

NET SAFETY

MONITORING INC.

MODEL: CL2-10-ASSY 0-10ppm.

ELECTROCHEMICAL CL2
DETECTOR
(used with ST1500 Sensor)



(Photo for illustration purpose only.)

ISO 9001:2000



MAN-0080-00 Rev 00 Jul 2007

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This manual is a guide for the use of a Toxic Gas Transmitter and the data and procedures contained within this document have been verified and are believed to be adequate for the intended use of the transmitter. If the transmitter or procedures are used for purposes other than as described in the manual without receiving prior confirmation of validity or suitability, Net Safety Monitoring Inc does not guarantee the results and assumes no obligation or liability.

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Net Safety Monitoring Inc products are carefully designed and manufactured from high quality components and can be expected to provide many years of trouble free service. Each product is thoroughly tested, inspected and calibrated prior to shipment. Failures can occur which are beyond the control of the manufacturer. Failures can be minimized by adhering to the operating and maintenance instructions herein. Where the absolute greatest of reliability is required, redundancy should be designed into the system.

Net Safety Monitoring Inc, warrants its sensors and detectors against defective parts and workmanship for a period of 24 months from date of purchase and other electronic assemblies for 36 months from date of purchase.

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DESCRIPTION

The Net Safety Monitoring Inc. CL2-10-ASSY electrochemical Chlorine (CL2) gas detector consists of an enclosure, electronic circuitry and an electrochemical CL2 sensing element. This CL2 sensor provides continuous monitoring of chlorine concentrations in the range of 0 to 10 parts per million (ppm). The detector can be used with one of the Net Safety Monitoring Inc. Controllers or with other devices that are capable of monitoring a 4 to 20 mA dc input and provide for calibration of the incoming signal. The explosion-proof detector is CSA certified for use in hazardous locations.

FEATURES

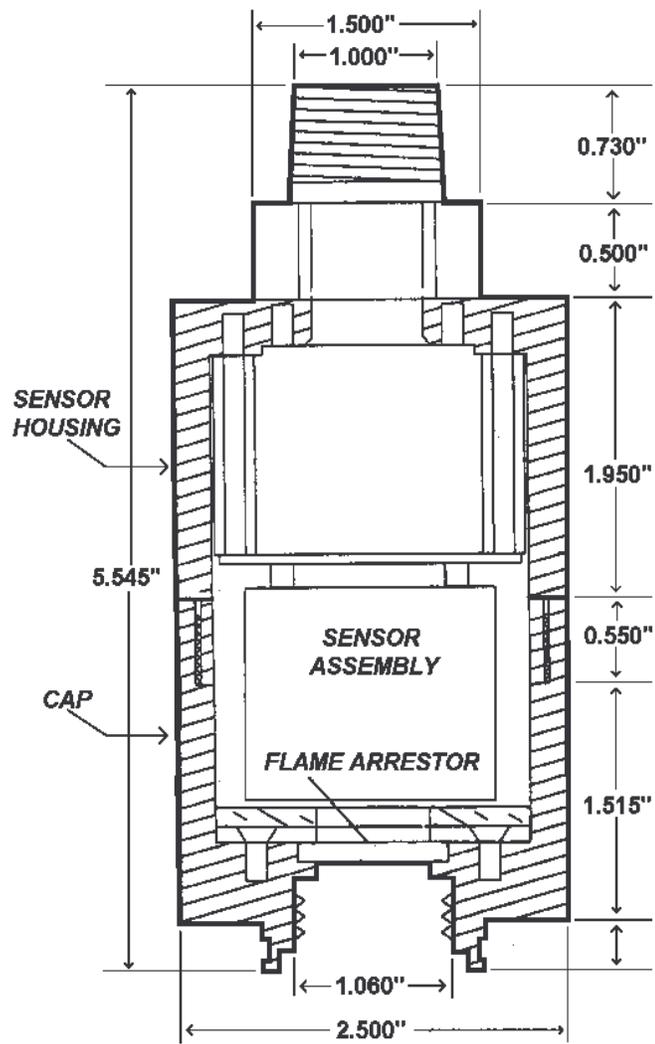
- ▶ Electrochemical sensor for increased accuracy, repeatability and reliability.
- ▶ Temperature compensation to ensure consistent performance over the entire operating temperature range.
- ▶ EMI/RFI protected.

SPECIFICATIONS

- ▶ **Operating Range:**
0 to 10 ppm
- ▶ **Response Time:**
90% full range within 60 seconds
Note: When CL2 concentration equal to full scale is applied.
- ▶ **Drift:**
Less than 2 ppm per month.
- ▶ **Linearity / Repeatability:**
3% FS / 2% FS.
- ▶ **Sensor Life:**
2 years in air
- ▶ **Operating Voltage:**
10 to 32Vdc. 24Vdc nominal.
- ▶ **Temperature Range:**
Operation: -20°C to +50°C (-40°F to +122°F)
Recommended Storage: 0°C to +20°C (+32°F to +68°F)
- ▶ **Humidity Range:**
15 to 90% RH, non-condensing.
- ▶ **Certification:**
CSA certified, Class 1, Division 2, Groups C & D.
- ▶ **Enclosure Material:**
Anodized aluminum or optional stainless steel.

- ▶ **Dimensions:**
Refer to *Figure 1*
- ▶ **Shipping Weight (Approximate):**
Housing: 2.5 pounds (1.1 kilograms)
Sensing element: 0.2 pounds (0.1 kilograms)

Figure 1 - CL2 Detector Assembly



SENSOR OPERATION

SENSING ELEMENT

The electrochemical sensing element uses capillary diffusion barrier technology for detecting the presence of chlorine gas. The electrochemical sensing element provides improved accuracy, reliability and extended calibration intervals when compared to ordinary solid-state type sensors.

The response of the sensing element is highly specific to CL2. Since many commonly encountered gases have little, if any, effect on the electrical response of the sensor, false indications caused by the presence of these gases is greatly reduced. Below is a list of typical responses of the CL2 electrochemical sensor when exposed to a given test gas concentration.

Gas	Concentration	CL2	Gas	Concentration	CL2
H2	100 ppm	0 ppm	HCN	10 ppm	0 ppm
CO	300 ppm	0 ppm	HCL	5 ppm	0 ppm
SO2	5 ppm	-0,05 ppm	NO2	5 ppm	= 5ppm
NO	35 ppm	0 ppm	C2H4	100 ppm	0 ppm

Table 1 - Cross Sensitivity of CL2 Sensor to Various Gas Concentration

SENSOR OUTPUT

The sensor housing contains circuitry for generating a 4 to 20 mA dc output signal corresponding to levels of CL2 from 0 to 10. The 4 to 20 mA output is an un-calibrated signal, therefore, calibration capabilities must be provided by a transmitter, controller or display module to be used with the sensor.

The sensor may be calibrated externally by removing it from the housing and placing it in a calibration appliance for adjustment. Consult your distributor.

INSTALLATION

CAUTION

The electrochemical sensor contains semiconductor devices that are sensitive to electrostatic discharge. Handle the device by the housing, taking care not to touch electronic components or terminals. Refer to 'Electrostatic Sensitive Device Handling Procedure' in the Appendix for further details.

DETECTOR POSITIONING

Proper detector positioning is essential for providing maximum protection. The most effective number and placement of sensors varies depending on the conditions at the job site. The individual performing the installation must rely on experience and common sense to determine the number of detectors needed and the best detector location.

NOTE

The finest detection system is of little value if the CL2 gas cannot readily come in contact with the sensor. First priority should be placing the sensor where the highest concentration of gas is anticipated.

The following factors are important and should be considered for every installation:

- ▶ Since chlorine is heavier than air, it will tend to settle near the floor or ground, unless it is heated, mixed with other gases that are lighter than air or prevented from settling by air movement.
- ▶ Consider how rapidly the CL2 will diffuse into the air. Select a location for the sensor as close as practical to an anticipated source.
- ▶ Consider ventilation characteristics of the immediate area. Air movement will cause the gas to become more concentrated in some areas than others. Always place the sensors where the most concentrated accumulation of chlorine gas is anticipated. Also consider the fact that some ventilation systems do not operate continuously.
- ▶ Locate the sensor away from potential sources of contamination (dirt, etc.) if possible.
- ▶ The sensor should be installed with **the flame arrestor pointing down** (refer to *Figure 1*) to prevent build-up of contaminants and enhance weather resistance.
- ▶ The sensor must be accessible for testing and calibration.
- ▶ Exposure to excessive heat or vibration can cause premature failure of electronic devices and should be avoided if possible. Shielding the device from intense sunlight will reduce solar heating and may increase the life of the unit.

WIRING REQUIREMENTS

Two wire cable is used for connecting the sensor to a transmitter, controller, or display module. The use of shielded cable is highly recommended to protect against interference caused by extraneous electrical "noise."

The maximum distance between the sensor and controller is limited by the resistance of the connecting wiring, which is a function of the gauge of the wire used. See table below for the maximum wiring distance for a given wire size. If a transmitter is used, refer to the transmitter manual for specific wiring instructions.

Wire Size (AWG)	Maximum Sensor To Controller Distance	
	Feet	Meters
18	5700	1750
16	9000	2800

Table 2 - Maximum Wiring Distances Sensor to Controller/Transmitter

SENSOR WIRING

1. Determine the best mounting locations for the sensors.
2. Mount the sensor junction box, allowing room between the junction box and the mounting surface for the sensor and calibration cup. The junction box should be electrically connected to earth ground
3. Remove the cover from the junction box.

NOTE

Do not apply power to the system with the junction box cover removed unless the area has been declassified.

4. Remove the cap from the sensor housing.
5. Remove the sensing element assembly from the packaging. Determine proper orientation for the assembly, then **carefully** plug it into the sensor housing.

NOTE ***Handle the sensing element assembly carefully. To avoid possible damage, observe the normally accepted procedures for handling electrostatic sensitive devices. Refer to 'Electrostatic Sensitive Device Handling Procedure' in the Appendix for further information.***

6. Place the cap back on the sensor housing. **Do not over tighten.**
7. Thread the sensor housing into the junction box. The sensor should be tight to ensure an explosion proof housing, but do **not** over tighten. CSA requires 5 full threads engaged.

NOTE

Coat sensor threads with an appropriate grease to ease installation. Lubricate the junction box cover threads and O-Ring to ensure a water-tight enclosure.

8. Connect the sensor wires to the sensor terminals inside the junction box. Connect the controller wiring to the controller wiring terminal block. Refer to *Figure 2* on the next page. **Connect the shield to earth ground at the controller end only.** Under normal conditions, the other end of the shield should not be connected at the sensor junction box unless such a connection is required by local wiring codes.

Wiring Code:	Red lead:	+24Vdc, (+12Vdc version dependant)
	Black lead:	signal
	Green lead:	Chassis (earth) ground

9. Check the sensor wiring to ensure proper connections. Place the cover back on the junction box.

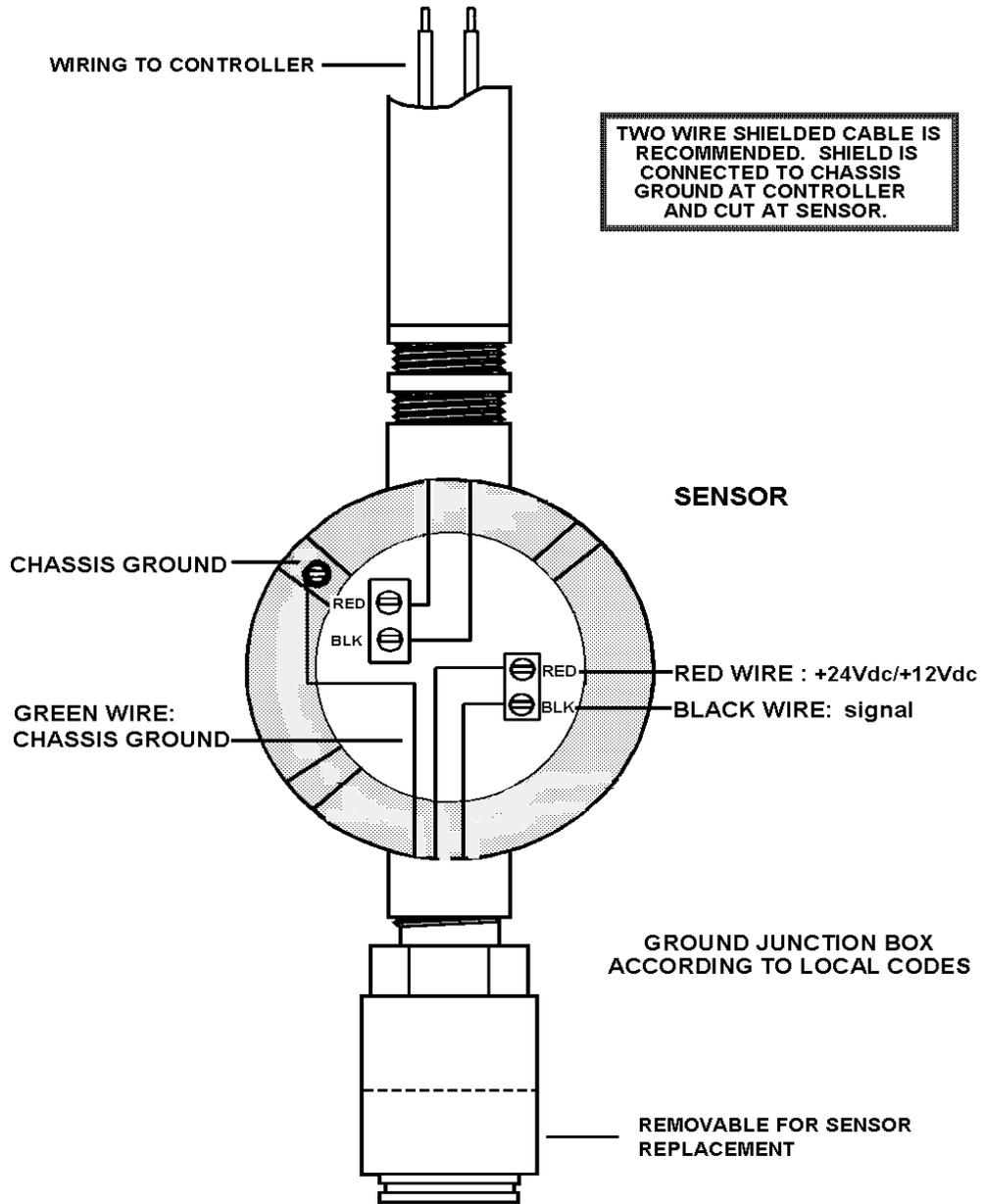


Figure 2 - Sensor Wiring

START-UP PROCEDURE

1. Secure output loads that are actuated by the system to prevent activation of these devices.
2. Check all wiring for proper connection. Be sure that the sensor has been wired properly.
3. Apply power to the system and allow the sensor to operate for about an hour, then perform the "Start-up Procedure" and "Calibration Procedure" as outlined in the transmitter, controller, or display module manual.
4. Place the system in normal operation.

CALIBRATION

Since each application is different, the length of time between regularly scheduled calibrations can vary from one installation to the next.

Calibration must be performed when:

- ▶ a new system is initially put into service;
- ▶ the sensing element is replaced, or;
- ▶ a transmitter or controller used with the sensor is replaced.

IMPORTANT

Do not use ampules and dilution bottles for calibration. Use certified bottled gas. To ensure adequate protection, the (CL2) detection system must be calibrated on a regularly scheduled basis.

It is recommended that the sensor be calibrated one hour after power-up and calibration should be checked every 30 days thereafter and re-calibrated if necessary. Consult the controller manual for proper calibration procedure.

It is acceptable to use ampules and dilution bottles for checking sensor response but not for calibration. **Use bottled gas for calibration.** Bottled gas has a limited shelf life. Be sure it is fresh.

MAINTENANCE

To ensure reliable protection it is important to check and calibrate the (CL2) detection system on a regularly scheduled basis. The frequency of these checks will vary depending on conditions such as relative humidity, dirty or dusty environments and exposure to CL2

Relative humidity is an important factor in the life expectancy of a sensor. Constant exposure to extremely dry conditions will shorten the sensor life. If possible, sensors that are operated in extremely dry areas should periodically be rotated to more humid environments in order to re-hydrate. A sensor that has been exposed to extremely dry environments and can no longer be spanned during calibration or has low sensitivity can be treated. The sensor should be placed in a moistened sealed bag and put in the refrigerator for 24 to 48 hours. Do not freeze. If this does not restore normal response the sensor must be replaced.

A rain shield/dust cover such as the CCS-1 should be used when the sensor may be exposed to rain, water splash or dust. Be aware that ice and snow build-up could block gas from entering the sensor.

SENSING ELEMENT REPLACEMENT

The sensing element assembly is not intended to be repaired. When calibration can no longer be performed properly, the assembly must be replaced. Spare sensing element assemblies should be kept on-hand for field replacement.

Care should be taken in storing spare sensing elements. For maximum protection against contamination and deterioration, sensing elements should not be removed from the original protective packaging until the time of installation. To ensure maximum storage life, sensing elements should be stored at a temperature between 5°C and 20°C (40°F and 68°F) and a relative humidity between 15 and 90 percent. A typical refrigerator is a good place for storage. Do not freeze. Storage time should be limited to 6 months or less.

The area must be de-classified or power to the detector must be removed prior to replacing the sensing element in a hazardous area.

To replace the sensing element in the CL2 detector:

1. Remove power from the detector.
2. Remove the cap from the detector housing.
3. Remove and discard the old sensing element assembly. Check for corrosion or contamination on the terminals inside the sensor enclosure; clean if necessary.
4. Determine the proper orientation for the new assembly, then **carefully** plug it in.

NOTE

Handle the sensing element assembly carefully. To avoid possible damage, observe the normally accepted procedures for handling electrostatic sensitive devices. Refer to "Electrostatic Sensitive Device Handling Procedure" for further information.

5. Place the cap back on the detector housing. Tighten only until snug; **do not over tighten.**
6. Re-apply power.
7. Allow time for the sensor to warm-up (approximately one hour for best results), then calibrate. **Always calibrate after replacing the sensing element.**

NOTE

The sensing element contains an acid that can leak. If a leakage should occur, handle the assembly carefully to prevent any acid from contacting the skin. If acid should come in contact with the skin, wash the affected area thoroughly with soap and water. Never attempt to open the sensing element.

TROUBLESHOOTING

PROBLEM	RECOMMENDATION
No 4 - 20 mA output	<ol style="list-style-type: none"> 1. Check the 10 to 32 power input. 2. Check that the green LED on the sensor circuit board is on. If off, check wiring, especially the polarity. Also check for proper connection at the sensor terminals in the junction box.
Fluctuating current output	<ol style="list-style-type: none"> 1. Check that all connections are good. 2. Check for AC noise interference on the cable. If noise does appear, contact your local distributor for assistance.
Cannot zero during calibration	<ol style="list-style-type: none"> 1. If used with a transmitter, controller, or display module, check for AC noise on the cable. If noise does appear, contact your local distributor. 2. Check current output from sensor by opening the loop or checking voltage across series resistor on terminal board. If output from sensor is too low (approx. 2.8mA or less), replace sensor.
Cannot span during calibration	<ol style="list-style-type: none"> 1. If the current output from the sensor is low the sensor may have been exposed to an extremely dry environment. Refer to 'Maintenance' section to rehydrate. 2. If output from sensor is too low replace sensor.
Low sensitivity	<ol style="list-style-type: none"> 1. Sensor may have been exposed to an extremely dry environment. Refer to 'Maintenance' section. 2. Check for a dirt deposit or other obstruction of the flame arrestor. Clean if necessary. Use a rain shield/dust cover if necessary.

Table 3 - Troubleshooting Guide

SPARE PARTS

XP-CL2 housing

ST1500-10ppm sensor

JB-T-A junction box

JB-T-A-PCBA connector board

Appendix A

Net Safety Monitoring Inc. Electrostatic Sensitive Device Handling Procedure

With the trend toward increasingly widespread use of microprocessors and a wide variety of other electrostatic sensitive semiconductor devices, the need for careful handling of equipment containing these devices deserves more attention than it has received in the past.

Electrostatic damage can occur in several ways. The most familiar is by physical contact. Touching an object causes a discharge of electrostatic energy that has built up on the skin. If the charge is of sufficient magnitude, a spark will also be visible. This voltage is often more than enough to damage some electronic components. Some devices can be damaged without any physical contact. Exposure to an electric field can cause damage if the electric field exceeds the dielectric breakdown voltage of the capacitive elements within the device.

In some cases, permanent damage is instantaneous and an immediate malfunction is realized. Often, however, the symptoms are not immediately observed. Performance may be marginal or even seemingly normal for an indefinite period of time, followed by a sudden and mysterious failure.

Damage caused by electrostatic discharge can be virtually eliminated if the equipment is handled only in a static safeguarded work area and if it is transported in a package or container that will render the necessary protection against static electricity. Net Safety Monitoring Inc. modules that might be damaged by static electricity are carefully wrapped in a static protective material before being packaged. Foam packaging blocks are also treated with an anti-static agent. If it should ever become necessary to return the module, it is highly recommended that it be carefully packaged in the original carton **and static protective wrapping**.

Since a static safeguarded work area is usually impractical in most field installations, caution should be exercised to handle the module by its metal shields, taking care not to touch electronic components or terminals.

In general, always exercise all of the accepted and proven precautions that are normally observed when handling electrostatic sensitive devices.

A warning label is placed on the packaging, identifying those units that use electrostatic sensitive semiconductor devices.



*Published in Accordance with E1A standard 471

MAN-0080-00 Rev 00 Jul 2007

Appendix B

Wire Resistance In Ohms

DISTANCE (FEET)	AWG #20	AWG #18	AWG #16	AWG #14	AWG #12	AWG #10	AWG #8
100	1.02	0.64	0.40	0.25	0.16	0.10	0.06
200	2.03	1.28	0.08	0.51	0.32	0.20	0.13
300	3.05	1.92	1.20	0.76	0.48	0.30	0.19
400	4.06	2.55	1.61	1.01	0.64	0.40	0.25
500	5.08	3.20	2.01	1.26	0.79	0.50	0.31
600	6.09	3.83	2.41	1.52	0.95	0.60	0.38
700	7.11	4.47	2.81	1.77	1.11	0.70	0.44
800	8.12	5.11	3.21	2.02	1.27	0.80	0.50
900	9.14	5.75	3.61	2.27	1.43	0.90	0.57
1000	10.20	6.39	4.02	2.53	1.59	1.09	0.63
1250	12.70	7.99	5.03	3.16	1.99	1.25	0.79
1500	15.20	9.58	6.02	3.79	2.38	1.50	0.94
1750	17.80	11.20	7.03	4.42	2.78	1.75	1.10
2000	20.30	12.80	8.03	5.05	3.18	2.00	1.26
2250	22.80	14.40	9.03	5.68	3.57	2.25	1.41
2500	25.40	16.00	10.00	6.31	3.97	2.50	1.57
3000	30.50	19.20	12.00	7.58	4.76	3.00	1.88
3500	35.50	22.40	14.10	8.84	5.56	3.50	2.21
4000	40.60	25.50	16.10	10.00	6.35	4.00	2.51
4500	45.70	28.70	18.10	11.40	7.15	4.50	2.82
5000	50.10	32.00	20.10	12.60	7.94	5.00	3.14
5500	55.80	35.10	22.10	13.91	8.73	5.50	3.46
6000	61.00	38.30	24.10	15.20	9.53	6.00	3.77
6500	66.00	41.50	26.10	16.40	10.30	6.50	4.08
7000	71.10	44.70	28.10	17.70	11.10	7.00	4.40
7500	76.10	47.90	30.10	19.00	12.00	7.49	4.71
8000	81.20	51.10	23.10	20.20	12.70	7.99	5.03
9000	91.40	57.50	36.10	22.70	14.30	8.99	5.65
10 000	102.00	63.90	40.20	25.30	15.90	9.99	6.28

NOTE: RESISTANCE SHOWN IS ONE WAY. THIS FIGURE SHOULD BE DOUBLED WHEN DETERMINING CLOSED LOOP RESISTANCE.

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MAN-0080-00 Rev 00 Jul 2007

