Chapter	Title	Topics Covered
Appendices		
A	Specifications	Specifications for the VHSC module.
B	Sample Programs	Sample programs for various PLC programs.
C	Application Considerations	Selection of input devices and circuit descriptions.
D	Questions and Answers	Helpful answers to the most asked questions.
E	Period/Rate and Continuous/Rate Examples	Examples of the differences of these 2 modes

Related Products

You can install your input module in any system that uses Allen-Bradley programmable controllers with block transfer capability and the 1771 I/O structure.

Contact your nearest Allen-Bradley office for more information about your programmable controllers.

Product Compatibility

This module can be used with any 1771 I/O chassis. Communication between the module and the processor is bidirectional. The PLC sends module information using block transfer write instructions and the 1771 I/O backplane. The PLC receives module status information through block transfer read instruction and places it in the data table. I/O image table use is an important factor in module placement and addressing selection. The module's data table use is listed in the following table.

Table P.A
Compatibility and Use of Data Table

Catalog Number	Use of Data Table				Compatibility			
	Input Image Bits	Output Image Bits	Read Block Words	Write Block Words	Addressing 1/2 -slot	Addressing 1-slot	Addressing 2-slot	Chassis Series
1771-VHSC Rev. A	8	8	18 max	64 max	Yes	See note	See note	A and B
1771-VHSC Rev. B	8	8	26 max	64 max	Yes	See note	See note	A and B

A = Compatible with 1771-A1, A2, A4 chassis.
B = Compatible with 1771-A1B, A2B, A3B, A4B chassis.
Yes = Compatible without restriction
NOTE: - Restricted to complementary module placement (refer to chapter 2)

Related Publications

For a list of publications with information on Allen-Bradley programmable controller products, consult our publication index SD499.

Overview of the Very High Speed Counter Module

Chapter Objectives

This chapter gives you information on:

- features of the VHSC module
- how the module communicates with programmable controllers.
- how the module operates

Module Description

The VHSC module performs high speed counting for industrial applications. The module is an intelligent block transfer I/O module that interfaces signals with any Allen-Bradley programmable controller that has block transfer capability. Block transfer programming moves module status data from the module's memory to a designated area in the processor data table. It also moves configuration words from the processor data table to the module memory.

The VHSC module is a single-slot module that does not require an external power supply. (**Note:** The outputs **do** require a power supply.) After scanning the inputs and updating the outputs, the input data is converted to a specified data type in a digital format to be transferred to the processor's data table on request. Command and configuration data is sent from the programmable controller data table to the module with a BTW instruction.

Features of the Module

The VHSC module counts pulses from encoders (such as Allen-Bradley Bulletin 845H, K, F, P, E and L), pulse generators or mechanical limit switches, proximity switches, etc. and returns either a count or frequency in binary or BCD format.

The module's features include:

- 4 input channels configurable for encoder mode, counter mode, period/rate mode and continuous/rate mode
- 8 outputs, isolated in groups of 2
- outputs are current-sourcing at 5 to 24V dc (2A maximum per output)
- single-ended or differential inputs
- 2-phase encoder inputs up to a frequency of 250KHz
- single-phase counter inputs up to a frequency of 1MHz
- input voltage range of 5 to 24V dc

- returns in status either count or frequency in binary or BCD format
- input counts as high as 999,999
- up to 500KHz in period/rate or rate measurement frequency modes
- outputs can be tied to any counter
- each output has a user-selectable on-off value
- outputs can be tied back to an input for cascading
- automatic default configuration
- each counter has a user-selectable preset and rollover value
- period/rate w/periodic outputs and period/rate w/dynamic outputs can be used for totalization

The 1771-VHSC module operates in the following modes:

- counter mode
- encoder X1 mode
- encoder X4 mode
- period/rate mode
- rate measurement frequency mode
- continuous/rate mode

The operation of the module in these modes is described below.

Operation in Encoder or Counter Mode

The operation of encoder and counter modes is virtually identical. The only difference between the two modes is in the type of feedback used.

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

Use the encoder modes if you need the module to read incoming quadrature pulses and return them to the programmable controller 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.

The operation of the module in the encoder/counter modes is as follows:

- counter mode - channel B is tied high or low. Channel A input is used for pulse. The count is unidirectional with the direction determined by
  channel B.
- encoder X1 - This is a bidirectional count mode; counting up or down, using quadrature input signals.
- encoder X4 - This is a bidirectional count mode, using quadrature input signals, with 4 times the resolution of X1.

Each of the counters in encoder/counter mode has values associated with it. These are:

- preset value
- rollover value
- gate/reset input
- output

Counter Mode

The counter mode allows the module to read incoming pulses and return them to the programmable controller processor as a binary or BCD number (0-999,999).

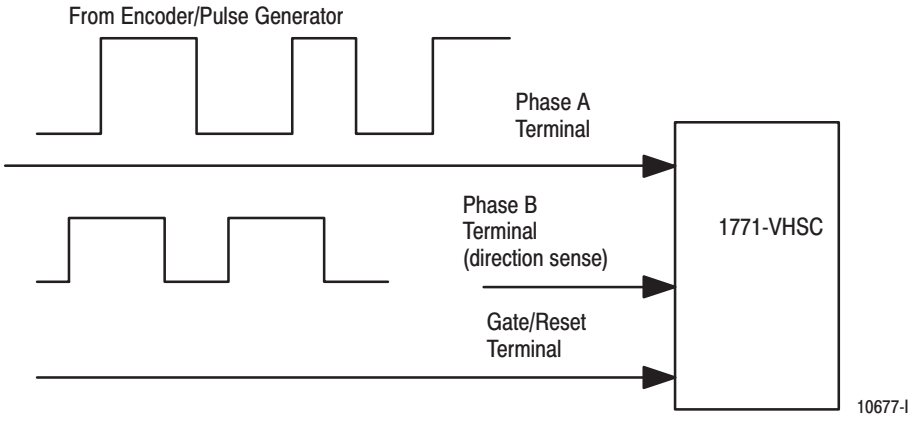
In the counter mode, direction (up counting or down counting) is determined by the phase B input, which can be a random signal. If Phase B is high, the counter will count down. If phase B is low or floating, (that is, not connected), the counter counts up.

If Phase B is:	Counter will count (direction):
High	Down
Low or floating (not connected)	Up

The module reads incoming pulses from a maximum of 4 encoders (single-ended or differential), counters, pulse generators, mechanical limit switches, and so forth and returns a count to the programmable controller processor in a binary or BCD number (0-999,999).

The counter mode accepts only one phase feedback. This relationship is shown in 1.1.

Figure 1.1
Block Diagram of Counter Mode



Encoder Mode

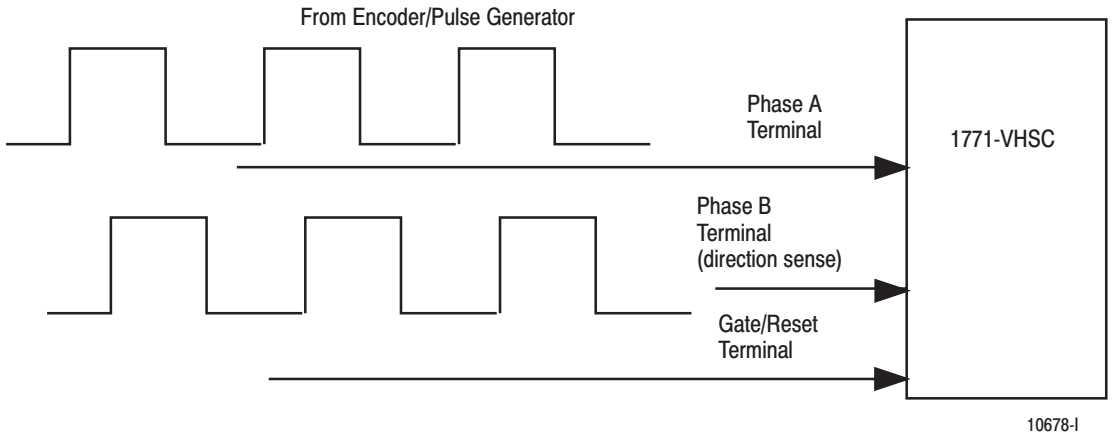
The encoder mode allows the module to read incoming pulses and return them to the programmable controller processor as a binary or BCD number (0-999,999).

In this mode, the module will accept two phase quadrature feedback. The module senses the relationship between the 2 phases and counts up or down accordingly.

Encoder X1 mode uses channel A for the pulse input. With B low (floating), the count direction is up; when B is high, the count direction is down.

Encoder X4 mode is identical to X1, except it uses quadrature signals on channel A and channel B, and counts on the leading and trailing edges of
A and B.

Figure 1.2
Block Diagram of Encoder Mode

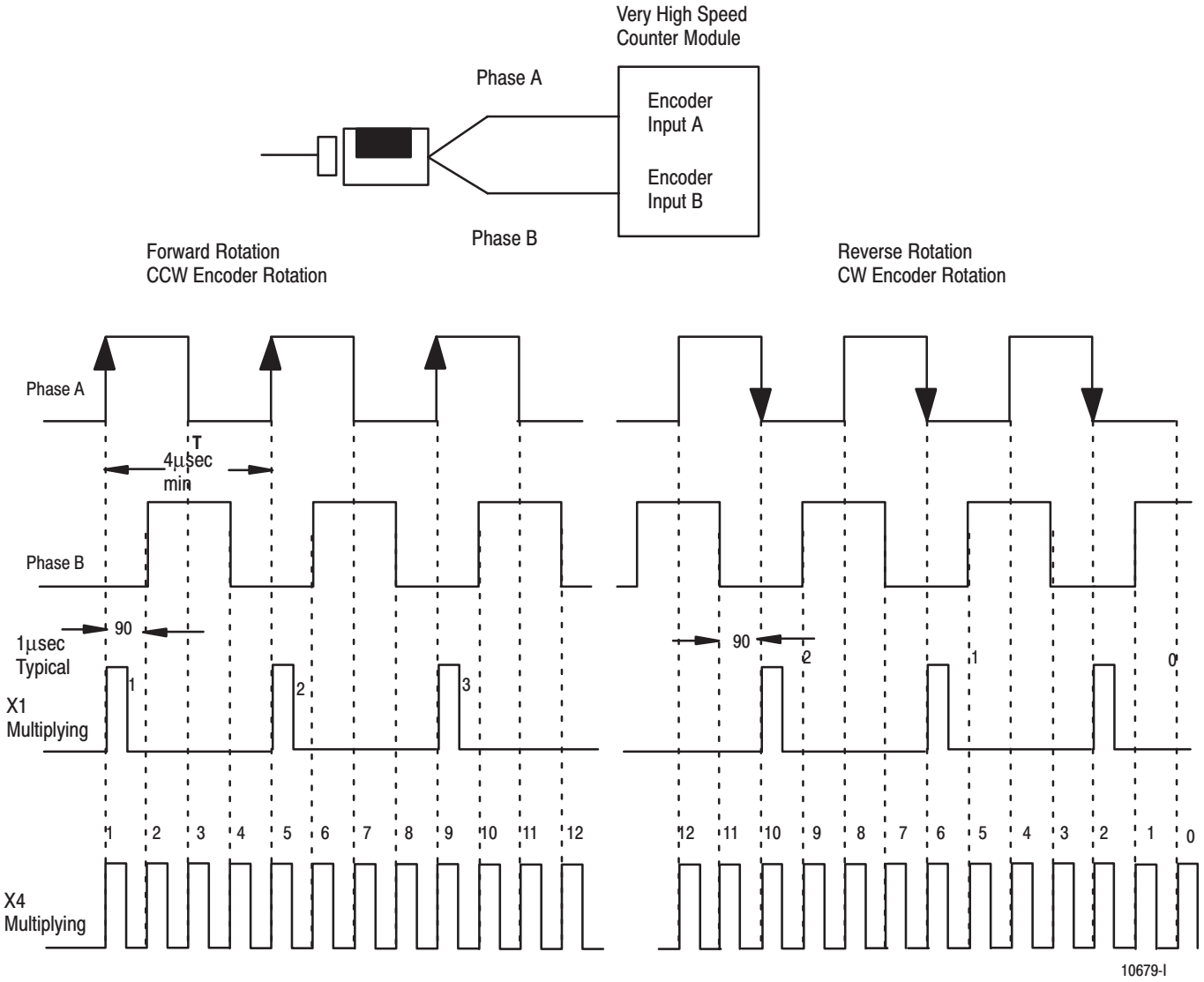


Direction of Count

The module can count either up or down, depending upon the condition of the B input for each counter. In encoder applications, the counter will increment on the leading edge of Phase A, while phase B determines the direction of the count.

You also have the option of X1 and X4 multiplying of the input pulses. 1.3 shows the relationships between phases A and B for forward and reverse directions in encoder applications.

Figure 1.3
Phase Relationship for Forward or Reverse Directions

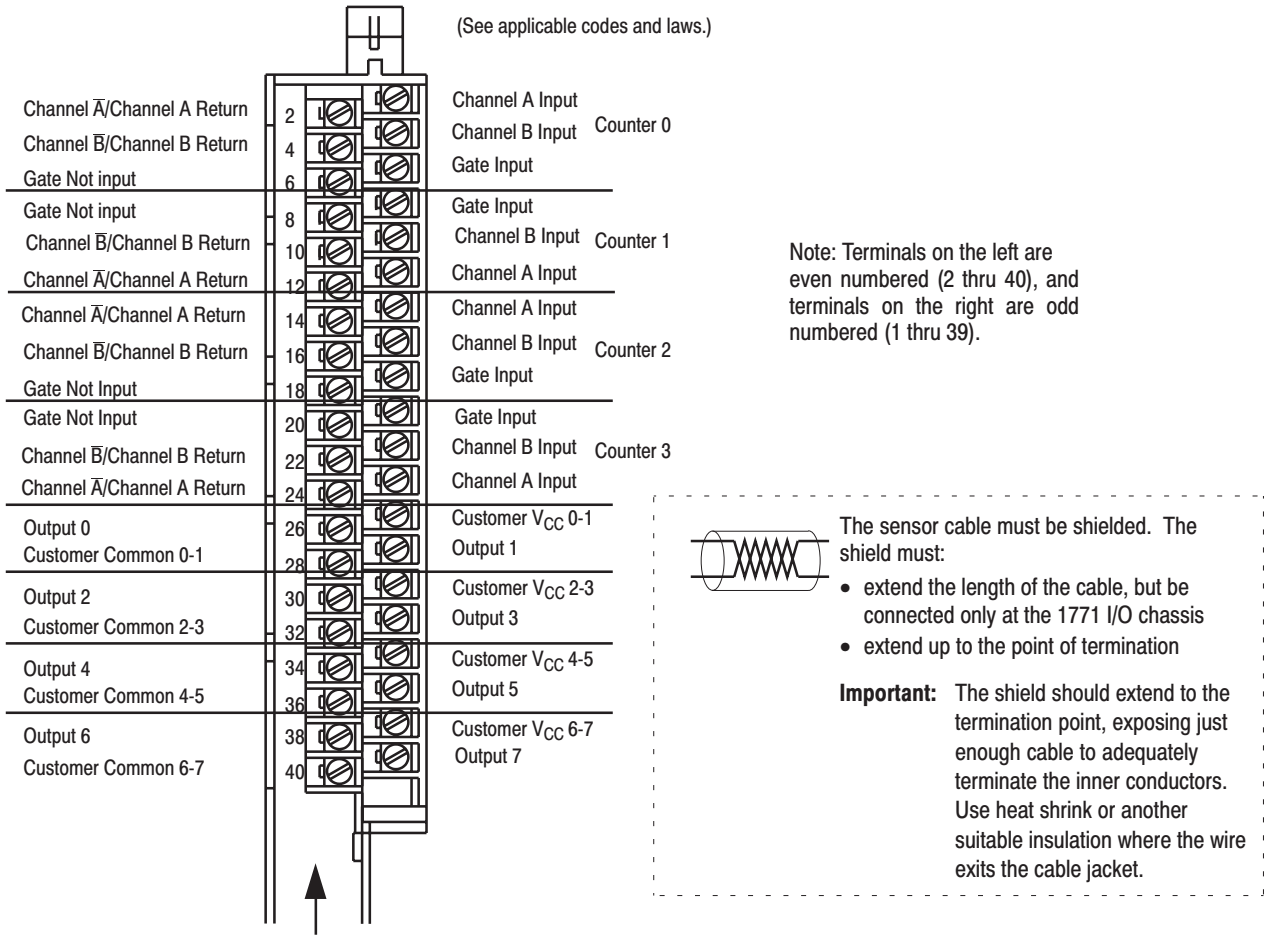


The following paragraphs apply to both encoders and counters.

Preset Value

Each of the 4 counters has one preset value associated with it. In the encoder or counter modes, the preset value represents a reference point (or count) from which the module begins counting. The module can count either up or down from the preset value. Preset values are loaded into the count registers through the preset count bits. (Refer to word 1, bits 8-11 of the block transfer write initialization block in chapter 5.) Preset values can range from 0 to 999,999 binary or BCD.

Figure 2.3
Connection Diagram for Very High Speed Counter Module (1771-VHSC)



Grounding the VHSC Module Wiring

When using shielded cable, ground the foil shield and drain wire only at one end of the cable. We recommend that you wrap the foil shield and drain wire together and connect them to a chassis mounting bolt (Figure 2.4). At the opposite end of the cable, tape exposed shield and drain wire with electrical tape to insulate it from electrical contact.

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)		5.5ms - binary 11ms - BCD } on a configuration change (1.5-2.9ms — typical)
Maximum Input Frequency		100Hz for switch bounce; electromechanical switch (user-selectable) 250kHz in encoder modes (2–channel quadrature) 500kHz in period/rate, rate/measurement and continuous/rate modes 1MHz in counter modes (single channel)
Inputs per Counter		3 – A, B, Gate/reset
Input Voltage		5V or 12–24V (user selectable)
Input Current		Typically 7mA @ 5V; 7.0 to 15.0mA @ 12–24V
Minimum Input Current		4mA
Number of Outputs		8
Maximum Output Off-state Leakage Current		less than 10μA @ 24V dc
Maximum On-state Voltage Drop		0.05Ω 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		< 10μs turn on; < 100μs turn off Typical: 3μs turn on; 30μs turn off
Filtering		Selectable — high-speed or normal (normal = below 100Hz)
Backplane Current		650mA
Isolation Voltage		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 (76.2m)
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)
Keying		Between 24 and 26 Between 28 and 30
Field Wiring Arm		40-terminal cat. no. 1771–WN
Wiring Arm Screw Torque		7-9 inch-pounds

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