MicroChem-D

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TPS
PRECISION MEASUREMENT™

Congratulations!

Your new **micro*CHEM*-DO_2** transmitter module is a simple, lower power device for interfacing a Dissolved Oxygen 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 **micro*CHEM*-DO_2** is compatible with most such devices.

The **micro*CHEM*-DO_2** 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 **micro*CHEM*-DO_2**. 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 **micro*CHEM*-DO_2**, 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.

Contents

1. Introduction

1.1 Unpacking Information

Before using your new **micro*CHEM*-DO_2**, please check that the following accessories have been included:

		Part No
1.	**micro*CHEM*-DO_2** Transmitter Module	113144
2.	Mounting feet, kit of 4, complete with screws	NRMICRO
3.	**micro*CHEM*-DO_2** Handbook	130050

TPS ED1M Sensor (submersible to 3m max):

1.	ED1M Dissolved Oxygen Sensor, NO CABLE	123440
2.	5m Cable for ED1M	123236
3.	Extended cable/metre	130040

EDYSI Sensor (submersible to 60m):

1.	EDYSI Dissolved Oxygen Sensor NO CABLE	123204
2.	5m Cable for EDYSI	123210
3.	Extended cable/metre	130040

1.2 Specifications

Range 0 to 200.0 % Saturation
or
0 to 20.00 ppM (mg/L)
Ranges selectable by jumper setting.

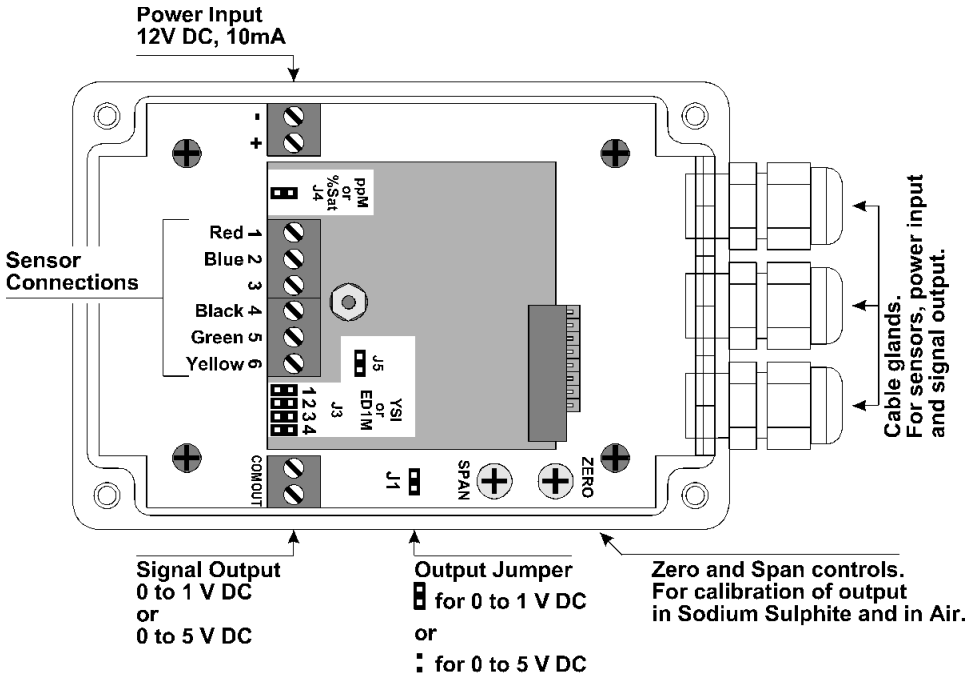
Resolution	±1mV (0 – 1 V DC Output) or ±5mV (0 – 5 V DC Output)
Accuracy	±1mV (0 – 1 V DC Output) or ±5mV (0 – 5 V DC Output)
Linearity	±1mV (0 – 1 V DC Output) or ±5mV (0 – 5 V DC Output)
Repeatability	±1mV (0 – 1 V DC Output) or ±5mV (0 – 5 V DC Output)
Ambient Drift	<0.05% span / ^{O}C
Long term drift	<0.2% per year
Zero Range	±10 %
Span Range	70 to 130%
Temperature Compensation	Dual Automatic Temperature Compensation system, 0 to 50 ^{O}C (sensor limit).
Sensor	Polarographic sensor with in-built ATC sensor. Factory set for TPS ED1M or EDYSI sensor.
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 ºC
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

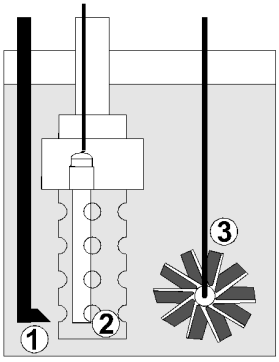
The **micro*CHEM*-DO_2** can be mounted directly onto a wall or into a separate enclosure using the mounting kit supplied. Please use the screws supplied to ensure that the waterproof integrity of the enclosure is not compromised.

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.

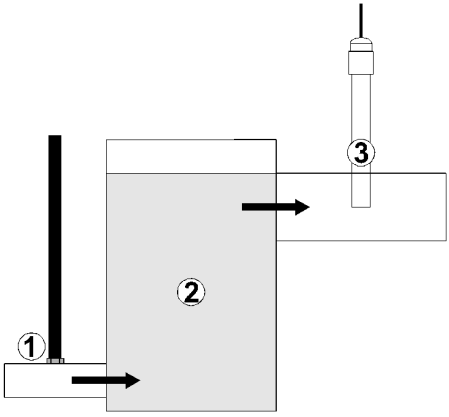
Dip Mounting

1. Injection point close to sensor.
2. Submersible housing to protect sensor 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. DO_2 sensor mounted as close to vertical as practical, through a suitable gland fitting.



2.4 Terminal Connections

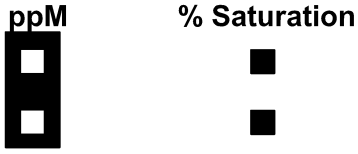
Terminal No.	Connection	Colour
Sensor Connections		
1	ATC Sensor for ppM operation	Red
2	ATC Sensor for ppM operation	Blue
3	No Connection	
4	Common	Black
5	DO_2 Sensor Anode	Green
6	DO_2 Sensor Cathode	Yellow
Power Input Connections		
–	Negative of 12V DC Input	Customer-defined
+	Positive of 12V DC Input	Customer-defined
Signal Output Connections		
COM	Common of voltage output	Customer-defined
OUT	Positive of voltage output	Customer-defined

***** The ATC connection to terminals 1 and 2 is to be connected only when the unit is reading Dissolved Oxygen in units of ppM (mg/L). For % Saturation readout, do not connect these.

2.5 Selecting ppM (mg/L) or % Saturation mode

This setting is normally made at the factory according to your requirements. However, it may be changed at any time. Please switch the **micro*CHEM*-DO_2** OFF before changing this jumper setting.

1. Locate the jumper labelled **J4** near the terminal strip.
2. Set **J4** to CLOSED to select ppM (mg/L) mode.
3. Set **J4** to OPEN to select % Saturation mode.



Note

When setting **J4** to open, we recommend that it is fitted to one of the pins.

This is a safe place to keep it, in case the **micro*CHEM*-DO_2** needs to be reset for ppM operation in the future.

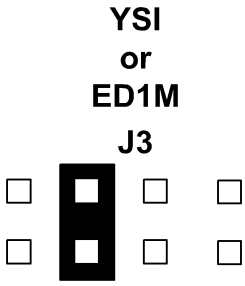
2.6 Selecting TPS ED1M or YSI Sensor

Switch the micro*CHEM*-DO_2 OFF before changing any jumper settings.

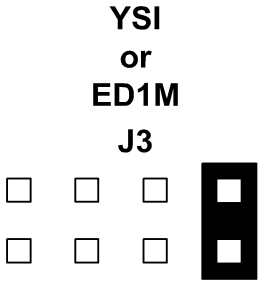
2.6.1 YSI Dissolved Oxygen Sensor Configuration

1. Set the **YSI or ED1M (J5)** jumper in the terminal area to be closed.

2. (a) Set the **YSI or ED1M (J3)** jumper in the terminal area across the second jumper (from the left).

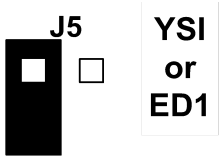


(b) When the **mini*CHEM*-DO_2** is set to ppM readout and the samples have a high salinity, there may not be enough adjustment available with the **SPAN** control to calibrate the unit. If this is the case, set the **YSI or ED1M (J3)** jumper to the following setting…

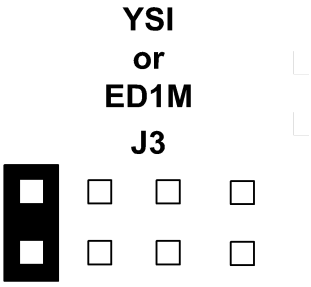


2.6.2 ED1M Dissolved Oxygen Sensor Configuration

1. Set the **YSI or ED1M (J5)** jumper in the terminal area to be open. Fit the jumper to one of the pins, as shown below, in case this is needed later.

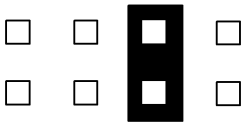


2. (a) Set the **YSI or ED1M (J3)** jumper in the terminal area across the first jumper (from the left).



(b) When the **mini*CHEM*-DO_2** is set to ppM readout and the samples have a high salinity, there may not be enough adjustment available with the **SPAN** control to calibrate the unit. If this is the case, set the **YSI or ED1M (J3)** jumper to the following setting…

YSI
or
ED1M
J3



2.7 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 **micro*CHEM*-DO$_2$** needs to be reset for 0 to 1 V DC output in the future.

3. Calibration

3.1 Calibration Procedure

1. Switch the **micro*CHEM*-DO_2** on.

2. Ensure that the Dissolved Oxygen sensor is correctly connected (see section 2.4).

3. Rinse the Dissolved Oxygen sensor in distilled water and blot dry.

Zero Calibration

4. (a) Place the sensor into an oxygen-free solution. This solution may be prepared by dissolving 2g of Sodium Sulphite in 100mL of distilled water. A 50g bottle of Sodium Sulphite powder (part number 123302) is supplied with new ED1M and EDYSI sensors for this purpose.

(b) Wait for the output of the **micro*CHEM*-DO_2** to stabilise at or near zero. This may take 2-3 minutes.

(c) Adjust the **ZERO** control until the output signal is 0 mV

5. Rinse the Dissolved Oxygen sensor in distilled water and blot dry.

Span Calibration

6. (a) Hang the Dissolved Oxygen sensor in air. The tip of the sensor should be pointing downwards.

(b) Allow the output of the **micro*CHEM*-DO_2** to stabilise. After a zero calibration, this may take up to 5 minutes.

(c) For % Saturation readout, adjust the **SPAN** control until the output signal is 500.0 mV (0-1V DC) or 2500 mV (0-5V DC).

For ppM readout, adjust the **SPAN** control for the ppM (mg/L) Dissolved Oxygen value at the current air temperature, and the expected salinity value of the final solution being monitored. Refer to the Calibration Data table in section 3.3 for the applicable outputs.

If the expected salinity value of the sample solution is quite high, there may not be enough adjustment in the **SPAN** control to calibrate the readout. If this is the case, please see section 2.6 for details on how to set the internal jumpers to allow for higher salinities.

7. The **micro*CHEM*-DO_2** is now calibrated and ready for Dissolved Oxygen measurements.

3.2 Calibration Notes

1. A Span calibration should be performed at least weekly. In applications where the sensor can become dirty or coated, such as sewage effluent, mining slurries etc, a Span calibration may have to be done daily.
2. The Zero calibration is quite stable long term. Monthly Zero calibration is recommended, mainly as a routine check.
3. Both a Zero and a Span calibration need to be performed when the membrane is replaced.

3.3 Calibration Data

The following table lists the Air calibration data for the **micro*CHEM*-DO_2**, when set to ppM mode.

Salinity (g/L Cl^-)	0.0			4.0			8.0			16.0			20.0		
Salinity, (ppK NaCl)	0.0			6.6			13.2			26.4			33.0		
Temp °C	ppM DO_2	mV Output (0-1V DC)	mV Output (0-5V DC)	ppM DO_2	mV Output (0-1V DC)	mV Output (0-5V DC)	ppM DO_2	mV Output (0-1V DC)	mV Output (0-5V DC)	ppM DO_2	mV Output (0-1V DC)	mV Output (0-5V DC)	ppM DO_2	mV Output (0-1V DC)	mV Output (0-5V DC)
0	14.57	728.5	3643	13.91	695.5	3478	13.26	663.0	3315	11.94	597.0	2985	11.29	564.5	2823
1	14.17	708.5	3543	13.54	677.0	3385	12.90	645.0	3225	11.63	581.5	2908	11.00	550.0	2750
2	13.79	689.5	3448	13.18	659.0	3295	12.56	628.0	3140	11.33	566.5	2833	10.72	536.0	2680
3	13.43	671.5	3358	12.83	641.5	3208	12.24	612.0	3060	11.05	552.5	2763	10.45	522.5	2613
4	13.08	654.0	3270	12.50	625.0	3125	11.93	596.5	2983	10.78	539.0	2695	10.20	510.0	2550
5	12.74	637.0	3185	12.19	609.5	3048	11.63	581.5	2908	10.52	526.0	2630	9.96	498.0	2490
6	12.42	621.0	3105	11.88	594.0	2970	11.34	567.0	2835	10.27	513.5	2568	9.73	486.5	2433
7	12.11	605.5	3028	11.59	579.5	2898	11.07	553.5	2768	10.03	501.5	2508	9.51	475.5	2378
8	11.81	590.5	2953	11.31	565.5	2828	10.81	540.5	2703	9.80	490.0	2450	9.30	465.0	2325
9	11.53	576.5	2883	11.04	552.0	2760	10.56	528.0	2640	9.58	479.0	2395	9.09	454.5	2273
10	11.26	563.0	2815	10.79	539.5	2698	10.31	515.5	2578	9.37	468.5	2343	8.90	445.0	2225
11	10.99	549.5	2748	10.54	527.0	2635	10.08	504.0	2520	9.17	458.5	2293	8.72	436.0	2180
12	10.74	537.0	2685	10.30	515.0	2575	9.86	493.0	2465	8.98	449.0	2245	8.54	427.0	2135
13	10.50	525.0	2625	10.07	503.5	2518	9.65	482.5	2413	8.79	439.5	2198	8.37	418.5	2093
14	10.27	513.5	2568	9.86	493.0	2465	9.44	472.0	2360	8.62	431.0	2155	8.20	410.0	2050
15	10.05	502.5	2513	9.65	482.5	2413	9.25	462.5	2313	8.45	422.5	2113	8.04	402.0	2010
16	9.83	491.5	2458	9.44	472.0	2360	9.06	453.0	2265	8.28	414.0	2070	7.89	394.5	1973
17	9.63	481.5	2408	9.25	462.5	2313	8.87	443.5	2218	8.12	406.0	2030	7.74	387.0	1935
18	9.43	471.5	2358	9.06	453.0	2265	8.70	435.0	2175	7.97	398.5	1993	7.60	380.0	1900
19	9.24	462.0	2310	8.88	444.0	2220	8.53	426.5	2133	7.82	391.0	1955	7.46	373.0	1865
20	9.06	453.0	2265	8.71	435.5	2178	8.36	418.0	2090	7.67	383.5	1918	7.32	366.0	1830
23	8.55	427.5	2138	8.22	411.0	2055	7.90	395.0	1975	7.25	362.5	1813	6.93	346.5	1733
24	8.39	419.5	2098	8.07	403.5	2018	7.76	388.0	1940	7.12	356.0	1780	6.80	340.0	1700
25	8.24	412.0	2060	7.93	396.5	1983	7.61	380.5	1903	6.99	349.5	1748	6.68	334.0	1670
26	8.09	404.5	2023	7.78	389.0	1945	7.47	373.5	1868	6.86	343.0	1715	6.55	327.5	1638
27	7.95	397.5	1988	7.64	382.0	1910	7.34	367.0	1835	6.73	336.5	1683	6.42	321.0	1605
28	7.81	390.5	1953	7.51	375.5	1878	7.21	360.5	1803	6.60	330.0	1650	6.30	315.0	1575
29	7.68	384.0	1920	7.38	369.0	1845	7.07	353.5	1768	6.47	323.5	1618	6.17	308.5	1543
30	7.55	377.5	1888	7.25	362.5	1813	6.95	347.5	1738	6.34	317.0	1585	6.04	302.0	1510
31	7.42	371.0	1855												
32	7.30	365.0	1825												
33	7.18	359.0	1795												
34	7.07	353.5	1768												
35	6.95	347.5	1738												

4. Troubleshooting

4.1 Instrument Function Troubleshooting

Symptom	Possible Causes	Remedy
Incorrect analogue output signal.	**1.** **J1 Output Jumper** incorrectly set for required output.	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 2.7).
	2. Instrument is faulty.	Return to TPS for repair.

4.2 Dissolved Oxygen Troubleshooting

Symptom	Possible Causes	Remedy
• Zero calibration fails (Zero is greater than 10%) • Air calibration fails (Span is less than 70% or greater than 130%). • Unstable or inaccurate readings.	1. Membrane is leaking or broken. 2. Gap between membrane and gold cathode is dry. 3. Incorrectly fitted membrane. 4. Sensor is empty. 5. Sensor is faulty.	Replace membrane and refill sensor. **ED1M:** Undo the barrel 1 to 3 turns, then re-tighten to re-flush the filling solution. **EDYSI:** Gently pump the pressure compensation diaphragm to re-flush the filling solution. Membrane should be smooth and convex with no wrinkles. Re-fit membrane if necessary. Replace membrane and re-fill electrode. Return sensor to factory for repair or replacement
Blackened Silver anode.	Electrode has been exposed to sulphides or other chemical poisoning.	See section 5 for the sensor cleaning procedure. If no improvement, return to the TPS factory for cleaning and service.
Tarnished or scratched Gold cathode.	Sensor has been chemically poisoned or physically damaged.	Return to the TPS factory for cleaning and service.
Meter reads full scale or greater in all samples.	1. Sensor has not yet polarised. 2. Electrode is faulty	Wait for 2-3 minutes for the electrode to polarise after the **micro*CHEM*-DO_2** is switched on. Return electrode to factory for repair or replacement.

5. Appendices

5.1 Cleaning the Dissolved Oxygen Sensor

If the silver anode of a Dissolved Oxygen sensor becomes contaminated with materials such as sulphide, the electrode will become poisoned. This will cause calibration to become more difficult and eventually impossible. The following procedure can be used for less serious poisoning.

1. Ensure that the electrode is actually the faulty part of the system, by trying a different electrode, cable or meter. If any of these items are not available, check all cable connections and the condition of the membrane. If the membrane is loose, has bubbles underneath it or is dirty or greasy, replace it and try the probe again.
2. If you have determined that the probe is the faulty part…
   (a) For the ED1M, completely unscrew and remove the barrel. The silver anode is the wire wrapped around the sensor stem.
   (b) For the EDYSI, remove the membrane and the pressure compensation pump assembly (refer to the YSI instruction leaflet). The silver anode is the triangular block inside the tip of the sensor.

   The usual indication of poisoning of the silver anode is blackening.
3. Rinse the sensor to remove any loose particles.
4. Soak the electrode for 10 minutes in 5% Ammonia solution.
5. Rinse well under a tap.
6. If an ultra-sonic cleaning bath is available, add a few drops of detergent (eg: dishwashing liquid) to the water so that it covers the silver anode. Turn on the cleaner for approximately 5 minutes.
7. Rinse well under a tap.
8. Re-assemble the sensor, re-fill the electrode and fit a new membrane, as per the instructions supplied with the sensor.
9. If the electrode still fails to calibrate or read correctly, TPS can attempt further cleaning by electrolysis. This procedure removes the outmost layer of the anode and actually reduces its size. Whilst the procedure is hard on the sensor, it does often restore the probe's performance.

10. If poisoning is a problem for the EDYSI, then please refer to the YSI instruction leaflet and TPS appendix to the leaflet regarding correct fitting of the membrane.

6. 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 (our service form is available on our website www.tps.com.au):

- **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.**