WEIGH SYSTEM TECHNOLOGY

VISHAY PRECISION GROUP

BLH

LCm-200
NTEP Certified Weigh Indicator
Operator's Manual

TM040
Rev C
6/1/11
Doc 35114

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SECTION 1. General Information

1.1 Instrument Description

The LCm-200 'Expert Series' indicator/controller (Figure 1-1) is a microprocessor based device designed to meet NIST Handbook 44 (NTEP) and Canadian Weights and Measures legal-for-trade requirements. All segments of this manual pertaining to legal-for-trade requirements will display the double logo depicted in this paragraph.

Figure 1-1. The LCm-200.

LCm-200 units convert the mV/V signal from strain gage type force transducers (load cells) into a high resolution digital signal representing force, weight, or mass flow rate. Units operate at either 115 or 230 VAC and provide a regulated, fault protected 10 VDC excitation for up to eight 350 ohm transducers. Standard features include rate-by-weight operation, an RS-422/485 serial port with PC interface or simplex output ASCII protocol (Digi-System Network available in 1996), a sigma delta type ND converter, system simulation mode, 8 open collector process control set-points, and dynamic digital filtering. Options include a sixteen bit resolution analog output, Allen Bradley Remote I/O interface, various serial protocols, 8 solid state ac set point outputs, and an internal modem for remote configuration, service, and monitoring.

Each unit is housed in an aluminum case with a powder coated aluminum panel mounting bezel. NEMA 4, 4X or explosion-proof wall mount enclosures are available as options. Simple entry of calibration data, diagnostic parameters, and filter selections is accomplished using the front panel keypad. All electrical connections are made at the rear panel with unpluggable screw terminal connectors.

1.1.1 Introducing the Plug-n-Weigh Concept

The BLH Plug-n-Weigh concept takes advantage of technology to minimize start-up time and the operator learning curve. Intuitive configuration menus, self configuration of many set-up parameters, and simple push-button type digital calibration combine together to make the LCm-200 one of the easiest process instruments to configure and operate.

1.1.2 The Safe-Weigh Software System

Safe-Weigh software system benefits include Expert System Diagnostics, Dynamic Digital Filtering, and a wide range of proven DCS/PLC connectivity options. Expert System Diagnostics provides on-line preventative maintenance information which quickly identifies electrical and/or mechanical problems. Dynamic Digital Filtering ensures precise, repeatable set point control in 'noisy' process environments. Proven connectivity with Allen-Bradley, Modicon (AEG Schneider) General Electric, Johnson Yokogawa, Honeywell, Fisher-ProVox, Bailey, and other PLC/DCS devices eliminates the risks associated with digital integration of weight information into the process control environment.

1.1.3 The LCm-200 Front Panel

All configuration, calibration, and operation transactions are performed using the front panel numeric keypad, operating push but-tons, and the high intensity vacuum fluorescent display (Figure 1-2). The user friendly design separates the operating push buttons (gross/net, zero, tare and print) from the configuration menu numeric keypad. The two line alphanumeric display indicates weight data and status while in the operate mode and provides instructions etc. during the configuration mode.

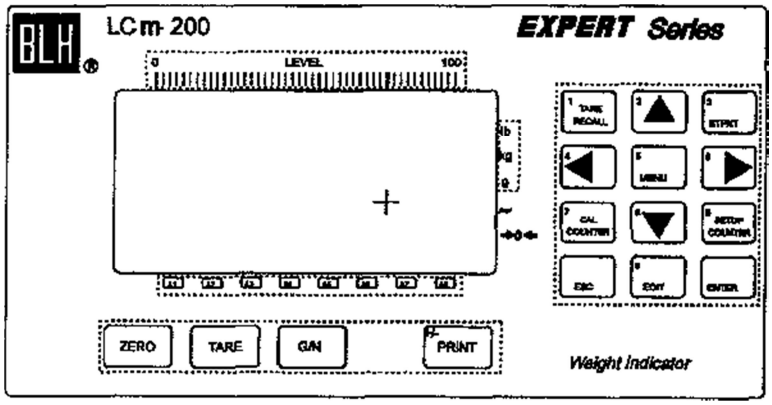


Figure 1-2. The LCm-200 Front Panel.

1.1.4 Main Configuration Flow Diagram

LCm-200 configuration is performed using the menu driven keypad on the right side of the front panel and follows the flow diagram presented in Figure 1-3. This diagram shows the overall structure and general guidelines of the LCm-200 set-up, calibration, filter, display, I/O, diagnostic, and security configuration routines. Detailed explanations of sub menu parameter selections are defined in sequential chapters, starting with Section III. To browse through the menus, press MENU and use the arrow keys to move across menu subjects, or up and down within a menu. Parameters are not actually changed until the edit and enter keys are used. Another copy of this diagram is presented in Appendix B.

1.1.5 Serial Communication

The standard LCm-200 is equipped with a single serial communication port that can be selected to operate as an RS 422 full duplex, or RS 485 half duplex port. The type selection is made using a series of DIP switches on the back panel. Protocol selection is made within the keypad menu structure. The standard version is provided with BLH network or ASCII protocol selections. The BLH network protocol (avail. 1997) allows the LCm-200 to communicate in a local area network to a BLH network controller/gateway. The ASCII protocol option is designed to communicate with a printer, PC, remote display, or data logger and can be selected for continuous or demand operation. Extensive diagnostics verify transmit and receive, proper parity and framing, and a visualization function allows the user to view the actual serial transmit and receive characters. See Section II for wiring information and Section VI for protocol information.

1.2 OPTIONS

LCm-200 units are available with several different application enhancement options. Options include various mounting enclosures, solid state relay set point outputs, custom network interfaces and protocols, and a factory-link modem for on-line service/calibration assistance. All options will be fully defined later in this manual.

1.2.1 Mounting Options

For units located in a general factory/plant floor, or if corrosive, hose down, or sanitary requirements are a factor, a NEMA 4X stainless steel enclosure is avail-able. For Div. 2 hazardous locations, units are available with FM approval as a non-incendive device. For Division 1 hazardous locations an explosion proof enclosure is available. (Note: BLH Intrinsic Safety Barrier Sets must be specified when load cells are located in a Division I area.) Refer to Appendix A for detailed enclosure outline drawings.

1.2.2 Internal Summing Junction Board

For systems where the LCm-200 is located within 10 meters of the load cells, an optional

306 summing board is available mounted inside the NEMA 4/4X enclosure.

1.2.3 Analog Output

The LCm-200 is available equipped with a high resolution 16 bit analog output. This output can be configured for 4-20 mA, 0-20 mA, or 0-24 mA operation via rear panel DIP switch selections. Set-up and calibration of the analog output is configured via the menu keypad and can be configured to track gross or net weight data. Loop diagnostics are also provided to verify that the analog connection is intact. See Section II for wiring information and Section VI for configuration details.

1.2.4 Solid State Relay Set Point Outputs

Solid state relay outputs provide ac set point control for up to 8 weight or rate values. As with standard open collector outputs, values can be entered through the front panel numeric keypad or downloaded serially from a host device.

1.2.5 Allen-Bradley Remote I/O Network Interface

The Allen-Bradley Remote I/O interface is a communication link that supports remote, time critical I/O control communications between a master processor and a remote I/O slave. It is typically used to transfer I/O bit images between the master and slave. The LCm-200 represents a quarter (1/4) Rack of discrete I/O with 32 bits of input and .output image files to the scanning PLC. All weight data and status information uses discrete reads and writes to communicate scale information to the PLC in the shortest time possible. Block data transfers are used to communicate non-time critical diagnostic and calibration data, remotely configure diagnostic limits, and digital filter parameters.

1.2.6 MODBUS RTU Protocol

MODBUS is recognized as an industry standard digital communication protocol between a master or host computer and a slave device. This protocol was originally developed by Modicon to communicate discrete and analog information between a PLC and a master host. As implemented in the LCm-200, this protocol efficiently communicates weight and diagnostics information to a MODBUS Master driver equipped host.

1.2.7 Fisher Provox Protocol

This option allows direct communication with a Fisher CL6921 type interface card when the CL6921 is con-figured for the 'Toledo' interface. Weight and/or rate data is transmitted every 50 milliseconds from the standard LCm-200 serial output port.

1.2.8 On-line Service Modem

A built-in modem is available to connect the LCm-200 via the telephone system, to the BLI-I factory field service office. Over the communication link, remote configuration, diagnostics of system problems, and service procedures can be performed economically and virtually immediately. The on-line connection can also accommodate the download of upgraded operating software.

1.2.9 MODBUS Plus Protocol

MODBUS Plus protocol allows the LCm-200 to communicate on a peer-to-peer network link with Modicon 984 and Quantum PLC devices. See Section XI for a full description of this interface.

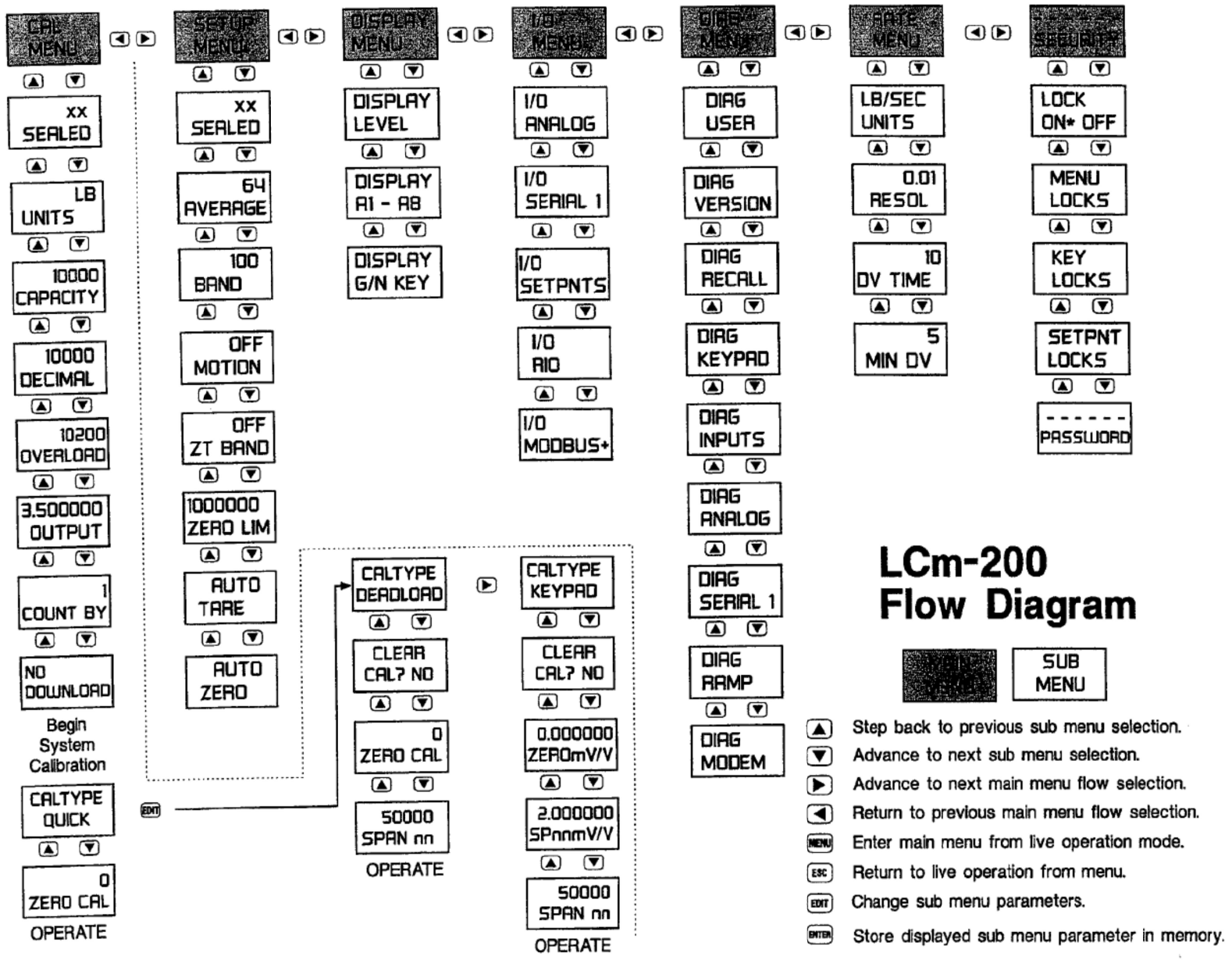


Figure 1-3. Main Flow Diagram.

1.3 LCm-200 Specifications

Performance	
Internal Resolution	1,048,576 total counts
Max. Display Resolution	700,000 total counts
Conversion Speed	50 msec
Displayed Sensitivity	0.05 µV per count
Noise	0.4 µV per count (min filter setting)
Full Scale Range	3.5 mV/channel
Dead Load Range	100%
Input Impedance	10 M-ohms, min.
Excitation Voltage	10 VDC @250 mA
Linearity	± 0.0015% of full scale
Software Filter (Std.)	multi-variable up to 10,000 ms
Step Response	one conversion
Temp. Coefficient (Zero)	±2ppm/°C
Temp. Coefficient (Span)	±7ppm/°C
Environment	
Operating Temperature	-10 to 55°C (12 to 131°F)
Storage Temperature	-20 to 85°C (-4 to 185°F)
Humidity	5 to 90% rh, non-condensing
Voltage	117/230 ± 15% 50/60 Hz
Power	15 watts max
Parameter Storage	EEPROM
EMI/RFI interference	Shielded from typical industrial
Enclosure	
Dimensions (std)	4.63 x 8.40 x 6.5 in. HWD
NEMA 4/4X, 12 (opt)	8.5 x 13.5 x 10.45 in. HWD
Materials	
Aluminum Case & Bezel	overlay meets 94V-0 rating
Display	
Type	high intensity cobalt green vacuum fluorescent
Active Digits	7 digit alpha numeric .59" high for weight, 8 digit alpha numeric .39" for status
Analog Output (Optional)	
Conversion	16 bit D-A
Current Selectable	4-20 mA or 0-20 mA - 600 ohm max.
	0-24 mA - 500 ohm max.
Remote Digital Inputs (Optically Isolated)	
(Contact closure or dc logic compatible)	
Closed (Momentary)	logic low
Open	logic high
Cable Length	100 feet max.

DC Set point Outputs (Standard)	
Type	open collector (current sinking)
Operating Voltage	5-35 VDC
ON Voltage	1.2VDC@40 mA
	0.8 VDC @ 1 mA
OFF State Leakage	0.04 uA @ 40 VDC
Power	extemal supply required
AC Set Point Outputs - 8 (Optional)	
Type	triac
Operating Voltage	12 - 240 VAC
AC Frequency	20 - 500 Hz
ON State Voltage Drop 1	.2 Vrrns
Min - Max Load Current	5mA - 1A
Leakage Current	1 mA @ full rated load voltage
Power	external supply required
Communications (Standard)	
Serial RS4W485	full or half duplex ASCII, printer, Provox, MODBUS or BLH network Protocols odd, even or no parity-selectable
Baud Rates	300, 1200, 2400,4800,9600, or 19200
Addressing	0-99
Special Interfaces (Optional)	
Allen-Bradley	Remote I/O – 1/4 Logical Rack
Modbus	RTU slave
Fisher Provox Card	CL6921 Weigh Scale Interface
Modbus Plus	peer-to-peer
Internal Service Modem (Optional)	
Baud Rate	2400: Bell 212 and 103 compatible
Availability	USA. and Canada only
Approvals/CE Marking	
FM (Factory Mutual)	3611
CSA	C22.2 (all applicable sections)
IEC 801-2	ESD susceptibility, category B
IEC 801-3	radiated electromagnetic field, cat. A
IEC 801-4	conducted line transients, cat. B
EMI Emissions	FCC part 15 subpart B, Class A
Canadian Dept of Comm..	Class A
EN 5501	Group 1, Class A
IEC 1010-1/EN61010-1	Electrical Safety
EN50082-1 1992	Susceptibility: subparts 801,2,3 & 4
EN55011	Emissions: Equipment Class I, Group A

1.4 ORDERING INFORMATION

Basic Unit: LCm-ZOO [M]-[AP]-[C]-[B]-[M]

[M] Mounting	(1) NEMA 4X Panel Mount
	(2) #1 & FM/CSA Division 2 Approval
	(5) NEMA 4x Stainless Steel Wall Mount
	(6) #5 & FM/CSA Division 2 Approval
	(7) #5 with 306 Internal Summing Board
	(8) #6 with 306 Internal Summing Board
	(13) #6 with Type Y Purge per NFPA 496 (suitable for Div. 1)
	(14) #8 with Type Y Purge per NFPA 496 (suitable for Div. 1)
[A] Expansion Slot A	(1) None
	(3) MODBUS Plus
	(4) Allen-Bradley Remote If0
[P] Process Inputs and Outputs	(1) Remote Function Inputs
	(2) #1 & Analog Current Output

[C] Communication	(1) RS-485 or RS-422 with PC Interface ASCII Protocol
	(2) #1 & MODBUS RTU Protocol
	(3) #1 & Fisher Provox Protocol (includes 20 mA serial converter board)
[B] Expansion Slot B Outputs	(1) None
	(2) 8 Open Collector (DC) Set Point Outputs
	(3) 8 Soli State Relay (AC) Set Point Outputs
[M] Modem/On-Line Service	(1) None
	(2) Modem W/90 Days On-Line Service

NOTE: Always contact your local BLH representative for accurate ordering information

1.5 WARRANTY POLICY

BLH warrants the products covered hereby to be free from defects in material and workmanship. BLH's liability under this guarantee shall be limited to repairing or furnishing parts to replace, f.o.b. point of manufacture, any parts which, within three (3) years from date of shipment of said product(s) from BLH's plant, fail because of defective workmanship or material performed or furnished by BLH. As a condition hereof, such defects must be brought to BLH's attention for verification when first discovered, and the material or parts alleged to be defective shall be returned to BLH if requested. BLH shall not be liable for transportation or installation charges, for expenses of Buyer for repairs or replacements or for any damages from delay or loss of use for other indirect or consequential damages of any kind. BLH may use improved designs of the parts to be replaced. This guarantee shall not apply to any material which shall have been repaired or altered outside of BLH's plant in any way, so as in BLH's judgment, to affect its strength, performance, or reliability, or to any defect due in any part to misuse, negligence, accident or any cause other than normal and reasonable use, nor shall it apply beyond their normal span of life to any materials whose normal span of life is shorter than the applicable period stated herein. In consideration of the forgoing guarantees, all implied warranties are waived by the Buyer, BLH does not guarantee quality of material or parts specified or furnished by Buyer, or by other parties designated by buyer, if not manufactured by BLH. If any modifications or repairs are made to this equipment without prior factory approval, the above warranty can become null and void.

1.6 FIELD ENGINEERING

Authorized BLH Field Service Engineers are available around the world to install LCm-200 transmitters and/or train factory personnel to do so. The field service department at BLH is the most important tool to assure the best performance from your application. Field service phone numbers are listed below.

Factory: (Main Number)

(781) 298-2000

Southwest: (281) 655-5041

Midwest: (614) 476-6453

Canada: (416) 251-2554

or

(800) 567-6098 toll free

SECTION 2. Installation

2.1 INTRODUCTION.

This chapter provides LCm-200 mounting and electrical installation information. Instruments will operate accurately (to specification) in locations with temperatures ranging from -10°C to + 55°C (+ 14°F to + 130°F). The installation location should be free of vibration. Unless equipped with the proper enclosure option, instruments should not be located in areas containing explosive or corrosive vapors. In all installations, ac (mains) power should be supplied from a clean (transient free) instrument power source.

2.2 MOUNTING

2.2.1 Standard Unit Mounting

Standard LCm-200 controllers are shipped with the necessary hardware for panel mounting. Outline and panel cutout dimensions are depicted in Figure 2-1. Installation of panel mount adapters is shown in Figure 2-2.

2.2.2 Optional NEMA 414X Enclosures

NEMA 4 and 4X enclosures are equipped with four pre-punched holes for mounting to a wall or bracket. A U-bolt can be used for mounting to a pipe support. The enclosure should be installed in a vibration free environment close to the load cell summing junction box. If conduit is used to shield interconnecting cables, drains should be provided to reduce the possibility of condensate entering the enclosure. Outline dimensions for NEMA 4/4X enclosures are presented in Figure 2-3.

NOTE: Units purchased with the NEMA enclosure option can be equipped with an internal transducer summing board (see paragraph 2.3.11).

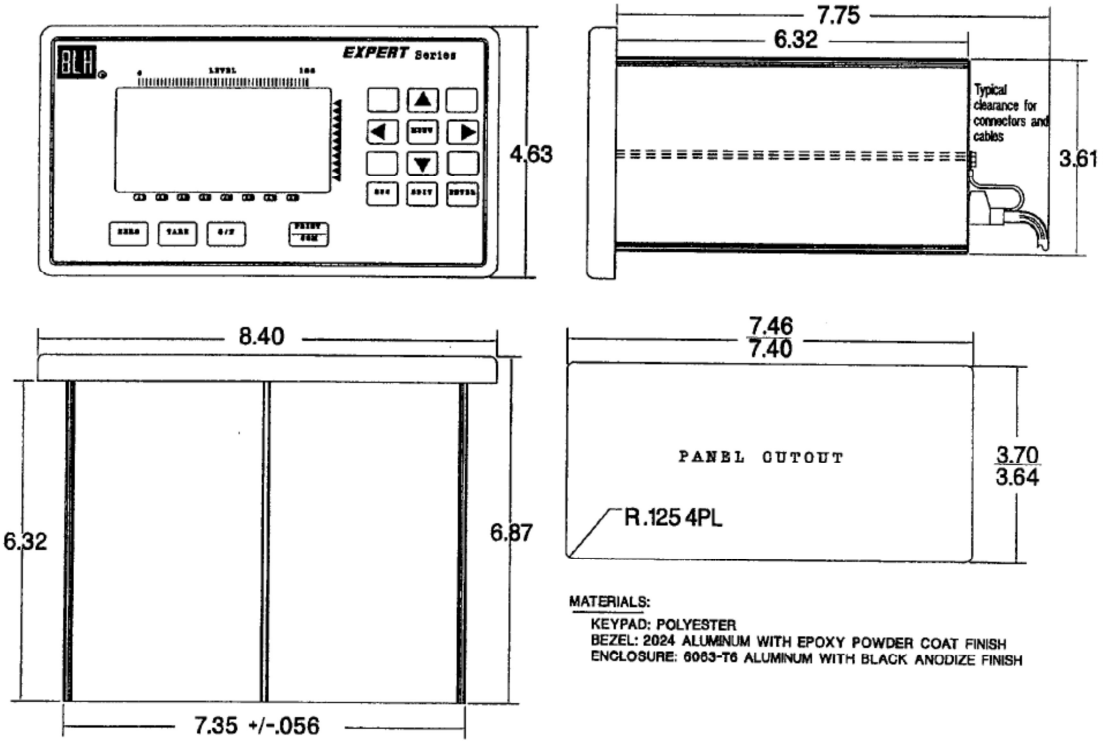


Figure 2-1. Standard Unit Outline Dimensions.

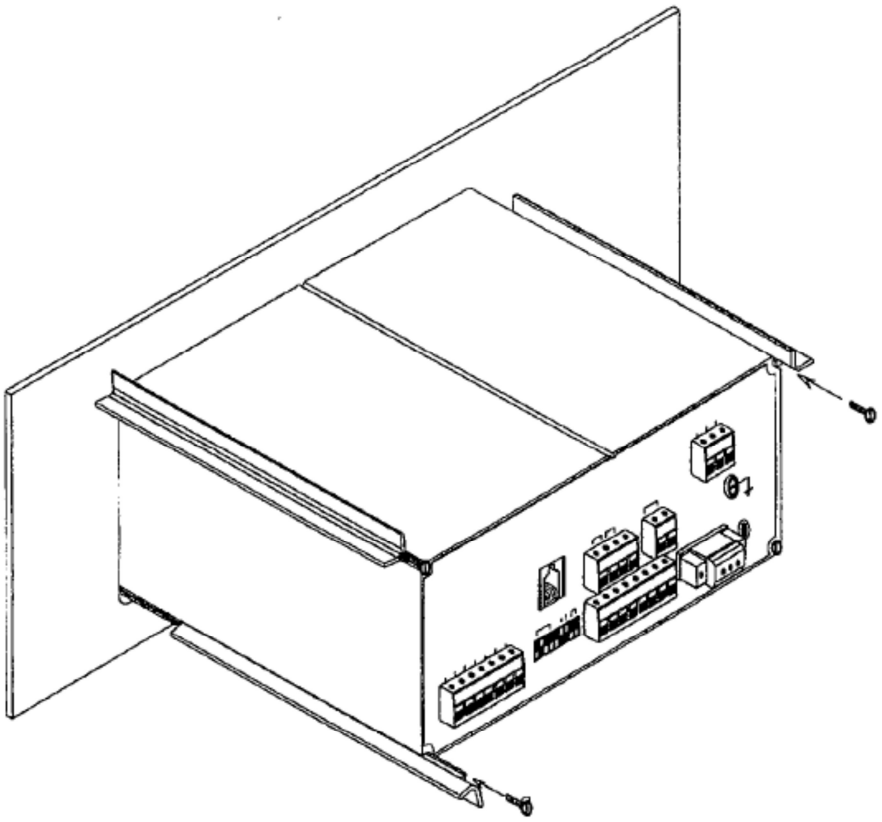


Figure 2-2. Panel Mounting Arrangement.

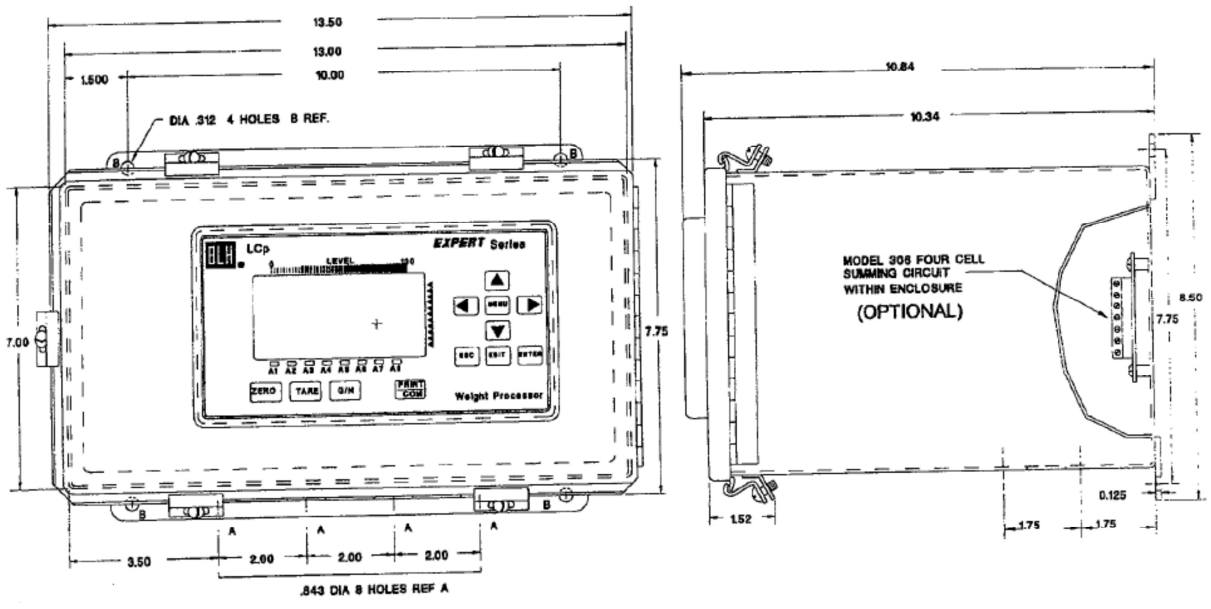


Figure 2-3. NEMA 414X Outline Dimensions.

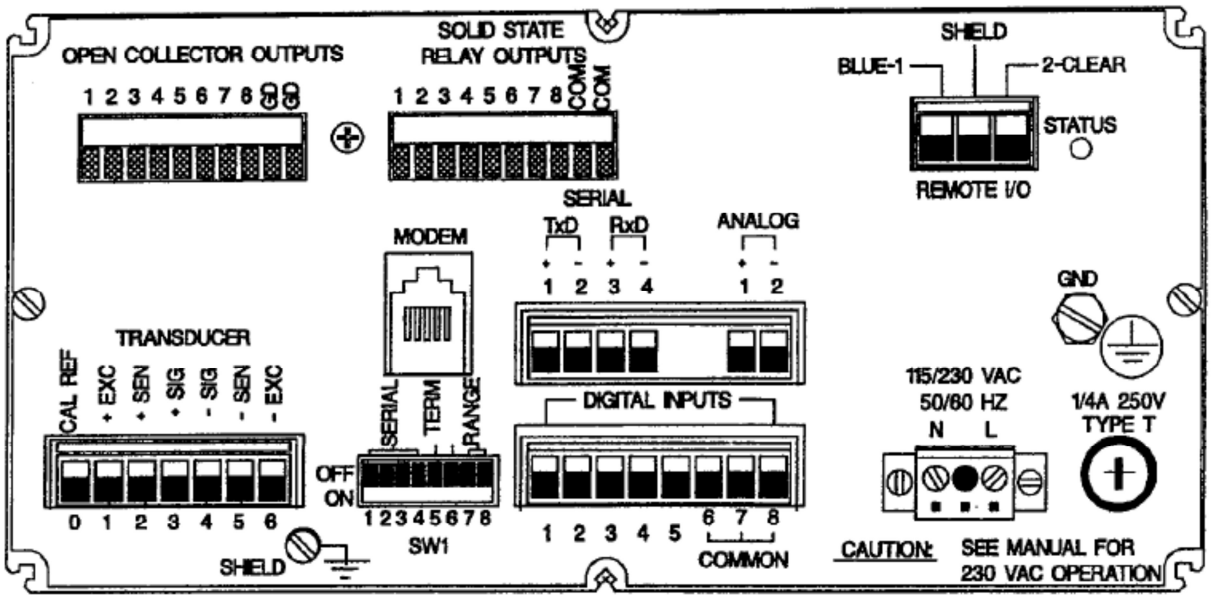


Figure 2-4. LCm-200 Rear Panel.

2.3 ELECTRICAL CONNECTIONS

2.3.1 The LCm-200 Rear Panel

Figure 2-4 shows the LCm-200 rear panel. Call outs depict wiring locations for all electrical connections. NOTE: See Appendix A for all electrical wiring diagrams on a single page.

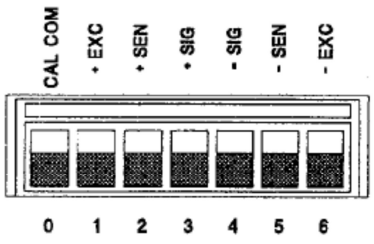
2.3.2 Transducer Signal Inputs

Transducer input leads are wired to the LCp rear panel terminal block shown in Figure 2-5. BLH load cells and junction box cables are shipped with pre-stripped, tinned leads so that leads need only be inserted in the proper terminal location and the screw above tightened securely. Lead designations are clearly labeled for standard six conductor input cables (usually coming from a junction box).

For applications which use a four conductor cable (usually coming from a single load cell), jumpers must be installed from SEN + to EX + and SEN - to EX -. To insure good electrical and mechanical connection, BLH recommends that jumper leads be soldered to load cell leads.

NOTE: For many load cells, excitation (EX) leads are referred to as INPUT, and signal leads (SIG) are referred to as OUTPUT.

NOTE: If tension load cell s are used, red (- signal) and white (+signal) leads may need to be reversed.



LOAD CELL INTERCONNECT WIRING

JUMPERS	PIN #	SIGNAL	TYPICAL COLOR	
	0	CAL COM	NO CONNECTION	
	1	+ EXC	GREEN	
	2	+ SENSE	ORANGE	
	3	+ SIGNAL	WHITE	SEE NOTE 2
	4	- SIGNAL	RED	
	5	- SENSE	BLUE	
	6	- EXC	BLACK	

NOTES:
1. JUMPER WIRES REQUIRED FOR FOUR WIRE LOAD CELLS
2. FOR SYSTEMS USING TENSION LOAD CELLS, THE RED AND WHITE LEADS MAY NEED TO BE REVERSED

Figure 2-5. Load Cell Connections.

2.3.3 Mains (ac) Power

LCm-200 instruments are shipped ready to operate at 115 VAC (50 or 60 Hz). For 220 VAC operation, re-move the rear panel and change the internal voltage selection switch as shown in Figure 2-6.

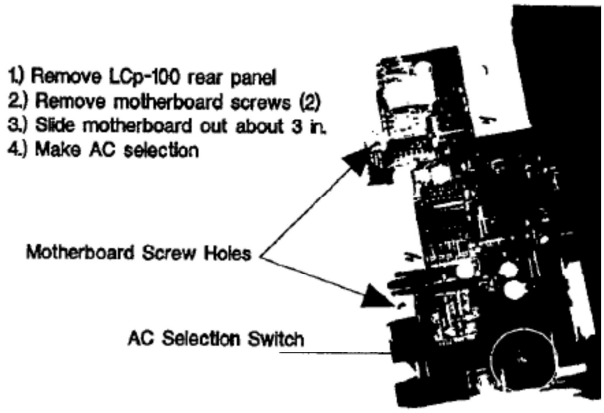


Figure 2-6. Load Cell Connections.

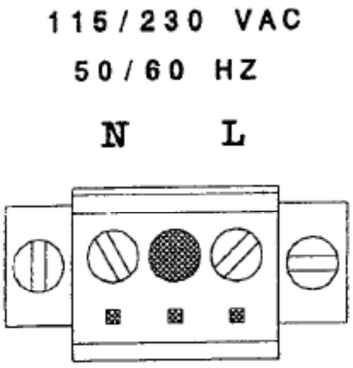
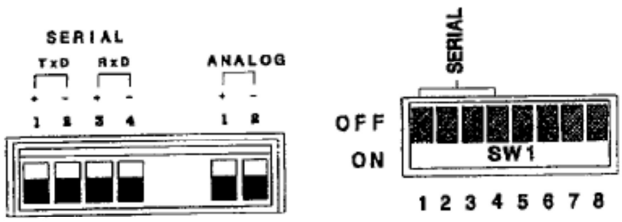


Figure 2-7. AC Power Receptacle.

2.3.4 Serial Communication

A 4-socket mating half connector is provided for serial communication wiring. Connect wires for either RS-485 or RS-422 operation as shown in Figure 2-8. Set DIP switch S1 positions 1-4 for desired interface function (Figure 2-8). See Section VI for details concerning serial interfacing.



RS 422/ 485 COMMUNICATION			
PIN NO	SIGNAL NAME	SIGNAL	
		RS 422	RS 485
1	TxD+	TRANSMIT DATA +	NOT USED
2	TxD-	TRANSMIT DATA -	NOT USED
3	RxD+	RECEIVE DATA +	DATA +
4	RxD-	RECEIVE DATA -	DATA -

DIP SWITCH SETUP				
	SW1.1	SW1.2	SW1.3	SW1.4
RS 422 MULTIDROP	ON	OFF	OFF	OFF
RS 422 FULL DUPLEX	OFF	OFF	OFF	OFF
RS 485 HALF DUPLEX	ON	ON	ON	ON

TERMINATION RESISTOR

DIP SWITCH #5 IN ON POSITION CONNECTS AN INTERNAL 120 OHM RESISTOR ACROSS THE RxD+ AND RxD- SIGNALS

Figure 2-8. Serial Communication Configuration.

2.3.5 Analog Output (Option)

Analog current output is optional on LCm-200 instruments. To select current output type; 4-20 mA, 0-20 mA, or 0-24 mA, set rear panel DIP switch positions 7 and 8 as shown in Figure 2-9. Use the two-socket mating half terminal connector to attach plus and minus signal wires as shown in Figure 2-9. Route wires away from ac power lines and other EMI sources to prevent interference. Section VI provides analog out-put configuration procedures.

Each instrument is protected with a 114 amp, 250 volt 7' type fuse located adjacent to the ac power socket. If the fuse opens, replace it with the same type, current, and voltage rating.

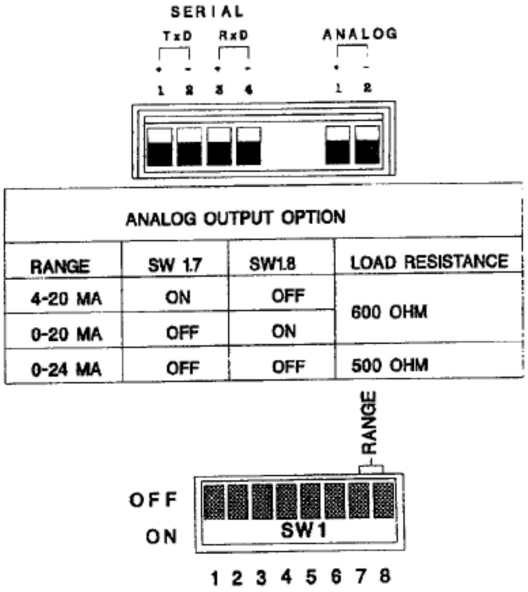


Figure 2-9. Analog Current Selection/Connection.

2.3.6 Digital (Remote) Inputs

Certain front panel key functions can be initiated remotely using the rear panel digital inputs. Figure 2-10 gives wiring designations for remote operation of the ZERO, TARE, Gross/Net (GN), and PRINT keys. Interconnecting wire/cable length should not exceed 50 feet. Route wires/cable away from ac power lines and other EMI sources to prevent interference.

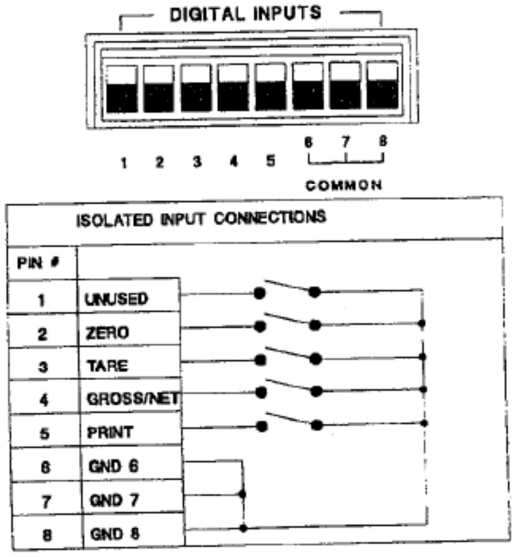


Figure 2-10. Remote Digital Inputs.

2.3.7 Open Collector (Set Point) Outputs

Standard units are equipped with eight open collector type set point outputs. Outputs can be configured for main or dribble operation with inflight compensation (see Section VI). Outputs are open collector type, capable of sinking 35 mA at 1.2 VDC. Wire set point outputs as shown in Figure 2-11.

2.3.8 Allen Bradley Remote I/O (Optional)

Units ordered with the Allen-Bradley remote I/O option have a 3-socket mating half connector for the RE¬MOTE I/O port. Wiring designations are presented in Figure 2-12. Technical manual TM020 presents a complete description of the Allen-Bradley interface.

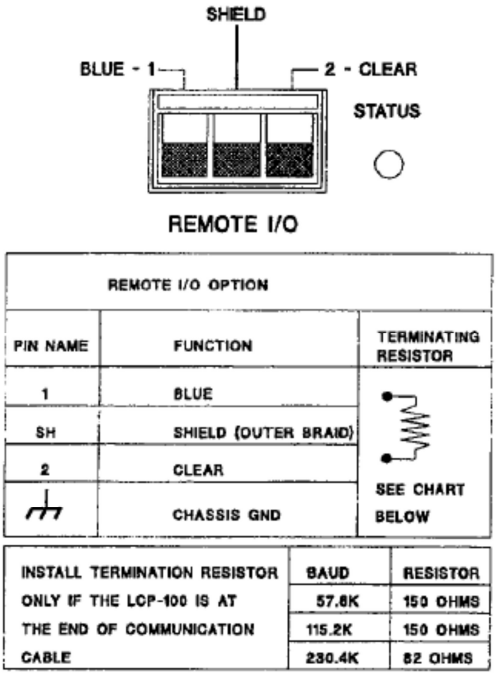


Figure 2-12. Allen-Bradley Remote I/O Option.

2.3.9 Factory-Link Modem (Optional)

An optional factory-link modem ties the LCm-200 directly to the BLH field service department. Simply plug a standard telephone cable into the jack provided (Figure 2-13) and an RJ-11

telephone wall socket. All other instructions for using the internal modem are presented in Section XI.

Note: Modem designed for use in the U.S.A. and Canada.

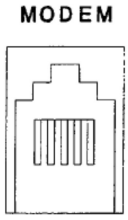


Figure 2-13. Modem Connection.

2.3.10 Summing Junction Box Considerations

BLH recommends using the Model 306 (not supplied) transducer summing junction box with the LCm-200. If the BLH Model 308A junction box is used, resistors R1 and R2 must be removed to ensure proper operation of Plug-n-Weigh features (see Figure 2-14).

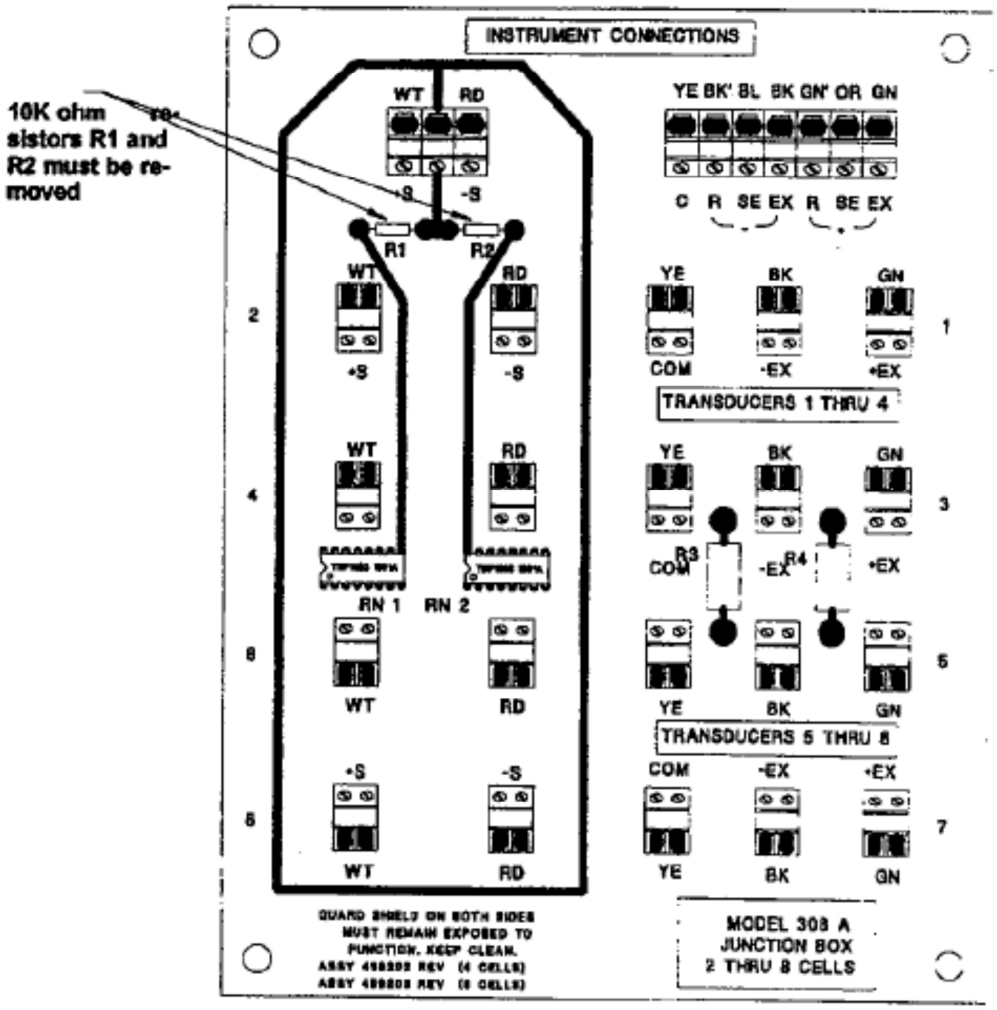


Figure 2-14. 308A Junction Box Modification.

2.3.11 Internal 306 Junction Board (Optional)

Units shipped in the optional NEMA 4/4X enclosure may be ordered with an internal summing junction board as shown in Figure 2-3 (NEMA 414x outline dimensions). If the 306 option board is installed, transducers connect directly to the junction board, within the enclosure, eliminating the need for an external junction box. Connect transducers as shown in Figure 2-15. Wiring between the 306 board and the LCm-200 transducer input is performed and tested at the factory.

2.3.12 Solid State Relay Outputs (Optional)

When installed, the solid state relay outputs parallel the standard open collector set point outputs. Solid state triac outputs operate at 12 to 240 VAC and handle loads of 50 mA to 1 amp. Operationally, they are identical to the open collector set point outputs defined in paragraph 2.3.7. Wire outputs in accordance with Figure 2-16.

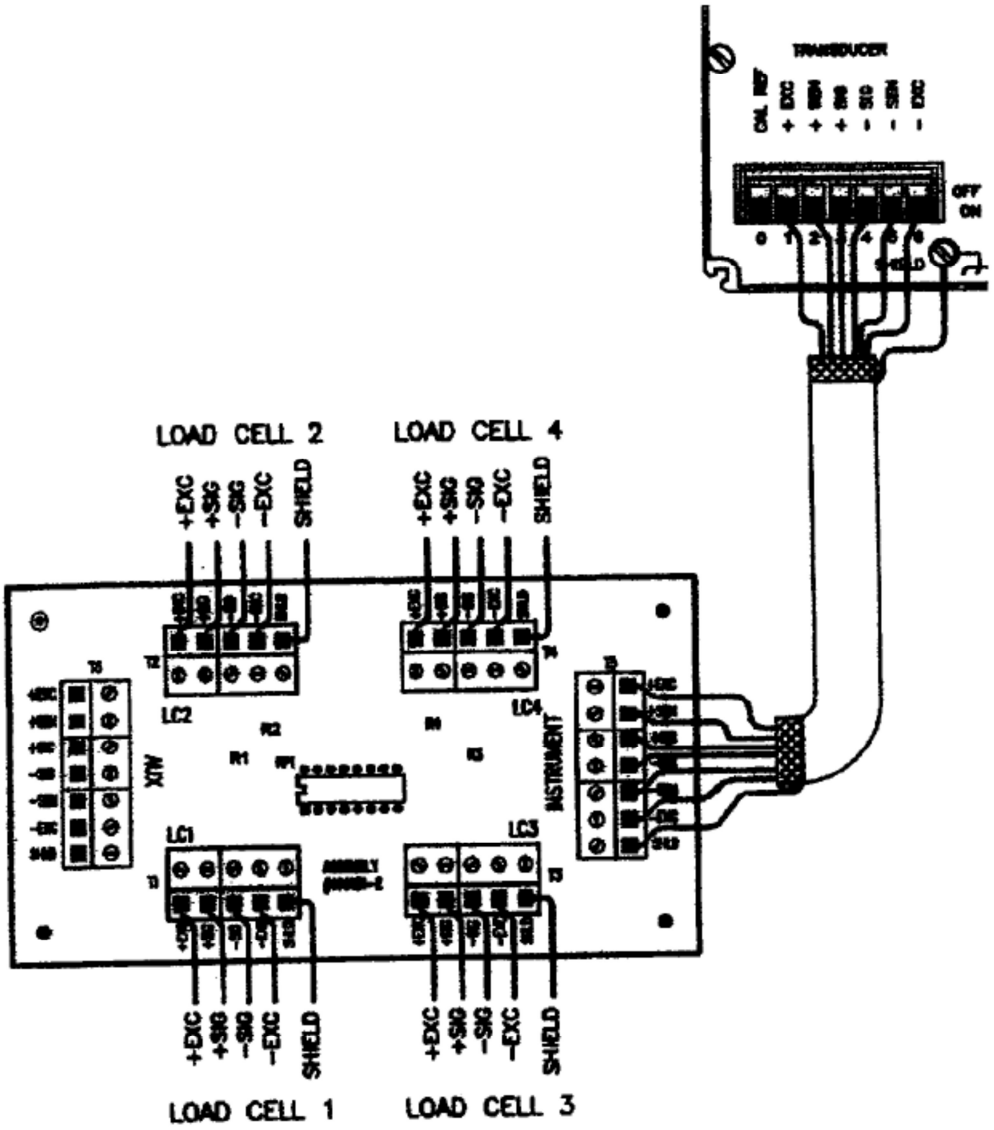
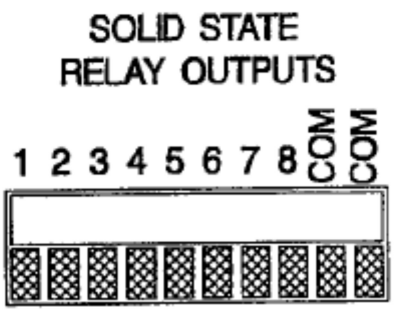
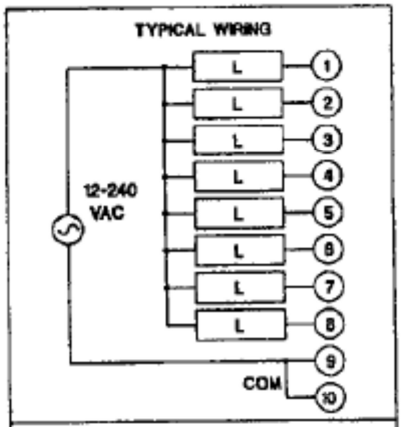


Figure 2-15. 306 Junction Board Transducer Connections.





SS RELAY OUTPUTS	
TYPE	TRIAC
OPERATING VOLTAGE	12-240 VAC
ON VOLTAGE	1.2 VRMS @ 1AMP
OFF STATE LEAKAGE	1ma @ 240 VAC
POWER	EXTERNAL POWER REQUIRED
MAX LOAD	1 AMP
MIN LOAD	50 ma
FREQ	20-500 HZ

Figure 2-16. Solid State Set Point Output Wiring.

SECTION 3. Calibration

3.1 INTRODUCTION

After installation, Calibration is the next step in preparing the LCm-200 for operation (see main menu diagram-Figure 1-3, page 1-2). Calibration is accomplished easily using the front panel display and eight configuration keys. Figure 3-1 (page 3-3) presents de-tails for set-up parameter entry and Figure 3-2 (page 3-4) shows procedures for each calibration type.

3.2 CALIBRATION PARAMETERS

Calibration firstly establishes scale operating parameters such as system capacity, decimal point location, display units, count by, etc. Follow the flow diagram presented in Figure 3-1 to alter these parameters. The second calibration phase presents the three calibration methods described in paragraph 3.3.

3.2.1 Instrument Sealing

To comply with legal-for-trade requirements (Sealing Electronic De-vices, Category 2), calibration parameter access is sealed. To change parameters, the seal must be 'opened' by pressing EDIT and then ENTER to increment the seal lock counter. Each time calibration parameters are altered, the seal lock counter is incremented by '1'. For seal counter inspection (view counter total), press the front panel CAL key at any time during normal operation. Exiting calibration menus automatically re-seals the LCm-200.

NOTE: Calibration parameters may be viewed without unsealing the instrument by pressing the down arrow key.

3.2.2 Display Units

Designate the desired display units as pounds, kilo-grams, ounces, grams, newtons, or kilonewtons. Selection also appears on printouts and other serial transactions.

3.2.3 Capacity

Enter the full scale system capacity value. (capacity is the rated load of the load cell(s) or platform - not simply live load or gross weight.) See Table 3-1 for legal-for-trade guidelines.

Table 3-1. Legal-for-Trade Classification Guide.

Class	Accuracy	Verification scale interval (e)		Number of verification scale intervals	
		International Units	Canadian Units	Min	Max
III	Medium	0.1g≤ e≤ 2g 5g≤ e	0.0002lb (0.005oz)≤ e≤ 0.005lb (0.1oz) 0.01lb (0.2oz)≤ e	100 500	10,000 10,000
IIIHD	Medium (high capacity devices)	2kg≤ e	5lb≤ e	2000	-

3.2.4 Decimal Point Location

Position the decimal point as desired for weight display and serial communication. If the decimal point is activated, all digits to the right of the decimal point also will be active. For Class III scales (10,000 count maximum), using the decimal point limits count by selection to 1, 2, or 5 (see paragraph 3.2.7).

3.2.5 Overload

System overload can be configured from0 to 102% of system capacity (102% legal-for trade maximum). If capacity is changed, overload should be changed accordingly, however, the LCm-200 will always limit overload to 102% of capacity.

3.2.6 Output

Enter the rated mV/V output of the system. (The electrical output at rated capacity independent of excitation) The rated output of multi-cell system is the average of the rated output of all the cells. For example: In a three cell system with load cell rated outputs of 2.01, 2.05, and 1.95 mV/V, the average rated output is 2.003 mV/V.

3.2.7 Front Panel Display Counts

Define the count value of each display increment by selecting 1, 2, 5, 10, 20, 50, or 100 (note that decimal selection still applies).

3.2.8 Parameter Downloading

Calibration parameters can be downloaded from a host device (through the serial port) only when the instrument seal is 'open'. Download is not configurable, it simply indicates that the system seal is open (YES) and ready for downloading or closed (NO) and downloading prohibited. The communicating device cannot open the seal remotely. The seal must be manually opened via the keypad in order to achieve 'YES' status for downloading. After downloading, the operator must manually exit (via the keypad) the calibration menu to re-seal the instrument and resume normal operation.

3.3 SYSTEM CALIBRATION

The LCm-200 offers three types of calibration; quick, deadload, and keypad. Both quick and keypad calibration use an internal mV/V reference within the LCm-200 to perform an electrical only type calibration. The deadload type calibration is a method that is used when known amounts of weight are applied to the vessel or scale to achieve calibration. Figure 3-2 provides flow diagrams for each calibration type.

For a more detailed discussion of the most appropriate calibration method refer to BLH Pub. FSD 001, 'An Overview of Calibration Methods and Procedures for Process and Inventory Weigh Systems'.

3.3.1 Quick Type Calibration

Quick calibration is the fastest and least complex method of calibration. Based upon entries of scale capacity and mV/V output, the LCm-200 will automatically establish a calibration. This method is generally suitable on any linear system that has minimal piping or other load shunting structures.

3.3.2 Deadload Calibration

Deadload calibration is potentially the most complex method but results in the highest system accuracy. Deadload calibration requires that known quantities of weight be added incrementally to the scale/vessel, preferably to full capacity. This method is preferred on systems that have attached pipes or other load shunting structures.

3.3.3 Keypad Calibration

The LCm-200 is factory calibrated as a very precise mV/V measurement device. The keypad calibration method establishes a relationship between force and mV/V, resulting in a very accurate electrical type of calibration. Keypad calibration requires a calibration sheet (Figure 3-3, page 3-4) for each weigh system load cell. The cal. sheet presents the load cell mV/V output reading for either 3 or 10 known weight/force values. Sheets also include a zero balance (no load) mV/V reading. The keypad calibration method allows for the entry for the keypad entry of up to 10 points. On multi-cell systems, each point is an average of all the load cells at that specific capacity. This method is applicable on systems with minimal piping or other load shunting structures and can be used to correct for load cell non-linearities.

NOTE: Whenever new calibration parameters are entered using the keypad, the LCm-200 tare value is set to zero ('0').

Enter/Alter Calibration Parameters

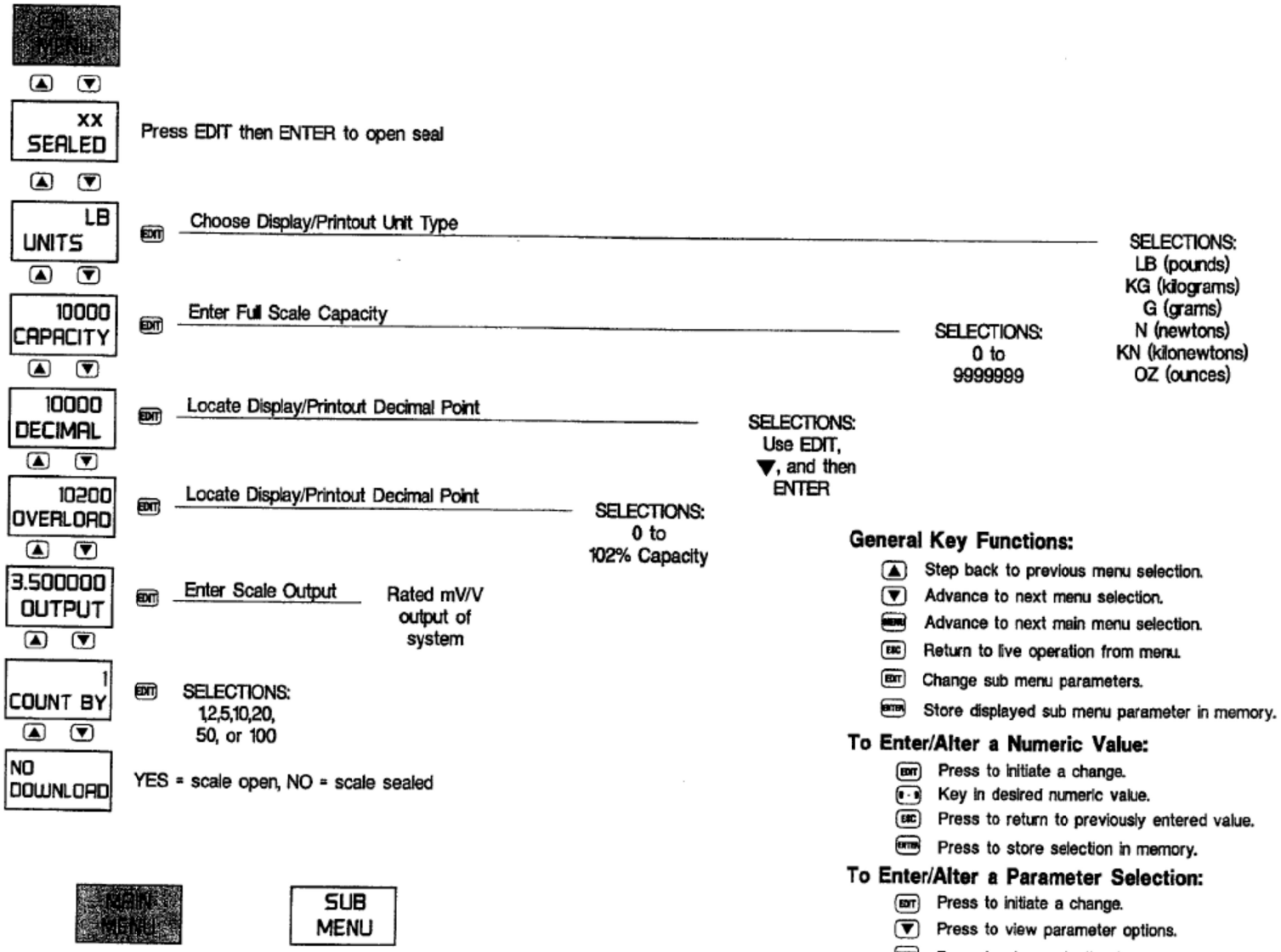


Figure 3-1. Setup Parameter Entry.

Calibration Type - Flow Diagrams

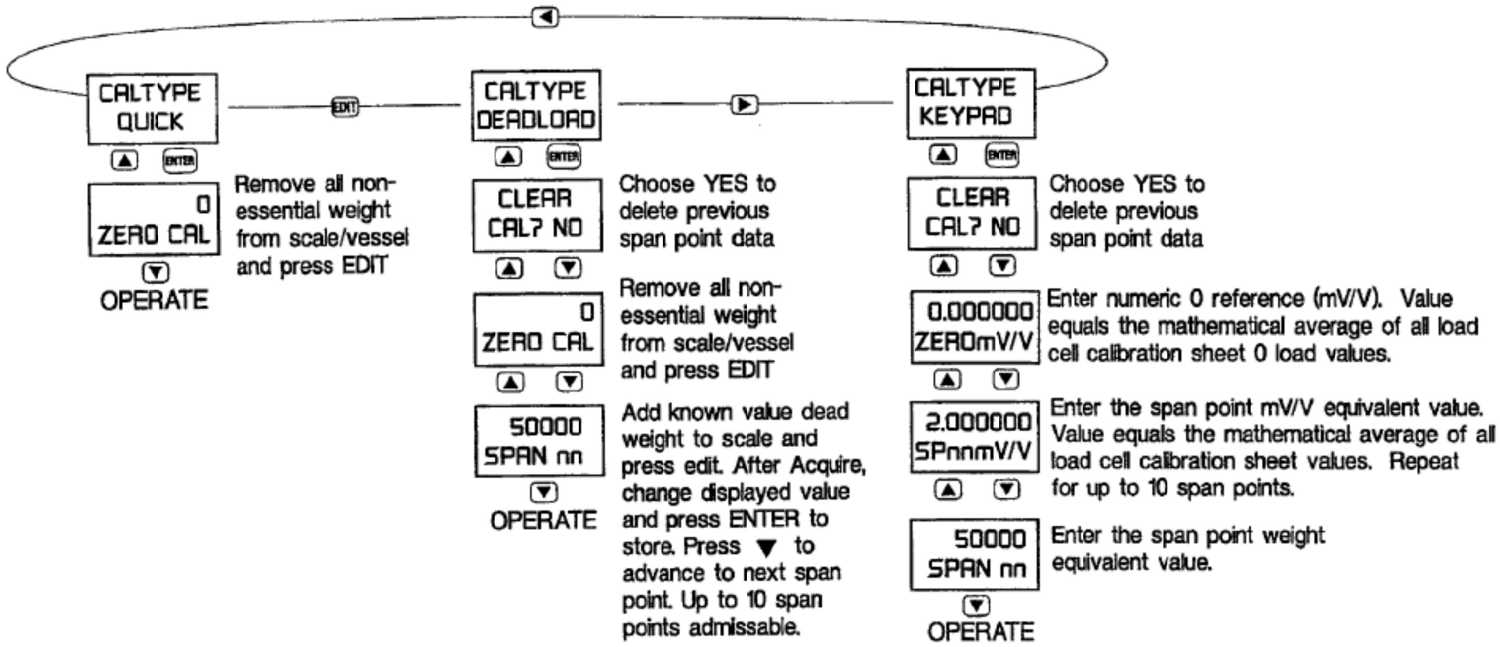


Figure 3-2.Calibration Types and Parameters.

General Key Functions:

- ▲ Step back to previous menu selection.
- ▼ Advance to next menu selection.
- MENU Advance to next main menu selection.
- ESC Return to live operation from menu.
- EDIT Change sub menu parameters.
- ENTER Store displayed sub menu parameter in memory.

MAIN MENU

SUB MENU

To Enter/Alter a Numeric Value:

- EDIT Press to initiate a change.
- 0 - 9 Key in desired numeric value.
- ESC Press to return to previously entered value.
- ENTER Press to store selection in memory.

To Enter/Alter a Parameter Selection:

- EDIT Press to initiate a change.
- ▼ Press to view parameter options.
- ENTER Press to store selection in memory.

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Calibration Chart

Customer:	ABC Co.			**P.O :**	28523004D
Capacity	50000 lb	**Type**	C2P1	**Serial No.**	71258
Mode	Tension	**Bridge**	A	**Test Report No.**	C37-8500
Indicator	N.A.	**Serial No.**	N.A.		
Date Of Calibration	4/45/98			**Temperature :**	70 F
Calibrated By:	M. Houston			**Humidity :**	58 %

Applied Load lbf	Response Run 1 mv/V	Response Run 2 mv/V	Response Run 3 mv/V
0	0.0000	0.0000	0.0000
5,000	0.2000	0.2000	0.2000
10,000	0.4001	0.4001	0.4001
15,000	0.6001	0.6001	0.6001
20,000	0.8002	0.8002	0.8002
25,000	1.0003	1.0003	1.0003
30,000	1.2003	1.2003	1.2003
35,000	1.4003	1.4003	1.4003
40,000	1.6003	1.6003	1.6003
45,000	1.8003	1.8003	1.8003
50,000	2.0003	2.0003	2.0003
25,000	1.0000	1.0000	1.0000
0	0.0000	0.0000	0.0000

Applied Load [lb]	Output Average lb	Ideal Output lb	Output Error lb	Output Error % FS	Hysteresis Error % FS
0	0.0000	0.0000	0.0000	.000%	
5,000	0.2000	0.2000	0.0000	-.001%	
10,000	0.4001	0.4001	0.0000	.002%	
15,000	0.6001	0.6001	0.0000	.000%	
20,000	0.8002	0.8001	0.0001	.004%	
25,000	1.0003	1.0002	0.0001	.007%	
30,000	1.2003	1.2002	0.0001	.006%	
35,000	1.4003	1.4002	0.0001	.004%	
40,000	1.6003	1.6002	0.0001	.003%	
45,000	1.8003	1.8003	0.0000	.001%	
50,000	2.0003	2.0003	0.0000	.000%	
25,000	1.0000	1.0002	-0.0002	-.007%	-.015%
0	0.0000	0.0000	0.0000	.000%	.000%

Q. C. Manager 4/21/98

Figure 3-3. Sample Load Cell Calibration Certificate.

SECTION 4. Set-Up

4.1 GENERAL

Setup follows calibration. Parameters entered in this section include filter, motion, zero tracking, auto tare, and auto zero. Like calibration, LCm-200 setup parameters are sealed to comply with legal-for-trade requirements. Use the flow diagram provided in Figure 4-1 to enter/alter all setup parameters.

4.2 PARAMETER SEALING

To comply with legal-for-trade requirements (Sealing Electronic Devices, Category 2), setup parameter access is sealed. To change parameters, the seal must be 'opened' by pressing EDIT and then ENTER to increment the seal lock counter. Each time setup parameters are altered, the seal lock counter is incremented by '1'. For seal lock counter inspection (view counter total), press the front panel SETUP COUNTER key at any time during normal operation. Exiting the setup menu automatically re-seals the LCm-200.

NOTE: Setup parameters may be viewed without un-sealing the instrument by pressing the down arrow key.

4.3 DYNAMIC DIGITAL FILTERING

The LCM-200 uses a two stage digital filter. Each stage requires parameter entries as shown in Figure 4-1 (next page). Make parameter entries while viewing live weight value on the front panel display.

4.3.1 Digital Averaging

The filter first stage calculates a running average of weight input readings. Available selections are 1, 2, 4, 8, 16, 32, 64, and 128 conversions (see Figure 4-1). Using a 'first in - first out' algorithm, running averaging provides display updates every 50 msec regardless of the number of readings averaged. However, since each conversion averaged adds 50 msec to the filter length, the larger the averaging selection, the longer the filter length becomes. Table 4-1 shows the time relationship between conversions averaged and filter length.

Table 4-1. Averaging Selections and Filter Length

Average	Response
1	0.05 sec
2	0.10 sec
4	0.20 sec
8	0.40 sec
16	0.80 sec
32	1.60 sec
64	3.20 sec
128	6.40 sec

4.3.2 Band Selection

The second stage of the filter, BAND, is applied after averaging is selected. A BAND value between 0 and 100 must be entered as shown in Figure 4-1. Dynamic Digital Filtering constantly compares the amount of input signal change between consecutive conversions. If the difference falls within the BAND setting, a mathematical filter attenuates the conversion to conversion variation. Once the difference between conversions exceeds the BAND selection, the BAND filter is canceled and the display tracks live weight with maximum response. To achieve the best overall filter response, keep the BAND selection as low as possible without hindering system performance (see next paragraph for set-up instructions). If the BAND setting is higher than necessary, sensitivity to small weight changes will be reduced.

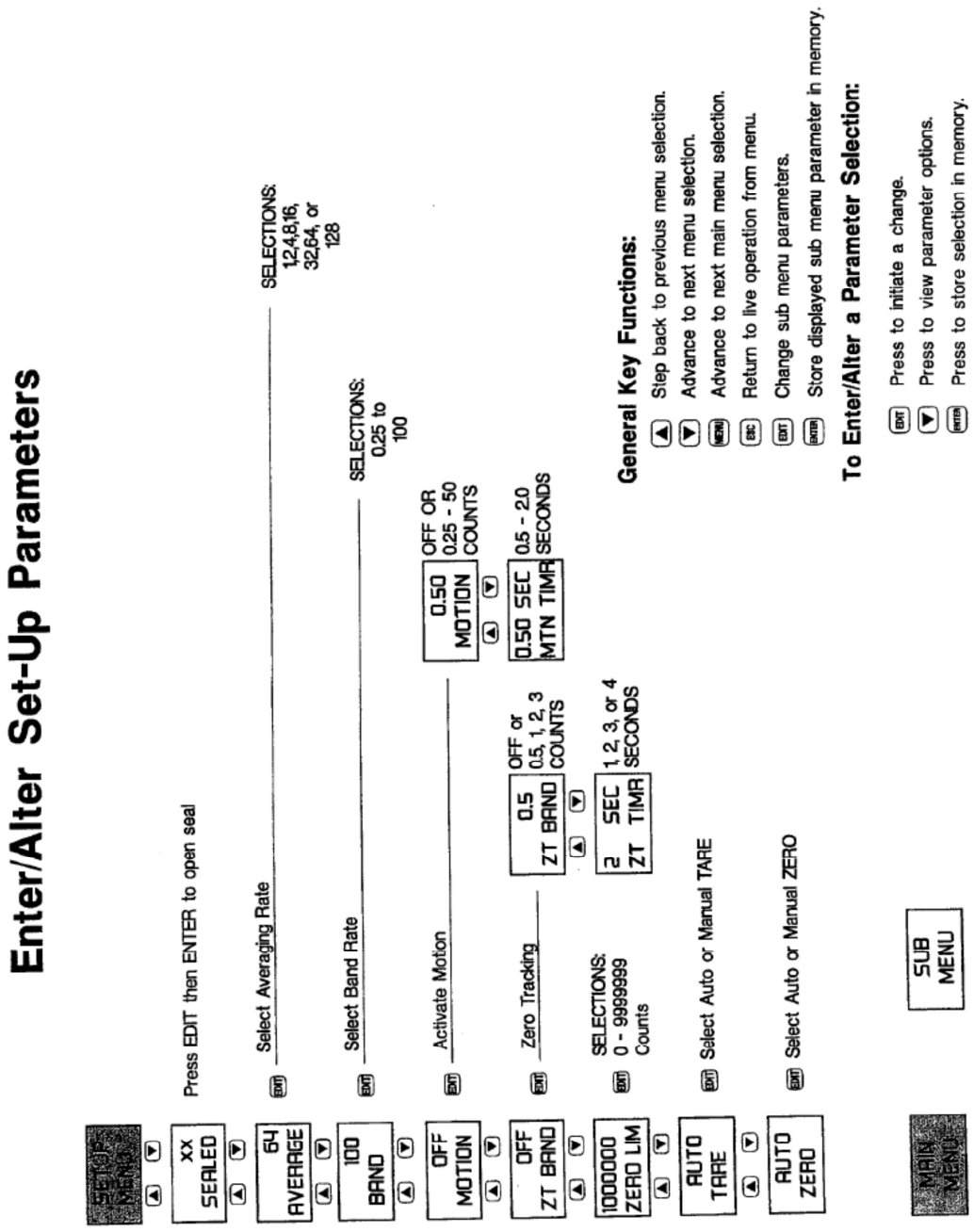


Figure 4-1. Dynamic Digital Filter Parameter Entry.

4.3.3 Filter Set-Up Procedures

Setting filter parameters requires a balance between achieving maximum noise reduction and maintaining quick response and good sensitivity to real weight changes. The goal of filter set-up is to use the lowest averaging and BAND selections needed for smooth system display/operation. If selections are higher than necessary, accurate detection of small weight changes may be hindered. Using the six steps presented in Table 4-2, tune the system to its maximum performance level.

Table 4-2. Dynamic Digital Filter Set-Up Procedures

1. Begin with the BAND set at a low value (approx. 4-10).
2. Increase averaging until the noise (watch display) is reduced to the least significant digit (approx. +/- 10 divisions).
3. Increase BAND, if necessary, to reduce the remaining noise to the desired level.
4. If increasing the BAND value does not re-duce the noise, return to averaging and select the next higher setting, then repeat step three.
5. If the BAND value required to quiet the display becomes large (65-100), it may be better to use more averaging. Try to achieve the best balance between BAND (small weight change sensitivity reduction) and averaging (longer response time).

4.4 SYSTEM MOTION DETECTION

Motion determines how many counts must be exceeded before the 'in motion' alarm annunciator is activated. The motion timer determines how long the motion alarm remains activated after the motion condition is cleared. Legal-for-trade requirements stipulate that the motion timer be set to 1 count or less for capacities up to 2000 kg (5000 lb) and 3 counts or less for capacities over 2000 kg (5000 lb).

4.5 ZERO TRACK OPERATION

When selected (selection other than OFF), zero tracking functions automatically (on gross weight) in both gross and net modes of operation. Zero tracking maintains a scale reference zero point in applications where small amounts of residual build-up are expected to accumulate upon the scale/vessel during normal operation. For example, a scale located out-of-doors on a snowy day will slowly accumulate the residual weight of the snow. Zero tracking is designed to automatically 'zero out' the slowly accumulating weight of the snow without operator intervention. Note that the zero track range is limited to 2% of the scale capacity (legal-for-trade). Once accumulated material reaches a weight value greater than 2% of scale capacity, zero tracking will cease to function. For applications where weight build-up may be detrimental to the weigh vessel or process, zero track should be turned off.

Since zero tracking is a function of time as well as weight, both a count and timer value must be entered according to Figure 4-1.

Select a zero track band of 0.5 (112 count) to comply with legal-for-trade requirements.

4.6 ZERO LIMIT

The value entered for zero will limit the range of the front panel zero key (2% maximum allowed legal-for-trade). If the zero limit is exceeded, a front panel display of ZERO LIMIT flashes to alert the system operator.

4.7 TARE and ZERO SELECTIONS

Choose automatic (AUTO) or MANUAL tare (net weight) and zero (gross weight) functions. When AUTO is selected, tare or zero transpires by pressing the front panel ZERO or TARE key. If MANUAL is selected, a value from 0 to 9,999,999 must be entered after pressing the front panel TARE or ZERO key.

Note that tare and zero only apply to positive values. The LCm-200 cannot tare or zero if gross weight is negative. Zero also is restricted to the zero limit value entered in the preceding paragraph. Zero will not function if the zero limit has been exceeded.

NOTE: Attempting to tare when gross weight value is negative results in the tare value being set to zero ('0').

SECTION 5. Front Panel Display Functions

5.1 FRONT PANEL FUNCTIONS

The front panel display of the LCm-200 (Figure 5-1) includes a two line alpha numeric digital display for weight and status information as well as horizontal and vertical bar graphs and diagnostic alarm annunciators. The bar graphs and alarm annunciators can be configured to display various information. Use the display menu flow diagram (Figure 5-2) to configure the front panel functions for desired system operation.

5.1.1 Horizontal Bar Graph

The horizontal bar graph is typically used to monitor the overall gross weight contents of the scale vessel. Vacuum fluorescent segments located under the 0 to 100% bar graph give instant visual reference to system capacity. Select ON to use; OFF for no function. Choose net or gross weight tracking and then enter the starting and ending weight values. Note that this indicator also can be configured for reverse polarity depending upon the starting and ending values.

5.1.2 Alarm Status Annunciators

Eight front panel alarm/status annunciators provide ongoing system diagnostic information. Each annunciator can be configured to represent 1 of 16 conditions; OFF (no function), system in motion, zero limit exceeded, overload limit exceeded, serial communication receive, serial communication transmit, serial communication parity error, serial framing error, analog output fault, analog output over high selection, analog output under low selection, Allen-Bradley Remote I/O (option) status, modem receive active, modem transmit active, set point active, or Modbus Plus status. Once configured as A1-A8, vacuum fluorescent segments will be illuminated when configured condition is true. Configure each annunciator consecutively as shown in Figure 5-2.

5.1.3 Units Indication

Pounds, kilograms, and grams are displayed using vacuum fluorescent segments on the right edge of the display panel. (Figure 5-1, units). Tons, newtons, and ounces are appear as the two, right-hand digits of the lower display.

5.1.4 Center Zero Indication

The center zero indicator will be illuminated whenever the LCm-200 is within 1/4 display count (display counts are derived from a range of instrument internal counts) of true zero.

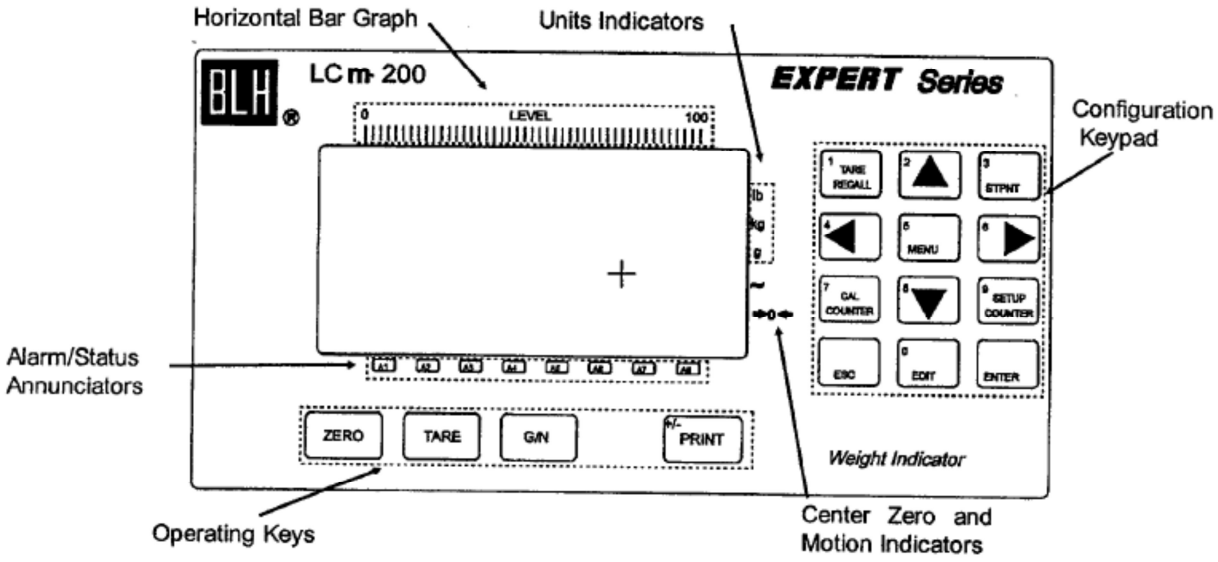
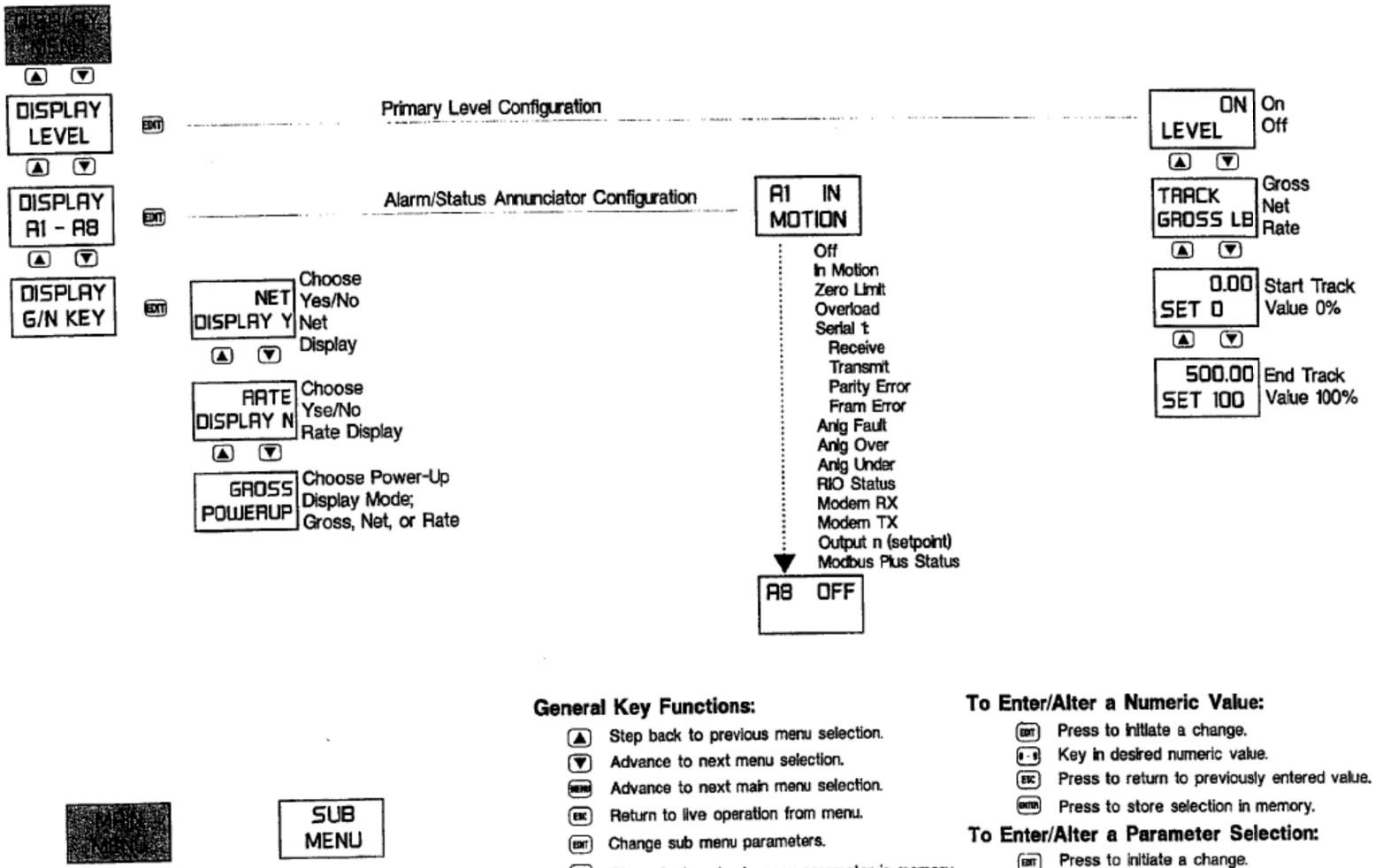


Figure 5-1. LCm-200 Functional Front Panel.

Display Menu Flow Diagram



General Key Functions:

- ▲ Step back to previous menu selection.
- ▼ Advance to next menu selection.
- MENU Advance to next main menu selection.
- ESC Return to live operation from menu.
- EDIT Change sub menu parameters.
- ENTER Store displayed sub menu parameter in memory.

To Enter/Alter a Numeric Value:

- EDIT Press to initiate a change.
- 0 - 9 Key in desired numeric value.
- ESC Press to return to previously entered value.
- ENTER Press to store selection in memory.

To Enter/Alter a Parameter Selection:

- EDIT Press to initiate a change.
- ▼ Press to view parameter options.
- ENTER Press to store selection in memory.

Figure 5-2. Front Panel Functions, Configuration Menu.

In accordance with legal for trade specifications, zero indication is relative to the selected front panel display count (count-by) range (paragraph 32.7). If count-bys equal 1, 2, or 5, then zero is displayed as '0'. If count-bys equal 10, 20, or 50, then zero is displayed as '00'. If count-bys are set for 100, then zero will be displayed as '000'.

When a decimal point is selected, all digits to the right of the decimal point also will be displayed and active (see paragraph 3.2.4 on page 3-1).

5.1.5 In Motion

In-Motion conditions are displayed by the front panel — indicator (see paragraph 4.4).

5.1.6 Configuring the Gross/Net (G/N) Key

With the addition of rate-by-weight processing to LCm-200 units, the GIN key actually toggles between Gross, Net, and Rate. Rate and/or Net can be removed from this toggle sequence by selecting 'NO' in the DISPLAY GIN KEY menu.

Power-up selection determines which mode (gross, net, or rate) the unit displays upon power-up. This selection applies to all communication outputs as well as the front panel display.

NOTE: Units always power-up in the selected mode, regardless of what mode they were powered-down in.

5.2 VIEW mV/V SIGNAL

Pressing the right arrow configuration key during live operation results in a display of the current mV/V input signal. This function is useful for diagnosing electrical drift/malfunction errors. Recording mV/V signals during calibration procedures provides check-cal or re-calibration test points.

Pressing the left arrow configuration key during live operation results in a display of the current live mV/V input signal (dead weight signal subtracted).

5.3 QUICK-VIEW KEYS

Three Configuration Keypad keys (Figure 5-1) accommodate quick viewing of seal and tare values. Press the CAL COUNTER key to view the current calibration seal counter value. Press the SETUP COUNTER key to view the current set-up parameter seal counter value. The TARE RE¬CALL key displays the stored tare value.

SECTION 6. Analog Output, Serial Communication, and Set Points

6.1 ANALOG OUTPUT CONFIGURATION (Optional)

6.1.1 Output Definition

LCm-200 indicators provide a high resolution analog current output representing either gross or net weight for driving external process equipment/recorders. Use rear panel switch 1 positions 7 and 8 (Figure 2-8) to select either 4-20, 0-20, or 0-24 mA operation (note load resistance reduction with 0-24 mA). This output is based upon a 16 bit digital to analog (D-A) conversion which represents up to one part in 65536 of analog precision. The scaling of the output is accomplished after the LCm-200 is calibrated and can be ranged for any portion of the gross or net weight out-put curve.

Systems using the analog output for level control usually configure the output to track gross weight (live product weight). Batch control systems that use weight as a variable to determine set point cutoffs can be configured to operate in the net weighing mode while using a discrete remote input to activate the tare function.

6.1.2 Set-Up Procedure

Connect a current meter to the rear panel analog out-put points (see Figure 2-8 for +, - designations) and proceed with ANALOG I/O configuration as shown in Figure 6-1 (page 6-3).

6.2 SERIAL COMMUNICATION

LCm-200 units come with a versatile, bi-directional, serial communication port. Electronically, this port can be configured for RS-422 multi-drop (loop), RS-422 full duplex (point-to-point, transmit/receive), or RS-485 half duplex (point-to-point, transmit then receive) operation. Selection is made via rear panel DIP switch positions 1-4 (see Figure 2-9).

After selecting the electrical interface, the port operating parameters must be entered using the flow diagram presented in Figure 6-1. Figure 6-2 (page 6- 4) provides a full description of each (serial communication) parameter block depicted in Figure 6- 1. Note that certain parameter entries are dependent upon the print format selection (accessed by pressing edit when SERIAL I/O is displayed). Standard LCm¬200 indicators offer 3 formats; PRINT for output to a printer, CON'T (continuous) for constant output to a data logger, PLC, etc., and PC for full duplex interfacing with a more sophisticated host device. Modbus, Fisher ProVox, and Allen-Bradley Remote I/O options will be discussed in Section XI.

6.2.1 Transmit Only Output Formats (ASCII) Both the PRINT and

CON'T ASCII output formats are transmit only. Figure 6-1 presents all the options available for the print-out string. Selecting YES includes data in the print string and NO excludes data from the printout. To comply with legal-for-trade regulations, GROSS¬NET-TARE, leading zeros, and expanded units are always included in the printout. Status does not print out in PRINT or CON'T modes. Output transmissions are canceled if motion, overload, and ND converter fault conditions are detected. The PRINT format is designed -for use in conjunction with the front panel PRINT/COM key. Table 6-1 shows the printer output format used for each transmitted data string.

The CON'T output string is defined in Table 6-2 (page 6-2). Continuous output transmissions occur at the time rate configure in Figure 6-1. Continuous outputs 'feed' weight data, status, and address information to a remote data logger or PLC type device without operator intervention.

Table 6-1. Printer Output Transmission String

Print string: sbdadr/data/units/status/sp/crlf

Defined:

stx.... start of text character, hex 02
adr.... address, 3 ASCII chars: first two are '01'-'99' followed by an ASCII space
data weigh data 8 characters: 7 digits with decimal point or leading space; if msd is an ASCII minus'-', the data is negative
expanded units (default)ten characters; first three characters are a space plus a two character units abbreviation 'lb', kg',' tn',' oz', or' gm' for pounds, kilograms, tons, ounces, or grams. The last seven characters are a space plus the data type spelled out with added spaces' GROSS ', ' NET ', ' ZERO ', or ' TARE '.
space ASCII space, hex 20
CRLF carriage return linefeed two characters 0DH 0AH
Bits per Character = 1 start, 1even parity, 7 data, 1 stop

Table 6-2. Continuous Output String Format

Print string: sbdadr/data/units/status/sp/crlf

Defined:

stx.... start of text character, hex 02
adr.... address, 3 ASCII chars: first two are '01'-'99' followed by an ASCII space
data weigh data 8 characters: 7 digits with decimal point or leading space; if msd is an ASCII minus'-', the data is negative
expanded units (default)ten characters; first three characters are a space plus a two character units abbreviation 'lb', kg',' tn',' oz', or' gm' for pounds, kilograms, tons, ounces, or grams. The last seven characters are a space plus the data type spelled out with added spaces' GROSS ', ' NET ', ' ZERO ', or ' TARE '.
space ASCII space, hex 20
CRLF carriage return linefeed two characters 0DH 0AH
Bits per Character = 1 start, 1even parity, 7 data, 1 stop

Output string formats can be modified to accommodate custom interface requirements (Figure 6-1). Leading zeros can be replaced with ASCII spaces. SD< (start of text), address, and instrument status can be omitted by selecting 'NO'. Units can be expanded or abbreviated in the print format and dropped altogether from the continuous format. Line feed can be deleted from the CRLF output or both characters can be replaced by an ASCII space. Figure 6-2 provides definitions for each parameter to assist in formatting custom output strings.

6.2.2 Full/Half Duplex Bi-Directional Interface

If PC output format is selected, units are capable of transmitting and receiving ASCII data strings. Table 6- 3 (page 6-5) presents digit for digit data and syntax information for this interface.

Basically, the LCm-200 has 92 internal (EEPROM) registers which store all calibration, configuration, operation, and live weight data parameters. The PC format allows data in these registers to be read or rewritten. By re-writing calibration span points (keypad type calibration) and operating parameters, the LCm¬200 can be quickly and completely re-configured by a remote host device.

Several additional tables are provided to explain PC interfacing. Table 6-4 (page 6-7) provides examples of EEPROM reading/writing, and error code exchanges. Table 6-5 (page 6-8) demonstrates live weight transactions. Table 6-6 (page 6-10) gives set point communication formats and examples.

6.2.3 Modbus RTU Protocol (Optional)

Refer to Section XI for details concerning optional Modbus RTU protocol formatting.

6.2.4 Modbus Plus Protocol (Optional)

Refer to Section XI for details concerning optional Modbus Plus protocol formatting.

6.2.5 Fisher Rosemount - Provox Protocol (Optional)

Refer to Section 11 for details concerning optional Provox protocol formatting.

6.2.6 Allen-Bradley Remote I/O (Optional)

The Allen-Bradley Remote I/O interface is fully defined in BLH technical manual # TM020. LCm-200/R10 wiring is defined in Section II, paragraph 2.3.8 of this manual.

6.3 SETPOINT CONFIGURATION

LCm-200 controllers provide eight outputs for set point operation. Standard units offer open collector/TTL signals at the rear panel connector. Optionally, triac based analog outputs may be ordered. In either case, the output signals are identical, based upon configuration selections presented in Figure 6-1. Following the flow diagram to select main or dribble function for each output used. Also, select the polarity (valve 'ON' above or below set point) and a tag description (name) for each set point.

6.3.1 Main Function

Main corresponds to a fast (coarse) or high speed in-put. To avoid overfilling in fast mode, enter an inflight value which corresponds to ingredient weight that will fall into the process vessel after valve closure. To make sure the valve does not reopen, enter a dead-band (hysteresis) value. After vessel motion ceases, the LCm-200 checks vessel weight against the main set point value (entered via the front panel STPNT key). If vessel weight is less than the set point value minus the total inflight and deadband values, the LCm-200 will signal the valve to reopen, otherwise the main set-point is complete.

6.3.2 Dribble Function

Many high resolution process systems have two speeds (or two valves) for ingredient filling. Dribble represents the slow, (fine) precision, fill mode. Select a value that allows ample time for the system to switch from main to dribble (dribble value is subtracted from the main value) and achieve a highly accurate final fill.

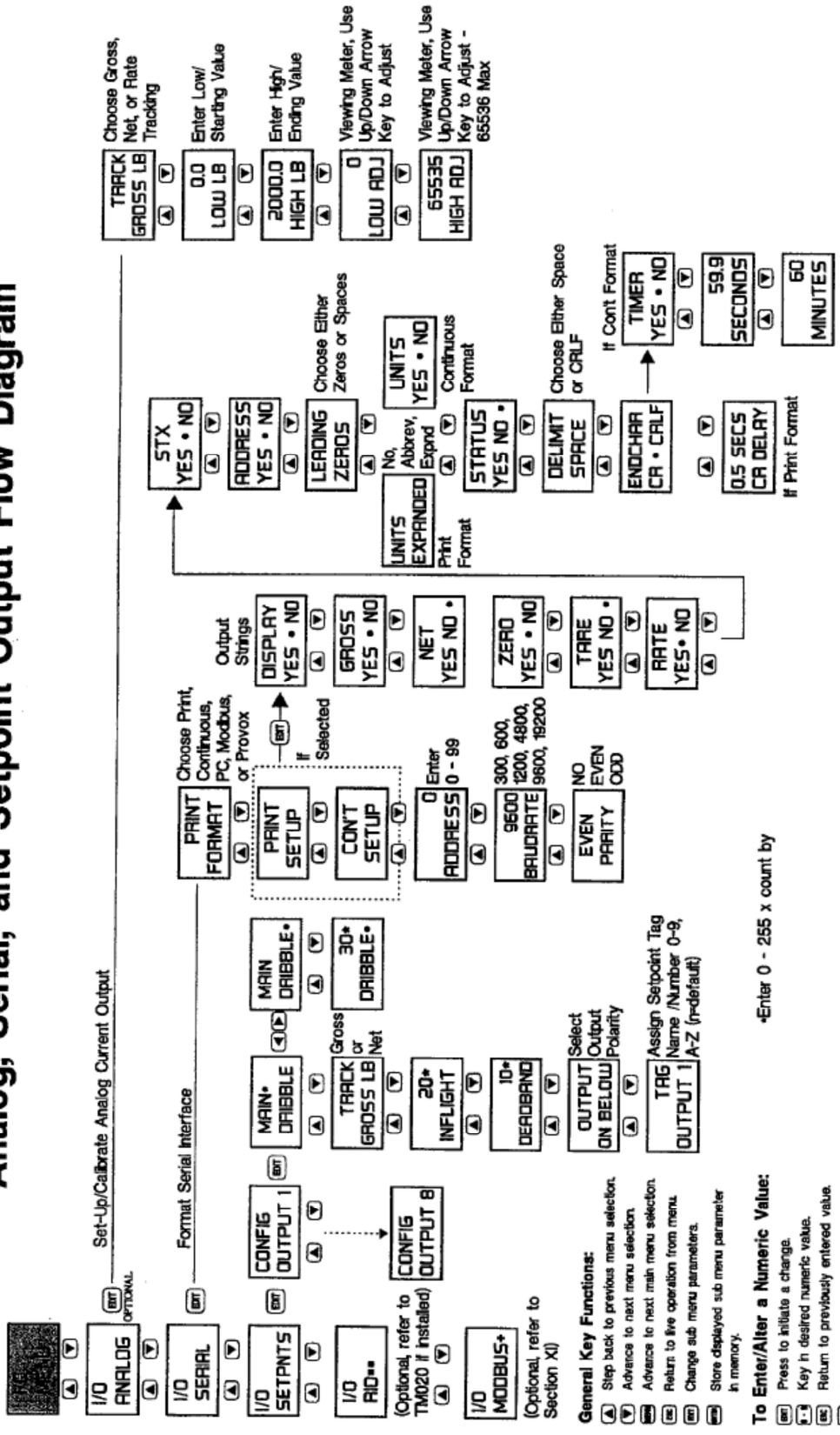


Figure 6-1. Analog and Serial Communication Menu.

Serial Output Flow Diagram Block Explanations

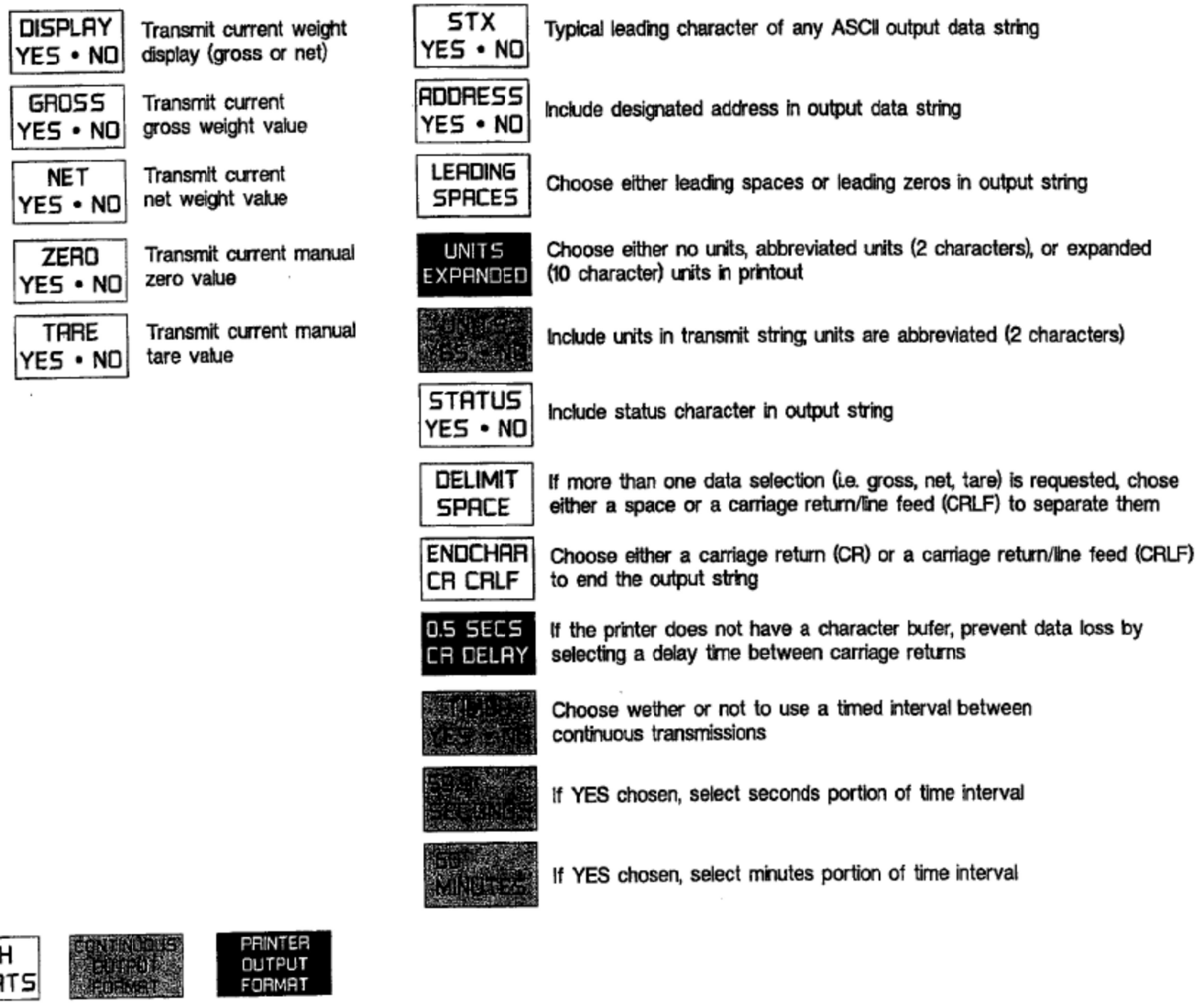


Figure 6-2. Parameter Definitions.

Table 6-3. Bi-Directional PC Interface Register Assignments

Note - This is an ASCII interface. Requesting data from the LCm-200 is done mainly by sending a 3 character command followed by a carriage return (0DH). These 3 character commands are listed under CODE in the following chart. The LCm-200's response to these commands is listed under RESPONSE. The response data is followed by a carriage return line feed (0DH,0AH).
There are also ways of stringing the commands together as shown in examples immediately following this chart.

Note - < 00000000> represents weight data: # of zeros = number of digits. If there is a decimal point there will be one less digit. If the number is negative the most significant digit will be an ASCII minus '-' i.e. -500 will be '-< 00000000> 0500', -0.5 will be '-< 00000000> 00.5' is numeric data,< x.xxxxxx> is mV/V data; if negative leading x = '-'.

Note - To download parameters, the seal must be open (see paragraph 3.2.8)

CODE	DEFINITION	RESPONSE	EXPLANATION
00;	A/D REV	00< 1A>	1-9 = A/D TYPE, A-Z = REV
01;	SERIAL #	01< 1234567>	1 = YEAR, 2-3 = WEEK, 4-7 = instrument number
02;	REF DATE	02< MMDDYY>	Month Day Year of mV/V cal
03;	mV/V ZERO CAL	03< x.xxxxxx>	instrument mV/V zero cal point
04;	mV/V SPAN CAL	04< x.xxxxxx>	instrument mV/V span cal point
05;	ZERO mV/V	05< x.xxxxxx>	zero in mV/V
06;	SPAN1 mV/V	06< x.xxxxxx>	span1 in mV/V
07;	SPAN1 units	07< 00000000>	span1 in units
08;	SPAN2 mV/V	08< x.xxxxxx>	span2 in mV/V
09;	SPAN2 units	09< 00000000>	span2 in units
10;	SPAN3 mV/V	10< x.xxxxxx>	span3 in mV/V
11;	SPAN3 units	11< 00000000>	span3 in units
12;	SPAN4 mV/V	12< x.xxxxxx>	span4 in mV/V
13;	SPAN4 units	13< 00000000>	span4 in units
14;	SPAN5 mV/V	14< x.xxxxxx>	span5 in mV/V
15;	SPAN5 units	15< 00000000>	span5 in units
16;	SPAN6 mV/V	16< x.xxxxxx>	span6 in mV/V
17;	SPAN6 units	17< 00000000>	span6 in units
18;	SPAN7 mV/V	18< x.xxxxxx>	span7 in mV/V
19;	SPAN7 units	19< 00000000>	span7 in units
20;	SPAN8 mV/V	20< x.xxxxxx>	span8 in mV/V
21;	SPAN8 units	21< 00000000>	span8 in units
22;	SPAN9 mV/V	22< x.xxxxxx>	span9 in mV/V
23;	SPAN9 units	23< 00000000>	span9 in units
24;	SPAN10 mV/V	24< x.xxxxxx>	span10 in mV/V
25;	SPAN10 units	25< 00000000>	span10 in units
26;	# of SPAN POINTS	26< xx>	00 - 10
27;	CAL TYPE	27< x>	0 = QUICK, 1 = DEADLOAD, 2 = KEYPAD
28;	ENG UNITS	28< x>	0 = LB, 1 = KG, 2 = TN, 3 = OZ, 4 = GM
29;	CAPACITY	29< 00000000>	sum of rated capacity of load cells
30;	DECIMAL POINT	30< x>	0 - 6 decimal point position 0 = none, 3 = 0.000
31;	RATED OUTPUT mV/V	31< x.xxxxxx>	average of load cells rated output in mV/V
32;	UNIT COUNT BY	32< x>	0 - 6 = 1,2,5,10,20,50,100
33;	ZERO LIMIT	33< 00000000>	keypad push to zero limit from cal zero, 0 = no limit
34;	OVERLOAD	34< 00000000>	overload limit, 0 = no limit
35;	LEVEL CONFIG	35 < x>	level bar graph configuration 0 = off/gross, 1 = on/gross 2 = off/net 3 = on/net 4 = off/rate 5 = on rate
36;	LEVEL 0%	36< 00000000>	level 0% setting
37;	LEVEL 100%	37< 00000000>	level 100% setting
38;	ARROWS CONFIG	38< x>	side arrows configuration 0 = off/gross, 1 = on/gross 2 = off/net 3 = on/net 4 = off/rate 5 = on/rate
39;	ARROWS 0%	39< 00000000>	arrows 0% setting
40;	ARROWS 100%	40< 00000000>	arrows 100% setting
41;	A1 ANNUNCIATOR	41< xx>	0-13: 0 = off 1 = in motion 2 = zero lim 3 = overload 4 = ser1 rx 5 = ser1 tx 6 = ser1 par err 7 = ser1 fram err 8 = analog fault 9 = analog over 10 = analog under 11 = rio status 12 = modem rx 13 = modem tx
42;	A2 ANNUNCIATOR	42< xx>	
43;	A3 ANNUNCIATOR	43< xx>	
44;	A4 ANNUNCIATOR	44< xx>	
45;	A5 ANNUNCIATOR	45< xx>	
46;	A6 ANNUNCIATOR	46< xx>	
47;	A7 ANNUNCIATOR	47< xx>	
48;	A8 ANNUNCIATOR	48< xx>	
49;	ZERO KEY CONFIG	49< x>	0 = auto, 1 = manual
50;	TARE KEY CONFIG	50< x>	0 = auto, 1 = manual
51;	ANALOG CONFIG	51< x>	0 = gross, 1 = net, ~~2 = rate~~
52;	ANALOG LOW	52< 00000000>	low output weight setting
53;	ANALOG HIGH	53< 00000000>	high output weight setting
54;	ANALOG LOW ADJUST	54< xxxxx>	low analog output adjustment
55;	ANALOG HIGH ADJUST	55< xxxxx>	high analog output adjustment
56;	MANUAL ZERO	56< 00000000>	manual zero

Table 6-3. con't.

57;	MANUAL TARE	57< 00000000>	manual tare
58;	FILTER AVERAGING	58< x>	0 - 7 = 1,2,4,8,16,32,64,128
59;	FILTER BAND	59< xxxx>	0, 0.25 - 2.50, 3 - 100
60;	MOTION	60< xxxx>	0, 0.25 - 2.50, 3 - 50
61;	MOTION TIMER	61< x>	0 - 3 = 0.5, 1.0, 1.5, 2.0
62;	SECURITY LOCK	62,X	0 = off, 1 = on
63;	PASSWORD	63< AAAAAAA >	security password 1-0,'-',' ',A-Z
64;	MENU LOCKS	64< xxxxx>	0 = off, 1 = on; msd - lsd = rate,diag,i/o,display,filter,cal
65;	KEY LOCKS	65 < xxxxx>	0 = off, 1 = on; msd - lsd = edit,print,g/n,tare, zero
66;	SERIAL 1 FORMAT	66< x>	0 = print, 1 = continuous, 2 = pc, 3 = Modbus, 4 = ProVox
67;	SERIAL 1 ADDRESS	67< x>	0 - 99
68;	SERIAL 1 BAUD RATE	68< x>	0 = 9600, 1 = 19200, 2 = 300, 3 = 600, 4 = 1200, 5 = 2400, 6 = 4800
69;	SERIAL 1 PARITY	69< x>	0 = none, 1 = even, 2 = odd
70;	PRINT DATA	70< xxxxx>	0 = no, 1 = yes; msd - lsd = rate,tare,zero,net,gross,display
71;	PRINT DATA FORMAT	71< xxxxxxx>	lsd = stx: 0/1 = no/yes 2sd = address: 0/1 = no/yes 3sd = leading 0s: 0 = spaces, 1 = zeros 4sd = units: 0 = no, 1 = abbreviated, 2 = expanded 5sd = status: 0/1 = no/yes 6sd = delimiter: 0 = space, 1 = crlf 7sd = end character:, 0 = crlf, 1 = cr
72;	PRINT CRLF DELAY	72< x.x>	0.0 - 9.9 seconds
73;	CON'T DATA	73< xxxxx>	0 = no, 1 = yes; lsd - msd = rate,tare,zero,net,gross,display
74;	CON'T DATA FORMAT	74< xxxxxxxx>	lsd = stx: 0/1 = no/yes 2sd = address: 0/1 = no/yes 3sd = leading 0s: 0 = spaces, 1 = zeros 4sd = units: 0/1 = no/yes 5sd = status: 0/1 = no/yes 6sd = delimiter: 0 = space, 1 = crlf 7sd = end character:0 = crlf, 1 = cr 8sd = timer: 0/1 = no/yes
75;	CON'T TX TIMER	75< xx.x>	00.0 - 59.9 seconds
76;	CON'T TX TIMER	76< xxx>	0 - 240 minutes
77;	TAG NO.	77< AAAAAAA>	cust tag no. 1-0,'-',' ',A-Z
78;	CAL DATE	78< MMDDYY>	Month Day Year of calibration
79;	NEXT CAL	79< MMDDYY>	Month Day Year of next cal
80;	RIO BAUDRATE	80< x>	0 = 57.6K, 1 = 115.2K, 2 = 230.4K
81;	RIO RACK #	81< xx>	0-63 = 1-77 octal
82;	RIO QUARTER	82< x>	0-3 = 1-4 starting quarter
83;	RIO LAST RACK	83< x>	0 = not last rack, 1 = last rack
84;	INSTRUMENT	84< xxxx>	instrument type (0200) for LCm-200
85;	FIRMWARE VERSION	85< xxxx>	firmware version (1.00, 9020 etc.)
86;	OPTIONS	86< xxxxxx>	[M]-[A]-[P]-[C]-[B]-[M]
87;	RATE UNITS	87< x>	rate units: 0 = unit/sec, 1 = unit/min
88;	RATE RESOLUTION	88< xx>	rate resolution (0-12)
89;	RATE DV TIME	89< xxxx>	rate derivation time (1-1250) secs
90;	RATE MIN DV TIME	90< xxxx>	rate minimum dv time (1-1250) secs
91;	G/N KEY CONFIG	91< xxx>	lsd = display powerup: 0 = gr, 1 = nt, 2 = rate 2sd = net display 0/1 = no/yes msd = rate display 0/1 = no/yes
92;	MODBUS+ GLOBAL DATA	92< xxxxxxxx>	0 = no, 1 = yes 1sd = status, 5sd = live mV/V 2sd = gross, 6sd = rate 3sd = net, 7sd = setpoints 4sd = mV/V, msd = spare
VER	SOFTWARE VERSION	VER< x.xx>	1.00 - 9.99
OPT	OPTIONS	OPT< xxxxxx>	[M]-[A]-[P]-[C]-[B]-[M]
CLR	CLEAR	CALCLR	clear calibration
CAL	CALIBRATE		used to precede other commands

Table 6-4. Read/Write and Error Code Examples.

EEPROM data request examples:

note - CRLF = carriage return = two ASCII characters 0D, 0A Hex
note - CR = carriage return = one ASCII character 0D Hex
note - using a dash between command numbers facilitates retrieving multiple parameters (see example # 3).

1. to get span 1 mV/V value (code 06;)

sent	received
06;CR	06< x.xxxxxx> CRLF

2. to get span 1 mV/V and units values (code 06; and 07;)

sent	received
06;07;CR	06< x.xxxxxx> 07< 00000000> CRLF

3. to get complete analog output setup (codes 51; through 55;)

sent	received
51-55;CR	5152< 00000000> 53< 00000000> 54< xxxxx> 55< xxxxx> CRLF

EEPROM data write examples:

Note - Downloading data to the LCm-200 is done by sending a 3 character command, the data enclosed in brackets < > , and a carriage return as shown in the examples below. The response will be staggered depending upon the time it-takes-to-store the data. First the command will be returned and then after the data is stored the CRLF or next command will be returned.

1. to download capacity setting (code 29;), send (if capacity is 50000):
   29< 00050000> CR or 29< 50000> CR
   response will be: 29< 00050000> CRLF

2. to download display LEVEL bar graph settings (codes 35; 36; 37;), send (if tracking gross and 0% is 0 and 100% is 15000):
   35< 0> 36< 00000000> 37< 00015000> CR or 35< 0> 36< 0> 37< 15000> CR
   response will be: 35< 0> 36< 00000000> 37< 00015000> CRLF

3. to download zero and span 1 settings (codes 05; 06; 07;), send (if zero mV/V = 0.500000> , span1 mV/V = 1.500000, span1 units = 20000): 05< 0.500000> 06< 1.500000> 0720000> CR
   response will be: 05< 0.500000> 06< 1.500000> 07< 00020000> CRLF

4. to acquire an new system zero (not download) (code 05;), send CAL05< 0> CR:
   The LCm-200 will store the current mV/V value as a new system zero
   response will be: immediately CAL then after zero is acquired: 05< x.xxxxxx> CRLF

5. to acquire a live deadload span 1 (code 07;), send (if span 1 = 2000.0) CAL07< 2000.0> CR:
   the LCm-200 will store the current live (above system zero) mV/V level as span 1 mV/V value (code 06;) and store 2000.0 as the units value
   response will be: immediately CAL, then after span is acquired: 07< 0002000.0> CRLF

6. to clear existing calibration send CALCLR CR:
   If the LCm-200 is in deadload or keypad cal all spans will be cleared, # of span points will be set to 0 and digital output will be based on system capacity and load cell mV/v output settings.
   response will be: immediately CALCLR then after cal is cleared, CRLF.

Note: cal zero is not cleared by this command. If the LCm-200 is in quick cal, response will be: CALCLR< NA> ,CRLF.

INTERFACE ERROR CODES

NA = not allowed
NT = no terminator
LM = limit
BF = input buffer overflow (too many characters sent, max is 255)
AD = a/d error
? = unknown command

ERROR CODE EXAMPLES

sent	received	description
99,CR	99,?CRLF	unknown command
CR	?CRLF	unknown command
00< A1> CR	00< NA> CRLF	not allowed value for a/d rev
00< 000> CR	00< NA> CRLF	not allowed value for a/d rev
28< 5> CR	28< LM> CRLF	value limit for eng units
07< 000050000> CR	07< NT> CRLF	no terminator (too many digits)

Table 6-5. Live Data Transactions and Default Settings

LIVE DATA

Note: - live weight data uses () and not as a frame, this is because the numerical part of the live weight data and stored eeprom data codes are the same number sequence 00 01 etc.

CODE	DEFINITION	RESPONSE	EXPLANATION
00,	GROSS	00(00000000)	current gross weight
01,	NET	01(00000000)	current net weight
02,	mV/V	02(x.xxxxxx)	current mV/V data
03,	LIVE mV/V	03(x.xxxxxx>)	current live mV/V data
04,	WEIGHT STATUS	04(A)	A = a/d status ( ) = normal (M) = motion (U) = signal underload (V) = above overload limit (O) = signal overload (E) = load cell connect fault
05,	ANALOG STATUS	05(A)	A = analog output status ( ) = normal (U) = analog underrange (O) = analog overrange (E) = analog open circuit
06,	ANALOG	06(xxxxx)	0 - 65537 analog output
07,	DISPLAY	07(ABCDEFGH	upper display - alpha numeric with dp or leading space
		IJKLMNOPQ	lower display - alpha numeric with dp or leading space
		R	level - from left to right - = off @ = left arrow on A-Z = segments on + = right arrow on
		S	arrows- from bottom to top - = off @ = bottom arrow on A-I = arrows on + = top arrow on
		TU)	annunciators - A1,A2,A3,A4 = low 4 bits of T T = 1 0 0 0 0 0 0 A1 A2 A3 A4 for A1-A4 off T = @ (40 hex) if A3 is on T = B (42 hex) A5,A6,A7,A8 = low 4 bits of U U = 1 0 0 0 0 0 0 A5 A6 A7 A8 for A5-A8 off U = @ (40 Hex) if A6,A7 are on U = F (46 hex)
08,	REMOTE INPUTS	08(XXXXX)	remote inputs msd-> lsd = inputs 5-1 print,g/n/r,tare,zero,unused (0 = low and 1 = high)
09,	RATE	09(00000000)	rate data

LIVE DATA REQUEST EXAMPLES

1. to get gross weight (code 00,) if current gross weight is -10.1 lb

sent	received
00,CR	00(-000010.1)CRLF

2. to get gross & net weights and status (codes 00, 01, 04,) if current gross weight is 440.05, tare value is 200.1 and scale is in motion:

sent	received
00,01,04,CR	00(000440.05)01(000240.04)04(M)CRLF

3. to get live data codes 00 - 05 (data values used as example only):

sent	received
00-05,CR	00(000440.05)01(000240.04)02(1.200505)03(0.800400)04(M)05( )CRLF

Table 6-5. con't.

LIVE DATA CONVENIENCE COMMAND CODES

code	definition	response	explanation
G	SWITCH TO GROSS	(per print format)	switch to gross and return current gross weight
N	SWITCH TO NET	(per print format)	switch to net and return current net weight
T	SWITCH TO NET & TARE	(per print format)	switch to net, tare, return current net weight
Z	SWITCH TO GROSS & ZERO	(per print format)	switch to gross, zero, return current gross weight

LIVE DATA CONVENIENCE COMMANDS (examples)

1. to switch the LCm-200 to gross mode and get gross weight (code G), if current gross weight is -10.1 lb, unit # is 01, and scale is in motion:

sent	received (according to print format setup)
GCR	01 -000010.1LGMCRLF

2. to switch the LCm-200 to net mode, tare and get net weight (code T), if current gross weight is -10.1 lb, unit # is 01:

sent	received (according to print format setup)
TCR	01 000000.0LN CRLF

Table 6-6. Set Point Data Communication Format

SETPOINT DATA for Discrete outputs 1-8.

Note - setpoint data uses [] and not < > or () as a frame, this is because the numerical part of the live weight data and stored eeprom data codes are the same number sequence 00 01 etc.

CODE	DEFINITION	RESPONSE	EXPLANATION
00/	OUTPT 1 MAIN	00[00000000]	output 1 main value
01/	OUTPT 1 INFLIGHT	01[000000]	output 1 inflight
02/	OUTPT 1 DEADBAND	02[000000]	output 1 deadband
03/	OUTPT 1 CONFIG	03[000]	output 1 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
04/	OUTPT 1 TAG	04[AAAAAAAA]	output 1 tag; space,1-0,'-',A-Z
05/	OUTPT 2 MAIN/DRIB	05[00000000]	output 2 main or drib value
06/	OUTPT 2 INFLIGHT	06[000000]	output 2 inflight if config is main
07/	OUTPT 2 DEADBAND	07[000000]	output 2 deadband if config is main
08/	OUTPT 2 CONFIG	08[000]	output 2 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
09/	OUTPT 2 TAG	09[AAAAAAAA]	output 2 tag; space,1-0,'-',A-Z
10/	OUTPT 3 MAIN/DRIB	10[00000000]	output 3 main or drib value
11/	OUTPT 3 INFLIGHT	11[000000]	output 3 inflight if config is main
12/	OUTPT 3 DEADBAND	12[000000]	output 3 deadband if config is main
14/	OUTPT 3 CONFIG	13[000]	output 3 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
14/	OUTPT 3 TAG	14[AAAAAAAA]	output 3 tag; space,1-0,'-',A-Z
15/	OUTPT 4 MAIN/DRIB	15[00000000]	output 4 main or drib value
16/	OUTPT 4 INFLIGHT	16[000000]	output 4 inflight if config is main
17/	OUTPT 4 DEADBAND	17[000000]	output 4 deadband if config is main
18/	OUTPT 4 CONFIG	18[000]	output 4 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
19/	OUTPT 4 TAG	19[AAAAAAAA]	output 4 tag; space,1-0,'-',A-Z
20/	OUTPT 5 MAIN/DRIB	20[00000000]	output 5 main or drib value
21/	OUTPT 5 INFLIGHT	21[000000]	output 5 inflight if config is main
22/	OUTPT 5 DEADBAND	22[000000]	output 5 deadband if config is main
23/	OUTPT 5 CONFIG	23[000]	output 5 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
24/	OUTPT 5 TAG	24[AAAAAAAA]	output 5 tag; space,1-0,'-',A-Z
25/	OUTPT 6 MAIN/DRIB	25[00000000]	output 6 main or drib value
26/	OUTPT 6 INFLIGHT	26[000000]	output 6 inflight if config is main
27/	OUTPT 6 DEADBAND	27[000000]	output 6 deadband if config is main
28/	OUTPT 6 CONFIG	28[000]	output 6 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
29/	OUTPT 6 TAG	29[AAAAAAAA]	output 6 tag; space,1-0,'-',A-Z
30/	OUTPT 7 MAIN/DRIB	30[00000000]	output 7 main or drib value
31/	OUTPT 7 INFLIGHT	31[000000]	output 7 inflight if config is main
32/	OUTPT 7 DEADBAND	32[000000]	output 7 deadband if config is main
33/	OUTPT 7 CONFIG	33[000]	output 7 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
34/	OUTPT 7 TAG	34[AAAAAAAA]	output 7 tag; space,1-0,'-',A-Z
35/	OUTPT 8 MAIN/DRIB	35[00000000]	output 8 main or drib value
36/	OUTPT 8 INFLIGHT	36[000000]	output 8 config; msd on below(0)/above 2sd gross(0)/net, lsd main(0)/dribble
39/	OUTPT 8 TAG	39[AAAAAAAA]	output 8 tag; space,1-0,'-',A-Z
40/	SETPOINT LOCKS	40[xxxxxxxx]	setpoint locks 0 = off, 1 = on; lsd - msd = setpnt 1 - 8

SETPOINT DATA request examples

1. to get output 1 main (code 00/) if main = 2000

   sent: 00/CR

   received: 00[0002000)CRLF

2. to get output 1 main, inflight, deadband, status, tag, and output 2 is configured as dribble to output 1; if main = 2000, inflight = 10, deadband = 5, status = on below tracking net weight, tag = SLURRY, dribble = 35:

   sent: 00-09/CR

   received: 00[00002000]01[000010]02[000005]03[010]04[SLURRY]
   05[00000035]06[000000]07[000000]08[001]09[OUTPUT 2]
   CRLF

3. to get outputs 1 - 4 main values: if 2000, 4000, 6000, and 8000

   sent: 00/05/10/15/CR

   received: 00[00002000]05[00004000]10[00006000]15[00008000]CRLF

Table 6-6 con't.

OUTPUT data write examples:

Note - Downloading data to the LCm-200 is done by sending a 3 character command, the data inclosed in [] brackets, and a carriage return as shown in the examples below. The response will be staggered depending upon the time it takes to store the data. First the command will be returned and then after the data is stored the CRLF of next command will be retruned.

1. to download output 1 (code 00/)
   send (if main = 50000)
   00[00050000]CR or 00[50000]CR
   response will be: 00[00050000]CRLF

2. to download output 1 inflight deadload status and tag
   send (if inflight and deadband are 15 and 5, configured as on below tracking gross, and tag is WATER)
   01[000015]02[000005]03[000]04[WATER]CR or
   01[15]02[5]03[000]04[WATER]CR
   response will be: 01[000015]02[000005]03[000]04[WATER]CRLF

SECTION 7. System Diagnostics

7.1 OVERVIEW

LCm-200 diagnostics provide easy access to critical operating system data, and test verification procedures for many indicator functions. Unique to LCm-200 diagnostics is the simulated weighment or ramp feature. Figure 7-1 (next page) presents the diagnostic flow diagram. Follow the procedures in this diagram to view values, set function limitations, test the front panel keypad, verify I10 functions, and run a simulated weighment.

7.1.1 Diagnostic User

Diagnostic user provides three registers for storage of customer tag and calibration records. Users may enter a tag number, current calibration date, and projected date of next calibration, if desired.

7.1.2 Diagnostic Version

Diagnostic version provides the software version, the installed option code derived from the ordering specification, the serial number, the AID converter revision level, and the date of the factory calibration.

7.1.3 Diagnostic Recall

Recall allows the operator to view current tare and zero values.

7.1.4 Front Panel Key Test

DIAG KEYPAD allows an operator to functionally test any/all front panel keys. Press any two keys simultaneously to exit.

7.1.5 Check Remote Inputs

DIAG INPUTS is a check of all remote inputs. If inputs are inactive, their respective numbers will appear (54321). Once activated, the input number will change to a dash.

7.1.6 Test/Verify the Analog Output

DIAG ANALOG tests the analog output. Test should be performed with a current meter attached. Testing firstly shows the actual analog count value being transmitted. Since the analog output is based on a 16 bit D-A conversion, the percent of span can be calculated by dividing the displayed counts by 65535.

Secondly, any value may be entered to test the analog output. Enter a known value such as 65535 (max setting) and check current meter for appropriate output.

Exiting this menu will automatically discontinue the test mode.

7.1.7 Test/Troubleshoot the Serial Output

DIAG SERIAL provides the means to view both the transmit and receive buffers. After pressing EDIT, use the left/right arrow keys to increment forward or decrement backward through the selected buffer and view the hexadecimal value of each character. Using this procedure, incoming data requests can be checked for protocol/syntax accuracy and compared to LCm-200 output responses.

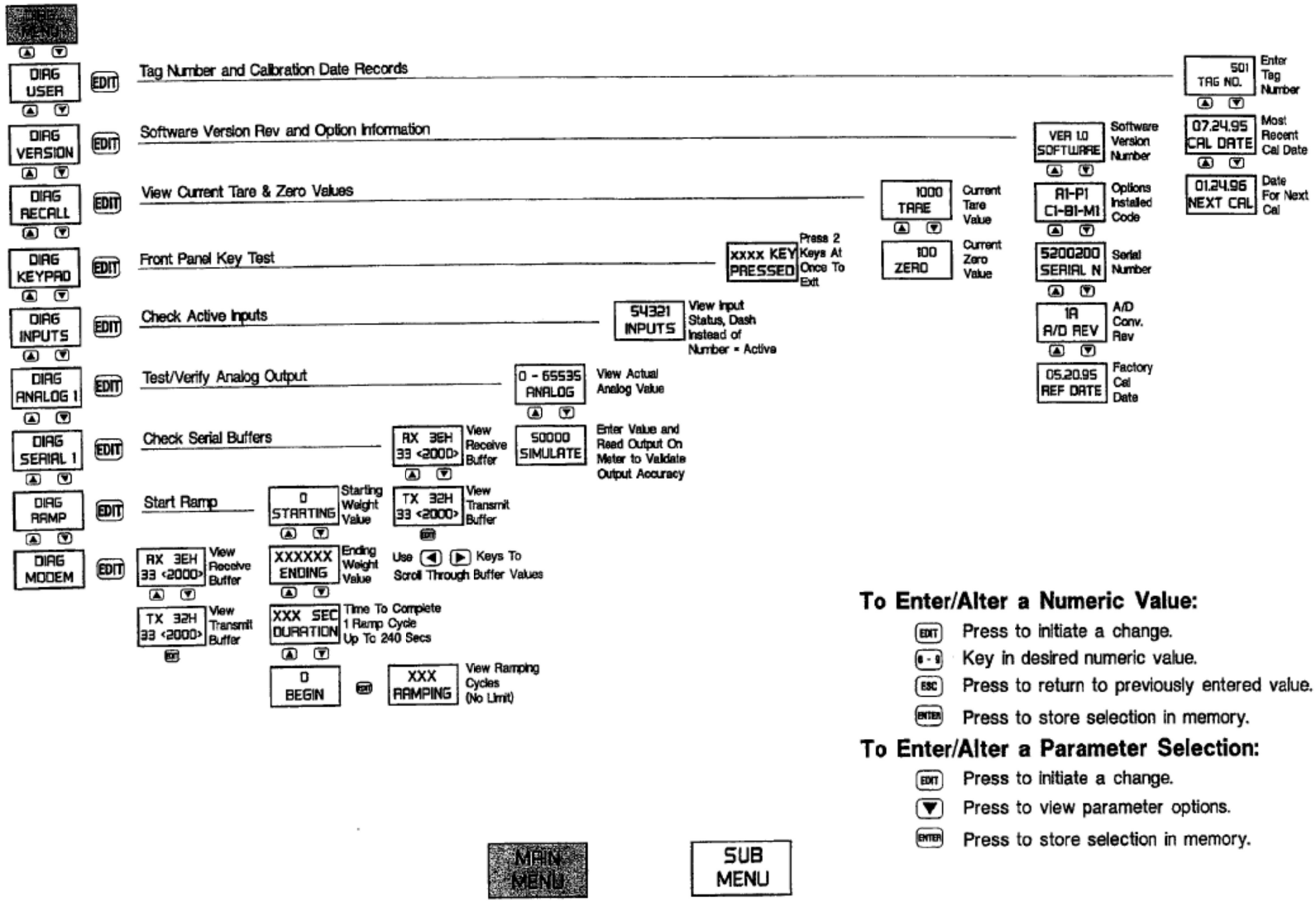
7.2 SIMULATING A WEIGHMENT

'Ramping' allows entry of starting and ending gross weight values, and then simulates a live weight addition without adding actual product/ingredients to the vessel. During the ramping exercise all outputs function as if an actual weight change were in progress. DIAG RAMP allows entry of simulated starting (typically 0) and ending (typically full scale system capacity) weight points. Time for a complete ramp 'up' cycle (starting point up to ending point) can be selected from 1 to 240 seconds. Once ramp 'up' is complete, a ramp 'down' (ending point down to starting point) sequence automatically begins. At the BEGIN display, press EDIT to start ramping. Ramping will continue until ESC is pressed.

7.3 TEST/TROUBLESHOOT THE INTERNAL MODEM

DIAG MODEM allows evaluation of the modem transmit and receive buffers. See paragraph 7.1.8 for operational details.

Diagnostic Menu Flow Diagram



To Enter/Alter a Numeric Value:

- EDIT Press to initiate a change.
- 0 - 9 Key in desired numeric value.
- ESC Press to return to previously entered value.
- ENTER Press to store selection in memory.

To Enter/Alter a Parameter Selection:

- EDIT Press to initiate a change.
- ▼ Press to view parameter options.
- ENTER Press to store selection in memory.

Figure 7-1. Diagnostic Menu Flow Diagram.

SECTION 8. Rate by Weight

8.1 GENERAL

LCm-200 controllers calculate the mass flow rate by dividing change in weight by elapsed time. Flow rate is computed each update based upon filtered weightment's data. Rate values are accumulated based upon the derivation time selected by the operator (Figure 8-1, page 8-3). Display and output values are the average of accumulated rate updates during the derivation time period. For example, if a derivation time of ten seconds is selected, display updates will be based upon the running average of 200 rate updates which occur every 50 ms. The minimum derivation time selection is calculated automatically by the LCm-200 based upon unit and resolution entries (Figure 8-1). Longer derivation time selections result in greater sensitivity (resolution) while selecting a time less than the calculated minimum derivation could result in erroneous readings.

8.1.1 Determining Minimum Flow Rate Capability

Application parameters such as transducer type, dead/live loads, and the use of intrinsic safety barriers (Div 1 hazardous locations only) affect the instrument's ability to measure very low flow rates. Use the equation presented in Table 8-1 to determine the limitations induced by the application.

Table 8-1. Minimum Derivation Time Calculation.

Equation for determining mimimum derivation time to achieve desired flow rate resolution:

$$\frac{\text{(System Capacity)}}{\text{(Load Cell Output)(Desired Flow Rate Resolution)}} \times (5 \times 10^{-6}) = \text{Minimum Derivation Time}$$

EXAMPLE

Given:

Minimum flow rate = 1.8 lb/min.
System capacity = 20,000 lb.
Load cell output (full scale) = 2 mV/V.
Desired flow rate resolution = 0.01 lb/sec.
5×10^{6} is the constant sensitivity of the instrument.

$$\frac{20{,}000 \text{ lb}}{(2 \text{ mV/V})(0.01 \text{ lb/sec})} \times (5 \times 10^{-6}) = 5 \text{ seconds}$$

Conclusion: 0.01 lb/sec can be achieved with a minimum derivation time of 5 seconds

8.1.2 Determining Display and Output Update Frequency Based On Selected Derivation Time

The LCm-200 allocates finite memory buffers to accumulate weight data over time in order to calculate rate. When long derivation times are used, pre-set buffer limits are imposed. As a result, effective display and output frequencies are affected. Table 8-2 summarizes this relationship.

8.1.3 Determining Weight/Rate Resolution

Rate resolution varies according to unit selection (seconds or minutes) and display count (count by's) configuration. Also, static weight and rate-by-weight resolutions can be set independently. For example, a system with a static weight resolution of 1.0 Ib. can potentially have a rate resolution of 0.002 Ib. /sec.

Table 8-3 shows the effect of units and count by selections on rate resolution.

8.2 PARAMETER SELECTIONS

Figure 8-1 shows the flow diagram for selecting and entering rate parameters. Follow the sequence to make all entries and then check to be sure the derivation time entered is not LESS than the automatically calculated minimum derivation time.

8.2.1 Units

Faster flow rates should be entered as units (Ib., kg, etc., see paragraph 3.2.1) per second while slower flow rates should be entered as units per minute.

Table 8-2. Derivation Time and Update Frequency.

DV TIME (sec)	Update Frequency (msec)
1 – 25	50
26 – 50	100
51 – 100	200
101 – 125	250
126 – 250	500
251 – 500	1000
501 – 1000	2000
1001 - 1250	2500

8.2.2 Resolution

Select the resolution that corresponds to the units previously specified. This selection tells the LCm-200 approximately how many units will flow in the time frame selected; i.e. 0.01 pounds per second.

8.2.3 Derivation Time

Derivation time is the estimated time frame in which a specified amount (resolution/units) of material will flow into or out of the weigh vessel. Minimum derivation time is automatically calculated by the LCm-200 (next parameter). Do not enter a value less than the calculated minimum value or erroneous readings may result.

8.2.4 Minimum Derivation Time

This value is automatically calculated by the LCm-200 based upon units and resolution entries. This value cannot be changed .and serves only as a minimal guideline for the previous entry. If a derivation time value has been entered that is less than this value step back to derivation time (DV TIME) and change it before attempting system operation.

Table 8-3. Instrument Weight and Rate Resolution Settings (without decimal point).

Rate Resolution Examples - Possible Settings		
	Units/Second	
0.001	0.002	0.005
0.002	0.005	0.01
0.005	0.01	0.02
0.01	0.02	0.05
0.02	0.05	0.1
0.05	0.1	0.2
0.1	0.2	0.5
0.2	0.5	1
0.5	1	2
1	2	5
2	5	10
5	10	20
10	20	50
Units Per Minute		
0.01	0.2	0.5
0.2	0.5	1
0.5	1	2
1	2	5
2	5	10
5	10	20
10	20	50
20	50	100
50	100	200
100	200	500
200	500	1000
500	1000	2000
1000	2000	5000

Rate-By-Weight Flow Diagram

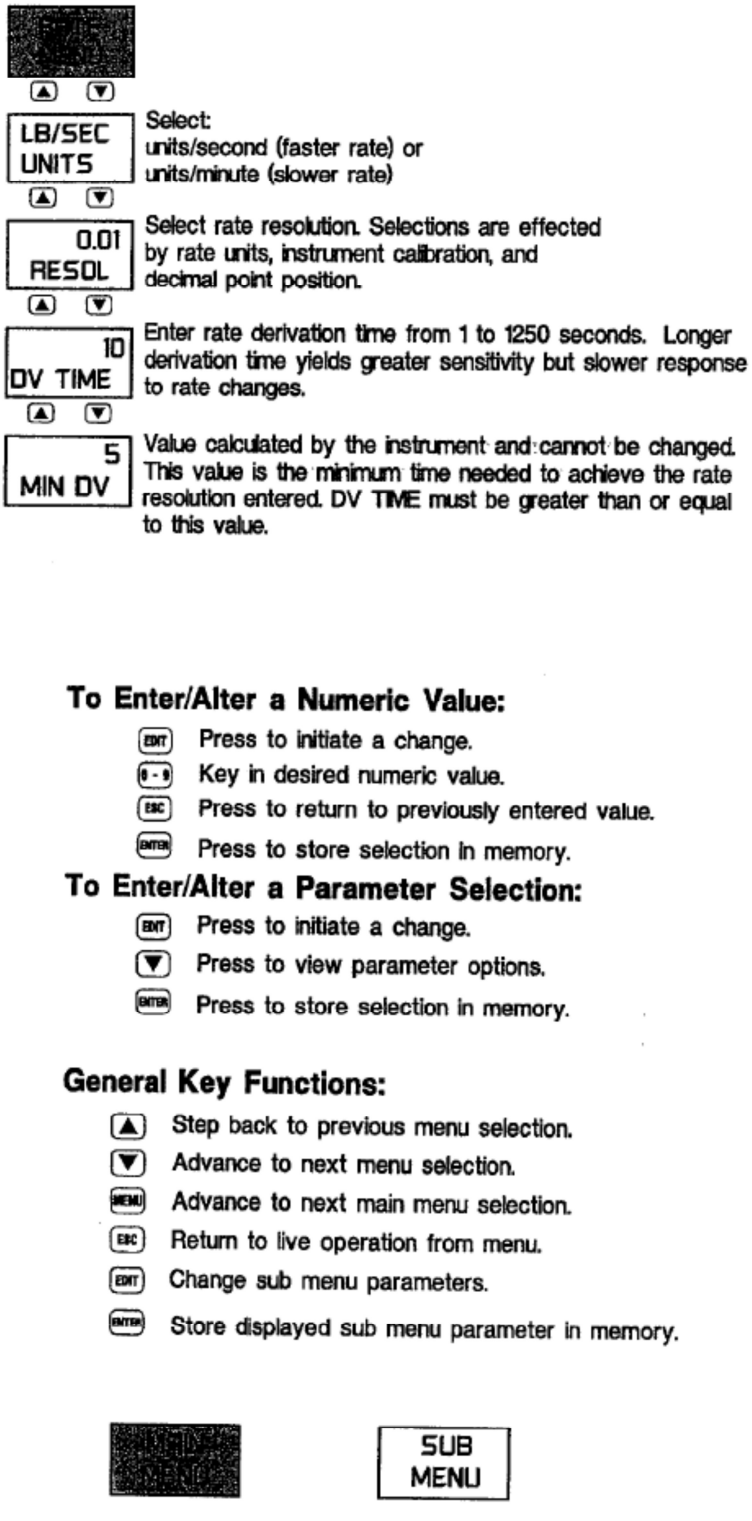


Figure 8-1. Rate-by-Weight Flow Diagram.

SECTION 9. Security System

9.1 INTRODUCTION

From password access to individually selectable menu and key 'locks', Safe-Weigh Software protects the entire weigh system from overt tampering or accidental data/configuration/calibration alterations. Figure 9-1 (next page) presents the security menu flow diagram. Follow the procedures designated to secure as many parameters as desired.

9.1.1 Lock On/Off

Lock 'On' restricts access to the security menu and. All other menus/keys designated as 'locked'. If locked, the designated password (see paragraph 9.2) must be entered to gain access to the security menu. Units are shipped with the lock 'Off to allow initial configuration without a password.

9.1.2 Menu Locks

Any or all of the LCm-200 main menus can be 'locked' to prevent parameter changes. To lock a menu, choose ON by pressing the EDIT and RIGHT arrow keys in sequence. Then press ENTER to store. Once a menu is designated as locked access to that menu is barred. To 'unlock' a locked menu, return to the security menu, enter the correct password, and change the status to OFF.

9.1.3 Key Locks

Five of the LCm-200 front panel keys can be 'locked' to prohibit key function. Keys that can be locked are; ZERO, TARE, GIN (gross/net), PRINT, and EDIT. To lock a key, choose ON by pressing the EDIT and RIGHT arrow keys in sequence. Then press ENTER to store. If a key is designated as locked, it will not function when pressed. To 'unlock' a locked key, return to the security menu, enter the correct password, and change the status to OFF.

9.1.4 Set Point Locks

Set Point entries may be locked to prevent accidental value changes and maintain recipe integrity

NOTE: Lock conditions apply only to operator key entries. Lock conditions do not affect serial interface transactions.

9.2 PASSWORD ACCESS

If lock ON is selected (paragraph 9.1.1), password must be entered to regain access to the security menu. The following paragraphs explain how to select and enter a password. Once a password is chosen, it should be written down and stored in a confidential area.

9.2.1 Selecting/Storing a Password

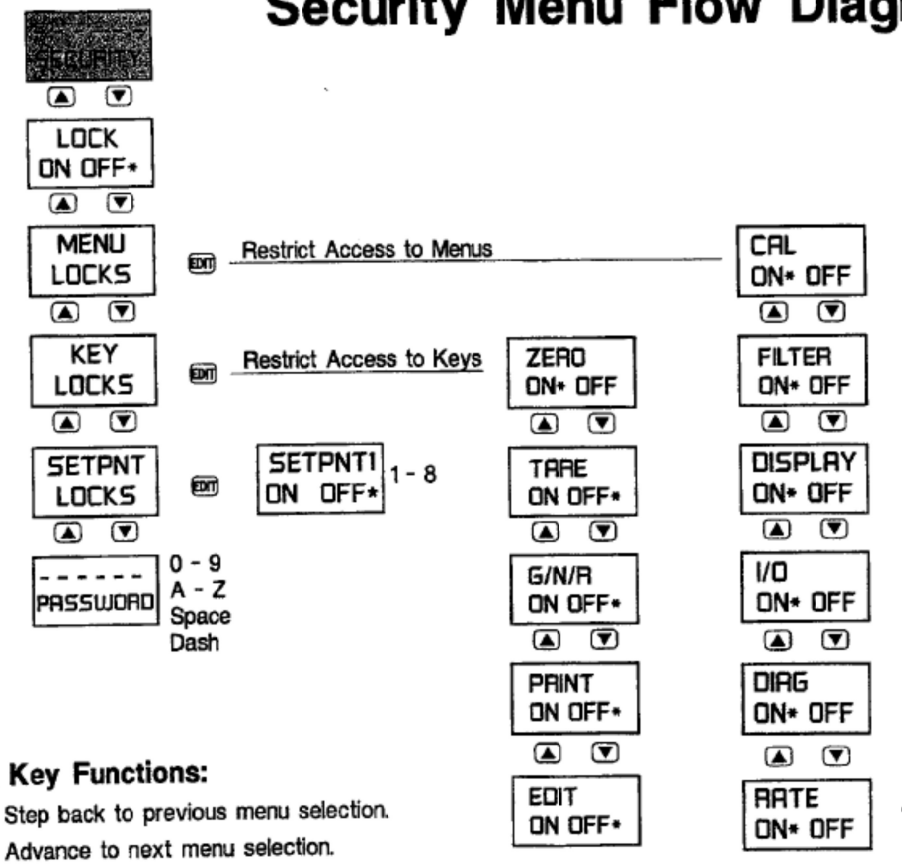
A password can be any combination of alpha-numeric characters up to seven digits long. It is not necessary to use all seven -digits. At the PASSWORD display, key in the designated characters using the arrow keys (LEFTIRIGHT to change digits, UPIDOWN to select character). When the password is correctly displayed, press ENTER to store.

9.2.2 Entering the Password

If the lock is 'ON', the password must be entered to access the security menu. With the display reading SECURITY (a row of dashes above), press EDIT. Use the arrow keys to enter the complete password, as it was stored, on the row above SECURITY. When the correct password is displayed, press ENTER Note that entering the password does not turn the lock off, it simply allows access to the security menu. If the lock is left ON, the password must be entered each time the security menu is accessed.

Master Password: In addition to-the user selected password there is also factory installed master password. If the user selected password is lost, contact any BLH service location for the master password.

Security Menu Flow Diagram



General Key Functions:

- ▲ Step back to previous menu selection.
- ▼ Advance to next menu selection.
- MENU Advance to next main menu selection.
- ESC Return to live operation from menu.
- EDIT Change sub menu parameters.
- ENTER Store displayed sub menu parameter in memory.

MAIN MENU

SUB MENU

To Enter/Alter a Numeric Value:

- EDIT Press to initiate a change.
- 0 - 9 Key in desired numeric value.
- ESC Press to return to previously entered value.
- ENTER Press to store selection in memory.

To Enter/Alter a Parameter Selection:

- EDIT Press to initiate a change.
- ▼ Press to view parameter options.
- ENTER Press to store selection in memory.

Figure 9-1. Security Menu Functions.

SECTION 10. Operation

10.1 GENERAL

LCm-200 indicator/transmitters power up in the gross weight weighing mode. If no system errors are detected, the front panel display will show the system live gross weight value. Note: For initial system power up, units are factory pre-calibrated with default values. Calibration (SECTION 3), however, should be performed before attempting system operation. Figure 10-1 presents the front panel switch functions for the operating mode GIN toggles the operating mode from gross to net to rate (see Section 5 paragraph 5.1.6). ZERO performs push to zero (gross mode) and TARE initiates the tare function in the net mode. PRINT/COM transmits the current weight status data to a printer if print format is selected. If the LCm-200 is connected to a host computer or PLC, gross, net, zero, tare, and print functions can be initiated remotely using the rear panel digital inputs.

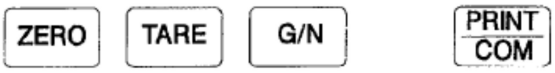


Figure 10-1. Front Panel Operating Keys.

10.2 GROSS WEIGHT WEIGHING

In the gross mode, all of the live weight of the system is displayed on the front panel. Live weight does not include the dead weight of a vessel or other mechanical equipment that is factored out during calibration.

10.3 ZERO OPERATION

A new zero can be acquired to compensate for changes in the dead load of the system due to heel build-up etc. Acquiring a new zero reference value does not affect the slope of the calibration. The push to zero range in the LCm-200 can be configured from OFF to 100% of system capacity (or 9999999). To prevent system overload, the zero selection limit usually does not exceed 20% of system capacity. Zero may be acquired only if the system is not in motion and the zero limit has not been-exceeded

10.4 NET WEIGHT WEIGHING

Net weight weighing is used when the operator wants to reset zero to compensate for the addition of live weight, or a container, before adding a specific amount of material. Tare is used to establish a zero reference in net mode.

10.5 TARE OPERATION

With the LCm-200 in net weighing mode, the tare function resets the output to zero. Push button taring (TARE key) allows the operator to achieve a new zero reference before addition of each ingredient so that errors do not become cumulative. If manual tare is selected, a tare value must be entered using the 0 – 9 numeric keys (press ENTER to store). Manual tare values typically represent the known weight of empty containers placed upon the scale/platform.

10.6 RATE-BY-WEIGHT

Mass flow rate (rate-by-weight) may be displayed at any time by pressing the GIN operating key. LCm-200 algorithms constantly convert change in weight to a rate equivalent based upon parameters entered in Section 8. Continuous serial communication outputs reflect rate data in this operating mode.

10.7 SETPOINT FUNCTION

Set Point values are entered using the configuration keypad (reference Figure 5-1) numeric keys, 0-9. To enter or alter set point values, start by pressing the STPNT key. The front panel display will display the current value of set point I. To enter or alter set point 1, key in the desired numeric value i.e. '1000' and press enter. Press the down arrow key to advance to the next set point(s) and enter/alter in the same way.

After values are established, press the MENU key to return to live operation. Set points function in accordance with parameters entered in Section VI. If rate-by-weight mode is selected, set points will function based upon vessel weight.

10.8 ERROR DETECTION AND CORRECTION

Should an error condition occur, a scrolling message will appear on the bottom line of the front panel display. As much as possible, messages define the exact error and suggest a remedy. Once the error is cleared, the scrolling message will stop and normal operation will resume. Table 10-1 presents all error messages with recommended solutions.

Table 10-1. Error Messages and Explanations.

FAULT CONDITION	DISPLAY	REMEDY
POWER-UP FAULT MESSAGES		
The a/d module does not have a revision number	NO A/D REV	Factory procedure
The a/d module does not have a mv/V calibration date	NO CAL DATE	Factory procedure
The a/d module does not have a temperature compensation reference	NO TMP COMP	Factory procedure
The a/d module does not have a mv/V calibration	NO mv/V CAL	Factory procedure
The instrument serial number has not been downloaded	NO SER NUMBER	Factory procedure
The instrument has not been calibrated for weight	NO CAL	Set to quick cal or Acquire deadload cal or Enter keypad cal
The instrument does not have a manual zero value	NO MAN ZERO	Acquire zero using zero key or enter manual zero
The instrument does not have a manual tare value	NO MAN TARE	Acquire tare using tare key of enter manual tare
OPERATE MODE FAULT DISPLAYS		
Load cell excitation short, or no excitation	FAULT LOAD CELL scrolling message = "EXCITATION FAULT CHECK CONNECTIONS"	Check connections
Load cell excitation fault cleared	FAULT CLEARED	
A/D reference values out of limit	A/D FAULT followed by RESTART, followed by reset of instrument	Check connections, possible sense line open
Eeprom read/write failure when storing parameters	EEPROM ERROR	Contact BLH field service
A/d output has reached maximum value	OVER RANGE	Check connections, excitation to signal short
A/d output has reached minimum value	UNDER RANGE	Check connections, excitation to signal short
OPERATE MODE SPECIAL DISPLAYS		
Gross weight is equal to or greater than overload setting	5000 OVER LB (over is blinking)	
Rate of change too large for internal math registers	OVERFLW LB/SEC	Lower rate resolution
Attempt to enter locked menu or perform locked function	LOCKED	Go to security menu to unlock
Attempt to zero gross weight when in net mode	SWITCH TO GROSS	Switch to gross mode
Attempt to tare net weight when in gross mode	SWITCH TO NET	Switch to net mode
Attempt to zero gross weight at or above zero limit	ZERO LIMIT	
Attempt to zero gross weight or tare net weight in motion	IN MOTION	Wait for stable weight signal
Attempt to zero gross weight	NEGATIVE GROSS	None

SECTION 11. Modem and Protocol Options

11.1 GENERAL

Section XI provides information for LCm-200 interface and protocol options. Options such as the Service Link Modem, Modbus RN, Modbus Plus, and Provox protocol are currently available. Fieldbus will be offered in the future.

11.2 THE SERVICE LINK MODEM

The LCm-200 modem is a V.22 bis data modem compatible with CCITT V.22 bis (2400 bps), Bell 212A (1200 bps), and Bell 103 (300 bps). It is programmed to answer a call after 1 ring. The originating modem should be set for 2400 baud using 8 data bits with no parity. Once connection is established, all data transfers follow the PC format presented in Section 6, Table 6-3. When BLH Field Service is desired, contact the field service manager at (781) 821-2000 extension 21 5. The Field Service Manager will arrange a diagnostic session, via modem, between the factory computer system and the installed LCm-200.

The Service Link Modem is currently operable only in the United States and Canada. Outside these territories, please contact the factory for assistance.

11.3 MODBUS RTU PROTOCOL

This interface method is applicable to virtually any PC or other process control computer with Modbus RTU Master communication capability. The interface provides weight and diagnostic information and allows for remote control of tare, zero, and gross/net functions. New calibration data also may be downloaded via this interface. Information is transmitted in blocks of data, thereby minimizing polling and response time delays.

The interface operates with the LCm-200 configured as the slave device and the host computer as the master. To initiate Modbus RTU protocol, simply select the Modbus print format as shown in Figure 6-1 (page 6-2). Modbus RTU uses the standard LCm-200 RS-4851422 communication port and requires no hardware alterations.

11.3.1 Common Data Format

Table 11-2 presents a complete overview of Modbus register and bit allocations. Table 11-2 information which appears in conventional text applies to both Modbus RTU and Modbus Plus formats. Allocations which pertain only to Modbus Plus appear in italic text. In addition to Table 11-2 information, the following data formats and definitions are identical for both Mod bus protocol options:

Weight Data (BLH format for Modbus Plus) - Two 16 bit signed integers, the first (high) integer must be multiplied by 32768 and then added to the second (low) integer.

Status and setup parameters - One 16 bit unsigned integer. Alpha data - For each register: high byte is first character, low byte is second character. NOTE: If a decimal point is required the resulting value must be multiplied by the appropriate fraction, i.e. 0.01 for hundreds of a unit. In the case of mV/V values the multiplier is 0.000001. The LCm-200 range is (-9999991+ 9999999).

NOTE: counts refers to displayed counts. If displayed weight is counting by 2 Ib. increments then presetting a register to 9 would mean 18 Ibs.

11.3.2 Modbus RTU Functions Supported

02 Read Input Status

03 Read Holding Registers

06 Preset Single Register

16 (10 Hex) Preset Multiple Registers

11.3.3 Setup

Modbus RTU format: Device address, baud rate, and parity are all selectable under the SERIAL 1 section of the 110 MENU.

11.4 MODBUS PLUS INTERFACE

BLH is an official ModConnect Partner. As such, BLH has been authorized by Schneider Automation to incorporate Modbus Plus Communication Technology in its LCm-200 series product line. Modbus Plus protocol allows the LCm-200 to communicate on a peer-to-peer network link with Modicon 984 and Quantum PLC devices. LCm-200 units equipped with the Modbus Plus option have a custom rear panel with a specific MODBUS PLUS connector (see Figure 11-2 and paragraph 11.4.3). The Modbus Plus interface does not use the standard LCm-200 RS-4851422 communication port.

11.4.1 Routing Path Addressing

The LCm-200 Modbus Plus node is a Host Computer node with 8 data-slave input paths. When using Read/Write MSTR operations, or multiple Modbus Plus networks, take note of the message routing format. A routing address is five bytes in length. This allows communication between multiple Modbus Plus Networks over Bridge Mux hardware devices. Since the LCm is a host computer node, two of the five routing address bytes are required to identify it. The next-to-last non-zero byte specifies the network node station address (1-64). The last non-zero byte specifies the input path or task number (1-8) to which the message is assigned. The other three routing address bytes allow communication through up to 3 Bridge Mux Devices. Table 11-1 depicts the address routing path for an LCm device at address 12, using path/task number 1.

Table 11-1. Routing Path Address Designations

Routing Path Example	Five Byte Address
No Bridge Mux Devices	12 - 1 - 0 - 0 - 0
Bridge Mux @ Address 26	26 - 12 - 1 - 0 - 0
1st Bridge Mux @ Ad. 26, 2nd Bridge Mux @ Ad. 28, 3rd Bridge Mux @ Ad. 30	26 - 28 - 30 - 12 - 1

NOTE: If multiple devices access the same LCm, BLH recommends using a different task/path number for each requesting device. This will prevent address contention problems.

NOTE: Host device routing path format is different from PLC designated device addressing. When using PLC designated devices, the input path/task number is not required since it is automatically selected.

NOTE: BLH assumes reader/operator familiarity with Modbus Plus token passing network operation. Readers/operators unfamiliar with Modbus Plus should obtain the 'Modicon Modbus Plus Network Planning and Installation Guide' (GM-MBPL-001) and ‘Modicon Ladder Logic Block Library User Guide' (840 USE 101 00) from the Schneider Corporation.

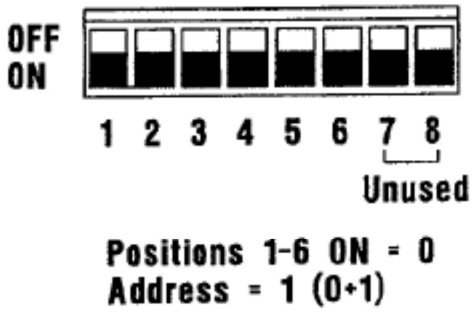
11.4.2 Global Data Transfers

For high speed process control, BLH recommends that global data transfers be used. LCm-200 Global data allocations are defined in the Figure 11-1 parameter selection menu.

11.4.3 Wiring and Node Addressing

Wring is simply a matter of connecting the Modicon supplied, 9 pin D-type connector cable to the LCm- 200 rear panel Modbus PLUS D-type socket mating half (see Figure 11-2).

LCm-200 nodes may occupy any station address location from 1 to 64. Selection is made at the rear panel (see table in Figure 11-2) DIP Switch designated AD DRESS. Add 'I' to the switch selection to obtain the actual address (i.e., selection 0 + 1 = 1). DIP switch positions 7 and 8 are unused.



NOTE: Switch selections are read only during power up. If the address selection is changed,

the instrument must-be powered down and then powered up again.

11.4.4 Configuration

Figure 11-1 presents the Modbus Plus configuration menu. Parameters are as follows: ADDRESS is non-configurable. It simply indicates that the network has recognized the LCm-200 device at the designated address. GLOBAL DATA allows up to 14 words of live weight and status data to be selected for broadcast with each token pass. Each item selected represents two words of global data. The first item selected 'YES' becomes the first two words, the second 'YES' becomes words three and four, and so forth. The five available selections, status, gross weight, net weight, mV/V, live mV/V, rate, and set points are defined in Figure 11-1. ROTATION is non-configurable. Rotation shows the time used for one complete token pass of all network nodes

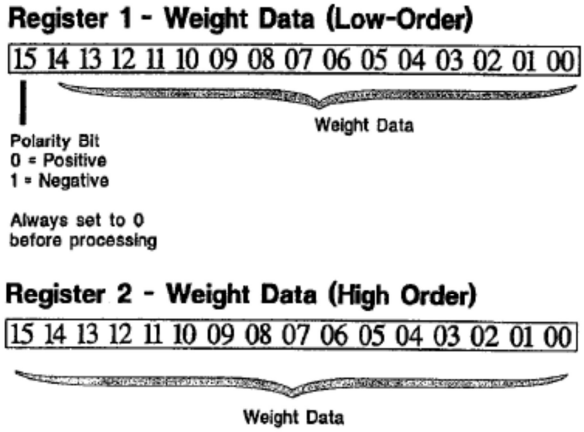
11.4.5 Data Formatting

Table 11-2 presents a complete overview of Modbus register and bit allocations. Table 11-2 information which appears in conventional text applies to both Modbus RTU and Modbus Plus formats. Allocations which pertain only to Modbus Plus appear in italic text.

Double Precision Format

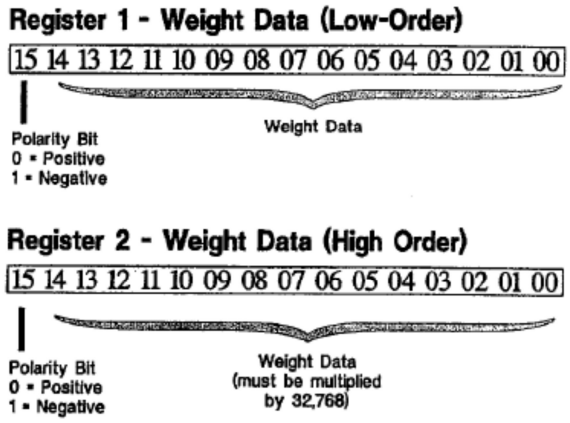
Modicon Double Precision EMM Functions allow PLC users to perform math functions in a 32 bit format. This is accomplished by combining data from two 16 bit registers. Each register holds a value in the range of 0 to 9999, for a combined Double Precision value in the range of 0 to 99,999,999. The combined value is referred to as operand 1. The low-order half of operand 1 (register 1) is stored in the displayed register and the high-order half is stored - in the implied register (register 2). Double precision formatting, however, makes no provision for transmitting a data polarity indicator (plus or minus). BLH therefore, makes a slight format modification to transmit this vital statistic. Double Precision data formatting uses two, 16 bit registers of information to transmit weight data (see below). Each register contains four significant digits.

Since the most significant bit of register one is unused (always 'O'), BLH uses this bit to transmit data polarity. If data is negative, this bit is set to a '1'. If data is positive (as assumed with conventional Double Precision format), this bit remains a zero. Upon receiving a data transmission, the polarity bit must be immediately evaluated. If data is negative (MSB = '1'), store the negative polarity bit in another PLC register (establish a negative data flag) and reset the MSB of register 1 to ZERO. Do not process the data in register 1 until the MSB is set to zero. Attempting to process data with the negative polarity bit set will result in erroneous information. Once the MSB of register 1 is confirmed to be zero, process data using conventional Double Precision EMM instructions.



BLH Data Format

BLH formatted weight data consists of two 16 bit signed integers, the first (high) integer must be multiplied by 32768 and then added to the second (low) integer (see below).



NOTE: If a decimal point is required the resulting value must be multiplied by the appropriate fraction, i.e. 0.01 for hundreds of a unit. In the case of mV/V values the multiplier is 0.000001. The LCm-200 range is (-999999/+ 9999999). NOTE: counts refers to displayed counts. If displayed weight is counting by 2 Ib. increments then presetting a register to 9 would mean 18 Ibs.

11.4.6 Flashing LED Status

A flashing green 'ACTIVE' LED located on the LCm- 200 rear panel (Figure 11-2) indicates the status of Modbus Plus network operation. To interpret flash patterns, refer to the Modbus Plus Planning Guide (GM-MBPL-004).

NOTE: To display flashing status on the LCm-200 front panel, configuring an Alarm/Status Annunciators for 'Modbus Plus Status' indication (see Section 5). 11.4.7 Manipulating the Front Panel Display Provision has been made for the host PLC to display messages on the LCm-200 front panel display. Messages may occupy both the upper (7 character) and lower (8 character) display lines (Figure 11-3). To send a message, the host PLC transmits the message coded in conventional ASCII characters* to registers 40258 thru 40265 along with a display control word; register 40257. Information written to these LCm-200 registers determines not only the message content but also the display time period. When the host message display time period expires, the LCm-200 will revert to its normal weight/status display. See Table 11-2 and Figure 11-3 for a detailed breakout of register allocations and functions. Host messages displayed on the LCm front panel can be used to alert operators to error conditions, prompt - required inputs, etc.

NOTE: Host messages are not displayed if the LCm- 200 is in any calibration or parameter configuration menu mode. * To transmit a decimal point, set the 7sd of the ASCII character byte to a '1'.

11.5 PROVOX PROTOCOL

This interface allows direct communication with a Fisher Rosemount CL6921 type external interface card (card must be configured for 'Toledo' communication format). For further details, request BLH document TD- 073.

11.5.1 Wiring

The Provox interface is transmit only and requires only a twisted pair of wires. Connect wires to the TxD+ and TxD- screw terminals on the 470294-1 interface converter board as shown in Figure 114. Plug the interface converter board into the LCm-200 rear panel serial port as shown in Figure 11-4. Set the SW1 DIP switches as shown in Figure 11-4 (BLH drawing #4703152). Note that the 470294-1 converter board supplied by BLH converts the LCm-200 output signal from RS-422 to.20 mA current loop for Provox operation. The CL6921 external interface card input wiring pins are 17 (Rx-) and 18 (Rx+) as shown in Figure 114.

11.5.2 Configuration

To configure the LCm-200 for Provox communication use the flow diagram presented in Figure 6-1. At the I10 serial display, simply press edit and select the Provox PRINT FORMAT. Once Provox format is selected, all parameters such as 4800 baud rate, string format, even parity, and transmission timing are automatically specified; no further parameter entries are needed.

11.5.3 Operation

With Provox format selected, the LCm-200 continuously transmits 18 bytes of information

containing displayed and tare weight data to the external interface card at 4800 baud. This rate is predefined by Fisher Rosemount and cannot be changed. Each byte is 10 bit ASCII formatted as follows: bit 1 = start, bits 2-8 contain actual data, bit 9 = even parity, and bit 10 = stop. Table 11-3 presents the protocol for each of the 18 bytes.

Table 11-2. MODBUS Register Allocations

REGISTER ADDRESSES

Registers 1 - 18 are read only, 20 - 136 are read/write, 256 is write only

Note - To download parameters, the seal must be open (see paragraph 3.2.8)

REG#	DATA	REGS		DESCRIPTION
40001	SERIAL #	4		7 ASCII digits 0-9 starting with high byte of reg 40001 to high byte of reg 40004; reg 40004 low byte = 0
40005	SOFTWARE VER	1		number with 2 decimal places
40006	A/D REV	1		2 ASCII chars starting with high byte
40007	REF DATE	3		MMDDYY Month Day Year of internal cal; 6 ASCII digits 0-9 starting with high byte of reg 40007 to low byte of reg 40009
40010	STAT1	1		status register 1 (see page 11-6, Table 11-2 for def)
40011	STAT2	1		status register 2 (see page 11-6, Table 11-2 for def)
40012	GROSS WEIGHT	2		
40014	NET WEIGHT	2		
40016	mv/V ACTUAL	2		
40018	mv/V LIVE	2		
40020	ZERO	2		
40022	TARE	2		
40024	ZERO mv/V	2		zero cal point in mv/V
40026	SPAN1 mv/V	2		span1 cal point in mv/V
40028	SPAN1 units	2		span1 cal point in units
40030	SPAN2 mv/V	2		span2 cal point in mv/V
40032	SPAN2 units	2		span2 cal point in units
40034	SPAN3 mv/V	2		span3 cal point in mv/V
40036	SPAN3 units	2		span3 cal point in units
40038	SPAN4 mv/V	2		span4 cal point in mv/V
40040	SPAN4 units	2		span4 cal point in units
40042	SPAN5 mv/V	2		span5 cal point in mv/V
40044	SPAN5 units	2		span5 cal point in units
40046	SPAN6 mv/V	2		span6 cal point in mv/V
40048	SPAN6 units	2		span6 cal point in units
40050	SPAN7 mv/V	2		span7 cal point in mv/V
40052	SPAN7 units	2		span7 cal point in units
40054	SPAN8 mv/V	2		span8 cal point in mv/V
40056	SPAN8 units	2		span8 cal point in units
40058	SPAN9 mv/V	2		span9 cal point in mv/V
40060	SPAN9 units	2		span9 cal point in units
40062	SPAN10 mv/V	2		span10 cal point in mv/V
40064	SPAN10 units	2		span10 cal point in units
40066	# SPAN POINTS	1		0 - 10 (0 if no deadload or keypad cal)
40067	CAL TYPE	1		0 = QUICK, 1 = DEADLOAD, 2 = KEYPAD
40068	ENG UNITS	1		0 = LB, 1 = KG, 2 = TN, 3 = OZ, 4 = GM, 5 = N, 6 = KN, 7 = L
40069	CAPACITY	2		sum of rated capacity of load
40071	DECIMAL POINT	1		0-6 decimal point position: 0= none, 3= 0.000
40072	RATED OUTPUT	2		average of load cells rated output in mv/V
40074	UNIT COUNT BY	1		0-6 = 1,2,5,10,20,50,100
40075	ZERO LIMIT	2		keypad push to zero limit
40077	OVERLOAD	2		overload limit, 0 = no limit
40079	LEVEL CONFIG	1		level bar graph configuration: 0 = off/gross, 1 = on/gross, 2 = off/net, 3 = on/net 4 = off/rate, 5 = on/rate
40080	LEVEL 0%	2		level 0% setting
40082	LEVEL 100%	2		level 100% setting
40084	ARROWS CONFIG	1		side arrows configuration: 0 = off/gross, 1 = on/gross, 2 = off/net, 3 = on/net 4 = off/rate, 5 = on/rate
40085	ARROWS 0%	2		arrows 0% setting
40087	ARROWS 100%	2		arrows 100% setting
40089	A1 ANNUNCIATOR	1	0-15:	0 = off 1 = in motion 2 = zero lim 3 = overload 4 = ser1 rx 5 = ser1 tx 6 = s1 par err 7 = s1 fram err 8 = d/a fault 9 = d/a over 10 = d/a under 11 = rio status (led) 12 = modem rx 13 = modem tx 14 = setpoint output 15 = modbus+ status
40090	A2 ANNUNCIATOR	1		
40091	A3 ANNUNCIATOR	1		
40092	A4 ANNUNCIATOR	1		
40093	A5 ANNUNCIATOR	1		
40094	A6 ANNUNCIATOR	1		
40095	A7 ANNUNCIATOR	1		
40096	A8 ANNUNCIATOR	1		
40097	ZERO KEY CONFIG	1		0 = auto, 1 = manual
40098	TARE KEY CONFIG	1		0 = auto, 1 = manual
40099	ANALOG CONFIG	1		0 = gross, 1 = net, 2 = rate
40100	ANALOG LOW	2		low analog output weight setting
40102	ANALOG HIGH	2		high analog output weight setting

40104	ANALOG LOW ADJ	2	low analog output adjustment
40106	ANALOG HIGH ADJ	2	high analog output adjustment
40108	FILTER AVERAGING	1	0-7 = 1,2,4,8,16,32,64,128 conversions
40109	FILTER BAND	1	0-10 = 0-2.5 counts, 11-108 = 3-100 counts
40110	MOTION	1	0 = off, 1-10 = 0-2.5 counts, 11-58 = 3-50 counts
40111	MOTION TIMER	1	0 - 3 = 0.5, 1.0, 1.5, 2.0 seconds
40112	PASSWORD	4	allowable ASCII chars are 0-9,A-Z, minus, space. Reg 40112 high byte is first char, reg 40115 high byte is last char; reg 40115, low byte set to 0
40116	KEY/SECY LOCKS	1	bits 0-4 = zero,tare,g/n,print,edit keys bit 5 = security lock; 0 = off, 1 = on
40117	MENU LOCKS	1	bits 0-5 = cal,filter,display,i/o,diag, rate; 0 = uniock, 1 = lock
40118	SERIAL 1 FORMAT	1	0 = print, 1 = continuous, 2 = pc, 3 = Modbus, 4 = Provox
40119	SERIAL 1 ADDRESS	1	0 - 99
40120	SERIAL 1 BAUD RATE	1	0 = 9600, 1 = 19200, 2 = 300, 3 = 600, 4 = 1200, 5 = 2400, 6 = 4800
40121	SERIAL 1 PARITY	1	0 = none, 1 = even, 2 = odd
40122	PRINT DATA SELECT	1	bits 0-5 = display,gross,net,zero,tare, rate; 0 = no, 1 = yes
40123	PRINT DATA FRMAT	1	bits 0-1 = stx,address; 0 = no, 1 = yes bit 2 = leading 0s: 0 = spaces, 1 = zeros bit 4 = status; 0 = no, 1 = yes bit 5 = delimiter; 0 = space, 1 = crlf bit 6 = terminating char; 0 = crlf,1 = cr bits 7,3 = units; 00 = no, 01 = abbreviated
40124	PRINT CRLF DELAY	1	0-99 = 0.0 - 9.9 seconds
40125	CON'T DATA SELECT	1	bits 0-5 = display,gross,net,zero,tare, rate; 0 = no, 1 = yes
40126	CON'T DATA FRMAT	1	bits 0-1 = stx,address; 0 = no, 1 = yes bit 2 = leading 0s; 0 = spaces, 1 = zeros bit 3-4 = units,status; 0/1 = no/yes bit 5 = delimiter 0 = space, 1 = crlf bit 6 = terminating char; 0 = crlf,1 = cr bit 7 = timer; 0 = no, 1 = yes
40127	CON'T TX TIMER	1	0-599 = 00.0 - 59.9 seconds
40128	CON'T TX TIMER	1	0-240 = 0 - 240 minutes
40129	TAG NO.	4	allowable ASCII chars are 0-9,A-Z, minus, space. Reg 40129 high byte is first char, reg 40132 high byte is last char, reg 40132 low byte set to 0.
40133	CAL DATE	3	MMDDYY Month Day Year of customer cal 6 ASCII digits 0-9 starting with high byte of reg 40133 to low byte of reg 40135.
40136	NEXT CAL	3	MMDDYY Month Day Year of customer next cal. 6 ASCII digits 0-9 starting with high byte of reg 40136 to low byte of reg 40138
40139	RIO BAUD RATE	1	0 = 57.6K, 1 = 115.2K, 2 = 230.4K
40140	RIO RACK #	1	0-63 = 1-77 octal
40141	RIO QUARTER	1	0-3 = 1-4 starting quarter
40142	RIO LAST RACK	1	0 = not last rack, 1 = last rack
40143	INSTRUMENT	1	instrument type: 200 for LCm-200
40144	OPTIONS	3	[M]-[A]-[P]-[C]-[B]-[M] 6 ASCII digits 0-9 starting with high byte of reg 40144 to low byte of reg 40146
40147	RATE UNITS	1	rate units; 0 = unit/sec, 1 = unit/min
40148	RATE RESOLUTION	1	rate resolution; (0-12) 0 = highest, 12 = lowest
40149	RATE DV TIME	1	rate derivation time (1-1250) seconds
40150	RATE MIN DV TIME	1	rate minimum derivation time (1-1250) seconds
40151	CURRENT RATE DATA	2	current rate data
40153	G/N KEY CONFIG	1	low nibble = display power up; 0 = gross, 1 = net, 2 = rate high nibble: 4 = net display (0/1 = no/yes) 5 = rate display (0/1 = no/yes); 6&7 = spare
40154	***MB+ GLOBAL DATA***	***1 (bits 0-7)***	***0 = no, 1 = yes*** ***bit 0 = status*** ***bit 1 = gross*** ***bit 2 = net*** ***bit 3 = mV/V*** ***bit 4 = live mV/V*** ***bit 5 = rate*** ***bit 6 = setpnts*** ***bit 7 = spare***
40155 - 40169			spare
40170	OUTPT 1 MAIN	2	output 1 main value
40172	OUTPT 1 INFLIGHT	1	output 1 inflight
40173	OUTPT 1 DEADBAND	1	output 1 deadband
40174	OUTPT 1 CONFIG	1	output 1 configuration; bit 0 = main(0)/drib(1), bit 1 = track gross(0)/net(1), bit 2 = 0, bit 3 = on below (0)/above (1)
40175	OUTPT 1 TAG	4	output 1 tag; 8 ASCII characters (space,1-0,'-',A-Z) starting with high byte of reg 40175 to low byte of reg 40178

40179	OUTPT 2 MAIN/DRIB	2	output 2 main (or output 1 dribble) value
40181	OUTPT 2 INFLIGHT	1	output 2 inflight
40182	OUTPT 2 DEADBAND	1	output 2 deadband
40183	OUTPT 2 CONFIG	1	output 2 config; see definition for output 1 config
40184	OUTPT 2 TAG	4	output 2 tag; see definition for output 1 tag
40188	OUTPT 3 MAIN/DRIB	2	output 3 main (or output 2 dribble) value
40190	OUTPT 3 INFLIGHT	1	output 3 inflight
40191	OUTPT 3 DEADBAND	1	output 3 deadband
40192	OUTPT 3 CONFIG	1	output 3 config; see definition for output 1 config
40193	OUTPT 3 TAG	4	output 3 tag; see definition for output 1 tag
40197	OUTPT 4 MAIN/DRIB	2	output 4 main (or output 3 dribble) value
40199	OUTPT 4 INFLIGHT	1	output 4 inflight
40200	OUTPT 4 DEADBAND	1	output 4 deadband
40201	OUTPT 4 CONFIG	1	output 4 config; see definition for output 1 config
40202	OUTPT 4 TAG	4	output 4 tag; see definition for output 1 tag
40206	OUTPT 5 MAIN/DRIB	2	output 5 main (or output 4 dribble) value
40208	OUTPT 5 INFLIGHT	1	output 5 inflight
40209	OUTPT 5 DEADBAND	1	output 5 deadband
40210	OUTPT 5 CONFIG	1	output 5 config; see definition for output 1 config
40211	OUTPT 5 TAG	4	output 5 tag; see definition for output 1 tag
40215	OUTPT 6 MAIN/DRIB	2	output 6 main (or output 5 dribble) value
40217	OUTPT 6 INFLIGHT	1	output 6 inflight
40218	OUTPT 6 DEADBAND	1	output 6 deadband
40219	OUTPT 6 CONFIG	1	output 6 config; see definition for output 1 config
40220	OUTPT 6 TAG	4	output 6 tag; see definition for output 1 tag
40224	OUTPT 7 MAIN/DRIB	2	output 7 main (or output 6 dribble) value
40226	OUTPT 7 INFLIGHT	1	output 7 inflight
40227	OUTPT 7 DEADBAND	1	output 7 deadband
40228	OUTPT 7 CONFIG	1	output 7 config; see definition for output 1 config
40229	OUTPT 7 TAG	4	output 7 tag; see definition for output 1 tag
40233	OUTPT 8 MAIN/DRIB	2	output 8 main (or output 7 dribble) value
40235	OUTPT 8 INFLIGHT	1	output 8 inflight
40236	OUTPT 8 DEADBAND	1	output 8 deadband
40237	OUTPT 8 CONFIG	1	output 8 config; see definition for output 1 config
40238	OUTPT 8 TAG	4	output 8 tag; see definition for output 1 tag
40242	SETPOINT LOCKS	1	bits 0-7 = setpoints 1-8; 0= off, 1 = on
40243-40255			spare
40256	COMMAND	1	Write only register. 1 = tare net weight 2 = push to zero gross weight 3 = clear status register 1
40257	***CONTROL DATA***	***1***	***if bit 0 = 1, apply data in registers 40258-40261 to upper display*** ***if bit 1 = 1, apply data in registers 40262-40265 to lower display*** ***if bit 2 = 1 and bit 0 = 1, flash the upper display*** ***if bit 3 = 1 and bit 1 = 1, flash the lower display*** ***bits 4-7 are spares, set to zero*** ***bits 8-15 are the display timer, each increment adds 50 msec*** ***i.e. 00000001 = 50 msec timer; 00000010 = 100 msec timer*** ***NOTE: 00000000 = 12800 msec timer (12.8 seconds)***
40258-40261	***UPPER DISPLAY DATA***	***4 registers***	***see Figure 11-3 for byte allocations***
40262-40265	***LOWER DISPLAY DATA***	***4 registers***	***see Figure 11-3 for byte allocations***

Table 11-3. Status Byte Bit Allocations

STATUS REGISTERS

Note: Status registers 1 & 2 are read only (function 03) registers. The bits in these registers can also be read as inputs 1 - 32 using function 02.

Note: In status register 1 the bits latch on if the condition is true. To clear status register 1 a 3 must be sent to command register 40256. In status register 2 the bits do not latch but follow the current status of the condition.

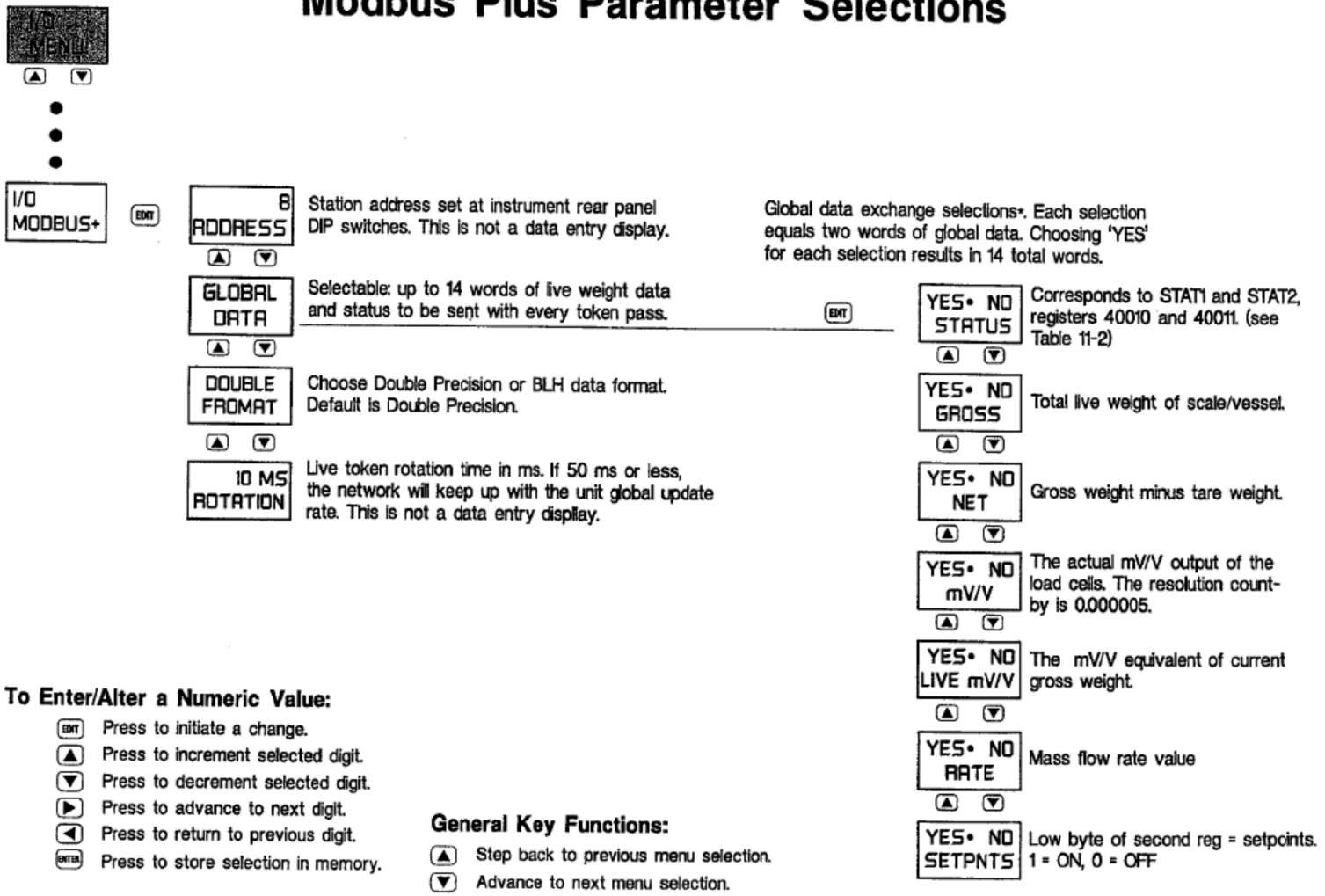
(INPUT) STAT1 STATUS REGISTER 1

(1)	BIT	0 - POWERUP
(2)	BIT	1 - UNABLE TO TARE/ZERO BECAUSE OF MOTION
(3)	BIT	2 - UNABLE TO ZERO BECAUSE OF LIMIT
(4)	BIT	3 - LOAD CELL SIGNAL UNDERRANGE
(5)	BIT	4 - LOAD CELL SIGNAL OVERRANGE
(6)	BIT	5 - LOAD CELL CONNECT FAULT
(7)	BIT	6 - ANALOG OUTPUT UNDERRANGE
(8)	BIT	7 - ANALOG OUTPUT OVERRANGE
(9)	BIT	8 - ANALOG OUTPUT OPEN CIRCUIT
(10)	BIT	9 - NO mV/V CAL
(11)	BIT	10 - NO ENGINEERING CAL
(12)	BIT	11 - NO TEMPERATURE COMPENSATION
(13)	BIT	12 - NO MANUAL ZERO
(14)	BIT	13 - NO MANUAL TARE
(15)	BIT	14 - EEPROM ERROR
(16)	BIT	15 - SPARE

(INPUT) STAT2 STATUS REGISTER 2

(17)	BIT	0 - POWERUP (on for 5 seconds after power up)
(18)	BIT	1 - UNABLE TO TARE/ZERO BECAUSE OF MOTION (on for 2 sec if true)
(19)	BIT	2 - UNABLE TO ZERO BECAUSE OF LIMIT (on for 2 sec if true)
(20)	BIT	3 - LOAD CELL SIGNAL UNDERRANGE
(21)	BIT	4 - LOAD CELL SIGNAL OVERRANGE
(22)	BIT	5 - LOAD CELL CONNECT FAULT
(23)	BIT	6 - ANALOG OUTPUT UNDERRANGE
(24)	BIT	7 - ANALOG OUTPUT OVERRANGE
(25)	BIT	8 - ANALOG OUTPUT OPEN CIRCUIT
(26)	BIT	9 -
(27)	BIT	10 -
(28)	BIT	11 -
(29)	BIT	12 - MOTION
(30)	BIT	13 - FAULT (on if any bits on in status register 1)
(31)	BIT	14 - ZERO LIMIT
(32)	BIT	15 - OVERLOAD

Modbus Plus Parameter Selections



To Enter/Alter a Numeric Value:

- EDIT Press to initiate a change.
- ▲ Press to increment selected digit.
- ▼ Press to decrement selected digit.
- ▶ Press to advance to next digit.
- ◀ Press to return to previous digit.
- ENTER Press to store selection in memory.

To Enter/Alter a Parameter Selection:

- EDIT Press to initiate a change.
- ▼ Press to view parameter options.
- ENTER Press to store selection in memory.

General Key Functions:

- ▲ Step back to previous menu selection.
- ▼ Advance to next menu selection.
- MENU Advance to next main menu selection.
- ESC Return to live operation from menu.
- EDIT Change sub menu parameters.
- ENTER Store displayed sub menu parameter in memory.

* This data also may be selected by writing to register 40147 bits 0-6 where bit 0=status, bit 1=gross weight, etc. Data formats for this exchange are defined in Table 10-1. Register locations are 40010 to 40023.

Figure 11-1. Modbus Plus Parameter Selections

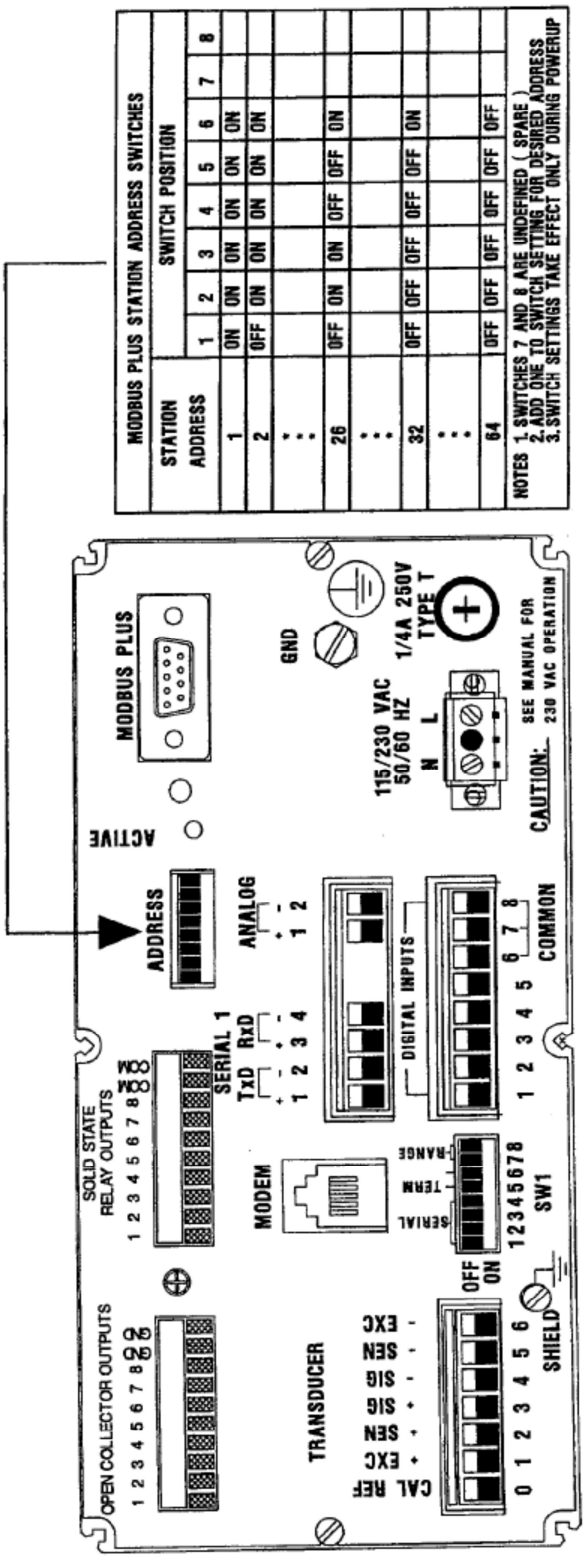


Figure 11-2. Modbus Plus Rear Panel Configuration.

Instrument Upper Display Line

40258 High Byte	40258 Low Byte	40259 High Byte	40259 Low Byte	40260 High Byte	40260 Low Byte	40261 High Byte

Instrument Lower Display Line

40262 High Byte	40262 Low Byte	40263 High Byte	40263 Low Byte	40264 High Byte	40264 Low Byte	40265 High Byte	40265 Low Byte

Figure 11-3. Display Write, Register and Byte Allocations

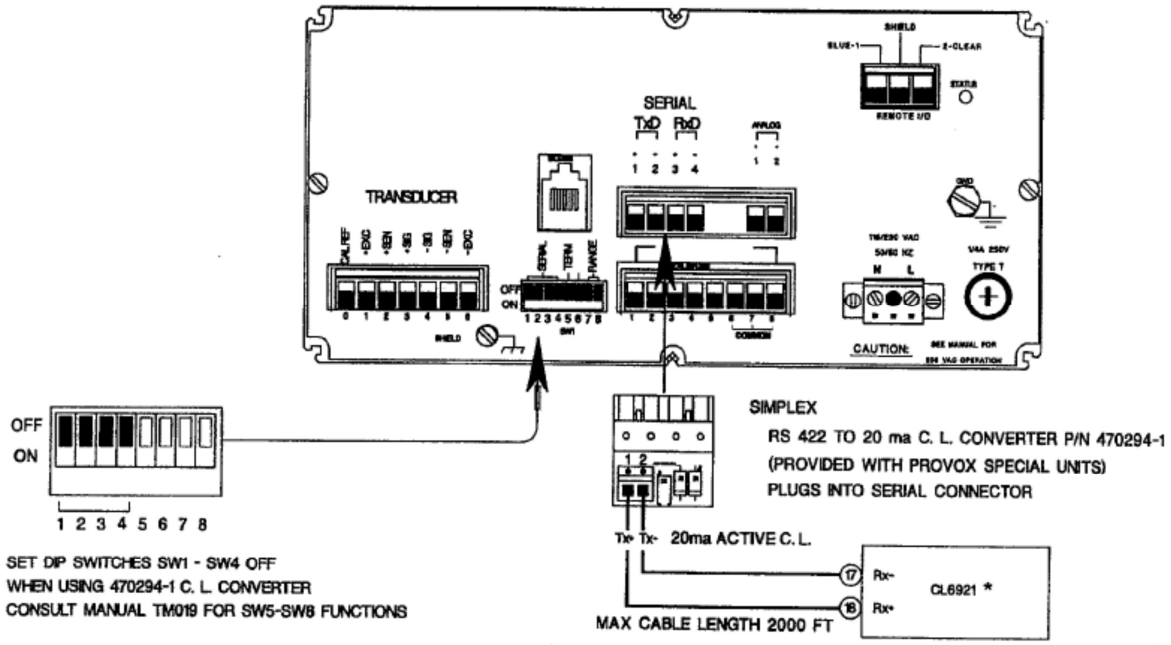


Figure 11-4. Fisher Provox Wiring Arrangements

Table 11-3. 18 Byte Fisher Provox Protocol

Byte 1: STX (02H)

Byte 2: Status Word A - Decimal Point Position or Dummy Zero Status

Bit	X00	X0	X	0.X	0.XX	0.XXX	0.XXXX	0.XXXXX
0	0	1	0	1	0	1	0	1
1	0	0	1	1	0	0	1	1
2	0	0	0	0	1	1	1	1

Byte 2: Status Word A - Count By Factor

Bit	Count By 1	Count By 2	Count By 5
3	1	0	1
4	0	1	1

5 - Always a 1

6 - Always a 0

Byte 3: Status Word B

Bit	Status - 0	Status - 1
1	Gross	Net
2	Positive	Negative
3	Not Overrange	Overrange
4	No Motion	Motion
5 - Always a 1		
6	Normal Operation	Power Up

Byte 4: Status Word C - Bit 5 = 1, all other Bits = 0

Bytes 5:-10: Indicated Weight Value

Bytes 11-15: Tare Weight Value

Byte 17: Carriage Return (0DH)

Byte 18: Checksum Character

*Wiring designations based upon BLH's current understanding of the CL6921 board. Always consult with Fisher Rosemount to verify correctness of information.

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