TRAX

Intelligent Pipeline Technology

LOOP

VERSATILE SUBSEA DATA HUB

Operating Manual

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CONFIGURATION INFORMATION	
LOOP SERIAL NUMBER	
SENSOR 1 SERIAL NUMBER	
SENSOR 1 FULL SCALE RANGE	
SENSOR 2 SERIAL NUMBER	
SENSOR 2 FULL SCALE RANGE	
SENSOR 3 SERIAL NUMBER	
SENSOR 3 FULL SCALE RANGE	
SENSOR 4 SERIAL NUMBER	
SENSOR 4 FULL SCALE RANGE	
FLOW SENSOR 1 K FACTOR	
FLOW SENSOR 2 K FACTOR	

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1. GENERAL DESCRIPTION

The LOOP Subsea Logger is a compact, self-contained, subsea unit which logs and displays readings from external digital pressure sensor(s), in BAR or PSI, temperature sensor(s), in Celsius or Fahrenheit, and pulse output flow meters.

A high visibility OLED display shows the current readings subsea. The user can turn the unit on and off as well as modify all available settings using a single control button and intuitive menu system.

Up to 4 off digital pressure sensors and 2 off digital output flow meters can be connected by various combinations of cables supplied by OEL.

This LOOP interfaces to Hydromea Luma 250LP optical modem under control of an external ROV switch using OEL-006817-00V0B Interface Cable Assembly. This allows downloading of logged data subsea in conjunction with an ROV. The logged data 9is transmitted to the surface via the umbilical where a computer application decodes and saves the data. Manual download of logged data can also be performed via the same Burton 5507-1508 connector.

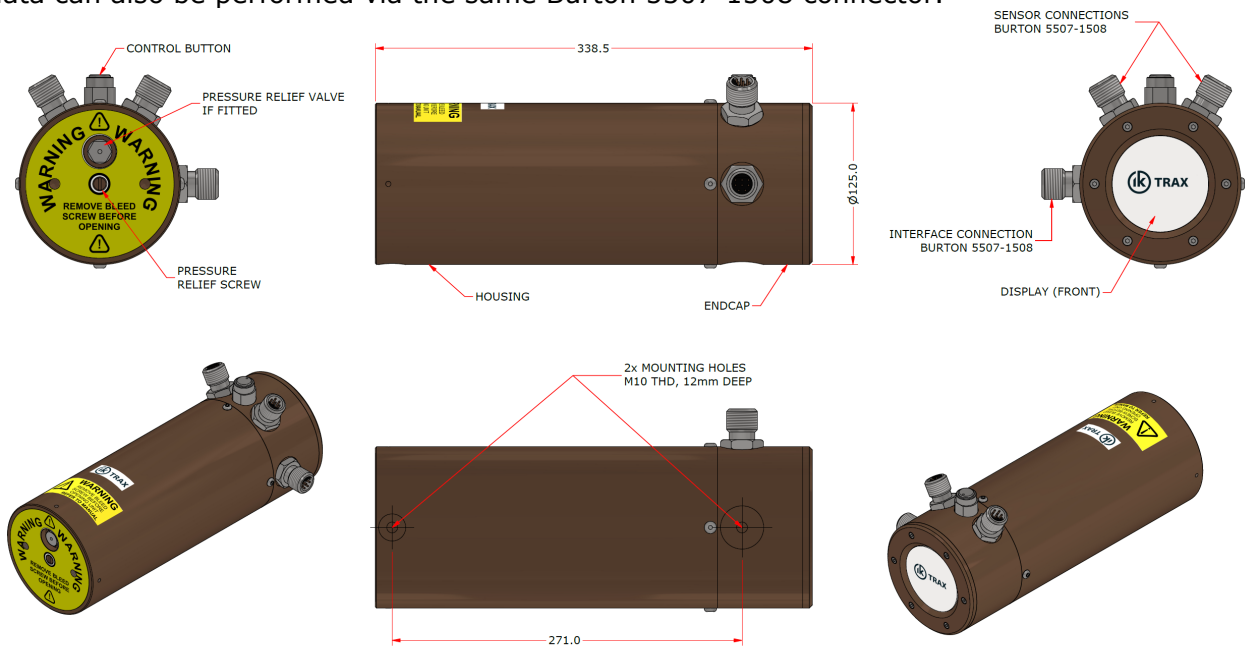


Figure 1

MOUNTING OPTIONS: As standard, the unit is supplied with 2x 12mm deep, M10 threads, 271 mm apart as shown above.

POWER OPTIONS: The unit is powered from an internal battery pack consisting of 21 off Alkaline cells connected in series.

RS485 OPTION: An optional RS485 link, using dedicated software, provides download of data by ASCII or Xmodem protocol. Standard terminal software such as HyperTerminal or TeraTerm can also be used.

1.1. CABLE OPTIONS

OEL CABLE	CABLE FUNCTION	CONNECTION POINT
6002_0103_B INTERFACE CABLE	LUMA 250LP/RS485 and ROV switch.	INTERFACE CONNECTION
6000_0107_D DLOAD CABLE	RS485/USB Download Cable	INTERFACE CONNECTION
6002_0105_A SINGLE SENSOR CABLE	Single pressure/temperature cable.	SENSOR CONNECTION
6002_0104_A DUAL SENSOR CABLE	Dual pressure/temperature cable.	SENSOR CONNECTION
6002_0106_A FLOWMETER CABLE	Single flow meter cable.	SENSOR CONNECTION

1.2. IK TRAX SHORTCUT

IK Trax offers a comprehensive range of resources to support the operation and configuration of the EMTx 50 device. To make accessing these materials easier, we've provided a QR code that allows you to instantly connect to our online resource hub using any mobile device. Simply scan the QR code to explore detailed guides, troubleshooting tips, and other essential materials to help you get the most out of your LOOP Subsea Data Hub.

2. SPECIFICATIONS

Below are the standard specifications for the LOOP. Please refer to the table on the cover of this manual for the specifications of the LOOP delivered with this manual.

GENERAL

Battery life at 5°C/40°F with LOW POWER mode DISABLED ..... 40* days

Battery life at 5°C/40°F with LOW POWER mode ENABLED.....105* days

Battery voltage 31.5V

Battery type .....31.5V Alkaline pack (OEL-000008)

Operating temperature range..... -5°C to +65°C/23°F to 149°F

Operating depth 3000m/10,000ft*

Pressure display resolution .....<1000BAR 0.001/0.01 or >= 1000BAR 0.01 bar/0.1 psi

Pressure sensor connection..... 2 off Burton 1508 5502 type connectors

Temperature display resolution .....0.1°C/0.1°F

Weight in air 15kg/33lb

*Battery life for LOOP when not powering interfaces, with 4 remote sensors connected.

MATERIALS:

Housing material .....ALLOY BRONZE CA104 EN 12163

Endcap material .....ALLOY BRONZE CA104 EN 12163

Bleed screw material.....ALLOY BRONZE CA104 EN 12163

Window material .....ACRYLIC

Endcap O-rings ..... 2x BS 50-243 NBR70 with 2x BS 250-243 PTFE BURs

Window O-ring ..... 1x BS 50-236 NBR70

Bleed screw O-ring ..... 1x BS 50-008 NBR70

OPTIONS:

Data communication RS485

Data format ..... 115200BAUD, N, 8 ,1

Sensor communication RS485

Sensor data format ..... 115200BAUD, N, 8 ,1

Sensor cable(s) OEL-006816-00V0B

Interface cable OEL-006817-00V0B

*imperial units have been rounded for clarity

3. RULES FOR SAFE OPERATION

⚠ **WARNING**: Any operation involving pressure is potentially hazardous. No person should use this equipment unless fully aware of the potential hazards of working with pressurised vessels. The purchaser of this equipment is responsible for the training and competence of operators and the manner in which it is used. This manual should be read through and understood before installation and commissioning so that the operator is familiar with the equipment. Contact IK Trax immediately should any difficulty arise in the use of this equipment.

The 6002SD may have a Pressure Relief Valve (PRV) at the bottom of the housing next to the pressure relief Bleed Screw. Should an internal pressure leak occur the PRV is configured to operate at > 5 – 10psi (>0.35 – 0.67BAR). It has a depth rating greater than that of the housing.

⚠ **CAUTION**: Care should be taken to ensure the PRV does not become blocked with debris.

⚠ **WARNING**: ALWAYS loosen the bleed screw to relieve any internal pressure prior to opening the unit.

⚠ **WARNING**: ALWAYS check for any signs of water ingress on retrieval after deployments. The bleed screw should be loosened and re-tightened on retrieval to ensure there has been no pressure build up in the unit during deployment.

⚠ **WARNING**: Always use caution when opening equipment which has been in a pressurised environment. It is possible for pressure to leak into the equipment and remain there even after external pressure has been removed. ALWAYS point the end to be opened towards a safe area and away from yourself or others. Contact Online Electronic immediately if there is a suspicion that the equipment has become pressurised.

⚠ **CAUTION**: Opening of the equipment should take place in a clean, dry, laboratory environment.

⚠ **CAUTION**: To prevent the formation of condensation within the unit, allow the unit temperature to stabilise within the laboratory environment for a minimum of 6 hours prior to opening.

⚠ **CAUTION**: It is possible for liquids to become trapped in threads and/or gaps around openings. ALWAYS point the end to be opened downwards to allow any trapped liquid to drain out of and not into the equipment.

⚠ **CAUTION**: Do not expose to aggressive solvents or chemicals which could be harmful to the HOUSING, O-RINGS, CONNECTORS or any other parts of the equipment.

⚠ **CAUTION**: If the external connector is unused, it MUST be fitted with a suitable blanking connector (e.g. BURTON 5501-1508-0000) to prevent conduction between the pins and malfunction.

⚠ **CAUTION**: A protective rubber cap is fitted over the control button to prevent ingress of debris. Always ensure that after pressing the control button it returns to the un-pressed position. If required the button can be un-screwed and rinsed in fresh water to clear out any debris.

4. OPERATION

NOTE 1 - IF ANY EXTERNAL CONNECTOR IS NOT USED THE BURTON CONNECTOR MUST BE FITTED WITH A BURTON 5501-1508-0000 BLANKING PLUG TO PREVENT CONDUCTION BETWEEN THE PINS AND MALFUNCTION.

NOTE 2 - ALWAYS LOOSEN THE BLEEDSCREW TO RELIEVE ANY INTERNAL PRESSURE PRIOR TO OPENING.

NOTE 3 - DO NOT EXPOSE TO AGGRESSIVE SOLVENTS OR CHEMICALS WHICH COULD BE HARMFUL TO THE HOUSING, NITRILE RUBBER O-RINGS, THE ACRYLIC WINDOW, OR CONNECTORS.

NOTE 4 - OPENING OF THE UNIT SHOULD ONLY TAKE PLACE IN A CLEAN, DRY, LABORATORY ENVIRONMENT.

NOTE 5 - TO PREVENT THE FORMATION OF CONDENSATION WITHIN THE UNIT ALLOW THE UNIT TO STABILISE WITHIN THE LABORATORY ENVIRONMENT FOR A MINIMUM OF 6 HOURS PRIOR TO OPENING.

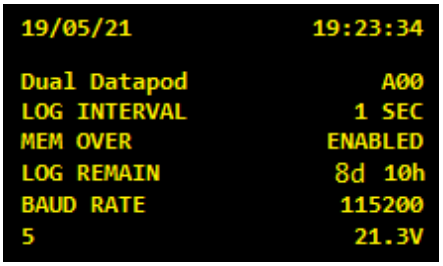
4.1. TURNING ON

To turn the unit on simply press and hold the control button until the IK TRAX logo is displayed.

After 5 seconds the 6002 product logo is displayed at which point the control can be released.

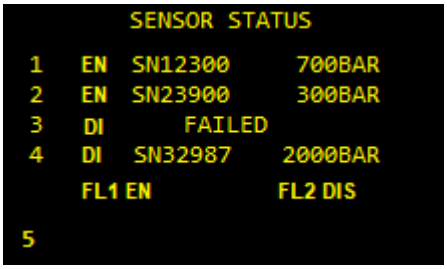
The LOOP will carry out a self-check of the RTC circuitry and logger memory. If any problems are detected then an error message will be displayed.

The next screen is the STATUS screen. This shows the current configuration of the log interval, memory overwrite setting, the remaining time left for logged data and the configured BAUD rate.

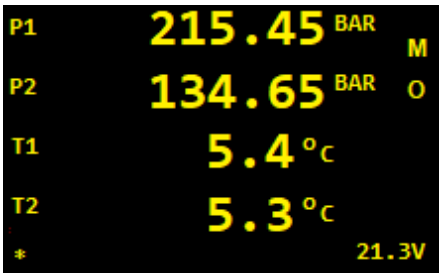


The LOOP will the try and communicate with all (4 off) possible sensors connected and display a status screen showing if the sensor is currently enabled (EN) or disabled (DI), the serial numbers and range of those sensors found. If Flow Meter interface is detected it also shows the status of the flow meter channels.

If a sensor is shown as FAILED but is connected its cable and connections should be checked.

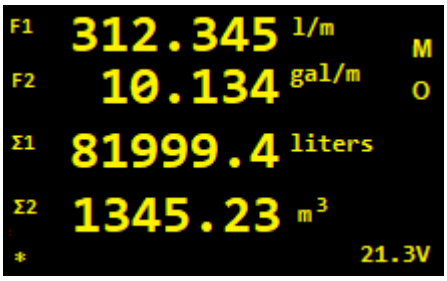


After displaying these screens the LOOP will begin displaying reading(s), based on the screen configuration (refer to Section 4.2.13), in the units configured.



A LOG message is displayed to confirm logging at the configured LOG INTERVAL. No logging message is displayed for logging intervals < 30 seconds.

If the value of the totalisers (when displayed) is greater than 1,000,000 the font reduces in size in order to display their value.



Status information regarding memory overflow (O), memory overflow enabled(M), ROV switch active (R) and switch active (S) may also appear if active.

An asterisk is displayed for half a second at the bottom left of the screen when a reading is taken (not necessarily logged) by the sensor every second.

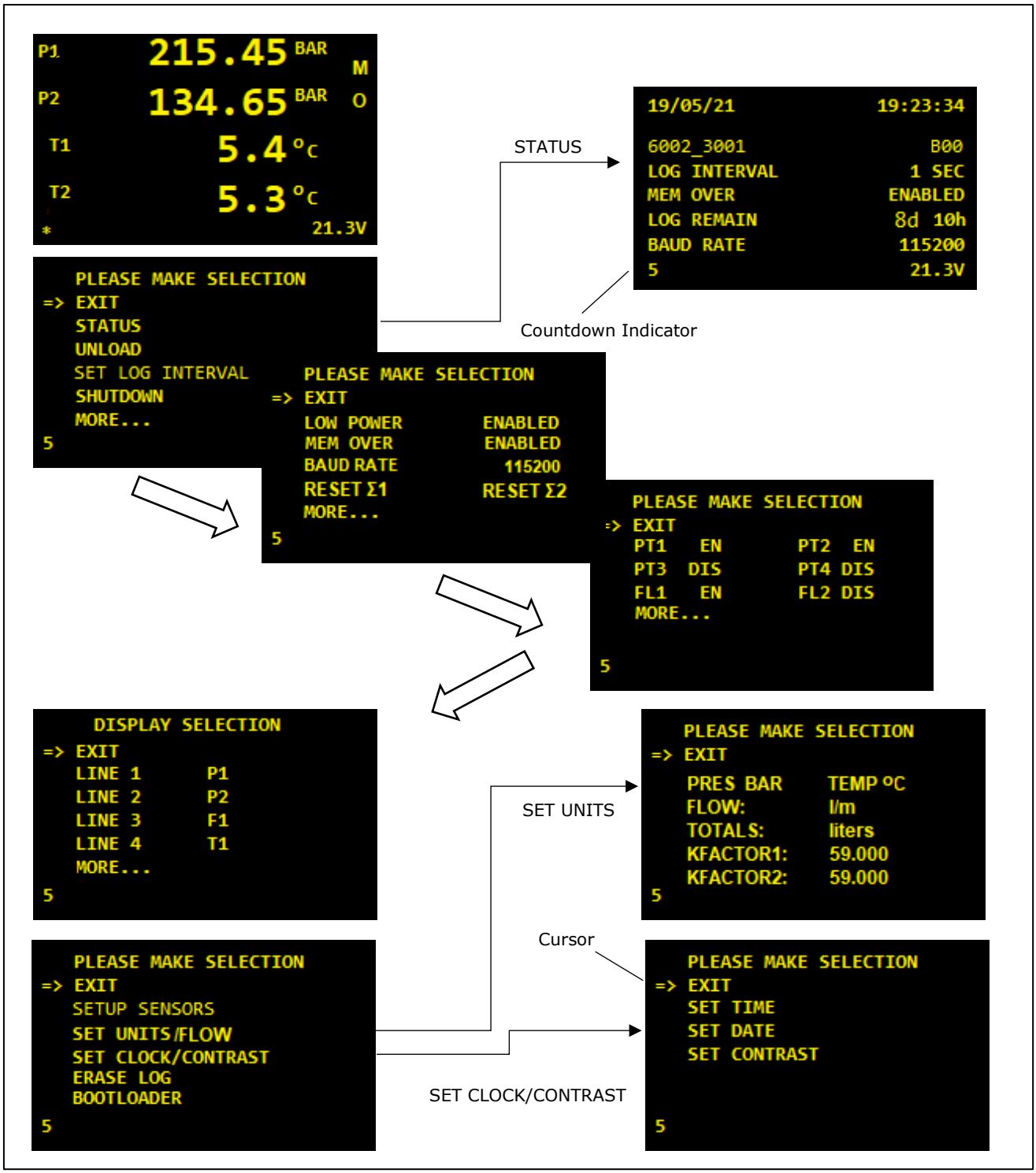
The battery voltage displayed is the minimum measured since the unit was powered up. This provides a more realistic battery terminal voltage as under load conditions this voltage drops as the battery is discharged.

Over time, as the battery is used/discharged, the battery voltage will drop. At lower values the LOOP draws more current speeding up this discharge period. For the alkaline battery pack used the end voltage ~21V. This is based on the individual cell voltage < 1.0V, the battery pack is made up of 21 alkaline cells. The LOOP does not shutdown automatically due to low batteries and can operate below the 21V indicated but the remaining battery life will be unpredictable. It is recommended that the battery voltage is checked before deployment and if approaching this end voltage a new battery pack is used.

4.2. SINGLE BUTTON MENU INTERFACE

Refer to the figure on the following page. At any point, while the LOOP is displaying reading(s), the control button can be pressed to enter the menu interface. From the menus the user can view and change several parameters which are discussed in this section.

While in the menu system, every time the user presses the control button the CURSOR will move down one line and the COUNTDOWN INDICATOR will be reset to 5. Once the CURSOR is pointing at the desired item the user simply allows the COUNTDOWN INDICATOR to reach 0 and the selected item will be executed. This simple behaviour is used throughout the menu interface to modify settings and interact with the LOOP unit.



4.2.1. EXIT

Every page of the menu system starts with EXIT. If EXIT is selected then the LOOP will exit to the previous menu screen and eventually resume taking and displaying readings from all enabled sensors. The menu system is designed so that if the control button is not pressed then the LOOP will always exit back through the menu system and resume taking readings as normal.

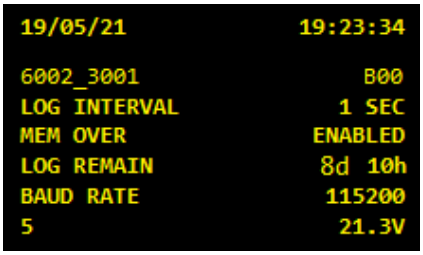
4.2.2. UNLOAD

Selecting this item causes the LOOP to unload all logged data via RS485. Refer to section 6 DATA UNLOAD for instructions regarding retrieving logged data. Selecting this item does not erase any logged data.

4.2.3. STATUS

The STATUS screen is shown at power-up after the LOOP logo and can also be viewed at any point by selecting STATUS from the menu system. It shows the Date, Time, Firmware type, Firmware version, Log interval, Memory overwrite setting and the remaining log capacity based on the current logging interval. If the capacity left > 10 days then only the number of days is displayed. If memory overwrite is enabled and the logging memory has already overflowed then 'LOG OVERWRITING' is displayed indicating that logged data is being overwritten. The current communications interface BAUD rate is also shown.

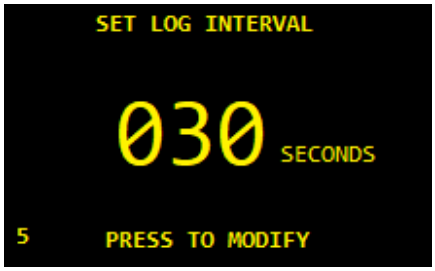
The STATUS screen can be halted by pressing and holding the control button for as long as necessary.



Ensure all settings are at the required values.

4.2.4. SET LOG INTERVAL

Selecting this item allows the user to change the LOG INTERVAL. The LOG INTERVAL can be set in seconds from 1 to 300 seconds. At each log interval the LOOP will log the Date (DD/MM/YY), Time (HH:MM) along with data from all enabled sensors. Refer to section and section 6.1.1 LOGGED DATA FORMAT for more information.



4.2.5. SHUTDOWN

Selecting this item switches off the LOOP. The LOOP is fitted with non-volatile memory which will remember all settings (such as LOG INTERVAL and LOW POWER mode) made via the menu system next time the unit is switched on.

4.2.6. MORE

Selecting this item shows the next page of the menu system. Refer to the figure in section 4.2 SINGLE BUTTON MENU INTERFACE to see the menu pages and items available.

4.2.7. LOW POWER ENABLED / DISABLED

This item shows the current state of LOW POWER mode as ENABLED or DISABLED. If LOW POWER is DISABLED then the display is permanently on and will update readings every 1 second.

If LOW POWER is ENABLED then the display turns on for 3 seconds every 15 seconds to show the sensor readings. Use of LOW POWER mode significantly increases battery life as the OLED display does consume significant current and should be selected where long term deployment and logging is required.

When LOW POWER is enabled for logging intervals of < 30 seconds then power is permanently applied to the sensors.

If either flow sensor is enbaled then power is permanently applied to the sensors.

4.2.8. MEM OVER ENABLED / DISABLED

This item shows configures MEMORY OVERWRITE as ENABLED or DISABLED. ENABLE MEMORY OVERWRITE to allow the logger to overwrite oldest data first should the logger memory become full. DISABLE MEMORY OVERWRITE to prevent the logger from overwriting old data should the logger memory become full.

4.2.9. BAUD RATE

Allows selection of communication BAUD rate. BAUD rates of 9600, 19200, 38400, 56700 & 115200 can be configured.

4.2.10. K FACTOR

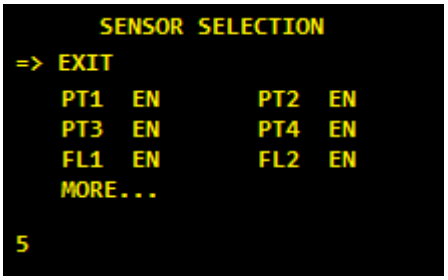
Allows individual selection of the K Factor for the flow meters connected. No facility exists to set a minimum or maximum flow rate.

4.2.11. RESET Σ1 & RESET Σ2

The totalisers can be reset. Confirmation is requested before being actioned.

4.2.12. SENSOR SELECTION

The Sensor Selection menu allows the user to ENABLE or DISABLE the reading of connected sensors.



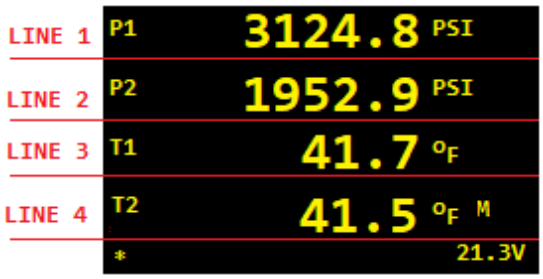
All sensors are logged at the Logging Interval whether enabled or disabled.

The LOOP will try to communicate with all sensors that are enabled and return a reading. Dashes will be displayed and 'sensor offline' status will be logged if the sensor fails to respond for whatever reason.

If a sensor is disabled then the LOOP does not try to communicate with the sensor. Sensor 'offline status' is logged for disabled sensors.

Note: It is important to disable sensors which aren't connected as delays occur when sensors do not respond slowing down the operation of the LOOP.

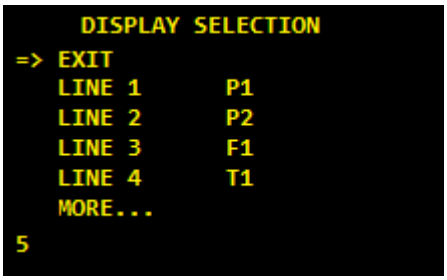
4.2.13. DISPLAY SELECTION



The LOOP display can be configured to display any combination of the readings taken.

The display is split into 4 lines of readings. The user can select any reading from the possible list of sensors (4 off pressure, 4 off temperature and 2 off flow) to be displayed on a line or leave a line blank.

Use the DISPLAY SELCTION MENU to select the reading required for each line.



Move the cursor to the line to be edited. Wait for the COUNTDOWN period to elapse.

The cursor will move to the reading type to be displayed.

Press the button to cycle through the possible reading types and blank.

Wait for the COUNTDOWN period to elapse to save the entry.

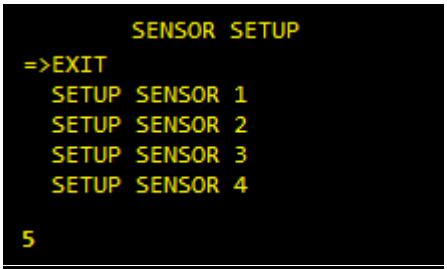
4.2.14. SETUP SENSORS

As standard the LOOP is configured for four digital pressure and temperature sensors with addresses 1, 2, 3 & 4. These addresses must be programmed into the digital pressure sensors. This can either be done using the digital pressure sensor manufacturers configuration software or using this menu item. Along with the address the sensors must be configured to communicate at 115200 BAUD. Communications with the sensors use MODBUS RTU protocol over RS485.

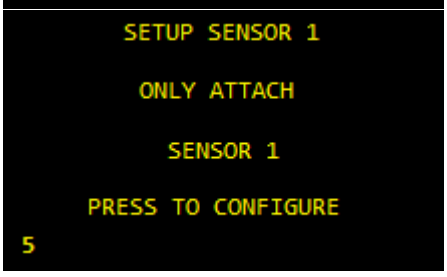
If new sensors need to be configured using the LOOP (as opposed to the sensor manufacturer software) then all sensors must be disconnected from the LOOP and each sensor, requiring configuration, must be connected in turn to the LOOP.

To program a sensor:

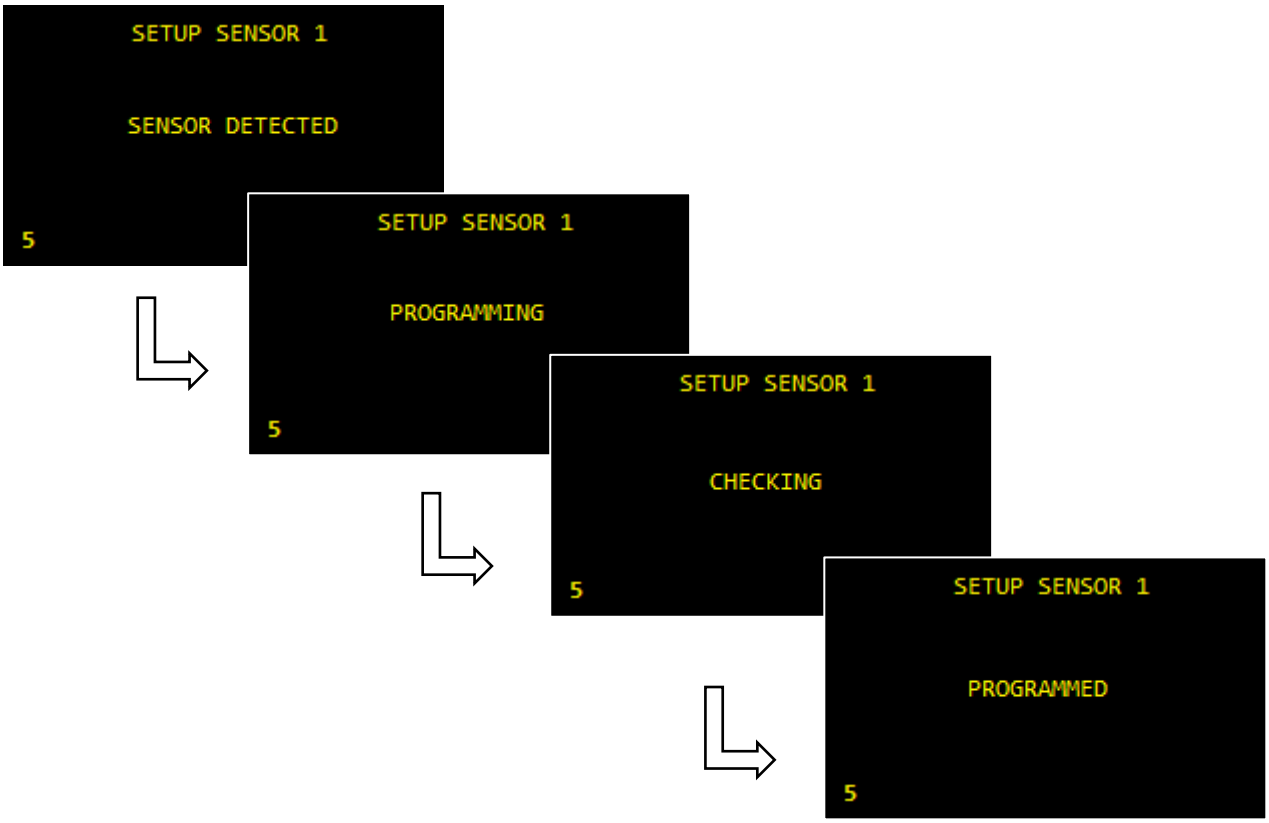
- Disconnect all sensors from the LOOP
- Connect the sensor to be configured
- Select SETUP SENSORS menu item
- Select the sensor to be configured



- The LOOP will try and communicate with the sensor attached.



- If successful it will display SENSOR DETECTED, PROGRAMMING, CHECKING and finally PROGRAMMED.

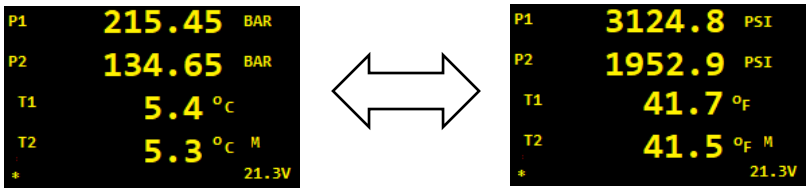


- If more sensors require configuration, then disconnect the sensor just programmed and repeat for each sensor.
- Once all sensors are programmed they can be attached to the cables in the required order.

4.2.15. SET UNITS/FLOW

This item allows the user to set both the units used for pressure (bar or psi) and temperature (Celsius or Fahrenheit) to be selected. Selection of units used for flow (l/min, gallons/min & m^3/min) and the totalisers (liters, US gallons & m^3) can also be configured.

To view or change settings, select this item. On the following screen select the units desired.



4.2.16. SET TIME & DATE

Enters further menu to allow time and/or date to be set. Follow the instructions given on screen to modify this value.

4.2.17. SET TIME

This item allows the user to set the internal time which is logged with each reading. Follow the instructions given on screen to modify this value.

4.2.18. SET DATE

This item allows the user to set the internal date which is logged with each reading. Follow the instructions given on screen to modify this value. Ensure a valid date is used, for example February does not have 31 days.

4.2.19. SET CONTRAST

This item allows the user to set the contrast, brightness, of the display. As with LOW POWER mode this can significantly improve battery lifetime and should be set to an acceptable level for clarity in order to aid this.

4.2.20. ERASE LOG

Selecting this item will erase all logged data once the user has been prompted to confirm. Configuration settings remain unchanged. Ensure that any important data has been unloaded and saved before selecting this item.

It is advisable to UNLOAD and save previous logged data and then ERASE the log prior to each deployment to ensure the log does not overflow and data is possibly lost.

4.2.21. BOOTLOADER

To allow software upgrades and/or fixes a bootloader has been incorporated in the software which allows OEL, or the end user, to re-program the unit via the LOOP Burton Interface Connector.

An application is required to be installed on a PC/laptop to download new firmware to the 6002 Dual Data Pod – OEL 6002_3102 UNL SOFTWARE. An updated firmware file is also required which will be downloaded to the LOOP using this application.

The process of upgrading the firmware should only be done with assistance/instruction of OEL personnel.

Download firmware upgrade manual OEL 6002_5002 DUAL DATA POD FIRMWARE UPDATE
Install OEL SerialBootloaderDataSource application.
Download new firmware 6002_3001 Dual Data Pod Firmware.hex

Connect the 6000_0107_D DLOAD CABLE to the LOOP Interface connector.

Follow the instructions in LOOP FIRMWARE UPDATE Section 4 to the point where a message 'Waiting for commands from the Master MCU…' is displayed.

On the LOOP menu, go to the BOOTLOADER item and select.

4.3. RAM ERROR

The LOOP contains a coin cell (BR2032) used to permanently power the Real Time Clock circuitry which stores the date and time as well as other system variables such as LOW POWER mode while the unit is turned OFF.

At switch ON the LOOP conducts a self-check on the RTC circuitry as per section 4.1 TURNING ON. If any problems are found then the error message shown will be displayed and the LOOP will reset all system variables to default values. Please contact IK Trax if you see this message. The most likely cause is that the coin cell has expired. See section 14.3, ROUTINE MAINTENANCE AND STORAGE, for more information.

Note that if the unit has detected a problem and has reset to default values (shown below) then an UNLOAD will result in the entire logger memory unloading and any blank areas in the memory will contain 'Fs' instead of numerical data.

PT1	ENABLED
PT2	ENABLED
PT3	ENABLED
PT4	ENABLED
FL1	ENABLED
FL2	ENABLED
MEM OVERFLOW	DISABLED
LOW POWER MODE	ENABLED
LOG INTERVAL	30 seconds
DISPLAY LINES	P1,T1,P2,T2
K FACTOR 1&2	59.0
PRESSURE UNITS	BAR
TEMPERATURE UNITS	CELCIUS
FLOW UNITS	L/M
FLOW TOTAL UNITS	LITERS

4.4. MEMORY FULL

At switch ON the LOOP conducts a self-check on logger memory as per section 4.1 TURNING ON. If the logger memory is found to be full then the message shown will be displayed.

If MEMORY OVERWRITE is DISABLED and the logger memory is FULL then the logger will not log any new readings and this error message will be shown every time the logger attempts to log.

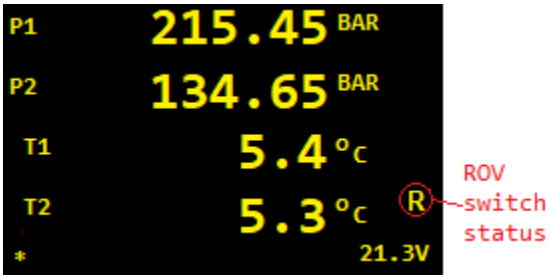
If continuous logging is required the memory should either be erased as per section 4.2.20 and/or MEMORY OVERWRITE should be ENABLED as per section 4.2.8 MEM OVER ENABLED / DISABLED.

5. ROV SWITCH

An externally connected ROV switch controls the operation of the Luma unit in order to reduce the power requirements when communications are not required.

When the ROV switch is rotated to the 'ON' position power is applied to the LUMA unit and communications with it are enabled.

When the ROV switch is first activated the display will show 'ROV SWITCH ACTIVE' for 3 seconds before reverting to normal operation. An 'R' will be displayed in the status area of the display whilst the ROV switch is active.



6. DATA UNLOAD

Data unload can be achieved using the 6000_0107 DOWNLOAD CABLE (OEL-000358-00V0D) attached to the INTERFACE CONNECTION (Figure 1) or via the LUMA L250LP connected to the LOOP using INTERFACE CABLE (OEL-006817-00V0B).

6.1. LOGGING CAPACITY

The LOOP unit is fitted with 32 Mbytes of internal memory available for logging allowing it to store over 2,000,000 records (1 record contains either 2 pressure & temperature readings or 1 flow and totaliser reading). If 4 off pressure sensors (2 records per reading) or 2 off flow sensors (2 records per reading) would equate to a logging capacity of ~12 days logging every second or ~1 year logging every 30 seconds or over ~2 year logging every minute. If the logging memory becomes full then it automatically wraps around and begins overwriting the oldest data first when memory overwrite option is enabled.

The LOOP unit can take a significant amount of time to transmit all logged data depending on how much data has been stored. Unloading the entire memory can take up to 60 minutes and the resultant file size will be many megabytes.

6.1.1. LOGGED DATA FORMAT

The LOOP only stores the readings from sensors that are enabled. Each record is TAB delimited format in columns representing 'Date Time', P1, P2, T1, T2, P3, P4, T3, T4, FL1, TOTAL1,FL2,TOTAL2 are respectively, only those enabled are displayed:

```
DD/MM/YY<SP>HH:MM:SS
              <TAB>P1<TB>P2<TB>T1<TB>T2<TAB>P2<TAB>T1<TAB>T2
                     <TAB>P3<TAB>P4<TAB>T3<TAB>T4<TAB>F1<TAB>TOTAL1<TAB>F2<TAB> TOTAL2<CR><LF>
```

Where <TAB>, <SP>, <CR>, and <LF> represent 'Tab', 'Space', 'Carriage Return', and 'Line Feed' characters respectively. This data can be loaded or pasted directly into a spreadsheet for analysis and/or for generating graphs. All pressure values are displayed to the resolution of the sensor connected, for <1000BAR 3 decimal places, for >1000BAR 2 decima places. >temperatures are displayed to one decimal place.

The LOOP unit transmits logged data in ASCII format at the BAUD RATE configured, 8 Data bits, No parity, 1 Stop bit, and with No Flow control. Any terminal program such as HyperTerminal or TeraTerm configured with these settings can be used to receive the logged data if required.

If a sensor has been disconnected, incorrectly addressed, or has malfunctioned then the sensor reading output will be replaced with dashes.

Ensure that the sensor is connected and that the address shown on the STATUS screen matches the address marked on the sensor itself.

Also ensure that the LOOP download cable is never left attached to the LOOP when the USB end is disconnected or connected to a PC which has been turned off.

6.2. LOOP XMODEM UNLOAD SOFTWARE

Communication with the Loop can be enabled using a protocol based on XMODEM file transfer protocol which provides robust half duplex communication and downloads the data in binary rather than text format.

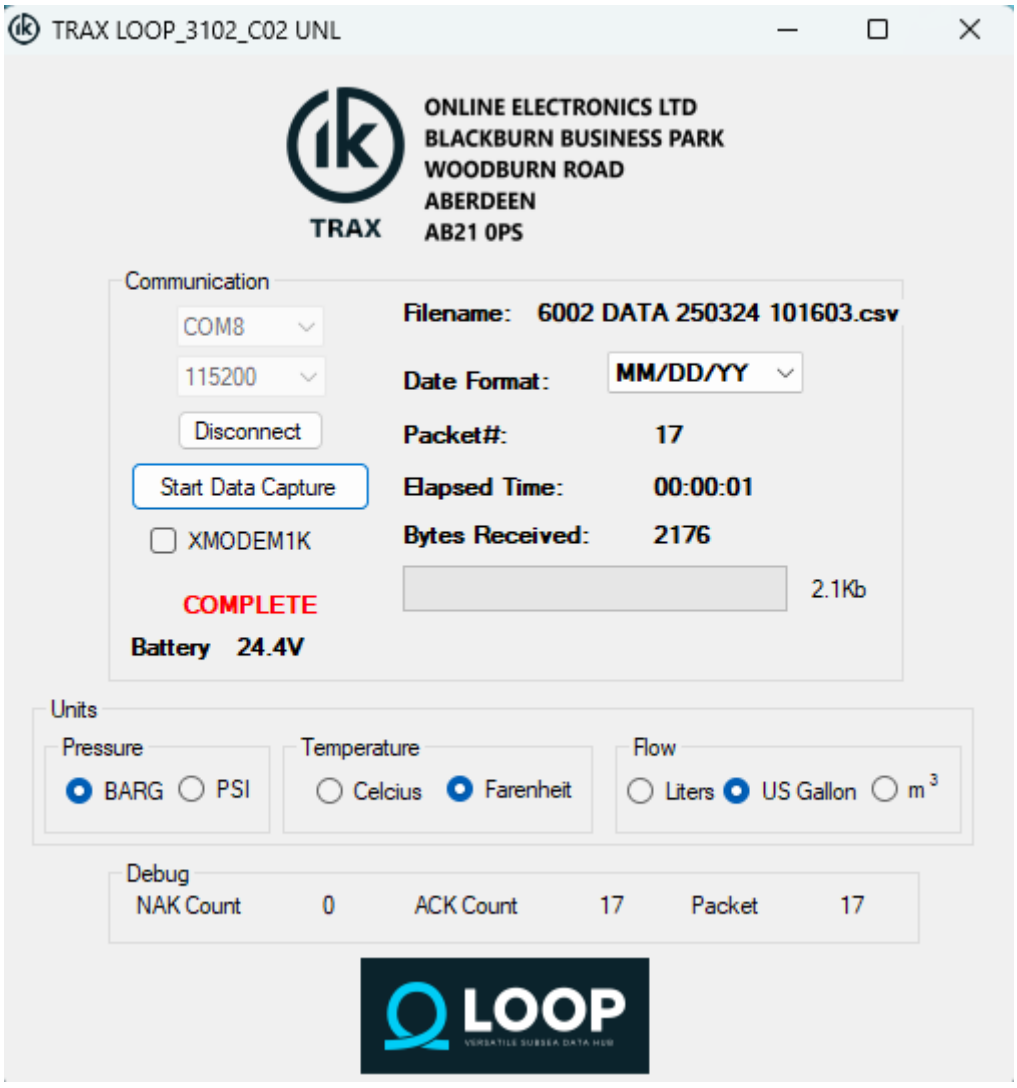
The LOOP is intended to be interfaced to a Hydromea LUMA 250LP optical modem subsea via INTERFACE CABLE (OEL-006817-00V0B) cable which has a Burton 1508 and MCIL6F connector to allow connection to the LOOP and the LUMA 250LP MCIL6 M tail.

The 6000SD DOWNLOAD CABLE can be used to download data when the unit is retrieved or tested topside.

1. For download topside or for testing connect the USB end of the 6000SD DOWNLOAD CABLE to a PC/Laptop and the Burton end to the Interface Connection on LOOP unit (Figure 1).

2. Referring to the figure below, open the software. Select the required units to be logged using the radio buttons in the Units section.

3. Select the COM port which the LOOP USB download cable is connected to in the 'Available COM Ports' drop down menu. If the correct COM port number is not known then each available COM port can be tried in turn until the correct one is found or the correct COM port can be identified from the Device Manager within windows (right click on My Computer> Properties> Device Manager).



4. For topside download turn the LOOP unit ON by pressing and holding the control button until the IK logo appears on the display.

5. Select the appropriate BAUD rate to match the BAUD rate configured on the LOOP.

6. Press the 'Connect' button to connect to the LOOP unit.

7. The tick box XMODEM1K enables transmission of 1 kilobyte blocks of data. If un-ticked the block size is 128 bytes and will take considerably longer to download data but may aid reliable transmission in difficult conditions (with reference to using the optical modem).

8. Press the 'Start Data Capture' button and a directory window will appear. Ensure that the location is somewhere easy to find such as the Documents. Captured data will be saved with filename 'LOOP DATA YYMMDD HHMMSS.CSV'.

9. Once a file location has been confirmed the application communicates with the LOOP. Whilst downloading data no readings are taken or logged. The LOOP will display 'XMODEM Unload'. The LOOP unit will handshake the data via the LUMA 250LP modem or download cable.

   During the download the packet count received will increment along with a progress bar showing the progress of the download with the total number of byes expected. The transfer process can take up to 60 minutes, depending on how much data has been logged. The process can be terminated at any point by pressing the Stop Data Capture button.

10. A message will be displayed if the download is successful or if the download is stopped. The download may display TIMEOUT if too many errors are encountered in which case the LUMA 250LP modem link should be investigated. After completion or if 'Stop Data Capture' button within the software to save the logged data to the 'LOOP DATA YYMMDD HHMMSS.TXT' file.

11. Open the 'LOOP DATA YYMMDD HHMMSS.CSV' file and ensure that the required data has been stored. Note the 'csv' file created may be too large for MSEXCEL to handle and may require an alternative application to be used for analysis.

12. If the unit has been retrieved the data on the LOOP unit can be erased by selecting the ERASE LOG option within the LOOP display menu. This means there will be less data to unload next time.

13. Press the 'Disconnect' button to disconnect from the LOOP unit and then exit the software.

14. Always disconnect the LOOP download cable from the LOOP when not in use. In particular never leave the download cable connected to the LOOP while the USB end is not connected to a PC or the PC has been turned off.

7. BATTERY REMOVAL

1. Opening of the unit should only take place in a clean, dry, laboratory environment.

2. To prevent the formation of condensation within the unit allow the unit to stabilise within the laboratory environment for a minimum of 6 hours prior to opening.

3. Loosen the bleed screw to relieve any internal pressure.

4. Remove the 4x M5 screws around the perimeter of the housing.

5. Carefully remove the housing from the endcap. Ensure that the O-ring seals are protected from damage and contamination while the unit is open.

6. The LOOP fitted with a single battery pack (31.5V Alkaline pack (OEL-000008)).

7. Ensure the unit is turned OFF before disconnecting each battery connector. Replace the batteries. Ensure all wires are installed neatly and protected from accidental damage.

8. Examine the O-ring seals for any signs of damage or contamination. Replace if necessary. Ensure the spiral tails of the Back-Up Rings do not protrude from the assembly before fitting the Endcap. These can be secured in place with silicone grease.

9. Reassemble the unit following the above instructions in reverse.

10. Tighten the bleed screw.

7.1. BATTERY LIFETIME

As with all battery powered equipment the operating temperature which the LOOP is used at alters the operating lifetime. Typically colder temperatures shorten the lifetime. For the standard Alkaline pack the lifetime at +20°C will typically be 20% more than the lifetime at +5°C. Please contact IK Trax for more details or to discuss your requirements.

The battery voltage displayed is the minimum measured since the unit was powered up. This provides a more realistic battery terminal voltage as under load conditions this voltage drops as the battery is discharged.

8. SOFTWARE INSTALLATION

There are three stages to the software installation. Instructions for each stage are given below.

8.1. MICROSOFT .NET FRAMEWORK INSTALLATION

The software supplied by Online Electronics requires the Microsoft .NET Framework to be installed on the host PC. For more information about the .NET, or to download the latest version, visit www.microsoft.com/net. The latest version can also be found on the software CD supplied by Online Electronics and can be installed by following the instructions below.

1. Log into the host PC as an administrator with full administrator rights.

2. Execute the dotNetFx40_Full_x86_x64.exe file found in the .NET folder on the CD.

3. Follow all instructions provided on screen to complete the installation.

8.2. LOOP SOFTWARE INSTALLATION

The LOOP unit transmits data in ASCII or binary format at selected BAUD rate (default 115200 baud), 8 Data bits, No parity, 1 Stop bit, and with No Flow control. Any terminal program such as HyperTerminal or TeraTerm configured with these settings can be used to receive the logged data.

The LOOP UNL software supplied by IK Trax is basically a simple terminal program which receives ASCII data from a COM or serial port. The Dual Data Pod_3102 software uses XModem protocol and binary data.

To install either of the dedicated software supplied by Online Electronics follow the instructions below.

1. Log into the host PC as an administrator with full administrator rights.

2. Execute the setup.exe file found in the LOOP UNLOAD folder on the USB thumb drive.

3. Follow all instructions provided on screen to complete the installation.

4. The software will now be available in the Start Menu directly or via a sub-directory on the Start Menu.

8.2.1. USB-RS485 DRIVER INSTALLATION

The LOOP download cable includes a USB to RS485 converter which requires VCP (Virtual COM Port) drivers to be installed on the host PC. For more information, or to download the latest version, visit www.ftdichip.com/FTDrivers.htm. The latest driver version can be found on the software CD supplied by Online Electronics and can be installed by following the instructions below.

1. Log onto the host PC as an administrator with full administrator rights.

2. Connect the USB to an available USB port on the host PC. If windows does not already have suitable drivers installed it will automatically detect the device and prepare to install drivers.

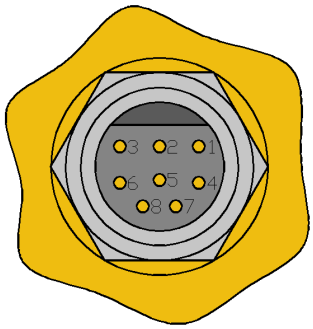
3. When prompted to, point windows towards the RS485 DRIVERS folder on the CD.

4. Follow all instructions provided on screen to complete the installation.

9. EXTERNAL DATA CONNECTION

THE LOOP IS NOT CONFIGURED FOR EXTERNAL POWER.
DO NOT CONNECT EXTERNAL POWER AS THIS WILL RESULT IN PERMANENT DAMAGE.

The unit is fitted with a Burton 5507-1508, 8 way, bulkhead connector to provide connection to external power, communications using 6002 Interface Cable Assembly (OEL-007982-00V0B), and other interfaces.



BURTON 5507-1508 BCR MATING FACE

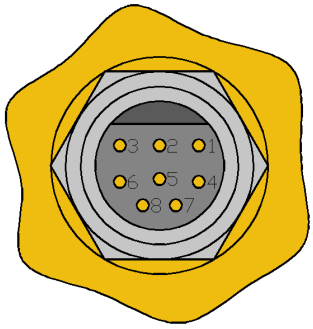
SIGNAL	BURTON CONNECTION
GND	1
SUPPLY TO EXTERNAL INTERFACE	2
NO CONNECTION	3
RS485 D-	4
ROV SWITCH	5
RS485 D+	6
NO CONNECTION	7
NO CONNECTION	8

10. REMOTE SENSOR CONNECTIONS

The LOOP is fitted with 2 of Burton 5507-1508 for connection to remote sensors.

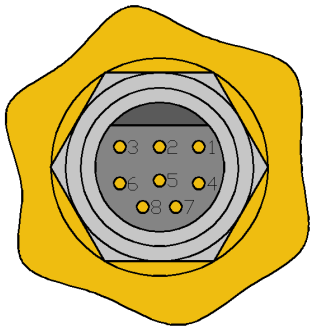
Remote pressure sensors can be connected individually via a 6002 Single Sensor Cable (OEL-008033-00V0A) or as a pair via Dual Sensor Cable (OEL-008032-00V0A).

10.1. REMOTE PRESSURE SENSOR CONNECTIONS



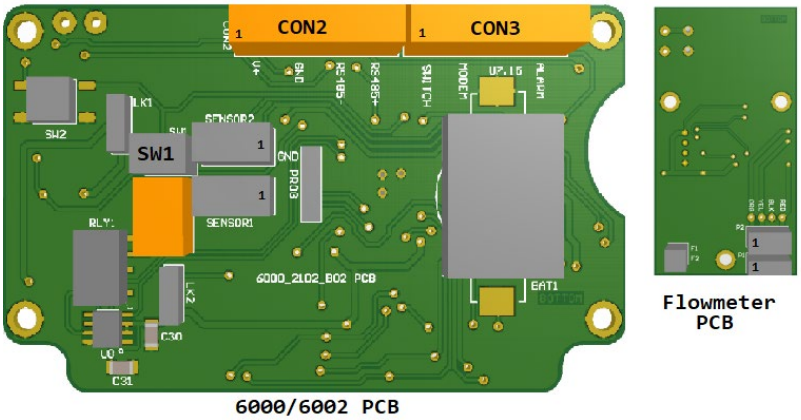
SIGNAL	BURTON CONNECTION
GND	1
SUPPLY TO PRESSURE SENSOR	2
NO CONNECTION	3
NO CONNECTION	4
NO CONNECTION	5
NO CONNECTION	6
RS485 D-	7
RS485 D+	8

10.2. REMOTE FLOW METER CONNECTIONS



SIGNAL	BURTON CONNECTION
GND	1
SUPPLY TO FLOW METER	2
PULSE INPUT	3
NO CONNECTION	4
NO CONNECTION	5
NO CONNECTION	6
NO CONNECTION	7
NO CONNECTION	8

11. PCB CONNECTIONS



Connections are made to the internal PCBs by wires to the Burton connectors. Where a flowmeter PCB is present (fitted to the battery compartment plastic cover) the battery is connected to connector block visible on the rear of the PCB.

The Flowmeter PCB is connected to the 6000/6002 PCB by a cable connecting to either SENSOR1 or SENSOR2 on the 6000/6002 PCB.

As there are only 2 off Burton connectors available for connection of pressure or flow inputs the sensor cables are wired internally to provide the necessary power and interface connections to the Burton connectors as detailed in Section 10.1and 10.2. Cables either containing pressure or flow or combining pressure and flow in one cable are available.

Pressure sensors are either connected directly to SENSOR1 & SENSOR2 connectors on the 6000 PCB or, when a flowmeter PCB is present, to P1 & P2 connectors on the flowmeter PCB.

Pressure Sensor Wiring SENSOR1/SENSOR2 on 6000/6002 PCB

PIN	Wire Colour	FUNCTION
1	ORANGE	RS485+
2	YELLOW	RS485-
3	BLACK	SUPPLY 0V
4	RED	SUPPLY +ve

Flowmeter Sensor Wiring F1/F2 on Flowmeter PCB

CONNECTOR	PIN	Wire Colour	FUNCTION
F1/F2	F1	PINK	FLOW PULSE
F1/F2	F2	BLUE	FLOW PULSE
P1 or P2	3	BLACK	SUPPLY 0V
P1 or P2	4	RED	SUPPLY +ve

12. OPTICAL MODEM OPTION

The LOOP interface provides an interface to a Hydromea LUMA 250LP optical data modem using 6002 INTERFACE CABLE. The interface uses RS485 communications at various BUAD rates with N, 8, 1 format.

The LUMA 250LP modems have been marked 'ROV' and 'LOOP'.

The unit marked 'LOOP' should be connected to LOOP using the 6002 Interface Cable.

The unit marked 'ROV' should be interfaced to the ROV communications port.

Both LUMA 250LP units have been configured using Luma Configuration Utility 250LP software with:

LUMA Configuration Parameter	Value
Serial Baud Rate	115200
Optical Baud Rate	250000
Max. Packet Size	64
Data Wait Time	1000
Bi-Directional Gap	0
Forward Error Correction	None
Packet Transmit Mode	4.1
Transmit Power	3

These values can be adjusted by the user although some advice from Online Electronics or Hydromea may be sought.

The LOOP is battery powered and to maximise battery lifetime, given the significant time that may be required to download data, the Transmit Power should be reduced to a value which provides reliable communication whilst keeping power drain to a minimum.

To aid battery life the Luma 250LP connected to the 'LOOP' has been configured with an AUTO SLEEP DELAY of 60 seconds and the Luma 250LP connected to the ROV has been configured for BEACON MODE of 20 seconds. This means that if no beacon signal is received from the Luma 250LP connected to the ROV the modem connected to the LOOP will go into a very low power sleep mode conserving battery power until needed. It should be noted that light sources present during sleep mode (ROV lights etc.) may partially wake up the modem causing it to draw higher currents.

During retrieval of data subsea the LUMA 250LP on the ROV should be switched on. On switch on it will then start to transmit beacon signals every 20 seconds (or as configured). Once both modems are in range the modem connected to the LOOP will wake up and start consuming power. There is no indication provided of exit from SLEEP MODE although if communications are started (using the OEL LOOP Xmodem UNL software) then the modems will start to communicate.

It is therefore possible to drain the battery of the LOOP if other light sources are bright enough to cause it to come out of sleep mode.

See section 6.2 LOOP XMODEM UNLOAD SOFTWARE or detail of using the software.

13. DEPLOYMENT CONSIDERATIONS

The following section does not provide a comprehensive deployment procedure as every deployment is different; however it does outline the most important considerations when deploying the LOOP and should be read and understood well in advance of deployment.

At least 24 hours prior to deployment any personnel who will be involved with the operation of the LOOP should review this entire manual to familiarise themselves with the unit. They should also be allowed time to operate the unit on deck. Simply allowing personnel to 'play' with the unit before it is actually deployed can save significant costs compared to deploying the unit without understanding how it works and then suffering from an unnecessary operator error.

OEL recommend fitting new battery packs before each deployment to ensure longest possible lifetime should the job be unexpectedly extended.

Turn the unit on and confirm that it is configured as required and functioning. Check that the unit is logging data and the data can be unloaded successfully.

Ensure that any unused connectors are suitably blanked (e.g. with Burton #5501-1508-0000) to prevent conduction between pins and malfunction when submerged in saltwater.

14. MAINTENANCE

NOTE 1 - IF THE EXTERNAL CONNECTOR IS UNUSED IT MUST BE FITTED WITH A SUITABLE BLANKING CONNECTOR (e.g. Burton 5501-1508-0000) TO PREVENT CONDUCTION BETWEEN THE PINS AND MALFUNCTION.

NOTE 2 - ALWAYS LOOSEN THE BLEEDSCREW TO RELIEVE ANY INTERNAL PRESSURE PRIOR TO OPENING.

NOTE 3 - DO NOT EXPOSE TO AGGRESSIVE SOLVENTS OR CHEMICALS WHICH COULD BE HARMFUL TO THE HOUSING, NITRILE RUBBER O-RINGS, THE ACRYLIC WINDOW, OR CONNECTORS.

NOTE 4 - OPENING OF THE UNIT SHOULD ONLY TAKE PLACE IN A CLEAN, DRY, LABORATORY ENVIRONMENT.

NOTE 5 - TO PREVENT THE FORMATION OF CONDENSATION WITHIN THE UNIT ALLOW THE UNIT TO STABILISE WITHIN THE LABORATORY ENVIRONMENT FOR A MINIMUM OF 6 HOURS PRIOR TO OPENING.

14.1. O-RING REPLACEMENT

The product uses the following O-rings:

1x 50-008 groove in piston bleed screw O-ring.
2x 50-243 groove in piston endcap O-rings with 2x 250-243 PTFE Back Up Rings.
1x 50-236 groove in flange window O-ring / 1x 50-237 groove in piston window O-ring.

Ensure the free space at the tails of the spiral back up rings are filled with silicone grease and then apply a layer of grease over the seams to secure them in place. The spiral tails should not protrude from the assembly.

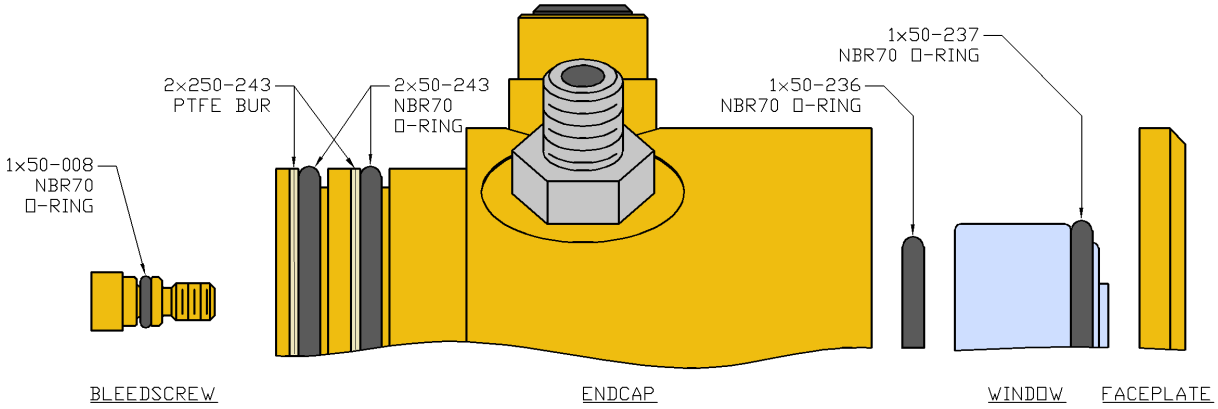


Figure 2

14.2. SUBSEA CABLES / CONNECTORS

Subsea connectors require regular cleaning and lubrication to ensure that contacts are clean, electrically isolated from each other and to prevent water intrusion when submerged. Before every deployment all subsea connectors and cables should be visually inspected for any visible signs of cable sheath damage, crush damage, bending damage, poorly mated or misaligned connectors etc. Seal all unused connectors with appropriate blanking caps or plugs to prevent water ingress and corrosion. Every time a connector is unmated and at least every 6 months all connectors should be inspected as follows:

1. Disconnect the connector without pulling on the cable and with no rocking or twisting motions.

2. Inspect both mating halves of the connector. Check that all connector contacts are free of any accumulation of chemical deposits, saltwater, sand, mud or other debris and that all contacts are undamaged and aligned properly.

3. Accumulation of debris or corrosion should first be removed with fresh water and a brush where required, then cleaned with a suitable contact cleaner and lubricant. Do not use chemicals which could damage the connector rubber such as WD40. Any O-rings must be inspected and if marked or damaged they must be replaced.

4. When mating connectors, lubricate the connector interfaces with Molykote 111 compound (or Silicone grease) sparingly. The two halves should be pushed squarely together with no rocking or twisting motions. If the connectors have to be forced together then something is probably wrong. Do not use the locking sleeve to pull or force the connectors together. Do not over tighten the locking sleeve as this can deform the contact alignment. Locking sleeves should be tightened firmly by hand only, when the connector is subsea the water pressure will hold the connections tightly together.

14.3. ROUTINE MAINTENANCE AND STORAGE

All IK Trax products are designed to require minimum maintenance. The housing should be cleaned using fresh water and cleaning agents after each deployment and as otherwise necessary. Do not use chemicals which could be damaging to the housing, the nitrile rubber O-rings, the acrylic window, or any connectors.

Especially clean out areas where salt water can collect and is difficult to flush out such as the Control Button. This should be carefully removed and cleaned out every 3 months and before the unit is put into storage.

The LOOP contains a coin cell (BR2032) used to permanently power the Real Time Clock circuitry which stores the date and time as well as other system variables such as LOW POWER mode while the unit is turned OFF. This battery should be replaced every 5 years at IK Trax premises.

If the unit is to be placed in storage for a long period of time ensure the unit has been cleaned and disconnect the main battery.

15. DISPOSAL OF UNIT

IK Trax takes its responsibilities under the WEEE Regulations extremely seriously and has taken steps to be compliant in line with our corporate and social responsibilities. In the UK, OEL has joined a registered compliance scheme WeeeCare (registration number **WEE/MP3538PZ/SCH**).

Electrical and electronic equipment should never be disposed of with general waste but must be separately collected for the proper treatment and recovery.

The crossed out bin symbol, placed on the product, reminds you of the need to dispose of it correctly at the end of its life.

When buying a new product you will have the possibility to return, free of charge, another end of life product of equivalent type that has fulfilled the same functions as the supplied equipment.

These items may be deposited at:

IK Trax
Online House
Blackburn Business Park
Woodburn Road
Aberdeen
AB21 0PS
UK

Alternatively, to arrange a collection of any waste electrical equipment, obligated to OEL please telephone WeeeCare on **0844 800 2004**.

16. WARRANTY

Online products are guaranteed for one year from the date of purchase. Goods should be returned transportation prepaid to Online Electronics Limited, Blackburn Business Park, Woodburn Road, Aberdeen.

There is no charge for parts or labour should any product require repair due to a manufacturing deficiency during the guarantee period.

In the event of a manufacturing deficiency the inward transportation costs will be repaid to the client.