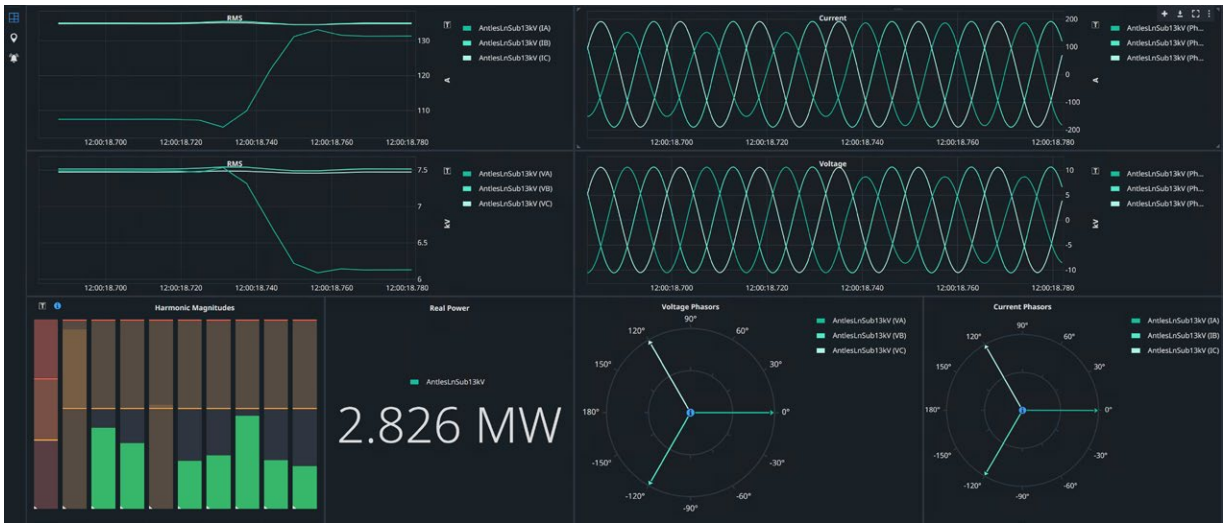
Capture Every Disturbance With Continuous Waveform Recording



Continuously measure, stream, and record time-synchronized waveform oscillography

- Precisely measure energy exchange regardless of frequency, phase angle, or signal distortion.
- Analyze disturbances at 3 or 14.4 kilosamples per second (ksps) on ac current and voltage waveforms
- View waveforms in real time from microseconds to days.
- Visualize positive, negative, and net-energy packets in 1 or 10 ms intervals.
- Trend and view alarms for metering and power quality measurements.
- Receive alarms when system conditions exceed user-defined thresholds.

Capture Every Event

Conventional power monitors depend on phasor-based calculations to detect faults and disturbances, but energy flow changes faster than once per cycle. Time-domain measurements in ksps expose power system disturbances that traditional power monitors do not typically capture, allowing you to take immediate action.

Monitoring devices—including protective relays and power quality meters—capture several cycles of waveform disturbance data based on predefined event conditions. The growing integration of distributed energy resources and nonlinear loads is reshaping the power system and introducing greater complexity and new operational challenges. Monitoring devices may miss events such as voltage oscillations. Additionally, disturbances like voltage sags on distribution circuits may persist longer than the waveform recording window, making them difficult to capture with traditional monitoring equipment.

The SEL continuous waveform streaming and recording system provides gapless recording of voltage, current, and energy transfer, so you never miss an event.

Virtual Metering Expands Power Monitoring Applications

Virtual metering allows users to monitor power quality with installed SEL streaming devices, eliminating the need for additional hardware. Use the Virtual Meter application within SEL Synchrowave® software to calculate metering quantities from continuous waveform streaming data.

The application calculates fundamental and rms voltage, current, and power values as well as frequency and power factor. This software-based approach provides a flexible and cost-effective way to gain detailed metering quantities using infrastructure already in place.

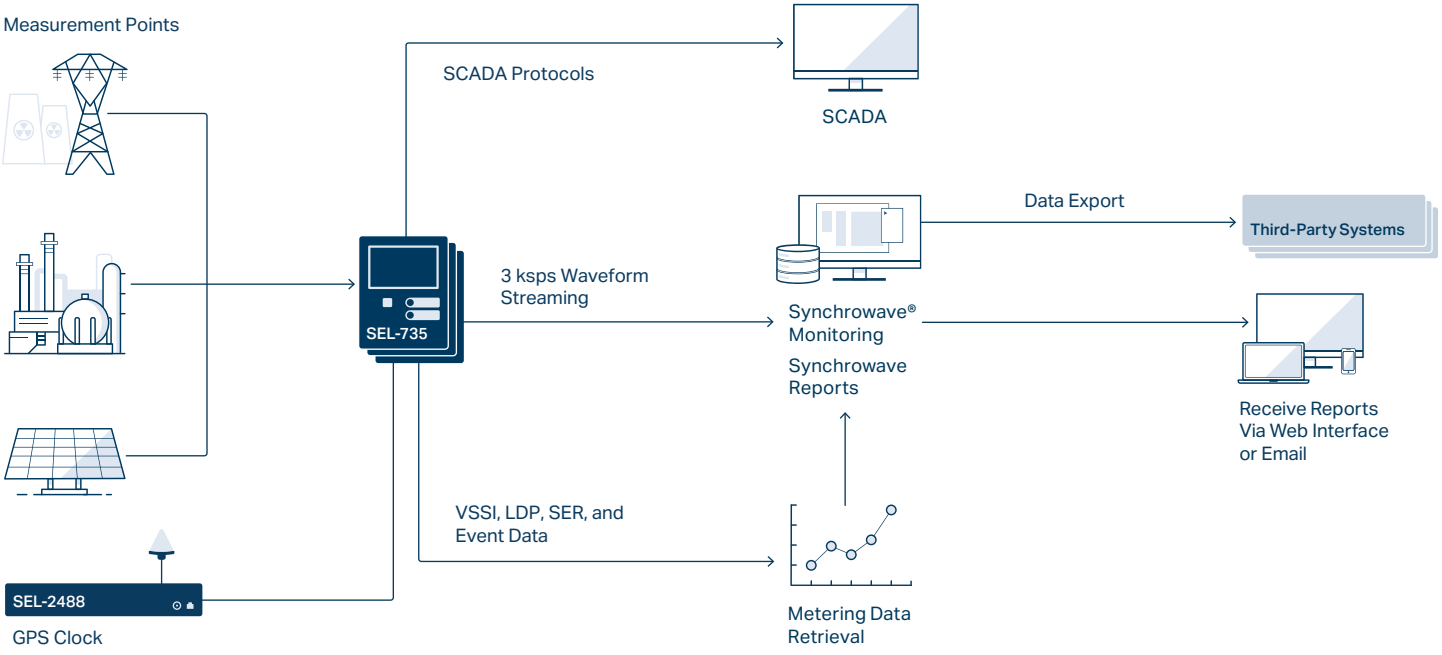
Continuous Waveform Streaming: Product Comparison

Application	SEL-735	SEL-2240 Axion®	SEL-T35
Revenue metering	On box	—	—
SCADA protocols	On box	On box	—
IEC 61000-4-30	Class A Virtual metering	Virtual metering	Virtual metering
Event capture	On box Virtual metering	On box Virtual metering	Virtual metering
Load profile	On box	On box	Virtual metering
Harmonics	On box	On box Virtual metering	Virtual metering
Transient capture	Virtual metering	On box Virtual metering	Virtual metering
Rapid voltage change	Virtual metering	On box Virtual metering	Virtual metering
1 ms energy packets	—	—	On box

SEL-735: Precise Metering With Continuous Waveform Streaming

The SEL-735 Power Quality and Revenue Meter captures every power system disturbance with optional continuous waveform streaming. Synchrowave software displays and analyzes precise 3 ksps voltage and current waveform data that stream from the SEL-735.

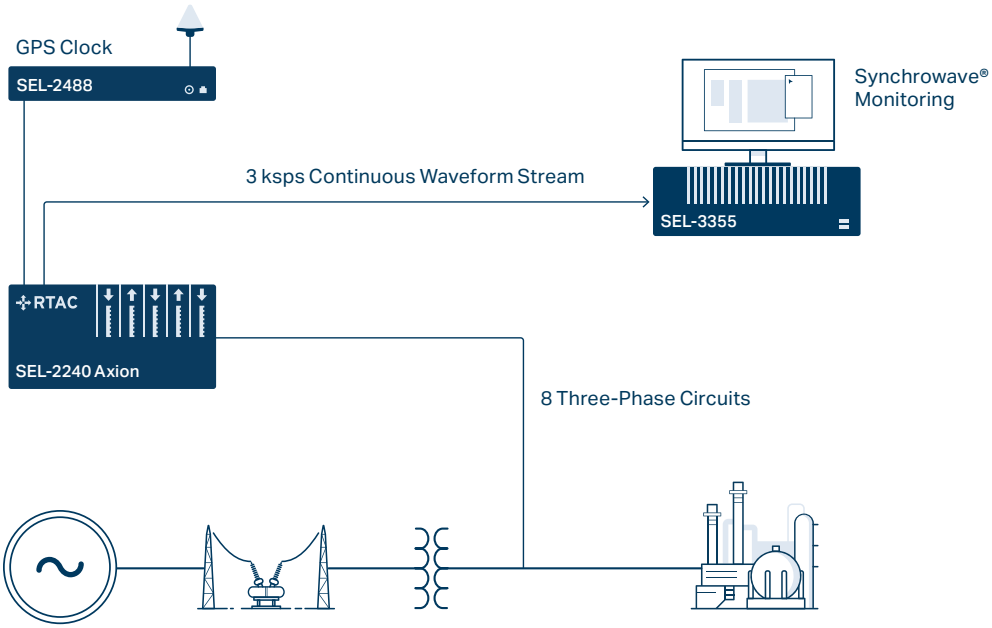
Bundle the SEL-735 with Synchrowave software to streamline ordering and simplify license management. Choose from a variety of bundles for a low-cost incremental license purchase tailored to your application.



SEL-2240 Axion: Scalable I/O With Continuous Streaming and Continuous Recording

Deploy the Axion as a standalone continuous waveform streaming device or with a companion SEL-3350 Real-Time Automation Controller (RTAC) or SEL-3555 RTAC to enable both continuous streaming and recording.

Configure the Axion, a rugged and modular hardware platform, with an SEL-2245-42 AC Protection Module and an onboard SEL-2241-2 RTAC logic engine to stream current and voltage measurements directly to Synchrowave software. With its optional full-color touchscreen and the ability to stream up to 96 channels of current and voltage measurements at 3 ksps, the Axion is ideal for multicircuit monitoring and control applications.



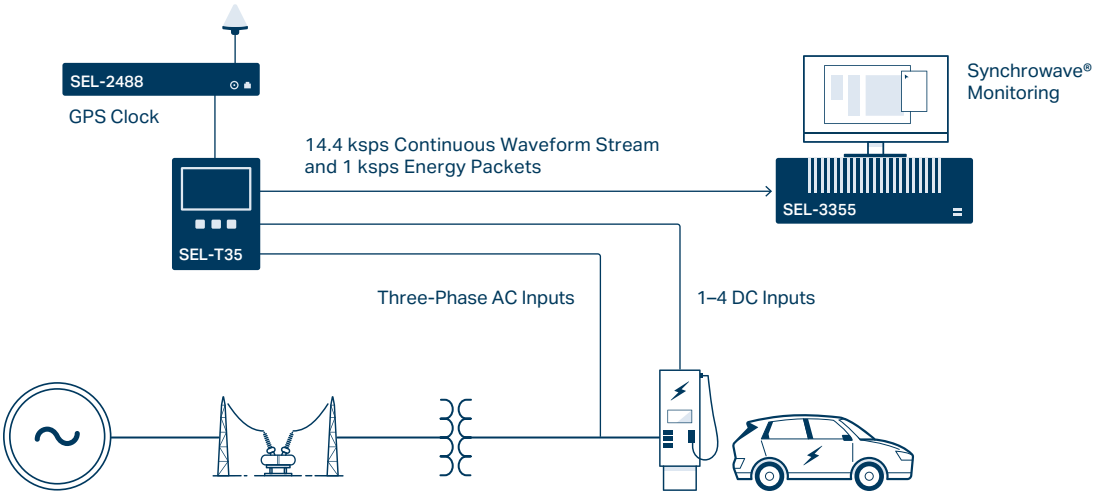
COMING SOON

SEL-T35 Time-Domain Power Monitor

The SEL-T35 precisely samples ac and dc signals and streams voltage and current waveform data at 14.4 ksps and energy packets at 1 ksps to Synchrowave software. These packets deliver energy measurements that are independent of frequency and phase angles.

View ac and dc voltage and current measurements directly on the color touchscreen HMI, which offers oscilloscope-like features. The SEL-T35 also has low-level milliampere (mA) dc analog inputs that accept signals from third-party transducers—including measuring temperature, solar irradiance, or high-energy dc voltage/current—enabling conversion efficiency analysis within Synchrowave software. The integrated ride-through pack allows the SEL-T35 to stream data to Synchrowave software for at least seven seconds during brief power interruptions.

Directly measure dc voltage and current for monitoring battery charge and health, solar panels, inverters, and dc rail lines. Included universal current sensors handle current transformer input channels and are capable of measuring full-spectrum ac and dc signals across a wide current range. These sensors are especially useful for detecting dc and fault currents that exceed the range of standard metering CTs.



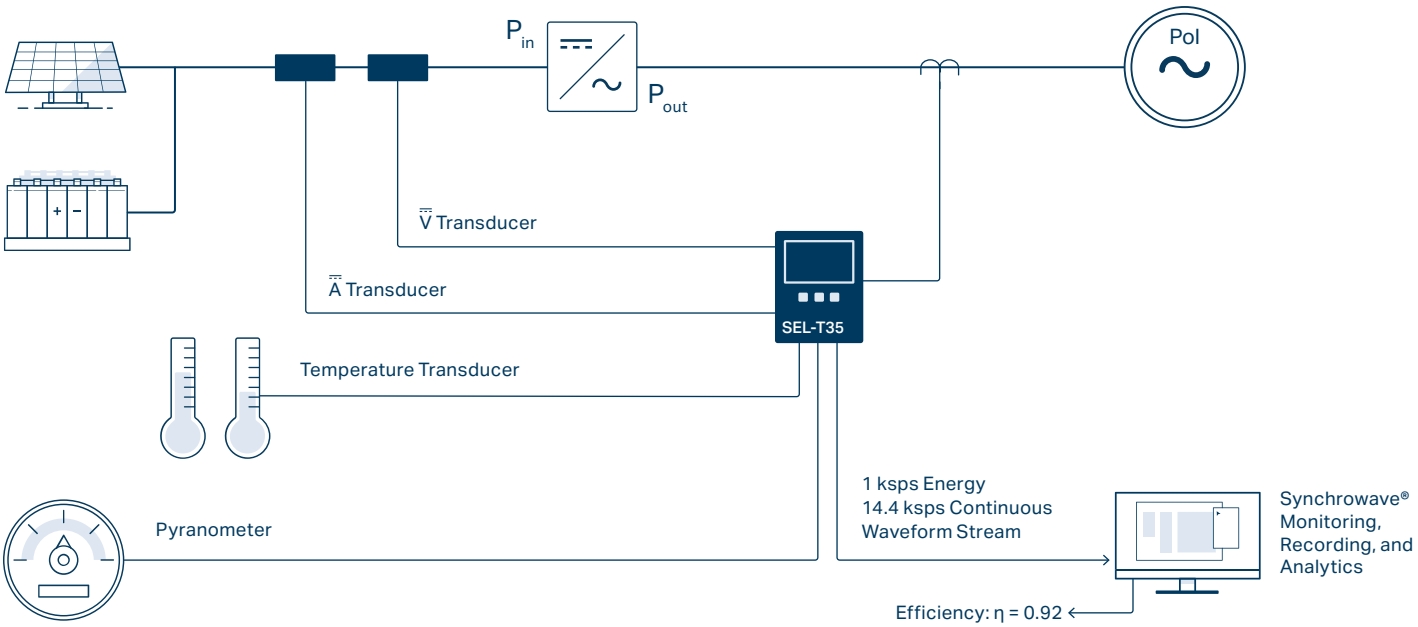
Energy Measurement Redefined

Industry-exclusive energy packet technology from SEL precisely reports energy flow under all system conditions, regardless of frequency, angle, or distortion. Positive energy packets represent energy delivered to the load. Negative energy packets represent the energy returned from the load. Negative energy packets can indicate reduced system capacity and increased losses. Energy packets assist operators in identifying load changes, such as motor starts, inverter oscillations, and inrush events.

The SEL-T35 calculates single-phase and three-phase energy flow by integrating instantaneous power over a 1 ms period, while SEL-5703 Synchrowave Monitoring software calculates 10 ms energy packets from the Axion data streams. This time-domain calculation enables accurate energy measurements under all system conditions. Energy packets continuously stream at a 1 ksps rate. This allows faster time-deterministic control of inverters and rotating machines.

See application guide AG2023-19, "View Streamed Axion Wave Server Time-Series Data in Synchrowave Monitoring and Calculate Energy Packets in RTAC Logic Engine," to apply energy packet technology with the Axion data streams. The guide provides instructions on how to calculate and visualize energy packets.

Configure an Axion to share energy packet information with control and monitoring systems via traditional protocols, including GOOSE, DNP3, and Modbus.



Measure production and calculate power conversion efficiency and distortion.

Flexible Systems to Support Any Application

SEL provides multiple time-synchronized continuous waveform streaming devices that integrate with SEL-5702 Synchrowave Operations and Synchrowave Monitoring.

Single-Circuit Monitoring

The SEL-735 meter streams three current and three voltage measurements. The SEL-T35 power monitor streams four current, four voltage, and four 0—50 mA analog measurements. These devices are well suited for distributed three-phase circuit monitoring.

Multicircuit Monitoring

The SEL Axion and RTAC monitoring system can stream up to 96 channels of current and voltage measurements at 3 ksps. Each SEL-2245-42 AC Protection Module streams measurements from a three-phase circuit, and the system supports up to 16 modules in total—designed for bus monitoring, digital fault recording, and centralized power monitoring.

	SEL-735	SEL-2240 Axion	SEL-T35
Streaming sample rate	3 ksps	3 ksps	14.4 ksps
Three-phase circuits	1	16	1
0—50 mA analogs	—	—	4
Digital inputs	6	Up to 1,700	2
Auxiliary 0—300 V ac/dc inputs	—	—	1
Energy packets	—	10 ms	1 ms
Synchrowave software license	Optional	Optional	Included
Onboard storage	Load profile and event reports	8 TB*	—
DC metering	—	—	Included
Cost per circuit	$$	1 circuit: $$$ 9 circuits: $	$$

*Continuous recording requires pairing the Axion with the SEL-3350 RTAC or the SEL-3555 RTAC.

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