

Introducing **S4ADWi** ^{w/} *internal Processing*



Currents
Directional Waves
MultiParameter Data
& Much More...

ALL-IN-ONE INSTRUMENT!

Featuring:

Hydrographic & Oceanographic Data
Real Time Processed Data Output
WorldWide - R/T - Remote Data Access
Data-on-Demand! (Query Mode)
High Performance, High Resolution
User Selected Sensors/Parameters
Proven Robust Design

S4ADWi is the latest evolution of the highly successful **S4A** series of versatile solid-state self-contained microprocessor driven instruments that acquire and record data for coastal, oceanographic and hydrographic applications with high accuracy and reliability. This instrument is the tool of choice for coastal scientists and engineers requiring precise high-resolution measurements, as well as commercial and military users requiring long-term robust solutions.

The **S4A Base Unit** measures the true magnitude and direction of current motion in any water environment including low current regimes. The instrument accomplishes this by electromagnetic technique, using two pairs of electrodes on the surface of the housing. The compass and all electronics, including memory and power supply, are sealed within the compact spherical housing. User programmability, 32MB-256MB memory and optional sensors of conductivity, temperature, depth, tilt, and processed directional wave data permit highly flexible and expansive data collection. Up to eleven (11) additional parameters can be added based on user's requirements.

The EEPROM programmed microprocessor affords ultimate flexibility and simplicity of use. Multi-tasking dual-mode operation allows the user full control of multiple concurrent sampling schemes with programming for any combination of burst sampling, vector averaging, and sampling interval for each mode. Data may be transmitted in real time via cable, modem, or acoustic link, and may be stored in the self-contained non-volatile memory for later retrieval and downloading to a PC computer, terminal, or other storage device using an RS485 connection.

The grooved spherical surface of the S4A produces stable hydrodynamic characteristics, ensuring exceptional linearity and stability. The sealed, easy to use spherical housing of the S4A, and its rugged design enables easy handling with minimal maintenance requirements while the glass-filled cycloaliphatic epoxy based housing and titanium mooring components provide long operational life and ultimate long-term durability, even under extreme conditions.

The **S4ADW** Directional Wave Instrument is a configuration of the S4A that provides data for determining all characteristics of directional wave spectra, as well as current speed/direction and tide measurements (see table for additional options). The S4ADW measures directional waves by recording the time series of high-resolution particle kinematics (V_n/V_e velocity) and pressure (depth) data. Typically, this raw data is downloaded from the S4ADW instrument using the S4 Application Software, and is converted to the frequency domain with Wave for Windows directional wave processing software. Using Fast Fourier Transform (FFT) techniques, this software provides a detailed wave analysis that includes directional wave spectra and associated energy density at the observed frequency bands.

With the introduction of *internal processing*, the **S4ADWi** now becomes the instrument of choice for providing processed directional wave and hydrographic data for **real-time** systems. By utilizing its internal processor for the analysis of particle kinematics and FFT processing, the S4ADWi enables simple integration with real-time remote telemetry systems, without the need for specialized software for control, post-processing or analysis.



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S4ADWi

S4 OCEANOGRAPHIC INSTRUMENT W/ INTERNAL PROCESSING

The **S4ADWi** provides users with a number of Cost Saving, Ease-of-Integration, and Quality Assurance advantages. The user gets useful calibrated results in engineering units *directly from the instrument*, reducing the possibility of data loss or corruption associated with large file transfer over cable or wireless links. This also allows the **S4ADWi** to reduce transmission times as well as associated air-time cost, and simplifies systems integration. The robust and user-friendly **S4ADWi** smart sensor allows ultimate flexibility and unique advantages as a stand-alone instrument or real-time plug-and-play sensor for integrated systems.

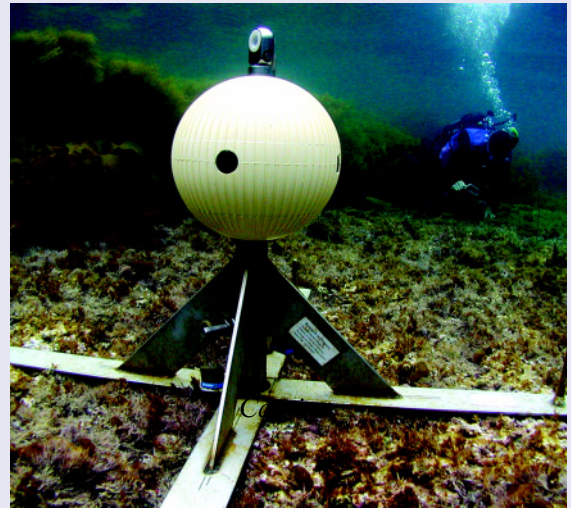
S4ADWi Standard Features:

- **16 Channel Capability – More Sensor Options for Monitoring Additional Parameters!**
- **Outputs ASCII Engineering Units – No Conversion Required!**
- **Simple Integration – No Interface, No Software!**
- **RS-485 Output – Increased Network Versatility and Ability to Operate Over Long Cables!**
- **Waves Internally Processed – Reduces Data Throughput for Reduced Airtime and Costs!**
- **Self-Recording and/or Real Time!**
- **Fully Automatic Depth Attenuation Correction and High-Frequency Cut-off Ensures Quality of Wave Analysis!**
- **Link Multiple Remote S4ADWi's to a Single Base Station Using InterOcean's Remote Telemetry Unit (RTU).**
- **Raw "Burst" Data (2 Hz Vn/Ve/Pressure) is Available –The System Acts as a Standard S4ADW with Internal Processing "Disabled".**

Summary of S4ADWi Operation:

S4ADWi operators program the instrument based on the following parameters - A) desired FFT sample size for processing (512, 1024, 2048, 4096, or 8192), B) sampling interval for wave (every 10 min, 15 min, 20 min, 30 min, 1 hr, 2 hr, ...24 hr), C) ON time for acquiring current data (1 min average, 2 min average, 3 min average, 4 min average, 5 min average), and D) sample interval for acquiring current data (every 5 min, 10 min, 15 min, 20 min, 30 min, 1 hr, 2 hr, ...24 hr). A programming matrix is available which shows all programming possibilities.

Users already familiar with the operation of the standard S4A or S4ADW may note that the internal processing mode of the S4ADWi described above may be "enabled" or "disabled" as desired by the user. When internal processing of wave data is disabled, the operation of the S4ADWi instrument, with the exception of RS-485 communication, becomes compatible with earlier S4A models allowing raw "burst" data (2 Hz Vn/Ve/Pressure) to be recorded and downloaded for post processing with Wave for Windows software.



Seabed Deployment, Catalina Island, California.
Photo courtesy of Loretta Roberson, Cal State Northridge.

Real-Time Data available directly from S4ADWi:

1) Processed Wave Statistics -

Wave Direction	Period of Maximum Wave Height
Spectral Bandwidth	Period of Peak Wave Energy
Average Wave Height	Period of Significant Wave
Maximum Wave Height	Crest Crossing Period
Significant Wave Height	Zero Crossing Period
Highest 1/10 Wave Height	Standard Deviation

2) Directional Wave Spectra (15 band) -

Spectral energy density report in 15 bands of periods (sec) of: 30+, 28-30, 26-28, 24-26, 22-24, 20-22, 18-20, 16-18, 14-16, 12-14, 10-12, 8-10, 6-8, 4-6, 2-4. This report includes energy and direction at each period band for every wave sample.

3) Directional Wave Spectra (256 band) -

Spectral energy density report in 256 frequency bands. This report includes 256 smoothed spectral energy components (energy and direction) at each frequency band for every wave sample. The bandwidth for each frequency is 0.0039 Hz. This report is recorded in internal memory and is available for downloading from the S4ADWi, but is not output in real-time.

4) Water Quality Data -

Current Speed and Direction (Vn, Ve), Heading (Hx, Hy), Tide (Water Depth), CPU & Main Batteries, and 11 optional parameters including: Tilt, Water Temperature, Conductivity, Turbidity, Photosynthetically Active Radiation (PAR), Fluorescence, Chlorophyll concentration, Dissolved Oxygen, pH, and other physical, biogeochemical, or meteorological parameters!

S4ADWi available as an Upgrade for Existing S4's
Also available in a Vertical Profiling System(VPS) configuration

APPLICATIONS

- Hydrographic/Oceanographic Monitoring**
- Water Quality Monitoring**
- Harbor Monitoring**
- Coastal Process Studies**
- Long-Term Ocean Observation**
- Integrated METOC Systems**
- Vessel Berthing/Approach Systems**
- SBMs & Offshore Platforms**
- Dredging & Sediment Transport**
- Military-Specific Applications**



PARAMETERS INCLUDED

- Current Speed & Direction**
- Tide (Depth)**
- Directional Wave Statistics**

ADDITIONAL PARAMETERS

- Conductivity, Temperature**
- Salinity, Density, Sound Velocity**
- Tilt, Turbidity, Optical Backscatter**
- pH, Redox, Dissolved Oxygen**
- PAR, UV-B, Ocean Color**
- Chlorophyll, Fluorescence, & More...**

**Many More Bio/Physical/Chemical Sensors
& Meteorological Sensors Available**

Please discuss your requirements w/IOS Sales Engineer



REMOTE TELEMETRY UNIT (RTU)

The S4ADWi Remote Telemetry Unit (RTU) provides a simple wireless communication method for real-time data applications using cellular telephone, satellite, or radio telemetry. The RTU consists of two primary components – an InterOcean Serial Interface Unit (SIU) and a communication terminal – all in one small enclosure.

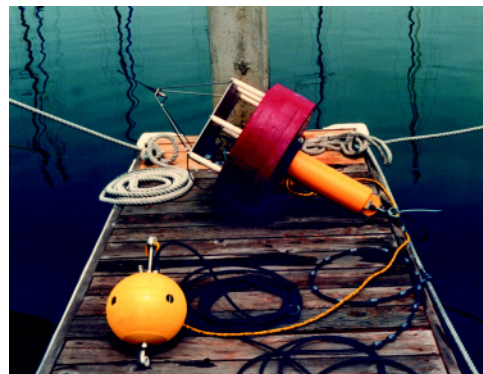
Each RTU is configured for the preferred mode of remote communication, including:

- **UHF narrow-band radio (450-470MHz)**
- **Spread-spectrum radio (900 MHz, 2.4GHz & 5.8GHz)**
- **GSM cellular network (900, 1800, 1900MHz)**
- **Iridium satellite**
- **GlobalStar satellite**
- **CDMA cellular**
- **& Other modes (please discuss w/ IOS sales engineer)**

S4ADWi Remote Telemetry Unit (RTU) offers many advantages for wireless communication systems, including:

- **Full Two-Way Communication**
- **Data Buffering**
- **Unique ID for MultiSensor Network**
- **Regulated & Isolated Power Supply**

Please refer to RTU spec. sheet for complete product details



ADDITIONAL PRODUCT OPTIONS

• **MOORINGS:** Bottom-Mounted Frames (various types), Pier/Piling Mounting Hardware, Remote Acoustic Recall Systems, Winch Deployment & Recovery Systems.

• **TELEMETRY BUOY:** 1 or 3 Meter Discus. Designed for Long-Term Performance & Survival in Coastal or Open Ocean.

• **SOFTWARE:** Integrated Real Time Display, Control, & Archiving of Data. Output to Additional Display Unit or Any other User Device. Remote Access available for Online Factory Support and Assistance.

• **EXTENSION CABLE/CONNECTORS:** MultiConductor w/Double Armored Steel Jacket, or Kevlar-Reinforced Polyurethane Jacket. Any Length!

• **SUPPORT:** Spares, Field Service, Extended Warranty, Engineering Assistance, Systems Integration, & Factory Support.

SPECIFICATIONS

S4ADWi

CURRENT SPEED

Type: Electro Magnetic, 2 Axis
Range: 0-350 cm/sec (standard)
0-50, 0-100, 0-600, 0-750 cm/sec (optional)
Resolution: 0.2 cm/sec 0-350 range
0.03 cm/sec (0-50 range)
0.06 cm/sec (0-100 range)
0.35 cm/sec (0-600 or 0-750 range)
Accuracy: 2% of reading +/- 1 cm/sec (0.03 ft/sec)
Noise: Less than the resolution for averages of 1 min. or longer
0.05 cm/sec rms for 10 second averages
0.25 cm/sec rms for 2 second averages
0.75 cm/sec rms for burst sampling (0.5 second rate)
Vert. Response: True cosine response (Internally corrected w/ Tilt Option)

DIRECTION

Type: Flux-Gate Compass
Range: 0 - 360°
Resolution: 0.5°
Accuracy: +/- 2° within tilt angles of 5°
+/- 4° for tilt angles between 15° and 25°

WAVE STATISTICS

See page 2 of this brochure for summary of Wave Data

DEPTH (TIDE)

Range: 0-70 m (other ranges available)
Resolution: 4 mm
Accuracy: 0.10% FS or better

TILT OPTION

Angle Range: +/- 45°
Resolution: 0.06°
Accuracy: (Angle output) +/- 0.25°
(Speed correction) +/- 1% of reading at 45° tilt

CPU

Type: High Performance 32 Bit CMOS microprocessor
Compatibility: New CPU board available as retrofit of existing S4's to S4ADWi configuration.
(Please note that upgrade also requires conversion to RS485, and optional new application software)

MEMORY

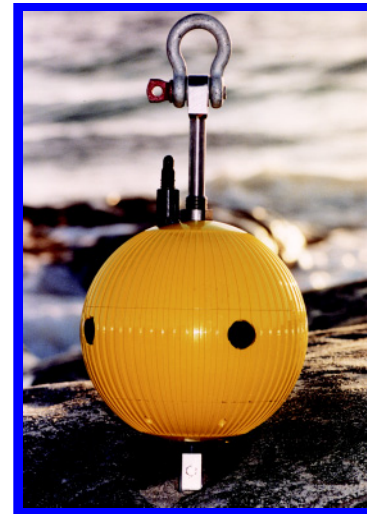
Type: PC MCIA Series II
Flash EEPROM Memory Card
Capacity: 32 Megabyte Standard, 256 Megabyte (optional)

TIMEKEEPING

Type: Temperature stable quartz oscillator
Accuracy: +/- 12 minutes/year
Power: Temperature stable non-restricted Lithium battery (3 yrs.)

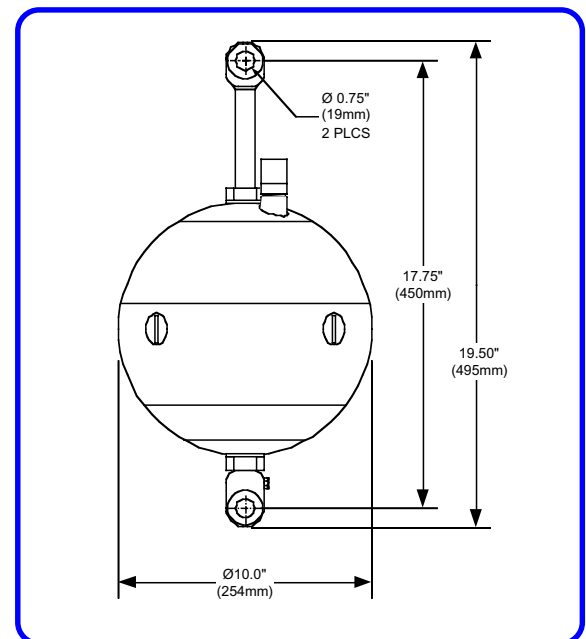
POWER SUPPLY

Type: Internal batteries: 6 Alkaline "D" cells, Lithium (optional)
Endurance: Alkaline cells: 440 hours combined sampling time.
Lithium cells: 1,600 hours combined sampling time.



MECHANICAL

Size: Sphere, 25 cm (10 in.) diameter
Weight: In-Air, 11 kg (24 lbs.)
In-Water, 1.5 kg (4 lbs.)
Mooring: In-Line, Bracket, Buoy, or Bottom Mount
Through Load: 4,500 kg (10,000 lbs.) working
Pad Eyes: Insulating liner
--accepts 1.6 cm (5/8 in.) shackle pin
Material: Sphere: Glass-filled cycloaliphatic epoxy.
Mooring rod: Titanium 6 AL-4V
Drag: 4 kg (9 lbs) at 250 cm/sec (8 ft/sec)
Depth: 1,000 Meters (3,200 ft.) Maximum.
Temperature: Storage, -40 to +50°C
Operating, -5 to +45°C



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