

CATH-TECH

CORROSION CONTROL EQUIPMENT

Operation Manual for Smart Logger II

GPS Synchronized Stationary Data Logger



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Limited Warranty

All Cathodic Technology Limited (Cath-Tech) instruments and equipment are warranted against defects in materials, design or workmanship for a period of two years from date of sale. This warranty excludes damage due to misuse, abuse, tampering or acts of God such as fires, floods, wind damage, lightning etc.

We will repair or replace at our option any defective component, after examination in our manufacturing facility, if the fault is due to defective materials or labour, within two years of the purchase date. For warranty repair, a Returned Goods Authorization (RGA) must be obtained from Cathodic Technology Ltd prior to shipping the defective unit pre-paid to our location.

Note: *There is no warranty expressed or implied on batteries.*

Cath-Tech Policy

- Cath-Tech extends a two-year in use warranty on all units, which have been designed and/or manufactured by Cath-Tech staff.
- Cath-Tech reserves the right to make any changes in design or specification which it deems an improvement, with no liability to make the same changes on existing equipment.
- This warranty is in lieu of all other warranties or guaranties, expressed or implied, which might otherwise exist. The purchaser is relying only upon this guarantee and not upon any representations not herein expressed.
- Any material or equipment being returned to the factory must first have a Returned Goods Authorization (RGA) from Cath-Tech.

Welcome

On receipt of this precision instrument unpack carefully and examine for damage in transit. If damage is detected, file a claim with the carrier immediately. If damage is not detected verify that you received all of the pieces.

Your Smart Logger II Package Includes:

- Smart Logger II
- GPS Antenna
- Battery Charger
- Test Leads
- Instruction Manual
- Calibration Certificate



Charging the Battery

The battery is the latest generation of rechargeable nickel metal hydride type, (NiMH) rated for 450mAh. NiMH does not develop a memory. If looked after it will provide many years of service. Do not allow the battery to freeze, likewise do not store in a hot location.

It is recommended that you charge the battery for 24 hours upon receipt of the unit and prior to survey season. The nominal battery voltage is 7.2 volts and when charging may exhibit voltages as high as 8.4 volts. The battery is exhausted when the voltage drops to 6.5 volts.

GPS Engine

The standard GPS engine/antenna supplied with the Smart Logger II is a 12 satellite WAAS enabled unit. It is capable of resolving position information with an accuracy of 3 metres if the WAAS differential correction is being received.

The GPS engine is connected to the Smart Logger II by a circular connector on the outside of the case.

Normally the GPS will lock within 5 minutes, however, if the GPS has been moved far from its last position, has not been used for a long period or if the signal is weak, it may take up to 10 minutes to lock.

If the GPS engine will not lock;

- Locate it in a position that has a good view of the sky in all directions, on the roof of a parked car is usually good
- Connect it to the Smart Logger II
- Check in the main menu that G-GPS is on
- Leave it alone for 10 minutes or so
- Usually the GPS will lock in this situation



If the GPS loses lock while in survey mode, this is not usually a problem. The PPS (Pulse Per Second) signal will coast or free run and the ON/OFF measurements will still be accurate. Eventually, after some hours the PPS will start to slip and synchronization with other GPS devices in use such as a Hexcorder or the current interrupters will be lost. This will normally take several hours and a short term loss of signal is not a problem. The GPS will typically regain lock long before the timing drift has any influence on the recorded data.

In the Test Menu there is an option to display information on the satellites from which the GPS antenna is receiving data, quality of data and other information. See section 5-Test for more information.

NOTE: The Smart Logger II uses the exact date and time supplied by the GPS satellite system. This time is in UTC (Coordinated Universal Time). To convert to your local time, add or subtract the local time zone correction. All of the equipment uses UTC for synchronization; the equipment does not show local time.

Features

Full 40 Key
QWERTY Keyboard

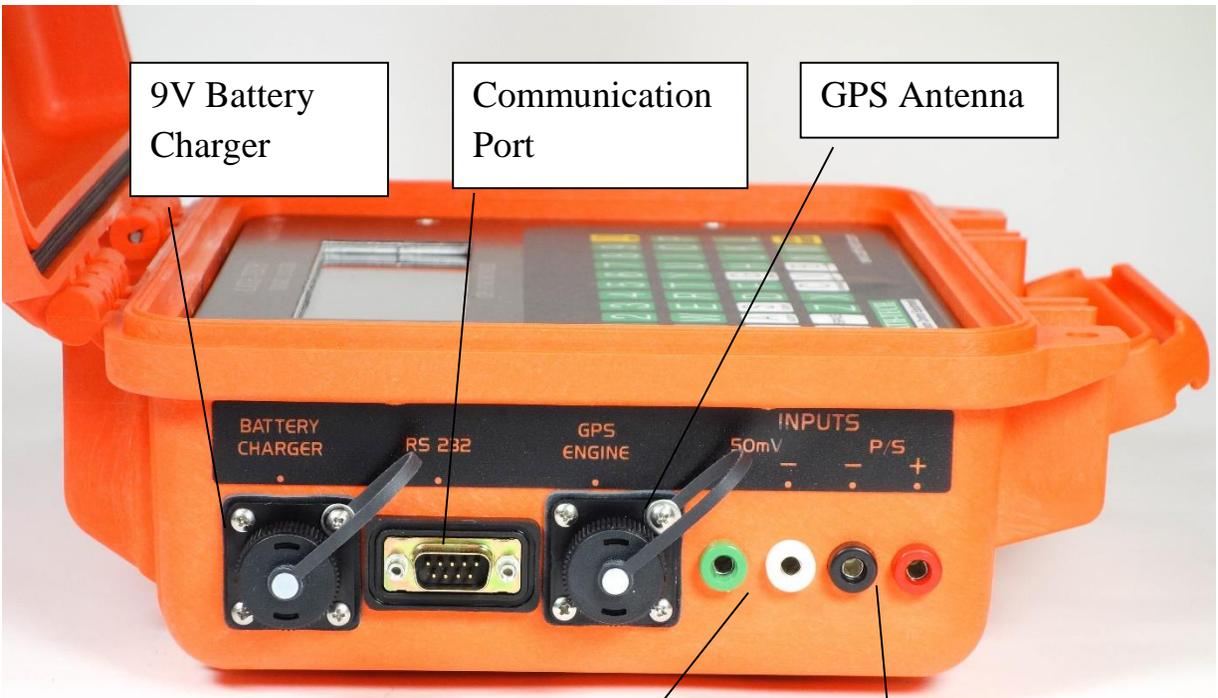
240 x 64
Graphic Display



9V Battery
Charger

Communication
Port

GPS Antenna



50 mV IR/Shunt
Connections

Pipe & 1/2 Cell
Connections

Main Menu

To turn on the Smart Logger II, press the upper yellow key on the keyboard. The main menu appears after the Smart Logger II boots up.

To return to the Main Menu at any time, press the two yellow keys on the keyboard simultaneously.

- The first 3 lines are the various functions
- The next two lines indicate the date, time and GPS position if GPS is locked
- The last line indicates the firmware version, amount of memory used and battery voltage

CATH-TECH		SMARTLOGGER	
1-survey	2-setup	3-export-data	
4-set-time	5-test	6-wav	OF-off
EM-erase-mem	S-scope	G-GPS	on
TUE 11 JAN 11			15:14:24
4507.5514N	07942.9672W		04
28 V 07			00% 7.4V

If the GPS is off, the date and time displayed is that of the Smart Logger II real time clock. If the GPS is ON but not locked, the position information will be blank until the GPS is locked.

OF-Off

To turn the unit off, press both yellow keys simultaneously to return to the main menu. Then press the 'O' and 'F' keys simultaneously. The screen will change to a shut down screen and the unit will turn off.

G-GPS

The 'G' key turns the GPS function on and off. GPS synchronized logging requires the GPS to be on and functioning. GPS can be turned off for high/low and non-interrupted modes. However, the timing of the readings is more accurate with the GPS on.

2 – Setup

Before a survey can be performed the Smart Logger II must be configured for the type of survey to be done. Press 2 from the main menu to enter the setup procedure. The Smart Logger II will display the last setup that was used for data logging.

- Press F to start a new file with the same parameters as previously used.
- Press A to exit without changing anything.
- Press C to continue with setup.

```
Data logger +-5V
GPS synchronized
00200ms off 00800ms on 100Mohm
60Hz

Memory 00% File 01

F-new-file    C-change A-accept
```

NOTE: After erasing the memory, the set up procedure must always be completed once to tell the Smart Logger II how and when to record your data.

- File Number
- The Smart Logger II automatically assigns a new file number if the setup is changed.
- Press A to accept and continue

```
File 01

N-change-file-name

A-accept
```

Inputs to Log

NOTE: The Smart Logger II is a dual input data logger designed for measuring pipe-to-soil potential and current flow in pipelines or shunts. The pipe-to-soil input channel has two ranges, +/- 5000 millivolts and +/- 25000 millivolts. The IR channel has a range of +/- 50.0 millivolts for measurement of IR drops or current flow through a shunt. Either channel may be used or both channels can be active if it is desirable to measure and record the pipe-to-soil potential at the same time as the current flow through a pipeline or shunt. This feature is extremely handy for monitoring the affect of an electrical bond between pipelines; the current flow through the bond can be measured simultaneously with the pipe-to-soil potential.

The following steps must be completed:

- Enable or disable P/S
- Press C to toggle between ENABLE and DISABLE pipe-to-soil potential measurement (Enable P/S = Measure and Record the pipe-to-soil potential).
- Once set, press A to accept and continue.
- If pipe-to-soil measurement is ENABLED the Smart Logger II then asks for the measurement range to be used.
- Press C to toggle between +/- 5 volts and +/- 25 Volts
- Once set, press A to accept and continue.

```
Inputs to log

P/S enabled

C-change          A-accept
```

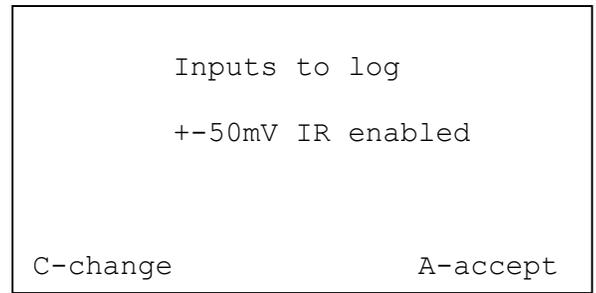
```
Inputs to log

P/S +-5V

C-change          A-accept
```

Enable or disable IR Measurement

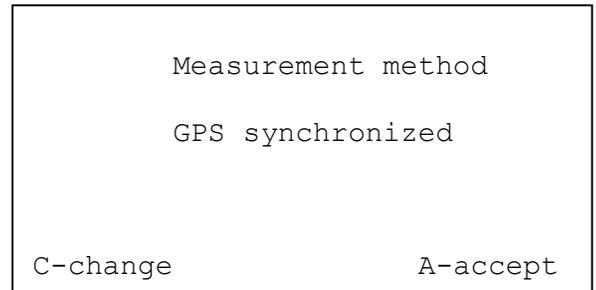
- At this screen the +/- 50mV input may be ENABLED or DISABLED.
- This input can be used to record the voltage drop on a the pipeline or across a shunt and has a range of +/- 50mV.
- Disabling this input will save memory.
- Press C to toggle between ENABLE and DISABLE.
- Once set, press A to accept and continue.



Measurement Method

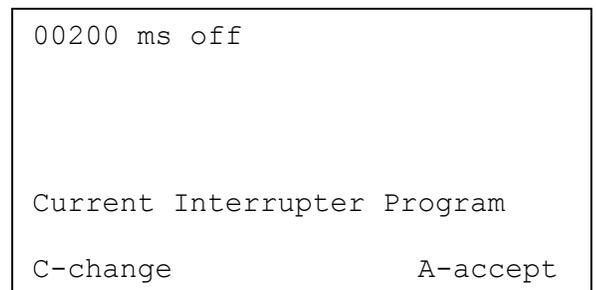
There are 3 measurement methods:

- Not Interrupted (logs once per cycle)
- High/Low (logs the highest and lowest value per cycle)
- GPS Synchronized (logs the readings at specific time points)
- Press C to toggle between modes
- Once set, press A to accept and continue

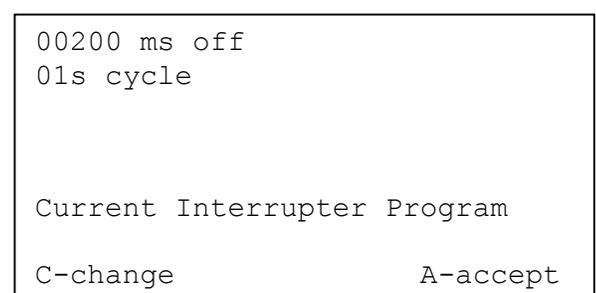


In GPS synchronized and High/Low the same program as the current interrupters have must be entered into the Smart Logger II to record at the correct time in the interruption cycle.

- Enter the rectifier OFF time in milliseconds.
- Press C then enter the OFF time numerically. Must enter 5 digits.
- Once set, press A to accept and continue.



- Press C to select the current interruption cycle length in seconds.
- Cycle length = OFF Time + ON time
- Once set, press A to accept and continue



Note: The programmed rectifier ON and OFF times must exactly match the rectifier ON and OFF times programmed in the current interrupters.

Instant OFF Measurement Delay

In GPS synchronized mode we can have increased survey accuracy by performing a delay, after the start of the ON/OFF time, before the ON/OFF potential is measured. When the cathodic protection is first turned on or off, there can be an inductance spike in the voltage due to the capacitance of the coating. A more accurate reading can be obtained by inserting a delay, instead of taking the reading right as the rectifiers turn off, wait 100ms, then take the reading. Inductive spikes can be seen on any waveforms taken, see section 6-Wave or S-Scope for more information.

- Press C to enter the delay time in milliseconds.
- The allowable delay time is dependent on the length of time that the rectifier is OFF.
- Once set, press A to accept and continue

```
00100 ms off

i-off measurement delay
10ms to 0150ms typical 0100ms

C-change                A-accept
```

OFF Time Milliseconds	Recommended Delay before Measurement
200 Milliseconds	100 Milliseconds
300 Milliseconds	150 to 200 Milliseconds
400 Milliseconds	200 to 300 Milliseconds
500 Milliseconds	300 to 400 Milliseconds

Note: The Smart Logger II must be programmed to exactly match the programming of the HEXCORDER Survey Instrument and the GPS synchronized current interrupters being used.

Input Impedance

The Smart Logger II has a selectable input impedance of either 10 Meg Ohms or 250 Meg Ohms.

- Press C to toggle between the two input impedances
- Once set, press A to accept and continue
- Use 250 Mohm for arid/dry conditions

```
Input impedance

010 Mohm

C-change                A-accept
```

Store GPS

The Smart Logger II always stores the GPS time with each reading, you can also store the GPS coordinates and information about the GPS signal by answering yes to the store GPS selection, this is not really necessary if the logger is stationary. The logger stores the GPS co-ordinates once at the top of the file regardless of this setting. Not storing the co-ordinates for each reading can extend the memory.

```
Store GPS ?

NO

C-change                A-accept
```

Power System Frequency

The Smart Logger II needs to know the power system frequency where the unit is deployed in order to properly configure the AC filter.

- Press C to change between 50Hz and 60Hz
- North and Central America use a 60-hertz power system frequency.
- Europe and Asia use a 50-hertz power system frequency.
- Select the power system frequency for your area.
- Once set, press A to accept and continue.

```
Power System Frequency

60Hz

C-change                A-accept
```

Setup Screen

After setup is complete, the Smart Logger II will return to the main setup screen

- Press C to cycle through the options again.
- Press F to change the file name
- Press A to finish the setup and return to the main menu

```
Data logger +-5V
GPS synchronized
00200ms off 00800ms on 100Mohm
60Hz

Memory 00% File 01

F-new-file C-change A-accept
```

4 - Set Clock

The set time and date function is accessible from the main menu and sets the RTC (Real Time Clock) inside the Smart Logger II. The RTC is normally only used in non GPS modes of operation, as the GPS system also provides the date and time. Press 4 to change or set the time and date.

- The time and date should be entered using the following format:
- yy = Last 2 digits of year
- mm = Month
- dd = Day of month
- w = Week day (Monday = 1, also used in GPS mode to display the day of the week)
- hh = Hour in 24 hour clock
- mm = Minutes
- ss = Seconds

```
yymmddwhhmmss
```

```
C-clear ENTER
```

1-Survey

From the Main Menu, press 1 to start survey or data logging mode. If this is the first time a particular file number has been used, there will be a prompt to enter a description for the file otherwise, this screen will be skipped.

- You may enter some text to describe the survey, this will be stored at the beginning of the data file as a header.
- GPS location co-ordinates will also be stored in the file header.
- Press Enter to continue

Enter description

If GPS synchronization is enabled, survey mode will not start until the GPS engine is connected and locked. A message will appear on the screen “Please wait for PPS from GPS”. Ensure that the GPS is connected and has a clear view of the sky. Also note that the GPS may take up to 10 minutes to lock. Once the GPS is locked, the main survey screen will appear.

- The following parameters are visible on the main survey screen:
- Pipe to soil input voltage, mV, ON and OFF
- +/- 50mV input, voltage, mV, ON and OFF
- Record number
- Date and Time, UTC. (unless operating without GPS when the RTC. is used)
- Current Position; Latitude, Longitude & quality of signal
- Memory % used, altitude and PDOP (Position Dilution of Precision) from GPS.

	ON	OFF
P/S	1257mV	0924mV
+/-50mV IR	31.2mV	22.5mV
Record# 00052		
Mon 08 Aug 11		19:52 09
4351.6000N	07943.5664W	QU05
Memory 01%	257.1m	PDOP 1.9

If you have any issues with the GPS, turn to pages 3 & 4 for more information on the GPS.

6 – Wave Function

When 6 is pressed, special software is invoked that records exactly 2,000 readings per second for the programmed time interval at a scheduled date and time. During the wave function the normal AC and noise filtering circuits are bypassed to allow electrical interference on a pipeline to be captured. Up to six separate waveform captures can be programmed. The length of time the waveform can be taken over is also set. There is a minimum of 1 second (2000 readings) to a maximum of 5 seconds (10,000 readings).

- Navigating the Wave Schedule Screen
- U – Up: Moves the cursor up one line
- D – Down: Moves the cursor down one line
- I – Insert: Inserts an entry at the current cursor position
- C – Change To change or enter an entry in the schedule
- R – Remove: Erases an existing entry

Wave files: date time & length	
2011 08 08 13:35 02s	
2011 08 08 14:35 05s	U-up
	D-down
	I-insert
	R-remove
C-change	A-accept

Move the flashing cursor to the top line, then press C for change. The cursor will move to the left and YY will be highlighted. Enter the last 2 digits of the year. After you have entered 2 digits for the year the cursor will move to the right and highlight “mm” for month. Enter 2 digits corresponding to the month of the year. The cursor then moves to the right and highlights “dd”. Enter 2 digits representing the day of the year. Continue on entering the time as hours (UTC or GMT Time) “hh” and the minutes. The last function, “ss” is the length of the wave recording in seconds.

NOTE: The wave recording times must be in order. Scheduled recordings may not occur if they are out of sequence.

A – Accept: To continue on to next screen.

Wave Function Mode Selection

You must now decide between the two available modes of operation:

W-Wave Only or

S-Survey + Wave

Wave Only

In this mode, the Smart Logger II only records waveforms according to the schedule previously programmed. As each entry becomes valid, the Smart Logger II will record 2,000 readings per second for the duration of the programmed recording interval, 1 to 5 seconds.

- The following screen will show on the LCD display:
- As each waveform is stored the # stored will increase. Its entry line in the schedule will be deleted and the remaining entries will move up.

Please wait
1 stored
08 Aug 11 13:35:30
06

NOTE:

At present, (Ver 28 V 07) only times scheduled for the current day will be executed.

Survey + Wave

If this option is selected, you will be returned to the main menu. Nothing will happen until 1-Survey is selected. The Smart Logger II will then record and store pipe-to-soil or IR drop data in survey mode until the time scheduled for a programmed wave recording becomes valid. It will then suspend survey mode and record a waveform for the specified interval, Survey mode will then be continued normally.

This process will repeat for each entry in the waveform recording schedule.

S-Scope Function

This Main Menu function is used for capturing waveforms **manually**, one at a time. This function should not be confused with the 6-Wave function, which is used to capture Waveforms **automatically**.

S-SCOPE will capture and store 2,000 readings per second for the duration of the interruption cycle, as configured in the S-SETUP menu. If you are using a 1 second interruption cycle then the Smart Logger II will record and store 2,000 readings in each file. If however your interruption cycle is 4 seconds, 1 second OFF and 3 seconds ON for instance, the Smart Logger II will record and store 8,000 readings in each file.

The scope function is accessed from the main menu by pressing “S”.

The GPS must be locked for the S-SCOPE function to operate

- When the S-SCOPE is invoked, after a short delay, the following screen will appear:



The first screen displays the first 100mS period following the start of the interruption cycle. This also, will normally be the start of the OFF period. Subsequent screens can be viewed, (100mS each), by pressing the arrow keys (V for left and B for right) to move back and forth through the waveform, the screen number is displayed on the right.

The voltage range in mV of the vertical axis is displayed in the right corners of the screen. This will normally be preset to +10000mV and -10000mV at the factory, but may be adjusted as required, see below. This will not affect the data to be stored in memory, but will allow the waveform to be sized appropriately for viewing. The maximum input range for the waveform function is +/- 40,000mV. If the input voltage is larger than this, clipping may occur.

Press the ‘S’ key to change the display voltage range, and a new screen will appear:

- Display Voltage Range
- Press C to change the upper limit and enter a 5 digit number representing the upper voltage limit of the graph in mV.
- Press A to accept the setting and continue.

```
02000
C-change A-accept
```

The next screen allows the polarity of the limit to be changed

- Press “S” to change the polarity
- Press A to accept the setting and continue
- The next two screens allow the lower limit to be changed in a similar way

```
+02000
S-change-sign A-accept
```

The previous waveform will now be displayed according to the new upper and lower limits.

Storing a Waveform

Press ENTER to store the waveform. The Smart Logger II will ask to confirm storage of the waveform.

- Press “N” to discard the waveform and return to the Main Menu or press “Y” to continue

```
store Y N
```

Now it will ask to confirm the file number.

- Press “N” to change the file number.
- Press “A” to accept and continue

```
file 01
N-change-name A-accept
```

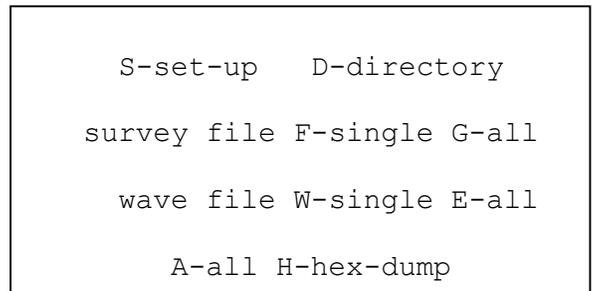
Finally enter a description of the waveform, which will be stored with the data.

To complete the storage of the waveform data press “ENTER”.

The waveform will now be stored in memory and you will be returned to the Main Menu.

3 - Export Data

The data stored in the Smart Logger II must be exported to a computer on a regular basis. Typically this is done once per day. After the data is downloaded and secured, the memory should be erased to ensure there is ample space available for the next day's data.



In order to extract the data from the Smart Logger II, it needs to be connected to a computer with an RS232 serial port. USB to RS232 adapters are available. A terminal emulation program must be installed on the computer, e.g. Windows HyperTerminal, Mirror or equivalent. Set up for 38400, N,8,1 with no handshaking.

Hyper Terminal is included in Windows 95 to XP. For Windows Vista, 7 and other operating systems go to www.hyperterminal.com and download a copy of HyperTerminal or search on the internet for a com port data emulator. HyperTerminal 5.0 is the free version that was included in Windows XP and can often be found for downloading from various sites. In Windows XP HyperTerminal is found in Programs → Accessories → Communications.

Turn on the computer and Smart Logger II. Connect the Smart Logger II to the computer using the supplied DB9 straight through cable and start HyperTerminal. If needed, an RS-232 to USB adapter is included with the Smart Logger II.

Configure HyperTerminal

When HyperTerminal is opened, it will prompt for a connection name. Enter 'Smart Logger II' then change the port connection to:

- Direct to COM 1 or whichever COM port your computer uses.

Then click on 'OK'. A New Box will appear where you can change the configuration of the COM port.

- Baud Rate 38400
- Data Bits 8
- Stop Bits 1
- Parity NONE
- Flow Control X ON X OFF

If you need to check or change the settings later on, in HyperTerminal, go to Call → Disconnect, then go to File → Properties. This shows your connection port. Click the 'Configure...' button below the port to access the full configuration.

S-Set-up

Baud Rate

The baud rate can be set at any speed between 50 and 115200 bits per second; common settings are 1,200, 2,400, 4,800, 9,600, 19,200 and 38,400. The default baud rate is 38,400 which is recommended.

- Press C to change the setting
- If in doubt set the baud rate to 038400 as shown above
- Press A to accept the setting and continue

```
038400
baud rate 50-115200

8 data, 1 stop, no parity

C-change A-accept
```

Sign Convention

- Press C to toggle the polarity of the data output
- Signs inverted reverses the polarity of the data output
- Signs normal does not reverse the polarity of the data output
- Press A to accept and return to the Export Data Main Menu Screen

```
signs inverted

C-change A-accept
```

D-Directory

Note: At this stage, communication with your PC can be confirmed by pressing the D key. This will display the file directory on the Smart Logger II *and* send it via RS232 to the PC. If HyperTerminal is working correctly, the directory information should appear on the computer screen.

File Directory

- This screen lists your files by number and lists the number of bytes of data in each file
- Press A to Accept and continue to a similar screen with details of the wave files stored
- Press A again to accept and continue

```
01          000001325

survey
A-accept
```

Memory Information

- This screen indicates the number of bytes of memory used in data storage and the number of bytes available for data storage
- Press A to accept and return to the Main Export Data Menu

```
000001325 bytes stored
001047251 bytes free

A-accept
```

Exporting Data

To capture the data in the PC, it is necessary to open a capture file in HyperTerminal. Go to Transfer → Capture Text and select the location and name for the file on the computer. The file extension should be .txt or .csv to ensure the computer recognizes the file type.

On the Smart Logger II single files can be downloaded or all files together. To download a single file, press F for a survey file or W for a wave form. The next screen will prompt you for the file name. Press C to cycle through the available files and A to start that file downloading.

To download a group of files, press G for survey files or E for wave form files. These will create one large text file divided into sections by the file header information (serial number, GPS location, description, etc).

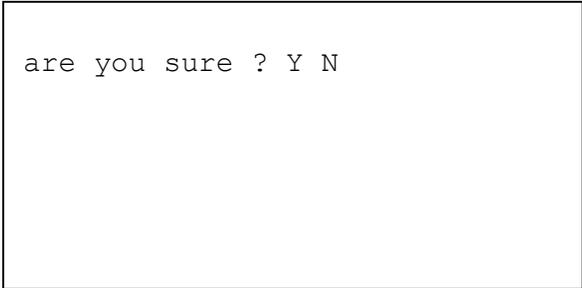
As the information is downloading, the Smart Logger II will display 'Please Wait'. Once the download is complete and the Smart Logger II has returned to the Export Data screen, the file in HyperTerminal needs to be closed. Go to Transfer → Capture Text → Stop.

To return to the Smart Logger II Main Menu, press the two yellow keys simultaneously.

EM- Erase Memory Function

Occasionally it will be necessary to erase the memory to remove old data from the Smart Logger II. When the erase memory function is used, the data is removed from memory and unrecoverable. Please make sure your data is backed up on another device before erasing the memory.

- The Smart Logger II requires confirmation before it erases the memory
- If you are sure that you wish to erase the memory press 'Y'
- If you do not wish to erase the memory press "N" to exit without erasing



```
are you sure ? Y N
```

After erasing the memory, the full setup must be verified prior to commencing the next survey, see the section for 2-Setup.

5 - Test

To enter the Test Menu press 5 from the Main Menu.

- There are 4 tests that can be performed;
- Keyboard function
- Memory integrity
- Eprom (processor)
- Satellite information

```

K-keyboard  M-memory  E-eprom

001048576 bytes      Serial #
28 v 07              S-satellites
  
```

To return to the Main Menu at any time, press the two yellow RESET keys simultaneously.

K – Keyboard Test

Press K to invoke the keyboard test

- While at the keyboard test screen, each key pressed on the keyboard, will be echoed to the LCD.
- Press each key in turn and check that it appears on the LCD.
- Any key that does not appear is defective and the Smart Logger II should be returned for service.

```

QWERTY
  
```

M - Memory Test

This tests the integrity of the CMOS non-volatile RAM memory. Do not touch the keyboard during this test as the memory is being fully tested and any interruption could result in loss of data.

At the end of the memory test, the Smart Logger II will display the number of Good bytes of memory. This value should match the memory size you purchased.

```

001048576 bytes

do not touch keyboard to
protect stored data
  
```

E - EPROM Test

The EPROM, which contains the operating program, can also be tested; press E for EPROM test and the following screen appears:

The Hexadecimal values must exactly match, if not then the EPROM is damaged and the unit should be returned for repairs.

```

005D9EA5 = 005D9EA5

A-accept
  
```

S – Satellites Test

The satellite screen is displayed which provides information about the GPS satellites being received and other information.

- The screen lists the satellites received by satellite number
- PPS presence: (Pulse Per Second), is indicated by a flashing square box character on the screen, between PPS and PDOP
- PDOP.: (Position Dilution Of Precision) value
- QU: quality of the satellite signal
- UTC. date and time, the position (Latitude Longitude & Altitude)
- Number of satellites being received

```
sat 05 14 15 18 22
sat
PPS  PDOP 1.9 QU 2

3 Aug 11 14:15:37
4401.1287N 07958.1698W 05
alt 236.5m sat
```

Replacement Parts & Accessories

CTL-134

Cu CuSO4 half cell with cone tip



CTL-311

GPS 18X, long lead

- Current Interrupters & Smart Logger II



CTL-224

Test leads, Smart Logger II



CTL-515

QWERTY keypad assembly for Smart Logger II



CTL-235

7.2V charger Hexcorder, Smart Logger II, CI-25 & 50



CTL-516

LCD display for Hexcorder & Smart Logger II



CTL-236

12VDC to 7V cigar charger Hexcorder & SL



CTL-530

7.2V battery for Hexcorder & Smart Logger II



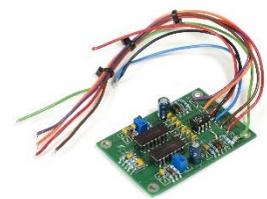
CTL-252

RS232 cable Hexcorder & Smart Logger II



CTL-626

Circuit board Hexcorder & Smart Logger II active AC filter



CTL-258

USB to serial port adapter



CTL-627

Circuit board Smart Logger II





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