

SAM40 Sensor Acquisition Modules



Key Features

8, 16 or 24 input channels

24-bit resolution

High precision and accuracy

40 kHz bandwidth (100 kS/s)

**Plug-and-play with a supported
4 or 8 channel 12-bit resolution
high definition oscilloscope (HDO)**

Complete physical units conversion

- More than 65 SI and English system units supported
- Simple rescale directly in the channel setup dialog

**IEPE/ICP sensor support with
internal 4mA bias**

**BNC input compatible with wide
variety of off-the-shelf sensors**

Built-in bandwidth limiting

Adjustable gain in 1, 2, 5 steps

- 1mV/div to 10 V/div

The SAM40 provides up to 24 input channels for low frequency (sensor signal) acquisition and analysis. It connects to a 4 or 8 channel Teledyne LeCroy 12-bit resolution high definition oscilloscope (HD4096 HDOs and MDAs) to provide Analog+Digital+Sensor (up to 8+16+24 channel) acquisitions. This capability is ideal for system debug and analysis of deeply embedded, electromechanical, and mechatronic designs in the medical, mil/aero, motors and drives, power, appliance, Internet of Things (IoT), vehicle/automotive and other applications.

24-bit Precision

All channels have 24-bit resolution (stored in 32-bit floating point format) with ~0.05% total accuracy. Built-in filters with settings as low as 100 Hz further reduce noise. Adjustable gain ranges (1 mV to 10 V/div) accurately acquire a wide range of signal levels.

Plug-and-play

The SAM40 simply connects to the supported Teledyne LeCroy oscilloscope with a USB2.0 cable for data transfer and control/trigger commands, and BNC cables for clock/timebase synchronization. No programming or complex setups are required.

Unit Conversion and Rescaling

More than 65 different SI and English system physical units are supported for length, mass, temperature, angle, velocity, acceleration, volume, force/weight, pressure, electrical, magnetic, energy and rotating machine quantities. Math and measurements applied to rescaled waveforms correctly read and convert to new units as required.

Deep Toolbox

The oscilloscope math, measure, analysis, pass/fail and option packages utilize the sensor inputs the same as any other channel. Teledyne LeCroy's deep toolbox just got even more powerful.

The SAM40 sensor acquisition module simply and quickly interfaces to a supported Teledyne LeCroy 12-bit high definition oscilloscope (HDO). The SAM40 acquires very low speed (40 kHz bandwidth) sensor and other signals and the HDO acquires higher speed analog, digital and serial data signals. The HDO cross-triggers the SAM40, and the SAM40 sends acquisition data to the HDO for time-synchronized display with the high bandwidth HDO analog and digital channels.



The 'Units' menu is shown, allowing selection of units for various physical quantities. A sub-menu is open for 'Angle', showing options: Wb, T, H, A/m, and H/m.

Below the menu, several floating labels show unit conversion examples for different sensors (SE6, SE3, SE13, SE1, SE8, SE2, SE14, SE9) with their respective units and offsets.

Sensor	Unit 1	Unit 2	Offset
SE6	2.00 Wb	0.00 μ Wb	
SE3	1.00 m/s ²	0.00 μ m/s ²	
SE13	1.00 arcsec	0.0 μ arcsec	
SE1	100 mF/m	0 nF/m ofst	
SE8	1.00 $^{\circ}$ C/div	0.00 μ° C	
SE2	2.00 m/s	0.00 μ m/s	
SE14	50.0 mTorr	0 nTorr ofst	
SE9	2.00 N-m	0.00 μ N-m	
	50.0 mA	0 nA offset	

UP TO 8 ANALOG + 16 DIGITAL + 24 SENSOR CHANNELS

Engineers commonly use multiple instruments to debug and validate complex deeply embedded control systems, mechatronics, and electro-mechanical systems. Multiple instruments report different information on different displays and in different formats. An HDO with a sensor acquisition module cost-effectively replaces multiple instruments with one consolidated view of system performance. Leverage the Teledyne LeCroy deep toolbox to perform math, measurements, pass/fail and other analysis on all acquired data, or apply an application package to gain even faster time to insight.



4 analog channel + 16 digital channel, 1 GHz, 12 bit resolution
HDO6104A-MS high definition oscilloscope with SAM40-8 provides
4+16+8 channel acquisition capability.



8 analog channel + 16 digital channel, 1 GHz, 12 bit resolution
HDO8108 high definition oscilloscope with SAM40-24 provides
8+16+24 channel acquisition capability.

4 + 16 (Analog + Digital) Channel Oscilloscope with SAM40-8 Sensor Acquisition Module

The most basic system available combines a 350 MHz, 500 MHz, or 1 GHz 12-bit resolution, 4 channel oscilloscope (HDO4000A or HDO6000A Series) with a SAM40-8 eight channel acquisition module. This triples the number of available inputs for a very modest price, and preserves high bandwidth oscilloscope inputs for the most important uses, or provides capability to view more high bandwidth signals than would have previously been possible without the SAM40. 16 and 24 channel acquisition modules may also be used. MSO oscilloscope models further add 16 digital logic input channels.

8 + 16 (Analog + Digital) Channel Oscilloscope or Motor Drive Analyzer with a SAM40-24 Sensor Acquisition Module

Pair the SAM40-24 with the world's only 8 channel, 1 GHz, 12-bit resolution oscilloscope and obtain an unbelievable 8+16+24 analog+digital+sensor inputs. Make fast debug work of deeply embedded systems that combine power electronics, motors, and sensors into one complex, dynamic system. Utilize the SAM40 for analog speed or torque sensor signals, vibration sensors or accelerometers, and other mechatronic signals. For the ultimate in motor drive analysis, pair the SAM40 with the MDA800A and gain the deepest static and dynamic understanding of three-phase power system and mechanical motor behaviors.

SPECIFICATIONS AND ORDERING INFORMATION

Specifications

Vertical

Bandwidth	40 kHz
Input Channels	8 (SAM40-8), 16 (SAM40-16), 24 (SAM40-24)
Vertical Resolution	24 bits, stored and displayed as 32-bit floating point waveforms
Effective Number of Bits (ENOB)	13 (40 kHz bandwidth), 15 (2 kHz bandwidth)
Vertical Noise Floor	31 μ Vrms at 1-2 mV/div, 35 μ Vrms at 5-100 mV/div, 56 μ Vrms at 200 mV/div, 355 μ Vrms at 500 mV/div and 1 V/div
Sensitivity	1 mV to 10 V/div in 1, 2, 5 steps
DC Vertical Gain Accuracy	$\pm(0.02\%$ of reading + 0.02% F.S. + 100μ V) at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$. Add $\pm(0.0015\%$ F.S. + 10μ V)/ $^{\circ}\text{C}$ outside of stated temperature range
Maximum Input Voltage	± 50 Vpeak for DC, AC, and GND coupling. ± 24 Vpeak for IEPE coupling (use IEPE coupling with appropriate sensor).
Input Coupling	AC 1M Ω , DC 1M Ω , IEPE, GND. AC coupling frequency 0.16 Hz $\pm 10\%$
Input Impedance	1 M Ω $\pm 0.5\%$ // 55 pF
Bandwidth Limiters	100 Hz, 500 Hz, 2 kHz, 10 kHz. Implemented as digital IIR filters in FPGA
Rescaling	Length: meters, inches, feet, yards, miles; Mass: grams, slugs; Temperature: celsius, fahrenheit, kelvin; Angle: radian, arcdeg, arcmin, arcsec, cycles, revolutions, turns; Velocity: m/s, in/s, ft/s, yd/s, miles/s; Acceleration: m/s ² , in/s ² , ft/s ² g0; Volume: liters, m ³ , in ³ , ft ³ , yd ³ ; Force (Weight): newton, grain, ounce, pound; Pressure: pascal, bar, atmosphere (technical), atmosphere (standard), torr, psi; Electrical: volts, amps, watts, volt-amperes, volt-amperes reactive, farad, coulomb, ohm, siemen, volt/meter, coulomb/m ² , farad/meter, siemen/meter, power factor; Magnetic: weber, tesla, henry, amp/meter, henry/meter; Energy: joule, Btu, calorie; Rotating Machine: radian/second, frequency, revolution/second, revolution/minute, N-m, lb-ft, lb-in, oz-in, watt, horsepower; Other: %

Horizontal and Acquisition

Acquisition Modes	Real-time (coincident with and as controlled by a compatible oscilloscope)
Sample Rate (single-shot)	1 S/s to 100 kS/s on all channels
Memory Length	2.5 Mpt/ch on each acquisition channel

Triggering System

Modes	Normal, Auto, Single, and Stop when cross-triggered by a supported oscilloscope
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Probes

Probe System	BNC Input, IEPE/ICP Compatible. Excitation Output Current = 4mA $\pm 15\%$ ($23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, $+0.5\%/^{\circ}\text{C}$ outside of range). Compliance Voltage = 24V
Scale Factors	Manually selected in supported oscilloscope

Power Requirements

Voltage	100–240 VAC $\pm 10\%$ at 45-66 Hz; 100-120 VAC $\pm 10\%$ at 380-420 Hz; Automatic AC Voltage Selection
Max. Power Consumption	50 W / 50 VA

Environmental

Temperature	0 $^{\circ}\text{C}$ to +50 $^{\circ}\text{C}$ (operating); -40 $^{\circ}\text{C}$ to +70 $^{\circ}\text{C}$ (non-operating)
Humidity	5% to 90% relative humidity (non-condensing) up to +30 $^{\circ}\text{C}$. Upper limit derates to 50% relative humidity (non-condensing) at +50 $^{\circ}\text{C}$. (operating). 5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F (non-operating)
Altitude	Up to 10,000 ft. (3048 m) at or below +25 $^{\circ}\text{C}$ (operating). Up to 40,000 ft. (12,192 m) (non-operating)

Size and Weight

Dimensions and Weight	3.97"H x 16.79"W x 13.38"D (101 mm x 426 mm x 340 mm)
Weight	9.56 lbs. (4.35 kg)

Certifications

CE Certification	CE Compliant
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Ordering Information

Product Description

Product Code

SAM

Sensor Acquisition Module, 8 input channels, 40 kHz bandwidth, 100 kS/s sample rate, 2.5 Mpts/ch.	SAM40-8
Sensor Acquisition Module, 16 input channels, 40 kHz bandwidth, 100 kS/s sample rate, 2.5 Mpts/ch.	SAM40-16
Sensor Acquisition Module, 24 input channels, 40 kHz bandwidth, 100 kS/s sample rate, 2.5 Mpts/ch.	SAM40-24

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year. This warranty includes:

- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge



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