Media-Level Redundancy Plug-In

Table of Contents

Media-Level Redundancy Plug-In

Help version 1.034

CONTENTS

Overview

The Media-Level Redundancy Plug-In facilitates duplicate or backup systems used to maintain reliable communications with the critical components in the environment. This practice allows the duplicate, or redundant, system to take over without interruption of service in the event of a failure. This server supports two types of redundancy:

- **Communications Path Redundancy:** To communicate with the same device over multiple communications methods. For example, a device may support communications via TCP and RS-485. For redundancy, configure a primary communications path via TCP, but assign the device to use RS-485 when the Ethernet network is unavailable.
- **Device Pair Redundancy:** To communicate with two identical devices configured as a redundant unit (each running the same logic). For example, two devices are on the same RS-485 network monitoring the same process condition. Client monitoring software must be able to receive information from at least one of these devices to maintain the information integrity.

Tip: The Media-Level Redundancy Plug-In is an optional feature you select during installation (or select Full Installation, which includes the feature).

Notes:

1. To eliminate the single point of failure with either the communications path or the device, users can combine the redundancy types.

2. A redundant connection contains a pair of devices that use Communications Path Redundancy or Device Pair Redundancy. Each device is designated primary or secondary. Redundancy configuration begins by identifying the primary device and proceeds by choosing a different, compatible device to use as the secondary device.
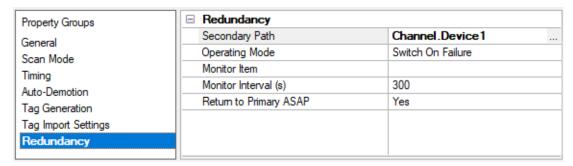
Supported Use

Media-Level Redundancy Plug-In is available on devices that communicate using serial, Ethernet, or Modbus Plus drivers operating in client mode or communicating using the OPC UA Client Driver. Media Level Redundancy cannot be enabled if a suitable device does not exist for the secondary device. Suitability is determined based on the following:
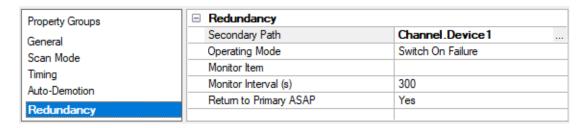
- The device is not the same as the primary.
- The device is not already in use as a primary in another redundant pair (such that a circular path back to the primary on the new redundant pair results).
- The device uses a serial, Ethernet, or Modbus Plus client driver or the OPC UA Client Driver for communications.

Accessing the Media-Level Redundancy Plug-In

The Media-Level Redundancy Plug-In is only available to supported devices. The user interface is available through the **Redundancy** property group in Device Properties on the primary device, where supported.
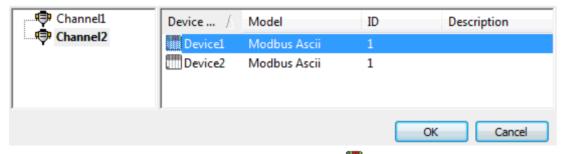
Redundancy Options

Secondary Path: Specify the explicit, unaliased path to the device serving as backup should the primary device fail. The valid format is *<channel>.<device>*. The default setting is blank.
🟢 **Tip**: If the device specified by this path is on the same channel as the primary device, the redundancy type is Device Path Redundancy. Otherwise, it is Communications Path Redundancy.
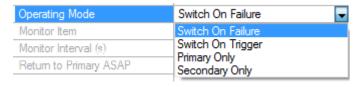
In Device Browser, locate the device and double-click or click **Apply**.

🟢 **Tip**: A device with a redundant configuration displays the icon 🔲 in the server Configuration Project View user interface.

Operating Mode: This parameter specifies how the active device is chosen at runtime. Options include Switch On Failure, Switch On Trigger, Primary Only, and Secondary Only. The default setting is Switch On Failure. Descriptions of the options are as follows:

- **Switch On Failure**: In this mode, communication fails over to the secondary device when the primary device enters an error state (and vice versa). Initial communication begins on the primary device. The options are described below. *For detailed information, refer to Switch On Failure.*

- **Switch On Trigger**: In this mode, the server monitors a configured trigger item. When the configured trigger condition becomes true, communication switches over to the secondary device. As long as the condition is false, communication remains on the primary device. Communication is initiated with the primary device until the trigger condition can be evaluated. The options are described below. *For detailed information, refer to Switch On Trigger.*
  ● **Note**: For Switch On Trigger mode, the communication path is dictated entirely by the trigger state. Unlike the Switch On Failure mode, the communication path is not updated in the case of compromised physical communication.
- **Primary Only**: In this mode, communication is fixed to the primary device regardless of the error state. This option is used for maintenance when the secondary device needs to be taken offline.
- **Secondary Only**: In this mode, communication is fixed to the secondary device regardless of the error state. This option is used for maintenance when the primary device needs to be taken offline.

The following settings are only available when **Switch On Failure** operating mode is selected.

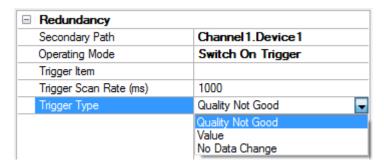| ⊟	**Redundancy**	
	Secondary Path	Channel1.Device1 ...
	Operating Mode	Switch On Failure
	Monitor Item	
	Monitor Interval (s)	300
	Return to Primary ASAP	Yes

Monitor Item: Specify a valid device tag name or address on both the primary and secondary devices that is used to monitor communications on both devices. Valid formats include the device address (such as "400001") or a partially qualified tag name (such as "Tag1") to identify a static tag at the device level (or "Group1.Tag1" to identify a tag in "Group1" and so forth). The default setting is blank.
● **Note:** Only tags that require device communication may be used. *For more information, refer to Monitor Items*.

Monitor Interval: Specify the rate at which the Monitor Item is polled on each device in a redundant pair. It is the rate at which the error tag updates on the inactive device in a pair. The valid range is 30 to 999 seconds. The default setting is 300 seconds.

Return to Primary ASAP: Specify whether the primary device should become the active device as soon as possible after a failover. When checked, the primary is re-activated as soon as possible following a transition of its error state from True to False.
The following settings are only available when **Switch On Trigger** operating mode is selected.

⊟	**Redundancy**	
	Secondary Path	**Channel1.Device1**
	Operating Mode	**Switch On Trigger**
	Trigger Item	
	Trigger Scan Rate (ms)	1000
	Trigger Type	Quality Not Good ▾
		Quality Not Good
		Value
		No Data Change

Trigger Item: Specify a fully qualified dynamic or static item reference. This item is used as the source of the trigger and is regularly evaluated at the configured scan rate to determine if a switchover is required. To choose a static item reference defined in the server,
● **Note**: The Trigger Item can be any server tag, but cannot be an array data type.

Trigger Scan Rate: Specify the frequency, in milliseconds, at which the Trigger item is evaluated.

Trigger Type: Specify the type of condition evaluated on the Trigger item. The supported trigger types are Quality Not Good, Value, and No Data Change.

- **Quality Not Good**: When the trigger type is configured as Quality Not Good, the Trigger item change in quality to bad or uncertain causes communication to switch to the secondary device. When the Trigger item quality returns to good, communication switches back to the primary.
- **Value**: When the trigger type is configured as Value, the item is compared using an operator from the drop-down list and data in the entry field. The value entered should be compatible with the data type of the selected trigger item. When the trigger item value meets the condition defined by the configured string and operator, the trigger is considered "set" and communication switches from the primary to the secondary. When the trigger item value no longer meets the criteria, communication switches back to the primary. Available operators are equals (=), does not equal (≠), greater than (>), greater than or equal to (≥), less than (<), and less than or equal to (≤).
  🔹**Tips:** This field accepts an arbitrary length string of alpha-numeric characters. When the trigger item is a string type, comparisons are case insensitive ("Hello, World" and "HELLO, WORLD" are considered a match). When the trigger item is a float type (double or float type), care must be exercised because comparisons do not consider precision loss (1.499999 is not considered equal to 1.5).
- **No Data Change**: When the trigger type is configured as No Data Change, the Timeout field represents the period (in milliseconds) during which the trigger item value must change. If the trigger item does not change within the configured period, the trigger is considered "set" and the communication switches from the primary to the secondary. To return to the primary, the value of the trigger item must change twice within the configured timeout period.

🔹**See Also**: *Switch On Failure*, *Switch On Trigger*

Switch On Failure

Failover

When the operating mode is set to Switch On Failure, failover to the secondary device occurs as soon as the primary device enters an error state. When the secondary device is active, failover to the primary occurs when the primary device is no longer in an error state.

The failed read or write that caused the error state to occur on the primary device is submitted to the secondary device after switchover. Any subsequent failed write completion notifications or tag invalidations received from the primary device are submitted to the secondary device to avoid the failures being reported to the client.

If both the secondary device and the primary device are in an error state, the failed read or write that caused the error state results in a bad-quality update being sent to the client for that item. Any subsequent failures that cannot be handled (due to the devices being in an error state) are passed along to the client in the form of bad-quality updates or write completion failures.

Falling Back to the Primary

If the operating mode is set to Switch On Failure and the "Return to primary connection ASAP after failover" setting is enabled, the error state on the primary device is queried for use each time that a tag is updated (or a write completes on the secondary device) to determine if it is ready. If the primary device is not in an error state, the active device is switched back to the primary device.

Switchover

The internal switchover process is as follows:

1. Set all client items on the active device to inactive, making note of which were active at the time of the switch.

2. Activate all items on the secondary device that were active on the primary device.

3. Request reads and writes for any items that have these actions pending as the result of a failover.

4. Record the active device time as "Previous" for _PreviousActiveSec.

5. Reset the active device time to 0 seconds.

6. Increment the switch count.

7. Post an Event Log message indicating a switchover has occurred.

8. Update the System tags.

See Also:
Redundancy Options

Switch On Trigger

This mode evaluates the configured trigger condition at the configured scan rate. When the condition is true, communication switches to the secondary device. When the condition is not true, communication switches to the primary device.

A common use of this mode is driving switchover between redundant remote servers communicating with the server through two client driver devices. In this case, a Quality Not Good trigger is configured using a tag on the primary remote server as the trigger item. When the quality of that item transitions from good to bad (indicating some sort of communications problem between the remote server and its data source), the server triggers a seamless switch to the secondary remote server.

See Also:
Redundancy Options

Monitor Items

The user-defined monitor item identifies a single item to poll while the active device is in use. This periodic item poll ensures that the inactive device's error state is updated so that it can be switched to when needed. The default setting is 300 seconds; however, when the active device is in an error state, the default setting is accelerated to a fixed rate of 30 seconds.

When there is no monitor item defined, the first available client item that requires device communications is used for polling if the secondary device is active. When the secondary is communicating successfully, the monitored item interval is 300 seconds; however, when the secondary device is in an error state, the monitored item interval is 30 seconds (regardless of the setting in the property editor).

Notes:

1. A poll is not issued unless a minimum of one client item that requires device communications exists on the primary device.

2. The default setting is not accelerated in Switch On Trigger Mode.

Important: An explicitly defined monitor item must require device communication: this ensures that the poll updates the error state.

Dynamic Changes to Redundancy Settings

Changes made to the redundancy settings are applied as soon as they are received from the server Configuration. If the secondary device is the active device at the time of the update, the active device time is reset to zero seconds and a switchover is recorded. At that time, any items that fail to map to the new secondary device receive a bad-quality update.

Note: If the operating mode is set to Switch On Failure, the primary device is active when it is not in an error state. When it is in error state, the secondary device is active.

Runtime Functions

For more information on a specific aspect of the Media-Level Redundancy Plug-In runtime functions, select a link from the list below.

Initialization
System Tags
Client Item Management

Initialization

When a project that contains redundant device definitions loads or assigns redundancy settings to a primary device for the first time, the Media-Level Redundancy Plug-In initializes each redundant pair to do the following:

- Create system tags on the primary device for monitoring redundancy configuration and state.
- Mirror any items to the secondary device that may already exist on the primary device.
- Set the appropriate device (primary or secondary) active, depending on the parameters in the redundancy definition.
- Begin monitoring the primary device for client requests to add/remove items, change an item's active state or data type, or read/write an item.

System Tags

Each redundancy definition has the following read-only system tags created in the _System tag group on the primary device.

Name	Data Type	Description
_ActivePath	VT_BSTR	The fully qualified path of the active device.
_ActiveSec	VT_UI4	The number of seconds that the active device has been active.
_PreviousActiveSec	VT_UI4	The number of seconds that the previously active device has been active.
_Switchovers	VT_UI4	The number of times the active device has changed.
_OperatingMode	VT_BSTR	The pair's current operating mode.*
_SecondaryPath	VT_BSTR	The current value of the Secondary Device parameter.

*Options include Switch On Failure, Switch On Trigger, Primary Only, and Secondary Only.

Switch On Failure Mode

Name	Data Type	Description
_ActiveMonitor Item	VT_BSTR	The fully-qualified path to the last item used to ping the inactive device.
_FavorPrimary	VT_BOOL	The current value of the Return to primary connection ASAP after failover parameter.
_MonitorItem	VT_BSTR	The current value of the Monitor Item parameter.
_MonitorIntervalSec	VT_UI4	The current value of the Poll Monitor Item Every *x* Seconds parameter.

Switch On Trigger Mode

Name	Data Type	Description
_TriggerItem	VT_BSTR	The fully qualified path of the trigger device.
_TriggerScanRate	VT_UI4	The rate, in milliseconds, at which the trigger item is scanned and evaluated.
_TriggerType	VT_BSTR	The trigger type: one of Quality Not Good, Value, or No Data Change.
_TriggerValue	VT_BSTR	The value used to evaluate the trigger. Context is specific to the trigger type.

Updating System Tags

System tags are updated whenever a switchover occurs or the redundancy configuration changes and periodically at 500 millisecond intervals. If the redundancy configuration is removed from the primary device, the system tags that have an active client reference count receive a bad-quality update to indicate that the data is no longer valid.

🔹 See Also:
Redundancy Options

Client Item Management

In all operating modes, the primary device is monitored for add/remove item activity. When this activity is detected, it is mirrored on the secondary device. Although it may take twice as long to complete item addition, it greatly

reduces the time it takes to perform a switchover (since the necessary tags are already in place on both devices).

As a side effect of this model, the total tag count is different for the same client conditions with and without redundancy. For example, a project has one channel and two devices, where each device has one static tag defined. If a client maps an item to the tag in Device 1, the total tag count is reported as one. If Device 2 is then configured as the secondary device for Device 1, the same condition results in a total count of two because the tag is mirrored on the secondary device. This increased tag count only affects the server tag count. Clients only see the tag count relevant to the primary device.

Note: Having a monitor item defined can affect the tag count.

Adding Client Items

When a client item is added to the primary device, the item mirrored on the secondary device is generated based on the qualified item ID received from the client. If the item ID maps to a static tag in the project name space beneath the primary device, the leading path information is replaced such that the secondary item ID contains the path to the secondary device followed by the remaining path information that identifies the tag. For the mapping to succeed, this tag must exist on the secondary device.

Client items added using dynamic addressing are passed as-is to the secondary device for validation and addition. For the mapping to succeed, the address must be valid on the secondary device. Any item that cannot be mapped to the secondary device results in an error message.

Data Type Conversion

The Media-Level Redundancy Plug-In performs data type conversion for any mirrored item that cannot be mapped with the same data type used on the primary device. Data type equivalence between the primary and secondary device is determined based on the client data type returned from the tag to which the item is assigned. For example, a type conversion is required when an item mapped to a tag on the primary device uses scaling and the mirrored item is mapped to a tag on the secondary device without scaling, and the scaled data type on the primary device differs from the data type on the secondary device. The same is true when mapping to two scaled tags that have different scaled data types or (two un-scaled tags that have different raw data types).

Notes:

1. A failed conversion results in a bad quality update to the client. A conversion may fail when the range of the two types is different, and the result of the conversion exceeds the range of the target type.

2. For mapping to succeed, the primary and secondary item data types must be compatible (if not equivalent). For example, if the data type on the primary is an array type and the data type on the secondary is not, mapping is not established because a conversion cannot be made between array and non-array types. The same is true when mapping to two arrays with different dimensions.

Event Log Messages

The following information concerns messages posted to the Event Log pane in the main user interface. Consult the OPC server help on filtering and sorting the Event Log detail view. Server help contains many common messages, so should also be searched. Generally, the type of message (informational, warning) and troubleshooting information is provided whenever possible.

🍀 **Tip**: Messages that originate from a data source (such as third-party software, including databases) are presented through the Event Log. Troubleshooting steps should include researching those messages online and in vendor documentation.

Attempt to map redundant item to secondary device failed. | Item = '<item ID>', Secondary device = '<path>'.

Error Type:
Error

Possible Cause:

1. Tags are configured differently for the primary and secondary device.

2. Tags were created with a driver import feature and have a different hierarchy in the primary than in the secondary.

Possible Solution:
Match the tag groups and tag names for the primary and secondary devices.

Specified secondary device does not exist. | Secondary device = '<path>'.

Error Type:
Error

Possible Cause:
A device indicated cannot be located or is not an actual device.

Possible Solution:
Specify a different device as the secondary.

Specified secondary device is the same as the primary. | Secondary device = '<path>'.

Error Type:
Error

Possible Cause:
A single device cannot serve as both the primary and secondary to achieve redundancy.

Possible Solution:
Specify a different device as the secondary.

Specified secondary device cannot be used because the driver type is not supported. | Secondary device = '<path>'.

Error Type:
Error

Possible Cause:

The specified secondary device exists, but the channel to which it belongs uses a driver that does not meet the requirements.

Possible Solution:

Define a different secondary device or re-configure the channel on that device.

Specified primary device does not exist. | Primary device = '<path>'.

Error Type:

Error

Possible Cause:

A device indicated cannot be located or is not an actual device.

Possible Solution:

Specify a different device as the primary.

Secondary device cannot be paired with primary because a circular dependency would result. | Secondary device = '<path>', Primary device = '<path>'.

Error Type:

Error

Possible Cause:

The specified secondary device is not suitable.

Possible Solution:

Define a different secondary device.

Specified primary device cannot be used because the driver type is not supported. | Primary device = '<path>'.

Error Type:

Error

Possible Cause:

The specified primary device exists, but the channel to which it belongs uses a driver that does not meet the requirements.

Possible Solution:

Define a different primary device or re-configure the channel on that device.

Trigger item must be a valid static or dynamic item reference.

Error Type:

Error

Possible Cause:

The Trigger Item is not a valid item reference in the server.

Possible Solution:

Specify a different Trigger Item or correct the item reference in the server project.

See Also:

1. Redundancy Options

2. Switch On Trigger

Data type is not allowed for trigger item. | Data type = '<type>'.

Error Type:
Error

Possible Cause:
Redundancy is configured in Switch on Trigger mode and the trigger item has been edited to an unsupported data type.

Possible Solution:
Specify a different Trigger Item or correct the data type.

● See Also:
1. Redundancy Options
2. Switch On Trigger

Failed to activate trigger item. | Trigger item = '<item ID>'.

Error Type:
Error

Possible Cause:
The server was unable to activate a subscription with the configured trigger item.

Possible Solution:
Verify that the trigger item is a valid and accessible item or select a different trigger item.

● See Also:
1. Redundancy Options
2. Switch On Trigger

Trigger item is no longer valid. This may cause a quality change that results in a switchover. | Trigger item = '<item ID>'.

Error Type:
Error

Possible Cause:
Redundancy is configured in Switch on Trigger mode and the trigger item has been deleted. This may result in an unnecessary switchover, depending on the trigger type.

Possible Solution:
Specify a different Trigger Item or restore the original item.

● See Also:
1. Redundancy Options
2. Switch On Trigger

Data type is not allowed for trigger item. No switchover will be triggered by any value of this item until it is changed to a supported type. | Trigger item = '<item ID>', Data type = '<type>'.

Error Type:

Error

Possible Cause:

Redundancy is configured in Switch on Trigger mode and the trigger item has been edited to an unsupported data type.

Possible Solution:

Specify a different Trigger Item or correct the data type.

See Also:

1. Redundancy Options

2. Switch On Trigger

Invalid redundancy configuration on %1:

Error Type:

Error

Setting primary device active. | Primary device = '<path>'.

Error Type:

Informational

Setting secondary device active. | Secondary device = '<path>'.

Error Type:

Informational

Redundancy disabled on primary. | Primary device = '<path>'.

Error Type:

Informational

Redundancy initialized on primary. | Primary device = '<path>', Secondary device = '<path>'.

Error Type:

Informational

Secondary device path changed on primary. | Primary device = '<path>', New secondary device = '<path>'.

Error Type:

Informational

Redundancy configuration updated on primary. | Primary device = '<path>'.

Error Type:

Informational

Index

O

R

S

T