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**Model HP2A**

**Dual pH/REDOX, pH/pH, REDOX/REDOX Controller**

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## 1. Introduction

Congratulations! You have chosen the latest in pH and REDOX Control Systems. This manual is intended to make it easy to install and use the HP2A controller.

Please take the time to read it completely. If you have any questions, please contact your TPS distributor, or the TPS factory in Brisbane.

The HP2A Controller is a combination pH/REDOX, pH/pH or REDOX/REDOX controller. The factory configures the HP2A as one of the above 3 combinations.

The HP2A controller has special electronic circuitry to compensate for the effect of Temperature variation on the accuracy of the readings.

The pH value is usually by controlled addition of ACID, to correct a rising pH condition, or by addition of ALKALI, to correct a falling pH condition.

NOTE: For pH, the HP2A is supplied configured for Acid Addition.  
That is, the pH relay changes over if the pH is ABOVE the :LIMIT set-point.

For ALKALI addition, remove the jumper-link. (See Page 8)

O.R.P. is Oxidisation / Reduction Potential (i.e. REDOX value), and is usually controlled by an oxidizing agent such as Sodium Hypochlorite or by a Chlorine or Ozone (Ultra-violet) generator.

NOTE: For REDOX the HP2A is supplied configured for oxidant addition.  
That is, the REDOX relay changes over if the O.R.P. is BELOW the :LIMIT

For reverse addition, remove the jumper-link. (See Page 8)

### 1.1 Control Method

The HP2A continuously measures pH and/or O.R.P. (REDOX value) of the solution. When either value changes away from the "LIMIT" value as set on the front panel controls, the appropriate relay output is switched on. This controls addition of chemical, or the operation of the oxidant generator. When the chemical value returns within limits, the output function is switched off again.

### 1.2 Timed Addition

The HP2A also has the facility of "ADDITION TIMER". This is a variable timer. This prevents overshoot of control if the electrodes are not placed correctly.

#### Example

If the Timer control is set to 2 minutes, then, at approx. every 15 minutes, the HP2A will check the pH and/or O.R.P. of the solution. If correction is required, the HP2A will do this correction (or alarm) for up to the 2 minutes, and then stop.

The controller then waits for approx. 13 mins. more (15 less the 2 minutes) to allow mixing to take place before operating again.

The minimum setting of the TIMER is approx. 20 seconds.

#### Note

When the TIMER control is turned fully counter-clockwise, there is a switch "CLICK" position. In this position, the timer function is disabled, and correction or alarm will occur on "DEMAND". In this mode, the relays will operate as soon as the relevant "LIMIT" value is exceeded, and will operate continuously, until the pH and/or O.R.P. returns to normal.

## 2. Controls

### 2.1 Main Function Switch

- CALIB** In this position, the displays show data from the 2 sensors. The 2 output relay functions are disabled. This allows calibration to be performed without alarms or output operation.
- AUTO** Normal operation mode. The displays show data from the 2 sensors and the 2 output relay functions are readied for correction.
- :LIMIT** In this position, the displays show the set values of the :LIMIT controls. The 2 output relay functions are disabled. This allows setting of the :LIMIT values without alarms or output operation.

### 2.2 pH Section

- ZERO** This screwdriver set control is used to calibrate the pH section and pH sensor to the known pH value of the standard buffer.
- :LIMIT** This control determines the value of pH above which acid is to be added to reduce the pH value. The pH section must be correctly calibrated. If the pH reading exceeds this control setting, the “:” on the pH display is on, and the pH relay is activated (depending also on the TIMER). The pH relay is then used to control the Acid Pump or solenoid. The reverse action occurs if the HP2A has been configured for HP2A for ALKALI.
- Reverse action can also be configured. See Jumper on Page 8.
- pH SPAN** This is an internal screwdriver set adjustment to set the pH section to read the correct pH when the probe is placed in pH buffer 4.00.

### 2.3 REDOX/ORP Section

- SPAN** This screwdriver set control is used to set the SPAN of the REDOX section in a solution of known REDOX potential. This needs only very occasional readjustment as it is very stable long term.
- ZERO** This screwdriver set control is used to calibrate the REDOX section at 0 mV. This calibration is also very stable.
- :LIMIT** This control sets the value of REDOX below which the REDOX relay contact operates to correct a low level. When the relay contact operates, the colon “:” on the display is turned on to give a front panel indication of the output function.
- Reverse action can also be configured. See Jumper on Page 8.

### 2.4 Addition Timer

This is a timer adjustment which can be set from approx. 20 seconds minimum to approx. 10 minutes maximum. This timer sets the length of time the output relays operate. The timer permits addition on a 15 minute cycle.

**For Example:** If the timer is set to 2 minutes, then addition can take place for 2 minutes (if the :LIMIT value is exceeded), and then the controller will turn off for 13 minutes (15 minutes less this 2 minutes). If the control is switched fully counter-clockwise to the "DEMAND" position the timer is disabled, and the relays operate immediately when required.

### **3. Planning the Installation**

#### **3.1 Power Requirements:**

The HP2A controller requires a standard 240 Volt AC power supply. This should be wired by your local electrical contractor, in accordance with local supply authority requirements. The power requirements for the controller are very small (only 5 watts). You may require single or 3 phase power for pumps etc, depending, on your particular installation. In this case, external contactors must be used and these controlled by the HP2A. The HP2A relay contacts are designed to switch up to 1 Amp max.

#### **3.2 Solenoid Valves:**

The HP2A can also be used to switch solenoid valves to control addition using gravity-feed from storage containers. If the sensors are in a flow through assembly, delivery of the additions should be adjacent to the probes to avoid overshoot of the pH or O.R.P. values.

#### **3.3 Air Pumps**

The HP2A can be used to control simple air pumps which pressurize the addition containers. Delivery, should be adjacent to the sensors to avoid overshoot of the pH or O.R.P. values.

#### **3.4 Chemical Feeder Pumps**

Most accurate, but more expensive.

These are Electrically driven positive displacement pumps. The rate of addition can be adjusted on each pump. The HP2A controller turns power on and off to the pumps to control the length of time that the pumps operate.

#### **3.5 Probe Installation**

The probes can be fitted into the pipe lines themselves. The probe is supplied with an adaptor fitting to suit installation into 40 mm PVC pipe. This saddle adaptor should be glued onto the wall of the pipe so that the electrode can screw into it. The angle from vertical of the probe (with the bulb/end DOWN) when installed should be no greater than 80 Degrees for correct operation. That is, the probe can be mounted at any angle between near-horizontal and vertical with the bulb/end DOWN.

**DO NOT** install the probes upside-down, as an internal bubble in the probe tip will form, and noisy erratic readings will result.

#### **3.6 Probe Cleaning**

The sensors are sealed units and need no maintenance other than periodic gentle cleaning. A weak acid soak followed by a fresh water wash of half an hour is recommended. In case of pH, if the bulb is cracked or if the "Set 6.88" adjustment is impossible, the electrode probably requires replacement.

## 4. Terminals

Under the Terminal cover are 2 terminal connection strips. These provide for all connections to sensors, outputs and 240v AC power input. The rear or bottom panel of the case can be punched to allow wiring access to the terminal strips.

### 4.1 Terminal Strip #1 (Left)

1:	240v AC ACTIVE input	BROWN
1:	240v AC ACTIVE input	(Spare for wiring)
1:	240v AC ACTIVE input	(Spare for wiring)
2:	MAINS EARTH	YELLOW/GREEN
2:	MAINS EARTH	(Spare for wiring)
2:	MAINS EARTH	(Spare for wiring)
3:	240v AC NEUTRAL input	BLUE
3:	240v AC NEUTRAL input	(Spare for wiring)
3:	240v AC NEUTRAL input	(Spare for wiring)
4:	pH/ORP #1 relay Normally Closed contact	
5:	pH/ORP #1 relay Pole (common)	
6:	pH/ORP #1 relay Normally Open contact	
7:	pH/ORP #2 relay Normally Closed contact	
8:	pH/ORP #2 relay Pole (common)	
9:	pH/ORP #2 relay Normally Open contact	
10:	Chart Recorder Output Common	
11:	Chart Recorder Output #1	0 to -2.5v = 0 to 2000 display
12:	Chart Recorder Output #2	0 to -2.5v = 0 to 2000 display

### 4.2 Terminal Strip #2 (Right)

1:	pH #1 ATC	White/Clear (n/c for REDOX)
2:	pH #1 ATC	Black (n/c for REDOX)
3:	SOLUTION GROUND and SHIELD	Green/Braid or wire to pool
4:	pH/REDOX #1 Probe (Ref)	Black
5:	pH/REDOX #1 Probe (shield)	No connection for 2 wire sensor
6:	pH/REDOX #1 Probe (Signal)	Clear
7:	pH #2 ATC	White/Clear (n/c for REDOX)
8:	pH #2 ATC	Black (n/c for REDOX)
9:	SOLUTION GROUND and SHIELD	Green/Braid or wire to pool
10:	pH/REDOX # 2 Probe (Ref)	Black
11:	pH/REDOX # 2 Probe (shield)	No connection for 2 wire sensor
12:	pH/REDOX #2 Probe (Signal)	Clear

The solution guard terminal (terminals 3 & 9) is most important for elimination of noise pickup in the system. It should be connected to the tank (if metal) or to a stainless steel rod or bolt in the solution. This connection prevents the solution becoming charged and effecting the reading. When removing the electrode to do a buffer calibration, this lead MUST accompany the electrode. It is sufficient to simply dangle a wire (from the guard terminal) into the buffer beaker. Such a piece of wire is only temporary as it will corrode in the long term.

### 4.3 Power

The unit requires 240v 5 Watts. The outputs provide contact changeovers ONLY. The contacts are rated at 240v 1A. The air pumps or Solenoids require less than this current. Larger pumps require a repeating contactor. Please consult your installation electrician, or TPS.

## 5. Commissioning

### 5.1 Calibrating the pH section

1. Set the function switch to "CALIB".
2. Place the pH Electrode in a small amount of buffer 6.88.  
Immerse the probe tip to half an inch or more.
3. The following step is essential!  
Add a solution guard wire from the buffer solution to the guard terminal.
4. Adjust screwdriver "ZERO" for 6.88 pH on the appropriate section.
5. Place the pH Electrode in a small amount of buffer 4.00.  
Immerse the probe tip to half an inch or more.
6. Adjust screwdriver "SPAN" for 4.00 pH on the appropriate section.
7. Return the pH Electrode to the tank (or flow cell) and reconnect the Solution Guard.  
Discard the used buffer solution sample.
8. Return the function switch to "AUTO".

**SIMPLER ALTERNATIVE METHOD:** Measure the solution pH with a separate instrument, and set the pH ZERO control for this same value.

### 5.2 Calibrate the REDOX Section

Standard REDOX solutions are notoriously unstable. The REDOX section has been factory-calibrated for ZERO and SPAN. These controls should not need adjustment.

The REDOX electrode and instrument performance can be checked if necessary, by the following procedure.

1. Set the function switch to "CALIB".
2. Place the REDOX Sensor tip in a small amount of freshly mixed standard REDOX solution.  
Immerse to half an inch or more.  
(Add a solution guard wire from the REDOX solution to the guard terminal 9 described above.)
3. Check that the REDOX value is +186 mV +/- 50 mV.  
If so, this indicates the REDOX section is function OK.
4. Discard the used standard solution sample.  
Return the REDOX Sensor to the tank (or flow chamber) and reconnect the Solution Guard connection.
5. Return the function switch to "AUTO".

**NOTE: For noise-free operation of the sensors, it is essential that a wire be connected from a metal fitting in contact with water, to the GUARD(S) of Tagblock 2 (right). This provides a ground for the electronics.  
DO NOT CONNECT the GUARD(S) to a Mains Earth.**

The sensors are supplied with adaptor fittings to suit installation into 40 mm PVC pipe. This saddle adaptor should be glued onto the wall of the pipe so that the sensor can screw into it.

The angle from vertical of the sensor (with the sensing end DOWN) when installed should be no greater than 90 Degrees for correct operation. That is, the sensor can be mounted at any angle between horizontal and vertical with the sensing end DOWN.

## **6. Setting Limits**

1. Switch to "LIMIT" on the main function switch.
2. Set the REDOX :Limit control so the display shows the value at which the relay contact is to operate. The relay operates when the REDOX is TOO LOW. The reverse occurs if the factory has configured the opposite action. (This :LIMIT can be adjusted at any time.)
3. Set the pH :Limit control so the display shows the value at which the relay contact is to operate. The Relay operates when the pH is too HIGH and so adds ACID. For factory configured ALKALI addition the reverse applies. (This :LIMIT can be adjusted at any time.)
4. Return to "AUTO".

### **6.1 Finding Redox Limit For Swimming Pool Applications**

1. Using a colorimetric test kit, or similar, manually bring the pool to the desired levels of pH and free chlorine.

NOTE: DO NOT USE THE CONTROLLER FOR THIS PURPOSE.

2. Switch to "CALIB" on the main function switch.
3. Note the reading given on the REDOX display.  
This is the reading which corresponds to the correct level of
4. chlorine in the pool.
5. Switch to "LIMIT" on the main function switch.
6. Adjust screwdriver ":LIMIT" control of the REDOX channel so the display reads the value noted in [3] above.
7. Switch to "AUTO".
8. After a few days, recheck the pool using the colorimetric test kit, or similar. It may then be necessary to "fine tune" the :LIMIT value, using the procedure above, starting at [2].

## 7. Spares And Accessories

### Standard Kit Includes

	<b>Part No</b>
pH ELECTRODE (SCREW-IN TYPE) with 5 Metre cable	111244
REDOX Sensor (SCREW-IN TYPE) with 5 Metre cable	111262
pH 4.00 Standard pH solution	121381
pH 6.88 Standard pH solution	121306
Plastic pipe adaptor to suit pH or REDOX probes (2)	111305
Handbook	130050

### Options:

pH ELECTRODE, DIP, Non-flow reference, 5 Metre cable	111228
REDOX Sensor, DIP, Non-Flow reference, 5 Metre cable	111260
Spare Plastic REDOX probe adaptors	111305
Standard REDOX solution	121309
pH ATC probe (screw-in type) 5m cable	111264
pH ATC probe, DIP type, 5m cable	111274
Solenoid valve 240 Volt, ABS plastic body	P.O.A.
Solenoid valve 24 Volt, ABS plastic body	P.O.A.
Power supply, 240 Volt to 24 Volt AC	P.O.A.

## 8. Control Programming Jumpers

To access the control programming jumpers:

1. Turn of the power to the HP2A controller.
2. Remove the 4 corner screws from the front panel.
3. Pull out the front panel and attached printed circuit board.
4. Be careful not to strain the cable, (or unplug the connectors on the cable ends,) which connects the front and rear printed circuit cards.
5. The jumpers are on the rear (printed wiring) side of the printed circuit board. If jumpers are to be removed, simply unplug the black jumper plug from the correct pair of pins, and replace the jumper plug onto 1 of the 2 pins for safe-keeping.

Programming Jumpers on the front display card are provided as follows:

### LEFT DISPLAY DECIMAL POINTS

1999 (no decimal points, for example 1999 mV)  
 1.999 (bottom of 3 jumpers)  
 19.99 ( for pH etc, for example 7.00 pH)  
 199.9 (top of 3 jumpers)

### JUMPER

J4, J5, J6 ALL OFF  
 J4 ON  
 J5 ON  
 J6 ON

### RIGHT DISPLAY DECIMAL POINTS

1999 (no decimal points, for example 1999 mV)  
 19.99 ( for pH etc, for example 7.00 pH)  
 199.9 (top of 2 jumpers on right)

### JUMPER

J4, J5, J6 ALL OFF  
 J7 ON  
 J8 ON

### DISPLAY

### DIRECTION OF CONTROL

LEFT DISPLAY	LEFT RELAY MAKES ON INCREASING
RIGHT DISPLAY	RIGHT RELAY MAKES ON INCREASING

### JUMPER

J9 ON  
 J10 ON

### FOR EXAMPLE:

pH in LEFT side	Add ACID when pH is TOO HIGH	J9 is ON
ORP in RIGHT side,	Add CHLORINE when ORP is TOO LOW	J10 is OFF

(These 2 jumpers are just above the switch on the rear side of the front panel printed circuit board)

## 9. Troubleshooting

### Excess Slope Response.

For the pH function, for certain applications where Automatic Temperature Compensation of the probe signal is not required, ATC probes for pH will NOT be supplied originally.

In this case for pH only, resistors will have been factory-installed on the rear printed circuit board to take the place of the ATC probe.

This makes the controller "think" that the solution temperature is always 25 °C. If the ATC probes are subsequently retro-fitted, these resistors will have to be cut out for the controller to function correctly.

If the resistors are left in place, the controller will be able to be calibrated in a pH 6.88 or 7.00 buffer OK. However, when in a pH = 4 buffer for slope adjustment, the controller will function with excess "SLOPE" response, and the display will show approx pH=2 or less.

To remove these resistors for the LEFT pH display, cut out R9 and R10 on the bottom card.

To remove these resistors for the RIGHT pH display, cut out R29 and R30 on the bottom card.

### 9.1 Dosing Problems

Normal dosing pumps require a contact closure to START pumping. There have been instances where pumps require a contact closure to STOP pumping.

Make sure when testing the installation that:

1. The pump operates when the REDOX or pH value is on the correct "SIDE" of the LIMIT SET POINT.

For example:

**REDOX:** If the pump is adding chlorine, the REDOX will rise with increasing Chlorine.

Set the LIMIT value to +550 mV (or so). Set the display back to AUTO, showing the Probe REDOX.

Now, when the REDOX goes ABOVE the set point value (550), the pump should STOP.

When the REDOX falls BELOW the set point value (550), the pump should START again.

IF THIS DOES NOT OCCUR, the jumper on the back of the display card will require re-setting for correct direction of operation. See the discussion on this on Page 1 and Page 8.

## 10. Replacement of LCD display

Fault: Segments missing on LCD display

Cause: Faulty display, sometimes caused by pressure of a connector cable against back of display.

Fix: Remove and replace LCD, bend cable so it does not press against the edge of the display.

Method:

1. Open the front clear plastic cover.
2. Remove the 4 corner screws holding the front panel.
3. Remove the front panel and attached printed circuit card.  
(Take care- The front and rear card are attached by a connector cable.)
4. Note how the connector cable plugs into the rear card for replacement later.
5. Unplug the connector cable.  
(The front panel and card is now detached from the case.)
6. Remove the two front panel knobs.
7. Remove the 4 mount nuts and lock washers from the Printed circuit cards mounting bolts.
8. Remove the printed circuit card.
9. Note if the ribbon cable is pressing against the back edge of the faulty display. If so, bend the ribbon cable where it exits from the side of the plug to move it away from the rear of the LCD display.
10. Remove the faulty LCD display from the socket using a broad flat screwdriver. Lever the display up gently against each side, adjacent to the connector strip.
11. Replace with a new LCD display. The display has a "Key" notch visible on the LEFT side of the black border of the display.
12. Press into the socket one side at a time using 2 thumbs along the connector strips.  
DO NOT press in the centre of the glass.

Check again the ribbon is not touching the EDGE of the display.

(It can rest against the display along the BACK without any problem.)

13. Replace the card on the panel, bolt up.
14. Replace the knobs.
15. Replace the connector plug.
16. Replace the front panel screws.
17. Turn on, select "LIMITS". Adjust the LIMITS pot for the channel where the LCD display was replaced and see all segments are now correct.

## 11. Warranty

TPS Pty. Ltd. guarantees all instruments and electrodes to be free from defects in material and workmanship when subjected to normal use and service. This guarantee is expressly limited to the servicing and/or adjustment of an instrument returned to the Factory, or Authorised Service Station, freight prepaid, within twelve (12) months from the date of delivery, and to the repairing, replacing, or adjusting of parts which upon inspection are found to be defective. Warranty period on electrodes is three (3) months.

There are no express or implied warranties which extend beyond the face hereof, and TPS Pty. Ltd. is not liable for any incidental or consequential damages arising from the use or misuse of this equipment, or from interpretation of information derived from the equipment.

Shipping damage is not covered by this warranty.

### **PLEASE NOTE:**

A guarantee card is packed with the instrument or electrode. This card must be completed at the time of purchase and the registration section returned to TPS Pty. Ltd. within 7 days. No claims will be recognised without the original guarantee card or other proof of purchase. This warranty becomes invalid if modifications or repairs are attempted by unauthorised persons, or the serial number is missing.

### **PROCEDURE SERVICE**

If you feel that this equipment is in need of repair, please re-read the manual. Sometimes, instruments are received for "repair" in perfect working order. This can occur where batteries simply require replacement or re-charging, or where the electrode simply requires cleaning or replacement. TPS Pty. Ltd. has a fine reputation for prompt and efficient service. In just a few days, our factory service engineers and technicians will examine and repair your equipment to your full satisfaction.

### **To obtain this service, please follow this procedure:**

Return the instrument AND ALL SENSORS to TPS freight pre-paid and insured in its original packing or suitable equivalent. INSIST on a proof of delivery receipt from the carrier for your protection in the case of shipping claims for transit loss or damage. It is your responsibility as the sender to ensure that TPS receives the unit.

Please check that the following is enclosed with your equipment:

- **Your Name and daytime phone number.**
- **Your company name, ORDER number, and return street address.**
- **A description of the fault. (Please be SPECIFIC.)**  
(Note: "Please Repair" does NOT describe a fault.)
- **Either \$12 for return freight for units under warranty, or \$20 to cover inspection costs and return freight. (These amounts are not applicable to full-account customers.)**

Your equipment will be repaired and returned to you, freight paid.

For out-of-warranty units, a repair cost will be calculated from parts and labor costs. If payment is not received for the additional charges within 30 days, or if you decline to have the equipment repaired, the complete unit will be returned to you freight paid, not repaired. For full-account customers, the repair charges will be debited to your account.

- **Always describe the fault in writing.**
- **Always return the sensors with the meter.**