

Sequence of Events Recording (SER)

Precision timing is essential for modern industrial/commercial power systems. In complex electrical networks, state changes can occur in a quarter-cycle or less, and so system-wide clock **synchronization is needed for meaningful analysis.**



Understand - Use as a forensics tool to gain knowledge

- Perform root-cause analysis based on reliable data.
- View current and voltage waveforms captured with each event.
- Determine if the initial source was internal or external.

Respond - Verify that systems operated as designed

- Evaluate control sequences, timing, and operator actions.
- Confirm protective device time-current coordination.
- Restore service quickly if an outage does occur.

Prevent - Implement corrective actions to prevent problems

- Resolve or mitigate persistent problems.
- Provide documentation for the electric utility, legal, insurance, etc.
- Identify slow breakers before they can cause an arc flash hazard.

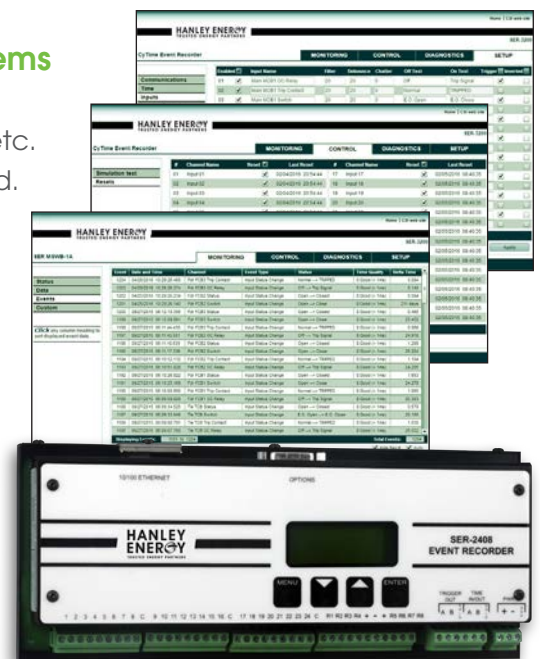
SER systems record the exact time of all events in chronological order. Some events are bad because they cannot be anticipated, and even worse if they cannot be explained.

Other events are planned responses (breaker trips, control system actions, etc.). It is equally important to know that these events happened on time as designed - or know if they didn't and why.

Know what happened & when to

1 ms

Events happen. Reduce your risk.

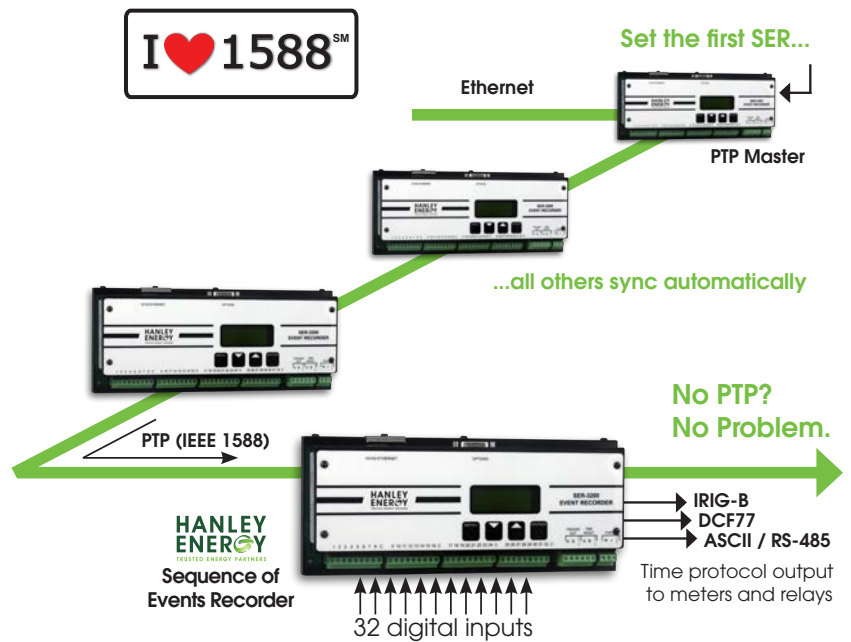


Sequence of Events Recording (SER)

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

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



CyTime SER-3200/2408 features

- Status monitoring (32 digital inputs)
- Event recording (1 ms timestamp accuracy)
- Elapsed time, stop-watch function (1 ms)
- Operations counters (individual reset)
- Web interface for setup and monitoring
- Remote control (on/off) via Modbus TCP
- Trigger waveform capture by power meter
- Clock sync via PTP, IRIG-B, NTP or others
- Time master (OUT) via PTP, IRIG-B, DCF77, ASCII/RS-485 or 1per10

PTP-enabled SER: Simple. Affordable. Scalable.

Today, EPMS devices can have their clocks synchronized over Ethernet to under 100 μ s via Precision Time Protocol (PTP) per IEEE Std. 1588. No special switches are needed, and devices that do not yet support PTP are synchronized easily, using a legacy protocol they do support.

Event reconstruction and analysis

- 1 Event details, 1 ms timestamps
- 2 Elapsed time between start-stop pairs
- 3 Export events to Excel

For system-wide visualization, native drivers for Hanley Energy SER-3200/2408 are available for most EPMS software. Integration is easy via Modbus TCP and web technologies.

Event	Date and Time	Channel	Event Type	Status	Time Quality	Delta Time
1204	04/11/2016 16:41:45:488	Input 22	Input Status Change	Off → On	0:Good (+ time)	0.391
1203	04/11/2016 16:41:45:374	Input 21	Input Status Change	Off → On	0:Good (+ time)	0.140
1202	04/11/2016 16:41:45:234	Input 20	Input Status Change	Off → On	0:Good (+ time)	0.094
1201	04/11/2016 16:41:45:140	Input 19	Input Status Change	Off → On	0:Good (+ time)	197:days
1200	09/27/2015 09:12:10:076	Input 24	Input Status Change	Off → On	0:Good (+ time)	0.533
1199	09/27/2015 09:12:09:943	Input 23	Input Status Change	Off → On	0:Good (+ time)	25.112
1198	09/27/2015 09:11:44:591	Input 22	Input Status Change	Off → On	0:Good (+ time)	0.250
1197	09/27/2015 09:11:43:581	Input 21	Input Status Change	Off → On	0:Good (+ time)	24.987
1196	09/27/2015 09:11:18:573	Input 20	Input Status Change	Off → On	0:Good (+ time)	0.605
1195	09/27/2015 09:11:17:967	Input 19	Input Status Change	Off → On	0:Good (+ time)	23.790
1194	09/27/2015 09:10:52:207	Input 18	Input Status Change	Off → On	0:Good (+ time)	1.050
1193	09/27/2015 09:10:51:147	Input 17	Input Status Change	Off → On	0:Good (+ time)	24.993
1192	09/27/2015 09:10:26:153	Input 16	Input Status Change	Off → On	0:Good (+ time)	0.742
1191	09/27/2015 09:10:25:411	Input 15	Input Status Change	Off → On	0:Good (+ time)	23.380
1190	09/27/2015 09:10:05:023	Input 14	Input Status Change	Off → On	0:Good (+ time)	0.097
1189	09/27/2015 09:09:59:926	Input 13	Input Status Change	Off → On	0:Good (+ time)	23.550
1188	09/27/2015 09:09:34:575	Input 12	Input Status Change	Off → On	0:Good (+ time)	0.697
1187	09/27/2015 09:09:33:978	Input 11	Input Status Change	Off → On	0:Good (+ time)	25.312
1186	09/27/2015 09:09:08:605	Input 10	Input Status Change	Off → On	0:Good (+ time)	1.249
1185	09/27/2015 09:09:07:416	Input 09	Input Status Change	Off → On	0:Good (+ time)	24.783

Precision Timing for Reliable Power. Simplified.



Consult us to find the perfect solution for you.

+353 1 841 4832
energy@hanleyenergy.com
hanleyenergy.com

Unit 7 & 8, Block 4, City North
Business Park, Stamullen,
Co. Meath, Ireland, K32 RX53

Ref: SER GCC

@HanleyEnergy
/hanley-energy
HanleyEnergy

