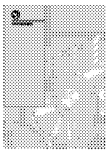
Very High-speed Counter Module
(Catalog Number 1771-VHSC)

Contents



This icon is used when additional information is available in the *Very High-speed Counter Module User Manual*, publication 1771-6.5.74.

If you need a copy of this manual, fax the enclosed *User Manual Request Card* to 1-800-576-6340.
If you are outside the U.S., fax to 1-330-723-4036.

Use this document as a guide when installing a Very High-speed Counter module.

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ATTENTION: Electrostatic discharge can damage integrated circuits or semiconductors if you touch backplane connector pins. Follow these guidelines when you handle the module.

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the backplane connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the VHSC module in its static-shield bag.

Understand Compliance to European Union Directives

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2EMC – Generic Immunity Standard, Part 2 – Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131–2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as these Allen-Bradley publications:

Publication	Publication number
Industrial Automation Wiring and Grounding Guidelines For Noise Immunity	1770-4.1
Guidelines for Handling Lithium Batteries	AG-5.4
Automation Systems Catalog	B111

Calculate Power Requirements

Your module receives its power through the 1771 I/O chassis backplane from the chassis power supply. The maximum current drawn by the VHSC module is **650 mA** (3.25 W).

Add this value to the requirements of all other modules in the I/O chassis to prevent overloading the chassis backplane and/or backplane power supply.

Set the Input Channel Jumpers

The VHSC module has user-selectable jumpers for each input channel. These jumpers consist of one:

- filter or high speed operation jumper
- +5V or +12-24V operation jumper

Each counter has a total of 6 jumpers associated with it:

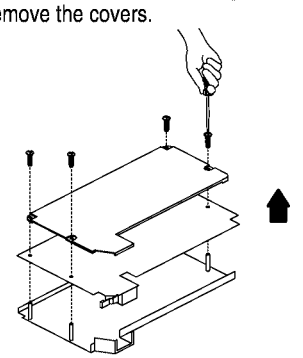
- Channel A filter/high speed jumper
- Channel A voltage jumper
- Channel B filter/high speed jumper
- Channel B voltage jumper
- Gate/reset filter/high speed jumper
- Gate/reset voltage jumper

These jumpers can be set independent of each other. You can select the filter action and voltage for each channel and for the gate/reset input independently.

The high speed operation is the preferred mode of operation for the VHSC module. Use this mode when the inputs are driven by devices such as encoders or line drivers.

Important: Use the filter mode on the inputs when an electromechanical switch is providing the input. The filter provides de-bouncing for the switch. *When the filter mode is selected, the module does not detect frequencies greater than 100Hz.*

1 Remove the four screws securing the side cover to the module and remove the covers.



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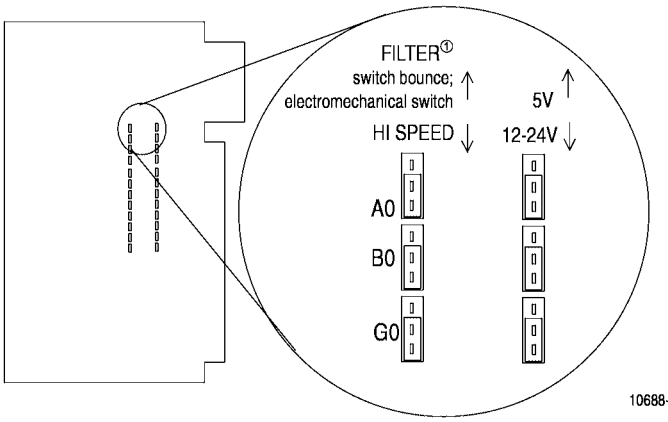
2 Using your fingers, reposition the jumpers associated with each input channel according to your requirements.

For this operation	Set this jumper Filter	Voltage
12-24V high speed (factory default setting)	down	down
5V high speed	down	up
12-24V with low speed filter	up	down
5V with low speed filter	up	up



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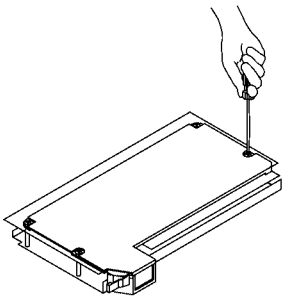
① In the filter position, the module does not detect frequencies above 100Hz.

3 Reposition the cover and secure with the four screws removed in step 1.



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Determine VHSC Module Placement

Place your module in any slot of the I/O chassis except for the extreme left slot. This slot is reserved for processors or adapter modules.

For this addressing	Place your module in any module group with
2-slot	any 8-bit or block transfer module
1-slot	any 8-bit, 16-bit or block transfer module
1/2-slot	no restrictions

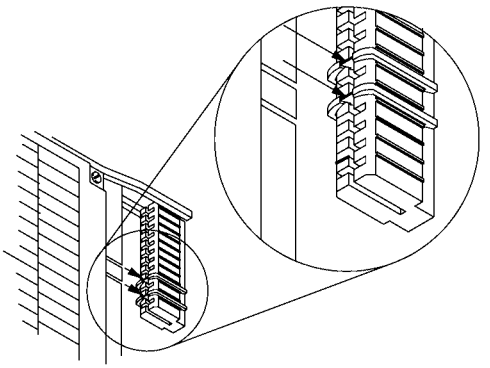
Key the Backplane Connector

ATTENTION: Observe the following precautions when inserting or removing keys:

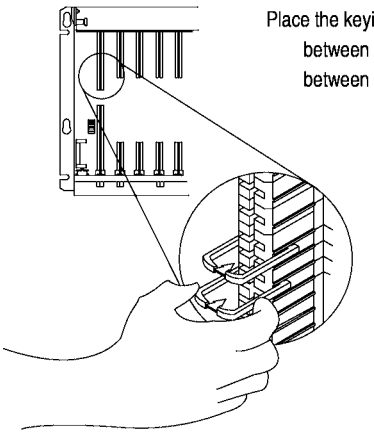
- insert or remove keys with your fingers
- make sure that key placement is correct

Incorrect keying or the use of a tool can result in damage to the backplane connector and possible system faults.

The VHSC module's printed circuit board is slotted in two places on the rear edge to mate with the plastic keying bands supplied with the I/O chassis.



Position the keying bands in the backplane connectors to correspond to the key slots on the VHSC module.



Install the Module

ATTENTION: Remove power from the 1771 I/O chassis backplane before you install the VHSC module. Failure to remove power from the backplane could cause:

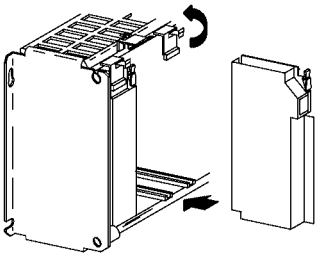
- injury
- equipment damage due to unexpected operation
- degradation of performance

At power-up, the active and fault indicators are on. An initial module self-check occurs. If there is no fault, the fault indicator turns off. See page 18 for information on interpreting the status indicators.

1 Place the module in the card guides on the top and bottom of the chassis that guide the VHSC module into position.

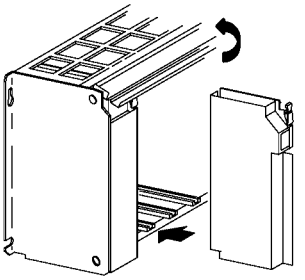
Important: Apply firm even pressure on the module to seat it into its backplane connector.

1771-A1B, -A2B, -A3B, -A3B1, -A4B I/O chassis



Snap the chassis latch over the top of the module to secure it.

1771-A1B, -A2B, -A3B1, -A4B Series B I/O chassis



Swing the chassis locking bar down into place to secure the modules. Make sure the locking pins engage.

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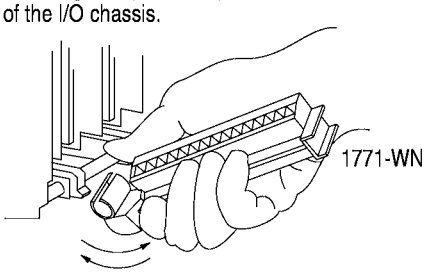
2 Attach the wiring arm (1771-WN) to the horizontal bar at the bottom of the I/O chassis.



The wiring arm pivots upward and connects with the module so you can install or remove the module without disconnecting the wires.

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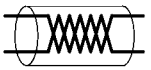
Make Connections to the Field Wiring Arm

Connect your I/O devices to the 40-terminal field wiring arm (cat. no. 1771-WN) shipped with the VHSC module.

ATTENTION: Remove power to all I/O devices before you connect them to the wiring arm. Failure to remove power from your I/O devices could cause:

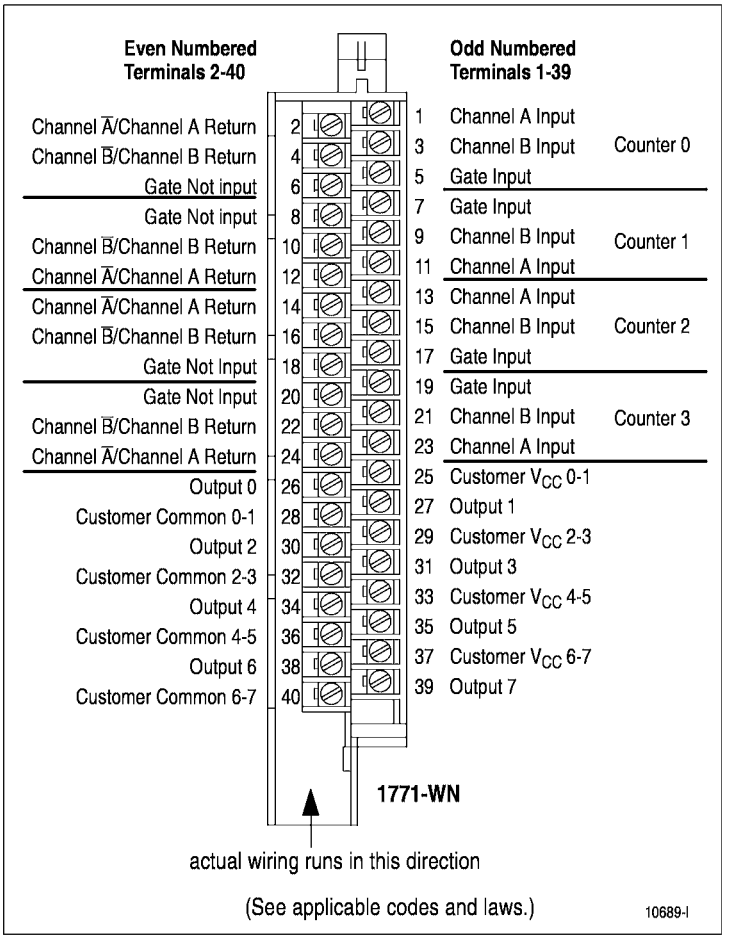
- injury
- damage to module circuitry
- equipment damage due to unexpected operation



The sensor cable must be shielded. The shield:

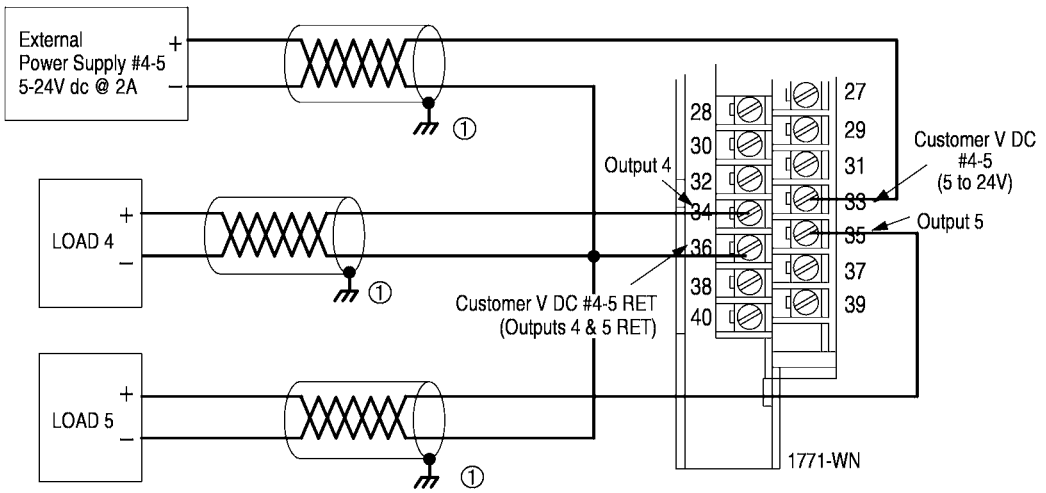
- must extend the length of the cable, but be connected only at the 1771 I/O chassis
- must extend up to the point of termination

Important: The shield should extend to the termination point, exposing just enough cable to adequately terminate the inner conductors. Use heat shrink or another suitable insulation where the wire exits the cable jacket.



Wiring Example

Standard Output

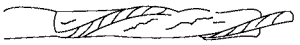


① For new installations, terminate the shields at the chassis. While not recommended, existing installations can continue to terminate the shields at the return (RET) terminal.

Ground Connections

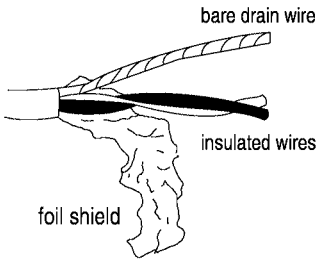
Use the following diagrams to ground your I/O chassis and VHSC module.

1 Remove a length of cable jacket from the Belden 9182 cable.



Belden 9182 cable

2 Pull the foil shield and bare drain wire from the insulated wires.



3 Twist the foil shield and drain wire together to form a single strand.

4 Attach a ground lug.

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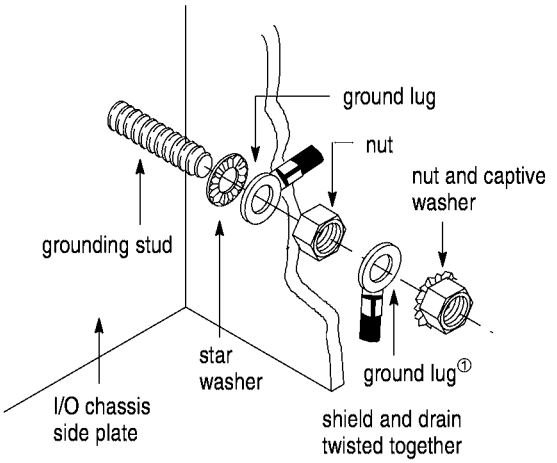
When using shielded cable wire, ground the foil shield and drain wire only at one end of the cable. We recommend that you wrap the foil shield and drain wire together and connect them to a chassis mounting bolt. At the opposite end of the cable, tape exposed shield and drain wire with electrical tape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

For additional grounding information, see the *Industrial Automation Wiring and Grounding Guidelines for Noise Immunity*, publication 1770-4.1.

Chassis Ground

When you connect grounding conductors to the I/O chassis grounding stud, place a star washer under the first lug, then place a nut with captive lock washer on top of each ground lug.



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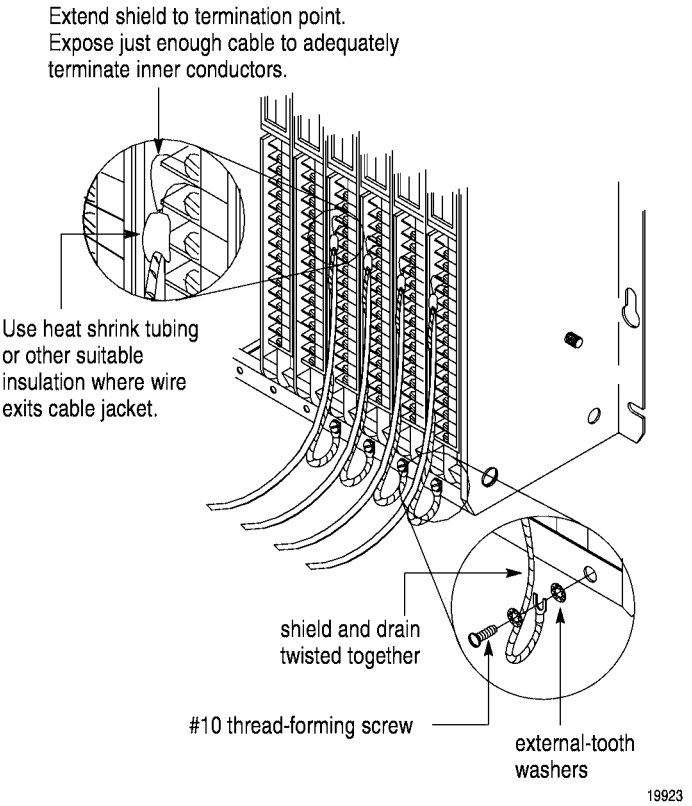
①Use the cup washer if crimp-on lugs are not used.

Single-point Grounding



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Configure the Module

You configure your module to conform to the input device and specific application that you have chosen. To configure the module, you:

- enter BTW and BTR instructions into your ladder logic
- enter data into the BTW instruction

If you want to enter data in the BTW instruction	You
through I/O Configuration software (if you are using a PLC-5 family processor[1])	enter the appropriate information on the VHSC module edit screens.
by editing bits at the address of the BTW instruction	edit the data file addresses in the BTW instruction to match your particular application. Use the word assignments on pages 14 and 15 to help you edit the bits that apply to your application(s).

[1] See *PLC-5 Programming Software I/O Configuration Manual*, publication 6200-6.4.12, for supported processors.

During normal operation, the processor transfers from 1 to 64 words to the VHSC module when you program a BTW instruction to the VHSC module's address.

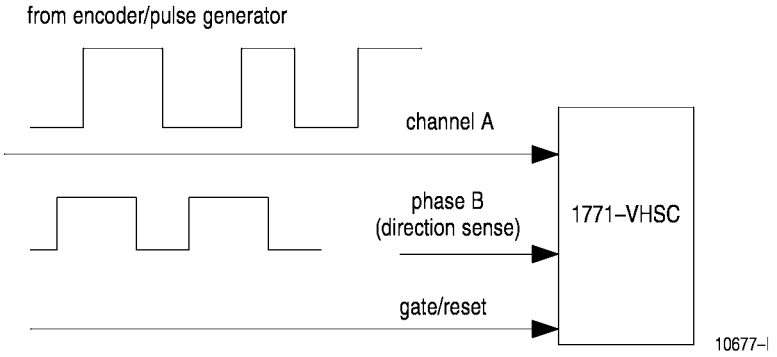
Selecting the Mode of Input

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:

Use this mode	To	See page
Counter Mode	use channel A input for pulse counting and use channel B to determine direction.	9
Encoder X1 Mode	use quadrature input signals for a bidirectional count.	9
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 *after* the user specified number of input signal pulses.	10
Rate/Measurement Mode	determine the frequency of input pulses by counting these pulses over a **user-specified time interval**. Outputs are updated *after* the user specified time interval.	10
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 *continuously*.	11

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.

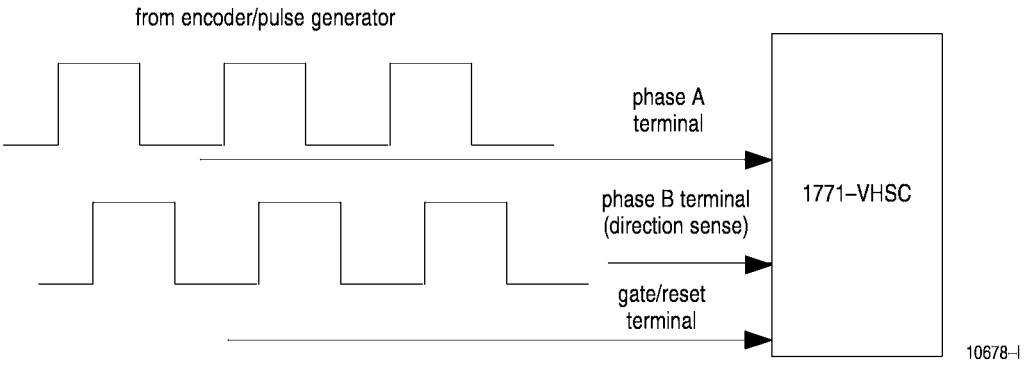


In this mode, direction (up counting or down counting) is determined by the channel B input, which can be an asynchronous signal.

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.

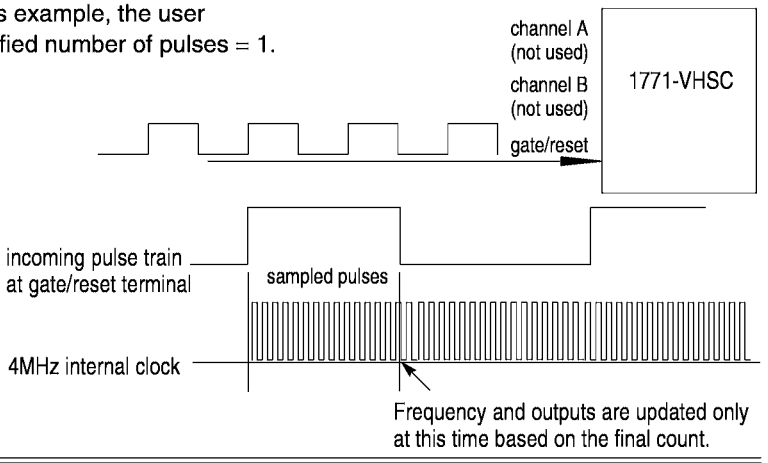


This mode	Uses
Encoder X1 mode	quadrature input signals for a bidirectional count.
Encoder X4 mode	quadrature input signals to count on leading and trailing edges of A and B for a bidirectional count.

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.

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

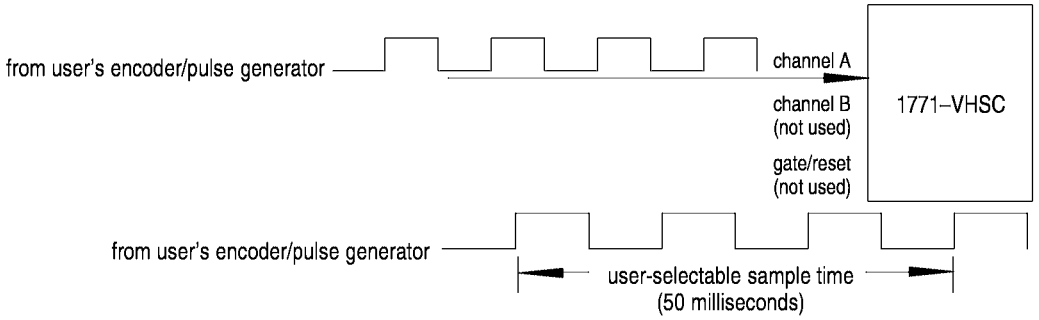


Rate/Measurement Mode

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.

In this example:

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



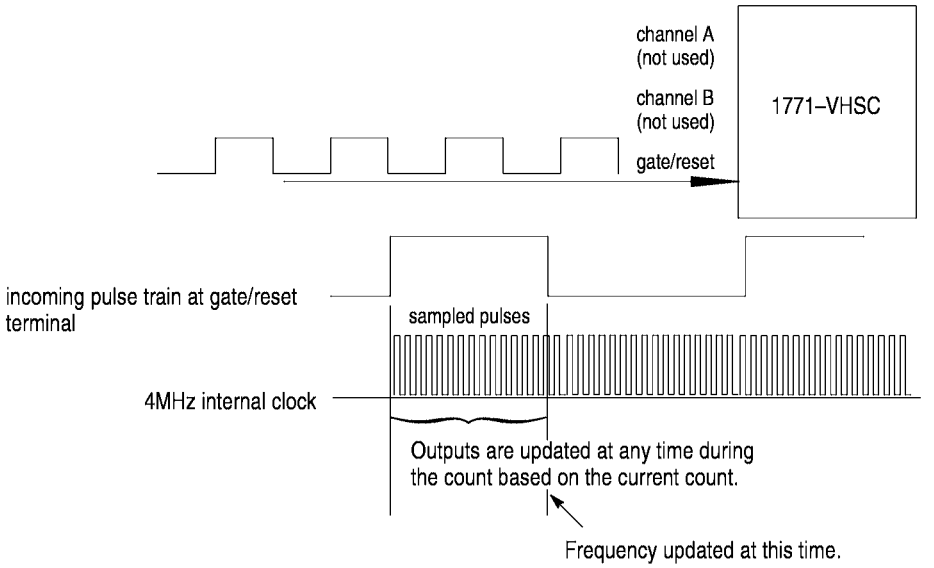
The frequency returned to the PLC processor in would be:

Frequency = Counts/Sample period = 3 counts/50 milliseconds = 60 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.

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



Using the Gate/Reset Input

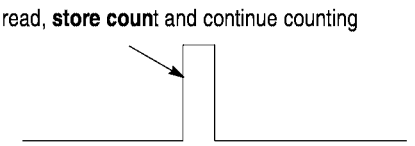
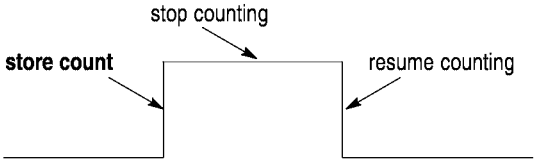
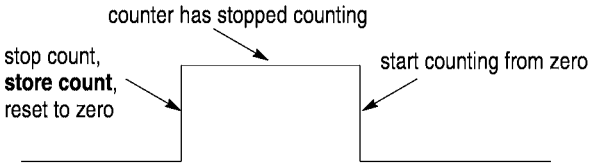
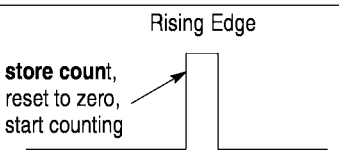
If you are using the encoder or counter modes, you have the option of using the gate/reset input. There is one gate/reset input terminal for each of the four counters.

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 mode①	Store count feature operating on the rising edge of the gate/reset pulse
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.	
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.	
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.	
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.	

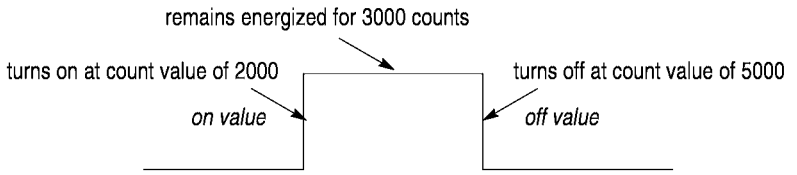
① You can also select these features using the falling edge of the gate/reset pulse. This selection is made through the gate invert bit, which is active in the store count and period/rate modes.

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.

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 the **rate measurement mode**

BTW Word Assignments

Word(s)[1]	Bit(s)															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
1	Format				Preset				New Data Acknowledge				Reset			
2	Force Outputs								Enable Outputs							
3	Gate/ Reset	Counter 1 configuration							Gate/ Reset	Counter 0 configuration						
4	Gate/ Reset	Counter 3 configuration							Gate/ Reset	Counter 2 configuration						
	Counter 0 (words 5-6), Counter 1 (words 7-8), Counter 2 (words 9-10), Counter 3 (words 11-12)															
5, 7, 9, 11	Rollover Counter **X** MSD															
6, 8,10, 12	Rollover Counter **X** LSD															
	Counter 0 (words 13-14), Counter 1 (words 15-16), Counter 2 (words 17-18), Counter 3 (words 19-20)															
13, 15, 17, 19	Preset Counter **X** MSD															
14, 16, 18, 20	Preset Counter **X** LSD															
21	Scaler 1, Counter 0															
22	Scaler 2, Counter 1															
23	Scaler 3, Counter 2															
24	Scaler 4, Counter 3															
	Output 0 (words 25-29), Output 1 (words 30-34), Output 2 (words 35-39), Output 3 (words 40-44), Output 4 (words 45-49), Output 5 (words 50-54), Output 6 (words 55-59), Output 7 (words 60-64)															
25, 30, 35, 40, 45, 50, 55, 60	Not used												Tie Output *x* to Counter			
26, 31, 36, 41, 46, 51, 56, 61	Output **X** ON MSD															
27, 32, 37, 42, 47, 52, 57, 62	Output **X** ON LSD															
28, 33, 38, 43, 48, 53, 58, 63	Output **X** OFF MSD															
29, 34, 39, 44, 49, 54, 59, 64	Output **X** 0FF LSD															

[1] Valid BTW length = 0, 1, 2, 4, 12, 20, 24, 29, 34, 39, 44, 49, 54, 59, 64.

Bit/Word Definitions

Word(s)	Bit(s)	Description
1	00-03	These bits control the reset function. When one of these bits transitions from 0 to 1, the counter is reset to 0 and begins counting. Bit 00 = counter 0; bit 01 = counter 1; bit 02 = counter 2; bit 03 = counter 3.
	04-07	New data acknowledge bits. When one of these bits transitions from 0 to 1 the corresponding new data bit in BTR word 1, bits 4-7 will be reset. Bit 04 = counter 0; bit 05 = counter 1, bit 06 = counter 2; bit 07 = counter 3
	08-11	These bits control the preset function. When one of these bits transitions from 0 to 1, the preset count value is automatically loaded into the counter and the counter begins counting. *The preset count values are loaded into words 13 through 20.* Bit 08 = counter 0; bit 09 = counter 1; bit 10 = counter 2; bit 11 = counter 3.
	12-14	Not used
	15	This bit determines whether BCD or binary format is used. Diagnostic byte (word 1) is always BCD. If = 0, all values in the BTW and BTR files will be in binary. If = 1, all values in the BTW and BTR files will be in BCD.
2	00-07	Enables outputs. Bit 00 corresponds to output 0, bit 01 to output 1, etc. Outputs must be enabled before they can be turned ON. Bits must be set (1) before the output can be turned on.
	08-15	Output forcing bits. Setting a bit to 1 allows the output to be forced. Bit 08 corresponds to output 0, bit 09 corresponds to output 1, etc. Outputs must also be enabled.

Word(s)	Bit(s)	Description
3, 4	00-02	Determine mode for counter 0 (word 3) and counter 2 (word 4) For this mode: — Set bit 02 01 00 Counter mode — 0 0 0 Encoder X1 mode — 0 0 1 Encoder X4 mode — 0 1 0 Counter not used — 0 1 1 Period/rate mode — 1 0 0 Rate Measurement mode — 1 0 1 Continuous/rate mode — 1 1 0
	03	Not used
	04-06	Determine store count mode for counter 0 (word 3) and counter 2 (word 4). For this mode: — Set bit 06 05 04 Store count mode (not used for counter 0) — 0 0 0 Mode 1 (store/continue) used — 0 0 1 Mode 2 (store/wait/resume) used — 0 1 0 Mode 3 (store-reset/wait/start) used — 0 1 1 Mode 4 (store-reset/start) used — 1 0 0
	07	Invert signal bit for gate/reset terminal. If = 0, not inverted; if = 1, inverted.
	08-10	Determine mode for counter 1 (word 3) and counter 3 (word 4). For this mode: — Set bit 02 01 00 Counter mode — 0 0 0 Encoder X1 mode — 0 0 1 Encoder X4 mode — 0 1 0 Counter not used — 0 1 1 Period/rate mode — 1 0 0 Rate Measurement mode — 1 0 1 Continuous/rate mode — 1 1 0
	11	Not used
	12-14	Determine store count mode for counter 1 (word 3) and counter 3 (word 4). For this mode: — Set bit 06 05 04 Store count mode (not used for counter 0) — 0 0 0 Mode 1 (store/continue) used — 0 0 1 Mode 2 (store/wait/resume) used — 0 1 0 Mode 3 (store-reset/wait/start) used — 0 1 1 Mode 4 (store-reset/start) used — 1 0 0
	15	Invert signal bit for gate/reset terminal. If = 0, not inverted; if = 1, inverted.
5-12		Rollover value. When rollover value is reached, the counter value becomes 000,000 and counting continues from that point. Counter 0 (words 5-6), Counter 1 (words 7-8), Counter 2 (words 9-10), Counter 3 (words 11-12)
5, 7, 9, 11	00-15	Rollover value. Most significant digit for counter **X**. Range = 0-999.
6, 8, 10, 12	00-15	Rollover value. Least significant digit for counter **X**. Range = 0-999.
13-20		A preset value loaded into the respective counter when its preset bit is set. This value overrides the current count value, and becomes the new value in the counter. When this value is loaded, the counter begins counting from this value.
13, 15, 17, 19	00-15	Preset value. Most significant digit for counter **X**.
14, 16, 18, 20	00-15	Preset value. Least significant digit for counter **X**.
21-24	00-15	The ranges of words 21 thru 24 depend on the mode selected in word 3, bits 00-02. In this mode — These are encoder/counter or period/rate — scalar words, and divide the incoming pulse train at the gate/reset terminal by a predetermined integer (1, 2, 4, 8, 16, 32, 64 or 128). Default value is 1. rate measurement — time base values. Range = 10ms- 2s in 10ms intervals.
25, 30,35, 40, 45, 50, 55, 60	00-03	Allows you to tie the output to any of the 4 counters. Bits correspond to the counters: bit 00 for counter 0, bit 01 for counter 1, bit 02 for counter 2, and bit 03 for counter 3.
	04-15	Not used.
26-64		Output 0 (words 25-29), Output 1 (words 30-34), Output 2 (words 35-39), Output 3 (words 40-44), Output 4 (words 45-49), Output 5 (words 50-54), Output 6 (words 55-59), Output 7 (words 60-64)
26, 31, 36, 41, 46, 51, 56, 61	00-15	Most significant digit of the ON value of output **X**.
27, 32, 37, 42, 47, 52, 57, 62	00-15	Least significant digit of the ON value of output **X**.
28, 33, 38, 43,48, 53, 58, 63	00-15	Most significant digit of the OFF value of output **X**.
29, 34, 39, 44, 49, 54, 59, 64	00-15	Least significant digit of the OFF value of output **X**.

Interpret Module Status and Input Data

Your PLC processor gets data from the VHSC module using BTR instructions in your ladder logic program. The VHSC module transfers up to 26 words to the PLC processor's data table file. The words contain module status and input data from each channel. When a BTR of 0 is programmed, the module returns 18 words.

BTR Word Assignments

Word(s)	Bit(s)															
	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
1	Diagnostics (always in BCD)								New Data				Not Used			PU①
2	Not used				Gate/Reset input state				Status of outputs							
	Counter 0 (words 3-4), Counter 1 (words 5-6), Counter 2 (words 7-8), Counter 3 (words 9-10)															
3, 5, 7, 9	Counter **X** MSD (0-999)															
4, 6, 8, 10	Counter **X** LSD (0-999)															
	Counter 0 (words 11-12), Counter 1 (words 13-14), Counter 2 (words 15-16), Counter 3 (words 17-18)															
11, 13, 15, 17	Counter **X** Store count values MSD (range 0-999) in encoder/counter mode; or frequency value MSD (range 0-500) in rate measurement or period/rate mode															
12, 14, 16, 18	Counter *x* Store count values LSD (range 0-999)															
	Counter 0 (words 19-20), Counter 1 (words 21-22), Counter 2 (words 23-24), Counter 3 (words 25-26)															
19, 21, 23, 25②	Counter **X** Total counts occurring at gate/reset pin in period/rate or continuous/rate modes (MSD range = 0-999)															
20, 22, 24, 26②	Counter **X** Total counts occurring at gate/reset pin in period/rate or continuous/rate modes (LSD range = 0-999)															

① **PU** = Power up bit (refer to word/bit description)

② Words 19 through 26 are optional and used only in period/rate and continuous/rate modes. They are accessed with a BTR length between 19 and 26.

Bit/Word Descriptions

Word(s)	Bit(s)	Definition
1	00	This bit indicates if a successful BTW with valid data has occurred since powerup, or since last switched from Program to Run mode. If bit = 0, a successful BTW has occurred; if bit = 1, one has not occurred.
	01-03	Not used
	04-07	These bits indicate that a store register (BTR words 11-18) has been updated. They are reset by a 0 to 1 transition of the new data acknowledge bits in BTW word 1, bits 4-7. Bit 04 = counter 0, bit 05 = counter 1, bit 06 = counter 2, bit 07 = counter 3.
	08-15	Diagnostic byte that indicates the number of the first word in the BTW file that was incorrect. This value is always in BCD. See page 18 for other diagnostic error codes returned by the module.
2	00-07	Status bits for outputs. If bit = 0, output is OFF; if bit = 1, output is ON. Bit 00 = counter 0, bit 01 = counter 1, bit 02 = counter 2; bit 03 = counter 3.
	08-11	State of gate/reset input. If bit = 0, gate input inactive; if bit = 1, gate input active. Bit 08 corresponds to counter 0, bit 09 to counter 1, bit 10 to counter 2, bit 11 to counter 3.
	12-15	Not used
3, 5, 7, 9		Contains the most-significant digit (MSD) for counter **X** (counter 0-word 3, counter 1-word 5, counter 2-word 7, counter 3-word 9). Range: 0-999.
4, 6, 8, 10		Contains the least-significant digit (LSD) for counter **X** (counter 0-word 4, counter 1-word 6, counter 2-word 8, counter 3-word 10). Range: 0-999.
11, 13, 15, 17		Counter 0 Store count values MSD (range 0-999) in encoder/counter mode; or frequency value MSD (range 0-500) in rate measurement or period/rate mode
12, 14, 16, 18		Counter 0 Store count values LSD (range 0-999)
13		Counter 1 Store count values MSD (range 0-999) in encoder/counter mode; or frequency value MSD (range 0-500) in rate measurement or period/rate mode
14		Counter 1 Store count values LSD (range 0-999)
15		Counter 2 Store count values MSD (range 0-999) in encoder/counter mode; or frequency value MSD (range 0-500) in rate measurement or period/rate mode
16		Counter 2 Store count values LSD (range 0-999)
17		Counter 3 Store count values MSD (range 0-999) in encoder/counter mode; or frequency value MSD (range 0-500) in rate measurement or period/rate mode
18		Counter 3 Store count values LSD (range 0-999)

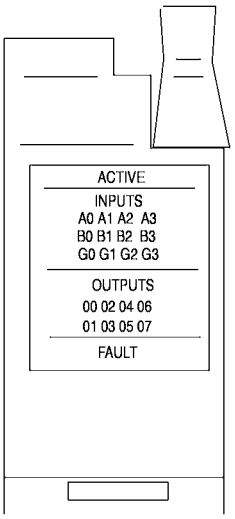
Word(s)	Bit(s)	Definition
19, 21, 23, 25		Counter 0 Total counts occurring at gate/reset pin in period/rate or continuous/rate modes (MSD range = 0-999)
20, 22, 24, 26		Counter 0 Total counts occurring at gate/reset pin in period/rate or continuous/rate modes (LSD range = 0-999)

Diagnostics and Troubleshooting

The VHSC module returns diagnostics to the processor in word 1 of the BTR file. These diagnostics help you determine what has caused an error to occur.

Word	Bit	Indication
1	00	Power-up bit indicates whether a successful BTW with valid data has occurred since power-up, or since last switched from Program to Run mode. Bit 0 = 0 - Successful BTW Bit 0 = 1 - BTW has not occurred
	01-03	Not used
	04-07	New data bits. Bit 04 corresponds to counter 0, bit 05 to counter 1, etc.
	08-15	Diagnostic byte. This byte is always in BCD format. This byte indicates which word (1-64) in the BTW file that was incorrect, or one of the following error codes. The codes are as follows: Code — Means 87 Preset or reset illegal for counter 0 with frequency mode 88 Preset or reset illegal for counter 1 with frequency mode 89 Preset or reset illegal for counter 2 with frequency mode 90 Preset or reset illegal for counter 3 with frequency mode 91 Store count illegal for counter 0 with frequency mode 92 Store count illegal for counter 1 with frequency mode 93 Store count illegal for counter 2 with frequency mode 94 Store count illegal for counter 3 with frequency mode 95 Preset greater than rollover for counter 0 96 Preset greater than rollover for counter 1 97 Preset greater than rollover for counter 2 98 Preset greater than rollover for counter 3 99 BTW length invalid - length not equal to 0, 1, 2, 4, 12, 20, 24, 29, 34, 39, 44, 49, 54, 59, 64.

The VHSC module has these status indicators:

Indicators	If indicator	Is ON	Is OFF
	ACTIVE	the VHSC module is successfully receiving power and operational	• Check FAULT LED — if on, follow the steps listed under if FAULT is ON. • Check the power supply.
	INPUTS (A0-F3, B0-B3, G0-G3)	a signal is present at the designated input terminal (high)	a signal is not present at the designated input terminal (low)
	OUTPUTS (O0-O7)	the module has commanded an output on	the output is off
	FAULT	1. Turn off power to the I/O chassis backplane and wiring arm. 2. Reseat the VHSC module in the I/O chassis. 3. Restore power to the I/O chassis backplane and wiring arm. **Important:** If the fault LED remains on, there may be an internal problem. Contact your local Allen-Bradley representative for additional assistance.	normal operation

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 μA @ 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		< 10 μs turn on; < 100 μs turn off Typical: 3 μs turn on; 30 μs turn off
Filtering		Selectable — high-speed or filtered (filtered ≤ 100Hz)
Backplane Current		650 mA
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 2① 250 feet
Output Conductors	Wire Size Category	Belden 9182 or equivalent Category 1①
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
Agency Certification (when product or packaging is marked)		• UL CSA Class 1 Div 2 Hazardous② • CE marked for all applicable directives

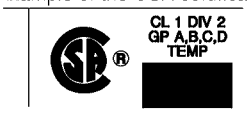
① Use this conductor-category information for planning conductor routing as described in the system-level installation manual.

② CSA certification— Class I, Division 2, Group A, B, C, D or nonhazardous locations.

CSA Hazardous Location Approval

CSA certifies products for general use as well as for use in hazardous locations. **Actual CSA certification is indicated by the product label** as shown below, and not by statements in any user documentation.

Example of the CSA certification product label

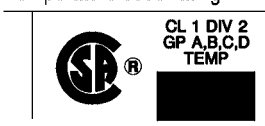


To comply with CSA certification for use in hazardous locations, the following information becomes a part of the product literature for CSA-certified Allen-Bradley industrial control products.

- This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D, or non-hazardous locations only.
- The products having the appropriate CSA markings (that is, Class I Division 2, Groups A, B, C, D), are certified for use in other equipment where the suitability of combination (that is, application or use) is determined by the CSA or the local inspection office having jurisdiction.

Important: Due to the modular nature of a PLC control system, the product with the lowest temperature rating determines the overall temperature code rating of a PLC control system in a Class I, Division 2 location. The temperature code rating is marked on the product label as shown.

Temperature code rating



The following warnings apply to products having CSA certification for use in hazardous locations.

ATTENTION: Explosion hazard —

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components unless power has been switched off or the area is known to be non-hazardous.
- Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Do not disconnect connectors unless power has been switched off or the area is known to be non-hazardous. Secure any user-supplied connectors that mate to external circuits on an Allen-Bradleyproduct using screws, sliding latches, threaded connectors, or other means such that any connection can withstand a 15 Newton (3.4 lb.) separating force applied for a minimum of one minute.

Approbation d'utilisation dans des emplacements dangereux par la CSA

La CSA certifie les produits d'utilisation générale aussi bien que ceux qui s'utilisent dans des emplacements dangereux. **La certification CSA en vigueur est indiquée par l'étiquette du produit** et non par des affirmations dans la documentation à l'usage des utilisateurs.

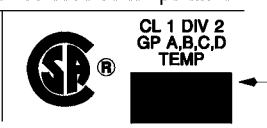
Exemple d'étiquette de certification d'un produit par la CSA

Pour satisfaire à la certification de la CSA dans des endroits dangereux, les informations suivantes font partie intégrante de la documentation des produits industriels de contrôle Allen-Bradley certifiés par la CSA.

- Cet équipement convient à l'utilisation dans des emplacements de Classe 1, Division 2, Groupes A, B, C, D, ou ne convient qu'à l'utilisation dans des endroits non dangereux.
- Les produits portant le marquage approprié de la CSA (c'est à dire, Classe 1, Division 2, Groupes A, B, C, D) sont certifiés à l'utilisation pour d'autres équipements où la convenance de combinaison (application ou utilisation) est déterminée par la CSA ou le bureau local d'inspection qualifié.

Important: Par suite de la nature modulaire du système de contrôle PLC), le produit ayant le taux le plus élevé de température détermine le taux d'ensemble du code de température du système de contrôle d'un PLC dans un emplacement de Classe 1, Division 2. Le taux du code de température est indiqué sur l'étiquette du produit.

Taux du code de température



Les avertissements suivants s'appliquent aux produits ayant la certification CSA pour leur utilisation dans des emplacements dangereux.

AVERTISSEMENT: Risque d'explosion —

- La substitution de composants peut rendre ce matériel inacceptable pour lesemplacements deClasse I, Division 2.
- Couper le courant ou s'assurer quel'emplacement est désigné non dangereux avant de remplacer les composants.
- Avant de débrancher l'équipement, couper le courant ou s'assurer que l'emplacement est désigné non dangereux.
- Avant de débrancher les connecteurs, couper le courant ou s'assurer que l'emplacement est reconnu non dangereux. Attacher tous connecteurs fournis par l'utilisateur et reliés aux circuits externes d'un appareil Allen-Bradley à l 'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens permettant aux connexions de résister à une force de séparation de 15 newtons (3,4 lb. - 1,5 kg) appliquée pendant au moins une minute.

Rockwell Automation

Allen-Bradley

Allen-Bradley, a Rockwell Automation Business, has been helping its customers improve productivity and quality for more than 90 years. We design, manufacture and support a broad range of automation products worldwide. They include logic processors, power and motion control devices, operator interfaces, sensors and a variety of software. Rockwell is one of the world's leading technology companies.

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Publication 1771-5.42 — April 1996

PN 955124-90

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