1756-OBV8S Output Module Features

This chapter describes features that are supported on the 1756-OVB8S output module.

Overview

The 1756-OBV8S is a safety output module that uses eight safety outputs. You use the outputs in one of the following ways:

- Sourcing/sinking outputs in Bipolar Output mode
- Sourcing outputs in Sourcing Output mode.
- Solid-state outputs
- Single-channel mode uses one output signal, that is, data from an output channel, to provide control.

> **IMPORTANT**   Single-channel mode is only certified for functional safety applications with process safety times greater than or equal to 200 ms; or, applications with demand rates less than or equal to 3 demand per minute.

- Dual-channel mode uses two output signals, that is, data from two output channels to provide redundant control.
- Safety outputs can be pulse-tested to detect field wiring short-circuits to 24V DC.
- The 1756-OBV8S module follows the mode of the Safety Task, which can be different than the mode of the controller.

When the safety task encounters a nonrecoverable safety fault, a standard major recoverable fault is also logged, and the controller proceeds to execute the controller fault handler, if one exists. If the controller fault handler handles this fault, then the standard tasks continue to run, even though the safety task remains faulted.

If a recoverable fault occurs in the safety application, the system can halt the execution of the safety task, depending upon whether or not the fault is handled by Program Fault Routines in the safety application. If the recoverable safety fault is not handled, a standard major recoverable fault is also logged, and the controller proceeds to execute the controller fault handler, if one exists. If the controller fault handler handles this fault, then the standard tasks continue to run, even though the safety task remains faulted.

In these scenarios, the 1756-OBV8S module follows the Safety Task and will be in Program Mode/Communications Fault mode even though the controller is still in Run mode.

For information on Safety Faults, see the ControlLogix® 5580 and GuardLogix® 5580 Controllers User Manual, publication 1756-UM543.

> **IMPORTANT**   If there is a fault on a separate safety output on the same module, the module could switch off all outputs.

Safety Application Suitability Level

Table 13 describes the safety application suitability levels for the 1756-OBV8S module.

**Table 13 - Safety Application Suitability for 1756-OBV8S Module**

Suitability Level	Conditions	Notes
Safety applications that are rated up to, and including, **SIL CL3, PLd, Cat. 2** as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.	The safety function uses **single -channel** mode. • Module Output Mode is Sourcing • Module channel Point Operation Type is SINGLE • Module channel Point mode is Safety Pulse test. The safety function uses **single-channel** mode • Module Output Mode is bipolar • Module channel Point mode is Safety Pulse test	Consider the following: • Single-channel mode refers to a single-channel actuator subsystem driven by one sourcing output channel configured for SINGLE, or one bipolar output channel configured for SINGLE. • Dual channel mode refers to a dual channel actuator subsystem driven by two sourcing output channels configured for DUAL, or one bipolar output channel configured for SINGLE. • The 1756-OBV8S module is capable of being a SIL CL3/PLe/Cat. 4 subsystem (SRP/CS) when either a single-channel or dual-channel safety device is wired to the output channels. • The channel mode type, that is, single or dual, affects Category and Performance Level. You can use the modules in SIL CL3, PLe applications regardless of channel mode type.
Safety applications that are rated up to, and including, **SIL CL3, PLe, Cat. 4** as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.	The safety function uses **dual-channel** mode. • Module Output Mode is Sourcing • Module Channel Point Operation Type is DUAL • Module channel Point mode is Safety Pulse test. The safety function uses **dual-channel** mode • Module Output Mode is bipolar • Module channel Point mode is Safety Pulse test	The determining factor to whether a 1756 ControlLogix digital safety I/O module resides in a SIL CL3, PLe, Cat. 4 safety application is that the overall safety architecture be a dual-channel system. • The requirement that Point Mode be Safety Pulse Test assumes that only the safety modules provide diagnostics to a specific Suitability Level. The larger safety system within which the safety I/O module resides can provide the diagnostics necessary to achieve the stated Suitability Level without the requirement that Point Mode be Safety Pulse Test.

Safety Output with Test Pulse

When the safety output is on, the safety output can be configured to pulse test the safety output channel. By using this function, you can continuously test the ability of the safety output to remove power from the output terminals of the module.

If an error is detected, the safety output data and individual safety output status turn off.

Figure 13 - 1756-OBV8S Test Pulse in a Cycle

Sourcing Output

Sinking Output
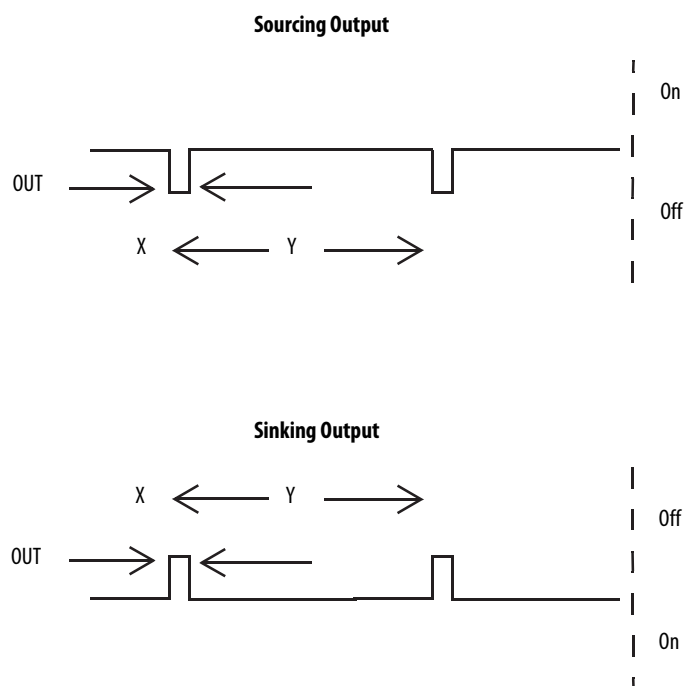
On the 1756-OBV8S module, the pulse width (X) is less than 750 μs, and the pulse period (Y) is less than 96 ms.

> **TIP** To help prevent the test pulse from causing the connected device to malfunction, pay careful attention to the input response time of the output device.
>
> An open wire test and main switch pulse test can also generate a pulse on a safety output even in safety mode.
>
> Two successive safety output pulses are required to determine if a short circuit fault exists. As a result, the effective pulse period is 192 ms, max.

Single-channel Point Operation Type

When the output channel is in the On state and without any faults, the safety outputs turned on. The status is normal. If a fault is detected on the output channel, the safety output data and individual safety output status turn off.

For information on how using single-channel Point Operation Type with a 1756-OBV8S module affects the safety application suitability level, see .

Figure 14 - 1756-OBV8S Single-channel Point Operation Type (Not to Scale)
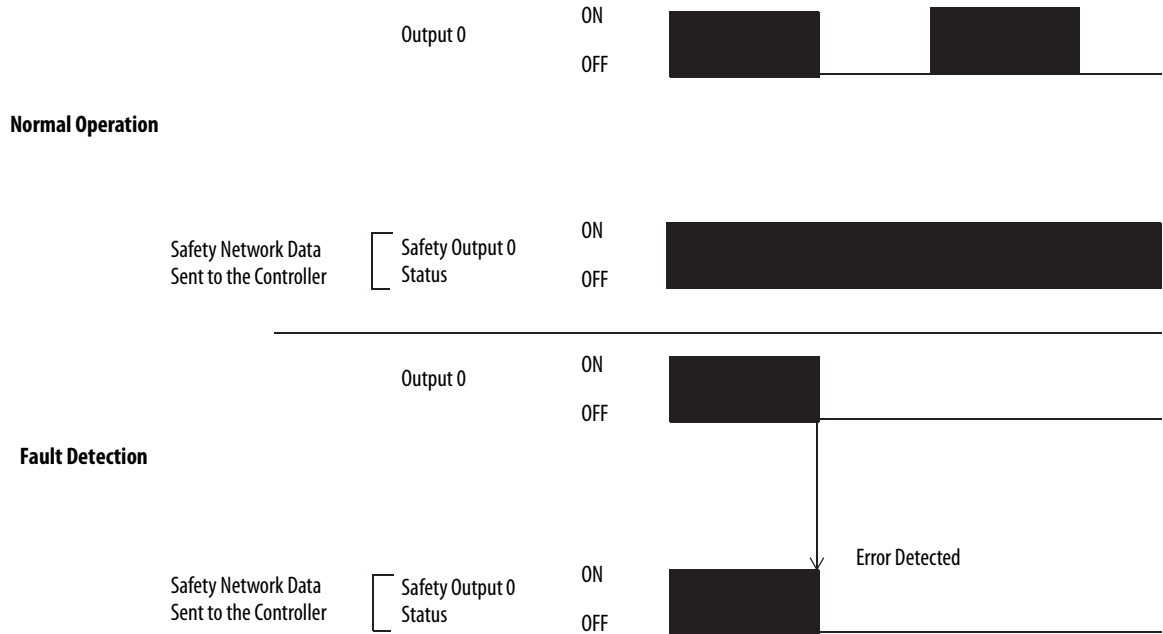
Dual-channel Point Operation Type

When dual-channel Point Operation Type is used, output channels function as connection pairs. Connection pairs are as follows:

- Channels 0 and 1
- Channels 2 and 3
- Channels 4 and 5
- Channels 6 and 7

> **IMPORTANT**   Dual-channel Point Operation Type is only available if the module is connected so that Output Mode is Sourcing.

When both output channels in a connection pair are in the On state and without any faults, the safety outputs are turned on.

For information on how to use dual-channel Point Operation Type with a 1756-OBV8S module affects the safety application suitability level, see Table 13 on page 59.

Figure 15 - 1756-OBV8S Dual-channel Point Operation Type (Not to Scale)
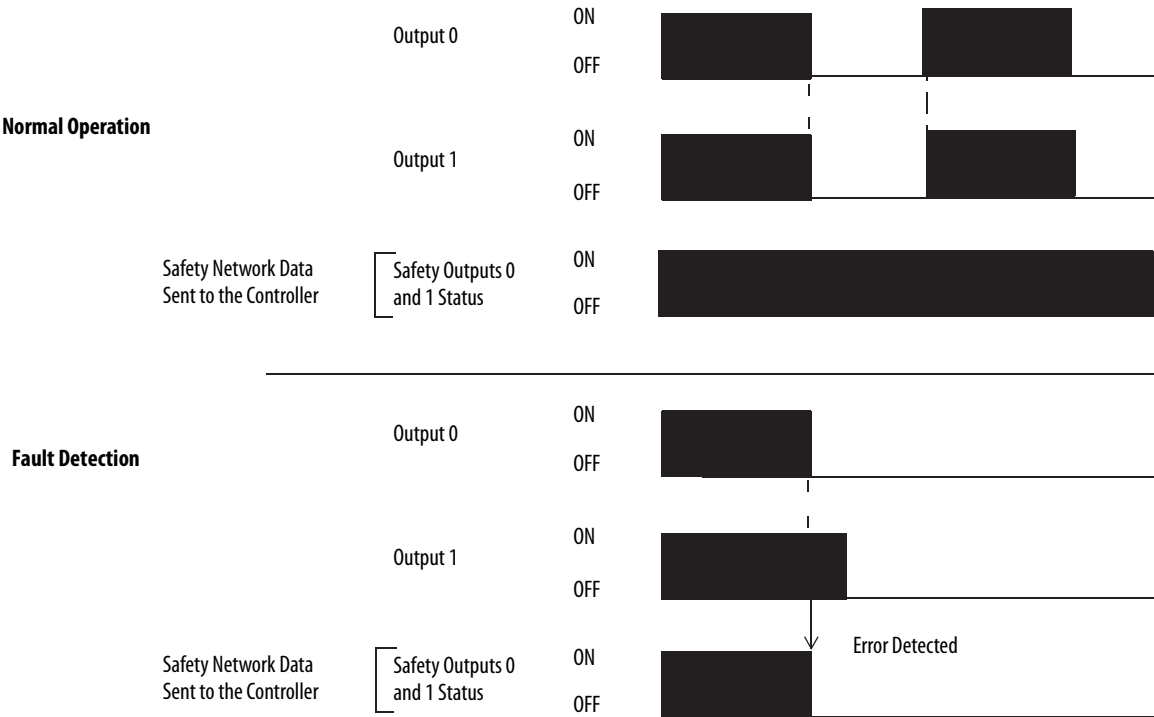
Safety Output Fault Reset

The I/O channel supports a module-level user-configurable 'Latch Fault until reset via output tag' mode and recovers from only these field faults:

- Field Power Off Detection
- Safety Output ShortCircuitGround
- Safety Output Overload

The recovery time is 1 second for Field Power Off, and 10 seconds for Short or Overload.

'Latch Fault until reset via output tag' mode is Enabled

When Latch Fault... mode is Enabled, the I/O channel holds safety output fault indications until it checks that the field fault is removed. If the field fault is removed, the channel clears the fault status only upon detecting that the ResetFault in its consume assembly channel sees a rising edge.

'Latch Fault until reset via output tag' mode is Disabled

When Latch Fault... mode is Disabled (default), the I/O channel holds safety output fault indications for 1 second until it checks if the field fault is removed. If the field fault is removed, the channel clears the fault status only upon detecting the consume data bit is low. The fault status will also be cleared by a module reset or power cycle or when "Output State During Program Mode and Communications Fault Mode" is configured to Off and any of the following conditions:

- Controller in Program mode
- Controller or Safety task fault
- Communications fault
- Module inhibit

After the channel clears the fault, the I/O indicator (red) turns off. The output data can now be controlled.

IMPORTANT	If module outputs experience persistent high faults, consider cycling power to the module to clear the error.

Fault and Status Reporting

The 1756-OBV8S module multicasts fault and status data with channel data to the owner and listening controllers. The data is returned via module tags that you can monitor in your Logix Designer application.

For more information on how to use module tags to monitor fault and status reporting, see Table 24 on page 71

- Appendix A, Troubleshoot Your Module on page 103.

Module Health Diagnostics

Each output module has a status indicator on the front of the module that indicates module health. For more information on module health diagnostics, see Appendix A, Troubleshoot Your Module on page 103.

Point Diagnostics

Point diagnostics provide information on an individual point basis. For example, you can check individual points on a 1756-OBV8S safety output module for the presence of a Short Circuit condition.

To access output point diagnostics on the 1756-OBV8S module, click the Diagnostics button for the point.

Figure 16 - Point Diagnostics

Field Power Loss Detection

The Field Power Loss Detection feature monitors for the loss of field power.

> **IMPORTANT**   The 1756-OBV8S module supports Field Power Loss Detection.
>
> The module receives field-side power via the DC power terminals on the module. When field-side power is lost on the 1756-OBV8S, it is lost from the DC power terminals.
>
> See 1756-OBV8S Module Wiring Diagrams on page 123.

Keep in mind that all points on the module fault when a field power is lost.

Table 14 describes what happens when a field power loss **condition is detected**.

Table 14 - Field Power Loss Detection

Output Behavior	Tag Value	Diagnostic Value	I/O Status Indicator State
• Faults • Turns off	One of the following: • I.Ptxx.FieldPowerOff tag = 1 • I.Ptxx.Fault tag = 1	FieldPowerOff diagnostic = 1	• Solid red

To correct the issue, you must reapply field power to the output module.

Table 15 describes what happens when a field power loss condition is resolved, and the module is recovered.

Table 15 - Field Power Loss Detection

Output Behavior	Tag Value	Diagnostic Value	I/O Status Indicator State
Restarts in its commanded state.	One of the following: • I.Ptxx.FieldPowerOff tag = 0 • I.Ptxx.Fault tag = 0	FieldPowerOff diagnostic = 0	Off

> **IMPORTANT**   The module can require up to 2 seconds to complete the recovery.

Field Power Loss Detection has a corresponding tag that can be examined in the user program if a fault occurs. For information on module tags, see Appendix B, Module Tag Definitions on page 113.

You can also monitor a point for the presence of a field power loss via the diagnostics that are available in the Module Properties dialog box in Logix Designer application.

> **IMPORTANT**   Keep in mind the following:
>
> • For the 1756-OBV8S module, Field Power Loss detection is in regard to loss of field power on the DC power terminals, or the presence of Undervoltage or Overvoltage conditions on the DC Power bus.

No Load Detection

No Load Detection detects when a wire is disconnected from the output, or a missing load for each output point in the Off state.

No Load Detection is enabled by default on the 1756-OBV8S modules. You cannot configure it.

The module supports these minimum load currents:

- Safety output modules - The load detection current is ≥10 mA. For example, 2.4 kΩ at 24V DC.

In the On state, the module must be connected to a load that draws a minimum current equal to these values.

| IMPORTANT | An output must remain in the off state a minimum of 300 ms for an open load to be detected. |

Table 16 describes what happens when a No Load **condition is detected**.

Table 16 - No Load Detection - 1756-OBV8S Module

Condition	I/O Status Indicator State
No Load condition exists	• Flashing red if a No Load condition exists and the output is off. • Flashing red/yellow if a No Load condition already exists and the output is on. **IMPORTANT**: A No Load condition is only detected when the output is off.

Table 17 describes what happens when a No Load **condition is corrected.**

Table 17 - No Load Detection - 1756-OBV8S Module

Condition	I/O Status Indicator State
No Load condition corrected	• Off if the output is off. • Steady yellow if the output is on.

You can monitor a point for the presence of a No Load condition via the diagnostics page that is available in the Module Properties dialog box in Logix Designer application.

Short Circuit Protection

Short Circuit Protection helps to prevent damage to the output that can result when more current is present at the output than it can handle.

Table 18 describes what happens when a short circuit **condition is detected** on a 1756-OBV8S module.

Table 18 - Short Circuit Protection - 1756-OBV8S Module

Output Behavior	Tag Value	Module Properties Points Tab Diagnostic Value	I/O Status Indicator State
• Faults • Turns off	One of the following: • If the output point is shorted to 24V DC, the I.Ptxx.ShortCircuit tag = 1. • If the output point is shorted to ground, no tags are changed.	One of the following: • If the output point was shorted to 24V DC when the short circuit condition was detected, the Short Circuit diagnostic = Yes. • If the output point is shorted to ground when the short circuit condition was detected, the Short Circuit to Ground diagnostic = Yes.	One of the following: • Flashes red if the output point is shorted to 24V DC. • Off if the output point is shorted to ground.

Table 19 describes what happens when the short circuit condition is removed from a 1756-OBV8S module and the data is set to safe state, that is, the off state.

Table 19 - Short Circuit Protection - 1756-OBV8S Module

Output Behavior	Tag Value	Module Properties Points Tab Diagnostic Value	I/O Status Indicator State
Restarts in its commanded state	One of the following: • If the output point is shorted to 24V DC, the I.Ptxx.ShortCircuit tag = 0. • If the output point is shorted to ground, no tags are changed.	One of the following: • If the output point was shorted to 24V DC when the short circuit condition was detected, the Short Circuit diagnostic = No. **IMPORTANT**: You must cycle power to the module to reset the diagnostic. • If the output point is shorted to ground when the short circuit condition was detected, the Short Circuit to Ground diagnostic = No	Turns off if there is no longer a load that is connected to the output.

You can monitor a point for the presence of short circuit faults via the diagnostics page that is available in the Module Properties dialog box in Logix Designer application.

For more information on the maximum current that you can apply to an output, see the 1756 ControlLogix I/O Specifications Technical Data, publication 1756-TD002.

Other Conditions That Can Trigger the Short Circuit Diagnostic on the 1756-OBV8S Module

Table 20 describes conditions that can trigger the Short Circuit diagnostic.

Table 20 - Conditions That Trigger Short Circuit Diagnostic

Conditions	Output Behavior	Tag and Diagnostic Combinations	I/O Status Indicator State
• Output Mode - Sourcing • Point Operation Type - Single • Point Mode - Safety Pulse Test • O.Ptxx.Data tag = 1 • Output point is **shorted to 24V DC.**	• Faults • Turns off	• I.Ptxx.ShortCircuit tag = 1 • Short Circuit diagnostic = 1 • I.Ptxx.Fault tag = 1 or • I.Ptxx.Fault tag = 1 • Internal Fault diagnostic = 1 **IMPORTANT**: The tag and diagnostic combinations that are described occur on the faulted output point and all of its associated group points.	The I/O status indicator for the faulted output point turns off.
These conditions exist on a pair of module outputs: • Output Mode - Sourcing • Point Operation Type - Dual • Point Mode - Safety Pulse Test • O.Ptxx.Data tag = 1 (Either output point in the pair) • Output point is **shorted to 24V DC (Either output point in the pair).**	• Faults • Turns off	• I.Ptxx.ShortCircuit tag = 1 • I.Ptxx.Fault tag = 1 • Short Circuit diagnostic = 1 • Internal Fault diagnostic = 1 or • I.Ptxx.Fault tag = 1 • Internal Fault diagnostic = 1 **IMPORTANT**: The tag and diagnostic combinations that are described occur on the faulted output point and all of its associated group points.	
These conditions exist on a pair of module outputs: • Output Mode - Sourcing • Point Operation Type - Dual • O.Ptxx.Data tag = 1 (Both output points in the pair) • Output points are **shorted to each other.**	• Faults • Turns off	• I.Ptxx.ShortCircuit tag = 1 (Both output points in the pair) • Short Circuit diagnostic = 1 (Both output points in the pair) • I.Ptxx.Fault tag = 1 or • I.Ptxx.Fault tag = 1 (Faulted output point and all of its associated group points) • Internal Fault diagnostic = 1 (Faulted output point and all of its associated group points	

When the conditions that trigger the diagnostics as described in Table 20 are corrected, the results are the same as described in Table 19 on page 68.

Output Recovery After Overload or Short Circuit to Ground Condition

Table 21 describes test output recovery after overload or short circuit to ground conditions occur.

Table 21 - Output Recovery - 1756-OBV8S Module

Cause of Fault	Module Operating Conditions	Correction	Recovery Time
Overload Condition	• Output Point Mode - Safety or Safety Pulse Test. • Output Data tag = 1. • Overload current ≥1.5 A[1]	Remove the load from the output point.	See Safety Output Fault Reset on page 63.
Short Circuit to Ground Condition	• Output Point Mode - Safety or Safety Pulse Test. • Output Data tag = 1. • Output is connected directly to ground.	Remove the output connection to ground and set the output to a safe state.	

(1)   Do not use the module beyond the rated the capacity of 1 A per channel for continuous operation. For ratings, see the 1756 ControlLogix I/O Specifications Technical Data pub 1756-TD002.

Thermal Shutoff

Thermal Shutoff helps prevent damage to the output that can result when an output gets hotter than it can handle.

This feature is **directly related to Short Circuit Protection** feature. The increased temperature at the output results from an excessive load at the output. That is, a load with high current is applied to the output. The high current heats the output beyond an acceptable temperature and the output turns off.

Table 22 describes what happens when a thermal shutoff **condition is detected** on a 1756-OBV8S module.

Table 22 - Thermal Shutoff - 1756-OBV8S Module

Output Behavior	Tag Value	Diagnostic Value	I/O Status Indicator State
• Faults • Turns off	One of the following: • If the output point is shorted to 24V DC when the thermal shutoff condition occurred, the I.Ptxx.ShortCircuit tag = 1. • If the output point is shorted to ground when the thermal shutoff condition occurred, there is no change to the tags.	One of the following: • If the output point is shorted to 24V DC when the thermal shutoff condition occurred, there is no change in the diagnostics. • If the output point is shorted to ground when the thermal shutoff condition occurred, the ShortCircuitGround diagnostic = 1.	Steady red

Table 23 describes what happens when the thermal shutoff **condition is corrected** on a 1756-OBV8S module.

Table 23 - Thermal Shutoff - 1756-OBV8S Module

Output Behavior	Tag Value	Diagnostic Value	I/O Status Indicator State
Remains in the off state	I.Ptxx.ShortCircuit tag = 0	One of the following: • If the output point was shorted to 24V DC when the thermal shutoff condition occurred, the Overload diagnostic = 0. **IMPORTANT**: You must cycle power to the module to reset the diagnostic. • If the output point was shorted to ground when the thermal shutoff condition occurred, the ShortCircuitGround diagnostic = 0.	Turns off if there is no longer a load that is connected to the output.

For more information on how to use the modules, see Appendix B, Module Tag Definitions on page 113.

Fault and Status Reporting

The output modules multicast fault and status data with channel data to the owner and listening controllers. The data is returned via module tags that you can monitor in your Logix Designer application.

Table 24 lists tags that are used on the 1756-OBV8S module.

IMPORTANT	For more information on the valid values for each tag in Table 24, see Appendix B, Module Tag Definitions on page 113.

Table 24 - 1756-OBV8S - Fault and Data Status

Data Type	Tag Name	Triggering Event That Sets
Fault	ConnectionFaulted[1]	The owner-controller loses its connection to the module.
	Ptxx.Fault	The point data quality is bad or the channel is set to Not Used.
	Ptxx.ShortCircuit	A short circuit condition exists on the point.
	Ptxx.FieldPowerOff	A field power lost condition exists on the point.
Status	RunMode	The module is in Run Mode.
	DiagnosticActive	Indicates if any diagnostics are active or if the prognostics threshold is reached.
	DiagnosticSequenceCount	The count increments each time that a diagnostic condition is detected or removed.
	Ptxx.Readback	A 24V DC power source is connected to the output circuit.
	Ptxx.Uncertain	The point data can be imperfect.
	Ptxx.Status	The point state transitions from normal to faulted or faulted to normal.

(1) This tag provides module-wide data an affects all channels simultaneously.

For more information on fault reporting, see Appendix A, Troubleshoot Your Module on page 103.

Configurable Channel-level Output State in Program Mode or Fault Mode

You can configure individual output channels to specific states when the module is in Program mode or Communications Fault mode. These output states are available:

- Off
- Hold

> ⚠️ **WARNING:** The selection of "Hold" for Output State During Program Mode and Communications Fault Mode prevents the output point from going to the safe state, making the output point not suitable for a SIL or PL rated safety function. Set Output State During Program Mode and Communications Fault Mode to "Off" to allow points to go to safe state.
>
> TÜV Rheinland has approved GuardLogix 5580 and Compact GuardLogix 5380 controller systems for use in safety-related applications where the de-energized state is always considered to be the safe state. You must ensure each configuration of the safety IO module is set for "Off" under the Output State During Program Mode and Communications Fault Mode selection to consider those output points as part of any equipment's safety function.

To see how to configure the output states in Program mode or Fault mode, see Edit the 1756-OBV8S Module Points Category on page 90:

Connection Fault Handling

You can configure module behavior when a connection fault occurs, that is, the connection between the owner-controller and the output module breaks. You must define the immediate output behavior when the connection breaks.

Output Behavior Immediately After a Connection Fault

> ⚠ **ATTENTION:** If you change the Output state from OFF to HOLD during Program or Communication Fault modes, make sure this does not create an unsafe state of your safety system.

When the connection between an owner-controller and output module breaks, the output can behave in these ways, depending on how the Fault Mode parameter is configured:

- Turn off - Default
- Hold its last state

If you configure the output to hold its last state, the output remains at that state value until this occurs:

- The connection to the owner-controller is re-established.
- The output returns to normal operation, as defined in the module configuration.

Output State Once Connection is Re-established

Once the connection between the owner-controller and output module is re-established, the output resumes normal operation.

Forcing

Use a force to override data that your logic either uses or produces.

> **IMPORTANT**   When a safety signature exists, forcing safety I/O is not permitted in the safety portion of the application.

- Test and debug your logic.

- Temporarily maintain normal system operations when an input device has failed.

Use forces only as a temporary measure. They are not intended to be a permanent part of your application.

Make sure that you understand this before you use forces.

> ⚠️ **ATTENTION:** Forcing can cause unexpected machine motion that could injure personnel. Before you use a force, determine how the force affects your machine or process and keep personnel away from the machine area.
> - Enabling I/O or SFC forces causes your machine or process to go to another state or phase.
> - Removing forces can still leave forces in the enabled state.
> - If forces are enabled and you install a force, the new force immediately takes effect.

Enable Forces

For a force to take effect, you enable forces. You can only enable and disable forces at the controller level.

- You can enable I/O forces and SFC forces separately or simultaneously.

- You cannot enable or disable forces for a specific module, tag collection, or tag element.

Disable or Remove a Force

To stop the effect of a force and let your project execute as programmed, disable or remove the force.

- You can disable or remove I/O and SFC forces simultaneously or separately.

- When you remove a force on an alias tag, you also remove the force on the base tag.

> ⚠️ **ATTENTION:** Changes to forces can cause unexpected machine motion that could injure personnel. Before you disable or remove forces, determine how the change affects your machine or process and keep personnel away from the machine area.

Check Force Status

Before you use a force, determine the status of forces for the controller.

The Online toolbar shows the status of forces. It shows the status of I/O forces and SFC forces separately.

To determine the status of this	Use any of these
I/O forces	• Online toolbar • GSV instruction
SFC forces	Online toolbar
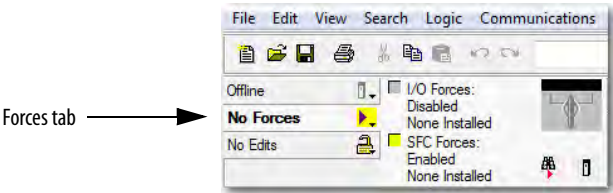
Forces tab →

Forces Tab Status	Means
Enabled	• If the project contains any forces of this type, they are overriding your logic. • If you add a force of this type, the new force immediately takes effect
Disabled	Forces of this type are inactive. If the project contains any forces of this type, they are not overriding your logic.
Installed	At least one force of this type exists in the project.
None Installed	No forces of this type exist in the project.

GSV Instruction

This example shows how to use a GSV instruction to get the status of forces. For the purposes of this example, Force_Status is a DINT tag.
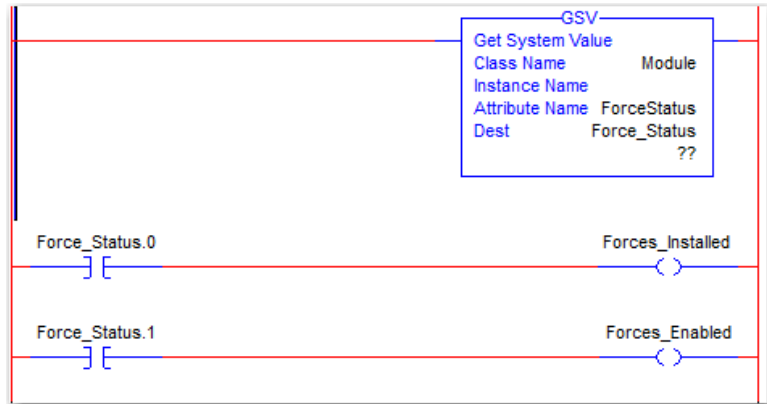
To determine this	Examine this bit	For this value
Forces are installed.	0	1
No forces are installed.	0	0
Forces are enabled.	1	1
Forces are disabled.	1	0

Notes: