EASZ-1 Standard Range

Water In Oil Monitor

Installation and Operating Manual

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ATEX / IECEx / CSA INSTRUCTION MANUAL Water In Oil Monitor

Hazardous Area Versions

Safety Precautions (Hazardous Area Versions)

- ✓ You must carefully read all the instructions in this manual. You must not start the installation before taking these instructions into account.
- ✓ This equipment might receive some hazardous voltages. If you do not consider taking these instructions seriously, you may risk facing serious injuries.
- ✓ Before setting up your installation, check the model suits your application. The wiring of this equipment must comply with regulations and be executed by qualified personnel.

Start up Instructions (Hazardous Area Versions)

- FUNCTION: The EASZ-1 Water In Oil Monitor (Water-Cut / BS&W) is aimed at measuring water content in hydrocarbon liquids. The equipment delivers a 4-20 mA signal proportional to the measured water content.
- ATEX MARKING MEANING AND ATEX INSTALLATION ZONES: refer to the following page
- INSTALLATION

✓ Location: This equipment can be installed in defined explosive atmospheres and is in compliance with the 94/9/EC ATEX directive. The surface temperature must not exceed that indicated by the label.

✓ Fixing and mounting: The housing must be protected against mechanical shocks. No drilling or machining must be done. Make sure the cable gland is appropriately tightened and make a loop with your cable to avoid running water alongside. If you do not take these precautions into account, the envelope certification will be at risk and the ingress of protection of the housing might be invalidated.

✓ Electrical wiring: Electrical wiring must be executed when DE-ENERGIZED after mounting and fixing the instrument. Electrical wiring must be executed with respect to sound engineering practices and enforced norms. Cables must be of the shielded type. In order to guarantee a perfect tightness, the cable gland should be screwed with an appropriate spanner. Terminal wiring is designed for 1.5mm² wires.

✓ Cable paths: The type and the path of cables (I.S. cables) must comply with regulations. Careful precautions must be taken to avoid electromagnetic coupling with other cables capable of causing hazardous voltages or currents. Cables and wires must be protected against any damage.

✓ Specials conditions for a safe use: refer to the following pages.

✓ SETTING: Setup can be done using the serial link cable or using a HART interface. Setup using the serial cable is only to be done in safe zone. HART can be used in hazardous areas provided a HART terminal with appropriate certification is used.

Maintenance (Hazardous Area Versions)

- Precautions to be observed during maintenance.

✓ The dismantling of the equipment must be executed when DE-ENERGIZED.

✓ **EESIFLO** guarantees the certification of the equipment Ex-Works. Any operation other than software changes will rule out **EESIFLO**'s responsibility in case of failure. If a fault is suspected or observed, the equipment must be checked / repaired only by authorized personnel or returned to our service department.

CONTACT US

- Updated EC type Examination Certificates can be obtained by contacting us at www.eesiflo.com

ATEX - Details (Hazardous Area Versions)

- ATEX CERTIFIED INSTRUMENT
  Ex ia I/IIB T4(-20°C < Ta + < +60°C) 2575 I M1/II 1G
- MARKING DETAILS

Manufacturer	EESIFLO International Pte Ltd 60 Kaki Bukit Place #02-19 Eunos Techpark Singapore 415979
Instrument type	EASZ-1 Water in Oil Monitor
ATEX protection	Intrinsic safety (according to EN 50014 – 50020)
Housing protection	IP 66 to EN 60529
EC examination type	ITS06ATEX25406X
Marking	Ex ia I/IIB T4 (-20°C< Ta + < +60°C) CE 2575 Ex I M1/II 1G
For zones	0/1/2 for gas of groups: IIB (according to EN60079-10)
Equipment category	Surface temperature 135°C (T4) at ambient

Special Conditions For Safe Use (Hazardous Area Versions)

Hazardous Area Versions must only be connected to intrinsically safe certified equipment. This association must be compatible to the intrinsic safety rules. The electrical parameters of this equipment must not exceed the values indicated in the "Electrical Parameters" table.

Electrical parameters	
Ui (V)	≤ 28 V
Ii (mA)	≤ 93 mA
Pi (W)	≤ 0.66 W
Ci	237 µF (at 7.2Vdc) or 110 nF (at 28Vdc)
Li	0 µH

The ambient temperature of use must never be outside the range of class T4 (-20°C < Ta + < +60°C)
The surface temperature of the device (indicated on the device) must never be exceeded. This temperature must take into account both ambient and fluid temperatures. The installation of equipment in zone 0 must comply with the EN 60079-14 norm and, in particular § 12.
The electrical connection of Water in Oil Monitors with output cable must comply with the EN 50020 (1994) norm and, in particular § 6.1.

Particular Recommendations (Hazardous Area Versions)

Make sure the cable gland is appropriately tightened. If you do not take these precautions into account, the envelope certification would be put at risk, and the index of protection of the housing might be compromised.
The EASZ-1 shall not be used with Zener barriers. Only IS barriers of the isolator/galvanic type shall be used.

Before Installing Your EASZ-1

- 99% of all problems with your EASZ-1 will result from incorrect wiring.
- The EASZ-1 must be installed on an isolated 4-20 mA current loop.
- If your wiring is grounded or shared with any other device, your **EASZ-1 WILL NOT WORK.**
- The recommended wiring for the EASZ-1 begins on page 14 of this manual.
- If you have any questions, please contact **EESIFLO** before beginning your installation.

Read Me First

EESIFLO throughout this manual shall not be held liable for technical or editorial errors or omissions in this manual.

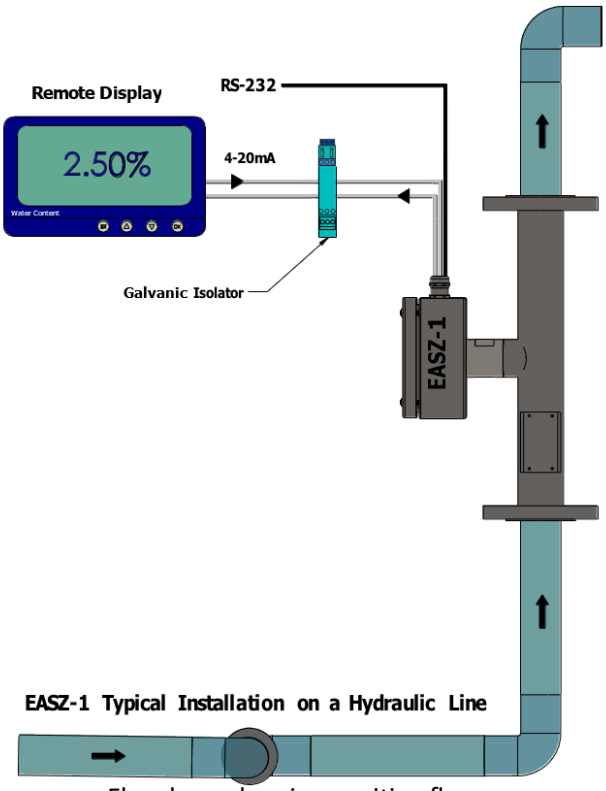
EESIFLO makes no warranties other than those detailed below, express or implied, including the implied warranties of merchantability and fitness for a particular purpose with respect to this manual and, in no event, shall **EESIFLO** be liable for any special or consequential damages including, but not limited to, loss of production, loss of profits, etc.

The contents of this manual are presented for educational purposes only, and while every effort has been made to ensure accuracy, these instructions are not to be construed as warranties or guarantees, expressed or implied, regarding the products or services described herein or their use or applicability.

EESIFLO reserves the right to modify or improve the designs or specifications of our products at any time. **EESIFLO** does not assume responsibility for the selection, use or maintenance of any product, which remains the sole responsibility of the purchaser and end-user.

Introduction to EASZ-1

The **EASZ-1** is an Online Water in Oil Monitor which has been designed to fit in a piping system and to measure the water content in an oil when there is a positive flow. The measurement works correctly only with a positive flow, unlike a laboratory instrument that will measure the water content of oil in a static condition. All wet calibrations of the instrument must be conducted while liquid is flowing through the unit and the liquid must be well-mixed.



Flow loop showing positive flow.

There are several reasons why the EASZ-1 requires a minimum flow to operate. Although it is capable of giving a reading in a static condition (no flow) it is important to understand that oil and water separate very quickly, and this separation may cause errors in the measurement. Water and oil do not easily mix but they begin to mix in a flowing stream, especially when they have to go through or around obstacles or if energy is applied. It is the responsibility of the user to ensure that the water and oil are well mixed in the pipe to obtain best results.

General Specifications

Operating Principle
Dielectric Constant/ Capacitance
Supply Voltage
12…24 V DC, 2 Wire Loop-Powered
Power Consumption
0.66 Watts
Output/Digital Protocol
4…20mA, HART
RS232 Full Duplex
Compatible with Universal HART®
Setup and Calibration
EASZ-1 GUI Software for Windows® PC
Connection Via USB-RS232 Comm. Cable (Optional: HART Modem Cable)
Typical Accuracy

Parameters	Low Range		Mid Range	High Range	Full Range
Measuring range	0…5%	0…25%	0… Inversion	80…100%	**0…100%**
Accuracy	**± 0.02**	**± 0.03**	**± 0.50**	**± 0.2**	**See EASZ-2**

*Values are typical and do not represent every situation.
Electronics Enclosure
Stainless Steel 316, IP66
Ambient Temperature
-20°C…60°C (-4°F…140°F)
Response Time
1 second nominal (no averaging applied)
1…20 second programmable averaging time
Start-Up Time
≤ 20 Seconds
Remote Display
Panel or Field Type (galvanically isolated)
Process Temperature
Up to 130°C (266°F)
Process Pressure
Up to 100 Bar (1,450 Psi), higher pressure consult EESIFLO with process information.
Connection Size
DN25…DN600 (1" Inch…24" Inch), larger sizes consult EESIFLO with process information.
Process Connection
NPT, BSP, ANSI flanges, PN flanges, JIS flanges
Body & Sensing Element Construction Material
Stainless Steel 316/316L (Standard), NACE Compliant.
Optional Duplex, Monel, Hastelloy and more upon request
Seals and Spacers
Teflon and Polyether Ether Ketone (PEEK)
Installation
Inline or bypass setup, (Optional: integral with dual element static mixer)
Approvals
Intrinsic Safety (IS) ATEX, IECEx, CSA
CE Mark

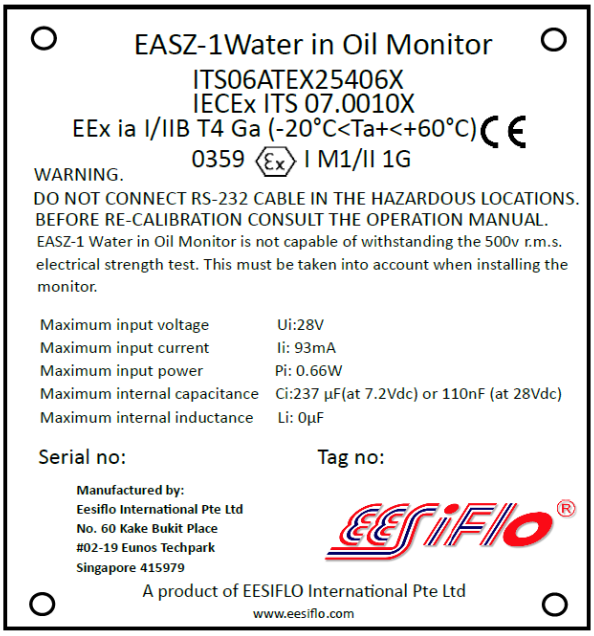
ATEX SPECIFICATION (Standard Range Unit)

EASZ-1	**Ex Version Only**	
Production	II 1 G Ex ia	ITS06ATEX25406x/4
Certificate	Detailed when certification officially provided	
Power Supply	2 wire 24Vdc	

Data Plates

The information on the data plates must always be clearly visible at all times. Data plates must be protected from any damage. In the event of damage, the Ex-certification will be compromised, immediately contact the manufacturer to coordinate and authorize repairs.

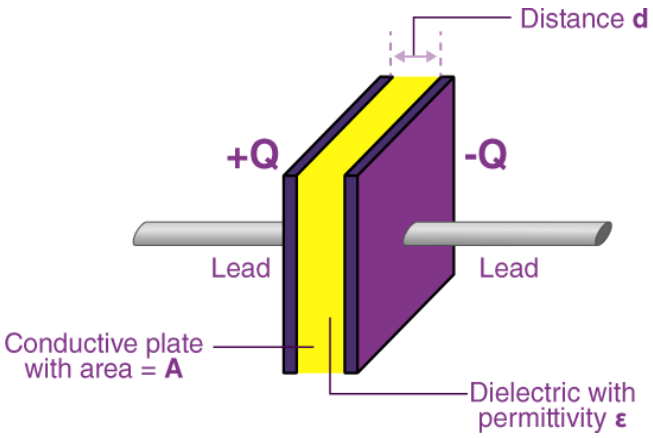
Data plates will be updated to comply with any certification updates or additions.



The data plates clearly describe the product type, serial number, manufacturer, and information in regard to electrical safety for hazardous area applications. If the unit is not being used in a hazardous area, the information will be more general.

Basic Principle of Measurement

The EASZ-1 measurement units are in in picofarads (pF) A picofarad is a unit used to measure capacitance i.e., the ability of a system to store an electric charge.

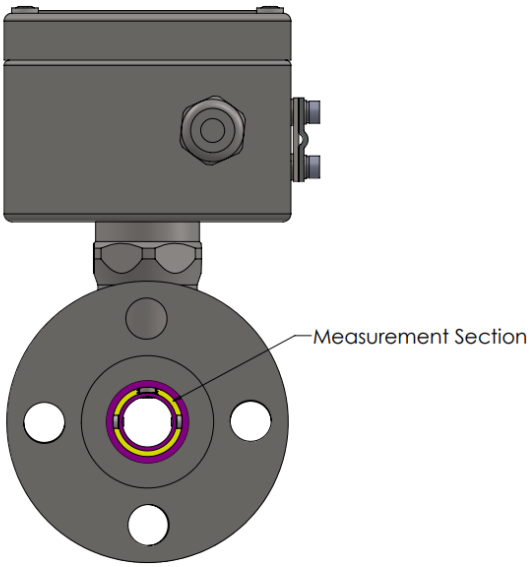


Measurement of Capacitance between 2 plates

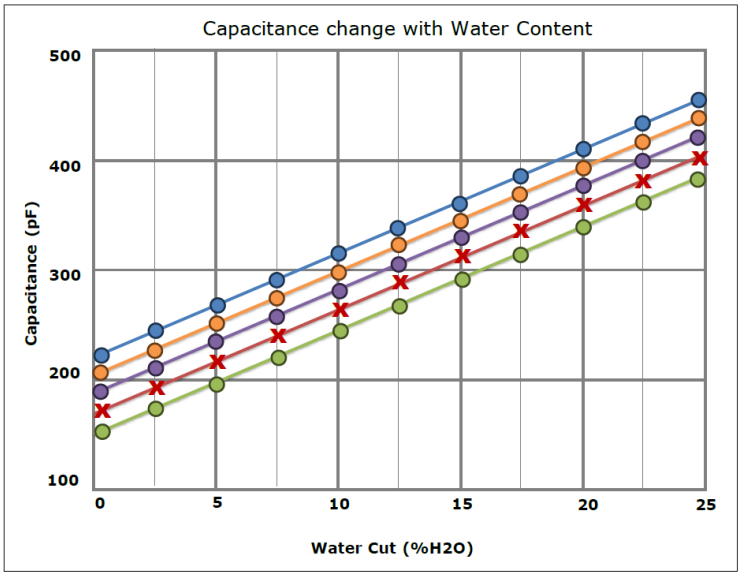
Instead of measuring the capacitance between 2 plates, the EASZ-1 is measuring the capacitance between 2 pipes. The mechanical measurement section consists of 2 pipes, an inner and outer pipe.

The EASZ-1 measures the ability of the liquid to store energy while passing through these 2 pipes.

Measurement of Capacitance between two pipes



Typical Measurement Scenario (Low Range Unit only)



Graph showing a Picofarad (pF) Increase in oils of differing density as water content increases (1-inch EASZ-1)

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a. Capacitance: 179.8pF H2O: 0%
b. Capacitance: 185.3pF H2O: 1%
c. Capacitance: 190.9pF H2O: 2%
d. Capacitance: 196.7pF H2O: 3%
e. Capacitance: 202.6pF H2O: 4%
f. Capacitance: 208.7pF H2O: 5%
g. Capacitance: 215.0pF H2O: 6%
h. Capacitance: 221.5pF H2O: 7%
i. Capacitance: 228.1pF H2O: 8%
j. Capacitance: 235.0pF H2O: 9%
k. Capacitance: 242.0pF H2O: 10%
l. Capacitance: 256.9pF H2O: 12%
m. Capacitance: 280.9pF H2O: 15%
n. Capacitance: 307.0pF H2O: 18%
o. Capacitance: 335.6pF H2O: 21%
p. Capacitance: 366.9pF H2O: 24%
q. Capacitance: 377.9pF H2O: 25%
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Lookup Table in EASZ-1 pF to H2O %

The EASZ-1 is not limited to measuring only water in oil. It is a device that can measure the concentration of one type of liquid in another. However, there must be a very big difference in the dielectric constant of the liquids in order for a meaningful measurement. In the case of most oils, we see that the dielectric constant is around 2 while the dielectric constant of water is about 80 at room temperature.

Liquid Type	Dielectric Constant (DC) @20 °C
Benzene	2.28
Diesel	2.1 to 2.4
Petroleum	2.1 to 2.4
Crude Oil	2.1 to 2.4
Coconut (Refined)	2.9
Kerosene	1.8
Naptha	2.5
Palm Seed Oil	1.8
Xylene	2.0

If the above low dielectric liquids have water added to them, there will be a significant increase in the picofarad readings. It only takes a small increase in water content to see the change. The EASZ-1 has not been designed to measure concentrations of water in liquids that possess a high dielectric constant e.g., Methanol- which has a dielectric constant of 33. For measurements of water content in higher dielectric constant liquids, contact **EESIFLO**.

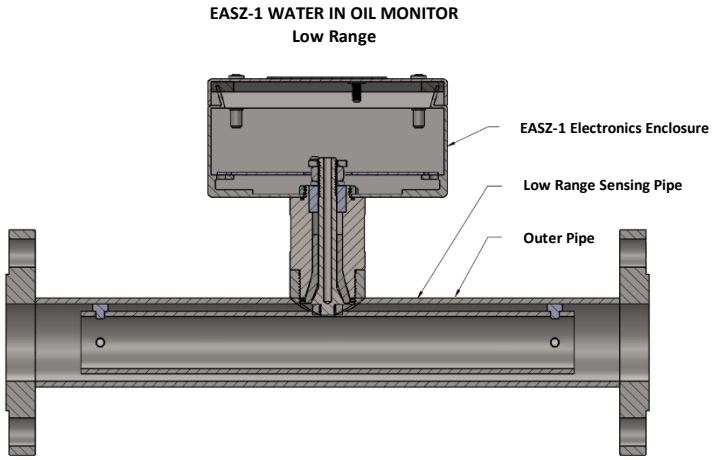
Standard Range vs High Range

The most common applications for the EASZ-1 are in the range of 0-25%. If you have a requirement for high range version of this product, you will need to request for a high range unit. There are mechanical differences between the two.

The EASZ-1 is available in two hardware configurations to accommodate the most common water content scenarios. A Standard Range EASZ-1 will measure total water content from 0 to 25% and an optional High Range EASZ-1 will measure total water content in higher ranges. These physical differences are referred to as Hardware Ranges and can be recognized by looking inside the sensing chamber of the EASZ-1 and examining the sensing element.

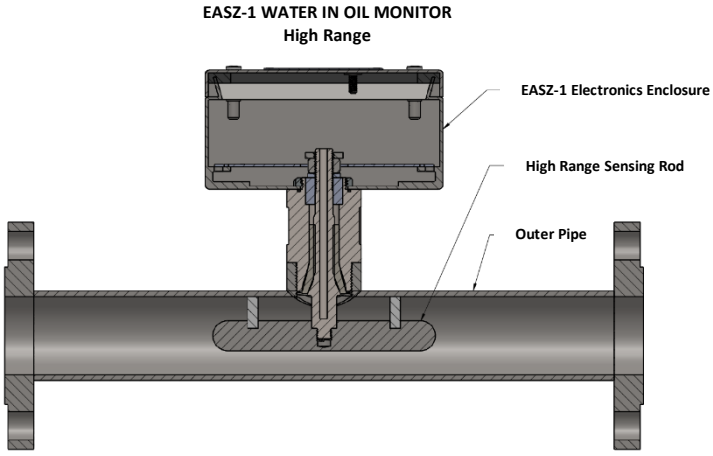
Standard Range EASZ-1

A Standard Range EASZ-1 is manufactured as a "pipe within a pipe" and can be easily recognized by looking inside the sensor. If your EASZ-1 looks like a pipe suspended within a larger pipe, you're looking at a Standard Range EASZ-1, capable of accurate measurements from 0 to 25% total water content.

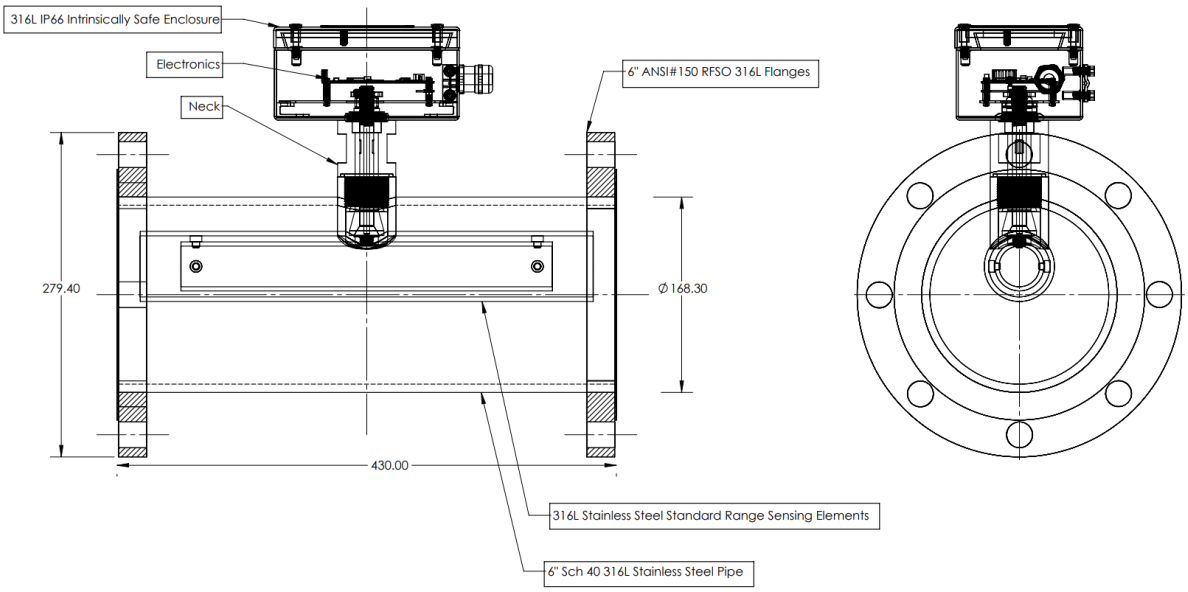


High Range EASZ-1

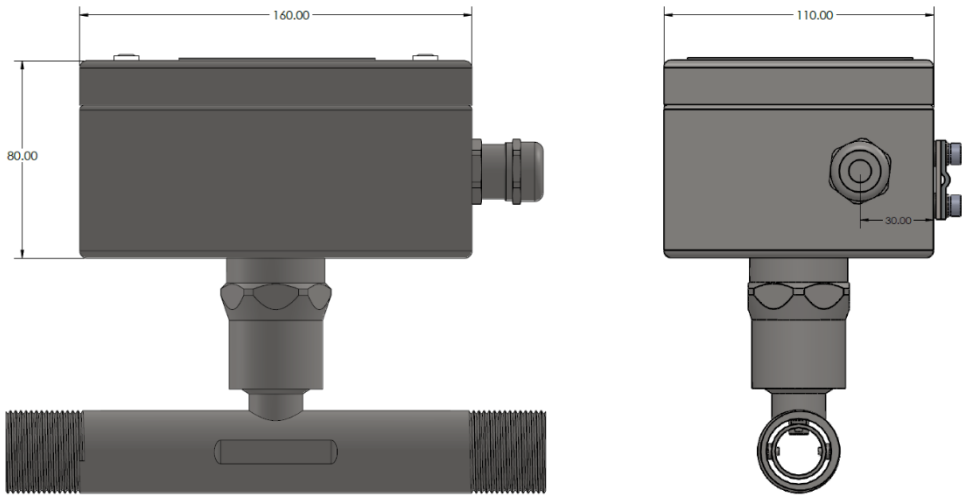
High Range EASZ-1's are manufactured as a "rod within a pipe", and can be recognized by looking inside the sensor. If the inner sensor is a solid rod, you're looking at a High Range EASZ-1 which is capable of measuring all water content in higher ranges.



INSTRUMENT OVERVIEW



DIMENSIONS



* The dimensions of mechanical pipe sections will vary according to process installation requirements. Refer to “as built” drawings on each order.

HANDLING

The EASZ-1 is supplied as a complete working instrument and its main parts should never be dismantled for any reason. In order to protect the instrument from damage, the operators who are installing the monitor should avoid doing the following:

- When lifting or moving the unit, the operator should never lift the unit by the enclosure or neck. This could put too much stress on the enclosure or neck and could damage the instrument. It is better to lift the unit by attaching lifting devices to the main body or flanges.
- Avoid unscrewing or dismantling the neck portion of the device. If for some reason these parts have been dismantled, it will be necessary to rebuild the neck portion with new seals. These new seals must be ordered from EESIFLO.

WIRING

The EESIFLO EASZ-1 Water in Oil Monitor is a loop powered device. It runs on the power in the 4-20mA current loop. For hazardous area applications, it is important to make sure whatever device is powering the loop is appropriate for the hazardous area in question.

The 2 wire current loop is connected to the EASZ-1 Water in Oil monitor terminal J1.

Terminal	Description
1	Current loop +
2	Current loop -

MAKE SURE POLARITY IS CORRECT!

Grounding Your Plumbing

The EASZ-1 is an extremely accurate device capable of sensing capacitance in the picofarad (pf) range. Very small changes in the electrical disturbances in your entire installation will cause unwanted fluctuations in sensor readings. It is essential you understand how to recognize and eliminate this instability before it affects your readings.

Each EASZ-1 installation should be considered as two unique electrical components; the EASZ-1 sensor itself, and the plumbing to which it is attached. As long as the EASZ-1 is wired to the 24 VDC incorporating a galvanically isolated 4-20mA current loop as indicated elsewhere in this manual, it will provide you with reliable stable results.

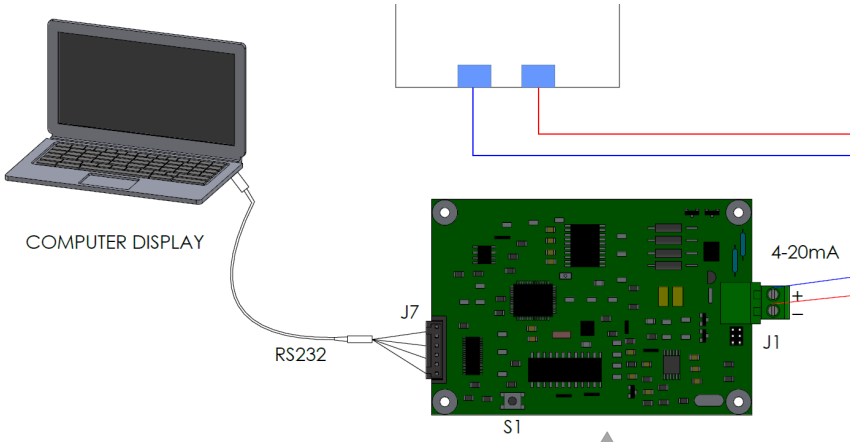
Experience has shown that on occasions, improper grounded piping or conduits into which the EASZ-1 is installed will cause unwanted electrical energy to slowly accumulate in the piping, thereby causing the EASZ-1 signal to slowly rise over time. If your signal increases from what you believe is a reliable value, to the maximum of 20 mA over an extended period of time, it is very likely that your plumbing is accumulating energy, which is causing the output signal to slowly rise. The solution to this problem is grounding your plumbing, thereby dissipating the accumulated energy into the local ground and returning the EASZ-1 signal to normal levels.

If your water data is increasing for no apparent reason, it is highly recommended that a permanent ground wire be run from the piping to a permanent and proper earthed facility.

J7- RS-232 CONNECTOR

Connector is to be used with supplied cable only and will provide a terminal interface via RS-232.

NOTE: THE RS-232 INTERFACE IS NOT TO BE USED IN HAZARDOUS AREAS WITHOUT APPROPRIATE WORK PERMITS AS USAGE WILL NOT BE INTRINSIC SAFE!

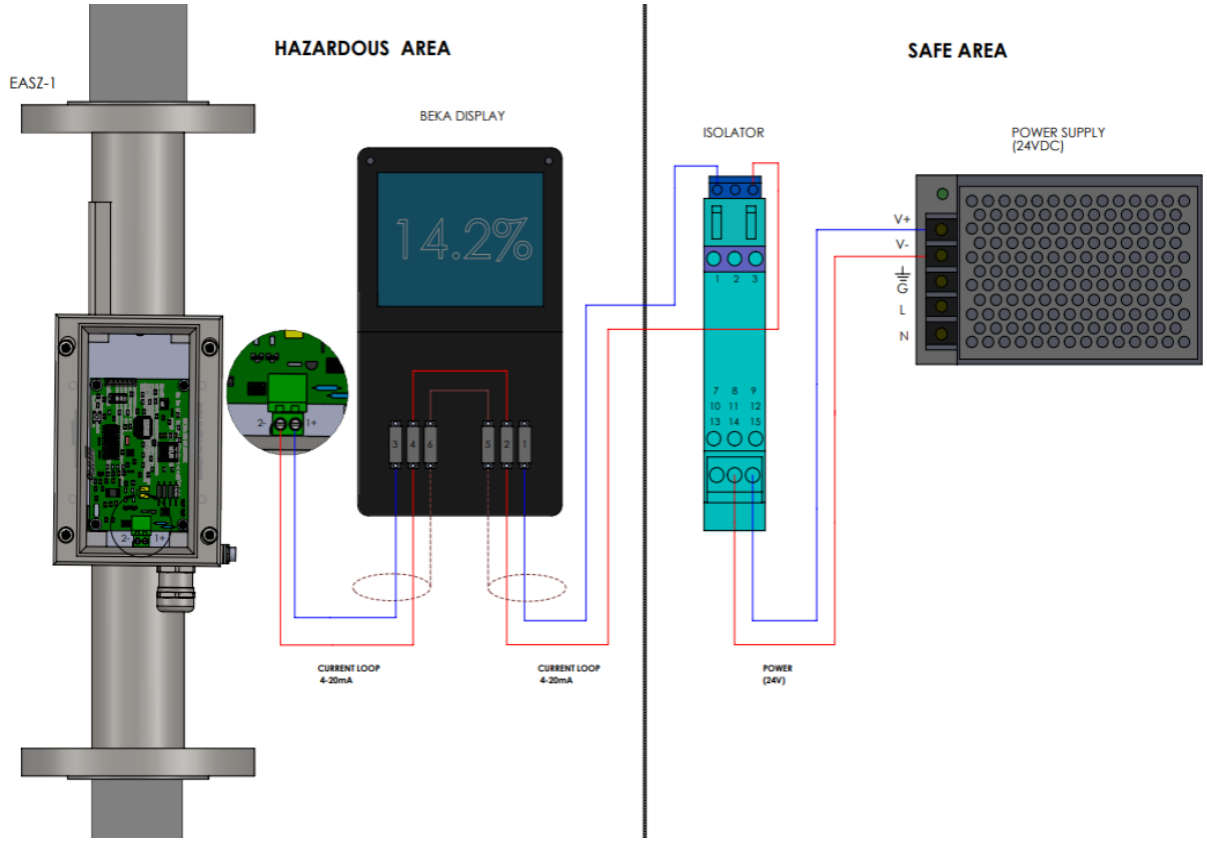


CABLE PATHS

Cables entering the unit via glands must not be mechanically stressed and must be properly fixed.

When running cables to or from the unit in cable paths, precaution must be taken to avoid electromagnetic interference.

Coupling with other cables is capable of causing hazardous voltages or currents. All cable runs must be protected against any damage.



INTRINSIC SAFE ISOLATOR–CONNECTION (Pepperl+Fuchs)

We supply the P&F model KFDO-SCS-EX1.55 for these applications. If you wish to use other brands or model numbers, you will need to check with EESIFLO on their suitability.

INTRINSIC SAFE LOCAL DISPLAY AND OUTPUT (Beka & Associates)

A Beka display is often supplied as a local indicator for hazardous areas using the same loop power.

GROUNDING/ ISOLATION

Warning: The current loop MUST BE FLOATING! A grounded or badly isolated loop will cause damage to the EASZ-1 Electronics!

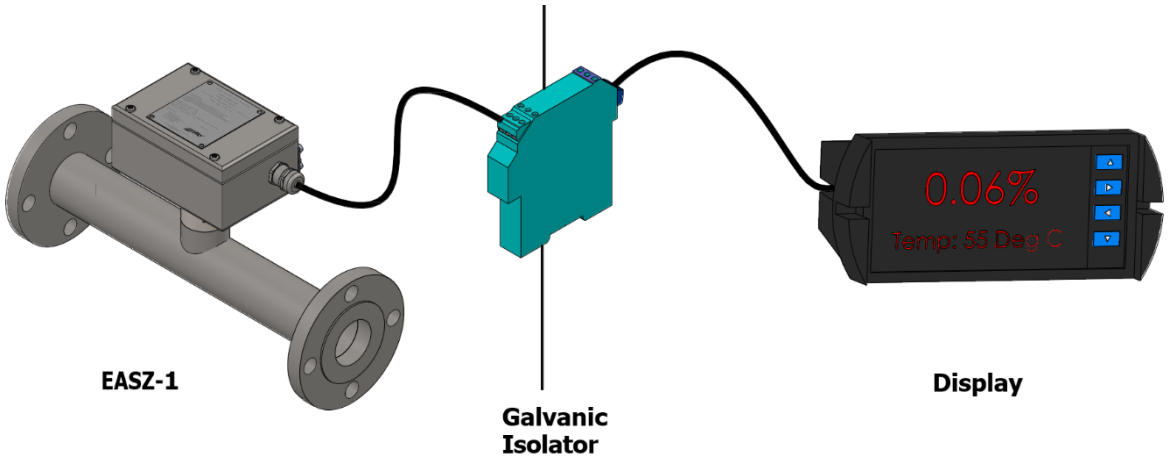
Always protect the EASZ-1 from electrical damage or erroneous readings by making sure you understand good electrical practices.

If you are using the EASZ-1 in a non-hazardous application, the power/signal loop should be galvanically isolated unless the EASZ-1 and remote device are sharing the same local ground.

Galvanic isolation is used where two or more electric circuits must communicate, but their grounds may be at different potentials. It is an effective method of breaking ground loops by preventing unwanted current from flowing between two units sharing a ground conductor. Galvanic isolation is also used for safety, preventing accidental electric shocks.

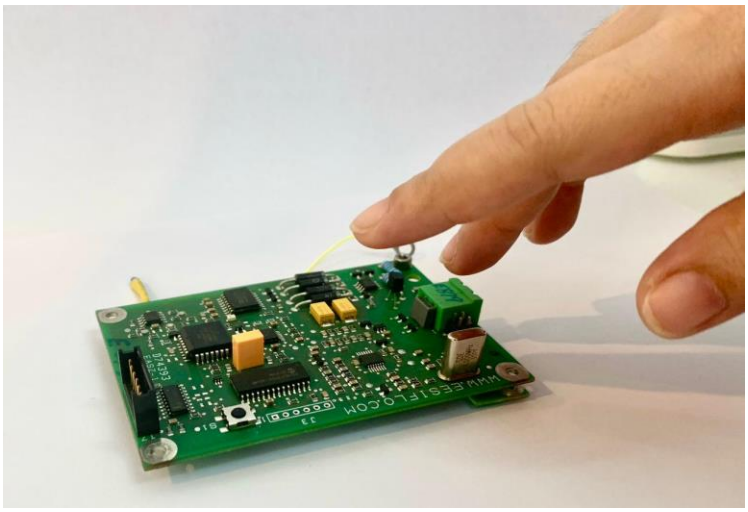
Galvanic Isolator

If the display/ PLC or remote device is not providing galvanic isolation as a standard option, use a galvanic isolator.



STATIC ELECTRICITY

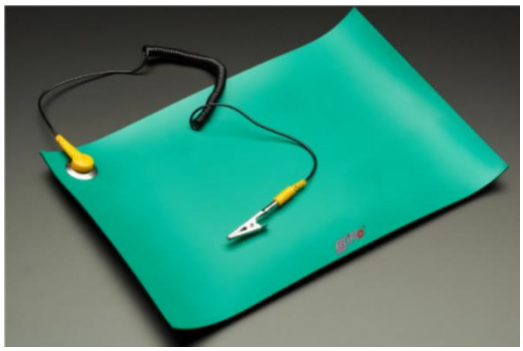
Warning: Static electricity can damage the PCB. If you are configuring the EASZ-1 in a lab or company workspace, always make sure that there is no chance of static being transferred to the board.



Static electricity will damage the board.

To avoid the possibilities of damaging the board, always use an anti-static mat, connected to a ground with an anti-static grounding wire.

EESIFLO does not warranty this product against improper handling. Always ensure that proper electrical handling practices ae followed when doing anything with the PCB. Always keep the PCB in an anti-static bag when not in use.



Grounding mat 1

Grounding mat 2

Anti-static bag

INSTALLATION

WARNING: The design of and the actual installation can only be performed by persons suitably qualified and trained while adhering to national and local standards and regulations.

MOUNTING

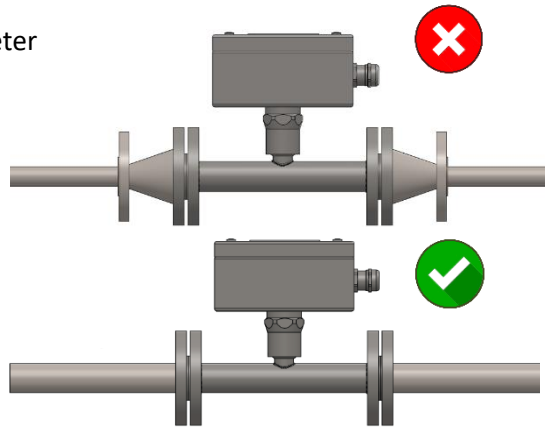
The EASZ-1 can be mounted in either a horizontal or vertical position. It is important to ensure that the pipe is always full of liquid. It is not advisable to mount it in a vertical position where the direction of flow is from up to down.

- When mounting the unit care must be taken to avoid any physical damage and mechanical shocks to the unit. Care must also be taken to avoid any damage to the PCB (See instructions on grounding and static)
- Do NOT turn the Body of the unit against the Sensor Pipe, this connection is factory tested and any damage will invalidate the warranty.
- When installing the unit into an existing pipeline with petroleum products, use protective rubber gloves and protect your face using a safety visor.
- If you have received a version with an integral Pre-mixer it is important to follow the arrow markings on the case to ensure that the unit and mixer are in the same direction as the pipeline flow direction. When used in conjunction with a static mixer ensure a minimum flow rate.

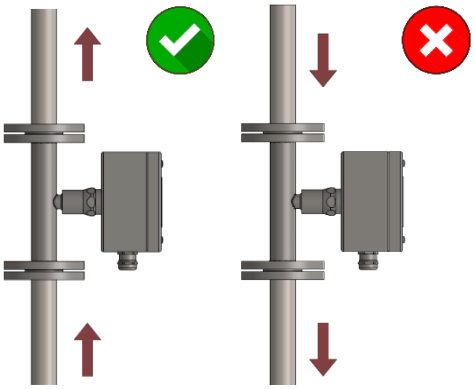
Position

The unit can be installed in either a horizontal or a vertical position to ensure accurate readings:

The sensor pipe must always be full of fluid (the pipeline diameter must not be smaller than the diameter of the sensor pipe and positive pressure must be applied)



When installing the unit in vertical position, the fluid must always flow upwards.



Warning: Never perform arc welding near to the EASZ-1. It will cause permanent damage to the electronics!

Optional: Static Mixer for large pipes

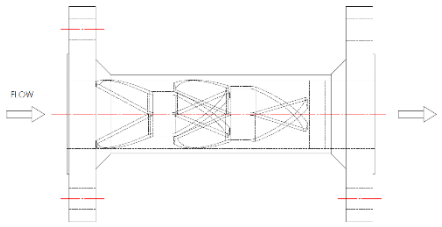
Because of their difference in density, water and oil begin to separate immediately after being mixed, especially in large pipes that do not have bends and disturbance elements upstream of the measurement point. If your mixture is moving along a pipeline in large pipes, the further it gets from the mixing point, the more separated the two constituents become.

Gravitational Separation will often cause the oil travelling along the bottom of the pipe to contain a much higher volume of water than the oil travelling along the top of the pipe.
To improve the level of accuracy, it may be necessary to ensure that effective mixing occurs just prior to entering the EASZ-1.

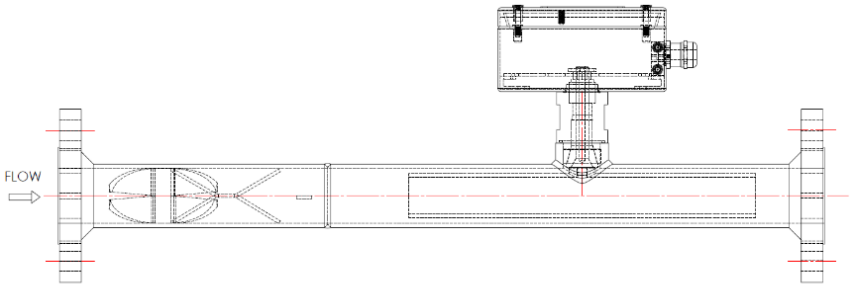
To maximize the accuracy of the EASZ-1, an inline static mixer will ensure the water and oil are mixed into a homogeneous solution prior to passing through the EASZ-1.

If there is any question about the homogeneity of your fluid, an EESiMix Static Mixer can be installed upstream of your EASZ-1 either as a stand-alone EESiMix or as mixing elements integrated into the body of the EASZ-1.

If you are unsure about whether a mixer is necessary, a spool piece can be installed just before the EASZ-1 in case it is determined that inline mixing is essential.
The two configurations of the EESiMix are as follows:



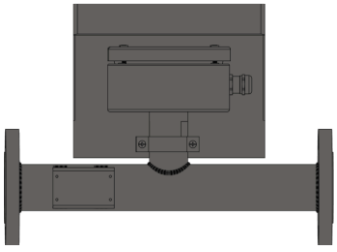
Inline Stand-Alone EESIMIX Static Mixer



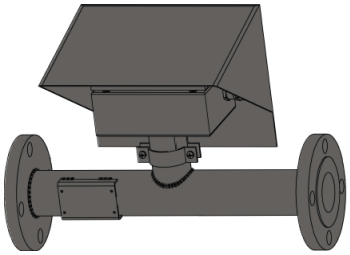
Easz1 with Integral EESIMIX Static Mixer

When deciding where to install the unit also take note:

Never install the unit in direct sunlight or near an intermittent heat source. Use a sunshade to protect the unit from damage if it is installed outdoors.
Install the unit in a location that is easy to access for calibration.



Optional: Thermal insulation box



Optional: sunshade for 2-inch pipe stand

*It is highly recommended to protect the EASZ-1 electronics from extreme temperature swings. In certain cases, it may be necessary to use a thermal insulation option e.g., PU foam encapsulated between GRP layers or some solution that best suits the environmental conditions.

⚠ When using EASZ-1IS, it is important to define the extent of hazardous areas in accordance with national and local standards and define how far these areas extend away from the installed units.

The ambient temperature must never exceed the range -20°C to +60 °C.

The surface temperature of the device (indicated on the device) must never be exceeded: this temperature must take into account both ambient and fluid temperatures.

The Effects of Air, Gas and Chemicals

Your EASZ-1 will produce accurate readings over its entire measurement range unless your oil contains excessive air or gas bubbles, or if chemicals have been added to your oil after calibrating your EASZ-1.

The EASZ-1 assumes that it is always full of fluid. If it is partially filled with air or gas, the water content readings will be reduced because the Dielectric Constant of the Air/Gas is much closer to oil than water. If you suspect that air or gas will be travelling along with your oil, always install your EASZ-1 in a vertical orientation to ensure that air or gas are not trapped inside the EASZ-1.

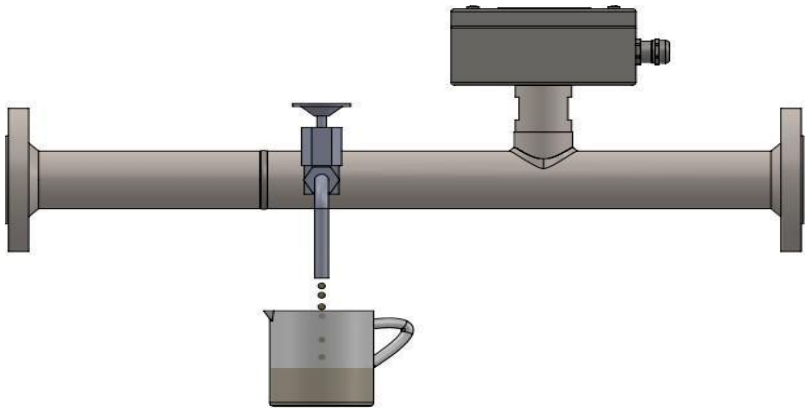
As a precaution, never mount an EASZ-1 directly after a Dump Valve on the outlet of any pressure vessel where the drop in pressure will cause process gases to form inside the EASZ-1. A similar situation exists when an EASZ-1 is installed prior to an automated Divert Valve which is opening and closing, causing the pressure inside the EASZ-1 to rise and fall. This change in pressure is also likely to cause process gases to form inside the EASZ-1, which will tend to lower the water content readings.

Chemicals added to your oil may also alter the accuracy of your readings. Might be necessary to recalibrate your EASZ-1 every time you add new chemicals or after every oil change.

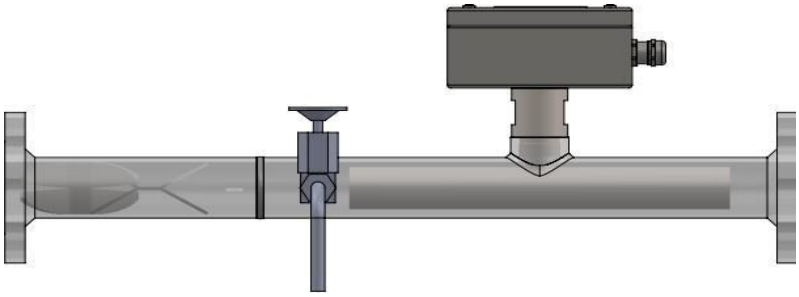
SAMPLING POINT

The sampling point must be located in an area where the sample will reflect the conditions in the pipe i.e a well- mixed fluid sample. It is also important to consider how the sample should be handled so that water does not evaporate during sample handling and transportation. The lab instrument used to measure the water content in oil will also need to be considered for it's accuracy and repeatability.

When designing your installation, a sampling point needs to be included just before the EASZ-1 unit for sampling and calibration purposes.



The sampling point can either be a standard "Tee" piece (threaded or flanged) added to the pipe work by the customer between the mixer (if installed) and the unit, or

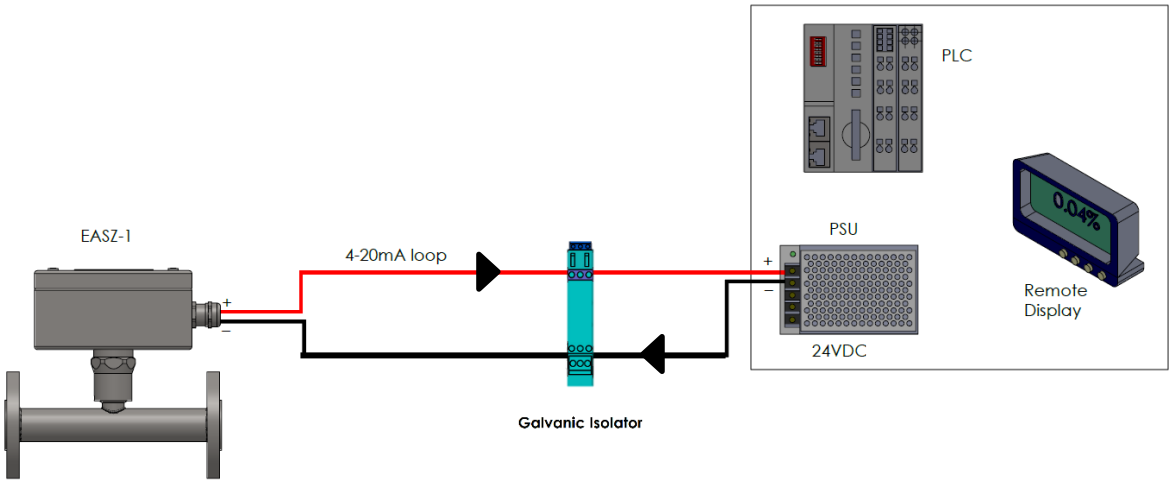


The sampling point can be ordered from EESIFLO factory fitted as a part of the sensor pipe and mixer (if required)

SAFELY CONNECTING TO THE EASZ-1

Ensuring Galvanic Isolation
The electrical connection must comply with local standards and regulations and persons carrying out the work must be appropriately trained and qualified.

To connect the unit correctly follow the instructions:



Before powering up the unit, make sure that any remote device that the EASZ-1 is connected to is galvanically isolated (see grounding/ isolation section.) Failure to properly protect the EASZ-1 electronics can result in catastrophic board failure. If you are using safety isolation barriers for hazardous area applications, then the galvanic isolation is already in place using the recommended P&F or GMI isolators.

CAUTION: If you are using the EASZ-1 in a non-hazardous area and are unsure if the display/PLC/DCS/Smart device providing power is galvanically isolated, then do not proceed with the installation until you are SURE that your power and wiring system are not causing a potential across the connection from the EASZ-1 to the remote device.

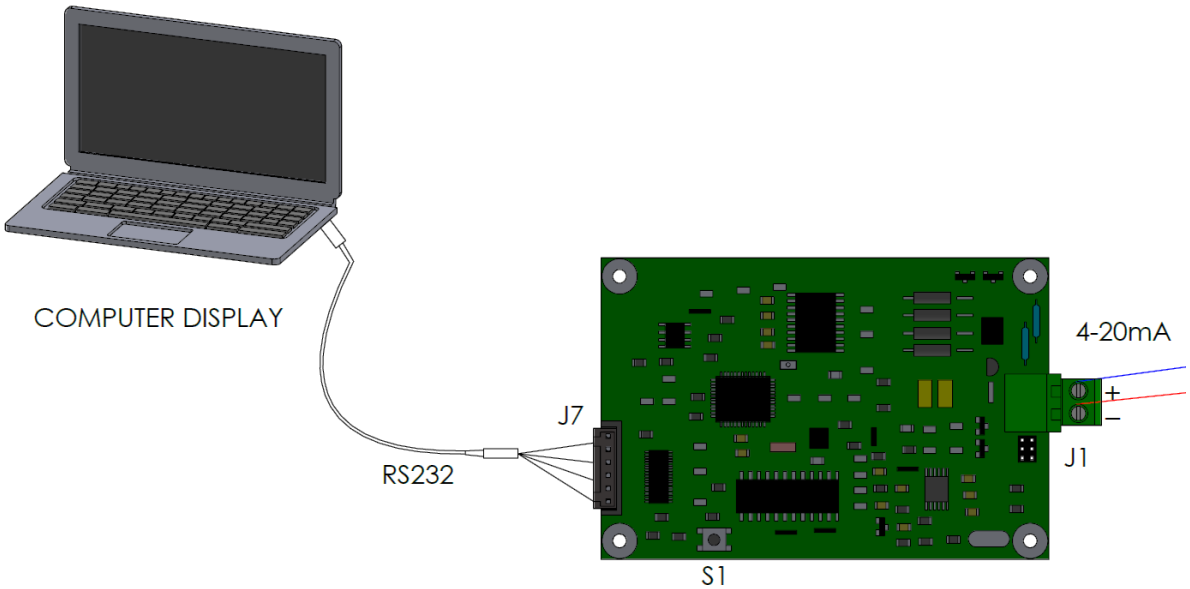
The EASZ-1 is a loop-powered, 2 wire device. The power and signal share the same 2 wires.

How does a 2-wire transmitter work?
As the name suggests, a two-wire transmitter has only two wires. These two wires provide power for the transmitter and also the signal. It is highly recommended that all wiring and set-ups be carried out by qualified and experienced technicians.

RS-232 Communication

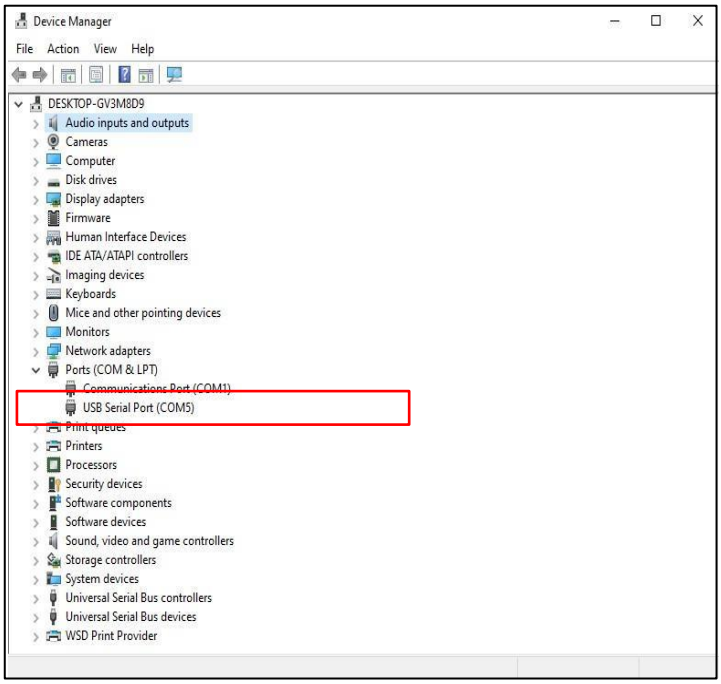
To connect to the EASZ-1 using RS-232 communication, always use the EESIFLO cable to ensure that the correct cable is being used. This cable comes with a USB connector.

1. Before connecting the cables to the EASZ-1, make sure that the EASZ-1 is de-energized (powered off)
2. Make sure that there is no chance of static electricity transfer from personnel to the card. If the EASZ-1 is being tested in a lab or a workshop, ensure that steps have been taken to ground the electronics and prevent any discharge of static electricity to the electronics due to handling. EESIFLO does not warranty this product against mishandling of the unit.
3. Connect the USB cable to the EASZ-1 Card and the ' 'SB port of the Windows PC.
4. Power up the EASZ-1.

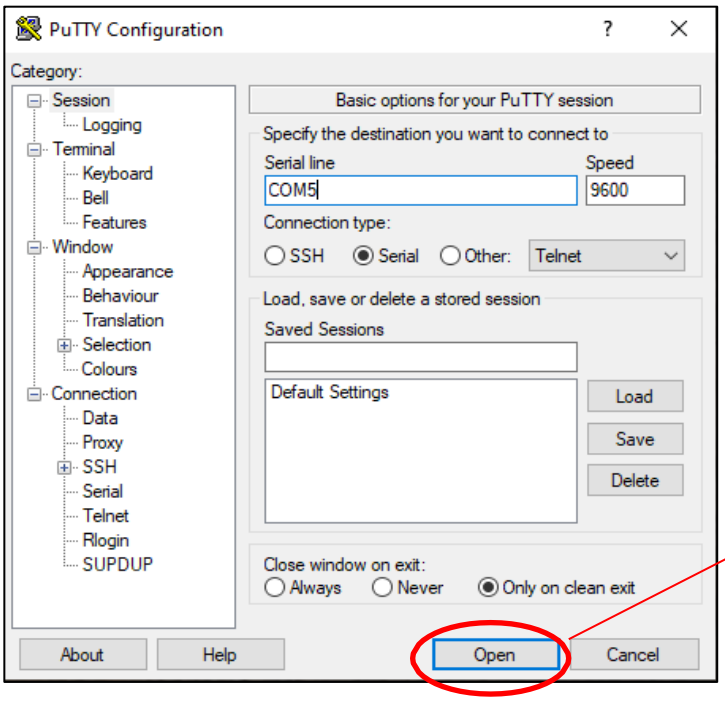


5. Install Putty Software. Choose the installer version which is compatible to your PC e.g., MSI Windows Installer- 64-bit x86. PuTTY is an SSH and telnet client, developed originally by Simon Tatham for the Windows platform. PuTTY is open-source software that is available with source code and is developed and supported by non-OEM sources. Once you have installed Putty Software, run it.

6. Go to the device manager and select the COM port.

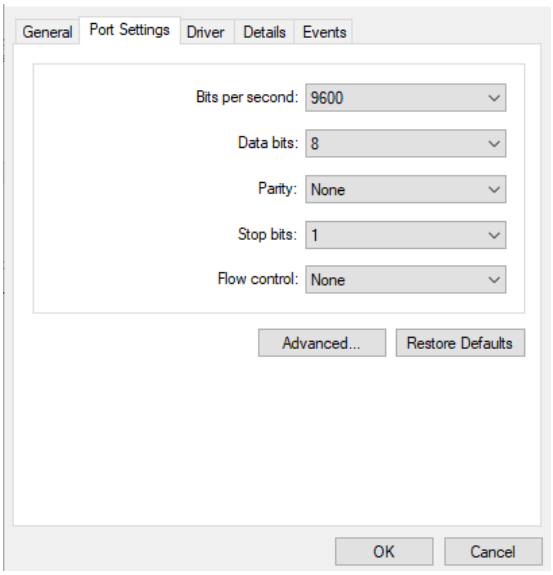


7. Once you select the COM port, go back to the Putty Software. Select “Serial” for connection type then type the serial line e.g. COM5 and click “OPEN”



Click to open Terminal Screen

The default port settings for the EASZ-1 are:



Bits per seconds	9600
Data bits	8
Stop bits	1
Parity	None
Flow Control	None

8. Type Command "**load**".
   If the response is "OK" it means the electronics is functioning.

List of Commands		
get	Provides a terminal output of the latest reading. **C** is the current reading of the capacitance value measurement of the liquid. **H2O** is the water content in percentage of The liquid. **T** is the liquid temperature measured Set "average 1" for faster updates.	Prog. Ver 1.1.10 get C: 89.81pF H2O: 0.98% T: 22.9C OK
list	This command lists the values in the table showing a linear relationship between probe capacitance and the water content. In this case from 0-25%. Only the Zero offset needs to be configured for different oils. This can be done using the calibration procedure for dry oil or for oil with a known water content.	list a. Capacitance: 179.8pF H2O: 0% b. Capacitance: 185.3pF H2O: 1% c. Capacitance: 190.9pF H2O: 2% d. Capacitance: 196.7pF H2O: 3% e. Capacitance: 202.6pF H2O: 4% f. Capacitance: 208.7pF H2O: 5% g. Capacitance: 215.0pF H2O: 6% h. Capacitance: 221.5pF H2O: 7% i. Capacitance: 228.1pF H2O: 8% j. Capacitance: 235.0pF H2O: 9% k. Capacitance: 242.0pF H2O: 10% l. Capacitance: 256.9pF H2O: 12% m. Capacitance: 280.9pF H2O: 15% n. Capacitance: 307.0pF H2O: 18% o. Capacitance: 335.6pF H2O: 21% p. Capacitance: 366.9pF H2O: 24% q. Capacitance: 377.9pF H2O: 25%

load	This command will load the factory default values into the table (required if the list has been corrupted or not correct)	load OK
stat	This command gives information about the current settings. It gives the user a snapshot of the most important settings and is useful for troubleshooting.	stat Calibrated to: 0.00% H2O Maximum range: 25.0% Set loop range: 1.0% Tempco: 1.0000 Saved cap.: 189.90pF Saved temp.: 22.9 C Ref. temp.: 22.9 C Alarm level: high Average over: 20 samples OK
range	This command will scale the 4-20mA output to the desired range. A lower range unit has a range of 0-25. If you type the command “range 25” then 4mA will correspond to 0% water while 20mA will be 25% water. If you type the command “range 10”, the set loop range will be 10 %. If you type the command “range 10” then 4mA will correspond to 0% water while 20mA will be 10% water.	range 10 OK Calibrated to: 0.00% H2O Maximum range: 25.0% Set loop range: 10.0% Tempco: 1.0000 Saved cap.: 189.90 pF Saved temp.: 22.9 C Ref. temp.: 22.9 C Alarm level: high Average over: 20 samples OK
store	Before storing any value, always type the “get” command first to see what the current value is. The store command will tell EASZ-1 to store it’s latest capacitance and temperature measurement as a calibration reference value to prepare for the next procedure which is normally a calibration. Set “average 1” for faster updates.	load OK get C: 280.9pF H2O: 15.00% T: 34.1C OK store Value saved: 280.9pF OK
cal	Typing “cal” will set the percentage value used to match the pF value stored by the previous “store” command. The internal calibration will be offset automatically.	cal 15 used value:280.9pF OK

average	Sets the number of measurements over which a reading is averaged. Example: Average 3 will take 3 measurements before displaying the measurement and give the average for the 3 measurements. Use “average 1” for faster measurement.	average3 OK
log	This command will make the unit send readings continuously over RS-232 at whatever rate is set by the command “average". To terminate logging, please type 'q' and then press Enter. These values can be copy and pasted into a notepad or CSV file to produce an excel spreadsheet of the data.	log 180.57;25.00;34.0; 181.37;25.00;34.0; 180.64;25.00;34.0; 180.42;25.00;34.1; 180.08;25.00;34.0; 181.75;25.00;34.1; 180.56;25.00;34.2;
sal	This sets the current loop alarm level for an out of range value. It can be either high or low, where low is 3.8mA and high is 20.5mA. Default is high.	sal low OK sal high OK
stc	This value sets temperature coefficient. It allows values between 0.51 and 1.99, with a maximum 4 decimal points. Factory Default is 1.0000 To understand this function, refer to the chapter on temperature coefficient procedure.	stc 1 OK

Application Example:
Some of the typical values you will encounter might be as follows:

EASZ-1 1 inch
Oil type: diesel
Empty pipe capacitance: 90pF
Full pipe (containing dry diesel): 180pF

Note: These values will be different for a different sized EASZ-1.

CALIBRATION EXAMPLES:

A Typical Calibration Scenario using RS-232

Zero Calibration

If the EASZ-1 has been installed and the operator is confident that the process oil contains no water, then a Zero calibration can easily be performed.

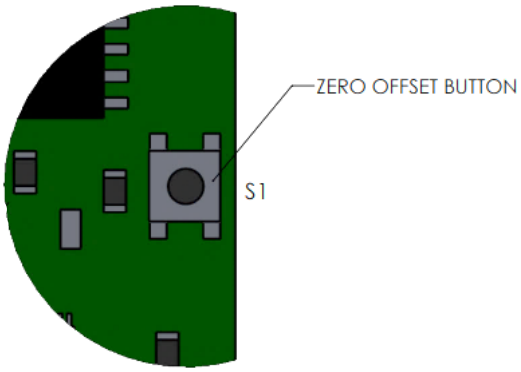
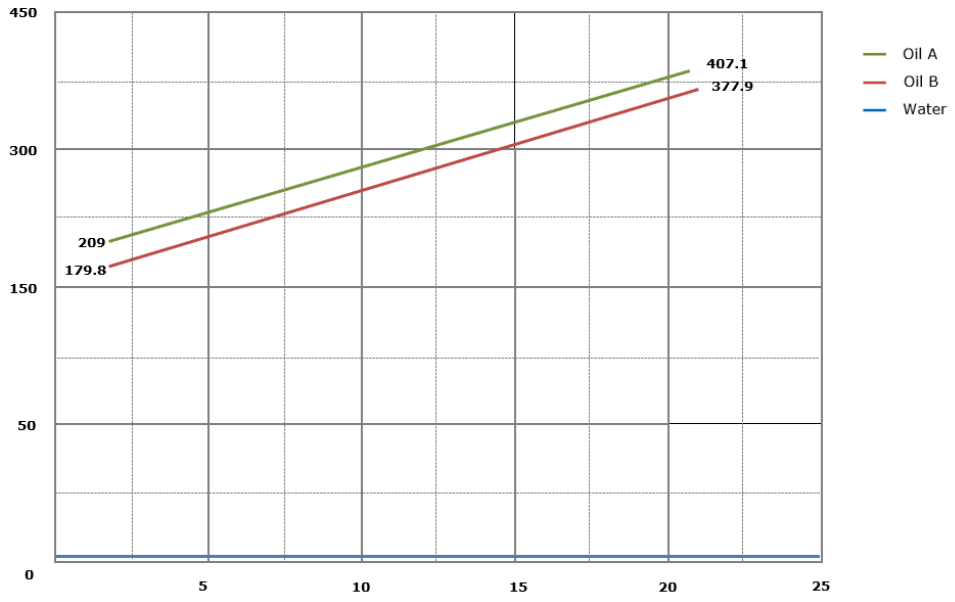


Fig. xxx One Step Zero Calibration

By simply pressing down the mechanical S1 button, the user has told the EASZ-1 that the current picofarad measurement is the 0 point for water in oil. An alternative way of doing this is through the software. If this is not being done at the installation point, make sure the EASZ-1 is completely filled with the dry oil and that the oil temperature is similar to the process temperature (see laboratory calibration section.)

The "cal" command is simply putting the measurement at specified point on the graph below. It is a Zero offset function, and the graph is linear. In most cases the default table in the EASZ-1 will be sufficient for most lower range scenarios.

Cal Command (Zero Offset Function)



To perform a Zero calibration using RS-232

Typing “store” will capture the current picofarad reading for the next command.

```
Store
Value saved: 180pF


OK
```

The next command is “cal 0”. The “cal 0” command will set a 0 reading for the picofarad reading that was captured.
The mA output should read 4mA for zero water and 20mA for the range that was set. (see range command)

If for example, the capacitance of the dry oil was 180 pF, then the store command will capture 180 pF and the subsequent “cal 0” command will set 180pF as a Zero reading. To check this has been done properly, the user can type in the “get” command.

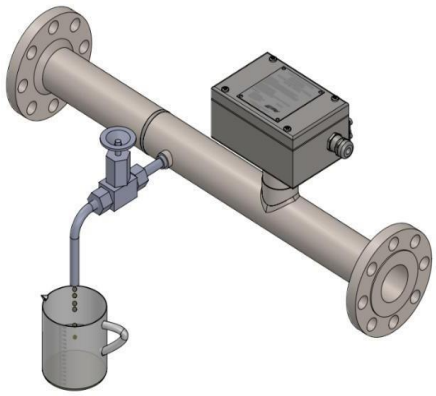
```
C: 180.00pF
H2O: 0.00%
T: 34.2C

OK
```

Here we see that the user has chosen a reading of 180pF to be equal to 0 water content at 34.2°C.

Percent Calibration

A percent calibration will be needed when there is already water present in the oil in a small or large amount.
In order to perform this calibration, a sample of the oil must be taken to a lab for testing.

Here are the steps:
Take a spot sample of the oil-water mixture and simultaneously capture the pF reading at the same time.



This is done by typing “store” at the time the sample is taken. The “store” command will keep the pF reading and use it as a value for the next command.

After getting the lab result for the water percentage i.e. if it was found that 1.5% water was in the sample, then type “cal 1.5”

If it was found that 10% water was in the sample, then type “cal 10”

Performing this will correct the Zero offset.

Note: If it becomes necessary to perform a temperature coefficient procedure because the liquid is experiencing large temperature swings, refer to the chapter on temperature coefficient procedure.

Temperature Coefficient Procedure

Most applications will not require temperature compensation. The EASZ-1 uses an internal Temperature Coefficient (TC) to compensate for changing capacitance during fluid temperature fluctuations, by multiplying the measured capacitance by a Temperature Coefficient to calculate a temperature compensated capacitance value using a formula.

Under most circumstances, the factory default coefficient of 1.0000 does not need to be adjusted; however, the **stc** button in the EASZ-1 Interface Software will enable modification of the coefficient between 0.5 and 2.0 with 4 decimal places of accuracy, when provided with two unique measured capacitance and temperature values.

Calculating your Temperature Coefficient is best performed with a sample of the actual oil being used in your process. Fill the EASZ-1 with what you consider to be dry oil at ambient temperature then use the **get button** in the EASZ-1 Interface software to recover a single capacitance and temperature value. Record these two values as C1 and T1. Raise the oil temperature by a minimum of 10 degrees (your maximum process temperature), let it sit for 10 minutes, then, using the **get button**, collect, and record a second capacitance and temperature value as C2 and T2.

The temperature coefficient can then be found by using the following formula:

$$TC = 1 - \frac{\left(\frac{C2-C1}{T2-T1}\right)}{C2}$$

T1 and T2 should ideally be 10 to 20 degrees apart and in the neighborhood of normal working temperatures.

For High Range Units

If you are using a High Range unit where large amounts of water are being measured, the calibration table will be different from the standard range table.

Here is an example:

```
list

a. Capacitance: 25.0pF  H2O: 0%
b. Capacitance: 28.1pF  H2O: 4%
c. Capacitance: 31.6pF  H2O: 8%
d. Capacitance: 35.6pF  H2O: 12%
e. Capacitance: 40.0pF  H2O: 16%
f. Capacitance: 45.1pF  H2O: 20%
g. Capacitance: 50.7pF  H2O: 24%
h. Capacitance: 57.0pF  H2O: 28%
i. Capacitance: 64.1pF  H2O: 32%
j. Capacitance: 73.9pF  H2O: 36%
k. Capacitance: 87.0pF  H2O: 40%
l. Capacitance: 120.4pF  H2O: 48%
m. Capacitance: 195.0pF  H2O: 60%
n. Capacitance: 566.0pF  H2O: 72%
o. Capacitance: 740.0pF  H2O: 84%
p. Capacitance: 893.0pF  H2O: 96%
q. Capacitance: 930.0pF  H2O: 100%

OK
```

Large amounts of water at higher temperatures may sometimes require a custom calibration (see custom calibration.)

CUSTOM CALIBRATION

In some applications it might be necessary to change the slope angle of the graph if there is a dependency affecting the results e.g. a lower dielectric constant of water (hot water) or some other influence that requires a slope change. It is highly recommended that this procedure is not implemented unless the user fully understands the implications in doing so. In most applications up to a 50% range, the default table will normally suffice.

** It is strongly suggested that you fully understand the impact of these changes before proceeding**

Capacitance to Water Content Procedure

1. Circulate dry oil through the probe.
2. Control the flow loop temperature to a desired temperature that reflects the temperature in the application that the unit will be installed in.
3. Use the terminal interface "get" command. Note the capacitance for dry oil as CCA. (Ignore the calculated % value since it is invalid at this point).
4. Add water one step at a time in accordance with the fixed percentages in the table below until you have enough values for your selected range. Note the capacitance for each step as CCB, CCC, CCD and so on (See table below).

Percentage	Code	Capacitance
0%	cca	
1%	ccb	
2%	ccc	
3%	ccd	
4%	cce	
5%	ccf	
6%	ccg	
7%	cch	
8%	cci	
9%	ccj	
10%	cck	
12%	ccl	
15%	ccm	
18%	ccn	
21%	cco	
24%	ccp	
25%	ccq	

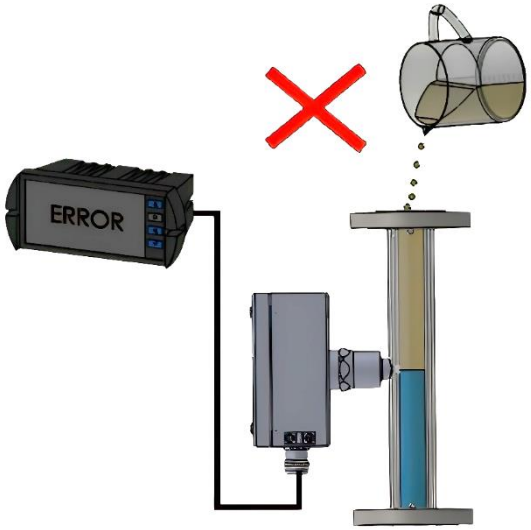
5. Use the terminal interface cc command to fill in the table as follows (sample values):

```
cca 169.1 (enter)
ccb 174.6 (enter)
ccc 180.2 (enter)
ccd 186.0 (enter)
cce 191.9 (enter)
…
```

6. Repeat for valid range. You have now created your custom calibration/linearization curve.

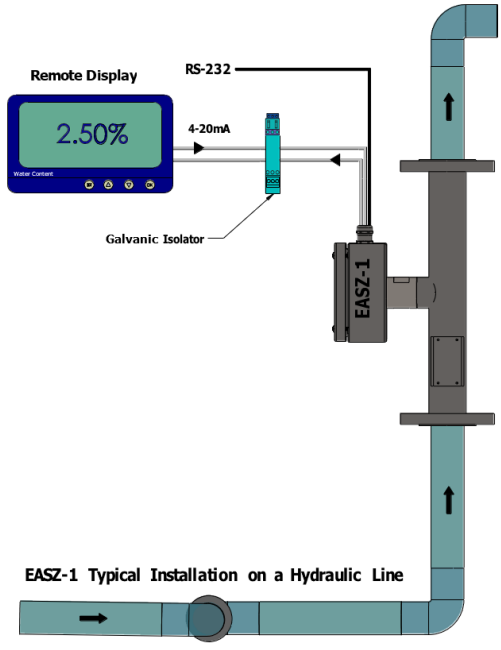
LABORATORY CALIBRATION

The EASZ-1 cannot be calibrated by pouring water and oil mixtures into the instrument cavity while the fluid is still in a static condition i.e. “no flow.” Any attempt to calibrate the instrument without a minimum flow rate will produce large errors.



*Water and Oil will separate very fast

Calibration Test Rigs



All testing for percentage water in oil must be carried out using a line pump and a test rig where there is enough flow/mixing to create a homogeneous liquid mixture free of air bubbles.

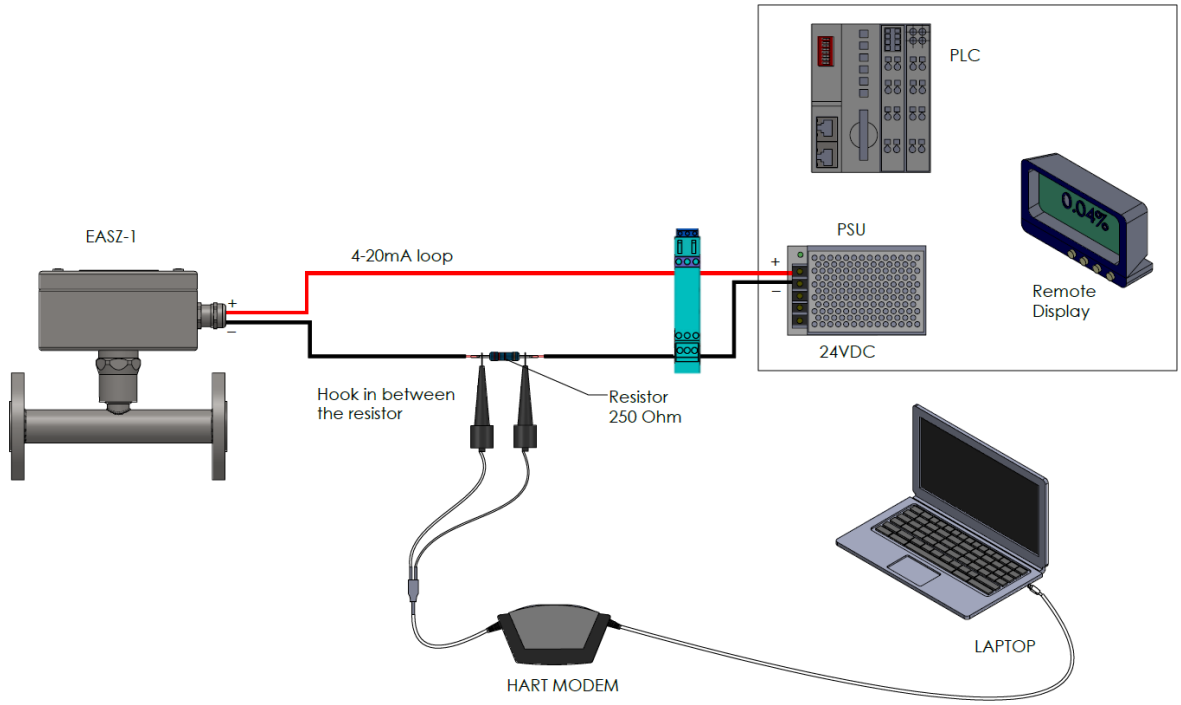
Although the EASZ-1 will show a reading in a non-flow static condition where there are these readings will be incorrect because of water and oil separation. The only meaningful calibration that can be done in a static condition is on a dry oil at process temperature to determine zero water.

COMMUNICATION THROUGH THE HART MODEM

The EASZ-1 has a built-in HART Modem. This option enables the user to communicate with the EASZ-1 remotely using a PC. Some additional operations have been added to the software which include the ability to trim the 4-20mA signal. This is useful in situations where the readings sent to the control room require adjustment (loop calibration)

If you are familiar with the RS-232 commands using PUTTY software, it should be relatively easy to understand the similar type commands being sent to the EASZ-1 modem using the HART protocol. EESIFLO can also (on request) provide special application software in cases where this instrument is being used on other fluids.

Wiring Configuration for the HART Modem



⚠ Do not use the RS-232 option with the RS-485 at the same time. The HART communication and RS-232 communication are not designed to work in tandem.

⚠ If using HART communication, a Galvanic Isolation Barrier is required. It is extremely important that the - mA loop MUST be isolated from all other sensors. If the negative side of the current loop is grounded to earth, the EASZ-1 WILL NOT WORK. This can also damage the instrument electronics.

Galvanic Isolation Barrier Example:

For all applications, we recommended the EASZ-1 be powered with a digital panel meter that includes galvanic isolation. It is always best practice to ensure that the power supply to the EASZ-1 is a galvanically isolated power supply.

Here are some examples of an Isolation Barrier/Power Supply or Isolation Barrier without power supply for Safe applications.

Manufactured by Pepperl & Fuchs

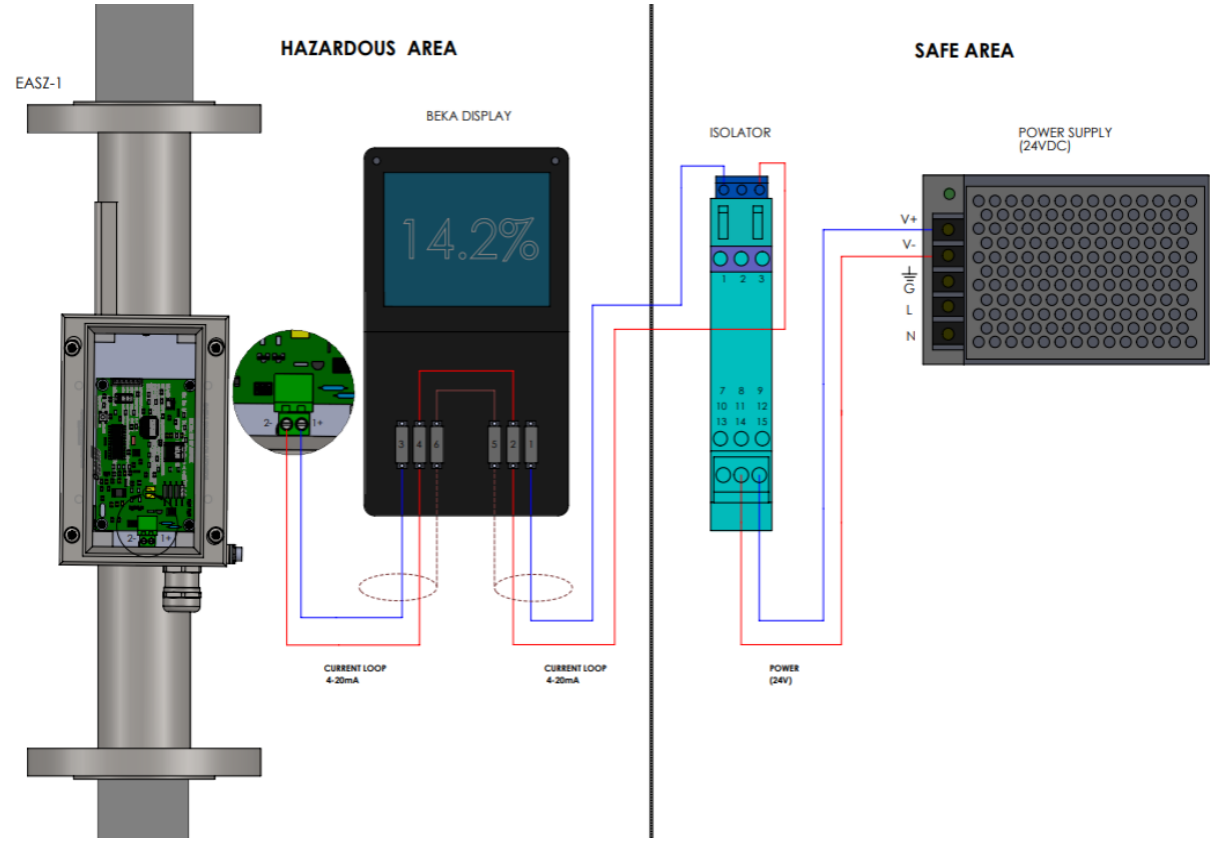
Manufactured by GMI

The isolated barriers pictured above are HART compatible and have a noticeably lower power loss.

The Pepperl & Fuchs KFD0-SCS EX1.55 and GMI D5011S is a single channel Repeater and Isolated Power Supply capable of high integrity analog input interface suitable for applications requiring SIL 3 level (according to IEC 61508) in safety related systems for high-risk industries. It provides a fully floating dc supply for energizing any EASZ-1 Water in Oil Sensor when located in a Hazardous Area and repeats the EASZ-1 current signal in a floating circuit to drive a Safe Area load. The circuit allows bi-directional communication for Hart transmitters and can be mounted on standard DIN-Rail, with or without Power Bus, or on customized Termination Boards, in Safe Area or in Zone 2.

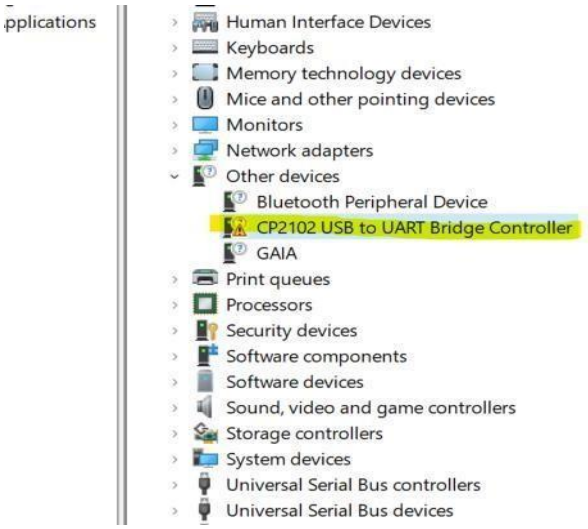
HART Communications can be performed with a Windows PC coupled with a USB HART Modem and software provided by **EESIFLO**.

If using the software provided by **EESIFLO** you will need a Windows PC with the proper driver installed. The EASZ-1 loop will need to have a Galvanic Isolation Barrier as described in the beginning of this section.



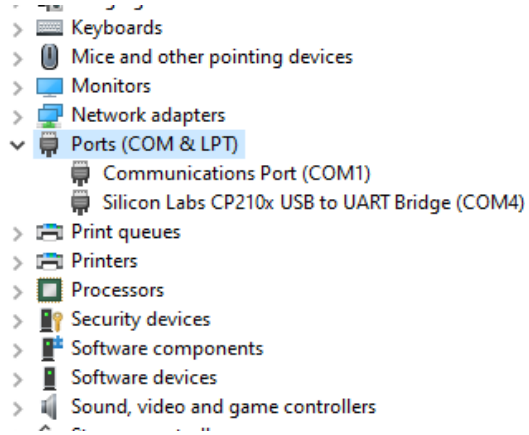
INSTALLING THE EESIFLO SOFTWARE FOR HART COMMUNICATION

Once you have installed this software make sure that your communication ports and drivers are working.

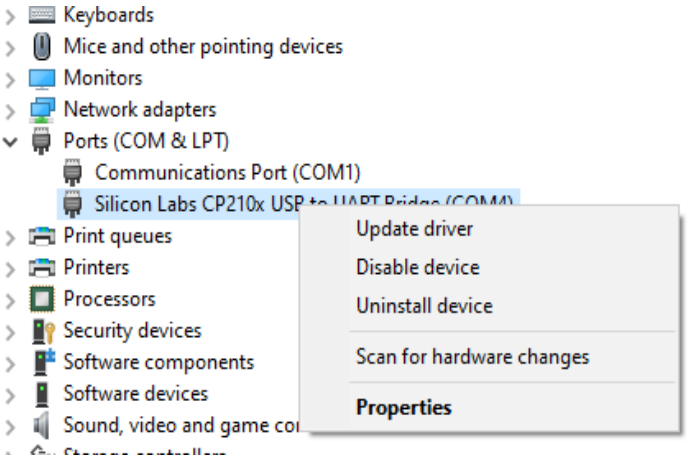


If something appears as above in the device manager, it means the driver is not fully or properly installed.

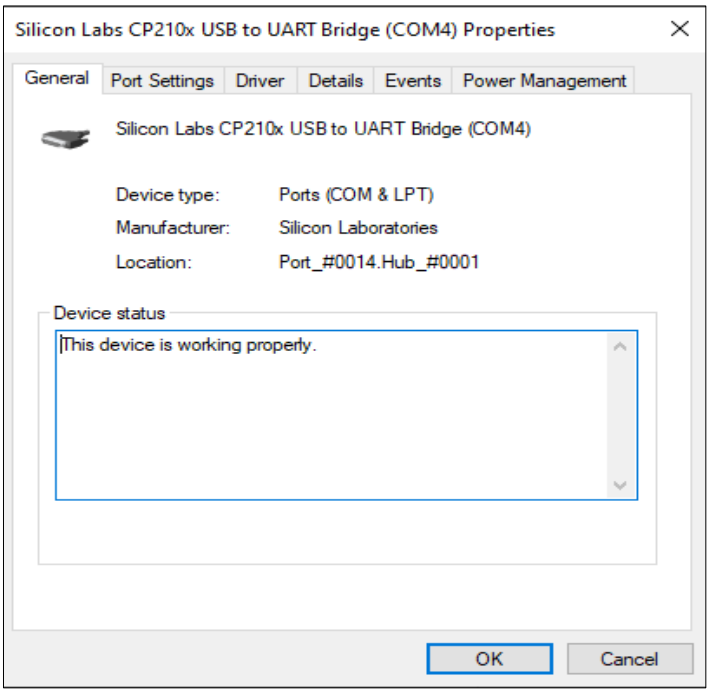
After the driver for the USB HART Communication is installed properly, it will show something similar to the following snapshot.



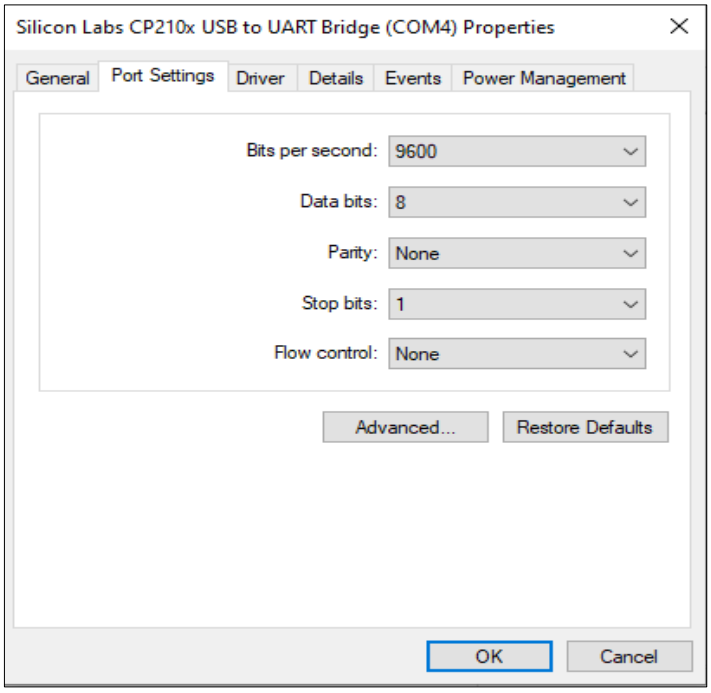
To ensure compatible communication settings, select the COM Port and properties as follows:



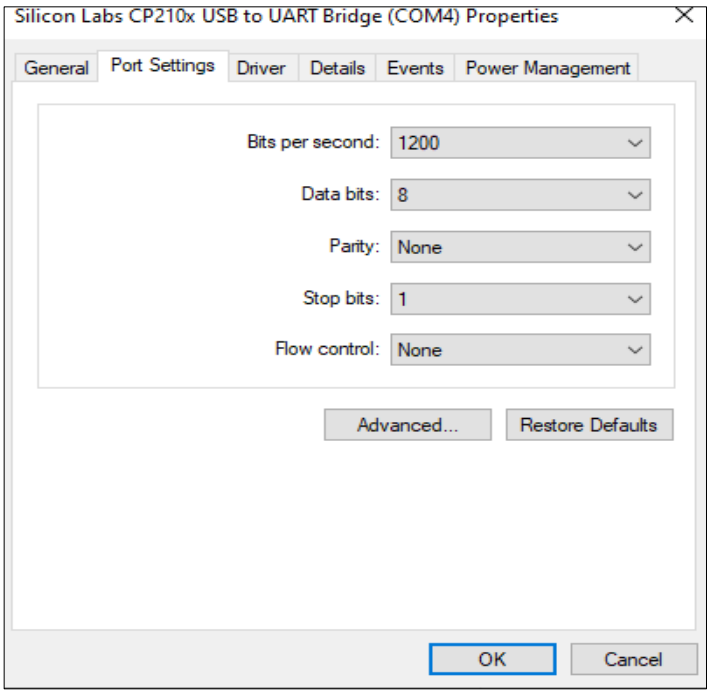
After clicking the properties box, the display should show the following:



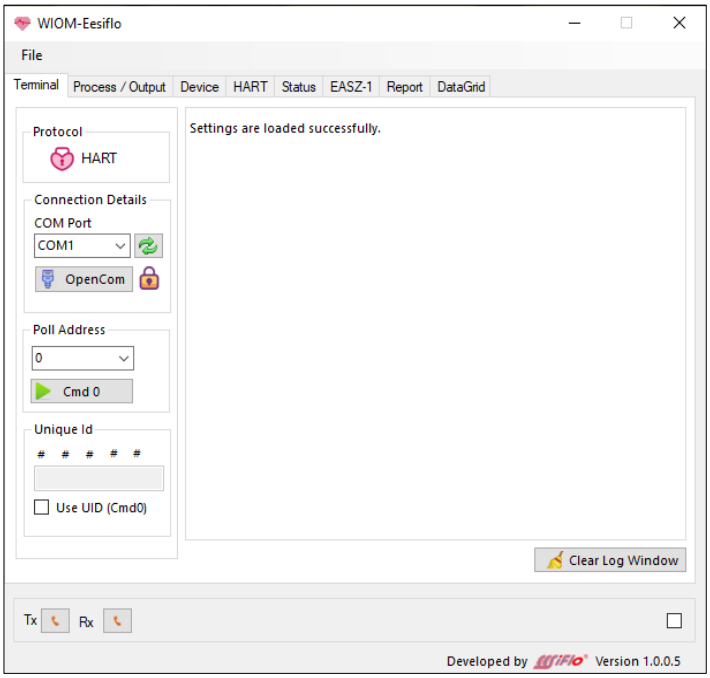
Select the tab “Port Settings”



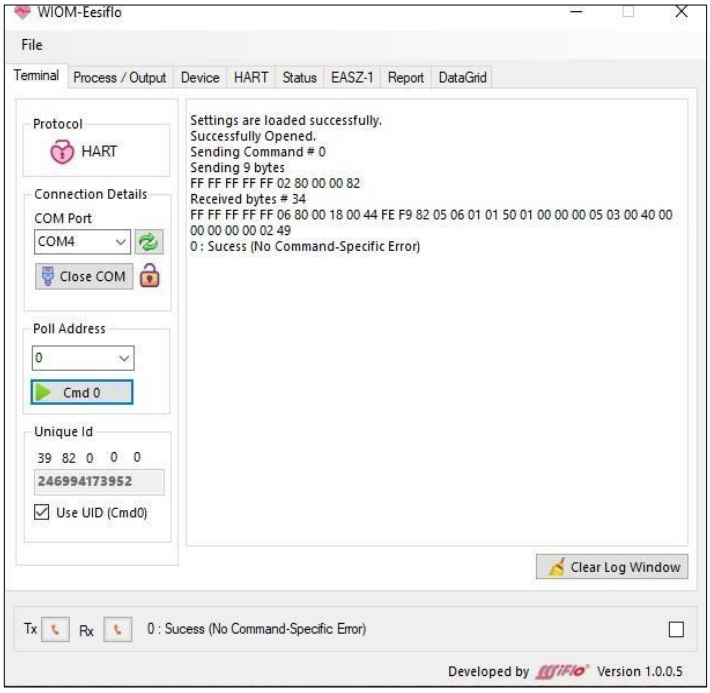
Change the bits per second to “1200”



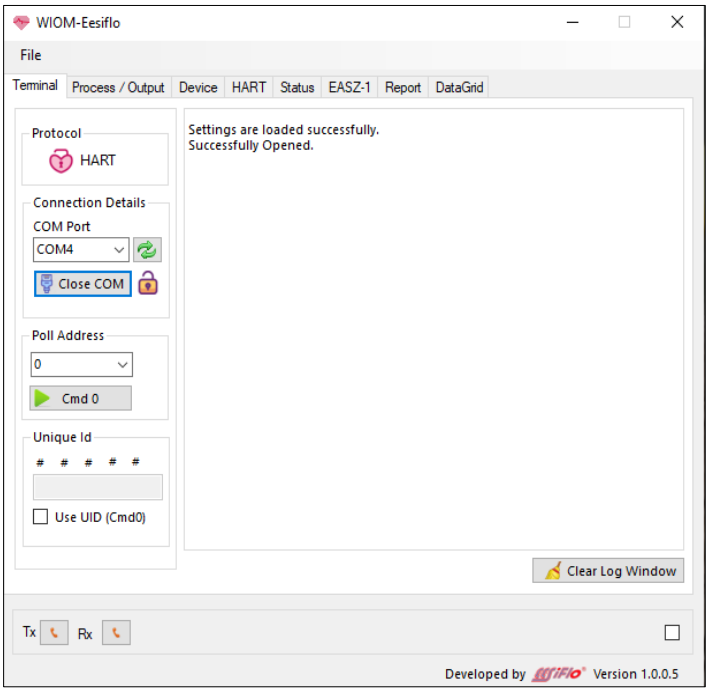
Now you should be ready to launch the EASZ-1 HART Software.



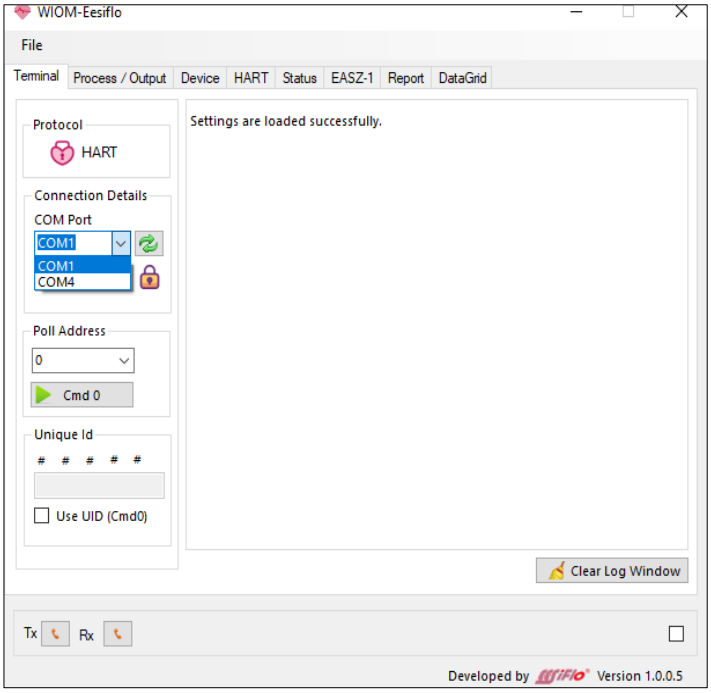
The EASZ-1 Software will run and display the default tab contents showing the contents of the terminal tab.



Select the correct COM Port according to your set up

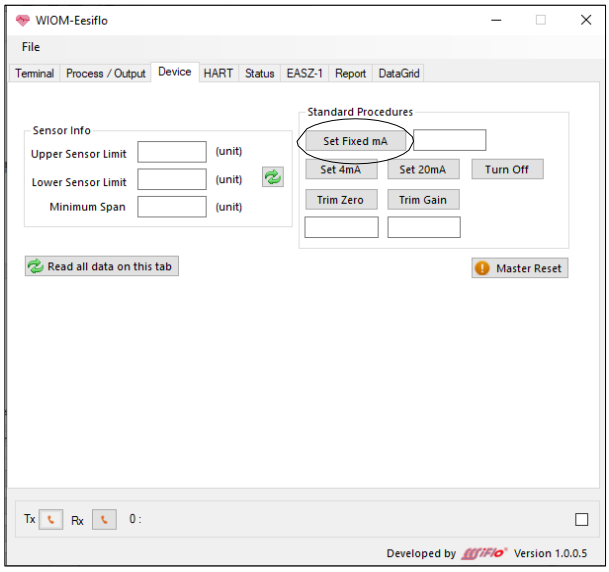


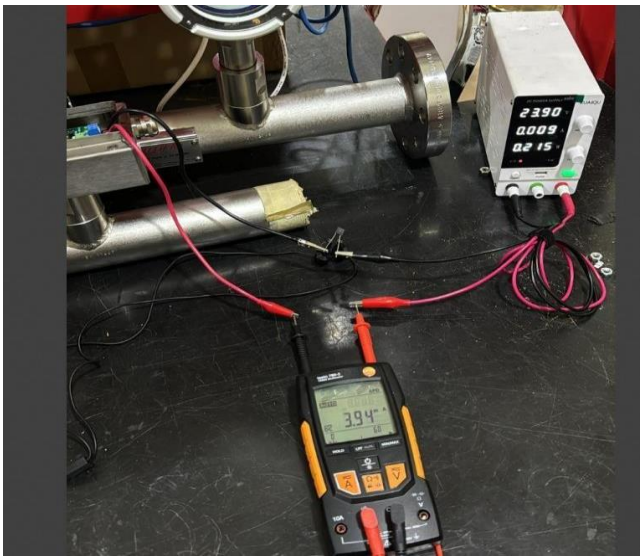
To check that the instrument is working properly with the software, click Open COM then click Cmd0. The screen should be shown as the snapshot below.



How to do 4-20mA Trim?

To do a trim you must click on the “device” Tab.
You will be shown the options to test that the mA signal is working properly by entering in a number between 4 and 20 into “Set Fixed mA”





Example test meter set-up

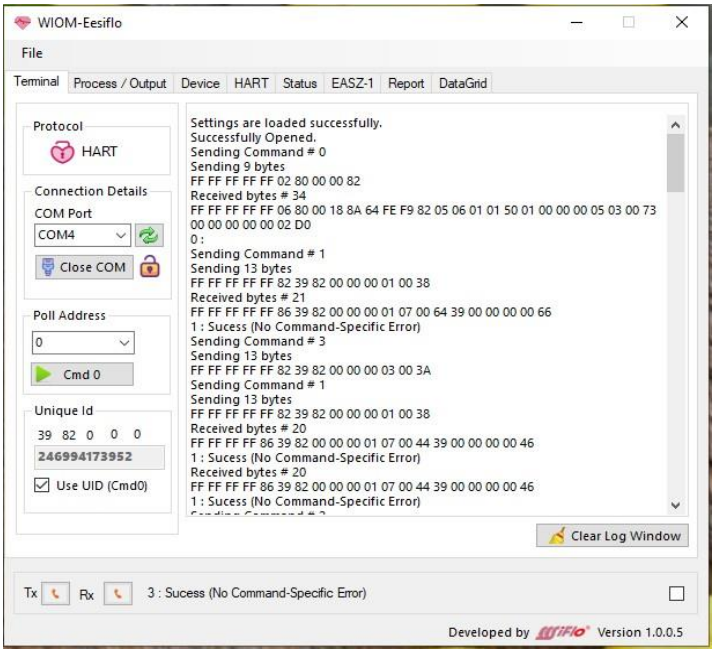
Electrical technicians familiar with setting up remote displays, PLC’s, Smart sensors and DCS systems may want to ensure that the 4-20mA signal corresponds to the desired value. This can be done in the field, or offline using a standard multimeter.

Before proceeding, ensure that you are measuring the current loop properly. Note the reading can only be taken with the metering device in series with the supply.

If required to calibrate the 4mA loop, type in the reading that the multimeter is showing above or below this value. Adjust trim zero as required reference the above calibration example. Set trim zero to 4.1 or 4.2 mA observe the multimeter reading and with your mouse pointer press the trim zero button until the desired multimeter reading is achieved.

(Note that due to the characteristics of the electrical circuits set zero will not always be possible +/- 0.1 -0.2 is normally acceptable)

Understanding the Functions of the HART Software

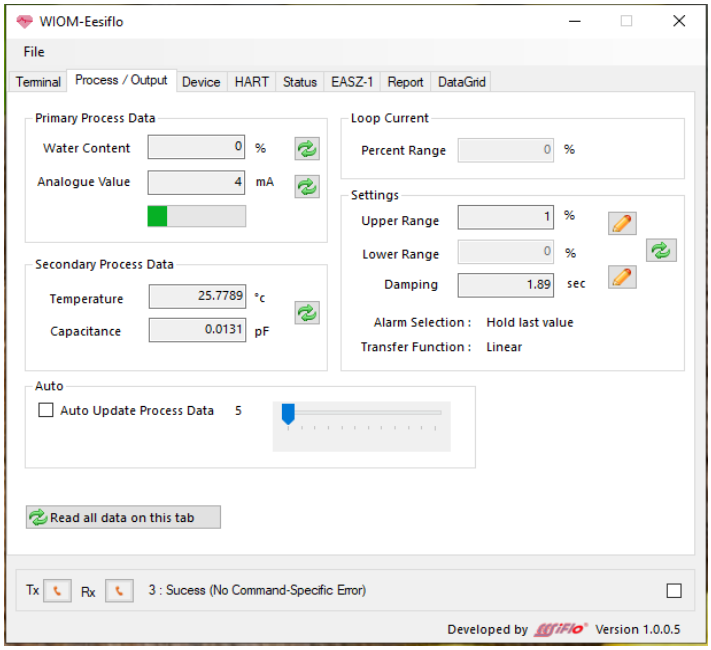


The terminal tab window is used to check if the EASZ-1 is communicating properly with your external device e.g. windows computer using a HART protocol.

It also enables the user to change the COM Ports to the correct number.

Each EASZ_1 card has a unique ID displayed in this box.

Tx and Rx show that communication is taking place by changing color



The Process/ Output window

Primary Process Data enables the user to display the current water content reading in a percentage and it's corresponding analogue output value.

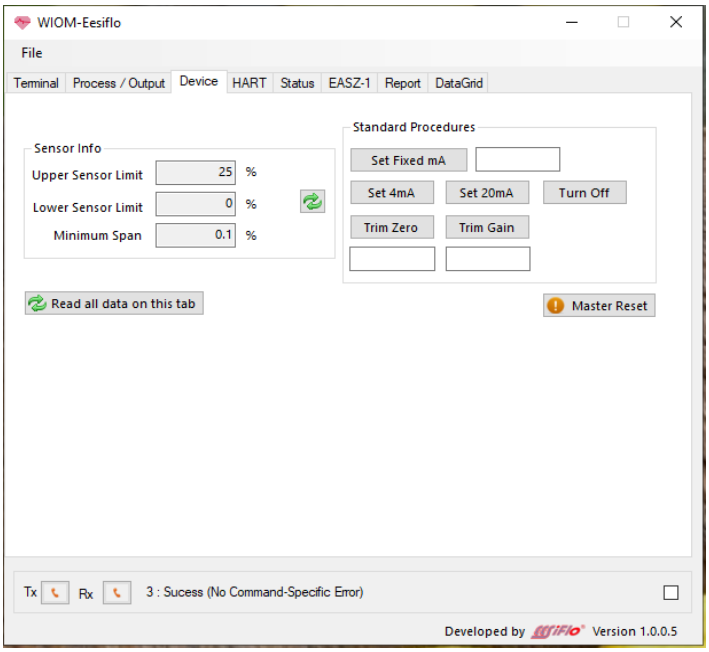
Secondary Process Data enables the user to display the current temperature in °C and the capacitance of the liquid in pF

Loop current percent range should normally be ignored. It has nothing to do with calibration ranges but is showing the percent of the range 4-20mA that is in used.

Settings – The lower range cannot be changed. It will always be 0%. The Upper range is the ranged of water in oil e.g. 0-1% water in oil or 0-10% water in oil.

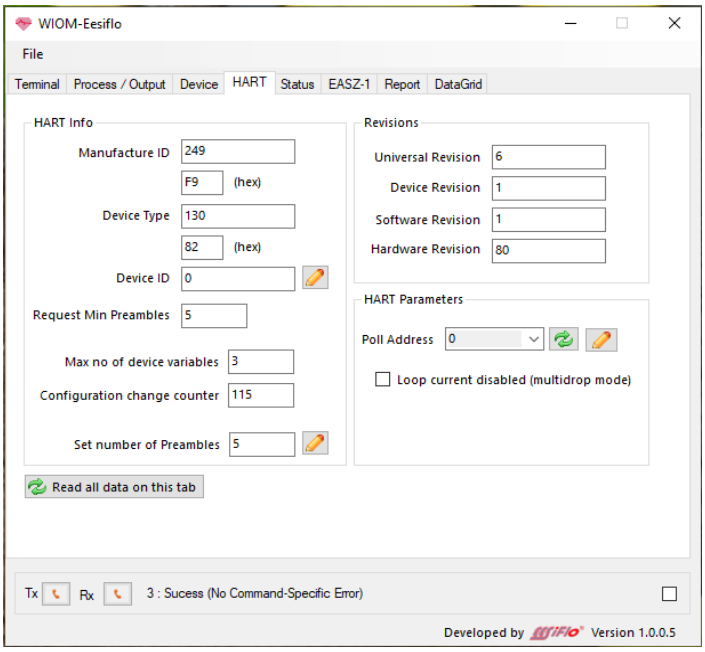
Damping is taking readings and reporting them over a time period e.g 5 secs. The maximum is 20 seconds.

Auto Update processs data is a slider that allows the user to control how often an update of the readings will be shown. The minimum is 5 seconds and the maximum 60 seconds.

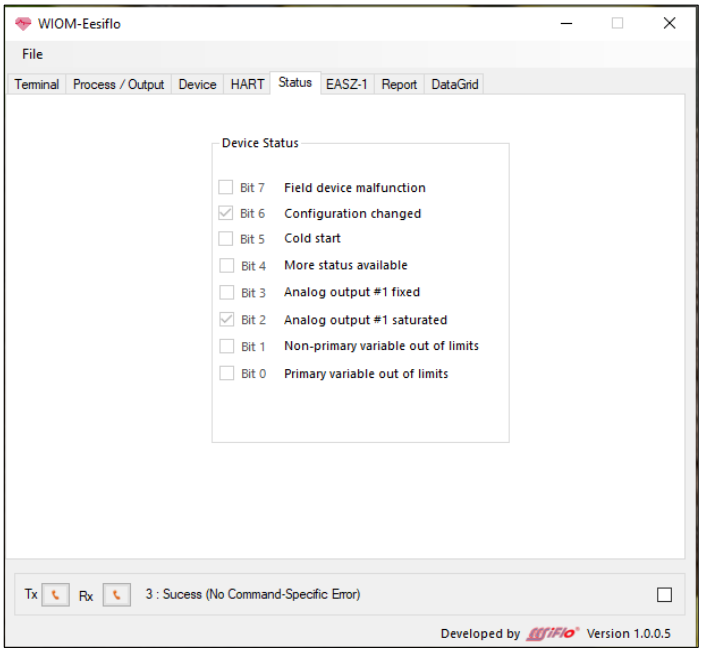


Device tab – the sensor Info cannot be edited an is displaying what limits were already sets for the measurement range e.g. 0-25%

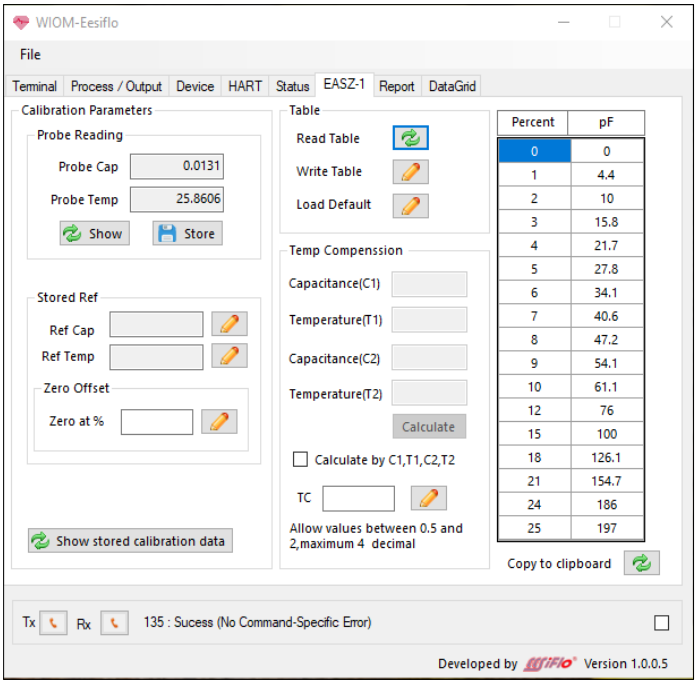
Standard procedures -this is the 4-20mA procedure which has already been explained in the HOW TO ENSURE A 4- 20mA TRIM section of this manual.



HART tab gives information for advanced HART users.



Status tab is for EESIFLO internal use for troubleshooting e.g. electronic malfunction.



Calibration Parameters

Show will display the current probe capacitance and temperature of the liquid.

Store is always used to immediately store the above probe capacitance and temperature to be used in a calibration.

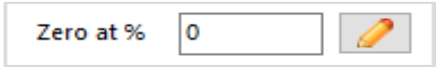
Stored Reference shows what capacitance and temperature are currently stored in the unit.

Zero at % is the percentage of water in oil at the stored capacitance. This is similar to the “cal” command using RS-232.

To calibrate the EASZ-1 use an uncontaminated sample of the oil that is being measured. (Uncontaminated oil contains no water)

If you are sure that the oil is uncontaminated, and water free, then capture the capacitance and temperature by using store. Clicking on to 

will capture the current picofarad reading/ temperature for the next step.

The next step is to calibrate the unit by telling it that the stored values equal 0. This can be done by typing 0 into the 

TO CALIBRATE FOR A PERCENTAGE

A percent calibration will be needed when there is already water present in the oil in a small or large amount. In order to perform this calibration, a sample of the oil must be taken to a lab for testing.

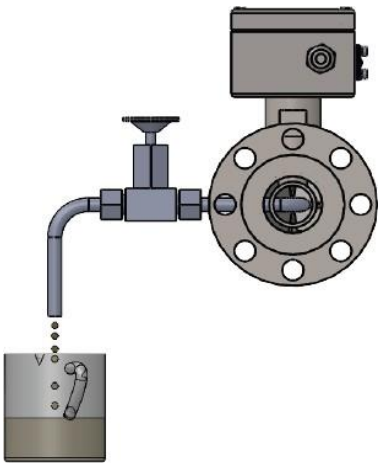
Here are the steps:

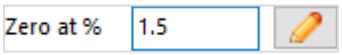
1. Take a spot sample reading of the oil-water mixture and simultaneously capture the capacitance/temperature reading at the same time.

- This is done by clicking 

at the time the sample is taken.

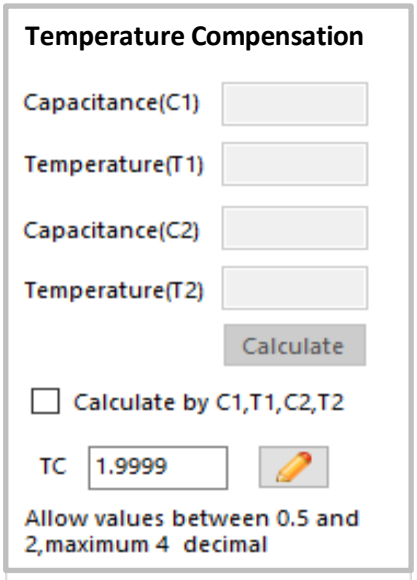
  The store command will keep the capacitance/ temperature reading and use it as a value for the calibration.



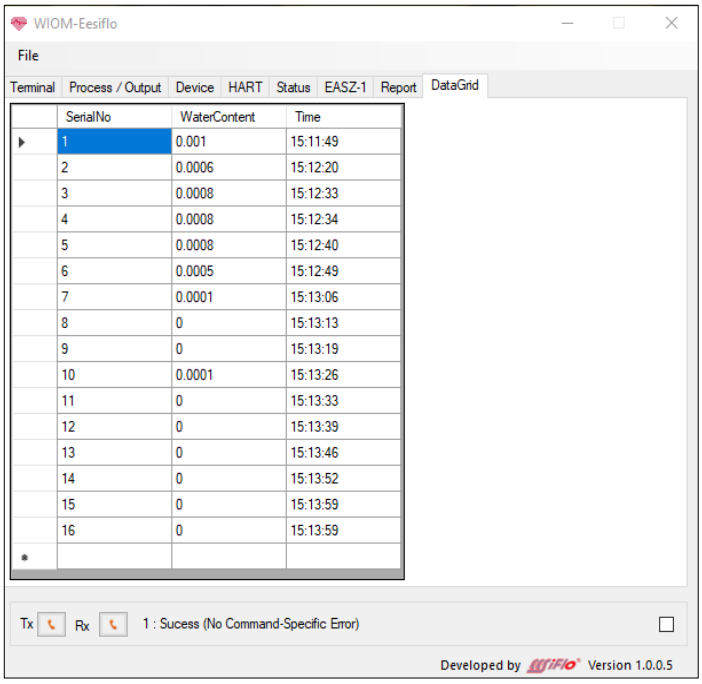
2. After getting the lab result for the water percentage e.g. if it was found that 1.5%water was in the sample then type 1.5 into 

9. If it was found that 10% water was in the sample, then type 10 into the box. Performing this will correct the Zero offset.

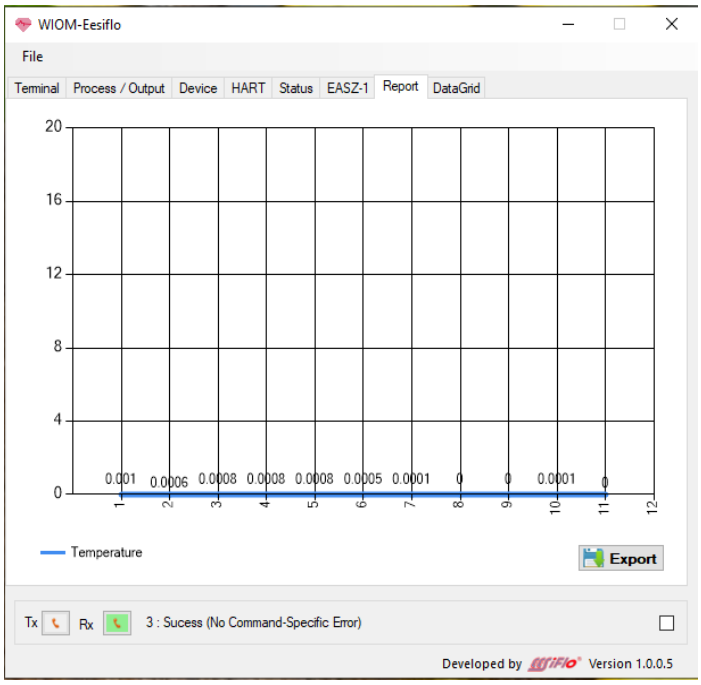
Note: It may be necessary to perform a temperature coefficient procedure if the liquid is experiencing large temperature swings. In this case, refer to the chapter on temperature coefficient procedure.



To perform this function, you will need to capture the capacitance at 2 different temperatures to calculate TC which is a temperature coefficient.



Report is a graphical representation.



Data grid is for logging events.

If a standalone HART Communication device is being utilized, please refer to the OEM equipment manual for usage instructions. Listed below are the Universal and EASZ-1 Specific HART command.

Standalone HART Communicator

The EASZ-1 will comply with HART protocol revision 6. This document specifies all devices specific features. The functionality of the EASZ-1 is described sufficiently to allow its proper application in a process and its complete support in HART capable host applications.

Resetting HART Poll Address

The HART Poll address can be reset to 0 by keeping the EASZ-1's S1 button pressed during power up.

Universal HART Commands

The following commands are implemented. Please refer to your HART documentation for extensive information on each of these commands.

Command 0:	Read unique identifier.
Command 1:	Read primary variable.
Command 2:	Read loop current and percent of range.
Command 3:	Read dynamic values and loop current.
Command 6:	Write polling address and set/reset multi-drop mode.
Command 7:	Read loop configuration.
Command 11:	Read unique identifier associated with tag.
Command 12:	Read message.
Command 13:	Read tag, descriptor and date.
Command 14:	Read primary variable transducer information.
Command 15:	Read device information.
Command 16:	Read final assembly number.
Command 17:	Write message.
Command 18:	Write tag, descriptor and date.
Command 19:	Write final assembly number.
Command 20:	Read long tag.
Command 22:	Write long tag.
Command 34:	Write primary variable damping factor.
Command 35:	Write primary variable range values.
Command 38:	Reset configuration changed flag.
Command 40:	Enter/exit fixed current mode.
Command 42:	Perform device reset.
Command 43:	Set primary variable 0.
Command 45:	Trim loop current zero.
Command 46:	Trim loop current gain.
Command 48:	Read additional device status.
Command 56:	Write device variable transducer serial number.
Command 59:	Write number of response preambles.

Warranty

Your EASZ-1 is warranted against defects in workmanship for a period of one year after shipment to the location indicated on your purchase documentation, only if the instructions in this manual have been followed explicitly, and the electronics have not been modified or removed from the enclosure without prior authorization of **EESIFLO**.

If you suspect a problem with your EASZ-1, please contact any of the offices of **EESIFLO** indicated on the bottom of each page in this manual.

If a fault is discovered that is attributable to defects in workmanship, **EESIFLO** will at our own discretion, repair or replace the defective product.

EESIFLO shall not be liable for loss production, use, profits, business, goodwill, or reputation or for business interruption, wasted expenditure or any incidental, special, consequential, or punitive loss or damages of any kind, whether suffered or claimed by you or any third party.

No warranty whatsoever is given with respect to the products, express or implied, including any warranty of merchant- ability and any warranty of fitness for a particular purpose. In addition, **EESIFLO** hereby disclaims liability for incidental or consequential damages for breach of any express or implied warranty including any implied warranty of merchantability and any implied warranty of fitness for a particular purpose.