

## Appendix B

# Building an Alarm Application

## ***Introduction***

There are two methods of alarm routing for the N30 Supervisory Controller: the Notification Class alarm routing feature and the Message Router feature. This appendix describes aspects of these features, including alarm routing recommendations, how Status Notification Reports (SNRs) are routed, how message filtering is configured, and how the Notification Class and Message Router objects interact with other objects.

For further information about the objects described in this appendix, see the *Working with Notification Class Objects (LIT-6892290)* and *Working with Event Enrollment Objects (LIT-1201218)* chapters in the *N30 Supervisory Controller User's Manual* and the relevant object chapters in the *Object Dictionary*. For information about generating N30 databases using Project Builder, refer to the *N30 Supervisory Controller Quick Start Technical Bulletin (LIT-6891200)*.

## Key Concepts

### Alarm Routing Recommendations

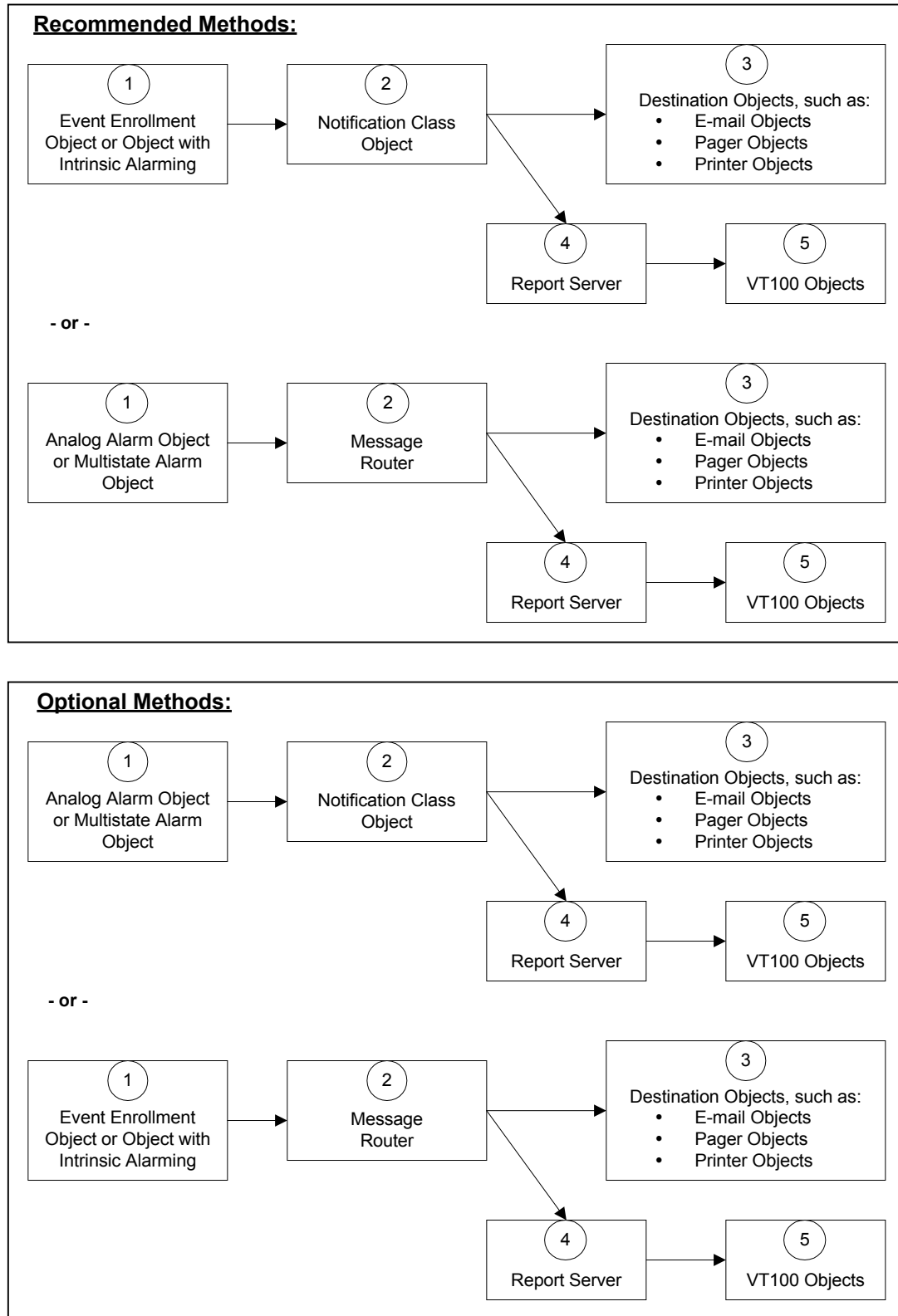
**Notification Class** - We recommend using Event Enrollment alarming or Intrinsic alarming with this type of alarm routing. If routing to third-party (non Metasys® system) BACnet™ devices is required, then Notification Class objects must be used for alarm routing.

**Message Router** - We recommend using the Analog Alarm or Multistate Alarm objects with this type of alarm routing.

Only one of these two routing methods can be used on a site for alarming to work properly. After determining the method for your site, use Project Builder to select the desired alarm routing option by clicking Edit Site from the Edit menu. Refer to the *Defining a Site* chapter (LIT-693220) of the *Project Builder User's Guide*.

Figure B-1 shows the recommended and optional alarming methods and shows examples of how the objects interact in alarm routing. Table B-1 describes the objects' role in alarm routing.

See the *Notification Class Alarm Routing* and *Message Router* sections in this appendix before reading about the individual alarming objects that trigger alarm routing.



Flow

**Figure B-1: Alarm Routing Examples**

**Table B-1: Alarm Routing Objects**

| Number | Object                                                                                                                                               | Role                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Analog Alarm Objects<br>Multistate Alarm Objects<br>Event Enrollment Objects<br>Objects with Intrinsic Alarming                                      | Generate alarm messages and SNRs that are routed by the configured alarm routing object (Notification Class object or Message Router object). For more information, refer to: <ul style="list-style-type: none"> <li>• <i>Working with Analog Alarm Objects (LIT-6892260)</i></li> <li>• <i>Working with Multistate Alarm Objects (LIT-6892270)</i></li> <li>• <i>Working with Event Enrollment Objects (LIT-1201218)</i></li> <li>• the chapter for the object using intrinsic alarming</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2      | Notification Class Object<br>Message Router Object                                                                                                   | Receive alarm messages and SNRs from alarm objects, work with the Report Server object to distribute the messages throughout the system. Specify priority and if acknowledgement is required. You can use only one alarm routing method for your site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3      | Destination Objects, such as: <ul style="list-style-type: none"> <li>• Printer Objects</li> <li>• E-mail Objects</li> <li>• Pager Objects</li> </ul> | Defined as recipients of SNRs in Notification Class or Message Router objects. For more information, refer to the desired chapter in the <i>N30 Supervisory Controller User's Manual</i> : <ul style="list-style-type: none"> <li>• <i>Working with Printer Objects (LIT-6892110)</i></li> <li>• <i>Working with E-mail Objects (LIT-1201112)</i></li> <li>• <i>Working with Pager Objects (LIT-1201113)</i></li> <li>• the chapter for the specific destination object</li> </ul> <p>To define M-Series Workstations as recipients, refer to the following chapters in the <i>M-Alarm User's Guide</i>:</p> <ul style="list-style-type: none"> <li>• <i>Getting Started with M-Alarm on the M3 Workstation (LIT-11537510)</i></li> <li>• <i>Getting Started with M-Alarm on the M5 Workstation (LIT-11537515)</i></li> </ul> <p>To define third-party BACnet devices as recipients, refer to the BACnet System Integrator for the project or the supplier of the third-party BACnet device to obtain the configuration and address information required.</p> |
| 4      | Report Server                                                                                                                                        | Receives alarm messages and SNRs from the configured alarm routing object (Notification Class object or Message Router object) that require acknowledgment and delivers them to VT100 objects.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 5      | VT100 Objects                                                                                                                                        | Contains the filtering information to determine what alarm messages and SNRs they receive from the Report Server for viewing. For more information, refer to <i>Working with VT100 Objects (LIT-6892050)</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Notification Class Alarm Routing

Notification Class objects receive alarm messages and route them to destinations such as printers and VT100s. They also handle routing messages requiring acknowledgement to the Report Server object.

Figure B-1 shows the different alarming methods. We recommend using Notification Class objects to route alarms generated by the Event Enrollment objects or objects with intrinsic alarming. If routing to third-party (non Metasys system) BACnet devices is required, then Notification Class objects must be used for alarm routing.

The Notification Class object can also route alarms from Analog Alarm or Multistate Alarm objects, but the Notification Class object overrides the alarm object's filtering and Ack Required attributes. See the *Analog Alarm Objects* and *Multistate Alarm Objects* sections of this appendix for details.

### ***Routing Status Notification Reports (SNRs)***

The SNRs are routed to the destinations defined in the Recipient List of the Notification Class object. These destinations need to be configured in every Notification Class object. When adding a new destination, such as a printer, add it to the Recipient List of all Notification Class objects from which SNRs are desired.

The Notification Class object determines if acknowledgement is required (unlike the Message Router feature, where the alarm object determines if acknowledgement is required). If acknowledgement is required, the SNRs are also automatically routed to the Report Server for delivery to VT100s.

One Notification Class object can distribute SNRs from various sources. The Notification Class object examines each SNR, determines if the SNR passes the filtering criteria, and routes it to either all destinations or no destinations based on the types of SNRs each destination is configured to receive.

For information about how SNRs appear on a VT100, refer to the *Getting Started (LIT-6892030)* chapter.

### ***Filtering***

For filtering, configure the Recipient List in the Notification Class object. Filter options include valid days, times, and types of SNRs. See the *Working with Notification Class Objects (LIT-6892290)* chapter for details.

### ***Default Notification Class Objects***

Each N30 contains three Notification Class objects by default (Table B-2). The objects, which generate SNRs, default to these Notification Class objects. However, additional Notification Class objects can be created and used to perform advanced filtering and routing. For example, you can configure a recipient as a destination during working hours and another recipient as a destination during non-working hours. See Table B-3.

**Table B-2: Default Notification Class Objects**

| <b>Default Notification Class object</b> | <b>Associated SNR*</b>                                                                                                           |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Alarm Notification</b>                | Analog Alarms, Multistate Alarms, Event Enrollment Alarms, Objects with Intrinsic Alarming (User Defined)<br>N2 Online/Offline   |
| <b>Offline Notification</b>              | N30 Online/Offline                                                                                                               |
| <b>System Notification</b>               | Memory/Central Processing Unit (CPU) Overload<br>Operator Login/Logout<br>Battery Status<br>Update References<br>Acknowledgement |

\* Offnormal, Normal, and Fault transitions correspond to the Event State of the alarming objects.

**Table B-3: Advanced Filtering and Routing Example**

| <b>Attributes</b>         | <b>Recipient 1</b>           | <b>Recipient 2</b>           |
|---------------------------|------------------------------|------------------------------|
| <b>Attribute Name</b>     | Value                        | Value                        |
| <b>From Time, To Time</b> | 8:01 A.M. to 5:00 P.M.       | 5:01 P.M. to 8:00 A.M.       |
| <b>Transitions</b>        | Offnormal, Normal, and Fault | Offnormal, Normal, and Fault |
| <b>Valid Days</b>         | Mon, Tue, Wed, Thur, Friday  | Mon, Tue, Wed, Thur, Friday  |

## Message Router

The Message Router object receives all alarm messages (including alarm messages requiring a user to acknowledge them) that are generated, and routes them to destinations, such as printers and workstations. It also handles rerouting messages to alternate destinations and sends all messages requiring acknowledgment to the Report Server object.

Figure B-1 shows the different alarming methods. We recommend using the Message Router to route alarms generated by Analog Alarm and Multistate Alarm objects. If routing to third-party (non Metasys system) BACnet devices is required, then Notification Class objects must be used for alarm routing. See *Notification Class Alarm Routing* in this appendix for information on routing alarms using the Notification Class object.

The Message Router object can also route alarms from Event Enrollment objects or objects with intrinsic alarming. You can use this alarming method when you configure Event Enrollment objects and objects using intrinsic alarming with non BACnet destinations such as VT100s or printers. We do not recommend this configuration because it mixes both alarming methods. See the *Event Enrollment Objects* and *Intrinsic Alarming Objects* sections of this appendix for details.

A Message Router object is a global object configured for each site. A primary Message Router object resides on the site manager device, and copies reside on all other controllers. The Message Router object is an internal object that is vital to the communication between objects. It works with the Report Server to ensure the delivery of messages within the system.

### ***Message Router Purpose***

The Message Router object controls where important dynamic system information is recorded or displayed. This information can include:

- object changes into and out of alarm
- changes offline and online by controllers or other devices
- reports from the system, such as those generated when elements of the site exceed user defined limits

This information is contained within SNRs that are generated by alarm objects and routed to various destinations for acknowledgment or storage.

### ***Routing Status Notification Reports (SNRs)***

The SNRs can be routed to defined destinations such as printers and VT100s. The Message Router and Report Server internal objects (one per site) are responsible for transmitting and managing acknowledgement for the defined set of destination devices. The routing mechanism uses the priority, BACnet event state, and timestamp of non-acknowledged events to provide the oldest, highest priority SNR to the acknowledging devices. The initiating alarm object provides this data.

Unacknowledged messages that appear on a VT100 may be replaced without user acknowledgement if the same event for the same object occurs before the acknowledgement of the original event. For example, an analog alarm has a value of High Alarm and is displayed on a VT100. If the alarm returns to a Normal state and then again goes into a High Alarm state, the VT100 displays the data for the newest High Alarm event.

Acknowledgement messages (for example, Acknowledged by: System or Login ID) are sent to non-acknowledging devices. Non-acknowledging devices, such as printers, receive SNRs in the order of their occurrence.

The Message Router feature distributes SNRs from the various sources. The Message Router examines each SNR and routes it to the appropriate destinations based on the types of SNRs each destination is configured to receive. All destinations receive the SNRs automatically.

For information about how SNRs appear on a VT100, refer to the *Getting Started (LIT-6892030)* chapter in this manual.

### ***Filtering***

Filtering is done by each destination using the priority, category, and message type of each SNR received. Two separate filters exist for each destination: Filter A and Filter B. The filtering operation allows output of SNRs based on a match on priority, category, and message type.

### **Active Filter Attribute**

The Active Filter attribute can be set to any of the following:

- Filters A and B
- Filter A
- Filter B
- Pass All (no filtering, all SNRs output)
- Pass None (no SNRs output)

The user can change the filter values to control which SNRs a destination receives based on time of day or an event (requires the use of schedule or interlock objects). For example, based on the time of day, SNRs can be routed to certain destinations during normal hours and other destinations during off-hours. Another example would be to change what is routed to a destination based on some event happening in the system.

### **Configuring Filter Destinations**

Table B-4 shows priority, category, and message type for SNRs created by the N30. This information can be helpful when configuring the filter destinations in the VT100 and Printer objects.

**Table B-4: Configuring Filter Destinations**

| <b>SNR Type</b>                                           | <b>Priority</b> | <b>Category</b> | <b>Message Type</b>  |
|-----------------------------------------------------------|-----------------|-----------------|----------------------|
| <b>Device Online and Offline<br/>(N30 and N2 Devices)</b> | Serious         | Services        | System Alert         |
| <b>Memory Overload</b>                                    | Serious         | Services        | System Alert         |
| <b>CPU Overload</b>                                       | Serious         | Services        | System Alert         |
| <b>Battery Status (Good or Bad)</b>                       | Serious         | Services        | System Alert         |
| <b>Update References</b>                                  | Serious         | Services        | System Alert         |
| <b>Acknowledgement</b>                                    | Status          | Services        | Operator Transaction |
| <b>Analog and Multistate Alarms<br/>(User Defined)</b>    | (User Defined)  | (User Defined)  | Alarm                |

## Analog Alarm Objects

The Analog Alarm object adds alarming capabilities for a floating point attribute of any object, such as the Present Value of an N2 Analog Input/BACnet Analog Input object. The Analog Alarm object detects an alarm based on up to four limits, and if configured to do so, reports that alarm.

We recommend using the Message Router to route alarms generated by Analog Alarm objects. You also can use the Notification Class feature to route Analog Alarms. Refer to *Routing Status Notification Reports (SNRs)* in the *Message Router* section or *Routing Status Notification Reports (SNRs)* in the *Notification Class Alarm Routing* section of this appendix for information on the two types of routing.

### Filtering

When using the Message Router, filtering is done by each destination using the Category, Fault Priority, Normal Priority, and Off-Normal Priority of each SNR received.

When using Notification Class alarm routing, filtering is done in the Notification Class object.

Table B-5 shows where the Analog Alarm object's filtering attributes are defined when using the Message Router or Notification Class alarm routing.

**Table B-5: Analog Alarm Filtering Attributes**

| Filtering Attribute     | Message Router                                                                                                                                                                                                                                                                    | Notification Class                                                                                                                                            |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ack Required</b>     | Defined in the Analog Alarm object by: <ul style="list-style-type: none"> <li>Fault Ack Required</li> <li>Normal Ack Required</li> <li>Offnormal Ack Required</li> </ul>                                                                                                          | Defined in the Notification Class object by Ack Required: <ul style="list-style-type: none"> <li>To Fault</li> <li>To Normal</li> <li>To Offnormal</li> </ul> |
| <b>Object Category*</b> | Defined in the Analog Alarm object by Object Category.                                                                                                                                                                                                                            | Not defined in the Notification Class object because it does <b>not</b> filter by Object Category.                                                            |
| <b>Priority</b>         | Defined in the Analog Alarm object by: <ul style="list-style-type: none"> <li>Fault Priority (Critical, Serious, Important, Status)</li> <li>Normal Priority (Critical, Serious, Important, Status)</li> <li>Offnormal Priority (Critical, Serious, Important, Status)</li> </ul> | Defined in the Notification Class object by Priority (range = 0-255, where 0 = highest).                                                                      |

\* The Object Category determines which category of alarms is sent to the destinations. For example, you can send alarms from the HVAC category to the destinations, but ignore alarms of the Services category.

Note: The Notification Class object can filter based on day of the week and time, but the Message Router object cannot perform that type of filtering.

## Multistate Alarm Objects

The Multistate Alarm object adds the alarming capability for a Boolean or multistate attribute for any object, such as the Present Value of an N2 Binary Input/BACnet Binary Input object. The Multistate Alarm object detects the alarm with respect to a difference from a defined normal state. In addition, the Multistate Alarm object can be configured to report the alarm.

We recommend using the Message Router to route alarms generated by Multistate Alarm objects. You also can use the Notification Class feature to route Multistate Alarms. Refer to *Routing Status Notification Reports (SNRs)* in the *Message Router* section or *Routing Status Notification Reports (SNRs)* in the *Notification Class Alarm Routing* section of this appendix for routing information.

### Filtering

When using the Message Router, filtering is done by each destination using the Category, Fault Priority, Normal Priority, and Off-Normal Priority of each SNR received.

When using Notification Class alarm routing, filtering is done in the Notification Class object.

Table B-6 shows where the Multistate Alarm object's filtering attributes are defined when using the Message Router or Notification Class alarm routing.

**Table B-6: Multistate Alarm Filtering Attributes**

| Filtering Attribute     | Message Router                                                                                                                                                                                                                                                                                     | Notification Class                                                                                                                                            |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ack Required</b>     | Defined in the Multistate Alarm object by: <ul style="list-style-type: none"> <li>Fault Ack Required</li> <li>Normal Ack Required</li> <li>Off Normal Ack Required</li> </ul>                                                                                                                      | Defined in the Notification Class object by Ack Required: <ul style="list-style-type: none"> <li>To Fault</li> <li>To Normal</li> <li>To Offnormal</li> </ul> |
| <b>Object Category*</b> | Defined in the Multistate Alarm object by Object Category.                                                                                                                                                                                                                                         | Not defined in the Notification Class object because it does <b>not</b> filter by Object Category.                                                            |
| <b>Priority</b>         | Defined in the Multistate Alarm object by: <ul style="list-style-type: none"> <li>Fault Priority<br/>(Critical, Serious, Important, Status)</li> <li>Normal Priority<br/>(Critical, Serious, Important, Status)</li> <li>Off Normal Priority<br/>(Critical, Serious, Important, Status)</li> </ul> | Defined in the Notification Class object by Priority (range = 0-255, where 0 = highest).                                                                      |

\* The Object Category determines which category of alarms is sent to the destinations. For example, you can send alarms from the HVAC category to the destinations, but ignore alarms of the Services category.

Note: The Notification Class object can filter based on day of the week and time, but the Message Router object cannot perform that type of filtering.

## Event Enrollment Objects

The Event Enrollment object monitors the value of a single attribute and reports events based on the attribute's configuration. This object provides alarm capabilities similar to the Analog Alarm and Multistate Alarm objects. In addition, the Event Enrollment object provides BACnet compliance, various algorithms for determining event and alarm occurrences, and object property references (input references) of different data types.

The Event Types for this object include:

- Change of Bitstring
- Change of State
- Change of Value
- Command Failure
- Floating Limit
- Out of Range

For example, you can configure the Change of State Event Type to monitor the reliability of a temperature sensor associated with an object. For more information on these Event Types, refer to the *Working with Event Enrollment Objects* chapter (LIT-1201218) of the *N30 Supervisory Controller User's Manual*.

We recommend using the Notification Class feature to route alarms generated by the Event Enrollment object. You also can use the Message Router to route Event Enrollment alarms. Refer to *Routing Status Notification Reports (SNRs)* in the *Notification Class Alarm Routing* section or *Routing Status Notification Reports (SNRs)* in the *Message Router* section of this appendix for information on the two types of routing.

### **Filtering**

When using Notification Class alarm routing, filtering is done in the Notification Class object.

When using the Message Router, filtering is done by each destination using the Category, Fault Priority, Normal Priority, and Off-Normal Priority of each SNR received. The Ack Required attributes are always True and the Priority attributes are always Critical.

Table B-7 shows where the Event Enrollment object's filtering attributes are defined when using the Message Router or Notification Class alarm routing.

**Table B-7: Event Enrollment Alarm Filtering Attributes**

| <b>Filtering Attribute</b> | <b>Message Router</b>                                                                                                                                                                              | <b>Notification Class</b>                                                                                                                                     |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ack Required</b>        | Defined in the Event Enrollment object by: <ul style="list-style-type: none"> <li>Fault Ack Required (True)</li> <li>Normal Ack Required (True)</li> <li>Off Normal Ack Required (True)</li> </ul> | Defined in the Notification Class object by Ack Required: <ul style="list-style-type: none"> <li>To Fault</li> <li>To Normal</li> <li>To Offnormal</li> </ul> |
| <b>Object Category</b>     | Defined in the Event Enrollment object by Object Category (HVAC).                                                                                                                                  | Not defined in the Notification Class object because it does <b>not</b> filter by Object Category.                                                            |
| <b>Priority</b>            | Defined in the Event Enrollment object by: <ul style="list-style-type: none"> <li>Fault Priority (Critical)</li> <li>Normal Priority (Critical)</li> <li>Off Normal Priority (Critical)</li> </ul> | Defined in the Notification Class object by Priority (range = 0-255, where 0 = highest).                                                                      |

Note: The Notification Class object can filter based on day of the week and time, but the Message Router object cannot perform that type of filtering.

## Intrinsic Alarming Objects

Some objects, such as Binary Value objects, have intrinsic alarming attributes that allow the objects to generate alarms in the occurrence of defined events. These attributes reside within the objects themselves and trigger alarms based on the defined parameters. The intrinsic alarming attributes detect the alarm with respect to a difference from a defined normal state, and report the alarm.

For example, you can configure the Present Value of the Binary Value object to generate an event if the value changes. The object sends an alarm to the defined routing object, then the alarm is sent to the user interface where the event is acknowledged by the user.

We recommend using the Notification Class feature with objects using intrinsic alarming. You also can use the Message Router to route alarms generated by objects with intrinsic alarming. Refer to *Routing Status Notification Reports (SNRs)* in the *Notification Class Alarm Routing* section or *Routing Status Notification Reports (SNRs)* in the *Message Router* section of this appendix for information on the two types of routing.

The following objects support intrinsic alarming:

- N2 Analog Input/BACnet Analog Input
- N2 Analog Output/BACnet Analog Output
- Analog Value
- N2 Binary Input/BACnet Binary Input
- N2 Binary Output/BACnet Binary Output
- Binary Value
- N2 Multistate Input/BACnet Multistate Input
- N2 Multistate Output/BACnet Multistate Output
- Multistate Value

### **Filtering**

When using Notification Class alarm routing, filtering is done in the Notification Class object.

When using the Message Router, filtering is done by each destination using the Category, Fault Priority, Normal Priority, and Off-Normal Priority of each SNR received.

Table B-8 shows where the filtering attributes are defined for objects with intrinsic alarming when using the Message Router or Notification Class alarm routing.

**Table B-8: Intrinsic Alarming Filtering Attributes**

| <b>Filtering Attribute</b> | <b>Message Router</b>                                                                                                                                                                                                                   | <b>Notification Class</b>                                                                                                                                     |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ack Required</b>        | Defined in the object using intrinsic alarming by: <ul style="list-style-type: none"> <li>Fault Ack Required (True)</li> <li>Normal Ack Required (True)</li> <li>Off Normal Ack Required (True)</li> </ul>                              | Defined in the Notification Class object by Ack Required: <ul style="list-style-type: none"> <li>To Fault</li> <li>To Normal</li> <li>To Offnormal</li> </ul> |
| <b>Object Category</b>     | Defined in the object using intrinsic alarming by Object Category (HVAC).                                                                                                                                                               | Not defined in the Notification Class object because it does <b>not</b> filter by Object Category.                                                            |
| <b>Priority</b>            | Defined in the object using intrinsic alarming, using the default Critical, by: <ul style="list-style-type: none"> <li>Fault Priority (Critical)</li> <li>Normal Priority (Critical)</li> <li>Off Normal Priority (Critical)</li> </ul> | Defined in the Notification Class object by Priority (range = 0-255, where 0 = highest).                                                                      |

Note: The Notification Class object can filter based on day of the week and time, but the Message Router object cannot perform that type of filtering.



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