Section 24. Speed Detector Module

24-1. Description

The Speed Detector Module determines the speed of a piece of equipment by measuring the frequency of the output signal from a tachometer. The tachometer output can be sinusoidal or a pulse train. The Speed Detector provides a 16-bit output at an update rate of 5 milliseconds for over-speed detection, and a 32-bit output at a variable update rate for speed regulation.

The Speed Detector Module is NOT applicable for CE Mark Certified Systems.

24-2. Module Groups

24-2.1. Electronics Module

There is one Electronics module group for the Speed Detector Module:

- 1C31189G01

24-2.2. Personality Module

There is one Personality module group for the Speed Detector Module:

- 1C31192G01

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Table 24-1. Speed Detector Subsystem [1]

Range	Channels	Electronic Module	Personality Module
16 bit speed (Low Res) 200 Hz min - 51200 Hz max	8	1C31189G01	1C31192G01
32 bit speed (High Res) 0.72 Hz min - 65535 Hz max	8	1C31189G01	1C31192G01

When using the Point Builder to define points for a Speed Detector module, only the following point types are valid for each channel:

I/O Channel	Name	Type	Terminal Block Connection
1	High Resolution (speed value)	Input (can select I/O 1 or 3)	In
3	Low Resolution (speed value)	Input (can select I/O 1 or 3)	In
5	Open Wire	Input	Not applicable
11	Latched Overspeed	Input	Not applicable
12	Overspeed	Input	Not applicable
13	Trip Relay Status	Output	Not applicable
1	Trip Relay	Input	Relay
2	Reset Calculations	Input	Not applicable

[1] This module will interface to **ONE** speed sensor to determine the rotation speed of a field device.

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24-3. Specifications

Electronics Module (1C31189) [1]
Personality Module (1C31192)

Table 24-2. Speed Detector Module Specifications

Description	Value
Number of Channels	1
Input Frequency Range	0.72 Hz to 65535 Hz for the 32-Bit Speed Output 200 Hz to 51,200 Hz for the 16-Bit Speed Output
Speed Measurement Resolution	1/65535 Hz for the 32-Bit Speed Output 1 Hz for the 16-Bit Speed Output
Guaranteed Speed Measurement Accuracy (@25°C)	Max. error for the 16-Bit Speed Output is 0.0033% of Sensor Frequency Speed Input Max. error for the 32-Bit Speed Output is the greater of 0.0025% or $[(25/10^6) + (1/(24 \times 10^6 \times \text{Update Period}))] \times 100\%$ of Speed Sensor Frequency Input Update Period = PULSES/FREQ (in seconds) FREQ = Speed Sensor output frequency PULSES = User specified Speed Sensor Pulse Count per 32-Bit Speed Output value update
Speed Output Update Rate	Update Period = 5 milliseconds for the 16-Bit Speed Output Update Period = PULSES/FREQ (in seconds) for the 32-Bit Speed Output FREQ = Speed Sensor output frequency PULSES = User specified Speed Sensor Pulse Count per 32-Bit Speed Output value update
Differential Input Impedance:	50 K OHM
Diagnostics	Open Speed Sensor Wires Detection (Speed Sensor source resistance must be </ = 5000 ohms). Over-speed detection.
Dielectric Isolation: Field Circuit to Logic Common	1000 VAC/DC
Max. Input Withstand Voltage	140 VAC rms or 150 VDC
Max. Usable Input Voltage	200 V peak-to-peak
Max. Off-State Input Voltage	0.2 V peak-to-peak
Input Duty Cycle	20% Min. 80% Max.
Max. Input DC Offset	150 VDC -0.5 x Max. Input Voltage (peak-to-peak)
Normal Mode Rejection	Maximum 140 VAC or 150 VDC
Module Power	4.8 W typical, 6.25 W maximum

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Table 24-2. Speed Detector Module Specifications (Cont'd)

Description	Value
Operating Temperature Range	0°C to 60°C (32°F to 140°F)
Storage Temperature Range	-40°C to 85°C (-40°F to 185°F)
Humidity (Non-Condensing)	0 to 95%
[1] Refer to the following table for information about different revisions of 1C31189.	

Table 24-3. Minimum Input Voltage (Peak-to Peak)

1C31189 Revision 1	1C31189 Revisions 2 and 3	1C31189 Revision 4 or later	Input Signal Frequency Range
5 volts	1 volt	1 volt	From 0.72 Hz up to 5 Hz
5 volts	1 volt	0.5 volt	From 5 Hz up to 1 kHz
5 volts	1 volt	1 volt	From 1 kHz up to 10 kHz
5 volts	1 volt	2 volts	From 10 kHz up to 20 kHz
10 volts	10 volts	10 volts	From 20 kHz up to 40 kHz
20 volts	20 volts	20 volts	From 40 kHz up to 50 kHz
40 volts	40 volts	40 volts	From 50 kHz up to 65535 Hz

24-4. Speed Detector Terminal Block Wiring Information

Each Personality module has a simplified wiring diagram label on its side, which appears above the terminal block. This diagram indicates how the wiring from the field is to be connected to the terminal block in the base unit.

The diagram for the Speed Detector Personality module is illustrated in Figure 24-1. The following table lists and defines the abbreviations used in this diagram.

Abbreviation	Definition
COM	Common terminal of relay's contact.
	Earth ground terminals used to connect to input signal's shield (see Figure 24-1 for field connections).
IN+, IN-	Positive and negative terminal connections of input signal.

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Abbreviation	Definition
NC	Normally closed terminal of relay's contact.
NO	Normally open terminal of relay's contact.
SHD	Shield of input signal's cable (see Figure 24-2 for field connection.)

All field signals leaving/entering the cabinet should be in shielded cables. The frequency input signal from the signal source must be in twisted-pair shielded cables. The shield must be grounded (see Figure 24-2).

Note

Do **not** use unmarked terminal block locations.

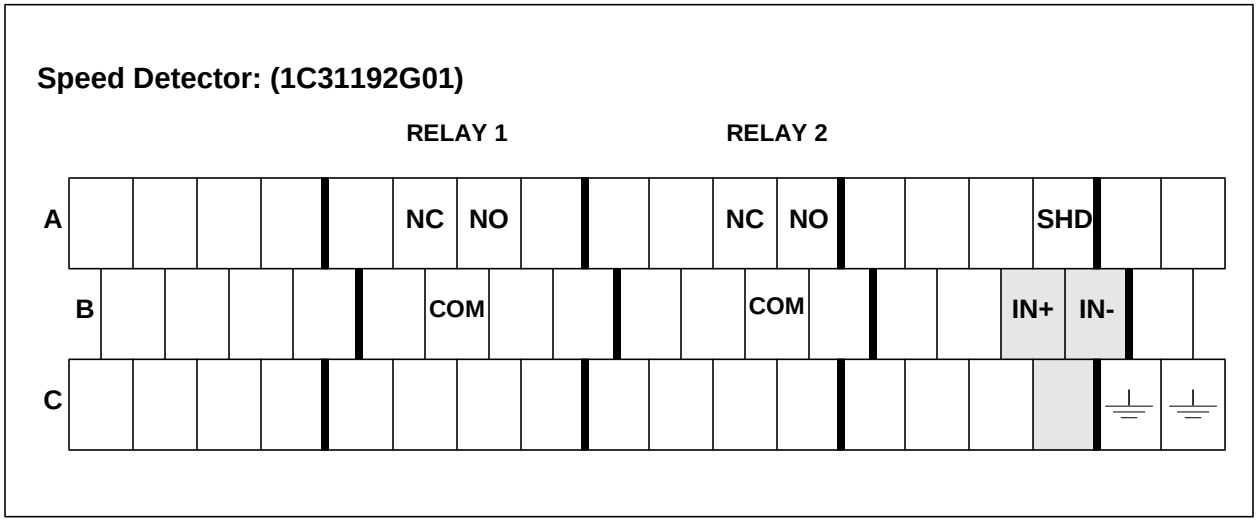


Figure 24-1. Terminal Block Connections for the Speed Detector Personality Module

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24-5. Speed Detector Field Connection Wiring Diagrams

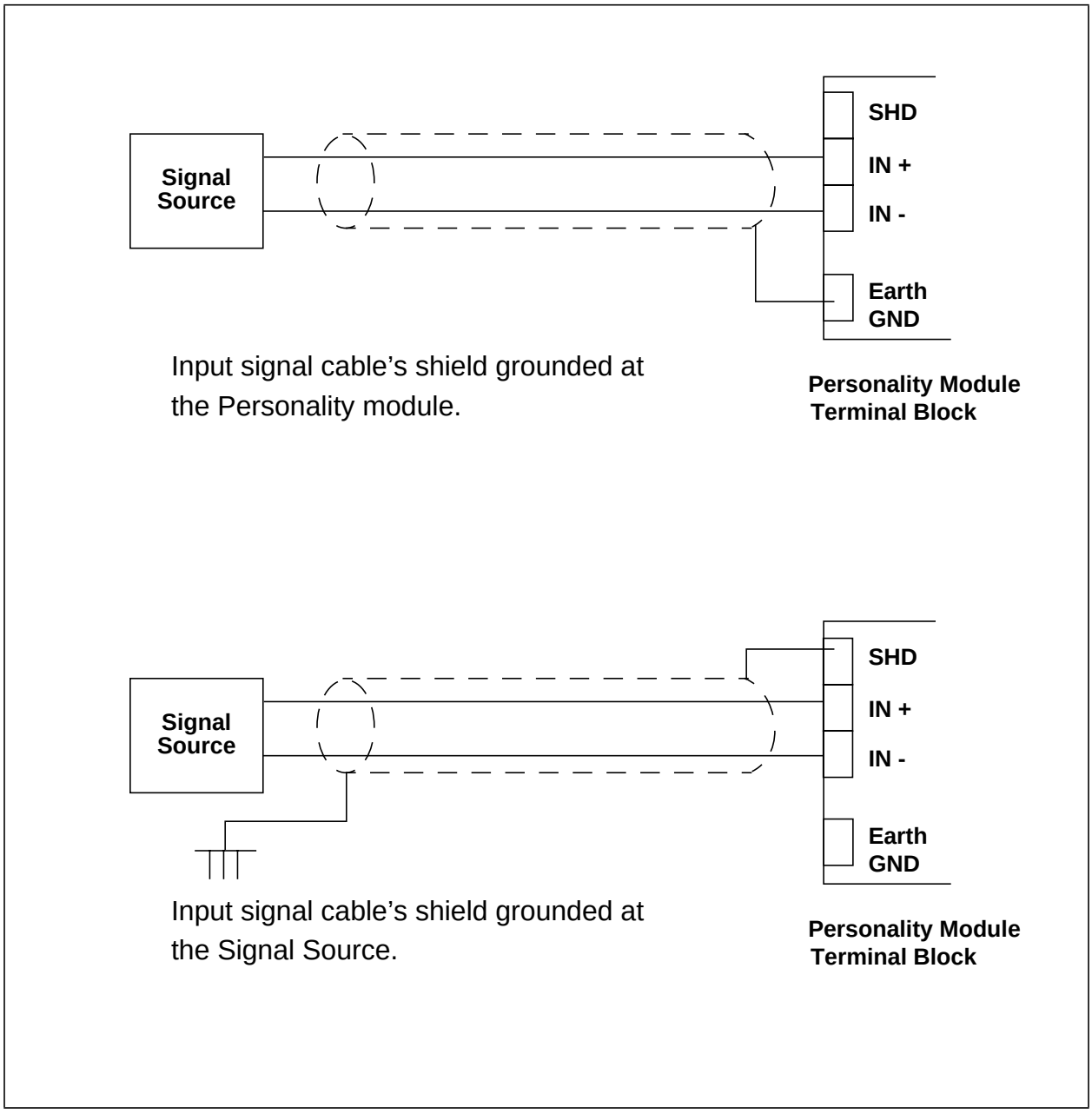


Figure 24-2. Field Connections for the Speed Detector Personality Module

24-6. Speed Detector Address Locations

24-6.1. Configuration and Status Register

Word address 13 (D in Hex) is used to write to the Module Configuration Register and to read the Module Status Register. The status register can be read by using the Point Information window at an Operator Station (see the Bit Pattern Field on the Hardware Tab).

Table 24-4. Speed Detector Configuration/Status Register (Address 13 or D in Hex)

Bit	Data Description - Configuration Register (Write)	Data Description - Status Register (Read)
0	Configure Module (1 = configure; 0 = unconfigure, causing a stoppage of both output measurements)	Module Configured (1 = configured; 0 = unconfigured causing a stoppage of both output measurements))
1	Force Internal Error (1 = force an attention status to be read by Controller; 0 = no forced error)	Forced Internal error (1 = forced error set by Controller; 0 = no forced error)
2	Not used	Not used
3	Not used	Not used
4	Not used	Bit 4 = 1, Open wire condition detected.
5	1 = enable open wire test	Bit 5 = 1, Open wire test enabled.
6	Not used	Not used
7	Not used	Not used
8	Not used	Not used
9	Not used	Not used
10	Not used	Bit 10 = 1, currently in overspeed condition.
11	Not used	Bit 11 = 1, an overspeed condition detected since last read of register D. Reading register D will clear this bit.
12	Not used	Bit 12 = 0, relay open. Bit 12 = 1, relay energized.
13	Not used	Not used.
14	Relay control 1	Relay control 0
15	Relay control 2	Relay control 1

24-6.2. Secondary Configuration and Status Register

Word address 14 (E in Hex) provides the Pulse Count per update setting.

24-6.3. Overspeed Register

Word address 12 (C in Hex) provides the Overspeed Condition setting.

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24-6.4. How to Specify the Pulse Count Per Update Setting

Determine the update period of the 32-Bit speed output. Normally, this is used to control the speed of equipment where accuracy is important. A longer update period will permit an higher accuracy output. Therefore, the maximum update period allowed by the control loop should be used to update the Speed Detector module's 32-Bit speed output.

Example: The Ovation control system runs at a 50 millisecond loop time. The equipment operates at 10,000 Hz. The largest Pulse Count per Update setting that should be written to register 0EH = 10,000 Hz x 0.050 seconds) = 500

Another factor that should be considered is the number of teeth in the speed sensor's gear. The Speed Detector module provides the speed sensor output signal frequency. The Ovation control system regulates equipment speed in revolutions per minute (rpm) using the measured Speed Detector module speed sensor output frequency (Hz) as follows:

Equipment speed (rpm) = 60 x frequency (Hz) / number of teeth in the gear.

To eliminate errors due to mechanical differences of teeth in the gear, complete revolutions of the speed sensor's gear must be counted when measuring frequency. To implement this requirement, the Pulse Count per Update setting written to Speed Detector module register 0EH should be specified as an integer multiple of the speed sensor gear teeth quantity.

Example: There are 60 teeth in the speed sensor's gear. With a 50 millisecond loop time and with the equipment operating at 10,000 Hz, the largest speed Speed Detector module Pulse Count per Update setting (written to register 0EH) is 500. The largest integer multiple of 60 teeth that is less than the maximum pulse count per update setting of 500 is 8. Therefore a Pulse Count per Update value of 8 x 60 = 480 should be written to register 0EH as the Pulse Count per Update. The Pulse Count per Update is set to 480 in order to be a multiple of the number of teeth in the gear. The Pulse Count per Update setting of 480 provides an update every (480/ 10,000 = 48 milliseconds) which is fast enough for a 50 millisecond control loop.

For this example, a value of 01EOH (480) should be written to the Speed Detector.

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