

## SCOPE OF MANUAL

This manual contains information concerning the installation, operation and maintenance of the Model 2100R+ flow meter. To ensure proper performance of the meter, the instructions given in this manual should be thoroughly understood and followed.

**Keep the manual in a readily accessible location for future reference.**

Changes and additions to the original edition of this manual will be covered by a "CHANGE NOTICE" supplied with the manual. The change notice will explain any differences between the product described in this manual.

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To avoid damage in transit, Badger products are shipped to the customer in special shipping containers. Upon receipt of the product, perform the following unpacking and inspection procedures:

**NOTE: If damage to the shipping container is evident upon receipt, request the carrier to be present when the product is unpacked.**

a. Carefully open the shipping container following any instructions that may be marked on the box. Remove all cushioning material surrounding the product and carefully lift the product from the container.

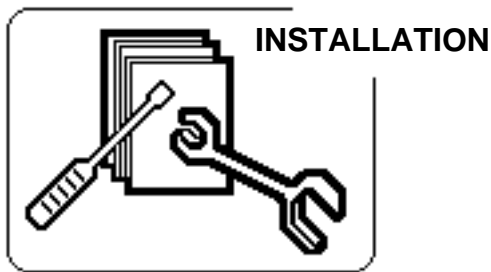
**Retain the container and all packing material for possible use in reshipment or storage.**

b. Visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

**NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the customer.**

## GENERAL SPECIFICATIONS

DISPLAYS	<p>Recorder: 2 line, 24 alphanumeric character per line Liquid Crystal Display. Displays instantaneous flow rate, totalization, alarm indication and is used to program the recorder through menu driven prompts.</p> <p>Flow Meter: 2 line, 24 alphanumeric character per line Liquid Crystal Display. Displays instantaneous flow rate, level, alarm indication and is used to program the flow meter through menu driven prompts.</p>																				
RECORDING	12 inch circular chart with 24 hour, 7 day or 31 day selectable chart speed, single disposable red ink pen.																				
PROGRAMMING	Menu driven display prompt with 5 key tactile feedback keypad.																				
OUTPUTS	<p>Recorder: 4-20 mADC signal into max. 1000 ohms 2 dry contact SPDT relays assignable to any of the following: High or low alarms, contact integrator, loss of 4-20 mA signal, EEPROM failure. Rated for 0.25 amp @ 120 VAC or 0.5 amp @ 24 VDC</p> <p>Flow Meter: 4 dry contact SPDT relays assignable to any of the following: High or low alarms, loss of echo, transmit failure, EEPROM failure, overrange and loss of 4-20 mA signal. Rated for 0.25 amp @ 120 VAC or 0.5 amp @ 24 VDC.</p>																				
ENCLOSURE	Indoor: NEMA 12, metallic; Outdoor: NEMA 4X, non-metallic																				
TEMPERATURE LIMITS	Indoor: 32° F to 150° F (0° C to 65° C) Outdoor: -40° F to 150° F (-40° C to 65° C)																				
POWER REQUIREMENTS	Standard: 117 VAC, 50/60 Hz +/- 10%, 20 watts Optional: 230 VAC, 50/60 Hz +/- 10% Heater & Thermostat: 220 watts																				
PERFORMANCE	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 35%;"></th> <th style="width: 20%; text-align: center;">Recording</th> <th style="width: 20%; text-align: center;">Indicating</th> <th style="width: 25%; text-align: center;">Totalization</th> </tr> </thead> <tbody> <tr> <td>Accuracy:</td> <td style="text-align: center;">+/- 0.5% of span</td> <td style="text-align: center;">+/- 1% or 1 LSD</td> <td style="text-align: center;">+/- 0.25%</td> </tr> <tr> <td>Linearity:</td> <td style="text-align: center;">+/- 0.5% of span</td> <td style="text-align: center;">+/- 0.5%</td> <td></td> </tr> <tr> <td>Hysteresis:</td> <td style="text-align: center;">+/- 0.5% of span</td> <td></td> <td></td> </tr> <tr> <td>Repeatability:</td> <td style="text-align: center;">+/- 0.5% of span</td> <td></td> <td></td> </tr> </tbody> </table>		Recording	Indicating	Totalization	Accuracy:	+/- 0.5% of span	+/- 1% or 1 LSD	+/- 0.25%	Linearity:	+/- 0.5% of span	+/- 0.5%		Hysteresis:	+/- 0.5% of span			Repeatability:	+/- 0.5% of span		
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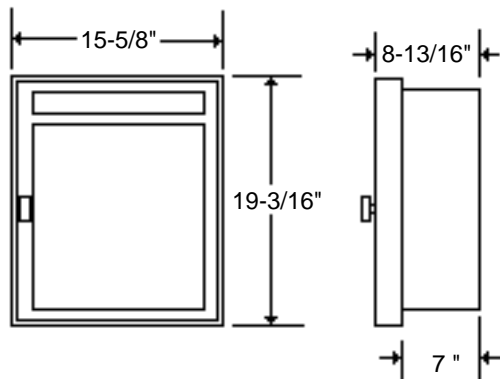


## ENCLOSURE DESCRIPTION

The Model 2100R+ ultrasonic flow meter with circular chart recorder is housed in either a NEMA 12 or NEMA 4X enclosure.

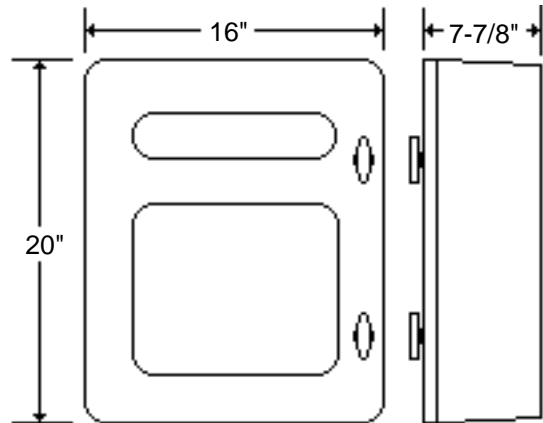
The NEMA 12 enclosure is suitable for indoor use and is designed to be panel mounted. It can be supplied with heater and thermostat for indoor installations in buildings that are not heated in the winter. Mounting hardware is provided for panel mounting of the enclosure. Care should be taken when selecting the mounting location so that the recorder door can be opened completely for access when changing charts.

### INDOOR ENCLOSURE DIMENSIONS



The NEMA 4X enclosure is suitable for outdoor use and can be wall or pole mounted. It comes equipped with heater and thermostat. The door can be supplied with or without a window. The door is provided with two lockable latches. Caution should be used when mounting the enclosure so that it is not exposed to direct sunlight. A sun shield is recommended to prevent the temperature inside the enclosure from reaching above the maximum rating of the electronics (see temperature specification under General Specifications). Viewing window is optional.

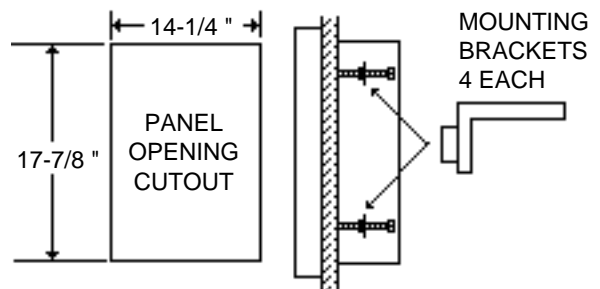
### OUTDOOR ENCLOSURE DIMENSIONS



### INDOOR PANEL MOUNTING

Prior to mounting the enclosure, it is recommended that the knockouts for the conduit fittings be removed. This should be done with the enclosure resting on a solid surface.

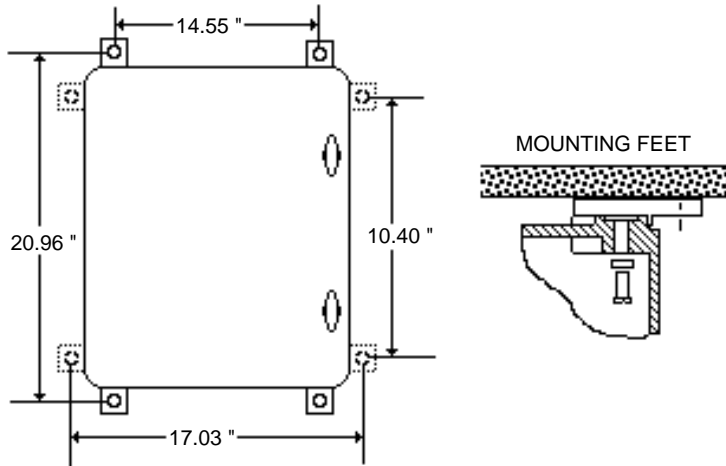
A hole 17-7/8" high by 14-1/4" wide is required for inserting the enclosure in a panel. Slide the recorder into the panel. Install the four mounting brackets into the slots in the sides of the enclosure as shown below. Tighten the mounting screws until the enclosure is secure to the panel.



## OUTDOOR ENCLOSURE MOUNTING

The NEMA 4X outdoor enclosure is provided with four mounting feet which are to be installed by the user at the orientation desired. Pictured below is the installation detail of the feet and the mounting hole dimensions.

If the outdoor enclosure has the window option, do not mount facing the sun or install a sun shade to prevent overheating of the electronics inside the enclosure.



## WIRING CONNECTIONS

The indoor case has six 7/8" diameter knockouts for use of 3/4" conduit connections. Three are located on the bottom of the case and three on the back of the case. The three you use will depend on whether you panel or wall mount the enclosure. The outdoor enclosure has three 7/8" diameter knockouts located at the bottom of the case.

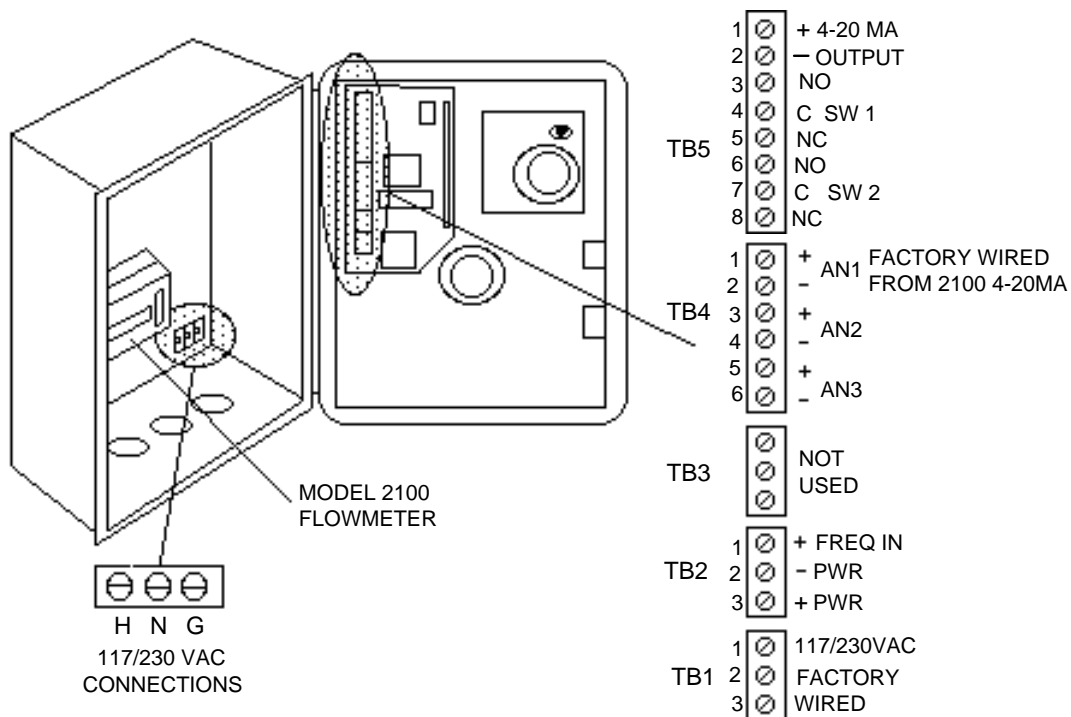
Local regulations for proper grounding and connection of the power to the recorder should be strictly followed.

The power wires are connected to the terminals located on the inside back of the enclosure (see Figure 2-1). To gain access, open the enclosure door and loosen the two screws at the top and bottom left side of the chart plate and swing out the chart plate. The AC voltage for which the unit has been set up for will be clearly marked near the terminal strip. **Verify that you are connecting the proper voltage to the recorder.** The terminal labeled H is the High (black) wire, the terminal labeled N is the Neutral (white) wire and the terminal labeled G is the Ground (green) wire. The power wires from the terminal strip to the recorder circuit board and the flowmeter power board are prewired from the factory.

The terminal blocks on the recorder circuit board have snap-on connectors. To connect the output wires for the relays or 4-20 mA retransmission, pull off the connectors from the terminal strips. Route the signal wires through the wiring clips. Loosen the screws on the connectors. Strip off about 1/4 inch of insulation from the wires. Insert the wire into the proper connector and tighten the screw securely. After connecting all of the wires to the connector, snap the connector back on the terminal strip.

### RECORDER RELAY OUTPUTS

TB5	1	+ 4-20 MA	<div style="border: 1px solid black; padding: 5px; width: fit-content;">                     DRY CONTACT                      RELAYS MAX                      LOAD 250 MA                 </div>
	2	- OUTPUT	
	3	NO	
	4	C SW 1	
	5	NC	
	6	NO	
	7	C SW 2	
	8	NC	

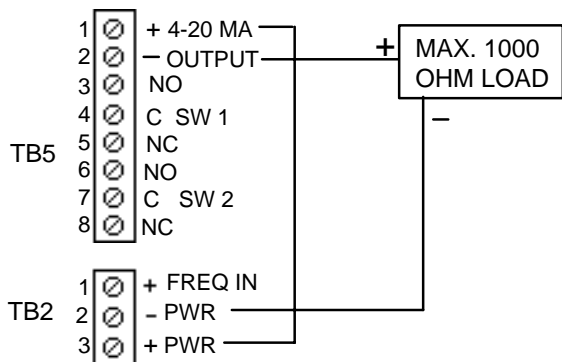


**FIGURE 2-1**

The recorder relay outputs are located on TB5 of the recorder circuit board. The relays are assignable to different functions. See the Recorder Operating Section of this manual.

**RELAY OUTPUTS** - TB2 also is the terminal block for the connections for the relay outputs. Terminal connections 7 through 18 are used for the four relays which are marked SW1, SW2, SW3 and SW4. These relays are single pole double throw with a 1.0 amp 24 VDC or 0.5 amp 120 VAC current rating.

**RECORDER 4-20 mADC OUTPUT**



The wiring connections are marked on the printed circuit board below the terminal block. Each relay terminal is marked NC (normally closed), C (common) and NO (normally open). The normally open and normally closed positions are with the relay de-energized. The relays are energized when they are tripped by the assigned level or alarm. The relays can be assigned for different functions which are explained in the Model 2100 Operation Section of this manual on Page 3-13.

The 4-20 mADC output is a retransmitted output of the flow signal which can be connected to other external devices. The wiring connections must be connected in series with the load, as shown above.

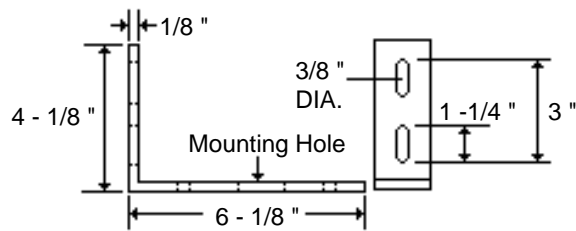
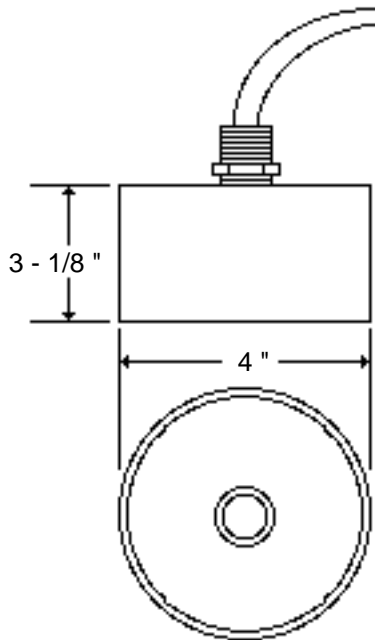
**FB-1 (FULL FACE)  
SENSOR INSTALLATION**

**GENERAL DESCRIPTION**

The Model 2100 FB-1 sensor has a PVC plastic housing. The sensor is back filled with an epoxy resin. The sensor head has a 3/4 inch NPT mounting nipple to secure the sensor to the mounting bracket and attaching a conduit fitting for routing the sensor cable back to the electronic enclosure. **Metallic conduit must be used to run the sensor cable back to the electronics.** The sensor must be mounted level. An 'L' mounting bracket is supplied with the sensor.

The sensor is supplied with 100 feet of triaxial cable. The sensor can be ordered with 300 feet of continuous cable, or additional cable (up to 1000 feet total) may be spliced onto the cable from the sensor. **Only Belden 9222 cable should be used.**

A component change in the electronics is required depending on the length of the cable. This is done at the factory based on the amount of cable ordered with the meter. The critical lengths of cable for the component change are 150 feet and 750 feet. If the user increases or decreases the length of cable, and the length change steps above or below the critical length points, the factory should be contacted for information regarding the correct component change.

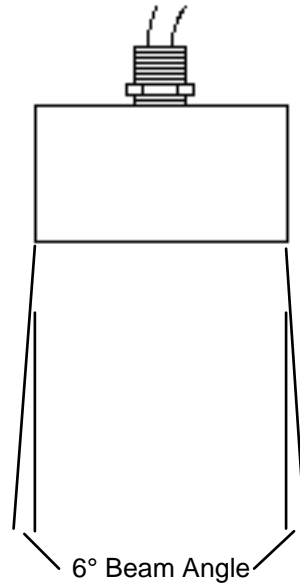
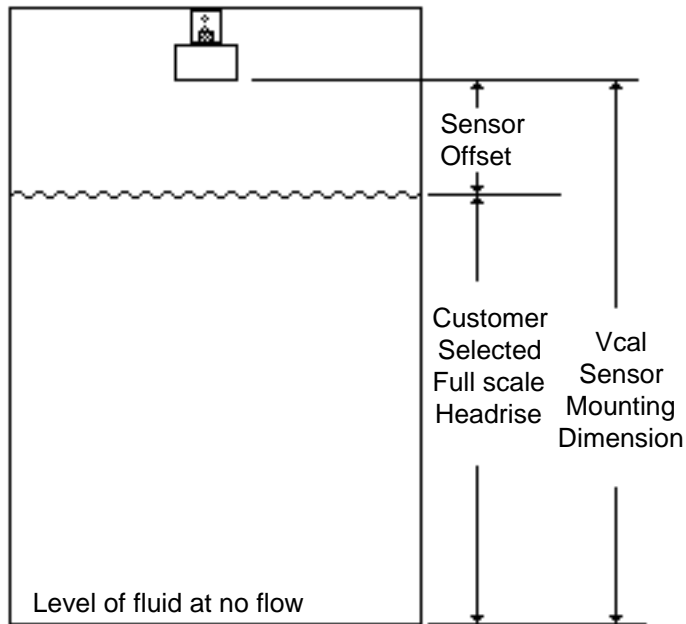


MOUNTING BRACKET

**INSTALLATION**

The meter is normally programmed at the factory to a specific application. The sensor must be installed to the proper mounting dimensions to ensure the accuracy of the flow meter. Refer to the Data Sheet in the front of this manual for these dimensions.

The dimension that is used when mounting the sensor is the vertical calibrated (Vcal) mounting distance. This is the distance from the surface of the fluid at no (zero) flow, to the face (bottom) of the sensor. There are two regions that make up the Vcal distance. These are the sensor **offset** and the customer selected **full scale headrise**.



**NOTE:**

**If sensor is exposed to sunlight, a sun shield should be used**

The sensor **offset** is the distance from the maximum level of the fluid to the face of the sensor. The minimum offset is 12 inches.

The **full scale headrise** is the level of the fluid at the **customer's selected full scale flow** for the flume or weir. The minimum full scale headrise is 4 inches and the maximum is 132 inches.

Therefore,

$$\text{Sensor vertical mounting distance (Vcal)} = \text{Customer full scale headrise} + \text{sensor offset}$$

When the Model 2100 is programmed at the factory, the Vcal is determined by taking the full scale headrise of the maximum capacity of the flume or weir plus 12 inches for the offset. This is done so that the flow meter can be

rescaled to a higher full scale flow in the future without having to move the sensor. This is reflected on the Mounting and Calibration Data Sheet in the front of the manual by the Max. Capacity (Element) and Customer Maximum Headrise. When the Customer Max. Flow is less than the Max. Flow (Element) then the sensor offset will be 12 inches plus the difference between Max. Flow (Element) and the Customer Max. Headrise.

The other mounting dimension that is important is the Horizontal (H) dimension. This is the horizontal distance from a reference point on the flume or weir to the sensor. Pages 2-6 through 2-9 show this dimension for the commonly used flumes and weirs.

Another aspect that must be considered when mounting the sensor is the distance of the sensor from the walls

of the structure in which the fluid is flowing. If the sensor is too close to the wall, reflections may occur which could cause inaccuracies in the level measurement. The beam angle of the transmitted signal from the sensor face is a maximum of 6 degrees. To determine the distance the sensor must be mounted from the wall, multiply the Vcal distance times 0.0524. This will give the distance required from the wall to the sensor housing.

The exit hole for the sensor cable on the top of the housing is a 3/4" NPT nipple which is used to mount the sensor to the mounting bracket and connecting the conduit for the cable. **The cable must be run in metallic conduit to prevent any stray noise interference from affecting the meter's operation.**

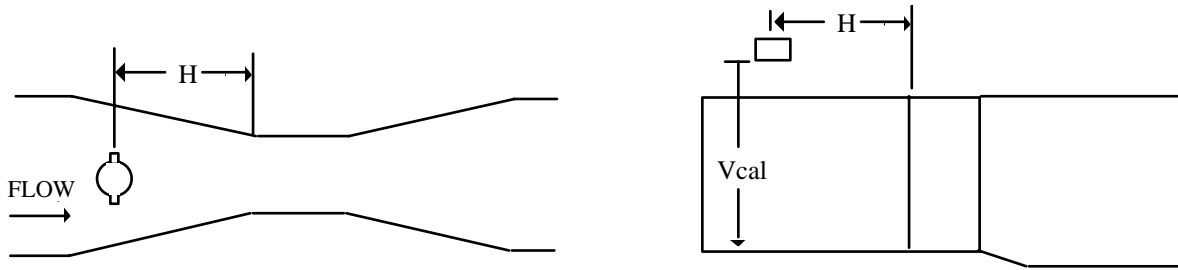
The mounting bracket provided with the sensor can be mounted directly to the wall for Vcal distances of 60 inches or less. An extension or mounting brace to the mounting bracket will be required for Vcal distances greater than 60 inches.

When installing the sensor, it is imperative that it be level. A level should be placed on top of the sensor and adjustments made to the mounting bracket to ensure the sensor face is level to fluid.

This completes the FB-1 sensor installation procedure. Refer to the Electronic Wiring Section for connecting the sensor cable to the electronics.



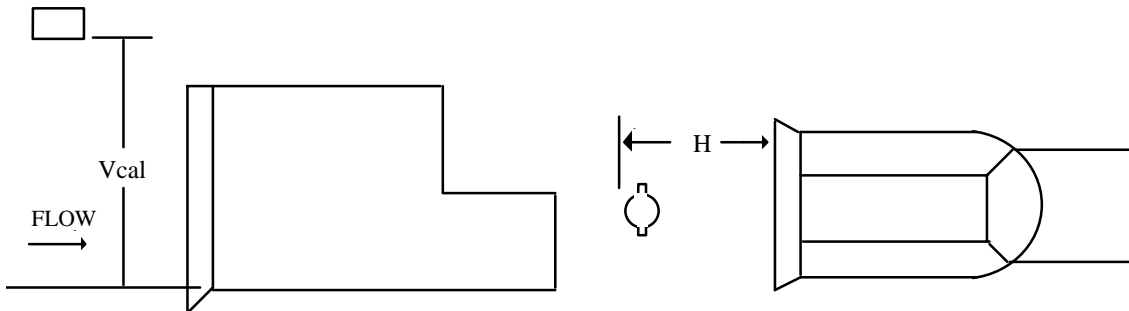
## PARSHALL FLUME INSTALLATION



Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
2	11.00	21.46	60	210	9.46
3	12.00	30.21	85	850	18.21
6	16.00	30.29	180	1800	18.29
9	22.50	38.01	280	4500	26.01
12	35.25	42.70	375	7500	30.70
18	37.25	43.70	550	12000	31.70
24	39.25	43.47	700	16000	31.47
36	43.25	43.98	1100	25000	31.98
48	47.00	44.75	1350	35000	32.75

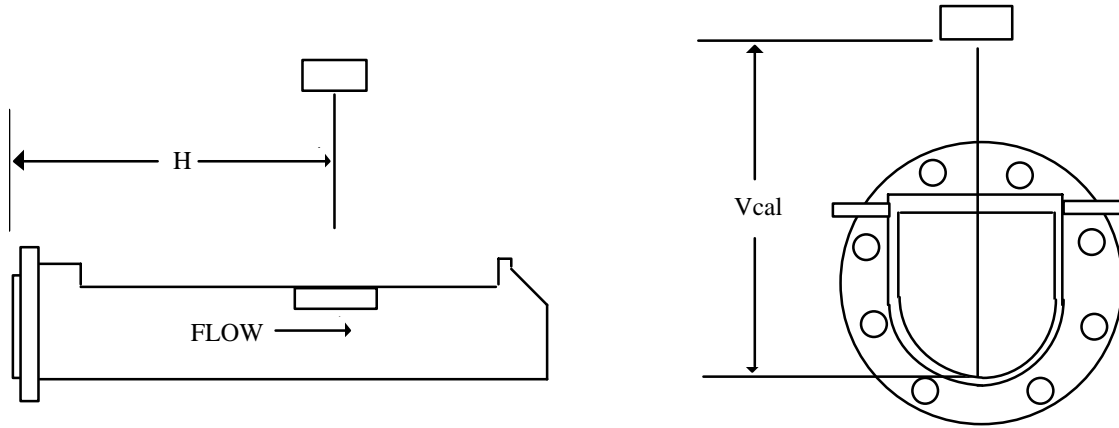
The H dimension is straight back from the entrance of the throat and not along the flume wall.

## MANHOLE FLUME INSTALLATION



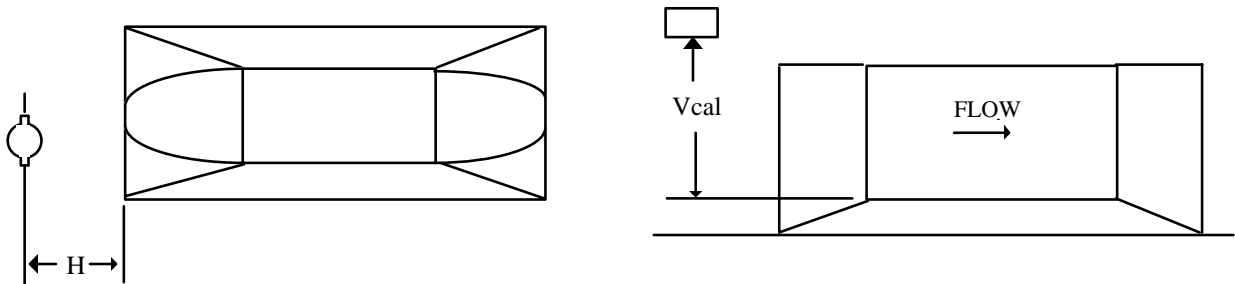
Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
4	5.75	17.86	45	90	5.86
6	7.75	20.94	60	250	8.94
8	9.75	24.32	75	550	12.32
10	11.75	27.58	80	1000	15.58
12	13.75	29.99	100	1500	17.99

## OPEN FLOW NOZZLE INSTALLATION



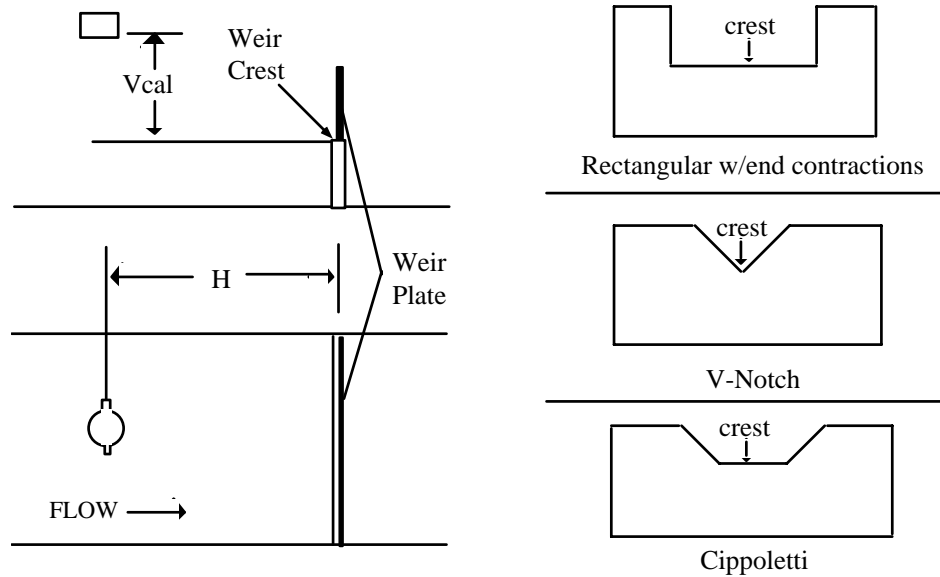
Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
6	21.00	16.79	125	180	4.79
8	23.00	18.66	150	400	6.66
10	25.00	10.77	165	800	8.77
12	29.00	21.55	145	1100	9.55
14	31.00	24.75	85	1600	12.75
16	35.00	25.87	100	1900	13.87
18	38.00	28.16	85	2600	16.16
20	40.00	30.78	90	3400	18.78
24	46.00	35.07	95	7000	23.07

## PALMER-BOWLUS FLUME INSTALLATION



Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
6	3.00	17.16	130	200	5.16
8	4.00	18.77	145	400	6.77
10	5.00	20.46	175	700	8.46
12	6.00	22.15	200	1100	10.15
15	7.50	24.96	220	2000	12.96
18	9.00	27.13	270	3000	15.13
21	10.50	29.85	300	4500	17.85
24	12.00	32.77	325	6500	20.77

## RECTANGULAR & V-NOTCH WEIR INSTALLATIONS



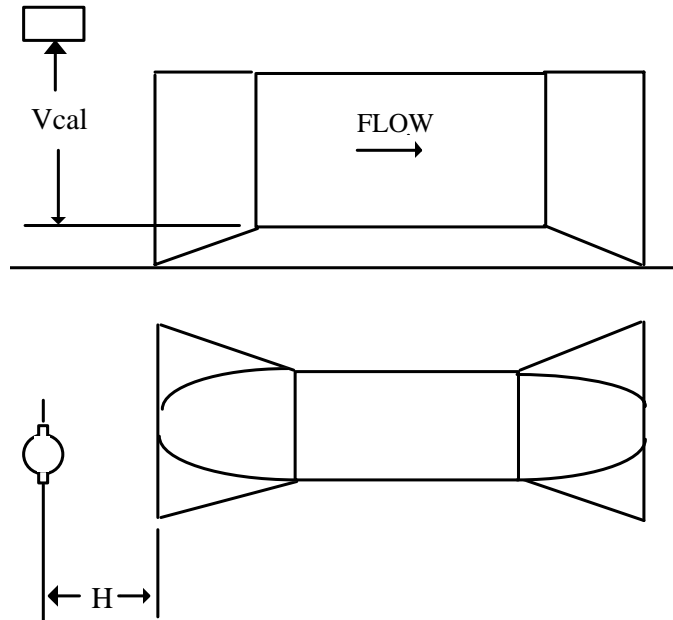
### RECTANGULAR WEIR WITH END CONNECTIONS

Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
12	*	19.96	280	700	7.96
18	*	24.71	420	2100	12.71
24	*	26.52	600	3500	14.52
36	*	29.27	850	7000	17.27
48	*	35.17	1200	14500	23.17
60	*	40.69	1500	25000	28.69
72	*	46.78	1800	40000	34.78
84	*	53.17	2000	60000	41.17
96	*	59.54	2400	85000	47.54

### V-NOTCH WEIRS

Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
22.5	*	36.00	15	1261	24.00
30	*	48.00	20	4729	36.00
45	*	48.00	30	7241	36.00
60	*	48.00	42	10096	36.00
90	*	48.00	72	17491	36.00

## LEOPOLD LAGCO FLUME INSTALLATION



Size (in.)	H Dim. (in.)	Vcal (in.)	Full Scale (GPM)		Full Scale Head Rise Max (in.)
			Min.	Max.	
6	*	16.91	10	140	4.91
8	*	17.98	135	250	5.98
10	*	20.16	180	500	8.16
12	*	21.06	210	700	9.06
15	*	23.19	250	1200	11.19
18	*	24.77	300	1750	12.77
21	*	28.45	360	3000	16.45
24	*	29.05	400	3600	17.05
30	*	34.84	500	7000	22.84
36	*	37.70	600	10000	25.70
42	*	42.38	675	15000	30.38
48	*	43.48	750	18000	31.48

(\* ) HORIZONTAL MOUNTING DIMENSIONS; LOCATE SENSOR JUST UPSTREAM OF CONVERGENCE ON ALL SIZES

## SENSOR CABLE CONNECTION

To wire the sensor head cable, the front half of the Model 2100 enclosure, mounted in the back of the Model 2100R+ housing, must be removed. Use the 5/32 inch Allen wrench supplied in the mounting hardware package to loosen and remove all four hex bolts in the front of the housing (see Figure 2-3). Separate the front and back housings. **CAUTION: THERE IS A COAX SIGNAL WIRE AND A RIBBON CABLE CONNECTED FROM THE POWER SUPPLY BOARD TO THE FRONT HOUSING THAT MUST BE DISCONNECTED WHEN REMOVING**

**THE FRONT HOUSING.** Place the front housing in a protected area so it will not be damaged. Figure 2-4 shows the back housing with the power circuit board and terminal connections. As mentioned before, the AC input power has been wired from the factory. The sensor cable connections are on the right side of the circuit board.

The cable for the sensor should be run in a separate metallic conduit. Refer to Figure 2-2 and prepare the cable ends in the following manner.

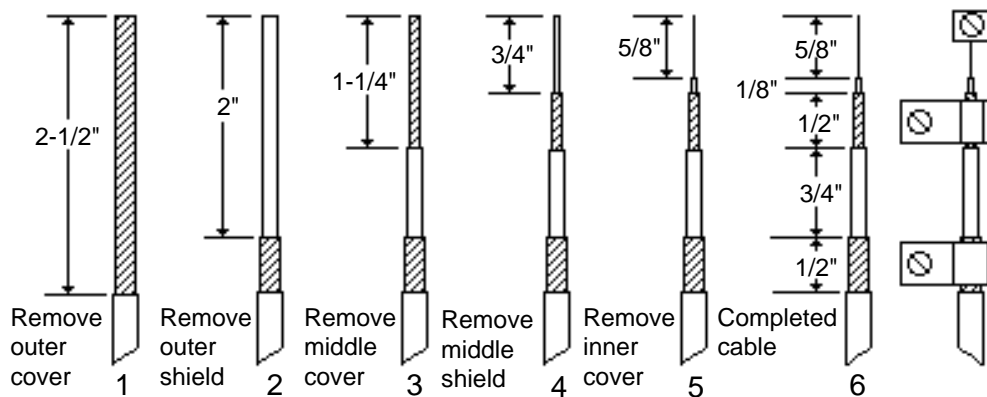


FIGURE 2-2

1. Remove outer cable cover. Measure 2-1/2" from the end of the cable. With a cutting tool, carefully cut through the outer covering completely around the cable making sure not to cut into the outer shield. Make another cut from the first cut to the end of the cable and remove the outer cover.

2. Remove outer shield. Measure 2" from the end of the cable. With a pair of small wire cutters, cut the shield around the cable at the measured point and remove the cut off shield.

3. Remove middle cover. Measure 1-1/4" from the end of the cable. With a cutting tool, carefully cut through the middle covering completely around the cable making sure not to cut into the middle shield. Make another cut from the first cut to the end of the cable and remove the middle cover.

4. Remove middle shield. Measure 3/4" from the end of the cable. With a pair of small wire cutters, cut the shield around the cable at the measured point and remove the cut off shield.

5. Remove inner cover. Measure 5/8" from the end of the cable. With a cutting tool, or pair of wire strippers, carefully cut the inner covering completely around the cable, making sure not to cut into the center conductor and remove the inner cover.

After the ends of the cables have been prepared, loosen the screws on the terminal for the center conductor. Remove the two cable clamps. Insert the center conductor of the sensor cable into the center conductor terminal and tighten the screw. Slightly pull on the cable to ensure the wire is secured to the terminal.

Place the two pairs of clamps over the middle and outer shields and secure them into place. Verify that the clamps are making good contact with the shields and that no wires of the shields are extending beyond their own clamp down area.

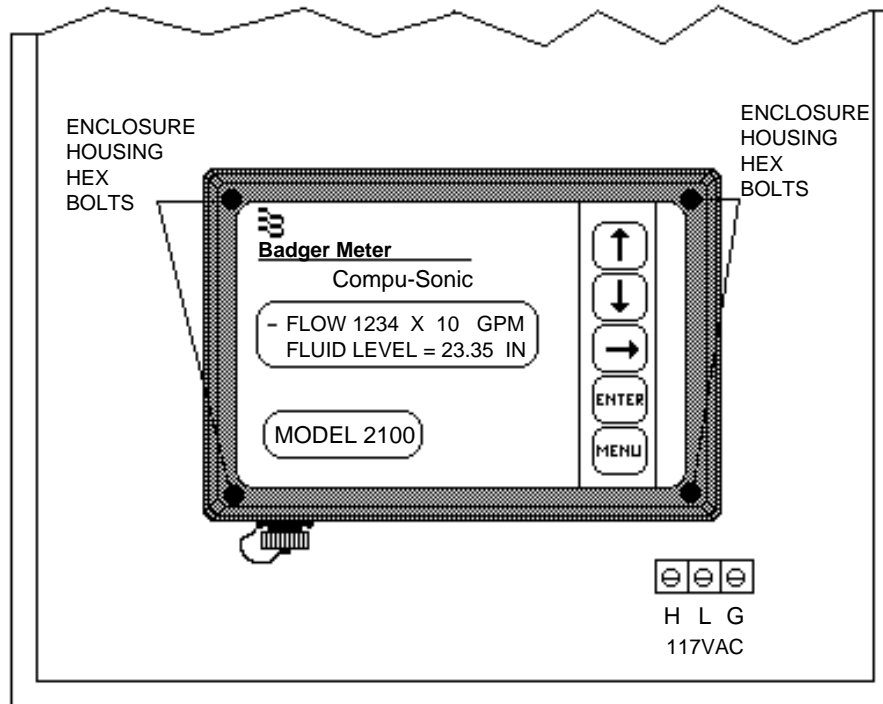


FIGURE 2-3

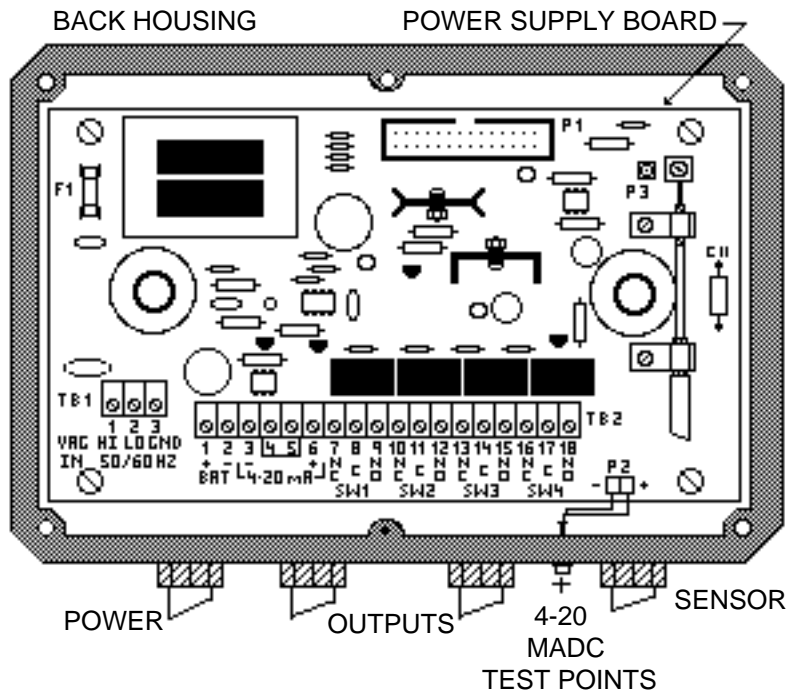
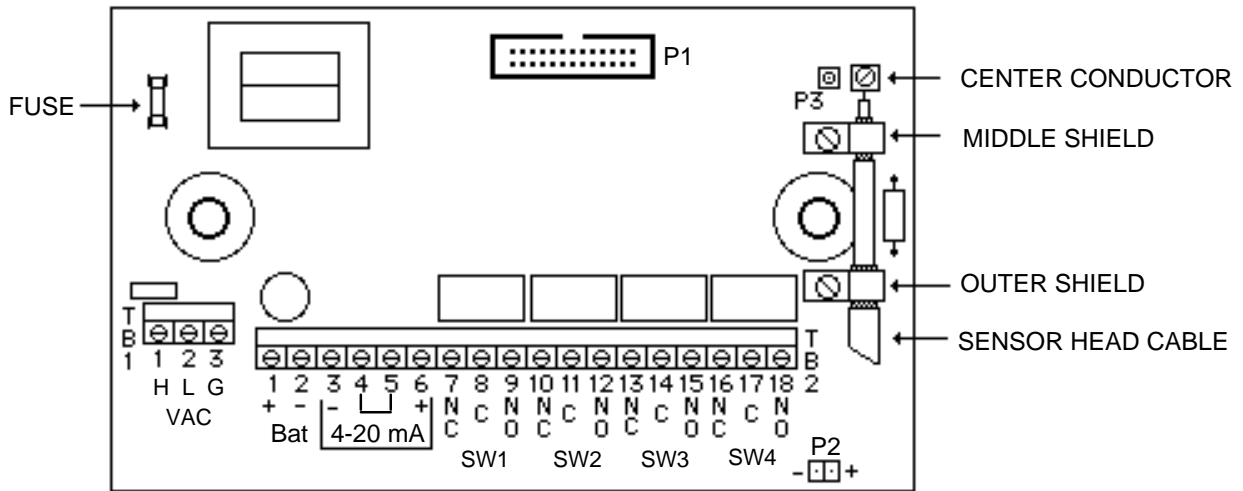


FIGURE 2-4



**FIGURE 2-5**

**Front housing installation.** After the wiring of the back housing is completed, the front housing can be reinstalled. Connect the ribbon cable plug S1 coming from the front housing into the socket connector P1 on the power supply in the back housing.

Connect the coax cable coming from the electronic board in the front housing to the connector P3 on the power supply board in the back housing.

Secure the front housing to the back housing with the four hex bolts.

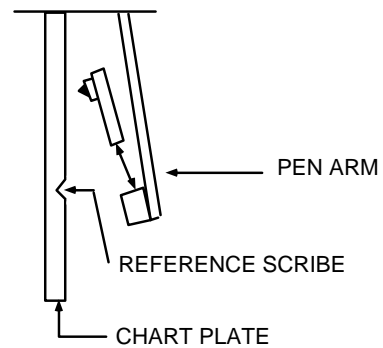
Connect the coax cable coming from the electronic

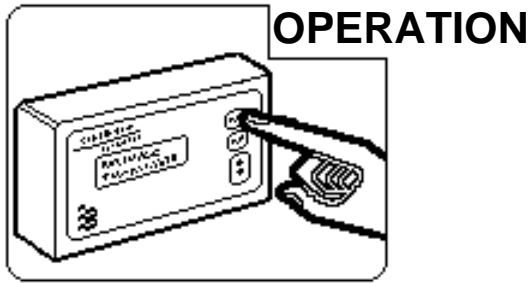
This completes the Enclosure Installation and Wiring Procedure.

### INSTALLATION OF CHART AND PEN ALIGNMENT

Open the recorder door and unscrew the knob from the chart hub. Lift the pen arm with the pen lifter off the chart plate. Remove the protective cap from the fiber tipped pen. Lower the pen close to the chart plate and adjust the pen until it aligns with the reference scribe on the chart plate.

Lift the pen back up with the pen lifter. Place a chart on the chart hub and screw the knob onto the hub loosely. Slide the edge of the chart under the five plastic holders. Rotate the chart until the proper time line is aligned with the pen. Tighten the knob to the hub assembly. Remove the backlash by turning the chart knob counterclockwise. Lower the pen arm until the pen is touching the chart.





## GENERAL DESCRIPTION

The Model 2100R+ combines the Model 2100 ultrasonic flow meter and Model 3000+ circular chart recorder into one enclosure package.

The recorder unit is supplied with a 2 line 24 character per line LCD display for indicating rate and totalization. The rate is displayed with 4 digits and its multiplier and unit of measurement. The totalizer is displayed with 8 digits and its multiplier and unit of measurement.

The flow meter unit is supplied with a 2 line 24 character per line LCD display for indicating rate and level. The rate is displayed with 4 digits and its multiplier and unit of measurement. The level is displayed with 4 digits and its unit of measurement.

The displays for each unit are also used to program the units through menu driven prompts. The programming is activated via front panel keys. Each unit has five keys that are used to access meter status information or to program the meter. These keys are the MENU, ENTER, UP arrow, DOWN arrow and RIGHT arrow.

The MENU key allows access to the Status Mode or Calibration Mode of the meter. It also can be used to return to normal operation any time you are in the Status or Calibration Mode. If you press the MENU key while in the Calibration Mode, the processor will store any programming changes made up to that point, but will retain the previous programming after that point.

The ENTER key is used to store any data changes that are made in the Calibration Mode and advance the screens in the Status Mode.

The UP, DOWN and RIGHT arrow keys are used for selecting or making changes in the various screens of the meter Calibration Mode.

The following will describe in detail the various functions of the Model 2100R+ and programming steps to recalibrate the meter in the field if necessary. The operating instructions will be divided into two parts. The first will cover the recorder operating and programming instructions and the second will cover the flow meter operating and programming instructions.

The Model 2100R+ is normally programmed at the factory for your specific application. Refer to the Data Sheets in the front of this manual for information pertaining to how your unit is programmed.

Certain parameter s such as relay assignments will be set in the field at the user's discretion. It is recommended that the complete operating instructions be read before attempting to make any changes to the meter.

## RECORDER OPERATION INITIAL POWER UP

After installation and wiring of the Model 2100R+, power may be turned on by the power switch on the lower right hand corner of the chart plate.

When power is applied, the display screen will have a solid line across the top of the display for a few seconds. Then the following screen will appear:





This screen informs the user of the Model of the recorder. This screen will be displayed for a few seconds.

The next screen to be displayed is the following:

SOFTWARE REVISION X.XX  
SERIAL NUMBER 12345678

This screen identifies the software revision the recorder is operating with and the serial number of the unit. This screen will be displayed for a few seconds.

The next screen shown is the screen that will be displayed during normal operation of the recorder.

\*FLOW 1234 X 10,000 GPM  
12345678 X 100,000 GAL

The top line displays the flow rate with its multiplier and the unit of measurement. The second line displays the totalized flow (8 digits) with its multiplier and unit of measurement.

In the upper left corner of the display there will be either a '—' or '\*'. The '—' indicates that the meter is functioning properly and that there are no alarms or relays tripped. The '\*' indicates that there are alarms or relays tripped.

The recorder should be fully operational if there is an input signal from a transmitter. The recorder is programmed at the factory with the information supplied by the user and the Zero and Span have been calibrated.

If the flashing asterisk is present, proceed to the Status Mode Section to determine the cause and proper action.

## STATUS MODE

The Status Mode contains the Alarms Tripped screen and the Self Test screen. To enter into the Status Mode, press the MENU key and the following screen will appear:

PRESS UP FOR CALIBRATION  
PRESS DOWN FOR STATUS

Press the DOWN key will allow entry into the Status Mode screens. If you decide not to enter the Status Mode,

press the MENU key and you will return to the normal operating screen.

Press the DOWN key and the following screen appears:

- ALARMS TRIPPED -  
IN LO HI CHT INT EE

The Alarms Tripped screen will display any alarm conditions that that occurred.

To clear the alarms, press the DOWN key. Should an alarm still be tripped it will still be shown on the display.

The definitions of the alarms are as follows:

IN = There is no 4-20 mA input signal or the input current is below the pen zero current value.

LO = This indicates that the low alarm setpoint has been tripped. This setpoint may be changed, refer to the Calibration Section of this manual.

CHT = This indicates that the chart has made a complete rotation and the chart needs to be changed.

INT = Indicates a contact integrator pulse output has occurred.

EE = EEPROM read/write error which indicates a failure in the microprocessor. Consult the factory.

To return to the normal operating screen, press the MENU key.

To enter into the Self Test screen, press the ENTER key and the following screen will appear:

- SELF TEST -  
PRESS UP TO ACTIVATE

If you decide not to enter into the Self Test section, press the MENU key and you will return to the normal display screen.

To enter into the Self Test section, press the UP arrow key and the following screen will appear:

- SELF TEST -  
EEPROM TEST => PASSED

This tests the EEPROM and indicates if it passed or failed. This takes a few seconds. The following screen will appear:

- SELF TEST -  
VREF TEST => PASSED

This tests the reference voltage and indicates if it passed or failed. The following screen will then appear:

- SELF TEST -  
SERVO TEST => PASSED

This tests the servo drive system and indicates if it passed or failed.

Should any of the screens indicate a failure, contact the factory for the appropriate action to be taken.

Upon completion of the Self Test the unit will return to the normal operating display screen. This completes the Status Mode Section.

## CALIBRATION MODE

The Calibration Mode allows the user to reprogram the 3000+ recorder to different parameters, calibrate the Zero and Span, and assign and set the relay outputs.

To enter into the Calibration Mode, press the MENU key and the following display screen will appear:

PRESS UP FOR CALIBRATION  
PRESS DOWN FOR STATUS

If you decide not to enter the Calibration Mode, press the MENU key and the display will return to the normal operating screen.

When in the Calibration Mode and the desired change has been made and no other changes are desired, you may skip to the end of the calibration screens by pressing the MENU key.

To enter the Calibration Mode, press the UP arrow key and the following screen will appear:

SECURITY ID  
INPUT 4 DIGIT ID 0000

This screen is the security identification which requires a security code to be entered before access is allowed into

the Calibration Mode. This code is set to 0000 at the factory. You may set a new code when in the Calibration screen.

To enter a security code use the RIGHT arrow key to move the cursor under the digit to be changed and use the UP or DOWN arrow keys to change the digit to the desired value. The values can be from 0 to 9 and A to F.

After entering the security code, press the ENTER key. If the code is incorrect the display will return to the normal operating screen. If the code is correct, the following screen will appear:

MEASUREMENT UNITS  
UNIT INITIALS=GPM

This screen allows the user to select the engineering unit of measure for the flow rate. To change the units, press the UP or DOWN arrow keys until the desired unit is shown. The engineering units available are:

GPM = Gallons per Minute  
GPD = Gallons per Day  
MGD = Million Gallons per Day  
CFS = Cubic Feet per Second  
CFM = Cubic Feet per Minute  
CFH = Cubic Feet per Hour  
CMM = Cubic Meters per Minute  
OPTION = Any three letters can be entered

After you have selected the unit desired, press the ENTER key. If you have selected OPTION, skip to the section titled OPTION on Page 3-7.

The next screen allows the selection of the multiplier for the unit of measurement and will appear as follows:

UNIT MULTIPLIER  
GPM X 1,000

When the UP or DOWN arrow keys to select the desired flow multiplier. The following multipliers are available:

X.001  
X.01  
X.1  
X1  
X10  
X100  
X1,000  
X10,000

FULLSCALE UNITS=GPM  
 FULLSCALE=0000 X 1,000

This screen allows the setting of the full scale range. Press the UP or DOWN arrow keys to change each digit to the desired value and the RIGHT arrow key to move the cursor under each digit. Press the ENTER key and the following screen will appear:

TOTALIZER MULTIPLIER  
 X 1,000

This screen allows the selection of the totalizer multiplier. Press the UP or DOWN arrow keys to select the desired multiplier and then the ENTER key. The following multipliers are available:

X.01	X100
X.1	X1000
X1	X10,000
X10	X100,000

The following screen will appear:

CHART REVOLUTION SPEED  
 1 REVOLUTION IN 1 DAY

This screen allows the selection of the chart rotation speed. The following speeds are available:

1 REVOLUTION IN 2 MINUTES  
 1 REVOLUTION IN 24 MINUTES  
 1 REVOLUTION IN 1 HOUR  
 1 REVOLUTION IN 1 DAY  
 1 REVOLUTION IN 7 DAYS  
 1 REVOLUTION IN 31 DAYS  
 -----  
 - - -

The two dash line positions are positions for future chart revolution speeds.

Press the UP or DOWN arrow keys to select the desired chart speed and press the ENTER key. The following screen will appear:

RECORDER DAMPING  
 DAMPING TIME = 6 SECS.

This screen allows the selection of the amount of damping in the response of the recorder. The damping times available are:

NONE

6

16	40
100	240
600	

These times are in seconds. Higher damping produces smoother pen lines. Press the UP or DOWN arrow key to select the desired value and then the ENTER key. The following screen will appear:

-FUNCTION SELECTION-  
 POWER=>LINEAR

This screen allows the selection of linearization functions for use with differential pressure transmitters, open channel flow measurement devices or any definable function. **Linear should be selected for the Model 2100R+.** Check the output specification of the device that is being connected to the recorder to determine the proper power selection. The functions available are:

POWER=>LINEAR  
 POWER=>1.55  
 POWER=>1.58  
 POWER=>1.9  
 POWER=>1/2  
 POWER=>3/2  
 POWER=>5/2  
 POWER=>OPTION

The linear function is used where the transmitter output is proportional to flow.

The 1.55 power is used with 1", 2", 3", 24" Parshall flumes and all Lago flumes.

The 1/58 power is used with a 6" Parshall flume.

The 1.9 power is used with Badger Meter Manhole flumes.

The 1/2 power is used with differential pressure transmitters where the output does not have the square root extracted.

The 3/2 power is used with all Rectangular and Cippoletti weirs.

The 5/2 power is used with all V-Notch weirs.

The OPTION power allows a 16 point HQ curve to be programmed into the recorder. Consult the factory for programming details.

Press the UP or DOWN arrow keys to select the linear function and then the ENTER key. The following screen will then appear:

INPUT SELECTION  
CHANNEL=ANALOG #1

This screen allows the selection of the desired input channels to be used as the input to the recorder. **For the Model 2100R+, ANALOG #1 should be selected.** There are four channels available to connect the input(s) signal(s): ANALOG #1, ANALOG #2, ANALOG #3, AND FREQUENCY.

Press the UP or DOWN arrow keys to select the ANALOG #1 input channel and then the ENTER key. The following screen will appear:

PRESS UP FOR PEN  
ARM CALIBRATION

This screen allows access into the zero and span pen arm calibration. **Do not enter unless the meter needs calibration.** Press the UP arrow key and the following screen will appear:

-CHART PEN ZERO-  
UP OR DOWN TO MOVE PEN

This screen calibrates the pen zero point on the chart paper to the zero of the input signal. This adjustment should be made in connection with the Model 2100. See Recorder Zero/Span adjustment procedure on Page 3-17.

**Do not press the UP or DOWN key at this time or an improper Zero capture may occur.** Press the ENTER key and the following screen will then appear:

-CHART PEN SPAN-  
UP OR DOWN TO MOVE PEN

This screen calibrates the pen span point on the chart paper to the span of the input signal. This adjustment should be made in conjunction with the Model 2100. See Recorder Zero/Span adjustment procedure on Page 3-17.

**Do not press the UP or DOWN key at this time or an improper Zero capture may occur.** Press the ENTER key and the following screen will then appear:

-RELAY ASSIGNMENT-  
RELAY 01=> LO

This screen allows the assignment of the relays for any of the alarm functions. The available alarm functions are:

LO - Low alarm trip  
HI - High alarm trip  
CHT - Completion of one chart rotation  
INT - Contact integrator pulse  
EE - Failure of EEPROM  
- - -  
- - -

There are two blank alarm positions which are represented by the dashed lines. Press the UP or DOWN arrow keys to select desired alarm and then press the ENTER key. The second relay assignment will appear with the same alarm functions to be selected as above. After assigning the desired alarm, the following screen will appear:

CONTACT INTEGRATOR  
0000 X 1,000 GAL

This screen allows the setting of the contact integrator to the desired amount of flow per each pulse output. For example, if the desire is to have a contact closure every 10,000 gallons, then the number to be entered above is 0010.

Press the UP or DOWN arrow keys to change the value of the digit and the RIGHT arrow key to move the cursor under the digit to be changed. Press the ENTER key. The following screen will appear:

INTEGRATOR PULSE WIDTH  
ON FOR 0000 X .0328 SEC.

This screen allows the setting of the pulse width of the contact integrator output pulse. If the device being connected to the contact integrator output requires an input with a minimum pulse width of 50 milliseconds, then the multiplier would be set to 2. Use the RIGHT arrow key to move the cursor under the digit to be changed and the UP or DOWN arrow key to set the desired value and press the ENTER key. The following screen will appear:

SET POINT ADJUSTMENT  
HI ALARM = 99 PERCENT

This screen allows the setting of the High and Low alarm set pints. Press the UP or DOWN arrow keys to the desired value and then press the ENTER key. The LO alarm screen set point will appear. Follow the same procedure above to set the low alarm. The following screen will then appear:

SET POINT ADJUSTMENT  
HYSTERESIS = 03 PERCENT

IN - Loss of input signal

This screen sets the hysteresis for the High and Low alarm set points. If the High alarm is set for 60 percent and the hysteresis is 3 percent, then the High alarm will trip closed at 63 percent and open at 57 percent.

Press the UP or DOWN arrow keys to the desired value and then press the ENTER key. The following screen will appear:

4-20 CURRENT OUT  
ZERO WORD=XXXX

This screen sets the zero (4 mA) of the isolated retransmitter. Connect a current meter to the output terminals and monitor the current output. The Zero word is a four digit word with the digit to the far left being the coarse adjustment and digits moving to the right being the finer adjustments. Press the RIGHT arrow key to move the cursor under the desired digit for adjustment and press the UP or DOWN arrow keys to adjust the output to the proper value. Press the ENTER key to store the new value. The following screen will appear:

4-20 CURRENT OUT  
SPAN WORD=XXXX

The SPAN WORD screen will then appear. Use the same procedure as above for setting the Span to 20 mA. After you have entered the span value, the following screen will appear:

SECURITY ID  
PRESS UP TO CHANGE

This screen allows the entry into the security code screen. Press the UP arrow key and the following screen will appear:

SECURITY ID  
INPUT 4 DIGIT ID 0000

To enter a new security code use the RIGHT arrow key to move the cursor under the digit to be changed and use the UP or DOWN arrow keys to change the digit to the desired value. The values can be from 0 to 9 and A to F.

After entering the security code, press the ENTER key and the following screen will appear:

- STORING PARAMETERS -  
PARAMETERS>PROGRAMMED

This screen indicates that the new parameters have been stored in the recorder. The display will then return to the normal operating screen. If this does not appear exactly as shown turn to Page 3-8 "Error Screens". This completes the Calibration Section.

## OPTION (FOR FLOW UNITS SCREEN)

Selecting OPTION in the FLOW UNITS screen allows the entering of any three letter label for special engineering units. Press the ENTER key with OPTION selected and the following screen will appear:

MEASUREMENT UNITS  
OPTION INITIALS = AAA

There will be a cursor under the first letter. Use the UP or DOWN arrow keys to select the desired letter. Press the RIGHT arrow key to move the cursor to the second and third letter and select the desired letter. Press the ENTER key to enter the OPTION INITIALS. The following screen will appear:

DISPLAY FLOW LABEL AND  
TOTALIZER ? YES

This screen asks if the FLOW label is to be displayed on the normal operating screen. If the recorder is to be used to record temperature or some other measurement not related to flow or not requiring totalization, then selecting NO will remove the FLOW label and the totalizer value from the screen. Use the UP or DOWN arrow keys to select YES or NO and press the ENTER key. The following screen will appear:

UNIT MULTIPLIER  
AAA X 1,000

This screen allows the selection of the desired flow rate multiplier. Press the UP or DOWN arrow keys to select the desired multiplier and then press the ENTER key. The following screen will appear:

FULL SCALE UNITS = AAA  
FULL SCALE = 0000 X 1,000

This screen allows the entering of the full scale flow rate desired. Press the UP or DOWN arrow keys to select the desired value and the RIGHT arrow key to move the cursor under the digit to be changed. After the desired value is selected press the ENTER key and the following screen will appear:

OFFSET UNITS=AAA  
OFFSET=0000 X 1,000

This screen allows an offset value to be used instead of 0 for a 4 mA input. If the input device has a value other than 0 for 4 mA, then that value would be entered into this screen. Press the UP or DOWN arrow keys to select

the desired value and the RIGHT arrow key to move the cursor under the digit to be changed. After the desired value is selected press the ENTER key.

If NO was selected for the totalizer, the next screen will be the Chart Revolution Speed screen. Go back to Page 3-4. If YES was selected, the following screen will appear:

TOTALIZER UNIT  
UNIT INITIALS = AAA

This screen allows the entering of the desired totalizer unit label. Press the UP or DOWN arrow keys to select the desired letter and the RIGHT arrow key to move the cursor under the letter to be changed. After the desired letters are selected, press the ENTER key. The following screen will appear:

TOTALIZER MULTIPLIER  
X 1,000

This screen allows the selection of the desired totalizer multiplier. Press the UP or DOWN arrow keys to select the desired multiplier and then depress the ENTER key. The following screen will appear:

- TOTALIZER WORD -  
0000 0000 0000

The Totalizer Word is required to set up the time base to properly totalize in the selected option units. The Totalizer Word is defined as follows:

$$\frac{\text{Totalizer Multiplier}}{\text{Max. Flow in Units/Sec}} \times 2,000,000 = \text{HEX}$$

### EXAMPLE:

Maximum flow = 1800 x 1 BPM (Barrels/min)

Totalizer multiplier = BAR x 100

Totalizer Word:

$$[100/(1800/60)] \times 2,000,000 = 6666666.6$$

Converted to Hexadecimal = 65B9AA (see Decimal to Hexadecimal Conversion Section).

The TOTALIZER WORD is 0000 0065 B9AA.

**NOTE: The totalizer word must be greater than HEX 1000.**

Use the UP and DOWN arrow keys to change each digit to the required value and the RIGHT arrow key to move the cursor. The ENTER key must be depressed after each set of four digits. Return to Page 3-4 where the next screen will be the Chart Speed Selection.

## ERROR SCREENS

There are several Error Screens that will be displayed by the recorder if the microprocessor detects errors in the values programmed into the recorder.

- CHART PEN ZERO -  
<INPUT ZERO ERROR>

OR

- CHART PEN SPAN -  
<INPUT SPAN ERROR>

If either of the two above Error Screens appears during the chart pen adjusting procedure, one of the following problems probably occurred.

1. There was not a 4-20 mADC analog signal to the recorder analog channel you selected while adjusting the chart zero or span.
2. An analog input signal channel was selected without adjusting the chart pen zero and span of this channel.

3. The Zero and Span of the recorder have been adjusted too close to the same input value.

To correct these errors, readjust the chart pen zero and span. Refer to Page 3-5 for the proper procedure.

- STORING PARAMETERS -  
<TOTALIZER WORD ERROR>

If the above Error Screen appears after pressing the ENTER key to store the calibration adjustments, this indicates that you have selected a totalizer multiplier that is too low for your selected flow rate. To correct this error, re-enter the Calibration Mode and when the Totalizer Multiplier Screen appears, increase the totalizer multiplier and press the ENTER key. Then press the MENU key to store the new multiplier and return to the normal operating screen.

If you still have a Totalizer Word Error message in the Storing Parameters Screen, then repeat the above procedure until the error is not present.

---

## FLOW METER OPERATION INITIAL POWER UP

After installation and wiring of the Model 2100R+, power may be turned on by the power switch on the lower right hand corner of the chart plate.

When power is applied, the display screen of the Model 2100 flow meter will have a solid line across the top of the display for a few seconds. Then the following screen will appear:

- BADGER METER -  
SOFTWARE REV. - X.XX

This will be displayed for about 3 seconds and then the next screen will show the serial number of the unit as shown below.

- BADGER METER -  
SERIAL NUMBER XXXXXXXX

This will be displayed for about 3 seconds and then the following screen will be displayed:

- FLOW 1234 X 10 GPM  
FLUID LEVEL = 99.99 IN

This screen is considered the normal operating screen. In the upper left corner of the display there will be either a flashing '-' or '\*'. The '-' indicates that the meter is functioning properly and that there are no alarms or relays tripped. The '\*' indicates that there are alarms or relays tripped. **If an 'F' appears, this indicates that the meter is performing an auto frequency tuning procedure and the MENU key will not respond until the 'F' goes away.**

The following two sections describe the operation of the Status and Calibration Modes of the Model 2100 flow meter portion.

## STATUS MODE

The Status Mode displays alarms and relays that are activated. It allows the direct reading of the measured fluid level and distance from the sensor head to the fluid level. The sensor signal strength and the measured temperature are displayed. It also has a self test screen that will perform diagnostics of the electronics and a level simulation screen.

To enter into the Status Mode, press the MENU key and the following screen will appear:

PRESS UP FOR CALIBRATION  
PRESS DOWN FOR STATUS

This screen allows the entry into the Calibration Mode or the Status Mode. Press the DOWN arrow key and the following screen will appear:

ALARMS TRIPPED  
ECHO 4-20 PNT #1

This screen indicates any malfunction alarms or set points that are tripped. The following alarms are possible:

- ECHO Loss of return echo of transmitted signal.
- EEPRM: Failure of the EEPROM in the microprocessor.
- OVRR: Fluid level is above maximum set span of the level meter.
- PNT#1: Set point #1
- PNT#2: Set point #2

To leave the Status Mode, press the MENU key and the meter will return to the normal operating mode. Pressing the ENTER key will step through the Status Mode screens. Press the ENTER key and the following screen will appear:

RELAYS TRIPPED  
RLY#1 RLY#2 RLY#3 RLY#4

This screen indicates the relays that are tripped. These relays may be assigned to set points or error alarms. The assignment of these is covered in the Calibration Mode Section.

Press the ENTER key and the following screen will appear:

FLUID LEVEL = 24.35 IN

DISTANCE = 14.58 IN

This screen indicates the level of the fluid in the primary device and the distance from the sensor face to the fluid level. This screen enables the user to verify that the sensor head mounting and the programming of the level information are correct.

By adding the fluid level value and the distance value, the sum should be the VCAL value (vertical mounting distance of the sensor) on the Data Sheet in the front of this manual. If these are not equal, then the sensor has been incorrectly mounted or the full scale head rise value or offset value are incorrect. Refer to the Sensor Head Mounting instructions or the Calibration Mode instructions for correction.

Press the ENTER key and the following screen will appear:

RX GAIN 78      TEMP. +21° C  
SIGNAL

This screen indicates the received signal strength and the temperature at the sensor head in degrees Celsius. A receiver gain of 01 indicates maximum signal strength and 99 indicates minimum signal strength. The bottom line of the screen will indicate the signal strength with square boxes. There should be 5 to 9 squares for good meter operation.

Press the ENTER key and the following screen will appear:

SELF TEST  
PRESS UP TO ACTIVATE

This screen allows entry into the self test diagnostics routine. Press the UP arrow and the following screen will appear:

SELF TEST  
EEPROM => TESTING

This screen indicates that the EEPROM of the microprocessor is being tested. After a few seconds the "TESTING" message will change to either "PASSED" or "FAILED". The following screen will appear:

SELF TEST  
SENSOR TX => TESTING



This screen indicates that the meter is testing the sensor head to determine if it is transmitting a signal. After a few seconds the "TESTING" message will change to either "PASSED" or "FAILED". The following screen will appear:

SELF TEST  
SENSOR ECHO=>TESTING

This screen indicates that the meter is testing for the presence of a return echo of the transmitted signal. After a few seconds the "TESTING" message will change to either "PASSED" or "FAILED".

The display will then return to the self test screen. You may repeat the self test, return to the normal operating mode by pressing the MENU key, or continue with the Status Mode screens by pressing the ENTER key.

Press the ENTER key and the following screen will appear:

LEVEL SIMULATION  
PRESS UP TO ACTIVATE

This screen allows the entry into the level simulation mode. In this mode the level can be simulated to check flow points of the H/Q curve, the set points, relay controls, and the 4-20 mA output.

Press the UP arrow key and one of the following screens will appear:

- BADGER METER -  
S FLUID LEVEL = 000.0 IN

OR

S FLOW 00 X 10 GPM  
LVL = 000.0 IN TPT = 1000

This screen allows the user to simulate the fluid level for indication of flow and level or level only depending on how the Model 2100 has been programmed. On the upper or lower left corner of the display there will be a flashing 'S'. This is to remind the user that the meter is in the simulation mode and not actually measuring level.

The Model 2100 has been programmed for flow measurement. The screen will show flow based on the flow curve selected in the calibration section.

To simulate a level, use the UP or DOWN arrow keys to change the fluid level value that is displayed on the

screen. The maximum level that can be simulated is the maximum level that has been programmed into the meter.

To leave the level simulation screen, press the MENU key. The display will return to the normal operating screen.

This completes the Status Mode Section of the Model 2100.

## CALIBRATION MODE

The Calibration Mode allows the user to calibrate the Model 2100 to the specific application for which the meter is to be used. The setting of set points and assignment of the relays is also accomplished in this mode.

To enter into the Calibration Mode, press the MENU key while the display is in the normal operating screen. The following screen will appear:

PRESS UP FOR CALIBRATION  
PRESS DOWN FOR STATUS

Press the UP arrow key and the following screen will appear:

SECURITY ID  
INPUT 4 DIGIT ID 0000

This screen is the security screen which requires the correct 4 digit number to allow entry into the Calibration Mode of the Model 2100. When the meter is shipped from the factory the security number is 0000. To change the value of each digit, move the line under the digit to be changed with the RIGHT arrow key and then use the UP or DOWN arrow keys to change the value of the digit. When the 4 digit number is correct then press the ENTER key. If the number is incorrect, the meter will go back to the normal operating screen. If the number is correct, the following screen will appear:

LEVEL UNIT  
SELECTION = IN (XX.XX)

This display allows the selection of the unit of measure to be used. The selections are:

- FT = Feet
- IN = Inches
- M = Meters
- mm = Millimeters

The X's in parentheses after the units represent how the level values will be displayed by the meter.

When selecting inches (IN) as the unit of measure, the value can be XX.XX or XXX.X and for feet (FT) the value can be X.XXX or XX.XX. You must step through the selections twice to view the two different choices for the inch and feet units.

To make the unit selection, use the UP or DOWN arrow keys until the correct unit is displayed and then press the ENTER key. The following screen will appear:

SELECTED FULLSCALE  
HEAD RISE = XX.XX IN

This sets the maximum head rise of the fluid based on the full scale to be measured for a specific application.

For example, if the Model 2100 was to be used on a 6 inch Parshall flume and the full scale of the meter was to be 1000 GPM, then the headrise value set in the meter would be 12.61. If the desired full scale had been 1800 GPM, then the headrise value would be 18.29. Refer to Data Sheet in front of this manual for actual headrise for your application.

If the Model 2100 is to be programmed for level measurement only, then the headrise value would be the maximum level to be measured.

The maximum headrise that should be used is 120 inches and the minimum headrise is 4 inches.

To adjust the headrise value, use the RIGHT arrow key to move the line under the digit to be adjusted and then use the UP and DOWN arrow keys to change the value of the digit. After the desired headrise value has been set, press the ENTER key to store this new value. The following screen will appear:

SENSOR  
OFFSET = XXX.X IN.

This screen allows the adjustment of the offset region. The offset region is the distance from the maximum fluid level to the face of the sensor head. The minimum offset is 12 inches. The total of the offset and headrise values should not be greater than 132 inches. To change the value of the offset, use the RIGHT arrow key to move the line under the digit to be changed and then use the UP or DOWN arrow keys to change the value of the digit. Once the correct value has been set press the ENTER key to store this value. The following screen will appear:

OUTPUT DAMPING  
XXX SECONDS

This screen allows the adjustment of the response time of the output signal to change in fluid level. To change this value, use the UP or DOWN arrow keys to change to the desired value. The available values are 8, 126, 32, 64, 128, 256, 512 and 1024 seconds. Once the desired value is displayed, press the ENTER key to store this new value. The following screen will appear:

LOST ECHO DEFAULT  
XXX SECONDS

This screen allows the setting of the time desired to hold the last level value after the loss of the return signal before defaulting to the selected no signal output value. The available time values are 8, 16, 32, 64, 128, 256, 512 and 1024 seconds. Use the UP or DOWN arrow keys to change to the desired value and press the ENTER key. The following screen will appear:

METER DISPLAY OPTION  
FLOW

This screen allows the selection of the display mode in which the Model 2100 is to operate. The two selections are FLOW or LEVEL. Use the UP or DOWN arrow key to change to the desired mode of operation and press the ENTER key. The following screen will then appear if FLOW is selected:

FLOW LABEL  
INITIALS = GPM

This screen allows the selection of the flow rate units. There are seven units that are stored in the memory of the meter. These are:

- GPM - Gallons per Minute
- GPD - Gallons per Day
- MGD - Million Gallons per Day
- CFS - Cubic Feet per Second
- L/S - Liters per Second
- M3H - Cubic Meters per Hour
- MLD - Million Liters per Day

There is also an OPTION choice that allows the user to choose any three letters or numbers to represent the flow rate unit that is desired. If OPTION is chosen, then the user will have to input a totalizer word. Refer to Page 3-16 for instructions.

Use the UP or DOWN arrow keys to select the desired flow rate unit. If OPTION is selected, use the RIGHT arrow key to move the cursor under the letter position to be changed and use the UP or DOWN arrow keys to

select the desired letter or number. After the stored flow rate unit or optional unit has been selected, press the ENTER key. The following screen will appear:

FLOW MULTIPLIER  
GPM X 100

This screen allows the selection of the flow rate multiplier. The flow rate display has four digits. The multipliers that are available are: .001, .01, .1, 1, 10, 100, 1,000, 10,000. The multiplier should be selected to allow all four digits of the flow display to be utilized. For example, if the meter is programmed for a full scale of 5 MGD then a multiplier of .001 should be selected.

Use the UP or DOWN arrow keys to select the desired multiplier and then press the ENTER key. The following screen will appear:

ELEMENT MAXIMUM CAPACITY  
1000 X 1 GPM

This screen sets the maximum capacity of the primary element for which the meter is being used. **This is the maximum full scale capacity of the primary element.** For example, if the meter is being used on a 6 inch Parshall flume then this value would be 1800 GPM even though the desired customer full scale of the flow meter may be 1000 GPM. Refer to Data Sheet in front of this manual for actual maximum capacity.

Use the RIGHT arrow key to move the cursor under each digit and use the UP or DOWN arrow keys to change to the desired value. After all four digits have been properly set, press the ENTER key. The following screen will appear:

ELEMENT MAXIMUM CAPACITY  
HEADRISE = 18.29 IN

This screen sets the maximum head rise of the primary element. This value represents the maximum full scale headrise of the primary element. This headrise equates to the maximum flow rate programmed in the previous screen. For example, if the meter is being used on a 6 inch Parshall flume which has a maximum capacity of 1800 GPM, then the maximum headrise would be 18.29 inches. Refer to Data Sheet in front of this manual for actual maximum headrise.

Use the RIGHT arrow key to move the cursor under each digit and use the UP or DOWN arrow keys to change to the desired value. After all four digits have been properly set, press the ENTER key. The following screen will appear:

ELEMENT FUNCTION

## 1.58 PWR

This screen selects the power function for the primary element for which the meter is being used. Following are seven power functions and the corresponding primary elements stored in the meter:

- 1.522 = 12" Parshall flume
- 1.53 = 9" Parshall flume
- 1.538 = 18" Parshall flume
- 1.55 = 1", 2", 3", 24" Parshall flumes, Lagco flumes
- 1.58 = 6" Parshall flume
- 1.95 = Manhole flumes
- 2.5 = V-Notch weirs

There is an OPTION selection that allows the user to input a 16 point H/Q curve for primary elements not included in the stored powers functions. For instructions on inputting a special curve see Page 3-15.

Use the UP or DOWN arrow keys to select the desired power function and then press the ENTER key. The following screen will appear:

TOTALIZER FUNCTION  
DISABLED

**The totalizer is disabled for the Model 2100R+.** Should the recorder malfunction, this can be enabled to totalize flow until the recorder is repaired. Use the UP or DOWN arrow keys to show ENABLE or DISABLE and press the ENTER key. The next screen will be the Relay Set Point screen. If the totalizer is enabled and an optional flow unit has been used, go to Page 3-7 for programming, otherwise the following screen will appear:

TOTALIZER MULTIPLIER  
X 1,000

**This screen does not appear with the standard set up of the Model 2100R+.** If at the TOTALIZER FUNCTION screen the totalizer is enabled, this screen will appear. Since the recorder has the totalizer function, the 2100 should not have the totalizer enabled unless there is a malfunction with the recorder.

This screen allows the selection of the totalizer multiplier. The totalizer will display a maximum of eight digits. The available multipliers are: .01, .1, 1, 10, 100, 1,000, 10,000, 100,000. If a multiplier is selected that cannot be used, an error message will appear on the screen indicating that the multiplier will have to be increased or decreased in value.

Use the UP or DOWN arrow keys to select the desired multiplier and then press the ENTER key. The following screen will appear:

CONTACT INTEGRATOR  
0000 X 1,000 GAL

**This screen does not appear with the standard setup of the Model 2100R+.** If at the TOTALIZER FUNCTION screen the totalizer is enabled, this screen will appear. Since the recorder has the totalizer function, the 2100 should not have the totalizer enabled unless there is a malfunction with the recorder.

This screen allows the setting of the rate of the contact integrator. The contact integrator can be assigned to one of the relays and be used as an output for a remote totalizer or to pace a sampler or other devices requiring a pulse input based on total flow.

The contact integrator can be set for multiples of the totalizer multiplier. For example, if it is desired to have a sampler take a sample every 10,000 gallons and the totalizer multiplier is 1,000, then the contact integrator would be set to 0010.

To set the contact integrator, use the RIGHT arrow key to move the cursor under the digit to be changed and then the UP or DOWN arrow keys to select the desired value. After the desired value has been set, press the ENTER key. The following screen will appear:

INTEGRATOR PULSE WIDTH  
ON FOR 0002 X .0655 SEC.

**This screen does not appear with the standard setup of the Model 2100R+.** If at the TOTALIZER FUNCTION screen the totalizer is enabled, this screen will appear. Since the recorder has the totalizer function, the 2100 should not have the totalizer enabled unless there is a malfunction with the recorder.

This screen allows the setting of the pulse width or duration of the contact integrator. The on time can be set for multiples of .0655 seconds. For example, if the contact closure must be at least 100 milliseconds, then the pulse width must be set for 0002 which would give a time of 131 milliseconds. If the pulse width must be 30 seconds in duration, the value would be set at 0459 which would give a time of 30.06 seconds.

Use the RIGHT arrow key to move the cursor under the digit to be changed and the UP or DOWN key to change to the desired value. Press the ENTER key and the following screen will appear:

ON AT XX% OFF AT XX%

This screen allows the setting of the set points for low or high alarms and the dead band. These values are in percent of the full scale value. **To make the set point a low alarm, the ON value must be lower than the OFF value.** For example, if the ON value was 30% and the OFF value was 35% then this set point alarm will be activated below a flow rate of 30% of full scale and will be deactivated at a flow rate above 35% of full scale.

**To make the set point a high alarm, the ON value must be higher than the OFF value.** For example, if the ON value was 60% and the OFF value was 50%, then this set point alarm will be activated at a flow rate above 60% of full scale and will be deactivated at a flow rate below 50% of full scale.

To set the desired values, use the RIGHT arrow key to move the line under the ON or OFF values and use the UP or DOWN arrow keys to change the values. Then press the ENTER key to store the new values. The screen will advance to the second set point. After the second set point has been entered, the following screen will appear:

RELAY ASSIGNMENT  
RELAY 01 => ECHO

In this screen the four relays are assigned to the alarm on which they are to activate. Any relays that have been used in the Pump Alternation assignments will not be displayed for assignment. The assignments available are:

- ECHO = Lost return echo
- EEPRM = Failure of the EEPROM
- OVRR = Level above the set span
- 4-20 = 4-20 mA output loop circuit open
- CINT = Contact Integrator
- TOTL = Totalizer
- PNT#2 = Set point number 2
- PNT#1 = Set point number 1

Once the desired alarm has been selected for relay #1, press the ENTER key to store this assignment. The screen will then advance through the three remaining relays. After the last relay assignment has been made, the following screen will appear:

4-20 CURRENT CALIBRATION  
PRESS UP TO CHANGE

This screen allows the entry into the calibration screens for the 4-20 mA current output. Press the UP arrow key and the following screen will appear:

4-20 M.A CALIBRATION  
ZERO WORD = XXXX

This screen allows the adjustment of the zero output to 4 mA. The 4-20 mA output can be monitored on the test jacks on the bottom of the back half of the housing. **The 4-20 mA output must be connected to a load for the test points to work.** Use the RIGHT arrow key to position the line under the digit to be adjusted. Fine adjustment is made on the right digit with the adjustment becoming more coarse with each digit to the left. Use the UP or DOWN arrow keys to adjust for the correct value. The value of the Zero Word is for reference only. Press the ENTER key to store the value. The following screen will appear:

4-20 M.A CALIBRATION  
SPAN WORD = XXXX

This screen allows the adjustment of span to 20 mA. The 4-20 mA output can be monitored on the test jacks on the bottom of the back half of the housing. Use the RIGHT arrow key to position the line under the digit to be adjusted. Fine adjustment is made on the right digit with the adjustment becoming more coarse with each digit to the left. Use the UP or DOWN arrow keys to adjust for the correct value. The value of the Span Word is for reference only. Press the ENTER key to store the value. The following screen will appear:

4-20 M.A CALIBRATION  
DEFAULT WORD = XXXX

This screen allows the setting of the 4-20 mA output signal when the meter goes into a default condition due to the loss of a return signal. This value is set depending on the user's desire for the value of the output to indicate a default condition. The 4-20 mA output can be monitored on the test jacks on the bottom of the back half of the housing. Use the RIGHT arrow key to position the line under the digit to be adjusted. Fine adjustment is made on the right digit with the adjustment becoming more coarse with each digit to me left. Use the UP or DOWN arrow keys to adjust for the correct value. Press the ENTER key to store the value. The following screen will appear:

DISTANCE CALIBRATION  
PRESS UP TO CHANGE

This screen allows entry into the distance calibration screen which enables the calibration of the transmitter if necessary. This is set at the factory and only needs to be checked every three months. Do not set the distance calibration to an arbitrary number. The display shows the actual distance from the sensor to the surface at that meas-

urement cycle. Checking will require measuring from the bottom of the sensor (face) to the water, then setting

distance calibration to this measurement. Press the UP arrow key and the following screen will appear:

DISTANCE CALIBRATION  
NEAR DIST. => XX.XX IN

This screen calibrates the meter for the maximum flow level. If this adjustment is made, the fluid surface should be smooth to assure a steady reading. The near distance calibration should be made during high flow - surface of fluid at, or close to, the maximum (full scale) level. **Do not perform this calibration if the distance from the sensor to the surface is greater than 48 inches.** The display shows the distance from the surface of the fluid to the sensor.

Checking will require measuring from the bottom of the sensor (face) to the surface of the fluid and adjusting the distance calibration to this measurement. Use the UP or DOWN arrow keys to adjust to the correct value. Allow time for the meter to settle. Press the RIGHT arrow key. The following screen will appear:

DISTANCE CALIBRATION  
FAR DIST. => XX.X IN.

This screen calibrates the meter for the zero flow level. If this adjustment is made, the fluid surface should be smooth to assure a steady reading. The far distance calibration should be made during low flow - surface of fluid at, or close to, the minimum (zero) level. **Do not perform this calibration if the distance from the sensor to the surface is less than 72 inches.** The display shows the distance from the surface of the fluid to the sensor.

Checking will require measuring from the bottom of the sensor (face) to the surface of the fluid and adjusting the distance calibration to this measurement. Use the UP or DOWN arrow keys to adjust to the correct value. Allow time for the meter to settle. Press the ENTER key and the following screen will appear:

SECURITY ID  
PRESS UP TO CHANGE

This screen allows the entry of the user's security identification number. When the meter is shipped from the factory, the security number is 0000. To prevent unauthorized entry into the Calibration Mode, the user should select a number, then record this number and store it in a secure area. In the event the security number is lost, access can be made through a special procedure. Call (918) 836-8411 for instruction. Press the UP arrow key to enter into the Security ID screen. The following screen will appear:

SECURITY ID  
INPUT 4 DIGIT ID XXXX

This screen allows the user to enter a new Security ID number. Use the RIGHT arrow key to move the line under the desired digit to change. Use the UP or DOWN arrow key to change the digit to the desired value. Press the ENTER key to store the new Security ID number. The following screen will appear:

- STORING PARAMETERS -  
PARAMETERS->STORED

This screen indicates that the new parameters are being stored into the EEPROM of the microprocessor. The display will then return to the normal operating screen.

The Calibration Mode does not have to be stepped all the way through to make changes in the calibration. Once the desired change(s) is(are) made, the MENU key can be pressed instead of the ENTER key and the microprocessor will store the new change and return to the normal operating screen.

This completes the Calibration Mode Section of the Model 2100.

## OPTIONAL PROGRAMMING SCREENS

### SPECIAL H/Q CURVE PROGRAMMING

The Model 2100 has stored in memory the standard power functions for most of the common open channel primary flow devices. These power functions and the corresponding primary devices are found on Page 3-12. An OPTION selection is available for the user to program 16 points of any head versus flow curve. The following will describe this procedure. After selecting OPTION, the ELEMENT FUNCTION screen will appear.

ELEMENT FUNCTION  
OPTION

Use the UP or DOWN arrow keys and select the desired OPTION power function and then press the ENTER key. The following screen will appear:

OPTIONAL H CURVE  
POINT 0 = FFFF

This screen begins with the first point of the Height (H) portion of the H/Q curve. The input data is required to be in hexadecimal form. Point 0 is the first point and should be the first low end point of the curve. The zero height point need not be input because this is already assumed. Each of the 16 points will represent a percent of the maximum height of the fluid at the maximum capacity of the primary device.

The hexadecimal value FFFF (65535 decimal) represents 100% of the maximum height. It will be necessary to determine the decimal value of the desired percent of the maximum height for each point. Page 3-19 explains

the procedure for converting hexadecimal to decimal and decimal to hexadecimal. The following is an example of a 16 point curve with the percent of maximum height to the corresponding decimal and hexadecimal values.

Point	Height	%Max	Decimal	Hexadecimal
0	0.48"	2	1311	051F
1	0.72"	3	1966	07AE
2	1.20"	5	3277	0CCD
3	1.68"	7	4587	11EB
4	2.16"	9	5898	170A
5	2.88"	12	7864	1EB8
6	3.60"	15	9830	2666
7	4.32"	18	11796	2E14
8	5.04"	21	13762	35C2
9	6.00"	25	16384	4000
A	7.20"	30	19660	4CCC
B	8.40"	35	22937	5999
C	10.80"	45	29491	7333
D	16.08"	67	43908	AB84
E	19.92"	83	54394	D47A
F	24.00"	100	65535	FFFF

Use the right arrow key to move the cursor under each digit and use the UP or DOWN arrow key to change to the desired value. After all four digits have been properly set, press the ENTER key. Do this for each point. After point F, the following screen will appear:

OPTIONAL Q CURVE  
POINT 0 = FFFF

This screen is to input the flow (Q) that corresponds to the same data point for the height just programmed. Use the same procedure as with the height points only divide the flow rate at each point (height in primary device) by the maximum flow capacity of the primary device (flow

at maximum headrise). Multiply this times 65536 and then convert to hexadecimal. For example:

If the maximum capacity of the primary device is 3000 GPM (15 24") and the flow at 0.48" (Point 0 from height curve example) is 20 GPM, then:

$$20/3000 = .006667 \times 65535 = 436.9 = 1B5 \text{ Hex}$$

therefore Point 0 = 01B5. Use this procedure for each flow point.

Use the RIGHT arrow key to move the cursor under each digit and use the UP or DOWN arrow keys to change to the desired value. After all four digits have been properly set, press the ENTER key. Do this for each point. After point F, the TOTALIZER FUNCTION screen will appear. Return to Page 3-7 to complete the programming procedure.

To verify the H/Q curve just programmed, go to the FLOW SIMULATION screen in the Status Mode and simulate the flow level and check the flow indicated. Refer to Page 3-10 for instructions.

This completes the procedure for programming an optional H/Q curve in the Model 2100.

### OPTIONAL FLOW RATE UNITS

When the standard flow units are not selected and the special flow units are programmed with the OPTION selection, and the totalizer has been enabled, the totalizer must be programmed by the totalizer word. The following screen will appear after the ELEMENT FUNCTION screen if an optional flow unit is programmed in the meter:

TOTALIZER UNIT  
UNIT INITIALS = AAA

This screen allows the entering of the desired totalizer unit label. Press the UP or DOWN arrow keys to select the desired letter and the RIGHT arrow key to move the

cursor under the letter to be changed. After the desired letters are selected press the ENTER key. The following screen will appear:

TOTALIZER MULTIPLIER  
X 1,000

This screen allows the selection of the desired totalizer multiplier. Press the UP or DOWN arrow keys to select the desired multiplier and then depress the ENTER key. The following screen will appear:

- TOTALIZER WORD -  
0000 0000 0000

The Totalizer Word is required to set up the time base to properly totalize in the selected option units. The totalizer word is defined as follows:

$$\frac{\text{Totalizer Multiplier}}{\text{Max. Flow in Units/Sec}} \times 2,000,000 = \text{HEX}$$

EXAMPLE:

Maximum flow = 1800 x 1 BPM (Barrels/min)

Totalizer multiplier = BAR x 100

Totalizer Word:

$$[100/(1800/60)] \times 2,000,000 = 6666666.67$$

Converted to Hexadecimal = 65B9AA (see Decimal to Hexadecimal Conversion Section).

The TOTALIZER WORD is 0000 0065 B9AA. **NOTE: The totalizer word must be greater than HEX 1000.**

Use the UP and DOWN arrow keys to change each digit to the required value and the RIGHT arrow key to move the cursor. The ENTER key must be depressed after each set of four digits. After the last set of four digits have been programmed, the next screen will be the CONTACT INTEGRATOR screen. Return to Page 3-5 to continue the programming procedure.

This completes the programming for the totalizer when optional flow units are used.

**RECORDER CHART PEN  
ZERO AND SPAN ADJUSTMENT**

The zero and Span adjustment for the chart pen of the recorder requires placing the Model 2100 in the calibration at the same time as the recorder. The following describes this procedure.

To help keep clear as to whether the screens refer to the 3000+ recorder or Model 2100 flow meter, 3000 or 2100 will be printed by the screen.

Once the power has been initialized to the Model 2100R+, loosen the two screws at the upper and lower left side of the chart plate. Swing out the chart plate to gain access to the Model 2100 flow meter.

The following screen should be displayed. If not, press the MENU key.

- FLOW 1234 X 10 GPM  
 FLUID LEVEL = 99.99 IN

2100

To enter into the Calibration Mode, press the MENU key while the display is in the normal operating screen as shown above. The following screen will appear:

PRESS UP FOR CALIBRATION  
 PRESS DOWN FOR STATUS

2100

Press the UP arrow key and the following screen will appear:

SECURITY ID  
 INPUT 4 DIGIT ID 0000

2100

This screen is the security screen which requires the correct 4 digit number to allow entry into the Calibration Mode of the Model 2100. To change the value of each digit, move the line under the digit to be changed with the RIGHT arrow key and then use the UP or DOWN arrow keys to change the value of the digit. When the 4 digit number is correct press the ENTER key. If the number is incorrect the meter will go back to the normal operating screen. If the number is correct the following screen will appear:

LEVEL UNIT  
 SELECTION = IN (XX.XX)

2100

Continue to press the ENTER key until the following screen is displayed (see Pages 3-10 to 3-13 for screens that will be seen):

4-20 CURRENT CALIBRATION  
 PRESS UP TO CHANGE

2100

This screen allows the entry into the calibration screens for the 4-20 mA current output. Press the UP arrow key and the following screen will appear:

4-20 M.A CALIBRATION  
 ZERO WORD = 2345

2100

This screen allows the adjustment of the zero flow output value for 4 mA. The 4-20 mA output can be monitored on the test jacks on the bottom of the back half of the housing. The 4-20- mA output must be connected to the 3000+ for the test points to work. Use the RIGHT arrow key to position the line under the digit to be adjusted. Fine adjustment is made on the most right digit to the left. Use the UP or DOWN arrow keys to adjust for the correct value. The value of the Zero Word is for reference only. **Do not press the ENTER key at this time.**

Close the recorder chart plate and view the display on the recorder. The following screen should be seen. If not, press the MENU key.

\*FLOW 1234 X 10,000 GPM  
 12345678 X 100,000 GAL

3000

To enter into the Calibration Mode, press the MENU key while the display is in the normal operating screen as shown above. The following screen will appear:

PRESS UP FOR CALIBRATION  
 PRESS DOWN FOR STATUS

3000

Press the UP arrow key and the following screen will appear:

MEASUREMENT UNITS  
 UNIT INITIALS = GPM

3000

Continue to press the ENTER key until the following screen is displayed (see Pages 3-3 to 3-5 for screens that will be seen):

- CHART PEN ZERO -  
 UP OR DOWN TO MOVE PEN

3000

This screen calibrates the pen zero point on the chart paper to the zero of the input signal. **It is important that the pen be properly aligned before making this adjustment (see Page 2-12).**

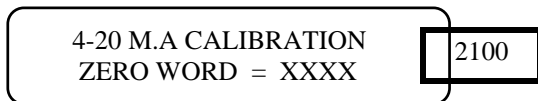


The Model 2100 is inputting 4 mA into the recorder at this time.

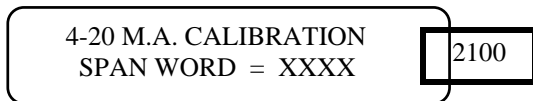
Press the UP or DOWN arrow keys to move the pen to the proper position. No changes will be made to the previously stored zero value unless the UP or DOWN arrow keys are pressed. So if the user is stepping through the program to access another programming screen, the input does not need to be at the zero value if the UP or DOWN arrow keys are not pressed. When pressing the UP or DOWN arrow keys, the display will indicate the direction of the pen movement. Once the pen is positioned to zero on the chart, press the ENTER key of the 3000+ recorder. The following screen will appear:



**Do not do anything with the recorder at this time.** Go back to the Model 2100 which has the following screen:

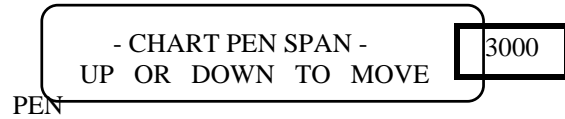


Press the ENTER key of the Model 2100. The following screen will appear:



This screen allows the adjustment of span to 20 mA. The 4-20 mA output can be monitored on the test jacks on the bottom of the back half of the housing. Use the RIGHT arrow key to position the line under the digit to be adjusted. Fine adjustment is made on the right digit with the adjustment becoming more coarse with each digit to the left. Use the UP or DOWN arrow keys to adjust for the correct value. The value of the Span Word is for reference only. **Do not press the ENTER key at this time.**

Close the recorder chart plate and view the display on the recorder. The following screen should be seen:

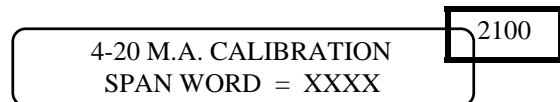


This screen calibrates the pen span point on the chart paper to the span of the input signal.

The Model 2100 is inputting 20 mA into the recorder at this time.

Press the UP or DOWN arrow keys to move the pen to the proper position. No changes will be made to the previously stored span value unless the UP or DOWN arrow keys are pressed. So, if the user is stepping through the program to access another programming screen, the input does not need to be at the span value if the UP or DOWN arrow keys are not pressed. When pressing the UP or DOWN arrow keys, the display will indicate the direction of the pen movement. Once the pen is positioned to span on the chart, press the ENTER key of the 3000+ recorder. The next screen to appear will be the Relay Assignment screen. Press the MENU key which will store the new values and return to the normal operating screen.

Go back to the Model 2100 which has the following screen:



Press the MENU key which will store the new values and return to the normal operating screen.

Close the chart plate and secure the two screens.

This completes the chart pen Zero and Span adjustments.

## HEXADECIMAL SYSTEM

The purpose of the hexadecimal number system is simply to reduce the number of units necessary for representing any given numerical figure, thereby reducing the amount of space in memory necessary to retain it.

Herein, a decimal (normal) number is converted to a correct hexadecimal number which consists of fewer characters.

The hexadecimal number system consists of only 16 characters which are shown below by the boldface characters.

0	=	<b>0</b>
1	=	<b>1</b>
2	=	<b>2</b>
3	=	<b>3</b>
4	=	<b>4</b>
5	=	<b>5</b>
6	=	<b>6</b>
7	=	<b>7</b>
8	=	<b>8</b>
9	=	<b>9</b>
10	=	<b>A</b>
11	=	<b>B</b>
12	=	<b>C</b>
13	=	<b>D</b>
14	=	<b>E</b>
15	=	<b>F</b>

These characters may be arranged in various sequences to produce an infinite number of representations of decimal numbers. For example: 6D4C = 27,980.

### CONVERSION OF DECIMAL WHOLE NUMBER TO HEXADECIMAL NUMBER

1. Divide the decimal number by 16.  
Example:  $57420/16 = 3588.75$

2. Multiply only the fractional part of the product by 16 to arrive at the first character in the hexadecimal equivalent. Remember, all numbers produced in this step are shown above. Also note that the product may have no fraction (.000) which would result in zero as the hexadecimal number.  
Example:  $.75 \times 16 = 12 = \mathbf{C}$

3. Divide the whole number portion of the product by 16 thereby producing yet another number.  
Example:  $3588/16 = 224.25$

4. Repeat steps 2 and 3 in a cyclical fashion until the numerator to be divided in Step 3 is less than 16. At that point, the numerator represents the final character in the hexadecimal sequence.

EXAMPLE: Convert 57,420 into a hexadecimal number:

- 1.)  $57,420/16 = 3588.75$
- 2.)  $.75 \times 16 = 12 = \mathbf{C}$
- 3.)  $3,588/16 = 224.25$
- 2.)  $.25 \times 16 = \mathbf{4}$
- 3.)  $224/16 = 14.00$
- 2.)  $.00 \times 16 = \mathbf{0}$
- 3.)  $14 = \mathbf{E}$

$57,420 = \mathbf{E04C}$

## CONVERSION OF A WHOLE HEXADECIMAL NUMBER TO A DECIMAL NUMBER

1. Multiply the left most character in the hexadecimal number by 16.  
Example:  $E = 14 \times 16 = 224$
2. Add to the product previously found the value of the next character.  
Example:  $224 + 0 = 224$
3. Multiply the previously found product by 16.  
Example:  $224 \times 16 = 3584$
4. Repeat steps 2 and 3 in a cyclical fashion until you have added the last hexadecimal character. Do not multiply beyond that point.

EXAMPLE: Convert E04C into a decimal number.

- 1.)  $E = 14; 14 \times 16 = 224$
- 2.)  $224 + 0 = 224$
- 3.)  $224 \times 16 = 3584$
- 2.)  $3584 + 4 = 3588$
- 3.)  $3588 \times 16 = 57,408$
- 4.)  $57,408 + 12 = 57,420$

$$E04C = 57,420$$

INSERT 3000+ DWG 600662-9999

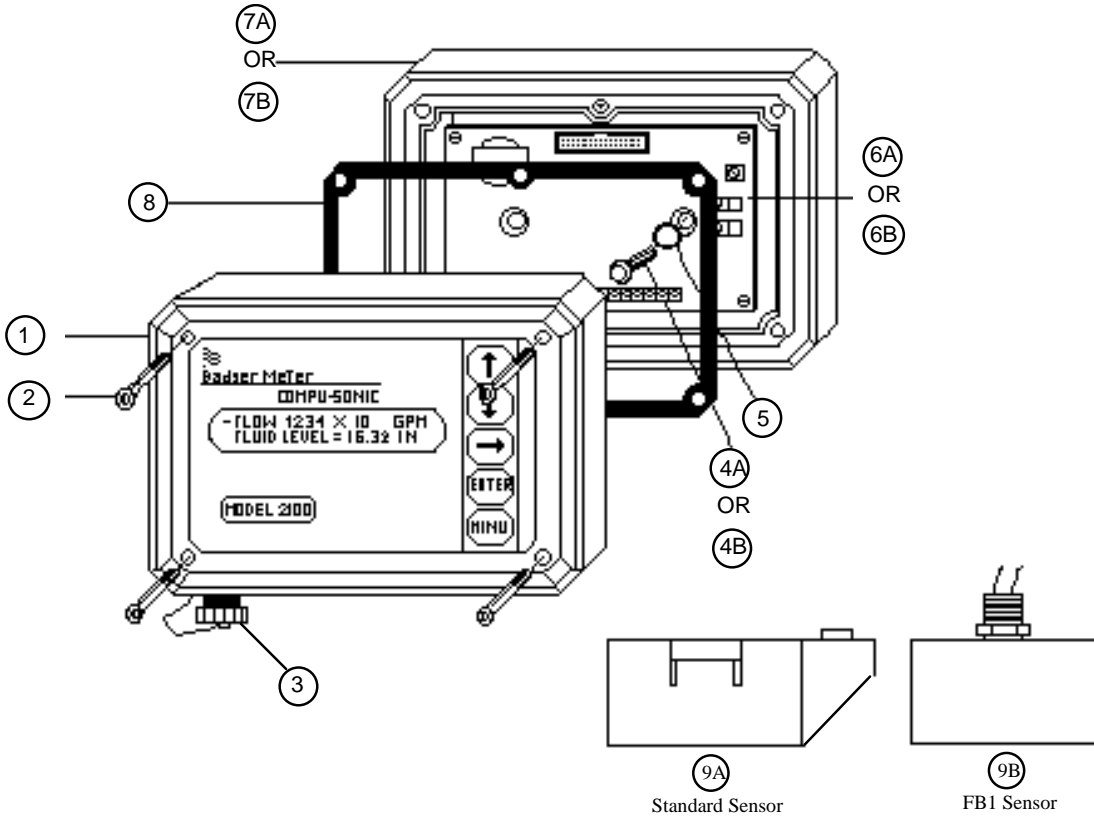
### CHART PLATE ASSEMBLY PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	UM	QTY
12	543744-0001	SERVO MECH ASSY	EA	1.0
13	400001-0088	HEX NUT 2-56 X 7/16	EA	4.0
14	430002-0106	FLAT WASHER	EA	4.0
15	501401-0001	SPACER #2	EA	2.0
16	151960-0001	PCB MOTHER BOARD	EA	1.0
17	510031-0131	SPRING	EA	1.0
18	543075-0001	LCD DISPLAY	EA	1.0
19	500050-0043	SPACER	EA	4.0
20	410001-0007	HEX NUT 6-32	EA	13.0
22	512645	HINGE	EA	1.0
23	512594	CHART PLATE	EA	1.0
24	501078	MEMBRANE SWITCH	EA	1.0
27	540769	CHAIN ASSY	EA	1.0
29	400002-0015	SCREW 6-32 X 5/16	EA	11.0
30	400005-0117	SCREW 2-56 X 3/16	EA	2.0
31	501132-0005	CONNECTOR HOUSING	EA	1.0
32	501425-0001	STEPPER MOTOR	EA	1.0
33	500050-0015	SPACER #6	EA	2.0
34	400006-0025	SET SCREW 4-40 X 3/16	EA	1.0
35	524720	CHART CLAMP BODY	EA	1.0
36	400006-0071	SET SCREW 5-40 X 5/16	EA	1.0
37	512610	COVER W/LOGO	EA	1.0
38	524743	CHART KNOB	EA	1.0
39	400002-0010	SCREW 6-32 X 5/8	EA	2.0
40	512114	PEN ARM	EA	1.0
41	500638-0003	ON/OFF SWITCH	EA	1.0
42	430002-0105	FLAT WASHER	EA	5.0
43	500983-0001	SNAP FASTENER	EA	5.0
44	512224	PEN REPLACEMENT DECAL	EA	1.0
45	500724-0001	RED FIBER TIP PEN	EA	2.0
46	440005	RETAINER	EA	2.0
47	501276-0002	SCREW	EA	2.0
48	500146-0005	LOCTITE	EA	0.01
49	501239	BELT CLAMP	EA	1.0
50	525733	PEN LIFTER	EA	1.0
52	430003-0002	WASHER	EA	11.0
79	500014	ON/OFF NAMEPLATE	EA	1.0

### CASE ASSEMBLY PART LIST

51	512599	CASE	EA	1.0
52	430003-0002	WASHER	EA	1.0
53	500023-0037	TERMINAL BLOCK	EA	1.0
54	512633	MTG BRACKET	EA	4.0
55	400013-0064	MTG SCREW 5/16-18 X 4.5	EA	4.0
56	501275-0001	CLIP	EA	2.0

## ILLUSTRATED PART LIST MODEL 2100 FLOW METER



ITEM #	PART NUMBER	DESCRIPTION	QUANTITY
1	543198-0005	Front Housing W/Electronics	1
2	400003-0048	Screw Schcap 10-32 x 2-1/2 LG SS	4
3	501153-0001	Cap Sealing	1
	501101-0001	Connector Recp 8ckts W/Sq-Flg	1
	400001-0025	Screw PNH-S 4-40 x 3/8 SS	4
4A	400029-0002	Screw Hex shrh 1/4-AB X .75 Stl	2
4B	400022-0016	Screw Hex whrh 1/4-20 (ROLOK) ZN	2
5	490004	O-Ring	2
6A	151925-0001	AC Power supply 115 VAC	1
6B	151925-0002	AC Power supply 230 VAC	1
	160978-0005	Fuse .5 x 20 mm .1 A 250 V	1
7A	543198-0002	Back Housing 117 VAC	1
7B	543198-0003	Back Housing 230 VAC	1
8	512310	Gasket	1
9A	543197-0001	Sensor Head W/100 Ft. Cable	1
9B	543372-0001	FB1 Sensor Head W/100 Ft. Cable	1
	500064-0012	Sensor Cable	

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