Product Data Sheet PDS 71-400/rev.I December 2008

Model 400 and 400VP Series

ENDURANCE[®] General Purpose Conductivity Sensors

- INITIAL CALIBRATION NOT REQUIRED.
 Pre-determined cell constant ensures out-of-the box accuracy.
- VERSATILE MOUNTING CONFIGURATIONS: screw-in, retractable, and flow-through.
- AVAILABLE WITH VARIOPOL (VP) quick disconnect fitting.

APPLICATIONS

The Model 400/400VP, 401, 402/402VP, and 404 sensors are intended for the determination of electrolytic conductivity in applications ranging from high purity water to cooling water. The sensors are ideal for use in clean, non-corrosive, samples having conductivity less than about 20,000 μ S/cm. For dirty or corrosive samples or for samples having high conductivity, a toroidal sensor such as the Model 228 or 226 is recommended.

FEATURES

ENDURANCE sensors are contacting conductivity sensors. They are available in cell constants of 0.01, 0.1, 1.0, and 10/cm. The choice of cell constant depends on conductivity. High conductivity samples require larger cell constants. Consult the analyzer Product Data Sheet for recommended ranges and accuracy.

Sensors with 0.01, 0.1 and 1.0/cm cell constants have concentric titanium electrodes separated by a PEEK insulator. EPDM O-rings seal the internal parts of the sensor from the process liquid. A platinum RTD in the center electrode measures the solution temperature. Electrolytic conductivity is a strong function of temperature. The temperature measurement is used for correcting the conductivity readings to a reference temperature.

Sensors with 10/cm cell constants have graphite electrodes and an epoxy body. The RTD is enclosed in a titanium capsule protruding from the end of the sensor.





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Model 400 sensors are designed for direct screw-in insertion into process piping using a 3/4-inch MNPT fitting. The Model 400 sensor can also be used in side-stream samples. A 1-inch pipe tee with a 3/4-inch bushing is a suitable flow cell. A 3/4-inch pipe tee can be used with 0.1 and 1.0/cm cells. A transparent plastic flow cell is also available (PN 24091-02).

Model 401 sensor is intended for measuring clean, non-corrosive samples having conductivity between about 500 and 200,000 μ S/cm. The sensor has a 10/cm cell constant.

Model 402 sensors are retractable; they can be removed from the process piping without shutting down and draining the line. Maximum retraction pressure is 64 psig (542 kPa abs). The sensor fits through a 1-1/4 inch full-port ball valve. Order the retraction assembly, which includes the ball valve, pipe nipple, packing adapter, and clamp to position the sensor, as an option.

Model 404 sensors combine the conductivity sensor with a flow cell. The design has a small holdup volume, so response to sudden changes in process conductivity and temperature are rapid. Model 404 sensors are available with a PVC or stainless steel body. The stainless steel version can be disassembled for cleaning. The PVC version cannot be taken apart.

Models 400 and 402 sensors are available with Variopol 6.0 quick disconnect watertight connectors. Wire the interconnecting cable to the analyzer and run the cable to the sensor. The sensor plugs into the cable receptacle. To replace the sensor, simply disconnect the Variopol fitting and plug in a new sensor. There is no need to rewire or rerun cable.

SPECIFICATIONS (Models 400 and 400VP)

Cell constants: 0.01, 0.1, and 1.0/cm

Wetted materials:

Electrodes: titanium Body: 316 stainless steel Insulator: PEEK O-rings: EPDM

Process connection: 3/4 inch MNPT

Temperature: 32 – 221°F (0 – 105°C)

Temperature (option -60): 32 – 392°F (0 – 200°C)

Pressure: 250 psig (1825 kPa abs) maximum

Vacuum: 7.4 psia (51 kPa abs)

Cable length (Model 400 only): 10 ft (3.1 m) standard; 50 ft (15.2 m) optional

SPECIFICATIONS (Model 401)

Cell constant: 10/cm

Wetted materials:

Electrodes: graphite Connector: PVDF (Kynar[®]) Insulator and body: epoxy O-rings: EPDM RTD capsule: titanium

Process connection: 3/4 inch MNPT

Temperature: (32 – 212°F) (0 – 100°C).

- Pressure: 200 psig (1481 kPa abs) maximum
- Cable length: 10 ft (3.1 m) standard; 50 ft (15.2 m) optional

SPECIFICATIONS (Models 402 and 402VP)

Cell constants: 0.01, 0.1, 1.0, and 10/cm

Wetted materials (0.01, 0.1, and 1.0/cm cells):

Electrodes: titanium Sensor tube: 316 stainless steel Insulator: PEEK O-rings: EPDM Washer: Neoprene

Wetted materials (10/cm cell):

Electrodes: graphite embedded in epoxy body Sensor tube: 316 stainless steel Insulator: Epoxy O-rings: EPDM Washer: Neoprene RTD capsule: titanium

Process connection: sensor is inserted through 1-1/4 inch NPT full port ball valve

Temperature: 32 – 212°F (0 – 100°C)

Pressure: 200 psig (1481 kPa abs) maximum

Retraction pressure: 64 psig (542 kPa abs) maximum

¹Kynar is a registered trademark of Elf Atochem North America, Inc.

Cable length (Model 402 only): 10 ft (3.1 m). For longer cable length, choose option -60 (integral junction box) and order interconnecting cable separately.

SPECIFICATIONS (Model 404)

400/400VP, PN 24091-02) Cell constants: 0.01 and 0.1/cm Wetted Materials: Wetted materials (option -16): Electrodes: titanium Body: polycarbonate, polyester Fittings: 316 stainless steel Insulator: PEEK O-rings: EPDM O-ring: silicone Body: PVC OD tubing Fittings: polyethylene Temperature: 122°F (50°C) maximum Wetted materials (option -17): Pressure: 65 psig (549 kPa abs) maximum Electrodes: titanium Insulator: PEEK O-rings: EPDM Body: 303 stainless steel Fittings: 316 stainless steel Wetted Materials: Process connection (option -16): 3/8 inch barbed tubing connector and seat steel Process connection (option -17): compression fit-Nipple: 316 stainless steel ting for 3/8 inch OD tubing. Fittings can be Packing rings: graphite removed to leave 1/4-inch FNPT ports. Packing bushing 303 stainless steel **Temperature (option -16):** 32 – 140°F (0 – 60°C). Retraction body: 316 stainless steel Temperature (option -17): 32 – 212°F (0 – 100°C).

- Pressure (option -16): 100 psig (791 kPa abs) at 77°F (25°C); 20 psig (239 kPa abs) at 140°F (60°C)
- Pressure (option -17): 100 psig (791 kPa abs) maximum
- Cable length: 10 ft (3.1 m) standard; 50 ft (15.2 m) optional

SPECIFICATIONS (Flow cell for Model

Process connection: compression fitting for 1/4 inch

SPECIFICATIONS (Retraction assembly for Model 402/402VP, PN 23765-00/01)

- Ball valve: 316 stainless steel with Teflon¹ seals
- **Process connection:** ball valve 1-1/4 inch FNPT: nipple 1-1/4 inch MNPT

Temperature: 32 – 212°F (0 – 100°C).

Pressure: 200 psig (1481 kPa abs) maximum

Retraction pressure: 64 psig (542 kPa abs) maximum

¹Teflon is a registered trademark of E.I. duPont de Nemours and Co.

SENSOR AND INSTRUMENT SELECTION GUIDELINES

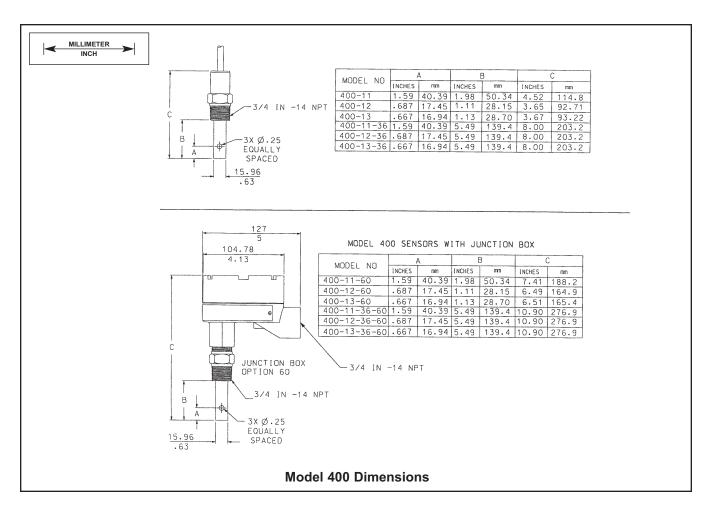
Instrument	Recommended for range for cell constant (µS/cm)				
motrament	0.01/cm	0.1/cm	1.0/cm		
1055	0-50	0.1-2500	10-8000		
1056	0-200	0.1-2000	1.0-20,000		
54eC	0-50	0.1-2000	10-12,000		
5081-C	0-50	0.1-500	10-20,000		
Xmt-C	0-50	0.1-500	10-20,000		

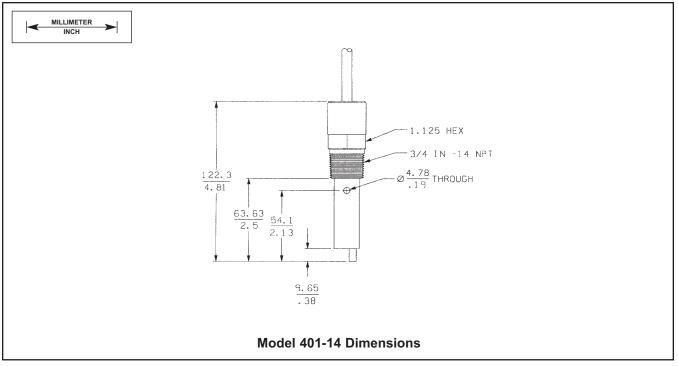
WEIGHTS AND SHIPPING WEIGHTS

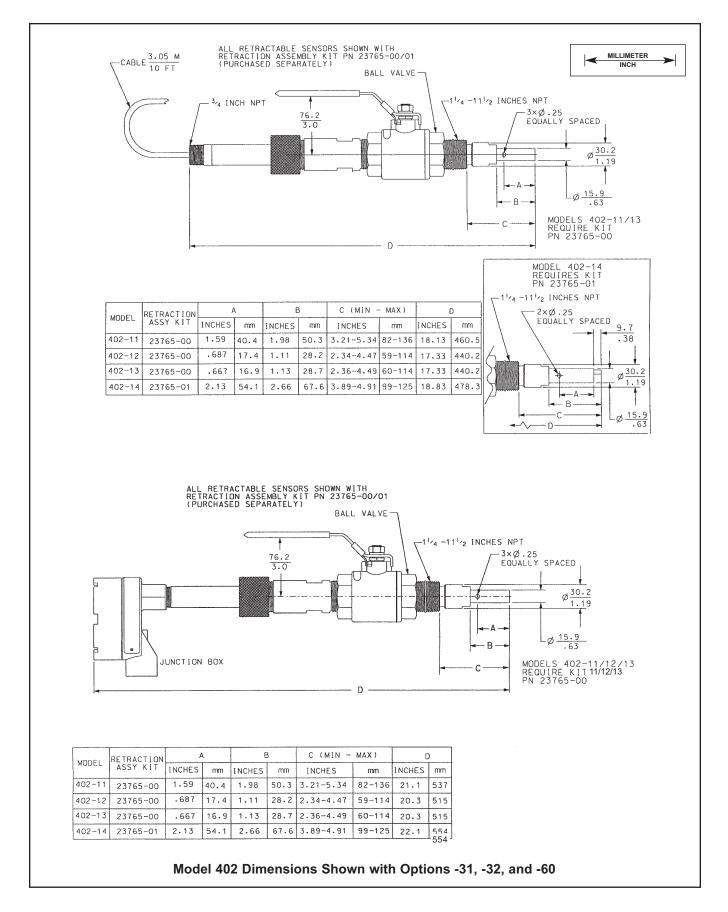
MODEL	WITH 10 ft. (3.1 m) CABLE		WITH 50 ft. CABLE		WITH JUNCTION BOX	
MODEL	Weight	Shipping Weight	Weight	Shipping Weight	Weight	Shipping Weight
400	1 lb (0.5 kg)	2 lb (1.0 kg)	4 lb (2.0 kg)	5 lb (2.5 kg)	3 lb (1.5 kg)	4 lb (2.0 kg)
401-14	1 lb (0.5 kg)	2 lb (1.0 kg)				
402	3 lb (1.5 kg)	4 lb (2.0 kg)			4 lb (2.0 kg)	5 lb (2.5 kg)
404-16	2 lb (1.0 kg)	3 lb (1.5 kg)	4 lb (2.0 kg)	5 lb (2.5 kg)		
404-17	4 lb (2.0 kg)	5 lb (2.5 kg)	6 lb (3.0 kg)	7 lb (3.5 kg)		

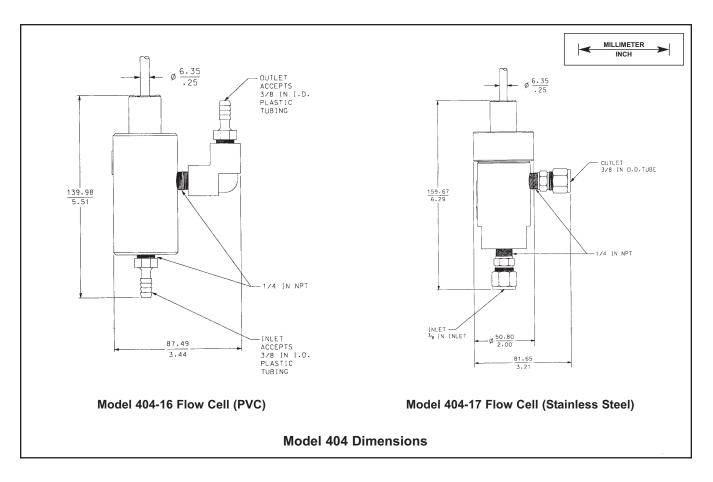
MODEL	Weight	Shipping Weight
400VP	1 lb (0.5 kg)	2 lb (1.0 kg)
402VP	3 lb (1.5 kg)	4 lb (2.0 kg)

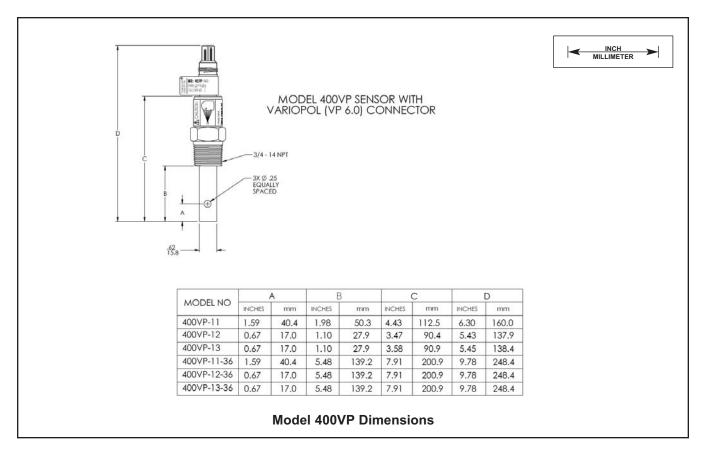
Interconnecting VP cable weighs 0.6 lb/10 ft (1.0 kg/10 m). For shipping weight add 1 lb (0.5 kg)

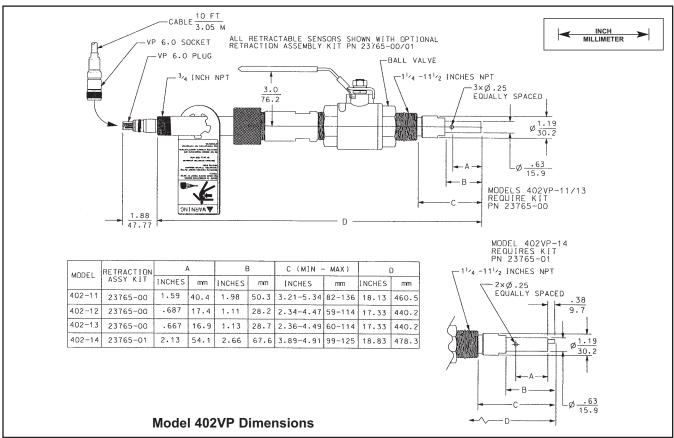




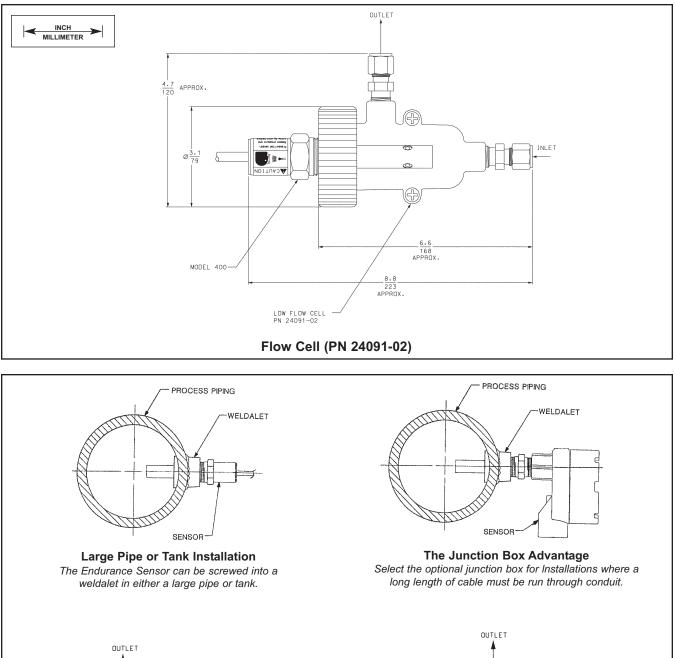


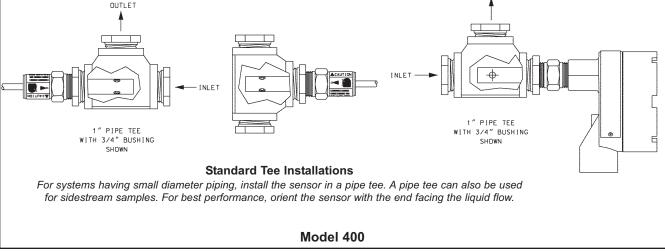




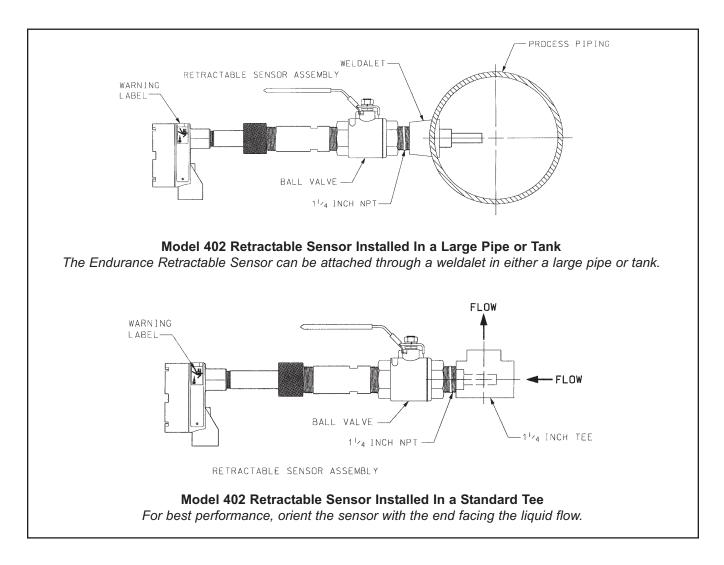


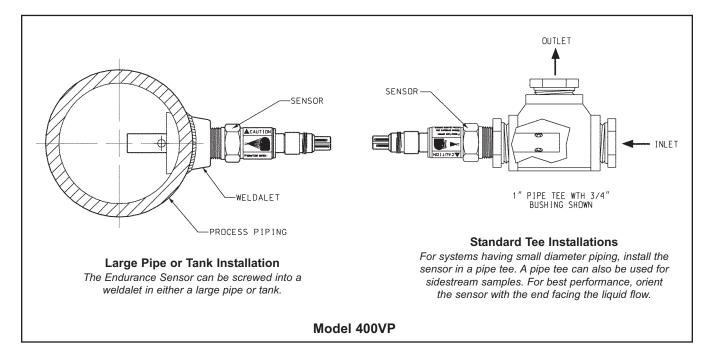
INSTALLATION DETAILS



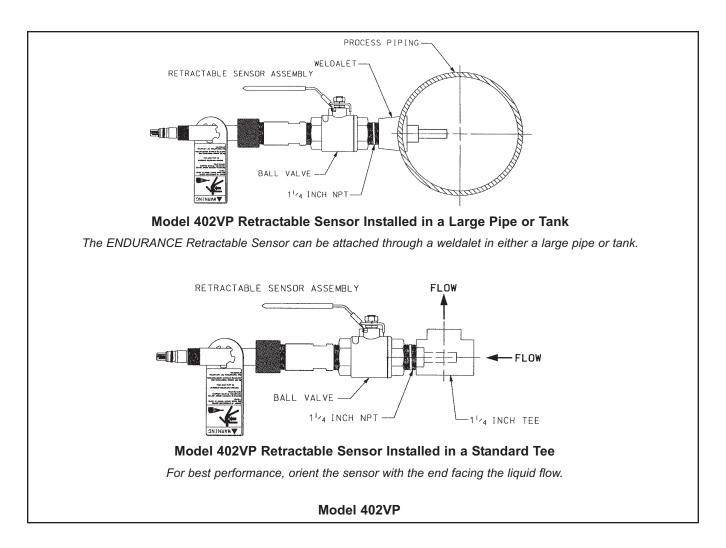


INSTALLATION DETAILS





INSTALLATION DETAILS



ORDERING INFORMATION

Model 400 Screw-in conductivity sensor with integral cable is intended for the determination of electrolytic conductivity in clean water applications where the sensor can be directly screwed into the process piping or used in a pipe tee or flow cell in a sidestream.

MODEL 400	SCREW-IN CONDUCTIVITY SENSOR
CODE	Cell Constant (required selection)
11	0.01/cm
12	0.1/cm
13	1.0/cm

CODE	Temperature Measurement	
	Pt 1000 for 1055, 1056, 54eC, 5081-C, and Xmt-C	

CODE	Additional Options (optional selection)		
36	Extended insertion length (5.5 in from bottom of threads to tip of sensor)		
50	Extended cable length, 50 ft (15.2 m)		
60	Integral junction box (required for high temperature applications) (See NOTE.)		
400	11	36	EXAMPLE

NOTE: Interconnecting cable between the junction box and analyzer must be purchased as a separate item. See **ACCESSORIES**.

Model 400VP Screw-in conductivity sensor with Variopol connector is intended for the determination of electrolytic conductivity in clean water applications where the sensor can be directly screwed into the process piping or used in a pipe tee or flow cell in a sidestream. **Interconnecting VP cable must be ordered separately and is required for all first time installations. See INTERCONNECTING VP CABLE on page 14.**

MODEL 400VP	SCREW-IN CONDUCTIVITY SENSOR
CODE	Cell Constant (required selection)
11	0.01/cm
12	0.1/cm
13	1.0/cm

CODE	Temperature Measurement	
	Pt 1000 for 1055, 1056, 54eC, 5081-C, and Xmt-C	

CODE	Additional Options (optional selection)		
36	Extended insertion length (6 in from inside face of flange to end of sensor)		
400VP	11 EXAMPLE		

Model 401 Screw-in contacting sensors for high conductivity water are intended for clean, non-corrosive samples having conductivity between about 500 and 200,000 µS/cm.

MODEL 401	SCREW-IN CONDUCTIVITY SENSOR WITH GRAPHITE ELECTRODES
CODE	Cell Constant (required selection)
14	10/cm, 3/4 inch MNPT process connection
CODE	Temperature Measurement

OODL	Tompolataro modearomont		
	Pt 1000 for 1055, 1056, 54eC, 5081-C, and Xmt-C		
CODE	Additional Options (optional selection)		

36	Extended insertion length (5.5 in from bottom of threads to tip of sensor)			
50	Extended cable length, 50 ft (15.2 m)			
401	14	36	EXAMPLE	

Model 402 Retractable conductivity sensor with integral cable or junction box is intended for the determination of electrolytic conductivity in clean water applications where the ability to remove the sensor without shutting down the process or draining the line or tank is required.

MODEL	
402	RETRACTABLE CONDUCTIVITY SENSOR
CODE	Cell Constant (required selection)
11	0.01/cm
12	0.1/cm
13	1.0/cm
14	10/cm

CODE	Temperature Measurement
	Pt 1000 for 1055, 1056, 54eC, 5081-C, and Xmt-C

CODE	Additional Options (optional selection)					
31	Retraction	Retraction assembly (complete) for options -11, -12, and -13				
32	Retraction	assembly (co	omplete) for	option -14 only		
60	Integral junction box (See NOTE.)					
61	Sensor cable terminated for use with sensor junction box (See NOTE.)					
402	11	32	60	61	EXAMPLE	

NOTE: Interconnecting cable between the junction box and analyzer must be purchased as a separate item. See **ACCESSORIES**.

Model 402VP Retractable conductivity sensor with VP connector is intended for the determination of electrolytic conductivity in clean water applications where the ability to remove the sensor without shutting down the process or draining the line or tank is required. **Interconnecting VP cable must be ordered separately and is required for all first time installations. See INTERCONNECTING VP CABLE on page 14.**

MODEL 402VP	RETRACTABLE CONDUCTIVITY SENSOR
CODE	Cell Constant (required selection)
11	0.01/cm
12	0.1/cm
13	1.0/cm
14	10/cm

CODE	Temperature Measurement
	Pt 1000 for 1055, 1056, 54eC, 5081-C, and Xmt-C

CODE	Additiona	l Options (op	otional selection)
31	Retraction	assembly (co	omplete) for options -11, -12, and -13
32	Retraction	assembly (co	omplete) for option -14 only
402VP	12	31	EXAMPLE

Model 404 Flow through conductivity sensor is intended for the determination of electrolytic conductivity in clean water applications where rapid response to changes in conductivity or temperature is needed. The sensor must be used in a sidestream sample.

MODEL 404	FLOW THROUGH CONDUCTIVITY SENSOR
CODE	Cell Constant (required selection)
11	0.01/cm
12	0.1/cm

CODE	Flow Cell body (required selection)
16 F	PVC
17 🕄	Stainless steel

CODE	Temperature Measurement
	Pt 1000 for 1055, 1056, 54eC, 5081-C, and Xmt-C

CODE	Additiona	l Options (op	tional selection)
50	Extended	cable length, 5	50 ft (15.2 m)
404	11	16	EXAMPLE

ACCESSORIES for all models

Part Number	Description	Weight	Shipping Weight
23550-00	Junction box for remote cable connection	8 lb (4.0 kg)	9 lb (4.5 kg)
9200275	Connecting cable, unterminated, specify length	0.6 lb/10ft (1 kg/10 m)	Add 1 lb (0.5 kg)
23747-00	Connecting cable, terminated, specify length	0.6 lb/10ft (1 kg/10 m)	Add 1 lb (0.5 kg)
9210004	Conductivity standard, 2,000 µS/cm, 16 oz (0.47 L)	2 lb (1.0 kg)	3 lb (1.5 kg)
SS-6	Conductivity standard, 200 µS/cm, 32 oz (0.95 L)	3 lb (1.5 kg)	4 lb (2.0 kg)
SS-6A	Conductivity standard, 200 µS/cm, 1 gal (3.78 L)	9 lb (4.5 kg)	10 lb (4.5 kg)

ACCESSORIES for Model 400 and 400VP

Part Number Description	Weight	Shipping Weight
24091-02 Flow cell, accepts sensor with 3/4-inch MNPT	1 lb (0.5 kg)	2 lb (1.0 kg)

ACCESSORIES for Model 402 and 402VP

Part Number	Description	Weight	Shipping Weight
23765-00	Retraction assembly kit (complete) for use with options -11, -12, and -13	8 lb (4.0 kg)	9 lb (4.5 kg)
23765-01	Retraction assembly kit (complete) for use with option -14	8 lb (4.0 kg)	9 lb (4.5 kg)
23796-00	Packing adapter subassembly for options -11, -12, and -13 (excludes ball valve and nipple, see figure on page 5 and 9).	4 lb (2 kg)	5 lb (2.5 kg)
23796-01	Packing adapter subassembly for options -11, -12, and -13 (excludes ball valve and nipple, see figure on page 5 and 9).	4 lb (2 kg)	5 lb (2.5 kg)
9340078	1.1/4 inch NPT full port ball valve	4 lb (2 kg)	5 lb (2.5 kg)
9160410	Packing rings for use packing adapter subassembly (PN 23796-00/01) and retraction assembly kit (PN 23765-00/01)	1 lb (0.5 kg)	2 lb (1.0 kg)

INTERCONNECTING VP CABLE for 400VP and 402VP sensor

Part Number	Description	Weight	Shipping Weight
23747-02	Interconnecting cable 10 ft (3.0 m) with VP 6.0 receptacle	1 lb (0.5 kg)	Add 1 lb (0.5 kg)
23747-03	Interconnecting cable 50 ft (15.2 m) with VP 6.0 receptacle	3 lb (1.5 kg)	Add 1 lb (0.5 kg)

ENGINEERING SPECIFICATIONS

Engineering Specification for 400 and 400VP sensor (Cell constants 0.01, 0.1, and 1.0/cm)

- 1. The sensor shall be suitable for the determination of electrolytic conductivity in clean, noncorrosive samples.
- 2. The sensor shall have a 3/4- inch MNPT fitting for direct insertion into pipes or tees. A clear plastic flow cell shall also be available for side-stream samples.
- 3. The sensor shall incorporate titanium electrodes and a PEEK insulator.
- 4. The sensor shall have an integral platinum RTD for temperature measurement.
- 5. The sensor shall be available with either integral cable or a Variopol quick disconnect fitting.
- The maximum temperature for the sensor shall be 221°F (105°C) at 250 psig (1825 kPa abs). A high temperature option that can be used at 392°F (200°C) shall also be available.
- 7. The sensor shall be suitable for vacuum service as low as 7.4 psia (51 kPa abs).
- 8. The sensor shall be Rosemount Analytical Model 400 (integral cable) or 400VP (Variopol fitting) or approved equal.

Engineering Specification for 402 and 402VP sensor (Cell constants 0.01, 0.1, and 1.0/cm)

- 1. The sensor shall be suitable for the determination of electrolytic conductivity in clean, noncorrosive samples where the ability to remove the sensor from the process piping or tank without shutting down or draining lines or equipment is desired.
- 2. The sensor shall be supplied with a retraction assembly and full port ball valve. The ball valve shall be connected to the piping or tank using a 1-1/4 inch close nipple.
- 3. The sensor shall incorporate titanium electrodes and a PEEK insulator.
- 4. The sensor shall have an integral platinum RTD for temperature measurement.
- 5. The sensor insertion tube shall be 316 stainless steel.

- 6. The ball valve shall be 316 stainless steel with Teflon seals and seats.
- 7. The retraction body shall be 316 stainless steel and shall use three graphite packing rings to seal the sensor tube.
- 8. The maximum temperature for the sensor shall be 212°F (100°C) at 200 psig (1481 kPa abs).
- 9. The maximum retraction pressure shall be 64 psig (542 kPa abs).
- 10. The sensor shall be available with integral cable, integral junction box, or a Variopol quick disconnect fitting.
- 11. The sensor shall be Rosemount Analytical Model 402 (integral cable) or 402VP (Variopol fitting) or approved equal.

Engineering Specification for 404 Sensor (0.01 and 0.1/cm cell constants)

- 1. The sensor shall be suitable for the determination of electrolytic conductivity in clean, noncorrosive sidestream samples where rapid response to changes in conductivity or temperature is needed.
- 2. The sensor shall incorporate titanium electrodes and a PEEK insulator.
- 3. The sensor shall have an integral platinum RTD for temperature measurement.
- 4. The sensor shall be available with either a PVC or stainless steel body flow cell
- 5. The PVC body sensor shall have 3/8-inch barbed tubing connectors.
- 6. The stainless steel body sensor shall have compression fittings for 3/8-inch OD tubing. The compression fittings shall be removable to leave 1/4-inch FNPT ports.
- The maximum temperature for the PVC body sensor shall be 140°F (60°C) at 20 psig (239 kPa abs).
- The maximum temperature for the stainless steel body sensor shall be 212°F (100°C) at 100 psig (791 kPa abs).
- 9. The sensor shall be Rosemount Analytical Model 404 or approved equal.

COMPATIBLE ANALYZERS AND TRANSMITTERS

The Model 1056 Dual Input Analyzer can be used with any ENDURANCE family conductivity sensor to measure electrolytic conductivity in a variety of applications. The Model 1056 can be set up as either a dual input conductivity analyzer, or



the second input can be connected to a pH, ORP, chlorine, oxygen, ozone, or turbidity sensor. The analyzer has two fully programmable analog outputs. Four fully programmable alarm relays are available as an option. The high contrast display shows measurement results in large, easy-to-read digits. Menu screens for programming are simple and intuitive. Plain language prompts (in seven languages) guide the user. The analyzer continuously monitors itself and the sensor for faults and alerts the user when it detects a problem. HART and Profibus digital communications are optional. HART allows the user to communicate with the analyzer through AMS (Asset Management Solutions) from a host anywhere in the plant.

The Model 5081-C Transmitter can be used with any ENDURANCE family conductivity sensor to measure electrolytic conductivity in a variety of applications, particularly where a robust, explosion-proof instrument enclosure



and loop power are needed. The conductivity reading is shown in large numerals in the top line of a two-line, seven-segment display. Local communication with the 5081-C is through a handheld infrared remote controller. Two digital communication protocols are available: HART and Foundation Fieldbus. Digital communications allows the user to communicate with the transmitter through AMS (Asset Management Solutions) from a host anywhere in the plant. The Model 54eC Analyzer can be used with any ENDURANCE family conductivity sensor to measure electrolytic conductivity in a variety of applications.The Model 54eC has an easy to use interface with an intuitive menu structure. Menu prompts are available in five, user-



selectable languages. The three-line display shows conductivity in large digits and the temperature in smaller digits in the second line. The third line can be programmed to show additional process variables. The analyzer has two fully programmable analog outputs, and three fully programmable alarm relays. A fourth relay is a dedicated fault alarm that alerts the user when the analyzer detects a problem with either itself or the sensor. PID and TPC control are available as options. HART digital communications, which allows the user to communicate with the analyzer through AMS (Asset Management Solutions) from any host in the plant, is also available as an option.

The Model Xmt-C Transmitter can be used with any ENDURANCE family conductivity sensor to measure electrolytic conductivity in a variety of applications, particularly in application where loop power is needed. The Xmt-C has a two-line display that can



be configured to meet user requirements. Menu screens (in six languages) for configuring and calibrating are simple and intuitive. Two digital communication protocols are available: HART and Foundation Fieldbus. Digital communications allows the user to communicate with the transmitter through AMS (Asset Management Solutions) from a host anywhere in the plant.

All Rosemount Analytical Conductivity Instruments feature automatic temperature correction for high purity water and cation conductivity. Programmable percent change per °C temperature correction is also available.



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