Configuring Device Alerts in a DeltaV™ System

This document provides information on configuring field device alerts in a DeltaV™ system using device alarms.
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Introduction

This document provides information on configuring field device alerts in a DeltaV™ system. In the context of a DeltaV system, these alerts are used to generate device alarms. DeltaV device alarms are available for both FOUNDATION Fieldbus and HART devices. Device alerts in Emerson devices provide consistent, predictive device condition monitoring and reporting, and can notify users of potential field device issues before they impact the plant’s process.

Historically, control systems generated alarms only when process conditions deviated too far from normal operation. These traditional process alarms typically do little to identify the root cause of the problem, such as the condition of the field devices monitoring or directing the process. DeltaV device alarms provide the framework for reporting the health of a device and its ability to perform its primary task. Rather than allowing the device to degrade until failure impacts production, corrective action can be taken to avert unnecessary plant shutdowns or losses due to production quality.

Device alerts are implemented in a DeltaV system as a separate alarm subgroup. This enables the system to target them to the right personnel. There are many different operational philosophies with respect to alarming, DeltaV device alarms enable users to adjust the system behavior to meet their specific needs.

Device alarms should be introduced methodically to a DeltaV system, to avoid inappropriate notifications to operators who either have no action to take when alerted or who have not been trained to respond. When properly deployed, DeltaV device alarms can significantly improve system availability and reduce unscheduled outages.

This paper assumes that the reader is familiar with the DeltaV field device definition and the DeltaV alarm management system, including the definition of alarm priorities and the function of plant areas within the alarm management scheme. For additional information on these features of the DeltaV system, please refer to the Books Online “System Alarm Management” topic.

Device Alerts within the DeltaV System

Device Alerts are implemented in the DeltaV alarm management system as device alarms. Most control systems use one mechanism to report process-related alarms and a different mechanism for reporting system hardware health or integrity. DeltaV device alarms expand the scope of system health to cover the field devices. The DeltaV system has incorporated the device and system hardware integrity alerts within the alarm management system to provide a consistent mechanism for handling all alarms and alerts in the system.

Device Alerts in FOUNDATION Fieldbus Devices

Fieldbus devices detect and report various conditions to a host system. These conditions range from hardware failures and sensor or control problems to proactive reporting of upcoming maintenance requirements. The device manufacturer determines whether a particular device condition can be suppressed, disabled or configured through the host system.

Standard FOUNDATION Fieldbus device conditions are reported through a single alert type, ABNORMAL. The device sets one of the bits in the standard block alarm on the resource block. Since all conditions are reported by the resource block under the same alert and with the same priority, it is difficult to distinguish which conditions are actionable by either operators or maintenance personnel.

Emerson FOUNDATION Fieldbus devices that support device alerts, together with the DeltaV system software, can accurately target device conditions to operators or maintenance personnel as appropriate. The system can also route lower-priority alerts to historical logs for later review.

The FOUNDATION Fieldbus devices detect device conditions, map conditions to an alert type, and report the alert to the host system. Depending on the particular device and version individual conditions may be enabled or disabled, given a different threshold, or be reassigned to a different alert type.
The DeltaV system reports these alerts through the system and maps the alert types to DeltaV alarm priorities. This ensures that device conditions are properly represented and reported to operators, maintenance personnel, the Event Chronicle, and so on.

Note thatFOUNDATION Fieldbus standard FF912 introduced a fieldbus device alert standard which, like DeltaV device alarms, specifies a hierarchy of alert types. For more information on configuring FF912 alarms in DeltaV, please refer to the whitepaper “Configuring FF912 Alarms in a DeltaV System”.

Device Alerts in HART Devices

DeltaV offers four device alarms (FAILED, MAINTENANCE, ADVISORY and COMMUNICATION) for all HART devices, based on the standard HART status conditions.

HART devices do not report alert conditions proactively to a host system, and must be polled to determine which device conditions are active or have been cleared. For HART devices, alert condition configuration, annunciation and reporting are managed in the DeltaV system, not the device. DeltaV device alarms work with HART 5, 6, and 7 devices.

DeltaV Hardware and Software Requirements

DeltaV device alarms were first introduced in DeltaV v6.3 with FOUNDATION Fieldbus devices from Emerson divisions. Later, device alarms were extended to HART devices connected to SIS Logic Solvers in v8.3. Then in v9.3, device alarms were implemented on all HART-enabled devices.

From a hardware perspective, the Series 2 H1 card is required to access device alerts in FOUNDATION Fieldbus.

DeltaV Device Alarm Classifications

DeltaV device alarms are used to classify and report device alerts in a proactive, meaningful structure that helps the user respond appropriately.

Device alerts are organized into three alarms based on the impact of the condition to the health of the device. A fourth alarm, communication, is created by the DeltaV system and activated based on the ability to communicate with the device.

Figure 1. HART Device Alarms
The DeltaV device alarms are assigned a priority to manage which are annunciated to the operator. From a device perspective, the impact of an alert condition would be the same in all instances of that device type, but the impact to production or product quality could be quite different based on how the device is used. The alarm priority can therefore be used to elevate those device alerts where prescribed actions should be taken in the event of the alert activation.

These four alarms are made visible through the DeltaV Live and DeltaV Operate alarm interface tools, such as the alarm banner and the alarm summary. These tools allow alarms to be separated into dedicated lists using filters that look at the alarm source, assigned plant area, associated unit or module, and assigned priority. Because device alerts are integrated into the alarm management system, they can be combined into broadly scoped lists or isolated into a very specific list, even to a single device.

## DeltaV Device Alarm Implementation

The DeltaV system has built-in default settings to help you take advantage of device alarms with minimal effort. This section provides information about the prioritization and distribution of alarms throughout the system to help you customize the settings according to your operational requirements and alarm management strategy.

The implementation of DeltaV device alarms should be included in the plant alarm philosophy so that all devices are configured in a consistent fashion and so that alarms are meaningful to those who receive them. The alarm philosophy defines the alarm priorities and their criteria for use within the system. The DeltaV system defines four alarm priorities by default and supports up to twelve different priorities.

To understand DeltaV device alarms, it is important to understand some of the basic functions of the DeltaV alarm management system.

- **Plant Areas** – The alarm system uses plant areas to target alarms and events to specific workstations and users, defining the scope of control for the user at each workstation. Every control module, device tag and DeltaV hardware component is associated with a plant area so that its alarm or integrity information can be targeted to the right user.

- **Alarm Priorities** – Each alarm and/or alert needs a defined priority. The priority is an indication of alarm importance and typically reflects several factors such as consequence of inaction and time to respond. The alarm system uses priority to determine which alarms or alerts are displayed in the alarm banner and the order alarms are listed in the alarm summaries.

- **Alarm Annunciation** – The DeltaV system groups alarms based on their source (process, device, hardware). Within a specific workstation’s alarm banner, these alarm groups are filtered by priority to match the primary task of the current user. Only alarms with sufficient priority are annunciated to the operator through the alarm banner, where the alarm horn is triggered and the alarm is acknowledged by the operator.

The DeltaV system provides a default alarm management scheme for device alarms. Only the Device Failure and Communication Failure alarms are annunciated to the operator because these reflect a loss of monitoring or control of the process. All other DeltaV device alarms are reported for reference and are primarily intended for maintenance personnel. All devices assume the same plant area as their associated control modules so that wherever a module is operated, all related device alarms are also available, but not necessarily annunciated.
Some customers may want to change the device alarm reporting, based on the criticality of service of certain devices, or have all alerts annunciate to the operator because of their particular work practices. Whatever the reason, the DeltaV system allows you to modify the presentation of device alarms to meet your needs, along with tools to help facilitate the implementation phase.

The remainder of this document focuses on device alarms and their implementation within the DeltaV system.

**Plant Area Assignment**

The DeltaV alarm management system uses Plant Areas to determine where alarms are available and who will see them. This is true for both process alarms and device alarms.

Initially, when the device is created and assigned to a controller’s I/O subsystem, it assumes the plant area of the controller. If the device is used for SCADA communication without a control module reference, the device alarms report to the same workstations as the controller’s integrity data, or hardware alerts.

*Figure 2. Controller Alarm and Events Area Association for Integrity Reporting*

When the field device is referenced by a control module, the DeltaV system automatically assigns the device to the module’s plant area. This ensures that the process alarms of the module and the device alarms of the referenced devices all report to the same operator stations. Even if the device alarms do not annunciate in the alarm banner, the operator has access to all the device condition information through the appropriate alarm summaries.
The plant area assignment is automatic and does not require any intervention on the part of the configuration engineer. It is important to have a consistent plant area association strategy because this governs where alarms and events are reported, including history collection. The default strategy in the DeltaV software ensures that all alarms and events of a physical process area are reported together and collected in history as a complete set. Assigning device alarms to separate areas from the referencing control modules requires additional management and configuration to direct the alerts to the correct destinations. Consider carefully whether to deviate from the default implementation because this could create additional alarm management and configuration.

To manually override the associated alarms and events area, open the device properties dialog, select the check box and manually define the desired plant area or control module.
Enabling DeltaV Device Alarms

By default, the DeltaV system enables device alarms when a device is created with the option Enable Device Alarms in the device properties dialog. Changing this setting requires a download to the controller. Disabling the device alarms also disables the communication alert.

![Figure 4. Enable Device Alarms Option](image1)

Individual device alarms can be disabled as shown below. This is not recommended, as disabled device alarms are not made available in AMS Device Manager.

![Figure 5. Disabling Individual DeltaV Device Alarms](image2)
Configuring DeltaV Device Alerts

Setting DeltaV Device Alarm Priority

The DeltaV system provides the ability to change the alarm priority of device alarms for individual devices, to fine tune the alarm system according to your plant alarm philosophy and to the criticality of the associated process.

![Figure 6. Changing DeltaV Device Alarm Priorities](image)

**Note:** The alarm priority is used only within the DeltaV alarm management system. When viewing devices in AMS Device Manger, device conditions are grouped by their assigned DeltaV device alarm, but they are all presented equally.

Presenting DeltaV Device Alarms to the Operator

Recapping the previous sections, HART and fieldbus device conditions are grouped into DeltaV device alarms (ADVISORY, MAINTENANCE, FAILED, and COMMUNICATION), and each device is assigned to a plant area with DeltaV alarm priority levels assigned to each of the four alarm types. In this section, we see how alarm priority is used by the DeltaV Operator Station and Maintenance Station to assure device alarms are matched to the roles of operators and maintenance staff.

You may recall that each DeltaV alarm priority is assigned a designated numeric weight, from 3 to 15, as seen here. The numeric value is important because this is what the filters in the alarm banner and alarm summaries use.
The alarm banner settings of each DeltaV workstation determine which alarms (device alarms, process alarms and hardware alarms) are annunciated, according to the source and numeric priority of the alarm. To annunciate means to sound the horn and show the alarm in the alarm banner and alarm list.

The DeltaV system default settings for device alarms assume that operators are interested in all process alarms but are interested only in higher priority (8 to 15) device conditions. The following shows the default priority assignment for device alarms.

![Figure 7. Alarm Priority Numerical Values](image-url)

The table shows the default priority assignment for device alarms, with the following values:

- **WARNING**: No, Value 11
- **PROMPT**: No, Value 5
- **LOG**: Yes, Value 3
- **CRITICAL**: No, Value 15
- **ALERT**: Yes, Value 4
- **ADVISORY**: Yes, Value 7

![Figure 8. DeltaV Device Alarm Priority Assignment](image-url)
Configuring DeltaV Device Alerts

The DeltaV workstation default settings for the alarm banner are as follows:

Table 1. Default Workstation Alarm Annunciation Settings

<table>
<thead>
<tr>
<th>Alarm Source</th>
<th>Log Only</th>
<th>Advisory Priority</th>
<th>Warning Priority</th>
<th>Critical Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Alarm</td>
<td>Log Only</td>
<td></td>
<td></td>
<td>Annunciate</td>
</tr>
<tr>
<td>Device Alarm</td>
<td>Log Only</td>
<td>Report Only</td>
<td></td>
<td>Annunciate</td>
</tr>
<tr>
<td>Hardware Alarm</td>
<td>Log Only</td>
<td>Report Only</td>
<td></td>
<td>Annunciate</td>
</tr>
<tr>
<td>SIS Process Alarm</td>
<td>Log Only</td>
<td></td>
<td></td>
<td>Annunciate</td>
</tr>
<tr>
<td>SIS Device Alarm</td>
<td>Log Only</td>
<td>Report Only</td>
<td></td>
<td>Annunciate</td>
</tr>
<tr>
<td>SIS Hardware Alarm</td>
<td>Log Only</td>
<td></td>
<td></td>
<td>Annunciate</td>
</tr>
</tbody>
</table>

The alarm banner priority thresholds can be set in the DeltaV Live library standards and in the UserSettings.grf file in DeltaV Operate. Refer to Books Online for information on how to modify these settings for the system or for individual workstations.

The DeltaV system’s alarm presentation is set up by default to show all process alarms to the operator and only higher-priority device alarms in an Operator Station alarm banner. In contrast, the Maintenance Station is designed to show only device alarms (not process alarms) in the alarm banner. If this matches the plant’s philosophy, then the system defaults should require little modification.

There are also specific preconfigured alarm summaries that allow anyone to see all alarms and/or alerts currently active in the system. These can be used to display all device alarms to the operator, including those that do not annunciate through the alarm banner.

The DeltaV Maintenance Station uses the same default alarm banner settings as the Operator Stations, but it only shows device alarms. The Maintenance Station does not have a DST size in its licensing, so all plant areas can be assigned to one station to manage all device level alarms from this single node. However, no process alarms are shown in the alarm banner or alarm summary of the Maintenance Station.

Customizing HART Device Alert Conditions

DeltaV device alarms deliver maximum value with a minimum configuration effort. Some FOUNDATION Fieldbus devices do offer the ability to change the condition mapping to customize the device alarm behavior using the AMS Device Manager application. Similarly, the DeltaV implementation for HART-based device alarms provide a mechanism for customizing the alert mappings of the HART device conditions. However, the HART device alert conditions are defined in the device EDDL file used by AMS Device Manager. If the DeltaV mapping is altered, AMS Device Manager will not be made aware of the change, which results in an alert condition reporting to the DeltaV workstation as one device alarm, but displayed in AMS Device Manager under the original alert mapping.

The Alarm Conditions mapping configuration is accessed from the HART device properties dialog. Selecting the Configure button displays the Alarm Condition dialog that contains three tabs: Status, Device and Subsystem. All HART devices support the standard Status conditions, and this dialog allows you to reassign the conditions to different DeltaV device alarms. By selecting None, a condition can be disabled from setting any DeltaV device alarm for that device, which could be useful in preventing a chattering condition from filling up the Event Chronicle. Notice that any single condition can be mapped only to a single alarm.
In addition to the standard HART status information, displayed under the Status tab, many HART devices have additional internal diagnostics called device-specific parameters. Emerson device manufacturers have defined the significance of device conditions and mapped them to DeltaV device alarms. This mapping is documented in the device EDDL files used by the AMS Device Manager and is imported into the DeltaV system as part of the device library so that the same DeltaV device alarms can proactively alert the operations and maintenance personnel.

For those defined with device-specific information, the Device tab displays a list of conditions. These are both categorized from a device-function perspective and mapped to DeltaV device alarms, based on their impact to the device. If the device does not support the device-specific conditions, this tab is blank.
The DeltaV system uses Command 48 to retrieve the device-specific conditions by polling the device periodically. This allows the DeltaV system to support HART 5, 6 and 7 devices with device alerts. AMS Device Manager also issues the same Command 48 to read the device-specific data from a HART device. If the AMS Device Manager screen for a HART device shows device alert information, but the DeltaV system does not, it is likely a new device definition must be imported into the DeltaV system. Check with the device manufacturer to see if there is a later version that supports device-specific diagnostic conditions.

The Subsystem tab provides additional alert conditions derived by the DeltaV system. All HART devices are verified for the correct device version to ensure that the correct device mappings are in use. A mismatch in a field device version could result in incorrect condition mappings.
Configuring DeltaV Device Alerts

Summary

Out of the box, the DeltaV system provides a comprehensive device alert reporting system suitable for most control system applications. On-board diagnostics in HART and FOUNDATION Fieldbus devices provide the basis for detecting and preempting device conditions that, if left unchecked, could lead to an abnormal process condition.

Fieldbus devices internally generate alerts based on device conditions and report them to the DeltaV system for annunciation and logging. HART devices generate alert conditions and rely on the host system to read them. DeltaV systems V8.4 and later poll HART devices to create the DeltaV device alarms that proactively alert operators and/or maintenance technicians.

The DeltaV system incorporates device alerts into the overall alarm management system with the ability to fine-tune annunciation based on assignment of alarm priority, plant area, and workstation alarm banner thresholds. Device plant area assignment automatically follows the control modules where they are assigned.

The DeltaV system provides advanced users with optional settings to tune each device’s alerts according to their own plant alarm philosophy and practical needs. While many users will find the default DeltaV out-of-the-box settings adequate for a complete device alarm implementation, advanced users can easily implement unique alarm management strategies such as:

- Creating custom DeltaV alarm priorities specifically for device alerts and hardware alerts
- Creating custom plant areas specifically for manual device alert and hardware alert assignment
- Creating custom device templates with pre-set device alarm priority settings for each type device, including device condition to alert level mapping for HART devices
- Tuning the alarm banner thresholds of individual workstations by modifying the DeltaV Live library standards or modifying the UserSettings.grf file for DeltaV Operate

Device alarms should be introduced methodically to a DeltaV system, to avoid inappropriate notifications to operators who either have no action to take when alerted or have not been trained to respond. When properly deployed, DeltaV device alarms can significantly improve system availability and reduce unscheduled outages.