770MAX
Multiparameter Analyzer/Transmitter
Service Manual
IMPORTANT SAFETY INFORMATION

This instrument is compliant with safety standards as outlined in the European Community low voltage directive EN61010-1 and with CSA Std C22.2, No. 0-M1982 General Requirements – Canadian Electrical Code, Part II, 0.4-M1982 Bonding and Grounding of Electrical Equipment and 142-M1987 Process Control Equipment. Certification is pending.

Please read and observe the following:

INSTALLATION: This instrument must be installed by trained instrumentation personnel in accordance with relevant local codes and instructions in this manual. Observe all instrument specifications and ratings.

SHOCK HAZARD: Make sure power to all wires is turned off before proceeding with installation or service of this instrument. High voltage may be present on the input power and relay wires.

RELAY CONTROL ACTION: 770MAX optional relays will always de-energize on loss of power, equivalent to normal state, regardless of relay state setting for powered operation. Configure any control system using these relays with fail-safe logic accordingly.

PROCESS UPSETS: Because process safety conditions may depend on consistent operation of this instrument, take appropriate action to maintain conditions during sensor cleaning, replacement or sensor or instrument calibration. A timed “Hold” function may be selected which holds analog output signals and relays with their existing conditions for a set maintenance time interval.

This manual includes safety information with the following designations and formats:

WARNING: POTENTIAL FOR PERSONAL INJURY.

CAUTION: possible instrument damage or malfunction.

NOTE: important operating information.

⚠️ On the instrument indicates: Caution, risk of electric shock

⚠️ On the instrument indicates: Caution (refer to accompanying documents)
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CHAPTER 1: INTRODUCTION

See Instruction Manual 84372 supplied with the instrument for standard operating information for the 770MAX. This service manual covers instrument calibration, upgrades, RS232 communications and other information for troubleshooting and training.

The 770MAX is provided with a Help key which provides supplementary information about the area of the menus being displayed. It can be especially helpful in initial configuration.

INSTRUMENT OVERVIEW

The 770MAX series utilizes 3 or 4 surface-mount printed circuit boards plus a display module which slide into the molded case and are held in place by the front cover secured by two screws.

The main circuit board is located in the front of the instrument. It contains the display module, main processor, operating firmware and flash memory which retains all setup configuration data plus calibration data for (standard) analog outputs 1-4.

The power supply circuit board is located on the left side of the instrument. It contains the universal 100-240 VAC or 24 VDC power supply plus terminal connections for the 4 standard analog outputs, RS232 communications, discrete inputs and outputs and pulse flow input circuits.

The measurement circuit board is on the right side of the instrument and contains the measuring and communication interface circuits for smart sensors plus the NVRAM with measuring circuit calibration data.

The options circuit board, if used, is in the center and contains 4 relays, and may contain 4 additional analog output circuits and their calibration data, depending on the option specified. The label on the rear of the case depends on which, if any, options board is installed. An options board may be installed in the field using the appropriate kit of parts.

770MAX exploded view
WIRING

For full installation wiring instructions, refer to manual 84372. Information here is for reference only.

CAUTION: Route all sensor and output signal wiring away from power and switching circuits to minimize noise pickup and interference.

AC Power Wiring

<table>
<thead>
<tr>
<th>Board</th>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1</td>
<td></td>
<td>Earth ground</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>AC power, neutral</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>AC power, hot</td>
</tr>
</tbody>
</table>

CAUTION: Power wire insulation must be stripped back 0.5 in. (13 mm) for reliable connection.

DC Power Wiring

<table>
<thead>
<tr>
<th>Board</th>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1</td>
<td></td>
<td>Earth ground</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>DC power, positive</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>DC power, negative</td>
</tr>
</tbody>
</table>

CAUTION: Power wire insulation must be stripped back 0.5 in. (13 mm) for reliable connection.

SENSOR WIRING

Smart sensor patch cords plug into jacks CH1 through CH4. To avoid confusion when unplugged, label the channel at the end of each patch cord.

Extending or making a break in patch cords must be done only using extension cables 1005-87 (5 ft, 1.5 m) or 1015-87 (15 ft, 3 m) and union connector 25320.

CAUTION: Do not cut or shorten patch cords. They use very fine gage shielded cable not suitable for screw terminals or splicing. Do not extend patch cords using computer network cables since they provide only 8 of the 10 conductors needed by 770MAX and will damage the modular jacks.

Pulse input flow sensor wiring is shown in Appendix B of Instruction Manual 84372.
# Other Connections

Refer to rear panel figure for location.

<table>
<thead>
<tr>
<th>Board</th>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB2</td>
<td>1</td>
<td>Shield</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>+5V</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Discrete in 2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Discrete out 2</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Channel 6 flow</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Channel 5 flow</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Digital ground</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>RS232 receive</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>RS232 transmit</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Shield</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Discrete in 1</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Discrete out 1</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Analog output 4 +</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Analog output 3 +</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Analog output -</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Analog output -</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Analog output 2 +</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Analog output 1 +</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Board</th>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB3</td>
<td>21</td>
<td>Shield</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>Not Used</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>Not Used</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>Analog output 5 +</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>Analog output 6 +</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>Analog output -</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>Analog output -</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>Analog output 7 +</td>
</tr>
<tr>
<td></td>
<td>29</td>
<td>Analog output 8 +</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Shield</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Board</th>
<th>Terminal</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB4</td>
<td>1</td>
<td>Relay 3, normally open</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Relay 3, common</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Relay 3, normally closed</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Relay 4, normally open</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Relay 4, common</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Relay 4, normally closed</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Relay 1, normally open</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Relay 1, common</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Relay 1, normally closed</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Relay 2, normally open</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Relay 2, common</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Relay 2, normally closed</td>
</tr>
</tbody>
</table>
CHAPTER 2: METER CALIBRATION

The 770MAX has been factory calibrated to meet its specifications. It is not normally necessary to re-calibrate unless extreme conditions cause out-of-spec operation shown by verification. Periodic verification or calibration may also be necessary to conform with QC requirements.

The 770MAX may be calibrated using high precision resistance decade boxes, voltage source and frequency generator with the following procedures. This is intended only for installations that have a policy of traceability to their own internal standards. Standards equipment accuracies must exceed the 770MAX specifications as required by the applicable QC policy.

NOTE: This is an extensive process requiring 72 calibration points to fully cover all measurement ranges of all parameters on all channels. It is strongly recommended, where possible, to use the Thornton 1875 Automatic Smart Calibrator Kit which is supplied with a traceable certificate of accuracy. It also enables printing out calibration certificates for instruments it has calibrated. It is supplied with its own instruction manual.

It is necessary to verify and/or calibrate only those measuring circuits actually being used in the installation. The following Adapters are needed to interface with standards equipment:

1000-82 resistance adapter for conductivity, resistivity, temperature.

1000-79 voltage adapter for pH, ORP, pressure, level.

1000-83 frequency adapter for flow.

Before attempting calibration, perform a verification to determine if calibration is, in fact, necessary. Verify at least one value for each internal range. Recommended values are given in the table at the end of the verification procedure.

VERIFICATION PROCEDURE

1. If the 770MAX outputs are connected for alarm or control, set a hold time per steps 3-6 of the calibration procedure in the next section. Press Menus twice to exit.

2. Connect the appropriate adapter to the patch cord of the channel to be verified.

3. Connect the adapter leads to the test equipment. (The resistance adapter has four leads—two for resistance and two for temperature.)

4. On the 770MAX front panel, press Menus.

5. Press the up arrow key until “Go to: Calibrate” is displayed. Press Enter.

6. Press the down arrow key to display “Go to: Meter-Verify”.

7. Press Enter. The channel, parameter and range identification are displayed.

8. Select the channel and measurement type to be verified using Enter and up arrow. (Measurement types are Res, Temp, Volts and Freq.)

9. Enter the verification value from Table A at “Input: __”, including any unit multiplier, e.g. K, M, etc.

10. Set the test equipment for exactly the same verification value from Table A.

11. Allow the error value to fully stabilize and then confirm that the resulting Error (in percent of reading, except for voltage) is acceptable.

12. NOTE: Calibration is unnecessary if the error is smaller than the limit of error of the standard or of the 770MAX specification.

13. Press Enter to reach the parameter/range field, e.g. Res #__.

14. Press up arrow to go to the next range and repeat steps 8-12 for the 3 remaining resistance verification points.

15. Repeat steps 8-13 for the other channels to be verified.

16. For the temperature range, repeat steps 2-14 but with the decade box connected to the temperature leads of the conductivity adapter.

17. For the voltage range, repeat steps 2-15 with a precision voltage source connected to Smart voltage adapter 1000-79.

18. For the frequency range, repeat steps 2-15 with a precision frequency generator producing a

---

1 The meter will display Res #1, Res #2, Res #3, or Res #4. This is to accommodate a future feature. All of these selections are equivalent: the meter will auto-range to the correct measuring circuit regardless of the number indicated.
0-3 V square wave connected to Smart frequency adapter 1000-83.

19. For frequency verification of channels 5 and 6, connect the frequency generator directly to TB2 terminals 7 (+) and 6 (+) respectively and to common, TB2 terminal 2 (-). Repeat step 18, omitting the adapter.

20. Press Menus twice to exit.

**Recommended Verification Points**

<table>
<thead>
<tr>
<th>Parameter &amp; Range</th>
<th>Verification Point</th>
<th>Range of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Res 4*</td>
<td>100 Ω</td>
<td>0 – 700 Ω</td>
</tr>
<tr>
<td>Res 3*</td>
<td>2000 Ω</td>
<td>300 – 14,000 Ω</td>
</tr>
<tr>
<td>Res 2*</td>
<td>50,000 Ω</td>
<td>3750 – 175,000 Ω</td>
</tr>
<tr>
<td>Res 1*</td>
<td>1 MΩ</td>
<td>150,000 – 10 MΩ</td>
</tr>
<tr>
<td>Temp</td>
<td>1100 Ω</td>
<td>900 – 1500 Ω</td>
</tr>
<tr>
<td>Volts</td>
<td>0.5 V</td>
<td>-1.5 to +1.5 V</td>
</tr>
<tr>
<td>Freq</td>
<td>500 Hz</td>
<td>0.5 – 4000 Hz</td>
</tr>
</tbody>
</table>

*The 770MAX automatically selects the appropriate measuring range for the resistance it detects.

**CALIBRATION PROCEDURE**

1. Connect the appropriate adapter to the patch cord of the channel to be calibrated.

2. Connect its leads to the test equipment. (The resistance adapter has four leads—two for resistance and two for temperature.)

3. On the 770MAX front panel, press Menus.

4. Press the up arrow key until “Go to Calibrate” is displayed, then press Enter.

5. Press the up arrow key to display “Go to: Meter” and press Enter.

6. In “Hold time= 00 mins”, if meter outputs are connected for alarm or control, enter a value greater than the time in minutes needed to complete calibration. Analog and relay outputs will be held at their current status for that period of time to prevent upset while off-line.

7. Press Enter. The channel, parameter and range identification are displayed.

8. Select the channel and range to be calibrated using Enter and up arrow. Select the calibration Type (number of points). It is recommended to do 3-point calibrations for resistance and 2-point calibrations for all other measurements, including temperature.

9. Press Page Down to display the CALIBRATE METER screen with the reading and the recommended calibration value.

10. Set the test equipment for the exact calibration value.ii

11. Press Page Down and wait for the calibration to be performed.

12. Repeat steps 10 and 11 for additional calibration points.

13. On completion, “METER CAL IS DONE” will be displayed. Correct the date if necessary and page up twice to the main calibration screen.

14. Set the channel, parameter, range and type for the next calibration and page down.

15. Repeat steps 8-14 for the remaining ranges.

16. Repeat steps 1 and 8-15 for the other channels to be calibrated.

17. For the temperature range, repeat steps 1-2 and 8-16 but with the decade box connected to the temperature leads of the conductivity adapter.

18. For the voltage range, repeat steps 1-2 and 8-16 with a precision voltage source connected to Smart voltage adapter 1000-79.

19. For the frequency range, repeat steps 1-2 and 8-16 with a precision frequency generator producing a 0-3 V square wave connected to Smart frequency adapter 1000-83.

20. For frequency calibration of channels 5 and 6, connect the frequency generator directly to TB2 terminals 7 (+) and 6 (+) respectively and to common, TB2 terminal 2 (-). Repeat step 19, omitting the adapter.

21. Press Menus twice to exit.

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ii Units manufactured prior to March 00, may give an erroneous default resistance on one range of 2Ω which should be changed in the display and in the decade box setting to 200Ω.
## Calibration Values

<table>
<thead>
<tr>
<th></th>
<th>Point 1</th>
<th>Point 2</th>
<th>Point 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Res #1</td>
<td>4.000MΩ</td>
<td>160.0KΩ</td>
<td>1.8MΩ</td>
</tr>
<tr>
<td>Res #2</td>
<td>160.0KΩ</td>
<td>7000Ω</td>
<td>25.0KΩ</td>
</tr>
<tr>
<td>Res #3</td>
<td>7000Ω</td>
<td>500.0Ω</td>
<td>2000Ω</td>
</tr>
<tr>
<td>Res #4</td>
<td>500.0Ω</td>
<td>10.0Ω</td>
<td>200.0Ω</td>
</tr>
<tr>
<td>Temp</td>
<td>1000Ω</td>
<td>1400Ω</td>
<td>-</td>
</tr>
<tr>
<td>Voltage</td>
<td>1.000V</td>
<td>-1.000V</td>
<td>-</td>
</tr>
<tr>
<td>Freq.</td>
<td>100.0 Hz</td>
<td>1000.0 Hz</td>
<td>-</td>
</tr>
</tbody>
</table>
CHAPTER 3: ANALOG OUTPUT CALIBRATION

ANALOG OUTPUT CALIBRATION

This section describes calibration of the 0/4-20 mA output signals. For startup information to scale the range that the signal represents in engineering units, see main Instruction Manual 84372, Chapter 4. Analog output signals are factory calibrated within specifications but may be re-calibrated if necessary.

The 770MAX analog output calibration is performed by measuring the output signal when it is set to its minimum (4 mA) and maximum (20 mA) limits and entering the exact mA value into the instrument’s display. The 770MAX automatically computes any deviation from 4 and 20 mA and adjusts itself accordingly. Verification of outputs is accomplished through a diagnostic menu.

It is desirable to calibrate and verify when the system receiving instrumentation is connected in the circuit to present the approximate operating load to the circuit. Maximum load is 500 ohms.

Calibration Procedure

1. Disable or place in manual any control system using the analog output signals since they will be interrupted during calibration.

2. Connect a high precision milli-ammeter in series with the analog output signal to be calibrated. (See Chapter 1 for terminal connections.)

3. Press Menus and Up arrow to display “Goto: Calibrate”, and press Enter.

4. Press Up arrow to display, “Goto: Analog”, and press Enter twice, (press Enter once for meters with software version 2.5 or greater), passing through the Hold Time screen.

5. Select the output signal # to be calibrated and press Enter.

6. Read the exact output current on the milli-ammeter and enter that precise value into the “4 mA reads= 4.0000” screen and press Page Down. (NOTE: For meters with software version 2.5 or greater, at the “4mA adjust=” screen, use arrow keys and re-adjust % value displayed until milli-ammeter reads 4.000mA and press Page Down.)

7. Read the exact output current on the milli-ammeter and enter that precise value into the “20 mA reads= 20.000” screen of the 770MAX and press Page Down. (NOTE: For meters with software version 2.5 or greater, at the “20mA adjust=” screen, use arrow keys and re-adjust % value displayed until milli-ammeter reads 20.000mA and press Page Down.)

8. Enter the date and press Page Down to save it.

9. Press page up twice and repeat steps 2 and 5-8 for the additional outputs.

10. Press Menus twice to exit and resume normal measurement. The 770MAX automatically computes any deviation from 4 and 20 mA and adjusts itself accordingly.

11. Reactivate any system suspended in step 1.

ANALOG OUTPUT VERIFICATION

Analog outputs may be verified using the 770MAX diagnostic menu and a milli-ammeter. The menu allows setting the analog outputs to specific mA values.

Verification Procedure

1. Disable or place in manual any control system using the analog output signals since they will be interrupted during verification.

2. Connect a high precision milli-ammeter in series with the analog output signal to be verified. (See Chapter 1 or terminal connections.)

3. Press Menus and Down arrow to display, “Goto: Diagnostic” and press Enter.


5. Using up/down arrows select the Analog Output # to be verified and press Enter.

6. Using up/down arrows set Output @ 4.00mA or another level to be verified.


8. Measure the actual output on the milli-ammeter, record the value and compare it with 770MAX output specifications.
9. Repeat steps 6 through 8 for 8, 12, 16 and 20mA.

10. Press Menus twice to exit

12. Reactivate any system suspended in step 1.
CHAPTER 4: UPGRADES

There is software for various functions located in the 770MAX. The need for field upgrade is likely to occur only with the Main Program and Measurement software.

Optional relays and additional analog outputs can be added in the field using the appropriate kits described later in this chapter.

MAIN AND MEASUREMENT SOFTWARE UPGRADE

For software upgrades, refer to upgrade kits: 91006 Upgrade Tools (one kit per site) and 91007 Upgrade Components (one kit per instrument) and their instructions 84551. For reference, the connections to the 770MAX RS232 port are given below. If the computer has a 25-pin connector, on that connector, pin 7 connects to Ground, pin 3 connects to Receive, and pin 2 connects to Transmit. Software upgrade kits may only be used in an instrument with main software revision 3.0 or higher.

770MAX to computer RS232 port wiring

OUTPUT UPGRADES

Relays and additional analog outputs may be added with circuit boards to an existing 775-_A0 Instrument (which has no option board already installed). Kit 1000-91 adds 4 SPDT relays to convert an instrument to model 775-_A1. Kit 1000-92 adds 4 SPDT relays and 4 additional analog outputs, to convert an instrument to model 775-_A2.

CAUTION: Adding these outputs restricts operating conditions:

Kit 1000-91 lowers the maximum ambient temperature rating to 104°F (40°C) when operating on 230 VAC power.

Kit 1000-92 lowers the maximum ambient temperature rating to 104°F (40°C) on 115 VAC power and cannot be used above 130 VAC. This kit may only be installed in an instrument with main software revision 1.5 or higher.

Output Kit Installation Procedure

1. Disconnect power wiring and unplug all input and output connections from the unit, labeling the location of each plug-in connector for use in re-installation.

2. Peel off the rear face terminal identification label and replace it with the label supplied in the kit which will have additional cutout(s).

3. Loosen the two front cover screws—they are captive and will be retained in the cover.

4. Lift the front cover off the instrument and unplug the keypad ribbon cable from the front circuit board.

5. Carefully slide the entire assembly of circuit boards out of the case onto a static-free surface.
6. As shown in the exploded view in Chapter 1: Introduction, align the new output option circuit board with the large dual connector at the bottom back, between the power supply and measurement boards. Carefully plug it into the back of the main circuit board.

7. Carefully align the entire circuit board assembly so each circuit board keys into its respective slot in the case and slide it in. Some flexing may be necessary to assure complete installation. The terminal blocks must fit into the cutouts to be flush with the back of the case.

8. Plug the front cover keypad ribbon cable back onto the display circuit board pins.

9. Replace the cover back onto the instrument and tighten the two cover screws.

10. Mark the instrument identification label with the appropriate model number: replace the final “0” in 775-_A0 with a “1” if using 1000-91 or with a “2” if using 1000-92.

11. Reinstall the existing wiring plugs to respective receptacles and add connections to the new outputs as required.
CHAPTER 5: TROUBLESHOOTING

ON-LINE ERROR MESSAGES
The following messages can appear in the “Go to: Messages” menu to indicate error conditions or problems with reading sensors. This menu area should always be checked first when an operating problem is encountered.

2. "No sensor on chan"
3. "Invalid sensor type"
4. "Sensor checksum err"
5. "Sensor const bad" – the sensor multiplier or adder factor may be wrong.
6. "Invalid pipe ID"
7. "Invalid tank height"
8. "Invalid channel" – the selected channel is wrong for the desired measurement (i.e. %Rejection, ratio, etc.).
9. "Res sensor open" – patch cord or sensor cable may be bad.
10. "Res sensor shorted" – patch cord or sensor cable may be bad.
11. "Compensate error" – wrong compensation method selected or conductivity may be too high for this compensation method.
12. "Temp out of range"
13. "Unable to measure R" – unable to measure resistance of sensor (air bubble, dry cell, etc.).
14. "Invalid max PSI"
15. "Invalid tank area"
16. "Unknown measurement"
17. "Too big to display" – the measurement is too large to be displayed.
18. "Total flow over" – total flow has reached the upper limit.
19. "Temperature high"
20. "Voltage over range" – the voltage from the sensor (pH, pressure) is too high (bad sensor).
21. "Invalid max GPM"
22. "Check TDS factor"
23. "Range may be wrong" – measurement may have a wrong range (i.e. set for S/cm instead of uS/cm).
24. "Invalid setpoint #"
25. "Reference volts bad" – for pressure sensors this is a bad sensor.
26. "Flow rate is 0" – the flow rate is zero gpm so the calculated measurement is zero or over range.
27. "Bad meter calibrate" – a meter calibration factor is bad, should recalibrate.
28. "A/D over range" – the A/D convert reported an error, may be a defective measurement board.
29. "Unknown error #xxxx"

"LSC is Locked" could appear in the startup screen and indicates that internal local serial channel communication has halted. This could be caused by loose internal connections. Re-seat all circuit board and ribbon cable connectors and re-power the instrument. If the message persists, factory service will be required.

NOTE: When a 500TOC Sensor is connected to a 770MAX instrument, the ‘Messages’ menu area will appear different. There will be three options shown on the message display: 1-Current Messages, 2-Messages History, and 3-Clear History. There may be Error and Fault messages specific to the 5000TOC Sensor within these menu options. Refer to the 5000TOC operations manual, 84445 for detailed information regarding Error and Fault messages specific to the 5000TOC Sensor and the use of these menus.

SENSOR TROUBLESHOOTING

Temp. Compensated Measurements
Temperature compensated measurements such as conductivity/resistivity and pH require the temperature signal from the sensor to be within range or the compensated measurement will display asterisks. If the temperature signal has failed or is not available, operation can be continued by changing the temperature source (under the Measurements menu) to a fixed value or to use the temperature signal from another channel that is also correct for this measurement. In some cases, using temperature from another channel
may be desirable anyway, to obtain a faster responding or more accurate temperature signal.

“Raw” Sensor Signals

Direct reading of the sensor output is available from the “Measurements” menu. It gives “raw” readings in base units, e.g. Hz for flowrate. It is not adjusted with calibration factors, temperature compensation, etc. and is helpful in finding the cause of erroneous readings.

To view the “raw” reading, press Menus and select the desired measurement. Page down to the last normal screen (indicated by disappearance of the down arrow in the lower right corner), then page down one more to see “Raw reading from the sensor= XXXXX XX” plus identification of channel (and internal range for resistivity).

OFF-LINE DIAGNOSTICS

The Diagnostic Menu is used to run a series of off-line automated diagnostic testing routines to verify the operation of system components, including: meter, sensors, analog output, serial port, network, display, keypad, flow channels, inputs and outputs.

NOTE: Some diagnostic tests may interrupt normal operation (such as analog outputs).

To access the Diagnostic Menu:

1. Press Menus.
2. Press the up arrow key until the Diagnostic Menu is displayed, and then press Enter.
3. Use the up/down arrow keys to select a test, then press Enter. The indicated test will be performed and the results displayed.
4. To test another component, press Page Up to return to the Diagnostic Menu and select the next component.
5. After completing the desired diagnostics, press Menus twice to exit the menu system and return to display mode.

See the appropriate section below for information regarding the specific diagnostic tests.

Meter Tests

Use to test the timers, ROM checksum, and RAM. Tests are performed sequentially, press Enter to perform next test.

Smart Sensors

Select a channel to view the raw sensor data (actual voltage, ohms, etc.).

Analog Output

Select an output to test, and then enter a current value (milliamps) to send out the analog output then press Page Down to set. Repeat test with a second current value to verify range response.

Serial Port

On back of meter, use a jumper wire to connect TB2 terminals 9 and 10 then press Enter to begin test.

Network

Diagnostic not currently available.

Display

An automated sequence will test the display of all characters (alpha, numeric and symbol). Press Enter to stop the test.

Keypad

Press any key to test its response; the correct name of the key should be displayed. Press Menus twice to exit this test.

Flow Channels

Diagnostic not currently available.

Inputs

The level of the input lines (high or low) will be displayed and updated every second.

Outputs

Set the outputs low or high for testing. Press 1 to set low or 2 to set high.

Self Tests

An automated series of tests will check the operation of the following components:

- Smart sensors
- Analog outputs
• Discrete outputs
• Discrete Inputs
• Network
• Display circuit board
• Measurement circuit board
• Options circuit board
• Other circuits (ROM, RAM, etc.)

The display shows how many tests have run, the elapsed time and the number of errors found. Press **Menus** to stop the test sequence.
CHAPTER 6: RS232 COMMUNICATIONS

Connections for the RS232 serial port are shown in Chapter 4.

GENERAL

The Serial Port Communications command set provides the user with complete control and configuration of a meter.

1. All messages sent to and from the meter will consist of the printable set of ASCII characters. Each message will be terminated with a carriage-return (<CR>) character.
2. All messages sent to the 770MAX will receive a response. The response will consist of the requested data, an "OK" message, or an error message.
3. All commands must specify an identifier address (same as the network address). The identifier address "00" will be read by any meter as its address. Therefore there are two addresses that the meter will respond to: address "00" and the address set as the Network Address.

COMMAND FORMAT

The format of all commands is: "axxc…c<CR>".
Where:
  "a" is the opcode (upper case letter from A to Z).
  "xx" This address is "00" for the serial port interface.
  "c…c" is the command data. Format may include "=" for setting parameters or special function characters
  <CR> is the ASCII carriage-return character.

RESPONSE FORMAT

The format of all responses is: "axx=c…c<CR>".
Where:
  "a" is the opcode (upper case letter from A to Z).
  "xx" is the network address of the unit (from 01 to FF hexadecimal).
  "c…c" is the response data.
  <CR> is the ASCII carriage-return character.

The response data will be one of the following types:
1. Command Accepted: if the command is accepted then the response data section will consist of the message "OK".
2. Command Data: if the command requests data then that information will be returned. The format of the data depends upon the command type.
3. Command Rejected: if the command is rejected then an error message will be returned with the format: "ERROR #yy" where "yy" is an error code.

ERROR CODES

The following error codes will be used when a command is rejected (the format is "ERROR #xx"):  
  01: invalid opcode.
  02: parameter error.
  03: checksum error.
  04: parity error.
  05: unit is not available.
  06: command failed.
  07: timeout error.
  0C: overflow error
  0D: invalid board type
  0E: data not available
## COMMAND SET

### Command Summary

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Opcode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Returns the software revision level and serial number.</td>
<td>A</td>
</tr>
<tr>
<td>Set Auto Data Output</td>
<td>Enables or disables the data output</td>
<td>B</td>
</tr>
<tr>
<td>Copy Calibration</td>
<td>Copies calibration data from one channel to all others</td>
<td>C</td>
</tr>
<tr>
<td>Get Data</td>
<td>Returns the latest set of measurement data</td>
<td>D</td>
</tr>
<tr>
<td>Echo Command</td>
<td>Echoes the characters in the command (for testing the port)</td>
<td>E</td>
</tr>
<tr>
<td>Get Messages</td>
<td>Returns all messages for a measurement</td>
<td>F</td>
</tr>
<tr>
<td>Get Parameter</td>
<td>Gets a parameter value</td>
<td>G</td>
</tr>
<tr>
<td>Print Meter Setup</td>
<td>Sends the meter setup out serial port (readable format).</td>
<td>H</td>
</tr>
<tr>
<td>Read Input Line</td>
<td>Reads the state of an input line</td>
<td>I</td>
</tr>
<tr>
<td>TOC Control</td>
<td>Performs various control functions on a TOC sensor</td>
<td>J</td>
</tr>
<tr>
<td>Key Press</td>
<td>Simulates a key press, returns the menus displayed</td>
<td>K</td>
</tr>
<tr>
<td>Get/Set Output Line</td>
<td>Gets or sets the state of an output line</td>
<td>L</td>
</tr>
<tr>
<td>Display Message</td>
<td>Displays a message</td>
<td>M</td>
</tr>
<tr>
<td>Set Analog Output</td>
<td>Sets the analog output current to a level (for testing)</td>
<td>O</td>
</tr>
<tr>
<td>Print Error Status</td>
<td>Returns a summary of all error counters</td>
<td>Q</td>
</tr>
<tr>
<td>Reset</td>
<td>Performs various types of resets</td>
<td>R</td>
</tr>
<tr>
<td>Set Parameter</td>
<td>Sets a parameter value</td>
<td>S</td>
</tr>
<tr>
<td>Get/Set Date/Time</td>
<td>Gets or sets the date or time</td>
<td>T</td>
</tr>
<tr>
<td>Self Test</td>
<td>Performs all of the self tests</td>
<td>U</td>
</tr>
<tr>
<td>Return All Setup</td>
<td>Returns all setup information</td>
<td>Z</td>
</tr>
</tbody>
</table>

All other opcodes will return an error message.

---

Chapter 6  RS232 Communications  15
Command Size

<table>
<thead>
<tr>
<th>Command</th>
<th>Opcode</th>
<th>Min/Max # of Bytes in Command</th>
<th>Min/Max # of Bytes in Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attention</td>
<td>A</td>
<td>2/4</td>
<td>43/73</td>
</tr>
<tr>
<td>2. Set Auto Data Output</td>
<td>B</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>3. Copy Calibration</td>
<td>C</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>4. Get Data</td>
<td>D</td>
<td>5/6</td>
<td>40/644</td>
</tr>
<tr>
<td>5. Echo Command</td>
<td>E</td>
<td>4/132</td>
<td>9/136</td>
</tr>
<tr>
<td>6. Get Messages</td>
<td>F</td>
<td>5</td>
<td>28/100</td>
</tr>
<tr>
<td>7. Get Parameter</td>
<td>G</td>
<td>9</td>
<td>10/29</td>
</tr>
<tr>
<td>8. Print Meter Setup</td>
<td>H</td>
<td>5</td>
<td>3000</td>
</tr>
<tr>
<td>9. Read Input Line</td>
<td>I</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>10. TOC Control</td>
<td>J</td>
<td>8</td>
<td>7/300</td>
</tr>
<tr>
<td>11. Key Press</td>
<td>K</td>
<td>6</td>
<td>89</td>
</tr>
<tr>
<td>12. Get/Set Output Line</td>
<td>L</td>
<td>7</td>
<td>7/8</td>
</tr>
<tr>
<td>13. Display Message</td>
<td>M</td>
<td>6/86</td>
<td>7</td>
</tr>
<tr>
<td>14. Set Analog Output</td>
<td>O</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>15. Print Error Status</td>
<td>Q</td>
<td>4</td>
<td>500</td>
</tr>
<tr>
<td>16. Reset</td>
<td>R</td>
<td>6/7</td>
<td>7</td>
</tr>
<tr>
<td>17. Set Parameter</td>
<td>S</td>
<td>10/29</td>
<td>7</td>
</tr>
<tr>
<td>18. Get/Set Date/Time</td>
<td>T</td>
<td>8/15</td>
<td>7/24</td>
</tr>
<tr>
<td>19. Self Test</td>
<td>U</td>
<td>5</td>
<td>7/14</td>
</tr>
<tr>
<td>20. Return All Setup</td>
<td>Z</td>
<td>5</td>
<td>25200</td>
</tr>
</tbody>
</table>

DATA OUTPUT FORMAT

If the data output feature is enabled then a date time stamp and the date for each active measurement will be sent. Each defined measurement will be transmitted as a separate string. Only values for the active measurements (A-P) will be sent. Each set of data will be preceded by a date/time stamp of the following format:

\[ T01=09/13/22, \ 08:37:04 \]

The data format will be:

"Daa=bcseeeeee ffiff ggg R= rrmmm hh"

<table>
<thead>
<tr>
<th>Position</th>
<th>Field</th>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:</td>
<td>&quot;D&quot;</td>
<td>This character always &quot;D&quot;.</td>
<td></td>
</tr>
<tr>
<td>02-03:</td>
<td>&quot;aa&quot;</td>
<td>Unit address (00 to FF).</td>
<td></td>
</tr>
<tr>
<td>04:</td>
<td>&quot;=&quot;</td>
<td>Always a &quot;=&quot; character.</td>
<td></td>
</tr>
<tr>
<td>05:</td>
<td>&quot;b&quot;</td>
<td>Measurement designator (A .. Z).</td>
<td></td>
</tr>
<tr>
<td>06:</td>
<td>&quot;c&quot;</td>
<td>Channel of measurement (1 – 6).</td>
<td></td>
</tr>
<tr>
<td>07:</td>
<td>&quot;s&quot;</td>
<td>Setpoint condition. (_ &quot;_ = no error, <em>&quot;&gt;&quot;</em> = high setpoint exceeded, <em>&quot;&lt;&quot;</em> = low setpoint exceeded).</td>
<td></td>
</tr>
<tr>
<td>08:</td>
<td>&quot; &quot;</td>
<td>Always a space.</td>
<td></td>
</tr>
<tr>
<td>09-18:</td>
<td>&quot;eeeee&quot;</td>
<td>Measurement data</td>
<td></td>
</tr>
<tr>
<td>19:</td>
<td>&quot; &quot;</td>
<td>Always a space.</td>
<td></td>
</tr>
</tbody>
</table>
Data Output Example

T01=09/13/22,  08:37:04
D01=A1     3.4685 Mo-cm  1B R= 1000000
D01=B1    21.4632  oC    09 R= 1000000
D01=K1     0.2930 uS/cm  13 R= 1000000
D01=L1     0.1100   PPM  56 R= 1000000

ATTENTION COMMAND

Description:
This command will return the software revision level, meter configuration, and serial number. It
is also used to determine if the meter is on line and able to communicate.

Command Format:
"Axx"
Where "xx" is 00 or the HEX value of the network address for the unit.
The command "AT" or "A" will also work.

Response Format:
"Axx=Thornton #775-yyy (aaaa….aa), Ver=zzz, S/N=bbbb…bb"
Where "xx" is the HEX value of the network address for the unit.
"yyy' is the model number
"zzz" is the software revision number.
"aaaa….aa" is the unit name (as programmed by the user – 20 characters maximum).
“bbbb….bb” is the serial number (15 characters maximum)

Example
Command:  "A00" or "Axx"
Response:  “A01=Thornton #775-VA2 (DI Service Unit #123), Ver=2.50, S/N=123456.”

Number of Bytes in Command
The minimum number of bytes in this command is 1 plus a <CR>.
The maximum number of bytes in this command is 3 plus a <CR>.

Number of bytes in Response
The minimum number of bytes in this response is 42 plus a <CR>.
The maximum number of bytes in this response is 72 plus a <CR>.

GET DATA COMMAND

Description:
This command will return the latest set of measurement data.

Command Format:
“Dxxbyz"
Where "xx" is 00 or the HEX value of the network address for the unit
"b" = measurement channel (A..P) to get. If this character is a "?" then all
measurements will be returned.
"y" = optional
   y = “F” to request measurement data in Thornton floating point format
\[ y = "E" \text{ to request measurement data in IEEE floating point format} \]
If \( y \) is blank, then data is returned in the real format

“\( z \)” required for the \(?E\) option
If \( z = 1 \) then measurements A-H will be sent.
If \( z = 2 \) then measurements I-P will be sent.

**Response Format:**

\[ Dxx=bcs eeeeeeey ffffff w w R = r r r r r h \]

Where “\( xx \)” is the network address of the unit.
“\( bc….h \)” is the data returned with the format described in section 2.2 of the MAX Service Manual.

**Response Format for “F” option:**

\[ Dxx=ccddeeffgmmnnooppww \]

**Response Format for “E” option:**

\[ Dxx=bmmnnooppddww \]

**Response Format for “?E1” option:**

\[ Dxx=AmmnnooppddBmmnnooppddCmmnnooppddDmmnnooppddEmmnnooppdddmmnnooppddGmmnnooppddAmnnnnooppddww \]

**Response Format for “?E2” option:**

\[ Dxx=ImmnnooppddJmmnnooppddKmmnnooppddLmmnnooppddMmmnnooppddNmnnnnooppddOmmnnooppddPmmnnooppddww \]

Eight measurements will be returned for the \( Dxx?Ez \) command. If \( z = 1 \) then measurements A-H will be returned. If \( z = 2 \) then measurements I-P will be returned. If a measurement is not active in the meter then the value \( mmnnoopp \) returned will be FFFFFFFF and the units (\( dd \)) will be 0.

Where:

“\( b \)” is the measurement designator A through P.

“\( cc \)” = measurement number

\[
\begin{align*}
A & \quad 00 \\
B & \quad 01 \\
C & \quad 02 \\
D & \quad 03 \\
E & \quad 04 \\
F & \quad 05 \\
G & \quad 06 \\
H & \quad 07 \\
I & \quad 08 \\
J & \quad 09 \\
K & \quad 0A \\
L & \quad 0B \\
M & \quad 0C \\
N & \quad 0D \\
O & \quad 0E \\
P & \quad 0F \\
\end{align*}
\]
“**dd**” = measurement type (in HEX)

<table>
<thead>
<tr>
<th>dd</th>
<th>Measurement Type</th>
<th>dd</th>
<th>Measurement Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>none</td>
<td>22</td>
<td>feet</td>
</tr>
<tr>
<td>01</td>
<td>Raw resistance reading from cell</td>
<td>23</td>
<td>% full (tank level)</td>
</tr>
<tr>
<td>02</td>
<td>Raw RTD reading from cell in ohms</td>
<td>24</td>
<td>ratio (X/Y)</td>
</tr>
<tr>
<td>03</td>
<td>Raw voltage reading from cell in volts</td>
<td>25</td>
<td>difference (X-Y)</td>
</tr>
<tr>
<td>04</td>
<td>Raw voltage from 2nd signal of cell</td>
<td>26</td>
<td>ppm grains (diCap)</td>
</tr>
<tr>
<td>05</td>
<td>Raw frequency reading from cell in Hz</td>
<td>27</td>
<td>grains (diCap)</td>
</tr>
<tr>
<td>06</td>
<td>UNUSED</td>
<td>28</td>
<td>Siemens/m</td>
</tr>
<tr>
<td>07</td>
<td>UNUSED</td>
<td>29</td>
<td>m³ (tank level)</td>
</tr>
<tr>
<td>08</td>
<td>ohms (resistivity)</td>
<td>2A</td>
<td>liters (tank level)</td>
</tr>
<tr>
<td>09</td>
<td>Siemens/cm (conductivity)</td>
<td>2B</td>
<td>gallons (tank level)</td>
</tr>
<tr>
<td>0A</td>
<td>TDS</td>
<td>2C</td>
<td>sum (X+Y)</td>
</tr>
<tr>
<td>0B</td>
<td>degrees C</td>
<td>2D</td>
<td>current</td>
</tr>
<tr>
<td>0C</td>
<td>degrees F</td>
<td>2E</td>
<td>equivalents (diCap)</td>
</tr>
<tr>
<td>0D</td>
<td>% HCl</td>
<td>2F</td>
<td>liters/second</td>
</tr>
<tr>
<td>0E</td>
<td>% NaOH</td>
<td>30</td>
<td>O₂ in grams per liter</td>
</tr>
<tr>
<td>0F</td>
<td>%H₂SO₄</td>
<td>31</td>
<td>O₂ in ppm</td>
</tr>
<tr>
<td>10</td>
<td>% rejection</td>
<td>32</td>
<td>O₂ in ppb</td>
</tr>
<tr>
<td>11</td>
<td>pH</td>
<td>33</td>
<td>O₂ saturation</td>
</tr>
<tr>
<td>12</td>
<td>volts</td>
<td>34</td>
<td>Volt-Amps</td>
</tr>
<tr>
<td>13</td>
<td>gpm (flow)</td>
<td>35</td>
<td>Watts</td>
</tr>
<tr>
<td>14</td>
<td>gallons (flow)</td>
<td>36</td>
<td>pH c</td>
</tr>
<tr>
<td>15</td>
<td>m³/hour (flow)</td>
<td>37</td>
<td>pbCO₂</td>
</tr>
<tr>
<td>16</td>
<td>Hertz (flow)</td>
<td>38</td>
<td>pbCl</td>
</tr>
<tr>
<td>17</td>
<td>m³ (flow)</td>
<td>39</td>
<td>pbSO₄</td>
</tr>
<tr>
<td>18</td>
<td>liters (flow)</td>
<td>3A</td>
<td>pmCO₂</td>
</tr>
<tr>
<td>19</td>
<td>liters/minute (flow)</td>
<td>3B</td>
<td>ppmCl</td>
</tr>
<tr>
<td>1A</td>
<td>feet/second (flow)</td>
<td>3C</td>
<td>pmSO₄</td>
</tr>
<tr>
<td>1B</td>
<td>% recovery</td>
<td>3D</td>
<td>ppm (TOC)</td>
</tr>
<tr>
<td>1C</td>
<td>psi</td>
<td>3E</td>
<td>gC/L (TOC)</td>
</tr>
<tr>
<td>1D</td>
<td>KPascals</td>
<td>3F</td>
<td>ohm-cm (TOC)</td>
</tr>
<tr>
<td>1E</td>
<td>mmHg</td>
<td>40</td>
<td>S/cm (TOC)</td>
</tr>
<tr>
<td>1F</td>
<td>bars</td>
<td>41</td>
<td>degrees C (TOC)</td>
</tr>
<tr>
<td>20</td>
<td>Kg/cm (pressure)</td>
<td>42</td>
<td>degrees F (TOC)</td>
</tr>
<tr>
<td>21</td>
<td>inches</td>
<td>43</td>
<td>ml/mn (TOC)</td>
</tr>
</tbody>
</table>

“**ee**” = multiplier:  
00 = none  
01 = nano  
02 = micro  
03 = milli  
04 = units  
05 = kilo  
06 = mega  
07 = auto

“**ff**” = status byte:  
00=ok.  
01=low setpoint  
02=high setpoint  
03=USP setpoint error  
04=over range  
05=under range

“**gg**” = not used  
“**ww**” = exclusive OR checksum of all the preceding bytes.
“mmnnoopp” = IEEE floating point data (4 bytes, ASCII characters). **NOTE** – the floating point number is sent in reverse byte order, i.e. the floating point number is ppoonnmm in IEEE format. Bit seven of the first byte (pp) is the sign bit for the number (=1 for a negative number). The next 8 bits are the exponent (power of 2). The exponent is offset by 127 (i.e. if the exponent is 126 then the exponent is –1, if the exponent is 127 then the exponent is 0, etc.). If the exponent is 00 and the mantissa is 0 then the number is 0. If the exponent is FF then the whole floating point value is not a number (this typically occurs from an overflow such as a divide by 0).

**Example #1:**
Command: "D00B
Response: " D01=A1 1940.8164 o-cm 6D R= 100 "

**Example #2:**
Command: "D00?" (all measurements active)
Response: "T01=09/13/22, 11:03:49
D01=A1 1907.6299 o-cm 61 R = 100
D01=B1 25.5012 oC 08 R = 100
D01=C1 527.2318 uS/cm 1B R = 100
D01=D1 77.9289 oF 00 R = 100
D01=E1 258.2900 PPM 5B R = 100
D01=F1 0.0000 %HCl 73 R = 100
D01=G1 0.0000 %NaOH 1D R = 100
D01=H1 0.0082 H2SO4 47 R = 100
D01=I1 52.7232 mS/m 51 R = 100
D01=J1 1907.6299 o-cm 6A R = 100
D01=K1 527.2318 uS/cm 13 R = 100
D01=L1 258.2900 PPM 52 R = 100
D01=M1 25.5012 oC 07 R = 100
D01=N1 77.9289 oF 0A R = 100
D01=O1 1907.6299 o-cm 6F R = 100
D01=P1 52.7232 mS/m 48 R = 100 "

**Notes:** If all of the data is requested by specifying the channel as "?" then a number of responses will be sent out with the format described above. Each response or line will be terminated with a CR character. For example, sending the command "D00?" may result is 8 responses for the 8 defined measurements in the meter.

**Number of Bytes in Command**
The minimum number of bytes in this command is 4 plus a <CR>.
The maximum number of bytes in this command is 6 plus a <CR>.

**Number of bytes in Response**
The minimum number of bytes in this response is 39 plus a <CR>.
The maximum number of bytes in this response is 644.

**SET AUTO DATA OUTPUT COMMAND**

**Description:**
This command will enable or disable the automatic data output.

**Command Format:**
"Bxxa"
Where "xx" is 00 or the HEX value of the network address for the unit
"a" = " 1" to enable the data output, "0" to disable the data output.

**Response Format:**
"Bxx=OK"
Where "xx" is the network address of the unit.

**Example**
To enable the data output of this unit:
Command: "B001"
Response: "B66=OK"

**Number of Bytes in Command**
The minimum number of bytes in this command is 4 plus a <CR>.
The maximum number of bytes in this command is 4 plus a <CR>.

**Number of bytes in Response**
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 6 plus a <CR>.

**Notes:**
The data output varies according to the number of parameters set for display A-P. (see also the Get Data Command, D01?)

**RESET COMMAND**

**Description:**
This command will perform various types of resets: either a system, measurement, total flow, or testing reset. The reset parameter character can be:
1. "S" - performs a system reset.
2. "M" - performs a measurement reset. Averaging buffers are cleared. RTDs are re-measured.
3. "T" - performs a total flow reset. The next character in the command specifies the channel (A … N).
4. "G" – resets a total grains measurement. The next character in the command specifies the channel (A … N).

**Command Format:**
"Rxx*ab"
Where "xx" is 00 or the HEX value of the network address for the unit.
"a" is reset type (either S, M, T, or G).
"b" is the optional information (such as channel letter for a total flow reset).

**Response Format:**
"Rxx=OK"
Where "xx" is the HEX value of the network address for the unit.

**Example 1:**
Perform a system reset.
Command: "R00*S"
Response: "R01=OK"

**Example 2:**
Perform a total flow reset on measurement C on unit #1E.
Command: "R1E*TC"
Response: "R1E=OK"

**Number of Bytes in Command**
The minimum number of bytes in this command is 5 plus a <CR>.
The maximum number of bytes in this command is 6 plus a <CR>.

**Number of bytes in Response**
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 6 plus a <CR>. 
Notes: The response to “Rxx*S” may not allow user to read the response, since this operation will restore the system to its original baud rate and parity defaults, which may not match those selected in the communicating program.

SET PARAMETER COMMAND

Description: This command will set a parameter value.

Command Format:
“Sxxaabb=cccccccccccc<CR>”
Where “xx” is 00 or the HEX value of the network address for the unit.
“aa” = code of parameter to be changed (00 to FF), see list below.
“bb” = index number for the parameter in hexadecimal notation. See table below.
“cccccccccccc” = value (up to 10 digits including a decimal point).
“d” = optional multiplier ("u" = micro, "m" = milli, "K" = kilo, or "M" = mega).

Response Format:
“Sxx=OK”. Where “xx” is the HEX value of the network address for the unit.

Example:
Set the value of setpoint #3 to 0.001125 on a MAX with network address 5.
Command: “S002A02=1.125000m”.
Response: “S05=OK”.

Number of Bytes in Command
See table below

Number of Bytes in Response
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 6 plus a <CR>.

Notes:
1. Setting sensor type and sub-type (Codes 05 and 06) does not change the meter display. The display only changes after entering the measurement menu.
2. The “cccccccccccc” can be a sub code for the change to be performed on the specific parameter. The sub codes are included in the Description column of the table below.

GET PARAMETER COMMAND

Description: This command will get a parameter value.

Command Format:
“Gxxaabb”
Where “xx” is 00 or the HEX value of the network address for the unit.
“aa” = code of parameter to get (00 to FF), see list below.
“bb” = channel or measurement number (index number, see below).

Response Format:
“Gxxaabb=ccccccccccccd”
Where “xx” is the HEX value of the network address for the unit.
“aa” = code of parameter to get (00 to FF), see list below.
“bb” = input channel (1…6).
“cccccccccccc” = value (up to 10 digits including a decimal point).
“d” = optional multiplier ("u" = micro, "m" = milli, "K" = kilo, or "M" = mega).
Example:
Get the value of setpoint #2.
Command: “G002A01”
Response: “G012A02=1.125000m”

Number of Bytes in Command
The minimum number of bytes in this command is 8 plus a <CR>.
The maximum number of bytes in this command is 8 plus a <CR>.

Number of bytes in Response
See table below

VARIABLES FOR GET AND SET PARAMETER COMMAND

For the index number, the maximum value depends upon the parameter type and may be:

1. #Channels = 6 (00-05)
2. #Circuits = 7 (00-06)
3. #Measurements = 16 (00-0F)
4. #Analogs = 8 (00-07)
5. #Relays = 4 (00-03)
6. #Setpoints = 16 (00-0F)

Note:
1. That the number of bytes sent or received in the table below includes the carriage return.
2. In some cases you can send data values that are outside of the proper range and these will set the
   parameter to an undetermined value that may cause operation problems. It is up to the
   programmer to assure that valid values are sent.
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Maximum Index Number</th>
<th>Minimum Number of Bytes</th>
<th>Maximum Number of Bytes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 SmasterPassword</td>
<td>String</td>
<td>1</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>Master password. The index number “bb” of the command has to be “00”. The password can be up to 5 characters long.</td>
</tr>
<tr>
<td>02 sUser1Password</td>
<td>String</td>
<td>1</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>User #1 password</td>
</tr>
<tr>
<td>03 sUser2Password</td>
<td>String</td>
<td>1</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>User #2 password</td>
</tr>
<tr>
<td>04 SCustomerName</td>
<td>String</td>
<td>1</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>Name of unit. Up to 20 characters long.</td>
</tr>
<tr>
<td>05 ISensorType</td>
<td>Integer</td>
<td>#Channels</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>Sensor type (0=NO SENSOR, 1=CONDUCTIVITY, 2=TEMPERATURE, 3=PRESSURE, 4=PH, 5=FLOW, 6=LEVEL, 7=VOLTAGE, 8=FREQUENCY, 9=CHEMICAL, 10= CALIBRATION, 11=INDUCTIVE, 12=ADAPTER, 13=DISSOLVED OXYGEN), 14=TOC</td>
</tr>
<tr>
<td>06 ISensorSpecifics</td>
<td>Integer</td>
<td>#Channels</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>Sensor sub-type (signal) 0 = no sensor or sub-type For Conductivity or pH: 01=1000 ohm RTD, 02=500 ohm RTD, 03=Thermistor, 04=Not RTD, 05=100 ohm RTD. For Flow Sensors: 01=Signet, 02=Data Industrial, 03=Hoffer, 04=Asahi, 05=Tokico, 06=Fluidyne, 07=Proteus. Additional, or with 0x20 for a 4-20mA sensor. For Pressure or Tank Level: 0x20= 4-20mA output 0x40= 0–1 volt output 0x08 = bridge with 5/11 ratio on supply. 0x10 = bridge with internal power supply compensation. For Voltage Sensors: 01= +/- 1.0 volt output 02 = +/- 0.1 volt output 03= 4-20mA output 04= 0-5volt output</td>
</tr>
<tr>
<td>07 IMeasureChan</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Command = 9</td>
<td>Result = 7</td>
<td>Measurement channel 0=CHANNEL1, 1=CHANNEL2, 2=CHANNEL3, 3=CHANNEL4, 4=CHANNEL5, 5=CHANNEL6, 6=Not Displayed, 7=Sensor, 8=Ch2, 9=Ch3 A-F = Chan1 10 and greater = Sensor</td>
</tr>
<tr>
<td>Name</td>
<td>Type</td>
<td>Maximum Index Number</td>
<td>Minimum Number of Bytes</td>
<td>Maximum Number of Bytes</td>
<td>Description</td>
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<tr>
<td>08</td>
<td>IMode</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd. = 9</td>
<td>Description mode</td>
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<td>Res. = 7</td>
<td>0= off (no display)</td>
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<td>1= ohms (adapter)</td>
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<td>2= ohms RTD (adapter)</td>
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<td>3= Volts (adapter)</td>
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<td>4= Volts(2) pressure</td>
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<td>5= Hz (adapter)</td>
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<td>6= xx (adapter)</td>
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<td>7= xx (adapter)</td>
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<td>8= ohm-cm</td>
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<td>9= S/cm</td>
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<td>10= TDS</td>
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<td>11= °C</td>
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<td>12= °F</td>
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<td>13= %HCl</td>
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<td>14= %NaOH</td>
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<td>15= %H2SO4</td>
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<td>16= % rejection</td>
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<td>17= pH</td>
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<td>18= V (pH)</td>
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<td>19= GPM</td>
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<td>20= Gallons total flow</td>
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<td>21= m³/hr flow</td>
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<td>22= Hz flow or frequency</td>
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<td>23= m³ total flow</td>
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<td>24= Liters total flow</td>
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<td>25= L/min</td>
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<td>26= ft/sec</td>
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<td>27= % recovery</td>
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<td>28= PSI</td>
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<td>29= KPa</td>
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<td>30= m mHg</td>
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<td>31= bars</td>
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<td>32= Kg/cm</td>
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<td>33= inches H2O</td>
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<td>34= feet H2O</td>
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<td>35= % Full</td>
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<td>36= ratio</td>
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<td>37= difference</td>
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<td>38= ppm grains</td>
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<td>39= grains</td>
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<td>40= S/m</td>
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<td>41= m³ tank level</td>
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<td>42= Liters tank level</td>
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<td>43= Gallons tank level</td>
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<td>44= sum</td>
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<td>45= Amps</td>
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<td>46= equiv</td>
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<td>47= L/s</td>
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<td>48= gO2</td>
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<td>49= ppmO2</td>
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<td>50= ppbO2</td>
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<td>51= % sat</td>
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<td>52= VA</td>
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<td>53= Watt</td>
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<td>54= pH c</td>
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<td>55= pbCO2</td>
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<td>56= ppbCl</td>
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<td>57= pbSO4</td>
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<td>58= pmCO2</td>
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<td>59= ppmCl</td>
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<td>60= pmSO4</td>
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<td></td>
<td>61= ppm (TOC)</td>
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<td></td>
</tr>
<tr>
<td>09</td>
<td>\textbf{iRange}</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd. = 9 Res. = 7 Cmd. = 10 Res. = 10 Measurement range (0=No range, 1=Nano, 2=µ, 3=milli, 4=units, 5=kilo, 6=mega, 7=auto).</td>
<td></td>
</tr>
<tr>
<td>0A</td>
<td>\textbf{iOtherChan1}</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd. = 9 Res. = 7 Cmd. = 10 Res. = 10 1st other channel needed for measure</td>
<td></td>
</tr>
<tr>
<td>0B</td>
<td>\textbf{iOtherChan2}</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd. = 9 Res. = 7 Cmd. = 10 Res. = 10 2nd other channel needed</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Type</td>
<td>Maximum Index Number</td>
<td>Minimum Number of Bytes</td>
<td>Maximum Number of Bytes</td>
<td>Description</td>
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<td>-----------------------</td>
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<td>-------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>0C iMeasureErrorCode</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd.= 9</td>
<td>Res. = 11</td>
<td>Measurement error codes 0= No measure error 1=Measure PCB failed</td>
</tr>
<tr>
<td>0D sName</td>
<td>String</td>
<td>#Measurements</td>
<td>Cmd.= 9</td>
<td>Res. = 15</td>
<td>Name of measurement</td>
</tr>
<tr>
<td>0E iAvgMode</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Averaging level 0= NONE, 1=LOW, 2=MEDIUM, 3=HIGH, 4=SPECIAL.</td>
</tr>
<tr>
<td>0F fCellMultiplier1</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Sensor Multiplier for main signal</td>
</tr>
<tr>
<td>10 fCellAdditive1</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Sensor additive for main signal</td>
</tr>
<tr>
<td>11 fCellMultiplier2</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Sensor multiplier for second signal</td>
</tr>
<tr>
<td>12 fCellAdditive2</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Sensor additive for second signal</td>
</tr>
<tr>
<td>13 fTDSFactor</td>
<td>Float</td>
<td>#Measurements</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>TDS factor</td>
</tr>
<tr>
<td>14 iCompMode</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Compensation method 0= NO COMP, 1=STANDARD, 2=CATION 3=GLYCOL 100,</td>
</tr>
<tr>
<td>15 fLinearComp</td>
<td>Float</td>
<td>#Measurements</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Linear compensation value in Percent</td>
</tr>
<tr>
<td>16 iTempSource</td>
<td>Integer</td>
<td>#Channels</td>
<td>Cmd.= 9</td>
<td>Res. = 7</td>
<td>Temperature source 0=this channel, 1=fixed, 2=channel 1, 3=channel 2,</td>
</tr>
<tr>
<td>17 fManualTemp</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9</td>
<td>Res. = 18</td>
<td>Fixed temperature value in DegC</td>
</tr>
<tr>
<td>Name</td>
<td>Type</td>
<td>Maximum Index Number</td>
<td>Minimum Number of Bytes</td>
<td>Maximum Number of Bytes</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------</td>
<td>----------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>iResolution</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Resolution for measurement 0=auto, 1=&quot;1.&quot;, 2=0.1&quot;, 3=0.01&quot;, 4=0.001&quot;</td>
</tr>
<tr>
<td>iSerialNumber</td>
<td>Long</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 10</td>
<td>Cmd.= 9 Res. = 19</td>
<td>Sensor serial number</td>
</tr>
<tr>
<td>iSensorCalDate</td>
<td>Long</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 17</td>
<td>Cmd.= 9 Res. = 17</td>
<td>Sensor calibration date/time</td>
</tr>
<tr>
<td>dTotalFlow</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 17</td>
<td>Cmd.= 20 Res. = 26</td>
<td>Total flow for channel. Response size varies with reading of the meter.</td>
</tr>
<tr>
<td>fPipeID</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 17</td>
<td>Cmd.= 17 Res. = 17</td>
<td>Pipe inside diameter in inches</td>
</tr>
<tr>
<td>iFlowExternReset</td>
<td>Integer</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>External flow reset enabled/disable 0=disable, 1=enable.</td>
</tr>
<tr>
<td>fMaxGPM</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 16 Res. = 25</td>
<td>Maximum GPM</td>
</tr>
<tr>
<td>fMaxPSI</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 16 Res. = 25</td>
<td>Maximum PSI</td>
</tr>
<tr>
<td>fTankHeight</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 16 Res. = 25</td>
<td>Tank height in feet</td>
</tr>
<tr>
<td>fTankArea</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 16 Res. = 25</td>
<td>Tank area in square feet</td>
</tr>
<tr>
<td>fIP</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 16 Res. = 25</td>
<td>IP factor for pH</td>
</tr>
<tr>
<td>fSTC</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 16 Res. = 25</td>
<td>STC factor for pH</td>
</tr>
<tr>
<td>fCellMultiplier3</td>
<td>Float</td>
<td>#Channels</td>
<td></td>
<td></td>
<td>2nd sensor multiplier for Inductive</td>
</tr>
<tr>
<td>fCellAdditive3</td>
<td>Float</td>
<td>#Channels</td>
<td></td>
<td></td>
<td>2nd sensor additive for Inductive</td>
</tr>
<tr>
<td>fInstallationK</td>
<td>Float</td>
<td>#Channels</td>
<td></td>
<td></td>
<td>Installation factor for Inductive sensors</td>
</tr>
<tr>
<td>iSpMeasurement</td>
<td>Integer</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 11 Res. = 11</td>
<td>Measurement for setpoint (0-15) -1 = not set</td>
</tr>
<tr>
<td>iSpType</td>
<td>Integer</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Type of setpoint 0=NO SETPOINT, 1=HIGH, 2=LOW, 3=USP, 4=RESET</td>
</tr>
<tr>
<td>iSpRelay</td>
<td>Integer</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Relay or output for setpoint (0=NONE, 1=relay #1, 2=relay #2, etc.)</td>
</tr>
<tr>
<td>fSpValue</td>
<td>Float</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 17 Res. = 24</td>
<td>Setpoint value</td>
</tr>
<tr>
<td>fSpMult</td>
<td>Integer</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Multiplier factor for setpoint (0=nano, 1=micro, 3=milli, 4=units, 5=kilo, 6=mega)</td>
</tr>
<tr>
<td>iSpIgnorOver</td>
<td>Integer</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Ignore over range for setpoint 0=OFF, 1=ON</td>
</tr>
<tr>
<td>ISPTimer</td>
<td>Long</td>
<td>#Setpoints</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 9 Res. = 18</td>
<td>Time since last setpoint error in seconds.</td>
</tr>
<tr>
<td>iRDelay</td>
<td>Integer</td>
<td>#Relays</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 13 Res. = 13</td>
<td>Relay delay in seconds</td>
</tr>
<tr>
<td>iRHyster</td>
<td>Integer</td>
<td>#Relays</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 12 Res. = 12</td>
<td>Relay hysteresis in Percent (range 0-255)</td>
</tr>
<tr>
<td>iRState</td>
<td>Integer</td>
<td>#Relays</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Relay state (0=normal, 1=inverted)</td>
</tr>
<tr>
<td>iExternReset</td>
<td>Integer</td>
<td>#Relays</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Reset relay externally via input line (0=input #1, 1=input #2).</td>
</tr>
<tr>
<td>iRType</td>
<td>Integer</td>
<td>#Relays</td>
<td></td>
<td></td>
<td>Type of relay (0=mechanical, 1=reed). Not used at this time.</td>
</tr>
<tr>
<td>iAoutSignal</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 11 Res. = 11</td>
<td>Measurement for analog output 0=Normal, 1=Bilinear, 2=Auto range, 3=log</td>
</tr>
<tr>
<td>iAoutType</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Analog output type 0=Normal, 1=Bilinear, 2=Auto range, 3=log</td>
</tr>
<tr>
<td>Name</td>
<td>Type</td>
<td>Maximum Index Number</td>
<td>Minimum Number of Bytes</td>
<td>Maximum Number of Bytes</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------</td>
<td>----------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>iAoutLowEnd</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Low end either 1=0 mA or 0=4 mA</td>
</tr>
<tr>
<td>iAoutControl</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Output to control for Auto-range 0 = none, 1 = relay1, 2 = relay2, 3 = relay3, 4 = relay4, 5 = Dout1, 6 = Dout2</td>
</tr>
<tr>
<td>iAoutOnFailure</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Output current on error or failure. 0 = Min., 1 = Max.</td>
</tr>
<tr>
<td>fAoutMin1</td>
<td>Float</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 21 Res. = 27</td>
<td>Measurement value for bottom of range 1</td>
</tr>
<tr>
<td>fAoutMid1</td>
<td>Float</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 21 Res. = 27</td>
<td>Measurement value for mid range 1 setting</td>
</tr>
<tr>
<td>fAoutMax1</td>
<td>Float</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 21 Res. = 27</td>
<td>Measurement value for the top of range 1</td>
</tr>
<tr>
<td>fAoutMin2</td>
<td>Float</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 21 Res. = 27</td>
<td>Measurement value for the top of range 2</td>
</tr>
<tr>
<td>fAoutMax2</td>
<td>Float</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 21 Res. = 27</td>
<td>measurement value for the top of range 2</td>
</tr>
<tr>
<td>iAMin1Mult</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Range factor for above value (0=No range, 1=Nano, 2= micro, 3=milli, 4=units, 5=kilo, 6=mega, 7=auto)</td>
</tr>
<tr>
<td>iMid1Mult</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Range factor for above value (0=No range, 1=Nano, 2= micro, 3=milli, 4=units, 5=kilo, 6=mega, 7=auto)</td>
</tr>
<tr>
<td>iMax1Mult</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Range factor for above value (0=No range, 1=Nano, 2= micro, 3=milli, 4=units, 5=kilo, 6=mega, 7=auto)</td>
</tr>
<tr>
<td>iMin2Mult</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Range factor for above value (0=No range, 1=Nano, 2= micro, 3=milli, 4=units, 5=kilo, 6=mega, 7=auto)</td>
</tr>
<tr>
<td>iMax2Mult</td>
<td>Integer</td>
<td>#Analogs</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Range factor for above value (0=No range, 1=Nano, 2= micro, 3=milli, 4=units, 5=kilo, 6=mega, 7=auto)</td>
</tr>
<tr>
<td>iLanguage</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Language (0=English). Not used</td>
</tr>
<tr>
<td>iBaud</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19.2K, 5 = 38.4K</td>
</tr>
<tr>
<td>iParity</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>0 = none, 1 = even, 2 = odd</td>
</tr>
<tr>
<td>iDataOutputOn</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>Set to 1 to have measure data sent out the RS-232 port. 0 = off</td>
</tr>
<tr>
<td>iOutputTime</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 12 Res. = 12</td>
<td>Data output time in seconds (0-255)</td>
</tr>
<tr>
<td>iNetworkAddress</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 12 Res. = 12</td>
<td>Network address (1 to 127)</td>
</tr>
<tr>
<td>iNetworkType</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>0 = none, 1 = Thornton TNET, 2 = Fieldbus Not used</td>
</tr>
<tr>
<td>iAutoScrollOn</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>1 = on, 0 = off</td>
</tr>
<tr>
<td>iDisplayMode</td>
<td>Integer</td>
<td>1</td>
<td>Cmd.= 9 Res. = 7</td>
<td>Cmd.= 10 Res. = 10</td>
<td>0 = auto, 1 = custom</td>
</tr>
<tr>
<td>Name</td>
<td>Type</td>
<td>Maximum Index Number</td>
<td>Minimum Number of Bytes</td>
<td>Maximum Number of Bytes</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------</td>
<td>----------------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>iDisplayStart</td>
<td>Integer</td>
<td>1</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 11 Res. = 11</td>
<td>Scrolls the display according to the number entered by user (i.e.: 1 will scroll one line down from A in the first line, 2 will scroll 2 lines down from A in the first line, etc.)</td>
</tr>
<tr>
<td>IDisplayOrder</td>
<td>Integer</td>
<td>#Measurements</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 11 Res. = 11</td>
<td>If Display mode = custom then assigns a measurement character (A-P = 1-16) for the display line (#measurement value).</td>
</tr>
<tr>
<td>bLockoutEnabled</td>
<td>Integer</td>
<td>1</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 10 Res. = 10</td>
<td>0 = Disable ; 1 = Enable</td>
</tr>
<tr>
<td>iUser1LockState</td>
<td>Integer</td>
<td>1</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 10 Res. = 10</td>
<td>0 = Disable ; 1 = Enable</td>
</tr>
<tr>
<td>iUser2LockState</td>
<td>Integer</td>
<td>1</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 10 Res. = 10</td>
<td>0 = Disable ; 1 = Enable</td>
</tr>
<tr>
<td>iPowerSave</td>
<td>Integer</td>
<td>1=00</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 10 Res. = 10</td>
<td>0 = off, 1 = on</td>
</tr>
<tr>
<td>dTotalppmG</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>DiCap-Total TDS*Gallons</td>
</tr>
<tr>
<td>dCell_K_Factor</td>
<td>Float</td>
<td>#Channels*10</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Cell's K factors (for asahi flow sensor)</td>
</tr>
<tr>
<td>dCell_F_Factor</td>
<td>Float</td>
<td>#Channels*10</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Cell's F factors (for asahi flow sensor)</td>
</tr>
<tr>
<td>lMDATETIME</td>
<td>Long</td>
<td>1</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Current time and date: # of seconds since 1/1/1998</td>
</tr>
<tr>
<td>dCalVerifyM1</td>
<td>Float</td>
<td>#Channels, #Circuit</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Meter verification measurement #1 (from Smart Calibrator)</td>
</tr>
<tr>
<td>dCalVerifyM2</td>
<td>Float</td>
<td>#Channels, #Circuit</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Meter verification measurement #2 (from Smart Calibrator)</td>
</tr>
<tr>
<td>dCalVerifyM3</td>
<td>Float</td>
<td>#Channels, #Circuit</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Meter verification measurement #3 (from Smart Calibrator)</td>
</tr>
<tr>
<td>d4mAACalValue</td>
<td>Float</td>
<td>#Analog outputs</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>4 mA Analog calibration data</td>
</tr>
<tr>
<td>d20mAACalValue</td>
<td>Float</td>
<td>#Analog outputs</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>20 mA Analog calibration data</td>
</tr>
<tr>
<td>lAOutCalDate</td>
<td>Long</td>
<td>#Analog outputs</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 15 Res. = 15</td>
<td>Analog output calibration date</td>
</tr>
<tr>
<td>dDisOxyHighGain</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>High gain factor for dissolved oxygen</td>
</tr>
<tr>
<td>dDisOxyLowGain</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Low gain factor for dissolved oxygen</td>
</tr>
<tr>
<td>lMeasureErrorCode2</td>
<td>Long</td>
<td>MAX_MEASUREMENTS</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Extension of error code bits: 0= No extended measurement error 1 = O2 sig over range 2 = O2 sig under range 3 = Sensor subID bad 4 = Calc pH error</td>
</tr>
<tr>
<td>iAOutDecades</td>
<td>Integer</td>
<td>#ANALOGS</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Number of decades for analog logarithmic output</td>
</tr>
<tr>
<td>dAtmPressure</td>
<td>Float</td>
<td>#Channels</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Atmosphere pressure</td>
</tr>
<tr>
<td>cTOCCurrentOperation</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 10 Res. = 10</td>
<td>Current TOC activity: 0 = TOC is idle 1 = TOC is measuring 2 = TOC is balancing 3 = TOC is rinsing 4 = TOC is setting flow rate</td>
</tr>
<tr>
<td>ILampLifeLimitHours</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 17 Res. = 17</td>
<td>Lamp life limit</td>
</tr>
<tr>
<td>cMeasureUnusedChannels_ZerosIsNo</td>
<td>Character</td>
<td>1</td>
<td>Cmd. = 9 Res. = 7</td>
<td>Cmd. = 10 Res. = 10</td>
<td>Set to zero to make meter skip unused channel (for faster measurements)</td>
</tr>
<tr>
<td>7C</td>
<td>fPsocVersionNumber</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>7D</td>
<td>ILampLifeTimer</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>7E</td>
<td>ILampResetDate</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>7F</td>
<td>cAutoStartOn</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>80</td>
<td>iSRinseCycleinMinutes</td>
<td>Integer</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>81</td>
<td>cAutoCalibrateOn</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>82</td>
<td>iTimeBetweenAutoBalanceInHours</td>
<td>Integer</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>83</td>
<td>iBalanceLimitinPercent</td>
<td>Integer</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>84</td>
<td>cTocMeasureOn</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>85</td>
<td>cAutoCalHold</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>86</td>
<td>cKeypadLock</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>87</td>
<td>cSetFlowRate</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>88</td>
<td>cTocOverRideLimit</td>
<td>Character</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>89</td>
<td>fTocCondLimit</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>93</td>
<td>dToc_Cond_Mult</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>94</td>
<td>dToc_Cond_Add</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>95</td>
<td>dToc_Temp_Mult</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>96</td>
<td>dToc_Temp_Add</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>9B</td>
<td>lSensorCalDate_C_Fact</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>9C</td>
<td>lSensorCalDate_C_User</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>9F</td>
<td>lSensorCalDate_User</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A0</td>
<td>dTocFlowMultiplier</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A1</td>
<td>dTocFlowAdditive</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A2</td>
<td>iTocCalDate_Flow</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A3</td>
<td>iTocCalDate_Flow_User</td>
<td>Long</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A4</td>
<td>dToc_Cond_Mult_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A5</td>
<td>dToc_Cond_Add_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A6</td>
<td>dToc_Temp_Mult_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>A7</td>
<td>dToc_Temp_Add_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>AC</td>
<td>dTocFlowMultiplier_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>AD</td>
<td>dTocFlowAdditive_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>AE</td>
<td>dCellMultiplier_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Res. = 7</td>
</tr>
<tr>
<td>AF</td>
<td>dCellAdditive_User</td>
<td>Float</td>
<td>#SMART CHANNELS</td>
<td>Cmd. = 9</td>
<td>Cmd. = 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CHANNELES</td>
<td>Res. = 7</td>
<td>Res. = 17</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>-----------</td>
<td>---------</td>
<td>----------</td>
<td></td>
</tr>
</tbody>
</table>
| B0| dFlow_AD_Cal_Offset| Float| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 17 Res. = 17  
|   |   |   |   | Toc flow AD cal offset |
| B1| dFlow_AD_Cal_Mult| Float| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 17 Res. = 17  
|   |   |   |   | Toc flow AD cal mult |
| B2| iTocSensorErrorCode| Long| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 17 Res. = 17  
|   |   |   |   | Toc sensor error code:  
|   |   |   |   |   | 1 = E-Lamp off  
|   |   |   |   |   | 5 = E-Lamp switched off  
|   |   |   |   |   | 6 = E-Lamp life exceeded  
|   |   |   |   |   | 7 = E-TOC reports error  
|   |   |   |   |   | 9 = E-NVRAM Failure  
|   |   |   |   |   | 11 = E-AutoBal too high  
|   |   |   |   |   | 12 = E-Flow too low  
|   |   |   |   |   | 14 = E-Cond Over Limit  
|   |   |   |   |   | 15 = E-Flow too high  
|   |   |   |   |   | 17 = E-Conductivity unstable  
|   |   |   |   |   | 25 = E-Conductivity low  
|   |   |   |   |   | 26 = E-Temp high  
|   |   |   |   |   | 28 = E-Temp low  
|   |   |   |   |   | 29 = E-TOC over range  
|   |   |   |   |   | 31 = E-Can't start rinse  
| B3| iTocSensorFaultCode| Long| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 17 Res. = 17  
|   |   |   |   | Toc sensor fault code:  
|   |   |   |   |   | 2 = F-No AC Power  
|   |   |   |   |   | 4 = F-Measure SW too old  
|   |   |   |   |   | 3 = F-Communication Err  
|   |   |   |   |   | 8 = F-TOC reports fault  
|   |   |   |   |   | 16 = F-UV Lamp Failure  
|   |   |   |   |   | 18 = F-Cond shorted  
|   |   |   |   |   | 20 = F-Cond open/shorted  
|   |   |   |   |   | 22 = F-Temp open/shorted  
|   |   |   |   |   | 24 = F-Conductivity high  
|   |   |   |   |   | 27 = F-Temp high  
|   |   |   |   |   | 32 = F-No flow detected  
| B4| iUsingUsersCal| Integer| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Using user calibration |
| B5| dBalanceInSiemens| Float| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 17 Res. = 17  
|   |   |   |   | Balance in siemens |
| B6| dBalanceInPercent| Float| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 17 Res. = 17  
|   |   |   |   | Balance in percent |
| B7| cTOCSensorStatus_c0| Character| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Toc sensor status 0 |
| B8| cTOCSensorStatus_c1| Character| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Toc sensor status 0 |
| B9| bSmartSensorInstalled| Integer| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Flag for smart sensor installed |
| BA| sSensorPartNumber| String| #SMART CHANNELES| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 14 Res. = 14  
|   |   |   |   | Sensor part number |
| BB| iMainRevLevel| Integer| 1| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Main software version |
| BC| iMeasureRevLevel| Integer| 1| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Measurement software version |
| BD| iDisplayRevLevel| Integer| 1| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Display software version |
| BE| iAnalogOptionsRevLevel| Integer| 1| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | Option board software version |
| BF| iLANOptionsRevLevel| Integer| 1| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | LAN options board software version |
| C0| iMeasureBuildNumber| Integer| 1| Cmd.= 9 Res. = 7  
|   |   |   |   | Cmd.= 10 Res. = 10  
|   |   |   |   | For debugging |
KEYPRESS COMMAND

**Description:**
This command is used to simulate a key press from the front panel. The response is a string of characters which is the message displayed as a result of the key press. Also, the cursor position is returned.

**Command Format:**
"Kxxaa"
Where "xx" is 00 or the HEX value of the network address for the unit.
"aa" is the key code as follows:
- 10  =  Key  #0(/=;)
- 01  =  Key  #1(ABC)
- 05  =  Key  #2(DEF)
- 04  =  Key  #3(GHI)
- 06  =  Key  #4(JKL)
- 0A  =  Key  #5(MNO)
- 09  =  Key  #6(PQR)
- 0B  =  Key  #7(STU)
- 0F =  Key  #8(VWX)
- 0E  =  Key  #9(YZ#)
- 03  =  Menu (exit)
- 13  =  Help key.
- 07  =  Right Arrow key.
- 11  =  Left Arrow key.
- 08  =  Up Arrow key.
- 0C  =  Down Arrow key.
- 0D  =  Page-Up key.
- 12  =  Page-Down key.
- 02  =  Enter Key
- 14  =  Decimal/minus Key
- FF  = special code to make the unit exit the menu mode.
All other codes are not used.

**Response Format:**
If the key code is valid then the display message will be returned as:
"Kxx=a...a:bb".
Where "xx" is 00.
"a...a" is the message displayed as a result of the key press.
"bb" is the cursor position.

**Example:**
Command: "K0003" Response: "K=01 MAIN MENU Select a menu using , then press EnterGoto: Measurements :42"

**Number of Bytes in Command**
The minimum number of bytes in this command is 5 plus a <CR>.
The maximum number of bytes in this command is 5 plus a <CR>.

**Number of bytes in Response**
The minimum number of bytes in this response is 88 plus a <CR>.
The maximum number of bytes in this response is 88 plus a <CR>. 
DISPLAY MESSAGE COMMAND

Description:
This command is used to display a message for a specified time period in seconds. The display time is from 0 to 256 seconds (specified as a hexadecimal number). If the unit is in the menu mode then the menus will be terminated before the message is displayed.

Command Format:
"Mxxaab...ba".
Where "xx" is 00.
"aa" is the display time in seconds (from 00 to FF).
"b..b" is the message to be displayed (up to 80 characters).

Response Format:
"Mxx=OK".
Where "xx" is 00.

Example:
Display "This is a test" for 10 seconds.
Command: "M000AThis is a test" Response: "M00=OK".

Number of Bytes in Command
The minimum number of bytes in this command is 5 plus a <CR>.
The maximum number of bytes in this command is 85 plus a <CR>.

Number of bytes in Response
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 6 plus a <CR>.

SELF-TEST COMMAND

Description:
This command is used to perform the self-test/diagnostic test.

Command Format:
"Uxx*".
Where "xx" is 00.

Response Format:
"Uxx=OK" if all of the tests pass.
"Uxx=FAILED=aa" if one or more tests fail.
Where "xx" 00.
"aa" = code of test that failed.
If more than one test fails then multiple codes will be included in this response, each separated by a comma. The codes are:
01 = ROM test fails.
02 = RAM test fails.
03 = NVRAM test fails.
04 = Timer test fails.
05 = A/D test fails.
06 = Serial port test fails.
07 = Network Test fails.
08 = Display test fails.
09 = Keypad test fails.
0A = Analog output test fails.

Example:
Command: "U00*" or
Response: "U00=FAILED=01,04". This response indicates that the ROM test and timer 1 tests failed.
**Number of Bytes in Command**

The minimum number of bytes in this command is 4 plus a <CR>.
The maximum number of bytes in this command is 4 plus a <CR>.

**Number of bytes in Response**

The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 13 plus a <CR>.

**ECHO COMMAND**

**Description:**

This command is used to test the serial port. The characters in the command are sent back in the response.

**Command Format:**

"Exxa…a"

Where "xx" is 00.
"a...a" = string of any ASCII characters used to test the port (up to 128).

**Response Format:**

"Exx=a...a=zz"

Where "xx" is 00.
"a...a" = string of characters from the command.
"zz" = "OK" if there is no communication problem.

**Example**

Command: "E00123456789A"
Response: "E00=123456789A=OK"

**Number of Bytes in Command**

The minimum number of bytes in this command is 3 plus a <CR>.
The maximum number of bytes in this command is 131 plus a <CR>.

**Number of bytes in Response**

The minimum number of bytes in this response is 8 plus a <CR>.
The maximum number of bytes in this response is 135 plus a <CR>.

**SET ANALOG OUTPUT COMMAND**

**Description:**

This command is used to set the analog output current to a value. It is intended for testing purposes only. When this command is received the analog outputs will be held at the set value until another command is received or a key is pressed.

**Command Format:**

"Oxxa=bbbbbbbb"

Where "xx" is 00.
"a" is the output channel number (1 - 8).
"bbbbbbbb" is the output current in mA.

**Response Format:**

"Oxx=OK"

Where "xx" is the network address.

**Example**

Set the output of channel 3 to 12.125mA:
Command: "O003=12.125"
Response: "O01=OK"
Number of Bytes in Command
The minimum number of bytes in this command is 13 plus a <CR>.
The maximum number of bytes in this command is 13 plus a <CR>.

Number of bytes in Response
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 6 plus a <CR>.

RETURN ALL SETUP COMMAND

Description:
This command will cause the entire meter setup to be returned. Each setup parameter is sent
with the same format as the "Get Parameter" command. This command is equivalent to sending
the "Get Parameter" command for every parameter.

Command Format:
"Zxx*"
Where "xx" is 00.

Response Format:
The response will be multiple lines of data. Each line will be terminated with a CR character and
will have the following format (same as the Get Parameter Command response):
Gxxaab=cccccccccccd".
Where "xx" is 00.
"aa" = code of parameter to be changed (00 to FF).
"bb" = channel or measurement number.
"cccccccccc" = value (up to 10 digits including a decimal point).
"d" = optional multiplier ("u" = micro, "m" = milli, "K" = kilo, or "M" = mega).

Number of Bytes in Command
The minimum number of bytes in this command is 4 plus a <CR>.
The maximum number of bytes in this command is 4 plus a <CR>.

Number of bytes in Response
The number of bytes in the response is approximately 25200 (twenty-five thousand two
hundred).

GET/SET OUTPUT LINE COMMAND

Description:
This command is used to set an output line to either a low or high level. It is also used to read
the state of the line without changing it.

Command Format:
"Lxxaab".
Where "xx" is 00.
"aa" = output number.
"b" = state (0=low, 1=high). If "b" is set to a "?" character then the state will be
returned (not changed).

Response Format:
"Lxxaa=b".
Where "xx" is meter address.
"aa" = output number. (00=output 1; 01=output 2)
"b" = the state of the output (0=low, 1=high).

Example #1:
Set output #1 high:
Command: "L01001"
Response: "L01=OK"
Example #2:
Read the state of output #2:
Command: "L0101?"
Response: "L0101=0"

Number of Bytes in Command
The minimum number of bytes in this command is 6 plus a <CR>.
The maximum number of bytes in this command is 6 plus a <CR>.

Number of bytes in Response
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 7 plus a <CR>.

READ INPUT LINE COMMAND

Description:
This command is used to read the state of an input line.

Command Format:
"Ixxaa?".
Where "xx" is 00.
"aa" = input line number (01 for line 1 and 02 for line 2)

Response Format:
"Ixxaa=b".
Where "xx" is 00.
"aa" = input number.
"b" = the state of the output (0=low, 1=high).

Example:
Read input #1 high:
Command: "I0001?"
Response: "I0001=1"

Number of Bytes in Command
The minimum number of bytes in this command is 6 plus a <CR>.
The maximum number of bytes in this command is 6 plus a <CR>.

Number of bytes in Response
The minimum number of bytes in this response is 7 plus a <CR>.
The maximum number of bytes in this response is 7 plus a <CR>.

GET/SET DATE/TIME COMMAND

Description:
This command is used to set or get the date and time.

Command Format:
"Txxaa=bbbbbbbb".
Where "xx" is 00.
"aa" = 01 for the date, 02 for the time if setting the parameter
"aa" = any characters for getting the date and time (both are received on one command)
"bbbbbbbb" = the time (hh:mm:ss) or date (mm/dd/yy). If "b" is set to a "?" character then the
date and time will be returned.

Response Format:
"Txx=OK" if setting the date or time
or
"Txx=mm/dd/yy, hh:mm:ss".
Where "xx" is the network address of the unit.
Example #1:
Set the time:
Command: "T0002=13:45:00".
Response: "T01=OK"

Example #2:
Read the data and time:
Command: "T0000=?"
Response: "T01=07/02/97, 13:45:20"

Number of Bytes in Command
- The minimum number of bytes in this command is 7 plus a <CR>.
- The maximum number of bytes in this command is 14 plus a <CR>.

Number of bytes in Response
- The minimum number of bytes in this response is 6 plus a <CR>.
- The maximum number of bytes in this response is 23 plus a <CR>.

PRINT ERROR STATUS COMMAND

Description:
This command is used to get a summary of all of the error counters

Command Format:
"Qxx".
Where "xx" is 00.

Response Format:
"aaaaaaa...."
Each error counter is returned as a string such as "Qxx =Messages sent: 45781".

Example:
Command: "Q00".
Response:

<table>
<thead>
<tr>
<th>T01</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q00</td>
<td>09/19/02, 15:17:47</td>
</tr>
<tr>
<td>Q01</td>
<td>Exceptions: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>Divide by 0: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>Host Messages sent: 1836.</td>
</tr>
<tr>
<td>Q01</td>
<td>Host Messages received: 78.</td>
</tr>
<tr>
<td>Q01</td>
<td>LSC Messages sent: 14010.</td>
</tr>
<tr>
<td>Q01</td>
<td>LSC Messages received: 13999.</td>
</tr>
<tr>
<td>Q01</td>
<td>Comm errors: 3.</td>
</tr>
<tr>
<td>Q01</td>
<td>Comm timeouts: 6.</td>
</tr>
<tr>
<td>Q01</td>
<td>LSC Bus Busy: 1.</td>
</tr>
<tr>
<td>Q01</td>
<td>Buffer overflows: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>Wrong sender: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>Error responses: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>LSC Collisions: 2.</td>
</tr>
<tr>
<td>Q01</td>
<td>LSC Tx Timouts: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>LSC Resets: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>EEPROM Errors: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>Sensor Nvram Errors: 0.</td>
</tr>
<tr>
<td>Q01</td>
<td>Measure glitches suppressed: 26.</td>
</tr>
</tbody>
</table>

Number of Bytes in Command
- The minimum number of bytes in this command is 3 plus a <CR>.
- The maximum number of bytes in this command is 3 plus a <CR>.

Number of bytes in Response
- The number of bytes in this response is approximately 500.
COPY CALIBRATION COMMAND

**Description:**
This command is used to copy the meter calibration from one channel to all other channels.

**Command Format:**
"Cxx*$a".
Where "xx" is 00.
"a" = the channel that holds the calibration data to be copied to all others.

**Response Format:**
"Txx=OK".

**Example:**
Command: "C00*$2".
Response: "C00=OK".

**Number of Bytes in Command**
The minimum number of bytes in this command is 6 plus a <CR>.
The maximum number of bytes in this command is 6 plus a <CR>.

**Number of bytes in Response**
The minimum number of bytes in this response is 6 plus a <CR>.
The maximum number of bytes in this response is 6 plus a <CR>.

GET MESSAGES COMMAND

**Description:**
This command will return all of the messages for a measurement.

**Command Format:**
"Fxxa".
Where "xx" is 00.
"a" = the measurement designator ("A" – “Z”).

**Response Format:**
"Fxx=yyyyyyyyy".

**Examples:**
Command: "F00A".
Response: "F01A = *No sensor on chan.
F01A = *Temp out of range.
F01A = *Res sensor open."
Command: "F00A".
Response: "F01A = No problems reported."

**Number of Bytes in Command**
The minimum number of bytes in this command is 4 plus a <CR>.
The maximum number of bytes in this command is 4 plus a <CR>.

**Number of bytes in Response**
The response size varies with the message produced by the meter (approximately 28 to 100 characters).

PRINT SETUP COMMAND

**Description:**
This command will instruct the meter to print the entire meter setup (same as the one from the menus).
**Command Format:**

```
"Hxx"
```

Where “xx” is 00

**Response Format:**

```
'aaaaaa....'
```

**Number of Bytes in Command**

The minimum number of bytes in this command is 4 plus a <CR>.
The maximum number of bytes in this command is 4 plus a <CR>.

**Number of bytes in Response**

The response will be a display of the entire meter setup. The length varies with the setup chosen by the user. The number of bytes is approximately 3000.

**Notes:**

The meter will restart after this command.

**TOC CONTROL COMMAND**

**Description:**

This command will instruct the meter on TOC operations.

**Command Format:**

```
"Jxxaa=bcde..."
```

Where "xx" is the network address of a unit (can set to 00 for this unit).
"aa" = opcode
"bcde ..." = data

```
"Jxx01=ab"  set TOC data output. a=channel, b=0 for output off, b=1 for output on
"Jxx02=ab"  set UV lamp on or off. a=channel, b==0 for off, b=1 for on
"Jxx03=ab"  set toc mode. a=channel, "b" = 1 for autobalance, b=2 for measuring
"Jxx04=ab"  set Flow command. b=1, sensor in setting flow mode. b=2, sensor in measurement mode.
"Jxx05=ab"  save TOC parameters to NVRAM" command, a=channel, b=1,  Save TOC Setup
b=2,  Save Lamp parameters
b=3,  Save Balance parameters
b=4,  Save Users Cal parameters
b=5,  Save Fact Cal parameters
b=6,  Save Faults and Errors
"Jxx06=a"  reset TOC sensor command. a=channel,
"Jxx07=a"  clear TOC History command. a=channel,
```

**Response Format:**

```
"Jxx=OK"
"Jxx=c...c"
```

Where "c...c" is the response

**Number of Bytes in Command**

The minimum number of bytes in this command is 8 plus a <CR>.
The maximum number of bytes in this command is 8 plus a <CR>.

**Number of bytes in Response**

The minimum number of bytes in this response is 6 plus 7 <CR>.
The maximum number of bytes in this response is 6 plus 300 <CR>.
CHAPTER 7: MENU TREES

The following menu trees illustrate the general sequence of settings available in the 770MAX. However, some low level menu items are dependent on the type of sensor connected and on previous menu selections. For example, only a flow measurement with totalized flow units selected will show the menu field for setting External Reset. Also, the model of 770MAX will determine how many analog outputs and relays are present for configuration.

The screens below will appear after pressing **Menu** only if security has been enabled. Otherwise pressing **Menu** accesses the Main Menu directly, as shown on the following pages.
MEASUREMENTS MENUS

Settings which can be changed are in Bold.

Some menu displays depend on previous settings, e.g. "Fixed Temp" appears only if 'Temp Source' has been set to 'Fixed'.

Main Menu
Select a menu using ↑↓ then press enter
Go to Measurements

Main Menu Options
1. Measurements
2. Messages
3. Calibrate
4. Analog Outputs
5. Selpoints
6. Relays
7. Display Setup
8. Security
9. Diagnostic
10. RS232 Setup
11. Network
12. Reset
13. Tech Support
14. Set Hold Time
15. Other Menus

For 5000TOC Sensor menus, see manual 84445.
ANALOG OUTPUTS, SETPOINTS AND RELAYS MENUS

Main Menu
Select a menu using
↑↓ then press enter
Go to Measurements

Analog Outputs

Types:
1. Normal (linear)
2. Bi-linear
3. Auto Range
4. Logarithmic

Analogue #1
Meas: A (DA-Tank S/cm)
Type: Normal
Low Value: 4mA

Analogue #1
4mA= 10,000 m S/cm
20mA= 20,000 m S/cm

Normal-Linear

Auto-Range

Bi-Linear

Logarithmic

Analogue #1
On failure set: Min
Calibrated: 03/17/97
Current Out= 14.24mA

Analogue #1
4mA= 0.0000 u S/cm
Mid= 1,0000 u
20mA= 11,000 u

Setpoints

Analogue #1
On failure set: Min
Calibrated: 03/17/97
Current Out= 14.24mA

Analogue #1
Range 1 Settings
4mA= 0.0000 u S/cm
20mA= 10,000 u

Analogue #1
Range 2 Settings
4mA= 0.0000 u S/cm
20mA= 100.00 u

Analogue #1
On failure set: Min
Calibrated: 03/17/97
Current Out= 14.24mA

Analogue #1
When using range 2, activates Relay 1
(more)

Relays

Setpoint #1
Measure: A (DA-Tank)
Value=18.123M (-cm)
Type: High

Setpoint #1
Activate: Relay #1
If sensor error: Off
(Status Next Page)

Setpoint #1
Activation: Relay #1
Ext Reset: In #1
Type is SPDT Mech.
Relay is now on.

Setpoint #1
Closed time since test activation is
(dd:hh:mm) 01:52:45
TECH SUPPORT, SET HOLD TIME AND OTHER MENUS

**Main Menu**
Select a menu using ↑↓ then press Enter
Go to: **Tech Support**

**Main Menu**
Select a menu using ↑↓ then press Enter
Go to: **Set Hold Time**

**Main Menu**
Select a menu using ↑↓ then press Enter
Go to: **Other Menus**

**Other Menus Options:**
1. Set Time/Date
2. Software Revs
3. View Total Flow
4. Print Config
5. Smart Sensors
6. Set Unit Name
7. Lost Passwords
8. Service Only
9. Advanced

**TECH SUPPORT**
Thorton Inc.
Phone: 781-301-8690
Fax: 781-271-0875

**SoftwRevs**
Display Rev: 1.10
Option 1 Analog v1.00
Option 2 Not Instal.

**Set Hold Time**
Hold outputs? Enter time or 00 for none. Hold time = 00 mins

**TECH SUPPORT**
Web: Thortoninc.com
Email: Service@Thortoninc.com

**Set Unit Name**
Name or location of this unit is:
0000000000000000

**Lost Passwords**
Password Needed
Please enter the service password.
Password=*****

**TOTAL Flow**
Total Flow on Chn5
Is: 125134.2396 Got

**PRINT METER SETUP**
Press Enter when ready to print the meter setup.

**PRINT METER SETUP**
Please wait...
Printing setup
Press Menu to quit

**SMART SENSORS**
Select a menu using ↑↓ then press Enter.
Go to: **Save Sensor Data**

**SET UNIT NAME**
Name or location of this unit is:
0000000000000000

**RECOVER PASSWORDS**
Master: AEC61
User #1: CH10
User #2: GKO6W

**Password Needed**
Password=*****

**SAVE SENSOR DATA**
Select a channel to save sensor data. Then press Enter

**CLEAR SENSOR DATA**
Select a channel to clear sensor data. Then press Enter

**RECALL SENSOR DATA**
Select a channel to recall sensor data. Then press Enter

**Timer/Date**
Time: 12:45:27
Date: 07/23/00
Page-Down key to set

**Software Revs**
Serial #: 012345
Main Program: 1.50
Measurements: 1.50

**Total Flow**
Total Flow on Chn5
Is: 125134.2396 Got

**Print Config**

**Smart Sensors**

**Edit Smart Data**

**Save Setup Data**

**Clear Setup Data**

**Recall Setup Data**
CHAPTER 8: PRINTER INSTALLATION INSTRUCTIONS

INSTALLATION INSTRUCTIONS FOR USE WITH THE THORNTON 770MAX SERIES INSTRUMENTS

1. Connect the AC adapter to the printer and load paper.
2. Connect the communications cable from the printer to the 770MAX series meter. The cable has a 9-pin (DB-9) male connector on one end and three tinned leads at the other end. The male 9-pin connector is attached to the connector located at the rear of the printer. Use Table 1 and the operating manual for the meter to determine how to wire the leads to the meter. Connect the leads to the pluggable connector that comes with each meter.
3. If the printer power is turned ON, turn the power switch OFF.
4. While pressing the ONLINE button, turn the power switch ON. Release the ONLINE button after the list of the current settings starts printing.
5. The printer will print the following prompt:
   Continue? :Push ‘ONLINE SW’
   Write? :Push ‘Paper feed SW’
6. Compare the DIP SW settings to the values in Tables 2-4 in this Installation manual.
7. If any of the DIP SW settings need to be changed, push the ONLINE button. Do not change any of the critical settings noted as ** in Tables 2-4. Go to Step 9.
8. If none of the DIP settings in Tables 2-4 need to be changed, push the FEED button. Go to Step 16.
9. The printer will print Dip SW-1, then prompt for the input of new settings starting with 1 and continuing through 8 of software Dip SW-1. To select OFF, press the FEED button. To select ON, press the ONLINE button. The resulting setting is then printed out to signify confirmation of the new setting. The ONLINE or FEED lamp lights also light when pressed to confirm button operation.
   The Dip SW Set mode can not be canceled once it is initiated. Input either “ON” or “OFF” for every setting in order from switch number 1 through 8.
10. After switch number 8 on DIP SW-1 is set, the printer once again prompts with
    Continue? :Push ‘ONLINE SW’
    Write? :Push ‘Paper feed SW’
11. If any of the DIP SW settings on SW-2 or SW-3 need to be changed, push the ONLINE button. Do not change any of the critical settings noted as * in Tables 2-4. Go to Step 13.
12. If the DIP SW-2 and SW-3 settings do not need to be changed, push the FEED button. Go to Step 16.
13. Repeat according to Step 9. As the settings are printed, press FEED to select OFF and press ONLINE to select ON.
14. After switch number 8 on DIP SW-2 is set, the printer once again prompts with
    Continue? :Push ‘ONLINE SW’
    Write? :Push ‘Paper feed SW’
15. Repeat this process for SW-3.
16. After all settings are selected, the ONLINE and FEED lamps blink alternately and the new settings are written to the memory. When the printer finishes writing everything to memory, “Dip SW setting complete!” is printed and the printer returns to ONLINE mode.

Never turn the printer off while the new settings are being written to the memory. Always wait until “Dip SW setting complete!” is printed. Then turn the power off.
The function settings in the tables shown with ** after them are required for proper operation of the connected instrument. To change other printer parameter software DIP switches see the DPU-414 manual.

### Table 1 (Serial Port Connection)

<table>
<thead>
<tr>
<th>770MAX</th>
<th>DPU-414 (Serial input connector Pin)</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>RxD</td>
<td>2 (TxD)</td>
<td></td>
</tr>
<tr>
<td>TxD</td>
<td>3 (RxD)</td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td>5 (GND)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2 (Software DIP SW-1)

<table>
<thead>
<tr>
<th>Switch</th>
<th>Function</th>
<th>Setting</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input Method</td>
<td>OFF</td>
<td>Serial **</td>
</tr>
<tr>
<td>2</td>
<td>Printing Speed</td>
<td>ON</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Auto loading</td>
<td>ON</td>
<td>On</td>
</tr>
<tr>
<td>4</td>
<td>CR function</td>
<td>ON</td>
<td>Carriage return and line feed **</td>
</tr>
<tr>
<td>5</td>
<td>DIP SW setting command</td>
<td>ON</td>
<td>Enable **</td>
</tr>
<tr>
<td>6</td>
<td>Print Density</td>
<td>OFF</td>
<td>100%</td>
</tr>
<tr>
<td>7</td>
<td>Print Density</td>
<td>ON</td>
<td>100%</td>
</tr>
<tr>
<td>8</td>
<td>Print Density</td>
<td>ON</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Table 3 (Software DIP SW-2)

<table>
<thead>
<tr>
<th>Switch</th>
<th>Function</th>
<th>Setting</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Print Mode</td>
<td>OFF</td>
<td>Condensed Printing (80 Columns) **</td>
</tr>
<tr>
<td>2</td>
<td>User-Defined Characters back-up</td>
<td>ON</td>
<td>On</td>
</tr>
<tr>
<td>3</td>
<td>Character type</td>
<td>ON</td>
<td>Ordinary Characters</td>
</tr>
<tr>
<td>4</td>
<td>Zero Font</td>
<td>ON</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>International Character Set</td>
<td>ON</td>
<td>American</td>
</tr>
<tr>
<td>6</td>
<td>International Character Set</td>
<td>ON</td>
<td>American</td>
</tr>
<tr>
<td>7</td>
<td>International Character Set</td>
<td>ON</td>
<td>American</td>
</tr>
<tr>
<td>8</td>
<td>International Character Set</td>
<td>OFF</td>
<td>American</td>
</tr>
</tbody>
</table>

### Table 4 (Software DIP SW-3)

<table>
<thead>
<tr>
<th>Switch</th>
<th>Function</th>
<th>Setting</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data Bit length</td>
<td>ON</td>
<td>8 Bit **</td>
</tr>
<tr>
<td>2</td>
<td>Parity permission</td>
<td>ON</td>
<td>None **</td>
</tr>
<tr>
<td>3</td>
<td>Parity condition</td>
<td>ON</td>
<td>Odd</td>
</tr>
<tr>
<td>4</td>
<td>Flow control</td>
<td>ON</td>
<td>H/W BUSY **</td>
</tr>
<tr>
<td>5</td>
<td>Baud Rate</td>
<td>OFF</td>
<td>19200 bps</td>
</tr>
<tr>
<td>6</td>
<td>Baud Rate</td>
<td>ON</td>
<td>19200 bps</td>
</tr>
<tr>
<td>7</td>
<td>Baud Rate</td>
<td>ON</td>
<td>19200 bps</td>
</tr>
<tr>
<td>8</td>
<td>Baud Rate</td>
<td>OFF</td>
<td>19200 bps</td>
</tr>
</tbody>
</table>

The default serial port settings on the 770MAX meters are 19.2kb and no parity. Other settings may be selected in the serial port of the meter is configured differently.
### ACCESSORIES

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch cords have connectors at both ends for 770MAX and Smart Sensors (not used with pulse input flow sensors). Pressure and level sensors are limited to 150 ft (45.6 m) maximum and 4-electrode conductivity sensors are limited to 50 ft (15.2 m) maximum length.</td>
<td></td>
</tr>
<tr>
<td>1 ft. (0.3 m) cord</td>
<td>1001-79</td>
</tr>
<tr>
<td>5 ft. (1.5 m) cord</td>
<td>1005-79</td>
</tr>
<tr>
<td>10 ft. (3 m) cord</td>
<td>1010-79</td>
</tr>
<tr>
<td>15 ft. (4.5 m) cord</td>
<td>1015-79</td>
</tr>
<tr>
<td>25 ft. (7.6 m) cord</td>
<td>1025-79</td>
</tr>
<tr>
<td>50 ft. (15.2 m) cord</td>
<td>1050-79</td>
</tr>
<tr>
<td>100 ft. (30.5 m) cord</td>
<td>1100-79</td>
</tr>
<tr>
<td>150 ft. (45.6 m) cord</td>
<td>1115-79</td>
</tr>
<tr>
<td>200 ft. (61 m) cord</td>
<td>1120-79</td>
</tr>
<tr>
<td>300 ft. (91 m) cord</td>
<td>1130-79</td>
</tr>
<tr>
<td>Rear cover for wall mounting and NEMA 4X, IP65 sealing</td>
<td>1000-69</td>
</tr>
<tr>
<td>Cable Grip Kit – for sealing 1/2&quot; conduit hole entrances for 2 patch cords to rear cover or other enclosure, with large grommets to pass modular connector of patch cord</td>
<td>1000-80</td>
</tr>
<tr>
<td>Pipe mounting bracket, for 2&quot; pipe</td>
<td>15540</td>
</tr>
<tr>
<td>Ferrite Suppressor Module (2 required on power line for CE compliance)</td>
<td>95010</td>
</tr>
<tr>
<td>Patch cord extension 5 ft (1.5 m)</td>
<td>1005-87</td>
</tr>
<tr>
<td>Patch cord extension 15 ft (4.5 m)</td>
<td>1015-87</td>
</tr>
<tr>
<td>Connector for patch cord extension</td>
<td>25320</td>
</tr>
<tr>
<td>12 VDC Power Supply for 1 or 2 pulse input flow sensors (powered by 85-265 VAC)</td>
<td>1000-65</td>
</tr>
<tr>
<td>24 VDC Power Supply for 1 or 2 pulse input flow sensors (powered by 85-265 VAC)</td>
<td>1000-66</td>
</tr>
<tr>
<td>Pulse input flow sensor kit, required for some pulse flow sensors</td>
<td>1000-67</td>
</tr>
<tr>
<td>Automatic Smart Calibrator Kit</td>
<td>1875</td>
</tr>
<tr>
<td>120VAC calibrator power supply, used when not connected to 770MAX, for downloading to PC</td>
<td>36151</td>
</tr>
<tr>
<td>Smart pH/ORP BNC preamp – for pH/ORP electrode with BNC connector (no temp. comp.)</td>
<td>1000-78</td>
</tr>
<tr>
<td>Smart pH/ORP K9 preamp – for pH/ORP electrode with K9 connector (no temp. comp.)</td>
<td>1000-84</td>
</tr>
<tr>
<td>Smart conductivity adapter cable – allows decade box input for calibration</td>
<td>1000-82</td>
</tr>
<tr>
<td>Smart frequency adapter cable – allows frequency input for pulse flow meters</td>
<td>1000-83</td>
</tr>
<tr>
<td>770MAX Service Manual</td>
<td>84373</td>
</tr>
</tbody>
</table>
## SPARE/REPLACEMENT PARTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Terminal pluggable connector, 2 for models 775-___0 &amp; 775-___1; 3 for model 775-___2</td>
<td>25302*</td>
</tr>
<tr>
<td>6 Terminal pluggable connector, 2 for models 775-___1 and 775-___2</td>
<td>25301*</td>
</tr>
<tr>
<td>Fuse, 0.5 A slo blo, 5 x 20 mm (Littlefuse 218.500 or equivalent)</td>
<td>35092*</td>
</tr>
<tr>
<td>Panel mounting screws (6-32 x 7/16”, 4 required)</td>
<td>21800</td>
</tr>
<tr>
<td>Front panel assembly, molded cover with gasket, screws, retaining washers and keypad</td>
<td>07331</td>
</tr>
<tr>
<td>Screws for front panel (2 required, included in front panel assembly above)</td>
<td>21674</td>
</tr>
<tr>
<td>Retaining washers for front panel (2 required, included in front panel assembly above)</td>
<td>21675</td>
</tr>
<tr>
<td>Vacuum fluorescent display module (order connector and mounting standoffs separately)</td>
<td>47048</td>
</tr>
<tr>
<td>Connector for vacuum fluorescent display module above</td>
<td>25300</td>
</tr>
<tr>
<td>Liquid crystal display module (order mounting standoffs separately)</td>
<td>47047</td>
</tr>
<tr>
<td>Display standoffs (4 required for either display above)</td>
<td>21673</td>
</tr>
<tr>
<td>Relay option kit (to convert model 775-___0 to 775-___1)</td>
<td>1000-91</td>
</tr>
<tr>
<td>Analog output &amp; relay option kit (to convert 775-___0 to 775-___2)</td>
<td>1000-92</td>
</tr>
</tbody>
</table>

*Recommended Spare parts
WARRANTY

Mettler-Toledo Thornton, Inc. warrants products it manufactures against defects in materials and workmanship for 18 months from the date of shipment from Thornton. Some non-Thornton manufactured resale items may have shorter warranties. Thornton honors only the warranty period of the original manufacturer. Consumable items such as pH and ORP sensors and TOC UV lamps are warranted for a period of 6 months from shipment in normal use and service.

Catalog descriptions, although accurate, should not be taken as a guarantee or warranty. Mettler-Toledo Thornton's obligation under the warranty shall be to repair at its facility or replace any products which Thornton finds to be defective. Items returned for warranty must be properly packaged, shipped prepaid and insured, and must be accompanied by a Return Materials Authorization (RMA) assigned by Thornton Customer Service. Proper return packaging for pH, ORP and dissolved oxygen sensors includes their original storage boot, chamber or alternative packaging containing a small amount of water to keep the sensor tip from drying out.

Note: Substitution, modification or mis-wiring of cables voids all warranties.

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