Developer's Guide to the Millennium Architecture

1. Objects in the Millennium Architecture

The following are objects in the Millennium Architecture. A particular device may consist of one or more of these objects.

Alarms	Audio
Diagnostic Devices	Transmission Systems
Bus Master	Video Signal Equipment
System Master	Recording Equipment
Alarm Master	Monitors
Switch	Access Control
Relays	3rd Party Interface
Lenses	SW User Interface
Cameras	HW User Interface
Enclosures	Power Supplies
Motion Control	System Clock
MUX	Video

This guide will attempt to address all objects in the Millennium Architecture in respect to the following subjects:

- Redundancy / Fault Tolerance
- Diagnostics

- Configuration
- Physical Layer Requirements
- Alarm Handling

2. Devices in General

2.1 Adding a new device

Any device added to the system is turned on-line by a Bus Master. The Bus Master keeps information about the devices on its bus and when a device's status on the bus changes, the new information is reported up to the System Master.

2.2 Device Addressing

A device must have a local address prior to being added to the bus. This is one byte of information that can be configured by an 8 position dip switch. Device addresses can range from 0 - 253, where 0 is normally reserved for the Bus Master. Addresses 254 and 255 are reserved in order to prevent the Header 0xFF or 255 from appearing in the address portion of a message.

2.3 Device IDs

Currently, the device information the System Master keeps includes the physical address of the device and a device ID or IDs. A list of Device ID's is associated with each device in the system. The Device ID is not a model number of the device but rather an ID of what the device can do. A Spectra would not be known to the System Master as a Spectra, but rather as a Positioning Device, a Lens Device, a Camera and potentially as an Alarm Gathering Device and/or Auxiliary device.

3. System Master

The System Master is a system component that keeps information about the system. More or less this is a database of what devices are in the system, where they are located, who is in control of them at any given moment, who or what has permission to control them, and who or what has higher priority of said device.

The System Master is in essence a large database that must be configured by the user. Where devices are at on the network does not need to be input by the user, the physical address of a device will be automatically gathered when the system is brought on line. Each device that comes on line must be associated to a logical number and device type. For example, CAMERA 1 may be assigned to the first camera device reported to the System Master. A device may or may not need to know its own logical address. A camera for example, does not care if it is CAMERA 1 to the rest of the system, but an Alarm Gathering Device needs to know what range of logical alarms correlate to its physical alarms in order to report the status of the alarms.

3.1 System Resources

A system resource is any device in the system that can be controlled by another device. In other words, a camera is a resource where a keyboard is not. A camera may be controlled by users, macros, sequences, alarms, or possibly other events in the system. The System Master is the mediator that knows who should have control of the camera at any given time.

3.1.1 Controlling a System Resource

A device that wishes to control a system resource needs only know the logical number and resource type of the resource to control. First, the device must ask permission to control the resource from the System Master. If the System Master grants permission to the requesting device, it will include the physical address of the resource in the reply. In this manner, a device wishing to control a resource will also be able to find the device on the network.

Once permission and physical address have been obtained to control a resource, the device controlling the resource is free to send commands or messages to the resource directly. There is no need to route data through the System Master, although this is possible and may be desirable in some instances (system 6800 works in this manner).

3.1.2 Releasing a System Resource

A device may voluntarily give up a system resource or it may be taken away by the System Master. For example, a keyboard controlling a camera may have the camera resource taken away by the System Master so that another keyboard with higher priority can control the camera resource.

3.2 Finding the System Master

All devices in the system need to know the address of the System Master. This information is provided to a device when the device is turned on-line by it's Bus Master. A Bus Master will not kick start the bus it controls until it has its own full address and the address of the System Master.

It should be noted that in a small system (one bus) the Bus Master can take the place of a true System Master. If the Bus Master is programmed to grant permission to all requests for resources, then devices on the bus are able to access and use these resources.

3.3 Redundancy

The M Architecture allows for graceful degradation. If the System Master should fail, permissions are lost, yet the system can still function as long as devices are able to find the addresses of other devices in the system.

3.4 Diagnostics

The System Master should include diagnostics that are accessible to the user through a GUI.

3.5 Configuration

A Software GUI will be used to configure the System Master.

3.6 Physical Layer

The System Master will be a high traffic device in the network. It should reside on a high speed bus.

3.7 Alarm Handling

The System Master should include the capability of acting as an Alarm Processing Device in order to execute Macros when an alarm is received.

4. The Bus Master

The Bus Master has the responsibility of keeping information flowing on a particular bus. The Bus Master performs the following duties:

- Bring devices on line by occasionally polling for new devices
- Provide the upper three bytes of a device's address
- Provide the address of the System Master and the Alarm Master
- Gather information about devices on the bus
- Forward device information to the System Master
- Ensure the token keeps moving
- Fill in messages for devices not responding

4.1 Redundancy

There can be only one Bus Master for a bus, however, it is possible to create a redundant Bus Master that takes over the bus when a Bus Master fails.

4.2 Diagnostics

The Bus Master should have built in diagnostics that allows for:

- Viewing what devices are on line
- Viewing/Changing the timeout of devices

4.3 Configuration

A Bus Master must know its full network address before starting the bus in order to provide devices on it's bus with their full addressing.

4.4 Physical Layer

A Bus Master must reside on all physical layers in the M Architecture.

4.5 Alarm Handling

Alarm handling is not a function of the Bus Master, but may be part of a device which is a Bus Master.

5. The Alarm Master

The Alarm Master is another system component that, much like the System Master, is known to all devices in the system. Its purpose is to keep track of where all alarms in the system reside. It may be part of the System Master in that it resides in the same device, but is separated logistically. As in the System Master, the address of the Alarm Master is provided by the Bus Master to all devices as they are brought on line.

The function of the Alarm Master is to provide a service for both Alarm Gathering Devices and Alarm Processing Devices. For Alarm Gathering Devices, the Alarm Master helps at configuration time. Alarm Gathering Devices will ask the Alarm Master if their default logical alarm range is ok, and the Alarm Master will either accept their default logical alarm range or change it to fit the system. For Alarm Processing Devices, the Alarm Master provides a database that retains the physical location of each alarm point in the system. If an Alarm Processing Device wishes to know the status of an alarm point, it must first query the Alarm Master for the physical address of the device where the alarm point is located so that it may poll for the alarm status.

5.1 Redundancy

If the Alarm Master fails, alarm devices should be capable of limited functionality from default settings. Without the Alarm Master it will not be possible to poll an alarm gatherer for it's alarm status unless the address of the alarm gatherer is manually entered. Alarm change of state reporting will continue to function normally.

5.2 Diagnostics

5.3 Configuration

N/A

5.4 Physical Layer

Unlike the System Master, the Alarm Master does not need a high speed bus since it is only dealing with requests from devices for finding Alarm Gathering Devices.

5.5 Alarm Handling

N/A

6. Alarms

6.1 Alarm Points

An alarm point may:

- Occur / Go away
- Get Acknowledged
- Be Enabled / Disabled (Armed or Disarmed)
- Report it's current state or be polled for it's current state
- Be Normally Open / Normally Closed

6.2 Alarm Gathering Devices

An Alarm Gathering Device is a device that senses alarms and reports them to the rest of the system.

6.2.1 Redundancy

Two alarm devices may be hooked up to the same alarm points for redundancy if desired. This would imply that one alarm gathering device be offline until the other fails. A macro could be used in the System Master to enable the redundant alarm gathering device at the Bus Master level when the main alarm gathering device fails or goes offline.

6.2.2 Diagnostics

N/A

6.2.3 Configuration

An Alarm Gathering Device will have a range of logical alarms associated with the alarm inputs it is gathering. This logical range can be defaulted by dip switch or another configuration method on the device itself or the logical alarm range can be provided by the Alarm Master. When an Alarm Gathering Device first comes on line it attempts to contact the Alarm Master to request a logical alarm range and provides the Alarm Master with it's defaulted range. The Alarm Master will reply with the logical alarm range of the alarms on the Alarm Gathering Device perhaps overriding the defaulted values provided by the device or limiting the range to fit within the overall system.

Once the logical alarm range has been established, the Alarm Gathering Device will report all changes of state to an alarm point to all devices on the network in a single command.

6.2.4 Physical Layer

An alarm gathering device is a low traffic device and may be placed on a low speed bus.

6.2.5 Alarm Handling

The main function of an Alarm Gathering Device is to hold the current state of an alarm point and to report a change in the state of an alarm point. However, like any other device in the system, the Alarm Gathering Device can also be an Alarm Processing Device.

6.3 Alarm Processing Devices

An Alarm Processing Device is a device that receives alarm change of state messages and acts upon them.

6.3.1 Redundancy

N/A

6.3.2 Diagnostics

N/A

6.3.3 Configuration

An Alarm Processing Device will contain an Alarm Response Table. An Alarm Response Table is a programmable table that allows the user to configure what an Alarm Processing Device does when an alarm message is received. An example of an Alarm Response Table for a Spectra might look like the following table:

Logical Alarm Number	Enabled / Disabled	Steps when Alarm ON	Steps when Alarm OFF	When Alarm i
1 - 65536	1 = Enabled 0 = Disabled	1. Go to preset 1 2. Wait 5 seconds 3. Go to preset 2	1. Frame Scan Mode	1. When Acl 2. When Ala msg rcvd. 3. When Tin occurs

6.3.4 Physical Layer

An alarm gathering device is a low traffic device and may be placed on a low speed bus.

6.3.5 Alarm Handling

An Alarm Processing Device will react to alarm change of states.

7. Relays

Relays or Auxiliaries are much like alarms in that a range of points exists on a particular device in the system. Like alarms, a relay device will have a default range of logical relays associated with the physical relay points on the device. The relay device will query the System Master for approval of the logical range of the relays on board the device and the System Master may or may not change this default logical range.

Individual relay points are grouped together into GPIs, which are groups of eight relays. This is done to make display of multiple relay points easier for the user.

7.1 Relay Points

A relay point may:

- Be Normally Open / Normally Closed
- Be Set / Cleared by command
- Be queried as to its current state

7.2 Redundancy

7.3 Diagnostics

7.4 Configuration

7.5 Physical Layer

7.6 Alarm Handling

8. Switches

A switch contains:

- Multiple inputs and outputs
- Text insertion hardware

- A clock
- Coaxitron insertion hardware
- Tie lines

8.1 Redundancy

Video must be looped to another switch for redundancy.

8.2 Diagnostics

8.3 Configuration

8.4 Physical Layer

8.5 Alarm Handling

9. Cameras

A camera contains:

- A video output
- Color / BW property
- Digital / analog property
- Motion detection / alarms
- Video blanking