General Specifications

Model LPC6900, LPC6910,
LPC6920, LPC6930
SEM Sequence of Events
Manager (for FIO)

CENTUM CS3000 R3

GS 33Q02N80-31E

■ GENERAL

This GS (General Specifications) describes the specifications of the Sequence of Events Manager (SEM). The SEM captures, records and displays in chronological order the sequence of events (SOE) prior to and during a plant trip. The SEM provides a means of recording activities leading to a potential plant upset or trip.

The SEM offers the following benefits:

- High-speed capturing of events with one millisecond time stamp resolution
- SOE inputs are made available for use as control and or monitoring signals.
- Time synchronization with an external master clock based on the global positioning system (GPS)
- Trip Report for a specified time period upon occurrence of user defined triggers
- Long-term data storage and automatic trip report generation
- SOE data output to OPC clients (e.g. Exaquantum)
- SOE viewing and reporting at multiple Human Interface Stations (HIS) and/or any other PCs via Ethernet
- SOE viewing and reporting that integrate SOE messages with process alarms and other process related events
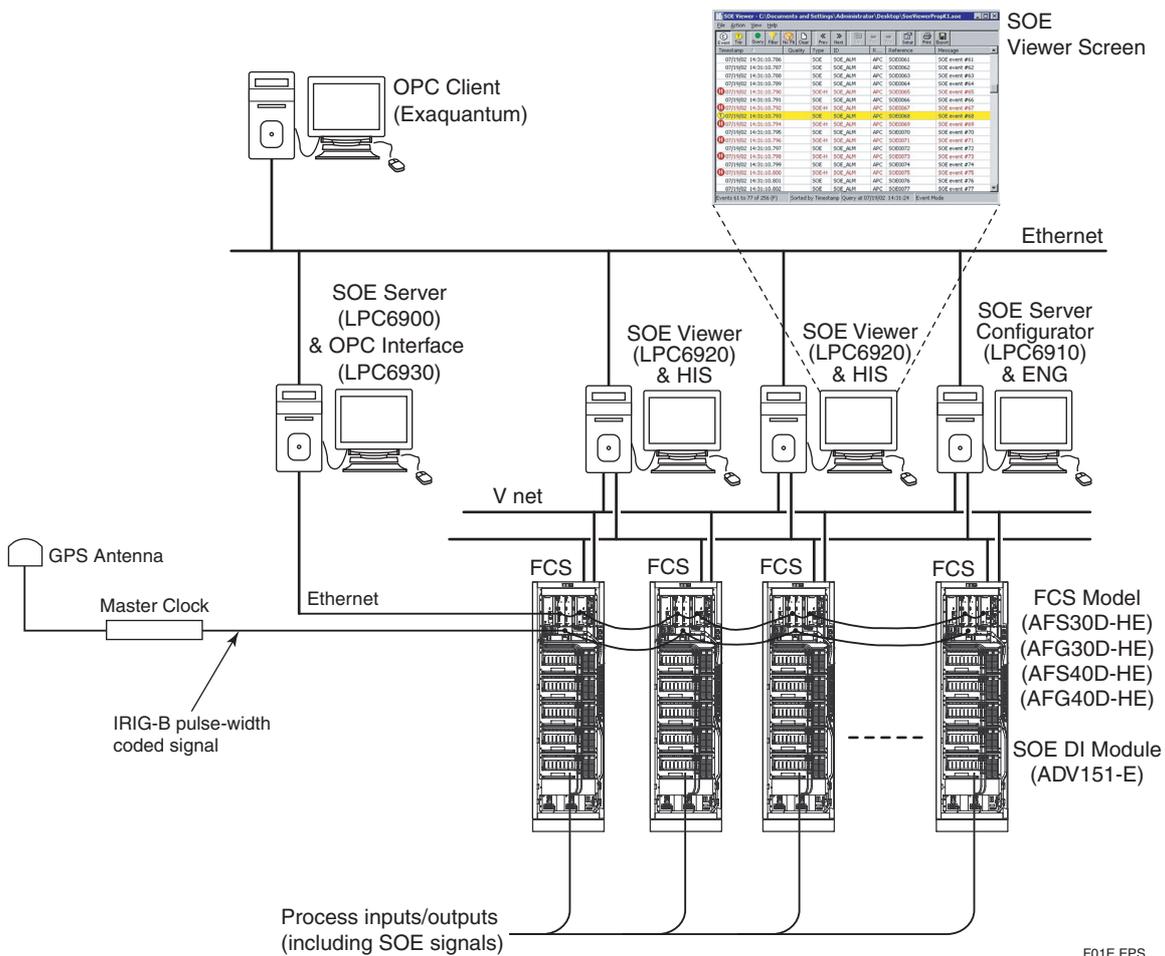

Figure: Example of SEM System Configuration

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■ SYSTEM COMPONENTS AND SOFT-WARE

The SEM is designed to capture the events using SOE digital input modules (ADV151-E). These modules apply time stamp and send the SOE data from the FCS to the SOE Server via Ethernet. A dedicated Ethernet network is used for SOE data to Separate event network traffic from the control network. The SOE data is sent to the SOE Server, stored in the SOE Server and displayed in chronological order on the SOE Viewer screen. As the SEM employs a Server/Client (Viewer) architecture, the SOE data stored in the SOE Server can be easily accessed from multiple HISs and/or any other PCs via Ethernet. The SEM consists of the following system components with the appropriate SEM software.

● Field Control Stations (FCS) with SOE Interface

The following FCS models can provide an interface to transfer time-stamped SOE data from SOE digital input modules to the SOE Server.

- AFS30D Duplexed Field Control Unit (for FIO, 19" rack mountable)
- AFS40D Duplexed Field Control Unit (for FIO, with cabinet)
- AFG30D Duplexed Field Control Unit (for FIO, 19" rack mountable)
- AFG40D Duplexed Field Control Unit (for FIO, with cabinet)

These FCS models are enabled to be time synchronized by an external master clock.

Each FCS with SOE Interface contains the following duplexed module in place of the standard SB301 ESB bus interface master modules:

- SB311 ESB bus Interface Master Module with SOE Interface

The SB311 module has two ports: an Ethernet port for transmitting the SOE data to the SOE Server, and an RS-422 serial port for receiving a time synchronization code (in IRIG-B format) from an external master clock.

For the specifications of these communication interfaces, see the "Networking Specifications" section of this GS.

● SOE Digital Input Module (Model: ADV151-E)

The ADV151-E has 32 digital input channels with an SOE capturing feature. Each input on state change can be configured individually whether or not to allot a SOE time stamp. All ADV151-E inputs can be used as control and monitoring signals in the control scheme. The ADV151-E modules can also be used in pairs to provide redundant inputs where high reliability is required. The ADV151-E has the same basic specification as ADV151. See the corresponding section of GS (GS 33Q06Q45-31E) "Digital I/O Modules (for FIO)".

● SOE Server

The SOE Server is designed to acquire and store SOE data from multiple FCSs and make available this data to multiple HIS or PCs running SOE Viewer software. The SOE Server is configured in a dedicated server PC equipped with two independent Ethernet networks: one for the SOE data acquisition from FCSs, and the other for the SOE data transmission to SOE Viewers. Microsoft SQL Server is used for database management. Long-term data storage is limited only by hard disc capacity.

● SOE Viewer

The SOE Viewer is designed to access and query the SOE Server. It displays the SOE data with filtering as specified by the user. The SOE Viewer generates and prints trip reports, and exports them to CSV (comma-separated value) format files. The SOE data from other data sources, such as messages stored in HISs, can also be displayed on the SOE Viewer. Each SOE point can be viewed with its associated time stamp, alarm class, equipment name, event message along with other configured in formation.
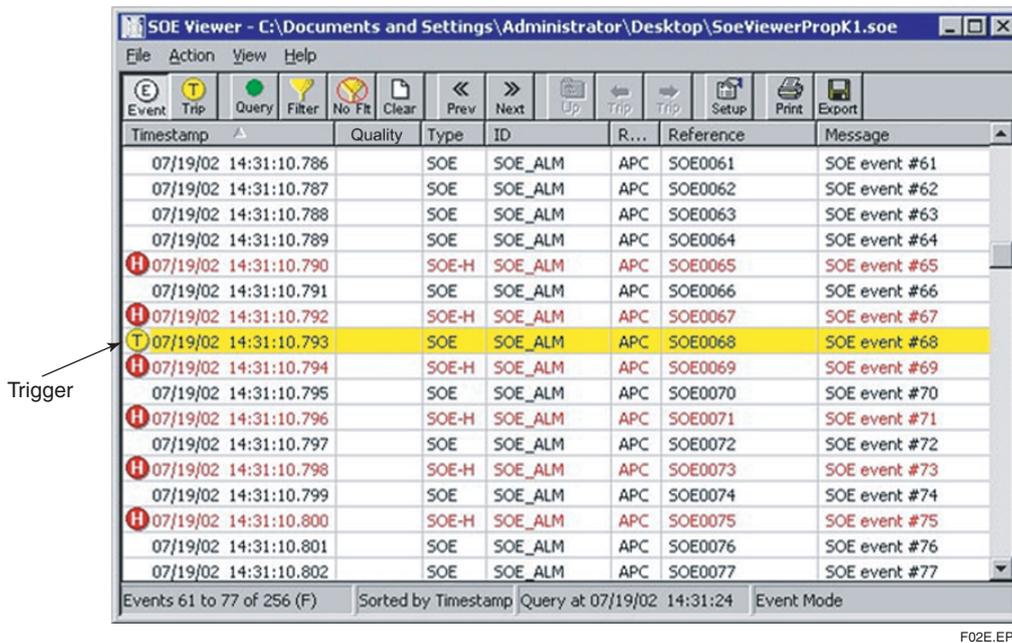
Trigger

Figure: SOE Viewer Screen

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● SOE Server Configurator

The SOE Server Configurator is designed to configure the SOE Server. The configurator is used to define various settings such as the station configuration, SOE input terminals and the trip report configuration.

● SEM OPC Interface

The SEM provides the OPC interface function which OPC clients such as Exaquantum can access the SOE data stored in the SOE server through Ethernet. The OPC interface works as an OPC Alarm and Events (A&E) server and an OPC Historical Data Access (HDA) server.

● Human Interface Stations (HISs)

Using the SOE Viewer Software an HIS can be used to access the SOE data stored in a SOE Server via Ethernet. The status of SOE modules, SB311 and ADV151-E can be displayed on the Station Status Display window of the HIS.

● Synchronization Interface

A FCS enabled with a SOE interface allows direct connection to an IRIG-B time coded format signal. The external synchronization signal synchronize the internal time for the SOE Digital Input modules. An External Master Clock incorporating a Global Positioning System(GPS) receiver or similar is recommended for accurate time synchronization.

■ SYSTEM SPECIFICATIONS

Number of SOE inputs: Up to 2000 points per SOE Server

Number of SOE Servers: One server per SEM system

Number of FCSs per SOE Server: Up to 16

Number of ADV151-E: Up to 80 modules per FCS

Number of Events retained in SB311 event buffer: Up to 40,000 events per 10 seconds

Number of Events retained in ADV151-E event buffer: Up to 500 events per two seconds

Time stamp resolution: One millisecond

Time-stamp delay compensation setting: Zero to 100 milliseconds

Automatic event deletion: Selection from among 15 options from no auto-deletion to auto-deletion of the five oldest events occurring within the last 3.5 seconds.

Software filter setting: Zero to 512 milliseconds (can be set increments of two milliseconds).

When the number of SOE inputs or FCSs exceeds the limitations for a single SEM system, multiple SEM systems can be installed, up to eight servers.

The SOE Viewers can access the SOE stored data from multiple SOE Servers via an Ethernet and display the SOE data on a single SOE Viewer window.

■ SPECIFICATIONS OF SOE SERVER

SOE Server PC: Dedicated server for the installation of SOE Server, SOE Viewer and SOE Server Configurator packages. It is not allowed to install any CENTUM CS 3000 software packages other than SOE software packages.

Event acquisition rate: Up to 2000 events per second

Number of Clients for SOE Viewer and SOE Server Configurator: Up to the number allowed by the licenses purchased for Microsoft SQL Server 2000, and Microsoft Windows 2000 Server or Microsoft Windows Server 2003

Hard disk size: 20 gigabytes (GB) or more recommended (for installation of the Microsoft Windows operating system, SQL Server 2000, and Yokogawa SOE Server Packages)

Database capacity: 6 GB for retaining a total of 7,300,000 historical events (e.g., the events of 20 years assuming 10,000 events occur per day)

■ SPECIFICATIONS OF SOE VIEWER

Number of data acquisition sources: Up to eight data sources or up to eight SOE Servers

Data acquisition source types: SOE Server, historical messages in HIS, Unified Operator Interface (UOI) messages

Number of events displayed: Up to 99,999 events

Display items in the SOE Viewer screen:

Time stamp: Date and time of occurrence of the corresponding event signal

Type: Importance level of the corresponding event, either "SOE" (ordinary) or "SOE-H" (important)

ID: Either "SOE_ALM" (occurrence of the alarm state) or "SOE_RTN" (return to normal state)

Resource: Equipment name (plant hierarchy name) associated with the corresponding SOE event signal

Reference: Reference number (tag name) of the corresponding SOE event signal

Message: Message text of the corresponding SOE event signal

■ SPECIFICATIONS OF SOE SERVER CONFIGURATOR

Number of SOE input assignments: Selection from 100, 500, and 2000 input points

Number of Trip trigger assignments: Up to 50 triggers

■ NETWORKING SPECIFICATIONS

The SEM uses two independent Ethernet networks (one for SOE data acquisition, and the other for SOE Clients such as SOE Viewers and the SOE Server Configurator). There is a separate time synchronization link for IRIG-B pulse-width coded communication by RS-422.

● Ethernet for SOE Data Acquisition

Application

The Ethernet for SOE Data Acquisition is used exclusively for SOE data acquisition. It connects the FCSs to the SOE Server.

Communication Specifications

Number of FCS stations: Up to 16 FCSs (up to 32 ports) and one SOE Server via an Ethernet hub

Communication specifications: IEEE802.3-compliant, 10Base-T, RJ-45 (on each FCS)

● Ethernet for SOE Clients

Application

The Ethernet for SOE Clients is used to connect clients such as SOE Viewers and SOE Server Configurator which access the SOE Server.

Communication Specifications

Node Type: HISs and PCs in which SOE Server, SOE Viewer and SOE Server Configurator are installed.

Communication specifications: IEEE802.3-compliant

● Time Synchronization Link

Application

A dedicated time synchronizing link using an IRIG-B time code format is used to synchronize SOE modules to an external master clock (using the IRIG-B branch unit of FCS).

Communication Specifications

Number of stations and nodes: Up to 16 FCSs per external master clock timing signal

Signal Level: RS-422

Time Code Format: IRIG-B pulse-width coded

Communication cable:

Cable type: Shielded pair of twisted pair cable (4 cores in total, 1st core for Rx+, 2nd core for Rx-, 3rd core for signal ground (SG) and 4th core for spare) applicable to RS-422. When an external master clock does not have signal ground (SG) output, a shielded twisted pair (2 cores) cable can be used.

Insulation resistance (at 20 ˚C): 10,000 MΩ / km or greater

Withstanding voltage: 500 V DC for 1 minute

Capacitance (at 1 KHz): 60 pF/m or greater

Characteristic impedance (1 MHz): 100 ±10Ω

Conductor resistance (20 ˚C):

54.4 Ω/km or less for 100 m or shorter (AWG24 or thicker)

36.0 Ω/km or less for 500 m or shorter (AWG20 or thicker)

17.2 Ω/km or less for 1000 m or shorter (AWG16 or thicker)

IRIG-B branch unit specifications in FCS:

Terminal block: M4 screw terminals suitable for 4-mm diameter crimping terminal lugs

Terminal assignments: 1 and 4 for Rx+, 2 and 5 for Rx-, 3 and 6 for SG

Terminator: Model YCB128 terminator must be installed on the IRIG-B coupler at the FCS that comes at the end of the RS-422 link.
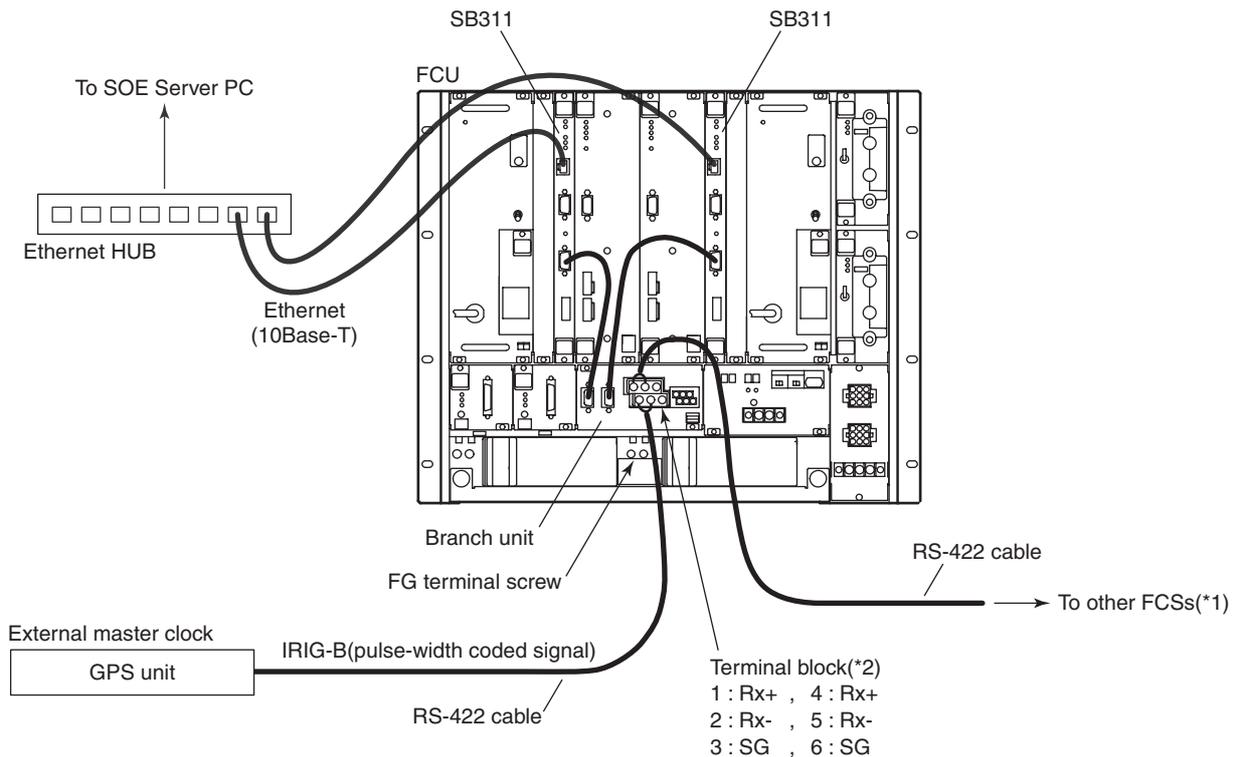
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Figure: Connection of External Master Clock to IRIG-B Branch Unit of FCS and SOE Server to Ethernet ports of FCS

*1:   Max. Number of FCSs connectable: 16 stations per external master clock
*2:   Model YCB128 terminator required at the FCS at the end of the RS-422 link.

■ SPECIFICATIONS OF MASTER CLOCK INPUT

● Time Code Format

IRIG-B unmodulated (pulse-width coded) time code is required.

The control functions are in compliance with the IEEE 1344 specification

● Output Signal Type

RS-422

Consult Yokogawa sales staff for details of suitable master clock equipment.

■ OPERATING ENVIRONMENT

● Hardware Requirements

SOE Server

The SOE Server function runs on a PC which meets the following requirements:

PC: A general-purpose personal computer (IBM PC/AT-compatible) following the basic specifications of HIS. For details of HIS, see GS 33Q02C10-31E.
Hard disk: 20GB or bigger
Network card(s): Two Ethernet network cards
Peripherals: CD-ROM drive
     Tape drive for data backup (optional)

SOE Viewer and/or SOE Server Configurator

PC: A general-purpose personal computer (IBM PC/AT-compatible) following the basic specifications of HIS. For details of HIS, see GS 33Q02C10-31E.
Network card: One Ethernet network card
Peripherals: CD-ROM drive

● Software Requirements

SOE Server

Operating system: Microsoft Windows 2000 Server SP4 or later,
     or Microsoft Windows Server 2003
Database system: Microsoft SQL Server 2000 Standard or Enterprise Edition, SP3a or later
SOE software packages:
 LPC6900 SOE Server Package
 LPC6910 SOE Server Configurator Package
 LPC6920 SOE Viewer Package
 LPC6930 SEM OPC Interface Package

The number of client licenses to be purchased for Microsoft SQL Server 2000 and Microsoft Windows 2000 Server or Microsoft Windows Server 2003 is determined by counting the number of clients (SOE Viewers and SOE Server Configurator) to be connected to the SOE Server.

SOE Viewer and/or SOE Server Configurator

Operating system: Follow the requirements for the HIS.
SOE software packages:
 LPC6910 SOE Server Configurator Package
 LPC6920 SOE Viewer Package

HIS

One OPC package is required for receiving the SOE Server system messages on to the HIS.

OPC software package:
 LHS2411 Exaopc OPC Interface Package

For the general specifications of the HIS, see GS 33Q02C10-31E.

CENTUM CS 3000 System Software

The version must be R3.04 or later.

■ LIMITATION OF INSTALLATION AND NOTICES

● Limitations of ADV151-E Installation

The SOE capture function of ADV151-E can be used only when it is installed in the FIO local node. See General Specifications "Digital I/O Modules (for FIO)", (GS 33Q06Q45-31E) for other limitations and precautions for installation.