



FCS™

The Sound Choice
for Leak Detection.™

IDT (PC/Windows) User Manual



Warning:



Please read, understand, and follow any instructions in the relevant manual for your logger or that were shipped with the equipment. Where a logger is for use in a potentially explosive atmosphere, also refer to the relevant additional safety (Ex) documents for the equipment.

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1 **PART1: ----- INTRODUCTION -----**

1.1 **DOCUMENTATION AND SUPPORT**

IDT is available in two versions: IDT (PC version) and IDT (app for mobile devices). This user guide covers the PC version. Any subsequent reference to “IDT” within this manual will refer only to the PC version.

Note: The screen shots and menu descriptions used throughout this manual refer to specific functionality that is only installed in certain device types. Always refer to the on-screen menu to determine which features are available on your device.

The system periodically has new features and changes released, thus you may observe slight changes in pictures from those shown in this manual.

Updates of the IDT software are available from the HWM support webpage:
<https://www.hwmglobal.com/idt-support/>

HWM provides support for products by means of our customer support webpages:
<https://www.hwmglobal.com/help-and-downloads/>

Note: The user has to be registered by HWM and have a password to gain access to documents and software downloads.

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

Note: This user-guide will frequently use the term ‘logger’ to refer to either a logger device or a unit designed for another purpose but that includes built-in logger facilities.

Most HWM logger devices (or devices with a built-in logger) that are supported by IDT will have some similarities in the setup process. For the purpose of providing an explanation to accompany a description of IDT settings, the document will refer to a non-specific, typical, generic logger device. Many HWM loggers will operate in a manner similar to the descriptions provided. Other HWM equipment will have been designed for a specific purpose and will have certain IDT settings that are only relevant for that purpose. Follow any additional guidance within the user-manual of your equipment.

1.2 **LOGGER DEVICES SUPPORTED BY IDT (PC VERSION)**

IDT (PC version) can be used with the following logger (and other product) families:

- COMLog2
- Intelligens
- LoLog 450, LoLog Vista
- Multilog2
- Multilog2WW
- Multilog LX2
- Pegasus 2, Pegasus Plus
- Sentinel 2, Sentinel Plus
- PermaNET+
- Wi5D (*Note: Use of IDT with Wi5D is not covered by this User-Guide*).

1.3 SYSTEM OVERVIEW

The IDT (Installation Diagnostic Tool) is installed onto a Personal Computer (commonly known as a "PC"), using the Microsoft Windows™ operating system. It uses a communications cable to communicate with compatible HWM logger devices. The software provides a graphical user interface for the purpose of Setup, Installation, Diagnostics, and Testing of a HWM logger.

HWM logger devices produce data. The logger is often deployed to a site with the intention of it interoperating with a central server for the purpose of storing data centrally; the server acts as a data receiver and a data warehouse.

HWM provides software for this purpose, for example the DataGate server software.

Other servers can be set up using HWM software as the front-end to act as the receiver and decoder of logger messages.

If logger data is stored on a central server, it can be integrated with other server software that provides the ability to view the data. This provides the ability for the viewing platform to present the data to the user in a more meaningful way than just tables of raw data.

e.g., HWM provides the following web-based viewing platforms:

- DataGate (includes a General-purpose graphical data view)
- DataView (general-purpose graphical data view / meter readings)
- PermaNetWeb (monitoring for potential water pipe leaks)
- PressView (water Pressure Reducing Valve performance viewing website)
- SpillGuard (monitoring system for potential water spills / floods)

A server usually has to be prepared to receive data from the logger device and can make the received data available to other users who are authorized to use the system.

Alternatively, the user can view logger data locally using IDT, but features are limited in comparison to use of a logger device with a server. Where a logger has been unable to communicate with DataGate for some time, its data can be downloaded by IDT, stored, and then uploaded to DataGate later on (from the PC, when internet is available / user request).

Logger devices are normally partially pre-configured for use within the factory, with the installer occasionally having to make limited on-site adjustments. (Discuss any requirements with your HWM representative prior to ordering). IDT can provide access to many, but not all, device settings. Some settings are exclusively factory set.

The data-warehouse often operates on the principle of a logger being installed for a time period onto an installation site. i.e., It is site-based.

The administrative links that bind a logger to a site can be manually configured (by an administrator) or partially automated by the use of the HWM deployment app (used in conjunction with a mobile phone).

1.4 LOGGER – TYPICAL OPERATION

A typical logger device will behave as follows:

The logger's main task is to make periodic measurements and store the results. In addition, the logger will have daily tasks at set times, such as uploading its un-sent data over the internet. 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 usually 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 of the network. Setup of the logger for use with the cellular network and SIM card network provider is required, as is the availability of a suitable signal from the network.

Most loggers are powered by a non-rechargeable Lithium battery, which implies their service life is limited before the battery has to be replaced. The installer should bear this in mind when making any changes to settings; in order to give best battery life, keep tasks (e.g., sample rate and call-ins) to the minimum required.

Most logger devices are shipped from the factory in an inactive state to preserve the life of the battery and will require activation during installation. Once activated, the logger will go into the state of "Recording" and begin repetitive logging of the various sensors fitted to the unit, according to its configuration and settings.

A typical logger can operate using two periods, known as the "sample period" and also the "log period". It will periodically sample the sensors at the *sample rate* to create temporary measurement samples. 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. The log period is always a multiple of the sample period.

The datapoints are stored in the memory of the unit. At a set time, the unit calls into the cellular data network in order to contact the server; the data is then uploaded.

The logger makes measurements (as described above) which are saved into an area of memory which is referred to as the "primary recording". In addition, if the logger has the feature enabled, it can also be set to occasionally save data into a "secondary recording" memory area (e.g., data sampled at a higher frequency). This is additional data.

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

The logger can be programmed to monitor data for certain patterns or conditions and can send a message to the server if it should detect a match. Commonly, this is used for setting a condition that can be an indication of an "alarm". Alarms can be sent to a limited set of users, but a better way of handling (and preserving battery power) is to send the message only to a server; the DataGate server has the facility to fork the message and send it to multiple users.

1.5 ACTIVATING THE COMMUNICATIONS LINK (FOR SETUP & TEST)

The logger will require a HWM communications cable (several types exist) for communicating with the IDT software running on a PC. Refer to your logger user-guide for details of the required cable and how to connect it to the logger. Attaching the cable between the logger and the PC usually activates the communications link, but only for a limited time. It will return to "standby" if not recently used. Remove the USB side of the cable and then re-attach if required; this will re-activate the communications link.


Some loggers have an option to provide additional power by means of an external battery. The external battery may share the same logger connector as is required by the communications cable. Temporarily remove the external battery to gain access to the connector if required. However, ensure the battery is re-fitted before leaving site.

Certain loggers require a cable with an adaptor (optical interface) for communication. Refer to your logger user-guide for details of the required cable and how to connect it to the logger. For loggers with an optical communications interface, some user action (usually with a magnet) is required to activate the communications link. It will then operate for a limited time, returning to "standby" if not recently used. Repeat the action (with the magnet) to re-activate the communications link if required.

1.6 PREPARING A LAPTOP PC (OR SIMILAR PC DEVICE) FOR USE WITH IDT

The PC must have a free USB port for use with the Communications cable.

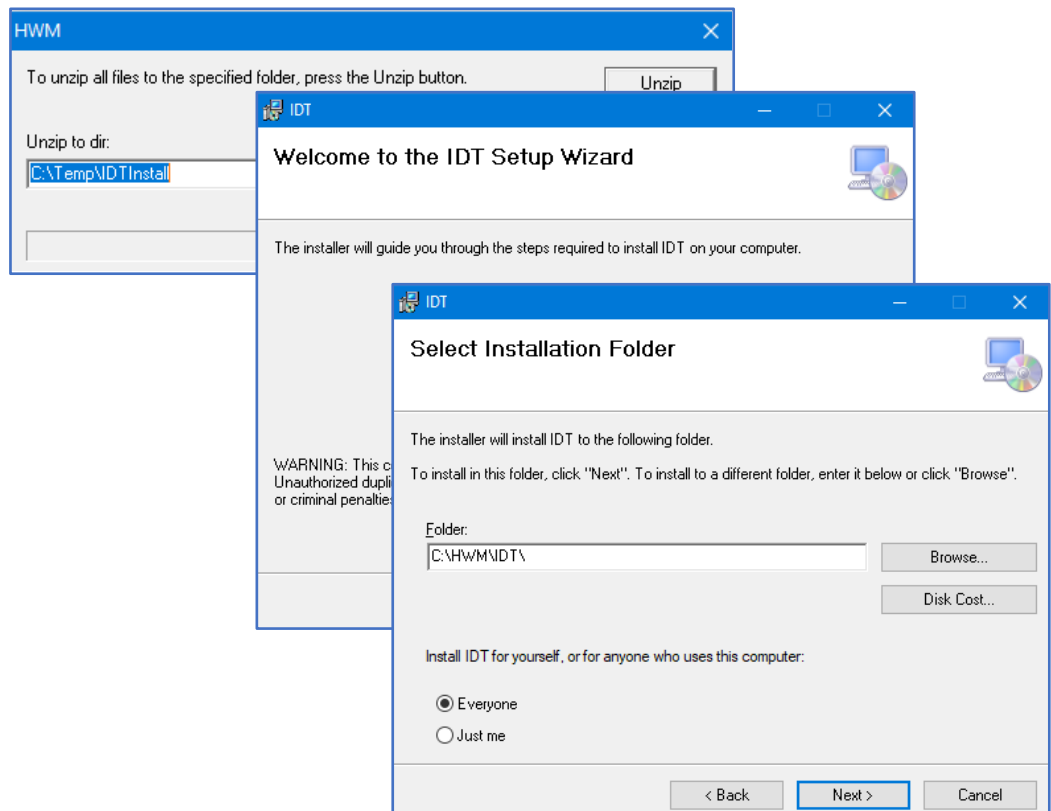
To install the IDT software, download and run the installation file from the HWM website at: <https://www.hwmglobal.com/idt-support/>

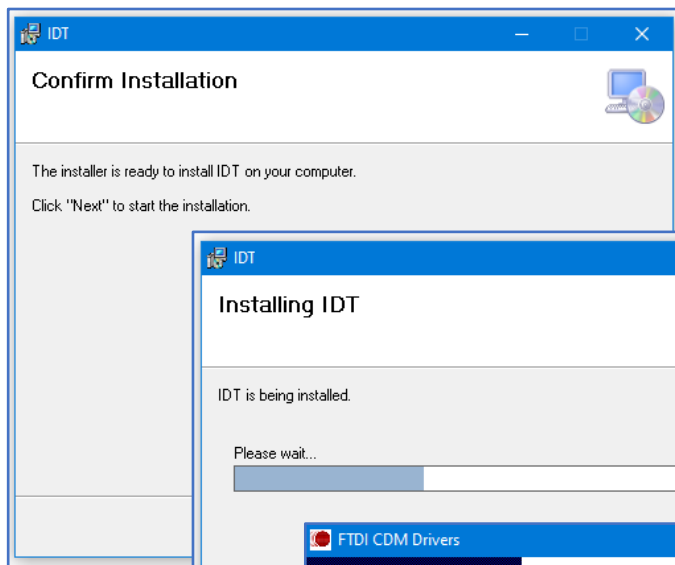
 IDT_Install_V3-16.exe

Follow the on-screen instructions to unzip the file to a temporary folder.

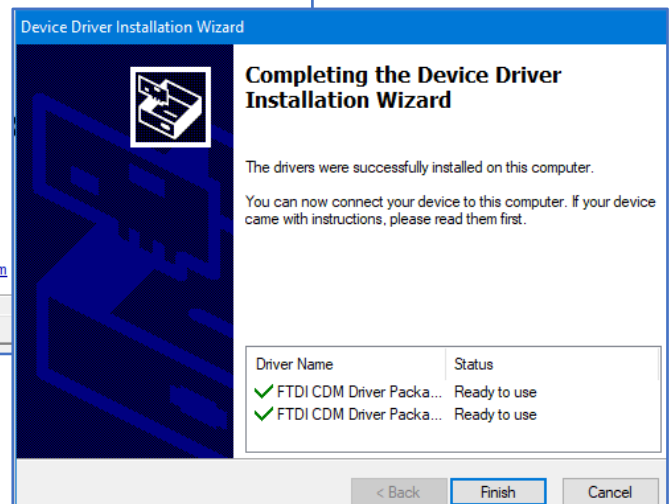
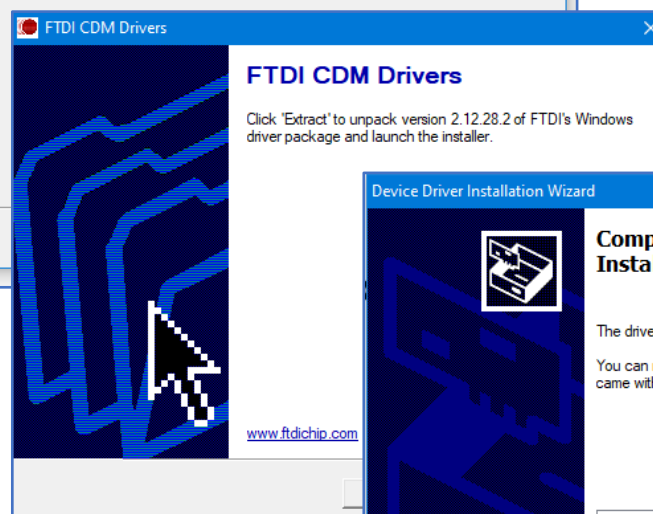
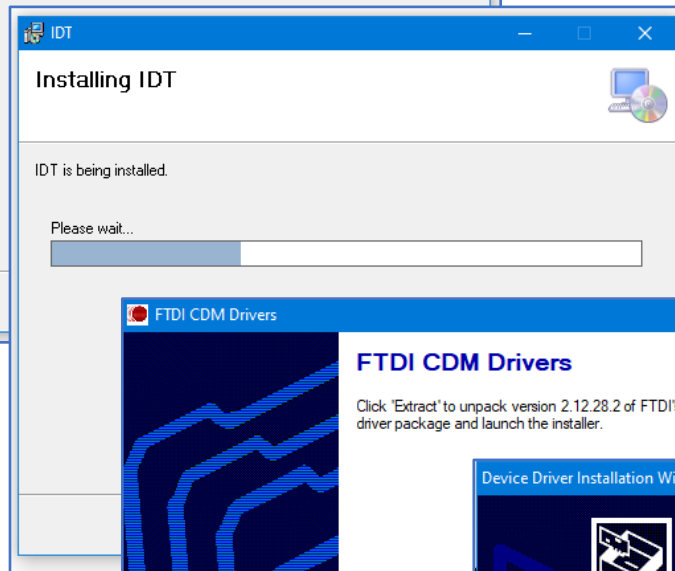
Then continue with the installation.

Choose a location or accept the default.



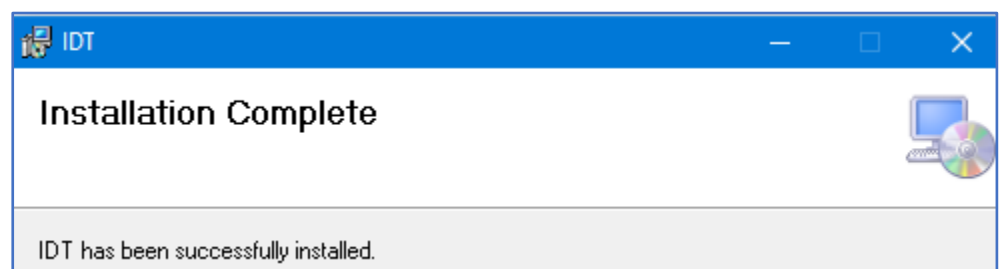


Continue to follow the on-screen instructions including the installation of any 3rd-party device drivers.



The drivers are required for communications with the logger device.

Confirm IDT has been successfully installed.



Once installed, an icon will be available on the PC desktop similar to that shown opposite:



1.7 LOGGER CHANNEL TYPES AND DATA INTERPRETATION

The IDT program has an *adaptive display*. Although it can be used with several types of HWM equipment, it will recognize the type that it is communicating with and will adapt the content of its display window to suit the specific equipment.

The user usually begins use of IDT by directing it to “Read Device”; this interrogates the connected device regarding what type of equipment it is (e.g. a specific logger family), what interfaces it has installed, and the current setup of the device (software settings).

IDT then generates its display contents to include only relevant details to the user.

IDT continually adapts the contents of its display based on current settings, and in some cases on sensors that have been attached.

A typical logger model family may have several sensor interface options available, but on any specific logger only certain options will be fitted and enabled (depending on the model supplied). The logger will have the appropriate electronic interfaces, and software options built into it during manufacture of the device.

Some of the logger’s electronic interfaces are multi-purpose in nature. The logger has to also use an appropriate software driver to make the interface work with a specific sensor.

The combination of both an electrical interface and a software driver, when put together, form a “channel type”. The user may have to make setup selections to determine the specific use of the interface.

When the logger makes readings from an interface, it obtains data. Data is simply a numeric value. Since the logger may have several interfaces producing data, IDT provides a means to identify each specific data stream; this is done by assigning a logical “channel number” to each data stream.

The installer (as part of channel setup) also has to guide the logger as to how to interpret the data into its real significance (i.e., what each measurement represents; the physical parameters being measured).

Steps for channel setup to measure from an interface and save data will include:
(IDT can be used to make or check the required settings).

- Assigning a channel number and channel type for an interface.
- Setup the logger to be able to interpret raw data from a channel into its real-world significance (including any calibration requirements).
- Determining how often to make the measurement, and if any mathematical operations should be applied to the raw measurement data (e.g. averaging several samples).

This will create “data-points” (the values saved as logged data).

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.

1.8 USE OF CELLULAR NETWORKS – IMPORTANT NOTES

Availability of SMS

Most logger models include the ability to communicate to a server via use of the cellular data network (as used by mobile phones). Loggers can communicate via the regular data network (which gives internet access). Alternatively, 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 **2G network**.

Important: 2G (GPRS) services, which carry the SMS messaging system, are slowly being turned off around the globe. Once 2G 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. 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). 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.

2 LOGGER COMMUNICATION WITH IDT

2.1 COMMUNICATING WITH THE LOGGER DEVICE

Launch the IDT (“Installation and Diagnostic Tool”) program on the PC. (Refer to section 1.6).



The start-up window is shown opposite.



To communicate with the logger a communications cable is required. Refer to section 2.1.1 and the user-guide of the logger for further information.

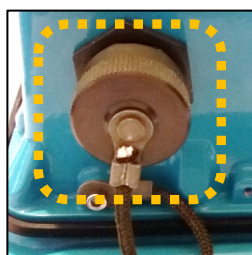
2.1.1 Connecting the Comms Cable

A typical communications cable is shown opposite. Refer to your logger user-guide for the correct cable to use for your logger.

Be especially careful with ATEX approved loggers as the cable may contain safety components.

Where the logger supports connection through a connector, temporarily remove the protective cover and attach the cable.

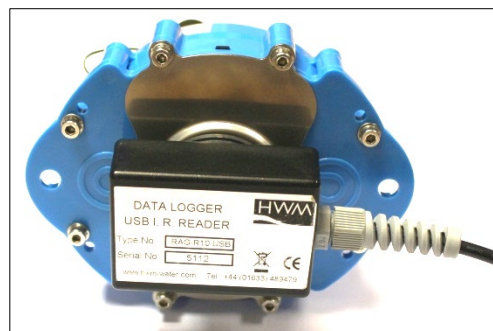
Typically, the logger will identify the port as “COMMS / EXT.BATTERY”.



Alternatively, some model families of logger require an optical coupler for communication.

This must be positioned over a window in the logger case for communications to occur.

Refer to your logger user-guide for more information.



Connect the USB connector to the PC.

Ensure any procedure to activate the logger communications channel has been followed (Refer to section 1.5 and also the logger manual).

It is now possible to communicate with the logger using IDT.

2.1.2 IDT – User-levels

IDT can be set to various user-level “views” including:

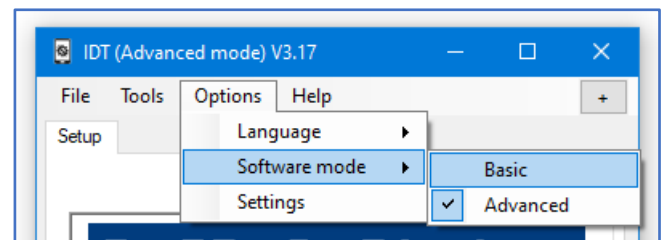
- “Basic” (no user-level is shown on the display).
... This gives basic details and is sufficient for most uses.
- “Advanced” (“User level: Advanced” appears on the display).
... Additional options are available for advanced users.



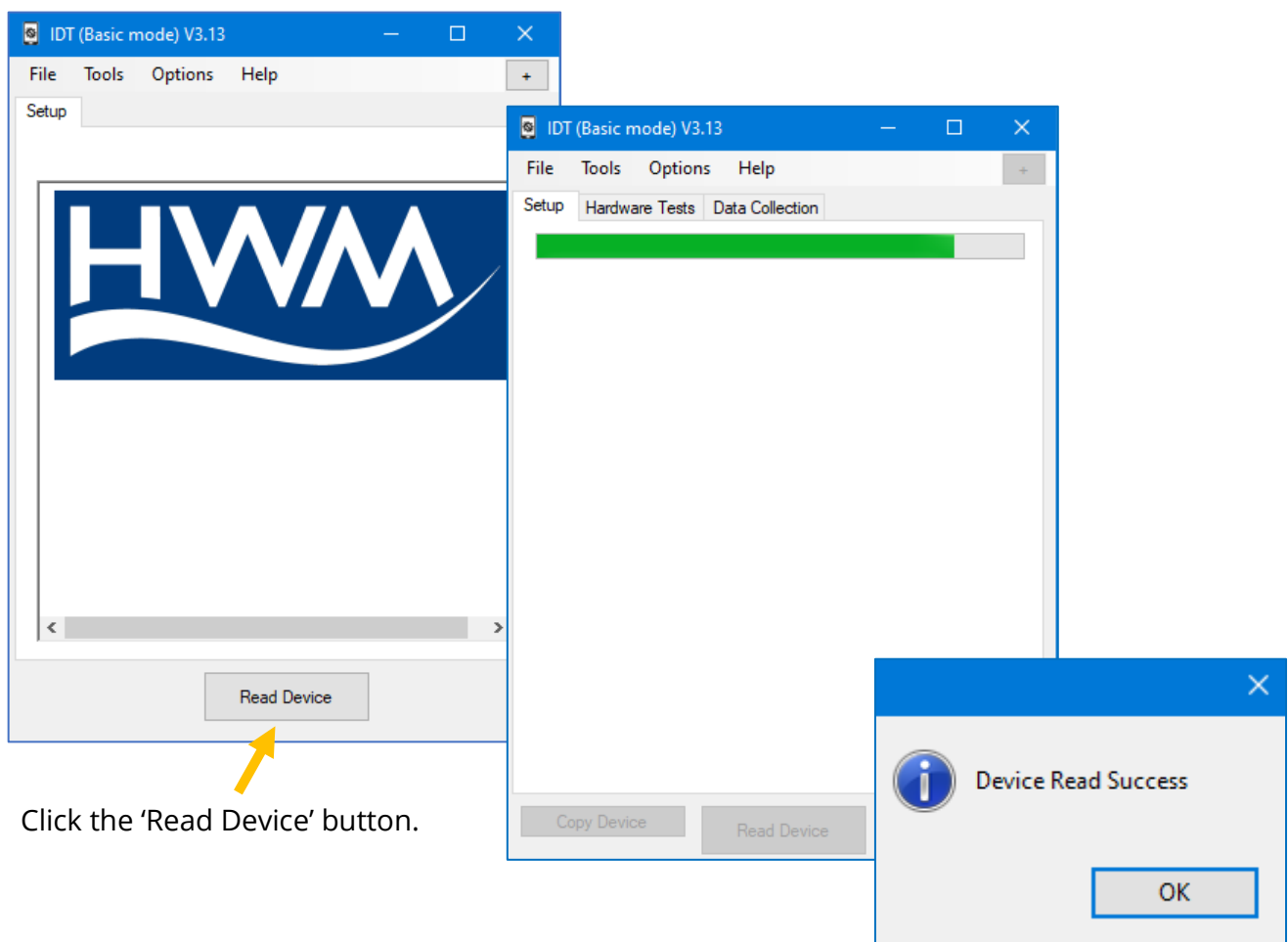
The user-level and IDT version number can be read within the title bar of the window.

Both user-levels are available and can be selected from the Options menu.

If the user-level is changed, IDT re-starts.
Choose the desired mode before making any program changes, or before first reading the logger.



2.1.3 Loading Logger device settings into IDT (Reading the device)



Click the 'Read Device' button.

A progress bar will show across the top of the page. When completed, an information box will appear stating 'Device Read Success'. Click "OK" to clear the box.

The IDT-PC program has now read the unit's program (settings) into the "current program" memory area.

The unit itself is not updated with any of the program changes unless the user later saves the settings stored in IDT back into the unit by clicking on the "Setup Device" button in IDT.

Setup Device

Some buttons in IDT will issue commands to the logger that can change its operation immediately; others are to control operations of the IDT program.

IDT will now display 3 basic tabs.
(More tabs may be visible depending on the model and also the IDT user-mode).

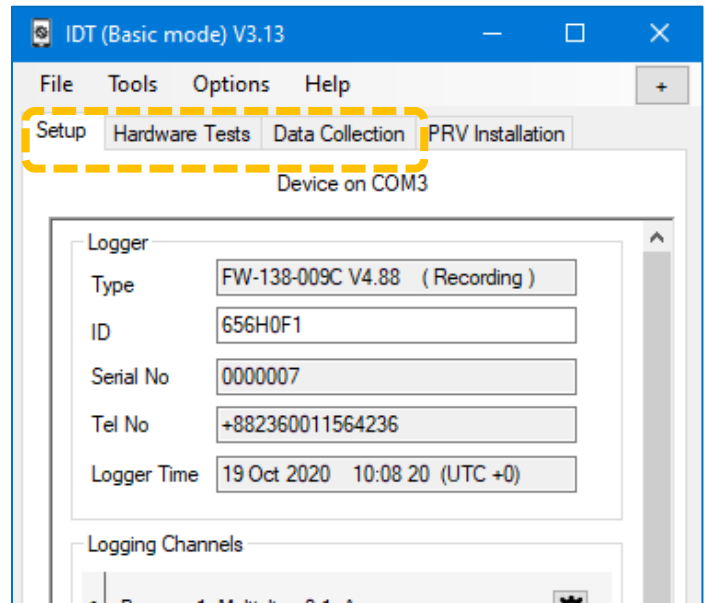
Within any tab, information is divided into various areas, or “panels”.

The “Setup” tab is used for displaying:

- Details of the logger unit.
- The current program settings of the unit.

The panel labelled “Logger” shows:

- The software version running on the unit (here it is shown as V4.88).
- Whether the logger built into the unit is:
 - (Stopped).
 - (Waiting).
 - (Recording).
- The logger’s serial number.
- The telephone number of the device. This is used as a logger identifier within data messages. It usually matches the number of the fitted SIM card, if factory fitted. It is also shown on the logger label (‘Phone Number’, ‘Tel No’, ‘SMS No’ or similar). (See section 1.8 for additional information).
- The logger date and time ... this is the *local time* for wherever the logger is installed. The offset of local time from UTC is shown in brackets.



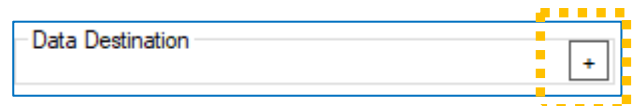
Any greyed-out fields indicate the user cannot adjust them, typically for factory-set parameters. Any non-greyed areas indicate the user can edit the field.

- The user can insert a “Site-ID” for the location, which is in the format of a 7-digit reference number. (e.g. UK format post-code, or any alternative scheme).

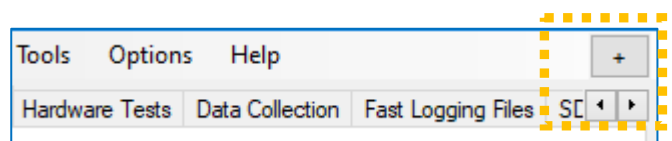
Other panels (not shown here) follow-on, with settings for various areas of the unit’s functionality.

The “Hardware Test” / “Data Collection” tabs shown in the above image provide access to information, settings, and control functions available in the unit and will be explained later in this manual.

Note: Sometimes the IDT display collapses panels to hide information. Panels can be expanded by clicking on the “+” symbol.



Use the arrows to show hidden tabs.
Use the “+” to enlarge or reduce the display.



2.1.4 Saving settings from IDT into the device (Setup device)

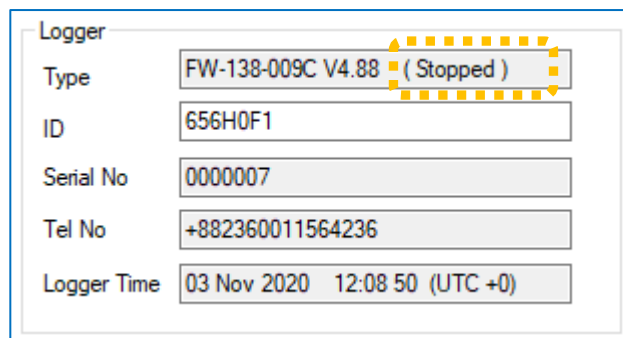
When the logger is shipped from the factory it is put into a “Shipping Mode”; most functions are deactivated, including the built-in logging functions, but the unit is able to communicate with the IDT tool.

After reading the current program settings into IDT, the user can modify them (as explained within this manual) and then update the logger device by writing back the settings into the unit. This action can also be used to **activate** the logger (or device with a built-in logger).

The *running status* of logger is shown on the top line of the Logger panel (within the setup tab), as shown.

Here, it is shown as “Stopped”.

The process of writing settings into a stopped logger will cause it to *schedule a re-start*.

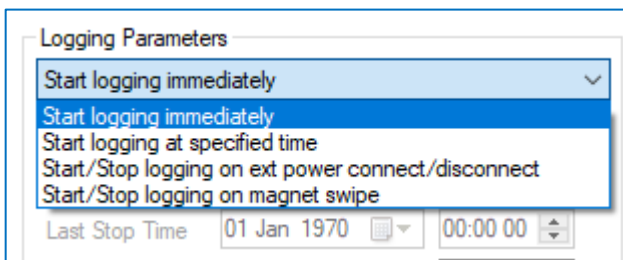


The screenshot shows the 'Logger' panel with the following fields:

Type	FW-138-009C V4.88 (Stopped)
ID	656H0F1
Serial No	0000007
Tel No	+882360011564236
Logger Time	03 Nov 2020 12:08 50 (UTC +0)

The re-start timing is determined by a setting within the Setup tab.

Select “Start Logging immediately” (this is the most typical logger setting).



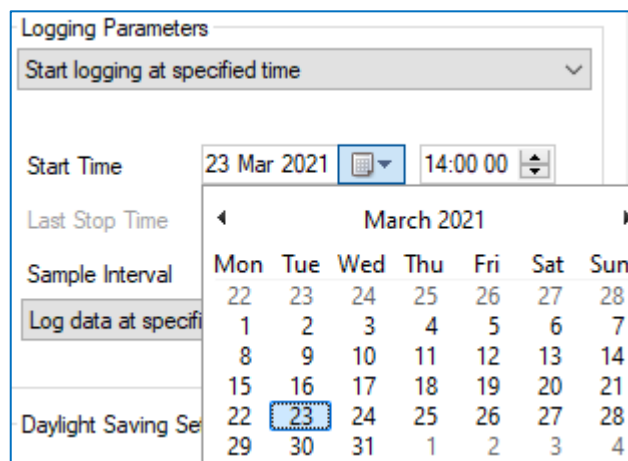
The screenshot shows the 'Logging Parameters' panel with a dropdown menu open, displaying the following options:

- Start logging immediately (selected)
- Start logging at specified time
- Start/Stop logging on ext power connect/disconnect
- Start/Stop logging on magnet swipe

Below the dropdown, the 'Last Stop Time' is set to 01 Jan 1970 00:00 00.

Note: Alternative settings for logger start-up can be specified, if required:

- The logger can be programmed for logging to start at a specified time.
(To use, select a date and time using the selection tool).
- The logger can be programmed for logging to start from detecting a magnet
(only applicable for loggers that have this sensor).

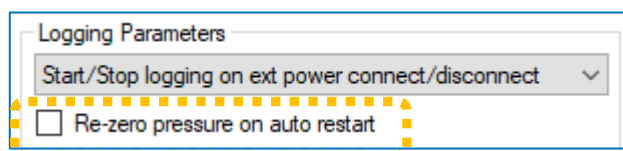


The screenshot shows the 'Logging Parameters' panel with the 'Start logging at specified time' option selected. The 'Start Time' is set to 23 Mar 2021 14:00 00. A calendar is open showing the month of March 2021, with the 23rd highlighted. The 'Last Stop Time' is set to 01 Jan 1970 00:00 00. The 'Sample Interval' is set to 1. The 'Log data at specified time' is set to 1. The 'Daylight Saving Set' is set to 23.

- The logger can be programmed for logging to start as soon as power from external battery is detected (only applicable for loggers that have an external power option).

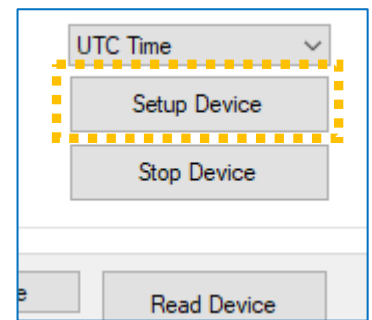
This is used where the logger is required to be activated immediately it arrives deployed to a site; typically for gathering data reactively for an ongoing incident. It can be used in conjunction with a logger that is able to detect and log its geographical location, so the incident can be located and logged with minimal on-site setup using IDT.

Some additional options may be available when magnet swipe or power connect options are used.

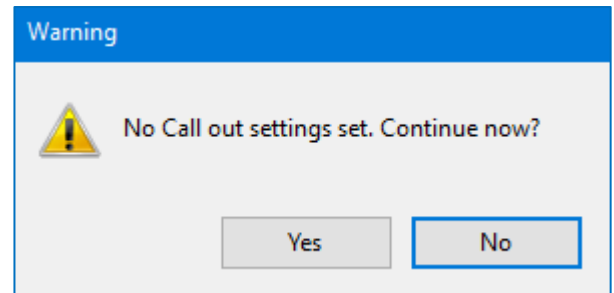


The screenshot shows the 'Logging Parameters' panel with the 'Start/Stop logging on ext power connect/disconnect' option selected. The 'Re-zero pressure on auto restart' checkbox is checked.

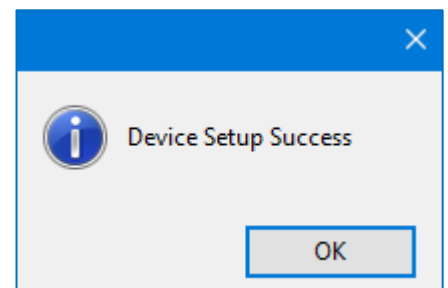
Scroll to the bottom of the Setup tab and click the “Setup Device” button.



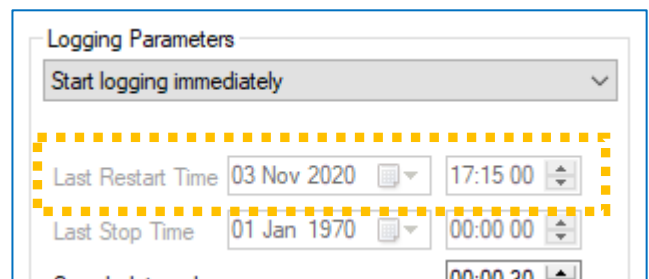
IDT may warn you that there may be some unintended errors in your settings (e.g. see opposite); Since we have not yet set these parameters but will do so later, click “Yes”.



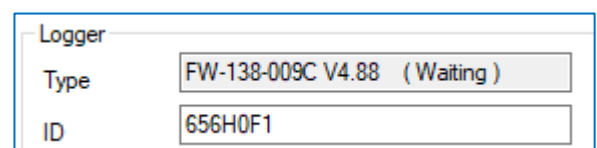
IDT reports that the unit has been given the new settings successfully.



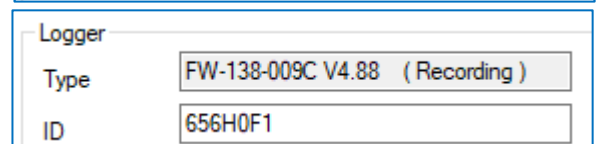
The logger functions have been set to start at a convenient time.



The logger is “Waiting” for the recording start time to arrive.



The logger will later begin “Recording”; this is its regular repetitive logging task.

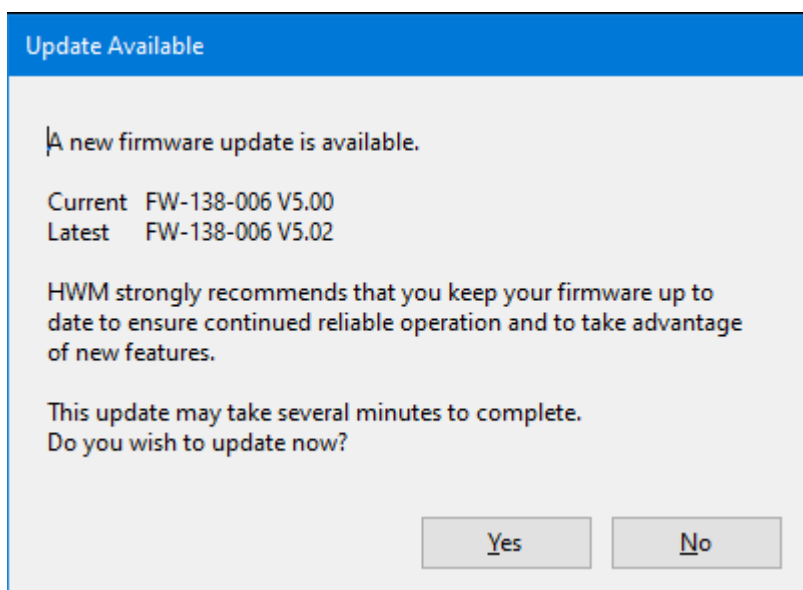


2.2 LOGGER FIRMWARE UPDATES (IF AVAILABLE)

New software releases (firmware) for loggers are occasionally released from HWM. They are bundled with updates to the release of IDT. (Whenever IDT is launched it can also check a server and download any new versions of logger firmware that are available).

When reading a device, IDT automatically checks the existing logger firmware version.

If a newer one is available, the user will be prompted with the option to update the logger using the file saved within the PC's IDT folder. This is recommended. However, the logger will be restarted so you may wish to transfer any logged data first, in which case click "No" (see note below).



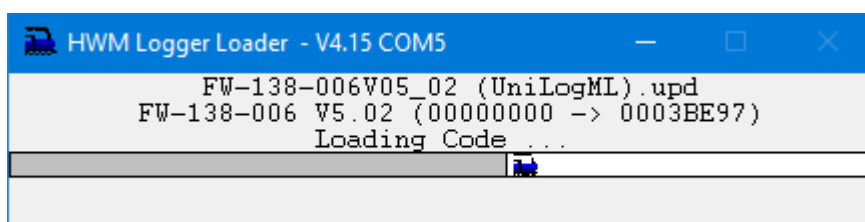
Note: A logger "restart" will occur on any significant changes to the logger, such as channel configuration changes or new firmware. The logger memory is wiped clean to store fresh channel data. It is therefore recommended to consider downloading any valid data from the logger prior to any restart.

Click on Yes when you are ready to start the upgrade, which takes a couple of minutes.

The "logger Loader" program is launched.

Progress is shown.

The logger is updated, and then automatically has the settings re-read.



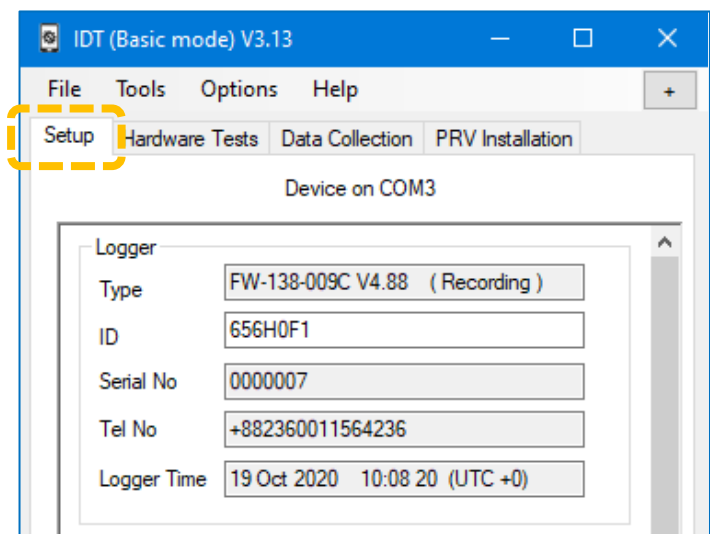
Note: New logger firmware releases are included in the IDT updates; keep IDT up to date to obtain the firmware update files.

3 IDT – SETUP TAB – (MAIN SETTINGS PAGE)

The main settings page is shown when the setup tab is selected.

It is divided into panels of related information and settings.

The first panel (“Logger”) provides details about the identity of the logger and its current operational status. (Refer to section 2.1.3 for a description of the logger operational details).



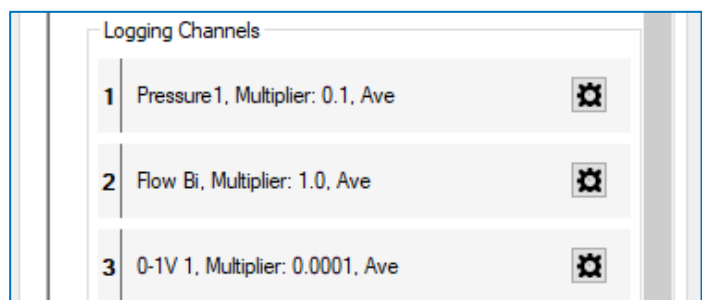
The “Logger” panel is mainly for information.

Subsequent panels follow-on, with settings for various areas of the unit’s functionality. The IDT display is adaptive according to what logger model it connects to (and the interfaces are installed), but there are some areas of the display that are common to many models.

The user can use IDT to check the device configuration (settings) or re-configure the device if an adjustment is required.

Your logger will usually have some means of identifying the installed interfaces (connectors). A common method is for a label to identify the interface. Alternatively, the label may provide a key linking a connector a location and the type of interface fitted. Refer to your logger user-guide for more information.

Your logger may be pre-configured by the factory with some default settings. If so, the “Logging Channels” panel will show some information regarding current channel setup.



The content is largely dependent on the hardware configuration of the logger; the electrical interfaces have been built into the unit.

3.1 SETTING / CHECKING THE LOGGER TIME-ZONE (UTC OFFSET)

Prior to commencing any checks or setup of the logger, it is advisable to check or adjust the time-zone of the logger (this prevents any confusion to the user over time settings).

The logger communicates to DataGate using the global time reference, (called “UTC”; Coordinated Universal Time; it is similar to Greenwich Mean Time, GMT).

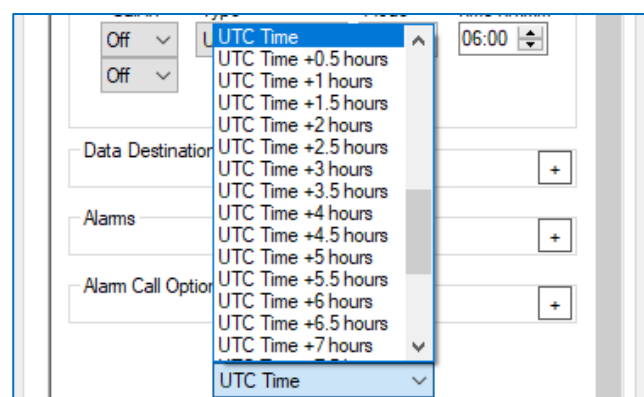
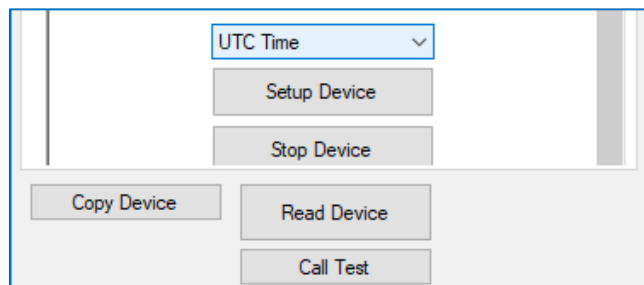
IDT allows the user to program loggers using local time. The logger needs to know the offset of the local time zone from UTC so it can communicate the correct timestamps for data to the server. This can be set using the “UTC time” control.

Towards the end of the contents of the Setup tab, locate the selector for “UTC time”.

Confirm or adjust the setting (as required).

e.g., If your local time is 4 hours behind UTC / GMT then set this field to “ - 04.00”.

When a user adjusts the UTC offset, the setting does not *immediately* change the “Logger Time”. The update only takes effect after the logger has the program settings written back into the unit. ... Therefore, adjust the UTC time offset as required and then click on the Setup Device button.

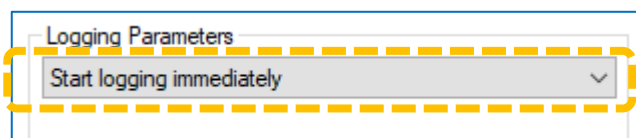


3.2 SETTING CONDITIONS TO INITIATE LOGGER START-UP

The “Logging Parameters” panel (within the settings tab) shows timing parameters for the logger.

There is a control that sets the conditions under which an inactive logger will start-up and begin recording data.

Refer to section 2.1.4 for a discussion of this control.

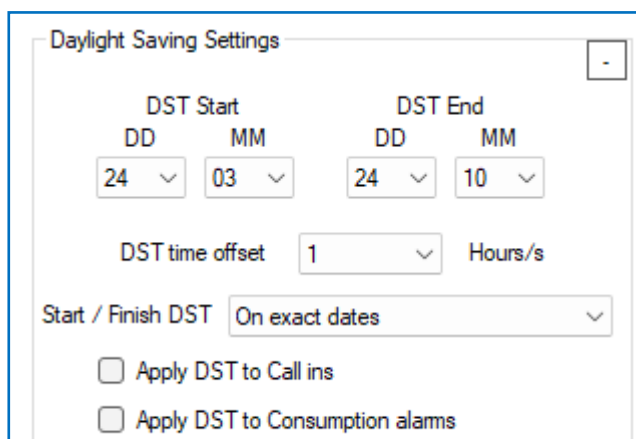


3.3 ANNUAL TIME ADJUSTMENTS

The logger can be set to match changes in consumer behavior, such as annual time adjustments (e.g. Daylight Saving schemes).

Set to '0 hours' to de-activate the feature. or set the appropriate dates and adjustment time required.

Set other options, to set the scope required.



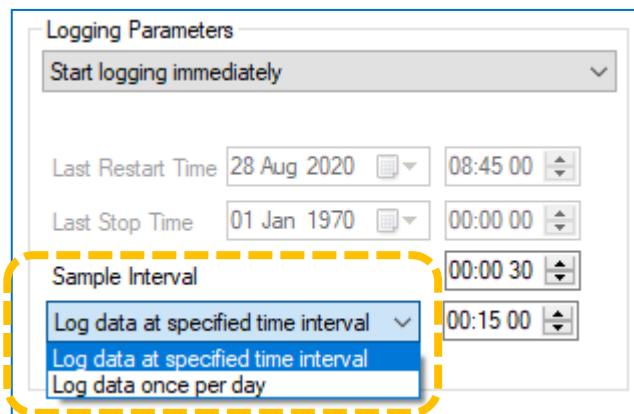
3.4 TIMING INTERVALS FOR MAKING MEASUREMENTS

3.4.1 Standard Logging

The “Logging Parameters” panel (within the settings tab) shows timing parameters for the logger.

It shows details of when the logger was last activated or restarted. (For information only).

There is a control that determines whether the logger will make only one measurement per day (Log data once per day) or if it will make multiple measurements per day (Log data at specified time interval).



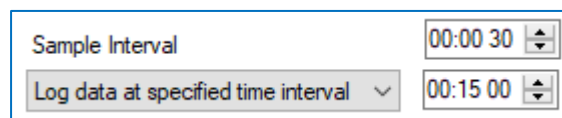
Most logger applications require the measurement interfaces to be logged frequently. For these, set to “Log data at specified time interval”.

The “Sample Interval” sets the time between making measurements on most of the interfaces.

It is used to produce a set of data for the purpose of applying optional statistical functions (e.g. Average).

The “Log ... interval” is used to save a datapoint once any statistical functions have been applied to the latest set of measurements. The Log interval must be a multiple of the sample interval.

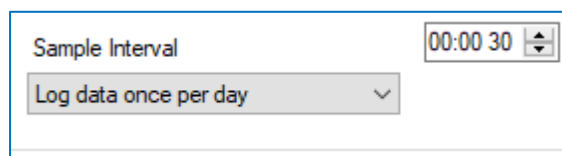
The settings shown above are typical for periodic logging. With the settings shown, 30 measurements can be taken for each data-point produced. (Any statistical functions will be applied to the set of 30 samples).



Other HWM loggers require just one measurement a day; this is shown opposite.

(e.g. Some scenarios exist where the logger is being used with specialized sensor to run a daily test and log the result).

The setting here should be read as the *time of day* at which the measurement is taken.



3.4.2 Enhanced Logging (optional) / Fast Logging

The logger normally samples data at the set sample period, and records datapoints at the set log period; Refer to section 1.4 and 3.4.1; This is its normal repetitive operation.

Certain models of logger devices are (if the feature is enabled on your model) able to make additional data recordings at higher sampling rates.

There are two possible classes of such recordings:

- Produce a data recording at the set sample rate (rather than the log rate). This is called “making a **secondary recording**”; the data recording is in addition to any normal repetitive data recording being made, which continues without interruption.

- Produce samples at a rate determined by a fixed frequency (several frequency options may be available from which the user is able to choose; 5Hz to 25Hz are typical). This is called “making a **Transient recording**”; the data recording is in addition to any normal repetitive data recording being made, which continues without interruption.

If any of the features are available, they will be found in the “Fast Logging” panel of the Setup tab.

This should be disabled if the feature is not required, to preserve battery power.

The feature works in two basic modes:

- Recording at **specific times**.
(Manually set time events to have data recorded at a higher speed).
- Recordings triggered by an **alarm event**.
(The logger monitors a sensor. If the measurement value is outside of programmed limits, the logger then makes a data recording).

3.4.3 Recording at specific times

First select which type of fast recording option is required (Secondary or Transient).

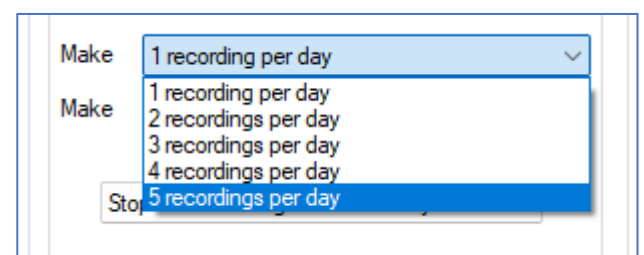
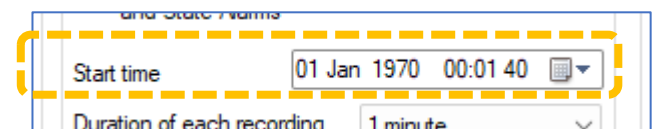
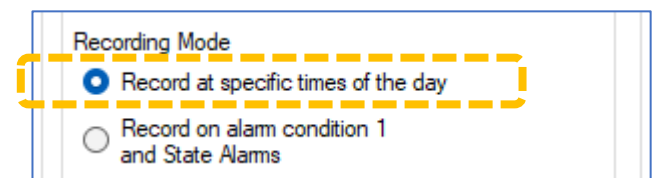
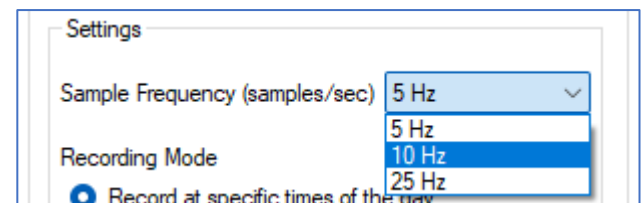
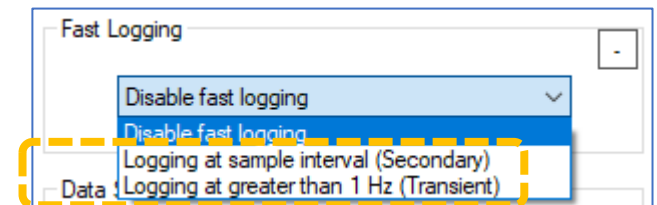
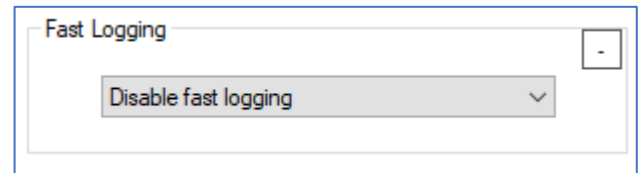
(IDT will then display additional setting options)

When ‘Transient’ logging has been chosen, also select one of the available sampling rates.
(Secondary recording is fixed to the regular logging ‘background sampling’ rate).

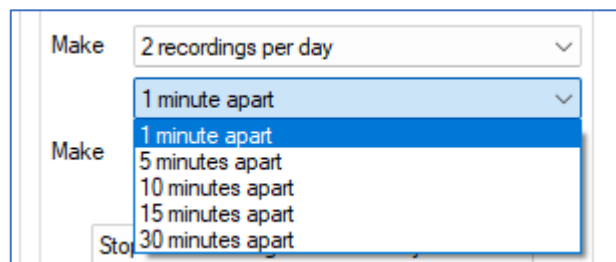
Then select “Record at specific times of day”
(within the ‘settings’ panel within the ‘Fast Logging’ panel).

Select a start time and date for the recording(s).

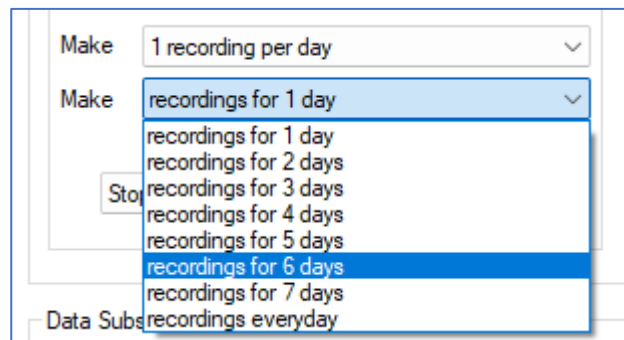
Select how many recordings you want to make per day.



Select the gap required between each recording.

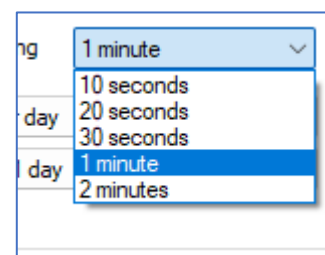
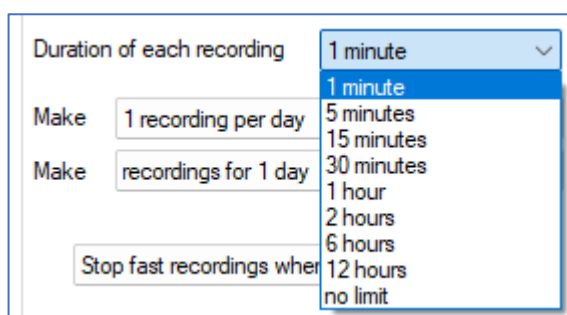


Select how many consecutive days you want the data recording to be repeated.



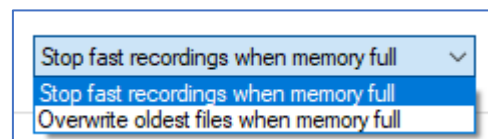
Select a duration for each data recording.

Note: Transient recordings (see right) are of a shorter duration than Secondary recordings (see left) due to the faster sampling rate producing data at a faster rate, but the logger has finite memory.



In addition, Secondary data recordings have a memory management option available, allowing the Secondary data recording process to stop when the allocated memory is full or to continue, but overwrite oldest files.

(The memory area is separate to that being used for routine logging).



Within the Settings panel, select which channels are to be included within the Secondary data recording; At least one channel must be included.

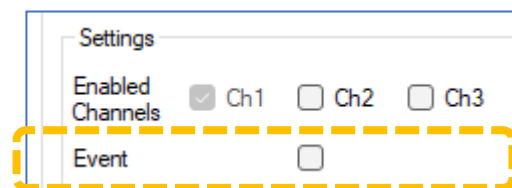
(This setting option is applicable when making a 'Secondary recording' only; It is not available when making a 'Transient recording').



When there is a 'Flow' channel available for selection as a 'Secondary recording', an additional selection control is available, called 'Event'.

When 'Event' is enabled, any Flow channels will (for the purpose of producing datapoints for the Secondary recording only) switch to Pulse Interval Timing mode.

(See section 5.6.4. This can improve the resolution of the data during times of a low flow rate).

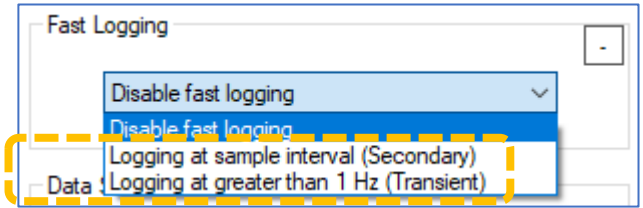


3.4.4 Record on an Alarm condition or a State alarm

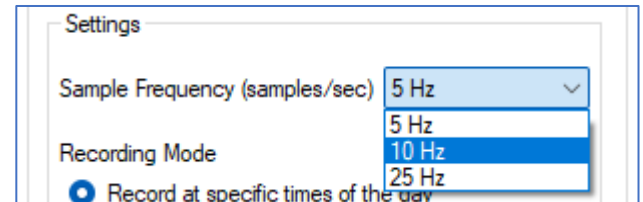
First select which type of fast recording option is required (Secondary or Transient).
(IDT will then display additional setting options)

When 'Transient' logging has been chosen, also select one of the available sampling rates.
(Secondary recording is fixed to the regular logging 'background sampling' rate).

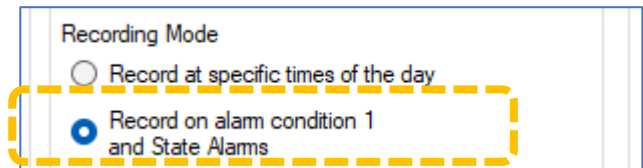
Then select "Record on alarm condition 1 and State Alarms" (within the 'settings' panel within the 'Fast Logging' panel).



The 'Fast Logging' panel shows a dropdown menu with three options: 'Disable fast logging', 'Logging at sample interval (Secondary)', and 'Logging at greater than 1 Hz (Transient)'. The 'Logging at greater than 1 Hz (Transient)' option is highlighted with a dashed yellow box.



The 'Settings' panel shows the 'Sample Frequency (samples/sec)' dropdown menu with three options: '5 Hz', '10 Hz', and '25 Hz'. The '10 Hz' option is highlighted with a dashed yellow box.



The 'Recording Mode' panel shows two radio button options: 'Record at specific times of the day' and 'Record on alarm condition 1 and State Alarms'. The 'Record on alarm condition 1 and State Alarms' option is selected and highlighted with a dashed yellow box.

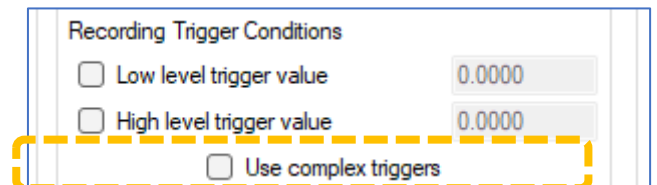
Setup to use Alarm Conditions:

When 'Transient recording' is set, the logger will associate the 'Pressure 1' channel with the 'Cond1' alarm trigger condition. Similarly, the 'Pressure 2' channel (if fitted) will be associated with the 'Cond2' alarm trigger condition.

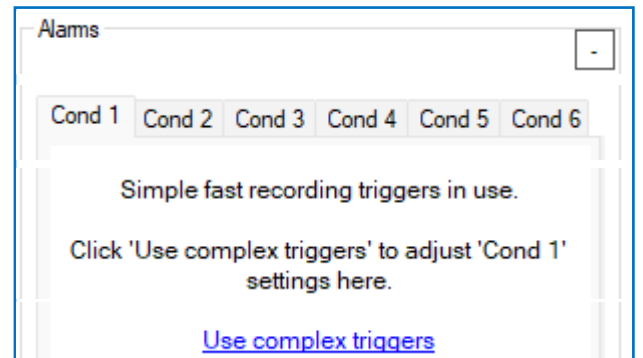
However, with 'Use complex triggers' un-ticked...

... the settings for these trigger conditions are removed.

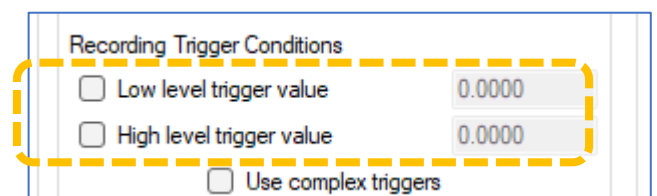
They are replaced by a simplified method of having a high level and low level for the channel. Enable one (or both) thresholds and add an appropriate limit.
(Since it is a transient, some other settings, such as persistence, become irrelevant).



The 'Recording Trigger Conditions' panel shows three checkboxes: 'Low level trigger value', 'High level trigger value', and 'Use complex triggers'. The 'Use complex triggers' checkbox is un-ticked and highlighted with a dashed yellow box.



The 'Alarms' panel shows a tabbed interface with tabs for 'Cond 1' through 'Cond 6'. The 'Cond 1' tab is selected. The panel displays the message 'Simple fast recording triggers in use. Click 'Use complex triggers' to adjust 'Cond 1' settings here.' and a link 'Use complex triggers'.



The 'Recording Trigger Conditions' panel shows three checkboxes: 'Low level trigger value', 'High level trigger value', and 'Use complex triggers'. The 'Low level trigger value' and 'High level trigger value' checkboxes are un-ticked and highlighted with a dashed yellow box.

If simpler settings do not suit the application needs, enable the 'Use complex settings' to revert to normal setup.

☒ Use complex triggers

Note: Setting to use complex triggers **also** opens up the trigger condition to include additional alarms ('any alarm condition'), as shown below.

Recording Mode

☐ Record at specific times of the day
 ☒ Record on alarm condition 1 and State Alarms

Recording Trigger Conditions

☐ Low level trigger value 0.0000
☐ High level trigger value 0.0000
☐ Use complex triggers

→

Recording Mode

☐ Record at specific times of the day
 ☒ Recording triggered on any alarm condition

☒ Use complex triggers

When 'Secondary recording' is set, setup is similar to 'Transient recording', except that the sensor input is less constrained. Because of this, the 'Trigger channel' control has to be set to identify the desired logger data channel number for which the simplified settings are applicable.

☒ Record on alarm condition 1 and State Alarms

Recording Trigger Conditions

Trigger channel

1

☐ Low level trigger value
☐ High level trigger value
☐ Use complex triggers

Having made the above settings, both Secondary recording and Transient recording should be set to include the time-window of the data required prior to and after the event being triggered.

Include 5 minutes of data prior to event

Duration of each recording 1 minute

Use the 'Include' control to set the amount (time) of pre-event data required.

Use the 'Duration of each recording; control to set the amount of data required following the triggering event.

The durations will vary depending on the Fast recording type (Secondary or Transient).

Include 5 minutes of data prior to event

Duration of each recording 1 minute

Stop fast recordings when

Data Substitution
 ☐ Enable data substitution while in alarm

prior to event

1 minute

10 seconds

20 seconds

30 seconds

1 minute

2 minutes

SD card Use:

Certain loggers also have facilities to store larger periods of Fast data but may require additional memory to be fitted to the logger during its construction (e.g. an 'SD card'). Discuss with your HWM representative prior to ordering, if required.

Download of additional data from an SD card requires a manual download via IDT, and (depending on how much data is saved) can take a considerable time. Therefore, the usual practice is to select the 'SD Card Data' tab in IDT, and then only download the time period of interest.

The screenshot shows the 'SD Card Data' tab selected in the top navigation bar. Below the tabs, there are two radio buttons: 'Download all available data' (unselected) and 'Download time period' (selected). Under 'Download time period', there are two time selection fields: 'Download start time' and 'Download end time', both showing '19 Jun 2024 16:30 28'. At the bottom, there is a 'Download data' button.

Setup to use State Alarms:

State alarms are discussed in section 5.2.11.

After setting up a State Trigger Alarm (see opposite for an example), along with earlier settings within this section, the logger will start the accelerated recording within a minute of the switch being closed (in this example).

The screenshot shows the 'State Trigger Alarms (Checked once / minute)' panel. A dropdown menu is set to 'Trigger when closed'. Below this, there are four checkboxes for digital inputs: 'Digital input 1' (unchecked), 'Digital input 2' (checked), 'Digital input 3' (unchecked), and 'Digital input 4' (unchecked).

Note that the state switches are sampled *once per minute* regardless of the sample rate setting. If faster rates of state checking are required, the standard alarms should be used.

3.4.5 Memory Allocation

When making secondary recordings, the logger has to use some of its resources for storage. The user can determine what proportion of memory is allocated to primary (regular) data recording vs secondary data recordings using a slider control.

(This control is found in its own panel in the Setup tab).

The screenshot shows the 'Memory Allocation' panel. It features a slider control between 'Main' and 'Secondary' memory allocation. The 'Main' allocation is set to '589 Days 12 Hours 16 Mins 0 Secs' and the 'Secondary' allocation is set to '64 Days 17 Hours 4 Mins 0 Secs'. A small square icon is visible in the top right corner of the panel.

3.5 CREATING A LOGGER CHANNEL

Note: Loggers are usually shipped from the factory pre-configured to the requirements of a customer order. The steps described here therefore only need to be followed for setup of a new channel or modifying existing settings.

As discussed in section (1.7), a channel requires:

- A way to identify the channel and its data-stream.
(IDT gives the channel a “channel number” for this purpose).
- A “channel type” (electrical interface and software driver)
(IDT uses “input selector” and “sensor type” for this purpose).
- A means of interpreting data obtained from the sensor.
(IDT uses such things as “input multiplier” and “units” for this purpose).
- Settings to govern when and how datapoints are produced for storage.
(IDT uses the “log period” and “Logging mode” for this purpose).

The actual fields that are needed are *dependent on the type of sensor* and what a measurement from it represents. This user-guide will give an example of the considerations needed and steps taken to set up a *typical general-purpose* logger channel for a *simple sensor*. This is for introduction purposes only; many channels will follow a similar setup procedure.

However, note that some loggers employ specialized sensors or specialized logger operation which may require further discussion. (Refer to section 5 and onwards for further details).

Note: A channel can contain one of the following:

- A stream of data measured *direct from the sensor interface*. or
- A stream of *indirect data* derived from the direct data stream.
e.g., Meter pulses (direct sensor data) can be used to indicate consumption.
Indirect data can be in the form of rate of flow (when the pulses are timed)
or a calculated current meter reading (if the initial meter reading is known).

The example is based on simple sensor that is able to detect if a switch is open or closed. These can be used for a variety of applications including detecting output pulses from a water meter.

3.5.1 Example 1: Water flow and automated meter readings

A water meter pulse represents a volume of water that has travelled through the meter. To interface with the meter pulses, the logger is required to use a *digital flow* input channel.

Note: This type of logger interface has many uses and could equally be set up to interface with other types of utility meters.

The wiring of the interface will not be shown here; refer to the logger user-guide. It is important to know the characteristics of the equipment that the logger is being connected to, since flow meters have several “flavors” of output pulse signals.
e.g.:

1. Uni-directional flow is represented by a single output from a meter.
2. Bi-directional flow is represented using two outputs from the meter, and therefore require two signals within the input to the logger.

The logger allows the installer to choose from several available options when setting up the logger channel; this selects the appropriate driver for the interface.

A typical water meter has uni-directional flow, with a single pulse output.

The rate of water flow is derived from the pulses by requiring the logger to count the number of pulses obtained during a fixed interval of time; this is to be repeatedly logged.

A meter reading could also be obtained (if we also record the initial meter reading) by accumulating the total number of meter pulses.

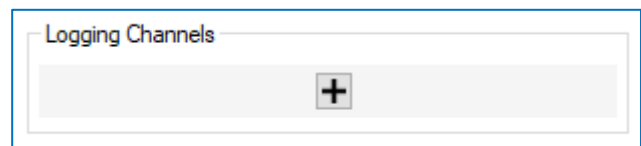
3.5.2 Setup of a new channel / checking existing settings.

In order for a logger to operate correctly, the input channels must be set up, along with any calibration data and also various other settings.

Select the Setup tab in IDT. Scroll to the “Logging Channels” panel.

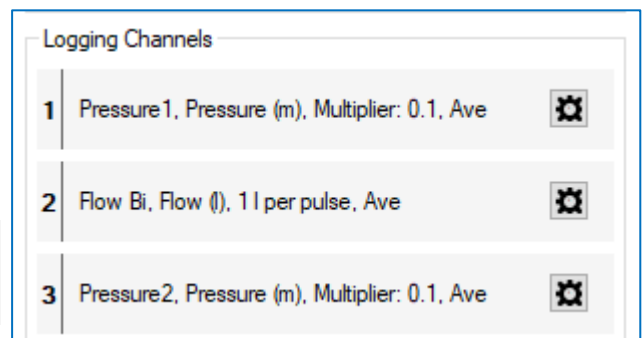
This panel lists information regarding the type of interfaces fitted into the unit that have also been configured for use.

(Here, the list is empty).



Once configured, the panel represents the transducers as inputs to a data-recorder which has several channels of recording memory. i.e. it is arranged as a set of “logging channels”.

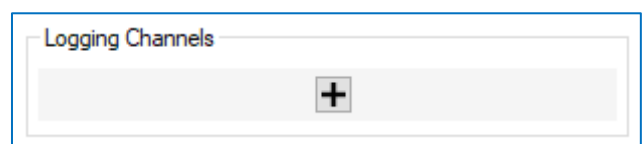
To modify an already existing channel, click on the relevant settings (cog) button.



Note: Logger channels may be pre-configured by the factory prior to shipment, but the installer is responsible for confirming they are correctly configured to suit the installation site.

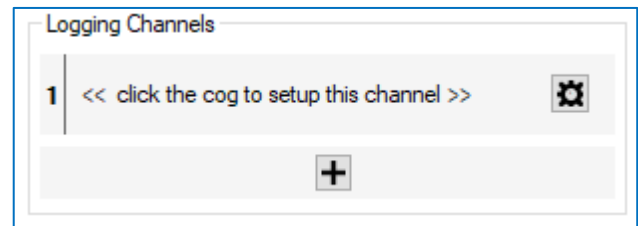
Electrical interfaces can sometimes be general-purpose in nature, so the unit has to be informed (by settings) of what type of transducers are attached. Also, it needs to be informed of how to interpret numeric readings into physical measurements.

To add a new channel, click on the “+” symbol.

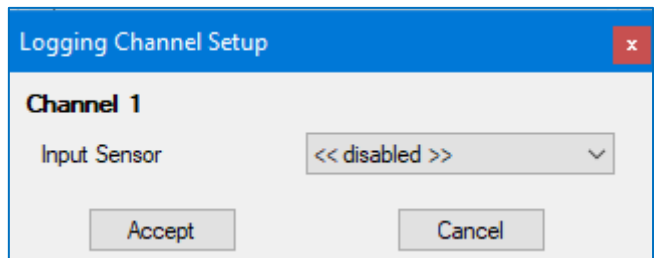


The new channel is enumerated; here it is logical channel "1".

The channel has not yet been set up.
Click on the cog icon to start the process.



Initially the Channel is "<< disabled >>"; it has no selection for the input sensor.
(This setting can also be employed if you do not wish to use the channel).



Use the drop-down box to select the sensor for the interface you are going to use.
The drop-down box will list all installed sensor interface options.

Where a logger has several of the same type of interface fitted, they will be shown enumerated (e.g., Flow 1, Flow 2).

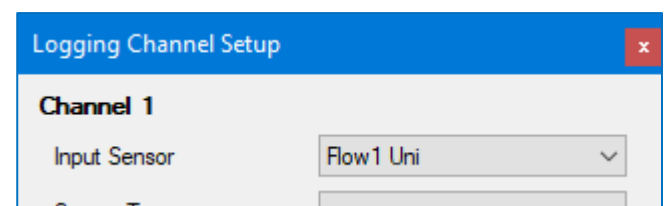
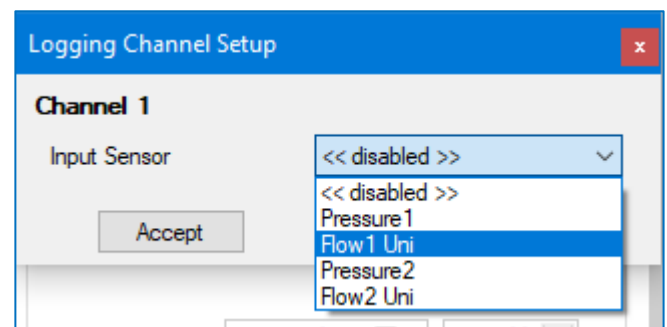
(Refer to your logger user-guide for their location on the logger connector / cables).

For this example, a uni-directional flow sensor is required. ... Select "Flow 1 Uni" from the list.

The selection commits the electrical interface for use by the logger.

(i.e., The relevant pins of the connector are now committed for a specific use, as is the software driver being used). In this example, the software driver will count meter pulses appearing on a single pin of the connector.

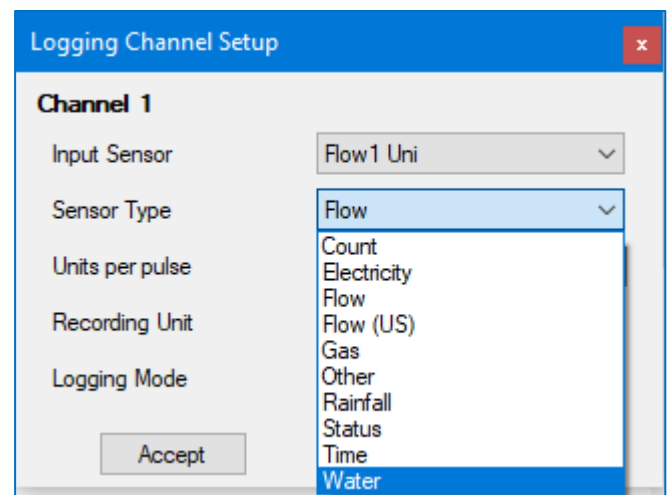
The software will count pulses, but the logger has no idea of whether it is measuring the flow of electricity, water, or something else. The next steps are used to identify what the pulse count represents.



The "Sensor Type" drop-down selection box starts the configuration of how data from this interface will be interpreted.

Click on the "Sensor Type" control.
A list of options is presented.

Select the type of measurement being made.
(In our example we are measuring water. ...
Therefore, choose "Water")

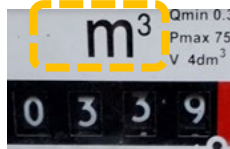


Next click on "Recording Unit"

Select a unit of measurement from the list.
(Units of measurement listed will vary according to earlier-made selections).

(In our example this has to match the units used by the specific meter installed.

e.g., m^3 for the example shown opposite).

A screenshot of the 'Logging Channel Setup' dialog box. The 'Channel 1' section shows the following settings: 'Input Sensor' is 'Flow1 Uni', 'Sensor Type' is 'Water', 'Units per pulse' is '1.0', 'Recording Unit' is 'm³', and 'Logging Mode' is 'Average'. The 'Recording Unit' dropdown menu is open, showing 'm³' as the selected option. At the bottom are 'Accept' and 'Cancel' buttons.

A relevant calibration factor for a water-meter is units per meter pulse. (Other types of equipment may require a different type of calibration factor).

Edit the "Units/Pulse".

This selects the pulse significance of the meter.
Select the correct setting based on the meter equipment you have attached the sensor to.

e.g. If the meter pulse represents 0.001 m^3 of water,
the units/pulse should be set to 0.001.

A screenshot of the 'Logging Channel Setup' dialog box. The 'Channel 1' section shows the following settings: 'Input Sensor' is 'Flow1 Uni', 'Sensor Type' is 'Water', 'Units per pulse' is '0.001', 'Recording Unit' is 'm³', and 'Logging Mode' is 'Average'. The 'Units per pulse' text box is active. At the bottom are 'Accept' and 'Cancel' buttons.

Next select the required logging mode.

(The available options may change as they depend on what is being measured).

For example, "Average" will produce a datapoint (logged data) that is an average of the measurement samples it has made since it last produced a datapoint.

(i.e., A new datapoint value is produced and saved to memory at the rate set by the Log period setting).

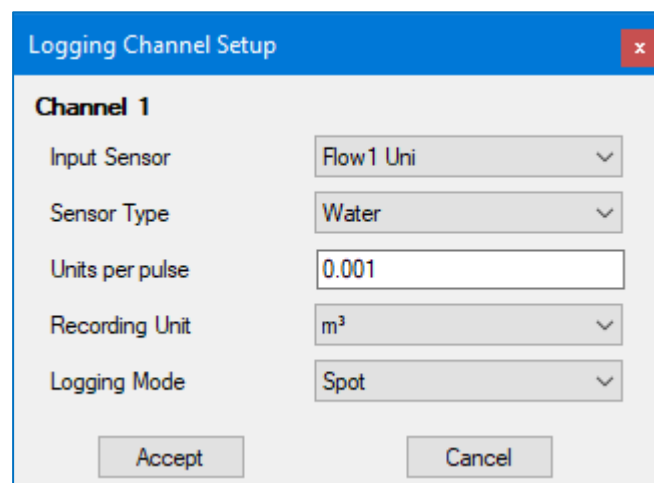
For a water flow reading, the channel should be set to "Spot".

The result will be the pulse count (i.e., total flow) since the last datapoint was produced.

A screenshot of the 'Logging Channel Setup' dialog box. The 'Channel 1' section shows the following settings: 'Input Sensor' is 'Flow1 Uni', 'Sensor Type' is 'Water', 'Units per pulse' is '0.001', 'Recording Unit' is 'm³', and 'Logging Mode' is 'Average'. The 'Logging Mode' dropdown menu is open, showing options: 'Average', 'Minimum', 'Maximum', 'Spot', 'Time High', 'Time Low', 'Pulse Interval Time Ave', 'Pulse Interval Time Min', 'Pulse Interval Time Max', and 'Standard Deviation'. The 'Spot' option is highlighted. At the bottom are 'Accept' and 'Cancel' buttons.

By repeatedly counting the number of pulses from the meter over a fixed period of time (the log period), the logger is able to determine the flow rate through the meter.

Finally, click on the Accept button.



The screenshot shows a dialog box titled "Logging Channel Setup" with a close button (X) in the top right corner. It contains settings for "Channel 1":

Property	Value
Input Sensor	Flow1 Uni
Sensor Type	Water
Units per pulse	0.001
Recording Unit	m ³
Logging Mode	Spot

At the bottom of the dialog are two buttons: "Accept" and "Cancel".

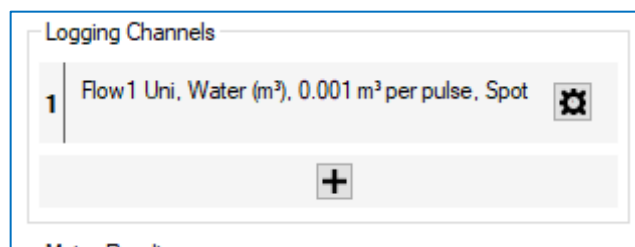
The completed settings are now shown within IDT but have not yet been saved to the logger.

The logical channel will now appear in the Logging Channels list.

("1" shown here represents channel 1).

Datapoints will appear as the "Channel 1" data stream sent to the server.

Where multiple channels have been set up, they will all be shown here along with a summary of their settings.



The screenshot shows a section titled "Logging Channels". It contains a list with one entry:

Channel	Summary	Settings Icon
1	Flow1 Uni, Water (m ³), 0.001 m ³ per pulse, Spot	

Below the list is a button with a "+" sign. At the bottom of the window, the text "Meter Readings" is partially visible.

Further discussion of setup of a logger for automated water meter readings will not be discussed here, except to summarize:

- Because the context of the channel use is connection to a water meter, additional options become available in IDT for a logger to be used in AMR applications ...
 - The current meter reading can be taken and recorded in the logger as part of the setup of "meter readings" settings within IDT. It is linked to the water flow channel.
 - The logger may offer the ability to regenerate meter pulses on a digital output from the logger. This allows the meter pulses to be made available to other instruments that require this information. Enable this feature if required.

For further information refer to section 5.6.1.

3.6 SETTING CHANNEL TRIGGER CONDITIONS (CHANNEL ALARMS)

Once channels are set up, a steady stream of data is made by the logger at both the log rate and also (stored temporarily) at the sample rate. Trigger-conditions for the channels can now be created. IDT (PC version) refers to these as conditions for "Alarms".

Locate the “Alarms” panel within the settings tab.

The panel includes a set of tabs (labelled “Cond 1” though to “Cond 6”). Each tab represents an independent monitoring function within the logger. Each can monitor for a single condition or combination of conditions to occur on the data produced by selected channels.

If any of the conditions are met, the logger can be set to act on the event. The actions available depends upon the logger family. For most loggers, the only available action is to inform the server of the event; this is referred to as being in an alarm condition.

The screenshot shows the 'Alarms' panel with the 'Cond 1' tab selected. The 'Profile Alarms' checkbox is unchecked. A list of alarm conditions is shown: Lower, Upper, Minimum Night Flow, Rate of Change, Dif>, Dif<, Out Band, and In Band. The 'Persistence' is set to 1 out of 1.

The setup of the trigger conditions begin by selecting (ticking) one or more of the options available.

The IDT display will update to show fields relevant to the type of alarm condition(s) have been ticked.

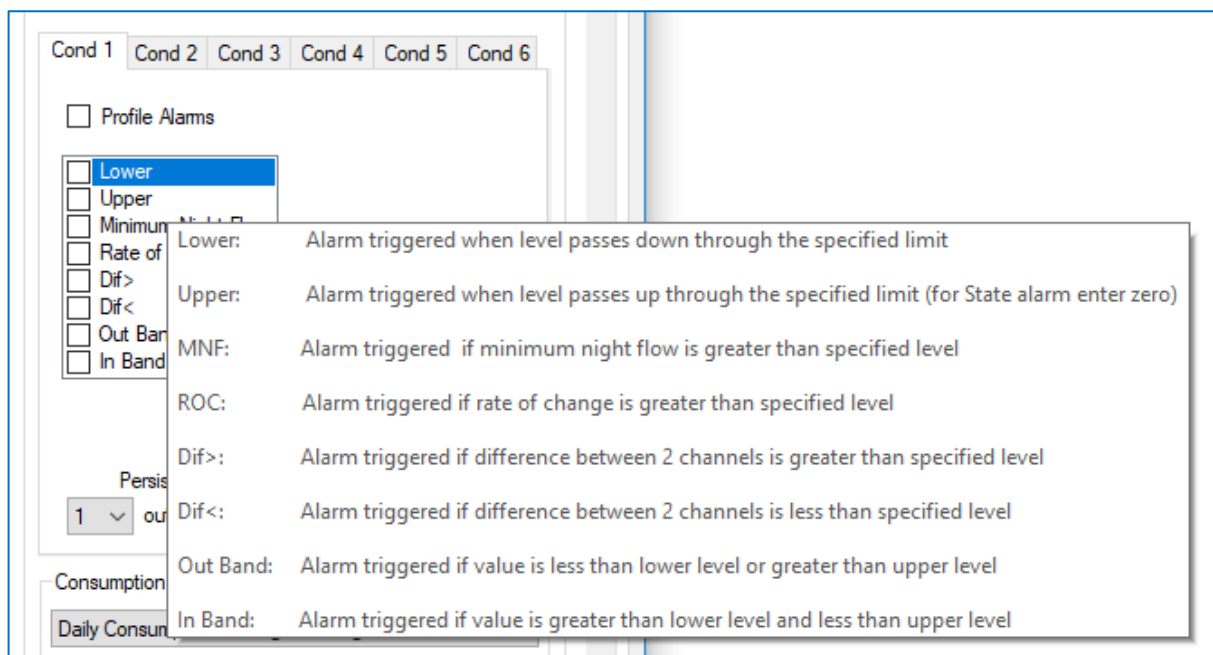
An alarm condition should be considered to be a test of the data-stream (logged data-points) to see if the alarm condition has been met. If met, the alarm is triggered and becomes activated.

Each of the tests can (if ticked) activate a distinct individual alarm. It is therefore possible to set multiple types of alarm within a tab; each will generate its own distinct alarm message upon activating and (optionally) on clearing.

The screenshot shows the 'Alarms' panel with the 'Cond 1' tab selected. The 'Profile Alarms' checkbox is unchecked. The 'Lower' condition is selected (checked). The 'Lower level' is set to 0.00 and the 'Hysteresis' is set to 0.00. The 'Chan No' is set to 1 and the 'Persistence' is set to 1 out of 1.

The relevant channel(s) have to be selected within the tab. The channels must have previously been set up and also saved to the logger; if not, they are unavailable for selection.

Hovering the mouse over the selections will produce a guidance window to remind you of the available functions.



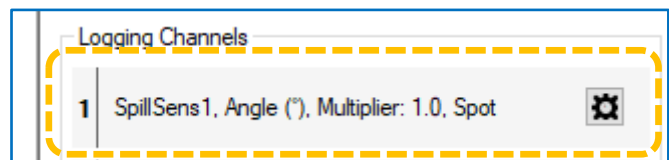
The settings have to be saved to the unit before they will take effect.

Note: There are other types of alarms available.

This section will use an example of setting alarm trigger and release conditions for a sensor...

3.6.1 Example 2: Introduction to setup of alarm activation & clearing conditions

A logger channel has already been set up, with datapoints being obtained as summarized in the diagram opposite.

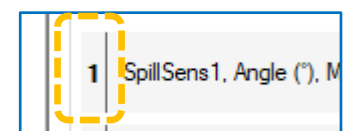


(This is for a HWM sensor called SpillSens, which is a digital float switch with an output data-stream of an angle in ° from vertical; vertical is defined as 0°).

The requirements for Example 2 are:

Setup a trigger to look at the data from this sensor. We require the trigger to be activated at a value of 50° or more. The server should be informed when the trigger condition is met (by sending an alarm message). Similarly, the server is to be informed when the trigger condition is no longer met (send an alarm clear message). The condition we require for removing the activated trigger is for the sensor data to be at a value of 40° or less. Both messages (alarm and alarm clear) are required be sent immediately.

Make a note of the channel number assigned as the Logging Channel for the SpillSens sensor.
e.g., Channel "1" is assigned in the diagram opposite.



Select the Setup tab and locate the “Alarms” panel.

Find the Conditions area within the Alarms panel and locate an unused tab, as shown opposite; no conditions are currently set (no options are ticked).

Alarms

Cond 1 Cond 2 Cond 3 Cond 4 Cond 5 Cond 6

☐ Profile Alarms

☐ Lower

☒ Upper

☐ Minimum Night Flow

☐ Rate of Change

☐ Dif>

☐ Dif<

☐ Out Band

☐ In Band

Persistence

1 out of 1

The alarm in this example needs to trigger when the angle is equal to or exceeds 50°.

This can be selected by selecting the “Upper” checkbox.

After ticking the Upper selection option, some additional fields become visible:

- Chan No.
(Channel number to monitor for this condition).
- Upper level.
(The threshold that causes an alarm condition to be met).
- Hysteresis.
(The margin from the threshold that must be exceeded before an existing alarm will be cancelled).

Alarms

Cond 1 Cond 2 Cond 3 Cond 4 Cond 5 Cond 6

☐ Profile Alarms

☐ Lower

☒ Upper

☐ Minimum Night Flow

☐ Rate of Change

☐ Dif>

☐ Dif<

☐ Out Band

☐ In Band

Upper level 0.00

Chan No 1

Persistence 1 out of 1

Hysteresis 0.00

Set the Chan No to match the channel number for the sensor.
(e.g. The SpillSens is located at channel “1”, so set the Chan No to “1”).

Chan No

1

Set the “Upper level” value to the required limit. In our example, this is “50”.

Upper level 50.00

(When the measurement is greater than or equal to this value, the trigger condition is met and the alarm will be activated).

Set "Hysteresis" to the required value, explained below...

Hysteresis 10.00

An activated alarm will be **held as active** whilst greater than or equal to the *Upper level* value minus the *hysteresis* value.

When lower, the alarm condition will be **released from being active**; it can be described as de-activated or "cleared").

... In our example, this is "10".

$50 - 10 = 40^\circ$; the threshold for cancelling the alarm condition.

For an immediate response, the setting for Persistence should be left as shown. (See also section 5.2.6).

Persistence
1 out of 1

The logger also has to be programmed as to how to handle an alarm condition being first activated, or an alarm being subsequently cleared (i.e. what actions to take).

In our example we require an action of and immediate call into the server to send an alarm message to it (and similarly an immediate alarm cleared message).

To set this up:

Locate the "Alarm Call Options" panel.

Tick "Enable notifications when alarm condition cleared". This enables the generation of all "alarm cleared" messages for the server.

Tick "Call in when Alarm occurs".

This will set the logger to make an immediate call for any alarm messages (or any alarm clear messages, if enabled).

(If not ticked, alarm condition changes will only be reported at the next scheduled call-in time).

Note: These settings are universal, and affect the actions that will be taken whenever **any** of the trigger conditions (Cond 1, etc.) are activated, or become cleared.

Alarm Call Options

MNF Window end hh:mm 06:00

☒ Enable notifications when alarm condition cleared

☐ Resend active alarms at midnight

☒ Call in when Alarm occurs

3.7 LOGGER AND SENSOR TESTS

IDT provides access to be able to test some of the logger interfaces and the functioning of attached sensors.

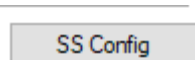
Select the Hardware Tests tab.

The tab is home to a variety of information display areas and also control buttons.

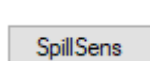
The content of this tab will vary according to the interfaces that are available, configured or sensors that are fitted to your logger.

e.g.:

Button added to configure SonicSens sensor.



Button added for SpillSens sensor.



Click on the Start Test button to see live measurement data from the sensors.

The test will time out after a number of seconds (as counted down on the button).

Use the time to diagnose any issues with the sensors or cabling.

To end earlier, click on the Stop button.

Examples:

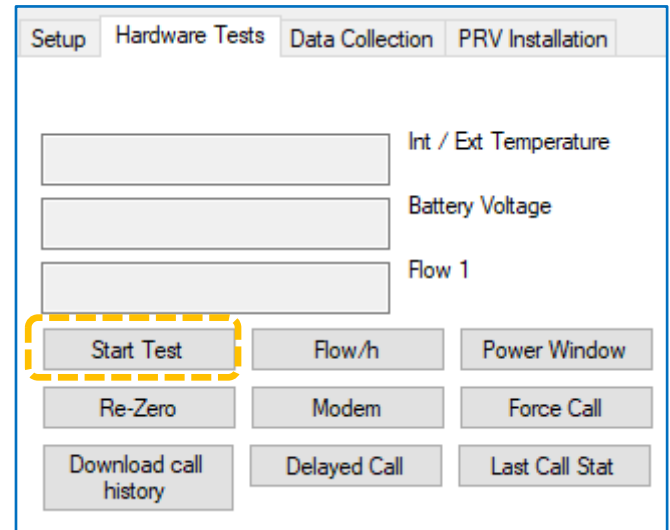
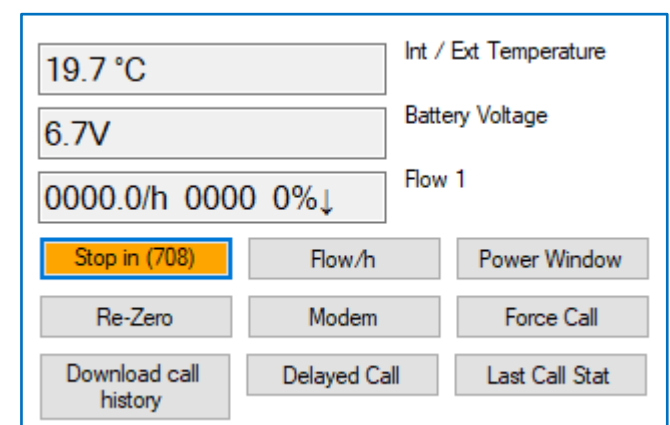
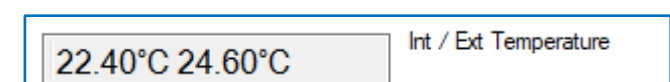
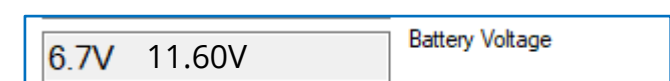
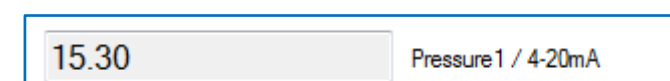
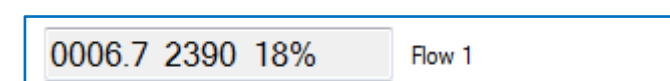
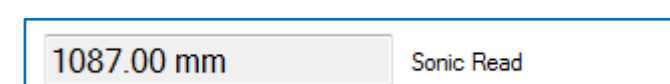
Ambient and external probe temperatures.

Primary battery and external supply voltages.

Measured Pressure.

Flow Channel pulse information.
(Flow Rate, Count, % of Device range)

Sonic Sens measurement.

The screenshot shows the "Hardware Tests" tab selected in a software interface. At the top are four tabs: "Setup", "Hardware Tests", "Data Collection", and "PRV Installation". Below the tabs are three input fields for "Int / Ext Temperature", "Battery Voltage", and "Flow 1", all of which are currently empty. A grid of buttons is displayed below the fields. The "Start Test" button is highlighted with a dashed orange border. Other buttons include "Flow/h", "Power Window", "Re-Zero", "Modem", "Force Call", "Download call history", "Delayed Call", and "Last Call Stat".This screenshot shows the same "Hardware Tests" tab interface but with live data displayed in the input fields. The "Int / Ext Temperature" field shows "19.7 °C", "Battery Voltage" shows "6.7V", and "Flow 1" shows "0000.0/h 0000 0%↓". The "Stop in (708)" button is now highlighted with a solid orange border, indicating the test is in progress.A close-up of the "Int / Ext Temperature" display, showing two temperature readings: "22.40°C" and "24.60°C".A close-up of the "Battery Voltage" display, showing two voltage readings: "6.7V" and "11.60V".A close-up of the "Pressure" display, showing a single reading: "15.30". The label "Pressure1 / 4-20mA" is visible to the right.A close-up of the "Flow 1" display, showing three values: "0006.7", "2390", and "18%".A close-up of the "Sonic Read" display, showing a single reading: "1087.00 mm".

3.8 SETUP OF DATA DELIVERY

The logger can be setup to call into the HWM DataGate server (over the mobile phone network) at specific times. During a call-in it will send measurement data or receive “remote programming commands”.

The installer should setup the logger with the required schedule.

Note: If more than two call are required per day, an external battery pack will often be required. Without an external battery providing power, the logger may restrict itself to typically two calls per day, irrespective of its settings.

Unsent data will be stored in the unit and will be sent at next call-in.

3.8.1 Call-in times (schedule and protocol)

Within the Settings tab, locate the “Times Data is Sent” panel.

IDT displays a table for call-in settings.

A selector on the first line determines if the unit will call-in at regular intervals (select a mode of “Freq”) or at specific times (select a mode of “Time”).

The screenshot shows the 'Time(s) Data Is Sent' panel with two rows. The first row has 'Call in' set to 'Off', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Time', and 'Time hh:mm' set to '06:00'. The second row has 'Call in' set to 'Off', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Time', and 'Time hh:mm' set to '06:00'. The 'Time' mode is highlighted in the dropdown menu.

When **Frequency** is selected, it is not possible to add any additional lines to the table; just one exists.

The frequency is set by entering the required time interval between call-ins.

The screenshot shows the 'Time(s) Data Is Sent' panel with two rows. The first row has 'Call in' set to 'On', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Freq', and 'Freq hh:mm' set to '06:00'. The second row has 'Call in' set to 'On', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Freq', and 'Freq hh:mm' set to '06:00'. The 'Freq' mode is highlighted in the dropdown menu.

When **Time** is selected, additional lines will automatically be added if a line is enabled (by selecting “On”) using the call-in control.

Set the time of the call-in at the end of the line.

Times can be “deleted” by selecting a line to “Off”.

The screenshot shows the 'Time(s) Data Is Sent' panel with two rows. The first row has 'Call in' set to 'On', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Time', and 'Time hh:mm' set to '06:00'. The second row has 'Call in' set to 'On', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Time', and 'Time hh:mm' set to '06:00'. The 'On' option is highlighted in the 'Call in' dropdown menu.

Note: If no remote communication is required, set each ‘Call in’ drop box as ‘Off’.

The protocol for sending in the data should also be selected. This should be UDP for most logger uses as it offers the most secure method of data transfer.

UDP is a true 2-way confirmed data transfer process via the internet over a GPRS connection.

SMS is a one-way unacknowledged data transfer service using the common text messaging service.

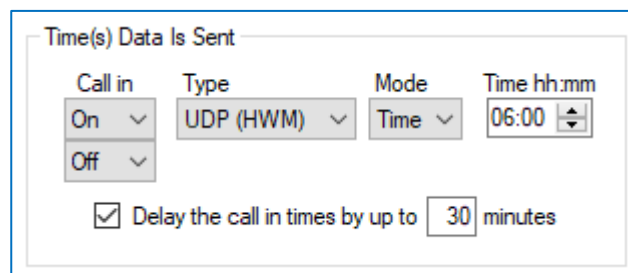
(See important note in section 1.8 about SMS use; Do not use SMS if it is unavailable).

The screenshot shows the 'Time(s) Data Is Sent' panel with two rows. The first row has 'Call in' set to 'Off', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Time', and 'Time hh:mm' set to '06:00'. The second row has 'Call in' set to 'Off', 'Type' set to 'UDP (HWM)', 'Mode' set to 'Time', and 'Time hh:mm' set to '06:00'. The 'UDP (HWM)' option is highlighted in the 'Type' dropdown menu.

Note: The unit may be set to generate a message to the server, often called an alarm. These may be set to make calls *in addition to* any schedule programmed here.

There is a feature in some loggers to add a random delay to the call-in time. If too many loggers were to call-in at exactly the same time the server load will be considerable. Enabling the call delay can improve the server response times by spreading the load over more time.

(This option is available in Advanced mode view only).

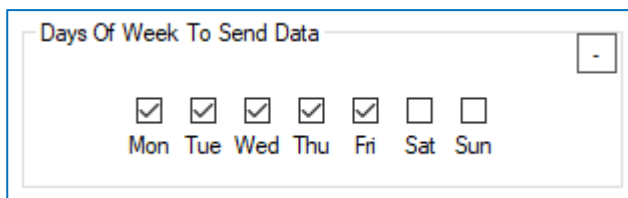


The screenshot shows a configuration panel titled "Time(s) Data Is Sent". It contains four dropdown menus: "Call in" (set to "On"), "Type" (set to "UDP (HWM)"), "Mode" (set to "Time"), and "Time hh:mm" (set to "06:00"). Below these is a checkbox labeled "Delay the call in times by up to" followed by a text input field containing "30" and the word "minutes".

Further settings are available in the "Days Of Week To Send Data" panel.

An example of the use of this setting is to save battery use in the logger when no-one is going to be viewing data on certain days. The logger still makes measurements but defers sending the data in until the next enabled day.

(This option is available in Advanced mode view only).



The screenshot shows a configuration panel titled "Days Of Week To Send Data". It features seven checkboxes corresponding to the days of the week: Mon, Tue, Wed, Thu, Fri, Sat, and Sun. The checkboxes for Mon, Tue, Wed, Thu, and Fri are checked, while the checkboxes for Sat and Sun are unchecked.

3.8.2 Data Destination settings / call-in backup options

The unit requires details of the data destination so that it can send it to the correct server via the internet. It should be entered into the "Address" field

The format can be an internet address (IPv4 format) for the server. Alternatively, enter the sever URL.

In order to route the data to the server a UDP port-number is also required.

The server can also process messages sent via the SMS (text message) service.

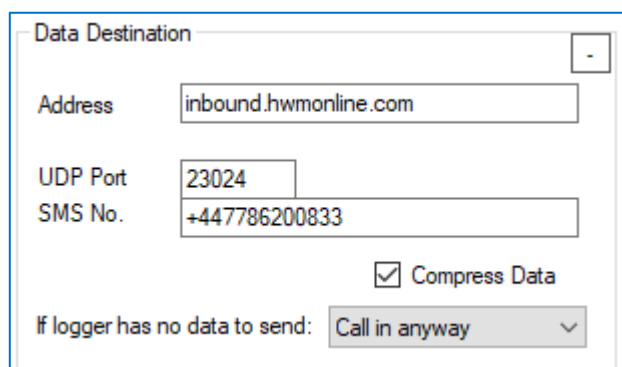
The SMS number is the **destination** "mobile phone number" for SMS messages to be received and forwarded to the server.

(See important note in section 1.8 about SMS use. If SMS is not to be used ensure the destination SMS number is deleted).

Note: The address settings and SMS number required for your company's server will be provided by your **system administrator**.

For companies having their own data server, the UDP address & port no of the server are required.

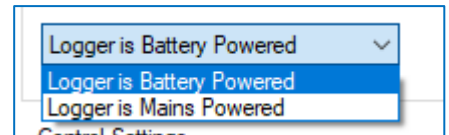
The SMS telephone number is for the modem that will be receiving the SMS messages.



The screenshot shows a configuration panel titled "Data Destination". It contains three text input fields: "Address" (containing "inbound.hwmonline.com"), "UDP Port" (containing "23024"), and "SMS No." (containing "+447786200833"). Below these is a checkbox labeled "Compress Data" which is checked. At the bottom, there is a label "If logger has no data to send:" followed by a dropdown menu set to "Call in anyway".

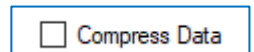
Some options in the “Data Destination” panel are related to power use by the logger:

Most loggers will be battery operated and therefore have limited power; the logger restricts power use wherever possible. (Select Battery powered).

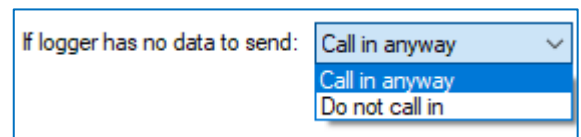
A screenshot of a dropdown menu with the title "Logger is Battery Powered". The menu is open, showing three options: "Logger is Battery Powered" (selected), "Logger is Battery Powered", and "Logger is Mains Powered". The text "Control Settings" is visible at the bottom of the menu.

Certain logger applications permit the use of an external power source, in which case the logger can be less restrictive in its power use. (Select Mains powered).

Data compression can be set to minimize length of messages and hence call times.

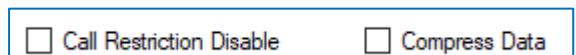
A screenshot of a checkbox labeled "Compress Data". The checkbox is currently unchecked.

Some loggers may have multiple call times programmed just in case the network is sometimes busy; it can try again at a later time. If the logger has no data to send (e.g., it measures once a day, and has sent in its data earlier), this setting is used to stop unnecessary calls.

A screenshot of a dropdown menu with the title "If logger has no data to send:". The menu is open, showing three options: "Call in anyway" (selected), "Call in anyway", and "Do not call in".

The logger has a built-in call limit of 2 calls per day, starting at midnight (irrespective of call schedule).

Tick “Call Restriction Disable” to disable this restriction and allow loggers to and to be able to call more than twice per day. (Caution: Consider the impact to the battery use). Most loggers should not have this feature enabled. (This option is available in Advanced mode view only).

A screenshot of two checkboxes: "Call Restriction Disable" and "Compress Data". Both checkboxes are currently unchecked.

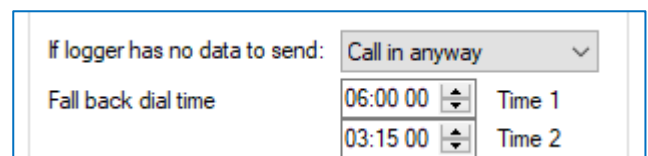
Most loggers have the feature to set the logger to use SMS messaging as a fall-back contact method if the primary call method (usually set to UDP) proves to be problematic.

Examples of problems are:-

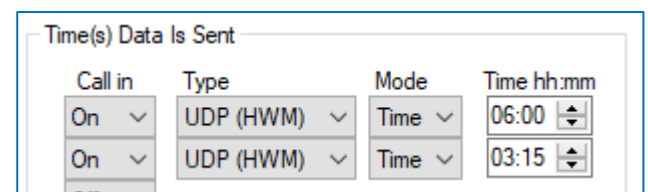
- If a connected external battery goes flat.
(The device will default from the normal call out requirement to a 2 times per day routine. The times of these calls are specified by both Fall back time 1 and 2).
- If a GPRS data call cannot be completed due to non-availability of a GPRS service for a 24-hour period.
(The device will try to send an SMS message at the Fall back time 1).

Fall-back times can be set within the Data Destination panel.

(Note: They only appear within IDT if the call-in pattern is set to “frequency” rather than “time”).

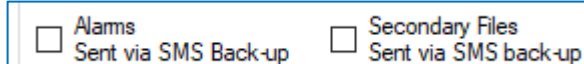
A screenshot of the "Fall back dial time" settings. It shows a dropdown menu for "If logger has no data to send:" set to "Call in anyway". Below it, there are two time selection fields: "Fall back dial time" with "06:00 00" and "03:15 00" and labels "Time 1" and "Time 2".

For a logger with fixed call times, the fall-back functionality still exists, but the fall-back dial times will correspond to the first two call times shown in the regular “Time Data is Sent” panel.

A screenshot of the "Time(s) Data Is Sent" panel. It shows a table with columns: "Call in", "Type", "Mode", and "Time hh:mm". There are two rows of data: "On" with "UDP (HWM)" and "Time" set to "06:00", and "On" with "UDP (HWM)" and "Time" set to "03:15".

Primary data channels (regular logging) will fall-back to being sent via SMS messages if the server cannot be reached by the mobile data network.

If secondary files (any supplementary logged data) or alarm information is required to be sent using the fall-back SMS process, tick as required.

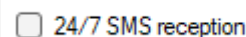
A screenshot of a settings panel with two checkboxes. The first checkbox is labeled 'Alarms Sent via SMS Back-up' and the second is labeled 'Secondary Files Sent via SMS back-up'. Both checkboxes are currently unchecked.

Note: (See important note in section 1.8 about SMS use. If SMS is not to be used ensure the '... via SMS back-up' settings are deactivated).

Continuous modem operation

The 'Data Destination' panel includes a control (24/7 SMS reception) that sets the logger to be continuously connected to the cellular network (rather than only connecting when needed).

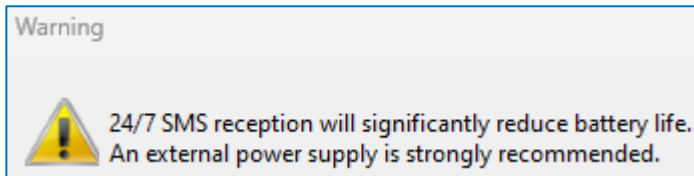
This control should usually be set to disabled, as shown.

A screenshot of a control labeled '24/7 SMS reception' with an unchecked checkbox.

The control is rarely enabled. It is for a specialized application of the logger, which will be mains powered. The application allows the logger to be queried for current channel values, and to respond, using an SMS-based protocol (outside of the scope of this user-guide).

Note: If enabled, the battery life will be significantly reduced.

If accidentally set, IDT will give a warning during program save and re-load. The user should rectify the situation by disabling the control before leaving site.

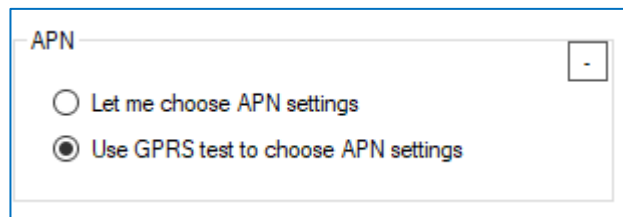


(See important note in section 1.8 about SMS use. If SMS is not available, ensure the control is deactivated).

3.8.3 SIM settings (Access Parameters for Network)

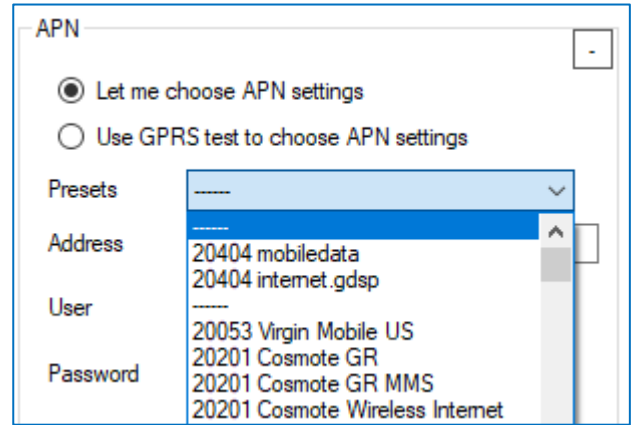
The unit needs to know how to connect to the internet using the mobile-phone data network. These details are set in the "APN settings" panel (located in the Setup tab).

Either select the option to "Use GPRS test to choose APN settings" to allow automatic set-up ... or "Let me choose APN settings" to configure them manually.

A screenshot of the 'APN' settings panel. It has a title bar 'APN' and a close button. Below the title bar are two radio button options: 'Let me choose APN settings' and 'Use GPRS test to choose APN settings'. The second option is selected with a filled radio button.

(If you have ordered a data pack / SIM from HWM you can usually leave this setting alone; your device will have been preconfigured by HWM).

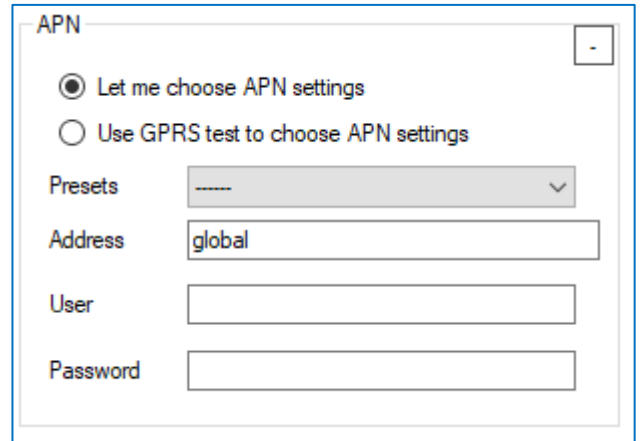
If the installer knows the type of SIM card fitted, the parameters may be selectable from one of the pre-sets known to IDT.



The screenshot shows the 'APN' settings window. At the top, there are two radio buttons: 'Let me choose APN settings' (selected) and 'Use GPRS test to choose APN settings'. Below these is a 'Presets' dropdown menu. The dropdown is open, showing a list of presets: '20404 mobiledata', '20404 internet.gdsp', '20053 Virgin Mobile US', '20201 Cosmote GR', '20201 Cosmote GR MMS', and '20201 Cosmote Wireless Internet'. The 'Address', 'User', and 'Password' fields are currently empty.

Alternatively, the user can enter the parameters for their fitted SIM card.

If the connection requires authentication, enter the username and password for gaining access to the network connection.



The screenshot shows the 'APN' settings window with the 'Let me choose APN settings' radio button selected. The 'Presets' dropdown is closed. The 'Address' field contains the text 'global'. The 'User' and 'Password' fields are empty.

Note: The settings required will be provided by your **system administrator**.

3.9 CELLULAR NETWORK SETUP - PROTOCOLS AND TESTS / ANTENNA CHECKS

IDT can be used to check that the logger can connect to the cellular network and provide information to help the installer to choose the optimal position of the antenna.

- Inspect or modify modem settings (if required).
- Perform the “Signal Test” to confirm the logger connects to the mobile network and find the best location of the antenna.

Note: The process is different for 4G networks in comparison with the 2G and 3G networks.

- Perform a “Call Test” to confirm the logger can communicate with the DataGate server.

3.9.1 Modem Settings

The loggers have a built-in modem circuit for connection to the cellular network. Depending on the part fitted, IDT can display different contents for modem setup and also signal quality tests (required for finding the optimal antenna location).

The differences are mainly based around the capability of the modem to access various mobile cellular networks (2G, 3G, or 4G).

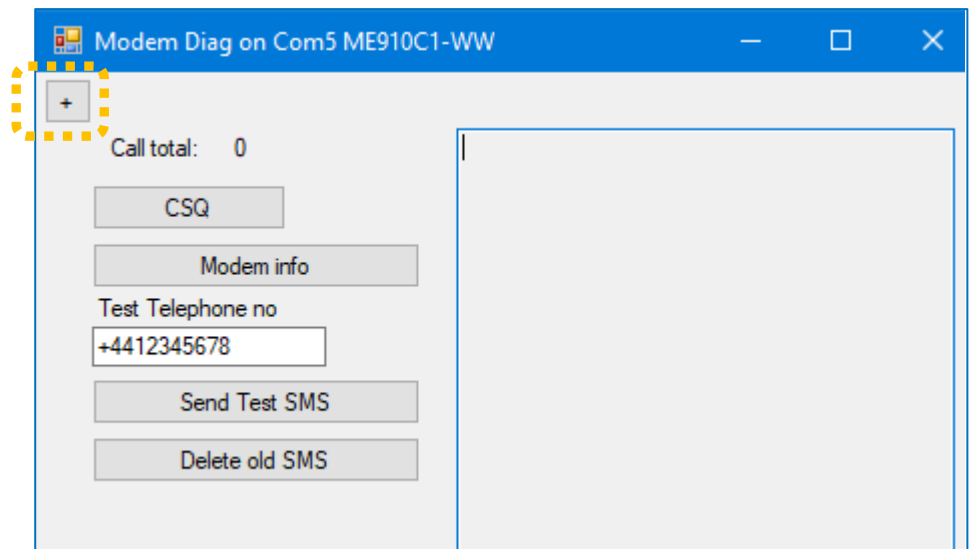
To determine whether your device has a modem which is capable of accessing the 4G network, take the following steps:

Select the Hardware Tests tab and click on the “Modem” button.

The screenshot shows the IDT software interface with the 'Hardware Tests' tab selected. The interface includes several input fields for sensor data and a grid of buttons. The 'Modem' button is highlighted with a yellow dashed border.

Setup	Hardware Tests	Data Collection	PRV Installation
<input type="text"/> Int / Ext Temperature			
<input type="text"/> Battery Voltage			
<input type="text"/> Pressure1 / 4-20mA			
<input type="text"/> Pressure2 / 4-20mA			
<input type="text"/> Flow Net 1,2			
Start Test	Flow/h	Power Window	
Re-Zero	Modem	Force Call	
Download call history	Delayed Call	Last Call Stat	

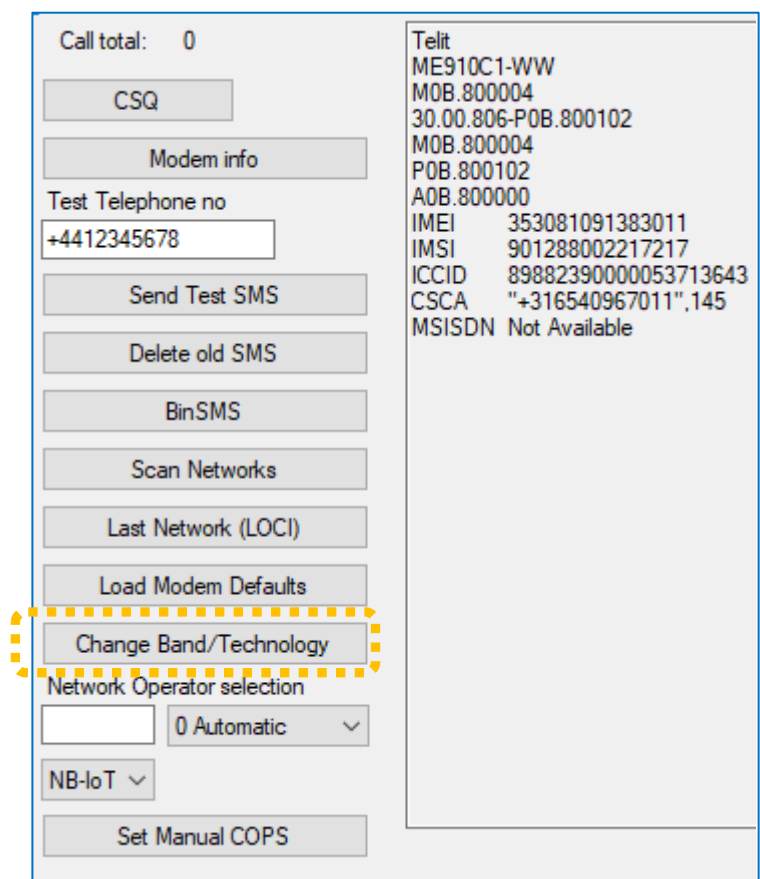
Then, after the “Modem Diag...” window loads, click on the “+” button.



A unit with a 4G network capable modem will have an additional button, “Change Band / Technology” present.

If this button is not present, the unit’s modem is only 2G or 3G capable.

A 4G capable modem can usually also be set up to operate in an area only covered by a 2G or 3G network.



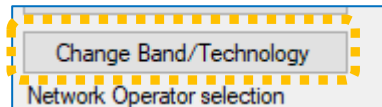
If you were to click on the “Change Band / Technology” button, further options would be available for you to configure the network that you wish to access, as described in section 3.9.2.

3.9.2 4G Network modem settings

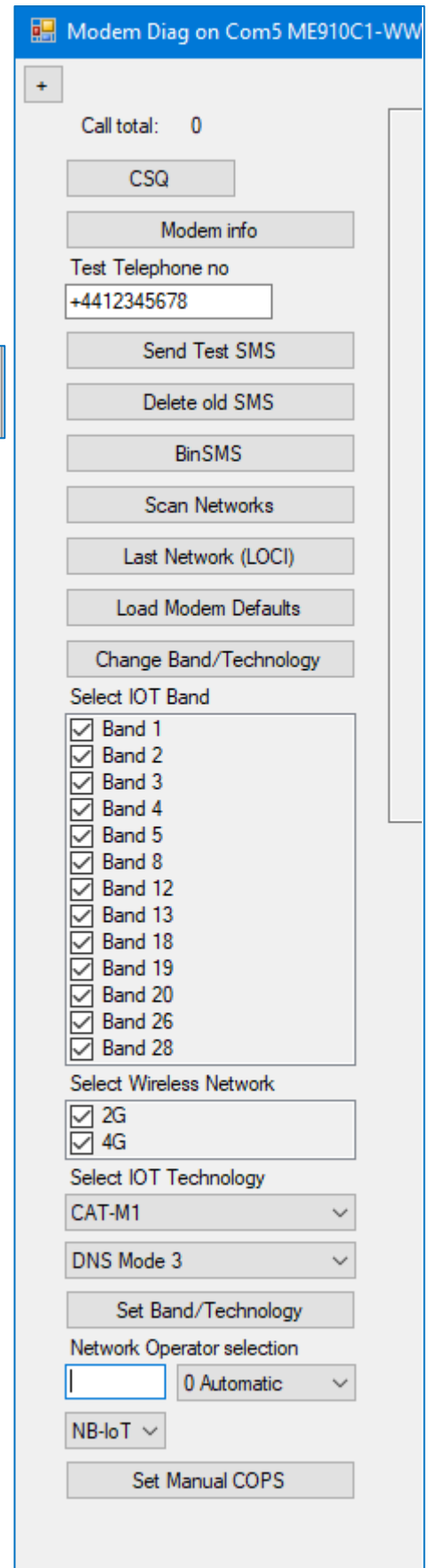
CAUTION: Most installers **should not modify** these settings.
(Skip to section 3.9.3 or 3.9.4);
The settings are for expert use only.

Additional settings are available on 4G-capable modems.

To access the settings in IDT, click on the button
“Change Band / Technology”
(refer to section 3.9.1).



The available settings are shown opposite.



3.9.3 2G and 3G Networks: Signal Test (signal strength - CSQ) / Antenna check

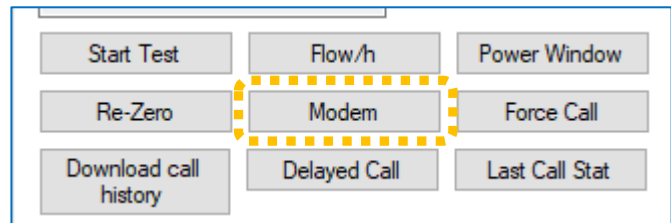
The best location for the antenna can be found by comparing the CSQ value at various alternative locations. (CSQ applies to 2G and 3G networks only).

Ensure the antenna is connected to the antenna port.

Select the "Hardware tests" tab.

Then click on the "Modem" button.

(The modem is the cellular communications module built into the logger).



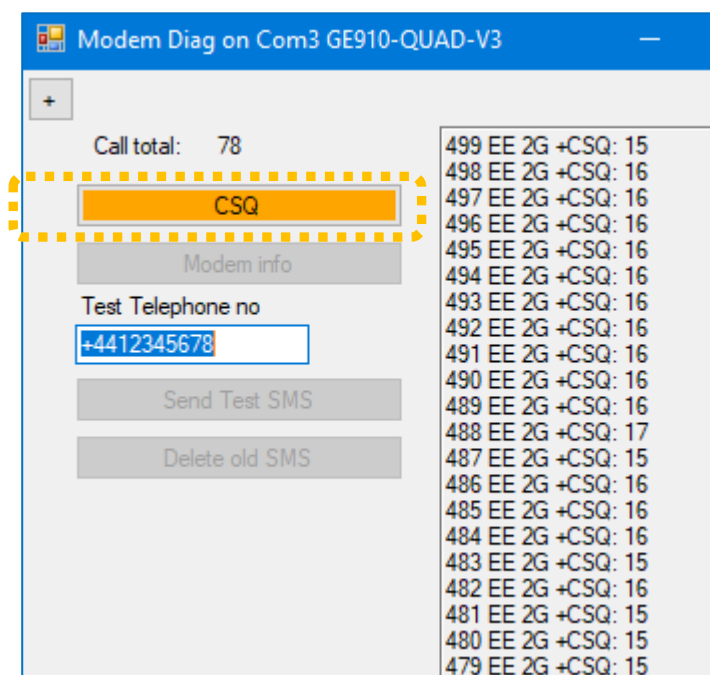
A new window will open with various types of modem tests.

Click on the "CSQ" button.

Once connected to the mobile network, the provider details and signal strength indicator (CSQ) are displayed; it is updated every few seconds.

CSQ values are in the range of 1 to 33; a higher number is better.

Move the antenna to various alternative locations to find the most suitable position. Stand well back from the antenna whilst the measurement is being made to ensure you are not blocking the signal.



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 what the local signal strength is.

Then, with the test still running, close the chamber (or nearly close it ... due to the communications cable). The CSQ will drop 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 strength (CSQ). The antenna should finally be installed in the best signal-strength position.

To stop the test, click the CSQ button once more.

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: When using a modem with 4G Network protocols (NB-IoT and LTE-M), CSQ levels are replaced with different quality parameters.
(Refer to section 3.9.1 to determine what modem settings are in use for the logger. Refer to section 3.9.4 for 4G Network signal quality assessment).

3.9.4 4G Networks (NB-IoT, LTE-M): Signal Tests / Antenna check

Modems that use 4G networks have different signal quality parameters than those using 2G and 3G networks; CSQ is not available.

Proceed as per the tests described in section 3.9.3, but for loggers that have been configured to use (and are connected to) a 4G network, an additional option will be visible. ... Tick the "Details" control.

Additional information will be displayed when the logger updates the display with latest results.

The shown parameters are:




- Signal - Signal Strength (instantaneous and average)
- PWR - Signal Power
- RSRP - Signal RSRP (dBm)
(Reference Signal Received Power; A Signal Strength indication).
- RSRQ - Signal RSRQ (dBm)
(Reference Signal Received Quality; A Signal Quality indication).

These parameters may be used to assess the suitability of the logger communication with the cellular data network, as shown below.

The screenshot shows a software interface for testing cellular signal quality. On the left, there is a control panel with a 'Call total' of 1361, a 'CSQ' button, a 'Details' checkbox which is checked, and buttons for 'Modem info', 'Test Telephone no' (with the number +4412345678), 'Send Test SMS', and 'Delete old SMS'. On the right, a list of signal quality data is displayed for Vodafone UK NB-IoT. The data includes signal strength (Ave), PWR, RSRQ, and RSRP for various signal levels (Ave05 to Ave10). A dashed yellow box highlights the 'Details' checkbox and the corresponding signal quality data for Ave05 to Ave10.




Signal Level	Signal	PWR	RSRQ	RSRP
Ave10	499	0	-16	-130
Ave10	498	0	-20	-136
Ave09	497	0	-20	-135
Ave08	496	0	-20	-135
Ave08	495	0	-20	-135
Ave07	494	0	-20	-135
Ave06	493	-114	-20	-137
Ave05	492	-114	-20	-136

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).

Note: The above values are negative. The higher the value (less negative) the better.

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).

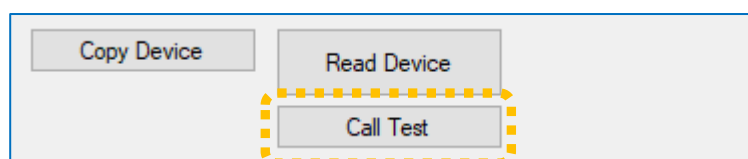
Note: The above values are negative. The higher the value (less negative) the better.

3.9.5 Making a test call (test internet data network)

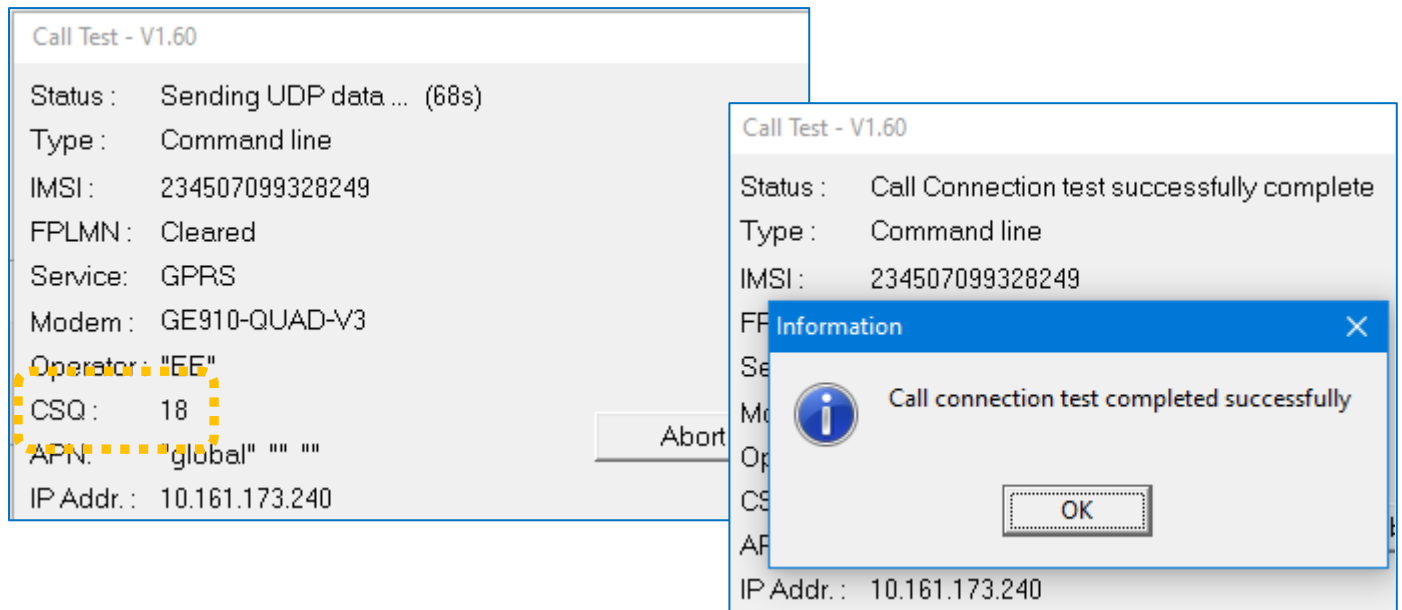
Communications can be confirmed by making a test call. This test confirms that the logger can **communicate with the DataGate server** over the cellular internet data network.

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

Click on the “Call Test” button, located at the bottom of the IDT program window.



The call test will proceed.



Confirm that a “Call connection test successfully complete” information box appears.

Note the parameter “CSQ”; this is an important indication of the signal strength with the antenna in the current position.

3.9.6 Making a test call (test SMS network)

This test confirms the logger can **communicate using outgoing SMS messages** over the cellular network. (See important note in section 1.8 about SMS use).

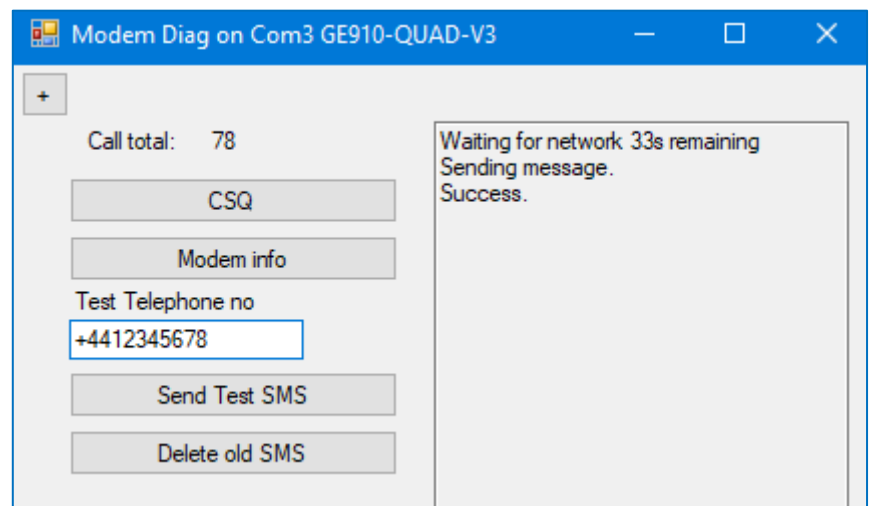
If *both your SIM and the Cellular Network* supports SMS messages, this will send a text to your phone confirming the phone number of the SIM and that calls can be made from the modem.

Enter your mobile phone number into the ‘Test Telephone no’ box in international format as shown opposite.

Click the “Send Test SMS” button.

If you fail to receive a text message this could indicate a SIM or modem fault, but first verify that both the SIM and Cellular Network support SMS messages.

When finished, tap on the “Delete Old SMS” button.



3.9.7 Troubleshooting a Call Test failure

Possible Issues and Checks

There are a number of reasons why a Call test (see section 3.9.5) 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. The device may call into the data warehouse once per day using an SMS message; relocate the device if more frequent communications is required.
Network signal not strong enough. You need a CSQ (reported by the Call test) of at least 8 for reliable communications.	Relocate the antenna if possible or try alternative antenna configurations. Ensure antennas are vertically orientated where possible. Refer to the antenna installation guide.
APN settings incorrect.	Check with your network operator that you have the correct settings for your SIM. Select "Use GPRS test selection to choose APN" option. The tester knows about a large number of cellular networks and will try as many settings as possible and correct any error automatically.

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

4 DATA DOWNLOAD TO IDT / VIEW GRAPHICALLY

Measurements are saved by the Logger. To view data on any portal, the data must be delivered to that destination.

Data can be downloaded from the logger into IDT for viewing locally; you must be on-site to do this.

The logger is normally set to incrementally upload its data to a server (e.g., DataGate) so that it can be centrally stored, or (for some customers only) exported to another server.

The data for the installation site can then be viewed using a web browser as an on-line data viewing tool (e.g., to view pages from one of the data viewing websites provided by HWM).

4.1 DATA VIEWING PORTALS

Data from the logger can generally be viewed using various portals (websites) provided by HWM:

- DataGate can be used to view logger data, but only one site at a time.
- Other portals can be used to view data from a group of sites, typically showing at which sites a logger has detected an alarm condition.

The websites are application specific. Examples include:

- PermaNetWeb (detection of possible leaks in clean-water supply).
- PressView (monitoring and control of water network pressure)
- SpillGuard (monitoring of wastewater network for overflow conditions).

Your utility company may also employ its own data viewing tool.

4.2 MANUAL DOWNLOAD OF DATA INTO IDT / VIEW AS A GRAPH

Select the “Data Collection” tab.

This initially shows only a set of controls.

Setup Hardware Tests Data Collection PRV Installation

Download period Un-Sent

Download Post files Clear files

Download period Un-Sent

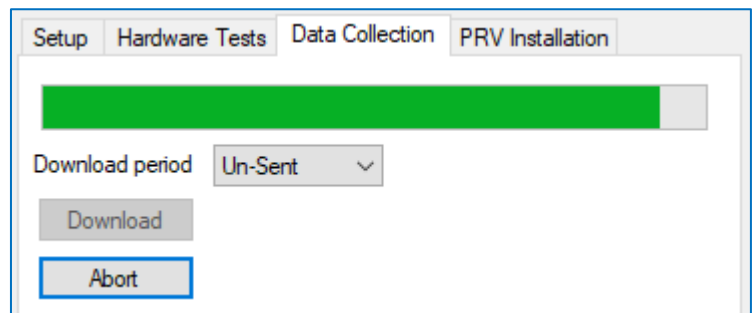
Download

All
Un-Sent
1 Week
2 Weeks
3 Weeks
1 Month
2 Months
3 Months
4 Months
5 Months
6 Months
1 Year

Choose a download period using the selector.

Then click on the “Download” button.

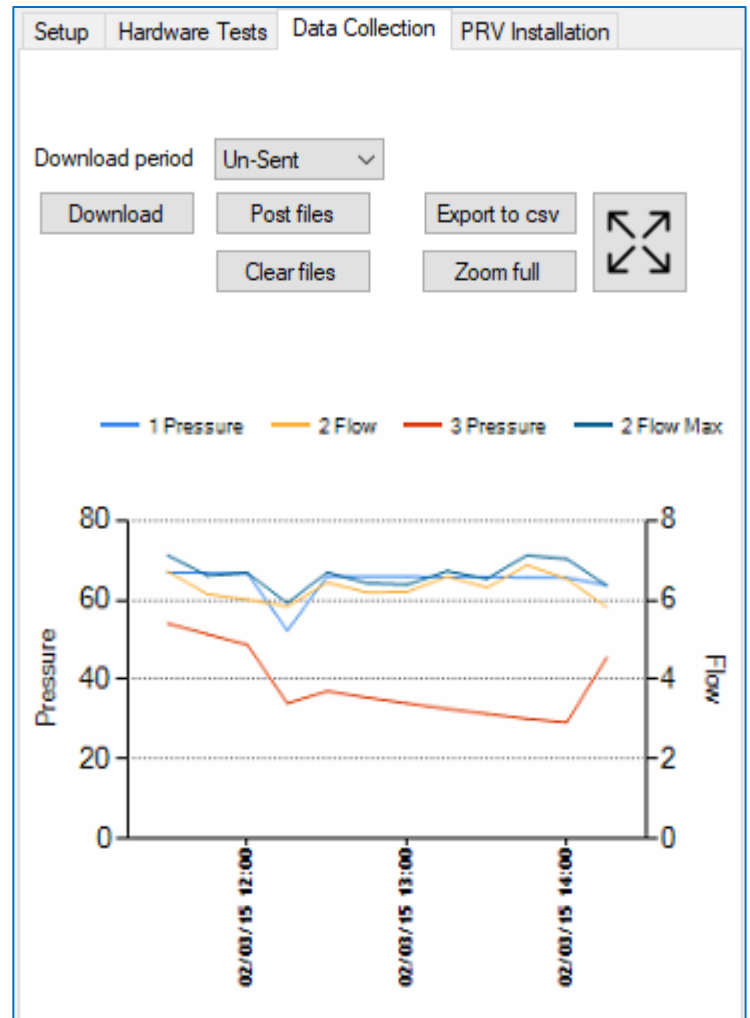
The data for the requested period will be downloaded into a file within the PC by the IDT program.



A graph will be displayed showing the data of the channels being logged.

To zoom to specific times/dates, click and drag over the part of the screen required. Click the "Zoom Full" button to show all data once more.

A larger display can be shown by clicking the button shown opposite.



Note: The graph contents will vary according to the sensors attached to the logger, the type of data produced, how long the logger has been running and other factors.

5 PART2: ----- INTERFACES AND TRIGGER-ACTIONS -----

Note: Certain sensors have their own User Guide regarding installation and configuration using IDT. Follow the additional guidance, where available.

5.1 SUPPORT OF MULTIPLE ALARM TRIGGERS

The logger device has a comprehensive alarm system. It can be configured to send out Alarm messages when certain defined conditions are breached.

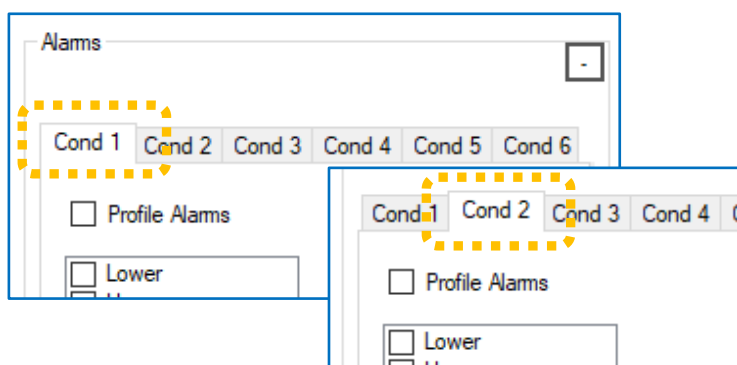
Up to 6 independent general-purpose alarm triggers are supported by most loggers and also IDT; each are evaluated independently.

Each of the general-purpose alarm triggers can be set-up by selecting one of the “Cond...” tabs (“Cond” is an abbreviation of “condition”).

5.1.1 From different sensors

To program an alarm triggering condition from different sensors, use a different tab for each sensor.

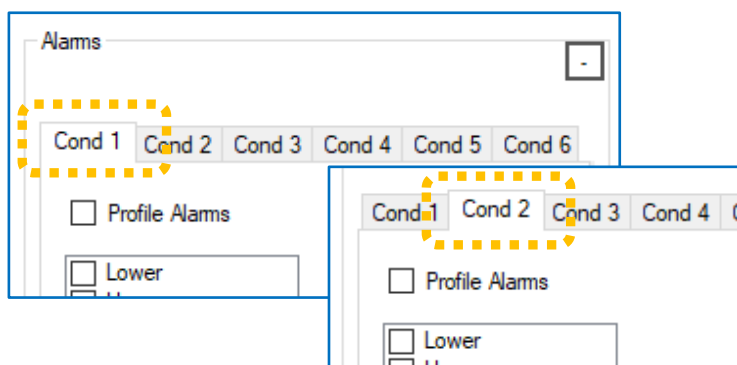
Then set the triggering condition for each of the sensors independently. (see section 5.2).



5.1.2 From the same sensor

To program multiple alarm triggering conditions from the same sensor, use a two or more tabs to set up each triggering condition for the sensor.

The alarms are independent from each other.



e.g. If a logger has a SpillSens sensor fitted, configured to produce data for Channel 1; the data represents an angle. It is required to send in messages (when the sensor has exceeded an angle) at two different angle thresholds (such as is required by the SpillGuard system):

- Use two different triggering condition tabs (e.g., Cond 1 and Cond 2).
- Set the trigger for the lower angle threshold using the first tab.
- Set the trigger for the higher angle threshold using the second tab.
- Both tabs are to be set to monitor the same channel number (Chan No 1, in our earlier example).

5.2 ALARM TRIGGER CONDITIONS AND OPTIONS

The general-purpose Alarm Condition tabs show a selection of available triggers. Each selection will generate its own type of alarm message to the server.

Normally only one is selected; IDT then adds fields to the display for any additional parameters that are required for the selected alarm type.

(There are exceptions to only one being selected; see section 5.2.9).

Cond 1 Cond 2 Cond 3 Cond 4 Cond 5 Cond 6

☐ Profile Alarms

☐ Lower

☐ Upper

☐ Minimum Night Flow

☐ Rate of Change

☐ Dif>

☐ Dif<

☐ Out Band

☐ In Band

Persistence

1 out of 1

5.2.1 “Lower” and “Upper” Limit types

An alarm set as shown opposite will become active when the value of datapoints from the selected channel (here, channel 1) are **below** the value shown in the “Lower level” limit.

Once activated, the alarm remains held in the active state until it is above a different limit, due to the Hysteresis field also having a value.

The release limit is: (Lower Level + Hysteresis).
(Here, it equals $20 + 10 = 30$).

☒ Lower

☐ Upper

☐ Minimum Night Flow

☐ Rate of Change

☐ Dif>

☐ Dif<

☐ Out Band

☐ In Band

Lower level 20.00

Chan No 1

Persistence 1 out of 1

Hysteresis 10.00

Similarly, an alarm set as shown opposite will become active when the value of datapoints from the selected channel (here, channel 1) are **above** the value shown in the “Upper level” limit.

Once activated, the alarm remains held in the active state until it is below a different limit, due to the Hysteresis field also having a value.

The release limit is: (Upper Level - Hysteresis).
(Here, it equals $80 - 10 = 70$).

☐ Lower

☒ Upper

☐ Minimum Night Flow

☐ Rate of Change

☐ Dif>

☐ Dif<

☐ Out Band

☐ In Band

Upper level 80.00

Chan No 1

Persistence 1 out of 1

Hysteresis 10.00

Refer to section 5.2.6 for a discussion of Persistence.

5.2.2 "Dif >" and "Dif <" types (Comparing two channels)

Channels that *measure similar parameters* and with an identical *unit of measure* in use can be compared. Or, more precisely, the datapoints from each channel can be compared.

The comparisons are called "Dif >" and "Dif <" within IDT; "Dif" is an abbreviation of "Difference".

It should be noted that this is not a true difference comparison; this would disregard any sign of the difference between the channels. Rather, the comparisons are more accurately described as "greater than" (">") and "less than" ("<").

An alarm set as shown opposite will compare the values of datapoints from the two selected channels (here, channel 1 and channel 2).

The alarm will become active if:

$(ch1 - ch2) > (DIF \text{ level})$. (greater than)

Once activated, the alarm remains held in the active state until the result of the above falls below a different difference limit, due to the Hysteresis field also having a value.

The release limit is: $(DIF \text{ level}) - (Hysteresis)$.

(Here, the difference release limit equals $20 - 10 = 10$).

The screenshot shows the IDT alarm configuration interface. On the left, a list of comparison types includes: Lower, Upper, Minimum Night Flow, Rate of Change, Dif > (checked), Dif < (highlighted), Out Band, and In Band. Below this list, the 'Chan No' is set to 1 and 'Chan No diff' is set to 2. The 'DIF level' is set to 20.00 and 'Hysteresis' is set to 10.00. The 'Persistence' is set to 1 out of 1.

Similarly, an alarm set as shown opposite will compare the values of datapoints from the two selected channels (here, channel 1 and channel 2).

The alarm will become active if:

$(ch1 - ch2) < (DIF \text{ level})$. (less than)

Once activated, the alarm remains held in the active state until the result of the above equation falls above a different difference limit, due to the Hysteresis field also having a value.

The release limit is: $(DIF \text{ level}) + (Hysteresis)$.

(Here, the difference release limit equals $20 + 10 = 30$).

The screenshot shows the IDT alarm configuration interface. On the left, a list of comparison types includes: Lower, Upper, Minimum Night Flow, Rate of Change, Dif > (highlighted), Dif < (checked), Out Band, and In Band. Below this list, the 'Chan No' is set to 1 and 'Chan No diff' is set to 2. The 'DIF level' is set to 20.00 and 'Hysteresis' is set to 10.00. The 'Persistence' is set to 1 out of 1.

Refer to section 5.2.6 for a discussion of Persistence.

5.2.3 “Rate of Change” type Alarm Trigger

It is possible for the logger to look at how quickly the datapoint values of a channel are changing, and if it exceeds a set limit to activate an alarm. This is known as a Rate of Change alarm trigger.

The “ROC level” field is the Rate of Change trigger threshold.

The logger looks at the current and previous data-point values to evaluate the rate of change. Therefore, the time period involved is the *log-period* of the logger channel.

If the values differ by more than the amount in the ROC level, the alarm will become active.

An alarm set as shown opposite will compare the values of the current datapoint and the previous datapoint from the selected channel (here, channel 1).

The alarm will become active if:

(current value) – (previous value) is greater than the ROC level.

Once activated, the alarm remains held in the active state until the result of the above calculation falls below a different limit, due to the Hysteresis field also having a value.

The release limit is: (ROC level) – (Hysteresis).

(Here, the release limit equals $2.00 - 0.50 = 1.50$).

The screenshot shows a configuration window for an alarm. On the left, a list of trigger types is shown with checkboxes: Lower, Upper, Minimum Night Flow, Rate of Change (checked and highlighted in blue), Dif>, Dif<, Out Band, and In Band. Below this list, 'Chan No' is set to 1. At the bottom, 'Persistence' is set to 1 out of 1. On the right side of the window, 'ROC level' is set to 2.00 and 'Hysteresis' is set to 0.50.

The Rate of Change trigger acts on datapoints which are increasing in value. (There is no equivalent trigger for datapoints that are decreasing in value).

Refer to section 5.2.6 for a discussion of Persistence.

5.2.4 “In Band” and “Out band” types of Alarm Trigger

It is possible to define a “band” (a range with upper and lower boundaries) of values for the logger to test against. The test applied can be whether the datapoint value is within that range (called “In-band”) or outside of that range (called “Out of band”).

An alarm set as shown opposite will become active when the value of datapoints from the selected channel (here, channel 1) are **between** the values shown in the “Lower level” limit and “Higher Level” limit.

Once activated, the alarm remains held in the active state until it is outside of different limits, due to the Hysteresis field also having a value.

The hysteresis is applied to both sides of the specified band.

The lower release limit is: (Lower Level - Hysteresis).
(Here, it equals $20 - 10 = 10$).

The upper release limit is: (Upper Level + Hysteresis).
(Here, it equals $80 + 10 = 90$).

The screenshot shows the 'In Band' alarm configuration interface. At the top, there are tabs for 'Cond 1' through 'Cond 6', with 'Cond 1' selected. Below the tabs, there is a section for 'Profile Alarms' with a checkbox that is unchecked. A list of alarm types is shown with checkboxes: 'Lower', 'Upper', 'Minimum Night Flow', 'Rate of Change', 'Dif>', 'Dif<', 'Out Band', and 'In Band'. The 'In Band' option is checked and highlighted in blue. To the right of the list, there are input fields for 'Lower level' (20.00) and 'Upper level' (80.00). Below the list, there is a 'Chan No' dropdown menu set to '1'. To the right of the dropdown, there is a 'Persistence' dropdown menu set to '1' and a 'Hysteresis' input field (10.00). The 'out of' label is visible between the 'Persistence' and 'Hysteresis' fields.

An alarm set as shown opposite will become active when the value of datapoints from the selected channel (here, channel 1) are **outside of** the values shown in the “Lower level” limit and “Higher Level” limit.

Once activated, the alarm remains held in the active state until it is outside of different limits, due to the Hysteresis field also having a value.

The hysteresis is applied to both sides of the specified band.

The lower release limit is: (Lower Level - Hysteresis).
(Here, it equals $20 + 10 = 30$).

The upper release limit is: (Upper Level + Hysteresis).
(Here, it equals $80 - 10 = 70$).

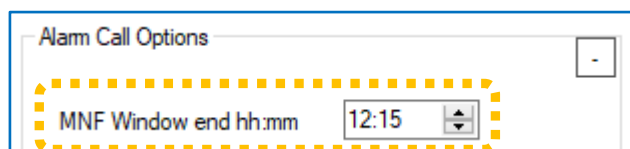
The screenshot shows the 'Out Band' alarm configuration interface. At the top, there are tabs for 'Cond 1' through 'Cond 6', with 'Cond 1' selected. Below the tabs, there is a section for 'Profile Alarms' with a checkbox that is unchecked. A list of alarm types is shown with checkboxes: 'Lower', 'Upper', 'Minimum Night Flow', 'Rate of Change', 'Dif>', 'Dif<', 'Out Band', and 'In Band'. The 'Out Band' option is checked and highlighted in blue. To the right of the list, there are input fields for 'Lower level' (20.00) and 'Upper level' (80.00). Below the list, there is a 'Chan No' dropdown menu set to '1'. To the right of the dropdown, there is a 'Persistence' dropdown menu set to '1' and a 'Hysteresis' input field (10.00). The 'out of' label is visible between the 'Persistence' and 'Hysteresis' fields.

Refer to section 5.2.6 for a discussion of Persistence.

5.2.5 “Minimum Night Flow” type Alarm Trigger

The “Minimum Night Flow” alarm trigger is designed for a specific application (looking at data from a channel collecting pulses from a water meter), however it can be applied to any channel producing datapoints.

The test looks at the datapoints the channel has produced **between midnight (0:00) and a specified time**. The time is adjustable. It is specified within the setup tab and is found under the “Alarm Call Options” panel.



The screenshot shows a panel titled "Alarm Call Options". Inside, there is a dashed yellow box containing the text "MNF Window end hh:mm" followed by a time input field set to "12:15".

This test can be considered to be made at the time specified above, rather than a continuous test. However, it looks at many data-points (midnight until the specified time).

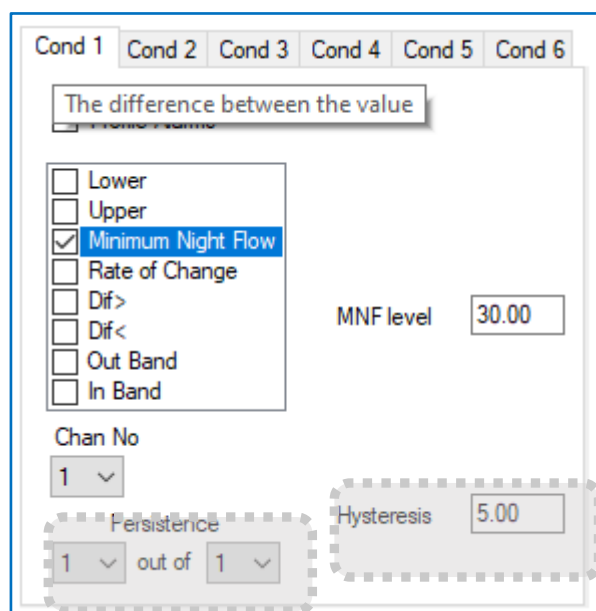
Specify the channel from which the datapoint values are to be taken (typically, this is from a flow channel).

At the specified time, the logger will check all data-points to verify that one or more samples were **at or below** the value set as **the MNF level**.

If it finds suitably low values, raising an MNF alarm is evaded.

If it does not find any suitably low values, the Minimum Night Flow alarm is activated.

The alarm remains activated until the following day, whereupon a new judgement is made. If the values are now suitably low, the alarm is cleared.



The screenshot shows a panel with tabs for "Cond 1" through "Cond 6". Under "Cond 1", there is a dropdown menu with the text "The difference between the value". Below this is a list of checkboxes: "Lower", "Upper", "Minimum Night Flow" (which is checked), "Rate of Change", "Dif>", "Dif<", "Out Band", and "In Band". To the right of this list is a text input field labeled "MNF level" with the value "30.00". Below the checkboxes is a "Chan No" dropdown set to "1". At the bottom, there are two dashed boxes: one for "Persistence" set to "1" out of "1", and another for "Hysteresis" set to "5.00".

Note: Hysteresis settings have no bearing on the function of this trigger.

Persistence settings have no bearing on the function of this trigger.

Use Example:

The alarm is designed for use as a means of detecting potential water leaks, using a water-meter. The logger will be set up to monitor the flowrate through the meter.

Typically, water use falls to a minimum level during the night.

A suitable MNF level is chosen (*just above the expected minimum water flow*).

The data from a flow channel should always *at some point* fall below the chosen level when a leak (down-stream from the meter) is absent.

However, if a new leak is present, there will be an increased water flow through the meter and *no datapoints will be below the chosen level*.

(The alarm trigger may have other applications).

5.2.6 Hysteresis and Persistence - Explanation

Hysteresis

Hysteresis can sometimes be used as a means to avoid excessive messages being sent to the server, which could drain the logger battery prematurely.

When an alarm is triggered, and the hysteresis value is set to zero then:

- Immediately after the threshold is re-crossed, another message (alarm clear) will be sent.
- If there is a period when the channel data is borderline with the alarm threshold, this can result in numerous messages being generated for what is effectively the same event.
- By specifying a value in the Hysteresis box, you can provide a window that allows the threshold to be repeatedly crossed without sending excessive messages.
e.g. With an Upper limit of 80 and a hysteresis of 10, the alarm will trigger at 80, but the alarm will not clear (and no clear message will be sent) until the value drops to below 70.

The screenshot shows a configuration window for an alarm. On the left, a list of alarm types includes 'Lower', 'Upper' (checked), 'Minimum Night Flow', 'Rate of Change', 'Dif>', 'Dif<', 'Out Band', and 'In Band'. To the right, the 'Upper level' is set to '80.00'. Below the list, 'Chan No' is set to '1'. At the bottom, 'Persistence' is set to '1' out of '1'. A dashed yellow box highlights the 'Hysteresis' field, which is set to '10.00'.

Persistence

If an immediate response is required when the channel datapoint meets the threshold to trigger an alarm, the persistence settings should be set to "1 out of 1".

This screenshot is identical to the one above, showing the same alarm configuration. However, a dashed yellow box highlights the 'Persistence' field, which is set to '1' out of '1', indicating the required setting for an immediate response.

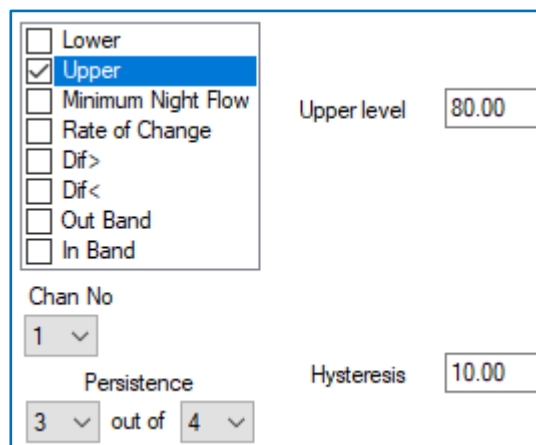
However, if the data from the channel has any possibility of "blips" (spikes or other noise characteristics) the use of the **persistence** settings can be employed to ensure (add greater certainty) that the trigger threshold has been crossed. This is, however, at the expense of delaying the alarm message; it is the nature of the assessment process.

e.g.,

With an alarm set as opposite, the persistence settings require a minimum or 3 or maximum of 4 samples to evaluate the result. The samples used here are the datapoints.

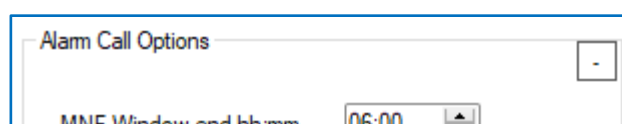
Since data-points are produced at rate set by the log period, 2 or 3 log periods needs to elapse before the logger has sufficient data to judge the alarm condition.

It requires a minimum of 3 out of the last 4 samples to activate the alarm. If it finds 3 samples in a row meet the threshold, it will activate the alarm. If there were not 3 in a row, it waits for the 4th sample to judge if the alarm should be activated.



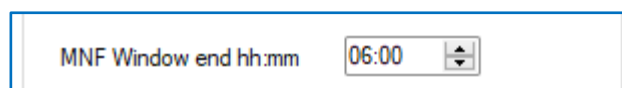
5.2.7 Alarm Options

To check or adjust alarm options, locate the 'Alarm Call Options' panel (within the Setup tab).

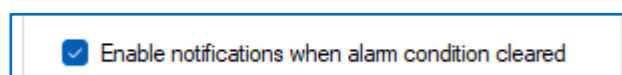


Note: These settings are universal and affect the actions that will be taken whenever any of the channel alarms (Alarm 1 to 8) are activated or become cleared.

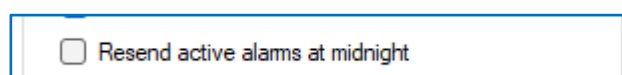
The 'MNF window end' control is discussed in section 5.2.5



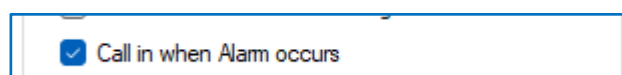
The 'Enable notifications when alarm condition cleared' control should normally be enabled. This switches on the generation of all "alarm cleared" messages for the server.



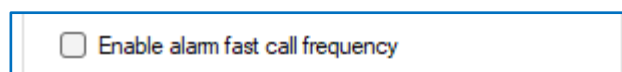
The 'Resend active alarms at midnight' control can be used to cause the logger to make an additional call to the server at around midnight, if any alarms are still active. This allows the logger to re-assert any alarm messages, in case a DataGate user has cleared the alarm on the server, in error.



The 'Call in when an alarm occurs' control can be used to cause the logger to make an *immediate* call to the server for any alarm messages (or alarm clear messages, if enabled). (When disabled, alarm condition changes will only be reported at the next scheduled call-in time).



When a Channel Alarm becomes active, it may be desirable to send in channel data more frequently. This can be selected using the 'Enable alarm fast call frequency' control.



(Normally, this should be set to 'No' to preserve battery life).

If required, enable the control and then set the required period between call-ins.

Call frequency while in alarm 23:59

When in an alarm condition, the logger temporarily disregards the regular call-in schedule and replaces it with a new call-in schedule (as specified above).

Note: Due to increased battery use, it is a requirement to attend the installation site and rectify the cause of any channel alarms that indicate a fault condition promptly.

The logger can detect certain hardware fault conditions. Typically, these will be related to a fault in communication with a sensor (e.g., A Modbus sensor) or an internal component. The data stream still has to be filled with values at the logged intervals to maintain continuity of data.

The logger supports two options:

- Use the last successfully obtained value.
or
- Use some default data value (which must be user-defined).
(Select 'user-defined value' and then specify the value to be used. This could be chosen to be an 'obviously wrong' measurement level).

☒ Use last value during hardware fault
☐ User defined value -1

Note: If the fault is not temporary, the DataGate server can detect that the sensor is producing 'flatline data' and raise the appropriate system alarm.

The logger (as discussed elsewhere) has the ability to send alarms and/or data via SMS messages to DataGate; this is a back-up option where UDP messages fail to be sent. The logger can also send SMS (text) messages regarding alarms to other destinations (having telephone numbers).

If this feature is required, enable it.

Then add up to 8 destination telephone numbers for the SMS alarm messages.

(See important note in section 1.8 about SMS use.

If SMS is not to be used ensure the destination SMS numbers are deleted and that the control is deactivated).

☒ Alarms sent via SMS

Alarm SMS No 1

Alarm SMS No 2

Note: A new call is required for each destination, which leads to more power use.

A more power efficient way to distribute alarm messages is by use of DataGate to forward an alarm to subscribed users; this requires only one call from the logger.

5.2.8 Event Duration Alarm

This 'alarm' can be considered to be a report of supplementary information regarding a channel alarm.

Channel alarms were introduced in section 3.6, where a set of alarm triggering conditions (shown as tabs 'Cond 1', 'Cond 2', etc.) could be set.

The logger can monitor one of the conditions and provide date and times of when the alarm was active, along with its duration (in seconds). The report is sent to the server when the alarm event ends.

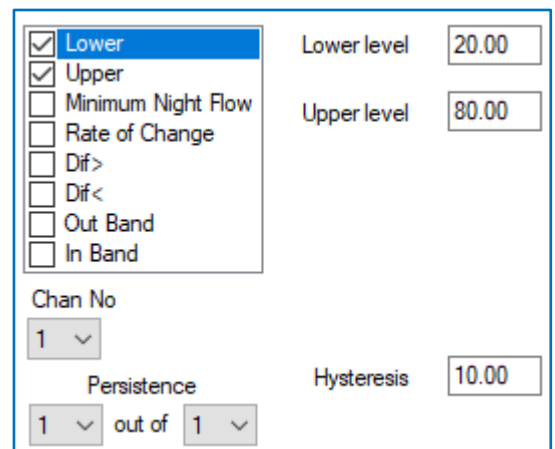
Event Duration Alarm	Off
<input type="checkbox"/> Alarms sent via SMS	Off
Memory Allocation	Condition 1
	Condition 2
	Condition 3
	Condition 4
	Condition 5
	Condition 6
Restart Test Call	Condition 7
	Condition 8

5.2.9 Combining trigger types

Trigger types can be combined within a single Condition tab, provided any common fields *hold a common value*.

e.g.1: Upper limit and lower limit types can be combined, provided the use situation allows a common Hysteresis and Persistence settings.

If the common values are not acceptable, use separate condition tabs acting on the same channel datapoints.



The screenshot shows a configuration window for a condition tab. On the left, there is a list of trigger types with checkboxes: 'Lower' (checked), 'Upper' (checked), 'Minimum Night Flow' (unchecked), 'Rate of Change' (unchecked), 'Dif >' (unchecked), 'Dif <' (unchecked), 'Out Band' (unchecked), and 'In Band' (unchecked). To the right of this list are input fields for 'Lower level' (20.00) and 'Upper level' (80.00). Below the trigger type list is a 'Chan No' dropdown menu set to '1'. At the bottom, there is a 'Persistence' section with a dropdown set to '1' and the text 'out of 1', and a 'Hysteresis' input field set to '10.00'.

The installer should however confirm that the selected combinations make sense.

e.g.:

- Combining "Dif >" and "Dif <" triggers will result in an almost constant alarm being active.
- Combining "In Band" and "Out of band" triggers will result in an almost constant alarm being active.

5.2.10 Time-dependent trigger thresholds (Profile: “Lower” and “Upper” Limits)

The Lower and Upper alarm types were described earlier, in section 5.2.1.

These generally have fixed limits for the alarm threshold. However, it is possible to set up time-dependent limits using the “Profile Alarms” option. Tick the Profile Alarms selection box.

The 'Alarms' window has tabs for Cond 1 through Cond 6. Below the tabs, there is a checkbox for 'Profile Alarms' which is checked. Below this, there are checkboxes for 'Lower' and 'Upper' alarm types, both of which are also checked. A yellow dashed box highlights the 'Profile Alarms' checkbox and the 'Lower' and 'Upper' checkboxes.

This will disable other options in the regular alarm type selection box, and unconditionally enable the Upper and Lower alarm type selections.

Next tick the “Edit Profile” button.

The 'Alarms' window shows the 'Profile Alarms' checkbox checked. Below it, the 'Lower' and 'Upper' checkboxes are checked. To the right of these checkboxes is a red button labeled 'Edit Profile'. A yellow dashed box highlights the 'Edit Profile' button.

A new box will appear to allow the profile details to be displayed and also edited.

The graph is for display / confirmation purposes only. It shows 1 week of the profile; profiles repeat every week.

The graph shows a red line as the upper-level limit and a green line as the lower-level limit. There is a light-blue area between the limits.

The profile is edited by means of a set of tables, one for each day; the day is selected via a selector tool, shown.

To use the profile, it must be saved when editing is completed, using the Save button, shown.

The 'Profiles' window displays a graph at the top with a y-axis from 0 to 12 and an x-axis showing days from Sun 00 to Mon 00. A light blue shaded area represents the profile, bounded by a red line (upper limit) and a green line (lower limit). Below the graph is a table for editing the profile. The table has columns for Time, Low, and High. The first row is highlighted. To the right of the table is a selector tool with a dropdown menu set to 'Edit Monday'. Below the table are buttons for 'Insert Row', 'Delete Row', 'Disable/Enable Row', 'Save', and 'Cancel'. A yellow dashed box highlights the 'Save' button. To the right of the table are buttons for 'Copy to Monday', 'Copy to Tuesday', 'Copy to Wednesday', 'Copy to Thursday', 'Copy to Friday', 'Copy to Saturday', 'Copy to Sunday', and 'Copy to Everyday'.

Time	Low	High
00:00:00	0.000	10.000
00:00:00	0.000	10.000
00:00:00	0.000	10.000
00:00:00	0.000	10.000

A triangular cursor can be positioned on a specific line by clicking on the relevant cell.

	Time	Low	High
▶	00:00:00	0.000	10.000
	00:00:00	0.000	10.000
	00:00:00	0.000	10.000
	00:00:00	0.000	10.000

The line of the table can be deleted, or a new row added by using the Delete Row or Insert Row buttons, respectively.

Select the day you wish to edit. The table for that day will be shown.

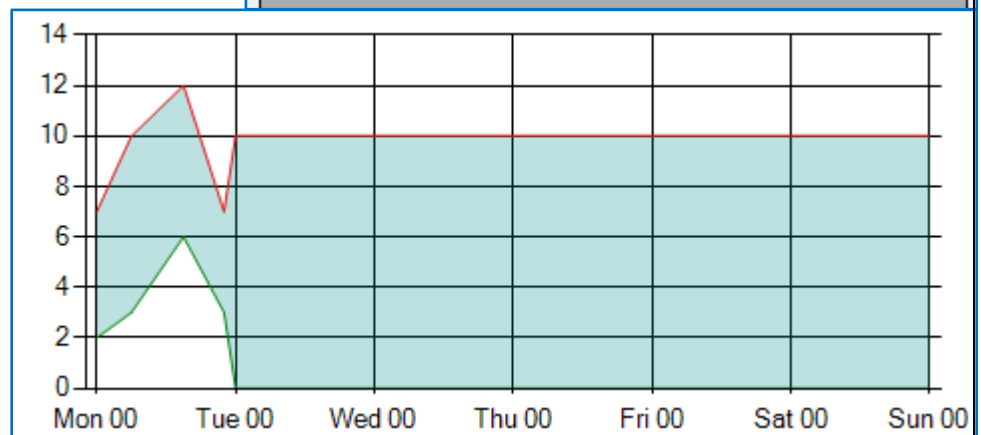
Edit the table to add relevant times to the profile where you wish the trigger levels to change.

Edit the Low and High values for each time.

	Time	Low	High
	00:00:00	2	7.000
	06:00:00	3	10.000
	15:00:00	6	12.000
▶	22:00:00	3	7

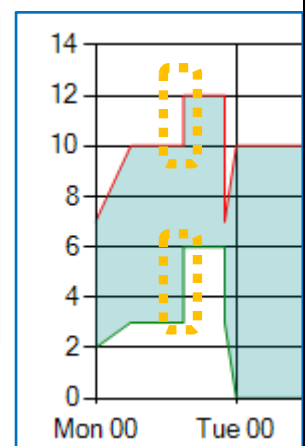
The profile will be represented graphically.

As can be seen in the graph, the logger will apply a linear interpolation between the points, to smooth out the transitions.

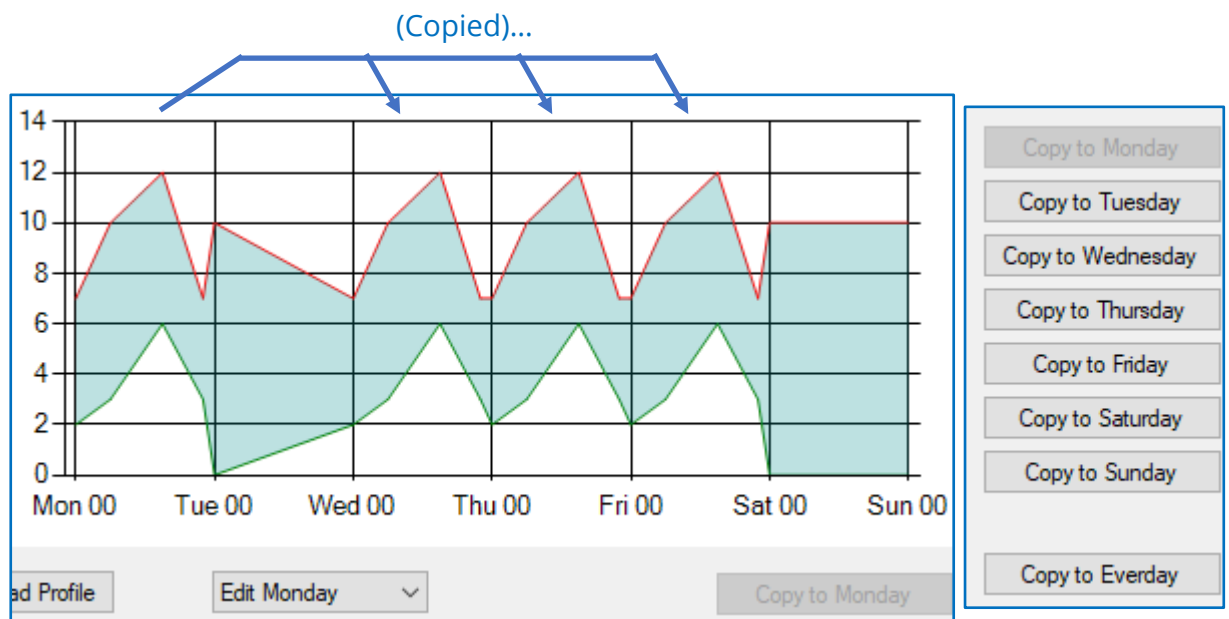


If a step change is needed, create additional lines within the table to ramp up or down to the new value in a short time, maybe a few seconds after the change is required.

	Time	Low	High
	00:00:00	2	7.000
	06:00:00	3	10.000
	15:00:00	3	10.000
	15:00:02	6.000	12.000
	22:00:00	6	12
▶	22:00:02	3.000	7.000



The buttons to the far right can be used to copy the currently shown table onto other days, if required.



After saving the profile, the button turns green.

The logger now behaves as if both lower and upper types of alarm trigger thresholds are in use, but the thresholds are time dependent.

Alarms

Cond 1 Cond 2 Cond 3 Cond 4 Cond 5 Cond 6

☒ Profile Alarms

☒ Lower

☒ Upper

☐ Minimum Night Flow

☐ Rate of Change

☐ Dif>

☐ Dif<

☐ Out Band

☐ In Band

Chan No

1

Persistence

1 out of 1

Hysteresis

2.00

Edit Profile

5.2.11 State Trigger Alarms (based on the state of a Digital Input)

If the logger has digital status inputs, it is possible to trigger an alarm based on the state of an input.

“Digital inputs” include:

- Digital status inputs. (See section 5.3).
- Digital flow channel inputs that are unused. (These are usually equivalent to a status input. e.g.:

Digital input 1 is not available opposite, as is being used as a Flow channel pulse input.

Unused Flow channels may be shown as Digital Inputs; here they are seen as Digital inputs 2, 3, and 4).

Select the required state of an input (open or closed) in order to generate an alarm (the selection chosen is then applicable to all selected inputs).

Then select (tick) the inputs to be monitored.

These inputs are checked once per minute.

If any selected input goes into the specified trigger state, an alarm message is generated.

When the input changes to the opposite state, an alarm clear message is generated.

5.2.12 State Event Logging

A ‘State Event’ refers to the logger monitoring one of its ‘digital’ inputs (i.e., can exist in one of two-states) for changes. For example, the input can detect that an external contact has changed from open to closed. (These are normally a Status Input or an unused Flow input).

To detect a change, the logger checks the input circuit once per second. Changes are recorded as a series of time-stamped ‘events’, and not as an alarm condition. However, the logger settings can include an immediate call-in to be made to update the server, or for the logger to defer the event notification to the next scheduled call-in time.

(For State Event Logging to be visible in IDT, a status input needs to be set as a logged channel).

The setup panel can be divided into three areas.

The top section deals with the setup of the input conditions required to be recognized as an event, and the required response (call-in urgency).

The middle section lists all of the available interface signals that are required to be monitored.
(The input conditions are common; They are applied to whichever inputs are selected as 'enabled').

The lower section contains buttons for download and clearing of the stored events.

Use the Trigger mode control to select which type of transitions will be recorded as events.

For most selections the inputs are checked every 1 seconds.

The 'bucket tip' selection is monitored more frequently (every 0.1 seconds), and is ideal for detecting short pulses.

It reacts to a Closed → Open transition.

The 'Ignore events shorter than...' control should be read as 'minimum duration between events'; After an event has occurred, any conditions that could potentially trigger additional events will be ignored, until this time period has expired.
(Use the control to enter a time interval).

Use the 'Call mode' control to select when the logger should notify the server.

Where possible, select to send only during scheduled calls (to minimize battery use).

Click on each of the inputs required to be monitored. (More than one input can be enabled.)
Choose whether the input is ignored (disabled), or whether it is enabled. There are two selections for enabled, allowing you to invert the logic of the input signal, if required.

Trigger on digital input 1	Disabled
Trigger on digital input 2	Disabled
Trigger on digital input 3	Disabled
Trigger on digital input 4	Disabled

State Event Logging

Trigger mode: Trigger on switch open/close

Call mode: Trigger on switch open

Ignore events shorter than: Trigger on switch open/close

Trigger on bucket tip

Trigger mode: Trigger on switch open/close

Call mode: Call in when event occurs

Ignore events shorter than: 63 Seconds

Call mode: Call in when event occurs

Ignore events shorter than: Send events during scheduled calls

Ignore events shorter than: 63 Seconds

Trigger on digital input 1: Disabled

Trigger on digital input 2: Disabled

Trigger on digital input 3: Enabled (Normal)

Enabled (Inverted)

5.2.13 Consumption Alarms

Consumption alarms look at Flow inputs over a period of up to one day and raise a 'consumption alarm' if the cumulative volume of fluid (or whatever the meter is measuring the consumption of) exceeds a certain amount. This is repeated each day.

Note: A derived flow measurement (e.g., datapoints from an Open Channel flow, FlowOCH, where flow is derived from a depth channel input) can be substituted instead of a metered flow input, if required.

Note: It is a pre-requisite for correct operation of the logger that the input being used for a consumption alarm is set up as a logged channel.

Depending on which logger is in use, up to 4 consumption alarms can be set.

Up to 4 Alarms can be set, (one per line).

Channel	Consumption limit
Pulse/Flow Bi	800000.0000
Off	0.0000
Off	0.0000
Off	0.0000

To set up an alarm, proceed as follows:

Choose a line and then use the drop-down selector control to set the input that is to be tracked for the consumption alarm.

Channel	Consumption limit
Pulse/Flow Bi	800000.0000
Off	0.0000
Pulse/Flow1 Uni	0.0000
Pulse/Flow2 Uni	0.0000
Pulse/Flow Bi	0.0000

Use the right-most field to edit the value of the consumption limit.

(Note that for Flow channels, the logger uses the first occurrence of the selected input type in the channel list as the reference for interpreting the unit of measure of the input, etc.).

Channel	Consumption limit
Pulse/Flow Bi	800000.0000
Off	0.0000
Off	0.0000

(An alarm will be raised as soon as this limit is exceeded within the specified time window. The alarm becomes cleared at the end time of the time-window).

There are several settings for setup of the time window used for consumption alarms.

First, use the top control select the time window mode:

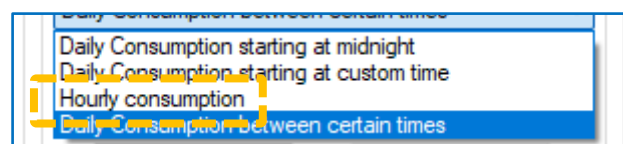
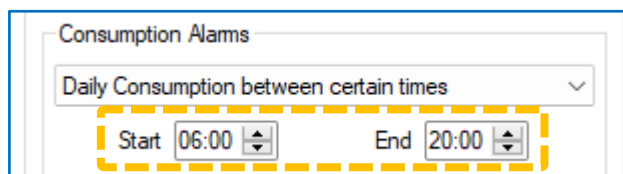
- Daily consumption modes create a 24-hour window. This either starts at midnight, or it can be set to start at an alternative time. (A change in the start time also changes the time of day when an alarm will be indicated, since the consumption is 'reset' at the start time).

Channel	Consumption limit
Pulse/Flow Bi	800000.0000
Off	0.0000
Off	0.0000
Off	0.0000

The 24-hour period is not mandatory; another mode allows the time-window to be set with start and end times.

Set any Start and End times, as appropriate for the mode you have selected.

There is also an option for an hourly consumption (24 x 1 hour time windows each day).



5.3 STATUS INPUTS

“Status Input” is a digital signal supported by some logger models.

Where more than one channel is available, they will be available as separate signals on the connector or cable.

They are often fitted supplied as pairs of inputs. An input pair will be labelled in IDT as one (or more) of the following:

Status1_0

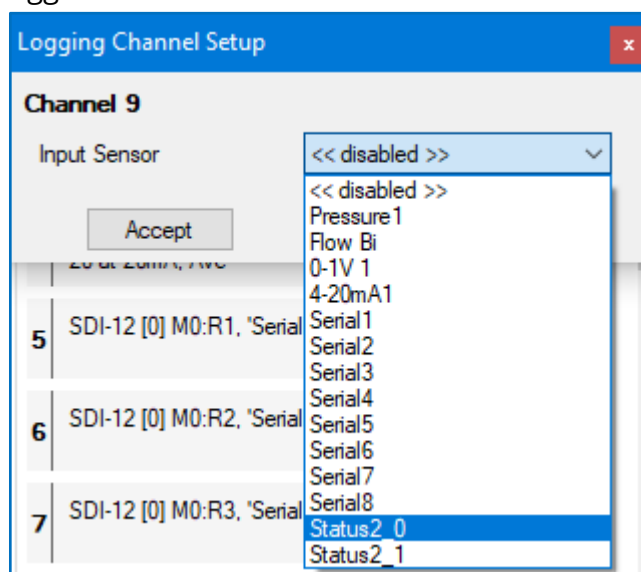
Status1_1

Status2_0

Status2_1

Status3_0

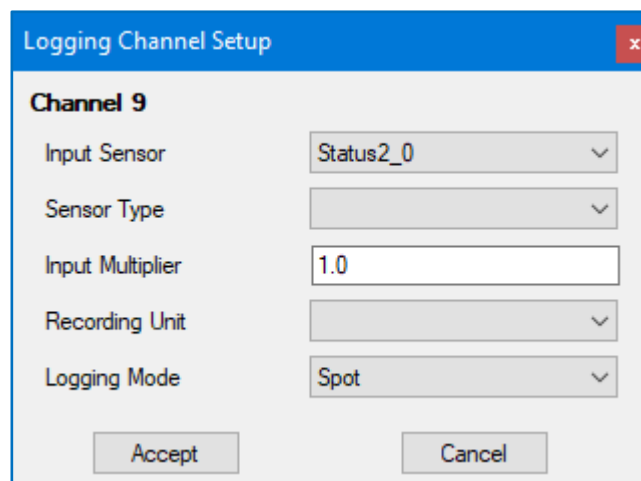
Status3_1 ... (etc.)



The “_0” and “_1” refers to the specific pin being used on the logger interface connector; refer to your logger user-guide for details of pin number or wire-colour of any HWM-supplied cable.

To setup a channel for use, first select the required sensor input (see also the picture above).

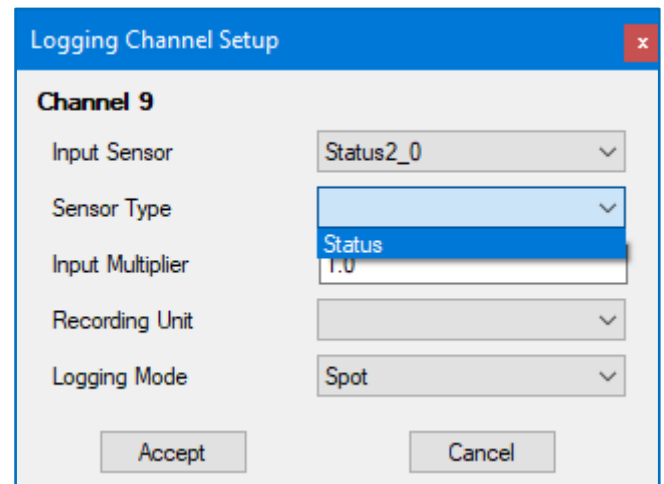
To continue setup, follow the steps in section 5.3.1 or 5.3.2



5.3.1 Use as a logic-level data stream

Complete the settings as shown below to use the sensor as a digital status input.
(i.e. it can be a value of either “1” or “0”).

Select “Status” from the available list of sensor types.



Logging Channel Setup

Channel 9

Input Sensor: Status2_0

Sensor Type: Status

Input Multiplier: 1.0

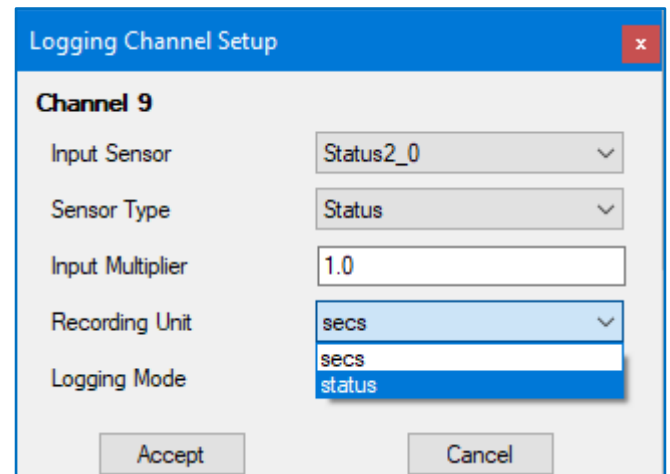
Recording Unit:

Logging Mode: Spot

Accept Cancel

The input multiplier should be set to 1.0

The Recording unit must be set to “status” to use as a digital value (0 or 1).



Logging Channel Setup

Channel 9

Input Sensor: Status2_0

Sensor Type: Status

Input Multiplier: 1.0

Recording Unit: secs

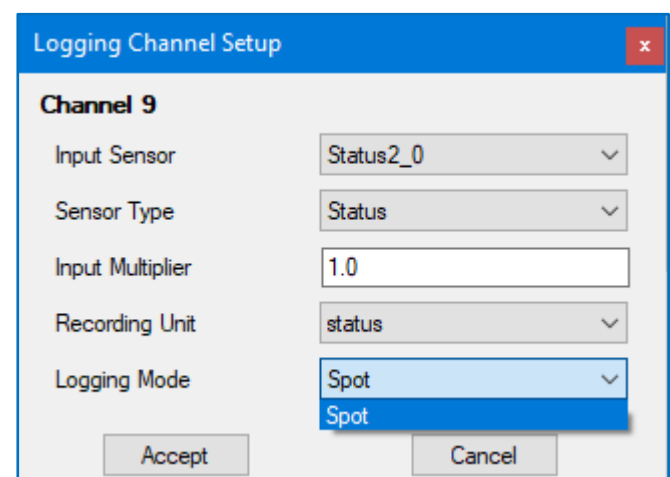
Logging Mode: Spot

Accept Cancel

Select “Spot” from the available list of logging modes.

The input will be logged as a digital status
(i.e., 0 or 1).

Triggers for alarms can be set to match specific conditions met by the data-stream.



Logging Channel Setup

Channel 9

Input Sensor: Status2_0

Sensor Type: Status

Input Multiplier: 1.0

Recording Unit: status

Logging Mode: Spot

Accept Cancel

Triggers for an alarm can be set using the regular setup procedure.

e.g. The settings shown opposite will trigger immediately if the input switches from 0 to 1. The alarm will clear immediately when the input switches back from 1 to 0.

The screenshot shows the alarm configuration for Channel 9. At the top, it displays 'Status3_0, Status (status), Multiplier: 1.0, Spot' with a gear icon. Below this is a tabbed interface with tabs for Cond 1 through Cond 6. The 'Cond 1' tab is active. Inside the tab, there is a section for 'Profile Alarms' with a list of options: Lower, Upper (checked), Minimum Night Flow, Rate of Change, Dif>, Dif<, Out Band, and In Band. To the right of this list is a text input field for 'Upper level' set to '0.00'. Below the list is a 'Chan No' dropdown set to '1'. At the bottom, there is a 'Persistence' section with two dropdowns set to '1' and 'out of 1', and a 'Hysteresis' text input field set to '0'.

5.3.2 Use as a Time-On data stream

An alternative use of the status input is to set the recording unit as "secs" (seconds).

This changes the logger to consider the input status as a function of time; the number of seconds the input is at a logic level of "1" between each datapoint being produced. This value is recorded as a channel datapoint.

The time counter resets to 0 seconds whenever a datapoint has been created.

(Refer to your logger user-guide for details of how a logic "1" or "0" can be input).

The screenshot shows the 'Logging Channel Setup' dialog box for Channel 9. It has a blue title bar with a close button. The dialog contains several fields: 'Input Sensor' set to 'Status2_0', 'Sensor Type' set to 'Status', 'Input Multiplier' set to '1.0', 'Recording Unit' set to 'secs' (with a dropdown menu open showing 'status' and 'secs'), and 'Logging Mode' set to 'status'. At the bottom, there are 'Accept' and 'Cancel' buttons.

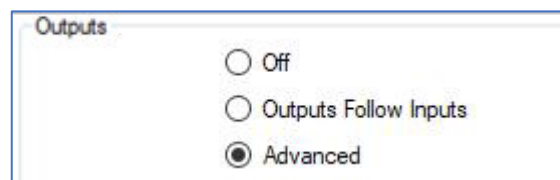
5.4 OUTPUTS (USER CONFIGURABLE DIGITAL OUTPUT)

Some logger models support an “Output” interface. This is a digital output which can be configured using IDT.

Where more than one channel is available, they will appear as distinct outputs in IDT (e.g. Output 1, Output 2), corresponding to separate output pins on the logger. (Refer to the logger user-guide).

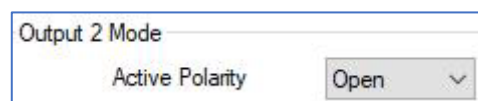
The outputs can be used for the following purposes, dependent on your logger configuration and supplied options:

- Off (non-functional / open circuit).
The setting will be applicable to all output pins.
- Used to provide pulse replication of Flow channel inputs (see section 5.6.6).
The setting will be applicable to all output pins.
- Advanced options.



Selecting “Advanced” will show a new set of available options; these can be set for individual output pins.

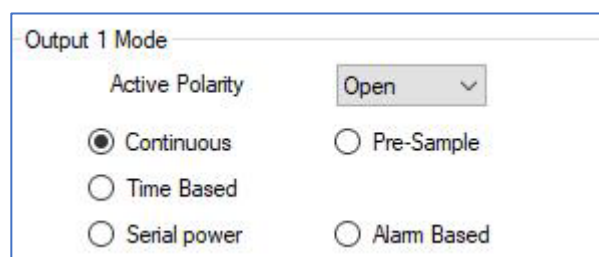
It is possible to set output condition (open or closed) that will exist when the output is in its active state.



Details of each option are provided in the following sections...

5.4.1 Continuous output

Selecting “Continuous” forces the output port permanently to the chosen condition.



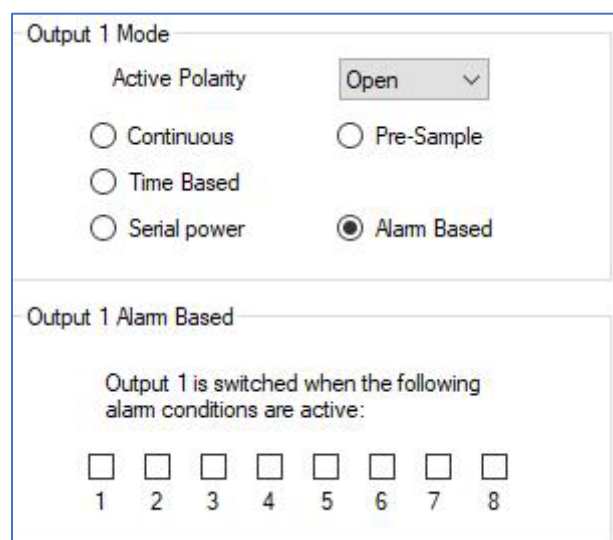
5.4.2 Alarm Based output

Selecting “Alarm Based” forces the output port to the chosen active polarity during the time when any of the selected alarm triggers are active.

The output will become inactive when none of the selected alarm triggers are active.

Select (tick) any alarm condition(s) that are needed.

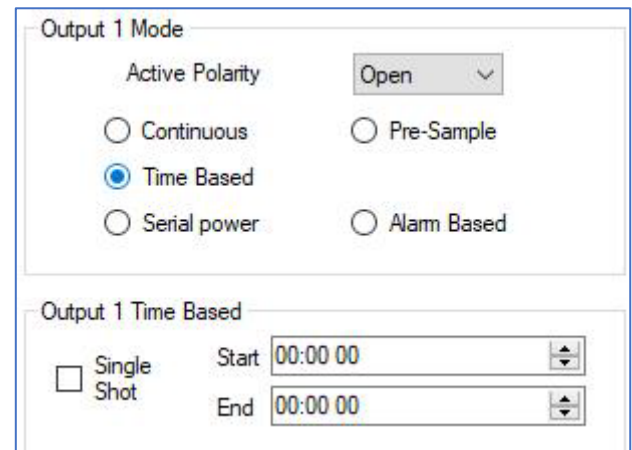
Tick-box 1 (thru 6) corresponds to the alarm set up on the Cond1 (thru 6) tabs). Refer to section 3.6.



5.4.3 Time Based output: Time of day

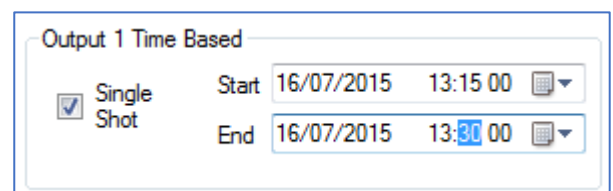
Selecting “Time Based” forces the output port to the chosen active polarity during selected times. The output cycle repeated daily.

Enter the start and end times for the output to be active.



It is possible to make the output active as a one-time event only; this is called a single shot event.

Tick the Single shot box to enable and set a time and date for the occurrence.



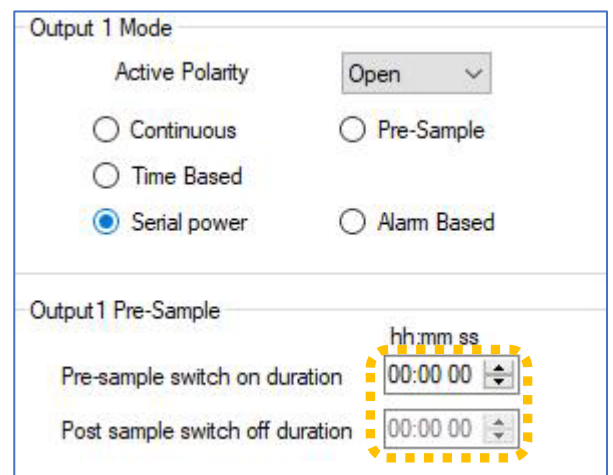
5.4.4 Time based output: Measurement time

Selecting “Serial Power” forces the output port to the chosen state between the time limits entered.

The time limits are relative to the Logging time only (the time when data-points are made). Therefore, only “Spot” measurements can be applied to these channels.

Example:

Logging time of 00:05:00,
Pre-sample switch on duration set to 00:00:10,
Post Sample set to 00:00:05.



These settings will switch the output port ten seconds before the data is logged and it would be held for 5 seconds afterwards. Then it would return to its inactive state.

Typical use of this facility is to use an output to control when a sensor should be pre-powered for several seconds before a measurement is taken. This allows the sensor to power-up and initialize before a measurement is requested. The measurement may also require several seconds to complete and for the data to transfer into the logger, so power is required to remain for several seconds afterwards.

(External equipment would be required to provide and switch the power in this example).

It could also be used as a control signal to the sensor.

5.4.5 Time based output: Measurement time (occasional)

Selecting “Pre-Sample” forces the output port to the chosen state between the time limits entered, but only occasionally (every ‘n’ samples).

The time limits are relative to the Logging time only (the time when data-points are made). Therefore, only “Spot” measurements can be applied to these channels.

Select ‘n’ using the drop-down selection tool.

Then set the required time limits.

Example:

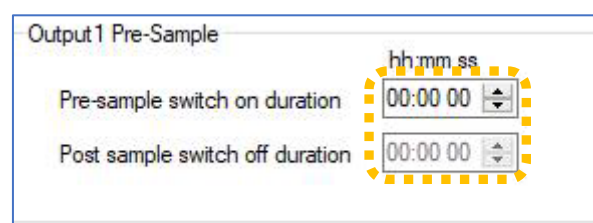
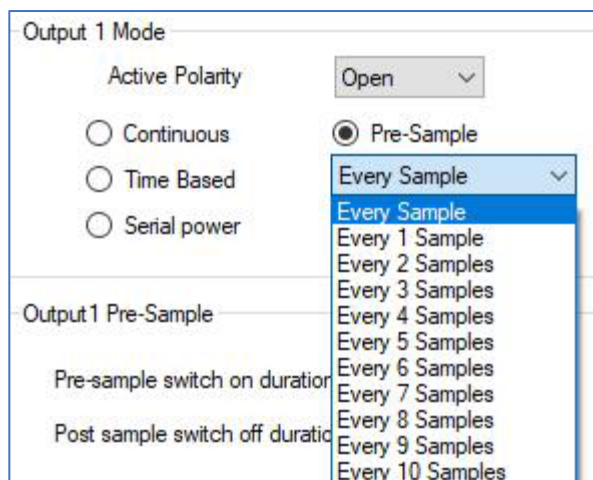
Logging time of 00:05:00,
Every 4 Samples is selected,
Pre-sample switch on duration set to 00:00:10,
Post Sample set to 00:00:05.

These settings will switch the output port only on every 4th log period.
Therefore 3 datapoints are produced with the output not activated, followed by a datapoint made with the output activated.

The activation will occur ten seconds before the data is logged and it would be held for 5 seconds afterwards. Then it would return to its inactive state.

This facility could be used, for example, to switch between sensors (using an external switching box) so the channel is multiplexed with data from 2 sensors.

It could also be used as a control signal to the sensor.



5.5 CONTROLLING THE TIMING OF SENSOR POWER

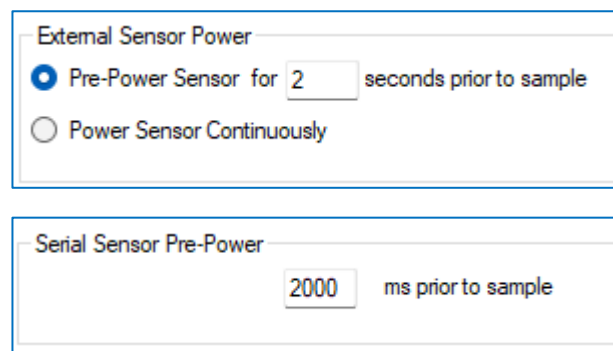
The timing of applying power to sensor equipment could be achieved for externally powered sensors by using an output to switch a relay. Controls discussed in sections 5.4.4 and 5.4.5 can be applied.

Most installations will use sensors where the logger applies limited power either directly to the sensor (e.g. via a pin on the connector) or via a battery within an External Sensor Interface (e.g. ESIB series, used on Intelligens loggers). For these, there is a control available to specify the timing of the power application to the sensor.

Two formats of the settings exist, depending on which sensors are involved (or which ESIB units are fitted). (see opposite).

These are available in the IDT 'Settings' tab. (Only visible if the logger has a relevant sensor).

Set a pre-power time to allow the sensor to power up and be prepared for making a measurement. (Refer to the sensor user-guide or data=sheet for its requirements).



The image shows two settings panels. The top panel, titled 'External Sensor Power', has two radio buttons: 'Pre-Power Sensor for 2 seconds prior to sample' (selected) and 'Power Sensor Continuously'. The bottom panel, titled 'Serial Sensor Pre-Power', has a text input field with '2000' and the label 'ms prior to sample'.

5.6 FLOW INPUT (FROM DIGITAL PULSE)

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 fitted and support the signaling from the meter to be compatible.

IDT can be used to set up the following options:

5.6.1 Uni-directional Flow

Channel summary:

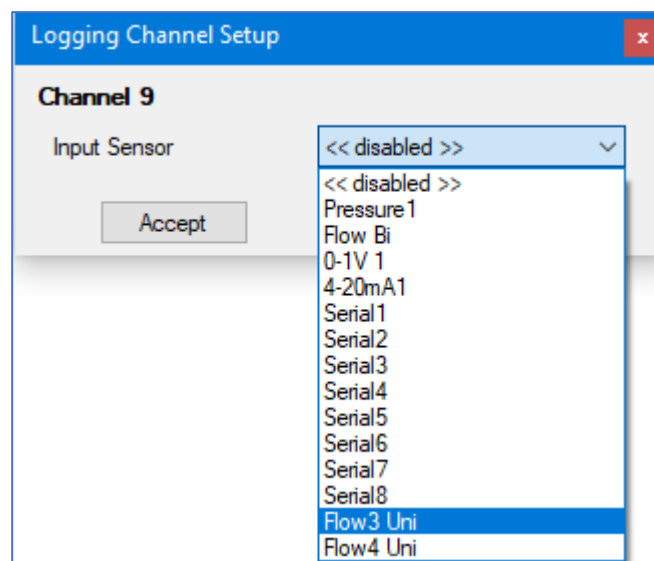
1 channel input signal (Flow Pulses) and produces 1 logical output (datapoint channel output): "unidirectional flow".

A single pulse input signal is used to produce a single logical (data) channel: unidirectional flow. (See also sections 3.5.1 and 3.5.2).

To select this type of flow interface, choose the relevant selection whilst setting up the channel. i.e. Flow(n) Uni.

Note: 'n' will depend on the internal configuration of the logger.

This type of input is commonly supplied in pairs on HWM loggers. Here, Flow3 and Flow4 may appear on the same connector.



The image shows a 'Logging Channel Setup' window for 'Channel 9'. It has an 'Input Sensor' dropdown menu currently set to '<< disabled >>'. A list of options is shown below the dropdown: '<< disabled >>', 'Pressure 1', 'Flow Bi', '0-1V 1', '4-20mA1', 'Serial1', 'Serial2', 'Serial3', 'Serial4', 'Serial5', 'Serial6', 'Serial7', 'Serial8', 'Flow3 Uni', and 'Flow4 Uni'. An 'Accept' button is visible below the dropdown.

Setup of the channel for collection of logged data may proceed as described in sections 3.5.1 and 3.5.2.

It is possible to use this channel to keep track of meter readings; refer to section 5.6.8.
(Refer also to section 5.6.5 for pulse sampling speed).

Uni-directional flow: Tamper-Alarm option:

If a logger has a spare flow pulse input, it can be re-purposed to provide a tamper alarm.
Refer to section 5.6.7.

HWM loggers often provide flow pulse inputs in pairs.

If Flow1 is used to detect uni-directional flow meter pulses, but Flow2 is unused, then Flow2 is a “spare”. Similarly, Flow3 may have Flow4 as “spare”, etc. ... depending on how the channels are put to use.

5.6.2 Bi-directional Flow (using Direction & Pulses; producing ‘net flow’)

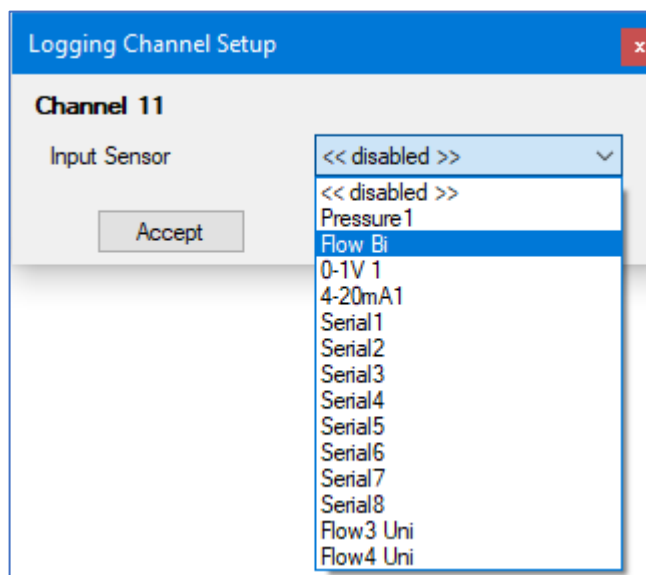
Channel summary:

1 channel uses 2 input signals (Flow direction, Flow Pulses) and
produces 1 logical output (datapoint channel output): “net flow”.

Two input signals are used. One indicates direction (forward or reverse) and the other indicates flow.

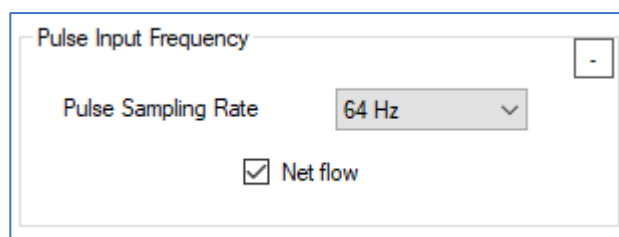
To select this type of flow interface, choose the relevant selection whilst setting up the channel.
i.e. Flow(n) Bi.

Note: ‘n’ will depend on the internal configuration of the logger.



Locate the “Pulse Input Frequency” panel in the setup tab.

Ensure the “Net Flow” box is ticked.



Setup of the channel for collection of logged data may proceed in a manner similar to that described in sections 3.5.1 and 3.5.2.

It is possible to use this channel to keep track of meter readings; refer to section 5.6.8.
(Refer also to section 5.6.5 for pulse sampling speed).

5.6.3 Bi-directional Flow (using Forward & Reverse pulses; producing 'net flow')

Channel summary:

1 channel uses 2 input signals (Forward flow pulses, Reverse flow Pulses) and produces 1 logical output (datapoint channel output): "net flow".

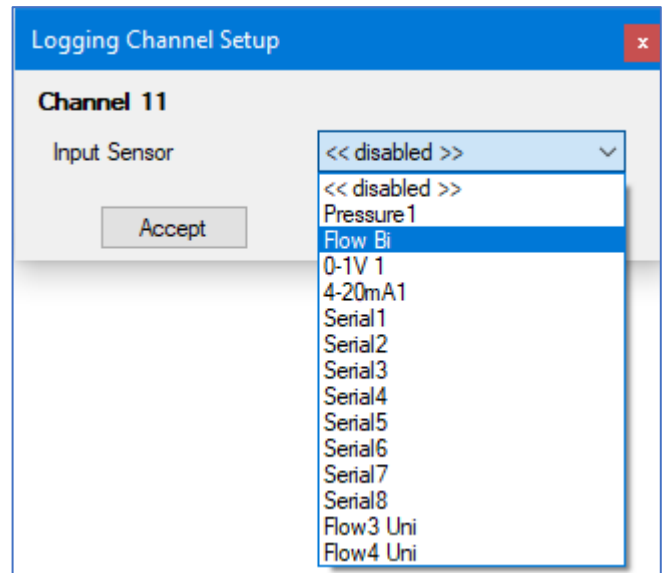
Two input signals are used.

One provides meter pulses indicating the volume of fluid flowing in the forward direction.

One provides meter pulses indicating the volume of fluid flowing in the reverse direction.

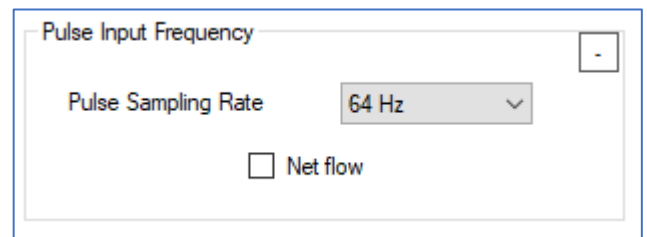
To select this type of flow interface, choose the relevant selection whilst setting up the channel.
i.e. Flow(n) Bi.

Note: 'n' will depend on the internal configuration of the logger.



Locate the "Pulse Input Frequency" panel in the setup tab.

Ensure the "Net Flow" box is not ticked.



Setup of the channel for collection of logged data may proceed in a manner similar to that described in sections 3.5.1 and 3.5.2.

It is possible to use this channel to keep track of meter readings; refer to section 5.6.8.
(Refer also to section 5.6.5 for pulse sampling speed).

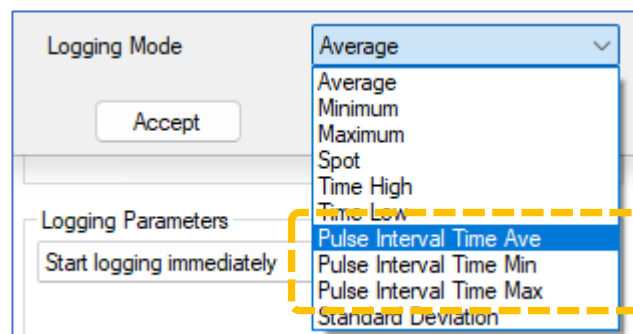
5.6.4 Logging Mode: Pulse Count or Pulse Interval Timing options

For Flow channels, additional Logging Mode selections are available. These modify the logger behavior and are useful for flow inputs that sometimes have infrequent meter pulses. They are known as Pulse Interval Time logging modes, also known as 'P.I.T.' modes.

When selected, the logger samples any flow input at a high frequency.

Instead of simply counting the number of pulses between log periods, the logger can also time pulses.

Set this mode of operation by using the Logging Mode settings (see opposite).



When set to 'Pulse Interval Time Ave':

- When the pulse arrival rate is low, the logger waits for the log period to pass and then waits for the next pulse. It can then calculate *an average value* of the flowrate and record it by backfilling any datapoints that were missed whilst waiting for the pulse to arrive.
- When the pulse arrival rate speeds up, a similar process operates, but the logger takes account of the additional pulses.

When set to 'Pulse Interval Time Min' or 'Pulse Interval Time Max':

- When the pulse arrival rate is low, the logger waits for the log period to pass and then waits for the next pulse. It can then calculate *an average value* of the flowrate and record it by backfilling any datapoints that were missed whilst waiting for the pulse to arrive.
(Minimum and Maximum are the same value).
- When the pulse arrival rate speeds up, a similar process operates, but the logger takes account of the additional pulses.

The Minimum flow rate during the log period is found from the pulse having the longest interval.

The Maximum flow rate during the log period is found from the pulse having the shortest interval.

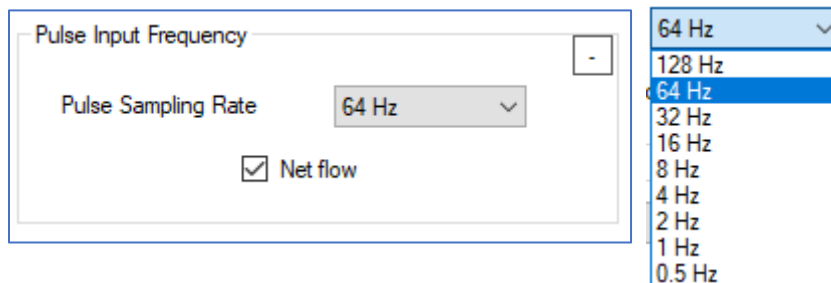
5.6.5 Pulse input speed: Logger adjustment requirements

Consideration should be given to the pulse speed of the meter, and the minimum pulse width, in order to ensure the logger is set to sample the interface signal level quick enough to catch the pulses.

Locate the “Pulse Input Frequency” panel in the setup tab.

Adjust the sampling frequency if required.

e.g. The 64 Hz setting samples every 1/64 seconds.



Ensure the logger can capture pulses that are generated at the *maximum* expected meter output rate.

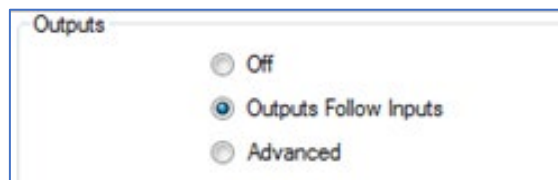
The duty cycle has to be considered as the logger has to pick up both the high and low parts of the meter pulses in order to detect them correctly.

5.6.6 Pulse Replication output

Utilities sometimes have several pieces of equipment installed that require access to the output pulse signal from a meter.

It is possible to replicate the meter pulse input signals onto the digital Status Outputs of the logger (if fitted). (Where fitted, the settings tab will include an Output panel).

If pulse replication is required check / adjust the setting to the selection shown.



Flow pulse1 input will be replicated to the Output1 status output,
Flow pulse2 input will be replicated to the Output2 status output, ... etc.

Additional equipment requiring access to the meter pulses can then be connected to the relevant logger outputs.

5.6.7 Tamper alarm sensor

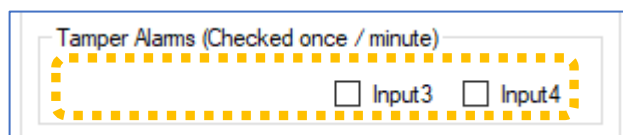
Utilities sometimes have equipment installed that are used for billing purposes (e.g., a gas meter). Utility companies can apply mechanical seals to bear witness to any attempt to tamper with the equipment.

Where a logger is being used for automated meter reading purposes it must remain connected to the utility meter at all times. Some loggers will have the facility of providing the facility to setup a “Tamper Alarm”. This monitors the inter-connecting cable between logger and meter electronically for any disconnection attempt (if the meter is compatible).

The facility is particularly useful on uni-directional flow inputs (see section 5.6.1) as these may have a spare input within the same cable (Flow pulse input channels are often provided in pairs on HWM loggers). After you have configured the main pulse input channels of your device, if you have a spare input, this can be configured as a Tamper circuit. The tamper input detects an electrical path exists (e.g. via a loop-back connection in the meter). If the electrical path is broken (e.g. the cable is unplugged) a tamper attempt is detected.

Other applications of this facility are possible (e.g. a door switch).

The Tamper Alarm controls are found in the setup tab. They are a sub-panel within the Alarms panel. The logger checks the tamper circuit once per minute.



Example:

A logger has a connector with an interface for “Flow3-Uni” and “Flow4-Uni” inputs. The on-site installation requires Flow3-Uni to be set up and installed to monitor pulses output from a meter that measures uni-directional flow. Flow4-Uni channel is not required; the input is “spare”.

Flow3 uses the same electronics on the logger as digital input 3.

Flow4 uses the same electronics on the logger as digital input 4.

Tick the “Input 4” box; this will now be used as a tamper alarm.

The meter must also be compatible with the use of the tamper-alarm; it must internally link the used signal to ground; refer to your logger user-guide for details.

If the circuit is broken (either by cutting the wire or with a door/window type sensor) then an alarm signal is sent via over the cellular network which will repeat once per day until the circuit is reclosed.

The Tamper Alarm can similarly be set using any type of digital status input; it is not restricted to a spare flow channel input. The alarm has many uses and is able to be adapted to monitor cables, access panels, doors, windows, and other possibilities with an appropriate sensor switch; provided the checking frequency is sufficient (once per minute).

5.6.8 Meter Reading(s)

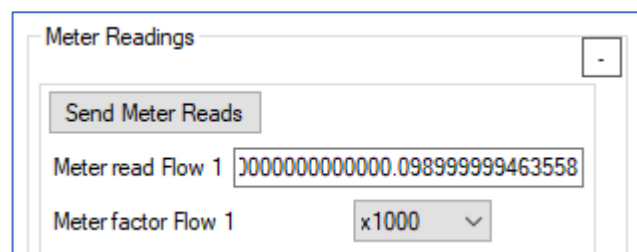
Flow pulse input channels are often used by a logger to track the usage of a commodity (e.g. of gas or electricity). The commodity passes through an on-site meter, which indicates throughput by providing meter pulses to the logger. The on-site meter indicates accumulated use by providing a numeric display. The logger is able to keep track of the meter display and send the accumulated use data to the server, thus providing an Automated Meter Reading capability (as well as the regular flow logging).

An initial meter reading has to be taken from the on-site meter and entered into the logger to enable this feature. When the logger calls into the server with the flow measurements datapoints it is then able to also include a calculated current meter reading.

Within the Settings tab, locate the Meter Readings panel.

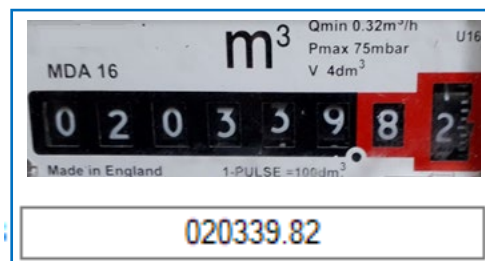
A “Meter read Flow(n)” section will be listed for all flow channels that have been set up for use.

Initially, no value has been set within the logger. (or there may be a small value from production testing).



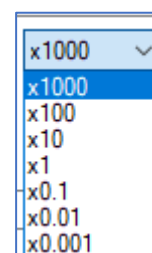
Read the main meter, noting its format.

Enter the meter reading into the “Meter read Flow n” field. (Include any leading, the decimal point, and any other displayed digits including trailing zeros).



Calculate and enter a meter factor.

Meter factor =
$$\frac{\text{Unit of volume measurement used on the Meter for each digit.}}{\text{Unit of volume measurement used on the Flow channel.}}$$



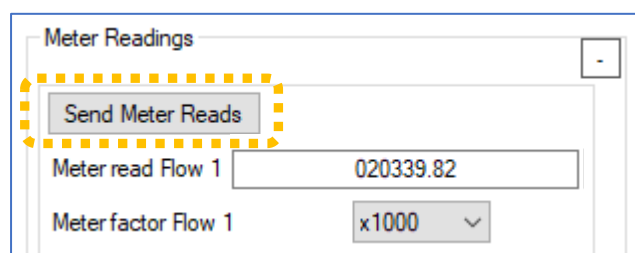
e.g. The above meter measures in m³.

If the flow channel measures in liters, the meter factor would be:

1000 (liters) / 1 (liters) = 1000.

After entering the above information for all meters, click the “Send Meter Reads” button.

This will immediately update the logger and allow it to track (stay in step with) the actual meter reading, by using the meter pulses.



The current meter readings can be obtained by re-reading the logger; they will be displayed here.

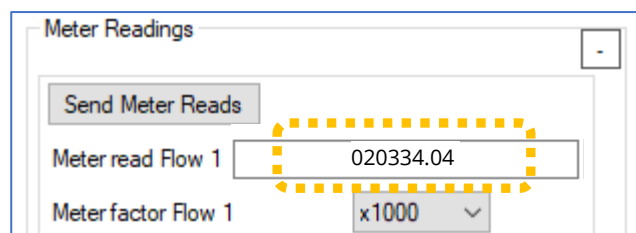
You can confirm logger is set up correctly by doing the following:

- After waiting for the meter to change by a few digits, note the meter reading and re-read the logger to refresh the meter reading values held by IDT.
- Confirm the updated reading matches the actual meter reading (noted earlier).

If the reading is not correct, re-check:

- The cables go to the correct meter.
- The meter factor is correct.
- The channel settings (units/pulse and recording unit) are correct.

... and then repeat the test.



5.7 PRESSURE SENSOR INPUT

The logger may have an “Internal Pressure” sensor fitted; ‘Internal’ indicates that the sensor is built-into the logger enclosure. (Note that certain loggers have an optional plug-in expansion unit to expand capacity. An internal pressure interface may be located within such an expansion unit). Another option is for the logger to have an “External Pressure” interface fitted. ‘External’ indicates that the sensor is attached to the logger via a cable.

The electronics of an external pressure sensor interface can be employed for other purposes, such as measuring depth (when used with a compatible cabled sensor). However, an internal pressure sensor is locked down so that it is only able to measure pressure. Therefore, the list of options presented during setup of internal and external pressure sensors will vary between the two types.

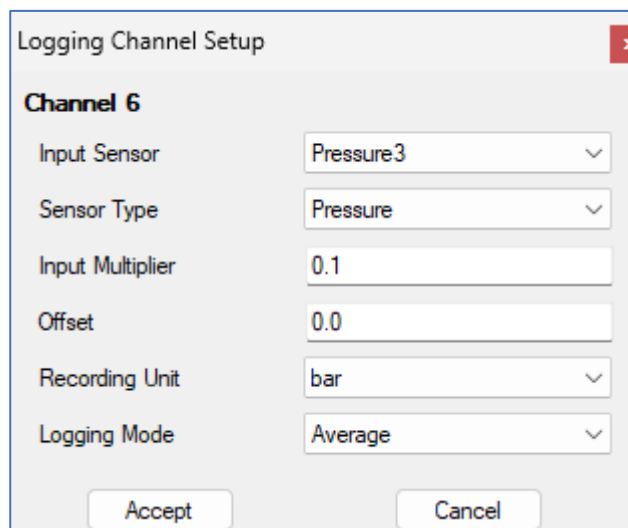
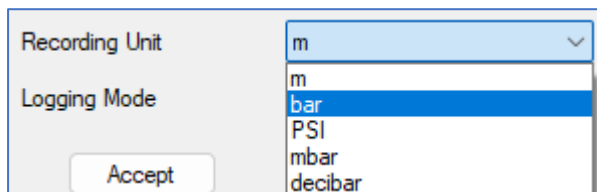
5.7.1 Setup of a Pressure Interface

Pressure sensors (internal or external) connect to pressurized fluids within a pipe, at a measurement tap / access point. Depth sensors (external) are installed at the bottom of a vessel and measure the depth of a fluid by also measuring pressure, which is related to the height of the fluid above the sensor.

When a logger is ordered with a sensor from HWM, the interface is normally setup for use by the factory prior to shipment.

An example of the settings to measure pressure is shown opposite.

A variety of Recording Units are available, as shown below.



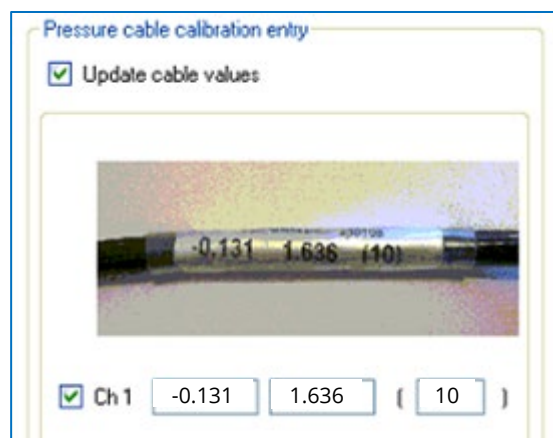
Setup of an external pressure sensor interface to record depth is similar. Select 'Depth' as the sensor type and then select a Recording Unit to the desired unit of measure (m, cm, mm ... etc.).

5.7.2 External Pressure Transducers – Calibration by entering coefficients

External pressure transducers from HWM sometimes have calibration coefficients that must be entered into IDT in order for the logger to use them correctly.

Enter the values, as per the example opposite (including any negative symbols).

The final number represents the *maximum pressure range* of the transducer (in bar).



Note: Entry of calibration coefficients (cable values) is the recommended method of entering calibration settings, whenever available.

For sensors without the cable values, there is an alternative calibration method, requiring a table to be constructed using known reference pressures. Once completed, the logger and sensor effectively become paired for use. When this type of external pressure sensor is supplied by HWM with a logger, the calibration of the sensor with the logger will normally have already been carried out within the factory.

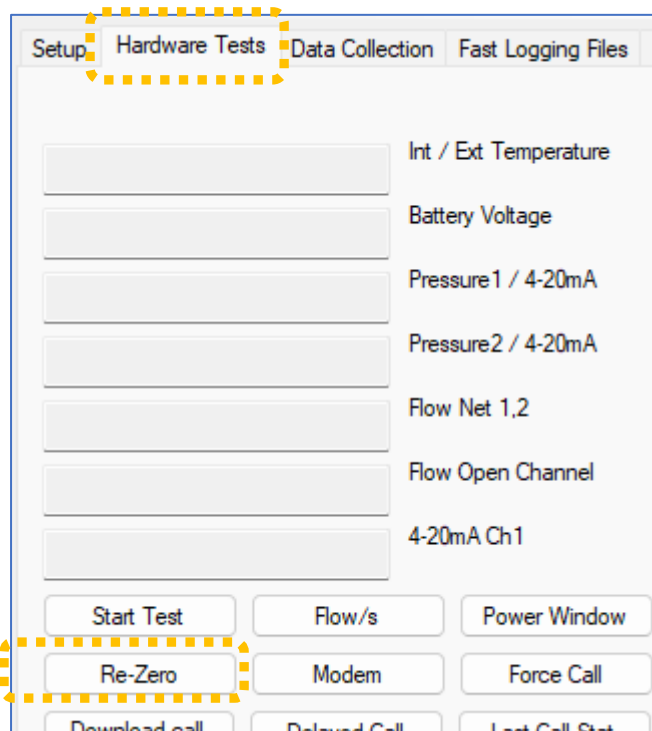
5.7.3 How to re-zero a Pressure Sensor to local atmospheric pressure

Pressure sensors supplied by HWM are often required to read the pressure relative to atmospheric pressure rather than absolute pressure. However, the local atmospheric pressure can vary according to the location of the installation. The user may therefore be required to re-zero the sensor to the local atmospheric pressure.

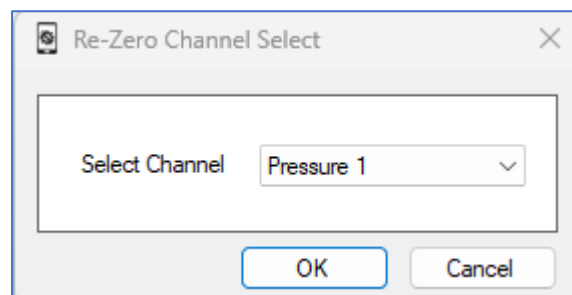
Important: The pressure sensor must be exposed to the local atmospheric pressure whilst making this setting.

Select the Hardware Tests tab in IDT.

Then locate and click on the Re-Zero button.



Select the channel (interface) which is to be re-zeroed and then click on OK.

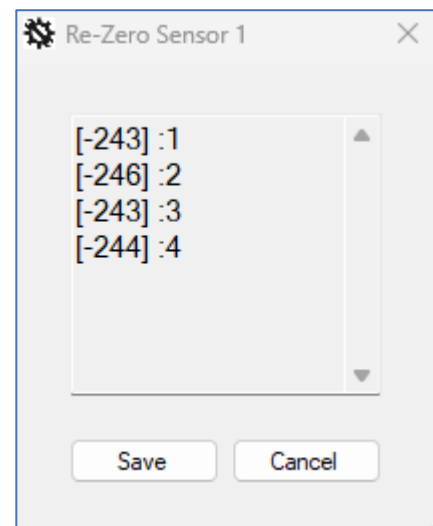
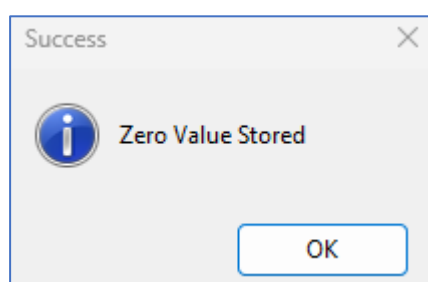


IDT will show a 'Re-Zero' window with a series of results (Raw values from the internal A/D converter).

Wait for the results to stabilize.

Then click on the Save button.

(The last result will be used as the new zero reference value).



5.8 VOLTAGE INPUT (0-1V, 0-10V)

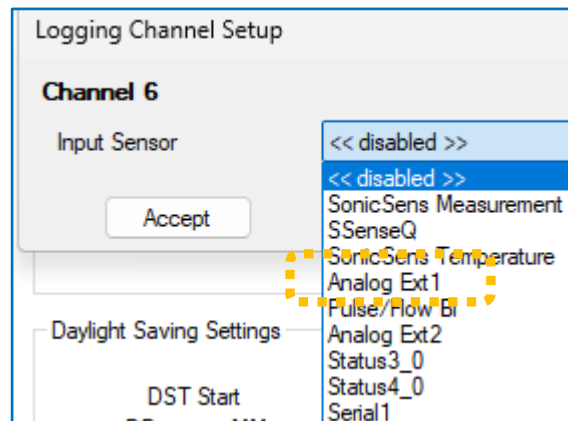
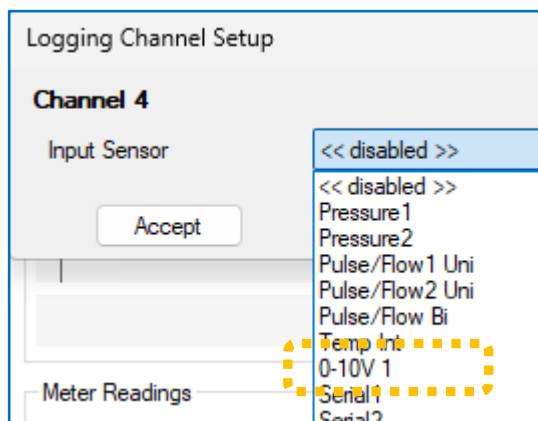
Your logger may have a 'voltage' interface fitted (either as part of the logger, or via additional 'interface' unit). This type of interface may be labelled as the following:

"Input Vol", "0-10V", "0-1V", (... or similar).

These interfaces are used with sensors that provide an output signal using an analogue voltage which varies between 0V and 10V (or 1V).

The logger is factory calibrated to accurately measure voltage throughout the 0-10V range.

To setup a channel for use, first select the required sensor input. (This could be listed in IDT as a 0-1V [n], a 0-10V [n], or as an Analog Ext[n] input. See diagram below).

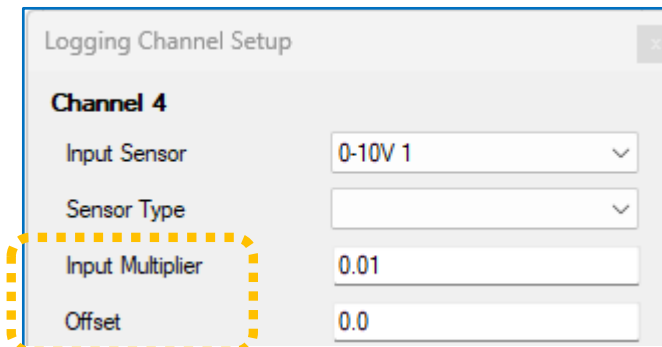


Note: When Analog Ext[n] is selected, it is usually associated with some additional interface unit for the logger (e.g. ESIB series for Intelligens loggers). The logger communicates with the interface unit to determine what type it is; In this case, a 0-10V unit is being used.

A logger restart is usually required for the additional interface unit to be identified.

The Input Sensor selection is stored in the field.

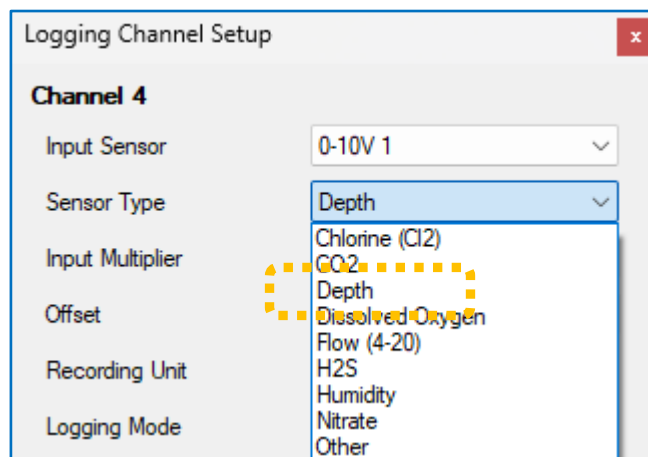
Confirm that the Logging Channel Setup box includes fields “Input Multiplier” and “Offset”.



Use the “Sensor Type” control to select the physical parameter that is being measured by the sensor.

(The choice will affect the units of measure offered later in the setup.)

e.g., For a 0-10V sensor which measures depth, select “Depth”.



e.g. (1)

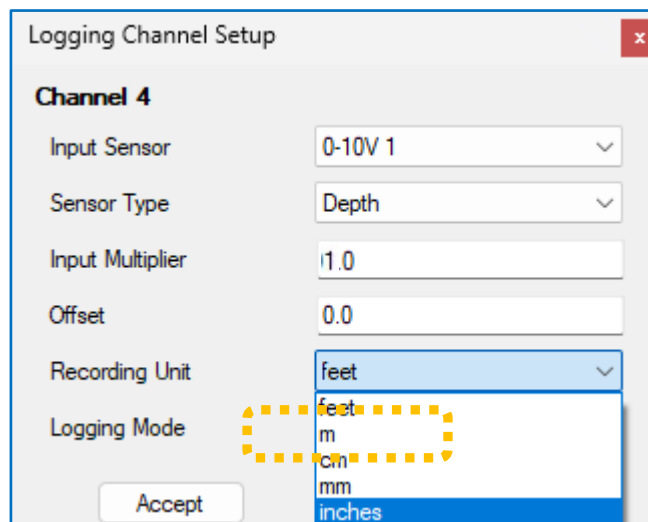
A depth sensor has a 0-10V output which represents a depth range of 0m to 10m.

(DataGate is set to expect a unit of measure of m).

Select a unit of measure which is appropriate to the sensor output.

In this example, set to m (as shown).

(The unit of measure must also match DataGate expectations).



Set the input multiplier and offset according to the range of the sensor and the expectations of DataGate unit of measure.

In this example:

Set multiplier to 1. ; (Range of 10m for 10V)
Set offset to 0. ; (Starting at 0m)

Select the desired logging mode and then click Accept.

e.g. (2)

A temperature sensor has a 0-10V output, which represents a temperature range of - 20 degrees C to 280 degrees C.

(DataGate is set to expect degrees C).

Set multiplier to 30. ; (Range of 300 for 10V)
Set offset to -20. ; (Starting at -20)

(The sensor type and recording unit should also be set to show the parameters, as shown above)

The channel summary is shown.

The settings will be saved during the usual "Setup Device" process.

An IDT app hardware test of the 0-10V sensor channel will indicate the sensor measurement in a similar way to that shown opposite.

i.e., IDT will show the calculated result, followed by the raw measurement (output of internal voltage to digit conversion).

(If the sensor is connected by an interface unit, it will also show its internal battery voltage).

5.9 CURRENT INPUT (4 ~ 20mA)

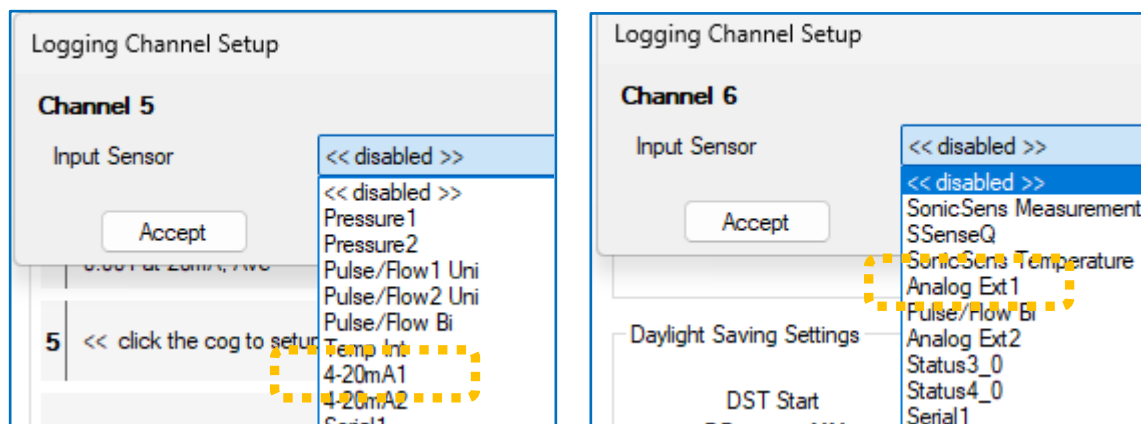
Your logger may have a '4 ~ 20mA' interface fitted (either as part of the logger, or via additional 'interface' unit). This type of interface may be labelled as the following:

"Input 4 ~ 20mA" (... or similar).

These interfaces are used with sensors that provide an output signal using an analogue current which varies between 4mA and 20mA.

The logger is factory calibrated to be able to accurately measure current in a 0 to 20mA range. Currents outside of the 4 - 20mA range usually indicate a fault condition (e.g., 0mA may indicate a broken sensor wire). (The logger can detect this fault condition as its current measuring range extends to below 0mA.)

To setup a channel for use, first select the required sensor input.
(This could be listed in IDT as a 4-20mA[n] input, or an Analog Ext[n] input. See diagram below).

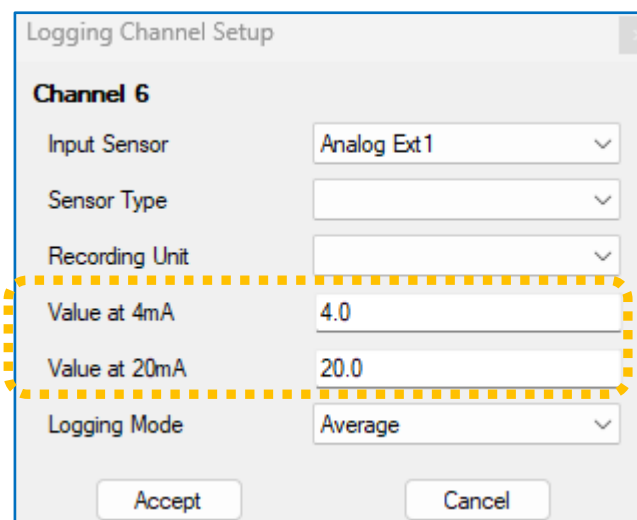


Note: When Analog Ext[n] is selected, it is usually associated with some additional interface unit for the logger (e.g. ESIB series for Intelligens loggers). The logger communicates with the interface unit to determine what type it is; In this case, a 4-20mA unit is being used.

A logger restart is usually required for the additional interface unit to be identified.

Confirm that the Logging Channel Setup box includes fields "Value at 4mA" and "Value at 20mA".

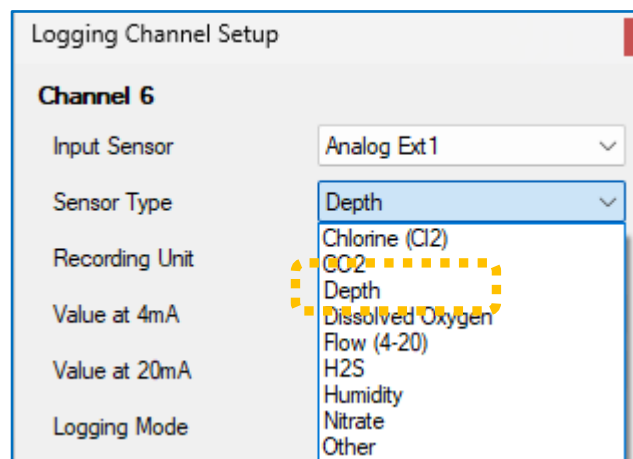
These fields correspond to the minimum and maximum valid signaling range of the sensor. (i.e., The values when output is 4mA and 20mA).



Next use the "Sensor Type" control to select the physical parameter that is being measured by the sensor.

(The choice will affect the units of measure offered later in the setup.)

e.g., For a 4 – 20mA sensor which measures depth, select "Depth".



Select the unit of measure which is appropriate to the sensor output.
e.g. cm (as shown).

(The unit of measure must match DataGate).

Adjust the 'Value at 4mA' and 'Value at 20mA' fields to the corresponding measurement values (using the recording unit of measure) that the sensor indicates at these current levels. (Refer to the sensor documentation).

(e.g. 4mA may signify 0cm depth and 20mA may signify 400 cm depth ... as shown in the diagram opposite).

Select the desired logging mode and then click Accept.

The channel summary is shown.
The settings will be saved during the usual "Setup Device" process.

An IDT app hardware test of the 4 – 20mA sensor channel will indicate the sensor measurement in a similar way to that shown opposite.

i.e., IDT will show the calculated result, followed by the input current.

(If the sensor is connected by an interface unit, it also shows its internal battery voltage).

Logging Channel Setup

Channel 6

Input Sensor: Analog Ext 1

Sensor Type: Depth

Recording Unit: cm

Value at 4mA:

Value at 20mA:

Logging Mode: Average

Logging Channel Setup

Channel 6

Input Sensor: Analog Ext 1

Sensor Type: Depth

Recording Unit: cm

Value at 4mA: 0

Value at 20mA: 400

Logging Mode: Average

Accept Cancel

6 Analog Ext1, Depth (cm), 0 at 4mA, 400 at 20mA, Ave

-0.025 (00.00mA) 10.6V 4-20mA 1

5.10 SPILLSSENS

- SpillSens is a digital float angle sensor.
- It is often used with the following viewing portals: SpillGuard.
- It requires specific settings to work to the requirements of DataGate and the SpillGuard website; Refer to the SpillSens User-guide for more details.
- Refer to your logger User-guide for information if this sensor is supported.

5.11 SONICSENS3 (DISTANCE / DEPTH SENSOR)

- SonicSens3 is a sensor which measures distance with ultra-sound.
- It is often used with the HWM DataView website as the viewing portal.
- Refer to your logger User-guide for information if this sensor is supported.
- This is an advanced sensor and requires some additional setup steps.
- Refer to the SonicSens3 User-guide for more details.

5.12 RADARSENS (DISTANCE / DEPTH SENSOR)

- RadarSens is a sensor which measures distance with a Radar signal.
- It is often used with the HWM DataView website as the viewing portal.
- The sensor is set up in several stages. IDT program setup screens for RadarSens facilitate this process.
- Refer to the RadarSens User-guide for details of installing the sensor. During the installation, the sensor should be checked and can be tuned to the installation site.
- Refer to the model number and/or interface labelling of your logger and also its user-guide to determine if it supports this sensor.
- The distance (or depth) measurement data produced from the sensor is logged as a set of channel datapoints. The datapoints can optionally be used as an input stream for other channels (e.g., Open Channel Flow) if the logger is set up to produce these additional channels.

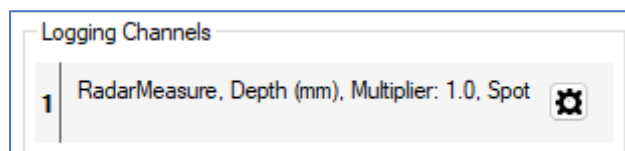
The setup of a logger to use RadarSens requires three stages:

1. Setup of the sensor to make it operational.
(At this stage, the sensor is also assigned a channel number for its output datapoint stream).
2. Setup of the sensor to tune it to the installation site and select which type of measurement is to be output (distance or depth). This includes verification of the sensor position and the strength of the reflected Radar signal.
3. Setup of the logger to use the datapoints being obtained from the sensor.

The logger supplied with RadarSens may have already been configured for RadarSens to be operational; if this is not the case, instructions are included within this user-guide. Additional site-specific settings (e.g., a depth reference point) are usually required.

5.12.1 Confirm RadarSens is recognized by the logger

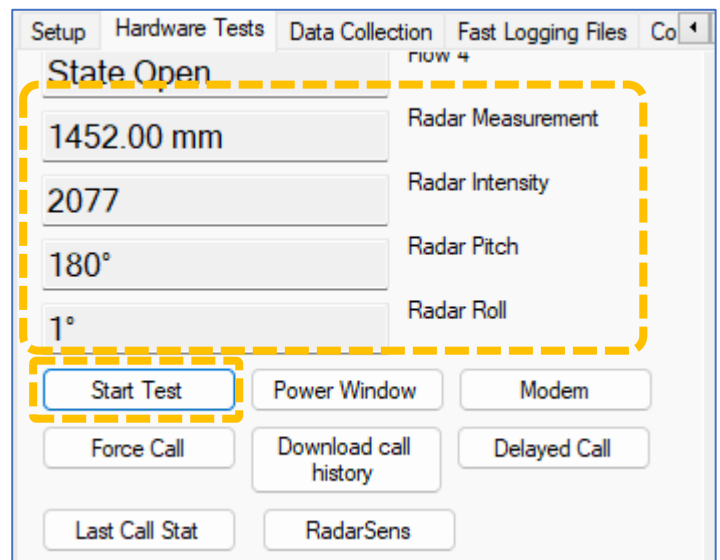
A logger that has been configured sufficiently to make RadarSens operational will have a channel setup for producing an outgoing datapoint stream.



This will subsequently produce RadarSens measurement result fields in the hardware test tab.

To verify the plugged-in sensor is recognized, start the hardware test, and check the fields show results. If the sensor is not recognized or does not operate, the test will halt, or an error condition will be displayed.

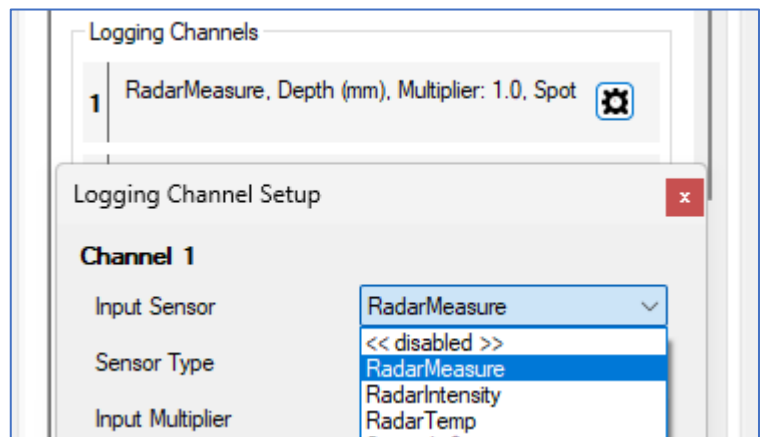
If RadarSens logging channel has not already been set up, refer to section 5.12.2. Otherwise, skip to section 5.12.3



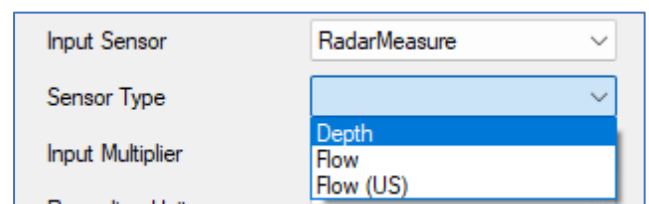
5.12.2 Initial setup of a RadarSens channel (for distance or depth measurement)

Click on “+” to make a new Logging channel available, then on the cog icon to begin setting it up.

Select RadarSens Measure.



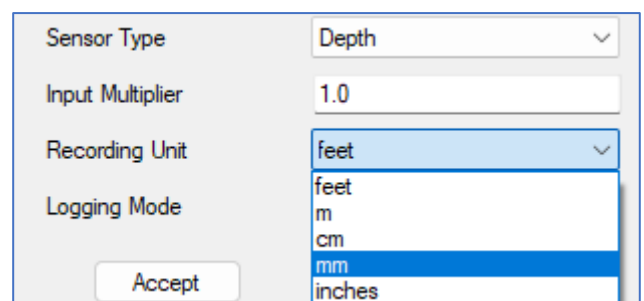
Select 'Depth' for both distance and depth measurement.



Select the required recording unit of measure; typically, this is mm.

Then select a logging mode (e.g., Spot).

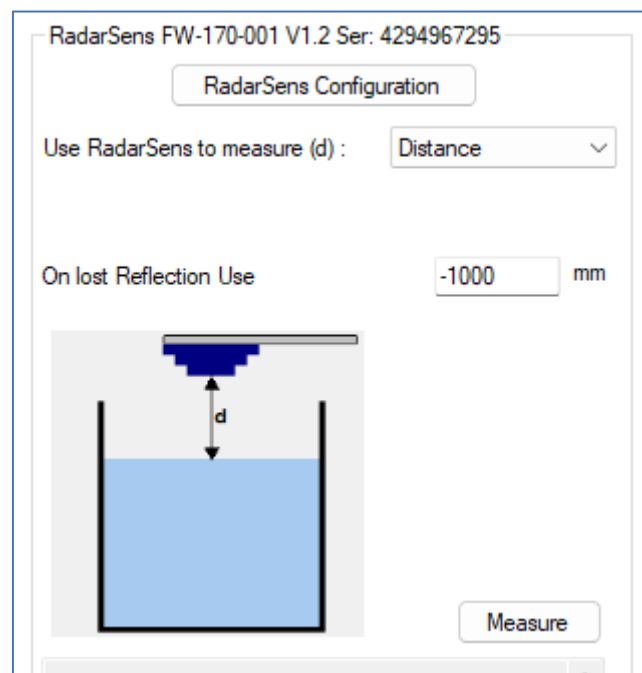
Finally click on Accept.



Save the settings from IDT to the logger, using the “Setup Device” button.

The logger will restart and show an additional panel (titled ‘RadarSens’) on the Settings tab, for further setup of the RadarSens sensor.

(Sensor details are shown at the top of the panel. These include serial number and firmware version).

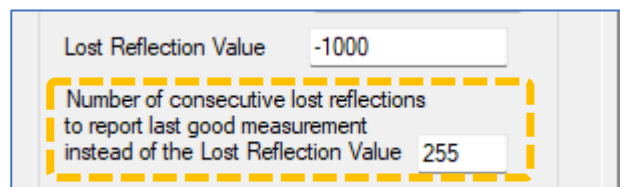


Next, set up the logger to handle the datapoint stream for situations where the RadarSens is unable to detect a reflection signal of any significance. These are known as ‘lost reflections’. (Typically, this will be due to a sensor which has not been correctly tuned to the site, or if the channel is dry and unreflective).

The datapoint stream must not have data gaps. Sensor measurement issues (i.e., lost reflections) can be detected in the datapoint stream by setup of a ‘lost reflection value’ which is out of the range of normal data. (Lost reflection errors can then be seen when inspected on a graph using DataView).



Note: This setting also appears in the RadarSens Configuration window (see section 5.12.3). This includes a setting allowing the logger to initially substitute a lost reflection with the last good measurement.



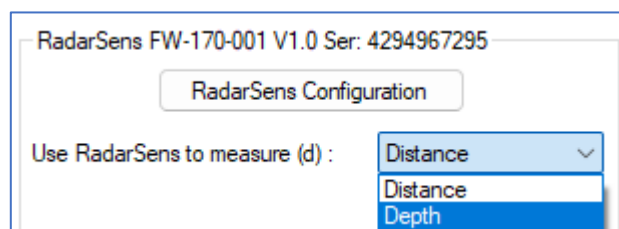
To deactivate this feature (never substitute last good reading; always send the lost reflection value when a reflection is lost), set the field to ‘0’ or ‘255’.

To activate the feature, set the field (in the range of 1 to 254), according to the number of times the last valid measurement is required to be substituted for a lost reflection.

Consider whether to set the logger to raise an alarm on the persistent presence of the ‘lost reflection’ value in the datapoint stream.

5.12.3 Configuration of RadarSens (Tuning to Installation Site Requirements)

Select whether RadarSens is to measure the depth of a fluid or the distance to the surface of a fluid.



When Depth is selected, IDT requires additional information about the chamber and sensor position. Measure from the bottom of the water channel (or Riverbed, or the internal base of a fluid containment vessel) to the lower face of the installed RadarSens. (Re-check and adjust if the sensor position is ever adjusted).

Note: The selected settings will not be saved to the logger using the normal 'Setup Device' button. Instead, you have to make a measurement using **the 'Measure' button**, as described below. **This saves the settings to both logger and the sensor.**

The Measure button provides a test utility to verify the RadarSens is operating.

It gives a Distance (or Depth) measurement, and also an Intensity measurement.

(Intensity is an indication of the strength of the received radar signal and can be used to check whether there could be any issue with the returned signal, for example due to the effects of turbulence.)

From the main RadarSens panel, Click on the RadarSens Configuration button.

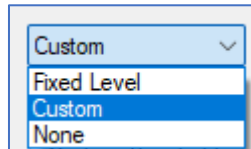
A new window will open, which includes three panels, 'Configuration', 'Intensity Test' and 'Installation Position'.

Some of the controls are duplicated in this window, for convenience.

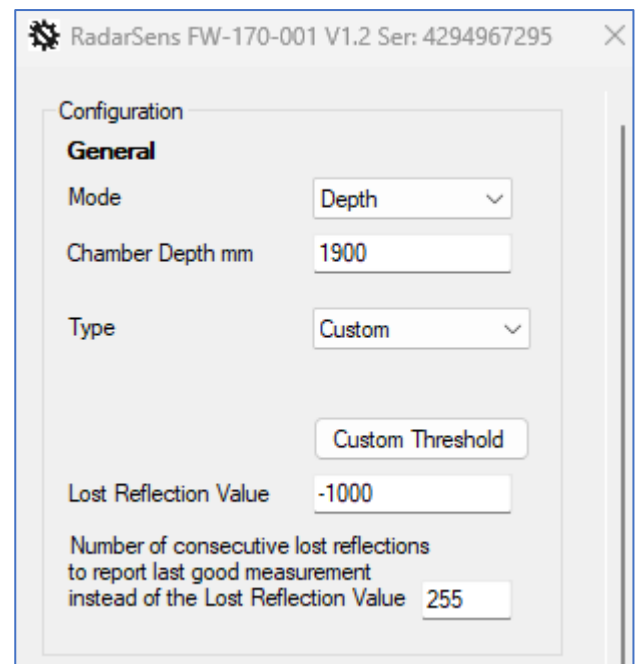
The next step is to check the radar signal is going to be reliable. Where potential problems exist (due to features of the installation chamber), make adjustments to the measurement thresholds in order to compensate for these.

Usual practice is to select a Threshold type of 'Custom'.

Then click on the 'Custom Threshold' button.

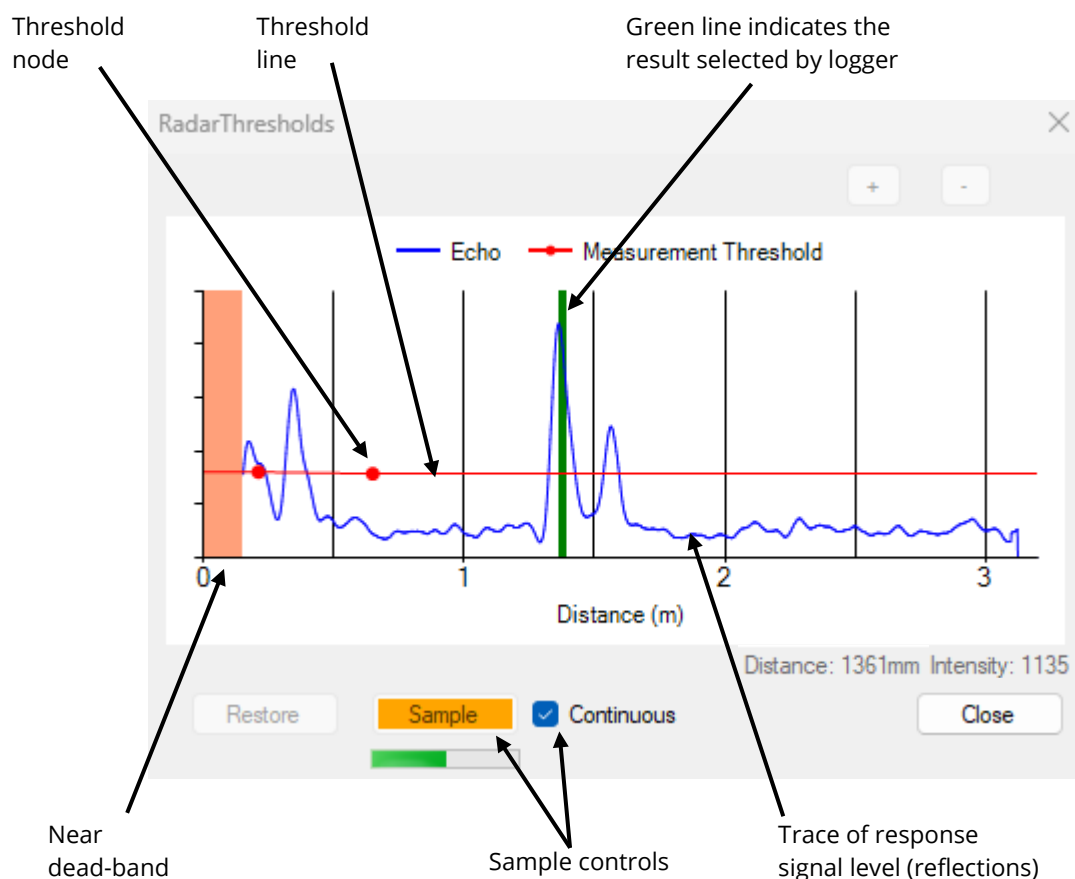


A graphical window, titled "Radar Thresholds", will appear.



A red line indicates the current signal level thresholds. Nodes (red dots) can be re-positioned on the screen by the user, as required. Nodes can be added or deleted using the '+' and '-' buttons. (Clicking the 'Restore' button will undo any editing of the threshold line).

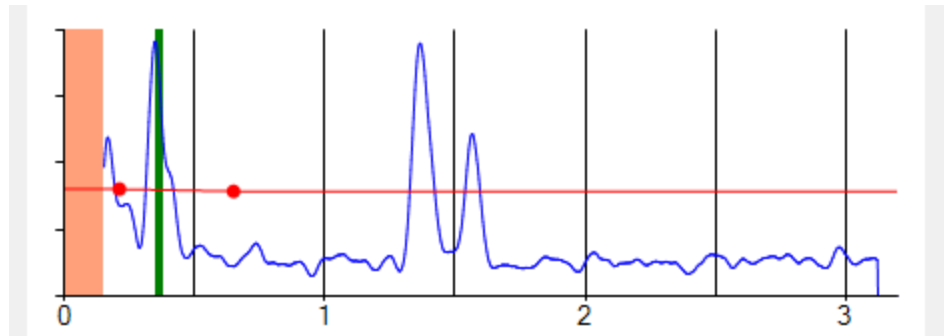
Click the 'Sample' button to begin a measurement and produce a graphical display of the returned radar signal level. Either a single measurement sample can be made or (by ticking 'continuous') multiple measurements can be made. (When finished, to close the window, untick the continuous box, and click on close). A small 'measurement progress' bar is shown in the bottom of the display; the progress includes measurement and also retrieving graph data.



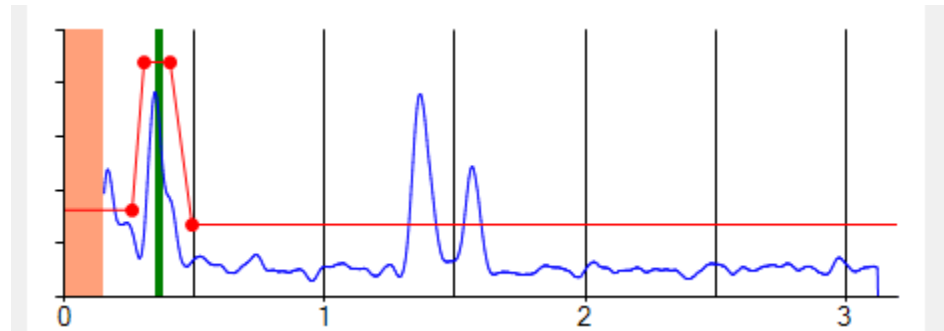
The RadarSens trace response shows the returned signal level, which comprises of a general noise-floor plus any signal peaks. The RadarSens has various strategies for selecting what it judges to be the correct peak for the water level. Generally, this will be the most dominant peak. However, it is possible that strong peaks of 'nuisance reflections' could also be present. To prevent the possibility of nuisance reflections leading to measurement errors, consider modifying the threshold line to mask-out (suppress) any problem reflections.

An example is shown as follows:

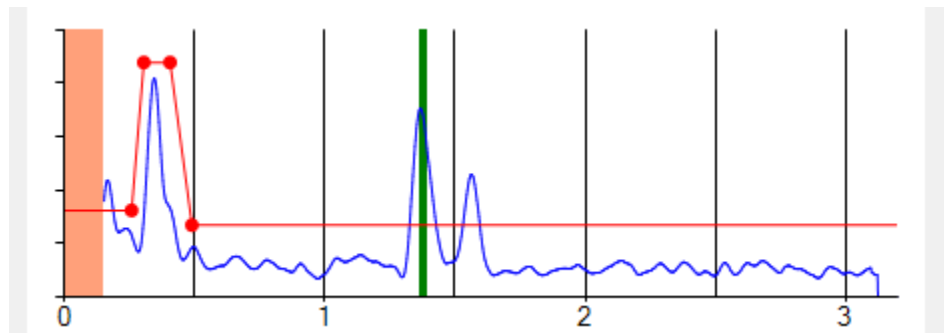
Logger has incorrectly selected a nuisance reflection because it is (occasionally) as strong as the correct peak.
(Green line = selected).



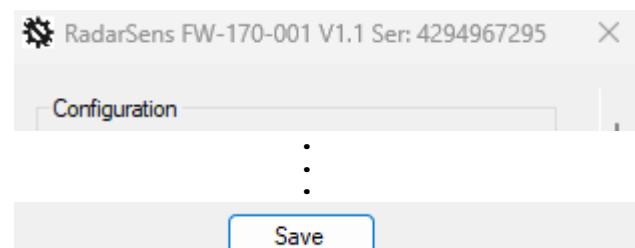
Stop the sampling.
Add nodes (as required) and position them around the nuisance reflection (cover it over to suppress it from being selected).



Re-start the sampling to check that the correct reflection is now being selected, and that the nuisance reflection (even if higher) is being disregarded.



Close the Radar Thresholds window.
Click the Save button to ensure the new thresholds (and any other changes) are saved.

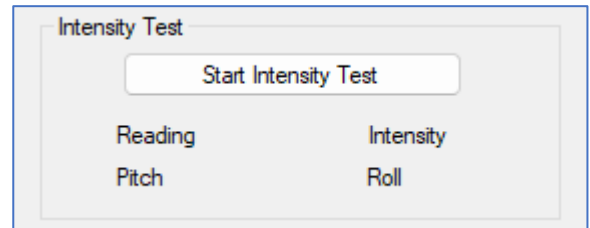


5.12.4 Check of returned Radar signal (reflection Intensity Test)

After making adjustments to the threshold (as described in section 5.12.3), a further check of the signal reliability can be made.

Navigate to the Intensity Test panel (found within the window that appears when RadarSens Configuration button is clicked).

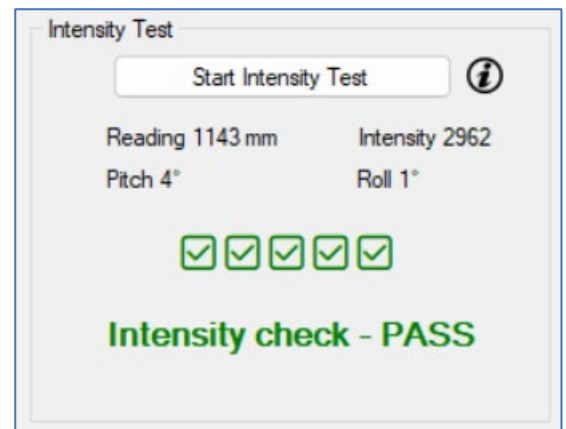
Click on the 'Start Intensity Test' button.



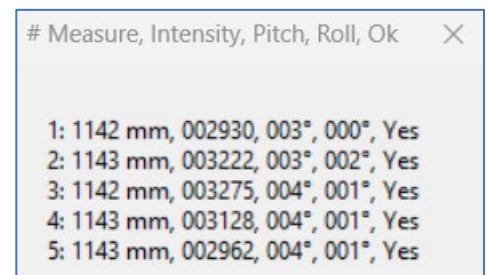
The logger will make several measurements from the RadarSens sensor and make a judgement about whether the reflected Radar signal level is suitable for producing reliable measurements.

(The pass level is dependent on the measured distance of the sensor from the water surface).

A tick or cross is shown for each test measurement, followed by a confirmation message (Pass / Fail) when the logger has finished its test cycle.



Click on the '(i)' symbol if you want to see the complete set of results.



Where the test shows a 'Fail' result, consider if the RadarSens could be re-positioned to improve.

- Is the sensor level?
- Is it aimed at turbulent water or bubbles?
- Is RadarSens aim perpendicular to the water surface? (The surface of flowing water may not be level; the RadarSens sensor may need to have a slight tilt from vertical to get best reflection).



5.12.5 Setup of auxiliary RadarSens data channels (RadarIntensity, RadarTemp)

The RadarSens sensor can provide useful additional information in the form of a sensor channel, called 'RadarIntensity', which gives the strength of the reflected signal. This can vary suddenly according to the reflective properties of the surface encountered by the radar signal during measurement. In continuously flowing water, the reflection should be reasonably consistent. A change in the reflective properties could indicate the presence of a foreign object or the start of a blockage.

The RadarSens can also provide a means of tracking air temperature, (which may be useful if your logger does not have its own internal temperature sensor).

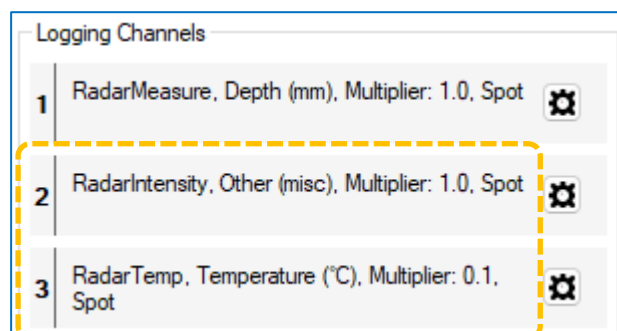
(Both of the channels are optional).

Navigate to the 'Logged Channels' panel.

If the logger is already setup, these RadarSens channels may be listed amongst any other sensor channels, (shown as 'RadarIntensity' and 'RadarTemp').

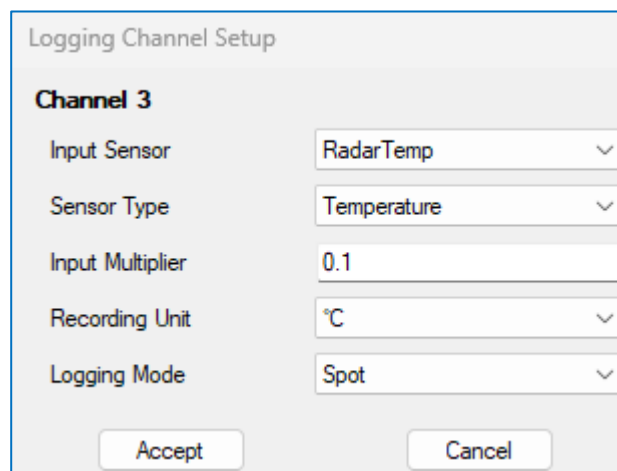
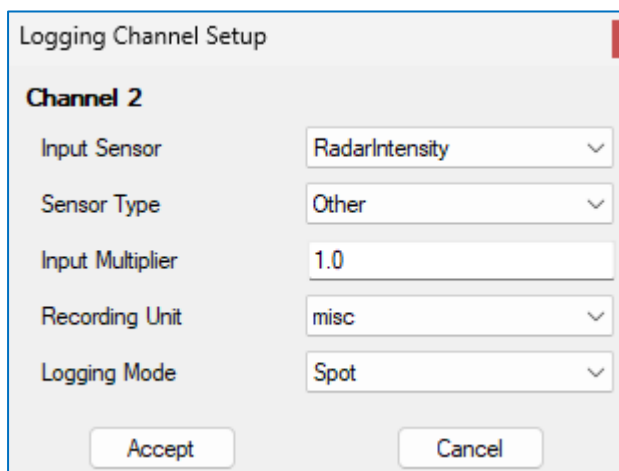
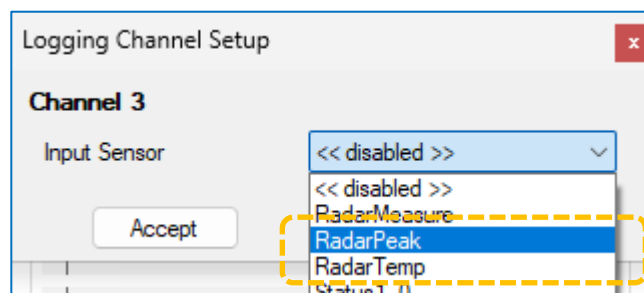
If not present but required:

Click on "+" to make a new Logging channel available, then on the cog icon to begin setting it up.



Depending on which channel you are currently setting up, select an Input Sensor of 'RadarIntensity' or 'RadarTemp'.

Then proceed through each remaining field, from top to bottom, to choose the required settings. (Typical settings are shown below, for each type of channel).



When finished, click the 'Accept' button. The channel will be saved to the logger and a summary will appear in the Logged Channels panel.

5.12.6 Configuration of sensor alarms

Measurement value alarms

Sensor data for depth or distance measurements can have alarms configured in the same manner as any other regular channel. Prior to leaving site, consider what alarm conditions should be communicated to the server, and how rapidly the alarm condition should be communicated. Set up an alarm for the channel accordingly.

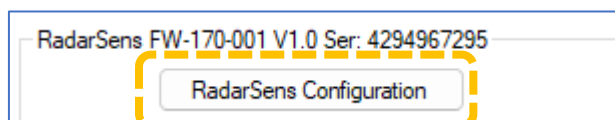
Equipment alarms

The RadarSens and logger are also able to detect certain fault conditions, and will generate either a warning or an alarm, which gets reported to the DataGate server.

A warning is communicated when the logger next does a scheduled call-in. An Alarm is communicated by the logger making an immediate call-in. The server determines how the warning or alarm is handled (e.g., forwarded to users that have subscribed to receive the alarm).

The RadarSens includes sensors (direction of gravity) for recognizing its orientation; these are 'pitch' and 'roll' sensors, as shown on the hardware test page. The installer is required to set up the equipment at the end of installation for it to be able to recognize a 'sensor has moved' fault condition.

From the main RadarSens panel, Click on the RadarSens Configuration button.



Locate the Installation Position panel on the window that opens.

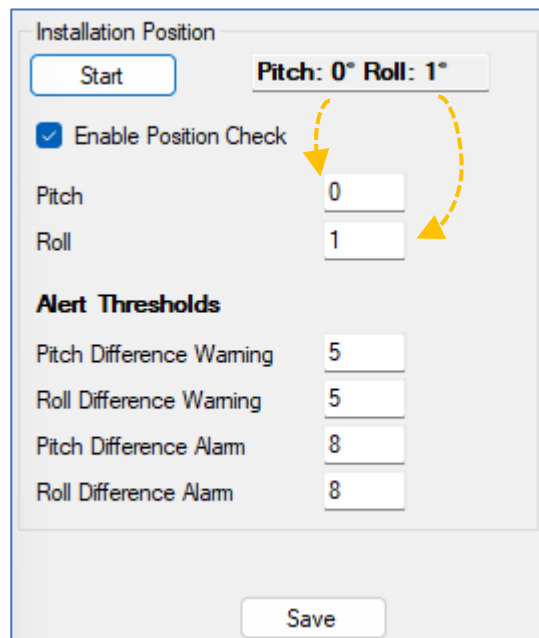
Ensure the 'Enable Position Check' setting is ticked.

When the RadarSens is in its final position, click on the 'Start' button to see live values of the sensor orientation. The current angular positions (Pitch and Roll) will be measured and shown.

Check the values are sufficiently close to '0', and then click the button once more to stop the live values being measured. The final values will be saved as the installed position for reference.

In addition, check that the alert thresholds are correctly set; typical values are shown, but can be adjusted if needed. If the sensor is disturbed or move out of its installed position by an amount exceeding the thresholds a warning or alarm message is sent to DataGate.

Save the settings and close the window.



5.13 LNS INPUT (LEAK-NOISE SENSOR / HYDROPHONE)

The LNS sensor and Hydrophone sensor are both high sensitivity audio sensors, used for detecting the noise of a leak from a pressurized water pipe. There are only minor differences in setup of the logger for their use.

Note: This section provides a summary of the logger's use of the sensors; For a detailed explanation, including setup of the logger using IDT, refer to the PermaNet+ with Hydrophone-2 user-guide (MAN-148-0007).

Behavior of Logger:

A logger uses the sensor to listen to sounds produced from the pipe network. It analyses the sound waveform to produce numeric value of certain characteristics (called 'level' and 'spread') and identifies (based on thresholds applied to the level and spread figures) whether a leak is likely to be present nearby.

The use of a Leak-Noise sensor or Hydrophone can cause some changes (additions) to the logger's pattern of behavior.

For most water network installations, the logger will typically run an extensive leak test cycle once in every 24-hour period. However, when used to monitor critical parts of the water network, such as trunk main, an alternative test cycle is available (called 'Trunk Main' mode); This runs a shorter test, but does so more frequently, to provide an earlier indication of potential leak issues.

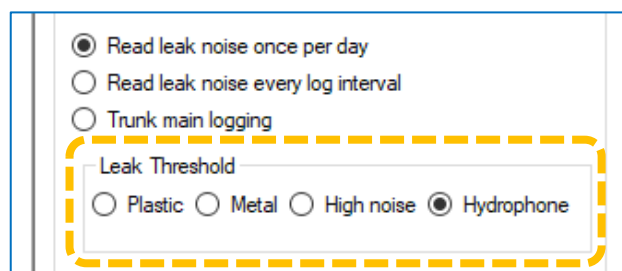
In addition to the leak detection parameters, the logger can produce other types of supplementary data, such as sound recordings (audio files). These are also uploaded to the server and can be listened to remotely by an experienced user, to make a judgement on whether the sound is similar to that of a water leak.

If the logger obtains a highly accurate time reference from where it is installed (e.g., from a communication network or GPS satellite), a high-accuracy time-stamp is linked to audio files.

The logger may also produce other data, such as noise histograms (to evaluate if a change has occurred in the pipe noise characteristics recently). Noise histograms require no programming with IDT; The logger will generate them if it is within its normal operation.

Note: In a daily leak evaluation mode, the settings for the Hydrophone differs from the LNS sensor due to its location and sensitivity.

- Select 'Hydrophone' when a Hydrophone is being used.
- Select one of the other settings, as appropriate, when the LNS sensor is being used.



5.14 GPS / TIME SYNC (SATELLITE ANTENNA) INPUT

An input for reception of GPS satellite signals can be used:

- To identify the current location of the logger.
- To provide an accurate time reference to the logger.

(These functions may be enabled/disabled depending on the logger model number).

5.14.1 Used as a Time Synchronization source (Time Sync)

When the GPS option is installed for the purpose of providing an accurate time reference to the logger, no user-settings for this feature are required.

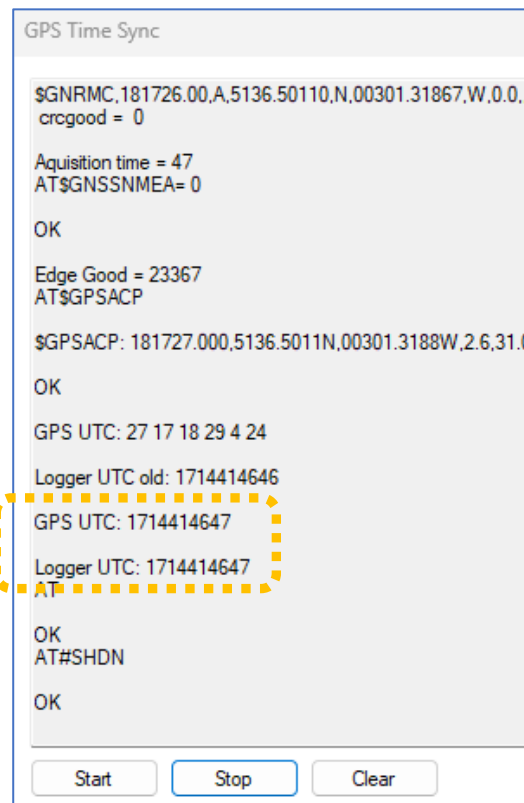
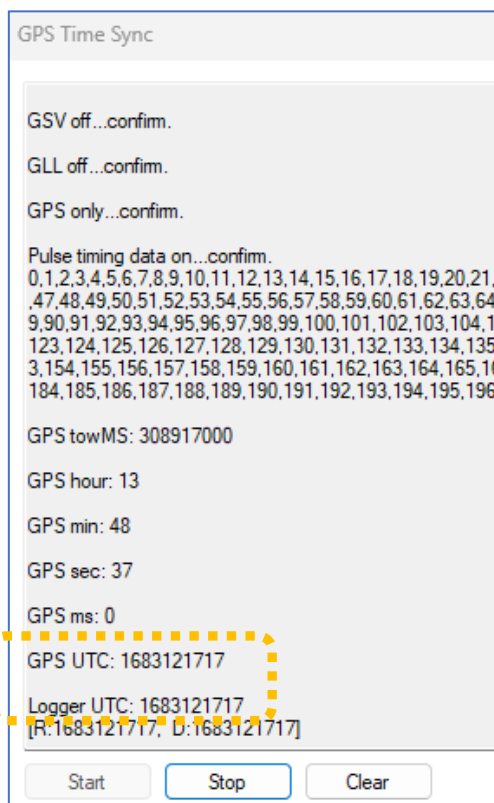
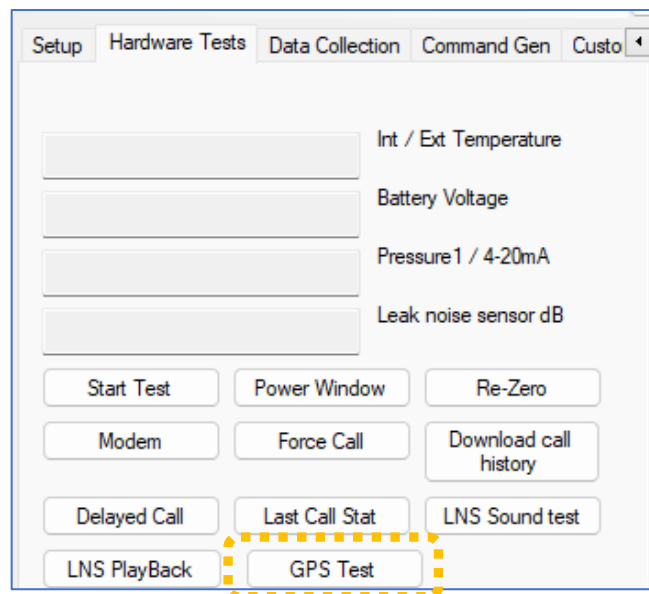
The installer is, however, required to verify that the GPS time reference functionality is correctly operating on the installed logger; this will confirm the GPS antenna is suitably located and is able to receive signals from overhead GPS satellites.

To start the test, first select the Hardware Tests tab and click on the "GPS Test" button.

A new window will open.

Click the "Start" button on the new window.

The window will display various messages as the test proceeds. Most of the messages can be ignored (unless required for diagnostic purposes), except for the ones which confirm that the logger has received an accurate time reference from the satellite.



The messages may vary, depending on the GPS device fitted inside the logger and satellites found. Examples of the messages that indicate successful test completion ('GPS UTC: ...' and 'Logger UTC: ...') are shown above. When these are shown, click on the "Stop" button and close the GPS Time Sync window.

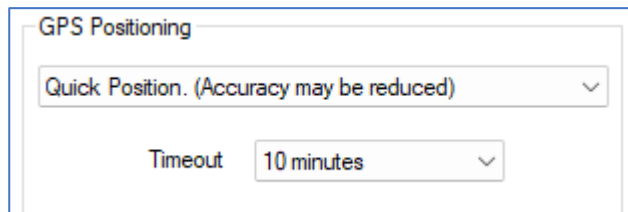
5.14.2 Used for obtaining Logger Location (GPS) / GeoFence Alarm

When the GPS option is installed for the purpose of providing logger location, three related settings panels will appear in the Setup tab of IDT.

The GPS Positioning panel contains settings regarding how much time to spend in obtaining the location.

Select either 'High Accuracy' (which will require more time), or 'Quick Position' if lower accuracy is acceptable, or if sky visibility is limited at the installation location.

A timeout control is also provided to limit the satellite search time. This is provided to limit battery use (in case of some temporary issue existing, such as a poor signal due to an object being placed over the antenna).



GPS Positioning

Quick Position. (Accuracy may be reduced) ▼

Timeout 10 minutes ▼

The GPS Set-up panel includes basic settings for when to start making GPS measurements (enter a start date). No GPS location fixes occur until after this date / time.

A GPS location fix can then be initiated by either a repetitive timed event or an alarm event.

- For timed events, use the 'Repeat GPS fix' control. Repeat duration can be hourly, daily, weekly or set a custom time (in minutes).

- For alarm events, select one or more of the (previously set up) alarm conditions that should initiate a new position fix.

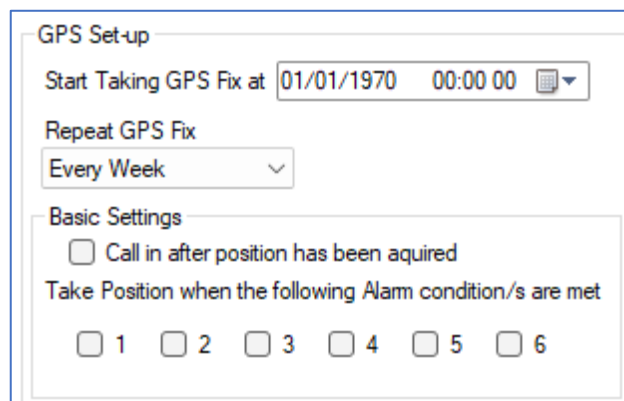
The location information (which is supplementary information, not a standard logged channel) is stored in the logger until it next calls in.

Leave the "Call in after position has been acquired" box unticked to wait for the next call. Alternatively, tick the control to call in immediately after a location fix.

If a channel alarm has initiated the location fix, both the location and alarm can be sent in the same call. If a GPS fix was not possible, it will be reported to DataGate as a system alarm.

The GPS GeoFence panel allows the installer to define a geographical area, within which the logger is expected to reside. If the logger discovers that it has gone outside of the defined area, it will (if enabled) raise a GeoFence alarm.

Enter the latitude and longitude of the installation site (GPS coordinates, using decimal degrees). This will be the center of the GeoFence area. (Use a device with a Map to GPS coordinates feature to obtain these).



GPS Set-up

Start Taking GPS Fix at 01/01/1970 00:00:00 ▼

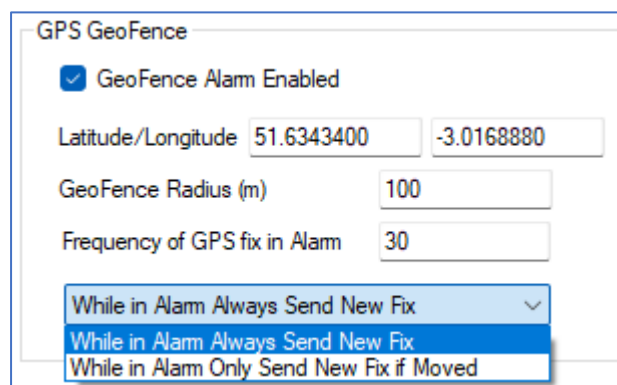
Repeat GPS Fix
Every Week ▼

Basic Settings

☐ Call in after position has been acquired

Take Position when the following Alarm condition/s are met

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6



GPS GeoFence

☒ GeoFence Alarm Enabled

Latitude/Longitude 51.6343400 -3.0168880

GeoFence Radius (m) 100

Frequency of GPS fix in Alarm 30

While in Alarm Always Send New Fix ▼

While in Alarm Always Send New Fix

While in Alarm Only Send New Fix if Moved

Enter the radius of the area (in meters); 100m is the minimum recommended but will depend on the accuracy setting (set earlier).

Whilst the GeoFence alarm is active, the logger will re-check its location (GPS fix) at a specified interval (Frequency of GPS fix in Alarm); Enter the required interval (in minutes).

The logger will repeatedly get GPS fixes whilst the GPS alarm is still active.

Note: GPS location fixes consume battery power. The interval between GPS fixes should therefore not be too rapid otherwise battery life will be reduced.

Whilst in alarm, the logger can send updates to DataGate whenever it has completed a new GPS location measurement. Alternatively, it can update DataGate only if it finds it has changed location once more.

Note: During installation, the GPS circuitry and antenna location can be tested in the same manner as described in section 5.14.1.

5.15 SERIAL SENSOR INTERFACE (SDI-12 OR RS485/MODBUS)

A logger may have one or more of the following interfaces included in its construction:

- SDI-12
- RS485 / MODBUS

IDT collectively refers to these as a 'Serial Interface' type of Input Sensor, although strictly speaking they are communications interfaces for connection with other equipment. The attached equipment is usually microprocessor-based device which can include one or more sensors and can provide several types of measurement data.

Both electrical interfaces can provide point-to-point or multi-drop connections; one or several devices could be electrically attached. Therefore, the logger will include several 'Serial[n]' 'input sensors' for use with these interfaces (Serial1 to Serial8 is typical). Each 'Serial[n]' can be used to access *one item* of measurement data in order to produce datapoints for a logger channel.

In IDT, the setup of this type of "sensor channel" consists of 2 areas.

The top area comprises the usual IDT settings that govern how datapoints will be obtained.

During setup, select an unused serial[n] input as the 'Input Sensor'.

Logging Channel Setup

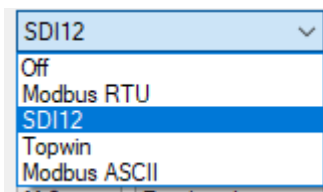
Channel 5

Input Sensor	Serial1
Sensor Type	
Input Multiplier	1.0
Offset	0.0
Recording Unit	
Logging Mode	Spot

Serial Settings

The bottom area ('Serial Settings') comprises settings that determine which serial protocol will be used.

Selecting the protocol also determines the electrical connections brought into use for communications (SDI-12 or RS-485).



The sensor equipment may hold the data in one of several addressable registers; these will be sensor specific. Therefore, to access specific data from a sensor, both protocols will require the setup of accompanying parameters. (These are shown after the protocol has been selected).

To set up the channel:

First use the pick-list to select a "Sensor type".

(Since the interfaces are widely used by sensor manufacturers, the list of physical parameters displayed is extensive. Contact HWM if the Type or Unit that you need is not available).

The "Recording units" selections will only list units of measure after the Sensor type is chosen. The units of measure will be appropriate for the selected sensor type.

Use the pick list to select the unit of measure which is output from the sensor. (DataGate must also be set to expect this unit of measure).

Channel Offset is normally set to '0.0'.

For Input Multiplier, refer to the **Discussion** below.

Set the logging mode in the same manner as any other channel.

If the mode is set to Spot, then the serial sensor is polled at the Logging interval.

For other settings the serial sensor is polled at the Sampling interval, and statistical functions applied to data before producing a data-point at the logging interval.

Discussion: Input Multiplier & Channel Resolution (Serial channels only)

The SDI-12 and RS485/Modbus serial channels transfer data from connected intelligent sensor equipment. The sensor equipment itself has been calibrated with the transducer and produces output data that has already been converted to use a standard unit of measure. The logger will (for storage purposes) convert the measurement into another format, which may involve some compression.

Of particular interest is the use of the 'input multiplier' field for serial channels.

This field is re-purposed and acts to set the **channel resolution** (number of digits available after the decimal point).

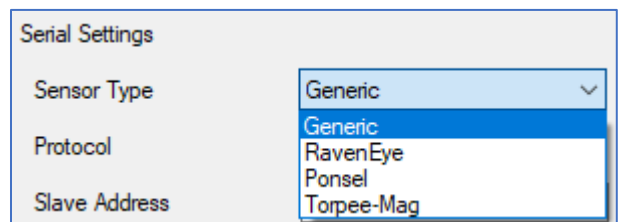
- 1 = No digits after decimal point.
- 0.1 = 1 digit used after the decimal point
- 0.01 = 2 digits used after the decimal point, etc.

This is applicable to:

- All SDI-12 channels
 - Any RS485 / MODBUS channels that require the 'Logged Format' field set to 'Float' or 'Double' in order to correctly interpret sensor measurement data.
-

Under 'Serial Settings', use the drop-down selection control called 'Sensor Type'.

First check if the sensor appears in the list; if so, select it. However, for most sensors the "Generic" Sensor type is used.



e.g. Some sensors behave co-operatively to give additional data. This requires the logger to orchestrate the movement of data between sensors.

The logger may measure from another sensor and send the results to this sensor before subsequently requesting it to make a measurement.

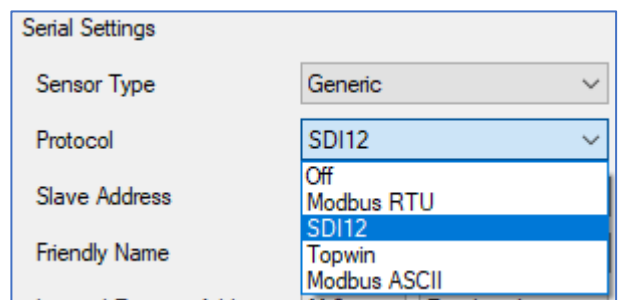
5.15.1 Serial Settings: Protocol selection

The Protocol drop-down selector tool will select the RS485 electrical interface for communications for each of the following:

- Modbus RTU
- Modbus ASCII
- Topwin

Selecting "Off" will de-activate any reading process.

The selector tool will select the SDI-12 electrical interface is selected for all other settings.



5.15.2 SDI-12

The SDI-12 bus specification defines a 3-wire interface containing power, ground, and serial data lines. Communications is at a fixed rate of 1200 baud.

Note: Some HWM logger interfaces do not support the power line (for powering the sensor);
For these, the sensor is required to have its own power source.

(Refer to the SDI-12 specification for more details; this can be found in the public domain on the internet).

SDI-12 is a half-duplex communications protocol. The logger device initiates communications with a sensor over the SDI-12 bus. It does this by sending a break to the line to wake any attached sensors. Then it sends a command to a specific sensor, using an address to select the required sensor; all sensors on the bus must have unique addresses. The address is the first character of the command. All other sensors on the bus return to a stand-by mode; only the addressed sensor will respond when it has completed the command. The logger waits until the sensor has the data available and then the transfer is made; one or more measurements may be transferred at a time.

The address is in the range of ASCII characters "0" through to "9".

"0" is the default address for many sensors.

Enter the SDI-12 address of the sensor in the 'Slave Address' field.

The sensor data can be given a 'Friendly name' (for easy identification when using IDT).

The "M" command initiates a single measurement to be made by the sensor.

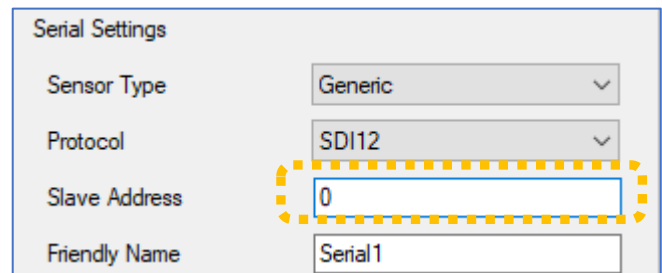
(This instruction is only to be used if there is only one device is on the SDI-12 bus).

The sensor device may support several measurement types, identified by "0" through to "9".

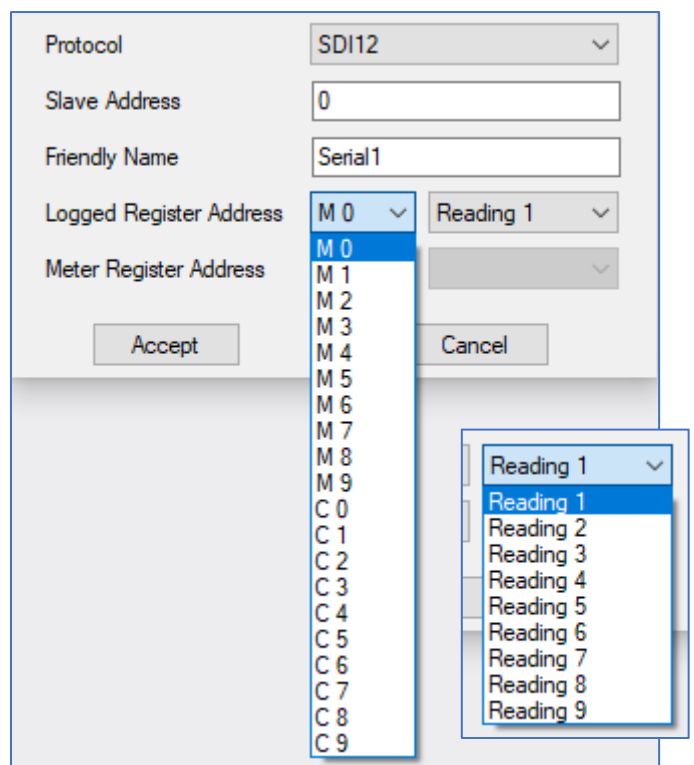
Refer to your sensor manual to determine the appropriate parameter to be included with the request to select your required measurement.

The sensor may reply by sending a block of data containing *multiple* measured parameters.

To select a *specific item* of the data from the response, an index is needed; this is specified by the "Reading n" control.



The 'Serial Settings' dialog box contains the following fields: 'Sensor Type' (dropdown menu set to 'Generic'), 'Protocol' (dropdown menu set to 'SDI12'), 'Slave Address' (text input field containing '0', highlighted with a dashed yellow border), and 'Friendly Name' (text input field containing 'Serial1').



The SDI12 configuration dialog box contains the following fields: 'Protocol' (dropdown menu set to 'SDI12'), 'Slave Address' (text input field containing '0'), 'Friendly Name' (text input field containing 'Serial1'), 'Logged Register Address' (dropdown menu with 'M 0' selected), 'Meter Register Address' (dropdown menu), 'Reading 1' (dropdown menu), and 'Reading 1' (dropdown menu). The 'Accept' and 'Cancel' buttons are at the bottom. A list of measurement types (M 0 through M 9 and C 0 through C 9) is shown in a dropdown menu next to 'Logged Register Address'. A list of readings (Reading 1 through Reading 9) is shown in a dropdown menu next to 'Reading 1'.

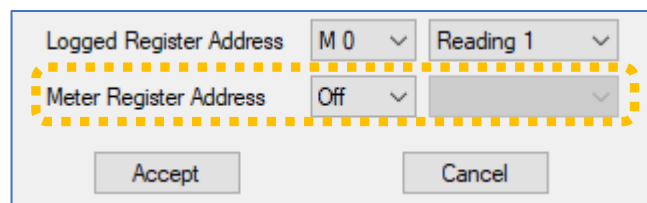
Where there are multiple sensor devices on the same SDI-12 bus, use the "C" command.

("C" is the concurrent command. Whilst waiting for one sensor, the logger can address other sensors on the bus; All must be accessed with the "C" command).

Refer to your sensor manual to determine the appropriate parameter to be included with the request to select your required measurement.

If the sensor happens to be some kind of flow meter, the current meter value may possibly be accessible via the SDI-12 link.

Setup the “Meter Register Address” parameters in a similar manner in order to access the current meter reading value.



Logged Register Address	M 0	Reading 1
Meter Register Address	Off	
Accept		Cancel

Note: Due to differences in the way the SDI-12 address is reported, some sensor manufacturers quote an integer style address, and some quote an ASCII style address. This means that the actual address can be one below the address in quoted in the manual or the configuration software.

e.g. Lufft UMB Weather Station device reports Device ID1 (default), which corresponds to SDI-12 address “0” (SDI-12 default).

When setup is complete, click on “Accept” to accept the settings; they are saved to the IDT copy of the program, but are not saved to the logger until the *entire program* is saved by using the Setup Device button.

5.15.3 RS485/Modbus

Modbus communicates serially using differential signaling.

- The RTU variant of the protocol uses timing gaps between communication frames, which can hold binary coding within messages.
- The ASCII variant of the protocol uses ASCII characters only, including to start and end the message.
- Topwin is a non-standard version of the Modbus protocol and is rarely used.

Note: The protocols (listed above) are incompatible. If the wrong protocol is selected, the sensor will not operate correctly with the logger; The frame format and content will be incorrect.

Be sure to select the correct one for use with the attached sensor equipment.

(See section 5.15.1 and refer to the sensor equipment user guide).

e.g., if your sensor requires Modbus ASCII, select it.

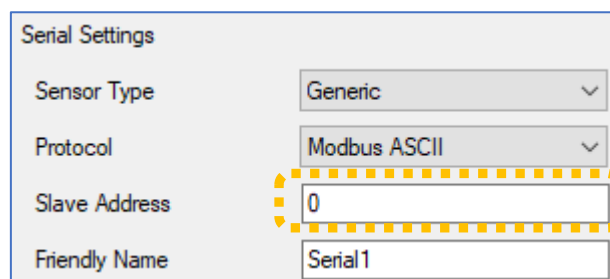
For Modbus over an RS485 interface, each device must have an address. The sensor address will normally be in the range of 1 to 247 decimal.

Address 0 should not be used; it is a broadcast address where sensors must process the request, but not send a reply.

Enter the address of the sensor in the Slave Address field.

(The address will normally be found in the sensor manual, termed ‘Sensor identification’, or ‘Unit ID’, or ‘Server ID’, or something similar).

Note: This is the device address, not register address.



Serial Settings	
Sensor Type	Generic
Protocol	Modbus ASCII
Slave Address	0
Friendly Name	Serial1

The sensor data can be given a ‘Friendly name’ (for easy identification when using IDT).

Use the drop-down selector control to enter the speed (baud rate) of the RS485 serial bus.
(This must match the baud rate of the sensor).

Add the bus 'timeout' and bus 'wake-up time' parameters.

The logger sends the sensor an initial command to wake it up (from standby); the sensor may be unable to process this command. The logger re-sends the required command after the specified wake-up time.

The bus timeout is normally a reduced time period that the logger uses in subsequent message transactions before repeating any commands to a sensor that has not responded.

The Modbus protocol has a suit of available functions for reading and writing data; Each has a function code. The logger will support a subset of the function codes.

For reading data from the sensor, the user can specify the following function codes:

- Function 03: Read Holding Registers
- Function 04: Read Input Registers

The function codes are used to access 16-bit wide registers inside the sensor device. Each register within the sensor has an associated address. The Modbus protocol requires the address of a register to be specified for a read operation. It also requires the quantity of registers that are to be read to be specified; these will begin from the register address sent. It is therefore possible to read data that is more than 16 bits wide and that spans several registers.

Refer to your sensor manual to locate the register start address of the data you require. Also, you will need to understand the format of the data returned by the sensor (how many bits wide the data is, whether the format allows whole numbers only or if numbers which include decimal places are being used, etc.).

Select the required function code, using the 'Modbus function' control.

In the "Logged Register Address" field, enter the start address of the register within the sensor equipment that holds the required data.

e.g., A velocity sensor specifies (in its manual) that the register with address 1000 holds the velocity data. ... So, enter "1000" into the field.

Register Number or Register Address?

Modbus documentation from sensor equipment can sometimes be difficult to interpret, due to there being several conventions for referencing registers (or other items, such as coils).

For different types of input, a 5-character 'reference address' could be used.

e.g. '0XXXX' is used for the on/off status of 'coil outputs'.

'1XXXX' is used for the on/off status of 'discrete inputs'.

'3XXXX' is used for the content of 'input registers'.

'4XXXX' is used for the content of 'holding registers'.

... etc.

Thus, if the data you need is described as being in register '4XXXX', the leading '4' indicates it is a *holding register*, so Function 03 (Read Holding Register) is required.

Similarly, if the data you need is described as being in register '3XXXX', the leading '3' indicates it is an *input register*, so Function 04 (Read Input Register) is required.

The sensor documentation may also make this clear by simply referring to the data being in a 'holding register', etc.

The leading digit in a 5-digit number becomes redundant and should be dropped when setting the logger. Regarding the 4 remaining characters 'XXXX', this is an address which refers to a register number. Here another cause for confusion can arise...

In Modbus messages, all data addresses are referenced to '0000'.

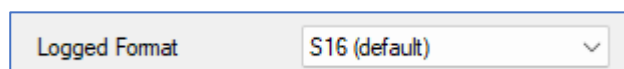
Thus, when the first reference to a data item is shown as non-zero (e.g. 'coil 1'), the Modbus address used in messages (for 'coil 1', in our example) will be '0000'.

Similarly, a holding register of '40001' will be referred to as '0000'. (by dropping the leading 4 and re-referencing the address to the starting point of '0000').

(To give another example, holding register '40106' is re-mapped to address '0105').

In some cases, it will not be clear whether the sensor documentation is providing a reference to a register number or address. If you are not getting the results you expect, try adding or subtracting one to the address field. (This is a trial-and-error process).

The "Logged Format" field must also be set to specify how many registers are being used to hold the data and what the number format is within the registers.



The image shows a software interface element labeled "Logged Format" next to a dropdown menu. The dropdown menu is open, showing the selected option "S16 (default)" and a small downward arrow icon to its right.

Examples of available selections are shown below:

U16: Unsigned Integer.
 16-bits wide (1 register) data.
 Includes positive integer values only.

S16: Signed Integer.
 16-bits wide data (1 register required).
 Includes positive and negative integer values only.

- S32: Signed Integer.
32-bits wide data (2 registers required).
Includes positive and negative integer values only.
- Float: Signed number including decimal point.
32-bits wide data (2 registers required).
Includes positive and negative values.
- Double: Signed number including decimal point.
64-bits wide data (4 registers required).
Includes positive and negative values.

The Modbus protocol does not define the format (byte order) that must be used on data that spans multiple registers. Often a sensor datasheet also does not detail this.

To overcome the above issue, the logger supports several alternatives for how data that is larger than 16-bits wide is to be read from the Modbus data frame into the logger memory.

The data type must be selected (e.g., "Float" or "S32" or "Double"; this dictates its size). In addition, there are options for the byte or word order (ABCD, etc.).

Use the 'Logged Format' control to make the selection.

Selecting the right byte order option is often a case of trying the alternative settings to find the one which matches the data presentation from your sensor; the data will then make sense.
(Check data using the IDT Hardware test feature).

S32 ABCD	Float ABCD
S32 CDAB	Float CDAB
S32 BADC	Float BADC
S32 DCBA	Float DCBA

e.g., A velocity sensor manual says that the velocity (in m/s) is stored in address 1000 and uses a "Float 32" number format.

The number will be a "Float" type; it is spread across 2 registers (to make 32-bits).

Selection of one of the "Float" format options is now required.

(Several of the byte order format options were tried until the data read was OK).

The choice of "Float BADC" was found to show meaningful data values during a hardware test of the example sensor.
(This selection was kept.)

Note: For RS485/MODBUS and SDI-12, an additional lightweight test facility is available, called 'Serial Test'.
This provides a faster configuration check of the serial channels.

The section regarding “Meter Format” can be set up in a similar way.

However, this is rarely used and can usually be de-activated (set to ‘Off’), as shown.
(It is provided only for flow sensors which include providing access to meter reading values over the RS485 / Modbus link).

Meter Format	S32 ABCD
Meter Register Address	

Meter Format	Off
Meter Register Address	1004

5.16 PEGAUS2 (PRESSURE REDUCING VALVE CONTROLLER)

- Pegasus2 is a PRV controller with built-in logger functions.
- It is often used with the following viewing portals:
PressView, DataView
- There are many settings within Pegasus2 that are common with loggers; these settings and operations are described in this user-guide.
- The settings and features specifically related to a PRV installation and test are described in the Pegasus2 User Guide (MAN-163-0002), which should be referred to for further information.

5.17 SENTINEL2 (PRESSURE REDUCING VALVE CONTROLLER)

- Sentinel2 is a PRV controller with built-in logger functions.
- It is often used with the following viewing portals:
PressView, DataView
- There are many settings within Sentinel2 that are common with loggers; these settings and operations are described in this user-guide.
- The settings and features specifically related to a PRV installation and test are described in the Sentinel2 User Guide (MAN-163-0004), which should be referred to for further information.

6 PART 3: ----- SETUP OF ADDITIONAL MEASUREMENTS (SYSTEM) -----

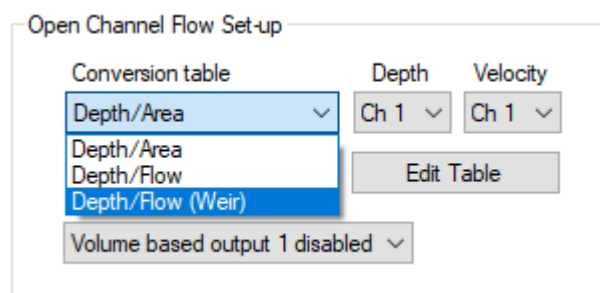
6.1 OPEN CHANNEL FLOW USING DEPTH & VELOCITY SENSORS

6.1.1 Flow of water from a WEIR (using depth sensor only)

A depth sensor (e.g., SonicSens 3, RadarSens) can be used to indirectly measure the water flowing from a weir. This requires the measurement from the sensor to be used as an input to the “Open Channel Flow Setup” panel (also called the FlowOCH channel). This channel requires the geometry of the weir to be entered. It then acts as a flow calculator, converting the depth of water into a flow calculation. The sensor (e.g., SonicSens 3) can provide the necessary depth of water to be input into the calculation.

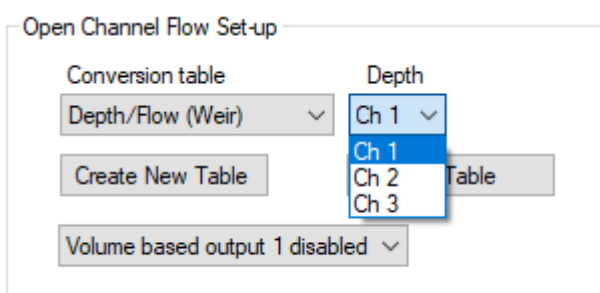
Select the Setup tab and scroll to the “Open Channel Flow Set-up” panel.

From the “Conversion table” selector, choose “Depth/Flow (Weir)”.



The depth input can come from any viable source. Use the “Depth” selector tool to map the depth input to one of the Logging channels.

In the example opposite, a SonicSens 3 depth is being logged as Channel 1, so “Ch 1” must be selected.

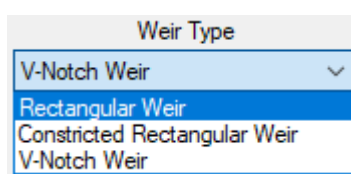


Weirs can have different shapes. Click on “Create New Table” to begin the process of entering the geometry of the weir.

Note: The depth of the water is measured from the bottom of the water channel.
The weir blocks the flow of water until its depth exceeds the minimum height of the weir. This point is known as the “crest”. This, and other dimensions need to be measured from the-site.

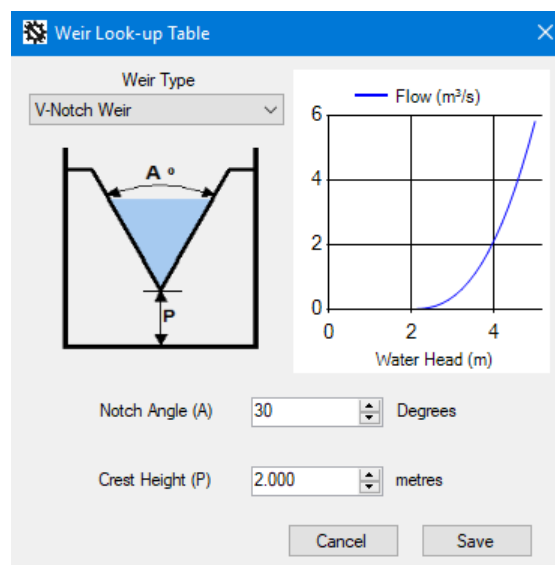
Select the Weir Type.

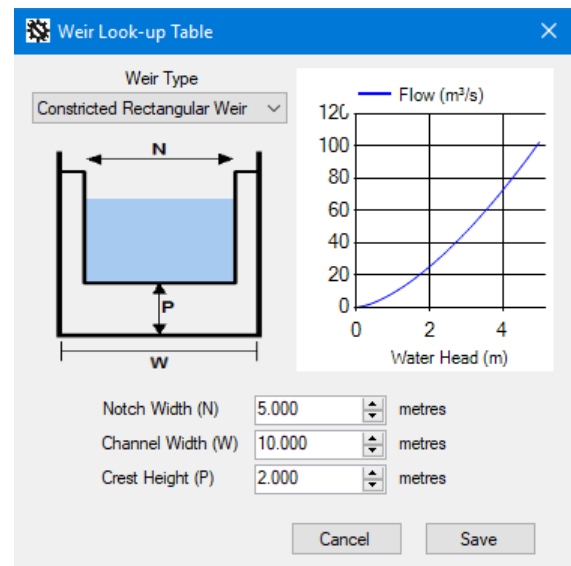
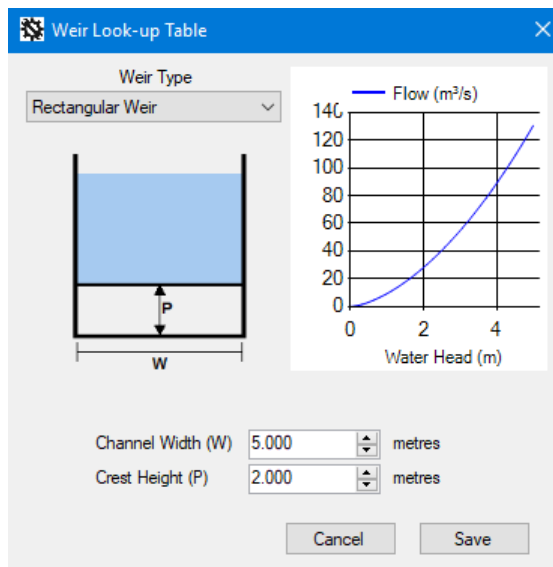
3 options are available.



Enter the measurements required, according to the selection made.

When finished, click on “Save”.





For a weir of a different shape to the above options, but where the “depth to flow” characteristics are known, they can be entered in tabular form.

Change the selection to “Depth / Flow”.

Then click on “Create New Table”.

Open Channel Flow Set-up

Conversion table: Depth/Flow

Depth: Ch 1

Buttons: Create New Table, Edit Table

Open Channel Flow Set-up

Conversion table: Depth/Flow

Depth: Ch 1

Buttons: Edit Table

Enter the Depth / Flow characteristics.

(There will be no flow until the crest is reached, then flow will increase with increasing depth).

Click in the box labelled with a dot to add a new line.

Click any other box to edit.

- The depth must be entered in mm.
- The flow rate must be entered in m³/s.

(Using one of the standard weir shapes, described earlier, IDT calculates and produces such a table from the entered geometry).

When finished, click on “Save”.

Note: To complete the logger setup (logging of datapoints), add a new logging channel and use ‘FlowOCH’ as the Input Sensor.

Table Editor

	Depth in channel (mm)	Flow in channel
▶	0	0
*		

Table Editor

	Depth in channel (mm)	Flow in channel
	0	0
	100	0
	200	0
▶	300	0.002743084
	400	0.008399513
	500	0.01807222
	600	0.03246019
	700	0.05229231
	800	0.07785564

Buttons: Delete Row, Load, Cancel, Save

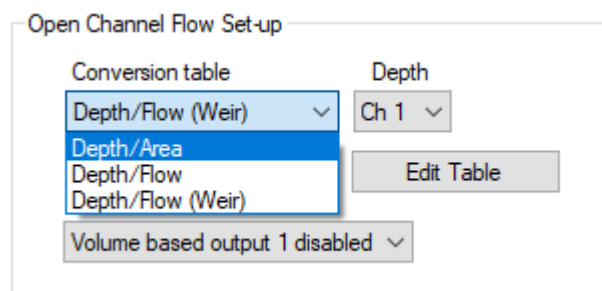
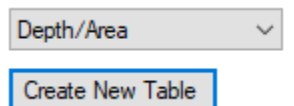
6.1.2 Flow of water through an open channel (using depth & velocity sensors)

If the depth sensor (e.g., SonicSens 3) is used with a logger that **also** has a means of measuring the velocity of the water (via another sensor), the flow can be calculated.

Flow (i.e., volume) = (cross-sectional area of water) x (velocity) x (time).

In the Open Channel Flow Set-up panel, select a Conversion Table of "Depth / Area".

Then click on
"Create New Table".

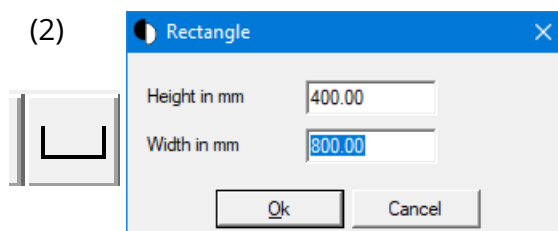
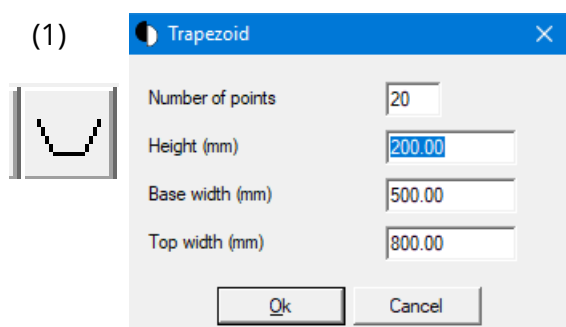


The cross-sectional area of the water depends on the shape of the water channel and the depth of water. Depth of water is also affected by any sediment in the channel.

The cross-sectional area of the channel (which should also be where the velocity is measured) can be input in graphical form, which is converted to a table. Channel shapes can be built-up from basic shapes stacked on top of each other.

For instance, the shape below consists of a trapezoid plus a rectangle.

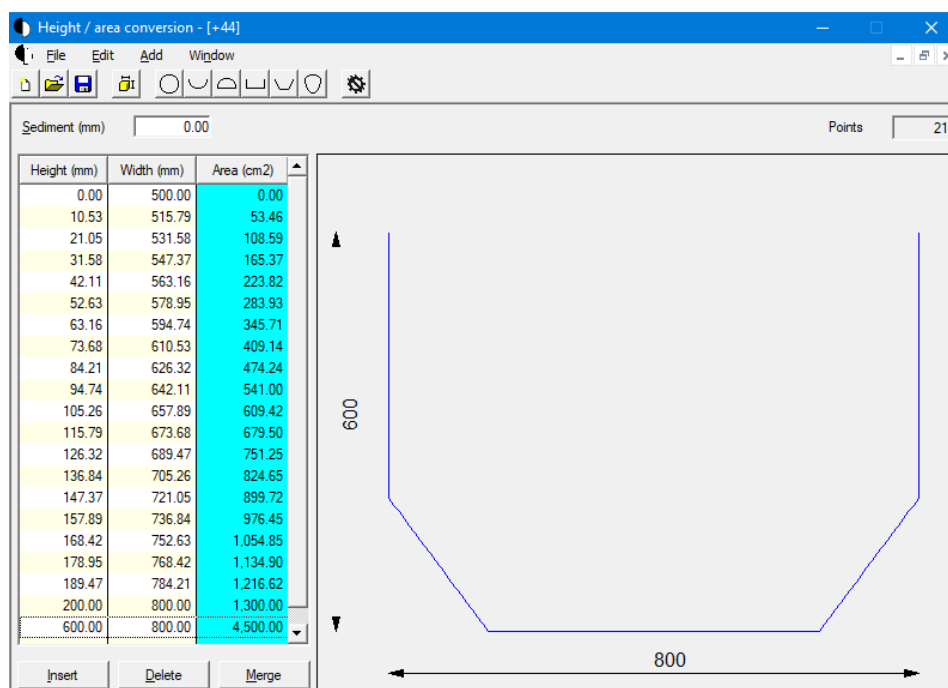
Enter the lowest part of the channel first, followed by subsequent changes in shape to build up the over-all shape of the channel.



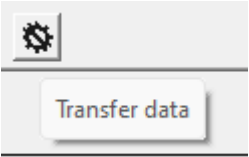
The table is automatically completed from the shape and dimensions. It can be further adjusted by inserting lines or deleting lines from the table. The cells with height and width data can be edited.

A sediment depth can be added to reduce the area.

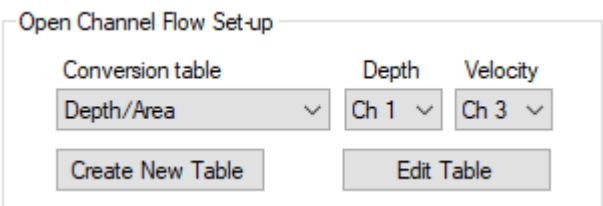
The cross-sectional area description can be saved to the PC if required, for later use.



The cross-sectional area table must be saved to the logger using the “Transfer Data” button/icon.



Complete the setting by choosing the logging channel number that is recording the velocity measurement (i.e., Ch 3, in the example shown).



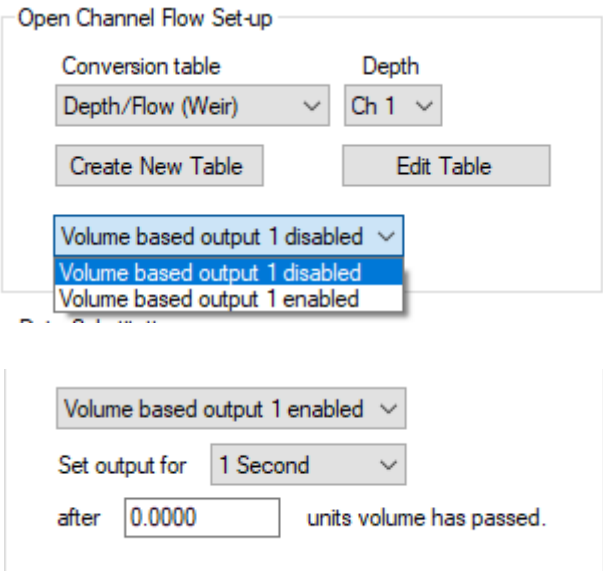
Note: To complete the logger setup (logging of datapoints), add a new logging channel and use ‘FlowOCH’ as the Input Sensor.

6.1.3 Volume-based pulse output for an Open channel

Where supported by the logger model, it is possible for the logger to generate a pulse of 1-20s duration on an output of the logger. The timing of the start of the pulse is based on a set volume of fluid being measured. The pulse repeats each time the specified volume of fluid passes. The output pin can be used to activate external (unspecified) equipment.

For loggers supporting this feature, the volume and timing of the pulse can be set as follows:

In the Open Channel Flow Setup panel,
Select “Volume-based output 1 enabled”.



Set the required pulse duration and the number of units of volume required to pass to activate each pulse event.



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