



OPTIMIZING WATER TREATMENT PROCESSES

OPERATIONS MANUAL

Particle Monitor

PM 2500

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SAFETY PRECAUTIONS

BEFORE ATTEMPTING TO UNPACK, SET UP, OR OPERATE THIS INSTRUMENT, PLEASE READ THIS ENTIRE MANUAL.

MAKE CERTAIN THE UNIT IS DISCONNECTED FROM THE POWER SOURCE BEFORE ATTEMPTING TO SERVICE OR REMOVE ANY COMPONENT.

FAILURE TO FOLLOW THESE PRECAUTIONS COULD RESULT IN PERSONAL INJURY OR DAMAGE TO THE EQUIPMENT.

WARRANTY INFORMATION

Chemtrac[®] Systems, Inc. warrants its equipment to be free from defects in material and workmanship for a period of one (1) year from date of shipment to the original purchaser. Upon receipt of written notice from purchaser, seller shall repair or replace the equipment (at option of Chemtrac[®] Systems, Inc.).

Chemtrac[®] Systems, Inc. assumes no responsibility for equipment damage or failure caused by:

1. Improper installation, operation, or maintenance of equipment.
2. Abnormal wear and tear on moving parts caused by some processes.
3. Acts of nature (i.e. lightning, etc.)

This warranty represents the exclusive remedy of damage or failure of equipment. In no event shall Chemtrac[®] Systems, Inc. be liable for any special, incidental, or consequential damage such as loss of production or profits.

1.0 GENERAL INFORMATION

1.1 INTRODUCTION

The monitor provides a sensitive indication of very low concentrations of particulate impurities in a flowing water sample. It is especially suitable for particles greater than 1 micron in size and can be over 100 times more sensitive than conventional nephelometric turbidimeters. There is no simple relationship between the monitor response and turbidity, since the techniques have very different dependencies on particle size. Turbidimeters respond well to sub-micron particles but give a much smaller response to particles a few microns in size. The new monitor is relatively insensitive to particles below about 0.5 microns, but is capable of detecting sub-ppb levels of larger particles. The two techniques have comparable sensitivity for particles around 1 micron in size.

It is not possible to derive absolute information on particle size or concentration, but the unit can be very useful for routine monitoring of the quality of filtered water. An increase in the monitor reading can be taken as an indication of “breakthrough” of particles from the filter. When the reading reaches a predetermined high threshold level, a backwashing sequence could be initiated. In installations where particle counting and sizing facilities are available, the particle monitor may provide a useful indication of when such measurements need to be made. If the monitor output remains reasonably steady, it may be assumed that the particle size and concentration are not changing significantly, so that new determinations are unnecessary. On the other hand if the monitor response does change, a determination of the new particle size distribution may be worthwhile.

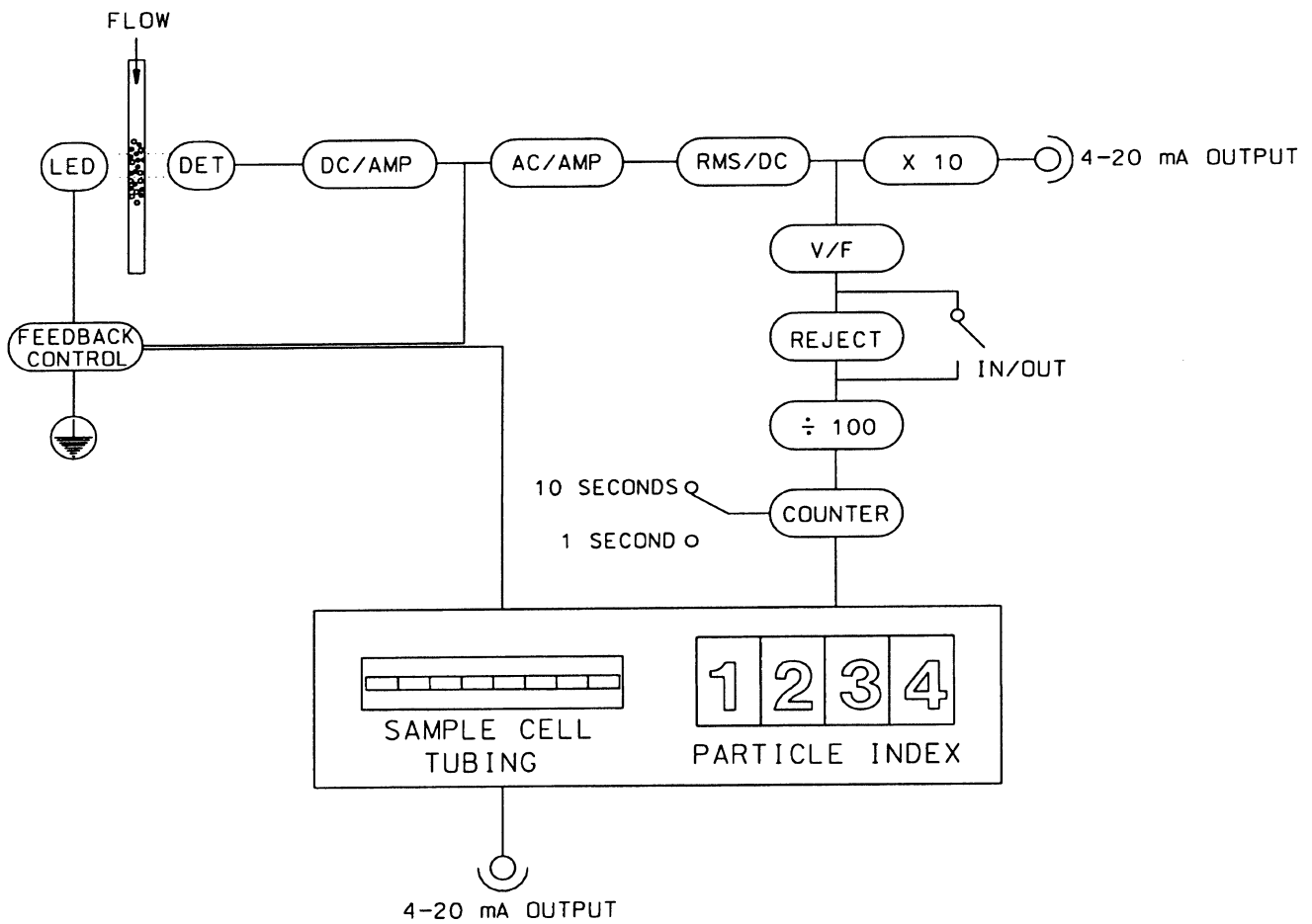
1.2 PRINCIPLE

Essentially, water flows through a transparent plastic tube and is illuminated by a narrow beam of infrared radiation (about 850 nm wavelength). The effective beam width is about 0.3 mm and the optical path length (tube diameter) is 3 mm, giving an illuminated sample volume of the order of 0.2 mm^3 (or $2 \times 10^{-4} \text{ cm}^3$). Only a small fraction of the total flow through the tube (about 20%)

passes through the illuminated volume, so that the majority of particles in the flowing sample are not “seen” by the monitor. However, provided that the fraction passing through the beam is representative of the whole flow, this does not cause any problems.

The transmitted radiation is monitored by a sensitive detector. The output from the detector is converted to a voltage, which consists of a large, steady component (the DC value) and a much smaller, fluctuating component (the AC value). The DC value is simply a measure of the average transmitted intensity and in the monitor this is kept constant at a value of about 5.7 volts, by means of feedback control. The AC component arises as a result of random variations in the number of particles in the light beam. In the case of fairly high concentrations there will always be particles in the beam - sometimes more and sometimes less than the average value. For low concentrations, especially of larger particles, the passage of a particle through the beam may be due to single particle events. For higher concentrations, especially of smaller particles, the passage of particles through the beam may be due to multiple particle events. Since the unit responds to multiple or single particle events, this technique minimizes problems associated with “coincidence” found in particle counters. This is caused in particle counters by multiple particles being counted as a single particle. A schematic diagram of the monitor is given in Figure 1. The AC value is separated from the DC value amplified and passed to an RMS-to-DC converter. The output from this device (the RMS value) is a DC voltage equal to the root mean square value of the amplified AC signal. For a given type of particle, the RMS value is proportional to the square root of the concentration. For a given (weight) concentration, the RMS value depends on particle size in a rather complex manner, but, up to about 2 microns, there is a strong increase with increasing particle size. Large aggregates (flocs) can give a very high response, but, in filtered water (for which the monitor is primarily intended), these should not be present in significant amounts (See Figure 1).

FIGURE 1



1.3 SIGNAL PROCESSING

For display purposes, the AC RMS value is passed to a Voltage-to-Frequency (V/F) converter, the output of which is a train of square-wave pulses, whose frequency is proportional to the RMS value. The passage of a single particle through the beam produces a brief rise in the RMS value and a short “burst” of pulses from the V/F converter. High concentrations of particles produce a more steady output of pulses. Simply counting the pulses over a fixed time interval gives a measure of the average RMS value and hence of the level of particulate impurities in the water. The V/F converter has been scaled so that a 1 volt input gives a 100 kHz output. With typical RMS values for water samples (10-200 mV) pulse frequencies of between 1 and 20 kHz can thus be expected. In order to obtain a representative reading for a flowing sample the pulses should be counted over a reasonably long time and in the present monitor this has been chosen as 10

seconds. Because this would give very large pulse counts (typically 10,000-20,000) the output from the V/F converter is divided by 100 before the pulses are counted. So, for most water samples the display will read between 100 and 2,000.

1.4 NOISE

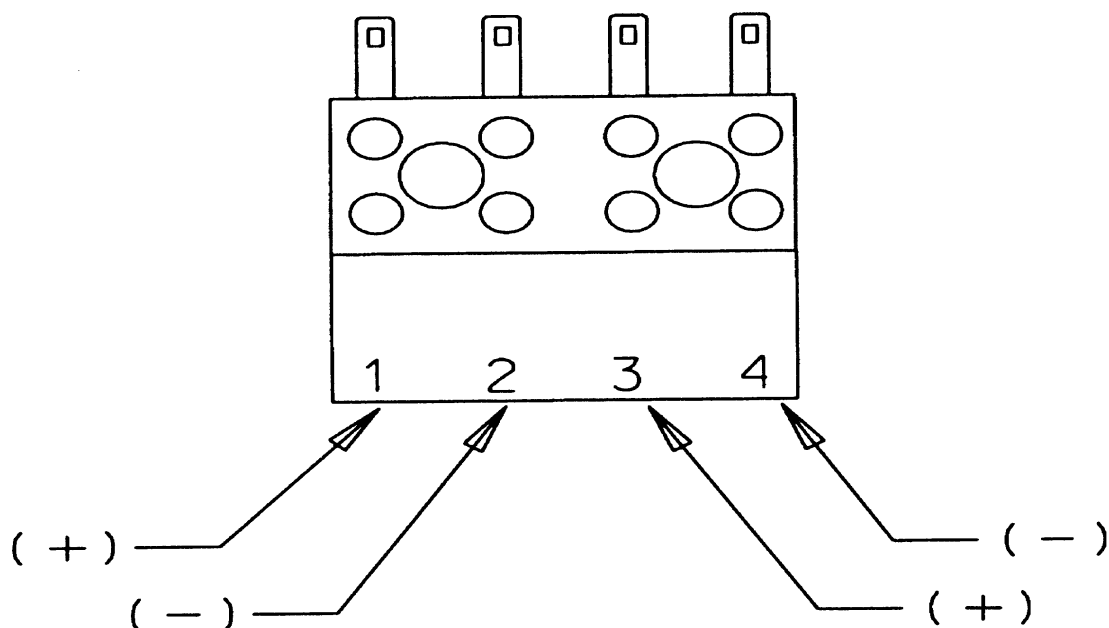
When an unusually large particle (e.g. dust) or an air bubble passes through the light beam, the RMS value can become very high momentarily, giving a very high frequency output from the V/F converter. When the frequency exceeds 100 kHz (i.e. 1 volt RMS), pulses are not counted so that such events have only a limited effect on the response. Because of this upper frequency limit, the count in 10 seconds cannot exceed 9999, when the REJECT function is selected, so that a 4-digit display is sufficient.

1.5 ANALOG OUTPUT

For analog display or data logging, the RMS value is available as a 4-20 mA output on the instrument. This has been amplified a further 10 times to give a reasonably high voltage level for chart recorders or other devices. So for an RMS value of 50 mV, V/F output would be 5 kHz and, after division by 100 and counting for 10 seconds, a count of 500 should be displayed. The corresponding analog output from the "RMS" terminals 1 & 2 would be 4.8 mA ($.05 \times 16 + 4$). This output has been timed smoothed 5 seconds to give fairly steady traces on chart recorders. The analog RMS output is not subject to the discrimination described above, so it will include the background noise (usually about 50 mV, because of the 10x gain) and will also respond more to very large particles and air bubbles. For moderate levels of particulate impurities, the noise can be ignored, as explained above. For very clean water, the noise may be backed off, although this procedure is not strictly valid, because of the non-additivity of signal and noise (See Figure 2).

FIGURE 2

4-20 mA OUTPUTS



1.6 FEEDBACK CURRENT

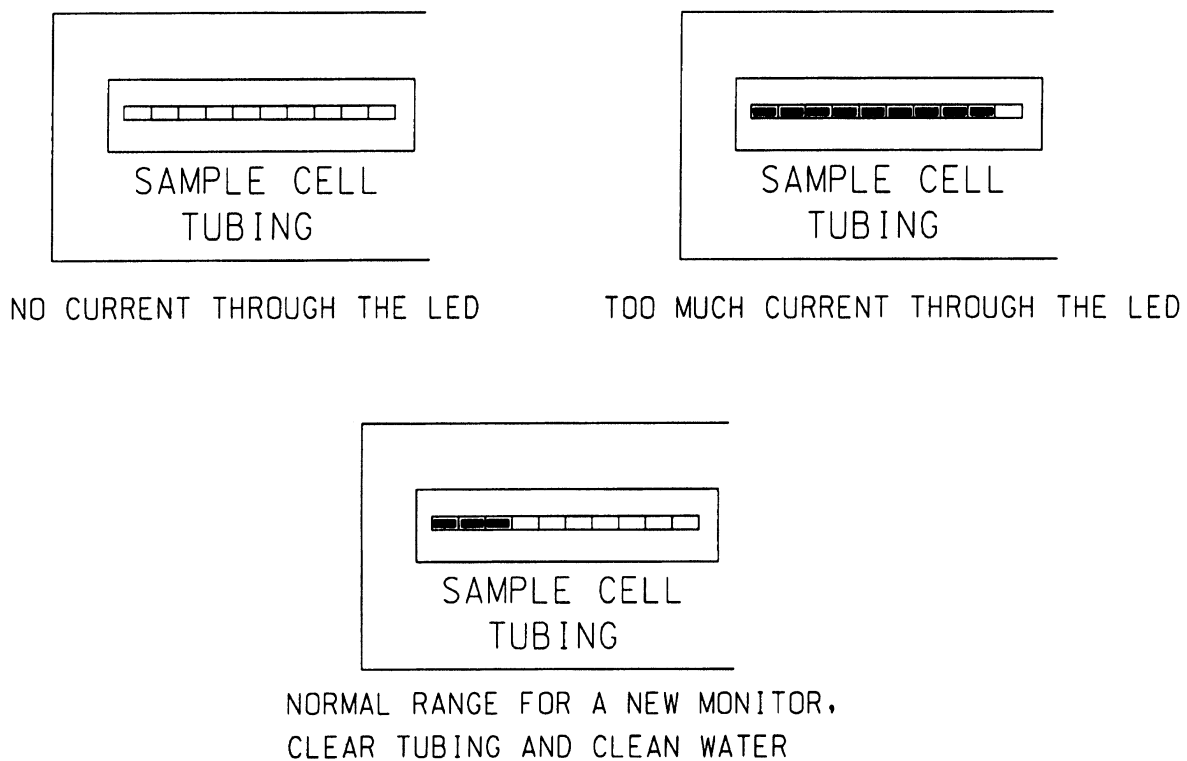
Feedback control regulates the current through the light-emitting diode so as to give a constant intensity of transmitted light, corresponding to a DC value of 5.7 volts DC. The current will depend on the efficiency of the LED, which varies from one unit to another and may also decline gradually during extended use. Another major factor affecting the current is the transmission properties of the tubing and the flowing sample. For highly transparent tubing and clean water, only a low feedback current will be necessary to give the required DC value. If the tubing becomes coated with adhering particles, it will transmit less light and more current will automatically be provided to maintain the DC value.

The feedback current thus provides useful information on the operating conditions. A visual indication is provided on the front panel as a Sample Cell Tubing display. The more segments illuminated, the greater the feedback current (approximately 5 mA per segment up to a maximum of 10 segments or 50 mA). With a new monitor, clear tubing and clean water, the required

current may be in the range 10-20 mA, depending on the efficiency of the LED. (Note that the current will usually be less with water in the tube than with air, because of the higher refractive index). If the tube becomes contaminated or if the LED becomes less efficient, then the indicated current will increase. The Sample Cell Tubing could indicate two possible fault conditions: (See Figure 3).

1. No segments illuminated - indicates no current through the LED and hence no illumination. This may be due simply to lack of power or to an electronics fault.
2. 9 or 10 segments illuminated - indicates too much current through the LED. Possible causes are a blocked light path, and incorrectly located tube, serious contamination ("fouling") of the tube surfaces, or a reduced efficiency of the LED. In this condition, the monitor may not give the correct response. Replace the tubing under this condition. If this doesn't correct problem, consult factory.

FIGURE 3



The feedback current display can be helpful in positioning a new tube in the slot - the tube should be adjusted to give the minimum number of segments illuminated. Once a current level has been established for a new monitor and tubing, the value should be checked from time to time. A significant increase should be taken as a warning that the tube may need to be replaced, or, less likely, that the efficiency of the LED has deteriorated.

In case data logging is carried out remote from the monitor and a remote check on the condition of the monitor is required, the feedback current is also available at terminals 3 & 4 inside the unit, as well as the Sample Cell Tubing display. This output is a 4-20 mA current proportional to the feedback current.

1.7 DIGITAL DISPLAY AND SWITCHES

The 4-digit display to the right of the bargraph gives the pulse count corresponding to the RMS level. In normal operations, the pulses will be subject to the discrimination described above, divided by 100 and counted for 10 seconds. The display will then change every 10 seconds to show the number of pulses counted during the previous count period. Two switches on the front of the monitor allow different count procedures to be adopted:

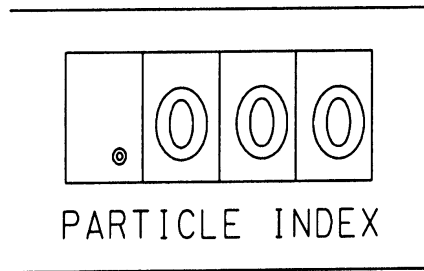
1. REJECT IN/OUT: in the OUT position, no digital discrimination is applied to the pulse train, so that even with no flow, a certain count due to noise will be registered. This can be useful in providing an occasional check on the noise level. For counts of about 200 or more, the noise makes virtually no difference to the reading. The high frequency limit is also disabled in the OUT position, so that very large particles and air bubbles will have a greater effect on the reading.
2. Count Time: as well as the recommended 10 second count period, a time of 1 second may be selected. This can be useful in giving an idea of the variability of the signal. If the readings over 1 second periods are reasonably constant, except for an occasional high value, it is likely that few large particles are present, among a much larger number of smaller particles. Such variability is not so easily seen with a 10 second count period. When in the 1 second count mode, the reading is displayed as a frequency in

kHz, with a decimal point. Thus, when the 10 second count is 500, the 1 second reading would be displayed as .050 (See Figure 4).

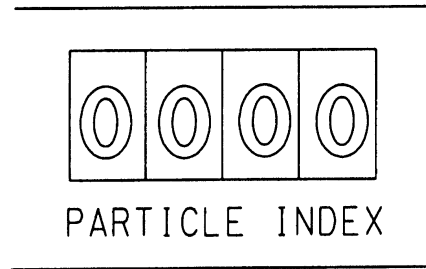
NOTE: Although these switches may be useful from time to time, the standard mode (10 second count, REJECT IN), will usually be found satisfactory for routine operations.

For a permanent record of the monitor response, the RMS output may be connected to a chart recorder (1 volt full scale will be suitable for fairly clean water samples) or other form of data logging device.

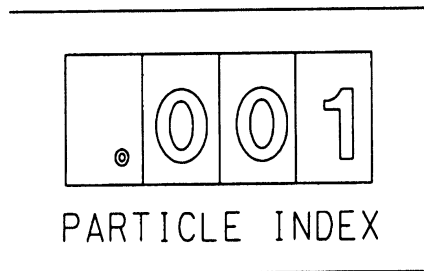
FIGURE 4



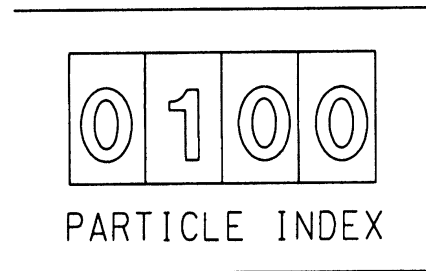
REJECT IN, 1 SEC INTERVAL



REJECT IN, 10 SEC INTERVAL



REJECT OUT, 1 SEC INTERVAL



REJECT OUT, 10 SEC INTERVAL

2.0 INSTALLATION

2.1 SUGGESTED APPLICATIONS

The Particle Monitor has a wide variety of applications, the following are a few of the suggested applications on a typical Industrial Boiler System, see diagram on page 11.

1. Monitor raw water particulates to prevent process/heat exchanger fouling and resultant efficiency loss.
2. Monitor filter influent/effluent particulates to prevent process fouling.
3. Monitor resin bed effluent for resin loss to avoid resin replacement costs and downstream fouling potential.
4. Monitor boiler feedwater for particulates/iron to prevent boiler fouling and tube failure.
5. Monitor for particulate laden stream leaks into condensate lines to prevent boiler fouling.
6. Monitor condensate return lines for particulates/iron to prevent boiler fouling.
7. Monitor microbiological particulates in chilled water to maintain system efficiency and reduce maintenance costs.
8. Monitor clarifier and lime softener sludge blanket level movement to maintain process efficiency. Downward movement may indicate potential for excess sludge disposal/handling costs.
9. Monitor for clarifier and lime softener carryover to prevent process fouling and improve filter run lengths.

2.2 INSTALLATION INSTRUCTIONS

Even though the Particle Monitor may be used for a wide variety of applications, as seen above, they can all be narrowed down to two basic categories: HOT and COLD liquids. For mounting dimensions, and external wiring refer to the diagrams on the following pages (See Figure 5).

NOTE: For further information on CHEMTRAC's Constant Head Device see section 5.0 "OPTIONAL EQUIPMENT / ACCESSORIES".

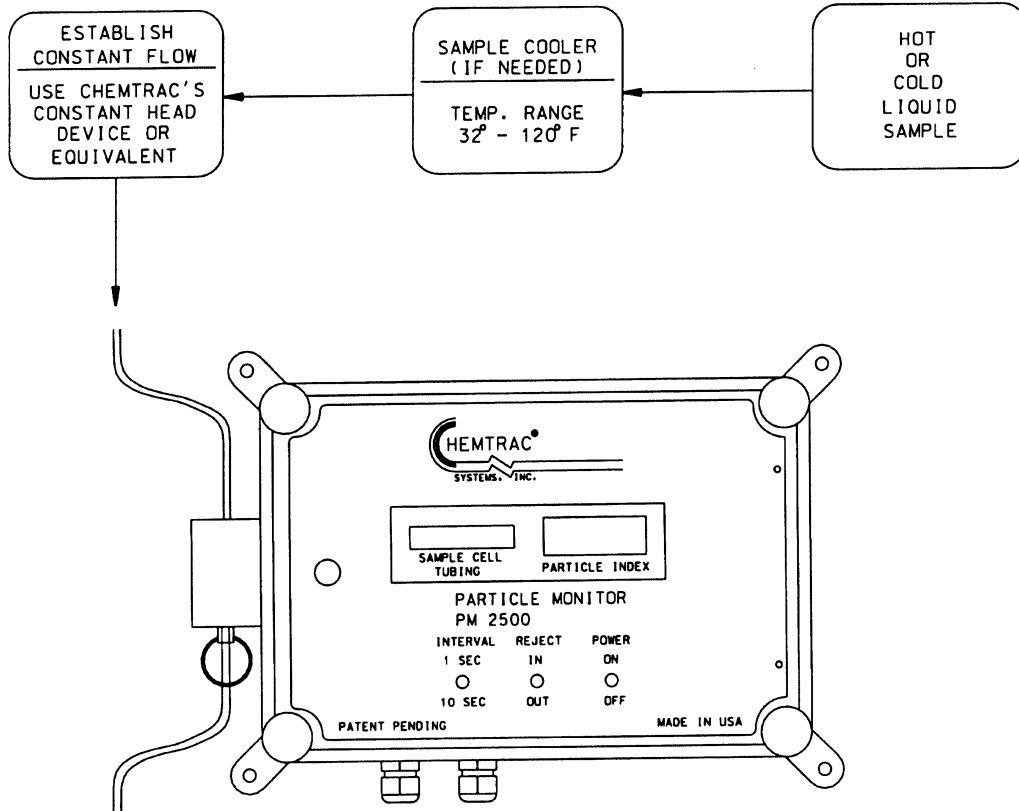
2.2.1 Hot Liquid Applications

1. Mount the Particle Monitor securely.
2. Cool sample to a temperature not exceeding 120° F.
3. Establish constant flow to the cell.
4. Reduce sample flow to the 1/8" tubing.
5. Insert tubing into the cell.

2.2.2 Cold Liquid Application

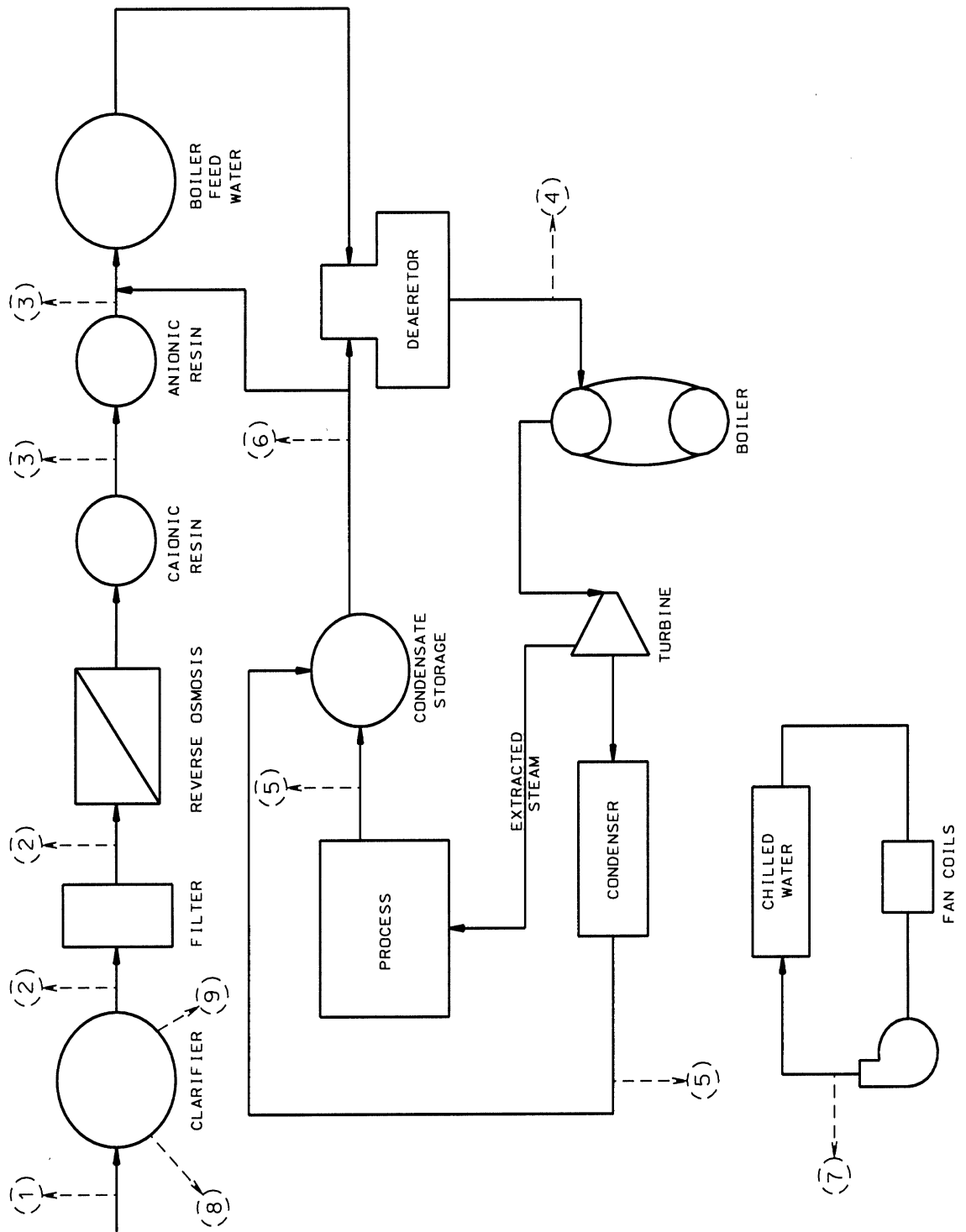
1. Mount the Particle Monitor securely.
2. Establish constant flow to the cell.
3. Reduce sample flow to the 1/8" tubing.
4. Insert tubing into the cell.

FIGURE 5



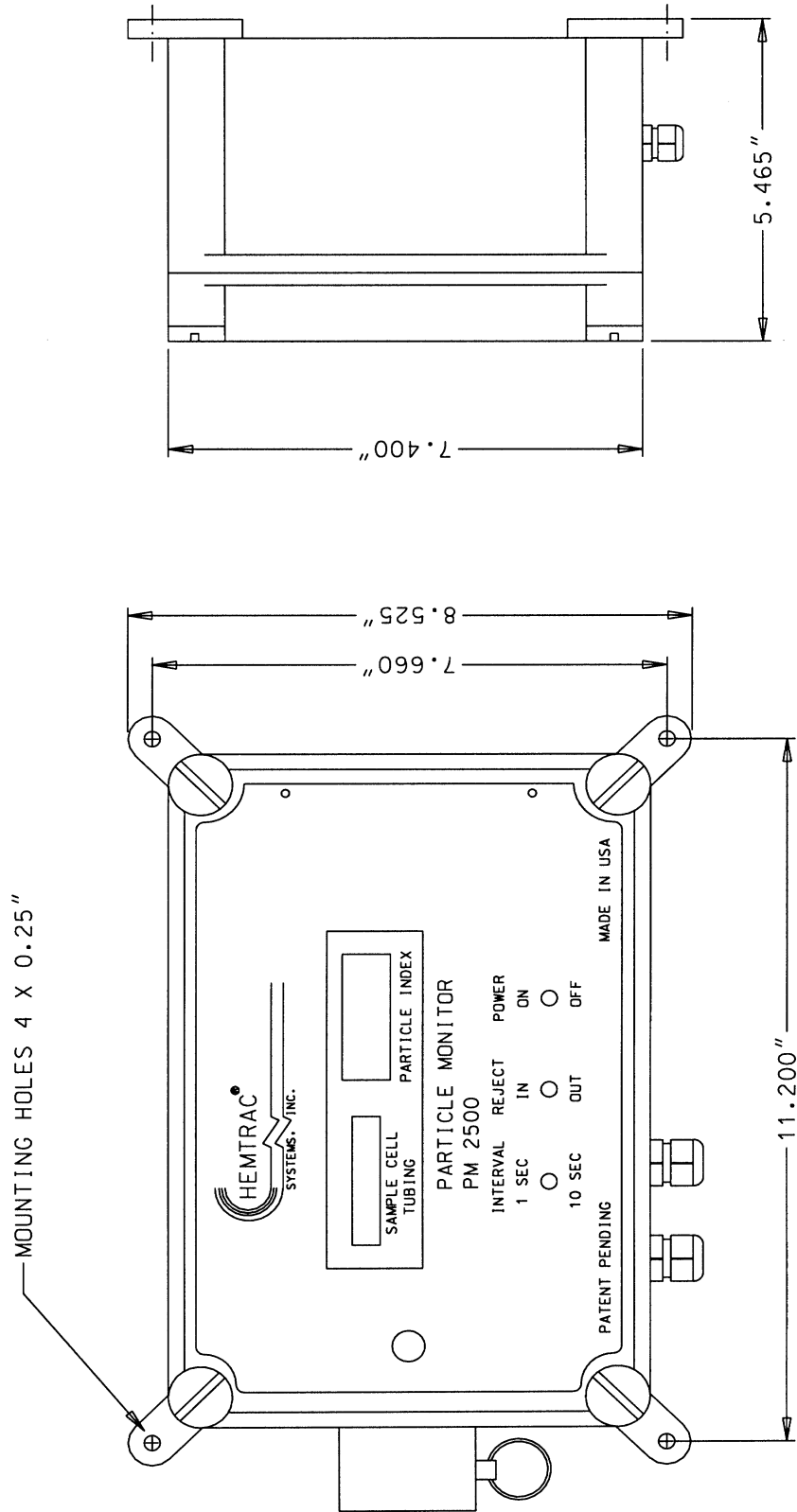
PM SUGGESTED APPLICATIONS

PARTICLE MONITOR SUGGESTED APPLICATIONS
SCHEMATIC OF A TYPICAL INDUSTRIAL BOILER SYSTEM



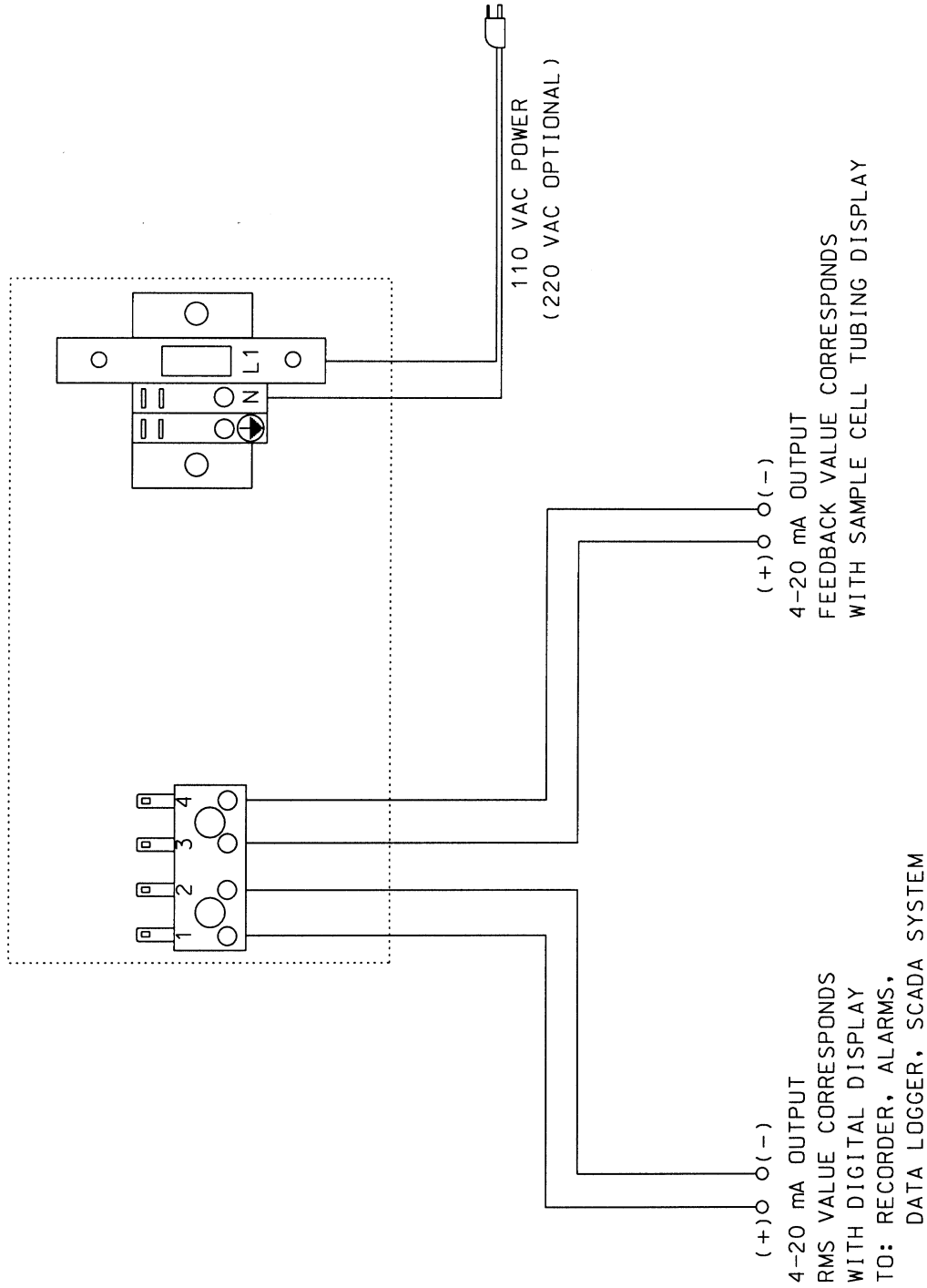
PM MOUNTING DIMENSIONS

PARTICLE MONITOR PM 2500 MOUNTING DIMENSIONS



PM EXTERNAL WIRING

PARTICLE MONITOR EXTERNAL WIRING



NOTES:

1. SIGNAL WIRE: 20 AWG SHIELDED TWISTED PAIR
2. POWER WIRE: 16 AWG STRANDED

3.0 OPERATION

3.1 OPERATION OF THE MONITOR

The most noteworthy feature of the monitor is the slotted block on the side of the unit into which the sample tube is inserted. This houses the electro-optic components and associated electronics. It is designed to take standard vinyl tubing of 1/8" bore and 1/32" wall thickness (i.e. 3/16" outside diameter). The tubing fits quite tightly in the block and must be pushed to the back of the slot, so that the light beam passes centrally through the tube. (Two precisely-aligned pinholes in opposite faces of the slot define the light path). A clamping pin is provided and should be pushed downwards into the block, in front of the tube. When this pin is pushed completely into the block, the tubing will be securely held, with the walls flattened against the inner faces of the slot, so that optically, the tubing behaves nearly as a parallel-sided cell.

The water sample should flow through the tube at a rate of at least 75 ml/min. At lower flow rates, the RMS value is reduced. (With no flow, the reading should be zero, if the noise is backed off - REJECT IN). Varying the flow rate from 75 to 150 ml/min. or more should give no change in the RMS value. If necessary, the flow rate could be reduced to 50 ml/min. without too much effect, but lower flow rates should be avoided. The most convenient arrangement is gravity flow from a suitable constant head device. This provides a steady flow rate and allows bubbles to escape. The constant head device should be vented to atmosphere, but covered to prevent contamination by airborne particles. Adequate flow to the constant head device must always be maintained to prevent access of air to the sample tubing. The tubing from the constant head device to the monitor should be as near vertical as possible to minimize buildup of deposited particles.

3.2 INTERPRETATION OF RESULTS

Because the monitor operates on a novel principle, it is not possible to draw upon previous experience in analyzing the data. The results are given on an arbitrary scale, which has no

absolute significance in terms of concentration and size of particles. Much the same remarks apply to turbidity measurements, but these have been routine for a long time and operators feel comfortable with the standard turbidity scale. A reading of 0.5 NTU indicates reasonable clarity, but gives no idea of the concentration or type of particles in the water. Generally, it is assumed that the lower the turbidity reading, the lower the concentration of suspended particles, and this will usually be a fair assumption.

The monitor has been scaled so that a standard concentration of mono-sized latex particles gives a fixed reading. The response to other suspensions (e.g. tap water) is then found to be closely similar for different monitors. There will be some inevitable variation from one monitor to another, but this should not exceed 5%. There is no provision for calibration or other adjustment by the user and it is very unlikely that significant changes will occur in normal use. Since the RMS value is always referenced to a constant DC level, most of the problems associated with long-term electronics drift are avoided. Changes in the efficiency of the LED or in the transmissivity of the tubing are automatically compensated.

As a guide to the readings that may be expected, a suspension of latex particles, 2.03 micron diameter, concentration 1000 particles per ml (about 4 ppb by weight) gives a reading of 200 units (counts in 10 seconds) and an analog RMS output of about 200 mV. The turbidity of the same suspension (Hach Ratio Turbidimeter) is about 0.05 NTU, which is only slightly greater than the reading obtained with pure, particle-free water (0.03 NTU). The monitor response for such suspensions is proportional to the square root of the concentration. A concentration of about 65 particles per ml (0.03 ppb) should be detectable, which is very much less than the minimum concentration that can be reliably monitored by a turbidimeter.

A laboratory tap water sample, after standing for about 4 hours, had a turbidity of 0.29 NTU and gave a monitor reading of 275 units. After filtering this sample through Whatman No. 1 filter paper, the turbidity was 0.23 NTU and the monitor reading 195 units. Because of the square root dependence of the monitor response, filtration appears to reduce the particle concentration by about 50%, whereas the turbidity (which should be proportional to particle concentration) is reduced by only about 20%.

This is consistent with the response of the two instruments to different particle sizes. Filter paper removes particles a few microns in size, but allows sub-micron particles through. Since turbidity responds mainly to smaller particles, this is little affected by filtration. On the other hand, the particle monitor response depends more on larger particles, which are better removed by filtration.

With good quality deionized water, there is no measurable turbidity above the 0.03 NTU background level, but the particle monitor may show a reading of 5-20 units (although this is very dependent on stray contamination). After membrane filtration (0.22 micron), the monitor response can be reduced practically to zero.

In practical operation, when the Particle Monitor is used to check the quality of filter water, reading of less than 100 units could probably be taken as indicating good quality water, although even lower readings may be routinely attainable. Readings greater than about 500 units may suggest an unacceptably high particle concentration. Actual thresholds adopted in practice will have to be established after appropriate operating experience has been obtained.

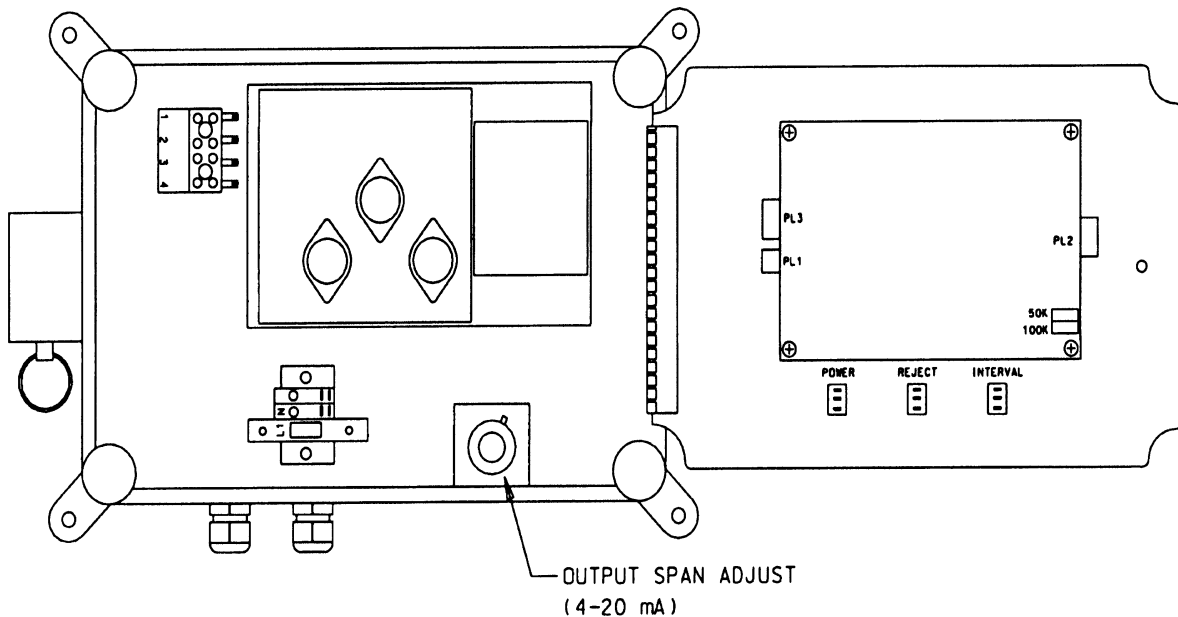
3.3 SUMMARY OF OPERATING PROCEDURE

1. Switch on the monitor and allow about 10 minutes warm-up period.
2. Insert clear vinyl tubing (1/8" ID, 3/16" OD) into the block and push into the slot. Insert the clamp pin and push fully downwards.
3. Fill the tube with water and then stop the flow. Check that the LED current (bargraph display) shows a reading which is not too high (typically 3 of 4 segments illuminated). A high reading may indicate a contaminated or badly-positioned tube. Try adjusting the position of the tube or replace it.
4. With the REJECT switch OUT, check the noise level (no flow). The reading obtained will vary from one instrument to another, but is typically of the order of 50 units (10 second count). With the REJECT switch IN (normal position the display should read zero for no flow). If the noise level seems unusually high, a possible cause may be badly contaminated tubing. Changing the tube may cure the problem.
5. Connect any peripheral devices needed (chart recorder, oscilloscope, etc.) to the appropriate terminals. RMS 4-20 mA terminals 1 & 2, FEEDBACK CURRENT 4-20 MA terminals 3 & 4.
6. Flow the sample at about 75 ml/min. or faster through the tube, preferably by gravity and without allowing air to be entrained. Readings can then be taken indefinitely, with no further attention needed, except for occasional check on the feedback current and noise level (see Step 4 above). These checks may indicate when the tubing needs to be changed.

3.4 OUTPUT SPAN ADJUSTMENT

The 4-20 mA particle index output (terminals 1 & 2) is scaleable. A ten turn potentiometer varies the 4-20 mA output scale. The potentiometer is located inside the monitor box in the lower right corner. Changing the 4-20 mA output scale does not change the 0-9999 display on the monitor. The graph “4-20 mA Span vs. # Turns” on the following page depicts the particle index level where the maximum of 20 mA is output, according to the number of turns on the potentiometer. The potentiometer may be locked in position by sliding the dial’s locking arm to the two o’clock position (See Figure 6).

FIGURE 6

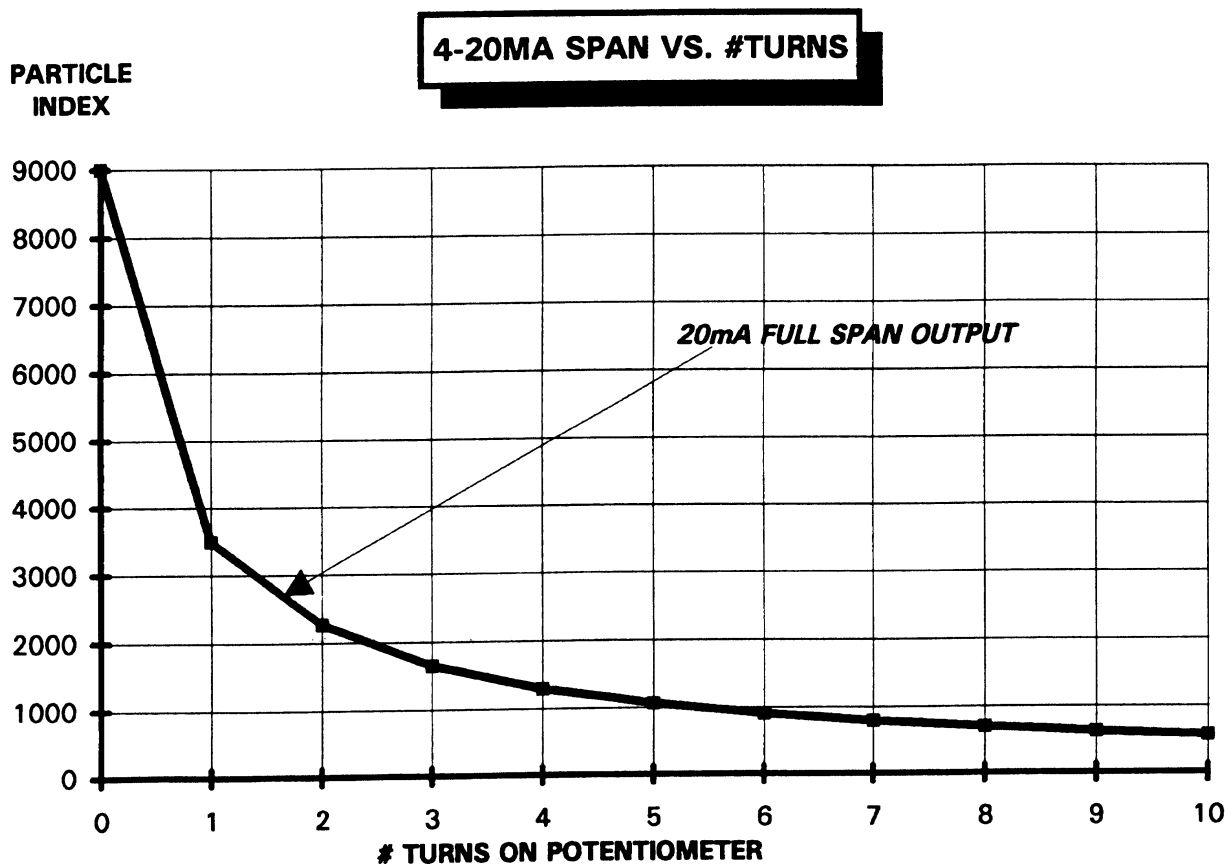


The 4-20 mA output span adjustment is useful to increase the resolution on a recorder in applications that only use the lower portion of the monitor's 0-9999 range. For example, if the measured sample never exceeded 3000 Particle Index, the potentiometer could be set at 1.5 turns to scale the output so that a “0” Particle Index corresponds to 4 mA and a “3000” Particle Index corresponds to 20 mA. At five turns the 4-20 mA output is scaled from 0-1000 Particle Index (See Figure 7).

To use the graph:

1. Observe the 0-9999 Particle Index display and document the maximum reading of the sample over time.
2. Find the # of turns on the graph that corresponds to the maximum reading.
3. Adjust the potentiometer to the desired # of turns and engage locking arm.
4. The 4-20 output is now scaled so that "0" = 4 mA and "maximum reading" = 20 mA.

FIGURE 7



4.0 TROUBLESHOOTING GUIDE

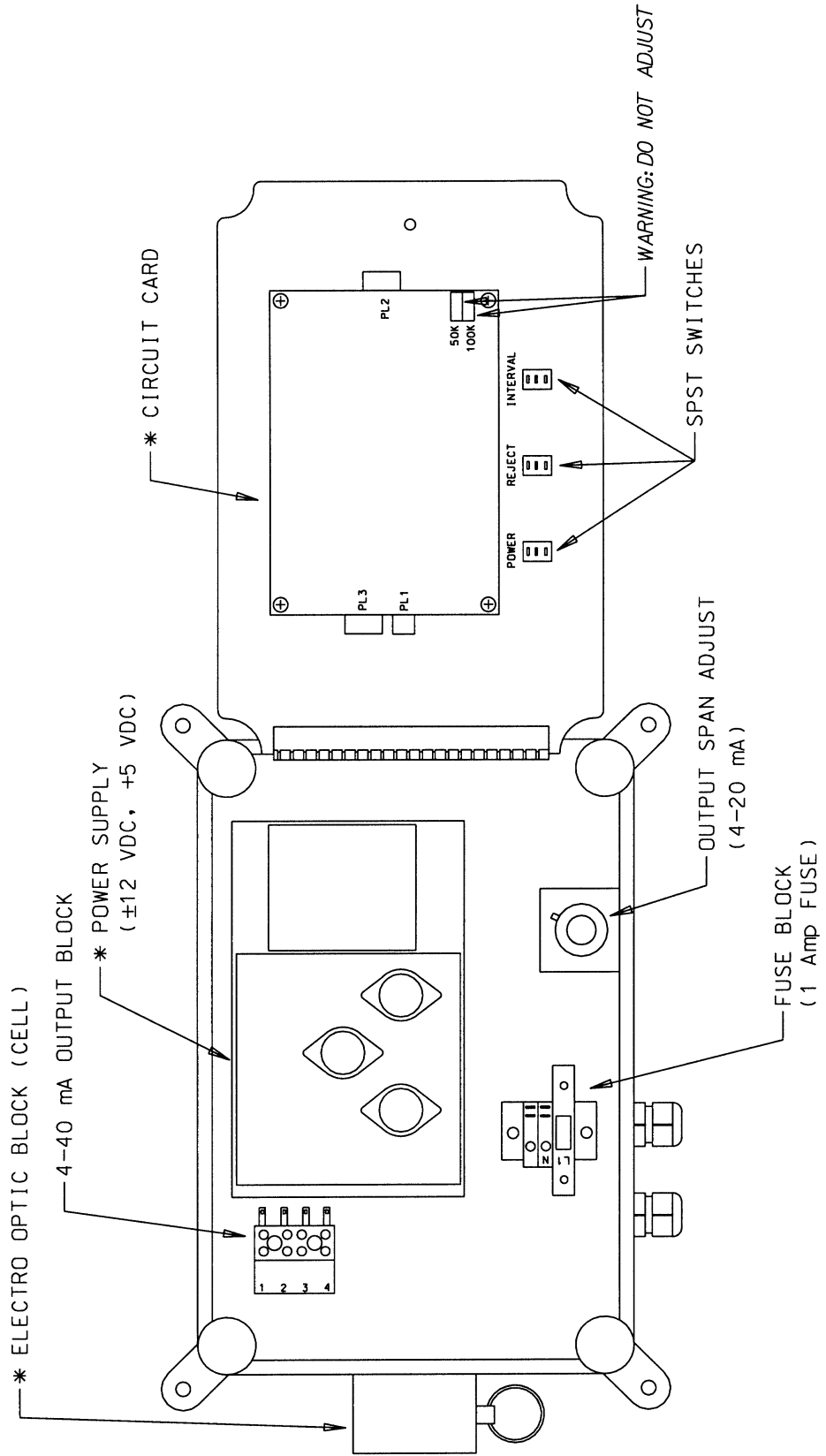
(References: Wiring Diagram, Parts Identification Drawings)

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
1. No displays	<p>A. Blown fuse.</p> <p>B. Power Supply 5VDC not present.</p> <p>C. Faulty circuit card.</p>	<p>A. Replace 1A/125V fuse</p> <p>B. Check for 5 VDC between Gnd PL2-10 (Green) and Pos PL2-6 (Blue). If not present, check for short between power supply and circuit card.</p> <p>C. Replace circuit card.</p>
2. Sample Cell Tubing Graph at 100%	<p>A. Dirty sample tube.</p> <p>B. Complete obstruction of light source.</p> <p>C. Power supply - 12VDC not present.</p> <p>D. Faulty circuit card</p>	<p>A. Replace tubing or reposition or cleaner segment.</p> <p>B. Clear obstruction and clean sensor block with alcohol and cotton swab.</p> <p>C. Check for - 12VDC between Gnd P12-8 (Green) and Neg P12-7 (Purple). If not present, check for short between power supply and circuit card.</p> <p>D. Replace circuit card.</p>
3. No numeric display or frozen numeric display, but feedback current display works.	<p>A. Interval circuit broken</p>	<p>A. Flip interval switch until count displays. If this fails, check continuity between P13-8 (Black) and P13-7 (Red) in 10 sec position; between P13-8 (Black) and P13-6 (Green) in 1 sec position.</p>
4. No feedback current display, but numeric display works.	<p>A. Power supply + 12VDC not present.</p> <p>B. Faulty circuit card</p>	<p>A. Check for 12VDC between Gnd P12-8 (Green) and Pos P12-9 (Red). If not present, check for short between power supply and circuit card.</p> <p>B. Replace circuit card.</p>
5. No 4-20 mA output current between terminals 1,2 and 3,4.	<p>A. Bad terminal connection</p> <p>B. Broken circuit</p>	<p>A. Check connections at 4-20 mA output block.</p> <p>B. With power off check continuity between output block and circuit card: Terminal 1 to PL2-4 (Red) Terminal 2 to PL2-5 (Black) Terminal 3 to PL2-3 (White) Terminal 4 to PL2-2 (Green)</p>

	C. Faulty circuit card	Repair broken wire or connection C. Replace circuit card.
6. Display varies rapidly and widely	A. Drastic flow rates change B. Intermittent bubbles in sample line C. Buildup of sedimentation in sample line	A. Check source of sample. Change sample point or introduce debubbler to stabilize flow rate. B. Check sample line connection for air leaks. If OK, install debubbler. C. Eliminate droops in sample line.
7. Low numeric display	A. Sample tube not wedged	A. Make sure wedge pin pinches sample line tube into sensor block.

PM 2500 COMPONENTS

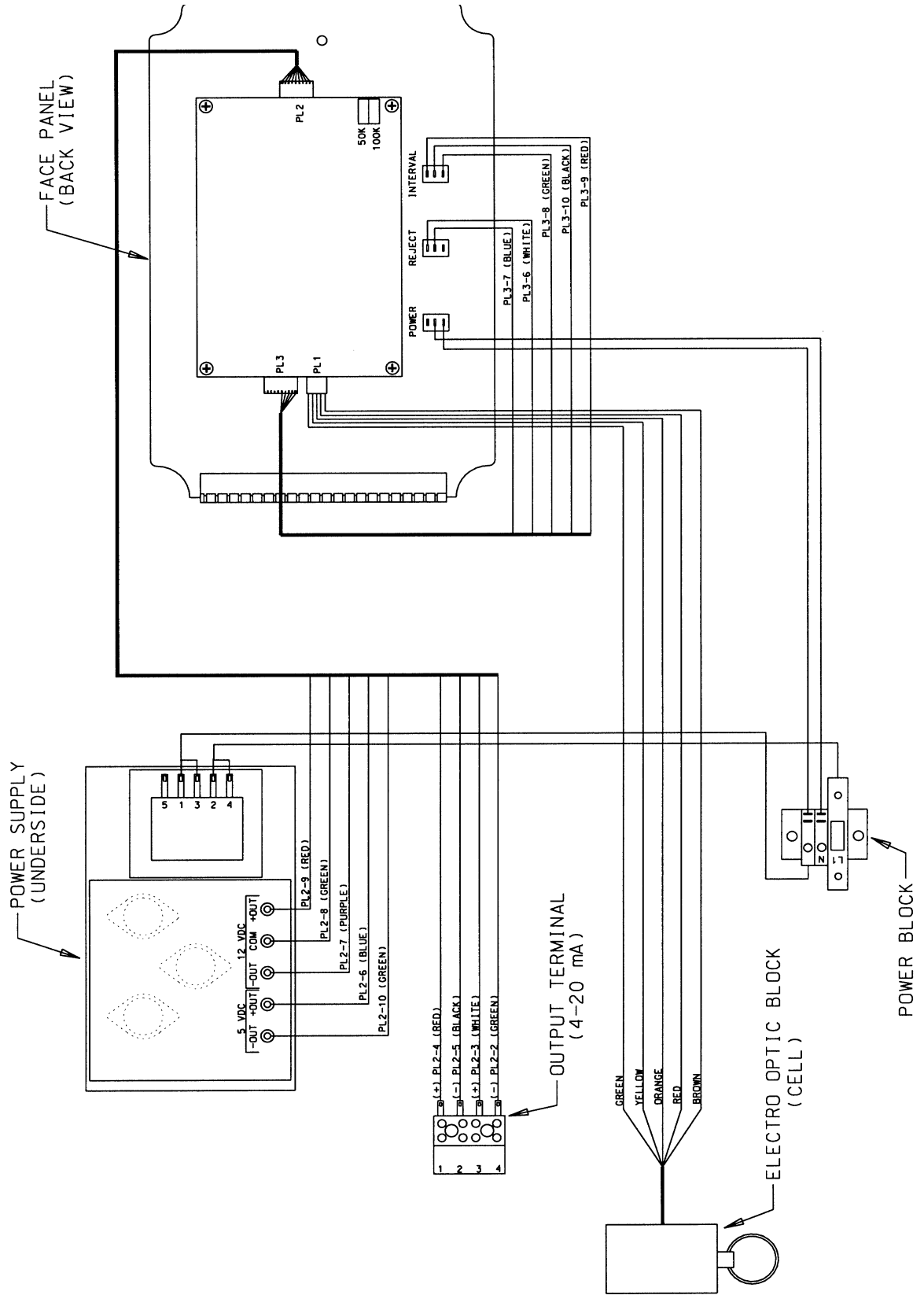
PM 2500 COMPONENTS



NOTE:
 * NOT USER SERVICEABLE

PM 2500 INTERNAL WIRING

PM 2500 INTERNAL WIRING (110 VAC)



5.0 OPTIONAL EQUIPMENT / ACCESSORIES

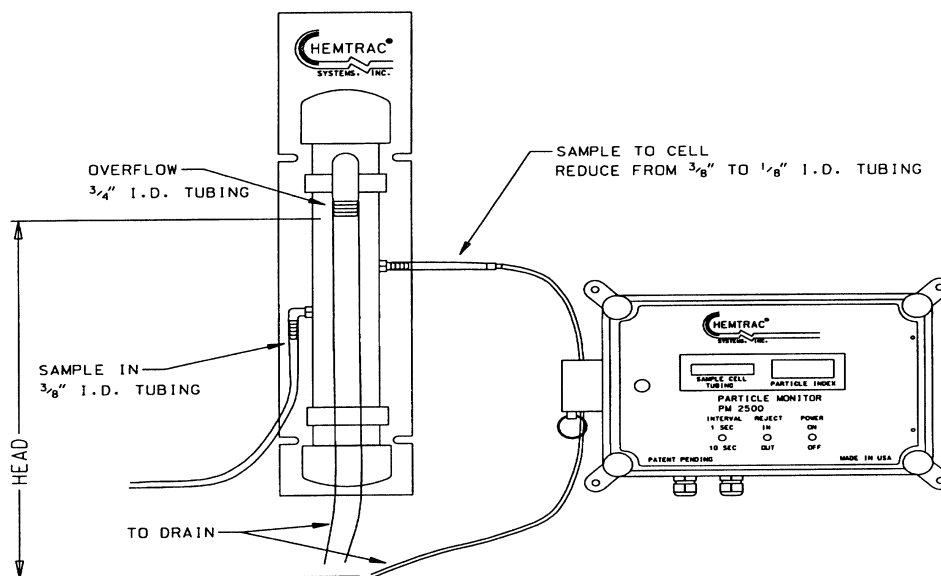
5.1 CONSTANT HEAD DEVICE

The constant head device is designed to deliver constant flow to the cell, despite changes in source pressure. Overflow must be maintained to ensure that full flow is achieved. The device consists of a cylinder mounted on a backplate. There are three fittings: one for the inlet, one for the overflow, and one for the flow to the sample cell. The flow into the device must be controlled so that it does not exceed the overflow capacity.

The flow must be reduced to enter the device through the 1/4" ID fitting near the bottom of the cylinder. The sample flow is taken from the 1/4" ID fitting in the middle of the cylinder, this flow must be reduced to a 1/8" ID tubing to go to the cell. The bigger fitting near the top of the cylinder is for the overflow.

Head adjustment is achieved by moving the sample cell outlet up or down until the desired flow rate is obtained (See Figure 8).

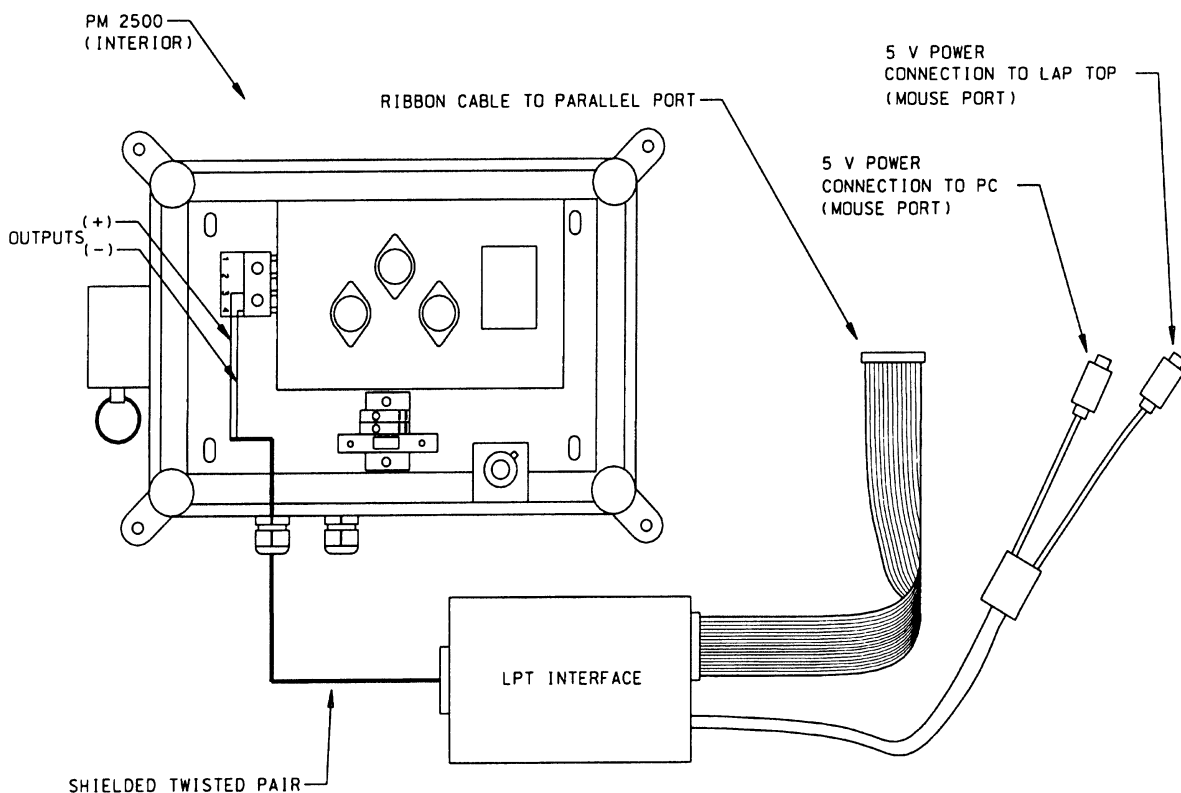
FIGURE 8



5.2 EZLOG V 1.0 SOFTWARE

EZLOG is an optional software package for the Particle Monitor. It allows data acquisition direct to a laptop or desktop personal computer under DOS. The software gathers data from the Particle Monitor's output terminals (3 & 4), and logs the date, time, and particle index at given time intervals. The time interval is set to 10 seconds to fit most data gathering applications. EZLOG saves the data in the ".txt" format to allow easy importing into any spreadsheet, like EXCEL, for manipulation and presentation (See Figure 9). The system is configured to accept 2 inputs (standard), and it can be configured to accept up to 6 inputs.

FIGURE 9



5.2.1 Setup Procedure

These steps should be followed to install and run the EZLOG software to your desktop or laptop computer:

1. Make sure that the PM 2500 is connected and running properly.
2. Connect the LPT Interface to terminals 3 and 4 on the Particle Monitor's output terminal block.
3. Connect the 5V power line to the computer's mouse port.
4. Connect the ribbon cable to one of the computer's parallel ports.
5. Turn computer on.
6. Type **mkdir EZLOG** at the C prompt. This creates a directory called EZLOG on the computer's hard disk.
7. Type **cd\EZLOG** at the C prompt. This brings up the directory that was created on step 6. The screen should display the following: "c:\EZLOG>"
8. Insert the EZLOG diskette into the computer's floppy drive (for example: a).
9. Type **copy a:*.***. This copies the files from the floppy disk to the EZLOG directory on the computer's hard disk.
10. Type **EZLOG** to execute the program. The program gathers the data and automatically saves it to a file called "RCD.TXT".
11. To stop the program PRESS ANY KEY.

NOTE: Since pressing any key interrupts the program, make sure that the keyboard is not disturbed during the data gathering period.

12. To retrieve the collected data TYPE or PRINT the rcd.txt file, for example:

Type **Type rcd.txt** to display the data on the screen.

Type **Print rcd.txt** to print the data.