

Chapter 1

Module Overview

The 1746sc-CTR4 and the 1746sc-CTR8 are 4 and 8 channel Counter/ Flow Meter modules. The modules are suitable for general purpose counter and flow meter applications that require a large number of input channels and high accuracy. The module supports both AC and DC input signal types. The counter functions include programmable control of the counter including start, stop, reset, preset control and user defined flags. The input levels for the counter mode are 5, 12, and 24 volts DC. The Flow Meter mode is compatible with variable reluctance AC input. This differential AC input will count AC zero crossing signals from 50 mV to 75 V peak.



Read this chapter to familiarize yourself further with your isolated analog module (shown above). This chapter covers:

- General features and benefits.
- Detailed specifications.

Section 1.1

General Features And Benefits

- 8 Input Channels or 4 Channels of Quadrature Encoders.
- 4 External Counter enable inputs.

- Input voltage ranges: AC (50mv–75V peak), 5 Vdc, 12 Vdc, 24 Vdc.
- Input frequency: AC 50 kHz Max, DC 50 kHz Max.
- Maximum count value: ± 32 K or ± 8 M.
- Programmable Scaling, K, M, R Factor.
- Channel update time of 4 msec/channel.
- Rate output mode (Integer and Floating Point).
- Counter logic level state.
- Programmable Counter functions: start/stop/reset/present.
- Programmable counter Alarm flags and zero flags.
- 3 Selectable filters: 15 kHz, 30 kHz, 50 kHz.
- Channel to back Plane isolation of 1000 VDC.

Section 1.2 Increased Accuracy and Reliability

The counter module offers ± 1 count accuracy and $\pm 1\%$ or better frequency measurement accuracy. Programmable functions allow the user to define counter ranges and flags to accommodate process-specific requirements. Full speed counter operation of over 50kHz is possible.

Section 1.3 Reduced System Costs

High Channel density allows for lower resource usage. Eight channels consume the resources associated with a standard two channel module.

Section 1.4 State- of-the-Art Performance

These modules incorporate state of the art Programmable Gate Array technology that allows high circuit density and functionality. The module uses proprietary Allen-Bradley technology, so they operate and perform like the latest Allen-Bradley products. They also provide high resolution, user-programmable range settings, continuous temperature compensation (no field calibration), software configuration, programmable output limits, and programmable safe states in case of a fault.

Section 1.5

Detailed Specifications

Table 1-1. Thermocouple Temperature Ranges

Specification	Description			
Configuration	4/8 Channel of differential counter inputs 2/4 Channels of quadrature encoding 2/4 Input enable Control lines			
Input Modes	DC counter, AC flow meter			
Voltage Range	AC 0-30 VP	5 VDC	12 VDC	24 VDC
VIL	-50 mV	1 V	3 V	5 V
VIH	+50 mV	3.5 V	9 V	13 V
Vmax (CE)	±75 V	±75 V	±75 V	±75 V
Vmax (UL)	±100 V	±100 V	±100 V	±100 V
Current Range	5 mA maximum at 120 V			
Input Impedance	Rin greater than 10 ohms when within -10 V to +12 V range. Rin = 25 Kohms when outside of -10 V to +12 V range Cin 100 pF Input Filter Off Cin 1000 pF Input Filter On			
Counter Speed	DC Inputs	0 Hz to 50 kHz		
	AC Inputs	0 Hz to 50 kHz		
Input Frequency	DC Inputs	1 Hz to 50 kHz		
	AC Inputs	1 Hz to 50 kHz		
Counter Enable Input	VIL	1.0 V maximum		
	VIH	3.5 V minimum		
	Vmax	75 V		
Input impedance	25 Kohms			
Input Filter:				
Digital Filter	50 kHz (Default)			
Digital Filter	30 kHz			
Analog Filter	15 kHz			
Min Pulse Time:				
DC mode	8 us			
External Enable/Disable	Enable and Disable setup time = 20 us			
Channel Update Time:				
Counter Output	Scaling OFF	ON		
	4.00	5.6 (msec per channel)		
Rate Output:				
Rate Instantaneous Mode	4.00	5.6 (msec per channel)		
Rate Average Mode	1.00	1.00 (sec per channel)		

Specification	Description	
Accuracy: Count mode Rate (Instant) Rate (Average)	± 1 Count $\pm 1\%$ at 50 kHz, .001% at 1 Hz ± 1 Hz	
Maximum Count Value	Low Range -32,768 to +32,767 High Range -8,388,608 to +8,388,607	
Fault detection	Over and under range status bits, for all modes.	
Data Format: Counter mode Rate mode	Max Binary Value: -8,388,608 to +8,388,607 Max Binary Value: -32,768 to +32,767	
Isolation: Channel to Rack Channel to Channel	1000 VDC Continuous Optical and magnetic 0 VDC	
Input Protection	Maximum input voltage ± 100 VDC, 150 VAC peak-to-peak Maximum input current ± 5 mA at 100 VDC	
Power Requirements:	CTR4	CTR8
Internal rack +5 V	17.5 mA	225 mA
Internal rack +24 V	75 mA	125 mA

Table 1-2 Physical Specifications

Specification	Description
LED Indicators	
Module Status	The Module Status LED indicates the status of the power up self-test. The LED is on when the module is ready. Any self-test error is indicated with a blink code.
Channel Status	CTR4 - 4 Green LEDs CTR8 - 8 Green LEDs The 8 Channel LEDs indicate that a channel is enabled.
Terminal Block	24-pin removable connector.
Wire Size	One 12 AWG to 28 AWG wire
Torque	0.5 Nm, (4.5 lb.-in)

Table 1-3 Environmental Specifications

Specification	Description
Operating Temperature	-0 °C to 60 °C (32 °F to 140 °F)
Storage/Non-Operating Temperature	-40 °C to 85 °C (-40 °F to 185 °F)
Operating Humidity	5% to 95%, non-condensing

Chapter 3

Configuring the 1746sc-CTR4/CTR8

This chapter explains how the module and the SLC processor communicate through the processor's I/O image tables. It also describes the module's input filter characteristics. Topics discussed include:

- Module ID code.
- Module addressing.
- Operating modes.
- Input configurations.
- Gate modes.
- Channel turn-on/turn-off/reconfiguration timing.
- Response to slot disabling.

Section 3.1 Module ID Code

The module ID code is a unique number assigned to each type of 1746 I/O module. The ID defines for the processor the type of I/O module and the number of words used in the processor's I/O image table. With APS software, use the system I/O configuration display to manually enter the module ID when assigning the slot number during the configuration. Do this by selecting (other) from the list of modules on the system I/O configuration display and enter 10200 as the ID code for the 1746sc-CTR4 and 10401 as the ID code for the 1746sc-CTR8.

No special I/O configuration (SPIO CONFIG) is required. The module ID automatically assigns the correct number of input and output words.

If you are using different programming software package, refer to the documentation that came with your software.

Section 3.2 Module Addressing

The CTR-8 module uses 32 input and 32 output registers, and the CTR-4 module uses 16 input and 16 output registers. Both modules use Class III mode operation and cannot be used with Class I operation. The following memory map shows you how the SLC processor's output and input tables are defined for the module. The SLC 5/01 processor does not support Class III operation and is not compatible with this module. This module is not suitable for use in remote rack applications with ASB modules due to the input / output word size. The following memory map shows you how the SLC processor's output and input tables are defined for the module.

Uni-Directional

With this configuration, the input increments in an upward direction. All 8 channels may be configured in the unidirectional mode. Every clock pulse will increment the counter on the rising edge.

NOTE 	The direction of the counter may be inverted by setting the Count Direction bit described in the Configuration chapter.
--	--

Bi-Directional

The bidirectional counter requires 2 input channels. In this mode one channel is used as the counter input and the second channel is used to determine the count direction. The counter will increment when the Direction Channel value is 0 and will decrement when the Counter Direction Channel value is 1.

X1 Quadrature Encoder

The quadrature mode requires 2 input channels. When a quadrature encoder is attached to an input channel pair, A and B, the count direction is determined by the phase angle between inputs A and B. If A leads B, the counter increments. If B leads A, the counter decrements. (The counter changes value only on one edge of input 1.) The counter increments once per quadrature cycle.

NOTE 	The X1 Quadrature mode provides additional Anti-Jitter circuitry. This distinguishes between a valid quadrature sequence and an invalid sequence due to electrical noise or jitter. Jitter can occur if a quadrature encoder stops rotating right at an input sensor trip point. This can cause additional unwanted clock pulses. The X1 quadrature mode can detect invalid transitions and filter these out.
--	--

X4 Quadrature Encoder

Like the X1 quadrature encoder, the count direction is determined by the phase angle between inputs A and B. If A leads B, the counter increments. If B leads A, the counter decrements. However, the counter changes value on the rising and falling edges of inputs A and B. The counter increments four times per quadrature cycle.