Portable Doppler Flow Meter

Doc Date: 15/06/2008

USER'S GUIDE

Installation & Operation Instructions

PORTABLE DOPPLER FLOW METER

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Introduction

The Portable Doppler Flow Meter - PDFM3 measures the velocity of fluids in pipelines using a totally non-intrusive principle.

The Portable Doppler Flow Meter utilises a high speed, 16-bit microprocessor unit with 32-Kbyte FLASH memory. The user-friendly flowmeter comes with a range of features to ensure easy and reliable flow measurement. The flow signal from the flow sensor is continuously analysed and should the signal quality become unacceptable an error message is displayed.

It is designed for use with sewage, waste water, pulp stock, mining slurries, food products and other fluids which contain in excess of 0,1% suspended solids or bubbles. The particle size for successful operation must be greater than 100 microns.

Sensor mounting

Location

- Select a location for mounting the sensor at a point where the flow profile is fully developed. Generally the principle of 10 pipe diameters of straight pipe upstream, and 5 pipe diameters downstream will suffice, but should valves or bends exist upstream of the sensor, the amount of straight pipe immediately upstream will need to be increased.

- Ensure that the sensor is mounted as far as possible from potential noise sources, such as pumps, control valves etc. and mount the sensor at approximately 3/9 o'clock on the pipe (if horizontal) to avoid errors due to air pockets on top, or sediment at the bottom of the pipe.

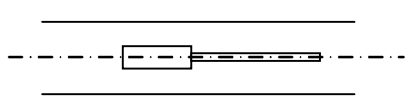
- Either vertical or horizontal pipe runs are acceptable for sensor mounting.

Surface preparation

- Before attaching the transducer head to the pipe surface, an area slightly larger than the flat surface of the transducer must be cleaned to bare metal. (A small amount of pipe pitting, even with spots of paint or rust, will not cause problems).

Orientation

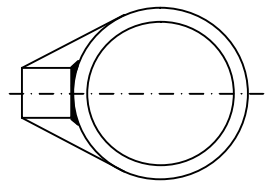
- The transducer must be mounted accurately, parallel to the pipe axis, for correct performance, and transducer to pipe contact should be along the centre line of the transducer head.



SIDE VIEW - 3 O'CLOCK POSITION ON PIPE IF HORIZONTAL

Bonding

- Bonding to the pipe is achieved with silicone coupling compound. Be sure to fill in any air gaps that may remain at the pipe transducer interface with additional compound.



GOOD

- A pipe clamp kit is included with the flow meter. It includes silicone coupling compound, a Neoprene rubber pad, and straps for pipe diameters up to 300 mm. In applications with excessive vibration it is recommended that the Neoprene rubber pad is inserted between the pipe and the transducer. Coupling compound must be applied to both sides of the pad.

Keypad System

Pressing the ON/OFF button turns the flowmeter ON and OFF.

The Portable Doppler Flow Meter has an easy to use 4-button programming system.

- The MENU button is used to scroll through the menu structure.
- The SAVE button is used to save entered changes to the flowmeter programme.
- The ► and ▲ buttons are used to change numbers and scroll through options.

Battery

Recharging and battery care

- The Portable Doppler Flow Meter is supplied with 4 x 1.2V 1300mAh AA size Ni-MH removable cells and a 230Vac battery charger.
- Charge battery fully before first use and thereafter recharge only when fully discharged. The Portable Doppler Flow Meter will indicate an error message when battery charge is low and automatically switch off.
- The 230Vac battery charger supplied as standard with the Portable Doppler Flow Meter is a constant current charger with 5 current settings. The following table shows us the charge time at each of the current settings.

CURRENT	CHARGE TIME
80mA	-
120mA	16 Hrs
180mA	11 Hrs

NOTE: Preferable charge rate is 120mA for 16Hrs. Do not exceed 180mA charge rate.

- The Portable Doppler Flow Meter should be switched off during charging. THE CELLS MUST NOT BE OVER CHARGED. Under charging of the cells will reduce the life and capacity of the cells.

Low power consumption

- The Portable Doppler Flow Meter is designed for low power consumption allowing over 10 hours operation before re-charging the battery. The Portable Doppler Flow Meter features a Low Battery warning with automatic power down.

Storage

- If the Portable Doppler Flow Meter is to be stored for an extended time period the cells should be removed.

Menu System (Portable Doppler Flow Meter Version 2.00)

The Portable Doppler Flow Meter menu system is easy to use and designed for programming simplicity.

With the Portable Doppler Flow Meter powered up the instrument will test the suitability of the flow signal. If the signal is suitable the flow total and flow rate are displayed, if not an error message is displayed.

00000000 lt
3.9768 l/s

START PROGRAMMING - Press "MENU"

Units

Mn_1 units?
Metric

Metric and English units of rate and total measurement are available.
Press ▲ until desired value is displayed and **MENU** to continue.

Pipe ID

Mn_2 Pipe ID mm
53.4

The precise dimension of the pipe internal diameter (ID) at the point of measurement must be entered.
Use the ► button to locate the curser below the number to be changed and press the ▲ button until the desired value is displayed and **MENU** to continue.

Rate units

Mn_3 rate units?
l/s

Press ▲ until desired unit is displayed and **MENU** to continue.

Total units

Mn_4 tot units?
lt

Press ▲ until desired unit is displayed and **MENU** to continue.

Clear total?

Mn_5 clr total? save total

The total can either be cleared or saved.
Press ▲ to either save or clear the total and **MENU** to continue.

Damping

Mn_6 damping? 5.0 Sec

The level of damping can be selected.
Press ▲ until desired unit is displayed and **MENU** to continue.

Cut-off

Mn_7 % cutoff 2%

The level of cut-off can be entered.
Press the ▲ button until the desired value is displayed and **MENU** to continue.

Save data

Mn_8 save data? Press SAVE

Press **SAVE** to accept all changes made.

Error/Warning Messages

ERROR MESSAGE	ERROR	POSSIBLE SOLUTION
• poor signal	• Poor signal • Flow rate less than minimum flow rate of 0.25m/s	• Increase flow rate
• no signal	• No signal	• Establish flow • Inject air into line
• charge battery	• Battery charge low	• Charge battery
• total error counts > 100/s	• Totaliser count-rate too high	• Select more suitable total units
• rate overflow	• Rate > 999 999	• Select more suitable rate units

Troubleshooting guide

PROBLEM	POSSIBLE SOLUTION
*Meter reading **lower** than expected*	
• Source particles velocity not indicative of average velocity	• Relocate sensor to a position where source particles are expected to be moving at the average velocity
• Incorrect mounting of flow sensor	• Remount sensor correctly
• Programming error	• Review all programmed entries
• Flow rate lower than expected	• Investigate possible causes and confirm flow rate independently
• Insufficient particle size or concentration	• Locate sensor at position where acceptable particle size or concentration is expected. • Inject air into the line
*Meter reading when there is **no flow***	
• Local ultrasonic noise source	• Relocate sensor or remove noise source
"Poor signal" *displayed when flow exists*	
• Insufficient particle size or concentration	• Locate sensor at position where acceptable particle size or concentration is expected. • Inject air into the line
• Sensor coupling to pipe poor	• Remount sensor to pipe correctly
*Meter reading **higher** than expected*	
• Programming error	• Review all programmed entries
• Flow rate higher than expected	• Investigate possible causes and confirm flow rate independently
• Particle velocity at sensor not indicative of average velocity	• Relocate sensor to a position where source particles are expected to be moving at the average velocity
• Incorrect mounting of flow sensor	• Remount sensor correctly
• Local electrical noise	• Relocate sensor
*Meter reading **erratic***	
• Particle velocity at sensor not indicative of average velocity and erratic	• Relocate sensor to a position where the velocity profile is expected to be suitable

Questions and Answers

The pipe vibrates. Will it affect the flow meter?
Common vibration frequencies are far lower than the sonic frequencies used by the flow meter, and will not normally affect accuracy or performance.

Will pipe corrosion affect accuracy of the flow meter?
Yes. Rust, loose paint etc. must be removed from the outside of the pipe to provide a clean mounting area when installing a Doppler sensor. Severe corrosion/oxidation on the inside of the pipe may prevent the Doppler signal from penetrating into the flow. If the pipe cannot be cleaned, a spool piece should be installed for sensor mounting.

What effect do pipe liners have on the flow meter?
The air gap between loose insertion liners and the pipe wall prevent the Doppler signal from entering the flow. Better results can be expected with bonded liners such as rubber, epoxy or tar, however an on site test is recommended to determine if the application is suitable for a Doppler flow meter.

Why is Doppler only recommended for liquids containing suspended solids or gases?
The Doppler sensor transmits sound into the flow stream, which must be reflected back to the sensor to indicate flow velocity. Gas bubbles or suspended solids act as reflectors for the Doppler signal. As a guideline, Flowmetrix Doppler flow meters are recommended for liquids containing solids or bubbles with a minimum size of 100 microns and a minimum concentration of 100 ppm.

Can the sensor be submerged in water?
Yes, for short periods of time or by accident, but not for continuous operation. The sensor is constructed to withstand submersion without damage, but external liquid moving in contact with the sensor can be interpreted as flow and cause false readings.

Can I change the length of the sensor cable?
No. A 2m cable is supplied with the Portable Doppler Flow Meter as standard.

Does the direction of flow matter for Sensor mounting?
The Doppler flow meter will measure and totalize flow in either direction. A check valve should be used in applications where backflow may occur.

Warranty

Flowmetrix SA CC warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in materials, workmanship and title and will be of the kind and quality designated in the proposal.
The foregoing warranty is exclusive and in lieu of all other warranties whether express or implied including any warranty of merchantability or of fitness for a particular purpose.

Warranties other than the above will only be effective if written and signed by an officer of Flowmetrix SA CC

If within 1 (one) year from the date of delivery, the equipment delivered hereunder does not meet the warranties specified above, Flowmetrix SA CC shall thereupon correct such defects, at its sole discretion, either by repairing or by replacing the instrument in its entirety.
The costs of returning the equipment to Flowmetrix SA CC and for the repaired or replaced item being returned to the purchaser shall be for the account of the purchaser.
The liability of Flowmetrix SA CC is conditioned upon the equipment covered hereunder being handled, installed, operated, maintained, stored or used, as the case may be, in strict accordance with the written instructions or technical direction supplied by Flowmetrix SA CC, and is further conditioned upon the purchasers prompt written notice (within 30 days) to Flowmetrix SA CC of such defects.
Flowmetrix SA CC makes no warranties which extend to the items covered hereby due to improper handling, installation, operation, maintenance, storage or use; abnormal or undisclosed environmental conditions; or operating or use in an otherwise improper manner.

The liability of Flowmetrix SA CC to the purchaser, except as to title, arising out of the supplying of the equipment or its use, under this warranty article, shall not, in any case, exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of the warranty described herein, all such warranty liability shall terminate. The foregoing shall constitute sole warranty remedy of the purchaser and the sole warranty liability of Flowmetrix SA CC.

Goods Return Procedure

Damaged or defective equipment should be returned to the supplier prepaid. Do not return goods until written authorisation to do so has been obtained. Returned goods must have accompanying them a letter stating the following:

- Your company name and order number
- The contact person at your company
- Serial number and name of product
- Description of damage and cause if known
- Nature of any repair attempted by the user
- Type of repair, replacement or adjustment requested

ASA steel pipe schedules

			ANSI B36.19								ANSI B36.10			
			Schedule											
	Outside diameter		5S		10S		40S/STD		80S/XS		STD		XS	
			Wall thickness and weight kg/mm											
DN	mm	NPS	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
8	10.3	1/8			1.24	0.28	1.73	0.37	2.41	0.48				
8	13.7	1/4			1.65	0.50	2.24	0.64	3.02	0.81				
10	17.2	3/8			1.65	0.64	2.31	0.86	3.20	1.12				
15	21.3	1/2	1.65	0.81	2.11	1.01	2.77	1.28	3.73	1.64				
20	26.7	3/4	1.65	1.03	2.11	1.3	2.87	1.71	3.91	2.23				
25	33.4	1	1.65	1.31	2.77	2.12	3.38	2.54	4.55	3.28				
32	42.2	1 1/4	1.65	1.67	2.77	2.73	3.56	3.44	4.85	4.53				
40	48.3	1 1/2	1.65	1.92	2.77	3.15	3.68	4.11	5.08	5.49				
50	60.3	2	1.65	2.42	2.77	3.99	3.91	5.51	5.54	7.59				
65	73.0	2 1/2	2.11	3.74	3.05	5.34	5.16	8.75	7.01	11.6				
80	88.9	3	2.11	4.58	3.05	6.55	5.49	11.5	7.62	15.5				
100	101.6	3 1/2	2.11	5.25	3.05	7.52	5.74	13.8	8.08	18.9				
100	114.3	4	2.11	5.92	3.05	8.49	6.02	16.3	8.56	22.6				
125	141.3	5	2.77	9.60	3.40	11.7	6.55	22.1	9.53	31.4				
150	168.3	6	2.77	11.5	3.40	14.0	7.11	28.7	10.97	43.2				
200	219.1	8	2.77	15.0	3.76	20.2	8.18	43.1	12.70	65.6				
250	273.0	10	3.4	22.9	4.19	28.2	9.27	61.1	12.70	82.7				
300	323.9	12	3.96	31.7	4.57	36.5	9.53	74.9	12.70	98.8				
350	355.6	14	3.96	34.8	4.78	41.9					9.53	82.5	12.70	109
400	406.4	16	4.19	42.1	4.78	48.0					9.53	94.6	12.70	125
450	457	18	4.19	47.4	4.78	54.1					9.53	107	12.70	141
500	508	20	4.78	60.2	5.54	69.6					9.53	119	12.70	157
	559	22	4.78	66.2	5.54	76.7					9.53	131	12.70	173
600	610	24	5.54	83.7	6.35	95.9					9.53	143	12.70	190
	660	26									9.53	155	12.70	206
700	711	28									9.53	167	12.70	222
	762	30	6.35	120	7.92	149					9.53	179	12.70	238
800	813	32									9.53	191	12.70	254
	864	34									9.53	204	12.70	270
900	914	36									9.53	216	12.70	286
	965	38									9.53	228	12.70	303
1000	1016	40									9.53	240	12.70	319
	1067	42									9.53	252	12.70	335
	1118	44									9.53	264	12.70	351
	1168	46									9.53	276	12.70	367
	1219	48									9.53	288	12.70	383
	1321	52									9.53	313	12.70	417
	1422	56									9.53	339	12.70	449
	1524	60									9.53	362	12.70	482
	1626	64									9.53	387	12.70	514

The table shows the ANSI B36.19 and a part of the B36.10 standard;
some of these dimensions are outside AST's production programme.

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ANSI B36.10

			Schedule													
	Outside diameter		10		20		30		40		60		80		120	
			Wall thickness and weight kg/mm													
DN	mm	NPS	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
8	10.3	1/8	1.24	0.28					1.73	0.37			2.41	0.48		
8	13.7	1/4	1.65	0.50					2.24	0.64			3.02	0.81		
10	17.2	3/8	1.65	0.64					2.31	0.86			3.20	1.12		
15	21.3	1/2	2.11	1.01					2.77	1.28			3.73	1.64		
20	26.7	3/4	2.11	1.30					2.87	1.71			3.91	2.23		
25	33.4	1	2.77	2.12					3.38	2.54			4.55	3.28		
32	42.2	1 1/4	2.77	2.73					3.56	3.44			4.85	4.53		
40	48.3	1 1/2	2.77	3.15					3.68	4.11			5.08	5.49		
50	60.3	2	2.77	3.99					3.91	5.51			5.54	7.59		
65	73.0	2 1/2	3.05	5.34					5.16	8.75			7.01	11.6		
80	88.9	3	3.05	6.55					5.49	11.5			7.62	15.5		
100	101.6	3 1/2	3.05	7.52					5.74	13.8			8.08	18.9		
100	114.3	4	3.05	8.49					6.02	16.3			8.56	22.6	11.13	28.7
125	141.3	5	3.40	11.7					6.55	22.1			9.53	31.4	12.70	40.8
150	168.3	6	3.40	14.0					7.11	28.7			10.97	43.2	14.27	55.0
200	219.1	8	3.76	20.2	6.35	33.8			8.18	43.1	10.31	53.8	12.70	65.6	18.26	91.7
250	273.0	10	4.19	28.2	6.35	42.3	7.8	51.7	9.27	61.1	12.70	82.7	15.09	97.3	21.44	135
300	323.9	12	4.57	36.5	6.35	50.4	8.38	66.1	10.31	80.9	14.27	110	17.48	134	25.40	190
350	355.6	14	6.35	55.5	7.92	68.9	9.53	82.5	11.13	95.9	15.09	128	19.05	160	27.79	228
400	406.4	16	6.35	63.5	7.92	78.9	9.53	94.6	12.7	125	16.66	162	21.44	206	30.96	291
450	457	18	6.35	71.6	7.92	88.9	11.13	124	14.27	158	19.05	209	23.83	258	34.93	369
500	508	20	6.35	79.7	9.53	119	12.70	157	15.09	186	20.62	251	26.19	316	38.10	448
	559	22	6.35	87.8	9.53	131	12.70	173			22.23	298	28.58	379	41.28	534
600	610	24	6.35	95.9	9.53	143	14.27	213	17.48	259	24.61	360	30.96	448	46.02	649
	660	26	7.92	129	12.70	206										
700	711	28	7.92	139	12.70	222	15.88	276								
	762	30	7.92	149	12.70	238	15.88	296								
800	813	32	7.92	159	12.70	254	15.88	317	17.48	348						
	864	34	7.92	170	12.70	270	15.88	337	17.48	370						
900	914	36	7.92	179	12.70	286	15.88	357	19.05	426						
	965	38	9.53	228	12.70	302	15.88	377								
1000	1016	40	9.53	240	12.70	319	15.88	397								
	1067	42	9.53	252	12.70	335	15.88	417								
	1118	44	9.53	264	12.70	351	15.88	438								
	1168	46	9.53	276	12.70	367	15.88	458								
	1219	48	9.53	288	12.70	383	15.88	478								
	1321	52	9.53	313	12.70	416	15.88	518								
	1422	56	9.53	337	12.70	448	15.88	558								
	1524	60	9.53	361	12.70	480	15.88	599								
	1626	64	9.53	385	12.70	512	15.88	639								

The table shows a part of the ANSI B36.10 standard;
some of these dimensions are outside AST's production programme.

FMLOG

OEM data logger

(1 x Digital count)

The FMLOG is an OEM data logger built into the PDFM3L flowmeter.

Setup and data download is achieved with FMLOG software and PC.

(Please Note only FMLOG software is suited to downloading data)

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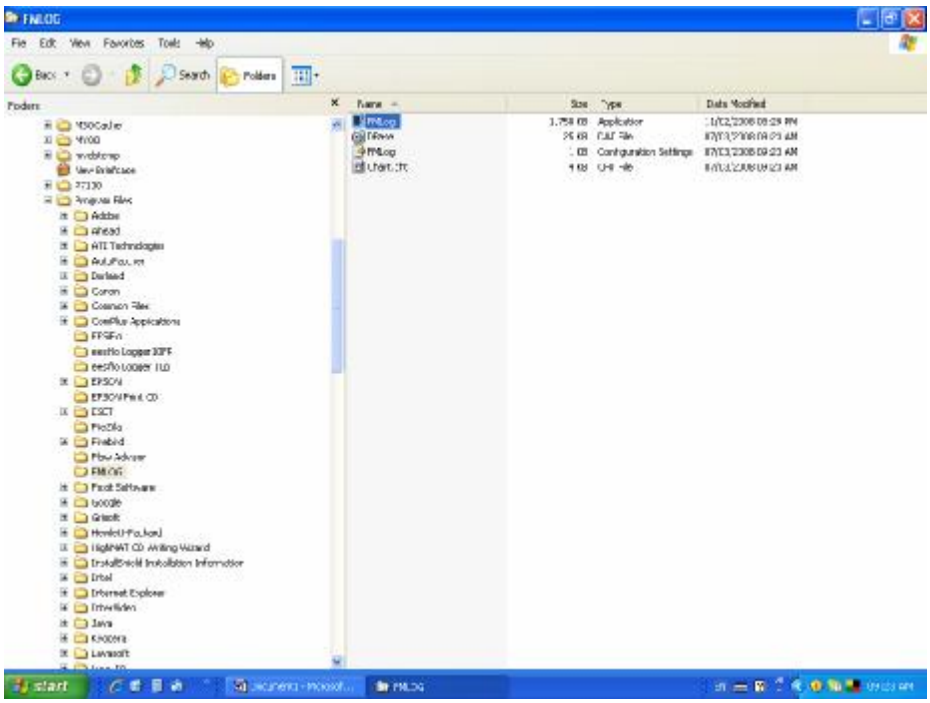
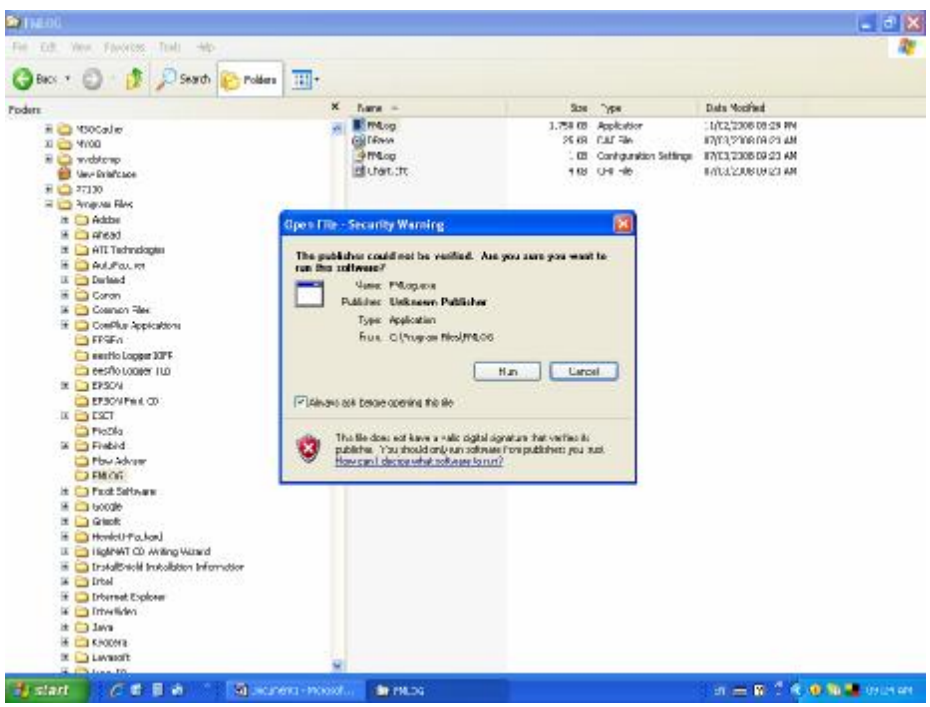
Installation of the software

Create a new folder in the Program Files folder called FMLOG. Copy FMLOG file into the FMLOG folder and run the FMLOG software. My Computer > C: > Program Files





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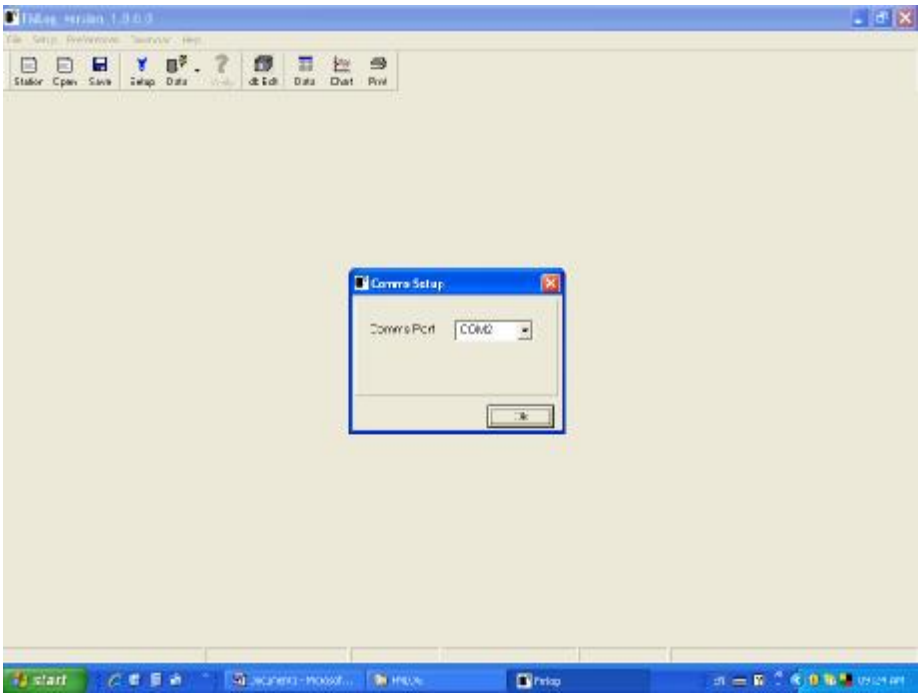
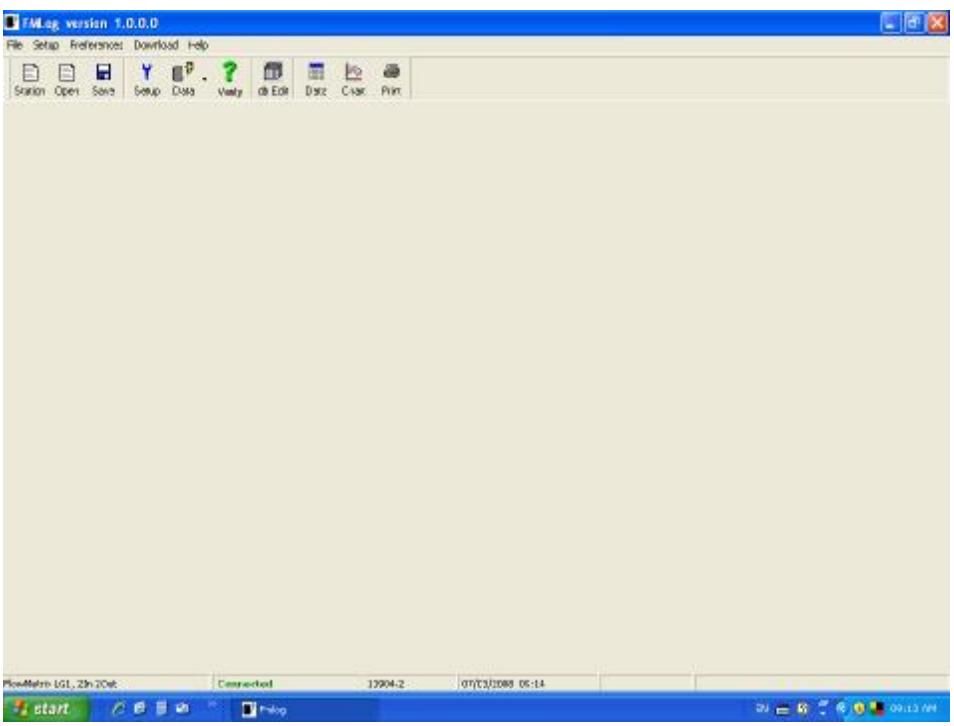
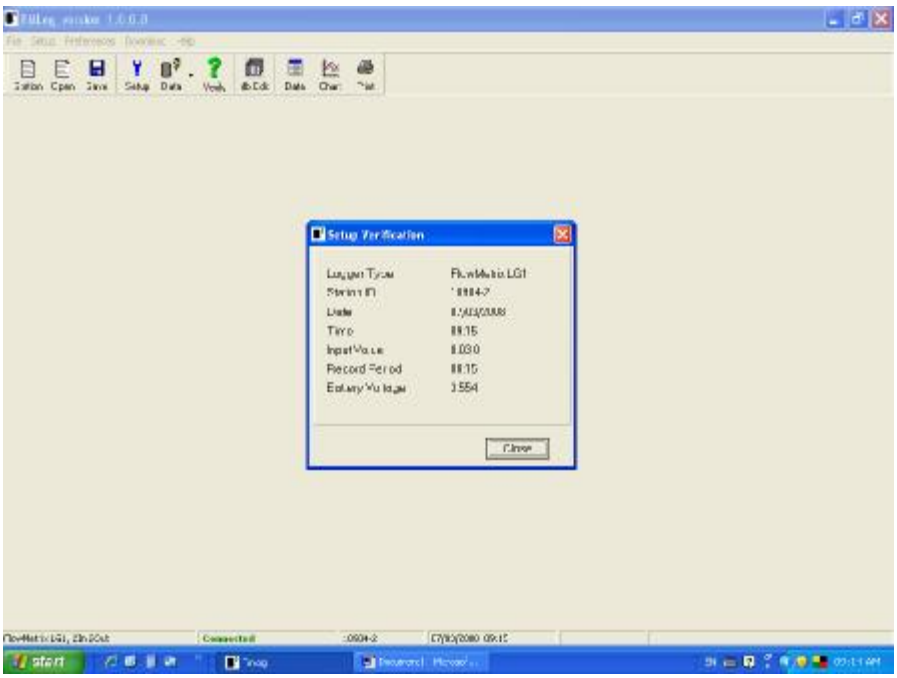
Select the correct Comms Port and ensure the Comms cable supplied is connected to the correct port as well as to the logger.



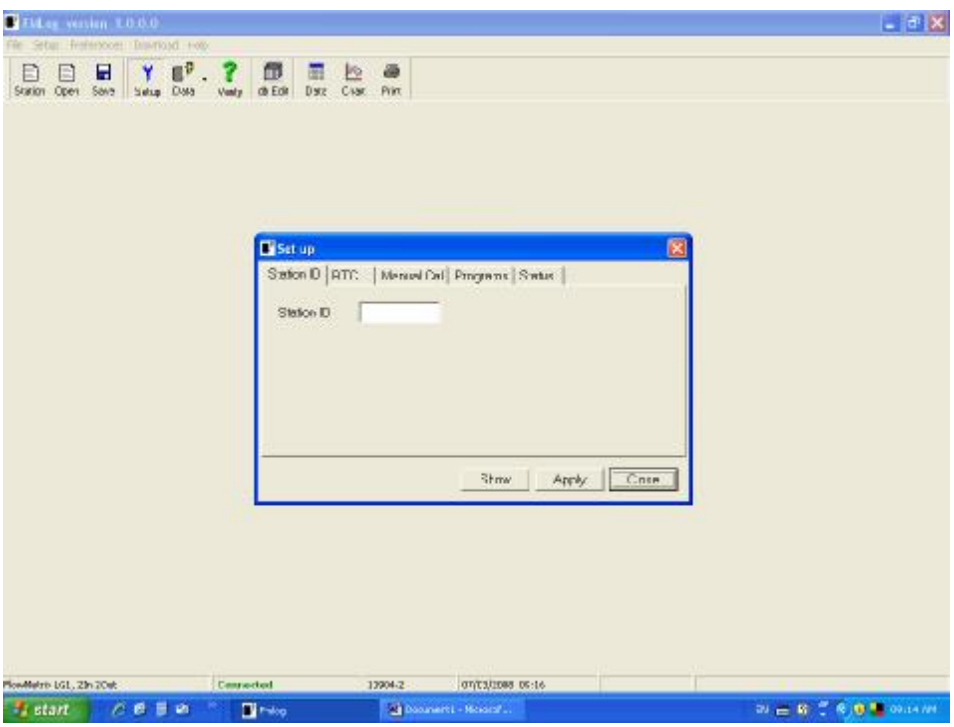
Check the connected message is displayed at the bottom of the screen.



Use the Verify button to check the setup data of the logger.

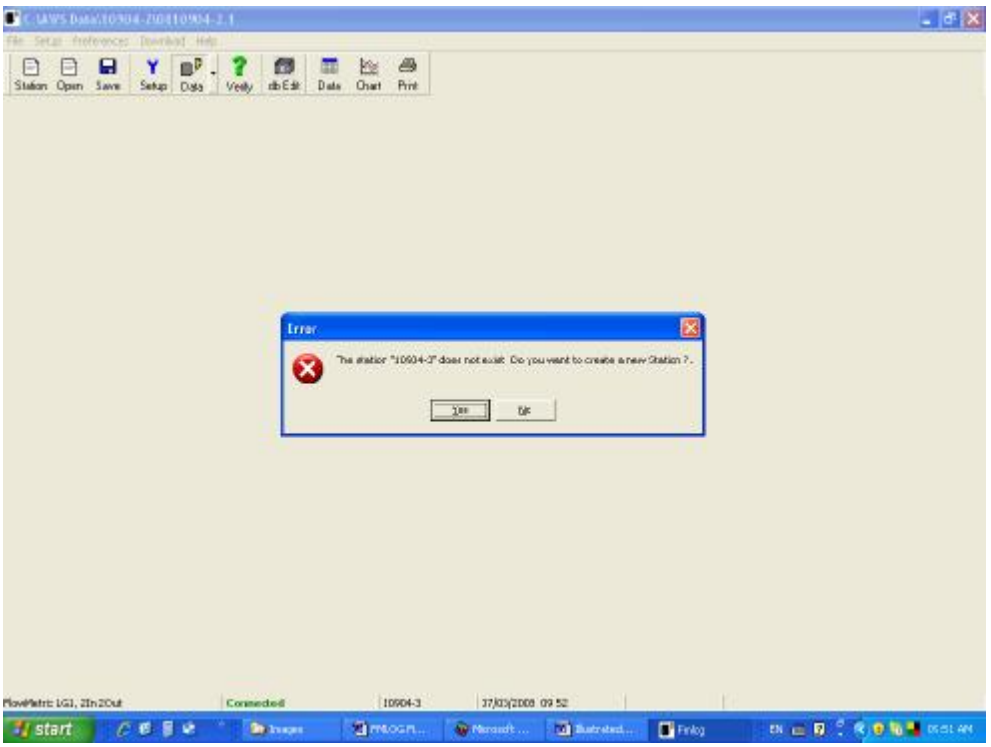


Use the Setup button to open the Setup window.

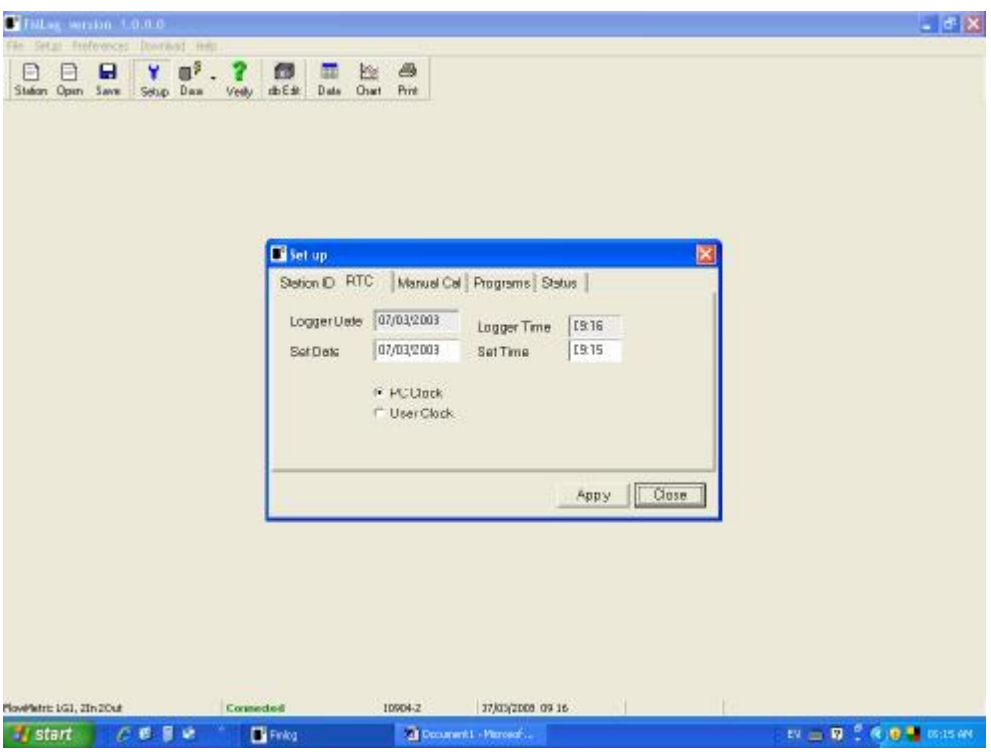


Station ID can be used to change the name of the logger. Use the Apply button to save the new name.

When the new data is retrieved you will be asked to create a new station.



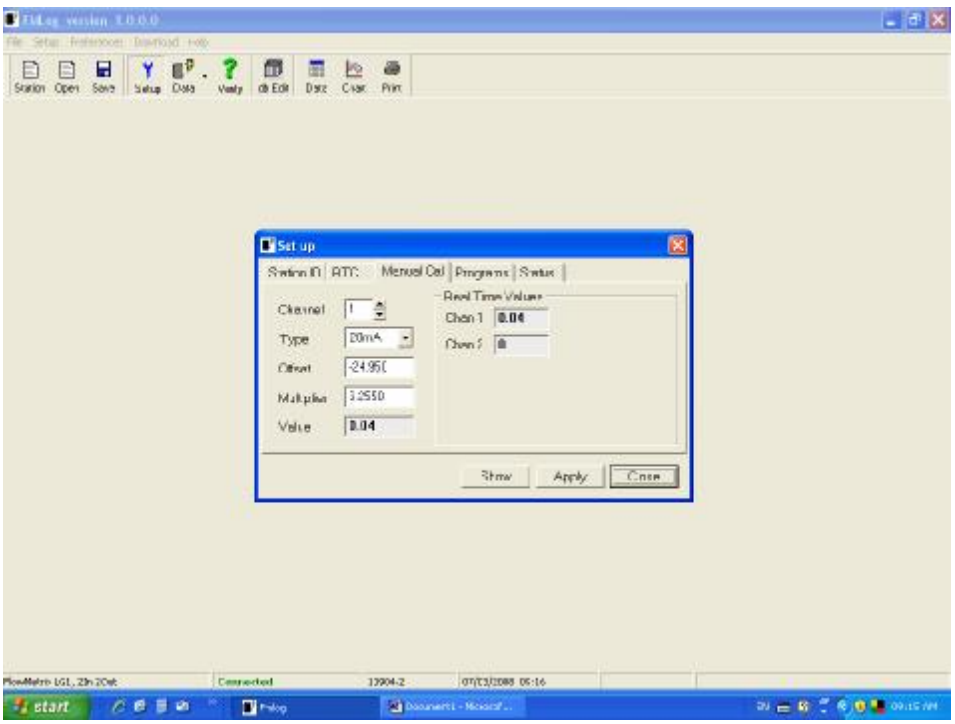
RTC = real time clock. Use PC Clock and Apply button to set the logger time to PC time.



Manual Calibrate Tab

Channel 2 is the Digital count logging channel (source must be a form of NO VOLTAGE SWITCH eg reed switch, open collector transistor etc.

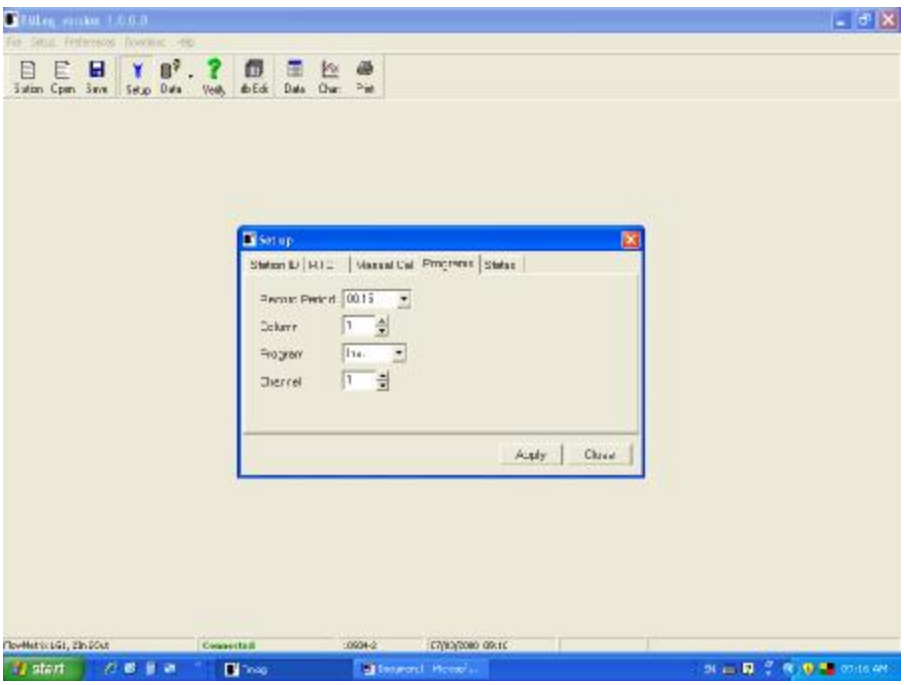
To turn a particular channel off use the OFF option under the Type menu and then the Apply Button.
If the logger is supplied for count value use only the 4-20mA Channel will be turned off at the factory.

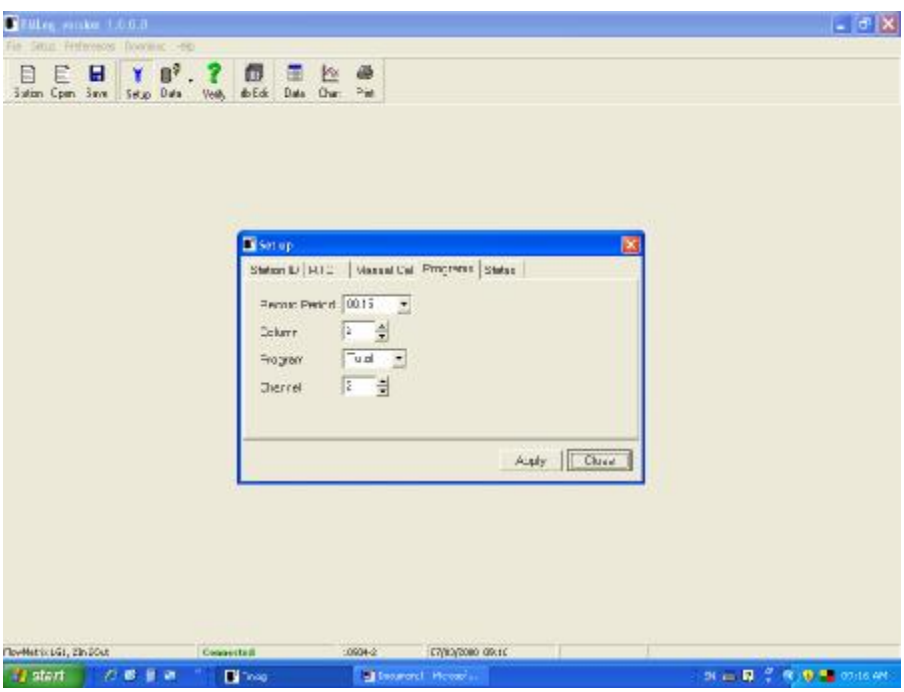


Programs Tab

The Record Period can be changes here. The minimum period is 1 minute and the maximum period is 24 hours. Remember to Apply all changes.

The remaining options should be left as supplied and indicated below.

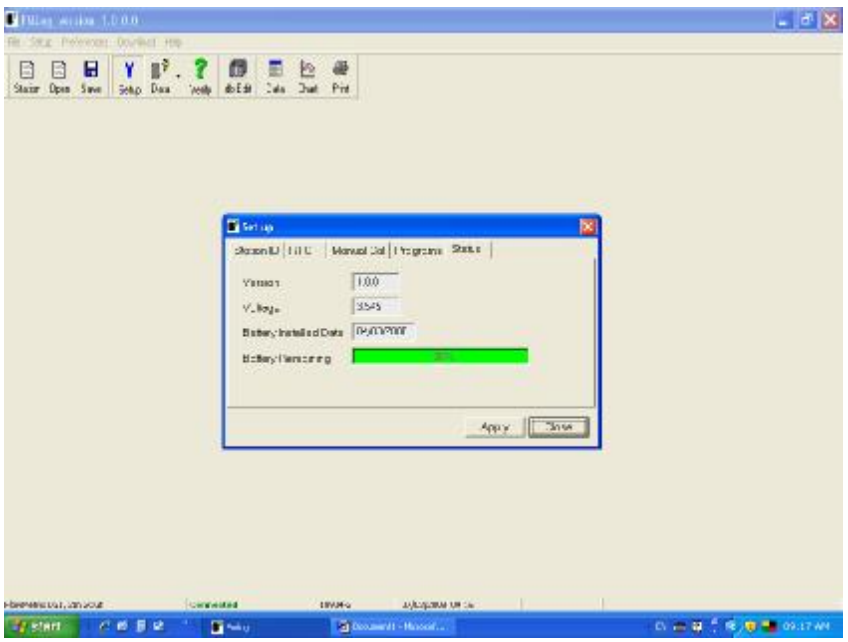




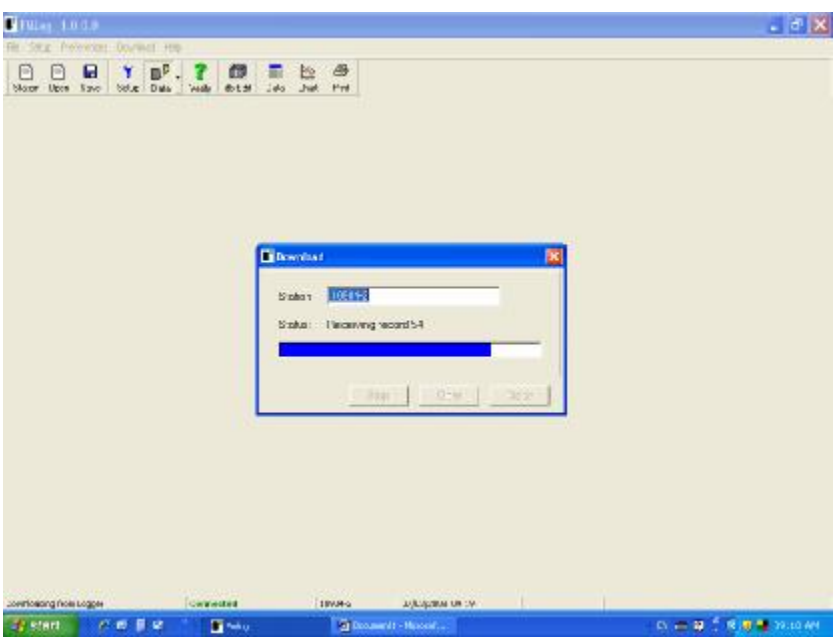
Status Tab

The battery voltage can be monitored and remaining life viewed. A battery should be expected to last 2 years. Replace with equal specification if you are uncertain.

The New Replacement Date must be clicked if a new battery has been inserted.



The Data button is pressed to receive logged data. A new logger name will need to have new folders created, take note of the folder locations created. Logged data files can also be opened in Excel.



Portable Doppler Flow Meter

General

While the data logger is connected to the PC, a green message 'Connected' is displayed. When the logger is not connected a red message is 'Not connected' is displayed.

The data logger will automatically be disconnected after a few minutes if no registers are being changed or viewed to conserve battery energy.

Note: Do note leave the logger connected to the PC for any unnecessary time, **as this will waste battery power**. The rule is, connect to the data logger, set any registers as required, download the data from the buffer, save the data as a file, reset the data buffer, and then physically disconnect the data logger by closing the program.

Battery Replacement

The battery type is a Tadiran TL2150 or Saft LS14250 3.6-volt Lithium Chloride battery or exact equivalent.

To replace the battery, remove the 4 screws of the data logger's lid. Note the orientation of the battery before removing the battery. After removing the old battery, do not replace the new battery straight away. Let the data logger discharge any remaining stored voltage for at least 5 minutes. Before inserting the new battery, note that the positive end of the battery faces towards the top of the printed circuit board with the battery on the right side. A plus sign is also imprinted in the battery holder. The battery has a positive sign (+) printed on the casing. The positive end of battery can also be identified as a 3mm in diameter contact, whereas the negative end (-) contact is the full diameter of the battery.

When inserting the new battery, the negative end of the battery must make contact first. Then firmly insert the positive end into the holder. While inserting the battery, the red LED (light emitting diode) will flash once. If it does not flash, then remove the battery and after 5 minutes, try again.

Once the logger is running again, check that all the registers, such as ID, the real time clock, input and output programs are correct. Then go to the Status menu, and click on the Update button to indicate a new replacement date for the battery.

Note: The battery remaining bar will be meaningless if this in not done.