

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

Cable

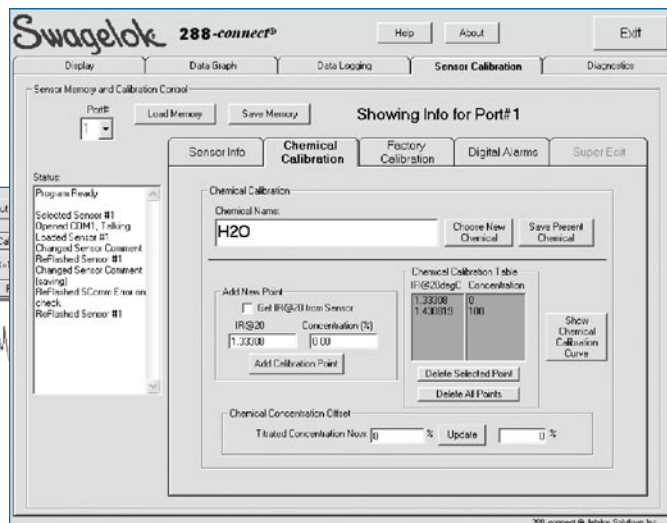
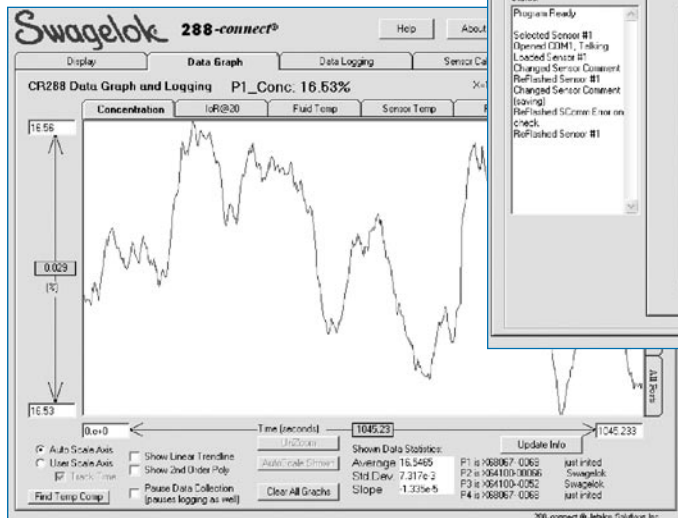
- Connects the sensor to the digital display unit
- FEP jacketed, EMC-shielded 10 ft (3 m) instrumentation cable
- IP67-rated snap-on connector to HD 15 serial connector

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

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



Sensor Materials of Construction

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

Wetted components listed in *italics*.

Performance Data

Data based on operation within the calibrated range, $\pm 10\%$ of the refractive index range.

- **Refractive Index Accuracy (Refractive Index Units, RIU):**
 $\pm 1 \times 10^{-4}$
- **Refractive Index Repeatability:** 1×10^{-5}
- **Concentration Accuracy:** $\pm 0.1\%$ ^①
- **Concentration Repeatability:** 0.01% ^①
- **Temperature Accuracy:** $\pm 0.1^\circ\text{C}$
- **Temperature Resolution and Repeatability:** 0.01°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

Fluid Pressure Rating	0 to 80 psig (0 to 5.5 bar)
Fluid Temperature Rating	60 to 149°F (16 to 65°C)
Process Fluid Index of Refraction Range	1.3138 to 1.4108

Digital Display Unit Operating Parameters

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

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.

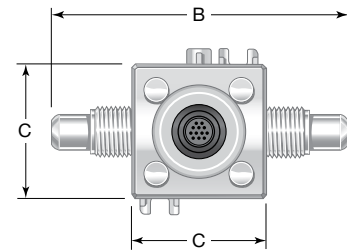
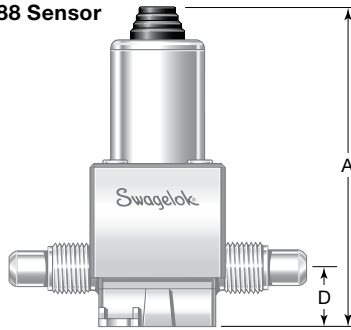
Ordering Information and Dimensions

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

Complete Sensor Kit

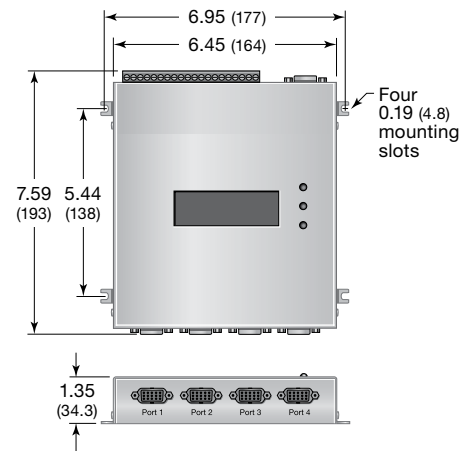
- 1 CR-288 sensor
- 1 sensor cable (1 required per sensor)
- 1 DDU kit
 - 1 digital display unit (supports up to 4 CR-288 sensors)
 - 288-connect software CD
 - Power supply
 - USB converter with driver
 - User's manual

CR-288 Sensor



Sensor End Connection Size	Complete Sensor Kit Ordering Number	Dimensions				C _v
		A	B	C	D	
Dimensions, in. (mm)						
Female NPT End Connections						
1/4	NXT-CR41AWCWC-KIT	3.78 (96.0)	2.12 (53.8)	1.29 (32.8)	0.84 (21.3)	0.74
3/8	NXT-CR41AWDWD-KIT		2.50 (63.5)			0.78
Fine Thread Flare End Connections						
1/4	NXT-CR41AFCFC-KIT	3.65 (92.7)	3.28 (83.3)	1.29 (32.8)	0.64 (16.3)	0.36
3/8	NXT-CR41AFDFD-KIT	3.65 (92.7)	3.48 (88.4)		0.59 (15.0)	0.70
1/2	NXT-CR41AFEFE-KIT	3.90 (99.1)	3.78 (96.0)	0.77 (19.6)	0.70	
Nippon Pillar Super 300 End Connections						
1/4	NXT-CR41ANCNC-KIT	3.65 (92.7)	2.40 (61.0)	1.29 (32.8)	0.64 (16.3)	0.43
3/8	NXT-CR41ANDND-KIT	3.86 (98.0)	2.71 (68.8)		0.83 (21.1)	0.61
1/2	NXT-CR41ANENE-KIT	3.86 (98.0)	3.29 (83.6)	0.77 (19.6)	0.78	
Dimensions, mm (in.)						
Nippon Pillar Super 300 End Connections						
6	NXT-CR41ANBNB-KIT	92.7 (3.65)	61.0 (2.40)	32.8 (1.29)	16.3 (0.64)	0.43
8	NXT-CR41ANFNF-KIT	92.0 (3.62)	63.8 (2.51)		15.0 (0.59)	0.70
10	NXT-CR41ANHNH-KIT	98.0 (3.86)	68.8 (2.71)		21.1 (0.83)	0.72
12	NXT-CR41ANINI-KIT	98.0 (3.86)	83.6 (3.29)		19.6 (0.77)	0.90

Digital Display Unit



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.

Description	Ordering Number
Sensor cable	CM-C10
Digital display unit (DDU)	CMU-DT-111
288-connect software CD	CMU-288-S
Power supply	CMU-DT-PS
USB converter with driver	MS-ADPT-USB-RS232
User's manual	MS-13-210
DDU kit (DDU, CD, power supply, USB, manual)	CMU-DT-111-PKG

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.

Warranty Information

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

Swagelok—TM Swagelok Company
 CR-288, 288-connect—TM Jetalon Solutions, Inc.
 DuPont, Teflon—TM DuPont. Only DuPont makes Teflon.
 Pillar—TM Nippon Pillar Packing Company, Ltd.
 Windows—TM Microsoft Corporation
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