

# ST100 Series Flare Gas Flow Meters

## Flow Meter Solutions for Land Based and Offshore Platform Flares



*Flaring systems are used to burn-off and dispose of waste, excess or off-gases, and as a safety system to protect processes and equipment. They are found throughout the world in oil and gas processing systems, refineries and petrochemical plants. Flare flow meters are a critical component used in these systems to monitor, measure and report the gas flows within these systems. Flare flow meters provide plant operations with a tool to signal abnormal process changes, early leak detection, and report on flared gases to comply with environmental agency reporting.*

### ST100 Series Flare Gas Flow Meters

- Oil, gas, petrochemical plant flares and feed lines
- LP and HP flare applications
- Environmental agency and emission trading compliance with exclusive SR2x™ option
- Lowest total installed cost solution
- Flow range from 0.25 SFPS to 1000 SFPS [0,07 NMPS to 305 NMPS]
- Mixed hydrocarbon gases calibration
- Up to five (5) separate, unique calibrations
- Direct mass flow measuring; no need for temperature and pressure sensors
- Up to 1000:1 turndown
- Patented in-situ calibration verification option
- Analog outputs or digital bus communications
- Global agency approvals for Ex installations
- Exclusive dual-element systems for larger flare lines
- All stainless steel enclosure option for offshore installations
- Auxiliary input channels for interface with gas analyzers

FCI has been a leading provider of flare gas flow meter solutions for more than two decades. FCI flow meters are installed in both land-based and offshore platform flare systems throughout the world. The new ST100 Series flow meters leverage these experiences with extensive features and functions that extend and optimize their application in flare flow measurement.

Whether your flares are single-line or a large flaring system with a complex array of tributary lines and mixed gases, there is an FCI solution. From superior low flow measurement to detect the smallest leaks and up to 1000 SFPS [305 NMPS] to accurately measure major upset conditions at very high flows, FCI ST100 Series flow meters are your best solution.

The ST100 Series flow meters combine a broad range of easy to install insertion flow elements with industry's most powerful and flexible electronics/transmitter and specialized, precision flare gas calibrations. With wide turn downs, specific calibrations for mixed gas compositions, FCI exclusive SR2x split-range/dual calibration (see page 3), and maximum output flexibility with 4-20mA analog outputs or bus communications such as HART, FOUNDATION™ fieldbus, or Modbus, ST100 Series delivers a truly state-of-the-art gas flow meter for industrial process, plant and offshore flare applications.

## ST100 Series Features

Four conduit ports provide greatest signal integrity and separation for power input, analog output lines, digital I/O, relays and/or auxiliary input signals; choice of NPT or M20 threads

AC or DC power supply

Weather-proof, ruggedized, Ex rated enclosures

- Choices for local or remote mounting
- NEMA 4X, IP67
- Aluminum or optional all stainless steel

Global agency approvals of entire instrument system for hazardous location installations:

FM, FMc, ATEX, IEC, NEPSI, CPA, Inmetro, GOST\*

Multiple calibrations

- Up to five independent, separate calibrations
- Same gas, different flow range to optimize accuracy and extend turndown up to 1000:1
- Exclusive SR2x™ split range / dual calibration

Precision calibration and calibration choices

- Specific gas and application matched calibration in FCI NIST traceable facility

Extensive selection of process connections

- Retractable packing gland assemblies
- Fixed connections
- ANSI or DIN flanges
- Simple, adjustable installation with threaded NPT connector

Stainless steel or Hastelloy-C276 wetted parts



Remote up to 1000' [300 m]



Extensive analog and digital communications output choices

- Triple 4-20 mA with HART
- FOUNDATION™ fieldbus H1
- PROFIBUS PA
- Modbus RS-485
- 0-1 kHz or 0-10 kHz frequency or pulse
- Dual relays
- USB port
- Ethernet

On-board data logger

Four (4) optical touch buttons

- Proximity activation, no need to open enclosure
- Full instrument programmability
- Protected against unwanted activation

Comprehensive informational display

- Digital readout of all measured parameters; flow rate, total flow, temperature and pressure with engineering units
- Analog flow rate bar graph
- Alarm relay status indication
- Instrument fault indication
- User programmable 17 character field (example: display gas type, tag number or application/location)
- Display orientation rotates in 90° increments electronically
- Backlighted: auto-on activation via proximity sensor or set for always on

Multi-function: measures mass flow rate and temperature; STP Series adds pressure measurement

Permanent laser-etched depth gauge markings; ensures accurate centering of adjustable-length elements

All welded sensor elements for maximum service life and leak-proofing

Precision, wide-ranging platinum RTD sensors

Exclusive equal mass sensors provide optimum performance in processes with wide temperature swings

Choice of flow element styles to optimize application performance

- FP style (shown)
- S style

\* Some approvals pending at time of publication; contact FCI for most current status

## ST100 Series Flare Gas Flow Meters

### FCI Exclusive Split-range, Dual Calibration – SR2x™ (Environmental Agency and Emissions Trading Compliance)

Many oil & gas operations, refineries and chemical plants have flare applications uniquely challenged with two diverse flow conditions, very low flow under normal conditions and very high flow during an upset/blowdown condition. These industries are then further challenged to comply with environmental agencies and emissions trading regulations for their flares stipulating flow meter accuracy of  $\pm 5\%$  of reading throughout the entire measuring range. FCI answers this challenge with our exclusive SR2x split-range/dual calibration option in the ST100 Series which provides:

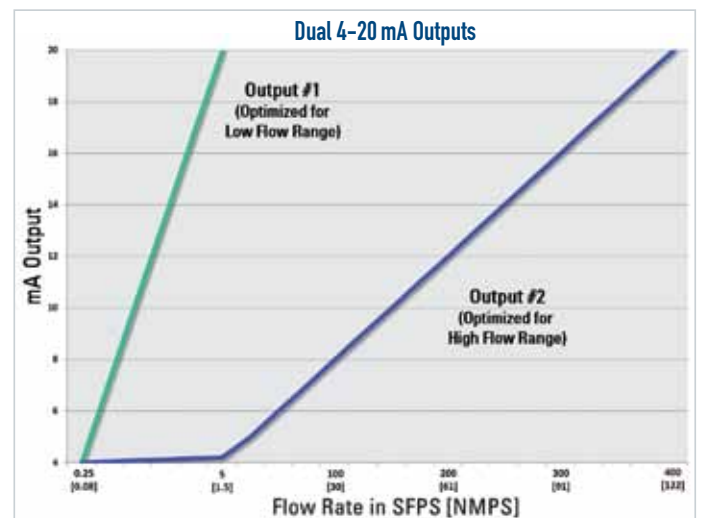
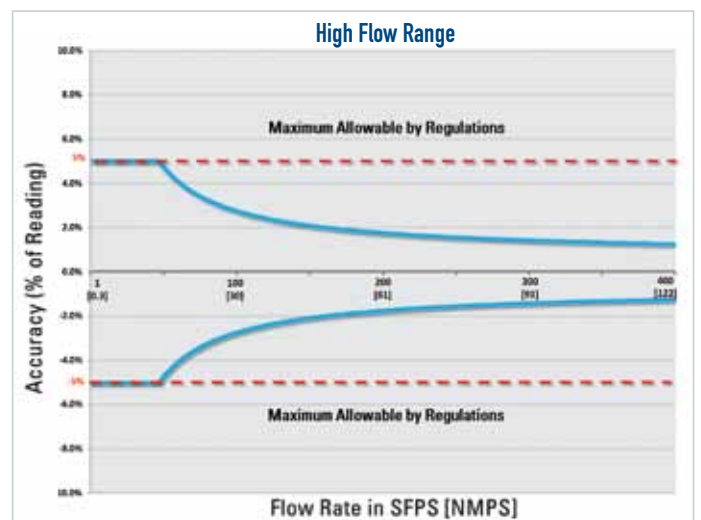
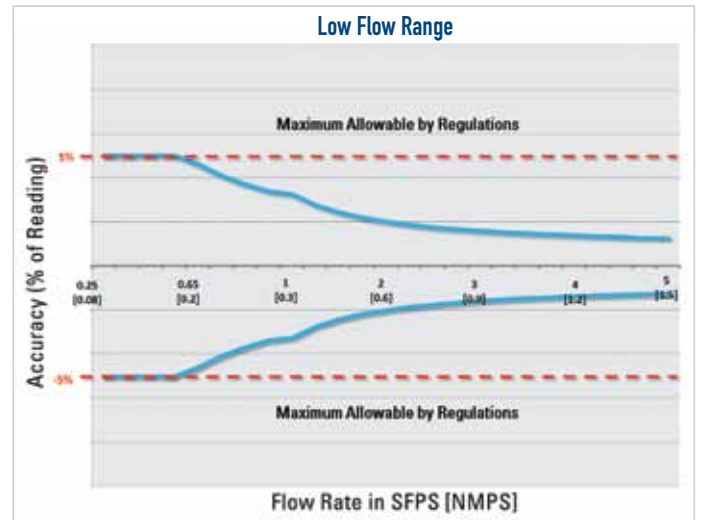
- **Split ranges:** Two separate and discrete ranges, one optimized in the low flow range and one optimized in the high flow range
- **Double calibration points** strategically placed and optimized in the low flow range and high flow range to achieve  $\pm 0.75\%$  reading,  $\pm 0.5\%$  of full scale to a maximum of  $\pm 5\%$  of reading
- **Dual 4-20mA analog outputs:** One dedicated to the low flow range and the other to high flow range; this ensures maximum resolution of both the low flow and high flow range at the DCS, or, if any of the bus communications are specified, a single, contiguous high accuracy digital value over the entire flow range is sent to the DCS

When your flare application is characterized by this difficult low flow/high flow situation, FCI's ST100 Series will provide a regulatory compliant, exclusive thermal dispersion flow meter solution.

### FCI Flare Gas Flow Meter Users *(partial list)*

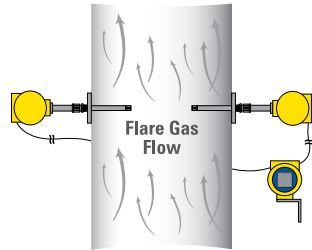
|                                |                               |                              |                                |                              |
|--------------------------------|-------------------------------|------------------------------|--------------------------------|------------------------------|
| ADGAS                          | DAQING PETRO-CHEMICAL         | HILDALGO PLATFORM            | ENTERPRISES MURPHY EXPLORATION | SHANGHAI PETROCHEMICAL       |
| AERA ENERGY                    | DEVON CANADA                  | HITCO CARBON COMPOSITES INC  | NAM                            | SHELL                        |
| ALLIED PETRO-CHEMICAL LLC      | DOW                           | HOLLY REFINING & MARKETING   | NEO TAUNTON LLC                | SHELL CHEMICAL               |
| AMERADA HESS                   | DYNEGY                        | HOUSTON REFINING             | NORCO / RESOLUTION LLC         | SICHUAN PETROCHEMICAL        |
| AMOCO TRINIDATE OIL CO         | E.I. DUPONT                   | HUNTSMAN                     | ONEOK                          | SINCLAIR REFINERY            |
| ANADARKO                       | EASTMAN CHEMICAL              | INDIAN OIL CORP              | ONGA                           | SINOPEC YANGZI PETROCHEMICAL |
| ANKOR ENERGY LLC               | EL PASO PRODUCTION CO         | INNOVENE USA LLC             | ONGC                           | SIPETROL                     |
| AOC TEXAS CITY                 | ELK CITY OKLAHOMA PIPELINE    | INVISTA INC                  | ORICA CHEMICALS                | SOLUTIA INC                  |
| APACHE                         | EMPRESA PETRO EQUILON         | IOCL                         | ORIGIN ENERGY                  | SOLVAY                       |
| ARKEMA                         | ENTERPRISES                   | KHALDA PETROLEUM             | PAN AMERICAN ENERGY            | SOMERSET ENERGY REFINING     |
| ATLAS PIPELINE                 | EQUISTAR CHEMICALS            | KINDER MORGAN                | PASADENA HYDROGEN PLANT        | SUNCOR                       |
| ATOFINA                        | ERG                           | KUWAIT NATIONAL PETROLEUM    | PECTEN CAMEROON CO             | SYNERGAS                     |
| ATOFINA PETRO-CHEMICALS        | ETHYL PETROLEUM ADDITIVES INC | LASMO                        | PEMEX                          | TALISMAN ENERGY              |
| BAPCO                          | EVALCO                        | LDH ENERGY                   | PENN WEST PETROLEUM LTD        | TARGA RESOURCES              |
| BASF CORP                      | EXCELVOR CORP                 | LUBRIZOL                     | PERTAMINA                      | TENNESSE GAS PIPELINE        |
| BAYER MATERIAL SCIENCE         | EXTERRAN                      | MARKWEST ENERGY              | PETROBRAS                      | TESORO                       |
| BG EXPLORATION                 | EXXON MOBIL                   | MARTIN MIDSTREAM             | PETROFAC                       | TEXAS EASTMAN                |
| BOAP OLEFINS                   | EXXON MOBIL CHEMICAL          | MARYSVILLE HYDROCARBONS      | PETRONAS                       | TOTAL                        |
| BOSNA - S OIL                  | FOREST OIL                    | MERIT ENERGY                 | PETROZUATA                     | TOTAL PETRO-CHEMICALS        |
| BP                             | FORTISTAR                     | MILLENIUM PETROCHEMICALS     | POLIMERI                       | UNION CARBIDE                |
| BUIMI CARE OFFSHORE PRODUCTION | METHANE GROUP                 | MM PRIMA DESHECHA ENERGY LLC | PPG INDUSTRIES                 | UNITED GASCO                 |
| CARMEL OLEFINS                 | FRONTIER EL                   | MOBIL CHEMICAL INC           | QUIMEX                         | VALERO                       |
| CENEX                          | DORADO REFINING               | MOTIVA                       | REPSOL                         | VENOCO                       |
| CEPSA                          | GASCO                         |                              | SABIC                          | WILLIAMS FIELD SERVICES      |
| CHEVRON                        | GODLEY GAS PLT                |                              | SABINE PLANT                   | WRB REFINING LLC             |
| CHEVRON PHILLIPS               | GULF ISLAND LLC               |                              | SAUDI ARAMCO                   | YANSHAN PETROCHEMICAL        |
| CHEVRON TEXACO                 | GULF LIQUIDS LLC              |                              | SECCO                          | ZHAIKMUNAI OIL               |
| CONOCO PHILLIPS                |                               |                              |                                |                              |

### Examples of Performance in 0.25 SFPS to 400 SFPS [0.08 NMPS to 122 NMPS]



## Dual-Element Systems

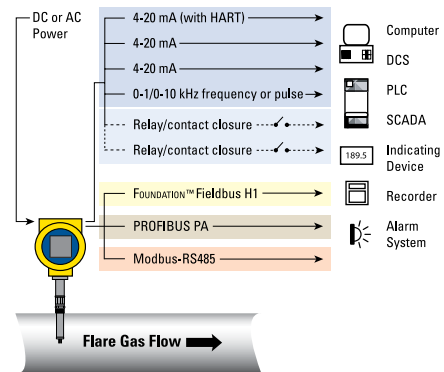
In pipe sizes larger than 16 inches [406 mm] a dual-element averaging system may provide better measurement performance and a more viable solution when it is impractical or impossible to provide the required straight-run or installation of a flow conditioner is difficult. ST100 Series models ST102A, ST112A, STP102A, and STP112A are dual-element averaging systems.



To determine if your flare meter application will benefit from using a dual-element averaging design, submit an FCI application data sheet or use AVAL, FCI's online flow meter sizing tool.

## Communicate the Flow

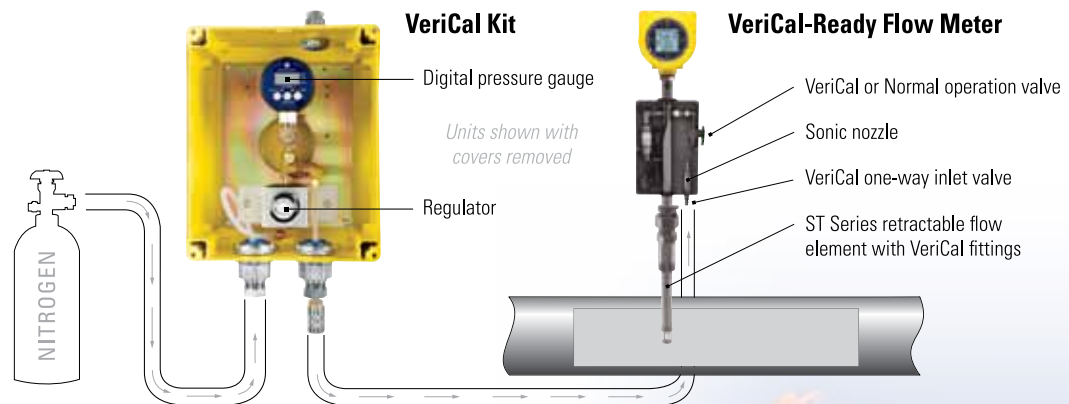
Local readout, multiple 4-20 mA analog outputs, digital bus communications including HART, FOUNDATION™ fieldbus, Modbus and more, are all available with ST100 Series to provide the flare flow data to you and your systems. There is simply no other flare meter with the comprehensive selection of interfaces as ST100 Series. And, should you ever want to change or upgrade, ST100 is field upgradeable to any of the available outputs.



## VeriCal™ In-Situ Calibration Verification

Many flare meter installations, either per plant edict or for compliance with environmental regulations, require regular validation of calibration. Traditionally this has required a cumbersome and costly project to remove the meter from service and return it to a lab, which is particularly frustrating if the meter is found to still be within calibrated specifications. FCI's exclusive VeriCal option eliminates the need for unnecessary de-installation. The VeriCal system provides

a simple-to-use tool to verify the FCI flow meter is still within calibration without extracting the meter from pipe. The VeriCal system consists of a special VeriCal ready flow sensor, a portable VeriCal Kit (which can be used with any number of VeriCal-ready ST100 flow meters) and an additional benchmark calibration document to which field verification samples are compared. For more detailed information on VeriCal, please refer to FCI ST100 Series brochure.



*Nitrogen and hose user supplied*

*"FCI flow meters have been providing accurate and easy-to-obtain venting data at our offshore facilities."*

– M. Skaer, Facilities Engineer  
ANKOR Energy LLC





Flare gas applications present several unique challenges to plant, process and instrument engineers when selecting a flow meter solution. These can include many or even all of the following:

- **Both low and high flow conditions** – low flow sensitivity is critical to capture leaking relief valves and sensing air leaking into system, and very high flows occur during upset conditions
- **Mixed gases** – flow meter calibration specifically for hydrocarbon composition gases and matched to actual process conditions
- **Large pipe sizes** – as line sizes increase effective and suitable flow metering technologies decrease
- **Lack of available straight-run** – larger line size and limited real estate, particularly on off-shore platforms, are restrictive to providing required straight-run to achieve repeatable flow metering accuracy
- **Compliance with local environmental regulations** – meet performance and calibration procedures mandated within local regulations such as US EPA's 10 CFR 40; 40 CFR 98; EU Directives 2003/87/EC and 2007/589/EC; US MMR 30 CFR Part 250, Subpart K, Section 250 and others
- **Limited access** – Pipe access and reaccess for installation, maintenance or servicing is difficult; spool-piece flow meters may require prolonged process shut-down and extensive on-site labor costs to install
- **Agency approvals for installation in hazardous (Ex) locations** – The entire flow metering instrument should carry agency approval credentials for installation in environments with potential hazardous gases; enclosure only ratings are inadequate (and risky)
- **Offshore platforms corrosive salt water** – offshore platform may require use of stainless steel on all exposed instrument materials, including sensors, process connections and enclosures

## Key Criteria For Flare Flow Meter Selection

- Meet local environmental agency requirements for accuracy and periodic calibration verification
- Wide turndown for both low flow and high flow conditions
- Certified calibration for mixed hydrocarbon flare gases
- Multiple calibrations for variations in composition
- Direct mass flow measurement
- Easy to install, minimal penetration points
- Non-clogging, non-fouling, no moving parts design for lowest maintenance
- Agency approved for installation in explosive gas classified environments
- Stainless steel wetted parts and optional stainless steel process connections and enclosure housings

## Comparison of Flow Meters Applied in Flares

|  | FCI Thermal Dispersion | Ultrasonic   | Optical  |
|--|------------------------|--|--|
| Purchase Cost  | \$                     | \$\$\$   | \$\$   |
| Installation Costs                                     | \$                     | \$\$\$\$   | \$\$   |
| Single Insertion Tap Installation                      | ✓                      |  | ✓  |
| Sensor Alignment Critical                              |                        | ✓  |  |
| Flow Range ≥ 328 FPS [100 MPS]                         | 1000 FPS [305 MPS] ✓   | 394 FPS [120 MPS] ✓  | 500 FPS [150 MPS] ✓  |
| Turn-down to 1000:1                                    | ✓                      | ✓  | ✓  |
| Direct Mass Flow Measuring                             | ✓                      | <b>NO</b><br><i>(Additional expense, process tap points and wire-ups for temperature and pressure sensors)</i> | <b>NO</b><br><i>(Additional expense, process tap points and wire-ups for temperature and pressure sensors)</i> |
| Meets Environmental Agency Specifications for Accuracy | ✓                      | ✓  | ✓  |
| SR2x™ Split-Range, Dual Calibration                    | ✓                      | <b>NO</b>  | <b>NO</b>  |
| Temperature Service to 850 °F [454 °C]                 | ✓                      | <b>NO</b><br>536 °F [280 °C]   | <b>NO</b><br>212 °F [100 °C]   |
| Pressure Service to 1000 psi [70 bar]                  | ✓                      | ✓  | <b>NO</b><br>300 psi [20 bar]  |

If you have previously applied thermal mass flow meters in your flare applications, look no further than ST100 for your next generation solutions. If you have never considered thermal flow meters for your flares, FCI's ST100 Series provides unsurpassed features, functions, performance and calibrations optimized for flare applications that deliver the best possible solution.

# General Specifications Summary

## Instrument

- **Measuring Capability**  
Flow rate, total flow and temperature (optional pressure)
- **Accuracy**  
**Flow**  
Standard:  $\pm 0.75\%$  reading,  $\pm 0.5\%$  full scale  
With SR2x:  $\pm 0.75\%$  reading,  $\pm 0.5\%$  full scale or  $\pm 5\%$  of reading – whichever is better  
**Temperature:**  $\pm 2^\circ\text{F}$  [ $\pm 1, 1^\circ\text{C}$ ]
- **Repeatability**  
**Flow:**  $\pm 0.5\%$  reading  
**Temperature:**  $\pm 1^\circ\text{F}$  [ $\pm 1^\circ\text{C}$ ]
- **Turndown Ratio**  
Standard: Up to 1000:1  
With SR2x: Low flow range 20:1 up to 40:1; high flow range up to 1000:1  
Total effectively up to 4000:1

## Flow Element

- **Material of Construction**  
All-welded 316L stainless steel; Hastelloy-C optional
- **Operating Pressure**  
Up to 1000 psig [69 bar (g)] depending on process connection type
- **Operating Temperature (Process)**  
From  $-40^\circ\text{F}$  to  $850^\circ\text{F}$  [ $-40^\circ\text{C}$  to  $454^\circ\text{C}$ ]
- **Pipe Sizes Supported**  
2 1/2" to 99" [63 mm to 215 mm] *For smaller line sizes, see Model ST100L*
- **Process Connection**  
Retractable packing glands 50 psi, 500 psi, 1000 psi [3,4 bar, 34 bar, 70 bar], ANSI or DIN flange adjustable; or welded fixed, compression fittings

## Flow Transmitter/Electronics

- **Enclosures**  
Polyester powder coated aluminum; optional all stainless steel; four (4) conduit ports threaded as 1/2" NPT or M20
- **Dust/Water Protection**  
IP67, NEMA 4X
- **Power Supply**  
24 Vdc or 85 Vac to 265 Vac

- **Remoteable**  
Yes, up to 1000' [300 m]
- **Outputs**  
Three (3) 4-20 mA with HART + one (1) frequency/pulse  
*Selectable as 0-1 kHz or 0-10 kHz*  
Three (3) 4-20 mA with HART + one (1) frequency/pulse  
*Selectable as 0-1 kHz or 0-10 kHz* + two (2) 2A relays  
*With SR2x, one 4-20 mA output is dedicated to flow rate for low flow range, and one is dedicated to flow for high flow range*  
FOUNDATION fieldbus H1  
PROFIBUS PA  
Modbus RS-485  
*USB connected serial port and ethernet port always included*
- **Inputs**  
Two (2) 4-20 mA
- **Readout/Display and Optical Touch Buttons (Optional)**  
Digital/graphical backlit LCD; displays all process measurements continuously; includes four (4) optically activated (through glass) programming buttons
- **Calibrations**  
Up to five (5) unique calibrations stored and electronically selectable
- **Data Logger**  
On-board micro-SD (secure digital) memory card; 2 GB capacity supplied, stores approximately 21 M readings

## Other Options

- **VeriCal™ In-Situ Calibration Verification System**
- **Dual-Element Systems**
- **Pressure Measurement**
- **Vortab® Flow Conditioners**
- **Transmitter Sun Shield**

For complete details and specifications please see FCI's ST100 Series brochure – visit [www.FluidComponents.com](http://www.FluidComponents.com) to request a copy or download a PDF

For smaller line applications (<2 1/2" [63 mm]) such as flare purge lines or assist gas feed lines, look to FCI in-line style flow meters – **ST100L** or **ST75-ST75V Series**.



**FCI** FLUID COMPONENTS INTERNATIONAL LLC

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Visit FCI online at [www.FluidComponents.com](http://www.FluidComponents.com) | FCI is ISO 9001:2000 and AS9100 Certified

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