

## SenGenuity ViSmart™ Viscosity Sensor Interface Options

### Summary

The digital solid-state ViSmart™ viscometers produced by SenGenuity offer several different options for connectivity. Regardless if the user is taking viscosity data for the first time or is looking to automate the measurement and integrate automatic process control there is a solution available that will accomplish the task. From initial testing and sensor evaluation to full OEM integration into customer products SenGenuity has a solution that will fit that need. This document details the different options available for sensor integration and how the user would accomplish the installation.

### Using the ViSmart™ Viscosity Sensor with SenGenuity Instrumentation

*For Use in the Laboratory:*

To give the customer an easy method of qualifying SenGenuity's ViSmart™ sensors (which provide viscosity and temperature readings) to their unique process there are two ways in which to start using the sensors immediately.

If the customer requires a test period for the sensor in order to qualify the sensor for their process or product and they intend to do so in a non-industrial setting then the simplest approach is to use a PC running Windows XP along with the ViSmart sensor USB adapter. The software that comes with the starter kit, PC ViscNet, allows the evaluator to immediately start using the sensor. The software (see Figure 1) is quite comprehensive and allows the user to log the data taken as well as perform real time averaging and standard deviation calculations. All of the viscosity and temperature data can be exported so that the user can further manipulate it using an external application such as Excel.

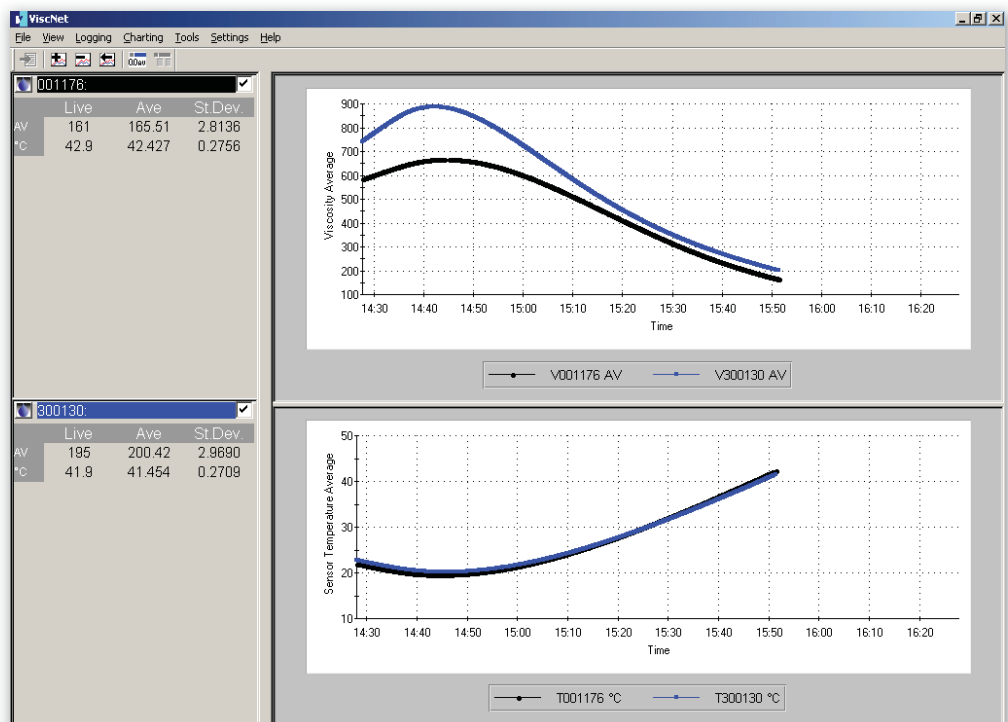


Figure 1: Screenshot of the ViscNet software

The software allows the customer to graph the real time viscosity and temperature as well as the running averages. The user can have up to four graphs on one screen that are dynamically adjusted depending on the user settings. Each graph can be changed to display any of the data that is being taken and can even graph one measurement vs. another so that a plot of viscosity vs. temperature is possible.

#### *For Use on the Process or Production Line:*

Many customers would like to evaluate the ViSmart™ viscosity sensors on the production floor but do not initially have the time or resources to perform a permanent installation. Other times the customer may wish to check the viscosity of fluids that are scattered around a facility or geographic region using the first sensor they purchase. For these applications SenGenuity offers the FluidTrackr™ ultra-mobile ruggedized sensor platform (see Figure 2). This provides the user with all of the features of the PC software but adds portability and the ability to withstand harsh environments. The system has a daylight visible display, 9 hour battery life, and Wi-Fi and Bluetooth connectivity.

The FluidTrackr™ can be used to measure fluid properties while moving from one location to another or it can be used at a single location as a process or equipment monitoring tool. With the addition of a USB hub the user can connect up to four sensors with USB adapters. This allows the customer to monitor up to four different viscosities and temperatures with one FluidTrackr™. Alternatively, if the customer needs sensors in line, but not continuously monitored, they can install sensors at different locations throughout their facility and use the FluidTrackr™ to plug into individual sensors and perform spot checks at specified intervals or when there is concern that the viscosity of the monitored fluid has changed.



*Figure 2: The FluidTrackr™ with a Low Shear Bolt Viscometer*

## **Integrating the ViSmart™ Using the VisConnect for Process Control**

SenGenuity offers an easy-to-use interface box called the VisConnect for the ViSmart™ line of digital viscometers. Each VisConnect attaches to a single sensor and outputs the viscosity and temperature data as analog signals that can be read by most PLCs and industrial process monitoring systems. The system can also connect to a computer using RS232 communication through the serial port. The VisConnect is optionally available with a CAN protocol serial output that allows for integration into existing CAN networks.

#### **Analog Output:**

The VisConnect comes equipped with two of either 0-4V or 4-20mA analog outputs that correspond to the viscosity and temperature measurements. These outputs are user configurable through the RS232 port. The measurements that correspond to the upper and lower analog signal limits can be changed to reflect the maximum and minimum of the process being measured. This allows the user to have the maximum measurement resolution for their particular process range.

Many manufacturing facilities have existing process monitoring equipment ranging from manufacturers such as Allen Bradley or Siemens. Regardless of the manufacturer if the PLC that is being used has the ability to accept a signal of either 4-20mA or 0-4V then the VisConnect will be able to interface with it. The user would initially connect the VisConnect to a PC via the serial port in order to set the output range. With that done the signal lines would then be connected to the PLC and the user would set up the process limit alarms in the existing PLC software. This would be the best possible way to integrate the SenGenuity ViSmart™ Viscometers into existing process control systems.

*RS232 Serial Output:*

The VisConnect comes standard with an RS232 serial communication port. Its primary purpose is to allow the user to set the measurement range limits for the analog outputs and to calibrate those outputs. It can also be used, however, as a means to integrate the sensor readings into the customer’s custom software. This eliminates the need to develop drivers for the operating system being used since it is relatively easy to integrate terminal emulation within the software itself. The command set for the VisConnect is succinct enough that minimal effort is required assimilate it into existing code.

*CAN Serial Output:*

CAN serial output is optionally available on the VisConnect. CAN protocol (CANOpen, DS301) is offered for customers who want to integrate viscosity monitoring into their existing can network. The CAN Bit Rate is up to 1 Mbits/sec. This is intended primarily for large mobile applications where CAN networks have been used for some time.

## Integrating the ViSmart™ to OEM platforms

Some customers would like to integrate the ViSmart sensors directly into their own equipment. This would be useful for companies that produce filtration units, gear boxes, bearings, or fluid diagnostic equipment. If there is already microcontroller inside the product and there is enough available digital IO then integrating the sensor requires little more effort than connecting the interface lines and updating the software to allow it to communicate.

The DB25 connector at the end of the cable has the following pin diagram:

Pin#	Name	Description
1	GND	Supply Voltage Return
2	GND	Supply Voltage Return
3	GND	Supply Voltage Return
4	GND	Supply Voltage Return
5	GND	Supply Voltage Return
6	GND	Supply Voltage Return
7	GND	Supply Voltage Return
8	GND	Supply Voltage Return
9	GND	Supply Voltage Return
10	GND	Supply Voltage Return
11	GND	Supply Voltage Return
12	GND	Supply Voltage Return
13	GND	Supply Voltage Return

Pin#	Name	Description
14	V+	5-10Vdc Supply input voltage
15	CS0	Chip select 0
16	IRQ	Interrupt request
17	CS2	Chip select 2
18	NC	No connection
19	RST	Reset
20	CS1	Chip select 1
21	PWREN	Power enable
22	SCK	Serial clock
23	MOSI	Master Out/Slave In
24	CSMEM	Memory chip select
25	MISO	Master In/Slave Out

The Serial Sensor Interface (SSI) of the sensor has a flash memory chip, an analog to digital converter, and a digital to analog converter. In order to communicate with the sensor using SPI protocol the user must select the chip that is to be communicated with using the correct combination of values for the chip select lines. It is also important to note that the SCK line is controlled by the host system external to the SSI. The following table shows the chip select values needed for these three chips.

SSI - High Shear Square and Low Shear Bolt V1						
Chip Selected	CS0	CS1	CS2	CSMEM	Part Number	Manufacturer
Analog to Digital converter	Low	High	N/A	High	LTC2418	Linear Technologies
Digital to Analog converter	High	Low	N/A	High	LTC2600	Linear Technologies
Flash Memory	High	High	N/A	Low	AT25P1024	Atmel

The links to the datasheets for the chip used are at the end of this document. The nuances of communicating with each chip can be found there. In addition, SenGenuity offers an OEM integration kit to customers that are interested in full internal sensor integration. This kit includes the C++ based code for communication with all hardware that SenGenuity offers. It also includes circuit and software documentation. Contact SenGenuity for more information on the OEM kit.

## Conclusion

There are three levels of interface options possible with the SenGenuity digital ViSmart™ viscosity sensors and each requires a different amount of integration on the part of the customer. SenGenuity's technical support is available to answer any questions on how best to integrate their sensors best for each application.

Part Number	Manufacturer	Datasheet Location
LTC2418	Linear Technologies	<a href="http://www.linear.com/pc/downloadDocument.do?navId=H0,C1,C1155,C1001,C1152,P2187,D2549">http://www.linear.com/pc/downloadDocument.do?navId=H0,C1,C1155,C1001,C1152,P2187,D2549</a>
LTC2600	Linear Technologies	<a href="http://www.linear.com/pc/downloadDocument.do?navId=H0,C1,C1155,C1005,C1156,P2290,D1753">http://www.linear.com/pc/downloadDocument.do?navId=H0,C1,C1155,C1005,C1156,P2290,D1753</a>
AT25P1024	Atmel	<a href="http://www.atmel.com/dyn/resources/prod_documents/doc1082.pdf">http://www.atmel.com/dyn/resources/prod_documents/doc1082.pdf</a>

## Contact Information

If you would like to learn more about our sensors, the markets we serve and customer applications we strive to address, please do not hesitate to contact our Application Engineering group at [support@sengenuity.com](mailto:support@sengenuity.com).

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