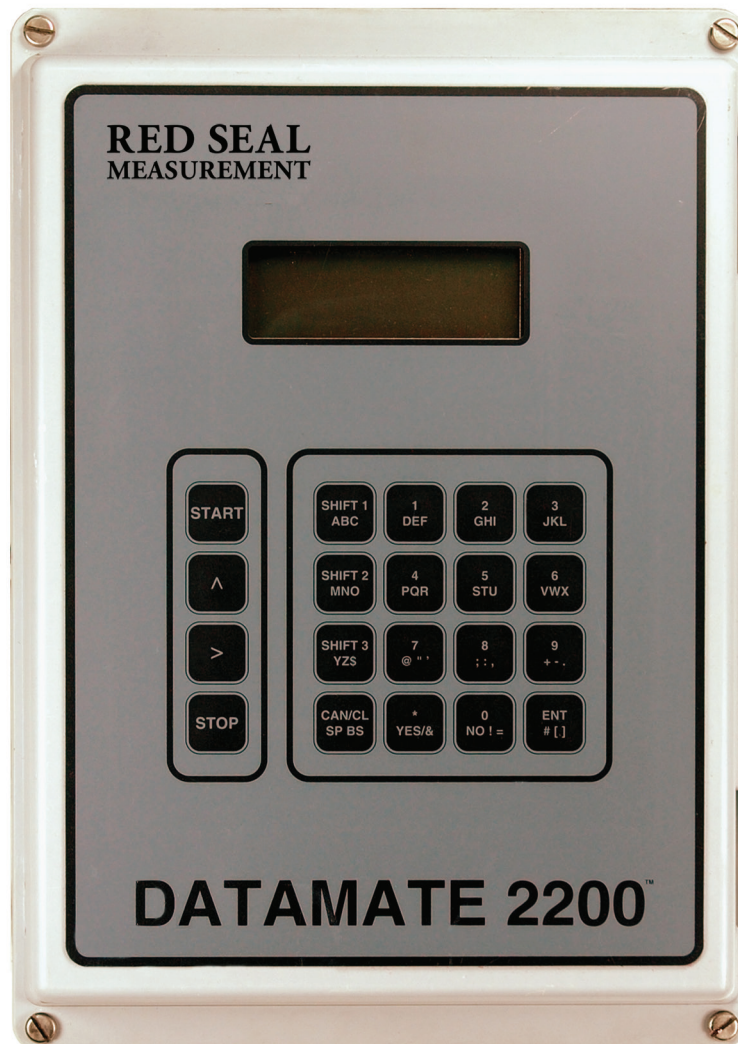**RED SEAL**
MEASUREMENT

Datamate 2200®
Operating & Maintenance Manual

WARNINGS, CAUTIONS, NOTES

Throughout this manual you will see **WARNINGS, CAUTIONS** and **NOTES**. They are here for your benefit and warrant attention. By paying careful attention to them you can prevent personal injury and possible equipment damage. Below are examples:

WARNINGS: INFORM THE READER OF POSSIBLE BODILY INJURY IF PROCEDURES ARE NOT FOLLOWED EXACTLY.

CAUTION: Alert the reader to possible equipment damage if procedures are not followed correctly.

NOTES: Inform the reader of a general rule for a procedure or of exceptions to such a rule.

Table of Contents

Table of Tables

TABLE LOCATIONS

Table of Figures

FIGURE LOCATIONS

Table of Drawings

DRAWING LOCATIONS

SECTION 1: WHAT YOU NEED TO USE THIS MANUAL

1.1   Introduction to the Datamate 2200® Red Seal Measurement Coriolis Flow Transmitter

Red Seal Measurement and its employees would like to express our thanks for purchasing the Datamate 2200 Red Seal Measurement Flow Transmitter.

The Datamate 2200 is the most versatile Coriolis Flow Transmitter available. It is the first transmitter with an open architecture platform and to employ Digital Signal Processing (DSP), full software configuration and optional batching capabilities.

1.2   About This Manual

This instruction manual explains how to install, start up, troubleshoot and program the Datamate 2200 for use with the Red Seal Measurement Coriolis Force Flow meters. For more information about the Red Seal Measurement transducer, consult the Transducer Installation Guide (M600).

CAUTION: Improper installation could cause error in measurement or failure of transmitter.

For safety purposes, please follow all instructions and adhere to all precautions outlines in this manual to assure the best operation of the Datamate 2200.

1.3   Terminology

The term *transducer* or *sensor* refers to an Red Seal Measurement Coriolis Force Flow Meter (CFF™). The term *transmitter* refers to a Datamate 2200 RSM Flow Transmitter.

1.4   Principle of Operation

The principle of operation applies directly to the transducer. For a complete explanation, please consult the Red Seal Measurement Mass Flow Transducer Installation Guide (M600).

1.5   Optional LCD

The Datamate 2200 transmitter is available with an optional Liquid Crystal Display (LCD). The LCD displays all functions of the transmitter and is fully configurable from the unit.

See FIgures 1.1, 1.2 and 1.3 for the different available configurations of the Datamate 2200.

KEYPAD

LIQUID
CRYSTAL
DISPLAY

ELECTRONICS
ENCLOSURE

HOUSING

CONDUIT ENTRY
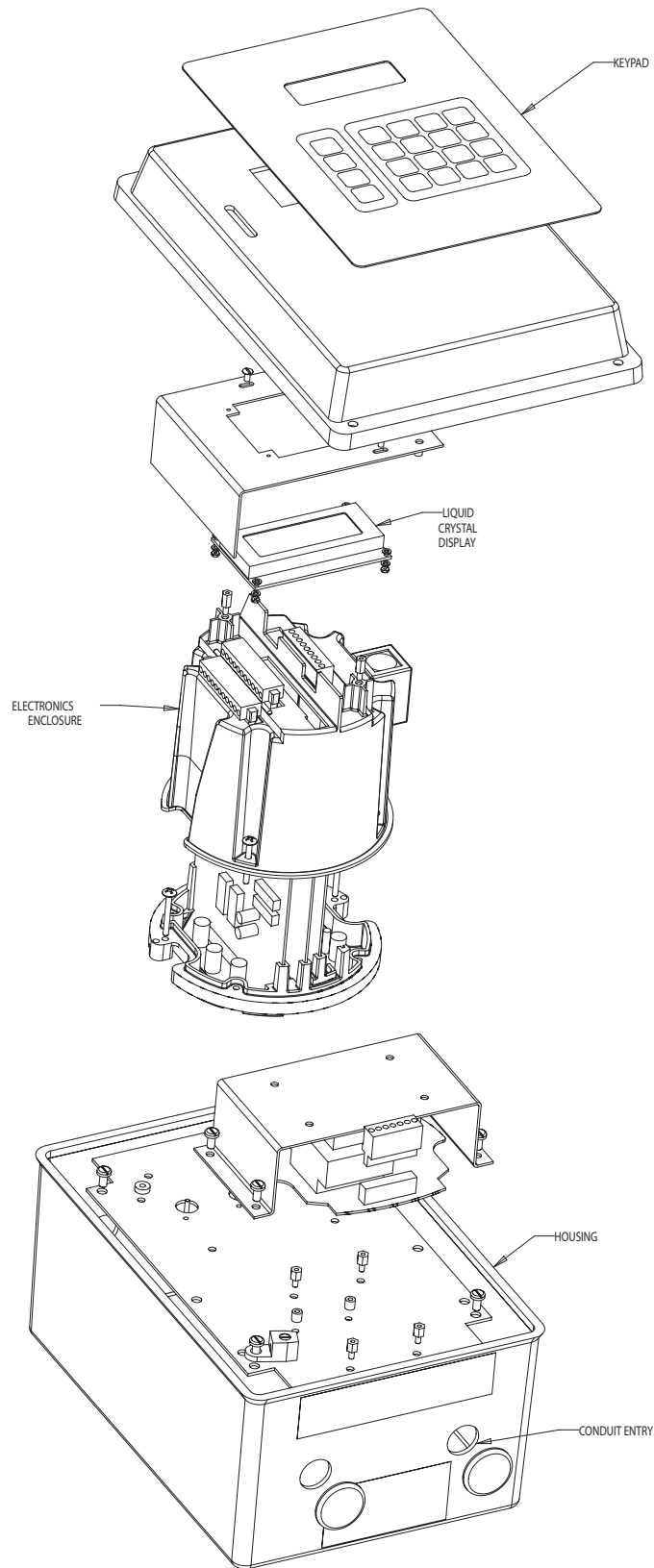
Figure 1.1: LCD Display Unit Component Highlights (with keypad)

ELECTRONICS
ENCLOSURE

HOUSING

CONDUIT ENTRY
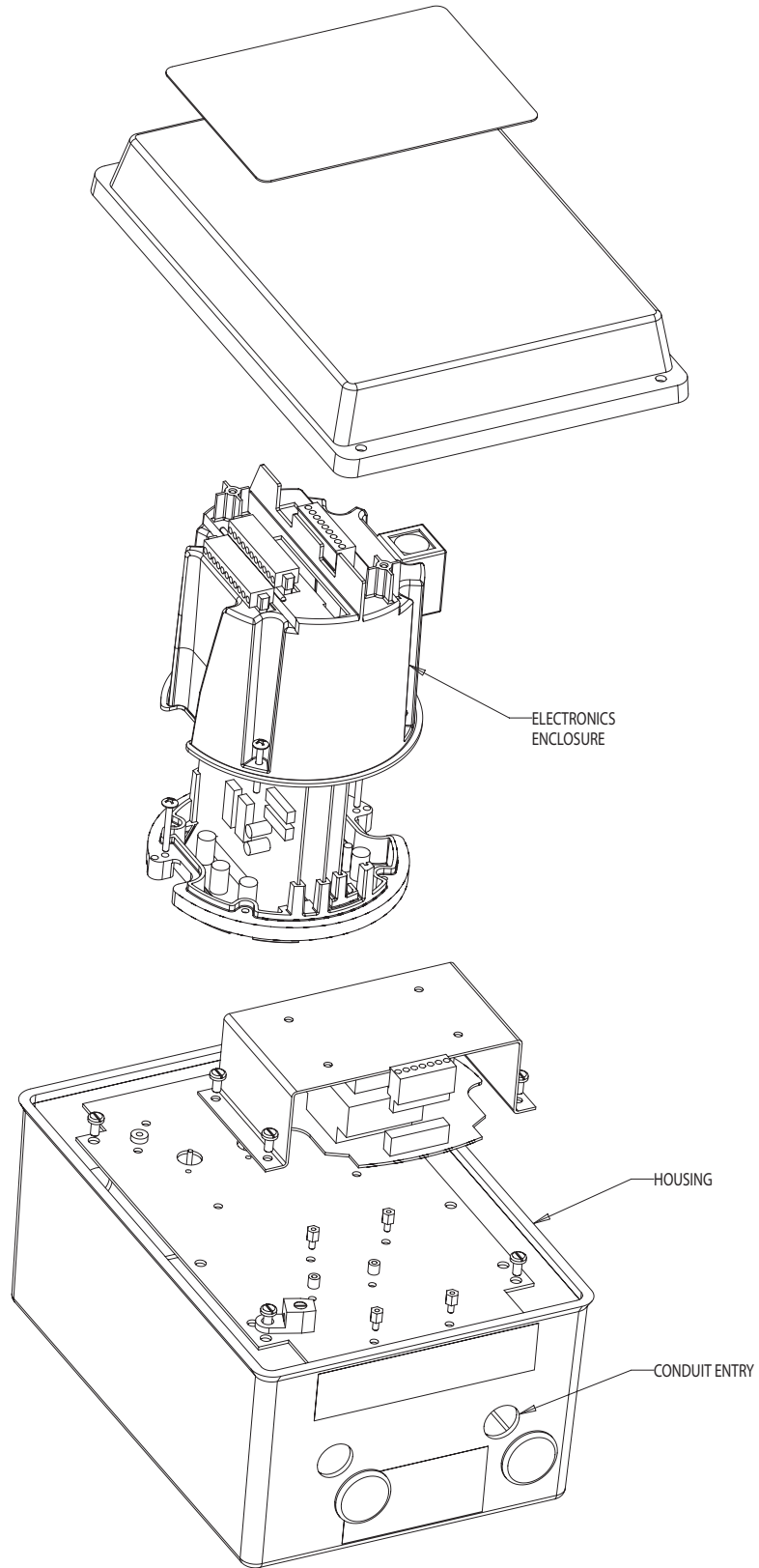
Figure 1.2: Blind Unit Component Highlights

LIQUID
CRYSTAL
DISPLAY

ELECTRONICS
ENCLOSURE

HOUSING

CONDUIT
ENTRY
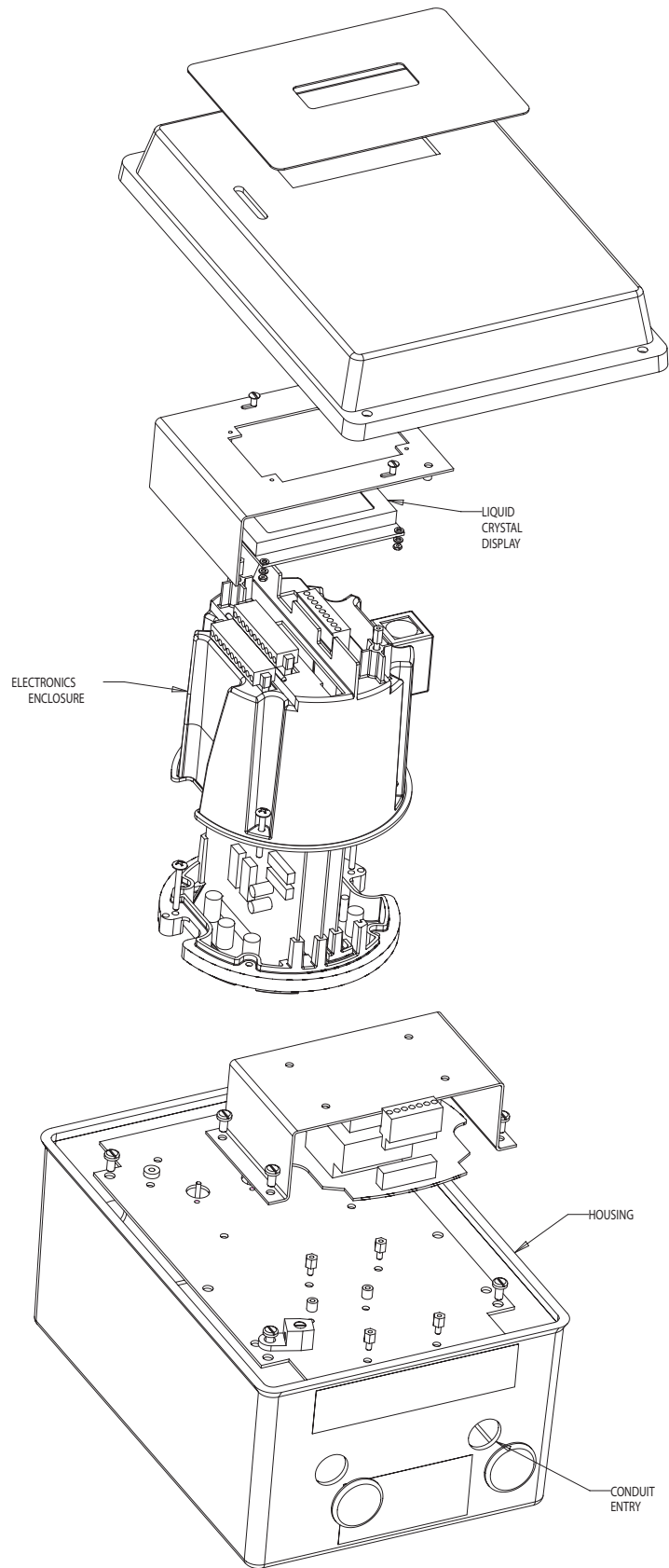
Figure 1.3: LCD Display Unit (Less Keys) Component Highlights

SECTION 2: READ THIS FIRST

2.1 Transmitter Area Classification

WARNING: IMPROPER INSTALLATION IN A HAZARDOUS ENVIRONMENT COULD CAUSE AN EXPLOSION. INSTALL THE Datamate 2200 IN AN AREA COMPATIBLE WITH THE HAZARDOUS ENVIRONMENT SPECIFIED ON THE APPROVALS TAG.

The Datamate 2200 has been tested by an independent third party laboratory and has been found to meet the following standards:

FCC Part 15, Class A - Emissions
EN61326 (1977), Class A - Emissions
EN61326 - Industrial Location Immunity

Hazardous Area Approval:

CSA   Class I, Div 2, Group C and D
                            Class II, Div 2, Groups E, F, and G
                            Class III

2.2 Orientation and Mounting

Orient the transmitter so that the enclosure cover and the conduit openings are easily accessible.

2.3 Temperature, EMI/RFI, Humidity, Vibration and Mechanical Shocks

The specified limits for the transmitter are as follows:
· Ambient temperature (with optional LCD) -4 to 140°F (-20 to 60°C)
· Ambient temperature (without optional LCD) -40 to 140°F (-40 to 60°C)
· EMI/RFI Class A digital device, pursuant to Part 15 of the FCC Rules
· Humidity: 10 to 100% condensing
· Vibration [Nonoperating 5g, 3 Axis, 10 sweeps from 10-800 Hz]
          [Operating 2.5g, 3 Axis, 10 sweeps from 10-800 Hz]
· Mechanical Shocks [Nonoperating 100 shocks up to 30g/11ms]
                    [Operating 100 shocks up to 15g/11ms]

SECTION 3: TRANSMITTER INSTALLATION

3.1   Mounting Location Guidelines

When mounting the Datamate 2200, perform the following:
- locate the transmitter where it is accessible
- in a hazardous area, install the transmitter as per Section 2.1
- maximum length of cable between the transmitter and the transducer must not exceed 1000 feet (300 meters)
- mount the transmitter to a stable surface or instrument pole that will minimize vibration

NOTE: Datamate 2200 transmitter requires 18 inches (450 mm) of clearance for opening the cover.

WARNING:
- **The Datamate housing has four 7/8 inch holes for conduit connections and cable entrance. Proper cable bushings or conduit fittings must be used to keep Datamate 2200 watertight. Any unused openings must be sealed with hole plugs.**

- **In order to maintain Type 4 rating and keep moisture out, the four mounting holes in the bottom of the enclosure must be sealed using the rubber-backed washers, 1/4 inch screws of appropriate length, and nuts and lockwashers necessary for the mounting.**

3.2   Mounting to a Wall

Refer to Figure 3.2.1 to mount the Datamate 2200 transmitter to a wall or other flat rigid surface:

- Use four 1/4-inch or M6 bolts and nuts to mount the transmitter to a wall or other flat surface. Use bolts and nuts that can withstand the process environment. RSM does not supply the bolts or nuts. **In order to maintain Type 4 rating, the four mounting holes in the bottom of the enclosure must be sealed using the rubber-backed washers supplied with the transmitter.**
- To minimize stress on the housing, secure all four mounting bolts to the same structure, which should be flat and should not vibrate or move excessively.
  Do not secure bolts to separate beams, girders, or wall studs which can move independently.
- Use washers to shim the housing if the mounting surface is not flat. Apply equal torque to all bolts to ensure the transmitter is firmly mounted. Red Seal Measurement does not supply washers.

Dimensions are inches

8.50

6.00

12.00

10.75

6.00

10.75

5/16 DIA. HOLES
4 PLACES

MOUNTING DIMENSIONS

6.88

.06
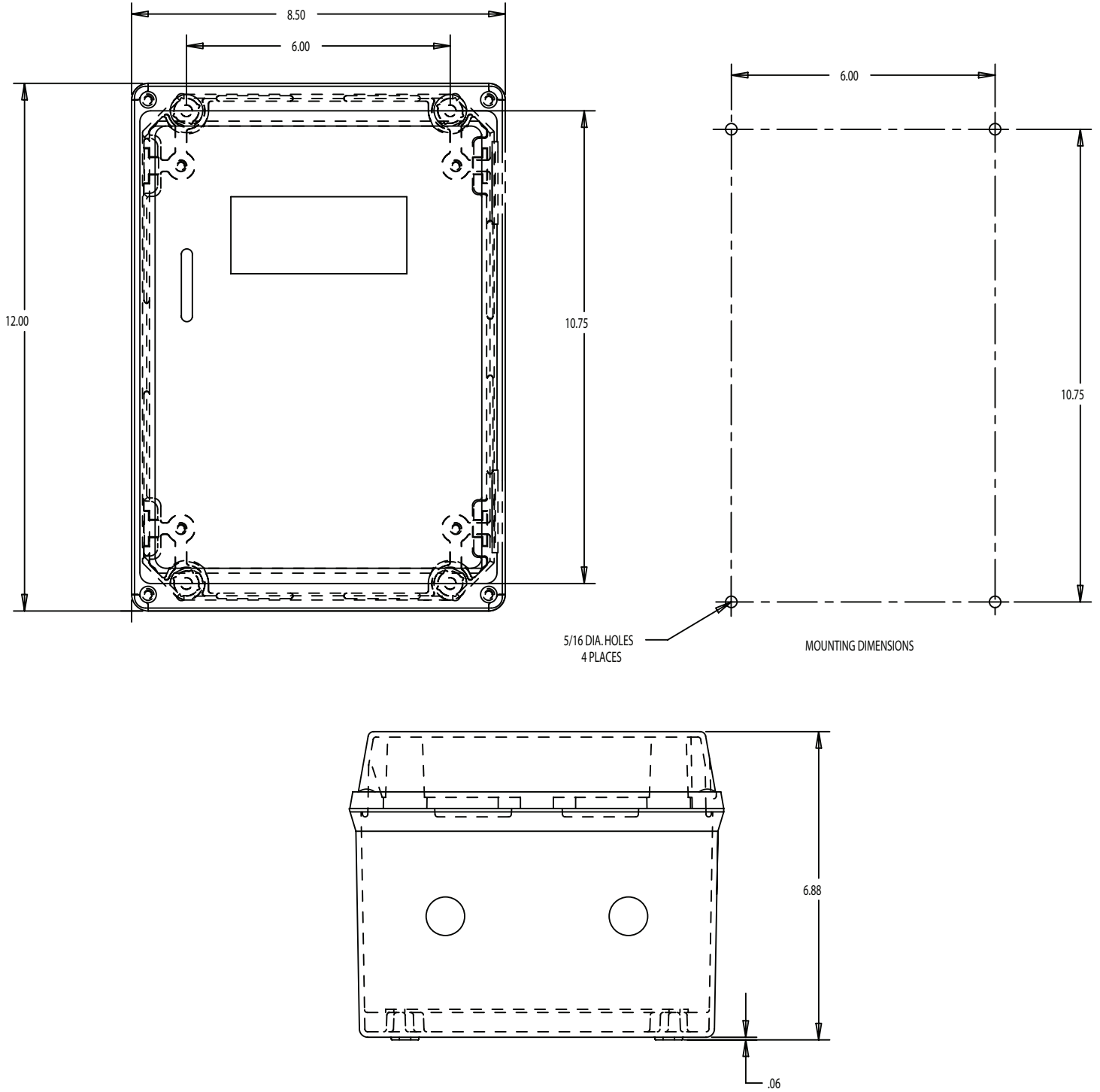
Figure 3.2.1: Dimensional and Mounting Information

3.3   Guidelines for Conduit
Install a drip leg in conduit to prevent liquids from entering the junction connector.

3.4   Transducer Cable Connections
1. Attach the transducer cable connector to the threaded male connector on the transducer.
2. Bring the other end of the transducer cable into the Datamate 2200 through the top right conduit opening. Strip the cable cover back a minimum of 10" and a maximum of 12". Run the wire up through the ferrite then wrap it around and back through the ferrite again.

The Belden 89892 cable is an 8 conductor cable. It consists of four individually twisted pairs and a shield.

The maximum length of cable between the transducer and transmitter is not to exceed 1000 feet (300 meters).

Splicing the cable is **not recommended**. If the length of cable does not meet your requirements, contact your local RSM representative for a replacement.

Do not install the Belden 89892 cable in the same conduit or cable tray as power cables.

Install weather-tight connectors and drip legs in conduits or cables to prevent moisture from entering the transmitter housing.

NOTE: See Figure 3.5.1 for proper connection of the transducer cable to the Datamate 2200.

TRANSDUCER CABLE
MUST COME THRU
THIS OPENING

SEE DETAIL "A"

CAPACITOR ASSEMBLY
ATTACHED TO GROUND
SCREW. REFERENCE DETAIL C.

TRANSDUCER I/O
INTRINSICALLY SAFE OUTPUTS
DETAIL A

CONNECT J2-2 AND J2-3
TO THE DESIGNATED INTRINSIC
SAFETY GROUND.

J2

1	IS GROUNDS
2	
3	

J3

1	GND	SHIELD
2	TUBE DRIVE	RED
3	DRIVE RETURN	BLACK
4	+RTD E	GRAY
5	+RTD S	YELLOW
6	-RTD S	GREEN
7	-RTD E	WHITE
8	SENSOR A	BLUE
9	SENSOR B	ORANGE

Figure 3.5.1: Transducer Cable Connections

1	START BATCH PB IN
2	PB RETURN
3	STOP BATCH PB IN
4	HART OUT
5	HART IN
6	12V RETURN (-)
7	RS485 A
8	RS485 B
9	ALARM1 OUT
10	ALARM RETURN
11	ALARM2 OUT
12	CURRENT1 OUT (+)
13	CURRENT1 RETURN (-)
14	CURRENT2 OUT (+)
15	CURRENT2 RETURN
16	12V SUPPLY (+)
17	PULSE OUT
18	PULSE/QUAD RETURN
19	QUADRATURE OUT
20	BATCH1 OUT
21	BATCH RETURN
22	BATCH2 OUT
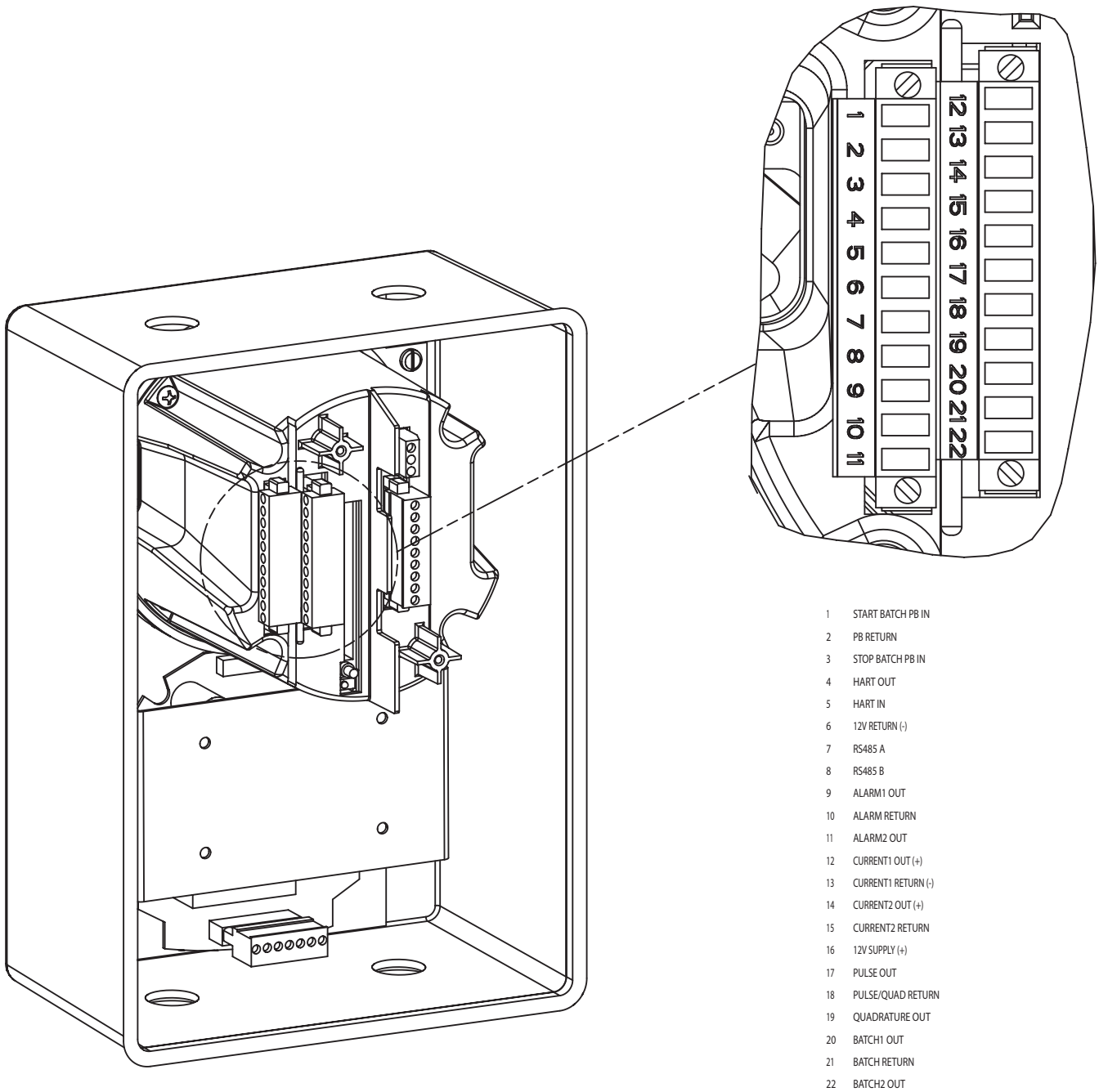
Figure 3.5.2: Transmitter Terminals

SECTION 4: POWER SUPPLY WIRING

4.1   Wiring Guidelines

WARNING: IMPROPER INSTALLATION IN A HAZARDOUS AREA COULD CAUSE AN EXPLOSION.

For intrinsically safe installations:
- Do not wire the transmitter until all electrical power to the transmitter has been shut off
- Follow the CSA installation drawing (pages 18-19).
- Install cable and wiring as per local code requirements
- Do not connect pumps, motors, transformers, solenoid valves and other high voltage equipment to the same circuit breaker as the transmitter
- Allow 18 inches (450mm) clearance for opening the cover and maintenance inside the Datamate 2200.

4.2   Grounding

Both the transmitter and transducer must be grounded for optimum performance. In safe area installations the power circuit ground from the power supply should be connected to the ground J2 on the barrier board and the transducer should be connected the same.

4.3 Power Supply Wiring Connections

CAUTION: Incorrect voltage or installation with power supply on will cause transmitter damage or failure.

- Match power supply voltage with the correct terminals (Refer to Figure 4.3.1)
- Shut off power before wiring transmitter

The Datamate 2200 transmitter has 12 to 36 VDC, 115/230 VAC ± 10%, 20-40 VA power inputs. Figure 4.3.1 shows the power supply wiring terminals in the transmitter housing.

WARNING: BOTH THE TRANSMITTER AND TRANSDUCER MUST BE GROUNDED FOR OPTIMUM PERFORMANCE. IN SAFE AREA INSTALLATIONS THE POWER CIRCUIT GROUND FROM THE POWER SUPPLY SHOULD BE CONNECTED TO THE GROUND J2 ON THE BARRIER BOARD AND THE TRANSDUCER SHOULD BE CONNECTED TO THE SAME.

NOTE: The power supply wiring terminals are accessed by opening the front panel. Refer to Figure 4.3.1 for the location of the power connection in the enclosure.

Remove power supply connector and terminate power supply connections. Please be sure to place jumpers in the correct location.
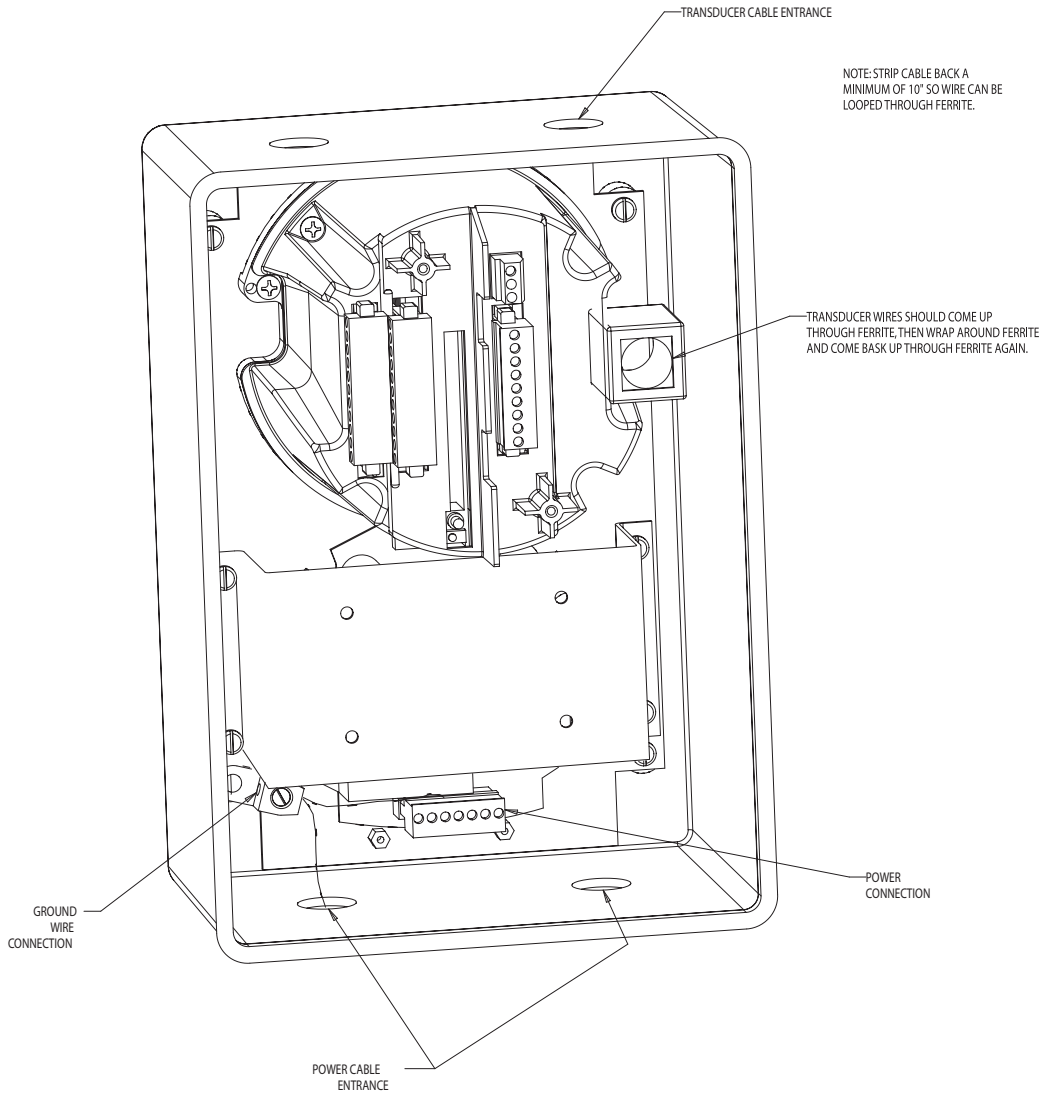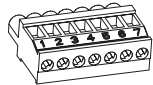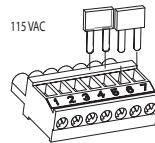
TRANSDUCER CABLE ENTRANCE

NOTE: STRIP CABLE BACK A MINIMUM OF 10" SO WIRE CAN BE LOOPED THROUGH FERRITE.

TRANSDUCER WIRES SHOULD COME UP THROUGH FERRITE, THEN WRAP AROUND FERRITE AND COME BASK UP THROUGH FERRITE AGAIN.

POWER CONNECTION

GROUND WIRE CONNECTION

POWER CABLE ENTRANCE

DC POWER SUPPLY

1	12-36 VDC (-)
2	12-36 VDC (+)
3	FIELD GROUND

115 VAC

3	FIELD GROUND
4	NEUTRAL: JUMP TO 5
5	NEUTRAL: JUMP TO 4
6	LINE: JUMP TO 7
7	LINE : JUMP TO 6

230 VAC
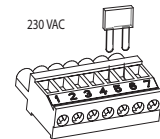
3	FIELD GROUND
4	NEUTRAL
5	JUMP TO 6
6	JUMP TO 5
7	LINE

Figure 4.3.1: Power Supply Wiring Location and Connections

DETAIL "A"
PROCESS CONTROL I/O

HEADER FOR LCD DISPLAY
CONNECTOR

DESIGNATED ENTRIES
FOR I/O CABLES

SEE DETAIL A

J2

1	START BATCH PB IN
2	PB RETURN
3	STOP BATCH PB IN
4	HART OUT
5	HART IN
6	12V RETURN (-)
7	RS485 A
8	RS485 B
9	ALARM1 OUT
10	ALARM RETURN
11	ALARM2 OUT
12	CURRENT1 OUT (+)
13	CURRENT1 RETURN (-)
14	CURRENT2 OUT (+)
15	CURRENT2 RETURN
16	12V SUPPLY (+)
17	PULSE OUT
18	PULSE/QUAD RETURN
19	QUADATURE OUT
20	BATCH1 OUT
21	BATCH RETURN
22	BATCH2 OUT

SEE NOTE #1

HEADER FOR KEYPAD
CONNECTOR

SEE NOTE #1

SEE DETAIL C

SEE NOTE #2

TRANSDUCER CABLE CONNECTION

SEE DETAIL D

DESIGNATED ENTRIES FOR POWER
AND I/O CABLES

CONDUIT

POWER

J2

1		
2	IS	
3	GROUNDS	

J3
TRANSDUCER CABLE CONNECTION

1	GND	SHIELD
2	TUBE DRIVE	RED
3	DRIVE RETURN	BLACK
4	+RTD E	GRAY
5	+RTD S	YELLOW
6	-RTD S	GREEN
7	-RTD E	WHITE
8	SENSOR A	BLUE
9	SENSOR B	ORANGE

DETAIL "B"
TRANSDUCER I/O

J2

CAPACITOR ASSEMBLY
ATTACHED TO GROUND
SCREW. REFERENCE DETAIL C.

J3

NONHAZARDOUS AREA

BELDEN #89892 or EQUAL
(4) PAIR CABLE

GROUND
PAD

ṁ ® MODEL M CORIOLIS MASS FLOWMETER

Model M012, M025, M050, M100,
M200, M300, M400
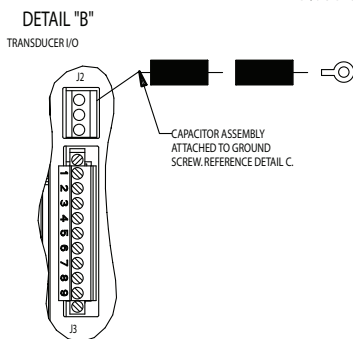
DETAIL "C"

GROUND ATTACHED
TO J2. REFERENCE
DETAIL B

NOTES:
1. TRANSDUCER WIRE TO BE ROUTED UP THROUGH FERRITE THEN WRAPPED AROUND FERRITE
AND ROUTED BACK UP THROUGH FERRITE AGAIN.
2. FIELD GROUND WIRE TO BE TERMINATED ON GROUND LUG ON BACK MOUNTING PLATE.
JUMPER WIRE TO BE CONNECTED FROM GROUND LUG TO POINT 3 ON POWER CONNECTOR.

DETAIL "D"
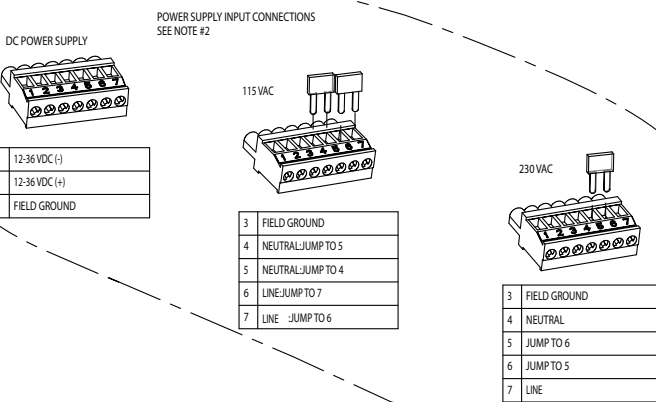
POWER SUPPLY INPUT CONNECTIONS
SEE NOTE #2

DC POWER SUPPLY

1	12-36 VDC (-)
2	12-36 VDC (+)
3	FIELD GROUND

115 VAC

3	FIELD GROUND
4	NEUTRAL:JUMP TO 5
5	NEUTRAL:JUMP TO 4
6	LINE:JUMP TO 7
7	LINE :JUMP TO 6

230 VAC

3	FIELD GROUND
4	NEUTRAL
5	JUMP TO 6
6	JUMP TO 5
7	LINE

MATERIAL
HEAT TREAT
FINISH SPECIFICATION

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN US STANDARD
BREAK EDGES .005/.015
SURFACE FINISH

FRACTIONS ±1/64 | DECIMALS 2 PL ±.01 3 PL ±.005 | ANGLES ±1
DO NOT SCALE DRAWING

DWG. RC
SHEET 1/1
SCALE NTS

TITLE
INSTALLATION DRAWING FOR ṁ® MODEL M CORIOLIS MASS FLOWMETER WITH DATAMATE 2200 FOR NONHAZARDOUS AREA

RED SEAL MEASUREMENT

NO. D600811-000
GREENWOOD, SOUTH CAROLINA

NONHAZARDOUS OR HAZARDOUS AREA

J2

1	START BATCH PB IN
2	PB RETURN
3	STOP BATCH PB IN
4	HART OUT
5	HART IN
6	I2V RETURN (-)
7	RS485 A
8	RS485 B
9	ALARM1 OUT
10	ALARM RETURN
11	ALARM2 OUT
12	CURRENT1 OUT (+)
13	CURRENT1 RETURN (-)
14	CURRENT2 OUT (+)
15	CURRENT2 RETURN
16	I2V SUPPLY (+)
17	PULSE OUT
18	PULSE/QUAD RETURN
19	QUADATURE OUT
20	BATCH1 OUT
21	BATCH RETURN
22	BATCH2 OUT

PROCESS CONTROL I/O
DETAIL A
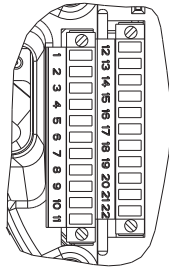
DATAMATE 2200 CORIOLIS FLOW TRANSMITTER
CLASS I, DIVISION 2, GROUPS A, B, C, & D
MAXIMUM TEMPERATURE 65°C
TEMPERATURE CODE T3C.
PROVIDES INTRINSICALLY SAFE CONNECTIONS TO ACTARIS
MODEL M CORIOLIS MASS FLOWMETERS LOCATED:
CLASS I, DIVISION I, GROUPS C & D
CLASS II, DIVISION I, GROUPS E,F,& G
CLASS III, DIVISION I

HEADER FOR LCD DISPLAY
CONNECTOR
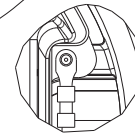
DISPLAY MOUNT P/N 60080

DESIGNATED ENTRIES
FOR I/O CABLES

SEE DETAIL A

DETAIL C
GROUND ATTACHED
TO J2. REFERENCE
DETAIL B
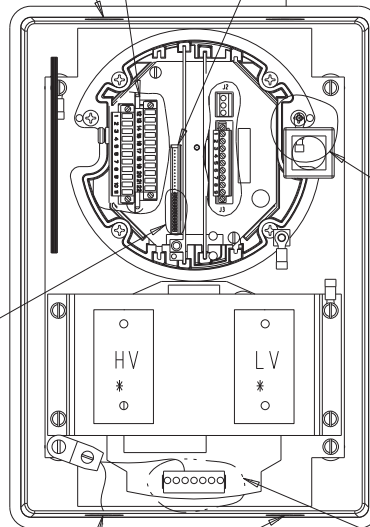
SEE DETAIL C

HEADER FOR KEYPAD
CONNECTOR

HV   LV
*   *

* NOTE - SHOWN WITH
OPTIONAL SOLID STATE RELAYS
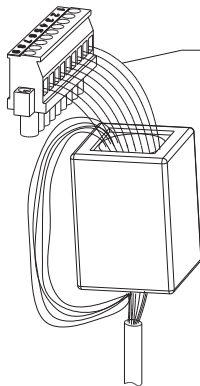
SEE WARNING #7

DESIGNATED ENTRIES FOR POWER
AND I/O CABLES
SEE WARNING 8

CONDUIT

POWER

POWER CONN
SEE DETAIL

TRANSDUCER CABLE CONNECTION

TRANSDUCER I/O
INRINSICALLY SAFE OUTPUTS
DETAIL B

CAPACITOR ASSEMBLY
ATTACHED TO GROUND
SCREW. REFERENCE DETAIL C.

J2

1	
2	IS
3	GROUNDS

J2
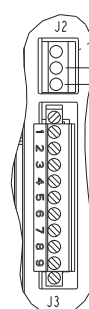
CONNECT J2-2 AND J2-3
TO THE DESIGNATED INTRINSIC
SAFETY GROUND.
SEE WARNING #1, #10, #11

J3

1	GND	SHIELD
2	TUBE DRIVE	RED
3	DRIVE RETURN	BLACK
4	+RTD E	GRAY
5	+RTD S	YELLOW
6	-RTD S	GREEN
7	-RTD E	WHITE
8	SENSOR A	BLUE
9	SENSOR B	ORANGE

J3

LTR	REVISION	DATE	ECN	BY	APPD
A	INITIAL RELEASE	12/13/07	00090776	RC	R.SMITH
B	ADDED MAX. TEMPERATURE AND TEMPERATURE CODE TO NOTE	3/26/08	00090778	RC	R.SMITH

HAZARDOUS AREA

CLASS I, II, III, DIVISION I, GROUPS C. D, E, F, G

MODEL mA - XXX2X
WHERE:
    A = BASE METER 012, 025, 050, 100, 200, 300, 400
    X = DOES NOT AFFECT HAZARDOUS AREA APPROVAL.

BELDEN #89892 or EQUAL (4) PAIR CABLE

BARRIER SHIELD P/N 600591-001

02-001
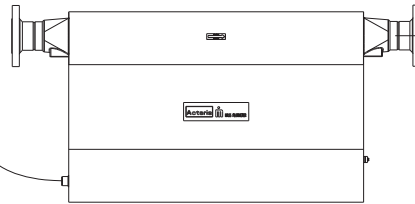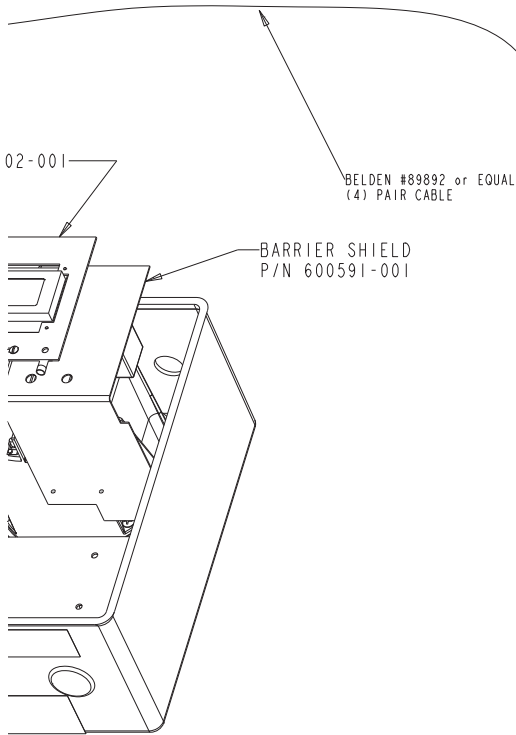
® MODEL M CORIOLIS MASS FLOWMETER
Model M012, M025, M050, M100, M200, M300, M400

MAXIMUM FLOWMETER CABLE INDUCTANCE & CAPACITANCE

GROUP	C CABLE (uF)	L CABLE (mH)	OR L/R CABLE (uH/Ω)
A, B (DIV 2)	9.3	25	-
C, E (DIV I)	10.3	2.48	287
D, F, G (DIV I)	41.0	17.4	574

WARNING:
1. RESISTANCE BETWEEN INT. SAFE GND. AND EARTH GROUND MUST BE LESS THAN I OHM.
2. CONTROL EQUIPMENT CONNECTED TO MUST NOT USE OR GENERATE MORE THAN 250 Vrms OR Vdc
3. NO REVISION TO THIS DRAWING WITHOUT PRIOR CSA APPROVAL.
4. INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS SHOULD BE IN ACCORDANCE WITH CCEC PT.I. SEC. 18. APPENDIX F.
5. TRANSDUCER CABLE TO BE STRIPPED A MINIMUM OF 10" BUT NO MORE THAN 12".
6. AN INTRINSIC SAFETY GROUND IS PROVIDED FROM TERMINAL NUMBER 3 ON THE BARRIER BOARD CONNECTOR THROUGH THE BLACK CONDUCTOR TO PIN "J" ON THE TRANSDUCER CONNECTOR. AN EXTERNAL INTRINSIC SAFETY GROUND IS NOT REQUIRED.
7. TRANSDUCER WIRE TO BE ROUTED UP THROUGH FERRITE THEN WRAPPED AROUND FERRITE AND ROUTED BACK UP THROUGH FERRITE AGAIN.
8. FIELD GROUND WIRE TO BE TERMINATED ON GROUND LUG ON BACK MOUNTING PLATE. JUMPER WIRE TO BE CONNECTED FROM GROUND LUG TO POINT 3 ON POWER CONNECTOR.
9. SUBSTITUTION OF DATAMATE 2200 COMPONENTS MAY IMPAIR INTRINSIC SAFETY OF TRANSDUCER.
10. REMOVE CAPACITOR ASSEMBLY IF INSTALLATION HAS AN EQUIPOTENTIAL GROUND SYSTEM.
11. REMOVE JUMPERS IF INSTALLATION DOES NOT HAVE AN EQUIPOTENTIAL GROUND SYSTEM AND CONNECT J2-2 AND J2-3 TO THE DESIGNATED INTRINSIC SAFETY GROUND.

DETAIL "D"

NECTION L "D"

DC POWER SUPPLY

POWER SUPPLY INPUT CONNECTIONS

115 VAC

I	12-36 VDC (-)
2	12-36 VDC (+)
3	FIELD GROUND

3	FIELD GROUND
4	NEUTRAL:JUMP TO 5
5	NEUTRAL:JUMP TO 4
6	LINE:JUMP TO 7
7	LINE:JUMP TO 6

230 VAC

3	FIELD GROUND
4	NEUTRAL
5	JUMP TO 6
6	JUMP TO 5
7	LINE

MATERIAL	UNLESS OTHERWISE SPECIFIED	DWG. RC	TITLE
	BREAK EDGES .005/.015	SHEET 1/1	INSTALLATION DRAWING FOR CSA INTERNATIONAL APPROVED INTRINSICALLY SAFE MODEL ■ CORIOLIS MASS FLOWMETER AND DATAMATE 2200 TRANSMITTER ASSEMBLY
HEAT TREAT	SURFACE FINISH .125	SCALE NTS	

FRACTIONS	DECIMALS	ANGLES		NO.	REV.
±1/64	2 PL .01 / 3 PL .005	±1°	**RED SEAL** MEASUREMENT	D600871-000	
	DO NOT SCALE DRAWING			GREENWOOD, SOUTH CAROLINA	

FINISH SPECIFICATION

SECTION 5: INPUT/OUTPUT WIRING

5.1 General Guidelines

The Datamate 2200 provides up to three (3) 4-20mA outputs (with HART option), and one (1) quadrature pulse output. (Refer to Figure 3.5.2 for Input/Output Cable Connections.)

CAUTION: NEVER install or remove any board with the Datamate 2200 transmitter power on.

WARNINGS:
- **INCORRECT WIRING OF INPUT/OUTPUT CONNECTIONS IN A HAZARDOUS AREA COULD RESULT IN AN EXPLOSION.**
- **WIRING FROM INPUT/OUTPUT CONNECTIONS IS NOT INTRINSICALLY SAFE.**
- **INPUT/OUTPUT WIRING AND TRANSDUCER SIGNAL WIRING SHOULD BE SEPARATED.**
- **ALL INPUT/OUTPUT CONNECTION DRAWINGS SHOULD BE FOLLOWED TO ENSURE CORRECT OPERATION.**

5.2 4-20mA Output

The 4-20mA output is an active output that can represent any of the measured or calculated variables except totals. The 4-20mA output does not require external power and is galvanically isolated to 2.5 Kv from earth ground.

NOTE: The analog return (negative) terminal is common to all of the 4-20mA outputs and can be grounded together. If the output communicates via HART® protocol, the analog return (negative) terminal should be grounded for optimal performance.
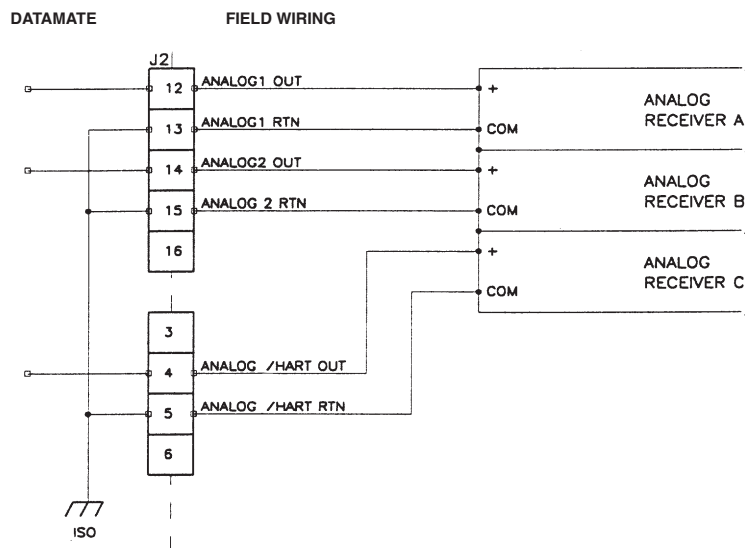
Figure 5.2.1: 4-20mA Output Wiring Connections

5.3   Pulse Output

The totalizer pulse output is a two channel quadrature pulse from open-collector NPN transistors. Galvanically isolated to 2.5Kv, opto-coupler with 100 ohm ON resistance. Maximum Voltage 26.5 VDC. Maximum Current 10mA. At maximum flow, the output has a range up to 10,000 Hertz, which can represent any variable.

CAUTION: Exceeding the specified current limit through the pulse output circuit will damage the transmitter.

Select the pull-up resistor RP to ensure that the current through the pulse output circuit does not exceed 10mA.
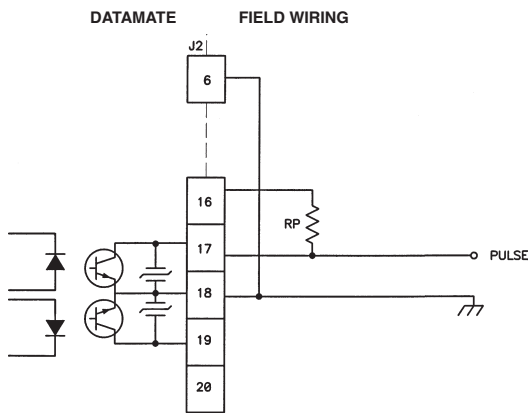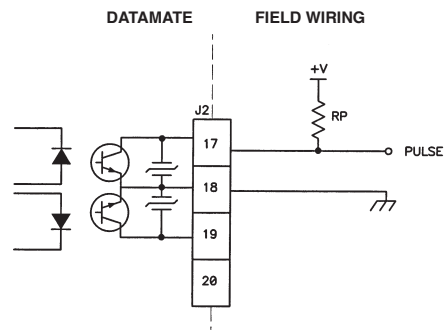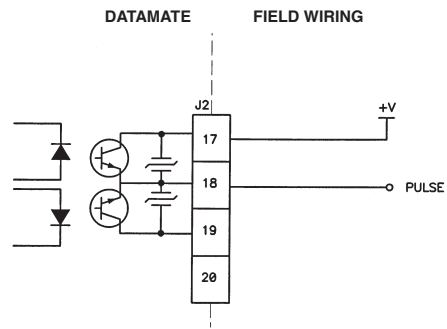
Figure 5.3.1: Pulse Output Wiring Connections

5.4 Alarm Output

The Datamate 2200 Coriolis Flow Transmitter provides two solid-state relays (SSR) outputs for alarm outputs. These can be programmed for activation from measurement values and system warnings. The SSRs are galvanically isolated to 3.75 Kv. The maximum load voltage and currents are 230 VDC/AC and 100mADC/AC.

The SSRs function as switches to make or break power to the alarm devices. The SSR outputs are not connected to a voltage source internally in the Datamate 2200. Figure 5.4.1 shows the connections for alarm devices that sense an open or closed contact.
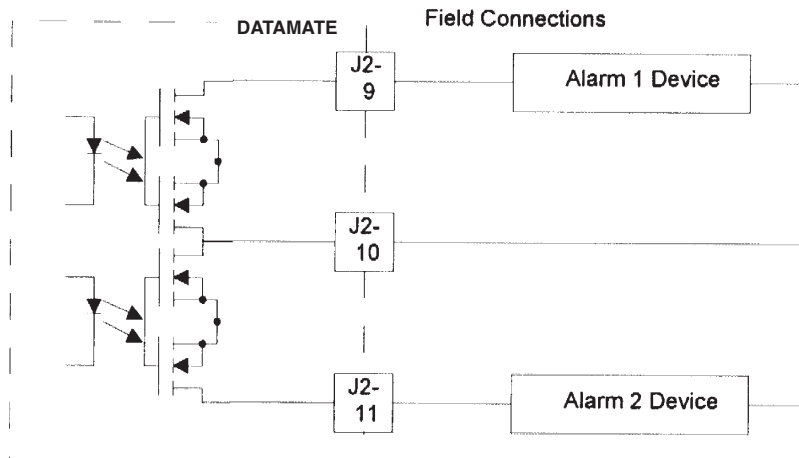
Figure 5.4.1: Field Connections for Alarm Devices without an External Voltage Source

For alarm devices that require a switched voltage, the user must make the connections required to switch voltage to the alarm devices as shown in Figure 5.4.2.
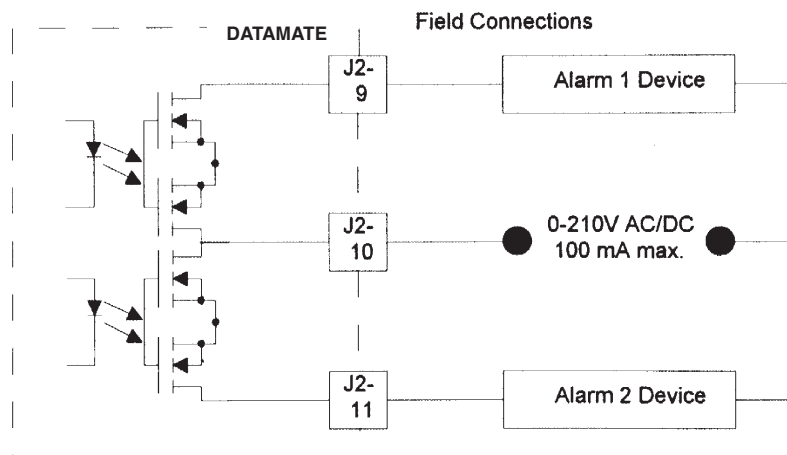
Figure 5.4.2: Field Connections for Alarm Devices with an External Voltage Source

5.5   Flow Direction Output

The Datamate 2200 transmitter can indicate direction of flow on the optional LCD display and through the two channel pulse output and 4-20mA output. The two channel pulse output produces two identical pulse signals. When flow is in the normal direction, the primary channel leads the quadrature channel by 90 degrees. If the direction of flow is reversed, the quadrature channel leads the primary channel by 90 degrees. The quadrature channel can also be used to verify the validity of the primary channel. The optional LCD also shows the direction of flow in the reverse direction by showing negative flow rates when the flow direction is programmed to forward. The 4-20mA output signal from the Datamate 2200 permits the user to configure the output to represent positive or negative measurement ranges.

Select the pull-up resistor RP to ensure that the current through the pulse output circuit does not exceed 10mA.

PULSE OUTPUTS (NON-ISOLATED 12V PULSE)

DATAMATE   FIELD WIRING

J2
5
12V RETURN   6

15
+12V SUPPLY   16
                RP   RP
17   o PRIMARY
                        PULSE
18
19   o QUADRATURE
                        PULSE
20

PULSE OUTPUT WIRING FOR PULSERS
REQUIRING A 12V PULSE IN ORDER TO
COUNT (NOT ISOLATED), RP = 1K TO 10K
DEPENDING ON COUNTER.
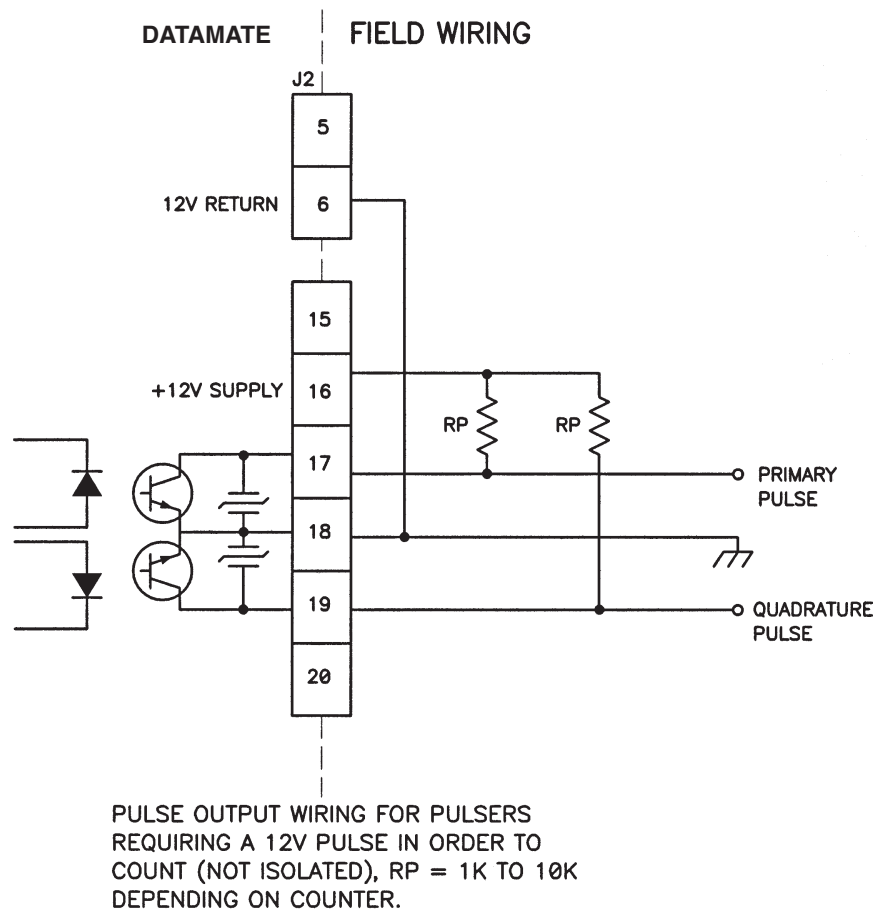
Figure 5.5.1: Connection to Remote Totalizer for Net Total

5.6 RS-485 Wiring Connections

The Datamate 2200 transmitter is equipped with an RS-485 asynchronous serial interface that uses Modbus®. Modbus allows a computer or a handheld communicator to communicate directly with up to 248 Datamate 2200 transmitters and send commands necessary to configure: batching, alarms, outputs, etc., and to read all measured variables.
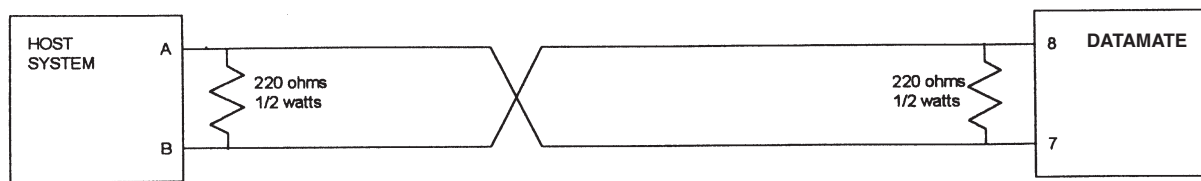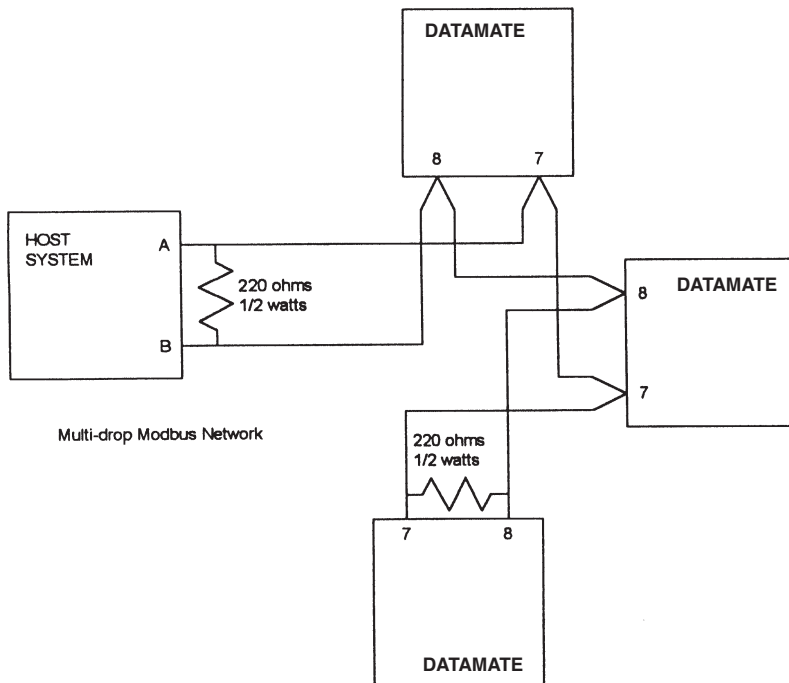
Figure 5.6.1: RS-485 Wiring Connections

5.7 RS485/RS232 Converter Connections

① RS485/RS232 Converter   ②   Serial Cable to PC

③ Twisted Pair to Datamate 2200   ④   Power Supply/Transformer for Converter
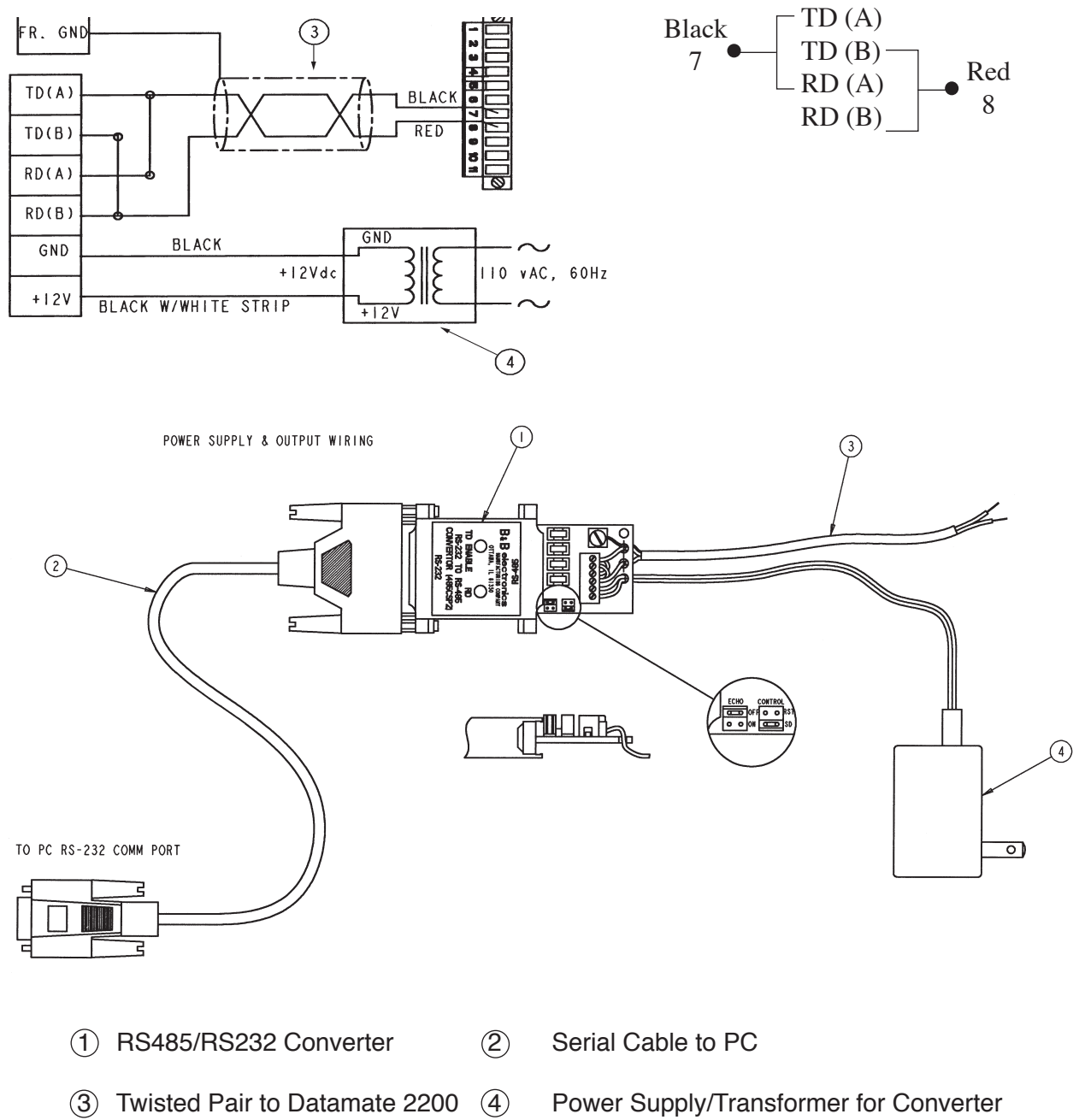
Figure 5.7.1: RS485/RS232 Converter Connections

5.8 HART® (Option Card) Wiring Connections

- Up to 10 transmitters can be connected into a HART multi-drop network.
- Using multiple transmitters in a HART® compatible network requires assigning a unique address of 1 to 15 to each transmitter
- Assigning an address of 1 to 15 to the transmitter causes the primary 4-20mA output to remain at a constant 4mA level
- The primary 4-20mA output MUST produce a 4-20mA current for the HART physical layer

Figure 5.8.1 shows how to connect wiring for a HART® compatible network. Connect the 4-20mA outputs from each transmitter together so they terminate at a common load resistor, installed in series, with approximately 250 ohms impedance. Figure 5.9.1 illustrates the handheld communicator connections for configuring the Datamate 2200 via HART.
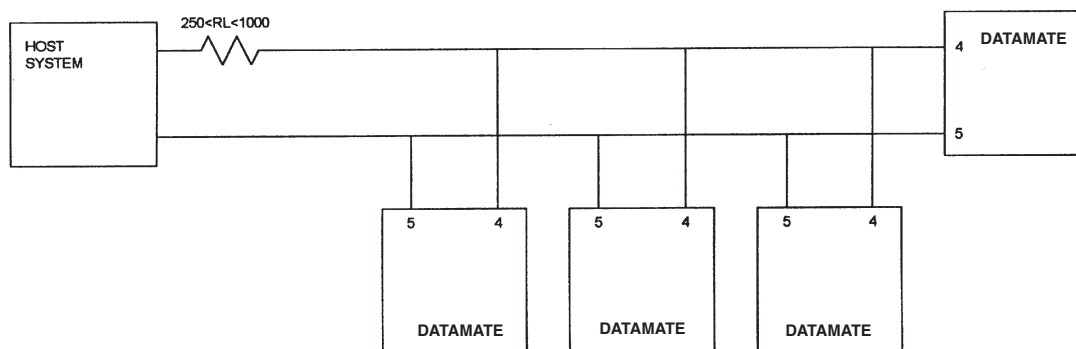
Figure 5.8.1: HART® Network Wiring

5.9   Hart® Communicator Connections

DATAMATE   (+) 4

250 ohms < RL < 1000 ohms

(-) 5

SP 75.3
PV 75.4
CV 25.8

RL is the current loop resistance.
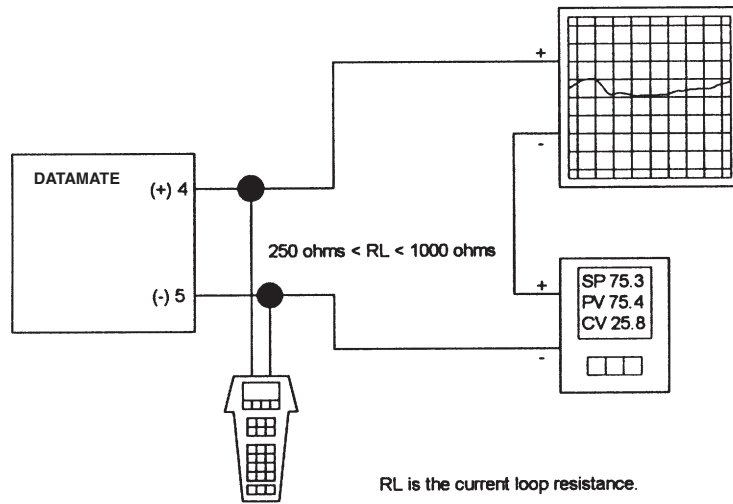
Figure 5.9.1: HART® Communicator Connections

SECTION 6: BATCH WIRING

6.1   Guidelines

The Datamate 2200 has the capability to be used as a two-stage batch controller. When purchased with the keypad and display, it provides the user with a full-featured preset batching system.

WARNING: GOOD PRACTICE DICTATES THAT A MANUAL METHOD (EMERGENCY STOP) OF DISCONNECTING ALL POWER TO THE BATCH CONTROL CIRCUITS BE INCLUDED IN THE USER'S BATCHING SYSTEM.

Caution: The Datamate 2200 and the batch control devices (e.g., motors, relays, solenoids, etc.) should be on separate power circuits from each other. If this is not possible, a power conditioner should be installed to isolate the Datamate 2200 from the voltage transients created by the batch control devices.

6.2   Batch Wiring Connections

The Datamate 2200 has 2 solid-state relays (SSRs) internal to the electronics module (see Figure 6.2.1). The internal solid-state relays are galvanically isolated to 3.75kV and the maximum voltage and current are 230VDC/AC and 100mADC/AC. The SSRs function as a switch to make or break power to the batch control devices. The internal SSR outputs are not connected to a voltage source in the standard Datamate 2200. If the Datamate 2200 is purchased with the optional pilot SSRs, this connection is done at the factory; otherwise, the user must make the connections required to switch voltage to the batch control devices (see Figure 6.2.2).

If the batch control device requires more current than the internal relays can provide then the optional pilot relays are required. The control voltage for the pilot relays is 12VDC, which is provided from the electronics module. The pilot relays come installed and wired on the control side when this option is purchased with the Datamate 2200. The switching voltage range is 24 –280 VAC and the current rating is 10A for the optional pilot relays (see Figure 6.2.3).

Some SSRs, when used as pilot relays, will allow enough current in the off-state to activate some high impedance devices (e.g., computer interfaces, PLC inputs, sensitive electro-magnetic relays, etc.) If this problem occurs, connect a 1000-ohm, 1-watt resistor across the input of the batch control devices.

For single stage batching, use the HF, LF, or both relays to control the batch control device(s). Both relays will close when a START signal received.

For two-stage batching the HF relay controls the first stage (trickle point) control devices and the LF relay controls the second stage (batch size) device. When the START signal received, both relays will close. When the first stage point is reached, the HF relay will open. Both relays will open when a STOP signal is received.

6.3   Remote Start/Stop Wiring Connections

The Datamate 2200 has the capability of a two-stage batch controller. The start and stop of the batch may be controlled from the start and stop buttons on the keypad or from remote start/stop push buttons. These push buttons should be of the normally open, momentary contact type. Figure 6.3.1 outlines the remote start/stop connector.
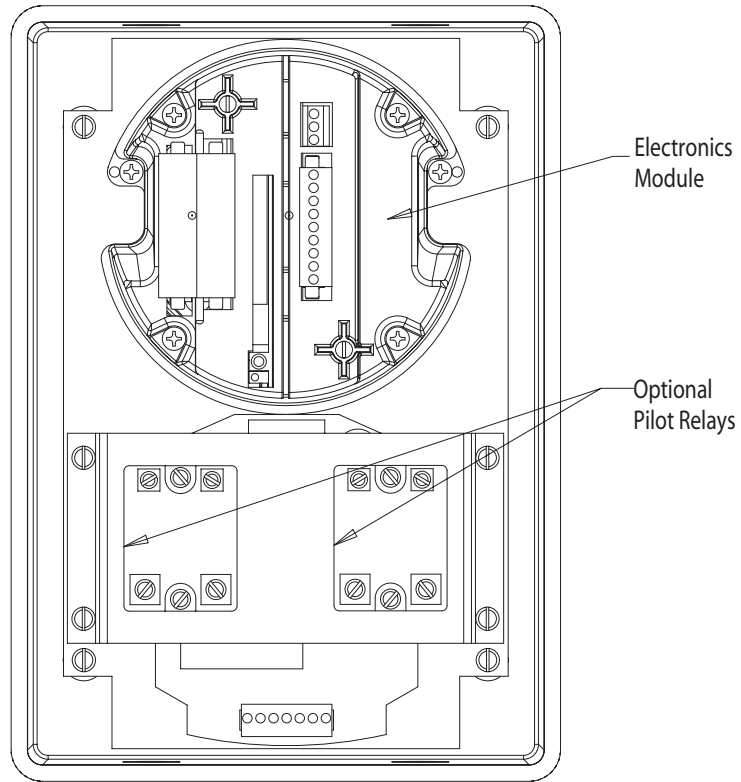
Figure 6.2.1: Relay Locations
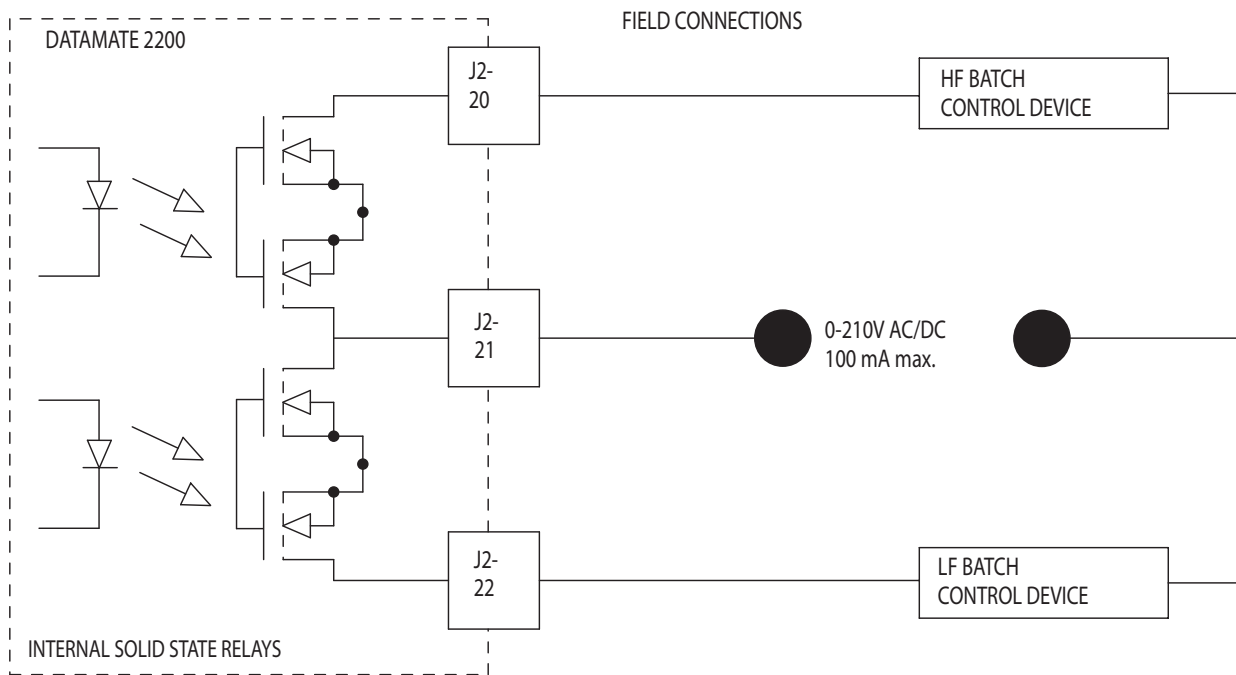
Figure 6.2.2.: Field Connections for Batch Devices That Do Not Require Pilot Relays
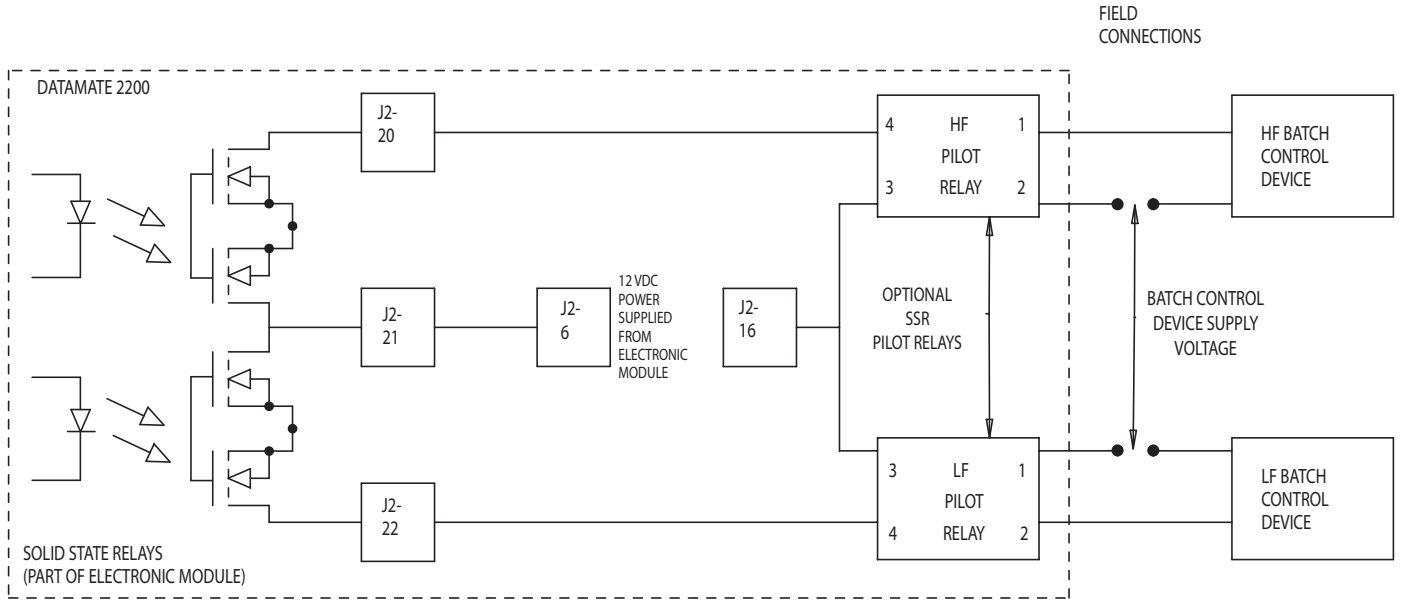
Figure 6.2.3.: Field Connections for Batch Devices That Require Pilot Relays

BATCH START/STOP INPUTS

THE BATCH START/STOP INPUTS REQUIRE A MOMENTARY
INPUT FROM A N.O. DRY (FORM C) CONTACT.
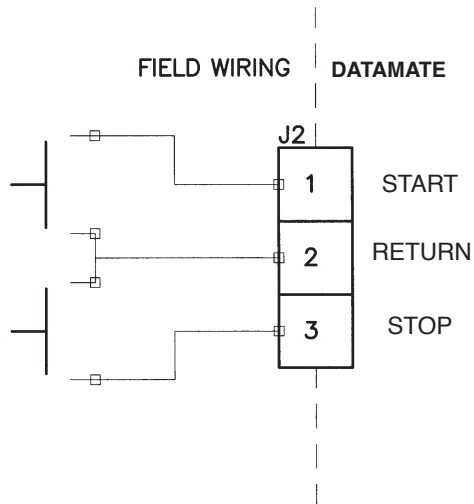
Figure 6.3.1: Remote Start/Stop Connection

SECTION 7: STARTUP

7.1 Power

NOTE: Access to field wiring and circuit board terminals is not required during flow meter start-up or zeroing.

After wiring connections have been made (Section 3.5), power can be supplied to the Datamate 2200 transmitter.

Start-up Mode: During start-up and initialization, the following start-up indicators can be observed:
- 4-20mA and pulse outputs go to undefined fallback levels
- The optional LCD on the cover reads for two seconds, "Red Seal Measurement Coriolis Flow Transmitter"
- The display on the HART® Communicator reads "Field device warming up"
- Alarm outputs are active

Operating Mode: After startup, the optional LCD display will indicate process measurements.

7.2 Startup with NexLink PC Software

Using Figure 5.6.1, complete wiring connections between the Datamate 2200 transmitter and an IBM compatible PC with RS485 serial interface.

At the Datamate 2200 using the following MENU TREE enter Comm Ports

From the Main Display press <Enter>, <3. Program>, <1. View Measurements>, <3. Program>, <3. Configuration>, <6. Outputs>, <5. Comm Ports>

Under Comm Ports select the following: Comm Port: <u>1-4</u>, Baud Rate: <u>9600</u>, Parity: <u>None</u>, Data Bits: <u>8</u>, Stop Bits: <u>1</u>, Protocol: <u>Modbus</u>, Modbus Mode: <u>ASCII</u>, Unit ID: <u>Select any number between 1-247</u>.

NOTE: All Datamate 2200 transmitters in the blind configuration are pre-programmed from the factory with ID number "247." Any change to the Unit ID or protocol, power to the Datamate 2200 is to be recycled for the change to be acknowledged. The default password for NexLink: User ID: <u>admin</u>, Password: <u>admin</u>

To change the Unit ID for a blind unit, within the NexLink PC software in the Configuration menu select <Outputs> and <Comm Port>.

Within the NexLink PC software, select the Comm Port pull-down menu from the Main Menu and configure the setting to match the Datamate 2200 transmitter settings. When all settings match, reboot the Datamate 2200 transmitter.

Within NexLink open up the "Comm Port" menu using the displayed icon, select View Measurements under the "Process Variables" pull down menu. If the NexLink is communicating with the Datamate 2200, the displayed measurement values will correspond to the Datamate 2200 display. If no communication exists, the NexLink PC software will respond with "Closing Comm Port." If this occurs, re-check wiring and communication settings.

7.3 Optional LCD

The Datamate 2200 transmitter is available with an optional LCD, as shown in Figure 7.3.1. The 4 x 20 digit four line display indicates all process measurements and any alarm warnings.

- For information about using the LCD during flow meter zeroing, see Section 7.4.
- For information about using the LCD for flow meter troubleshooting, see Section 8.

DETAIL A

SEE DETAIL A
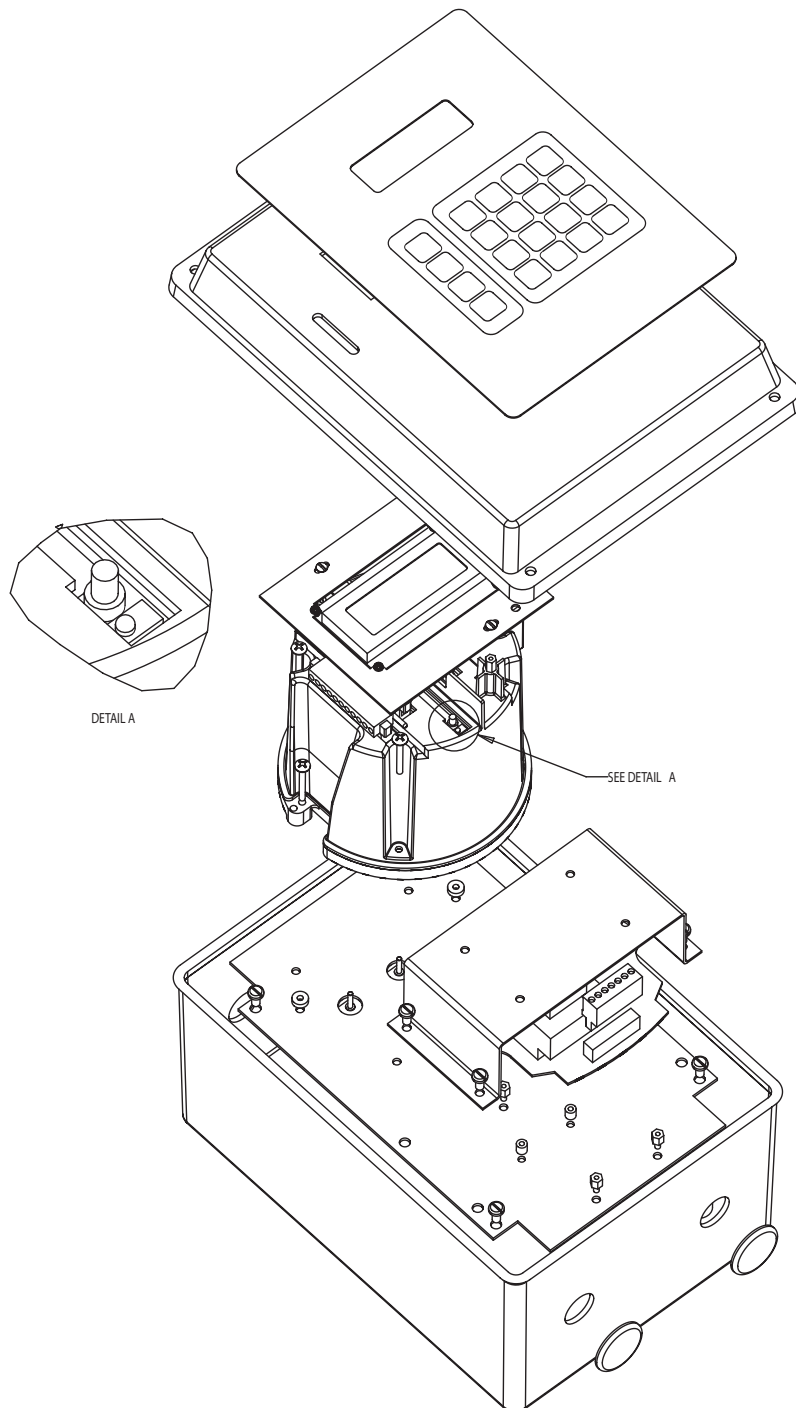
Figure 7.3.1: Location of LED, Zero Button and Optional LCD

7.4   Flow Meter Zeroing

CAUTION: Failure to zero the flow meter at initial startup will cause the transmitter to produce inaccurate pulse and analog output signals and on the optional LCD display may indicate flow registration under no flow conditions.

To ensure accurate measurements, zero the flow meter before putting the flow meter in operation.

Flow meter zeroing establishes the flow meter response to zero flow and sets the zero baseline for flow measurement.

7.4.1   Automatic Zeroing Procedure

1. Install the transducer according to the transducer installation guide (M600).
2. Fill the transducer completely with the process fluid.
3. Shutoff the downstream valve after the transducer. Ensure there is no flow through the transducer.

   CAUTION: Flow through the transducer during flow meter zeroing will result in an inaccurate zero setting.

   Make sure fluid through the transducer is completely stopped during flow meter zeroing.

4. Initiate flow meter zeroing in either of the following ways:
   1. Press and hold the ZERO button until the LED remains on continuously. Figure 7.3.1 shows the location of the ZERO button and LED in the transducer wiring compartment.
   2. Initiate a zero command from the optional key buttons on the Datamate 2200 unit or
   3. Initiate a zero command from a remote IBM-compatible computer with the NexLink software or a handheld HART Communicator.

   The LED remains on continuously or the optional LCD reads "Zeroing" for 1-2 minutes during zeroing. After the zeroing procedure has been completed, the LED will go off. The optional LCD will again indicate the flow rate.

   To abort at any time during the zeroing procedure, recycle power to the transmitter or press the CANCEL key on the Datamate 2200 enclosure if equipped.

7.5   Ready for Process Measurement

WARNING: OPERATING TRANSMITTER WITHOUT HOUSING IN PLACE EXPOSES ELECTRICAL HAZARDS THAT CAN CAUSE PROPERTY DAMAGE, INJURY OR DEATH.

After flow meter zeroing has been completed as described in Section 7.4 the Datamate 2200 transmitter is ready for process measurement.

7.6   Ready for Batch Operation (optional)

WARNING: OPERATING TRANSMITTER WITHOUT HOUSING IN PLACE EXPOSES ELECTRICAL HAZARDS THAT CAN CAUSE PROPERTY DAMAGE, INJURY OR DEATH.

The Datamate 2200 transmitter with optional keypad and LCD is a full featured two-stage batch controller. For accurate and repeatable batching, batch size should be large enough to allow the flow meter to run one (1) minute for each batch. If proper programming (Section 9) of the transmitter has been completed, the following procedures will allow you to control a batch with the Datamate 2200.

7.6.1   Running a Batch
Monitor the progress of the batching process. Configure the display to show the batch total.

You may see in the display the mass flow rate go to the fallback value. This indicates that the measured density of the process liquid is above or below the Low or High Density Cutoff respectively from that which is programmed in the DENSITY menu. When this message is displayed, the meter may no longer correctly measure flow and is assuming the fallback value as the flow rate. The mass flow rate will return to the measured flow rate when the liquid density is above or below the Low or High Density Cutoff respectively, **OR** when you disable the Slug Flow Feature by selecting Zero.

7.6.2   Beginning a Batch
You have programmed as Section 9.6.1 the transmitter to either allow the operator to change batch sizes before each batch (Run Mode Edit On), or run repeated batches of the same size (Run Mode Edit Off). In the event of a sensor error during a batch and the Batch Jog is enabled (YES), the transmitter can be programmed to allow the operator to be able to override the effect of the sensor error by depressing and holding down the start button, energizing the batch relays until the sensor error has cleared. This feature can be turned off (Batch Jog NO). If you programmed it to allow different size batches, press the remote START button. The display will show you the Batch Cutoff Point. This is the batch size. If you want to change the batch size, use the keypad to change the batch size, then press ENTER. When you have entered the correct batch size, press START again and the batch will begin. If you programmed the Datamate 2200 to run repeated batches of the same size, press START to begin the batch.

7.6.3   Interrupting a Batch
In the event you have to interrupt a batch, press the STOP button on the keypad.

7.6.4   Restarting a Batch
To continue a batch after interrupting it, press the START button on the keypad.

7.6.5   Terminating a Batch
To terminate a batch after interrupting it, press the STOP button again.

7.6.6   Starting a New Batch

After a batch has finished, the Datamate 2200 will display the amount of liquid delivered if a line of display has been set to BATCH TOTAL. If Run Mode Edit is Off, the pressing of the START button will start a new batch. If Run Mode Edit is On, press START twice to run the same size batch, or press START once, then enter the new batch size and press START again to run a batch of a different size.

7.6.7   Totalizer Reset

The Datamate 2200 transmitter totalizers cannot be reset in the Main Menu (operational mode). To reset the totalizers, enter the PROGRAM mode. In the Configuration Menu, under Totalizers, the resetting of any or all totalizers can be accomplished.

Note: If you experience relays de-energizing during batching, this might be the result of a Slug Flow alarm. See Section 8.7.

7.7   Viewing Other Process Variables (optional LCD required)

While you program the Datamate 2200 display to default to three process variables while in the RUN mode, it is possible to view other process variables while in the RUN mode. From the main display press <ENTER>, <ENTER>. You will be given a list of measurement variables that can be scrolled through under view measurement. By pressing the UP (^), ACROSS (>), or the ENTER key, four (4) process variables can be viewed at any time. Press CANCEL to return, until the Main Display is being viewed.

7.8   Concentration (%, Brix and Baume)

The Datamate 2200 transmitter may be programmed to calculate Concentration in different units like Percent, degrees Brix and degrees Baume using the measured temperature, density, and mass flow variables. The percent concentration is the percent by mass of one component in the process stream. Concentration Flow can be measured as well for % and Brix to indicate the flow rate in mass units of the target fraction.

Note that the term "target fraction" is used to denote the component of interest in a two-component process stream. That component may actually be solid (e.g. clay slurry), the dissolved solute of a solution (e.g. brine solution) or it could be a liquid (e.g. alcohol/water mixture). The software will work equally well in all cases. The term "carrier fraction" denotes the second (other) component of a two component stream.

Because the concentration is not measured directly, this function uses several assumptions in its calculations. They are the following:

1. Both the temperature and density measurements functions are correctly calibrated. If these calibrations are unsure, confirm them with the procedures outlined in the Calibration menu (See Section 9.4.2 & 9.4.3).

2. The process stream must act as a two-component system. A slurry of brine and sand cannot be handled by this software because it acts as a three-component system. For example, the amount of sand in the slurry will cause errors in the calculation of the salt concentration in the brine. On the other hand, measuring the amount of sand lifted from the ocean is possible because the salt in the ocean water is relatively constant.

3. There are no phase changes (solids - liquids - gas) taking place in the process stream. This can be a particular problem when the process temperature changes because such changes can often induce precipitates or cause additional solid to dissolve. For instance, a salt-brine slurry would allow extra salt to go into solution when it is heated; thus, giving a false percent solids reading. In general, errors can be expected when soluble precipitates and/or saturated solutions are present and the process temperature is not stable.

4. Except for changes due to temperature, the densities of the target and the carrier fractions must be constant and may not change from that used to set up the software.

5. If the process operates over a wide temperature range, ensure that the concentration table is set up at the normal process operating temperature (T_3) and two temperatures below (T_1 & T_2) and above (T_4 & T_5) the normal process operating temperature. The temperatures and densities that define the limits of the table should bracket the anticipated operating extreme for the process.

Before programming the concentration table, the user must determine a set of concentration and density pairs for at least two different temperatures. These pairs are entered into a table for up to 5 temperatures. From 2 to 14 pairs may be entered for each temperature.

6. Concentration calculation requires the temperatures and densities to be entered sorted from the lower to the higher value, i.e. $T_1 < T_2 < T_3 < T_4 < T_5$ and $D_{i,1} < D_{i,2} < D_{i,3} <...< D_{i,12} < D_{i,13} < D_{i,14}$; where T_i is the temperature for the column i; $D_{i,j}$ is the density for the row j at the temperature i and $C_{i,j}$ is the concentration for the density j at the temperature i.

7. The expected range of process temperatures, densities and concentrations should be enveloped by the values entered into the tables.

If the measured process temperature goes outside the range of temperatures given in the concentration table, the concentration will go to its fallback value. The fallback value will be used for all calculation using concentration.

If the measured process density is outside the range of the values given in the concentration table, 0 will be used if the measured density is low and 100 will be used if the density is high.

T_1	T_2	T_3	T_4	T_5
$D_{1,1}$; $C_{1,1}$	$D_{2,1}$; $C_{2,1}$	...	...	$D_{5,1}$; $C_{5,1}$
$D_{1,2}$; $C_{1,2}$	$D_{2,2}$; $C_{2,2}$	...	...	$D_{5,2}$; $C_{5,2}$
...	...	...	...	...
...	...	...	...	...
$D_{1,14}$; $C_{1,14}$	$D_{2,14}$; $C_{2,14}$	...	...	$D_{5,14}$; $C_{5,14}$

7.9 API

Datamate 2200 allows to measure density in degrees API. API gravity measures the relative density of liquid petroleum products, where 10°API is equivalent to the specific gravity of water. In order to provide these measurements, Datamate 2200 contains Volume Correction Factor (VCF) tables[1] for several petroleum products as well as a custom table that the user can load. The API correction tables provided are for 5 different petroleum products at two different temperature references: 60°F and 15°C. The custom table allows to input a maximum of 100 pairs of Temperature and VCF.

Fuel Oil (840) @ 60°F	Fuel Oil (840) @ 15°C
LPG (505) @ 60°F	LPG (510) @ 15°C
Gasoline (730) @ 60°F	Gasoline (730) @ 15°C
Kerosene (820.1) @ 60°F	Kerosene (820.1) @ 15°C
Light Lube Oil (878) @ 60°F	Light Lube Oil (878) @ 15°C
Custom Table	

The standard temperature, i.e. the temperature at which the density of water is taken as the reference to calculate specific gravity, will depend on the temperature unit selected in the temperature configuration menu. If the temperature selected is °F, the standard temperature will be 60°F and the reference density used will be 0.999042 g/cc. If the temperature selected is °C, the standard temperature will be 15°C and the reference density used will be 0.999129 g/cc.

NOTE: It is important to be consistent in selecting the correct temperature unit that matches the Volume Correction Factor table. For example, if the temperature unit is °F, but the VCF table selected is "Fuel Oil 840@15°C," the degrees API and Standard Volume measurements will not be correct.

If the measured process temperature is outside the range of the values given in the correction table for the selected product class, the correction factor for the nearest temperature in the table will be used.

Temperature	Correction Factor
T_1	VCF_1
T_2	VCF_2
...	...
T_{99}	VCF_{99}
T_{100}	VCF_{100}

---

[1] API Standard 2540 (1980).

7.10 Actual/Standard Volume

The Datamate 2200 calculates actual gross volume and standard volume flow rates and totals. The actual volume is obtained directly dividing the measured mass by the measured density. Whereas the standard volume is the equivalent volume at a standard condition, obtained dividing the measured mass by density of the fluid under the standard conditions (Standard Density).

NOTE: Standard Volume configuration can be skipped if you wish to use the measured density to calculate the actual volume or if you will not be using a volume value in the application.

Brix and Baume are concentration units, but they can be used to calculate standard volume since they can be related to specific gravity (See equations 7.10.1, 7.10.2 & 7.10.3). Therefore a standard density for the fluid at 60°F can be derived from the density vs. concentration tables.

If Brix or Baume is selected as the standard density unit, there is no need to input the Standard Density value granted the correct density vs. concentration tables were input in the Datamate 2200 (See Section 7.8).

Equation 7.10.1 $\qquad BRIX = 318.906 + \dfrac{66.1086}{SG^2} - \dfrac{384.341}{SG}$

Equation 7.10.2 $\qquad Be\ Lt = \dfrac{140}{SG} - 130 \qquad$ for liquids lighter than water (SG < 1.00)

Equation 7.10.3 $\qquad Be\ Hv = 145 - \dfrac{145}{SG} \qquad$ for liquids heavier than water (SG ≥ 1.00)

Standard Volume can also be obtained using API calculations. In this case it will be obtained by multiplying the actual volume to the Volume Correction Factor for the fluid at process temperature. The Volume Correction Factor is found in the look-up table provided for different petroleum products or the custom table that the user can load (See Section 7.9).

7.11 Net Oil and Well Testing (Optional)

The Datamate 2200, when purchased with the Net Oil and Well Testing option, calculates the net oil and net water (or saline water) present in an emulsion stream, utilizing Chevron's patented algorithm. This allows the user to integrate into one device the capabilities of a Coriolis Transmitter and a Net Oil Computer.

Mass flow rate, density and temperature are obtained directly from the Coriolis sensor. The standard Datamate 2200 will provide these direct measurements as well as volume and concentration flow. Adding the Net Oil and Well Testing option allows to obtain Water Cut, i.e., the volume fraction of water in the crude oil and water mixture at metering conditions, Net Oil rate and total (mass or volume of the crude oil corrected to standard temperature) and Net Water rate and total (mass or volume of the water or brine corrected to standard temperature).

Water cut determination is based on the principle that Crude Oil and Saline Water have different densities. Using the pre-determined, known densities of dry crude oil and produced saline water at standard temperature, the Datamate 2200 will adjust them for temperature effect and use them along with the measured density to obtain the volume fraction of the produced water.

The net oil mass rate is obtained by multiplying the mass fraction of crude oil times the mass flow of the emulsion stream, times the shrinkage factor[1]. Net oil volume rate is achieved using the previous value divided by the density of the crude oil at the reference temperature. Similar computations are performed for the net water rate.

To use the Net Oil functions, the user will have to set up the Well Data and Shrinkage Factor. Datamate 2200 can store data for up to 30 Wells, saving for each one of these the density of dry crude oil and density of produced water at the selectable reference temperature of 60°F or 15°C.

The Wells Testing feature works with the Net Oil measurements and provides the tool to run a *potential test* for a well. This test measures the largest amount of oil a well can produce over a 24-hour period under certain fixed conditions. Basically, the test involves allowing the well to produce for a given period of time and accurately measuring the production. Lease operators perform *potential tests* both when first producing the well (after completion) and again several times during its life.

To perform a well test, the user must input the information required to set up the Net Oil feature plus the selected well number to use for the testing, type of purge (none, elapsed time or dumps) and the time it will take for the test (0, 4, 8, 12, 20 or 24 hours).

---

1 At the allocation measurement point, a hydrocarbon liquid is normally at its bubble point (equilibrium vapor pressure) condition. When this liquid is discharged to a stock tank at atmospheric condition, the light components in the hydrocarbon evaporate, causing a reduction in liquid mass and volume. Therefore, a correction term called *shrinkage factor* may need to be applied to correct the measured lliquid volume from metering condition to stock tank condition.

While running the well test, Datamate 2200 will provide the following real time measurement:

• Elapsed test time.

• Net Oil Rate, instant and average value during the elapsed time of the test.

• Net Oil Total during the elapsed time of the test.

• Net Water Rate, instant and average value during the elapsed time of the test.

• Net Water Total during the elapsed time of the test.

• Water Cut, instant and average value during the elapsed time of the test.

• Net Flow Rate, instant rate of the oil/water emulsion stream.

SECTION 8: TROUBLESHOOTING

8.1 Customer Service

NOTE: Make sure you have the model number and serial number of the transmitter and the transducer prior to contacting your Red Seal Measurement Representative.

For local Customer Service assistance, contact your local RSM Representative or Distributor. You may also contact RSM directly at the address listed below.

Red Seal Measurement
1310 Emerald Road
Greenwood, SC 29646
Voice: Toll-Free 1-800-833-3357 or 1-864-223-1212 or
Fax: 1-864-223-0341

8.2   General Guidelines

WARNING: DO NOT REMOVE THE COVER OF THE DATAMATE 2200 TRANSMITTER TO TROUBLESHOOT THE UNIT IN A HAZARDOUS ENVIRONMENT.

Troubleshooting a Datamate 2200 transmitter is performed in the following two parts:
1. Tests of wiring circuit integrity
2. Observation of the transmitters diagnostic tools, which includes the diagnostic software and LCD, digital diagnostic messages, and fault output levels.

CAUTION: During troubleshooting, the transmitter could produce inaccurate flow signals.

For personal and system safety, make sure the control devices are set for manual operation before you troubleshoot the flow meter.

Before beginning the diagnostic process, become familiar with this instruction manual and with the installation guide of the transducer.

When troubleshooting, leave the transducer in place whenever possible. Problems often result from the specific operating environment of the transducer.

Check all signals under both flow and no-flow conditions.

In some situations, troubleshooting requires use of the transmitter's diagnostic tools, which are included in the software and diagnostic messages displayed on the optional LCD.

8.3   Transmitter Diagnostic Messages

The Datamate 2200 transmitter provides a large number of diagnostic messages, which can be viewed on the optional LCD display or in the NexLink software program.

Alarms

DSP Failure Alarm
- The Datamate 2200 digital signal processor has temporarily lost communication synchronization

RTD Failure Alarm
- The transducer RTD is not functioning
- Incorrect wiring at transmitter

Sensor Error Alarm
Indicates that one of the sensor voltages is less than 60 mVrms
- The transducer sensors are defective
- Incorrect wiring at transmitter

Temperature Alarm
- The maximum process temperature for the transducer has exceeded the set point or transducer maximum temperature

Tubes Not Vibrating Alarm
This alarm is displayed when both sensor signals are less than 60 mVrms. Some conditions that may cause this are:
- Flow meter tubes are not full
- Datamate 2200 Barrier board defective
- Check cable for continuity
- Density stratification of the process fluid

Errors

4-20mA Failure/Analog Fault (1, 2 or 4) Error
- The output current is incorrect. Possible causes: loop resistances greater than 1000 ohms and improper wiring.

DCM Error
- Data Code Memory has been corrupted. Recycle power to the Datamate 2200.

DSP Lost Event Error
- Internal communications failure, missing calculations event

DSP PLL Not Locked Error
- Unable to track tube frequencies or phase shift due to low sensor voltages

Pulse Output Buffer Overflow Error
- The buffer for storage of pulses has exceeded capacity

8.4   Power Supply

Check for specified power at the transmitter's terminals. If the transmitter has a nominal:

- 115 VAC, 50/60 Hz power source board, the line terminal is labeled '7' and the neutral terminal is labeled '4'. Place jumper on terminal on '4' & '5' and '6' & '7'.
- 230 VAC, 50/60 Hz power source board, the line terminal is labeled '7' and the neutral terminal is labeled '4'. Place jumper on terminals on '5' and '6'.
- 12-36 VDC power select board, the positive terminal is labeled '2' and the negative terminal is labeled '1'.

8.5   Wiring

For detailed wiring instructions, refer to Chapters 4, 5, and 6. Wiring problems are often incorrectly diagnosed as a faulty transducer. At initial startup of the transmitter, **ALWAYS** perform the following:

1. Check the proper cable and use of shielded pairs.
2. Check the proper wire termination by performing the following:
   a) Make sure the wires are on the correct terminals.
   b) Make sure the wires are making good connections with the terminal strip.
   c) Make sure the transducer cable connector is connected at the transducer terminals.

8.5.1   Cable Check

The cable and connector can easily be checked using a digital multimeter (DMM). The resistance of any conductor in this cable should be less than 1 ohm. Cables for CSA approved transducers will have a jumper between pins E-B and G-F for some cable configurations. In addition, the resistance between the shield (the non-insulated conductor) and any other conductor or the connector shell must be greater than 100 Mohms.

8.5.2   Output Board and Communications Test

To check all output and communications, use the diagnostic menu (Section 9.5) to simulate the appropriate output test. Use a DMM to check pulse/4-20mA outputs, and a remote communications device (e.g., computer) to test communications.

8.6 Transducer Resistances Nominal Value

Figure 8.6.1 lists the transducer pin designations for the Red Seal Measurement transcducers.
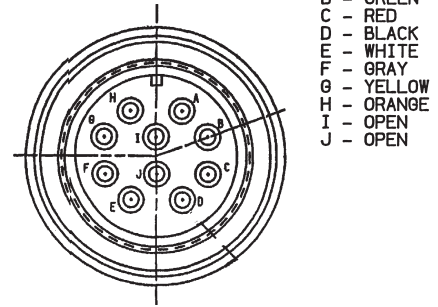
To check integrity of wiring circuits, complete the following steps:
1. Disconnect the transmitter's power supply.
2. Disconnect the transducer wiring from the transmitter's intrinsically safe terminal block in the transducer wiring area.
3. Use a digital multimeter (DMM) to measure resistance and voltage between wire pairs, as indicated in Table 8.6.2.
4. Use Table 8.6.3 to verify correct wiring at the Datamate 2200 transmitter terminals.
5. If the transmitter is remotely mounted from the transducer, repeat the measurements at the transducer cable connector on the transducer to distinguish cable failure from transducer failure.

```
A – BLUE
B – GREEN
C – RED
D – BLACK
E – WHITE
F – GRAY
G – YELLOW
H – ORANGE
I – OPEN
J – OPEN
```

Allowable Transducer Resistances
by Circuit and Transducer Size (ins.)

Conductor Color	Transducer Pin-pairs	Circuit	m012 (1/8)	m025 (¼)	m050 (½)	m100 (1)	m200 (2)	m300 (3)	m400 (4)
Red-Black	C-D	Drive	72-88	80-96	74-90	46-55	46-55	33-39	33-39
White-Blue	E-A	Sensor A	128-144	80-96	10-12	10-12	10-12	78-94	78-96
White-Orange	E-H	Sensor B	128-144	80-96	10-12	10-12	10-12	78-94	80-96
Green-Yellow	B-G	RTD Sense + to -	RTD - About 108 ohms at room temperature - all transducer sizes						
Black - CASE	J-CASE	Drive Return to transducer case	Less than 1 ohm - all transducer sizes						
	Any other combination		Over 100 megohms - all transducer sizes						
			Datamate			At Transducer			
Gray -Yellow	F-G	RTD Excite to Sense +	Less than 1 ohm - all transducer sizes			Over 100 megohms - all transducer sizes			
White-Green	E-B	RTD Excite to Sense -							

Table 8.6.2: Allowable Transducer Resistances

Connector Board Cable Connection Table

Terminal Block	Pin Number	Label	Conductor Color	Transducer Connector Pin	Function
J2	1	SHLD	Bare	None	Ground
J2	2	RED	Red	C	Tube Drive
J2	3	BLK	Black	D	Drive Return
J2	4	GRY	Gray	F	RTD Excite +
J2	5	YEL	Yellow	G	RTD Sense +
J2	6	GRN	Green	B	RTD Sense -
J2	7	WHT	White	E	RTD Excite -/ Sensor Common
J2	8	BLU	Blue	A	Sensor A
J2	9	ORG	Orange	H	Sensor B

Table 8.6.3: Connector Board Cable Connection Table

8.6.1   Transducer Tube Drive Test

The Datamate 2200 Coriolis Flow Transmitter incorporates a digital multimeter to provide diagnostic information on the transducer. This display permits the user to view four (4) diagnostic measurements from the transducer.

These measurements are
1. Drive Current (the measured AC current to the drive coil)
2. Sensor A voltage (the measured AC voltage from Sensor A)
    Sensor voltages for transducer sizes 1/8″ (m012) to 2″ (m200) should be in the range of 200mV ± 5mVrms. For 3″ (m300) and 4″ (m400) transducers this value should be 140mV ± 5mVrms.
3. Sensor B voltage (the measured AC voltage from Sensor B)
    Sensor voltages for transducer sizes 1/8″ (m012) to 2″ (m200) should be in the range of 200mV ± 5mV. For 3″ (m300) and 4″ (m400) transducers this value should be 140mV ± 5mVrms.
4. Drive Efficiency (a calculated value for determining drive efficiency)

If any value is out of range, it may suggest that the transducer tube driver is experiencing difficulties in maintaining the sensor voltages and/or the setpoint for the sensor voltages was not set to the optimum level as noted above.

8.6.2   Diagnostic Alarm Matrix

The diagnostic alarm matrix is highlighted in the following chart.

ALARM MATRIX

	Blue	Orange	Tubes Not Vibrating	Open: Gray	Open: Yellow	Open: Green	Open: White	Shorted: White to Gray	Shorted: White to Yellow	Shorted: White to Green	Shorted: Green to Gray	Shorted: Green to Yellow	Shorted: Yellow to Gray	Rloop> 1050 ohms	Analog 1	Analog 2	Analog 4	Relays De-energize
Errors Declared																		
Analog Fault - 4																	×	
Analog Fault - 2																×		
Analog Fault - 1															×			
DSP PLL Not Locked			×				×											
DSP Loss Event			×				×											
RTD Failure				×														
Alarms Declared																		
Slug Flow Alarm																		×
4-20 Failure															×	×	×	
DSP Failure							×											
RTD Failure				×	×	×		×	×		×	×						
Temperature				×	×			×	×		×	×						
Density							×											
% Concentration																		
Concentration Rate																		
Standard Volume Rate																		
Volume Rate																		
Mass Rate																		
Tubes Not Vibrating			×				×											
Sensor Error	×	×	×				×											
Measurements in Fallback																		
Temperature				×	×	×		×	×		×	×						
Density			×	×	×	×	×	×	×		×	×						
% Concentration			×	×	×	×	×	×	×		×	×						
Concentration Rate	×	×	×	×	×	×	×	×	×		×	×						
Standard Volume Rate	×	×	×	×	×	×	×	×	×		×	×						
Volume Rate	×	×	×	×	×	×	×	×	×		×	×						
Mass Rate	×	×	×	×	×	×	×	×	×		×	×						

Column groups: Sensor Error (Blue, Orange); Tubes Not Vibrating; RTD Failure — Open (Gray, Yellow, Green, White), Shorted (White to Gray/Yellow/Green, Green to Gray/Yellow, Yellow to Gray); Analog Output (Rloop> 1050 ohms, Analog 1, Analog 2, Analog 4); Relays De-energize.

8.7 Slug Flow Inhibit

The flow meter will resume normal operation when the density measurement level is above the low density cutoff value and below the high density cutoff value. The slug flow inhibit feature is intended to detect process changes due to density that may affect the meter operation. This feature works by monitoring the process density. When the process density goes above or below the slug flow setpoints, the mass rate defaults to the programmed fallback value. As recommended in the Mass Flow Installation Guide (M600), Red Seal Measurement recommends process piping that prevents large air slugs from mixing with the process liquid. However, if this is unavoidable, the effects of air slugs may be minimized using the Slug Inhibit software feature. The software feature works by looking for an increase or decrease in measured density. An increase or decrease in measured density occurs when air or gas becomes mixed with the process fluid. When the concentrations of gas become significant, air slugs develop and cause the indicated flow rate to fluctuate erratically. When the process density moves above or below the setpoints, the software feature causes the Datamate 2200 transmitter to ignore the erratic flow signal and
to substitute it with a fallback value. This fallback value is based on the programmed fallback values for mass and volume flow (See Section 9.6.5). Typically fallback values are selected to either lock into the last measured mass or volume flow rate prior to the increase or decrease in density, **OR** drop the flow rate to zero. Consequently, whenever the software feature is engaged, an active measurement of the flow in the tubes is no longer in effect.

A slug flow condition causes the following to occur:
• pulse output will hold at the fallback value frequency
• 4-20mA output will hold at the fallback current

8.8 Transmitter Power Failure

If the Datamate 2200 transmitter power fails, the following will occur:
• transmitter pulse outputs will go to 0 Hz
• transmitter 4-20mA outputs will go to 0mA

If the Datamate 2200 fails as a result of a "Tube Not Vibrating" or "Sensor Error," the following will occur:
• transmitter pulse outputs will go to the fallback value
• transmitter 4-20mA outputs will go to the fallback value

NOTE: If the remote system requires a fallback value lower or higher than the respective 4-20mA output signal, set the fallback (positive or negative) to a value at least 12.5% lower or higher than the 4-20mA span. This will drive the current output to a minimum value of 2mA or a maximum value of 22mA. (Example: If your 4-20mA flow range represents 0 to 1000 lbs/min, then by setting the fallback to a value greater than 1125 or less than -125, the analog output will be driven to 22mA or 2mA respectively.

SECTION 9: PROGRAMMING WITH OPTIONAL LCD

9.1   General Guidelines & Menu Tree

The Datamate 2200 is programmed and configured via the NexLink software (included with the unit), or by using menu driven user-interface and the alphanumeric keypad on its enclosure.

Navigation

To configure the Datamate 2200 the user must navigate to the desired parameter (menu item) and then enter the required data. The menu tree is laid out in rows and columns. Navigation through the menus is accomplished as follows:

The ENT key is pressed to enter the menu tree.

The ^ and > keys move the user down a column. At the end of a column, pressing one of these keys takes the user back to the top of the same column.

ENT allows the user access to the selected menu. In most cases, this can be thought of as moving to the right in the menus. Pressing ENT from any column position will take the user o the right one column from the current column position. Additional ENTs will take the user further to the right. Most new levels offer new rows with more levels. The one exception to the rule that ENT goes right is when the menu item is EXIT. Pressing ENT at EXIT will take the user to the left one column of the menu tree.

CAN closes the current menu and takes the user to the left one column of the menu tree.

Data Entry

There are two forms of data entry: free form and selection from a list. Free form data is numbers and/or text that cannot be restricted to a few items that can be easily fit into a list. The scaling factor for the pulse output or an instrument ID number are examples of free form data. Upon reaching the desired data entry menu, entry of free form data is performed as follows:

Data is entered at the location of the cursor left most digit first. (e.g., if 1234 is to be entered, start with the one.) Use the keypad to enter the characters from left to right. (Letters and punctuation characters are available only when non-numeric characters are allowed in the selected field. Signs, decimal points, and exponent indicators are available for numeric fields.)

MAIN MENU

```
---> (1) View Process Variables   ---> 1. View Measurements   ---> Mass Rate value (MRAT)
        Sect. 9.2                      Sect. 9.2                    Mass Total value (MTOT)
                                                                    Mass Total Forward value (MTOF)
                                                                    Mass Total Reverse value (MTOR)
                                                               ---> Volume Rate value (VRAT)
                                                                    Volume Total value (VTOT)
                                                                    Volume Total Forward value (VTOF)
                                                                    Volume Total Reverse value (VTOR)
                                                               ---> Spcl Vol Rate value (SVRA)
                                                                    Spcl Vol Total value (SVTO)
                                                                    Spcl Vol Total Forward value (SVTF)
                                                                    Spcl Vol Total Reverse value (SVTR)
                                                               ---> Batch Size value (BSIZ)
                                                                    Batch Total value (BTOT)
                                                                    % Concentration value (CONC)
                                                                    Conc Rate value (CORA)
                                                               ---> Conc Total value (COTO)
                                                                    Conc Total Forward value (COTF)
                                                                    Conc Total Reverse value (COTR)
                                                                    Water Cut (NOWC)
                                                               ---> Net Oil Rate (NORA)
                                                                    Net Oil Total (NOTO)
                                                                    Net Oil Total Forward value (NOTF)
                                                                    Net Oil Total Reverse value (NOTR)
                                                               ---> Net Water Rate (NWRA)
                                                                    Net Water Total (NWTO)
                                                                    Net Water Total Foward value (NWTF)
                                                                    Net Water Total Reverse value (NWTR)
                                                               ---> Density value (DENS)
                                                                    Temperature value (TEMP)
                                                                    Frequency value (FREQ)
                                                                    Phase value (PHAS)

                                      2. View Outputs          ---> 1. View Analog 1        ---> Process Variable Name
                                      Sect. 9.2                                                   Current Value
                                                                                                 % Range Value

                                                               ---> 2. View Analog 2        ---> Process Variable Name
                                                                                            ---> Current Value
                                                                                            ---> % Range Value

                                                               ---> 3. View Pulse           ---> Process Variable Name
                                                                                                 Current Value
                                                                                                 Current Frequency
                                                                                                 % Range Value

                                                               ---> 4. View Analog 4        ---> Process Variable Name
                                                                                                 Current Value
                                                                                                 % Range Value

                                                               ---> 5. Exit
```

MAIN MENU (continued)

---> (1) View Process Variables   ---> 3. Well Test Data   ---> Well# XX Testing
       Sect. 9.2   Sect. 9.2   Oil R:
                                                                   Oil A:
  Oil T:

---> Well# XX Testing
      Water R:
      Water A:
      Water T:

---> Well# XX Testing
      Water Cut:
      Net Flow:
      Well# XX Testing

---> Temp:
      Dens:
      Elapsed

|---> 4. Exit

---> 2. View Alarm Status   ---> 1. View Status
       Sect. 9.2   ---> 2. View Error Log
                                 ---> 3. Clear Error Log
                                 ---> 4. Exit

                                 ---> 1. Well Number (1-30)
                                 ---> 2. Purge Type
                                 ---> 3. Purge Time/Dumps
                                 ---> 4. Test Time
                                 |---> 5. Enter to Continue   ---> Well# XX Purging
                                                                   VRAT:
      Time/Dumps
      Remaining

---> Well# XX Testing
      Oil R:
      Oil A:
      Oil T:

---> Well# XX Testing
      Water R:
      Water A:
      Water T:

---> Well# XX Testing
      Water Cut:
      NetFlow:

---> Well# XX Testing
      Temp:
      Dens:
      Elapsed:

MAIN MENU (continued)

---> 4. Program | --->   Enter Password   ---> 1. Calibration   ---> | --->   1. Zero menu **(Sect. 9.4.1)**
      Sect. 9.3   [   ]   **Sect. 9.4**   2. Temperature **(Sect. 9.4.2)**
                                                                  3. Density **(Sect. 9.4.3)**
                                                                    4. Mass **(Sect. 9.4.4)**
                                                                    5. Analog Ouputs **(Sect. 9.4.5)**
                                                                    6. Exit

                                  ---> 2. Diagnostics   ---> | --->   1. Self Test **(Sect. 9.5.1)**
                                      Sect. 9.5   --->   2. Alarm Test **(Sect. 9.5.2.)**
                                                              --->   Batch Relay Test **(Sect. 9.5.3)**
                                                              --->   4. Analog Test **(Sect. 9.5.4)**
                                                              --->   5. Pulse Test **(Sect. 9.5.5)**
                                                              --->   6. Comm Test **(Sect. 9.5.6)**
                                                              --->   7. Tube Drive Test **(Sect. 9.5.7)**
                                                              --->   8. Buttons Test **(Sect. 9.5.8)**
                                                              --->   9. LCD Test **(Sect. 9.5.9)**
                                                              --->   A. Exit

                                  ---> 3. Configuration   ---> | --->   1. Batch **(Sect. 9.6.1)**
                                      Sect. 9.6   --->   2. Device Info **(Sect. 9.6.2)**
                                                              --->   3. Alarms **(Sect. 9.6.3)**
                                                              --->   4. Display **(Sect. 9.6.4)**
                                                              --->   5. Xmit Variables **(Sect. 9.6.5)**
                                                              --->   6. Outputs **(Sect. 9.6.6)**
                                                              --->   7. Totalizers **(Sect. 9.6.7)**
                                                              --->   8. Characterize Meter **(Sect. 9.6.8)**
                                                              --->   9. Exit

                                  ---> 4. System   ---> | --->   1. Set Date **(Sect. 9.7.1)**
                                      Sect. 9.7   --->   2. Set Time **(Sect. 9.7.2)**
                                                              --->   3. Display Date/Time **(Sect. 9.7.3)**
                                                              --->   4. Password **(Sect. 9.7.4)**
                                                              --->   5. Dbase/File Mgmt **(Sect. 9.7.5)**
                                                              --->   6. Exit

                                  ---> 5. Exit

9.2 Main Menu (Operational Mode)

The main menu is the normal operational mode of the Datamate 2200 transmitter. In the main menu, all process measurements, outputs, alarms and error log can be viewed. In addition the error log can be cleared. Access to the Program mode is also available through the use of a password. Using the MAIN MENU TREE enter MAIN MENU.

Menu or Display	Description
Default Display	The Datamate 2200 presents the default display after initialization at power up. The first three lines will display the process parameters selected by the user. The default parameters will be Mass Rate, Temperature, and Density. The fourth line prompts the menus enter keying and announces alarms. Pressing ENTER brings up the Main Menu. The word ALARM will be displayed when View Alarm Status (see below) list is not empty. ALARM will flash when a new alarm event is added to the View Status list until it is acknowledged by review
Main Menu	Allows the user to select between the Process Variables, View Alarm, and Program menus. Choices from the Main Menu are View Process Variable, View Alarm Status, Program and Exit.
Main Menu 1. View Process Variable	This menu allows the user to review the current value of the process variables, and/or the analog and pulse outputs. Choices from View Process Variable are View Measurements, View Outputs and Exit.
View Process Variable 1. View Measurements	This menu displays the current value of the process variables four at a time. Pressing ENTER, ^, or > will display the next four process variables.
View Process Variable 2. View Outputs	Allows the user to verify the current analog or pulse output value. Choices are View Analog X, View Pulse and Exit.
View Process Variables 3. Well Test Data	Displays the data obtained in the last well test performed
View Outputs 1. View Analog 1	Displays the process variable name and current value, the output current value, and the % of range for the analog output for the following: Mass Flow, Volume Flow, Density and Temperature.
View Outputs 2. View Analog 2	Displays the process variable name and current value, the output current value, and the % of range for the analog output for the following: Mass Flow, Volume Flow, Density and Temperature.
View Outputs 3. View Pulse Output	Displays the process variable name and current value, the output frequency, and the % of range for the analog output for the following: Mass Flow, Volume Flow, Density and Temperature. Displays the process variable name and current value, the pulses per unit of measure, and # of pulses sent for the following: Mass Total, Volume Total, Standard Volume Total, Concentration Total and Batch Total.
View Outputs 4. View Analog 4	Displays the process variable name and current value, the output current value, and the % of range for the analog output for the following: Mass Flow, Volume Flow, Density and Temperature.

Menu or Display	Description
Main Menu 2. View Alarm Status	This menu allows the user to review a list of parameters and diagnostics that are out of limits. The list is organized as last-in first-out. This will make the last event the first seen by the user. Events in this list will be removed form the list when they return to normal after they have been acknowledged.
View Alarm Status 1. View Status	List of the process variables that are currently in alarm. This list is empty when the Default Display does not have the 'ALARM' prompt displayed. Reviewing this list acknowledges any new alarms.
View Alarm Status 2. View Error Log	List of the internal errors that have occurred. This list is empty when the Default Display does not have the 'ALARM' prompt displayed. Reviewing this list acknowledges any new alarms.
View Alarm Status 3. Clear Error Log	Clears the View Error Log and sets counters to zero.

9.3 Well Testing

In this menu it is possible to set and run a well testing.

Using the CONFIGURATION MENU TREE enter the Well Test.
The following chart highlights the Well Test menu:

Main Menu 3. Well Test	Press ENTER to set up and start a Well Testing.
	Use the UP or ACROSS key to select the Well Number to obtain the Density of crude oil and water that will be used in the Well Testing calculations. **Well Number (1–30)** **[XXXXXXXXXXX]** Select the Purge Type option. Elapsed Time will run a count down clock, after which it will start the test. Dumps will count the number of times that the flow starts and stops, before starting the test. **Well# XX** **[XXXXXXXXXXX]** If the Purge Type was not selected as None, it is necessary to input the time that will take to purge or the number of dumps depending on the Purge Type selected before.
	Well# XX **Well# XX** **Purge Time** **No. of Dumps (1–10)** **[00:00] (HH:MM)** Use the UP or ACROSS key to set the amount of time for the duration of the test. Options are 0, 4, 8, 12, 20 or 24 hours. If 0 hours is selected the Well testing will not stop until it is manually canceled. **Well# XX** **Test Time** **[XX] Hours** Datamate 2200 will display the well number selected, purge type and test duration. To start the test press ENTER or if you want to modify the selection made press CANCEL. **Well# XX** **Purge XXXXXXXXXXX** **Duration XX Hours** **ENTER to Continue** During Purging, the remaining time or dumps will be displayed. After the purging is over, the testing will start automatically.

	Well# XX Purging **Well# XX Purging**
	VRAT:XX.XXX **VRAT:XX.XXX**
	XX:XX:XX TIME **X DUMPS**
	REMAINING **REMAINING**
	
	The following menus will show the information gathered while testing. Pressing the UP, ACROSS or ENTER key will scroll the different displays.
	      The first screen shows instant net oil flow rate (OIL R), average net oil rate (OIL A) and net total (OIL T) during the elapsed time of the test.
	      Well# XX Testing
	      Oil R:XXXXXXXXXXXX
	      Oil A:XXXXXXXXXXXX
	      Oil T:XXXXXXXXXXX
	      The second screen shows instant net water flow rate (WATER R), average net water rate (WATER A) and net water total (WATER T) during the elapsed time of the test.
	      Well# XX Testing
	      Water R:XXXXXXXXXXXX
	      Water A:XXXXXXXXXXXX
	      Water T:XXXXXXXXXXXX

The third screen shows instant water cut (Water Cut) and average net flow rate (NetFlow) during the elapsed time of the test.
Well# XX Testing
Water Cut: XX.X
NetFlow:XXXXXXXX
The last screen shows instant temperature (Temp), density (Dens) and the elapsed time of the test (Elapsed).
Well# XX Testing
Temp:XX.X
Dens:X.XXXX
Elapsed: XX:XX:XX

If the CANCEL key is pressed while running the test, Datamate 2200 will prompt if the user wants to stop the test. Pressing CANCEL will stop the test and the average net oil rate, net water rate and water cut as well as the net oil and the net water total will be saved in memory.
Test in Progress
Finished Testing?
ENTER to Continue
CANCEL to Exit

9.4   Program Mode

The program mode for the Datamate 2200 transmitter provides access to the user based on the password level. A clear explanation of access to the program mode and the password levels is listed below.

Menu or Display	Description
Main Menu 4. Program	This menu gives the user the ability to view and program the Datamate 2200 based on his/her password 'level.' When ENTER is pressed 'ENTER PASSWORD' is displayed. The password is then entered using the keypad. Entering the proper 'level' password allows access to configuration and programming features. The default passwords are: 11 for levels 0 and 1, and 22 for level 2. Level 0 and 1 passwords (11) only allow reviewing the configuration and programming data. Level 2 passwords (22) allow changing the user/application configuration and programming

CALIBRATION MENU

---> Main Menu 4. Program	---> Enter Password [ ]	---> Program 1. Calibration		
---> 1. Calibration **Sect. 9.5**	---> 1. Zero **Sect. 9.5.1**	---> Electronics Zero	---> 1. Elec Zero Params	---> Electronics Zero ---> StdDev
			---> 2. Zero Electronics	---> Zero: SDev: Enter to Calibrate
			---> 3. Exit	
		---> 2. Transducer Zero	---> Transducer Zero	
		---> 3. System Zero	---> 1. Syst Zero Params	---> System Zero ---> StdDev
			---> 2. Zero System	---> Zero: SDev: Enter to Calibrate
			---> 3. Exit	
		---> 4. Exit		
	---> 2. Temperature **Sect. 9.5.2**	---> 1. Temp Calib Param	---> RTD Offset	
		---> 2. Calibrate Temp	---> Temp: RTDRes: Enter to Calibrate	---> Actual Temperature
		---> 3. Exit		
	---> 3. Density **Sect. 9.5.3**	---> 1. Density Params	---> C1 ---> C2 ---> Air Frequency ---> Air Temperature	
		---> 2. Calibrate Density	---> Dens: Enter to Calibrate	---> Air Frequency ---> Air Temperature ---> Actual Density
		---> 3. Exit		
	---> 4. Mass **Sect. 9.5.4**	---> 1. Mass Params	---> Mass Scalar	
		---> 2. Dump Calib Mass	---> Scalar: Enter to Calibrate	---> MTOT: MRAT: Flow must=0 to start
		---> 3. Batch Calib Mass	---> Scalar: Enter to Calibrate	---> Batch Cutoff Qty ---> Trickle Offset Pt ---> MTOT: MRAT: Press START to begin
		---> 4. Exit		

CALIBRATION MENU (continued)

--->	Main Menu 4. Program	--->	Enter Password [ ]	--->	Program 1. Calibration		

---> 1. Calibration
Sect. 9.5

    ---> 5. Analog Outputs
    Sect. 9.5.5

      ---> 1. Analog 1

        ---> 1. Analog 1 Params   ---> Gain   ---> Offset

        ---> 2. Calibrate Analog 1   ---> Actual Current 4mA   ---> Actual Current 19mA

        ---> 3. Exit

      ---> 2. Analog 2

        ---> 1. Analog 2 Params   ---> Gain   ---> Offset

        ---> 2. Calibrate Analog 2   ---> Actual Current 4mA   ---> Actual Current 19mA

        ---> 3. Exit

      ---> 3. Analog 4

        ---> 1. Analog 4 Params   ---> Gain   ---> Offset

        ---> f2. Calibrate Analog 4   ---> Actual Current 4mA   ---> Actual Current 19mA

        ---> 3. Exit

      ---> 4. Exit

    ---> 6. Exit

9.5   Calibration Menu

The calibration menu provides menus for calibration of the following:
- zeroing the flow meter
- temperature
- density
- mass
- analog outputs

The pulse output only requires configuration. For pulse output configuration see Section 9.6.6.

9.5.1. Zero Calibration
NOTE: Correctly zeroing the mass flow meter is critical for accurate mass flow measurement.

The Datamate 2200 transmitter allows the user to review and modify the electronic zero, transducer zero and the system zero.

Automatic Zero Procedure - See Section 7.4.

Manual Zero Procedure

To complete a Manual Zero, use the following menu and description chart to perform the following:
- Set the SYSTEM ZERO to "0" DEG
- EXIT out to the MAIN MENU
- From the MAIN MEASUREMENT DISPLAY, press ENTER until PHAS DEG is displayed on the LCD
- Under no flow conditions record the maximum PHAS DEG value
- Enter the recorded value into the SYSTEM ZERO

The procedure for zeroing the flow meter is as follows:

Menu or Display	Description
Program 2. Zero	This menu allow the user to review and modify the Electronic, Transducer and System zeroes. Choices from this menu are Electronics Zero, Transducer Zero , System Zero, and Exit. The Transducer zero is the phase measurement offset of the transducer when there is on flow. The transducer zero cannot be measured directly and is defined as the difference between the System zero and the Electronic zero.
Zero 1. Electronic Zero	This menu allows the user to review and modify the Electronic zero of the Datamate 2200. The electronic zero is the zero offset contribution due to the electronics and is determined by zeroing the electronics with the sensor inputs shorted together. Choices from this menu are Elec. Zero Params, Zero Electronics, and Exit.

Menu or Display	Description
Electronic Zero 1. Elec. Zero Params	Displays the current electronic zero and the standard deviation for the last automatic zero. With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. Electronics Zero [SX.XXXXeSXX] DEG Pressing ENTER will display the standard deviation (StdDev) of the last automatic zero. The StdDev cannot be modified by the user. StdDev [SX.XXXXeSXX] DEG
Electronic Zero 2. Zero Electronics	Displays the current zero and the standard deviation for the zero. ZERO: SX.XXXXeSXX DEG SDEV: X.XXXXeSXX DEG ENTER to Calibrate CANCEL to Exit Choices from this menu are ENTER to re-zero and CANCEL to exit. While the Zero is performed the display will read: Zeroing When Zeroing is complete the new zero and the standard deviation is displayed: ZERO: SX.XXXXeSXX DEG SDEV: X.XXXXeSXX DEG CANCEL to Exit Press CANCEL to Exit and remove any jumper at the input of the Datamate 2200
Zero 2. Transducer Zero	Displays the current transducer zero. The transducer zero is the zero offset contribution of the transducer and installation. The transducer zero is determined by subtracting the electronic zero from the system zero. Press ENTER to review and/or modify the transducer zero.
Transducer Zero	With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. Transducer Zero [SX.XXXXeSXX] DEG
Zero 3. System Zero	This menu allows the user to review and modify the System zero of the Datamate 2200. The System zero is the combined zero offset of the electronics, transducer and the installation when there is no flow. Choices from this menu are Syst Zero Params, Zero System, and Exit.
System Zero 1. Syst Zero Params	Displays the current system zero and the standard deviation for the last automatic zero. Neither value can be modified from this menu System Zero [SX.XXXXeSXX] DEG Pressing ENTER will display the standard deviation (StdDev) of the last automatic zero. The StdDev cannot be modified by the user. StdDev [SX.XXXXeSXX] DEG

Menu or Display	Description
System Zero 2. Zero System	Displays the current system zero and the standard deviation for the zero. ZERO: SX.XXXXeSXX DEG SDEV: X.XXXXeSXX DEG ENTER to Calibrate CANCEL to Exit Choices from this menu are ENTER to re-zero and CANCEL to exit. While the Zero is performed the display will read: Zeroing When Zeroing is complete the new zero and the standard deviation is displayed: ZERO: SX.XXXXeSXX DEG SDEV: X.XXXXeSXX DEG CANCEL to Exit Press CANCEL to Exit

9.5.2 Temperature Calibration

The Datamate 2200 transmitter temperature measurement is factory calibrated.

NOTE: The temperature calibration if changed will affect the density measurement. After re-calibrating the temperature, the density measurement will require calibration.

To calibrate the temperature measurement, use the following menu and description chart to perform the following:
1. Enter Calibrate Temperature.
2. Press Enter until the temperature measured is displayed.
3. If incorrect, insert the correct temperature and press ENTER.

If the temperature is re-calibrated the temperature calibration factor (RTD offset) will change. Record the new values on the calibration sheet.

To view or re-enter these values 1) Enter Temp Calib Params, 2) Press enter until the RefRes constants are displayed, 3) View or Enter the RefRes values.

Using the CALIBRATION MENU TREE enter Temperature Calibration.

The procedures for calibrating the temperature measurement is as follows:

Menu or Display	Description
Calibrate Temp 1. Temp Calib Params	Allows for the manual entry of predetermined temperature calibration factors. Pressing enter brings: RTDOffset [0.0000] OHMS
Calibrate Temp 2. Calibrate Temp	Automatic determination of the temperature calibration factors is performed from this menu. Temp: XX.XXX DEG C RTDRes: XXX.XX OHMS ENTER to Calibrate Reference Resistor Pressing ENTER brings: Stabilizing Actual Temperature [xx.xx] DEG X Enter the correct temperature. Temp: XX.XXX DEG X RTDRes: XXX.XX OHMS ENTER to repeat Reference Resistor

9.5.3   Density Calibration

NOTE: The density calibration is dependent on accurate temperature measurement. Prior to re-calibrating the density, the temperature calibration should be verified. See Section 9.5.2 for the temperature calibration procedure.

The Datamate 2200 transmitter density calibration is factory calibrated. To calibrate the density measurement, use the following menu and description chart to perform the following:
1. Enter Calibrate Density.
2. Press Enter until the measured density is displayed.
3. If not correct, press ENTER, and enter a) tube in air frequency, b) tube temperature, c) actual density of the fluid inside the tubes.

If the density is re-calibrated, the density calibration constants C1 and C2 will change. Record the new values on the calibration sheet.

To view or re-enter these values, perform the following:
1. Enter Density Params
2. Press enter until the C1 and C2 constants are displayed
3. View or Enter the C1 and C2 values.

Using the CALIBRATION MENU TREE enter DENSITY MENU. The procedure for calibrating the density measurement is as follows:

Menu or Display	Description
Calibration 4. Density	
Calibrate Density 1. Density Params	From this menu the operator can view and modify the density calibration factors C1 and C2. Pressing ENTER displays the C1 Factor: C1 [_X.XXXXX] C2 [_X.XXXXX] Air Frequency [_XX.XXXX] HZ Air Temperature [_XX.XXXX] DEG C

Menu or Display	Description
Calibrate Density 2. Calibrate Density	Allows the operator to re-calculate the density factors C1 and C2. Pressing ENTER Displays the current density: DENS: X.XXXX g/cc ENTER to Calibrate CANCEL to Exit Pressing ENTER brings up: Air Frequency [_XX.XXXX] HZ Pressing ENTER to accept the Air Frequency when correct. Air Temperature [_XX.XXXX] DEG C Press Enter to accept the Air Temperature when correct. Actual Density [_X.XXXXX] g/cc Press ENTER to accept the Actual Density when correct. DENS: X.XXXX g/cc ENTER to Calibrate CANCEL to Exit

9.5.4   Mass Calibration

NOTE: The mass calibration is dependent on accurate temperature measurement. Prior to re-calibrating the mass, the temperature measurement calibration should be verified. See Section 9.5.2 for the temperature calibration procedure.

The Datamate 2200 transmitter mass calibration is factory calibrated and traceable to NIST standards. To calibrate the mass measurement use the following menu and description chart to perform the following:
- Enter Calibrate Mass
- Select Dump (manual batching) or Batch (automatic batching) calibration
- Tare an empty drum or tank.
- Open the downstream valve (Dump Mode) or Press the Remote Start (Batch Mode) and run product fluid into the container for a minimum of 1 minute
- Weigh the drum or tank and compare the reading to that of the Datamate 2200 transmitter LCD
- Enter the correct mass from the scale into the transmitter

If the mass is re-calibrated, then the mass calibration scaler will change. Record the new values on the calibration sheet.

To view or re-enter these values perform the following steps:
1. Enter Mass Calib Params.
2. Press enter until the Scaler constant is displayed.
3. View or Enter the Scale values.

Using the CALIBRATION MENU TREE enter MASS MENU. The procedure for calibrating the mass measurement is as follows:

Menu or Display	Description
Calibrate 5. Mass	From this menu the user can change the mass calibration factor (scaler) either manually or automatically. An automatic calibration may be done using external (dump mode) or internal (batch) flow control. Choices from this menu are Mass Params, Dump Calib Mass, Batch Calib Mass, and Exit.
Calibrate Mass 1. Mass Params	From the Mass Params menu the scaler can be modified directly. This method of calibration when entering the calibration factor of a new transducer or when it is desired to adjust the scaler by some percentage. Mass Scaler [_X.XXXXX]

Menu or Display	Description
Calibrate Mass 2. Dump Calib Mass	The dump calibration mode is used when the Datamate 2200 is not going to control the process flow with its batch control outputs. Pressing ENTER will display the current scaler: Scaler: XX.XXXXeSXX ENTER to Calibrate CANCEL to Exit Pressing ENTER brings up: MTOT: 0.000 UUU MRAT: 0.000 UUUU Start the flow of liquid through the transducer, and stop the flow when the desired test quantity is delivered. When the Datamate 2200 detects that the flow has stopped the user enters the correct value for the mass delivered. Actual Mass [＿ 0.0000] UUUU Next the entered mass value is displayed for approval. Actual Mass [XXXXXX.XX] UUUU Finally press ENTER, new Scalar is displayed Scaler:X.XXXXXeSXX ENTER to Calibrate CANCEL to Exit
Calibrate Mass 3. Batch Calib Mass	The batch calibration mode is used when the Datamate 2200's batching outputs are to be used to control the flow of the process flow. Pressing Enter displays: <Batch Calibration> Scalar: X.XXXXXX ENTER to Calibrate CANCEL to Exit Pressing ENTER Brings up. Batch Cutoff Amt [X.XXXXXX] UUU Use the ^ and > keys to enter the qty required for the calibration. Pressing ENTER twice brings up. Trickle Offset Pt [X.XXXXXX] UUU Use the ^ and > keys to enter the qty to flow between the closure of the trickle relay and the final batch cutoff. Pressing ENTER twice brings up. MTOT: 0.000 UUU MRAT: 0.000 UUU Press START to begin Press STOP to stop By pressing CANCEL the batch calibration will be aborted MTOT: XXX.XXXX UUU MRAT: XXX.XXXX UUU CALIBRATION ABORTED ENTER to Continued

9.5.5   Analog Output Calibration

NOTE: *None of the analog outputs will function until they are programmed.*

Using the CALIBRATION MENU TREE enter ANALOG OUTPUT MENU

The procedure for the programming of the analog outputs is as follows:

Menu or Display	Description
Calibration 6. Analog Outputs	From this menu the calibration factors for the analog (4-20 mA) outputs can be viewed and modified. Choices from this menu: Analog 1, Analog 2, Analog 4, & Exit.
Analog Outputs 1. Analog 1	Choices from this menu are Analog 1 Params, Calibrate Analog 1, and Exit.
Calibrate Analog 1 1. Analog 1 Params	From the Analog 1 Params menus the user can view and manually change (with level 2 access) analog 1's calibration factors. Pressing ENTER displays the Gain factor Gain [_X.XXXXeSXX] Offset [_X.XXXXeSXX] Press CANCEL to Exit when complete.
Calibrate Analog 1.	From this menu the Datamate 2200 will re-determine the calibration factors with Calibrate 1 Analog the assistance of the user. The user is required to measure and enter the output current when directed. Pressing Enter will bring up: Cal Current 1 = 4.000 mA Enter current measured at Analog Output 1 [_X.XXX] mA Cal Current 2 = 19.000 mA Enter current measured at Analog Output 1 [_XX.XXX] mA Gain [_X.XXXXeSXX] Offset [_X.XXXXeSXX
Analog Outputs 2. Analog 2	See Analog Outputs 1. Analog 1 above.
Calibrate Analog 2 1. Analog 2 Params	See Calibrate Analog 1 1. Analog 1 Params above.
Calibrate Analog 2 2. Calibrate Analog 1	See Calibrate Analog 1 1. Calibrate Analog 1 above
Analog Outputs 3. Analog 4	See Analog Outputs 1. Analog 1 above.
Calibrate Analog 4 1. Analog 4 Params	See Calibrate Analog 1 1. Analog 1 Params above.
Calibrate Analog 4 2. Calibrate Analog 1	See Calibrate Analog 1 1. Calibrate Analog 1 above
Calibration 7. Exit	

DIAGNOSTICS MENU

---> Main Menu	---> Enter Password	---> Program	
4. Program	[ ]	**2. Diagnostics**	

2. Diagnostics	---> 1. Self Test	---> Task List <ok>	
Sect. 9.6	**Sect. 9.6.1**		
	---> 2. Alarm Test	---> 1. Alarm 1 Test	
	Sect. 9.6.2	---> 2. Alarm 2 Test	
		---> 3. Exit	
	---> 3. Batch Relay Test	---> 1. Batch 1 HF	
	Sect. 9.6.3	---> 2. Batch 2 LF	
		---> 3. Exit	
	---> 4. Analog Test	---> 1. Analog 1 Test	---> Output Current
	Sect. 9.6.4	---> 2. Analog 2 Test	---> Output Current
		---> 3. Analog 4 Test	---> Output Current
		---> 4. Exit	
	---> 5. Pulse Test	---> Output Frequency	
	Sect. 9.6.5	---> Output Number of Pulses	
	---> 6. Comm Test	---> Displays & Echoes	
	Sect. 9.6.6	Data Recv on Comm	
	---> 7. Tube Drive Test	---> Current:	
	Sect. 9.6.7	Sensor A:	
		Sensor B:	
		Driff Eff:	
	---> 8. Buttons Test	---> Press Any Button	
	Sect. 9.6.8	---> Will not display numbers or letters *	
	---> 9. LCD Test	---> Press Enter Key to	
	Sect. 9.6.9	Toggle Pixels On/Off	
	---> A. Exit		

* The test can be done in, Device Info., Misc. Device Info, Tag.

9.6   Diagnostic Menu

9.6.1   Self Test
Using the DIAGNOSTIC MENU TREE enter the self test function.

The diagnostic menu provides test menus for the following:
1. Self Test
2. Alarm Test
3. Batch Relay Test
4. Analog Test
5. Pulse Test
6. RS485 Test
7. Tube Drive Test
8. Buttons Test
9. LCD Test

The following chart highlights the self test feature.

Menu or Display	Description
Program 2. Diagnostics	From this menu the user can perform a series of tests on various internal software and hardware items. Choices from this point are: Self Test, Alarm Test, Batch Relay Test, Analog Test, Pulse Test, Comm Test, Tube Drive Test, Button Test, LCD Test, and Exit.
Diagnostics 1. Self Test	The self test diagnostic reports the status of various software subsystems in the Datamate 2200. Pressing ENTER brings up: KPIF <EMBEDDED> QUAD <EMBEDDED> DSP <EMBEDDED> MENU <EMBEDDED> ENTER again brings RTD <EMBEDDED> BELV <EMBEDDED> MOD <EMBEDDED> RAPH <EMBEDDED> ENTER again brings SCHL <EMBEDDED> STAT <EMBEDDED> 420 <EMBEDDED> DISPLAYTXT <EMBEDDED> ENTER again brings LIBRARY <EMBEDDED> All items should be 'EMBEDDED'.

9.6.2   Alarm Test

Using the DIAGNOSTIC MENU TREE enter the Alarm Test.

The following chart highlights the Alarm Test feature.

Menu or Display	Description
Diagnostics 2. Alarm Test	The alarm test can be used to force the alarm outputs open and closed one at a time in order to test external wiring. Choices from this menu are: Alarm Test 1, Alarm Test 2, and Exit.
Alarm Test 1. Alarm 1 Test	Pressing Enter will close the output and bring up this display. Alarm Output 1 Test Output is CLOSED CANCEL to Exit Pressing ^ will change the state of the output and the display. Alarm Output 1 Test Output is OPEN CANCEL to Exit The output and display will change each time the ^ key is pressed.
Alarm Test 2. Alarm 2 Test	See Alarm Test 1. Alarm 1 Test above.

9.6.3   Batch Relay Test

Using the DIAGNOSTIC MENU TREE enter the Batch Relay Test.

The following chart highlights the Batch Relay Test.

Menu or Display	Description
Diagnostics 3. Batch Relay Test	The batch relay test can be used to force the batch relay outputs open and closed one at a time in order to test external wiring. Choices from this menu are: Batch 1 HF Test, Batch 2 LF Test , and Exit.
Batch Relay Test 1. Batch 1 HF Test	Pressing Enter will close the output and bring up this display. HF Batch Relay1 Test Output is CLOSED CANCEL to Exit Pressing ENTER will change the state of the output and the display. HF Batch Relay1 Test Output is OPEN CANCEL to Exit The output and display will change each time the ENTER key is pressed.
Batch Relay Test 2. Batch 2 LF Test	See Batch Relay Test 1. Batch 1 HF Test above

9.6.4   Analog Test

Using the DIAGNOSTIC MENU TREE enter the Analog Test.

The following chart highlights the Analog Test.

Menu or Display	Description
Diagnostics 4. Analog Test	The analog output tests may be used to provide a test current for testing equipment and wiring of 4-20 mA current loops. Choices from this menu are Analog 1 Test, Analog 2 Test, Analog 4 Test, and Test.
Analog Test 1. Analog 1 Test	From this menu the user sets the magnitude of the output current. The value of the current may be changed as often as necessary. Output Current [_ XX.XXX] mA When ENTER is pressed the magnitude of the output current will be displayed Output Current [_ XX.XXX] mA Output is [XX.XXX] mA
Analog Test 2. Analog 2 Test	See Analog Test 1. Analog 1 Test above.
Analog Test 3. Analog 4 Test	See Analog Test 1. Analog 1 Test above.

9.6.5 Pulse Test

Using the DIAGNOSTIC MENU TREE enter the Pulse Test.

The following chart highlights the Pulse Test.

Menu or Display	Description
Diagnostics 5. Pulse Test	The pulse output test is provides pulses to enable the user to test external wiring and hardware.
Pulse Test	Pressing ENTER brings the following display: Output Frequency [_ XX.XX] Hz Enter the desired output frequency (between 0 and 10,000 Hz) with the ^ and > keys. Press ENTER twice to confirm. Output Num Pulses [_ XXXXXX] Enter the number of pulses that the Datamate 2200 is to send (between 0 and 65000) with the ^ and > keys. When 0 is entered, pulses will be transmitted continuously until the CANCEL key is pressed. Press ENTER twice to confirm. Generating Pulses FREQ: XXX.XXXX HZ PULS: XXXXXX CANCEL to Exit

9.6.6 RS485 Communication Test

The RS485 Communication Test allows the user to test the external wiring, configuration and hardware of the serial communications ports. In this test the Datamate 2200 transmitter will echo all correct serial data received during the test.

Using the DIAGNOSTIC MENU TREE enter the RS485 Communication Test.

The following chart highlights the RS485 Communication Test.

Menu or Display	Description
Diagnostics 6. Comm Test	The comm (communication) test allows the user to test the external wiring, configuration, and hardware of the serial communications ports. In this mode the Datamate 2200 will echo and display all correct serial data received during the test.

9.6.7 Tube Drive Test

The tube drive test calculates the drive efficiency of the transducer and process.

Using the DIAGNOSTIC MENU TREE enter the Tube Drive Test.

The following chart highlights the Tube Drive Test.

Menu or Display	Description
Diagnostics 7. Tube Drive Test	The tube drive test calculates the drive efficiency of the transducer and process. Drive efficiency is defined as the ratio of sensor voltage to drive current. Pressing ENTER will display the following data: Current: XXX.X mA Sensor A: XXX.XX mV Sensor B: XXX.XX mV DRVEFF: XX.XXX

9.6.8 Buttons Test

The buttons test allows the user to confirm the operation of the START, STOP, ENTER, ^, >, CANCEL, and ZERO buttons.

Using the DIAGNOSTIC MENU TREE enter the Buttons Test.

The following chart highlights the Buttons Test.

Menu or Display	Description
Diagnostics 8. Button Test	Press Enter to start the test and the following will be displayed. Press any Button When a button or input is activated one at a time a message the indicated message will appear. When ^ is pressed the following message will be displayed Press any Button 　　UP When > is pressed the display will change to: Press any Button 　　RIGHT When ENTER is pressed the display will change to: Press any Button 　　ENTER When the Batch Start input is activated: Press any Button 　　Batch Start When the Batch Stop input is activated: Press any Button 　　Batch Stop When the Zero button is pressed, the display will change to: Press any Button 　　Zero When CANCEL is pressed the display will change to: Press any Button 　　CANCEL CANCEL to Exit To exit the Button Test press CANCEL from the above menu.

The alphanumeric keys may be tested by going to the following location in the menu tree:

Main Menu, 4. Program, 3. Configuration, 2. Device Info, 1. Misc Device Info, Tag.

Input a string of letters, numbers, and characters to check the alphanumeric buttons. Press Cancel and the original info in the tag location will remain.

9.6.9 LCD Test

Using the DIAGNOSTIC MENU TREE enter the LCD Test.

The following chart highlights the LCD Test.

Menu or Display	Description
Diagnostics 9. LCD TEST	Allows the user to test the display by alternately setting all pixel dark and light and displaying upper case letters. Press ENTER to start. Press ENTER Key to Toggle Pixels ON/OFF ENTER to Continue Cancel to Exit Pressing ENTER will turn on all pixels in the display. Pressing ENTER again will turn off all pixels in the display. Continuing to press ENTER will toggle the pixels between off and on. Pressing CANCEL will fill the display with all the upper case letters from A to Z one letter at a time. Each letter will be displayed for about 3/4 a second. AAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAA Pressing CANCEL will stop will stop the test.

CONFIGURATION MENU

---> Main Menu 4. Program	---> Enter Password [ ]	---> Program 3. Configuration

```
|--->  3. Configuration      |---> 1. Batch          ---> Parameter
       Sect. 9.7                   Sect. 9.7.1        ---> Unit
                                                      ---> Batch Cutoff Qty
                                                      ---> Trickle Offset Pt
                                                      ---> Low Alarm Offset
                                                      ---> Hi Alarm Offset
                                                      ---> System Response Time
                                                      ---> Auto Restart Delay
                                                      ---> Runmode Edit?
                                                      ---> Batch Jog?

                              2. Device Info        ---> 1. Misc Device Info      |--->  Tag
                              Sect. 9.7.2                                         --->  Descriptor
                                                                                 --->  Message
                                                                                 --->  Date
                                                                                 |--->  Device ID

                                                    ---> 2. Configuration Menu    |--->  Trans Model Num
                                                                                 --->  Trans Serial Num
                                                                                 --->  Elec Model Num
                                                                                 --->  Elec Serial Num
                                                                                 --->  Final Assy Num
                                                                                 --->  Wetted Materials
                                                                                 --->  Connection Size
                                                                                 --->  Connection Rating
                                                                                 |--->  Electrical Class

                                                    ---> 3. Revisions Number      |--->  Boot Rev
                                                                                 --->  OS Rev
                                                                                 --->  App Rev
                                                                                 --->  Elec Rev
                                                                                 |--->  Hart Rev

                                                    |---> 4. Exit

                              3. Alarms             ---> 1. Alarm 1               |--->  Alarm
                              Sect. 9.7.3                                         --->  Alarm Type
                                                                                 --->  Low Alarm SetPnt
                                                                                 |--->  Hi Alarm SetPnt

                                                    ---> 2. Alarm 2               |--->  Alarm
                                                                                 --->  Alarm Type
                                                                                 --->  Low Alarm SetPnt
                                                                                 |--->  Hi Alarm SetPnt

                                                    ---> 3. Startup Delay
                                                    |---> 4. Exit
```

CONFIGURATION MENU - continued

--->	Main Menu 4. Program	---> Enter Password [ ]	---> Program 3. Configuration

--->	3. Configuration **Sect. 9.7**	---> 4. Display **Sect. 9.7.4**	---> Line 1 ---> Line 2 ---> Line 3

---> 5. Xmit Variables   ---> 1. Flow Variables
Sect. 9.7.5

                ---> 1. Mass Flow
- ---> Unit
- ---> Fallback
- ---> Low Alarm Setpnt
- ---> Hi Alarm Setpnt
- ---> Hi Alarm Setpnt
- ---> LF Cutoff
- ---> Noise Damp Factor
- ---> Rate Damp Factor
- ---> Damp Thrshld 1-100

                ---> 2. Volume Flow
- ---> Unit
- ---> Fallback
- ---> Low Alarm Setpnt
- ---> Hi Alarm Setpnt
- ---> LF Cutoff
- ---> Noise Damp Factor
- ---> Rate Damp Factor
- ---> Damp Thrshld 1-100

                ---> 3. Standard Vol Flow
- ---> Unit
- ---> Fallback
- ---> Low Alarm Setpnt
- ---> Hi Alarm Setpnt
- ---> LF Cutoff
- ---> Std Density Unit

                ---> 4. Concen Flow
- ---> Unit
- ---> Fallback
- ---> Low Alarm Setpnt
- ---> Hi Alarm Setpnt
- ---> LF Cutoff

                ---> 5. Net Oil Flow
- ---> Net Mass or Volume
- ---> Use Data from Well
- ---> Net Oil Parameter
- ---> Unit
- ---> Fallback
- ---> Low Alarm Setpnt
- ---> Hi Alarm Setpnt
- ---> LF Cutoff
- ---> Shrinkage Factor

                ---> 6. Special Mass
- ---> Base Rate
- ---> Flow Factor
- ---> Flow Text

...continues next page | ...continues next page | ...continues next page | ...continues next page

CONFIGURATION MENU - continued

--->	Main Menu 4. Program	---> Enter Password [ ]	---> Program 3. Configuration

```
--->  3. Configuration    ---> 5. Xmit Variables  ---> 1. Flow Variables  ---> 6. Special Mass        |---> Totalizer Factor
      Sect. 9.7                 Sect. 9.7.4                                                             |---> Totalizer Text

                          ---> 5. Xmit Variables  ---> 1. Flow Variables  ---> 7. Special Volume       |---> Base Rate
                               Sect. 9.7.5                                                             |---> Flow Factor
                                                                                                       |---> Flow Text
                                                                                                       |---> Totalizer Factor
                                                                                                       |---> Totalizer Text

                                                                          ---> 8. Flow Direction
                                                                          |---> 9. Exit

                                                    ---> 2. Temperature   |---> Unit
                                                                          |---> Fallback
                                                                          |---> Low Alarm Setpnt
                                                                          |---> Hi Alarm Setpnt

                                                    ---> 3. Density        |---> Unit
                                                                          |---> Fallback
                                                                          |---> Low Alarm Setpnt
                                                                          |---> Hi Alarm Setpnt
                                                                          |---> Slug Low Limit
                                                                          |---> Slug Hi Limit
                                                                          |---> Slug Delay Time
                                                                          |---> Damp Factor

                                                    ---> 4. Concent./Solids |---> Unit
                                                                          |---> Fallback
                                                                          |---> Low Alarm Setpnt
                                                                          |---> Hi Alarm Setpnt
                                                                          |---> Clear Entire Table
                                                                          |---> Ref Temperature 1..5
                                                                          |---> Measured Density 1..14
                                                                          |---> Concert./Solids 1..14

                                                    ---> 5. Well Data      |---> Unit
                                                                          |---> Std Temperature
                                                                          |---> Clear Well Data
                                                                          |---> Well Number (1-30)
                                                                          |---> Oil Density ?
                                                                          |---> Water Density ?
                                                    |---> 6. Exit

                          ---> (4.3.6) Outputs     ---> 1. Analog         |---> Parameter
                               Sect. 9.7.6                                |---> Lower Range
                                                                          |---> Upper Range
                                                                          |---> Cutoff
                                                                          |---> Min. Span

        ...continues next page    ...continues next page
```

CONFIGURATION MENU - continued

--->	Main Menu 4. Program	--->	Enter Password [ ]	--->	Program 3. Configuration

--->	3. Configuration **Sect. 9.7**	--->	6. Outputs **Sect. 9.7.6**	--->	2. Analog	---> ---> ---> ---> --->	Parameter Lower Range Upper Range Cutoff Min. Span

```
                                                    ---> 3. Pulse      ---> Parameter
                                                                       ---> Lower Range
                                                                       ---> Upper Range
                                                                       ---> Min. Span
                                                                       ---> Max Output Freq.

                                                    ---> 4. Analog 4   ---> Parameter
                                                                       ---> Lower Range
                                                                       ---> Upper Range
                                                                       ---> Cutoff
                                                                       ---> Min. Span

                                                    ---> 5. Comm Port  ---> Baud
                                                                       ---> Parity
                                                                       ---> Data bits
                                                                       ---> Stop bits
                                                                       ---> Protocol
                                                                       ---> Address (1-247)
                                                                       ---> Transmission Mode

                                                    ---> 6. Option Card ---> Hart menu
                                                                        ---> Poll Address
                                                    ---> 7. Exit
```

	(3.3.7) Totalizers **Sect. 9.7.7**	--->	Reset Totalizer

```
        (3.3.8) Characterize Me    ---> 1. Sensor    ---> 1. Sensor Err Delay    ---> Sensor Error Delay
        Sect. 9.7.8

                                                     ---> 2. Calibrate Sensor   ---> Sensor A:
                                                                                ---> SensorB:
                                                                                ---> Sensor Set Point
                                                                                ---> Gain Control
                                                     ---> 3. Exit

                                   ---> 2. Zero      ---> 1. Electronics Zero    ---> Electronics Zero
                                                                                ---> StdDev

                                                     ---> 2. Transducer Zero    ---> Transducer Zero

                                                     ---> 3. System Zero         ---> System Zero
                                                                                 ---> Std Dev
                                                     ---> 4. Exit
```

CONFIGURATION MENU - continued

---> Main Menu 4. Program	---> Enter Password [ ]	---> Program 3. Configuration	

```
--->   3. Configuration      --->  8. Characterize Meter   --->  3. Temp Calib Param   |--->  RTD Offset
       Sect. 9.7                   Sect. 9.7.8

                                                            --->  4. Density Params     |--->  C1
                                                                                        |--->  C2
                                                                                        |--->  Air Frequency
                                                                                        |--->  Air Temperature


                                                            --->  5. Mass Params        |--->  Mass Scalar


                                                            --->  6. Analog Outputs      --->  1. Analog 1        |-->  Gain
                                                                                                                  |-->  Offset


                                                                                         --->  2. Analog 2        |-->  Gain edit
                                                                                                                  |-->  Offset edit


                                                                                         --->  3. Analog 4        |-->  Gain edit
                                                                                                                  |-->  Offset edit

                                                                                         |--->  4. Exit

                                                            |--->  7. Exit

                               9. Exit
```

9.7   Configuration Menu

The configuration menu provides menus for the configuration of the following:
- Batch Setup
- Device Information
- Alarm Setup
- Display Setup
- Transmitter Variables
- Pulse / 4-20mA / RS485
- Totalizer Reset
- Characterize Menu

9.7.1   Batch Setup Configuration

The Datamate 2200 transmitter has the option of a two stage batch controller with remote start stop feature. In this menu the batch control is configured.

Using the CONFIGURATION MENU TREE enter Batch Setup Menu.

The following chart highlights the Batch Setup Menu.

Menu or Display	Description
Program 3. Configuration	

Menu or Display	Description
Configuration 1. Batch	The Configuration Batch menu allows the user to setup the Datamate 2200 to batch. From here the user can select: the measurement used for batching, the units of the parameter, the Batch Cutoff Amt, the Trickle Offset Pt, High and low alarm setpoints, System response time, an Auto Restart Delay time, Run Mode Edit mode, and Batch Jog mode. Pressing ENTER bring up the Parameter selection display. Selection are made by using the ^ and > keys to scroll through the choices: MASS TOTAL, VOLUME TOTAL, STD VOL TOTAL, and CONC. TOTAL. Parameter [MASS TOTAL] When the desired parameter is displayed press ENTER to confirm and move on. The following display indicates the engineering units of the selected parameter. Units are selected in the CONFIG/XMITTERVAR/FLOW VAR menu Units [UUU] Press ENTER to set the Batch Cutoff Amt (batch size). If all batches are to be the same size enter the desired amount here. If batches will be different sizes enable Run Mode Edit below. Use the ^ and > keys to set the desired value. Batch Cutoff Amt [XXXX.XX] UUU When two stage batching is desired the next menu is used to set the first stage cutoff point. The Trickle Offset is the difference between Batch Cutoff Amt and the first stage cutoff point. This value is determined by the dynamics of the pumps, valves, and the piping and should be the same regardless of the Batch Cutoff Amt. Use the ^ and > keys to set the desired value. Trickle Offset Pt [XXXX.XX] UUU Alarms can be programmed to alert the user to under or over sized batches. The offsets are the allowable differences between the Batch Size and the Batch Total. The low alarm does not activate unless the flow rate is zero. Low Alarm Offset [XXXX.XX] UUU Hi Alarm Offset [XXXX.XX] UUU The System Response Time is a feature the allows the Datamate 2200 to anticipate when to stop a batch if there is a significant time delay between the signal to stop flow and flow stopping. The default value is 0.0 seconds for no delay. The maximum delay is 60 seconds. System Response Time [XXXX.XX] SEC When running many batches of the same size (like a manual container filling application) it may be desirable to automatically restart a batch after a pre-selected time. Maximum time: 600 seconds. Auto Restart Delay [XXXX.XX] SEC If you want the operator to be able to change the size of a batch, press the ^ key until this value is YES. Run Mode Edit [NO] In the event of a system error during a batch, if you want the operator to be able to clear the error by depressing the start button, press the ^ key until this value is YES. Batch Jog [NO]

9.7.2 Device Information

All information concerning the identification of the transmitter, transducer, and software revision is located in this menu.

Using the CONFIGURATION MENU TREE enter Device Information.

The following chart highlights the Device Information.

Menu or Display	Description
2. Device Information 1. Misc Device Info	In this area Tag identification for the device is entered. Tag [XXX XXXX] The description of the device can be entered. Descriptor [XXXXXXXXXXX.XX] A special message concerning the device can be entered here. Descriptor [XXXXXXXXXXX.XX] The date that information concerning the device was last updated Date [XX/XX/XX] Device ID number Device ID [XXXXXXXXXXXXX]
2. Configuration	The transducer model number Trans Model Num [XXXXXXXXXXX] Transducer Serial Number Trans Serial Num [XXXXXXXXXXX.XX]

Menu or Display	Description
2. Device Information 2. Configuration (continued)	Electronics Model Number Elec Model Num [XXXXXXX]] Electronics Serial Number Elec Model Num [XXXXXXXXX] Final Assembly Number Descriptor [XXXXXXXXXXX.XX] Wetted Materials of the transducer Wetted Materials [XXXXXXXXXXXXXX] Transducer Connection Size Connection Size [XX XXXX] Transducer Connection Rating Connection Rating [XXXXXXXXXXX] Transducer Electrical Class Electrical Class [XXXXXXXXXXX.XX]
2. Device Information 3. Revision Numbers	The installed Software Revision Numbers are listed. BOOT REV: [Cxxxxxxx] OS REV: [VXX.XXXXX] OPP REV: [XXXX] ELEC REV: [XXX XX XX] HART REV: [XX]
4. Exit	Exit the Device Information Menu

9.7.3   Alarm Setup Configuration

The Datamate 2200 transmitter has two high and low external alarms. These alarms can be programmed to represent any variable and system alarm.

Using the CONFIGURATION MENU TREE enter the Alarm setup configuration.

The following chart highlights the Alarm Setup Configuration.

Menu or Display	Description
Configure Alarms 1. Alarm 1	If you wish to configure Alarm 1, press ENTER. Press the up arrow key to select the alarm function. High and low setpoints can be configured. Alarm [Select Alarm Output]
2. Alarm 2	If you wish to configure Alarm 2, press ENTER. Press the up arrow key to select the alarm function. Alarm [Select Alarm Output]
3. Startup Delay	If a delay is required for the startup of the alarm, press ENTER. Press the up and across keys to set the delay. Startup Delay [XXXXXXXXXX]
4. Exit	To exit Configuration Alarm menu press ENTER

9.7.4   Display Setup Configuration

Within this menu the display can be set up to display three variables at one time on the LCD display.

Using the CONFIGURATION MENU TREE enter the Display Setup Configuration.

The following chart highlights the Display Setup Configuration.

Menu or Display	Description
Configuration 4. Display	The Datamate 2200 will allow the user to program three variables as a default on the optional LCD display. If you wish to configure the display, press ENTER. Use the up arrow key to select the default variable for Line 1. Line 1 [XXXXXXXXXXX] If you wish to configure the display for Line 2 press ENTER Line 2 [XXXXXXXXXXX] If you wish to configure the display for Line 3, press ENTER Line 3 [XXXXXXXXXXX]

9.7.5 Transmitter Variables Configuration

In this menu it is possible to set the Units, Fallback, Alarm Setpoints for each variable measured. Also the % Solids/Concentration, Brix or Baume table is entered here.

Using the CONFIGURATION MENU TREE enter the Transmitter Variable Configuration.

The following chart highlights the Transmitter Variable Configuration:

Menu or Display	Description
Configuration 5. Xmit Variables	Press ENTER in this menu to program the configuration of all measured variable. It will give access to the following options that can be scrolled using the up or across key: 1. Flow Variables 2. Temperature 3. Density 4. Concent./Solids 5. Exit
Configure Xmit Vars 1. Flow Variables	Press ENTER to configure the following Flow Variables: 1. Mass Flow 2. Volume Flow 3. Standard Vol Flow 4. Concen Flow 5. Net Oil Flow 6. Special Mass 7. Special Volume 8. Flow Direction 9. Exit
Configure Flow Vars 1. Mass Flow or Configure Flow Vars 2. Volume Flow	Press ENTER to configure Mass Flow Variables or Volume Flow. Use the UP or ACROSS key to select engineering unit to display the measured variable. Unit [XXXX] Use the UP or ACROSS key to set the fallback value in the event of a fault condition. Fallback [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual Low Alarm Setpoint. Low Alarm SetPnt [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual High Alarm Setpoint. Hi Alarm SetPnt [XXXXXXXXXXXX] Use the UP or ACROSS key to set the Low Flow Cutoff point. Below this Flow rate the meter will not register. LF Cutoff [XXXXXXXXXXXX] Use the UP or ACROSS key to adjust the dampening factors in whole seconds. Note: The Noise Damp Factor value must be larger than the Rate Damp Factor value. Noise Damp Factor: Enter a value from 0–256 to adjust the response time for the effects of signal noise. (Default = 0) A higher value will result in a slower response time. Rate Damp Factor: Enter a value from 0–256 to adjust the response time for the effects of incremental changes of flow rate. (Default =0) Damp Thrshld: The percent change in flow rate that will activate the Rate Damp as programmed.

Menu or Display	Description

Configure Flow Vars
3. Standard Vol Flow
	Press ENTER to configure Standard Volume Flow.
	    Use the UP or ACROSS key to select unit.
	Unit
	[XXXX]
	
	Use the UP or ACROSS key to set the fallback value in the event of a fault condition.
	Fallback
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the visual Low Alarm Setpoint.
	Low Alarm SetPnt
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the visual High Alarm Setpoint.
	Hi Alarm SetPnt
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the Low Flow Cutoff point. Below this Mass Flow rate the meter will not register.
	LF Cutoff
	[XXXXXXXXXXXX]
	
	A standard density unit or concentration unit can be selected, to correct the volume measurement to a referred density value for a given temperature. In the case of Concentration measurements using Brix or Baume (Be Lt or Be Hv), the density vs Brix table or density vs Baume table should be set first (please refer to the *Configure Xmit Vars, 4. Concent./Solids* menu found below).
	Std Density Unit
	[XXXX]
	    If API is selected an extra prompt will appear allowing to select the type of fluid measured. Please refer to the *Configure Xmit Vars, 3. Density* menu found below.
	
	The following menu will not display if the unit selected is Brix, Baume or API. Use the UP or ACROSS key to enter the value of the standard density.
	Standard Density
	[XXXXXXXXXXXX]

Configure Flow Vars 4. Concen Flow	Press ENTER to configure Concentration Flow, i.e. the mass flow rate of the target fraction. Use the UP or ACROSS key to select unit. Unit [XXXX] Use the UP or ACROSS key to set the fallback value in the event of a fault condition. Fallback [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual Low Alarm Setpoint. Low Alarm SetPnt [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual High Alarm Setpoint. Hi Alarm SetPnt [XXXXXXXXXXXX] Use the UP or ACROSS key to set the Low Flow Cutoff point. Below this concentration flow rate the meter will not register. LF Cutoff [XXXXXXXXXXXX]

Menu or Display	Description

Configure Flow Vars
5. Net Oil Flow
	Press ENTER to configure Net Oil Functions. This menu will be active only if Datamate 2200 was purchased with the Net Oil and Well Testing option. It is important to input first the Well Data, before attempting to configure the Net Oil functions (please refer to the *Configure Xmit Vars, 5. Well Data* menu found below).
	
	Use the UP or ACROSS key to select if the flow rates and totals are going to be displayed and calculated in Mass or Volume units.
	Net Mass or Volume
	[XXXXXXXXXX]
	Select the Well number that will be used, this will provide the density of dry crude oil and saline water used in the calculations.
	Use Data from Well
	[XXX]
	To configure the Water Cut, Net Oil and Net Water measurement, select the corresponding option using the UP or ACROSS key and then pressing ENTER.
	Net Oil Parameter
	[XXXXXXXXXXXXXXXXXX]
	    Use the UP or ACROSS key to select unit.
	    Unit
	    [XXXX　　]
	    Use the UP or ACROSS key to set the fallback value in the event of a fault condition
	    Fallback
	    [XXXXXXXXXXXX]
	    Use the UP or ACROSS key to set the visual Low Alarm Setpoint.
	    Low Alarm SetPnt
	    [XXXXXXXXXXXX]
	    Use the UP or ACROSS key to set the visual High Alarm Setpoint.
	    Hi Alarm SetPnt
	    [XXXXXXXXXXXX]
	    Only in the cases of Net Oil and Net Water parameter will be displayed the following prompt. Use the UP or ACROSS key to set the Low Flow Cutoff point. Below this value the meter will not register the flow rate.
	    LF Cutoff
	    [XXXXXXXXXXXX]
	    Only in the case Net Oil is selected as a parameter, it is necessary to provide the following variable, the allowable range for this field is between 0.5 and 1.5. The factory default is 1.0 (please refer to the *chapter 7.11 Net Oil and Well Testing* for an explanation on the meaning of this field).
	    Shrinkage Factor
	    [XXXXXXXXXXXX]

Menu or Display	Description
Configure Flow Vars 6. Special Mass or Configure Flow Vars 7. Special Volume	The Datamate 2200 permits the user to create a special mass or volume unit measurement for rate and totalizer to be displayed. The special unit should be created by multiplying an existing unit (Base Rate) to a multiplier (Flow Factor). The base rate is the measurement from which you will create the special calculation for flow rate. Base Rate [XXXXXXXXXX] Use the UP or ACROSS key to set the Flow Factor. Flow Factor [XXXXXXXXXX] Enter the label that will describe the new flow rate unit, using the UP or ACROSS key. Flow Text [XXXX] The Totalizer Factor is the multiplier that is required to set the totalizer to the special mass or volume total. Totalizer Factor [XXXXXXXXXX] Enter the label that will describe the new volume or mass unit, using the UP or ACROSS key. Totalizer Text [XXXX]
Configure Flow Vars 8. Flow Direction	The Datamate 2200 can be configured for forward or reverse flow. Press the UP or ACROSS key to scroll the options and press ENTER to select
Configure Flow Vars 9. Exit	Exit the Configure Flow Variables Menu
Configure Xmit Vars 2. Temperature	Press ENTER to configure Temperature measurements. Use the UP or ACROSS key to select engineering unit to display the measured variable. Unit [XXXX] Use the UP or ACROSS key to set the fallback value in the event of a fault condition. Fallback [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual Low Alarm Setpoint. Low Alarm SetPnt [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual High Alarm Setpoint. Hi Alarm SetPnt [XXXXXXXXXXXX]

Menu or Display	Description

Configure Xmit Vars
3. Density
	Press ENTER to configure Density measurements.
	Use the UP or ACROSS key to select engineering unit to display the measured variable.
	Unit
	[XXXX]
	      If API is selected an extra prompt will appear allowing to select the type of fluid measured.
	      API Product Class
	      [XXXXXXXXXXXX]
	            If the API Product Class "Special" is selected, it is necessary to input a Volume Correction Factor (VCF) Table and enter a label that will identify the new table for the specific fluid.
	            Product Class Name
	            [XXXXXXXXXXXXXXXXXX]
	            If a new table is being entered, RSM recommends that the old table be cleared by selecting **YES**. If a revision to a few of the entries in the existing table is all that is needed select **NO**.
	            Clear Entire Table
	            [XXX]
	            The VCF Table will hold a maximum of 100 pairs of Temperature and VCFs. The following two menus will repeat in order until CANCEL is pressed or the maximum number of entries is reached. Use the UP or ACROSS key to set the temperature.
	            XXXXXX VCF Table
	            — Entry Point XXX -
	            Temperature
	            [XXXXXXXXXX]
	            Use the UP or ACROSS key to set the VCF of the corresponding Entry Point.
	            XXXXXX VCF Table
	            — Entry Point XXX -
	            VCF
	            [XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the fallback value in the event of a fault condition.
	Fallback
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the visual Low Alarm Setpoint.
	Low Alarm SetPnt
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the visual High Alarm Setpoint.
	Hi Alarm SetPnt
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the Slug Low Limit. Below this density the meter will go to the density fallback value.
	Slug Low Limit
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the Slug High Limit. Above this density the meter will go to the density fallback value.
	Slug Hi Limit
	[XXXXXXXXXXXX]
	
	Use the UP or ACROSS key to set the maximum delay time in seconds for the slug limit to engage.
	Slug Delay Time
	[XXXXXXXXXXXX]

Menu or Display	Description
	Use the UP or ACROSS key to adjust the response time of the measurement in seconds. Damp Factor [XXXXXXXXXXXX]
Configure Xmit Vars 4. Concent./Solids	Press ENTER to configure Concentration, Brix or Baume Tables. Use the UP or ACROSS key to select engineering unit to display Concentration. The table that will be entered, should have the relation between temperature, density and the unit selected here (%, Brix, Be Lt or Be Hv). Unit [XXXX] Use the UP or ACROSS key to set the fallback value in the event of a fault condition. Fallback [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual Low Alarm Setpoint. Low Alarm SetPnt [XXXXXXXXXXXX] Use the UP or ACROSS key to set the visual High Alarm Setpoint. Hi Alarm SetPnt [XXXXXXXXXXXX] If this is a new table it is recommended to clear the entire table before entering the new data. In the case only an edition of the table is needed select NO. Clear Entire Table [XXX] The Table will hold a maximum of 14 pairs of Density and Concentration for 5 different operating temperatures. The Ref Temperature menu will repeat, after the list of densities and concentrations is entered for the specific temperature, until the 5 different temperatures are set sorted by value. Use the UP or ACROSS key to set the temperature. Ref Temperature X [XXXXXXXXXX] The following two menus will repeat, until CANCEL is pressed or after 14 Density and Concentration pairs are entered. Use the UP or ACROSS key to set the Measured Density. The density should be entered sorted from the lower to the higher value. TMPX:X.X — Entry Point XX — Measured Density [XXXXXXXXXX] Use the UP or ACROSS key to set the corresponding Concentration for the above entered density. TMPX:X.X — Entry Point XX — Concent./Solids [XXXXXXXXXX]

Menu or Display	Description

Configure Xmit Vars
5. Well Data
	Press ENTER to enter the data for each Well.
	
	It is important to input first the Well Data and then configure the Net Oil function, before attempting to run a Well Testing (please refer to the *Configure Xmit Vars, 5. Well Data and Configure Flow Vars, 5. Net Oil Flow* menus later in this manual).
	
	Use the UP or ACROSS key to select the engineering unit that will be used to enter the Density of crude oil and saline water.
	UNIT
	[XXXXXXXXXX]
	Use the UP or ACROSS key to select the standard temperature used as the reference to measure the Density of crude oil and saline water.
	Std Temperature
	[XXXXXXXXXX]
	Use the UP or ACROSS key to select if it is needed to delete the data for the complete table of wells. If this is a new table it is recommended to clear the entire table before entering the new data. In the case only an edition of the table is needed select NO.
	Clear Well Data
	[XXX]
	Use the UP or ACROSS key to enter the number of the well which data will be entered or changed.
	    Well Number (1-30)
	    [XXXXXXXXXXXX]
	    Use the UP or ACROSS key to enter the density, measured at the standard temperature, of pure crude oil recovered from the indicated Well.
	    Well # XX
	    Oil Density ?
	    [XXXXXXXXXXXX]
	    Use the UP or ACROSS key to enter the density, measured at the standard temperature, of the saline water extracted from the indicated Well.
	    Well # XX
	    Water Density ?
	    [XXXXXXXXXXXX]
	The three menus above will repeat while the Well Number increase. That number can be changed at any time to edit an specific Well.

9.7.6   Analog / Pulse / RS485 Output Configuration

Using the CONFIGURATION MENU TREE to enter the analog / pulse or RS485 output configuration.

The following chart highlights the configuration of the pulse / 4-20mA or RS485 outputs.

Menu or Display	Description
Configuration 6. Outputs	Configuration of the analog, pulse and communication outputs is completed in the Configuration menu. Configuration of Analog 1. Press ENTER to configure Analog 1
Configure Outputs 1. Analog 1	Use the UP or ACROSS key to select variable for Analog 1 Parameter [XXXXXX] Use the UP and ACROSS key to set Lower Range Lower Range [XXXXXX] Use the UP and ACROSS key to set Upper Range Upper Range [XXXXXX] Press enter to display Cutoff [XXXXXX] Press enter to display Min. Span [XXXXXX]
Configure Outputs 2. Analog 2	See Configure Outputs 1. Analog 1 above for non-total parameters.
Configure Output 3. Pulse	See Configure Outputs 1. Analog 1 above for non-total parameters. For total parameters Use ^ and > to select parameter Parameter [XXXXX] Use ^ and > to select K-Factor (pulses/unit) [XXXX.XXX] Use ^ and > to set max output frequency (max is 10,000 Hz) [XXXXX.XXX] Hz Max Output Frequency [XXXXX] Hz
Configure Outputs 4. Analog 4	See Configure Outputs 1. Analog 1 above

Menu or Display	Description
Configure Outputs 5. Comm Ports	Use the UP or ACROSS key to select baud rate Baud [XXXXXX] The parity odd or even is selected with the UP or ACROSS key. Parity [XXXX] Data bits value 7, 8 or 9 may be selected via the UP or ACROSS key Data Bits [X] Stop bits, value 1 or 2 may be selected via the UP or ACROSS key Stop Bits [X} The protocol to be used in communication with the Datamate 2200 can be selected with the UP or ACROSS key Protocol [XXXXXXXXXXXXXXXXX]
Configure Outputs 6. Option Card	If the optional card is installed in the Datamate 2200, it can be configured
Configure Outputs 7. Exit	Exit the configure outputs menu

9.7.7 Totalizer Reset

Using the CONFIGURATION MENU TREE enter the Totalizer Reset function.

The following chart highlights the resetting of the totalizer.

Menu or Display	Description
Configuration 7. Totalizers	When ENTER is pressed the UP OR ACROSS key can select all or the individual totalizer to be reset. When the totalizer variable(s) has been selected press ENTER to complete Reset Totalizer [XXXXXXXXXXXX]

9.7.8   Characterize Meter Configuration

Within this menu characterization of the transmitter and the transducer can be specially configured for the application.

Using the CONFIGURATION MENU TREE to enter the Characterization Meter Configuration.

The following chart highlights the Characterize Meter Configuration.

Menu or Display	Description
Characterize Meter 1. Sensor	This menu allow the user to modify and enter the calibration coefficients for the following: Sensor, Zero, Temp Calib Params, Density Params, Mass Params, and Analog Outputs.
Calibrate Sensor 1. Sensor Error Delay	With the Datamate 2200 you can enter the time in seconds before the transmitter goes into a sensor error delay. Maximum time: 30 seconds.
2. Calibrate Sensor	The Datamate 2200 allows the user to manually enter the sensor voltages which may be necessary in viscous applications. Sensor A [XXXX] mVrms Sensor B [XXXX] mVrms ENTER to Calibrate CANCEL to Exit If ENTER to calibrate is pressed, the transmitter will permit the user to set the Sensor voltage to be maintained Sensor Set Point [XXX] mVrms If ENTER is pressed again, you can use the UP and ACROSS key to set the Gain Control. This value should not be changed. Gain Control [XXXXXX]
Characterize Meter 2. Zero Electronics	This menu allows the user to review and modify the Electronic zero of the Datamate 2200. The electronic zero is the zero offset contribution due to the electronics and is determined by zeroing the electronics with the sensor inputs shorted together. Choices from this menu are Elec. Zero Params, Zero Electronics, and Exit.
Electronic Zero	Displays the current electronic zero and the standard deviation for the last automatic zero. With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. Electronics Zero [SX.XXXXeSXX] DEG Pressing ENTER will display the standard deviation (StdDev) of the last automatic zero. The StdDev cannot be modified by the user. StdDev [SX.XXXXeSXX] DEG

Menu or Display	Description
Zero 2. Transducer Zero	Displays the current transducer zero. The transducer zero is the zero offset contribution of the transducer and installation. The transducer zero is determined by subtracting the electronic zero from the system zero. Press ENTER to review and/or modify the transducer zero.
Transducer Zero	With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. Transducer Zero [SX.XXXXeSXX] DEG
Zero 3. System Zero	This menu allows the user to review and modify the System zero of the Datamate 2200. The System zero is the combined zero offset of the electronics, transducer and the installation when there is no flow. Choices from this menu are Syst Zero Params, Zero System, and Exit.
System Zero	Displays the current system zero and the standard deviation for the last automatic zero. With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. System Zero [SX.XXXXeSXX] DEG Pressing ENTER will display the standard deviation (StdDev) of the last automatic zero. The StdDev cannot be modified by the user. StdDev [SX.XXXXeSXX] DEG

Menu or Display	Description
Characterize Meter 3. Temp Calib Params	This menu allows the user to review and modify the Temperature Gain Coefficient of the Datamate 2200. RTD Offset [RX.XXXXeRXX] OHMS
4. Density Params	The Density Calibration Coefficient C1 and C2 can be reviewed and modified by the user in this menu. The user can modify the displayed Density Coefficient value with the ^ and > keys. C1 [DX.XXXXeDXX] Pressing ENTER will display the C2 value. The C2 value can be modified by the user. C2 [DX.XXXXeDXX] Pressing ENTER will display the Air Frequency. This value is located on the original transducer calibration sheet, and on the transducer nametag. Air Frequency [SX.XXXXeSXX] HZ Pressing ENTER will display the Air Temperature. This value is located on the original calibration sheet, and on the transducer nametag. Air Temperature [SX.XXXXeSXX] DEG C
Characterize Meter 5. Mass Params	Mass Parameters permits the user to manually enter the calibration scaler for the mass measurement. Mass Scalar [SX.XXXXeSXX]
Characterize Meter 6. Analog Outputs 1. Analog 1	The Datamate 2200 allows the user to modify the three (3) 4-20mA output calibration by using the Gain for zero mA and the Offset for 20mA Gain [GX.XXXXeGXX] Offset [OX.XXXXeOXX]

Characterize Meter
  2. Analog 2
  3. Analog 4
	See Analog Outputs
	1. Analog 1

Menu or Display	Description
Zero 2. Transducer Zero	Displays the current transducer zero. The transducer zero is the zero offset contribution of the transducer and installation. The transducer zero is determined by subtracting the electronic zero from the system zero. Press ENTER to review and/or modify the transducer zero.
Transducer Zero	With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. Transducer Zero [SX.XXXXeSXX] DEG
Zero 3. System Zero	This menu allows the user to review and modify the System zero of the Datamate 2200. The System zero is the combined zero offset of the electronics, transducer and the installation when there is no flow. Choices from this menu are Syst Zero Params, Zero System, and Exit.
System Zero	Displays the current system zero and the standard deviation for the last automatic zero. With the correct access (level 2) the user can modify the displayed ZERO value with the ^ and > keys. System Zero [SX.XXXX-e SXX] DEG Pressing ENTER will display the standard deviation (StdDev) of the last automatic zero. The StdDev cannot be modified by the user. StdDev [SX.XXXX- eSXX] DEG
4. Exit	

SYSTEM MENU

---> Main Menu
    4. Program
	---> Enter Password
	    [ ]
		---> Program
		    4. System

```
--->  4. System        --->  1. Set Date            --->  Date MM/DD/YY
      Section 9.8            Sect. 9.8.1

                       --->  2. Set Time            --->  Time HH:MM:SS
                             Sect. 9.8.2

                       --->  3. Display Date/Time    --->  MM/DD/YY  HH:MM:SS
                             Sect. 9.8.3                   CANCEL to Exit

                       --->  4. Password menu       --->  1. Change Password    ---> Old Password
                             Sect. 9.8.4                                        ---> New Password

                                                    --->  2. View Password      ---> Password=[XXXXXXXXX]

                                                    --->  3. Exit

                       --->  5. Dbase/File Mgmt     --->  1. File Directory
                             Sect. 9.8.5
                                                    --->  2. File Delete

                                                    --->  3. File Information

                                                    --->  4. Reboot System

                                                    --->  5. Reset Fctry Dflts

                                                    --->  6. Download DSP File   ---> DSP Download File edit

                                                    --->  7. Download ApplFile   ---> ENTER to Download

                                                    --->  8. Download OS         ---> ENTER to Download

                                                    --->  9. Exit
                       --->  6. Exit
```

9.8 System Menu

The system menu provides the user access to configuring the following:
- time
- date
- password
- database/file management.

9.8.1 Set Date and Time
This menu when selected will provide the user with options to change and display the date and/or time.

Using the SYSTEM MENU TREE enter Set Date or Set Time.

The following chart highlights the Set Date and Set Time feature.

Menu or Display	Description
System 1. Set Date	Set Date allows the user to confirm or set the Date. When ENTER is pressed the following will be displayed Set Date [mm/dd/yy]
2. Set Time	Set Time permits the user to confirm or set the Datamate 2200 to the time of day. When ENTER is pressed the following will be displayed Set Time [hr/min/sec]
3. Display Date/Time	Displays the system Date and Time, verifies the current time and date. When ENTER is pressed the following will be displayed. Time Date [hr/min/sec] [mm/dd/yy]

9.8.2 Password Configuration

This menu when selected will provide the user with the option to change the password for entry into the PROGRAM mode of the transmitter.

Using the SYSTEM MENU TREE enter the Password.

The following chart highlights the Password feature.

Menu or Display	Description
Password 1. Change Password	This menu allows the user to view and change the password to the PROGRAM menu When ENTER is pressed the following will be displayed Change Password [XXXXXXX]
2. View Password	Allows the user to view the password for the next lower access level. When ENTER is pressed the following will be displayed View Password [XXXXXX]

9.8.3   Dbase File Management

The Dbase File Management menu provides access to the following:

* File directory
* File Delete
* File Information
* Reboot System
* Reset to factory defaults
* Download DSP File
* Download Application File
* Download Operating System

Using the SYSTEM MENU TREE enter the Dbase File Management.

The following chart highlights the Dbase File Management menu.

Menu or Display	Description
Dbase/File Mgmt 1. File Directory	The current listing of the file directory is listed in this menu. When ENTER is pressed the name of any application files in RAM will be displayed [LIBRARY] [MENU] [DISPLAYTXT] [DSP] [RTD] [FUNC] [OUTPUTS] [BATCH] [STAT] [DIGITALPLL] [COMM]
2. File Delete	In this menu the user can delete any file listed in the File Directory. When ENTER is pressed the following message will be displayed File Delete [XXXXXXXX]
3. File Information	Information concerning the file listed in the file directory is listed. When ENTER is pressed the file directory listing will be displayed starting with the following: [LIBRARY] [XXXXX] [XXXX] LIB MM/DD/YY ENTER to Continue CANCEL to Exit
4. Reboot System	To reboot the system press ENTER. No programmed values will be lost The display will list the following options: To REBOOT the Datamate 2200 ENTER to Continue CANCEL to Exit To reset the software to factory defaults press ENTER
5. Reset Factory Defaults	The display will then list the following options: ENTER to Reset to the Factory Defaults CANCEL to Exit

Menu or Display	Description
6. Download DSP File	To download DSP file press ENTER: DSP Download File (Not available with user password access) [DIGITALPLL]
7. Download ApplFile	To download Application File press ENTER: Download DSP File (Not available with user password access) ENTER to Continue CANCEL to Exit
8. Download O/S	To download the Operating System press ENTER Download O/S (Not available with user password access) ENTER to Continue CANCEL to Exit

SECTION 9A: PROGRAMMING WITH THE HAND HELD COMMUNICATOR

9A. General Guidelines & Menu Tree

The Datamate 2200 is programmed and configured using either the NexLink software package (included with the unit), via the keypad on the transmitter enclosure, or by using a hand held communicator using HART protocol.

NexLink

The NexLink software program is a Windows-based application that allows the user to program and view data through an easy to use point-and-click user interface. This application uses MODBUS protocol.

Integral Keypad

The ENTER key sends the Datamate 2200 into the displayed menu, locks in data choices made with the ^ and > keys, and confirms the selections, unless otherwise noted.

The CANCEL key sends the Datamate 2200 into the next higher menus level, unless otherwise noted. Pressing ENTER when Exit is the menu choice sends the Datamate 2200 to the next higher menu level, unless otherwise noted.

Hand Held Communicator

The Datamate 2200 may also be programmed using HART protocol via a Hand Held Communicator. The menus for using the HHC are nearly identical to those used on the integral Datamate 2200 display. Navigation through the HART menu is accomplished by using the standard keystrokes as described in the instructions accompanying the HHC and used with any HART device.

Hand Held Communicator Menu Navigation

- Menu selections are made by either pressing the corresponding number on the numeric keypad or by using the ↑ and ↓ keys to highlight the selected option and then use the ➜ key to select that menu option.
- When there are more menu options than can be displayed on a single screen, additional options can be displayed by using the ↑ and ↓ keys to scroll through the options.
- At various points in the menu structure, the four function keys will be activated to perform certain functions.
  - F1   HELP   YES
  - F2   SAVE   SEND
  - F3   HOME   ABORT
  - F4   SEND   NO
- After programming or configuration data has been edited on the HHC, the SEND (F2) function must be used to change the Datamate 2200 programming or configuration.

Summary of HART Specific Programming Features and Functions

Section 5.7 — HART (Option Card) Wiring Connections

Up to 15 transmitters can be connected into a HART multi-drop network.

Section 9.2 - Main Menu (Operational Mode)

Default Display: The default display is not available on the HART communicator.
The top level menu on the HHC when connecting to a unit is the Main Menu with options as listed.

Main Menu / 1. View Process Variable / 1. View Measurements

Five process variables are available for selection on the screen. Additional variables are available by scrolling through the variable list using the ↑ and ↓ keys. The value of the variable highlighted may be viewed by pressing the ➔ key.

Main Menu / 1. View Process Variable / 2. View Outputs / 1. View Analog 1
Main Menu / 1. View Process Variable / 2. View Outputs / 2. View Analog 2
Main Menu / 1. View Process Variable / 2. View Outputs / 4. View Analog 4

The following information may be viewed from these menu options:

PV Process Var: (Primary Variable) The process variable that has been assigned to this output (Mass Rate, Volume Rate, Std Volume Rate, % Concentration, Concentration Rate, Density and Temperature)
Process Var: Present value of the selected output
AO1 current: The outputs present value in mA
AO1 % Range: The present % of range for the selected output

Main Menu / 1. View Process Variable / 2. View Outputs / 3. View Pulse Output

The following information may be viewed from this menu option:

TV Process Var: (Tertiary Variable) The process variable that has been assigned to this output (Mass Total, Mass Forward, Mass Reverse, Volume Total, Volume Forward, Volume Reverse, Std Volume Total, Std Volume Forward, Std Volume Reverse, Concentration Total, Concentration Forward, Concentration Reverse.
Unit Total: The present value of the output
Pulses/Unit: Pulses per unit of measure
Pulses Out: The number of pulses sent out.
OR
If a rate (mass, volume, standard volume or solids), temperature or density is assigned to the pulse output, the following information may be viewed:

TV Process Var: (Tertiary Variable) The process variable that has been assigned to this output (Mass Rate, Volume Rate, Std Volume Rate, % Concentration, Concentration Rate, Density and Temperature)

Process Var: Present value of the selected output

Frequency: The outputs present frequency value

% Range: The present % of range for the selected output

Main Menu / 2. View Status / 1. View Status

List the process variables that are currently in alarm. This list is empty when no alarms are active. Reviewing the list acknowledges any new alarms. Acknowledged alarms are automatically removed from the list when they return to normal.

Main Menu / 2. View Status / 2. View Error Log

List internal Datamate 2200 errors that have occurred. **Reviewing this list does not acknowledge the errors. The Clear Error Log must be performed.**

Section 9.4 — Program Mode

Main Menu / 3. Program

Selection of this menu gives the user the option of entering the user Password or of going directly to the Program menu. If the Program menu is selected without first entering the correct password, the configuration data will be displayed but cannot be changed. If an attempt is made to change any configuration data, the error message "In Write Protect Mode" will appear.

NOTE: This password is a 7-digit code that is independent of the password entered into the Datamate 2200 via the keypad or NexLink. When using the HHC, the configuration and programming data may be changed using only this password and is not protected by the password entered into the Datamate 2200.

THE DEFAULT PASSWORD IS "1111111".

If an incorrect password is used, the message "Password entered is incorrect" is displayed and the menu entry is exited. The "Enter Password" option must be reselected to input the correct password. When the correct password is entered, the menu will return to the previous selections. Enter "Program" at this point and data may be edited.

NOTE: **If the Datamate 2200 has been put in write protect mode via the keypad or NexLink, even though a correct password has been entered, the configuration of the device will not be changed. If this**

occurs, the message "In Write Protect Mode" will appear. (See Configuration Menu / Outputs / HART menu)

Paragraph 9.6 — Diagnostic Menu

The Diagnostic Menu provides test menus for the following:
- Self Test
- Alarm Test
- Batch Relay Test
- Analog Test
- Pulse Test
- Tube Drive Test

The following tests are not available via the HART interface and must be performed from the Datamate 2200 keypad.
- Comm Test
- Buttons Test
- LCD Test

Program / 2. Diagnostics / 1. Self Test

The Self Test diagnostic reports the status of various software subsystems in the Datamate 2200. All items should be "EMBEDDED".

Program / 2. Diagnostics / 2. Alarm Test / 1. Alarm 1 Test
Program / 2. Diagnostics / 2. Alarm Test / 1. Alarm 2 Test
Program / 2. Diagnostics / 3. Batch Relay Test / 1. Batch 1 HF Test
Program / 2. Diagnostics / 3. Batch Relay Test / 1. Batch 2 LF Test

When performing the above self tests, the user will be prompted to toggle the relay contacts. When "Yes" is selected, the relay will be toggled to the opposite state and the user is prompted to continue or exit. The relays will return to their original condition when the test is exited.

Paragraph 9.8 — System Menu

The System Menu provides access to configure the following:
- Time
- Date
- Password

Program / 4. System / 4. Password

The user may use this menu to change or view the **HHC password**. This is not the same password that is used to access the PROGRAM menu from the Datamate 2200 keypad.

NOTE: **The Database/File Management menu option is not available via the HART interface.**

9A.1   HART HHC Online Menu

The main menu is the normal operational mode of the Datamate 2200 transmitter. Unlike viewing the menus from the Datamate 2200 display, the available program features are arranged slightly different when using the Hand Held Configurator. Instead of all programming functions being centered around the Main Menu, they are instead accessible from the **"Online"** menu. From the HART **Online** menus, all process measurements, outputs, alarms and error log can be viewed. The error log may also be cleared from the Main Menu. Access to the Program mode is also available through the use of a password.

Menu or Display	Description
Default Display **1. Offline** **2. Online** **3. Frequency Device** **4. Utility**	The default display will appear on the HHC display when it is powered up and connected to a HART device. The HHC will connect to a device if one is present (connected). If several devices are connected, the HHC will poll as directed in the **Utility/Configure Communication/Polling Menu**.
Online Menu **1. View Process Vars** **2. View Status** **3. Program**	1. **View Process Vars** allows the user to review the present value of the process variables and/or the analog and pulse outputs. 2. **View Status** allows the user to review a list of parameters and diagnostics that are out of limits. The list is organized as last-in first-out. This will make the last event the first seen by the user. Events will be removed from the list when they return to normal after they have been acknowledge. 3. **Program** gives the user the ability to view and program the Datamate 2200. Entering the proper password allows access to configuration and programming data.
1. View Process Vars	1. **View Measurements** allows the user to view the present value of the process variables five at a time. All variables may be viewed by using the up/down arrow keys. The value of the variable highlighted may be viewed by selecting the right arrow key. 2. **View Outputs** allows the user to view the present analog or pulse output value.
2. View Outputs 1. Analog 1 2. Analog 2 3. Pulse Output 4. Analog 4	1. **Analog 1 / 2. Analog 2 / 4. Analog 4** displays the process variable name, present value, output current value and % of range for the output. 3. **Pulse Output** displays the process variable name, present value, output frequency and % of range for the output when a rate, density or temperature is assigned to the output. When a totalizer is assigned to the output, the process variable name, present value, pulses per unit of measure and number of pulses sent out will be displayed.

Menu or Display	Description

1. Analog 1 / 2. Analog 2 / 4. Analog 4
 	
   1. PV/SV/QV Process Variable
   2. Process Var
   3. AO1 Current
   4. AO1 % Range
	1. **PV (Primary Variable), SV (Secondary Variable), or QV (Quad Variable).** Process variable assigned to this output. Selections are Mass Rate, Volume Rate, Std Volume Rate, % Concentration, Concentration Rate, Density and Temperature.
	2. Present value of selected output.
	3. Output current of selected output.
	4. Percent of range of selected output.

3. Pulse Output
 	
   (Rate Variables)
   1. TV Process Var
   2. Process Var
   3. Frequency
   4. % Range
 	
   (Total Variables)
   1. TV Process Var
   2. Unit Total
   3. Pulses/Unit
   4. Pulses Out
	1. **TV (Tertiary Variable).** Process variable assigned to this output. Selections are Mass Total, Mass Forward, Mass Reverse, Volume Total, Volume Forward, Volume Reverse, Concentration Total, Concentration Forward, Concentration Reverse, and Batch Total
	2. **Process Var:** Present value of selected output.
	3. **Frequency:** Output frequency of selected output.
	4. **% Range:** Percent of range for selected output.
	
	1. **TV (Tertiary Variable):** Same as above.
	2. **Unit Total:** Present value of the output.
	3. **Pulses/Unit:** Pulses per unit of measure.
	4. **Pulses Out:** Number of pulses sent out.

2. View Status
 	
   1. View Status
   2. View Error Log
   3. Clear Error Log
	1. **View Status** list the process variables that are currently in alarm. This list is empty when no alarms are active. Reviewing this list acknowledges any new alarms.
	2. **View Error** Log list the internal errors that have occurred. Reviewing this list **does not** acknowledge the errors. The Clear Error Log must be performed.
	3. **Clear Error** Log clears the View Error Log and sets the counter to zero.

3. Program (Section 9.3A)
 	
   1. Enter Password
   2. Program
 	
NOTE:
	1. **Enter Password** allows the user to enter a password that will allow configuration data to be changed. If the entered password is incorrect, the message "Password entered is incorrect" will be displayed and the menu entry is exited. The entry must be reselected to input the correct password.
	
	This password is a 7-digit code that is independent of the password entered into the Datamate 2200 via the keypad or NexLink. When using the HHC, the configuration and programming data may be changed using only this password and is not protected by the password entered into the Datamate 2200. Default is "1111111".
	
	When the correct password is entered, the menu will return to the previous selections. Enter "Program" at this point and data may be edited.
	
	2. **Program** will allow the user to view the configuration data but no changes can be made unless the correct password has first been entered. After the correct password has been entered, this selection is used to access the configuration and programming menus.
	
	NOTE: If the Datamate 2200 has been put in write protect mode via the keypad or NexLink, even though a correct password has been entered, the configuration of the device will not be changed. If this occurs, the message "In Write Protect Mode" will appear.

Menu or Display	Description

2. Program
 	
   1. Calibration
   2. Diagnostics
   3. Configuration
   4. System
	1. **Calibration** allows the user to perform the following calibration functions: Zero, Temperature, Density, Mass and Analog Outputs.
	2. **Diagnostics** allows the user to perform the following diagnostic tests: Self Test, Alarm Test, Batch Relay Test and Analog Test.
	   NOTE: **The following tests are not available via the HART interface: Comm Test, Buttons Test and LCD Test.**
	3. **Configuration** provides the following menus for programming the unit: Batch, Misc Device Information, Alarms, Display, Xmitter Variables, Outputs, Totalizers and Char'ze Meter.
	4. **System** provides access to the following menus: Set Date, Set Time, Display Time/Date, and Password.

1. Calibration
 	
   1. Zero
   2. Temperature
   3. Density
   4. Mass
   5. Analog Outputs
	1. **Zero** provides menus that are used to zero the electronics, the transducer, and the system.
	2. **Temperature** provides menus to view the temperature calibration constants and to calibrate the unit's temperature measurement.
	3. **Density** provides menus that are used to view the density calibration constants and to calibrate the unit's density measurement.
	4. **Mass** provides menus that are used to view the mass calibration constants and to calibrate the unit's mass measurement.
	5. **Analog Outputs** provides menus that are used to view the analog outputs' calibration constants and to calibrate the selected output.

1. Zero
 	
   1. Electronics Zero
   2. Transducer Zero
   3. System Zero
	1. **Electronics Zero** is the zero offset contribution due to the electronics and is determined by zeroing the electronics with the sensor inputs shorted together.
	2. **Transducer Zero** is the zero offset contribution of the transducer and the installation. This is determined by subtracting the electronic zero from the system zero.
	3. **System Zero** is the combined zero offset of the electronics, transducer and the installation when there is flow.

2. Temperature
   1. Temp Cal Params
   2. Perform Cal
	1. **Temp Cal Params** allows viewing and manual entry of the temperature calibration constants.
	2. **Perform Cal** initiates the temperature calibration routine.

3. Density
   1. Dens Cal Params
   2. Perform Cal
	1. **Dens Cal Params** allows viewing and manual entry of the density calibration constants.
	2. **Perform Cal** initiates the density calibration routine.

4. Mass
 	
   1. Mass Cal Params
   2. Perform Dump Cal
   3. Perform Batch Cal
	1. **Mass Cal Params** allows viewing and manual entry of the mass flow scaler. The scaler may also be directly modified.
	2. **Perform Dump Cal** is used when the Datamate 2200 is not controlling the flow with its batch control outputs.
	3. **Perform Batch Cal** is used when the Datamate 2200's batching outputs via batch controller are used to control (start/stop) the flow.

5. Analog Outputs
   1. Analog 1
   2. Analog 2
   3. Analog 4
	1. **Analog 1 / 2. Analog 2 / 3. Analog 4**
	   Allows the user to edit the selected outputs Gain and Offset or to perform a calibration procedure on the selected output.

Menu or Display	Description
2. Diagnostics	1. **Self Test** reports the status of various software subsystems. All items should be "EMBEDDED". 2. **Alarm Test** is used to force the alarm outputs open and closed in order to test external wiring. 3. **Batch Relay Test** is used to force the batch relay outputs open and closed in order to test external Wiring. **WARNING: THIS TEST WILL OPEN/ENERGIZE ANY DEVICE ATTACHED TO THE BATCH OUTPUTS.** 4. **Analog Test** is used to provide a test current for testing equipment and wiring of 4-20mA current loops. 5. **Pulse Test** provides pulses to enable the user to test external wiring and hardware. 6. **Tube Drive Test** calculates the efficiency of the transducer and process defined as the ratio of sensor voltage to drive current.

3. Configuration
 	
   1. Batch
   2. Misc Device Info
   3. Alarms
   4. Display
   5. Xmit Variables
   6. Outputs
   7. Totalizers
   8. Char'ze Meter
	1. **Batch** allows the user to program all batch control data.
	2. **Misc Device Info** allows the user to enter or view identification information concerning the transmitter, transducer and software revision level.
	3. **Alarms** allows the user to program the two external alarms and an alarm start-up delay.
	4. **Display** allows the user to select three variables that will be displayed on the LCD display.
	5. **Xmit Variables** allows the user to enter the fallback and alarm setpoints for each flow variable, enter the % Solids/Concentration table, and program special flow units.
	6. **Outputs** allows the user to configure the analog, pulse and HART outputs.
	7. **Totalizers** allows the user to reset the Datamate 2200 totalizers.
	8. **Char'ze Meter** may be used to configure/modify the transmitter and transducer characterization.

4. System
 	
   1. Set Date
   2. Set Time
   3. Display Time/Date
   4. Password
	1. **Set Date** allows the user to set or confirm the date.
	2. **Set Time** allows the user to set or confirm the system time.
	3. **Display Time/Date** displays the current system time and date.
	4. **Password** permits the user to change or view the HHC password. **This is not the same password that is used to access the PROGRAM menu from the Datamate 2200 keypad.**

SECTION 10: MODEL NUMBER DESIGNATION

MODEL NUMBER								DESCRIPTION
DM2200	X	X	X	X	X	X	X	
	0							**Display**
	1							Blind - No Display or keypad
	2							LCD Display w/Function Keys
								LCD Display w/o Function Keys
		0						**Hazardous Approval Agency**
		2						None
								CSA
			0	0				**Option Board**
			1	1				None
								4-20mA Output
					0	0		**Special Application Software**
					1	0		None
								Net Oil
							0	**Batching Relays**
							1	None
								2 Relays 24-280 VAC

HART Accessories

PART NUMBER	DESCRIPTION
C0000012	Model 275 HART Hand Held Communicator w/ 4MB Memory
99999-700	Installation of Datamate 2200 HART Device Description on customer supplied Hand Held Communicator

SECTION 11: TRANSMITTER SPECIFICATIONS

Datamate 2200 Transmitter

Housing: Standard Temperature Limitations Housing: Blind LCD Display Power Max. Length of Signal Cable between transducer & Datamate 2200	Fiberglass IP66, NEMA 4 -40 to 60C (-40 to 140F) -20 to 60C (-4 to 140F) 12-36 VDC, 120/240 VAC, 50/60 Hz 20VA 300m (1000ft) Belden 89892, 8 conductor, 4 shielded twisted pairs

Hazardous Area Approvals	CSA - Class I, Div 2, Groups C and D
	      Class II, Div 2, Groups E, F, and G
	      Class III

Operator Interface	Front panel keypad Modbus, HART Communications RS485 Serial Communications
Configuration (via keypad or Modbus HART, RS485, NexLink Software	Display format, engineering units, system constants, scaling factors, output ranges, alarm set points, serial communication parameters, batch presets
Function commands	Display, interrogate, run, program, zero, calibrate, reset totalizers, clear alarms, initiate measurement

Local Display
 	
Flow Range
Density Range
Data Retention
Fault Diagnosis:
   Blind
   LCD Display
High and Low Alarms
 	
Serial Communications
 	
Digital Communications
	4-line, 40-character alphanumeric, displays mass, and volume, flow, flow rate and totals, density, temperature, solids/concentration & solids/conc low rate
	Complements the Red Seal Measurement Mass Flow Transducer
	0 to 3.0 g/cc
	Battery-backed RAM for 10 years in absence of power
	
	NexLink Software
	Error Message display and/or alarm outputs
	Two user-configured, open collector, 50 VDC, and 100mA maximum, programmable for all variables, plus batch total and diagnostics
	RS-485 selectable: baud rate; 1200, 2400, 4800, 9600, 10800, 12000,13200 parity, even, odd or none.
	Modbus, HART(optional)

Outputs (Standard)
 	
Mass Flow Rate
Mass Flow Total
Volume Flow Rate
Volume Total
Standard Volume Flow
Density
Temperature
Percent Solids/Conc
Two-stage batch control w/internal relays
Two-stage batch control w/optional
   pilot relays
Start/Stop Inputs
	Two 4-20mA, isolated, 1000 ohms load (max)
	Quadrature Pulse output, two channel 90 degrees out of phase phase 0.0025 to 10,000 Hz Full Scale
	g, kg, oz, lb, Ton, Spec, in time, units of seconds, minutes or hours
	g, kg, oz, lb, Ton, Spec
	cc,li, m3, usgpm, barrels, special
	cc, li, m3, gal, barrels, special
	cc,li, m3, usgpm, igpm, bb, special
	g/cc, lb/ft3, kg/m3, brix, baume, API
	deg C, deg F
	%
	Dual N.O solid state relays, 120VDC/AC, 100 mA
	Dual N.O. solid state relays, 240 VAC, 10A (U.L. Rating: 3A Resistive
	  for hazardous areas)
	Independent Momentary Contact

Manufacturer Instrument Model Number	Red Seal Measurement DM2200

Red Seal Measurement pursues a policy of continuous development and product improvement. The specifications above may thereof be changed without notice.

SECTION 12: REPLACING A DM2100 WITH A DM2200

Due to parameter changes from the DM2100 to the DM2200, the following information should be entered into the DM2200 upon changing out.

- Refer to Pg. 58 of the DM2200 O&M Manual for correct path to Electronic Zero, RTD Offset, Density Calibration Coefficients, and Scalar.

- Refer to Pg. 79 for Low-Flow Cutoff (Under Xmit Variables, Flow Variables, Mass Flow)

- The average values are to be entered into the DM2200 prior to test run.

Note: The relays supplied with the DM2200 are for AC systems only and will not operate on DC voltage. Relays for DC systems must be supplied by the user.

Meter Size	Scalar Average	Density Calibration Coefficients		Low-Flow Cutoff (lb./min.)	Average RTD Offset	Average Elect. Zero
		C1	C2			
1/8"	6.3528E+03	1.42E+05	1.53E+01	0.1	-0.0257	4.42E-05
1/4"	3.9242E+04	4.49E+04	6.05E+00	0.4	-0.0257	4.42E-05
1/2"	8.8785E+04	3.47E+04	3.84E+00	1.5	-0.0257	4.42E-05
1"	2.6172E+05	2.83E+04	3.45E+00	5.5	-0.0257	4.42E-05
2"	7.2392E+05	2.62E+04	2.59E+00	16	-0.0257	4.42E-05
3"	1.7596E+06	6.18E+03	1.88E+00	45	-0.0257	4.42E-05
4"	1.5633E+06	8.70E+03	2.53E+00	75	-0.0257	4.42E-05

SECTION 13: FORMS FOR RETURN OF GOODS

RED SEAL
MEASUREMENT

Red Seal Measurement, Inc. 1310 Emerald Road Greenwood, SC 29646	**RMA Certification** Transmittal Form	Ph: (864) 223-1212 Fax: (864) 223-0341
MSDS INCLUDED: YES ❑ NO ❑	**Date:** _____	**RMA Number:** _____
Company: _____		
Returned Materials: _____		
Model #: _____ Serial #: _____		
Fluid Identification: _____		

POLICY AND PROCEDURES FOR RETURNED MATERIALS

To ensure the safety of personnel and to prevent improper handling and disposal of materials including those listed in OSHA 1910, Subpart Z (Toxic and Hazardous Substance List), Red Seal Measurement has adopted the following policy and procedure for the return of goods to be evaluated or repaired.

POLICY

It is the policy of Red Seal Measurement that no returned materials would be accepted from any end user without a Return Material Authorization (RMA) number clearly visible on the exterior of the shipping container. Returned materials using the RMA number constitutes an agreement to comply with this policy and procedure. Goods received that are not in compliance will be returned to the end user and any cost incurred will be invoiced to the end user.

PROCEDURE

1. Prior to shipping, the end user will contact Red Seal Measurement to request a RMA number. The request will identify the material(s) to be reviewed, and either state that the device(s) are empty and free of all process and cleaning substances or provide Material Safety Data Sheets (MSDS) for the substances in the device(s), unless Red Seal Measurement agrees that a MSDS is not necessary for the process fluid.
2. The end user will contact Red Seal Measurement for instructions on opening any closed cavity if a leak into the closed cavity is suspected.
3. Red Seal Measurement will not accept any goods wetted with process or other fluid unless the MSDS has been submitted in advance for review and written approval.
4. The returned material(s) must be:
   (a) fully and accurately described by the proper shipping name;
   (b) properly classified, packed, marked and labeled, and;
   (c) in proper condition for transport by highway according to applicable international and national government regulations, the laws and regulations of the State of South Carolina and all other applicable laws and regulations.

END USER CERTIFICATION

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I am aware that violation of the policies and procedures of Red Seal Measurement will result in return of material(s) to the end user; and are subject to the possibility of penalties from the applicable international and national government regulations and the laws of the State of South Carolina; and agree to indemnify Red Seal Measurement for any loss or expense resulting from violation in the policies of Red Seal Measurement.

Upon compliance with the above steps, the shipper will place a signed copy of this form with the Red Seal Measurement address and RMA number visible along with all appropriate MSDS and additional information requested.

Signature: _____ **Date:** _____

Print Name: _____

RG-03   Revised   6/8/10

RED SEAL
MEASUREMENT

RETURN MATERIAL AUTHORIZATION
Please complete Form and Fax to 1-800-833-6971

<u>**Section A**</u>   <u>**Section B**</u>

An Incomplete Form May Delay Processing of this RMA.   **Return number: _____ RMA**

Dist/Rep Name and Address: Certification sheet or MSDS is Required

_____   **SHIP TO: Red Seal Measurement, Inc.**
_____   **1310 Emerald Road**
_____   **Greenwood, SC 29646**
_____
Account # _____
Contact Person: _____

Phone #: _____   ___ No Material to be Returned. Credit # _____

Fax #:   _____   ___ Parts to be returned for repair and replacement.

                                                        ___ Restocking fee to apply of _____%

SECTION C: Please Mark All Applicable Boxes with an "X"

    1. Register Repair   6. Ordered Wrong Part Number

    2. Defective Flow Meter/Part   7. Non-Warranty (Evaluate/Repair)

    3. Defective Replacement Part   8. Stock Return (On approval)

    4. Reimburse Labor Hours   9. Order Entered Incorrectly

    5. Shipped Incorrect Part Number

SECTION D: Please Complete the Following Information

    RSM Order No.   _____   Order Date: _____
    Distributor P.O. #:   _____   P.O. # Date: _____
    Date of Installation: _____   Size & Type of Meter: _____
    Flow Meter Serial #   _____   Register Serial #:   _____

Customer Name: _____   Address: _____
                                                                 _____

1) Describe Problem in Detail – (Attach Additional Sheet if Necessary)
    _____
    _____
    _____

2) Service Performed to Correct Problem – (Attach Additional Sheet if Necessary)
    _____
    _____
    _____

3) Location Where Service was Performed   _____   4) Labor Hrs. to Perform Service: _____
                                                                             (Travel Time Not Included)

SECTION E: Please List the Material Involved in Your Claim: (Ship Material Pre-Paid Only)

QTY	PART NUMBER	DESCRIPTION	REPLACEMENT ORDER

SECTION F: For Red Seal Measurement Use ONLY   DATE: _____   Value of Material : $ _____
               Authorized by (Up to $2,500):   _____
               Credit Returns $2,500 – Customer Service Mgr. _____
               Credit Returns $10,000 – General Mgr.   _____
               Credit Returns $10,000 – Controller   _____

Warranties and Limitations of Damages and Remedies

Seller warrants that at the time of delivery, products delivered or services to be performed hereunder will conform to applicable drawings and specifications and will be free from defects of materials and workmanship for a period of eighteen (18) months from the date of delivery to Customer, or twelve (12) months from the date of installation of products or the completion of services by Seller, whichever occurs first. Upon prompt notice by Customer of any nonconformity or defect, which notice must be given within thirty (30) days from date such nonconformity or defect is first discovered, Seller's obligation under this warranty is limited, and at its option, to replacing at its plant, with transportation charges prepaid by Customer, the product or component part thereof that is proved to be other than as herein warranted or, in the case of services, to promptly performing all reasonable repairs or replacement of defective or improperly installed products or components at Buyer's site where such defective or improperly installed components are located. This warranty does not extend to any of Seller's products which have been subject to misuse, abnormal use, accident, improper installation by Customer or improper storage, improper maintenance or application or unusual environmental conditions, nor does it extend to products which have been repaired or altered outside of Seller's plant unless authorized in writing by Seller or unless such installation, repair or alteration is performed by Seller, nor does this warranty extend to any labor charges for removal and/or replacement of the nonconforming or defective product or part thereof unless such product was originally installed by Seller.

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER EXPRESS OR IMPLIED WARRANTIES ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING ANY WARRANTIES OF MERCHANT-ABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT WILL SELLER BE LIABLE FOR INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES SUFFERED BY PURCHASER OR ITS CUS-TOMERS INCLUDING LOST PROFITS OR REVENUE.

Seller's liability for any claim arising hereunder shall not exceed the price of the product or service which gives rise to the claim or the cost by Seller to repair or replace defective products or installation, whichever is less. Customer assumes all other risk and liability for any loss, damage or injury to persons or property arising out of, connected with, or resulting from the use of Seller's products, either alone or in combination with other products.

RED SEAL
MEASUREMENT