration of Rate-of-Change WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 6 (decimal) bit 0 0 bit 1 1 bit 2 1 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Displayed Rate-of-Change time units: A value of 0 to 2 (0=sec, 1=min, 2=hr)	1	1
Rate-of-Change timebase evaluation period in seconds 0 = 1 second 4 = 5 seconds 8 = 15 seconds 12 = 240 seconds 1 = 2 seconds 5 = 6 seconds 9 = 30 seconds 13 = 450 seconds 2 = 3 seconds 6 = 10 seconds 10 = 60 seconds 14 = 900 seconds 3 = 4 seconds 7 = 12 seconds 11 = 120 seconds 15 = 1800 seconds	1	2
TOTAL NUMBER OF WORDS	3	

TABLE 5-9: BLOCK READ COMMAND NUMBER 6: CONFIGURATION OF RATE-OF-CHANGE

Block Read Command Number 7: BCD Output Configuration

BLOCK READ COMMAND NUMBER 7: BCD Output Configuration WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 7 (decimal) bit 0 1 bit 1 1 bit 2 1 bit 3 0 bit 4 0 bit 5 0 bit 6 0 bit 7 0 Format of output bit 8 If set, will update BCD output when “print” button or remote function is activated bit 9 Reserved for future use bit 10 If set, will output weight data currently displayed bit 11 If set, will output tare value bit 12 If set, will output net weight bit 13 If set, will output gross weight bit 14-15 Reserved for future use	1	0
Reserved for future use	1	1
TOTAL NUMBER OF WORDS	2	

TABLE 5-10: BLOCK READ COMMAND NUMBER 7: BCD OUTPUT CONFIGURATION

Block Read Command Number 8: Configuration of Analog Output

BLOCK READ COMMAND NUMBER 8: Configuration of Analog Output WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 8 (decimal) bit 0 0 bit 1 0 bit 2 0 bit 3 1 bit 4 0 bit 5 0 bit 6 0 bit 7 0 Weight parameter to be transmitted bits 8 - 15 A value from 0 to 4 (0 = Gross, 1 = Net, 2 = Rate-of-Change, 3 = Peak Force, 4 = Totalize amount)	1	0

BLOCK READ COMMAND NUMBER 8: Configuration of Analog Output WORD DEFINITIONS:	#WORDS	START WORD
Weight value represented by a zero scale analog output:	2	1
Weight value represented by a full scale analog output:	2	3
TOTAL NUMBER OF WORDS	5	

TABLE 5-11: BLOCK READ COMMAND NUMBER 8: CONFIGURATION OF ANALOG OUTPUT

Block Read Command Number 9: Configuration of Standard RS232 Port (HI 2151/20WC Only)

HI 2151/20WC Only.

BLOCK READ COMMAND NUMBER 9: Configuration of Standard RS232 Port WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 9 (decimal) bit 0 1 bit 1 0 bit 2 0 bit 3 1 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Format of Communication: bit 0 Print initiation (If configured as printer. 1 = print button 0 = continuous. If configured as bi-directional: 0 = print button, 1 = altered print). bit 1 Setpoint, Deadbands, and Preact values transmitted bit 2 Rate-of-Change transmitted bit 3 Tare weight transmitted bit 4 Net weight transmitted bit 5 Gross weight transmitted bit 6 Reserved for future use bit 7 Reserved for future use bits 8 - 15 Reserved for future use	1	1
Port Configuration bits 0 - 7 A value of 0 or 1 [0=Bi-Directional, 1 = Printer (output) only] Baud Rate bits 8 - 15 A value of 0 to 5 (0 = 600, 1 = 1200, 2 = 2400, 3 = 4800, 4 = 9600, 5 = 19200)	1	2
Parity bits 0 - 7 A value of 0 to 2 (0=None, 1 = 1 = Even, 2 = Odd)* Stop Bits bits 8 - 15 A value of 0 or 1 (0=one stop bit, 1 = two stop bits)* *Note: Parameters are not used in the HI 2151/30WC	1	3

BLOCK READ COMMAND NUMBER 9: Configuration of Standard RS232 Port WORD DEFINITIONS:	#WORDS	START WORD
Word Length bits 0 - 7 A value of 0 or 1 [0 = seven bits, 1 = eight bits* Handshake Control bits 8 - 15 A value of 0 or 1 (0 = Hardware, 1 = Software *Note: Parameters are not used in the HI 2151/30WC	1	4
Echo bits 0 - 7 A value of 0 or 1 (0= Off, 1 = On) Device Address bits 8 - 15 A value from 0 to 99	1	5
TOTAL NUMBER OF WORDS	6	

TABLE 5-12: BLOCK READ COMMAND NUMBER 9: CONFIGURATION OF STANDARD RS232 PORT

Block Read Command Number 10: Sticker Value

HI 2151/20WC Only.

NOTE: *Sticker Value is not used in the HI 2151/30WC*

BLOCK READ COMMAND NUMBER 10: Sticker Value (HI 2151/20SC Only) WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 10 (decimal) bit 0 0 bit 1 1 bit 2 0 bit 3 1 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Sticker Value A 20 bit number in proper integer format	2	1
TOTAL NUMBER OF WORDS	3	

TABLE 5-13: BLOCK READ COMMAND NUMBER 10: STICKER VALUE

Block Read Command Number 11: Auto Zero Tolerance

BLOCK READ COMMAND NUMBER 11: Auto Zero Tolerance WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 11 (decimal) bit 0 1 bit 1 1 bit 2 0 bit 3 1 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Auto Zero Tolerance A 16 bit number in proper integer format	1	1
TOTAL NUMBER OF WORDS	2	

TABLE 5-14: BLOCK READ COMMAND NUMBER 11: AUTO ZERO TOLERANCE

Block Read Command Number 12: Integrated Technician

HI 2151/30WC Only.

NOTE: *Integrated Technician is not used with the HI 2151/20WC*

BLOCK READ COMMAND NUMBER 12: Integrated Technician WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 12 (decimal) bit 0 0 bit 1 0 bit 2 1 bit 3 1 bit 4 0 bit 5 0 bit 6 0 bit 7 0 bit 8 Reserved for future use	1	0
Excitation Monitor On/Off bits 0 - 7 A value of 0 or 1 (0 = Off, 1 = On) OK/ERR bits 8 - 15 A value of 0 or 1 (o = OK, 1 = ERR)	1	1
TOTAL NUMBER OF WORDS	2	

TABLE 5-15: BLOCK READ COMMAND NUMBER 12: INTEGRATED TECHNICIAN

Block Transfer Read Example

This routine is set up to be used with the HI 2151WC series weight controllers. It is a Block Transfer Read (BTR) sub-routine, currently configured to do a BTR 2 of the relay setpoint data. The block length is the only value which needs to be changed to use other block transfer read types. This routine will continually read the HI 2151WC as long as it is running.

N21:0 will have a 2, to request a block transfer read #2.

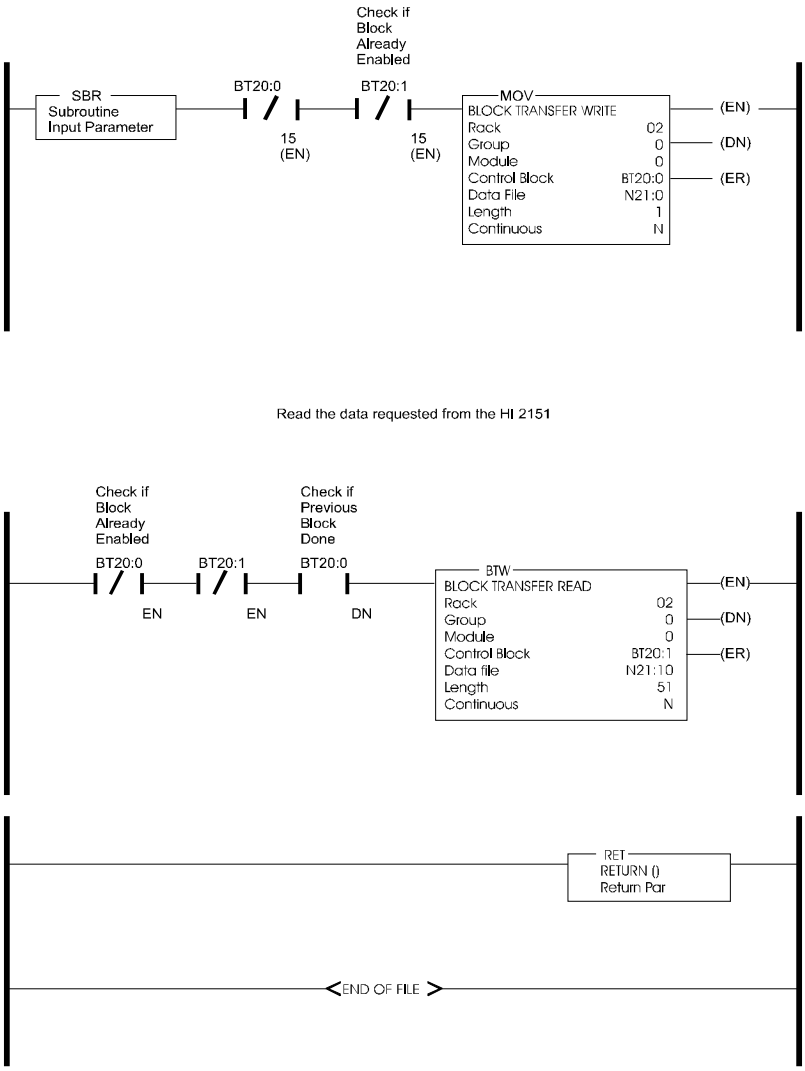


FIG. 5-1 BLOCK TRANSFER READ EXAMPLE

Block Write Commands

About Block Write Commands

After the PLC performs a block transfer write, a block read should be performed to evaluate the response code from the HI 2151 to verify that the data was received and implemented. The response word will either show a successful processing of the block or will indicate the first error encountered in processing of the data.

NOTE: *Setpoints, deadbands and preacts can all accept negative values. To enter negative values, use the "twos complement" method.*

NOTE: *Block Writes cannot be performed while the instrument is in calibration mode. The calibration must be sealed by pressing enter at Endcal.*

Block Write Command Number 51: Activate Scale Functions

BLOCK WRITE COMMAND NUMBER 51: Activate Scale Functions WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 51 (decimal) bit 0 1 bit 1 1 bit 2 0 bit 3 0 bit 4 1 bit 5 1 bit 6 0 bit 7 0 Remote Functions Byte bit 8 Acquire TARE (Set tare value = current gross weight)* bit 9 Initiates print on standard RS232 or optional BCD port* bit 10 Add current Net weight to Total*! bit 11 Clear Peak Hold register*! bit 12 Clear Totalizer Accumulation*! bit 13 Zero the instrument* bit 14 Enable Zero Tracking (Blind Unit Only) bit 15 Reserved for future use *Note: The bit must be toggled to activate this function !Note: Only active if the instrument is ordered with this option	1	0
TOTAL NUMBER OF WORDS	1	

TABLE 5-16: BLOCK WRITE COMMAND NUMBER 51: ACTIVATE SCALE FUNCTIONS

Block Write Command Number 52: Downloading Setpoint Relay Parameters

BLOCK WRITE COMMAND NUMBER 52:Downloading Setpoint Relay Parameters WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 52 (decimal) bit 0 0 bit 1 0 bit 2 1 bit 3 0 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use Setpoint Enable: bit 8 Enable Relay #8 to evaluate weight bit 9 Enable Relay #7 to evaluate weight bit 10 Enable Relay #6 to evaluate weight bit 11 Enable Relay #5 to evaluate weight bit 12 Enable Relay #4 to evaluate weight bit 13 Enable Relay #3 to evaluate weight bit 14 Enable Relay #1 to evaluate weight* bit 15 Enable Relay #2 to evaluate weight* *Note: Notice relays 1 and 2 are not in numerical sequence	1	0
Force Relay Status* bit 0 Turn relay #8 on regardless of weight (setpoint enable bit must be 0) bit 1 Turn relay #7 on regardless of weight (setpoint enable bit must be 0) bit 2 Turn relay #6 on regardless of weight (setpoint enable bit must be 0) bit 3 Turn relay #5 on regardless of weight (setpoint enable bit must be 0) bit 4 Turn relay #4 on regardless of weight (setpoint enable bit must be 0) bit 5 Turn relay #3 on regardless of weight (setpoint enable bit must be 0) bit 6 Turn relay #1 on regardless of weight (setpoint enable bit must be 0) bit 7 Turn relay #2 on regardless of weight (setpoint enable bit must be 0) *Note: Force relay on/off is only available over this interface. If you desire to manually set a relay to trigger on a weight parameter, make sure force relay bit is set to 0.	1	1
bits 8 - 15 Setpoint description byte A (See Table 5-18 & 5-19)		
bits 0 - 7 Setpoint description byte B (See Table 5-18 & 5-19)	1	2
bits 8 - 15 Setpoint description byte C (See Table 5-18 & 5-19)		
Deadband value for setpoint #1	2	3
Deadband value for setpoint #2	2	5
Deadband value for setpoint #3	2	7
Deadband value for setpoint #4	2	9
Deadband value for setpoint #5	2	11
Deadband value for setpoint #6	2	13
Deadband value for setpoint #7	2	15
Deadband value for setpoint #8	2	17

BLOCK WRITE COMMAND NUMBER 52:Downloading Setpoint Relay Parameters WORD DEFINITIONS:	#WORDS	START WORD
Preact value for setpoint #1	2	19
Preact value for setpoint #2	2	21
Preact value for setpoint #3	2	23
Preact value for setpoint #4	2	25
Preact value for setpoint #5	2	27
Preact value for setpoint #6	2	29
Preact value for setpoint #7	2	31
Preact value for setpoint #8	2	33
Setpoint value for setpoint #1	2	35
Setpoint value for setpoint #2	2	37
Setpoint value for setpoint #3	2	39
Setpoint value for setpoint #4	2	41
Setpoint value for setpoint #5	2	43
Setpoint value for setpoint #6	2	45
Setpoint value for setpoint #7	2	47
Setpoint value for setpoint #8	2	49
TOTAL NUMBER OF WORDS	51	

TABLE 5-17: BLOCK WRITE COMMAND NUMBER 52: DOWNLOADING SETPOINT RELAY PARAMETERS

NOTE: *Deadband must be numerically larger than preact.*

	Peak Force	Net Weight	Gross Weight	Rate-of-Change	Totalizer
Word 1, bits 8 - 15	0	0	0	0	1
Word 2, bits 0 - 7	0	0	1	1	0
Word 2, bits 8 - 15	0	1	0	1	0

TABLE 5-18: SETPOINT DESCRIPTION BYTES

The three setpoint description bytes are constructed by first reading the table above to determine the 1 and 0 pattern representing the weighing parameter you would like the setpoint to monitor, then writing that pattern below under the appropriate relay number. When patterns have been written for all desired relays then read bytes A, B, and C across from left to right.

SETPOINT DESCRIPTION BYTES								
	Relay 8	Relay 7	Relay 6	Relay 5	Relay 4	Relay 3	Relay 2	Relay 1
Word 1, bits 8-15								
Word 2, bits 0-7								
Word 2, bits 8-15								

TABLE 5-19: SETPOIINT DESCRIPTION BYTES

Example of Proper Setpoint Description Bytes

The proper setpoint description bytes for the following desired Relay types are as follows:

Relay 1 = Gross Word 1, bits 8 - 15 = 0001 0000 = 10 (hex)

Relay 2 = Net	Word 2, bits 0 - 7 = 1110 0101 = E5 (hex)
Relay 3 = Rate-of-Change	Word 2, bits 8 - 15 = 0000 0110 = 06 (hex)
Relay 4 = Peak	
Relay 5 = Totalizer	
Relay 6 = Gross	
Relay 7 = Gross	
Relay 8 = Gross	

Block Write Command Number 53: Send Tare Value

BLOCK WRITE COMMAND NUMBER 53:Send Tare Value WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 53 (decimal) bit 0 1 bit 1 0 bit 2 1 bit 3 0 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bit 8 -15 Reserved for future use	1	0
Tare Value	2	1
TOTAL NUMBER OF WORDS	3	

TABLE 5-20: BLOCK WRITE COMMAND NUMBER 53: SEND TARE VALUE

Block Write Command Number 54: Scale Calibration Action

BLOCK WRITE COMMAND NUMBER 54: Scale Calibration Action WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 54 (decimal) bit 0 0 bit 1 1 bit 2 1 bit 3 0 bit 4 1 bit 5 1 bit 6 0 bit 7 0 Remote Functions Byte bit 8 Setting then clearing this bit tells the instrument that current weight is an empty scale. bit 9 Setting then clearing this bit tells the instrument that current weight is span weight. bit 10 Setting then clearing this bit stores critical data in the Secure Memory Module. bit 11 Setting then clearing this bit restores critical data from the Secure Memory Module. bit 12 Setting then clearing this bit tells the instrument that current weight is Midpoint Linearity value. bit 13 Reserved for future use bit 14 Setting then clearing this bit tells the instrument that current weight is the C2™ reference point. bit 15 Reserved for future use	1	0
TOTAL NUMBER OF WORDS	1	

TABLE 5-21: BLOCK WRITE COMMAND NUMBER 54: SCALE CALIBRATION ACTION

Block Write Command Number 55: Calibration Parameters

BLOCK WRITE COMMAND NUMBER 55: Calibration Parameters WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 55 (decimal) bit 0 1 bit 1 1 bit 2 1 bit 3 0 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bit 8 - 15 Reserved for future use	1	0
Units of Measure: bits 0 - 7 0 = pounds, 1 = kilograms Decimal point position (places to right of decimal): bits 8 - 15 A value from 0 to 4	1	1
Totalizer decimal point position (places to right of decimal): bits 0 - 7 A value from 0 to 4 C2™, Second Generation Calibration bits 8 - 15 Load Cell Count (set to zero for Hard Cal)	1	2
Display Graduation Size (“count by”): A value of 1,2,5,10,20,50,100,200 or 500	1	3
Motion Tolerance: A sixteen bit value representing the lower 16 bits of the 20 bit internal weighing range	1	4
Zero Tolerance: A sixteen bit value representing the lower 16 bits of the 20 bit internal weighing range	1	5
Number of readings averaged: A value from 1 to 200	1	6
Span weight value (Use one of the following methods. Method one, with C2, Second Generation Calibration: Use the C2 reference point when using C2 load cells. Method two: use test weights for calibration) A 20 bit number in proper integer format	2	7
Scale Capacity (Full limit of scale): A 20 bit number in proper integer format	2	9
Mid-point Linearity calibration value: A 20 bit number in proper integer format	2	11
TOTAL NUMBER OF WORDS	13	

TABLE 5-22: BLOCK WRITE COMMAND NUMBER 55: CALIBRATION PARAMETERS

Block Write Command Number 56: Configuration of Rate-of-Change

BLOCK WRITE COMMAND NUMBER 56: Configuration of Rate-of-Change WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 56 (decimal) bit 0 0 bit 1 0 bit 2 0 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bit 8 - 15 Reserved for future use	1	0
Displayed Rate-of-Change time units: A value of 0 to 2 (0 = sec, 1 = min, 2 = hr)	1	1
Rate-of-Change timebase evaluation period: A value of 0 to 15 from list below: 0 = 1 second 4 = 5 seconds 8 = 15 seconds 12 = 240 seconds 1 = 2 seconds 5 = 6 seconds 9 = 30 seconds 13 = 450 seconds 2 = 3 seconds 6 = 10 seconds 10 = 60 seconds 14 = 900 seconds 3 = 4 seconds 7 = 12 seconds 11 = 120 seconds 15 = 1800 seconds	1	2
TOTAL NUMBER OF WORDS	3	

TABLE 5-23: BLOCK WRITE COMMAND NUMBER 56: CONFIGURATION OF RATE-OF-CHANGE

Block Write Command Number 57: BCD Output Configuration

BLOCK WRITE COMMAND NUMBER 57: BCD Output Configuration WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 57 (decimal) bit 0 1 bit 1 0 bit 2 0 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 Format of output: bit 8 If set, will update BCD output when “print” button or remote function is activated. bit 9 Reserved for future use bit 10 If set, will output weight data currently displayed bit 11 If set, will output Tare Value bit 12 If set, will output Net Weight bit 13 If set, will output Gross Weight bit 14 - 15 Reserved for future use	1	0
TOTAL NUMBER OF WORDS	1	

TABLE 5-24: BLOC WRITE COMMAND NUMBER 57: BCD OUTPUT CONFIGURATION

Block Write Command Number 58: Configuration of Analog Output

NOTE: *This command is only active if this option is installed in the HI 2151WC*

BLOCK WRITE COMMAND NUMBER 58: Configuration of Analog Output WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 58 (decimal) bit 0 0 bit 1 1 bit 2 0 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 Weight parameter to be transmitted bits 8 - 15 A value from 0 to 4 (0 = Gross, 1 = Net, 2 = Rate-of-Change, 3 = Peak Force, 4 = Totalized Amount)	1	0

BLOCK WRITE COMMAND NUMBER 58: Configuration of Analog Output WORD DEFINITIONS:	#WORDS	START WORD
Weight value represented by a zero scale analog output:	2	1
Weight value represented by a full scale analog output:	2	3
TOTAL NUMBER OF WORDS	1	

TABLE 5-25: BLOCK WRITE COMMAND NUMBER 58: CONFIGURATION OF ANALOG OUTPUT

Block Write Command Number 59: Configuration of Standard RS232 Port

HI 2151/20WC Only.

BLOCK WRITE COMMAND NUMBER 59: Configuration of Standard RS232 Port WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 59 (decimal) bit 0 1 bit 1 1 bit 2 0 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Format of Communication bit 0 Print Initiation (1 = altered print, bit 6 must = 0) bit 1 Setpoint, Deadbands, and Preact values transmitted bit 2 Rate-of-Change Transmitted bit 3 Tare Weight Transmitted bit 4 Net Weight Transmitted bit 5 Gross Weight Transmitted bit 6 Print initiation (0 = continuous, 1 = print button, bit 0 must = 0 bit 7 - 15 Reserved for future use	1	1
Port Configuration bits 0 - 7 A value of 0 or 1 (0 = Bi-Directional, 1 = Printer (output) only) Baud Rate bits 8 - 15 A value of 0 to 5 (0 = 600, 1 = 1200, 2 = 2400, 3 = 4800, 4 = 9600, 5 = 19200	1	2
Parity bits 0 - 7 A value of 0 to 2 (0 = None, 1 = Even, 2 = Odd)* Stop Bits bits 8 - 15 A value of 0 or 1 (0 = one stop bit, 1 = two stop bits)* *Note: Parameters not set by HI 2151/30	1	3
Word Length bits 0 - 7 A value of 0 or 1 (0 = seven bits, 1 = eight bits)* Handshake Control bits 8 - 15 A value of 0 or 1 (0 = Hardware, 1 = Software) *Note: Parameters not set by HI 2151/30	1	4

BLOCK WRITE COMMAND NUMBER 59: Configuration of Standard RS232 Port WORD DEFINITIONS:	#WORDS	START WORD
Echo bits 0 - 7 A value of 0 or 1 (0 = OFF, 1 = ON) Device Address bits 8 - 15 A value of 0 to 99	1	5
TOTAL NUMBER OF WORDS	6	

TABLE 5-26: BLOCK WRITE COMMAND NUMBER 59: CONFIGURATION OF STANDARD RS232 PORT

Block Write Command Number 60: Sticker Value

NOTE: *Not used with the HI 2151/30WC*

BLOCK WRITE COMMAND NUMBER 60: Sticker Value WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 60 (decimal) bit 0 0 bit 1 0 bit 2 1 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Sticker Value A 20 bit number in proper integer format	2	1
TOTAL NUMBER OF WORDS	3	

TABLE 5-27: BLOCK WRITE COMMAND NUMBER 60: STICKER VALUE

Block Write Command Number 61: Auto Zero Tolerance

BLOCK WRITECOMMAND NUMBER 61: Auto Zero Tolerance WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 61 (decimal) bit 0 1 bit 1 0 bit 2 1 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 bits 8 - 15 Reserved for future use	1	0
Auto Zero Tolerance A 16 bit number in proper integer format	1	1
TOTAL NUMBER OF WORDS	2	

TABLE 5-28: BLOCK WRITE COMMAND NUMBER 61: AUTO ZERO TOLERANCE

Block Write Command Number 62: Waversaver/ Excitation Monitor

HI 2151/30WC Only.

BLOCK WRITE COMMAND NUMBER 62: Waversaver/Excitation Monitor WORD DEFINITIONS:	#WORDS	START WORD
Command number: A value of 62 (decimal) bit 0 0 bit 1 1 bit 2 1 bit 3 1 bit 4 1 bit 5 1 bit 6 0 bit 7 0 Waversaver bits 8 - 15 Waversaver setting (1-5) (Error #87 returned if an error)	1	0
Excitation Monitor bit 0 0 = Disable Excitation Monitor, 1 = Enable Excitation Monitor bits 1 - 15 Reserved for future use	1	1
TOTAL NUMBER OF WORDS	2	

TABLE 5-29: BLOCK WRITE COMMAND 62: WAVERSAVER/EXCITATION MONITOR

Block Transfer Write Example

This is a Block Transfer Write (BTW) sub-routine, currently configured to do a BTW 52 of the relay setpoint data. The block length is the only value which needs to be changed to use other block transfer write types. Once called, the routine will write the block until a return code of 06 (BTW OK) is sent.

A value of 70 is at N 11:60
B 3:0 will enable routine and is cleared when completed
Valid BTW Data starts at N 11:0

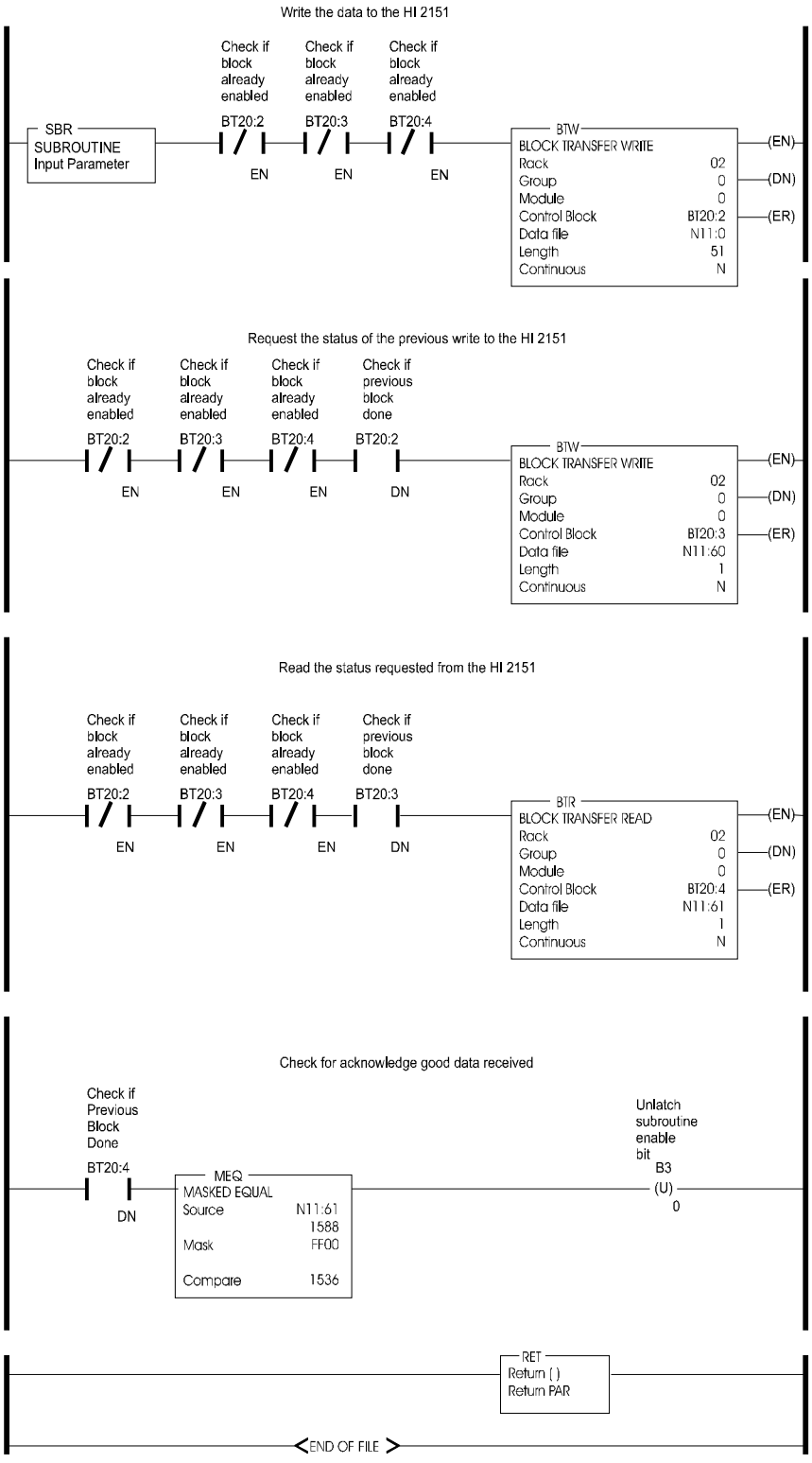


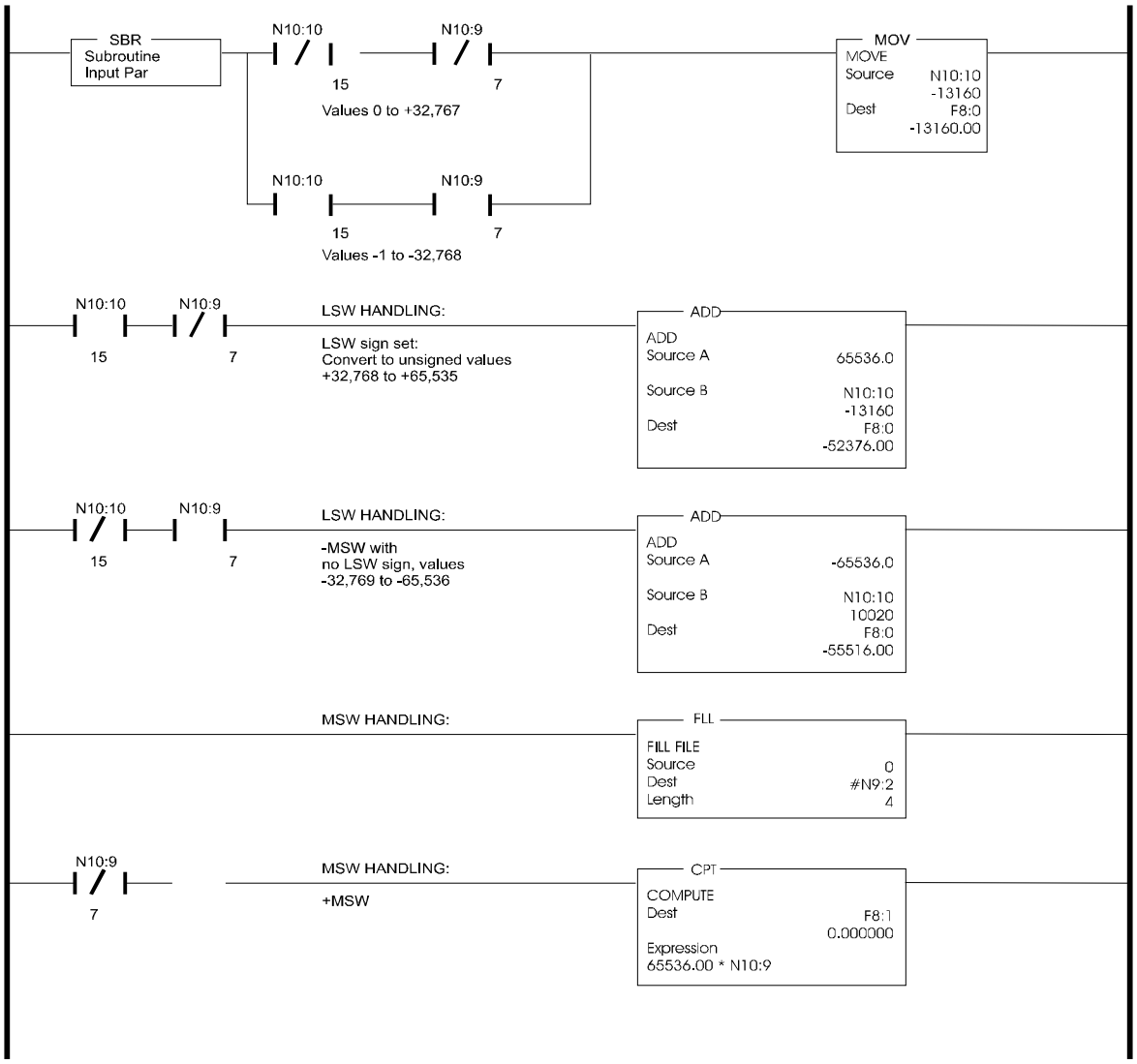
FIG. 5-2 BLOCK TRANSFER WRITE EXAMPLE

Integer to Floating Point Routine

This example assumes the two words representing the desired weight value have been read with a block transfer read. They must also reside

as MSW in memory location N10:9, and as LSW in memory location N10:10. This routine works for all values except the totalizer.

NOTE: *All negative numbers are sent from the weight controller to the programmable controller in "twos complements"*



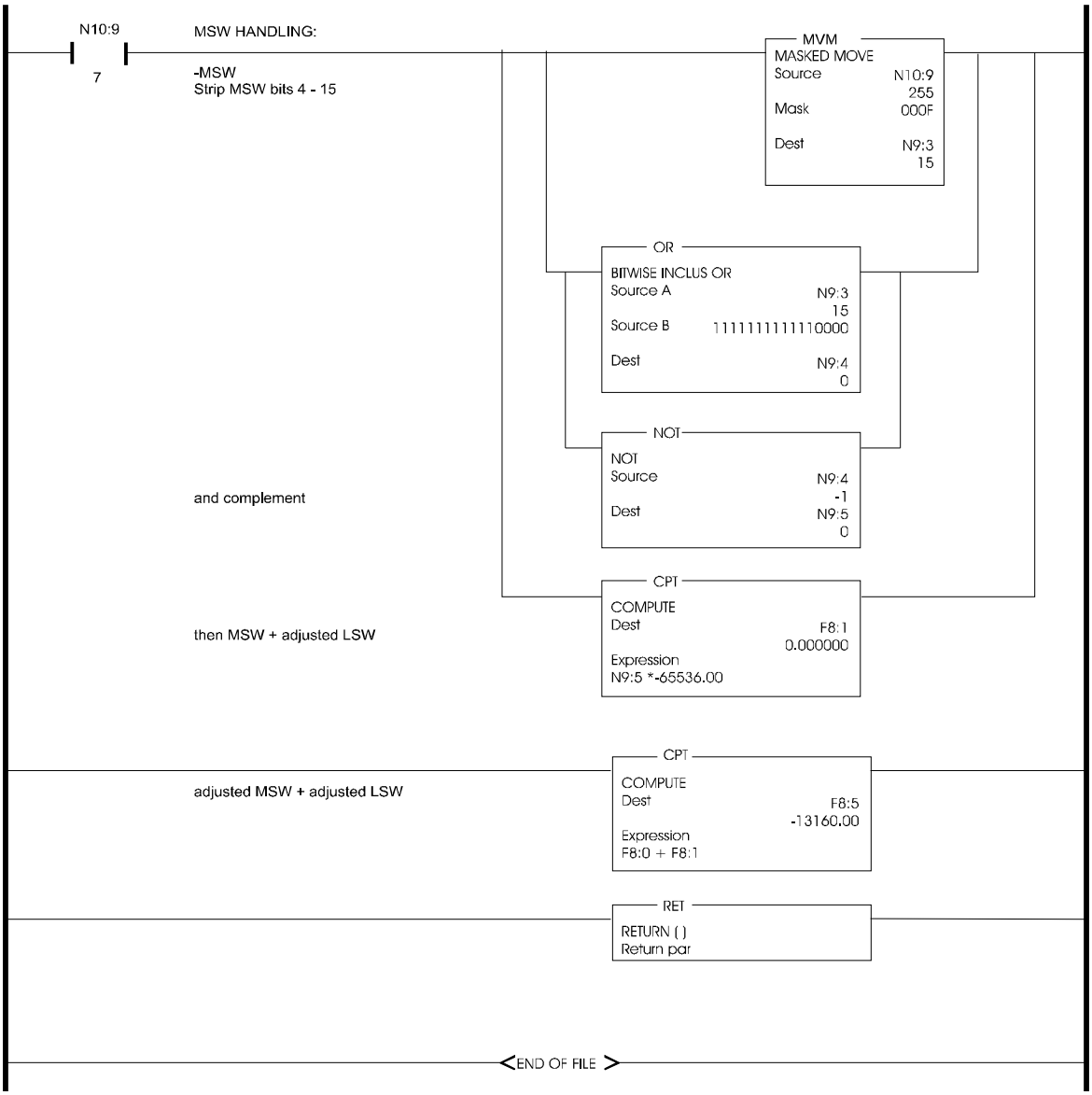


FIG. 5-3 INTEGER TO FLOATING POINT ROUTINE

Response and Error Codes

Each time the PLC performs a block write, it should then perform the response code block read. This block read will return two bytes. The first byte is the command number of the last block write performed. The second byte will be the response or error code returned. If the error code is a NACK (21) then the returned command number will be a 99.

BLOCK READ COMMAND NUMBER 70: Reading response code after a block write WORD DEFINITIONS	# WORDS	START WORD
Write command number (not 70 but the command number of the write performed) Bits 0 - 7	1	0
Response code from table below Bits 8-15		
TOTAL NUMBER OF WORDS	1	

TABLE 5-30: BLOCK READ COMMAND NUMBER 70: READING RESPONSE CODE AFTER A BLOCK WRITE

	Decimal	HEX	Description
Block Read or Block Write Error Codes	06	06	Acknowledge good data received
	21	15	NACK - illegal command
	22	16	Exceeded maximum legal words for block read and write
	23	17	In CAL mode
Block Write Error Codes	49	31	Scale in motion (for example: unable to calibrate while in motion)
	50	32	Current weight sensed over scale capacity (only functional for command 51)
	51	33	Weight not within zero tolerance, unable to zero
	52	34	Insufficient change in weight to calibrate span (display error #18)
	53	35	Decimal point places must be between 0 and 4
	54	36	Not a valid graduation size
	55	37	Motion value must be greater than graduation size
	56	38	Zero tolerance value must be greater than 0 and positive.
	57	39	Acceptable number of averages is between 1 and 200
	58	3A	Span weight value, during calibration, must be positive
	59	3B	Scale capacity value must be positive
	60	3C	Midpoint linearity value must be positive
	61	3D	Rate-of-Change time units selection must be 0,1 or 2
	62	3E	Rate-of-Change time base out of range
	63	3F	BCD option not installed
	64	40	Invalid BCD card bit request
	65	41	Analog output not installed
	66	42	Analog output request must be between 0 and 4
Error Codes for Block Write 59	67	43	Invalid serial port (RS-232) format request
	68	44	Serial configuration values 0 or 1
	69	45	Baud rate request out of range
	70	46	Parity request out of range, must be 0,1,or 2

	71	47	Stop bits must be 0 or 1
	72	48	Data length must be 0 or 1
	73	49	Control (Hardware or Software) must be 0 or 1
	74	4A	Device Address must be between 0 and 99
	75	4B	Echo request must be a 0 or 1
Error Code for Block Write Command #53	76	4C	Tare greater than span
Error Code for Block Write Command #51	77	4D	Blind unit option only
Error Code for Block Write Command #55	96	60	Load cell count error
	97	61	No C2™ load cells found
	98	62	Load cell capacity/sensitivity error
	99	63	Load cell checksum error
	100	64	Too many significant digits after the decimal to be displayed.

CHAPTER 6 - CONVERSION CHARTS AND FORMULAS

Hex Chart

Use the Hex Chart to translate bit values to a hex value.

Relay Status Example

For example the bit representative of the Relay status byte when set-point relays 8,5,3, and 1 are on is (01101001). This eight bit value is represented by two four bit nibbles (0110 and 1001). Looking at the table we see this is equal to a Hex value of 69.

Bit 3	Bit 2	Bit 1	Bit 0	Hex Value
Bit 7	Bit 6	Bit 5	Bit 4	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

TABLE 6-1: HEX CHART

Bit #	Bit Status	Hex	Description
Bit 0	1 = On	9	Relay #8 status (on/off)
Bit 1	0 = Off		Relay #7 status (on/off)
Bit 2	0 = Off		Relay #6 status (on/off)
Bit 3	1 = On		Relay #5 status (on/off)

TABLE 6-2: RELAY STATUS

Bit #	Bit Status	Hex	Description
Bit 4	0 = Off	6	Relay #4 status (on/off)
Bit 5	1 = On		Relay #3 status (on/off)
Bit 6	1 = On		Relay #1 status (on/off)
Bit 7	0 = Off		Relay #2 status (on/off)

TABLE 6-2: RELAY STATUS

Bit #	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Decimal Value	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1
	ONE WORD															

TABLE 6-3: BINARY TO DECIMAL CHART

Block Write Example

The following is an example using block write #51 to zero the scale. Command #51 is made up of one word. Bits 0-7 represent the address or the command number (00110011 = 51). To activate the scale function, toggle bit #13. This creates a word which has a decimal value of 8,243.

Bit #	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	1

TABLE 6-4: BLOCK WRITE EXAMPLE

Math Conversion Programs

Math conversion routines, written in ladder logic convert the twenty bit integer data available from the HI 2151WC to a PLC floating point format. Conversely, routines can convert from Floating Point to integer. To convert from integer to floating point, your ladder logic program would follow these steps:

Step 1. Convert the lower sixteen bits into a floating point number.
Step 2. Test the seventeenth bit (bit 16) and if set, add 65,536 to the floating point number.
Step 3. Test each subsequent bit and add the appropriate numeric value to the floating point number.