

Technical Specifications

Applied Microsystems

Micro *SV*

Instrument Overview

The Micro SV is part of the Micro family of instrumentation developed by Applied Microsystems. The Micro family consists of a series of miniature, intelligent, and interchangeable sensors that can be deployed in instrument housings that vary in diameter from 33 mm (1.3") to 102 mm (4.0"). All sensors and housings have common communication formats and data logger building blocks.

All sensors share standard pressure housing designs and connectors. Each Micro sensor incorporates discrete circuitry, firmware and calibration coefficients to allow independent operation. This provides for direct replacement or inter-changeability of one sensor with any other, simply by unplugging one sensor and plugging in the new sensor, without matching or changing calibration coefficients, sensor types or sensor ranges.

Key Features

The following is a list of key features of the Micro SV. For additional detail on these features, please consult the detailed sections of this document.

Use of Composite Materials

The Micro SV sensor head is made from hi-tech materials. There are three key advantages to the use of these new materials: 1) greatly reduced corrosion and resulting better stability of the sensor's path length; 2) The materials are bonded together in one single piece, with no need for screws and bolts, which are prone to vibration and corrosion; and 3) The materials are designed to have zero thermal expansion, and hence zero response time to temperature change. The resulting benefits include:

- ❑ An extended cycle between required calibrations, resulting in greater instrument uptime and reduced calibration costs; and
- ❑ Greater profiling accuracy – particularly in high speed profiling environments – due to the instrument's zero response time to temperature change.

Shorter Path Length

The Micro SV has a path length of 3.3 cm (1.3"), as compared to the industry standard of 10 cm (3.9"). A shorter path length means that the sheer force on the sensor arm is significantly reduced. The resulting benefit:

- ❑ Reduced sheer force reduces the likelihood of damage – either to the instrument or to the calibration - when the sensor is shocked or knocked on the sensor head.

Smaller Overall Size

The Micro SV is truly smaller than ever. The instrument's diameter is 33 mm (1.3") with a nominal overall length of 214- mm (8.4"). In contrast, Applied Microsystems' Smart SV is 46mm (1.8") by 315mm (12.4") and our SV Plus is 102 mm (4.0") by 675mm (26.6"). The resulting benefit:



- ❑ Reduced instrument size makes it ever easier to integrate this instrument into vehicles or platforms where instrument size plays a critical role. Similarly, reduced size enables vehicles to maximize their sensor payload and reduces drag.

Extended Sound Velocity Range

The Micro SV comes standard with the ability to measure sound velocity over the range of 1400 m/s to 1600 m/s.

Sampling Frequency

The Micro SV is able to sample as many as 25 times per second, which is a critical advantage in any high speed profiling application, either vertical or horizontal. The ability to sample so frequently – and with zero response time to temperature change – ensures maximum accuracy.

700 Calibration Points

Like all AML sound velocity instruments, the Micro SV receives over 700 individual calibration points. Calibrations are not extrapolated to cover the entire operating range of the instrument. This distinction is important. Instruments with extrapolated calibrations may find themselves significantly out of spec at individual sound velocity speeds, even while the instrument – as a whole – meets averaged accuracy requirements.

Mechanical Specifications

The standard Micro-SV housing and end cap is made of Acetyl homopolymer plastic (Delrin) and is rated to 500 meter depths. In its standard configuration, the instrument diameter is 33 mm (1.3") with a nominal overall length of 214-mm (8.4").

Larger housing diameters are also available for the Micro SV equipped with additional sensors such as temperature or pressure; see Instrument Options. Similarly, other pressure housing materials are available; see Instrument Options.

Connectors

The Micro SV comes standard with the Micro Series wet-pluggable underwater connector (6-pin or 8-pin, dependant on housing). Other connectors are available; see instrument Options.

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Sensor Specifications

The Micro SV includes Applied Microsystems' time-of-flight sound velocity sensor. Other sensors can be added. Most frequently, users complement their sound velocity sensor with pressure or temperature sensors. See Instrument Options for more detail.

Type:	Time of Flight Range: 1400 to 1600 m/s
Precision:	±0.05 m/s
Displayed Resolution:	0.01 m/s
Timing Resolution:	0.005 m/s

Electronics

The Micro family electronics are designed like building blocks. Sensor boards are dedicated to single or dual sensors. A low power micro controller and analog circuitry control each sensor. Analog to digital converters provide 65000 counts of resolution. The sensor boards are designed to operate either as stand alone units or to operate in conjunction with a data logger board and other sensors. The sensor boards can be connected to any of the communication boards to provide the desired output protocol. The Micro SV uses multi-layer surface mount boards. The standard MICRO-SV is composed of 2 boards:

- MICRO-SV, sound velocity board
- MICRO-232, RS-232 communications board

Instrument Output

The Micro SV comes standard with RS-232 communications. In RS-232 mode the sensor communicates directly with a computer or data logger equipped with a serial port. The RS-232 configuration comes with automatic baud rate detection (autobauding) from 2400 to 38400 baud. In RS-232 mode, each instrument requires it's own dedicated serial port on the host computer or data logger. Conversely, the optional RS-485 model allows multiple instruments to communicate through a single serial port. For more information on RS-485, see Instrument Options.

The user is able to configure the instrument to output data in real engineering units or in raw data format. Moreover, the instrument can output a single scan of data when polled or a continuous stream of data at the maximum scan rate of 25 scans per second.

Power Requirements

The unit requires 40mA at 8 to 16 volts DC, (12 volts nominal). Power is supplied externally via the data/power connector. The unit is powered up when the data/power cable is plugged into the connector.

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Instrument Software

The Micro-SV is shipped with two software programs, SmartTalk and "Integrated System Software" (ISS). SmartTalk is an easy to use program designed to allow the user to configure an instrument, view real-time or logged data in a tabular format and export data. It utilizes the computer's serial port to communicate with the instrument.

"Integrated System Software" (ISS) is a comprehensive Microsoft Windows (95/98/XP based program, which allows the user to communicate to the MICRO-SV through the computer's serial port. ISS also provides the user with real-time data display capabilities. All software functions, from setting the sampling parameters, downloading the logged files, graphing, filtering and exporting are handled in a user friendly, easy understand menu driven fashion.

The minimum system requirements are:

- 1) Pentium based computer
- 2) 32 Mbytes RAM
- 3) Windows 95 (or above)
- 3) One free serial port for communications with the instrument

Instrument Options

The following options can also be selected, to configure and manufacture an instrument that is ideal for the user's specific application.

Alternative Housing Diameter

To accommodate different physical requirements such as number of sensors required, intended operating conditions (depth, temp, liquid composition, vibration, etc.), other operational parameters (weight, size, etc.), and individual sensor physical constraints (size, power, interference, etc.), the Micro instrument packaging is offered in two additional package sizes:

The Micro 3 – able to manage as many as 5 sensors including the SV sensor – has an instrument diameter of 50 mm (1.98") and a length of 242 mm (9.54") (not including sensors or battery pack). The instrument can fit 3 sensors on the end cap and up to 2 additional sensors via additional connectors. The Micro 3 is often used for Micro SV & T, Micro SV & P, or Micro SV, T & P.

The Micro 7 is often used for multi-parameter oceanographic studies and can handle up to 13 sensors including the SV sensor. The instrument can fit 5 sensors on the end cap and up to 8 additional sensors via additional connectors. It has a diameter of 102 mm (4.0") and a length of 323 mm (12.7") (not including sensors or battery option). For additional information, please contact the factory.

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Alternative Housing Materials

Each package size comes in a variety of materials to meet specific depth and environmental requirements.

The Micro 1 and Micro 3 packaging options are available in:

- Delrin or Acetron® GP (Acetyl homopolymer plastic) – for depths up to 500m
- Stainless Steel 316 – for depths up to 4500m
- Titanium – for depths up to 10000m

The Micro 7 packaging option is available in:

- Aluminum 6061-T6, hard-anodized – for depths up to 5000m
- Aluminum 7075-T6, hard-anodized – for depths up to 8000m

Digital Output: RS 485 or TTL

The Micro SV can also be delivered with RS-485 communications or TTL communications. The following paragraphs provide more information on either option:

1) RS-485 mode:

RS-485 ½ duplex mode is ideally suited for multi-sensor systems where up to 128 sensors or instruments can be daisy-chained together on one RS-485 serial port. Each sensor has an internal identification number that the host computer or data logger presents to the sensor(s). The sensor with the matching identification number replies with its data string. The RS-485 configuration uses a factory pre-set baud rate between 2400 and 38400 baud.

2) TTL logic mode:

TTL logic mode is ideally suited for situations where fixed wiring to an external microprocessor is more desirable. The TTL configuration comes with automatic baud rate detection (autobauding) from 2400 to 38400 baud.

Analog Output

For single analog sensor configurations, 4-20 mA output is available. There is no bi-directional communication offered.

Alternative Connectors

The Micro SV non-logging version can also be provided with Micro Series 8 or IE55 6-pin wet-pluggable underwater connectors instead of Micro Series 6-pin connector.

Sensor Protection Cage

A sensor protection cage is available for each of the Micro SV packaging sizes. This cage is designed to

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protect all sensor heads mounted on the sensor end cap from being damaged by external objects.

Instrument Protection Cage

An instrument protection cage can be customized to meet specific configuration and application requirements.

Suspension Bar

A suspension bar is available for the Micro SV series. The suspension bar serves as a deployment frame to which the instrument is fixed. The frame is connected to a cable, and in turn is weighted, thus ensuring that instrument scoping is minimized.

Mounting Bracket

Mounting brackets for the instrument are available for each of the Micro SV packaging sizes. Mounting brackets are designed to fix the sensor to any tertiary object, i.e. AUV / ROV / tow body or to allow mounting of multiple instruments together. The mounting brackets are made of Delrin to ensure that they are electrically isolated.

Battery Pack

The Micro SV in the Micro 3 and Micro 7 mechanical housings have logging and therefore battery options. Note that the Micro SV in the Micro 1 housing does not have logging or battery options.

The Micro SV in the Micro 3 housing can be configured with an external battery pack. In fact, if required, multiple battery packs can be daisy chained together to enable longer deployments. The battery pack is entirely plug-and-play and requires no instrument adaptations. Battery specifications are as follows:

- Battery pack size is 50mm by 272mm
- Recommended battery type is Lithium LSH-14, 3 x 3.6V C Cell

With sound velocity, temperature, and depth sensors sampling once every 10 minutes, a single battery pack (as described above) running in data logging mode will last approximately 6000 hours or 250 days.

The Micro SV in the Micro 7 configuration has an internal battery option. The housing length for the internal battery option is longer measuring 498 mm (19.6") (not including sensors or protection cage) to accommodate 9 D-cell batteries. The batteries can be alkaline or NiCad rechargeable. For the rechargeable battery option, a NiCad rechargeable is available. There is a bulkhead between the battery compartment and the electronics to protect the electronics.

Data Logging Capabilities

The Micro SV can be configured with memory for data logging, although in order to do so the larger diameter instrument, Micro 3 or Micro 7, is required. The instrument's memory specifications are as follows:

- Non-volatile flash multimedia card
- 16Mb, 32Mb and 64Mb cards available

Optional Sensors

The Micro SV in the larger housings, either Micro 3 or Micro 7, can be configured to accommodate additional sensors:

- Micro 3 – up to 3 sensors on sensor end cap (including SV) and up to 2 additional sensors through additional connectors
- Micro 7 – up to 5 sensors on sensor end cap (including SV) and up to 8 additional sensors through additional connectors

Most frequently, customers choose to complement Sound Velocity with Pressure or Temperature sensors. Specifications on these sensors are as follows:

Temperature:

Manufacturer: Applied Microsystems
Type: Pressure protected precision thermistor
Time constant: 85 ms (16 ms for thermistor bead)
Range: -2 °C to 32 °C. (other ranges by request)
Accuracy: ±0.005 °C
Resolution: 0.001 °C
Precision: ±0.002 °C
Power: 12 mA at 8 to 16 volts DC (12V nominal)

Pressure:

Manufacturer: Keller (other supplier by request)
Type: Semiconductor bridge strain gauge
Time constant: <10 ms
Range: various 0-6000 dbars
Accuracy: ±0.05% full-scale range (RMS)
Precision: ±0.05% full-scale range
Resolution: 0.002% full-scale range
Power: 12 mA at 8 to 16 volts DC (12V nominal)

Right Angle Mounting

In some applications, space is a significant issue. To flexibly resolve this issue, the Micro SV also comes with a right angle mounting.

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