Pre-Installation

The ST50 can be specified with integral or remote electronics. The flow element has a serial number etched into the side of the extension pipe as shown on Figure A. The transmitter circuit card has a serial number noted on the board as shown in Figure B. The flow sensor and transmitter circuit have been calibrated as a matched set and should be paired together in service unless otherwise approved by a factory technician.

Flow Direction Alignment

All sensor elements have a flow arrow indicator marked on the element assembly at the reference flat. These flow elements have been calibrated in a particular direction and are designed to be used in service with the flow arrow facing in the same direction as flow in the pipe stream. See Appendix C for orientation and factory calibration details.

Recommended Straight Run

To optimize flow meter system performance, FCI recommends installation with a minimum of 20 pipe diameters upstream straight run and 10 pipe diameters of downstream straight run. Where straight run limitations significantly reduce the available pipe diameters, FCI utilizes Vortab flow conditioners to produce a transferable flow profile from the calibration installation to actual field installations. FCI’s proprietary AVAL software is available to make flow meter installation evaluations where straight run limitations are considered. See Figure C for recommended installation.

FCI flow meters may be installed with less than the recommended straight run, but may have performance limitations. FCI offers Vortab flow conditioners for use in applications that have significant straight run limitations. FCI uses the AVAL application modeling software to predict meter performance in each installation. AVAL outputs are available to review prior to order placement and will indicate performance expectations both with and without Vortab Flow Conditioning.
**Specifications**

**Instrument**

**Media Compatibility:** Air, compressed air, and nitrogen

**Pipe/Line Size Compatibility:** 23” to 24” [51 mm to 610 mm]

**Range:** Air, compressed air, or nitrogen: 0.75 SFPS to 400 SFPS [0.23 MPS to 122 MPS]

**Accuracy:**
- Standard: ±2% of reading, ±0.5% of full scale
- Optional: ±1% of reading, ±0.5% of full scale

**Repeatability:** ±0.5% of reading

**Temperature Compensation:**
- Standard: 40 °F to 100 °F [4 °C to 38 °C]
- Optional: 0 °F to 250 °F [-18 °C to 121 °C]

**Turndown Ratio:** 3:1 to 100:1

**Agency Approvals:**
- FM/CSA: Nonincendive for use in Class 1, Division 2, Groups A, B, C and D T4 Ta = 60 °C Indoor Hazardous (Classified) Locations.
- ATEX/IECEx: II 3 G EEx nA II T6; II 3 D T65°C (DC input power only)
- CPA, CE Mark, PED

**Warranty:** One year

**Flow Element (Standard or FPC Type)**

**Installation:** Insertion, variable length with 1/2" or 3/4" NPT(M) compression fitting.

**Type:** Thermal dispersion

**Material of Construction:** 316 stainless steel body with Hastelloy C thermowell sensors, 316 stainless steel compression fitting with Teflon or stainless steel ferrule

**Pressure (Maximum Operating without Damage):**
- Stainless steel ferrule: 500 psig [34 bar(g)]
- Teflon ferrule: 150 psig [10 bar(g)]
- Retractable packing gland: 500 psig [34 bar(g)]

**Temperature (Maximum Operation):**
- Stainless steel ferrule: 0 °F to 250 °F [-18 °C to 121 °C]
- Teflon ferrule: 0 °F to 200 °F [-18 °C to 93 °C]

**Process Connection:** 1/2" MNPT or 3/4" MNPT with stainless steel or Teflon ferrule; retractable packing gland, 1/2" or 3/4" MNPT with graphite or Teflon packing.

**Insertion Length:** Field adjustable lengths: 1" to 6" [25 mm to 152 mm]; 1" to 12" [25 mm to 305 mm]; or 1" to 18" [25 mm to 457 mm]

**Flow Transmitter**

**Enclosure:** NEMA 4X [IP67], aluminum, dual conduit ports with either 1/2" NPT or M20x1.5 entries. Epoxy coated.

**Analog Output Signals:** Dual 4-20 mA, configurable to flow rate and/or temperature (500 ohm max impedance) and a pulse output for total flow.

**Output Pulse, Source:** Totalized flow or alarm setpoint. 15 VDC. Pulse width at 50% duty cycle for rates 0 to 500 Hz, 0.5 second pulse width for pulse rates below 1 Hz. 25 mA maximum load pulsed, 10 mA maximum load if state set to normally on.

**Output Pulse, Sink:** Totalized flow or alarm setpoint. Pulse width at 50% duty cycle for rates 1 to 500 Hz, 0.5 second pulse width for rates below 1 Hz. Customer power source and load not to exceed 40 VDC and 150 mA.

**Communication Port:** RS232C, standard.

**Input Power:**
- DC: 18 VDC to 36 VDC (6 W maximum)
- AC: 85 VAC to 265 VAC (12 W maximum, 1.6 A fuse) (CE Mark Approval from 100 VAC to 240 VAC)

**Power Filter Board:**

<table>
<thead>
<tr>
<th>Amp Code</th>
<th>Rated Current</th>
<th>Voltage Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>374 1160 0410</td>
<td>1160</td>
<td>1.60 A</td>
</tr>
<tr>
<td>Breaking Capacity</td>
<td>50A/250 VAC 50-60 Hz cos φ = 1.0</td>
<td></td>
</tr>
</tbody>
</table>

**Operating Temperature:** For Indoor or Outdoor use, 0 °F to 140 °F [-18 °C to 60 °C]

**Maximum Relative Humidity:** 100%

**Maximum Altitude:** 12,000 ft. (3,658m)

**Digital Display:** ±9999 Counts LCD, 0.45" H [11.4 mm] characters, user scalable to flow rate units or as 0-100%. For applications in Div. 1 / Zone 1 environments and/or for dual-line digital display with built-in totalizer display, refer to FCI Model ST51.
Installing Flow Element

Compression Fitting Mounting

**Caution:** The element is shipped with a protective sleeve surrounding the flow element. After removing the sleeve, take care to prevent the element from sliding through the compression fitting and contacting the opposing wall with any force as it may cause damage to the element and potentially upset the calibration.

The ST50 is available with both Teflon compression fitting ferrules and metal ferrules. While the Teflon ferrule configuration can be readjusted, it is possible that over tightening may result in permanent positioning or damage to the extension pipe and will make future adjustment difficult. While Teflon provides for some adjustability, it has a lower process pressure rating and is not designed for continuous adjustments. The metal ferrule version can only be tightened down once and it becomes permanently positioned. The Ferrule type is indicated in the instrument part number displayed on the instrument tag. This can be cross referenced to the ordering information sheet.

All flow meters have been calibrated with the flow element located at the centerline of the pipe and flow stream as indicated in Figure D. Couplings and threadolets come in various dimensions. Proper installation requires that the element be measured with consideration to process connection dimensions and pipe centerline. FCI recommends that the element be first installed in the line with the compression fitting lightly tightened around the extension, then slowly move the pipe extension forward until the element is at centerline as shown.

**Caution:** On top mount installations, particularly, take care to prevent the element from sliding through the compression fitting and contacting the opposing wall with any force as it may cause damage to the element and potentially upset the calibration.

---

**FLOW ELEMENT INSTALLATION & “U” LENGTH ADJUSTMENT**

![Diagram](attachment:image.png)

**Figure D**

**Note:** For proper performance install the element so that probe tip is .50 inches [13 mm] past pipe centerline. The instrument is specifically calibrated for centerline referenced installation, which is critical for line sizes 4” [25 mm] and smaller.
To assist in final installation, FCI suggests making a readable mark on the extension pipe to indicate the final desired compression fitting position that will place the element at the centerline reference once the system is tightened down into place. With the compression fitting lightly tightened, hold the element assembly along the outside of the installation, or directly above, to visually verify the compression fitting location will ensure centerline installation. To calculate the actual “U” length dimension, take the inside diameter of the pipe or duct divide by 2, then add 0.50”, then add for the pipe wall thickness and the process fitting offset that allows the compression fitting to securely seat in the process port. See Figure D above.

Align the flat parallel to flow and adjust the instrument depth. Upon determination of the final compression fitting location on the extension pipe, apply the proper thread sealant to the NPT threads, firmly tighten the compression fitting into the mating process connection. Torque varies per application. Tighten the compression nut to the torque indicated with the corresponding ferrule material. Manufacturer recommends 1-1/4 turns from hand tight baseline.

<table>
<thead>
<tr>
<th>Ferrule</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon</td>
<td>65 in – lbs</td>
</tr>
<tr>
<td>316 SST</td>
<td>65 ft – lbs</td>
</tr>
</tbody>
</table>

**Retractable Packing Gland Mounting**

A retractable packing gland, with ½” MNPT or ¾” MNPT threads and graphite or Teflon packing, is a process connection option. FCI single point flow meters are calibrated at the centerline of the process pipe. The flow element is properly mounted when the tip of the flow element is located .50 inches (13 mm) past the pipe centerline. Follow the below steps to install/retract instruments with the retractable packing gland option.

1. The scale etched on the side of the insertion probe indicates the length to the tip of the flow element. Calculate the insertion depth using the equation, variables, and Figure E below.

   \[
   \text{INSERTION DEPTH} = 0.50 + \left(\frac{ID}{2}\right) + T + C
   \]

   \[
   \text{INSERTION DEPTH} = \underline{\text{______________}}
   \]

   Figure E

2. Mark the insertion pipe at the calculated insertion depth.

3. **Ball Valve Applications Only:** If a ball valve is required, install the ball valve to the process mounting coupling. Close the ball valve to prevent the process media from leaking out when installing the packing gland with the process line pressurized.

4. Apply the proper thread sealant compatible with the process media to the male threads of the packing gland. Fully retract the insertion probe into the cavity of the packing gland and install the packing gland into the process mounting coupling or ball valve. If a ball valve is not used, make sure to first depressurize the process line before installing.
5. Tighten the packing nut until the internal packing is tight enough to prevent excess process leakage, but also allow the insertion probe to be inserted into place. For ball valve applications, open the ball valve after the packing nut has been tightened.

Caution: For applications where the process media is pressurized to greater than 232 psig [16 bar(g)] make sure to first depressurize the process line before making the insertion.

6. Align the orientation flat and flow arrow parallel to the flow direction and proceed to insert the flow element into the process media pipe up to the insertion depth mark.

7. Tighten the packing nut another ½ to 1 turn tight (approximately 20 ft-lbs) until the packing has created a full seal.

8. Ensure the locking collar is properly secured to the back of the packing gland. Torque the two No. 8-32 socket head cap screws on the locking collar to 20 in-lbs using a 9/64" hex key.

Retraction/Removal Procedure

1. Loosen the socket head cap screw on the side of the locking collar. See Figure F below.

Caution: For applications where the process media is pressurized to greater than 232 psig [16 bar(g)] make sure to first depressurize the process line before retracting the flow element. At 232 psig [16 bar(g)], the effective force on the insertion probe is 45.5 lbs (20.6 kg), which is the limit at which the flow element can be safely guided by hand. When using hands to restrain the retraction, be prepared for a rapid pressure impulse of the flow element. Make sure that there are no objects directly behind the flow element as the insertion probe may retract very quickly.

2. Slowly loosen the packing nut until the insertion probe begins to retract. Use hands as needed to help control the retraction. If the probe does not begin to retract itself, gently shake and pull the insertion probe until the flow element has been fully retracted into the packing gland.

3. For ball valve applications, close the ball valve immediately after retraction to seal off the process. After closing the ball valve it is then safe to remove the flow element from the back end of the ball valve. If a ball valve is not being used, make sure to first depressurize the process line before removing the flow element.
**Instrument Wiring**

Before the instrument is opened to connect power and signal, FCI recommends that the following ESD precautions be observed:

Use a wrist band or heel strap with a 1 megohm resistor connected to ground. If the instrument is in the shop setting, there should be a static conductive mat on the work table or floor with a 1 megohm resistor connected to ground. Connect the instrument to ground. Apply antistatic agents such as Static Free made by Chemtronics (or equivalent) to hand tools to be used on the instrument. Keep high static producing items away from the instrument.

The above precautions are minimum requirements. The complete use of ESD precautions can be found in the U.S. Dept of Defense Handbook 263.

**Warning:** Only qualified personnel are to wire or test this instrument. The operator assumes all responsibility for safe practices while wiring and troubleshooting.

FCI recommends installing and input power disconnect switch and fuse near the instrument to interrupt power during installation and maintenance. Operator must have power disconnected before wiring.

Safety instructions for the use of the ST50 series (18 to 36 VDC version only) in Hazardous Areas. Approval, KEMA 06ATEX0207 X for Category 3 GD protection EEx nA T6 T65° Special conditions for safe use:

1) Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40%.
2) For applications in explosive atmospheres caused by air/dust mixtures, cables and conduit entries shall be provided a degree of protection of at least IP65 according to EN60529.

**Input Power**

The ST50 is available with both VDC and VAC input power configurations. Customers selecting VDC input power will have a VDC input board only. Similarly, the VAC power board is supplied only with VAC powered units. In addition, both boards are marked for either DC or AC power. Only connect the power specified on the wiring module as shown in Figures G and H. Both VAC and VDC inputs require a Gnd wire to be connected. Input power terminal blocks accept 14-26 AWG wire.

Make sure power is OFF before wiring the instrument. Pull the power and signal output wires through the port, using care not to damage wires. FCI recommends using crimp lugs on the output wires to ensure proper connection with the terminal strip. Connect the output wires as shown in Figures G and H. Note that when the 4-20 mA outputs are used simultaneously, a single return lead is used.
VDC Power
As Shown:
18-36 VDC power connected with Gnd
4-20 mA connected for flow and temperature
Pulse Out in source mode

*Note:* In source mode, 15 VDC output max, 50 mA max.

VDC Power
As Shown:
85-265 VAC power connected with Gnd
4-20 mA connected for flow and temperature
Pulse Out in sink mode

*Note:* In sink mode, 40 VDC max, 150 mA max customer-supplied power source.

Power Dissipation

**DC Version**
Power dissipation values under nominal conditions:
Instrument (electronics + sensor): 4.5 watts
Sensor only: 0.25 watts

Power dissipation values under maximum load conditions:
Instrument (electronics + sensor): 6 watts
Sensor only: 0.30 watts

**AC Version**
Power dissipation values under nominal conditions:
Instrument (electronics + sensor): 11.6 watts
Sensor only: 0.25 watts

Power dissipation values under maximum load conditions:
Instrument (electronics + sensor): 12 watts
Sensor only: 0.30 watts

Analog Output
4-20 mA: The instrument is provided with two 4-20 mA outputs. By default Output 1 is configured for flow and Output 2 is configured for temperature. Terminal blocks accept 14-28 AWG wire, 500 ohms max load per output.

VDC Input Power IO Board

VAC Input Power IO Board
Modify the analog output configuration using one of the below listed methods:

1. The RS232 port, a PC/terminal program or FC88 hand held terminal and single letter commands as summarized in Appendix A, Table 5. Use the “V” menu to configure the instrument analog outputs.
2. The RS232 port, a computer and the CLI commands as summarized in Appendix A, Table 6.

**Pulse Output Activation**

The ST50 provides an optional pulse output feature. Instruments ordered with this feature and volumetric or mass flow units will be factory set with totalizer and pulse output activated. The mode can be changed in the field. As required for your application wire the sink or source output as shown in “Pulse Output Wiring” on the next page.

**Source Mode:** 15 VDC output, 50 mA max.

**Sink Mode:** 40 VDC max, 150 mA max., customer supplied power source

**Pulse Output Setup**

The ST50 mass flow meter pulse output can be configured for either a pulse train (factory standard) for an external counter and/or flow rate indication or an alarm. The pulse output can be wired to use a source or sink outputs. The maximum frequency of the pulse output is 500 Hz. Set up the totalizer first, then configure the sink/source pulse output as required for the application (sink/source output, pulse factor, sample period and pulse state).

**Source mode:** In this mode the flow meter electronics supplies the voltage and current for the pulse. Maximum 15 VDC and 50 mA (depends on the connected load).

**Sink mode:** If the connected load requires >15 VDC and 50 mA an external power supply is required. Maximum 40 VDC and 150 mA.

**Pulse factor:** Number of pulses per selected engineering unit. Default = 1

Example in NCMH:

1 = 1 pulse per NCM
0.1 = 1 pulse per 0.1 NCM (10 pulses per 1 NCM)
10 = 1 pulse per 10 NCM

Range pulse factor 0.001 – 1000

**Sample time:** Time in seconds before calculating the next number of pulses.

**Pulse state:** Transitions High to Low or Low to High. Meaning the pulse is normally high or low.

**Pulse output functions:**

**Alarm:** can be set in Source and Sink mode. If this function is selected the state of the transistor driver changes from high to low or low to high, depending on the selected pulse state, at a set flow rate. (pulse factor and sample time not required).

**Counter:** can be set in Source and Sink mode. The transistor driver outputs the calculated number of pulses* based on the indicated flow. And external display will indicate the totalized flow.

**Flow rate:** can be set in Source and Sink mode. The transistor driver outputs the calculated number of pulses* based on the indicated flow. External display set to calculate flow from incoming pulses.

*Each sample period the number of pulses are calculated and output by the open collector. Any remaining fractional pulse in the calculation will be added to the next sample. Example:

flow = 90 NCMM (= 1.5 NCMS), Pulse factor =1, sample time is 1.
after 1 second the number of calculated pulses is 1.5, pulse out is 1. Remainder = 0.5
after the next second the number of pulses is 2 (1.5+0.5), pulses out is 2. Remainder = 0.
Pulse Output Wiring

(a) Source Output

(b) Sink Output

Pulse Output Wiring
**Setup Interface**

All parameters on this meter are set through the RS232 interface connection (modular jack P3). The RS232 interface allows the instrument to be set up with either an FC88 hand held communicator or a computer. The FC88 is powered through the meter and comes with the serial interface cable. If a computer interface is used, an adapter (RJ to 9-pin PC serial port) is required. The adapter can be obtained from FCI: Part No. 014108-02.

Using a serial comm/terminal program (e.g., HyperTerminal, TeraTerm, Putty, etc.) configure the PC’s serial port (the one intended to be connected to the instrument) as listed below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COM Port Number</strong></td>
<td>Number of COM port connected to instrument (COM1, COM2, etc.)</td>
</tr>
<tr>
<td><strong>Baud Rate</strong></td>
<td>9600</td>
</tr>
<tr>
<td><strong>Number of Bits</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>Stop Bits</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Flow Control</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Terminal Emulation</strong></td>
<td>VT100</td>
</tr>
</tbody>
</table>

After configuring the serial port (and making the PC-to-instrument connections) start a communications session with the applicable serial port. Enter any of the meter’s single letter commands in the program’s terminal window to execute a function. See “Table 5. ST50 List of Single Letter Commands” on page 25 (Appendix B) for the complete command list.

An additional command line interface (CLI) is available through the RS232 port. This interface is accessed with the “Y” command using a computer or FC88. The command line password is “357”. See Table 6 in Appendix B for command line details.
**Startup and Commissioning**

1. Verify that all input power and output signal wiring is correct.
2. Apply power to the instrument. Observe that the instrument initializes in the normal operation mode with all outputs active and the display (if so equipped) showing flow with the factory-set flow unit. Allow 10 minutes for the instrument to warm up and come to thermal equilibrium.

The following FC88 commands are typical commands that are used during startup and commissioning:

<table>
<thead>
<tr>
<th>Command</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Normal Operation Mode</td>
<td>All outputs are active</td>
</tr>
<tr>
<td>Z</td>
<td>Flow Unit Set-Up</td>
<td>Select Flow Units (5 English, 8 Metric), Pipe Dimensions</td>
</tr>
<tr>
<td>W</td>
<td>Totalizer</td>
<td>Enable/Disable</td>
</tr>
<tr>
<td>V</td>
<td>Output Configuration</td>
<td>Select a configuration: Pulse and/or Alarm, Pulse factor and/or setpoint, and source/sink polarity</td>
</tr>
<tr>
<td>F</td>
<td>K-Factor (default=1)</td>
<td>Flow factor</td>
</tr>
<tr>
<td>N</td>
<td>Warm Reset</td>
<td>Reinitialize C/B</td>
</tr>
<tr>
<td>S</td>
<td>Totalizer Menu</td>
<td>Enables W menu (Option)</td>
</tr>
</tbody>
</table>

An installed instrument indicates 0.000 with the process flow at zero. The flow engineering units are indicated on the instrument bezel. Additional units indicators are provided via self-adhesive labels if the instrument’s flow units are changed in the future.

**Flow Unit Modification**

Example: **SCFM Flow Units and 3 inch Sch 40 round pipe size set up:**

<table>
<thead>
<tr>
<th>Enter</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter menu: &gt;</td>
<td>From Normal Operation Mode</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>E for English M for Metric &gt;</td>
<td>Flow Unit Set-Up menu</td>
</tr>
<tr>
<td>E</td>
<td>0=SFPS, 1=SCFM, 2=SCFH, 3=LB/H,</td>
<td>English units</td>
</tr>
<tr>
<td>4=GPM #</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Dia.: 4.0260000</td>
<td>Select Round Duct</td>
</tr>
<tr>
<td></td>
<td>Change? (Y/N)&gt;</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Enter value: #</td>
<td></td>
</tr>
<tr>
<td>3.068</td>
<td>area: 7.3926572</td>
<td>3 inch Sch. 40 pipe I.D.</td>
</tr>
<tr>
<td>CMinflow: 0.000000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change? (Y/N)&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Maximum flow: 462.04</td>
<td></td>
</tr>
<tr>
<td>Enter to continue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Cmaxflow: 462.04</td>
<td></td>
</tr>
<tr>
<td>Change? (Y/N)&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>462.04</td>
<td>CMintemp (F): -40.000000</td>
<td></td>
</tr>
<tr>
<td>Change? (Y/N)&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>CMMaxtemp (F): 250.000000</td>
<td></td>
</tr>
<tr>
<td>Change? (Y/N)&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Percent of Range is: OFF</td>
<td></td>
</tr>
<tr>
<td>Change to ON?&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>LCD Mult Factor x1</td>
<td></td>
</tr>
<tr>
<td>Change? (Y/N)&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>100.0 SCFM</td>
<td>Instrument will end up in Normal Operation Mode</td>
</tr>
</tbody>
</table>
RS232 / FC88

Menu Control and Organization

All user entries begin at the input mode prompt “>” except when the instrument is in the Main Function Mode. Most entries require at least two key strokes; a capital letter and the [ENTER] key, or one or more numbers and the [ENTER] key. If the unit is in the Main Function Mode just press the desired function letter to make an entry.

Backspaces are made using the backspace [BKSP] key. Some entries are case sensitive between numbers and letters. Be sure the SHIFT key is pressed to indicate the correct case. A square after the prompt caret indicates the FC88 is in lower case. A slightly raised rectangle in the same spot indicates the FC88 is in the upper case.

It is recommended that the FC88 be plugged into the instrument before power is applied. If the FC88 is plugged in while the instrument power is on and the FC88 does not respond, press [ENTER]. If there is still no response press [N] or cycle the power.

Note: The Zero and Span may be changed from the original calibration, provided the new values are within the original calibrated range; i.e., if the original calibration was 1 to 100 SCFM (4-20 mA), the new zero (4 mA) must be equal to or greater than 1 SCFM, the new span (20 mA) must be equal to or less than 100 SCFM.

Some entries require a Factory pass code. If this occurs contact FCI Field Service to continue programming the instrument. The instrument will prompt the user when this is necessary. Do not change any parameters that require this code unless there is an absolute understanding of the instrument’s operation. The user cannot exit some routines unless all entries are completed or the power is cycled.

Note: Always press “T” before unplugging the FC88. If a frozen meter display is observed, reconnect the FC88 and wait 5 seconds for the meter to initialize. Disconnect the FC88 and confirm your meter display is varying.

The top level of the menu is shown in Table 5 in Appendix B. Enter the command letter mnemonic as listed in the tables below and in Appendix B to run a command. Exit a command at any time by entering “Q” [ENTER] in the menus D, K, V, W, or Z.

### Table 1. Diagnostics and Factory Settings

<table>
<thead>
<tr>
<th>C</th>
<th>Calibration Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Diagnostics</td>
</tr>
<tr>
<td></td>
<td>Display only: A/D, Delta-R, Ref-R data values</td>
</tr>
<tr>
<td>K</td>
<td>Factory Calibration Settings</td>
</tr>
<tr>
<td></td>
<td>Display only: Cal. parameters; i.e., linearization and temperature compensation coefficients</td>
</tr>
<tr>
<td>R</td>
<td>Factory Reset</td>
</tr>
<tr>
<td></td>
<td>Replaces user data with factory calibration data</td>
</tr>
</tbody>
</table>

### Table 2. Z Menu – Units and Scaling Setup

<table>
<thead>
<tr>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>or</td>
</tr>
<tr>
<td>or</td>
</tr>
</tbody>
</table>

For Volumetric or Mass Flow

| Set | D = Diameter or Wide x High (in inches or mm) |
| Set | CMaxflow = Maximum flow rate (span) |
| Set | CMinflow = Minimum flow rate (zero) |

Note: Changing units requires rescaling the unit (set new zero and span).

### Table 3. V Menu – Output Configuration Setup

| 1 | Source = Pulse |
| 2 | Source = Pulse |
| 3 | Source = Alarm0 |
| 4 | Source = Alarm0 |

Select 4-20 mA Output Configuration

Select NAMUR Mode

Select Source/Sink (Pulse) Output Configuration
“V” Menu Output Configuration Setup

Use the V menu to set up the 4-20 mA analog outputs (including NAMUR configuration) and source/sink (pulse) outputs.

Note: The display comes up to the last setting saved and stays for 2 seconds. If N or [ENTER] is entered, the menu proceeds to the Pulse out. If Y is entered, the display moves to the selection options and/or asks for confirmation. If you miss the option, select [Enter] repeatedly to loop around

Example: COMMAND V (Reference Table 3)

Case: 4-20 mA #1 = Flow, 4-20 mA #2 = Temperature, NAMUR = Low, Source Out = Pulse, Sink = Alarm1

Pressing [V] [ENTER] will display “Output Mode Selected”:

The last saved mode of the next menu item displays:

“4-20 mA #1 = Flow” “4-20 mA #2 = Temp” ...followed by the prompt:

“Change? (Y/N)”

Press [ENTER] (no change).

The last saved mode of the next menu item displays:

“NAMUR: Off”

“Change? (Y/N)” Select Y [Enter].

NAMUR: Off

“Enter 1 to make the selection #.” Select[ENTER] Bypassing “1” the next display reads,

“NAMUR: Low”

“Enter 2 to make the selection #.” Select[ENTER]

The last saved mode of the next menu item displays:

“Source: Pulse” “Sink: Pulse”

“Change? (Y/N)” Select Y [Enter].

Source: Pulse “Sink: Pulse”

“Enter 1 to make the selection #.” Select[ENTER] Bypassing “1” the next display reads,

“Source: Pulse” “Sink: Alarm1”

“Enter 2 to make the selection #.” Select[ENTER] “2” sets the new source/sink configuration.

The last saved mode of the next menu item displays:

“Source: Alarm0” “Sink: Pulse”

“Enter 3 to make the selection #”

Source: Alarm0 Sink: Alarm1

“Enter 4 to make the selection #”

Source: Alarm0 Sink: Alarm1

PFactor: 1.000

Change? (Y/N)?

If yes Enter new factor _______

Sample Period: 1 second

Change? (Y/N)?

If yes Enter new Sample Period: _______

If alarm in a selected output: Set point: 0.000

Set points are in the same units as the flow or temp.

Change? (Y/N)?

If yes Enter new set point: _______

Resume normal operation

Source state: High to Low

Change to Low to High?>

Respond with “Y” to enter a factor anywhere from 0.001 to 1000. A pulse factor of 1.000 outputs 1 pulse per unit of flow. If no change, select N and/or [ENTER] to continue.
The last saved mode of the next menu item displays:
“Sample Period”
“Change? (Y/N)>”
...followed by the prompt:
Respond with “Y” to enter a sample period value from 0.5 to 5 seconds.

If no change, select N and/or [ENTER] to continue.
The last saved mode of the next menu item displays:
“Source state: ”
“High to Low”
“Change to “Low to High?>”
...followed by the prompt:
Respond with “Y” to toggle to the alternate setting.

If no change, select N and/or [ENTER] to continue.
The last saved mode of the next menu item displays:
“Switchpt1”
“0.000000”
“Change? (Y/N)>”
...followed by the prompt:
Respond with “Y” to enter a setpoint value (value is in same units as the flow and must be within the calibrated range).

If no change, select N and/or [ENTER] to continue.
The last saved mode of the next menu item displays:
“Sink state: ”
“High to Low”
“Change to “Low to High?>”
...followed by the prompt:
Respond with “Y” to toggle to the alternate setting.

If no change, select N and/or [ENTER] to continue to normal operation (programming finished).
**Maintenance**

The FCI instrument requires little maintenance. There are no moving parts or mechanical parts subject to wear in the instrument. The sensor assembly which is exposed to the process media is composed of 316 SS and Hastelloy C.

Without detailed knowledge of the environmental parameters of the application surroundings and process media, FCI cannot make specific recommendations for periodic inspection, cleaning, or testing procedures. However, some suggested general guidelines for maintenance steps are offered below. Use operating experience to establish the frequency of each type of maintenance.

**Calibration**

Periodically verify the calibration of the output and recalibrate if necessary. FCI recommends every 18 months at a minimum.

**Electrical Connections**

Periodically inspect cable connections on terminal strips and terminal blocks. Verify that terminal connections are tight and physically sound with no sign of corrosion.

**Remote Enclosure**

Verify that the moisture barriers and seals protecting the electronics in the local enclosure is adequate and that no moisture is entering the enclosure.

**Electrical Wiring**

FCI recommends occasional inspection of the system’s interconnecting cable, power wiring and flow element wiring on a “common sense” basis related to the application environment. Periodically the conductors should be inspected for corrosion and the cable insulation checked for signs of deterioration.

**Flow Element Connections**

Verify that all seals are performing properly and that there is no leakage of the process media. Check for deterioration of the gaskets and environmental seals used.

**Insertion Type Flow Element Assembly**

Periodically remove the flow element for inspection based on historical evidence of debris, foreign matter, or scale build-up and appropriate plant shutdown schedules and procedures. Check for corrosion, stress cracking, and/or build-up of oxides, salts, or foreign substances. The thermowells must be free of excessive contaminants and be physically intact. Any debris or residue build-up could cause inaccurate flow indication. Clean the flow element, as necessary, with a soft brush and available solvents (compatible with stainless steel).
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**Troubleshooting**

**Application Verification**
After verifying that the flow meter is functioning, review the application parameters as shown below to verify the calibration matches the process media.

**Equipment Needed**
Flow Instrument Calibration Data  
Process Parameters and Limits

**Check Serial Numbers**
Verify that the serial number of the flow element and the flow transmitter electronics are the same. The flow element and the flow transmitter are a matched set and cannot be operated independently of each other.

**Check the Instrument Installation**
Verify correct mechanical and electrical installation. Verify the flow element is mounted at least 20 diameters downstream and 10 diameters upstream from any bends or interference in the process pipe or duct.

**Check for Moisture**
Check for moisture on the flow transmitter. Moisture may cause intermittent operation. Check for moisture on the flow element. If a component of the process media is near its saturation temperature it may condense on the flow element. Place the flow element where the process media is well above the saturation temperature of any of the process gases.

**Check Application Design Requirements**
Application design problems may occur with first time application instruments, although the design should also be checked on instruments that have been in operation for some time. If the application design does not match field conditions, errors occur.

1. Review the application design with plant operation personnel and plant engineers.
2. Ensure that plant equipment such as pressure and temperature instruments conform to the actual conditions.
3. Verify operating temperature, operating pressure, line size, and gas medium.

**Verify Standard Versus Actual Process Conditions**
The flowmeter measures the mass flow rate. The mass flow rate is the mass of the gas flowing through a pipe per time. Other flow meters, such as an orifice plate or a pitot tube, measure the volumetric flow rate. The volumetric flow rate is the volume of gas per time. If the readings displayed do not agree with another instrument, some calculations may be necessary before comparing them. To calculate the mass flow rate, the volumetric flow rate, and the pressure and temperature, the point of measurement must be known. Use the following equation to calculate the mass flow rate (Standard Volumetric Flow rate) for the other instrument:

**Equation:**

\[
Q_s = Q_a \times \frac{P_a}{P_s} \times \frac{T_a}{T_s}
\]

Where:

- \(Q_a\) = Volumetric Flow  
- \(Q_s\) = Standard Volumetric Flow  
- \(P_a\) = Actual Pressure  
- \(T_a\) = Actual Temperature  
- \(P_s\) = Standard Pressure  
- \(T_s\) = Standard Temperature  

PSIA and °R are used for pressure and temperature units.

**Example:**

\[
\left( \frac{1212.7 \text{ ACFM}}{1} \right) \left( \frac{19.7 \text{ PSIA}}{580° \text{ R}} \right) \left( \frac{530° \text{ R}}{14.7 \text{ PSIA}} \right) = 1485 \text{ SCFM}
\]

(Metric: Where bar(a) and °K are used for pressure and temperature.)
Calibration Parameters Verification

The instrument uses a set of predetermined calibration parameters to process flow signals. Most of these parameters should not change. Included with the instrument is a data package containing the ST50 Delta R Data Sheet. This contains the calibration parameters stored in the flow transmitter at the factory. To verify that these parameters have not changed, complete the following:

1. Identify the appropriate Delta R data sheets by serial number of the instrument.
2. Press [D] [ENTER] to examine each of the parameters. The [ENTER] key allows scrolling one message at a time. Use Table 4 to verify parameters with the Delta R data sheet ST50 Parameters.

Table 4. Diagnostic Test Sequence on Display

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/W Version:</td>
<td>dR Max:</td>
</tr>
<tr>
<td>Flow Factor:</td>
<td>Cal Ref:</td>
</tr>
<tr>
<td>Cmin Flow:</td>
<td>Tcslp:</td>
</tr>
<tr>
<td>Cmax Flow:</td>
<td>Tcslp 0:</td>
</tr>
<tr>
<td>Eng Units:</td>
<td>Tcslp 2:</td>
</tr>
<tr>
<td>Line Size 0:</td>
<td>Tot Menu:</td>
</tr>
<tr>
<td>Line Size 1:</td>
<td>Tot Flag:</td>
</tr>
<tr>
<td>Cmin Temp:</td>
<td>Totalizer:</td>
</tr>
<tr>
<td>Cmax Temp:</td>
<td>Rollover Cnt:</td>
</tr>
<tr>
<td>Min Flow:</td>
<td>Fix Pt Flag:</td>
</tr>
<tr>
<td>Max Flow:</td>
<td>Pulse Factor:</td>
</tr>
<tr>
<td>Density:</td>
<td>Pulse Out:</td>
</tr>
<tr>
<td>*C1 [1]:</td>
<td>Hours:</td>
</tr>
<tr>
<td>*C1 [2]:</td>
<td>Sample Period:</td>
</tr>
<tr>
<td>*C1 [3]:</td>
<td>dR Slope:</td>
</tr>
<tr>
<td>*C1 [4]:</td>
<td>dR Off Set:</td>
</tr>
<tr>
<td>*C1 [5]:</td>
<td>Refr Slope:</td>
</tr>
<tr>
<td>Break Pt:</td>
<td>Refr Off Set:</td>
</tr>
<tr>
<td>*C2 [1]:</td>
<td>SpanIDAC 0:</td>
</tr>
<tr>
<td>*C2 [2]:</td>
<td>ZeroIDAC 0:</td>
</tr>
<tr>
<td>*C2 [3]:</td>
<td>SpanIDAC 1:</td>
</tr>
<tr>
<td>*C2 [4]:</td>
<td>ZeroIDAC 1:</td>
</tr>
<tr>
<td>*C2 [5]:</td>
<td>T SpanIDAC 0:</td>
</tr>
<tr>
<td>dR Min:</td>
<td>T ZeroIDAC 0:</td>
</tr>
<tr>
<td></td>
<td>T ZeroIDAC 1:</td>
</tr>
</tbody>
</table>

An issue may exist if parameters with an asterisk (*) have changed. Consult with Customer Service if this is the case. If the parameters have not changed, continue with the next section.
Hardware Verification

Equipment Required:

- Digital Multimeter
- Screwdriver

The ST50 flow meter is made up of these basic components:

- Sensor element
- Customer interface circuit board
- Control circuit assembly circuit board module
- Electronics enclosure

Step 1
Verify fuse (F1) located on the customer interface circuit board is in normal working condition.

Remove power from the instrument. Open the electronics enclosure exposing the customer interface circuit board. This circuit board is located under the shorter enclosure lid along with all of the power and input/output connections. Unscrew the clear cover on the fuse and pull the fuse out of the fuse holder. Check the fuse for continuity. If fuse reads open, replace with equivalent component (FCI part no. 019933-01), Wickmann Inc. series 374, 1.6 A (amp code 1160), package 0410 (short radial leads).

Step 2
Verify interconnecting cable from the customer interface board and the control circuit board assembly module are correctly seated into the appropriate header.

Remove power from the instrument. Open the electronics enclosure exposing the customer interface circuit board. This circuit board is located under the shorter enclosure lid along with all of the power and input/output connections. Remove the 2 screws securing the interface circuit board to the electronics enclosure. Carefully lift the interface face board exposing the interconnecting cable between the interface board and the control circuit assembly. Verify cable is seated firmly at both ends of the cable header.
**Step 3**

Verify sensor element continuity and resistance.

Remove sensor element cable from the bottom of the control circuit assembly. Note that two of the wires have a red stripe and are located closest to the interconnecting cable header. Using an ohmmeter verify that resistance between the two red striped wires is approximately 1100 ohms +/- 20. This resistance is temperature dependant. The resistance at 70 degrees F should be 1082 ohms. Verify the resistance between the two natural colored wires are approximately the same.
Transmitter Circuit Calibration Check (Delta R Verification)

References
- Delta R data sheet

Equipment
- FC88 Communicator or equivalent.
- DMV
- Delta R data sheet - Match by serial numbers
- 2 ea. precision decade resistance boxes, 0.1% (Largest steps: 1k ohm, smallest steps 0.01 ohms)
- 250-ohm axial lead precision resistor, 0.1% or better, 1 W
- Small flat blade screwdriver, 3/32 inches wide blade
- FCI normalization cable, FCI part number 006407

Procedure
1. Verify all “D” mode calibration parameters are correct according to the meter’s Delta R data sheet, before starting verification.
2. Turn power OFF.
3. Mark all sensor element wires connected to the circuit board for easy reconnection to the proper terminals. Disconnect the wires. Note the orientation of the sensor element plug connected to the circuit board. Unplug the connector from the board.
4. Connect the resistance decade box to the electronics as per the appropriate diagram for the ST50. Connect the 250-ohm resistor across the 4-20 mA output terminals.

   Note: Interconnecting wiring (resistance decade box to electronics) must be same gauge and length (suggested: 24 AWG and 45") to avoid any inaccuracies in the Delta R verification caused by unequal wire lengths and/or wire gauges. Use of the FCI normalization cable avoids this issue.

5. Set both decade boxes for the nominal resistance value (1000 ohms) ±0.01%
6. Connect DVM to the meters output termination and monitor the meter output.
7. Turn power ON and allow the instrument 5 minutes to stabilize.
8. With the FC88 connected, press [T] [Enter] to view the Normal Operating Mode.
9. Adjust the Active decade box (Reference decade box remains fixed @ 1000 ohms) to achieve the appropriate Delta R for the displayed flow value and output, noted on the meter’s Delta R data sheet.
10. Note the [C] mode and verify the meters displayed TCDR and REFR values corresponding to the displayed flow rate as per the meter’s Delta R data sheet.
Appendix A - Approval Information

EU Information

EU DECLARATION OF CONFORMITY Model ST50

We, Fluid Components International LLC, located at 1755 La Costa Meadows Drive, San Marcos, California 92078-5115 USA, declare under our sole responsibility that the ST50 Flowmeter Product Family, to which this declaration relates, is in conformity with the following directives and specifications.

Directive 2014/30/EU Electromagnetic Compatibility EMC*

Immunity specification: EN 61000-6-2: 2005

Directive 2014/35/EU Low Voltage LVD*


Directive 2014/68/EU Pressure Equipment PED

The ST50 is an insertion style model and does not have a pressure bearing housing. It is therefore not considered as pressure equipment by itself according to article 2, paragraph 5.

Directive 2011/65/EU RoHS 2


Issued at San Marcos, California USA
January 2018

Eric Wible 2018.01.25 17:27:32 -0800

Eric Wible, Director of Engineering

* EMC and LVD Compliance Analysis
The test reports used to declare ST50 compliance to the EMC and LV directives were that of the ST56 Product Family. With the exception of the LCD (display) electronics, the active electronics between models are identical.

Flow/Liquid Level/Temperature Instrumentation
Visit FCI on the Worldwide Web: www.fluidcomponents.com
1755 La Costa Meadows Dr, San Marcos, California 92078 USA 760-744-9950 • 800-854-1003 • 760-738-6250
European Office: Parsembrookstraat 3-01 5047 THTILburg – The Netherlands – Phone 31-13-5158888 • Fax 31-13-5798035

Doc no. 23EN000017E
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## Appendix B - List Commands

### Table 5. ST50 List of Single Letter Commands

<table>
<thead>
<tr>
<th>COMMAND MNEMONIC</th>
<th>COMMAND FUNCTION</th>
<th>COMMAND DECRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>R</td>
<td>AvgDelta r, AvgRef</td>
</tr>
<tr>
<td>B</td>
<td>R</td>
<td>Delta r, Ref r</td>
</tr>
<tr>
<td>C</td>
<td>R</td>
<td>Tcdelta r, Ref r</td>
</tr>
<tr>
<td>D</td>
<td>R</td>
<td>Diagnostics</td>
</tr>
<tr>
<td>F</td>
<td>R/W</td>
<td>K-factors</td>
</tr>
<tr>
<td>G</td>
<td>R/W</td>
<td>Clear FlashEE, Boxcar Count, ADC to Ohms Cal</td>
</tr>
<tr>
<td>K</td>
<td>R/W</td>
<td>Cal Parameters</td>
</tr>
<tr>
<td>L</td>
<td>R/W</td>
<td>Output Cal</td>
</tr>
<tr>
<td>N</td>
<td>W</td>
<td>Warm Restart</td>
</tr>
<tr>
<td>R</td>
<td>W</td>
<td>Factory Restore</td>
</tr>
<tr>
<td>S</td>
<td>R/W</td>
<td>Totalizer Menu On/Off</td>
</tr>
<tr>
<td>T</td>
<td>R</td>
<td>Normal Mode</td>
</tr>
<tr>
<td>V</td>
<td>R/W</td>
<td>Output Config</td>
</tr>
<tr>
<td>W</td>
<td>R/W</td>
<td>Totalizer</td>
</tr>
<tr>
<td>Y</td>
<td>W</td>
<td>Command Line Interface</td>
</tr>
<tr>
<td>Z</td>
<td>W</td>
<td>Flow units, Pipe Size, and LCD Scaling</td>
</tr>
</tbody>
</table>

### Table 6. ST50 List of CLI Commands

<table>
<thead>
<tr>
<th>COMMAND MNEMONIC</th>
<th>COMMAND FUNCTION</th>
<th>COMMAND DESCRIPTION</th>
<th>DATA TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>R/W</td>
<td>Break Point</td>
<td>Float</td>
</tr>
<tr>
<td>BM</td>
<td>R/W</td>
<td>Boxcar Filter Max</td>
<td>Integer</td>
</tr>
<tr>
<td>CM</td>
<td>R/W</td>
<td>Cminflow</td>
<td>Float</td>
</tr>
<tr>
<td>CR</td>
<td>R/W</td>
<td>Calibration Ref</td>
<td>Float</td>
</tr>
<tr>
<td>CX</td>
<td>R/W</td>
<td>Cmaxflow</td>
<td>Float</td>
</tr>
<tr>
<td>C1[1-5]</td>
<td>R/W</td>
<td>Coefficients set1</td>
<td>Float</td>
</tr>
<tr>
<td>C2[1-5]</td>
<td>R/W</td>
<td>Coefficients set2</td>
<td>Float</td>
</tr>
<tr>
<td>D1</td>
<td>R</td>
<td>Diagnostics</td>
<td>Null</td>
</tr>
<tr>
<td>D2</td>
<td>R/w</td>
<td>DeltaR Minimum</td>
<td>Float</td>
</tr>
<tr>
<td>D3</td>
<td>R/W</td>
<td>Density</td>
<td>Float</td>
</tr>
<tr>
<td>D4</td>
<td>R</td>
<td>Delta R</td>
<td>Float</td>
</tr>
<tr>
<td>D5</td>
<td>R/W</td>
<td>DeltaR Maximum</td>
<td>Float</td>
</tr>
<tr>
<td>D6</td>
<td>R/W</td>
<td>DeltaR Slope</td>
<td>Float</td>
</tr>
<tr>
<td>D7</td>
<td>R/W</td>
<td>DeltaR Offset</td>
<td>Float</td>
</tr>
<tr>
<td>EU</td>
<td>R/W</td>
<td>Engineering Units</td>
<td>Integer</td>
</tr>
<tr>
<td>FF</td>
<td>R/W</td>
<td>Flow Factor</td>
<td>Float</td>
</tr>
<tr>
<td>FP</td>
<td>R/W</td>
<td>Fix Point Flag</td>
<td>Integer</td>
</tr>
<tr>
<td>F0</td>
<td>R/W</td>
<td>Pulse Out State0</td>
<td>Integer</td>
</tr>
<tr>
<td>F1</td>
<td>R/W</td>
<td>Pulse Out State1</td>
<td>Integer</td>
</tr>
<tr>
<td>HR</td>
<td>R/W</td>
<td>Tot Dump Hours Cntr</td>
<td>Integer</td>
</tr>
<tr>
<td>IF</td>
<td>R/W</td>
<td>I Factor</td>
<td>Float</td>
</tr>
</tbody>
</table>
### Table 6. ST50 List of CLI Commands, Cont.

<table>
<thead>
<tr>
<th>COMMAND MNEMONIC</th>
<th>COMMAND FUNCTION</th>
<th>COMMAND DESCRIPTION</th>
<th>DATA TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K[1-4]</td>
<td>R/W</td>
<td>K Factors</td>
<td>Float</td>
</tr>
<tr>
<td>L0</td>
<td>R/W</td>
<td>Line Size0</td>
<td>Float</td>
</tr>
<tr>
<td>L1</td>
<td>R/W</td>
<td>Line Size1</td>
<td>Float</td>
</tr>
<tr>
<td>MN</td>
<td>R/W</td>
<td>Minflow</td>
<td>Float</td>
</tr>
<tr>
<td>MX</td>
<td>R/W</td>
<td>Maxflow</td>
<td>Float</td>
</tr>
<tr>
<td>NN</td>
<td>R/W</td>
<td>Namur Mode</td>
<td>Integer</td>
</tr>
<tr>
<td>OM</td>
<td>R/W</td>
<td>Outmode</td>
<td>Integer</td>
</tr>
<tr>
<td>PF</td>
<td>R/W</td>
<td>Pulse Factor</td>
<td>Float</td>
</tr>
<tr>
<td>PL</td>
<td>R/W</td>
<td>Pulse Out</td>
<td>Integer</td>
</tr>
<tr>
<td>PS</td>
<td>R/W</td>
<td>Pulse Sample Period</td>
<td>Float</td>
</tr>
<tr>
<td>PW</td>
<td>R/W</td>
<td>Pulse Width</td>
<td>Float</td>
</tr>
<tr>
<td>P0</td>
<td>R/W</td>
<td>Switch Point0</td>
<td>Integer</td>
</tr>
<tr>
<td>P1</td>
<td>R/W</td>
<td>Switch Point1</td>
<td>Integer</td>
</tr>
<tr>
<td>RO</td>
<td>R/W</td>
<td>RollOver Cntr</td>
<td>Long</td>
</tr>
<tr>
<td>RR</td>
<td>R</td>
<td>Reference R</td>
<td>Float</td>
</tr>
<tr>
<td>RS</td>
<td>R/W</td>
<td>RefR Slope</td>
<td>Float</td>
</tr>
<tr>
<td>RF</td>
<td>R/W</td>
<td>RefR Offset</td>
<td>Float</td>
</tr>
<tr>
<td>SF</td>
<td>R</td>
<td>SFPS Flow</td>
<td>Float</td>
</tr>
<tr>
<td>SN</td>
<td>R/W</td>
<td>Serial Number</td>
<td>String (16 chars max)</td>
</tr>
<tr>
<td>SO</td>
<td>R/W</td>
<td>Shop Order Number</td>
<td>String (16 chars max)</td>
</tr>
<tr>
<td>S0</td>
<td>R/W</td>
<td>SpanDAC0 for 4-20mA #1</td>
<td>Integer</td>
</tr>
<tr>
<td>S3</td>
<td>R/W</td>
<td>SpanDAC1 for 4-20mA #2</td>
<td>Integer</td>
</tr>
<tr>
<td>S2</td>
<td>W</td>
<td>Save FACTORY</td>
<td>N/A</td>
</tr>
<tr>
<td>TC</td>
<td>R</td>
<td>TCdeltar</td>
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<td>R</td>
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<td>Integer</td>
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Command Line Password: 357
**Note:** When invoking a Write Function, separate the Command characters and the data value with a space. All Read and Write Functions are completed with a <CR>. To exit CLI, press <CR> following the last Command <CR>.

Examples:

- **RBK<CR>** (Read Breakpoint)
- **WBK 2222<CR>** (Write Breakpoint 2222)
- **RC11<CR>** (Read Coefficient C1,1)
- **WC11 -234.567<CR>** (Write Coefficient C1,1, -234.567)
- **<CR>** (Leave Command Line Mode)
Appendix D - Customer Service

Customer Service/Technical Support

FCI provides full in-house technical support. Additional technical representation is also provided by FCI field representatives. Before contacting a field or in-house representative, perform the troubleshooting techniques outlined in this document.

By Mail
Fluid Components International LLC
1755 La Costa Meadows Dr.
San Marcos, CA 92078-5115 USA
Attn: Customer Service Department

By Phone
Contact the area FCI regional representative. If a field representative is unable to be contacted or if a situation is unable to be resolved, contact the FCI Customer Service Department toll free at 1 (800) 854-1993.

By Fax
To describe problems in a graphical or pictorial manner, send a fax including a phone or fax number to the regional representative. Again, FCI is available by facsimile if all possibilities have been exhausted with the authorized factory representative. Our fax number is 1 (760) 736-6250; it is available 7 days a week, 24 hours a day.

By Email
FCI Customer Service can be contacted by email at: techsupport@fluidcomponents.com. Describe the problem in detail making sure a telephone number and best time to be contacted is stated in the email.

International Support
For product information or product support outside the contiguous United States, Alaska, or Hawaii, contact your country’s FCI International Representative or the one nearest to you.

After Hours Support
For product information visit the FCI website at www.fluidcomponents.com. For product support call 1 (800) 854-1993 and follow the prerecorded instructions.

Point of Contact
The point of contact for service, or return of equipment to FCI is your authorized FCI sales/service office. To locate the office nearest you, visit the FCI website at www.fluidcomponents.com.
**Warranty Repairs or Returns**
FCI prepays ground transportation charges for return of freight to the customer’s door. FCI reserves the right to return equipment by the carrier of our choice.
International freight, handling charges, duty/entry fees for return of equipment are paid by the customer.

**Non-Warranty Repairs or Returns**
FCI returns repaired equipment to the customer either collect or prepaid and adds freight charges to the customer invoice.

**Return to Stock Equipment**
The customer is responsible for all shipping and freight charges for equipment that is returned to FCI stock from the customer site. These items will not be credited to customer’s account until either all freight charges are cleared or until the customer agrees to have any freight costs incurred by FCI deducted, along with applicable return to stock charges, from the credit invoice. (Exceptions are made for duplicate shipments made by FCI.)
If any repair or return equipment is received at FCI, freight collect, without prior factory consent, FCI bills the sender for these charges.

**Field Service Procedures**
Contact an FCI field representative to request field service.
A field service technician is dispatched to the site from either the FCI factory or one of the FCI representative offices. After the work is complete, the technician completes a preliminary field service report at the customer site and leaves a copy with the customer.
Following the service call, the technician completes a formal, detailed service report. The formal report is mailed to the customer within five days of the technician’s return to the factory or office.

**Field Service Rates**
All field service calls are billed at the prevailing rates as listed in the FCI Price Book unless specifically excepted by the FCI Customer Service Manager. FCI reserves the right to bill for travel times at FCI’s discretion.
Customers are charged for shipping costs related to the transfer of equipment to and from the job site. They are also invoiced for field service work and travel expenses by FCI’s Accounting Department.
Return Authorization Request

1. Return Customer Information

   Returning Company's Name: ______________________ Phone#: ______________________
   Return Contact Name: ______________________ Fax #: ______________________
   Email Address: ______________________

2. Return Address

   Bill To: ______________________ Ship To: ______________________

3. Mandatory End User Information

   Contact: ______________________ Company: ______________________ Country: ______________________

4. Return Product Information

   Model No: ______________________ Serial No(s): ______________________
   Failure Symptoms (Detailed Description Required): __________________________________________________
   What Trouble Shooting Was Done Via Phone or Field Visit by FCI: ______________________________________
   FCI Factory Technical Service Contact: ______________________

5. Reason For Return
   ☐ Sensor Element   ☐ Electronics   ☐ As Found Testing   ☐ Credit
   ☐ Recalibrate (New Data)   ☐ Recalibrate (Most Recent Data)   ☐ Other

   (Note: A new Application Data Sheet (ADS) must be submitted for all recalibrations and re-certifications)

6. Payment Via
   ☐ Faxed Purchase Order   ☐ Visa   ☐ MasterCard

   (Note: A priced quotation is provided for all Non-Warranty repairs after equipment has been evaluated. All Non-Warranty repairs are subject to a minimum evaluation charge of $250.00)

   Factory Return Shipping Address: Fluid Components International LLC
   1755 La Costa Meadows Drive
   San Marcos, CA 92078-5115
   Attn: Repair Department
   RA #: ______________________

   FCI Document No. 05CS0000000 [U]
The following Return Authorization Request form and Decontamination Statement MUST be completed, signed and faxed back to FCI before a Return Authorization Number will be issued. The signed Decontamination Statement and applicable MSDS Sheets must be included with the shipment. FCI will fax, email or telephone you with the Return Authorization Number upon receipt of the signed forms.

Packing Procedures

1. **Electronics** should be wrapped in an anti-static or static-resistant bag, then wrapped in protective bubble wrap and surrounded with appropriate dunnage* in a box. Instruments weighing more than 50 lbs., or extending more than four feet, should be secured in wooden crates by bolting the assemblies in place.

2. The sensor head must be protected with pvc tubing, or retracted the full length of the probe, locked and secured into the Packing Gland Assembly (cap screws tightened down).

3. FCI can supply crates for a nominal fee.

4. No more than four (4) small units packaged in each carton.

5. FCI will not be held liable for damage caused during shipping.

6. To ensure immediate processing mark the RA number on the outside of the box. Items without an RA number marked on the box or crate may be delayed.

7. Freight must be “PrePaid” to FCI receiving door.

* Appropriate dunnage as defined by UPS, will protect package contents from a drop of 3 feet.

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**Decontamination Statement**  **This Section Must Be Completed**

Exposure to hazardous materials is regulated by Federal, State, County and City laws and regulations. These laws provide FCI's employees with the "Right to Know" the hazardous or toxic materials or substances in which they may come in contact while handling returned products. Consequently, FCI's employees must have access to data regarding the hazardous or toxic materials or substances the equipment has been exposed to while in a customer's possession. Prior to returning the instrument for evaluation/repair, FCI requires thorough compliance with these instructions. The signee of the Certificate must be either a knowledgeable Engineer, Safety Manager, Industrial Hygienist or of similar knowledge or training and responsible for the safe handling of the material to which the unit has been exposed. Returns without a legitimate Certification of Decontamination, and/or MSDS when required, are unacceptable and shall be returned at the customer's expense and risk. Properly executed Certifications of Decontamination must be provided before a repair authorization (RA) number will be issued.

**Certification Of Decontamination**

I certify that the returned item(s) has(have) been thoroughly and completely cleaned. If the returned item(s) has(have) been exposed to hazardous or toxic materials or substances, even though it (they) has (have) been thoroughly cleaned and decontaminated, the undersigned attests that the attached Material Data Safety Sheet(s) (MSDS) covers said materials or substances completely. Furthermore, I understand that this Certificate, and providing the MSDS, shall not waive our responsibility to provide a neutralized, decontaminated, and clean product for evaluation/repair at FCI. Cleanliness of a returned item or acceptability of the MSDS shall be at the sole discretion of FCI. Any item returned which does not comply with this certification shall be returned to your location Freight Collect and at your risk.

This certification must be signed by knowledgeable personnel responsible for maintaining or managing the safety program at your facility.

Process Flow Media __________________________

Product was or may have been exposed to the following substances: ______________________________________________________

Print Name ____________________________________________ Date ____________________________

Authorized Signature ___________________________ Date ____________

Company Title ____________________________

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Visit FCI on the Worldwide Web:  www.fluidcomponents.com

1755 La Costa Meadows Drive, San Marcos, California 92078-5115 USA  Phone: 760-744-6950  800-854-1993  Fax: 760-736-6250

FCI Document No. 06CS000004D [U]
**Instrument Warranty**

Goods furnished by the Seller are to be within the limits and of the sizes published by the Seller and subject to the Seller’s standard tolerances for variations. All items made by the Seller are inspected before shipment, and should any of said items prove defective due to faults in manufacture or performance under Seller approved applications, or fail to meet the written specifications accepted by the Seller, they will be replaced or repaired by Seller at no charge to Buyer provided return or notice of rejection of such material is made within a reasonable period but in no event longer than one (1) year from date of shipment to Buyer, and provided further, that an examination by Seller discloses to Seller’s reasonable satisfaction that the defect is covered by this warranty and that the Buyer has not returned the equipment in a damaged condition due to Buyer’s or Buyer’s employees’, agents’, or representatives’ negligence and Buyer has not tampered, modified, redesigned, misapplied, abused, or misused the goods as to cause the goods to fail. In addition, this warranty shall not cover damage caused by Buyer’s exposure of the goods to corrosive or abrasive environments. Moreover, Seller shall in no event be responsible for (1) the cost or repair of any work done by Buyer on material furnished hereunder (unless specifically authorized in writing in each instance by Seller), (2) the cost or repair of any modifications added by a Distributor or a third party, (3) any consequential or incidental damages, losses, or expenses in connection with or by reason of the use of or inability to use goods purchased for any purpose, and Seller’s liability shall be specifically limited to free replacement, or refund of the purchase price, at Seller’s option, provided return or rejection of the goods is made consistent with this paragraph, and the Seller shall in no event be liable for transportation, installation, adjustment, loss of good will or profits, or other expenses which may arise in connection with such returned goods, or (4) the design of products or their suitability for the purpose for which they are intended or used. Should the Buyer receive defective goods as defined by this paragraph, the Buyer shall notify the Seller immediately, stating full particulars in support of his claim, and should the Seller agree to a return of the goods, the Buyer shall follow Seller’s packaging and transportation directions explicitly. In no case are the goods to be returned without first obtaining a return authorization from the Seller. Any repair or replacement shall be at Seller’s factory, unless otherwise directed, and shall be returned to Seller transportation prepaid by Buyer. If the returned goods shall prove defective under this clause they will be replaced or repaired by Seller at no charge to Buyer provided the return or rejection of such material is made within a reasonable period, but in no event longer than (1) year from the date of shipment of the returned goods or the unexpired terms of the original warranty period whichever is later. If the goods prove to be defective under this paragraph, the Buyer shall remove the goods immediately from the process and prepare the goods for shipment to Seller. Continued use or operation of defective goods is not warranted by Seller and damage occurring due to continued use or operation shall be for Buyer’s account. Any description of the goods contained in this offer is for the sole purpose of identifying them, and any such description is not part of the basis of the bargain, and does not constitute a warranty that the goods will conform to that description. The use of any sample or model in connection with this offer is for illustrative purposes only, is not part of the basis of the bargain, and is not to be construed as a warranty that the goods will conform to the sample or model. No affirmation of that fact or promise made by the Seller, whether or not in this offer, will constitute a warranty that the goods will conform to the affirmation or promise. THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES WITH RESPECT TO THE GOODS OR THEIR INSTALLATION, USE, OPERATION, REPLACEMENT OR REPAIR, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS OF PURPOSE; AND THE GOODS ARE BEING PURCHASED BY BUYER “AS IS”. SELLER WILL NOT BE LIABLE BY VIRTUE OF THIS WARRANTY OR OTHERWISE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGE RESULTING FROM THE USE OR LOSS OF USE OF THE GOODS.