

INSTRUCTION MANUAL  
**Turbi-Tech 2000**  
Suspended Solids and Turbidity Sensor



**Sira MC060083/00**

Partech (Electronics) Ltd  
Charlestown, St Austell  
Cornwall, PL25 3NN, UK

Phone: +44 (0) 1726 879800  
Fax: +44 (0) 1726 879801

Email: [sales@partech.co.uk](mailto:sales@partech.co.uk) website: [www.partech.co.uk](http://www.partech.co.uk)

## Contents

|   |    |
|---|----|
| Contents.....                                       | 2  |
| Health and Safety Information.....                  | 3  |
| MCERTS Product Certification.....                   | 4  |
| Introduction.....                                   | 5  |
| <i>Turbi-Tech Self Cleaning Sensors</i> .....       | 5  |
| <i>Turbi-Tech 2000 Light Scatter</i> .....          | 5  |
| <i>Turbi-Tech 2000 Light Absorption</i> .....       | 6  |
| <i>Turbi-Tech 2000 High Range</i> .....             | 6  |
| <i>7200 Monitor</i> .....                           | 7  |
| <i>WaterWatch2300 Monitor</i> .....                 | 7  |
| <i>WaterWatch2600 Monitor</i> .....                 | 7  |
| Installation.....                                   | 8  |
| <i>Location</i> .....                               | 8  |
| <i>Partech Brackets and Mounting Shafts</i> .....   | 9  |
| <i>Flow cells</i> .....                             | 14 |
| Configuration.....                                  | 16 |
| <i>Clean Cycle Time</i> .....                       | 16 |
| <i>Calibration - General</i> .....                  | 16 |
| <i>Calibration (Primary Standard)</i> .....         | 16 |
| <i>Calibration (Secondary Standard)</i> .....       | 17 |
| <i>Calibration – Equipment and Procedures</i> ..... | 17 |
| <i>Linearisation (LA and HR)</i> .....              | 18 |
| <i>Gain Adjustment (LS Only)</i> .....              | 18 |
| Maintenance.....                                    | 19 |
| <i>Inspection</i> .....                             | 19 |
| <i>Replacement of Seals</i> .....                   | 21 |
| <i>Removing the sensor body</i> .....               | 22 |
| <i>Fault Finding</i> .....                          | 23 |
| <i>Technical Support</i> .....                      | 24 |
| Technical Specification.....                        | 25 |
| Spare Parts List.....                               | 26 |
| Preparation of Fullers Earth Solutions.....         | 27 |
| Preparation of Formazin Turbidity Standard.....     | 28 |
| Declaration of Conformity.....                      | 30 |

## **Health and Safety Information**

The following information is a guide and does not in anyway replace legal requirements for the handling of the equipment and chemicals or any safe working practise defined outside of this manual.

Care needs to be taken to ensure that the system can be accessed safely for calibration and maintenance.

To ensure that our products are safe and without risk to health, the following must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packaging must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably qualified personnel and in accordance with the information given.
4. Standard safety precautions must be taken to avoid the possibility of an accident occurring in conditions of high pressure and/or high temperature.
5. Chemicals should be stored appropriately and protected from temperature extremes. Follow normal safe handling procedures.
6. When disposing of chemicals ensure that no two chemicals are mixed.

### **Electrical Connections**

Please refer to the electrical installation section for connection details, all relevant regulations must be followed and the supply must be isolated before work is carried out.

Safety advice concerning the use of the equipment described in this manual may be obtained from:

Partech Electronics Ltd  
111/113 Charlestown Road  
Charlestown, St Austell  
Cornwall PL25 3NN  
United Kingdom  
[www.partech.co.uk](http://www.partech.co.uk)

## MCERTS Product Certification

Increasingly, with 'Modern Regulation' and in order to strengthen its auditing of operators' self-monitoring arrangements, the Environment Agency is moving towards more efficient regulation through Operator and Pollution Risk Appraisal (OPRA), Operator Monitoring Assessment (OMA) and its Monitoring Certification Scheme (MCERTS)

MCERTS is now well established and is seen as a mark of quality. It provides a framework within which environmental measurements can be made in accordance with the Agency's quality requirements. The scheme covers a range of monitoring, sampling and inspection activities including product certification. Partech Instruments manufacture and supply the first certified Turbidity Monitoring System under the Environment Agency's MCERTS scheme for Continuous Water Monitoring equipment (CWM's).

The current performance standard for CWM's is available at:

<http://publications.environment-agency.gov.uk/pdf/GEHO0206BKGA-e-e.pdf>

The scheme is operated on behalf of the Environment Agency by Sira. The United Kingdom Accreditation Service (UKAS) accredits Sira to undertake the product and personnel certification activities which underpin the MCERTS scheme. The scheme provides a framework within which instruments and measurements can be made in accordance with the Agency's quality requirements.

Partech Instrument's Certified Turbidity System consists of the 7200 Monitor and Turbi-Tech 2000LS Sensor.

The system underwent laboratory testing in accordance with the MCERTS performance standard and can only be described as an MCERTS certified system when installed and operated as a system in accordance with recommended procedures. 7200 Monitors sold with any other sensor are not certified.

The system has been certified in the ranges 0-50FTU/FNU and 0-500FTU/FNU and to measure Turbidity.

Partech's Turbidity MCERTS certificate is available at:

<http://www.sira.co.uk/MCERTS/MC06008300.pdf>

For further information on the various MCERTS schemes visit:

<http://www.mcerts.net/>

## Introduction

This manual covers the Turbi-Tech 2000 range of sensors and should always be read in conjunction with the manual covering the 7200 Monitor. Whilst every attempt has been made to ensure that the instructions are correct, common sense and good engineering practice should always be used to adapt to specific site details. If you are in any doubt please contact Partech or your local distributor for further information.

### **Turbi-Tech Self Cleaning Sensors**

All Turbi-Tech 2000 (TT2000) sensors use an infra red light source, which offers long-term stability, low maintenance and high reliability. All TT2000 sensors have the following features.

#### **Self-Cleaning Mechanism**

The TT2000 sensors use the latest revision of the cleaning system that has been used in Partech sensors for over 15 years. The 2 precision ground Pyrex® glass tubes are withdrawn into the sensor housing each passing through 2 'H' section seals and a polyurethane wiper ring. The wiper ring removes the bulk of the fouling, the first 'H' section seal polishes the measuring surface and the second seal ensures that the main sensor housing remains dry. The seal assembly is the only user serviceable part and will normally need replacement every 2 years or as indicated by the 7200 Monitor, further details of seal life and replacement are shown later in the manual.

The servicing routine has been designed to be performed without specialist training and should take 10-15 minutes, some spare parts are required and should be purchased prior to starting work on the servicing.

#### **Mounting Options**

A range of mounting options are available for the Turbi-Tech 2000 sensors, which will allow the user to apply the sensor in a wide variety of locations. Drawings of the brackets are shown in the relevant sections of this manual. When assessing mounting options, attention should be paid to the accessibility of the sensor for calibration and maintenance, stability of the sensor in the flow conditions present on site and to ensuring the sensor is fully submerged at all times. It is recommended that the sensor is located in an area where there is sufficient movement to keep the solids in suspension and where any turbulence provides minimum impact on the sensors.

### **Turbi-Tech 2000 Light Scatter**

The Turbi-Tech 2000 Light Scatter (TT2000LS) sensor is intended to monitor low range suspended solids in the ranges 0-50 up to 0-500mg/l. An internal adjustment will allow measurement up to 1000mg/l in some circumstances. Alternatively the range of the sensor can be expressed as 0-50 to 0-1000 NTU or FTU depending on the method of calibration. All range statements are based on the solids present on a typical sewage treatment works and although they are useful as guidance the ranges will be affected by the nature of the solids being monitored.

The sensor uses the widely accepted 90° light scatter principle and uses an infra red light source operating at 860nm in accordance with BS EN ISO 7027:2000.

The sensor has been designed as a monitor for suspended solids in a variety of applications such as final effluent from treatment works or any outfall into a watercourse or sewer. The sensor can also operate as an inlet suspended solids monitor for water treatment works.

### Turbi-Tech 2000 Light Absorption

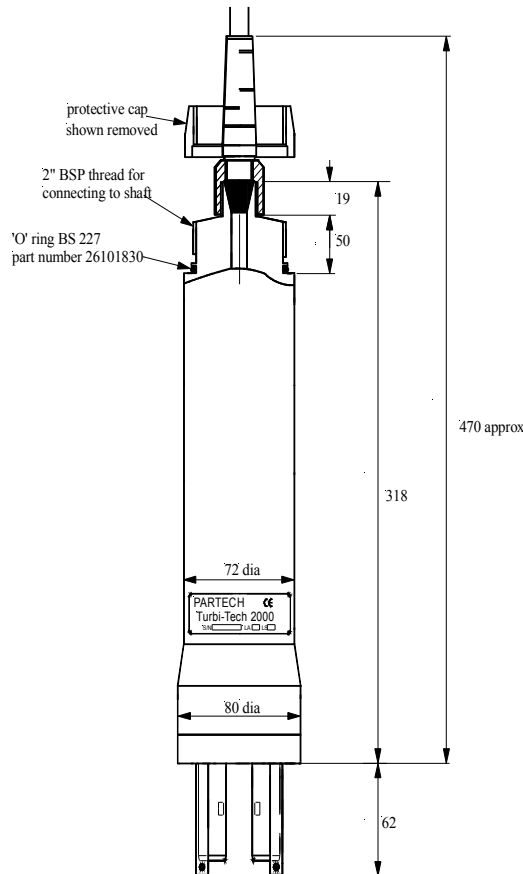
The Turbi-Tech 2000 Light Absorption (TT2000LA) sensor is intended to monitor medium to high range suspended solids in the ranges 0-4,000 up to 0-20,000 mg/l. No internal adjustment is available, however measurement outside these ranges is sometimes possible and can be determined by experimentation. All range statements are based on the solids present on a typical sewage treatment works and although they are useful as guidance the ranges will be affected by the nature of the solids being monitored.

The sensor uses the light absorption principle, with the light source an infra red LED operating at 860nm.

The sensor has been designed to monitor suspended solids in the activated sludge phase of wastewater treatment, typically Mixed Liquor Suspended Solids (MLSS) and Returned Activated Sludge (RAS).

### Turbi-Tech 2000 High Range

The Turbi-Tech 2000 High Range (TT2000HR) sensor is intended to monitor high range suspended solids in the ranges 0-10,000 up to 0-30,000 mg/l. No internal adjustment is



**Figure 1 TT2000 Dimensional Drawing**

available, however measurement outside these ranges is sometimes possible and can be determined by experimentation. All range statements are based on the solids present on a typical sewage treatment works and although they are useful as guidance the ranges will be affected by the nature of the solids being monitored.

The sensor uses the light absorption principle, with the light source an infra red LED operating at 860nm.

The sensor has been designed to monitor suspended solids in Sludge Thickening Processes, Membrane Batch Reactors (MBR's), and high concentration Mixed Liquor Suspended Solids (MLSS) and Returned Activated Sludge (RAS).

### **7200 Monitor**

The Turbi-Tech 2000 sensor is supplied as part of a system with a 7200 Monitor. This instruction manual relates specifically to the sensor and it is therefore very important that it is read in conjunction with the 7200 Monitor instruction manual.

### **WaterWatch2300 Monitor**

The Turbi-Tech 2000LS version of the sensor can be used in conjunction with the WaterWatch2300 Monitor (PN222487). This allows the user to provide a flow or sample present switch input. This input can be used to force the sensor to withdraw the probes on the sensor into the body of the sensor for protection during periods where there is no sample.

Please refer the instruction manual for the WaterWatch2300 for details of set-up and operation.

### **WaterWatch2600 Monitor**

The WaterWatch2600 series of monitors provide a wide variety of multi-parameter configurations, the Turbi-Tech 2000LS sensor can be one of the measurement options.

Please refer the instruction manual for the WaterWatch2600 for details of set-up and operation.

## Installation

### Location

Reliable accurate measurement from any instrument can only be achieved by correct



**Figure 2 Typical TT2000 Installation**

installation of the measuring device; in the case of turbidity and suspended solids this is particularly important. If you are in any doubt contact Partech or your local distributor for advice.



**Figure 3 View of TT2000 Immersed**

Below are some points that should be considered before starting to install the sensor, and again if the results obtained are not meeting your needs.

- Avoid areas of extreme flow or turbulence; air bubbles will disturb the reading.
- Do not place the sensor in an area of no flow, as the suspended solids will settle out and not provide a representative reading.
- Ensure that the sensor is immersed deeply enough into the flow to ensure that any surface flow patterns, such as vortices around the sensor body do effect the optical parts of the sensor.
- Probes must be kept wet at all times, running the cleaning mechanism with dry probes will cause excessive wear of the wiper and sealing rings, and hence increased maintenance costs.
- The sensor should be mounted in such a way as to allow easy access for calibration and maintenance. It should be possible to remove the sensor from the process without the need to shut the process down.
- The sensor must be monitoring a sample of the process that is representative of the whole process.

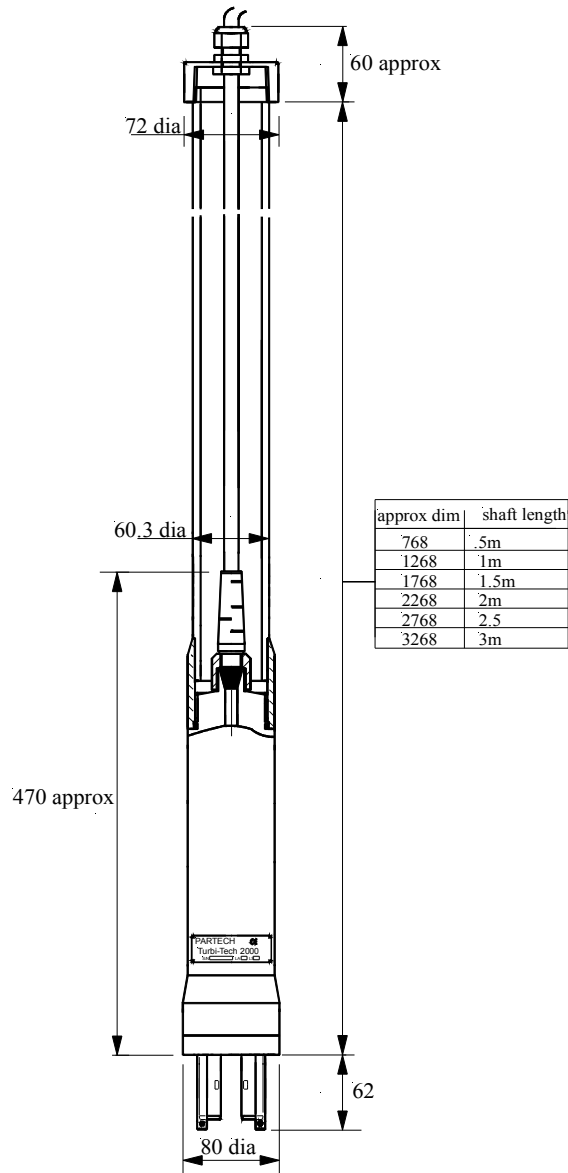
- To allow a single technician to calibrate and maintain the system the sensor should be placed within sight of the controller. Although cable runs of up to 100 metres are possible operational problems can be caused.
- When possible, angle the sensor so that it is pointing down stream, this will allow any “ragging” to be removed by the flow past the sensor.

### **Partech Brackets and Mounting Shafts**

Partech offer a range of mounting brackets for the installation of TT2000 sensors to suit various application needs, drawings are provided in the following sections.

The TT2000 sensors are all provided with a 2” BSP male thread that allows the attachment of any mounting accessories. Partech supply mounting shaft manufactured from 2” nominal bore grey ABS pipe in 0.5, 1.0, 1.5, 2, 2.5 and 3.0 metre lengths. Whilst other lengths can be provided as special orders it will normally be possible for the standard lengths to satisfy most requirements.

It should be noted that sensors with long mounting shafts are difficult to move safely and can present problems with calibration and maintenance, the shaft length should be kept to a minimum.



**Figure 4 TT2000 fitted with Mounting Shaft**

### Assembly of TT2000 onto Mounting Shaft

The TT2000 Sensor and Mounting Shaft are supplied separately, to assemble the sensor onto the shaft follow the procedure below.

1. Remove the protective cap from the top of the sensor. This will expose the mounting thread and sealing 'O' ring.
2. Remove the cable gland and cap from the top of the mounting shaft.
3. Thread the sensor cable through the mounting shaft.
4. Screw the mounting shaft onto the sensor until the coupling butts up against the sensor.
5. Feed the cable through the cap and cable gland and then screw the cap onto the top of the shaft. Tighten the cable gland.

### Handrail and Wall Mounting Brackets

The mounting shafts described above need to be attached to the structure of the tank or flow channel where measurement is required. The standard mounting bracket is attached to the mounting shaft using 'U' bolts, and provides a quick release mechanism to allow easy removal. The bracket also allows the sensor to be mounted away from the structure of the tank or channel into the main body of flow.

The sensor brackets have two holes to allow the bracket to be attached directly to the wall of the tank or channel, when this is not possible the handrail bracket can be used to mount directly onto the handrail.

Care should be taken to ensure that the sensor can be reached from the walkway to allow removal for calibration and maintenance.

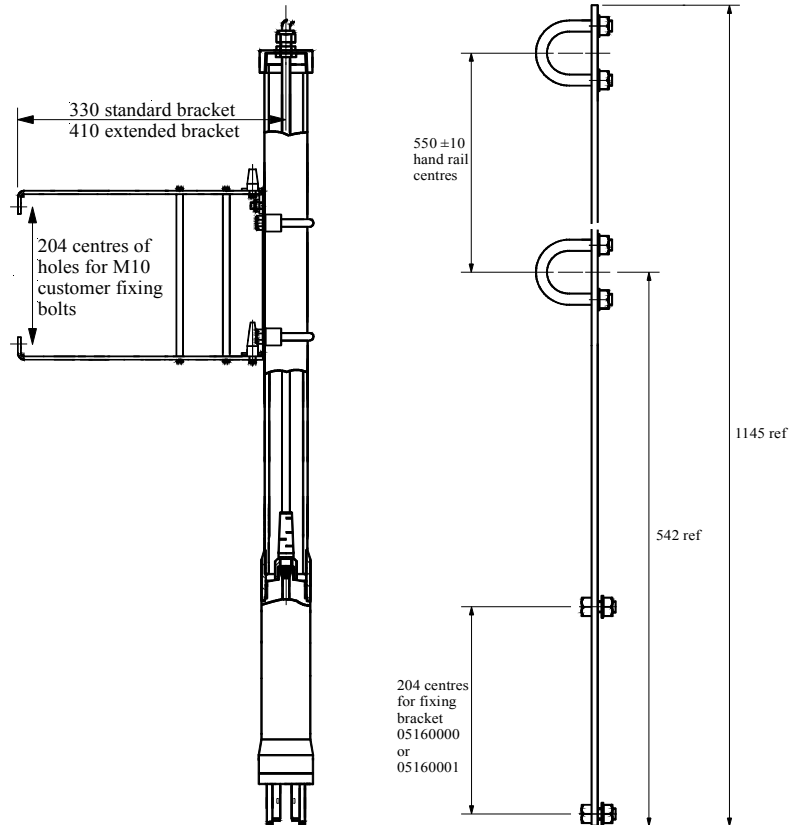


Figure 5 TT2000 Mounting Bracket      Figure 6 TT2000 Handrail Bracket

### Guide Tube Mounting System

For applications where it is not possible to mount the sensor using the brackets described previously the guide tube system provides a suitable alternative. Typical applications include long distance between the top water level and the access point, widely varying water levels that would otherwise necessitate long shaft lengths, and highly turbulent applications requiring a stilling tube to keep the sensor securely mounted.

The sensor is lowered into the outer tube until it reaches the mechanical stop at the bottom. The weight of the sensor is sufficient to hold it in place. The sensor can be removed simply by pulling on the cable.

The guide tube is provided with a number of holes at the bottom of the tube to allow the process liquid to flow through the tube preventing major fouling problems, the tube should be flushed periodically to ensure that sensor can easily be removed and re-installed.

The guide tube should be firmly secured at the lowest and highest practical points to ensure stability during use and to prevent stress on the mounting points.

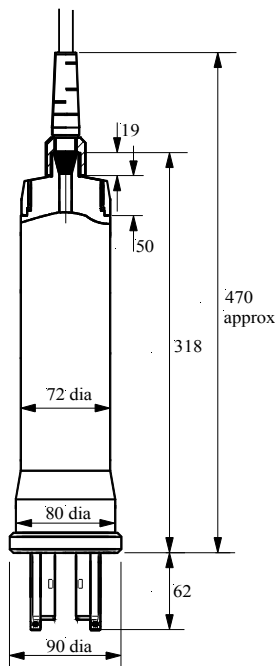
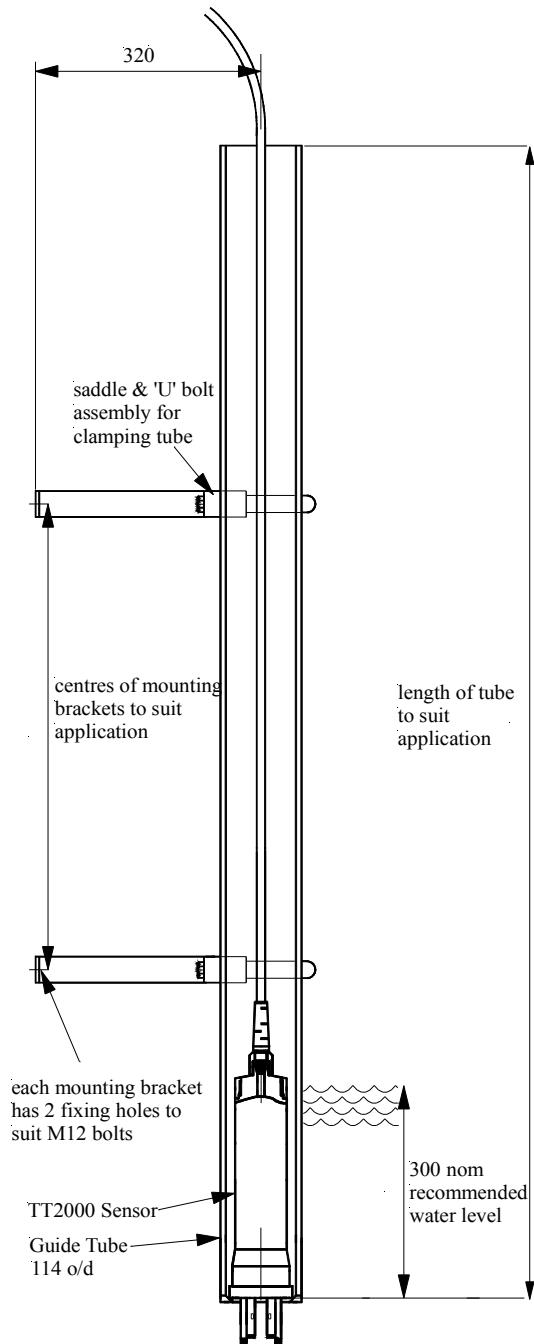


Figure 7 TT2000 Guide Tube Versions



**Figure 8 TT2000 Guide Mounting Systems**

## Flow cells

Where the process liquid that needs to be measured is contained within a closed pipe and no open channel or tank is available then a sample must be taken and passed through a flow cell to allow the sensor to measure the suspended solids or turbidity. The flow cells provided by Partech are not pressure containing devices and the flow must be fed to waste after passing the sensor.

The flow rate through the flow cell must be sufficient to ensure that the solids do not settle, this is dependant on the solids present but is typically 0.5 to 5 litres per minute.

The flow cell is provided with a 1/2" BSP inlet valve with a 1/2" BSP male hose adaptor and a 3/4" BSP outlet valve with a 3/4" BSP male hose adaptor. The inlet valve will allow the flow to be adjusted to the minimum necessary to ensure that the solids do not settle.

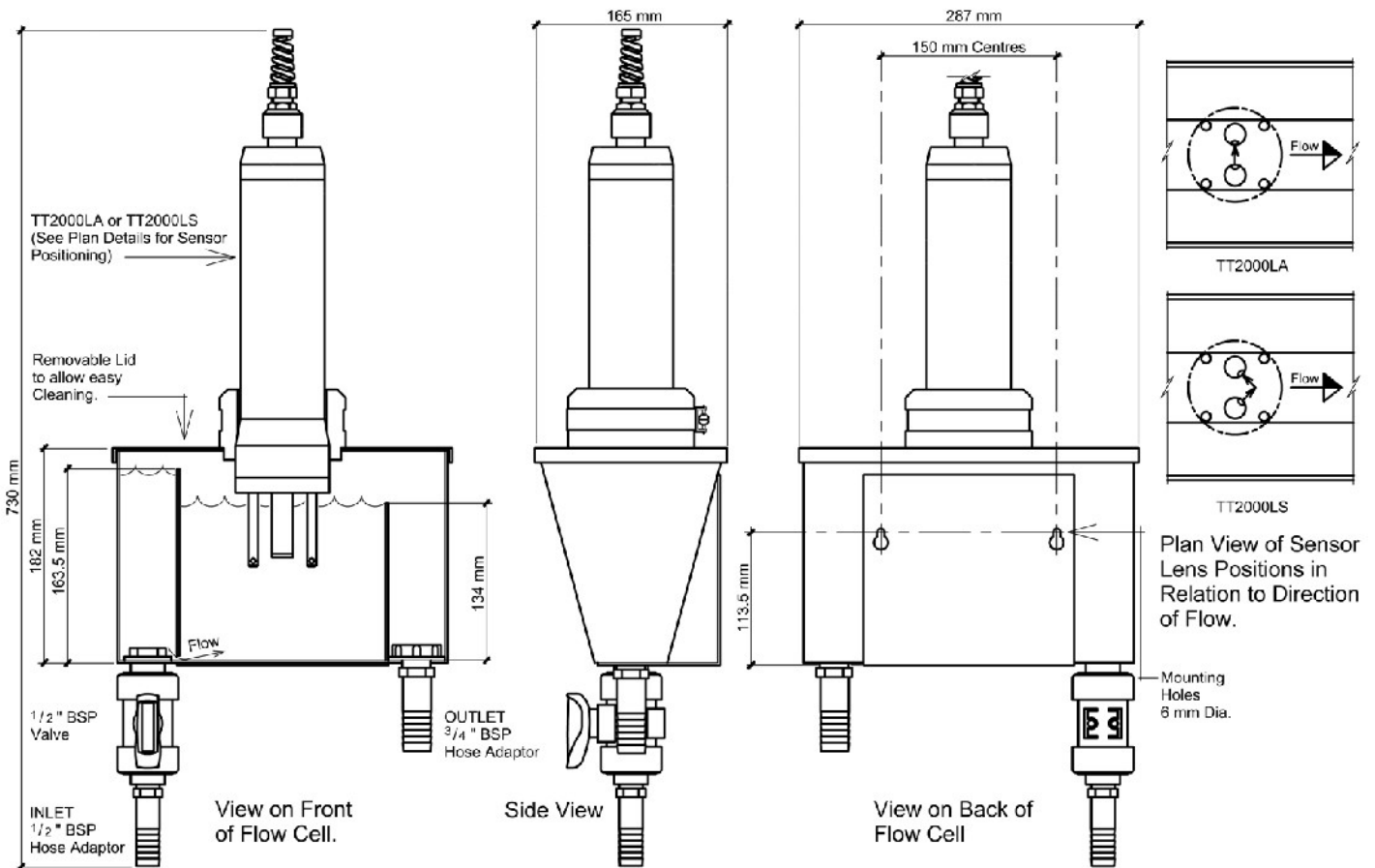


Figure 9 Flow Cell FC8

### **Customer Supplied Brackets**

When creating brackets to mount the TT2000 sensor, care should be taken to ensure that the following guidelines are observed:

- The bracket must be strong enough to support the sensor with minimum movement when installed into the sample.
- When attachments to the sensor are made, these should either be done using the threaded area at the top of the sensor housing or by clamping around the sensor body.
- Consideration should be given to enable simple removal and replacement of the sensor for inspection, calibration and servicing to be carried out.

### **Cable Routing**

Care should be taken to ensure that the cable routing does not cause problems with the sensor measurement; good engineering practice should be followed with particular attention being paid to the following points;

- The sensor cable should be kept to the minimum length possible.
- Sufficient spare cable should be provided to allow complete and easy removal of the sensor from the process.
- Any spare cable should be safely stored.
- The sensor cable should be kept separate from mains cable.

### **Care of glass tubes**

The optical part of the sensor uses two precision ground Pyrex® glass tubes, care must be taken at all times not to break the tubes. This is particularly important if the sensor is removed from the process, damage to the tubes will cause the sensor to leak. If any problem is found please contact Partech's Customer Support Manager before attempting to repair the sensor. If the sensor is to be returned to Partech the sensor must be suitably packed to prevent further damage.

## Configuration

### Clean Cycle Time

The frequency of cleaning can be set on the controller to meet the requirements of the application. It is possible to set the interval between cleaning in the range 30 minutes to 24 hours. The interval should be set to suit the level of fouling experienced in a particular installation. The factory default clean interval is set to 5 hours, however this may be adjusted. The best method of optimising the clean cycle interval is through observation of the probes prior to a clean taking place. An assessment of the level of fouling can then be made and the clean interval adjusted accordingly.

At a 5 hourly cleaning cycle the cleaning rings will last for approximately 730 days or 2 years. The actual wear rate of the cleaning rings is dependent on the solids being measured; an abrasive process will cause the seals to wear more rapidly.

It should be noted that the wiper and sealing rings are rated for 3500 clean operations; therefore using a short clean interval reduces the service interval of the sensor. An error message is displayed on the controller when the sensor has performed 3500 clean cycles.

### Calibration - General

When a new system is installed, a period of 4 hours should be allowed for the equipment to stabilise before calibration commences. This is to enable the system to adjust to the “new” ambient conditions. This should not be considered as a warm up time from power up, it allows the system to adjust from a warm store or office to a cold site.

Any containers used to store calibration samples should be cleaned prior to use. This is particularly important when performing the zero point calibration on a low range sensor.

The most accurate method of calibration is using a primary standard, i.e. calibration in the actual solution against a lab result. Where this is not possible or where the trend of the reading is necessary rather than an absolute value it is acceptable to use a secondary standard.

It is normally preferable to perform the calibration operation with the damping on the controller set to zero.

### Calibration (Primary Standard)

#### Zero

To zero the system, immerse the sensor in clean water and follow the zeroing procedure described in the controller manual. When the TT2000LS sensor is immersed, care should be taken to ensure the sensor is not looking at the side of the container, as this will give inaccurate calibrations. If the optics of the TT2000LS sensor are observed it will be noticed that the lenses are facing in a specific direction, ensure that they are pointing into the main volume of the sample.

#### Calibration

To get the best possible result the sensor should be installed in its normal mounting position, a sample should be taken from the process at the same point as the measurement. The “Take Sample” function on the controller should be used to record the sensor measurement when the sample is being taken.

## Calibration (Secondary Standard)

Zero the sensor in the same manner as for a primary standard.

### Formazin

Formazin can be used as a secondary standard for the TT2000LS sensor. The resultant measurement will be a Turbidity reading and the correct units of measurement are FTU's, the units on the controller should be changed to reflect this. It should be noted that there is no universal relationship between FTU's and mg/l, although it may be possible to derive a relationship by experimentation for a particular application.

Once a Formazin stock solution has been prepared, it can be diluted to the required value. (Preparation of Formazin, page 28)

Place the sensor in the sample taking the same precautions as the zero point calibration, and ensure that no settlement has occurred, then calibrate according to the controller instruction manual.

### Fuller's Earth

The use of Fuller's Earth is an alternative method of calibrating the TT2000LA and TT2000HR sensors, it should be noted that this would produce only an indication of the value being measured. Fuller's Earth has fallen out of common use and is included to give an alternative method of calibration if gravimetric analysis is not possible.

Prepare the Fuller's Earth sample as shown in the later section to the value required.

Place the sensor in the sample, ensure that the Fuller's Earth has not settled out, and perform the calibration per the controller instruction manual.

## Calibration – Equipment and Procedures

This section describes the materials and equipment you will need and the basic steps required to ensure a successful calibration of the Turbi-Tech 2000. It should be read in conjunction with the calibration section provided in the instruction manual for the 7200 Monitor.

The following is required:

- 2 Gallons filtered distilled water
- 2 Litres secondary standard (Formazin/Fullers Earth)
- Large (approx. 16'' x 20''), ideally black, container for Zero calibration point. A bucket is suitable.
- 8'' diameter 2-litre container, ideally black, for secondary standard solution.
- Protective gloves.
- Stainless steel spoon.

The use of protective gloves is recommended when performing calibration procedures.

Prior to taking any measurements, thoroughly wash the containers, the mixing spoon, the sensor and 1 meter of cable. Then rinse everything twice with filtered water. Ensure that calibration solutions are stirred.

Where appropriate, perform the calibration procedure under fluorescent light to avoid interference from incandescent light and solar radiation.

Always immerse the sensor in the containers so that the IR beam looks across the diameter of the sample to prevent the beam from reflecting off the walls on the container.

**Note: When calibrating in the field, where possible, perform checks in the shade to minimise the effects of stray-light.**

## Linearisation (LA and HR)

The 7200 Monitor uses an exponential equation to linearise the output of the TT2000LA and TT2000HR sensors. The equation has four constants to set the linearisation shape; the default values for these have been optimised for Fullers Earth. These have been found to be suitable for most applications; however if the response of the system is found to be non-linear revised values can be set. For assistance in calculating revised value please contact the Customer Support Manager at Partech.

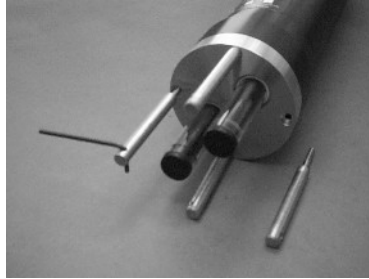


Figure 10



Figure 11

## Gain Adjustment (LS Only)

The TT2000LS sensor has a gain control located on a circuit board within the sensor body. The gain control is factory set fully clockwise for maximum gain and resolution. However in some applications it may be necessary to reduce the sensor gain such that the measurement range is increased.

To set the sensor gain the procedure below should be used, if this is the first time you have adjusted the gain on a Turbi-Tech sensor it may be advisable to contact Partech to ensure the procedure is fully understood. Once the gain control has been adjusted all previous calibration will be invalid.

**(Note: The numbers in brackets identify the part in Figure 12)**

1. Prepare a sample of the suspended solids that is at the maximum value that will need to be monitored, or near that maximum value.
2. Remove the body (5) from the sensor, to expose the circuit boards. Take great care not to damage the internal wiring. Ensure only the glass tubes (12,13) and mounting block are immersed in the sample.
3. Place the sensor in the sample, and observe the output signal displayed on the controller. (See controller manual for details of how to display the sensor output signal).
4. If the output signal is 'Over range' then adjust the gain control in an anti-clockwise direction until the reading gives between 4.5 and 5 mA, please note that there is a delay in reaction from the controller to the adjustment of the gain control, allow time for the reading to settle before further adjustments are made. It is suggested that the gain control is moved  $\frac{1}{2}$  a turn at a time, please note this is 20-turn control.
5. Once the reading has been adjusted, the sensor should be reassembled.
6. The system can now be calibrated to the new settings.

## **Maintenance**

To maximise the operational life of the sensor regular inspection and servicing is required. The frequency of this is dependent on the specific operation of each site, however an initial weekly inspection to observe the characteristics of the application is recommended, long term operational practice can be decided from these inspections.

Although the sensor will automatically clean the optical surfaces of the sensor the main sensor body and the mounting brackets will be subject to fouling. It is advisable that this fouling is not allowed to build up to such an extent that it affects the sensors ability to make the required measurement.

### **Inspection**

It is envisaged that an inspection of the sensor will include the following:

- Check security of brackets.
- Check for damage to cable.
- Removal of the sensor from the channel.
- Cleaning the sensor using a suitable detergent and remove all ragging.
- Inspection of the glass tubes for staining, scouring, cracks or chips.
- Check for moisture/signs of leakage inside the glass tubes.

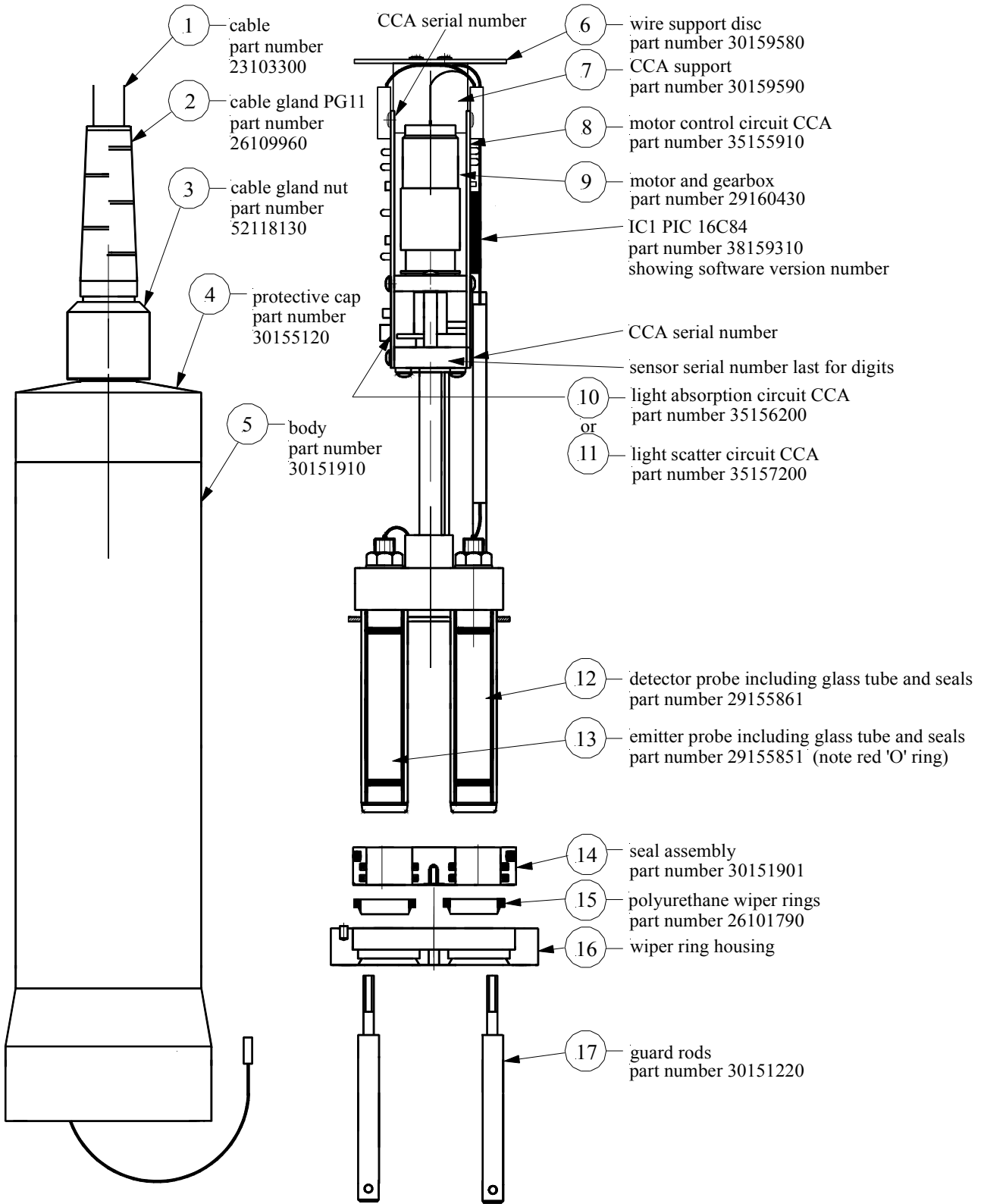


Figure 12 Exploded View of TT2000 Sensor

## Replacement of Seals

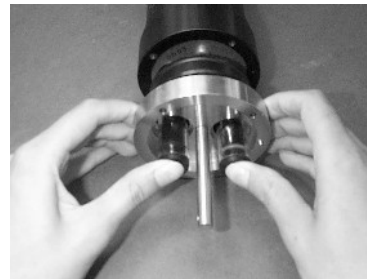
It is preferable to carry out this operation with the probes fully extended. However replacement of the seals can be done even if the probes are partially or full retracted.

*(Note: The numbers in brackets identify the part in Figure 12)*

1. Switch off the power to the controller.
2. Unscrew the four guard rods (17). A small Allen key or similar is suitable for using as a lever in the small hole located near the end of the guard rod.
3. Remove the stainless steel wiper ring housing (16) and carefully prise the yellow wiper rings (15) off the glass tubes (12, 13). Discard the worn wiper rings (15).



**Figure 13**



**Figure 14**

4. In the centre of the now exposed seal assembly (14) a small threaded hole should be visible. Fit the wiper ring housing onto the probes in a reverse direction to its correct installation. Screw one of the guard rods through the wiper ring housing into the threaded hole in the seal assembly. (Figure 13).
5. The reversed wiper ring housing can now be used as a lever to extract the seal assembly down and off the probes. This is best done by locating fingers underneath the wiper ring housing and thumbs on the ends of the probes (Figure 14).
6. Unscrew the guard rod from the old seal assembly and remove the wiper ring housing. Retain the seal assembly for return to Partech.
7. At this stage it may be necessary to clean the glass tubes. A damp soft cloth and some mild liquid detergent are suitable for this; however great care should be taken to ensure no water enters into the sensor body.
8. Fit the replacement seal assembly onto the probes such that the small threaded hole is facing outwards and the location dowel is aligned. Gently slide the seal assembly over the probes and press fully home into the sensor body.
9. Fit the replacement wiper rings over the probes and slide up to the seal assembly.
10. Locate the wiper ring housing onto the probes such that the small location dowels are aligned with their mating holes in the sensor body and seal assembly. Slide the wiper ring housing onto the sensor body.
11. Replace the guard rods ensuring that the wiper ring housing is square to the can. It should be possible to tighten the guard rods such that there is no gap between the wiper ring housing and sensor body by hand. A small Allen key or similar can be used to tighten the guard rods - care should be taken to prevent over tightening.

## **Removing the sensor body**

The sensor body can be removed to enable inspection of the clean mechanism and circuit boards and the adjustment of the gain control on the light scatter version of the sensor (TT2000LS). If removal of the body is required steps should be taken to prevent any moisture entering the sensor body and any damage being done to the cleaning mechanism and circuit boards.

To remove the sensor body in order to gain access to the sensor circuit boards and cleaning mechanism, follow steps 1 to 7 of the seal replacement procedure. Then continue as follows:

**(Note: The numbers in brackets identify the part in Figure 12)**

1. With the seal assembly removed from the sensor housing, gently pull the probes such that the sensor inner assembly is removed (6 - 13).
2. Withdraw the sensor inner assembly completely from the body. The connecting cable is long enough to permit complete removal.
3. If required, the connecting cable can be removed from the sensor circuit board by unplugging and sliding through the wire support disc. It is possible to carry out inspection or gain adjustment (TT2000LS only) without disconnecting the cable.
4. To refit the sensor inner assembly the procedure is the reverse of the above three steps and continues with steps 9 to 11 of the seal replacement procedure. Care should be taken to ensure that the connecting cable is securely fastened and it is not snagged when the sensor is replaced into the body.

## ***Fault Finding***

### ***Unstable reading on controller***

The following can cause an unstable display value:

- Material (rag, weed, etc.) caught on the sensor probes or guard rods and affecting the measuring system - remove sensor, manually clean and re-install.
- Turbulence (caused by high flow, aeration etc.) in the solution being measured - increase the level of damping on the controller.
- Bad connection in the sensor cable - check all connections are secured.

### ***Clean Fault displayed on controller***

Clean Fault is displayed when the controller has detected a fault with the cleaning system in the sensor. These faults include:

- A clean cycle not being completed within a set time.
- An internal fault has occurred within the sensor.

To investigate the cause of the clean fault, turn the power to the controller off, remove the sensor and manually clean the sensor as described previously. Inspect the glass tubes for damage and excessive build up of residue (if these have occurred the sensor needs to be serviced).

If once the sensor has been cleaned and there is no damage, switch the controller on. The sensor probes should move to the fully extended position (unless they were already fully extended). Once the probes are fully extended use the manual clean option on the controller to initiate a clean cycle. Observe the probes throughout the clean cycle, making sure that the clean status indicated on the controller follows the action of the sensor.

### ***Probes stopped partially in/out***

If the sensor probes are stopped partially retracted, the controller should be indicating "Clean Fault". Follow the investigative procedure given for Clean Fault displayed on controller.

### ***Sensor Limit displayed on controller***

The sensor limit error message is displayed when the measurement signal from the sensor exceeds a set minimum or maximum value. This can occur when:

- The sensor gap is obscured by weed or rag - remove sensor, manually clean and re-install.
- There is a poor connection in the sensor cable - check all connections between sensor and controller.
- A fault has occurred with the measurement system in the sensor.

## **Technical Support**

Technical Support is available by phone, fax, or email, the details of which are shown below. Our website also features a technical support page which includes a support FAQ (Frequently Asked Questions).

Phone: +44 (0) 1726 879800

Fax: +44 (0) 1726 879801

Email: [sales@partech.co.uk](mailto:sales@partech.co.uk)

Website: [www.partech.co.uk/techsupp](http://www.partech.co.uk/techsupp)

To enable us to provide quick and accurate technical support, please have the following information ready when you contact our Customer Support Manager:

- Controller type, serial number, and software version number.
- Sensor type, and serial number.
- Application details.
- Description of fault.

## **Returning Instruments for Repair**

If equipment needs to be returned to Partech for repair or service the following address should be used:

SERVICE DEPT.  
PARTECH (ELECTRONICS) LTD  
CHARLESTOWN  
ST AUSTELL  
CORNWALL  
PL25 3NN  
UNITED KINGDOM

Please include the following information with the returned equipment. Also ensure that sensors are adequately protected for transportation (Advice on packing can be provided by our service department).

- Contact name and phone number.
- Return address for equipment.
- Description of fault or service required.
- Any special safety precautions because of nature of application.

## Technical Specification

### General

|                              |  |
|------------------------------|--|
| Operation Voltage:           | 12Vdc (Supplied by Monitor)  |
| Clean Life:                  | 3500 Cycles  |
| Maximum Pressure:            | 2 bar  |
| Operating Temperature Range: | 0 to 50 °C   |
| Storage Temperature Range:   | -20 to +60 °C  |
| Environmental Rating:        | IP68   |
| Cable Type:                  | Marine specification., 6 core, loosely twisted, Polyurethane.                  |
| Materials:                   | Stainless Steel 316, Black Acetyl, PVC, Polyurethane, Nitrile 'O' rings, glass |
| Weight:                      | 2 Kg (without mounting shaft/bracket)  |
| Dimensions:                  | Length 540mm, Diameter 80mm (without mounting shaft/bracket)                   |
| Standard Cable Length:       | 10 metres (From sensor body/mounting shaft gland)                              |
| Maximum Cable Length:        | 100 metres   |
| EMC Emission:                | EN 61000-6-3:2001  |
| EMC Immunity:                | EN 61000-6-1:2001  |
| Light Source:                | Infra red LED, 860nm   |

### TT2000LA

|                      |                                 |
|----------------------|---------------------------------|
| Measuring Principle: | Light absorption                |
| Minimum Range:       | 0 to 4000 mg/l*                 |
| Maximum Range:       | 0 to 20,000 mg/l*               |
| Linearity:           | ±2% FSD (linearised by monitor) |
| Accuracy:            | ±5% FSD (actual sample)         |
| Repeatability:       | ±1% FSD                         |

### TT2000HR

|                      |                                 |
|----------------------|---------------------------------|
| Measuring Principle: | Light absorption                |
| Minimum Range:       | 0 to 10,000mg/l*                |
| Maximum Range:       | 0 to 30,000 mg/l*               |
| Linearity:           | ±2% FSD (linearised by monitor) |
| Accuracy:            | ±5% FSD (actual sample)         |
| Repeatability:       | ±1% FSD                         |

\* The measuring range varies according to the nature of the solids.

### TT2000LS

|                         |  |
|-------------------------|--|
| Measuring Principle:    | 90° Light Scatter                            |
| Minimum Range:          | 0-50FTU/FNU, 0-50mg/l                        |
| Maximum Range:          | 0-500FTU/FNU, 0-500mg/l**                    |
| Sensor Gain Adjustment: | Multi-turn pot located inside sensor housing |
| Linearity:              | ±2% FSD (linearised by monitor)              |
| Accuracy:               | ±5% FSD (actual sample)                      |
| Repeatability:          | ±1% FSD                                      |

\*\* The measuring range varies according to the nature of the solids. In some applications it may be possible for the TT2000LS sensor to measure up to 1000 mg/l.

## Spare Parts List

### Sensors

|        |  |
|--------|--|
| 146000 | Turbi-Tech 2000LA Sensor (Cable Length: 10 metres) |
| 220599 | Turbi-Tech 2000HR Sensor (Cable Length: 10 metres) |
| 159400 | Turbi-Tech 2000LS Sensor (Cable Length: 10 metres) |

Note:-

The above sensors have standard Nitrile Seals. Viton Seals are available for specific applications. Please call Partech to discuss.

### Mounting Brackets, Shafts, Flowcells

|        |  |
|--------|--|
| 152702 | 0.5 metre Mounting Shaft   |
| 152703 | 1.0 metre Mounting Shaft   |
| 152700 | 1.5 metre Mounting Shaft   |
| 152701 | 2.0 metre Mounting Shaft   |
| 152704 | 2.5 metre Mounting Shaft   |
| 152705 | 3.0 metre Mounting Shaft   |
| 160000 | Standard Mounting Bracket, must be used in combination with a Mounting Shaft               |
| 160080 | Handrail Bracket, must be combined with the Standard Mounting Bracket and a Mounting Shaft |
| 160200 | Guide Tube up to 4 metres long with 2 Fixing Brackets                                      |
| 158930 | Flow Cell FC/8 for Turbi Tech 2000   |

### Service Parts

|        |   |
|--------|---|
| 156260 | Seal Service Pack -<br>Turbi-Tech 2000LA/LS. TurbiTechw <sup>2</sup> LA/LS, Nitrile H Rings |
| 156261 | Seal Service Pack -<br>Turbi-Tech 2000LA/LS. TurbiTechw <sup>2</sup> LA/LS, Viton H Rings   |
| 220608 | Seal Service Pack - Turbi-Tech 2000HR, TurbiTechw <sup>2</sup> HR, Viton H Rings            |
| 220607 | Seal Service Pack - Turbi-Tech 2000HR, TurbiTechw <sup>2</sup> HR, Nitrile H Rings          |

### Calibration

|        |                    |
|--------|--------------------|
| 101940 | Fullers Earth Pack |
| 102130 | Formazin Pack      |

### Misc

|        |                                    |
|--------|------------------------------------|
| 161460 | Instruction Manual Turbi-Tech 2000 |
|--------|------------------------------------|

## Preparation of Fullers Earth Solutions

The Fuller's Earth is supplied in a sealed 20g package, the package contains sufficient to make a 20,000 mg/l (20 g/l) solution when combined with 1 litre of water. Alternate solutions can be obtained by increasing the amount of water used as shown in the table below.

| Solution Required (g/l) | Add pack to water (litres) |
|-------------------------|----------------------------|
| 2.5                     | 8.0                        |
| 5.0                     | 4.0                        |
| 10.0                    | 2.0                        |
| 20.0                    | 1.0                        |
| 40.0                    | 0.5                        |

The following points should be observed when preparing and using Fullers Earth solutions:

- The water used should be freshly distilled or de-mineralised.
- Ensure the container used for the solution is clean.
- During preparation and use, keep the solution covered to prevent contamination.
- When using the solution it must be continually stirred to ensure accurate and consistent measurements and to prevent settling.

## Preparation of Formazin Turbidity Standard

### Health & Safety Precautions

The chemicals used when following this procedure are harmful; therefore the correct safety precautions must be carried out. During handling, avoid inhalation and contact with the eyes or skin. Wash hands thoroughly after use. Refer to the data sheets for further details of the chemicals used.

### Method of Preparation

The preparation of a Formazin Turbidity Standard should be carried out with great care. Absolute cleanliness should be observed at all times to avoid any contamination of the solution.

All water used should be freshly distilled or de-mineralised. During preparation and use, keep the solution covered to prevent contamination.

1. Dissolve the Hydrazinium Sulphate 10g (32112680) into 1 litre of water. Stir the solution thoroughly.
2. Dissolve the Hexamine 100g (32112630) into 1 litre of water. Stir the solution thoroughly.
3. Pour the above solutions into a 2.5 litre Winchester or similar type amber glass bottle and mix thoroughly. Allow the mixture to stand undisturbed for 24 hours at 25°C. The resultant solution will have a turbidity of 4000 FTU.
4. Prior to use the standard should be mixed thoroughly. i.e. before pouring out the standard, shake the bottle well.

### Preparation of Dilution's.

The 4000 FTU standard can be used to prepare solutions of lower values by diluting with water. The formula below can be used to calculate the ratio of water to 4000 FTU standard to produce a solution of the required value.

$$W = \frac{4000}{A} - 1$$

W = parts water to 1 part 4000 FTU standard

A = Required FTU value

The Formazin Dilution Chart provides the mixture requirements to make various solutions using the 4000 FTU standard.

### Calibration

When Formazin solutions are used for calibration/testing of sensors, sufficient solution is required such that the sensor is completely immersed. When using light scatter sensors it is important that the sensor is positioned away from the sides and bottom of the container to prevent the light being reflected.

### Storage Life

The turbidity standard should be stored in the Winchester bottle and kept in a cool dark place. The bottle should be labelled to identify its content and also the date of preparation should be recorded. The 4000 FTU standard has a shelf life of one year after which it should be discarded and a fresh solution should be prepared.

Solutions made by diluting the 4000 FTU standard should also be stored in suitably labelled amber glass bottles and kept in a cool dark place. Solutions above 400 FTU have a shelf life of one month after which they should discard. Solutions below 400 FTU should be prepared from the 4000 FTU standard daily.

Solutions can be used outside of the storage lives specified above but any results taken must acknowledge this and be accepted as less accurate. When using solutions, watch for flocculation (the particles in the solution will appear to link together), if this occurs discard the solution and prepare a fresh standard.

## Declaration of Conformity

### DECLARATION OF CONFORMITY

According to EN 45014

We, Partech (Electronics) Limited, Charlestown, St Austell, Cornwall, United Kingdom, declare under our sole responsibility that the product:

**Product Name:** TT2000HR, TT2000LA, TT2000LS Sensors  
**Model Number(s):** 220599, 146000, 159400

to which this declaration relates is in conformity with the standards noted below:

**EN 61326:1998:** EMC requirements. Electrical equipment for measurement, control, and laboratory use.

**EN 61000-6-1:2001:** Electromagnetic compatibility (EMC)—Part 6-1: Generic standards—Immunity for residential, commercial, and light-industrial environments.

**EN 61000-6-3:2001:** Electromagnetic compatibility (EMC)—Part 6-3: Generic standards—Emission standard for residential, commercial, and light-industrial environments.

following the provisions of European Directives:

|                   |   |
|-------------------|---|
| <b>89/336/EEC</b> | Electromagnetic Compatibility Directive |
| <b>92/31/EEC</b>  | Amending 89/336/EEC                     |
| <b>93/68/EEC</b>  | Amending 89/336/EEC                     |
| <b>73/23/EEC</b>  | Low Voltage Directive                   |
| <b>93/68/EEC</b>  | Amending 73/23/EEC                      |
| <b>89/392/EEC</b> | Machinery Directive                     |
| <b>91/368/EEC</b> | Amending 89/392/EEC                     |
| <b>93/44/EEC</b>  | Amending 89/392/EEC                     |
| <b>93/68/EEC</b>  | Amending 89/392/EEC                     |



Roger Henderson, Technical Director, February 23, 2006