WorkstationST* Alarm Server Instruction Guide

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Document Updates

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<td>Removed this section and moved it to the <em>ToolboxST User Guide for Mark Controls Platforms</em> (GEH-6700), the chapter <em>WorkstationST Component Editor</em>, the section <em>Alarm Tab</em>.</td>
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Acronyms and Abbreviations

- **EGD**: Ethernet Global Data
- **SOE**: Sequence of Events
- **OPC**: A standard for data exchange in the industrial environment.
- **OPC AE**: OPC Alarms and Events
- **OPC DA**: OPC Data Access
- **PDH**: Plant Data Highway
- **SDI**: System Data Interface
- **TCP**: Transmission Control Protocol
- **UDH**: Unit Data Highway
- **UDP**: User Datagram Protocol
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1 Introduction

The WorkstationST® Alarm Server collects data from all system components it is configured to monitor, and makes the data available to alarm clients. The Alarm Server acts as a normalizing layer for the alarm data. The alarm clients connect to the Alarm Server to receive information and send commands (such as alarm acknowledge) to the components using the Alarm Server message protocol.

The Alarm Server does the following:

- Communicates with each component in its native alarm protocol
- Translates the alarm messages into the normalized Alarm Server protocol
- Translates commands from clients into the native protocol of the target component, and routes the command to it

The Alarm Server also receives alarms from WorkstationST OPC® Data Access (OPC DA) servers and third-party OPC Alarm and Event (OPC AE) servers.

![Alarm Server Data Flow Diagram]
The Alarm Server, external OPC AE server, and the Alarm Scanner option, and Alarm printing are configured through the WorkstationST component from the ToolboxST® application Alarm tab. For additional information and configuration procedures, refer to the ToolboxST User Guide for Mark Controls Platforms (GEH-6700), the chapter WorkstationST Component Editor, the section Alarm Tab.

2 Alarm Routing

The Alarm Server communicates directly with components over the Unit Data Highway (UDH). To minimize component load, clients do not communicate directly with the components but with the Alarm Server over the Plant Data Highway (PDH).
3 Alarm States

Alarm states are Alarm, Normal, Auto Reset, Shelved, or Out of Service depending upon the value of associated variables. An alarm is generated when a Boolean variable configured with the Alarm attribute transitions to True (or False if the Alarm On Zero attribute is set).

A typical sequence involves the Boolean variable transitioning to True, which causes the controller to send out a message to any connected clients (typically the Alarm Server) indicating that the alarm has entered the Alarm state. The controller also adds this alarm to its internal alarm queue.

After a period of time, the variable transitions to False, which causes the controller to send out a new message indicating that the alarm has entered the Normal state. The controller also updates the internal alarm queue. Unless the Auto Reset state is enabled, the alarm remains in the queue until a client (typically a user through the WorkstationST Alarm Viewer or the CIMPLICITY* Alarm Viewer) acknowledges and resets it. If the Auto Reset state is enabled, when an unacknowledged alarm returns to the Normal state the alarm clears. The internal alarm queue allows a client (typically the Alarm Server) to connect to the component and get the list of active alarms within the component.

**Note** The Auto Reset state is enabled on individual alarms in the ToolboxST application in the controller’s Component Editor.

Process alarms can be placed in the Out of Service state from the WorkstationST Alarm Viewer. The Out of Service state is used to manually suppress alarms when they are removed from service, typically for maintenance. An out of service alarm is under the control of maintenance and is noted on the Alarm Viewer.

Process alarms can be placed in the Shelved state from the Alarm Viewer. Alarm shelving allows an operator to temporarily suppress alarms from the WorkstationST Alarm Viewer filtered alarm display, and from HMI screens that display alarms. When an alarm is being shelved, the operator is prompted to enter an expiration time for the shelving and a comment as to why the alarms are being shelved. Once the alarms are shelved, the expiration time and the shelved time are used to determine when the shelved alarm is un-shelved. When the shelve command is issued, all alarm displays with alarm shelving enabled no longer display the shelved alarms. When the expiration time expires, the alarms again display.

All components maintain a process alarm queue. Mark* Vle and Mark VI components also support a Hold queue, a variation of process alarms that are stored in a separate queue. Many components also support hardware-oriented diagnostic alarms that are stored in separate queues.

The following diagram displays the simplified state machine that is implemented by controllers and other devices in the control system.
Alarm States Defined – Normal, Active, LoLoLo, LoLo, Lo, Hi, HiHi, HiHiHi, Deviation, Rate, Inhibit

Process Alarm State Machine Operator View
When an alarm becomes active it is added to the queue at Node 1 in the diagram.

**Nodes 1 – 4** represent transitions that can occur and the operator interaction with the alarm when the alarm is acknowledged. Alarms are displayed to the operator when they are in states 1-4.

**Node 5** removes the alarm from the queue after the alarm has transitioned to normal and has been reset.

**Inhibit state** occurs when the controlling application determines that the alarm is no longer of importance to the operator and removes it from the queue, thereby removing the alarm from the display to the operator.

**Out of Service, Return to Service, Locked, Unlocked, Silence and Not Silenced** represent attributes of the alarm. The operator causes these attributes to be set when commands are issued from the alarm display.

## 4 Events

An event is a message sent by the controller whenever a variable configured with the event attribute changes value. Once the event notification is sent to connected clients, the event is deleted from the controller. Events cannot be acknowledged or reset at the controller level because they are not maintained within a queue in the components. However, the Alarm Viewer maintains a queue of events for display purposes.

**Note** An event is not considered to have a state, and is not stored in a queue.

Some components, such as the Mark VIe and Mark VI, support a variation of events called sequence of events (SOEs). Unlike events, which are driven by variables, SOEs are driven by hardware inputs or outputs, and time stamped when the hardware state changes. Like events, SOEs are not maintained within a queue in the controller.
5 Alarm Types

Alarm types are either Live or Historical. Live Alarm data consists of component messages generated with the contents of the components’ alarm queues. The Live Alarms data provides a way for the user to troubleshoot the cause of active alarms.

The Historical Alarm data is a log of all alarm messages sent by the components, and can be retrieved and displayed by alarm clients. Historical Alarm data is used to troubleshoot system problems.

Note The Alarm Server preserves the alarm time stamp (Device Time) assigned by the component when the alarm was generated and also adds an additional time stamp (Recorded Time) that reflects the time (relative to the local computer time) when the alarm was received. This allows the correlation of alarm occurrences between components in situations where time synchronization has been lost.
The Alarm Server receives alarm information from the following components:

- Mark VIe
- Mark VI
- EX2100
- EX2100e
- LS2100
- LS2100e
- Power Conversion

Depending on the component, the Alarm Server either makes a TCP/IP connection to the controller or monitors UDP broadcasts from the controller to receive alarm messages. The Alarm Server only connects to, or monitors broadcasts from, the components from which it is configured to consume alarm data.

6 Alarm Clients

Alarm clients can be either local or remote. Alarm clients include:

WorkstationST Alarm Viewer is used to view both Live and Historical alarms.

CIMPLICITY External Alarm ManagerST can receive forwarded messages from the Alarm Server and receive command messages from the CIMPLICITY External Alarm Manager to forward to the components.

WorkstationST Recorder collects Historical Alarm Data along with other variable data.

WorkstationST Web View maintains the web page for the WorkstationST computer hosting it. The web view allows you to view Live and Historical alarms through a web browser.

7 Redundant Alarm Servers

Redundant Alarm Servers provide automatic fail-over protection if the primary Alarm Server goes offline. This feature is configured in the ToolboxST System Editor by specifying the two workstations (configured with the WorkstationST Alarm Server feature enabled) to be used. The primary Alarm Server configuration is then used by both the primary and secondary Alarm Servers and the ability to edit the Alarm Server configuration in the secondary is disabled.

Variable configuration and components required by the Alarm Server need to be configured in both the primary and secondary Alarm Servers. Prior to ControlST V05.01, the user had to put these variables on a redundant EGD page, driven by the primary and secondary workstations, to both avoid build errors and to ensure that variables in the secondary are used when the primary fails. Beginning with V05.01, the redundant variables no longer need to be put onto EGD. Instead, even though the alarm configuration may list the primary workstation as the Source Device Name, the secondary Alarm Scanner will use its own local signals with the same variable name (minus the workstation prefix, for example 00BBA01GH002XL41) if such a variable exists. In V05.01, the Alarm Scanner itself is more redundant. Previously, the Alarm Scanner only scanned variables from its local OPC DA Server. Starting with V05.01, each Alarm Scanner not only scans variables from its local OPC DA Server, it also makes a connection to its peer OPC DA Server and scans its variables. For example, the secondary Alarm Server will not only scan its local variables, but will also make a connection to the primary workstation's OPC DA Server and scan its variables. This way, if a local variable source is down, then this Alarm Server will still have the capability to alarm any condition that occurs.

Alarm Server configuration changes are reflected in the secondary Alarm Server when the primary Alarm Server is built. If an Alarm Server configuration changes, a download is only required to the primary Alarm Server. The secondary Alarm Server automatically receives the downloaded changes from the primary Alarm Server. The secondary Alarm Server must reference the primary Alarm Server either by Status Only or Yes in order to detect changes to the Alarm Server configuration.

Note Refer to the ControlST Software Suite How-to Guides (GEH-6808), the chapter How to Configure the Alarm Server in the WorkstationST Application, the section Redundant Alarm Server Configuration.
8 Alarm System

Alarm System
8.1 Consumed Devices

The components that the Alarm Server monitors are configured under the WorkstationST General tab Consumed Devices item. In the following figure the Alarm Server monitors alarms for components G1 and H1.

8.2 Component Alarms

The alarms generated by each component are configured in the ToolboxST application on a per component basis. The variable attributes that define the alarm behavior are Alarm, Event, Hold, SOE description, Alarm Class, and Alarm On Zero. The following figure shows a variable configured as an alarm in a Mark VIe component.
The following table describes some of the configuration properties that display in the Property Editor.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>When set to True, configures the variable to be scanned by the component's Alarm Scanner. An alarm is generated whenever the variable value transitions to the state configured in the Alarm On Zero attribute.</td>
</tr>
<tr>
<td>Event</td>
<td>When set to True, configures the variable to be scanned by the component's Event Scanner. An event message is generated whenever the variable value changes.</td>
</tr>
<tr>
<td>Hold</td>
<td>When set to True, configures the variable to be scanned by the component's Hold Scanner. A hold message is generated whenever the variable transitions to the state configured in the Alarm On Zero attribute.</td>
</tr>
<tr>
<td>SOE Description</td>
<td>This is used when an SOE message is generated.</td>
</tr>
<tr>
<td>Alarm On Zero</td>
<td>When set to False, causes the controller to generate a new alarm when the variable transitions to True, and to clear the alarm when the variable transitions to False.</td>
</tr>
<tr>
<td></td>
<td>When set to True, causes the controller to generate a new alarm when the variable transitions to False and to clear the alarm when the variable transitions to True.</td>
</tr>
<tr>
<td>Alarm Class</td>
<td>This is used by the Alarm Viewer for filtering and display purposes. The Alarm Class attributes define the alarm colors that display for each class. The variable's name and description also display</td>
</tr>
</tbody>
</table>

**Note** Refer to the ToolboxST User Guide for Mark Controls Platform (GEH-6700), the section Software Tab.

The WorkstationST Ethernet Global Data (EGD) Configuration Server provides the Alarm Server with the associated variable attributes, such as Variable Name, Alarm Class, and Description. When the Alarm Server starts up, it retrieves the variable information for each component from which it is configured to consume alarms. It builds a lookup table for each variable configured as an alarm. This information is then included whenever the Alarm Server sends an alarm message to the clients.
9 WorkstationST Status Monitor

The Status Monitor displays the status of all enabled WorkstationST Features, including the Alarm Server. The Alarm Server reports high-level errors here. Normal operation is as follows.

➢ To display the WorkstationST Status Monitor screen: double-click the tray icon.

The OPC DA Server is running but reporting an Error regarding its Status. Also, the Alarm Server and Recorder are reporting Warnings regarding their Status.

➢ To display additional information about the Alarm Scanner status

From the Status Monitor, right-click Alarm Server and select View Additional Status Detail.
This provides information about whether or not the Alarm Scanner is successfully connected to its local data source, or when a redundant alarm system is configured to its remote data source. It also indicates how many total variables are being scanned for each device, and how many of these variables are healthy.

➢➢

To display Alarm Server status

From the Status Monitor, right-click Alarm Server and select View Alarm Server Status.
Select from the available tabs to display more information.

### Alarm Server Configuration
- **CIMPLICITY Alarm Manager (CAM) Interface**
  - Send Alarms To CIMPLICITY = False

- **Legacy Alarm Support**
  - Connect To Legacy Alarm System (TCI) = False

- **Mark V Alarm Interface**
  - Disabled (No Mark V Devices Consumed by this Workstation)

- **Disk**
  - Disk Cleanup Enabled = True
  - Historical File Age = 30 Days.
  - Minimum Free Space = 10 megabytes.
  - Maximum Alarm Historical Disk Space Detection is Disabled.

- **General**
  - Automatically Reset Acknowledged Alarms = False
  - Emulate CIMPLICITY Event and SOE Behavior = False

- **Historical**
  - Historical Alarm Path = C:\GEWorkstationST\Historical\AlarmData
  - Historical D03 Alarms Enabled = False
  - Historical Workstation Alarms Enabled = True
  - Historical Workstation Text Alarms Enabled = False

- **Printing**
  - Alarm Printer =
  - Alarm Printing Enabled = False
  - Print Queue Limit = 0

- **Alarm Scanner**
  - Alarm Scanner Enabled = False
  - Scan Rate = 500

- **Fault Code Scanner**
  - Fault Code Scanner Enabled = False
  - Scan Rate = 500

- **Network Monitor/Control System Health Alarms**
  - Connection Type = None
  - Connection Hostname or IP Address = 127.0.0.1

- **Consumed Devices:**
  - MarkVieDualSystem: `<MarkVie>` <GeneralPurpose>

---

**Connected:** 127.0.0.1
Alarm Server Status Viewer - 127.0.0.1

Configuration | Alarm Sources | CAM Connections | Client Connections | Alarm Queues | Alarm Summary |

File

Connected: 127.0.0.1

CIMPLICITY Alarm Manager (CAM) Connections

Alarm Server CAM Connection is disabled. Alarm messages will not be forwarded to CIMPLICITY.

Alarm-Event Clients connect to the Alarm Server in order to receive Alarm messages and send Alarm commands. Examples of Alarm-Event Clients are the WorkstationST Alarm Viewer, Recorder, and GeCsS OFC AE Server. Each instance of this utility will generate a client connection.

3 Alarm-Event Clients are currently connected to the Alarm Server.

Client at Address 127.0.0.1:149218 (127.0.0.1:149219): Client Protocol Level = 7; Outgoing Message Queue Size = 0, Total Outgoing Message Count = 0, Total Cmd Msgs Recvd = 210

Client at Address 127.0.0.1:149221 (127.0.0.1:149221): Client Protocol Level = 7; Outgoing Message Queue Size = 0, Total Outgoing Message Count = 0, Total Cmd Msgs Recvd = 631

Client at Address 127.0.0.1:150555 (127.0.0.1:150555): Client Protocol Level = 7; Outgoing Message Queue Size = 0, Total Outgoing Message Count = 0, Total Cmd Msgs Recvd = 17

Connected: 127.0.0.1
Select the **Alarm Queues** tab and click an ellipsis button to display information for the queue.

Information for the selected **Alarm Queue** displays.

Codes for the **Flags** column are provided in the following table.

---

**Note** The alarm queue flag codes read from left-to-right and display in the order presented in the table (the flag for an acknowledged, low low level alarm that has been shelved would be A2LShelved).
### Alarm Queue Flag Codes

<table>
<thead>
<tr>
<th>Alarm State</th>
<th>Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledged</td>
<td>A</td>
</tr>
<tr>
<td>Locked</td>
<td>L</td>
</tr>
<tr>
<td>Overridden</td>
<td>O</td>
</tr>
<tr>
<td>Silenced</td>
<td>S</td>
</tr>
<tr>
<td>OPCQualityBad</td>
<td>OQB</td>
</tr>
<tr>
<td>Inhibited</td>
<td>I</td>
</tr>
<tr>
<td>HiLevelAlarm</td>
<td>H</td>
</tr>
<tr>
<td>HiHiLevelAlarm</td>
<td>2H</td>
</tr>
<tr>
<td>HiHiHiLevelAlarm</td>
<td>3H</td>
</tr>
<tr>
<td>LowLevelAlarm</td>
<td>L</td>
</tr>
<tr>
<td>LowLowLevelAlarm</td>
<td>2L</td>
</tr>
<tr>
<td>LowLowLowLevelAlarm</td>
<td>3L</td>
</tr>
<tr>
<td>DeviationAlarm</td>
<td>D</td>
</tr>
<tr>
<td>RateOfChangeAlarm</td>
<td>R</td>
</tr>
<tr>
<td>BadQuality</td>
<td>BQ</td>
</tr>
<tr>
<td>ConfigurationDrivenVariable</td>
<td>CDV</td>
</tr>
<tr>
<td>OutOfService</td>
<td>OOS</td>
</tr>
<tr>
<td>Shelved</td>
<td>Shelved</td>
</tr>
</tbody>
</table>

File menu items include:

**Alarm Server Hostname** is the hostname on the local computer (default) that has the Alarm Server enabled.

**Save Status to Text File** allows you to save the current Alarm Server status to a text file.
10 Log Files

The Alarm Server logs its startup sequence and error conditions to the AlarmLog.txt file. This file can be viewed directly in a text editor.

➢ To display the Alarm Server User Log: From the Alarm Viewer View menu, select Advanced, View Alarm Server Logs, and Alarm Server User Log.

The following AlarmLog.txt file displays the Alarm Server startup sequence. The Alarm Server reads the variable information for each consumed component (reading system topology section) and makes the component connections. Connection warnings to a TMR controller are also shown.
The Alarm Server also logs low-level status and error messages for debug purposes in the GeCssAlarmServer.txt file. This file can be viewed directly in a text editor, or from the Alarm Viewer (below) from the View menu and Advanced/View Alarm Server Logs/Alarm Server Debug Log.

11 Diagnostic Messages

The Alarm Server generates diagnostic alarm messages whenever an internal error condition is present, as well as when the Alarm Server starts up and shuts down. These diagnostic messages are sent to the alarm clients and logged in the historical log files as with other alarms. This allows Alarm Server errors to be easily displayed for troubleshooting. For example, the Alarm Server will generate a diagnostic alarm if it is configured to get alarms from the WorkstationST Network Monitor feature and the Network Monitor connection cannot be established. The period of time that communications were down is determined by checking the historical log entries.
12 Glossary of Terms

**Bind** - To establish the correspondence between the data in an exchange and variables in a device.

**Bind/Build** - To bind the configuration for each consumed exchange and create/update the configuration for any produced exchange.

**Collection** - More formally, an EGD Collection. A group of devices that constitutes a formal subset of the devices participating in a particular EGD installation. This arbitrary grouping allows users to subdivide the system to make some tasks easier.

**Consume** - To receive an EGD data message (exchange).

**Consumer** - An EGD node configured to receive an EGD data message.

**EGD** - A mechanism that provides access to global data between nodes supporting the EGD protocol.

**Exchange** - An EGD data message consisting of a header and a body of data. The header contains the producer ID and the exchange ID that uniquely identifies the message. The body of data is a block of bytes in a format agreed upon by the producer and all consumers.

**Feature** - An element of the WorkstationST runtime system, which can be optionally enabled through the ToolboxST application. Examples include OPC Server, Recorder, and Alarm Viewer.

**Global Data** - A concept in which multiple controllers on a network can share information by exchanging portions of their local memory with peer controllers.

**OPC** - A standard for data exchange in the industrial environment. The OPC foundation provides specifications for various OPC standards such as OPC DA (Data Access), OPC AE (Alarm and Event), and OPC UA (Unified Architecture).

**Produce** - To send an EGD data message (exchange).

**Producer** - The EGD node configured to send data messages. The source of the data samples for an exchange.

**Refresh** - To bind the configuration for each consumed exchange for a particular consumed device.

**Runtime** - Software stored in the controller’s Flash memory that converts application code (pcode) to executable code.

**Unbound Variables** - Variables required by a consumer that were not found in the producer configuration during the bind.