FCS™ The Sound Choice for Leak Detection.™

Intelligens

User Manual

This manual contains important safety and operating information.
Please read, understand, and follow the instructions in the manual
and also any safety / approvals or Intrinsic Safety (ATEX, IECEx or UKEX)
Safety Supplement documents shipped with the device.

TABLE OF CONTENTS

1. INTRODUCTION

Thank you for choosing an HWM data logger, we trust it will provide you with many years of service. The individual configuration of your logger may differ slightly from the detailed descriptions that follow, but any additional setup information that you need, should be available from our website.

"Intelligens" is a multi-purpose data logger device that can be built and configured to suit specific applications; several models are available. Please contact your sales representative for help with selection of an appropriate model and other items for your application.

"**COMlog-IS**" is also a multi-purpose logger, being based on the same design as the Intelligens. This user-guide shall use the term **"Intelligens"** to describe both logger families.

The logger consists of a main unit, with several (optional) plug-in units; The plug-in units are to be considered as extensions to and part of the logger; (see sections 11.2, 2.2 and 2.3).

Intelligens is designed for use in potentially explosive atmospheres, being an 'intrinsically safe' logger device. It is the responsibility of the installer to correctly specify and install the Intelligens in conjunction with other equipment, making the appropriate checks for safety markings and suitability for inter-connection of the equipment. See section 1.2. The installer should also follow any safety rules or guidelines that may be in place for the site.

Note: The logger can also be used in non-ATEX installations.

1.1. DOCUMENTATION AND SUPPORT OF PRODUCT

This user-guide covers the following models:

Model Number	Device Description
H95 / * / * / IS	Intelligens logger (main unit). COMLog-IS logger (main unit)
ESI2 / * - * / IS / *	External Sensor Interface (Intelligens plug-in option) (Series includes various depth or pressure transducers).
ESIB2 / 00V* / * / * / IS,	External Sensor Interface with Battery (Intelligens plug-in option) (Series provides 0-1V input for sensors)
ESIB2 / 002* / * / * / IS,	External Sensor Interface with Battery (Intelligens plug-in option) (Series provides 0-10V input for sensors)
ESIB2 / 005* / * / * / IS,	External Sensor Interface with Battery (Intelligens plug-in option) (Series provides a 4 to 20mA input for sensors)
ESIB2 / 5251 / * / * / IS	External Sensor Interface with Battery (Intelligens plug-in option) (Unit provides two 4 to 20mA inputs for sensors)
ESIB2 / 00M1 / * / * / IS,	External Sensor Interface with Battery (Intelligens plug-in option) (Unit provides a Modbus input for sensors)
ESIB2 / 00Q1 / * / * / IS	External Sensor Interface with Battery (Intelligens plug-in option) (Unit provides am SDI-12 input for sensors)
COMMS USB/IS, COMMS-Y USB/IS	COMMS BOX (Serial Communications lead) COMMS BOX (Serial Communications lead. Y-type)

This user-guide must be read in conjunction with:

Document Number	Document Description
MANEX-142-0002	Intelligens / COMLog-IS - Safety Supplement
MANEX-142-0003	External Pressure Sensor - Safety Guide
MANEX-142-0004	External Sensor Interface - Safety Guide
MANEX-142-0005	External Sensor Interface with Battery - Safety Guide

This user-guide should be read in conjunction with:

Document Number	Document Description
MAN-142-0008	Safety Warnings and Approvals Information (Intelligens)
Also read the user-guide for the setup tool used with your logger:	
MAN-130-0017	User Guide: IDT (PC version).

This user-guide provides details of the logger operation and how to install the product. You should also read the relevant parts of the IDT user-guide for guidance on how to confirm settings or modify the set-up of your logger. Also refer to any user-guides, safety information or datasheets for sensors that are applicable for your particular installation.

Note: The logger and programming tool may periodically have new software features added. These may lead to minor changes from the diagrams and features described in this manual. Available features can also vary depending on the model number of the logger. Therefore, always refer to the IDT screens to determine which features are available on the unit you are installing.

HWM provides support of the logger devices by means of our customer support webpages:
https://www.hwmglobal.com/help-and-downloads/

Should you have any questions that are not covered by this manual or online help, please contact the HWM Technical Support team on +44 (0) 1633 489479,
or email cservice@hwm-water.com

1.2. Safety Considerations

The Intelligens is an intrinsically safe logging device, designed for use within potentially explosive atmospheres. When installed in such an environment, Intelligens is required to be connected to other compatible devices that are approved for use within potentially explosive atmospheres.

Certification of Intelligens includes the following schemes (dependant on model):

Check the labels for the presence of any required approvals marks prior to use.

⚠ **Note**: Where this manual uses the terms “Intrinsically Safe” or “ATEX” throughout its content, this must be understood to mean whatever intrinsic safety standards (ATEX, UKEX, IECEx) are relevant or applicable to the country of installation.

⚠ **Note**: The installer is responsible for ensuring the logger and any connected equipment are certified for use and are also compatible for interconnection.

Safety Note:

Before continuing, carefully read and follow the information in the “**Safety Warnings and Approvals Information**” document supplied with the product. This provides general safety information. The installer or maintainer must also refer to the **Safety Supplement / Safety Guide**

documents, supplied with the main unit and other (optional) units that are part of the logger. These provide additional ATEX-related safety information, including port parameters.

Retain all documents for future reference.

Before using this product:

- Make a risk assessment of the installation site and expected work activity.
- Installations in a hazardous environment (e.g., ATEX) should be carried out by appropriate technicians with suitable training for that environment.
- Ensure any tools necessary for installation are suitable for use within the hazardous environment.
- Ensure suitable PPE (personal protective equipment) is used and that safe working practices are followed during installation or maintenance.
- Check with the site owner or supervisor for any additional safety requirements before commencing work.
- Ensure any equipment being used to assist in the install or setup of the logger is also suitable for use in any hazardous environment in which you are working.

Within an **ATEX environment**, only use an Intrinsically Safe model of the logger:

- Confirm the model number is for an intrinsically safe unit.
- Confirm that the logger label has suitable ATEX markings.

Before connecting the logger to sensors or other apparatus:

- Check the sensor or apparatus is approved and certified for use within the intended installation environment.
- Confirm the equipment has suitable ATEX markings and is being operated within its ATEX limits.
- Check the port parameters of the relevant logger interface and the equipment to be attached. Confirm they are suitable for interconnection.
- Check each item of equipment has a suitable cable and connector attached for interconnecting to the logger. A water-tight connection is required. For an ATEX environment, any materials used, and workmanship must meet the required ATEX standards.

Note: The logger can also be used in non-ATEX applications.

Before entering hazardous area:

- Check all equipment and apparatus have the right approvals and certifications for use within the intended installation environment.
- Confirm the equipment has suitable ATEX markings and is being operated within its ATEX limits.
- Check the port parameters of the relevant logger interface and the equipment to be attached. Confirm they are suitable for interconnection.

1.3. Operating Temperature

Refer to the product's Datasheet or your sales representative for guidance on the storage and operating temperature range of the logger device. Ensure the unit is within the operating temperature range prior to installation.

1.4. Use of Cellular networks – Important Notes

Availability of SMS

The logger includes the ability to communicate to a server via use of the cellular data network. This is usually via the regular data network (which gives internet access). Alternatively, the SMS (Short Message Service) messaging can be used; in most cases this will be as a fall-back if the logger is temporarily unable to access the regular data network. If configured for SMS use, the logger uses the available **4G network**.

Important: 2G (GPRS) services, which carry the SMS messaging system, are slowly being turned off around the globe. Once 4G is switched off, the SMS services available within the logger will no longer be able to function.
Unless deactivated in the logger settings, the logger will continue to try, wasting battery power. Therefore, check with your cellular network operator for their switch off date before setting the logger to use the SMS backup service or any other feature requiring SMS use.

To deactivate the use of the SMS system, any related SMS settings must be removed (switched off or deleted). Refer to the IDT User Guide for details of SMS settings.
Any modified settings must be saved to the logger.

Note: For use of SMS services, both the logger and the cellular network provider must support SMS. In addition, the SIM card fitted inside the logger must support SMS use. (Check with your SIM supplier if required).

Logger identity when using SMS

When using the cellular data network, the logger identity is included with the data within the message. However, when using the SMS system, the identity is the calling number (from the SIM card). Thus, when using any SMS services, these two numbers (IDT setting of logger telephone number and SIM telephone number) must match.

1.5. Viewing Data

To view logger data **remotely**, a viewing tool (website) is required, which presents the data stored for the installation site. Various websites are available. The choice of website will depend on the type of sensors used and their application.

Data from your logger can also be viewed **locally** using IDT during a site visit.

Refer to any user-guide or training materials available for your viewing tool and also the IDT user-guide for further information.

1.6. IDT – Software Tool (for logger programming and tests)

A software tool, known as "IDT" (Installation and Diagnostic Tool), is available for checking or making adjustments to the logger setup and also for testing the logger operation within its installed site. Prior to IDT being able to perform these functions, it has to 'connect to' the logger; this simply means that the two end devices (logger software and IDT software) are able to communicate with each other over a working communications path.

IDT is available in two versions. However, the Intelligens logger is compatible with:

- IDT (for PCs having a Windows-operating system), sometimes referred to as 'IDT (PC)'.

Refer to the IDT (PC) User-Guide (MAN-130-0017) for details of how to prepare your PC for communicating with the logger. IDT provides a graphical user interface to access various logger

settings and functions. The IDT user-guide provides setup steps and a description / explanation of each setting or control.

1.7. Cross-reference: Connector – Circuit Entity

The logger interface descriptions can sometimes differ between the labelling of the connection (see logger labels) and the entity parameters (see the Safety Supplement document).
The following cross-reference table is provided for your information:

Logger Connector Label	Circuit Entity
ANTENNA (FME SOCKET), PLASTIC ANTENNA, PLASTIC ANT CONNECTOR	GSM Antenna. Simple Apparatus
EXT POWER INPUT	External Power Inputs
(*Includes*) COMMS	Configuration Interface
(*Includes*) QUAD INPUT, (*Includes*) 2CH INPUT, (*Includes*) DUAL CH PULSE, (*Includes*) GLD PULSE UNI-D, (*Includes*) GLANDED PULSE	Flow/Status Inputs
(*Includes*) SINGLE PULSE REP, (*Includes*) DUAL PULSE REP, 2X USER CONFIG OUTPUTS	Pulse Replication Outputs
EXTERNAL mV SENSOR INPUT	External Pressure Sensor
EXT TEMP INPUT	PT100 Temperature Probe. Simple Apparatus
MODBUS INPUT (ESI), SDI-12 INPUT (ESI)	External Sensor Interface
ULTRA SONIC INPUT, RADARSENS INPUT	SonicSens Ultrasonic Level Sensor, External Equipment Power Output
SONIC SENS INPUT (Note: SonicSens2 does not use the External Equipment Power Output)	SonicSens Ultrasonic Level Sensor, External Equipment Power Output

2. Overview

2.1. Logger Device (main unit)

2.1.1. Physical Features & Connector Identification

The Intelligens logger family is flexible in design and can be built to suit a variety of uses. It has a plastic enclosure and is of a waterproof construction, using seals to keep out water.

An example of the logger (main unit) is shown in Figure 1. It is powered by a non-rechargeable Lithium battery. The life of the battery can vary with its orientation; Figure 1 shows the orientation that will give best battery life.

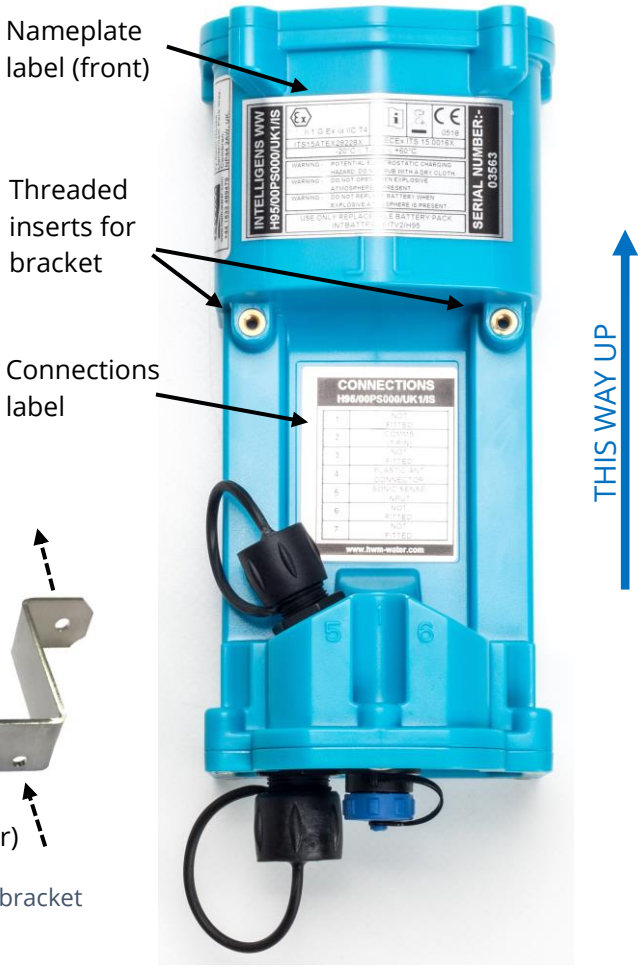


Figure 1. Intelligens logger (main unit)

The front face of the logger includes two threaded inserts for connection to an optional fixing bracket, which provides a means of wall-mounting the unit.

An example mounting bracket is shown in Figure 2.

(Consult your HWM representative about fixing bracket options).

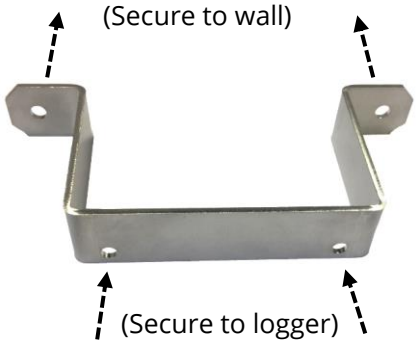


Figure 2. Example mounting bracket

Various labels are present on the logger.
These include: an 'SMS number' (phone number),

- The front nameplate label, which includes the logger part-number and its serial number, also includes any ATEX related approvals markings and safety warnings.
  (It is an IS requirement that the information is visible once the device is installed).
- The rear labels show additional information, including manufacturer details.
- A label on the side of the unit shows the serial number and phone number allocated to the device.
  It may also include information about any special protocol employed for communicating to the server.
  (See Figure 3, for example).

Figure 3. Side label.
(Can show if model uses a non-standard server protocol)

- A ‘Connections’ label is located in the middle of the front face of the logger. (See Figure 4 for example).

  This label identifies the types of interfaces included in the built logger and the physical location used for the connector.
  (See also section 1.7).

The physical locations of the connectors, which are on the lower section of the logger enclosure, are shown in Figure 5. The number of connectors fitted, their type, and their location will depend on model number.

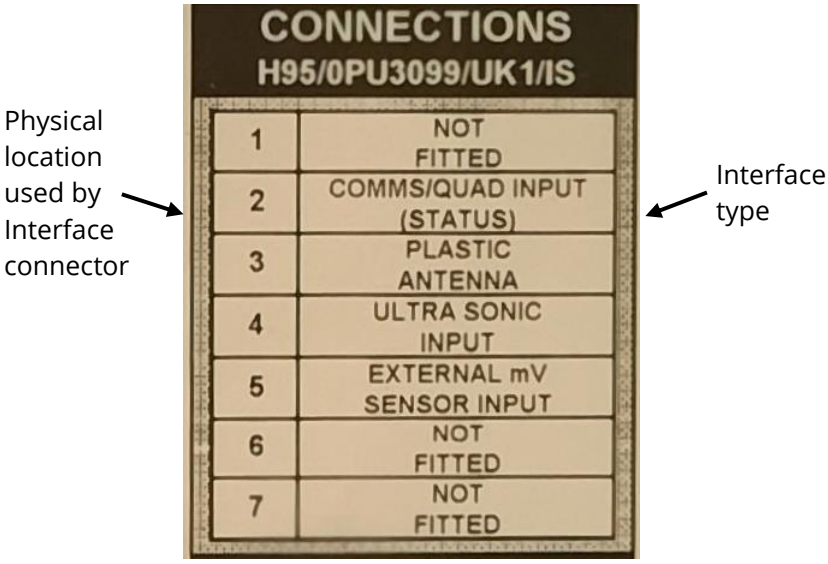


Figure 4. Connections label (example)

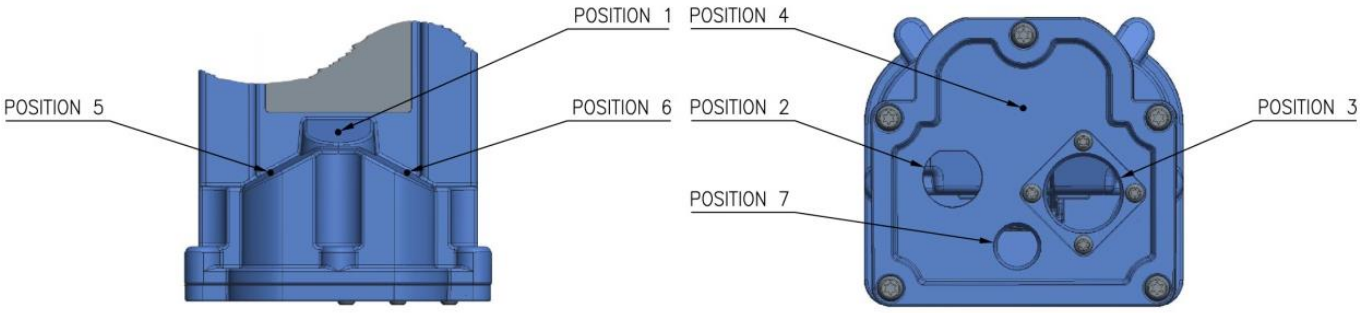


Figure 5. Map of (numbered) physical locations available for connectors.
(Holes shown are for illustration purposes only).

For convenience, the connector locations can be found by inspection of the plastic enclosure.

(See Figure 6).

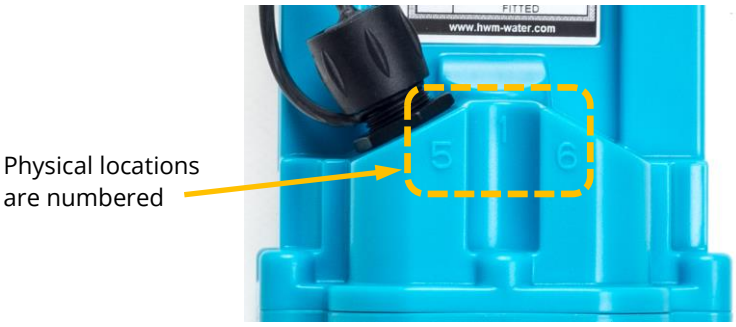


Figure 6. Numbered locations are shown in plastic enclosure.

2.1.2. NAME VARIANTS

The logger can be labelled as one of the following, depending on its build configuration and intended application:

- Intelligens WW … (see example opposite)
- Intelligens GNS
- Intelligens PRS
- COMLog IS

All are approved under the same ATEX certificates.

Logger name appears on nameplate labels and top face.

2.2. ESI (EXTERNAL SENSOR INTERFACE) UNIT

The Intelligens logger can be extended with an 'External Sensor Interface' unit (see Figure 7).

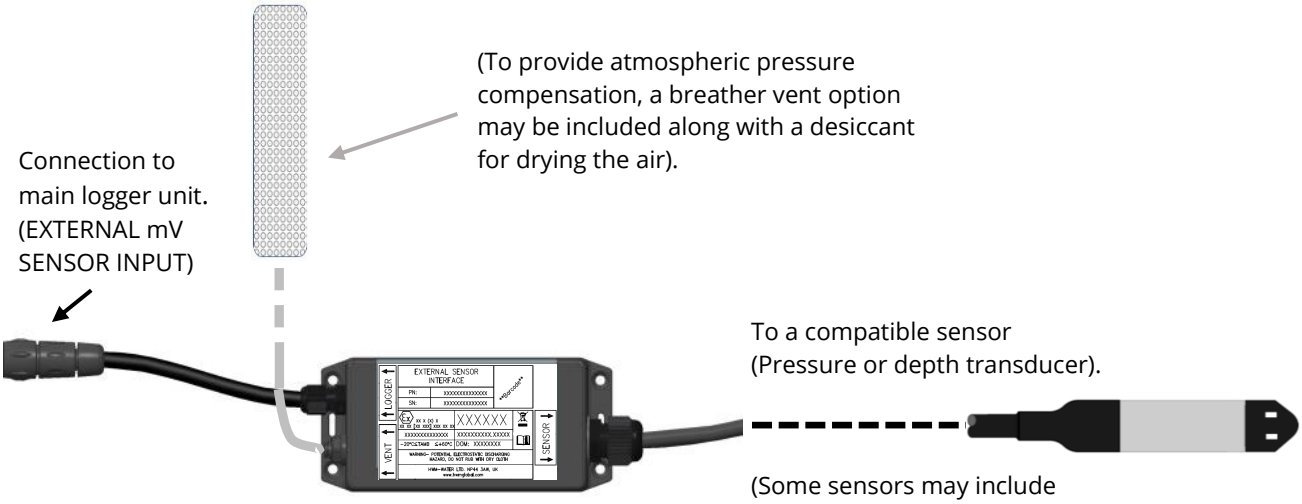
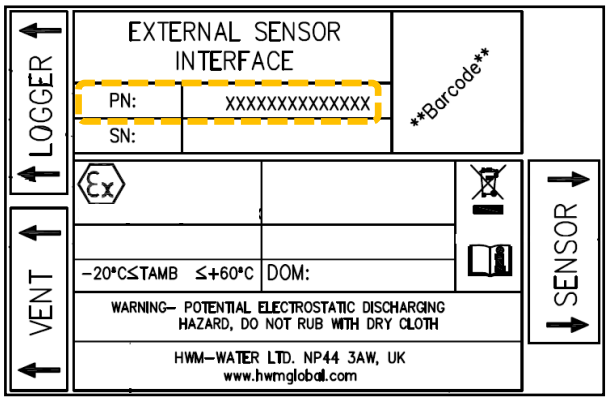


Figure 7. External Sensor Interface unit, with depth transducer.

This unit plugs into the main logger unit interface labelled as "EXTERNAL mV SENSOR INPUT". (Note: This is a digital multi-purpose interface and does not directly measure mV).

An example label format is shown opposite.

The sensor maximum measurement range can be determined by examination of the part-number and by referring to the relevant table in Section 10.



External Sensor Interfaces are available with either a pressure sensor or depth sensor; refer to Figure 8.

A variety of models are available.
(Discuss your requirements with your HWM representative).

Figure 8. Cabled pressure sensor (top) and depth sensor (bottom)

Where the sensor supplied is at the lower end of the available range, an air breather tube may be supplied to provide a pressure reference to compensate for local atmospheric pressure and thereby maintain accuracy. This connects to the 'Vent' port. The desiccant must be changed periodically during routine maintenance of the equipment; dried air prevents damage to the sensor.

The unit plugs into the main logger unit interface labelled "EXTERNAL mV SENSOR INPUT". (Note: This is a multi-purpose interface and does not directly measure mV).

When a measurement is required, the logger main unit powers the interface. After a short settling time, the reading is taken, and the interface is then powered down to conserve power.

The pressure / depth input initially appears in IDT as an “Analog Ext[n]” input sensor. It then has to be further identified (as pressure, depth, etc) as the setup proceeds. (Refer to the IDT user Guide).

No calibration of the unit is required; Calibration details are electronically stored in the unit. However, the sensor will be required to be re-zeroed to local atmospheric pressure during installation.

2.3. ESIB (External Sensor Interface with Battery) unit

Note: This section refers to the models that have a part-number beginning with “**ESIB2/**”. For other models, which have a part-number beginning with “ESIB/”, refer to section 11 and 11.3.

The Intelligens logger can be extended using one or more of the “ESIB” units (External Sensor Interface with Battery). This is a family of devices (see Figure 9) which primarily act as a battery power source. They also include some interface electronics to facilitate connection to a variety of cabled sensors.

The ESIB unit provides power to the sensor, under the control of the logger. The battery life of the main logger unit is therefore relatively unaffected by power consumed by the ESIB and its connected sensor.

The following versions of ESIB units exist:

- 4 ~ 20mA
- 0 ~ 1V
- 0 ~ 10 V
- SDI-12
- RS485 / MODBUS

Note: This refers to the sensor interface available from the ESIB unit. (The logger connection uses different methods of signalling).

The ESIB units have a short captive cable, terminated with a connector. This is for connection to an appropriate logger interface for the particular ESIB unit being used.

ESIB units may be either landscape or portrait form-factor (See Figure 9). Each includes keyholes for mounting onto the side of a chamber wall. The units may have either a single sensor interface, or a dual interface.

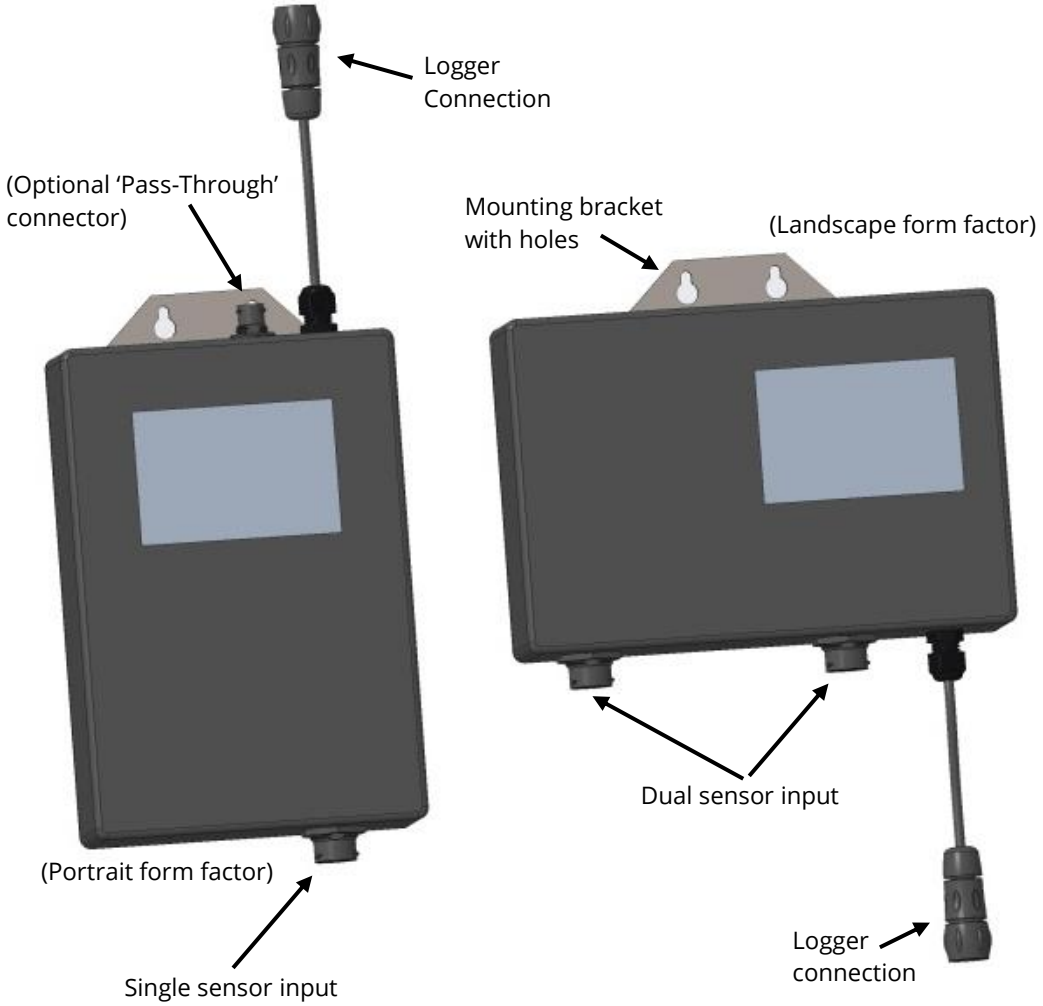


Figure 9. External Sensor Interface with Battery units – examples of form factor.

Note: Install portrait form factor units wherever possible as these have an improved battery life.

The logger connection depends on the ESIB unit used.

Units that provide an **analogue interface**:

- For a 0-1V ESIB unit… use the connector labelled 'EXTERNAL mV SENSOR INPUT'.
- For a 0-10V ESIB unit… use the connector labelled 'EXTERNAL mV SENSOR INPUT'.
- For a 4-20 mA ESIB unit… use the connector labelled 'EXTERNAL mV SENSOR INPUT'.

Units that provide a **serial digital interface**:

- For an SDI-12 ESIB unit… use the connector labelled 'SDI-12 INPUT (ESI)'.
- For a Modbus ESIB unit… use the connector labelled 'MODBUS INPUT (ESI)'.

Note: Despite the labelling difference, the 'SDI-12' and 'Modbus' inputs on the Intelligens logger are identical; They are converted to the same digital interface to the logger.
For setup purposes, IDT will regard them both as a 'serial input'.

ESIB units that provide an analogue interface may be fitted with a 'pass-through' connector. This connector replicates the logger interface connection, allowing a second ESIB unit to be also connected to the logger via the first ESIB unit. (See Figure 10).

Pass-through is only available on units with a single analogue sensor interface.

Inter-connection is only permitted for two units with a single analogue sensor interface.

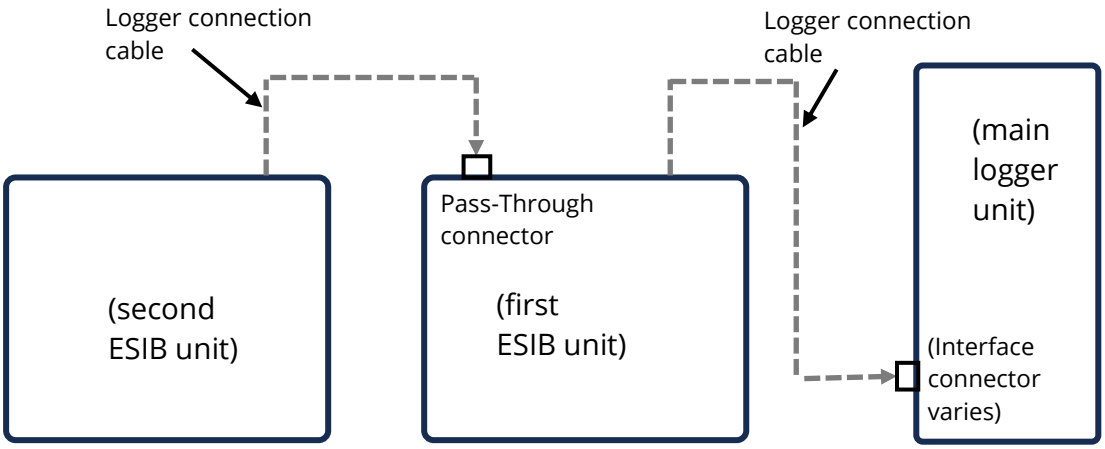


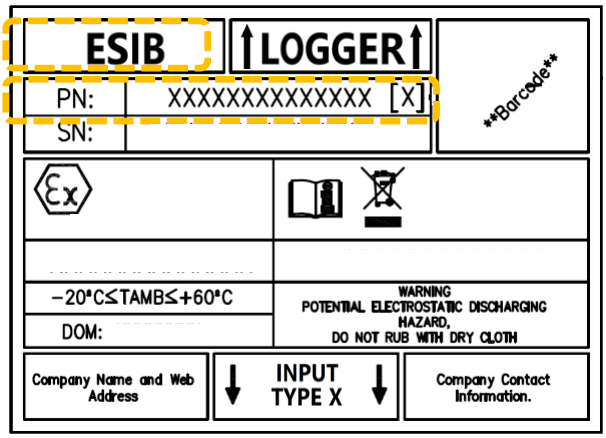
Figure 10. Use of 'Pass-Through' interface on ESIB units providing a single analogue interface

For equipment inter-connected via a Pass-Through connection, the interconnecting unit must use the same type of main logger interface as the connected equipment.
(e.g. A unit requiring an 'External mV Sensor Input' can only be connected via another unit also requiring an 'External mV Sensor Input' logger connection).
When daisy-chaining equipment which can connect to the 'External mV sensor input' type interface, the two units must have a different 'address' to allow the logger to separate the signals.
(Refer to the ESIB2 part-number details within section 10; Address pairs are shown for each interface type, encoded into the part-number).

An example label format is shown opposite.
(The layout can vary according to the port configuration).

An ESIB unit can be identified by the "ESIB" name.
The version can be identified by inspecting the labels related to each interface, or by inspection of the unit's part-number.

The sensor maximum measurement range can be determined by examination of the part-number and by referring to the relevant table in Section 10.



Limitations of use:

- SDI-12 and MODBUS
  (logger 'Q' and 'M' configuration selections; see section 10).
  The logger can be built to support either the SDI-12 unit or the MODBUS unit, but only one of these options can be included in a logger.

2.3.1. VERSION: 4 ~ 20MA

A Dual sensor 4-20mA unit (or the first single sensor 4-20mA unit, where units are being cascaded) plugs into the main logger unit interface labelled "EXTERNAL mV SENSOR INPUT".
(Note: This is a multi-purpose digital interface and does not directly measure mV or mA).

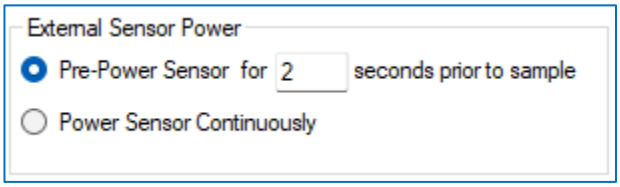
If a second single sensor 4-20mA unit is connected to the first unit, it plugs into its connector labelled "Pass-Through". It must have a different bus address to the first unit.

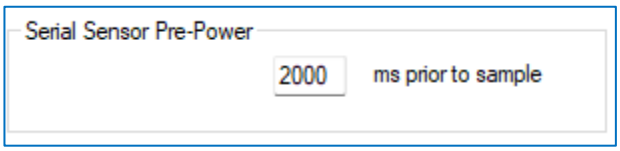
This version of ESIB unit has a connector labelled "**INPUT, 4-20mA**" (or similar). This is suitable for use with an appropriate (and compatible) cabled sensor which uses an industry-standard 4-20mA signalling scheme.

The ESIB unit provides power to the sensor from its own internal battery. However, the power is controlled by the main logger unit, which signals to pre-power the sensor a short time before a measurement is needed and deactivate it when not in use.

Refer to the IDT user-guide and the sensor documentation for guidance on setting the IDT control for sensor pre-power.

Note: Two formats of the settings exist, depending on whether other types of ESIB are also fitted. (see opposite).





The ESIB unit contains a small electronic circuit which modifies the 4-20mA sensor output signal to a format that is compatible with the logger interface. The logger can be set to interpret the 4-20mA signal into the actual physical parameter and range being measured by the sensor; refer to the IDT user guide for the steps required to do this.

The power feed from the ESIB unit must be compatible with the sensor used. The maximum current available to power a sensor from this ESIB unit is 24mA. In addition, the sensor must be checked to ensure its port parameters are compatible, whenever the equipment is being installed in an ATEX environment.
(Enquire to your HWM representative if you have any requirements regarding a new type of sensor).

2.3.2. VERSIONS: 0 ~ 1V & 0 ~ 10V

A Dual sensor 0-1V (or 0-10V) unit (or the first single sensor 0-1V (or 0-10V) unit, where units are being cascaded) plugs into the main logger interface labelled "EXTERNAL mV SENSOR INPUT". (Note: This is a multi-purpose digital interface and does not directly measure mV or mA).

If a second unit is connected to the first unit, it plugs into the connector labelled "Pass-Through". The two units must have different addresses.

This version of ESIB unit has a connector labelled "**INPUT, VOL**" (or similar). This is suitable for use with an appropriate (and compatible) cabled sensor which uses a 0-1V (or 0-10V) signalling scheme.

The ESIB unit provides power to the sensor from its own internal battery. However, the power is controlled by the main logger unit, which signals to pre-power the sensor a short time before a measurement is needed and deactivate it when not in use. (There are no user-accessible settings for this).

The unit contains a small electronic circuit which modifies the 0-1V (or 0-10V) sensor output signal to a format that is compatible with the logger interface. The logger can be set to interpret the voltage signal into the actual physical parameter and range being measured by the sensor; refer to the IDT user guide for the steps required to do this.

The power feed from the ESIB unit must be compatible with the sensor used. The maximum current available to power a sensor from this ESIB unit is 24mA. In addition, the sensor must be checked to ensure its port parameters are compatible, whenever the equipment is being installed

in an ATEX environment. (Enquire to your HWM representative if you have any requirements regarding a new type of sensor).

2.3.3. VERSION: SDI-12

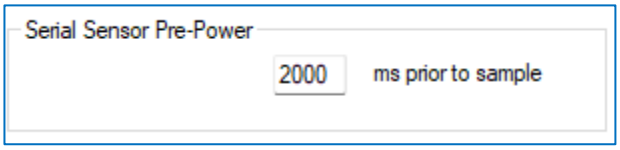
This version of ESIB unit plugs into an interface in the main logger labelled “SDI-12 INPUT (ESI)”.

Note: The connector on the main logger unit is not SDI-12, but a proprietary multi-purpose interface, sometimes referred to as ‘ESI’. (‘ESI’ stands for ‘External Sensor Interface’). However, do not confuse this with the ‘ESI’ equipment referred to in section 2.2; they are electrically and functionally different.

This version of ESIB unit has a connector labelled “INPUT, SDI-12” (or similar).
The interface is suitable for use with an appropriate (and compatible) cabled sensor which uses an industry-standard SDI-12 signalling scheme.

The ESIB unit provides power to the sensor from its own internal battery. However, the power is controlled by the main logger unit, which signals to pre-power the sensor a short time before a measurement is needed and deactivate it when communication with the sensor is completed.

Refer to the IDT user-guide and the sensor documentation for guidance on setting the IDT control for sensor pre-power.



The unit contains a small electronic circuit which translates the SDI-12 sensor messages into a format and protocol that is compatible with the interface on the main logger unit.

The logger can be set to obtain measurement data from the sensor and then to interpret it into the actual physical parameter(s) being measured; Refer to the IDT user guide for the steps required to do this.

When using IDT, this equipment will appear as a ‘Serial[n]’ input. It requires further setup for the logger to use the correct protocol and to obtain the desired measurement readings.

The power feed from the ESIB unit must be compatible with the sensor used. In addition, the sensor must be checked to ensure its port parameters are compatible, whenever the equipment is being installed in an ATEX environment.

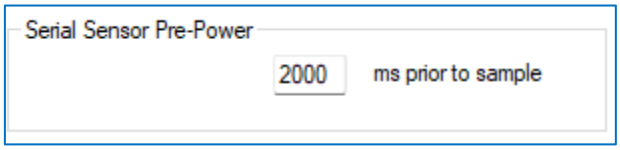
Note: SDI-12 data protocol is not fixed. Message data content and sensor requirements may vary. Always check with your HWM Global representative to ensure that your sensor of choice is compatible with the logger.

2.3.4. VERSION: RS485 / MODBUS

This version of ESIB unit plugs into an interface in the main logger labelled “MODBUS INPUT (ESI)”.

Note: The connector on the main logger unit is not RS485 / MODBUS, but a proprietary multi-purpose interface, sometimes referred to as ‘ESI’. (‘ESI’ stands for ‘External Sensor Interface’). However, do not confuse this with the ‘ESI’ equipment referred to in section 2.2; they are electrically and functionally different.

This version of ESIB unit has a connector labelled “INPUT, Modbus” (or similar).
The interface is suitable for use with an appropriate (and compatible) cabled sensor which uses an industry-standard RS485 / MODBUS signalling scheme.



The ESIB unit provides power to the sensor from its own internal battery. However, the power is controlled by the main logger unit, which signals to pre-power the sensor a short time before a measurement is needed and deactivate it when communication with the sensor is completed.
Refer to the IDT user-guide and the sensor documentation for guidance on setting the IDT control for sensor pre-power.

The unit contains a small electronic circuit which translates the MODBUS sensor messages into a format and protocol that is compatible with the interface on the main logger unit.

The logger can be set to obtain measurement data from the sensor and then to interpret it into the actual physical parameter(s) being measured; Refer to the IDT user guide for the steps required to do this.

When using IDT, this equipment will appear as a 'Serial[n]' input. It requires further setup for the logger to use the correct protocol and to obtain the desired measurement readings.

The power feed from the ESIB unit must be compatible with the sensor used. In addition, the sensor must be checked to ensure its port parameters are compatible, whenever the equipment is being installed in an ATEX environment.

(Enquire to your HWM representative if you have any requirements regarding a new type of sensor).

Note: Modbus data protocol is not fixed. Message data content and sensor requirements may vary. Always check with your HWM Global representative to ensure that your sensor of choice is compatible with the logger.

2.4. External Battery Pack (option)

Most Intelligens models have a connector that allows an ATEX-approved External Battery to be connected. The battery provides the logger with additional power capacity.

An example battery pack is shown in Figure 11.

Always use a compatible ATEX Battery Pack supplied by HWM that has been approved for use with the Intelligens logger.

The Battery Pack will plug into a connector on the main logger unit labelled as “EXT POWER INPUT”.

Prior to fitting any power source to the EXT POWER INPUT, check its port parameters are compatible with the logger.

Ensure the cable supplied with the Battery Pack is suitable for the external power connector fitted to your logger.

(For situations where the use of an external battery is required, seek the advice of your HWM representative).

Figure 11. ATEX approved External Battery Pack

2.5. Logger Operation

The logger software is designed to minimise battery use and thereby prolong the expected battery life. However, battery life is also affected by user-programable settings. The user is advised to set the logger tasks and sample frequencies to the minimum requirements of the intended use in order to manage battery power effectively.

Where supplied, the external battery power is used to extend the battery life of the logger or to allow more frequent communications with the host server.

The logger (main unit only) is normally shipped from the factory in an inactive state (referred to as ‘shipping mode’, or ‘sleep mode’) to preserve the life of the battery.
When activated (see section 2.10), the logger will initially go into the state of “Waiting” (for a short time). Then it will go into the state of “Recording” and begin repetitive logging of measurements from the various sensors fitted to the unit, according to its configuration and settings.

The logger operates using two time periods, known as the “sample period” and the “log period”. It will sample the sensors at the *sample rate* to create temporary measurement samples; this is a repetitive background task. After taking several measurement samples, some statistical functions can be optionally applied to produce a *datapoint* that is logged (saved) at the *log rate*; these form the recorded (logged) measurements and are saved into an area of memory which is referred to as the “primary recording”.
The log period is always a multiple of the sample period.

If the logger has the feature enabled, it can also be set to occasionally save additional data into a "secondary recording" memory area (see section 2.6), (e.g., data sampled at a higher frequency, such as by using the "sample period" rather than the "log period").

Note: This is not available on all supplied units and must be arranged through your sales representative before placing an order; it has implications concerning expected battery life of the unit.

The logger will also have daily tasks at set times, such as uploading its unsent data over the internet (via the cellular mobile communications network). When sending data, the logger waits to receive confirmation from the server that the data was received without error; If confirmation is not received, it will re-send the data at the next call-in time.

The logger can be programmed to monitor data for certain patterns or conditions and can send a message if it should detect a match. Commonly, this is used for setting a condition that can be an indication of an "alarm". The message can be sent to either the server (the usual destination) or another device (e.g. direct to a mobile phone).

2.6. Enhanced Logging (options)

Section 2.5 gave a description of logger operation that is available as standard on Intelligens logger models; The logger normally samples data at the set sample period, and records datapoints at the set log period. However, certain models offer options for making *additional* recordings (of logged data) at higher-than-normal sampling rates. The additional data is recorded within the "secondary recording" memory area.
This is sometimes referred to as "Enhanced Network" logging, or "Fast Logging".

Note: The feature can only be installed by the factory at the time of build. The option must therefore be specified at the time of ordering.
Additional sampling has implications for power consumption and may require the use of external batteries to meet the required service life.

The fast-logging features of the logger can be disabled during logger setup. Where enabled, the logger has two strategies for dealing with memory becoming full. Either the fast logging will stop, or older data can be over-written. Make the selection you require during setup.

Not all sensor types are able to work at high sampling frequencies. The feature is therefore usually set to work with analogue sensors, such as pressure transducers.

Enhanced Network Logging:

- This option allows certain events to create a secondary data recording.
- The recording will be made at the background sampling rate.
- The recording can be a single channel or can include additional channels (if the sensor can cope with the speed). Up to 4 channels can be used.
- The maximum sampling rate is limited to a frequency of 1Hz.

The recordings can be set to occur either at specific times or in response to various alarm events or a change in a Status Input (i.e., triggered by a switch output from external equipment).

2.7. SERVER INTEGRATION – STORING AND VIEWING DATA

The Intelligens logger includes an interface (referred to as a modem) that provides access to the internet via the cellular mobile communications network. A SIM card is used to give access to the network.

Measurement data is initially stored within the logger, until the next call-in time. The data can then be uploaded to the server using an encrypted format. Typically, the server used to receive and store the data will be an HWM Global "DataGate" server, although (by special request / agreement) other servers may be used in conjunction with software from HWM Global. (Use with other servers is not available to all customers. Discuss with your HWM Global representative).

The logger data may be viewed using a viewing portal which has access to the data stored on the server. (Refer to the relevant user guide for details of how your data viewer can be used to view the logger data).

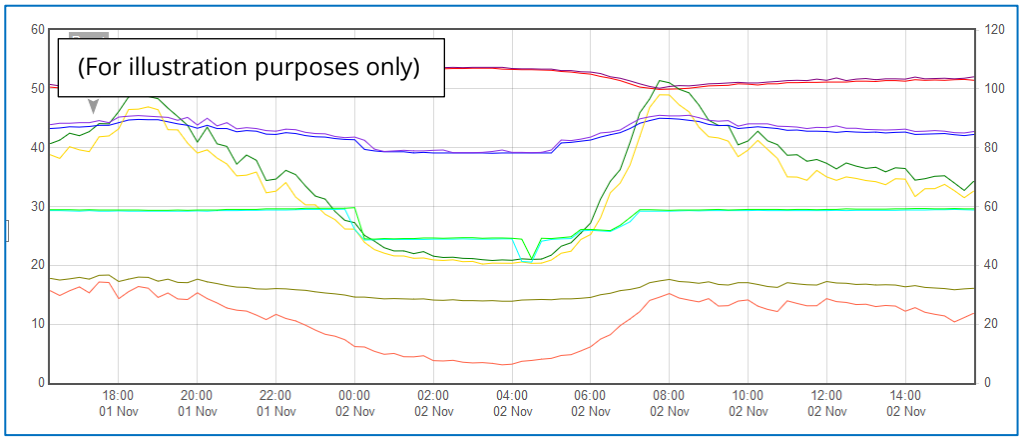
Note: Intelligens loggers supporting WITS protocol behave differently to the above. These loggers do not use DataGate but communicate with a WITS Master Station. The data can be viewed only by use of the WITS system.

2.7.1. DATAGATE SERVER / DATA VIEWING PORTALS

When integrated with HWM's DataGate server, the logger's measurement data can be stored centrally and made available to users via a viewing portal (website). The data storage server can handle receipt and storage of data from a single unit, or from an entire fleet of loggers.

Viewing Primary Recordings:

The data from your logger(s) can be viewed remotely / graphically by anyone authorised to do so, with a suitable user account (and password) using a standard web-browser.



HWM has a selection of websites that can be used to view logger data. The best choice of website depends upon the type of sensors used with the logger.

A website with a generic data viewer can show data graphically, but only for one logger at a time, installed on one site.

A website which can show a fleet of loggers, each having the same type of sensor, can often present data in a more meaningful way to the user, along with useful supplementary information (e.g., a map showing the logger locations). Thus, a website may give a picture of the current status of many sites at one time.

Refer to the IDT user guide or sensor user-guide for details of which viewing portal is most appropriate to use. Alternatively, discuss this issue with your HWM representative.

The DataGate server can also forward any alarms received from the logger to all users that have subscribed to them; one logger alarm message can therefore be distributed to multiple DataGate users.

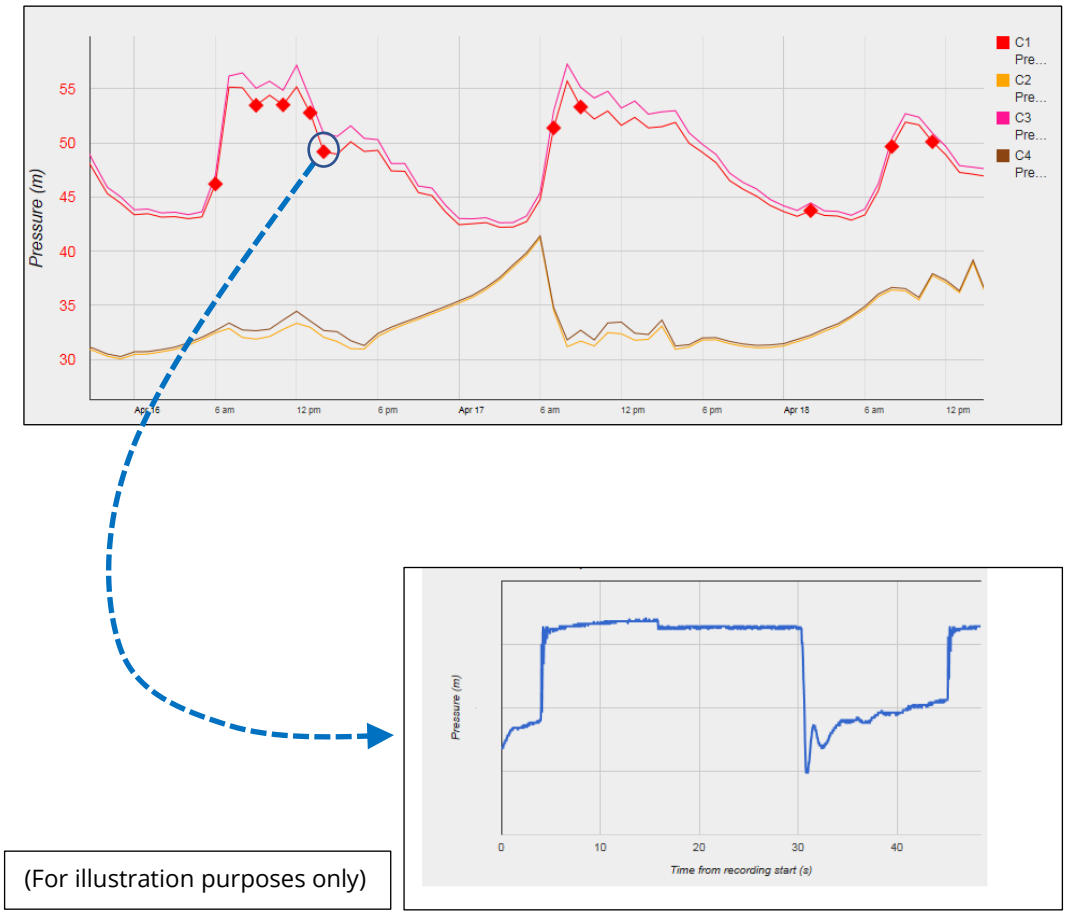
DataGate can also (by arrangement with your sales representative) be used to export logger data to other servers.

Some administrative setup of the server and of the viewing portal is normally required to facilitate receiving, storing, and presenting logger data correctly. (Setup of and use of the DataGate system (or any other server) are not covered by this user guide).

Viewing Secondary Recordings:

For sites which have logger models with Fast logging included, secondary recordings may have been made. These are also stored on the server.

Your data viewer will have a means of displaying secondary recordings.
It may, for example, show a marker on the main trace to indicate the point where fast data is available (e.g., where a transient occurred). Click the marker to provide a close-up view of the transient.



(For illustration purposes only)

2.8. Installation Accessories

Accessories (e.g. antenna and brackets for mounting the unit) are available to suit various installation situations; discuss availability with your HWM representative.

2.9. COMMUNICATIONS INTERFACES AND PROGRAMMING CABLES

To communicate with the Intelligens logger, an ATEX-approved programming cable is required.
E.g. part-number COMMS USB/IS or COMMS-Y USB/IS.

The in-line COMMS BOX contains safety barrier components. It is required for ATEX compliance. Do not attempt to use any other type of communications (programming) cable with Intelligens.

Figure 12. COMMS-Y USB/IS cable with in-line 'COMMS BOX'

The standard version of the COMMS connector is 7-pin. However, for some models, a 3-pin COMMS connector is used. For the latter, the COMMS BOX cable (7-pin) should still be used, but a 7-pin to 3-pin adaptor cable is required, as shown in Figure 13.

Figure 13. Comms adaptor cable 7-pin to 3-pin (part-number CABA9450)

The 7-pin connector may be shared with other signals. The Y-adaptor version of the COMMS BOX cable allows the other signals to be passed through whilst using IDT with the logger.

To use the communications cable, temporarily remove any existing connector, and re-connect it when finished. Using the ATEX-approved programming cable, connect the logger to the PC (USB-A port) as shown in Figure 14.

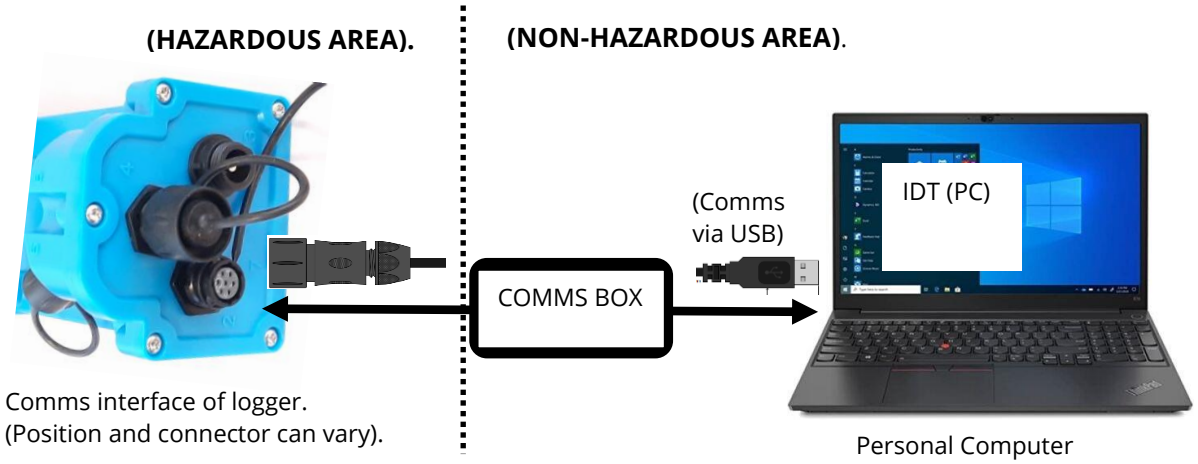


Figure 14. Using the communications cable

Note: Prior to use, the PC should have the IDT programming tool installed.
When used within an ATEX environment, the PC must be Intrinsic Safety certified if used inside the zone.

The communications interface is always monitored for activity and the logger will usually respond, unless it is busy communicating to the cellular network.

2.10. Logger Activation Process (for first-time use)

When shipped from the factory, the unit is in 'shipping mode' (deactivated; not logging or calling in). This mode is suitable for shipping or long-term storage. To use the logger, it must first be *activated*.

The process for doing this depends upon the logger setting for logging re-activation.
Various setting options are available (specified time, upon connection of an external battery, upon the activation of a magnetic switch, 'immediately').

Most Intelligens loggers are set to start 'immediately' upon having their settings **read by IDT** and then **saved back** to the unit. (Refer to the IDT user-guide for the steps required to read the logger program and then to save it back to the unit using the 'Setup Device' button).

Once activated, the logger will initially go into a status of 'Waiting' (for a short time). Then it will enter a status of 'recording', where it is executing its repetitive logging functions.

The installer should additionally check / configure at least one call-in time in order for the logger to start sending data into the server.

Note: Before leaving site, check that the logger has been correctly set up for logging, call-in tasks, and that it is **'Recording'** (logging).
Refer to the IDT user-guide for guidance on how to check these points.

3. Interfaces and sensors supported

Note: Support for specific interfaces or functions vary and are dependent upon the model supplied, and any additional external sensor interface units required.

3.1. Available sensors

When installing the Intelligens within an ATEX environment, all attached sensors and installation cables must meet ATEX requirements.

Intelligens has sensors and / or interfaces available to measure many parameters, including:

- Gas Pressure
- Water Pressure
- Temperature
- Distance to a water surface
  e.g. RadarSens, SonicSens3.
- Water depth
  e.g. RadarSens, SonicSens3, SpillSens, Depth gauge.
- Water velocity.
- Water flow rate (volume per second / total consumption)
  e.g. Flow / Pulse inputs.
- (Many others).
  Support for sensors using a voltage output, 4-20mA output, Modbus or SDI-12 type signalling.
  Contact your sales rep for more information or to discuss your requirements.

Sensors provided by HWM will include a cable with a suitable connector for the Intelligens.

IMPORTANT: The Intelligens data logger must only be used in conjunction with connection cables from HWM Global.

4. INSTALLATION

4.1. SUMMARY OF INSTALLATION STEPS

- Check that an assessment of the work has been done and that any safety measures are in place. (E.g., Safety precautions, protective clothing and/or equipment being used).
- Check that all equipment is suitable for use at the installation site (e.g., ATEX markings). This must include the main Intelligens logger unit and any additional units that attach to the Intelligens.
  Check that you have the required sensors and that these are suitable for use at the installation site. (e.g., Check suitable ATEX markings are present).
  Check port parameters permit interconnection of the various items of equipment in an ATEX environment.
- Check that you have the required antenna, and any mounting brackets.
- Consider where the equipment is going to be located within the available space. Any ESI or ESIB units will be required to be located within connection range of the main logger unit.
- Check that all sensors have cables of a suitable length. Similarly, check any required connection hoses are of a suitable length.
- Check fittings are available to connect to any pressure measurement point.
- Mount the Intelligens and other items using the mounting points or suitable brackets
- Attach any additional Intelligens units (ESI, ESIB).
- Connect the sensors electrically to the logger.
- Cables and hoses should be routed and secured so as to not cause any hazards. Do not allow any equipment to rest on cables, connectors, or hoses as crush damage can result.
- Select the ATEX approved programming cable for the logger and attach it to the logger COMMS connector. Connect the other end to the host device of the IDT software.
- Read the logger settings into IDT. Re-start the logger to recognise any attached ESI / ESIB unit (if required).
- Update the logger firmware (if required) on the main unit or if IDT offers updates for any connected sensor or unit. (Refer to the IDT manual for guidance; consider downloading any existing data from the logger prior to upgrade).
- Use IDT to check or modify existing logger settings:
  (Refer to the IDT user-guide for guidance).
  - Program a local time-zone into the logger (check or modify)..
  - Set timing intervals for making measurements (sample interval and log interval). They should be configured to suit your use of the device and any specific logging requirements. (minimise sampling rates to preserve battery life).
  - Check / modify channel settings to produce measurement samples and the required datapoints from each interface.
    - Configure each logger channel to match the sensor or other equipment that the logger connects to. (Check units of measure are correct, etc)
    - Ensure each sensor is mapped to the correct output channel number; This is an identifier used when uploading the logged measurement data to the server. (i.e., Channel numbers must match between logger and DataGate).
    - Apply any required statistical functions to the background measurement samples in order to produce logged data-points (saved values).

    - Where required, undertake the setup of any additional options related to the channel. (e.g., Add an initial meter reading, pulse replication setting, sensor calibration; these will be dependent on sensor and logger use).
      (Refer to the IDT user-guide for guidance regarding any additional settings related to an interface).
- For pressure or depth sensors, re-zero them (using IDT) before commencing making a connection to the measurement point. During the re-zero process the sensor should be exposed to the local atmospheric pressure.
- Install (position and connect) each sensor to its measurement point.
- Bleed any connections to water.
- Where required, insulate any water-filled tubing connected to pressure transducers to protect them from frost.
- Ensure any electrical connections made on site are dry, durable and water-tight.
- Use IDT to:
    - Test the logger and sensors are functioning correctly.
      (Some can be done pre-installation; others post installation).
    - Setup the logger for any alarms. Consider the conditions for activating alarm messages and also the conditions for the alarm to clear.
    - Check / modify the communications settings of the logger device, as required:
        - SIM settings (parameters for giving access to the cellular network).
        - Modem settings (cellular network technology).
        - Data delivery settings (server contact details).
        - Call-in times and protocol settings.
    - Verify any changes to settings have been saved prior to leaving site.
      Check that the logger is in a "recording" state prior to leaving site.
- Install (position and connect) the antenna for server communications.
  Use IDT to test the cellular communications performance.
- Ensure details of the site of logger deployment are recorded.
  (The administration for the server could be handled by office staff, or the installer could use the HWM Deployment app).

4.2. Installing the Logger

The logger must be mounted in a suitable location where the sensors to be attached can reach their intended installation points. Position loggers, sensors, and antenna away from sources of electrical interference such as motors or pumps. Cables and hoses should be routed without causing any hazards. Do not allow any equipment to rest on hoses, cables or connectors as crush damage can result.

The main logger unit should be installed in the orientation shown in Figure 15 for optimum battery performance.

4.2.1. WALL-MOUNTING

The Intelligens logger (main unit) can be secured to a wall using a suitable bracket, an example of which is shown in Figure 15.
First secure the bracket to the logger using two machine screws. Then fasten the bracket to the wall.
Ensure the wall and fixings used are able to bear the weight of the logger and cables attached.

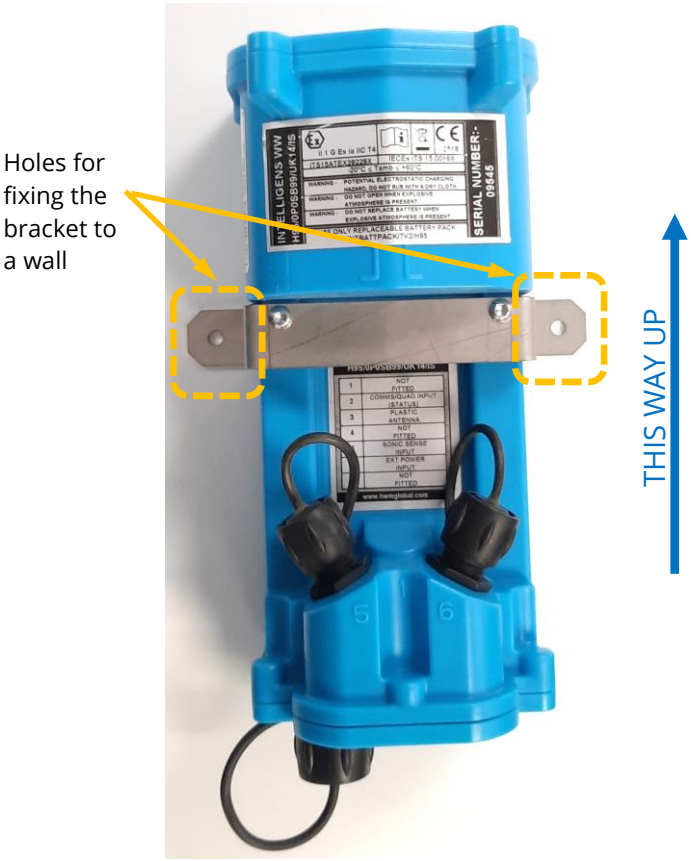


Figure 15. Example mount bracket for main unit.

The Intelligens logger (ESIB units) are equipped with a metal wall-mount bracket, an example of which is shown in Figure 16.
The two key-hole fixing holes can be used to fasten the ESIB unit to the wall.
Ensure the wall and fixings used are able to bear the weight of the equipment and cables attached.

After fixing the logger to the wall, the ESIB unit can be plugged into the logger main unit.

Note the orientation required for best battery life.

Figure 16. Example mount holes for ESIB units
Other ESIB units have similar mount holes and orientation requirements,

Intelligens is sometimes supplied pre-mounted onto a carrier frame, such as the 'Intelligens Flow' system, an example of which is shown in Figure 17. This is a kit of equipment, normally supplied pre-assembled, which includes an Intelligens logger.

The base of the frame can be used to keep the system upright and prevent connector damage during storage and transport. When installed in a hung position, it can provide an optional anchor point for securing the near part of the sensor cables or storing excess length.

The top of the frame is curved and provides two 'hooks' which can be used to hang the system over the rung of a ladder. Always secure the system with additional ties to prevent it from becoming accidentally detached from the rung.

(The wire handle can be used in place of cable ties; Un-clip one end from the frame, wind around the hook and rung to bind together, and then re-clip the wire end to the frame).

The wire handle can similarly be used to hang the system on a suitable bracket.

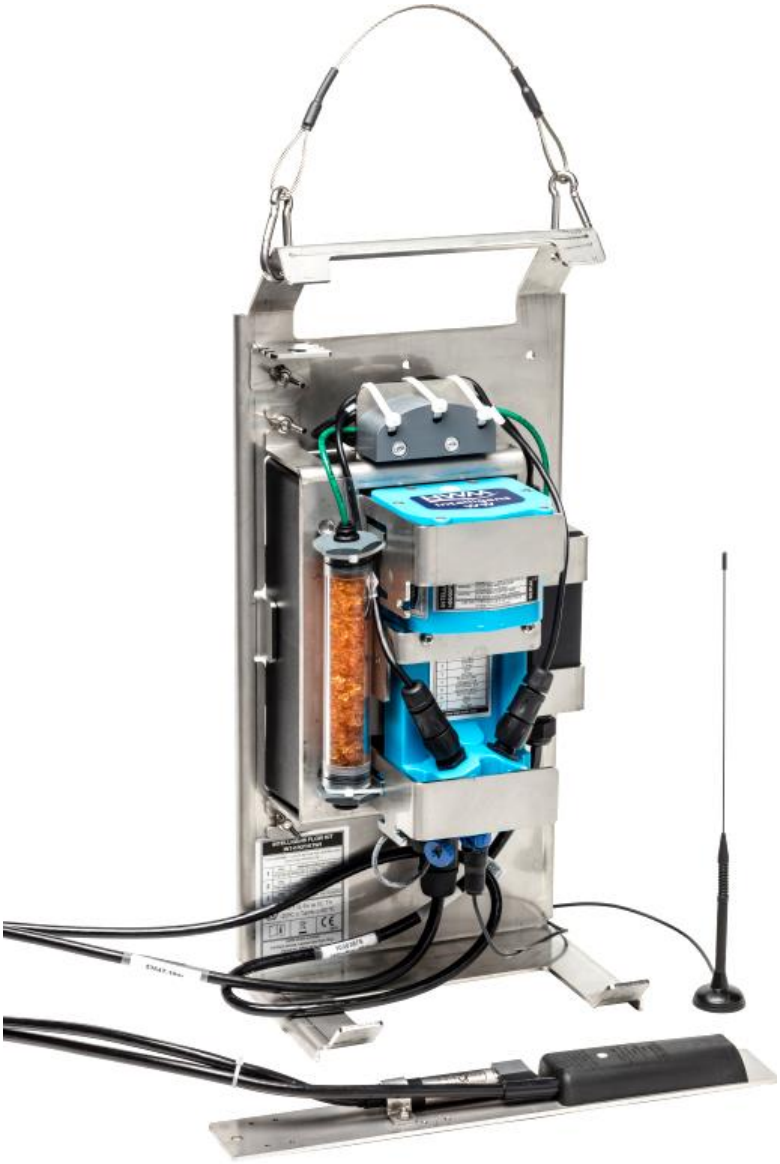


Figure 17. An example of Intelligens Flow system, mounted onto a carrier frame.

4.2.2. ELECTRICAL CONNECTIONS TO THE LOGGER

When making electrical connections to the logger (e.g., attaching a connector for a sensor), ensure the connector is correctly fitted. Both parts of the connector should be dry and free of debris. The connectors are keyed to ensure correct alignment of pins and receptacles. Align the sensor to the logger connector and push fully home. Then rotate the outer part of the sensor connector until it engages with the fastening mechanism and locks into place. The connector will then be secure and watertight.

When removing connections, follow the reverse steps of the procedure describe above. Always handle the connection by the connector; do not pull the cable as this could cause damage. Where fitted, use the connector cover cap to seal against water and dirt ingress into the connector.

Route all cables so they do not cause any potential hazards and secure into place using suitable ties.

For the antenna connection, follow the steps given in section 4.15.

4.2.3. Factory settings

Note: The logger will usually have settings pre-programmed by the factory prior to shipping. However, **the installer has responsibility for confirming the settings are appropriate** for use at the installed site.
If you have specific requirements this can be discussed with your HWM sales representative at the time of ordering the loggers.

Where required, IDT can be used to check or make any changes to the logger settings.

For most sensor interfaces, follow the general guidance within the IDT user-guide; the logger complies with the description and examples of setup provided therein.
However, some HWM sensors require specialised setup screens or have their own user-guide which provides further guidance.

4.3. Pressure Sensor Inputs

Note: When connecting pressure sensors to water, add insulation to the pipe to prevent freezing. If the water in the hose or the sensor itself freezes, there is a danger of permanent damage to the pressure transducer.

4.3.1. Re-zero Facility (for pressure relative to local atmosphere)

Pressure sensors supplied by HWM normally measure pressure relative to atmospheric pressure. Since there can be some variation in atmosperic pressure (e.g., due to altitude), the loggers have a facility to re-zero the pressure sensor.
This must be done **with the sensor exposed to local atmospheric air**.

Prior to connecting the transducer to the actual measuring point, leave it exposed to air. Then "re-zero" the sensor using the method found in the IDT user-guide.

4.3.2. Pressure Sensor (External Sensor Interface) / Depth Sensor

The External Sensor Interface is used to connect a compatible cabled pressure sensor to the Intelligens logger. An air-breather option may also be fitted to provide atmospheric pressure compensation (important for lower range transducers). Both pressure and depth versions are available (refer to Figure 7 and Figure 8).

Connect the External Sensor Interface to the main logger unit, via the attached cable. (Refer to section 4.11).

Note: Do not connect the sensor to the measurement point before going through the **re-zero** (to local atmospheric pressure) process, if required.
(Refer to the IDT user-guide for the required steps).

The captive sensor transducers are factory calibrated, with calibration values stored in the ESI unit. No on-site calibration is required.

Ensure the interface box is securely mounted to a suitable surface and that any atmospheric breather tube is mounted in a dry location. The unit contains no internal batteries, so is indifferent to its orientation.

Where a pressure transducer has a threaded end for connection to the pressure measurement point, fittings may be required to modify the connection (e.g., a quick-release connector for connection to a hose). For example, see Figure 18.

Assemble any required fittings to the sensor.

Straight or elbow styles of coupling kits are available.

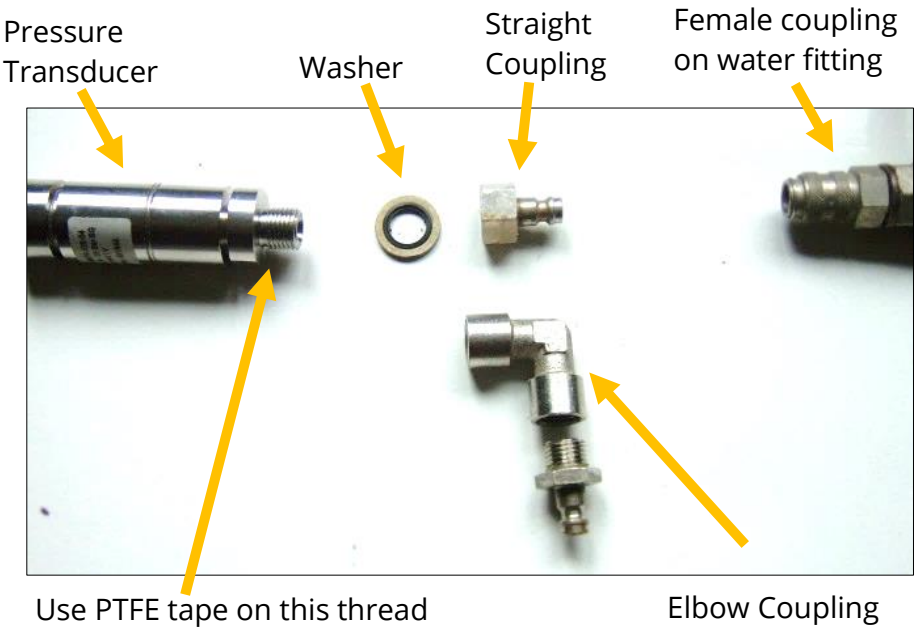


Figure 18. Adapting a pressure sensor with fittings

After completing the Re-zero process, the sensor transducer can be connected to the measuring point. The transducers are factory calibrated. No on-site calibration is required.

For a **pressure sensor**, attach to the measurement point and (if applicable) bleed any connecting hose.

For a **depth sensor**, the sensor should be weighted down or mounted securely at the bottom of the water channel, using a fixture (e.g., a carrier plate or anchoring bracket) if required. The cable should also be secured in place to prevent moving water from acting on the cable to pull the sensor out of position or stress any connections.

4.4. Flow Sensor Input (meter pulse collection)

Depending on the model supplied, the logger may have 0 to 4 Flow inputs (also sometimes called Pulse inputs). These are digital inputs, designed to sense the open or closed condition of a switch (activated by the meter pulse output of an installed meter). To use the flow channel(s) the logger must be set up (using IDT) to know what each meter pulse represents.

4.4.1. Explanation of Flow Channels & Input Signals

Flow of a fluid in a pipe is usually detected by a meter, which produces pulses related to the volume of fluid passing through it. There are several types of meters; some can detect both forward flow and reverse flow (bi-directional flow); some can detect flow in one direction only (uni-directional flow). There are therefore several ways of implementing the meter pulse output signals from a meter. Your logger must have the correct interface and settings for the signalling from the meter to be compatible with it.

The Intelligens logger requires two Flow input signals in order to work with the meter-pulse signalling of certain meters. A pair of inputs can therefore sometimes be configured to work together to operate as a single channel. Other meter types require only one signal, so the pair of inputs can operate as two separate channels (or alternatively as a single channel with the added capability of a 'Tamper detect' function).

The pair of Flow signals can be referred to in one of the following ways:

	Alternative signal names				
Pair of FLOW signals	Flow Input 1	Flow 1	Pulses	Flow (Forward)	Flow Input 1
	Flow Input 2	Flow 2	Direction	Flow (Reverse)	(Tamper)
Common	Flow_GND				

Where the logger is **pre-configured by the factory to produce only 1 Flow channel** (datapoint stream), the pair of inputs can be used in one of three different ways:

(1) Input 1 can be used with a **Uni-directional meter** (one which only measures forward flow / consumption).
For use in this configuration:

- Input 1 acts to collect meter pulses, and
- input 2 is usually left disconnected (or allocated to be used as a 'Tamper Alarm', or used as a Status input).

(2) Inputs 1 and 2 can be used as a pair with a **Bi-directional meter** (one which can measure both forward and also reverse flow).
For use in this configuration:

- Input 1 acts to collect meter pulses, and
- input 2 is used for the flow direction indication from the meter (open = forward flow, closed = reverse flow).

(3) Inputs 1 and 2 can be used as a pair with a **Bi-directional meter** (one which can measure both forward and also reverse flow).
For use in this configuration:

- Input 1 acts to collect meter pulses (forward flow direction), and
- input 2 acts to collect meter pulses (reverse flow direction).

Where the logger is **pre-configured by the factory to produce 2 Flow channels** (datapoint streams), the pair of inputs can be used in one of two different ways:

(4) Inputs 1 and 2 are configured to act as two independent uni-directional Flow input channels). Each input can be used with a **Uni-directional meter** (one which only measures forward flow / consumption).
For use in this configuration:

- Input 1 acts to collect meter pulses, and
- input 2 can be left disconnected (or used with a second uni-directional meter).

(5) Inputs 1 and 2 are configured as Uni-Directional meter inputs, but their function can be changed in IDT to be used as a pair with a **Bi-directional meter**, as in (2) above.
For use in this configuration:

- Input 1 acts to collect meter pulses, and
- input 2 is used for the flow direction indication from the meter (open = forward flow, closed = reverse flow).

This differs from (2) in that **two** output channels (datapoint streams) are produced. One records the forward flow. The other records the reverse flow.

The Intelligens can be fitted with up to 2 input pulse (flow) signal pairs.

Labelling:
The logger labelling of the pulse (flow) inputs depends on the factory default configuration of the Flow channels on your logger model-number. (Different functionality can sometimes be achieved by changing logger settings).

How many Flow / Pulse pairs?

- When a **one pair** of Pulse (Flow) inputs are present, the logger label will include: "DUAL CH PULSE", "2 CH INPUT", or similar.
- When a **two pairs** of Pulse (Flow) inputs are present, the logger label will include: "QUAD INPUT", or similar.

How is the pair configured?

- An input with software driver configured for a Uni-directional meter will have a label that includes:
  "UNI-D PULSE". ; The logger is set to operate as in (1) or (4), above.
- An input pair with a software driver configured for a Bi-directional meter will have a label that includes:
  "P&D=NET FLOW", ; The logger is set to operate as in (2), above.
  ; If 'Status' is included in a Quad Input, 2nd pair are status inputs.
  "F&R=NET FLOW". ; The logger is set to operate as in (3), above.
  "P&D=LOG SEP", ; The logger is set to operate as in (5), above.

- An input pair with a software driver configured for a status input will have a label that includes:
  "STATUS". ; The logger is set to operate as a digital input, able to sense an open / closed circuit. (This is the same electrical circuit but does not measure Flow).

4.4.2. Via a Logger 7-pin Bulkhead Connector

Intelligens Flow signal inputs are presented on a 7-pin connector, which may also be used for the IDT/programming cable (shared connector use). Each connector has two pairs of Flow signal inputs.

The pinout of this connector is shown below:

	Logger bulkhead connector pinout : 7-pin Flow Inputs						
Pin	A	B	C	D	E	F	G
	(Pair1)		(Pair2)				
Signal	Flow Input 1	Flow Input 2	Flow Input 3	Flow Input 4	Flow_GND	(used for COMMS BOX)	(used for COMMS BOX)

Check the meter to which the logger is going to be connected and ensure its meter pulse signalling method is understood, along with the significance of each meter pulse.

Connect the logger to the meter-pulse outputs of the meter using a suitable cable
(e.g. Always use HWM Flow connection cable, CABA9420-Y ; Y indicates cable length in meters).

Connections:	Blue	Flow / Pulse / Status - Digital Input1
	Yellow	Flow / Pulse / Status - Digital Input2
	Violet	Flow / Pulse / Status - Digital Input3
	Brown	Flow / Pulse / Status - Digital Input4
	Green	Ground

Note: When used in an ATEX environment, approved Intrinsically safe installation methods/equipment need to be used for making these connections and the work should only carried out by an ATEX / Intrinsic Safety trained installer.

Ensure any electrical connections are sound and watertight.

Use IDT to complete the setup, ensuring the logger is correctly set to interpret the meter pulses. If the logger is required to keep track of the meter counter display, take an initial reading of the meter counter and program it into the logger. The logger uploads additional consumption regularly, so a meter reading can be made remotely.

Note: The cable connection must be temporarily disconnected whenever a logger programming cable needs to be attached. To maintain data logging integrity, use of the Y-cable version of the programming cable is recommended, which passes through the Flow / Status signals.

4.5. Status Inputs

4.5.1. Via a Logger 7-pin Bulkhead Connector

The Status Input pins are a re-purposed use of the Flow input electronics (see section 4.4). A change in the software driver for the connector gives the input pins a different functionality.

The Status signal inputs are presented on a 7-pin connector, as shown below. (This connector is also used for connecting to a programming / communications cable). Each connector has two pairs of Status (/Flow) signal inputs.

The pinout of this connector (with both uses of the pin shown) is shown below:

	Logger bulkhead connector pinout : 7-pin Flow Inputs						
Pin	A	B	C	D	E	F	G
	(Pair1)		(Pair2)				
Signal	Status or Flow Input 1	Status or Flow Input 2	Status or Flow Input 3	Status or Flow Input 4	Status_GND / Flow_GND	(used for COMMS BOX)	(used for COMMS BOX)

The Status Input signals can be configured for general-purpose use in detecting switch contacts. This has many uses.

e.g.

- Detection of door / window / equipment-access openings for security purposes.
- A 'spare' pin on a flow channel can be used to generate a 'tamper' alarm in the event that the logger cable is cut or removed from the meter.
  (The meter must support this facility by providing a closed loop from the tamper input to the return pin, Status_GND).

Connect the logger to the external equipment using a suitable cable, as shown in section 4.4.2.

Note: When used in an ATEX environment, approved Intrinsically safe installation methods/equipment need to be used for making these connections and the work should only carried out by an ATEX / Intrinsic Safety trained installer.

Ensure any electrical connections are sound and watertight.

Use IDT to complete the setup, ensuring the logger is set to generate any desired alarm.

Labelling:

The logger labelling of the pulse (flow / status) inputs depends on the factory default configuration of your logger model-number.

- The logger label for the interface will include: 'Status'.

4.6. OUTPUTS (DIGITAL SWITCH: OPEN/CLOSED)

Intelligens Outputs are presented on a 3-pin connector. Up to two outputs can be supported.

The pinout of the connector is shown below:

	Logger bulkhead connector pinout : 3-pin Outputs		
Pin	A	B	C
Signal	Output 1	Output 2	GND

The logger does not supply any power to the output. The output takes the form of an electronic switch (transistor), which can either be open or closed. When closed, a current path exists between the output pin and ground.

A common use of the Output pins is for pulse replication (of meter pulses that are input to the Flow channels). Where this is implemented:

- Flow input 1 is replicated to Output 1
- Flow input 2 is replicated to Output 2

(Note: Pulse replication for Flow Input 3 and Flow Input 4 are not supported).

The Output 'switch' may also be used to activate external equipment.

In order to use the outputs, a suitable cable is required (the exact requirements will depend on the equipment the logger is being used with; discuss with your HWM representative).

Note: When used in an ATEX environment, approved Intrinsically safe installation methods/equipment need to be used for making these connections and the work should only carried out by an ATEX / Intrinsic Safety trained installer.

Ensure any electrical connections are sound and watertight.

Use IDT to complete the setup, depending on your application for the output. (Refer to the IDT user-guide).

Labelling:

The logger labelling of any fitted Outputs depends on the factory default configuration of the logger model-number.

- The logger label for the interface will include one of the following:

  DUAL PULSE REP (UNI-DIR, INC TAMP) ; 2 outputs are used in pulse replication mode. (First output replicates Meter pulse. (Second output replicates Tamper signal).

  SINGLE PULSE REP OUTPUT (BI-DIR) ; 2 outputs are used in pulse replication mode. (Both outputs replicate Meter signals)

  '2 x USER CONFIG OUTPUTS' ; 2 outputs are user-configurable.

4.7. Combined Flow Input / Pulse Replication output on RJ11 connectors

Certain loggers have a glanded dual-cable output, with RJ11 connectors (see Figure 19).

The connector pinout is shown in the table below:

	Pin 2 (black)	**Pin3** (red)	**Pin4** (green)	**Pin5** (yellow)
RJ11 Plug (inputs)	Tamper -- (Gnd)	Flow/Pulse -- (Gnd)	Flow/Pulse + (Input 1)	Tamper + (Input 2)
RJ11 Socket (outputs)	Tamper -- (Gnd)	Flow/Pulse -- (Gnd)	Flow/Pulse + (Output 1)	Tamper + (Output 2)

The logger can be connected to a compatible meter via the RJ11 plug. Other equipment requiring access to the meter pulse signal can be connected via the RJ11 socket.

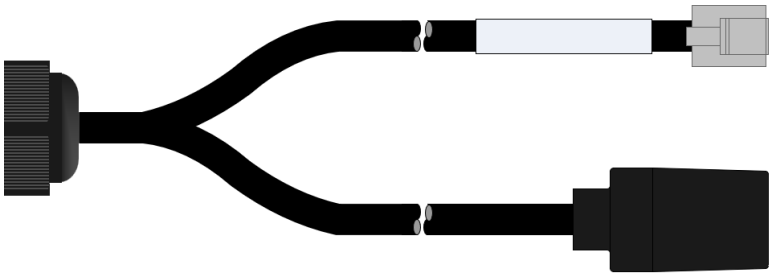


Figure 19. RJ11 cable for Uni-directional Flow and Tamper Inputs (with replicated outputs).

Note: Another option is available for an RJ11 pulse input only. (The RJ11 output socket is absent).

4.8. Temperature Input (RTD - PT100)

The logger may include a 4-pin connector for connection of a temperature sensor. Typically, this will be a PT100 RTD sensor.

The logger interface will be labelled “EXT TEMP INPUT” (or similar).

The pinout of the connectors in the table below:

Logger bulkhead connector pinout : 4-pin Temperature (RTD -PT100)			
A	B	C	D
RTD_V +	RTD_SENS +	RTD_V -	RTD_SENS -

When the temperature sensor is ordered from HWM along with the logger, the sensor will have the correct connector fitted for the Intelligens logger. The logger input will also be factory calibrated for use with the supplied sensor.

4.9. SonicSens 3 (distance / depth sensor using ultrasound)

Where a SonicSens3 interface is available on your logger, it will have a 6-pin connector, labelled “ULTRA SONIC INPUT”.

The interface provides power and communications to the sensor, which measures distance to a fluid surface. By input of other parameters (e.g., distance from the bottom of the water channel) the logger can calculate water depth. It can also derive a variety of other measurements such as flow rates if situated near an open weir, if the channel option is enabled.

Refer to the SonicSens-3 user-guide (MAN-153-0001) for instructions on how to install and setup the sensor for operation.

Note: This input is multi-purpose. If enabled, your setup tool may include facilities to change the logger input to an alternative sensor type. (e.g. SonicSens to RadarSens).

4.10. RadarSens (distance / depth sensor using ultrasound)

Where a RadarSens interface is available on your logger, it will have a 6-pin connector, labelled "RADARSENS INPUT".

The interface provides power and communications to the sensor, which measures distance to a fluid surface. By input of other parameters (e.g., distance from the bottom of the water channel) the logger can calculate water depth. It can also derive a variety of other measurements such as flow rates if situated near an open weir.

Refer to the RadarSens user-guide (MAN-170-0001) for instructions on how to install and setup the sensor for operation.

Note: This input is multi-purpose. If enabled, your setup tool may include facilities to change the logger input to an alternative HWM sensor type. (e.g. RadarSens to SonicSens 3).

4.11. External mV input (interface for analogue interfaces)

The 'External mV' input on the main logger unit is a general purpose interface. It does not directly measure mV, but is used for one of the following:

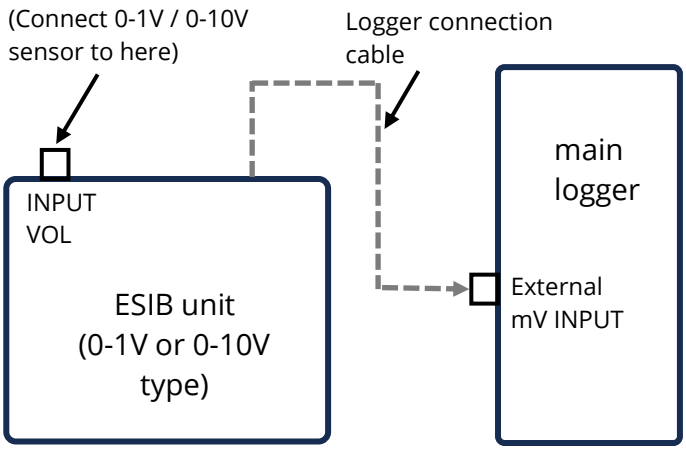
- Pressure / Depth sensors (cabled) via the External Sensor Interface series of units.
  (Refer to section 2.2).
- External Sensor Interface (with Battery) for 0 ~ 1V and 0 ~ 10V sensor types
  (Refer to section 2.3.2 and 4.11.1).
- External Sensor Interface (with Battery) for 4 ~ 20 mA sensor types
  (Refer to section 2.3.3 and 4.11.2).
- Pressure sensors (built-in) via the 'External Pressure Box' (EXTPRESS) series of units.
  (Refer to section 11 and 11.2).

Note: The logger detects which specific sensor interface has been connected during a logger restart. Therefore, during installation, first connect any External Sensor Interface (with Battery) units to the logger.
Then force a logger restart prior to making any programming checks and adjustments.
Refer to the IDT user-guide for the steps to take to restart the logger.

Within IDT the interface is known as 'Analog Ext [n]'.

The External Sensor Interface units that include a battery must be mounted in the preferred orientation for optimal battery life. Refer to Figure 16.

4.11.1. ESIB UNIT: 0~1V AND 0~10V VERSIONS



This version of the External Sensor Interface (with battery) contains a lithium battery power source and some interface electronics for conversion of the attached sensor signalling method into a format acceptable to the logger.

The unit is for connection of a sensor which uses an output voltage level as its method of signalling. Both a 0-1V and a 0-10V input interfaces are available but must be specified at the time of ordering.

The internal battery supplies a limited amount of power to the sensor (up to 24V, current limited), but the timing of the power availability is under control of the logger. A small amount of power is additionally consumed by the interface circuitry itself.

The sensor is connected to the logger unit via a 4-pin connector, Labelled “INPUT VOL” (or similar).

The pinout of the connector is shown in the table below:

ESIB connector pinout (INPUT VOL)				
Pin	1	2	3	4
Signal	Sensor PWR +ve	Sensor +ve	Sensor -ve	GND

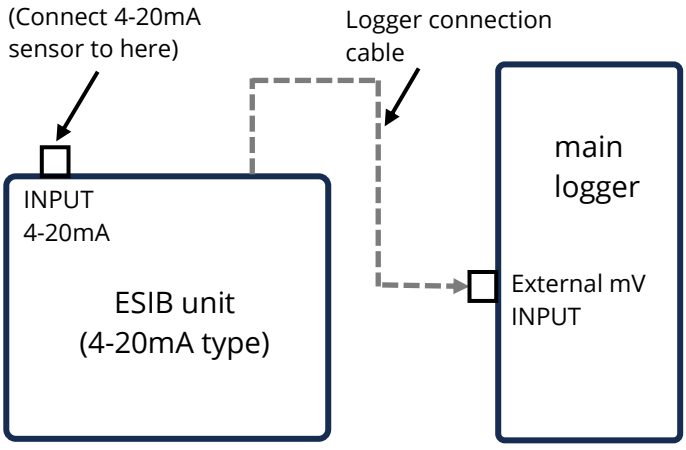
A wide variety of sensors are available with this interface.

When ordered from HWM, the sensor will have the correct connector fitted for the Intelligens logger.

IDT gives access to controls to set the amount of time the sensor has power applied prior to and during measurement. Set these to allow for any initialisation or settling time that the sensor requires.

Use IDT to confirm or adjust logger settings to correctly scale and interpret the physical parameters the attached sensor is used to detect.

4.11.2. ESIB UNIT: 4~20MA VERSION



This version of the External Sensor Interface (with battery) contains a lithium battery power source and some interface electronics for conversion of the attached sensor signalling method into a format acceptable to the logger.

The unit is for connection of a sensor which uses an output current (in the 4 to 20mA range) as its method of signalling.

The interface is supports Active Sensors (those requiring power supplied to them).

The internal battery supplies a limited amount of power to the sensor (up to 24V, current limited), but the timing of the power availability is under control of the logger. A small amount of power is additionally consumed by the interface circuitry itself.

The sensor is connected to the logger unit via a 4-pin connector, labelled “INPUT 4-20mA” (or similar).

The pinout of the connector is shown in the table below:

ESIB connector pinout (INPUT 4 – 20mA)				
Pin	1	2	3	4
Signal (4-wire)	Sensor PWR +ve	Sensor +ve	Sensor -ve	GND
Signal (2-wire)	Sensor PWR +ve	Sensor +ve	(Link together for 2-wire sensors)	

A wide variety of sensors are available with this interface.

When ordered from HWM, the sensor will have the correct connector fitted for the Intelligens logger.

IDT gives access to controls to set the amount of time the sensor has power applied prior to and during measurement. Set these to allow for any initialisation or settling time that the sensor requires.

Use IDT to confirm or adjust logger settings to correctly scale and interpret the physical parameters the attached sensor is used to detect.

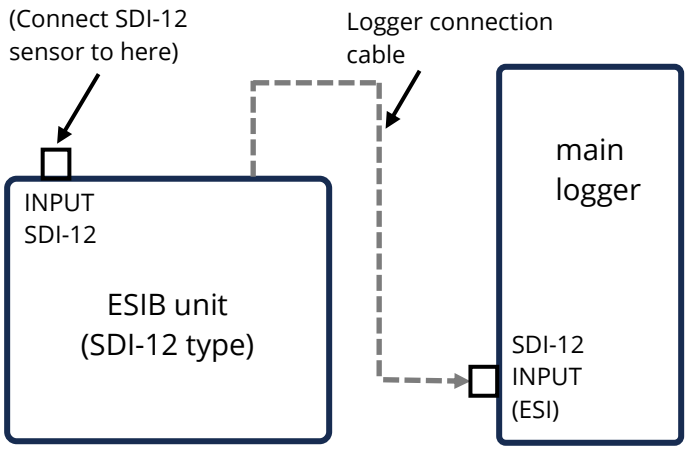
The interface can also be used with compatible sensors having their own source of power.

4.12. Serial Input (SDI-12) / ESIB unit

The main logger unit may include a 4-pin connector labelled “SDI-12 INPUT (ESI)”. This is not directly an SDI-12 input; The connection is a proprietary interface.

To provide an SDI-12 Interface, an ESIB unit is required.

Connect an ‘SDI-12’ version of the ESIB to the ‘SDI-12 INPUT (ESI)’ connector on the main logger unit for correct operation.



The ESIB unit then supplies an SDI-12 interface via a 3-pin connection labelled “INPUT SDI-12” (or similar). Connect equipment that uses SDI-12 signalling to this connector.

The attached sensor equipment drives any sensor electronics. Often data from multiple sensors may be available from it.

The ESIB unit includes a battery, and should be mounted in the preferred orientation for optimal battery life. (Refer to Figure 16).

The pinout of the SDI-12 connector is shown below:

ESIB connector pinout (INPUT SDI-12)		
A	B	C
Sensor PWR +ve	SDI-12	GND

A wide variety of sensors are available with this interface.

When ordered from HWM, the sensor will have the correct connector fitted for the Intelligens logger. In addition, the sensor type will have been tested with the logger to confirm compatibility for use to obtain certain measurements. However, this may require selecting a specific driver for the sensor within IDT.

Operation and setup summary:

IDT will initially recognise the unit as a 'Serial connection', with further setup being required to extract data from the sensor(s) over an SDI-12 link.

Note: Ensure the attached sensor has the SDI-12 protocol selected, otherwise communications will fail.

Using the SDI-12 protocol, the logger can make a request for a measurement to the equipment attached to the EISB. The attached equipment responds when the measurement has been obtained.

The sensor equipment will have an address that the logger must use when communicating with it. Obtaining data begins by the logger requesting a measurement (sending an "M" command or a "C" command).

Some sensor equipment will send multiple items of measurement data as a block (e.g., one piece of equipment may include several sensors). The setup of the logger can include an index to select the required data from the block.

The installer will have to use IDT to confirm or adjust the settings of the logger to request the required measurement data from the sensor. Setup of the logger should include the relevant addresses, commands, and indexes that are required to start the measurement and then select the specific data item required.

The installer is required to correctly scale and interpret the physical parameters the sensor is used to detect.

(Refer to the IDT user-guide for further information on how to set up the logger to use the SDI-12 interface).

Consult your HWM representative for advice on sensor compatibility or if you have any specific sensor requirements.

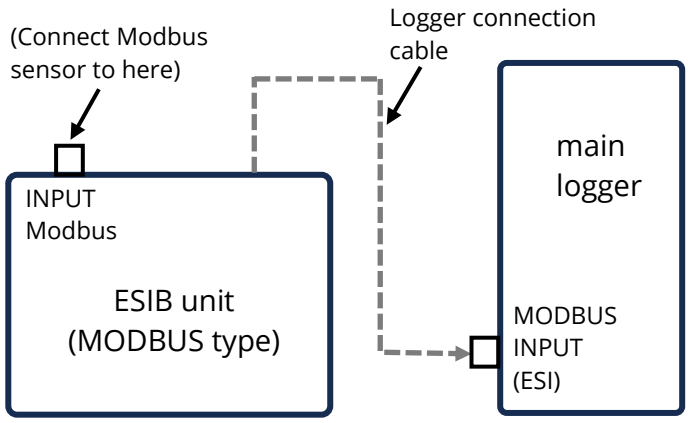
4.13. Serial Input (RS485 / MODBUS) / ESIB unit

The main logger unit may include a 4-pin connector labelled "MODBUS INPUT (ESI)". This is not directly a RS485 / MODBUS input; The connection is a proprietary interface.

To provide a MODBUS Interface, an ESIB unit is required.

Connect a 'MODBUS' version of the ESIB to the 'MODBUS INPUT (ESI)' connector on the main logger unit for correct operation.

The ESIB unit then supplies a MODBUS interface via a 3-pin connection labelled "INPUT MODBUS" (or similar). Connect equipment that uses MODBUS signalling to this connector.



The attached sensor equipment drives any sensor electronics. Often data from multiple sensors may be available from it.

The ESIB unit includes a battery, and should be mounted in the preferred orientation for optimal battery life. (Refer to Figure 16).

The pinout of the connector is shown below:

ESIB connector pinout (INPUT MODBUS) / RS485			
1	2	3	4
Sensor PWR +ve	RS485+ (A)	Sensor PWR -ve	RS485- (B)

A wide variety of sensors are available with this interface.

When ordered from HWM, the sensor will have the correct connector fitted for the Intelligens logger. In addition, the sensor type will have been tested with the logger to confirm compatibility for use to obtain certain measurements. However, this may require selecting a specific driver for the sensor within IDT.

Operation and setup summary:

IDT will initially recognise the unit as a 'Serial connection', with further setup being required to extract data from the sensor(s) over a MODBUS link.

Note: Ensure the attached sensor has the RS485 / MODBUS protocol selected, otherwise communications will fail.

The Intelligens operates as the master device when using the Modbus protocol. It sends setup instructions and other information to the attached sensor equipment (which operates in slave mode). The protocol includes the ability to address each register in order to read and (depending on the attached unit) write to the registers. Measurement results are made available to the logger by reading them from specific registers in the sensor equipment over the Modbus link.

The sensor equipment will have an address that the logger must use to identify it when communicating. The setup of the logger should therefore include the sensor address as well as the register access details (function code, start register address).

The quantity of registers to be read will depend on the format of the data within the sensor registers. The logger can handle multiple formats of numeric data (e.g., 16-bit signed, 16-bit unsigned, float, double); however, the expected data format must be specified in the logger setup; this will ensure that the required number of registers are read and that the data is correctly interpreted by the logger. The read data can then be used to obtain the channel datapoints.

When setting the logger for use with your sensor, usually the “generic” setting is suitable. However, some modification of the logger operation is required for certain types of sensor equipment in order to get the best out of them. IDT provides a control to select specific sensors from a list. Once chosen, the logger will handle any peculiarities of the behaviour of the sensor, its protocol, or additional needs for the measurement being taken (e.g., additional exchanges of information between the logger and the sensor equipment).

The installer will have to use IDT to confirm (or adjust) the settings of the logger that request the required measurement data from the sensor. Setup of the logger should include the relevant slave address, Modbus read function, register start address and data format. These are required to start the measurement read and interpretation of its stored format.

Then use IDT to correctly scale and interpret the physical parameters the sensor is used to detect.

(Refer to the IDT user-guide for further information on how to set up the logger to use the RS485 / Modbus interface).

Consult your HWM representative for advice on sensor compatibility or if you have any specific sensor requirements.

4.14. External Battery

The use of an ATEX-approved external battery pack (see section 2.4) is optional for many installations but may be required to support the logger in order to obtain the required length of service.

For best battery life, orient the external battery in its preferred orientation (refer to the labelling on the battery). Batteries are heavy devices. When positioning the battery, check that it is not crushing any cables or tubes within the installation. Ensure the battery is secure in its installation position (so it cannot fall). Then connect it to the logger.

The logger connection for the external battery will be presented via a (2-pin) connector, labelled “EXT POWER INPUT”.

4.15. Antenna (Cellular communications)

An antenna should be selected to suit the available space in the chamber, allowing some space for it to be re-positioned (if required). Only use HWM-provided antenna with your logger, to ensure the radio interface meets approvals requirements (safety, etc).

4.15.1. Connecting the antenna

Intelligens has two alternative antenna connector types:

- Antenna (plastic “Bulgin” style connector shell).
- Antenna (metal “FME” style connector).

(The connector fitted depends on model ordered).

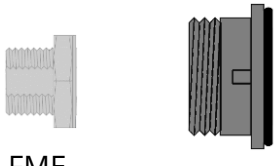


Figure 20. Alternative types of connector for cellular communication antenna

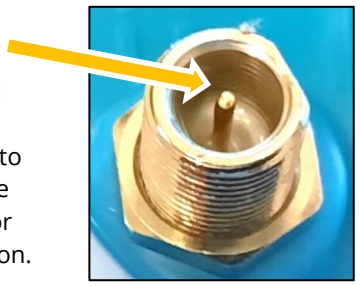
Plastic connectors are recommended for wastewater applications, where the environment may cause the FME connector to corrode. The FME connector is generally used for clean water or gas applications, where the environment is less harsh.

When a plastic connector is used, plug in the antenna connector and tighten until finger-tight.

When using the metal “FME” style antenna connector, some additional preparation is needed.

Prior to connecting the antenna, ensure that the connector is dry and clear of dirt and debris; trapped moisture or contaminants can impair the antenna performance. Clean if necessary.

Apply SG M494 silicon grease (or HWM approved equivalent) to the connector as required.



The antenna connector has an O-ring included for protection against water and moisture ingress; it acts as a seal. Check that the O-ring is present and undamaged.

Ensure that the connector and O-ring are dry and clear of dirt and debris. Clean carefully if necessary.

Insert the antenna connector into the logger connection and ensure it is fully home. Tighten the connector correctly; the nut on the antenna should be finger tight, plus 1/4 turn.

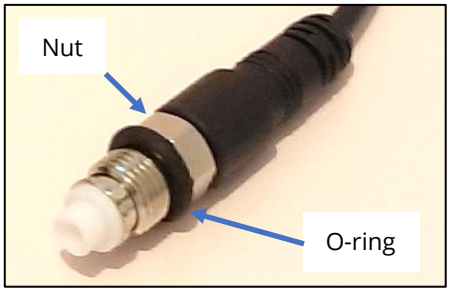


Figure 21. Antenna connector detail (FME type)

4.15.2. ANTENNA TYPE, PLACEMENT AND CABLE CHECKS

For all antenna types:

No sharp bends should exist at the cable ends, or in the routing of the antenna cable.

To avoid risk of crush damage to the antenna cable, check that no equipment is placed onto it. Similarly, cable ties fixing the cable in place should not be too tight.

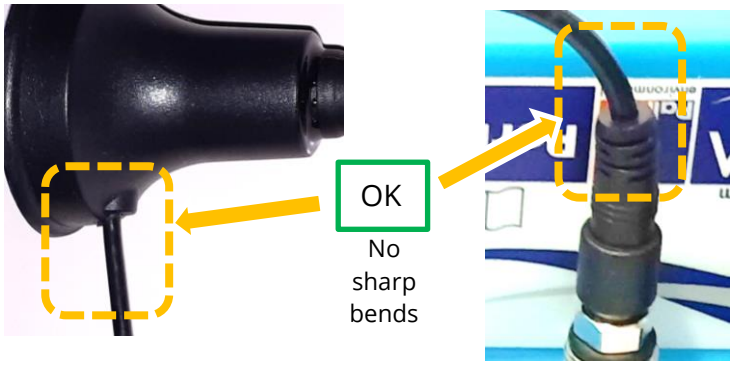


Figure 22. Protect from sharp bends (especially near connectors)

The antenna should not be bent to fit the installation; if it is too big for the chamber, use a smaller type of HWM approved antenna.

When positioning the antenna, ensure that the radiating end of the antenna does not touch or go close to a metal surface.

The radiating element of the antenna should ideally be positioned in free air (free from obstructions).

Try to avoid placing the antenna in a location where it can be flooded. If this is unavoidable, then place it where the risk is at its minimum.

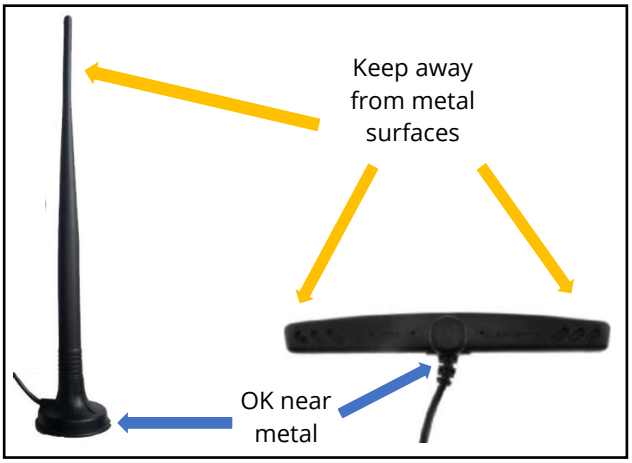


Figure 23. Antenna and metal surfaces

For equipment that is installed in a chamber below ground level, the antenna should be placed above ground level if possible. Where this is not possible, position it near to the top of the chamber.

Some general advice is given below:

Monopole Antenna

For most installations, a monopole antenna will give acceptable performance.

Installation Considerations:

- Always comply with any installation restrictions as per warnings in the documentation supplied.
- The antenna has a magnetic base to be used for mounting.
  For optimum performance, the antenna requires a “ground plane” (metal surface) at its base.
- When installing the antenna in large underground chambers it should be positioned close to the surface.
- Ensure that any chamber lid will not interfere with the antenna or cables when being opened/closed.
- This antenna is vertically polarised, it should always be installed in the vertical orientation.
- Never bend the radiating element of the antenna.
- The antenna can also be attached to an installation bracket mounted to an existing marker post.
- Where an antenna is held in place by magnets, ensure the weight of any cables does not excessively load the magnet so as to detach it from the installed location.
- Do not allow any equipment to rest on the antenna connector as crush damage to the connector or antenna cable can result.

For other antenna options and additional installation guidelines, refer to the documents available on the support webpage: https://www.hwmglobal.com/antennas-support/

4.15.3. Positioning and testing the Antenna

IDT should be used to check that the logger can connect to the cellular network and that the antenna is in the optimal position for the site.

Choose a suitable antenna for the installation and decide on its initial position.

Initially, perform Network Signal tests (see section 4.15.4) to confirm the logger connects to the mobile network. Use the results of the signal test (see sections 4.15.4.1 and 4.15.4.2) to find the best initial installation location for the antenna.

Next perform a Call Test (see section 4.16) to confirm that the logger can communicate with the DataGate server.

4.15.4. Cellular Network – Signal Test

The Signal Test will produce an indication of the suitability of the received cellular network signal for communication. This will include:

- A ‘CSQ’ value (for 2G and 3G networks).
  (This is a measure of signal strength).
- ‘RSRP’ and ‘RSRQ’ values (for 4G networks).
  (Reference Signal Received Power; A Signal Strength indication).
  (Reference Signal Received Quality; A Signal Quality indication).

Check the results are suitable (see section 4.15.4.1 or 4.15.4.2, as appropriate).
Make adjustments to the installation, as needed.

Initially this test should be done with an open chamber. This is to verify that the connection to the mobile network works, and to determine the signal levels in a 'best case' situation.

Then, with the test still running, close the chamber. The values will degrade due to the lid of the chamber reducing the strength of the received signal.
Re-position the antenna within the chamber to find the best signal results. The antenna should finally be installed in the most optimal position found during signal test.

- Determine the network technology being used and then use the appropriate signal quality limits. (Refer to the IDT user-guide).
- Perform Network Signal tests to confirm the logger connects to the mobile network and find the best location of the antenna. Re-position if required.
- Perform test calls to confirm the logger can communicate with the DataGate server via the internet and (if required / available) SMS.

(Details of use of IDT for making these tests are provided in the IDT app user-guide).

4.15.4.1. CSQ GUIDELINES

During signal tests, once connected to a 2G or 3G mobile network, the provider details and a colour-coded signal strength indication (CSQ) is displayed by IDT.

The following guidelines are given for the cellular network signal strength
(as measured by CSQ result, with the chamber closed):

15+ **Good**.
(Data transmission should be reliable).

8-14 **Fair**.
(Depending upon the ambient conditions data transmission may be possible. It is important to select the correct antenna and install it in the most suitable location).

0-7 **Poor.**
(The logger may be able to register with network but will not be able to send or receive data reliably).

Note: Poor CSQ levels will reduce battery life.

4.15.4.2. RSRP AND RSRQ GUIDELINES

During signal tests, once connected to a 4G mobile network (NB-IOT and LTE-M), the provider details and a colour-coded indicators of the RSRP and RSRQ values are displayed by IDT.

RSRP value: The following guidelines are given for the cellular network signal,
(as measured with the chamber closed):

>= -105 **Good.**
(Data transmission should be reliable).

-106 to -120 **Fair.**
(Data transmission should be reasonably reliable).
It is important to select the correct antenna and install it in the most suitable location).

< -120 **Poor.**
(Reliable data speeds may be possible but drop-outs may occur.
The logger may be able to register with network but will not be able to send or receive data reliably).

RSRQ value: The following guidelines are given for the cellular network signal, (as measured with the chamber closed):

> -9	**Good.** (Data transmission should be reliable).
-10 to -12	**Fair.** (Data transmission should be reasonably reliable). It is important to select the correct antenna and install it in the most suitable location).
< -13	**Poor.** (Reliable data speeds may be possible but drop-outs may occur. The logger may be able to register with network but will not be able to send or receive data reliably).

Note: Poor RSRP or RSRQ levels will reduce battery life.

4.16. Making a Call Test (test internet data network)

Communications can be confirmed by making a test call with the chamber closed.
This test confirms that the logger can **communicate with the DataGate server** over the cellular internet data network / internet. (If required / available, also test an SMS call).

Confirm that your device is communicating with the server ***before you leave site***.

(Details of use of IDT for making these tests are provided in the IDT app user-guide).

Trouble-shoot a test-call failure if required, using the advice in the IDT app user-guide.
Further information is given in the HWM Antenna Installation Guide (MAN-072-0001).

Troubleshooting a Call Test failure

There are a number of reasons why a Call test may fail.
The following points should be checked before calling HWM support for assistance:

Possible Problem	Solution
Network Busy due to excessive traffic. Commonly occurs around schools and at peak travel times.	Retry the test after a few minutes.
Network signal not available at your location. Not all Cell masts carry data traffic	Relocate the logger to an area that has a data service or change to a different network provider.
Network signal not strong enough. For 2G and 3G networks, you need a CSQ (reported by the Call test) of at least 8 for reliable communications. For 4G networks, check the RSRP and RSRQ values are suitable, as described section 4.15.4.2.	Relocate the antenna if possible or try alternative antenna configurations.
APN settings incorrect.	Check with your network operator that you have the correct settings for your SIM.

If you continue to experience problems with communication, you may need to check the network coverage in your location.

5. Maintenance, Service and Repair

Unauthorised servicing will void the warranty and any potential liability for HWM-Water Ltd.

5.1. Cleaning

Note the safety warnings that are applicable to cleaning. The unit should only be cleaned using a mild cleaning solution and a **damp** soft cloth. Always keep connectors free of dirt and moisture.

5.2. Replaceable Parts

Antenna

- Only use antenna recommended and provided by HWM.

For details of antenna options and part-numbers to order, refer to the following link: https://www.hwmglobal.com/antennas-support/ (or consult your HWM representative).

Batteries

- Only use batteries and parts recommended and provided by HWM.
- Internal batteries of the main logger unit are only replaceable by a HWM approved service centre or relevantly trained technician. Contact your HWM representative for more details if required.
  (See also section 7).
- Batteries can be returned to HWM for disposal. To arrange the return, complete the on-line RMA (Returned Materials Authorisation) form: https://www.hwmglobal.com/hwm-rma/
  Refer to the Safety Warnings and Approvals Information for guidelines of the packing requirements.

SIM-card

- Only use consumable parts recommended and provided by HWM.
- SIM-cards are replaceable by a HWM approved service centre or relevantly trained technician. (See also section 8).

ESIB units

- The ESIB unit mostly consists of an internal battery. In addition, there is a small electronic interface board. When the battery is depleted the ESIB unit must be replaced.

External Battery Pack units

- The External Battery Pack unit mostly consists of an internal battery. When the battery is depleted the External Battery Pack unit must be replaced.

Desiccant replacement (ESI units with an air breather)

- The desiccant compound should be periodically replaced for any pressure / depth interfaces with a breather tube fitted. (Discuss with your HWM representative).

5.3. RETURN OF PRODUCT

When returning product for investigation or repair, be sure to follow the instructions of your distributor to document why the product is being returned and provide contact details.

If returning to FCS, this can be done by completing the on-line RMA (Return Materials Authorisation) form:

https://www.fluidconservation.com/support/#submit-an-rma

Ensure the unit is cleaned, disinfected, and dried prior to shipment.

6. TROUBLESHOOTING

Any issues should consider all parts of the system (IDT, the user, the logger, sensors, the cellular network, and the server).

General checks:

Initial checks to be made during a site visit include:

- Check that the latest version of IDT is being used.
- Check that the logger being used has the latest software (IDT will offer to upgrade if required).
- Check the battery voltage of logger is good (using the IDT Hardware Test).
  Also check the battery voltage of any ESIB units in a similar way.
- Check the cable and connectors between sensors and the logger are in an OK condition, with no damage or water ingress.

The logger does not appear to be able to communicate with IDT:

- The logger may have shut down the connection to IDT due to is not being used for several minutes. Re-read the logger settings into IDT. Any previously unsaved settings will have been lost.

The data from the logger does not appear on the server:

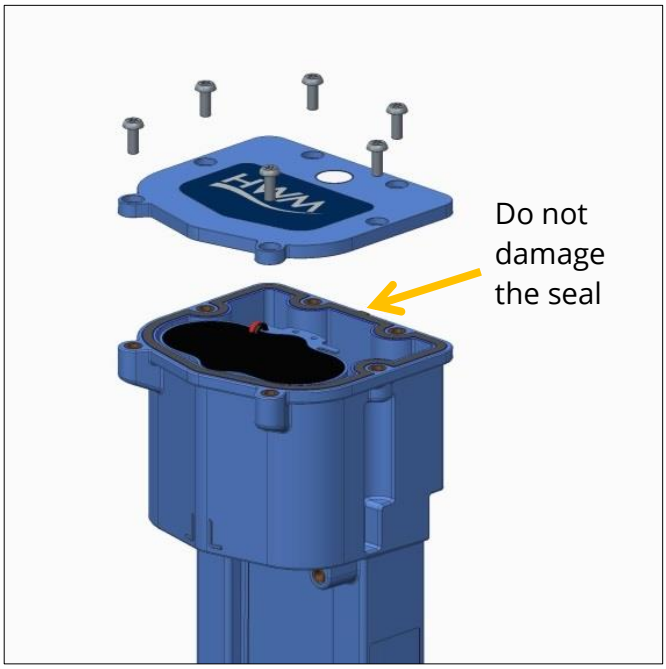
- Check the settings for the SIM card to access the mobile data network.
- Ensure the logger uses the correct data destination URL and port-number for your server.
- Check call-in times have been set.
- Check antenna is attached and in an OK condition.
  Check signal quality and strength parameters are suitable. Re-locate the antenna, if required, or try an alternative type of antenna.
- Make a Call Test and confirm OK.
- Ensure your server is correctly configured to receive and present the data.

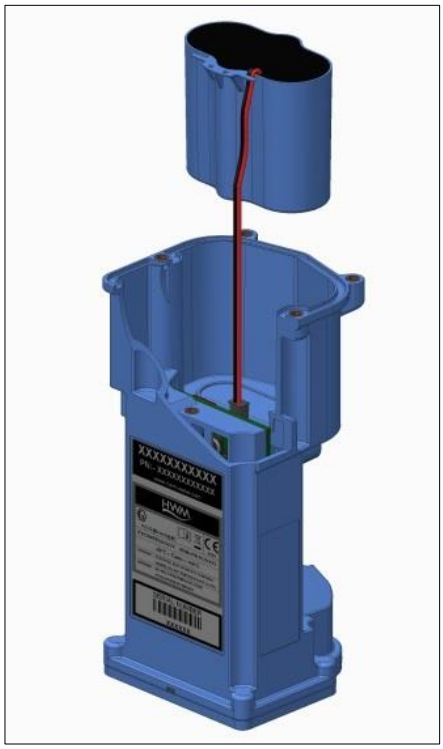
7. Appendix 1 – Battery Replacement (Internal)

Warning:

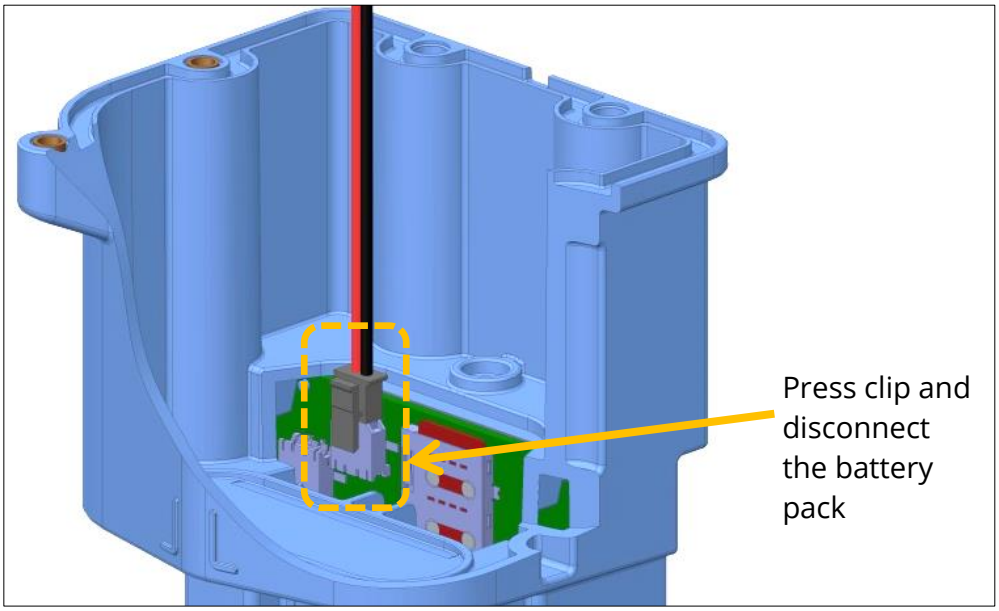
ALWAYS USE BATTERY PACK INTBATTPACK/7V2/H95 AND
NEVER OPEN THE UNIT IN AN EXPLOSIVE GAS ENVIRONMENT

1) Remove the lid, taking care not to damage the seal. Then lift out the battery





2) Disconnect and remove the old battery; press the clip on the top of the plug to release it.



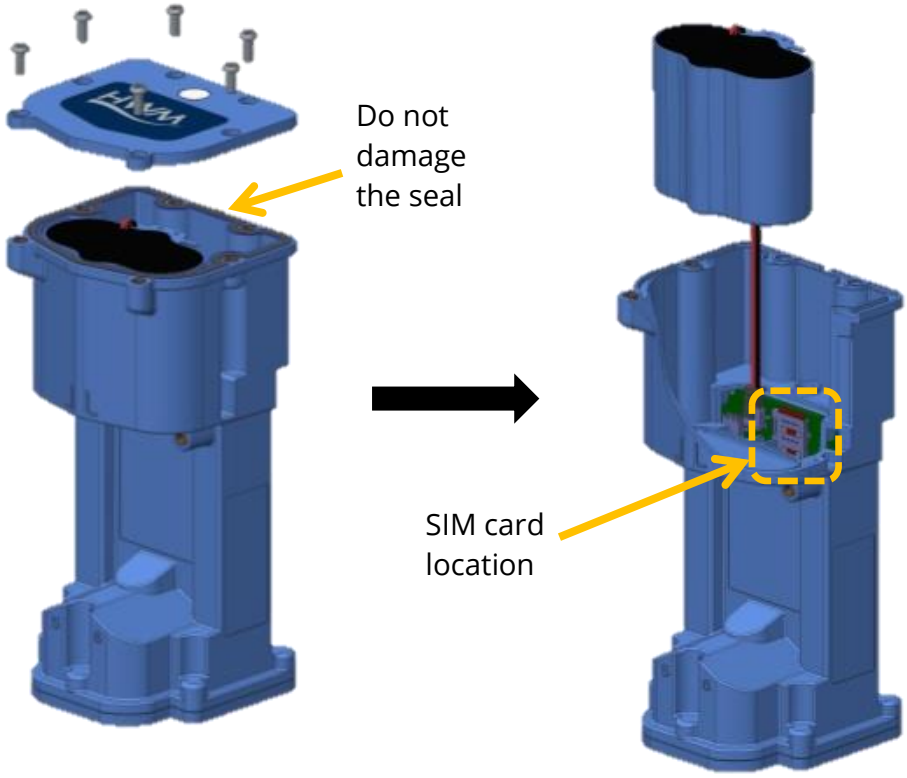
3) Fit the new battery pack and refit the lid.
Ensure the rubber seal is seated in the groove before tightening the screws.

8. Appendix 2 – Fitting your own SIM card

Warning:

DO NOT OPEN WHEN EXPLOSIVE ATMOSPHERE IS PRESENT.
DISCONNECT THE BATTERY **BEFORE** REMOVING OR INSERTING A SIM CARD

1) Remove the lid of the logger, taking care not to damage the seal.



2) Lift out and disconnect the battery.

   IMPORTANT: Failure to do this can result in permanent damage to your logger.
   The SIM card in the intrinsically safe product is **NOT** hot swappable.

   The SIM card slot is located beside the battery plug.

3) Insert the SIM with the shaped corner facing down and away from the battery connector.

4) Refit the battery and lid ensuring the screws are retightened to 1.2Nm to ensure the logger remains water tight.

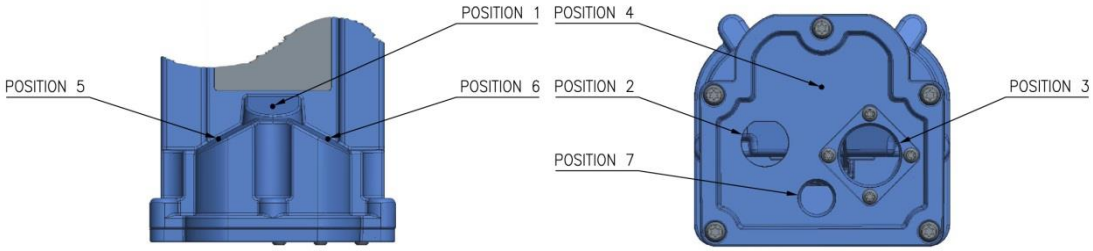
5) (Only required for loggers using the 2G network).
   Proceed with programming the logger and ensure you enter the new SIM phone number into the logger using the IDT software (refer to the IDT user-guide for details). The phone number must include the '+' symbol and the international dialling code with no spaces.
   e.g. +4477xxxx.
   This is an important step as the logger sends an SMS message to itself once a month to synchronise its clock. If the wrong phone number is entered, this can result in an international SMS message being sent.

9. APPENDIX 3 – TECHNICAL SPECIFICATIONS

(For Technical Specifications, please refer to the product datasheet)

10. APPENDIX 4 – CONFIGURATION OPTIONS

Data logger physical port positions



Part Number make-up – H95/xxxxxxx/xxxxxx/IS

H95	/xxxxxxx	/xxxxxx	/IS
HWM Logger Type No	Antenna, Communications & Input/Output Channel Configuration (See tables below)	Modem opt (See table)	Safety Designation

Input Channel Type Matrix (/xxxxxxx/xxxxxx)

Select the channel types required from the table below and build the number based on your required case positions in the order – **1 3 4 5 6 2**

Note: Each case position can only be used **once**, for unused positions enter '0'

Channel Type	Description	Case Position
Antenna option (/Xxxxxxx)		
F	Antenna FME socket	1
Pressure measurement (Input 1) (/xXxxxxx)		
1	Internal Pressure Transducer (100mBar) (Refer to Note (2), below)	3
2	Internal Pressure Transducer (350mBar) (Refer to Note (2), below)	3
3	Internal Pressure Transducer (500mBar) (Refer to Note (2), below)	3
4	Internal Pressure Transducer (5Bar) (Refer to Note (2), below)	3
5	Internal Pressure Transducer (3.5Bar) (Refer to Note (2), below)	3
6	Internal Pressure Transducer (10Bar) (Refer to Note (2), below)	3
7	Internal Pressure Transducer (20Bar) (Refer to Note (2), below)	3
8	Internal Pressure Transducer (35Bar) (Refer to Note (2), below)	3
Communications and Antenna options (/xxXxxxx)		
P	Plastic antenna connector – deletes FME socket	3
J	3 Pin communications for use with Digital metering (required with options K & K5)	4
Other logger connections (/xxXXXxx) up to 3 can be selected		
1	Single Pulse Replicator Output (Matching input) Bi-directional	Can be fitted in positions 4, 5 or 6.
2	Dual Pulse Replicator Outputs (Matching input) Uni-directional (inc tamper)	
3	External mV sensor input connector. (Input for an EXTPRESS or ESI or ESIB unit) (For EXTPRESS unit, refer to Note (2), below)	
4	2 x user configurable Outputs	
B	External power input	
C	External temperature input	
L	*(Reserved for future use)* Leak Noise Sensor input	
M*	Input from an 'External Sensor Interface with Battery' (Modbus type) (See Note (1)).	
Q*	Input from an 'External Sensor Interface with Battery' (SDI-12 type) (See Note (1)).	
S	SonicSens input (for SonicSens 2) (Refer to Note (3), below)	
U	Ultrasonic sensor input (for SonicSens 3)	4
D	RadarSens input	4
Digital metering inc. Comms if J not selected - (Max 4 channel inputs) (/xxxxxXX)		
0	Standard 7-pin communication connector only	2
1	2 Flow inputs (configured as Pulses & Direction) producing a "net flow" data channel	2
A	2 Flow inputs (configured as Forward & Reverse pulses) producing a "net flow" data channel	2
4	2 Flow inputs (configured as Pulses & Direction) producing 2 data channels Forward flow / Reverse flow (logged separately)	2
8	2 Flow inputs (Pulses) producing 2 data channels (2 x independent uni-directional flow)	2
K	Glanded Uni-directional pulse input for meter interface RJ11	2
K5	Glanded Uni-directional pulse input for meter interface RJ11 with tamper input. Glanded Outputs (Replication of Pulse input + tamper input)	2
9	2 inputs configured as 2 independent (open / closed) Status inputs	2

Notes:- (1) (*) Modbus and SDI-12 cannot be ordered together.
(2) This option is being phased out. Refer to section 11. Use External Pressure Sensor (ESI) units as an alternative.
(3) Logger interface available, but SonicSens2 is no longer available.

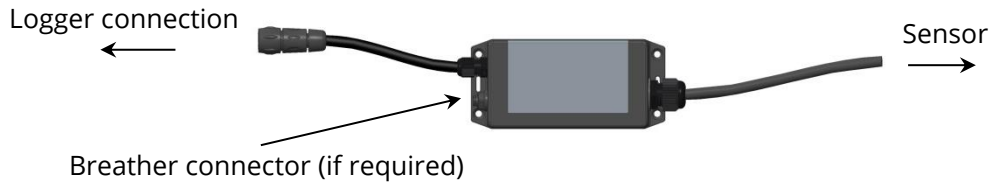
Modem types and data option (/xxxxxxx /xxxxxx)

Modem Type no	Description
CCCxxx	International country letter code
xxxnnn	Customer variant code nnn – contact HWM for details

Example UK & Europe GPRS Data Logger Order Codes	
H95/F000001/UK1/IS	Single channel (Pulses/Dir) producing one data channel "net flow"
H95/F010001/UK1/IS	Single channel (Pulses/Dir) producing one data channel "net flow" & 1 pulse replicator output
H95/F000008/UK1/IS	Dual channel Uni-directional flow
H95/F020008/UK1/IS	Dual channel Uni-directional flow &2 pulse replicator outputs
H95/F0J00K5/UK1/IS	Single channel uni-directional flow + Tamper & 2 Pulse Replicator outputs (Pulse + Tamper)
H95/00P3Q99/UK1/IS	External mV Interface (configuration depends on sensor interface unit ordered with logger) & Interface for SDI-12 support via an ESIB (SDI-12) unit & 4 x Status Inputs & Plastic Antenna connection.

External Sensor Interface

(used for mV sensors, e.g. pressure / depth)



Part Number make-up – ESI2/xy-len/IS

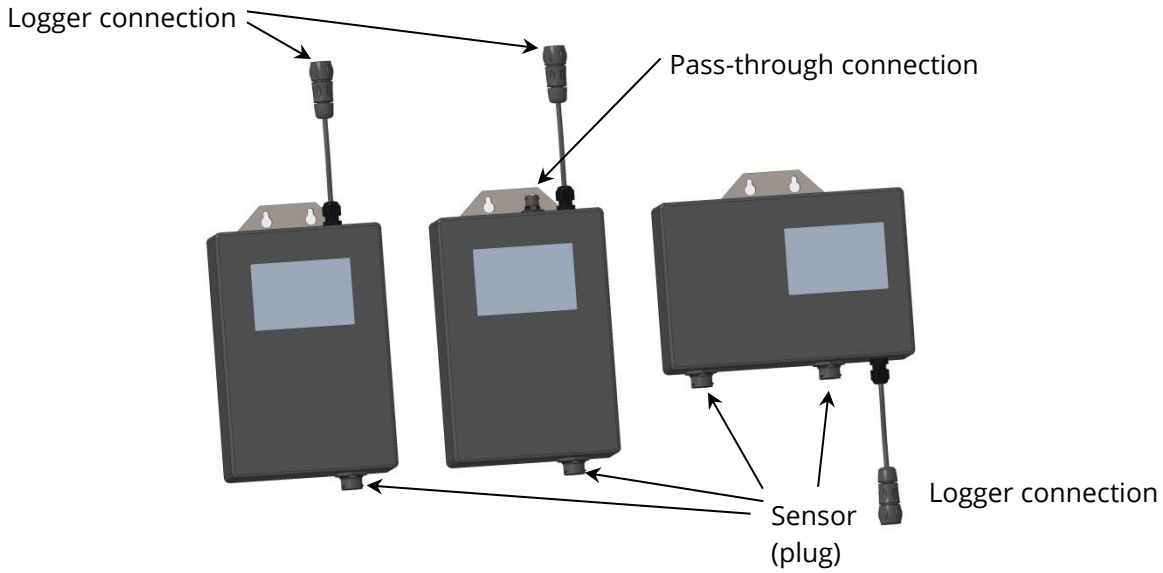
ESI2	/xy-len	/IS
HWM External Sensor Interface revision 2	(x = Sensor selector. y=Mounting type. ien = cable length)	Safety Designation
21	Depth Transducer 350mBar (Type 1 - frame mounted)	
22	Depth Transducer 350mBar (Type 2 - wall mounted)	
31	Depth Transducer 700mBar (Type 1 - frame mounted)	
32	Depth Transducer 700mBar (Type 2 - wall mounted)	
41	Depth Transducer 1Bar (Type 1 - frame mounted)	
42	Depth Transducer 1Bar (Type 2 - wall mounted)	
61	Depth Transducer 35Bar (Type 1 - frame mounted)	;1830 series
62	Depth Transducer 35Bar (Type 2 - wall mounted)	;1830 series
71	Depth Transducer 35Bar (Type 1 - frame mounted)	;5000 series
72	Depth Transducer 35Bar (Type 2 - wall mounted)	;5000 series

Example part number: **ESI2/21-10/IS**
350mBar Depth Transducer 10m length.

Note: The External Sensor Interface must only be used with the Intelligens / COMLog™IS data logger, HWM Part number H95/xxxxxxx/xxxxxx/IS which must include a type 3 entry in the part number.

External Sensor Interface with Battery

(used for powered sensors, e.g. 4-20mA (Radar) or SDI-12 (Doppler Velocity Probe) sensors)



Part Number make-up – ESIB2/xxyy/zz/Vs/IS

ESIB2	/xx		yy		/zz	/Vs	/IS
	xx – Input channel 2		yy – Input channel 1		Pass through / Mounting option	Battery Configuration	Safety Designation
Product generic part number prefix revision 2	00	None	V1	Voltage 0-1V Address 1	See table below for details	See note 3	See note 4
	00	None	V2	Voltage 0-1V Address 2			
	00	None	21	Voltage 0-10V Address 1			
	00	None	22	Voltage 0-10V Address 2			
	00	None	51	4-20mA Address 1			
	00	None	52	4-20mA Address 2			
	52	4-20mA Address 2	51	4-20mA Address 1			
	00	None	M1	Modbus	(Not currently available)		
	00	None	Q1	SDI-12			

/z – Pass through	z – Mounting option
0 – No Pass through	P – portrait – wall bracket
1 – Pass through	L – landscape – wall bracket
	F – frame mounting – no bracket

Notes:

1. Only the 4-20mA build is currently approved as a dual configuration for intrinsic safety.
2. The pass through option is only applicable to voltage and 4-20mA type builds with single input channels (yy = V1, V2, 21, 22, 51 and 52).
3. Typical battery configuration is 1082.
4. Characters 'IS' are not present for non-intrinsically safe build options.
5. The External Sensor Interface must only be used with the Intelligens / COMLog™IS data logger, HWM Part number H95/xxxxxxx/xxxxxx/IS.
6. The use of voltage / 4-20mA variants requires the Intelligens / COMLog™IS data logger to be equipped with option '3' from the 'other logger connections' options.
7. The use of SDI-12 and MODBUS variants requires the Intelligens / COMLog™IS data logger to be equipped with options 'Q' or 'M' respectively from the 'other logger connections' options.
8. The maximum current available to power sensors in voltage and 4-20mA variants is 24mA. See section 2.3.2 and 2.3.1 for configuration of the sensor power.
9. ESIB2/*/*/*/IS series is a revised version of the original product (ESIB/*/*/*/IS series). Refer to section 11.3 for details.

Part Number make-up – ESIB2/xxyy/zz/Vs/NIS

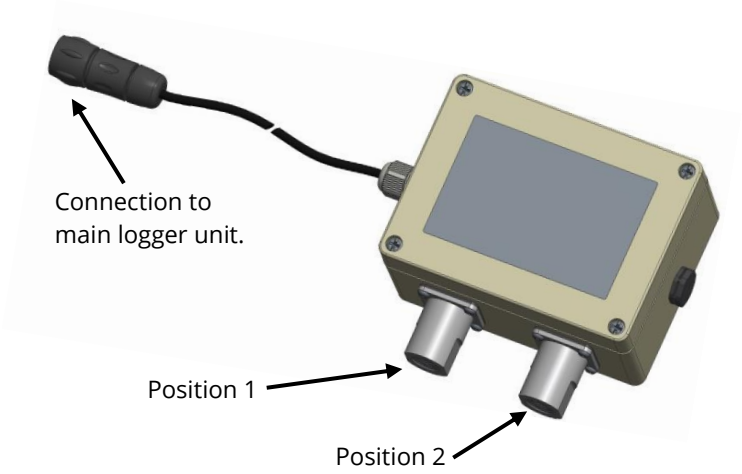
Note: These models are **not** of the '**Intrinsically Safe**' construction, and can be used only for non-ATEX applications.

ESIB2	/xx		yy		/zz	/Vs	/NIS
	xx – Input channel 2		yy – Input channel 1		Pass through / Mounting option	Battery Configuration	Safety Designation
Product generic part number prefix revision 2	00	None	Q3	SDI-12 – 12V output – Non IS	See table below for details	See note 2	See note 3
	Q3	SDI-12 – 12V output – Non IS	Q3	SDI-12 – 12V output – Non IS			

/z – Pass through	z – Mounting option
0 – No Pass through	P – portrait – wall bracket
1 – Pass through	L – landscape – wall bracket
	F – frame mounting – no bracket

Notes:
1. The pass through option is not available on these models.
2. Typical battery configuration is 1082.
3. Characters 'IS' are not present for non-intrinsically safe build options. They are replaced by 'NIS'.
4. The External Sensor Interface must only be used with the Intelligens / COMLog™IS data logger, HWM Part number H95/xxxxxxx/xxxxxx/IS.
5. The use of SDI-12 variants requires the Intelligens / COMLog™IS data logger to be equipped with options Q from the 'other logger connections' options.

External Pressure Box



Notes:
1. This product (part number series EXTPRESS/*/IS) is being phased out / discontinued. Refer to section 11 and 11.2 for further details and part-number scheme.

11. APPENDIX 5. - SUPPLEMENT FOR DISCONTINUED ITEMS

This section is provided for support of previously manufactured items, but which are being phased out. (For latest availability situation, check with your HWM Global representative).

A product summary is provided here. If additional information is required, refer to earlier versions of product documentation (e.g. MAN-142-0001-O), which may be obtained by contacting your HWM Global representative or Customer Support.

11.1. PRESSURE SENSOR (INTERNAL)

Description:

A gas pressure input may be presented as a built-in transducer (as shown in Figure 24).

An air-breather option may also be fitted to provide atmospheric pressure compensation (important for lower range transducers). Where a breather is fitted, the IP rating of the logger is reduced to IP67.

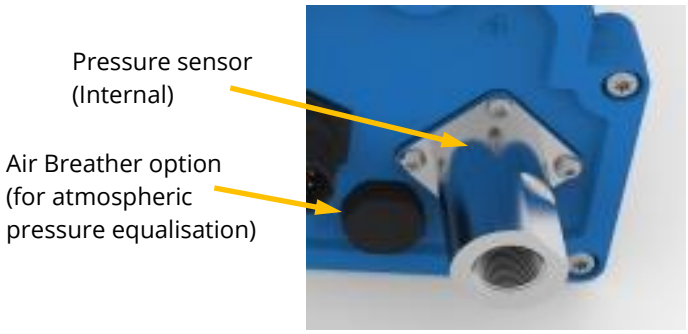


Figure 24. Pressure Sensor (built-in)

The transducers are factory calibrated, with calibration values being stored in the logger unit. No on-site calibration is required.

11.2. INTELLIGENS EXTPRESS (EXTERNAL PRESSURE SENSOR BOX) UNIT

Description:

Where additional 'built-in' gas pressure sensors are required for Intelligens, the logger capacity is extended by use of an EXTPRESS 'External Pressure Sensor Box' unit (see Figure 25).

The unit plugs into the main logger via an interface labelled as "EXTERNAL mV SENSOR INPUT". (Note: This is a multi-purpose interface and does not directly measure mV).

The transducers are factory calibrated, with calibration values stored in the EXTPRESS unit. No on-site calibration is required.

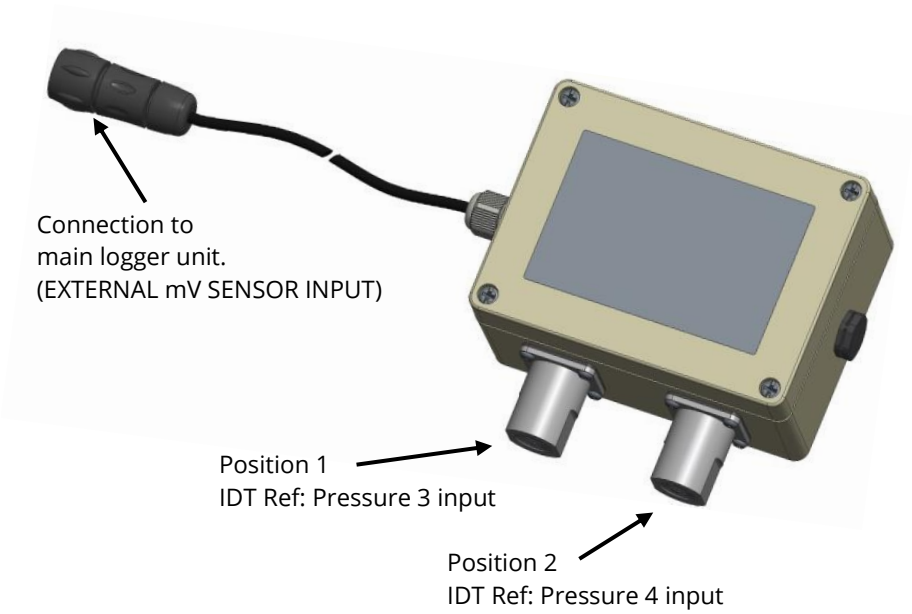
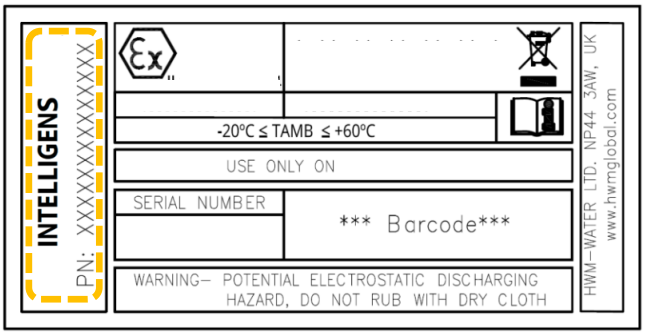


Figure 25. Intelligens External Pressure Sensor Box unit

The unit can be recognised from the part-number on the label, which begins with 'EXTPRESS'. The label also identifies "Intelligens" as the compatible logger type.

Additional labels are placed adjacent to each of the fitted pressure transducers, which identify its maximum pressure range.

The EXTPRESS pressure inputs will appear as 'Pressure 3' and 'Pressure 4' inputs in IDT.



Part Number make-up – EXTPRESS / x y / IS

EXTPRESS	/xy	/IS
HWM External Pressure Box	x – Position 1, Input 3 y – Position 2, Input 4 (See below for pressure type number)	Safety Designation
0	Not fitted	
1	Pressure Transducer (100mBar)	
2	Pressure Transducer (350mBar)	
3	Pressure Transducer (500mBar)	
5	Pressure Transducer (3.5Bar)	
4	Pressure Transducer (5Bar)	
6	Pressure Transducer (10Bar)	
7	Pressure Transducer (20Bar)	
8	Pressure Transducer (35Bar)	
9	Pressure Transducer (70Bar)	

Example part number:
EXTPRESS/07/IS.
20 Bar transducer fitted in position 2.
Configure input channel as Pressure 4.

Note: The External Sensor Interface must only be used with the Intelligens / COMLog™IS data logger, Part number H95/xxxxxxx/xxxxxx/IS which must include a type 3 entry in the part number.

11.3. ESIB (External Sensor Interface with Battery) unit

Early versions of the ESIB unit (models that have a part-number beginning with "**ESIB/**") have been discontinued, being replaced by revised models which have a part number in the "**ESIB2/**" series. (See section 2.3).

Note: "ESIB/" and "ESIB2/" models have **different port parameters**. Therefore, **check port parameters of each unit** before use.

Fluid Conservation Systems
1960 Old Gatesburg Road
Suite 150
State College PA, 16803
(800) 531-5465
www.fluidconservation.com