

Model HP2

Conductivity/TDS plus pH/Redox Controller

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1. Introduction

Congratulations! You have chosen the latest in Control Systems for Conductivity or TDS plus pH or Redox. This manual is intended to make it easy to install and use the HP2 controller.

Please take the time to read it completely.

If you have any questions, please feel free to contact your TPS distributor, or the TPS factory in Brisbane.

1.1 Overview

The standard HP2 is a combination Conductivity and pH controller. For other applications, the Conductivity section can be factory re-configured for TDS and the pH section can be factory re-configured for Redox.

The HP2 is designed to continuously measure and automatically control the two parameters at set-point that can be entered by the user.

1.2 Conductivity/TDS Control

In applications such as cooling towers Conductivity or TDS needs to be controlled when readings get too high. For other applications where take-up of the ions (eg: hydroponics) or dilution is a problem, Conductivity or TDS needs to be controlled when readings get too low. A standard HP2 is set up for the latter.

If Conductivity/TDS needs to be controlled at a “too high” limit, then this can be changed by the user as follows:

1. There is a jumper link which sets the direction of the Conductivity/TDS control behind the Conductivity/TDS display. Locate this jumper link (it is a small black header mounted on two pins).
2. For a standard HP2, this jumper link will NOT be shorting the two pins (ie: it will be connected to just one of the pins). This is set up for “too low” control.
3. Remove and re-install the jumper link so that it shorts the two pins.
4. The HP2 is now set up to control at a “too high” Conductivity or TDS limit.

1.3 pH Control (if the HP2 is set up for pH):

pH can be controlled by the use of acid to lower the pH when it gets too high, or by alkali addition to raise the pH when it gets to low. A standard HP2 is set up for acid addition when the pH gets too high.

If pH needs to be controlled at a “too low” limit, then this can be changed by the user as follows:

1. There is a jumper link which sets the direction of the pH control behind the pH display. Locate this jumper link (it is a small black header mounted on two pins).
2. For a standard HP2, this jumper link will be shorting the two pins (ie: it will be connected to both pins). This is set up for “too high” control.
3. Remove and re-install the jumper link so that it is connected to just one of the two pins. This avoids losing the jumper pin if it needs to be re-configured later.
4. The HP2 is now set up to control at a “too low” pH limit.

1.4 Redox Control (if the HP2 is set up for Redox):

Redox can be controlled by the use of agent such as Chlorine when the reading gets too low. It is generally not controlled at a “too low” limit. A standard HP2 is set up for reagent addition when the Redox gets too low.

If Redox needs to be controlled at a “too high” limit, then this can be changed by the user as follows:

1. There is a jumper link which sets the direction of the Redox control behind the Redox display. Locate this jumper link (it is a small black header mounted on two pins).
2. For a standard HP2, this jumper link will NOT be shorting the two pins (ie: it will be connected to just one of the pins). This is set up for “too low” control.
3. Remove and re-install the jumper link so that it shorts the two pins.
4. The HP2 is now set up to control at a “too high” Redox limit.

1.5 Control Method:

The HP2 continuously measures the Conductivity/TDS and pH/Redox 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 then controls the addition of chemical. When the chemical value returns to be equal to the setting of the control on the panel, the output function is switched off again.

1.6 Timed Addition

The HP2 also has the facility of "TIMED ADDITION". This is a variable timer with a front-panel control setting.

EXAMPLE: If the Timer control is set to 2 minutes, then at approximately every 15 minutes, the HP2 will check the Conductivity/TDS and pH/Redox of the solution. If correction of Conductivity/TDS or pH/Redox is required, the HP2 will add solution for up to this 2 Minutes, then stop adding (or before if the data becomes correct). It then waits for approx. 15 less this 2 mins (ie 13 minutes) checking again. The minimum setting for the TIMER is approx. 20 seconds.

This prevents overshoot of control action if the electrodes have not been placed correctly.

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 reagent will be added on "DEMAND". In this mode, the relays will operate as soon as the relevant "LIMIT" value is exceeded, and will operate continuously, until the Conductivity/TDS or pH/Redox value returns to normal.

2. Planning The Installation

2.1 Power Requirements

The HP2 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 HP2.

3. Probe Installation

The sensors can be installed into a tank directly, as long as they are constantly immersed, including when the pump is operating. Alternatively, if PVC pipe is being used (as is often the case), the probes can be fitted into the pipe lines themselves. The pH/Redox 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 tip 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 DOWN.

The Conductivity/TDS probe supplied with the HP2 has a 3/4" BSP thread. This screws directly into standard PVC 20 mm Pressure fittings. A suitable method of installation would be to use a 40 mm PVC "T" fitting with a 40 to 20 mm threaded reducing adaptor glued into one side of the "T". The probe then screws into this female socket, and the "T" fitting is used as an elbow joint in the pipe system. Avoid air traps inside the cover of the Conductivity /TDS probe.

4. Controls

4.1 Conductivity/TDS Section

SPAN: This screwdriver set control is used to adjust the conductivity/TDS section to a known standard. The Conductivity/TDS calibration needs only very infrequent readjustment as it is very stable long term. See Commissioning.

ZERO: This screwdriver set control is used to adjust the zero of the Conductivity/TDS section with the probe dry and in air. It is a one-off adjustment done at commissioning only.

LIMIT: This control determines the limit value at which conductivity/TDS is to be maintained. The ":" sign on the Conductivity/TDS display is switched on when the relay is activated.

4.2 pH/Redox Section

LIMIT: This control determines the limit value at which pH or Redox is to be maintained. When the pH/Redox reading exceeds this control setting, the ":" sign on the display is switched on, and the relay is activated (depending also on the TIMER setting).

ZERO: This screwdriver set control is used to calibrate the pH section and pH sensor to the known pH value of the standard buffer. If the HP2 is set up for Redox, then this control is factory set and will not require user adjustment. See Commissioning.

SPAN: This screwdriver set control is used to calibrate the pH section and pH sensor to read the correct pH when the probe is placed in pH buffer 4.00 (or other buffer away from pH 6.88 (or pH 7). Alternatively, this control is used to set the Redox value to that of a reliable Redox standard, such as Zobell solution. See Commissioning.

4.3 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 (ie: 15 minute cycle less 2 minutes ON = 13 minutes OFF)

If the control is switched fully counter-clockwise to the "DEMAND" position the timer is disabled, and the relays operate immediately when required.

5. Connectors

Connections are made to the HP2 controller on 2 sets of terminal connectors. These are conveniently located under a separate waterproof cover at the bottom of the unit.

From Left to right, the connections are:

TERMINAL STRIP 1 (left)

1: Mains Power Input ACTIVE	240 V AC	BROWN
1: Mains Power Input ACTIVE	240 V AC	(spare for wiring)
1: Mains Power Input ACTIVE	240 V AC	(spare for wiring)
2: Mains Power Input GROUND		YELLOW/GREEN
2: Mains Power Input GROUND		(spare for wiring)
2: Mains Power Input GROUND		(spare for wiring)
3: Mains Power Input NEUTRAL	240 V AC	BLUE
3: Mains Power Input NEUTRAL	240 V AC	(spare for wiring)
3: Mains Power Input NEUTRAL	240 V AC	(spare for wiring)
4: Conductivity/TDS Relay Contact	Normally Closed	
5: Conductivity/TDS Relay Contact	Common	
6: Conductivity/TDS Relay Contact	Normally Open	
7: pH/Redox Control Relay Contact	Normally Closed	
8: pH/Redox Control Relay Contact	Common	
9: pH/Redox Control Relay Contact	Normally Open	
10: Recorder Output	Common	
11: Recorder Output for Conductivity/TDS	0 to -2.5v for 0 to 2000 display	
12: Recorder Output for pH/Redox	0 to -2.5v for 0 to 2000 display	

TERMINAL STRIP 2 (right)

1: Conductivity/TDS Probe		RED
2: Conductivity/TDS Probe		BLACK
3: Conductivity/TDS Probe Auto Temp Compensator (ATC)		BLUE
4: Conductivity/TDS Probe Auto Temp Compensator (ATC)		WHITE
5: n/c		
6: n/c		
7: n/c		
8: n/c		
9: pH/Redox Solution ground wire *		
10: pH/Redox reference	Coax Cable Braid of cable (BLACK)	OR (1 pair + shield) (BLACK)
11: pH/Redox Shield (if fitted)	Not Fitted	Braid (GREEN)
12: pH/Redox Signal	Centre core of coax (CLEAR)	(CLEAR or WHITE)

* The solution guard terminal is most important for elimination of noise pick up in the system. It should be connected to the holding tank (if metal) or to a stainless steel rod or bolt in the solution. This connection prevents the solution becoming charged and effecting the pH or Redox reading. When removing the pH or Redox electrode for calibration, this lead MUST accompany the pH or Redox electrode. It is sufficient to simply dangle a wire (from the guard terminal) into the standard solution beaker. The wire will corrode in the long term.

6. Power

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

7. Commissioning

7.1 Calibrate the pH Section (if the HP2 is set up for pH):

- 1: Set to "CALIB". **The output relays are disabled in this mode.**
- 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 pH screwdriver "ZERO" control for 6.88 pH.
This step should be performed once a week.
- 5: Rinse the pH electrode and place in a small amount of buffer 4.00.
- 6: Adjust pH screwdriver "SPAN" control for 4.00 pH.
This step should be performed once a month.
- 7: Now switch the function switch to "LIMIT".
Both Conductivity/TDS and pH displays are now showing the value at which the output relays will operate. Set the pH limit to the desired value.

The output relays are disabled when the HP2 function switch is set to "LIMIT".

- 8: Return the pH Electrode to the tank (or flow cell) and reconnect the Solution Guard. Discard the used buffer solution sample.
- 9: Return to "AUTO"

7.2 Calibrate the Redox Section (if the HP2 is set up for Redox):

- 1: Set to "CALIB". **The output relays are disabled in this mode.**
- 2: Place the Redox Electrode in a small amount of Zobell solution.
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 "SPAN" control for 186 mV.
This step should be performed once a week. (Note that Redox electrodes can be very unstable long term.)
- 5: **NOTE:** The Zero control is factory set for Redox. **DO NOT** alter this adjustment.
- 6: Now switch the function switch to "LIMIT".
Both Conductivity/TDS and Redox displays are now showing the value at which the output relays will operate. Set the Redox limit to the desired value.

The output relays are disabled when the HP2 function switch is set to "LIMIT".

- 7: Return the Redox Electrode to the tank (or flow cell) and reconnect the Solution Guard. Discard the used standard solution sample.
- 8: Return to "AUTO"

7.3 Calibrate the Conductivity/TDS Section:

- 1: Set to "CALIB". **The output relays are disabled in this mode.**
- 2: Rinse the Conductivity/TDS electrode and allow to dry.
- 3: Adjust the screwdriver "ZERO" control for zero on the display.
This step should be performed once a month.
- 4: Place the Conductivity/TDS Probe into some Standard Solution. (eg: 2.76mS/cm or 2 ppK TDS). Immerse at least to the vent hole in the white plastic cover. Wait 2 minutes until the Temperature Compensator (inside the probe) reaches the final temperature.
- 5: Adjust the screwdriver "SPAN" control for until the display reads the value of the standard.
This step should be performed once a week.
- 6: Switch the function switch to "LIMIT".
Both Conductivity/TDS and pH/Redox displays are now showing the value at which the output relays will operate. Set the Conductivity/TDS limit control to the value at which it is to be maintained.
- 7: Return the Conductivity/TDS Probe to the tank (or flow cell).
- 8: Return to "AUTO"

8. Spares And Accessories:

Standard Kit Includes

	Part No.
pH Electrode (Screw-In Type) with 5 Metre cable	111244
Conductivity/TDS Probe with 5 Metre cable	112206
pH 4.00 Standard pH solution	121381
pH 6.88 Standard pH solution	121306
Standard Conductivity Solution 2.76 mS	122306
Handbook	130050

Options

Redox Electrode (Screw-in Type) with 5 Metre cable	111262
TDS Standard Solution 2ppK	122307
Zobell Redox Standard Solution	121309

9. pH Electrode Appendix

9.1 Sensor Maintenance

The pH Sensor is a sealed unit and needs no maintenance other than periodic gentle cleaning. A weak acid soak followed by a fresh water wash of half an hour is recommended. If the bulb is cracked or if the “Set 6.9” adjustment is impossible, the electrode probably requires replacement.

- If the electrode has been left dry in air for several days, its immediate use will sometimes give a slow response. If the pH electrode has been received without its plastic “wetting cap” over the pH bulb, the electrode should be immersed in a standard solution or in distilled water for about 24 hours before its use. Immersing the electrode in about 1/10N hydrochloric acid for a few minutes serves as an expedient.
- The HP2 is supplied with a sealed GEL reference system which needs no filling for its lifetime. Electrodes should be stored wet and disconnected from the meter.
- Cracks in Glass Bulb
If the meter indicates almost the same value with the electrode in various standard solutions, the trouble may be caused by a crack in the glass membrane. Replace the electrode.
- Insulation and Internal Resistance
The glass electrode has a membrane resistance of several hundred million ohms and every part of the meter has been carefully insulated. If this insulation value is lowered, the needle will go off scale or become unstable. Great care must be taken not to wet the plug or cap of the electrode nor the meter and connector themselves. Clean with pure alcohol and cotton wool. Blow dry with a heat gun set at a moderate temperature.

9.2 pH Troubleshooting

1: pH reading unstable:

a) Electronics fault ?

Check controller by disconnecting leads from the pH electrode (Terminal strip 2 (right) 10, 12) Replace with a wire linking the 2 terminals 10,12. If the pH reading is now stable, and can be adjusted between approximately 6 to 8 pH with the ZERO control, the electronics are probably correct. The sensor (or wiring) is probably faulty.

b) ATC sensor **OR** solution earth wire not in solution

An ATC sensor **OR** a solution earth wire should be immersed in the solution. The braid of the ATC sensor **OR** the solution earth wire should be connected to Terminal strip 2 (right) terminal 9.

c) Clogged pH electrode Reference Junction.

Check reading stability in pH Buffer solutions. Remember to put solution from the ATC sensor **OR** the into the buffer solution alongside the pH electrode.

Clean, Refill, or Replace electrode.

d) pH glass bulb dirty.

Clean electrode bulb with Acetone, or other suitable solvent, considering the solutions being measured.

2. Low or Excessive response to pH change:

a) Check pH sensor in buffers. Clean, Refill, or Replace electrode.

b) Check ATC sensor.

Measure sensor resistance from black to white wires, (disconnected from the controller). This should be approx 110 Ohms at 25oC. Also check the shield wire is connected to the Stainless Steel barrel of the ATC sensor.

If this cannot be done, check the cell connections.

If connections are OK, return the meter and call for service.

10. Conductivity/TDS Electrode Appendix

10.1 Sensor Maintenance

The Conductivity/TDS Probe (including Temperature Compensator in its barrel) has platinum wire electrodes coated with a special material for stable readings. It should simply be rinsed in dilute Hydrochloric acid occasionally to remove dirt build up which can reduce its reading.

So long as it is mechanically intact, it needs no replacement.

IMPORTANT: The wires should **** NOT **** be rubbed clean. This will remove the “Platinum-Black” coating and give unstable readings. This coating can be replaced by return of the probe to the factory for service.

11. Output Relay Fuse Replacement

Fault : Pump fails to operate when colon on display shows relay operating.

Cause : Pump may have failed. Check using another pump on the same outputs.

Cause : Blown fuse.

Fix : Check/replace fuse.

Method:

1. Ensure unit is turned off and disconnect all power sources
2. Open the front clear plastic cover.
3. Remove the 4 corner screws holding the front panel.
4. Remove the front panel and attached printed circuit card. (Take care- The front and rear card are attached by a connector cable.). **DO NOT DISCONNECT CABLE.**
5. The fuses for each output are visible in a black plastic carrier next to the larger relays. Use a torch to view the glass section of the fuse. A single strand of wire should be visible.
6. If the fuse requires replacement, pry up the ends of the fuse holder and replace with a new fuse of identical size and current rating. (250VAC 1 AMP).
7. Replace fuse holder. Replace the front panel and mounting screws.
8. Check that output/pump is now operating as required.

NOTE: A blown fuse may indicate that the output is being overloaded. Ensure that the load does not exceed 1 AMP. If the fuse is being blown repeatedly please contact the dealer or TPS

12. 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.**