IB-SER-02
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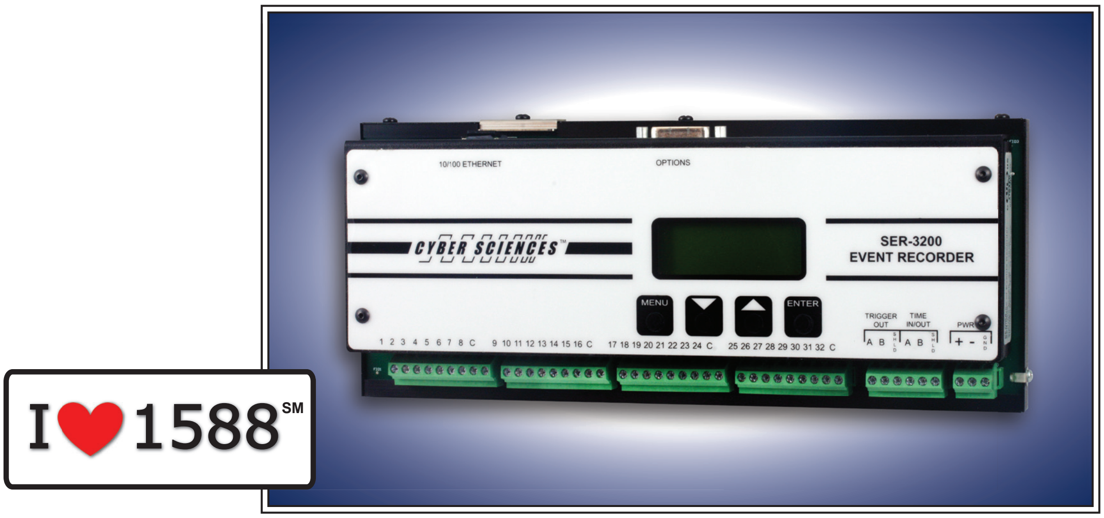
INSTRUCTION BULLETIN
REFERENCE GUIDE

CyTime™
Sequence of Events Recorder
SER-3200 / SER-2408



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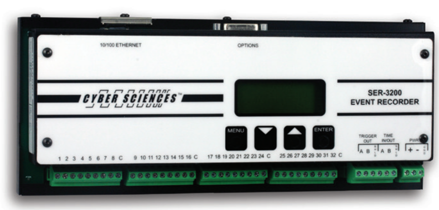

See Also—SER User's Guide:

- *Product Overview*
- *Installation*
- *Wiring*
- *Local Display and Keypad*
- *Setup & Monitoring via Web Pages*
- *Specifications*

For More Information

CyTime SER User's Guide (IB-SER-01)
EZC Instruction Bulletin (IB-EZC-01)
PLX Instruction Bulletin (IB-PLX-01)
STR-IDM Instruction Bulletin (IB-IDM-01)
Tech Note: Hi-res Time Sync using PTP/1588 (TN-100)
Tech Note: SER System Architectures (TN-101)
Tech Note: SER Data Export to CSV File (TN-201)

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SAFETY PRECAUTIONS

Important safety precautions must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions outlined below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical practices. For example, in the USA, see NFPA 70E.
- Turn off all power supplying the equipment in which the device is to be installed before installing and wiring the device.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Beware of potential hazards, wear personal protective equipment, and carefully inspect the work area for tools and objects that may have been left inside the equipment.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.

Failure to follow these instructions can result in death or serious injury.

NOTE:

Electrical equipment should be serviced by qualified personnel. No responsibility is assumed by Cyber Sciences, Inc. for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

1—ETHERNET COMMUNICATIONS

Ethernet Protocols Supported

Note: This instruction bulletin describes product features and behaviors for the latest firmware version available at the time of publication. Cyber Sciences recommends updating to the latest firmware whenever feasible, available for free download:

www.cyber-sciences.com/downloads

Note: This XML Sockets section only applies to firmware v2.16 and earlier.

Note: The maximum number of supported TCP connections is 44. The first five (5) are reserved for system use, leaving a total available for customer use = 39. Any combination of these is possible, subject to the limits shown at right for Modbus TCP connections (32 max) and FTP (5 max).

The CyTime™ SER-3200 / SER-2408 Sequence of Events Recorder supports the following Ethernet protocols:

- **Hypertext Transfer Protocol (HTTP):** HTTP is a networking protocol used by web browsers to access and present data. The CyTime SER uses HTTP to provide web server functionality over TCP port 80 (default).
- **XML Sockets:** The Actionscript 3.0 XMLSocket class implements client sockets that allow the Adobe Flash Player to communicate with the SER web server to obtain real-time data from the device using TCP port 8080. A master security policy file is served from the SER over TCP port 843, per Adobe standards.
- **File Transfer Protocol (FTP):** FTP is a networking protocol that provides the ability to transfer files over Ethernet from one computer to another, using TCP port 21 (default). The SER supports both active and passive FTP modes. The maximum number of concurrent FTP sessions is five.
- **Modbus TCP:** Modbus TCP is a combination of the Modbus protocol, which provides master-slave communication between devices, and TCP/IP, which provides communications over an Ethernet connection. Modbus TCP can be used by application software, PLCs, or other master devices to access data or send commands to the SER, using TCP port 502. The following Modbus Function Codes are supported: 01, 02, 03, 05, 06, 16 and 20. Note: Connections ("Modbus TCP Sockets") that remain idle for 75 seconds and then fail to acknowledge after three (3) retries are closed automatically (TCP keep-alives).
- **Simple Network Time Protocol (SNTP):** SNTP is a time protocol used to synchronize clocks of networked devices to a time reference provided by an NTP time server, using UDP port 123.
- **Precision Time Protocol (PTP):** PTP, defined in IEEE Std. 1588-2008, takes advantage of special time-stamping Ethernet hardware to distribute a precise time reference over Ethernet, ensuring time accuracies of 100 µs or better. The PTP "grandmaster" broadcasts precise date/time and network delay correction data to PTP slaves using UDP ports 319 (ptp-event) and 320 (ptp-general) via multicast IP address 224.0.1.129. (Applies only to SER models with optional PTP license key.)

Modbus Addressing Conventions

The standard Modbus data model consists of four data tables, and a convention used by most manufacturers is to add a single-digit prefix to indicate register type:

0xxxxx — Discrete Output Coils (000001 to 065536)

1xxxxx — Discrete Input Contacts (100001 to 165536)

3xxxxx — Analog Input Registers (300001 to 365536)

4xxxxx — Analog Output Holding Registers (400001 to 465536)

In this convention, register references use a 1-index, while the actual values used in the data address field of Modbus messages are 0-based (0 to 65535). Thus, a holding register reference number **400201** would be read with function code 03 at data address field **0200**.

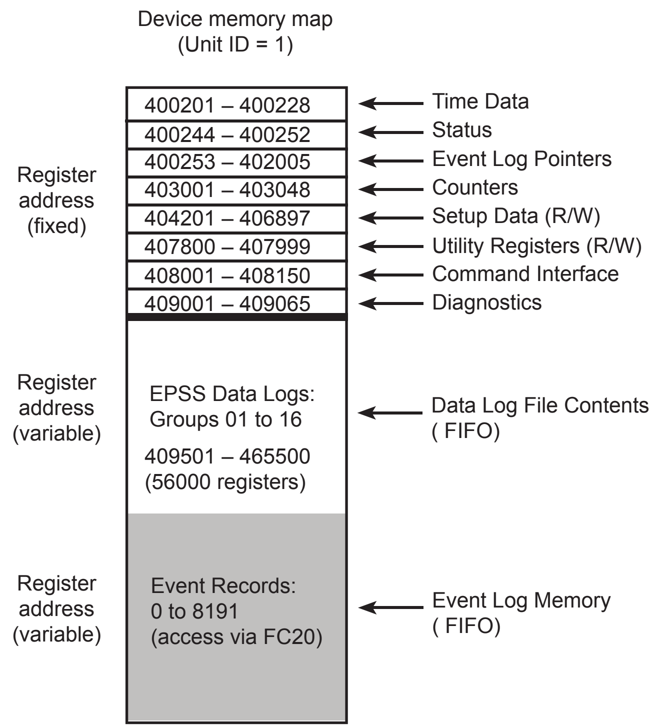
In this document, all Modbus registers are expressed using this de facto convention (single-digit prefix to indicate register type, plus offset of 1 from the data address used in the actual Modbus message).

Modbus Memory Map

Note: The SER-3200 / SER-2408 responds to ID=1 in the "unit identifier" field in the Modbus Application Protocol header.

The CyTime SER-3200 / SER-2408 provides access to real-time data, configuration values and event records via Ethernet using Modbus TCP protocol. The SER supports Modbus function codes 01, 02, 03, 05, 06, 16 and 20. Up to 32 concurrent Modbus TCP connections are supported. All registers in the SER are read-only holding registers unless otherwise noted.

The SER-3200 / SER-2408 features a non-volatile event log for SER applications and a second data logging space for Emergency Power Supply Systems (EPSS) reporting. The Modbus memory map contains all the required data to support both functions, as illustrated below.



Note: In general, data from I/O channels 1 to 32 is organized into contiguous blocks of 32 registers or 32-bit bitmaps, regardless of whether the channels consist of 32 inputs (model SER-3200) or 24 inputs and 8 outputs (SER-2408). In some cases, relay output data is also duplicated separately, and the user has the choice of which register access is best suited to a given software application. The following pages provide details on the register maps for the SER-3200 and SER-2408.

The CyTime SER-3200 / SER-2408 primary register map is organized into a fixed-register section with designated data fields and two variable memory sections—the first for EPSS data logs and the second for event records, accessible using Function Code 20. The EPSS data log area consists of sixteen (16) user-configurable data log groups to enable EPSS reporting. The record size depends on the number of inputs (or outputs) assigned to the group by the user. Up to 56000 registers can be allocated by the user to all data logs.

For sequence of events recording (SER) a total of 8192 events are stored in non-volatile memory; each event record consists of 8 registers. Additional details are provided in the next sections. See the figure above and the next sections for details.

Byte Order

Note: Where applicable, the SER uses "big-endian" encoding, consistent with Modbus standards. That is, the most significant byte or word is stored in the first position, or lowest register. The one exception is the event log—here encoding is reversed ("little-endian") to maintain compatibility with legacy event recorders.

Modbus protocol is based on 16-bit registers, each of which can contain up to 2 bytes. Unsigned values greater than 65535 are encoded as 32-bit integers using 2 registers, 4 bytes total. The order in which these bytes are stored must therefore be known for the data to be retrieved and correctly interpreted. Modbus declares itself as a 'big-endian" protocol, per Modbus Application Protocol Specification, V1.1.b:

"Modbus uses a 'big-endian' representation for addresses and data items. This means that when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first."

Following this convention, the SER stores all values as "big-endian" except where noted otherwise.

A copy of the Modbus protocol specification is available for free download from the Modbus web site: www.modbus-IDA.org.

Date/Time Conventions

The CyTime SER-3200 / SER-2408 provides a user-configurable setting for time-zone offset: the time in hours to add to or subtract from Coordinated Universal Time (UTC) to adjust for local time. All date/time values shown in this document are expressed in local standard time, based on the value for time-zone offset stored in the XML setup file.

The CyTime SER supports adjustments for Daylight Saving Time (DST) or Summer Time (added in firmware version 2.14). However, Cyber Sciences recommends that event timestamps be based exclusively on standard time, since discontinuities introduce potential for confusion and make comparisons of historical values more difficult. If an adjustment for DST is desired, this should be made by application software at the end point of consumption (for display or analysis). This topic is discussed in more detail later in this document.

Three (3) different conventions are used by the SER to store the current date/time, depending on the context:

- **Expanded (7-register) format**, in which each element (year, month, day, hour, minute, second), is stored in a separate register. Example: present date/time, in registers 400203 to 400209.
- **Condensed (3 or 4-register) format**, in which two elements are stored per register (month/day in MSB/LSB, year/hour in next register, etc.). The 4th register (for milliseconds) is optional. See Table 1-1 below for details. Example: present date/time, condensed, in registers 400210 to 400212.
- **Compressed (2-register, 32-bit unsigned integer) format**, in which the date/time is expressed in seconds since the "epoch" date of Jan 1, 1984. Example: SER event log, registers 3 and 4 in each event record.

Note: The accuracy of NTP time sync depends on external factors; therefore, when the SER time source is NTP, the SER uses only two states for Time Quality as follows: Time Quality = "2:OK (NTP)" if locked to a server, or "3: Bad (no sync)" if no NTP server is found.

Table 1-1 – Condensed Date/Time Format (with optional ms)

	High-byte (MSB)	Low-byte (LSB)
register 1	Month (0 - 12)	Day (0 - 31)
register 2	Year (0 - 199) (add 1900)	Hour (0 - 23)
register 3	Minute (0 - 59)	Second (0- 59)
register 4 *(optional)*	Milliseconds (0 - 999)	

Note: To get the year, add 1900 to the value in register 2 high-byte (e.g., a value of 112 in register 2/high-byte represents 112 + 1900 = the year 2012).

2—MODBUS REGISTER LIST

Register	Description	Type	Range	Notes
(ID = 1)	TIME DATA, ACTUAL			
400101	Daylight Saving Time (DST) is in effect	integer	0 or 1	0 = false 1 = true ①
400201	Time source (actual)	integer	0 to 32	0 = None (manual / external) 1 = NTP 2 = IRIG-B 4 = Inter-SER (IRIG-B) 8 = DCF77 16 = Inter-SER (DCF77) 32 = PTP (IEEE 1588)
400203	Present day of week	integer	1 to 7	1 = Sunday, 2 = Monday, etc.
400204	Present month	integer	1 to 12	
400205	Present day of month	integer	1 to 31	
400206	Present year	integer	2000 to 2120	
400207	Present hour	integer	0 to 23	
400208	Present minute	integer	0 to 59	
400209	Present second	integer	0 to 59	
400210 to 400212	Present Date/Time (condensed format)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	Condensed date/time format, without ms (see Table 1-1)
400213	Last NTP sync, day of week	integer	1 to 7	1 = Sunday, 2 = Monday, etc.
400214	Last NTP sync, month	integer	1 to 12	
400215	Last NTP sync, day of month	integer	1 to 31	
400216	Last NTP sync, year	integer	2000 to 2120	
400217	Last NTP sync, hour	integer	0 to 23	
400218	Last NTP sync, minute	integer	0 to 59	
400219	Last NTP sync, second	integer	0 to 59	
400222	Time quality (see note on previous page for time source = NTP)	integer	0 to 3	0 = Good (< 1 ms error) 1 = Fair (< 50 ms error) 2 = Poor (> 50 ms error) 3 = Bad (no time sync)
400225 to 400228	Last NTP sync, server IP address, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
400229	PTP Port State	integer	0 to 9	0 = Not Applicable 1 = Initializing 2 = Faulty 3 = Disabled 4 = Listening 5 = Pre-master 6 = Master 7 = Passive 8 = Uncalibrated 9 = Slave

① *This register is set to 1 (true) if DST is enabled and the current date/time is within the specified DST interval (between start and end date/time).*

Register	Description	Type	Range	Notes
(ID = 1)	TIME DATA, ACTUAL (CONT.)			
400230	PTP Clock Class	integer	0 to 255	00 = Not Applicable 06 = Normal (PTP Timescale) 07 = Holdover (PTP) 13 = Normal (UTC Timescale) 14 = Holdover (UTC) 52 = Out-of-spec (PTP) 58 = Out-of-spec (UTC) 255 = Slave-only
400231	PTP Clock Accuracy	integer	0 to 254	00 (0x00) = Not Applicable 32 (0x20) = 25 ns 33 (0x21) = 100 ns 39 (0x27) = 100 µs 41 (0x29) = 1 ms 43 (0x2B) = 10 ms 45 (0x2D) = 100 ms 47 (0x2F) = 1s 49 (0x31) = >10s 254 (0xFE) = unknown
400232	PTP Clock Source (PTP Time Source)	integer	0 to 255	00 (0x00) = Unknown 16 (0x10) = Atomic clock 32 (0x20) = GPS 64 (0x40) = PTP 80 (0x50) = NTP 96 (0x60) = Hand-set (manual) 144 (0x90) = Other 160 (0xA0) = Internal (none)
400233	PTP License Status	integer	0 to 3	0 = None (no key) 1= Valid PTP license key 2 = Fail (invalid key) 3 = Not applicable
400234	*reserved*			
400235	*reserved*			
400236	PTP communications model	integer	1 or 2	1 = Unicast 2 = Multicast
400237	PTP network transport protocol	integer	0, 1 or 2	0 = UDPv4, 1 = UDPv6, 2 = 802.3 (Layer 2)
400238	PTP operating mode	integer	1 or 2	2 = two-step 1 = one-step
400239	PTP path delay mechanism	integer	0, 1 or 2	0 = disabled 1 = End-to-End (E2E) 2 = Peer-to-Peer (P2P)
400240	PTP announce interval (master)	signed integer	-128 to 127	log-base2 of value in seconds ①
400241	PTP announce receipt time-out (master)	integer	2 to 10	multiple of announce interval
400242	PTP sync interval (master)	signed integer	-128 to 127	log-base2 of value in seconds ①
400243	PTP delay request interval (master)	signed integer	-128 to 127	log-base2 of value in seconds ①

① *Please see Section 8 for more details on the convention used in IEEE 1588 to express interval settings in terms of log-base 2.*

Register	Description	Type	Range	Notes
(ID = 1)	STATUS			
400244	Forced OFF—Channels 1 to 16 (Inputs 1-16)	bitmap	0x0000 – 0xFFFF	0 = Normal, 1 = Forced OFF bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
400245	Forced OFF—Channels 17 to 32 (SER-3200: Inputs 17-32) (SER-2408: Inputs 17-24 and Outputs R1-R8)	bitmap	0x0000 – 0x00FF	0 = Normal, 1 = Forced OFF bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 15 – Output R8
400246	Forced ON—Channels 1 to 16 (Inputs 1-16)	bitmap	0x0000 – 0xFFFF	0 = Normal, 1 = Forced ON bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
400247	Forced ON—Channels 17 to 32 (SER-3200: Inputs 17-32) (SER-2408: Inputs 17-24 and Outputs R1-R8)	bitmap	0x0000 – 0x00FF	0 = Normal, 1 = Forced ON bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 15 – Output R8
400248	Inversion of Inputs (Inputs 1-16)	bitmap	0x0000 – 0xFFFF	0 = Normal, 1 = Inverted bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
400249	Inversion of Inputs (SER-3200: Inputs 17-32) (SER-2408: Inputs 17-24)	bitmap	0x0000 – 0x00FF	0 = Normal, 1 = Inverted bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 07 – Input 24

Register	Description	Type	Range	Notes
(ID = 1)	STATUS			
400250	Status—Outputs R1 through R8 and Virtual Relays VR9 through VR16 ① (SER-2408 only)	bitmap	0x0000 – 0x00FF	0 = OFF, 1 = ON bit 00 – Output R1 bit 01 – Output R2 bit 02 – Output R3 : bit 07 – Output R8 bit 08 – Output VR9 bit 09 – Output VR10 bit 10 – Output VR11 : bit 15 – Output VR16
400251	Status—Channels 1 to 16 (Inputs 1-16)	bitmap	0x0000 – 0xFFFF	0 = OFF, 1 = ON bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
400252	Status—Channels 17 to 32 (SER-3200: Inputs 17-32) (SER-2408: Inputs 17-24 and Outputs R1-R8)	bitmap	0x0000 – 0x00FF	0 = OFF, 1 = ON bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 07 – Input 24
	EVENT LOG REGISTERS			
400253	Number of events in event log	integer	1 to 8192	
400254	Position of first event record	integer	0 to 8191	
400255	Position of last event record	integer	0 to 8191	
400256 to 400257	Sequence number of last event record	32-bit integer	0 to 4,294,967,295	note: reg 400256 = high word (big-endian—MSW first)
	EVENT LOG REGISTERS (Duplicate set)			
402001	Number of events in event log	integer	1 to 8192	
402002	Position of first event record	integer	0 to 8191	
402003	Position of last event record	integer	0 to 8191	
402004 to 402005	Sequence number of last event record	32-bit integer	0 to 4,294,967,295	note: reg 402004 = high word (big-endian—MSW first)

① *Outputs 9-16 are "virtual relays," they are controlled via Modbus for event logging only and do not control any physical outputs.*

Register	Description	Type	Range	Notes
(ID = 1)	DATA LOG FILE TABLE OF CONTENTS LOCATIONS			
402020	Group 01		(see below)	block of 20 registers total
402040	Group 02			
402060	Group 03			
402080	Group 04			
402100	Group 05			
402120	Group 06			
402140	Group 07			
402160	Group 08			
402180	Group 09			
402200	Group 10			
402220	Group 11			
402240	Group 12			
402260	Group 13			
402280	Group 14			
402300	Group 15			
402320	Group 16			
	DATA LOG FILE TOC DETAILS (typical for 16)			
base + 0	File Header Location (register number)	integer	9501 to 65535 (409501 to 465535)	starting register number of header for a given group (65535 = log file not used)
base + 1	File Type	integer	0 or 1	fixed = 1 (data log)
base + 2	File Size (total allocated), in records	integer	0 to 14000	
base + 3	Record Length (Number of registers per record)	integer	5 to 14	max group members = 10
base + 4	File Mode	integer	fixed = 1	1 = FIFO
base + 5	Record Entry Enable/Disable	integer	0x0000 to 0xFFFF	0x0000 = disabled 0xFFFF = enabled
base + 6	Entry Update Interval	integer	0 to 65535	not used (fixed = 0)
base + 7	Entry Interval Offset Time	integer	0 to 65535	not used (fixed = 0)
base + 8	Current No. of Records in File	integer	0 to 14000	
base + 9	Current First Record Sequence	integer	0 to 14000	pointer—oldest s/n
base + 10	Current Last Record Sequence	integer	0 to 14000	pointer—latest s/n
base + 11 to 13	Date/Time of Last File Reset/Clear (if event log cleared or EPSS data logs re-configured)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	Condensed date/time format, without ms (see Table 1-1)
base + 14	File Size (total allocated), in records	integer	0 to 14000	(same as base + 2)
base + 15	Record Length (Number of registers per record)	integer	5 to 14	(same as base + 3)
base + 16	File Status (actual vs. allocated)	integer	0 to 255	0 = ok 1 = internal failure 255 = file disabled due to invalid configuration
base + 17	Data Location (starting register number of data)	integer	9501 to 65535 (409501 to 465535)	starting register number for the file's data (after header)

Register	Description	Type	Range	Notes
(ID = 1)	OPERATIONS COUNTERS			
403001	Counter—Channel 01 (Input 01)	integer	0 to 65535	
403002	Counter—Channel 02 (Input 02)	integer	0 to 65535	
403003	Counter—Channel 03 (Input 03)	integer	0 to 65535	
403004	Counter—Channel 04 (Input 04)	integer	0 to 65535	
403005	Counter—Channel 05 (Input 05)	integer	0 to 65535	
403006	Counter—Channel 06 (Input 06)	integer	0 to 65535	
403007	Counter—Channel 07 (Input 07)	integer	0 to 65535	
403008	Counter—Channel 08 (Input 08)	integer	0 to 65535	
403009	Counter—Channel 09 (Input 09)	integer	0 to 65535	
403010	Counter—Channel 10 (Input 10)	integer	0 to 65535	
403011	Counter—Channel 11 (Input 11)	integer	0 to 65535	
403012	Counter—Channel 12 (Input 12)	integer	0 to 65535	
403013	Counter—Channel 13 (Input 13)	integer	0 to 65535	
403014	Counter—Channel 14 (Input 14)	integer	0 to 65535	
403015	Counter—Channel 15 (Input 15)	integer	0 to 65535	
403016	Counter—Channel 16 (Input 16)	integer	0 to 65535	
403017	Counter—Channel 17 (Input 17)	integer	0 to 65535	
403018	Counter—Channel 18 (Input 18)	integer	0 to 65535	
403019	Counter—Channel 19 (Input 19)	integer	0 to 65535	
403020	Counter—Channel 20 (Input 20)	integer	0 to 65535	
403021	Counter—Channel 21 (Input 21)	integer	0 to 65535	
403022	Counter—Channel 22 (Input 22)	integer	0 to 65535	
403023	Counter—Channel 23 (Input 23)	integer	0 to 65535	
403024	Counter—Channel 24 (Input 24)	integer	0 to 65535	
403025	Counter—Channel 25 (Input 25 or Output R1)	integer	0 to 65535	
403026	Counter—Channel 26 (Input 26 or Output R2)	integer	0 to 65535	
403027	Counter—Channel 27 (Input 27 or Output R3)	integer	0 to 65535	
403028	Counter—Channel 28 (Input 28 or Output R4)	integer	0 to 65535	
403029	Counter—Channel 29 (Input 29 or Output R5)	integer	0 to 65535	
403030	Counter—Channel 30 (Input 30 or Output R6)	integer	0 to 65535	
403031	Counter—Channel 31 (Input 31 or Output R7)	integer	0 to 65535	
403032	Counter—Channel 32 (Input 32 or Output R8)	integer	0 to 65535	

Register	Description	Type	Range	Notes
(ID = 1)	DATE/TIME OF LAST RESET, COUNTERS			
403301 to 403303	Date/Time of Last Reset—Channel 01 (Input 01)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	See Table 1-1 for details
403304 to 403306	Date/Time of Last Reset—Channel 02 (Input 02)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403307 to 403309	Date/Time of Last Reset—Channel 03 (Input 03)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403310 to 403312	Date/Time of Last Reset—Channel 04 (Input 04)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403313 to 403315	Date/Time of Last Reset—Channel 05 (Input 05)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403316 to 403318	Date/Time of Last Reset—Channel 06 (Input 06)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403319 to 403321	Date/Time of Last Reset—Channel 07 (Input 07)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403322 to 403324	Date/Time of Last Reset—Channel 08 (Input 08)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403325 to 403327	Date/Time of Last Reset—Channel 09 (Input 09)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403328 to 403330	Date/Time of Last Reset—Channel 10 (Input 10)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403331 to 403333	Date/Time of Last Reset—Channel 11 (Input 11)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403334 to 403336	Date/Time of Last Reset—Channel 12 (Input 12)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403337 to 403339	Date/Time of Last Reset—Channel 13 (Input 13)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403340 to 403342	Date/Time of Last Reset—Channel 14 (Input 14)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403343 to 403345	Date/Time of Last Reset—Channel 15 (Input 15)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403346 to 403348	Date/Time of Last Reset—Channel 16 (Input 16)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	

Register	Description	Type	Range	Notes
(ID = 1)	DATE/TIME OF LAST RESET, COUNTERS (CONT.)			
403349 to 403351	Date/Time of Last Reset—Channel 17 (Input 17)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	See Table 1-1 for details
403352 to 403354	Date/Time of Last Reset—Channel 18 (Input 18)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403355 to 403357	Date/Time of Last Reset—Channel 19 (Input 19)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403358 to 403360	Date/Time of Last Reset—Channel 20 (Input 20)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403361 to 403363	Date/Time of Last Reset—Channel 21 (Input 21)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403364 to 403366	Date/Time of Last Reset—Channel 22 (Input 22)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403367 to 403369	Date/Time of Last Reset—Channel 23 (Input 23)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403370 to 403372	Date/Time of Last Reset—Channel 24 (Input 24)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403373 to 403375	Date/Time of Last Reset—Channel 25 (Input 25 or Output R1)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403376 to 403378	Date/Time of Last Reset—Channel 26 (Input 26 or Output R2)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403379 to 403381	Date/Time of Last Reset—Channel 27 (Input 27 or Output R3)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403382 to 403384	Date/Time of Last Reset—Channel 28 (Input 28 or Output R4)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403385 to 403387	Date/Time of Last Reset—Channel 29 (Input 29 or Output R5)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403388 to 403390	Date/Time of Last Reset—Channel 30 (Input 30 or Output R6)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403391 to 403393	Date/Time of Last Reset—Channel 31 (Input 31 or Output R7)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	
403394 to 403396	Date/Time of Last Reset—Channel 32 (Input 32 or Output R8)	3-register date/time	Jan 1, 2000 to Dec 31, 2120	

Register	Description	Type	Range	Notes
(ID = 1)	SETUP DATA—COMMUNICATIONS			
404010	Ethernet media type	integer	0 to 4	0 = 10/100BaseTx Auto 1 = 10BaseT Half Duplex 2 = 10BaseT Full Duplex 3 = 100BaseTx Half Duplex 4 = 100BaseTx Full Duplex
404011	DHCP enabled	integer	0 or 1	0 = disabled 1 = enabled
404012 to 404015	IP address, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
404016 to 404019	Subnet mask, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
404020 to 404023	Default gateway, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
404024 to 404050	*reserved*			
404051	FTP server enabled	integer	0 or 1	0 = disabled 1 = enabled
404052 to 404101	*reserved*			
404102 to 404107	Device ID (12 characters, 6 registers)	character array		
404108 to 404123	Device name (32 characters, 16 registers)	character array		

Register	Description	Type	Range	Notes
(ID = 1)	SETUP DATA—TIME			
404191	Daylight Saving Time (DST) adjustment	integer	0 or 1	0 = disabled 1 = enabled
404192	DST start—month	integer	1 to 12	1 = January, 2 = February, etc.
404193	DST start—week	integer	1 to 5	1st, 2nd, 3rd, 4th or 5th
404194	DST start—day of the week	integer	1 to 7	1 = Sunday, 2 = Monday, etc.
404195	DST start—time (hour)	integer	0 to 23	0 = 00:00 (midnight)
404196	DST end—month	integer	1 to 12	1 = January, 2 = February, etc.
404197	DST end—week	integer	1 to 5	1st, 2nd, 3rd, 4th or 5th
404198	DST end—day of the week	integer	1 to 7	1 = Sunday, 2 = Monday, etc.
404199	DST end—time (hour)	integer	0 to 23	0 = 00:00 (midnight)
404201	Time source (user setting)	integer	0, 1, 2, 3, 4, 5 or 7	0 = IRIG-B (5V DCLS via EZC) 1 = IRIG-B (over RS-485) 2 = NTP 3 = None (manual or external) 4 = DCF77 (24V DCLS via EZC) 5 = DCF77 (over RS-485) 7 = PTP (IEEE 1588) slave
404202	Time sync master (OUT)	integer	0 or 1	0 = disabled 1 = enabled
404203	Time zone offset	integer	-1200 to +1300	Divide by 100 to get hours
404204	Hourly test event (formerly called hourly time update)	integer	0 or 1	0 = disabled 1 = enabled
404205	Time zone offset: Apply to PLX (IRIG-B, DCF77 or 1per10 time-sync output)	integer	0 or 1	0 = disabled 1 = enabled
404206	Time zone offset: Apply to ASCII (RS-485)	integer	0 or 1	0 = disabled 1 = enabled
404207	Alternate date format	integer	0 or 1	0 = disabled (mm/dd/yyyy) 1 = enabled (dd/mm/yyyy)
404211 to 404214	Primary NTP time server IP address, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
404215 to 404218	Secondary NTP time server IP address, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
404219	NTP poll interval, in minutes	integer	1 to 10080	1, 2, 5, 10, 15, 30, 60, 120, 240, 480, 720, 1440, 10080 (minutes)
404220	Time sync output (if time sync master enabled)	integer	0, 4, 6, 7, 8, 9 or 10	0 = IRIG-B (over RS-485) 4 = DCF77 (over RS-485) 6 = ASCII (over RS-485) 7 = PTP (IEEE 1588) master 8 = IRIG-B (via PLX) 9 = DCF77 (via PLX) 10 = 1per10 (via PLX)

Register	Description	Type	Range	Notes
(ID = 1)	SETUP DATA—TIME (CONT.)			
404221	PTP version	integer	2 (fixed)	IEEE 1588-2008 (v2)
404222 to 404224	PTP Profile ID	hex	00-1B-19-00-01-00 (fixed)	IEEE 1588 E2E Default Profile (Annex J)
404225	PTP domain number	integer	0 to 127	(default = 0)
404226	PTP communications model	integer	2 (fixed)	1 = Unicast 2 = Multicast
404227	PTP network transport protocol	integer	0 (fixed)	0 = UDPv4, 1 = UDPv6, 2 = 802.3 (Layer 2)
404228	PTP operating mode	integer	2 (fixed)	2 = two-step 1 = one-step
404229	PTP path delay mechanism	integer	1 (fixed)	1 = End-to-End (E2E) 2 = Peer-to-Peer (P2P)
404230	PTP announce interval (master)	signed integer	1 (fixed = 2 sec)	log-base2 of value in seconds ①
404231	PTP announce receipt time-out (master)	integer	3 (fixed)	multiple of announce interval
404232	PTP sync interval (master)	signed integer	0 (fixed = 1 sec)	log-base2 of value in seconds ①
404233	PTP delay request interval (master)	signed integer	5 (fixed = 32 sec)	log-base2 of value in seconds ①
404234	PTP packet time to live (TTL)	integer	64 (fixed)	
404235	PTP priority1	integer	0 to 255	PTP master only
404236	PTP priority2	integer	0 to 255	PTP master only
	SETUP DATA—INPUTS/OUTPUTS			
404248	Inputs—inverted (Inputs 1-16)	bitmap	0x0000 – 0xFFFF	0 = Normal, 1 = Inverted bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
404249	Inputs—inverted (SER-3200: Inputs 17-32) (SER-2408: Inputs 17-24)	bitmap	0x0000 – 0x00FF	0 = Normal, 1 = Inverted bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 15 – Input 32
404250	Event recording—Outputs R1 through R8 (SER-2408 only)	bitmap	0x0000 – 0x00FF	0 = disabled, 1 = enabled bit 00 – Output R1 bit 01 – Output R2 bit 02 – Output R3 : bit 07 – Output R8

① *Please see Section 8 for more details on the convention used in IEEE 1588 to express interval settings in terms of log-base 2.*

Register	Description	Type	Range	Notes
(ID = 1)	SETUP DATA— INPUTS/OUTPUTS (CONT.)			
404251	Event recording—Channels 1 to 16 (Inputs 1-16)	bitmap	0x0000 – 0xFFFF	0 = disabled, 1 = enabled bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
404252	Event recording—Channels 17 to 32 (SER-3200: Inputs 17-32) (SER-2408: Inputs 17-24 and Outputs R1-R8)	bitmap	0x0000 – 0x00FF	0 = disabled, 1 = enabled bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 15 – Input 32
404302 to 404333	Inputs 1 to 32—Filter, in ms	integer	0 to 65535	0 = disabled
404334 to 404365	Inputs 1 to 32—Debounce, in ms	integer	0 to 65535	0 = disabled
404366 to 404397	Inputs 1 to 32—Chatter count	integer	0 to 255	0 = disabled
404402 to 404913	Inputs 1 to 32—Input names (32 characters, 16 registers each)	character array		(SER-2408: last 8 channel data is for output names)
405002 to 405257	Inputs 1 to 32—off text (16 characters, 8 registers each)	character array		(SER-2408: last 8 channel data is for output names)
405302 to 405557	Inputs 1 to 32—on text (16 characters, 8 registers each)	character array		(SER-2408: last 8 channel data is for output names)
405651	High-speed trigger output—Inputs 1 to 16	bitmap	0x0000 – 0xFFFF	0 = disabled, 1 = enabled bit 00 – Input 1 bit 01 – Input 2 bit 02 – Input 3 : bit 15 – Input 16
405652	High-speed trigger output—Inputs 17 to 32 (SER-2408: Inputs 17 to 24)	bitmap	0x0000 – 0x00FF	0 = disabled, 1 = enabled bit 00 – Input 17 bit 01 – Input 18 bit 02 – Input 19 : bit 15 – Input 32
406001 to 406128	Outputs R1 to R8—Output names (32 characters, 16 registers each)	character array		(SER-2408 only)
406257 to 406384	Outputs R1 to R8—off text (16 characters, 8 registers each)	character array		(SER-2408 only)
406513 to 406640	Outputs R1 to R8—on text (16 characters, 8 registers each)	character array		(SER-2408 only)

Register	Description	Type	Range	Notes
(ID = 1)	SETUP—INPUTS/OUTPUTS LOG GROUP (CONT.)			
406641	Input 01: Log Group	integer	0 to 32768	0 = None Assigned 1 = Log Group 1 2 = Log Group 2 4 = Log Group 3 8 = Log Group 4 16 = Log Group 5 : 32768 = Log Group 16
406642	Input 02: Log Group	integer	0 to 32768	
406643	Input 03: Log Group	integer	0 to 32768	
406644	Input 04: Log Group	integer	0 to 32768	
406645	Input 05: Log Group	integer	0 to 32768	
406646	Input 06: Log Group	integer	0 to 32768	
406647	Input 07: Log Group	integer	0 to 32768	
406648	Input 08: Log Group	integer	0 to 32768	
406649	Input 09: Log Group	integer	0 to 32768	
406650	Input 10: Log Group	integer	0 to 32768	
406651	Input 11: Log Group	integer	0 to 32768	
406652	Input 12: Log Group	integer	0 to 32768	
406653	Input 13: Log Group	integer	0 to 32768	
406654	Input 14: Log Group	integer	0 to 32768	
406655	Input 15: Log Group	integer	0 to 32768	
406656	Input 16: Log Group	integer	0 to 32768	
406657	Input 17: Log Group	integer	0 to 32768	
406658	Input 18: Log Group	integer	0 to 32768	
406659	Input 19: Log Group	integer	0 to 32768	
406660	Input 20: Log Group	integer	0 to 32768	
406661	Input 21: Log Group	integer	0 to 32768	
406662	Input 22: Log Group	integer	0 to 32768	
406663	Input 23: Log Group	integer	0 to 32768	
406664	Input 24: Log Group	integer	0 to 32768	
406665	Input 25 OR Output R1: Log Group	integer	0 to 32768	
406666	Input 26 OR Output R2: Log Group	integer	0 to 32768	
406667	Input 27 OR Output R3: Log Group	integer	0 to 32768	
406668	Input 28 OR Output R4: Log Group	integer	0 to 32768	
406669	Input 29 OR Output R5: Log Group	integer	0 to 32768	
406670	Input 30 OR Output R6: Log Group	integer	0 to 32768	
406671	Input 31 OR Output R7: Log Group	integer	0 to 32768	
406672	Input 32 OR Output R8: Log Group	integer	0 to 32768	

Register	Description	Type	Range	Notes
(ID = 1)	SETUP DATA—GROUPS			
406740	Total number of groups (as enabled by user)	integer	0 to 16	
406741	Groups 1 to 16 – EPSS data logging disabled/enabled	bitmap	0x0000 – 0xFFFF	0 = disabled, 1 = enabled bit 00 – Group 1 bit 01 – Group 2 bit 02 – Group 3 : bit 15 – Group 16
406742 to 406997	Groups 1 to 16 – Group names (32 characters, 16 registers each)	character array		
	UTILITY REGISTERS			
407800 to 407999	Mailbox registers (read/write) for customer use (total of 200 16-bit registers)			
	COMMAND INTERFACE			
408001	Command register (used to initiate all commands)	integer	0 to 65535	See Section 4 for details
408002 to 408150	Additional registers for control parameters or returned data	integer	0 to 65535	
	COMPATIBILITY REGISTERS			
000001 to 400198	Registers supported for backwards compatibility with some legacy devices (by other manufacturers)			See Section 2 for details

Register	Description	Type	Range	Notes
(ID = 1)	DIAGNOSTICS			
409001	Device ID code	integer	2408 or 3200	2408 = SER-2408 3200 = SER-3200
409002	Catalog number code	integer	1 to 42	1 = SER-3200-P2X2 32 = SER-3200-32GB 24 = SER-2408-P2X2 25 = SER-2408-32GB 41 = SER-3200-PTP 42 = SER-2408-PTP
409003	Hardware version	hex	A0 to FF	
409004	Firmware version, event processor	integer	100 to 999	Divide value by 100
409005	Firmware version, time processor	integer	100 to 999	Divide value by 100
409006	Firmware version, system processor	integer	100 to 999	Divide value by 100
409007	Date of manufacture, month	integer	1 to 12	
409008	Date of manufacture, year	integer	2000 to 2120	
409009	Firmware version, consolidated (max of all 3)	integer	100 to 999	Divide value by 100
409010	Ethernet media type (actual)	integer	1 to 4	1 = 10BaseT Half Duplex 2 = 10BaseT Full Duplex 3 = 100BaseTx Half Duplex 4 = 100BaseTx Full Duplex
409011	IP address type: static or dynamic (actual)	integer	0 or 1	0 = static, 1 = dynamic
409012 to 409015	IP address, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
409016 to 409019	Subnet mask, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
409020 to 409023	Default gateway, octet 1 to 4 (MSB to LSB)	integer	0 to 255	
409024 to 409025	Serial number ①	32-bit integer	0 to 4,294,967,295	note: reg 409024 = high word (big-endian—MSW first)
409042 to 409047	MAC address (MSB to LSB)	hex	0x0000 to 0xFFFF	format hh-hh-hh-hh-hh-hh
409048	TCP sockets, number used	integer	0 to 44	
409049	TCP sockets, number free	integer	0 to 44	
409050	Firmware build number (internal use)	integer	0 to 65535	

① *Added in firmware version 2.11.*

Register	Description	Type	Range	Notes
(ID = 1)	DIAGNOSTICS			
409051	Device diagnostics, self-test results	bitmap	0x0000 – 0xFFFF	0 = normal, 1 = error bit 00 – set to "1" if any failure bit 01 – error, event processor bit 02 – error, time processor bit 03 – error, system proc. bit 04 – DHCP failed bit 05 -- NTP server not found bit 06 – SD card error bit 07 – Invalid XML setup file bit 08 – PTP license key fail bit 09 – *reserved* bit 10 – *reserved* : bit 15 – *reserved*
409052	Device diagnostics, relay outputs (SER-2408 only)	bitmap	0x0000 – 0xFFFF	0 = normal, 1 = error bit 00 – set to "1" if any failure bit 01 – R1 bit 02 – R2 bit 03 – R3 bit 04 – R4 bit 05 – R5 bit 06 -- R6 bit 07 – R7 bit 08 – R8 (bits 01–08: control failed: commanded state does not match actual state) bit 09 – 24V not ok (R1-R4) bit 10 – 24V not ok (R5-R8) bit 11 – Relay load error bit 12 – Over temperature bit 13 – *reserved* bit 14 – *reserved* bit 15 – *reserved*
409061	SD card, scale factor for registers 409061 – 409062	integer	1 or 1024	1 (default) or 1024 (-32GB option)
409062 to 409063	SD card, total memory, in bytes (MSW, LSW) (multiply by scale factor)	32-bit integer	0 to 4,294,967,295	note: reg 409062 = high word (MSW first);
409064 to 409065	SD card, free space, in bytes (MSW, LSW) (multiply by scale factor)	32-bit integer	0 to 4,294,967,295	note: reg 409064 = high word (MSW first);
409201 to 409299	*reserved for factory use*			

3—ACCESSING THE SER EVENT LOG

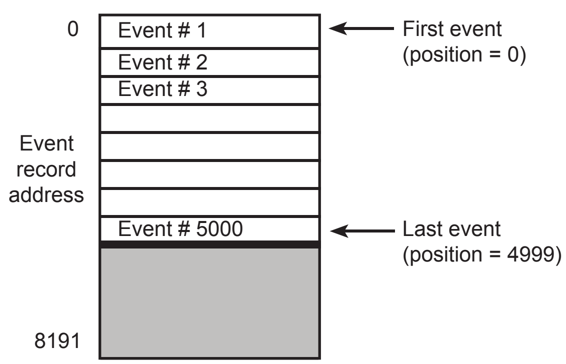
Event Log Contents

The CyTime SER-3200 / SER-2408 features an event log file system containing up to 8192 event records. Each record consists of 8 registers describing the event:

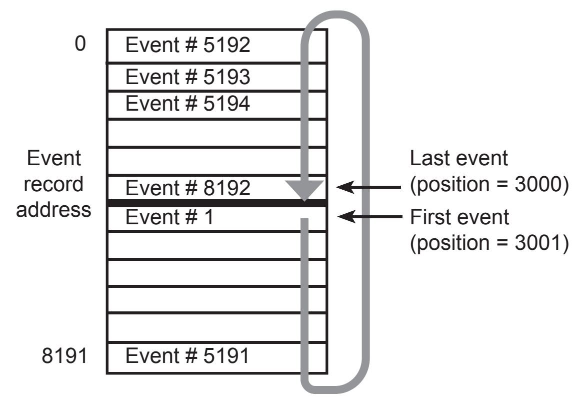
- date and time of the event (adjusted for local time, if applicable)
- input name
- event type
- input status
- time quality at time of the event
- unique record sequence number

File Record Access

The primary method for retrieving SER events is "file record access" using Modbus function code 20. The SER event log memory stores event records in "circular" fashion, rolling over after 8192 events, in a first-in-first-out (FIFO) stack. The total number of events is stored in holding register 402001, with record pointers in 402002 and 402003. First, these values are read (e.g., function code 03), then event records are accessed one at a time using function code 20, starting with the first event record position (from register 402002) through 8191, and starting over at 0, if necessary, up to the last event record position (stored in register 402003). To ensure reliable software access even after rollover (excess of 8192 events), the sequence number of last event record (registers 402004-402005) may be read periodically as well.



Example 1:
Total # of events = 5000



Example 2:
Total # of events = 8192

Table 3-1 – File Record Access (FC 20) Example

Description	Bytes	Request (hex)	Notes
Modbus Function Code 20	1 byte	0x14	function code 20 (hex 14) for file record access
Byte count	1 byte	0x07	always 0x07
Reference type	1 byte	0x06	always 0x06
File number	2 bytes	0x0001	always 0x0001
Record number	2 bytes	0x0000 to 0x1FFF	record position number of event to be read (based on value in register 402002: starting position)
Record length	2 bytes	0x0008	always 0x0008 (8 registers)

Event Log Registers

Registers 402001 through 402005 are read using Modbus function code 03, while event records (8 registers per event record) are read using Modbus function code 20 for efficient file record access.

Table 3-2 – Event Log Registers

Register	Description	Type	Range	Notes
(ID = 1)	EVENT LOG REGISTERS			
402001	Number of events in event log	integer	1 to 8192	
402002	Position of first event record	integer	0 to 8191	
402003	Position of last event record	integer	0 to 8191	
402004 to 402005	Sequence number of last event record	32-bit int	0 to 4,294,967,295	note: reg 402004 = high word (big-endian—MSW first)
	EVENT LOG FILE RECORD (TYPICAL FOR 8192)			
1	Event description, part 1	bitmap	0x0000 – 0xFFFF	bit 00 – bit 04: event type, 0 to 31 (see event codes) bit 05 – bit 09: SER-3200: 0 to 31 = inputs 1 - 32; SER-2408: 0 to 23 = inputs 1 - 24, 24 to 31 = R1 - R8, 8 to 15 = VR9 - VR16 bit 10 — Input/Output status (0 = OFF, 1 = ON) bit 11 — DST (0 = STD, 1 = DST) bit 12 – bit 15: reserved
2	Event description, part 2	bitmap	0x0000 – 0xFFFF	bit 00 – bit 09: ms, 0 to 999 bit 10 – bit 12: reserved bit 13 — always = 0 bit 14 – bit 15: time quality, 0 to 3 0 = good (< 1 ms) 1 = fair (< 50 ms) 2 = poor (> 50 ms) 3 = bad (unknown)
3 and 4	No. of seconds since Jan 1, 1984 (LSW, MSW)	32-bit int	0 to 4,294,967,295	note: reg 3 = low word (little-endian—LSW first)
5 and 6	Event sequence number (LSW, MSW)	32-bit int	0 to 4,294,967,295	note: reg 5 = low word (little-endian—LSW first)
7 and 8	Event Timestamp Record. Register 7 contains events from input 1-16. (bit 15 is input 1, whereas bit 00 is input 16) Register 8 contains events from input 17-32. (bit 15 is input 17, whereas bit 00 is input 32)			

Record Sequence Numbers

Unique sequence numbers are assigned to each event record in the file, ranging from 0 to 4,294,967,295. Sequence numbers may be useful with application software to verify the sequence of event data uploaded over a period of time, even if the SER event record rolls over internally after its 8192 limit. In addition, if the event log is cleared, the unique sequence numbers distinguish new events from those previously recorded.

Event Codes

The event codes shown below are used in the event log file record to describe the type of event recorded by the SER.

Table 3-3 – Event Codes

Event Code	Type
0	Output Status Change (Off to ON, On to OFF) ③
1	Input Status Change (Off to ON, On to OFF)
2	Input (or Output) Enabled for Event Recording (by User)
3	Input (or Output) Disabled for Event Recording (by User)
4	Input Chatter Count Off (Event Recording Resumed)
5	Input Chatter Count On (Event Recording Suspended)
6	Power On
7	SER Inter-Device (RS-485) Time Sync Lock
8	SER Inter-Device (RS-485) Time Sync Fail
9	Internal Error
10	Event Log Cleared
11	*reserved*
12	*reserved*
13	Hourly Test Event (formerly called Hourly Time Update)
14	Manual Time Set ①
15	Setup Configuration Changed
16	Daylight Saving Time (DST) Start/End Switchover
17	Reset
18	*reserved*
19	Power Fail
20	PTP / NTP Time Sync Lock ①④
21	PTP / NTP Time Sync Fail ①④
22	Time Sync Lock (IRIG-B or DCF77) ②
23	Time Sync Fail (IRIG-B or DCF77) ②
24	Test Mode ON
25	Test Mode OFF
26	High-Speed Trigger Out
27	Test Mode Input Status Change (Forced OFF or ON)
28	Test Mode Output Status Change (Forced OFF or ON) ③
29 to 31	*reserved*

① *Added in version 1.10 (with support for NTP and manual/external time sync)*
② *Changed in version 1.51 (with support for DCF77)*
③ *Added in version 2.00 (SER-2408 only)*
④ *Changed in version 2.10 (with support for PTP)*

Type 2 Buffer (Compatibility Mode)

Note: with this method, only one master may retrieve event records, since the event log is cleared as events are read. This does not affect access to event log using File Record Access method (FC 20) described previously.

To maintain backwards compatibility with some legacy devices, the CyTime SER supports an additional method for retrieving event records. The table below shows the registers used (ID=1). The procedure is as follows:

1. Read coil (FC 01) at address 000001 until a "1" is returned.
2. Next, read holding register (FC 03) at address 400103 to get the total number of events in buffer (0 to 22).
3. Then read holding registers 400111 through 400198 (or fewer if buffer contains less than 22 events).
4. Once buffer contents read, write a "1" to coil at address 000002 (FC 05).
5. Begin reading coil 000001 again until value is set to "1"
6. Repeat process until all events are retrieved.

Table 3-4 – Compatibility Registers

Register	Description	Type	Range	Notes
(ID = 1)	COMPATIBILITY REGISTERS			
000001	Data buffer ready	bit (coil)	0 or 1	value of "1" indicates "ready"
000002	Data buffer acknowledge	bit (coil)	0 or 1	write "1" to clear buffer
400102	Buffer type	integer	2	
400103	Number of events in buffer	integer	0 to 22	
400111 to 400198	Event data (4 registers per event record)	bitmap, 32-bit int	---	see table with event log registers, reg 1 to 4

4—ACCESSING EPSS DATA LOGS

EPSS Data Log Overview

The CyTime SER-3200 / SER-2408 has 16 data log files each containing a variable number of event records. Each record consists of at least 5 registers describing the event, depending on the number of inputs (and outputs) in the data log group:

- date and time of the event (adjusted for local time, 4 registers)
- input or output status at time of event (one register per group member)

Unlike the SER event log, the EPSS data logs record the details of an input or output whose status changes and *also* the status of all group members at the time of the event. This can be used by EPSS software to report the status change of one group member to trigger an event, such as an ATS switching to emergency power, while simultaneously reporting the condition of associated equipment in the emergency power supply system.

The data log structure for EPSS report data consists of up to 16 data log groups, each of which can be allocated a variable number of registers, up to a total of 56,000 for all log files. Data log file table of contents (TOC) are stored in fixed locations beginning with register number 402020. Each log file's TOC contains information describing the file's contents, including pointers to a header record at the beginning of each file which, in turn, contains the registers pointing to the status of group members. Refer to the diagram below for an explanation of this file structure.

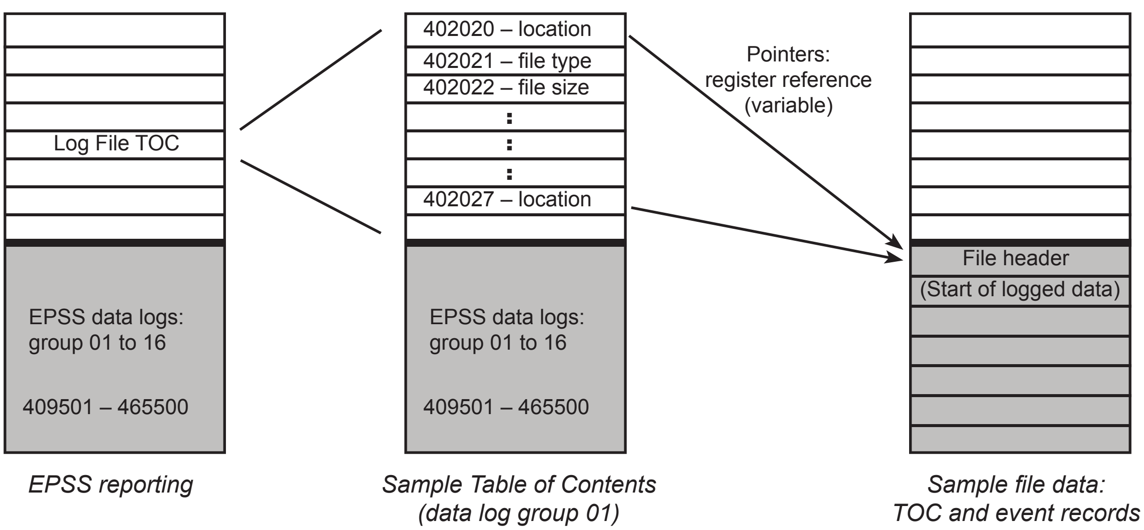


Fig 4–1. EPSS data file structure: overview

EPSS Data Log File Structure

The SER-3200 / SER-2408 EPSS data log structure is composed of variable-length records, depending on the number of inputs or outputs assigned to a data log group. Each data file location (starting register number) is specified in the file's "Table of Contents" (TOC). The first record in each EPSS data log file is a header record matching the register structure of all data records, but its values contain the channel number(s) whose status values are stored.

Legend

Header = Header record which defines the contents of data records
Record Length (RL) = 4 registers (for date/time) + 1 to 10 registers (1 per group member)
Allocated File Size (AFS) = Total number of registers per log group allocated by user
File Size (FS) = Actual number of registers used (equals "no. of records + 1" x RL)

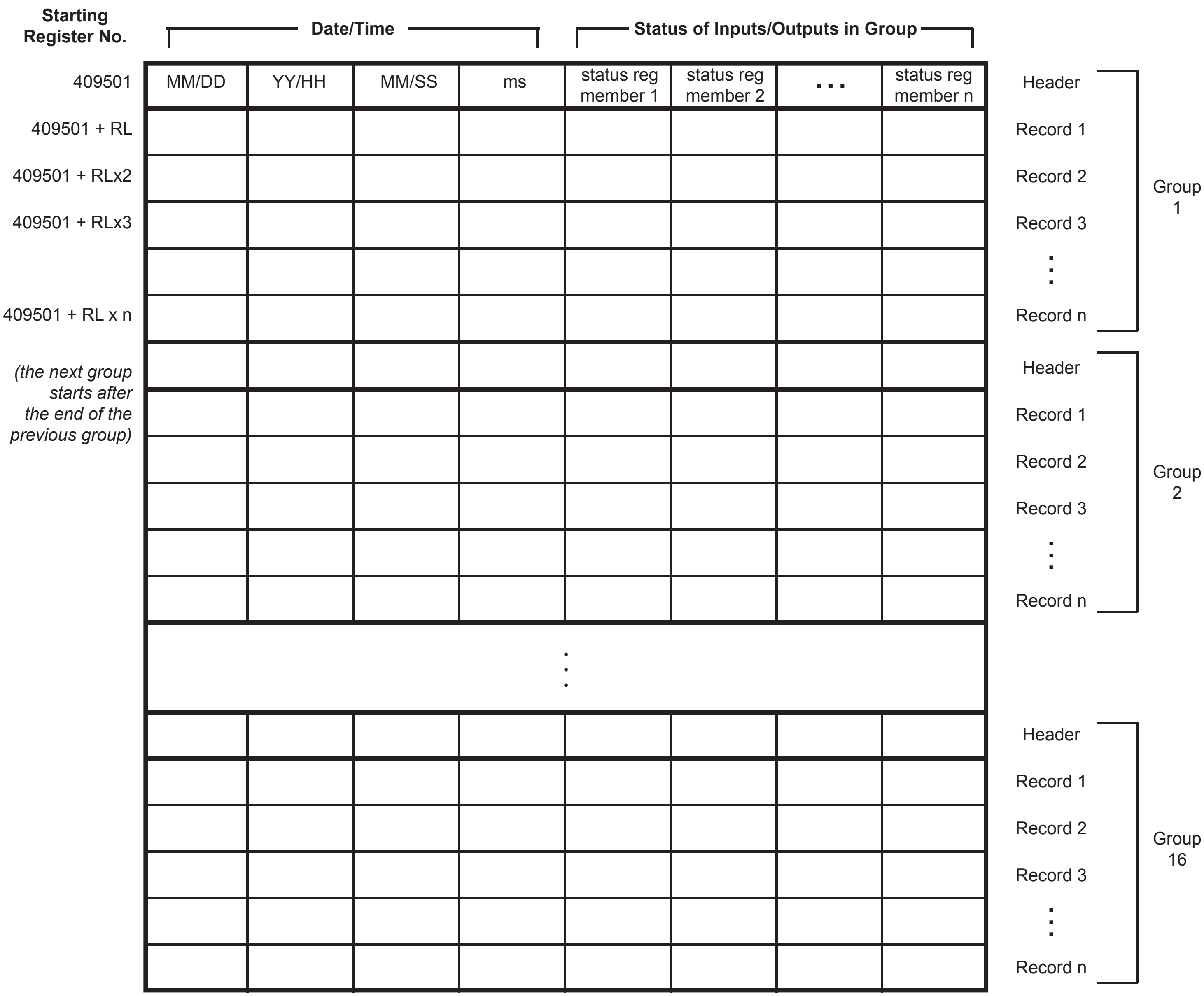


Fig 4–2. EPSS data log structure

5—COMMAND INTERFACE

Description

The CyTime SER-3200 / SER-2408 provides a command interface to support selected control actions over an Ethernet communications network using Modbus TCP. Single- or multiple-register writes are supported (Function Codes 06 or 16, respectively).

Table 5-1 – Command Interface Registers

Register	Description
(ID = 1)	COMMAND INTERFACE
408001	Command register (accepts command code)
408002 to 408016	Registers used to specify additional parameters, if applicable
408021 to 408150	Registers used for returned data, if applicable (reserved for future use)

Table 5-2 – Command Codes/Parameters

Command		Command Parameter		Description
REGISTER	CODE	REGISTER	PARAMETER(S)	
408001	1110	none	none	causes soft reset of the unit (restarts device)
408001	4210	408002	1	clears event log
408001	21930	408002	24	initiates auto-test (simulation): 1) generates a "Test Mode ON" event (code 24) in event log 2) generates a "Test Status Change" event, off-to-on and then back on-to-off, for each channel at 1 ms intervals. 3) generates a "Test Mode OFF" event (code 25) in event log indicating the end of test mode. (The device returns to normal mode and resumes event recording immediately after the test is completed.)
408001	25000	408002 and 408003	current date/time (local time) in sec. since Jan 1, 1984	sets device clock to the specified date/time (big-endian): 1) place high word (MSW) in register 408002 2) and low word (LSW) in register 408003
408001	25001	408002 to 408005	current date/time	uses condensed, 4-register format for date/time (includes ms)
408001	3320	408002	R1-R8 (or VR9-VR16)	de-energize (turn off) the specified relay output ①
408001	3321	408002	R1-R8 (or VR9-VR16)	energize (turn on) the specified relay output ①
408001	3322	408002	16-bit bitmap corresponding to Relay outputs (R1-R8) and Virtual Relay outputs (VR9-VR16)	control relay outputs—energize or de-energize the relay outputs, according to an 16-bit bitmap (allows simultaneous command of multiple relays using a single write). VR = Virtual Relay ① 0 = de-energize (open), 1 = energize (close) bit 00 – Output R1 / bit 08 – Output VR9 bit 01 – Output R2 / bit 09 – Output VR10 bit 02 – Output R3 / bit 10 – Output VR11 : / : bit 07 – Output R8 / bit 15 – Output VR16
408001	3365	408002	input number (1-32)	reset operations counter for the specified input
408001	3365	408002	9999	reset operations counters—all inputs
408001	3361	408002	output number (1-8)	reset operations counter for the specified output
408001	3361	408002	9999	reset operations counters—all 8 outputs

① *Outputs 9-16 are "virtual relays," they are controlled via Modbus for event logging only and do not control any physical outputs.*

Command Interface Example 1: Clear Event Log

Example: To clear the event log using the command interface:

1. Write value of 1 to parameter register 408002.
2. Write command code 4210 (0x1072) to command register 408001.
3. The SER clears the event log, records an "Event Log Cleared" event (code 10), then resets automatically.
4. Upon restart, new events are recorded for Reset, Power Fail, Power On, and Time Source Lock (if applicable).

Note: The command interface registers can be written in one step using FC16 (multiple register write) or two steps using FC06 (single register write). If command is done in two steps, it must be done in the order shown above.

Command Interface Example 2: Initiate Auto Test

Example 2: To initiate auto-test using the command interface:

1. Write value of 24 to parameter register 408002.
2. Write command code 21930 (0x55AA) to command register 408001.
3. The SER enters test mode and generates "Test Status Change" events (code 27), off-to-on and on-to-off, for each input at 1 ms intervals, as well as test mode on/off events (codes 24 and 25).
4. Repeat process to initiate another test, if desired.

6—XML SETUP FILE

Setup File Overview

Note: the XML setup file should only be modified by advanced users familiar with XML structure, since errors could cause the SER to malfunction.

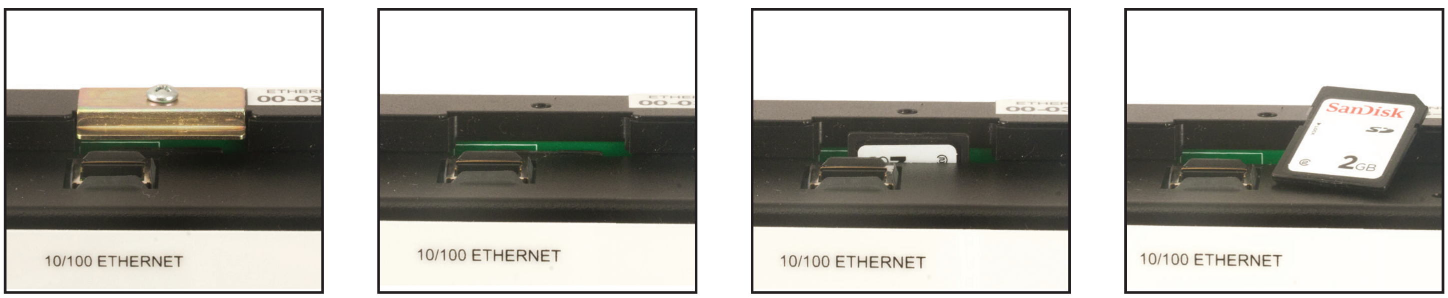
SER-3200 / SER-2408 setup data is stored in non-volatile memory on its SD flash memory card in an XML file format. While the normal method for configuring the unit is through its embedded web pages, setup changes can also be made simply by editing the XML setup file using a text editor, such as Windows Notepad. In this way, standard setup templates can be created and replicated quickly across multiple units.

The setup file ("_SETUP.XML") can be accessed in one of two ways:

- Direct access of SD memory card's file system (FAT32) using SD card reader
- FTP access over a network

SD Card Direct Access

To access the SD memory card's file system directly, first remove control power from the SER-3200 / SER-2408, then remove the SD card as shown below. Insert the SD card into a card reader slot of a PC or external card reader and access the file system using Windows Explorer. When replacing the card, ensure the card remains "unlocked" to allow read/write access.



a) SD cover in place. *b) SD cover removed.* *c) Push SD card in; card then pops up for access.* *d) SD card removed.*

Fig 6–1. Accessing SER-3200 / SER-2408 SD memory card

FTP Access over Ethernet

To access the XML Setup file via ftp (over Ethernet):

1. Open Windows Explorer, type FTP:// followed by the IP address of the CyTime SER-3200 / SER-2408 (e.g., FTP://169.254.0.10), then hit Enter.
2. When prompted, enter the CyTime SER user name and password (default = admin / admin).
3. Select the file called "_SETUP.XML" to highlight it.
4. Right-click the file, then click "Copy to Folder..." (or hit <CTRL + C>) to copy this file to the clipboard.
5. Now click a local folder on the PC, such as the Desktop and hit <CTRL+V> to paste the file to this location.
6. Edit the _SETUP.XML file using a text editor such as Windows Notepad and save desired changes.
7. Right-click the modified file, then click "Copy to Folder..." (or hit <CTRL + C>), navigate to the SER IP address again, click in an open area, right-click and choose "Paste" (or hit <CTRL + V>). Confirm overwrite and close Explorer.

Note: setup changes made by editing the XML file directly are not recorded as a "Setup Change" event in the event log.

XML Setup File Example

Eleven (11) system files are stored in non-volatile memory on the removable SD card and are required for proper operation:

- **SETUP.XML**
- **DEVNAME.XML**
- **DEVDATA.XML**
- **SYSDATA.XML**
- **CUSTOM.HTM**
- **CUSTOM.SWF**
- **EVENTS.SER**
- **EVENTS2.SER**
- **SER_SP_B.S19**
- **IBSER01.PDF**
- **IBSER02.PDF**

Optional (if PTP license option installed):
KEY_PTP.TXT

WARNING: Do <u>not</u> re-format the SD card from FAT32 (default) to another file system (e.g., NTFS).

Note: An XML schema document (ser.xsd) is provided to help an advanced user ensure that changes do not result in invalid data. The schema defines the specific structure and allowable limits of each setup element. The SETUP.XML file can be considered an instance document of its parent class, defined by the ser.xsd schema document.

To access the schema XML and schema file information [Click Here]

Cyber Sciences strongly recommends that manual changes to the XML setup file be validated against this schema using a standard XML validation tool.

SER-3200 / SER-2408 setup data is stored in XML file format on the SD card. Most system file names start with an underscore to make it easier to distinguish them from files added by the user. (See information box at left.) The XML setup file is called "_SETUP.XML" An excerpt of the XML setup file is shown below.


```
<?xml version="1.0" encoding="UTF-8"?>
- <setup schemaVersion="7" xsi:noNamespaceSchemaLocation="http://www.cyber-
  sciences.com/products/xsd/ser.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  - <comms>
      <media_type>0</media_type>
      <DHCP_enabled>false</DHCP_enabled>
      <IP_address octet="1">192</IP_address>
      <IP_address octet="2">168</IP_address>
      <IP_address octet="3">1</IP_address>
      <IP_address octet="4">99</IP_address>
      <subnet_mask octet="1">255</subnet_mask>
      <subnet_mask octet="2">255</subnet_mask>
      <subnet_mask octet="3">255</subnet_mask>
      <subnet_mask octet="4">0</subnet_mask>
      <default_gateway octet="1">192</default_gateway>
      <default_gateway octet="2">168</default_gateway>
      <default_gateway octet="3">1</default_gateway>
      <default_gateway octet="4">1</default_gateway>
      <FTP_enabled>true</FTP_enabled>
      <device_ID>CyTime SER</device_ID>
      <device_name>CyTime Event Recorder</device_name>
    </comms>
  - <time>
      <time_source>0</time_source>
      <time_sync_master>false</time_sync_master>
      <time_sync_out>0</time_sync_out>
      <time_zone_offset>0</time_zone_offset>
      <time_zone_offset_PLX>false</time_zone_offset_PLX>
      <time_zone_offset_ASCII>false</time_zone_offset_ASCII>
      <DST_enabled>false</DST_enabled>
    - <DST_start>
        <month>3</month>
        <week>2</week>
        <day>1</day>
        <hour>2</hour>
      </DST_start>
    - <DST_end>
        <month>11</month>
        <week>1</week>
        <day>1</day>
        <hour>2</hour>
      </DST_end>
      <alt_date_format>false</alt_date_format>
      <hourly_time_update>false</hourly_time_update>
      <NTP_interval>60</NTP_interval>
      <NTP_server1 octet="1">24</NTP_server1>
      <NTP_server1 octet="2">56</NTP_server1>
      <NTP_server1 octet="3">178</NTP_server1>
      <NTP_server1 octet="4">140</NTP_server1>
      <NTP_server2 octet="1">129</NTP_server2>
      <NTP_server2 octet="2">6</NTP_server2>
      <NTP_server2 octet="3">15</NTP_server2>
      <NTP_server2 octet="4">30</NTP_server2>
      <PTP_domain_number>0</PTP_domain_number>
      <PTP_priority1>128</PTP_priority1>
      <PTP_priority2>128</PTP_priority2>
    </time>
  - <inputs>
    - <input id="1">
        <enabled>true</enabled>
        <input_name>Input 01</input_name>
        <filter>20</filter>
        <debounce>20</debounce>
        <chatter>0</chatter>
        <off_text>Off</off_text>
        <on_text>On</on_text>
        <trigger>false</trigger>
        <inverted>false</inverted>
        <log_group>1</log_group>
      </input>
        ⋮
    </inputs>
  - <outputs>
    - <output id="1">
        <enabled>true</enabled>
        <output_name>Output 01</output_name>
        <off_text>Off</off_text>
        <on_text>On</on_text>
        <log_group>0</log_group>
      </output>
        ⋮
    </outputs>
  - <groups>
    - <group id="1">
        <enabled>false</enabled>
        <group_name>Group 01</group_name>
        <log_size>0</log_size>
      </group>
        ⋮
    </groups>
  - <admin>
      <username>admin</username>
      <password>admin</password>
    </admin>
</setup>
```


Fig 6–2. XML setup file (_SETUP.XML)

7—CUSTOM PAGES

Customization

To enable user extensions, the SER-3200 / SER-2408 provides a means for integrating custom web pages into its standard navigation structure. Clicking the "Monitoring" tab, then the "Custom" link brings up the following screen:

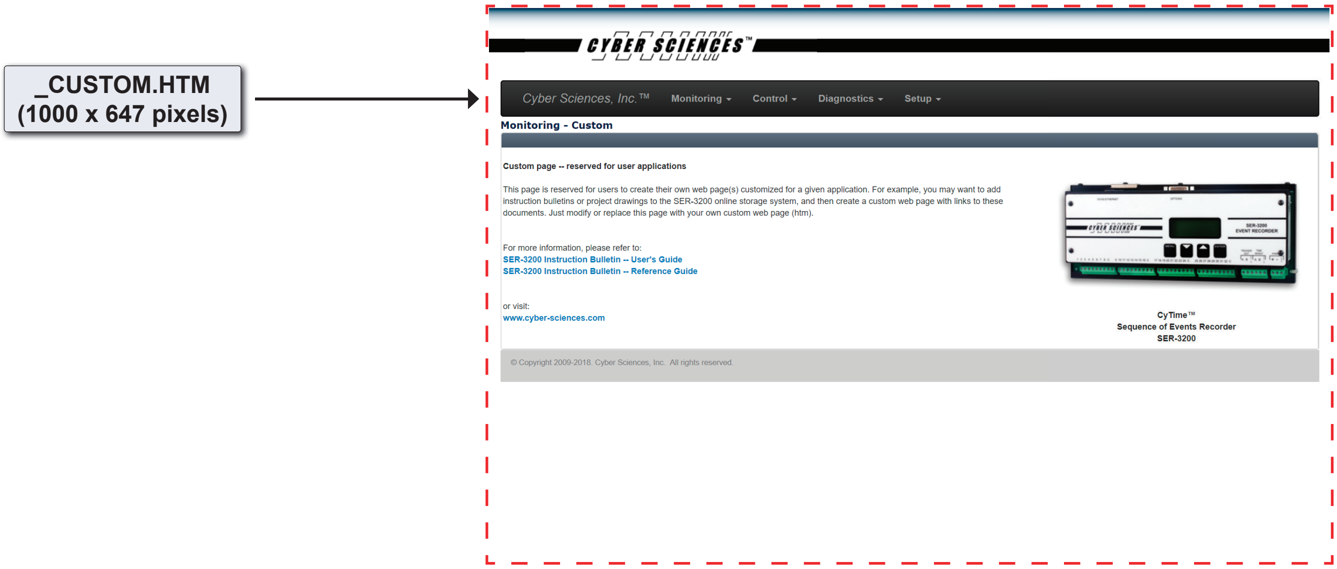


Figure 7-1. Custom page

Details

The custom page includes links to the SER-3200/2408 user's guide and reference guide, and the Cyber Sciences web site. It also serves as a placeholder to allow users to create their own web page(s) customized for a given application. For example, you may want to add instruction bulletins or project drawings to the CyTime SER online storage system (SD memory card), and then create a custom web page with links to these documents.

The default custom page is named "_CUSTOM.HTM" and is stored on the removable SD card. This file can be modified or replaced to add customized functionality. Users can leverage the HTML5 web interface based on a "REST-ful" API to create these custom pages.

For more information on modifying or creating your own custom web pages for the SER-3200/2408, please contact Cyber Sciences at sales@cyber-sciences.com or 615-890-6709.

8—PRECISION TIME PROTOCOL (PTP)

Precision Time Protocol (per IEEE 1588™)

1588 Time Settings Convention:

The IEEE 1588 standard expresses Announce, Sync and Delay message interval settings as a log base-2 of the value in seconds (2^{-128} to 2^{127}), subject to further limits established in a PTP profile.

For example, a setting of "0"= 2^0 (1 second). See the conversion table below for some common values.

Interval Setting (Log Base 2)	Interval Setting (Seconds)
-1	0.5
0	1
1	2
2	4
3	8
4	16
5	32

To avoid confusion, Cyber Sciences expresses all time intervals in seconds, except for Modbus register values (which require a signed-integer format). When comparing with third-party PTP settings, be careful to note the convention used.

Introduction to IEEE 1588-2008

IEEE Std 1588 defines the Precision Time Protocol (PTP) with a goal of achieving very high precision for time-synchronization over a packet-based network such as Ethernet. PTP takes advantage of special Ethernet hardware for precise time-stamping of the Ethernet frame send and receive times and prescribes a very precise mechanism to correct for delays introduced in the network path from the master clock (time reference), through multiple levels of switches, to the slave clocks (time consumers).

The Simple PTP Profile—Based on IEEE 1588 Default Profile

CyTime SER-3200/2408 Event Recorders use a "Simple PTP" Profile (dubbed "SPTP") optimized for commercial/industrial power system applications (including data centers, hospitals and microgrids). SPTP is intended to achieve time sync over Ethernet with accuracy of at least 100 µs, taking advantage of the same Ethernet network infrastructure used for power monitoring—without requiring special PTP-compliant Ethernet switches (transparent clocks). There is no need for special prioritization of PTP packets in managed switches, nor any constraints on network topology.
To accomplish time synchronization, SPTP uses the PTP delay request-response mechanism (also called "End-to-End"). Other simplifications include using UTC as its timescale (instead of TAI) and longer message intervals (e.g., updates every 32s) to minimize network traffic.

PTP Options Supported by CyTime SER-3200/2408

Though the "Simple PTP" Profile is proposed by Cyber Sciences, it is not proprietary; SPTP is based on the IEEE 1588 "Default Profile" defined in Annex J. Devices using SPTP are interoperable with others set to use this profile.

When SER-3200/2408 Event Recorders are used as both the PTP master and PTP slaves, then they support the PTP options indicated below. When a third-party clock is used as grandmaster, the SER-3200/2408 PTP slaves can support the options shown in the column at right. In general, set the third-party clock to use the Default Profile (Delay Request-Response, or E2E) for compatibility with the SER-3200/2408.

PTP Options	Range of Supported Values	
	SER Master and Slave (SPTP)	**SER Slave-only (compatibility)**
PTP Version Number (IEEE 1588)	v2 (2008)	v2 (2008)
PTP Profile ID (IEEE 1588 Default Profile, Annex J)	00-1B-19-00-01-00	00-1B-19-00-01-00
Clock Types Supported	Ordinary clock: Grandmaster-capable Slave-only	Ordinary clock: Slave-only
Communications Model	Multicast	Multicast
Network Transport Protocol	UDP/IPv4	UDP/IPv4
Path Delay Mechanism	End-to-end (E2E)	End-to-end (E2E)
Operating Mode	2-step	1-step or 2-step
Timescale	Application-specific (UTC)	Application-specific (UTC) or PTP (TAI)

PTP Settings and Attributes Supported

When SER-3200/2408 Event Recorders are used as both the PTP master and PTP slaves, then they support the simplified PTP settings and attributes indicated below. For compatibility with a third-party clock used as grandmaster, SER-3200/2408 PTP slaves can support a wider range of settings and attributes, as shown on right.

PTP Settings and Attributes	Range of Values Supported	
	SER Master and Slave (SPTP)	SER Slave-only (compatibility)
Domain Number	0 to 127 (default = 0)	0 to 127 (default = 0)
Announce Interval (master)	2 seconds	1, 2, 4, 8, 16, 32 sec
Announce Receipt Time-out (master)	3 (Multiple of Announce Interval)	2 to 10 (Multiple of Announce Interval)
Sync Interval (master)	1 second	0.5, 1, 2, 4, 8, 16, 32, 64 sec
Delay Request Interval (master)	32 seconds	0.5, 1, 2, 4, 8, 16, 32, 64 sec (1588 std requires Delay Request Interval to be >= the Sync Interval and <= 32x)
Priority1 and Priority2	0-255 (master), 255 (slave)	255 (slave)
Clock Identity	(Usually based in part on MAC address)	(Usually based in part on MAC address)
Port State	1 = Initializing (transient state) 2 = Faulty (error condition) 3 = Disabled (PTP not used) 4 = Listening (waiting for sync) 5 = Pre-master (transient state) 6 = Master (normal state for PTP master) 7 = Passive (only for multiple masters) 8 = Uncalibrated (transient state) 9 = Slave (normal state for PTP slave)	1 = Initializing (transient state) 2 = Faulty (error condition) 3 = Disabled (PTP not used) 4 = Listening (waiting for sync) 5 = Pre-master (not applicable) 6 = Master (not applicable) 7 = Passive (not applicable) 8 = Uncalibrated (transient state) 9 = Slave (normal state for PTP slave)
Clock Class	13 = Normal (UTC) 14 = Holdover (UTC) 58 = Out-of-spec (UTC) 255 = Slave-only	06 = Normal (PTP Timescale) 07 = Holdover (PTP Timescale) 13 = Normal (UTC) 14 = Holdover (UTC) 52 = Out-of-spec (PTP Timescale) 58 = Out-of-spec (UTC) 255 = Slave-only
Clock Source *	16 (0x10) = Atomic clock 32 (0x20) = GPS 64 (0x40) = PTP 80 (0x50) = NTP 96 (0x60) = Hand-set (manual) 144 (0x90) = Other 160 (0xA0) = Internal (none)	16 (0x10) = Atomic clock 32 (0x20) = GPS 64 (0x40) = PTP 80 (0x50) = NTP 96 (0x60) = Hand-set (manual) 144 (0x90) = Other 160 (0xA0) = Internal (none)
Clock Accuracy *	39 (0x27) = 100 µs 41 (0x29) = 1 ms 43 (0x2B) = 10 ms 45 (0x2D) = 100 ms 47 (0x2F) = 1s 49 (0x31) = >10s 254 (0xFE) = unknown	32 (0x20) = 25 ns 33 (0x21) = 100 ns 39 (0x27) = 100 µs 41 (0x29) = 1 ms 43 (0x2B) = 10 ms 45 (0x2D) = 100 ms 47 (0x2F) = 1s 49 (0x31) = >10s 254 (0xFE) = unknown
PTP Packet Time-To-Live (TTL)	64	1 to 64

** for PTP slaves, this value is obtained from the PTP grandmaster.*

Timescales and Leap Seconds

> **Relationships of Timescales**
>
> *GPS = Global Positioning System*
> *TAI = International Atomic Time*
> *UTC = Coordinated Universal Time*
>
> *TAI is always ahead of GPS time by 19 seconds. At the time of this publication, there have been 36 leap seconds. This gives the following relationships:*
>
> *TAI = GPS + 19 s*
> *UTC = GPS - 17 s (and counting)*
> *UTC = TAI - 36 s (and counting)*

There are three different timescales used for time synchronization: UTC, TAI and GPS. UTC is adjusted periodically for changes in the rate of the earth's rotation by adding or subtracting leap seconds, whereas, TAI and GPS are not affected. PTP specifies TAI as its default timescale. Today, the use of TAI vs. UTC is somewhat academic; most devices use UTC as their time reference but ignore any advance warning of "leap second coming" even if present, such as the announce bit in the IRIG-B standard. Furthermore, it's not clear how they would use this information even if they did support it. There have been several instances of leap seconds in the past 20 years, the most recent in 2016. Timestamps of events recorded just before or just after the leap second may produce confusing data, but otherwise, devices are expected to operate normally without incident.

The PTP standard also allows for other timescales (primarily UTC), but these are designated by alternate attribute codes. Any timescale other than TAI is called "Arbitrary" (or "ARB") or "application specific."

Please refer to the summary chart at left for a comparison of the three timescales, as well as their relationship to each other.

Adjusting for Local Time Zone

Historical events are stored with date/timestamps relative to a known time reference, such as UTC (Coordinated Universal Time). There are two accepted methods for adjusting timestamps for a local time zone: adjust once at the final point of consumption (Figure 8-1), or set each intermediate device to use the appropriate time zone offset, but still transfer the time reference to each via UTC (Figure 8-2).

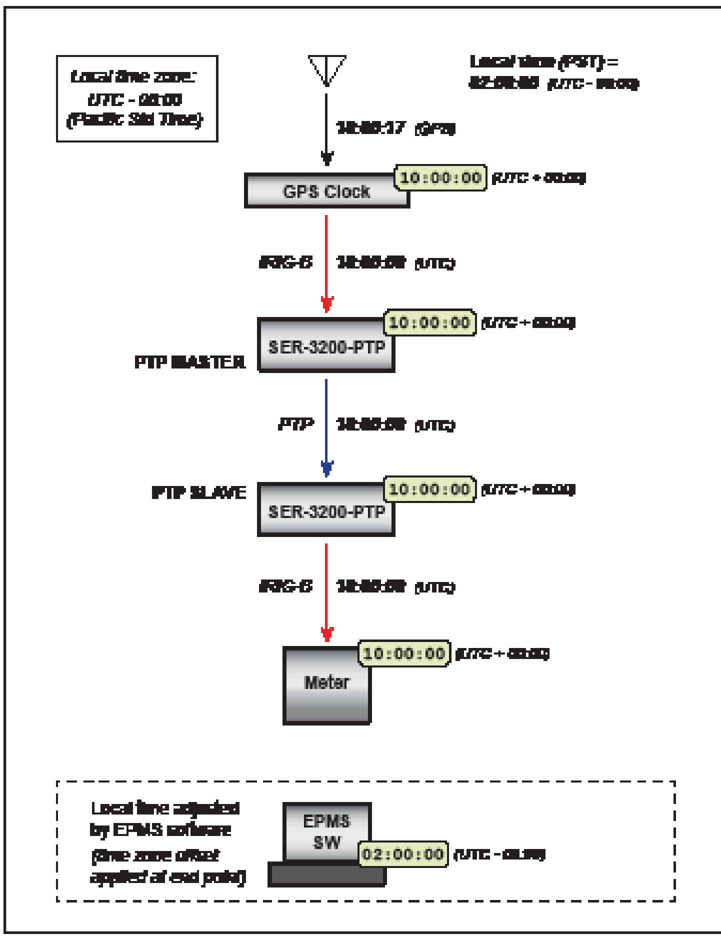


Figure 8-1. Local time adjusted at end-use point (EPMS software).

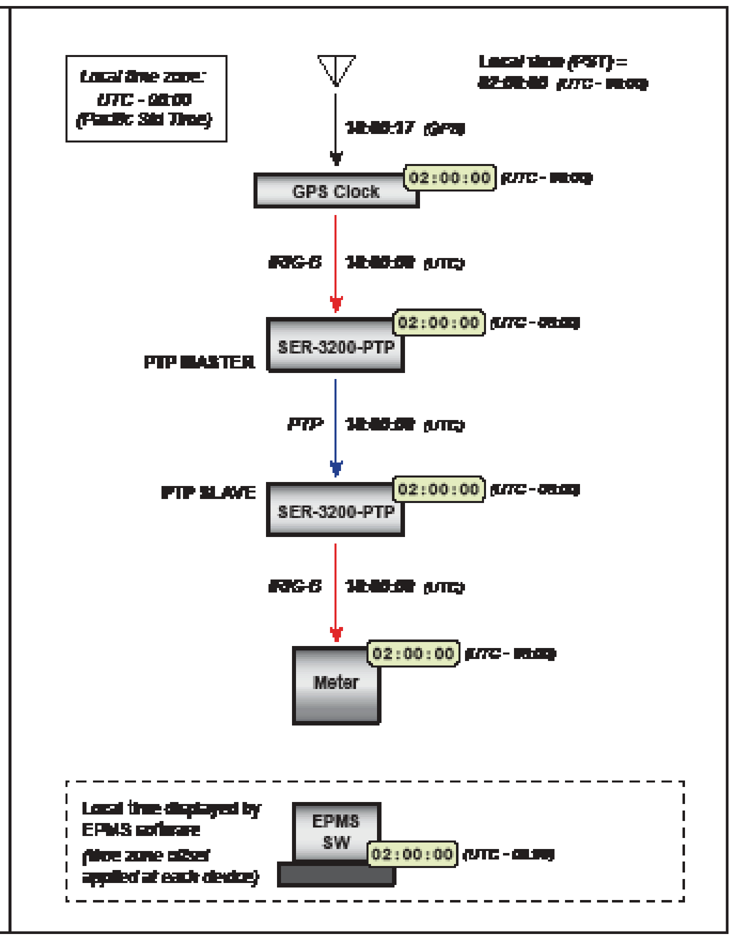


Figure 8-2. Local time adjusted at each device in system.

Adjusting for Local Time Zone (cont.)

Note: The option to adjust the SER time-sync output for local time zone offset was introduced in SER firmware v.2.12. Earlier firmware versions must be updated to v.2.12 or later to use this feature.

The example in Fig 8-1 is attractive for its simplicity, and the example in Fig 8-2 is sometimes considered more intuitive. However, this second option requires that all devices be equipped with a local time zone setting, which is not always the case. Consider the example in Fig 8-3 which includes a PowerLogic CM4000T meter from Schneider Electric. Without some way to adjust the time reference in the DCF77 signal to the meter, the CM4000T will simply display the time as received (UTC).

To solve this interoperability problem, the CyTime SER-3200/2408 offers a setup option to “apply local time zone offset” to one or more of its output signals (IRIG-B of DCF77 via PLX accessory or ASCII/RS-485 output native to the SER). Fig. 8-4 illustrates the solution for the CM4000T employing this method. Instead of transferring the time reference based on UTC between devices, the SER outputs the time reference in DCF77 already adjusted for the local time zone.

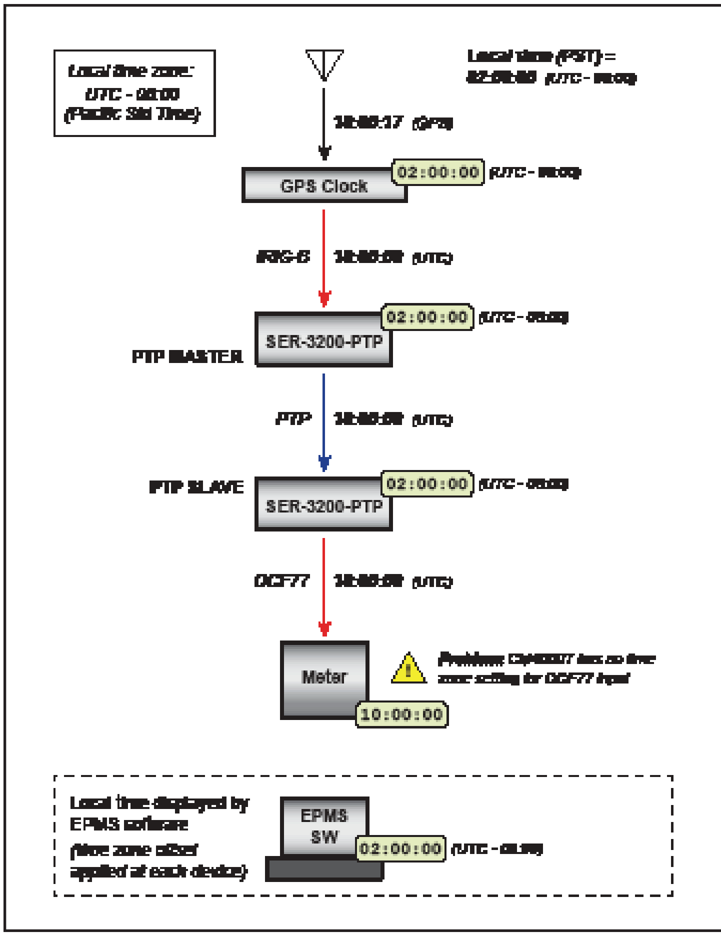


Figure 8-3. Local time adjusted at each device—except one.

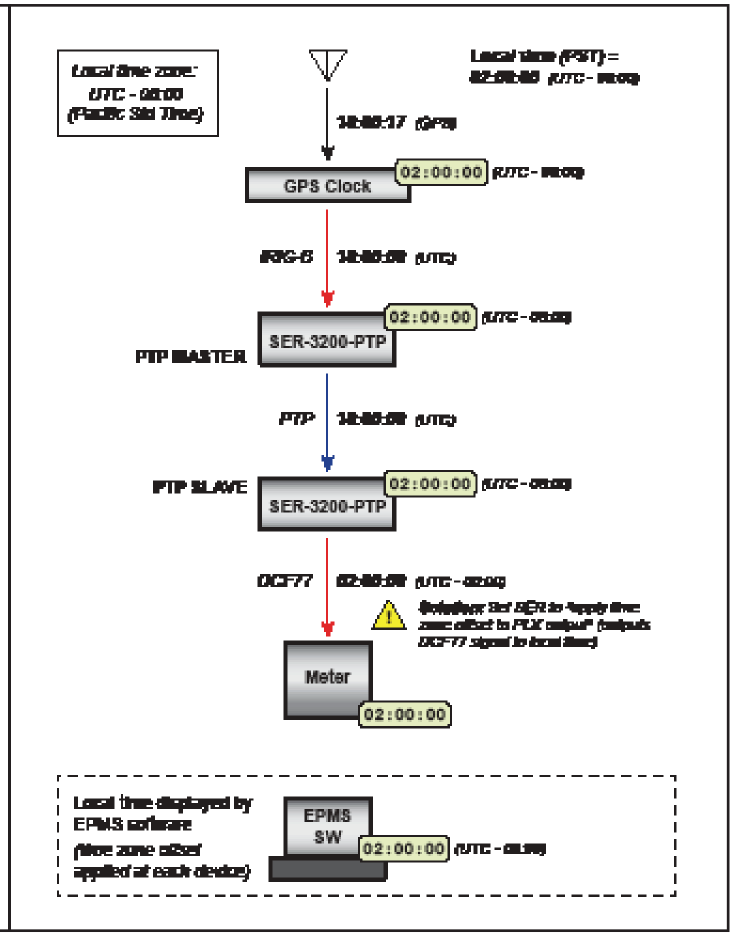


Figure 8-4. Local time adjusted at (or to) each device.

Adjusting for Local Time Zone (cont.)

One final example of adjusting clocks for local time zone offset is shown in Fig. 8-5 below. In this example, a third-party GPS clock is configured as PTP master, and transmits its time reference in terms of TAI. PTP slave devices such as the CyTime SER automatically adjust from TAI timescale to UTC timescale. Then, if desired, each device adjusts its own clock for the local time zone according to its user setting.

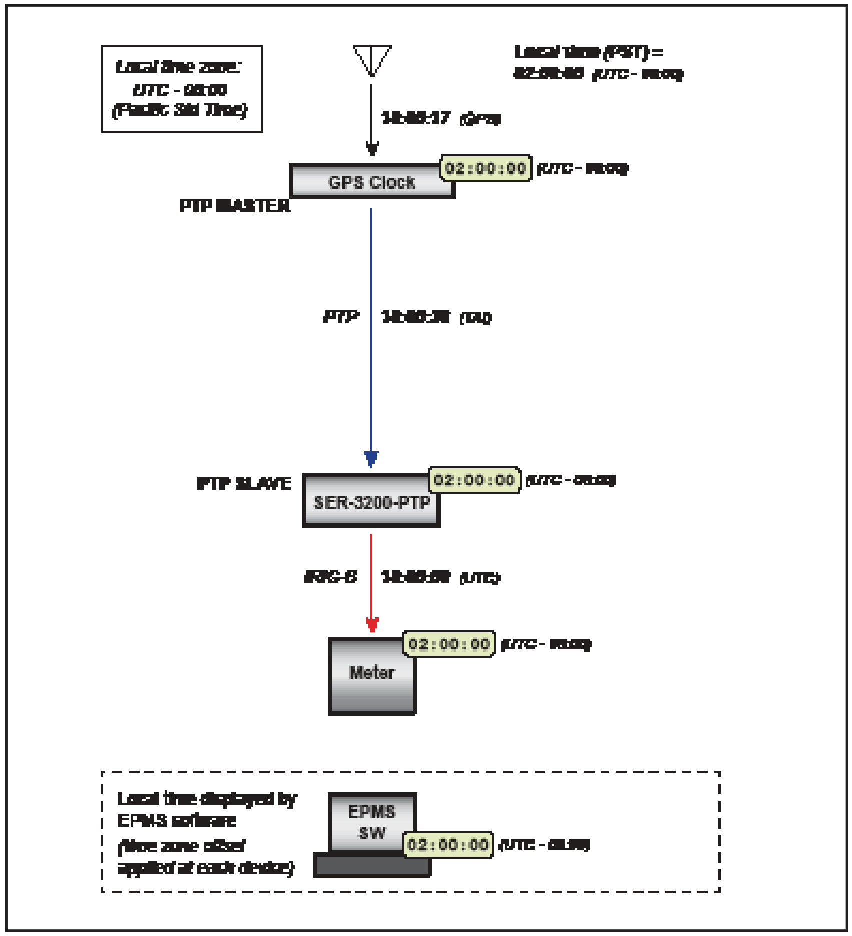


Figure 8-5. Local time adjusted at each device in system (GPS clock as PTP master).

Daylight Saving Time (DST)

Cyber Sciences recommends that event timestamps be based exclusively on standard time, since discontinuities introduce potential for confusion and make comparisons of historical values more difficult. For example, if events occur around the time of the start of DST ("Spring forward"), their timestamps may appear one hour further apart than the actual elapsed time.

Even worse, events recorded during the ending changeover ("Fall back"), can have the same timestamps as events actually occurring one hour apart, with no way to distinguish the truth. Clearly, the concept of Daylight Saving Time is not compatible with timestamps in sequence of events recording.

To provide maximum flexibility, the CyTime SER supports adjustments for Daylight Saving Time (DST) or Summer Time (firmware version 2.14 and later). However, if possible, all event timestamps should be stored in reference to UTC, and then adjusted for DST by application software at the point of consumption (edge) for display or analysis.

9—TROUBLESHOOTING

Symptom	Possible Cause	Suggested Action(s)
LCD Error messages		
ERROR 1000 FW update failed	The new firmware file (.S19 extension) or start file (_LOAD_SP.TXT) may be corrupted.	Download update files again. Re-copy to the SER and restart. If problem persists or if no firmware update was attempted, contact factory.
ERROR 1010 FW update error	The setup file (_SETUP.XML) could not be loaded or could not be updated to later schema version required by new firmware.	Download correct version of the setup file, edit as needed, then copy to the SER via ftp. If problem persists or if no firmware update was attempted, contact factory.
ERROR 2000 (or 2010 or 2020) Internal error EP (or TP or SP)	Any of these errors indicate failure to initialize properly on startup. The cause could be a hardware defect or corrupted firmware file.	If firmware related, it may be possible to restore normal operation by updating firmware. If problem persists, contact factory for repair or replacement.
ERROR 3000 XML settings error	The _SETUP.XML file may be missing or corrupted.	If the _SETUP.XML file has been edited manually, try validating changes using the published schema file (ser.xsd) for the schema version. If you made a backup copy of the _SETUP.XML file, try copying this to the SER. Or, download correct version of the setup file, edit as needed, then copy to the SER via ftp. If problem persists contact factory.
ERROR 3088 Invalid PTP key	The PTP license key is missing or has become corrupted.	Re-enter the PTP key (Setup-Admin web page) or contact factory for assistance.
ERROR 4000 System task failed	This indicates failure to initialize properly on startup.	Contact factory for repair or replacement.
ERROR 4010 DHCP failed	The SER is set to obtain an IP address automatically using DHCP; however, a working DHCP server was not found.	Verify network connections and DHCP server operation. Or, change setup to use a valid static (fixed) IP address. (A restart is required.)
ERROR 5000 (and all series 5000 errors) Local setup failed	Such an error may occur if a brownout happens when local changes to IP address are saved. It can also indicate corrupted firmware, setup file or hardware defect (rare).	Contact factory for repair or replacement.
ERROR 6000 (also 6010) SP init failed	Upon restart, the unit was unable to initialize the backup event files.	Try restarting unit by cycling control power or by pressing the hardware reset button at the top of the SER. If problem persists contact factory.
ERROR 7000 SD read error	SD card may be defective or become corrupted.	Contact factory to obtain a replacement SD card with necessary factory image or request repair or replacement of the entire unit.
ERROR 8000 SD write error	SD card may be defective or become corrupted.	Contact factory to obtain a replacement SD card with necessary factory image or request repair or replacement of the entire unit.
ERROR 9000 SD card missing	The SD card is missing or not seated firmly in its socket.	Insert (reinsert) SD card firmly into place. For firmware version v2.12 and later, the SER should automatically recognize the SD card. If not, restart the unit. If problem persists contact factory.
ERROR 9010 SD card error	There may not be sufficient free space on the SD card to continue normal operation.	Contact factory for help to safely free space.

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