

Free Chlorine Measuring System

- COMPLETE SYSTEM INCLUDES sensor, connecting cable, analyzer, and flow controller.
- CONTINUOUS pH CORRECTION eliminates expensive and messy reagents and troublesome sample conditioning systems.
- MEASURES FREE CHLORINE IN SAMPLES having pH as high as 9.5.¹
- VARIOPOL QUICK-DISCONNECT FITTINGS make replacing sensors easy.
- CHOOSE FROM THREE feature-packed analyzers



¹In some cases, the sensor can be used in samples having pH as great as 10.0. Consult the factory.

APPLICATIONS

The Model FCL free chlorine system is intended for the determination of free chlorine in fresh water. Unlike free chlorine analyzers from other manufacturers, the Model FCL does not use expensive sample conditioning systems or messy reagents to control pH. Instead, the analyzer automatically compensates for changes in the pH of the sample. The Model FCL is not intended for the determination of total chlorine or combined chlorine (like monochloramine). Nor, can the FCL be used for the determination of chlorine in seawater.

FEATURES

The Model FCL uses a membrane-covered amperometric sensor. A polarizing voltage applied to a platinum cathode behind the membrane destroys any chlorine that diffuses through the membrane, keeping the concentration of chlorine in the sensor equal to zero. The current generated by the cathode reaction is proportional to the rate of diffusion of chlorine through the membrane. Because the concentration of chlorine in the sensor is zero, the diffusion rate and the current are proportional to the concentration of chlorine.

There is a difficulty, however. Amperometric free chlorine sensors measure only hypochlorous acid. Because free chlorine is a pH-dependent mixture of hypochlorous acid and hypochlorite ion, a change in pH will cause the sensor response to change even though the free chlorine level remained constant. Most manufacturers solve the problem by treating the sample with acid, which lowers the pH and converts hypochlorite ion into hypochlorous acid. The Model FCL avoids the expense and inconvenience of

sample conditioning by measuring the pH and applying a correction to the raw chlorine sensor signal. The correction is valid between pH 6.0 and 9.5. Below pH 6.0, no correction is needed. For samples having pH between 9.5 and 10.0, consult the factory.

The Model FCL is available in two options: Model FCL-01 with manual pH correction and Model FCL-02 with continuous pH correction. Choose the FCL-01 if the pH varies less than 0.2 or if pH changes are predictable or seasonal. Choose the FCL-02 if the pH varies more than 0.2. To provide the continuous pH correction, the Model FCL-02 requires a separate pH sensor.

Maintenance is fast and easy. Replacing a membrane requires no special tools or fixtures. A screw cap holds the pre-tensioned membrane in place. Replacing the electrolyte solution takes only minutes.

Valves, rotameters, and pressure regulators to control sample flow are things of the past with the Model FCL. A constant head overflow sampler ensures the correct sample flow to the sensors. To eliminate wiring hassles, quick-disconnect Variopol cable prewind to the analyzer is standard.

The Model FCL is available with the choice of three easy to use analyzers.

Stable free chlorine standards do not exist. The chlorine sensor must be calibrated using the results of a laboratory test run on a grab sample.

SPECIFICATIONS — GENERAL

Sample requirements:

Pressure: 3 to 65 psig (122 to 549 kPa abs)

A check valve in the inlet prevents the sensor flow cells from going dry if sample flow is lost. The check valve opens at 3 psig (122 kPa abs). If the check valve is removed, minimum pressure is 1 psig (108 kPa abs).

Temperature: 32 to 122°F (0 to 50°)

Minimum Flow: 3 gal/hr (11 L/hr)

Maximum flow: 80 gal/hr (303 L/hr); high flow causes the overflow tube to back up.

Sample Conductivity: >50 µS/cm at 25°C

Process connection: 1/4-in OD tubing compression fitting (can be removed and replaced with a barbed fitting for use with soft tubing).

Drain connection: 3/4-in barbed fitting. Sample must drain to open atmosphere.

Wetted parts:

Overflow sampler and flow cell: acrylic, polycarbonate, Kynar^{®1}, nylon, silicone

Chlorine sensor: Noryl^{®2}, Viton^{®3}, wood, silicone, polyethersulfone, polyester, and platinum

pH sensor: Tefzel^{®4}, Viton, glass, ceramic

Response time to step change in chlorine concentration: <80 sec to 95% of final reading for inlet sample flow of 3 gph (11 L/hr).

Weight/shipping weight:

Model FCL-01: 10 lb/13 lb (4.5 kg/6.0 kg)

Model FCL-02: 11 lb/14 lb (5.0 kg/6.5 kg)

[rounded to the nearest 1 lb. (0.5 kg)]

SPECIFICATIONS — SENSOR

Free chlorine range: 0 to 10 ppm as Cl₂. For higher ranges, consult the factory.

pH correction range: 6.0 to 9.5. For samples having pH between 9.5 and 10.0, consult the factory. For manual pH correction, choose option -01. For continuous pH correction choose option -02.

Accuracy: Accuracy depends on the accuracy of the chemical test used to calibrate the sensor.

Electrolyte volume: 25 mL (approx.)

Electrolyte life: 3 months (approx.); for best results replace electrolyte monthly.

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

² Noryl is a registered trademark of General Electric.

³ Viton is a registered trademark of E.I. duPont de Nemours & Co.

⁴ Tefzel is a registered trademark of E.I. duPont de Nemours & Co

SPECIFICATIONS — MODEL 1055-24 ANALYZER

Case: ABS. NEMA 4X/CSA 4 (IP65).

Conduit openings: Accepts PG13.5 or 1/2 in. conduit fittings

Display: Two line, 16-character, back-lit display. Character height: 4.8 mm. Display can be customized to meet individual requirements.

Ambient temperature and humidity: 0 to 50°C, (32 to 122°F) RH 5 to 95% (non-condensing)

Note: The analyzer is operable from -20 to 60°C (-4 to 140°F) with some degradation in display performance.

Power:

115/230 Vac ±15%, 50/60 Hz ±6%, 8.0W
Installation Category II

 Equipment protected throughout by double insulation.

Ordinary Location:



POLLUTION DEGREE 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

RFI/EMI: EN-61326

LVD: EN-61010-1



Outputs: Two 4-20 mA or 0-20 mA isolated outputs.

 Continuously adjustable. Linear or logarithmic. Maximum load 600 ohms. Output dampening with time constant of 5 sec is user-selectable.

Alarms: Three alarm relays for process measurement(s) or temperature. Alarm 3 can be configured as a fault alarm, instead of a process alarm. Each relay can be configured independently. Alarm logic (high or low activation) and deadband are user-programmable.

Relays: Form C, SPDT, epoxy sealed



	Resistive	Inductive
28 Vdc	5.0 A	3.0 A
115 Vac	5.0 A	3.0 A
230 Vac	5.0 A	1.5 A

Terminal Connections Rating: 26-14 AWG wire size

SPECIFICATIONS — MODEL 54eA ANALYZER

Case: Epoxy-painted cast aluminum, NEMA4X (IP65).

Front Panel: Membrane keypad with tactile feedback. Three green LEDs indicate alarm status. Red LED indicates fault condition.

Conduit Openings: Accepts PG 13.5 or 1/2 inch conduit fittings

Display: Three-line, back-lit, dot matrix LCD, 70 x 35 mm. First line is measurement reading. Second line is temperature and current output. Third line is user-selectable. Character heights: 1st line - 16 mm (0.6 in.), 2nd and 3rd lines - 7 mm (0.3 in.).

Ambient Temperature and Humidity: 0 to 50°C (32 to 122°F). 95% (maximum) non-condensing.

Analyzer can be operated between -20 and 60°C (-4 to 140°F) with some degradation in display quality.

Power: 100-127 Vac ± 10%, 50/60 Hz ± 6%, 8 W
200-253 Vac ± 10%, 50/60 Hz ± 6%, 8 W

RFI/EMI: EN-61326



LVD: EN-61010-1

Outputs: Two 4-20 mA or 0-20 mA isolated outputs. Continuously adjustable. Outputs can be assigned to chlorine or temperature. Output dampening is user-selectable. Maximum load at 115/230 Vac is 600Ω. Maximum load at 100/200 Vac is 550Ω.



Alarms: Three alarm relays for process measurement, temperature or interval timer. The fourth alarm relay is a sensor/analyzer process fault alarm.

Relay Contacts: Relays 1-3: Form A, SPST, NO, epoxy sealed. Relay 4: Form C, SPDT, epoxy sealed



	Resistive	Inductive
28 Vdc	5.0	3.0
115 Vac	5.0	3.0
230 Vac	5.0	1.5

SPECIFICATIONS — MODEL 1056 ANALYZER

Case: Polycarbonate NEMA 4X/CSA 4 (IP65).

Conduit openings: Accepts PG13.5 or 1/2 in. conduit fittings

Display: Monochromatic back-lit LCD. Main character height 0.6 in (15mm). Display is user-programmable

Ambient temperature and humidity: 32 to 131°F (0 to 55°C); RH 5 to 95% (con-condensing)

Storage temperature: -4 to 140°F (-20°C and 60°C)

Power: 84-265 Vac, 47.5 to 65.0 Hz, switching, 15 W

Equipment protected by double insulation

RFI/EMI: EN-61326



LVD: EN-61010-1

Outputs: Two 4-20 mA or 0-20 mA isolated outputs. Continuously adjustable. Linear or logarithmic. Maximum load 550 ohms. Output dampening is user-adjustable.



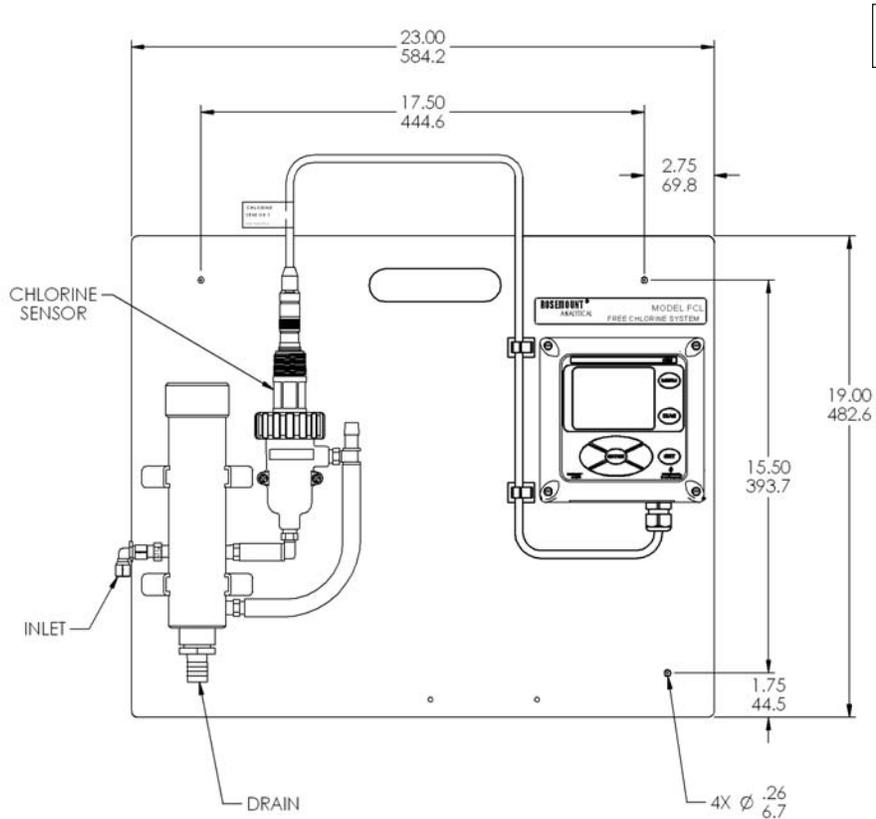
Alarm relays (option -03 only): Four alarm relays for process measurement(s) or temperature. Any relay can be configured as a fault alarm instead of a process alarm. Each relay can be configured independently and each can be programmed with interval timer settings.

Relays: Form C, SPDT, epoxy sealed

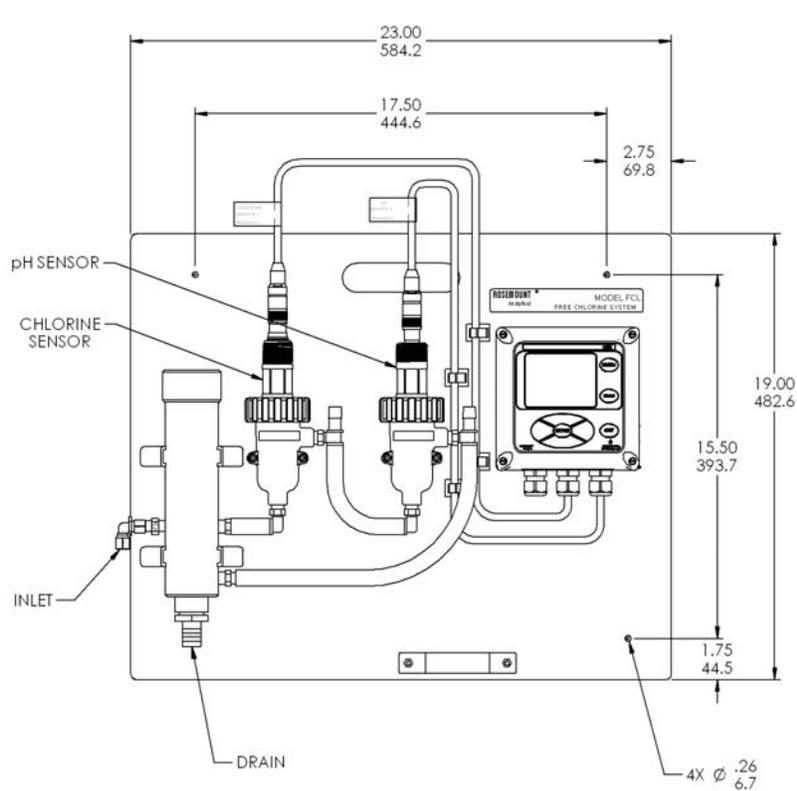


	Resistive	Inductive
28 Vdc	5.0	3.0
115 Vac	5.0	3.0
230 Vac	5.0	1.5

Terminal Connections Rating: Power connector (3-leads): 24-12 AWG wire size. Signal board terminal blocks: 26-16 AWG wire size. Current output connectors (2-leads): 24-16 AWG wire size. Alarm relay terminal blocks: 24-12 AWG wire size.



Model FCL-01-220 shown. All versions of the FCL-01 have the same overall dimensions



Model FCL-02-221 shown. All versions of the FCL-02 have the same overall dimensions

MODEL FCL-1055 ENGINEERING SPECIFICATION

1. The system shall be suitable for the determination of free chlorine in water having conductivity greater than about 50 uS/cm at 25°C and pH between about 5.5 and 9.5 without the use of reagents.
2. The system shall consist of an analyzer, a free chlorine sensor, a pH sensor (if required), flow cells for each sensor and a flow controller. The components shall be mounted on a back plate. Sensor cables shall be pre-wired to the analyzer. Sensors shall plug into the cables using Variopol quick disconnect fittings. The sensor flow cells shall be clear plastic to allow the sensors to be easily inspected for fouling. The inlet shall be fitted with a check valve to ensure the sensors remain wet in the event sample flow is lost.
3. The system shall use no mechanical devices, such as pressure regulators, valves, or rotameters, to control flow. Instead, flow shall be regulated using a constant head flow controller. Minimum sample flow shall be no more than about 3 gallons per hour (11 liters per hour). Maximum flow can be as high as 80 gallons per hour (303 liters per hour). The flow controller shall be able to handle inlet pressure between 3 and 65 psig (122 to 549 kPa abs) and temperature between 32 and 122°F (0 and 50°C).
4. The free chlorine sensor shall be a two-electrode, membrane-covered amperometric sensor. The free chlorine sensor shall be fitted with an RTD to allow continuous correction for changes in membrane permeability caused by temperature. The linear range of the free chlorine sensor shall be at least between 0 and 10 ppm as Cl₂.
5. The pH sensor shall be a combination electrode having a glass sensing membrane and a double junction reference electrode.
6. The pH sensor shall be required if the pH of the sample varies more than about 0.2 units peak-to-peak. For pH variations less than 0.2, the pH sensor shall generally not be required.
7. The analyzer shall have dual input, one for the free chlorine sensor and the other for the pH sensor (if needed). The analyzer shall receive the raw signal from the free chlorine sensor and automatically correct it for temperature and pH effects. Results shall be displayed as ppm Cl₂.
8. The analyzer shall require single point calibration if the expected chlorine level is within the linear range of the sensor. For high concentrations, where the sensor response is slightly non-linear, a dual slope calibration shall be available. A correction for the sensor zero current shall also be available.
9. The analyzer shall have automatic buffer recognition for pH sensor calibration.
10. The analyzer shall have a two line, back lit display. The display shall show ppm chlorine, pH, and temperature on one screen. The display shall be programmable to show additional information such as raw sensor current.
11. The analyzer shall be capable of operating between 32 and 122°F (0 and 50°C) and between 5 and 90% relative humidity (non-condensing).
12. The analyzer shall have dual 0/4-20 mA isolated outputs. Outputs shall be fully scalable and assignable independently to chlorine, pH, or temperature.
13. The analyzer shall have three alarm relays fully programmable for logic (high or low operation), dead band, and setpoint. One alarm shall be configurable as a fault alarm.
14. All analyzer programming shall be through a front panel membrane keypad. The language (English, Spanish, Italian, Portuguese, German or French) used in the menu screens shall be selectable by the user.
15. The analyzer shall have a security feature to prevent unauthorized tampering with calibration and configuration settings.
16. The analyzer shall be Rosemount Analytical Model FCL-01-210 (free chlorine only) or Model FCL-02-211 (free chlorine with continuous pH correction) or approved equal.

MODEL FCL-1056 ENGINEERING SPECIFICATION

1. The system shall be suitable for the determination of free chlorine in water having conductivity greater than about 50 uS/cm at 25°C and pH between about 5.5 and 9.5 without the use of reagents.
2. The system shall consist of an analyzer, a free chlorine sensor, a pH sensor (if required), flow cells for each sensor, and a flow controller. The components shall be mounted on a back plate. Sensor cables shall be pre-wired to the analyzer. Sensors shall plug into the cables using Variopol quick disconnect fittings. The sensor flow cells shall be clear plastic to allow the sensors to be easily inspected for fouling. The inlet shall be fitted with a check valve to ensure the sensors remain wet in the event sample flow is lost.
3. The system shall use no mechanical devices, such as pressure regulators, valves, or rotameters, to control flow. Instead, flow shall be regulated using a constant head flow controller. Minimum sample flow shall be no more than about 3 gallons per hour (11 liters per hour). Maximum flow can be as high as 80 gallons per hour (303 liters per hour). The flow controller shall be able to handle inlet pressure between 3 and 65 psig (122 to 549 kPa abs) and temperature between 32 and 122°F (0 and 50°C).
4. The free chlorine sensor shall be a two-electrode, membrane-covered amperometric sensor. The free chlorine sensor shall be fitted with an RTD to allow continuous correction for changes in membrane permeability caused by temperature. The linear range of the free chlorine sensor shall be at least between 0 and 10 ppm as Cl₂.
5. The pH sensor shall be a combination electrode having a glass sensing membrane and a double junction reference electrode.
6. The pH sensor shall be required if the pH of the sample varies more than about 0.2 units peak-to-peak. For pH variations less than 0.2, the pH sensor shall generally not be required.
7. The analyzer shall have dual input, one for the free chlorine sensor and the other for the pH sensor (if needed). The analyzer shall receive the raw signal from the free chlorine sensor and automatically correct it for temperature and pH effects. Results shall be displayed as ppm Cl₂.
8. The analyzer shall require single point calibration. A correction for the sensor zero current shall also be available.
9. The analyzer shall have automatic buffer recognition for pH sensor calibration.
10. The analyzer shall have a four line, back lit display. The display shall show ppm chlorine, pH (if required), and temperature on one screen. The display shall be programmable to show additional information such as raw sensor current.
11. The analyzer shall be capable of operating between 32 and 131°F (0 and 55°C) and between 5 and 95% relative humidity (non-condensing).
12. The analyzer shall have dual 0/4-20 mA isolated outputs. Outputs shall be fully scalable and assignable independently to chlorine, pH, or temperature.
13. The analyzer shall have four alarm relays fully programmable for logic (high or low operation), dead band, and setpoint. Relays shall also be configurable to energize when the analyzer detects a fault with the sensor or itself.
14. All analyzer programming shall be through a front panel membrane keypad. The language (English, Spanish, Italian, Portuguese, German, French, or Chinese) used in the menu screens shall be selectable by the user.
15. The analyzer shall have a security feature to prevent unauthorized tampering with calibration and configuration settings.
16. The analyzer shall be Rosemount Analytical Model FCL-01-220 (free chlorine only) or Model FCL-02-221 (free chlorine with continuous pH correction) or approved equal.

MODEL FCL-54EA ENGINEERING SPECIFICATION

1. The system shall be suitable for the determination of free chlorine in water having conductivity greater than about 50 uS/cm at 25°C and pH between about 5.5 and 9.5 without the use of reagents.
2. The system shall consist of an analyzer, a free chlorine sensor, a pH sensor (if required), flow cells for each sensor, and a flow controller. The components shall be mounted on a back plate. Sensor cables shall be pre-wired to the analyzer. Sensors shall plug into the cables using Variopol quick disconnect fittings. The sensor flow cells shall be clear plastic to allow the sensors to be easily inspected for fouling. The inlet shall be fitted with a check valve to ensure the sensors remain wet in the event sample flow is lost.
3. The system shall use no mechanical devices, such as pressure regulators, valves, or rotameters, to control flow. Instead, flow shall be regulated using a constant head flow controller. Minimum sample flow shall be no more than about 3 gallons per hour (11 liters per hour). Maximum flow can be as high as 80 gallons per hour (303 liters per hour). The flow controller shall be able to handle inlet pressure between 3 and 65 psig (122 to 549 kPa abs) and temperature between 32 and 122°F (0 and 50°C).
4. The free chlorine sensor shall be a two-electrode, membrane-covered amperometric sensor. The free chlorine sensor shall be fitted with an RTD to allow continuous correction for changes in membrane permeability caused by temperature. The linear range of the free chlorine sensor shall be at least between 0 and 10 ppm as Cl₂.
5. The pH sensor shall be a combination electrode having a glass sensing membrane and a double junction reference electrode.
6. The pH sensor shall be required if the pH of the sample varies more than about 0.2 units peak-to-peak. For pH variations less than 0.2, the pH sensor shall generally not be required.
7. The analyzer shall have dual input, one for the free chlorine sensor and the other for the pH sensor (if needed). The analyzer shall receive the raw signal from the free chlorine sensor and automatically correct it for temperature and pH effects. Results shall be displayed as ppm Cl₂.
8. The analyzer shall require single point calibration if the expected chlorine level is within the linear range of the sensor. For high concentrations, where the sensor response is slightly non-linear, a dual slope calibration shall be available. A correction for the sensor zero current shall also be available.
9. The analyzer shall have automatic buffer recognition for pH sensor calibration.
10. The analyzer shall have a three line, back lit display. The display shall show ppm chlorine and temperature on one screen. The user shall be able to customize the display to show additional information such as raw sensor current or analog output.
11. The analyzer shall be capable of operating between 32 and 122°F (0 and 50°C) and at 95% maximum relative humidity (non-condensing).
12. The analyzer shall have dual 0/4-20 mA isolated outputs. Outputs shall be fully scalable and assignable independently to chlorine, pH or temperature.
13. The analyzer shall have four alarm relays. Three shall be fully programmable for logic (high or low operation), dead band, and setpoint. The fourth alarm shall be a fault alarm.
14. All analyzer programming shall be through a front panel membrane keypad. The language (English, Spanish, Italian, German or French) used in the menu screens shall be selectable by the user.
15. The analyzer shall have a security feature to prevent unauthorized tampering with calibration and configuration settings.
16. The analyzer shall be Rosemount Analytical Model FCL-01-230 (free chlorine only) or Model FCL-02-230 (free chlorine with continuous pH correction) or approved equal.

ORDERING INFORMATION

Model FCL Free Chlorine Measuring System. The FCL is a complete system for the determination of free chlorine in water. It consists of the sensor(s), analyzer, and constant head overflow cup to control sample flow. All components are mounted on a backplate. Model option -02 includes a pH sensor for continuous, automatic pH correction. Three replacement membranes and a 4-oz. bottle of electrolyte solution are shipped with the chlorine sensor.

MODEL FCL FREE CHLORINE MEASURING SYSTEM	
CODE	pH CORRECTION (required selection)
01	Without continuous pH correction
02	With continuous pH correction
CODE	ANALYZER (required selection)
210	1055-01-10-24-68 1055, single input (chlorine) with UL approval (option -1 only)
211	1055-01-10-24-32-68 1055, dual input (chlorine and pH) with UL approval (option -2 only)
220	1056-03-24-38-AN, single input (chlorine) (option -01 only)
221	1056-03-24-32-AN, dual input (free chlorine) (option -02 only)
230	54eA-01 (for options -01 and -02)
FCL-02-221	EXAMPLE

COMPONENT PARTS

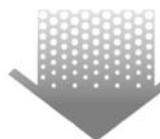
ANALYZER MODEL	DESCRIPTION
1055-01-10-24-68	1055 analyzer, single input (chlorine), wall mount, 115/230 Vac, with UL approval
1055-01-10-24-32-68	1055 analyzer, dual input (chlorine and pH), wall mount, 115/230 Vac, with UL approval
1056-03-24-38-AN	1056 analyzer, single input (chlorine), alarm relays, analog output, 115/230/VAC
1056-03-24-32-AN	1056 analyzer, dual input (chlorine and pH), alarm relays, analog output, 115/230 VAC
54eA-01	54eA analyzer, 115/230 VAC

SENSOR MODEL	DESCRIPTION
499ACL-01-54-VP	Free chlorine sensor with Variopol connector
399VP-09	pH sensor with Variopol connector

SENSOR CABLE	DESCRIPTION
23747-04	Interconnecting cable, Variopol for 499ACL sensor, 4 ft (1.2m)
23645-08	Interconnecting cable, Variopol for 399VP sensor, 4 ft (1.2m)

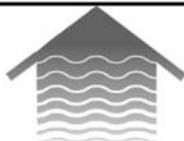
ACCESSORIES

PART #	DESCRIPTION
9240048-00	Tag, stainless steel (specify marking)



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the right answers,
right now.*

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Specifications subject to change without notice.



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