

Alarming in the openPDC and openPG

With release of openPDC 1.5 a full featured Alarming Component is available with both the openPDC and openPG. The component generates alarms by sampling the full resolution phasor data in real-time with features to export alarm state to external systems that can be used to annunciate and manage these alarms.

Creating an alarm requires the addition of a new “signal” in the openPDC or openPG that represents the alarm state. This signal is published on change of alarm state and is time stamped at the time of this change of state. For example, for a source signal of frequency values would be tested at the periodicity of the incoming data (e.g., 30 times a second). Once an alarm condition is detected, say for low frequency, an alarm signal value would be published with the alarm state set to TRUE.

The alarm signal produced by the Alarming Component can be exported as part of phasor data streams or exported via other provided openPDC and openPG interfaces – such as web services or via the Gateway Exchange Protocol (GEP)

The Alarming Component can generate Condition Based Alarms such as Internal/External Range, Unreasonable Data and Latched Values

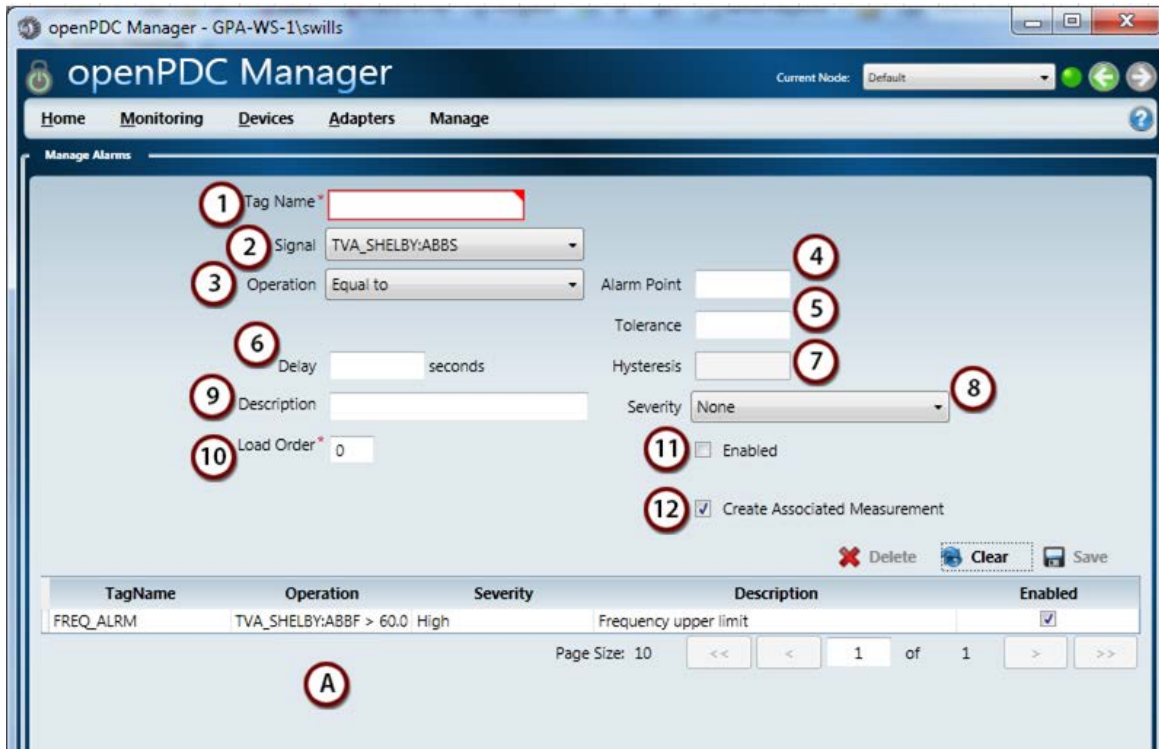
The Alarm Configuration Screen

The alarm configuration window screen provided by the openPDC Manager is shown below. It allows the openPDC administrator to:

1. Define an Alarm Point which can be “in Alarm” or not.
2. Associate this alarm point with a source measurement, or signal
3. Define a test on this signal to determine if it is an alarm state

As is the case for other configuration settings in the openPDC, the definition of the alarm entered on this configuration screen is saved in the configuration database.

Each input field is labeled in Figure 1 and a description of this input field is provided below.



openPDC Manager - GPA-WS-1\swills

openPDC Manager

Current Node: Default

Home Monitoring Devices Adapters Manage

Manage Alarms

1 Tag Name*

2 Signal TVA_SHELBY:ABBS

3 Operation Equal to

4 Alarm Point

5 Tolerance

6 Delay seconds

7 Hysteresis

9 Description

8 Severity None

10 Load Order* 0

11 Enabled

12 Create Associated Measurement

Delete Clear Save

TagName	Operation	Severity	Description	Enabled
FREQ_ALRM	TVA_SHELBY:ABBF > 60.0	High	Frequency upper limit	<input checked="" type="checkbox"/>

Page Size: 10 << < 1 of 1 > >>

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Figure 1. Alarm Configuration Screen

1 Tag Name

The alarm state is set in the openPDC within a standard signal, or measurement point. Signals are identified by their unique tag name. Therefore, each alarm must have a tag name as its unique identifier. Typically, an alarm tagging pattern is developed by each company to distinguish alarm tags from others. For example, an alarm tagging pattern could be:

[ALRM_] + [Type] + [Device]; e.g., ALRM_FREQ_SHELBY

Tag names are limited to 200 characters.

2 Source Signal

Alarms are raised through tests on signals. This signal can be among any defined within this openPDC instance. This field is used to select the source signal for the alarm.

3 Operation

Through this drop-down box, the openPDC administrator selects the “test” or operation to be performed on the source signal to determine if the source signal is in an alarm state. The first six options are logical operators. The last item, “latched” is

used to alarm on a point that never changes value. Operation options are show below:

1. Equal To
2. Not Equal To
3. Greater Than or Equal To
4. Less Than or Equal To
5. Greater Than
6. Less Than
7. Latched

By far, the most used operation options are “Greater Than” and “Less Than”.

4 Alarm Point

The Alarm Point is the triggering value for the alarm. For example, to alarm on frequency greater than “60.05” Hz, the alarm point would be “60.05”.

5 Tolerance

For only the “Equal To” and “Not Equal To” operations a setting is provided to enable the user to specify a band, or tolerance, around which the source signal can be assume to equal (or not equal) the alarm point. Tolerance is typically set based on the accuracy of transducers.

If no value is entered, a null entry is made to the configuration database and an effective tolerance value of zero is used for this alarm point.

6 Delay

To avoid chattering alarms, i.e., alarms that come and go quickly, typically a time delay is used to assure that the source signal is clearly in the alarm state prior to raising the alarm. Delay is the time (in seconds) that a signal must be outside alarm point before the alarm is raised.

If no value is entered, a null entry is made to the configuration database and an effective time delay value of zero is used for this alarm point.

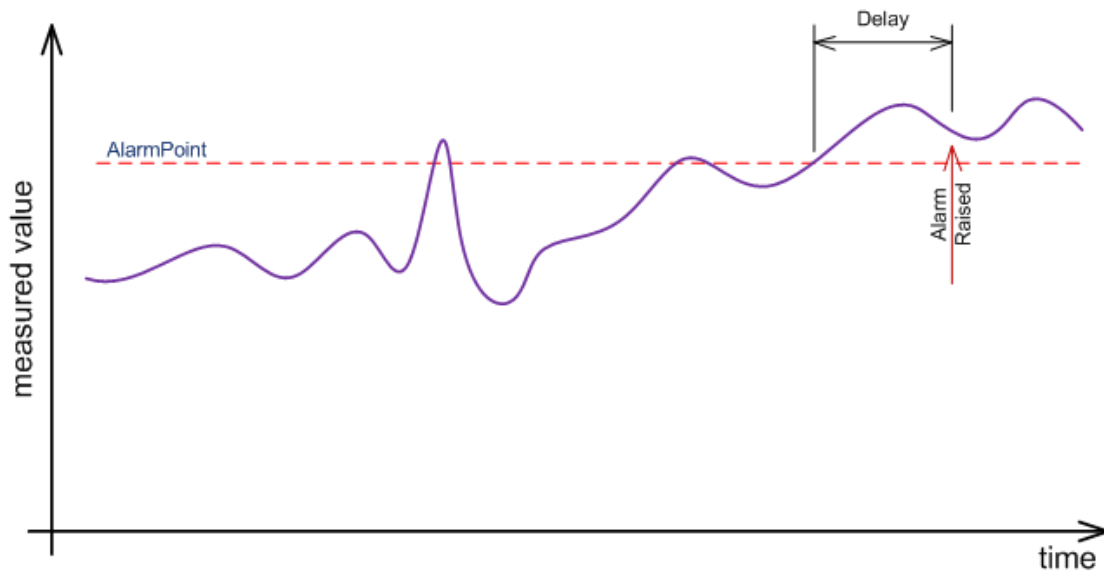


Figure 2. Alarm Delay

Note: In Figure 2 and subsequent figures, the measured value, or source signal, is not continuous as depicted by the purple line. Rather it is a stream of sampled values that are tested at the sampling rate for that signal.

7

Hysteresis

As a second method to reduce chatter in the change of alarm state, a value can be entered which biases the Alarm Point by an additional amount prior to clearing the alarm. As seen in Figure 3, this biased Alarm Point is called the Hysteresis Point.

Unlike the delay parameter, which is time based, hysteresis is entered as an incremental value in the units of the source signal. For example, it might be desirable to set an low frequency alarm at 59.95 hertz but not clear that alarm until frequency is clearly on the upswing – say 59.98 hertz. In this case, the hysteresis would be 0.03. Hysteresis is always a positive value regardless of the alarm condition test.

If no value is entered, a null entry is made to the configuration database and an effective hysteresis value of zero is used for this alarm point.

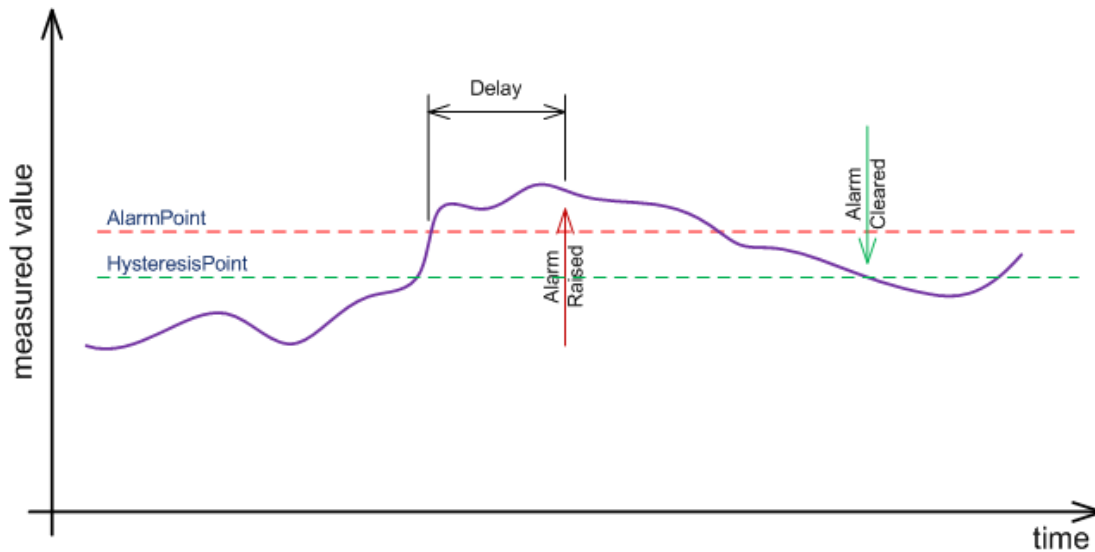


Figure 3. Hysteresis

8

Severity

Quite often an event will trigger multiple alarms. So that downstream alarm managers can effectively manage alarms, the Alarming Component allows the drop-down assignment of alarm severity level. The Alarm Component has been developed to be compliant with OPC standards for alarm severity designation. Severity levels have been assigned with the Alarm Component to correspond to OPC numeric severity designations. Listed below are the names for these levels with their corresponding OPC numeric designation.

- Information (50)
- Low (150)
- Medium Low (300)
- Medium (500)
- Medium High (700)
- High (850)
- Critical (950)
- Error (1000)

Within the openPDC architecture, alarm severity is not included as part of the signal information that indicates alarm state. There is no place for this information within the message payload for the openPDC. However, this information can be obtained through query of the configuration data base or through use of the web-services interface to the openPDC.

9 Description

A long description of the alarm can be entered here. This field effectively has no maximum length.

10 Load Order

This parameter was added to the Alarming Component to assure consistency with other openPDC configuration screens. It can be ignored for now.

11 Enabled

Alarms can be pre-configured but not enabled. This check box enables/disables the alarming for this alarm point.

12 Create Associated Measurement

In general, an associated measurement should be created along with this alarm point. Not doing so does not automatically recreate a record in the measurements table.

A Established Alarm Listing

This is a list of all alarms that have been created with all relevant information displayed. You may click on the column header to have it sort the list of alarms by that column.

Advanced Alarming

Often a single alarm on a signal is not sufficient. For example, a set of alarms – one for high alarm and one for low alarm is typically implemented. In addition, alarms may need to be nested so that the first alarm provides a warning and the second an alert. As shown in Figure 4, the Alarming Component can be configured to implement nested alarms.

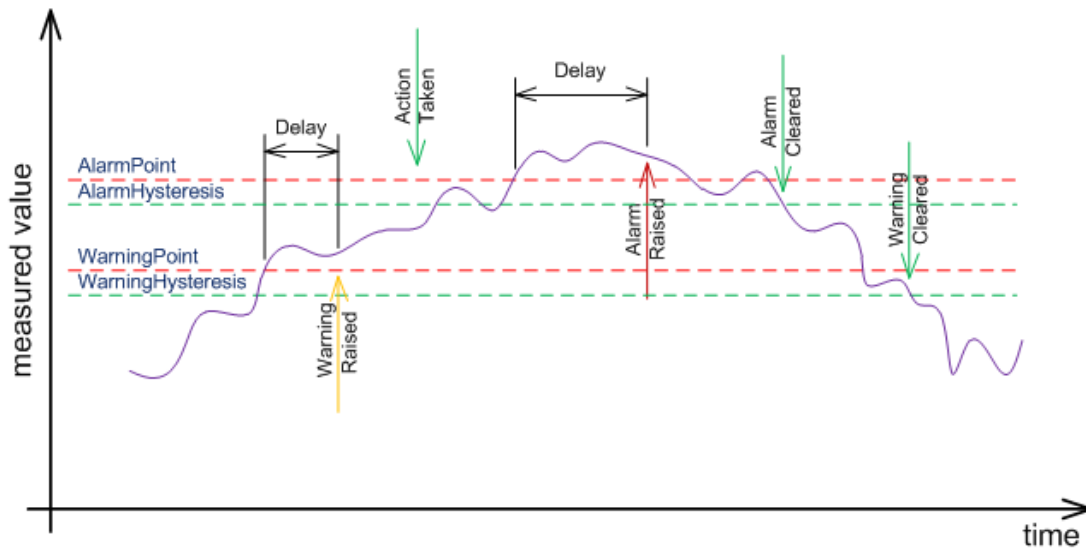


Figure 4. Alarm Nesting

Alarming the openPDC Performance Historian

An openHistorian can be configured to become an Alarm Historian of raw alarm signals. Turning off openHistorian compression allows the logging of all alarm state changes prior to filtering without historian overload.

Alarms are sent from the Alarming Service to the Alarm Repository through an alarming message that allows easy integration of the openAlarm Alarming Service and Manager

The Alarm Manager can also accept OPC-based alarm messages

Example 1 –PMU Connection Alarm

This is an example of how an alarm should be constructed for a Boolean signal such as the status of a PMU connection.

Tag Name = ALRM_NOconnection_SHELBY

Signal = "TVA:SHELBY!ST11" NOTE: This signal is from Performance Historian and is recorded every 10 seconds.

Operation = Less Than

Alarm Point = 100

Tolerance = N/A

Delay = 60 seconds

Hysteresis = 0

Severity = Error (1000)

Load Order = N/A

Enabled = True (checked)

Create Associated Measurement = True (checked)

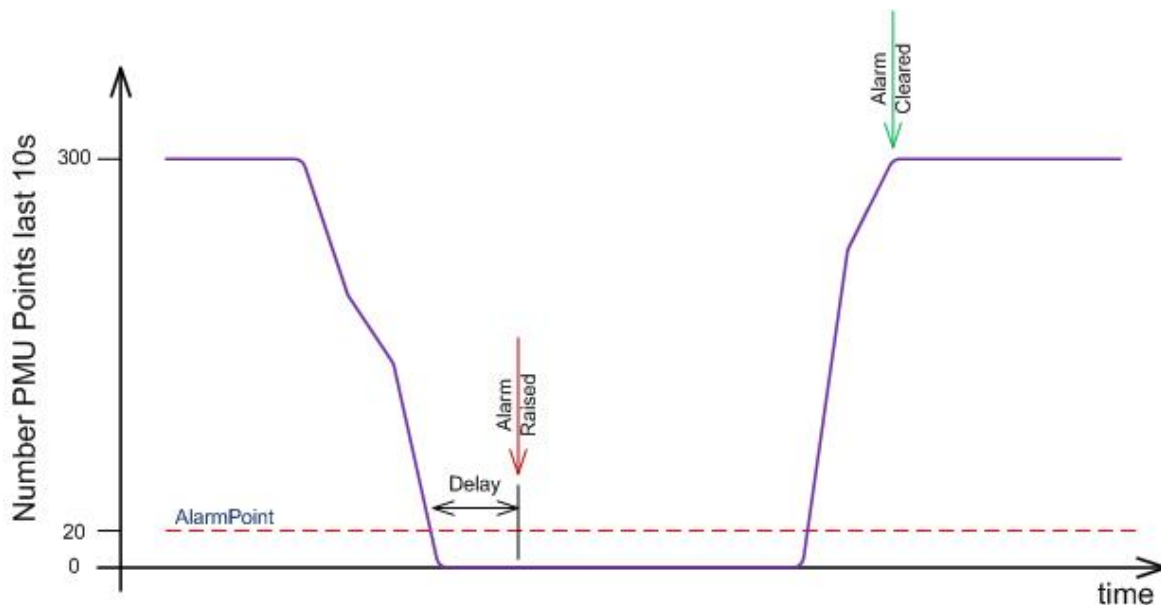


Figure 5 - PMU connection example

Example 2 –Low Frequency Alarm

Tag Name = ALRM_LOWFREQ_SHELBY

Signal = “TVA:SHELBY:ABBF”

Operation = Less Than

Alarm Point = 59.95 Hz

Tolerance = N/A

Delay = 0.5 (seconds)

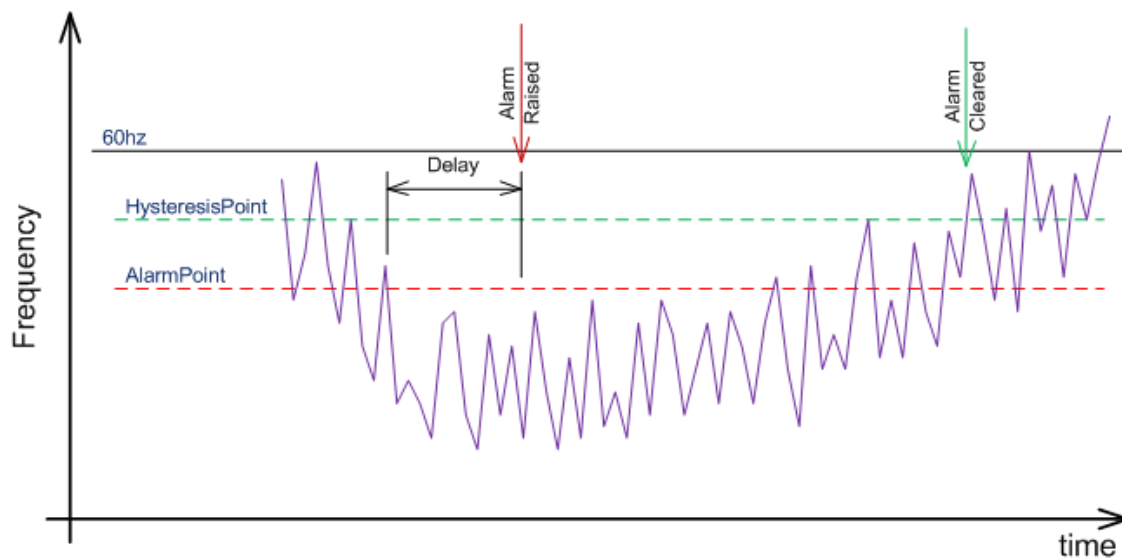
Hysteresis = 0.03

Severity = Medium (500)

Load Order = N/A

Enabled = True (checked)

Create Associated Measurement = True (checked)



Example 3 – Alarming for Latched Phasor Magnitude

Tag Name = ALRM_LATCHEDVOLTS_SHELBY

Signal = “TVA:SHELBY:ABB?”

Operation = Latched

Alarm Point = N/A

Tolerance = N/A

Delay = 300s

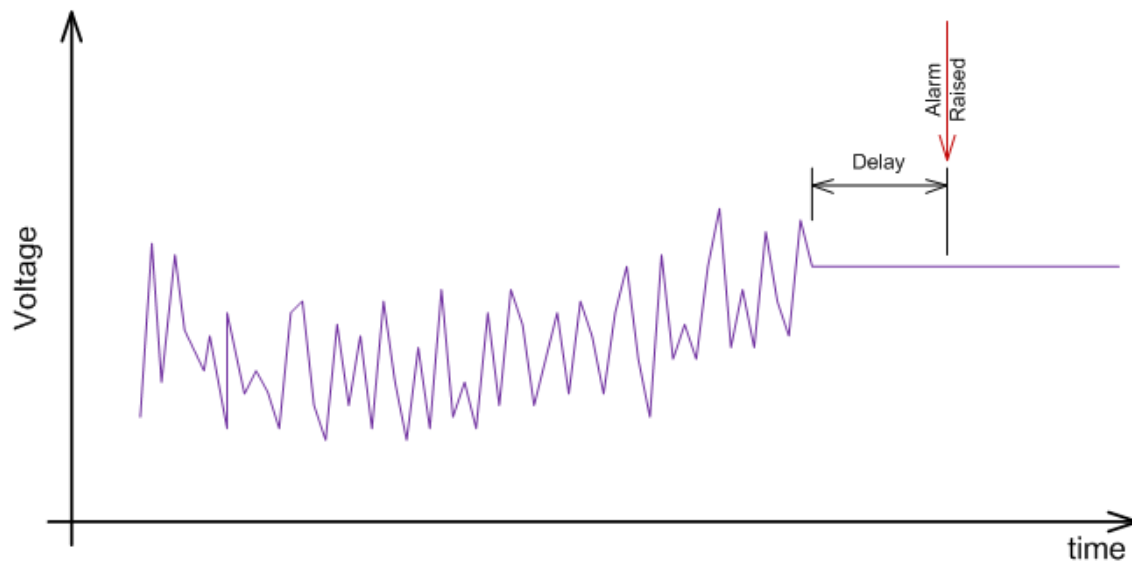
Hysteresis = N/A

Severity = Error (1000)

Load Order = N/A

Enabled = True (checked)

Create Associated Measurement = True (checked)



ABOUT THE AUTHOR

Shawn Williams is a project manager at GPA with extensive experience within the process control industry.
