- Monitor concentration, density and viscosity of liquids
- Typical accuracy of $\pm 0.10\text{ wt.}\%$, some applications to $\pm 0.01\text{ wt.}\%$
- Stores recipes for up to 16 applications
- Automatic temperature compensation
- Low maintenance – no moving parts
- Can multiplex two sonic sensors from two different processes
- Handles two variable streams with external sensor input
- Provides two independent 4-20 mA outputs
- Easy setup via keypad or external PC
### SPECIFICATIONS

**POWER REQUIREMENTS:**
- 115 (±10%) volts ac
- 230 (±10%) volts ac

**TRANSMITTER POWER CONSUMPTION:**
- Standard: 35 watts
- With Heater: 200 watts @ 115 VAC
  - 250 watts @ 230 VAC

**OUTPUT SIGNALS:**
- **Concentration:** 4-20mA (isolated) into 600 ohms max
- **Temperature:** 4-20mA (isolated) into 600 ohms max
- **Fault Indication:** Form-C Relay
  - 1.5 A @ 115 VAC
  - 1.0 A @ 230 VAC
- **High/Low Setpoints:** Form-C Relay
  - 1.5 A @ 115 VAC
  - 1.0 A @ 230 VAC
- **Data Link:** RS-232, RS-485 optional

**SOUND VELOCITY RANGE:**
- 500 - 2500 meters/sec

**ACCURACY:**
- Depends on measured variable.
- Typically ±0.10 wt.%, some applications up to ±0.01 wt.%

**REPEATABILITY:**
- Measured Variable
  - Depends on characteristics of measured substance - typically ±0.01 wt.% to ± 0.10 wt.%

**ENCLOSURE DIMENSIONS:**
- **NEMA 4X:** 15.3"(h) x 13.3"(w) x 8.3"(d)
- **NEMA 7:** 21.9"(h) x 15.9"(w) x 10.8"(d)

**WEIGHT:**
- **NEMA 4X Enclosure:** 20 lbs. (9.1 kg)
- **NEMA 7 Enclosure:** 114 lbs. (51.7 kg)

**OPERATING TEMPERATURE RANGE:**
- **Standard Transmitter:** 0°C to +50°C (0°F to 122°F)
- **With Heater:** -60°C to +50°C (-76°F to 122°F)
- **Standard Transducer:** -40°C to +150°C
- **Optional:** -200°C to +350°C

**PRODUCT MATERIAL:**
- **Standard Transducer:** 316L Stainless Steel
- **Optional:** Carpenter-20, Hastelloy B, C, F, & G, Titanium, Kynar, Polypropylene, Zirconium.

**Display:**
- Liquid crystal (LCD)
- 2-line x 16 character

**COMPENSATION RANGE:**
- 0°C to 100°C standard
- Other 100°C spans optional (ext: 30°C to 150°C, 100°C to 200°C)

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**NuSonics Division**

**SYSTEMS INTEGRATORS**

23630 N 35th Drive, Suite 1  Glendale, Arizona 85310 USA
Introduction. The Mesa Laboratories, Inc., NuSonics Model 86 SCM determines liquid concentration by measuring sound velocity. The sound velocity of any liquid is unique! The relationship between sound velocity, liquid concentration and temperature is different for every liquid. Once the relationship is known, sound velocity can be used to monitor changes in liquid concentration, often with much greater resolution than can be realized with other measuring instruments. It is this precision that makes the Model 86 SCM such a desirable process monitor because it can detect small changes in concentration that could otherwise be missed. Typically, the resolution ranges from 0.005 to 0.05 weight percent of the actual concentration.

Applications. The Model 86 SCM has been utilized in the production of acids, bases, salt solutions, emulsions, alcohols, food products and polymers, just to name a few. Currently there are more than 500 applications where the Mesa Laboratories, Inc., NuSonics concentration monitor can serve your needs. More information is available on tested products.

Binary Liquids are Best. The Model 86 SCM works best in binary liquids or in liquids for which only one ingredient of the concentration is changing. If there are two ingredients varying at the same time and both affect the sound velocity, an error may result. Sometimes another sensor can be used to monitor the unwanted variable and output of this sensor fed to the Model 86 SCM to compensate for the second ingredient. The NuSonics applications staff can offer assistance in this area.

Sonic Sensor. The patented HSX/T (high sensitive sonic transducer), Figure 1, is a major advance in sensor technology. There are no O-rings or gasket seals to leak because the sensor is welded.

The HSX/T sensor is available with optional materials that will permit continuous operation up to 350°C (662°F). A wide range of materials are available for the sensor including 316 stainless steel, Hastelloy B, C, F & G, Alloy 20, Zirconium, Titanium (various grades), aluminum, Kynar, polypropylene and others to meet your process requirements.

Sensor Mounting. The HSX/T sensor assembly is a wetted part that can be mounted into the process stream in a variety of configurations. In many applications the HSX/T sensor is mounted to a standard 2” flange and placed directly into the process line or storage tank. Other applications employ a small side stream from the process column or reactor and run this stream through a Sample Chamber, Figure 2. For very small lines, the flow-through cell, Figure 3, is an excellent choice, able to accommodate lines down to 1/2” in diameter while retaining an internal volume of 145ml. A wide variety of other configurations are available.

Multiplexing of Two HSX/T Sensors. The Model 86 SCM is capable of monitoring up to two sensor assemblies in the multiplexing mode. The Model 86 SCM uses two of its recipes to store both the transducer constants and the process calibration data. The two processes can be identical or completely different. The Model 86 SCM has two modes of operating with multiplexed sensors: manual and automatic.
**Manual configuration.** The HSX/T probe selection is made manually through the Model 86 SCM keypad. Calibration constants for each probe switchover with the keypad entry. The polynomial equation constants, zero and span setting can be different for each of the two sensor assemblies. A different recipe from the Model 86 SCM menu is assigned to each of the two separate sensor assemblies. In this configuration, the Model 86 SCM can only utilize two recipes maximum.

The two analog 4-20 mA outputs of this option track/change with the sensor selection. Output #1 is assigned to concentration and Output #2 is assigned to temperature.

![Figure 4 - MULTIPLE HSX/T CONFIGURATION](image)

**Automatic configuration.** This option allows both manual and automatic switching of the sensor assemblies. As described above, calibration constants for each probe switchover with the keypad entry. The polynomial equation constants, zero and span setting can be different for each of the two sensor assemblies. A different recipe from the Model 86 SCM menu is assigned to each of the two separate sensor assemblies. In this configuration, the Model 86 SCM can only utilize two recipes maximum.

The automatic option allows the sensor assemblies to be toggled back and forth automatically at a user selectable interval. This interval is configurable for rates from once every 15 seconds to once every 5 minutes. With the automatic option, the analog 4-20 mA outputs are dedicated to each sensor assembly. Each of the two 4-20 mA analog outputs are dedicated to concentration measurement, one for each sensor. The analog output for the unused sonic sensor remains frozen at the last measured value.

**Payback.** Perhaps the most common use for the Model 86 SCM is to circumvent the need for labor intensive and time consuming laboratory analysis by using the instrument directly in the process line where it will give continuous, real-time readings of concentration. The result is a substantial payback to the user in the form of better control of the process, enhanced efficiency, greater product quality and yield.

In one process a customer is saving more than one million dollars each year because a NuSonics Sonic Concentration Monitor provides a means for continuous, real-time monitoring of process concentration. It’s an exceptional return on investment where the cost of the concentration monitor is paid back every two days!

**RS-232.** RS-232 Communication is a standard feature (RS-485 optional). All displayed variables (sound velocity, temperature, concentration, etc.) can be read by computer, using very simple syntax. Calibration constants can be read and overwritten as well. A "host lockout" feature prevents tampering with certain critical calibration constants via computer. Similar code access protects these constants from unauthorized access via keypad. (NuSonics offers data logger software which operates as a stand-alone program on PC-compatibles. This program logs and stores data in ASCII files for coefficient-regression purposes.)

**Multiplier Liquids.** The multiple RECIPE feature in the Model 86 SCM software is of enormous value when more than one liquid is to be monitored. There are 16 recipes available for as many liquids. The operator simply calls up the PARAMETERS menu and enters the appropriate recipe number. Each recipe is stored in non-volatile memory along with the output span. The desired span is entered via the SETUP menu and this span is stored with each recipe. The recipe feature is especially useful in quality control laboratories when many different liquids must be assayed. The user simply enters the desired recipe number and the transducer in the liquid to be assayed. The concentration is displayed in a matter of seconds.

**Alarms.** High/Low and Fault Alarms are standard features of every Model 86 SCM. Each alarm energizes a Form-C relay when activated. The fault alarm activates if excessive bubbles or suspended solids should occur in the process liquid, or if there is a component failure. High/Low alarms are activated when the calculated concentration falls outside the setpoint range defined by the user and stored in RAM. Alarms are not available in the multiplex configuration.

The Model 86 SCM will be used: 1). When no other instrument has succeeded in measuring the process concentration; 2). When the desired measurement accuracy cannot be achieved with another instrument; and 3). When real-time process monitoring is needed to replace a slow and expensive laboratory procedure. In many cases, the Model 86 SCM sonic concentration monitor can justify its cost very quickly in savings in manual sample gathering and analysis costs.
Sonic Concentration Monitor
Probe Assembly Dimensions

Figure 1 – FLANGE MOUNT HSX/T

Figure 2 – FLOW-THROUGH CELL

Figure 3 – 1 INCH SAMPLE CHAMBER
NOTES:
1. All dimensions are in inches.
2. Connection heads shown are used with 1/2" SV (sound velocity) transducers.
   * Nominal value, for 1" SV transducers.
   ** Nominal value, for 1/2" SV transducers.
   *** Dimension for RTD with thermowell.

Manufactured under one or more of the following patents:
3,890,423; 3,892,127; 3,973,430; 4,417,490;
4,515,160; 4,573,346; 4,596,136; 4,649,754;
4,656,889; 4,763,513.

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