The Sound Choice for Leak Detection.™

SpillSens
User Manual

MAN-159-0001-C

TABLE OF CONTENTS

3

1 INTRODUCTION, SAFETY AND SUPPORT OF PRODUCT

Thank you for choosing a HWM device. We trust it will provide you with many years of service.

SpillSens is a sensor that measures the presence of water above a pre-set height, similar to a float switch. The height is governed mainly by the position of installation. It can connect to various HWM logger devices, which provide it with power and use it for obtaining measurements. The logger detects when measurements exceed set limits.

This user-guide covers the SpillSens sensor. Please also refer to the user-guide of your HWM logger for details of how to install the logger being used with SpillSens.
The user-guide for your logger will provide details of tests to confirm that the call-in function of the logger is working.

This user-guide covers the following models:

Model Number(s)　　　Description
S159 / * / * / IS / *　　SpillSens
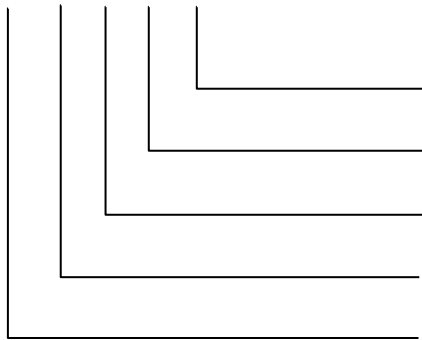
(reserved).

IS = Intrinsically Safe model.

elect. options; odd = SpillSens1 / even = (reserved).

Mechanical options (e.g. Cable Length).

SpillSens device.

Note: SpillSens2 devices are not currently available.

The model number can be found on the label that is secured to the SpillSens cable, near the connector to the logger.

(The label may differ to the one shown in this illustration).

Do not remove the label as it contains important safety information.

1.1 SAFETY

Before continuing, please read the "Safety Warnings and Approvals Information" document supplied with the product (MAN-159-0002), which provides general safety information (not ATEX related).

The installer or maintainer should also refer to document MANEX-159-0001 "SpillSens User Manual 2/2 - Safety Supplement". This provides additional ATEX-related safety information including port parameters.

Before using this product, please make a risk assessment of the installation site and expected work activity. Installations in a hazardous environment (e.g. ATEX) should be carried out by appropriate technicians with suitable training for that environment. Ensure any tools necessary for installation are suitable for use within the hazardous environment. Ensure suitable protective clothing is worn and working practices are followed during installation and any maintenance.

Within an ATEX environment, only use an Intrinsically Safe model of SpillSens, which should be used in conjunction with a known Intrinsically Safe model of HWM logger (e.g. ISLog). For ATEX installations, confirm the SpillSens and logger both have ATEX markings.

Ensure any communications device being used to assist in the install or setup of the logger and SpillSens are also suitable for use in any hazardous environment in which you are working.

SpillSens can also be used in non-ATEX applications.

1.2 SUPPORT OF PRODUCT

The manual introduces the HWM SpillSens, a sensor for use with compatible HWM logger devices. It provides information regarding the installation of the sensor and its on-site configuration using the HWM IDT app.

The manual describes how the sensor can be used in general, by describing how to setup a compatible logger to acquire data from the sensor and monitor for specific events and link actions to those events. It is usual for any data that is collected, or any event information, to be sent to a server for further processing and use. The manual also describes, as an example application of the device, its setup for use with the SpillGuard system (a HWM application for the device). (Refer also to the SpillGuard user guide, if required).

HWM also provides support of the product by means of webpages:
https://www.hwmglobal.com/spillsens-support/

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

2 OVERVIEW

SpillSens is a sensor that is used as one component of a wastewater spillage warning system provided by HWM-Water. This section gives an overview of SpillSens, the equipment that is required to use it, and various other system elements.

2.1 SPILLSENS - DESCRIPTION

SpillSens is a sensor that is buoyant (capable of floating) in wastewater. The sensor can detect whether it is hanging vertically in mid-air or floating at an angle. The sensor is typically installed at a critical height in an access chamber to the wastewater network. Its purpose is to sense whether the wastewater is at an unexpectedly high level.

SpillSens is constructed from the following materials:

- Enclosure: PC / ABS
- Protective bumper: Neoprene
- Enclosure gasket: Closed Cell Polyurethane Foam
- Screws and Nuts: Stainless Steel
- Cable gland: Polyamide
- Cable Sheath: PUR (Polyurethane)

The materials are durable and should not be adversely affected by long-term exposure to a domestic wastewater environment that is within the defined temperature operating limits of the product. The installer is advised to check the suitability of these materials for the wastewater environment in which the SpillSens is to be installed to ensure they are not adversely affected.

The temperature operating limits of SpillSens are:

- Minimum ambient temperature: -20 ˚C
- Maximum ambient temperature: +60 ˚C

SpillSens cannot function alone; it needs to be connected to a compatible HWM logger device. HWM produces a variety of logger device models, including some (e.g. ISLog) that can include an interface for SpillSens. The logger interface provides SpillSens with power and also a wired communications link so that the logger is able to read measurements from it.

SpillSens has a thin flexible electrical cable, which is part of the unit. The cable is captive at the SpillSens float and has a 4-pin connector at the other end. Models are available with various cable lengths, up to 3 meters. The cable connector attaches to the logger and is water-tight when correctly fitted.

A software tool is required to test and to modify the setup of SpillSens for use (see section 3). The software tool is called "IDT" (Installation Diagnostic Tool). IDT communicates with the logger. The logger stores the settings for SpillSens operation. The logger is shipped with factory-programmed settings that are suitable for most installations.

Note: IDT may restrict programming access for some users; access permissions may be limited by the system administrator or they may require an IDT password to enable the feature.

Note: Changing the settings from those set by the factory may affect the operation of the logger and sensor, including reducing the battery life.

2.2 SPILLSENS - FUNCTION

One application of SpillSens is within sewage systems. SpillSens is installed such that, under normal conditions, it hangs vertically within a wastewater access chamber. The sensor is positioned at a height which is around the upper limit (maximum height) of the normal expected operating range of the wastewater sewer. If the water level should rise above this point it is an indication that the pipe capacity is close to being exceeded, resulting in a risk of wastewater / sewage escaping from the chamber. This in turn indicates there is potentially a blockage or restriction downstream in the sewer pipe network.

When the wastewater level exceeds the installation height of SpillSens, the sensor begins to float. The higher the water level, the higher the sensor will float, and the more slack will exist in the cable.

A hinge point is formed by the natural weight of the cable plus an added weight.
The sensor will not just float, but also tilt at a varying angle.

SpillSens therefore has a range of float angles that can vary from 0˚ to approaching 180˚ from its normal rest position.

(Acceptable range of water levels)
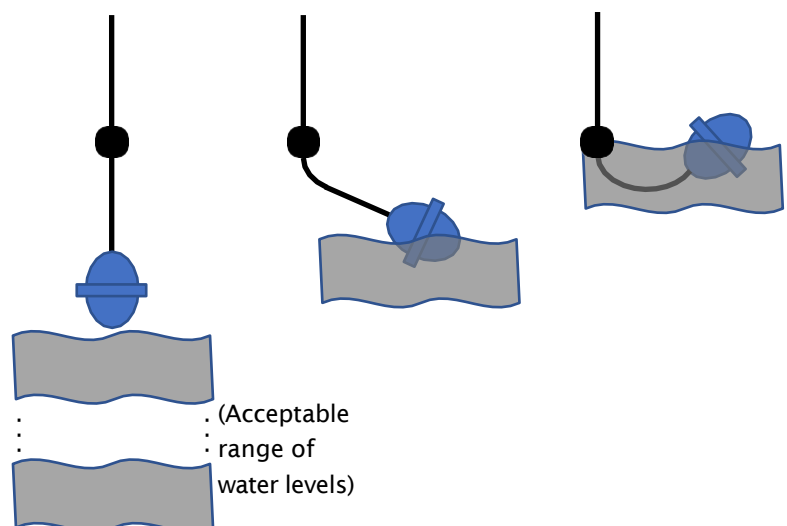
Note: SpillSens is not recommended for installation where fast-flowing surface water can exist in a flood situation. Contact HWM Sales dept for additional information in the case of fast flowing applications of the product.

7

SpillSens is normally powered down by the logger. Each time it is required to make a measurement, the logger powers up SpillSens and a measurement is requested; this takes a fraction of a second. SpillSens makes the measurement and sends the result to the logger device. The data includes the current the tilt angle.

The data is: Angle to x-axis

(an integer in the range 0 to 180, representing "degrees from regular free-hanging position"; On SpillSens the x-axis is aligned with gravity).

The angle data can be processed by the logger or a server to interpret its significance.

2.3 LOGGER FUNCTION

The logger must include a SpillSens interface in order to be compatible with SpillSens. Measurements are stored in the memory of the logger, which can monitor the data for any interesting events (e.g. the tilt angle exceeding a threshold). The measurements are eventually sent into to a cloud-based server (e.g. a HWM DataGate server) at a time the logger determines is appropriate. The logger can be programmed to send the data to the server at fixed times or at fixed intervals. The transfer of data occurs when the logger calls into the server over the cellular network. The logger may send additional messages to alert the server if any conditions (e.g. angle thresholds) are met (or if they were previously met, have just cleared); these are sent almost immediately.

The logger is programmed to measure the tilt-angle of SpillSens at specified intervals. This is a repetitive task. Each measurement is "logged" (stored in the logger's internal memory), awaiting upload to the server. The memory and its stored data are referred to as the "primary data recording" for the assigned channel. The logger continues with its task, uploading data in batches at the appointed times.

The logger is typically programmed to monitor some of the most recent data samples to detect whether the sensor is floating. It does this by checking if the tilt angle has passed a programmed threshold.
The logger can use statistical functions (e.g. measurement persistence) to filter-out spurious measurements, which is particularly useful for problematic sites.

Angle x°

The *logger* regards passing through a threshold as a change of its state (a threshold has been met or is no longer being met). It takes appropriate actions, as set by its programming, which can include informing the server. The logger then (if it has any "actions" programmed) modifies its behavior as appropriate to its new state.

8
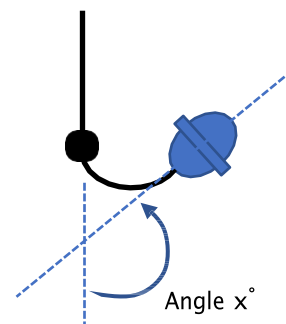
The *server* will typically regard the message of going above or below the threshold angle as the start of a meaningful event (i.e. a potential spillage warning), or the end of an event (problem over) respectively.

To avoid excessive messages being generated (due to flapping; a term which refers to frequently switching states when close to the threshold), thresholds are normally programmed into the logger with a hysteresis value included. Thus, a single angle threshold plus hysteresis work together to form a pair of angles, one indicating a condition of rising water and a slightly lower one indicating falling water. Introducing hysteresis as a margin to distinguish between the water rising and falling ensures that any transition is clear-cut and stable, and no "nuisance messages" will be generated.

The logger could, for example, be programmed to "trigger" for SpillSens measurements with a threshold (Th1), as illustrated below:

Including some hysteresis (Hyst) in the threshold settings serves to include a small margin of separation between the rising and falling water levels. In the diagram opposite, these are labelled Th1(R) and Th1(F), which are the thresholds for rising water and falling water, respectively.

e.g. A trigger threshold of 50° and a hysteresis value of 10° gives:

50°   Threshold Th1(R), during a rise in water level.
40°   Threshold Th1(F), during a fall in water level.

The diagram shows the logger's view of SpillSens being in one of two possible states, either High or Normal. These states correspond to the angle exceeding the threshold or not.

Note: It is not necessary for the sensor to completely return to the rest position.

The logger reports both events to the cloud server:

- (Th1)Normal ➔ (Th1)High   ; SpillSens has gone above (Th1)threshold.
- (Th1)High   ➔ (Th1)Normal   ; SpillSens has gone below (Th1)threshold.
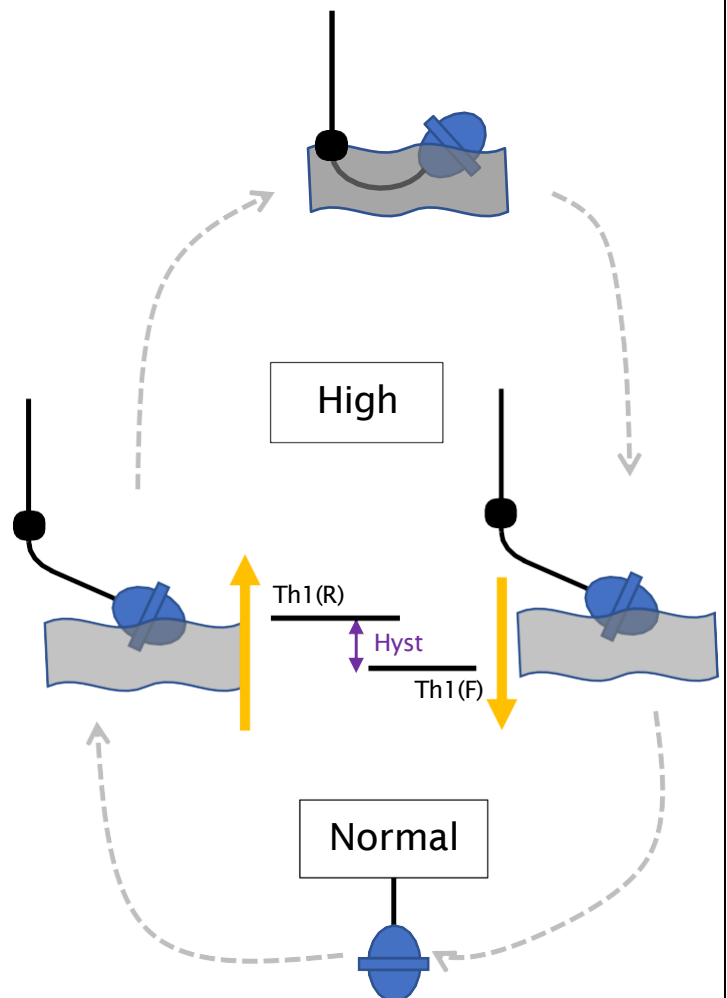
It should be noted that the above diagram illustrates the setup of a logger with a *single* trigger programmed into it, monitoring for SpillSens exceeding a specified angle. However, the logger can be programmed with *multiple* triggers, and thus it can monitor for SpillSens exceeding *multiple* angles.

e.g. A second angle threshold (Th2) could be programmed at 110˚ and hysteresis 10˚.

The logger can now also report these additional events to the cloud server:

- (Th2)Normal   ➔   (Th2)High   ; SpillSens has gone above (Th2)threshold.
- (Th2)High   ➔   (Th2)Normal   ; SpillSens has gone below (Th2)threshold.

It is for the server (or user) to understand the significance of each message.

For example:

A SpillSens sensor used within the **SpillGuard** system will have a logger with two such triggers (Th1 and Th2) programmed into it, triggering at two different levels (angles) of rising water (and, due to hysteresis being added, two different levels of falling water).

The regular status of a site within SpillGuard is *OK*.

When the SpillGuard system receives messages from the logger, it implies the meaning of either a *warning* alarm or a *spill* alarm for exceeding the lowest and highest angle thresholds, (Th1 and Th2) respectively, for rising water. Similarly, it interprets the messages for falling water levels as a de-escalation of the problem, eventually returning to *OK*.

Although the angle data is sent, SpillGuard only uses the messages relating to the changes of angle through any of the thresholds. Because the SpillGuard system disregards any angle information, the logger is required to be set up with the first threshold (shown as Th1) to be set to the lowest angle and the second threshold (shown as Th2) to be set as the highest angle. These
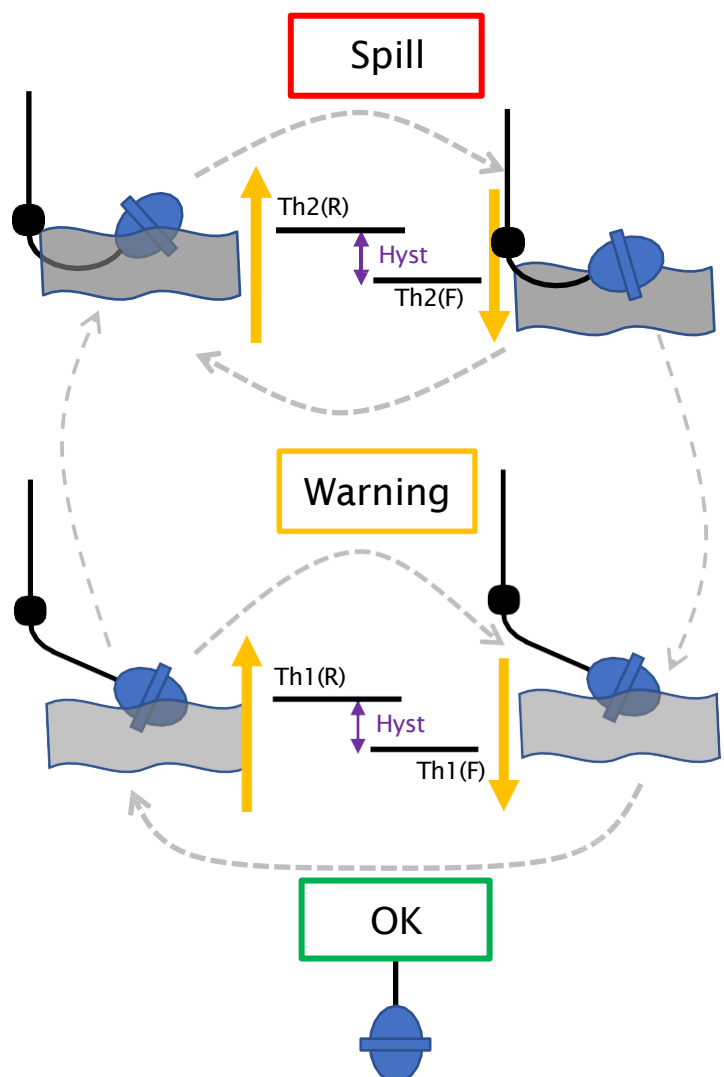
must be programmed as two separate triggers for the SpillSens channel, Trigger1 and Trigger2, respectively.

Going beyond the example of SpillGuard, the sensor may be used in other applications, which may have different requirements. The logger settings are quite versatile to accommodate other requirements. These include using a trigger to increase the call-in rate (thus sending in data more frequently). Examples for programming additional actions are given later in the manual, however it is recommended to consider the effect on the battery life of the logger before use. Only implement the minimum requirements for your application in order to avoid unnecessary use of battery power.

2.4 SERVER / DATA VIEWING PORTAL

The data sent to the server can be viewed using a web-browser. To access the data a user must have access the SpillGuard portal, including a user login account.

The SpillGuard system provides various views into the current working state of the wastewater pipe network, including showing sites where possible flood events have occurred or are at risk of occurring. (Refer to the SpillGuard user guide for further details).

2.5 SPILLSENS INSTALLATION ACCESSORIES

No custom accessories are required for mounting the SpillSens; the installer may be able to utilize existing metalwork within the site.

HWM has the following optional parts available to support the installation, if required:

Logger fixing points
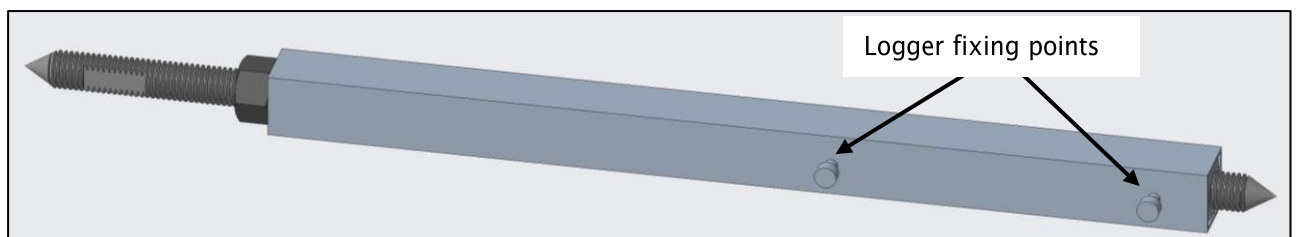
- Horizontal Bar (adjustable 400-600 mm)
- Horizontal Bar (adjustable 600-800 mm)

Certain loggers (see below) can be supported by the bracket, as shown.

- IS-LOG
- COMLog2-IS

11
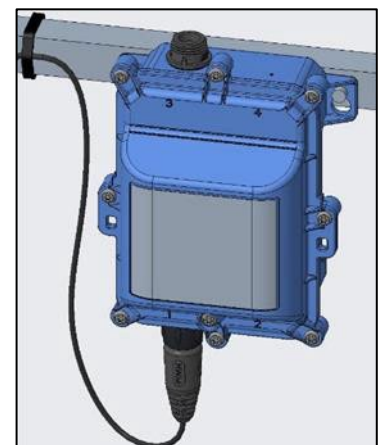
3 INSTALLATION OF IDT / COMMUNICATING WITH THE LOGGER

IDT (**I**nstallation and **D**iagnostic **T**ool) exists in two formats:

- Mobile phone version.
- PC version.

Refer to your logger guide for details of which version is required and how to download the IDT app.

IDT can be set to different operational user-level "views" (which set the user-interface and available options). The "basic" or "advanced" view is sufficient for checking the setup and the test of SpillSens.

If the view is not "basic", the user-level will be shown. e.g. IDT (mobile) shows "User level: Advanced", opposite.

Note: Editing of certain fields may require setting IDT into a more advanced user-level "view", which will be password restricted.
The ability to edit certain fields can also be restricted for some users; this is set by your system administrator.

The logger manual will also give instructions for establishing communication with the logger and reading the logger configuration into the memory of the IDT app. You should follow the logger guide for details of how to perform these actions.

This guide picks up IDT usage at the point where IDT shows the main page, as below:

IDT (PC version)   IDT (mobile version)

On IDT (PC), click the button "Read Device" to obtain the configuration from the logger.
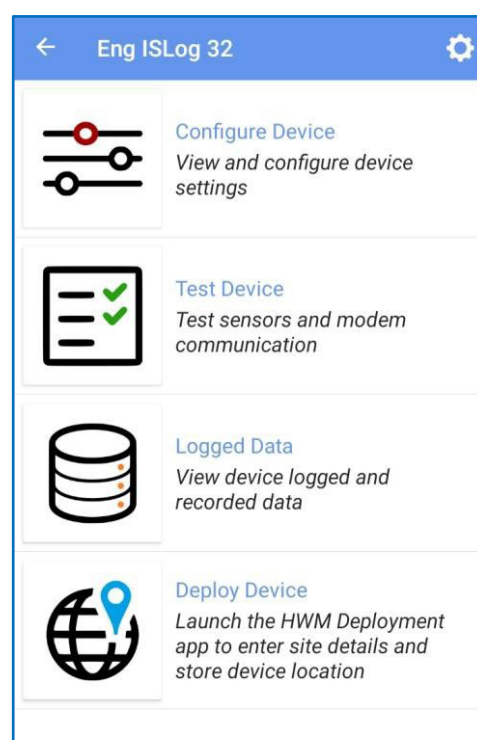
4 CHECKING / CONFIGURING SPILLSENS

4.1 USING IDT (MOBILE)

4.1.1 Checking if a channel configuration / triggers already exist

Tap on the "Configure Device" line.

The app will show the "Channels" page and any channels that are already configured into the logger.
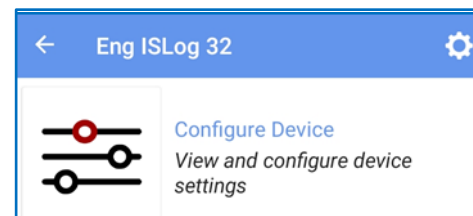
The example opposite shows a summary of several channels that are already set up, including channel 1 which is for a SpillSens1 sensor. (The channel number may vary).

Note the symbol with two arrows on the SpillSens1 line. This indicates that two triggers have also been set for this channel.
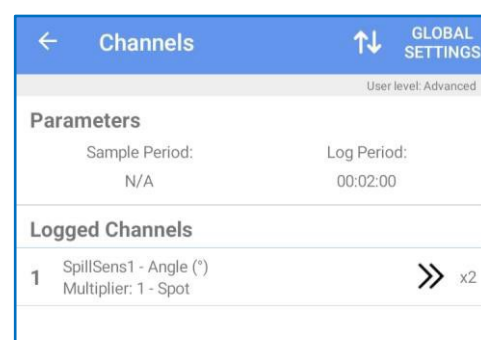
Tap on the line which shows the SpillSens channel, a page will appear with two tabs, "Basic" and "Triggers". This will show a summary of any Triggers that have been set in the logger.

The purpose of setting a trigger is to make the logger monitor the channel to check for a specific condition. If that condition is met, it is linked with one or more actions that should be taken.

Although the trigger and its linked actions can be programmed into the logger, it can also be disarmed.

An IDT line is shown greyed-out for any line showing a disarmed trigger (see opposite). When not disarmed it appears as white (see above).

If the SpillSens channel is already established, the settings can be checked and (if you have permissions) adjusted if required. This is covered in section 4.1.5; skip to this section.

If the channel has not yet been set up, instructions to do so begin in the section 4.1.2.

13
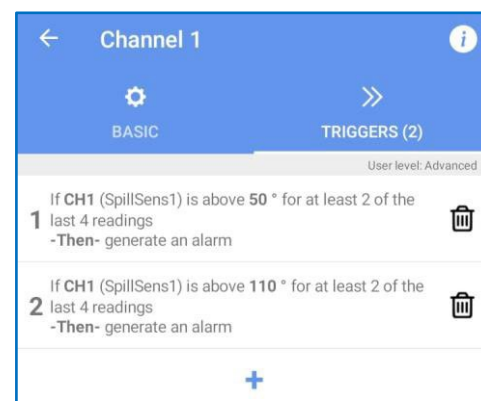
4.1.2 Creating a new SpillSens channel (if required)

Go to the main page (see opposite).

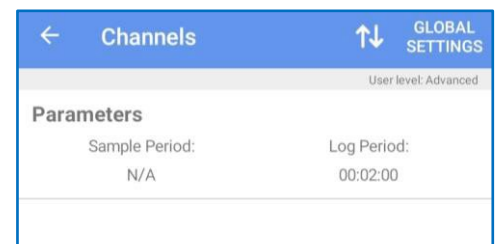Tap on the "Configure Device" line.

(Configuration is only possible if you have permissions).

Then, on the next page, tap on the "Channels" line.
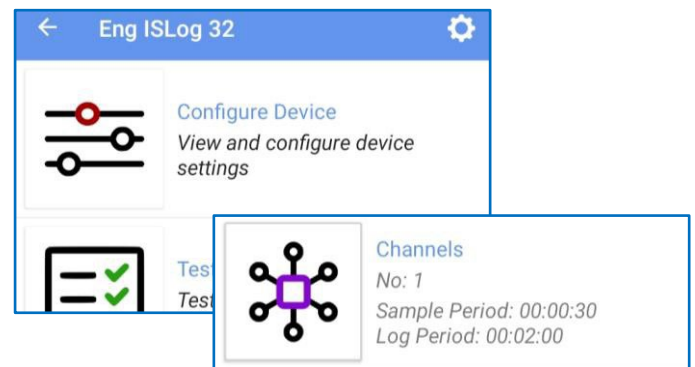
The Channels page will be shown.

The illustration opposite shows a logger where no channels have been configured.

To add a channel, tap the "+" line.

The logger names the channel as "Channel 1" (the next available channel).

The new channel requires the selection of an input sensor; currently it is listed as "<Disabled>".

Tap on the "Input Sensor" line.

The logger will display a list of all the types of sensor options that your logger has available for use.

Note: The list will vary according to the model number of the logger.

14
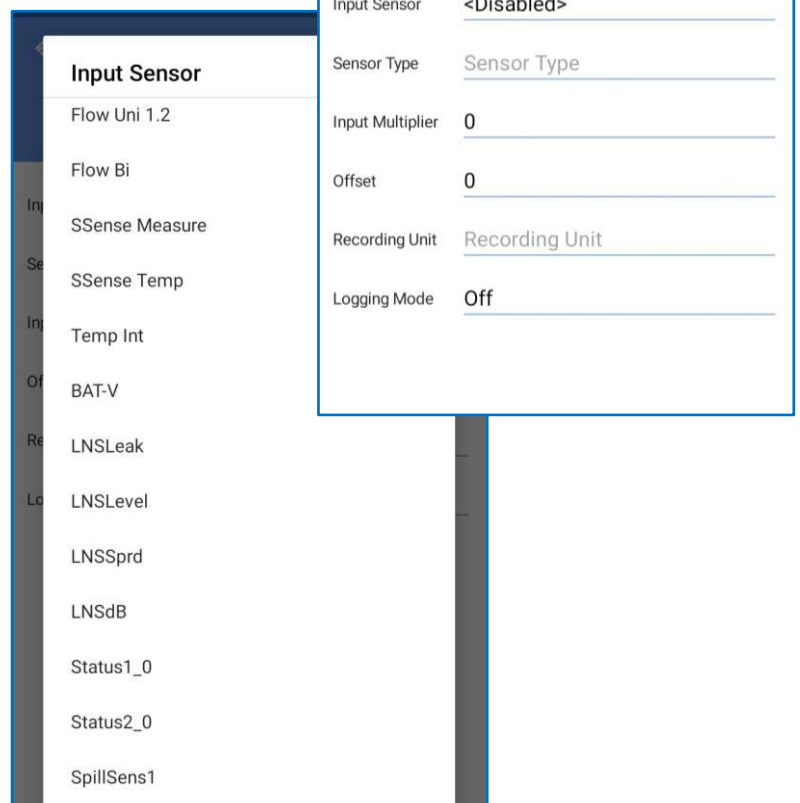
Tap on "SpillSens1".

The page for Channel 1 will now be updated to show that SpillSens1 is the input sensor.

Continue to set up the page with the parameters shown opposite. Where required, a line can be edited by tapping it and picking from the selection.

The "Logging Mode" has a list of available options.

The one that should be used for SpillSens is "Spot".

"Spot":

- Selects the period called "Log Period" from the two available sampling rates, and stores data at that rate into the primary recording.
  (Other selections are not explained here).
- Each time a new measurement has been made; the last few measurements saved to the primary recording are used to evaluate the result of any triggers that have been programmed.

Finally, tap the "Accept" button to save the channel.

Note that no triggers have been set up on this channel. These will be covered in section 4.1.3.
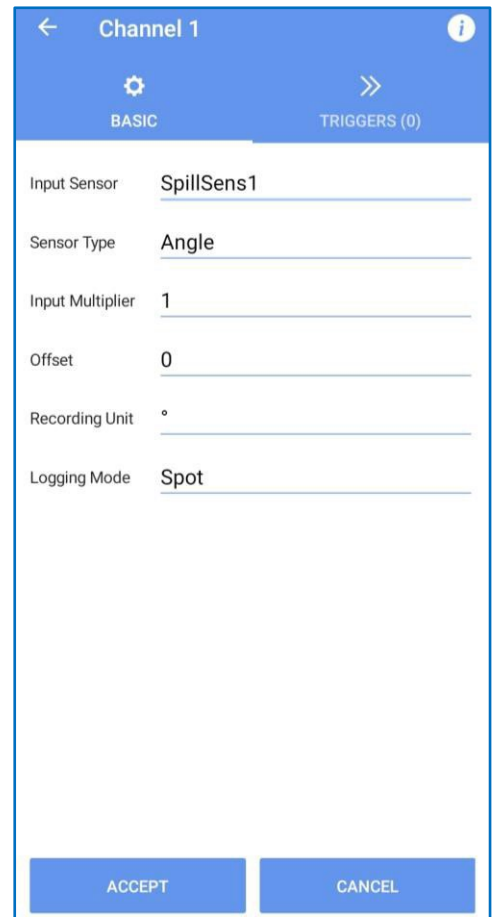
4.1.3 Creating a new Trigger for a SpillSens channel (if required)

Select the required SpillSens channel from the list of channels that have been set up on the logger.

The channel settings will be shown on a page with two tabs, "Basic" and "Triggers".

The illustration opposite shows that no triggers have been set up for this channel, "Triggers (0)".

Select the "Triggers" tab.

Initially there are no triggers.

To begin a new trigger for this channel, tap on the "+" line.

The logger names the Trigger as "Trigger-Action 1" (the next available Trigger that is available on this channel).

The new trigger for this channel requires the selection of the input conditions that it should check for; currently they are not set and are shown as greyed-out prompts.


The trigger is always paired with at least one action (otherwise there is no point of having a trigger), hence the name "Trigger-Action". The first action is added in readiness for the user to complete. This is similarly not set and shown as greyed-out prompts.

The slider switch control at the top of the page allows the trigger to be armed (as shown) or dis-armed. (To change the setting, tap on the slider symbol).

Set the fields on the page by tapping on each one and adjusting from the topmost settings downwards.

An example is shown opposite which is set to trigger when the angle reaches more than 50˚. This is discussed further detail in section 4.1.6.

The hysteresis is set to 10.0 here and will be discussed later – see section 4.1.6.

16
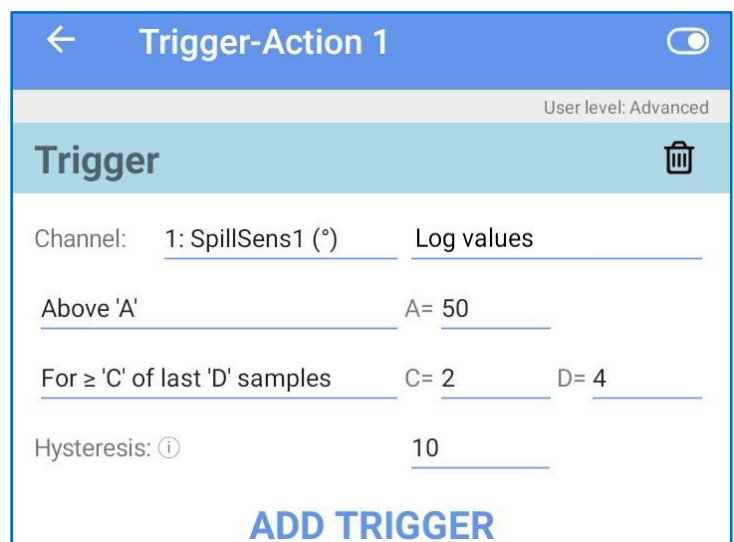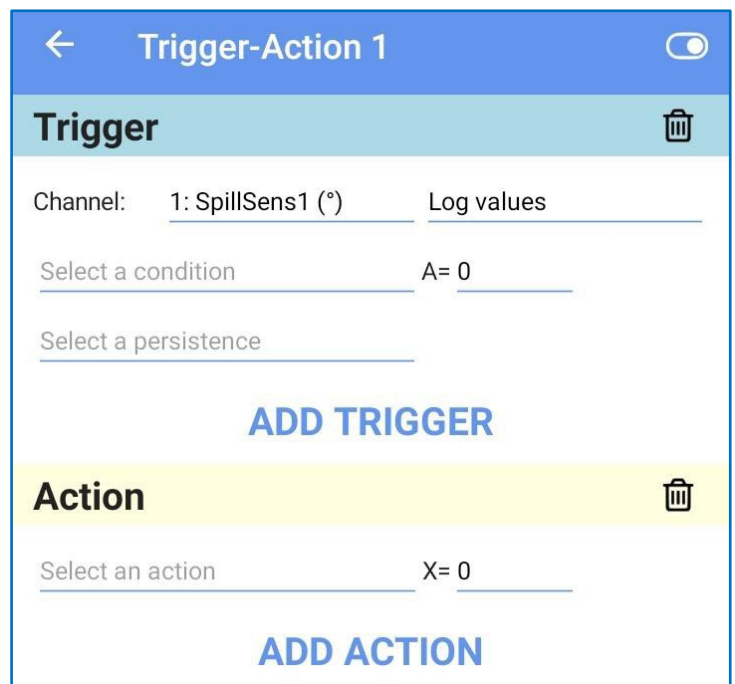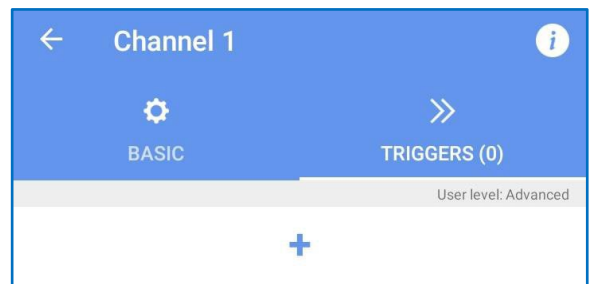
Note: There is an "Add Trigger" button here, but its function is different to the one earlier described.

Here it provides a way of chaining together several conditions with logical operations (AND, OR etc.) to form a single trigger-action that uses combinational logic.

(This is not required for operation with SpillGuard).

ADD TRIGGER

An example of entering an "Action" is shown below.

This action-type is called "Generate an Alarm". This alerts the server that the logger trigger threshold has been exceeded. With the settings shown, it also sends a message to the server when the trigger conditions are no longer met, when the situation has cleared.

Action 🗑

Generate an alarm

Report alarm immediately   On activating and clearing

Send 'alarm cleared' message ⬤   Report as tamper alarm ◯

Complete the actions as shown opposite.

Tap a field to edit it to the required setting. Adjust from the top downwards.

If required, further actions can be linked to the same trigger (single or combinational) by tapping on the "Add Action" line.

ADD ACTION

For example, an additional action could be to call in at a faster rate, as shown opposite. There are other possible action types available for selection.

Action 🗑

Call-in at fast call rate

(Notes: The setting of additional actions are not required for operation with SpillGuard. Any changes to the call-in rate may affect the battery life).

(An explanation is given in section 4.1.6)

When complete, tap on the left-arrow symbol and then accept the change.

← **Trigger-Action**

17

4.1.4 Checking / Adjusting the Sample and Log intervals

Navigate to the Channels page.
(See the start of section 4.1.2 for how to do this).

Current timing settings available for making measurements are shown in the "Parameters" section.
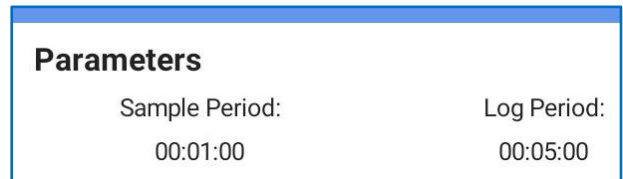
Tap on the Parameters line, or on "Global Settings".

Note: The "Parameters" section is *common to all the channels* and shows the basic measurement rate of the logger device.

- **Sample Period** is the smallest available measurement interval.
  It can only be activated for logging data if an "action" specifies it to be used (e.g. when data needs to be recorded with a high sample rate, as a secondary data recording).
  Its use is not required for SpillSens.
- **Log Period** is a larger interval, used to produce the primary data recording.

These measurement intervals can be adjusted (see below).

A page is displayed where the timing details of the logger are shown and can be edited.

A typical setting of a logger used with SpillSens is for the Sample Period to be set to 30 seconds.

A typical setting of a logger used with SpillSens is for the Log Period to be set to 2 minutes.
This field must be an exact multiple of the "Sample period".
Data is stored in the primary recording data area at this rate.

Tap on a field to edit its setting.

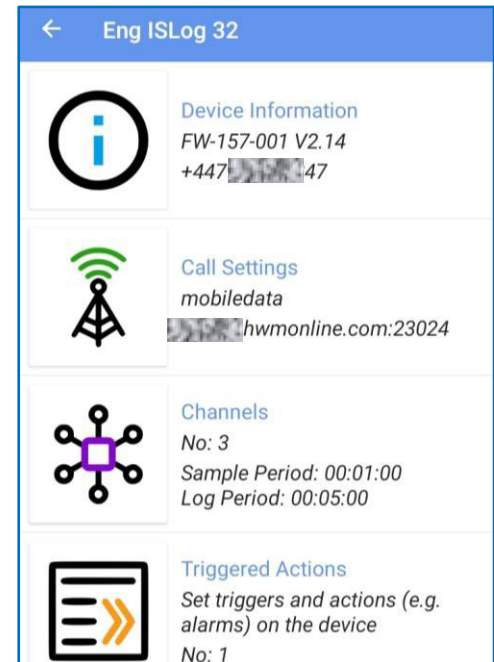For SpillSens, the Pulse Input Frequency is irrelevant (it is for another type of sensor).

18

4.1.5 Checking / Adjusting an existing SpillSens channel

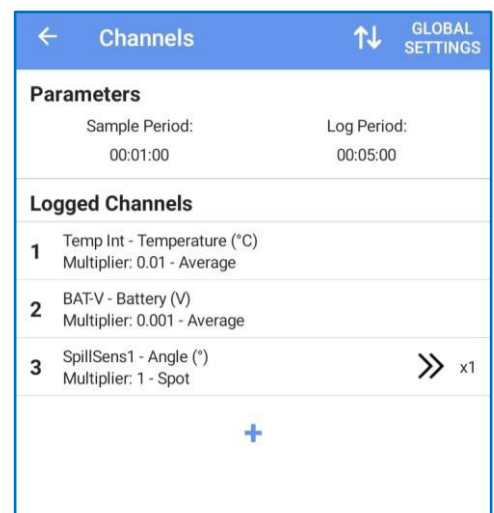Go to the main page and tap on "Configure Device".
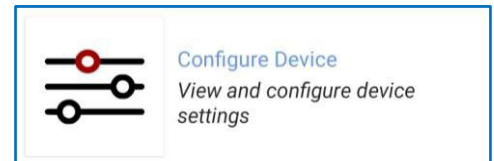
A new page will load with various setup options.

Tap on "Channels".

The Channels summary page appears.

This page shows the data channels which are already configured within the logger.
(The illustration is from a logger with 3 channels set up).

When shipped from the factory, the logger will usually have some pre-configured channels, including SpillSens. If this is not the case, the SpillSens channel must be added in order to produce data. (See sections 4.1.2 and 4.1.3 for how to do this).

From the diagram opposite, it can be seen that a SpillSens channel has already been set up on the logger.

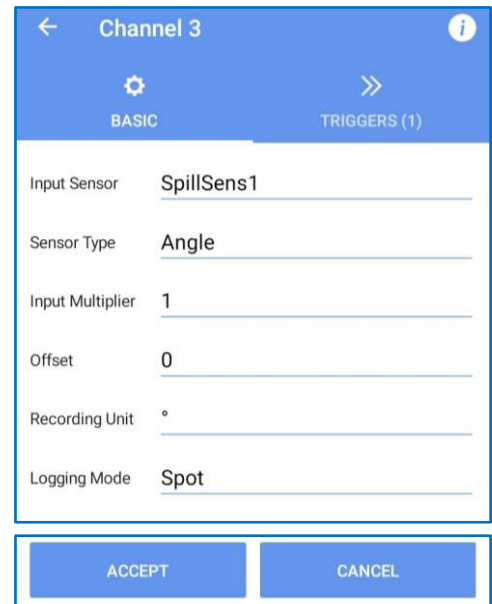You can see the current settings of a channel by tapping on the relevant line, "SpillSens1" in this example.

19

The channel details are shown in a new page. (Ensure the "Basic" tab is selected).

Tapping on any field allows it to be edited.

The page is common to several types of sensor. Selections made at the top of the page can affect available options lower down, so make changes starting at the top and moving downwards.

When finished, press the "Accept" button to save changes, or "Cancel" to reject any changes. The logger is automatically updated.

Note: This page sets up the measurements destined for the Primary Recording data area of this channel.

The parameters shown above are the correct settings for a SpillSens1 device.

4.1.6 Checking / Adjusting existing SpillSens channel trigger-actions

The setup of the logger for SpillSens is not complete until the required Trigger-Action settings of the channel are correct. The logger requires setup of the following:
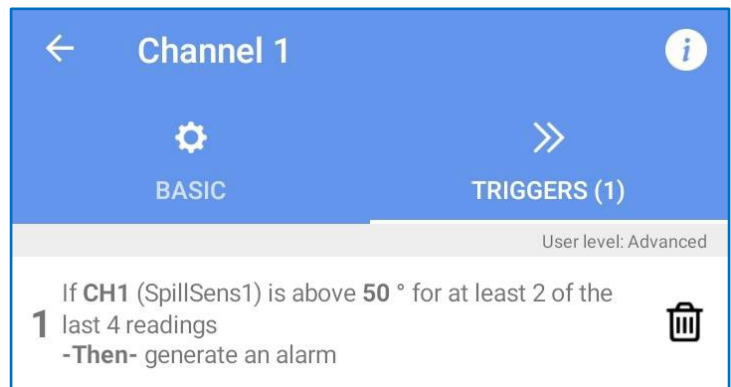
- **Trigger** parameters (usually one or more triggers are required).
- Any **actions** that should be carried out due to the trigger being activated. Some examples of actions are:
    - Send a message to the server to indicate the trigger has been activated. / Send a message to the server to indicate when it is de-activated. (A requirement for use with the SpillGuard system).
    - The additional making of faster measurements, to be stored within the secondary recording data area. / Cancel when exiting to the Normal (non-triggered) state. (Not a requirement for use with the SpillGuard system).

Triggers:

Navigate to the page as shown at the end of the previous section.

To check any existing triggers, select the "Triggers" tab.

Any existing triggers will be displayed in summary form.

20

Note: Additional triggers can be added by tapping on the "+" line. (e.g. To add another triggering angle).

> **+**

Tap on a line to show the settings in detail (a "Trigger-Action" page).

> **1** If **CH1** (SpillSens1) is above **50** ° for at least 2 of the last 4 readings
> **-Then-** generate an alarm 🗑

An example of a "Trigger-Action" page is shown below. The title of the page shows the name of the particular Trigger-Action settings being viewed, "Trigger-Action 1" in this example.

- The logger monitors the selected channel, looking for data which matches the pattern described in the "**Trigger**" section of the page.
- When the logger finds a match, it begins the action (or a set of actions) described in the "**Action**" list.

> ← **Trigger-Action 1** ⬤
>
> **Trigger** 🗑
>
> Channel: 3: SpillSens1 (°)   Log values
>
> Above 'A'   A= 90
>
> For ≥ 'C' of last 'D' samples   C= 1   D= 1
>
> Hysteresis: ⓘ   0.0
>
> **ADD TRIGGER**
>
> **Action** 🗑

Note: Triggers and Actions can be deleted using the bin icon.

The example above shows settings for a trigger looking at the SpillSens1 channel. The logger should monitor the last few samples of "Log values" (i.e. the Primary Recording data). When the last measured angle goes over 90˚ the trigger could become active. In fact, in this example it always becomes active because it is set as only needing one matching sample (C=1, D=1; for ≥ 1 of last 1 samples; " ≥ " is read as "greater than or equal to").

The Hysteresis in the example above is set to 0.0, so there could be a lot of triggers generated when the water level causes the float to tilt to around 90˚, due to ripples on the surface of the wastewater or turbulence. Multiple triggers are unwanted. It is therefore important to add some amount of Hysteresis.

If, for example, we changed the Hysteresis to 10, this trigger still activates at 90˚. However, it will no longer deactivate at any value below 90˚.
The deactivation point has now become 80˚ (90˚ – 10˚).

The hysteresis setting can therefore be used for two purposes. It both removes nuisance messages and also sets the lower angle threshold used for detecting falling water levels.

Explanation of Trigger settings and adjustments for problematic sites:

For problematic sites, the **hysteresis** value can be increased. This has the effect of increasing the difference of water levels between an event starting and clearing.

OR

Change the channel trigger requirements to add more **persistence** in a measurement before it triggers. (There is a side-effect to this that the trigger will be delayed).

The example shown opposite requires a minimum of 2 of the last 4 samples to exceed the angle threshold (A) to **activate** the event trigger.

Change the persistence values.

This requires between 2 and 4 measurement values to evaluate (a 2 to 6 minute delay with a 2 minute sample interval).

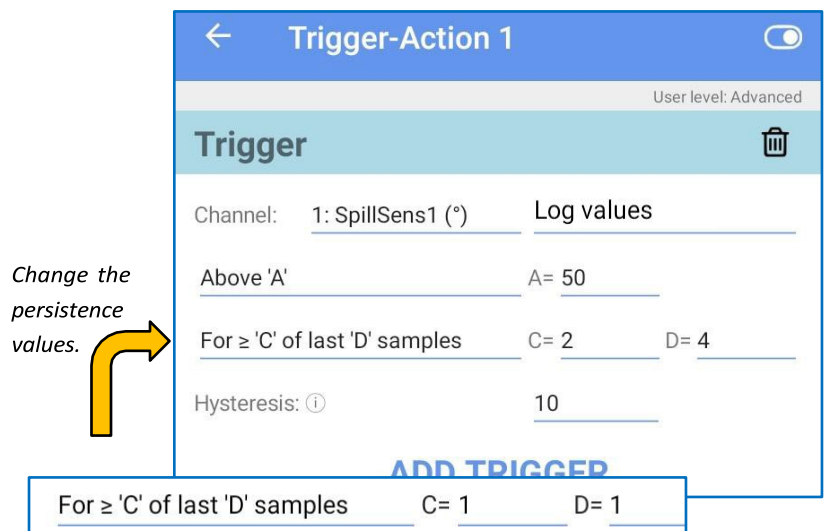Once triggered, it will be held in its new state until the event is considered to be over.

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).
On the settings shown in this example, this is 40 (50 – 10).

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

Note: The technician should carefully consider the values used to ensure they are reasonable and do not compromise the operation of the system.

22

Actions:

Some examples of possible actions were listed earlier. Explanations of the settings for each example are given below.

Note: The actions only occur or become active when the logger enters (or is held in) the triggered state. They cease when the trigger clears.

Action Example 1:

Send a message to the server to indicate the trigger has been activated.
/ Send a message to the server to indicate when it is de-activated.

The action type to send a message to the server is "Generate an alarm".

The server is the recipient of the alarm and needs the information to arrive quickly (not at the next regular dial-in, which could be many hours in the future), in order to alert system users of rising water levels. Therefore, the logger should be set to report the alarm immediately "On activating and clearing".

i.e. When it meets the trigger threshold, and also when it clears the threshold (including the hysteresis margin).

The settings of the logger for this type of action should be set as shown above.

Note: The "Report as tamper alarm" slider should be deactivated (greyed out); this is a state-change alarm requiring immediate action, not a tamper alarm (relevant to other types of equipment).

Action Example 2:

The additional making of faster measurements, to be stored within the secondary recording data area.
/ Cancel when exiting to the Normal state.

(Note: This action is not a requirement for use with the SpillGuard system).

The action type, to make additional measurements, is "Log Channel 'X' at its sample period".

Whilst the trigger is active, additional datapoints will be saved to the secondary recording data memory, at a fast rate.

Be sure to set 'X' to the correct data channel for the SpillSens.
Here, the channel is set to "3" because this is the channel number the logger used for SpillSens. (Refer to the diagram opposite).
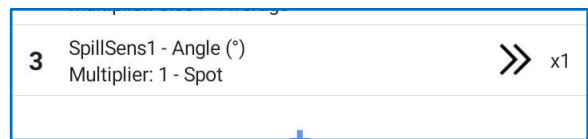
Using this action within a trigger changes the timing of measurements being made.
The *sample period* is used whilst the trigger is active. *Additional* measurement values will be stored as a data-point in the secondary recording memory area. However, this does not change the existing process of recording being used for the primary recording.
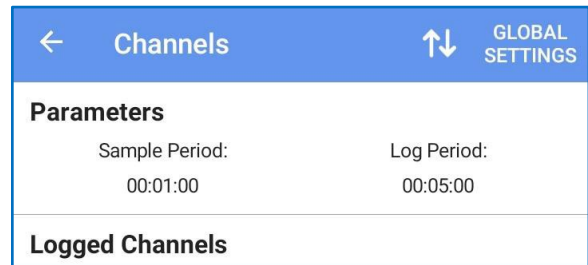
The secondary data recording can provide supplementary data that compliments the data of the primary recording. Both sets of data will be uploaded to the server.

4.1.7 Checking / Adjusting logger call-in rates

The logger uploads data to the server. In order to do this, it must activate its communications modem and connect to the GSM network using a radio link.

The call-in settings can be checked and set as follows:

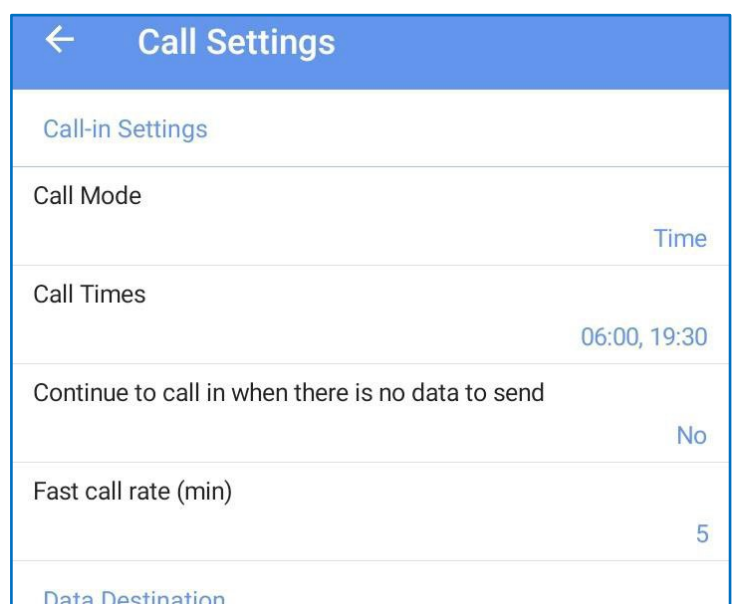From the main page, tap on "Call Settings".
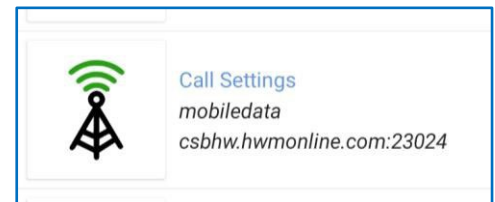
The Call Settings page is shown.

(The Call-Mode has the option to call in at regular intervals or at fixed times).

The Call Mode is shown set to "Time". One (or several) call-in times can be set here.

"Continue to call in …" should be set to "No".

The Fast call rate can also be set here, shown set to every 5 minutes in this example.

(Explanation of Fast call rate:

Some applications of the logger include sensors that monitor for events and require time-critical data to be sent to the server during the event. This can be a significant volume of data. It is possible for an action to change the call-in pattern to call at a faster rate when this occurs, but at the cost of using significantly more battery power.

Note: SpillSens / SpillGuard does not require that the logger should have an action to use the fast call rate; **do not use**).
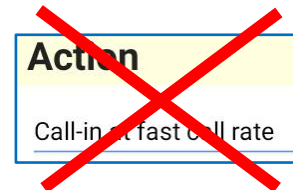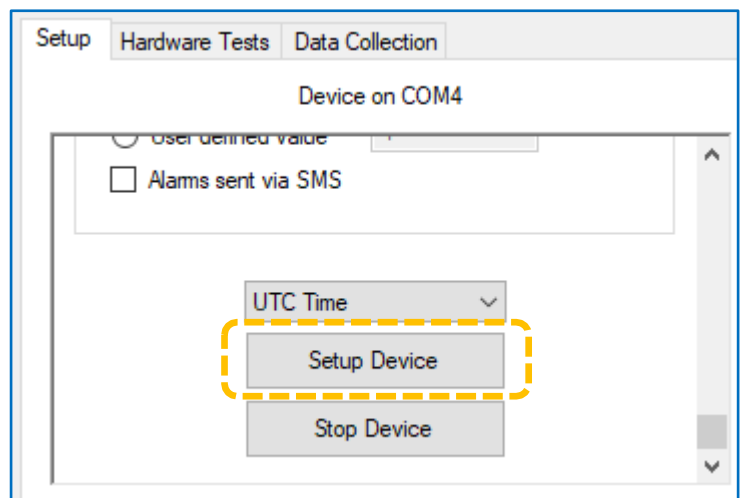
4.2 USING IDT (PC)

Note: If any changes are made to the settings within IDT (PC) they do not become effective until they are saved to the logger.

To save the settings from the IDT program to the logger, click on the "Setup Device" button.

(The process can take around a minute and may prompt you io verify it is OK to proceed if certain settings have not yet been completed).

4.2.1 Checking if a channel configuration / triggers already exist

When shipped from the factory, the logger will usually have some pre-configured channels, including SpillSens. If this is not the case, the SpillSens channel and any trigger conditions must be added in order to produce data. (See sections 4.2.2 and 4.2.3 for how to do this).

After reading the logger configuration, select the Setup tab and locate the "Logging Channels" panel; this shows any channels that are already configured for data-logging.

If a SpillSens channel has already been created, it will be listed (along with any other channels). A summary of its settings is also shown.

Make a note of the channel number assigned as a Logging Channel for the SpillSens sensor. (The channel number may vary).
e.g. Channel "1" is assigned in the diagram opposite.

SpillSens applications (e.g. SpillGuard) can also require trigger conditions to be set for alarm messages to be generated.

To locate any triggers which exist for the data produced for this channel, first locate the Alarms panel.

Check each of the tabs (Cond 1 thru 6) to find any that are monitoring the channel number noted earlier for the SpillSens sensor.

If any relevant triggers are found, then the settings can then be checked to verify they are correct; confirm they match your requirements.
(Requirements for use with the SpillGuard system are detailed in section 9.2).
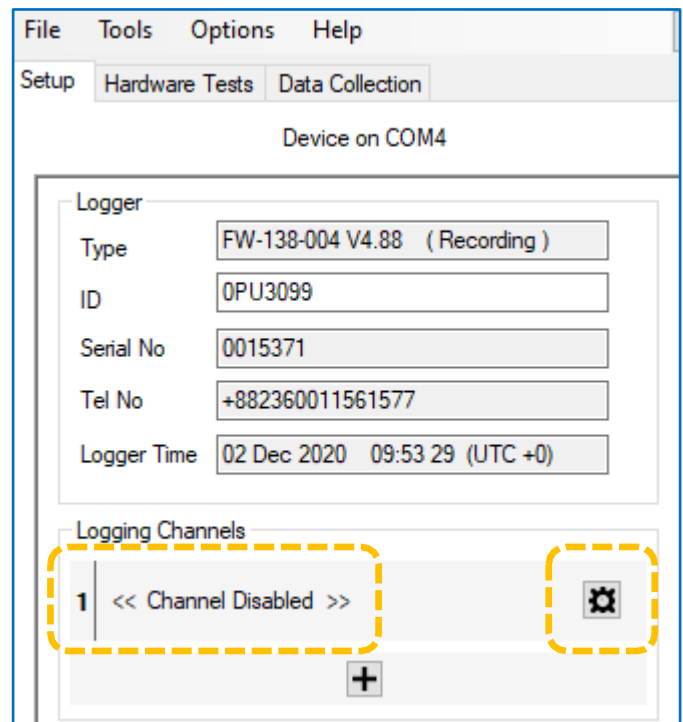
26

4.2.2 Creating / adjusting a SpillSens channel (if required)

Select the Setup tab and locate the Logging Channels panel.

If there is no SpillSens channel listed in the configuration it must be created.

If required, Click the "+" button to make an empty channel appear in the list (shown as "<< Channel Disabled >>").
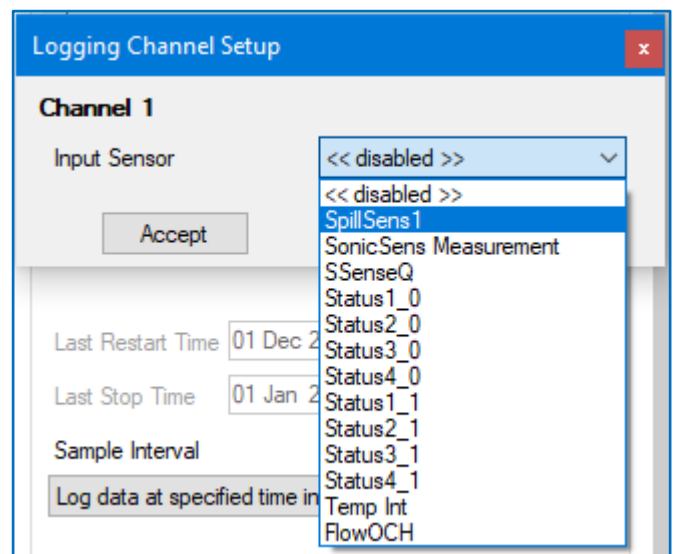
Click on the settings button (cog icon).

The channel requires the selection of an input sensor; currently it is listed as "<<disabled>>".

Use the drop-down selector control.

The logger will display a list
of all the types of sensor options
that your logger has available
for use.

Note: The list will vary according to the model number of the logger.

 "SpillSens1" should be listed; select it.

Continue to set up with the parameters shown opposite. Then click the "Accept" button to save the channel.

The Logging Mode selection "Spot" :

- Selects the period called "Log Period" from the two available sampling rates, and stores data at that rate into the primary recording.

27
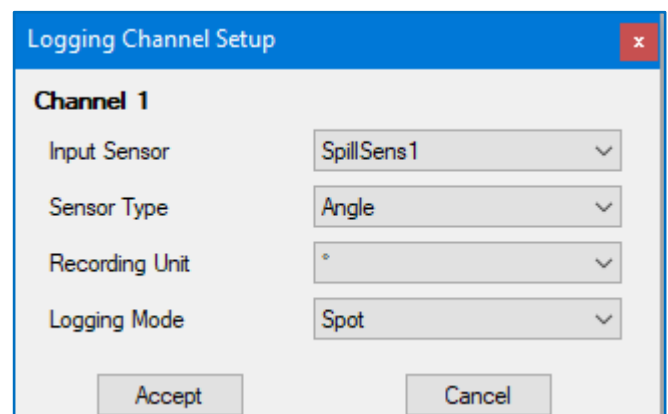
The Logging Channels panel now lists this channel along with a summary of the settings for interpreting the raw (numeric) data from this channel; it is to be interpreted as an angle measurement.
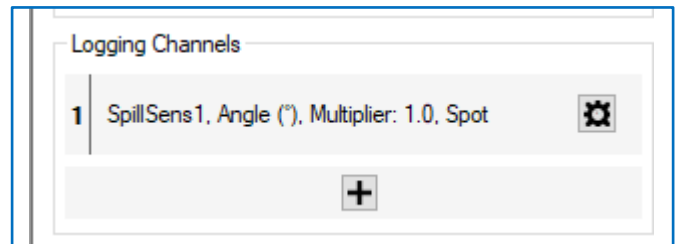
Note that no triggers have been set up on this channel. These will be covered in section 4.2.3.

4.2.3 Creating / adjusting Triggers for a SpillSens channel (if required)

The purpose of setting a trigger is to make the logger monitor the data produced from the sensor of a channel to check for a specific condition. For the purpose of detecting a trigger condition a set of recent sensor data is checked at a rate defined by the channel's Logging Mode setting:

- For "spot" and "average", the logged data is examined.
- For other settings, the sample-rate data is examined.

Since SpillSens uses "Spot" the set of data being examined is taken from the recent logged datapoints.

Select the Setup tab and locate the "Alarms" panel.

(The diagram opposite shows a logger which has six available trigger condition settings available, Cond 1 thru Cond 6. Cond 1 is shown with no triggering conditions set).

If there are no trigger conditions set for the SpillSens channel they can be created (if required).

e.g. How to setup a SpillSens to trigger to send an alarm message at 50˚, and another message to cancel the alarm at 40˚:

Find the Conditions area within the Alarms panel and locate an unused tab, as shown opposite; no conditions are currently set (no options are ticked).
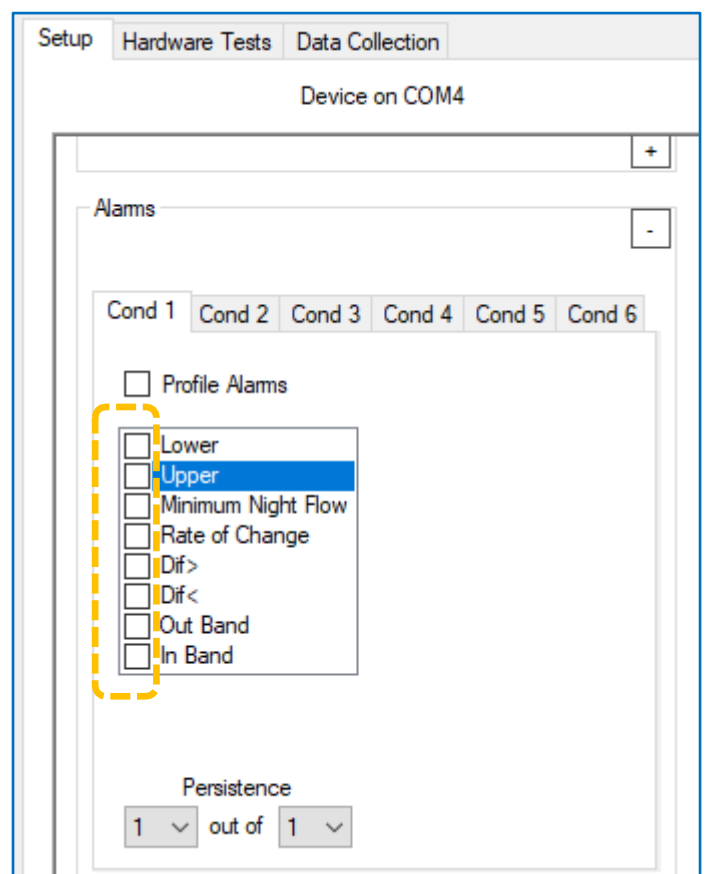
The regular (OK) condition of a SpillSens sensor is for it to be suspended at 0° to the vertical. When it starts to float, the angle increases.

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

This can be selected by selecting the "Upper" checkbox.

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

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

Set the Chan No to match the SpillSens logged channel number.
(e.g. The SpillSens is located at channel "1" in the diagram opposite, so set the Chan No to "1").

Set the "Upper level" value to the required value (the alarm condition will be met when greater than or equal to this value). In our example, this is "50".

Set "Hysteresis" to the required value.
(A triggered alarm condition will be **held** whilst greater than or equal to the *Upper level* value minus the *hysteresis* value; if lower, the alarm condition will be released).
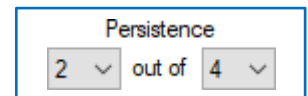
… In our example, this is "10".
    50 – 10 = 40° ; the threshold for cancelling the alarm condition.

Note: The use of *hysteresis* and *persistence* is discussed further in the explanation below.

29

For SpillSens, it is advisable to use a persistence requirement for a trigger condition to be recognized. This can be added by using Persistence settings. Persistence affects an alarm activation but does not affect its release.

e.g. In this diagram opposite, at least 2 of the last 4 samples are required to exceed the triggering threshold for an alarm condition to be met.

Explanation of Trigger settings and adjustments for problematic sites:

For problematic sites, the **hysteresis** value can be increased. This has the effect of increasing the difference of water levels between, say, a flood event starting and clearing. It also compensates for water ripples and turbulence (which could otherwise generate many short-duration triggers and therefore many alarm messages).

OR

Change the channel trigger requirements to add more **persistence** in a measurement before it triggers; momentary changes in sensor position are more likely to be ignored. (There is a side-effect to this that the trigger will be delayed).

The example shown opposite requires a minimum of 2 of the last 4 samples to exceed the angle threshold ("Upper level" value) to **activate** the event trigger.
This requires between 2 and 4 measurement values to evaluate (a 2 to 6 minute delay with a 2 minute Log interval).
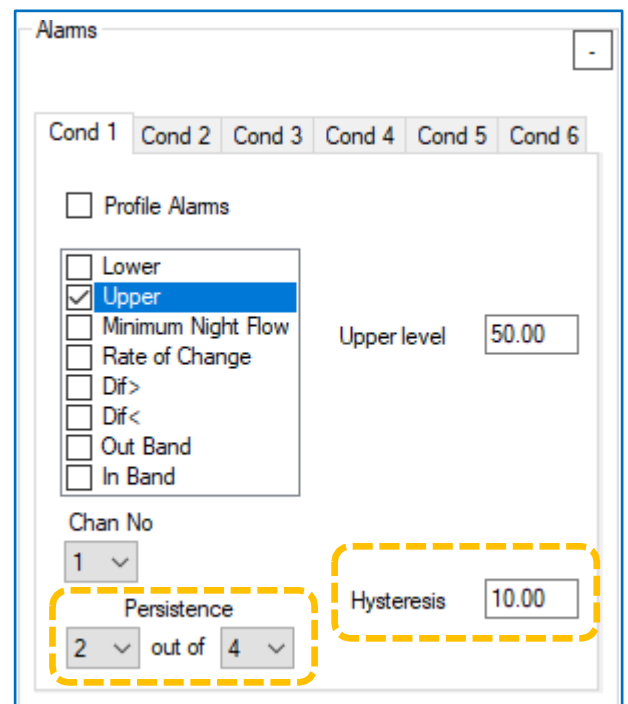
Once triggered, it will be held in its new state until the event is considered to be over.

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. "Upper level" value – "Hysteresis" value).
On the settings shown in this example, this is 40° (= 50 – 10).

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

Note: The technician should carefully consider the values used to ensure they are reasonable and do not compromise the operation of the system.

The logger has to be programmed as to how to handle an alarm condition being met, or an alarm being cleared. The normal action is to call into the server and send a message to it concerning the start of or end of the alarm condition.

Locate the "Alarm Call Options" panel. This specified any actions that will be taken whenever **any** of the trigger conditions (Cond 1, etc.) are activated, or become cleared.

For SpillSens, the server will usually be required to be informed immediately when an alarm condition occurs (and for some applications, such as SpillGuard, when the alarm condition has cleared).

These options can be set by ticking the required selections, as shown.
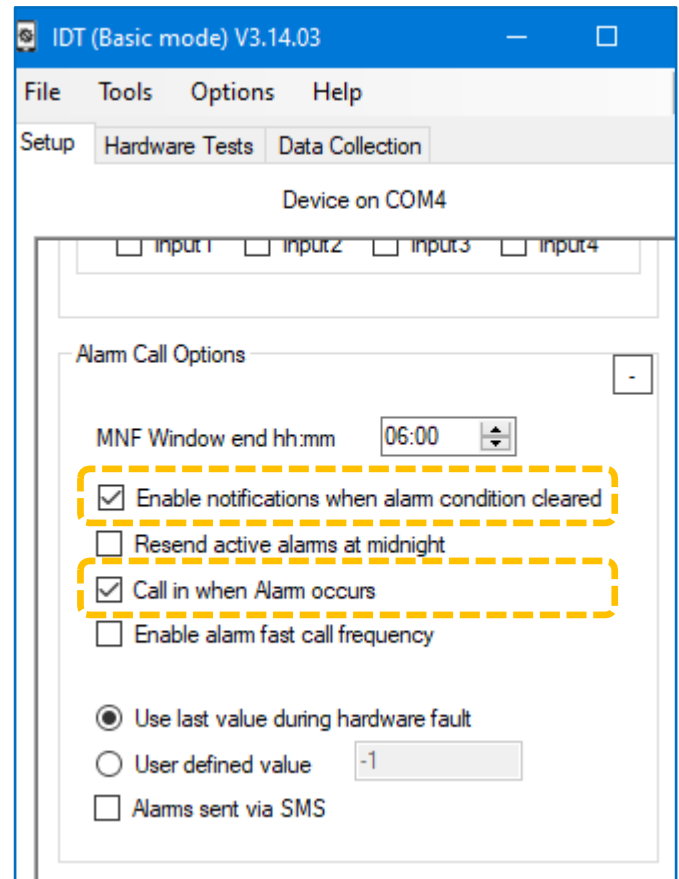
(If not set, alarm condition changes will only be reported at the next scheduled call-in time).

Multiple alarm conditions can be set for the same channel by using additional tabs.

e.g. If the logger is required to send in messages for two different SpillSens angle thresholds (such as is required by the SpillGuard system):

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

31

4.2.4 Checking / Adjusting the Sample and Log intervals

Select the Setup tab and locate the "Logging Parameters" panel.

Current timing settings available for making measurements are shown, as shown opposite.

Note: The values shown in this panel is *common to all the channels* and shows the basic measurement rate of the logger device.

- **Sample Interval** is the smallest available measurement interval.
- **Log interval** is a larger interval, used to produce the primary data recording. (For some applications, a logger can be set to make a single daily measurement, "Log data once per day". For SpillSens, "Log data at specified time intervals" is normally used).

These measurement intervals can be adjusted (see below).

A typical setting of a logger used with SpillSens is for the Sample Period to be set to 30 seconds.

A typical setting of a logger used with SpillSens is for the Log Period to be set to 2 minutes. This field must be an exact multiple of the "Sample period". Data is stored in the primary recording data area at this rate.

To edit a setting, click on the part of the time you wish to adjust (hours, minutes, seconds) and modify its value.

4.2.5 Checking / Adjusting logger call-in rates

The logger uploads data to the server. In order to do this, it must activate its communications modem and connect to the GSM network using a radio link.
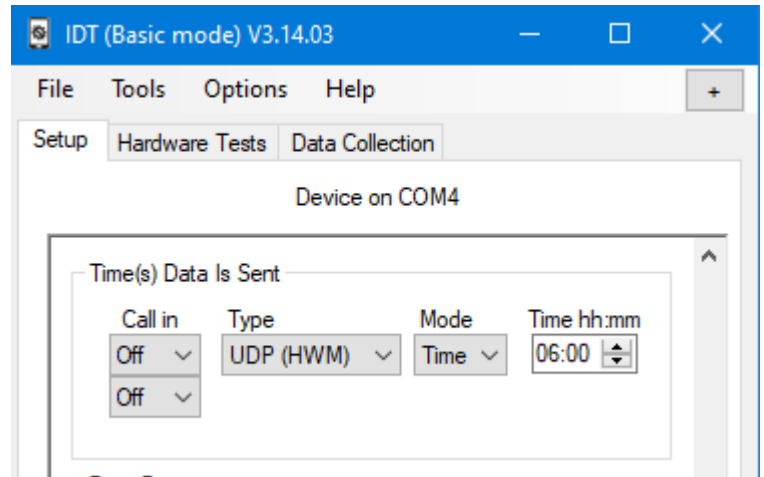
The call-in settings can be checked and set as follows:

Select the Setup tab and locate the "Time Data is sent" panel.

(The Mode has the option to call in at regular intervals or at fixed times).

The Call Mode is shown set to "Time". One (or several) call-in times can be set here.

(Refer to the user-guide for your logger for further information if required).

5 CONNECTION AND TEST

The logger will be shipped from the factory with the channel for SpillSens already set to a default configuration.

If the user has permissions, they can change the settings. For other users, fields may be displayed as "read only". (This is set by your system administrator, or the IDT user-type).

The logger does not require SpillSens to be connected for the task of creating or editing the channel.

Caution: The user should beware of connecting the SpillSens too early in the installation process, as it may cause an immediate alarm to be generated by the logger.
(e.g. Even if placed on a level surface, the sensor may already exceed the programmed angle threshold, thus causing an alarm to be sent to the server when the first few measurements are obtained).
If desired, the installer may position the sensor in a suitable jig to hold it upright until ready to install it in a hanging position.

5.1 USING IDT (MOBILE)

5.1.1 Confirm SpillSens is recognized / Test

Launch IDT.

Start communication between the IDT app and the logger using the Bluetooth connection available within your mobile phone.

(Refer to the logger user-guide for the above steps).

IDT will automatically read the existing logger configuration immediately after it connects to the logger and has any permissions required to use it.

Your logger should normally be supplied pre-configured by the factory to use the SpillSens interface.

34
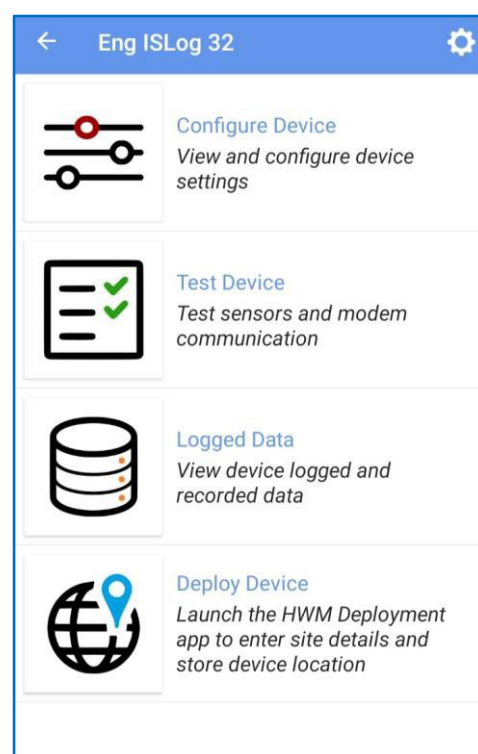
Disarming the SpillSens channel trigger before connecting or testing ...
(Note: Some users may not have privileges to arm / disarm the channel trigger).

Unless the SpillSens float is already hanging vertically, or is held upright in a jig, consider if the channel trigger should be disarmed prior to connecting the sensor or testing it. Alternatively, the user may wish to use the triggering of an alarm as a way of verifying the unit and logger are working and able to send a message to the server.

To disarm the trigger:

Tap on the "Configure Device" line.
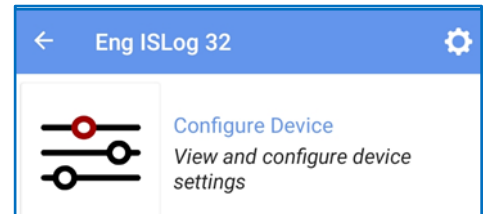
The app will show the "Channels" page and any channels that are already configured into the logger.
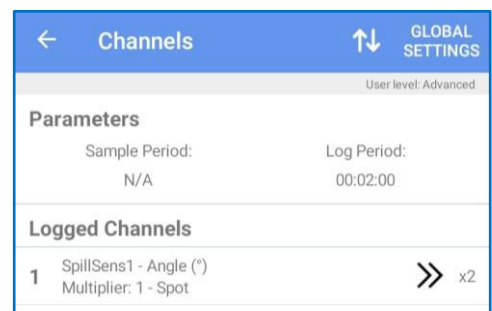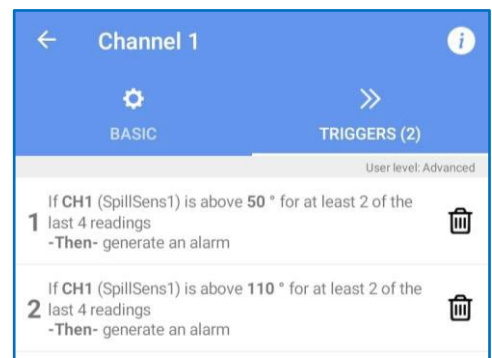
Select the channel for the SpillSens by tapping on the relevant line.

A page will appear for the channel with two tabs, "Basic" and "Triggers". Select the Triggers tab.
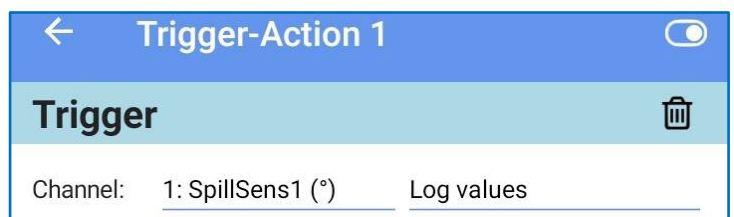
This will show a summary of any Triggers that have been set in the logger.
Tap on the trigger summary to show a page with its setup details.

At the top of the screen there is a slider control that can be used to disarm the trigger.

- The rightmost position is armed.
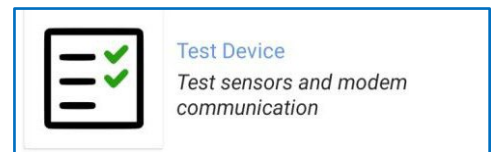- The Leftmost position is disarmed.

If required, disarm the trigger before connecting the SpillSens for test.

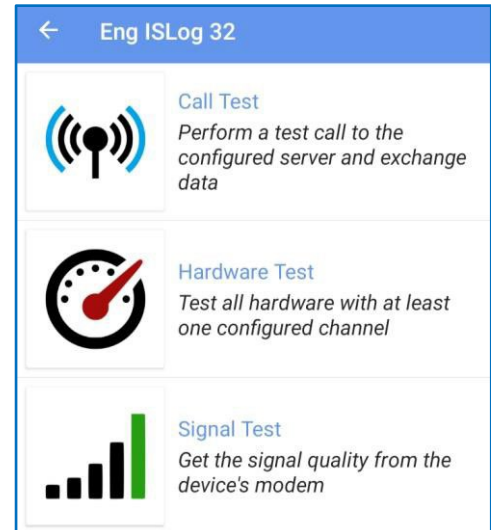The SpillSens may now be connected (refer to section 8)

35

To confirm that the logger and IDT have recognized the attached SpillSens device, go to the Test Device page…

Tap on "Test Device".

Test Device
Test sensors and modem communication

A new page will load with various test options.

← Eng ISLog 32

Call Test
Perform a test call to the configured server and exchange data

Hardware Test
Test all hardware with at least one configured channel

Tap on "Hardware Test"

Signal Test
Get the signal quality from the device's modem

The hardware test page will load, showing all available sensors that are fitted to the logger.

Check that the SpillSens is listed.

Move the SpillSens by pointing the base of the float downwards and at various other angles. The displayed angle will change. This confirms the SpillSens is operational.
(During test, the page updates approximately once every second).

← Hardware Test	ⓘ
1 Temp Int	23.77 °C
2 BAT-V	7.07 V
3 SpillSens1	93 °
Tap to cycle through units	

Position the sensor upright using a jig or alternatively disconnect SpillSens after completing the test. The SpillSens channel must be re-armed.
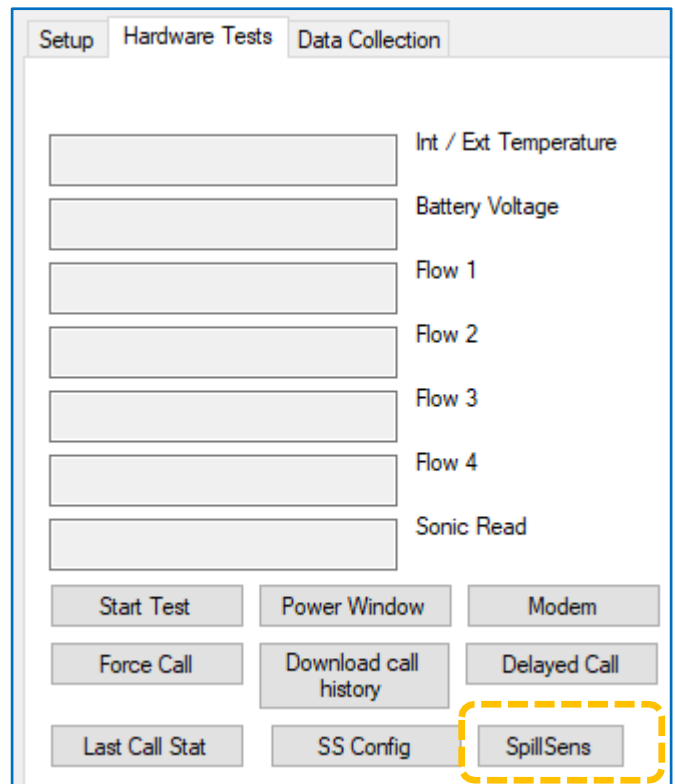(The steps to do so are similar to those taken earlier to dis-arm the channel).

5.2 USING IDT (PC)

5.2.1   Confirm SpillSens is recognized / Test
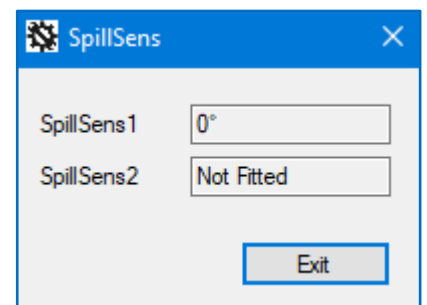
Select the Hardware Tests tab.

This tab contains many test options, but only the one control is relevant for SpillSens.

Click on the "SpillSens" button.

A dialogue box will appear which shows if the SpillSens sensor is recognized.

The picture opposite confirms that the SpillSens1 sensor has been recognized; there is no SpillSens2 fitted.

Tilt the sensor through various angles and observe that the angle changes; it is operating correctly.

Position the sensor upright using a jig after completing the test (to prevent a false spill alarm message being sent to the server).

Click on the Exit button to end the test.

37
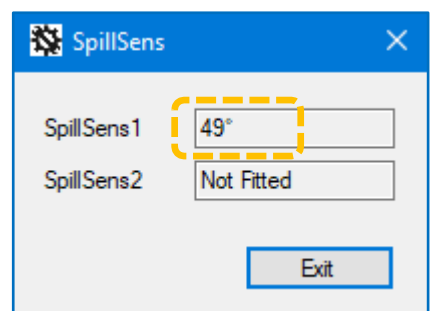
6 CHOOSING A SUITABLE POSITION FOR SPILLSENS

The body of SpillSens tilts (changes its angle of inclination) as it floats, as shown in the diagrams opposite.

The angle of inclination SpillSens gives an indication of the change of height of the sensor from its rest position, and hence the height of the wastewater. The greater the angle, the greater the water height. It is therefore important that this movement is not in any way impeded.
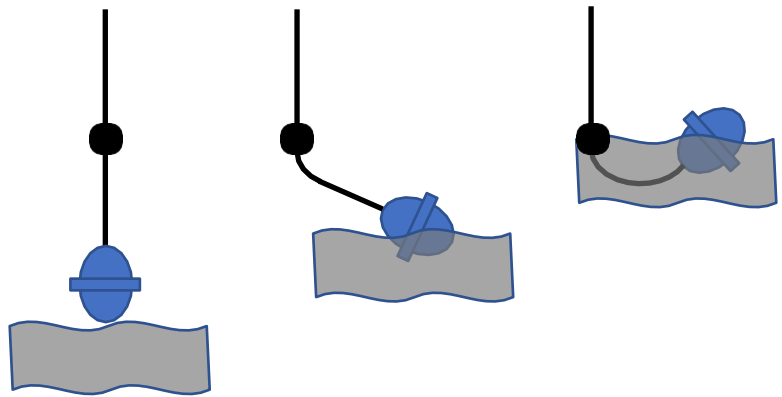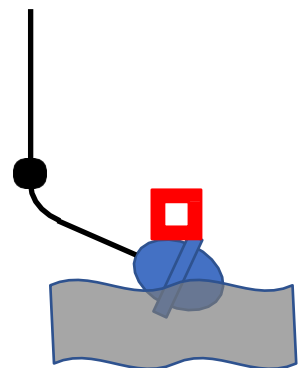
The SpillSens should be positioned so that it is free to float in an upwards direction without any restriction.

e.g.   The diagram shows the SpillSens float can become trapped by a near-by object.

This includes the possibility of the float being washed into the opening of a pipe by flowing wastewater.
Do not position the sensor where ice could form on it in adverse weather; this could also temporarily trap or weigh-down the sensor.

The SpillSens should also be positioned such that its cable cannot become entangled with any object during the rise and fall of water or due to turbulence.

e.g.   The diagram shows the SpillSens cable can become entangled or trapped by a near-by object.

38
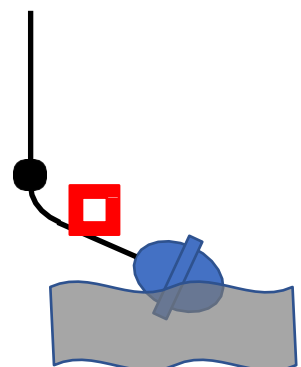
7 INSTALLATION OF SPILLSENS

If required, SpillSens installation can commence with the sensor disconnected from the logger, so it cannot generate a false spillage alarm.

Be careful not to damage the label on the cable as it contains important information regarding the identity and safety of the unit.

Decide on the required location of the SpillSens sensor (see section 6) and also the logger. Ensure the logger is located close enough to the SpillSens so that its cable reaches the connector and that it can be connected without any stress being applied.

SpillSens should be positioned such that it does not collide with other surfaces in the chamber. SpillSens should be positioned such that it does not tangle around or could become trapped by any object within the chamber.

Be careful not to damage the cable during installation as it may cause the sensor to be inoperable.

Ensure that the sensor cable is held securely (so it does not slip, even if there is a flow of wastewater and foreign bodies drag on it, commonly known as "ragging").

Ensure the cable is protected from damage by sharp edges at its fixing point and that the chosen fixing method will not cut into the cable, even if it is tensioned by any flow of wastewater. The free cable should also not come into contact with any sharp edges.

During installation, or removal, ensure the cable is not damaged by any tool used. Check the cable for any damage before considering to re-use.

7.1 FIXING OPTIONS

SpillSens may be suspended from a bar or other suitable fixing which does not have sharp edges. Locate (or install) a suitable bracket or bar. An example is shown opposite.
HWM can supply a suitable bar if required.

The SpillSens must be mounted securely so that it hangs by the cable in the required position. Adjust the sensor to the required height and then fasten securely with a non-perishable fastener.

The trigger point(s) will depend on the programmed angle(s) and will be slightly above the resting position.
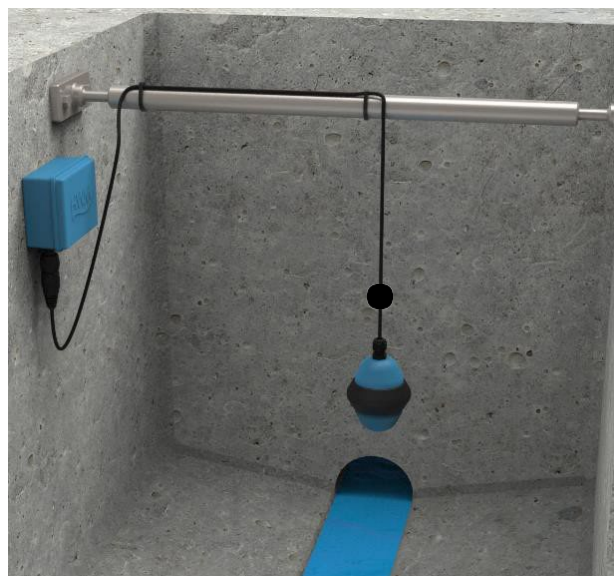
The logger must be installed I a position where the SpillSens cable can reach the logger connector. An example of wall-mount is shown above. An example of mounting the logger on the HWM bracket is shown opposite.

Caution is required in wire routing so as to not leave loops of wire within the chamber which could collide with the sensor or through which the sensor could thread itself if water level rises.

SpillSens must not be able to tangle around any object. (Check by moving the float to check the limits of its movement).
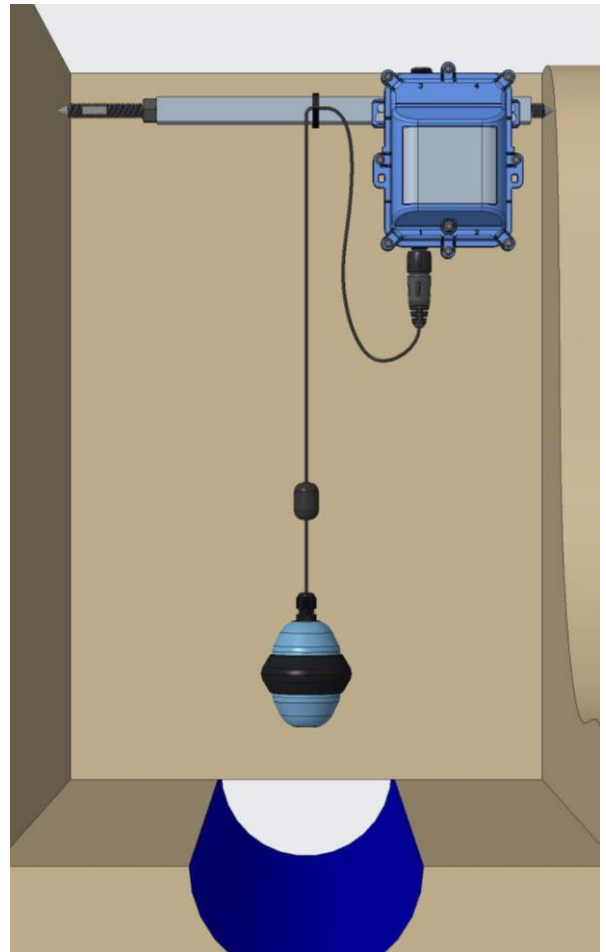
The SpillSens should be allowed to settle and come to rest. Once any swinging has stopped, **it must be connected to the logger** (see section 8).

Note: The logger installation should also be completed; refer to the user-guide of the logger for details.

40

8 CONNECTING SPILLSENS TO THE LOGGER

Caution: Before connecting SpillSens for test purposes, consider if the interface trigger should be temporarily dis-armed. (See section 5.1.1).
Consider if the SpillSens should be disconnected during installation, until it is stationary in its rest position.
Failure to comply with any of the above can result in false alarms being sent to the server during test or installation.

The SpillSens sensor should only be connected to a SpillSens interface on a compatible logger. Ensure your logger has a SpillSens interface installed before attempting installation. This can be determined by the port label on the logger, or from the part-number of the logger. *Refer to your logger's manual for guidance.*

Attach the 4-way cable to the SpillSens port of the logger.

Attach Cable

Logger
(for illustration
purposes only)

The logger has a water-tight connector for attaching the SpillSens sensor. Be sure to install the sensor and tighten the connector so that it is water-tight prior to use. Ensure that the connector is free of moisture prior to fitting.
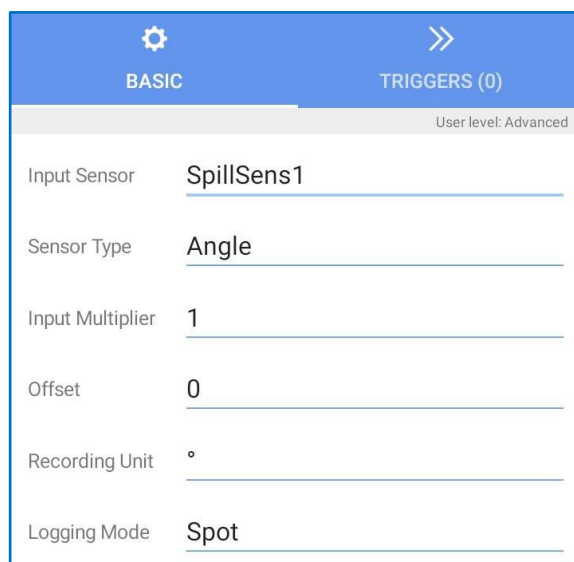
41
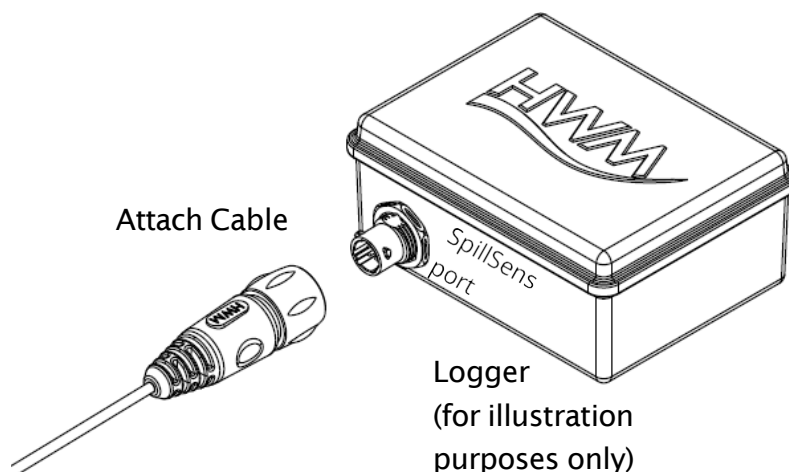
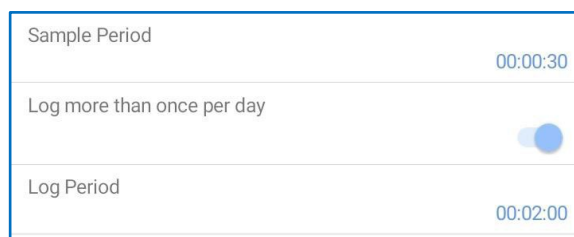# 9 Configuration for use with HWM SpillGuard system

9.1 Using IDT-mobile

To be used with the HWM SpillGuard system, a logger with an attached SpillSens must be configured as follows:

The logger will include a SpillSens channel.
(Refer to the diagram opposite for setup details).

	⚙ BASIC ≫ TRIGGERS (0)
	User level: Advanced
Input Sensor	SpillSens1
Sensor Type	Angle
Input Multiplier	1
Offset	0
Recording Unit	°
Logging Mode	Spot

The logger will have a sample interval of 30 seconds (although it will not be used).
The logger will have a log interval of 2 minutes.

It will log (create a datapoint) at the log interval.

Sample Period	00:00:30
Log more than once per day	⬤
Log Period	00:02:00

The logger must have two triggers set:

- Trigger1:
    - Trigger becomes active at 50° (or above) for rising water.
    - Trigger becomes inactive at below 40° for falling water.
    - Check data at the Log rate.
    - Trigger activates on persistence of 2 of last 4 data samples.
    - Actions Linked to Trigger1:
        - Send an alarm to the server on "activating" and also on "clearing".
- Trigger2:
    - Trigger becomes active at 110° (or above) for rising water.
    - Trigger becomes inactive at below 100° for falling water.
    - Check data at the Log rate.
    - Trigger activates on persistence of 2 of last 4 data samples.
    - Actions Linked to Trigger2:

42

- Send an alarm to the server on "activating" and also on "clearing".
- SpillGuard requires that Trigger1 to be set at a lower angle than Trigger2.

The required settings for Trigger-Action1 are shown opposite.

Note: Only 1 action is required … to send in an alarm message immediately.

Note: The persistence included in the settings imply that a delay of 2 to 6 minutes is required to trigger.

43

The required settings for Trigger-Action2 are shown opposite.
Note: Only 1 action is required … to send in an alarm message immediately.

Note: The persistence included in the settings imply that a delay of 2 to 6 minutes is required to trigger.

Note: The logger should be set to call in at least once daily, typically at 7:00am.

← **Trigger-Action 2**

User level: Advanced

Trigger

Channel: 1: SpillSens1 (°)   Sample values

Above 'A'   A= 110

For ≥ 'C' of last 'D' samples   C= 2   D= 4

Hysteresis: ⓘ   10

ADD TRIGGER

Action

Generate an alarm

Report alarm immediately   On activating and clearing

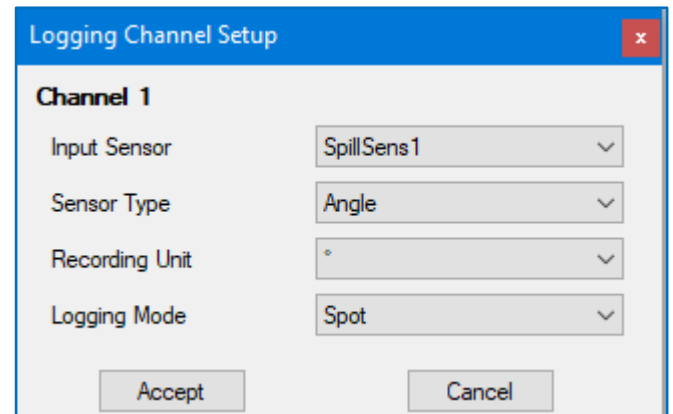Send 'alarm cleared' message   Report as tamper alarm

44

9.2 USING IDT-PC

To be used with the HWM SpillGuard system, a logger with an attached SpillSens must be configured as follows:
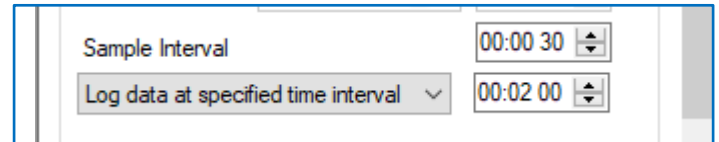
The logger will include a SpillSens channel.
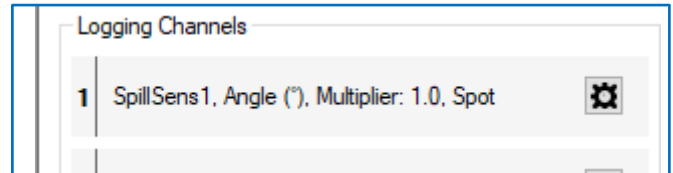
(Refer to the diagram opposite for the channel setup details for SpillSens).

The logger will have a sample interval of 30 seconds (although it will not be used). The logger will have a log interval of 2 minutes.

It will log (create a datapoint) at the log interval.

The logger must have two triggers set (within the Alarms panel):

- Trigger1:
  - Trigger1 must be set using the "Cond 1" tab in IDT.
  - Trigger becomes active at 50° (or above) for rising water.
  - Trigger becomes inactive at below 40° for falling water.
  - Check data at the Log rate.
  - Trigger activates on persistence of 2 of last 4 data samples.
- Trigger2:
  - Trigger2 must be set using the "Cond 2" tab in IDT.
  - Trigger becomes active at 110° (or above) for rising water.
  - Trigger becomes inactive at below 100° for falling water.
  - Check data at the Log rate.
  - Trigger activates on persistence of 2 of last 4 data samples.

45

The logger must have the following actions set (within the Alarm Call Options panel):

- Send an alarm to the server on any condition "activating".
- Send an alarm to the server on any condition "clearing".
- SpillGuard alarm message interpretation requires that Trigger1 to be set at a lower angle than Trigger2.

The required settings for Trigger1 are shown opposite. They must be set on the "Cond 1" tab.

Note: The persistence included in the settings imply that a delay of 2 to 6 minutes is required to trigger.

The required settings for Trigger2 are shown opposite. They must be set on the "Cond 2" tab.

Note: The persistence included in the settings imply that a delay of 2 to 6 minutes is required to trigger.

Note: The logger should be set to call in at least once daily, typically at 7:00am.

46

10 USER-SERVICEABLE PARTS

SpillSens is a sealed unit and has no user-serviceable parts.

Do not attempt to disassemble the unit since it may become damaged, which will not be covered by warranty.

Due to its construction, SpillSens has no factory serviceable parts, but can be checked for correct functioning if returned to the HWM authorized service center.

Suspect units can be returned to the HWM service center for investigation by completing an on-line RMA form (Return Materials Authorization).

https://www.hwmglobal.com/hwm-rma/

Ensure the unit is cleaned with a mild cleaning solution and soft brush, disinfected, and dried prior to shipment. Any cleaning must be done outside of an ATEX environment.

11 TROUBLESHOOTING

11.1 INCORRECT TRIGGER POINT

- Check SpillSens is connected.
- Check SpillSens trigger is armed.
- Check settings of SpillSens channel and triggers.
- Check SpillSens is installed at a suitable height; modify if required.
- Check SpillSens is not contaminated with dirt or debris that could weigh it down. Clean using a mild cleaning solution and a soft cloth or brush if required. Any cleaning must be done outside of an ATEX environment.

11.2 SPILLSENS NOT FOUND

- Check SpillSens is connected.
- Check latest version of IDT is being used.
- Check battery voltage of logger is good, using IDT (see section 5).
- Check cable between SpillSens and the logger is in an OK condition, with no damage or water ingress.
- Check the model number of SpillSens to confirm it is the correct type and is the same as has been programmed for use. (e.g. SpillSens1, not SpillSens2).

11.3 SPILLSENS DOES NOT OPERATE CORRECTLY WITH SPILLGUARD PORTAL

- Check SpillSens channel and trigger settings. In particular, check that the lower threshold angle is set using Cond 1 (IDT-PC) / Channel Trigger 1 (IDT-mobile).
- Check SpillSens channel and trigger settings. In particular, check that the higher threshold angle is set using Cond 2 (IDT-PC) / Channer Trigger 2 (IDT-mobile).
- Check the actions are correctly set to call in immediately when an alarm is active and cleared.

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

MAN-159-0001-C   January 2021.