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Fluoroprobe®

O & M Manual

MODEL FL-2-S0

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Fluoroprobe

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Fluoroprobe™ (FL-2) O&M Manual
Product Description

Section 1

The Fluoroprobe™, FL-2 is an environmental instrument with a newly patented optical sensor designed for long term monitoring and control of dissolved oxygen in remote and harsh environments. The probe is designed to provide years of service without the constant maintenance required by galvanic or polargraphic type probes.

The Fluoroprobe™ is housed in a PVC body or stainless steel body with 0-ring sealed Duran end caps. The entire contents of the probe are potted with epoxy to eliminate any air space or leaks. **Warning: If any attempt is made to open the probe, the end connections will break loose and will not be able to be placed back together. The warranty will then be voided.**

The sensor is glass bonded on the end of the probe. There are no parts to replace or maintain, the lifetime of the sensor is based solely on the user's application and the surrounding environment's effect on the silicone rubber. It is suggested that the sensor be wiped off as needed, (at least once a month with a soft toothbrush or cloth) for preventative maintenance. An optional solar powered brush for cleaning the sensor can be ordered mounted on a float for remote or aquaculture applications. Unlike polargraphic and Galvanic probes, the Fluoroprobe™ sensor does not consume oxygen in order to operate, and therefore flow is not required across the sensor to continuously monitor oxygen.

The controller is housed in a weather proof NEMA 4X enclosure for permanent installation either outdoors or indoors. The enclosure has a clear viewing window and a large backlit display to read at a glance day or night.

Section 2 Control Settings - Description

The controller has several functions in its program. The rotary switch in the center is the main selector switch for the controller (See, fig-2 for faceplate Drawing). The D.O. position is the normal operating position that displays the level of oxygen in the environment to which the probe is exposed. The HIGH and LOW set points are adjusting pots for the main relay, which requires a small screwdriver to set. There is an optional pair of relays with set points for a system with multiple aeration control. These adjusting pots tell the relays when to turn on and are labeled SET 2 and SET 3 (See fig-3 for Relay Terminal Location).

The 4 to 20 mA connections are located on (fig-4). Also, information on span adjustments and wiring for data access.

Controls and Set Points

HIGH SET: Turn the rotary switch to **HIGH SET** and adjust the **HIGH SET** pot (on the right side of the controller) to the level you select as a cut off point. This adjustment can be made with a small screwdriver. This set point must be Higher than the **LOW SET** in order for the Low- High relay to operate.

LOW SET: Turn the rotary switch to **LOW SET** and adjust the **LOW SET** pot (on the lower right corner of the controller) to the level you select as the first relay cut on point. This adjustment can he made with a small screwdriver. This set point must be Lower than the **HIGH SET** in order for the Low-High relay to operate.

SET 2 is a back up relay for auxiliary equipment in case the oxygen level keeps falling. This relay has one setting, the **HIGH SET** will act as the cutoff.

SET 3 operates the same as **SET 2** and can be used for back up if the oxygen levels keep decreasing or an alarm.

OPERATION: Turn the rotary switch to the **DO** position and the system will operate automatically in accordance with the setting you have selected. **NOTE: If 4-20 mA output is being monitored by a computer or data logger, etc. The rotary switch must be in the D.O. position. The relay set points are not affected by the position of the rotary switch.**

Section 3 Introduction to Calibration

After installing the unit, allow the sensor 2 or 3 days in its new environment to stabilize before calibrating. The Fluoroprobe^{TM} is very stable and the longer it stays in the water, the better. The Fluoroprobe^{TM} is calibrated before shipping to a known zero (0) ppm standard, and air saturated water (8.47 D.0. @ 20^{o}C / 3000ft). Generally, the Fluoroprobe will not require calibration after installation, however, it is recommended to check the calibration at first use.

The operator should take D.O. readings with their hand held probe over the first few days at the location where the probe is installed. It is important that several days of readings with your handheld be observed before you make any adjustments to the Fluoroprobe^{TM}. The best thing to do if the units' readings appear odd is to do nothing and investigate thoroughly before making any adjustments. If your operation range is from 4.0 ppm down to 0.0 ppm, you should calibrate to a portable meter or a know standard in that range. Always use the **ZERO** calibration pot to make adjustments below 4.0 ppm. When the range is from 4.0 ppm and higher or you are calibrating to ambient air, use the **AIR** calibration pot only.

Note-. If air calibrating, allow thirty (30) minutes or more to stabilize the unit before comparing readings or making any adjustments. If the FL-2 reads zero (0.0) ppm, check the oxygen level with a handheld and then check the probe for trash blockage and/or clean the probe sensor with a small toothbrush. If the display stays at 19.90 all the time the unit has other problems and should be sent back to the manufacturer. **You may give us a call anytime for help - please see the back of the manual for the telephone number.**

Note: If the probe is being air calibrated in a pipe where the end of the pipe is submerged, vent holes must be drilled on both ends of the pipe to allow ambient air to purge the gases, which might give a false air calibration value. Drill holes in pipe just above the water line and at the top of the pipe. When air calibrating, the probe should be suspended between the holes in a white PVC pipe to help reflect heat from the sun.

Do not air calibrate the FL-2 if air temperatures is + 10 or -10 degrees from water temperature. Leave the probe in the water and use a handheld to compare readings. The FL-2 has temperature compensation, so never calibrate it until you know the probe has had ample time to adjust to temperature. If the readings do not look right to you investigate everything involved and wait till the next day to try again.

Suggested calibration for wastewater treatment: There are four (4) basic ways to calibrate the Fluoroprobe^{TM} controller, which are described in the following sections.

If you are using the FL-2 in a wastewater application and your operation range is 3 or 4 ppm down to 0 ppm use a hand held instrument to compare or calibrate. The sensor is more responsive and stable when left continuously in the water and calibrated within its normal operating environment. Always clean sensor with a toothbrush and place back in aeration 30 minutes or longer before any calibration. Bio-growth or debris covering the sensor will cause oxygen reading to slowly fall to zero, the only maintenance needed is once a month toothbrushing. Many aeration basins never have this growth problem.

1. **Air Saturated Water Calibration:**. For this technique, a volume of water must be aerated for twenty (20) minutes or longer at a constant temperature. The operator can use an aquarium pump and a stone diffuser (air stone). A cylinder of some type is best. PVC pipe (2"or 3") with a cap on the bottom is a good vessel to use for this method. Place the probe in the aerated water keeping the probe sensor near the top of the container for maximum efficiency. To obtain the correct current atmospheric pressure reading, use the local altitude or the true atmospheric pressure from a mercury barometer or weather bureau report. The same air calibration table used for polargraphic or galvanic calibration may also be used for reference. This technology is for long term monitoring and taking your time is very important when calibrating this instrument. After the probe has been submerged for twenty (20) minutes or more in the air-saturated water, press the **READ** button on the faceplate of the instrument. The operator will have about two (2) minutes to adjust the air calibrate adjustment screw on the faceplate to the air saturated water concentration. No water flow or movement in the probe is necessary in order to obtain 0_2 concentration readings. A hand held oxygen meter can be used in calibration to assure air saturation. If you are also zero calibrating, be sure to clean the probe before changing from one liquid to the next.

2. **Zero Calibration:** First prepare a container of oxygen depleted water. One of the chemicals that are effective in depleting the 0_2 in water is Sodium Sulfite ($NaSO_2$). Use one gram/quart of water, mix well and allow up to one hour to deplete the oxygen before using. **Warning: let probe sit in prepared water for (30) minutes or longer in order to allow the sensor to equilibrate prior to adjustment.** It may take as long as (45) minutes or more to go from air to zero level, so make sure a stable zero level has been obtained before adjusting the instrument. The probe can be gently moved up or down to speed the process, however no flow is required to calibrate or operate the instrument. When ready, press the red read button on the faceplate of the unit. This will allow (2) minutes to adjust the instrument using the zero calibrate set point. After adjustment, the unit will be calibrated to zero (0). Changing the probe from zero to air can contaminate the calibration solution so be sure to rinse the probe clean before each step.

3. **Air Calibration:** Air calibration is an easy and reliable method to use to calibrate the unit. This technique must be performed out of direct light. If the probe is mounted in a float device for aquaculture or mounted in a pipe for wastewater, pull the probe out of the water and wipe off the sensor end. After making sure the sensor is clean. **Note:** If the end of the probe is dried cleaned with a soft toothbrush the sensor will air saturate quicker. To calibrate, place the probe back in the pipe and leave probe suspended between the holes above the water for about twenty (20) minutes. Do not air calibrate if air and water temperatures are + or – 10^oC difference.

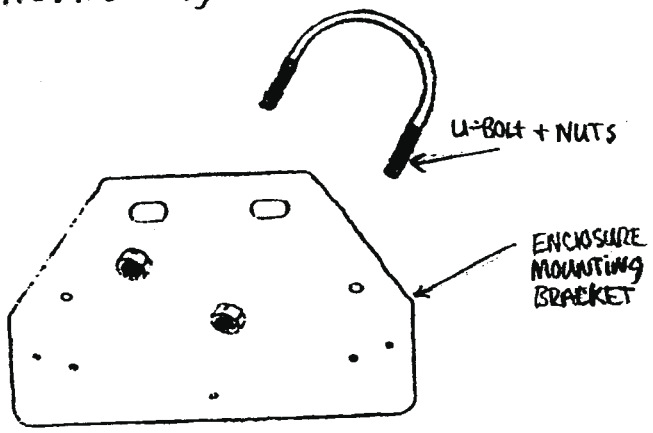
   Using the enclosed pressure/altitude chart (fig-3) and the altitude of the location where the unit will be housed, select the proper calibration value. Press the red **Read** button on the faceplate of the unit. The operator will have two (2) minutes to adjust the Air calibrate pot using a small screwdriver. After completing the adjustment, replace the probe back in to the water. **Warning: If the pipe is submerged it has to be vented below the point at which the probe is in the air due to treatment gases in the pipe.**

4. **Calibration using hand held DO meter:** Take handheld readings in the location where the Fluoroprobe^{TM} has been installed. As soon as the hand held reading has been taken, make sure the selector switch is on DO, then press the red **READ** button. The operator will have two (2) minutes to make the adjustment to the unit. Allow the reading to stabilize before making adjustments. Uses the Air calibrate pot for 4ppm and greater or use the zero for 4ppm and below. Adjust to the handheld DO meter reading. The instrument is now ready to operate and needs no further adjustment.

   Warning:. If the unit has just been put in the water, allow at least two (2 or 3) days to equilibrate to the type of environment the sensor will be used in before calibrating. Do not calibrate if probe has been removed from water, wait 30 minutes or longer before adjusting.

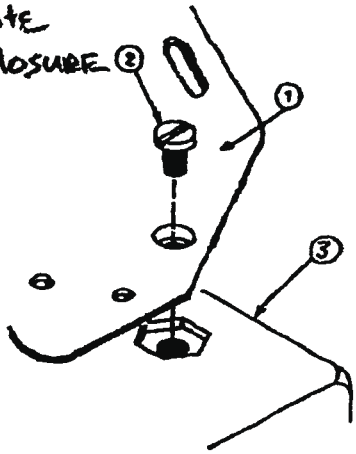
5. **Probe and Sensor Maintenance:** The factory request that the probe be inspected at least once a month. The probe can be washed down in the probe holder before the inspection of the sensor takes place. A soft toothbrush should be used on the black sensor on the end of the probe. Place back in water and allow at least (1) one hour to stabilize.

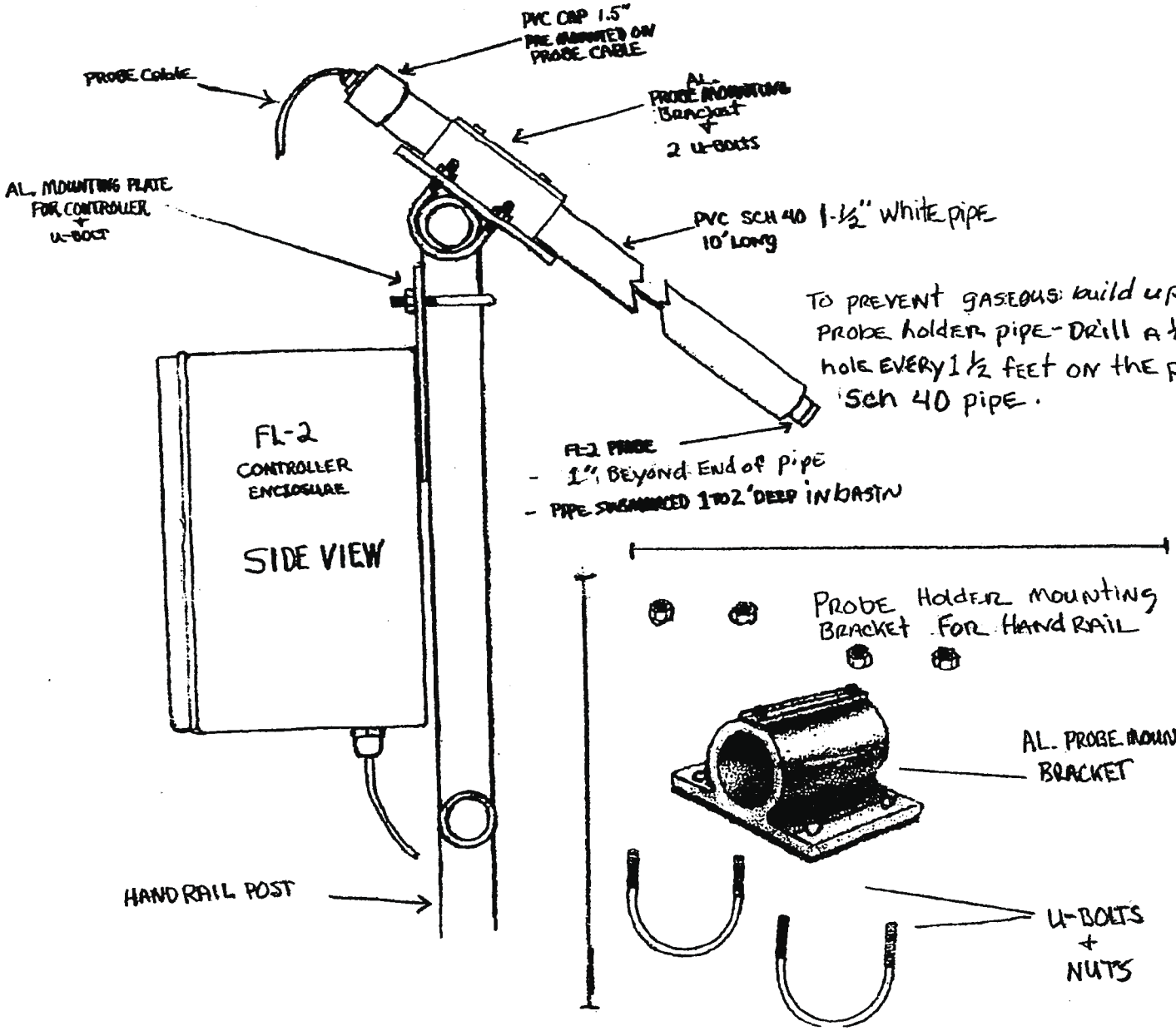
AL. Mounting Bracket Hardware



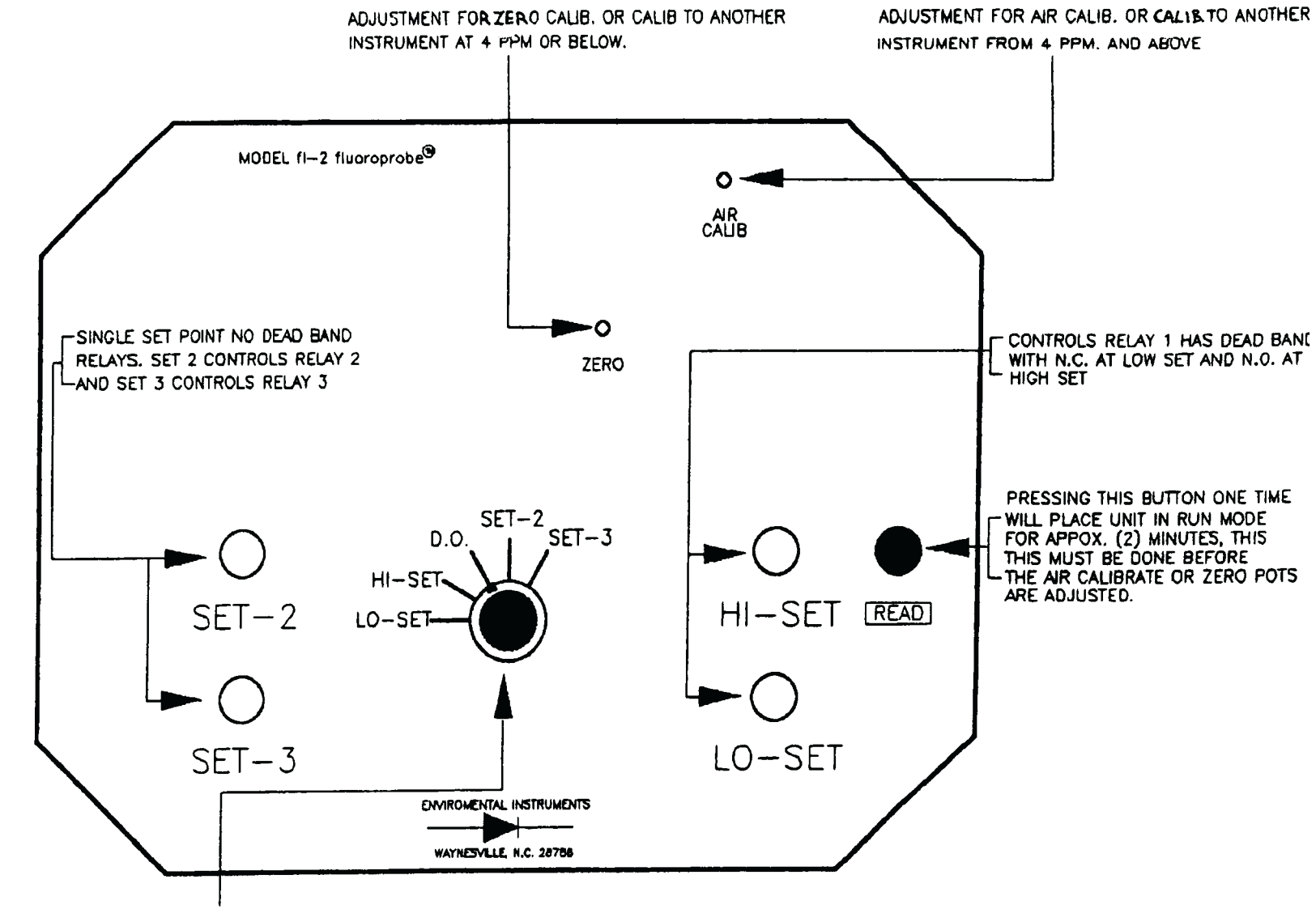
① ENCLOSURE MOUNTING BRACKET FOR HANDRAIL POST
② SCREWS INSIDE ENCLOSURE IN PLASTIC BAGGIE
③ BACK VIEW OF ENCLOSURE.

SCREW AL. PLATE TO TOP of ENCLOSURE BACK SIDE.





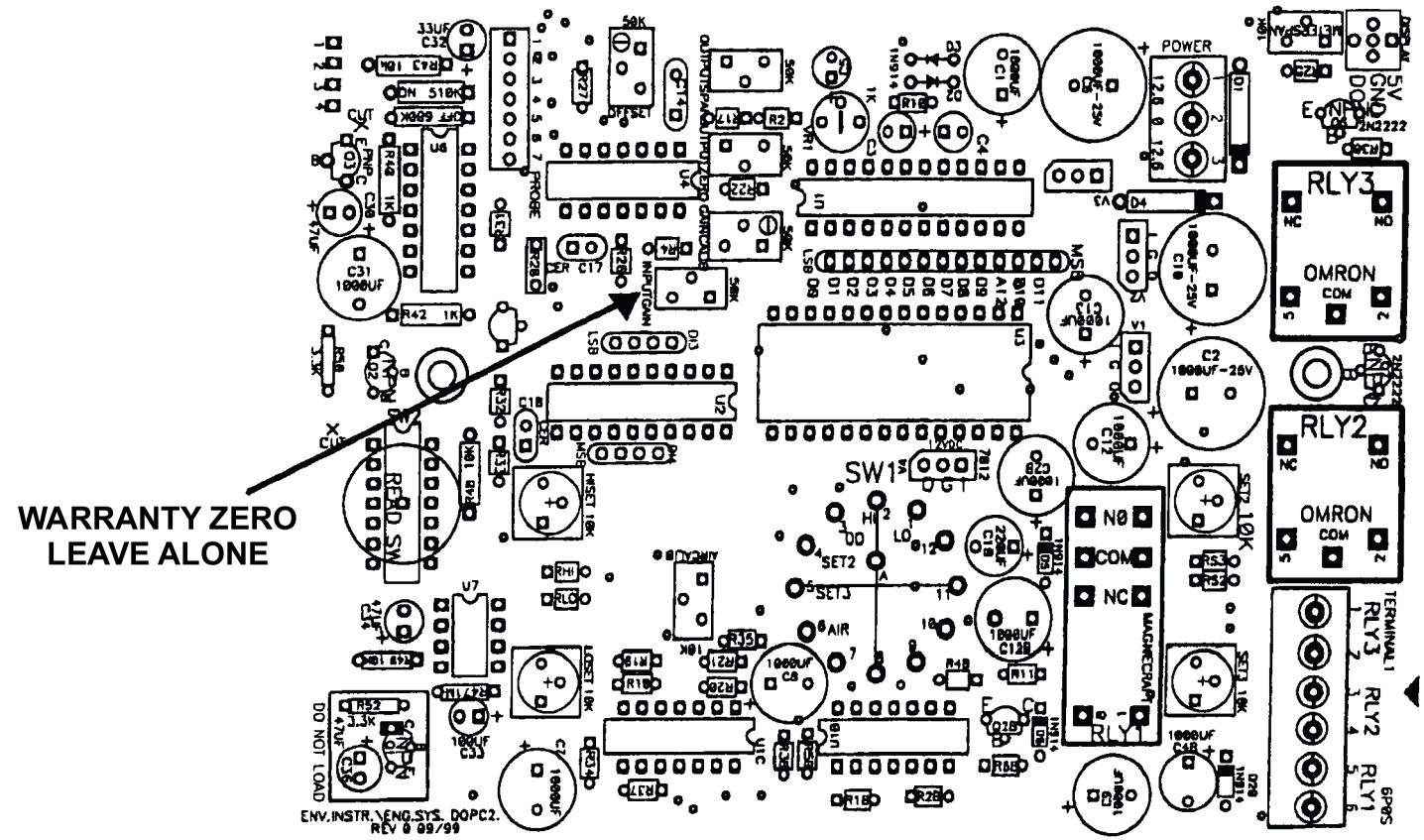
TO PREVENT GASEOUS build up IN PROBE holder pipe - Drill a ¼" hole EVERY 1½ feet ON the PVC Sch 40 pipe.



NOTE..... ALL RELAYS HAVE A TIME DELAY FEATURE WHICH PREVENTS RAPID CYCLING OF CONTROL EQUIPMENT WHICH MIGHT BE CONNECTED.

FL2 CONTROLS/DESCRIPTIONS

			Rev
DATE		DRAWN BY	
FILENAME		SHEET	of



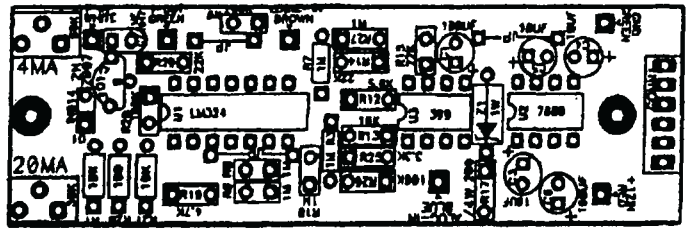
TERMINAL POS

1 2	RELAY 3 10A 250VAC
3 4	RELAY 2 10A 250VAC
5 6	RELAY 15A 250VAC

Title: **RELAY LOCATION**		
Size	Number	Rev
Date		Drawn By
File Name		Sheet of

THIS POT ADJUSTS
THE 4mA AT 0 PPM

THIS POT ADJUSTS THE SPAN
CAN BE ADJUSTED FOR 20mA
AT 10 PPM TO 19.99 PPM



BLUE WIRE 4-20 (+)
WHITE WIRE 4-20 (-)

TO S.C.A.D.A.
OR OTHER
DATA ACCESS

NOTE: MAX LOOP RESISTANCE IS 550 ohms

Title: **FL-2 4-20mA CONNECTION**		
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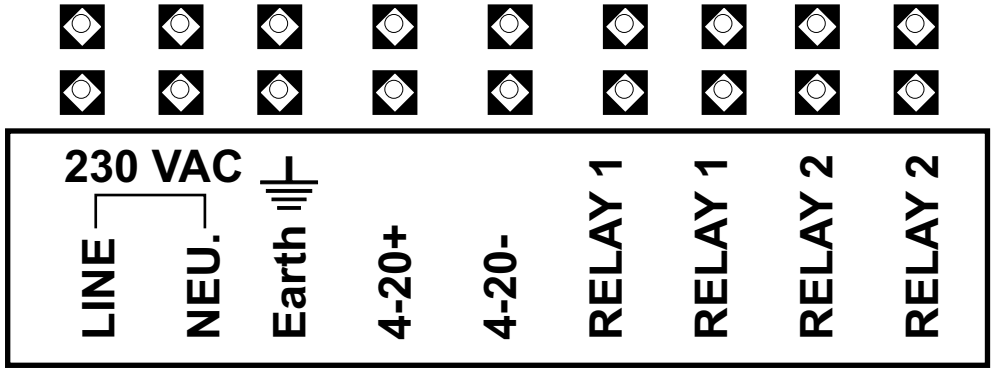
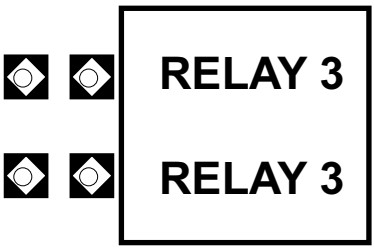
Date		Drawn By
File Name		Sheet of





MODEL FL-2-SWING OUT

WIRING DIAGRAM

FL2-FLUOROPROBE SPECIFICATIONS

Application Temperature Range:

Instrument	-30°C to +50°C
Sensor Material	0°C to +50°C

Operation Range:

Aqueous Solutions	0_{ppm} to Supersaturation

Response Time:

Aqueous Solutions	10 min
Gaseous Phases	80 sec

Accuracy:

Aqueous Solutions – Range	0 to 10_{ppm}
Accuracy	0.2_{ppm}

Sensor Lifetime:	Based solely upon the application environment and the effect on Silicone Rubber. 3 year Sensor warranty on approved applications.
4-20 mA	**Max. Resistance 550 ohms**

Features:

Temperature Compensation	Yes
Ambient Excitation Compensation	Yes
Instrument Measurement	Steady State (Amplitude)/Lifetime

NOTE 1: Response Time based upon approximately 1 ft/minute flow across sensor- Response time will decrease with increased flow, however, FLOW IS NOT REQUIRED FOR MEASUREMENTS!

Calibration Tables

Table I shows the amount of oxygen in mg/L that is dissolved in air saturated fresh water at sea level (760 mmHg atmospheric pressure) as temperature varies from 0° to 45°C.

Table I - Solubility of Oxygen in Fresh Water

Temp °C	Solubility mg/L	Temp °C	Solubility mg/L	Temp °C	Solubility mg/L
0	14.62	17	9.67	34	7.07
1	14.22	18	9.47	35	6.95
2	13.83	19	9.28	36	6.84
3	13.46	20	9.09	37	6.73
4	13.11	21	8.92	38	6.62
5	12.77	22	8.74	39	6.52
6	12.45	23	8.58	40	6.41
7	12.14	24	8.42	41	8.31
8	11.84	25	8.26	42	6.21
9	11.56	26	8.11	43	6.12
10	11.29	27	7.97	44	6.02
11	11.03	28	7.83	45	5.93
12	10.78	29	7.69	46	5.84
13	10.54	30	7.56	47	5.74
14	10.31	31	7.43	48	5.65
15	10.08	32	7.31	49	5.56
16	9.87	33	7.18	50	5.47

Derived from 17th Edition, *Standard Methods for the Examination of Water and Wastewater.*

Table II shows the correction factor that should be used to compensate for the effects of variation in atmospheric pressure or altitude. Find true atmospheric pressure in the left hand column and read across to the right hand column to determine the correction factor. (Note that "true" atmospheric pressure is as read on a barometer. Weather Bureau reporting of atmospheric pressure is corrected to sea level.) If atmospheric pressure is unknown, the local altitude may be substituted. Select the altitude in the center column and read across to the right hand column for the correction factor.

Pressure in inches Hg	mm Hg	kPa	Altitude in Feet	Meters	Correction Factor (%)
30.23	768	102.3	-276	-84	101
29.92	760	101.3	0	0	100
29.33	745	99.3	558	170	98
28.74	730	97.3	1126	343	96
28.11	714	95.2	1703	519	94
27.52	699	93.2	2290	698	92
26.93	684	91.2	2887	880	90
26.34	669	89.2	3496	1066	88
25.75	654	87.1	4115	1254	86
25.12	638	85.1	4747	1447	84
24.53	623	83.1	5391	1643	82
23.94	608	81.1	6047	1843	80
23.35	593	79.0	6717	2047	78
22.76	578	77.0	7401	2256	76
22.13	562	75.0	8100	2469	74
21.54	547	73.0	8815	2687	72
20.94	532	70.9	9545	2909	70
20.35	517	68.9	10293	3137	68
19.76	502	66.9	11058	3371	66

The temperature/solubility relationship of oxygen in sea water is not the same as that in fresh water. Oxygen solubility in sea water is shown in Table III.

Table III - Solubility of Oxygen in Sea Water

(Chloride concentration 20,000 mg/L)

Temp. °C	Solubility mg/L	Temp. °C	Solubility mg/L	Temp. °C	Solubility mg/L
0	11.41	11	8.77	21	7.20
1	11.11	12	8.58	22	7.07
2	10.83	13	8.41	23	6.95
3	10.56	14	8.24	24	6.83
4	10.30	15	8.07	25	6.71
5	10.05	16	7.91	26	6.60
6	9.82	17	7.78	27	6.49
7	9.59	18	7.61	28	6.38
8	9.37	19	7.47	29	6.28
9	9.16	20	7.33	30	6.18
10	8.96				

Derived from 15th Edition, *Standard Methods for the Examination of Water and Wastewater*