Sequence of Events Recording (SER)

Reliable power starts with precision timing

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 and when—

to
1 ms

Events happen. Reduce your risk.

I ♥ 1588[SM]

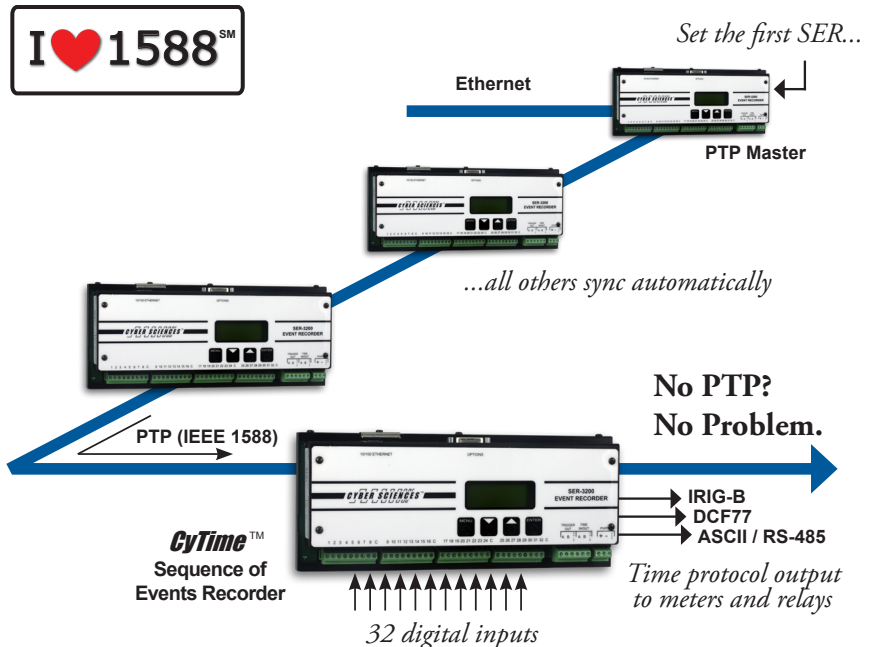www.cyber-sciences.com/SER

CYBER SCIENCES™

Sequence of Events Recording: part of every Electrical 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

I ♥ 1588^{SM}

Set the first SER...

Ethernet

PTP Master

...all others sync automatically

PTP (IEEE 1588)

**No PTP?
No Problem.**

CyTime™
**Sequence of
Events Recorder**

→ IRIG-B
→ DCF77
→ ASCII / RS-485

*Time protocol output
to meters and relays*

32 digital inputs

PTP-enabled SER: *Simple. Affordable. Scalable.*

Today, EPMS devices can have their clocks synchronized over Ethernet to under 100 µs 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

❶ Event details, 1 ms timestamps
❷ Elapsed time between start-stop pairs
❸ Export events to Excel

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

CYBER SCIENCES™

Home | CSI web site

SER-3200

CyTime Event Recorder   ❶   MONITORING | CONTROL | DIAGNOSTICS | SETUP ❷

Status
Data
Events
Custom

Click any column heading to sort displayed event data.

Event	Date and Time	Channel	Event Type	Status	Time Quality	Delta Time
1204	04/11/2016 16:41:45.468	Input 22	Input Status Change	Off --> On	0:Good (< 1ms)	0.094
1203	04/11/2016 16:41:45.374	Input 21	Input Status Change	Off --> On	0:Good (< 1ms)	0.140
1202	04/11/2016 16:41:45.234	Input 20	Input Status Change	Off --> On	0:Good (< 1ms)	0.094
1201	04/11/2016 16:41:45.140	Input 19	Input Status Change	Off --> On	0:Good (< 1ms)	197 days
1200	09/27/2015 06:12:10.076	Input 24	Input Status Change	Off --> On	0:Good (< 1ms)	0.533
1199	09/27/2015 06:12:09.543	Input 23	Input Status Change	Off --> On	0:Good (< 1ms)	25.152
1198	09/27/2015 06:11:44.391	Input 22	Input Status Change	Off --> On	0:Good (< 1ms)	0.830
1197	09/27/2015 06:11:43.561	Input 21	Input Status Change	Off --> On	0:Good (< 1ms)	24.987
1196	09/27/2015 06:11:18.573	Input 20	Input Status Change	Off --> On	0:Good (< 1ms)	0.606
1195	09/27/2015 06:11:17.967	Input 19	Input Status Change	Off --> On	0:Good (< 1ms)	25.760
1194	09/27/2015 06:10:52.207	Input 18	Input Status Change	Off --> On	0:Good (< 1ms)	1.060
1193	09/27/2015 06:10:51.147	Input 17	Input Status Change	Off --> On	0:Good (< 1ms)	24.993
1192	09/27/2015 06:10:26.153	Input 16	Input Status Change	Off --> On	0:Good (< 1ms)	0.742
1191	09/27/2015 06:10:25.411	Input 15	Input Status Change	Off --> On	0:Good (< 1ms)	25.388
1190	09/27/2015 06:10:00.023	Input 14	Input Status Change	Off --> On	0:Good (< 1ms)	0.097
1189	09/27/2015 06:09:59.926	Input 13	Input Status Change	Off --> On	0:Good (< 1ms)	25.350
1188	09/27/2015 06:09:34.575	Input 12	Input Status Change	Off --> On	0:Good (< 1ms)	0.597
1187	09/27/2015 06:09:33.978	Input 11	Input Status Change	Off --> On	0:Good (< 1ms)	25.312
1186	09/27/2015 06:09:08.665	Input 10	Input Status Change	Off --> On	0:Good (< 1ms)	1.249
1185	09/27/2015 06:09:07.416	Input 09	Input Status Change	Off --> On	0:Good (< 1ms)	24.783

Displaying Events: 1101 to 1204   Total Events: 1204

☐ Load all events   [Export] ❸   ☑ Hide Seq # ☑ Auto

Precision Timing for Reliable Power. *Simplified.* ^{SM}

CYBER SCIENCES™