

Congratulations !

Your new **microCHEM-pH** transmitter module is a simple, lower power device for interfacing a pH and temperature sensor with datalogging and process control equipment. The industry standard 0 to 1 V DC and 0 to 5 V DC outputs ensure that the **microCHEM-pH** is compatible with most such devices.

The **microCHEM-pH** is a breeze to operate. This manual has been designed to help you get started, and also contains some handy application tips. If at any stage you require assistance, please contact either your local TPS representative or the TPS factory in Brisbane.

The manual is divided into the following sections:

1. Table of Contents

Each major section of the handbook is clearly listed. Sub-sections have also been included to enable you to find the information you need at a glance.

2. Introduction

The introduction has a diagram and explanation of the display and controls of the **microCHEM-pH**. It also contains a full listing of all of the items that you should have received with the unit. Please take the time to read this section, as it explains some of items that are mentioned in subsequent sections.

3. Main Section

The main section of the handbook provides complete details of the **microCHEM-pH**, including operating modes, calibration, troubleshooting, specifications, and warranty terms.

4. Appendices

Appendices containing background information and application notes are provided at the back of this manual.

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microCHEM-pH Transmitter Module

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1. Introduction

1.1 Unpacking Information

Before using your new **microCHEM-pH**, please check that the following accessories have been included:

	Part No
1. microCHEM-pH Transmitter Module.....	111144
2. Mounting feet, kit of 4, complete with screws	NRMICRO
3. pH6.88 Buffer, 200mL	121306
4. pH4.00 Buffer, 200mL	121381
5. microCHEM-pH Handbook.....	130050

Options that may have been ordered with your microCHEM-pH:

Dip mounted pH and ATC Sensors, and submersible assembly...

1. Submersible, Non-flow pH Sensor, 5m..... 111228
2. Intermediate Junction pH Sensor, 5m..... 111227
3. Industrial 12K ATC Sensor, 5m..... 111275
4. Submersible protective housing for pH & ATC 111303

Screw-in pH and ATC Sensors, and adaptor for 40mm PVC pipe...

1. Screw-in, Non-flow pH Sensor, 5m 800010
2. Screw-in Industrial 12K ATC Sensor, 5m..... 111265
3. ¼" BSP thread adaptor for 40mm PVC pipe..... 111305

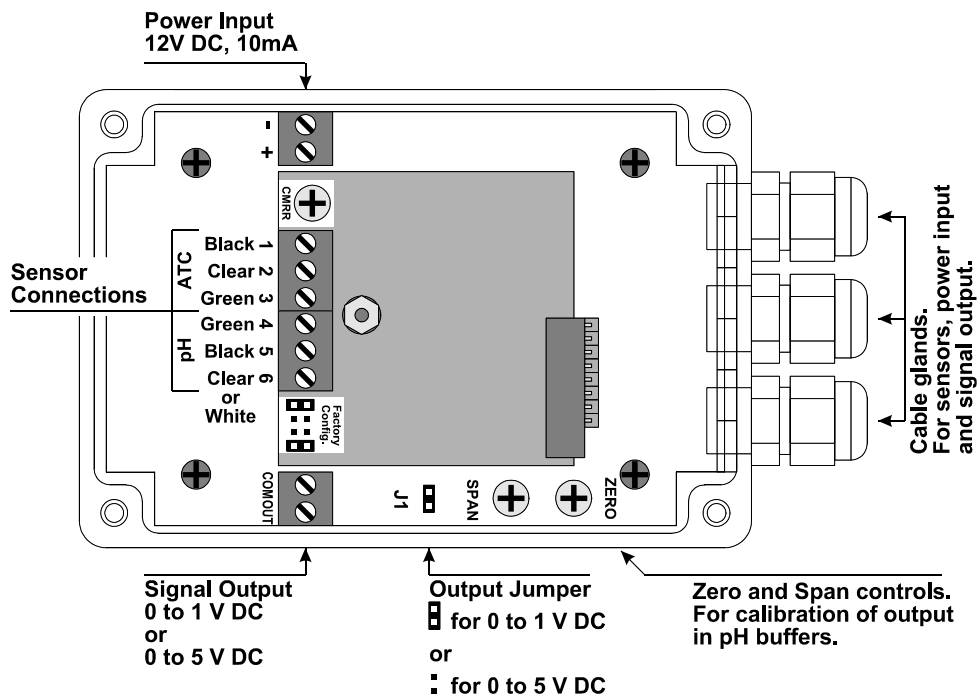
1.2 Specifications

Range	0 to 14.00 pH
Resolution	$\pm 1\text{mV}$ (0 – 1 V DC Output) or $\pm 5\text{mV}$ (0 – 5 V DC Output)
Accuracy	$\pm 1\text{mV}$ (0 – 1 V DC Output) or $\pm 5\text{mV}$ (0 – 5 V DC Output)
Linearity	$\pm 1\text{mV}$ (0 – 1 V DC Output) or $\pm 5\text{mV}$ (0 – 5 V DC Output)
Repeatability	$\pm 1\text{mV}$ (0 – 1 V DC Output) or $\pm 5\text{mV}$ (0 – 5 V DC Output)
Ambient Drift.....	<0.01 pH per 10°C change
Long term drift.....	<0.1% per year
Input Impedance	$>3 \times 10^{12} \Omega$
Asymmetry Range	± 1.00 pH
Slope Range	80 to 110%
Temperature Compensation	Automatic, 0 to 100.0 °C (with ATC Sensor), or fixed at 25 °C with 12K resistor.
Common Mode Rejection	120 dB
Enclosure	Polycarbonate, waterproof to IP65
Analogue Outputs	0 to 1 V DC or 0 to 5 V DC
Isolation	Galvanic isolation of sensor input
Power	12V DC, approx 10mA
Dimensions	Enclosure : 125 x 85 x 56 mm PCB only : 115 x 77 mm (82 x 58 mm mounting hole centres)
Mass.....	Instrument only: Approx 250 g Full Kit : Approx 1.0 kg
Operating Environment:	Temperature : 0 to 45 °C Humidity : 0 to 95 % R.H.

2. Installation and Set-up

2.1 Connection and Configuration Diagram

The diagram below is provided as a reference for the terminal connections, configuration jumpers and user-adjustable trimmers that are discussed throughout this section.



2.2 Mounting the Enclosure

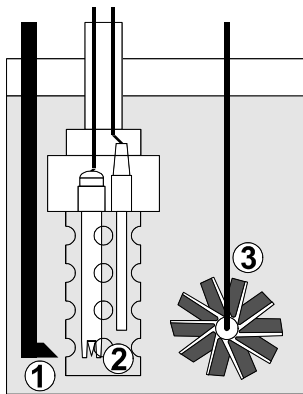
The **microCHEM-pH** can be mounted directly onto a wall or into a separate enclosure using the mounting kit supplied. Please use the screws supplied to ensure that the waterproof integrity of the enclosure is not compromised.

2.3 Mounting the Sensors

Mounting the sensors is a very important aspect of the installation, and is often done incorrectly. In automatic control situations, the sensors should always be mounted as close as possible to the injection point. This will cause the sensors to detect the added chemicals immediately, and shut the addition off until mixing has taken place. For in-line mounting, it is important that chemicals are injected upstream. Additionally, the line must be run through a mixing chamber, such as a large drum, to ensure that the injected chemical has mixed in properly by the time the solution flows past the sensors. There must always be adequate flow of fresh sample past the sensor for accurate monitoring. The diagrams below show typical mounting arrangements for “dip” mounting and in-line mounting.

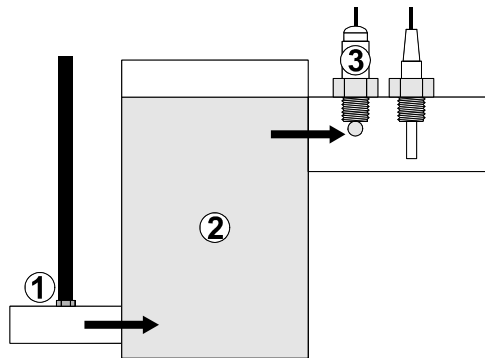
Dip Mounting

1. Injection point close to sensor.
2. Submersible housing to protect sensors and waterproof rear of cable (part no 111303).
3. Continuous stirring.



In-line Mounting

1. Injection point upstream from and close to sensor.
2. Mixing container after injection and before sensor.
3. pH sensor mounted as close to vertical as practical.



2.4 Terminal Connections

Terminal No.	Connection	Colour
Sensor Connections		
1	12K ATC Sensor *	Black
2	12K ATC Sensor Common *	Clear
3	Solution Guard	Green of ATC Sensor OR: Solution guard rod, if no ATC Sensor is installed.
4	pH Shield (if fitted)	Green
5	pH Reference	Black
6	pH Signal	Clear or White
Power Input Connections		
-	Negative of 12V DC Input	Customer-defined
+	Positive of 12V DC Input	Customer-defined
Signal Output Connections		
COM	Common of voltage output	Customer-defined
OUT	Positive of voltage output	Customer-defined

- * If an ATC sensor is not fitted, then a 12K resistor may be connected between terminals 1 and 2 to simulate 25 °C. If this is done, then a stainless steel solution guard rod must be connected to terminal 3.

2.5 Selecting 0 to 1 V DC or 0 to 5 V DC Output

1. Locate the jumper labelled **J1** on the main circuit board.
2. Set **J1** to closed to select 0 to 1 V DC output.
3. Set **J1** to open to select 0 to 5 V DC output.

0 to 1 V DC



0 to 5 V DC



Note

When setting **J1** to open, we recommend that it is fitted to one of the pins.

This is a safe place to keep it, in case the **microCHEM-pH** needs to be reset for 0 to 1 V DC output in the future.

2.6 CMRR Control

The Common Mode Rejection Ratio (CMRR) is factory-set with the CMRR trimmer.

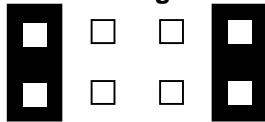
DO NOT ATTEMPT TO ADJUST THE CMRR TRIMMER.

If this trimmer is accidentally re-set, the unit would best be returned to the factory for re-calibration.

2.7 Factory Config. Jumpers

The **Factory Config.** jumpers are factory set, and must not be altered. In case any of these jumpers are changed or removed, re-fit them as shown below. The **microCHEM-pH** must be switched OFF before changing jumper settings.

**Factory
Config.**



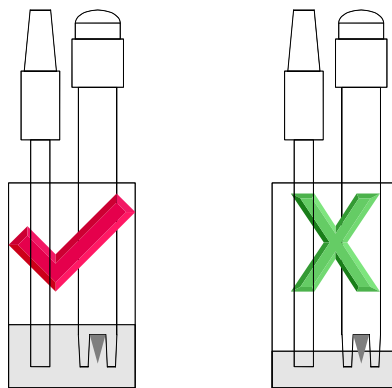
3. Calibration

3.1 Calibration Procedure

1. Switch the **microCHEM-pH** on.
2. Ensure that the pH and ATC sensors are correctly connected (see section 2.4).
3. If no ATC sensor is fitted, then a 12K resistor should be connected between terminals 7 and 8. A stainless steel guard rod should then be substituted for the ATC sensor during the calibration procedure detailed below.
4. Remove the wetting cap from the pH sensor.
5. Rinse the pH and ATC sensors in distilled water and blot them dry.

Asymmetry (Zero) Calibration

6. Place both sensors into a small sample of pH6.88 or pH7.00 buffer, so that the bulb and reference junction are both covered (see diagram below). **DO NOT** place the electrodes directly into the buffer bottle. Discard the used buffer after use.



7. When the reading has stabilised, adjust the **ZERO** control until the output corresponds to the value shown in the Calibration Data table in section 3.3.
8. Rinse the pH and ATC sensors in distilled water and blot them dry.

Span Calibration

9. Place both sensors into a small sample of pH buffer, that is several pH away from pH7 (e.g. pH4.00 or pH9.23). Ensure that the bulb and reference junction are both covered (see diagram in step 6, above). **DO NOT** place the electrodes directly into the buffer bottle. Discard the used buffer after use.

NOTE: pH buffers above pH9 are highly unstable. Avoid using these buffers if possible. Discard immediately after use.

pH4.00 buffer is recommended for its stability. Most users report readings up to pH12 to be more accurate when using this buffer than when using pH9.23 or pH10.00 buffer for span calibration.

10. When the reading has stabilised, adjust the **SPAN** control until the output corresponds to the value shown in the Calibration Data table in section 3.3.
11. Rinse the pH and ATC sensors in distilled water and blot them dry.
12. The **microCHEM-pH** is now calibrated and ready for pH measurements.

3.2 Calibration Notes

1. An Asymmetry (Zero) calibration should be performed at least weekly. In applications where the electrode junction can become blocked, such as dairy products, mining slurries etc, an asymmetry calibration may have to be done daily.
2. A full 2-point Asymmetry and Span calibration should be performed at least monthly. Of course, more frequent calibration will result in greater confidence in results.

3.3 Calibration Data

The following table lists the pH value of various buffers between 10 and 40 °C.

Temp °C	pH Value	mV Output (0 – 1 V DC)	mV Output (0 – 5 V DC)
pH4.00 Buffer			
10	4.00	285.7	1428.6
15	4.00	285.7	1428.6
20	4.00	285.7	1428.6
25	4.01	286.1	1430.4
30	4.01	286.4	1432.1
35	4.02	287.0	1435.0
40	4.03	287.6	1438.2
pH6.88 Buffer			
10	6.92	494.5	2472.5
15	6.90	492.9	2464.3
20	6.88	491.5	2457.5
25	6.87	490.4	2451.8
30	6.85	489.5	2447.5
35	6.84	488.6	2442.9
40	6.84	488.6	2442.9
pH7.00 Buffer			
10	7.06	504.2	2521.1
15	7.04	502.6	2512.9
20	7.02	501.1	2505.7
25	7.00	500.0	2500.0
30	6.99	499.1	2495.7
35	6.98	498.4	2492.1
40	6.97	498.1	2490.7
pH9.23 Buffer			
10	9.33	666.6	3332.9
15	9.28	662.6	3312.9
20	9.23	658.9	3294.6
25	9.18	655.7	3278.6
30	9.14	652.8	3263.9
35	9.10	650.1	3250.7
40	9.07	647.7	3238.6
pH10.00 Buffer			
10	10.18	727.1	3635.4
15	10.12	722.7	3613.6
20	10.06	718.7	3593.6
25	10.01	715.1	3575.7
30	9.97	711.9	3559.3
35	9.93	708.9	3544.6
40	9.90	707.4	3536.8

4. Troubleshooting

4.1 Instrument Function Troubleshooting

Symptom	Possible Causes	Remedy
Incorrect analogue output signal.	<ol style="list-style-type: none"> J1 Output Jumper incorrectly set for required output. Instrument is faulty. 	<p>Check that the J1 Output Jumper is correctly set for 0 to 1 V DC or 0 to 5 V DC output, as per requirements. Adjust if necessary (see section 2.5).</p> <p>Return to TPS for repair.</p>

4.2 pH Troubleshooting

Symptom	Possible Causes	Remedy
Asymmetry (Zero) calibration fails (insufficient range with ZERO control).	<ol style="list-style-type: none"> Reference junction blocked. Reference electrolyte contaminated. 	<p>Clean reference junction, as per instructions supplied with the electrode.</p> <p>Flush with distilled water and replace electrolyte.</p>
Span calibration fails (insufficient range with SPAN control).	<ol style="list-style-type: none"> ATC probe not connected. Glass bulb not clean. Electrode is aged. Buffers are inaccurate. 	<p>Connect ATC probe to terminals 1 & 2 (see section 2.4).</p> <p>Clean glass bulb as per instructions supplied with the electrode.</p> <p>Attempt rejuvenation, as per instructions supplied with the electrode. If not successful, replace electrode.</p> <p>Replace buffers.</p>

Continued over page...

pH Troubleshooting, continued...

Unstable readings.	<ol style="list-style-type: none"> 1. Solution guard not fitted. 2. Reference junction blocked. 3. Glass bulb not clean. 4. Bubble in glass bulb. 5. Reference junction not immersed. 6. KCl crystals around reference junction, inside the electrolyte chamber. 	<p>Connect the green wire from the ATC (or solution guard rod if no ATC sensor is fitted) to terminal 3 (see section 2.4).</p> <p>Clean reference junction as per instructions supplied with the electrode.</p> <p>Clean glass bulb as per instructions supplied with the electrode.</p> <p>Flick the electrode to remove bubble.</p> <p>Ensure that the bulb AND the reference junction are fully immersed.</p> <p>Rinse electrolyte chamber with warm distilled water until dissolved. Replace electrolyte.</p>
Inaccurate readings, even when calibration is successful.	Reference junction blocked.	Clean reference junction as per instructions supplied with the electrode.
Output corresponds to approx pH7 in all solutions	Electrical short inside electrode or in cable.	Test system with a new electrode and replace if necessary.
Output corresponds to approx pH4 - 5 pH for all solutions.	Glass bulb or internal stem cracked.	Replace electrode.

5. 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 FOR 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.)

Your equipment will be repaired and returned to you by air express where possible.

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.**

6. Appendices

6.1 Checking the reference junction of a pH electrode.

If pH readings are inaccurate or unstable, the reference junction of the electrode may be blocked. The following test can be performed to determine if the reference junction of a pH electrode is making adequate contact with the sample solution.

1. Calibrate the **microCHEM-pH**, as per section 3.1.
2. Dilute 1 part of pH6.88 buffer with 9 parts of distilled water.
3. Measure the pH of the diluted buffer. The result should be 7.06 ± 0.05 pH.
4. If the value obtained is outside of these limits, then clean the reference junction as per the instructions supplied with the pH electrode.
5. Re-calibrate the **microCHEM-pH** and repeat the test.
6. If the value obtained is still outside 7.06 ± 0.05 pH, then the electrode may need to be replaced depending on the level of accuracy required.

6.2 Determining if an instrument or electrode is faulty

The following test can be performed to help determine if the **microCHEM-pH** or the pH electrode is faulty.

1. Disconnect the pH electrode.
2. Connect a short piece of wire or a paper clip etc. between terminals 5 and 6.
3. The **ZERO** control should have sufficient range to obtain an output corresponding to exactly pH7.00 (500mV for 0 – 1 V DC or 2500mV for 0 – 5 V DC).
4. If the **microCHEM-pH** is operating correctly, the reading should be totally stable with the wire in place. If not, the meter requires servicing.
5. Now carefully disconnect the wire from terminal 6 only (make sure the other end of the wire remains connected to terminal 5).
6. The reading should steadily drift away from 7.00 (either up or down) at a rate of approximately 1 pH or less every 3 seconds. If the drift rate is faster than this, then input circuitry of the **microCHEM-pH** is faulty and requires servicing.
7. Disconnect the wire from terminal 5. Either re-connect a new pH electrode, or return the **microCHEM-pH** to the factory or your distributor for servicing.