Concentration Monitor

CR-288®

- Provides process monitoring for inline liquid chemical applications
- Provides real-time information for point-of-use chemical mixing/blending, spiking, and dilution without process intrusion or interruption
- PC-based graphical user interface software for data collection, analysis, and field calibration
- Stand-alone tool for improved productivity
CR-288 Concentration Monitor

The Swagelok® CR-288 concentration monitor provides real-time, temperature-compensated concentration measurement in a compact, ultrahigh-purity package. The monitor uses an optical system to accurately measure liquid chemical concentration in real time. The digital display unit and the 288-connect® software package combine convenient, scalable data interface and acquisition options via a graphical user interface and liquid crystal display (LCD).

Features

Sensor

- Compact, ultrahigh-purity package
- Meets SEMI F57-0301
- Based on the principle of index of refraction
- Bowl design optimizes fluid flow over sensor
- Fine thread flare and Nippon Pillar® Super 300 end connections standard; other end connections available

288-connect Software

- Windows® based
- Interfaces into real-time process
- Real-time concentration and temperature data logging
- Allows rapid field calibration to specific process fluid

Cable

- Connects the sensor to the digital display unit
- FEP jacketed, EMC-shielded 10 ft (3 m) instrumentation cable
- IP67-rated snap-on connector to HD 15 serial connector

Digital Display Unit (DDU)

- LCD display
- 4 to 20 mA output for temperature and concentration
- Two 5 V digital output channels
- RS-232 communication with computer software package
- Connects up to four sensors per DDU
- RS-232 serial DB25/DB9 to USB 1.1 adapter included
- White, powder-coated aluminum housing with mounting slots
### Sensor Materials of Construction

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>DuPont® Teflon® (modified PTFE)</td>
</tr>
<tr>
<td>Optical window</td>
<td>Semiconductor-grade sapphire</td>
</tr>
<tr>
<td>Cable receptacle</td>
<td>Polyphenylene sulfide (PPS)</td>
</tr>
<tr>
<td>Screws</td>
<td>PTFE-coated stainless steel</td>
</tr>
<tr>
<td>Bonnet, mounting plate</td>
<td>Homopolymer polypropylene (PP)</td>
</tr>
<tr>
<td>Body-to-bonnet gasket</td>
<td>DuPont Teflon (modified PTFE)</td>
</tr>
</tbody>
</table>

Wetted components listed in *italics*.

### Performance Data

- **Refractive Index Accuracy (Refractive Index Units, RIU):** \( \pm 1 \times 10^{-4} \)
- **Refractive Index Repeatability:** \( 1 \times 10^{-5} \)
- **Concentration Accuracy:** \( \pm 0.1 \%^{(1)} \)
- **Concentration Repeatability:** \( 0.01 \%^{(1)} \)
- **Temperature Accuracy:** \( \pm 0.1^\circ C \)
- **Temperature Resolution and Repeatability:** \( 0.01^\circ C \)
- **Response Time:** 1.2 s (undamped)
  - Damping is user configurable.

\(^{(1)}\) Based on measuring ethylene glycol and water at 20 psig (1.3 bar), 76.1 to 78.8°F (24.5 to 26.0°C), and a calibration range of 0 to 100 % concentration.

### Cleaning and Packaging

Every Swagelok CR-288 sensor is cleaned and packaged in accordance with SEMI Standard F57-301 for ultrahigh-purity fluid system components.

### Testing and Calibration

Every Swagelok CR-288 sensor is factory leak tested to meet SEMI Standard E49.3, Section 9.2 for allowable leak rate.

Each sensor is factory calibrated to deionized water at 20°C. The sensor calibration table can be updated with the 288-connect software to optimize performance with other liquids.

### Traceability

Sensor bonnets are laser marked for traceability.

### Technical Data

#### Sensor Operating Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Pressure Rating</td>
<td>0 to 80 psig (0 to 5.5 bar)</td>
</tr>
<tr>
<td>Fluid Temperature Rating</td>
<td>60 to 149°F (16 to 65°C)</td>
</tr>
<tr>
<td>Process Fluid Index of Refraction Range</td>
<td>1.3138 to 1.4108</td>
</tr>
</tbody>
</table>

#### Digital Display Unit Operating Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDU Power Requirements</td>
<td>24 V (dc) ± 10 %; 0.5 A max</td>
</tr>
<tr>
<td>Power Supply Input Requirements</td>
<td>100/240 V (ac) 50/60 ± 3 Hz</td>
</tr>
<tr>
<td>Analog Output</td>
<td>4 to 20 mA for temperature and concentration percentage per sensor; up to four sensors per DDU</td>
</tr>
<tr>
<td>Serial Port</td>
<td>RS-232</td>
</tr>
<tr>
<td>LCD Display</td>
<td>Backlit LCD with three LED status lights</td>
</tr>
<tr>
<td>Sensor Electrical Connector</td>
<td>IP67-compliant, 12-pole, 1 A, panel-mount type</td>
</tr>
<tr>
<td>Ambient Operating Environment</td>
<td>Room temperature: 77 ± 9°F (25 ± 5°C)</td>
</tr>
<tr>
<td>Electromagnetic Compatibility</td>
<td>CE-conformity, EN61326, FCC part 15, IDES-001, SEMI E33-94</td>
</tr>
</tbody>
</table>

### Software

Windows-based interface for user setup, calibration, monitoring, and data logging of up to four sensors.

System requirements: Windows 98 or higher, 128MB+ RAM, CD-ROM.
Ordering Information and Dimensions

Dimensions, in inches (millimeters), are for reference only and are subject to change.

Complete Sensor Kit

- 1 CR-288 sensor
- 1 sensor cable (1 required per sensor)
- 1 DDU kit
  - 1 digital display unit (supports up to 4 CR-288 sensors)
  - 288-connect software CD
  - Power supply
  - USB converter with driver
  - User’s manual

Individual Components

Sensors, cables, and DDU kits and components can be ordered separately.

To order a sensor and cable kit, insert VC into a complete sensor kit ordering number.

Example: NXT-CR41AFCFC-VCKIT

To order a sensor only, remove -KIT from a complete sensor kit ordering number.

Example: NXT-CR41AFCFC

To order other components and kits, select an ordering number from the table at right.

<table>
<thead>
<tr>
<th>Description</th>
<th>Ordering Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor cable</td>
<td>CM-C10</td>
</tr>
<tr>
<td>Digital display unit (DDU)</td>
<td>CMU-DT-111</td>
</tr>
<tr>
<td>288-connect software CD</td>
<td>CMU-288-S</td>
</tr>
<tr>
<td>Power supply</td>
<td>CMU-DT-PS</td>
</tr>
<tr>
<td>USB converter with driver</td>
<td>MS-ADPT-USB-RS232</td>
</tr>
<tr>
<td>User’s manual</td>
<td>MS-13-210</td>
</tr>
<tr>
<td>DDU kit (DDU, CD, power supply, USB, manual)</td>
<td>CMU-DT-111-PKG</td>
</tr>
</tbody>
</table>

Warranty Information

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit swagelok.com or contact your authorized Swagelok representative.

Safe Product Selection

When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.

Caution: Do not mix or interchange parts with those of other manufacturers.