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INSTRUCTION MANUAL

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atrato™

A genuine step change in flowmeter technology

Ultrasonic Flowmeter Range

Titan Enterprises Limited

Distributor: DDM GmbH & Co. KG Phone: +49 661 967 962-0 » Email: info@ddm-sensors.de » Web: www.ddm-sensors.de

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Document ID: *Atrato_Instruction_Manual_2306*

These instructions are intended for use with the Atrato® Ultrasonic Flowmeter installed with OS 7.8.4, App Version 3.2.44 or higher; and the Interface Software Version 4.3L.0.3 or higher.

This Version contains improved operation and configuration of the Atrato® meters including:

1. ASCII Flow Streaming via USB
2. Reverse Flow Linear Correction
3. Disable/enable total reset function of Display Button

To view the version number, click the button

Intended use:

- *The Atrato® Ultrasonic flowmeter is intended for use with filtered, homogenous liquids*
- *It is not recommended for highly pulsating flow systems*
- *It is not recommended for systems with entrained gas*
- *The flow tube should be kept full of liquid when powered*
- *Ultrasonic flowmeters **Must** be installed with positive back pressure to function correctly*

Disclaimer:

This information has been reviewed and believed to be correct at the time of publication. Titan Enterprises holds no responsibility for any inaccuracies. The material in this document is for information purposes only.

Storage:

The equipment should be stored in its original packaging in a non-hazardous area. Care must be taken to ensure it is not subjected to extremes of temperature or humidity. Store away from solvents.

General Safety:

Installation should be done by competent personnel who understand the electrical and mechanical requirements of electronic flow metering devices.

Opening of the equipment will void any calibration and warranty.

Equipment must be protected from electric shock, fire and solvents.

ATTENTION:

Please read this instruction manual carefully before installation and operation of this device by competent personnel.

Failure to follow these guidelines may result in damage to the equipment or personal injury.

Manufacture Information:

The Atrato® Ultrasonic Flow Meter is designed and manufactured by:

Titan Enterprises Ltd, Unit 2, 5A Coldharbour Business Park, Sherborne, Dorset, United Kingdom DT9 4JW

And conforms to:

- *CE*
  - *EMC Directives (2004/108/EC) EU Directive (2014/30/EU)*
  - *Pressure Equipment Directive (2014/68/EU) PED*
- *UKCA*
  - *The Pressure Equipment (Safety) Regulations 2016*
  - *Electromagnetic Compatibility Regulations 2016*

1. General

The Atrato® range represents a new generation of through bore, time of flight ultrasonic flowmeters that uses breakthrough technology to offer a wide ranging yet accurate meter. It is ideal for many process control, instrumentation and laboratory applications. The user must make sure that the flowmeter selected is suitable for the application and that the chemical compatibility, temperature and pressure requirements are within the Atrato®'s operating range.

Please check the model number before proceeding.

All meters can be programmed and monitored via the USB connection.

PRODUCT ORDERING CODE
First Three Digits = Flow Range
710 - = 2-500 ml/min
720 - = 0.01-1.7 l/min
740 - = 0.02-5 l/min
760 - = 0.1-20 l/min
Fourth Digit = Seal Material
V = Viton™
N = Nitrile
E = EPDM
S = Silicone
K = Kalrez®
Fifth Digit = End Fittings
0 = 3/8" John Guest (10bar)
1 = 1/2" BSP PEEK (10bar)
2 = 1/2" NPT 316 Stainless Steel (30bar)
3 = 1/2" BSP 316 Stainless Steel (30bar)
Sixth Digit = Wetted Material
0 = PEEK / 316 Stainless Steel
1 = PEEK / Borosilicate Glass
Seventh/Eighth Digit = Electronic Package
A = Analog Output
D = Display and Analog Output
RA = 110°C Sensor Remote Electronics Analog Output
RD = 110°C Sensor Remote Electronics Display and Analog Output

Example: 760 - V10 - D

This model is a 20 L/Min flowmeter with Viton™ seals, half inch BSP PEEK fittings and a 316 stainless steel flow tube with PEEK mounts; fitted with a local digital display and an analog output.

1.1. Button Operation: Models with Display

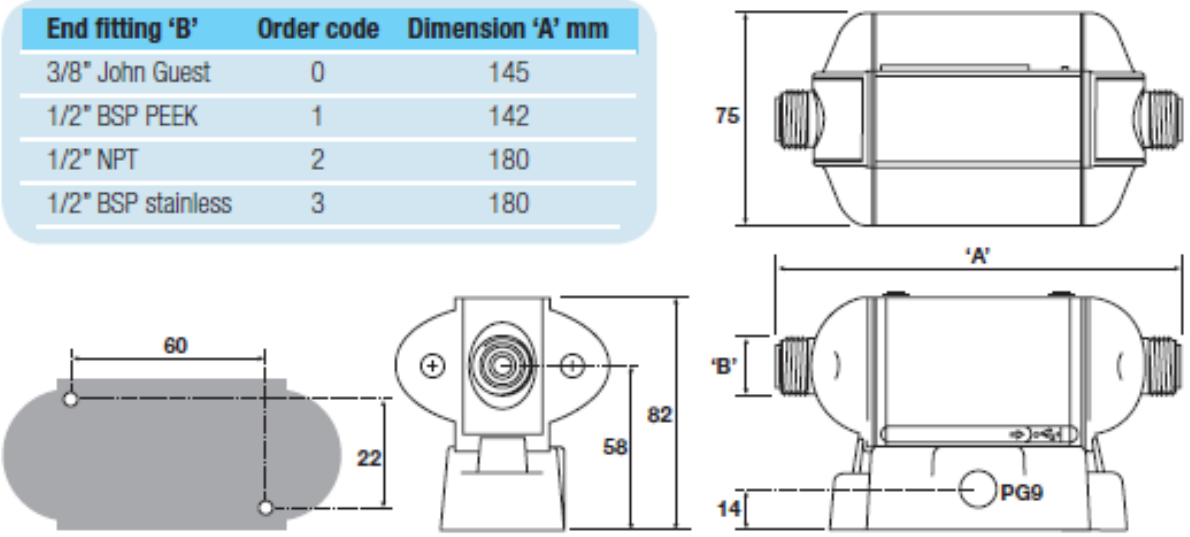
All models with display have a left and right hand button with local functionality.

Display Mode	Left Hand Button	Right Hand Button
TOTAL Mode	-	RESET TOTAL Press and Hold for **5 Seconds**
RATE Mode	-	-
BOTH Mode	Switches Between RATE and TOTAL on Display	RESETS TOTAL when on TOTAL display: Press and Hold for **5 Seconds**
BATCH Mode	START / PAUSE Batch	RESET BATCH TOTAL (at end of batch) *NOTE: Batch mode can be reset to Ready Mode by Pressing and Holding for **5 Seconds** after start /pause has been operated*
LATCH ALARM OUTPUT	RESET LATCHED ALARM Press and Hold for **5 Seconds**	-

2. Installation

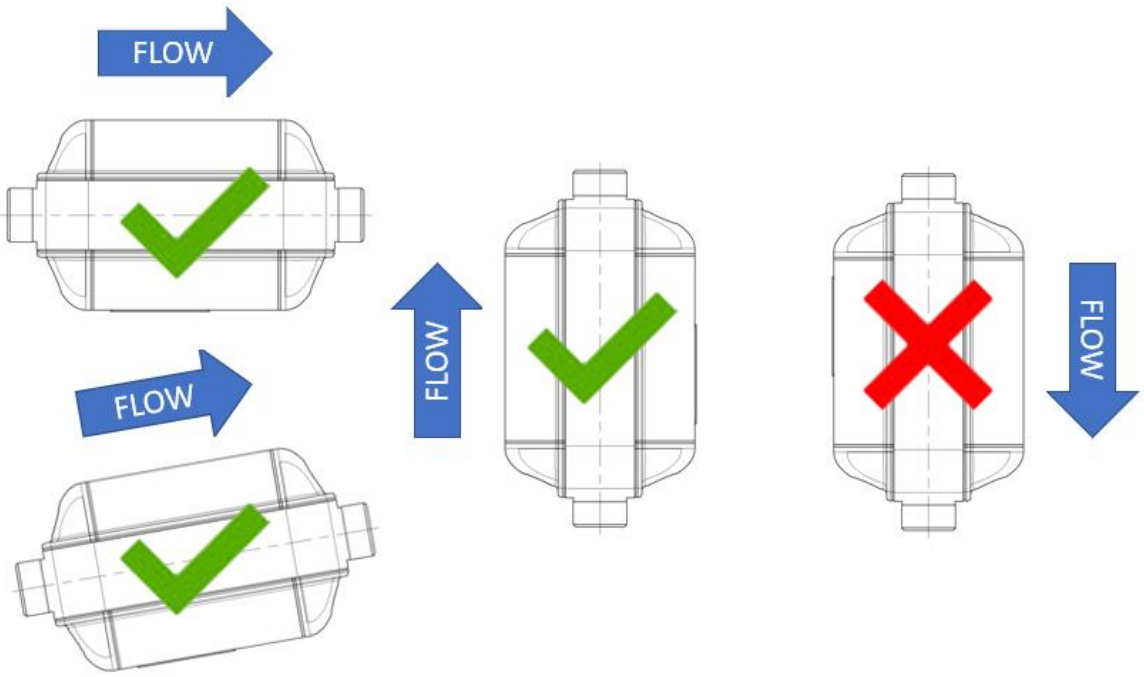
- The Atrato® must be installed in a positive pressure system. Ensure that there is sufficient back pressure on the flowmeter to keep any gas in solution.
  Back Pressure >500mbar plus two times the liquid vapour pressure
  Speed of Sound Limitation ± 30% of speed of sound of water
- Locate the flowmeter in a sheltered position away from falling water.
- Care must be taken to ensure that the end fittings on the meter are not stressed during use. Ideally, flexible tubes should be used.
- Ideally the meter should be installed with minimum straight lengths of tube either side for a distance of **10 pipe diameters upstream** and **5 pipe diameters downstream**.
- Install the device well away from valves, regulators, bends and other components that could cause excessive turbulence on the fluid entering or leaving the meter.
- If necessary, use spacer blocks and mounting clips to raise the pipe work centre line 58mm above the surface.
- It is good practice to use upstream and downstream isolating full bore ball valves to facilitate easy meter installation or removal.
- If push-in 3/8" John Guest fittings are used, clip the pipes to the mounting surface 300mm upstream and 150mm downstream.
- If there is any chance of air passing through the system, mount the Atrato® in a vertical pipe with the flow in an upward direction. Otherwise, air can remain trapped in the meter and affect its performance.
- The Atrato® is **not** recommended for pulsating flow. Any pulsations must be damped to less than 10Hz to prevent aliasing of measurement.

End fitting 'B'	Order code	Dimension 'A' mm
3/8" John Guest	0	145
1/2" BSP PEEK	1	142
1/2" NPT	2	180
1/2" BSP stainless	3	180



Using suitable fixings, mount the connection box onto a rigid surface with the cable entry preferably at the bottom.

The flowmeter should be clipped into place with the terminal screws positioned at the lower edge. Note that the rubber strip covering the terminals on the meter will not seal if water is persistently present in this area. Ensure the meter is not pressure washed. The Atrato® can easily be dismounted by inserting a screwdriver under the mounting clip and gently unclipping it to release the main body. The PG9 thread can be either connected to a suitable flexible conduit or may be fitted with the supplied cable gland.



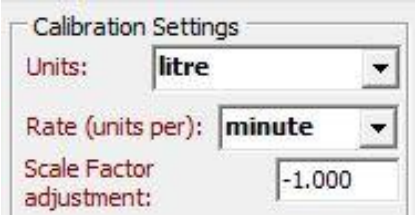
Position flow meter to prevent gas lock in measurement tube

2.1. Reverse Installation

With the display models it may be desirable to install with flow in the reverse direction to design, so that the display can be read by operators.

The Atrato® software is configured to enable this, though the meter is not calibrated in reverse orientation and may show drift in accuracy in the bottom few percent of flow.

To enable reverse flow, simply change the scale factor adjustment to a negative number:



3. Electrical

WARNING:

The Atrato® is designed to be powered from either USB or external DC power. When connected to both supplies, there is potential for damage to the flow meter from ground loops or direct shorting of any non-isolated power supplies. The user must ensure the 0V from the USB and the negative terminal of the DC supply are not at different voltages, by correct earthing or isolation.

The Atrato® can be programmed using the USB connection via a computer.

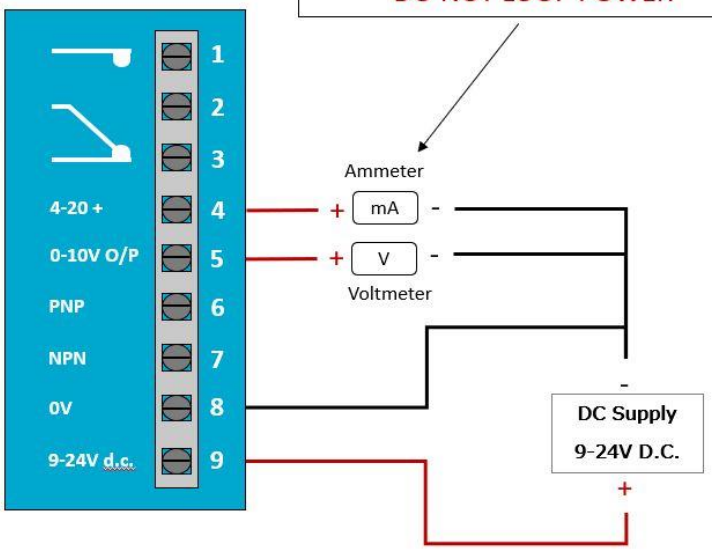
The Atrato® can operate solely on USB power via the computer or a high quality USB2 power supply (e.g. RS 9076255 5V 5W supply). The meter display will function, as will the relay and pulse outputs (require target power).

For full functionality, including the analog outputs, **15-24VDC** external power is required.

The unit will work with systems from Windows XP onwards.

The maximum connector cable size is 2.5mm (22-14AWG); for ease of assembly we recommend 1mm. Care should be taken when terminating the wires as the conductors should be stripped to 4 to 5mm maximum and the wire ends must be pushed fully into the connector before tightening. These cables pass through a slot cut in the aluminium housing. Please ensure that no bare conductors are in contact with the surface of the connector strip prior to closing the housing.

PIN 1	NO (Normally Open) Relay Output
PIN 2	Common Relay Output
PIN 3	NC (Normally Closed) Relay Output
PIN 4	4mA Analogue Output
PIN 5	10V Analogue Output
PIN 6	Input or output: Pull down resistor required
PIN 7	Input or output: Pull up resistor required
PIN 8	Power Supply ground
PIN 9	Power Supply positive



NOTE: The Titan Interface Software allows the user to test the outputs from the flow meter. See Section 5.1.4: Test Outputs.

= Operates on External Power **or** USB

= Operates on External Power only

Atrato® Connector Assignments

PIN	Label	Function
1	Relay NO	Isolated relay contact; normally open contact 24V 100mA
2	Relay Common	Isolated relay contact; change over contact 24V 100mA
3	Relay NC	Isolated relay contact; normally closed contact 24V 100mA
4	4-20mA	Analog current (4-20mA) output (reference to 0V)
5	0-5/10V	Analog voltage (0-5/10V) output (reference to 0V)
6	PNP	Output 1 open collector PNP OR Input 1 (5-24V dc) e.g. switch to PIN 9
7	NPN	Output 2 open collector NPN OR Input 2 (5-24V dc) e.g. switch to PIN 8
8	0V	External ground, common for PNP, NPN and Analog outputs
9	+9 -24V DC	External power VDC; +9V - 24V (15V - 24V for Analog output)

4. ASCII Data Stream via USB

ASCII Flow Data Stream via USB for Atrato® Flow meters, is a feature to ease customer system integration.

Each meter operates whilst real-time flow readings are streamed as ASCII encoded Carriage-Return+ Line-feed terminated strings, via the USB connector. Thus, enabling easy integration of the Atrato® flow information into customer operating and monitoring systems. Each ASCII line is a single number with decimal point, showing the flow rate in the configured units and time period, (e.g. litres per minute). Scientific format is not used and the output is restricted to six decimal places.

The flow readings are reported at approximately 20Hz and configured as the same as those set in the meter using the "Titan Interface Software".

4.1. How to Enable ASCII Streaming

ASCII streaming is conveyed via the FTDI USB chip (FT232RL) and requires the FTDI driver to be loaded on the PC being used. Windows drivers are loaded automatically with the installation of the Titan Interface Software.

More details on the FTDI USB communications can be found at https://ftdichip.com/

On power up, the Atrato® defaults to ASCII Streaming mode of flow data. This is an "output only" and any message received by the meter will automatically switch the Atrato®'s communication mode to "non-streaming". For example, when the Titan Interface Software attempts connection it will first switch the unit into "non-streaming" mode. On exiting, the software will automatically return the connected meter into ASCII streaming mode.

NOTE: *If the Titan Interface Software is not closed correctly or the meter is disconnected via the cable prior to closing the software, the ASCII will not be enabled.*

4.2. Serial Port settings for ASCII Streaming

Windows™	The Virtual COM port (VCP) driver must first be enabled for the USB Connection. See Appendices for details on how to do this.
Linux™	The VCP driver is enabled by default.

After the serial port driver has been enabled, customer software should configure the COM port with the following settings:

- FTDI Baud Rate*: 1250000
- Parity: None
- Stop Bits: 1
- Data Bits: 8

NOTE: The ASCII streaming is **not RS232 like data transmission. The Baud rate must be set to the indicated value to enable the Atrato® flow meter to communicate via USB. The FTDI VCP driver converts the USB data stream to ASCII.*

A test program for Windows™, (ASCII_Test_Atrato®.exe), is included which can be used to verify that the Atrato® stream is being properly received by the PC. Also included is a Python Script for testing on Linux™ systems.

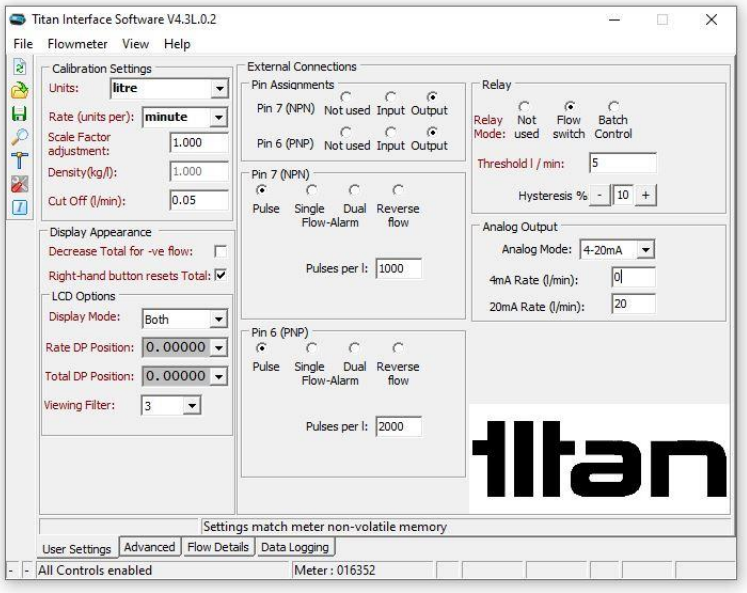
5. Interface Setup

5.1. Connecting Meter to PC

Before use, download and install the current **Titan Interface Software** from memory stick or the Titan Enterprises Website.

The Atrato® low-flow ultrasonic flowmeter should be set up using the USB interface and a suitable windows-based computer.

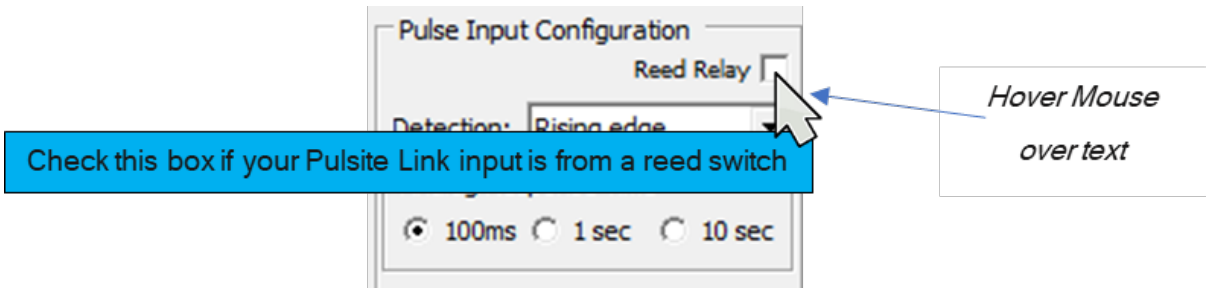
Below is a screen shot of the opening Software screen:



NOTE: *When correctly connected, the two bars will rotate in the bottom left hand corner and you should see "All Controls enabled" along with the Meter Serial Number displayed*

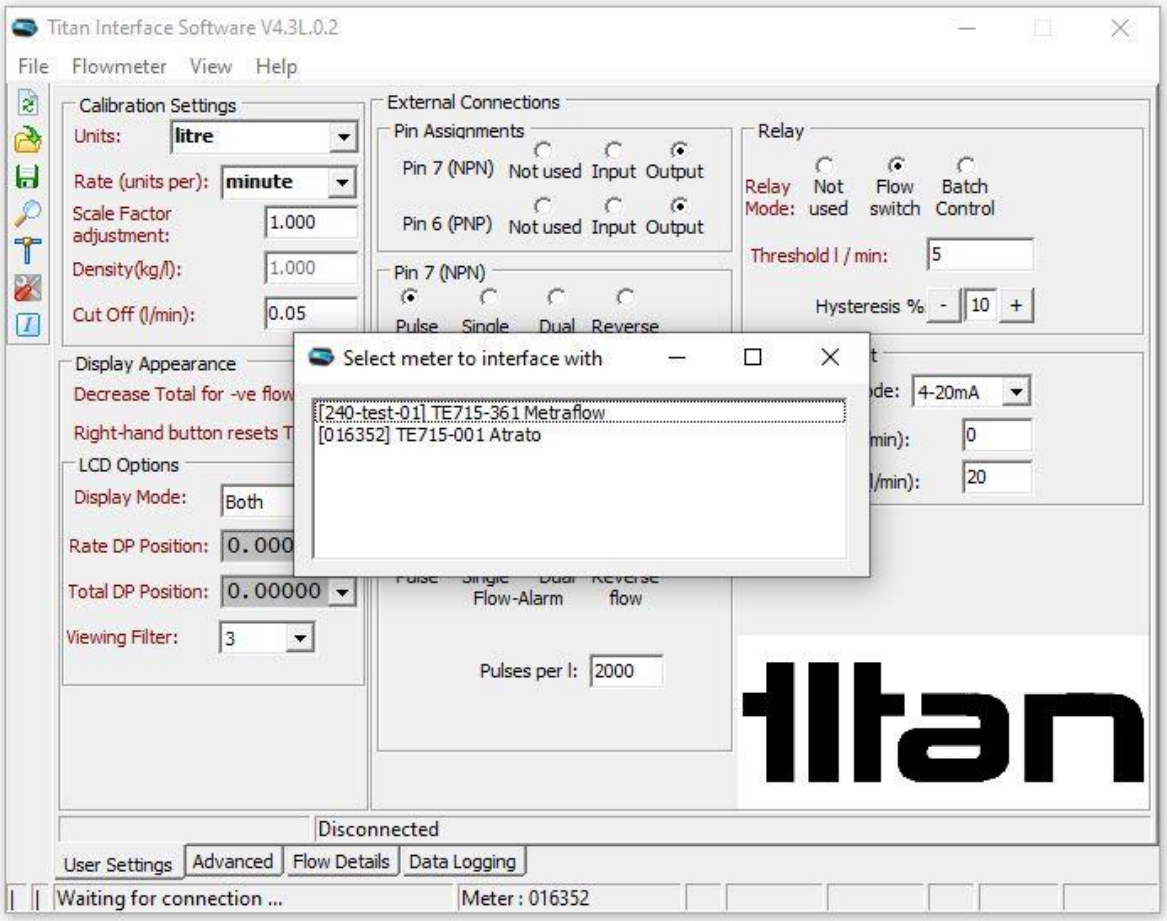
On connecting an Atrato® flowmeter, the Software will normally automatically load the settings currently saved in the memory of the connected meter. The user can use the spy-glass icon to automatically pull the meter saved settings at any time.

From this Software, the user is able to configure all options of the meter. Detailed descriptions follow, but if the user hovers the mouse over a menu item, a brief description will be displayed to help.



5.1.1. Connecting Multiple Meters

If more than one meter is connected to the same PC, when starting, the Interface Software will open the window to choose which you wish to connect:



By opening another copy of the Titan Interface Software, you can connect and modify multiple meters from the same computer.

The panel below shows the main menu function icons of the Interface Software as seen on the top left-hand bar of the screen.


Save settings to meter's non-volatile memory


Load settings from a file on the computer


Save settings to a file on the computer


Retrieve settings from meter


Test outputs

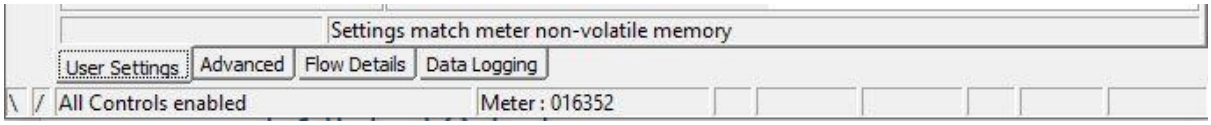

Diagnostic tools


Software Information

5.1.2. Retrieve Settings from Meter

When connected, the settings will normally be automatically retrieved from the meter. If this is not the case, or the user wishes to check the meter's saved settings against those shown in the software, they can be retrieved from the non-volatile memory of the flow meter by pressing the spy-glass icon.

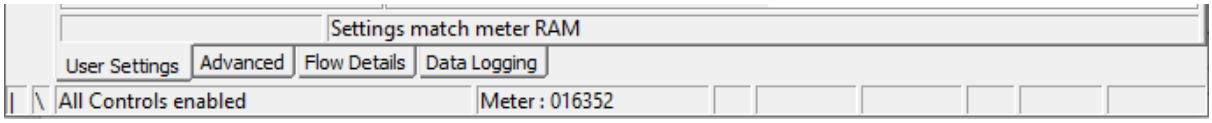
The software message bar will display "Settings match meter non-volatile memory" once any changes are saved:



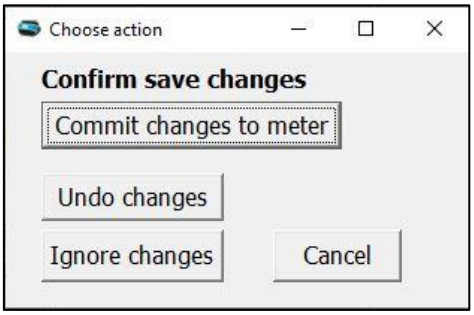
5.1.3. Saving Settings to Meter

As configuration adjustments are made in the software, the operation of the connected meter will change accordingly but will not store those setting changes until the Save Settings icon is pressed.

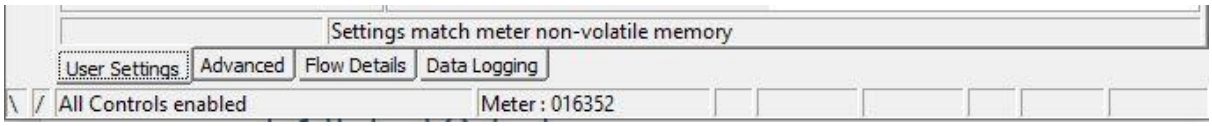
This is indicated in the message bar on User Setting tab, by "Settings match meter RAM" text:



To save new settings to the non-volatile memory click the  and the Confirm save menu will appear before those settings are stored.

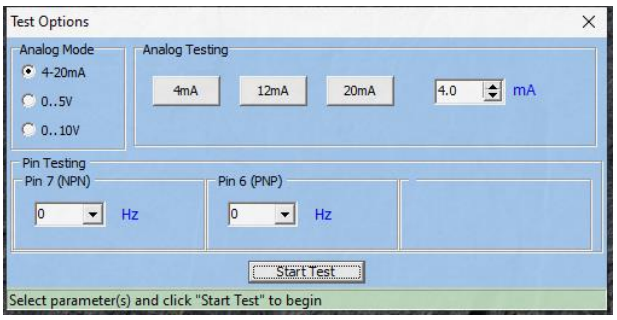


Once stored, the software message bar will display "Settings match meter non-volatile memory":



5.1.4. Test Outputs

This tab enables the user to manually set outputs on the PINs for testing to the target device.



Once the required output is selected click the “Start Test” button and all PINs will give the selected output rate for 32 seconds.

5.1.5. Diagnostic Tools

This section can be used with Titan Enterprises’ assistance for updating software and settings, as well as creating diagnostic log files of the ultrasonic meter’s performance.

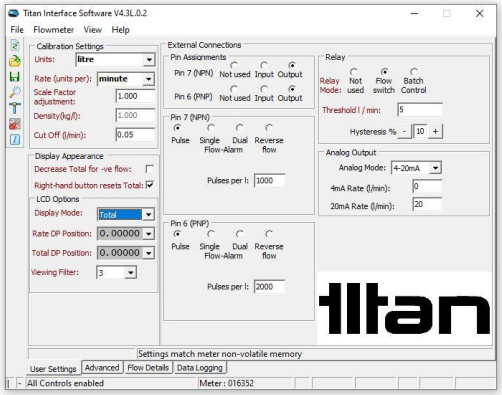
5.1.6. Software Information

This displays the current software version of the Interface Software and the flow meter connecte

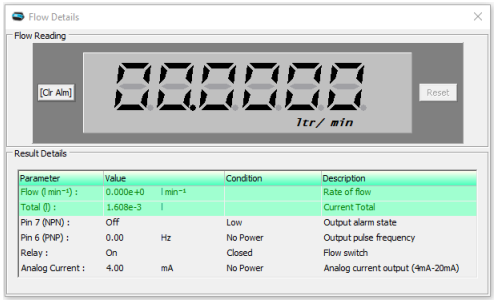
5.2. Window Tab Descriptions

On connection with the Titan Interface Software a window will open with four tabs of settings and information.

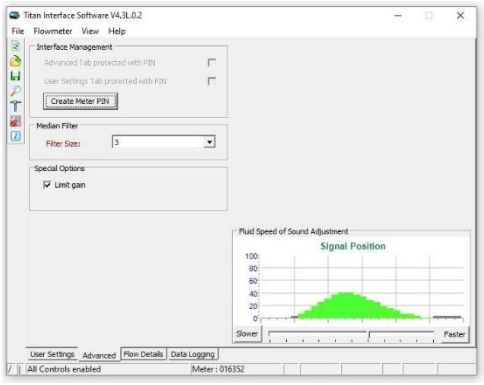
User Settings: Here you can configure how you wish the meter to present the flow and outputs.



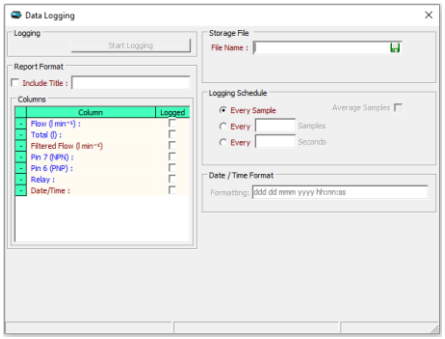
Flow Details: Shows the user real time data from the meter including flow and outputs.



Advanced: For advanced user features including signal position and Median filter.



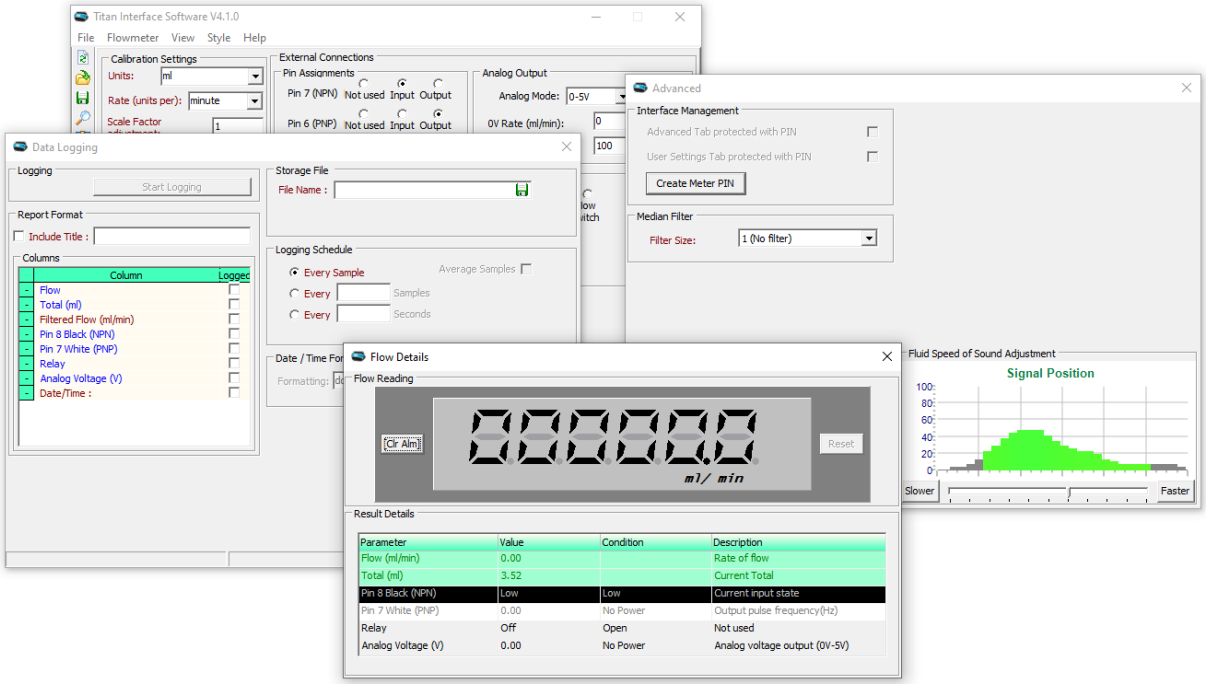
Datalogging: Enables the user to log the meters output data on the connected computer.



Multiple Window Display

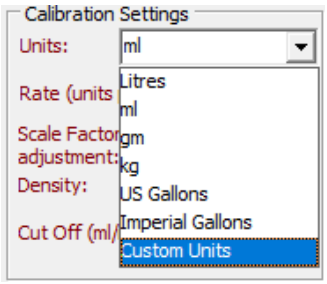
To aid set up whilst operating the meter, it is possible to detach the Flow Details, Datalogging and Advanced windows by dragging and dropping the bottom tabs away from the main window. This allows the user to view those tabs whilst adjusting the User Settings. The Flow Details window may be further reduced or expanded using the “minimise” and “maximise” icons respectively in the top right hand of the window.

To return all windows to docked Mode use the View drop down menu, Restore Defaults.



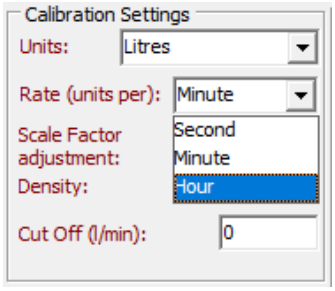
5.3. User Settings Tab

5.3.1. Calibration Settings

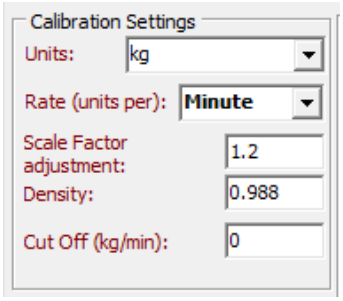


Units: A drop down menu offers the choice of Litres, ml, gms, kg, US gallon, Imperial gallon or Custom units i.e. blank.

Note that the Custom Units setting will be equivalent to Litres if no modifications are made to scale factor.



Rate (units per): This is the time base for the flow rate and has the option of Second, Minute or Hour.



Scale Factor Adjustment: This allows the user to adjust or tune the calibration flow value if required.

Entering -1 enables the meter to be used in reverse flow.

Density: The flowmeter is fundamentally a volumetric device, but a density figure can be entered here if one of the mass units is selected. Caution must be used however, as there is no temperature/density correction.

Cut Off: Flow values below this level will be set to zero.

5.3.2. Display Appearance

Decrease Total for -ve flow: The meter will not register negative flow on its outputs unless this box is checked.

For reverse flow the rate will show a "-" sign before the rate and the total will be reduced accordingly.

One of the transistor outputs (PNP or NPN on PIN 6 or 7) are configurable to give a logic level when reverse flow is detected.

Once selected, the totaliser will adjust with the negative flow and the NPN and PNP outputs will give a pulse output in proportion to reverse flow seen.

The analog PINs will give an output if scaled appropriately.

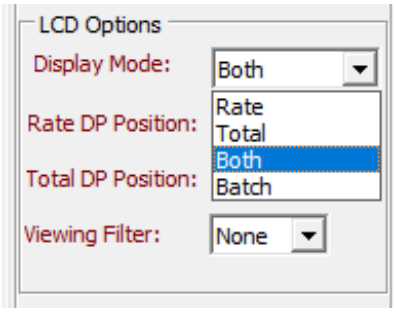
Right-hand button resets Total: When ticked the user can reset any totals using the right-hand buttons on the display units. See section 1.1: Button Operation: Models with Display.

When unticked the Total cannot be manually reset using the LCD buttons.

5.3.3. LCD Options

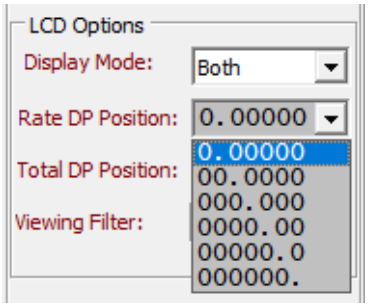
Display Mode: Allows user to select from:

- *Rate* – The display will show flow rate only.
- *Total* – The display will show total flow only.
- *Both* – The display can be cycled from rate to total using the Left-Hand button on the Atrato® or the left button in the "Flow Details" window.
  The Total can be Reset at any time on the display model by pressing the Right-Hand Button when the Total is being displayed. Alternatively, a remote input can be used if either PIN 6 or PIN 7 has been utilised.
- *Batch* – By choosing batch mode, the Relay can be switched and utilised (via external equipment) to control flow to deliver a fixed-sized 'batch' of fluid.



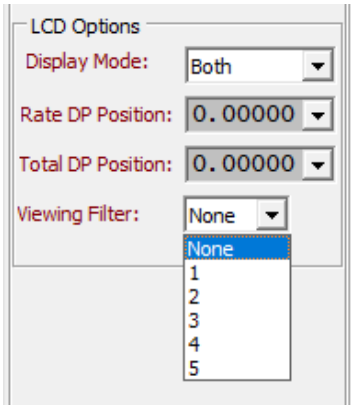
In batch mode, the left-hand button is used to start or pause the batch, and the right-hand button is used to Reset or 'prime' the system for the next batch after the current batch has been delivered.
For more detail see Relay section.

Rate DP Position: Use the drop-down menu to choose the default decimal point position.



Total DP Position: Use the drop-down menu to choose the default decimal point position.
If the decimal point is set too low and the display value exceeds the setting capacity, the display will auto-range.

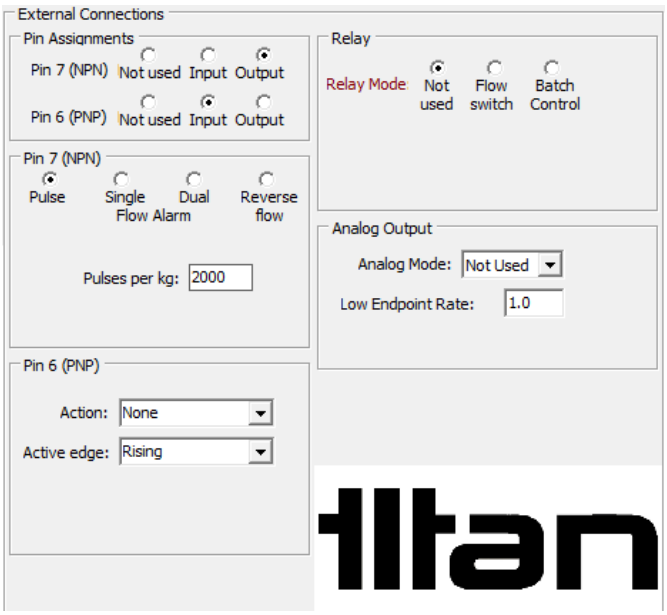
Viewing Filter: This prevents the display, flow switches and analog outputs from jittering with irregularities in the flow by averaging the results over a short amount of time. The increments are arbitrary with the degree of damping approximately doubling with each level. At level 5 the display may take up to a minute to accurately reflect any changes in the flow.



NOTE: This filter affects the Flow LCD display and the analog outputs only.
Flow Switch alarms operate using the Filtered Flow.
It has no effect on the NPN and PNP outputs which report the unfiltered flow reading.

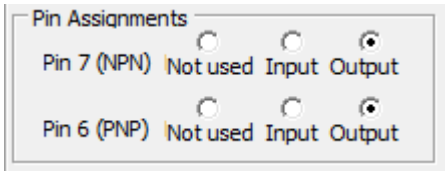
5.3.4. External Connections:

Within this section the user can configure pulse, analog and alarm outputs.



PIN Assignments:

The options for each PIN are: ⊙ Not Used ⊙ Input or ⊙ Output



Each of the PIN Assignments can be configured as either an input or an output function.

The operation to modify PIN 6 and PIN 7 is identical within the software, with the exception of the type of transistor pulse output:

- PIN 6 is PNP, whilst PIN 7 is a NPN type.

The options for each PIN, are:

⊙ Not Used ⊙ Input or ⊙ Output

NOTE: These instructions are the same for PIN 6 and PIN 7 with the exception of the transistor wiring and operation.

For example: For PIN 7 (NPN) the idle state is switch 'open' which will be a high Volt output if there is a pull-up in the circuit. PIN 6 (PNP) would be the opposite, at zero Volt.

Output

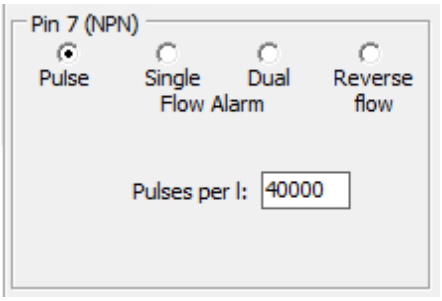
If Output is selected the output options are:

- Pulse
- Single/ Dual flow alarm
- Reverse Flow

Pulse:

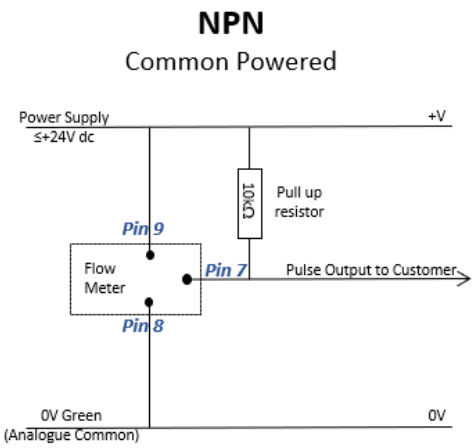
Enter the number of pulses per unit volume required. This figure can be adjusted to suit the application and the flow range required from the meter.

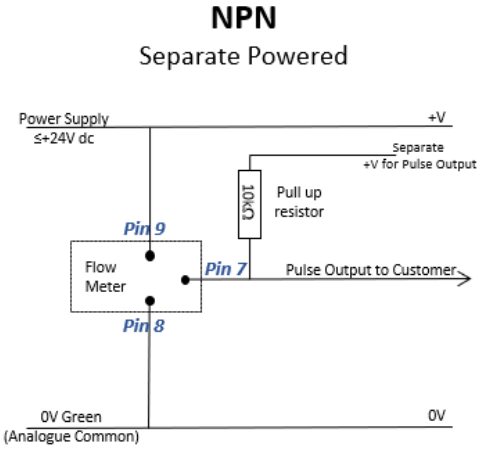
The maximum output frequency is 1000 Hz so care must be taken to ensure that this pulse rate is not exceeded.

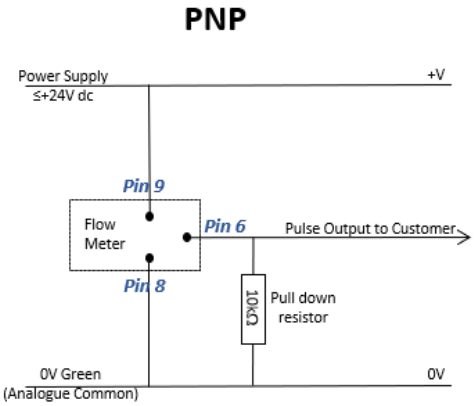


Example Wiring for NPN and PNP pulse outputs:

NOTE: Best practice is to place Pull Resistor up near target device



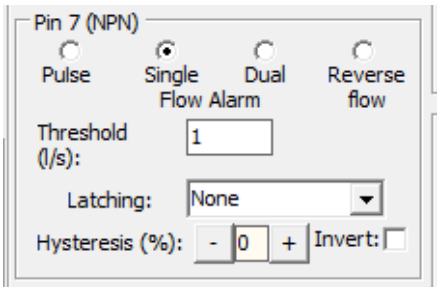




Single Flow Alarm:

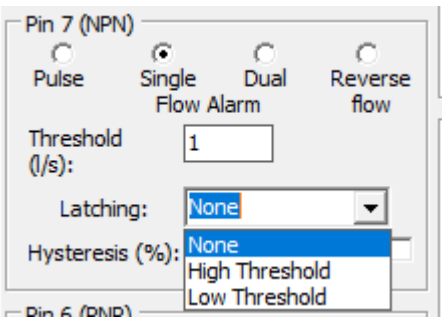
NOTE: *Alarms use Filtered Flow Values!*

Checking this option opens up input boxes for **Threshold**, **Latching** and **Invert**.



Set the Threshold to the flow value you require the transistor to operate.
The logic of operation can be adjusted with the Invert check box.

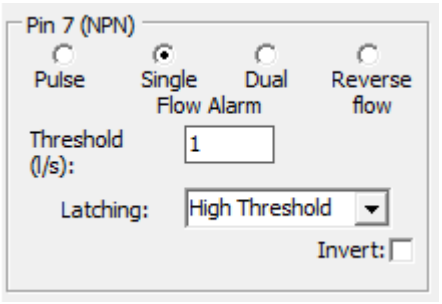
Latching: This gives the user three options of None; High Threshold and Low Threshold.



NONE will cause the alarm to be triggered when the threshold flow is met. The alarm state will then reset in accordance with the user set Hysteresis.
HIGH THRESHOLD will cause an alarm signal to Latch on when flow is seen above the set value.
LOW THRESHOLD will cause an alarm signal to Latch on when flow is seen below the set value.

NOTE: Latched alarms will remain Active until they are reset.

Reset Latch Alarms by either a signal Input on another Input/Output PIN, or by Pressing and Holding the Left-Hand Button on the Local Display on the flow meter for 4 seconds.



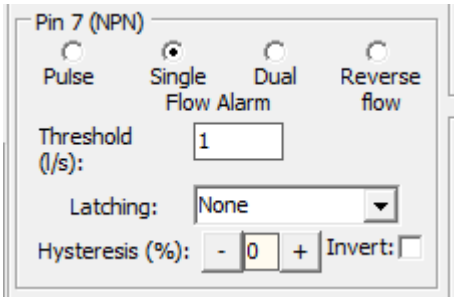
NOTE: The alarm points are driven by the display value on the "flow reading" screen. Any changes to the VIEWING FILTER value will affect the response time of the alarm points.

This gives the user two adjustable parameters to ensure "fluttering" does not happen with small flow fluctuations – meter response time and hysteresis.

Hysteresis (%): This is used when Latching is set to None to prevent "fluttering" of the alarm signal when flow is around the threshold level.

The % value is set around the Threshold value.

For example: Threshold set at 1.0 and Hysteresis at 20%. The PIN will turn ON at 1.1 and off at 0.9.



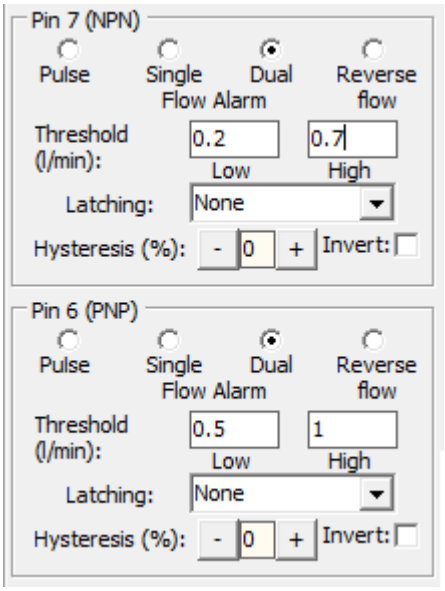
NOTE: The Invert checkbox will reverse the action of the alarm output.

For details for each PIN see the Alarm Logic Table or hover mouse over the set point to see the action of the output with the chosen settings.

Dual Flow Alarm:

***NOTE:** Alarms use Filtered Flow Values!*

Checking this will enable a range of flow to be entered. When the flow is outside/inside of this range the alarm will be triggered.



The remaining settings in the input box are the same as for Single Flow alarms.

- When no Latching is chosen the alarm will automatically activate and reset in proportion to the user set Hysteresis of the Threshold levels.
- The Latched Alarm can be reset by a signal Input on one of the other Input/Output PINS, or by pressing and holding the left-hand button on the local display on the flow meter for 4 seconds.
- The Invert checkbox will reverse the action of the alarm output. (See the Alarm Logic Table).

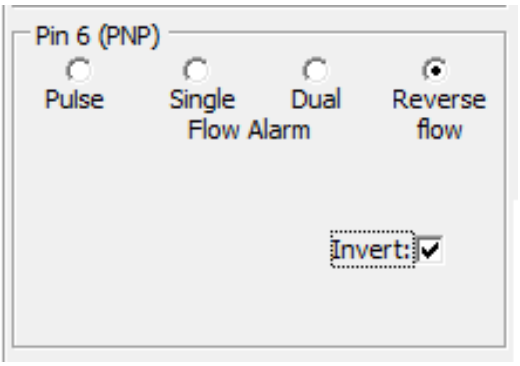
For details for each PIN see the Alarm logic table or hover mouse over the set point to see the action of the output with the chosen settings.

Reverse Flow:

NOTE: *Alarms use Filtered Flow Values!*

Choosing the Reverse flow option allows the user to send a signal from the assigned PIN when reverse flow is seen.

Selecting Invert will reverse the action of the signal to transmit when a positive flow is detected.



Alarm Logic Table

Flow Alarm	Latching	Invert	Alarm Action	
			Below Threshold	Above Threshold
Single	None	Unticked	OFF	ON
Single	None	Ticked	ON	OFF
Single	High Threshold	Unticked	OFF	ON
Single	High Threshold	Ticked	ON	OFF
Single	Low Threshold	Unticked	ON	OFF
Single	Low Threshold	Ticked	OFF	ON
			In Range	Outside Range
Dual	None	Unticked	ON	OFF
Dual	None	Ticked	OFF	ON
Dual	Out of Range	Unticked	OFF	ON
Dual	Out of Range	Ticked	ON	OFF
			Forward	Reverse Flow
Reserve Flow	n/a	Unticked	OFF	ON
Reverse Flow	n/a	Ticked	ON	OFF

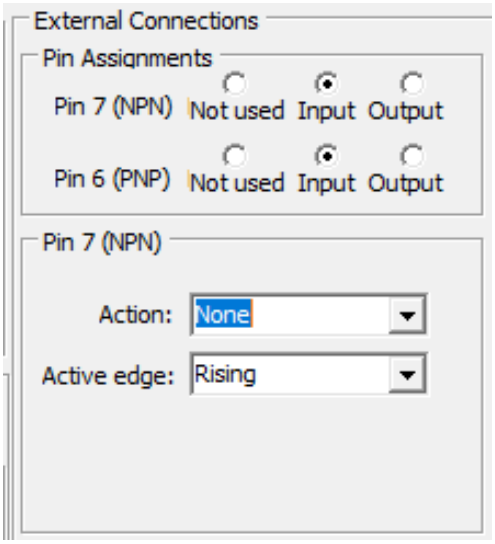
NOTE: The NPN and PNP have different outputs when used due to their wiring.

- Using the NPN: OFF =Powered +VDC and ON = Unpowered 0VDC
- Using the PNP: OFF=Unpowered 0VDC and ON = Powered +VDC

NOTE: *Alarms use Filtered Flow Values!*

Input

If Input is selected, operations can be remotely operated by using a switch and resistor to apply a suitable voltage (between 5 and 24 Vdc) to either PIN 6 or PIN 7.

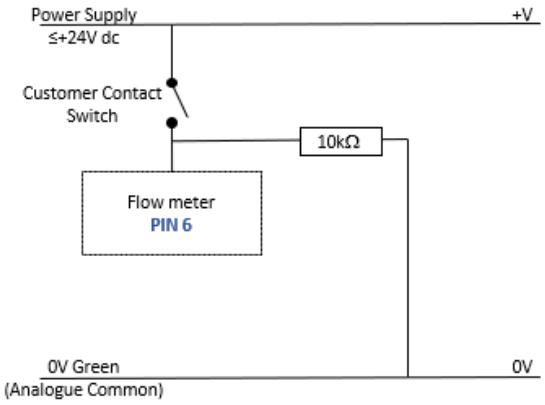


In Input mode, the open collector/drain output is disabled, and the Input PIN responds to an external input voltage at TTL levels (VinH ≥ 2.4V; VinL ≤ 0.8V). This input must be driven by an external voltage supply which can safely be in the full range of zero to the external supply voltage (zero to 24V for PIN 7/NPN output). Because of the potential for conflict, should the PNP output be activated accidentally, Titan recommends a resistor so that the sink current cannot exceed 5mA.

Example circuits:

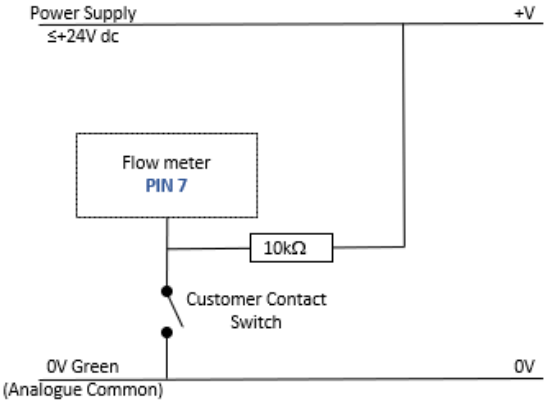
PIN 6:

PNP

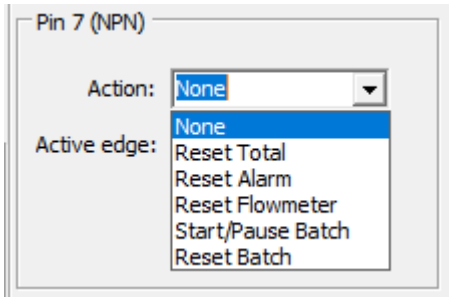


PIN 7:

NPN

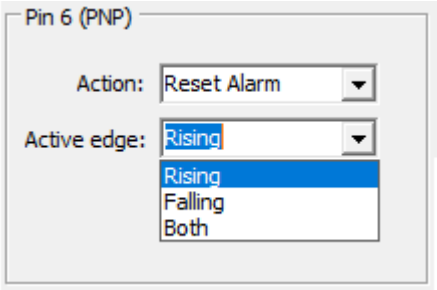


One of the following actions can be selected for each PIN configured as an Input:



- **Reset Total**: Resets the total flow display to zero. Equivalent to pressing the right hand button on the flowmeter.
- **Reset Alarm**: Clears output alarm conditions active on any PINs configured as alarms.
- **Reset Flowmeter**: Initiates the equivalent of a power-on reset of the meter.
- **Start/Pause Batch**: Starts or pauses batch. Equivalent to the display left button press in batch mode *(use rising or falling edge mode - DO NOT USE BOTH).*
- **Reset Batch**: In batch mode, primes batch system for new batch, resetting total to zero.

Equivalent to the display right button press in batch mode.



Additionally, the input can be configured to act on a rising or falling edge or both types of edge of the pulse as the trigger.

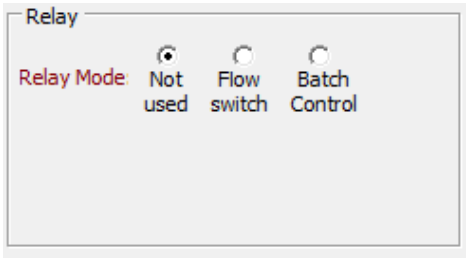
Relay Flow Switch and Batch Control

NOTE: *Flow Switch uses Filtered Flow Values!*

Depending on the mode chosen this Relay (Terminals 1,2 and 3) triggers when flow or volume reaches a certain threshold.

Relay Mode: has options for:

- **Not used**: No relay
- **Flow switch:** Flow rate activated relay
- **Batch Control**: Total volume activated relay.

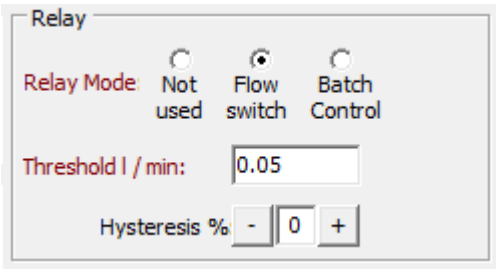


Flow switch:

NOTE: *Flow Switch uses Filtered Flow Values!*

- Threshold l/min: the maximum flow rate after which the relay is triggered.
- Hysteresis:

If Positive: Relay Activates above the Threshold plus the Hysteresis and deactivates when the Flow drops below the Threshold Value.
If Negative: Relay Activates below the Threshold Value minus the Hysteresis and Deactivates when Flow increases above the Threshold value.



Example:
Set up: Threshold 1.00 l/min; Hysteresis +20%
Condition: Power On; No Flow = Relay OFF

- First Trigger is Threshold PLUS Hysteresis (1.00 + 20%)

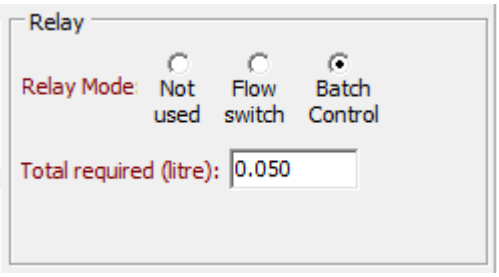
Flow >1.20 l/min = Relay ON

- Relay Resets when Threshold met:

Flow Drops <1.00 = Relay OFF

Batch Control:

- Total required (Litres): the volume that can pass through the meter before the batch is considered complete and the relay is triggered.



The Atrato® has a simple Batch Control operation with the inbuilt relay. The operation is based on a relatively constant flow being seen by the meter during the batch fill. An internal algorithm predicts when the target flow level will be seen and shuts off the relay accordingly.

This prediction does not take into account any delay in the downstream control valve system.

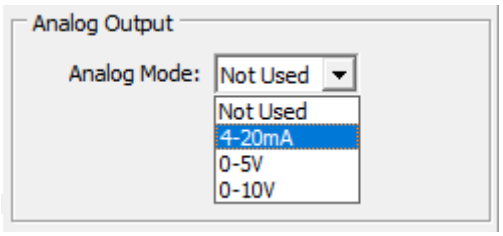
The operation is:

- The relay is activated when the batch is started - either by the left-hand button being pressed or from an appropriately configured input (PIN 6 or 7) and is deactivated when the Total Required has flowed through the meter.
- After the batch has been delivered, the meter waits for a Reset action. Either the right-hand button being pressed or from an appropriately configured input (PIN 6 or 7) before preparing itself for the next batch to be started.
- The batch delivery can be paused and resumed by additional presses of the left button (or activations of an appropriately configured input) which cause the relay to be deactivated/activated accordingly.
- The amount of fluid delivered is shown on the meter display, and this value is reset to zero when a reset action happens.

NOTE: IF THE DECREASE TOTAL WITH NEGATIVE FLOW IS CHECKED THE BATCHING TOTAL WILL DECREASE WITH REVERSE FLOW.

Analog Outputs

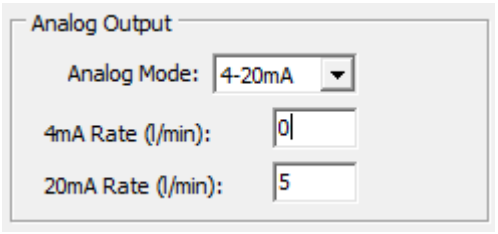
NOTE: FOR FULL ANALOG OUTPUT FUNCTION EXTERNAL POWER OF >15VDC MUST BE CONNECTED



There are four options on the Analog Mode drop-down menu:

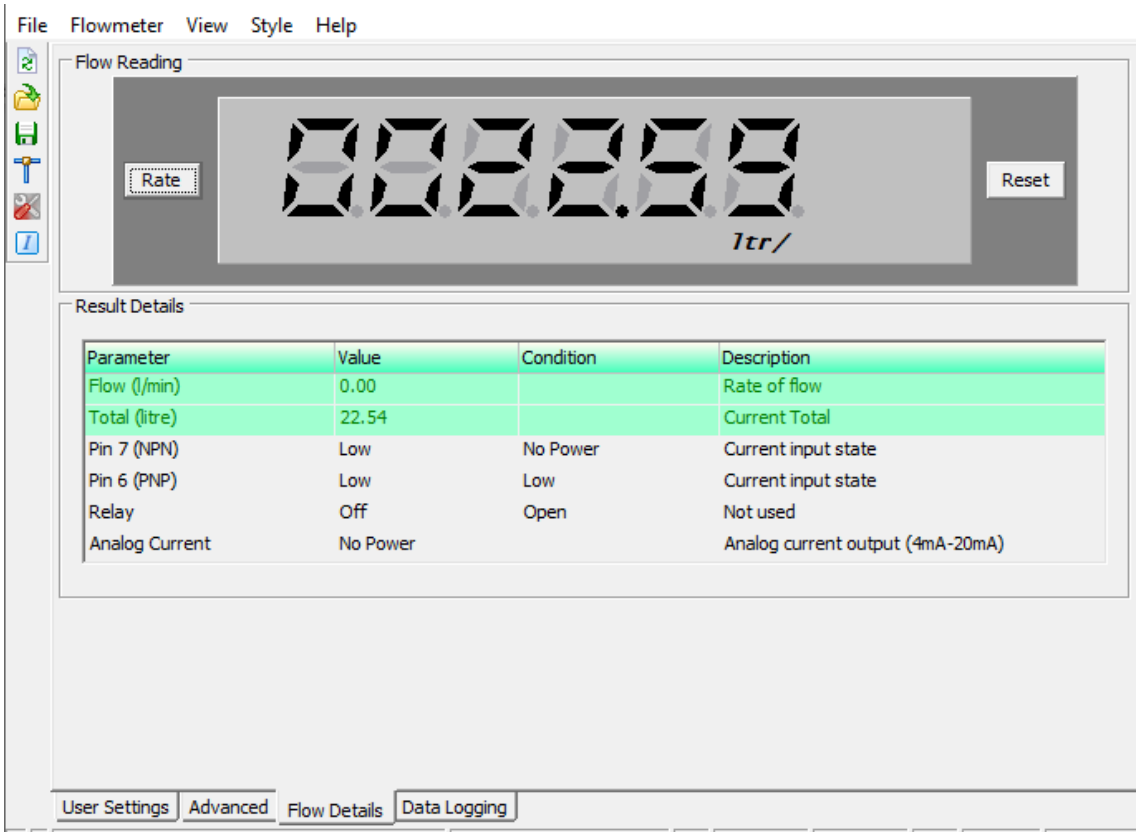
- Not Used
- 4-20mA (active)
- 0-5 Volt
- 0-10 Volt.

NOTE: The 4-20mA is **ACTIVE** (Not loop powered)



Once the Analog Mode selection has been made you can enter the low and high flows for the Analog Outputs as required. These are numeric entries in the units and time base selected in calibration settings.

5.4. Flow Details Tab



The Flow Details tab displays the performance of the meter in real time.

The main large display reflects the meter readings showing on the Atrato® LCD Display, if fitted, and will mimic that display. The buttons either side have the functions selected on the 'Configuration' screen and work in parallel with the buttons on the Atrato® flowmeter display unit itself.

The flow displayed will be the Filtered Flow Rate as determined by the Viewing Filter Level in the User Settings Tab.

The **Results Details** small window below the rate and total display shows various relevant operational parameters whilst the unit is operating, e.g. relay status and frequency output if these options are selected.

Parameters:

- **Flow**: This is the instantaneous flow rate and is updated approximately every 100 milliseconds.
- **Total**: The total liquid passed since the last reset.
- **PIN 6 & 7**: If no selection is made "Not used" will be in the Description column. See following text and chart for the display legends.
    - OR: When PIN 6 or 7 is set to "Output" and set to "Pulse" this will display the frequency of the running output and the number of pulses per litre selected.
    - OR: If set to "Output" and set to "Flow switch" the Value column will show the transistor status either "low" or "high" and the notes will show the selected switch points.
    - OR: If "Output" and "Reverse Flow" are selected the Value column will show either "low" or "high" depending on forward or reverse flow.
    - OR: If "Input" is selected the Value column will show "high" or "low" depending on the switch condition and "Input Logic level" in the Notes column.
- **Relay**: If no function is set for the relay the Value column will show "Off" otherwise it will display the function and its operating parameters.
- **Analog**: Displays the chosen analog output and value.

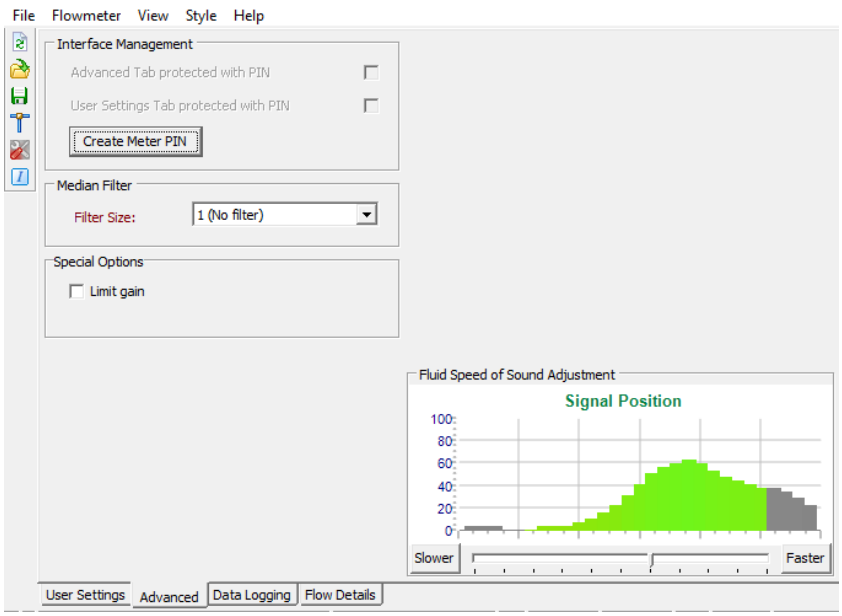
The chart shows the various display messages for the operating functions. During operation only one message will be shown for each parameter.

Parameter	Value	Condition	Description	Additional Comments
Flow	12.54		Rate of Flow	*Raw Flow Reading (without viewing filter)*
Total	647.97		Current Total	*Total volume since last Reset*
PIN 7 (NPN)	Off	Low	Not Used	*NOTE: Will Read +VDC if pull up connected*
	237	No Power		
	237	Active	Output Pulse Frequency (Hz)	
	Off	High	Output Alarm State	*No Alarm* *+VDC*

	On	Low	Output Alarm State	*Alarm Triggered* *0VDC*
	On	Low	Output Alarm State	*Invert Selected* *No Alarm* *0VDC*
	Off	High	Output Alarm State	*Invert Selected* *Alarm Triggered* *+VDC*
	On (Latched)	Low	Output Alarm State	*Alarm triggered and Latched* *0VDC* *(Reset by press and hold Left Button)*
	Off (Latched)	High	Output Alarm State	*Invert Selected* *Alarm triggered and Latched +VDC* *(Reset by press and hold Left Button)*
PIN 6 (PNP)	Off	Low	Not Used	*NOTE: Will Read +VDC if pull up connected*
	237	No Power	Output Pulse Frequency (Hz)	*No +VDC. The PNP will not work on USB power alone*
	237	Active	Output Pulse Frequency (Hz)	
	Off	Low	Output Alarm State	*No Alarm* *0VDC*
	On	High	Output Alarm State	*Alarm Triggered* *+VDC*
	On	High	Output Alarm State	*Invert Selected* *No Alarm* *0V*
	Off	Low	Output Alarm State	*Invert Selected* *Alarm Triggered* *0VDC*
	On (Latched)	High	Output Alarm State	*Alarm triggered and Latched* *+VDC* *(Reset by press and hold Left Button)*
	Off (Latched)	Low	Output Alarm State	*Invert Selected* *Alarm triggered and Latched 0VDC* *(Reset by press and hold Left Button)*

Relay	Off	Open	Not Used	
	Off	Open	Flow Switch	*Flow Switch* *No Alarm*
	On	Closed	Flow Switch	*Flow Switch* *Alarm*
Analog Current	12.54	OK	Analog Current output (4mA-20mA)	
	12.54	Fault	Analog Current output (4mA-20mA)	*Wiring disconnected*
	12.54	No Power	Analog Current output (4mA-20mA)	*No external power to meter*
Analog Voltage	3.22	OK	Analog Voltage output (0V-5V)	*Same for 0-10V*
	3.22	No Power	Analog Voltage output (0V-5V)	*No external power to meter*

5.5. Advanced Tab



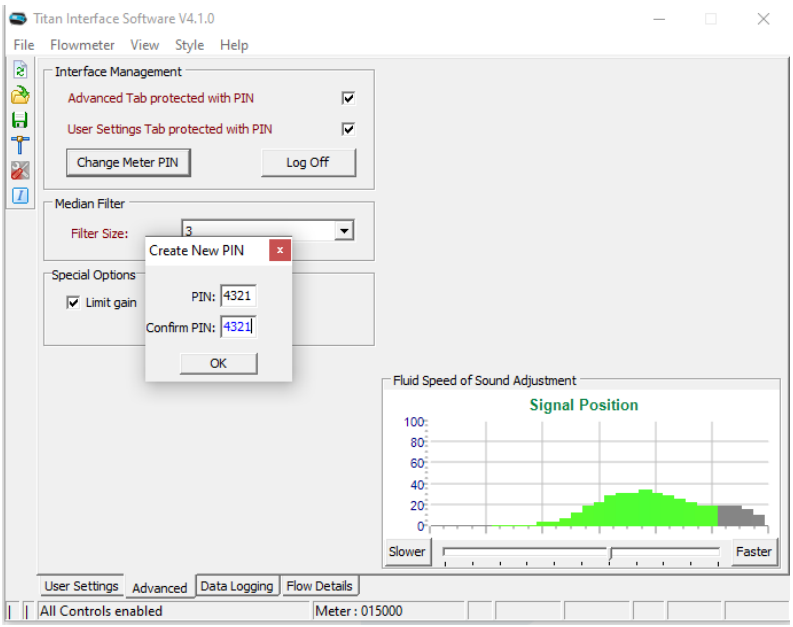
5.5.1. Interface Management

To use these features, it is first necessary to create a security METER PIN. This is a four-digit number in the range 0001 to 9999. After allocating a security PIN these check boxes can lock all of the settings or just the advanced user. Once entered, all the setting parameters remain visible.

When logged on the security PIN can be changed or removed.

A security PIN can be removed either by setting it to zero (0000) or by de-selecting the “Advanced Tab protected with PIN” option.

If you forget the security PIN please contact your supplier for resetting instructions.



5.5.2. Median Filter

This filter removes short term anomalies in the recorded flow, e.g. caused by an air bubble passing through the meter. It should be used with caution as it is theoretically possible that overuse of this feature could lead to incorrect results in certain circumstances. Under normal operating conditions the meter returns around 25 results per second and a regular occurrence at this frequency could be completely ignored, thus causing problematic readings.

The filter is a moving window taking the middle number from an odd number of results selectable between 1 and 21. It is not a mean and it is designed to totally ignore one or more results as shown:

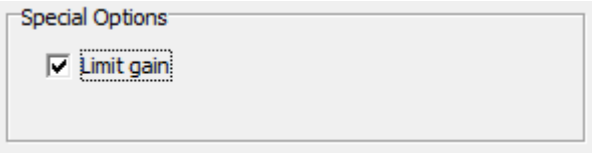
Recorded flow	Used flow
0	0
1	1
1	1
2	2
2	2
3	2
0	3
3	3
4	4
4	4
4	4

Recorded and numerical order		
2 3 0	0 2 3	2 is used
3 0 3	0 3 3	3 is used
0 3 4	0 3 4	3 is used

The seventh flow in the table above is zero. This could have been a small bubble passing through the 710 flowmeter, which has a 1mm bore, which would completely absorb the ultrasound. The median filter completely ignores this reading and for the zero reading

returns the value of 3 from the results either side. This filter is particularly useful at low flows where a small dip in value could drop a result below the internal cut off levels.

5.5.3. Special Options: Limit Gain



The Atrato® has an internal automatic gain control which will boost or reduce the ultrasonic signal if required. As standard, this gain control is limited to 2 levels to prevent the meter attempting to measure background noise. Without this the software can boost the noise in the body and focus at the wrong time location for the ultrasonic signal in the liquid.

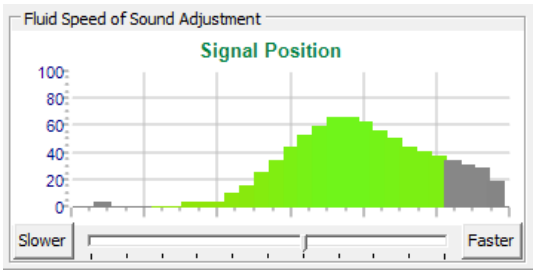
If the liquid has a very low signal due to its acoustic properties, the operator can configure with this limit removed.

WARNING: If the flow meter is powered and the flow tube is only part full or empty, removing the Limit Gain check may cause the meter measurement point to move far from the actual area it should be. This will cause erroneous flow readings for some or all of the measurement period. A power cycle will set the meter back to its calibration focus point.

5.5.4. Speed of Sound Compensation and Signal Strength

The Atrato® ultrasonic flowmeter is factory calibrated on clean water and therefore the window of calibration is based around the measured time of flight of the ultrasonic signal based on the speed of sound of water.

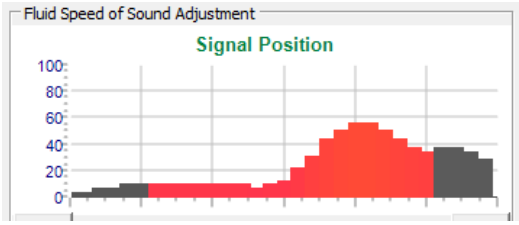
The Atrato® meters can reliably measure liquids with speed of sound approximately 20% faster and 50% slower than that of water at 20°C. A scale factor may be required to correct the calibration.



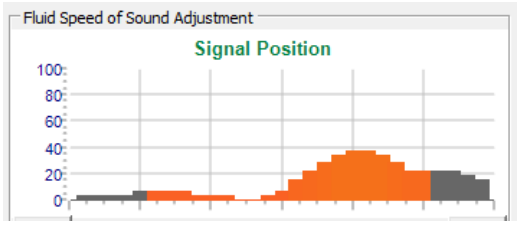
The graphic should show a large green signal centrally in the window, such as above.

A red graphic indicates a very poor signal, orange indicates a weak signal. This could be due to the acoustic properties of the fluid or insufficient back pressure on the flow meter.

The Atrato® flowmeter has an automatic gain which will increase in order to find a signal. The more this is increased above calibration, the weaker the signal is in the liquid.

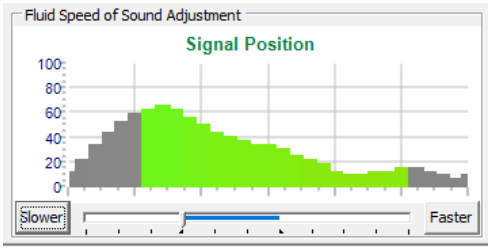


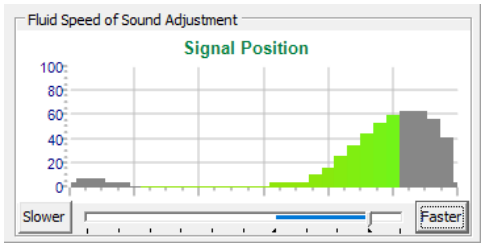
Very Poor/Weak Signal



Poor/Weak Signal

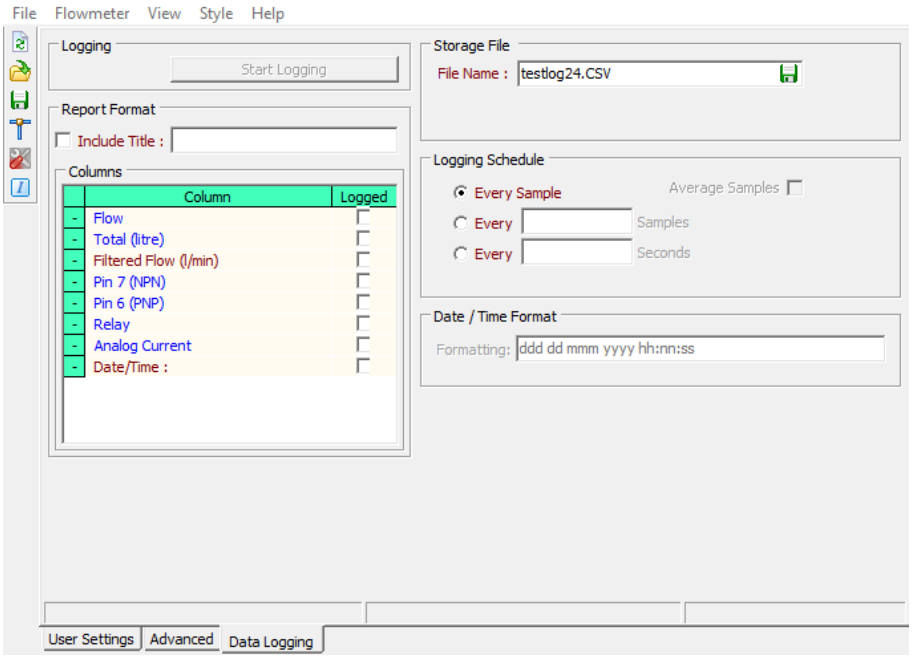
When a liquid is used in the meter that has a significantly different speed of sound to that of water, the stable signal may move outside of the window causing the meter to read incorrect and unstable time of flight signals. In this scenario, you can compensate by manually adjusting the measurement window of the meter in the Advanced Tab feature for Fluid Speed of Sound Adjustment. A bar is seen in the graph indicating whether a strong signal is being measured. If a liquid has a faster speed of sound, the user can click the “Faster” button to adjust the measurement window to a stronger signal point and, if slower, the user can use the “Slower” button to adjust the signal to the left of the measurement window.





If required, the user can then enter a simple scaling factor on the User Settings tab, to adjust the water calibration to that of the liquid being measured.

5.6. Data Logging

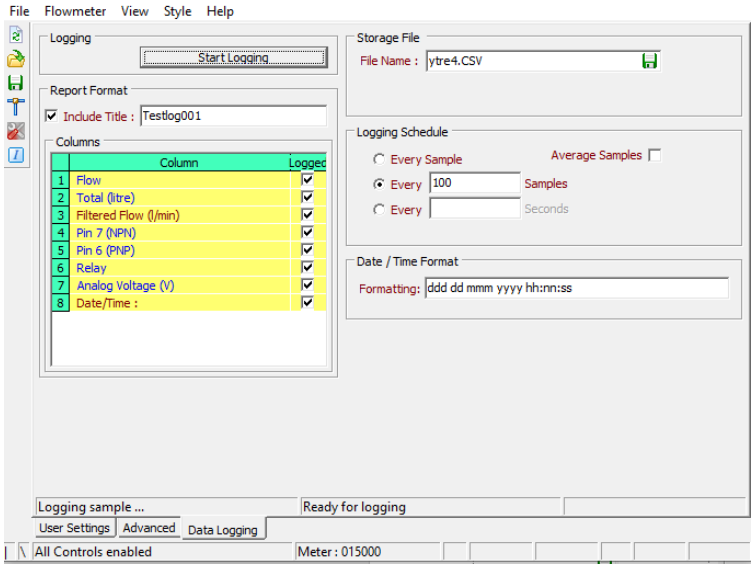


For general monitoring purposes it is possible to log the meter's performance using the Data Logging Tab function.

The logging is not internal to the flowmeter but stored to the connected PC and therefore only occurs whilst the PC is connected to the meter via the USB.

Simply check the relevant parameter you wish to log, choose a sensible sampling period (i.e. for longer data logging periods choose 10+ second intervals to limit the size of the file created).

Then click the  Icon under Storage File and enter a simple filename (no spaces) at a location you desire.



Once all are selected correctly the Start Logging button will become enabled. Click it to start the data logging file creation. In the bottom left corner the samples collected will be listed as the log file builds.

To finish the log file, simply click Stop Logging.

6. Technical Specification

Linearity		±1.0% of reading over flow range
Repeatability		±0.1% from 25% to 100% ±0.5% from 0% to 25%
Housing		IP54
LCD display		Reflective 6x8mm high main characters 2.5mm enunciators Gal. ml. kg. gm. L. /sec. /min. /Hr
Fluid temperature range		-10 to 60°C or -10 to 110°C with remote electronics
Storage temperature		-20 to 110°C
Pressure rating		10 bar standard; 30 bar with stainless steel end fittings
Pulse output (PNP or NPN)		Maximum frequency: 1 kHz 24V @ 20mA maximum Duty cycle: 50% (derated to 40%-60% above 400 Hz) Output impedance: <30 Ω Maximum pin voltage (open): 32 V
Relay		24V dc 500mA max non inductive
PIN 6 transistor	Output	PNP 24V @20mA maximum
	Input	Pull down resistor required (10kΩ)
PIN 7 transistor	Output	NPN 24V @20mA maximum
	Input	Pull up resistor required (10kΩ)
4 - 20mA output		Into 250Ω maximum 16 Bit resolution ±0.012% linearity (plus flowmeter accuracy) ±0.15% max total output error (plus flowmeter accuracy)
0 - 10 Volt output		16 Bit resolution (14 Vdc min power supply) ±0.1% linearity (plus flowmeter accuracy) ±0.5% maximum total output error (plus flowmeter accuracy)
0 - 5 Volt output		15 Bit resolution ±0.1% linearity (plus flowmeter accuracy) ±0.5% max. total output error (plus flowmeter accuracy)
USB ASCII flow data stream		Flow information only Reported approx.20Hz

LCD display	Reflective 6x8mm high main characters 2.5mm enunciators Gal. ml. kg. gm. L. /sec. /min. /Hr
Wiring terminals	2.5mm maximum
Power supply	9 – 24V dc (15 – 24V dc for 4-20mA or 0-10V output)
Power consumption	110mA (plus analog current)
Connections	½" BSP male PEEK or ½" NPT or BSP 316. 3/8" John Guest push-in
Wetted Materials of Construction:	
End Fittings	PEEK (food and medical grade) or 316 Stainless steel
Flow tube	316 Stainless Steel as standard Alternative – Boroscilicate glass
Seals	Viton™ as standard Alternative – Nitrile, EPDM, Silicone, Kalrez®
Other Non-Wetted Materials:	
Housing	Aluminium extrusion
End Caps	ABS/PC
Mounting bracket	ABS/PC
External elastomeric seals	PTE

7. Interface Software Features

Password Protectable	Use security PIN to lock configuration inputs
Display Configuration	Selectable units, scaling, cut off flow and display filter
Flow Switches	Via NPN PNP and Relay
Remote Control	Via NPN PNP; • Power cycle meter • Reset Totaliser • Batch Control of Relay • Reset Latched alarm •
Output Simulated Testing	Test output signals from pulse and analog to aid set up and installation
Ultrasonic Signal Strength indicator	Allows user to check if ultrasonic signal is strong enough and in the correct position for stable accurate measurement
Speed of Sound Adjustment	Adjust window of measurement position for best signal
Adjustable K-factor	Set the pulse per litre appropriate for the system
Datalogging of all meter output parameters	Via USB connected PC
Software-based flow indicator	Displays flow and I/O status of configuration and meter
Multiple meter configuration	Multiple meters can be USB connected to Titan Interface Software

8. Troubleshooting

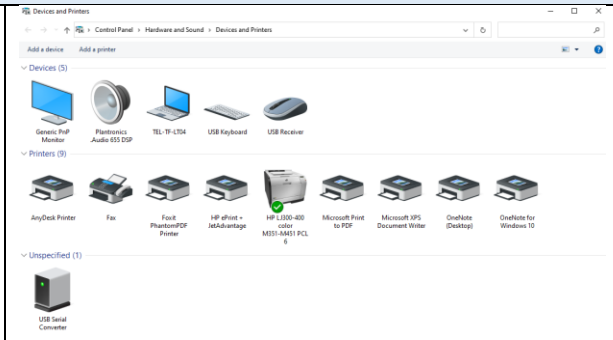
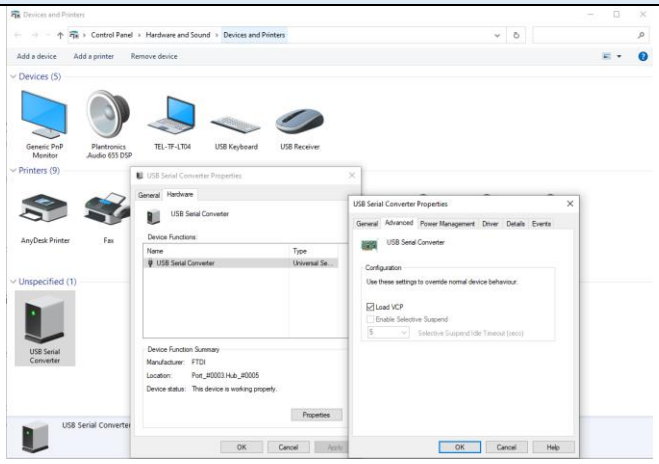
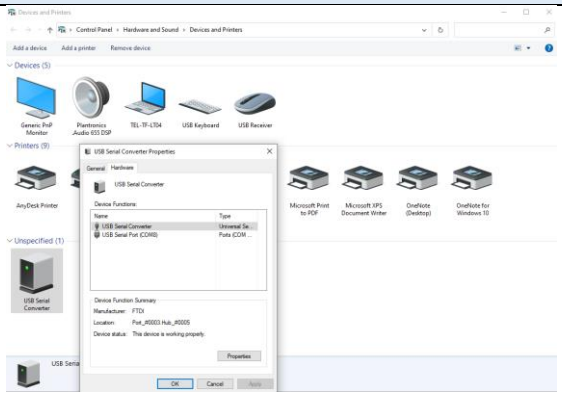
Symptom	Cause	Solution
No LCD Display	Power supply too low	Ensure >10VDC supply connected
LCD stays displaying u 3-01 or 3.2.38 or similar	Failure of unit to boot main Operating System Disconnected PCB to display	Disconnect power and USB If restart fails to resolve PCB requires replacement Contact Titan Enterprises
"FLUID" shown on LCD Display on meter or in Titan Interface Software	No fluid in the meter	Check meter for fluid supply
	Fluid back pressure too low	Increase Back pressure on meter
	Damage to internals of meter	Contact Titan Enterprises
	***NOTE:** For low signal fluids the Limit Gain can be unticked on the Advanced Tab.*	
Erratic/incorrect flow reading And/or loss of accurate flow at top end of meter flow range	Signal too weak	Check Advanced Tab for signal strength
	Back Pressure too low for adequate signal	Increase Back Pressure to 500mbar + 2.x.vapour pressure of the liquid
	Gas in flow meter	Increase flow to purge line Ensure position optimum for ensuring no gas can be entrained in the flowmeter
Erratic or cycling flow rates at constant liquid flow	Pulsating flow causing aliasing of the flow meter sampling in relation to the flow pulsation	Remove or Dampen pulsation to below 10Hz
Noisy flow reading at low flow	Gas in flow meter	Increase flow to purge line Ensure position optimum for ensuring no gas can be entrained in the flowmeter
Total or Batch Flow continues to rise even though no flow through the meter	Background noise is giving a small flow signal to the meter	Increase the Cut Off setting to ensure any noise-induced signals are set to zero flow
Flow reading incorrect after period of shut down	Flow Signal incorrectly positioned due to air in meter or background noise	Reset the meter - power cycle Ensure the Limit Gain is checked on the Advance Tab
	Gas lock in pipe	Purge line with high flow and restart meter Ensure the Limit Gain is checked on the Advance Tab

Calibration incorrect	Zero set at wrong temperature (Metraflow® ultrasonic flowmeter only)	Remove Null by power cycling meter or using Titan Interface Software
Calibration incorrect at start up After minutes of operation, system corrects itself	Speed of sound of fluid significantly faster/slower than water	Check signal using Titan Interface Software and manually adjust to ensure meter starts up looking in correct time window.
No Pulse Output on wire but output showing on Interface Software	Incorrect wiring	Check Pull-Up or Pull-Down resistor are wired correctly according to the diagrams in the manual
No Pulse Output on output or showing on Titan Interface Software	Reverse flow	Check Settings installation If reverse flow is required to give a pulse output, check the Decrease Total for -ve Flow box in the User Settings If orientated in reverse flow direction set the Scale Factor to a Negative number
No Analog Output	Incorrect configuration	Check that the correct configuration and wiring is used. Ensure Values in the range boxes are adequate for the flow being measured
	Indicated “Fault” in Value column of Flow Details Tab of Interface Software when using 4-20mA.	4-20mA circuit broken Check wiring
	Indicated in “No Power” in Value column of Flow Details Tab of Interface Software.	Check power wiring to meter To function correctly >15VDC
	Component Failure on PCB Note: +V into the V analog output will cause it to fail	Return to Titan Enterprises for repair
Analog Output incorrect	Voltage too low	Increase power to meter to >15VDC
	Settings incorrect for Range	Use Titan Interface Software to range the analog output flow min and max points
ASCII not being seen/sent	ASCII Streaming not enabled	Power cycle the device and/or connect Titan Interface Software and exit program before disconnecting unit.

	VPN not set up correctly on receiving device	Set up VPN – See Section 4 ASCII Data Stream via USB
Titan Interface Software opens but shows not connected to meter (no spinning bars in bottom left of screen)	Two windows of the Interface Software are open and second window is masking connected window	Either drag window out of the way or close second window using task bar
	Damage to USB Connection	Return to Titan Enterprises for repair
Titan Interface Software is not showing all Tabs (User Settings; Flow Details; Advanced; Datalogging)	Software is placing the tab window outside the monitor area	Go to View on the top bar menu and click Restore Defaults. This restores the viewing defaults and re-docks all tabs to the main window
Moisture in Display Window	Condensation or water in the flowmeter	Dry unit before use Extensive water contamination will cause multiple errors on the device and will require repair by Titan Enterprises
Leak from end of the body of meter	Poor seal on inlet/outlet	Correct seal
	Housing damage on polymer end caps leading to internals leaking	If damage is seen, return unit to Titan Enterprises for repair and recalibration

9. Appendices

9.1. Setting serial port to enable VCP on Windows PC

Open Control Panel Devices and Printers on your PC	
Plug in the ASCII Streaming device and identify the New Device	
Highlight and Right Mouse Click to Access Properties	
In Advanced Tab enable VCP	
Disconnect and Re-Connect the USB to the ASCII Streaming Device	
Find and open Device Properties and look to Hardware to identify the COM Port Value. E.g. COM8	
If required, test the Streaming using the included program ASCII_Test.exe	

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