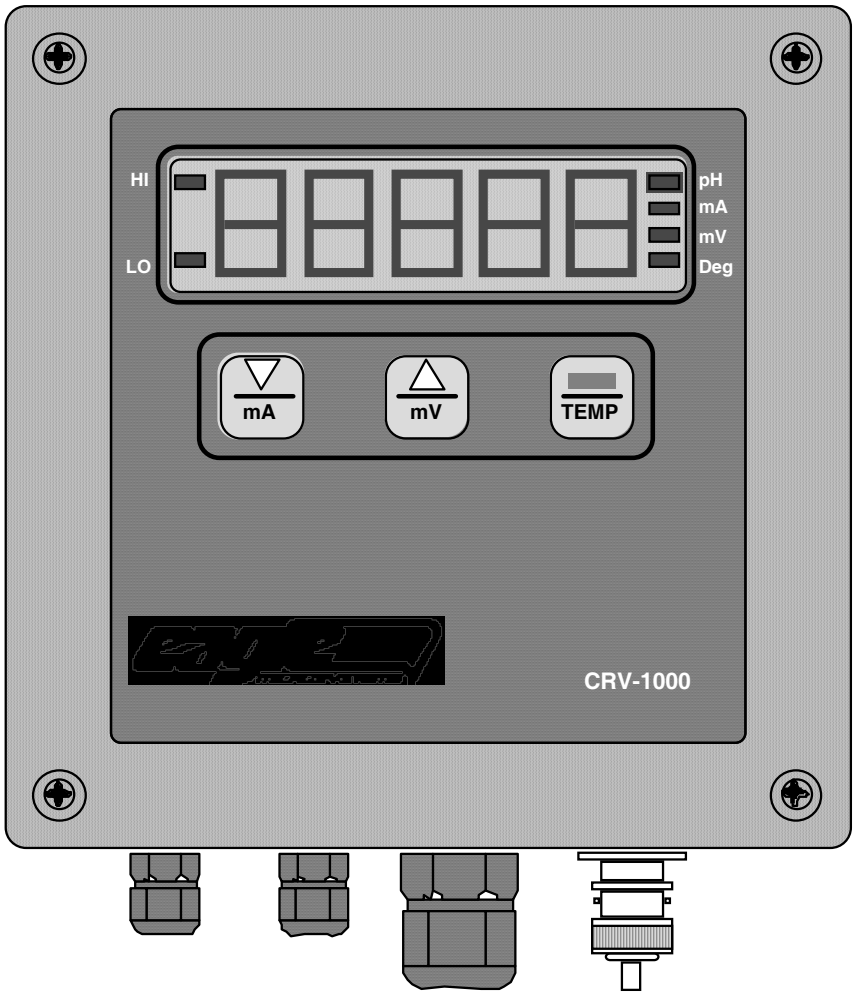
CRV1000

pH MONITOR/TRANSMITTER



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CRV1000 SPECIFICATIONS

Power supply:	A.C. 117V +15% / -25%, 220V optional
Compatible Probe:	pH, (60mV/pH) High-Z voltage output.
Probe Selection:	Internal switch (pH/ORP select)
pH Display Range:	0 to 14
pH Display Resolution:	0.01pH
pH Voltage Input:	+/- 550mV
pH Accuracy:	+/- 0.01pH
Temperature Input Range:	0 to 50˚C, 32 to 122˚F
Temperature Display Resolution:	1 ˚C/˚F
Temperature Sensor:	1000 Ω Pt RTD
Temperature Accuracy:	+/-1˚C/˚F
Analog Output Type:	4-20mA (X2)
Analog Output Compliance:	510 Ω
Resolution:	12 bit
Isolated:	Yes
Breakdown Voltage:	1500VAC.
Function:	Probe and temperature
Relay Outputs:	Two, Form-A
Functions:	Low & High set points
Voltage:	250V A.C./D.C.
D.C. & A.C. Current:	5A (resistive)
Display:	Five, 7-segment, red, 0.56”
LED bars:	Up to 8
Pushbuttons:	Three
ROM Memory:	32k, FLASH
Field Upgradeable:	Yes (via RS232 port)
Serial Communications:	RS232*
Operating Temperature Range:	-10˚C to 50˚C / -14˚F to 122˚F
Humidity:	10%, non-condensing

*The RS-232 port is only used to upgrade the CRV1000 firmware. It is not usable for other communications.

INTRODUCTION

The CRV1000 (meter) series microprocessor based transmitters are used to monitor and transmit a 4-20mA analog signal for pH applications such as effluent monitoring, signal conditioning for PC's or PLC's and simple on/off control in water treatment, waste-water treatment and other industrial uses. **Depending on the model ordered, the unit is powered by 115VAC or 230VAC (A.C. line voltage must be specified when ordering). Check the model number/serial number label on the unit for the proper A.C. voltage before connecting power to the unit. There is also a 115V/230V marker on the power supply board.**

The unit is compatible with any electrode that generates a millivolt (mV) signal and may be used with Pt 1000 automatic temperature compensation (ATC) probes. If no ATC probe is detected, the controller will automatically go into manual compensation mode.

Two isolated 4-20mA outputs (temperature and probe) are standard and are powered internally. Also, two set point relays are provided with user adjustable set points.

PACKING LIST

Notify your carrier immediately if there are any signs of damage to the CRV1000 or its parts. Contact your distributor if any parts are missing. The CRV1000 series transmitter shipping carton should contain the following:

- CRV1000 meter
- Probe (pH) with BNC connector and optional Pt-1000 RTD (free leads).
- Cable glands (should be installed on the CRV1000 enclosure)

INSTALLATION

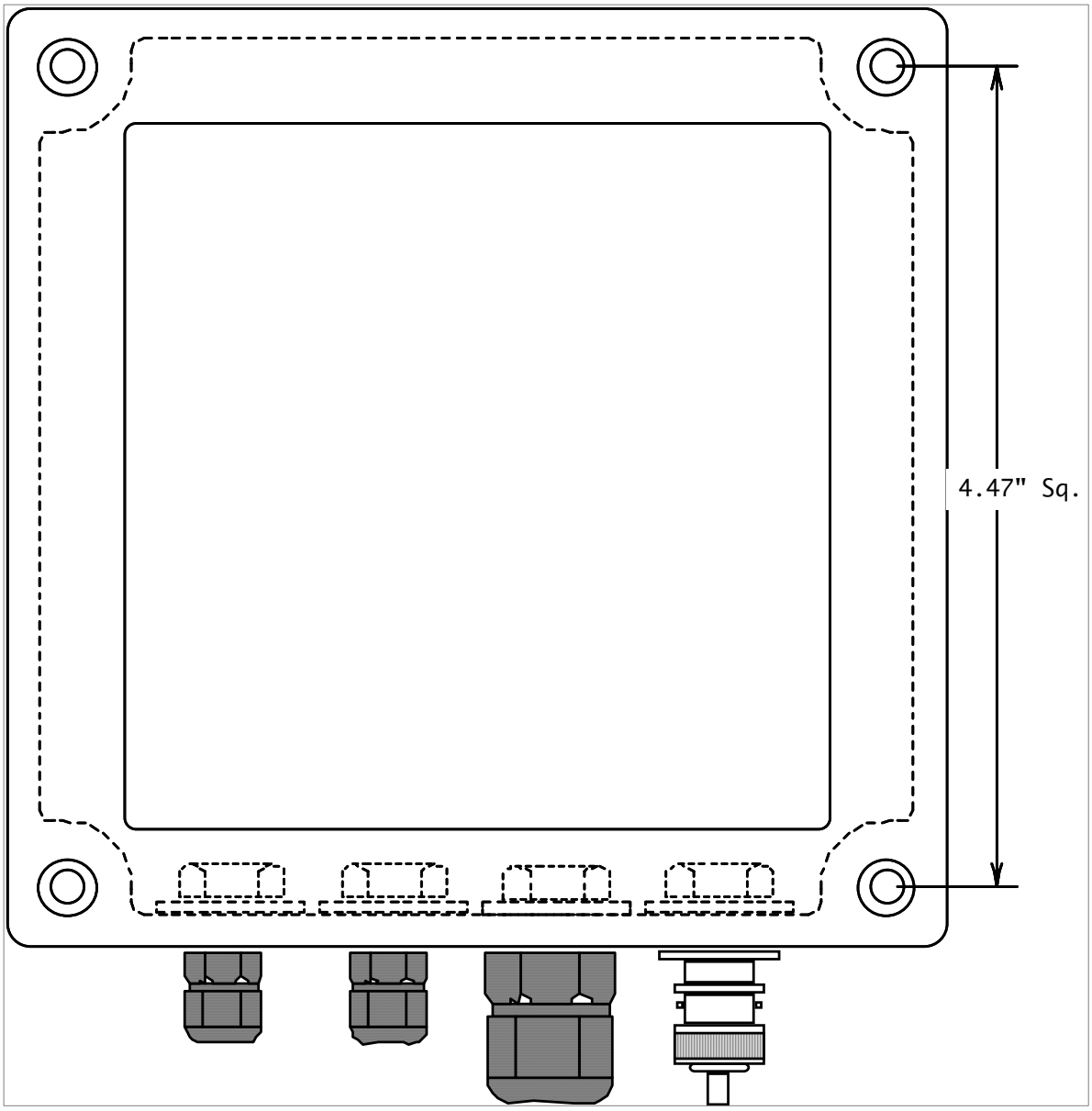
The CRV1000 series units are designed to be mounted within the cable length supplied. It's not advisable to use cable extenders for the high-impedance probe; twenty (20) feet is the typical maximum.

The A.C. power should be wired into the CRV1000 (TB1) by a qualified electrician. This is not covered by Eagle Microsystems, Inc. or its distributors.

WALL MOUNT

The CRV1000 series models are ideally mounted with the display at eye level on a vibration-free surface and in a location where it will not be splashed while the enclosure cover is removed. Remove the front cover and mount the unit to the wall using screws which are inserted into the holes at the four corners of the enclosure. See mounting template below... IMPORTANT: Don't use any of the blind holes on the back of the enclosure for mounting, as those screws may penetrate the enclosure and damage the internal electronics. Route the wires through the provided cable glands. Install the wiring, carefully observing the polarity of the 4-20mA outputs. Connect the pH electrode to the BNC connector, and, if present, wire the Pt-1000 RTD (temperature) connections to TB3 (see the AUTOMATIC TEMPERATURE PROBE CONNECTIONS section of this manual). Finally, reinstall the front panel of the unit and tighten the four corner screws and cable glands around the wiring just installed. Use rubber plugs for any cable glands that are not in use.

Mounting Template



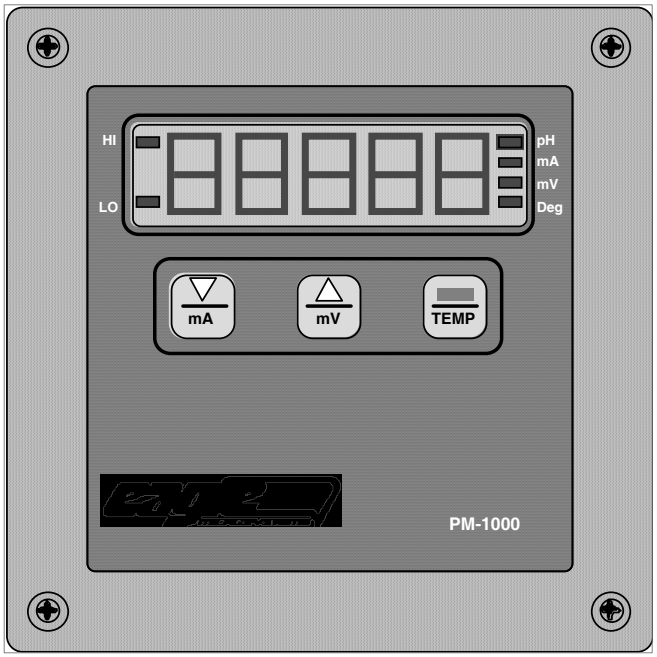
Field Wiring Connectors (number and type of cable glands may be different from the above image).

INITIAL STARTUP

The monitor arrives with the alarm limits set to 4 and 10 pH. The 4-20mA output is also set to represent the 4-10 pH (PROBE) span and 0C/32F to 50C/122F (TEMP). The unit is calibrated to read a perfect pH electrode at 25C/77F (0.00mV). As a minimum, one should calibrate the monitor to read the pH correctly using the two-point calibration as outlined in this manual. Power on the unit, calibrate, and set the process temperature. It is recommended that one performs a calibration, at least, once every week for the first few months.

OPERATION WITH THE KEYPAD (PUSHBUTTONS)

All operations (calibration, configuration, etc.) are performed using the three push-buttons DOWN, UP and ENTER, which are located under the LED display panel. The following functions are available when the CRV1000 is displaying the pH, which is referred to as the "main operating mode."



View mA (milliamperes)
Pressing the DOWN /mA push-button will change the display to read the probe 4-20mA output for as long as the push-button is pressed. The corresponding mA LED on the display panel will light.

View mV (millivolt)
Pressing the UP/mV push-button will change the display to read the current millivolt (mV) value for as long as the push-button is pressed. The corresponding mV LED on the display panel will light.

View Temperature
If the probe contains a temperature sensor in the probe (automatic temperature compensation, ATC) for pH measurement, the temperature at the probe element will be displayed. If the temperature is not sensed by the probe, pressing the ENTER/TEMP push-button will display the current calibration temperature for as long as the push-button is pressed. A corresponding LED on the display panel will light.

OPERATION

Once all of the values have been programmed to the desired settings, the 4-20mA outputs are continuously updated and the alarm points are monitored. The 4-20mA outputs are capable of driving a maximum load of 510Ω, which should be suitable for most applications.
The alarm outputs are potential-free, electro-mechanical relays rated for 5 Amps at 115/230 VAC or 30 VDC. The alarm relays are activated for high or low alarm conditions and the corresponding indicators on the front panel are lit.

IMPORTANT

SWITCHES ON THE POWER SUPPLY

There are two configuration switches on the power supply board that must be set to specific positions, which are as follows:

PROBE (S1) must be set to pH (switch is set to the left position).
RTD (S2) must be set to 1000 ohms (switch is set to the down position).

The CRV1000 will not function properly otherwise.

SETUP MODE

Entering setup:
Press and hold the UP and ENTER push-buttons simultaneously for one (1) second to enter the setup mode (menu). The display shows “SETUP” for one (1) second to indicate that the setup mode has been enabled. In this (setup) mode, one can calibrate the probe, adjust probe and temperature sensor parameters, adjust the set point values, etc.

Exiting setup:
Press and hold the UP and DOWN push-buttons simultaneously for one (1) second to exit the programming mode. OPR (main operating mode) is displayed when exiting the setup mode. Any changes made in setup are permanently stored in non-volatile EEPROM memory, which stores the calibration and parameter values so they are restored when power is again applied to the CRV1000.

NOTES:
* If, at anytime, one is not satisfied with the adjustments made in setup, cycle the power to the CRV1000 and all changes made in setup will be lost.
* While in setup mode, the 4-20mA outputs continue to function, but the relays are frozen to prevent energizing/de-energizing during calibration.

SETUP MENU

The main menu is displayed after entry into the setup mode. A menu header selection is made using the UP and DOWN push-buttons. To enter a particular sub menu, press the ENTER push-button. The main menu summary is as follows:

MENU HEADER	Description
PH.CFG	Adjust pH probe configuration (e.g., decimal point and display update rate), temperature units, and the 4-20mA points for the probe and temperature.
CAL.2P	Two-point pH calibration sequence.
CAL.AO	Test & calibrate the 4-20mA outputs – Note: The 4-20mA outputs will be altered when this selection is made.
Set.Pt	Set point mode and values are set in this sub menu.

pH CONFIGURATION (PH.CFG) ADJUSTMENTS

To enter the PH.CFG menu, press ENTER... Step through the parameters by pressing ENTER if the value is correctly set. Use the DOWN and UP push-buttons to adjust the value of the selected parameter. The display will alternate between the parameter name and its setting/value. To exit setup, one must step through each parameter until the display reads PH.CFG again. One can, at this point, exit the set up mode by pressing and holding both the DOWN and UP push-buttons for greater than a second.

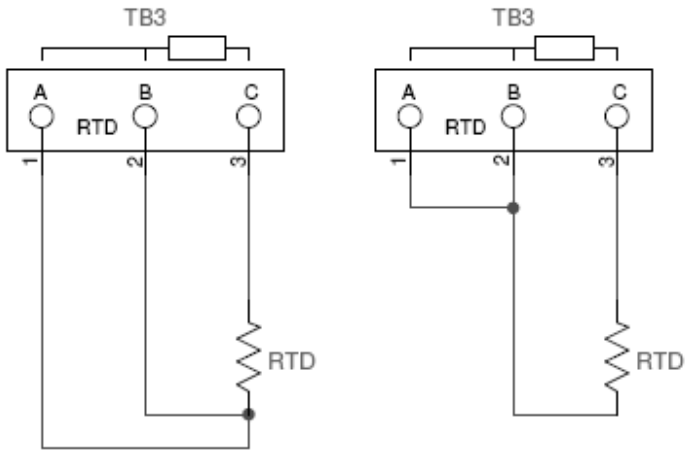
dpt	pH decimal point adjustment. Values are 0, 0.0 and 0.00. Typically, this is set to the maximum setting of two places after the decimal point (0.01pH resolution).
dsP.Ud	Display update rate – This parameter sets the rate at which the display is updated. The selections are 0.2s (5/s), 0.4s (2.5/s) , 1s, 2s, 3s, 5s, 8s, and 10s. The slower update rates yield a more stable display. A typical setting is either 0.4s or 1s.
P.o 4	This parameter sets the value of pH that will transmit a 4mA signal out of the PROBE 4-20mA signal. This value defaults to a pH of four (4).
P.o 20	This parameter sets the value of pH that will transmit a 20mA signal out of the PROBE 4-20mA signal. This value defaults to a pH of ten (10).
dEG	This parameter selects either Celsius or Fahrenheit (C or F, respectively) for all displayable temperature readings.
t.o 4	This parameter sets the value of temperature that will transmit a 4mA signal out of the TEMP 4-20mA signal. This value defaults to 0C (32F).
P.o 20	This parameter sets the value of temperature that will transmit a 20mA signal out of the TEMP 4-20mA signal. This value defaults to 50C (122F).

TWO-POINT pH CALIBRATION

The pH meter (CRV1000) requires a two-point calibration in order to ensure an accurate pH reading. Typically, one will use a pH buffer of 4 or 10 and a neutral 7 buffer.

- Enter the calibration mode (CAL.2P is displayed) by pressing ENTER from the setup menu.
- The actual temperature of the probe should be displayed. If the probe doesn't have automatic temperature compensation (Pt-1000), the user must enter the temperature of the buffer solution.
- Press ENTER to view and adjust the pH point 1 (lower) buffer value.
- Press ENTER to view the probe mV input.
- Place the sensor probe into the lower pH solution (e.g., 4, 7) and allow the temperature to stabilize. Constant stirring is typically required for accurate readings. What for this value to stabilize (within 2-3mV).
- Press ENTER and the input will be sampled and stored. The display will then show the pH point 2 (higher) value. Set this value to the second buffer solution (e.g., 7, 10).
- Press ENTER to again view the probe mV value.
- Rinse the probe and then place it into the second pH solution. Constant stirring is typically required for accurate readings.
- Wait for the reading to stabilize (2-3mV).
- Press ENTER and the input will be sampled and stored.
- The calibration constant which is will be displayed for a second and whether or not the calibration passed or failed. If the calibration has failed, the old calibration is restored.

AUTOMATIC TEMPERATURE PROBE (RTD) CONNECTIONS



3-WIRE RTD 2-WIRE RTD

- If automatic temperature compensation (i.e., no RTD) is not embedded in the probe, make sure all connections on TB3 are open (i.e., not connected).
- If "RTd ?" is displayed, disconnect the jumper from TB3-A to TB3-B.
- Some sensors will have two wire colors that are the same, connect one to the A terminal and the other to the B terminal.
- The pH probe output must be reliably connected to the BNC connector. Do not splice/extend the probe cable.
- Run the RTD wires through one of the provided cable glands on the CRV1000.

Calibration FAIL message…

Cause: The calibration process yielded a "slope" less than 30 mV/pH or greater than 90 mV/pH, or an offset from the expected mV reading that is grater than 35 mV. This may be caused by an incorrect calibration attempt or defective electrode, cable, buffer solution or wiring.

Correction: Use this table as a guide when calibrating your pH electrode. It lists the most common buffers and their corresponding **mV** readings when used at different temperatures.

pH	TEMPERATURE (T) in degrees Celsius/Fahrenheit									
	0/32	**5/41**	**10/50**	**15/59**	**20/68**	**25/77**	**30/86**	**35/95**	**45/113**	**50/122**
14	-379.4	-386.3	-393.3	-400.2	-407.1	-414.1	-421.0	-428.0	-441.9	-448.8
13	-325.2	-331.1	-337.1	-343.0	-349.0	-354.9	-360.9	-366.8	-378.7	-384.7
12	-271.0	-275.9	-280.9	-285.9	-290.8	-295.8	-300.7	-305.7	-315.6	-320.6
11	-216.8	-220.7	-224.7	-228.7	-232.7	-236.6	-240.6	-244.6	-252.5	-256.5
10	**-162.6**	**-165.6**	**-168.5**	**-171.5**	**-174.5**	**-177.5**	**-180.4**	**-183.4**	**-189.4**	**-192.3**
9	-108.4	-110.4	-112.4	-114.3	-116.3	-118.3	-120.3	-122.3	-126.2	-128.2
8	-54.2	-55.2	-56.2	-57.2	-58.2	-59.2	-60.1	-61.1	-63.1	-64.1
7	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
6	54.2	55.2	56.2	57.2	58.2	59.2	60.1	61.1	63.1	64.1
5	108.4	110.4	112.4	114.3	116.3	118.3	120.3	122.3	126.2	128.2
4	**162.6**	**165.6**	**168.5**	**171.5**	**174.5**	**177.5**	**180.4**	**183.4**	**189.4**	**192.3**
3	216.8	220.7	224.7	228.7	232.7	236.6	240.6	244.6	252.5	256.5
2	271.0	275.9	280.9	285.9	290.8	295.8	300.7	305.7	315.6	320.6
1	325.2	331.1	337.1	343.0	349.0	354.9	360.9	366.8	378.7	384.7
0	379.4	386.3	393.3	400.2	407.1	414.1	421.0	428.0	441.9	448.8

$$mV = 0.1984(T+273.16)(7 - pH)$$

If the readings do not match these guidelines, try to determine if the monitor or the pH electrode is at fault. Disconnect the pH electrode from the BNC connector. Use a pH simulator to give the unit a known mV input. If the unit reads correctly, then the electrode or its cable is at fault. If a simulator is not available, one can use a bent paper clip to short the outside shell of the BNC connector to the inside contact of the BNC connector. This should simulate pH of 7 or 0mV. Use the UP/mV push-button to view the mV reading. If the reading is between -10mV and +10mV then the electrode is probably at fault. If the reading does not improve with a new electrode, contact Eagle Microsystems customer service.

pH doesn't match the pH reading of another meter…

Causes:

- Incorrect calibration of either or both meters.
- Inconsistency between electrodes.
- Lab meter's electrode is not at the same temperature as the process.
- Analysis sample taken from different location than the process sample.
- Contaminated probe…

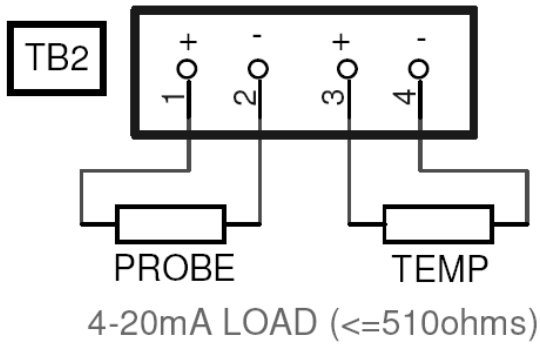
Correction: This is a complex problem that can best be corrected with some simple guidelines. Make sure all process related variables are taken into consideration. Calibrate both meters with the same buffer solutions, carefully following the manufactures guidelines. If the process measurement is being done at an elevated temperature, make certain that the lab meter's sample has been heated to the same temperature as the process. If all of these suggestions are followed and the pH still does not match, recalibrate the unit using the CAL.2P process.

4-20mA ANALOG OUTPUT CALIBRATION & TEST

To enter the CAL.AO menu, press ENTER. Step through the parameters by pressing ENTER if the value is correctly set. Use the DOWN and UP pushbuttons to adjust the value of the selected parameter. To exit setup, one must step through each parameter until the display reads CAL.AO again. One can at this point exit the set up mode by pressing and holding both the DOWN and UP pushbuttons for greater than a second.

tESt	Allows one to sent test 4-20mA signals to the remote device (SCADA, RTU, chart recorder, etc.) The test signals range from 4mA to 20mA in 1.6mA steps.
Po 4	4mA probe output calibration point adjustment.
Po 20	20mA probe output calibration point adjustment.
to 4	4mA temperature (TEMP) output calibration point adjustment.
to 20	20mA temperature (TEMP) output calibration point adjustment.

While adjusting the calibration of the 4-20mA outputs, the display does not indicate the 4-20mA output is changing, so one must connect a device to the mA output in order to fully calibrate the 4-20mA output.



4-20mA OUTPUT CALIBRATION ADJUSTMENT

- Power down CRV1000 meter.
- Disconnect any external devices (SCADA) from TB2.
- Connect a DMM or equivalent to either the probe or temp output. A 3¾-digit DMM is recommended. Power the CRV1000 meter.
- After the pH reading is displayed (after a few seconds), press and hold both the UP and ENTER pushbuttons.
- Using the UP or DOWN pushbutton, select CAL.AO.
- Repeatedly press ENTER until the appropriate 4mA point is selected. The DMM should show the mA level (4 +/-1.0mA).
- Adjust the mA point using the DOWN and/or UP pushbuttons until the value on the DMM is either 4.00mA.
- Press ENTER to select the 20mA point. The DMM should show the mA level (20+/-1.0mA).
- Repeat for the other mA output if necessary.
- Reconnect the external device (SCADA) to TB2.

SET POINT (SEt.Pt) ADJUSTMENTS

To enter the SEt.Pt menu, press ENTER. Step through the parameters by pressing ENTER if the value is correctly set. Use the DOWN and UP pushbuttons to adjust the value of the selected parameter. The display will alternate between the parameter name and its setting/value. To exit setup, one must step through each parameter until the display reads SEt.Pt again. One can at this point exit the set up mode by pressing and holding both the DOWN and UP pushbuttons for greater than a second.

SET POINT MODES

HI	A HI setting is a high-level set point where the corresponding relay is energized when the pH is equal to or above the corresponding set point setting.
LO	A LO setting is a low-level set point where the corresponding relay is energized when the pH is equal to or below the corresponding set point setting.

NOTE: All set point modes have a 0.05pH hysteresis to avoid relay outputs that constantly energize and de-energize (chatter).

SEL.S1	This parameter sets operating mode for set point one (1) which controls relay K1. The selections are HI (default) and LO.
S1.UAL	Set point one (1) value in pH units. The default value is a pH of 10.
SEL.S2	This parameter sets operating mode for set point two (2) which controls relay K2. The selections are HI and LO (default).
S2.UAL	Set point two (2) value in pH units. The default value is a pH of 4.

DISPLAY MESSAGES

Vx.xx	Version of the firmware
8.8.8.8.8.	Display test
-----	A/D sampling (during calibration modes)
Err10	Positive value can't be displayed
Err13	Negative value can't be displayed
CS.BAD	* The firmware is corrupted.
Err.AD	* The A/D converter is not functioning.
EExxx	EE set fix – This should not normally happen. It indicates that the firmware corrected a configuration set error which is normally not an issue.
AUTO	This message is displayed on power up. The contents of the EEPROM have been detected as invalid. The CRV1000 will require a full hardware calibration, probe calibration, and parameter and set point adjustments.
tYP.Ld	The user loaded factory default values. The CRV1000 will require a full hardware calibration, probe calibration, and parameter and set point adjustments.

***Contact the factory for service to the CRV1000**.

POWER UP FUNCTIONS

These functions are not typically used by the operator in the field but are listed to aid in troubleshooting/calibrating the CRV1000.

UP or DOWN
Skip power up messages (e.g., version number).

ENTER
Show calibration factor. Value is from 0.1000 to 0.3000. Used for factory troubleshooting.

DOWN+UP+ENTER
Load factory default – All parameters, set points, calibration, hardware calibration are reset to factory default. The message "TYP,Ld" is displayed to acknowledge that factory defaults have been loaded.

UP+ENTER
Enter hardware calibration mode. The factory accesses this mode to normalize/calibrate the hardware.

HARDWARE CALIBRAITON MODE

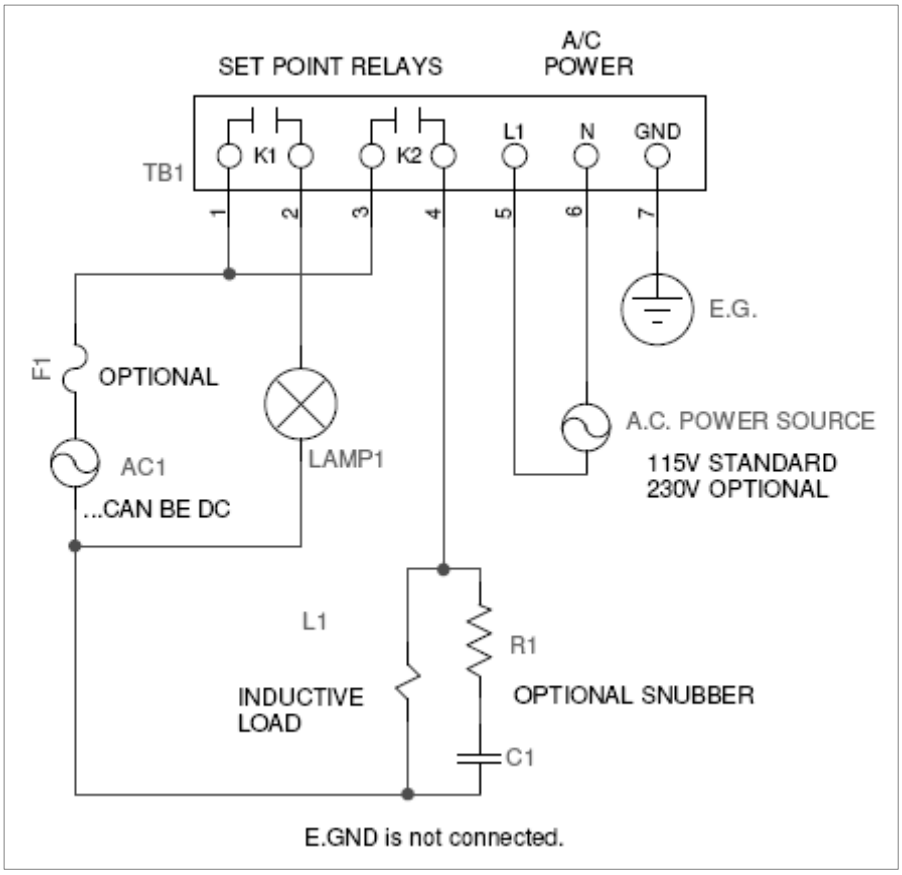
This function is performed by the factory during production testing. The navigation is exactly like the setup mode described above.

"CAL.P.1" allows one to zero the probe mV input and scale the mV input to a known value. After a factory default process, at a minimum, one should zero the probe input by shorting the probe BNC connector (use a bent paperclip). At the CAL.P.1 prompt, press the ENTER pushbutton. The probe mV input is displayed. Apply a shorted input or known mV input. If the mV input is detected as +/-25mV, pressing the DOWN or UP pushbutton will zero the input. If the mV input is above 25mV or below -25mV, pressing the DOWN or UP pushbutton will allow one to set the value of the applied mV. The display alternates between "In.SIG" (input signal) and the mV setting. Press ENTER when the value set is correct. Press ENTER again to return to the CAL.P.1 prompt. One can at this point exit the hardware calibration mode by pressing and holding both the DOWN and UP pushbuttons for greater than a second.

"CAL. t" allows one to calibrate the RTD (temperature) input. The user must have access to two known resistances (1.000k and 1.210k are what the factory uses). The 2-wire wiring configuration is used (see earlier in this manual). First, connect the 1000 ohms, make adjustments (DOWN/UP), and then press ENTER. Second, connect the 1210 ohms, make adjustments (DOWN/UP), and then press ENTER. After the above steps are complete, press ENTER to return to the CAL t prompt. One can at this point exit the hardware calibration mode by pressing and holding both the DOWN and UP pushbuttons for greater than a second.
If no RTD is connected or is not connected properly to TB3, the message OPEN will be displayed. If "RTd ?" is displayed, A & B are connected but the resistor is not connected properly.

Note: One must exit the hardware calibration mode (return to the pH display) to save the changes. Exit the hardware calibration mode by pressing and holding both the DOWN and UP pushbuttons for greater than a second.

A.C. POWER SUPPLY CONNECTIONS & SET POINT RELAY EXAMPLE.



SERVICE POLICY

The CRV1000 series pH transmitters/monitors have a 2 year warranty on electronic components and a 1 year warranty on mechanical parts (push-buttons, terminal strip, relays). Consult the factory regarding the probe warranty.

We stock circuit boards for immediate exchange after we have isolated the cause of the problem. Factory authorized repairs that are received by “next day air” will be returned within 24 hours. Normal priority for returns is two weeks. Out of warranty repairs or circuit board exchanges are done on a flat fee basis after the warranty has expired.