Rosemount™ 396/396VP/396P/396PVP/ 396R/396RVP

TUpH pH/ORP Sensors

TUpH sensors for your tough pH/oxidation reduction potential (ORP) applications

Rosemount TUpH pH/ORP sensors are robust sensors designed to meet a number of difficult application requirements. Sensors feature a variety of options suited to meet a number of installation requirements and are ideal for use in dirty, abrasive, coating, and high solid applications.

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Overview

Robust sensor design

- TUpH reference technology minimizes sensor maintenance and ensures a steady pH/oxidation reduction potential (ORP) signal even when sensor is coated.

- Maximize sensor life with poisoning-resistant helical reference pathway design.

- Optional flat pH glass electrode for abrasive and coating applications.

- Maximum process pressure: 150 psig (10.34 barg).

- Maximum process temperature: 212.0 °F (100 °C).

Versatile mounting options to meet your installation requirements

- Rosemount 396P/396PVP sensors feature 1 in (25 mm) male national pipe thread (MNPT) front and rear facing process threads.

- Rosemount 396R/396RVP offered in 21 in (533 mm) and 36 in (914 mm) lengths suitable for use with retraction assemblies. Easily remove sensors for maintenance and calibration without having to shut down your process.

- Variopol (VP8) cable connection option, for quick cable-to-sensor release, eliminates cable twisting.

Contents

Ordering information

Rosemount 396 and 396VP ordering information

Rosemount 396 and 396VP sensors feature a stainless steel body for use with optional 1 in (25 mm) threaded process connectors suitable for insertion, submersion, or flow-through installation. Sensors are available with either a standard pH hemi glass bulb or optional pH flat glass bulb. Rosemount 396 sensors feature a standard 15 ft (4.57 m) cable, and Rosemount 396VP sensors feature a Variopol cable connection for use with VP8 quick disconnect interconnecting cables (sold separately).

Related information

Accessories

Rosemount 396 ordering information

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Model

Code	Description
396	pH sensor: TUpH® insertion/submersion/flow-through

Cable termination

Code	Description
54	For use with Rosemount 56, 1056, 1066, 1057, and 5081

Sensor Output & Connection

Code	Description
_	No selection, standard 15 ft (4.57 m) cable
62	Cable without BNC for direct wiring to Rosemount 56, 1056, 1057, 1066, and 5081
07	Without preamplifier, 4 ft (1.22 m) cable
08	Without preamplifier, 10 ft (3.05 m) cable

Optional selections

Measurement Electrode

Code	Description
71	GPHT flat bulb

Calibration and conformance certificates

Code	Description
CC	Certificate of Calibration (no test data given)
LC	Loop Calibration Certificate (sensor and transmitter calibrated together with test data)
EC	Electronic Calibration Certificate (sensor calibrated against factory instrument with test data)

Material Traceability Certificates

Code	Description
MC	Material Traceability Certification

Rosemount 396VP ordering information

Note
The sensor includes a general purpose glass pH electrode and a large area polypropylene reference junction with a gel filled reference electrolyte. The Rosemount 396VP TUpH® sensor is only available without an integral preamplifier. Automatic temperature compensation is standard (Pt-100 resistance temperature detector [RTD]).

Note
VP8 cable assembly works with both VP6 and VP8 connectors.

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Model

Code	Description
396VP	pH sensor: TUpH® Varipol connector

Sensor Output & Connection

Code	Description
54	Analog - VP8 Connector (Cable Sold Separately)
55	Analog With Preamplifier - VP8 Connector (Cable Sold Separately)

Optional selections

Measurement Electrode

Code	Description
71	pH General Purpose Glass, Flat Bulb

Preamplifier options

Code	Description
70	SMART preamplifer[1]

(1) *For -55 only.*

Calibration and conformance certificates

Code	Description
CC	Certificate of Calibration (no test data given)

Code	Description
LC	Loop Calibration Certificate (sensor and transmitter calibrated together with test data)
EC	Electronic Calibration Certificate (sensor calibrated against factory instrument with test data)

Material Traceability Certificates

Code	Description
MC	Material Traceability Certification

Rosemount 396P and 396PVP ordering information

Rosemount 396P and 396PVP pH/oxidation reduction potential (ORP) sensors feature a model reinforced polypropylene body with forward and rear facing 1 in (25 mm) male pipe threads (MPT) suitable for insertion, submersion, and flow-through installations. The Rosemount 396P sensor has an integral cable connection, and the Rosemount 396PVP sensor has a Variopol cable connection for use with VP8 interconnecting cables (sold separately).

Related information

Accessories

Rosemount 396P ordering information

Note

The Rosemount 396P pH/oxidation reduction potential (ORP) sensor is available with or without an integral hermetically sealed preamplifier.

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Model

Code	Description
396P	pH sensor: TUpH® insertion/submersion/flow-through

Sensor Output & Connections

Code	Description
01	Preamplifier, 25 ft (7.62 m) cable. (Preamplifier is SMART for pH electrodes used with -55 option only).
02	Without integral preamplifier, 15 ft (4.57 m) cable
03	Analog with preamplifer, 33 ft (10.06 m) cable[1]
04	Analog with preamplifer, 50 ft (15.24 m) cable[1]
05	Analog with preamplifer, 66 ft (20.12 m) cable[1]
06	Analog with preamplifer, 100 ft (30.48 m) cable[1]
07	No preamplifier, 4 ft (1.22 m) cable

Code	Description
08	No preamplifier, 10 ft (3.05 m) cable

(1)   *Standard preamplifier if used with oxidation reduction potential (ORP)*

Measuring electrode

Code	Description
10	pH - General purpose low resistivity (GPLR) glass
12	Oxidation reduction potential (ORP)
13	pH - GPLR flat bulb

Transmitter/thermocouple compatibility

Code	Description
54	For use with Rosemount 1054, 2054, and 2081 (Pt-100)
55	For use with Rosemount 56, 1056, 1057, 1066, and 5081

Optional selections
Sensor tip

Code	Description
41	Slotted tip

Calibration and conformance certificates

Code	Description
CC	Certificate of Calibration (no test data given)
LC	Loop Calibration Certificate (sensor and transmitter calibrated together with test data)
EC	Electronic Calibration Certificate (sensor calibrated against factory instrument with test data)

Material Traceability Certificates

Code	Description
MC	Material Traceability Certification

Rosemount 396PVP ordering information

Note
The Rosemount 396PVP comes standard with a patented reference junction, a solution ground, and a recessed electrode; an optional slotted tip is also available. You must purchase a mating Variopol (VP) cable for all new Rosemount 396PVP installations. The VP8 cable assembly works with both the VP6 and VP8 sensor connectors.

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Model

Code	Description
396PVP	pH sensor: TUpH® Variopol connector

Measuring electrode

Code	Description
10	pH - General purpose low resistivity (GPLR) glass
12	Oxidation reduction potential (ORP)
13	pH - GPLR flat bulb

Transmitter/thermocouple compatibility

Code	Description
54	For use with Rosemount 1054, 2054, and 2081 (Pt-100)
55	For use with Rosemount 56, 1056, 1057, 1066, and 5081

Optional selections

Sensor tip

Code	Description
41	Slotted tip

Preamplifier options

Code	Description
70	SMART preamplifier (for use with -10, -13, and -55 only)

Calibration and conformance certificates

Code	Description
CC	Certificate of Calibration (no test data given)
LC	Loop Calibration Certificate (sensor and transmitter calibrated together with test data)
EC	Electronic Calibration Certificate (sensor calibrated against factory instrument with test data)

Material Traceability Certificates

Code	Description
MC	Material Traceability Certification

Rosemount 396R and 396RVP ordering information

Rosemount 396R and 396RVP pH/oxidation reduction potential (ORP) sensors are available in 21 in (533 mm) and 36 in (914 mm) titanium tube sensor lengths for use with a ball valve (sold separately) for hot tap applications. Rosemount 396RVP sensors feature a Variopol cable connection for use with VP8 quick disconnect interconnecting cables (sold separately).

Related information

Accessories

Rosemount 396R ordering information

Note

You must order junction box kits with preamplifiers separately if the transmitter does not have an integral preamplifier within 15 ft (4.57 m) of the sensor.

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Model

Code	Description
396R	pH sensor: TUpH® retractable

Measuring electrode

Code	Description
10	pH - General purpose low resistivity (GPLR) glass
12	Oxidation reduction potential (ORP)
13	pH - GPLR flat bulb

Mounting Style

Code	Description
21	Retractable: NaN in. (NaN mm) 21-in. (533 mm) length, Titanium
25	Retractable: NaN in. (NaN mm) 36-in. (914 mm) length, Titanium

Temperature Sensor

Code	Description
54	PT100

Optional selections

Sensor Connection

Code	Description
60	9.5 in (241 mm) cable with BNC
61	9.5 in (241 mm) cable without BNC
08	Without preamplifier, 10 ft (3.05 m) cable

Calibration and conformance certificates

Code	Description
CC	Certificate of Calibration (no test data given)
LC	Loop Calibration Certificate (sensor and transmitter calibrated together with test data)
EC	Electronic Calibration Certificate (sensor calibrated against factory instrument with test data)

Material Traceability Certificates

Code	Description
MC	Material Traceability Certification

Rosemount 396RVP ordering information

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Model

Code	Description
396RVP	pH sensor: TUpH® retractable Variopol connector

Measuring electrode

Code	Description
10	pH - General purpose low resistivity (GPLR) glass
12	Oxidation reduction potential (ORP)
13	pH - GPLR flat bulb

Mounting Style

Code	Description
21	Retractable: NaN in. (NaN mm) 21-in. (533 mm) length, Titanium
25	Retractable: NaN in. (NaN mm) 36-in. (914 mm) length, Titanium

Sensor Output & Connection

Code	Description
54	Analog - VP8 Connector (Cable sold separately)
55	Analog with preamplifer - VP8 Connector (Cable sold separately)

Optional selections

Preamplifier options

Code	Description
70	SMART preamplifier (for use with -10, -13, and -55 only)

Calibration and conformance certificates

Code	Description
CC	Certificate of Calibration (no test data given)
LC	Loop Calibration Certificate (sensor and transmitter calibrated together with test data)
EC	Electronic Calibration Certificate (sensor calibrated against factory instrument with test data)

Material Traceability Certificates

Code	Description
MC	Material Traceability Certification

Specifications

Table 1: Rosemount 396/396VP/396P/396PVP/396R/396RVP Sensors Specifications

Specifications	Rosemount 396/396VP	Rosemount 396P/396PVP	Rosemount 396R/396RVP
Photo			
Measurements and ranges	pH: 0 to 14	pH: 0 to 14 Oxidation reduction potential (ORP): -1500 to 1500 mV	pH: 0 to 14 ORP: -1500 to 1500 mV
Available pH ACCUGLASS types	GPHT hemi bulb or GPHT flat bulb	General purpose low resistivity (GPLR) hemi bulb or GPLR flat bulb	GPLR hemi bulb or GPLR flat bulb
Wetted materials	316 stainless steel, polypropylene, EPDM, glass	Titanium, polypropylene, EPDM, glass, platinum (ORP only)	Titanium, polypropylene, EPDM, glass, platinum (ORP only)
Process connection	None, use 1 in (25 mm) NPT process connector, PN 23166-00 or 23166-01 (sold separately)	1 in (25 mm) male national pipe thread (MNPT) front and rear facing threads	None, use 1 in (25 mm) process connector or ball valve kit (1.5 in (38 mm) or 1.25 in (31.8 mm)) sold separately
Temperature range	32.0 °F (0 °C) to 212.0 °F (100 °C)		
Pressure range-hemi bulb	0 psig (0.00 barg) to 150 psig (10.34 barg)		
Pressure range-flat bulb	0 psig (0.00 barg) to 100 psig (6.89 barg)		
Maximum pressure at retraction or insertion	Not applicable	Not applicable	Code 21: 64 psig (4.41 barg) Code 25: 35 psig (2.41 barg)
Minimum conductivity	100 µS/cm		
Integral cable	Various, coaxial with BNC	Code 01, 03, 05, and 06: Various lengths, 11 conductor Code 02, 07, and 08: Various lengths coaxial	Standard: 15 ft (4.57 m) coaxial Code 60: 9.5 in (241 mm) coaxial with BNC Code 61: 9.5 in (241 mm) coaxial
Preamplifier options	Remote or integral SMART		
Weight/shipping weight	1 lb (0.5 kg)/2 lb (0.9 kg)	1 lb (0.5 kg)/2 lb (0.9 kg)	Sensor: Code 21: 2 lb (0.9 kg)/3 lb (1.4 kg) Code 25: 3 lb (1.4 kg)/4 lb (1.8 kg) Ball valve PN 23240-00: 5 lb (2.3 kg)/7 lb (3.2 kg) Junction box: 3 lb (1.4 kg)/4 lb (1.8 kg)
VP cable	Use cable PN 24281-XX (where XX = -01 through -08 and designates various cable lengths).		

Table 2: Percent Linearity over Various pH Ranges

pH range	Rosemount 396/396VP		Rosemount 396P/396PVP		Rosemount 396R/396RVP	
	GPHT hemi	GPHT flat	GPHT hemi	GPHT flat	GPHT hemi	GPHT flat
0 to 2 pH	94%	95%	94%	N/A	94%	93%
2 to 12 pH	99%	99%	97%	98%	97%	98%

Table 2: Percent Linearity over Various pH Ranges *(continued)*

pH range	Rosemount 396/396VP		Rosemount 396P/396PVP		Rosemount 396R/396RVP	
	GPHT hemi	**GPHT flat**	**GPHT hemi**	**GPHT flat**	**GPHT hemi**	**GPHT flat**
12 to 13 pH	97%	96%	98%	95%	98%	95%
13 to 14 pH	92%	N/A	98%	N/A	98%	N/A

Dimensional and installation drawings

Note
Dimensions show millimeters above and inches below.

Figure 1: Rosemount 396 with Optional Connector Dimensional Drawings
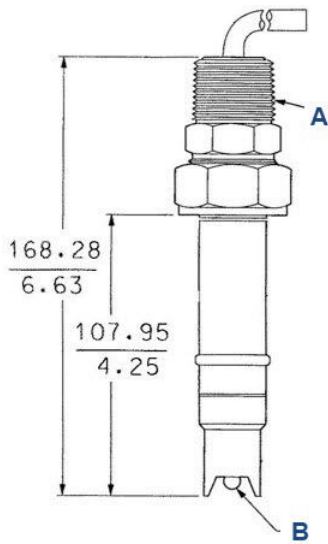
A. 1 in (25 mm) x 1 in (25 mm) NPT male connector 316 stainless steel or titanium
B. pH electrode

Figure 2: Insertion Adapter (PN 23166-00 or 23166-01) with Rosemount 396 pH Sensor
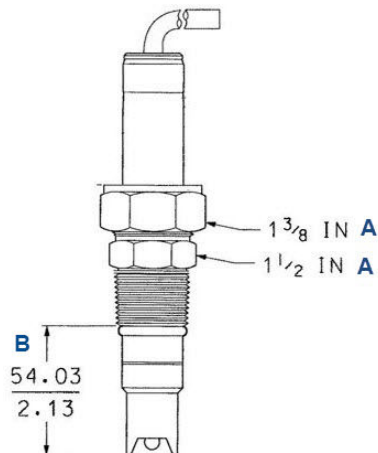
A. *Hex*
B. *pH electrode*

Metal process connector PN 23166-xx (xx = 00 for 316 stainless steel and xx=01 for titanium) can be used for insertion or submersion Rosemount 396 connection to 1 in (25 mm) tee fittings. It also must be used to connect the Rosemount 396R to ball valve PN 23240-00 or directly to the process.

The metal process connector gives the sensor various insertion depths, depending on where you locate the compression fitting. Also, you can switch the threads to face the cable end of the sensor for connection to submersion pipes.

Figure 3: Rosemount Metal Process Connector

Figure 4: Rosemount 396P/396PVP Dimensional Drawing
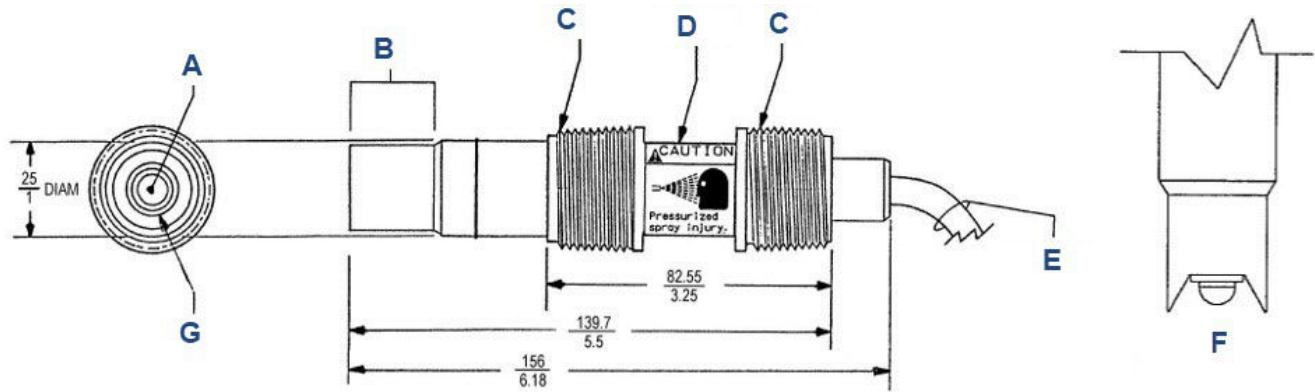
A. Electrode
B. Reference junction
C. 1 in (25 mm) male national pipe thread (MNPT)
D. 1 in (25 mm) wrench opening
E. Cable or V connector (not shown)
F. Sensing end tip, slotted tip option
G. Solution ground

Figure 5: Retraction Assembly (PN 23240-00) and Process Connector (PN 23166-00 or 23166-01) with Rosemount 396R pH Sensor
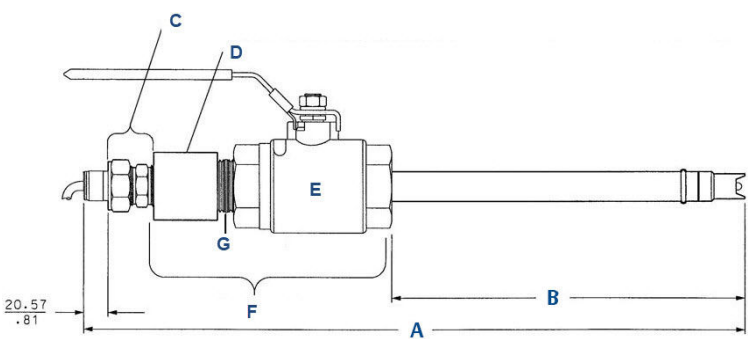
A. Dimension (see Table 3)
B. Dimension (see Table 3)
C. Process connector (PN 23166-00 or 23166-01) (not included with ball valve kit)
D. 1 ½-in (38 mm) to 1-in (25mm) reducer (PN 9310104)
E. Ball valve (PN 9340065)
F. Ball valve kit (PN 23240-00)
G. 1 ½-in close nipple (PN 9310102)

Note
Dimensions are in millimeters/inches.

**Table 3: Rosemount 396R Insertion Lengths for Retraction Assembly 23240-00**

Sensor tube length	A	B (maximum)
21-in (533 mm)	23.1-in (587 mm)	12.9-in (328 mm)
36-in (914 mm)	37.58-in (954.5 mm)	27.4-in (696 mm)

Ball valve kit includes a 1.5 in (38 mm) full port ball valve, a 1.5 in (38 mm) FTP to 1 in
(25 mm) FTP reducer (which serves as the retraction chamber), and a 1.5 in (38 mm)
close nipple that connects the reducer to the ball valve. A connector (PN 23166-00 or
23166-01) is required to connect the sensor to the reducer.

Figure 7: Retraction Assembly (PN 23765-00) with Rosemount 402 Conductivity Sensor
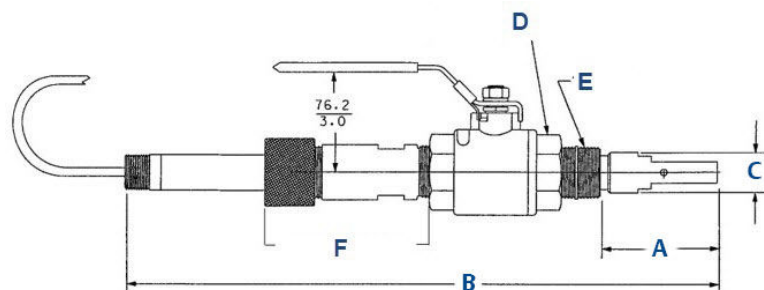
- A. Dimension
- B. Dimension
- C. 30.2 mm (1.19 in.)
- D. 1 ¼-in full port ball valve (PN 9340078)
- E. 1 ¼-in to 11 ½-in NPT nipple (PN 4342M)
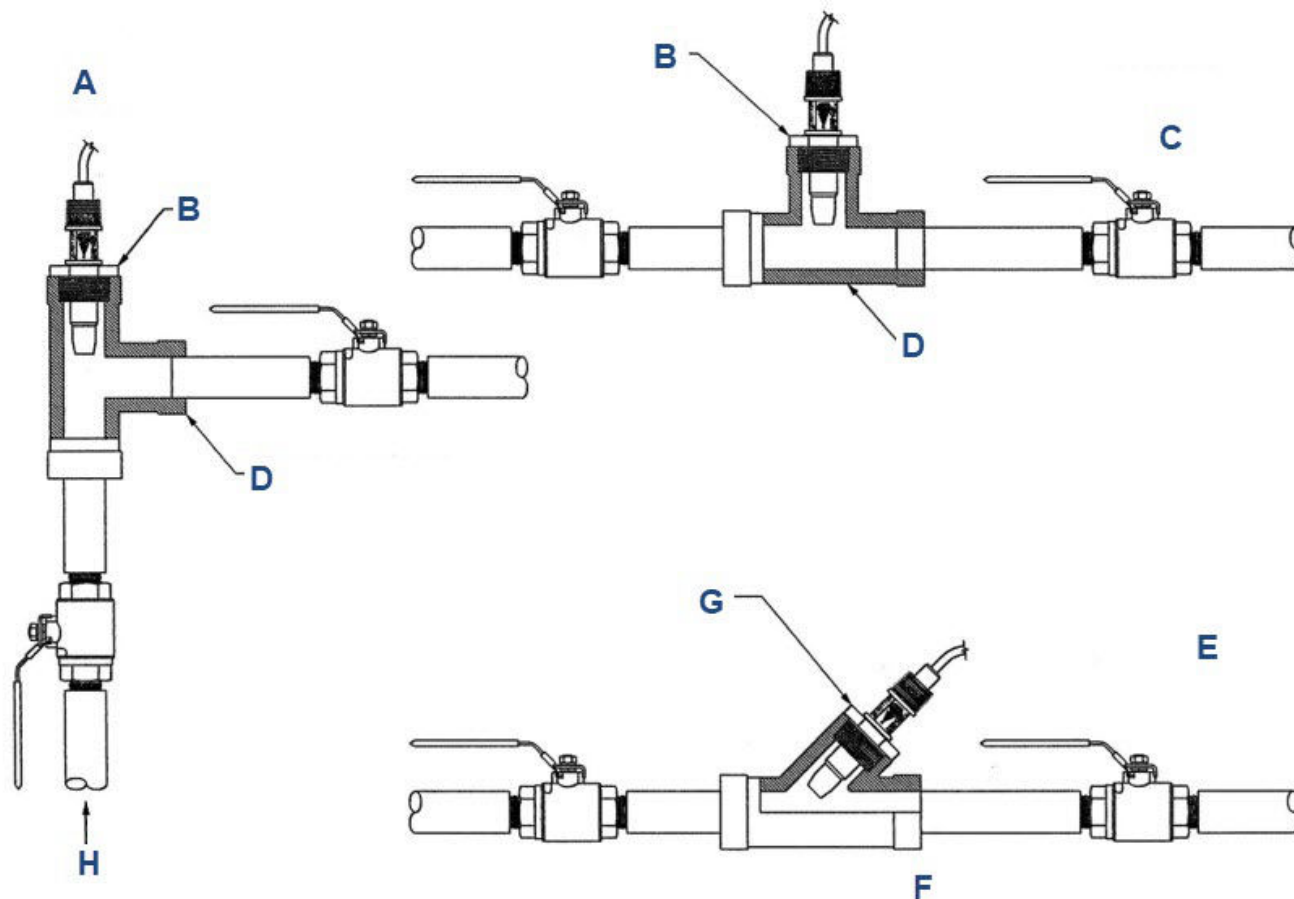- F. Retraction kit (PN 23796-00)

Note
Dimensions are in millimeters/inches.

Ball valve kit includes a 1.25 in (31.8 mm) full port ball valve, a 1.25 in (31.8 mm) nipple,
and a retraction chamber.
The ball valve kit (PN 23765-00 or -01) has all parts needed to install the sensor. You can
purchase the retraction chamber (PN 23796-00) separately.

**Figure 8: Typical Flow-through Installation**

Sensor must be installed at last 10 degrees above the horizon.

   A. *Angle flow shown*
   B. *1.5 in (38 mm) x 1 in (25 mm) reducing bushing*
   C. *Straight flow shown*
   D. *1.5 in (38 mm) pipe tee with reducing bushing PN 2002011*
   E. *Pipe "Y" installation shown*
   F. *1.5 in (38 mm) pipe "Y" (by others)*
   G. *1.5 in (38 mm) x 1 in (25 mm) reducing bushing PN 9330044*
   H. *Flow*
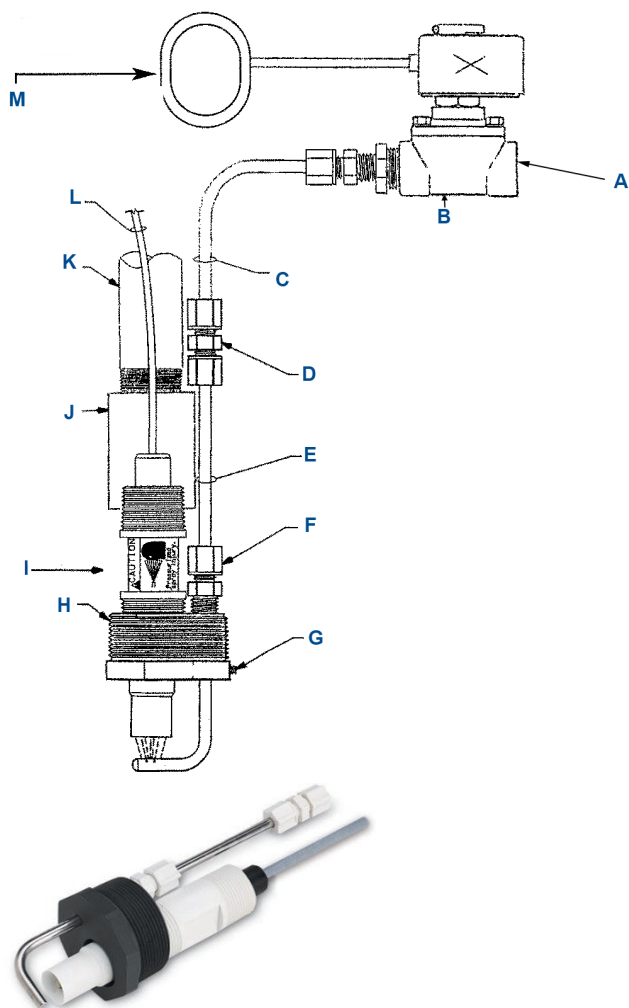
A. Cleaning solution by others
B. Solenoid valve or manual valve (supplied by others)
C. Corrosion resistant tubing (supplied by others)
D. Polypropylene 0.25 in (6.4 mm) compression fitting
E. 0.25 in (6.4 mm) 316 stainless steel
F. 0.25 in (6.4 mm) polypropylene
G. Stainless set screw for adjustable spray nozzle height
H. 2 in (51 mm) NPT threads
 I. Sensor
 J. 1 in (25 mm) PVC coupling for submersible applications (supplied by others)
K. 1 in (25 mm) PVC or stainless conduit (supplied by others)
 L. Cable
M. Timer supplied by others or use timer feature in transmitter.

Figure 9: Low Flow Cell (PN 24091-00) for Rosemount 396 and 396P-41 Sensor
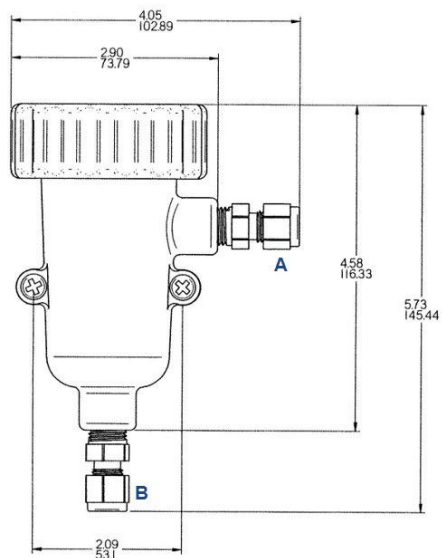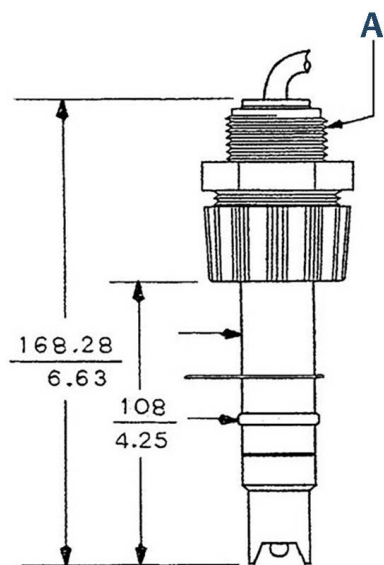

A. Outlet
B. Inlet

Note
Maximum pressure: 65 psig (4.48 barg); maximum temperature: 122.0 °F (50 °C)

Figure 10: Insertion Adapter (PN 9510066) with Rosemount 396 Sensor

A. 1 in (25 mm) x 1 in (25 mm) NPT male connector, nylon (PN 9510066)

Accessories

Table 5: Connector Cable (Required for all First Time Installations)

Part number	Description
24281-00	15 ft (4.57 m) VP8 cable
24281-01	25 ft (7.62 m) VP8 cable
24281-02	2.5 ft (0.762 m) VP8 cable
24281-03	50 ft (15.24 m) VP8 cable
24281-04	100 ft (30.48 m) VP8 cable
24281-05	4 ft (1.22 m) VP8 cable
24281-06	10 ft (3.05 m) VP8 cable
24281-07	20 ft (6.10 m) VP8 cable
24281-08	30 ft (9.14 m) VP8 cable

Table 6: Extension Cables (Requires a Remote Junction Box)

Part number	Description
23646-01	Extension cable, 11-conductor, shielded, prepped, per foot
9200273	Extension cable, 11-conductor, shielded, unprepped, per foot

Table 7: Mounting Assemblies

Part number	Description
11275-01	Handrail mounting assembly
2002011	CPVC flow through tee: 1.5 in (38 mm) NPT process connection
24091-00	Cell, low flow, 0.25 in (6.4 mm) inlet and outlet
915240-03	Tee, flow-through, 2 in (51 mm) PVC, 0.75 in (19.0 mm) NPT
915240-04	Tee, flow-through, 2 in (51 mm) PVC, 1 in (25 mm) NPT
915240-05	Tee, flow-through, 2 in (51 mm) PVC, 1.5 in (38 mm) NPT
23240-00	Ball valve assembly, 316 stainless steel, 1.5 in (38 mm) (process connector required)
23765-00	1.25 in (31.8 mm) ball valve assembly

Table 8: Process Connectors (Required for all First Time Installations)

Part number	Description
23166-00	Connector: 1 in (25 mm) x 1 in (25 mm) 316 stainless steel with O-ring groove
23166-01	Connector, 1 in (25 mm) x 1 in (25 mm) titanium with O-ring groove
9510066	Process connector, nylon, submersion. 1 in (25 mm) male national pipe thread (MNPT)

Table 9: Remote Junction Boxes

Part number	Description
2002565	Mounting bracket kit
23550-00	Junction box, remote, without preamplifier
23555-00	Junction box, Rosemount 5081 compatible preamplifier

Table 10: Sensor Head Junction Box

Part number	Description
23709-00	Junction box, sensor head with preamplifier for Rosemount 54/3081

Table 11: Other Accessories

Part number	Description
12707-00	Jet spray cleaner
23242-02	Mounting adapter, 1.5 in (38 mm) insertion, 1 in (25 mm) x 0.75 in (19.0 mm)
9120516	BNC adapter
9120531	BNC splitter, female BNC to 20 American wire gauge (AWG) leads
9210012	Buffer solution, pH 4.01, 16 oz
9210013	Buffer solution, pH 6.86, 16 oz
9210014	Buffer solution, pH 9.18, 16 oz
9320057	Union, PVC
R508-8OZ	Oxidation reduction potential (ORP) standard, 475 mV, 8 oz

Table 12: Spare Parts

Part number	Description
2001492-00	Tag (label one hole, blank stainless steel)
2001492-01	Tag (label two holes, blank stainless steel)
23557-00	Preamplifier for remote weatherproof junction box
33946-00	Shroud, Rosemount 396/396P
BG0228	Union for flow-through tee
23472-00	Connector, junction box to tube
23594-01	O-ring, 2-214, EPDM, 4 each with lube
33046-00	Ferrule, 1 in (25 mm) 316 stainless steel split
9310096	Nut, Swagelok®, 1 in (25 mm) 316 stainless steel

For more information: **Emerson.com/global**

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