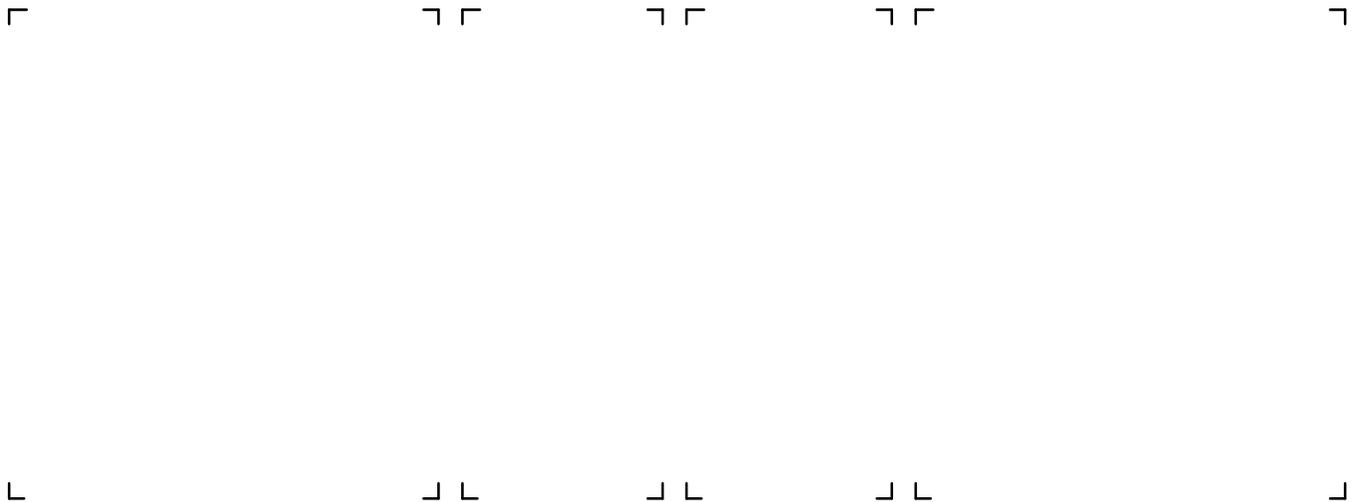




Very High Speed Counter Module

(Cat. No. 1771-VHSC)

Product Data



The 1771-VHSC module is an intelligent block-transfer I/O module that:

- **performs high-speed counting for industrial applications.**

The module counts pulses from:

- encoders (such as Allen-Bradley Bulletin 845H, K, F, P, E, and L)
- dc pulse generators
- dc flow meters
- mechanical limit switches

and returns either a count or frequency in binary or BCD format.

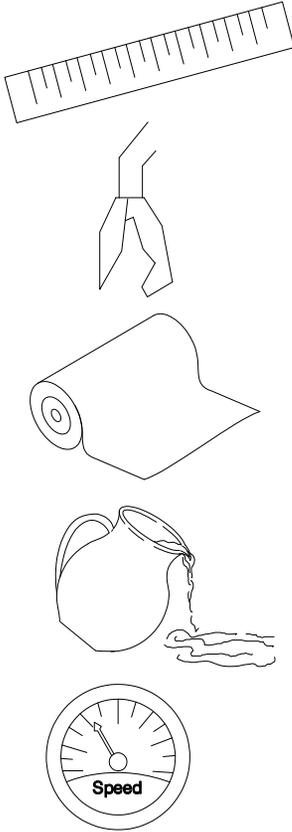
- **interfaces with any Allen-Bradley PLC[®] programmable controller that has block-transfer capability.** Block transfer:

- moves module status data from the module's memory to a designated area in the processor data table
- moves configuration words from the processor data table to the module memory

Product Data

Very High Speed Counter Module
1771-VHSC

Using the VHSC Module



You can use the VHSC module in the automotive, oil and gas, food and beverage, pharmaceutical, and pulp and paper industries for various high-speed counting applications, including:

■ length measurement applications

- cut-to-length operations — track and cut at specified length
- linear measurements — strip/webbing

■ positioning applications

- pick and place
- storage and retrieval

■ winder/spooler measurements

- total length of product
- thickness
- diameter of wound product
- linear speed

■ flow calculations

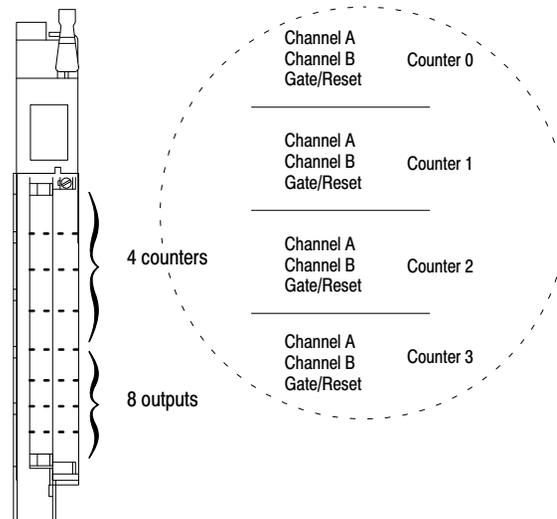
- flow rate
- total flow
- alarming based on rate

■ real world simulations

- tachometers
- speedometers
- oscillators

Understanding the VHSC Module

The VHSC module accepts input for four counters and has eight assignable outputs.



Inputs

Each of the four counters:

- accepts single-ended or differential inputs
- has an input voltage range of 5 to 24V dc
- has a maximum count of 999,999 (binary or BCD in 2 words)

The VHSC module has a maximum input frequency of:

- 100 Hz — for switch bounce; electromechanical switch (user-selectable)
- 250 kHz — 2-channel counter mode (for encoder signals)
- 500 kHz — period/rate, rate measurement, or continuous/rate mode
- 1 MHz — single-channel counter mode

Configuring the Module

To configure the module you use your PLC processor to send instructions over the remote I/O link. Using 6200 series software, you can easily configure the module using fill-in-the-blank templates.

Outputs

The 1771-VHSC module has eight outputs, isolated in groups of two. The outputs:

- are current sourcing at 5 to 24V dc (2A max per output)
- can be tied back to an input for cascading
- can be assigned to any counter
- each have a user-selectable on and off value
- must be connected to an external power supply
- turn on in less than 10 μ s when the appropriate count value has been reached
- each have an output voltage range of 5 to 24V dc

Enabling and Forcing Outputs

Outputs may be forced on or off independent of count or frequency value. To force the outputs, they must first be enabled. Once the outputs have been enabled, they may be forced on and off by setting bits in the block transfer write (BTW) configuration block.

Assigning Outputs to Counters

You can assign as many as eight outputs to a given counter; however, you can not use the same output with two different counters.

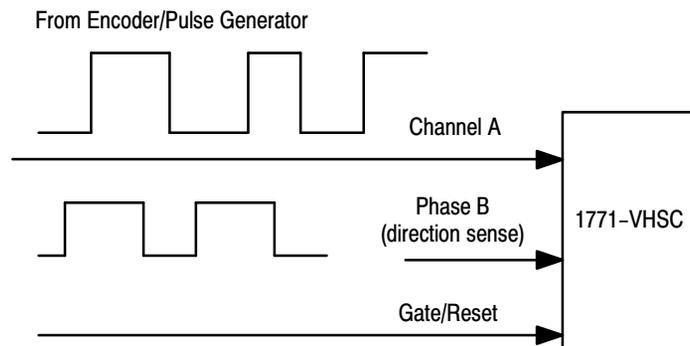
Selecting the Mode of Input

The module provides six different modes of operation to achieve application specific results that help increase overall system performance. You can configure any of the four input counters for any one of these modes:

Select This Mode:	To:
Counter Mode	use channel A input for pulse counting and use channel B to determine direction.
Encoder X1 Mode	use quadrature input signals for a bidirectional count.
Encoder X4 Mode	use quadrature input signals to count on leading and trailing edges of A and B for a bidirectional count.
Period/Rate Mode	determine the frequency of input pulses by counting the number of internal 4 MHz clock pulses over a user-specified number of input signal pulses . Outputs are updated <i>after</i> the user specified number of input signal pulses.
Rate/Measurement Mode	determine the frequency of input pulses by counting these pulses over a user-specified time interval . Outputs are updated <i>after</i> the user specified time interval.
Continuous/Rate Mode	determine the frequency of input pulses by counting the number of internal 4 MHz clock pulses over a user-specified number of the input signal pulses . Outputs are updated <i>continuously</i> .

Counter Mode

Use the counter mode if you need the module to read incoming pulses from a maximum of 4 encoders (single-ended or differential), counters, pulse generators, mechanical limit switches, etc. and return them to the PLC processor as a binary or BCD number (0-999,999). In this mode, the module accepts only one channel feedback.



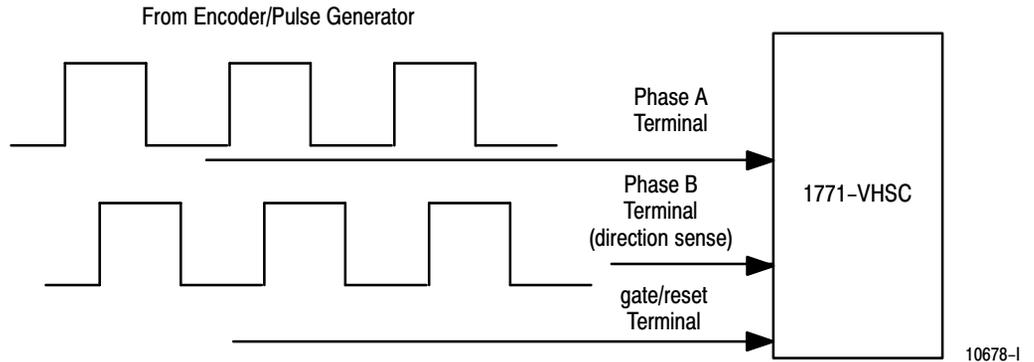
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In this mode, direction (up counting or down counting) is determined by the channel B input, which can be an asynchronous signal.

If Phase B is:	Counter will Count (direction):
high	down
low or floating (not connected)	up

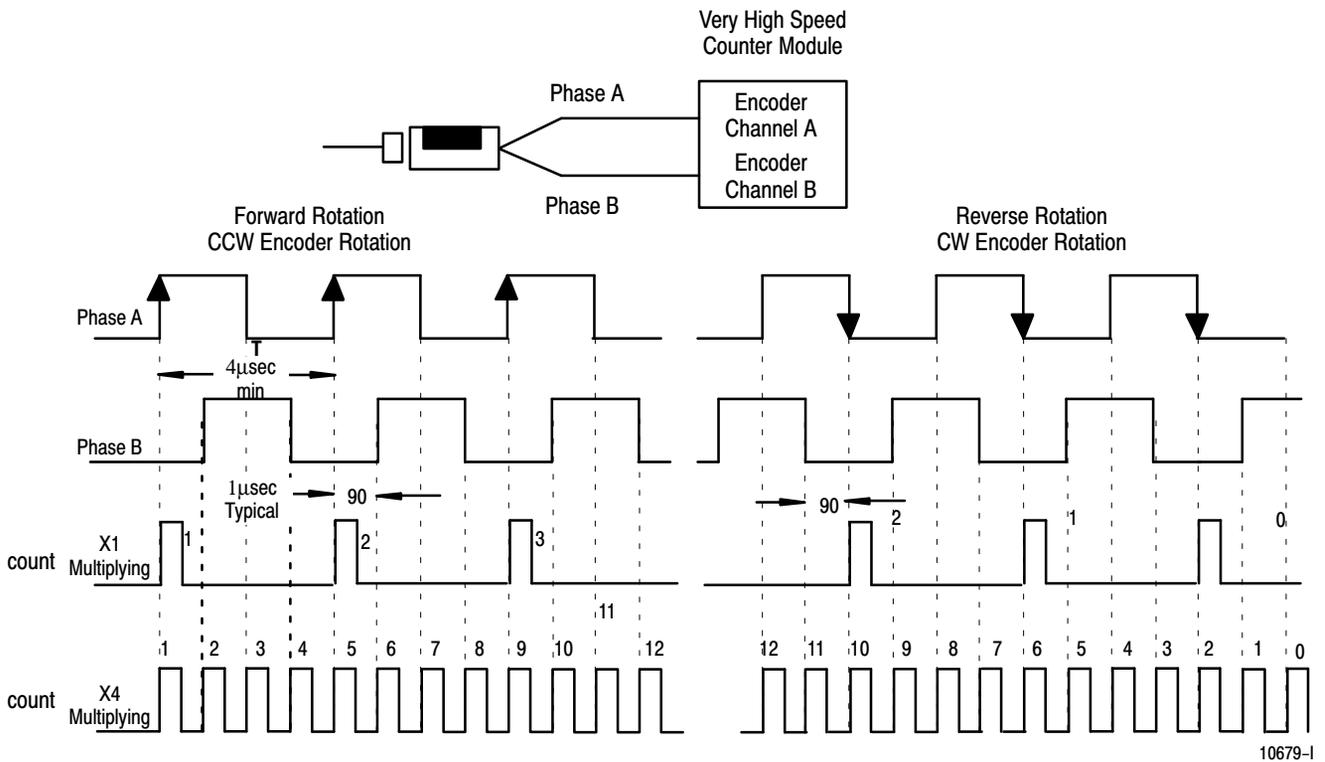
Encoder Modes

Use the encoder modes if you need the module to read incoming quadrature pulses and return them to the PLC processor as a binary or BCD number (0-999,999). In these modes, the module accepts two-phase quadrature feedback and counts up or down depending upon the condition of the Phase B input for each counter.



Encoder X1 Mode — this mode uses quadrature input signals for a bidirectional count.

Encoder X4 Mode — this mode uses quadrature input signals to count on leading and trailing edges of A and B for a bidirectional count.

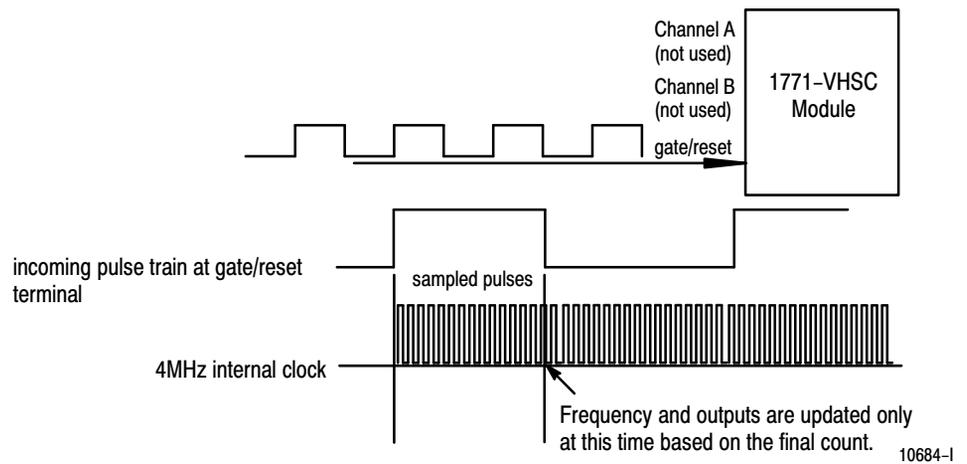


Period/Rate Mode

Use the Period/Rate mode to determine the frequency of input pulses by counting the number of internal 4 MHz clock pulses over a **user-specified number of input signal pulses**. At the end of the specified number of pulses, the module returns the frequency and the number of internal 4 MHz pulses. When the frequency and count are updated, any associated outputs are checked against their associated presets.

Example — Period/Rate Mode

In this example, the user specified number of pulses = 1.



Rate/Measurement Mode

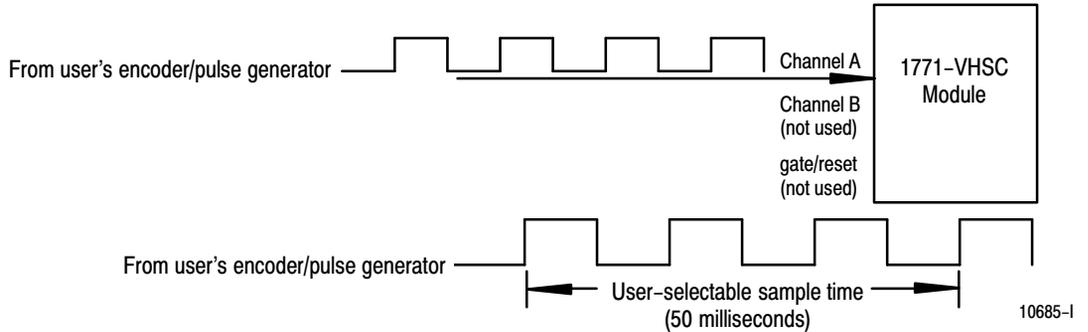
Use the Rate/Measurement mode to count incoming pulses for a **user-specified time interval**. At the end of the interval, the module returns a value representing the sampled number of pulses and a value indicating the incoming frequency. When the count and frequency are updated, any associated outputs are checked against their associated presets.

The sample period can range from 10 milliseconds to 2 seconds in 10 millisecond increments.

Example — Rate/Measurement Mode

In this example:

- sample time period = 50 milliseconds
- number of counts accumulated during the period = 3



The frequency returned to the PLC processor in would be:

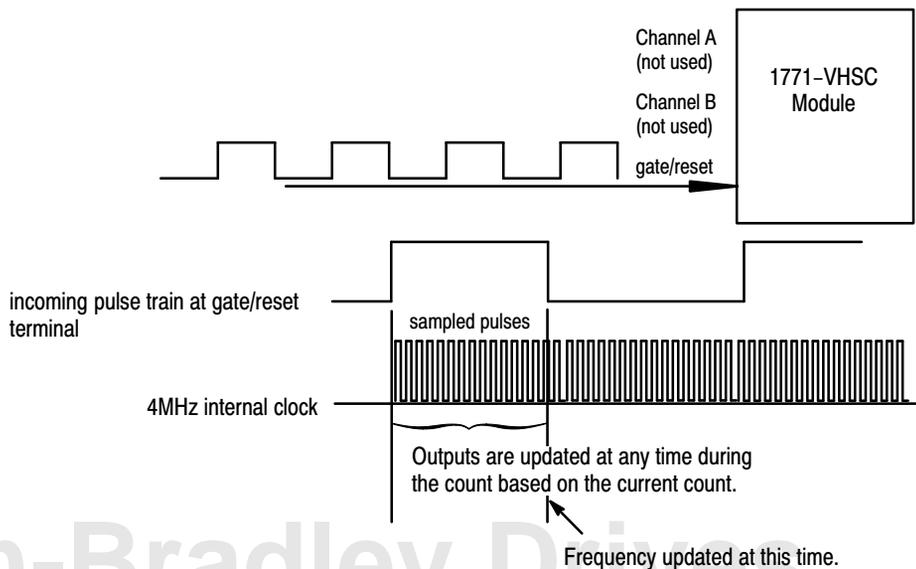
$$\text{Frequency} = \text{Counts/Sample period} = 3 \text{ counts}/50 \text{ milliseconds} = 60 \text{ Hz}$$

Continuous/Rate Mode

Use the Continuous/Rate mode to determine the frequency of input pulses by counting the number of internal 4 MHz clock pulses over a **user-specified number of input signal pulses**. Each output is turned on as soon as the turn-on count is reached and turned off as soon as the turn-off count is reached. At the end of the user-specified number of pulses the frequency is updated.

Example — Continuous/Rate Mode

In this example, the user-specified number of pulses = 1.



Using the Gate/Reset Input

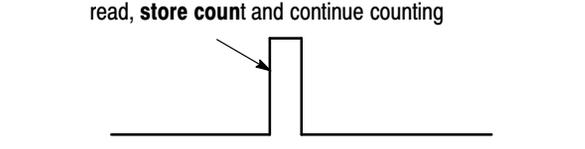
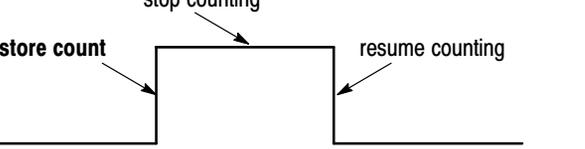
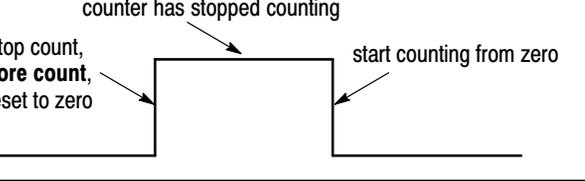
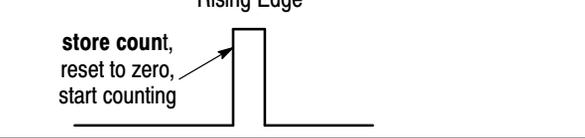
If you are using the encoder or counter modes, you have the option of using the gate/reset input. There is one gate/reset input terminal for each of the four counters.

You can scale the incoming count at the gate/reset input. Scaling allows the incoming pulses at gate/reset input to be divided by a user-defined number. There is one scaler value for each counter.

Store Count Feature

The store count feature is triggered by the state of the gate/reset input on the module. This feature allows the module to store the current count value of any (or all) of the four counters. The stored count of each counter is placed in a separate word in the block transfer read (BTR) file. The stored count value will remain in the BTR file until a new trigger pulse is received at the gate/reset input. The old count value is then overwritten by the new value.

You set the gate/reset terminal input for one of these store count modes:

Store Count Mode ¹	Store Count Feature Operating on the Rising Edge of the Gate/Reset Pulse
<p>Mode 1 — store/continue The leading edge of a pulse input on the gate/reset terminal will cause the current value in the counter to be read and stored. The counter will continue counting. The stored count will be available in the BTR file and remain there until it is overwritten by new data.</p>	
<p>Mode 2 — store/wait/resume The gate/reset terminal provides the capability to inhibit counting when the gate/reset input is high. Counting resumes when the input goes low. Mode 2 does not reset the counter, although it does store the count value.</p>	
<p>Mode 3 — store-reset/wait/start The rising edge of the pulse on the gate/reset terminal causes the counter to stop counting, store the current count value in the BTR file and reset the count to zero. The counter does not count while the input pulse on the gate/reset terminal remains high. Counting resumes from zero on the falling edge of the pulse at the gate/reset terminal.</p>	
<p>Mode 4 — store-reset/start The rising edge of a pulse input at the gate/reset terminal will cause the counter to store the accumulated count value and will reset the counter to zero. The counter continues counting, and the stored count is available in the BTR file.</p>	

¹ You can also select these features using the falling edge of the gate/reset pulse. This selection is made through the gate invert bit, which is active in the store count and period/rate modes.

Enabling the Outputs

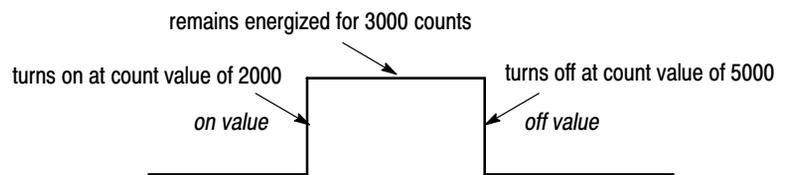
When the outputs for the VHSC module are enabled and assigned to a counter they operate in an ON–OFF fashion. The ON and OFF values are circular around zero.

Example

If you program the module to:

- turn ON an output when a count value = 2000
- remain energized for a period of 3000 counts and then turn OFF

The output:



In the rate measurement mode, the ON and OFF values associated with each output represent a frequency value instead of a count value. The maximum frequency value that may be entered in an ON or OFF value is 500,000Hz.

Isolation of Outputs

The module provides 1500V ac forced rms isolation between each of the counters and the backplane of the I/O rack.

Tying Outputs to Counters

You can jumper any of the outputs to any of the counter inputs on the module field wiring arm. In this way, it is possible to use the outputs to reset a counter or to cascade counters.

Handshaking

Two handshaking bits are available for each counter. These bits are called New Data (ND) bits in the BTR instruction, and New Data Acknowledge (NDA) bits in the BTW instruction. They indicate when a stored data value has been most recently updated. These bits are for count/accumulate applications, but can be used whenever the stored data is updated at a rate slower than the block–transfer time.

The New Data bit can be used to indicate that a store register has been updated by one of the following events:

- an active gate transition in any of the **store count modes**
- the end of the gate sample period in either of the **period rate modes**
- the end of the programmed sample period in **rate measurement mode**

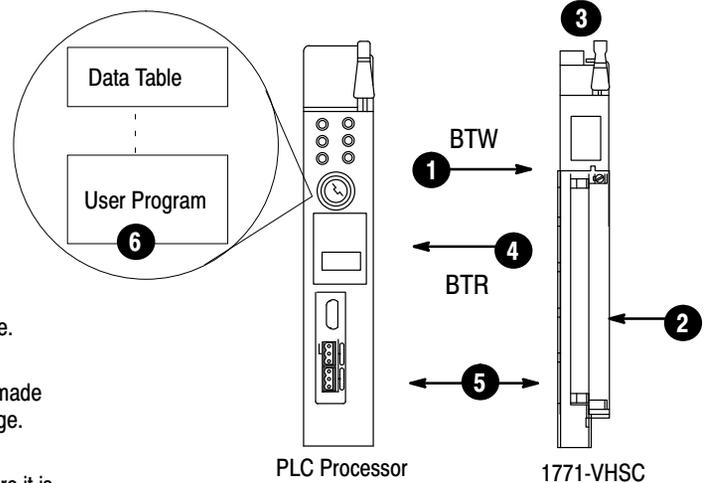
Product Data

Very High Speed Counter Module
1771-VHSC

Communicating with a Programmable Controller

The processor transfers data to and from the module using block-transfer write (BTW) and block-transfer read (BTR) instructions in your ladder program. These instructions let the processor obtain input values and status from the module and let you establish the module's mode of operation.

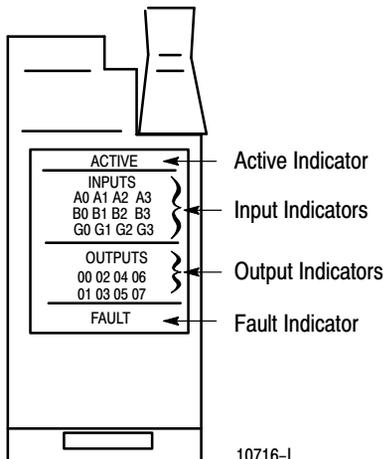
- 1 The processor transfers your configuration data and commands to the module using a BTW instruction.
- 2 External devices generate input signals that are transmitted to the module.
- 3 The module converts these signals into natural binary or BCD format and stores these values until the processor requests their transfer.
- 4 When instructed by your ladder program, the processor performs a BTR of the values and stores them in a data table.
- 5 The processor and module determine that the transfer was made without error and that input values are within a specified range.
- 6 Your ladder program can use/or move the data (if valid) before it is written over by the transfer of new data in a subsequent transfer.



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Troubleshooting

The VHSC module has these LED indicators to provide status indication during module operation:



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Indicator	If on:
Active	the module has successfully powered up
Inputs A - channel A B - channel B G - gate/reset	the input is high
Outputs	the module has commanded the output to be on
Fault	internal problem

Specifications

Number of Counters	4	
Module Location	1771 Series A or B I/O chassis	
Maximum Count Value	0-999,999 (programmable)	
BTW Processing Time (worst case)	5.5 msec - binary } 11 msec - BCD } on a configuration change (1.5-2.9 msec — typical)	
Maximum Input Frequency	100 Hz for switch bounce; electromechanical switch (user-selectable) 250 kHz in encoder modes (2-channel quadrature) 500 kHz in period/rate, rate/measurement and continuous/rate modes 1 MHz in counter modes (single channel)	
Inputs per Counter	3 – A, B, Gate/reset	
Input Voltage	5V or 12-24V (user selectable)	
Input Current	Typically 7 mA @ 5V; 7.0 to 15.0mA @ 12-24V	
Minimum Input Current	4 mA	
Number of Outputs	8	
Maximum Output Off-state Leakage Current	less than 10 μ A @ 24V dc	
Maximum On-state Voltage Drop	0.05 Ω x current	
Output Control	Any number of outputs are assignable to any of 4 counter channels. One “turn-on” preset value and one “turn-off” preset per output.	
Output Voltage	5 to 24V dc, customer supplied	
Output Current	2A per channel sourced out of module. All outputs can be on simultaneously without derating.	
Output Switching Time	< 10 μ s turn on; < 100 μ s turn off Typical: 3 μ s turn on; 30 μ s turn off	
Filtering	Selectable — high-speed or normal (normal = below 100Hz)	
Backplane Current	650 mA	
Isolation	1500V between input and backplane 1500V between output and backplane 300V between isolated channels	
Power Dissipation	13 Watts (max); 2 Watts (min)	
Thermal Dissipation	54.2 BTU/hr (max); 6.8 BTU/hr (min)	
Input Conductors	Wire Size Category Length	Belden 9182 or equivalent Category 2 ¹ 250 feet
Output Conductors	Wire Size Category	14 gauge stranded (max) 3/64 inch insulation (max) Category 1 ¹
Fuse		2AG 3A fuse — Littelfuse 225003
Environmental Conditions	Operating Temperature Storage Temperature Relative Humidity	0 to 60°C (32 to 140°F) -40 to 85°C (-40 to 185°F) 5 to 95% (without condensation)
Field Wiring Arm		40-terminal cat. no. 1771-WN
Wiring Arm Screw Torque		7-9 inch-pounds
Keying		Between 24 and 26 Between 28 and 30

¹ Use this conductor-category information for planning conductor routing as described in the system-level installation manual.



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