

1756-OF6CI and 1756-OF6VI Module Features

This section describes features specific to ControlLogix isolated analog output modules that provide a high level of noise immunity. The 'C' and 'V' in the respective catalog numbers indicate 'current' and 'voltage'.

Data Format Options

Data format defines the format of channel data that is sent from the controller to the module, defines the format of the 'data echo' that the module produces, and determines the features that are available to your application.

This table shows the features that are available in each format.

Features Available in Each Data Format

Data Format	Features Available	Features Not Available
Integer mode	Ramp to program value Ramp to fault value Hold for initialization Hold Last State or User Value in fault or program mode	Clamping Ramp in Run mode Rate and Limit alarms Scaling
Floating point mode	All features	N/A

Ramping/Rate Limiting

Ramping limits the speed at which an analog output signal can change. This helps prevent fast transitions in the output from damaging the devices that an output module controls. Ramping is also known as rate limiting.

This table describes the types of ramping that are possible.

Ramping Type	Description
Run mode ramping	This type of ramping occurs when the module is in Run mode and begins operation at the configured maximum ramp rate when the module receives a new output level. IMPORTANT: This is only available in floating point mode.
Ramp to Program mode	This type of ramping occurs when the present output value changes to the Program value after a Program command is received from the controller.
Ramp to Fault mode	This type of ramping occurs when the present output value changes to the Fault value after a communications fault occurs.

The maximum rate of change in outputs is expressed in engineering units per second and called the maximum ramp rate.

Hold for Initialization

Hold for Initialization causes outputs to hold their present state until the value the controller commands matches the value at the output screw terminal within 0.1% of full scale, providing a bumpless transfer.

If Hold for Initialization is selected, outputs hold if there's an occurrence of any of these three conditions.

- Initial connection is established after power-up.
- A new connection is established after a communications fault occurs.
- There's a transition to Run mode from Program state.

The InHold bit for a channel indicates that the channel is holding.

Clamping/Limiting

Clamping limits the output from the analog module to remain within a range configured by the controller, even when the controller commands an output outside that range. This safety feature sets a high clamp and a low clamp.

Once clamps are determined for a module, any data that is received from the controller that exceeds those clamps sets an appropriate limit alarm and transitions the output to that limit but not beyond the requested value.

For example, if the high clamp that is configured for a module is 8V and the low clamp that is configured is -8V, and the controller sends a value of 9V to the module, the module will only apply 8V to its screw terminals.

Clamping alarms can be disabled or latched on a per channel basis.

IMPORTANT

Clamping is only available in floating point mode.

Clamp values are in engineering scaling units and aren't automatically updated when the engineering high and low scaling units are changed. Failure to update the clamp values generates a small output signal that could be misinterpreted as a hardware problem.

Clamp/Limit Alarms

This function works directly with clamping. When a module receives a data value from the controller that exceeds clamping limits, it applies signal values to the clamping limit and sends a status bit to the controller as notification that the value sent exceeds the clamping limits.

Using the previous example, if a module has clamping limits of 8V and -8V but then receives data to apply 9V, only 8V is applied to the screw terminals and the module sends a status bit back to the controller informing it that the 9V value exceeds the module's clamping limits.

IMPORTANT

Limit alarms are available only in floating point mode.

Data Echo

Data Echo automatically multicasts channel data values that match the analog value that was sent to the module's screw terminals.

Fault and status data is also sent. This data is sent in the format (floating point or integer) selected at the requested packet interval (RPI).

User Count Conversion to Output Signal

User counts can be computed in Integer mode for the 1756-OF6CI and 1756-OF6VI modules.

The straight-line formulas that can be used to calculate or program a Compute (CPT) instruction are shown in this table.

Available Range	User Count Formula
0...20 mA	$y = 3109.7560975609754x - 32768$ where y = counts; x = mA
+/-10V	$y = 3115.669867833032x - 0.5$ where y = counts; x = V

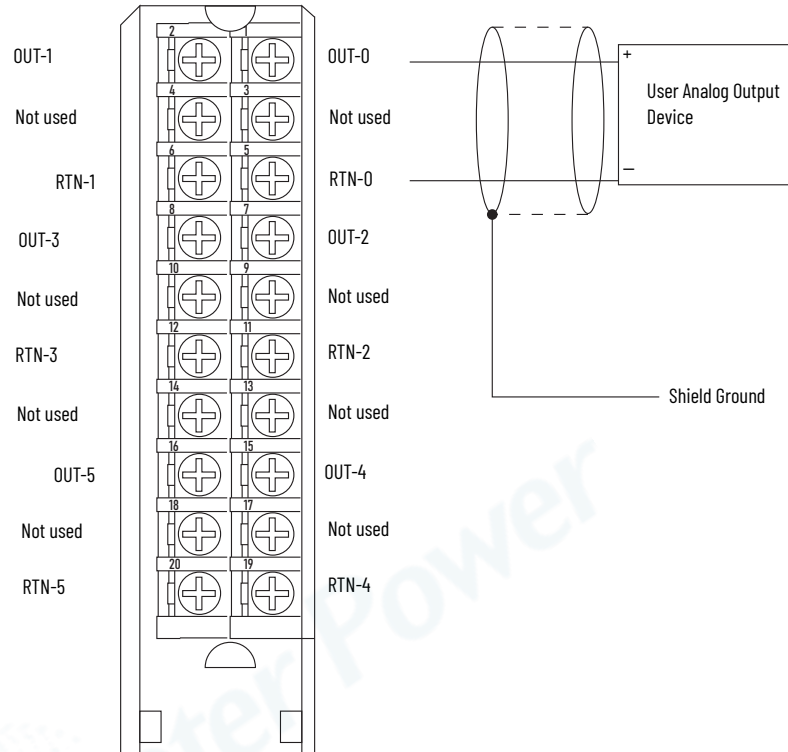
For example, if you have 3.5 mA in the 0...20 mV range, the user counts = -21884. Counts = 6231 for 2V in the +/-10V range.

For a table with related values, see Knowledgebase Technote, [ControlLogix 1756-OF6CI User Count Conversion to Output Signal](#) and [ControlLogix 1756-OF6VI User Count Conversion to Output Signal](#).

1756-OF6VI Module Wiring

This illustration shows wiring examples for the 1756-OF6VI module.

1756-OF6VI Wiring example



Keep in mind the following:

- Place additional devices anywhere in the loop.
- Do not connect more than two wires to any single terminal.



ATTENTION: If you use a separate power source, do not exceed the specific isolation voltage.

1756-OF6CI and 1756-OF6VI Module Fault and Status Reporting

The 1756-OF6CI and 1756-OF6VI modules multicast status and fault data to the owner and/or listening controller with its channel data. The fault data is arranged in such a manner as to let you choose the level of granularity that is desired for examining fault conditions.

Three levels of tags work together to provide an increasing degree of detail as to the specific cause of faults on the module.

This table lists tags that can be examined in ladder logic when a fault occurs.

Tag	Description
Module Fault Word	This word provides fault summary reporting. Its tag name is ModuleFaults.
Channel Fault Word	This word provides underrange, overrange, and communications fault reporting. Its tag name is ChannelFaults.
Channel Status Words	This word provides individual channel underrange and overrange fault reporting for process alarms, rate alarms, and calibration faults. Its tag name is ChxStatus.

IMPORTANT Differences exist between floating point and integer modes as they relate to module fault reporting. These differences are explained in the following two sections.

Fault Reporting in Floating Point Mode

This illustration provides an overview of the fault reporting process for the 1756-OF6CI or 1756-OF6VI module in floating point mode.

Module Fault Word
(described on [page 167](#))

- 15 = AnalogGroupFault
- 13 = OutGroupFault
- 12 = Calibrating
- 11 = Cal Fault
- 14 isn't used by the OF6CI or OF6VI

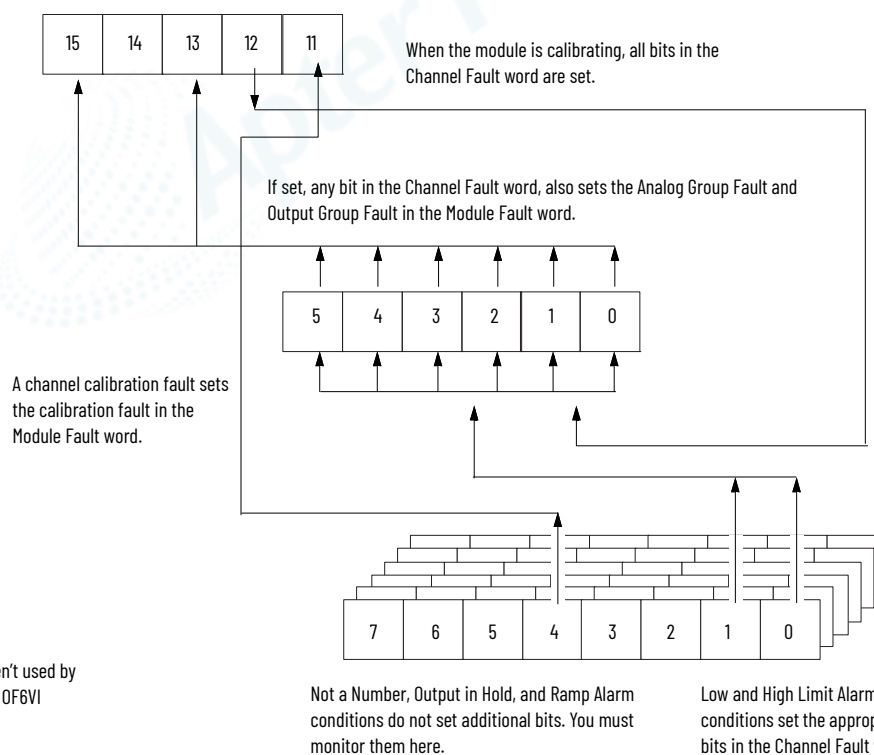
Channel Fault Word
(described on [page 167](#))

- 5 = Ch5Fault
- 4 = Ch4Fault
- 3 = Ch3Fault
- 2 = Ch2Fault
- 1 = Ch1Fault
- 0 = Ch0Fault

Channel Status Words
(one for each channel,
described on [page 167](#))

- 5 = ChxNotANumber
- 4 = ChxCaLFault
- 3 = ChxInHold
- 2 = ChxRampAlarm
- 1 = ChxLLimitAlarm
- 0 = ChxHLimitAlarm

7 & 6 aren't used by
OF6CI or OF6VI



Bits in this word provide the highest level of fault detection. A nonzero condition in this word reveals that a fault exists on the module.

This table lists tags that you can further examine in ladder logic to isolate the fault.

1756-OF6CI, 1756-OF6VI Module Fault Word Bits – Floating Point Mode

Tag	Description	Tag Name
Analog Group Fault	This bit is set when any bits in the Channel Fault word are set.	AnalogGroupFault
Output Group Fault	This bit is set when any bits in the Channel Fault word are set.	OutputGroupFault
Calibrating	This bit is set when any channel is being calibrated. When this bit is set, all bits in the Channel Fault word are set.	Calibrating
Calibration Fault	This bit is set when any individual Channel Calibration Fault bits are set.	CalFault

During normal module operation, Channel Fault word bits are set if any of the respective channels has a High or Low Limit Alarm. A quick way to check for High or Low Limit Alarm condition on a channel is to check this word for a nonzero condition.

This table lists the conditions that set **all** Channel Fault word bits in floating point mode.

1756-OF6CI, 1756-OF6VI Channel Fault Word Bits – Floating Point Mode

Condition	Display
A channel is being calibrated	'003F' for all bits
A communications fault occurred between the module and its owner-controller	'FFFF' for all bits

Set your logic to monitor the Channel Fault bit for a particular output, if you either:

- set the high and low limit alarms outside your operating range.
- disable output limiting.

Any of the six Channel Status words, one for each channel, displays a nonzero condition if that particular channel has faulted for the conditions that are listed below. Some of these bits set bits in other Fault words.

When the High or Low Limit Alarm bits (bits 1 and 0) in any of the words are set, the appropriate bit is set in the Channel Fault word.

When the Calibration Fault bit (bit 4) is set in any of the words, the Calibration Fault bit (bit 11) is set in the Module Fault word.

This table lists the conditions that set each of the word bits.

1756-OF6CI, 1756-OF6VI Channel Status Word Bits – Floating Point Mode

Tag (Status word)	Bit	Event that sets this tag
ChxNotaNumber	Bit 5	This bit is set when the output value that is received from the controller is NotaNumber (the IEEE NAN value). The output channel holds its last state.
ChxCalFault	Bit 4	This bit is set when an error occurred when calibrating. This bit also sets the appropriate bit in the Channel Fault word.
ChxInHold	Bit 3	This bit is set when the output channel is holding. The bit resets when the requested Run mode output value is within 0.1% of the current full-scale echo value.
ChxRampAlarm	Bit 2	This bit is set when the output channel's requested rate of change would exceed the configured maximum ramp rate requested parameter. It remains set until the output reaches its target value and ramping stops. If the bit is latched, it remains set until it's unlatched.
ChxLLimitAlarm	Bit 1	This bit is set when the requested output value is beneath the configured low limit value. It remains set until the requested output is above the low limit. If the bit is latched, it remains set until it's unlatched.
ChxHLimitAlarm	Bit 0	This bit is set when the requested output value is above the configured high limit value. It remains set until the requested output is below the high limit. If the bit is latched, it remains set until it's unlatched.

IMPORTANT The 1756-OF6CI and 1756-OF6VI modules do not use **bits 6 or 7** in this mode.

Fault Reporting in Integer Mode

This illustration provides an overview of the fault reporting process for the 1756-OF6CI or 1756-OF6VI module in integer mode.

Module Fault Word

(described on [page 168](#))

- 15 = AnalogGroupFault
- 13 = OutGroupFault
- 12 = Calibrating
- 11 = Cal Fault
- 14 isn't used by the 1756-OF6CI or 1756-OF6VI.

Channel Fault Word

(described on [page 169](#))

- 5 = Ch5Fault
- 4 = Ch4Fault
- 3 = Ch3Fault
- 2 = Ch2Fault
- 1 = Ch1Fault
- 0 = Ch0Fault

Channel Status Word

(described on [page 169](#))

- 14 = Ch0InHold
- 12 = Ch1InHold
- 10 = Ch2InHold
- 8 = Ch3InHold
- 6 = Ch4InHold
- 4 = Ch5InHold

15, 13, 11, 9, 7, & 5 aren't used by the 1756-OF6CI and 1756-OF6VI in integer mode.

When the module is calibrating, all bits in the Channel Fault word are set.

If set, any bit in the Channel Fault word, also sets the Analog Group Fault and Output Group Fault in the Module Fault word.

Output in Hold conditions must be monitored here.

In integer mode, Module Fault word bits (bits 15...11) operate exactly as described in floating point mode.

This table lists tags that you can further examine in ladder logic to isolate the fault.

1756-OF6CI, 1756-OF6VI Module Fault Word Bits - Integer Mode

Tag	Description
Analog Group Fault	This bit is set when any bits in the Channel Fault word are set. Its tag name is AnalogGroupFault.
Output Group Fault	This bit is set when any bits in the Channel Fault word are set. Its tag name is OutputGroupFault.
Calibrating	This bit is set when any channel is being calibrated. When this bit is set, all bits in the Channel Fault word are set. Its tag name is Calibrating.
Calibration Fault	This bit is set when any of the individual Channel Calibration Fault bits are set. Its tag name is CalFault.

In integer mode, Channel Fault word bits (bits 5...0) operate exactly as described in floating point mode for calibration and communications faults.