User Guide: IDT (app for mobile devices) - Logger User Interface.

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.

TABLE OF CONTENTS

1 PART 1: ----- 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 latter. Any subsequent reference to "IDT" within this manual will refer only to the mobile app version.

IDT is currently available on mobile devices employing the Android and also iOS operating systems (from the Google and Apple corporations respectively).
Where the manual uses the phrase "mobile phone", it implies the use of any mobile / cellular device with suitable functionality.

This manual uses screenshots from an Android-based device. Some small differences in appearance or operation may exist between Android and iOS devices. The user interface uses controls that are widely used on each device; the user should find familiar.

Note: The system periodically has new features and changes released, thus you may observe slight changes in pictures from those shown in this manual.
Most users will be able to automatically download updates of the app from the usual app download servers.

Note: Your chosen tablet or mobile phone device may present the information slightly differently in layout or appearance. When your device is being used in landscape mode, information may be shown using additional columns.

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

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

Most HWM logger devices supported by the app 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 generic logger device, but some distinction between the logger groups may be included to help the user to determine whether the text is relevant (or non-applicable) to their logger.

Acknowledgements:

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1.2 LOGGER DEVICES SUPPORTED BY THE IDT APP

The IDT tool is designed to support a variety of HWM products. This user-guide covers its use with logger products. However, not all sections will apply to every logger, as the

functionality will vary from one logger family to another. The loggers can be loosely classed into three different groups:

Group 1: Basic loggers. These are designed to be left on site for basic logging operation. When the task is complete, the user returns to extract the data from the logger using the IDT tool.

Group 2: Loggers that include a modem that can be used communicate to a remote sever. These loggers have the ability to periodically call into the server to automatically deliver their data. The loggers can also be programmed to monitor logger input channels for specific conditions, and (when met) trigger an event. The event can be used to start-up other activities within the logger.

Group 3: Loggers that also include a modem but offer some alternative features to the 'Group 2' loggers. The alternative features sometimes require different setup steps.

Note: The grouping of loggers is for the purpose of this user-guide only and has no other significance.

The IDT app can be used with the following logger families (Group 1):

- LoLog 450, 500, Vista

The IDT app can be used with the following logger families (Group 2):

- (Not currently supported)

The IDT app can be used with the following logger families (Group 3):

- COMLog2-IS
- ISLog
- Multilog-IS
- Permanet-SU
- StopwatchGSM

1.3 SYSTEM OVERVIEW

The IDT app (Installation Diagnostic Tool) is installed onto a mobile phone, or similar device. It uses a Bluetooth radio link to communicate with compatible HWM logger devices (Group 3 loggers), but for other loggers a communications cable will be required. The app provides a graphical user interface for the purpose of Setup, Installation, Diagnostics, and Testing of a HWM logger.

HWM logger devices produce data. The data needs to be obtained from the logger in order to be viewed. For 'group 1' loggers, the data is obtained manually. For the other logger groups, the logger is usually 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 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 various formats, some more meaningful way than just tables of raw data.

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

- DataView (includes a General-purpose graphical data view)
- 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 authorised to use the system. The central server can similarly provide an authentication service to the IDT app in order to verify that a user is registered on the system and has suitable permissions to access the settings of a logger.

Alternatively, the user can view logger data locally using the app and the mobile phone display, but features are limited in comparison to use of a logger device with a server.

Logger devices are normally partially pre-configured for use within the factory, with the user 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 links that bind a logger to a site can be manually configured (by an administrator) or partially automated by the use of another app by the installer (e.g., the HWM deployment app).

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 may 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 task of logging does not stop during any communications.

Some loggers include 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.

The loggers are powered by a non-rechargeable battery, which implies their service life is limited before the battery must be replaced. The installer should bear this in mind

when making any changes to settings; keep tasks to the minimum required in order to give best battery life.

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. For loggers with a modem, 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 feature is not supported by 'group 1' loggers).

The loggers (except those in 'group 1') 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 to the server, which often has the facility to fork the message and send it to multiple users.

1.5 LOGGER SECURITY: SECURE AND UNPROTECTED MODES

(Note: This feature is not applicable to 'group 1' loggers or 'group 2' loggers).

At the time of leaving the factory, the loggers will be pre-configured to the requirements of the customer, including any *security settings*. The logger can include a setting that determines whether it operates as either a "Secure" or "Unprotected" device. The loggers can communicate their security requirements to the IDT app. The setting will influence the cooperation of the device with the HWM IDT App tool.

When required, this manual will refer to a logger as being either a "secure" or "unprotected" logger.

The "Secure" mode restricts unauthorised users from making changes to the logger settings and or accessing logged data.

Secure loggers:

- Must be correctly registered on the Datagate server with appropriate ownership settings.
- Require the IDT user to successfully authenticate with the Datagate server (periodically).
- Block connections from unauthorised IDT users.

Unprotected loggers:

- Do not require registration on the DataGate server to be used with IDT.
- Can be connected to and have settings modified by anyone with the IDT app. (The user can implement a measure of security by programming the device with a user-defined PIN number; Factory default units need no PIN to gain access).

Loggers set as “secure” therefore require DataGate (or a compatible server) for IDT to operate with them.

1.6 Activating the Communications Link

Group 1 loggers:

These loggers have a communications interface that will require a cable. The communications link is automatically activated when both ends of the cable are attached and IDT is used.
(Note: The connection requires a tablet; it is incompatible with a mobile phone).

Group 3 loggers:

The logger will include a Bluetooth radio interface, used for short-range communication. The IDT app similarly utilises the Bluetooth radio interface of a mobile phone for communications. No communications cable is required.

For the IDT app to communicate with logger devices, both ends of the Bluetooth communications link must be active.

Refer to section 2.4 for details regarding activating the mobile phone side of the link.

Since the radio interface uses power but is infrequently needed (it is only required when someone is attending to the logger on-site) it is normally on standby and has to be activated for temporary use. Refer your logger user-guide for specific details.
If communications is lost during the use of IDT, it may be due to the logger deciding the radio link is no longer being used and putting it back into standby; Re-activate the link if required. Another explanation is that the mobile phone is out of range of the logger, and the installer should keep the two devices closer together.

Where several loggers are within radio range, the user will need to select one using IDT.

1.7 Preparing a Mobile Phone (or similar device) for use with IDT

The HWM IDT app is available for both Android and iOS-based mobile devices.

The examples used in this guide will show an Android device, but similar methods, views and behaviour will exist using an iOS (Apple) device.

The mobile phone must have Bluetooth-Low-Energy (BLE) compatibility, GPS, and Internet capability.

1.7.1 Installing the HWM software (IDT App and HWM Deployment App)

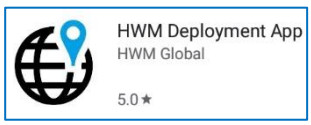
The mobile device (for 'group 3' loggers) or tablet device (for 'group 1' loggers) must be prepared by installing the HWM "IDT" app.

On an Android device, scan the QR code (shown opposite) or search for "HWM global" using the "Play-Store" application. Select the "IDT" app and install it.

"IDT" is the "**I**nstallation and **D**iagnostic **T**ool" for various HWM loggers.

Note: The IDT app can employ the use of the "HWM Deployment App" for collecting and uploading details of logger deployment to the DataGate server, so this may also be installed.

On an Android device, scan the QR code (shown opposite) or search for "HWM global" using the "Play-Store" application. Select "HWM Deployment App" and install it.



For iOS-based devices, the Apple App store can be used to obtain the above two apps, or scan the QR codes shown below:

Note: For Apple / iOS, the IDT App can only be used with loggers from 'group 3'.

IDT App

Deployment App

1.8 LOGGER CHANNEL TYPES AND DATA INTERPRETATION

The IDT app has an *adaptive user interface*. For example, although it can be used with several types of logger, it recognises the logger type that it is communicating with and adapts the content of its screens so that it presents only the options relevant to the

logger model in use. Similarly, it presents only options that make sense based on any previous setup selections.

A typical logger model family may have many possible configuration options, but only certain options will be fitted for a customer order. These will have the appropriate electronic interfaces, including any connector options, built into the unit during its manufacture.

Some interfaces are single purpose, and both their functionality and channel allocation are fixed. These will have only a few setup steps. ('Group 1' logger input interfaces all behave like this).

The installer (as part of channel setup) also has to set the logger to interpret the data into its real significance (i.e., what each measurement represents).

Other electronic interfaces are multi-purpose in nature. For these, the logger has to use an appropriate software driver to make an interface work. The combination of both an electrical interface and a software driver put together form a "channel type". During manufacture, the logger will include (factory-only) settings that define what channel-types are built into the unit. IDT uses this information to adapt its display to show only relevant and sensible options to the user.

Sometimes an electronics interface can support several alternative types of channel (each requiring a different driver). The user can make just one selection from the set. IDT will subsequently exclude the other options from being available; the interface use has been already committed.

When the logger makes readings from an interface, it obtains data. Data is simply a numeric value. IDT provides a means to identify a specific stream of measurement data; this is done by assigning an outgoing "channel number" to each data stream.

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.

1.9 Logger setup requirements for use with a DataGate server

When a logger is set up for use in conjunction with the DataGate server, there are certain requirements for inter-operability between them. These include:

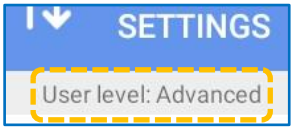
- All loggers must be previously entered into the DataGate system (registered using their SMS number and linked to a dummy site) by an 'Admin' user.
- Loggers that are listed within 'group 1' have additional administrative requirements for identifying them; refer to the logger user-guide for further details.
- Loggers having modems (i.e., those from 'group 2' and 'group 3') must be set up to be able to communicate with the DataGate server, using appropriate credentials.
- DataGate and the logger must agree on the way data is presented to the server.
    - Channel numbers in use and the channel content from the logger must agree with the expectations of the server, in order to correctly receive and process the data.
    - Number formats and the units of measure in use must match between logger and server.

2 Using the IDT App / Modes of use

2.1 IDT – User-levels

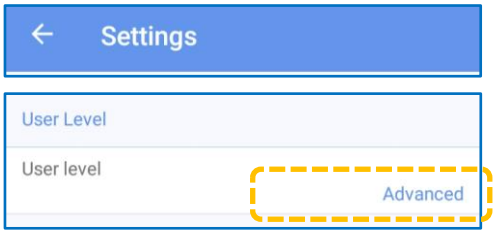
IDT can be set to various user-level "views" including:

- "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.



Both user-levels are available and can be selected within the app from the Settings screen.

To change, navigate to the settings screen and tap the 'User level' line.



2.2 IDT - Modes of use

IDT may be used in two modes of operation:

- Operated *with* the use of the DataGate server.
  IDT refers to this as the option to "Log in".
- Operated *without* the use of the DataGate server.
  IDT refers to this as the option to "Log in without DataGate".

Using IDT *without the DataGate server* removes access to some of the capabilities of IDT:

- The user is not required to authenticate themselves with a username and password.
- A regular internet connection is not needed since there is no communications from IDT to any server during use. (IDT requires occasional internet connection for obtaining any updates, including obtaining updates for the logger firmware).
- The user will be unable to manage or access the data of secure loggers (applies to 'Group 3' loggers only).
- The user will be unable to store the logger data on the server for future reference (applies to 'Group 1' loggers only), although the user can share data via the clipboard or e-mail.

Using IDT *in conjunction with the DataGate server* adds certain requirements for use and gives the user access to the comprehensive functionality of IDT, including:

- An internet connection is required initially for the authentication process and also at other times for communication to the server.
- The user is required to authenticate themselves with a username and password.
- Logging in gives the app a token which enables IDT to be used for up to 48 hours, after which the user is required to log in again.
- The User and loggers are required to have been setup on DataGate correctly to give the required permissions, such as logger ownership.
- The user is given the ability to manage secure loggers (as well as unprotected loggers). (Applies to 'Group 3' loggers only).
- IDT can retrieve data from loggers and upload it to a server for storage.

A list of the loggers you have permission to access to is also transferred at login time; this is also required for the HWM Deployment app, in order for it to record changes in the logger location into the DataGate database.

2.2.1 Use of IDT without Logging in

It is possible to use IDT without going through the login process, but restrictions will exist, (see also section 2.2).

('Group 3' loggers only). It will not be possible to see any secure logger, only unprotected ones.

Note: It will not be possible to go through the deployment process (using an app to record site installation details) *without* logging into DataGate.

After the initial splash-screen (which shows the IDT logo), the user will have the option to either log in or select to use the app without DataGate. If the user chooses to "Log in without DataGate", the app will, in future, bypass the "Log In" page.

Note: Bypassing the log-in page still allows app communication with unprotected loggers. These can be set to communicate with DataGate if so desired. It is simply *the app* that does not communicate with DataGate.

If you have selected the "Log in without DataGate" option, skip to section 2.3.

2.2.2 Logging in and initial actions

Locate the IDT icon and launch the app.

The initial screen is shown.

After several seconds, the “Log In” screen appears.

After launching the app for the first time, the Log In screen has to be configured to point to the correct server.

Tap the settings control.

Type the URL of the DataGate server being used. (This will be provided by your system administrator).

To verify the server details are valid, tap on “TEST CONNECTION”.

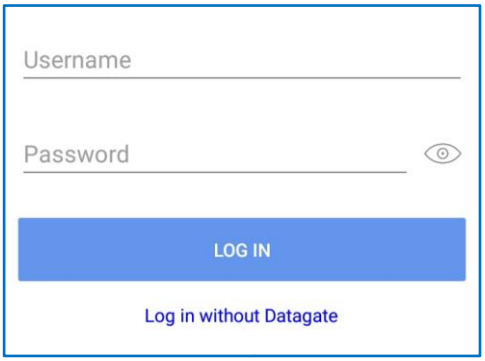
This tests the URL, to verify it is valid and that a server is reachable using the entered details. It does not authenticate the app or its user for using the system.

Ensure the “Connection test successful” appears.

Tap the back-arrow to return to the Log In window.

Enter your DataGate username and password for your mobile phone app.

Password visibility can be turned on using the view control.



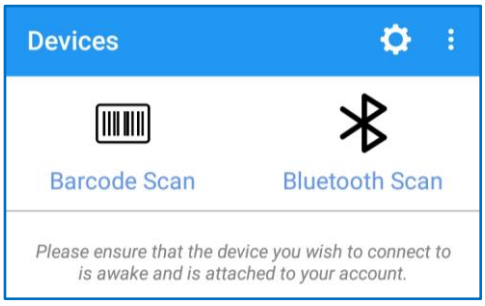
Tap the “LOG IN” button, and the app will attempt to log into DataGate as an authenticated user.

Following a successful login, DataGate downloads some information to the IDT app.

Note: The Username is case-sensitive.

2.3 DEVICES (INITIAL SELECTION SCREEN)

If login and authentication was successful, the app will show the “Devices” window.

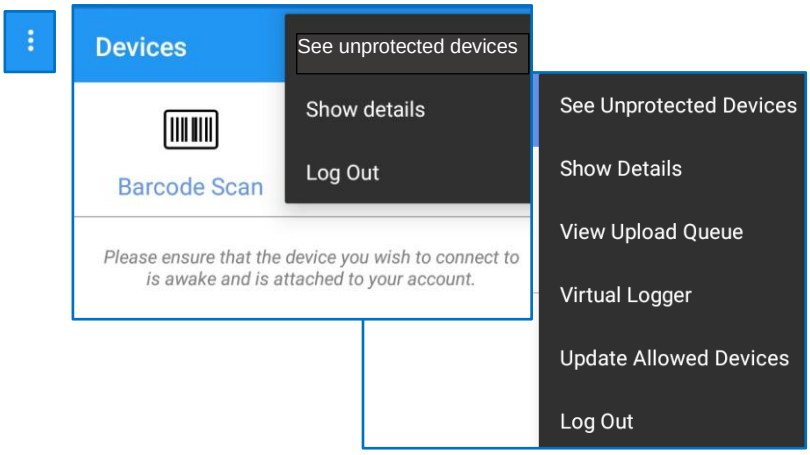


(This will also be shown if you have previously selected to use the app without DataGate, as in section 2.2.1).

(‘Group 1’ loggers only).
When a tablet is directly connected to an IR Reader, the initial Devices selection screen will also show a “USB Connections” area which lists the IR Reader.

Note: Tap on the options control to access an options menu.

(The menu can vary).



2.4 SELECTING A LOGGER DEVICE

Three methods exist to select the logger that IDT should communicate with:

- Connection via a cabled connection (wired selection). See section 2.4.1
  (This is available on ‘Group 1’ loggers only).
- Bar-code scan (automatic selection). See section 2.4.2.
  (This is available on ‘Group 3’ loggers only).
- Bluetooth scan (manual selection). See section 2.4.3.
  (This is available on ‘Group 3’ loggers only).

If using a logger from ‘Group 3’, select and un-pack the logger and ensure its communications link has been activated (see section 1.6, and the relevant section of the logger user-guide). The logger will broadcast its presence over the Bluetooth radio link.

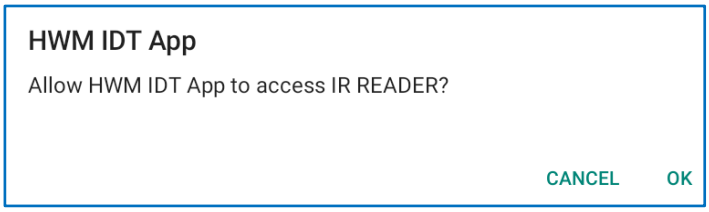
2.4.1 Wired Selection

(This method can be used for a ‘Group 1’ logger that uses a USB port of a tablet to connect with a cabled connection to an IR Reader).

Position the IR Reader over the logger you wish to connect to.

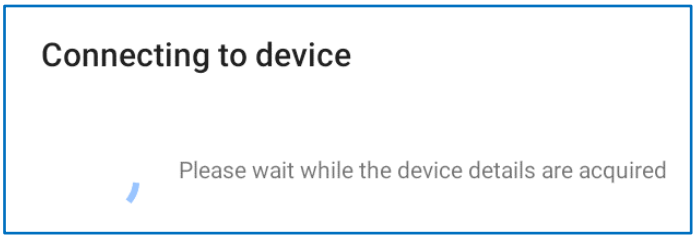
From the IDT Devices screen, tap the “IR Reader” line.

Give permission for the IDT app to use the IR Reader that is attached.



Wait for a few seconds whilst the IDT app reads the logger program and status via the IR Reader cable.

(If the connection to the logger is successful, the app will load the main options screen, as shown in section 3).

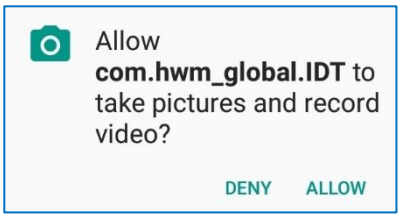


2.4.2 Automatic Selection using barcode scan

From the Devices window…

Tap the “Barcode Scan” icon.

The app may request permission to use the camera for photos and video.
Tap on ALLOW.



The phone’s camera will activate, and the phone will display what is within its view.

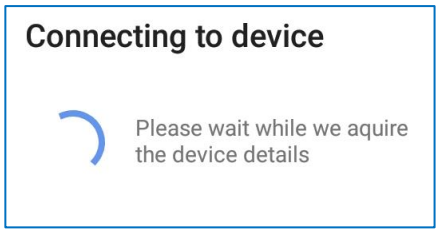
Locate and view the logger barcode using the camera. The red line in the displayed image should be positioned over the barcode.

The app will continuously attempt to read the bar-code, changing focus settings until it comes into clear view.

When the phone reads the barcode successfully, it will check that it has permission (a serial-number match) to use the logger. If it has no permission, it will not move from the barcode scan window.

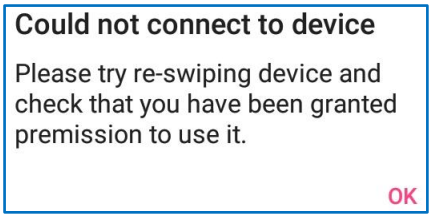
IDT next confirms the logger is physically present by trying to detect it. It therefore starts a scan and looks for Bluetooth devices in the area.

If it finds the logger signal, it connects with it.



If the logger device is not discovered, an error message is displayed. (The phrase “re-swiping device” means to re-activate the logger’s communications link).

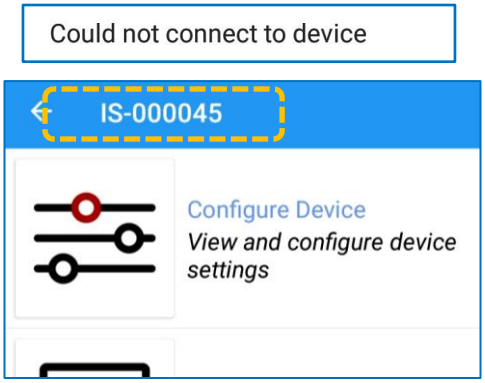
Follow the guidance message and then tap OK.



If the logger radio link disappears, you may get an error message … re-activate the logger communications link and try again.

When successful, the identity of the logger is shown, along with controls to access various options.

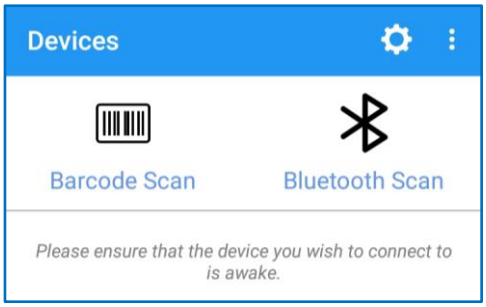
This is the main options page.



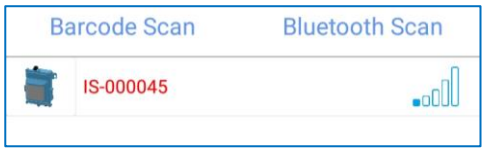
The IDT app automatically communicates with the logger and obtains its configuration and settings. (Skip to section 2.5)

2.4.3 Manual Selection using Bluetooth scan

From the Devices window… Tap the “Bluetooth Scan” icon.



A scan will commence and list some of the Bluetooth-enabled logger devices found. The scan can pick up several types of logger, as long as they are within communications range.



Your logger can usually be identified by comparing with information on its label (e.g., serial number).
If your logger is not listed, try re-activating the logger communications link.

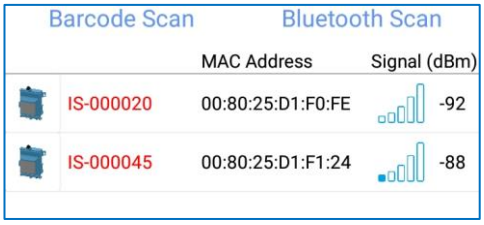
If you are not using DataGate:

- All loggers you have access to appear in black text.

If you are logged into DataGate:

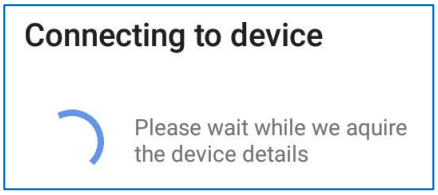
- Secure loggers that you own are listed with black text.
- Unprotected loggers that you "own" (on DataGate) are listed with red text (providing "show unprotected devices" is selected from the local menu).
- Loggers that you do not own are not listed.

Note:  Use of the options control gives the ability to *show details*: MAC address (Android only) and dBm.



Confirm (using the serial number) the correct logger device is listed on IDT.

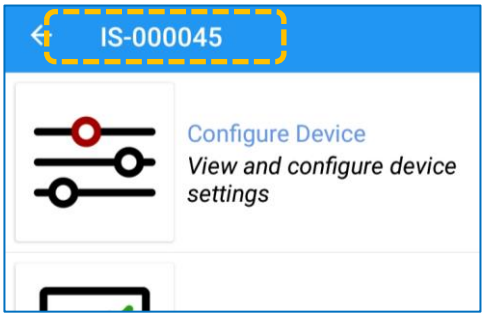
Tap on the line to select it. IDT will connect with it.



The identity of the logger is shown, and IDT displays some graphical controls that give access to the various options.

This is the main options screen.

The IDT app automatically communicates with the logger and obtains its configuration and settings.

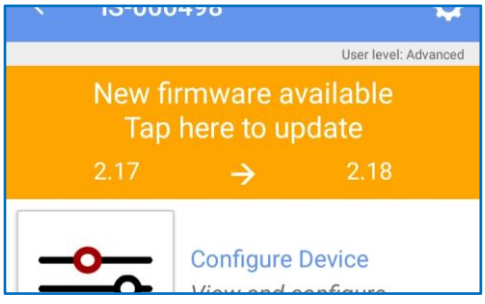


2.5 Logger Firmware Update

New software releases (firmware) for loggers are occasionally released from HWM.

Before reaching the main options page, IDT automatically checks the existing logger firmware version. If a newer one is available, the user will be offered the option to update the logger using the file saved in the phone. This is recommended.

Tap the "New firmware available" line to start the upgrade, which takes approximately one minute.

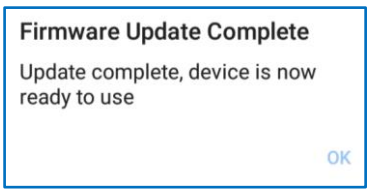


(Note: The IDT App does not support this facility for 'Group 1' loggers).

Progress is shown.

(Loading → Restarting Device → Firmware Update Complete).

The main options screen is then shown.

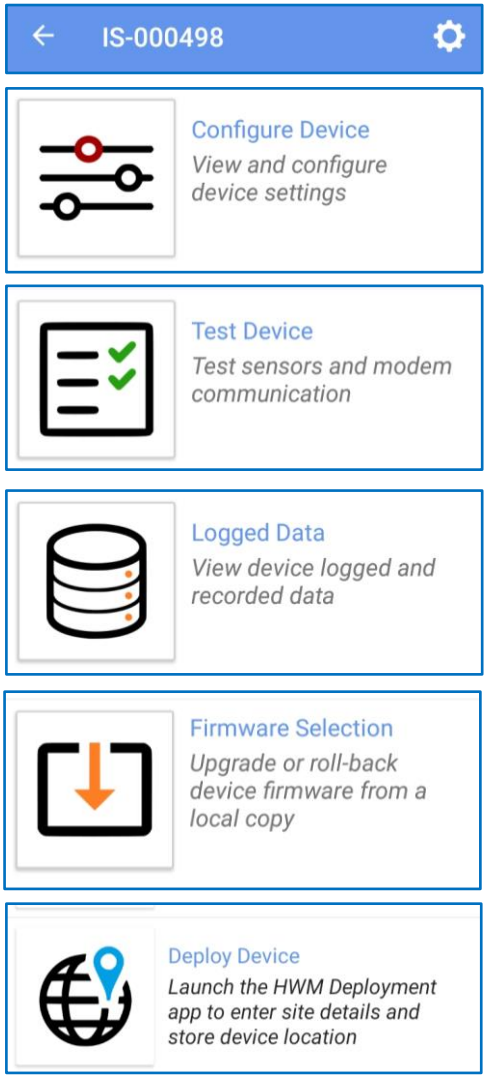


3 IDT – MAIN OPTIONS PAGE

The main options page is shown below.

This page functions as a menu. Selecting an option on this page will open up a new sub-page with further options.

Controls are displayed for the user to select how they wish to use IDT app:



Configure Device:
The user can use the app to check the device configuration (settings) or re-configure the device.

Test Device:
The user has access to some tests, to be able to confirm the logger device is operational within its installed environment.

Logged Data:
This shows when data is present. The user can access measurement data held within the logger device.
(Access is temporary; data is not stored by the app).

Firmware Selection:
The user can modify the device firmware.
(Roll-back is rarely used, only if advised by HWM)

Deploy Device:

Note: This option is only available when IDT is used with DataGate.

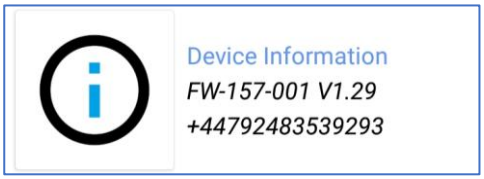
Tapping the Deploy Device option will launch the HWM Deployment app and passes details of the logger to it. The user is able to record the installation location of the device.
(The HWM Deployment app is then used to complete the task of selecting the site of deployment and an administrative update of the DataGate system).

3.1 DISPLAYING LOGGER DEVICE INFORMATION

3.1.1 ID information / Telephone number (SMS)

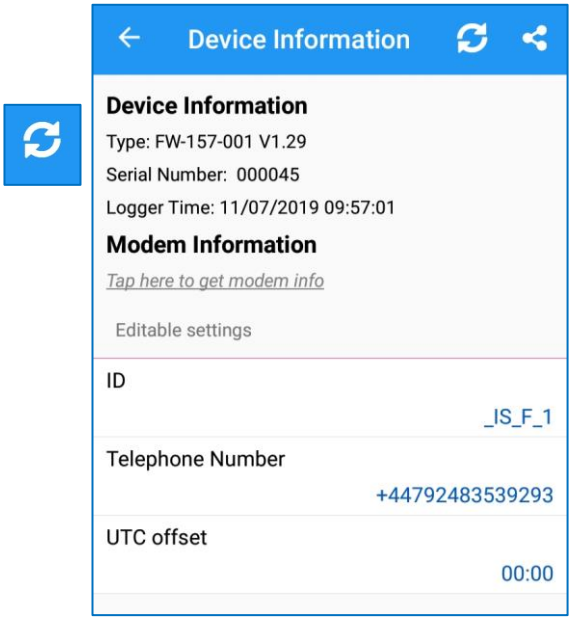
From the main page, tap on the "Configure Device" selection.

A new menu page will open with various configuration options. Select "Device Information".



A new page will open with a read-only area showing various logger parameters, including the firmware version, serial-number, and its current time.

The refresh symbol on this page updates the displayed Logger Time.



(The Logger time can be used to check the UTC offset has been set correctly; see section 3.1.2).

The 'settings' section allows the user to:

- (Optionally) input a unique identifier in the ID field.
- Modify the "Telephone Number" of the logger.
  Note: This acts as an identifier of the logger to the DataGate system, so **caution** should be taken.
  Only modify this field if advised by HWM.
  (Modification of this field is not permitted by IDT for some loggers. For 'Group 1' loggers the field may even be blank).

The logger telephone number displayed (also known as an 'SMS number') is not read from the SIM card but has to be independently programmed into the logger memory.
Where applicable, it should match the number that appears on the logger front-panel label, (see example opposite).

The telephone number is usually pre-programmed into the logger by HWM prior to shipping and should remain unchanged. This is the case even if the SIM is changed.

3.1.2 Time-zone (UTC offset)

The logger communicates to DataGate using the global time reference, (called "UTC"; Coordinated Universal Time).
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 by the user by tapping the "UTC offset" line.

For 'group 3' loggers, when a user adjusts the UTC offset, the setting does not *immediately* change the displayed "Logger Time". The update only takes effect after the logger next calls into the server; the server then changes the logger's time. This allows

the server to be able to correctly interpret logger timestamps during any UTC offset change.

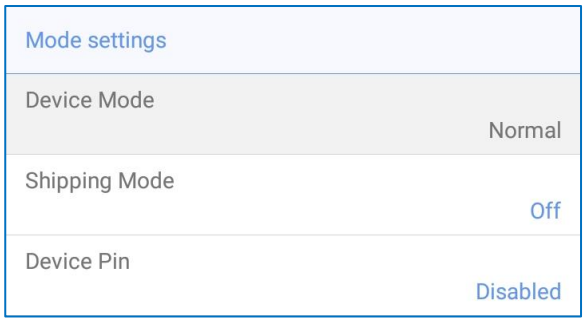
E.g. If your local time is 4 hours behind UTC / GMT then set this field to " - 04.00".

3.1.3 Logger mode / Security PIN

(Skip this section if using a 'Group 1' logger; It is not applicable).

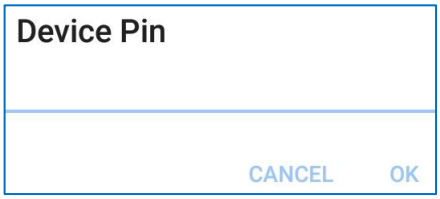
The "Mode Settings" area contains miscellaneous controls that affect device operation.

Device Mode should be "normal"; this is unavailable to edit for most users and is password protected.



Shipping mode is used to render the device inactive and is used for shipping the unit and for long term storage. (Refer to section 6.1).
If 'shipping mode' is 'off', the logger will be in a recording state.

Device PIN gives the user the option of setting a user-defined PIN on an Unprotected device.
Tap on the line if you wish to set a PIN.
The PIN can be up to 8 characters in length.
Once set, IDT will not allow access to the device without a valid PIN being entered.
If you forget the PIN, the device can only be recovered using a HWM Master PIN; the PIN is unique to each device.



3.1.4 Status (Logger recording status)

(This section is applicable to 'Group 1' loggers only).

The "Status" line indicates the recording status of the logger.

Here, the logger is indicating that it is "stopped".
(This state is often used for long-term storage and for shipping the logger in an inactive state).

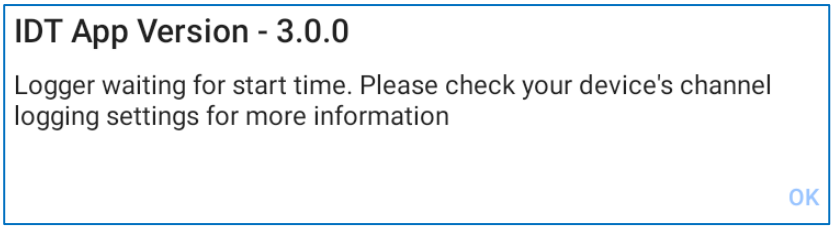
To change the current state of the logger, tap on the "Status" line.

The logger status will change between:
Stopped → Waiting → Recording (... and → Stopped, if required).

If changing from the 'Stopped' status, IDT will write the program settings back to the logger and then cause the logger to re-start.

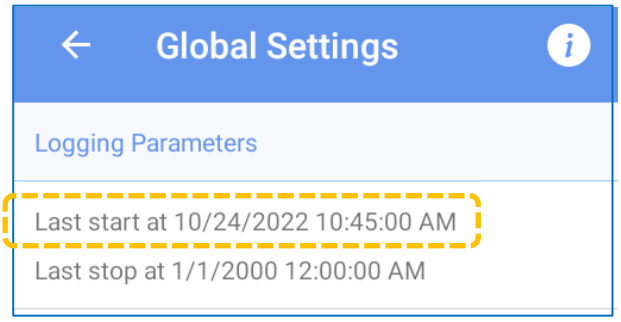
After the logger has been re-started, it initially goes into a state of 'Waiting', usually only for a short interval.

Once in the 'Waiting' state, tapping the Status line will refresh the displayed information and display an advisory message if still waiting for the start time.



The standard logger behaviour is to commence logging at the earliest possible time, but it must start at a suitable '15-minute' time boundary. (E.g., If restarted at 10:26 the logger will not start until 10:30 or 10:45).

The expected start time can be checked on the Global Settings page (see section 3.3).



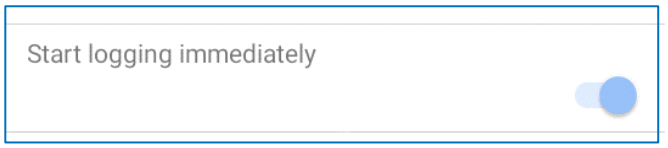
Upon reaching the start time, the logger will move into a state of 'Recording' and begin its regular repetitive program cycle of measuring from sensors and logging the results.

Note: Tapping on the Status line when the logger is in a recording state will put the unit into a "stopped" state, suitable for long-term storage. Collect any required data from the unit before doing this.

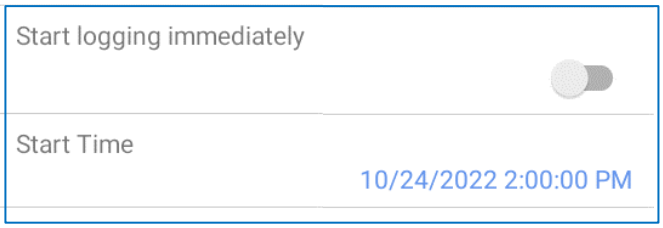
Every time a change is made to the logger program, it is immediately uploaded to the logger. For changes that affect the channels, or the log period, the logger will also undergo a re-start. The most common practise is for logging (data recording) to begin immediately, although this can be deferred to a later time if required.

To defer the data recording start time, navigate to the Global Settings page.

The standard logger behaviour is to commence logging at the earliest possible time, by setting the "Start Logging Immediately" slider control to 'on'.



If the logger re-start is required to be deferred to a later time, move the slider to the 'off' position and then set the required time and date for the data logging to begin.



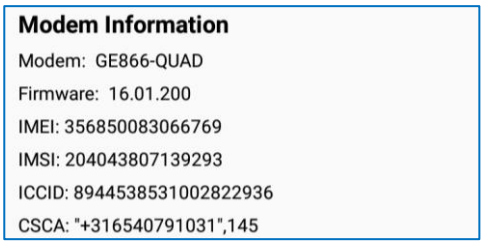
When programming a logger start time, it should be noted that the logger may move the time forward to the next suitable time boundary.

Note: A re-start of the logger deletes any previously stored data and begins storing fresh data. It is therefore important to retrieve any data from the logger prior to either stopping the logger or making any program changes.

3.1.5 Modem Information

(Not applicable to 'Group 1' loggers).

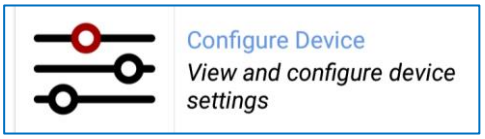
Modem details can be shown by tapping the "... get modem info" line.
These can be forwarded to expert users for assistance by tapping on the share control.



3.2 DISPLAYING / EDITING CALL-IN SETTINGS

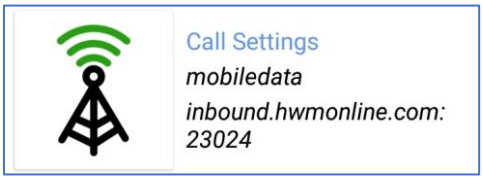
(Not applicable to 'Group 1' loggers).

From the main options page, tap on the "Configure Device" selection.



A new page will open with various configuration options. Select the "Call Settings" option.

The current call settings of the logger will be displayed.



Tap on any line to change the setting; the change is made to the logger immediately without having to confirm it.

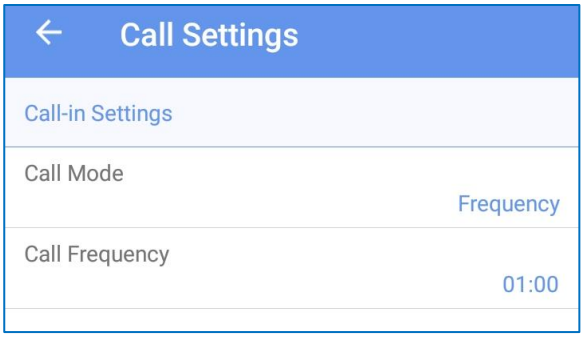
The page is divided into 4 areas of settings (1 for IDT in "Basic mode"):

- Call-in settings (also available in Basic mode) ; Refer to section 3.2.1.
- Data Destination settings ; Refer to section 3.2.2.
- SIM settings ; Refer to section 3.2.3.
- Modem settings ; Refer to section 3.7.1.

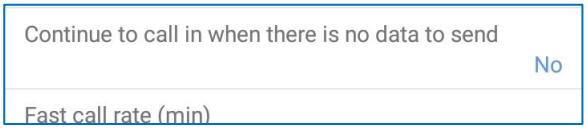
3.2.1 Call-in settings

The Call-in settings for an IDT user-level of Basic are shown opposite.

The Call-in settings affect when the logger calls in with measurement data.

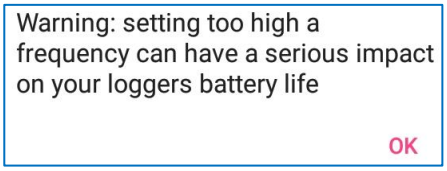


Additional settings can be accessed at a user-level of Advanced.



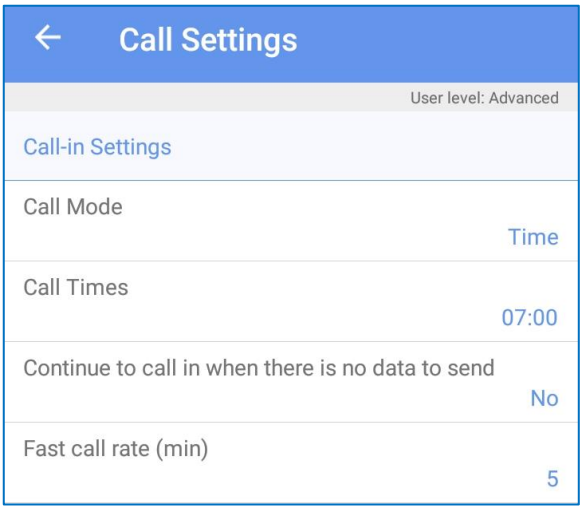
Note: These settings should be carefully chosen since every call-in uses some power from the battery.
To prolong battery life, keep the number of call-ins per day minimal.
3 calls per day (maximum) are recommended.

IDT provides some warnings and restrictions to limit very excessive call-levels being set by a user (e.g., at hourly intervals or less).



Call mode:

- Select "Time" to have the logger call-in at fixed times. (Then set the required call times).
- Set to "Frequency" to have the logger call in regularly after a set period of collecting measurement data. (Then set the required period between calls).



Continue to call when there is no data:

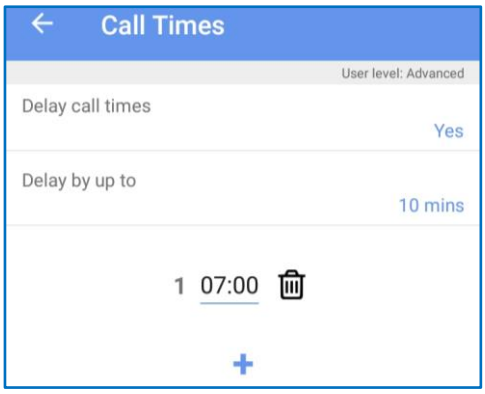
- This should usually be set to "No"; It is to save battery power.
  It takes effect when measurements are made infrequently; if there is no new (or unsent) data then do not call in.

If the logger is unsuccessful at the first attempt to call-in (e.g., the network is busy), it will re-try at the next earliest call time, until it is successful. A logger can send in data from several previous days if it needs to (e.g., if the data could not be sent because the site was temporarily flooded, and the antenna signal was degraded).

The selection method can vary according to what is call-mode details are being set (time or frequency). Tap on the part of the field you wish to change (i.e., hours or minutes), then make the adjustment.

When the Call-mode is set to “Time”:

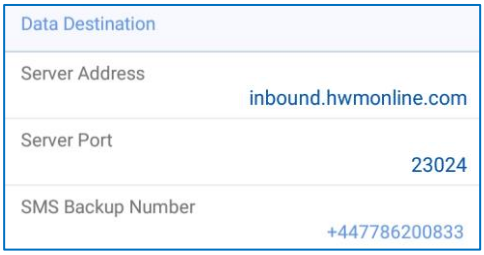
- Controls are available to delay the Fixed call-in times by a short random time; this can be used to reduce the peak load on the server.
- Fixed call-in times can be added. (Logger has a typical limit of 8).
- Fixed call-in times can be deleted.



When the Call-mode is set to “Frequency”:

- The logger calls-in at the chosen interval, starting at midnight.
- If less than 1 hour, the logger calls in hourly, and the minutes setting governs the time past the hour when the call-in is made.

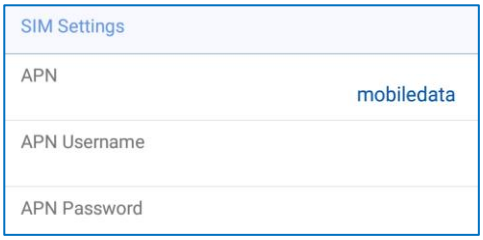
3.2.2 Data Destination settings



- Set the URL (sever address) and port number as required for your server.
  (Check with your system administrator).
  (Settings shown are for illustration purposes only).
- The SMS backup number is the telephone number that the logger can use to send messages to the server. (Settings shown are for illustration purposes only).
  The SMS (text message) service is a fall-back connection path only used if the internet cannot be accessed for some time. Not all loggers or SIM cards support the SMS messaging service.

3.2.3 SIM settings

- Confirm the settings match those of your mobile-network data service provider.
- Edit any that are incorrect.
  (Settings shown are for illustration purposes only).



The APN (Access Point Name) is the name of the gateway being used by the mobile service provider to access the internet. If required, enter a username and password.

3.3 TIMING INTERVALS FOR MAKING MEASUREMENTS

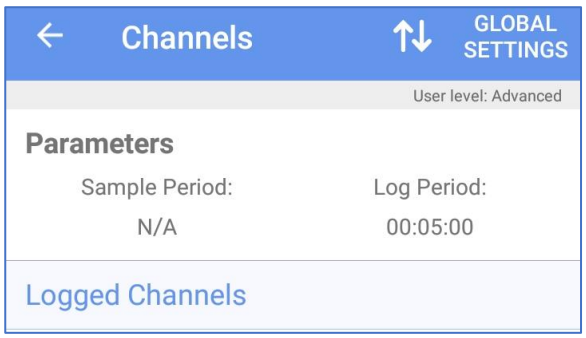
These settings determine what time periods the logger uses for its background activity of gathering data. (See also section 6.6).

From the main options page, tap on the “Configure Device” selection.

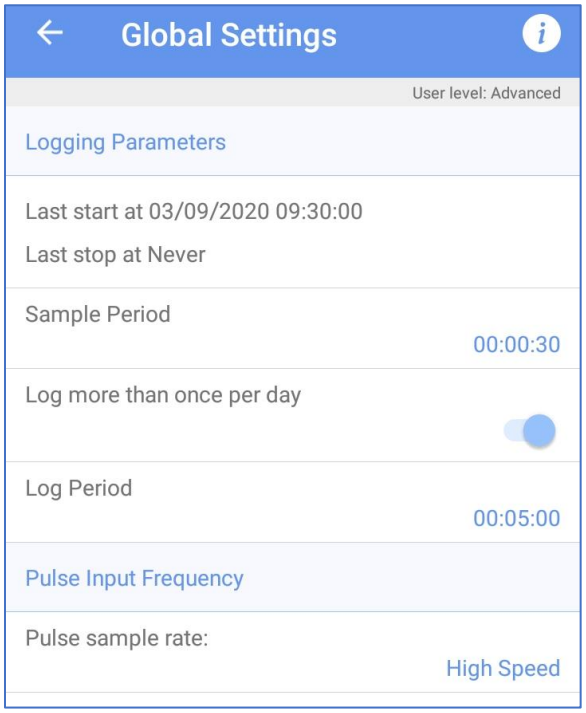
A new page will open with various configuration options. Select the “Channels” option. (Information displayed will vary with logger model).

The “Channels” summary page is displayed.

Tap on the “Parameters” line, or the “Global Settings” link.



A new page is shown, called “Global settings”.



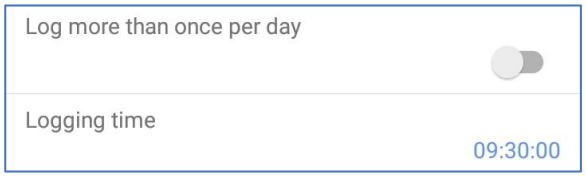
The page gives details of when logging was last started (or, if recently activated, is due to start).

The “Last stop” time will usually be a default value (as shown) unless the logger is currently in a stopped state.

There is a slider switch which determines if the logger “logs more than once per day” or if it produces just a single log value per day.

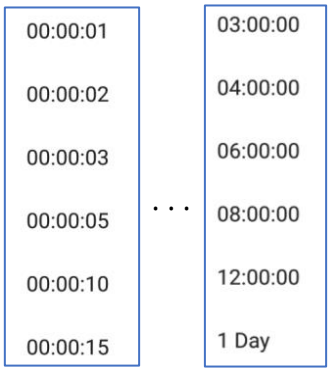
Most general-purpose loggers should be set to log more than once a day.

Note: When ‘once a day’ is selected, the time of measurement is additionally required.
(For ‘group 1’ loggers, there is no ‘Logging time’ field, and the logger will make and log a measurement at midnight).



The “Sample period” line will not be shown when the logger model auto-configures this, based on the log-period setting.

Where shown, “Sample Period” sets the time interval between making measurements on most of the interfaces.



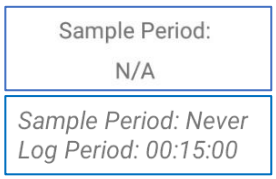
The value can be selected from one of the many available options.

The “Log Period” sets the time interval between storing values and is set in a similar manner to that described for the sample period.

The Log period must be a multiple of the sample period. If the user does not select an appropriate value, IDT will automatically adjust the input.

The data value stored is known as a "datapoint", normally produced at the log period rate. The value is formed by (optionally) applying some mathematical function on a set of raw data measurements (made at the sample rate); the samples obtained between the log period intervals.

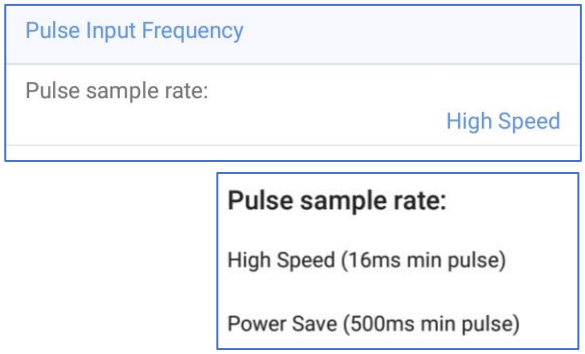
Note: "Sample Periods" for 'group 1' loggers are displayed as "N/A" or "Never" in IDT because it is adjusted by the logger software. Background sampling of the sensors still occurs so that the logger can make an accurate assessment of the average value between producing the datapoints. (The 'N/A' and 'Never' descriptions can therefore be disregarded).



Loggers with a pulse collection type of interface (e.g. digital flow interfaces detect and count pulses output from meters) have to respond rapidly to the input signals.

Pulse input interfaces are sampled at a much higher rate than regular channels and (except for 'group 1' loggers) have their own control for selecting timing.

Select the most appropriate setting based on the expected maximum pulse rate and also the minimum pulse-width.
Where appropriate, battery life can be extended with the "power save" setting option.



3.4 CREATING (OR MODIFYING) 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 1.8, 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. There is also some variation in the fields required dependent on the model of logger; 'group 1' loggers are relatively basic in design and less setup steps are required than for the 'group 2' and 'group 3' loggers.

Furthermore, 'group 2' and 'group 3' loggers can also use the measurement channel datapoints to derive indirect data streams (in the form of additional channels) or other indirect information. For example, a meter pulse input can produce:

- A stream of data measured *direct from the sensor interface*.
- A stream of *indirect data* derived the direct data stream.

Here, Meter pulses indicate consumption of a volume of fluid or gas.
Indirect data can be in the form of flow rate (when timed)
or a calculated meter reading (if the initial meter reading is known).

Examples will be given of the considerations needed and steps taken to set up a logger channel for typical sensors. This is for introduction purposes only; many sensors will follow a similar setup procedure. However, some sensors (or logger behaviour with the sensor) can be more complicated and require further discussion. (Refer to section 7 for further details of sensor setup).

The first example is based on an interface can detect if a switch is open or closed. A typical application of this interface is for the detecting output pulses from a gas or water meter. The logger input in the example will usually be labelled as either 'Flow' or 'Pulse', and IDT will similarly refer to the input by including 'Flow' or 'Pulse' in the description.

Note: The wiring of the interface will not be considered here. However, it is important to know the characteristics of the equipment that the logger is being connected to, since flow meters can have several "flavours" of output pulse signals.
e.g.:

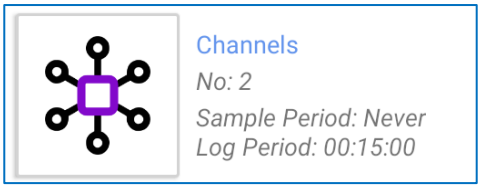
1. Uni-directional flow is represented by a single output from a meter.
2. Bi-directional flow can be represented (in several ways) by using two outputs from the meter, and therefore requires two signals within the input to the logger.

A typical gas meter has uni-directional flow, with a single pulse output. The rate of gas 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.

3.4.1 Example 1: Flow Channel (using a logger from 'group 1')

To check for the number of pre-programmed channels that the logger may have, refer to the "Channels" option line.

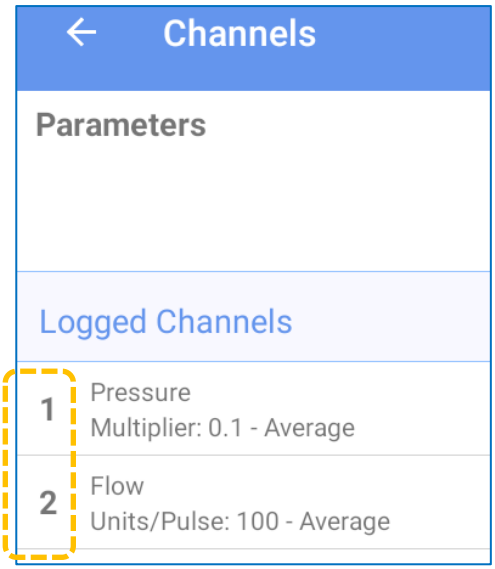
"No: 2", indicates that the logger has 2 channels set up.



To check what channels exist tap the “Channels” line.

The “Channels” page will open.

A summary of the channel settings is shown below the “Logged Channels” line.

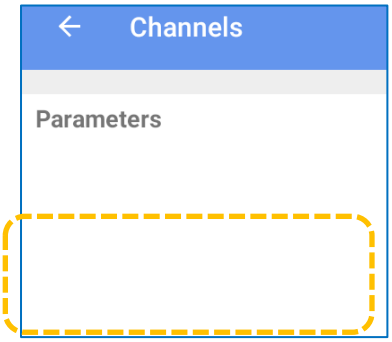


The numbers on the left are the assigned channel numbers for the data streams. (On ‘group 1’ loggers these cannot be changed from factory settings).

Tap a line if you wish to view more details or to edit the settings.

When a logger has no channels set up, there are none shown in the “Channels” page, nor is there a “Logged Channels” line. (See blank area in the diagram opposite).

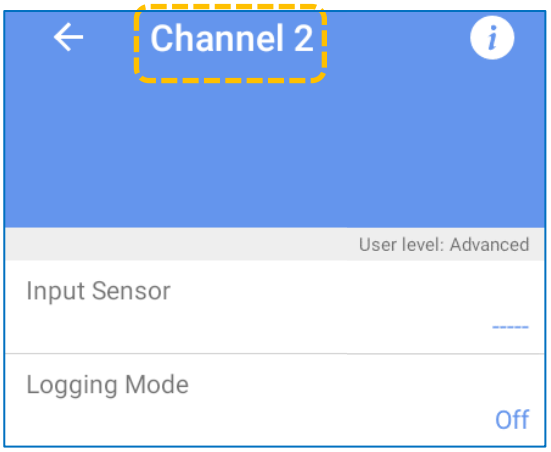
The channels can be added, as per the instructions that follow.



From the “Channels” page, Tap on the “ **+** ” symbol. (The symbol is blue if a channel can be added, but grey if no further channels are available).

A channel number is allocated for the data stream, and a page is loaded with the current settings.

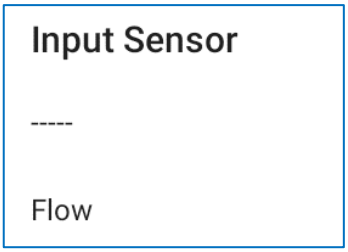
Initially there is no Input Sensor selected. (Shown here as “-----“, the channel is disabled).



To select an electrical interface for an input sensor, tap on the “Input Sensor” line.

A pop-up box is shown on the screen for the user to select which input to use for this channel. (Here, the logger offers either to disable the input, or to use a “Flow” sensor input).

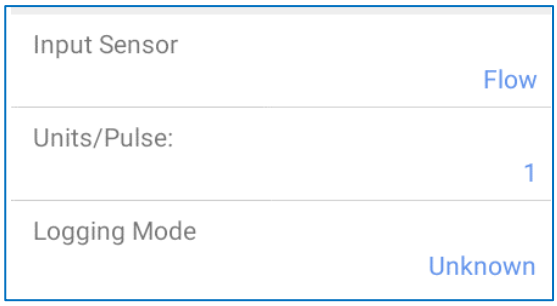
Tap on the Flow line to make the selection.



Note: Where a 'group 1' logger has an unused interface, the related channel can be temporarily disabled (removed) to reduce battery power consumption and the saving of zero/null or erroneous data. Select '-----' to remove the channel.
For 'group 1' loggers the channel can be easily re-enabled by adding it back, as described in this section.

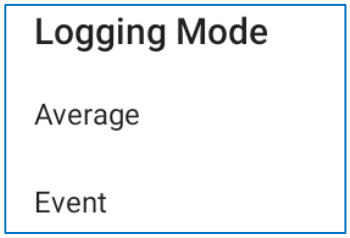
The input sensor of "Flow" has now been selected.

(For operational details of the interface, refer to the logger user-guide).



Now select the logging mode.

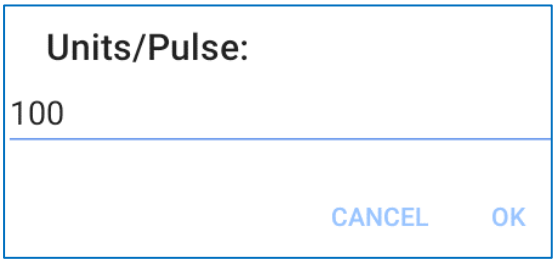
- Choose "Average" when connecting to meters that are producing frequent meter pulses.
- Choose "Event" when connecting to meters that are producing infrequent meter pulses.



Notes: "Average" counts pulses between log periods, and from that it calculates the flow rate.
"Event" 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.

The "Units / Pulse" field can be edited by tapping on the line and entering the appropriate value.

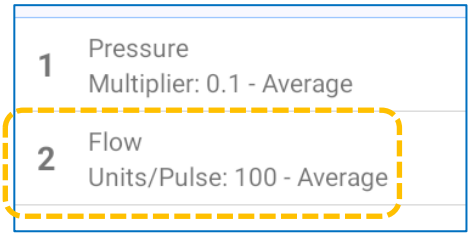
(E.g., If you wish to record consumption in litres, and the meter generates one pulse per 100 litres consumption, then set this field to "100".
Tap on OK to confirm the change).



Tap on the "accept" button to commit the changes to the logger.

IDT will take a few seconds to modify the program settings within the logger. It will then re-start the logger, so the logger will be making a new recording; This is required because the operation of the channels has been changed.

Tap the left arrow to return to the Channels screen, and check that the channel is now present and has correct settings.



For setup details of other channels, refer to the relevant sub-section within section 7.

3.4.2 Example 2: Flow Channel (using a logger from 'group 3')

A gas meter pulse represents a volume of gas that has travelled through the meter.
To accept the meter pulses, the logger is required to have a suitable interface. On some loggers, the interface that handles pulse inputs may be labelled as "Single Bidirectional Flow" or "Dual Unidirectional Flow" or similar. For other loggers, interfaces may be unlabelled, but their type can be found from examination of the model-number of the logger (refer to the logger user-guide if required). They are often supplied as a pair of pulse input pins on a single connector. IDT will refer to each of these as a ***pulse input***.

Setup of the channel is like the method described in section 3.4.1, but the logger offers more flexibility with the use of the pins on the connector. The setup of the interface therefore requires more steps (see also sections 7.4 and 7.6). Once the installer has made selections from the options, the logger then uses the most relevant driver with the chosen settings.

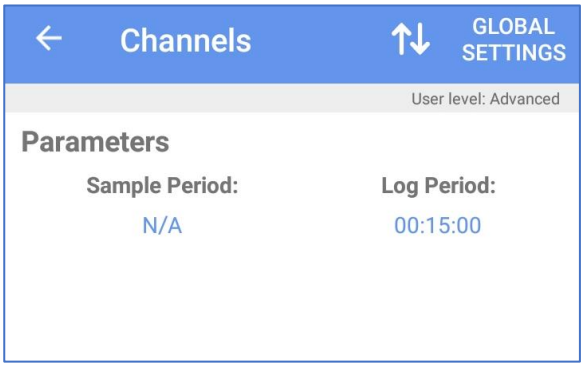
When set as a flow channel, the logger will count the number of pulses obtained on specified pins during a fixed interval of time; this will be repeatedly logged.
If the logger has the option enabled in the factory, an up-to-date meter reading can also be obtained (if the initial meter reading is entered) by accumulating the total number of meter pulses.

Tap the Channels icon to begin setup of a channel.

("Combos: 0" is a summary of the total number of programmed 'combos' that exist, here '0').

A summary of any channels and trigger-action combos (discussed in section 3.5) that are already configured is shown on the page.

(Here, the list is empty).

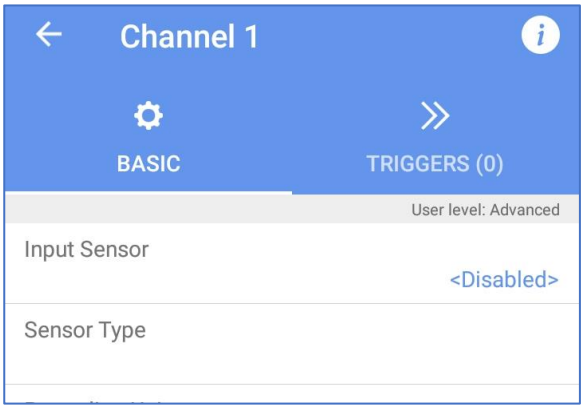


Tap the " + " line to add a new channel.

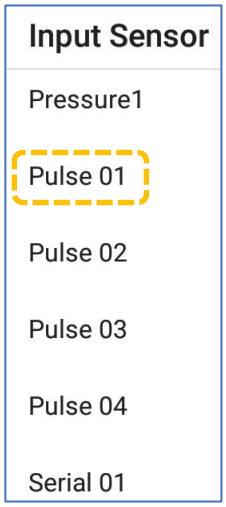
The new channel is enumerated by IDT; here it is channel "1". (Outgoing channel numbers are not fixed but need to match DataGate expectations).

There are two tabs; select the "BASIC" tab.

Tap the "Input Sensor" line.
(Currently, it shows "<Disabled>"; it is unconfigured).



A pop-up selection box appears listing all installed sensor interface options.



Notes:

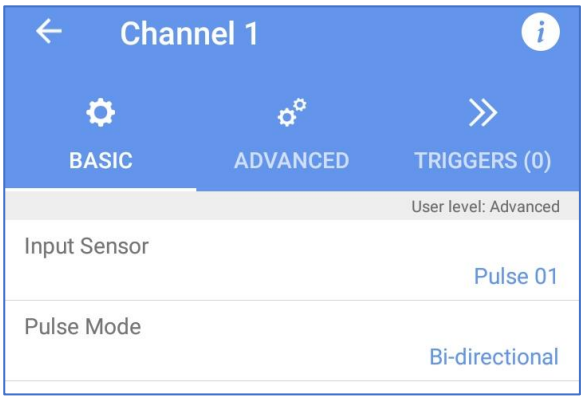
- The list will show available interfaces.
  (It will vary according to logger model-number and also any requirements specified at the time of the logger being ordered).
- Selecting "<Disabled>" will delete any current configuration of the channel, including any calibration data.

For this example, (a uni-directional gas meter), a uni-directional flow sensor will be required; this uses only 1 pulse input pin.
Select a Pulse pin from the selection list by tapping it. (e.g., "Pulse 01").

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

The screen updates to show the selected interface.

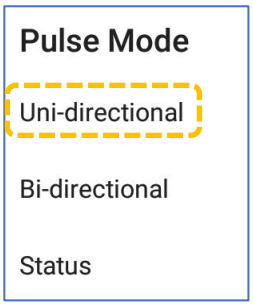
For this particular type of interface, multiple software driver options exist, and hence a new setting line is displayed, "Pulse Mode".



Tap on the Pulse mode setting and select from the available options.

For this example, a uni-directional flow sensor is required.
Therefore select "Uni-directional".

This selection commits the relevant pins of the interface connector for a specific use. In this example, the software driver will count meter pulses that appear across the relevant pins of the connector.

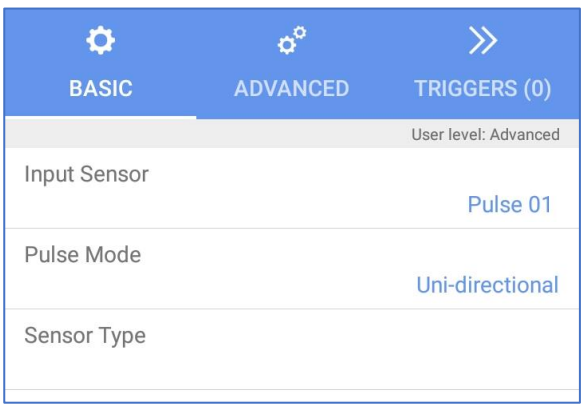


The selections made are shown in the channel configuration screen.

The software is now prepared to count pulses but has no idea of whether it is measuring the flow of electricity, water, or something else.

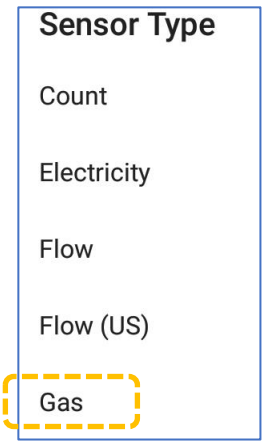
The next steps are to identify what the pulse count is representing.

Tap on the "Sensor Type" line.



A list of options is presented.

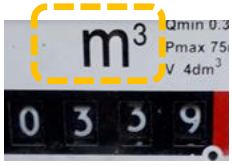
Select the type of measurement being made.
(In our example we are measuring gas. … Therefore, choose “Gas”).

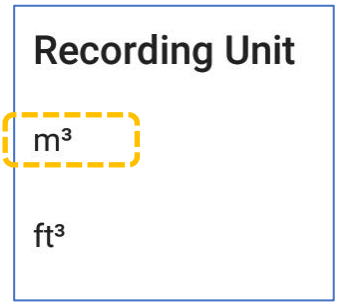


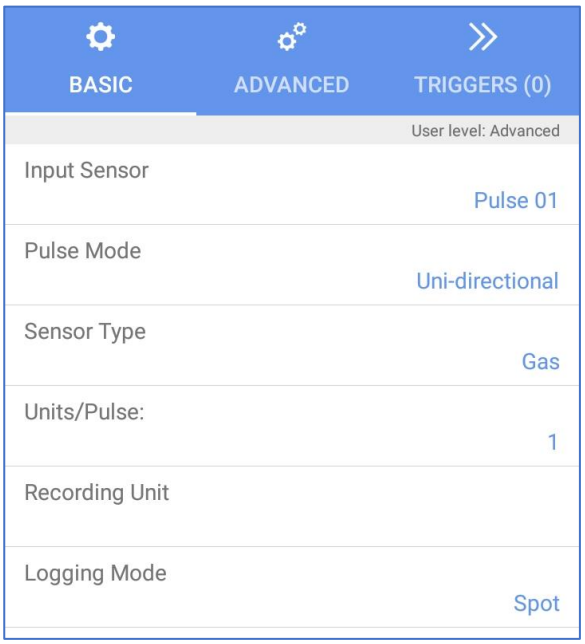
Next tap on “Recording Unit” and select a unit of measure from the list.

(Units of measurement listed will vary according to earlier-made selections).

(In our example this has to match the units used by the specific gas meter installed. e.g., m^3 for the meter shown opposite).







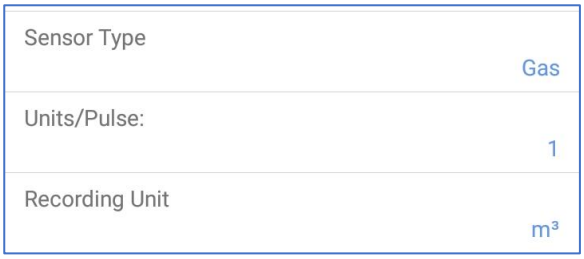
A relevant calibration factor for a gas-meter is units per meter pulse. (Other types of equipment may require a different type of calibration factor).

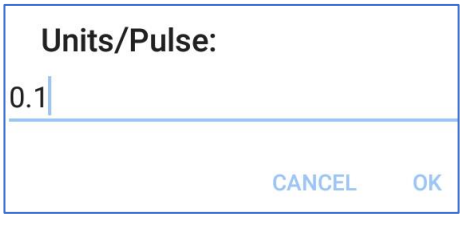
Tap on “Units/Pulse”.

This selects the pulse significance of the meter.

Enter the correct setting based on the equipment you have attached the sensor to.

e.g. If the meter pulse represents 0.1 m^3 of gas, the units/pulse should be set to 0.1.

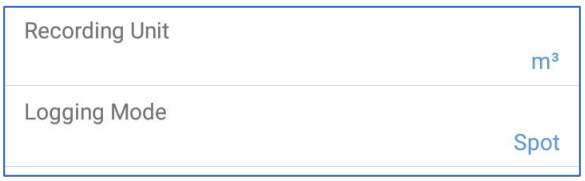


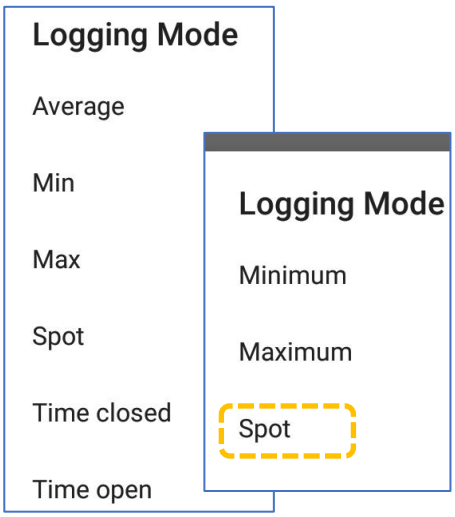


(By repeatedly counting the number of pulses from the meter over fixed time periods, the logger is able to determine the flow rate through the meter).

Next select the required logging mode.

The available options depend on what is being measured.





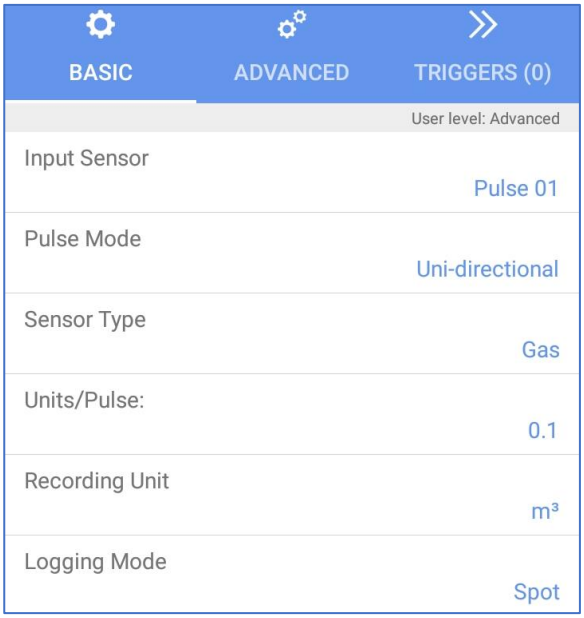
For example, “Average” will produce a datapoint (logged data) that is an average of the measurement samples it has made since it last produced a datapoint.

However, for a gas flow measurement, the shown options are less. (IDT presents only useful options based on any previous selections).

For a gas 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.

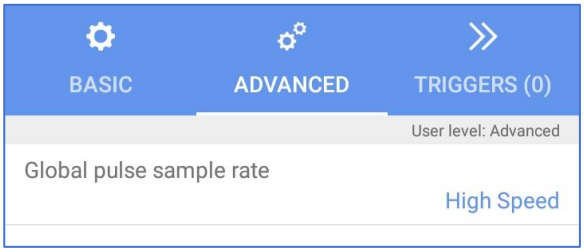
The completed settings are now shown within IDT but have not yet been saved.

Tap the “ACCEPT” button.
IDT will save the channel settings to the logger.



Select the “Advanced” tab.

Check the selection within the “Global pulse sample rate”. (“Global”, here, means that the selection is a single setting *applicable to all pulse channels* within the logger).



Select the fastest sample rate needed by the set of pulse channels in use.
(The setting may be changed here, or on the “Global Settings” screen; see section 3.3.)

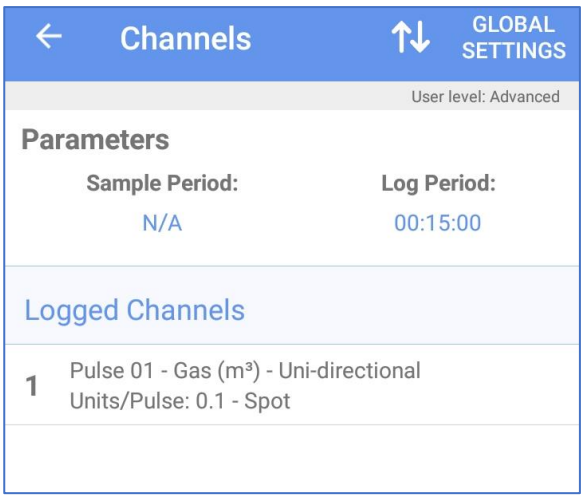
Tap the “ACCEPT” button; IDT will save the channel settings to the logger.

Then tap the “back” button.

The channel is now set up and will appear in the Channels list.
("1" shown here represents channel 1. Datapoints will appear as the outgoing Channel 1" data stream sent to the server).

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

(To edit settings, tap on the relevant line).



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

- Because the context of the channel use is connection to a gas meter, additional options become available for a logger to be used in that application…
- 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 Uni-directional flow (Pulse input) channel.
- The logger may offer the ability to regenerate meter pulses on an output channel. This allows the pulses to be passed to other instruments using a logger output interface. Enable this feature if required.

For further information refer to section 7.6.

3.4.3 Channel Swap Utility

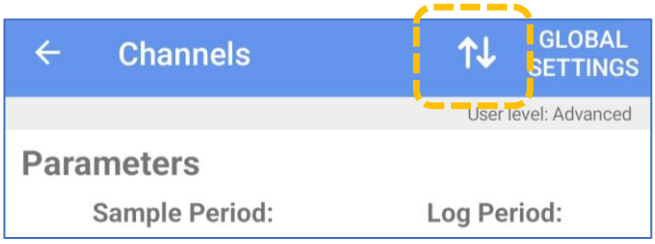
(This feature is not available on loggers from 'group 1' or 'group 2')

If a logger has several channels set up, but they are incorrectly numbered (e.g., If DataGate requires the data to be allocated to different channels), the IDT app has a utility to swap two channels over, thereby re-numbering them.

The IDT app handles all the required re-programming related to the channel swap, including any trigger-actions that may be set up. Calibration of the sensors is not affected by the channel swap.

Navigate to the Channels page.

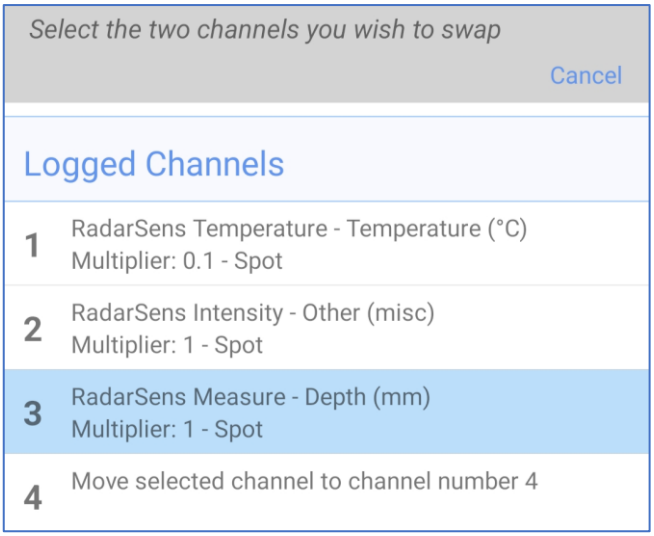
Tap the channel swap control (up and down arrows).



Tap on two lines to select the two channels you wish to swap over.
(The selected channel lines will be coloured).

(The option to move to an unused channel is also available).

The IDT app will re-program the logger to swap the channel numbers over.



3.5 SETTING TRIGGERS AND ACTIONS FOR A CHANNEL

(Skip to section 3.6 if using a 'Group 1' or 'Group 2' logger; Triggers and Actions are not applicable).

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-Actions can now be created.

A "Trigger" is a monitoring function within the logger. It monitors for a single condition or combination of conditions to occur on the data produced by selected channels. If the condition(s) are met, the logger can be set to take one or more actions (e.g., inform the server of the event, thus indicating a potential alarm condition).

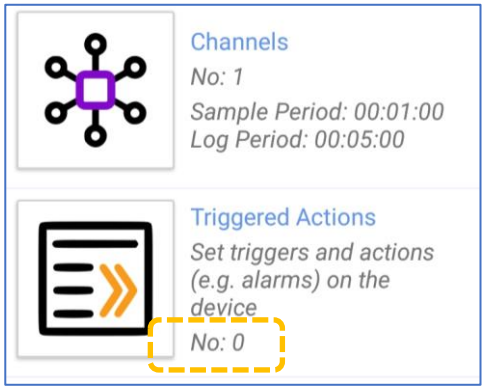
The conditions being monitored are referred to as a "Trigger" by IDT. Any subsequent action is referred to as an "Action" by IDT. The Trigger-Action(s) are sometimes referred to as "combos" (short for "Combination").

Within any trigger-action combo, either a *single condition*, or a *set of several conditions* can be used to evaluate the trigger result. Where multiple conditions are set, Boolean logic functions (AND or OR) can be applied.

This section will use an example of setting a trigger-action for a sensor.

3.5.1 Example 3: Introduction to Triggers and Actions

A channel has been set up, with samples and datapoints being obtained as summarised in the diagram opposite.



Trigger-actions are summarised with the number currently set within the logger being shown on the bottom line. The logger has no trigger-actions set, as indicated by "No: 0".

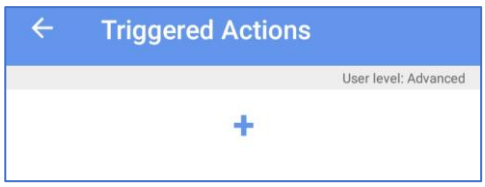
The requirement for our example is for a trigger to be setup, looking at the data from a sensor using channel 1, and used to inform the server (send an alarm message) for when the trigger condition is met. Similarly, we wish to inform the server (send an alarm clear message) when the trigger condition is no longer met. We require the trigger to be activated at a value of 50 or more and to be removed at a value of 40 or less. Both messages are required be sent immediately.

3.5.2 Setup of conditions for TRIGGER *start* and *end*

To setup the trigger action, tap on the "Triggered Actions" line.

This page summarises any existing trigger-actions.
It also gives edit-access to any listed action.
(Currently none are set).

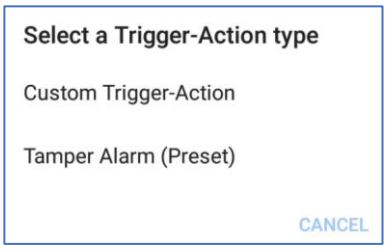
To add a new Trigger-Action, tap the " + " icon.



Then select a Trigger-Action type.

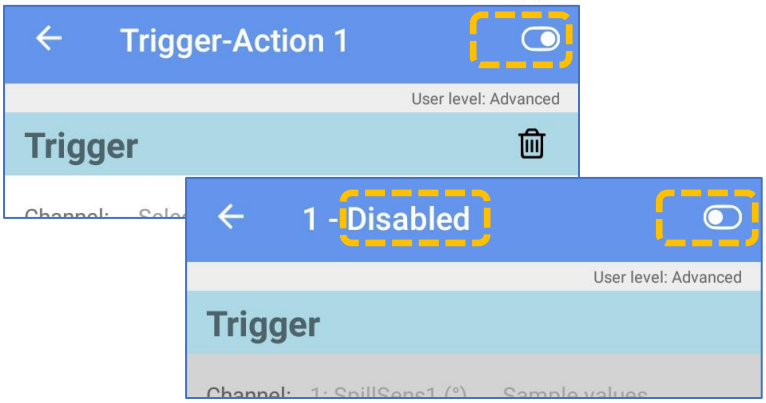
For our example, tap the "Custom Trigger-Action" line.

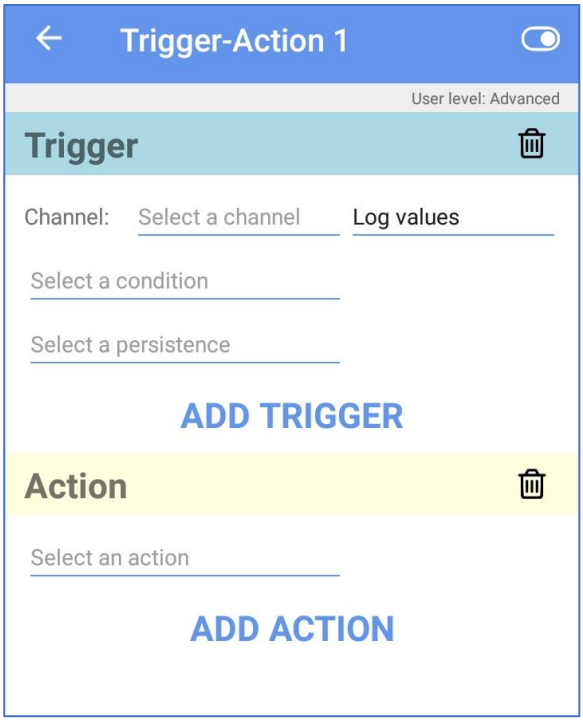
(Pre-set alarm types are also listed here but are not relevant to our example).



A Trigger-Action details page appears, which requires completion. Once completed, tap on “Save” to store the settings in the logger.

The slider-control at the top-right can be used to enable or disable a Trigger-Action.



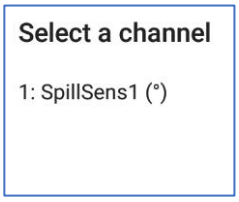


Set the triggering conditions, as follows:

Tap on the location which currently displays “Select a channel”.

A list appears showing all currently configured channels.

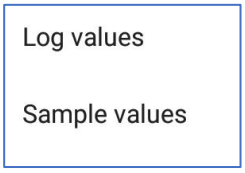
Tap on a line to select the required channel.

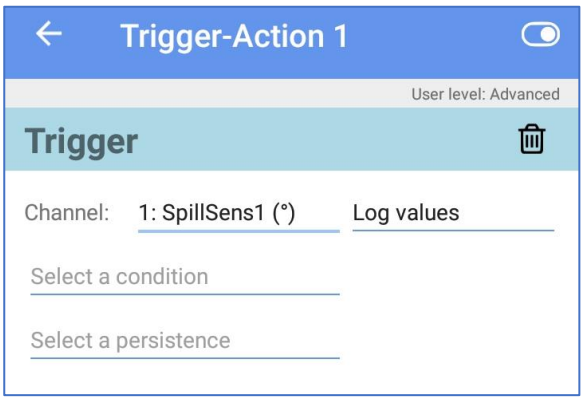


(In the logger used in this example, only one channel has been programmed; it is monitoring data from a SpillSens sensor, which produces angle measurement data).

The channel is selected.

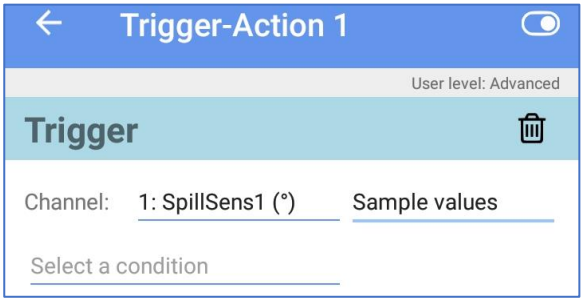
The data values being watched are, by default, the Log values; this can be changed to the sample values if required. (Tap on the value and make a new selection).



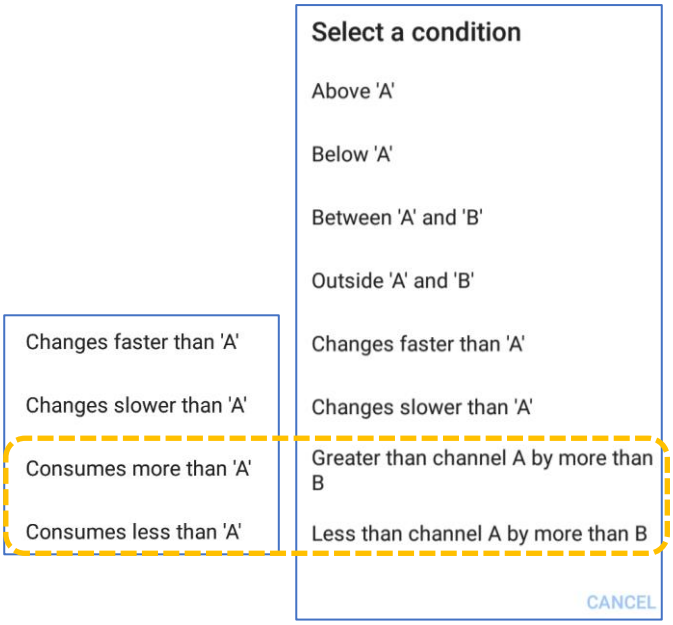


Tap on “Select a condition”.

Select a condition to monitor for from the available list.



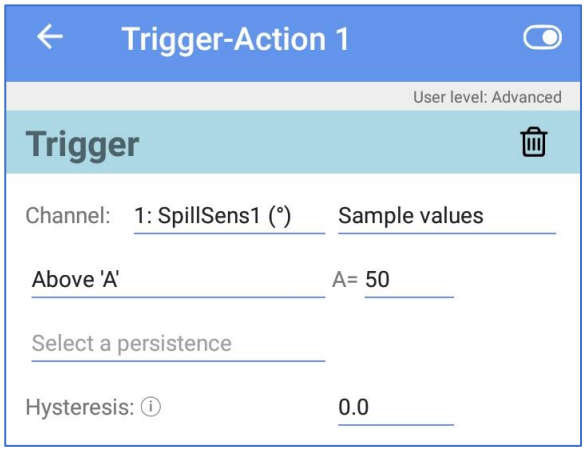
In our example, we wish to monitor for an angle exceeding 50°.
The appropriate selection is … Above ‘A’.



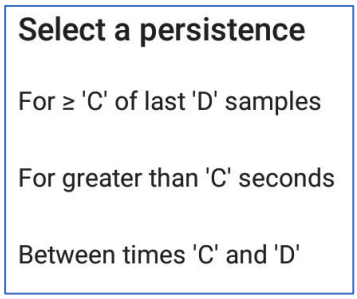
Note: IDT display content is adaptive.
The list can vary according to the type of channel or other settings.

Add the appropriate value threshold(s).

In our example, we want to trigger when the angle is above the threshold of 50°.
The appropriate selection is … 50.

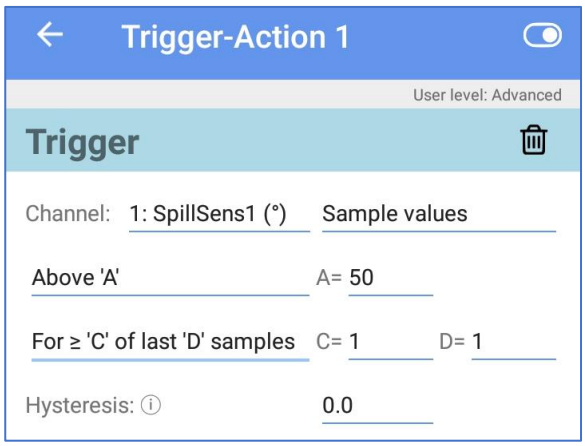


Tap on “Select a persistence”.
Then select the type of persistence that is required before the trigger condition is evaluated as true.



Complete any other settings required for the persistence.

e.g. The settings shown will meet the trigger condition on first time the angle is above 50°.

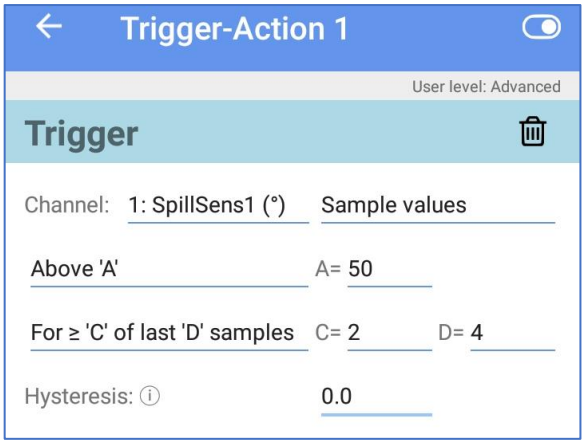


If you try to set an impossible situation, IDT will highlight the error (e.g., red text).

In our example, we want to trigger when the angle is above the threshold of 50 degrees for 2 out of 4 samples.

(e.g., We may have chosen to use persistence in order to disregard any transient "glitch" measurement conditions.
There is a side-effect to this that the trigger will be slightly delayed).

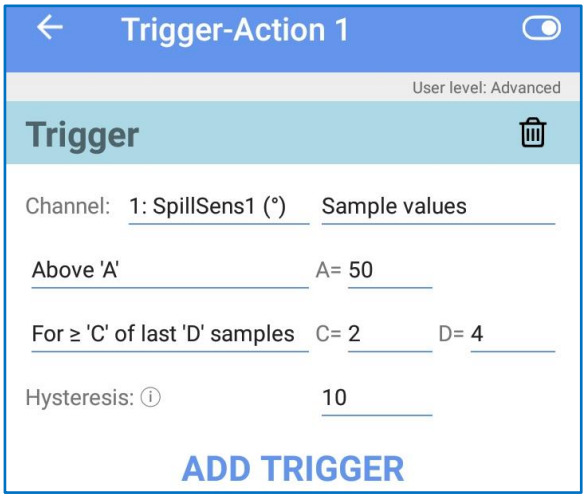
When selecting some trigger conditions, an additional field (hysteresis) is added.



Hysteresis can be used to provide a different threshold for when the logger releases from a triggered state. Thus, the logger trigger will **start** (or activate) when it first meets the triggering conditions, and it will remain *held in a triggered state* until it no longer meets the second threshold (determined by the hysteresis value); then the trigger will **end** (or clear).

The example shown opposite requires a minimum of 2 of the last 4 samples to exceed the angle threshold (A) to **activate** the trigger.
This requires between 2 and 4 measurement values to evaluate.

Once triggered, it will be held in its triggered state providing the holding condition remains True.



The evaluation for **holding** the triggered state is that a minimum of 2 of the last 4 samples is required to be over the release threshold (i.e., A – hysteresis).
For the settings shown, this is 40; (A = 50, Hysteresis = 10 ; 50 – 10 = 40).

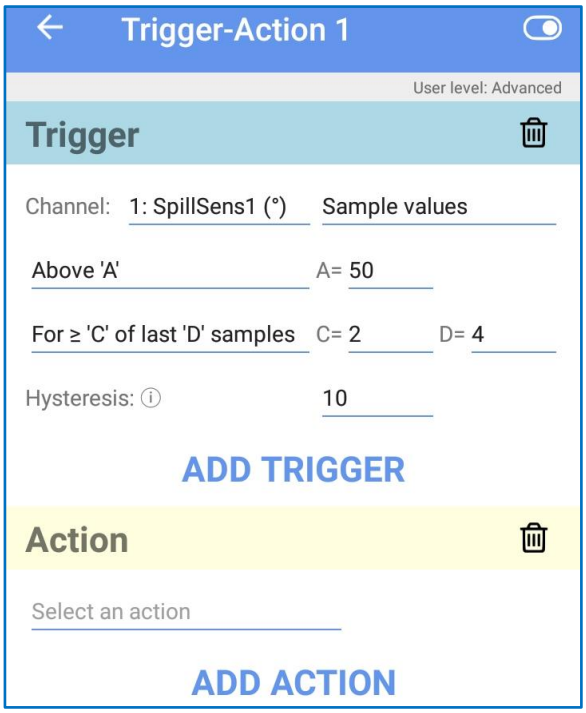
If the holding requirement is no longer met, the logger returns to the normal (non-triggered) state.

3.5.3 Setup of ACTIONs related to a triggered condition

A trigger does not do anything on its own; actions should be linked to it in order to accomplish something useful.

To set an action that should begin when the trigger activates … tap on “ADD ACTION “.

(This is not required if only one action is needed).

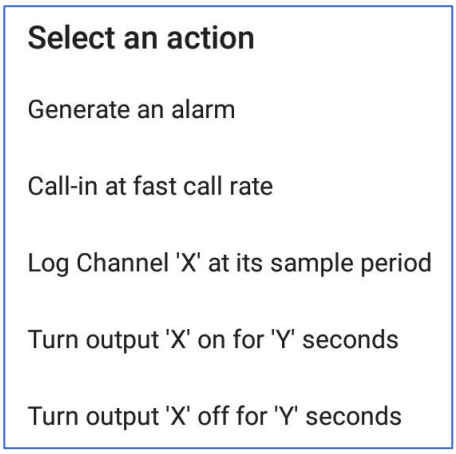


Within the action area, tap on “Select an action”.

Several options may be listed, as shown opposite:

Logging a channel at a faster rate or calling into the sever more frequently will only occur whilst the in the triggered state. Normal operation resumes afterwards.

Turning a status output on or off will only occur whilst in the triggered state, and for a defined period. Normal operation resumes afterwards. (Note: Only available if a logger has outputs fitted).

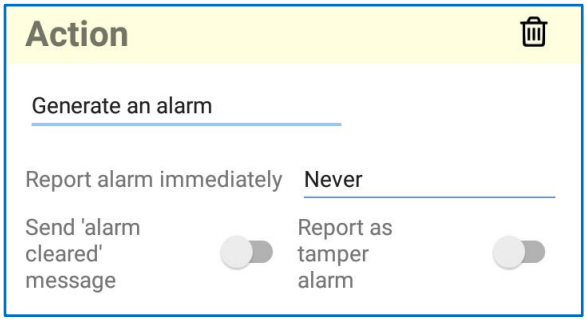


Tap on the required action to select it.

In our example we want to generate messages to the server; these are also known as alarms … so select “Generate an alarm”.

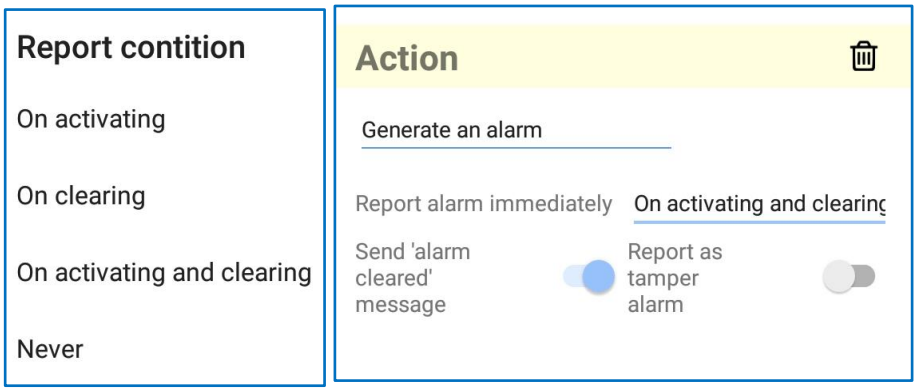
Select the required condition(s) that should be reported…

Note:
This control determines what messages get sent *immediately*, rather than waiting until the next scheduled call-in time.



The conditions are shown in the setup screen.

When “On activating and clearing” is set, the “send alarm cleared message” is also becomes selected. The server will therefore be informed of when the triggered state is activated and also when it is cleared.



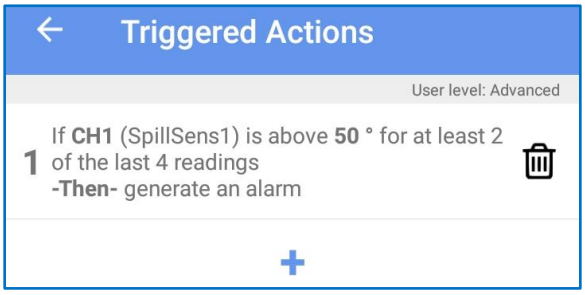
(An alternative would be to report the alarm immediately “On activating”, and to use the slider control to also send an “alarm cleared” message. However, with these settings the “alarm cleared” message would not be sent until the next scheduled call-in time).

Note: The “Report as tamper alarm” slider should be deactivated (greyed out); A tamper alarm is not relevant to this type of sensor.

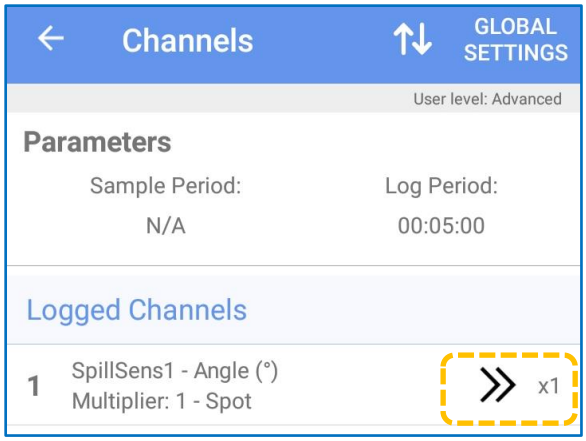
Tap the back-arrow and a summary of the Trigger Actions is displayed.

(Additional trigger-action combos can be added if required, using the “ + ” button).

When finished, tap the “Save” button to write the combo(s) into the logger memory.



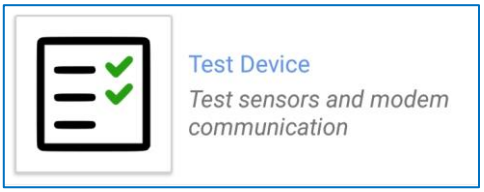
When a channel is being monitored for a trigger-action combination, this will be shown in the channel summary page, as shown here.



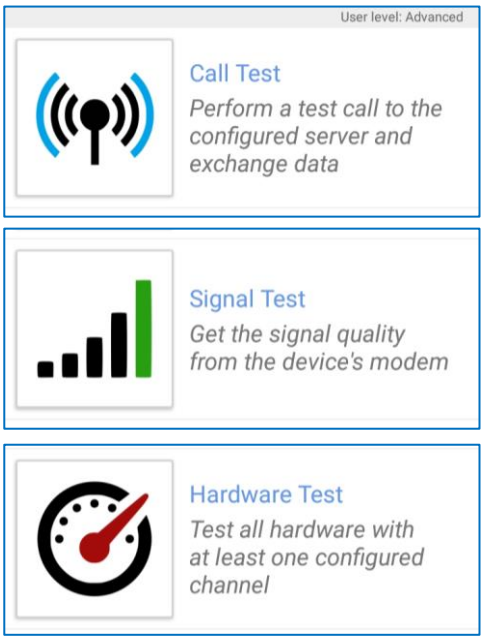
3.6 LOGGER AND SENSOR TESTS

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

To access the logger test menu, tap on the “Test Device” line.



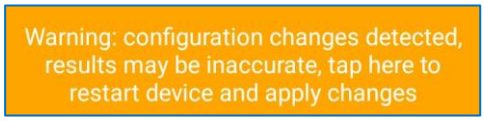
A new view will open with various test options.
(Only Hardware Test will be shown on 'group 1' loggers; they have no modem to test).



(Signal Test and Call Test are tasks to be performed at the end of logger installation and are covered in section 3.7).

Tap on "Hardware Test".
A "Hardware Test" page will be generated.

If there are recent changes, the logger may have to be restarted; tap the orange warning notice.

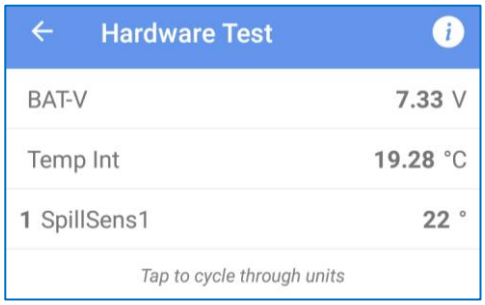


Note: Previous data is saved during a restart for loggers that use the IDT app.

The test requires an interface to be configured for use before tests can be made; a channel must be configured to use the interface. Often the sensor also needs to be attached.

The content of the test page will therefore depend on the logger model number (interfaces available) and configuration (settings).

Each of the interfaces that have been configured for use by a channel will be shown, along with some additional internal sensors.



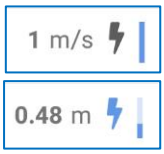
e.g. The diagram opposite shows a logger with Channel1 configured to use a SpillSens sensor.
The sensor is also fitted.

The hardware in this example can be tested by changing the position of the SpillSens digital float switch.
The example shows a sensor at 22 degrees from vertical; when the angle is changed the display will update to show a new angle; it can be proved to be functioning OK.

The display is updated at 1 second intervals (approximately).

Similar methods will exist for many other interfaces and sensors.

When powered sensors are in use, a lightning symbol is shown. Tap the symbol to power the sensor constantly (blue) for faster readings (from all channels using this sensor); other powered sensors will be disabled. This will deplete the battery, so minimise the time used. Tap to cancel.
A progress bar gives approximate timing before the start of a sensor read cycle.



3.7 CELLULAR NETWORK SETUP - PROTOCOLS AND TESTS

(Skip this section if using a 'Group 1' logger; It is not applicable. These loggers can only utilise the IDT App and the phone facilities to transfer data to a server.).

The IDT app 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.

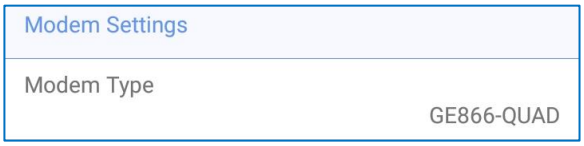
3.7.1 Modem Settings

CAUTION: Most installers **should not modify** these settings (Skip to section 3.7.2 or 3.7.3); They are for expert use only.

(See section 3.2 for how to navigate to these settings).

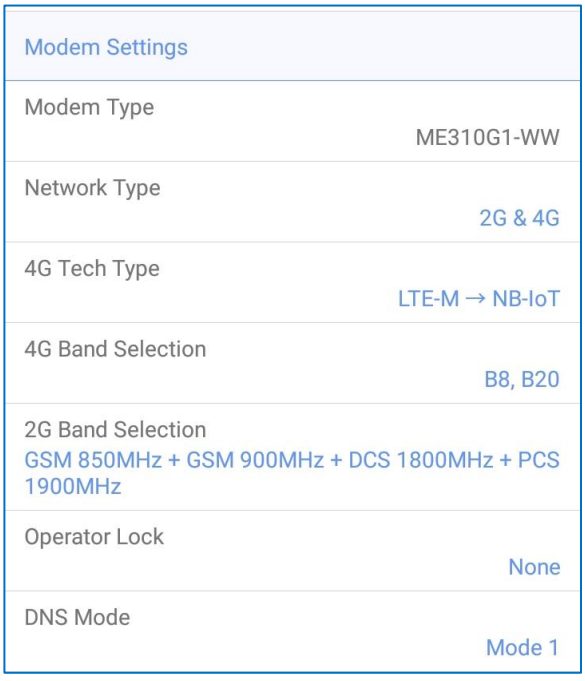
The loggers have a built-in modem circuit for connection to the cellular network. Depending on the modem fitted, IDT can show a different content of control settings within the “Modem settings” section.

e.g. No setting options, shown opposite.



or …

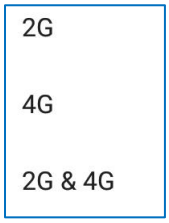
e.g., Many setting options, shown opposite.



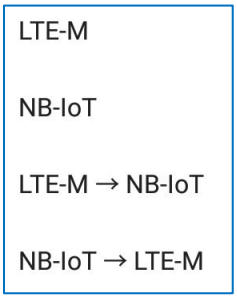
These settings are normally best left at the factory default, unless you understand cellular mobile technologies.

For those that do understand cellular mobile technologies, the controls are available to use if you are aware of the SIM capabilities and also the radio services available local to the installation site.

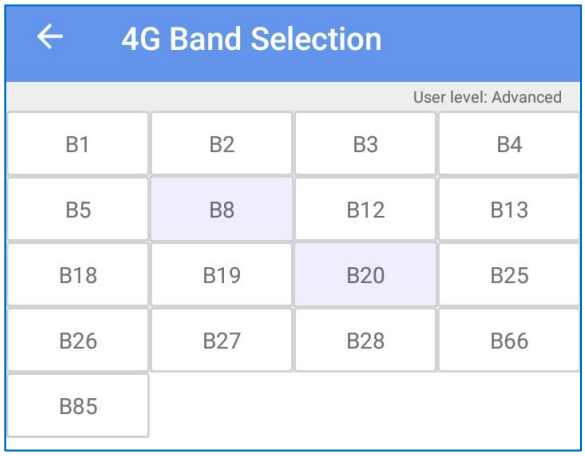
Network Type setting determines which network generation should be used to establish a connection.



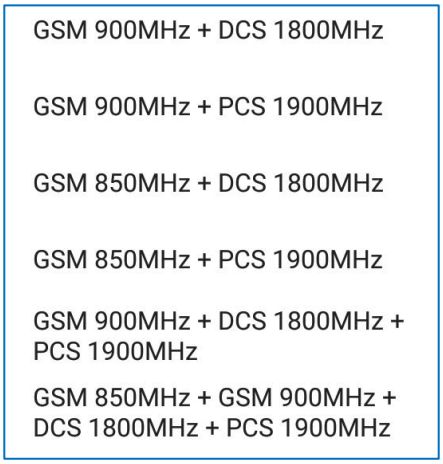
4G Technology Type setting determines which network generation should be used to establish a connection.



4G Band Selection setting determines which frequency bands can be used to establish a 4G connection.



2G Band Selection setting determines which frequency bands can be used to establish a 2G connection.

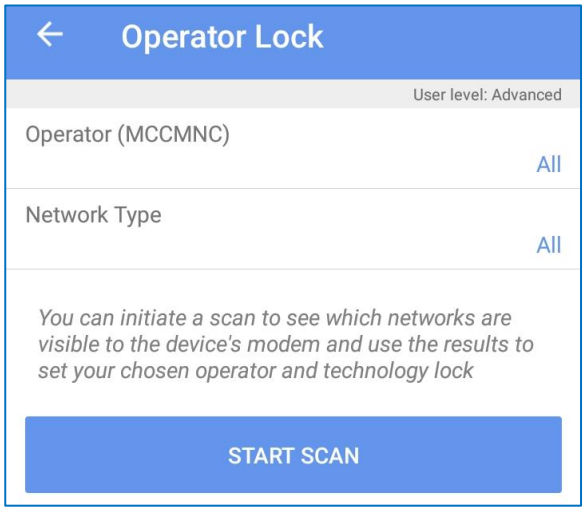


Operator Lock

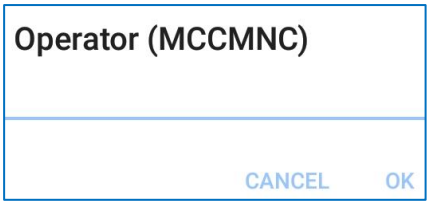
The Operator lock screen allows you to lock the logger to a specific Mobile Network Operator.

When set to “none” the logger will try an assortment of operators sequentially until it finds one that accepts the connection attempt.

Each Mobile Network Operator can be identified by a 5-digit code – The MCC / MNC code. (MCC / MNC codes can be found from an internet search).

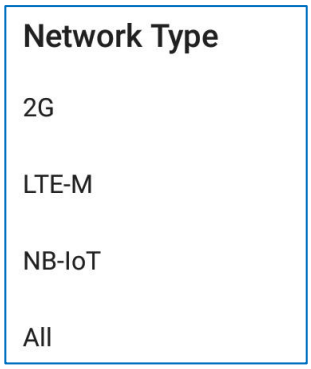


If the code for the operator is known, it can be set from this screen. Tap on MCCMNC line and set the code.



Note:
For the above setting to be functional, the SIM must also support the chosen network operator.

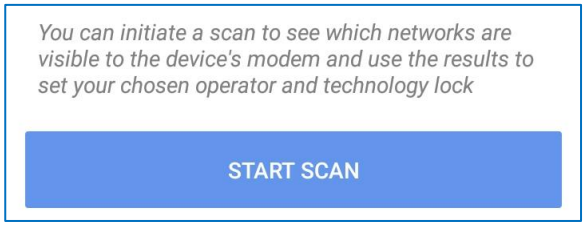
If a specific type of network technology is required, it can be set from this screen. Tap on the Network Type line and select from the list.



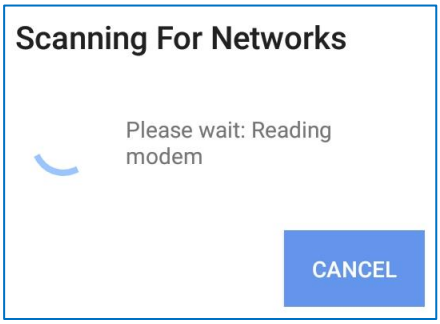
Note:
For the above setting to be functional, the SIM must also support the chosen network type.

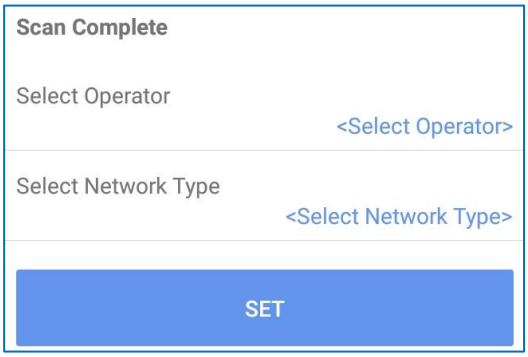
There is a tool to help with making the above settings:

Tap on the “Start Scan” button.

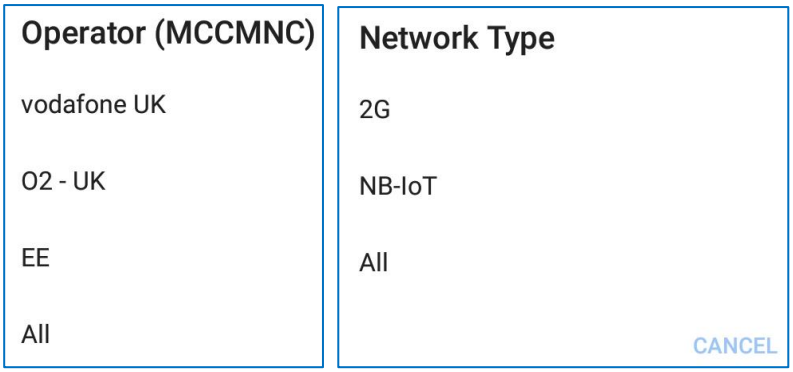


The logger will scan for local networks.





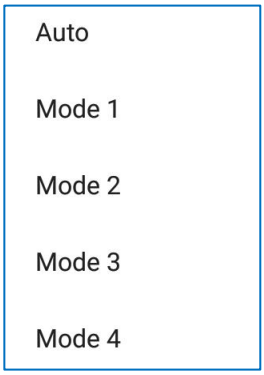
When finished, tap on each of the controls to make a selection from those listed.
(Contents vary according to what is found to be locally available).



Note:
For the above setting to be functional, both the SIM and the network operator must also support the selections.

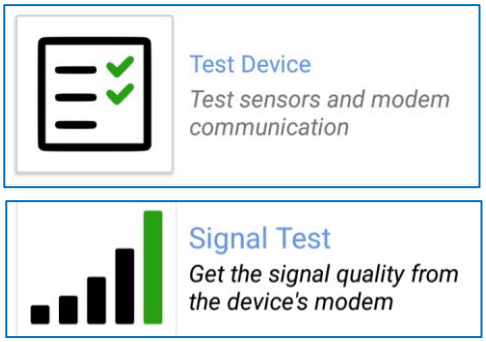
DNS Mode (Domain Name System) is factory set to “Auto”.

When the logger dials-in it resolves the Domain Name part of the URL by doing a DNS lookup over the network.
The network may not support all DNS protocol versions, so the logger (if set to Auto) tries several types until it finds one that works. It then uses that protocol option for future operation.



Alternatively, the user can pre-set this mode using the control.

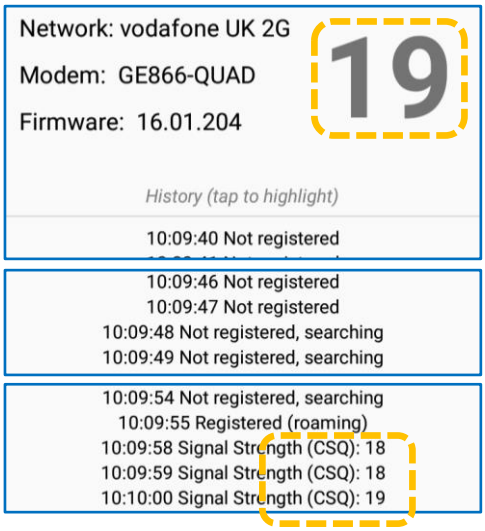
3.7.2 2G and 3G Networks: Signal Test (signal strength - CSQ)



To access the logger test menu, tap on the "Test Device" line.

Access the "Test Device" menu and then tap on "Signal Test".

This test measures the **signal strength** (CSQ) of the received 2G mobile network signal.



Once connected to the mobile network, the provider details and signal strength indicator (CSQ) are displayed. The default is to show the average value of the last 10 readings, but it can be changed to show the latest value (by tapping on the number).

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. 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.

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

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

8-14 **Acceptable**.
(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).

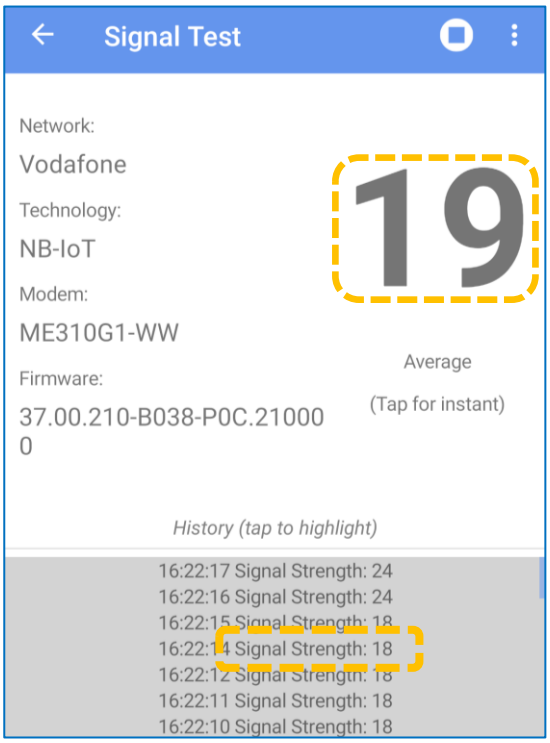
15+ **Good**.
(Data transmission should be reliable).

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 3.7.1 to determine what modem settings are in use for the logger. Refer to section 3.7.3 for 4G Network signal quality assessment).

3.7.3 4G Networks (NB-IoT, LTE-M): Signal Tests

Modems that use 4G networks have a different set of parameters for signal quality than those using 2G and 3G networks.

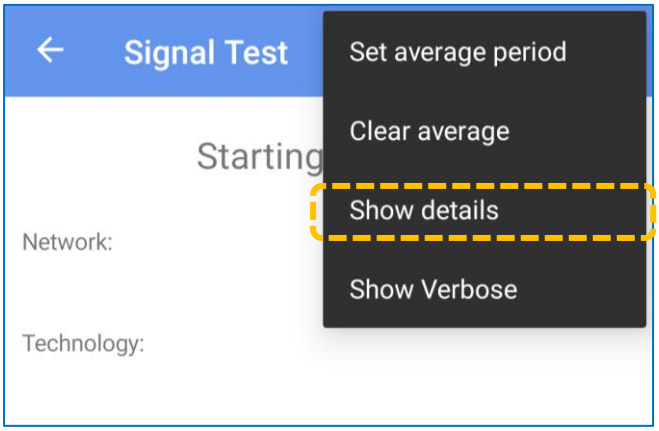
Navigate to the Signal Test screen, as detailed in section 3.7.2.



The CSQ indication is replaced for 4G networks by a "Signal Strength" indication.

(Note: CSQ is missing from the lower listing).

Select "Show details" from the local menu to provide additional information.



The lower listing will show additional parameters:

- Signal Strength
- Signal Power
- Signal RSRP (dBm)
  (Reference Signal Received Power).
- Signal RSRQ (dBm)
  (Reference Signal Received Quality).

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

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

>= -80	Excellent. (Data transmission should be reliable).
-80 to -90	Good. (Data transmission should be reasonably reliable). It is important to select the correct antenna and install it in the most suitable location).
-90 to -100	Fair to Poor. (Reliable data speeds may be possible but drop-outs may occur. Performance drops considerably as the value approaches -100. 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.

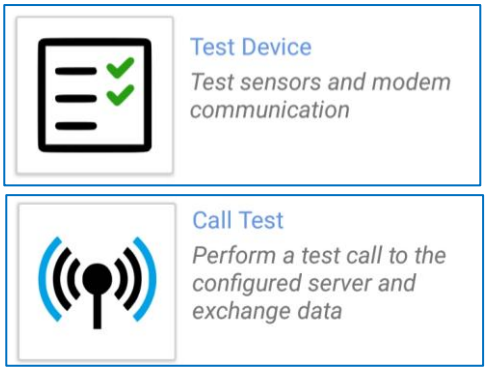
RSRQ value: The following guidelines are given for the cellular network signal, (as measured with the chamber closed):

>= -10	Excellent. (Data transmission should be reliable).
-10 to -15	Good. (Data transmission should be reasonably reliable). It is important to select the correct antenna and install it in the most suitable location).
-15 to -20	Fair to Poor. (Reliable data speeds may be possible but drop-outs may occur. Performance drops considerably as the value approaches -100. 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.

3.7.4 IDT – Call Test (logger to server)

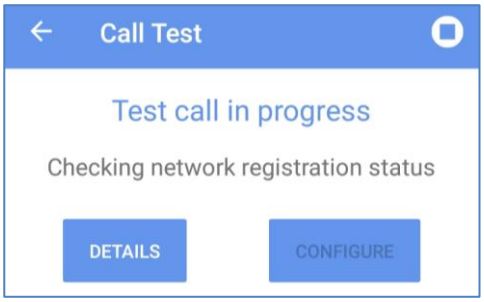
This test confirms the logger can **communicate with the DataGate server**.



Access the “Test Device” menu and then tap “Call Test”.

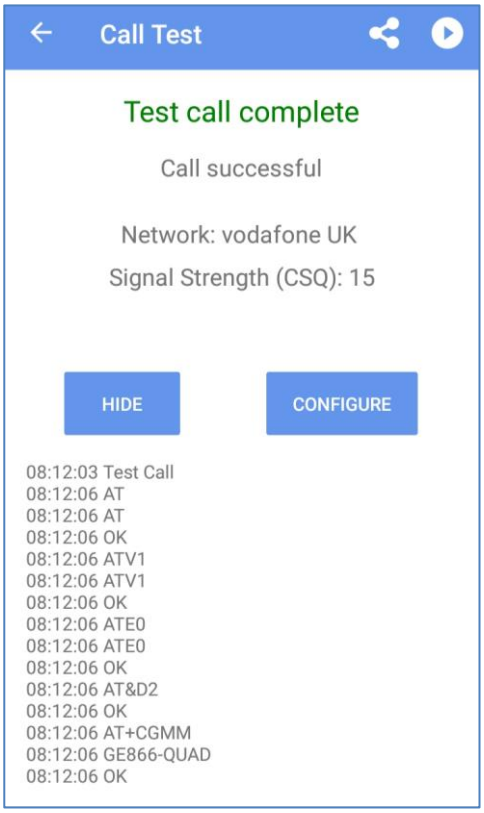
The call test will automatically start.
(The top-right corner of the display has a control to start and stop the test).

The logger makes a test-call to the data-server over the mobile network.



The call will progress through various stages until it is complete.

Check if it is successful.



If there is some problem with the test-call, some details are available to assist in finding where the problem exists. (Tap the “Details” button to show).

The details can be forwarded to expert users for assistance by tapping on the share control.

Note: When the equipment is installed below ground level, the Call Test can be made initially with the chamber lid open, to prove it is possible to communicate with DataGate using an unimpaired mobile phone signal.

Repeat the test later with the lid closed to confirm the signal is not degraded to an unusable level by the chamber lid.

3.7.5 Troubleshooting a Call Test failure

Possible Issues and Checks

There are a number of reasons why a Call test may fail.

IDT provides some error messages to help diagnose problems:

e.g.:

- SPC low. Please wait for charge.
  (Power boost circuit within the logger requires time to re-charge).
- SIM card error. Please check SIM fitment.
  (SIM must be clean and fitted correctly).
- No networks found. Please check antenna connection and position.
  (Check antenna is undamaged and connected).
- DNS lookup failure. Please check server address.
  (Check with your system administrator that the URL entered as the server address is correct).
- Network registration was denied. Please check that SIM is activated on network.
  (Check SIM card is able to use the selected network operator for data).

(The above list is not exhaustive).

The following points should be checked before calling HWM support for assistance: -

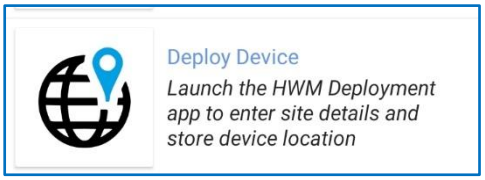
Possible Problem	**Solution**
Network Busy due to excessive traffic. Commonly occurs around schools and at peak travel times.	Retry the test after a few minutes.
Network signal not available at your location. Not all Cell masts carry data traffic.	Relocate the logger to an area that has a data service or change to a different network provider.
Network signal not strong enough. 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.
APN settings incorrect.	Check with your network operator that you have the correct settings for your SIM.

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

4 RECORDING INSTALLATION SITE DETAILS FOR DATAGATE SERVER

When a logger is being used in with the DataGate system, details of the site where the logger has been deployed have to be recorded and entered into the server. This is an administrative function, possibly undertaken by system administrators. However, the IDT app can be integrated with the HWM Deployment app to ease collection of the relevant data and automate many of the administrative tasks.

Tapping the Deploy Device option will launch the HWM Deployment app and pass details of the logger to it. The user is then able to record the installation location of the device.



(The HWM Deployment app is used to complete the task of recording details of the site of deployment and the administrative update of the DataGate system).

(For further guidance on the HWM Deployment app, refer to the relevant user guide, MAN-2002-0001).

The data sent by (or retrieved from) the logger will be stored on the DataGate server, linked to the site on which the logger is currently deployed.

Note: If the logger is removed from the site this should be registered with the DataGate server, as should any subsequent re-deployment of the logger to another site. This will allow the server to link subsequent data to the new deployment site.

5 RETRIEVING, STORING, AND VIEWING DATA

Measurement data is initially stored within the logger.

For 'group 3' loggers, the device is usually set up to call into a server, where data is stored. The device keeps track of what has been already sent in order to minimise call length (to save unnecessary power consumption). Data will therefore automatically appear on the server, with site visits only needed for any maintenance tasks.

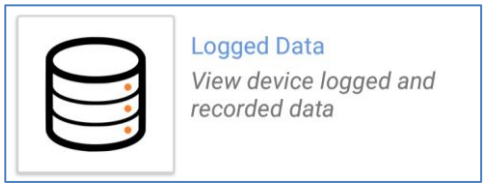
For 'group 1' loggers, the device does not call into a server, so all data is retained within the logger. To access the stored data, return to the logger after some time and re-connect to it using the IDT app. The data can be temporarily downloaded into IDT and viewed graphically (See section 5.1). However, the graph can only be viewed whilst the IDT app is connected to the logger; the IDT app does not store the data. The data may also be shared with other apps whilst connected; refer to section 5.2. For data retrieval and permanent storage, IDT is required to be used in conjunction with the DataGate server (Refer to sections 4 and 5.3); the data can be manually uploaded to the server using the data modem within the mobile phone.

Data is best viewed with a viewing tool (webpage) that can access the data stored on the server. (Refer to the appropriate manual or instructions for your viewing tool).

5.1 VIEWING DATA (WITHIN IDT)

The logger data can be viewed graphically by using IDT to temporarily copy the data from the logger.

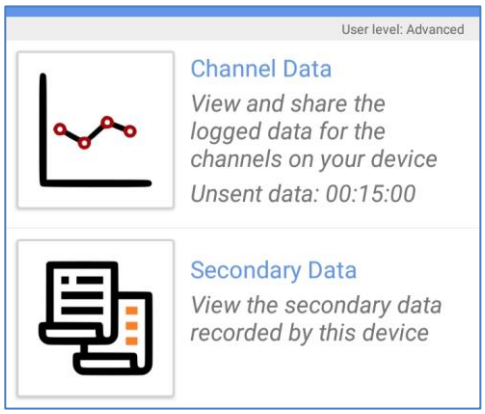
Tap on the “Logged data” line.



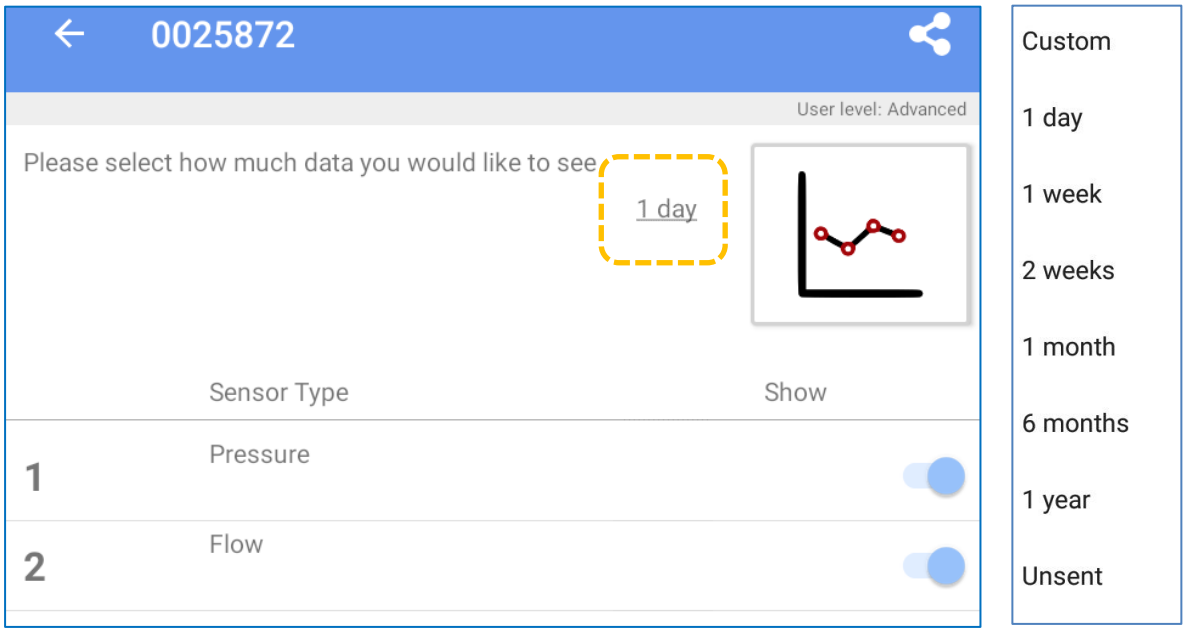
A new screen is displayed. This screen gives access to any data contained in the logger’s primary data recording. It will also give access to the logger secondary data recordings if they exist.

Tap “Channel Data” for access to the primary data recordings.
(For ‘group 3’ loggers, this line will show the duration of any unsent data (format: d:hh:mm:ss)).

Tap “Secondary Data” for access to the secondary data recordings.

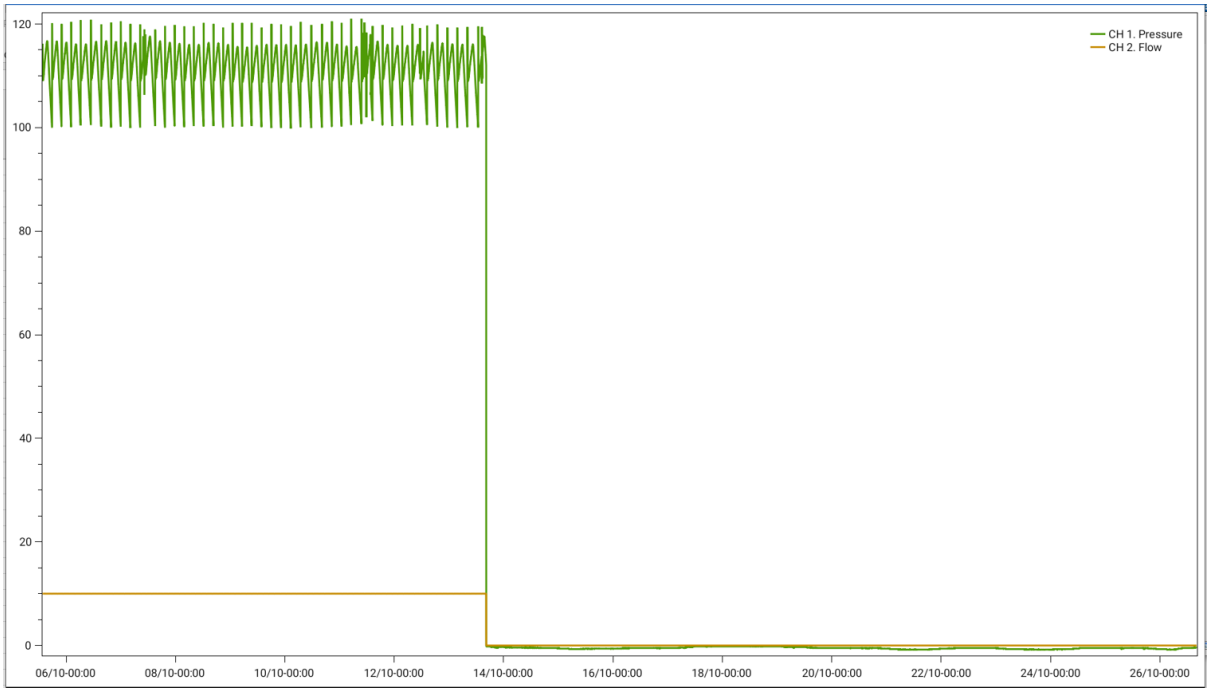


Tap to the left of the graph symbol to select a duration that you wish to see on the graph. (The ‘unsent’ option is not available on ‘group 1’ loggers).

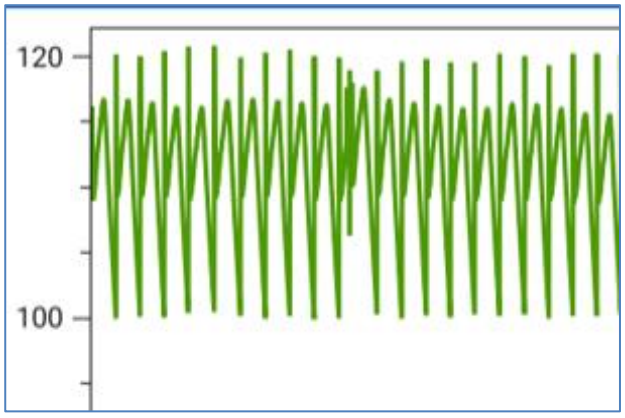


The slider controls can be used to include or exclude data from a sensor on the graph.

Tap on the graph symbol to initiate the transfer of data from the logger to a temporary data store in IDT. Once the data is available a graph will be produced.



The graph can be examined in more detail using the standard techniques available on your tablet or phone.
(E.g., finger movements to zoom in or out, re-position the graph within the display, etc).



Tap the back-arrow control to exit.

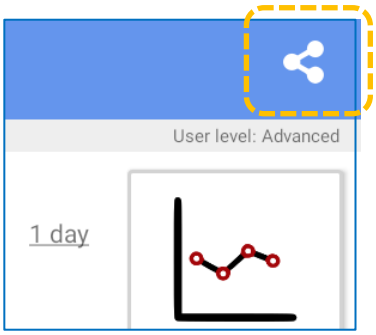
Note: The graph contents will vary according to the sensors attached to the logger, the type of data produced, how long the logger has been running and other factors.

Once the graph page has been closed, the data is deleted from IDT. However, it is still present in the logger.

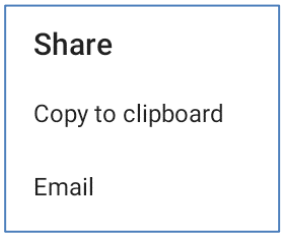
5.2 SHARING DATA (IN CSV FORMAT)

To share the logger data, follow the steps for viewing data in IDT (see section 5.1) up until the point where the channels and time period that are required have been selected.

Then tap on the “share” icon.



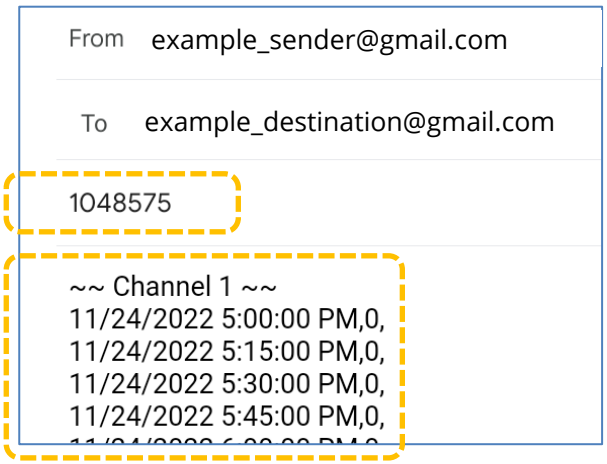
IDT offers the option of either copying the data to the clipboard (to be able to paste the data into another application), or to generate an e-mail with the data.



E.g., tap on “Email” and IDT will fetch the data from the logger. IDT will then select your e-mail application (or allow you to choose if more than one is installed) and compose the message part of the e-mail.

The e-mail will include the logger identity (as a serial number) for the subject.
The main body of the e-mail is in plain text which is also in a c.s.v. (comma separated values) format.

Complete the e-mail by adding e-mail addresses to the “To” field, and then send.



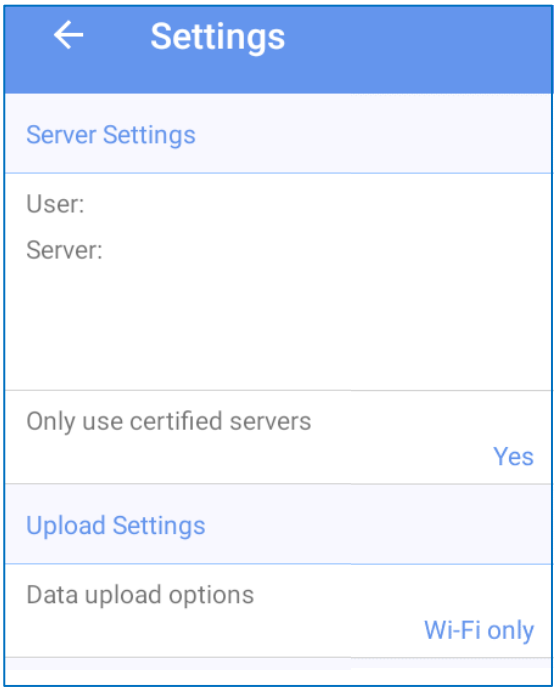
5.3 UPLOAD OF DATA TO DATAGATE SERVER.

Note: In order to successfully upload data to the DataGate server, all loggers must be previously entered into the DataGate system (registered using their SMS number and linked to a dummy site; HWM usually does the initial logger registration. However, loggers within ‘group 1’ do not have a standard SMS number, so require some alternative way to allocate an SMS number for use as an identifier; refer to the logger user-guide for details.

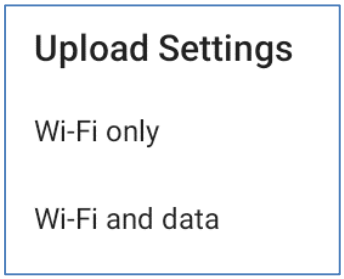
After logging into the IDT app, the tablet receives a token allowing use with the server for up to 48 hours. The IDT app can be used to retrieve data from a logger and store it for upload to the DataGate server for permanent storage. If no internet connection exists, the data is temporarily stored in data files which go into an “upload queue”. This pending data will upload later when an internet connection becomes available.

Note: This method of uploading data is normally not needed for ‘group 3’ loggers, since they are able to upload data regularly. It can however be used when visiting site for maintenance work. The primary use is with ‘group 1’ loggers, as these have no facility for automatic upload of data to the server.

Options for use of various internet connections (Wi-Fi or by use of Cellular / Mobile Data) can be set within the app Settings page.

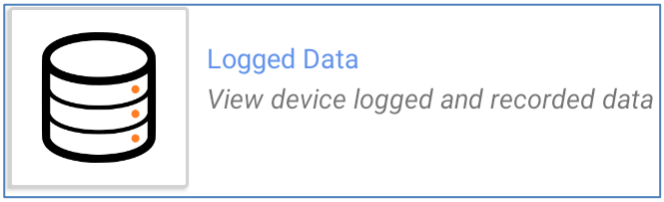


Tap on the “Data upload options” line.

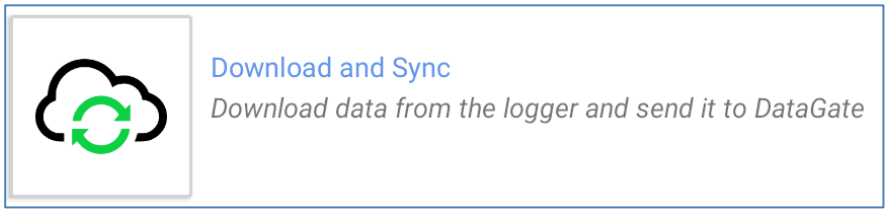


Select “Wi-Fi only” if you have a limited data package on your SIM card. This will defer data uploads to the server until a Wi-Fi connection is available.

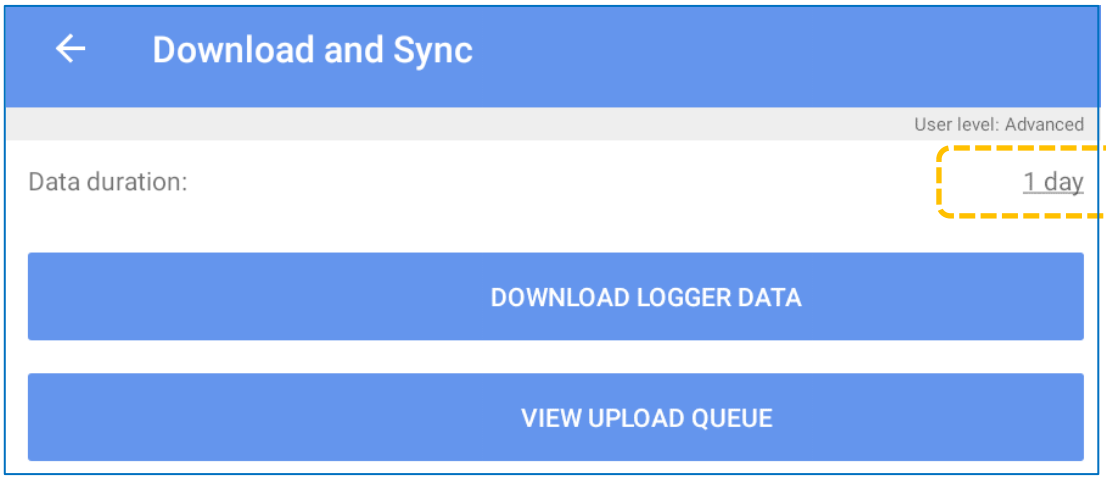
After connecting to your logger, tap on the “Logged Data” option.



Then tap on “Download and Sync”.



A new page will load.



Tap on the “Data duration” line and select the required time period of the data you wish to retrieve.

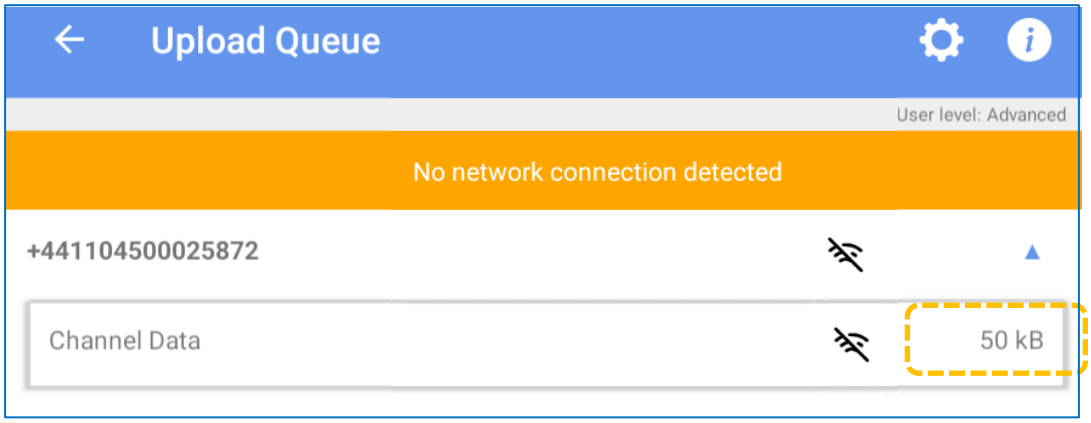
Then tap on the “Download Logger Data” button.

The IDT app will transfer the data from the logger device.

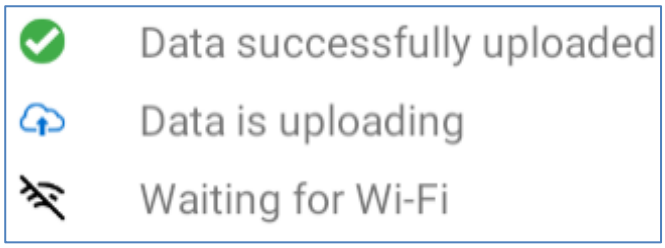
Note: IDT does not keep track of what data records (normally selected by a date range) have been uploaded to DataGate. To ensure IDT has all the available datapoints, the user should select a large enough date-range to over-lap with any previously obtained data. If there are any duplications of data sent, the system will remove them before storage on the server.

To view data that is queued for upload, tap on the “View Upload Queue” line.

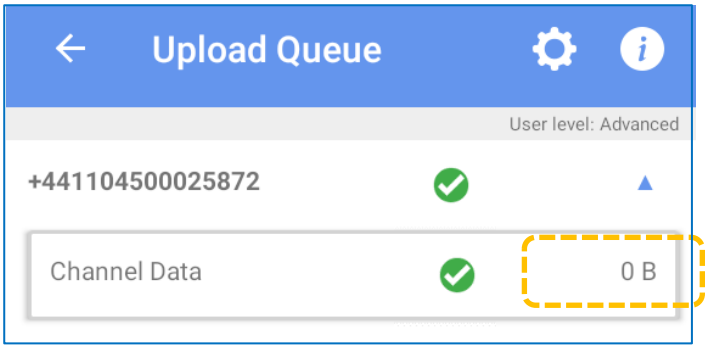
A list of data that has been obtained from loggers is shown along with a status indication (icon) and number of bytes left to upload.



Tap the “ *i* “ button for a key with an explanation of the symbols.



When upload is finished, all logger devices should show ‘0 B’ (0 bytes) as being left to upload, and a green circle with a tick as the status.



To clear the list, first check that all data items have been sent.
Then tap on the “Clear Sent Data” button.
(This does not erase any data from the logger).

6 TROUBLESHOOTING

The app, the logger, the user and sometimes the server interact with each other. Any issues in use of the app should consider all four parts of the system.

(Refer also to section 9, which describes a few of the differences of operation of IDT under various use circumstances).

6.1 PUTTING THE EQUIPMENT INTO SHIPPING MODE (DE-ACTIVATING)

Before removing HWM equipment from an installation site for storage, repair, etc, it must be put into "Shipping mode". This will prevent invalid measurements from being recorded. In addition, some equipment includes sensors for detecting movement or changes in logger position and could send an alarm to the server.

Note: Be sure to upload any unsent data before this operation.

'Group 3' loggers:

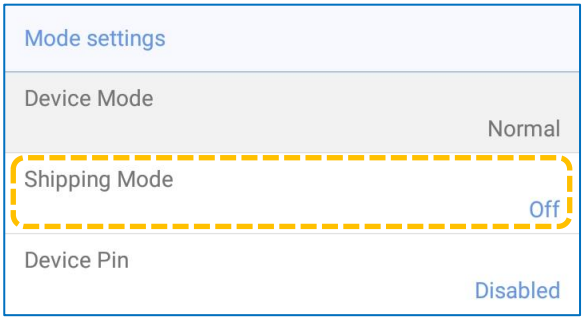
To put the equipment into shipping mode:

From the main options page, tap on the "Configure Device" selection.
Then select the "Device Information" option.

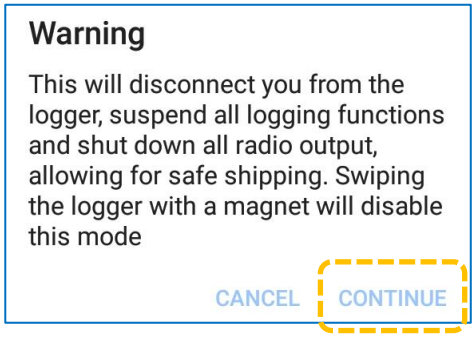
Move the display to show the Mode Settings panel.

The "shipping mode" setting will be shown as "off" since the logger is in use.

Tap on the shipping mode line.

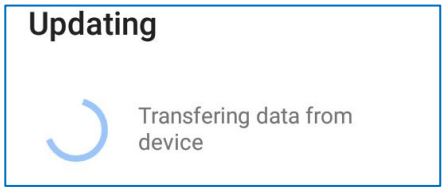


Read and accept the warning (by tapping on "Continue").



IDT will update the device.

The device will go into shipping mode and drop the communications link.
(IDT will therefore begin scanning for devices).



'Group 1' loggers:

The equivalent to shipping mode is a recording state of 'stopped'. Refer to section 3.1.4 for how to do this.

6.2 THE USER CANNOT LOG IN USING THE APP

- Ensure the correct server URL exists (Test connection).
- Ensure the correct username and password are being used.
- Ensure the user is correctly set-up on DataGate.

(Refer to your system administrator for assistance if required).

6.3 THE IDT APP DOES NOT LIST THE LOGGER

- The logger communications link is not activated.
  – Activate the logger communication link again (see section 1.6).
- The phone may be out of the communication link range of the logger.
  - Bring them closer together.
- The logger battery may be depleted, or the logger may be defective.

When used with DataGate:

- The logger is not correctly registered on DataGate.
- The user is not logged into the app, or the initial synchronisation is incomplete.
- The user does not have the appropriate DataGate permissions.
- Try selecting “show unprotected devices”. If the logger then appears listed in red, it is functioning correctly in “unprotected mode”.
- Try re-starting the phone and the app.
  – Confirm the app Bluetooth connection is working correctly by trying with another logger.

6.4 THE DATA FROM THE LOGGER DOES NOT APPEAR ON THE SERVER.

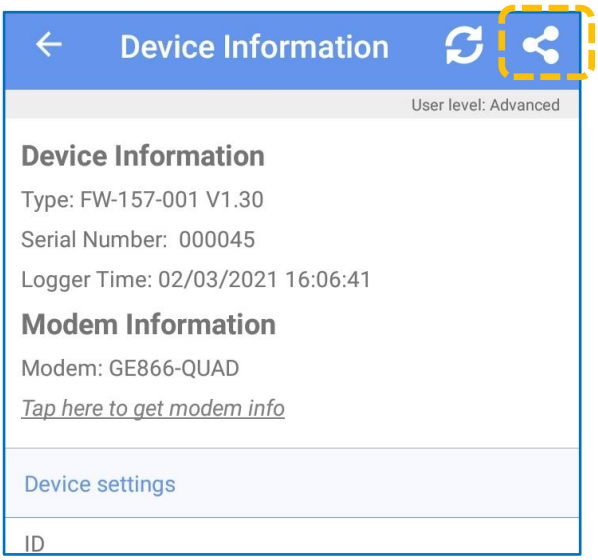
- Ensure the logger uses the correct data destination URL and port-number for your server.
- Check the logger antenna is attached and in an OK condition.
- Make a Call Test and confirm OK.
- Ensure your server is correctly configured to receive and present the data from the logger.

6.5 TRANSFER OF LOGGER SETTINGS FOR ASSISTANCE / LOAD VIRTUAL LOGGER

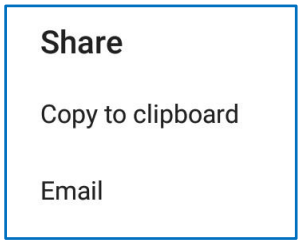
If requested by HWM-water, the logger configuration settings can be saved to a file and forwarded to HWM-water for assistance.

Connect to the logger and from the main screen navigate to the Device Information screen.

Tap on the Share icon.



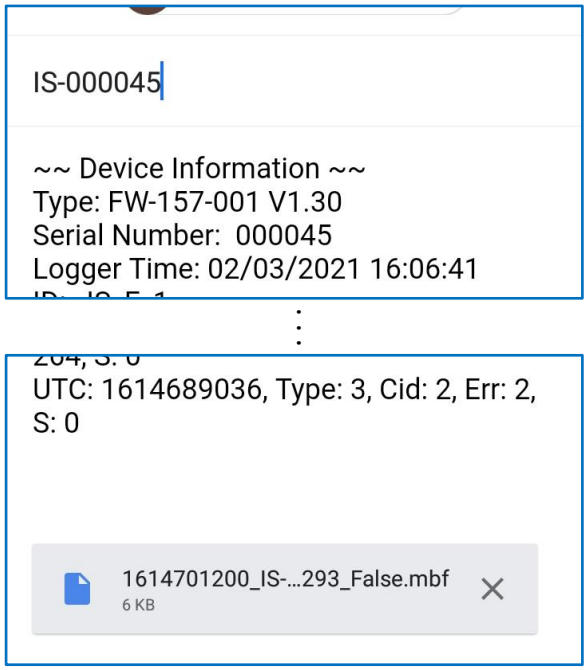
Select a method for sharing the information (a logger configuration file + recent event log messages).



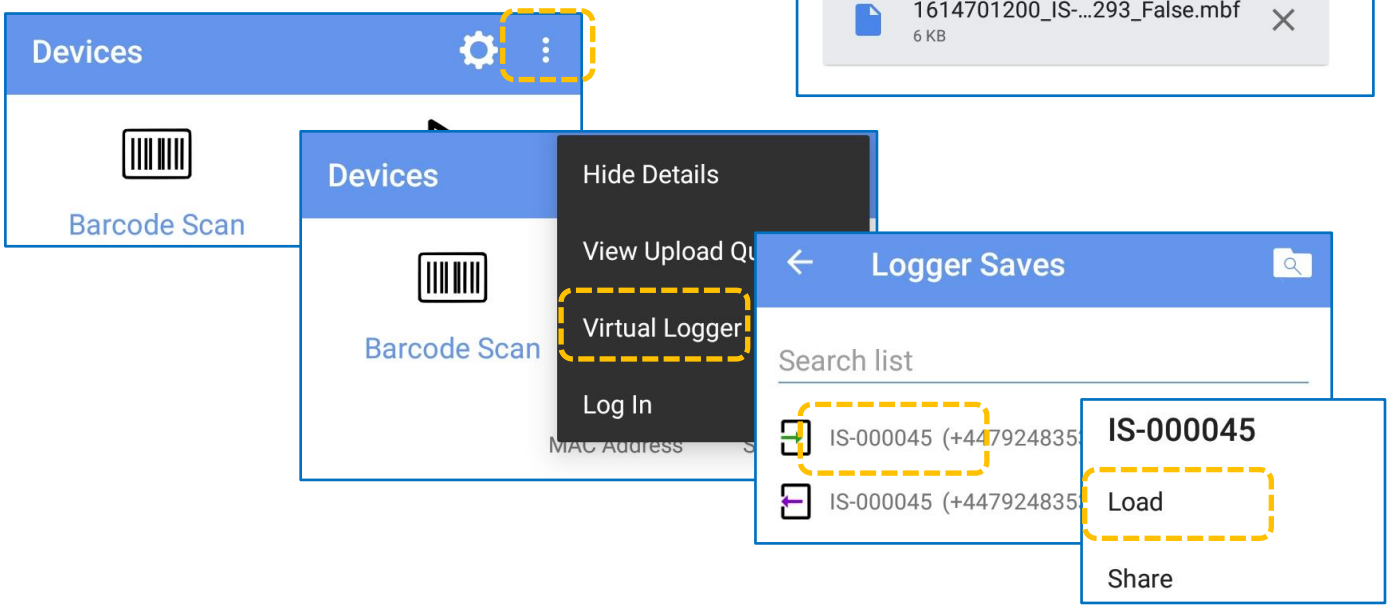
Typically, this will be via e-mail.

Select an e-mail program when the phone prompts you.

The contents of the e-mail are automatically generated. You will simply need to complete the destination e-mail address.



The logger details and a copy of its configuration file can now be sent for examination and debug.

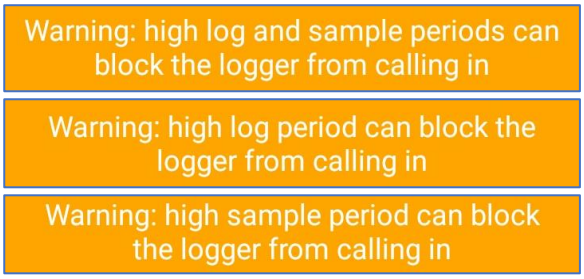


All setting details will be available for inspection once the email recipient loads the configuration details as a “virtual device” (click as shown above, from left to right).

6.6 " ... BLOCK THE LOGGER FROM CALLING IN" WARNING (LOGGER OVER-COMMIT)

The logger schedules its repetitive measurement tasks and also evaluates how much time is available for other tasks such as calling into the server. Whilst programming settings into the logger, it is possible for the user to over-commit the logger resources. If some potential issue is found where the logger is likely to be over-committed and unable to fit all tasks into its schedule, it warns the user via an IDT warning message.

If IDT issues a warning during setup of the logger, similar to those shown opposite, it indicates that the logger may have insufficient time to call into the server.



The logger manages its expected power use during operation (so as to not cause an over-demand of the supply current beyond what is available). Some measurements are from sensors that use very little power and are only required to be powered for very short intervals. Other sensors may require more power or may need to be powered for several tens of seconds before a measurement can be obtained. Each measurement therefore has a power and time budget for the logger to consider when scheduling tasks, as does the operation of making a call-in to the server. The logger may manage power-use by sequencing certain measurement tasks to occur one after another rather than being done simultaneously.

The user should therefore consider a worst-case scenario in which only one sensor can be powered at any given time. Each sensor may need to be activated sequentially. Certain sensors may require a pre-power period and / or additional time for a measurement to be made and then communicated to the logger). The user should also add approximately one minute for the call-in time.

Sensor interfaces that should especially be taken into consideration are:

- 4-20mA (active) ; Pre-power time
- SDI-12 ; Pre-power time ; Measurement time varies.
- RS485 ; Pre-power time ; Measurement time varies.
- SonicSens3 ; Measurement time is approx. 10s.

The user should minimise the period of use and number of samples obtained from sensors using the above interfaces. This helps the logger to schedule tasks. It also helps towards minimising over-all power consumption from the logger battery.

If IDT generates a warning message, the sensor pre-power timings, sample period, log period and logging mode should be re-visited and adjusted. Try:

- Use a "spot" logging mode (which samples only at the log rate) where possible ; Other logging modes require more samples to obtain datapoints.
- A log period of 5 minutes or longer is recommended.

7 PART 2: ----- TRIGGER-ACTIONS AND SENSOR INTERFACES -----

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

7.1 DATA VIEWING PORTALS

- Data from the logger can generally be viewed using webpages provided by HWM DataView website.
- Where other HWM data viewing portals (websites) exist for certain sensors, they are identified within each sensor description.
- Your utility company may also employ its own data viewing tool.
- To view data on any portal, the data must be delivered to the server.

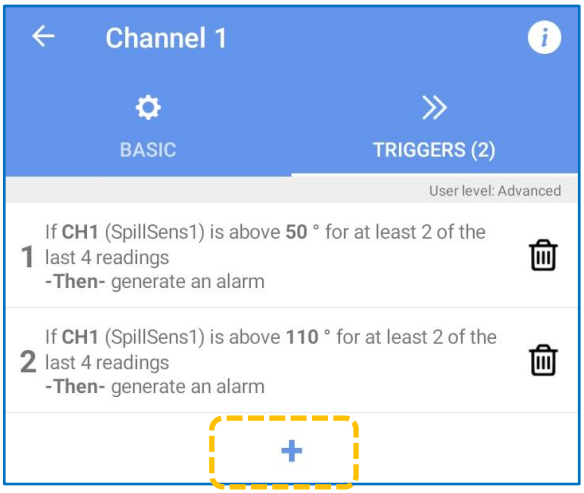
7.2 TRIGGER-ACTION FEATURES (USING 'GROUP 3' LOGGERS)

7.2.1 Support of multiple triggers from same sensor

Loggers can support programming of multiple trigger conditions related to the same sensor.

This can be programmed within IDT by tapping the "+" line to add additional triggers.

e.g. Refer to the diagram opposite, which shows two triggers set up for different angles of a SpillSens sensor.
Here these are both set to generate an alarm, but alternative actions may be selected.



7.2.2 Support of multiple conditions for a single trigger

IDT supports setup of multiple-condition triggers, if supported by the logger.

From the main screen, select the Triggered Actions line.

Tap on the "+" symbol to create a new trigger action. And then select "Custom Trigger-Action".

Tap on “Add Trigger” to allow two or more conditions that are to be considered as part of the over-all trigger result.

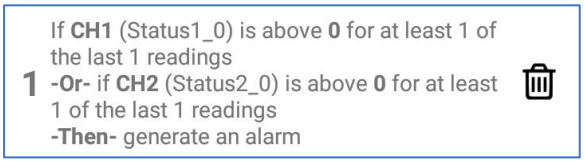
Select each condition.

The conditions may be connected into either an “AND” gate or an “Inclusive OR” gate; only one selection is allowed per trigger-action (although additional Trigger-Actions can be set up to cover other combinations if required).

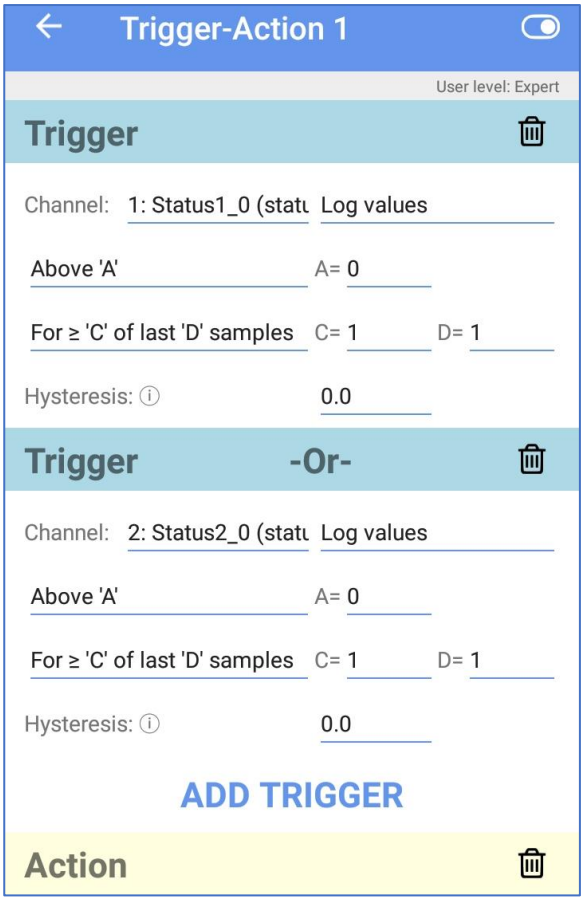
(Tap on the “-Or-“ line to change the logic gate used).

Add trigger requirements.

Tap the back-arrow to show a summary:



When finished, tap on the ‘save’ button.



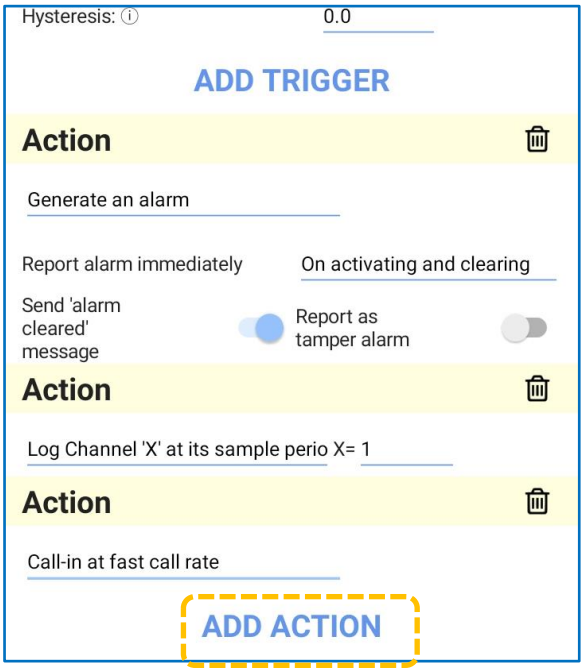
7.2.3 Support of multiple actions from a single trigger

IDT can support the programming of multiple actions conditions related to the same trigger, if supported by the logger.

This can be programmed within IDT by tapping the “Add Action” line to add the first and any required additional actions.

e.g. Refer to the diagram opposite, which shows three different actions set up for a single trigger condition.

Available options will depend on the model number of your logger and the options supported / enabled.



7.3 Flow Sensor input (Using 'Group 1' Loggers)

To set up a Flow sensor input on this group of loggers, refer to section 3.4.1. Flow inputs have no other function on this logger group; skip to section 7.7.

7.4 Status Input (from a Flow / Pulse interface)

(This section applies to 'group 3' loggers only).

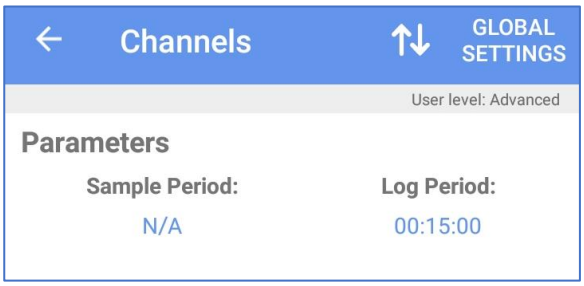
The interface known to IDT as "Pulse" may (where fitted) be labelled "Bi-Directional FLOW" or "Uni-Directional Flow" or similar. It may also be unlabelled except via inspection of the model-number of the logger (refer to the logger manual).

Note: "Pulse input" can be considered as the *general-purpose* name for the interface.
It can be known by additional (more specific) names when the function has been set within the logger setup.
A pair of pins (i.e., 2 pulse inputs) is normally presented on a single connector.
Each pin may be assigned a different use, or their use combined as a pair.

The interface is versatile and can be used for a variety of purposes. One such use is as a **Status Input**. A status input requires just one pin.

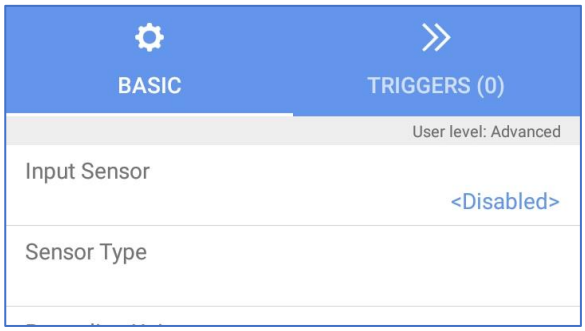
To set up a new Status Input channel:

Go to the Channels screen.



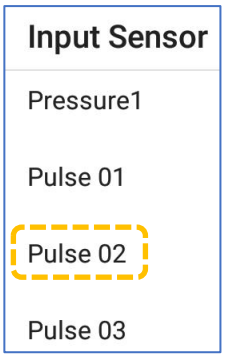
Tap the " + " line to add a new channel.

Tap the "Input Sensor" line.
(Currently, it shows "<Disabled>"; it is unconfigured).

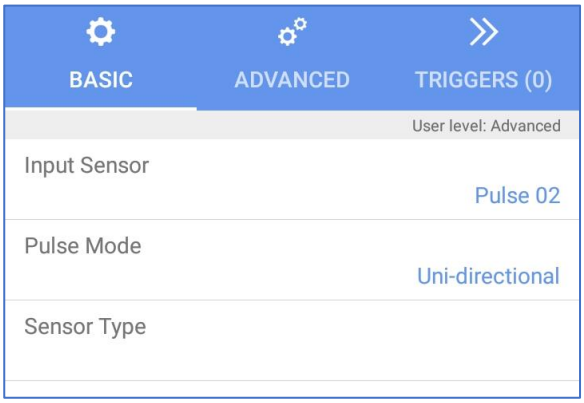


Select the required "Pulse (n)" type interface from the list of interfaces.

e.g., Tap on "Pulse 2".



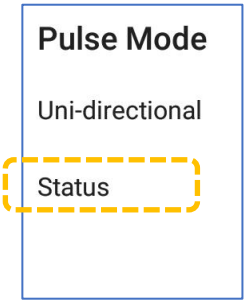
For this particular interface, multiple software driver options exist, and hence a new setting line is displayed, “Pulse Mode”.



Tap on the Pulse mode setting and select from the available options.

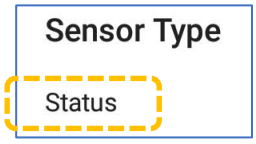
For this example, a Status sensor is required.
Therefore select “Status”.

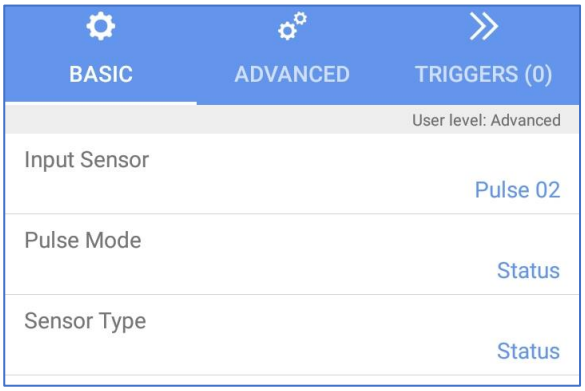
This selection commits the relevant pin of the interface connector for a specific use). For this selection, the software driver will use the input as for sensors that give a simple status indication (typically signalled by a switch being open or closed).



Ensure the “Sensor Type” also reads “Status”.

(Select if not already selected).





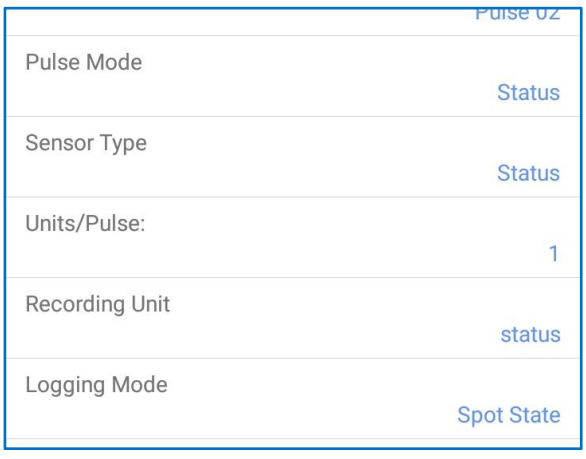
The selections made (so far) are shown in the channel configuration screen.

Additional settings are required, depending on what is to be measured and logged from the input …

7.4.1 Use as a logic-level data stream

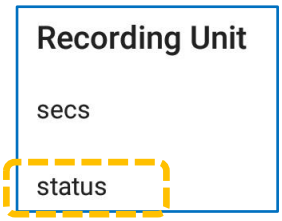
Complete the settings as shown to use the sensor as a digital status input.
(i.e., The input status can be either “1” or “0”.
Or, more precisely, either “Open” or “Closed”).

Note: The IDT app sometimes shows:
“Open” as “O”.
“Closed” as “X”.



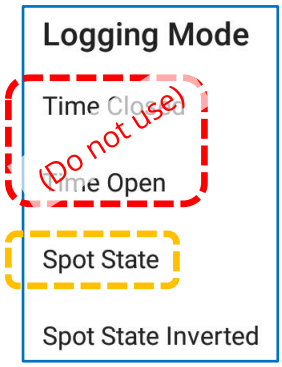
The recording unit must be set to “status”.

This ensures the Pulse input is logged as a digital status (a value of either 0 or 1).



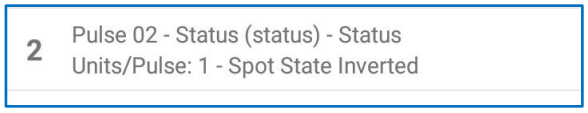
Select a logging mode of “Spot State” to record (log) the regular input status.

If you wish to change (invert) the logic of the status input, the “Spot state inverted” option may be chosen.
(e.g., This may be required for a switch which has a “normally closed” rather than a “normally open” condition).



The summary status is shown opposite for a channel set up to the log normal state input.

The summary status is shown opposite for a channel set up to the log inverted state input.



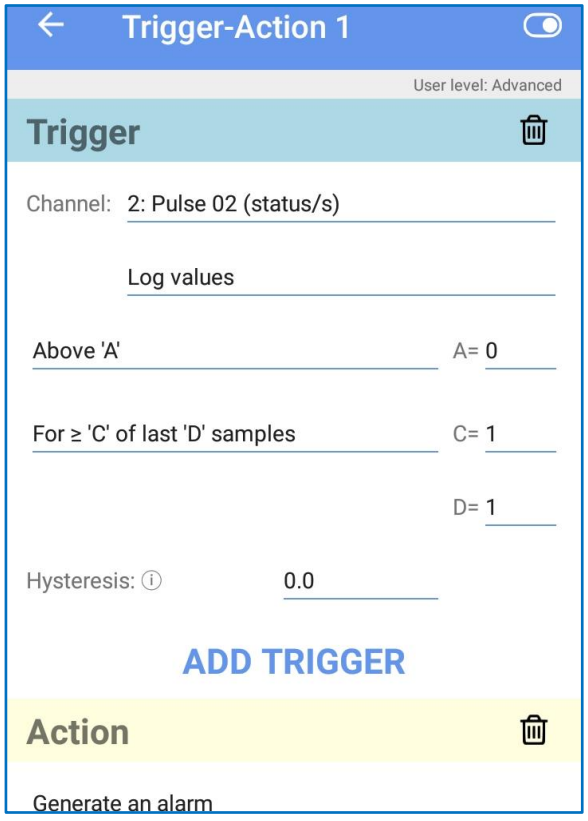
Both of the above give the same result for a hardware test; it reports the raw input state (before any inversion is applied).

Triggers and actions can be set using the regular setup process, where triggers can be set to match specific conditions from recently logged datapoints.
(The datapoints can be either the regular or inverted status input, depending on the channel settings).

e.g. The settings shown opposite will trigger immediately (on a log boundary) if the input switches from 0 to 1.

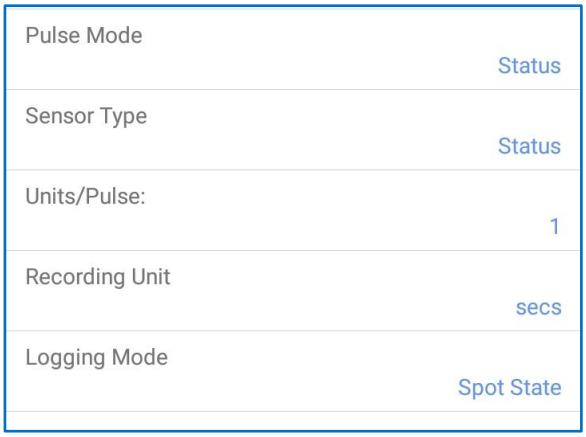
The user should consider any threshold values carefully to ensure the logger can be triggered.

e.g. In the example, setting A to “1” will not permit the logger to trigger since the required data value would be out of range; the data range for a status type data stream cannot exceed “1”, so cannot be “Above 1”.

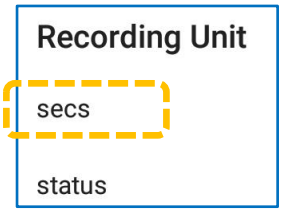


7.4.2 Use as a Time-On data stream

The logger can measure how long a status input remains in a specific state within each log period. The results can be recorded (as datapoints) using a unit of time, namely seconds.

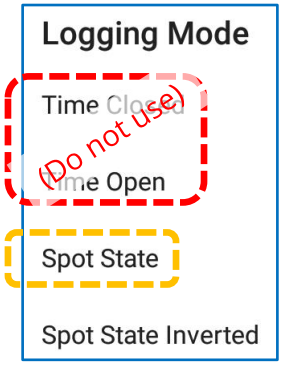


To accomplish this, select a recording unit of “secs”.



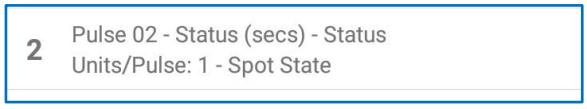
Set the Logging mode to be “Spot State” to consider the regular input status.

If you wish to change (invert) the logic of the status input, the “Spot state inverted” option may be chosen.
(e.g., This may be required for a switch which has a “normally closed” rather than a “normally open” condition).

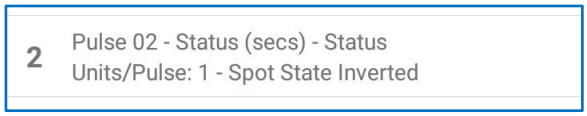


This changes the logger trigger options to consider the input status as a function of time; the number of seconds the input is at a logic level of “1” between each datapoint being produced.
The time counter resets to 0 seconds whenever a new datapoint has been created.

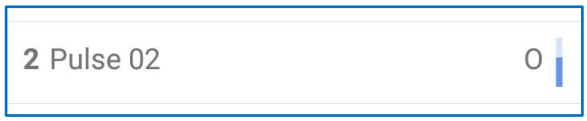
The summary status is shown opposite for a channel set up to the log normal state input.



The summary status is shown opposite for a channel set up to the log inverted state input.



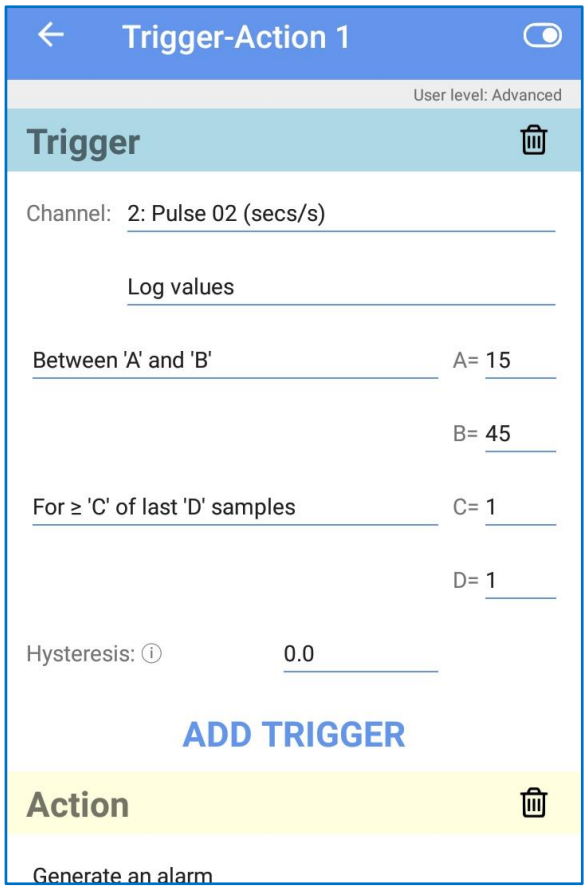
Both of the above give the same result for a hardware test; it reports only the raw input state (before any inversion is applied).



Note: The *time-on result* is not shown.

Triggers and actions can be set using the regular setup process, where triggers can be set to match specific conditions from recently logged datapoints.
(The datapoints can be either the regular or inverted status input, depending on the channel settings).

e.g. The settings shown opposite will trigger immediately (on a log boundary) if the status input is closed for a total time of between 15 to 45 seconds during the last log period.

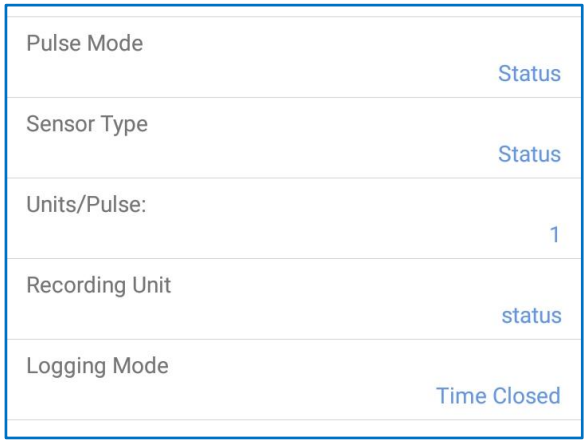


The user should consider any threshold values carefully to ensure the logger can be triggered.

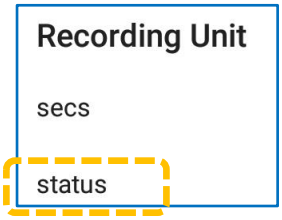
e.g. In the example, say the log period is set to be 5 minutes. (300 seconds).
Setting A above “300” will not permit the logger to trigger since the data value would be out of range; the data range for this channel data stream cannot exceed “300” (seconds) due to the log period set.

7.4.3 Use as a Time-On (%) data stream

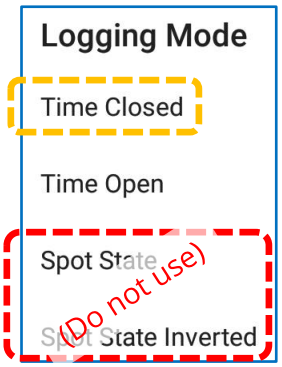
The logger can measure what % of the time a status input is in a specific state within each log period. The results can be recorded (as a series of datapoints).



To accomplish this, select a recording unit of “status”.



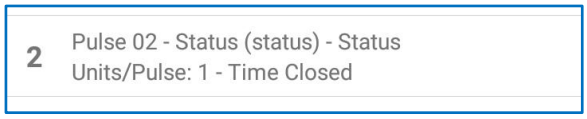
Set the Logging mode to be “Time Closed”.
(This should be considered as “% of time closed”).



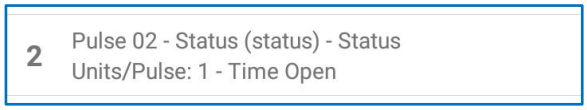
A “Time Open” option may alternatively be chosen if required.
(e.g., This may be required for a switch which has a “normally closed” rather than a “normally open” condition).

The logger calculates the proportion of time (relative to a log period) that the Status pin is in the chosen condition. The datapoints will be in the range of 0 to 10000.
So, if “Time Closed” is chosen, then a value of “0” would indicate permanently open, whilst a value of “10000” would indicate permanently closed.

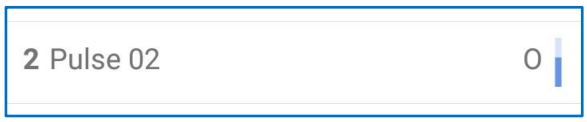
The summary status is shown opposite for a channel set up to the log % of Time Closed.



The summary status is shown opposite for a channel set up to the log % of Time Open.



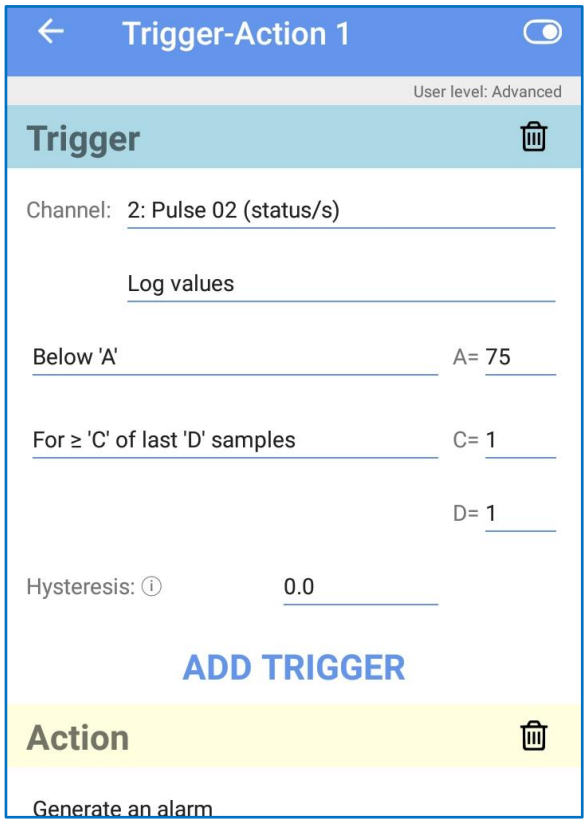
Both of the above give the same result for a hardware test; it reports the raw input state (before any inversion is applied).



Note: The *% time-on result* is not shown.

Triggers and actions can be set using the regular setup process, where triggers can be set to match specific conditions from recently logged datapoints.
(The datapoints can be based on either the proportion of Time Open or proportion of Time Closed, depending on the channel settings).

e.g. The settings shown opposite will trigger immediately (on a log boundary) if the status input is closed for a proportion of less than 75% of the time during the last log period.



The user should consider any threshold values carefully to ensure the logger can be triggered.

e.g. In the example trigger shown:

Setting A as “0” (or lower) will not permit the logger to trigger since the channel datapoint value would always exceed this; the data range for this channel data stream is always “0” (or above).

Setting A as “101” (or higher) will not permit the logger to clear from being triggered since the data value would always be below this; the data range for this channel data stream is always “100” (or below).

7.5 Status Outputs

(This Sub-section applies to ‘group 3’ loggers only).

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

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

IDT provides support for the setup of the logger for the following use of an output signal:

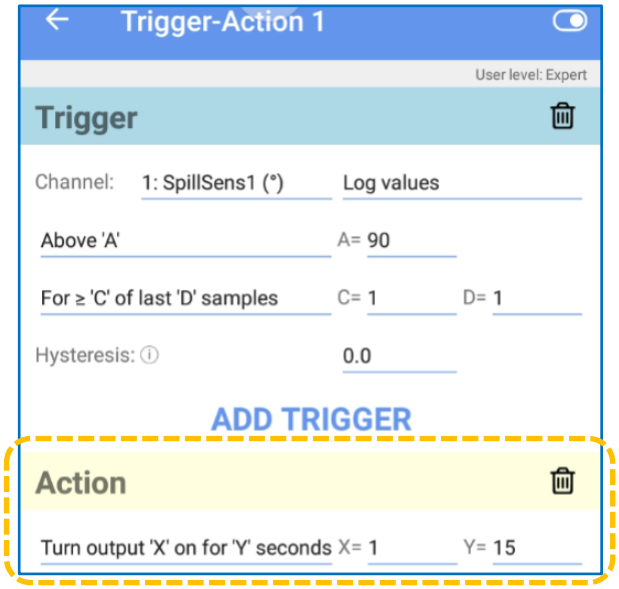
- Pulse replication of a digital flow meter (i.e., one which generates meter pulse outputs). (See section 7.6.2).
- General-purpose output signal that can be switched as the action part of a trigger-action logger setting. (See section 7.5.1).

7.5.1 Use of Status output as part of a trigger-action

A Status Output can be used to control the activity of equipment external to the logger.

An example of use would be for the logger to monitor the water level of a channel and if it goes above a certain level (possibly indicating some spillage of wastewater into a river due to drains being overloaded), the output can be used to activate some water quality measuring equipment.

The trigger is set using data from an appropriate sensor. The action is set to drive the status output signal for a set time (e.g., see opposite).



7.6 Flow Input (from a Flow / Pulse interface)

(This Sub-section applies to ‘group 3’ loggers only).

The interface known to IDT as “Pulse” may (where fitted) be labelled “Bi-Directional FLOW” or “Uni-Directional Flow” or similar. It may also be unlabelled except via inspection of the model-number of the logger (refer to the logger manual).

Note: “Pulse input” can be considered as the *general-purpose* name for the interface.
It can be known by additional (more specific) names when the function has been set within the logger setup.
A pair of pins (i.e., 2 pulse inputs) is normally presented on a single connector.
Each pin may be assigned a different use, or their use combined as a pair.

The interface is versatile and can be used for a variety of purposes. One such use is as a **Flow Input**. The interface supports a family of different types of Flow measurements, depending on the logger setup.

The interface is best considered as a pair of pulse input pins, since many Flow interface configurations require the use of two pins; others require just one pin. The two separate pins of a pulse input pair, however, are not necessarily equal in functionality. One of the pulse inputs (usually the odd numbered one, Pulse1, Pulse3 … etc) should be assigned a use first.

During setup of the odd-numbered pulse input, the logger determines how many pins are required to implement the chosen functionality. The even-numbed pulse input may be automatically seized by the logger for interfaces that require the two pins to be used together.

The interfaces that can be supported by **a single pulse input** (1 pin) are:

- Uni-directional Flow:
  Each open → closed transition of the input (from a meter) signals the flow of a set volume of a fluid. The rate of meter pulse arrival indicates the rate of fluid flow through the meter.
  The meter signalling gives no direction indication and is commonly used for uni-directional metering. For instance, uni-directional flow can indicate the consumption of a commodity (e.g., Water, Gas, or other fluids).

The interfaces that can be supported by **a pair of pulse inputs** (2 pins) are:

- Bi-directional Flow:
  Various systems of signalling can be used to indicate the flow of a set volume of a fluid and to specify the direction of flow (Forward or Reverse). The rate of meter pulse arrival (by various types of signalling) indicates the rate of fluid flow through the meter.
  The meter signalling includes direction information and is therefore used for situations that require 2-directional flow of fluid to be metered.

Note: Update of the logger firmware to the latest version is recommended.

If the user chooses to continue to operate a logger with firmware earlier than v3.0.0, then refer to the earlier version of this user guide (i.e., MAN-2000-0001-A) for a description of setup of the flow interface and its operation. The setup method and selection choices are different, and the descriptions here do not apply.

Note: On some logger models, Status Inputs may share the same input electronics. However, only one purpose can be assigned to a pin at any time.

Setup of a Flow interface can be summarised as follows:

- Select the relevant Pulse interface for use.
  (For bi-directional meters this will require the setup of a specific pulse input of a pulse-input pair. For uni-directional meters, any input can be selected from the pulse input pair).
- Set the mode of the input (uni-directional or bi-directional).
- For bi-directional only:
  - Set the Pin Configuration / signalling.
  - Set the method of storing Flow results.
- Continue setting the channel in a manner similar to most other channels.
- Check that the sampling rate is suitable for the meter signals; adjust if needed.
  Unlike most other channels, a Flow (meter pulse detection) channel requires very frequent sampling of the input pins, so have an additional setting for timing.

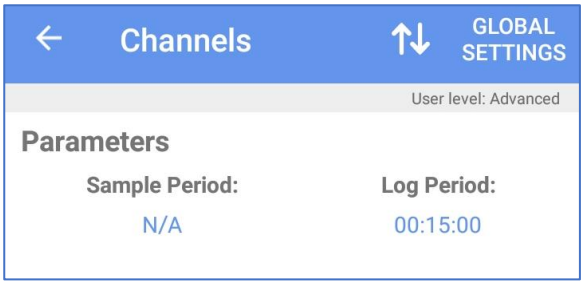
Flow was introduced during an example earlier in the user-guide (see section 3.4.2).
Here we will consider the channel setup in more detail…

7.6.1 Flow input selection

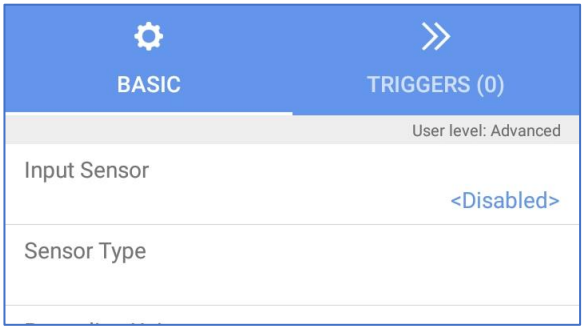
To set up a new Flow (meter pulse input) channel:

Go to the Channels screen.

Tap the " + " line to add a new channel.



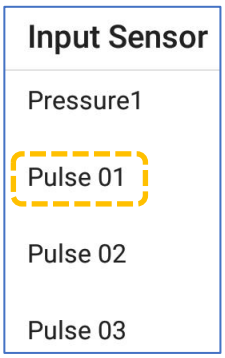
Tap the "Input Sensor" line.
(Currently, it shows "<Disabled>"; it is unconfigured).



Select the required "Pulse (nn)" type interface from the list of interfaces.

If you are required to make an interface for a bi-directional meter, use an odd Pulse (nn) input (Pulse 01. Pulse 03, … etc)

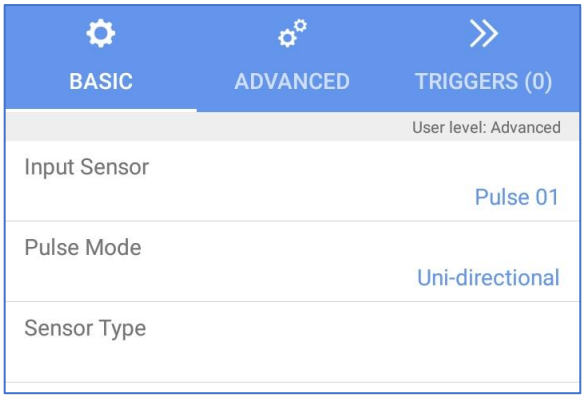
e.g., Tap on "pulse 01".



The selection is shown on the screen.

The “Pulse-Mode” setting may have defaulted to some value, which can be changed if required.

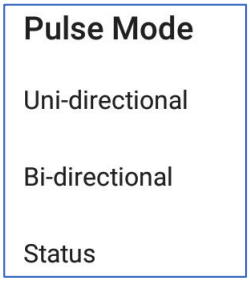
(An “Advanced” tab also now appears).



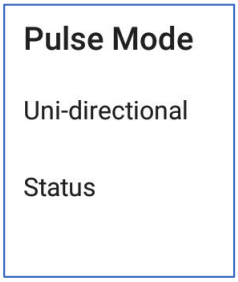
Next tap on the “Pulse Mode” line.

The shown options will vary according to whether an odd or even Pulse input is being set up.

Tap on the selection required.
e.g. For a uni-directional flow meter type interface, select “Uni-directional”.



Pulse nn, (for odd nn)

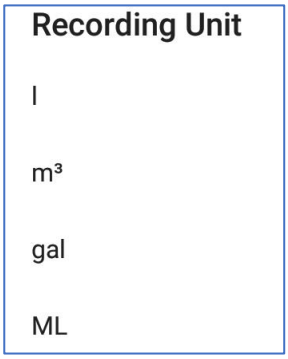


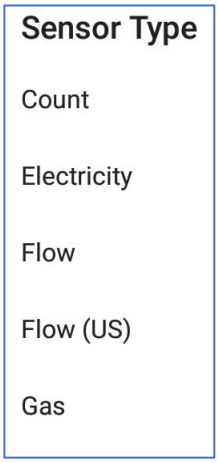
Pulse nn, (for even nn)

For a Pulse Mode of “Uni-directional” …

Tap on “Sensor Type” select the physical substance or characteristic which is being measured.

The selection here will determine the list of units of measure which are available to choose from later (i.e., the available recording units).



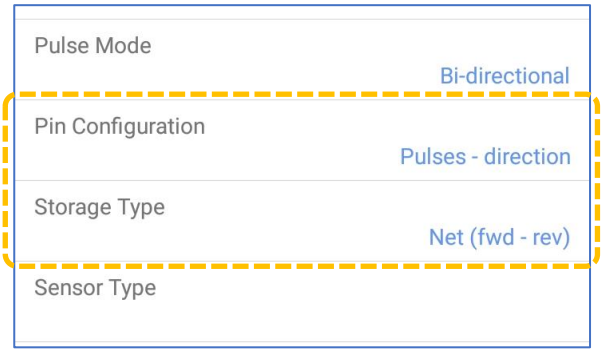


Continue setup by choosing a recording unit, etc; follow the guidance in section 3.4.2 (as required).

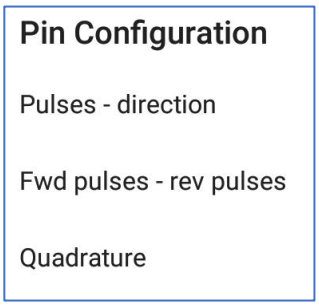
For a Pulse Mode of “Bi-directional” …

Further setting stages appear…

Tap on “Pin Configuration”.



Select from the listed options.
(e.g., “Pulses – direction”).
This sets the signalling protocol for the interface, and so must be set to match the meter that is being connected to the logger.



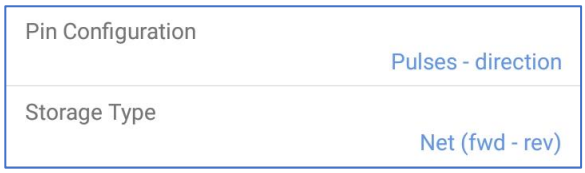
- Pulses – direction (Pulses & Direction signals)
  - The even pin (Pulse 02, Pulse 04, etc) acts as a direction indicator.
  - The odd pin (Pulse 01, Pulse 03, etc) acts as a meter pulse to indicate a volume of the commodity has passed through the meter.

  Note: The logger supports “net flow” for this type of interface signalling. The logger can alternatively split the flow information into 2 separate datapoint streams (forward flow and reverse flow).
- Fwd pulses – rev pulses (Forward Pulses & Reverse Pulses)
  - The even pin (Pulse 02, Pulse 04, etc) acts as a meter pulse to indicate a volume of the commodity has passed through the meter in the Reverse direction.
  - The odd pin (Pulse 01, Pulse 03, etc) acts as a meter pulse to indicate a volume of the commodity has passed through the meter in the Forward direction.

  Note: The logger supports “net flow” for this type of interface signalling. If 2 separate datapoint streams (forward flow and reverse flow) are required, use 2 Uni-directional channels instead; the split into forwards and reverse flow directions is already done at the meter.
- Quadrature
  - The signalling is encoded in grey-scale binary.
  - Sequence 00 → 01 → 11 → 10 → 00 ; Each transition indicates forward flow through the meter.
  - Sequence 00 → 10 → 11 → 01 → 00 ; Each transition indicates reverse flow through the meter.

  Note: The logger supports only “net flow” for this type of interface signalling.

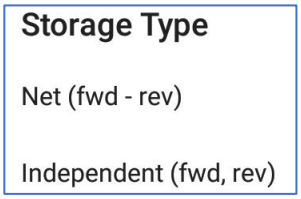
When the Pin Configuration is set to “Pulses – Direction”:



Tap on “Storage Type”.

Then select from the listed options.
(e.g., “Net (fwd – rev)”).

This sets the method used to produce and store channel datapoints.

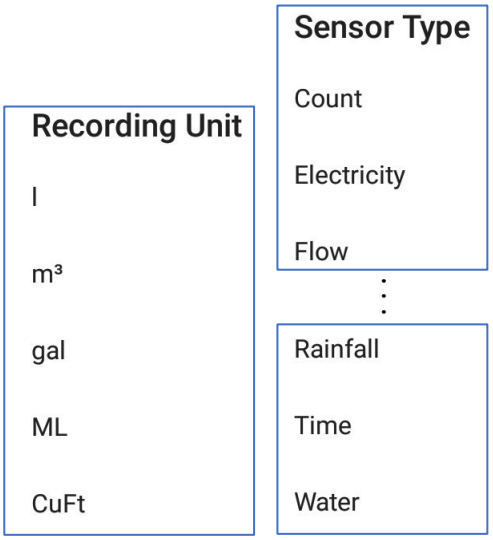


- Net (fwd – rev)
    - The logger keeps track of a forward and reverse consumption (flow pulses) using counters.
    - A single set of Flow Rate datapoints is added to the logger recording memory and is assigned to the channel number being set up.
    - The logger uses a Net Flow calculation to produce the datapoints. (Value recorded = Forward pulse count – Reverse pulse count … for new pulses obtained between each log period).
- Independent (fwd , rev)
    - The logger keeps track of a forward and reverse consumption (flow pulses) using counters.
    - Two sets of Flow Rate datapoints are added to the logger recording memory, one indicating the consumption in the forward direction and the other consumption in the reverse direction. … for new pulses obtained between each log period.
    - The Forward set of datapoints is assigned to the (odd) channel number being set up.
    - The Reverse set of datapoints is assigned to the (even) channel number immediately above the channel being set up. (It will be shaded grey when shown in IDT; There is no direct edit availability).

Tap on “Sensor Type” select the physical substance or characteristic which is being measured.

The selection here will determine the list of units of measure which are available to choose from later (i.e., the available recording units).

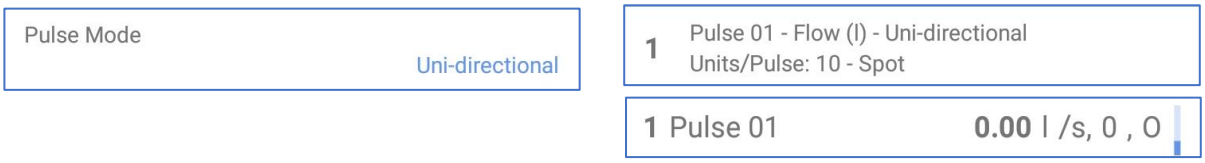
Continue setup by choosing a recording unit, etc; follow the guidance in section 3.4.2 (as required).

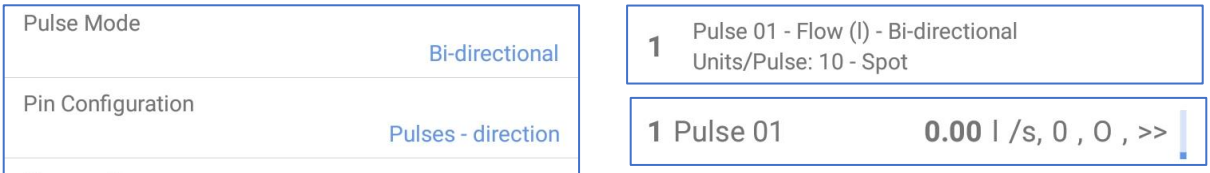


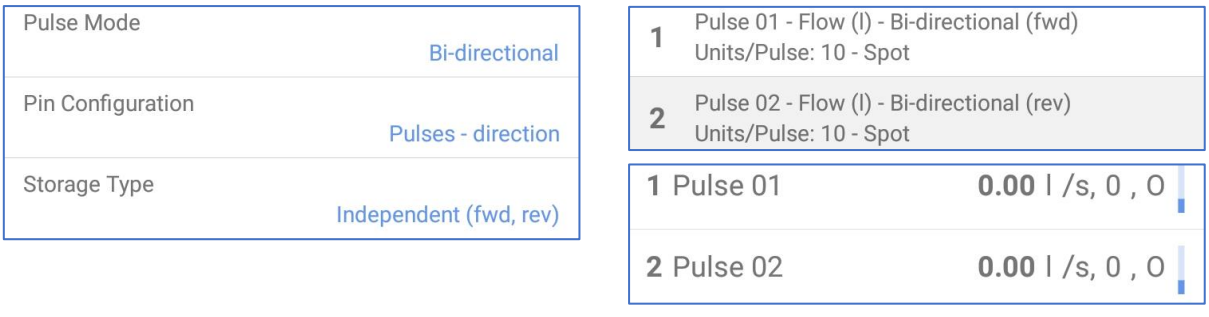
Typical Channel summary and Hardware Tests are shown below for the various options:

Formats: Flow value, unit, pulse count, pin state or
pulse count, pin state or
Flow value, unit, pulse count, pin state, pin direction or
Flow value, unit, pulse count, pin state, pin state.

Key: O = Open
X = Closed
<< = Reverse Direction
>> = Forward Direction.

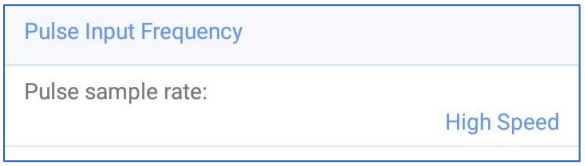




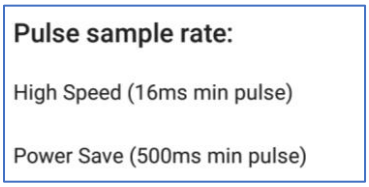


Pulse speed / Timing

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

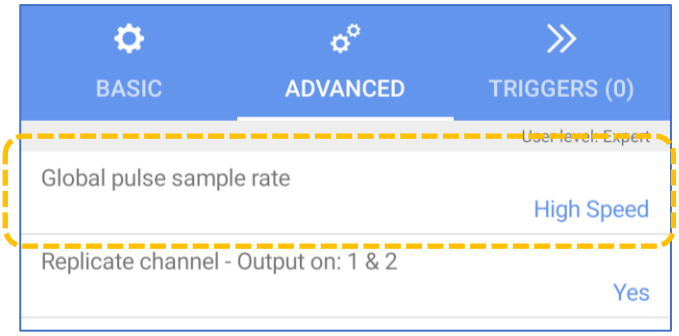


Refer to section 3.3 for details of how to check or adjust this timing parameter (see opposite).



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

For convenience, the same control is accessible within the "Advanced" tab of the setup of a Flow (pulse) interface.
Note that the setting will be applied to all Flow (pulse) channels.



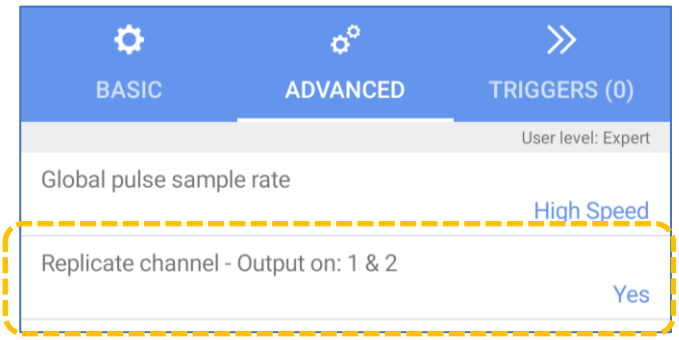
7.6.2 Pulse Replication output

Utility companies sometimes install several items of equipment that each require access to the meter output signals. One solution to this is for equipment to replicate the meter pulse signals that are input to them. The items of equipment can then be serially interconnected so that the pulse information is transferred from one unit to another.

It is possible to re-purpose a Status Output from certain loggers to replicate the meter pulse signals.

Select the logger channel that uses the meter signals.

In the channel configuration screen, select the Advanced tab.



If pulse replication is required check / adjust the setting for the "Replicate Channel – Output on: …". Setting to "Yes" will activate the pulse replication.

The line lists the status outputs that are being used for the pulse replication. (One is required for a Uni-directional meter. Two are required for a Bi-directional meter).

Note: Not all loggers have this feature available.
Pulse replication may not be available for all pulse input channels. Check logger user-guide for any restrictions of pulse replication.

7.6.3 Tamper alarm sensor

Utility companies sometimes have items of equipment installed that are used for billing purposes (e.g., a gas meter). The logger may be used for automated meter reading purposes and must therefore remain connected to the utility meter at all times.

Utility companies can apply mechanical seals to bear witness to any attempt to tamper with the equipment. However, some loggers also have a facility of providing detection of a customer tamper attempt. Here, the inter-connecting cable between logger and meter is monitored electronically for any disconnection attempt (if the meter is compatible).

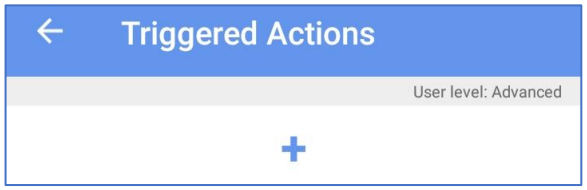
For loggers that support this facility, it is possible to use (re-purpose) a Flow (Pulse) Input to implement the tamper-detection. The pulse (tamper) input detects an electrical path (loop) is present when it is attached to the meter. If the cable is unplugged from the meter, the path no longer exists, and a tamper alarm can be indicated to the server.

Note: A single cable should include the meter pulse signals and the tamper detection signal, with both sharing the same connectors.
For loggers that are supplied with 2 pulse inputs per connector, the consequence is that the tamper detection feature is only available using a uni-directional flow channel (and is used at the expense of disabling the availability of the second flow channel within the interface).

To set up a sensor for Tamper alarm, first setup the Flow channel for use (see section 7.6.1) then follow the following steps:

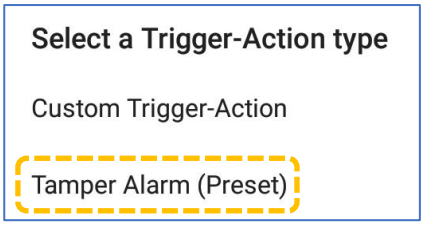
From the main page, find the Triggered Actions control and tap on it.

Tap on the "+" line to add a new Trigger-action combination.



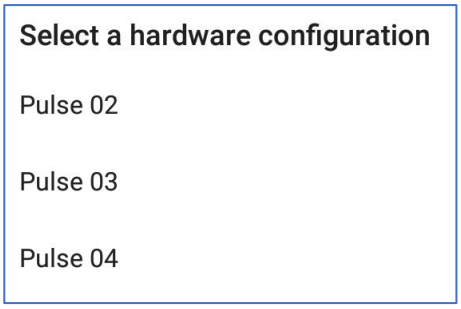
IDT has a facility to use a *Tamper-Alarm pre-set* to simplify its setup. Tap on this line.

(Pre-sets can sometimes implement settings that the user may not have direct access to).



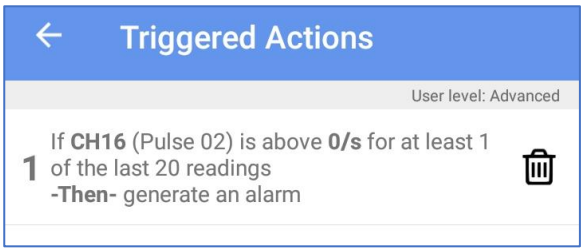
Next select the Pulse input pin that is to be used as the Tamper detection signal.

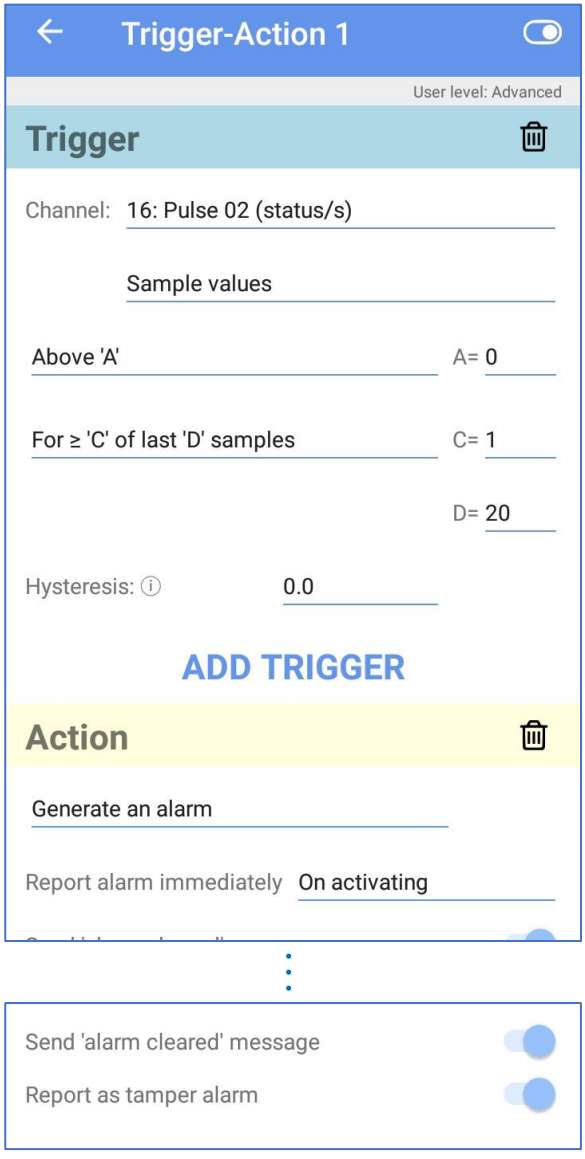
e.g., To protect a uni-directional Flow input set up using the Pulse 01 input, Pulse 02 should be chosen if it shares the same connector.

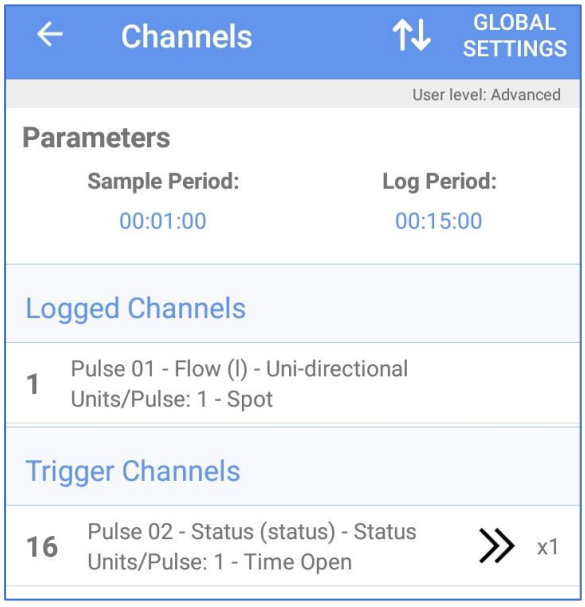


IDT will make several changes to logger settings to implement a tamper detection and the appropriate alarm.

(The illustrations opposite and below are for information only... The tamper detection has been implemented using the Pulse 02 input signal, monitoring time open, and triggering immediately when first seen.
It requires a compatible cable where Pulse 01 / Pulse 02 share the same connector; Pulse 02 input protects against removal of Pulse 01, which is the meter pulse input).





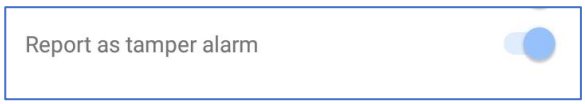


Note: Channel 16 is being used by the logger here. IDT chooses this “end channel number” to keep it separate from any channels that are in use for regular data-logging.

7.6.4 Tamper alarm (message option)

It should be noted that the tamper detect facility described in section 7.6.3 is distinct from the ability to send a "report as tamper alarm" message, although they are intended to be used together.

The "Report as tamper alarm" option *includes an additional message* when sending the alarm to the server. It (if the server software supports) allows regular alarm conditions to be prioritised and handled differently to customer tamper attempts.



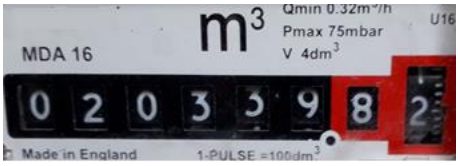
7.6.5 Meter Reading(s)

Digital Flow Interface channels are often used to track the usage of a commodity (e.g., of gas or electricity) supplied by a utility company. The commodity passes through an on-site meter, which can indicate consumption (use) by providing meter pulses. An initial meter reading has to be taken and entered into the logger to enable this feature. When the logger calls into the server with the flow measurements datapoints it can also include a calculated current meter reading.

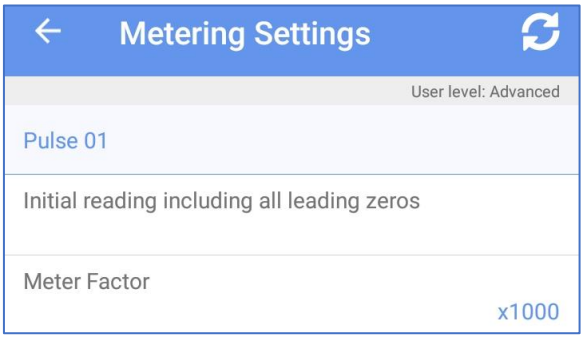
From the main screen, locate the Metering settings control. (This includes a summary of all meters being monitored by the logger, as space allows, depending on how many meter interfaces are currently in use).

Tap on the "Metering Settings" line.

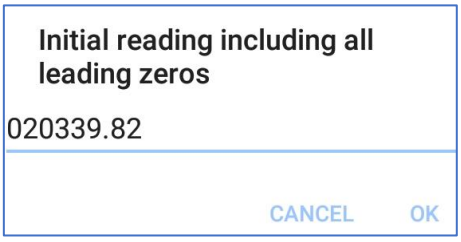
Read the main meter, noting its format.



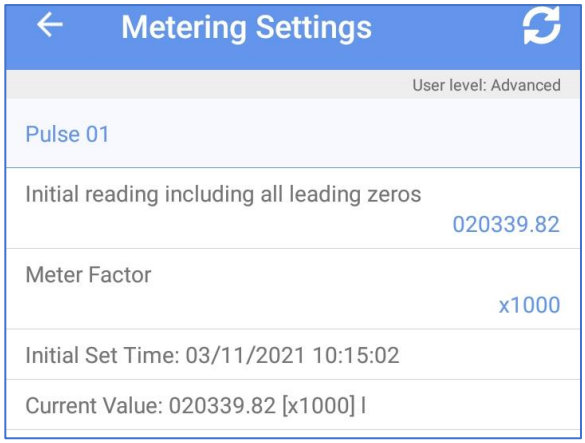
Tap on the "Initial reading …" line for the Pulse interface connected to the meter.



Next enter the meter reading.
(Include any leading zeros, the decimal point, and any other displayed digits).



The screen will update to show the meter reading that was entered.



It also shows the time the initial meter reading was obtained.

The "Current Value" will show the *calculated* current meter value. This is not live but updated upon entering the "Metering Settings" screen.

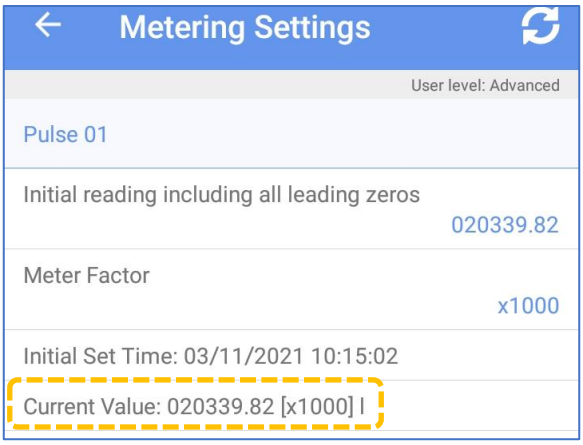
Calculate and enter a meter factor.

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

Tap the back-arrow and the entered reading for Meter 1 is now shown. (This is not a live value).

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

Wait for the display of the real meter to change by a few digits.
Note the meter reading and tap on the "Meter Settings" control.
Confirm the logger's "Current value" reading matches the 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.

Where more than one Pulse channel is used for metering purposes, the meter reading entry page will show a section for each one. Make the settings (as above) for each meter in the relevant section. Then confirm the operation of each metering (calculated current value) is operating as expected, using the method described earlier.

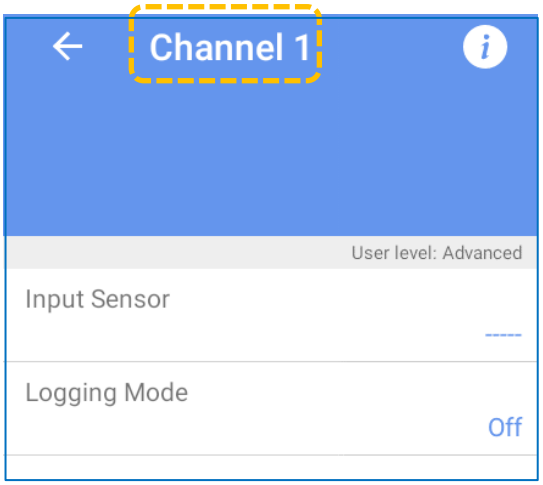
7.7 Pressure Sensor input (Using 'Group 1' Loggers)

7.7.1 Setup

From the "Channels" page, tap on the " **+** " symbol to add the channel.

A channel number is allocated for the outgoing data stream, and a page is loaded with the current settings.

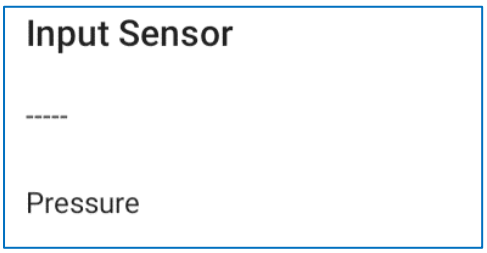
Initially there is no Input Sensor selected.
(Shown here as "-----", the channel is disabled).



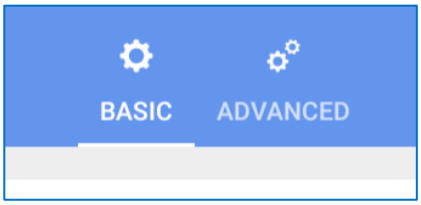
To select an electrical interface for an input sensor, tap on the "Input Sensor" line.

A pop-up box is shown on the screen for the user to select which input to use for this channel.
(Here, the logger offers either to disable the input, or to use a "Pressure" sensor input).

Tap on the Pressure line to make the selection.



Continue channel set-up using the "Basic" tab.
However, certain sensors require additional settings or controls, which may cause other tabs to appear on the page, such as the "Advanced" tab (shown opposite); check for these.

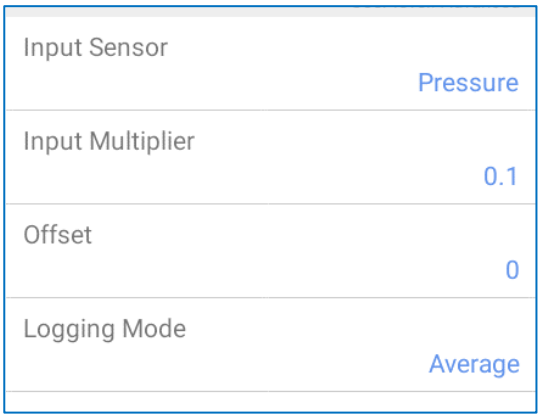


The input sensor of "Pressure" has now been selected.

Check the other fields before accepting the change.

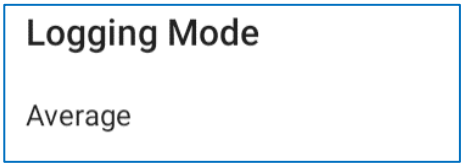
The input multiplier field should be set to give your required unit of measure. (Refer to the logger user-guide for further information).

The offset for a pressure channel is usually "0".



The Logging mode lists all available modes of operation on the channel for obtaining the datapoints.

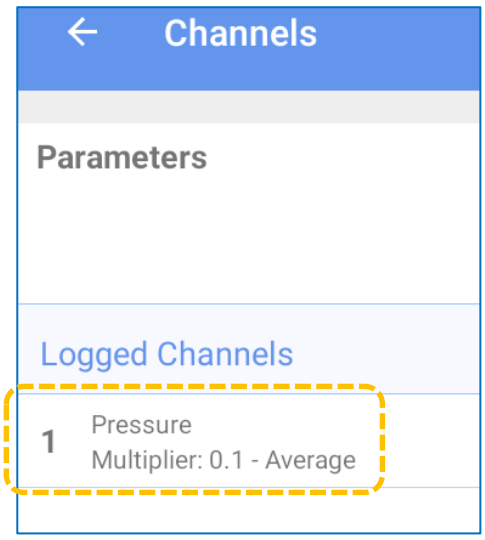
Here, an "average" value of the sensor reading is the only available option.



Once the content of all the fields is correct, tap on the “accept” button to commit the changes to the logger.

IDT will take a few seconds to modify the program settings within the logger. It will then re-start the logger, so that the logger is making a new recording (because the operation of the channels has been changed).

Tap the left arrow to return to the Channels screen, and check that the channel is now present and has correct settings.



Note: Before using a pressure channel, be sure to re-zero the sensor. Refer to section 7.7.3.

7.7.2 Calibration

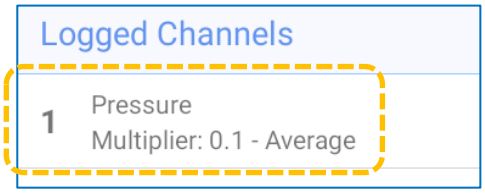
Pressure transducers supplied with loggers listed in ‘group 1’ are factory calibrated with the logger that they are supplied with. Any subsequent calibration must be made by an authorised service center.

7.7.3 Re-zeroing a pressure channel

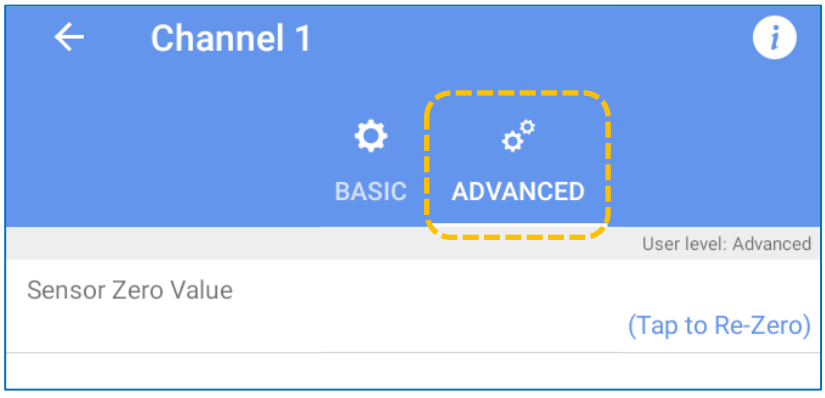
IDT allows the user to re-zero the pressure channel to local atmospheric pressure prior to being used.

Note: Before proceeding, ensure that the pressure sensor has been removed from the measurement point and exposed to the local atmosphere.

From the Channels page, tap on the Pressure channel that is to be re-zeroed.



Select the “Advanced” tab on the setup page of the channel.

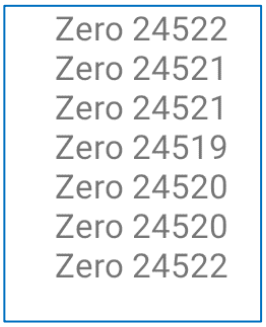


When ready, tap on the “Sensor Zero Value” line.

Then tap on the “Start” button.

The screen will start making periodic measurements and will indicate a numeric (raw data) result.

Wait for the readings to stabilise.



Then tap on the Store button.

(This saves the last result as the pressure calibration ‘zero’ reference).

7.8 Pressure Sensor input (Using ‘Group 3’ Loggers)

Your logger may have an “External Pressure” interface fitted. ‘External’ indicates that the sensor is attached to the logger via a cable (in contrast with a sensor that is built-into the logger enclosure).

Depending on the type of sensor supplied, the interface to the sensor could be analogue or digital.

7.8.1 Setup of External Pressure Interface (analogue)

This takes the form of an *analogue* interface which is compatible with certain analogue sensor transducers. Compatible sensors are available to measure:

- Pressure of a fluid or gas.
- Depth of a fluid.

Pressure sensors connect to pressurised fluids within a pipe, at some measurement tap. Depth sensors are installed at the bottom of a vessel and measure depth of a fluid by also measuring pressure, which is related to the height of the fluid above the sensor.

The sensors are required to be calibrated with the logger prior to use. Recalibration is required if sensors are replaced (or if swapped between logger connectors).

The IDT app gives access to the calibration settings as part of the channel setup, although the logger may optionally be set to default settings within the factory and calibrated with the sensor prior to shipping.

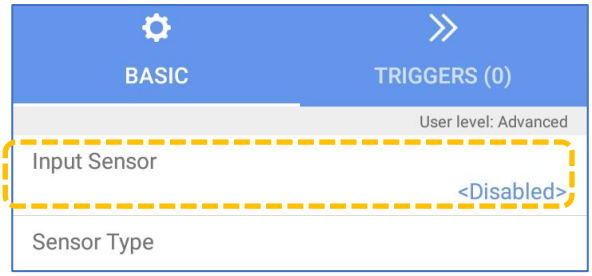
7.8.1.1 Channel Setup (pressure or depth measurement)

Pressure and Depth setup are very similar.

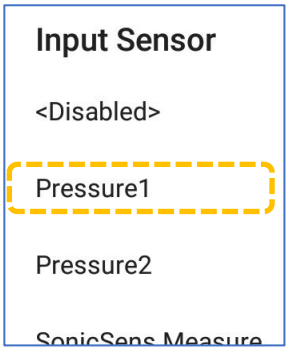
When creating a new channel for the sensor, initially there are 2 tabs displayed.

Select the “basic” tab.

Tap on the “Input Sensor” line.

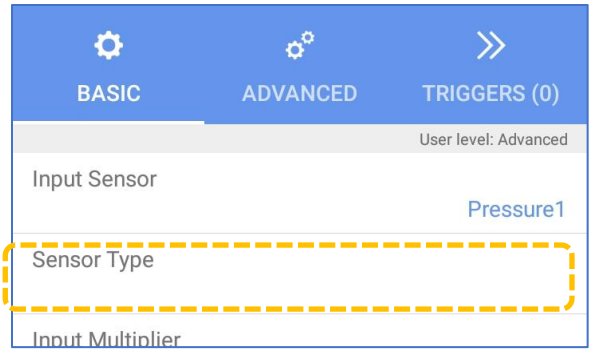


Select the relevant interface by choosing “Pressure1” (or “Pressure2” if you are setting up a second interface, if fitted, … etc.).



Note: This selection is also for sensors that measure fluid depth.

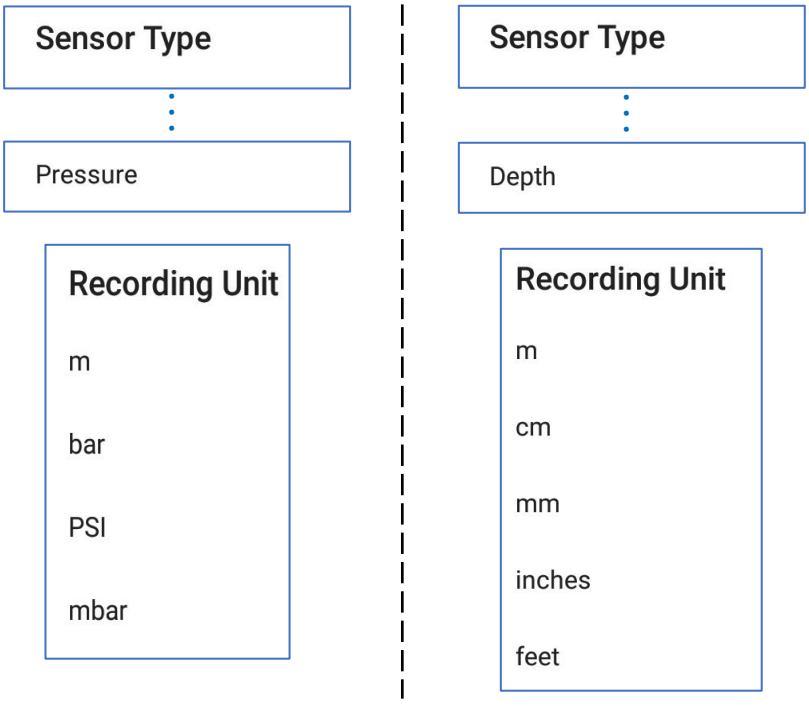
The screen shows the selected pressure channel. In addition, it will now show an “advanced” tab.



Tap on the Sensor Type line.

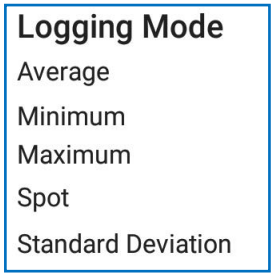
A list of physical parameters will be displayed. (Many choices are available, as the setup of some other sensor types follow a similar process).

Select the physical parameter of “Pressure” or “Depth” from the displayed list.



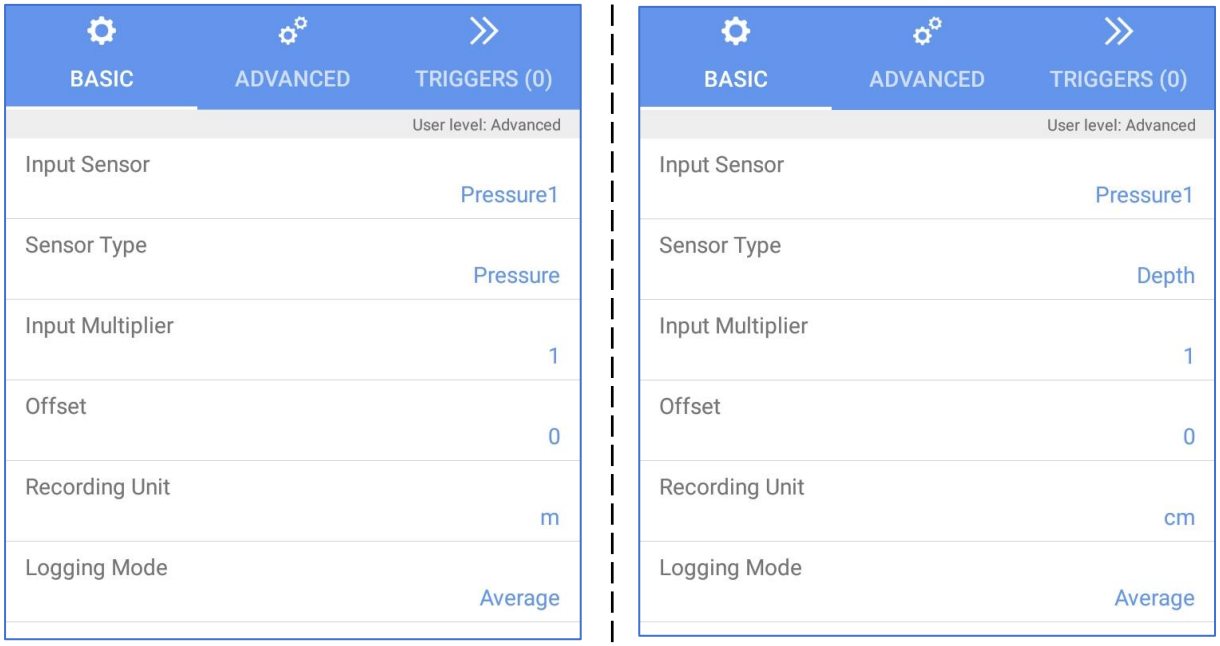
Tap on “Recording Unit” and then select the required unit of measure for the sensor data.

Tap on “Logging Mode” and then select the logging mode you require for producing the channel datapoints.



The completed channel setup screens (for pressure and depth) are shown below.

.



The input multiplier and offset settings can be adjusted if required.

Usually, the Offset is left at “0”, as shown.

The Input Multiplier setting will depend on several factors including:

- What the recording unit is set to.
  (This must be common between the logger and any server expectations for the channel data).
- What units the sensor has been calibrated in.

e.g.(1), If the sever expects a recording (data stream) to use a unit of measure of meters (m) of H^2O, but the sensor has been calibrated in millibars (mbar), then a multiplier of “0.0102” is required to convert from the numeric value in mbar to a numeric value in m of H^2O.
(1m of H^2O = 98 mbar ; 1 mbar = 0.0102 m of H^2O).

e.g.(2), If the sever expects a recording (data stream) to use a unit of measure of meters (m) of H^2O, but the sensor has been calibrated in centimetres (cm) of H^2O, then a multiplier of “0.01” is required to convert from the numeric value in cm to a numeric value in m (of H^2O).
(1m = 100cm ; 1 cm = 0.01m).

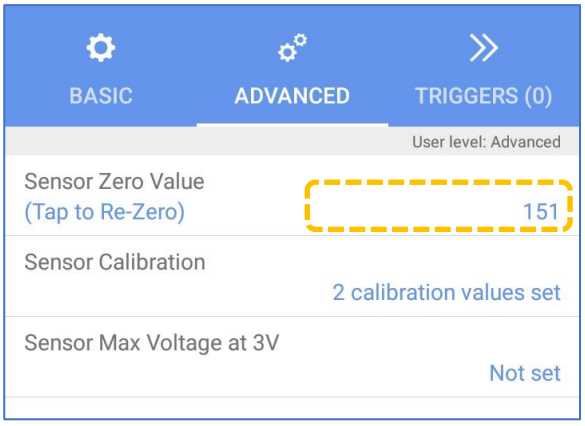
When finished, tap the “Accept” button to save the settings to the logger.

Note: The advanced tab includes controls to re-zero the pressure reading to local atmospheric pressure. (Refer to section 7.8.2)
It also includes access to calibration controls. (Refer to sections 10.1 and 10.2).

7.8.2 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.

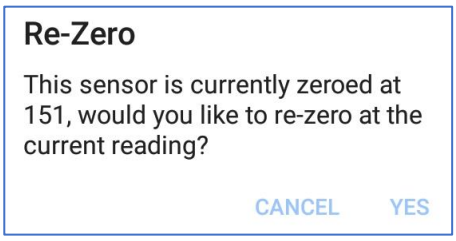
Important: The pressure sensor must be exposed to the local atmospheric pressure whilst making this setting.



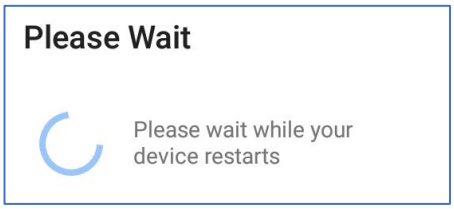
Select the “Advanced” tab of the pressure channel configuration.

Then tap on the “Sensor Zero Value” line. This will record the current sensor output as a new value for a pressure of “0” (relative to atmospheric pressure).

Tap on “Yes” to accept the re-zero.



The logger will restart.



7.9 RTD (TEMP) INTERFACE - TEMPERATURE (USING 'GROUP 3' LOGGERS)

Your logger may have an "RTD (Temp)" interface fitted. This is an interface for use with analogue temperature sensors (RTD types).

Temperature sensors supplied by HWM will come complete with an attached cable and a connector suitable for the logger. The logger will also be supplied calibrated for use with the sensor.

Note: Other temperature sensors may be listed by IDT, such as those built into the logger or built into certain sensors (temperature is not their primary purpose). This section does not cover the setup of any such internal temperature sensors.

The interface for a temperature sensor will appear in the IDT app as a "Pressure" input sensor. (The logger interface electronics and its driver may be multi-purpose, but in this case it is wired and configured for use as a RTD temperature input, rather than a pressure input).

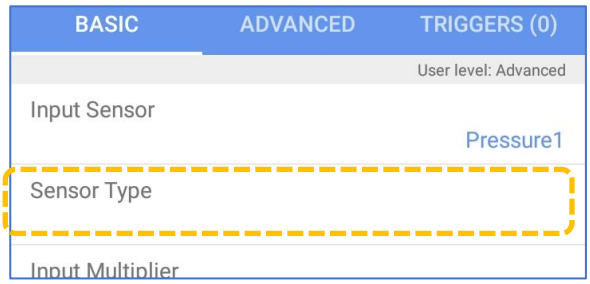
Temperature sensors must be calibrated with the logger prior to use. Recalibration is required if sensors are replaced (or if similar sensors are swapped between two similar logger connectors).

The IDT app gives access to the calibration settings as part of the channel setup (see section 10.3), although the logger may be set to default settings within the factory and calibrated with the supplied sensor prior to shipping.

For setup, proceed as follows:

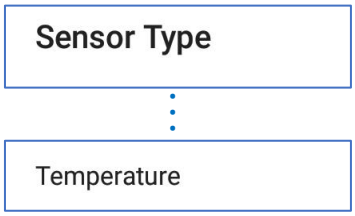
Follow the steps detailed in section 7.8.1.1, until the stage of entering a 'Sensor Type' is required.

Tap on the Sensor Type line.



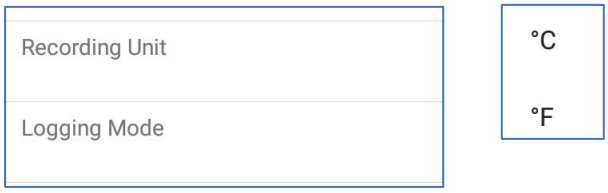
A list of physical parameters will be displayed. (Many choices are available.)

Select "Temperature" from the displayed list.



Tap on 'Recording Unit' and set to the required unit of measure. (Selections listed are now appropriate to temperature measurement).

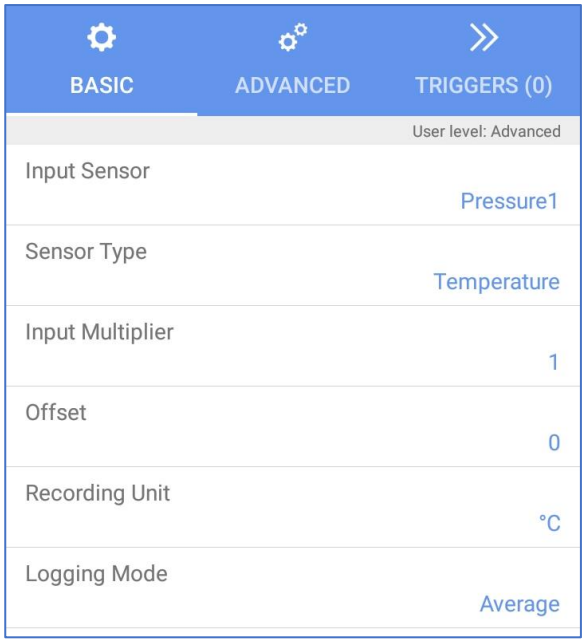
Select the logging mode required for producing the channel datapoints.



The input multiplier and offset settings can be adjusted if required but should usually be set as shown.

Note: An example use of multiplier and offset is for a temperature sensor which has been calibrated in degrees Centigrade but you wish to log results in degrees Fahrenheit.

Since deg F = (1.8 x deg C) + 32 , for the logger to convert:
set Input multiplier to 1.8,
set Offset to +32,
set Recording unit to deg F.



Tap the "Accept" button to save the settings to the logger.

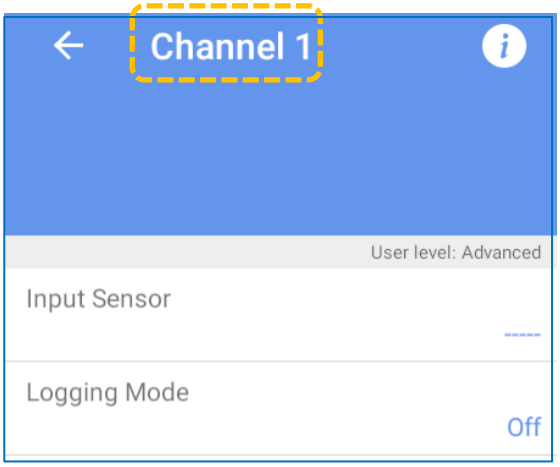
7.10 4 – 20mA INPUT (USING 'GROUP 1' LOGGERS)

From the "Channels" page, tap on the " **+** " symbol. (The symbol is blue if a channel can be added, but grey if no further channels are available).

A channel number is allocated for the data stream, and a page is loaded with the current settings.

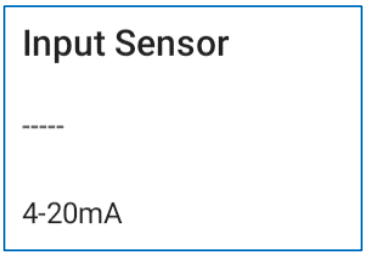
Initially there is no Input Sensor selected.
(Shown here as "-----", the channel is disabled).

To select an electrical interface for an input sensor, tap on the "Input Sensor" line.

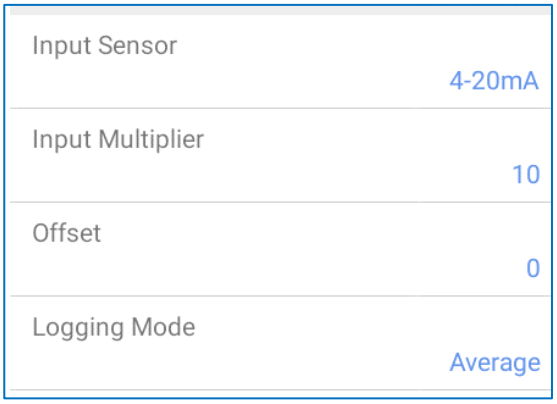


A pop-up box is shown on the screen for the user to select which input to use for this channel.
(Here, the logger offers either to disable the input, or to use a "4 – 20mA" sensor input).

Tap on the 4 – 20mA line to make the selection.



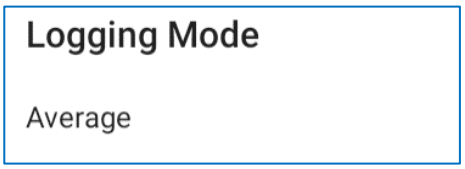
The input sensor of “4 – 20mA” has now been selected.



Check the other fields before accepting the change. They should usually be set as shown in the diagram opposite.

Tap on any line to edit it. Then tap on OK to confirm the change.

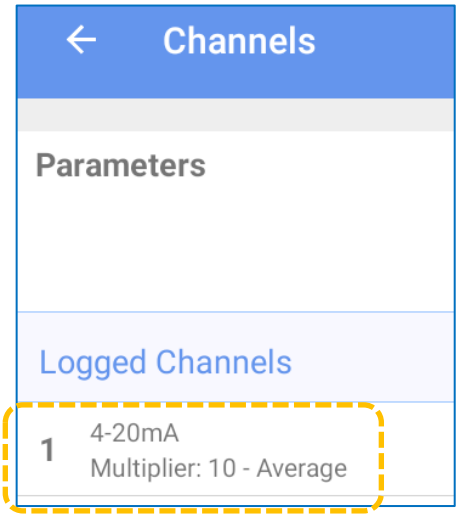
The Logging mode lists all available modes of operation on the channel for obtaining the datapoints.



Here, an “average” value of the pressure reading is the only available option.

Once the content of all the fields is correct, the “accept” button to commit the changes to the logger. IDT will take a few seconds to modify the program settings within the logger. It will then re-start the logger, so the logger is making a new recording (because the operation of the channels has been changed).

Tap the left arrow to return to the Channels screen, and check that the channel is now present and has correct settings.



7.11 4 – 20mA Input (Passive or Active) (Using ‘Group 3’ Loggers)

Your logger may have a “4 – 20mA” interface fitted. These interfaces may be labelled as one of the following:

- “Single Passive 4 – 20mA”
- “Dual Passive 4 – 20mA”
- “Single Active 4 – 20mA” (… or similar).

These are analogue interfaces and are for use with sensors that give an output signal in the form of an analogue current. In particular, they are used with sensors that provide an industry-standard output signal using a current of between 4mA and 20mA.

A wide variety of sensors exist having a 4 to 20mA output signal. Currents outside 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 below 4mA.)

Single and Dual refer to the quantity of inputs that are present in the logger connector. From an IDT perspective, one channel is required per current input.
Dual inputs therefore require the setup of 2 channels.

"**Passive** 4 – 20mA" interfaces are for use with sensors that do not require power from the logger.

"**Active** 4 – 20mA" interfaces are for use with sensors that require power from the logger. The logger is able to supply a limited amount of power for a short period of time (programable) whenever a measurement is required.

The logger is usually factory calibrated for a 0 to 20mA range. The IDT app also gives access to the calibration settings (as part of the channel setup) if re-calibration of the input should ever be required (see section 10.4).

Pairing of a 4-20mA sensor to the logger requires setup of the following two aspects:

- Channel configuration for interpretation of the 4-20mA signalling.
- Consideration of the power requirements for the sensor.

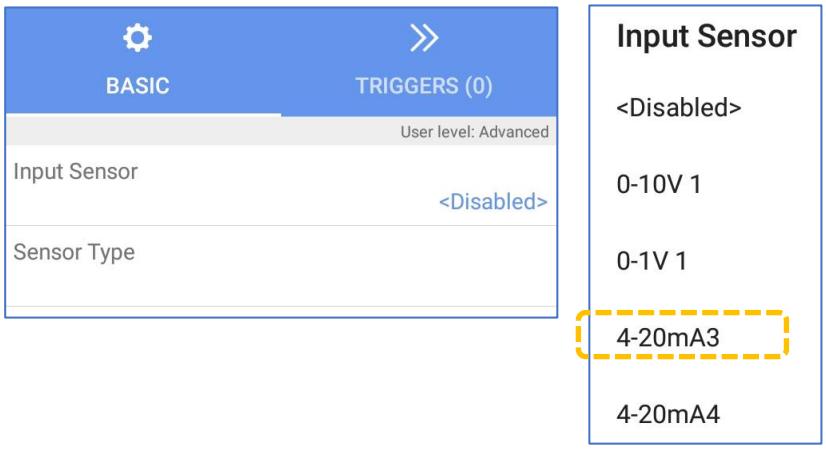
Signalling:

When creating a new channel for the sensor, initially there are 2 tabs displayed.

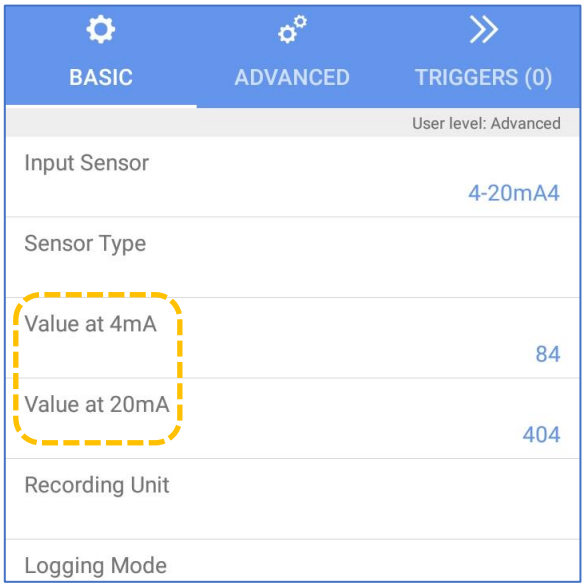
Select the "basic" tab.

Tap on "Input Sensor" and then select the relevant interface by choosing the required "4 – 20mA (n)" sensor.

(Refer to the logger user guide regarding which selections apply to passive or active interfaces).



The screen shows the selected current input interface. In addition, it will now show an "advanced" tab.



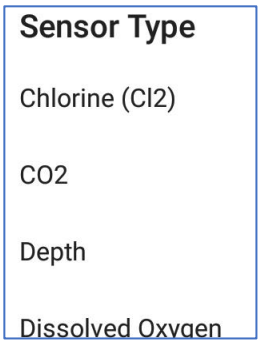
Two additional fields become visible, corresponding to the minimum and maximum valid signalling range of the sensor. (i.e., The values when output is 4mA and 20mA).

Note: These are present when the interface has been calibrated using a base unit of "mA". (Refer to section 10.4).

Tap on the "Sensor Type" line.

Choose from the wide variety of physical parameters offered. (The choice will affect the units of measure offered later in the setup.)

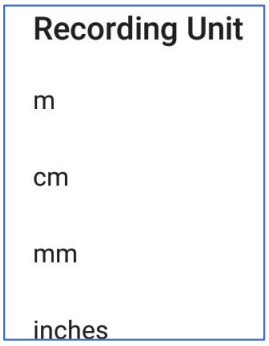
e.g., For a 4 – 20mA sensor which measures depth, select "Depth".

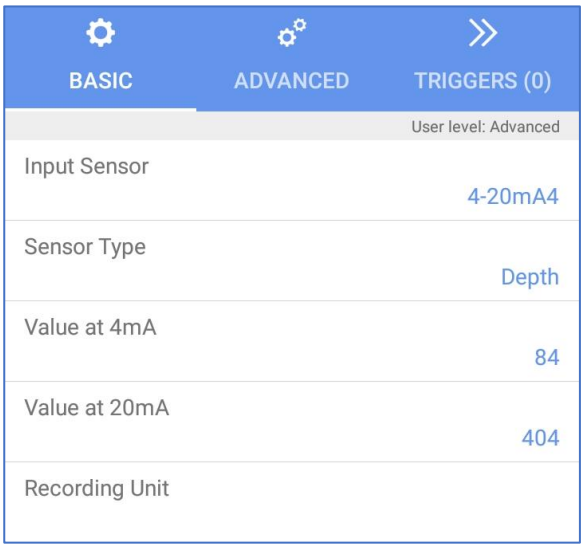


The screen now shows the selected physical parameter to be measured by the channel, but the 4mA and 20mA values are not yet set.

Tap on "Recording Unit".

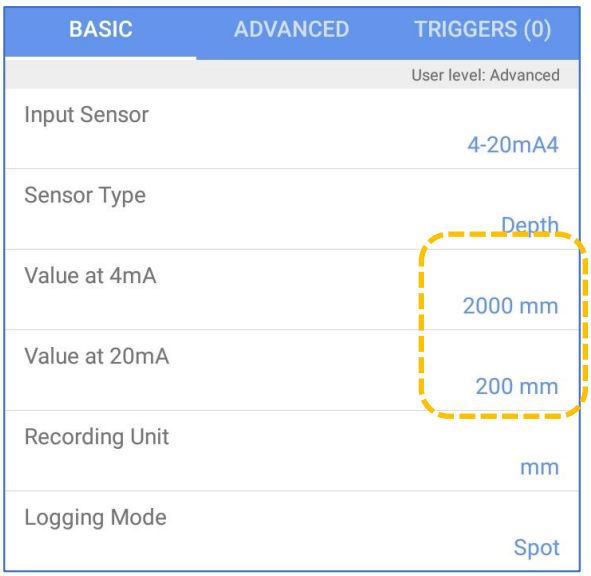
Select the unit of measure which is appropriate to the sensor output.





Refer to the sensor documentation and enter the values which correspond to the currents of 4mA and 20mA through the logger interface.

i.e., The “value at 4mA” and
the “value at 20mA”
in the example opposite.



Select the desired logging mode.

When finished, tap on “Accept”.

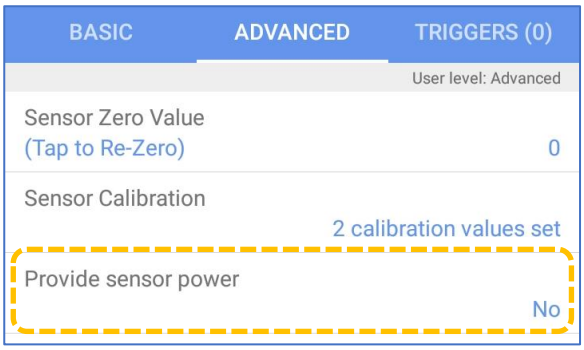
Power:

A sensor may depend on the logger as its source of power. If so, an active interface type is required.

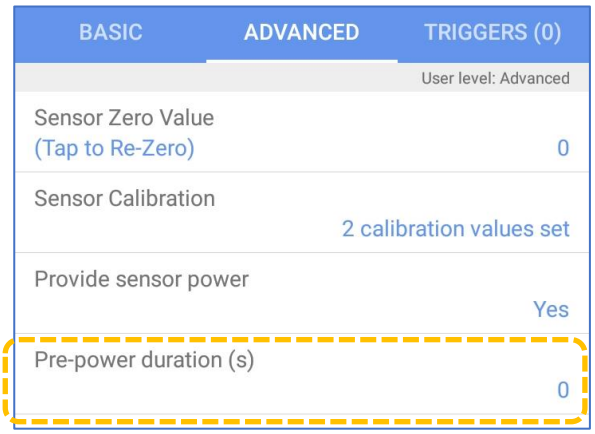
For the “**Active**” 4 – 20mA interface, there are settings to control the power feed to the sensor:

Select the “Advanced” tab.

If the sensor requires power from the logger, tap on “Provide sensor power” and select “Yes”.



Enter the required pre-measurement power duration; This allows the sensor to power up and may include a settling time.
(Refer to the sensor manual for guidance).



When complete, tap on the “Accept” button to save the settings.

When setup of the logger 4 – 20mA interface with the sensor is complete:

The channel summary will indicate the settings (this will depend on the physical parameters the sensor measures).

An IDT app hardware test of the 4 – 20mA sensor will indicate the sensor measurement in a similar way to that shown opposite.
(i.e., IDT will show an input current, rather than the physical parameter being measured by the sensor).

7.12 VOLTAGE INPUT (0-1V AND 0-10V) (USING 'GROUP 3' LOGGERS)

Your logger may have a voltage interface fitted. These interfaces may be labelled as one of the following:

- "Single 0-1V"
- "Dual 0-1V"
- "Single 0-10V"
- "Dual 0-10V" (... or similar).

These interfaces are for use with sensors (not powered from the logger) that give an output signal in the form of an analogue voltage.

Single and Dual refer to the quantity of inputs that are present in the logger connector. From an IDT perspective, one channel is required per input voltage.
Dual inputs therefore require the setup of 2 channels.

A wide variety of sensors exist that have a voltage output signal and can be used with these logger interfaces.

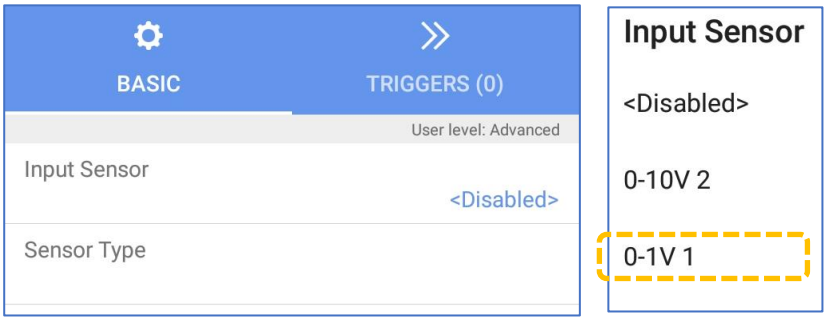
The logger is usually factory calibrated for the indicated voltage range. The IDT app also gives access to the calibration settings (as part of the channel setup) if re-calibration of the input should ever be required (see section 10.5).

For setup, proceed as follows:

When creating a new channel for the sensor, initially there are 2 tabs displayed.

Select the "basic" tab.

Tap on "Input Sensor" and then select the relevant voltage interface.

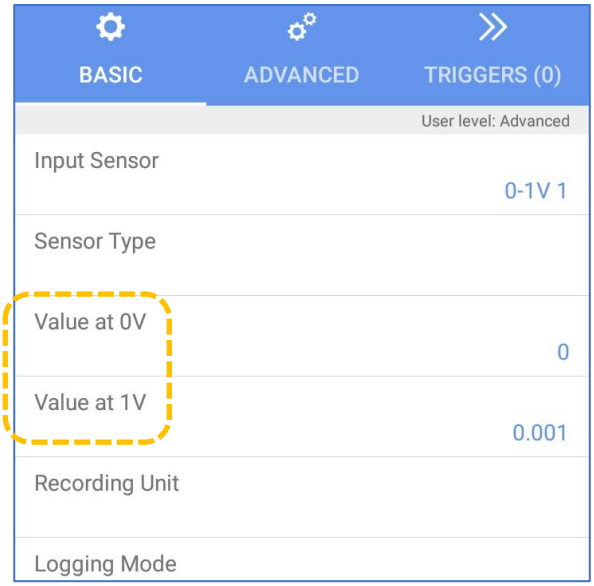


The screen shows the selected voltage input interface. In addition, it will now show an "advanced" tab.

Two additional fields become visible, corresponding to the minimum and maximum valid signalling range of the sensor. (i.e., The values when output is 0V and 1V).

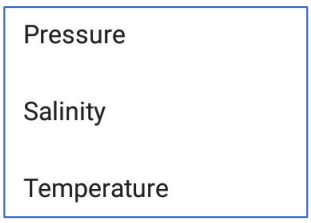
Note: These are present when the interface has been calibrated using a base unit of "volts". (Refer to section 10.5).

Tap on the "Sensor Type" line.

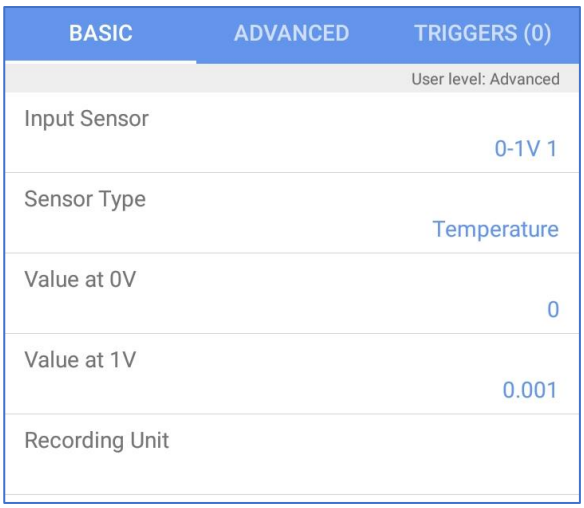


Choose from the wide variety of physical parameters offered.
(The choice will affect the units of measure offered later in the setup.)

e.g., For a 0 to 1V sensor which measures temperature, select “Temperature”.



The screen now shows the selected physical parameter being measured by the channel, but the 0V and 1V values are not yet set.



Tap on “Recording Unit”.

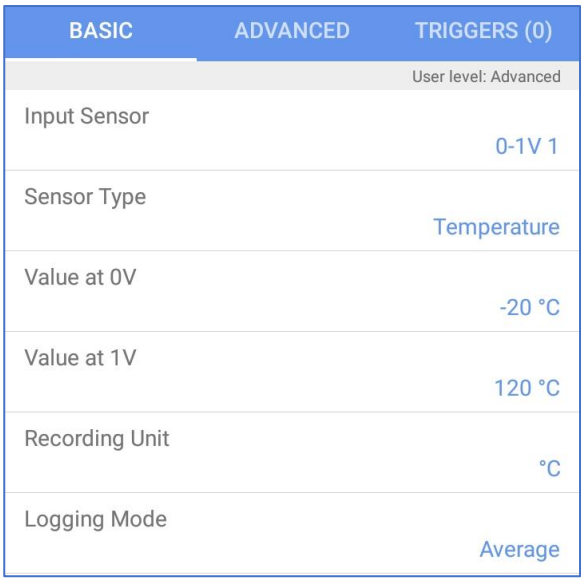
Select the unit of measure which is appropriate to the sensor output.

Refer to the documentation of the sensor and enter the values which correspond to the minimum and maximum voltage of the interface.

i.e., The “value at 0V” and the “value at 1V” in the example opposite.

Select the desired logging mode.

When finished, tap on “Accept” to save the settings.



When setup of the logger voltage interface with the sensor is complete:

The channel summary will indicate the settings (this will depend on the physical parameters the sensor measures).

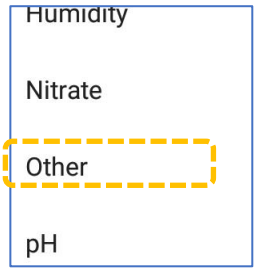
An IDT app hardware test of the 0-1V sensor will indicate the sensor measurement in a similar way to that shown opposite.
(i.e., IDT will show an input voltage, rather than the physical parameter being measured by the sensor).

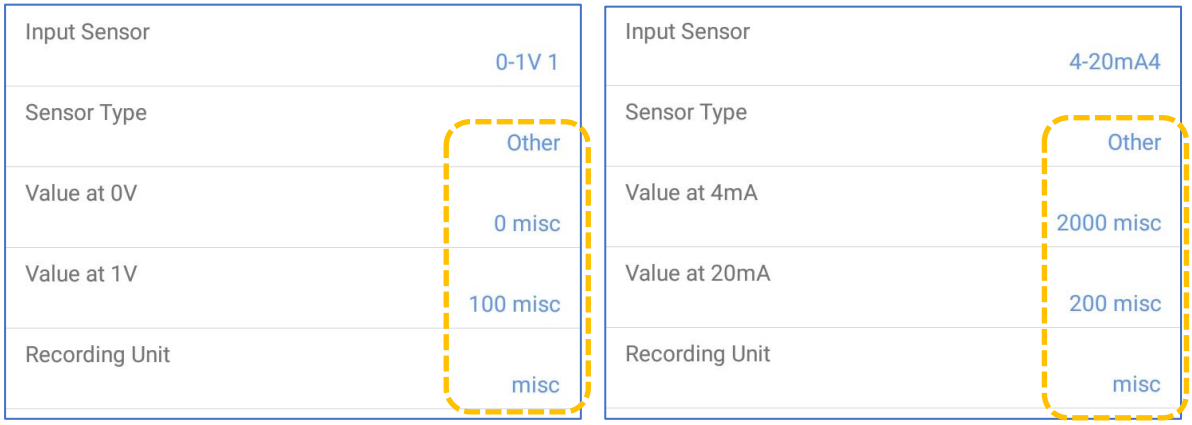
7.13 New/Unknown types of analogue sensor (Using 'Group3' loggers)

The loggers and IDT app support the measurement of a wide variety of physical properties on the analogue interfaces (voltage or 4-20mA inputs).

If a sensor measures a physical parameter that is not listed, it may be possible to support it by selecting "other" during channel setup.

This is available for both 0-1V and 4-20mA inputs.





Thus, when none of the offered choices are suitable, select "Other"; this will use a unit of measure as "misc" as the recording unit. (The user must document elsewhere what "misc" represents, corresponding to the parameter measured by sensor).

7.14 SDI-12 interface (Using 'Group 3' Loggers)

Some loggers may be fitted with an SDI-12 interface, with the ability to power the sensor from the logger (various voltages are available).

SDI-12 is a multidrop serial communications interface that is supported by various intelligent sensors as a means of exchanging information with another device, such as the logger. The sensor equipment attached to the logger can supply a single item or multiple items of measurement data to the logger.

Some intelligent sensors have multiple connection options; Use the SDI-12 option when connecting to the logger SDI-12 interface.

Note: Study the manual for the sensor before proceeding to understand how it should be installed, how it presents data, and any other requirements (e.g., power).

HWM supplied sensors will be supplied with an appropriate connector for your logger and will have had interoperability testing to ensure the sensor and logger are compatible.

Where the logger is supplied without any pre-configuration for the sensor, setup proceeds as follows:

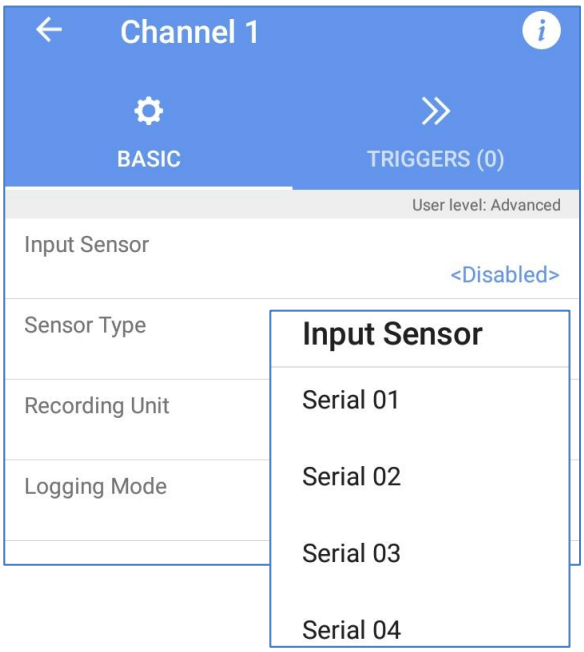
From the "Channels" page, tap on the " + " button to start setup of the interface for the sensor.

A channel setup screen will be shown with an available logger channel number allocated.

Initially, the channel will be disabled.

Tap on the input sensor line and choose one of the “Serial nn” options from the selection; *it must be one that is not already in use*.

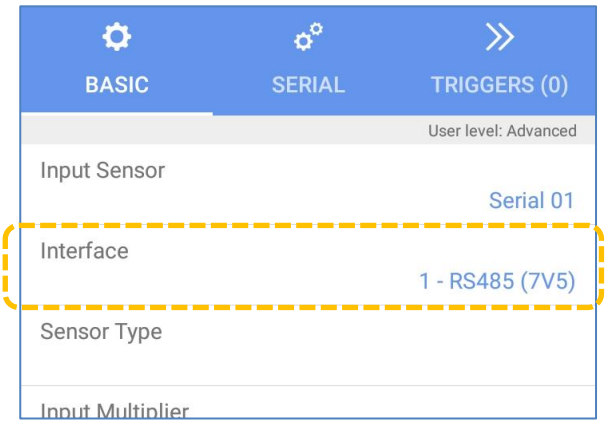
(e.g., Tap on Serial 01)



Note: Multiple “Serial nn” interfaces are provided by the logger. An intelligent sensor can often produce more than one type of measurement. The logger will need to extract each of the required measurements individually using the SDI-12 link. The logger uses a dedicated “Serial nn” selection for each of the required measurements; the data stream will occupy its own channel number in the logger’s recording memory.

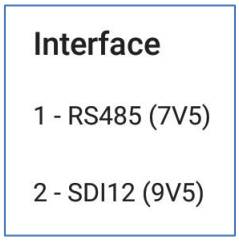
The chosen serial input is displayed as the input sensor. A “SERIAL” tab is also added to the page.

For loggers that have more than one interface fitted (of the type SDI-12 or RS485), the screen will also show an “Interface” selection line.



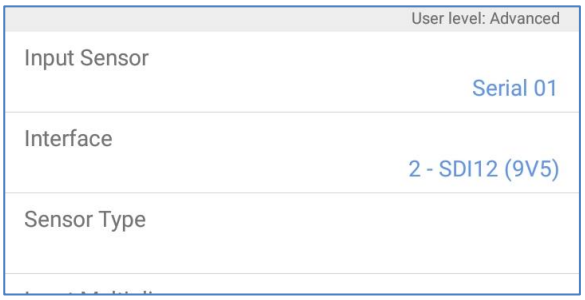
Tap on the Interface line to select the interface (connector) being used. (If required).

Select an SDI-12 interface.



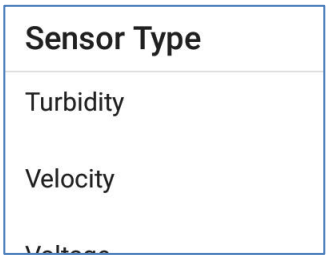
Note: Check the voltage is appropriate for the sensor that is being attached. (The voltage may also be shown on the logger label for the connector).

The SDI-12 interface is selected and displayed.
(Only where more than one option exists).

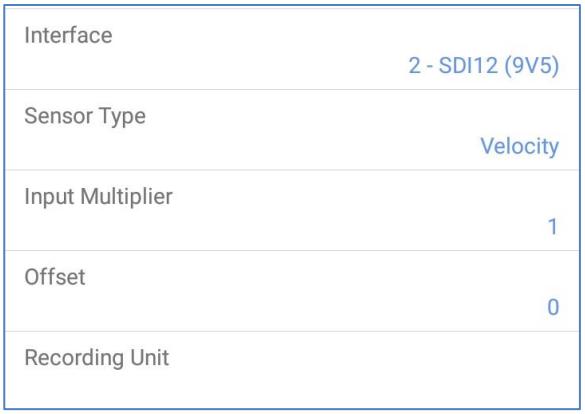


Next tap on Sensor Type.

Select from the list the *physical parameter* which is being measured.
e.g., For a sensor which measures velocity of water, select "Velocity".



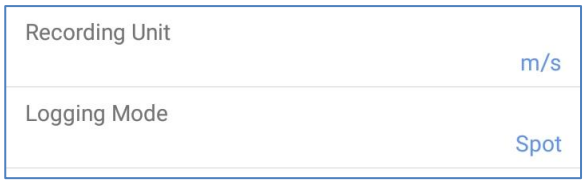
The Sensor type is set to the chosen parameter.



Next tap on "Recording Unit" and set an appropriate unit of measure.

(Refer to the sensor manual for the units of measure employed).

The chosen recording unit is displayed.



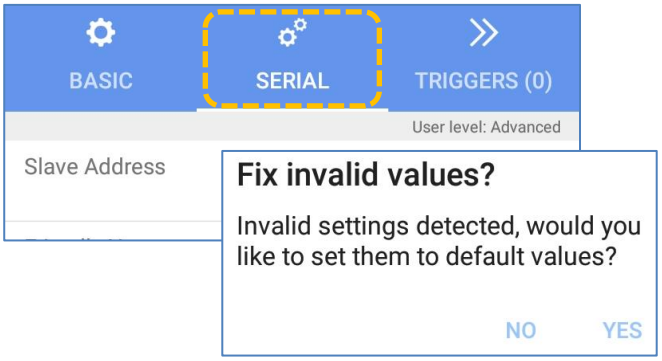
Set the input multiplier as required (see note below).

Note: SDI-12 always returns an ASCII format number which includes a decimal point. The Input multiplier shown here is not strictly a number multiplier; Instead, it sets the resolution of the data. (Refer also to the notes and illustration of hardware test results at the end of section 7.15).

Tap on "Logging Mode" and select according to your requirements (e.g., Spot).

Check the settings on the screen and then tap on "Accept" to save the settings to the logger.

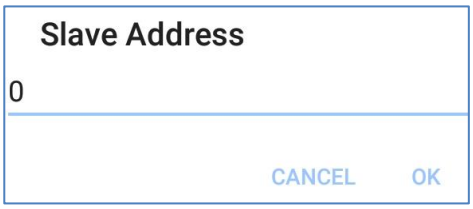
Next select the “SERIAL” tab.



If a “Fix invalid values” message appears, tap on “Yes”.
(This may occur if, for example, IDT has detected blank values in fields on this page. IDT will fill the fields with some default settings. The user can then modify whatever settings need to change).

Tap on “Slave Address”.

The “Slave Address” should be set to the current address of the sensor. The logger supports addresses in the single digit range (i.e., 0 ~ 9).

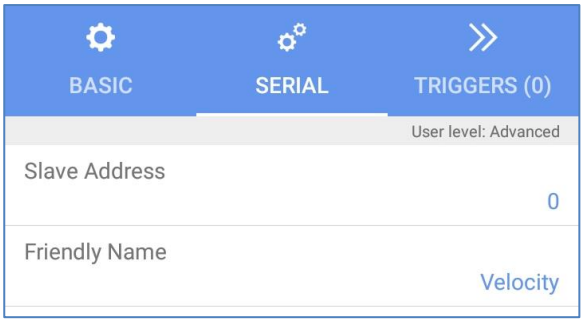


The default address for most SDI sensors is “0”, but some sensors may be required to be set to a different address.

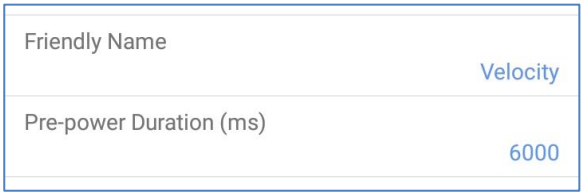
Note: If more than one piece of equipment is attached to an SDI-12 bus, each must be set to a different address. For instructions of how to set the address within each piece of equipment, refer to its documentation.

The chosen address is displayed.

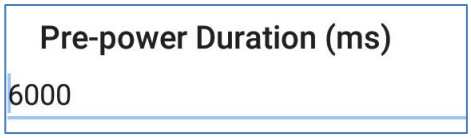
IDT suggests a “Friendly name” based on the measurement parameter. This can be changed if required.



The logger usually only provides power to the sensor when it requires a measurement to be taken. However, most intelligent sensors require power to be applied for a minimum time in order to set up and complete the measurement cycle and any associated communications.
This time period (plus some small margin) must be entered into the “Pre-power Duration” field.

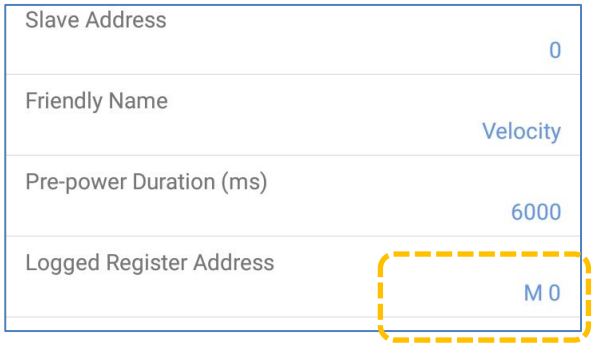


Tap on the line and enter the required value.
(this can be 0 to 63750 in 250ms steps).
Refer to your sensor manual for guidance.



The logger must send a command to the SDI-12 sensor to initiate a measurement cycle.
This is typically achieved by the logger issuing a "M" type of command to the sensor (in the range of M0 to M9).

Following receipt of the command, the sensor will initiate the measurement and reply cycle.



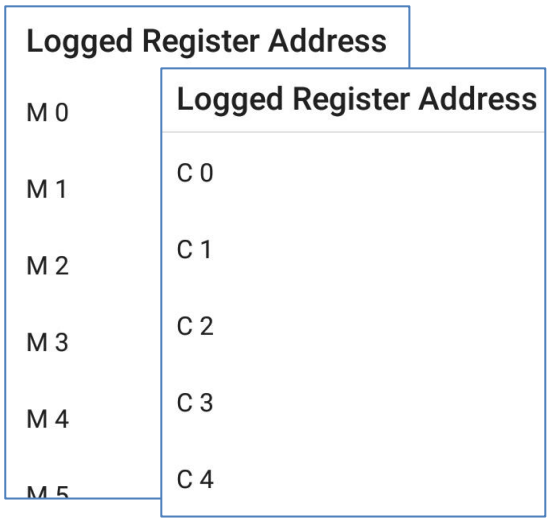
Most SDI-12 sensors require only a M0 command. This will return a set of measurement data. More complex sensor equipment may arrange its data in groups and send a different set of measurement data according to which M command is sent.

The sensor indicates when data will be available (by providing an initial acknowledgement response to the logger, which includes the measurement delay). The logger waits, and then automatically fetches the data until the transfer is completed (it makes data transfer requests using a series of D commands).

Tap on the "Logged Register Address" line and pick from the selection of available commands.

Refer to the sensor manual for the specific command needed by the sensor.

Refer also to the SDI-12 specification for more details of the protocol.

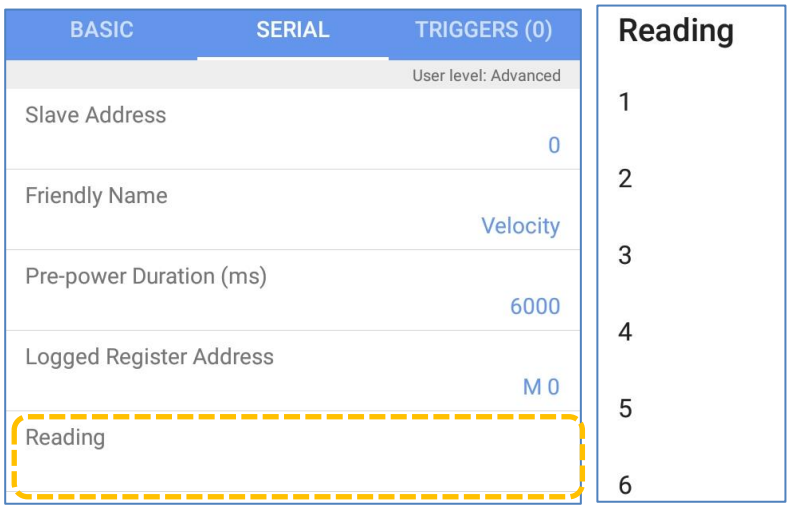


The sensor may send a block of data with many different measurement results enclosed.

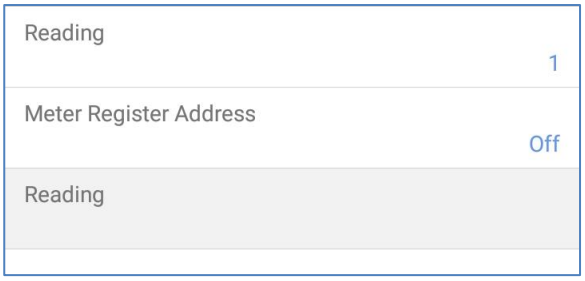
It is necessary to pick out (index) the measurement that is required. This is done by entering a "Reading" value (to index which result is required for the logger recording).

e.g. A sensor using SDI-12 provides a block of data in its reply in the following sequence:
Velocity, Direction, Temperature.

To select "Velocity", choose a "Reading" index value of "1".



The reading index value is displayed.



Note: The section regarding “Meter Register Address” is rarely used and usually be left as shown.
(It is provided only for flow sensors which include providing access to meter reading values over the SDI-12 link).

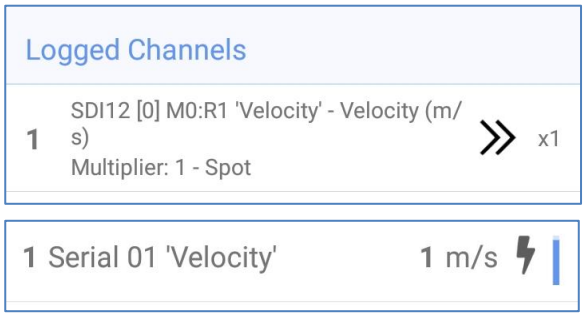
Tap on “Accept” to save the changes to the logger.

Note: Repeat the setup process for any additional parameters required from the sensor. Use a different serial channel for each required measurement.

A typical summary configuration of the SDI channel setup is shown opposite.

(A trigger-action has also been set up, in the shown example).

During Hardware test the SDI-12 channel will typically be displayed as shown opposite.



7.15 RS485 / MODBUS INTERFACE (USING ‘GROUP 3’ LOGGERS)

Some loggers may be fitted with an RS485 / MODBUS interface, with the ability to power the sensor from the logger (various voltages are available).

RS485 is a multidrop serial communications interface that is supported by various intelligent sensors as a means of exchanging information with another device, such as the logger. The sensor equipment attached to the logger can supply a single item or multiple items of measurement data to the logger.

Some intelligent sensors have multiple connection options; Use the RS485 option when connecting to the logger RS485 / MODBUS interface.

Note: Study the sensor manual before proceeding to understand how it should be installed, how it presents data, and any other requirements (e.g., power).

HWM supplied sensors will be supplied with an appropriate connector for your logger and will have had interoperability testing to ensure the sensor and logger are compatible.

Where the logger is supplied without any pre-configuration for the sensor, setup proceeds as follows:

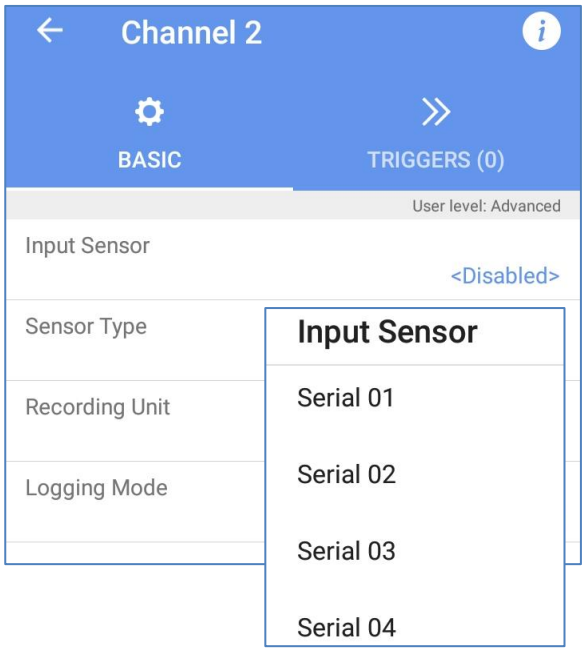
From the “Channels” page, tap on the “ + ” button to start setup of the interface for the sensor.

A channel setup screen will be shown with an available logger channel number allocated.

Initially, the channel will be disabled.

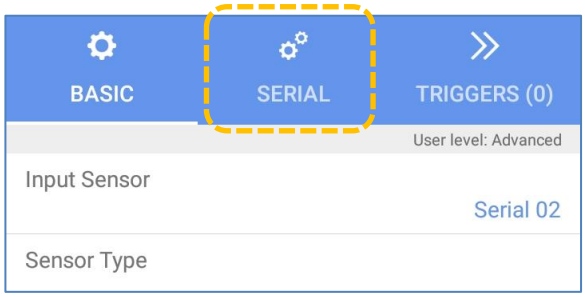
Tap on the input sensor line and choose one of the "Serial nn" options from the selection; *it must be one that is not already in use*.

(e.g., Tap on Serial 01)

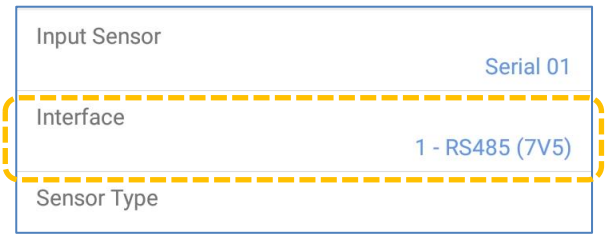


Note: Multiple "Serial nn" interfaces are provided by the logger. An intelligent sensor can often produce more than one type of measurement. The logger will need to extract each of the required measurements individually using the RS485/MODBUS link. The logger uses a dedicated "Serial nn" selection for each of the required measurements; the data stream will occupy its own channel number in the logger's recording memory.

The chosen serial input is displayed as the input sensor. A "SERIAL" tab is also added to the page.

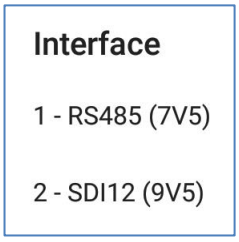


For loggers that have more than one interface fitted (of the type SDI-12 or RS485), the screen will also show an "Interface" selection line.



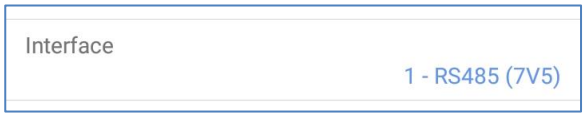
Tap on the Interface line to select the interface (connector) being used. (If required).

Select an RS485 interface.

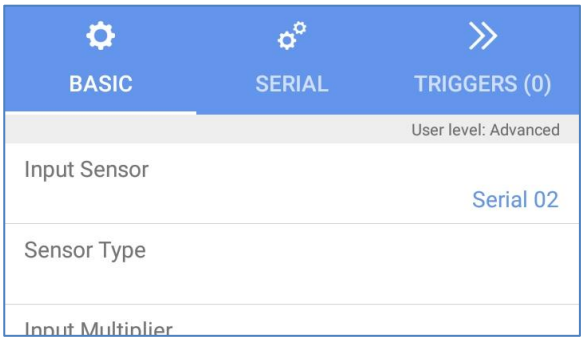


Note: Check the voltage is appropriate for the sensor that is being attached. (The voltage may also be shown on the logger label for the connector).

The chosen RS485 interface is displayed.

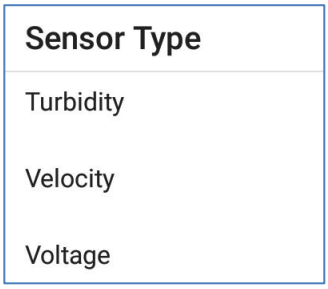


Next tap on Sensor Type.



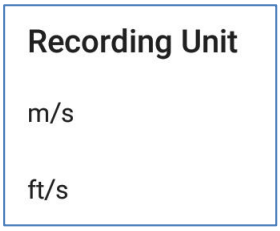
Select from the list the *physical parameter* which is being measured.

e.g., For a sensor which measures velocity of water, select "Velocity".

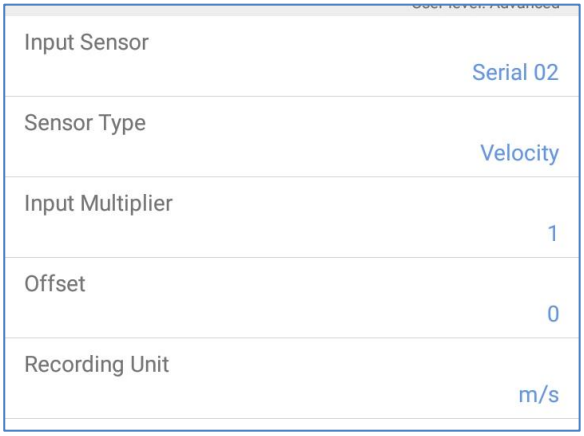


The Sensor type is set to the chosen parameter.

Next tap on "Recording Unit" and set an appropriate unit of measure.



The chosen recording unit displayed.



(Refer to the sensor manual for the units of measure employed).

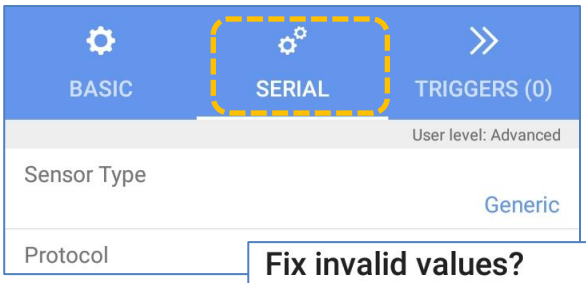
Set the input multiplier as required (see note below).

Note: The Input multiplier shown here is not strictly a data multiplier; Instead, it sets the resolution of the data. (Refer also to the notes and illustration of hardware test results at the end of this section).

Tap on "Logging Mode" and select according to your requirements (e.g., Spot).

Check the settings on the screen and then tap on "Accept" to save the settings to the logger.

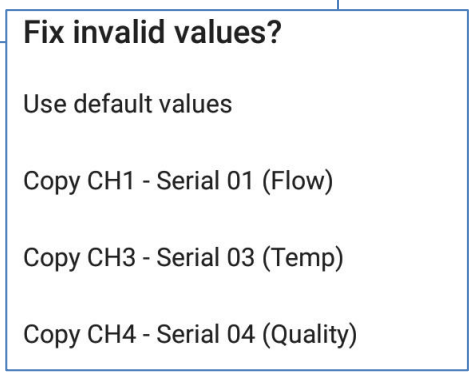
Next select the “SERIAL” tab.



Note:

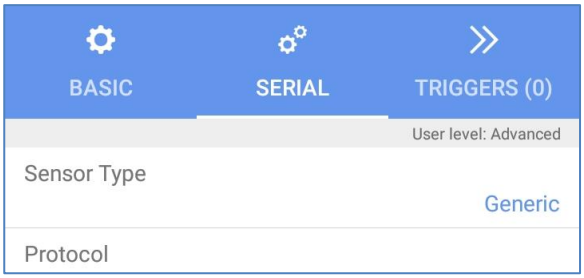
If a “Fix invalid values” message appears, it is likely that several “serial nn” channels are set up to use the same sensor equipment, but the default settings for the Serial tab (e.g., pre-power time) are inconsistent with existing channels.

Tap on “Use default values” to ignore (and re-enter the settings of each field) or choose “Copy …” to copy settings across from another channel.



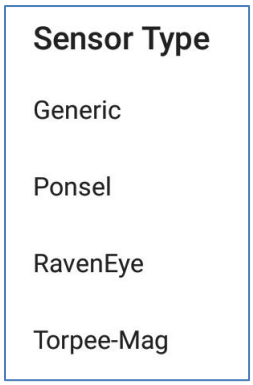
Tap on “Sensor Type”.

Choose “Generic” for most MODBUS / RS485 sensors.



Note: The logger may show other choices.
These options are from a library of known sensors for which the logger gives additional support to ensure the logger and sensor interoperate optimally. Often these are not protocol issues but are related to the sensor operation, requiring a specific sequence of operations to be undertaken to obtain certain data.
These sensors may also require additional setup options.

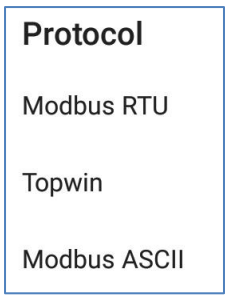
HWM supplied sensors have completed interoperability tests to ensure readings can be correctly obtained.



Note: For some the remaining setup parameters, you will need to refer to the sensor’s manual to understand its requirements.

Tap on “Protocol”.

For most sensors, select Modbus RTU or Modbus ASCII, according to the requirements of your sensor; refer to the sensor manual.
(Topwin is a rarely used protocol).

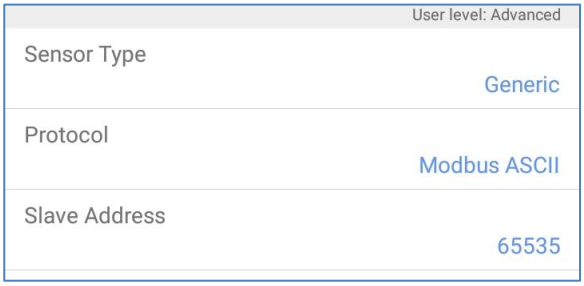


Note: If the wrong protocol is selected, the sensor will not operate correctly with the logger; The frame format and content will be incorrect.

e.g., if your sensor requires Modbus ASCII, tap on it to select.

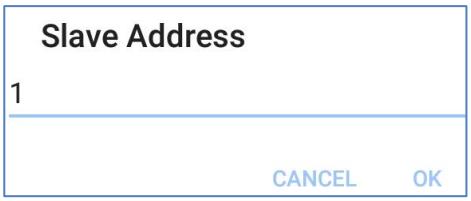
The chosen protocol is displayed.

Tap on the “Slave Address” line.

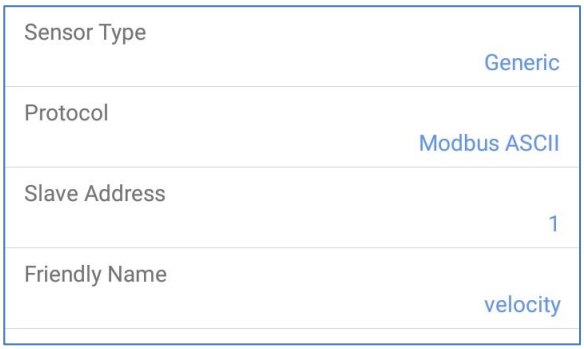


For Modbus over an RS485 interface, each device must have an address in the range 1 to 247.

Refer to your sensor equipment documentation and locate its address. Enter the address and then tap on OK.



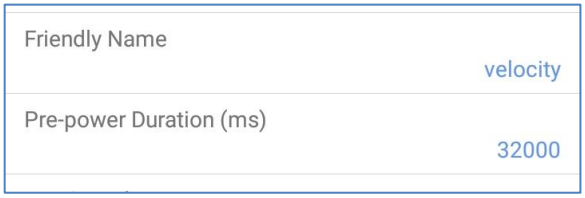
The address is displayed.

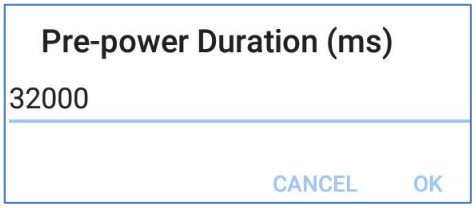


IDT suggests a “Friendly name” based on the measurement parameter. This can be changed if required.

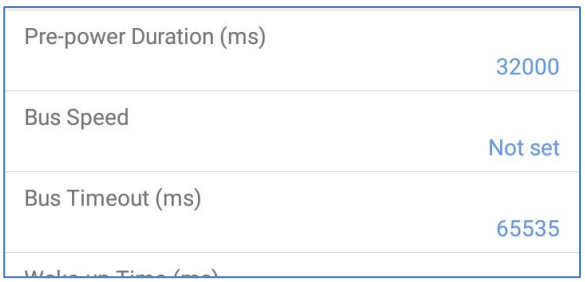
The logger usually only provides power to the sensor when it requires a measurement to be taken. However, most intelligent sensors require power to be applied for a minimum time in order to set up and complete the measurement cycle and any associated communications. This time period (plus some small margin) must be entered into the “Pre-power Duration” field.

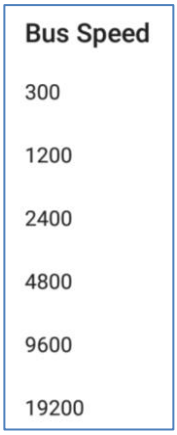
Tap on the line and enter the required value.
(0 to 63750ms in 250ms steps).
Refer to your sensor manual for guidance.





The chosen value is selected and displayed.

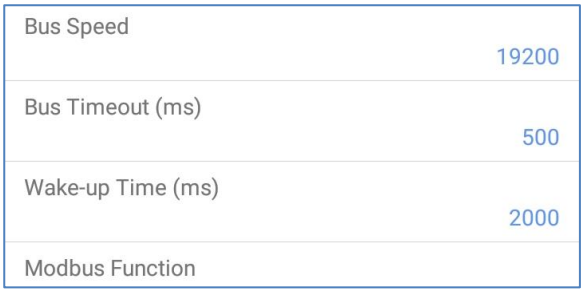




Next select the Bus speed (communications speed, also known as "Baud rate"); this must match your sensor.

Note: The Baud rate is the only serial communications parameter that can be set within the logger.
Communication format is: 1 start bit, 8 data bits, no parity, 1 stop bit.

Next set the "Wake-up Time" and "Bus Timeout" parameters for communication.



The logger will send the sensor an initial command to wake it up (from standby); the sensor may not be able to process this command. After the specified wake-up time, the logger will send the required command, which the sensor should now be able to accept and process.

The bus timeout is the time period that the logger uses in subsequent message transactions to allow time for the sensor to send an initial response. If the sensor has not responded after this time, the logger will assume the message is lost and will repeat sending the command.

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.

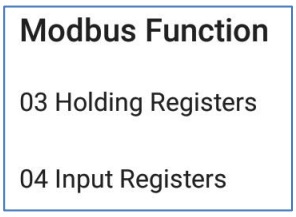
For reading data from the sensor, the user can specify the following function codes:

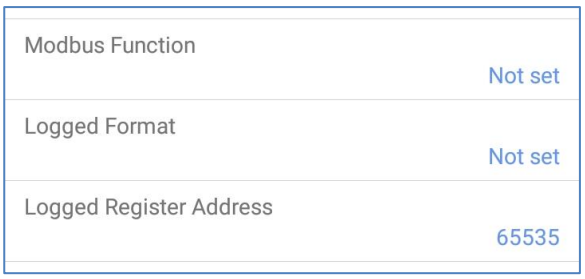
- Function 3: Read Holding Registers
- Function 4: Read Input Registers

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 sent register address. 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 (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).

Tap on “Modbus Function” and select the required function code.

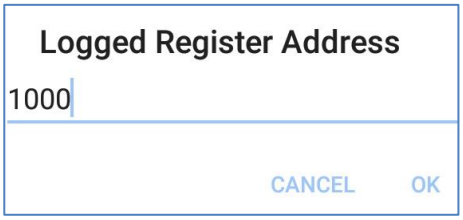




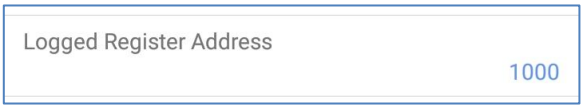
The chosen Modbus function is displayed.

Tap on “Logged Register Address” and enter the start address of the register that holds the required data within the sensor equipment.

e.g., A velocity sensor specifies (in its manual) that the register with address 1000 holds the velocity data.
… so enter “1000” and then tap on “OK”.



The start register address for the data is now displayed in IDT.



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.

U16: Unsigned Integer.
16-bits wide (1 register) data.
Includes positive integer values only.

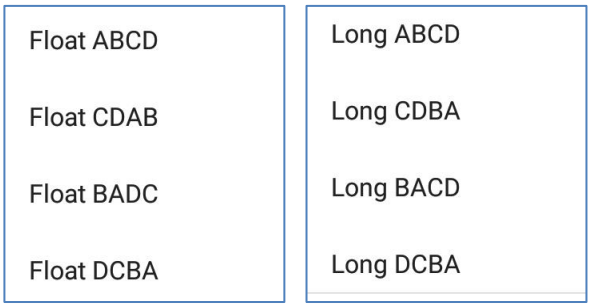
S16: Signed Integer.
16-bits wide data (1 register required).
Includes positive and negative integer values only.

Long: Signed Integer.
64-bits wide data (4 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 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 "Long"; this dictates its size) along with one of the options for the byte or word order.

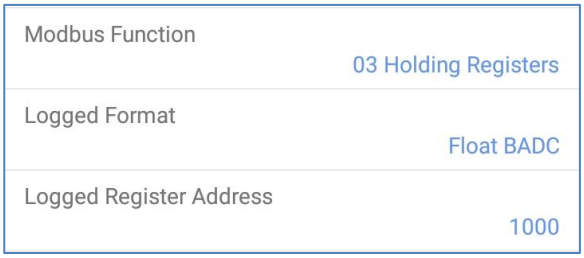
Selecting the right byte order option is often a case of trying the alternative settings to find the one which matches the data presentation from your sensor; the data will then make sense. (Check data using the IDT Hardware test feature).

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.

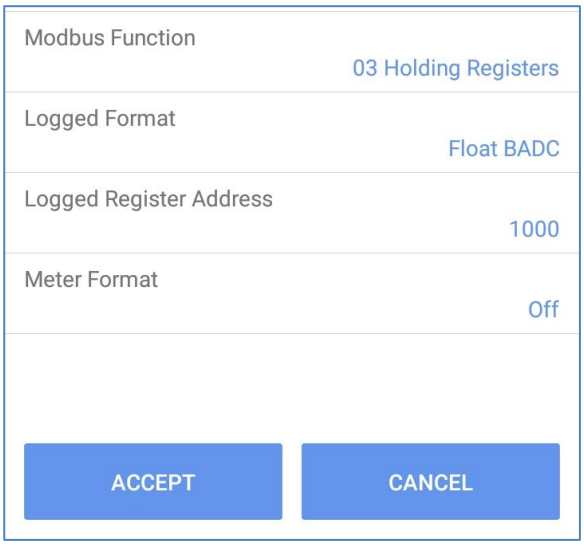
The number will be a "Float" type; it is spread across 2 registers (to make 32-bits).

The selection of one of the "Float" formats is now required.
(Try various options until 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.)



The Logged format is displayed.

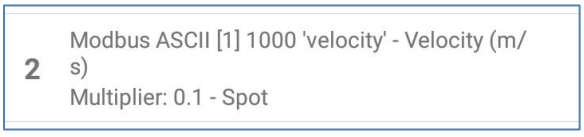


The section regarding "Meter Format" is rarely used and can be left as shown.
(It is provided only for flow sensors which include providing access to meter reading values over the RS485 / Modbus link).

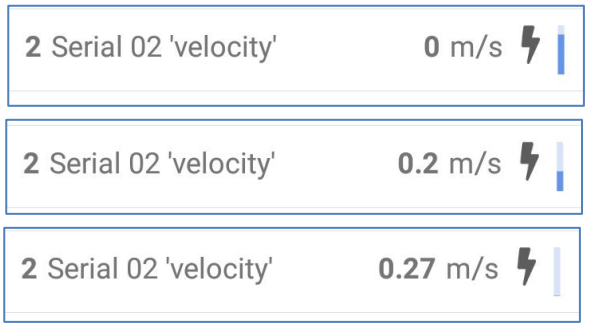
Tap on "Accept" to save the changes to the logger.

Note: Repeat the setup process for any additional parameters required from the sensor.
Use a different serial channel for each.

A typical summary configuration of the RS485 / Modbus channel setup is shown opposite.



During Hardware test the RS485 / Modbus channel will typically be displayed as shown opposite (depending on setting of the “input multiplier”; x1, x10, x100 examples shown).



Note: (Use of Input Multiplier on MODBUS & SDI-12)

For reasons of data compactness, the logger converts some sensor data formats to a Signed 16-bit format (S16) plus an indication of the applied multiplier.
For the Modbus (and SDI-12) interface, the multiplier (x1, x10, x100) is used to multiply the read sensor measurement value (if it includes any digits after a decimal point) before storage. Only the whole number part of the result is stored as S16.
The original data value can be reconstructed by then dividing the (S-16) stored number by the saved multiplier value.

e.g. 123.45 can be stored as: “12345” and an applied multiplier of “100”.
To reconstruct: Original value = 12345 divided by 100 = 123.45

The *input multiplier* used here therefore acts as a method to *set the data resolution* (i.e., the number of required decimal places). (See hardware test illustration shown above). However, it must be set such that the stored S16 number range is not exceeded (-32767 to +32768).

7.16 Digital Sensor interface

The Digital Sensor interface is available on some logger models. It is an interface that is required for the attachment of certain sensors supplied by HWM.

Currently supported sensors include:

- SpillSens.

7.16.1 Use with a SpillSens sensor

SpillSens is a digital float angle sensor.

SpillSens is often used with the following data viewing portals:

- SpillGuard.

SpillSens requires a specialised method of setup, especially when used with the SpillGuard data viewing portal. Refer to the SpillSens User-guide for more details.

7.17 SPILLSENS INTERFACE

A Digital Sensor interface type that has been set up by the factory for use with a SpillSens sensor is sometimes factory labelled as “SpillSens” instead of “Digital Sensor”.

(Refer to section 7.16 for further details).

7.18 LEAK-NOISE SENSOR

- A leak-noise sensor listens for leaks in water pipe networks.
- It is often used with the following viewing portals:
  PermaNETWeb.
- This is a complex sensor and requires a specialised method of setup.
- Refer to your logger User-guide for information if this sensor is supported and for more details.

7.19 SONICSENS3 SENSOR

- SonicSens3 is a sensor which measures distance with ultra-sound.
- It is often used with the following viewing portals:
  DataView
- This is a complex sensor and requires a specialised method of setup.
- Refer to your logger User-guide for information if this sensor is supported.
- Refer to the SonicSens3 User-guide for more details.

7.20 RADARSENS 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 app 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).
3. Setup of the logger to use the datapoints being obtained from the sensor.

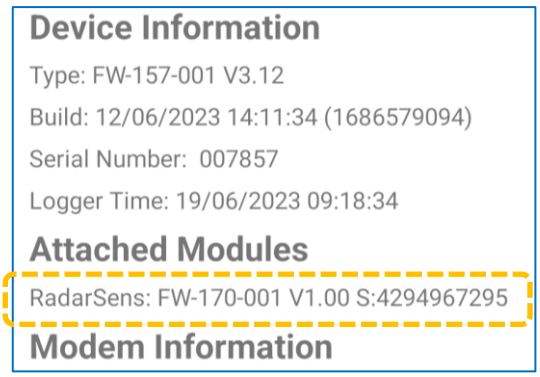
The logger supplied with RadarSens may have already been configured for RadarSens to be operational; if this is not the case, instructions are included within this user-guide. Additional site-specific settings (e.g., a depth reference point) are usually required.

7.20.1 Confirm the RadarSens is recognised

A logger that has been configured sufficiently to make RadarSens operational will recognise the sensor once it is connected.

Check the Device Information page of the logger.

RadarSens will be listed amongst the other information shown. It includes details of the serial number and firmware version of the unit.

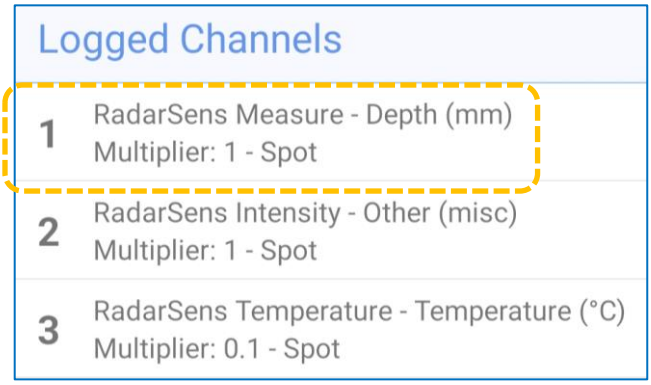


7.20.2 Setup and check of RadarSens channel (Distance or Depth)

The first stage of setup or check of a RadarSens proceeds in a similar manner to basic channels.

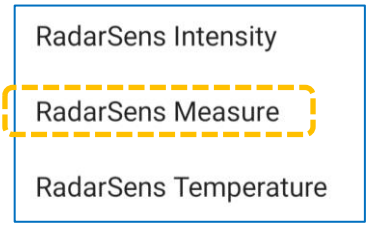
Navigate through Configure Device → Channels to reach the 'Logged Channels' screen.

If the logger is already setup, the RadarSens primary channel (shown as 'RadarSens Measure') will be listed amongst any other sensor channels.
Settings can be checked by tapping the appropriate line.



If the 'RadarSens Measure' channel is not listed, the channel must be set up.

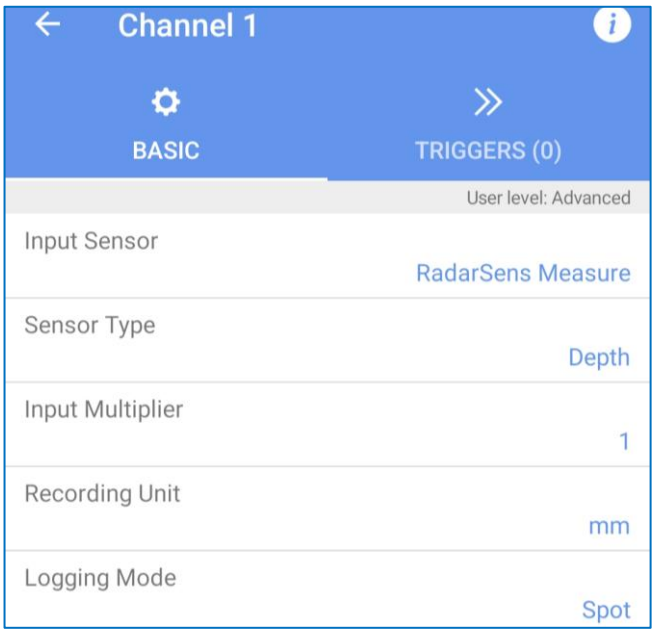
To set up the channel, tap the ' + ' control. This will allocate a new channel number for RadarSens and display the channel setup screen.



To measure the separation (gap) between the RadarSens and a water surface, first select an Input Sensor of 'RadarSens measure'.

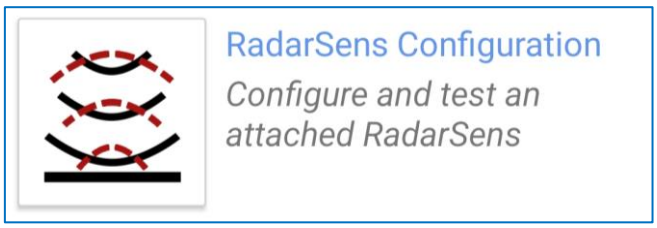
For Sensor Type, select 'Depth'; This selection choice is used for any distance or depth types of measurement.

Then proceed through each remaining field, from top to bottom, to choose the required settings. (Typical settings are shown).



When finished, tap the 'Accept' button. The channel will be saved to the logger and a summary will appear in the Logged Channels screen.

Note: If the distance/depth channel was newly added, the RadarSens Configuration option will also become available in the main options page.



Note: The logger is now set to obtain numeric measurement data from the RadarSens sensor, but these are not yet suitable for being logged:

- The sensor must be set to use a profile that is suitable for the installation site. This includes setup for sensor range. It also includes the threshold limits for acceptance (or rejection) of a reflected radar signal.
  (These should be set following the sensor being mounted in position).
- Further setup is also required regarding how to handle the raw data from the sensor to produce datapoints for logging.

  (Refer to section 7.20.3 for further information).

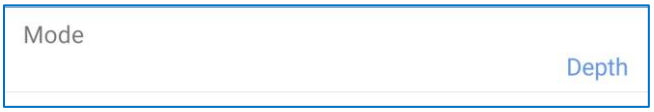
7.20.3 Configuration of RadarSens (Tuning to Installation Site Requirements)

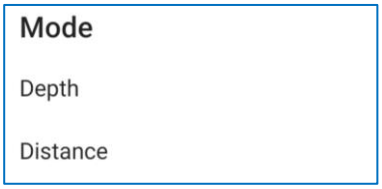
From the main options page, tap on the RadarSens Configuration line.

The serial number of the RadarSens unit is shown at the top of the screen.

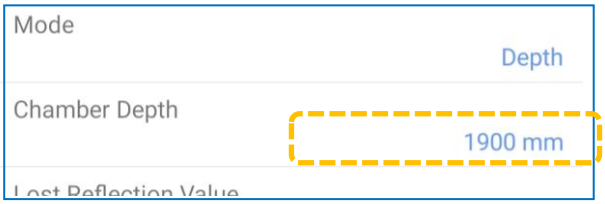
At this point, decide whether the measurement data you require is simply distance (from the sensor base to the surface of the water) or the water depth (from the bottom of the water channel to the water surface).

Tap the 'Mode' line and make the required selection.





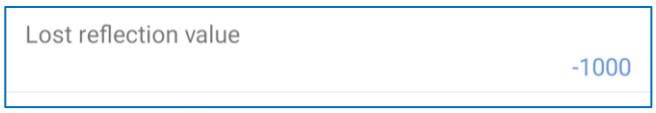
When Depth has been selected, it is also necessary to enter a value (in mm) for the distance between the lower surface of the installed RadarSens unit to the very bottom of the fluid being measured. (e.g., The bottom of a water channel, the Riverbed, the internal base of a fluid containment vessel).



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.

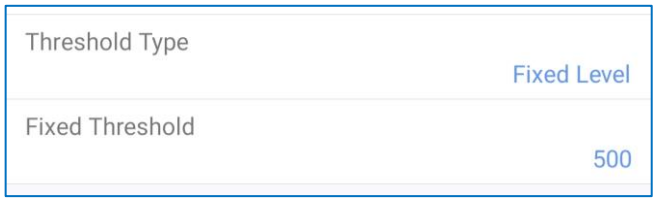
(Typically, this will be due to a sensor which has not been correctly tuned to the site, or if the channel is dry and unreflective).

A common approach is to record a 'nonsense' fixed value (e.g., ' – 1000') on lost reflections, to indicate the error condition. (The lost reflection errors can then be seen when inspected on a graph using DataView).

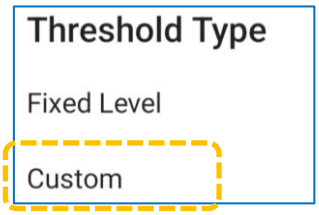


Tuning of the sensor includes options concerning the returned radar signal.
If examined graphically, an ideal signal would be a single reflection pulse (signal peak) as a response, with no background signal. In practise however, some 'background noise' signal will also be present. Additional pulses may also be present due to near-by objects or additional signal reflection paths. RadarSens settings can be adjusted to compensate for these situations.

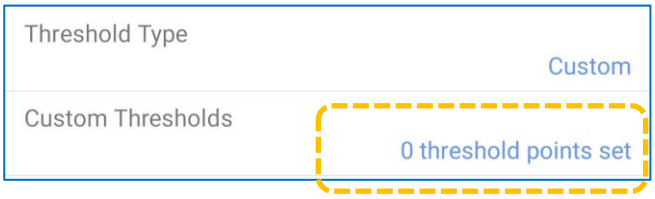
A simple approach to disregard the background signal is to set the Threshold Type control of RadarSens to 'Fixed Level', and then to set a value in the Fixed Level control high enough to filter out the background noise.



The preferred method of setup is to make manual adjustments to the *threshold profile*, which can be enabled by setting the Threshold Type to 'Custom'. This facility can filter out background noise on the signal. It additionally allows some compensation to be included for 'nuisance reflections' that may exist within the installation site.



When 'Custom' is selected, an additional settings line (Custom Thresholds) is displayed showing how many threshold points are currently set up. Tap on the 'Custom Thresholds' line to begin the threshold tuning process.



Threshold adjustments should be made when the water channel is empty of water and debris.

A graphical screen, titled "Calibration", will appear. An initial measurement is made, and its results are traced out on the screen (X-axis = Distance, Y-axis = Signal level).

Several tools are available. A summary of their function is as follows:


Adds a new threshold node (handle for adjusting) to the graph.

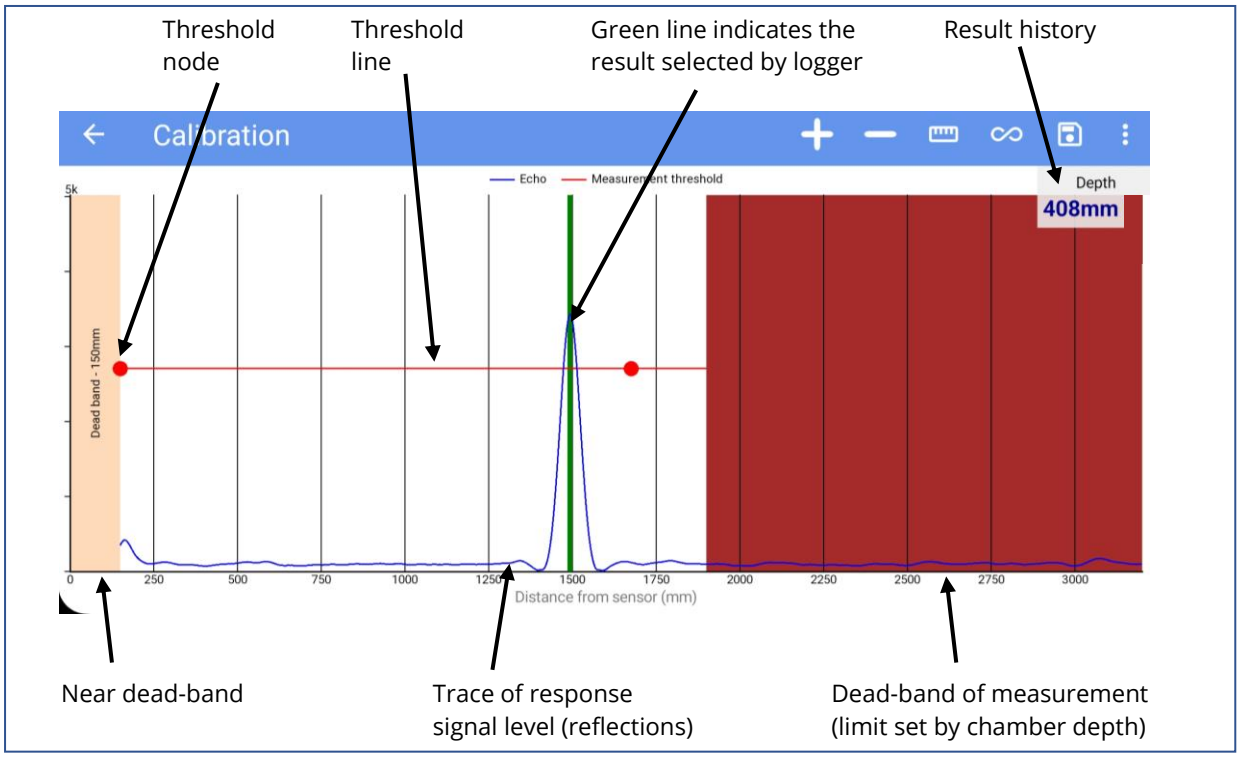

Removes a threshold node from the graph.

Initiates a single measurement cycle.

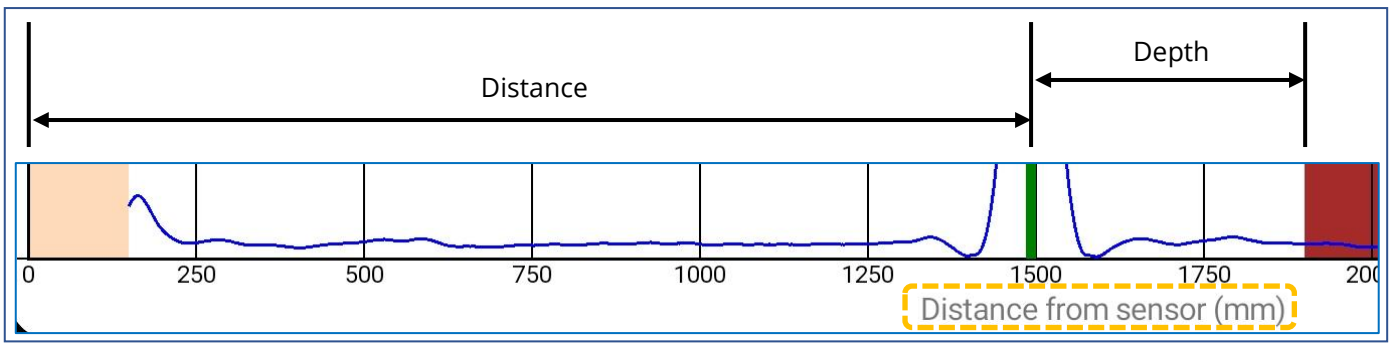
Initiates a repetitive measurement cycle (at intervals of approx. 8 seconds).

Saves current threshold settings.

Activates a local menu (e.g., to access help).

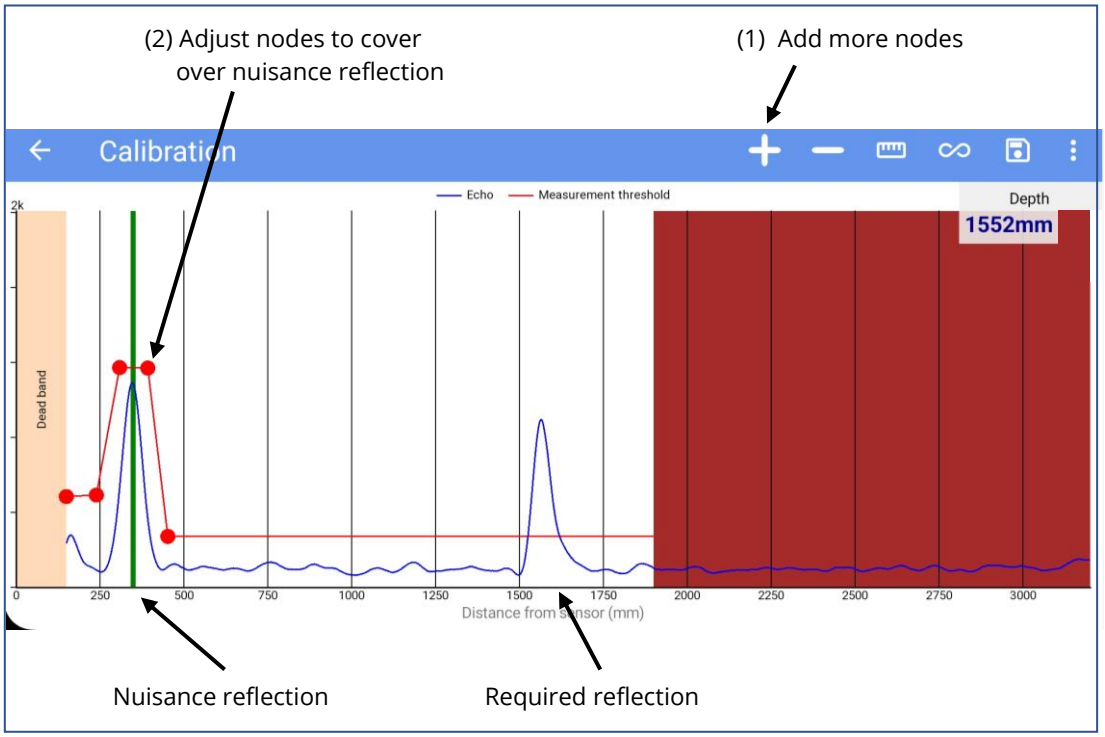


Note that the result history shows the measured value (either distance or depth), as setup within the logger. However, the trace is always level vs distance from the sensor.

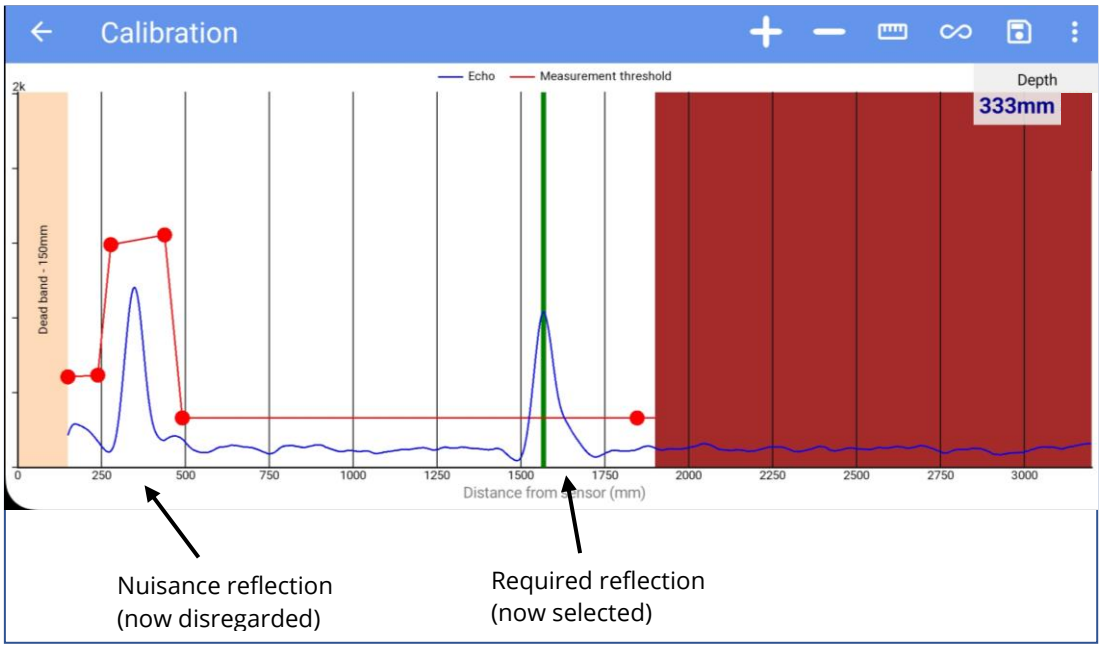


A minimum of 2 nodes are required on the calibration screen. Where the signal trace is clear of nuisance reflections, as shown above, check that the level of the threshold line is appropriately set (drag the nodes if required), and then tap on the Save icon.

Where nuisance reflections exist, further nodes can be added to the threshold line by tapping on the ' + ' icon. Drag the nodes around the nuisance reflection so that the pulse lies underneath the threshold line. Then tap on the Save icon.



Tap the 'single measurement' control to confirm the operation with the new threshold settings. The logger will subsequently disregard the nuisance reflection, and lock onto the required reflection, as shown below.

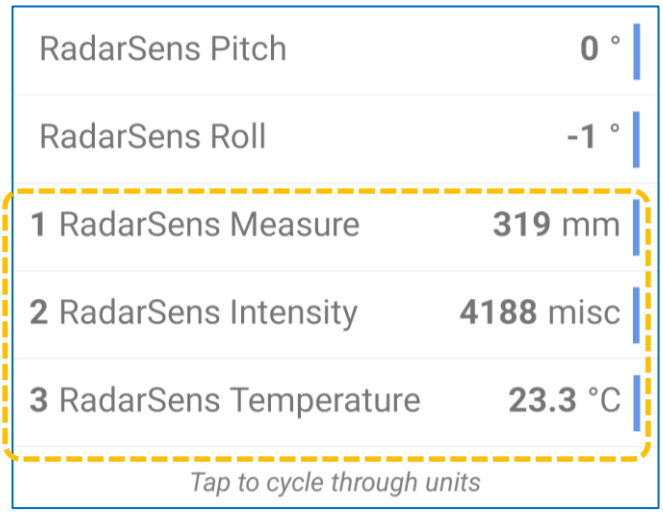


Results during Hardware Test

During hardware test, depending on which channels are available, results will be displayed as shown opposite.

Tapping on a measurement will cycle through alternative units of measure if they are available. (The measurement values are orange in colour if converted to a different unit of measure).

Note: RadarSens auxiliary sensors ('pitch' and 'roll') are also shown.



7.20.4 Configuration of sensor alarms

Measurement value alarms

Sensor data for depth or distance measurements can have trigger conditions and actions (including 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.

Equipment alarms

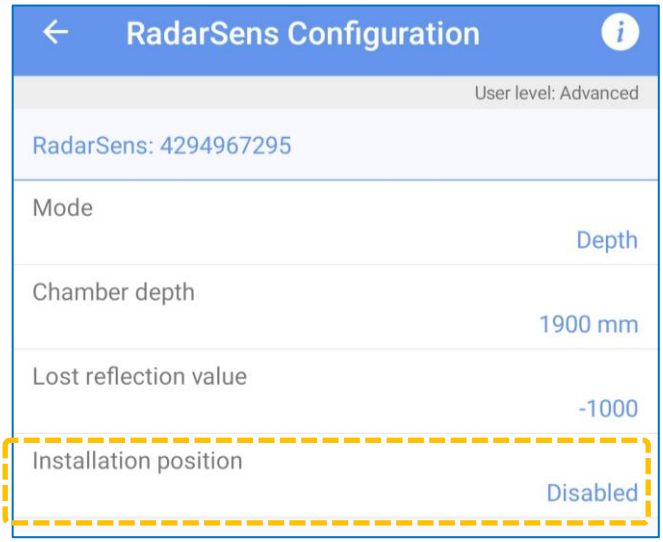
The RadarSens and logger are also able to detect certain fault conditions, and will generate either a warning or alarm, which gets reported to the DataGate server.

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 (of direction of gravity) for recognising 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 recognise a 'sensor has moved' fault condition.

Navigate to the RadarSens Configuration page.

Tap on the "Installation Posistion" line to begin set up the logger for this feature.



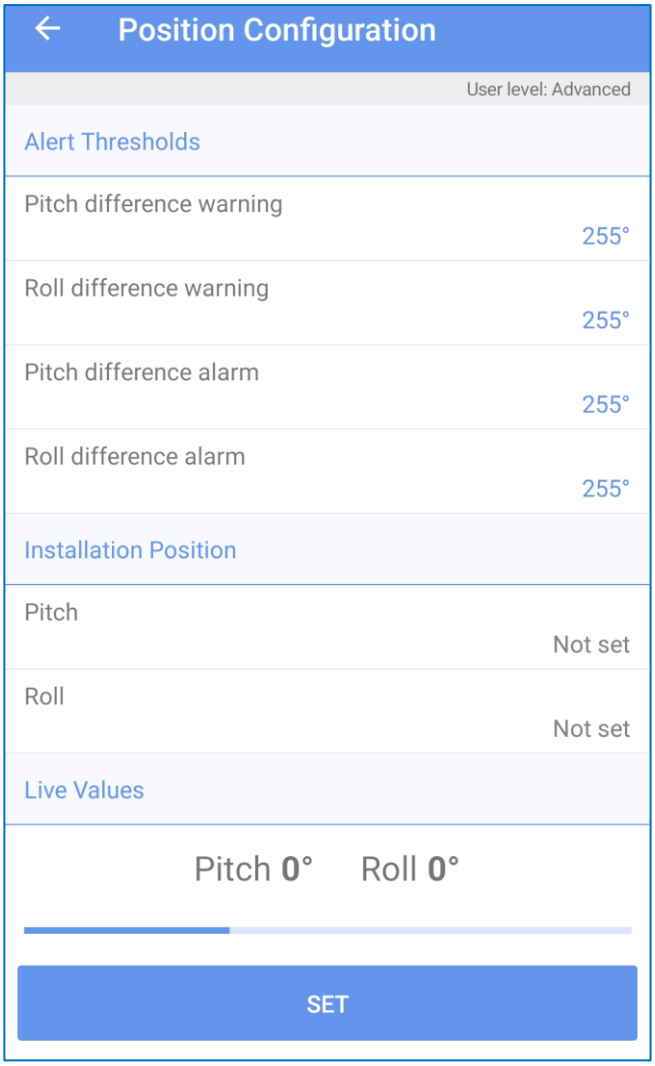
The ‘Position Configuration’ page is shown.

A live reading of the sensor’s current pitch and roll results are shown. When the sensor is in its final location, tap the ‘Set’ button. This will record the values (which will also be shown in the ‘Installation Position’ area of the page.

Finally, edit the ‘difference’ values that will trigger a warning or alarm condition.

Typically, this will be around 5 degrees for a warning, and 8 degrees for an alarm.

When finished, tap the back-arrow.



Sensor measurement issues (i.e., lost reflections) can be detected by setup of a ‘lost reflection value’ which is out of the range of normal data. Set the logger to trigger on the persistent presence of the ‘lost reflection value’ in the datapoint stream.

7.20.5 Setup and check of auxiliary RadarSens channels (Intensity, Temperature)

The RadarSens sensor can provide useful additional information in the form of a sensor channel, called ‘Intensity’. This 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.

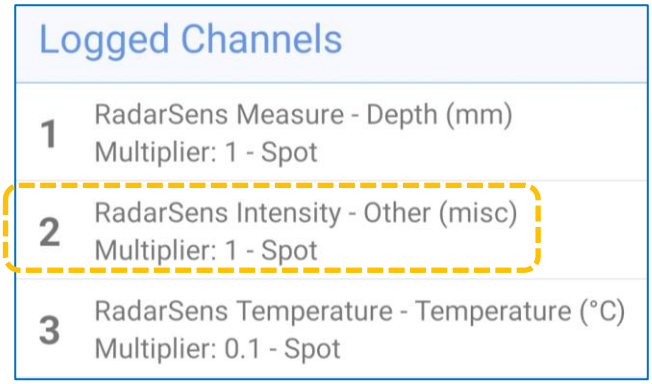
The RadarSens can also provide a means of tracking air temperature, (which may be useful if your logger does not have its own internal temperature sensor).

(Both of the channels are optional).

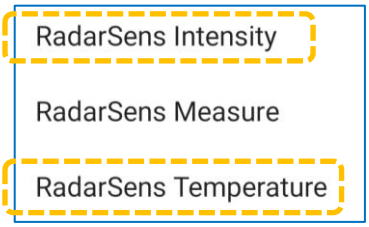
Navigate through Configure Device → Channels to reach the ‘Logged Channels’ screen.

If the logger is already setup, these RadarSens channels may be listed amongst any other sensor channels, (shown as 'RadarSens Intensity' and RadarSens Temperature).
A channel can be checked by tapping on the line.

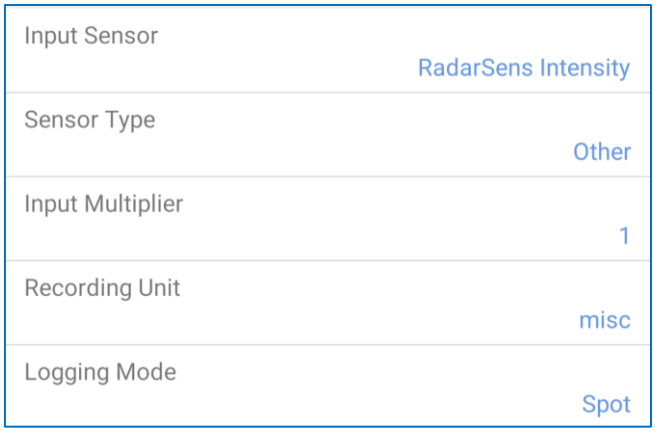
To set up the additional channels, tap the ' + ' control.
This will allocate a new channel number and display the channel setup screen.

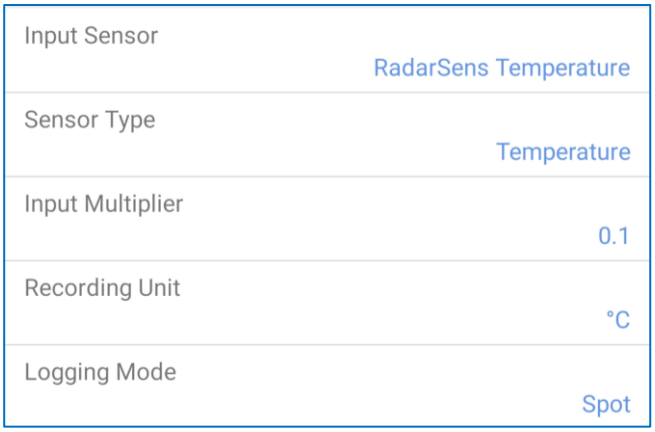


Depending on which channel you are currently setting up, select an Input Sensor of 'RadarSens Intensity' or 'RadarSens Temperature'.



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, tap the 'Accept' button. The channel will be saved to the logger and a summary will appear in the Logged Channels screen.

8 PART 3: ----- ADDITIONAL MEASUREMENTS (SYSTEM) -----

8.1 OPEN CHANNEL FLOW USING VELOCITY & DEPTH SENSORS

The rate of flow of water through an open channel can be calculated if both the cross-sectional area of the moving body of water and the velocity of the water are known.

The velocity can be measured by the use of an appropriate type of sensor.

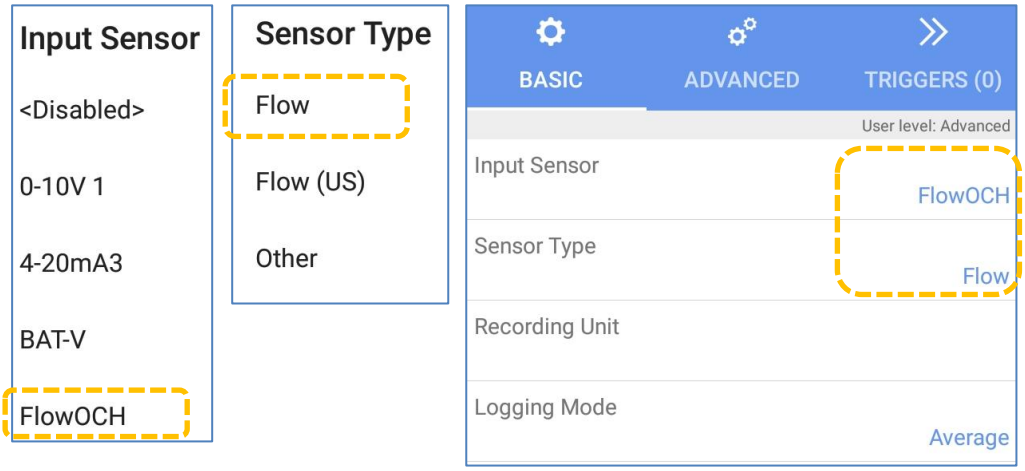
The cross-sectional area of the body of water can be determined from the depth of the water and the channel geometry. The required water depth can be determined by measurement using an appropriate type of sensor.

The logger, if equipped with suitable velocity and depth sensors, can produce flow-rate data (by calculation). This is achieved by setting up a "FlowOCH" channel, as follows:

Add a new channel to the logger (use the + button).

Choose "Flow OCH" as the Input Sensor.

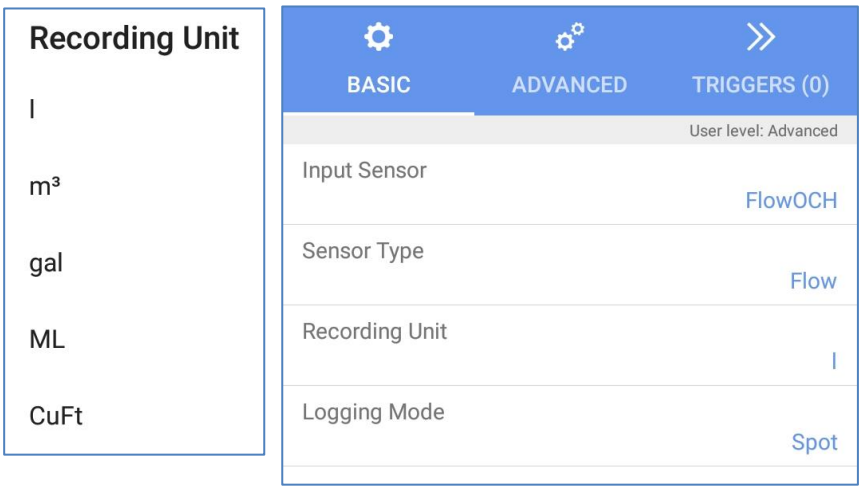
Choose a sensor type of "Flow"; this is the physical parameter being recorded for this channel.



Select a recording unit.

The measurement is an instantaneous rate of flow, so when "l" is selected, "litres per second" is implied, etc.

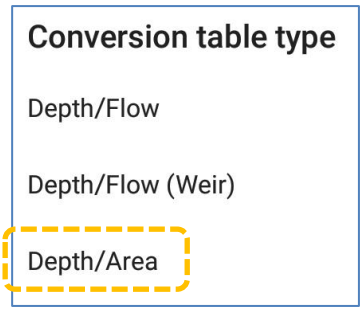
The logger calculates the instantaneous flow from the water channel dimensions and water velocity, using an internal unit of measure. It subsequently converts the flow result to the unit of measure chosen here, which is used in producing datapoints.

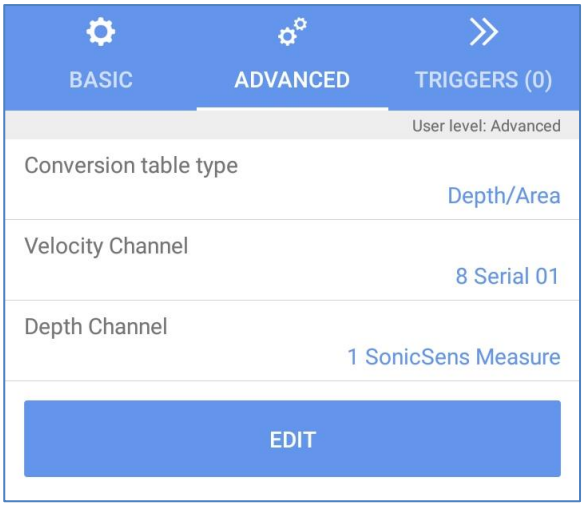


Select the Advanced tab and select a Conversion table type of “Depth/Area”.

Tap on “Velocity Channel” and pick the relevant sensor for the water velocity.

Tap on “Depth Channel” and pick the relevant sensor for the water depth.





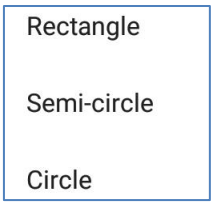
Note: The chosen channel must measure the *water depth*, (or provide a calculated water depth), and not the distance to the water surface.
The sensor must be set up to measure depth in mm.

Next the channel geometry should be entered:

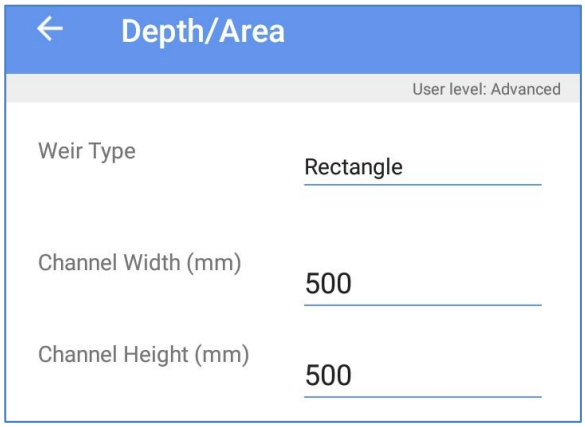
Tap on the Edit button.

Then tap on Weir type.

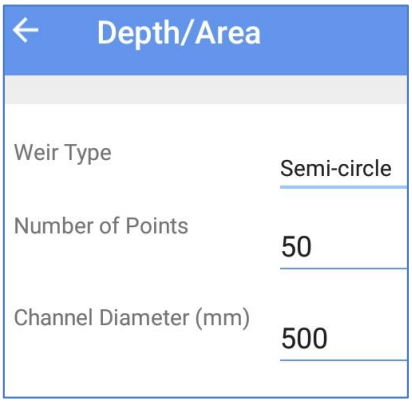
Select the shape that best describes the cross-section area of the water channel at the measurement point.

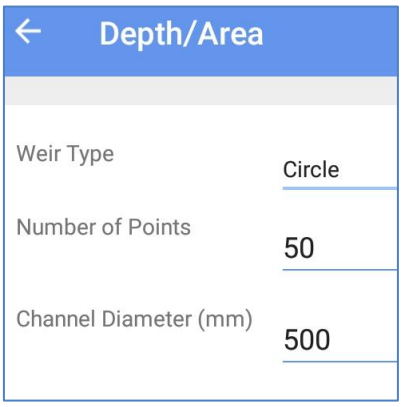


For a rectangular cross-section, measure and enter the height and width in mm.



For a semi-circle or circle, enter the diameter in mm.
Also enter a value (between 2 and 247) for the “number of points”.

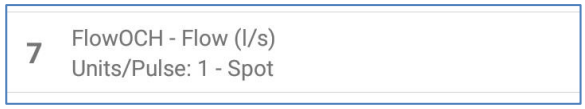




IDT will construct a table for use in the depth to flow conversion based on the entered geometry, dimensions, and number of points (lines) required.

The table will be uploaded into the logger after the user taps the “Accept” button.
(For increased accuracy, the logger also interpolates between lines in the table when producing flow calculations).

A typical summary configuration of the FlowOCH channel setup is shown opposite.
(The units/pulse information should be ignored for a FlowOCH channel)



During Hardware test the FlowOCH channel will typically be displayed as shown opposite.

A message of "Error reading sensor" will be shown should any of the sensors employed to produce the flow calculation has an error condition.

8.2 System – obtaining Open Channel Flow from a RAVEN-EYE Sensor

Some logger systems are supplied with a RAVEN-EYE type sensor, which can measure water velocity in an open water channel.

The sensor requires the following to be set in the logger:

- A pre-power time of 32,000 milliseconds.
- A bus timeout of 500 milliseconds.
- A wake-up time of 2000 milliseconds.
- Modbus function "03 Holding Registers" should be selected for register reads; Refer to the sensor manual for the register addresses required to be read for specific measurement values to be obtained.

When the logger is also supplied with a method of measuring water depth within the open channel, the system can be used to calculate the water flow through the channel.

Two methods are possible:

- Use the logger to make the rate of flow calculation (see section 8.1).
- Use the RavenEye sensor to make the rate of flow calculation (described here).

Setup of the system requires the entry of information concerning the geometry of the channel, using the software provided with the RAVEN-EYE sensor. All required tables are stored in the RAVEN-EYE sensor. A depth measurement (provided from another sensor installed with the logger) is used by RAVEN-EYE to evaluate the cross-sectional area of the body of flowing water. The RAVEN-EYE sensor measures the velocity of the water.

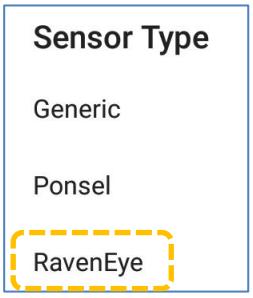
For setup of the RAVEN-EYE sensor, follow the guidance for a RS485 / Modbus sensor, as described in section 7.15, except as follows:

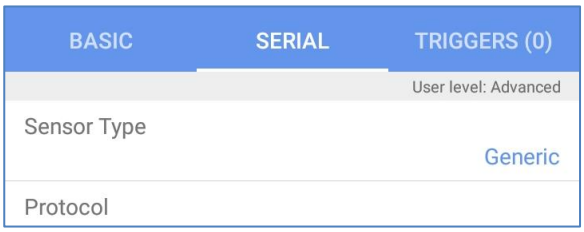
First, *set up the logger to obtain water velocity data* from the RAVEN-EYE sensor. However, when making settings on the "Serial" tab:

Tap on “Sensor Type”.

Choose the “RavenEye” setting.

Note: This selection *must be applied consistently* across any channels obtained from the RAVEN-EYE sensor.

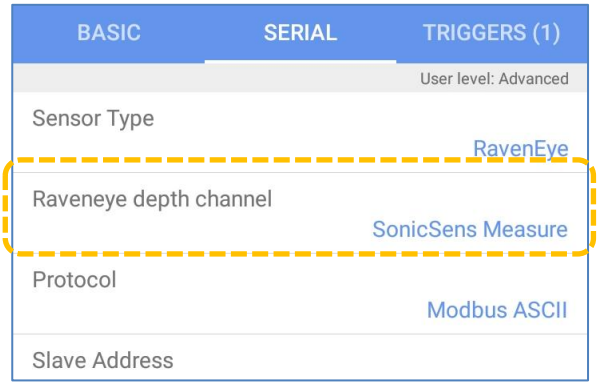




An additional setting line will appear called “Raveneye depth channel”.

Any channel (which must have been previously set up) which measures the depth of water in the open channel can be used.
(Here, a SonicSens3 sensor is being used to provide the depth measurements).

Note: The unit of measure of the selected depth channel is important; the RAVEN-EYE sensor requires the chosen depth sensor channel to be set to use mm.



Continue to set up the velocity channel using the register specified for velocity in the sensor manual. RAVEN-EYE usually requires a Modbus-ASCII setting (but also check with the manual for your sensor model).

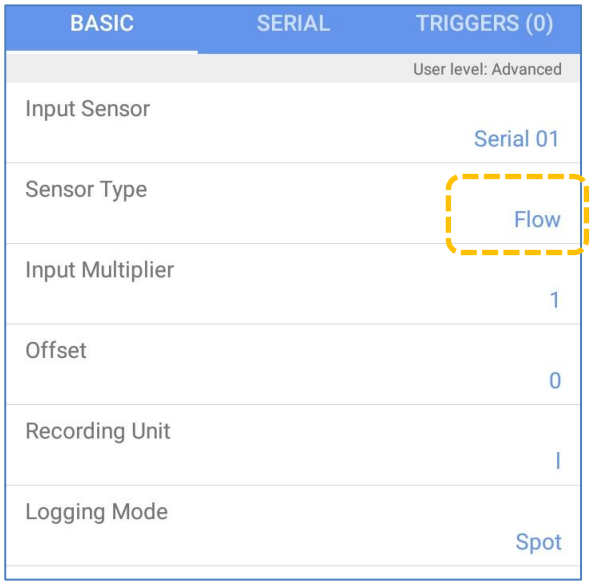
Note: By selecting a sensor type (in the serial tab) of “RavenEye” and then selecting a “Raveneye depth channel”, the logger is put into a mode to support additional requirements of the sensor, ensuring good interoperability with it.
In particular, the logger passes (writes) depth data into the logger as part of the measurement cycle. This happens in the background; no additional setup of the logger for the Modbus register writes is required.

The RAVEN-EYE sensor does a calculation of flow rate (using the depth data passed to it from the logger) and the result is made available via a Modbus register read.
An additional channel is therefore required to be set up for the flow-rate measurement:

Setup the logger to obtain the Flow data from the RAVEN-EYE sensor via a RS485 / Modbus register read.

The register data must be interpreted as “Flow” and the selected unit of measure is to be “L” (litres, for litres per second).

(On the Serial tab, the Sensor type and protocol settings will remain the same as earlier chosen for obtaining the velocity data from the sensor. Only the Logged Register Address will change to select the register in the sensor which holds the Flow-rate data (in litres / second).



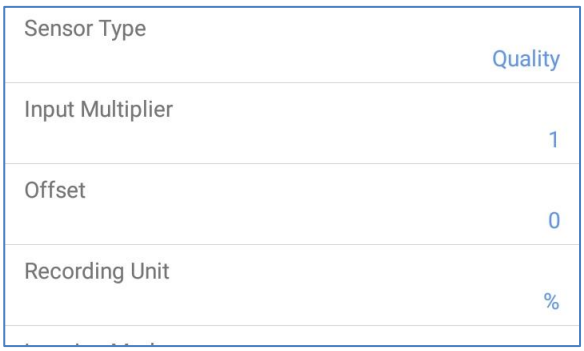
During Hardware test the RS485 / Modbus channels and chosen depth channel will typically be displayed as shown opposite.

The velocity will be shown during hardware test.

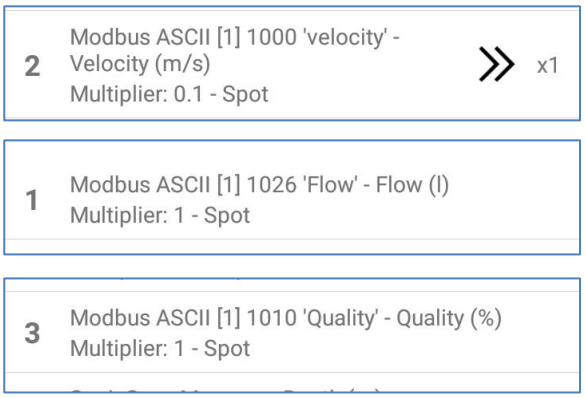
The flow result shown opposite is the rate of flow (in litres / second).

The RAVEN-EYE sensor has a variety of other parameters available including temperature and various judgements of the quality of its measurements.

These may be added to other logger channels if required.



A typical summary configuration of the RS485 / Modbus channel setup for RAVEN-EYE sensors is shown opposite.



8.3 SETUP – HYDREKA DVP (SDI-12)

The Hydreka DVP (Doppler Velocity Probe) is a sensor which measures water velocity.

It is typically positioned at the bottom of an open channel or on the wall of a pipe; both require a custom bracket or other means to hold the sensor firmly in position.

The sensor can communicate with the logger over an SDI-12 interface.

To setup this sensor to obtain water velocity data, refer to guidance of section 7.14.

BASIC	SERIAL	TRIGGERS (0)
		User level: Advanced
Input Sensor		Serial 01
Interface		2 - SDI12 (9V5)
Sensor Type		Velocity
Input Multiplier		0.1
Offset		0
Recording Unit		m/s
Logging Mode		Spot

BASIC	SERIAL	TRIGGERS (0)
		User level: Advanced
Slave Address		0
Friendly Name		Velocity
Pre-power Duration (ms)		6000
Logged Register Address		M 0
Reading		1
Meter Register Address		Off
Reading		

Channel settings are typically as shown above (subject to change; refer to the sensor manual for latest sensor requirements).

9 IDT - Operation Differences

The IDT app adapts the content of its screen options based on many factors:

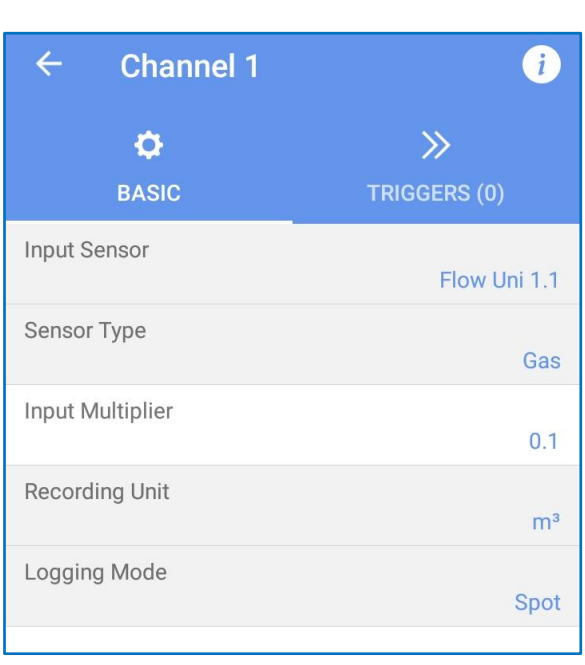
- IDT User level.
- Use of IDT with or without login to the server.
- Type of logger (logger family).
- Interfaces available for use (unconfigured and configured).
- Sensor attached or missing (applies to certain sensors only).
- Previously entered setting choices.
- Device security settings.

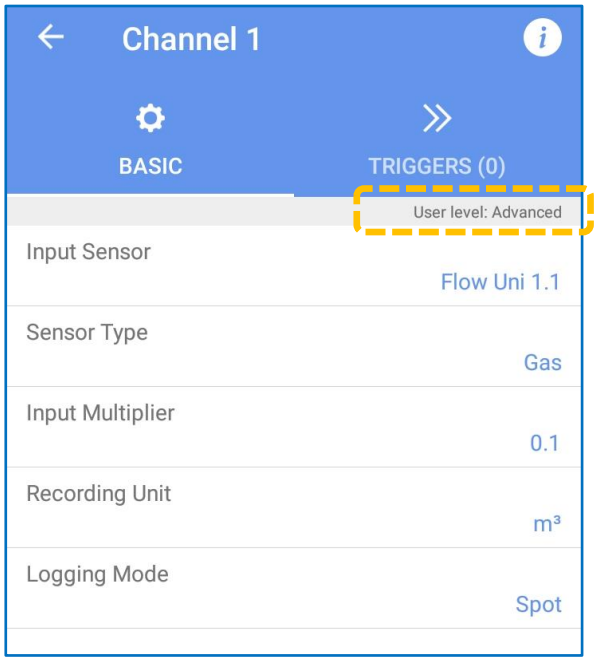
This section describes how this may sometimes affect the operation of IDT.
The description is not exhaustive but indicate typical issues which may arise due to circumstance of IDT use.

9.1 Restrictions of IDT Basic Mode

When operating IDT in BASIC mode, some features are restricted.

e.g. The ability to modify channel settings is restricted in BASIC mode (greyed-out), but available in Advanced mode. (See below for an example).



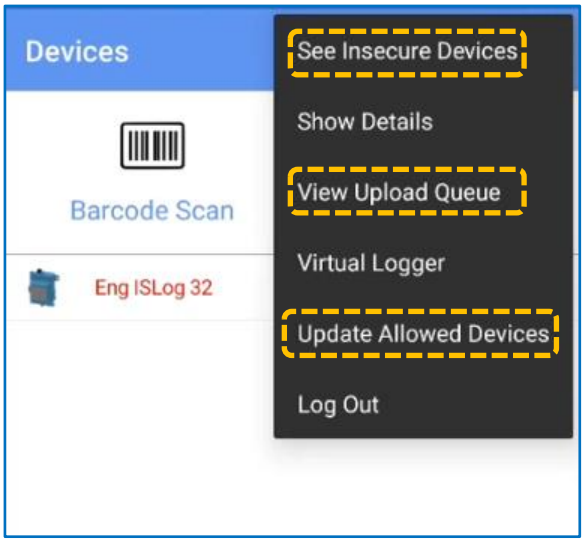


9.2 USE OF IDT WITH DATAGATE VS WITHOUT DATAGATE

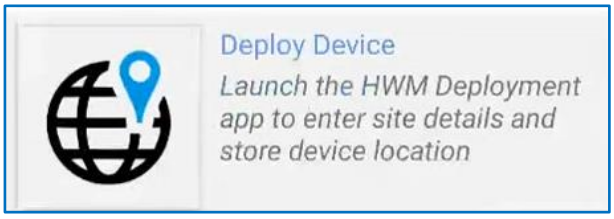
Certain menus adapt to whether IDT is being used with or without the DataGate server.

Since DataGate is a player in the security of logger settings, the options to update allowed devices and see unprotected devices is removed when IDT is not used with DataGate.

Similarly, IDT will make no attempt to queue data for upload since it has nowhere to send the data from the phone device.



The main screen does not show the “Deploy Device” option.
It is not possible to deploy the device using the same credentials as was used to log the IDT app into DataGate; you have not provided credentials as you have not logged in.



9.3 USE OF IDT WITH A VIRTUAL LOGGER

When IDT is used for inspecting the settings of a virtual logger (loaded from a logger settings file) it is read-only access. (See section 6.5)

IDT is not connected to any real device and has no facility to update either a real device or the settings file.

10 Appendix A – Calibration Procedures

This Appendix gives guidance on accessing and using calibration procedures for loggers.

Note: Most loggers will be paired with a set of sensors, and **calibration will have already been undertaken** in the factory prior to shipment.
In such circumstances, the calibration facilities of IDT are not required.

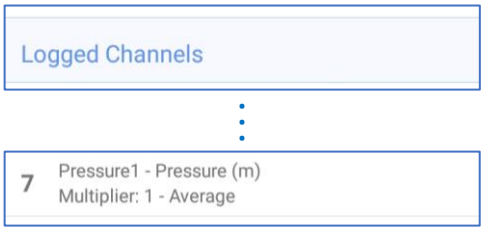
Calibration procedures can vary between interfaces and also logger types. Differences are sometimes required due to the internal electronics of the unit supplied.

10.1 External Pressure Interface –using cable values (group 3 loggers)

This method can be used with pressure sensors supplied by HWM that include calibration values printed on a pressure (or depth) sensor cable.
(Not all loggers have this calibration method available).

To access the calibration screen for an external pressure sensor:

Display the list of channels.
(Tap on "Configure Device", then "Channels").



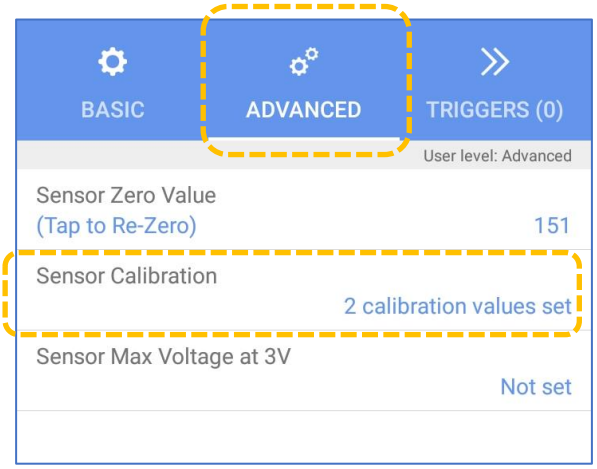
Then tap on the relevant line to select the pressure channel.
(The channel must be set to measure pressure or depth).

Select the "Advanced" tab.

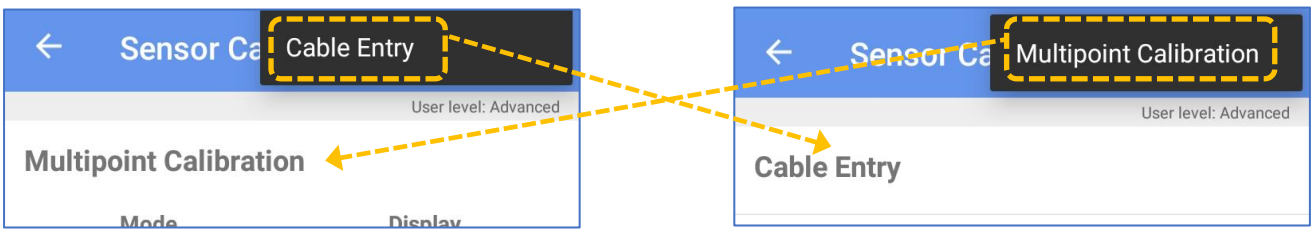
This tab displays options to adjust several settings related to sensor operation.

To select the pressure sensor calibration screen, tap on the "Sensor Calibration" line.

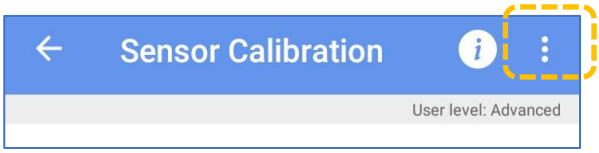
Note: If displayed, DO NOT make any adjustments to the "Sensor Max Voltage" setting when using this method of calibration.



There are two possible methods for calibration with a pressure sensor. Each method has different screens. You may have to swap which screen is displayed.

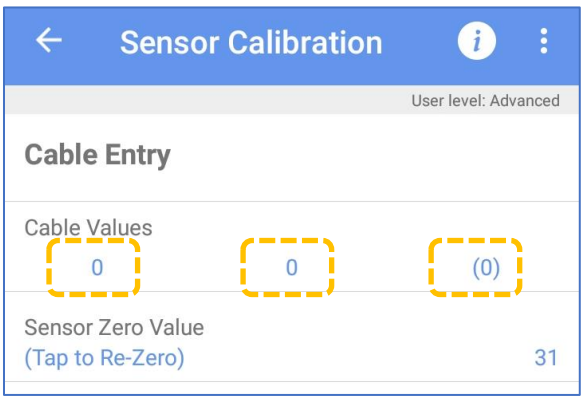


To swap screens, use IDT 'advanced' mode.
Use the local menu (tap on the 3 dots) to switch between the two calibration methods.



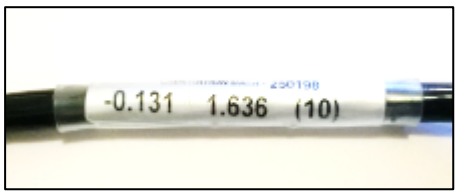
Note: Your logger may support just one method (available in IDT basic mode) or possibly both methods (but only available when in IDT advanced mode).

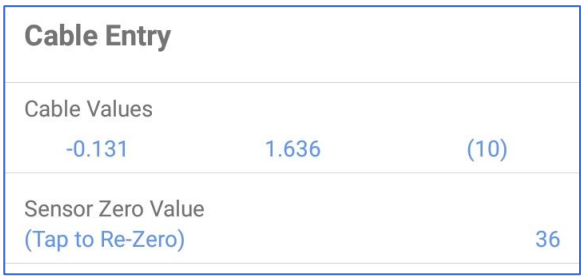
The screen for the "cable values entry" calibration method is shown opposite.



Tap in each of the areas shown and enter the corresponding value as read off the pressure sensor cable (no brackets required).

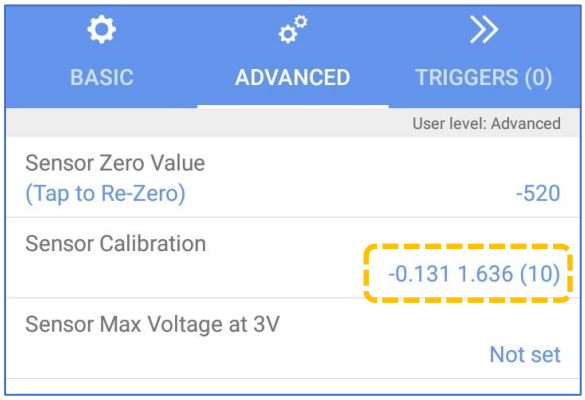
An example is shown:





Save the settings.

The calibration figures from the cable are now in use.

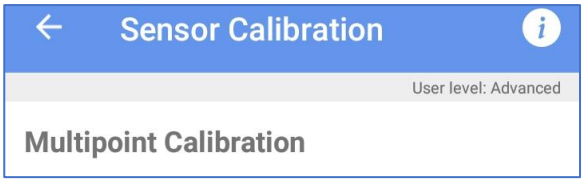


10.2 External Pressure Interface (analogue) (group 3 loggers)

IDT supports the following 2 methods of calibrating a logger input for a pressure (or depth) sensor:

- Entry of calibration coefficients using the values printed on the cable. (Refer to section 10.1).
- Multipoint calibration, (described in this section).

To use multipoint calibration, first navigate to the Sensor Calibration page, as described in the early parts of section 10.1.



A related setup stage (input sensitivity adjustment) may also be required (described in section 10.2.1).

When calibrating a pressure sensor, an appropriate calibration rig and sealing adaptor is required to apply pressure levels to the sensor. This task should be completed by a service center, or similar facility, which has the required equipment; ensure the calibration rig has a valid calibration record prior to use.

The multipoint calibration process pairs a reference pressure (entered into IDT by the user) with the corresponding numeric value that is output from the A to D converter. By using two or more reference pressures, the user can produce a table of calibration values. The logger can subsequently use the calibration table to determine the characteristics of the attached sensor. It uses both interpolation and extrapolation to calculate the currently applied pressure level.

Calibration: Units of measure conversion feature

IDT can use the same unit of measure as employed by the calibration jig for entering the reference pressure values. The IDT calibration process refers to this unit of measure as the "**Display"** unit.

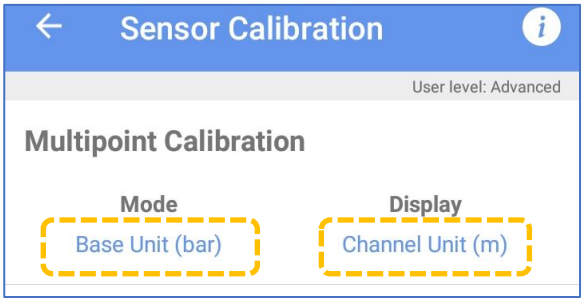
- Prior to entering the reference pressures, ensure the Display unit of measure is correctly set within IDT.

The logger can be set to employ a different (or the same) unit of measure for calibration of the sensor input. The IDT calibration process refers to the logger unit of measure as the "**Mode**" unit.

IDT converts between the pressure levels entered by the user (using the display unit of measure) into the corresponding value required for the logger (the mode unit of measure). Thus, values entered by the user in one unit of measure can be converted into a different unit of measure for storage in the logger calibration table.

To calibrate, proceed as follows:

Check Mode and Display units of measure currently shown on the calibration screen. (Adjust if required; It may be useful to change the 'Display' unit of measure to match the calibration rig during this process).



Attach the sensor to the calibration rig.

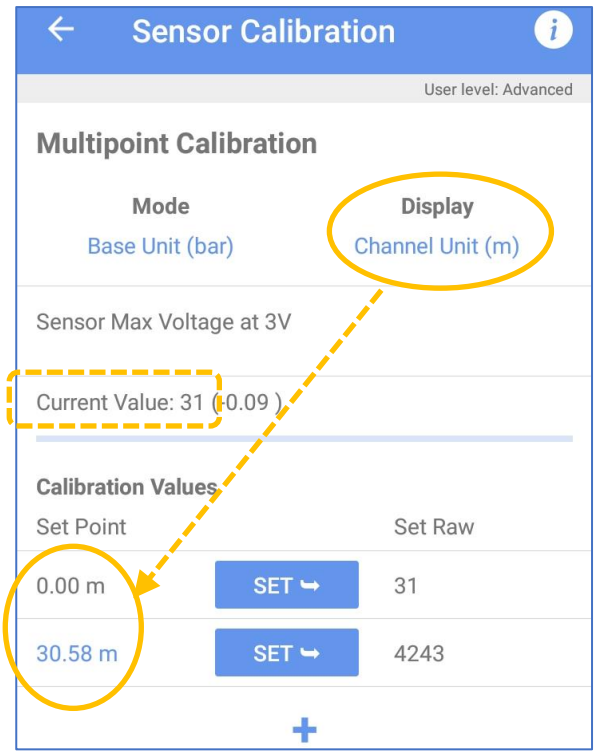
Decide on the calibration reference pressures that are to be used. Enter each of these into the 'Set point' column.

Apply a known pressure (one of the calibration references) to the sensor.

When the 'current value' number stabilizes, tap on the corresponding SET button.

Repeat the process for each of the calibration reference pressures.

This produces a table of calibration points, and the corresponding Analogue to Digital converter output values, listed in the 'Set Raw' column.



During the process, a line of the table which has a pink background has some error condition. (Either the "Set Raw" value is not correctly set, or the table line has not yet been saved.)

When the table is complete, tap on the save button to store the calibration table into the logger. The calibration is now complete. However, see the note (below).

When finished, discharge the applied pressure safely and then remove the sensor from the calibration rig.

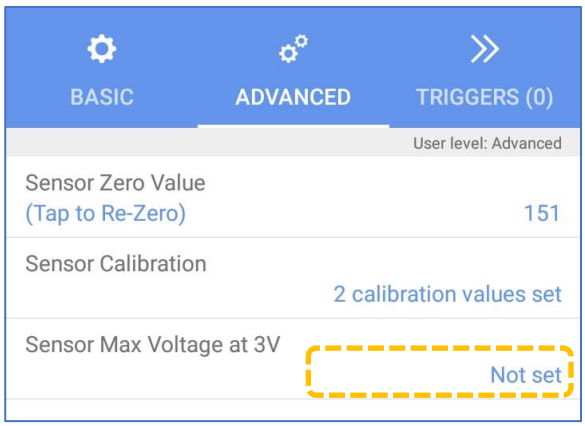
The sensor interface is calibrated according to the unit of measure chosen in 'Mode'. (The 'mode' set points are not shown, but the corresponding value produced by the logger's analogue to digital convertor are listed as 'Set Raw' values.)

The logger uses straight-line interpolation to produce measurement results between (and beyond) the stored points.

Note: (Sensitivity / Numeric range check)
The user may wish to predict (calculate) maximum and minimum "Set Raw" value that the sensor could produce, and if required adjust the input sensitivity, (as described in section 10.2.1).
If adjusted, the calibration process should be re-done.

10.2.1 Analogue Inputs - Sensitivity Adjustment (Group 3 loggers)

Note: Do not adjust the sensitivity of the External Pressure interface if your sensor has calibration values and you intend to use the cable values calibration method.

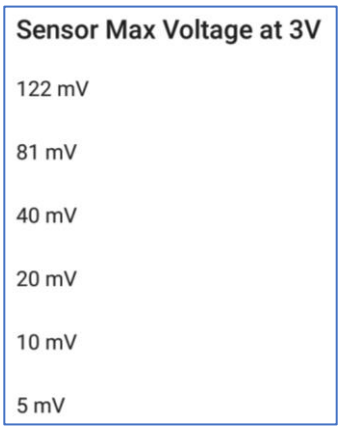


Some 'group 3' loggers contain a programable attenuator for certain analogue inputs. This allows the sensitivity of the input to be adjusted so that (even at maximum or minimum sensor input) the logger electronics does not saturate, and the available numeric range is not exceeded.

To access the sensitivity adjustment screen, first select the Advanced tab of the channel setup page. The sensitivity adjustment control for the channel will be shown (if applicable).

The logger will use its default value if not set.

The logger stores values obtained from analogue sensors in a S16 format (i.e., signed, 16-bits wide) which has a numeric range of -32767 to +32768. Ideally, the logger should make good use of the available number range (i.e., cover several 1000s), but not saturate at input levels slightly over the sensor's maximum level.



Refer to your logger manual for guidance regarding whether a specific setting may be required for your sensor.
If so, tap the "Sensor Max Voltage … " line and select the appropriate value.

Note: If the sensitivity of the input is modified, the interface will require re-calibration.

For most loggers the sensitivity is pre-set by the factory to match the sensor that has been supplied with your logger and should not be changed.

10.3 Calibration of RTD (Temp) input (Group 3 loggers)

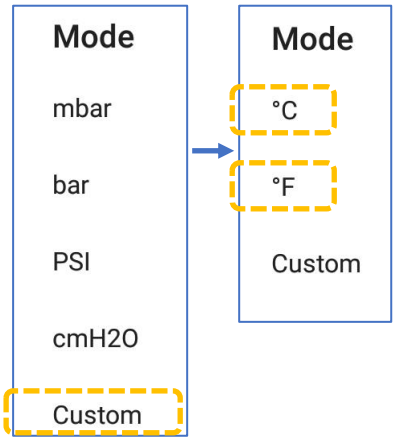
The temperature probe can be calibrated by inserting the probe into locations of known temperatures (e.g., ice-cooled water at 0 degrees C and boiling water at 100 degrees C). To calibrate, enter the known temperature references and set the corresponding A to D values. This produces the relevant calibration points within the logger calibration table.

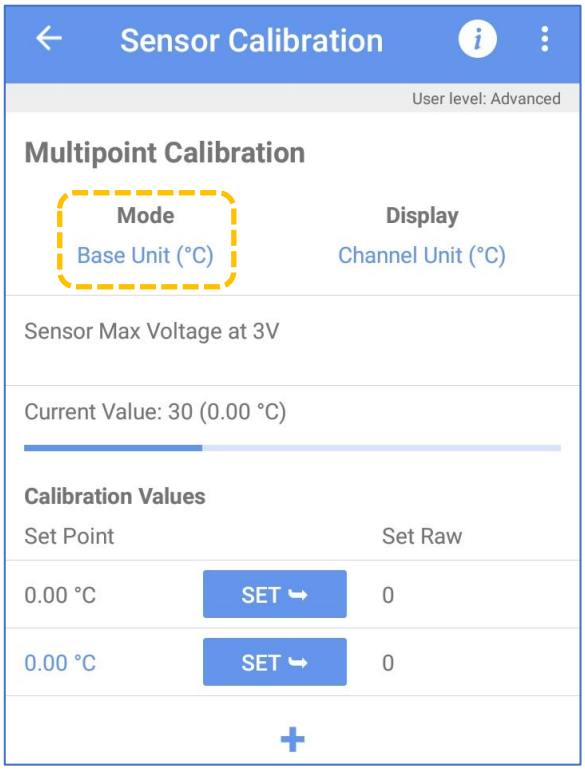
For loggers shipped with HWM supplied temperature sensors, calibration (and adjusting any input sensitivity) will not be necessary. The logger will be factory set to the most appropriate settings for the supplied sensor.

Calibration of the RTD (Temp) interface for temperature sensors follows a similar process to that described in sections 10.2 and 10.2.1. To re-calibrate the sensor, follow steps (in the sections just listed), but with the following differences:

Ensure the sensor calibration mode is set to be relevant to the unit of measurement of temperature.

Tap on mode and make changes until the required unit of measurement for the sensor calibration is available.





Set the display unit to a unit of measure to match your calibration reference equipment (if needed).

For temperatures beyond the calibration table values, the calibration curve will be extrapolated, allowing the sensor to continue to be used (but with limited accuracy).

When setup of the temperature sensor is complete:

The channel summary will indicate the current settings (a pressure channel reading temperature).

An IDT app hardware test of the temperature sensor will indicate the measured temperature in a similar way to that shown opposite.
(i.e., IDT will show a multi-purpose “Pressure” channel which is configured to measure from a temperature sensor).

10.4 4 - 20mA INTERFACE (ANALOGUE) (GROUP 3 LOGGERS)

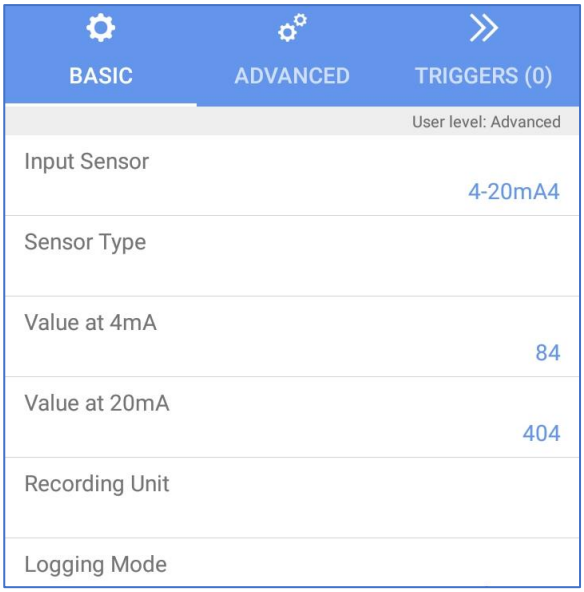
The interface can be calibrated by applying a constant current at 0mA, 4mA and 20mA references.
Apply the known reference current and then set the corresponding A to D values. This will build the required calibration table within the logger.

To calibrate the channel, first navigate to the channel configuration page.

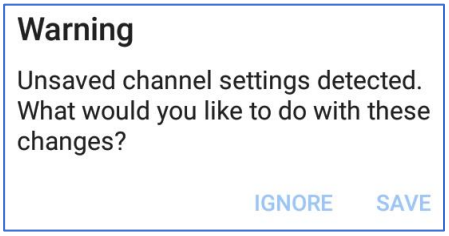
The BASIC tab of the logger channel setup must be at least partially completed before calibration can be undertaken.

i.e. The Input Sensor must have been selected, and the ADVANCED tab must be showing.

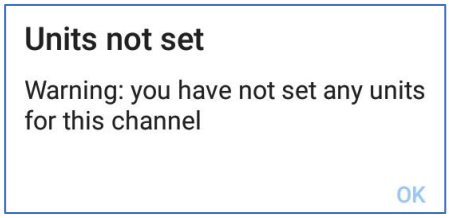
Select the ADVANCED tab.



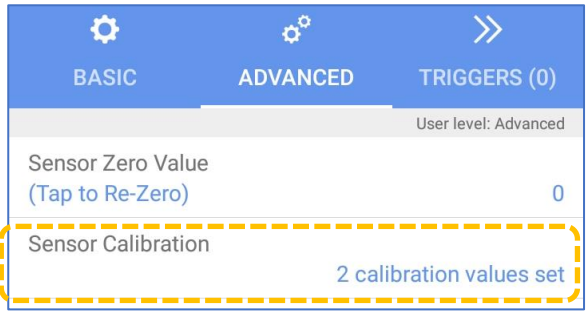
(If warned, then save the settings).



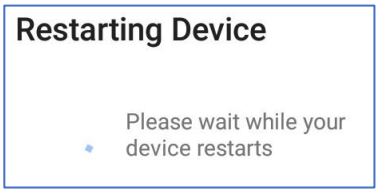
(Any "Units not set" warning is for information only.)



Tap on the "Sensor Calibration" line.



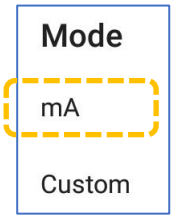
The logger may have to restart (to begin a new recording).

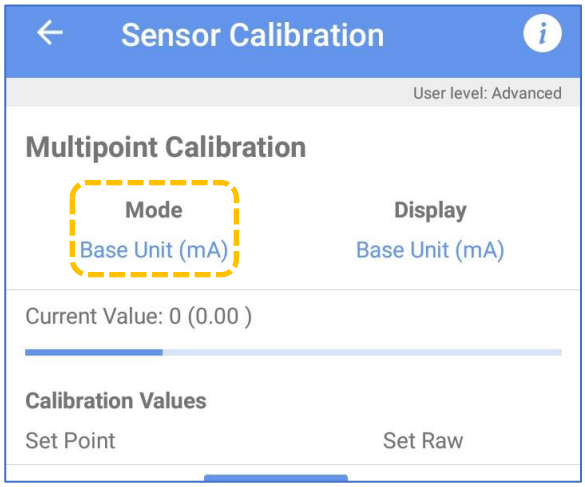


Ensure the Mode is set to "Base Unit mA".

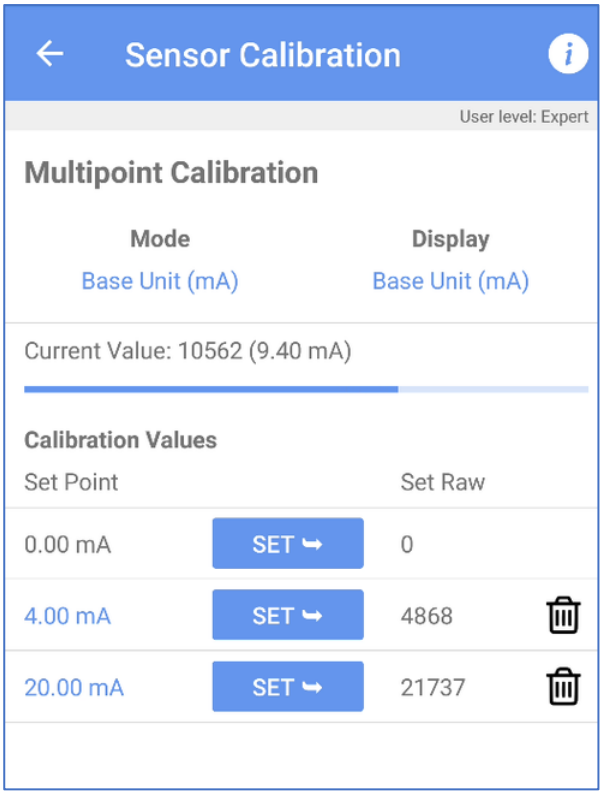
(Adjust if required; select "mA", and not "Custom").

(See section 10.2 for an explanation of Display and Mode units.)





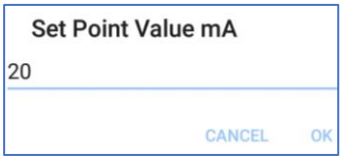
Set the Display unit to show your preferred units for calibration (mA or A).



Ensure the following set-points are available:

0mA, 4mA, 20mA.
(Tap the + symbol to add new lines to the table if needed)

(Tap on the values in the "Set Point" column to edit the reference current values).



Apply an input current of 0mA, 4mA and 20mA.

At each of the currents, monitor the live reading in the 'current value' until it stabizes. Then tap the relevant 'Set' button. This will save the current A to D value into the table.
(Repeat for each of the reference currents).

When the table has been completed, tap on the Save button. Calibration of the 4-20 mA interface is now complete.

Note: Channel setup will not be complete until all settings in the Basic tab are also completed; The additional settings are sensor dependent.

10.5 0-1V & 0-10V INTERFACES (ANALOGUE) (GROUP 3 LOGGERS)

Apply known reference voltages and then set the corresponding A to D values. This will build the required calibration table within the logger. For 2-point calibration, use 0v and the maximum voltage of the interface (as shown on the logger label).

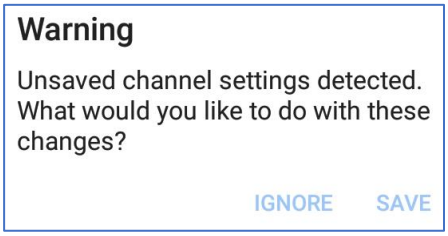
To calibrate the channel, first navigate to the channel configuration page.

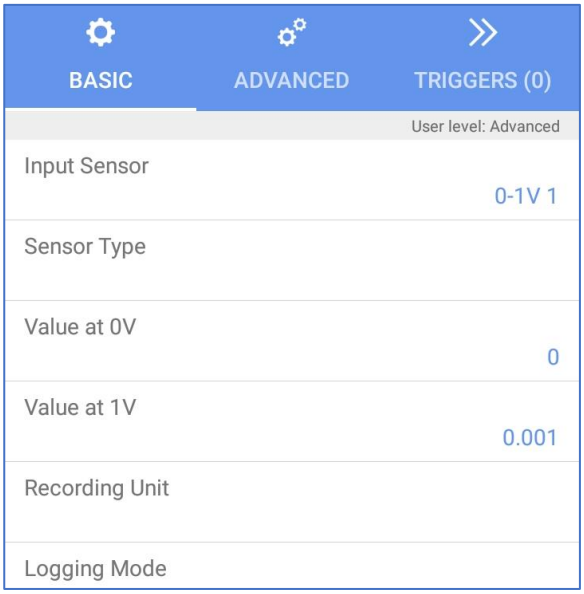
The BASIC tab of the logger channel setup must be at least partially completed before calibration can be undertaken.

i.e. The Input Sensor must have been selected, and the ADVANCED tab must be showing.

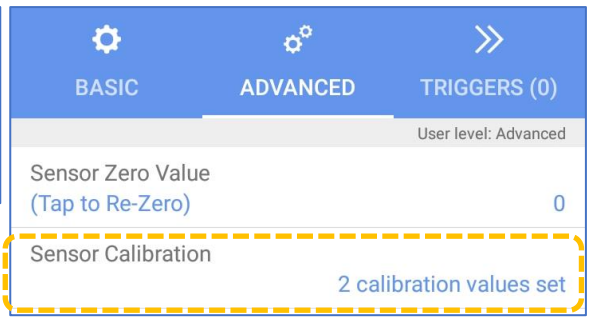
Select the ADVANCED tab.

(If warned, then save the settings).



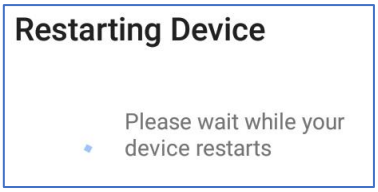


(Any “Units not set” warning is for information only.)



Tap on the “Sensor Calibration” line.

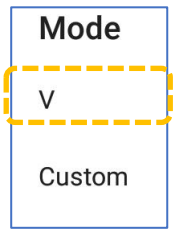
The logger may have to restart (to begin a new recording).

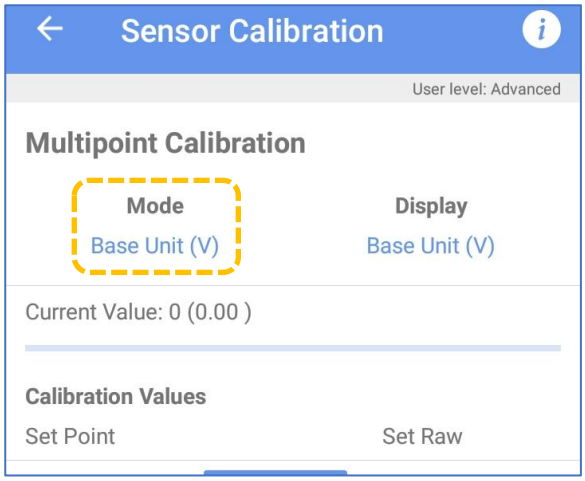


Ensure the Mode is set to “Base Unit (V)”.

(Adjust if required; select “V”, and not “Custom”).

(See section 10.2 for an explanation of Display and Mode units.)





Set the Display unit to show your preferred units for calibration (V or mV).

Ensure the following set-points are available:

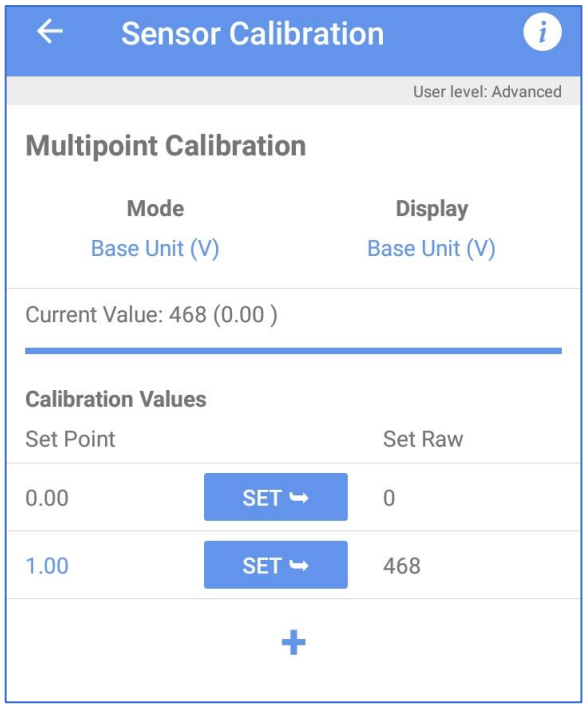
0V, 1V (or 0V, 10V for 0-10V input range).

(Tap the + symbol to add new lines to the table if needed)

(Tap on the values in the “Set Point” column to edit the reference values, if needed)

Apply an input of 0V and 1V (for a 0-1V channel) or an input of 0V and 10V (for a 0-10V channel).

At each of the voltages, monitor the live reading in the ‘current value’ until it stabilizes. Then tap the relevant ‘Set’ button. This will save the current A to D value into the table.
(Repeat for each of the reference voltages).



When the table has been completed, tap on the Save button. Calibration of the voltage input interface is now complete.

Note: Channel setup will not be complete until all settings in the Basic tab are also completed; The additional settings are sensor dependent.

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