Operating Instructions

Cole-Parmer pH 500
pH/Temperature Controller

Cole-Parmer Instrument Company

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I. INITIAL INSPECTION AND ASSEMBLY

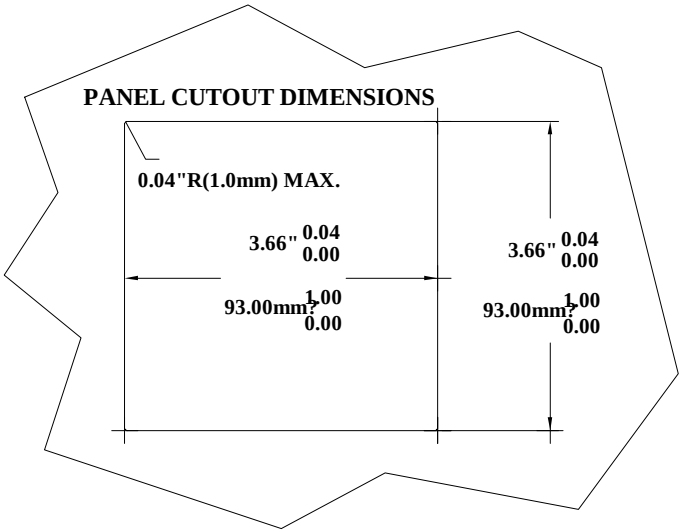
Carefully unpack the instrument and accessories. Inspect for damages made in shipment. If any damage is found, notify your Cole-Parmer representative immediately. All packing materials should be saved until satisfactory operation is confirmed.

MOUNTING PROCEDURE

1. Make a cutout on any panel, with a thickness of 1/16 in. (1.5 mm) to 3/8 in. (9.5mm).

2. Remove the mounting assembly from the controller and insert the controller into the cutout.

3. Replace the mounting bracket assembly onto the controller and secure the controller to the mounting panel.



Warning:

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Cleaning the instrument:

1. Be sure to remove the power before attempting to clean the meter.

2. Use a lint free cloth and clean water or neutral detergent.

3. Wipe the outer surface of the instrument only.

4. Wipe-dry the instrument before powering again.

II. GENERAL INTRODUCTION

The Cole-Parmer Model pH 500 (pH and Temperature) System is a rugged microprocessor based instrument assembled in a watertight ¼ DIN case, designed for use in laboratories and process control applications.

The model pH 500 microprocessor allows the user to easily recalibrate the parameters for the probes. The microprocessor also performs a self-diagnostic routine every time you turn on the unit providing you with basic information about the stability of the instrument.

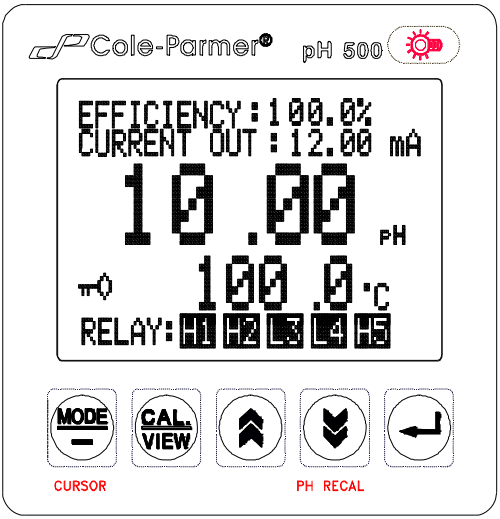
The system simultaneously displays pH, Temperature, Alarm status and current output in one LCD graphic screen. The LCD also includes a backlight for dark environments. This system uses glass electrode for the pH and a precise thermistor for temperature providing you with accurate readings for all your measurements.

The model pH 500 is equipped with five relays (2 active Low and 2 active High relays for pH and one programmable high or low relay for temperature); all relays are hysteresis driven and configurable to CENTER or EDGE mode. The system also has a isolated 4-20mA analog output, offset and span configurable for the pH display.

The model pH 500 comes with a RS485 interface that can easily let the user log all data (from multiple model pH500) with an IBM© PC/AT compatible computer. For advanced users, the model pH 500 may also be remotely controlled from main display mode to all calibration/setting modes.

III. USING THE COLE-PARMER MODEL pH 500

A. FRONT PANEL



1. The [**MODE /-**] key.
   1a. In **Main Display** mode this key has no function.
   1b. In **Calibration/Setting** mode this key will move to the next digit of the current active parameter.
   1c. In **Calibration/Setting** mode, pressing this key for two seconds will move you back to the previous parameter.

2. The [**CAL / VIEW**] key.
   2a. Pressing this key for about two seconds, during main display mode will switch to Calibration/Setting mode.
   2b. During **Calibration/Setting** mode this key will switch to the next available Calibration/Setting page. Pressing this key at the last User/Calibration page will return the user to the main display mode.

3. The [▲] **UP** key.

During **Calibration/Setting** mode this key will **increment** the current blinking digit of the active parameter.

4. The [▼/**pH-Recal**.] DOWN/pH Recalibrate key.

4a. During **Calibration/Setting** mode this key will **decrement** the blinking digit of the active parameter.

4b. During pH calibration, instead of SAVING the new pH Stand or Slope you can press this key to recalibrate the buffer again.

5. The [↵] **ENTER** key.

During **Calibration/Setting** mode, this key will save the current modified parameter and move to the next parameter.

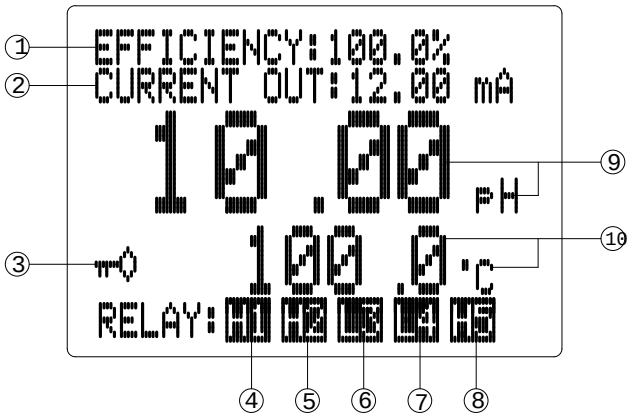
6. The [☼] **LIGHT** key.

This key will turn on or turn off the backlight of the LCD.

The backlight will automatically turn off if there is no key activity within two minutes.

7. LCD screen.

B. NORMAL MODE DISPLAY



1**. EFFICIENCY** - this will display the efficiency of the pH electrode based on the last pH calibration.

2. **CURRENT OUT** - this will display the actual output of the 4-20 mA circuit. At POWER-ON this will show "**OFF**" for about three seconds before going to main display mode. After exiting the Calibration /Setting pages a "**FROZEN**" message will be displayed for about 3 seconds if the unit is not password locked.

3.  **annunciator** - this will be displayed if Calibration /Setting pages are password locked meaning the user can't calibrate or change the settings unless the correct 4 digit number has been entered, but user still can view all the settings.

4. **H1 (High action relay 1) annunciator -** this is the status of pH Relay 1, if this is displayed then the relay is ON.

5. **H2 (High action relay 2) annunciator** – this is the status of pH Relay 2, if this is displayed then the relay is ON.

6. **L3 (Low action relay 3) annunciator** – this is the status of pH Relay 3, if this is displayed the Relay is ON.

7. **L4 (Low action relay 4) annunciator** – this is the status of pH Relay 4, if this is displayed then the Relay is ON.

8. **H5 (High action relay 5)** or **L5 (Low action relay 5) annunciator** – this is the status of the Temperature Relay 5, if this is displayed then the Relay is ON. **H5** means the relay action is HIGH while **L5** means the relay action LOW.

9. **pH Display**.

10**. Temperature Display**.

C. REAR CONNECTORS

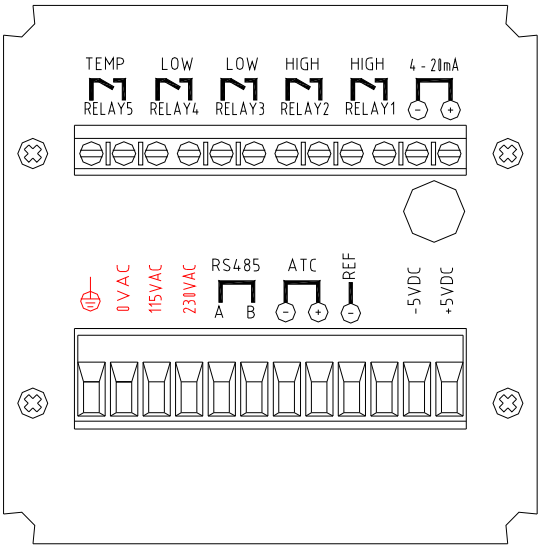
Before wiring the probes, relays, analog output, RS485 and power cord be sure that you are connecting to the right terminal as shown below. Remember that the unit is ON once the user plugs in the power cord to an AC power supply.

1. Connect the AC line to the rear of the instrument. The model pH 500 can be used with 115 or 230VAC 50/60 Hz. Power consumption is 6 watt. Make sure the **EARTH** connector is connected to the earth lead of the AC power line.

2. Connect the proper load to the output relays. Make sure that the load does not exceed the relay rating, 5Amp at 115VAC and 2.5Amp at 230 VAC.

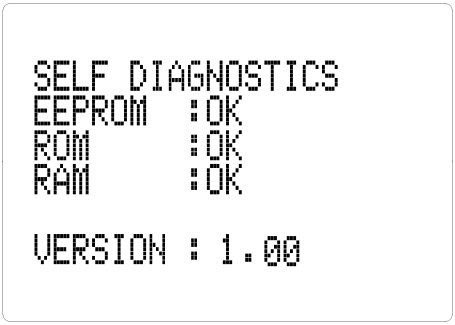
3. Set the proper load to the 4-20mA output connector. Make sure that the load impedance is less than 500 Ohms.

4. A +5VDC and -5VDC (max 20mA for each) output to provide excitation voltage for pH pre-amplifier.



CAUTION: Make sure you connect the AC power cord to the correct AC terminals. Connecting incorrectly may damage the unit permanently.

D. TURNING ON/OFF THE INSTRUMENT



By just plugging the unit to a correct AC voltage, the unit will be ready for use. There is no Power key so unplugging and plugging the unit will turn OFF or turn ON the unit respectively.

After the unit is turned on, it will perform some basic self diagnostics and will display “OK” or “BAD”. If you received any “BAD” messages, turn OFF the unit and turn it ON again.(see **VIII. ERROR DISPLAYS AND TROUBLESHOOTING**).

If the message persists then you might need to call your distributor. (See **XI. WARRANTY**)

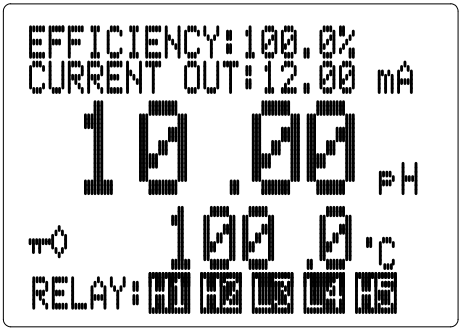
If the message persists, then you might need to call our Applications Specialists.

After the self-diagnostic is complete, the temperature will be displayed on the lowest part of the screen and you are ready to make conductivity or TDS measurements. Just immerse the probes halfway to the liquid. If possible do not allow the probes to touch any solid object in the solution. There should be no air bubbles around the probes either. Shaking or moving the probes vigorously before recording any measurement will dislodge any bubbles formed in the probes.

After the self-diagnostic is complete the temperature will be displayed on the lower part of the LCD screen and you are ready to make pH calibration or measurements. Just immerse the probes halfway to the buffer or liquid. If possible do not allow the probes to touch any solid object in the buffer or solution. There should be no air bubbles around the probes either. Shaking or moving the probes vigorously before recording any measurement will dislodge any bubbles formed in the probes.

IV. MODEL pH 500 MODES

A. MAIN DISPLAY MODE



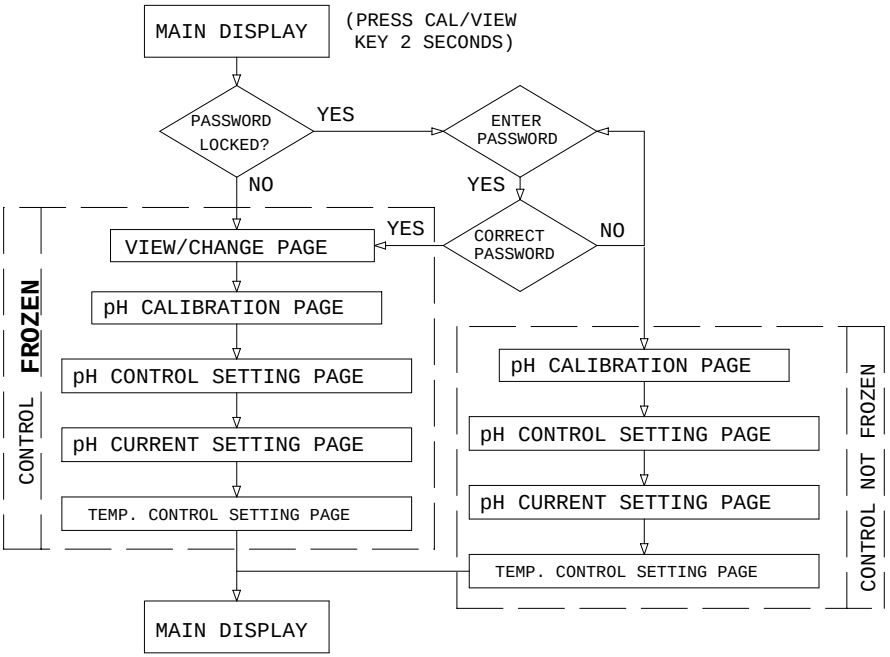
Turning ON the unit will always start in normal display mode.
This instrument is designed to provide two distinct measurements:

1. **Temperature** - current temperature of the solution.

2. **pH** - the current degree of acidity or alkalinity of the solution with automatic temperature compensation.

B. CALIBRATION/SETTING MODE

Pressing the [**CAL/VIEW**] key for about two seconds during main display mode will bring-up the first page of six pages of the **Calibration/Setting** mode. Pressing [**CAL/VIEW**] key will switch to the next page until the last page, where pressing [**CAL/VIEW**] again will return the user to main display mode.
Below is a simple flowchart showing the path of the [**CAL/VIEW**] key:



C. HOW TO USE THE KEYS

1. At MAIN DISPLAY you need to press and hold the [CAL/VIEW] key for two seconds to change the display to VIEW SETTING PAGE or if the instrument is password locked the display will be PASSWORD CHECK page.

2. You can change any blinking options or digit by pressing the [▲] or [▼] keys.

3. During pH STAND & SLOPE calibration you can press [▼/**pH-Recal**.] key to recalibrate the buffer again.

4. For options in digit format you need to press the [MODE/-] key to move the cursor to the next digit.

5. If you are satisfied with the selection you made you need to press the [↵] **ENTER** key to save the changes and move to the next option.

6. If you ***don't*** need to change the current blinking option, just press the [↵] **ENTER** key to move to the next selection.

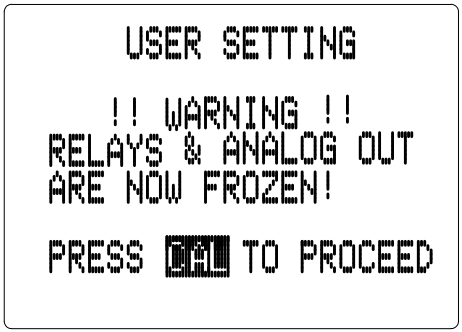
7. You also can press and hold [MODE/-] key for two seconds and it will move back the cursor to the previous option.

a. **CHECK PASSWORD** page

You will only see this page if the unit is password locked. To change any settings or calibration you need to unlock the system to remove the "**PASSWORD LOCKED**" message. You need to enter the correct 4-digit number on the "**ENTER PASSWORD**" input. You can still view all the pages of **Calibration/Setting mode** if the system is password locked by just pressing the **[CAL/VIEW]** key on this page. If the unit is "**PASSWORD LOCKED**" going to **Calibration/Setting mode** will not affect the function of the relays.

CAUTION: If the unit is **not locked** then every time the user enters the **Calibration/Setting mode** the relays and analog out will be **frozen**.

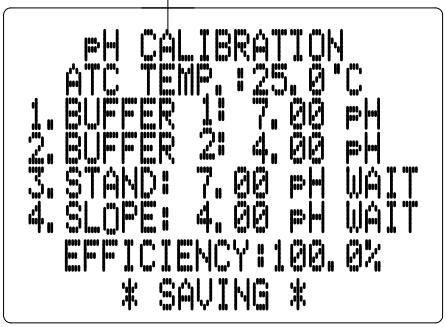
b. **USER SETTING** page



You will only see this page if the unit is not password locked. This page is just a **WARNING**, telling you that all relays are frozen, and that you can calibrate and change the settings.

NOTE: FROZEN MEANS ALL THE RELAYS AND THE ANALOG OUT WILL MAINTAIN THEIR LAST STATE UNTIL THE USER RETURNS TO MAIN DISPLAY MODE.

c. **pH CALIBRATION** page



ATC TEMP. – the current temperature of the solution.

1. **BUFFER 1** - in this option you can select which buffer to use for the standardization calibration. You can choose **7.00** pH or **6.86** pH by using the [⮝] and [⮟] keys and pressing the [↵] key to save your choice.

2. **BUFFER 2** - after you selected the buffer 1 this option will let you select the second buffer to use to calibrate the slope. You can choose 4.00pH, 4.01pH, 9.18pH or 10.01pH by using [⮝] and [⮟] keys and pressing the [↵] to save your choice.

3. **STAND** - this is the actual pH calibration process, this line will display the buffer to be used for STAND (OFFSET) calibration, depending on the choice you made on **BUFFER 1**. (See **Step by step pH Calibration.**)

4. **SLOPE** - this is part 2 of the pH calibration process, this line will display the buffer to be used for SLOPE calibration, depending on the choice you made on **BUFFER 2**. (See **Step by step pH Calibration.**)

EFFICIENCY -After saving the SLOPE a new efficiency will be displayed for about 4 seconds and then will move to the next page.

Efficiency = (new slope/ ideal slope) × 100%

We recommend that you use a new electrode, if the electrode efficiency is lower than 80%.

Step by step pH calibration

1. Press the [CAL/VIEW] key to go to pH Calibration page. If the unit is password locked, remove the password lock first.

2. Select buffer 1 (7.00 or 6.86), by using the [▲] or [▼/**pH-Recal**.] keys, then press the [↵] key to save your selection.

3. Select buffer 2 (4.00, 4.01, 9.18 or 10.01), by using the [▲] or [▼/**pH-Recal**.] keys, then press the [↵] key to save your selection.

4. Clean the pH electrode and temperature probe with de-ionized or distilled water.

5. Place the pH electrode and Temperature probe into buffer 1.

6. Press the [↵] key. A "**WAIT**" message will blink indicating that the instrument is waiting for a stable reading. The display will be locked to the buffer value corresponding to the temperature of buffer 1 (See **IX. pH Buffers**). When a stable reading is reached, the unit will blink a "**SAVE**" message.

7. Press the [↵] key to save the STAND calibration and prepare to do a SLOPE calibration or press the [▼/pH-Recal.] key to recalibrate buffer 1 and repeat from step 6.

If "**OVER**" or "**UNDER**"(See **VIII. ERROR DISPLAYS AND ROUBLESHOOTING**) is displayed or a blinking "**SAVE**" does not show after more than few minutes then something is wrong with your buffer 1 or electrode. Be sure your buffer 1 is correct or change a new electrode and repeat from step 4.

8. Clean the pH electrode and temperature probe with the de-ionized/distilled water.

9. Place the pH electrode and Temperature probe into buffer 2.

10. Press the [↵] key. A "**WAIT**" message will blink indicating that the instrument is waiting for a stable reading. The display will be locked to the buffer value corresponding to the temperature of buffer 2 (See **IX. pH Buffers**). When a stable reading is reached, the unit will blink a "**SAVE**" message.

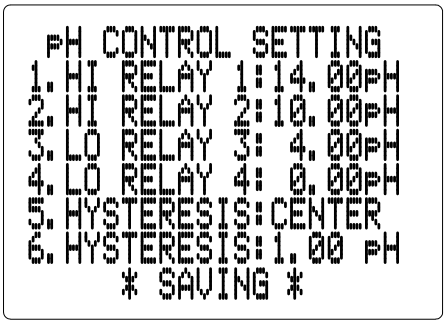
11. Press the [↵] key to save the SLOPE calibration or press the [▽/**pH-Recal**.] key to recalibrate buffer 2 and repeat from step 8.

If "**OVER**" or "**UNDER**"(**VIII. ERROR DISPLAYS AND TROUBLESHOOTING**) is displayed or a blinking "**SAVE**" does not show after more than few minutes then something is wrong with your buffer 2 or electrode. Be sure your buffer 2 is correct or change a new electrode and repeat from step 4.

12. Set-up your Relay, mA OUT and Temperature control.

13. The unit is ready for measurement and control.

d. **pH CONTROL SETTING** page



1. **HI RELAY 1** - The action for this relay is fixed to HIGH. In HI-action the relay will turn **ON** if the pH is greater or equal to RELAY 1 value, which is modified by the hysteresis value and hysteresis mode. (See chapter **V. CONTROLLING THE RELAYS**).

Use [△] and [▽/**pH-Recal**.] keys to change the blinking digit, use the [**MODE/-**] key to select another digit and the [↵] key to save the new value.

2. **HI RELAY 2** - The action for this relay is fixed to HIGH. In HI-action the relay will turn **ON** if the pH is greater or equal to RELAY2 value, which is modified by the hysteresis value and hysteresis mode. (See chapter **V. CONTROLLING THE RELAYS**.) Use [△] and [▽/**pH-Recal**.] keys to change the blinking digit, use the [**MODE/-**] key to select another digit and the [↵] key to save the new value.

3. **LO RELAY 3** - The action for this relay is fixed to LOW. In LO-action the relay will turn **ON** if the pH is less than or equal to RELAY3 value, which is modified by the hysteresis value and hysteresis mode. (See chapter **V. CONTROLLING**

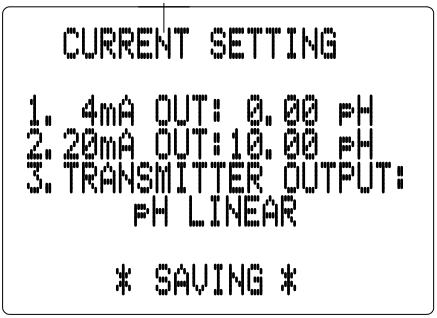
THE RELAYS.) Use [⮝] and [⮟/**pH-Recal**.] keys to change the blinking digit, use the [**MODE/-**] key to select another digit and the [↵] key to save the new value.

4. **LO RELAY 4** - The action for this relay is fixed to LOW. In LO-action the relay will turn **ON** if the pH is less than or equal to RELAY4 value, which is modified by the hysteresis value and hysteresis mode. (See chapter **V. CONTROLLING THE RELAYS**) Use [⮝] and [⮟/**pH-Recal**.] keys to change the blinking digit, use the [**MODE/-**] key to select another digit and the [↵] key to save the new value.

5**. HYSTERESIS** (**mode**) -this is the hysteresis mode for pH
RELAY 1 to 4. You can choose **CENTER**" or "**EDGE**". (See chapter **V**. **CONTROLLING THE RELAYS**.)

6. **HYSTERESIS** (**value**) - this is the actual value of the hysteresis. You can change this value from 0.00 pH to 3.99 pH **(**See chapter **V. CONTROLLING THE RELAYS).**

e. **CURRENT SETTING** page



1. **4mA OUT** – This value will be used in conjunction with 20 mA to plot the current output. (See chapter **VI**. **4-20 mA OUTPUT**.)

2**. 20mA OUT** – This value will be used in conjunction with the 4 mA value to plot the output. (See chapter **VI**. **4-20 mA OUTPUT**.)

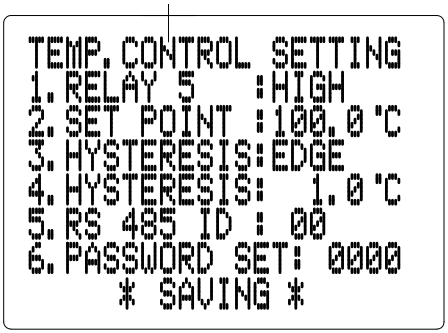
3. **TRANSMITTER OUTPUT** – This option would let you choose if the current output type is linear or antilog.

f. **TEMP. CONTROL SETTING** page

1. **RELAY 5** - the temperature has only one relay to control you need to set what action it will use, HIGH or LOW action. . (In HIGH-action the relay will turn **ON** if the temperature is greater or equal to RELAY5 value, in LOW-action the relay will turn **OFF** if the temperature is less than or equal to RELAY5 value, which is modified by the hysteresis value and hysteresis mode.)((See chapter **V. CONTROLLING THE RELAYS** .)

2. **SET POINT**- this is the user changeable value for the Temperature Alarm relay.

3. HYSTERESIS (**mode**) -this is the hysteresis mode for TEMPERATURE alarm. You can choose "**CENTER**" or "**EDGE**". (See chapter **V**. **CONTROLLING THE RELAYS**)



4. **HYSTERESIS** (**value**)- this is the actual value of the hysteresis. You can change this value from 0.0 to 19. 9°C. (See chapter **V**. **CONTROLLING THE RELAYS**)

5. **RS 485 ID** – this is the unique ID/Address for the unit. If you are connecting multiple model pH 500 or other Cole-Parmer models for logging purposes then this ID/Address must be unique for each connected unit. This ID/Address is the same address that must be used by the PC program to communicate with this unit.

6. **PASSWORD SET** - this is your security code if the unit is locked the value here will not be available. You need to input the correct code in the PASSWORD CHECK page.

CAUTION: The user is responsible in remembering their password number otherwise you would no be able to calibrate or change the settings.

V. CONTROLLING THE RELAYS

A. RELAY ISOLATION VOLTAGE

The maximum isolation voltage of the relay output contacts is 1500 VDC. The voltage differential between the relay output contacts and the load should not exceed 1500 VDC.

B. RELAY OUTPUT LOAD

The current through the relay output contacts should not exceed 5 Amp at 115 VAC and 2.5 Amp at 230 VAC in order not to cause permanent damage to the relay contacts. This rating is specified for **resistive** loads only.

C. RELAY ACTION, SET POINT, HYSTERESIS

Relay Action	Hysteresis mode	Effective RELAY-**ON** Point	Effective RELAY-**OFF** Point
HIGH	CENTER	S.P.+ ½(H.V.)	S.P. -½ (H.V.)
HIGH	EDGE	S.P.	S.P. –(H.V.)
LOW	CENTER	S.P.-½ (H.V.)	S.P.+½ (H.V.)
LOW	EDGE	S.P	S.P.+(H.V.)

S.P. = Relay Set point
H.V.= Hysteresis value (Dead Band)

If the relay action is set to HI and the hysteresis mode is **CENTER**, the relay will turn **ON** at [(RELAY SETPOINT) + (0.5 * hysteresis value)], and will turn **OFF** at [(RELAY SET POINT) - (0.5 * hysteresis value)].

If the relay action is set to HI and the hysteresis mode is **EDGE**, the relay will turn ON at (RELAY SET POINT), and will turn OFF at [(RELAY SET POINT)-(hysteresis value)].

If the relay action is set to LO and the hysteresis mode is CENTER, the relay will turn **OFF** at [(RELAY SET POINT) + (0.5 * hysteresis value)], and will turn **ON** at [(RELAY SET POINT) - (0.5 * hysteresis value)].

If the relay action is set to LO and the hysteresis mode is EDGE, the relay will turn **OFF** at [(RELAY SET POINT)+(hysteresis value)], and will turn **ON** at (RELAY SET POINT).

D. pH RELAYS

There are four independent Alarm channels for pH display. (see **figure 1.**). The hysteresis mode (center or edge, see **figure 1.**) and hysteresis value will be used by both pH relays.

The action of the pH relays is dependent on set point, relay action type (HIGH or LOW), hysteresis mode (Center or Edge) , hysteresis value and the current pH display. (see **figure 1.**).

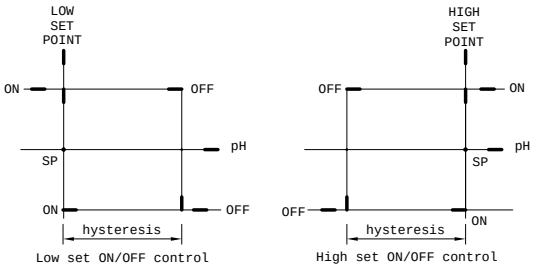


Figure 1

E. TEMPERATURE RELAY

One relay channel is available for temperature display which has independent set point, action (see **fig. 1**) setting (HIGH or LOW), hysteresis mode (center or edge) and hysteresis value.

The action of the Temperature relay is dependent on set point, relay action (HIGH or LOW), hysteresis mode (Center or Edge), hysteresis value and the current Temperature display. (See fig. 1).

VI. 4 - 20 mA OUTPUT

A. ISOLATION VOLTAGE

The maximum isolation voltage of the 4-20 mA output is 500 VDC. The voltage differential between the 4-20 mA output and the load should not exceed 500 VDC.

B. OUTPUT LOAD

The maximum load is 500 . Output current inaccuracies may occur for load impedance in excess 500 .

C. pH LINEAR OUTPUT

The analog output will produce a linear analog output if the user selects this option (see **figure 2**). The analog output will be dependent on the **pH_4 mA setting**, **pH_20 mA setting** and the **current pH display**.

The pH LINEAR analog output is based on the following equation:

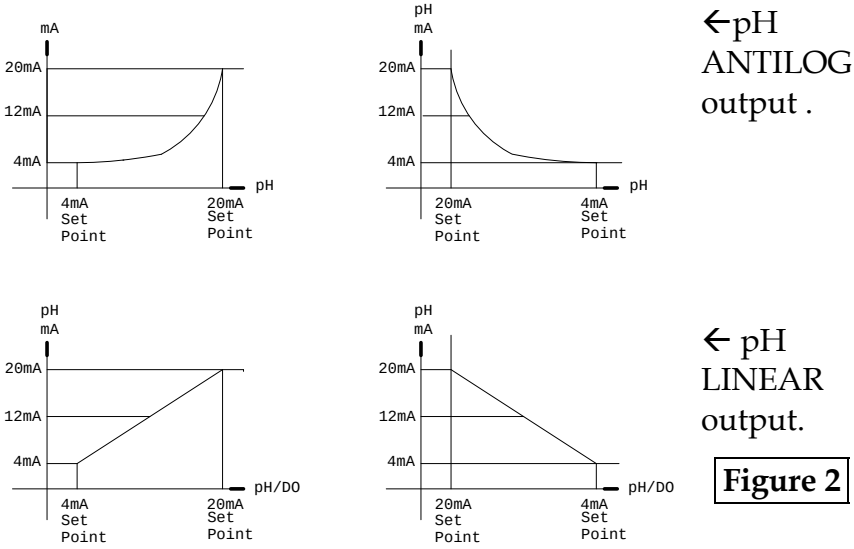
$$mA_{(pH)} = 4mA+(16mA)*(D_{(pH)} - pH(4)) / (pH(20) - pH(4))$$

Where:

$mA_{(pH)}$ = analog output
$D_{(pH)}$ = current pH display
pH(4) = pH user setting for 4 mA
pH(20) = pH user setting for 20 mA.

Note:
1. The range for 4mA and 20mA settings is 0.00 to 14.99 pH.

2. The absolute difference of the 4mA and 20mA settings must be greater or equal to 0.10pH or else the analog output will be disabled.



←pH ANTILOG output .

← pH LINEAR output.

Figure 2

D. pH ANTILOG OUTPUT

The analog output will produce a antilog analog output if the user selects this option (see **figure 2**). The analog output will be dependent on the **pH _4 mA setting**, **pH _20 mA setting** and the **current pH display**.

The pH ANTILOG analog output is based on the following equation:

$$mA_{(pH)} = 4mA + (16mA) * (10^{\wedge D(pH)} - 10^{\wedge pH(4)}) / (10^{\wedge pH(20)} - 10^{\wedge pH(4)})$$

Where:

$mA_{(pH)}$ = analog output
$D_{(pH)}$ = current pH display
pH(4) = pH user setting for 4 mA
pH(20) = pH user setting for 20 mA.

Note:
1. The range for 4mA and 20mA settings is 0.00 to 14.99 pH.

2. The absolute difference of the 4mA and 20 mA settings must be greater or equal to 0.10pH or else the analog output will be disabled.

VII. RS485 INTERFACE OPERATION

A. INTRODUCTION

This section assumes you are familiar with the basics of computer programming, data communication, the RS485 interface and possess a copy of any programming language software capable of interfacing with a RS485 card or a RS232-RS485 converter (third party vendor) module.

A demo program for Windows (XP, 7) is included in the accompanying disk.

B. PREPARING THE METER

This meter comes equipped with a 2-wire RS485 interface. Just connect each terminal to the respective RS485 terminal on your PC. (If the DEMO program is not working, try reversing the connections of the terminals.) After you have connected the meter (or multiple meters with unique ID number) correctly and turned on both the meter(s) and the computer, you are now ready to program a simple routine to read data from the instrument.

Read the included file “Model pH500 protocol.doc” to help you make a program to communicate with the Model pH500.

VIII. ERROR DISPLAYS AND TROUBLESHOOTING

LCD display	**ATC display**	**DISPLAY unit**	**Possible cause(s) [Action(s)]**
"OVER"	"OVER"	pH	a. Temperature > 120.0°C. [Bring buffer/solution to a lower temperature.] [Replace temperature probe.] b. No temperature sensor.. [Use a temperature probe.]
"OVER"	"UNDR"	pH	Temperature < -10.0°C. [Bring buffer/solution to a higher temperature.]
"OVER"	-10.0~ 120.0°C	pH	pH>16.00 . [Over Range or Recalibrate.]
"OVER"	0.0 ~ 60.0°C	a.pH-Cal-STAND	a. Offset @ 7.00pH:

		b.pH-Cal-SLOPE	mV>100mV Offset@6.86pH: mV>108.3mV b. New slope>ideal slope by 30% [Use a new buffer solution.] [Replace electrode.]
"UNDR"	0.0 ~ 60.0°C	a.pH-Cal-STAND b.pH-Cal-SLOPE	a. Offset @ 7.00pH: mV<-100mV Offset@6.86pH:mV< -91.7 mV b. New Slope<ideal slope by 30% [Use a new buffer solution.] [Replace electrode.]
"UNDR"	-10.0~ 120.0°C	pH	pH<-2.00 [Under Range or Recalibrate.]
EEPROM: BAD		During power-on	Unit has failed its EEPROM test. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]
ROM : BAD		During power-on	Unit has failed its ROM test. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]
RAM : BAD		During power-on	Unit has failed its RAM test. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]

IX. pH BUFFERS

The temperature characteristics of pH calibration buffers 4.00, 4.01, 6.86, 7.00, 9.18 and 10.01 are stored inside the instrument. The buffers used to calibrate the instrument must exhibit the same temperature characteristics as the stored values.

TABLE1.

°C	4.00	6.86	9.18	4.01	7.00	10.01
0	4.01	6.98	9.46	4.01	7.11	10.32
5	4.00	6.95	9.39	4.01	7.08	10.25
10	4.00	6.92	9.33	4.00	7.06	10.18
15	4.00	6.90	9.28	4.00	7.03	10.12
20	4.00	6.88	9.23	4.00	7.01	10.06
25	**4.00**	**6.86**	**9.18**	**4.01**	**7.00**	**10.01**
30	4.01	6.85	9.14	4.01	6.98	9.97
35	4.02	6.84	9.10	4.02	6.98	9.93
40	4.03	6.84	9.07	4.03	6.97	9.89
45	4.04	6.83	9.04	4.04	6.97	9.86
50	4.06	6.83	9.02	4.06	6.97	9.83
55	4.07	6.83	8.99	4.08	6.97	9.80
60	4.09	6.84	8.97	4.10	6.98	9.78

Note: The actual reading of the instrument can differ from the values shown by ±0.01 pH.

X. SPECIFICATIONS

pH

Range	Resolution	Accuracy
-2.00 to 16.00 pH	0.01 pH	±0.01 pH ± 1 LSD

Temperature

Range	Resolution	Accuracy
-10.0 to 120.0 °C	0.1 °C	±0.1 °C ± 1 LSD

pH

pH buffer recognition **(STAND)** pH 7.00 or 6.86
(SLOPE) pH 4.00 4.01, 9.18 or 10.01

pH Temperature compensation AUTO -10.0 to 120.0°C

pH Buffer Temperature range 0.0 to 60.0°C

pH Electrode Offset recognition	100 mV at pH 7.00 +108.3 mV/-91.7 mV at pH 6.86
pH Electrode Slope recognition	30% at pH 4.00, 4.01, 9.18 & 10.01
Input impedance	$>10^{13}$
Calibration point sensing	Yes
Excitation voltage	5VDC, 20 mA max
Temperature	
Temperature sensor	Thermistor, 10.00kohm at 25°C
4-20mA Output	
Current output type	Linear or Antilog (user programmable)
Current output range	4 to 20 mA (isolated)
Current output scale	user programmable
Maximum load	500
Accuracy	± 0.02mA
Isolation voltage	500VDC
Controller	
Control type	(five) ON/OFF control
Relay output	5A at 115VAC or 2.5A at 230VAC Resistive load only
GENERAL	
Keys	Audio feedback in all keys
Security protect	4-digit password
Communication	RS485
Power Source	115VAC or 230VAC 50/60Hz
Power consumption	6watt
Fuse	315mA/250V fast acting glass tube
Ambient Temperature range	0.0 to 50.0 °C
Display	128x64 graphic LCD w/ backlight
Case	IPT65 ¼ DIN case, depth 148 mm
Weight	950 g

XI. WARRANTY

The Cole-Parmer Instrument Company warrants this product to be free from significant deviations in material and workmanship for a period of one year. If repair or adjustment is necessary and has not been the result of abuse or misuse, within the twelve month period, please return, freight-prepaid, and correction will be made without charge (see note on return of items). Cole-Parmer alone will determine if the product problem is due to deviations or customer misuse.
Out of warranty products will be repaired for a nominal charge.

XII. RETURN OF ITEMS

Authorization must be obtained from our Customer Service Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned. A restocking charge will be made on all unauthorized returns.

For your protection, items being returned must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Cole-Parmer will not be responsible for damage resulting from careless or insufficient packing.

Note: The Cole-Parmer Instrument Company reserves the right to make improvements in design, construction and appearance of our products without notice.

We stand behind our products. For additional information on our products, warranty, or returns please contact our office or visit our website listed on front page.

机型	pH 500	文件名称	使用说明书(英)		
文件编号	KpH 500-02	编制人	汪蕾	编制日期	2013/04/11
版本号	02	核准人		核准日期	