# Sequence of Events Recorder (SER-3200/SER-2408)



**Know what happened and when—to 1ms!** The Hanley Energy Sequence of Events Recorder monitors the status of 32 channels and records state changes with 1ms accuracy. Over 8,000 events are stored in non-volatile memory.

Two models are available: the SER-3200 features 32 high-speed digital inputs, and the SER-2408 has 24 inputs and 8 relay outputs. An embedded web server enables setup and monitoring over an Ethernet network using a standard web browser.

Flexible time synchronization and Modbus TCP communications enable easy integration with supervisory systems such as an Event and Power Management System (EPMS), all in high definition. Command relays over the network (model SER-2408). Open/close relay outputs remotely over an Ethernet network using Modbus TCP.

#### **Key Functions**

- Status monitoring (32 digital inputs)
- E Event recording (1-ms time-stamp accuracy)
- Δt Stopwatch function, elapsed time (to 1 ms)
- <sup>123</sup> Operations counters (with individual reset)
- Remote control (on/off) via Modbus TCP
- M Trigger output for Waveform Capture
- 1588 Time-sync output for non-PTP devices



\* Inter-SER (RS-485) is for existing installations only. Replaced by PTP master/slave for new projects. Hanley Energy Event Recorders offer simple setup using a web

browser-no proprietary software required. An embedded web server hosts user-friendly pages for setup and monitoring. Digital inputs have

user-configurable filter, debounce and chatter functions. Each input can

be customized with descriptive name (32-char. max.), and assigned

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#### Setup and Monitoring Using any Web Browser

#### SER typical monitored points:

- Breaker status: open/closed/tripped
- Relay trip signal: normal/trip
- Control switches: open/close commands
- Control scheme status: auto/manual/test
- Auto-transfer switch (ATS) status: normal/emergency/test
- UPS status: normal/transfer/bypass
- Generator status: stopped/running
- Battery status: normal/alarm
- TVSS, transformer temperature, fan status and other auxiliary contacts and alarms

| IRVATED ENE          | KOT FAI | INCKS   |                        |            |          |             |           |             | SI           | ER-32 |
|----------------------|---------|---------|------------------------|------------|----------|-------------|-----------|-------------|--------------|-------|
| yTime Event Recorder |         |         |                        | MONITORING |          | CONTROL DIA |           | GNOSTICS    | SETUP        |       |
|                      | Enab    | ed 🕅    | Input Name             | Filter     | Debounce | Chatter     | Off Text  | On Text     | Trigger Inve | rted  |
| communications       | 01      | 1       | Main MCB1 OC Relay     | 20         | 20       | 0           | Off       | Trip Signal | <b>V</b>     | 1     |
| ïme                  | 02      | ~       | Main MCB1 Trip Contact | 20         | 20       | 0           | Normal    | TRIPPED     |              |       |
| nputs                | 03      |         | Main MCB1 Switch       | 20         | 20       | 0           | E.O. Open | E.O. Close  | ~            | [     |
| nputs (Group)        | 04      | ~       | Main MCB1 Status       | 20         | 20       | 0           | Open      | Closed      |              |       |
| roups                | 05      | ~       | Main MCB2 OC Relay     | 20         | 20       | 0           | Off       | Trip Signal | ✓            | 1     |
| Administration       | 06      | 1       | Main MCB2 Trip Contact | 20         | 20       | 0           | Normal    | TRIPPED     |              |       |
|                      | 07      | ~       | Main MCB2 Switch       | 20         | 20       | 0           | E.O. Open | E O. Close  | V            | í     |
|                      | 0.8     | V       | Main MCB2 Status       | 20         | 20       | 0           | Open      | Closed      | 11           |       |
|                      | 09      | ~       | Tie TCB OC Relay       | 20         | 20       | 0           | 01        | Trip Signal | ×            |       |
|                      | 10      | 1       | Tie TCB Trip Contact   | 20         | 20       | 0           | Normal    | TRIPPED     |              |       |
|                      | 11      | ~       | Tie TCB Switch         | 20         | 20       | 0           | E.O. Open | E.O. Close  |              |       |
|                      | 12      | ~       | Tie TCB Status         | 20         | 20       | 0           | Open      | Closed      | Tel:         |       |
|                      | 13      | ~       | Fdr FCB1 OC Relay      | 20         | 20       | 0           | Off       | Trip Signal | V            | -     |
|                      | 14      | ~       | Fdr FCB1 Trip Contact  | 20         | 20       | 0           | Normal    | TRIPPED     | 11           |       |
|                      | 15      | ~       | Fdr FCB1 Switch        | 20         | 20       | 0           | Open      | Close       | ~            | 1     |
|                      | 16      | 1       | Fdr FCB1 Status        | 20         | 20       | 0           | Open      | Closed      |              |       |
|                      | A.L     | 1.65.10 | ▼[17 to 32]            |            |          |             |           |             |              |       |

#### View Events, Export to Excel, Access via Modbus TCP

The Hanley Energy Event Recorder's Events web page displays detailed information for all event records, sortable by any field. An Export button makes it easy to save data to Excel for further analysis or reports. These tools are useful during commissioning or troubleshooting, even if the same data is also integrated into a comprehensive power monitoring system, building management system or other host software.



Customize

text to describe on and off states.

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# **Time Synchronization Made Simple** SER-3200 or SER-2408

No PTP? No Problem.

Ethernet





#### Automatic Time Sync (within 100 microseconds)

Hanley Energy's SER enables hi-res (sub-millisecond) time synchronization over the same Ethernet network used for the Event and Power Monitoring System (EPMS). Set the time in the first Event Recorder, and all other SER devices sync automatically over Ethernet. The breakthrough technology: PTP (Precision Time Protocol), per IEEE Std 1588<sup>™</sup>. Time-sinc input (time source) options are shown below:



#### Hanley Energy SER Outputs All Legacy Protocols

Hanley Energy Event Recorders don't simply leverage the power of PTP for themselves. Any SER-3200/2408 configured to accept PTP as its time source (PTP slave) can in turn output the legacy protocol required by complementary devices, such as relays or meters. ASCII/RS-485 is available directly from the SER, while others (IRIG-B, DCF77 or 1per10) require a small adapter, PTP Legacy Interface (PLX-5V or PLX-24V), according to the voltage supported by the target device.

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#### Sequence of Events Recorder (SER-3200/SER-2408)

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#### **Specifications**

#### Dimensions



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| Electrical                    |  |  |  |  |
|-------------------------------|--|--|--|--|
|                               | Number of optically-isolated inputs              | 32 (SER-3200) or 24 (SER-2408)   |  |  |
| Digital inputs                | Voltage, operating                               | 24 Vdc (-15% to +10%)  |  |  |
|                               | Must turn on/off voltage                         | 20 Vdc (on) / 9 Vdc (off)  |  |  |
|                               | Input impedance                                  | 10K ohms resistive, 1 mA current draw (max.)                                     |  |  |
| Relay Outputs<br>(SER-2408)   | Number and type of outputs                       | 8 Form A, solid-state relays (two groups of four)                                |  |  |
|                               | Voltage operating range                          | 16 to 30 Vdc (24 Vdc nominal)  |  |  |
|                               | Current capacity                                 | 2.0 A per relay output (8.0 A per group, 16 A total)                             |  |  |
| High-speed Trigger<br>Output  | Relay type                                       | Form A, solid-state relay  |  |  |
|                               | Maximum current                                  | 100 mA at 24 Vdc nominal   |  |  |
|                               | Contact closure characteristics                  | Momentary contact closure, duration of 100 ms                                    |  |  |
|                               | Voltage, operating                               | 24 Vdc (± 10%)   |  |  |
| Control Power                 | Burden (max.)                                    | Steady state: 10 VA (10 watts) / Inrush current: 0.8 A for 5-8 ms                |  |  |
| Time Synchronization          |  |  |  |  |
|                               | PTP slave (requires license key)                 | IEEE 1588-2008 (v2), E2E Default Profile, per Annex J.                           |  |  |
|                               | IRIG-B (via optional EZC-IRIG-B connector)       | Unmodulated IRIG-B (5V DCLS) types B004 - B007 (IEEE-1344 extensions ON)         |  |  |
| Time Source                   | DCF77 (via optional EZC-DCF77 connector)         | DCF77 (24 Vdc)   |  |  |
| Supported                     | SER inter-device time sync (legacy applications) | RS-485 (IRIG-B or DCF77 time code)   |  |  |
|                               | NTP (SNTP) client                                | User-configurable NTP primary/secondary servers and update interval              |  |  |
|                               | PTP master (requires license key)                | IEEE 1588-2008 (v2), E2E Default Profile, per Annex J.                           |  |  |
| Time-sync                     | IRIG-B (via optional PLX-5V connector)           | Unmodulated IRIG-B (5V DCLS) type B006   |  |  |
| Output Protocols<br>Supported | IRIG-B (via optional PLX-24V connector)          | IRIG-B (24V DCLS) type B006, compatible with STR-IDM                             |  |  |
|                               | DCF77 or 1per10 (via PLX-24V connector)          | DCF77 (24 Vdc) or 1 pulse per 10 seconds (24 Vdc)                                |  |  |
|                               | RS-485   | ASCII / RS-485 (ASCII + Quality) or SER inter-device time sync / RS-485 (legacy) |  |  |
|                               | Accuracy   | < 100 µs (with time source = PTP, IRIG-B or DCF77)                               |  |  |
| CIOCK                         | Holdover (after sync for at least 2.5 min.)      | 5 min. (remains within 100 µs even after loss of sync for up to 5 min.)          |  |  |
| Communications                |  |  |  |  |
|                               | Modbus TCP (TCP port 502)                        | 32 simultaneous TCP connections (Modbus TCP sockets), max.                       |  |  |
| Ethernet Interface            | Web server (TCP ports 80, 8080, 843)             | W3C standards-compliant. Flash Player v.10 or later required.                    |  |  |
|                               | FTP file server (TCP port 21)                    | 5 simultaneous FTP sessions, max.  |  |  |
| Memory                        | SDHC flash memory card (user-accessible)         | 8GB (32GB when ordered with -32GB option)  |  |  |
| Mechanical / Environ          | mental / Regulatory                              |  |  |  |
|                               | Mounting   | Standard DIN rail (EN 50022, 35 mm x 15 mm)                                      |  |  |
|                               | Wire sizes supported                             | #24 to #12 AWG (#26 to #14 for F7C 3-position connector)                         |  |  |
| Mechanical                    | Dimensions (W x H x D)                           | 11.25 x 4.75 x 3.13 inches (286 x 121 x 79 mm)                                   |  |  |
|                               | Dimensions (W x H x D), in carton                | 12.50 x 6.50 x 4.50 inches (318 x 165 x 114 mm)                                  |  |  |
|                               | Weight   | 3.0 lbs. (1.4 kg) / in carton: 3.5 lbs. (1.6 kg)                                 |  |  |
| Environmental                 | Temperature                                      | -25° to +70° C (Operating) / -40° to +85° C (Storage)                            |  |  |
|                               | Humidity rating                                  | 5% to 95% relative humidity (non-condensina) at 40° C                            |  |  |
| Regulatory<br>Compliance      | UL Listing                                       | UL-61010. UL-508. CUL. CSA C22.2   |  |  |
|                               | Global standards                                 | CE Mark, RCM Mark, EN standards  |  |  |
|                               | Radiated Emissions                               | ECC Class A / EN 55022:2010 (CISPR 22:2008) Class A                              |  |  |
|                               |  |  |  |  |
|                               | Sustainability                                   |  |  |  |



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## Sequence of Events Recording (SER)

#### Sequence of Events Recording: part of every Event and Power Management System (EPMS)

#### **Ordering Information**

The following models and accessories are available for the SER-3200 and SER-2408 Event Recorders:

|  | Catalog no.      | Description  |  |  |
|--|------------------|--|--|--|
| Hanley Energy<br>Sequence of Events<br>Recorders (SER) | SER-3200-P2X2    | CyTime Event Recorder, 32-inputs   |  |  |
|  | SER-3200-PTP ①   | CyTime Event Recorder, 32-inputs, PTP option                                       |  |  |
|  | SER-3200-32GB ①  | CyTime Event Recorder, 32-inputs, PTP + 32GB options                               |  |  |
|  | SER-2408-P2X2    | CyTime Event Recorder, 24-inputs/8-outputs   |  |  |
|  | SER-2408-PTP ①   | CyTime Event Recorder, 24-inputs/8-outputs, PTP option                             |  |  |
|  | SER-2408-32GB ①  | CyTime Event Recorder, 24-inputs/8-outputs, PTP + 32GB options                     |  |  |
|  | PTP-UPGRADE 10 2 | PTP (IEEE 1588) Field Upgrade Kit for CyTime SER-3200/SER-2408                     |  |  |
| Accessories (for SER)                                  | EZC-IRIG-B       | EZ connector for SER (IRIG-B input)  |  |  |
|  | EZC-DCF77        | EZ connector for SER (DCF77 input)   |  |  |
|  | PLX-5V           | PTP Legacy Interface (5V DCLS, for unmodulated IRIG-B output)                      |  |  |
|  | PLX-24V          | PTP Legacy Interface (24V DCLS, for DCF77, 1per10 or 24V IRIG-B output to STR-IDM) |  |  |
|  | STR-IDM          | IRIG-B Distribution Module (requires STR-100/IRIG-B or PLX-24V)                    |  |  |

① The PTP option is activated by a software license key, unique to each SER. When ordered with the -PTP or -32GB suffix, this key is installed at the factory. When ordered as a field-upgrade to an existing SER-3200/2408 (requires hardware version B1 or later), the key is provided via a license certificate.

② To order PTP field upgrade, please provide the serial number and MAC address of the existing SER at the time the order is placed.

#### For More Information

Handout: Sequence of Events Recording (SER) Data Sheet: Precision Timing via PTP (DS-PTP-01) SER User's Guide (IB-SER-01) SER Reference Guide (IB-SER-02) Guide Spec: Sequence of Events Recording (SER) Tech Note: Hi-res Time Sync using PTP/1588 (TN-100) Tech Note: SER System Architectures (TN-101) Tech Note: IRIG-B Time Codes (TN-102) Tech Note: DCF77 Time Protocol (TN-103)

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