

# FCI Industry Guide



**Water and Wastewater Industry**

**User Application Guide**



**FCI** FLUID COMPONENTS  
INTERNATIONAL LLC

**The mass flow experts for flow, level  
and temperature instrumentation**

## Solving critical process applications for the Water and Wastewater Industry



From the early 1960s, Fluid Components International recognized the need for flow and level instrumentation which met specific customer requirements and demands for the Water and Wastewater Industry. By utilizing Thermal Dispersion and Coriolis technology exclusively in all FCI flow, level, interface, temperature switches and mass flow meters, our products solve typical Water and Wastewater Industry application challenges with standard product features such as:

- › No moving parts
- › All welded materials of construction
- › Direct mass flow measurement
- › No pressure drop
- › Explosion-proof design
- › Wide flow range
- › Low flow capability

By closely monitoring the everchanging requirements for the Water and Wastewater Industry, FCI has maintained its reputation as the technology leader with new product features such as:

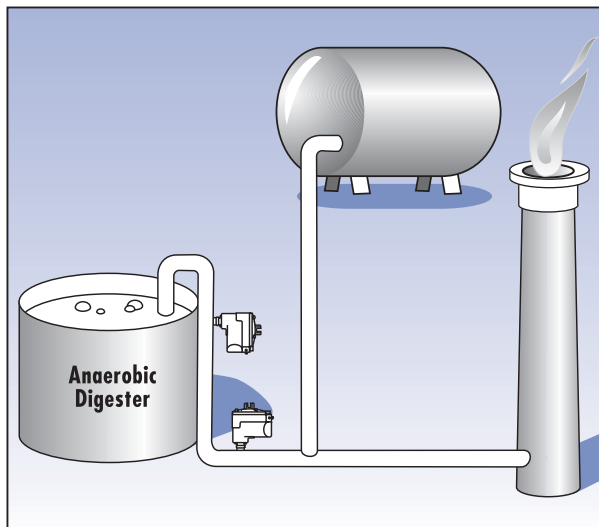
- › Modern digital communications with HART, Modbus, Profibus, Ethernet and ASI
- › Fail-safe mode selection per Namur NE43
- › Compliance with the latest approval requirements of FM, CSA, CRN, ATEX, CE Mark and PED
- › Application focused marketing and engineering research and design
- › Secondary sealed flow element sensor design
- › Integral flow conditioners
- › Two-wire loop-power flow, level and interface detection

### **FCI Water and Wastewater Industry customers**

- › F. Wayne Hill Water Resources Center, Gwinnett County, GA
- › Green Bay Metropolitan Sewerage District, Green Bay, WI
- › East Bay Municipal Wastewater Treatment Plant, Oakland, CA
- › Käppala Wastewater Treatment Plant, Stockholm, Sweden
- › Ulu Pandan Wastewater Reclamation Plant, Singapore
- › Alexandria Sanitation Authority Advanced WWT Facility Alexandria, VA
- › City of Las Vegas Northwest Water Resource Center, Las Vegas, NV
- › City of Dayton Wastewater Treatment Plant, Dayton, OH
- › City of Orlando Wastewater Treatment Plant, Orlando, FL
- › NY DEP, Queens, NY

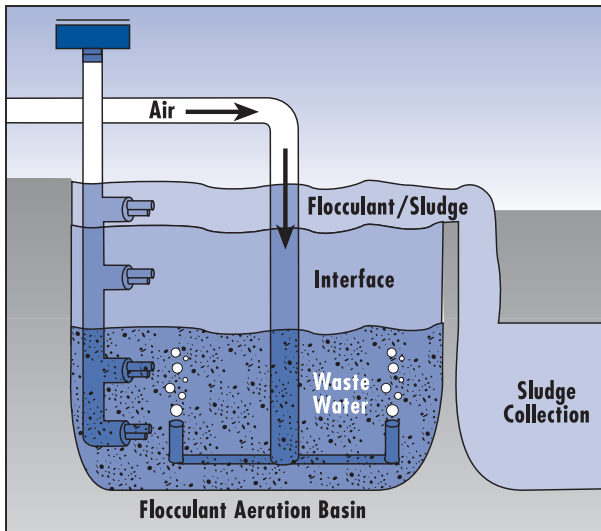
### **FCI Water and Wastewater Industry customers for Engineering, Procurement & Construction (EPC)**

- › CH2M Hill
- › Black & Veatch Environmental
- › Hazen & Sawyer
- › Camp Dresser McKee
- › Metcalf & Eddy
- › Montgomery Watson
- › Parsons
- › Malcom Pirnie
- › Brown & Caldwell
- › Jacobs Engineering



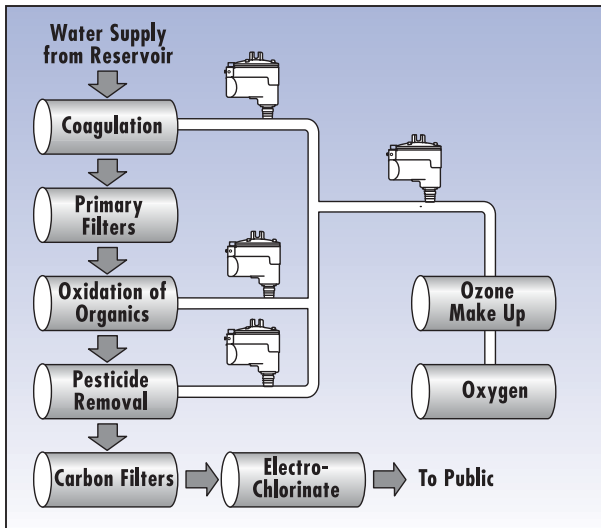
### **› Digester gas flow monitoring**

The flow measurement of digester gas is critical to waste water treatment plant operations. Typical plants have multiple digesters that need constant monitoring. FCI's ST98 FlexMASter® Series mass flow meter provides extremely low flow sensitivity and wide turndown range. The no moving parts design is unaffected by this dirty, humid gas.



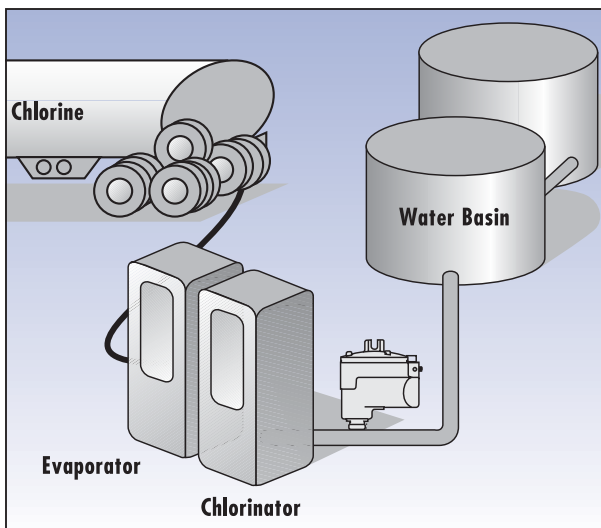
### > Flocculant/sludge control

Many sludge clarifiers separate solids from the effluent system by introducing air and flocculants, so that sludge rises to the top the vessel and spills over a weir. The amount of air and flocculant are controlled by the level of the interface between the sludge and water. Optical detectors, as interface sensors, have not been successful in this application because the sensors fail due to fouling. FCI's FLT93S FlexSwitch® Series multipoint assembly identifies the changing level of the sludge interface to enable control of flocculant and air addition.



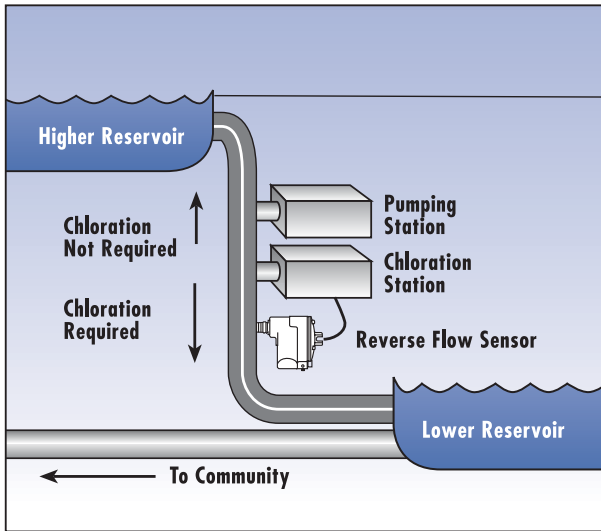
### > Oxygen/ozone flowmetering

Advanced water treatment plants are using ozone and activated carbon filters to reduce chlorine requirements in order to improve the taste and appearance of the water they produce. On-site generation of ozone can become a significant operating expense; thereby making its measurement and control an important requirement to efficient operation of the plant. Ozone flow needs to be introduced into the filtration process at three different points: For coagulation prior to primary filtration, for low flow as an oxidizing agent, and for high flow disinfecting to breakdown pesticides. FCI's ST98L FlexMASter inline mass flow meters are installed at each point to measure the ozone flow. The ST98L has the dynamic flow range and accurate sensitivity required for ozone applications.



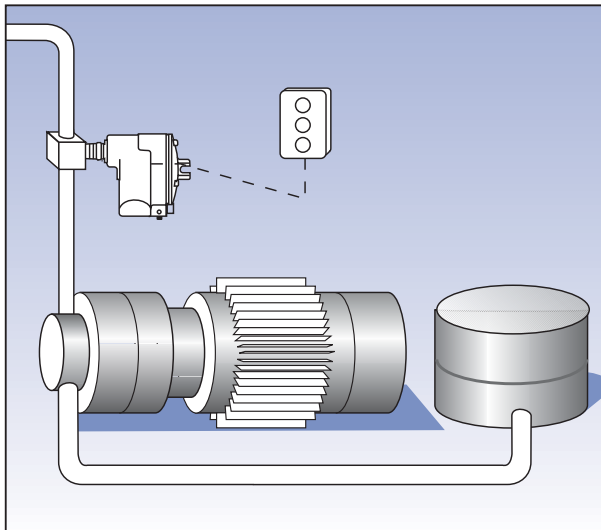
### > Chlorine gas flow monitoring

Municipal water districts and waste water treatment facilities use chlorine to disinfect water. Proper, real-time control of chlorine dosage is critical to ensure smooth operation. FCI's ST98 FlexMASter Series mass flow meters with a Hastelloy C-276 flow element installed directly in the chlorine line ensures this critical flow. It is specifically calibrated to anticipate chlorine demand based on water temperature, flow rates, time of year and residual chlorine levels.



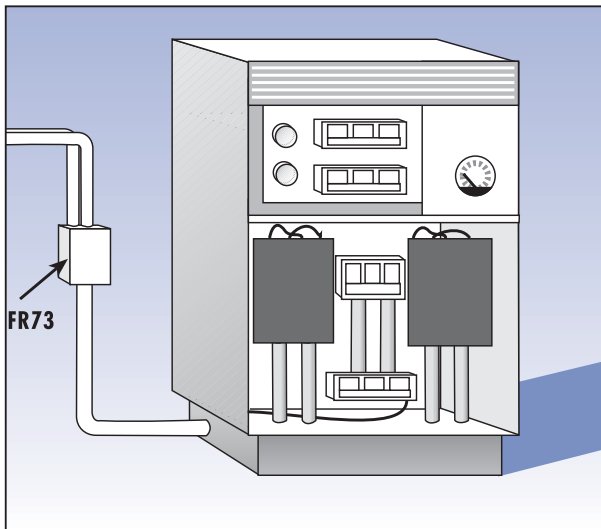
### > Reverse flow detection

Large water storage reservoirs are often filled and drained through the same water line. Federal and state requirements mandate that all water delivered for human consumption be disinfected. In order to minimize disinfectant usage, avoid overdosing and forgo disinfecting water going into the reservoir, it is critical for water plant operators to know the direction of water flows within the pipe lines. The use of FCI's RF83 bi-directional flow monitor detects instantaneous flow direction, providing improved disinfectant control.



### > Chemical injection/additive flow monitoring

In monitoring chemical and other additive injection flow, the ultra-sensitive FLT93L inline FlexSwitch outperforms the competition. It detects gas flows down to 0.6 cc/sec and liquid flows down to 0.02 cc/sec -- ideal for virtually all injection processes. The no-moving-parts flow element design provides outstanding durability and reliability under the harshest process conditions. And, the inherent thermal time-delay, available in all FCI flow switch/monitors, prevents false alarms caused by flow pulsation and eliminates the need for auxiliary time-delay relays. Optional dual switch point circuitry helps maintain product quality and process safety by alarming both high flow and low flow conditions.



### > Sample flow and gas chromatography

FCI inline flow switch/monitors are an integral part of sampling equipment ranging from ultra-sensitive gas chromatographs to large fluid sampling systems used to test for toxic agents in wastewater effluent. Highly repeatable, with low flow sensitivity, FCI flow switches ensure that sample rates will be maintained at the right flow for accurate analysis. In systems where several products are tested individually by the same analyzer, each sample line is monitored to verify that products are flowing one at a time. The FR73 inline ultra low flow monitor is especially well suited for gas chromatographs; while the FLT93S FlexSwitch Series and FR78 inline low flow monitor are recommended for larger analyzers.

## Serving critical process instrumentation needs around the world

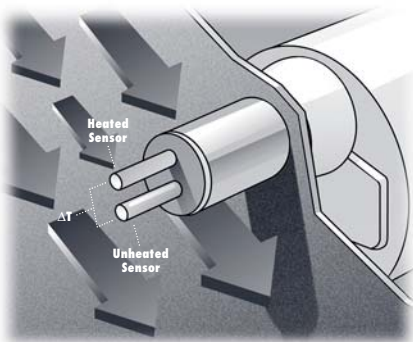


CI introduced the first thermal flow switch/monitor in 1964 and has since established a worldwide reputation for the design and production of precision high performance flow, level and temperature instrumentation. With reliability second to none, FCI has placed over 200,000 units in the field covering the full range of liquid, gas and slurry process requirements. FCI products service some of the world's most demanding processes in industries such as food & beverage, pharmaceutical, chemical, oil and gas, pulp and paper, power and energy, water and wastewater, nuclear power, aerospace and more. FCI offers a broad range of instrumentation solutions and services, from off-the-shelf devices to custom engineered systems. FCI's engineering staff provides expertise in mechanical, electronic and thermo-dynamic disciplines offering innovative solutions to specialized customer application needs, configuration objectives, software enhancements, and material problems.

### Thermal Dispersion principle

The typical sensing element contains two thermowell-protected precision platinum Resistance Temperature Detectors (RTDs). When placed in the process stream, one RTD is heated and the other RTD senses the process temperature. The temperature difference between the two RTDs is related to the process flow rate as well as the

*Thermal mass flow technology supports virtually all gas or air measurement needs. It is especially well suited for dirty gas because of its no-moving parts design with no orifices, bearings, or seals to foul or fail.*



*Product development, testing and calibration are performed in FCI's laboratory using NIST traceable equipment, which ensures highly reliable performance in hundreds of applications.*

properties of the process media. Higher flow rates or denser media cause increased cooling of the heated RTD and a reduction in the RTD temperature difference.

### FlexSwitch® FLT93 Series

The FLT93 Series utilizes proprietary thermal dispersion technology to provide the highest reliability in flow, level and temperature detection. The sensing element is composed of two matched RTD's. One RTD is preferentially heated. The other RTD is unheated and thermally isolated to provide continuous process condition temperature and baseline indication. At no flow or under dry conditions, the temperature differential between the two RTDs is greatest.

#### > For flow/no flow detection

No-flow conditions produce a large signal. As flow increases, the heated RTD is cooled and proportionally reduces the temperature differential. Changes in flow velocity directly affect this rate of heat dissipation. An electronic circuit normalizes the differential measurement with the process media temperature and converts

the RTD temperature/resistance differential into a DC voltage signal. This signal is provided at output terminals and used to drive two adjustable setpoint alarm circuits that are independently field configurable for specific flow service applications.

#### > For liquid level/ interface detection

Dry conditions (no liquids present) produce the greatest temperature differential. The signal decreases when the level element is submerged as the cooling effects of the fluid drive the temperature/resistance differential downward. Since all process fluids have different thermo physical properties, different fluids exhibit unique heat transfer characteristics. Interface detection between non-miscible fluids can be factory or field calibrated to alarm when the fluid changes from liquid to foam, between two different fluids, or between fluid and rag layer or emulsion.

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# FCI's complete line of flow, level and temperature instrumentation



ST98 FlexMASter



ST98HP FlexMASter



GF92



MT Series

## Thermal Mass Flowmeter Series

	<b>ST98 FlexMASter®</b> Insertion Gas Mass Flowmeter	<b>ST98L FlexMASter®</b> Inline Gas Mass Flowmeter	<b>ST98HP</b> <b>FlexMASter</b> Inline High Purity and Ultra High Purity Mass Flowmeter	<b>GF90</b> Insertion Gas Mass Flowmeter	<b>GF92</b> Inline Gas Mass Flowmeter	<b>GF03</b> Insertion Flare & Mixed Gas Mass Flowmeter	<b>MT Series</b> Multi-Point Mass Flowmeters
<b>Sensing/Flow Element Range</b>	0.75 to 600 SFPS* [0.21 to 172 NMPS]	0.0062 to 1850 SCFM* [0.01 to 3,140 NCMH]	2.0 to 3183 SCFM* [3.4 to 5409 NCMH]	0.25 to 1600 SFPS* [0.08 to 488 NMPS]	0.006 to 2000 SCFM* [0.01 to 3398 NCMH]	0.5 to 275 SCFM* [0.15 to 84 NCMH]	0.25 to 150+ SFPS* [0.08 to 46 NMPS]
<b>Adjustable Response Time</b>	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Process Connection</b>	3/4" male NPT stainless steel adjustable compression fitting with Teflon or metal ferrule. Flange connections and field retractable packing gland assemblies available.	Female NPT standard on 1" tubing; 1", 1.5" or 2" schedule 40 pipe; flange connections available.	3/4" to 4" [19 to 102 mm] with butt weld or sanitary flange connections. <b>Standard:</b> 14 Ra electropolish <b>Optional:</b> 10 Ra electropolish	1" male NPT. Flange connections and field retractable packing gland assemblies available.	3/4" female NPT standard. 1", 1.5" and 2" male or female NPT. Flange connections available.	1" male NPT standard. 1 1/4" male NPT, flange connections and field retractable packing gland assemblies available.	2" male NPT or 3" 150 lb raised-face carbon steel flange. Other flange connection sizes and materials available.
<b>Insertion Length or Inline Sensor Assembly Body Length</b>	Field adjustable lengths: 1 to 6" [25 to 152 mm], 1 to 12" [25 to 305 mm] or 1 to 21" [25 to 533 mm]; custom lengths optional.	1" tubing/pipe: 9" [228 mm] 1.5" pipe: 13.5" [342 mm] 2" pipe: 18" [684 mm]	1" flow tube: 5.25" [133 mm]; 1.5" flow tube: 5.75" [146 mm]; 2" flow tube: 6.75" [171 mm]; 3" flow tube: 7.75" [197 mm]	Variable insertion lengths; customer specified.	1" tubing/pipe: 7.25" [184mm] 1.5" to 2" pipe: 12" [304mm]	Variable insertion lengths; customer specified.	Variable insertion lengths; customer specified.
<b>Enclosure Classification</b>	<b>Standard:</b> NEMA/CSA Type 4X (equivalent to IP66) and Division 2 (Ex n). <b>Option:</b> Aluminum is rated for hazardous location use Class I and II, Division 1 and 2, Group B, C, D, E, F, and G; and EEx d IIC and resists the effect of weather and corrosion.	<b>Standard:</b> NEMA/CSA Type 4X (equivalent to IP66) and Division 2 (Ex n). <b>Option:</b> Aluminum is rated for hazardous location use Class I and II, Division 1 and 2, Group B, C, D, E, F, and G; and EEx d IIC and resists the effect of weather and corrosion.	<b>Standard:</b> NEMA/CSA Type 4X (equivalent to IP66) and Division 2 (Ex n). <b>Option:</b> Aluminum is rated for hazardous location use Class I and II, Division 1 and 2, Group B, C, D, E, F, and G; and EEx d IIC and resists the effect of weather and corrosion.	<b>Standard:</b> Fiberglass NEMA Type 4X remote. <b>Option:</b> Aluminum and stainless steel enclosures are rated for hazardous location use(Class I and II, Division 1 and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66).	<b>Standard:</b> Fiberglass NEMA Type 4X remote. <b>Option:</b> Aluminum and stainless steel enclosures are rated for hazardous location use(Class I and II, Division 1 and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66).	<b>Standard:</b> Fiberglass NEMA Type 4X remote. <b>Option:</b> Aluminum is rated for hazardous location use(Class I and II, Division 1 and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66).	<b>Standard:</b> Carbon steel, epoxy coated NEMA Type 4. <b>Option:</b> Aluminum is rated for hazardous location use (Class I and II, Division 1 and 2, Group B, C, D and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4 (meets IP66).
<b>Sensing/Flow Element Operating Conditions</b>	<b>Temperature:</b> -40° to +350° F [-40° to +177° C] <b>Option:</b> -40° to +500° F [-40° to +260° C] <b>Pressure:</b> to 250 psig [17 bar(g)]	<b>Temperature:</b> -40° to +350° F [-40° to +177° C] <b>Pressure:</b> to 250 psig [17 bar(g)]	<b>Temperature:</b> -40° to +350° F [-40° to +177° C] <b>Pressure:</b> to 250 psig [17 bar(g)]	<b>Temperature:</b> -50° to +350° F [-45° to +177° C] <b>Option:</b> -100° to +850° F [-73° to +454° C] <b>Pressure:</b> to 1000 psig [69 bar(g)]	<b>Temperature:</b> -50° to +350° F [-45° to +177° C] <b>Pressure:</b> to 1000 psig [69 bar(g)]	<b>Temperature:</b> -50° to +350° F [-45° to +177° C] <b>Pressure:</b> to 1000 psig [69 bar(g)]	<b>Temperature (MT86/MT91):</b> -50° to +350° F [-45° to +177° C] <b>Option:</b> -50° to +850° F [-45° to +454° C] <b>Pressure:</b> to 50 psig [3.4 bar(g)]

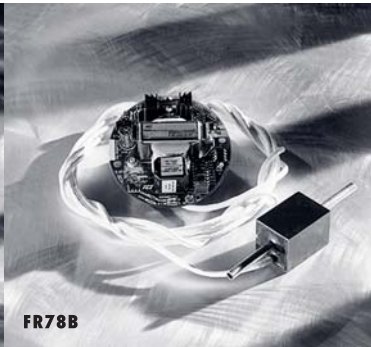
\* Air at 70° F [21.1° C] and 14.7 psia [1.01325 bar (g)] (reference)



FLT93 FlexSwitch



12-64B and 8-66B



FR78B



NuTec FS2000L

## Flow, Level and Temperature Switch Series

<b>FLT93S FlexSwitch®</b> <b>FLT93F FlexSwitch®</b> Insertion Flow/Level/ Temperature Switches	<b>FLT93L Flexswitch®</b> Inline Flow/Level/ Temperature Switch	<b>FLT93C FlexSwitch</b> Insertion Sanitary Flow/Level/Temperature Switch	<b>12-64B</b> Insertion Flow Switch <b>8-66B</b> Insertion Level/ Interface Switch	<b>FR78B</b> Low Flow Inline Monitor	<b>FR73B</b> Ultra Low Flow Inline Monitor	<b>NuTec® FS2000</b> Insertion Flow Switch <b>NuTec® LS2000</b> Insertion Level Switch	<b>NuTec® FS2000L</b> Inline Non-Intrusive Flow Switch																
Water-Based Liquids: 0.01 to 3.0 FPS [0.003 to 0.91 MPS]  Hydrocarbon-Based Liquids: 0.01 to 5.0 FPS [0.003 to 1.52 MPS]  Air/Gas: 0.25 to 120 SFPS [0.08 to 37 NMPS]	Water-Based Liquids: .015 to 50 cc/sec. [0.0009 to 3 lps]  Hydrocarbon-Based Liquids: .033 to 110 cc/sec. [0.002 to 6.6 lps]  Air/Gas: 0.6 to 20,000 cc/sec. [0.036 to 1197.6 lps]	Water-Based Liquids: 0.01 to 3.0 FPS [0.003 to 0.9 MPS]  Hydrocarbon-Based Liquids: to 5.0 FPS [0.0003 to 1.5 MPS]  Air/Gas: 0.25 to 120 SFPS [0.08 to 36.6 SMPS]	<b>12-64B:</b> Water-Based Liquids: 0.015 to 0.5 FPS [0.005 to 0.15 MPS] Hydrocarbon-Based Liquids: 0.01 to 2.0 FPS [0.003 to 0.61 MPS] Air/Gas: 1.0 to 125 SFPS [0.3 to 38 NMPS]  <b>8-66B:</b> Point Level/Interface	Water-Based Liquids: 0.08 to 2.25 cc/sec.  Hydrocarbon-Based Liquids: 0.05 to 25 cc/sec.  Air/Gas: 4.0 to 1500 cc/sec.	Water-Based Liquids: 0.01 to 1.25 cc/min.  Hydrocarbon-Based Liquids: 0.04 to 2 cc/min.  Air/Gas: 1.0 to 1000 cc/min.	<b>FS2000:</b> Water-Based Liquids: 0.015 to 1.5 FPS [0.045 to 0.45 MPS] Hydrocarbon-Based Liquids: 0.015 to 1.5 FPS [0.045 to 0.45 MPS] Air/Gas: 0.5 to 100 SFPS [0.15 to 30 SMPS]  <b>LS2000:</b> Point Level/Interface	Water-Based Liquids: 0.03 to 85.5 FPS [0.11 to 324 MPS]  Air/Gas: 0.02 to 342 SCFM [0.0006 to 9.70 NCMM]																
From 0.5 seconds	From 0.5 seconds	From 0.5 seconds	<b>Flow:</b> 10 to 300 seconds <b>Level:</b> From 5.0 seconds	1 to 150 seconds	1 to 150 seconds	0.5 to 2.5 seconds	From 0.5 to 2.5 seconds																
3/4" male NPT, 1" BSP, 1" male NPT; Flange connections and field retractable packing gland assemblies available.	1" male NPT or 3/4" female NPT both ends. Flange connections available.	3/4", 1", 1.5" and 2" sanitary flanges	1" male NPT	0.25" tubing x 1.8" [46 mm] long with 0.028" [0.7 mm] wall thickness; 0.375 and 0.50" tubing available.	0.125" OD tubing x 2" [50 mm] long with 0.028" [0.7 mm] wall thickness.	3/4" male NPT	<b>Standard:</b> Butt weld  <b>Optional:</b> Male NPT or sanitary flange																
Standard lengths of 1.2" [30 mm], 2" [51 mm], 4" [102 mm], 6" [152 mm], 9" [229 mm], 12" [305 mm], and 18" [457 mm], custom lengths available.	3.375" [86 mm]; custom lengths available.	<table border="1"> <thead> <tr> <th>Line Size</th> <th>Tea Length</th> </tr> </thead> <tbody> <tr> <td>3/4"</td> <td>5.25" [133 mm]</td> </tr> <tr> <td>1"</td> <td>4.75" [121 mm]</td> </tr> <tr> <td>1.5"</td> <td>5.50" [139 mm]</td> </tr> <tr> <td>2"</td> <td>7.00" [177 mm]</td> </tr> <tr> <td>2.5"</td> <td>5.68" [144 mm]</td> </tr> <tr> <td>3"</td> <td>7.50" [190 mm]</td> </tr> <tr> <td>4"</td> <td>9.00" [229 mm]</td> </tr> </tbody> </table>	Line Size	Tea Length	3/4"	5.25" [133 mm]	1"	4.75" [121 mm]	1.5"	5.50" [139 mm]	2"	7.00" [177 mm]	2.5"	5.68" [144 mm]	3"	7.50" [190 mm]	4"	9.00" [229 mm]	1.2" [30 mm], 2.0" [51 mm]	5.3" [135 mm]; Custom lengths available.	7.0" ± 0.25" [178 mm ± 6 mm]	2" [51 mm]; 6" [152 mm]; Custom lengths available.	9" [229 mm] male NPT; 6" [152 mm] butt weld or sanitary flange
Line Size	Tea Length																						
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<b>Standard:</b> Aluminum is rated for hazardous location use (Class I and II, Division I and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66). <b>Option:</b> Stainless steel	<b>Standard:</b> Aluminum is rated for hazardous location use (Class I and II, Division I and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66). <b>Option:</b> Stainless steel	<b>Standard:</b> Aluminum is rated for hazardous location use (Class I and II, Division I and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66). <b>Option:</b> Stainless steel	<b>Standard:</b> Aluminum is rated for hazardous location use (Class I and II, Division I and 2, Group B, C, D, E, F and G; and EEx d IIC) and resists the effect of weather and corrosion. NEMA and CSA Type 4X (meets IP66).	<b>Standard:</b> No enclosure <b>Option:</b> Aluminum is rated for NEMA and CSA Type 4 and resists the effects of weather and corrosion (meets IP66).	<b>Standard:</b> No enclosure <b>Option:</b> Aluminum is rated for NEMA and CSA Type 4 and resists the effects of weather and corrosion (meets IP66).	<b>Standard:</b> Aluminum is rated for general purpose use (Class I and II, Division I and 2, Group B, C, D).	<b>Standard:</b> Weatherproof  <b>Optional:</b> Aluminum NEMA Type 4X and hazardous location use (Class I and II, Division I and 2, Group B, C, D, E, F and G; and EEx d IIC)																
<b>Temperature:</b> -40° to +500° F [-40° to +260° C] <b>Option:</b> -100° to +850° F [-73° to +454° C] <b>Pressure:</b> to 3500 psig [241 bar(g)]	<b>Temperature:</b> -40° to +500° F [-40° to +260° C] <b>Pressure:</b> to 2000 psig [138 bar(g)]	<b>Temperature:</b> -40° to +500° F [-40° to +260° C] <b>Pressure:</b> to 2000 psig [138 bar(g)]	<b>Temperature:</b> -100° to +350° F [-73° to +177° C] <b>Pressure:</b> to 3000 psig [207 bar(g)]	<b>Temperature:</b> -100° to +350° F [-73° to +177° C] <b>Pressure:</b> to 1000 psig [69 bar(g)]	<b>Temperature:</b> -100° to +350° F [-73° to +177° C] <b>Pressure:</b> to 1000 psig [69 bar(g)]	<b>Temperature:</b> -40° to +250° F [-40° to +121° C] <b>Pressure:</b> to 500 psig [35 bar(g)]	<b>Temperature:</b> -40° to +250° F [-40° to +121° C] <b>Pressure:</b> to 500 psig [35 bar(g)]																

### > **For temperature detection**

The unheated RTD serves as the baseline for establishing the differential temperature and continuous monitoring of the process temperature. Being thermally isolated, the unheated RTD provides accurate indication and detection of process fluid temperatures. Simultaneous temperature and flow and level detection can provide comprehensive process monitoring as well as critically supplement operator process health and efficiency awareness.

### **NuTec® 2000 Series**

#### > **2-wire loop-power and non-intrusive switches**

Extraordinarily responsive and accurate, the versatile NuTec flow/level switch series offers superior reliability in extreme process conditions. The FS2000 and LS2000 switches feature the first 2-wire thermal flow/no flow and level detection switches. These insertion switches are designed with FCI's proven thermal mass flow sensor technology in a rugged package that is easy to install and requires minimal maintenance. The FS2000L inline flow switch has an advanced non-intrusive sensor design constructed of 316L stainless steel with up to a 10 Ra electropolish finish approved for 3A sanitary and high purity applications. The FS2000L is available with inline sizes of 1/2 inch, 1 inch and 2 inches for easy installation using male NPT, butt-weld or sanitary flanges.

### **FlexMASter® ST Series and GF Series mass flow meters**

Because the relationship between flow rate and cooling effect directly relates to mass flow in gas applications, FCI thermal mass flow meters provide a highly repeatable and accurate measurement of gas or air mass flow rates. The ST98 Series "smart" electronics, equipped with advanced micro-processor-based circuitry, enable

customers to reconfigure the signal outputs easily, as well as, display or alarm in the field by using either a built-in key pad or a handheld communicator. The GF Series offers wide turndown ratios up to 800:1 with multiple gas calibrations with analog electronic circuitry.

FlexMASter technology delivers performance and value by offering the most innovative, accurate and cost effective gas mass flow measurement systems available in the industrial flowmetering marketplace today. This highly reliable instrument provides the durability and speed required for today's harsh process environments and delivers true direct mass flow measurement. FCI's FlexMASter simplifies gas mass flowmetering with a single process penetration, eliminating costly temperature or pressure transmitters and a flow computer required with other technologies.

### **CMF FlexCOR® Series**

The CMF FlexCOR Series Coriolis flow meters push development a giant leap forward in Coriolis measurement technology. Unaffected by variations in pressure, temperature, density, electrical conductivity and viscosity, the FlexCOR Series provides highly accurate mass flow measurement over wide flow ranges while utilizing its advanced technology to achieve unsurpassed operational performance stressing safety, reliability and quality.

### **VORTAB® flow conditioners**

FCI ensures the field performance of its highly accurate mass flow meter product lines by offering VORTAB flow conditioners. VORTABs ensure accurate, repeatable gas flow measurement and are the efficient alternative to long lengths of straight piping or ducting upstream of a flow meter installation location. VORTAB units reduce or eliminate pressure drop, swirl, jetting and

more, while requiring just six diameters of pipe upstream from the flow meter. Each of the three available flow conditioner configurations consist of a short section of swirl reduction tabs combined with three arrays of patented VORTAB profile conditioning tabs.

### **FCI's extensive instrument test and calibration laboratory**

FCI maintains an extensive, instrument test and calibration laboratory at its headquarters in San Marcos, California. Utilizing the latest in advanced, computerized data acquisition systems and calibration test equipment, this facility permits comprehensive product development, testing, and calibration. Any FCI product can be calibrated in accordance with customer specifications. Laboratory standards are maintained with NIST (National Institute of Standards and Technology) traceable Cavitating Venturis (CVs) and precision calibrated, pressure and temperature corrected turbine flow meters. Combustible and non-combustible gas calibration flow stands allow for the calibration of FCI products in a wide range of gases as gas mixtures in flow stand sizes as small as 1/8 inch to 30 inches [3 to 760 mm] in diameter. A variety of flow profiles from laminar to turbulent conditions are generated to duplicate actual field conditions. Flow rates from 0 to 20,000+ SCFM [0 to 34,000 NCMH], velocities from 0 to 800 SFPS [0-240 NMPS], pressures from vacuum to 3000 psig [200 bar(g)], and temperatures from -100° to 850°F [-70° to + 454°C].

### **FCI on-site instrument calibration and training**

In-situ calibration is available from FCI's Field Service Engineers where precise test and calibration is accomplished in actual media conditions.

NIST Net

**FCI** FLUID COMPONENTS  
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HART  
FIELD COMMUNICATIONS PROTOCOL

Web: [www.fluidcomponents.com](http://www.fluidcomponents.com)

1755 La Costa Meadows Drive, San Marcos, California 92078 USA | Phone: 760-744-6950 | Toll free: 800-854-1993 | Fax: 760-736-6250  
European Office: Persephonestraat 3-01 5047 TT Tilburg, The Netherlands | Phone: 31-13-5159989 | Fax: 31-13-5799036

ISO 9001:2000 and AS9100 certified