

INSTRUCTION MANUAL

CONDUCTIVITY SENSOR



404 General Purpose



401 Hot Condensate



405 Easy Clean Sensor



425 UNIVERSAL



403 for the strength of SS; insertion or ball valve



402 Pure Water Conductivity

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Conductivity Measurement

Introduction

Electrolytic conductivity is a measure of the ability of a solution to carry a current. In the 1980's international agreement adopted the basic unit of conductivity as the Siemen, and it is defined as the reciprocal of the resistance in ohms of a 1 cm cube of the liquid at a specified temperature. The units of measurement are the reciprocal of ohm-cm, which was expressed as mho/cm, usually expressed in millionths of a mho/cm, that is micro-mho/cm or simply μmho . North American practice historically used μmho units now renamed μSiemen .

Current flow in liquids differs from that in metal conductors in that electrons cannot flow freely, but must be carried by ions. Ions are formed when a solid such as a salt dissolved in a liquid to form electrical components having opposite electrical charges. (Example, sodium chloride separates to form Na^+ and Cl^- ions) All ions present in solution contribute to the current flowing through the sensor and therefore contribute to the conductivity measurement.

The physical structure of a conductivity sensor is important as in a liquid the only restrictions on an ion's movement are the physical limits of the liquid

itself. A conductivity analyzer measures all the current that will flow between two charged electrodes. A conductivity sensor is constructed so that there is an exact volume between the two electrodes.

What is a Cell Constant?

The volume of the liquid between the electrodes must be exact so that the analyzer can determine how much current will flow through a known amount of liquid. The controlled volume of a conductivity sensor is referred to as its *cell constant*.

A cell constant of 1.0 describes a cell with an enclosed volume equal to 1.0 cubic centimeter. A cell constant of 1.0 is the easiest constant to work with, as conductivity describes the amount of current flow per centimeter.

A cell constant is usually chosen to produce a steady flow of current between the two electrodes. Moderate current and voltage levels can usually be achieved by selecting the proper cell constant. A high cell constant is used for solutions with high conductivity, and a low cell constant is used for solutions with low conductivities.

Model / Cell Constant	0.01	0.02	0.1	0.2	0.5	1.0	2.0	5.0	10	20	50
401 hot condensate sensor			X	X		X	X				
402 high purity sensor	X	X	X	X							
403 ball valve sensor	X	X	X	X		X	X	X			
404 general-purpose			X	X		X	X				
405 easy-clean sensor				X	X	X	X				
406 high conductivity flow								X	X	X	
412 high conductivity piper									X	X	X
425 quick union sensor			X	X		X	X				

Table 1 Electrode models and cell constants

A cell constant of 0.1 would typically carry ten times the current flow; all other factors held constant and present one tenth, the resistance to the measuring circuit, when compared to a basic 1.0 cell. When an application turns out to have a high enough solution resistance across the sensor to drop the analyzer’s drive signal to non-detectable and/or marginal levels, substituting a sensor with a lower cell constant will lower the apparent solution resistance, boost the current flow and produce a stronger, more interference resistant conductivity reading. Conversely, where too high a current flow (too low solution resistance) tends to load the analyzer down, substituting a higher constant sensor will decrease the loading and similarly improve results.

Cell Constant and Range

Changing the cell constant, to say 0.01, typically achieves ranges of 1, 10, 100, and 1,000; while 20 achieves 2,000; 20,000; 200,000; and 2,000,000 when used with IC CONTROLS analyzers. The analyzers range gain also impacts the conductivity range seen and must be considered. For IC CONTROLS analyzers refer to the “GUIDE TO CELL CONSTANTS AND THEIR USEABLE RANGES” to select a suitable cell constant for your application.

IC CONTROLS conductivity sensors and their available constants are listed in table 1

Temperature Compensation

Ionic movement, and therefore conductivity measurement, is directly proportional to temperature. The effect is predictable and repeatable for most chemicals, although basically unique to each chemical. The effect is instantaneous and quite large, typically between 1 and 3 percent per degree Celsius, with reference to the value at 25°C. Almost all industrial applications encounter fluctuating temperature and need rapidly responding automatic compensation. IC CONTROLS conductivity sensors normally have a TC built into the conductivity sensor.

IC CONTROLS analyzers normally use a linear temperature compensation method with default set at 2% per °C

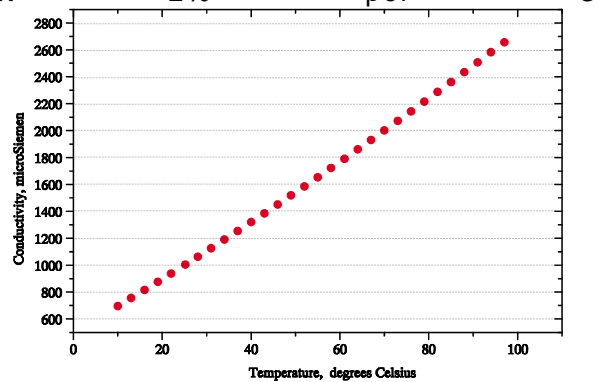


Figure 1 Typical Temperature Response

2% per °C is an average found typical of many water samples with some dissolved solids. Over wide temperature spans (e.g. 0 to 100 °C) the temperature compensation factor may not remain constant,

GUIDE TO CELL CONSTANTS AND THEIR USEABLE RANGES

CELL CONSTANT	DESIGN RANGE	LOWEST RANGE	HIGH RANGE	OVER RANGE*
0.01	0 to 10 µS	0 to 1 µS	0 to 100 µS	0 to 1,000 µS
0.02	0 to 20 µS	0 to 2 µS	0 to 200 µS	0 to 2,000 µS
0.1	0 to 100 µS	0 to 10 µS	0 to 1,000 µS	0 to 10,000 µS
0.2	0 to 200 µS	0 to 20 µS	0 to 2,000 µS	0 to 20,000 µS
0.5	0 to 500 µS	0 to 50 µS	0 to 5,000 µS	0 to 50,000 µS
1.0	0 to 1,000 µS	0 to 100 µS	0 to 10,000 µS	0 to 100,000 µS
2.0	0 to 2,000 µS	0 to 200 µS	0 to 20,000 µS	0 to 200,000 µS
5.0	0 to 5,000 µS	0 to 500 µS	0 to 50,000 µS	0 to 500,000 µS
10	0 to 10,000 µS	0 to 1,000 µS	0 to 100,000 µS	0 to 1,000,000 µS
20	0 to 20,000 µS	0 to 2,000 µS	0 to 200,000 µS	0 to 1,000,000 µS
50	0 to 50,000 µS	0 to 5,000 µS	0 to 500,000 µS	0 to 1,000,000 µS

NOTE: Use with caution, some sensor designs limit when used on over range and do not reach the maximum.

making it difficult to obtain a good value. If the temperature curve of the sample is known, set the linear TC constant to match the curve in the temperature range the analyzer will be measuring in.

Manual Compensation

If no automatic temperature compensator is available, manual temperature compensation can be used. If the temperature of the sample is constant, set the manual TC temperature to the process temperature. If the process temperature varies or is unknown, the default temperature of 25°C or 77°F is normally used.

TC for High Purity Water

Very low conductivity water or “high purity” in a strongly temperature-dependent way. The presence of trace impurities such as acids, salts and bases each dramatically and uniquely affects the TC curve needed. Model 455 option -63 applies ASTM D1125-95 (1999) and later formula for best results.

Setting the Linear TC Constant

Depending on the chemical involved the value for temperature compensation will vary. The values change from approximately 1 to 3%. The following is a general guide for typical applications:

Chemical	Typical <i>temperature compensation constant</i>
acids	1.0 to 1.6% per °C
bases	1.8 to 2.2% per °C
salts	2.2 to 3.0% per °C
neutral water	2.0% per °C

The formula for the temperature-corrected conductivity value C_{25} is:

$$C_{25} = \frac{C_T}{1 + \alpha(T - 25)}$$

where C_T is the conductivity at the current temperature, T is the current temperature, and α is the *temperature compensation constant*.

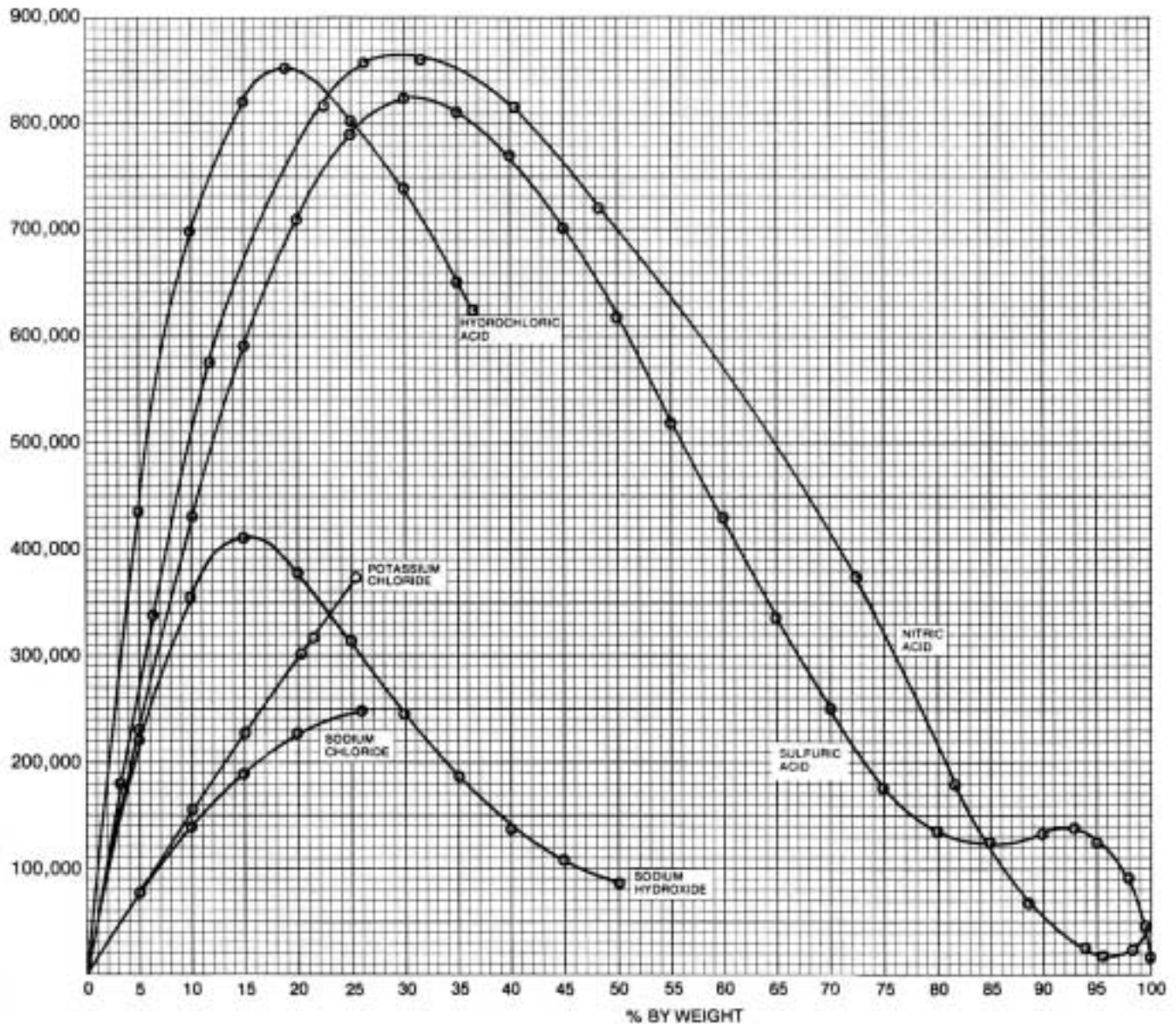
The linear TC constant is normally displayed as change per degree Celsius. If the units for temperature are changed from °C to °F then the linear TC constant would be changed to % change per degree Fahrenheit.

Some chemicals that are frequently diluted for use have non-linear temperature compensation requirements as well. IC CONTROLS has programmed special model 455 versions with TC in the memory; e.g. NaOH 455-21, H₂SO₄ 455-22, HCl 455-23, NaCl 455-24, that read out in % concentration, plus TDS (Total Dissolved Solids) 455-25, resistivity 455-26, ppt salinity 455-27, and very low conductivity (high purity) water 455-63.

PERCENT CONCENTRATION

Examples of conductance of various materials with changing concentration are shown below. Sodium Hydroxide NaOH also exhibits quite variable temperature related rates of concentration change. It is clear from the graph that both Sulfuric acid,

H₂SO₄, and Nitric acid, HNO₃, have unusual 'conductivity' vs '% by weight' relationships as well. It clearly shows that there is no "conductivity constant" between chemical combinations



CONDUCTIVITY vs CONCENTRATION for COMMON CHEMICALS

Installation

Selecting the Location

The sensor should be positioned to see the change of interest (eg. after the leak point) in order to respond well. Long sample lines should be avoided wherever the conductivity signal must be responsive to sudden changes, to avoid sample transport lag problems. For the sensor to work correctly, the installation location must ensure that the cell is always full of liquid completely. Care must be taken to ensure any bubbles entrained in the liquid will not lodge in the cell cavity as the void they create in the measuring circuit will reduce the current flow and produce an erroneous result. Similarly, solids or sludge should be taken into account that may coat the electrodes and the sensor positioned to pick-up only the cleanest possible sample. The most satisfying installations also provide for easy sensor calibration, with sensor removal room and 3' or so of flex-conduit for calibration.

Analyzer Location

The sensor is typically supplied with at least a 5 foot lead as standard. The analyzer should be kept within the sensor lead length, and mounted typically on a wall at eye height. Position the analyzer to allow the sensor still connected up to be removed and the electrode tip placed in a beaker on the floor for cleaning or calibration. Assume the safest place for the beaker is on the floor the service person stands on. Horizontal separation between rows of analyzers should allow for electrode leads which need periodic replacement, and the electrical conduit. IC CONTROLS recommends 10cm (4 in) minimum separation between rows / columns.

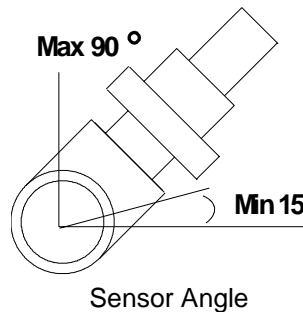
Pipe mounting kits, IC CONTROLS analyzer option-8 for 5cm (2in) pipe, P/N A2500255 are also available. They may also be used to surface mount the transmitter by removing the 2" U bolts and using the holes in the mounting plate for wall studs (*using customer-supplied studs*). The mounting plate dimensions are 20.3cm x21.6cm (8"x8.5") with elongated U bolt holes.

Panel mounting kits, IC CONTROLS analyzer option-9, P/N A2500201 are also available. They requires a customer supplied panel cut-out.

Sensor Mounting

It is recommended that the sensor be located as near as possible to the conductivity transmitter, to minimize any effects of ambient electrical noise

interference. Flow sensors can be in any orientation but should be mounted tip down at an angle anywhere from 15° above horizontal to vertical, 15° above horizontal is best because air bubbles will rise to the top and grit will sink, both bypassing the sensor.



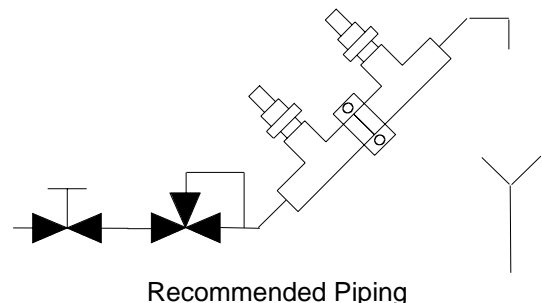
Submersion sensors, do not mount where a lot of air bubbles rise in the tank; they will cause spikes in your conductivity readout. If a bubble is allowed to lodge in the sensing tip, electrical continuity between the electrodes may be disrupted.

TYPICAL FLOW MOUNTING

Flow type installations available are;

1. 316 SS flow housing for use on hot condensates and pure applications (option -73 for 401, 402 and 403 sensors) P/N A3100071.
2. Sch. 80 pipe tee with 1 1/4" connections or bushings for 1" connections (offers economy and general utility with 404 and 405 sensors). In PVC P/N A3100146, in PVDF P/N A3100147.
3. CPVC flow housing with 1.5" FNPT connections (for use with 425 Quick Union Sensors). In CPVC P/N A2300073 In PVDF P/N A2300074 In 316 SS P/N A2300075
4. CPVC 1.5 Flowcell, 1" connections (for use with 406 % acid/caustic sensor, P/N A2100051)

Install the housing vertically and position the sensor so that the cross channel or vent hole is below the cell outlet. This will ensure the cell is full at all times, even if the exit pipe drains to atmosphere and air can enter. Flow should be upwards and out the side, thereby flushing any bubbles out of the cell area. An alternative acceptable installation is possible with the



flow housing at 45° and the side vented; bubbles should be released but grit and/or rust will cause a problem if present. Never install in such a way that the sensor internal cell area is inverted as it will accumulate any solids and short the sensor or throw it off.

The housings can be used as an in-line body or in a side stream line. Always place on the pressurized side of a pump, not the suction side, and if using as an in-line arrangement allow for the added flow resistance caused by the sensor body.

TYPICAL INSERTION MOUNTING

Insertion type installations available are;

1. 316 SS insertion gland fitting for use on hot condensates and pure applications (option -74 for 402 and 403 sensors) P/N A3100002.
2. Direct threaded in insertion with model 401, 404, 405 sensors.
3. Quick Connect insertion fitting with 1" MNPT connections (for 425 sensors) In;
CPVC P/N A3100126, 60 psi at 90°C(194°F)
PVDF P/N A3100129, 100 psi at 110°C(230°F)
316 SS P/N A3100128, 100 psi at 150°C(302°F)
4. Ball Valve Insertion Retractable, model 403

If the vessel will be full at all times when the conductivity needs to be measured, the sensors can be inserted into a threaded opening. The location must ensure the sensor is fully submerged and not subject to blanketing with deposits.

The major consideration for insertion mounting is the fact that a hole exists in the vessel/pipe wall if the sensor is removed for calibration, etc. The IC CONTROLS Model 403 ball valve insertion / retractable sensor was developed to handle that problem. With its use, the benefits and economy of no sampling system are available even where the process must stay pressurized or draining the system would be costly.

Removal clearance is necessary with any insertion sensor and usually 12" is sufficient. With the 403 retractable sensor, 30" clearance is needed and the sensor normally extends about 18" from the mounting opening.

TYPICAL SUBMERSION MOUNTING

Circulation is the prime consideration in installing a submerged sensor. The location must have sufficient flow or agitation to ensure a representative sample reaches the sensor. Sensors with surface electrodes are preferred for this service; never use 403 or 406 sensors as they have

long internal passages that would not normally see adequate circulation without a forced flow.

For dirty applications such as sewers, the 405-2.0 sensor with flat surface presents an easy to clean solution; however, care must be used to ensure it is not placed closer than 2" from the channel bottom.

Submersion can be up to 3 meters (9 ft), or more, with most IC CONTROLS sensors (standard lead length 10 ft). They should be mounted preferably in a female thread on the end of a 1 1/4" Sch. 80 PVC, or SS, pipe for best rigidity. Smaller diameter pipe can be used with a coupling to adapt where whipping due to flow resistance will not present a problem. IC CONTROLS recommends mounting a 400-78xp J-box on top of the pipe, cutting the sensor leads to approximately 12" longer than needed to reach the junction box and terminating there. For ease of calibration, allow pipe length plus 3-4' extra of flex-conduit, and where possible install the support pipe on a channel iron quick disconnect rail.

Sensor Wiring

The basic wiring scheme for all IC CONTROLS conductivity sensors is shown in drawing D5920095, plus a description of the 400 interface to the analyzer.. This wiring scheme is intended for cable runs less than 20 meters (65 feet) where electrical interference is low. This cable is available from IC CONTROLS as A9200000. Use of other cables is not recommended since experience has shown many other cables have capacity that interferes with the conductivity sensor signal, causing errors.

Take care to route all sensor wiring away from AC power lines, to minimize unwanted electrical interference. When installing sensor cable in conduit, use caution to avoid scraping or cutting the cable insulation, the resulting short of the cable's internal driven shield will cause conductivity errors. Avoid twisting the sensor lead, to minimize possibilities for broken wire. Make sure the sensor connections are clean and tight.

CONNECTIONS

IC CONTROLS conductivity sensors are supplied with four leads. Black and white are always connected to the sensor cell electrodes. They should be insulated from each other and from the temperature compensator between them with insulation to ground or the cell leads. T.C. leads are not polarity specific, however with some concentric electrode sensors, use of white as probe drive and black as probe sense is required.

Instrument Shop Tests

CHECKING THE SENSOR

The sensor should be checked against the ordered specification to ensure the correct sensor for the job is used. Refer to Specification Sheets, Sensor Selection Guide, to confirm the model number received. Electrical checks may be made to ensure the sensor is in good condition before installation. Between the cell leads, white and black insulation value should exceed 1 meg ohms. Between the temperature compensator leads, yellow and green, there should appear the resistance value given for the T.C. at $25^{\circ}\text{C} \pm 10\%$. Between either T.C. lead and either cell lead there should be insulation values exceeding 1 meg ohms.

Preparation for use

1. Moisten the sensor body with tap water and remove the lower (storage) plastic cap. Rinse the exposed Conductivity elements with tap water.
2. For the first time use, or after long term storage, immerse the lower end of the sensor in a conductivity standard for 30 minutes. This wets the Conductivity electrodes and prepares them for stable readings with test solutions.

Note: IC CONTROLS sensors are shipped dry. These electrodes are often ready for use immediately with typical accuracy of $\pm 2\%$ Conductivity without calibration. We recommend a soak in standard plus calibration with an appropriate conductivity standard to achieve good accuracy..

Testing with the Analyzer

Refer to your analyzers instruction manual for proper wiring instructions unique to it.

1. Apply power to the analyzer.
2. Hook up your sensor, and remove orange protective cap, (for this test we assume a 1.0 cell constant).
3. Sensor in air the Conductivity Analyzer should come up reading 0.0 ± 5
4. Run a "Air" zero calibration, use wires to be field installed and allow 30 minutes warm-up time for the electronics to stabilize.
5. Run the "Std." (span) calibration, place the Sensor in 1000 $\mu\text{Siemens}$ standard. The display should read approximately 1000 ± 10 .
6. To check for general performance place the Sensor 100 $\mu\text{Siemens}$ standard. The display should read approximately 100.
7. Sensor is now ready for field installation.
8. You may also wish to setup your analyzer at this time. See its instructions.

CALIBRATION KITS



As part of IC CONTROLS ongoing commitment to assure our customers the best possible results from their conductivity systems we QC IC CONTROLS Standards to NIST Materials and then we put together calibration kits. These kits conveniently package requirements for Conductivity calibrations, in amounts for easy use, along with the necessary utensils and accessories. These items are provided in durable plastic. This way, you are assured reliable and accurate results, and at the same time the technician's job is easier.

Calibration Kit	Contents	Part No.	Size
A1400051 Low Conductivity Calibration Kit Cell Constants 0.01 to 0.2	100 μ Siemen	A1100161 (x2)	500 mL
	Demin Water	A1100192 (x4)	500 mL
	Syringe	A7400031	10 mL
	Polyethylene graduated cylinders	A1100007 (x2)	100 mL
	Sensor Cleaning Brush, ¼"	A1100016	1
	Instruction sheet	V9803460	1
A1400052 Medium Conductivity calibration kit Cell constants 0.1 to 5.0	100 μ Siemen	A1100161	500 mL
	1,000 μ Siemen	A1100162 (x2)	500 mL
	10,000 μ Siemen	A1100163	500 mL
	Demin Water	A1100192	500 mL
	Syringe	A7400031	10 mL
	Polyethylene Beakers	A7400020 (x3)	250 mL
	Sensor Cleaning Brush, ¼"	A1100016	1
Instruction sheet	V9703440	1	
A1400053 High Conductivity Calibration Kit Cell constants 10.0 to 50.0	10,000 μ Siemen	A1100163 (x2)	500 mL
	100,000 μ Siemen	A1100164 (x2)	500 mL
	367,000 μ Siemen	A1100165 (x2)	500 mL
	100,000 μ Siemen	A1100164 (x2)	500 mL
	Syringe	A7400031	10 mL
	Sensor Cleaning Brush, ¼"	A1100016	1
	Instruction sheet	V9703470	1
A1400054 Conductivity Chemical Cleaning Kit	Cleaning and Conditioning Solution	A1100005 (x4)	500 mL
	Demin Water	A1100192	500 mL
	Syringe	A7400031	10 mL
	Polyethylene Beakers	A7400020 (x2)	250 mL
	Sensor Cleaning Brush, ¼"	A1100016	1
	Rubber Gloves	1 pair	

About Calibration . . .

When you buy from IC CONTROLS our commitment to you includes the standards to properly clean and calibrate the equipment. Our commitment to you does not stop when we ship the equipment, it continues until you have calibrated the analyzer system, are satisfied with the results, and beyond. To assist you in obtaining reliable results, IC CONTROLS developed calibration and cleaning procedures and manufactures and packages the necessary standards, buffers and supplies in convenient usage quantities. If you need assistance with calibration techniques or any other matter, our application development laboratory specialists are only a toll-free phone call away for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you get outstanding customer support as well as quality industrial equipment; in short, REAL SOLUTIONS.

Conductivity CALIBRATION

The conductivity sensor-analyzer system is usually calibrated using standard conductivity solutions. Alternatively grab-sample analysis on a previously calibrated laboratory reference conductivity meter can be used.

Ionic movement, and therefore conductivity, is proportional to temperature. The effect is predictable and repeatable for most chemicals, although unique to each. It is instantaneous and large, typically 1 to 3 percent per degree Celsius.

Overall system accuracy is maintained by calibrating the sensor and analyzer together in a standard close to the expected sample concentration. Calibration determines the effective cell constant of the conductivity sensor. The cell constant is affected by the shape of the sensing surface and electrode surface characteristics. The effective cell constant will change over time as deposits form, and anything else affects either the controlled volume or the effective electrode surface area..

Selecting a standard

Conductivity standards provide the simplest and most accurate method of calibrating the conductivity sensor and analyzer. The some analyzers such as IC CONTROLS 455 have been programmed to correct for the three most common standards used for calibration: 100, 1000, and 10,000 μ Siemen at 25°C(77°F). To achieve greater accuracy, the temperature compensated values for the 100, 1000, and 10,000 Conductivity standards are calculated by the analyzer. Simply place the sensor in the standard and the 455 analyzer will use the correct temperature adjusted value for the standard.

Temperature Dependence of standards

The formula for the temperature-corrected conductivity value C_{25} is:

$$C_{25} = \frac{C_T}{1 + \alpha(T - 25)}$$

where C_T is the conductivity at the current temperature, T is the current temperature, and α is the *temperature compensation constant*. The temperature compensation constant for IC CONTROLS standards is 2% per degree C

If manual temperature compensation has been selected then the manual temperature compensation setpoint is used as the standards

temperature. Measure the STD temperature and enter it for best accuracy.

Other standards or custom standards

If a "Custom Value" conductivity standard is to be used, press *select* [Cal] *select* [100], then *enter* to edit to the known value. Values entered this way should be the known value at the current temperature; they are not temperature - compensated by the analyzer.

Where to do Conductivity Calibrations

A suitable place to conduct a calibration is at a counter or bench with a sink, in an Instrument Shop or Laboratory. However, IC CONTROLS Conductivity calibration kits are kept small and portable so that they can be taken to installation sites, together with a bucket of water (for cleaning/rinsing) and a rag/towel (for wiping or drying).

NIST Traceable

IC CONTROLS QC's Conductivity Standards with NIST materials. Certificates of Traceability to NIST are available as P/N A1900333

Calibration Using Standards

Select a conductivity standard with a concentration which is close to and above the expected sample concentration. A second conductivity standard can be used to verify that the conductivity sensor is responding properly. This second standard can be any value, but typically 10% of the first standard works well, giving checks at 100% and 10% of range.

- 1 Obtain calibration supplies such as a graduated cylinder or beaker which is large enough to submerge the conductivity sensor, plus distilled or demineralized water in a squeeze bottle for rinsing, or an IC CONTROLS calibration Kit.
- 2 Remove the conductivity sensor from the process and inspect the sensor for any deposits. If the sensing surface is coated, clean the sensor before proceeding. See *Sensor Maintenance, Chemical Cleaning* . Rinse the sensor cell area with distilled water.
- 3 Rinse the graduated cylinder or beaker with some of the standard, then pour the selected higher conductivity standard into the graduated cylinder or beaker.
- 4 Immerse the sensor and ensure the sensor electrode area is completely submerged. If the

sensor has vent holes then the sensor must be submerged below the vent holes and there must be no air bubbles inside.

Important:

- a) Air bubbles inside the controlled volume area of the conductivity sensor cause major upsets to ion flow and result in large errors in the reading.
- b) If the analyzer is not reading on-scale, it may be because the range is wrong. Select a different range until a reading comes up.

Used conductivity standard should be discarded because exposure to air and contamination causes the conductivity of standards to change.

Note:

The sensor condition can be verified by measuring the concentration of a second standard. Rinse the sensor surface with demineralized water and then measure the concentration of the second standard (refer to step 4). If the analyzer reads correctly then the sensor condition is good. If the analyzer does not read correctly then the sensor may not be responding properly and may need to be cleaned.

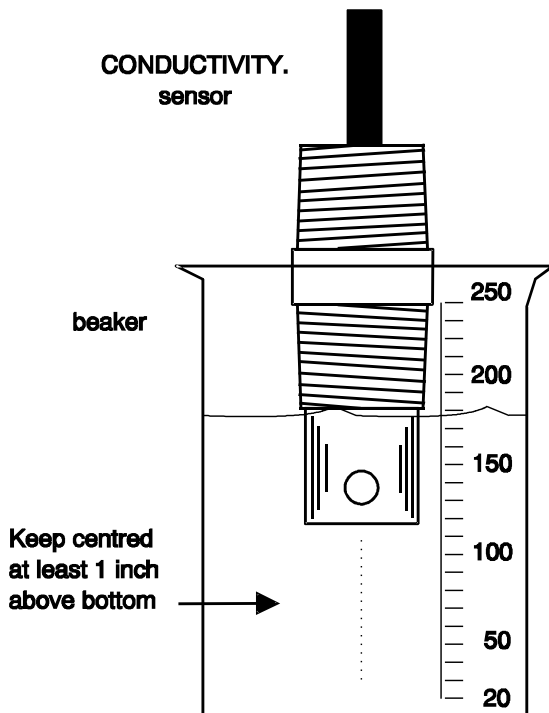


Figure 2 CONDUCTIVITY CALIBRATION

- 5. Select from the menu the standard value of the standard you are using.
 - 6. Start the calibration. Like an analyzer expert, wait until the reading has stabilized, then adjust the reading to the temperature-compensated value of the conductivity standard.
- Note:*
- a) Digital analyzers may this step automatically for you.
 - b) Repeat the process to ensure the calibration is correct.
- 7. The conductivity sensor and analyzer pair are now calibrated.

Grab-Sample Calibration

The grab-sample technique is quicker and easier if the sensor is not easily accessible. This procedure describes how to calibrate the analyzer without taking the sensor out of the process. The procedure requires that you measure the sample with a second analyzer. Normally a laboratory analyzer is used to determine the actual conductivity of the sample.

- 1. Obtain the following materials: a second conductivity analyzer, sensor of known constant and calibration standards for it, a clean beaker for taking a sample, and a calculator.
- 2. Record the cell constant of the sensor if available. The cell constant is typically displayed by pressing *Sample*, and then selecting [cond][CELL][1] from the menu.
- 3. Draw a sample from the process. In order for the procedure to work properly you must make sure that the sample you are drawing is representative of the sample being measured by the conductivity analyzer.
- 4. Record the conductivity and temperature of the sample as displayed by the conductivity analyzer.
- 5. Measure the conductivity of the sample using the second conductivity analyzer and record the conductivity reading. For accurate results the sample must be at the same temperature and the analyzers must use the same temperature compensation method.

6. For IC CONTROLS digital analyzers calculate the new cell constant to be entered into the analyzer using the following formula:

$$\text{new cell const} = \frac{\text{lab reading}}{\text{field reading}} \times \text{old cell const}$$

For example, if the analyzer was reading 820 μ Siemen, and the cell constant (from step 2) was 1.0, plus the reading from the second analyzer is 890 μ Siemen, then the new cell constant becomes

$$\text{new cell const} = \frac{890}{820} \times 1.0 = 1.09$$

7. For IC CONTROLS digital analyzers, adjust the cell constant to the new value, e.g. 1.09 as in the example.
- 7a For older analyzers with standardize adjustments, return to the unit and note the current reading (say 840). Adjust the current reading to 1.09 times its value, $840 \times 1.09 = 916$.
8. The analyzer should now read accurately.

Conductivity Standards



Conductivity is one of the more neglected industrial measurements, frequently operating with large errors due to cell coating and aging during use. Accurate calibration is difficult since there are special rinsing requirements at high and low conductivity levels, as well as variations in technical literature describing how to make up standards. IC CONTROLS has produced the following standards, traceable to NIST, from the highest quality raw materials to help solve this problem.

Part No.	Description		Size	6-pack
A1100161	Conductivity Standard,	100 μ Siemen	500 mL	A1100161-6P
A1100162	Conductivity Standard,	1,000 μ Siemen	500 mL	A1100162-6P
A1100163	Conductivity Standard,	10,000 μ Siemen	500 mL	A1100163-6P
A1100164	Conductivity Standard,	100,000 μ Siemen	500 mL	A1100164-6P
A1100165	Conductivity Standard,	367,000 μ Siemen	500 mL	A1100165-6P
A1100195	Conductivity Standard,	250 μ Siemen	500 mL	A1100195-6P
A1100196	Conductivity Standard,	500 μ Siemen	500 mL	A1100196-6P
A1100197	Conductivity Standard,	750 μ Siemen	500 mL	A1100197-6P
A1100198	Conductivity Standard,	1,500 μ Siemen	500 mL	A1100198-6P
A1100199	Conductivity Standard,	2,000 μ Siemen	500 mL	A1100199-6P
A1100200	Conductivity Standard,	2,500 μ Siemen	500 mL	A1100200-6P
A1100201	Conductivity Standard,	3,000 μ Siemen	500 mL	A1100201-6P
A1100202	Conductivity Standard,	4,000 μ Siemen	500 mL	A1100202-6P
A1100203	Conductivity Standard,	5,000 μ Siemen	500 mL	A1100203-6P
A1100204	Conductivity Standard,	7,500 μ Siemen	500 mL	A1100204-6P
A1100205	Conductivity Standard,	15,000 μ Siemen	500 mL	A1100205-6P
A1100206	Conductivity Standard,	20,000 μ Siemen	500 mL	A1100206-6P
A1100207	Conductivity Standard,	25,000 μ Siemen	500 mL	A1100207-6P
A1100208	Conductivity Standard,	50,000 μ Siemen	500 mL	A1100208-6P
A1100209	Conductivity Standard,	75,000 μ Siemen	500 mL	A1100209-6P
A1100192	Deionized Water		500 mL	A1100192-6P
Conductivity Standards to ASTM D1125:				
A1100229	Conductivity Standard A	111,342 μ Siemen	500 mL	A1100229-6P
A1100230	Conductivity Standard B	12,856 μ Siemen	500 mL	A1100230-6P
A1100231	Conductivity Standard C	1,408.8 μ Siemen	500 mL	A1100231-6P
A1100232	Conductivity Standard D	146.93 μ Siemen	500 mL	A1100232-6P



QC'd to NIST MATERIALS

Trace Certificate, P/N A1900333, records full calibration trail to NIST SRM and their lot numbers

About Calibration . . .

When you buy from IC CONTROLS our commitment to you includes the standards to properly clean and calibrate the equipment. Our commitment to your does not stop when we ship the equipment, it continues until you have calibrated the analyzer and are satisfied. If you need assistance with calibration techniques, our application development laboratory specialists are only a toll-free phone call away.

0 - 100µS CALIBRATION

A1400051 CALIBRATION KIT

Theory of Conductivity Calibration

Conductivity measures the ability of a liquid to carry current. Electrical flow in liquids differs from that in metal conductors in that electrons cannot free flow but must be carried by ions. Ions are formed when a solid such as salt, NaCl, etc, dissolves to form two or more elemental components (ions) having opposite electrical charges. Conductivity is non-specific and all ions present in solution contribute to the current.

Periodic calibration of conductivity sensors in continuous use is recommended. Various factors can affect the physical limits on the liquid and the apparent cell constant; scale, biological growths, oils, wax, gum, etc all reduce the area for current-carrying liquid.

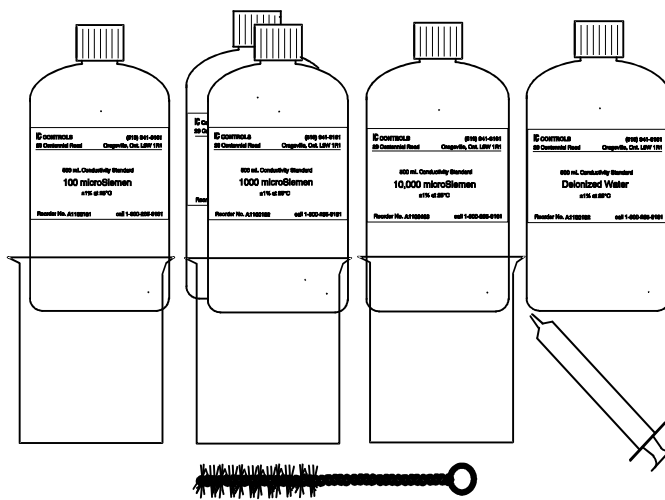
A conductivity cell's physical size and shape are important. In a liquid the only restrictions on an ion's movement are the physical limits of the liquid. A conductivity analyzer measures all the current that will flow between two electrodes; thus if there are no restrictions not only will the shortest path between the electrodes carry current, but also other roundabout paths will carry a smaller share of current. The controlled volume of a good conductivity sensor places physical limits on the liquid and controls current paths, plus it is identified by the "cell constant".

Low constants like 0.01 tend to have large electrode surfaces which are close together, making for fairly large sensors. They need a long, slim container to be fully immersed in liquid for calibration. Medium constants like 0.1 and 1.0 are much smaller and more compact and can usually be calibrated in a beaker if kept suspended above the bottom. High

range cells with 10, 20, 50 constants usually include an internal liquid passage that requires a long thin vessel to be immersed or may require a pumped sample for calibration.

Where to do Conductivity Calibrations

A suitable place to conduct a calibration is at a counter or bench with a sink, in an Instrument Shop or Laboratory. However, IC CONTROLS kits are kept small and portable so that they can be taken to installation sites, together with a bucket of water (for cleaning/rinsing) and a rag/towel (for wiping or drying).



NIST Traceable

IC CONTROLS QC's these Conductivity Standards with NIST materials. Certificates of Traceability to NIST are available as

P/N A1900333

Calibrations Direct from Standards

Constant	Std µS	%Scale	Std µS	%Scale
0.1	100	100%	-	-
1.0	1000	100%	100	10%
2.0	1000	50%	100	5%

Calibrations from Dilution Method

Dilute strong standards using the syringe to measure out a small amount and dilute to desired strength.

Examples to produce 150mL in a beaker:

- A) 10µS std = 15cc of 100µS std + 135cc of Demin water
- B) 5000 µS std = 75cc of 10,000µS + 75cc of Demin water

Constant	Std µS	%Scale	Std µS	%Scale
0.1	100	100	10	10
5.0	5000	100	1000	20

A1400051 Instruction Sheet

The 1400051 is a Low-Range Conductivity Calibration Kit of solutions and necessary items. Its equipped for 0 to 100 µSiemen Calibrations.

It contains the following:

Standards:	2x100 µSiemen,
Demin Water	4 x 500mL for dilution or rinsing
Graduates:	2 x 100mL
Syringe:	1 x 10mL for accurate dilutions and/or provide a squirt stream.
Brush:	1 x Sensor cleaning

Instructions for A1400051 Low-Range Conductivity Calibration Kit

a) Set up the calibration supplies where you plan to do the calibration. Lay out the 2 graduated cylinders, one for Span or High End Standard, one for Low End Standard. Set out the sensor cleaning brush, syringe, standards and rinse solutions.

b) Remove the conductivity sensor from the process and examine it for deposits. Use the sensor cleaning brush and rinse water to flush away any deposits within the cell measurement area. Use detergent to remove oil films. Tenacious deposits may require chemical cleaning, see A1400054 Kit.

c) Pour approximately 75mL of 100 µSiemen High End Conductivity Standard into a graduate so it is about three quarters full. Lower the conductivity cell into the graduate.

Tip: Ensure there are no air bubbles inside the cell, they will cause low conductivity readings. Remove by tapping or alternately raise / lower the sensor to flush them out.

d) With the conductivity cell centered and no air bubbles in the cell, monitor the reading for stability then calibrate. Note: The reading may gradually change while the sensor equilibrates to the standard temperature. With micro analyzers, the program acts as an expert thermal equilibrium detector and flashes its reading until the temperature stabilizes. A different steady reading indicates calibration is complete.

e) Verify your calibration by:

1st. Rinse the sensor in demin water.

2nd. Check with 10 µSiemen Low End Standard at about 10% of

scale using the procedure from c) and d) above.

Notes:

- 1) Make Low End standard by dilution, example; add 7.5 mL 100 Std then top up to 75 mL to get 10 µS.

CAUTION: Low conductivity water will dissolve CO² from the air raising conductivity 1 to 2 µS, plus pickup in storage and from containers, so 10 µSiemen will likely read 11, 12, or 13 µSiemen (possibly even more). Use three repeats with fresh standard and the same calibration value to ensure good calibration is achieved.

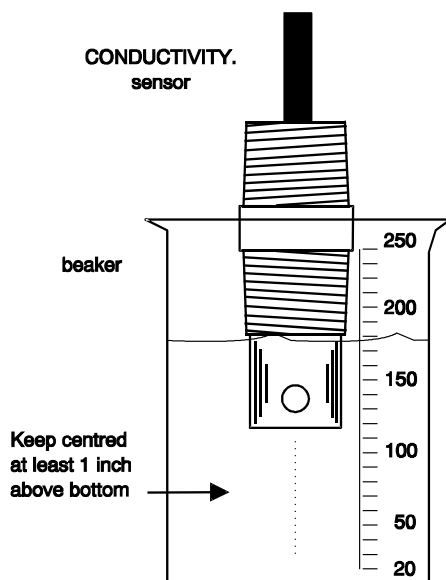
- 2) If the sensor reads correctly the calibration and sensor condition are good. If the sensor reads wrong it may have had trapped bubbles inside. Re-test; if problem persists, try chemical cleaning.
- 4) A clean, rinsed and dried conductivity sensor should read near zero in air. If it does not, troubleshoot the sensor, wiring, and analyzer.
- 6) Low conductivity grab samples for laboratory calibration checks are not reliable due to CO² absorption from air.

CAUTION: Less than 10 µS Standards made in air will dissolve CO² raising conductivity 1 to 3 µS, so are un-reliable. Stored Demin will also exhibit 2 or 3 µS from containers and should not be used. For

1 µS try triple rinsing all vessels with less than 1 µS sample and using sample in place of stored demin in dilutions. Alternately contact IC CONTROLS Customer Service.

Available Supplies:

A1100161 100 µS, -6P= 6 pk
 A1100162 1,000 µS, -6P= 6 pk
 A1100192 Demin Water, -6P= 6 pack
 A1900333 Trace to NIST Cert.
 A7400022 Graduated Cylinder
 A7400031 10 mL Syringe
 A1100016 Brush Sensor Clean
 A1400051 Low Cond. Cal Kit
 A1400052 Med. Cond. Cal Kit
 A1400053 Hi Cond. Cal Kit
 A1400054 Clean & Cond. Kit.



CONDUCTIVITY CALIBRATION

1000 & 10000 μ S CALIBRATION

A1400052 CALIBRATION KIT

Theory of Conductivity Calibration

Conductivity measures the ability of a liquid to carry current. Electrical flow in liquids differs from that in metal conductors in that electrons cannot free flow but must be carried by ions. Ions are formed when a solid such as salt, NaCl, etc, dissolves to form two or more elemental components (ions) having opposite electrical charges. Conductivity is non-specific and all ions present in solution contribute to the current.

Periodic calibration of conductivity sensors in continuous use is recommended. Various factors can affect the physical limits on the liquid and the apparent cell constant; scale, biological growths, oils, wax, gum, etc all reduce the area for current-carrying liquid.

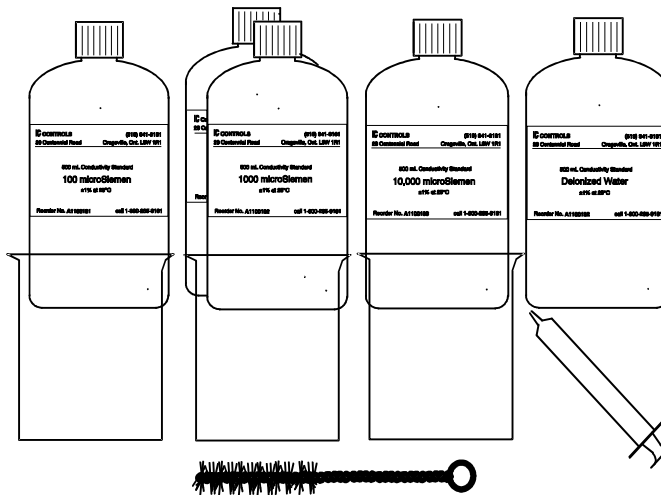
A conductivity cell's physical size and shape are important. In a liquid the only restrictions on an ion's movement are the physical limits of the liquid. A conductivity analyzer measures all the current that will flow between two electrodes; thus if there are no restrictions not only will the shortest path between the electrodes carry current, but also other roundabout paths will carry a smaller share of current. The controlled volume of a good conductivity sensor places physical limits on the liquid and controls current paths, plus it is identified by the "cell constant".

Low constants like 0.01 tend to have large electrode surfaces which are close together, making for fairly large sensors. They need a long, slim container to be fully immersed in liquid for calibration. Medium constants like 0.1 and 1.0 are much smaller and more compact and can usually be calibrated in a beaker if kept suspended above the bottom. High

range cells with 10, 20, 50 constants usually include an internal liquid passage that requires a long thin vessel to be immersed or may require a pumped sample for calibration.

Where to do Conductivity Calibrations

A suitable place to conduct a calibration is at a counter or bench with a sink, in an Instrument Shop or Laboratory. However, IC CONTROLS kits are kept small and portable so that they can be taken to installation sites, together with a bucket of water (for cleaning/rinsing) and a rag/towel (for wiping or drying).



NIST Traceable

IC CONTROLS QC's these Conductivity Standards with NIST materials. Certificates of Traceability to NIST are available as P/N A1900333

Calibrations Direct from Standards

Constant	Std μ S	%Scale	Std μ S	%Scale
0.1	100	100%	-	-
1.0	1000	100%	100	10%
2.0	1000	50%	100	5%

Calibrations from Dilution Method

Dilute strong standards using the syringe to measure out a small amount and dilute to desired strength.

Examples to produce 150mL in a beaker:

- A) 10 μ S std = 15cc of 100 μ S std + 135cc of Demin water
- B) 5000 μ S std = 75cc of 10,000 μ S + 75cc of Demin water

Constant	Std μ S	%Scale	Std μ S	%Scale
0.1	100	100	10	10
5.0	5000	100	1000	20

A1400052 Instruction Sheet

The 1400052 is a Mid-Range Conductivity Calibration Kit of solutions and necessary items its equipped for 0 to 1,000 and 0 to 10,000 μ Siemen Calibrations (or 0 to 1 & 0 to 10 milliSiemens).

It contains the following:

- Standards: 1x100 μ Siemen,
2x1,000 μ Siemen
1x10,000 μ Siemen
- Demin Water: 1 x 500mL for dilution or rinsing
- Beakers: 3 x 250mL
- Syringe: 1 x 10mL for accurate dilutions
and/or provide a squirt stream.
- Brush: 1 x Sensor cleaning

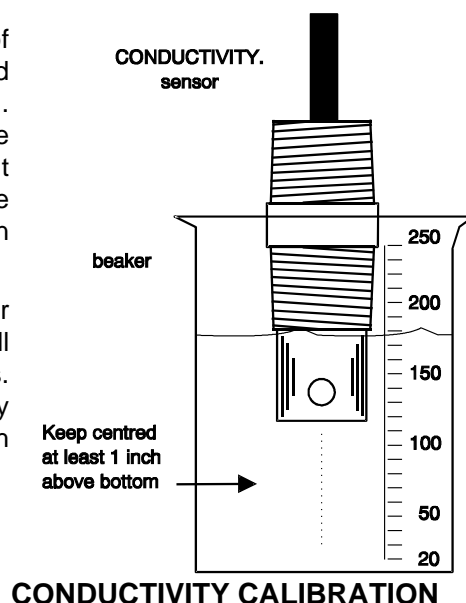
Instructions for A1400052 Mid range Conductivity Calibration Kit

a) Set up the calibration supplies where you plan to do the calibration. Lay out the 3 beakers, one for Span or High End Standard, one for Low End Standard, one for rinsing off the sensor between standards. Set out the sensor cleaning brush, syringe, standards and rinse solutions.

b) Remove the conductivity sensor from the process and examine it for deposits. Use the sensor cleaning brush and rinse water to loosen and flush away any deposits within the cell measurement area. In remote locations squirt with the syringe for flushing. Detergent can be added to remove oil films and non-tenacious deposits. Hard scales and other tenacious deposits may require chemical cleaning, see A1400054 Clean and Condition Soln. Kit.

c) Pour approximately 150mL of High End Conductivity Standard into a beaker so it is about half full. Lower the conductivity cell into the center of the beaker keeping it suspended 1 inch or 2.5 cm above the bottom to avoid any effects on the cells outer current paths.

Tip: Ensure there are no air bubbles inside the cell, they will cause low conductivity readings. Remove by tapping or alternately raise / lower the sensor to flush them out.



d) With the conductivity cell centered and no air bubbles in the cell, monitor the reading to stabilize and then calibrate the analyzer. Note: The reading may gradually change for some time while the sensor equilibrates to the standard temperature. With analog conductivity analyzers the technician must decide when the temperature is stable and then turn the standardize adjuster. With microprocessors, the program acts as an expert thermal equilibrium detector and flashes its reading until temperature stabilizes. A somewhat different but steady (non- flashing) reading indicates calibration is complete.

e) Verify calibration by:

- 1st. Rinse the sensor in demin water; or tap water if the High standard used was higher than tap water.
- 2nd. Check with Low End Standard at about 10% of scale using the procedure from c) and d) above.

Notes:

- 1) If the sensor reads correctly the calibration and sensor condition are good.
- 2) If the sensor reads wrong it may need to be chemically cleaned, or could have had trapped bubbles inside. Re-test; if problem persists, chemical cleaning is called for.
- 3) A clean, rinsed and dried conductivity sensor should read zero in air. If it does not, troubleshooting of the sensor, wiring, and analyzer are needed.

Available Supplies:

- A1100161 100 μ S, -6P=6pk
- A1100162 1,000 μ S, -6P=6pk
- A1100163 10,000 μ S, -6P=6pk
- A1100164 100,000 μ S, -6P=6pk
- A1900333 Trace to NIST Cert.
- A1100192 Demin, -6P=6pk
- A7400020 poly Beaker
- A7400031 10 mL Syringe
- A1100016 Brush Sensor Clean
- A1400051 Low Cond. Cal Kit
- A1400052 Med. Cond. Cal Kit
- A1400053 Hi Cond. Cal Kit
- A1400054 Clean & Cond. Kit.

100,000 μS , % Solutions CALIBRATION

A1400053 CALIBRATION KIT

Theory of Conductivity Calibration

Conductivity measures the ability of a liquid to carry current. Electrical flow in liquids differs from that in metal conductors in that electrons cannot free flow but must be carried by ions. Ions are formed when a solid such as salt, NaCl, etc, dissolves to form two or more elemental components (ions) having opposite electrical charges. Conductivity is non-specific and all ions present in solution contribute to the current.

Periodic calibration of conductivity sensors in continuous use is recommended. Various factors can affect the physical limits on the liquid and the apparent cell constant; scale, biological growths, oils, wax, gum, etc all reduce the area for current-carrying liquid.

A conductivity cell's physical size and shape are important. In a liquid the only restrictions on an ion's movement are the physical limits of the liquid. A conductivity analyzer measures all the current that will flow between two electrodes; thus if there are no restrictions not only will the shortest path between the electrodes carry current, but also other roundabout paths will carry a smaller share of current. The controlled volume of a good conductivity sensor places physical limits on the liquid and controls current paths, plus it is identified by the "cell constant".

Low constants like 0.01 tend to have large electrode surfaces which are close together, making for fairly large sensors. They need a long, slim container to be fully immersed in liquid for calibration. Medium constants like 0.1 and 1.0 are much smaller and more compact and can usually be calibrated in a beaker if kept suspended above the bottom. High

range cells with 10, 20, 50 constants usually include an internal liquid passage that requires a long thin vessel to be immersed or may require a pumped sample for calibration.

Where to do Conductivity Calibrations

A suitable place to conduct a calibration is at a counter or bench with a sink, in an Instrument Shop or Laboratory. However, IC CONTROLS kits are kept small and portable so that they can be taken to installation sites, together with a bucket of water (for cleaning/rinsing) and a rag/towel (for wiping or drying).

NIST Traceable

IC CONTROLS QC's these Conductivity Standards with NIST materials. Certificates of Traceability to NIST are available as P/N A1900333

Calibrations Direct from Standards

Constant	Std μS	%Scale	Std μS	%Scale
0.1	100	100%	-	-
1.0	1000	100%	100	10%
2.0	1000	50%	100	5%

Calibrations from Dilution Method

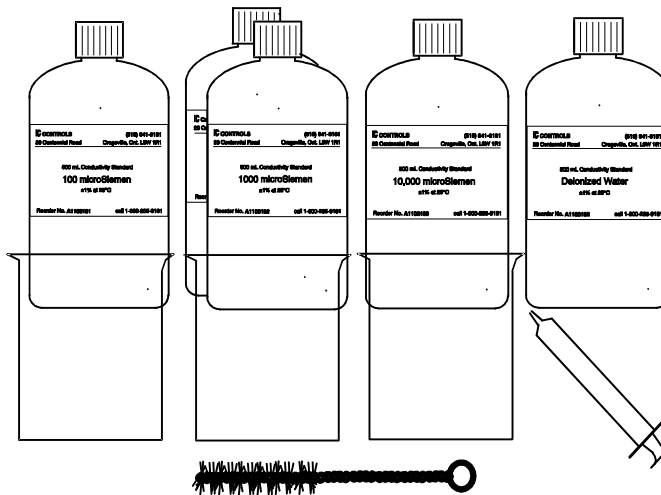
Dilute strong standards using the syringe to measure out a small amount and dilute to desired strength.

Examples to produce 150mL in a beaker:

A) 10 μS std = 15cc of 100 μS std
+ 135cc of Demin water

B) 5000 μS std = 75cc of 10,000 μS
+ 75cc of Demin water

Constant	Std μS	%Scale	Std μS	%Scale
0.1	100	100	10	10
5.0	5000	100	1000	20



A1400053 Instruction Sheet

The 1400053 is a High-Range Conductivity Calibration Kit of solutions and necessary items its equipped for 0 to 100,000 and 0 to 500,000 μ Siemen Calibrations (or 0 to 100 & 0 to 500 milliSiemens).

It contains the following:

- Standards: 2x 10,000 μ Siemen,
- 2x 100,000 μ Siemen
- 2x 367,000 μ Siemen
- Syringe: 1 x 10mL for accurate dilutions
 and/or provide a squirt stream.
- Brush: 1 x Sensor cleaning

Notes:

- 1) The practical limit for high conductivity standard is 367,000 μ Siemen. For 500,000 range use 367,000 as high end standard.
- 2) High cell constant often exhibit high reading non-linearity. Check for this at 75% of range.

Instructions for A1400053 High-Range Conductivity Calibration Kit

a) Set up the calibration supplies where you plan to do the calibration. Lay out the sensor cleaning brush, syringe, standards and rinse solutions, plus your calibration cup or sensor end-sealing device.

b) Remove the conductivity sensor from the process and examine it for deposits. Use the sensor cleaning brush and rinse water to loosen and flush away any deposits within the cell measurement area. In remote locations squirt with the syringe for flushing. Detergent can be added to remove oil films and non-tenacious deposits. Hard scales and other tenacious deposits may require chemical cleaning, see A1400054 Clean and Condition Soln. Kit.

c) For flow-through sensors seal one end to form a container inside the sensor body.

d) Pour High End Conductivity Standard in until the sensor is full; or lower the conductivity cell into the center of the calibration cup until the top hole is submerged.

Tip: Ensure there are no air bubbles inside the cell, they will cause low conductivity readings. Remove by tapping or alternately raise / lower the sensor to flush them out.

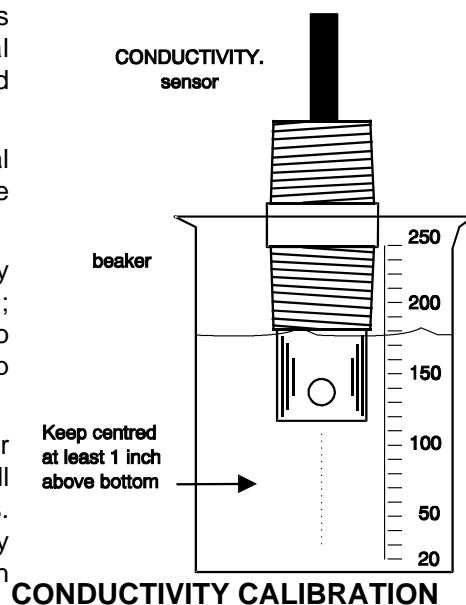
e) With the conductivity sensor full and no air bubbles in the cell, monitor the reading to stabilize and then calibrate the analyzer. Note: The reading may gradually change for some time while the sensor equilibrates to the standard temperature. With analog conductivity analyzers the technician must decide when the temperature is stable and then turn the standardize adjuster. With microprocessors, the program acts as an expert thermal equilibrium detector and flashes its reading until temperature stabilizes. A somewhat different but steady (non- flashing) reading indicates calibration is complete)

Verify calibration by:

- 1st. Rinse the sensor in tap water.
- 2nd. Check with Low End Standard at about 10% of scale using the procedure from d) and e) above.

Notes:

- 1) Always start with a standard a little higher than your expected high reading.
- 2) If the sensor reads correctly the calibration and sensor condition are good. If the sensor reads wrong it may need to be chemically cleaned, or could have had trapped bubbles inside. Re-test; if problem persists, chemical cleaning is called for. On very high conductivities some sensors may read a little high at the low end.
- 3) A clean, rinsed and dried conductivity sensor should read near zero in air. If it does not, troubleshooting of the sensor, wiring, and analyzer are needed.



Available Supplies:

- A1100161 100 μ S, -6P=6pk
- A1100162 1,000 μ S, -6P=6pk
- A1100163 10,000 μ S, -6P=6pk
- A1100164 100,000 μ S, -6P=6pk
- A1100165 367,000 μ S, -6P=6pk
- A1900333 Trace to NIST Cert.
- A7400020 poly Beaker
- A7400031 10 mL Syringe
- A1100016 Brush Sensor Clean
- A1400051 Low Cond. Cal Kit
- A1400052 Med. Cond. Cal Kit
- A1400053 Hi Cond. Cal Kit
- A1400054 Clean & Cond. Kit.

SENSOR MAINTENANCE

Sensor Removal Warning

Before sensor removal the process pressure at the sensor must be lowered to zero, or a dangerous pressure stream of process liquid will blast out. 401, 402, 404, 405, 406, 412 and 425 sensors leave a hole in the line, vessel or tank when removed, and are intended for use only where pressure can be lowered to zero for servicing. Use of model 403 Ball Valve Insertion / Retractable sensor is recommended where pressure cannot be reduce to zero for service.

Vessels and tanks must be drained until the liquid level is below the sensor insertion hole for the pressure to be zero and no process liquid to escape.

Submersion installations can typically be lifted out with the concern being liquid on the support pipe or wires.

Use rubber gloves and appropriate face / eye protection when handling sensors coated with aggressive liquids.

Sensor Insertion

Sensors should be examined for good clean sealing surfaces and reinstalled carefully. Clean seals such as O'rings should be lubricated with silicone grease to ensure liquid tight performance.

Removal 403 Ball Valve Sensor

- 1 Inspect the safety cables and replace if corroded or damaged. P/N A1100011

CAUTION: On hot processes there is a risk of steam jets or liquid squirts. The gland has two seals to reduce this risk but scratches and grit may defeat them.

2. Release the gland nut slowly about 2 or 3 turns, allowing the sensor to slide back until the safety cables are tight.
3. Once the 403 is fully retracted, cables tight, shut off the ball valve.
4. Remove the gland nut completely.
5. Remove the safety cables from the valve housing.
6. The 403 body can now be removed.

Note: Always inspect and clean the 403 sensor body, gland, and seals, plus relubricate the seals before re-installing.

Sensor Storage

Short term: Rinse the sensor electrodes in demin water, allow to dry and store dry.

Long term: Rinse the sensor electrodes in demin water, allow to dry, cover with tip with a plastic shipping cap and store dry.

Monthly Maintenance

A monthly maintenance check is recommended by grab sample calibration since the sensor is typically installed in the process and not easy to remove. Follow the procedure under calibration by grab sample. Keep a log of the cell constant at each monthly calibration.

Yearly Maintenance

Follow the monthly maintenance procedure. Check the cell constant log. If the cell constant has changed more than 20 percent over the past year, it may need to be chemically cleaned—follow the *Chemical Cleaning of Sensor* procedure.

O'rings and teflon-sealing ferrules should be replaced on 402, 403, 412, 414, and 425 sensors. The condition of electrical connections in 400 junction boxes should be examined for signs of corrosion and tight connections, replace if corroded. The condition of the safety cables on 403 sensors should be examined for rust or bent mounting screws. Replace if deterioration shows.

When to clean your sensor

Various factors can affect the physical limits on the liquid and the apparent cell constant; scale, biological growths, oils, wax, gum, etc all reduce the area for current-carrying liquid. Periodic cleaning of conductivity sensors in continuous use will remove these deposits, restore the conducting surfaces, controlled cell volume, and thus the cell constant.

Mechanical Cleaning of Sensor

The sensor will require cleaning if sludge, slime, or other tenacious deposits build up in the internal cavities of the sensor.

Wherever possible clean with a soft brush and detergents. General debris, oil films and non-tenacious deposits can be removed in this way.

For flat-surface sensors use a potato brush and a beaker or bucket of water with a good liquid detergent. Take care not to scratch the electrode

surfaces. Internal cavities of standard sensors can be brushed with a soft quarter-inch diameter brush.

Plastic body sensors should be washed over all the wetted surfaces with a soft cloth. This will return their appearance to like-new condition and removes sites for buildups to occur.

When to Chemical Clean

After cleaning as above check the sensor against a conductivity standard. If the sensor is still not developing the proper cell constant ±5% (or reading in the standard) proceed to the Chemical Cleaning procedure, otherwise return the sensor to the process.

Troubleshooting Hints

Slow Response—typically due to excessive sample line length and low flow, thus producing long sample transport lags. Resolve by adding a fast-flow loop with the sensor in a short side stream, or by shortening the line.

Slow response can also be caused by a buildup of dirt in the sample line. In this case the problem may be alleviated by changing the take-off point or by installing a knock-out pot.

Readings consistently low or spike low—characteristic of bubbles in the sample line passing through the sensor or hanging up in the sensor.

Readings gradually falling—the analyzer can no longer be calibrated properly. This problem is typical of scale or sludge/slime deposits in the sensor. The sensor may need to be cleaned.

Readings at maximum—under all conditions. First verify that analyzer is displaying conductivity using mSiemen units. Some analyzers will display “+Err” if conductivity is above 9999 µSiemen with µSiemen units selected for the display.

If unit selection is not the problem, then either the sensor is shorted or there is a problem with the wiring/analyzer setup. Test for shorts by disconnecting wiring and checking impedance between black and white lead with sensor in air. Insulation value should exceed 1 MΩ (megaohm). If the sensor is OK then substitute resistors for the sensor to test the wiring and the analyzer. If the problem persists with the resistors in place then it is an analyzer problem. Use the following formula or consult the table below for resistance values to use.

Conductances, µSiemen	Resistance ohms, 1.0 cell constant	Resistance ohms, 0.1 cell constant
1	1 000 000	100 000
10	100 000	10 000
100	10 000	1 000
1 000	1 000	100
10 000	100	10
100 000	10	1
1 000 000	1	0.1

Table 2 Resistance values for simulation

$$Resistance\Omega(ohms) = \frac{Cell\ Constant \times 10^6}{microSiemen\ of\ solution\ at\ 25^\circ C}$$

If the sensor tests OK, e.g. no shorts above, and the analyzer and wiring work OK with substitute resistors as in table 5, but the “+Err” or over scale still occur when the analyzer and sensor are hooked up and placed in service, then the conductivity is too high for the cell constant used. Resolve by determining the actual conductivity and selecting a new conductivity sensor with the correct cell constant.

Elevated readings on low conductivity—the analyzer reads high at the low end of the range. In some cases the analyzer will give a low reading even with the conductivity sensor in air. Large zero signals are indicative of a wiring problem. Look first at shielding between leads and ensure the shield is connected to the analyzer shield terminal rather than electrical ground. Other known causes are wrong cable or too long a cable for the application.

Where the elevated zero is small it is likely due to cable resistance / capacitance and can be zeroed out using the Air Zero Calibration procedure.

The above symptoms cover most difficulties associated with conductivity sensors. The major key to isolating problems to the sensor or analyzer lies in being able to separate the two with resistor simulation. For difficult problems, assistance is available from

IC CONTROLS; call toll free at 1(800)265-9161.

Chemical Cleaning of Sensor

A1400054 Instruction Sheet

The 1400054 is a Conductivity Sensor Chemical Cleaning Kit of solutions and necessary items.

It contains the following:

Cleaning	4x 500ml Clean & Condition soln.
Final Rinse	1x 500ml Demin
Beakers	2x 250ml plastic
Gloves	1x pair Rubber Gloves
Syringe:	to provide a squirt stream
Brush:	1x Sensor cleaning

Instructions for A1400054

Conductivity Chemical Cleaning Kit

NOTE 1: A suitable place to do chemical cleaning is at a counter or bench with a Laboratory sink, with a chemical drain where waste is contained and treated before release.

Note 2: IC CONTROLS kits are kept small and portable so that they can be taken to installation sites, together with a plastic bucket of water (for rinsing) and a rag/towel (for wiping or drying). Waste materials (particularly acid leftovers) should be returned to the Laboratory sink for disposal.

CAUTION: Use extra caution when handling cleaning solution as it contains acid.

Wear rubber gloves and adequate facial protection when handling acid. Follow all A1100005 MSDS safety procedures.

a) Set up the cleaning supplies where you plan to do the cleaning. Lay out the sensor cleaning brush, syringe, cleaning solutions and rinse solutions, plus your beakers and sensor if already at hand.

Note: Ensure your Cleaning Solution beaker is on a firm flat surface since it will contain acid.

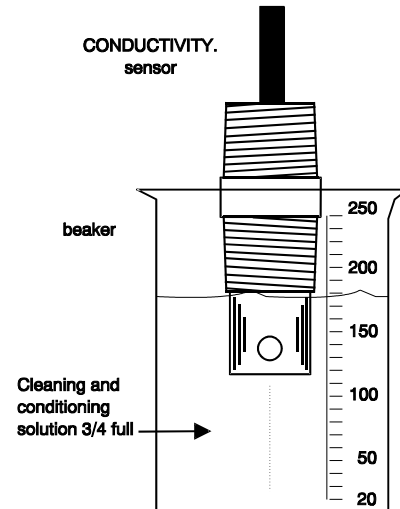
b) First remove the conductivity sensor from the process and examine it for deposits. Use the sensor cleaning brush and tap rinse water to loosen and flush away any deposits within the cell measurement area. Detergent can be added to remove oil films and non-tenacious deposits. Hard scales and other tenacious deposits may require chemical cleaning.

c) **CHEMICAL CLEANING** Fill a beaker $\frac{3}{4}$ full of cleaning and conditioning solution A1100005, or for flow-through sensors seal one end to form a container inside the sensor body.

d) Lower the conductivity cell into the center of the beaker until the top hole is submerged; or pour the solution in until the flow sensor is full.

e) Keep removing, re-immersing the sensor until the sensor electrodes appear clean. Stubborn deposits can be worked on with the brush and syringe to squirt cleaner into hard to reach areas.

CAUTION: Use great care when brushing and squirting acid. **Wear rubber gloves and facial protection.**



f) Rinse the cleaned sensor thoroughly in tap water and squirt with Demin 2nd rinse before calibrating.

g) Check the sensor against a conductivity standard. near full scale. If the sensor is still not developing the proper cell constant $\pm 5\%$ (or reading in the standard), re-clean or proceed to troubleshoot or replacement.

h) A clean, rinsed and dried conductivity sensor should read near zero in air. If it does not, troubleshoot the sensor, wiring, and analyzer.

Available Supplies:

A1100161	100 μ S,	-6P=6pk
A1100162	1,000 μ S,	-6P=6pk
A1100163	10,000 μ S,	-6P=6pk
A1100164	100,000 μ S,	-6P=6pk
A1100165	367,000 μ S,	-6P=6pk
A1900333	Trace to NIST Cert.	
A7400020	poly Beaker	
A7400031	10 mL Syringe	
A1100016	Brush Sensor Clean	
A1400051	Low Cond. Cal Kit	
A1400052	Med. Cond. Cal Kit	
A1400053	Hi Cond. Cal Kit	
A1400054	Clean & Cond. Kit.	

NEW CONDUCTIVITY SENSORS

The 455 can be used with any IC CONTROLS Conductivity sensor. IC CONTROLS sensors are available in the following types;

- 1 submersion service
- 2 sample side stream service, (flow through)
- 3 insertion through pipe/tank wall installation
- 4 insertion with ballvalve for retraction without lowering process pressure.
- 5 universal type, flow / submersion / insertion
- 6 pure water (low conductivity) service
- 7 dirty water (sewer, sludge, mine slurry, pulp stock), service

Standard Sensors are:

for	Conductivity	SERVICE
401	SS Hot Condensate Sensor	³
402	SS High Purity Water	^{2,3,6}
403	SS Insertion/Ball Valve Retractable	⁴
404	General purpose sensor	^{1,2,3,7}
405	Easy-clean sensor	^{5,7}
406	High Conductivity Flow Sensor	²
412	High Conductivity in pipe Sensor	²
425	Quick Union Universal, Industrial	^{1,2,3,5}

Various other options may also be selected, see IC CONTROLS Catalogue for full details, or contact Customer Service at :
www.ICCONTROLS.COM
 Phone 1-519-941-8161
 FAX 1-519-941-8164



404 General Purpose



401 Hot Condensate



405 Easy Clean Sensor



402 Pure Water Conductivity



403 for the strength of SS; insertion or ball valve



412 Pipe Sensor



425 UNIVERSAL



406 High Conductivity Flow Sensor

Glossary

mho the reciprocal of ohm; ohm spelled backwards. The equivalent of mho/cm is Siemen, which is the modern naming for this unit.

μSiemen unit of conductivity, pronounced micro-siemen. Micro is the metric prefix meaning *one millionth*.

$$\mu\text{Siemen} = \frac{1}{10^6 \text{ ohm} \cdot \text{cm}} = 10^{-6} \text{ Siemen}$$

Cell Constant describes enclosed volume between electrodes in the conductivity sensor. Units are cm^{-1} . Higher cell constants produce higher analyzer ranges, lower cell constants produce lower ranges.

Conductivity The amount of electrical current that flows through a liquid. Generally reported as μmho or mmho .

mSiemen unit of conductivity.
1 milliSiemen = 1 000 microSiemen. mS is short for milliSiemen. Milli is the metric prefix meaning *one thousandth*.

Siemen A conductivity unit,

$$\text{Siemen} = \frac{1 \text{ ohm}}{\text{cm}}$$

TC Temperature Compensator.

Temperature Compensation Correction for the influence of temperature on the sensing electrode. The analyzer reads out concentration as if the process were at 25°C or 77°F, regardless of actual solution temperature.

PARTS LIST

Part #	Description	Drawing #
401 Condensate Conductivity Sensor (J-box & Term. 400-78XP)		
401-?.?-77	Basic (no J-box or term. strip), ?.?=Cell Const.	
A3100071	SS flow cell, 1/8" NPT, 70mL. (401, 402, 403)	
402 Pure Water Conductivity Sensor (J-box & Term. 400-78XP)		
402-?.?-77	Basic (no J-box or term. strip), ?.?=Cell Const.	
A3100001	Fitting 3/4 NPT, J-Box mounting	
A3100002	SS Insertion Gland 3/4 NPT, snsr mount. (402, 403)	
403 Ball Valve Conductivity Sensor (J-box & Term. 400-78XP)		
403-?.?	Basic (no J-box, term. strip, or fittings), ?.?=Cell Const.	
A7100001	SS reducer 1" NPT to 3/4" NPT	
A1100011	Retainer Cable and Lanyard Set 403	
A1100013	Kit O'ring and ferrule for 403 gland fitting (P/N A3100002)	
A3100002	SS insertion gland fitting 3/4" NPT, snsr mount (402, 403)	
A3100004	SS Ball Valve 1" NPT	
A7100003	SS Nipple 1" NPT	
404 Threaded General Purpose Conductivity Sensor		
404- ??	Replacement Sensor, ?.?=Cell Const.	
A3100146	PVC flow cell, 1" FNPT	
A3100147	PVDF flow cell, 1" FNPT	
405 Sewer Conductivity Sensor		
405- ??	Replacement Sensor, ?.?=Cell Const.	
406 High Conductivity Flow Sensor		
406- ??	Replacement Sensor, ?.?=Cell Const.	
A2100051	CPVC 1 1/2" flow cell, 1" FNPT connections	
425 Quick Union General Purpose Sensor		
425- ??	Replacement Sensor, ?.?=Cell Const.	
A9551062	Sensor seal O'ring	
A2300091	Replacement Sensor Retainer and Union Ring CPVC	
A2300092	Replacement Sensor Retainer and Union Ring PVDF	
A7201113	Replacement SS Retainer Nut	
A3200090	CPVC flow cell, 1 1/2" SLIP	
A3200073	CPVC flow cell, 1 1/2" FNPT	
A2300074	PVDF flow cell, 1 1/2" FNPT	
A2300075	316 SS flow cell, 1 1/2" FNPT	
A2300086	CPVC union insertion fitting, 1 1/2" MNPT	
A2300087	PVDF union insertion fitting, 1 1/2" MNPT	
A2300088	SS union insertion fitting, 1 1/2" MNPT	
400 J-Box, Wall Mount Type		
A2101514	Weather proof, wall mount J-box (only)	
A9120050	Terminal block, 6 CKT for A2101514	D5920095
400-78XP J-Box, Pipe Top, Explosion-Proof Type		
A2101513	Explosion proof J-box and O'ring (only)	
A9120098	Terminal strip 6 CKT, for A2101513	D5920095
Interconnect Cable to 400 J-Box Interface		
A9200105	Conductivity cable, 5-conductor with shield	D5920095

Repair and Service

Field Service is dispatched in Canada from the home office of IC CONTROLS. In North America, call 1-800-265-9161, or call 519-941-8161. Outside of North America consult your authorized IC CONTROLS distributor, or:

IC CONTROLS Ltd.
29 Centennial Road
Orangeville, Ontario
CANADA

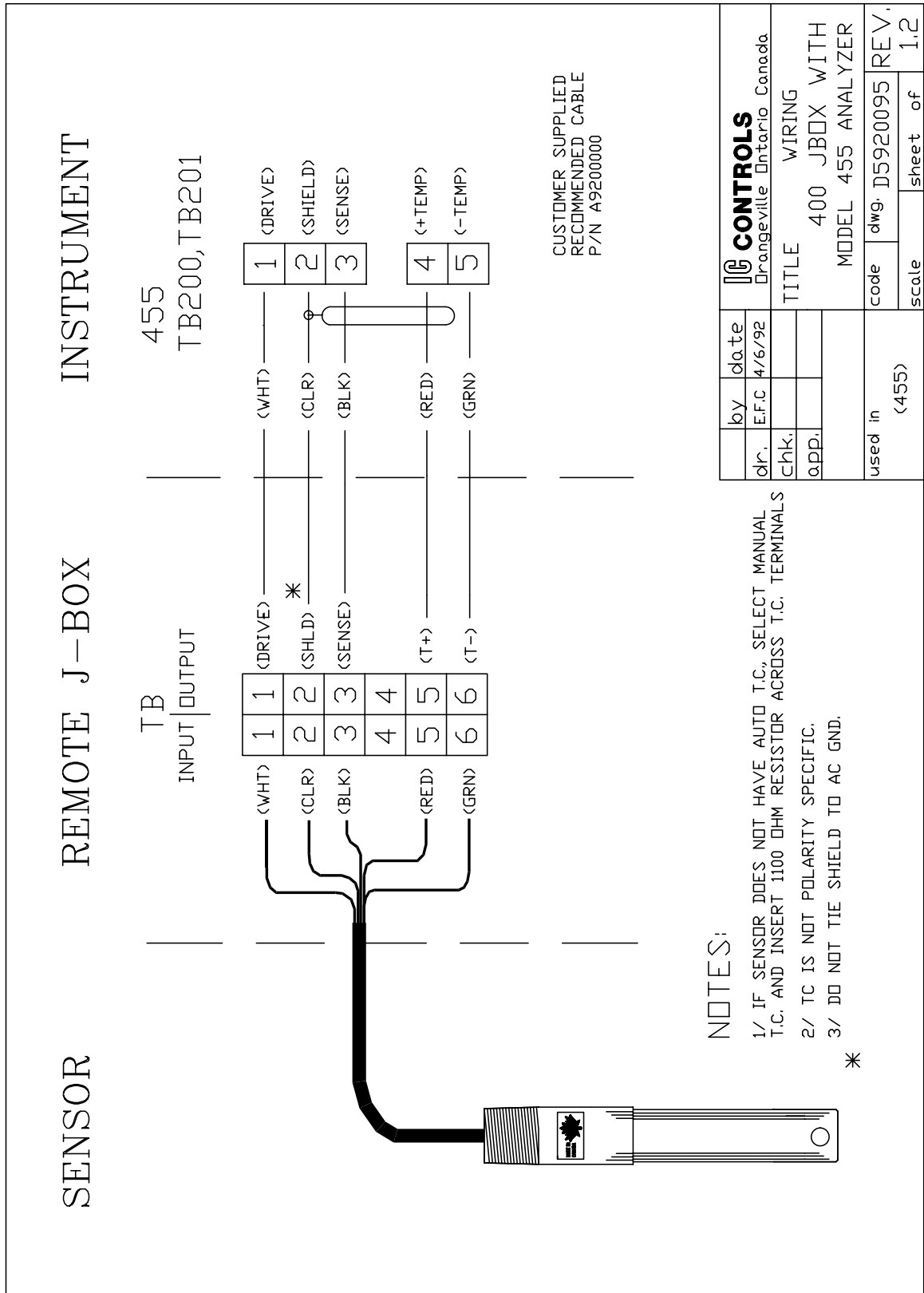
FAX 519-941-8164

email: service@iccontrols.com

www.iccontrols.com

Drawings

Sensor Wiring, including 400 J-Box Interface





29 Centennial Road, Orangeville, Ontario, L9W 1R1 Canada

Head Office, Manufacturing & Research

Tel: (519) 941-8161 Fax: (519) 941-8164

Industrial Products Warranty

Industrial instruments are warranted to be free from defects in material and workmanship for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment from IC CONTROLS whichever is earlier, when used under normal operating conditions and in accordance with the operating limitations and maintenance procedures in the instruction manual, and when not having been subjected to accident, alteration, misuse, or abuse. This warranty is also conditioned upon calibration and consumable items (electrodes and all solutions) being stored at temperatures between 5°C and 45°C (40°F and 110°F) in a non-corrosive atmosphere. IC CONTROLS consumables or approved reagents must be used or performance warranty is void. Accessories not manufactured by IC CONTROLS are subject to the manufacturer's warranty terms and conditions.

Limitations and exclusions:

Industrial electrodes, and replacement parts, are warranted to be free from defects in material and workmanship for a period of three (3) months from the date of installation or eighteen (18) months from the date of shipment when used under normal operating conditions and in accordance with the operating limitations and maintenance procedures given in the instruction manual and when not having been subjected to accident, alteration, misuse, abuse, freezing, scale coating, or poisoning ions.

Chemical solutions, standards or buffers carry an "out-of-box" warranty. Should they be unusable when first "out-of-box" contact IC CONTROLS immediately for replacement. To be considered for warranty, the product shall have an RA (Return Authorization) number issued by IC CONTROLS customer service department for identification and shall be shipped prepaid to IC CONTROLS at the above address.

In the event of failure within the warranty period, IC CONTROLS, or its authorized dealer will, at IC CONTROLS option, repair or replace the product non-conforming to the above warranty, or will refund the purchase price of the unit.

The warranty described above is exclusive and in lieu of all other warranties whether statutory, express or implied including, but not limited to, any implied warranty of merchantability or fitness for a particular purpose and all warranties arising from the course of dealing or usage of trade. The buyer's sole and exclusive remedy is for repair, or replacement of the non-conforming product or part thereof, or refund of the purchase price, but in no event shall IC CONTROLS (its contractors and suppliers of any tier) be liable to the buyer or any person for any special, indirect, incidental or consequential damages whether the claims are based in contract, in tort (including negligence) or otherwise with respect to or arising out of the product furnished hereunder.

Representations and warranties made by any person, including its authorized dealers, distributors, representatives, and employees of IC CONTROLS, which are inconsistent or in addition to the terms of this warranty shall not be binding upon IC CONTROLS unless in writing and signed by one of its officers.

Appendix A: 455 Spec. Sheet

INTELLIGENT CONDUCTIVITY ANALYZER



IC CONTROLS has incorporated intelligence into the microprocessor analyzers via the IC Net™ Advanced Intelligence Access Program. Measurements such as conductivity can be critical to your process and must be strictly monitored and maintained. Analyzer Intelligence goes beyond measurement and control; it provides the user with all necessary historical data, including events such as calibration, upsets, diagnostics and more. This information can be communicated for trending or advanced control, even to remote locations. Ultimately, the user has superior control with a competitive advantage.

The analyzer stores the last 12 monthly calibration records for communication or download and even keeps upset records! The last 20 upsets are recorded and date stamped (ie: out of spec, alarm, power interruptions, etc.) Factors leading to alarm conditions are recalled and for measurement trend hundreds of data points can be accessed at user defined time intervals. All of this communication is extremely fast; up to 38k baud.

The optional IC Net™ Intelligence Access Program runs in your PC Window using RS485/RS232 and provides your networked PC's access to multiple analyzers. IC Net™ allows intelligent system performance that emulates human intelligence through reasoning, manipulation of signals (or advance process control), and remote monitoring (via computer network, DCS, phone, Internet or satellite link).

This analyzer supports and communicates diagnostics! Settings can be viewed, functions tested, calibration updated and remote operated from your computer terminal (Note: requires IC Net™ Advanced Intelligence Access Program). An optional Real-Time clock allows accurate tagging of events and duration even through power outages.

Every IC CONTROLS microprocessor analyzer incorporates intelligence that enables advanced process control and the ability to communicate with ease and flexibility - all in one analyzer!

Let IC CONTROLS provide you with REAL SOLUTIONS to your control needs - buy IC CONTROLS Intelligent Analyzers.

The industrial conductivity instrument from IC CONTROLS, the Model 455, gives you maximum flexibility, reliability, and ease of use.

Intuitive user friendly program, "just seems to do what you expect":

- Auto calibration - recognizes your standards
- Self and sensor diagnostics
- Fault tolerant
- Output hold during calibration
- Two programmable 4-20mA for conductivity &/or temperature
- Dual programmable alarms with self and sensor alert
- Optional PID control
- Frequent adjustments by keypad prompts
- Program remembers what you were doing
- No long key sequences
- Instant return to sample
- Operate without menu or manual
- LCD displays Conductivity, temperature, alarm setpoints and calibration status.

EASY MAINTENANCE

- Reliable, separately powered and optically isolated output circuit prevents computer interface problems
- Alignment controls hidden, but accessible when needed
- 3 Level Security to protect settings
- Calculates sensor cell constant
- Durable housing withstands hosing down. Survives acid and caustic fumes, humidity, etc.

AUTOMATIC RANGING

- Reads directly in microsiemens (= micromhos)
- Full scale 1 to 200,000 micro siemens
- Values 10,000 and higher displayed as millisiemens

USE ANY COMBINATION OF THE FOLLOWING

- Local digital indication
- 4-20 mA signals
- 4-20 mA Micro PID Control
- Adjustable alarms
- ON-OFF control

The Model 455 is 115/230 VAC operated.

Model 455

SELECTION GUIDE

ORDER BY FAX: (519) 941-8164

MODEL 455	BASIC DESCRIPTION (NETWORKABLE MICROPROCESSOR CONDUCTIVITY ANALYZER)	
	<p>Industrial, input/output isolated INTELLIGENT CONDUCTIVITY analyzer/controller with NEMA 4X surface type housing. Front window shows 4½ digit display for autorange conductivity, temperature, current output and program messages. Precision ±1 digit, stability ± 2 digits per month. Future compatible Intelligent Analyzer logs in memory calibration records, alarms, and current measurement trends; or via RS485 two way communication in host real-time log; or sends its memory records on hosts request. 115 VAC line operated with serial RS485 output plus dual 4-20 mA DC outputs, fully program assignable span within 10 to 100% conductivity or -25 to 150°C (-13 to 302°F). Two relays, fully assignable, alarm on-off control, SPDT 10 Amp 115 VAC resistive; fully programmable setpoint and deadband, second relay may be used for intelligent problem alert. Includes activatable security, activatable uncompensated conductivity (USP23 compliant), and one instruction manual. See Option 35, IC Net™ Intelligence Access program for multi-analyzer to networked computers via two-way communication.</p>	
	ADD PROCESS CONTROL OUTPUT OPTIONS - FOR FULL PID CONTROL	
	-1	Single, PID driving 4-20 mA output
	-2	Single, PID driving pump pulser output
	-3	Single, PID driving time proportional on-off via relay #1
	ADD	OPTIONS
	-8	2" pipe / surface mounting kit, P/N A2500255
	-9	Panel mounting kit, P/N A2500201
	-10	supplied in a 1/2 Din metallic panel mount 144x144mm case (139x139 cutout)
	-21	0-15% NaOH (Sodium Hydroxide), uses 406-10.0 or 20.0
	-22	0-15% H2SO4 (Sulfuric Acid), uses 406-20.0
	-23	0-15% HCl (Hydrochloric Acid), uses 406-20.0
	-24	0-15% NaCl (Sodium Chloride), uses 406-10.0 or 20.0
	-25	TDS (Total Dissolved Solids)
	-26	0-20 Meg Ohm Resistivity, uses 402-0.01
	-27	0-200 ppt Salinity, uses 406-20.0
	-34	Real Time Clock for correct time with the power off
	-35	Advanced, IC Net™ Intelligence Access window program for multiple analyzers over one RS485 two-way link to multiple networked workstations. See Computer section.
	-36	Binary communication documentation for user to write a custom Intelligence Access program
	-37	RS232 Single Analyzer Communication, replaces RS485 loop communication
	-38	Reserved for future Fieldbus, replaces RS485
	-52	Back Lit Display, uniform green, P/N A9130023
	-62	Calibration and program for T.C. to 250°C (482°F)
	-63	Calibration and T.C. Program for High Purity Water
	-70(x)	Extra Instruction Manuals (x)
	-72(x)	Extension wire, 400 J-Box to analyzer, P/N A9200000, (x)ft. @ \$/ft.
	-89	Stainless Steel tag
	-90	100 µSiemen standard, 500 mL bottle, P/N A1100161 (available 6 pack is P/N A1100161-6P)
	-91	1,000 µSiemen standard, 500 mL bottle, P/N A1100162 (available 6 pack is P/N A1100162-6P)
	-92	10,000 µSiemen standard, 500 mL bottle, P/N A1100163 (available 6 pack is P/N A1100163-6P)
	-93	100,000 µSiemen standard, 500 mL bottle, P/N A1100164 (available 6 pack is P/N A1100164-6P)
	-96	Low Conductivity calibration kit for cell constants 0.01 - 0.1, P/N A1400051; STDs, supplies, instructions
	-97	Medium Conductivity calibration kit for cell constants 0.1 - 1.0, P/N A1400052; STDs, supplies, instructions
	-97	High Conductivity calibration kit for cell constants 10.0 - 50.0, P/N A1400053
	-99	Special

Sample Order:

455	-1	-	Conductivity Analyzer with PID control
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APPLICATION TIPS:

Autorange gains are cell constant x100, x1000, x10,000, x100,000 micro Siemens
 Select sensor cell constant to achieve desired span on x1000 for best results.

Appendix B: 456 Spec. Sheet

TWO SENSOR ANALYZER



IC CONTROLS has incorporated intelligence into the microprocessor analyzers via the IC Net™ Advanced Intelligence Access Program. Measurements such as conductivity can be critical to your process and must be strictly monitored and maintained. Analyzer Intelligence goes beyond measurement and control; it provides the user with all necessary historical data, including events such as calibration, upsets, diagnostics and more. This information can be communicated for trending or advanced control, even to remote locations. Ultimately, the user has superior control with a competitive advantage.

The analyzer stores the last 12 monthly calibration records for communication or download and even keeps upset records! The last 20 upsets are recorded and date stamped (ie: out of spec, alarm, power interruptions, etc.) Factors leading to alarm conditions are recalled and for measurement trend hundreds of data points can be accessed at user defined time intervals. All of this communication is extremely fast; up to 38k baud.

The optional IC Net™ Intelligence Access Program runs in your PC Window using RS485/RS232 and provides your networked PC's access to multiple analyzers. IC Net™ allows intelligent system performance that emulates human intelligence through reasoning, manipulation of signals (or advance process control), and remote monitoring (via computer network, DCS, phone, Internet or satellite link).

This analyzer supports and communicates diagnostics! Settings can be viewed, functions tested, calibration updated and remote operated from your computer terminal (Note: requires IC Net™ Advanced Intelligence Access Program). An optional Real-Time clock allows accurate tagging of events and duration even through power outages.

Every IC CONTROLS microprocessor analyzer incorporates intelligence that enables advanced process control and the ability to communicate with ease and flexibility - all in one analyzer!

Let IC CONTROLS provide you with REAL SOLUTIONS to your control needs - buy IC CONTROLS Intelligent Analyzers.

The two conductivity instrument from IC CONTROLS, the Model 456, gives you maximum flexibility, reliability, and ease of use.

Intuitive user friendly program, “*just seems to do what you expect*”:

Auto calibration - recognizes your standards

Self and sensor diagnostics

Output hold during calibration

Two programmable 4-20mA for conductivity &/or temperature

Dual programmable alarms with self and sensor alert

Optional PID control

Frequent adjustments by keypad prompts

Program remembers what you were doing

Instant return to sample

Operate without menu or manual

LCD displays Conductivity, temperature, alarm setpoints and calibration status.

USE YOUR TWO SENSORS

Redundant back up, switching automatically from sensor A to B on deviation.

Conductivity functions: Difference (a-b), Ratio (a/b), %Rejection (a-b)/a x 100, %Passage (b-a)/a x 100, and Temperature difference (Ta-Tb).

Two separate conductivity loops.

EASY MAINTENANCE

Reliable, separately powered and optically isolated output circuit prevents computer interface problems

Alignment controls hidden, but accessible when needed

3 Level Security to protect settings

Calculates sensor cell constant

Durable housing withstands hosing down. Survives acid and caustic fumes, humidity, etc.

AUTOMATIC RANGING

Reads directly in microsiemens (= micromhos)

Full scale 1 to 200,000 microsiemens

Values 10,000 and higher displayed as millisiemens

USE ANY COMBINATION OF THE FOLLOWING

Local digital indication

4-20 mA signals

4-20 mA Micro PID Control

Adjustable alarms

ON-OFF control

The Model 456 is 115/230 VAC operated.

Model 456

SELECTION GUIDE ORDER BY FAX: (519) 941-8164

Cond.

Conductivity

MODEL 456	BASIC DESCRIPTION (NETWORKABLE TWO-SENSOR DIFFERENTIAL CONDUCTIVITY ANALYZER)	
	Two Input Conductivity. Industrial, input/output isolated INTELLIGENT analyzer with NEMA 4X surface type housing. Front window shows 4½ digit display for autorange conductivity, temperature (or sum, difference, ratio, rejection %, & deviation), current output and program messages. Precision ±1 digit, stability ±2 digits per month. 115 VAC line operated with Serial RS485 output. Future compatible Intelligent Analyzer logs in memory calibration records, alarms, and current measurement trends; or via RS485 two way communication in host real-time log; or sends its memory records on hosts request. Dual 4-20 mA DC outputs, fully program assignable span within 10 to 100% conductivity or -25 to 150° C (13 to 302°F). Two relays, fully assignable, alarm on-off control, SPDT 10 Amp 115 VAC resistive; fully programmable setpoint and deadband, second relay may be used for intelligent problem alert. Includes activatable security and one instruction manual. Requires two conductivity sensors. See Option 35, IC Net™ Intelligence Access program for multi-analyzer to networked computers via two-way communication.	
	ADD PROCESS CONTROL OUTPUT OPTIONS - FOR FULL PID CONTROL	
	-1	Single, PID driving 4-20 mA output
	-2	Single, PID driving pump pulser output
	-3	Single, PID driving time proportional on-off via relay #1
	ADD	OPTIONS
	-5	Integral audible sonic alarm wired to relay A
	-6	Interact Output #1, 4-20 mA follows Difference (or Sum, Ratio, Rejection %, Deviation, etc.) readout
	-8	2" pipe / surface mounting kit, P/N A2500255
	-9	Panel mounting kit, P/N A2500201
	-10	supplied in a 1/2 Din metallic panel mount 144x144mm case (139x139 cutout)
	-34	Real Time Clock for correct time with the power off
	-35	Advanced, IC Net™ Intelligence Access window program for multiple analyzers over one RS485 two-way link to multiple networked workstations. See Computer section.
	-36	Binary communication documentation for user to write a custom Intelligence Access program
	-37	RS232 Single Analyzer Communication, replaces RS485 loop communication
	-38	Reserved for future Fieldbus, replaces RS485
	-52	Back Lit Display, uniform green, P/N A9130023
	-62	Calibration and program for T.C. to 250°C (482°F)
	-63	Calibration and T.C. Program for High Purity Water
	-70(x)	Extra Instruction Manuals (x)
	-72(x)	Extension wire, 400 J-Box to analyzer, P/N A9200000, (x) ft. @ \$/ft.
	-89	Stainless Steel tag

Sample Order:

456	-	-	Two Sensor Differential Conductivity Analyzer
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APPLICATION TIPS:

Autorange gains are cell constant x100, x1000, x10,000, x100,000 µSiemens
Select sensor cell constant to achieve desired span on x1000 for best results.

Appendix C: 453 Spec. Sheet

MICRO CONDUCTIVITY TRANSMITTER



IC CONTROLS has incorporated microprocessor intelligence into the Two-Wire Transmitters. Measurements such as Conductivity can be critical to your process and must be strictly monitored and maintained. Analyzer Intelligence goes beyond measurement and control; it provides the user with calibration data, including events such as sensor cell constant, range and diagnostics. Information can be communicated for trending or advanced control, even to remote locations. Ultimately, the user has superior control with a competitive advantage.

The analyzer stores the last calibration record Settings can be viewed, functions tested, calibration updated without opening the enclosure, by use of the front panel keypad.

Available in an Explosion Proof barrel housing. Useful even in sever plant environments it is always operated with the case sealed. Settings are viewed, functions tested, calibration updated without opening the housing, by use of an infrared remote keypad. The infrared light passes through the front viewing window to operate the micro, just like a TV. The remote can individually address any one of a group of units mounted together.

These Analyzers / Transmitters are 2-wire 24 VDC operated. Installation costs are less because no 115/240 VAC is needed at the transmitter field location. They require a separate 24 VDC supply and typically a 4-20 mA receiver.

Let IC CONTROLS provide you with REAL SOLUTIONS to your control needs - buy IC CONTROLS Microprocessor Two-Wire Transmitters.

The industrial microprocessor two-wire Conductivity transmitter from IC CONTROLS, the Model 453, gives you maximum flexibility, reliability, and ease of use. The transmitter is easily applied and panel mounts in a standard 1/2 DIN size RFI/EMI resistant case, with options available for pipe or wall mount. When needed a very rugged explosion proof case, option -9, is also available.

Not just a Transmitter, it is a full Conductivity Analyzer! You get full sensor functions, Standardize (cell constant calibration) and Auto Range adjustment, plus independent program adjustable 4-20 mA zero and span. Even with old deteriorated sensors, you enjoy higher accuracy over broad conductivity ranges. This Analyzer corrects for sensor condition to give corrected precision readings.

Intuitive user friendly program, “just seems to do what you expect”:

Auto calibration

Self and sensor diagnostics

Output hold during calibration

Reversible, programmable 4-20 mA zero and span

Adjustments by keypad or infra-red remote

Program remembers what you were doing

Instant return to sample, quickly locates you

Easy to operate without menu or manual

LCD displays Conductivity, temperature, mA output and calibration status.

EASY MAINTENANCE

Reliable, separately powered and input-output isolated circuit prevents computer interface problems

Calculates Conductivity sensor “Cell Constant”

Durable IP65 (Nema 4X) housing withstands hosing down. Survives acid and caustic fumes, humidity, etc.

USE ANY ELECTRODES

Submersible

Flow

Insertion / retractable

USE ANY OF THE FOLLOWING

Local digital indication

4–20 mA signal

IC Net™ Intelligence communication

The Model 453 is 24 VDC Two-Wire loop operated.

Model 453

Cond.
Conductivity

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 453	BASIC DESCRIPTION (MICROPROCESSOR CONDUCTIVITY TRANSMITTER)	
	Industrial, input/output isolated microprocessor Conductivity Transmitter with IP65 (NEMA 4X) panel type 1/2 DIN housing. Clear front window shows 4½ digit display selectable for Conductivity, temperature, current output and program messages. Precision ±1 digit, stability ±2 digits per month. 24 VDC 2-wire operated with 4-20 mA output. Fully program configurable 4-20 mA span, within 10 to 100% conductivity. Includes one instruction manual. Requires conductivity sensor sold separately.	
	ADD	(FUTURE) OUTPUT OPTIONS, (Note: a 4-20 mA is included)
	-35	(Future) Advanced, IC Net™ Intelligence Access window program for multiple analyzers over one serial two-way link to multiple networked workstations. See Computer section.
	-37	(Future Hart) Analyzer Communication, replaces IC Net™ loop communication
	-38	Reserved for future Fieldbus, replaces IC Net™
	ADD	OPTIONS
	-1	Configured for use with 400 interface; sensor within 300 ft. maximum
	-5	24 VDC power supply model 540 (115 or 230 VAC +/- 10% 50/60 Hz)
	-6	Intrinsic safe barrier
	-7	Wall mounting kit, P/N A2500268
	-8	2" pipe mounting kit, P/N A2500267
	-9	Explosion proof, class 1, Div. 1, barrel housing kit (requires opt -10 remote keypad)
	-10	Remote control keypad, intrinsic safe infra-red, operates one or more transmitters individually.
	-70(x)	Extra instruction manuals, \$ (ea.)
	-72(x)	Extension wire, 400 J-Box to analyzer, P/N A9200000; specify (x) ft. @ \$/ft.
	-89	Stainless Steel tag
	-99	Special

Sample Order:

453	-	-8	MICROPROCESSOR CONDUCTIVITY Transmitter, with pipe mounting kit
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APPLICATION TIPS:

- Aotorange gains are cell constant x100, x1000, x10,000, x100,000 micro Siemens
- Select sensor cell constant to achieve desired span on x1000 for best results
- Due to limited drive power (4 mA) the 453 may limit on the top conductivity range; use the next higher probe constant or Model 455 which has much higher probe drive power available.
- Two-wire 24V DC instruments require a power supply. To specify IC CONTROLS 2-wire power supply, see option -5
- Alarms can be added remotely using Model 585 Signal Conditioner

Appendix D: 401 Spec Sheet

HOT CONDENSATE SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

FOR RELIABLE MEASUREMENT

Return condensates (0 to 100 micro Siemens)

Hot aqueous samples

Tough environment problems

BENEFITS

Rugged industrial sensor

Low maintenance

Easy to calibrate

Rapid and accurate response

Weatherproof/explosion proof

Automatically temperature compensated

High operating temperature and pressure

IC CONTROLS factory certified calibration

Constructed of 316 SS and Kel-F

Direct insertion, 3/4" NPT screw-in design, or install into a 3/4" NPT tee. 1.0 and 2.0 constants require a 1" to 3/4" bushing and a 1" NPT tee.

Submersion mountable, using 3/4" FNPT on inside of a 1" pipe and a long sensor lead.

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 401	BASIC DESCRIPTION (complete Condensate Conductivity Sensor)	
	Rugged industrial condensate conductivity sensor with J-box, includes IC CONTROLS 455 temperature compensation, 0-150°C (32-302°F), 316 SS and Kel F construction for 400 PSIG at 100°C (212°F) or 250 PSIG at 150°C (302°F), and UL/CSA weatherproof/explosion proof terminal box. Process connection 3/4" MNPT, screw-in mount. Includes one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-0.1	0.1 sensor constant, recommended for 0-100 µSiemen, OK on 0-10 & 0-1,000	
-0.2	0.2 sensor constant, recommended for 0-200 µSiemen, OK on 0-20 & 0-2,000	
-1.0	1.0 sensor constant, recommended for 0-1,000 µSiemen, OK on 0-100 & 0-10,000	
-2.0	2.0 sensor constant, recommended for 0-2,000 µSiemen, OK on 0-200 & 0-20,000	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Change to 10K T.C. for 452 (& old uniloc type)	
-32	Change to 100 ohm Platinum T.C. (many makes)	
-51	Change to 100 Kohm T.C. for high temp. Recommended for 150-200°C (302-392°F); 452 & old uniloc type	
ADD	MATERIAL OPTION	
-62	High temperature, 316 SS and PEEK, maximum 200°C (392°F), required over 150°C (302°F)	
	ADD	OPTIONS
	-70(x)	Extra copies of instruction manual (x), \$ (EA)
	-71(x)	Long sensor cable (x)ft, maximum 100 ft, 100°C (212°F) max., length times \$/ft
	-72(x)	Cond. 400 J-Box to analyzer cable (x) feet, P/N A9200000. Priced length (x) times \$/ft.
	-73	Stainless steel flow cell, 1/8" NPT, 70 mL Volume, P/N A3100071
	-76	Small 14 mL volume stainless steel flow cell, 1/8" NPT, P/N A3100142
	-77	Basic replacement cell (no junction box & terminals)
	-78	Surface 400 J-Box & terminal strip for extr. wiring; -78XP =Xproof pipe type
	-89	Stainless steel tag
	-90	100 µSiemen standard, 500 mL bottle, P/N A1100161
	-97	Conductivity calibration kit for cell constants 0.1 - 5.0, P/N A1400052
	-99	Special

Sample Order:

401	-0.2	-	-	-90	Condensate diversion cell with 100 µSiemen standard
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RECOMMENDATION FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: 100 µSiemen standard, 500 mL bottle, P/N A1100161 (option -90)
- Normal: Medium Conductivity calibration kit for cell constants 0.1-5.0, P/N A1400052 (option -97)
- 1 mixed 6-pack of conductivity standards and accessories
 - one 500 mL 100 µSiemen (P/N A1100161)
 - two 500 mL 1,000 µSiemen (P/N A1100162)
 - one 500 mL 10,000 µSiemen (P/N A1100163)
 - one 500mL bottle of demin water for rinsing (P/N A1100192)
 - three 250 mL polyethylene beakers (P/N A7400020)
 - one 10 mL syringe (P/N A7400031)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9703440)

Appendix E: 402 Spec Sheet

HIGH PURITY SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

FOR RELIABLE MEASUREMENT

High purity water (10 micro Siemens to below 1 micro Siemens)

Hot pressurized samples

0 to 1 and 0 to 2 micro Siemens ranges

BENEFITS

Rugged industrial sensor

Low maintenance

Easy to calibrate

Rapid and accurate response

Weatherproof / explosion proof

High operating temperature and pressure, with automatic temperature compensation

IC CONTROLS factory certified calibration

Construction of 316 SS and Kel-F

Use in a sample flow system with a SS flow cell. (Picture has 1/8" NPT inlet and outlet ports.)

Direct insertion, 3/4" NPT screw-in design.

Submersion mountable by reversing 3/4" NPT fitting and installing into 3/4" FNPT on inside of a 1" pipe (requires long sensor leads).

SELECTION GUIDE

ORDER BY FAX: (519) 941-8164

MODEL 402	BASIC DESCRIPTION (complete Pure Water Conductivity Sensor)	
	High purity industrial conductivity sensor with J-box, includes IC CONTROLS 455 temperature compensation, 0-150°C (32-302°F). 316 SS and Kel F construction for 400 PSIG at 100°C (212°F) or 250 PSIG at 150°C (302°F), and UL/CSA weatherproof/explosion proof terminal box. Process connection ¾" MNPT, screw-in mount. Includes one instruction manual.	
	ADD SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
	-0.01	0.01 sensor constant, recommended for 0.0-1.0 and 0-10 µSiemen, OK on 0-100
	-0.02	0.02 sensor constant, recommended for 0.0-2.0 and 0-20 µSiemen, OK on 0-200
	-0.1	0.1 sensor constant, recommended for 0-100 µSiemen, OK on 0-10 & 0-1,000
	-0.2	0.2 sensor constant, recommended for 0-200 µSiemen, OK on 0-20 & 0-2,000
	ADD BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
	-31	Changed to 10K T.C. for 452 (& old uniloc type)
	-32	Changed to 100 ohm Platinum T.C. (many makes)
	ADD MATERIAL OPTION	
	-62	High temperature, 316 SS and PEEK, maximum 200°C (392°F), required over 150°C (302°F)
	ADD OPTIONS	
	-70(x)	Extra copies of instruction manual (x), \$ (EA)
	-71(x)	Long sensor cable (x)ft, maximum 100 ft, 100°C (212°F) max., length times \$/ft
	-72(x)	Cond. 400 J-Box to analyzer cable (x) feet, A9200000, length x \$/ft
	-73	Stainless steel flow cell 1/8" FNPT, recommended <10 µSiemen, P/N A3100071
	-77	Basic replacement cell, no J-Box and terminals
	-78	Surface 400 J-Box & terminal strip for extrn. wiring; -78XP =Xproof pipe type
	-89	Stainless steel tag
	-90	100 µSiemen standard, 500 mL bottle, P/N A1100161
	-97	Low Conductivity calibration kit for cell constants 0.01 to 0.2, P/N A1400051
	-99	Special

Sample Order:

402	-0.02	-	-	97	0 to 2 µSiemen high purity cell with calibration kit for accurate dilution standard
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RECOMMENDATION FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: 100 µSiemen standard, P/N A1100161, 500 mL bottle (option -90)
- Normal: Low Conductivity calibration kit for cell constants 0.01 to 0.2, P/N A1400051 (option -97)
 - 1 mixed 6-pack of conductivity standards and accessories
 - two 500 mL 100 µSiemen (P/N A1100161)
 - four 500 mL bottles of demin water for rinsing (P/N A1100192)
 - one 10 mL syringe (P/N A7400031)
 - two 100 mL polyethylene graduated cylinders (P/N A1100007)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9803460)

Appendix F: 403 Spec Sheet

BALL VALVE SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

FOR RELIABLE MEASUREMENT

- Return condensate
- Hot and/or pressurized aqueous samples
- Tough environment problems
- Applications where pressure cannot be reduced to zero for electrode removal

BENEFITS

- Ball valve retractable
- Rugged industrial sensor
- Low maintenance
- Easy to calibrate
- Rapid and accurate response
- Weatherproof/explosion proof
- Automatically temperature compensated
- High operating temperature and pressure
- IC CONTROLS factory certified calibration
- Construction 316 SS and Peek or Kel-F
- Can be used in a sample flow system with a stainless steel flow cell

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 403	BASIC DESCRIPTION (Ball Valve Removable Type Conductivity Sensor) Ball valve retractable industrial conductivity sensor, includes IC CONTROLS 455 temperature compensator 0-150°C (32-302°F) 316 SS, Ti, and Kel F construction for 100 PSIG at 100°C (212°F) or 75 PSIG at 150°C (302°F), with 1ft cable. Process connection 1" MNPT via ball valve, 3/4" direct. Includes one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-0.01	0.01 sensor constant, recommended for 0-1 and 0-10 µSiemen, OK on 0-100	
-0.02	0.02 sensor constant, recommended for 0-2 and 0-20 µSiemen, OK on 0-200	
-0.1	0.1 sensor constant, recommended for 0-100 µSiemen, OK on 0-10 & 0-1,000	
-0.2	0.2 sensor constant, recommended for 0-200 µSiemen, OK on 0-20 & 0-2,000	
-1.0	1.0 sensor constant, recommended for 0-1,000 µSiemen, OK on 0-100 & 0-10,000	
-2.0	2.0 sensor constant, recommended for 0-2,000 µSiemen, OK on 0-200 & 0-20,000	
-5.0	5.0 sensor constant, recommended for 0-5,000 µSiemen, OK on 0-500 & 0-50,000	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Changed to 10K T.C. for 452 (& old uniloc type)	
-32	Changed to 100 ohm Platinum T.C. (many makes)	
ADD	OPTION	
-19(x)	Extra long body (x) for thick walls (12" cable), (x)-17 x \$ per extra inch	
-21	Retraction ball valve (max 100 PSIG), fittings, safety lanyards, etc., P/N A2100052	
-22	Integral mounted explosion proof UL & CSA J-Box and terminal strip	
-70(x)	Extra copies of instruction manual (x), \$ (EA)	
-71(x)	Long sensor cable (x)ft, maximum 100 ft, 100°C (212°F) max., length times \$/ft	
-72(x)	Conductivity 400 J-Box to analyzer cable (x) feet, P/N A9200000, length times \$/ft	
-74	Stainless steel insertion gland fitting 3/4" MNPT, P/N A3100002	
-78	Surface 400 J-Box & terminal strip for extn. wiring; -78XP =Xproof pipe type	
-89	Stainless steel tag	
-90	100 µSiemen standard, 500 mL bottle, P/N A1100161	
-91	1,000 µSiemen standard, 500 mL bottle, P/N A1100162	
-92	10,000 µSiemen standard, 500 mL bottle, P/N A1100163	
-93	100,000 µSiemen standard, 500 mL bottle, P/N A1100164	
-97	Medium Conductivity calibration kit for cell constants 0.1 - 5.0, P/N A1400052; for cell constants 0.01 & 0.02, P/N A1400051	
-99	Special	

403	-1.0	-	-21-22	Normal ball valve configuration (as pictured)
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RECOMMENDATIONS FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: Low and high range of constant selected of options -90 & -91 or -91 & -92 or -92 & -93
- Normal: Medium Conductivity calibration kit for cell constants 0.1-5.0, P/N A1400052 (option -97)
- 1 mixed 6-pack of conductivity standards and accessories
 - one 500 mL 100 µSiemen (P/N A1100161)
 - two 500 mL 1,000 µSiemen (P/N A1100162)
 - one 500 mL 10,000 µSiemen (P/N A1100163)
 - one 500mL bottle of demin water for rinsing (P/N A1100192)
 - three 250 mL polyethylene beakers (P/N A7400020)
 - one 10 mL syringe (P/N A7400031)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9703440)

Appendix G: 404 Spec Sheet

GENERAL PURPOSE SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

FOR RELIABLE MEASUREMENT

Medium conductivity applications
Corrosive and chemical problems
Process liquids

BENEFITS

Universal industrial sensor
Low maintenance
Easy to calibrate
Rapid and accurate response
Automatically temperature compensated
Medium temperatures and pressures
IC CONTROLS factory certified calibration
Constructed of Hastelloy "C" and PVC with PVDF and TFE available for higher temperatures and pressures
Dual threaded design handles submersion, screw-in and flow through applications; all with one interchangeable sensor

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 404	BASIC DESCRIPTION (complete General Purpose Screw-In Conductivity Sensor) Universal industrial conductivity sensor, includes IC CONTROLS 455 temperature compensator, 0-120°C (32-248°F), used with IC CONTROLS 455 analyzers. Titanium and PVC construction for 60 PSIG at 60°C (140°F) to 175 PSIG at 38°C (100°F). Process connection 1" MNPT. Screw-in mount or submersion. Supplied with 10' lead length. Includes one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-0.1	0.1 sensor constant, recommended for 0-100 µSiemen, OK on 0-10 & 0-1,000	
-0.2	0.2 sensor constant, recommended for 0-200 µSiemen, OK on 0-20 & 0-2,000	
-1.0	1.0 sensor constant, recommended for 0-1,000 µSiemen, OK on 0-1,000 & 0-10,000	
-2.0	2.0 sensor constant, recommended for 0-2,000 µSiemen, OK on 0-200 & 0-20,000	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Changed to 10K T.C. for 452 (& old uniloc type)	
-32	Changed to 100 ohm Platinum T.C. (many makes)	
ADD	OPTIONS	
-51	Titanium, TFE and PVDF construction for 60 PSIG at 120°C (248°F) to 175 PSIG at 50°C (122°F)	
-70(x)	Extra copies of instruction manual (x), \$ (EA)	
-71(x)	Long sensor cable (x)ft, maximum 100 ft, 100°C (212°F) max., length times \$/ft	
-72(x)	Cond. 400 J-Box to analyzer cable (x) feet, A9200000, length x \$/ft	
-73	PVC flow cell, 1" FNPT, P/N A3100146	
-74	PVDF flow cell, 1" FNPT, P/N A3100147	
-78	Surface 400 J-Box & terminal strip for extn. wiring; -78XP = Xproof pipe type	
-89	Stainless steel tag	
-90	100 µSiemen standard, 500 mL bottle, P/N A1100161	
-91	1,000 µSiemen standard, 500 mL bottle, P/N A1100162	
-92	10,000 µSiemen standard, 500 mL bottle, P/N A1100163	
-97	Medium Conductivity calibration kit for cell constants 0.1 - 5.0, P/N A1400052	
-99	Special	

Sample Order:

404	-1.0	-51	-	Process style PVDF and TFE sensor for medium temperature and pressure
404	-2.0	-	-91	PVC type sensor for 0-2,000 µSiemen with standard, used up to 60 PSI & 60°C (140°F)

RECOMMENDATIONS FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: Low and high range for sensor constant selected of options -90 & -91 or -91 & -92.
- Normal: Medium Conductivity calibration kit for cell constants 0.1-5.0, P/N A1400052 (option -97)
- 1 mixed 6-pack of conductivity standards and accessories
 - one 500 mL 100 µSiemen (P/N A1100161)
 - two 500 mL 1,000 µSiemen (P/N A1100162) - one sensor cleaning brush (P/N A1100016)
 - one 500 mL 10,000 µSiemen (P/N A1100163) - one instruction sheet (P/N V9703440)
 - one 500mL bottle of demin water for rinsing (P/N A1100192)
 - three 250 mL polyethylene beakers (P/N A7400020)
 - one 10 mL syringe (P/N A7400031)

Appendix H: 405 Spec Sheet

EASY-CLEAN SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

RELIABLE MEASUREMENT

Sewers
Fouling environments
Tough problem areas

FEATURES

Easy to clean and can be filed to renew surface
Easy to calibrate
Flat or open surfaces
Rapid and accurate response
Ambient temperature and pressure
Constructed of carbon, PVC and epoxy
Automatically temperature compensated
IC CONTROLS factory certified calibration
Dual threaded design allows use as submersion, screw-in or flow sensor

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 405	BASIC DESCRIPTION (Easy Clean Style Sewer Conductivity Sensor) Sewer conductivity sensor, includes IC CONTROLS 455 temperature compensator, 0-75°C (32-167°F). Sensor has flat open slot construction for easy maintenance. Construction for 20 PSIG at 60°C (140°F) to 100 PSIG at 38°C (100°F). Process connection 1" FNPT. Screw-in or submersion, 10' lead length. Includes one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-0.2	0.2 sensor constant, recommended for 0-200 µSiemen, OK on 0-20 & 0-2,000,	
-0.5	0.5 sensor constant, recommended for 0-500 µSiemen, OK on 0-50 & 0-5,000,	
-1.0	1.0 sensor constant, recommended for 0-1,000 µSiemen, OK on 0-100 & 0-10,000	
-2.0	2.0 sensor constant, recommended for 0-2,000 µSiemen, OK on 0-200 & 0-20,000	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Changed to 10K T.C. for 452 (& old uniloc type)	
-32	Changed to 100 ohm Platinum T.C. (many makes)	
ADD	OPTIONS	
-70(x)	Extra copies of instruction manual (x), \$ (EA)	
-71(x)	Long sensor cable (x)ft, maximum 100 ft, 100°C (212°F) max., length times \$/ft	
-72(x)	Cond. 400 J-Box to analyzer cable (x) feet, A9200000, length x \$/ft	
-73	PVC flow cell, 1" FNPT, P/N A3100146	
-78	Surface 400 J-Box & terminal strip for extrn. wiring; -78XP = Xproof pipe type	
-89	Stainless steel tag	
-90	100 µSiemen standard, 500 mL bottle, P/N A1100161	
-91	1,000 µSiemen standard, 500 mL bottle, P/N A1100162	
-92	10,000 µSiemen standard, 500 mL bottle, P/N A1100163	
-97	Medium Conductivity calibration kit for cell constants 0.1 - 5.0, P/N A1400052	
-99	Special	

Sample Order:

405	-0.5	-	-90	Oily sewer sensor for 0-500 µSiemen with calibration standard
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RECOMMENDATION FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: Low and high range of constant selected of options -90 & -91 or -91 & -92.
- Normal: Medium Conductivity calibration kit for cell constants 0.1-5.0, P/N A1400052 (option -97)
- 1 mixed 6-pack of conductivity standards and accessories
 - one 500 mL 100 µSiemen (P/N A1100161)
 - two 500 mL 1,000 µSiemen (P/N A1100162)
 - one 500 mL 10,000 µSiemen (P/N A1100163)
 - one 500mL bottle of demin water for rinsing (P/N A1100192)
 - three 250 mL polyethylene beakers (P/N A7400020)
 - one 10 mL syringe (P/N A7400031)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9703440)

Appendix I: 406 Spec Sheet

HIGH CONDUCTIVITY FLOW SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

RELIABLE MEASUREMENT

0 to 12% NaOH

0 to 15% H₂SO₄

High conductivity solutions

BENEFITS

Industrial sensor

Low maintenance

Easy to calibrate

Rapid and accurate response

Automatically temperature compensated

IC CONTROLS factory certified calibration

Constructed of carbon, PVC and epoxy

Direct insertion screw-in design, cell can be installed directly into end of 1¼" pipe, or in flow cell design use 1¼" NPT tee

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 406	BASIC DESCRIPTION (High Range & Acid/Caustic Concentration Flow Sensor) Acid/caustic conductivity flow sensor, includes IC CONTROLS 455 temperature compensator, 0-60°C (32-140°F). Carbon PVC and epoxy construction for 10 PSIG at 60°C (140°F) to 100 PSIG at 38°C (100°F). Process connection 1" MNPT. Screw-in via 1½" tee, or option -75. Supplied with 5 foot lead length. Includes one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-5.0	5.0 sensor constant, recommended for 0-5,000 µSiemen, OK on 0-500 & 0-50,000	
-10.0	10.0 sensor constant, recommended for 0-10,000 µSiemen, OK on 0-1,000 & 0-100,000	
-20.0	20.0 sensor constant, recommended for 0-20,000 µSiemen, and % Acid/Caustic with 455	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Changed to 10K T.C. for 452 (& old uniloc type)	
-32	Changed to 100 ohm Platinum T.C. (many makes)	
ADD	OPTIONS	
-70(x)	Extra copies of instruction manual (x), \$ (EA)	
-71(x)	Conductivity sensor extension cable (x) length (25 ft. max.), cable length times \$/ft	
-72(x)	Cond. 400 J-Box to analyzer cable (x) feet, A9200000, length x \$/ft	
-75	CPVC 1½" flow cell, 1" FNPT connections, P/N A2100051	
-78	Surface 400 J-Box & terminal strip for extrn. wiring; -78XP = Xproof pipe type	
-89	Stainless steel tag	
-92	10,000 µSiemen standard, 500 mL bottle, P/N A1100163	
-93	100,000 µSiemen standard, 500 mL bottle, P/N A1100164	
-94	367,000 µSiemen standard, 500 mL bottle, P/N A1100165	
-97	High Conductivity calibration kit for cell constants 10.0 - 50.0, P/N A1400053	
-99	Special	

Sample Order:

406	-20.0	-	-93	0-15% H2SO4 sensor (opt-22 in 455) 100,000 µSiemen standard
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RECOMMENDATION FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: 100,000 µSiemen standard, P/N A1100164 (option -93)
- Normal: Two Calibration Caps for 406 (P/N A2100053); plus High Conductivity Calibration Kit for cell constants 10.0-50.0, P/N A1400053 (option -97)
- 1 mixed 6-pack of conductivity standards and accessories
 - two 500 mL 10,000 µSiemen (P/N A1100163)
 - two 500 mL 100,000 µSiemen (P/N A1100164)
 - two 500 mL 367,000 µSiemen (P/N A1100165)
 - one 10 mL syringe (P/N A7400031)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9703470)

Appendix J: 412 Spec Sheet

IN-PIPE CONDUCTIVITY SENSOR

Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!



RELIABLE MEASUREMENT

High conductivity applications

Large bore for Viscous fluids

Percent Acid or Caustic applications

Samples with entrained solids

BENEFITS

Safe in line flow through design

Large ¾" openings pass problem solutions with minimum maintenance

Removable sensor design makes calibration easy

Rapid and accurate response

Automatically temperature compensated

Medium temperatures and pressures

IC CONTROLS factory certified calibration

Constructed of CPVC, Viton and Titanium

Removable electrode design makes cleaning easy

SELECTION GUIDE
ORDER BY FAX: (519) 941-8164

MODEL 412	BASIC DESCRIPTION (Large 3/4" Bore In-Line Conductivity Sensor) Large bore high conductivity flow sensor, includes IC CONTROLS 455 temperature compensator, 0-90°C (32-194°F). Titanium, CPVC, and Viton construction for 60 PSIG at 80°C (176°F) to 100 PSIG at 38°C (100°F). Process connection 3/4" FNPT, in-line. Supplied with 5 foot lead length. Includes surface J-box (-78) and one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-10.0	10.0 sensor constant, recommended for 0-10,000 µSiemen, OK on 0-1,000 & 0-100,000	
-20.0	20.0 sensor constant, recommended for 0-20,000 µSiemen, and % Acid/Caustic with 455	
-50.0	50.0 sensor constant, recommended for 0-50,000 µSiemen, OK on 0-500,000 & 0-1,000,000	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Changed to 10K T.C. for 452 (& old uniloc type)	
-32	Changed to 100 ohm Platinum T.C. (many makes)	
ADD	OPTIONS	
-70(x)	Extra copies of instruction manual (x), \$ (EA)	
-72(x)	Conductivity 400 J-Box to analyzer cable (x) feet, P/N A9200000, length times \$/ft	
-78	Surface 400 J-Box & terminal strip for extrn. wiring; -78XP = Xproof pipe type	
-89	Stainless steel tag	
-92	6-pack 10,000 µSiemen standard, 500 mL bottle, P/N A1100163-6P	
-93	6-pack 100,000 µSiemen standard, 500 mL bottle, P/N A1100164-6P	
-94	6-pack 367,000 µSiemen standard, 500 mL bottle, P/N A1100165-6P	
-97	High conductivity calibration kit for cell constants 10.0 - 50.0, P/N A1400055, for long sensor	
-99	Special	

Sample Order:

412	-50.0	-	-94	500,000 µSiemen sensor with calibration standard
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RECOMMENDATION FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: 100,000 µSiemen standard, P/N A1100164 (option -93)
- Normal: One calibration endcap for 412 (P/N A2100058); plus Long Sensor Conductivity Calibration Kit for cell constants 10.0-50.0, P/N A1400055 (option -97)
 - 1 mixed 6-pack conductivity standards and accessories
 - 6-pack 500 mL 10,000 µSiemen (P/N A1100163-6P)
 - 6-pack 500 mL 100,000 µSiemen (P/N A1100164-6P)
 - 6-pack 500 mL 367,000 µSiemen (P/N A1100165-6P)
 - one 10 mL syringe (P/N A7400031)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9703470)

Appendix K: 425 Spec Sheet

QUICK UNION SENSOR



Why buy from IC CONTROLS ?

You will get REAL SOLUTIONS for conductivity: reliable, accurate, long-life sensors, free application support and ongoing help with calibration and service. You get sensors designed to give you the best possible value for money expended. The result is reliable, continuous, accurate conductivity readings, even in dirty, hot, humid corrosive environments, and a commitment from the IC CONTROLS team to get you those results. You get access to our conductivity specialists "Free of Charge" who are generally chemists and/or chemical engineers that understand conductivity sensors and how they interact with process liquids. Also "Free of Charge", you get access to our unique Application Development Laboratory. If you want help or better performance we will review your application and analyze any used conductivity sensor. This extra value added is then formulated into recommendations to improve your results, cut work needed, and costs.

Frequently new users have told us that they were referred to IC CONTROLS by staff at a related plant who were impressed by the extra value work done for them, the improved results and reduced workload achieved. They want to buy from IC CONTROLS too, to get that extra value for the day when they encounter problems.

IC CONTROLS does not just supply the conductivity sensors and some backup tests. Our commitment to you includes the supplies to properly clean and calibrate your sensors, and continues until you are satisfied with the results. IC CONTROLS developed calibration and cleaning procedures for continuous measurement calibration systems. IC CONTROLS NIST traceable conductivity standards and cleaning solutions provide you with the ability to maintain accuracy through proper calibration and cell integrity. An IC CONTROLS conductivity user in need of assistance with calibration techniques or any other matter is only a phone call away from our Application Development Laboratory specialists for advice and/or laboratory simulation of your problem. Buy from IC CONTROLS because you know the accuracy of your readings are as good as the quality of your calibrations, and you want the best results.

In short, buy from IC CONTROLS because you want to make your life easier, plus maintain or improve your conductivity results, but not increase costs. You want REAL SOLUTIONS to conductivity, value for your money!

The Model 425 Quick Union Conductivity Sensor is a universal version offered in an easy to install configuration for insertion or submersion applications. The Union style threaded fitting locks in the electrode for extra safety and very easy removal.

Recommended for applications where frequent removal in tough applications for calibration, cleaning or Q.C. checks are required.

RELIABLE MEASUREMENT

Environmental Monitoring
 Medium Conductivity applications
 Corrosive and Chemical problems
 Process Liquids

BENEFITS

Only one sensor needed for all uses
 Low maintenance
 Easy to calibrate
 Rapid and accurate response
 Automatically temperature compensated
 Medium temperatures and pressures
 IC CONTROLS factory certified calibration
 Constructed of Hastelloy "C" and CPVC with PVDF and TFE available
 QUICK UNION design handles, submersion, screw-in and flow through applications all with one interchangeable sensor

SELECTION GUIDE

ORDER BY FAX: (519) 941-8164

MODEL 425	BASIC DESCRIPTION (complete unit)	
	Universal industrial, union-type conductivity sensor, includes IC CONTROLS 455 temperature compensator 0-150°C (32-302°F). Standard Titanium & CPVC body construction for 60 PSIG at 90°C (194°F) to 100 PSIG at 50°C (122°F). Cable length 5ft, process connection 1½" MNPT Quick Union fitting or submersion mounted on ¾" FNPT. Includes one instruction manual.	
ADD	SENSOR CONSTANT OPTIONS and RECOMMENDED RANGE	
-0.1	0.1 sensor constant, recommended for 0-100 µSiemen, OK on 0-10 & 0-1,000	
-0.2	0.2 sensor constant, recommended for 0-200 µSiemen, OK on 0-20 & 0-2,000	
-1.0	1.0 sensor constant, recommended for 0-1,000 µSiemen, OK on 0-100 & 0-10,000	
-2.0	2.0 sensor constant, recommended for 0-2,000 µSiemen, OK on 0-200 & 0-20,000	
ADD	BASE UNIT INCLUDES TC for 455; TO CHANGE TC	
-31	Changed to 10K TC for 452 (& old uniloc type)	
-32	Changed to 100 ohm Platinum TC (many makes)	
ADD	OPTIONS	
-53	PVDF body for 130°C (266°F) maximum. Requires -78	
-69	CPVC flow cell and insertion fitting, 1½" slip	
-70(x)	Extra copies of instruction manual (x), \$ (EA)	
-71(x)	Long sensor cable, (x) ft, min. 5 max. 100 ft, cable length times \$/ft	
-72(x)	Conductivity 400 J-Box to analyzer cable (x) feet, P/N A9200000, length times \$/ft	
-73	CPVC flow cell, 1½" FNPT, P/N A2300073	
-74	PVDF flow cell, 1½" FNPT, P/N A2300074	
-75	316 SS flow cell, 1½" FNPT, P/N A2300075	
-76	CPVC union insertion fitting, to 60 PSI at 90°C (194°F) maximum, 1½" MNPT, P/N A2300086	
-77	PVDF union insertion fitting, to 60 PSI at 90°C (194°F) maximum, 1½" MNPT, P/N A2300087	
-78	316 SS union insertion fitting, to 90 PSI at 130°C (266°F) maximum, P/N A2300088	
-89	Stainless steel tag	
-80	Surface 400 J-Box & terminal strip for extrn. wiring; -78XP =Xproof pipe type	
-90	100 µSiemen standard, 500 mL bottle, P/N A1100161	
-91	1,000 µSiemen standard, 500 mL bottle, P/N A1100162	
-92	10,000 µSiemen standard, 500 mL bottle, P/N A1100163	
-97	Conductivity calibration kit for cell constants 0.1 - 5.0 (1 year supply), P/N A1400052	
-99	Special	

Sample Order:

425	-1.0	-53-78	Hot water cell for 90°C (194°F) and 90 PSIG
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RECOMMENDATION FOR CALIBRATION AND SERVICE SUPPLIES:

- Minimum: Low and high range for sensor constant selected of options -90 & -91 or -91& -92
- Normal: Conductivity calibration kit for cell constants 0.1-5.0, P/N A1400052 (option -97)
 - 1 mixed 6-pack of conductivity standards and accessories
 - one 500 mL 100 µSiemen (P/N A1100161)
 - two 500 mL 1,000 µSiemen (P/N A1100162)
 - one 500 mL 10,000 µSiemen (P/N A1100163)
 - one 500mL bottle of demin water for rinsing (P/N A1100192)
 - three 250 mL polyethylene beakers (P/N A7400020)
 - one 10 mL syringe (P/N A7400031)
 - one sensor cleaning brush (P/N A1100016)
 - one instruction sheet (P/N V9703440)

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TWO SENSOR ANALYZERS



CONDUCTIVITY TWO-WIRE TRANSMITTER



pH ANALYZERS



ORP ANALYZERS



pH/ORP TWO-WIRE TRANSMITTERS



ppm DO ANALYZERS



ppb DO



ppm DO TWO-WIRE TRANSMITTERS



ppm CHLORINE ANALYZERS



CALIBRATORS



pH/ORP BASED CHLORINE