ViscoSite VL800 Viscometer
Operating Manual

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NOTICES

This system is covered by a limited warranty. A copy of the warranty is included with this manual.

The operator is required to perform routine maintenance as described herein to keep the warranty in effect.

Note: Changes or modifications not expressly approved by Galvanic Applied Sciences, Inc. could interfere with the user's ability to operate the system.

All information in this manual is subject to change without notice and does not represent a commitment on the part of Galvanic Applied Sciences, Inc.

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Safety Symbols Used in This Manual

DANGER	The Danger symbol indicates a hazardous situation that, if not avoided could result in serious injury or death.
WARNING	The Warning symbol indicates a hazardous situation that, if not avoided, could result in serious injury.
CAUTION	The Caution symbol indicates a hazardous situation that, if not avoided could result in minor or moderate injury.
NOTICE	The Notice symbol indicates important information that will optimize the use and reliability of the system.

IMPORTANT!

RETAIN THE SHIPPING CONTAINER (CRATE/BOX) AND ALL PACKAGING MATERIALS FOR THE TRANSDUCER.

Failure to do so may lead to transducer damage during shipping to the factory and may void any remaining warranty on the system.

Contact Galvanic Applied Sciences if you require factory approved shipping materials.

Important Safety Guidelines for the ViscoSite VL800 Viscometer

Please read the following warnings and cautions carefully before using the ViscoSite VL800 Viscometer.

⚠WARNING	This equipment must be used as specified by the manufacturer or overall safety will be impaired.
⚠WARNING	Access to this equipment should be limited to authorized, trained personnel ONLY.
⚠WARNING	Observe all warning labels on the transmitter and transducer enclosures.
⚠WARNING	The isolated analog outputs and alarm relay contacts of the ViscoSite system may be powered by a source separate from the one(s) used to power the ViscoSite transmitter. Disconnecting the main power source to the ViscoSite transmitter may not remove power from the Isolated Analog Output signal terminals.
⚠CAUTION	During installation, commissioning, normal operation, maintenance, and servicing, this system contains items which may be hazardous to humans if handled or operated incorrectly or negligently.

Any safety recommendations or comments contained herein are suggested guidelines only. Galvanic Applied Sciences Inc. bears no responsibility and assumes no liability for the use, implementation, and/or failure to implement these suggested recommendations.

The ViscoSite VL800 Viscometer transmitter can be configured to be safely operated in Class 1, Div 2, Groups B, C. D areas and General-Purpose areas.

Manufacturer's Warranty Statement

Galvanic Applied Sciences Inc. (Seller) warrants that its products will be free from defects in materials and workmanship under normal use and service in general process conditions for the effective period set out below. This warranty and its remedies are in lieu of all other warranties expressed or implied, oral or written, either in fact or by operation of law, statutory or otherwise, including warranties of merchantability and fitness for a particular purpose, which Seller specifically disclaims.

Seller shall have no liability for incidental or consequential damages of any kind arising out of the sale, installation, or use of its products.

Seller's obligation under this warranty shall not arise until Buyer notifies Seller of the defect. Seller's sole responsibility under this warranty is, at its option, to replace or repair any defective component part of the product. Except in the case of an authorized distributor or Seller, authorized in writing by Seller to extend this warranty to the distributor's customers, the warranty herein applies only to Buyer as the original purchaser from Seller and may not be assigned, sold, or otherwise transferred to a third party. A warranty of 90 days is provided with respect to repaired Products. No warranty is offered for reconstructed, refurbished, or previously owned products, which will be so marked on the sales order and will be sold "As Is."

BUYER'S SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY IS THAT THE SELLER EITHER AGREES TO REPAIR OR REPLACE, AT SELLER'S SOLE OPTION, ANY PART OR PARTS OF SUCH PRODUCTS THAT UNDER PROPER AND NORMAL CONDITIONS OF USE, PROVE(S) TO BE DEFECTIVE WITHIN THE APPLICABLE WARRANTY PERIOD. ALTERNATELY, SELLER MAY AT ANY TIME, IN ITS SOLE DISCRETION, ELECT TO DISCHARGE ITS WARRANTY OBLIGATION HEREUNDER BY ACCEPTING THE RETURN OF ANY DEFECTIVE PRODUCT PURSUANT TO THE TERMS SET FORTH HEREIN AND REFUNDING THE PURCHASE PRICE PAID BY BUYER.

THE TRANSDUCER MUST BE SHIPPED BACK TO THE SELLER OR ITS AGENTS IN ITS ORIGINAL PACKING CRATE/BOX TO AVOID DAMAGE DURING SHIPPING. BUYER MUST CONTACT SELLER IF ORIGINAL PACKING MATERIALS ARE NOT AVAILABLE. SELLER SHALL FURNISH PROPER SHIPPING PACKAGING AT THE REQUEST OF THE BUYER.

FAILURE TO SHIP THE TRANSDUCER IN SELLER-PROVIDED PACKAGING WILL VOID THE REMAINDER OF THE WARRANTY.

Place of Service

Seller shall use its best efforts to perform all warranty services hereunder at the Buyer's facility, as soon as reasonably practicable after notification by the Buyer of a possible defect. However, the Seller reserves the right to require the Buyer to return the Product to Seller's production facility, transportation charges prepaid, when necessary, to provide proper warranty service. Should Buyer require the assistance of the Seller's Agents or employees for service calls covered by the above warranty clause, Buyer shall pay travel time, mileage

from the Seller's facility or travel costs to the airport / train station closest to Buyer's facility plus all other travel fees, hotel expenses, and subsistence.

Effective Warranty Period

The effective warranty period for new systems as purchased is 12 months from the date of analyzer start-up or 18 months from the date of shipping from Seller's production facility to Buyer, whichever occurs first. Products are guaranteed to be free from defects in materials and workmanship for parts and labour during this period, subject to the following limitations.

Limitations

Products are guaranteed to be free from defects in materials and workmanship for parts and labour during the effective warranty period, with the following exceptions:

- The sole and exclusive warranty applicable to software and firmware products provided by Seller for use with a processor internal or external to the Product will be as follows: Seller warrants that such software and firmware will conform to Seller's program manuals or other publicly available documentation made available by Seller current at the time of shipment to Buyer when properly installed on that processor, provided however that Seller does not warrant the operation of the processor or software or firmware will be uninterrupted or error-free.
- Consumable items such as lamps are excluded from this warranty.
- Loss, damage, or defects resulting from transportation to the Buyer's facility, improper or inadequate maintenance by Buyer, software or interfaces supplied by the Buyer, unauthorized modification or operation outside the environmental specifications for the instrument, use by unauthorized or untrained personnel or improper site maintenance or preparation.
- Products that have been altered or repaired by individuals other than Seller personnel or its duly authorized representatives, unless the alteration or repair has been approved by Seller and is performed by an authorized factory trained service technician in accordance with written procedures supplied by Seller.
- Products that have been subject to improper installation, misuse, accident, neglect, and/or use under expected or unexpected process conditions reasonably expected to cause damage.

The warranty herein applies only to Products within the country of original delivery. Products transferred outside the country of original delivery, either by the Seller at the direction of the Buyer or by Buyer's actions subsequent to delivery, may be subject to additional charges prior to warranty repair or replacement of such Products based on the actual location of such Products and Seller's warranty and/or service surcharges for such location(s).

Repaired Products

Repaired products are warranted for 90 days with the above exceptions.

1 Introduction to the ViscoSite VL800 Viscometer

1.1 Contents

This manual contains the following information:

Section 1 *Introduction to the ViscoSite VL800 Viscometer* presents introductory information about this manual, the viscometer, and the principle of operation.

Section 2 *System Components* discusses the design of the major system components.

Section 3 *Receipt, Unpacking, Proper Handling, and Installation* describes unpacking the analyzer, safe handling of the transducer, installing it in the facility, and interfacing it with other devices.

Section 4 *Transmitter Configuration Using the Keypad and LCD Screen* provides step-by-step directions for setting up the transmitter's operating and display configurations via the front keypad and LCD screen.

Section 5 *Transmitter Configuration Using the ViscoSite Software for PC* provides an introduction to the ViscoSite Software for PC. Step-by-step directions for setting up the transmitter's operating and display configurations using the ViscoSite PC Software via local or remote connection to the transmitter are provided.

Section 6 *Preventative Maintenance* outlines steps that should be taken on a periodic basis to ensure long term trouble-free operation.

Section 7 *Troubleshooting the ViscoSite VL800 Viscometer* highlights commonly observed challenges which may arise when using the ViscoSite VL800 Viscometer, along with their most common causes.

Section 8 *System Diagrams* provides diagrams to assist the operator with interfacing auxiliary components to the transmitter.

Section 9 *Technical Specifications* provides the specifications for the system.

Section 10 *Spare Parts* provides a list of items which may be required to maintain operation of the system.

Section 11 *Modbus Registers* outlines the Modbus Register configuration for the ViscoSite transmitter to aid in the configuration of Modbus communications to a computer.

1.2 Overview

The ViscoSite VL800 Viscometer comprises a transmitter and a VL800 transducer and provides measurements from which process material viscosity may be determined. The system is capable of measuring flowing and stationary materials across a broad range of viscosities, temperatures, and densities. Temperature compensation per ASTM D341-03 for liquid petroleum products is available. With a known static or real-time density, the transmitter can display the measured viscosity in several standard viscosity units. In the absence of density information, the product of Viscosity and Density is displayed.

1.3 Principle of Operation

The ViscoSite VL800 Viscometer operates on the principle of torsional forced oscillation resonance. The ViscoSite transducer is depicted in Figure 1.1.

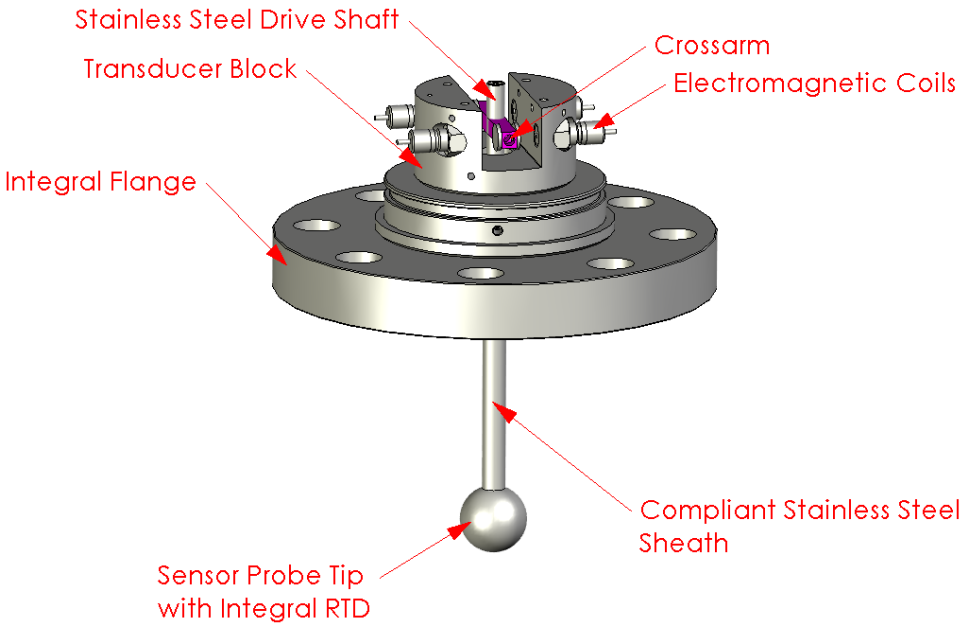

Figure 1.1: Anatomy of the ViscoSite VL800 Viscometer

The sensor tip is driven in sinusoidal rotational oscillation. Small amplitude oscillatory shear waves propagate through the material and are dampened. Dampening effects are dependent on the properties of the material. The presence of the material dampens the probe's motion, leading to changes in the resonant frequency and amplitude of sensor oscillation. The system is driven on resonance with constant amplitude (at all resonance frequencies) and the power required to do so is measured. Changes in viscosity and density affect the amount of power required to maintain this constant amplitude.

Measurement of the power required to drive the sensor at constant amplitude, the phase difference between the response signal and the constant amplitude drive signal, and knowledge of the material density allows calculation of viscosity.

Transducer sensor tips with different shapes and surface areas allow measurement across a broad range of kinematic viscosities from 0.1 to 1,000,000 cP (assuming a density of 1.00 g/cm^3).

1.4 Features of the ViscoSite Viscometer

The ViscoSite Viscometer provides

- Viscosity determination across a broad range (when material density is known)
- A separate transducer and transmitter, allowing for remote installation of the transmitter in non-hazardous areas, with a maximum separation of 300 metres
- A choice of transducer probe materials and coatings for low friction and/or harsh process environments
- Integral transducer cooling for high temperature applications
- User-programmable Isolated Analog Outputs (3) and Digital Relay Outputs (2) for remote data collection and alarm monitoring
- 1 Isolated Analog Input (Density)
- Multiple Communications Options – Modbus RTU over Ethernet, USB, and RS232C/RS485

1.5 Operational Control

The ViscoSite transmitter includes an on-board microprocessor which supplies and controls the

- Local User Interface (UI)
- Data acquisition and processing subsystem for determination of the
  - Resonance frequency
  - Power required to drive the transducer at constant amplitude (at resonance)
  - Phase angle between the response and drive signals
  - Transducer temperature (transducer probe and block)

Configuration of the system locally using only the transmitter keypad is outlined in Section 4.

Configuration of the system via local connection (USB) and/or remote LAN connection using the ViscoSite for PC software application is outlined in Section 5.

2 System Components

2.1 Overview

The ViscoSite VL800 Viscometer is a modular system comprising a ViscoSite transmitter and a VL800 viscosity transducer. The two components are coupled via a signal cable. The system determines the Viscosity x Density product of a material sample stream using the method outlined in Section 1.2.

The system can be installed in many hazardous areas with the use of Intrinsic Safety barriers between the transmitter and transducer. These barriers are provided by Galvanic Applied Sciences on a per-application basis and are delivered with the transducer.

An overview of the system is shown in Figure 2.1.

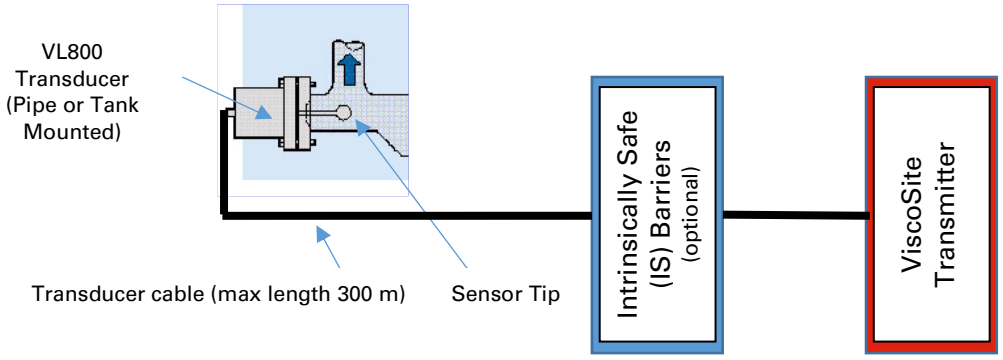

Figure 2.1: Block Diagram of ViscoSite VL800 Viscometer

The system consists of the following components:

- Transducer (Section 2.2)
- Transducer Cable (Section 2.3)
- Intrinsically Safe (IS) Barriers (Section 2.4)
- ViscoSite Transmitter (Section 2.5)

2.2 VL800 Viscosity Transducer - Overview

The ViscoSite VL800 Viscometer uses the VL800 transducer.

The transducer is available with cylindrical, spherical, or rod sensor tips. Each transducer is capable of measuring Viscosity x Density over a continuous five-decade range. Neck extensions are designed integral to the transducer as required to fill areas of possible stagnant flow ("dead space") that would otherwise exist near the probe tip at the installation site.

Your transducer configuration has been custom designed for optimal performance at the installation location in your process environment.

Table 2.1 lists the approximate sample Viscosity x Density ranges (expressed as cP x g/cm ^{3}) for each sensor tip geometry.

Transducer Tip Shape (Not to Scale)		[Viscosity x Density Range]
Rod		100 to 1 000 000 cP x g/cm ^{3}
Sphere		10 to 100 000 cP x g/cm ^{3}
Cylinder (MV)		1.0 to 10 000 cP x g/cm ^{3}
Cylinder (LV)		0.1 to 1000 cP x g/cm ^{3}

Table 2.1: Transducer Tips and [Viscosity x Density] Ranges

2.2.1 VL800 Transducer - Construction

The standard VL800 transducer is constructed from NEMA 4 rated 316 stainless steel. The standard VL800 has an integral flange to simplify installation in pipes and tanks. Other mounting approaches are discussed later in this manual.

Custom construction materials and coatings are available for harsh environments and materials with unique properties that require special consideration during processing.

A VL800 transducer with a spherical sensor tip (probe) and neck extension is shown in Figure 2.2.

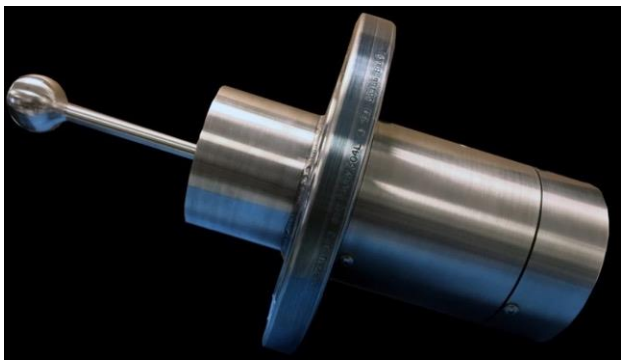

Figure 2.2: VL800 Transducer with Spherical Sensor Tip and Neck Extension

2.2.2 Transducer Operating Temperature Range and Cooling Requirements

The operating process temperature range of the VL800 transducer is **- 40 °C to 450 °C,** subject to the following requirements:

- Process Temperatures of **200 °C to 300 °C** require **Air / Inert Gas Cooling** (see Section 3.8.1).
- Process Temperatures of **300 °C to 450 °C** require **Water Cooling** (see Section 3.8.2).

NOTICE

Clean dry air/inert gas or clean water must be used to control the temperature of the transducer. Pre-filtering of the cooling source is strongly recommended.

Malfunction of or damage to the transducer resulting from moisture or other contaminants in the air / inert gas or water used to cool the transducer is **not** covered by your Warranty.

2.3 VL800 Transducer Cable

The ViscoSite VL800 Viscometer system uses a 3/8" diameter (O.D.) cable which

- Carries power from the transmitter to drive the transducer's torsional oscillatory motion
- Carries the transducer's response signal back to the transmitter for analysis
- Carries power from the transmitter to the transducer's sensor tip RTD and, if equipped, the block RTD, for temperature measurements
- Carries the signals from the RTDs back to the transmitter for analysis

A military spec NEMA-4X MS3102E (shell size 20) connector or a ½" NPT cable gland may be used to connect the transducer cable to the transducer dome.

NOTICE

The maximum length of the transducer cable is 300 metres.
Alteration of the transducer cable length WILL affect measurements.
Contact Galvanic Applied Sciences prior to making any changes to the sensor cable length.

2.4 Intrinsically Safe (IS) Barriers

The purpose of intrinsically safe barriers is to provide protection against explosions by restricting the total amount of electrical energy within the apparatus and interconnecting wiring which are exposed to a potentially explosive atmosphere to a level below that which can cause ignition by either sparking or heating effects.

⚠ DANGER

If the ViscoSite transducer is to be installed in a Class 1 Division 1 area, the transmitter and safety barriers must be installed outside the Class 1 Division 1 area unless additional safety measures are taken.

If required for your installation, the Intrinsically Safe barriers are pre-wired to the transmitter motherboard and installed within the ViscoSite transmitter enclosure as part of the initial configuration.

Typical IS barriers are shown in Figure 2.3.

Figure 2.3: Intrinsically Safe (IS) Barriers

NOTICE

System calibration is performed with the IS barriers installed.

If an Intrinsically Safe barrier needs to be replaced for any reason, the entire system will require recalibration.

Contact Galvanic Applied Systems.

2.5 ViscoSite VL800 Transmitter

The ViscoSite VL800 transmitter comprises

- The transmitter motherboard which contains:
  - 3 user-programmable Isolated Analog Outputs
  - 2 Digital Relay Outputs for remote data collection and alarm monitoring
  - 1 Isolated Analog Input (Density ONLY)
  - Multiple Communications Options – Modbus RTU over Ethernet, USB, and RS232C/RS485
- The transmitter LCD, Status LEDs, and Membrane Keypad mounted on a swing panel internal to the transmitter enclosure
- The system's power supply and conditioning circuitry (AC/DC or DC/DC as required)
- Intrinsically Safe (IS) barriers (as required)
- Ethernet and USB ports for connecting to the transmitter to a computer **locally** (USB) or **remotely** (Ethernet over LAN via the transmitter's IP address) using the Modbus RTU protocol.

The transmitter's components are housed in a fiberglass enclosure. The enclosure features a transparent latch closure hinged front door. The LCD and keypad panel are mounted within the enclosure and swing outward to provide access to the transmitter electronics for connection of the transducer, output, density, and RS232/RS485 wiring as required by your application.

The ViscoSite transmitter installed the standard fiberglass enclosure is shown in Figure 2.4.

Figure 2.4: ViscoSite Transmitter (Inside Standard Enclosure)

2.5.1 Transmitter Enclosure

The standard transmitter enclosure is NEMA-4X rated and is suitable for installation in Class 1 Division 2 hazardous and non-hazardous areas. The front of the standard enclosure allows the operator to observe both the analysis results and the overall system status without opening the enclosure.

ATEX and IECEx certifications are forthcoming.

⚠WARNING

If the ViscoSite transmitter is installed in a Class 1 Division 2 hazardous area, the hazardous area MUST be declassified prior to opening the transmitter enclosure for manual configuration.

2.5.2 LCD, Status LEDs, Keypad, and Swing Panel

In addition to housing the transmitter's electronics, the enclosure houses the LCD, status LEDs, and a membrane keypad. These are mounted on a swing panel, as shown in Figure 2.5.

Figure 2.5: Swing Panel front (L) and rear (R)

The LCD is a 4-line x 20 column display with a default configuration that displays

- The calculated [Viscosity x Density] product
- The transducer sensor tip (probe) temperature
- The transducer block temperature (optional)
- The present oscillation frequency of the transducer

The keypad below the LCD allows for local control of transmitter operation without a PC connection and may be used for configuration of operating parameters.

See Section 4 for a comprehensive guide to configuration and operation of the ViscoSite transmitter via the front keypad.

System status is indicated by 4 LEDs located above the LCD. Their functionality is described in Section 4.3.2.

The LCD's control electronics are mounted to the back side of the swing panel. The LCD and keypad are connected by a gray ribbon cable. A multicolour ribbon cable connects the LCD control board to the transmitter's motherboard. A potentiometer on the top right corner of the LCD electronics board adjusts the brightness of the LCD screen. Its location is denoted by the red circle in Figure 2.5.

2.5.3 Transmitter Motherboard

The ViscoSite transmitter's motherboard is mounted to the chassis base plate behind the swing panel. If Intrinsically Safe (IS) barriers are required for the application, they are also mounted **and grounded** (as provided) to the chassis base plate behind the swing panel. The motherboard of the ViscoSite transmitter is shown in Figure 2.6.

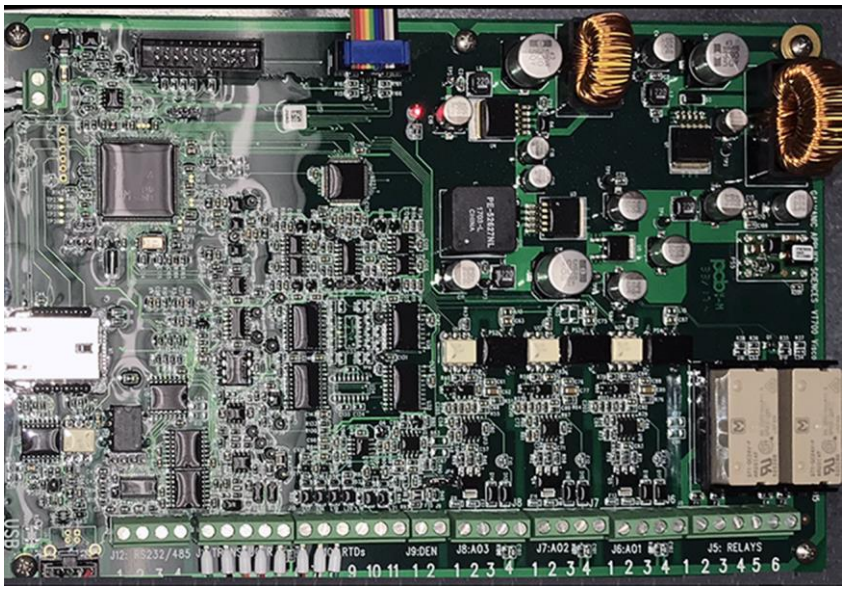

Figure 2.6: ViscoSite Transmitter Motherboard

The ViscoSite transmitter motherboard comprises:

- A signal generator and output circuit for driving the transducer
- A data acquisition and processing subsystem for determination of
  - Resonance Frequency
  - Power required to drive the transducer at constant amplitude
  - Phase angle between drive and response signals
  - Viscosity x Density Product
  - Viscosity (if Density information is known)
  - Transducer sensor tip and block temperature
  - Temperature compensated viscosity values (if desired)

The ViscoSite transmitter motherboard also provides terminal strip access to the following on-board components:

- 1 Isolated Analog Input (Density **only**)
- 3 configurable Isolated Analog Outputs
- 2 Configurable Digital Relay Outputs
- 1 3-Wire RTD (Transducer Sensor Tip)
- 1 3 Wire RTD (Transducer Block)
- 1 RS232C/485 Serial Communications Port
- 1 on-board 10/100 MB/sec Ethernet Port
- 1 USB-A (2.0) Female Connector
- 1 Transmitter Power Supply connection

2.5.4 Power Supply

The ViscoSite VL800 Viscometer's transmitter may be powered by either

- 24 VDC (10-32 VDC)

or

- 90-240 VAC 50-60 Hz

The transmitter has been configured at the factory for your power requirements. Transmitters powered by AC are equipped with AC to DC converters installed within the enclosure.

An EMI/RF filter has been placed in line with the power supply to reduce electrical noise and potential interference.

3 Receipt, Unpacking, Proper Handling, and Installation

3.1 Receiving the System

NOTICE

Inspect the packaging for external signs of damage upon arrival.
If there is any obvious physical damage, DO NOT OPEN. Contact the shipping carrier's agent and Galvanic Applied Sciences immediately to report the damage.

Please request that the carrier's agent be present when the packaging is opened, and the system is unpacked. Document all observed damage or suspected damage in writing

3.2 Unpacking the System

When unpacking the system:

- Open the shipping container and remove all packing material and boxes.
- Place the small packages aside in a safe, secure storage area until installation.
- Visually inspect the system and accessory packages to ensure that no damage has occurred.

NOTICE

If damage has occurred, stop and contact the shipping carrier and Galvanic Applied Sciences.

Do not proceed with further unpacking. Do not proceed with system installation.

NOTICE

Do not attempt to facilitate repairs yourself as this will likely negate / invalidate any potential shipping insurance claim and **will VOID** your Warranty.

IMPORTANT!

PLEASE KEEP THE SHIPPING CONTAINER (CRATE/BOX) AND ALL PACKING MATERIALS FOR THE TRANSDUCER FOR RETURNING THE TRANSDUCER TO THE FACTORY FOR SERVICE.

Failure to use factory approved shipping materials when shipping the transducer may lead to transducer damage and may void any remaining warranty on the system.

Please contact Galvanic Applied Sciences if you require factory approved shipping materials.

Transducers are shipped in cardboard containers or wooden crates as dictated by the dimensions of the transducer. The two types of packaging are shown in Figure 3.1.

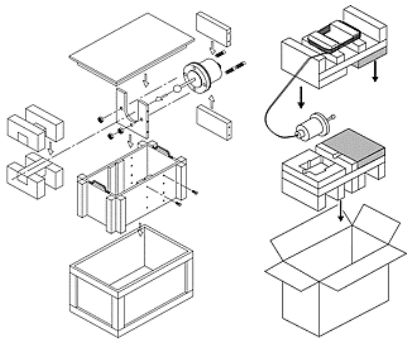

Figure 3.1: Transducer Shipping Containers:
Wooden Crate (L), Cardboard Box (R)

3.3 Proper Handling of the ViscoSite Transducer

Lift the transducer using the flange and/or transducer dome end and flange only! Refer to Figure 3.2.

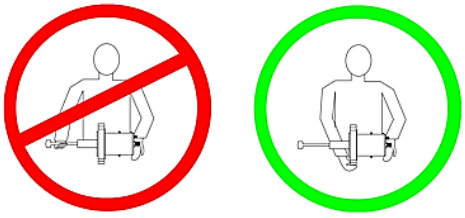

Figure 3.2: Handling the ViscoSite Transducer

NOTICE

DO NOT

- Lift or support the transducer by the sensor tip
- Lift or support the transducer by the outer sensor sheath
- Permit the transducer to rest such that the sensor tip is supporting any of the weight of the transducer

This may cause damage to the transducer and will **not** be covered under your warranty!

3.4 Installation Requirements

3.4.1 Electrical Requirements

The power requirement is 10W.

3.4.2 Selecting the Installation Location of the Transducer

3.4.2.1 *Sample Temperature and Environmental Considerations*

The operating temperature ranges and cooling **requirements** for the VL800 transducer are given in Section 2.2.1.

3.4.2.2 *Vibration Considerations*

While the ViscoSite VL800 Viscometer can operate with some process vibration present, minimizing vibration at the point of installation will provide the best results. Figure 3.3 shows the vibration tolerance for the VL800 viscosity transducer.

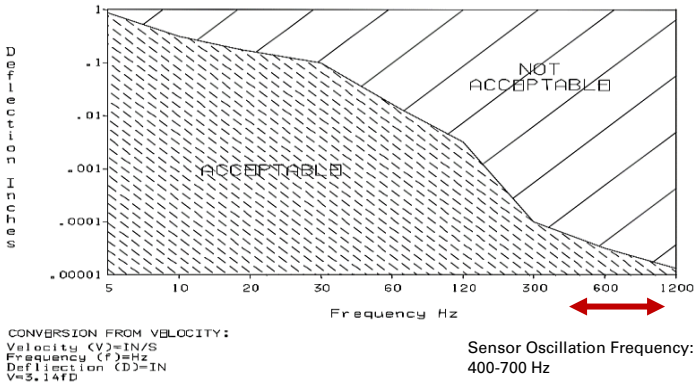

Figure 3.3: Vibration Tolerance Graph

- The desired installation location should be checked with a vibration analyzer that can determine both the frequency and deflection of the processing line/tank vibration.
- These measurements must be made under normal operating conditions with all normally operating equipment running to ensure representative data from which the acceptability of the desired location may be determined.

3.4.2.3 *Minimizing the Influence of Vibration*

Do's:

- Install the transducer either upstream or as far downstream as possible from mechanical noise sources such as pumps, motors, agitators, and moving machinery
- Install rigid floor supports for pipes
- Secure vertical pipes to major beams
- Install intermediate supports in long pipe runs
- Double clamp sections of pipe that exhibit flexing
- Load pipe with a mass to dampen vibrations
- Provide valves to control flow rate, as a lower flow rate may result in less pipe vibration
- Mount the transducer on the suction side of a pump
- Ensure pumps are balanced and shocks are properly installed.

Don'ts:

- Do **not** install the transducer in an unsupported "free" pipe
- If possible, avoid installing the transducer near equipment that generates significant external electromagnetic fields.

If vibrations cannot be reduced to acceptable levels per Figure 3.3, the transducer should be isolated from the source(s) of excessive vibration via installation in a bypass line as shown in Figure 3.4.

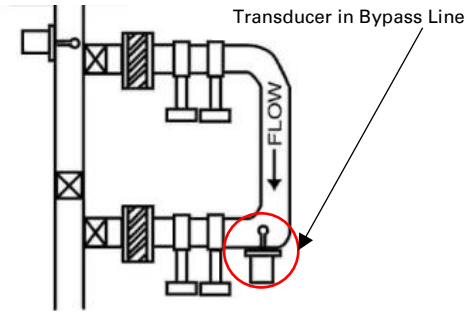

Figure 3.4: Transducer Installation in Bypass Line

If a bypass line is installed, rigid supports should be used to support the bypass line piping. Installation of flex hoses or expansion joints where the bypass line meets the main processing line may aid in reducing vibration of the bypass line.

3.4.2.4 *Flow Considerations*

- While the transducer can be installed at any angle relative to the direction of process flow, it is most desirable to install the probe pointing into the sample flow. This aids in minimizing stagnant flow and trapped air at the sensor tip.
- The sensor tip and outer sheath must be fully immersed in representative process material to obtain accurate measurements.

Figure 3.5 shows "preferred" and "undesirable" (not recommended) mounting scenarios for the transducer. Use of a neck extension (integral to the transducer) to fill dead space is recommended where necessary.

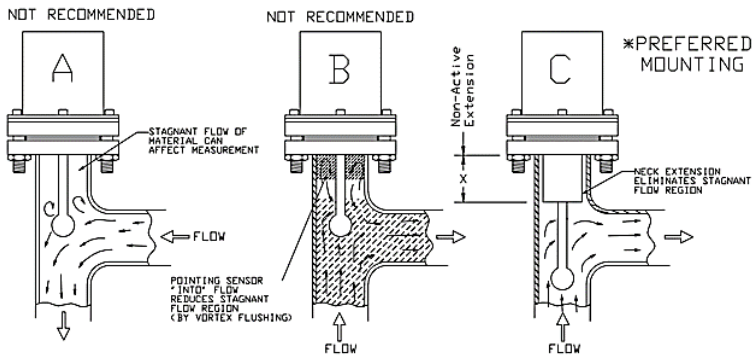

Figure 3.5: Preferred Transducer Mounting

NOTICE

In situations where the transducer *must* be installed perpendicular to the process flow, high viscosity material and / or higher flow rates may damage the transducer.

Galvanic Applied Sciences will work with you to address your needs during the design process.

3.4.3 Installation Considerations for the Transmitter

The ViscoSite transmitter is designed for operation at ambient temperatures from 0 to 60 °C. If the temperature falls outside this range, the transmitter must be installed in a temperature-controlled enclosure or shelter maintained between 0-60 °C.

Additionally, the transmitter should be mounted in a location

- Not exposed to direct sunlight or rainfall
- Not exposed to excessive vibration

- Within 300 metres of cable run to the transducer, taking into account indirect pathways

3.4.4 Installation Considerations and Space Requirements for the ViscoSite Transmitter Enclosure

The dimensions of the ViscoSite transmitter enclosure are shown in Figure 3.6.

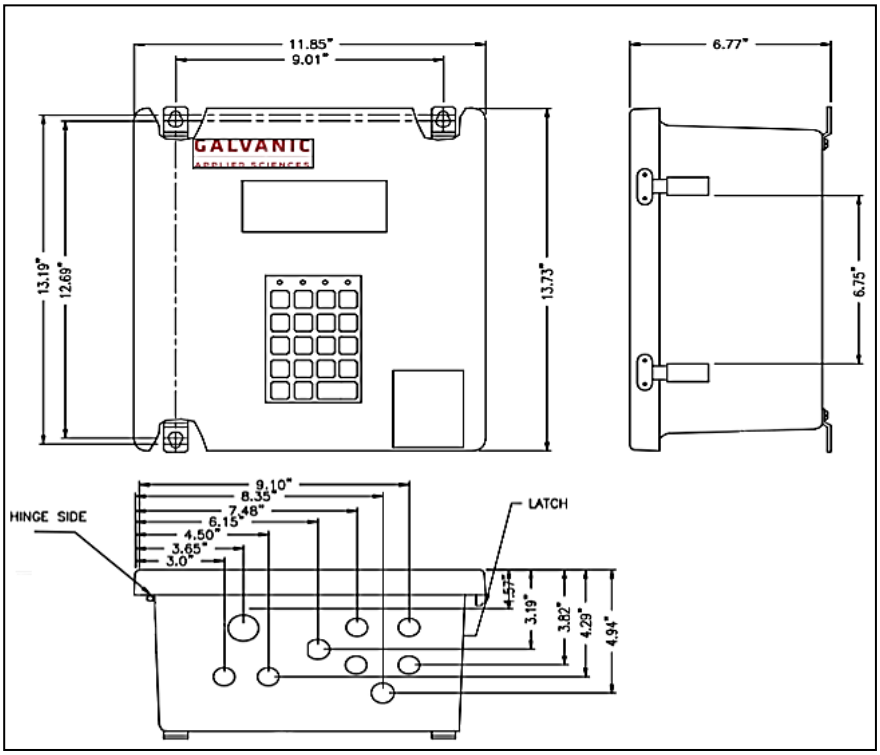

Figure 3.6: ViscoSite Transmitter Enclosure with Dimensions

NOTICE

Be sure to leave space below the transmitter enclosure to allow for the connection of signal, power, and communication wires.

Be sure to leave space to the left of the transmitter enclosure to allow the enclosure door and swing panel to fully open.

3.4.5 Hazardous Area Classification Information

Transmitter:

Class 1, Division 2 Groups B, C, D
ATEX / IECEx EEx G3 nC IIC T4 (Future)

Transducer:

Class 1 Division 1 Groups B, C, D
ATEX 1G EEX ia IIB T3 (VL800)

3.5 Transducer Installation

Install the transducer at a suitable location per Section 3.4.2.
Flange mount, Sanitary mount, and Thread Mount installations are included below.

NOTICE

If the transducer must be installed near equipment generating external magnetic fields (pumps, motors, etc.), rotating the sensor by 90° around the sheath's axis may substantially reduce magnetic interference.

3.5.1 Flange Mount Installation

3.5.1.1 *To Install a Flange-Mounted Transducer:*

- Install a flange gasket between the transducer and the pipe or vessel flange.
- Lift the transducer by the flange and/or the dome. **Do not lift the transducer by the sensor sheath or the probe tip.**
- Position the transducer against the pipe or vessel flange in the desired orientation.
- Couple the transducer flange to the pipe or vessel flange using appropriate flange mounting bolts.
- Always tighten the flange mounting bolts in a staggered crosswise fashion to ensure an evenly distributed coupling between the flange mating surfaces.
- Bolts should be well lubricated and torqued to 50% of bolt yield stress.

3.5.1.2 *Using the Transducer Position Indexing Mark During Installation and Removal*

Note the orientation of the Transducer Position Indexing Mark during initial installation. See Figure 3.7 for the location of the transducer indexing mark. Use the position indexing mark ^ as a reference for transducer installation orientation.

When the transducer has been uncoupled from the mating flange, be sure to re-install it in the same orientation as prior to removal.

Ensuring the transducer is always installed in the same orientation aids in consistent and reproducible coupling.

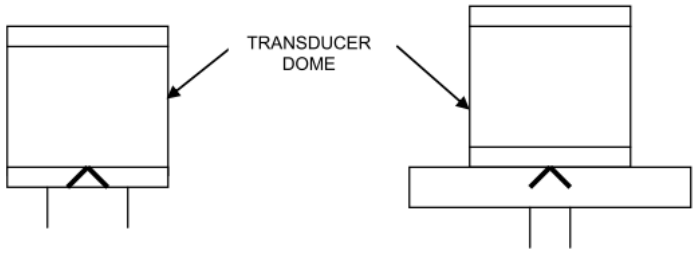

Figure 3.7: Transducer Installation Indexing Mark

3.5.2 Sanitary Mount Installation

If the processing system must be regularly disassembled for cleaning to ensure proper functionality and remain compliant with regulatory requirements, the ViscoSite transducer is coupled to the process using a sanitary mounting system.

NOTICE

The pipe on both sides of the transducer mounting location MUST be stabilized. As sanitary piping is generally not well supported, **use multiple pipe supports to rigidly attach the incoming and outgoing sanitary piping to a nearby floor, wall, or I-beam.**

If the process pipe cannot be suitably secured, an optional Sanitary Sample Cell can be used to ensure a stable, stress-free transducer mounting. Contact Galvanic Applied Sciences for further information.

NOTICE

For sanitary clamps, follow the clamp manufacturer's guidelines regarding minimum torque. A clamp which is not secured properly may lead to unstable ViscoSite Viscometer measurements.

3.5.3 Threaded Mount Installation

A threaded transducer mount may be appropriate for high-temperature and / or high-pressure applications. The threaded transducer mount eliminates the stagnant region of flow in a standard flange mount by flush mounting the probe into the process. This negates the need for a neck extension on the transducer.

3.5.3.1 *Installing a Thread Mount Transducer*

- Prior to installing the transducer, the threads must be coated with Dow Corning Molykote® P37 or equivalent anti-seize paste.
- Care must be taken to avoid thread galling during installation and removal.
- Use **only** the included wrench to install the transducer.

NOTICE

Use of **ANY other tools or methods** to install the transducer (pipe wrenches, etc.) **will VOID the instrument warranty.**

⚠CAUTION

Do not install the transducer more than **five (5)** full rotations into the mating connector. **Do Not Overtighten.**

3.6 Transmitter Enclosure Installation

The transmitter and its enclosure should be installed in a suitable location meeting the requirements set forth in Section 3.4.3.

3.7 Transducer Cable Installation

3.7.1 Cable Installation at the Transducer

- Run the transducer cable through rigid conduit from the transmitter to the transducer. **No rigid connections should be made to the transducer** to minimize transmission of vibrations to the transducer through the cable and conduit.
- After exiting the rigid conduit, route the transducer cable through flexible metal conduit (e.g. Sealtite NDA ½" type, minimum length 2') before connecting to the transducer.
- Spray the cable connecting receptacle on the transducer with contact cleaner/moisture repellant.

- Securely fasten the cable to the transducer receptacle using the threaded coupling at the end of the transducer cable. Figure 3.8 shows a representative transducer cable installation.

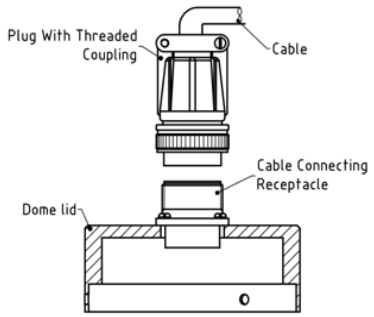

Figure 3.8: Connecting the Transducer Cable at the Transducer

Figure 3.9 shows the pinout of the cable connecting receptacle *on the dome lid.* Note that the pin layout is asymmetrical with Pin L at the top. There is no Pin I.

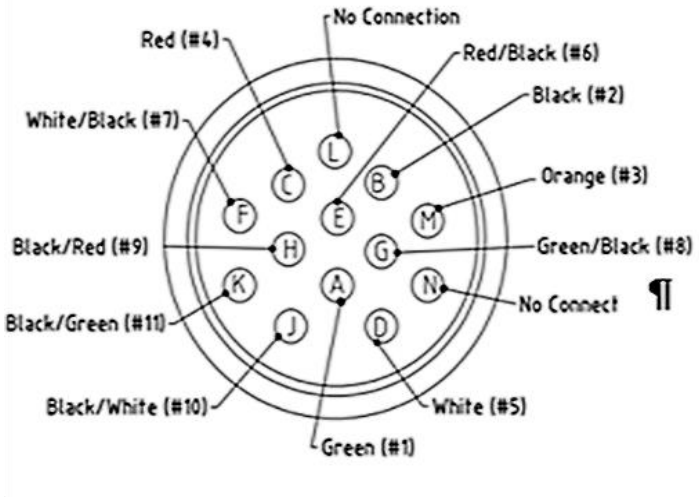

Figure 3.9: Transducer Cable Connecting Receptacle Pin Layout (Dome Lid (viewed from above)

NOTICE

If the provided cable is too long, **do not attempt to cut it. Cutting the cable WILL affect the calibration of the system** and **WILL yield inaccurate measurements.** Neatly wrap up the excess cable length.

3.7.2 Overview: Transducer Cable Connection at the Transmitter (no IS Barriers)

The transducer cable should enter the transmitter enclosure through gland E on the bottom of the transmitter enclosure (See Figure 3.15).

If the transmitter is **not** equipped with IS barriers (refer to Section 2.4), the transducer cable is wired directly to the transmitter motherboard terminal blocks **J10** (transducer drive and response signals) and **J11** (transducer RTDs (temperature sensors). The individual transducer cable wires are color-coded and labeled with wire numbers.

Transducer cable to transmitter connections are shown in Table 3.1.

Terminal Block	Terminal Number	Wire Number	Transducer Wire Color	Function
J11	1	1	Green	Detector +
	2	2	Black	Detector -
			Orange	Cable Shield / Drains (See Below) **
	4	4	Red	Drive +
	5	5	White	Drive -
J10	1	6	Red/Black	Sensor Tip RTD (GND)
	2	7	White/ Black	Sensor Tip RTD +
	3	8	Green/ Black	Sensor Tip RTD Sense
	4	9	Black/Red	Block RTD (GND)
	5	10	Black/White	Block RTD +
	6	11	Black/Green	Block RTD Sense

Table 3.1: Transducer Cable to Transmitter Terminal Blocks: No IS Barriers

3.7.2.1 *Connecting the Transducer Cable at the Transmitter (No IS Barriers)*

Connect the individual color-coded and numbered wires of the transducer cable to the numbered terminal positions on the terminal blocks on the motherboard as shown in Table 3.1.

*3.7.2.1.1 Grounding the Shield / Drain Wires at the Transmitter***

The shield / drain wires of the transducer cable twisted pairs are internally coupled to each other and to the **orange** wire. The **orange** wire is to be connected to earth ground via the chassis ground of the transmitter. ****Do NOT attach the orange wire at the transducer end of the cable.**

To Connect the Transducer Cable Orange Wire to Earth Ground via the Transmitter Chassis:

- Remove the **orange** topped screw on the transmitter chassis base plate.
- Center the ring terminal of the **orange** wire from the transducer over the screw hole.
- Reinsert and firmly tighten the **orange** topped screw.

NOTICE

Failure to connect the **orange** wire as described above may lead to increased susceptibility to external interference, unstable operation, and / or inaccurate measurements.

Galvanic Applied Sciences assumes no risk nor liability for any outcome associated with the failure to make the above described ground wiring connection.

3.7.3 Transducer Cable Connection at the Transmitter (with IS Barriers)

If the system is equipped with IS barriers (refer to Section 2.4), the individual wire connections between the motherboard terminal blocks **J10** and **J11** and the **(transmitter) non-intrinsically safe side** of the IS barriers have been made at the factory. Connection of the transducer cable to the intrinsically safe side of the IS barriers must be performed at the time of installation, *after* the transducer cable has been fed through the conduit and its position finalized.

3.7.3.1 *Connecting the Transducer Cable at the Transmitter (IS Barriers: Intrinsically Safe Side)*

- Connect the **transducer cable** to the **intrinsically safe side** of the IS barriers according to Figure 3.10 (*General Application / Standard IS Barrier Configuration*) or Figure 3.11 (*High Temperature IS Barrier Configuration*) as appropriate for your configuration.

- If the transducer includes a transducer block RTD for transducer block temperature measurement, use Figure 3.11. Otherwise, use Figure 3.10.

*3.7.3.1.1 Grounding the Shield / Drain Wires at the Transmitter***

The shield / drain wires of the transducer cable twisted pairs are internally coupled to each other and to the **orange** wire. The **orange** wire is to be connected to earth ground via the chassis ground of the transmitter. **Do NOT attach the orange wire at the transducer end of the cable.**

*To Connect the Transducer Cable **Orange** Wire to Earth Ground via the Transmitter Chassis:*

- Remove the **orange** topped screw on the transmitter chassis base plate.
- Center the ring terminal of the **orange** wire from the transducer over the screw hole.
- Reinsert and firmly tighten the **orange** topped screw.

NOTICE

Failure to connect the **orange** wire as described above may lead to increased susceptibility to external interference, unstable operation, and / or inaccurate measurements.

Galvanic Applied Sciences assumes no risk nor liability for any outcome associated with the failure to make the abovedescribed ground wiring connection.

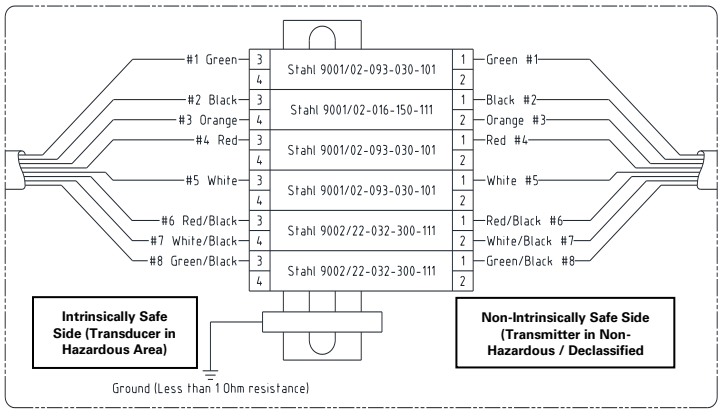

Figure 3.10: Standard IS Barrier Connection General Applications (Up to 200 °C)

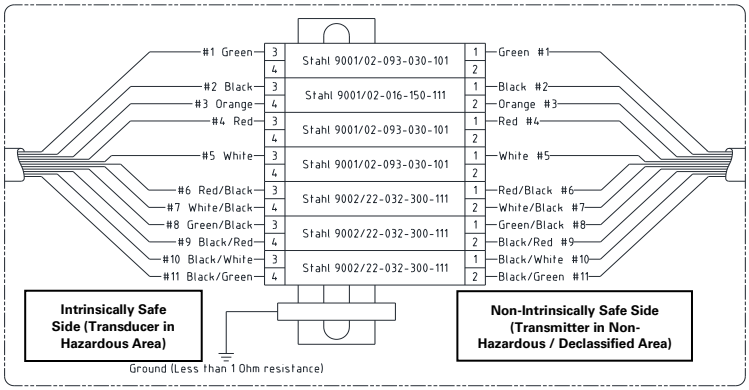

Figure 3.11: IS Barrier Connections - High Temperature Applications (200 °C to 450 °C). (Includes Transducer Block (Dome) RTD)

3.7.3.2 *Grounding of the Intrinsically Safe Barriers*

The Intrinsically Safe barriers, as installed in the transmitter enclosure from the factory, are connected to earth ground via the barrier mounting rail's attachment to the chassis.

⚠ DANGER

The Intrinsically Safe barriers **MUST** be connected to earth ground to provide a safe transducer installation in the hazardous area.

⚠ DANGER

Failure to ground the IS barriers MAY result in shock, injury, fire, explosion, and / or death.

⚠ DANGER

If the IS barriers must be relocated outside the transmitter enclosure, the Customer assumes all associated costs and risks related to their relocation and is solely responsible for

- **Providing a suitable earth ground for the IS barriers.**
- **Connecting the IS barriers to earth ground.**
- **Maintaining the required grounding of the IS barriers whenever the transducer**
  - **Resides in a hazardous area that has not been declassified**
    AND
  - **both the transmitter and transducer are both wired to the IS barriers such that the transducer is capable of operation.**

Galvanic Applied Sciences assumes no risk nor liability for any outcome associated with the failure to make or maintain the above described ground wiring connection.

3.8 Transducer Cooling Requirements

No additional transducer cooling is required for applications where the transducer block / dome temperature does not exceed 200 °C.

Additional Air / Inert Gas Cooling is required for applications where the block / dome temperature would reach 200 °C – 300 °C without additional cooling.

Additional Water Cooling is required for applications where the block / dome temperature would reach 300 °C – 450 °C without additional cooling.

NOTICE

Block/dome temperatures above 200 °C will damage internal components of the transducer.
Although the system may continue to produce readings, they will be inaccurate.

NOTICE

DO NOT use water or any other liquid to spray down the dome of a transducer whose dome/block temperature is reading above 200 °C. This may result in thermal shock and may lead to permanent, irreparable damage to the transducer that is not covered by your warranty.

3.8.1 Transducer Cooling - Air / Inert Gas

If the process temperature is such that the block / dome temperature *would* be between 200 °C and 300 °C without additional cooling, air / inert gas cooling is **required** to keep the block / dome temperature at or below 200 °C. A pressure of 5-10 psi @ 0.25 CFM is generally sufficient to keep block / dome temperatures at a suitable level (at or below 200 °C). Adjust the air / inert gas pressure to the minimum pressure required to maintain the transducer dome / block at or below 200 °C.

Air / inert gas cooling connection locations on the transducer dome are shipped with plugs installed in place of the required stainless steel fittings to prevent exposure of the transducer block to contaminants and moisture (including ambient air) during shipping.

3.8.1.1 *Installing the 1/8" NPT Air / Inert Gas Cooling Fittings*

- Remove the cooling port shipping plugs from locations B in Figure 3.12. **BOTH** shipping plugs must be removed, and **BOTH** fittings installed for proper cooling airflow.
- Use Teflon tape on the 1/8" NPT stainless steel fitting threads and install the fittings in the dome at the locations from where the plugs were removed (positions marked B) in Figure 3.12.
- Connect regulated moisture-free cooling air / inert gas to one of the cooling fittings B via flexible hose or tubing.

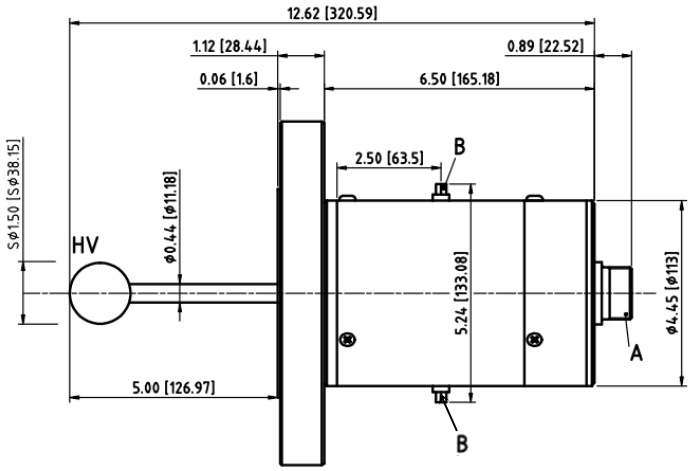

Figure 3.12: Location of Air / Inert Gas Cooling Fittings

An example of an air / inert gas cooling instillation is shown in Figure 3.13. An outlet hose is optional. No stress should be applied to the transducer from these cooling lines.

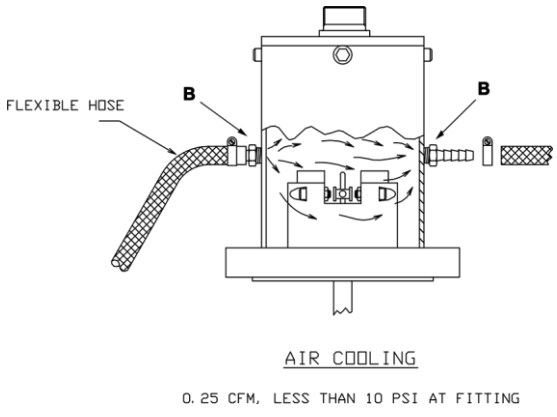

Figure 3.13: Installation of Air / Inert Gas Cooling for the ViscoSite Transducer

NOTICE

There is no hermetic seal within the dome to isolate sensitive transducer components, as this would hamper cooling. **The cooling air or inert gas MUST be dry and free of contaminants.**

Moisture or other contaminants in cooling air / inert gas may cause damage to or malfunction of the transducer. This damage is NOT covered by your warranty.

3.8.2 Transducer Cooling - Water

If the process temperature is such that the block / dome temperature *would* reach 300 °C – 450 °C without additional cooling, water cooling is **required** to keep the block / dome temperature at or below 200 °C. Low pressure water is generally sufficient to keep block / dome temperatures at a suitable level (at or below 200 °C). Adjust the water pressure and flow rate to the minimum pressure and flow rate required to maintain the transducer dome / block at or below 200 °C.

Water cooling connection locations on the transducer dome are shipped with plugs installed in place of the required fittings to prevent exposure of the transducer cooling channel to contaminants and moisture (including ambient air) during shipping.

3.8.2.1 *Installing the 1/8" NPT Water Cooling Fittings*

Four cooling ports are provided on the dome. Only two will be used.

- Remove the cooling port shipping plugs from only the two ports opposite one another to be used (inlet and outlet). The ports are located in the area below the screws used to mount the dome.
- Use Teflon tape on the 1/8" NPT stainless steel fitting threads and install the stainless fittings in the positions where the shipping plugs were removed (positions marked B in Figure 3.14 below).
- Connect clean, contaminate-free water to one of the cooling fittings B via flexible hose or tubing. Connect an outlet line for the cooling water at the other fitting labeled B, directly across from the inlet fitting.
- The supplied cooling water must enter and exit through flexible tubing or hoses. No stress should be applied to the transducer from these hoses.

A typical instillation is shown in Figure 3.14.

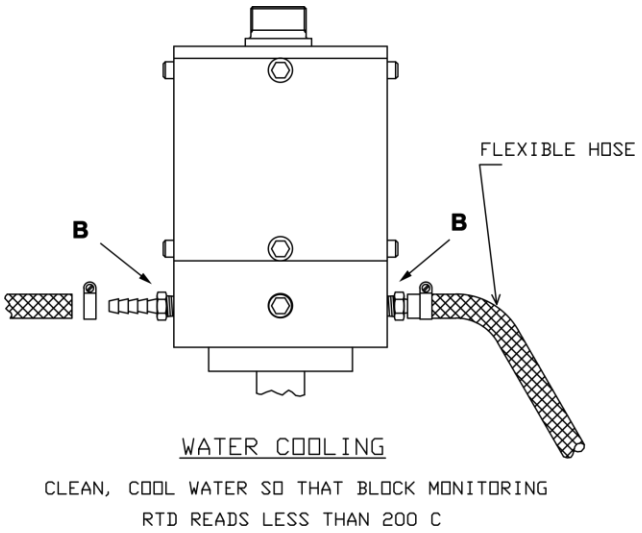

Figure 3.14: Installation of Water Cooling for the ViscoSite Transducer

NOTICE

Air cooling and water cooling ports look similar (1/8" NPT stainless fittings), but they are located in different regions of the transducer. **DO NOT apply water to air cooling ports!**

3.9 Enclosure Feedthroughs / (Glands) and External Ports

Feed-through glands are provided for passage of wiring into the ViscoSite transmitter enclosure for the following:

- 3 Isolated Analog Outputs
- 1 Isolated Analog Density Input
- 2 Digital Relay Outputs
- 1 RS232C/485 Serial Output

External ports are provided for the following connections:

- 1 USB-A Female port
- 1 Ethernet connection port (10/100 Mb/sec, half-duplex)

Gland / port identification is shown in Figure 3.15 for proper routing of wiring into the enclosure. Table 3.2 provides the same information in tabular form.

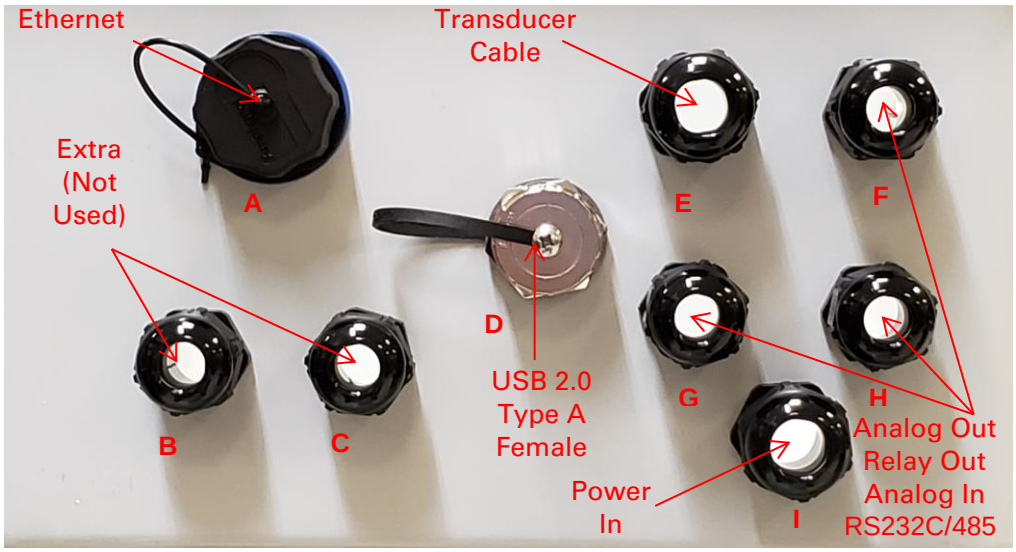

Figure 3.15: Transmitter Enclosure - Wiring Connections and Glands

Port/Gland	Function
A	Ethernet
B	Extra/Not Used
C	Extra/Not Used
D	USB 2.0 Type A (Female)
E	Transducer Cable
F	Analog Out Relay Out Analog In (Density) RS232C/485
G	
H	
I	Power In

Table 3.2: Wiring Glands / Ports for the Transmitter Enclosure

3.10 Transmitter Connections: Isolated Analog Outputs, Isolated Analog Input (Density), and Digital Relays

3.10.1 Isolated Analog Outputs

The ViscoSite transmitter provides three configurable self-powered 3- wire Isolated Analog Output channels. These Analog Outputs are accessed via **terminal blocks J6, J7,** and **J8** of the ViscoSite transmitter. The outputs may be independently configured to provide

- 0-20 mA
- 4-20 mA
- 0-10 VDC
- 2-10 VDC

output signals to an external data collection or process monitoring system.

Parameter choice and output type for each Isolated Analog Output may be configured via the keypad interface (see Section 4) and the ViscoSite software (see Section 5).

Connect the required Isolated Analog Output wiring to the transmitter motherboard according to Table 3.3.

3.10.1.1 *Isolated Analog Output Wiring Connections at the Transmitter*

- Determine the output mode (Voltage or Current) to be used for each Isolated Analog Output channel along with the corresponding full-scale limits as shown in Section 3.10.1.
- **For Current (0 - 20, 4 – 20 mA):** Connect terminal positions 1, 2, and 4 as shown in Table 3.3.
  - In Current Output Mode, the ground connection is for shielding of the wires. Do not connect a signal lead to terminal position 4 (ground) in Current Output Mode.
- **For Voltage (0 - 10, 2 - 10 VDC):** Connect terminal positions 3 and 4 as shown in Table 3.3.
  - In Voltage Output Mode, the voltage established at Pin 3 is relative to Pin 4, Ground. Connect the grounded reference line for your input to position 4.

Terminal Block	Isolated Analog Output Channel	Position	Function
J6	1	1	Current Out (0 – 20 / 4 - 20 mA) (+)
		2	Current Out (0 – 20 / 4 - 20 mA) (-)
		3	Voltage Out (0 – 10 / 2 - 10 VDC)
		4	Ground
J7	2	1	Current Out (0 – 20 / 4 - 20 mA) (+)
		2	Current Out (0 – 20 / 4 - 20 mA) (-)
		3	Voltage Out (0 – 10 / 2 - 10 VDC)
		4	Ground

Terminal Block	Isolated Analog Output Channel	Position	Function
J8	3	1	Current Out (0 – 20 / 4 - 20 mA) (+)
		2	Current Out (0 – 20 / 4 - 20 mA) (-)
		3	Voltage Out (0 – 10 / 2 - 10 VDC)
		4	Ground

Table 3.3: Isolated Analog Output Terminal Block Layout

3.10.2 Isolated Analog Input (Density)

The ViscoSite transmitter provides 1 Isolated Analog Input to be used **ONLY** for the input of a 0-20 mA or 4-20 mA signal from an external density measuring device.

NOTICE

Do NOT attempt to use this input for any other purpose, as damage to the transmitter electronics may occur, and this will not be covered by your warranty.

Do not overrange or reverse polarity on the Density input.

Do not connect a grounded input to the Density Input.

3.10.2.1 *Isolated Analog Output Wiring Connections at the Transmitter*

- Ensure the jumper **JP4** on the motherboard is installed across pins 1 and 2 before attaching the density signal input connections.
- Connect the appropriate density measurement device output cable to terminal block **J9** according to Table 3.4.

Terminal Block	Position	Function
J9	1	Density 0 - 20, 4 – 20 mA (-)
	2	Density 0 - 20, 4 – 20 mA (+)

Table 3.4: Isolated Analog Input (Density) Terminal Block Layout

Make no connections to terminal block **J9** if a density measuring device output will not be connected to the transmitter.

3.10.2.1.1 Correctly Calculating Viscosity Using Density Information

NOTICE

Density information representative of the material under process conditions *must be entered into the transmitter in order to accurately calculate viscosity in standard viscosity units.*

This may be accomplished via

- Real-time density data input to the transmitter's Isolated Analog Input (Density)
- Manual entry of a representative static density into the transmitter to be used for viscosity calculations

NOTICE

The default factory transmitter setting for density is 1.00 g/cm³. If density information is not provided, the calculated results in standard viscosity units will be inaccurate unless the process material density = 1.00 g/cm³.

The density parameter may be configured via the transmitter keypad (see Section 4) and/or the ViscoSite software (see Section 5).

3.10.3 Digital Relay Outputs

The ViscoSite transmitter provides 2 (two) Digital Relay Outputs. These Digital Relay Outputs are primarily used to provide notification of measured parameter values that are outside an expected range. They are especially useful when real-time data logging for a parameter is not required and only the range of a parameter value is of interest.

3.10.3.1 *Digital Relay Output Wiring Connections at the Transmitter*

Connect the Digital Relay Output wiring to terminal block **J5** as indicated in Table 3.5.

Terminal Block	Digital Relay Output Number	Position	Function
J5	1	1	Common
		2	Normally Closed (NC)
		3	Normally Open (NO)
	2	4	Common
		5	Normally Closed (NC)
		6	Normally Open (NO)

Table 3.5: Digital Relay Output Terminal Block Layout

Configuration of the relay state (NO/NC) may be accomplished via the transmitter keypad (see Section 4) and via the ViscoSite software (see Section 5).

3.11 Transmitter Connections: Communications Wiring – RS232C/RS485, USB, and Ethernet

The ViscoSite transmitter has 1 Ethernet, 1 USB, and 1 RS232C/RS485 serial communication port.

NOTICE

Modbus RTU protocol in master-/ slave configuration with a 100 msec delay between messages (as needed) is used for ALL communications across ALL communication interfaces.

3.11.1 RS232C/RS485

NOTICE

Measurement data is available via this port for capture and subsequent analysis.

Please contact Galvanic Applied Sciences if you wish to use the Modbus RTU output from this port.

3.11.1.1 *Serial Communications Port Wiring at the Transmitter*

Connect serial communications wiring at terminal block **J12** of the transmitter as indicated in Table 3.6 for your selected configuration.
Configuration of the serial port type can only be performed via the transmitter keypad. See Section 4.7.4.

Terminal Block	Pin Number	Function
J12	1	RS232C Transmit t/ RS485 (+)
	2	RS485 (-)
	3	RS232C Receive
	4	Ground

Table 3.6: RS232C/RS485 Terminal Block Layout

3.11.2 Local PC Connection to the Transmitter via USB

The external USB 2.0 Type A female port is used for communication between the ViscoSite transmitter and a **local** PC running the ViscoSite software.

NOTICE

A virtual COM (communications) port on the PC is required to establish a communications session between the ViscoSite transmitter and a **local** computer via USB.

The virtual COM port must be created and the USB cable connected to both the transmitter and the local PC prior to launching the ViscoSite software.

Several companies offer free software that include the required Windows drivers for different versions of the Windows PC operating systems. Many of Galvanic Applied Sciences' ViscoSite customers have had success with the software/drivers from STMicroelectronics (http://www.st.com).

You are not required to use the ST COM port software; any software capable of creating a virtual COM port is sufficient.

NOTICE

The customer is encouraged to thoroughly research available virtual COM port software packages. The customer is free to select a virtual COM port software / driver package of their preference.

Customer assumes all risk and responsibility related to the installation, maintenance, and function of virtual COM port software and / or drivers. Please contact your organization's IT department for assistance.

Galvanic Applied Sciences has no interest, financial or otherwise, in STMicroelectronics. Galvanic Applied Sciences shall not be held liable or responsible for any unexpected behavior of the customer's computing devices or network operations arising from the installation and /or use of any third-party software.

3.11.2.1 *Local PC / ViscoSite Transmitter Communications via USB*

- Create a virtual COM port on your local Windows PC by installing the (provided) ST Link virtual COM port drivers or run another virtual COM port software installer package on all PC's that will run the ViscoSite software. Be sure to use the installer appropriate for your Windows operating system version and select the 32-bit or 64-bit installer version that matches your operating system.
- Install the ViscoSite Software (provided) onto your **local** Windows PC. Follow all directions to complete the installation.
- Connect the **Male USB-A to Male USB-A** cable (provided) between the ViscoSite transmitter and an available USB port on the local PC.
- Power cycle the transmitter to ensure the serial output of the transmitter is reset and ready for communications. This is necessary only once.

See Section 5 for instructions regarding initiation of a communications session between the **local** PC and the transmitter using the ViscoSite software..

3.11.3 Remote PC Connection to the Transmitter via LAN (Ethernet)

The Ethernet port is used to establish a LAN-based connection between a **remote** (non-local) computer and the ViscoSite transmitter.

The Ethernet (LAN) port on the transmitter must be connected to a Local Area Network (LAN) using CAT5e (minimum requirement) network cable.

The transmitter requires a static IP address for proper network behavior and will not request addresses nor respond to DHCP commands. The network configuration, including the required **static** IP address for the transmitter, must be input via the transmitter keypad

(see Section 4.7.3 for full requirements). Once the network settings have been configured at the transmitter, connection between a **remote** PC and the ViscoSite transmitter can be established via Modbus RTU over Ethernet (LAN) using the ViscoSite software. Please see Section 5.5.1.2)

NOTICE

A communications session **cannot** be established by connecting an Ethernet cable from the Ethernet (LAN) port on the transmitter directly to the Ethernet (LAN) port of a local computer.

NOTICE

A virtual COM (communications) port on the PC is required to establish a communications session via Ethernet between the ViscoSite transmitter and a **remote** computer via Ethernet (LAN).

The virtual COM port must be created, and the LAN cables at the remote computer and the transmitter must be connected prior to launching the ViscoSite software. See Section 3.11.2 for instructions on how to create / install a virtual COM port.

3.11.3.1 *Remote PC / ViscoSite Transmitter Communications via Ethernet (LAN)*

- See Section 3.11.2 for instructions on how to create / install a virtual COM port on the **remote** PC.
- Install the ViscoSite software (provided) onto the **remote** PC. Follow all directions to complete the installation.
- Ensure the transmitter's static IP address, subnet, and gateway address for your environment have been correctly assigned, entered, and saved to the transmitter via the transmitter keypad. See Section 4.7.3.
- Ensure the transmitter's LAN port is connected to the LAN.
- Connect the PC's Ethernet LAN cable to the LAN on which the ViscoSite transmitter resides.
- See Section 5 for instructions regarding initiation of a communications session between the **remote** PC running the ViscoSite software and the ViscoSite transmitter.

3.11.4 Simultaneous Communication Sessions – USB and Ethernet: What Happens?

NOTICE

When a ViscoSite transmitter is simultaneously connected both **locally via USB and remotely via Ethernet, commands from the Ethernet-connected remote computer are locked out** until the USB connection is broken.

Once the USB connection is broken, the commands from the **remote** computer via the **Ethernet** port remain locked out until no transmitter keypad activity has occurred for 3 minutes.

NOTICE

There is **no lockout between the USB and the transmitter's keypad** (see Section 4). Both are **local** connections. Parameter changes ***can*** be made via the transmitter keypad while a **local** PC USB connection is present.

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4 ViscoSite Transmitter Configuration via the Integral Keypad and LCD

4.1 Introduction

The ViscoSite transmitter may be configured via the integral membrane keypad located on the front of the swing panel and the LCD screen above it. Through this interface, the user can view, edit, and save a variety of system settings (based on user access level). Real-time measurement display and customization of parameter views on the LCD offers the ability to display only what's required for your application.

Visual indication of the overall ViscoSite system status is provided via the front panel LEDs.

The ViscoSite transmitter can also be configured using a Windows PC running the ViscoSite software. See Section 5.

4.2 LCD Screen

At the top front of the swing panel is the LCD screen, which

- Displays the system's most recent measurements (default setting)
- Along with the keypad, allows display and modification of system operating parameters (based on system access level).

The default screen configuration is shown in Figure 4.1. (Note the temperature values shown are not representative of a transducer in normal operation).

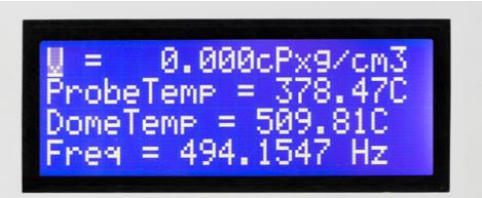

Figure 4.1: Default Transmitter LCD Screen Display Configuration

By default, the LCD displays 4 (four) measurement parameters:

- The present calculated (viscosity x density) product (expressed in cP x g/cm ^{3})
- The present transducer probe (sensor tip) temperature
- The transducer block / dome temperature (optional)
- The present oscillation frequency of the probe (sensor tip)

Each display line may optionally be configured to alternate between the display of a primary and secondary parameter selected by the user.

4.3 Integral Keypad and Status LEDs

The integral membrane keypad is located below the LCD on the front of the swing panel. It is used to retrieve, edit, and save parameter values to the ViscoSite transmitter

⚠WARNING

DO NOT OPEN THE TRANSMITTER ENCLOSURE if it is installed in a hazardous environment until the hazardous area has been de-classified and is known to be non-hazardous.

The keypad and status LEDs are shown in Figure 4.2.

Figure 4.2: ViscoSite Transmitter Keypad and Status LEDs

4.3.1 Integral Keypad

The numerical and decimal point keys are used for parameter value entry. The functions of the additional buttons on the keypad are listed in Table 4.1.

Button	Function
ESC	Exits out of a menu.
	Exits out of an active parameter editing sequence **without saving** changes.
Display Setup	Accesses the *Display Setup* menu, allowing the user to select and configure the parameters displayed on the transmitter's LCD screen. See Section 4.4.
Output Config	Accesses the *Output Configuration* menu, allowing user to select and configure the transmitter's Isolated Analog Outputs and Digital Relay Outputs. See Section 4.6.
Option Setup	Accesses the *Option* menu, allowing the user to configure other parameters that affect the operation of the ViscoSite system. See Section 4.7.
BACK SPACE	Removes one character in a data entry field (with each press).
↑ (Up Arrow)	On the main display screen, toggles between Primary and Secondary Display parameters.
	In menus, moves up one line in the menu.
	During parameter editing, scrolls up through available options.
↓ (Down Arrow)	On the main display screen, toggles between Primary and Secondary Display parameters
	In menus, moves down one line in the menu.
	During parameter editing, scrolls down through available options.
ENTER	Selects a choice within a menu.
	During parameter editing, queues the entered value to be saved to the transmitter.

Table 4.1: Transmitter Keypad Functions

4.3.2 Front Panel Status LEDs

A row of four LEDs Located above the keypad provides overall status information about the ViscoSite system. The LED functions and behaviors are listed in Table 4.2.

Label	Color (When Active)	State	Function
FAULT	Red	ON	On > 20 sec = Error (Fault) Detected
		ON, then OFF	On <20 sec = **Changes are being saved to the transmitter during parameter configuration via the ViscoSite software. This is **NOT** a Fault Condition.
		OFF	No Errors Detected.
COMM	Green	BLINK	Serial Communication in progress (transmit or receive) on any serial communication (COM) port
		OFF	No active communication via any serial port
TUNED	Green	ON	Transducer Oscillation Frequency is tuned to the resonance frequency of the transducer in the presence of the process material.
		OFF	Transducer Oscillation Frequency is **not** tuned to the resonance frequency of the transducer in the presence of the process material.
POWER	Green	ON	Power to transmitter **Present.**
		OFF	Power to transmitter **Not Present.**

Table 4.2: Front Panel Status LEDs

NOTICE

The "FAULT" LED is used for both system fault indication AND to indicate the writing of information to the transmitter's memory when using the ViscoSite software program described in Section 5. The length of time that the Fault light will remain on during *configuration data transfers* is approximately 15 to 20 seconds.

A FAULT LED lit solid when no configuration changes are being performed is in all likelihood a system FAULT.

4.4 Canceling Parameter Editing Without Saving Changes

NOTICE

Pressing **ESC** during parameter editing process when the cursor is at the end of a line aborts parameter editing without saving changes. This is a universal feature of the transmitter's programming routine.

This Notice will NOT be repeated in each programming section of the manual.

Pressing **ESC** from within different submenus results in the return to different menus and is dependent on the submenu within which **ESC** is pressed. This information IS provided in the programming steps for each parameter type for ease of navigation.

4.5 Display Setup Menu

Pressing the "Display Setup" button on the keypad accesses Display Setup menu. The Display Setup menu allows for selection of the parameters displayed on the transmitter's LCD and the units in which they are displayed.

4.5.1 Accessing the Display Setup Menu

- From the default LCD screen data display, press the "Display Setup" button on the keypad.
- The submenu shown in Figure 4.3 is displayed.

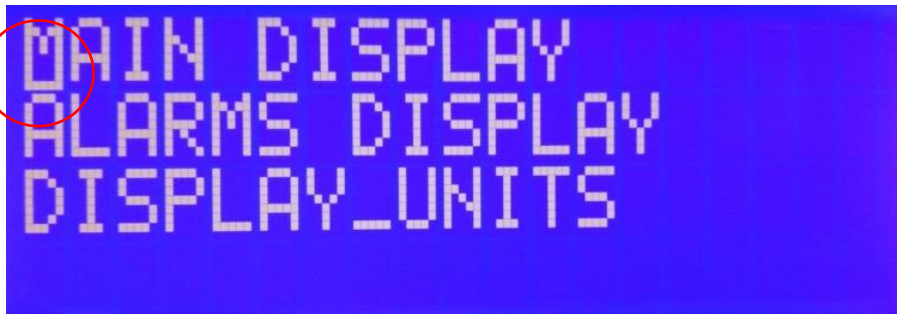

Figure 4.3: Display Setup Menu Screen

NOTICE

The selected parameter in any configuration screen will have a horizontal "cursor" below its first character. Note the circled M in Figure 4.3 has a horizontal cursor below it.

4.5.2 Main Display Submenu

4.5.2.1 *Accessing the Main Display Submenu*

With the cursor on Main Display, Press **ENTER**.
The Main Display submenu in Figure 4.4 is displayed.

Figure 4.4: Main Display Submenu (Partial) – Line Setup

The **L** in this submenu, followed by a number from 1 to 4, indicates which line of the LCD is being referenced. Lines 3 and 4 are accessed via the down arrow key.

Each line may be configured to:

- Display a single parameter (Pri=Primary)
  or
- Alternate between the display of a primary and secondary (Sec=Secondary) parameter.

The alternating display behavior on the configured line, if configured, takes effect once a secondary parameter choice has been saved to the transmitter. Alternating display cycle time is approximately 10 seconds and is not adjustable.

Table 4.3 contains the complete list of parameters that can be configured as primary and secondary parameters on the display.

Parameter	Meaning		Selectable Values
Primary (Pri)	The parameter configured to be displayed on a given LCD line.		None (Nothing displayed)
			Density
			Viscosity (units not yet specified)
			Temp Probe (transducer sensor tip temperature)
Secondary (Sec)	The parameter, *if configured*, to be displayed on a given LCD line when the up or down arrow on the keypad is pressed.		Temp Dome (transducer dome block RTD Temperature)
			Temp Elec (Transmitter internal temperature)
			Freq (Oscillation Frequency of Transducer)
			Temp Cp Vis (Temperature Compensated Viscosity)
			Pe and Gain ‡

Table 4.3: Parameters Selectable for Primary and/or Secondary Display for each Line (1-4) of the Display Setup Submenu

4.5.2.2 *Main Display Submenu Parameter Editing via the Keypad*

- From the Main Display submenu, Use the Up/Down arrow keys within the submenu to scroll through the available LCD lines to the line of interest.
- Press **ENTER** to select the desired <Line number/Pri> or <Line Number/Sec> entry.
- Use the Up/Down arrow keys to scroll through the parameters available for display.
- Press **ENTER** a second time to select the desired parameter and save the edited parameter value to the transmitter.
- Pressing **ESC** from the Display Units submenu when NOT actively editing a parameter returns to the Main Display Setup menu. Pressing **ESC** a second time returns to the Data Display.

NOTICE

The Main Display submenu selections can also be configured using the ViscoSite software. See Section 5.6.1.

NOTICE

‡The "Pe and Gain" selection is for diagnostic use only. Please do not configure this parameter for display unless requested by a Galvanic Applied Sciences Service Representative.

4.5.3 Alarms Display Submenu

4.5.3.1 *Accessing the Alarms Display Submenu*

With the cursor on Alarms Display in the Main Display Submenu, Press **ENTER**.
The Alarms Display submenu in Figure 4.5 is displayed.

Figure 4.5: Alarms Display Menu (Partial)

This submenu allows selection of the LCD line on which an alarm is displayed ***and*** the manner (method) in which it will be visually displayed.

NOTICE

The alarm parameters selected from this menu apply ONLY to VISUAL INDICATION of the alarms on the transmitter's display.

These selections do NOT control the selection of which parameters are monitored via the Digital Relays or Isolated Analog Outputs.

4.5.3.2 *Default Alarms Display Behavior*

Seven parameters (the maximum that can be configured to be Primary or Secondary display parameters) may be configured to **visually** indicate via the LCD when a configured Alarm Display parameter goes outside the defined limits.

When specifying the line on which to show a *display* alarm, a "method" is also selected to specify how the alarm is visually presented on the LCD.

The Alarms Display Menu (Figure 4-5) is used to configure a Display Alarm by *selecting the LCD line* ***and*** *the display behavior* (method) of the displayed alarm.

The Alarm Display behavior (method) options are:

- Steady
- Blinking
- Alternating

The default configuration for each of the seven lines is "Line **1**/Method **Steady**."

NOTICE

Due to the possible confusion related to the behavior of the LCD when displaying lists with more than four entries, it is strongly recommended that the first pair of entries in the menu be used to specify LCD Line 1 alarm/behavior, the second pair of entries be used to specify LCD Line 2 alarm behavior, etc.

NOTICE

The system default configured at the factory for LCD Line 1 ***Parameter Display*** (see Section 4.5.2) is **Primary parameter only, Steady display**.

The system default configured at the factory for the ***Alarm Display Method*** for LCD Line 1 is **Steady**.

It is critical to ensure that the alarm and non-alarm visual behavior visual behavior are configured differently for each LCD line*. If the two states are configured identically for an LCD line, no visual indication of display alarm status will be provided via the LCD.*

Be sure to update the Alarm Display Method if you will be using the LCD to monitor Display Alarm status.

The display alarm status *does* override the primary / secondary alternating display configuration when either the Primary or Secondary parameter for that line is in display

alarm, switching the LCD line behavior to what has been selected in the Alarms Display submenu.

The display method/behavior of a Display Alarm parameter in alarm is shown in Table 4.4.

Alarm Display Method	Behavior/Description
Steady	The measured value of the parameter in display alarm will display steadily on the configured line until the event triggering the display alarm condition is addressed.
Blinking	The measured value of the parameter in display alarm will blink on the given line until the event triggering the display alarm condition is addressed.
Alternating	The measured value of the parameter in display alarm and the PRIMARY parameter configured for that line in the Display Setup will alternate display on the given line until the event triggering the display alarm condition is addressed.

Table 4.4: Alarm Display Methods

NOTICE

If a parameter has NOT been configured to display as either a Primary or Secondary Display Parameter, **no VISUAL alarm indication will display.**

NOTICE

If using ONLY Primary display parameters AND alarming the display parameters, select the behavior method as blinking for the most visually noticeable Display Alarm on the LCD.

NOTICE

*The configuration of the **visual** Alarm Display settings in this menu correspond ONLY to the **visual** Alarm Display on the LCD.*

*They **DO NOT** correspond to alarm settings for the Isolated Analog and Digital Relay Outputs.*

4.5.3.3 *Alarms Display Parameter Editing via the Keypad*

- From the Alarms Display submenu, Use the Up/Down arrow keys of the transmitter within the submenu to scroll to the LCD line of interest.
- Press **ENTER** to select the desired line number.
- Use the Up/Down arrow keys to scroll through the display behavior choices to the desired behavior.
- Press **ENTER** a second time to select and save the behavior to the transmitter.
- Pressing **ESC** from the Alarms Display submenu when NOT actively editing a parameter returns to the Main Display Setup menu. Pressing **ESC** a second time returns to the Data Display.

NOTICE

The Alarms Display submenu selections can also be configured using the ViscoSite software. See Section 5.6.3.

NOTICE

The Upper and Lower Display Alarm Limits status of the **DISPLAY parameter** alarms configured in this section **cannot** be set from the transmitter. They must be set using the ViscoSite Software via the Alarms Display section of the Display Setup screen. See Section 5.6.3 for information on how to configure the Alarm Display limits.

NOTICE

*The configuration of the **visual** Alarm Display settings in this menu correspond ONLY to the **visual** Alarm Display on the LCD.*

*They **DO NOT** correspond to alarm settings for the Isolated Analog and Digital Relay Outputs.*

4.5.4 Display Units Submenu

4.5.4.1 *Accessing the Display Units Submenu*

With the cursor on Display Units, Press **ENTER**.
The submenu screen in Figure 4.6 is displayed.

Figure 4.6: Display Units Submenu

This submenu allows selection of measurement units for each parameter displayed on the LCD. The choices for each parameter are shown in Table 4.5.

Measurement Parameter	Selectable Units
Viscosity	cP x g/cm^3 (Viscosity x Density)
	mPa s (millipascal x Seconds)
	cP (Centipoise)
	cSt (Centistoke)
Density	g/cm^3
Temperature	°C °F
Distance	Metres Feet

Table 4.5: Selectable Display Units for each Measurement Parameter

4.5.4.2 *Display Unit Parameter Editing Via the Keypad*

- Use the Up/Down arrow keys to scroll through the entries.
- Press **ENTER** to select the desired parameter.
- Edit the parameter choice to reflect the desired units for the parameter.
- Press **ENTER** to save the edited selection to the transmitter.

NOTICE

- Pressing **ESC** from the Display Units submenu when NOT actively editing a parameter returns to the Main Display Setup menu. Pressing **ESC** again returns to the Data Display.

NOTICE

The display units can also be configured using the ViscoSite software. See Section 5.6.2.

4.6 Output Configuration Menu

4.6.1 Accessing the Output Configuration Menu

- From the Data Display, press the **Output Config** button on the keypad.
- The Output Configuration menu shown in Figure 4.7 is displayed.

This menu is used to configure the *operational modes and output scaling* of the three Isolated Analog Outputs and two Digital Relay Outputs.

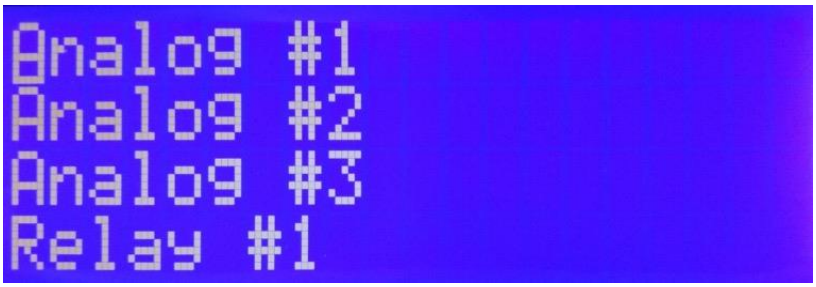

Figure 4.7: Output Configuration Menu (Partial)

4.6.1.1 *Accessing an Isolated Analog Output Configuration Submenu*

- With the cursor on the Isolated Analog Output of interest, Press **ENTER**.
- The Isolated Analog Output submenu in Figure 4.8 is displayed.

Figure 4.8: Isolated Analog Output Configuration Submenu

Four editable parameters exist for each Isolated Analog Output. They are shown in Table 4.6.

Parameter	Meaning	Selectable Values
MODE	Analog Output Signal Type (Current/Voltage)	Current 4 - 20 (mA) Voltage 2 – 10 (V DC) Current 0 – 20 (mA) Voltage 0 – 10 (V DC)
MEASURE	Measured Parameter assigned to the Analog Output	None
		Density
		Viscosity
		Temp Probe (Transducer Sensor Tip Temperature)
		Temp Dome (Transducer Dome (Block) Temp
		Temp Elec (Transmitter Motherboard Temp)
MIN	Lowest acceptable value of the selected MEASURE parameter	Value entered using the keypad
MAX	Highest acceptable value of the selected MEASURE parameter	Value entered using the keypad

Table 4.6: Analog Output Configuration Submenu

4.6.1.2 *Isolated Analog Output Configuration via the Keypad*

- From the Isolated Analog Output submenu of interest, use the Up/Down arrow keys to scroll through the editable parameters.
- Press **ENTER** to select the desired parameter.
- Edit the value for that parameter. Enter numeric values via the keypad as necessary.
- Press **ENTER** to save the edited value of the selection to the transmitter.

NOTICE

The acceptable minimum and maximum limits of the measured parameter assigned to an Isolated Analog Output are selected in this submenu. The specified range must match the range configured in the data collection system receiving the signals for proper alarm notification.

NOTICE

Pressing **ESC** from an Analog Output submenu when NOT actively editing a parameter returns to the main Output Configuration menu. Pressing **ESC** again returns to the Data Display.

NOTICE

The Isolated Analog Output configuration and scaling may also be performed in the ViscoSite software – refer to Section 5.7.1.

4.6.1.3 *Accessing a Digital Relay Output Submenu*

- With the cursor on the Digital Relay Output of interest, Press **ENTER**.
- The submenu in Figure 4.9 is displayed.

Figure 4.9: Digital Relay Output Configuration Submenu

Figure 4.9 shows the three parameters that can be edited for each Digital Relay Output. Table 4.7 indicates the available selections for these configurable parameters.

Parameter	Meaning	Selectable Values
MEASURE	Measured Parameter assigned to the Digital Relay Output	None
		Density
		Viscosity
		Temp Probe (Transducer Sensor Tip Temperature)
		Temp Dome (Transducer block RTD temperature)
		Temp Elec (Transmitter Motherboard Temp)
LOWER	Lower acceptable value of the selected MEASURE parameter	Value entered using the keypad

Parameter	Meaning	Selectable Values
UPPER	Upper acceptable value of the selected MEASURE parameter	Value entered using the keypad

Table 4.7: Digital Relay Output Configuration Submenu

4.6.1.4 *Digital Relay Output Configuration via the Keypad*

- From the Digital Relay Output submenu of interest, use the Up/Down arrow keys to scroll through the three editable parameters.
- Press **ENTER** to select the parameter.
- Edit the value for that parameter. Enter numeric values via the keypad as necessary.
- Press **ENTER** to save the edited value of the selection to the transmitter.

NOTICE

The acceptable lower and upper limits of the measured parameter assigned to a Digital Relay Output are selected in this submenu. The specified range must match the range configured in the data collection system receiving the signals for proper alarm notification.

NOTICE

Pressing **ESC** from a Digital Relay Output submenu when NOT actively editing a parameter returns to the main Output Configuration menu. Pressing **ESC** again returns to the Data Display.

NOTICE

The Digital Relay Outputs may also be configured using the ViscoSite software. See Section 5.7.2.

4.6.1.5 *Mirroring of Isolated Analog Output and Digital Relay Output Parameters on the Transmitter Display*

The transmitter does not monitor the Isolated Analog or Digital Relay outputs. However, if a visual indication for an output parameter is desired in addition to the output signal

itself, it is possible to configure a Display Alarm for the parameter.

A "mirrored" Display Alarm must be configured to monitor the same parameter of interest as the output with the same scaling (lower and upper range) and the same units. While a mirrored Display Alarm and an output are configured to monitor the same measured parameter, only the configured output sends an external signal to the local data collection system.

See Section 4.5.3 for configuration of Display Alarms.

NOTICE

A mirrored Display Alarm is **only a visual indication** of an output parameter that is outside the configured range. The transmitter does NOT send any out-of-range notifications to any external devices based on a Display Alarm. This is accomplished by the configuration of the outputs.

4.7 Option Setup Menu

4.7.1 Accessing the Option Setup Submenu

- Press the Option Setup button on the keypad.
- The Option submenu shown in Figure 4.10 is displayed.

The Option submenu allows for the configuration of parameters associated with data processing performed by the ViscoSite system.

Figure 4.10: Option Submenu (Partial)

4.7.2 Option Submenu Parameters

The Option submenu parameters, configurable settings, and functional descriptions are shown in Table 4.8.

Parameter	Configurable Settings	Functional Description
Density	Auto Density Enabled	The ViscoSite system is configured to receive density information for the material being processed via a real-time 0 - 20mA / 4 - 20mA Isolated Analog Input signal from an external density transducer. The density data is then used to calculate Viscosity values in standard viscosity units.
	Manual Density Enabled	A single representative density value is manually entered into the ViscoSite transmitter (See Section 5.8.1).
Nom Temp	Nominal Temperature: (User Entered for Temperature Compensation)	The temperature of the process at normal operating conditions. This value, along with other information, is used for calculating temperature compensated viscosity per ASTM D341. If temperature compensated viscosity determination is not desired, do not enter a value for this parameter. See Section 5.8.4.
Time Avg	Time Avg Viscosity Enabled (Checkbox Checked)	A time-averaged value of the viscosity parameter is calculated from viscosity parameter readings collected over a user defined time interval (Avg Time). See "Avg Time" later in this table and Section 5.8.5.1. Subsequent time averaged viscosity parameter calculations are determined based on viscosity parameter data collected over the same "Avg. Time" intervals.
	Time Avg Viscosity Disabled (Checkbox Not Checked)	No time averaging is applied to the viscosity parameter data.
Avg Time	Averaging Interval Time (sec)	Time interval for capture of viscosity parameter values for calculation of an average viscosity parameter value. **Avg Time is expressed in seconds.**

Table 4.8: Option Submenu Parameters Table (Part 1) with Available Settings and Functional Descriptions

4.7.2.1 *Option Parameter Editing via the Keypad: Density, Nom Temp, Time Avg, Avg Time*

- From within the submenu of interest, use the Up/Down arrow keys to scroll through the parameter list.
- Press **ENTER** to select the desired parameter.
- For multiple option parameters, click the desired radio button. Click on a numeric field to edit.
- Edit the value using the numbers on the keypad and/or the Up/Down arrow keys as appropriate.
- Press **ENTER** to save the edited value of the selection to the transmitter.

NOTICE

Pressing **ESC** from the Density, Nom Temp, Time Avg, or Avg Time submenus when NOT actively editing a parameter returns to the main Option menu. Pressing **ESC** again returns to the Data Display Screen.

NOTICE

The Option parameters may also be configured using the ViscoSite software – refer to Section 5.8.

4.7.3 Network Configuration

4.7.3.1 *Accessing the Network Configuration Setup Submenu*

- From the Data Display, press the Option Setup button on the keypad.
- The Option submenu shown in Figure 4.10 is displayed.
- Use the Up/Down arrow keys to scroll through the Options entries to the Network Setup submenu.

The Network Setup submenu, used to configure the ViscoSite transmitter for communication with a **remote** PC across a Local Area Network (LAN), is shown in Figure 4.11.

Figure 4.11: Network Setup Sub Menu

If use of the ViscoSite software via LAN is desired, the ViscoSite transmitter must be connected to a wired LAN via the transmitter's Ethernet port. The following parameters must be properly configured for communication with the transmitter over Ethernet:

IP – the assigned static IP address of the transmitter
GW – the IP address of the network gateway
Subnet – the Subnet mask for the network

The transmitter must be assigned a **static** IP address.
The ViscoSite system will not negotiate a connection with a DHCP server.

NOTICE

The network configuration values should be selected in consultation with the IT department at the user's facility. Incorrect setting of these values will result in the transmitter being unable to communicate with the remote PC via the LAN and could potentially create network-wide disturbances which may affect other plant instrumentation.

NOTICE

The network configuration parameters can only be entered via the ViscoSite transmitter keypad.

4.7.3.2 *Network Configuration Parameter Editing via the Keypad*

- From the Option submenu, Use the Up/Down arrow keys to scroll through the entries to the Network Config submenu.
- Press **ENTER** to select Network Config.
- Edit the numeric parameters. Include decimal points as required.
- Press **ENTER** after editing each parameter to save the edited value to the transmitter.

NOTICE

Pressing **ESC** from the Network Config submenu when NOT actively editing a parameter returns to the main Option menu. Pressing **ESC** again returns to the Data Display.

4.7.4 COM Setup

4.7.4.1 *Accessing the COM Setup Submenu*

- From the Data Display, press the Option Setup button on the keypad.
- The Option submenu shown in Figure 4.10 is displayed.
- Use the Up/Down arrow keys to scroll through the Option entries to the COM Setup submenu.

The COM Setup submenu, used to configure the ViscoSite transmitter's serial port, is shown in Figure 4.12.

Figure 4.12: COM Setup Submenu

The serial port communications protocol options are RS-232 and RS485.

4.7.4.2 *COM Setup Parameter Editing via the Keypad*

- Use the Up/Down arrow keys to scroll through the Options entries to the COM Setup submenu.
- Press **ENTER** to select COM Setup.
- Use the Up/Down arrow keys to scroll through the entries to the desired serial communications parameter.
- Press **ENTER** to select and save the edited value to the transmitter.

Pressing **ESC** from the COM Setup submenu when NOT actively editing a parameter returns to the main Option menu. Pressing **ESC** again returns to the Data Display.

NOTICE

Power cycle the transmitter to complete the configuration of the COM communications protocol. Changes to the COM port configuration do not take effect until the transmitter is power cycled.

NOTICE

The COM Setup must be configured via the transmitter keypad.

5 Transmitter Configuration Using the ViscoSite Software for PC

5.1 Introduction

The ViscoSite PC Software is a robust graphical user interface capable of configuring most of the transmitter's options, parameters, and settings. The ViscoSite PC Software communicates with the transmitter via a local PC USB connection or a remote PC Ethernet connection across a wired LAN.

Section 5 provides a description of the software's capabilities and their use to configure a ViscoSite transmitter using the ViscoSite software.

5.2 ViscoSite Software Home Screen

This discussion of the ViscoSite software assumes that the ViscoSite transmitter is connected and communicating either locally via USB or remotely via Ethernet. The network settings must be entered into the transmitter via the keypad prior to the first Ethernet LAN connection. Once entered, connect the transmitter to the LAN.

The hardware connections between the transmitter and the PC are discussed in Sections 3.11.2 and 3.11.3.

Launching the ViscoSite software program displays the home screen. See Figure 5.1. The purpose and functionality of all buttons, menus and submenus are shown below.

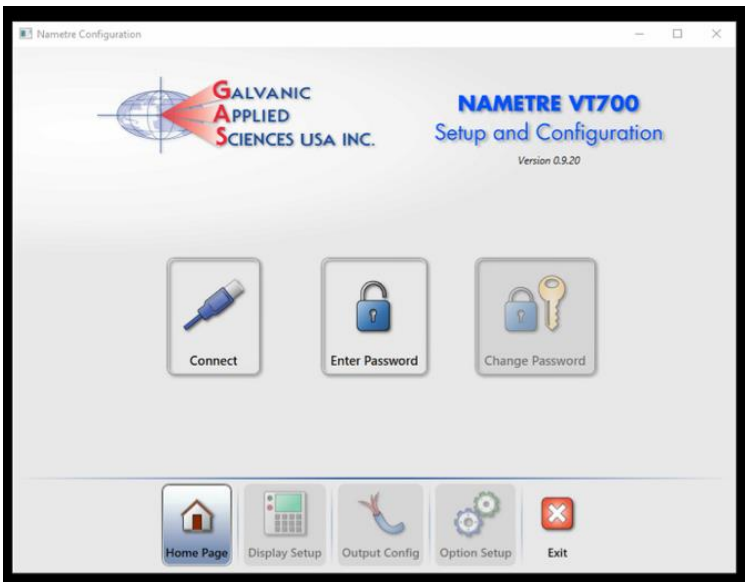

Figure 5.1: ViscoSite Software Home Screen

5.2.1 Connect, Enter Password, Change Password

- **Connect** –Selecting "Connect" displays the "Connection" dialog box listing all ViscoSite transmitters to which the user may connect. Refer to Section 5.5 for more details about connecting to a ViscoSite transmitter via the software. The ViscoSite software can connect to one ViscoSite transmitter at a time.

  - Once a connection is established between the ViscoSite software and a transmitter, this selection displays "Disconnect." Select "Disconnect" to terminate the connection between the PC and the ViscoSite transmitter.

- **Enter Password** – Selection displays the "Enter Password" dialog box. Password entry is used to access elevated access levels (*Technician* and *Factory*) that allow changes to transmitter settings. Access levels and passwords are discussed in Section 5.3.

  NOTICE

  - The ViscoSite software always launches in *Operator* (Read-Only) Mode.
  - No password is required for ViscoSite Software *Operator* use.
  - Logging in to one of the elevated access user levels (*Technician* and/or *Factory*) via the "Enter Password" dialog is required to make changes to parameters and settings. **No changes to parameters are possible in "Operator" Mode.**

- **Change Password** – Selecting "Change Password" displays the "Change Password" dialog box. This function is used to change the elevated access *Technician* password. The user must already be signed in at an elevated access level (*Technician* or *Factory*) to use this function. See Section 5.3 for a discussion of software access levels and changing passwords.

5.2.2 Toolbar (Operator Level)

The *Operator* level toolbar, located at the bottom of the home screen, is shown in Figure 5.2.

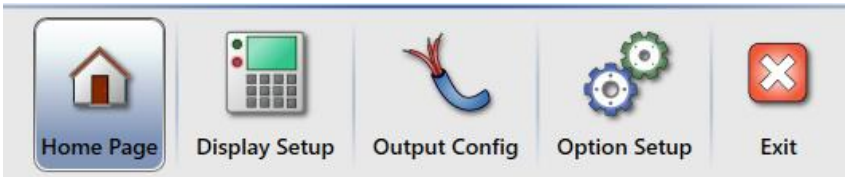

Figure 5.2: Toolbar (Operator Level)

The Operator level toolbar allows the Operator level user to navigate through the various configuration and setup menus of the ViscoSite

software in **Read-Only** mode. The functionality of each button is described below.

Button	Function	Section Reference
Home Page	Returns to the ViscoSite software home screen.	
Display Setup	Displays the "Display Setup" screen, allowing review of the transmitter's LCD configuration.	See Section 5.6
Output Config	Displays the "Output Configuration" screen, allowing review of the transmitter's Isolated Analog and Digital Relay Output configurations.	See Section 5.7.
Option Setup	Displays the "Option" screen, allowing review of the parameters that affect data processing and other configuration of the ViscoSite system.	See Section 5.8.
Exit	Terminates the PC's connection to the ViscoSite transmitter and closes the software application.	

5.3 Software Access Levels and Changing Passwords

The ViscoSite software provides three access levels:

- *Operator* (Read-Only)
- *Technician*
- *Factory*

Each access level has different permissions within the software.

Technician and Factory access levels are password protected; the correct password must be entered to gain elevated access/privileges associated with the desired role.

5.3.1 Accessing the Operator Level (Read-Only)

The ViscoSite SW connects to the transmitter by default at the **Operator (Read-Only)** access level. No password entry is required for this user level.

The Operator level user may **view** the configuration on each screen of the ViscoSite software but is **unable to make any changes** to the parameters or configurations.

5.3.2 Accessing the Technician and Factory Levels (Edit Parameters and Configuration)

The Technician level toolbar is shown in Figure 5.3. It is visually identical to the Operator level toolbar but allows the logged in Technician level user to make changes to the system parameters and configurations.

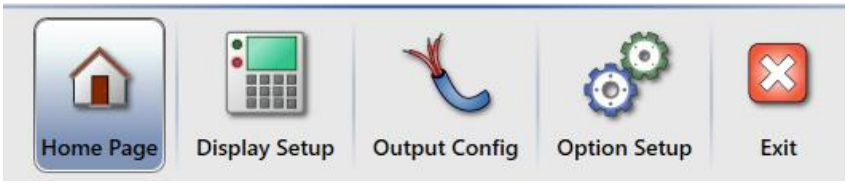

Figure 5.3: Toolbar (Technician Level)

5.3.2.1 *Accessing the Technician and Factory Levels*

- Select "Enter Password" from the home screen. This displays the login prompt shown in Figure 5.4.

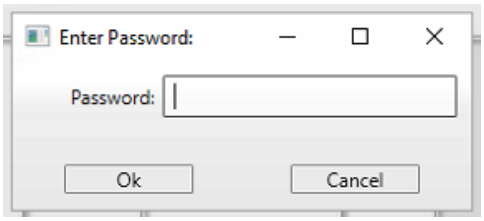

Figure 5.4: Enter Password Prompt

- Enter the password for the desired access level and select "OK."

If the entered password is correct, access is granted at the level associated with that password. If the entered password is incorrect, the message in Figure 5.5 is displayed.

Figure 5.5: Invalid Password

5.3.3 Changing a Password (Technician)

NOTICE

It is **HIGHLY RECOMMENDED** to **CHANGE the DEFAULT access password** for the **Technician access level** to prevent accidental parameter modification, unauthorized access, and/or tampering with the system configuration.

This operation can be carried out by a user logged in with Technician or Factory access.

5.3.3.1 *Changing Passwords (Technician)*

- Select "Change Password" from the home screen to bring up the prompt shown in Figure 5.6.

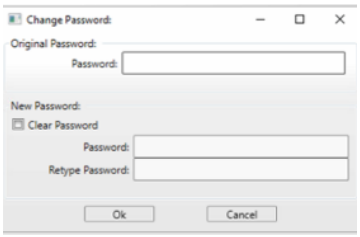

Figure 5.6: Change Password Prompt

- Enter the current password for the logged in user access level into the "Original Password" box.
- Enter the new Technician level password in the two boxes below.
- Click **OK**.

If the entry in the 'Retype Password' box doesn't match the entry in the 'Password' box, the password will not be changed.

5.3.4 Clearing Passwords for Password Protected Access Levels

NOTICE

Use of the "Clear Password" software functionality will clear the password for the Technician access level, allowing editing access to the system **without password entry**. Operator level permissions are unaffected. **However**, an Operator will gain access to Technician level access by opening the "Enter Password" box and clicking **"OK"**.

NOTICE

Galvanic Applied Sciences strongly recommends retaining password protection to the Technician access level to prevent accidental modification or unauthorized changes to critical system parameters.

5.3.4.1 *Clearing the Technician Access Level Password*

- Select "Change Password" from the home screen to bring up the prompt shown in Figure 5.7.

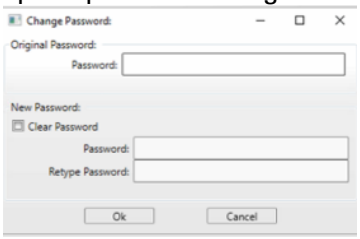

Figure 5.7: Change Password Prompt

- Type in the (current) password for the Technician access level.
- Check the "Clear Password" box.
- Leave the Password and Retype Password boxes blank.
- Click **OK** to complete the process of clearing the password for the currently logged in elevated level.

5.3.5 Reinstating Passwords for Password Protected Access Levels

5.3.5.1 *Reinstating a Password After the Technician Level Password has been Cleared*

- Once logged in at the Factory level, press the "Change Password" button. The same prompt shown in Figure 5.7 will appear, but the "Original Password" box will be grayed out.

- Enter the new password into the two text fields in the "New Password" section, ensuring that the passwords typed into the "Password" and "Retype Password" fields are the same.
- Click OK. The password for the Technician Level access is restored.

5.4 Technician and Factory Level Permissions

5.4.1 Technician Level (Edit Parameters and Configuration)

NOTICE

The Technician access level should only be granted to those users who are fully trained in the operation and configuration of the ViscoSite Viscometer.

With an active communications session between the PC and the ViscoSite transmitter, a user logged into the software at the **Technician** access level sees the toolbar shown below in Figure 5.8. (This figure is identical to Figure 5.3 and is repeated for convenience).

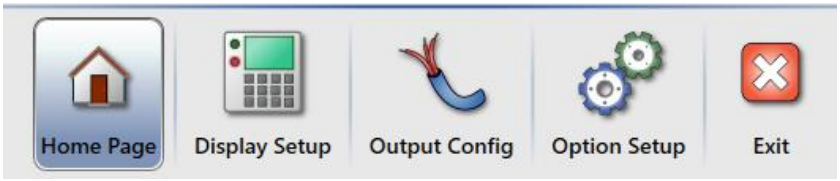

Figure 5.8: Toolbar (Technician Level)

Technician level users may view and edit the parameters and configurations in the

- Display Setup,
- Output Config,
- Option Setup

menus via selection of the buttons in the toolbar. See Section 5.2.2 for a high-level summary of the functionality of each selection. Menus and submenus are discussed in detail below starting in Section 5.6.

5.4.2 Factory Level (Edit Parameters and Configuration, Calibration, Engineering)

NOTICE

The Factory access level should only be granted to those who are fully trained in the operation and configuration of the ViscoSite Viscometer.

With an active communications session between the PC and the ViscoSite transmitter, a user logged into the software at the **Factory** access level sees the toolbar shown below in Figure 5.9.

Figure 5.9: Toolbar (Factory Level)

The **Factory** level user may view and edit the parameters and configurations in the

- Display Setup
- Output Config
- Option Setup
- Calibration
- Engineering

menus via selection of the buttons in the toolbar shown in Figure 5.9. See Section 5.2.2 for a brief discussion of the functionality of each selection on the toolbar. Menus and submenus are discussed in detail below starting with Section 5.6.

Engineering is outlined in 11.

5.5 Connecting to the Transmitter via the ViscoSite Software

Once the ViscoSite transmitter is physically connected to either a local PC (via USB) or a remote PC (via the network-configured transmitter's Ethernet connection to the LAN), it is possible to establish a communications session between a PC running the ViscoSite software and a ViscoSite transmitter.

5.5.1 Establishing a Communications Session with a ViscoSite Transmitter via the ViscoSite Software

Follow the directions below to establish a **local** or **remote** communications session, as applicable, between the ViscoSite Software and a Windows PC.

5.5.1.1 *Virtual COM Port Setup for Local Connection via USB*

Please see Section 3.11.2 for instructions on how to create a virtual COM port on your local PC. This is **required** to establish the **local** USB connection.

5.5.1.2 *Establishing a Communications Session (Connection) to a ViscoSite Transmitter via the ViscoSite Software*

- Launch the ViscoSite Software.
- From the Home Screen (Figure 5.1), press the "Connect" button, displaying the "Select Port" dialog. See Figure 5.10.

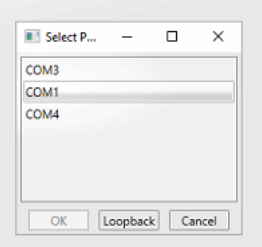

Figure 5.10: "Select Port" Dialog

- This prompt displays all COM (communications) ports through which the software can connect to ViscoSite transmitters. The list includes COM ports for both USB and Ethernet connections.
- Click on the COM port corresponding to the desired ViscoSite transmitter. Click "**OK**." If you do not see your desired connection, ensure the USB cable is properly connected and/or the LAN cable is properly connected.
- The ViscoSite software establishes a connection (communications session) to the ViscoSite transmitter via the communications path associated with the selected COM port.
- Depending on the type of communication port being used (USB or Ethernet), establishing a connection may take some time.
- A small ViscoSite transmitter icon appears in the bottom left corner of the Home screen when the software is connected to the transmitter. See Figure 5.11.
- Hovering the mouse pointer over this connection icon displays the COM port in use.

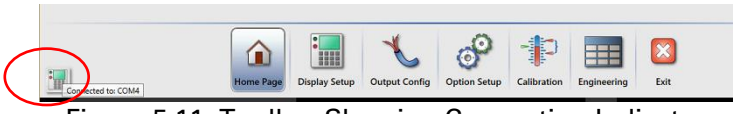

Figure 5.11: Toolbar Showing Connection Indicator

5.5.1.3 *Loopback*

Selecting "Loopback" in the 'Select Port' prompt (shown in Figure 5.10) allows access to the software screens of the ViscoSite software **without connecting the PC to a**

ViscoSite transmitter. This is useful for offline software training.

5.6 Display Configuration Page

Clicking the "Display Setup" button on the toolbar displays the Display Configuration screen. The Display Configuration screen is shown in Figure 5.12.

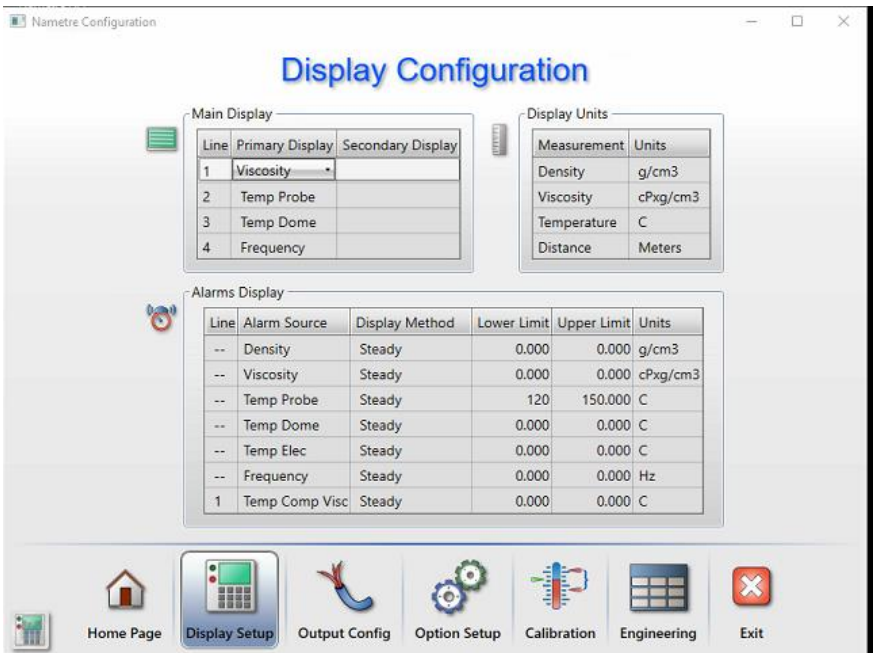

Figure 5.12: Display Configuration Page

The Display Configuration screen is divided into three sections:

- Main Display
- Display Units
- Alarms Display

5.6.1 Main Display Configuration/Editing

The Main Display section of the Display Configuration page permits configuration of the parameters to be displayed on the transmitter's front panel LCD. The Main Display section is shown in Figure 5.13.

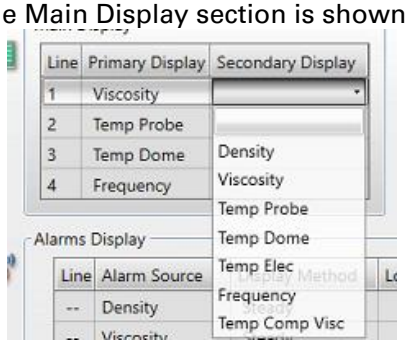

Figure 5.13: Main Display Selections (Display Configuration)

The Main Display section comprises a four-row table with columns for selecting the Primary and Secondary Display parameters to be displayed on the LCD.

The first column, titled "Line" indicates the line number of the LCD being configured (1 to 4). The numbers in the cells of this column cannot be edited.

The second column, "Primary Display," includes all parameters (in a drop-down list) that can be displayed on each line of the LCD as primary display parameters. The list of available parameters for this column are shown in Figure 5.13.

The third column, "Secondary Display," includes all parameters (in a drop-down list) that can be displayed on each line of the LCD as secondary display parameters. **The factory default setup is for no secondary parameter display.**

The available parameters are explained in Table 5.1.

Parameter	Explanation
<Blank>	<Nothing is output on this line>
Viscosity	Present calculated viscosity parameter
Temp Probe	Temperature measured by transducer probe (sensor tip) RTD
Temp Dome	Temperature measured by transducer block RTD
Temp Elec	Temperature measured inside transmitter enclosure
Frequency	Present oscillation frequency of the transducer
Temp Comp Visc	Measured viscosity parameter compensated for sample temperature

Table 5.1: Parameters Available for Primary and Secondary Display

5.6.1.1 *Selecting/Changing Primary and Secondary Display Parameters*

- Click twice on the desired cell to display a drop-down list of all parameters that can be displayed on a line of the LCD as Primary or Secondary display parameters.
- Select the desired parameter.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter selections as necessary, **pressing ENTER/RETURN after each selection**.
- Once all parameter values have been selected in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**

- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu **WITHOUT** saving the most recent changes, click "**Continue.**"
- Click "**Cancel**" to remain in the menu. Changes made are retained on screen but not yet stored to the transmitter.

5.6.2 Display Units – Configuration/Editing

The Display Units section of the Display Setup screen allows configuration of the measurement units to be displayed for each parameter measured or stored by the ViscoSite system. The default Display Units configuration is shown in Figure 5.14.

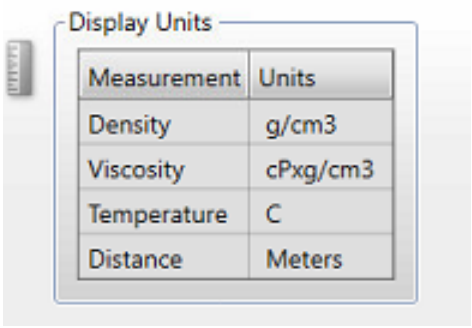

Figure 5.14: Default Display Units (Display Configuration)

The measurement parameters have user-selectable measurement units, with the exception of Density (always expressed as g/cm^3). The available units for the other displayed parameters are shown below in Table 5.2.

Parameter	Available Units for Display
Viscosity	cP x g/cm^3 (Viscosity x Density, default), cP, mPa s, cSt
Density	g/cm^3
Temperature	°C, °F
Distance	metres, feet

Table 5.2: Available Display Units (Display Configuration)

5.6.2.1 *Selecting/Changing the Display Units*

- Click twice on the cell to be edited to display a drop-down menu of available parameters.
- Select/left click the desired parameter.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter selections for the other units as necessary, **pressing ENTER/RETURN after each selection**.

- Once all parameters have been selected in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**
- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue.**"
- To remain in the menu, click "**Cancel.**" The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

NOTICE

Note that if a display unit other than the default cP x g/cm³ is selected for viscosity, the message shown in Figure 5.15 is displayed.

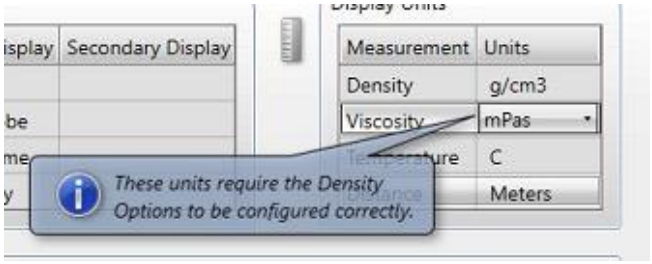

Figure 5.15: Viscosity Unit Selection-Density Option Warning

In order to calculate and express viscosity in commonly used units, a representative density value, either manually entered or from a real-time density transducer, is required.

Failure to configure the Density parameter will lead to inaccurately calculated viscosity values for cP, mPa s, and cSt.
See Section 5.8.1 to configure the Density Options.

5.6.3 Alarms Display - Configuration/Editing

The Alarms Display section of the Display Setup screen allows for configuration of the alarms displayed on the ViscoSite transmitter's LCD. The 7 possible alarmable display parameters are shown in the Alarms Display dialog shown in Figure 5.16.

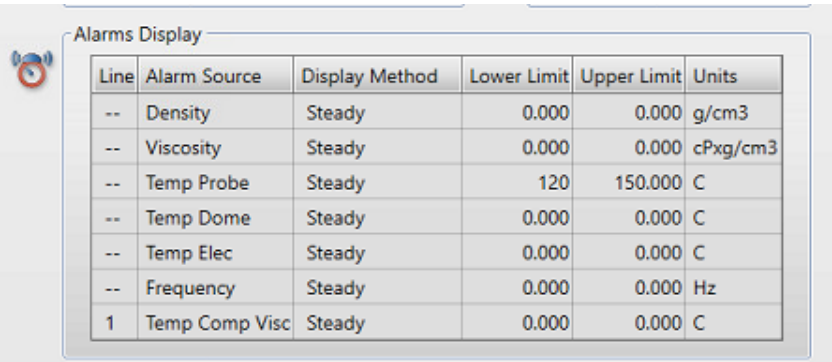

Figure 5.16: Alarms Display Configuration (Display Configuration)

The Alarms Display parameters, their options, and their functional descriptions are given in Table 5.3.

Parameter	Options	Functional Description
Line	1,2,3,4	Selects the line of the Transmitter LCD on which the alarm for the selected parameter is displayed. " --- " indicates unselected (not displayed).
Display Method	Steady	The parameter in Alarm will remain steadily displayed on the given configured line until the alarm is cleared.
	Blinking	The parameter in Alarm will blink on the given configured line until the alarm is cleared.
	Alternating	The parameter in Alarm will alternate display with any other parameter selected for display on the same line.
	<Blank>	No indication of an alarm will be displayed on the selected line if no alarmed parameter is configured.
Lower Limit	Numerical Value	Lower Alarm Limit below which a parameter goes into alarm. Expressed in the units selected in the Units Display submenu.
Upper Limit	Numerical Value	Upper Alarm Limit above which a parameter goes into alarm. Expressed in the units selected in the Units Display submenu.

Table 5.3: Alarm Settings Parameters (Display Configuration)

NOTICE

The Alarm Source column cannot be edited. It contains a simple list of all possible parameters than can be configured to display an alarm on the LCD.

NOTICE

The values in the "Units" column are derived from the measurement units selected in the Display Units portion of the Display Setup screen. See Section 5.6.2 to change the Display Units if necessary.

NOTICE

The Alarm *Display* limits configured here apply *only* to the value of the selected alarmed parameter that is *displayed on the LCD*. They do not correspond to the limits associated with any analog or relay outputs that may also be configured to output based on the value of the same parameter.

This allows the user to set a tighter parameter value range to trigger a **visual display alarm** on a parameter that is outside ideal limits but not far enough from ideal to warrant an Analog Output or relay (that has been configured to monitor the same parameter) going into full alarm status.

5.6.3.1 *Selecting and Editing a Display Alarm Configuration*

- Double click on the LCD display line on which the alarm is to appear.
- Select/left click the desired display line number.
- Double click on the parameter column on the same line in the table to display a drop-down list of the parameters available for Alarm Display on the LCD.
- Select the desired parameter from the drop-down list.
- Press **ENTER/RETURN** on the keyboard to select the parameter for Alarm Display.
- Make additional parameter selections as necessary, **pressing ENTER/RETURN after each selection**.
- Once all parameters have been configured in this submenu as described above, **click on another toolbar button to trigger the "Save Changes"** Dialog.
- To save the most recent changes, click "**Save**." This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue**."

- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.6.3.2 *Selecting and Editing a Display Alarm Upper or Lower Limit*

- Click on the desired Alarm Limit cell.
- Press **ENTER/RETURN** on the keyboard.
- Edit the numerical value.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter value entries as necessary, **pressing ENTER/RETURN after each value entered**.
- Once all parameters have been configured in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**
- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue**."
- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.7 Output Configuration Page

Selecting the "Output Config" button on the toolbar displays the Output Configuration screen shown in Figure 5.17.

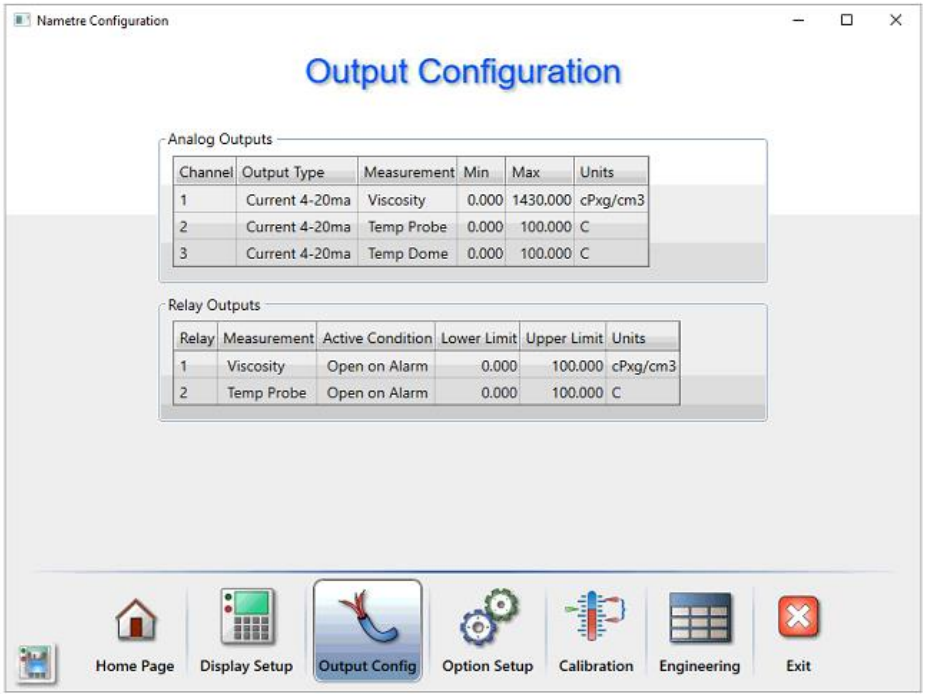

Figure 5.17: Output Configuration Page

The Output Configuration page is divided into two sections:

- Analog Outputs,
- Relay Outputs.

5.7.1 Analog Outputs

The Analog Outputs section of the Output Configuration page allows for configuration of each of the three isolated analog outputs of the ViscoSite transmitter. The Analog Outputs section of the Output Configuration page is shown in Figure 5.18.

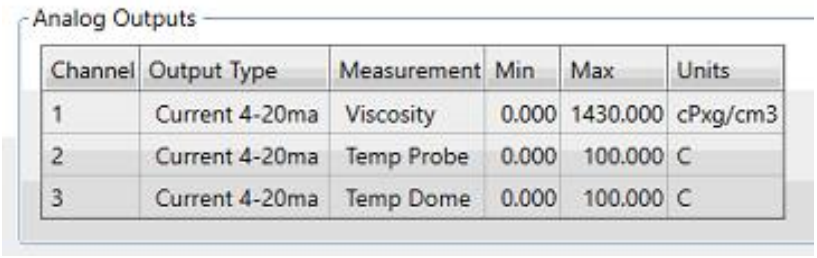

Figure 5.18: Analog Outputs Section (Output Configuration)

The parameters that can be edited are as follows:

- **Output Type** – Allows selection of how the signal is transmitted on an Isolated Analog Output and the minimum and maximum output levels for each configuration. The available choices for an Analog Output are:
  - Current 4-20mA;
  - Voltage 2-10VDC;
  - Current 0-20mA;
  - Voltage 0-10VDC.
- **Measurement** – Allows selection of which measurement parameter is output on the selected Isolated Analog Output channel. See Table 5.4 for the complete list of parameters that may be selected for output on Analog outputs.
- **Min** – Allows the user to configure the lower limit of the selected measured parameter (0/4mA or 0/2VDC signal), depending on the type of output selected. If the measured parameter drops below this entered value, an alarm will be triggered.
- **Max** – Allows the user to configure the upper limit of the selected measured parameter (20mA or 10VDC signal), depending on the type of output selected. If the parameter rises above this entered value, an alarm will be triggered.

NOTICE

The values in the "Units" column are derived from the measurement units selected in the **Display Setup** page (Section 5.6.2). They cannot be edited from this screen.

Parameter	Explanation
<Blank>	Nothing output on this line if this option is selected
Viscosity	Present calculated viscosity parameter
Temp Probe	Present temperature measured by the transducer probe RTD
Temp Dome	Present temperature measured by the transducer block RTD
Temp Elec	Present temperature measured inside the transmitter enclosure
Frequency	Present oscillation frequency of the transducer
Temp Comp Visc	Present measured viscosity compensated for sample temperature

Table 5.4: Parameters Available for Output on an Analog Channel

5.7.1.1 *Selecting and Editing an Output Type and/or Measurement Parameter for Analog Outputs*

- Double click on the desired field.
- Select the desired value from the drop-down menu that appears.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter selections or entries as necessary, **pressing ENTER/RETURN after each selection.**
- Once all parameters have been configured in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**
- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue.**"
- To remain in the menu, click "**Cancel.**" The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.7.1.2 *To Change/Edit Min and/or Max Numerical Values for Analog Outputs*

- Click on the desired cell.
- Type in the new value.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter entries as necessary, pressing ENTER/RETURN after each value entered.

- Once all parameters have been configured in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**
- To save the most recent changes, click "**Save**." This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue**."
- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.7.2 Relay Outputs

The Relay Outputs section of the Output Configuration page allows for association of each of two independent relays of the ViscoSite transmitter with the normal operating range for two user-selectable measurement parameters. Lower and Upper Limits selected by the user determine when the relay goes into Active Condition (see below). The Relay Outputs section of the Output Configuration screen is shown in Figure 5.19.

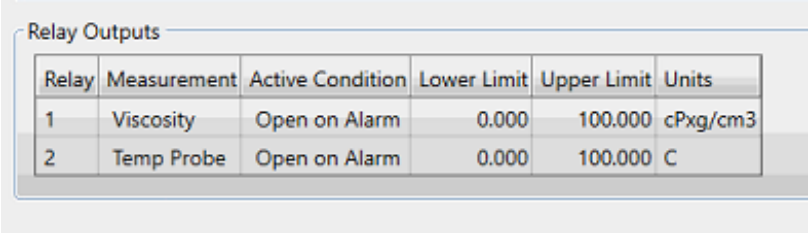

Figure 5.19: Relay Outputs Section (Output Configuration)

The values that can be edited are as follows:

- **Measurement** - Selects which measurement parameter is associated with the given relay. See Table 5.4 for the list of available parameters.
- **Active Condition** – Selects the relay behavior. The options are as follows:
  - Open on Alarm – This is equivalent to Normally Closed (NC) under normal operating conditions. When the selected parameter associated with the relay goes into alarm, the relay opens.
  - Close on Alarm – This is equivalent to Normally Open (NO) under normal operating conditions. When the selected parameter associated with the relay goes into alarm, the relay closes.
- **Lower Limit** - The lower numerical limit for the given parameter such that if the parameter's value drops below this value, the selected relay Active Condition will be triggered. Expressed in the

units for the parameter selected in the Display Units portion of the Display Configuration screen.

- **Upper Limit** – The upper numerical limit for the given parameter such that if the parameter's value rises above this value, the configured relay Active Condition will be triggered. Expressed in the units for the parameter selected in the Display Units portion of the Display Configuration screen.

NOTICE

The values in the "Units" column are derived from the measurement units selected in the "Units" section of the Display Setup page (see Section 5.6.2). They **cannot** be edited from this screen.

5.7.2.1 *Selecting and Editing Measurement and/or Active Relay Condition Parameters*

- Double click on the desired field.
- Select the desired value from the drop-down menu that is displayed.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter entries as necessary, pressing ENTER/RETURN after each value selected or entered.
- Once all parameters have been selected in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**
- To save the most recent changes, click "**Save**." This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue**."
- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.7.2.2 *Selecting and Changing Lower and/or Upper Limit Numerical Values*

- Click on the desired cell.
- Type in the new value.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter entries as necessary, pressing ENTER/RETURN after each value entered.
- Once all parameters have been configured in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**
- To save the most recent changes, click "**Save**." This sends the updated information to the transmitter.

- To exit the menu without saving the most recent changes, click "**Continue**."
- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

NOTICE

Section 5.7.2.2 applies ONLY to the configuration of lower and/or upper numerical limits for the Analog Output and relay ranges. Ranges for DISPLAY alarms are configured in the Alarms Display section of the software. See Section 5.6.3.2.

5.8 Options Setup Page

Pressing the "Options Setup" button on the toolbar displays the Options page. The Options page is shown in Figure 5.20.

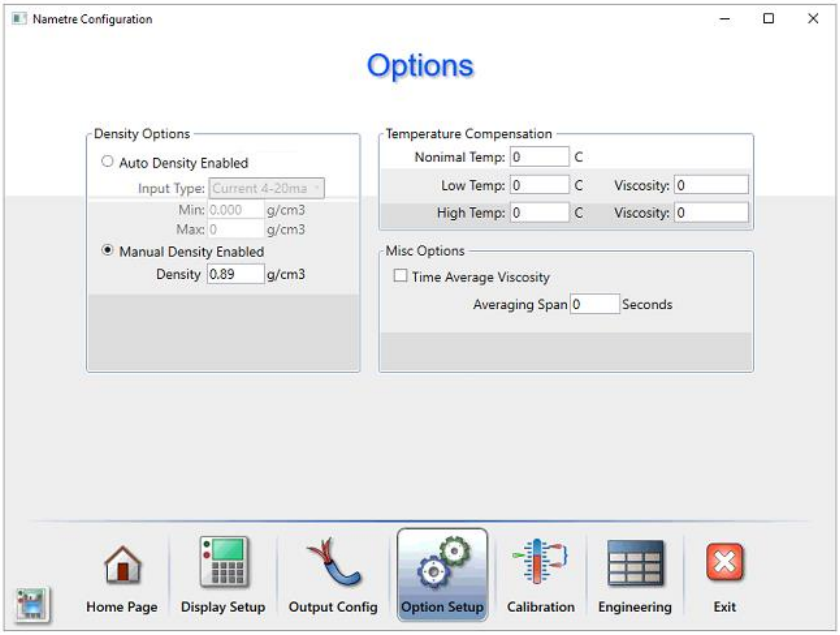

Figure 5.20: Options Page

The Options page comprises three sections:

- Density Options;
- Temperature Compensation;
- Miscellaneous Options;

5.8.1 Density Options

The Density Options section allows for configuration of how sample density information is provided to the ViscoSite transmitter. The two choices are

- Automatic (Auto) Density Enabled.
- Manual Density Enabled.

See Figure 5.21.

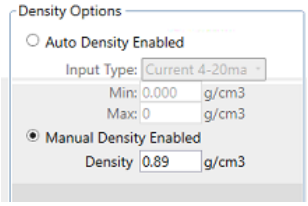

Figure 5.21: Density Options

NOTICE

To calculate **VALID** results for any measurement units other than (cP x g/cm ^{3}) (Viscosity x Density), the ViscoSite system **MUST** have valid density information at process conditions for the material being measured. Failure to provide density information for the process material in proximity of the transducer will lead to **invalid calculations** of viscosity expressed in standard viscosity units (cP. mPa s, cSt).

5.8.2 Automatic Density

The ViscoSite transmitter can accept a 0-20 mA or 4-20 mA signal from a real-time density transducer via an **isolated analog Density input** to enable calculations of viscosity in units of

- millipascal seconds (mPa s)
- centipoise (cP)
- centistokes (cSt)

5.8.2.1 *Enabling and Configuring Auto Density*

- Select the "Auto Density Enabled" radio button.
- Select the 0-20/4-20mA output type from the density transducer as the Auto Density Input Type. **(The other selections are not functional at this time. Do not select them). Press ENTER/RETURN** on the keyboard.
- Enter the minimum and maximum density values, taking into account the units shown, corresponding to the limits of the density transducer 0-20/4-20mA output signal as configured for the process. **Press ENTER/RETURN after each entry**.
- Once all parameters have been selected in this submenu, click on another toolbar button to trigger the "**Save Changes**" Dialog.

- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue.**"
- To remain in the menu, click "**Cancel.**" The most recent changes remain on the screen for further editing. They are not sent to the transmitter.
- Connect the real-time density transducer output to the ViscoSite transmitter Density Input as outlined in Section 3.10.2.

NOTICE

The ViscoSite Density input is an **ISOLATED** analog input. The density transducer output **MUST** be isolated from earth ground to avoid undesirable system behavior.

NOTICE

If the Density transducer output range is not configured correctly on the density transducer, incorrect values for the minimum and maximum densities are entered into the ViscoSite software.

NOTICE

If Auto Density is enabled when no density transducer is connected to the transmitter, **the calculated viscosity in units of mPa·s, cP, and cSt WILL BE INVALID.**

5.8.3 Manual Density

If no density transducer is present and/or a fixed density value sufficiently describes the material properties across the process range, a fixed value for the density of the material at process conditions may be entered into the ViscoSite software to allow for the calculation of viscosity in units of millipascal seconds (mPa s), centipoise (cP) or centistokes (cSt).

5.8.3.1 *Enabling and Configuring Manual Density*

- Select the "Manual Density Enabled" radio button.
- Input a density value representative of the material at process conditions.
- Press **ENTER/RETURN** on the keyboard.
- Make additional parameter entries as necessary, **pressing ENTER/RETURN after each value entered.**
- Once all parameters have been selected in this submenu as described above, **click on another toolbar button to trigger the "Save Changes" Dialog.**

- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue.**"
- To remain in the menu, click "**Cancel.**" The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

NOTICE

Manual Density is successfully used in processes where there is little to no variation in the material density during processing. If large variations in the material density are expected, Galvanic Applied Sciences, Inc. strongly recommends the use of a Density transducer installed in close proximity to the ViscoSite transducer's sensor tip for use with ViscoSite's Automatic Density option.

NOTICE

The ViscoSite system measurement is proportional to the *product* of Viscosity and Density (Viscosity x Density). Thus, **the cP x (g/cm³) values must be divided by the density to express viscosity in common units**. If the fixed density value entered is *not* representative of the material at process conditions**, the calculated viscosity in units of mPa·s, cP, and cSt will not be accurate.**

5.8.4 Temperature Compensation

The Temperature Compensation section of the Options screen allows entry of the parameters required for the ViscoSite system to compensate the viscosity reading for significant variations in sample temperature based on user data.

Temperature compensation is performed in accordance with ASTM Standard D-341, *Standard Practice for Viscosity-Temperature Charts for Liquid Petroleum Products*. The Temperature Compensation section of the Options screen is shown in Figure 5.22.

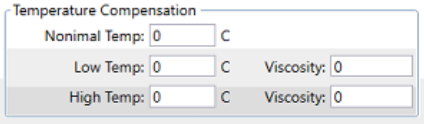

Figure 5.22: Temperature Compensation

5.8.4.1 *Configuring Temperature Compensation*

The values entered in this section will be used to calculate the '**Temp Comp Visc**' (temperature compensated viscosity) per ASTM D341.

NOTICE

All temperature values must be input in degrees Celsius.
All viscosities must be entered in the same units as those displayed on the LCD.

- Click in the **Normal Temperature** box and enter the expected "normal" material temperature the probe is expected to see when the process is functioning "ideally" or "normally."
- Click **ENTER/RETURN** on the keyboard.
- Click in the **Low Temperature** box and enter the lowest material temperature the transducer probe is expected to see when the process is functioning normally.
- Click **ENTER/RETURN** on the keyboard.
- Click in the **Viscosity** box to the right of the Low Temperature box and enter the viscosity of the process material at the temperature entered into the Low Temperature box.
- Click **ENTER/RETURN** on the keyboard.
- Click in the **High Temperature** box and enter the highest material temperature the transducer probe is expected to see when the process is functioning normally.
- Click **ENTER/RETURN** on the keyboard.
- Click in the **Viscosity** box to the right of the High Temperature box and enter the viscosity of the process material at the temperature entered into the High Temperature box.
- Click **ENTER/RETURN** on the keyboard.
- Click on another toolbar button to trigger the "**Save Changes**" Dialog.
- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue**."
- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.8.4.2 *Disabling Temperature Compensation*

- Set all parameter values outlined in Section 5.8.4.1 to zero (0), clicking **ENTER/RETURN** on the keyboard after each entry.
- Click on another toolbar button to trigger the "**Save Changes**" Dialog.
- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.

- To exit the menu without saving the most recent changes, click "**Continue**."
- To remain in the menu, click "**Cancel**." The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

5.8.5 Miscellaneous Options

5.8.5.1 *Time Average Viscosity*

The Miscellaneous Options section allows for calculation and display of the time-averaged viscosity parameter output values.

The Miscellaneous Options section is shown in Figure 5.23.

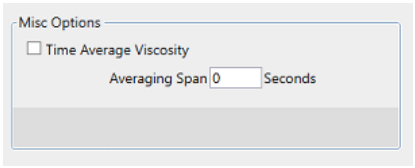

Figure 5.23: Misc. Options – Time Averaging of Viscosity-Related Output Values

5.8.5.2 *Enabling and Using the Time Average Viscosity Feature*

- Click the "Time Average Viscosity" checkbox to enable Time Averaging of the viscosity-related output values.
- Enter the desired averaging time into the "Averaging Time Span" **in units of seconds**.
- Click **ENTER/RETURN** on the keyboard.
- Click on another toolbar button to trigger the "**Save Changes**" Dialog.
- To save the most recent changes, click "**Save.**" This sends the updated information to the transmitter.
- To exit the menu without saving the most recent changes, click "**Continue.**"
- To remain in the menu, click "**Cancel.**" The most recent changes remain on the screen for further editing. They are not sent to the transmitter.

NOTICE

If a checkmark is placed in the 'Time Average Viscosity' box, this applies time averaging to the displayed viscosity parameter AND ALL viscosity-related parameters ON ALL OUTPUTS configured to output a viscosity parameter.

5.8.6 Selecting an Appropriate Time Averaging Span for Your Process

To determine an optimal time averaging span, begin with low values and increase the averaging time span to a value where the resultant ViscoSite readings are most representative of the aspects of the process behavior with which you are concerned while monitoring and controlling your process.

5.9 Other

5.9.1 Understanding the "Unsaved Changes" Prompt

Once changes have been made to parameters within a given menu, the changes must be uploaded to the transmitter. These changes are stored locally in the PC software until the user exits a software menu.

If the user wishes to exit a menu page, pressing another toolbar button will bring up the "Unsaved Changes" prompt shown in Figure 5-24.

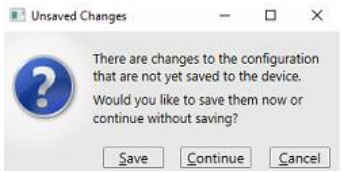

Figure 5.24: Unsaved Changes Prompt

The three options -- **Save**, **Continue**, or **Cancel** – are described below.

- Save – Click this button to save all changes made within the current menu to the transmitter.
- **Continue** – Click this button to **leave the current menu without saving changes** (and switch to a different menu).
- **Cancel** - Press this button to **remain on the current menu** in the software. Any changes made to parameters or values remain on the screen, but **they have not yet been saved to the transmitter**.

- **NOTICE**
- When data is being saved to the transmitter, the red FAULT light will illuminate for approximately 8-15 seconds during data transfer. This behavior is by design and does NOT indicate a fault of any kind.

5.9.2 Monitoring System Performance via the LCD Screen

It is sound practice to periodically observe the ViscoSite transmitter LCD screen to ensure satisfactory performance of the system. This is

especially true if alarms have been configured **ONLY** to display on the LCD and are **not** being communicated via relay or Isolated Analog Output to a central data center.

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6 Preventative Maintenance

6.1 Preventative Maintenance Guidelines

The transducer calibration should be checked at least once per year (See Section 6.3). The ViscoSite Viscometer has been designed for essentially maintenance-free operation. The transducer has no moving parts and is hermetically sealed from the process. However, there are some steps that can be taken on a periodic basis to ensure continued long term operation of the ViscoSite Viscometer.

The following general preventative maintenance guidelines should be followed:

- Inspect the seals on the transducer dome to cable connection to ensure that no moisture or other material has penetrated into the connector. Apply contact cleaner / moisture repellant to the sensor cable connections of transducer each time the check is performed.
- Ensure that air or inert gas provided for transducer cooling is **clean and dry**.
- Ensure that water provided for transducer water cooling is **clean**.
- In certain process environments, it may be necessary to periodically remove the transducer from the process for cleaning (see Section 6.2).

6.2 Removal and Cleaning of the Transducer Probe

In order to clean the transducer probe, in most situations it should be removed from the process line or tank. Correct removal of a transducer is shown in Figure 6.1. Ensure the transducer is supported by the flange and/or dome.

NOTICE

Do not support the transducer by the shaft or sensor tip.

Figure 6.1: Removing the Transducer

NOTICE

When removing the viscosity transducer for cleaning / maintenance, DO NOT lift the viscosity transducer by the probe end or allow the transducer to rest on the probe tip. This may cause irreparable damage to the viscosity transducer! Lift using the flange or transducer dome end only! Refer to Figure 6.2.

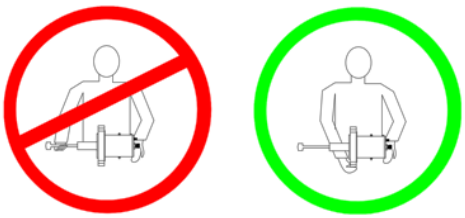

Figure 6.2: Proper Handling of the ViscoSite Transducer

If the sample temperature is sufficiently low to cause the transducer to freeze in contact with the mounting surface, avoid twisting the transducer as this may cause damage to the probe. Use localized heat such as a flange heater to increase the transducer temperature until removal is possible. Ensure that the transducer dome/block temperature does not exceed 200 °C to prevent damage to the transducer.

NOTICE

The probe end of the transducer should be cleaned thoroughly to remove any process material, taking great care not to bend it by placing too much lateral stress on the probe and outer sheath. A badly damaged transducer is shown in Figure 6.3.

Figure 6.3: Bent (Damaged) Transducer

NOTICE

The choice of cleaning materials used to clean the probe will depend on the nature of the process material residue on the probe. Choose an appropriate solvent and clean well.

Do NOT apply significant lateral force to the probe tip or use sharp objects to scrape process material off the transducer probe.

6.3 Checking the Transducer Calibration

While the transducer is removed from the installation location, the transducer calibration may be checked. In order to check the transducer calibration, a series of liquids of known viscosity (with known density at a known temperature) is required. This may be a Newtonian Viscosity Standard or other material of known viscosity and density at a known temperature.

Galvanic Applied Sciences Inc. recommends the use of Cannon Viscosity Standards, available directly from Galvanic. Should the viscosity measurement range of the transducer be sufficiently low, distilled water may be used. The viscosity of distilled water is about 0.9 cP at 25 °C, with a density of 1 g/cm^3.

The manufacturer of the viscosity standard provides both the viscosity and density values for the standard at a known temperature, as shown in Figure 6.4.

NOTICE

It is critical to ensure the viscosity standards and transducer are at a known and stable temperature – preferably the temperature listed on the label of the standard. If the test environment is not well controlled and at a temperature corresponding to the known viscosity of the standard, comparison to the original factory calibration is possible but should not be expected to be identical.

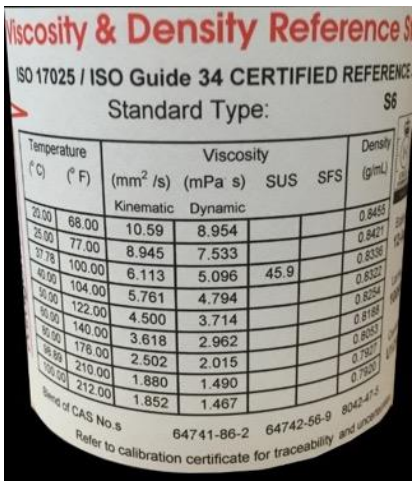

Figure 6.4: Viscosity Standard Label

6.3.1 Setting up the Transducer for the Calibration Check

A stable and well controlled temperature environment will provide the most accurate results.

6.3.1.1 *Mounting the Transducer for the Calibration Check*

For small transducers, mount the transducer on the stand originally provided using rubber shock mounts as shown in Figure 6.5.

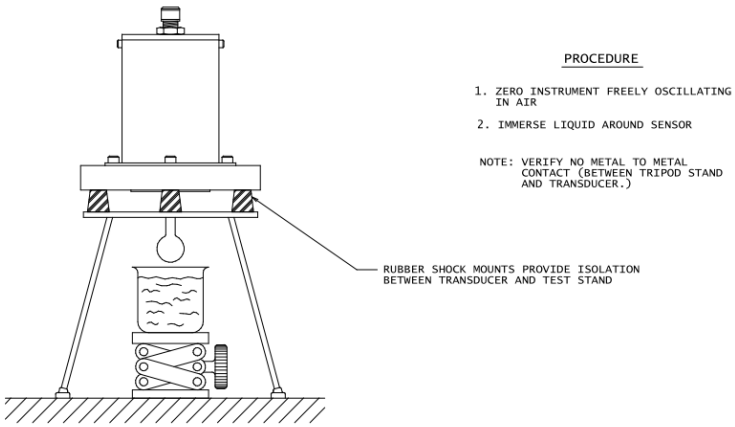

Figure 6.5: Setting up Transducer for the Calibration Check (Small Transducers)

For large transducers, if the transducer was originally shipped in a wooden crate, stably support the Mounting Board with which the transducer was originally shipped. Place the transducer on the shock mounts of the supported Mounting Board as shown in Figure 6.6.

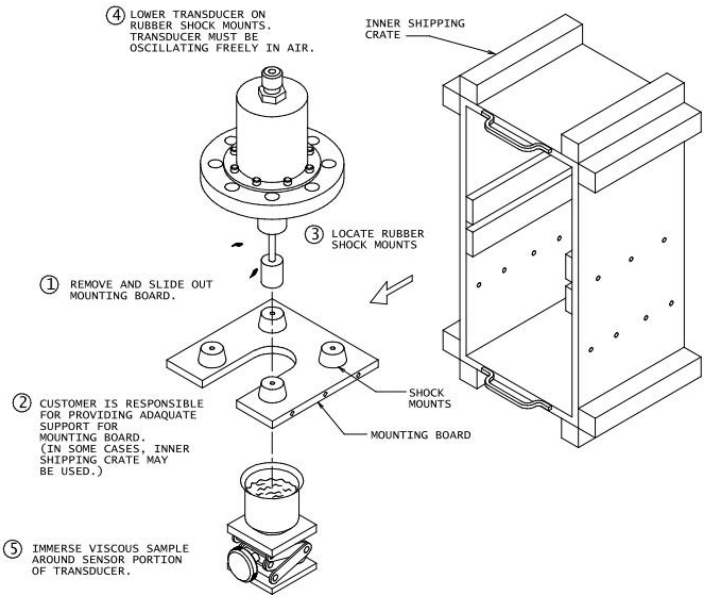

Figure 6.6: Setting up Transducer for the Calibration Check (Large Transducers)

6.3.1.2 *Performing the Calibration Check*

NOTICE

- Ensure the transducer and standards are at the desired test temperature.
- Set the density mode to Manual Density and enter the density of the standard to be measured and save it to the transmitter.
- Set the viscosity parameter to display in units of cP.
- Place the calibration standard into containers such that no surface of the container is within 1.5 in. of the sensor tip of the transducer. It is recommended NOT to use the standard bottle itself to avoid possible cross-contamination.
- Raise the container of the lowest viscosity standard and immerse the entire sensor and as much of the sheath as possible. For rod sensors, contact Galvanic for calibration check instructions.
- Allow the measurement reading to stabilize.
- Confirm that the measurement reported by the ViscoSite system is comparable to that given on the viscosity standard for dynamic viscosity. 1 Pa*s=1cP so there is no conversion factor. Values reported by the ViscoSite during the calibration check may not be the

same as those provided on the viscosity standard label due to temperature differences.

- Lower the calibration fluid, allow the majority of the standard to drain, and rinse with an appropriate solvent, and gently dry.
- Working from low to high viscosity, repeat the above process for as many standards as required to check the calibration at viscosities of interest in your application.
- If the calibration check is within acceptable limits, clean the transducer probe with an appropriate solvent, dry, and re-install in the process line / tank. Remember to follow the guidelines given in Section 3.5.1.2 when reinstalling a transducer.

If the calibration check does not produce acceptable results, refer to 7 and/or contact Galvanic Applied Sciences for support.

7 Troubleshooting the ViscoSite Viscometer

7.1 Introduction to Troubleshooting

While the ViscoSite is designed to provide long term trouble-free operation, troubleshooting is occasionally necessary when system behavior in the process material is not as expected. This section will highlight commonly observed issues that may arise with the ViscoSite and/or the process and discuss possible solutions.

7.2 Changes in ViscoSite Behavior – Process Related?

Changes/fluctuations in temperature, density, flow rate, material structure (settling, crosslinking, etc.) and pressure are just some of the variables that may result in a change in the ViscoSite viscosity reading or behavior under process conditions.

Experience has shown that unexpected instrument readings are often attributable to

- Short or long term changes in the process
- Batch to batch variations in raw materials used to make the material being monitored in process by the ViscoSite Viscometer
- Procedural changes in material production made upstream of the ViscoSite Viscometer that affect the nature of the material measured by the Viscometer and therefore the reading.

Review all upstream changes (reagent and process) for possible impact. Trending of other process measurements during the period of unexpected ViscoSite measurements may aid in the detection of any correlation, should it exist, between other process parameters and the ViscoSite measurements.

7.3 ViscoSite Troubleshooting Guide -- Commonly Observed Issues

Table 7.1 lists the most commonly observed issues and their most likely solutions. If the solutions listed in the table do not resolve the issue, please contact the Service Department of Galvanic Applied Sciences Inc. (see Section 7.5).

Symptom	Possible Causes / Solutions
Transmitter LCD screen dark	• Transmitter not connected to power supply. Check AC or DC connection. • Ribbon cable connecting from display board on swing panel to motherboard is loose/disconnected. • Adjust the LCD brightness adjustment screw on the back of the swing panel. • Thermal shutdown. Transmitter will only power up once the transmitter's internal temperature is below 70 °C.

Unchanging or erroneous values displayed
 	
(Viscosity parameter, Temperature)
	• If both temperature and viscosity parameter readings are not changing or seem far out of line:
	• Check for faulty connection between cable and transducer. Check cable continuity (See Section 7.4).
	• Transducer electronics may have failed.
	• If only the viscosity reading is out of line while the temperature reading seems correct:
	• Check for faulty connection between cable and transducer. Check cable continuity (See Section 7.4).
	• If meets specifications listed in Section 7.4:
	  • Material deposit on transducer probe preventing transducer contact with fresh process material. If sensor is pulled for inspection, follow directions in Section 6.2 for handling and cleaning.
	  • Drive or detection circuitry in transducer may be damaged.
	  • Transducer / Probe may be damaged / bent.

Viscosity parameter not reading zero in air	• Transducer not mounted securely.
	• Check for faulty connection between cable and transducer. Perform a continuity check (See Section 7.4).
	• If meets specifications in Section 7.4:
	  • Material deposit on transducer probe preventing transducer contact with fresh process material. If sensor is pulled for inspection, follow directions in Section 6 for handling and cleaning.
	  • Drive or detection circuitry in transducer may be damaged.
	  • Transducer / Probe may be damaged / bent.

Symptom	Possible Causes / Solutions

Viscosity parameter displays reading close to but out of normal range	• Process temperature or other process variable may have changed and is affecting viscosity. Investigate all other process parameters for possible correlation.
	• If using viscosity parameter units OTHER than cP x g/cm ^{3}, check the density input value (See Section 5.8.1).
	• Check for faulty connection between cable and transducer. Perform a continuity check (See Section 7.4).
	• If meets specifications in Section 7.4:
	  • Material deposit on transducer probe preventing transducer contact with fresh process material. If sensor is pulled for inspection, follow directions in Section 6.2 for handling and cleaning.
	  • Transducer / Probe may be damaged / bent.

Highly unstable viscosity parameter reading (in air or in process material)	• Power cord is not properly grounded. • Check for loose wiring at terminal screws on the transducer. • Check for loose wiring at the terminal screws on transmitter. • Improper grounding between transducer probe and electronics (check for ground loop). • Electromagnetic interference (Refer to Section 3.5). • Unstable mounting. Retighten bolts using stagger technique (Section 3.5.1) • Excessive pipe vibrations (Refer to Section 3.4.2). • Excessively high material flow rate (turbulent flow)
Transducer Ringing / Excessive Vibration of Transducer	• Check for faulty connection between the transducer cable and the transducer. Perform a continuity check (See Section 7.4). • Transducer probe is bent / damaged.
Current / Voltage of Analog Output doesn't Proportionally Correspond to Displayed Parameter Value	• Verify output min and max settings input to ViscoSite transmitter for parameter associated with output. Ensure min and max values have been entered taking the display units into account (see Section 5.7.1). • Verify input settings on system receiving the Analog Output signal match output settings on ViscoSite analog output.

Table 7.1: ViscoSite Troubleshooting Guide -- Commonly Observed Issues

7.4 Transducer Cable Continuity Test

When difficulties are encountered with the ViscoSite transmitter and/or transducer, a transducer cable continuity test can provide as much information as to what may be the cause as it can to what is not the cause.

A continuity test of the wires should be carried out on the transducer cable using a multimeter set to measure electrical resistance (Ω , Ohms). Table 7.2 shows the expected resistance (in Ohms) between specific pins of the terminal block with and without the intrinsically safe barriers present.

Terminal Block	Positions	Resistance (Ω) No IS Barriers (Ohms)	Resistance (Ω) With IS Barriers (Ohms)
J11	1 / 2	~70 to 100	~400 to 450
	4 / 5	~70 to 100	~750 to 800
J10	1 / 2	~ 110	~160
	1 / 3	~ 110	~160
	2 / 3	<10	<50
	4 / 5	~110	~160
	4 / 6	~110	~160
	5 / 6	<10	<50

Table 7.2: Transducer Cable Continuity Test – Expected Results

If the results of the continuity test do not match the expected results shown in Table 7.2, contact the Service Department of Galvanic Applied Sciences Inc for assistance. Refer to Section 7.5 for contact information.

7.5 Contact Galvanic Applied Sciences Inc.

In the event that the information in this section does not lead to a successful diagnosis and resolution of an issue with the ViscoSite Viscometer as implemented in your application, contact Galvanic Applied Sciences Inc.'s Service Department.

The Service Department offers both phone/e-mail technical support and on-site technical service as required.

For Service and/or Assistance, contact:

Galvanic Applied Sciences Inc. USA
101 Billerica Ave

Building 5, Suite 104
North Billerica, MA 01862
USA
Phone: (978) 848-2701

Toll Free (CANADA/USA): 1-866-252-8470
E-mail: service@galvanic.com

OR

Galvanic Applied Sciences Inc.
7000 Fisher Road SE
Calgary, AB T2H 0W3
CANADA
Phone: (403) 252-8470

Toll Free (CANADA/USA): 1-866-252-8470
E-mail: service@galvanic.com

8 ViscoSite System Diagrams

8.1 System Diagrams

8.1.1 Transmitter, Enclosure, and IS Barriers (6) – No Block / Dome RTD

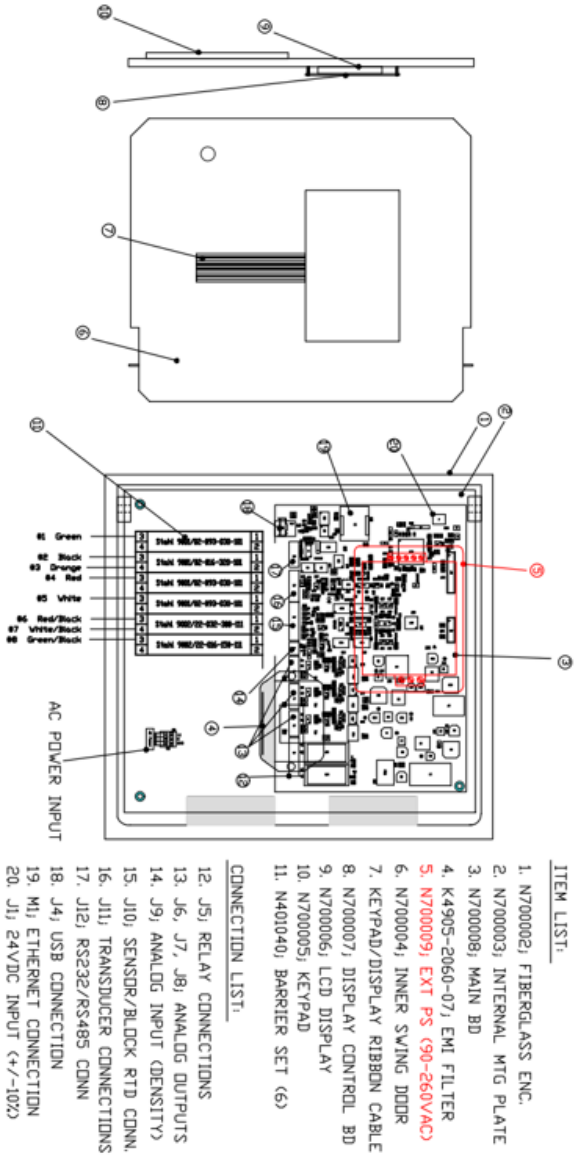

Figure 8.1: Transmitter, Enclosure, IS Barriers – No Block/Dome RTD

8.1.2 Transmitter, Enclosure, and IS Barriers (7) – With Block / Dome RTD

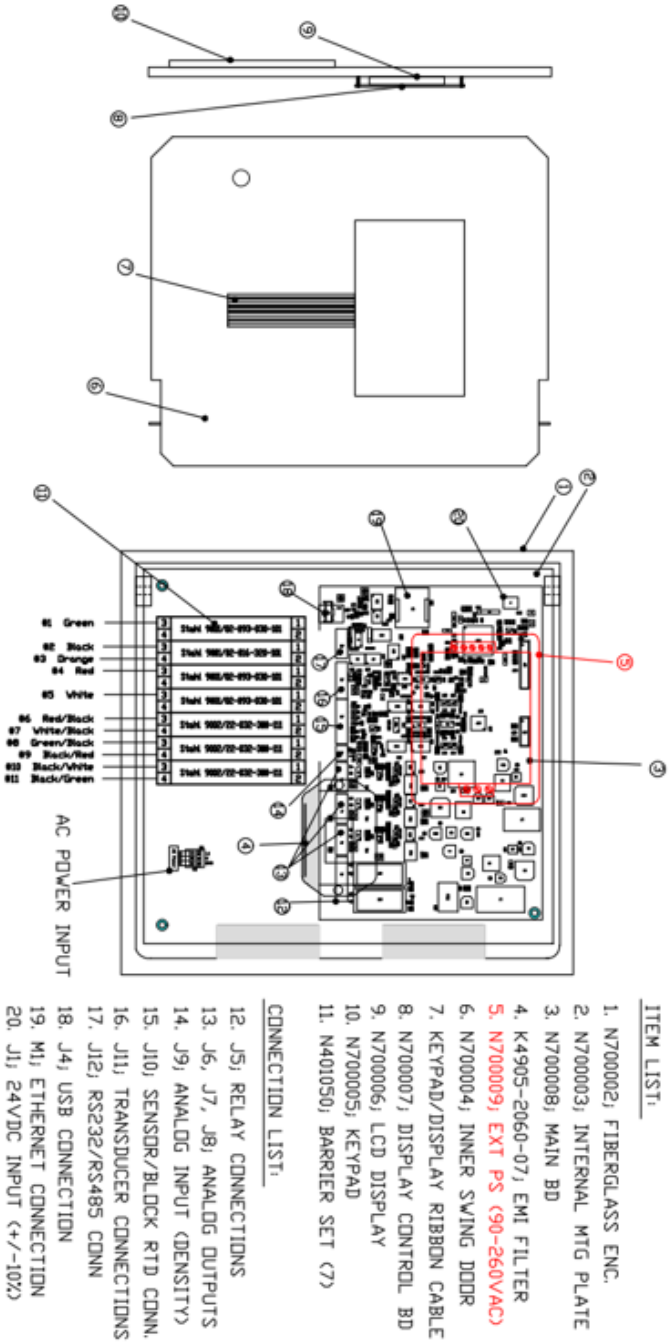

Figure 8.2: Transmitter, Enclosure, IS Barriers – With Block / Dome RTD

8.1.3 Transmitter, Enclosure – Without IS Barriers, With/Without Block / Dome RTD

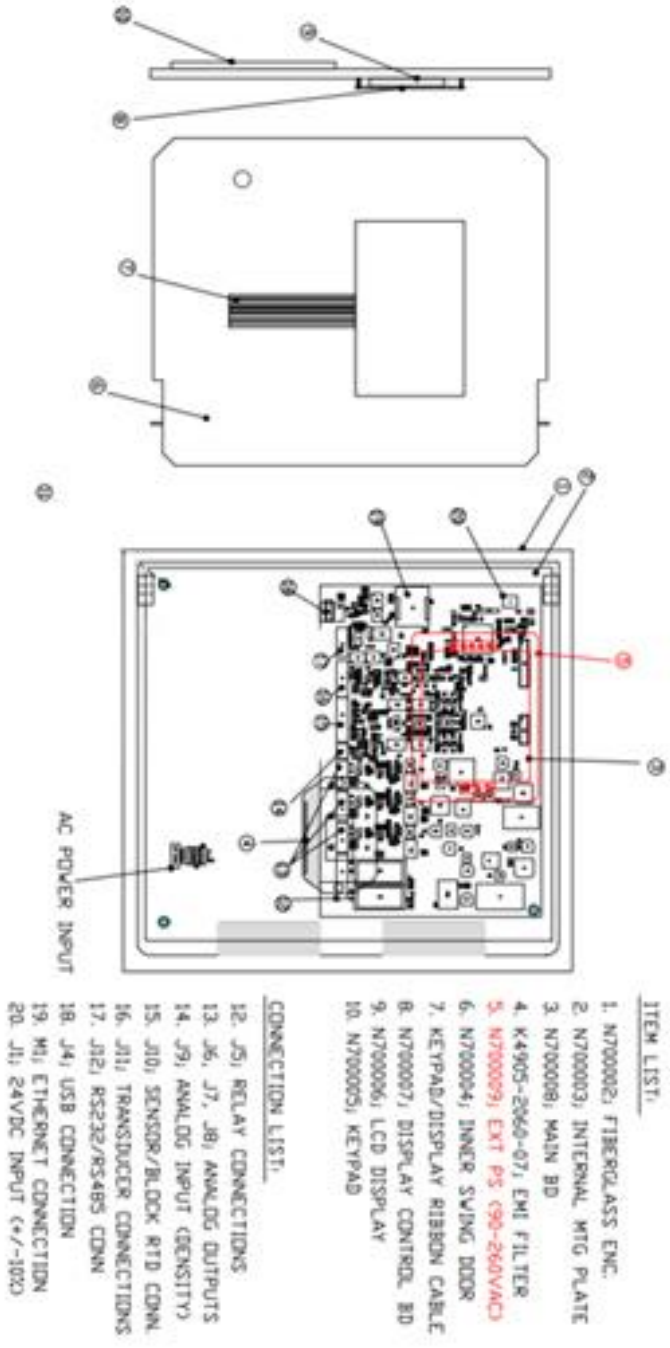

Figure 8.3: Transmitter, Enclosure – Without IS Barriers With/Without Block / Dome RTD

9 ViscoSite System Technical Specifications

9.1 Performance Specifications

Range	4 (four) decades from 0.1 – 1 000 000 cP x g/cm^3 (depends on transducer configuration) (See Section 2.2)
Accuracy	±2% of reading
Reproducibility	±1% of reading
Repeatability	±0.25% of reading
Response Time	Real-Time Analysis
Analysis Frequency	~1 Hz

Table 9.1: Performance Specifications

9.2 Communications / Interface

Outputs	3 0-10VDC / 2-10VDC / 0-20mA / 4-20mA isolated analog outputs (scaled to range, user configurable) 2 SPDT Alarm Relays, 4A @30VDC / 120VAC OR 2A @ 240VAC 1 USB 2.0 Port 1 Combined RS232c/RS485 isolated Serial port 1 Ethernet Port (RJ-45), 10/100 Mb/s, half-duplex
Communications	Modbus RTU across Ethernet, USB, Serial Ports
Inputs	1 0-10VDC / 2-10VDC / 0-20mA / 4-20mA isolated analog input for density transducer (scaled to range, user configurable, no sourcing current) 2 RTD Inputs (3 wire, PT100) (Transducer Probe (sensor tip) RTD, Transducer Block/RTD), factory configured / calibrated
Operator Interface	1 LCD Screen 4-line x 20 column, white print on blue with Front Panel membrane keypad (not intrinsically safe) 4 Front Panel Status LEDs 1 ViscoSite Software Program for local and remote PC configuration of ViscoSite transmitter

Table 9.2: Communications / Interface

9.3 Instrument Specifications

Size	**Transmitter:** 301mm (H) x 335mm (W) x 172mm (D) (12″ x 13″ x 7″) **VL800 Transducer:** Depends on application
Weight	**Transmitter:** 5.5kg (12lb) **VL800 Transducer:** Depends on application
Power Consumption	10 W @ 24VDC or 90-265 VAC
Electrical	CSA, C/US Certified
Classifications	**Transmitter:** Up to Class 1 Division 2 Groups ABCD T4 **Transducer:** Up to Class 1 Division 1 or ATEX Class 1 Zone 1
Ambient Temperature	**Transmitter:** 0-60°C (32-140°F) **Transducer:** Depends on model and installation location

Table 9.3: Instrument Specifications

10 ViscoSite Spare Parts

10.1 ViscoSite Spare Parts List

The following is a list of common spare parts available from Galvanic Applied Sciences Inc. for the ViscoSite system.

Description	Part Number
Power Supply	N700009
EMI/RF Filter	K4905-2060-07
LCD Screen	N700006
LCD Screen Driver Board	N700007
Keypad	N700005
Inner Swing Panel	N700004

Table 10.1: ViscoSite Spare Parts List

11 ViscoSite Modbus Registers Introduction

The Modbus Register list for the ViscoSite system can be viewed in the Engineering Page of the ViscoSite Software ONLY when logged in to the ViscoSite PC Software at the 'Factory' access level (see Section 5.4.2). Pressing the 'Engineering' button on the Factory Access level toolbar (Figure 5.8) displays the Engineering Page of the ViscoSite Software. See Figure 11.1.

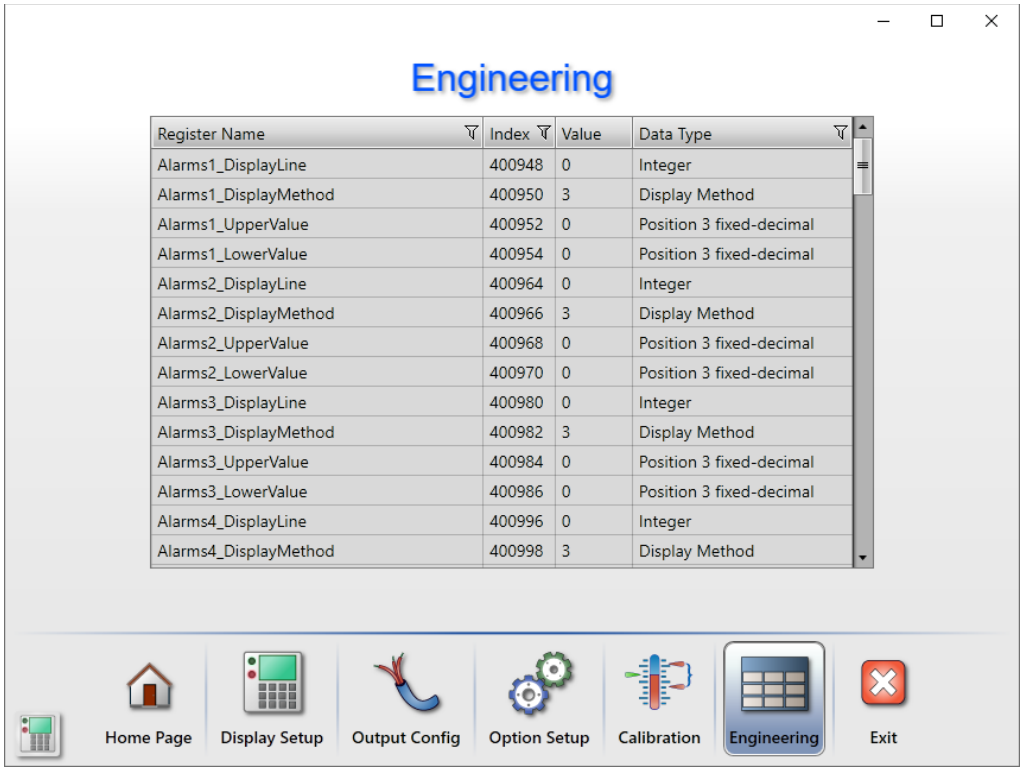

Figure 11.1: Engineering Page of the ViscoSite Software

The Engineering Page consists of a table with the following columns:

- **Register Name** – Indicates what data is output in that register;
- **Index** – Indicates the register number in extended register referencing. The initial digit of the index number indicates the type of register, as follows:
  - 0 – Coil
  - 1 – Discrete Input
  - 3 – Input Register
  - 4 – Holding Register

The majority of the data in the ViscoSite system's Modbus list is output in holding registers.

- **Value** - Indicates the current value of the register. This column is the only column that can be edited on this screen.
- **Data Type** – Indicates the type of data (refer to Section 11.3 for more information on data types).

11.2 Filtering the Modbus Register List

The Modbus data may be filtered to display subsets of information by

- Register name,
- Index,
- Data type.

11.2.1 To Filter the Modbus Register List

- Click on the funnel icon ( ) on the right side of the column header of the column you wish to filter by. This displays the menu shown in Figure 11.2.

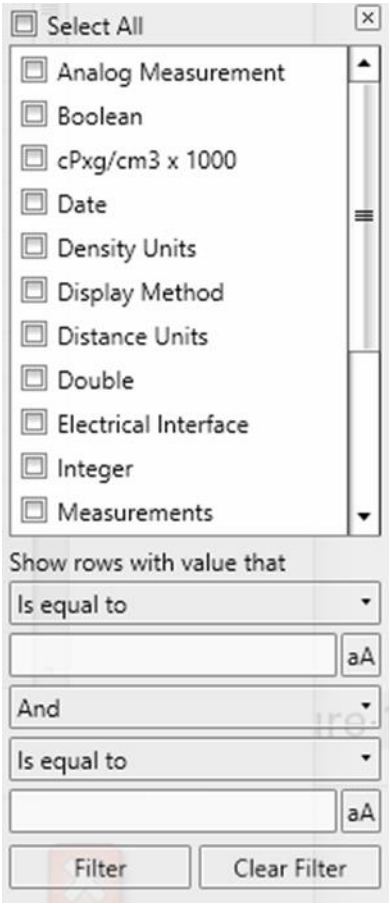

Figure 11.2: "Data Type" Filtering Dialog

The filtering dialog box shown in Figure 11.2 is for the **data type** column. The upper portion of the dialog lists all of the values in the column.

- Place a checkmark in the box to the left of the item by which to filter.
- Enter specific values or value ranges expressed in Boolean logic in the bottom half of the screen if so desired. The Boolean approach works best with numeric values.
- Click "Filter."
- The filtered results are displayed based on the selections.
- For example, in Figure 11.2, placing a checkmark in the 'Date' box and clicking "Filter" will filter and display ONLY registers that have the 'Date' data type. Multiple filtering criteria may be selected for advanced filtering.

11.2.2 Clearing All Currently Applied Filters

- Click the "Clear Filter" button.

11.3 Modbus Data Types

The Modbus list contains a number of different data types. The data types are summarized in Table 11.1 below.

Data Type	Explanation	Allowed Values
Analog Measurement	Stores selected measurement parameters associated with relay alarms	0 No Output 1 Density 2 Viscosity Parameter 3 Probe Temperature 4 Dome Temperature 5 Electronics Temperature 6 Oscillation Frequency 7 Temperature Compensated Viscosity
Boolean	Stores status of Manual Density enabled (default=1) and TimeAverageViscosity enabled (default = 0)	0 Off / False 1 On / True
(cP x g/cm^3) x 1000	Stores Calibration Viscosities / Temperatures and Low/High Temperature Calibration Limits (note units)	Any integer value
Date	Date associated with calibration	Date in the format mmddyyttttt

Data Type	Explanation	Allowed Values
Density Units	Stores selected units for density	0 g/cm^3
Display Method	Stores Alarm Display behavior on LCD Screen for all 7 alarmable parameters	0 Steady 1 Blinking 2 Alternating 3 Not used
Distance Units	Stores selected units to express length	0 Metres 1 Feet
Double	Double precision (64 bit) signed floating point data type that stores numeric variables, including those with decimal points Stores Viscosity, phase, resonance frequency, probe temperature, and block temperature	-1.7 x 10 $^{-308}$ to 1.7 x 10 $^{-308}$
Electrical Interface	Stores selected Isolated Analog Output type for each of the three Analog Outputs	0 4-20mA 1 0-10VDC 2 0-20mA 3 2-10VDC
Integer	Single precision (32 bit) signed register that stores positive or negative integer values Stores selected line number on which alarm is displayed Stores Calibration data and Instrument serial number.	–2,147,483,648 to 2,147,483,647
Measurements	Stores selected parameter to output on Analog Output. Stores selected parameter to display on LCD screen (Primary and Secondary Display configuration)	0 No Output 1 Density 2 Viscosity Parameter 3 Probe Temperature 4 Dome Temperature 5 Electronics Temperature 6 Oscillation Frequency 7 Temperature Compensated Viscosity

Data Type	Explanation	Allowed Values
mg/cm^3	Stores entered manual density value	Entered as mg/cm^3, not g/cm^3 so that value is stored as an integer number. (Default=1000 mg/cm^3 = 1.000 g/cm^3)
Milliseconds	Stores selected time average window for time-averaged viscosity parameter calculations	0 or positive integer
Position 3 Fixed-Decimal	Stores selected Alarm Min and Max Values for all 7 configurable alarms Stores selected Analog Output Min and Max values for Analog Outputs Stores Calibration frequency and calibration temperature data Stores Temperature Compensation variables Stores Relay Min and Max values.	0 or any positive integer where the last three digits of the entered value are to the right of the decimal point (E.g. 6000 = 6.000, 50 = 050=0.050)
Relay Trigger	Stores selected relay behavior on alarm. (Energized on alarm => Relay NO) (De-energized on alarm => Relay NC)	0 De-energized (Open on alarm) 1 Energized (Closed on alarm)
Temperature Units	Stores selected temperature units	0 Degrees Celsius 1 Degrees Fahrenheit
Viscosity Units	Stores selected viscosity parameter units	0 cP x g/cm^3 1 mPa s 2 cP 3 cSt

Table 11.1: Modbus Data Types, Descriptions, and Allowed Values

11.4 Editing Modbus Values

When editing the value column, the value entered must be within the limits given in the Allowed Values column of Table 11.1. If it is not, the cell border will turn red to indicate that the entered quantity is invalid. Hovering the mouse cursor over the triangle in the upper right corner of the red-bordered cell will indicate the valid range of values that can be entered into the cell, as shown in Figure 11.3.

Editing Modbus Register values shall be performed ONLY at the request of and under supervision of a Galvanic Applied Systems Service Technician.

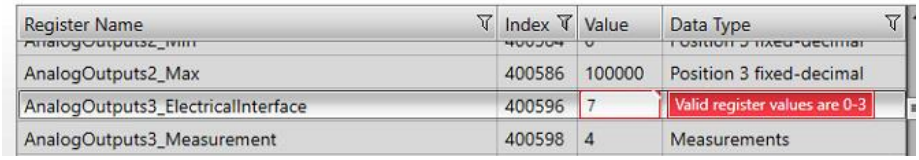

Figure 11.3: Invalid Register Value Message

11.5 Modbus Register Map

The Modbus Register mapping is shown in Table 11-2 below.

Register	Index	Data Type
DeviceInfo_SerialNumber	400100	Integer
DeviceInfo_CalibrationDate	400102	Date
DeviceInfo_ValidationDate	400104	Date
DeviceInfo_ViscosityUnderMeasurement	400106	Double
DeviceInfo_ResonantPhase	400108	Double
DeviceInfo_ResonantFrequency	400110	Double
DeviceInfo_TemperatureUnderMeasurement	400112	Double
DeviceInfo_DomeTemperatureUnderMeasurement	400114	Double
Units_Density	400164	DensityUnits
Units_Distance	400166	DistanceUnits
Units_Temperature	400168	TemperatureUnits
Units_Viscosity	400170	ViscosityUnits
Options_ManualDensity_Enabled	400180	Boolean
Options_ManualDensity_Density	400182	mg/cm^3
Options_TimeAverageViscosity_Enabled	400212	Boolean
Options_TimeAverageViscosity_AverageSpan	400214	Milliseconds
Options_CableLength_Enabled	400244	Boolean
Options_CableLength_Length	400246	Double
Options_TemperatureCompensation_HighTemperature	400276	Double
Options_TemperatureCompensation_HighViscosity	400278	Position 3 fixed-decimal

Register	Index	Data Type
Options_TemperatureCompensation_LowTemperature	400280	Position 3 fixed-decimal
Options_TemperatureCompensation_LowViscosity	400282	Position 3 fixed-decimal
Options_TemperatureCompensation_NominalTemperature	400284	Position 3 fixed-decimal
AnalogInputs1_ElectricalInterface	400436	Electrical Interface
AnalogInputs1_Measurement	400438	Measurements
AnalogInputs1_Min	400440	Position 3 fixed-decimal
AnalogInputs1_Max	400442	Position 3 fixed-decimal
AnalogOutputs1_ElectricalInterface	400564	Electrical Interface
AnalogOutputs1_Measurement	400566	Measurements
AnalogOutputs1_Min	400568	Position 3 fixed-decimal
AnalogOutputs1_Max	400570	Position 3 fixed-decimal
AnalogOutputs2_ElectricalInterface	400580	Electrical Interface
AnalogOutputs2_Measurement	400582	Measurements
AnalogOutputs2_Min	400584	Position 3 fixed-decimal
AnalogOutputs2_Max	400586	Position 3 fixed-decimal
AnalogOutputs3_ElectricalInterface	400596	Electrical Interface
AnalogOutputs3_Measurement	400598	Measurements
AnalogOutputs3_Min	400600	Position 3 fixed-decimal
AnalogOutputs3_Max	400602	Position 3 fixed-decimal
DisplayConfiguration1_Primary	400692	Measurements
DisplayConfiguration1_Secondary	400694	Measurements
DisplayConfiguration2_Primary	400708	Measurements
DisplayConfiguration2_Secondary	400710	Measurements
DisplayConfiguration3_Primary	400724	Measurements
DisplayConfiguration3_Secondary	400726	Measurements
DisplayConfiguration4_Primary	400740	Measurements
DisplayConfiguration4_Secondary	400742	Measurements

Register	Index	Data Type
Relays1_Measurement	400820	Analog Measurement
Relays1_TriggerResponse	400822	Relay Trigger
Relays1_UpperValue	400824	Position 3 fixed-decimal
Relays1_LowerValue	400826	Position 3 fixed-decimal
Relays2_Measurement	400836	Analog Measurement
Relays2_TriggerResponse	400838	Relay Trigger
Relays2_UpperValue	400840	Position 3 fixed-decimal
Relays2_LowerValue	400842	Position 3 fixed-decimal
Alarms1_DisplayLine	400948	Integer
Alarms1_DisplayMethod	400950	Display Method
Alarms1_UpperValue	400952	Position 3 fixed-decimal
Alarms1_LowerValue	400954	Position 3 fixed-decimal
Alarms2_DisplayLine	400964	Integer
Alarms2_DisplayMethod	400966	Display Method
Alarms2_UpperValue	400968	Position 3 fixed-decimal
Alarms2_LowerValue	400970	Position 3 fixed-decimal
Alarms3_DisplayLine	400980	Integer
Alarms3_DisplayMethod	400982	Display Method
Alarms3_UpperValue	400984	Position 3 fixed-decimal
Alarms3_LowerValue	400986	Position 3 fixed-decimal
Alarms4_DisplayLine	400996	Integer
Alarms4_DisplayMethod	400998	Display Method
Alarms4_UpperValue	401000	Position 3 fixed-decimal
Alarms4_LowerValue	401002	Position 3 fixed-decimal
Alarms5_DisplayLine	401012	Integer
Alarms5_DisplayMethod	401014	Display Method
Alarms5_UpperValue	401016	Position 3 fixed-decimal

Register	Index	Data Type
Alarms5_LowerValue	401018	Position 3 fixed-decimal
Alarms6_DisplayLine	401028	Integer
Alarms6_DisplayMethod	401030	Display Method
Alarms6_UpperValue	401032	Position 3 fixed-decimal
Alarms6_LowerValue	401034	Position 3 fixed-decimal
Alarms7_DisplayLine	401044	Integer
Alarms7_DisplayMethod	401046	Display Method
Alarms7_UpperValue	401048	Position 3 fixed-decimal
Alarms7_LowerValue	401050	Position 3 fixed-decimal
Calibration1_Value	401500	cPxg/cm^3 x 1000
Calibration1_ADValue1	401502	Integer
Calibration1_ADValue2	401504	Integer
Calibration1_ADValue3	401506	Integer
Calibration1_Frequency	401508	Position 3 fixed-decimal
Calibration1_ProbeTemperature	401510	Position 3 fixed-decimal
Calibration1_LotNumber	401512	Integer
Calibration2_Value	401516	cPxg/cm^3 x 1000
Calibration2_ADValue1	401518	Integer
Calibration2_ADValue2	401520	Integer
Calibration2_ADValue3	401522	Integer
Calibration2_Frequency	401524	Position 3 fixed-decimal
Calibration2_ProbeTemperature	401526	Position 3 fixed-decimal
Calibration2_LotNumber	401528	Integer
Calibration3_Value	401532	cPxg/cm^3 x 1000
Calibration3_ADValue1	401534	Integer
Calibration3_ADValue2	401536	Integer
Calibration3_ADValue3	401538	Integer
Calibration3_Frequency	401540	Position 3 fixed-decimal
Calibration3_ProbeTemperature	401542	Position 3 fixed-decimal
Calibration3_LotNumber	401544	Integer
Calibration4_Value	401548	cPxg/cm^3 x 1000

Register	Index	Data Type
Calibration4_ADValue1	401550	Integer
Calibration4_ADValue2	401552	Integer
Calibration4_ADValue3	401554	Integer
Calibration4_Frequency	401556	Position 3 fixed-decimal
Calibration4_ProbeTemperature	401558	Position 3 fixed-decimal
Calibration4_LotNumber	401560	Integer
Calibration5_Value	401564	cPxg/cm^3 x 1000
Calibration5_ADValue1	401566	Integer
Calibration5_ADValue2	401568	Integer
Calibration5_ADValue3	401570	Integer
Calibration5_Frequency	401572	Position 3 fixed-decimal
Calibration5_ProbeTemperature	401574	Position 3 fixed-decimal
Calibration5_LotNumber	401576	Integer
Calibration6_Value	401580	cP x g/cm^3 x 1000
Calibration6_ADValue1	401582	Integer
Calibration6_ADValue2	401584	Integer
Calibration6_ADValue3	401586	Integer
Calibration6_Frequency	401588	Position 3 fixed-decimal
Calibration6_ProbeTemperature	401590	Position 3 fixed-decimal
Calibration6_LotNumber	401592	Integer
Calibration7_Value	401596	cP x g/cm^3 x 1000
Calibration7_ADValue1	401598	Integer
Calibration7_ADValue2	401600	Integer
Calibration7_ADValue3	401602	Integer
Calibration7_Frequency	401604	Position 3 fixed-decimal
Calibration7_ProbeTemperature	401606	Position 3 fixed-decimal
Calibration7_LotNumber	401608	Integer
Calibration8_Value	401612	cP x g/cm^3 x 1000
Calibration8_ADValue1	401614	Integer
Calibration8_ADValue2	401616	Integer
Calibration8_ADValue3	401618	Integer
Calibration8_Frequency	401620	Position 3 fixed-decimal

Register	Index	Data Type
Calibration8_ProbeTemperature	401622	Position 3 fixed-decimal
Calibration8_LotNumber	401624	Integer
Calibration9_Value	401628	cP x g/cm^3 x 1000
Calibration9_ADValue1	401630	Integer
Calibration9_ADValue2	401632	Integer
Calibration9_ADValue3	401634	Integer
Calibration9_Frequency	401636	Position 3 fixed-decimal
Calibration9_ProbeTemperature	401638	Position 3 fixed-decimal
Calibration9_LotNumber	401640	Integer
Calibration10_Value	401644	cP x g/cm^3 x 1000
Calibration10_ADValue1	401646	Integer
Calibration10_ADValue2	401648	Integer
Calibration10_ADValue3	401650	Integer
Calibration10_Frequency	401652	Position 3 fixed-decimal
Calibration10_ProbeTemperature	401654	Position 3 fixed-decimal
Calibration10_LotNumber	401656	Integer
Calibration11_Value	401660	cP x g/cm^3 x 1000
Calibration11_ADValue1	401662	Integer
Calibration11_ADValue2	401664	Integer
Calibration11_ADValue3	401666	Integer
Calibration11_Frequency	401668	Position 3 fixed-decimal
Calibration11_ProbeTemperature	401670	Position 3 fixed-decimal
Calibration11_LotNumber	401672	Integer
Calibration12_Value	401676	cP x g/cm^3 x 1000
Calibration12_ADValue1	401678	Integer
Calibration12_ADValue2	401680	Integer
Calibration12_ADValue3	401682	Integer
Calibration12_Frequency	401684	Position 3 fixed-decimal
Calibration12_ProbeTemperature	401686	Position 3 fixed-decimal
Calibration12_LotNumber	401688	Integer
Calibration13_Value	401692	cP x g/cm^3 x 1000
Calibration13_ADValue1	401694	Integer

Register	Index	Data Type
Calibration13_ADValue2	401696	Integer
Calibration13_ADValue3	401698	Integer
Calibration13_Frequency	401700	Position 3 fixed-decimal
Calibration13_ProbeTemperature	401702	Position 3 fixed-decimal
Calibration13_LotNumber	401704	Integer
Calibration14_Value	401708	cP x g/cm^3 x 1000
Calibration14_ADValue1	401710	Integer
Calibration14_ADValue2	401712	Integer
Calibration14_ADValue3	401714	Integer
Calibration14_Frequency	401716	Position 3 fixed-decimal
Calibration14_ProbeTemperature	401718	Position 3 fixed-decimal
Calibration14_LotNumber	401720	Integer
Calibration15_Value	401724	cP x g/cm^3 x 1000
Calibration15_ADValue1	401726	Integer
Calibration15_ADValue2	401728	Integer
Calibration15_ADValue3	401730	Integer
Calibration15_Frequency	401732	Position 3 fixed-decimal
Calibration15_ProbeTemperature	401734	Position 3 fixed-decimal
Calibration15_LotNumber	401736	Integer
Calibration16_Value	401740	cP x g/cm^3 x 1000
Calibration16_ADValue1	401742	Integer
Calibration16_ADValue2	401744	Integer
Calibration16_ADValue3	401746	Integer
Calibration16_Frequency	401748	Position 3 fixed-decimal
Calibration16_ProbeTemperature	401750	Position 3 fixed-decimal
Calibration16_LotNumber	401752	Integer
Calibration17_Value	401756	cP x g/cm^3 x 1000
Calibration17_ADValue1	401758	Integer
Calibration17_ADValue2	401760	Integer
Calibration17_ADValue3	401762	Integer
Calibration17_Frequency	401764	Position 3 fixed-decimal
Calibration17_ProbeTemperature	401766	Position 3 fixed-decimal

Register	Index	Data Type
Calibration17_LotNumber	401768	Integer
Calibration18_Value	401772	cP x g/cm^3 x 1000
Calibration18_ADValue1	401774	Integer
Calibration18_ADValue2	401776	Integer
Calibration18_ADValue3	401778	Integer
Calibration18_Frequency	401780	Position 3 fixed-decimal
Calibration18_ProbeTemperature	401782	Position 3 fixed-decimal
Calibration18_LotNumber	401784	Integer
Calibration19_Value	401788	cP x g/cm^3 x 1000
Calibration19_ADValue1	401790	Integer
Calibration19_ADValue2	401792	Integer
Calibration19_ADValue3	401794	Integer
Calibration19_Frequency	401796	Position 3 fixed-decimal
Calibration19_ProbeTemperature	401798	Position 3 fixed-decimal
Calibration19_LotNumber	401800	Integer
Calibration20_Value	401804	cP x g/cm^3 x 1000
Calibration20_ADValue1	401806	Integer
Calibration20_ADValue2	401808	Integer
Calibration20_ADValue3	401810	Integer
Calibration20_Frequency	401812	Position 3 fixed-decimal
Calibration20_ProbeTemperature	401814	Position 3 fixed-decimal
Calibration20_LotNumber	401816	Integer
Validation1_Viscosity	402140	cP x g/cm^3 x 1000
Validation1_MeasuredViscosity	402142	cP x g/cm^3 x 1000
Validation1_ProbeTemperature	402144	Position 3 fixed-decimal
Validation1_LotNumber	402146	Integer
Validation2_Viscosity	402156	cP x g/cm^3 x 1000
Validation2_MeasuredViscosity	402158	cP x g/cm^3 x 1000
Validation2_ProbeTemperature	402160	Position 3 fixed-decimal
Validation2_LotNumber	402162	Integer
Validation3_Viscosity	402172	cP x g/cm^3 x 1000
Validation3_MeasuredViscosity	402174	cP x g/cm^3 x 1000

Register	Index	Data Type
Validation3_ProbeTemperature	402176	Position 3 fixed-decimal
Validation3_LotNumber	402178	Integer
Validation4_Viscosity	402188	cP x g/cm^3 x 1000
Validation4_MeasuredViscosity	402190	cP x g/cm^3 x 1000
Validation4_ProbeTemperature	402192	Position 3 fixed-decimal
Validation4_LotNumber	402194	Integer
Validation5_Viscosity	402204	cP x g/cm^3 x 1000
Validation5_MeasuredViscosity	402206	cP x g/cm^3 x 1000
Validation5_ProbeTemperature	402208	Position 3 fixed-decimal
Validation5_LotNumber	402210	Integer
Validation6_Viscosity	402220	cP x g/cm^3 x 1000
Validation6_MeasuredViscosity	402222	cP x g/cm^3 x 1000
Validation6_ProbeTemperature	402224	Position 3 fixed-decimal
Validation6_LotNumber	402226	Integer
Validation7_Viscosity	402236	cP x g/cm^3 x 1000
Validation7_MeasuredViscosity	402238	cP x g/cm^3 x 1000
Validation7_ProbeTemperature	402240	Position 3 fixed-decimal
Validation7_LotNumber	402242	Integer
Validation8_Viscosity	402252	cP x g/cm^3 x 1000
Validation8_MeasuredViscosity	402254	cP x g/cm^3 x 1000
Validation8_ProbeTemperature	402256	Position 3 fixed-decimal
Validation8_LotNumber	402258	Integer
Validation9_Viscosity	402268	cP x g/cm^3 x 1000
Validation9_MeasuredViscosity	402270	cP x g/cm^3 x 1000
Validation9_ProbeTemperature	402272	Position 3 fixed-decimal
Validation9_LotNumber	402274	Integer
Validation10_Viscosity	402284	cP x g/cm^3 x 1000
Validation10_MeasuredViscosity	402286	cP x g/cm^3 x 1000
Validation10_ProbeTemperature	402288	Position 3 fixed-decimal
Validation10_LotNumber	402290	Integer
Validation11_Viscosity	402300	cP x g/cm^3 x 1000
Validation11_MeasuredViscosity	402302	cP x g/cm^3 x 1000

Register	Index	Data Type
Validation11_ProbeTemperature	402304	Position 3 fixed-decimal
Validation11_LotNumber	402306	Integer
Validation12_Viscosity	402316	cP x g/cm^3 x 1000
Validation12_MeasuredViscosity	402318	cP x g/cm^3 x 1000
Validation12_ProbeTemperature	402320	Position 3 fixed-decimal
Validation12_LotNumber	402322	Integer
Validation13_Viscosity	402332	cP x g/cm^3 x 1000
Validation13_MeasuredViscosity	402334	cP x g/cm^3 x 1000
Validation13_ProbeTemperature	402336	Position 3 fixed-decimal
Validation13_LotNumber	402338	Integer
Validation14_Viscosity	402348	cP x g/cm^3 x 1000
Validation14_MeasuredViscosity	402350	cP x g/cm^3 x 1000
Validation14_ProbeTemperature	402352	Position 3 fixed-decimal
Validation14_LotNumber	402354	Integer
Validation15_Viscosity	402364	cP x g/cm^3 x 1000
Validation15_MeasuredViscosity	402366	cP x g/cm^3 x 1000
Validation15_ProbeTemperature	402368	Position 3 fixed-decimal
Validation15_LotNumber	402370	Integer
Validation16_Viscosity	402380	cP x g/cm^3 x 1000
Validation16_MeasuredViscosity	402382	cP x g/cm^3 x 1000
Validation16_ProbeTemperature	402384	Position 3 fixed-decimal
Validation16_LotNumber	402386	Integer
Validation17_Viscosity	402396	cP x g/cm^3 x 1000
Validation17_MeasuredViscosity	402398	cP x g/cm^3 x 1000
Validation17_ProbeTemperature	402400	Position 3 fixed-decimal
Validation17_LotNumber	402402	Integer
Validation18_Viscosity	402412	cP x g/cm^3 x 1000
Validation18_MeasuredViscosity	402414	cP x g/cm^3 x 1000
Validation18_ProbeTemperature	402416	Position 3 fixed-decimal
Validation18_LotNumber	402418	Integer
Validation19_Viscosity	402428	cP x g/cm^3 x 1000
Validation19_MeasuredViscosity	402430	cP x g/cm^3 x 1000

Register	Index	Data Type
Validation19_ProbeTemperature	402432	Position 3 fixed-decimal
Validation19_LotNumber	402434	Integer
Validation20_Viscosity	402444	cP x g/cm^3 x 1000
Validation20_MeasuredViscosity	402446	cP x g/cm^3 x 1000
Validation20_ProbeTemperature	402448	Position 3 fixed-decimal
Validation20_LotNumber	402450	Integer
TemperatureCalibration1_Temperature	402780	Position 3 fixed-decimal
TemperatureCalibration1_Value	402782	Position 3 fixed-decimal
TemperatureCalibration1_LotNumber	402784	Integer
TemperatureCalibration2_Temperature	402796	Position 3 fixed-decimal
TemperatureCalibration2_Value	402798	Position 3 fixed-decimal
TemperatureCalibration2_LotNumber	402800	Integer
DomeTemperatureCalibration1_Temperature	402940	Position 3 fixed-decimal
DomeTemperatureCalibration1_Value	402942	Position 3 fixed-decimal
DomeTemperatureCalibration1_LotNumber	402944	Integer
DomeTemperatureCalibration2_Temperature	402956	Position 3 fixed-decimal
DomeTemperatureCalibration2_Value	402958	Position 3 fixed-decimal
DomeTemperatureCalibration2_LotNumber	402960	Integer
Status_ADValue1	300100	Boolean
Status_ADValue2	300102	Boolean
Status_ADValue3	300104	Boolean
Status_Frequency	300106	Boolean
Status_Viscosity	300108	Boolean
Status_ProbeTemperature	300110	Boolean
Status_TempADD	300112	Boolean
Status_DomeTempADD	300114	Boolean

Table 11.2: Modbus Register Map