

**CTI 2553 TWO CHANNEL
ISOLATED MAG METER INPUT MODULE
INSTALLATION AND OPERATION GUIDE**

**Version 2.4
CTI Part #062-00120-024**

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PREFACE

This *Installation and Operation Guide* provides installation and operation instructions for the CTI 2553 Two Channel Isolated MAG METER Module for SIMATIC® 505 Series programmable controllers. We assume you are familiar with the operation of SIMATIC® 505 Series programmable controllers. Refer to the appropriate SIMATIC® user documentation for specific information on the SIMATIC® 505 Series programmable controllers and I/O modules.

This *Installation and Operation Guide* is organized as follows:

Chapter 1 provides a description of the module.

Chapter 2 covers installation and wiring.

Chapter 3 is a guide to troubleshooting.

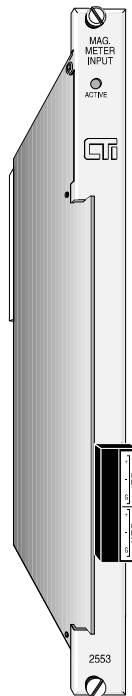


Figure 1 *The Model 2553 2-Channel Isolated MAG METER Input*

USAGE CONVENTIONS

NOTE:

Notes alert the user to special features or procedures.

CAUTION:

Cautions alert the user to procedures which could damage equipment.

WARNING:

Warnings alert the user to procedures which could damage equipment and endanger the user.

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CHAPTER 1. DESCRIPTION

The Two Channel MAG METER Input Module is a member of Control Technology's family of I/O modules compatible with the SIMATIC® 505 Series programmable controllers. The Model 2553 is designed to measure the frequency or period of Mag Meter or Turbine Meter pulses and convert the frequencies into equivalent digital words which are then sent to the programmable controller (PLC).

1.1 Asynchronous Operation

The module operates asynchronously with respect to the PLC; a scan of the PLC and input sampling of the module do not occur at the same time. Instead, the module will translate all inputs in one module update (7 mSec - in normal pulse count mode) and store the translated words in a buffer memory. The PLC retrieves the stored words from the module buffer memory at the start of the I/O scan.

1.2 Operating Modes

1.2.1 Normal Count Mode

In normal count mode, the 2553 precisely measures the amount of time between teeth (or blades) of the device being monitored. Normal count mode uses a measurement technique called "Reflex Counter" to achieve the high accuracy and high speed of the measurement. A reflex counter is basically an auto-ranging counter. Each input channel consists of an incoming pulse counter, a 5 MHz clock counter and appropriate gating and reset circuits. The following paragraph describes a typical measurement.

The first incoming pulse enables both the pulse counter and 5 MHz clock counter. The 2553 counts pulses and clocks until the clock counter is half full. On the next pulse input, the 2553 computes the frequency based on the number of 5 MHz clock pulses counted and the number of incoming pulses counted and outputs the value to the PLC. The frequency is derived by the following formula:

$$\text{Frequency (Hz)} = \frac{\text{Number of Input Pulses} \times \text{Clock Frequency (Hz)}}{\text{Number of Clock Counts}}$$

If an overflow is detected on the incoming pulse counter, the overrange/underrange bit will be set and 65535 will be reported to the PLC (see Section 1.4). If an overflow is detected on the 5 MHz clock counter, the overrange/underrange bit will be set and 0 will be reported to the PLC (see Section 1.4).

1.2.2 N-Tooth Count Mode

In N-Tooth count mode, the 2553 measures the amount of time of a full revolution of the wheel (based on the number of teeth entered in dip switch). The N-Tooth count mode is useful for compensating for errors introduced by wheel wobble (an effect that occurs when the wheel being measured is not perfectly round). Each input channel consists of an incoming pulse counter, a 5 MHz clock counter, a scaling dip switch, and appropriate gating and reset circuits. The following paragraph describes a typical measurement.

The first incoming pulse enables both the pulse counter and 5 MHz clock counter. The 2553 counts pulses and clocks until the pulse counter overflows. The 2553 computes the frequency based on the number of 5 MHz clock counts and the value entered in the dip switch (see Section 2.4.2).

1.3 Digital Word Map

Frequencies or period measurements are translated into a 16-bit digital word. The following figure shows the bit positions and magnitudes in a typical digital word.

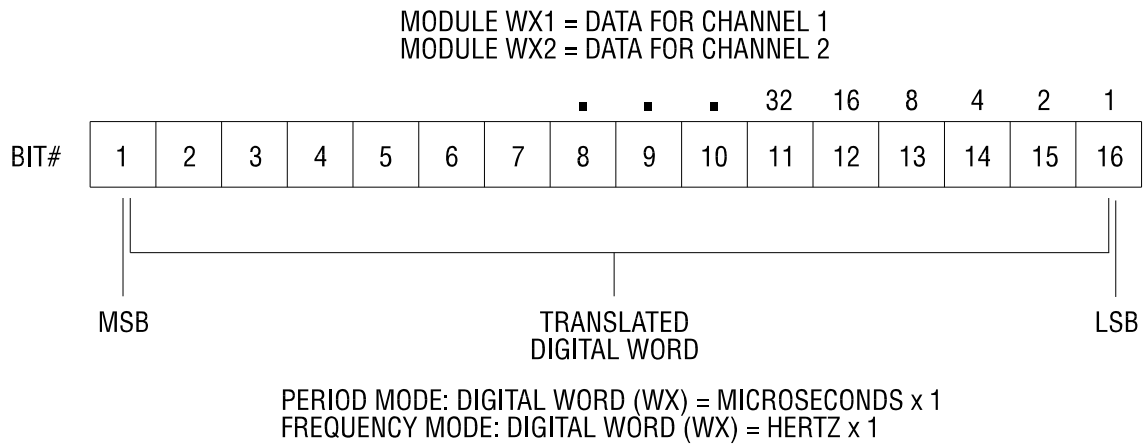


Figure 2 Word Map

1.4 Overage/Underrange Reporting

With no frequency input, the 2553 will report 0 in the data register (see Figure 2). The overrange/underrange bit (see Figure 3) will be set to 0.

For frequencies under 76 Hz, the 2553 will report 0 in the data register (see Figure 2). The overrange/underrange bit (see Figure 5) will be set to 1.

For frequencies between 76 Hz and 65535 Hz, the 2553 will report the correct frequency (or period if set for period mode) in the data register (see Figure 2). The overrange/underrange bit (see Figure 4) will set to 0.

For frequencies over 65535 Hz, the 2553 will report 65535 in the data register (see Figure 2). The overrange/underrange bit (see Figure 5) will be set to 1.

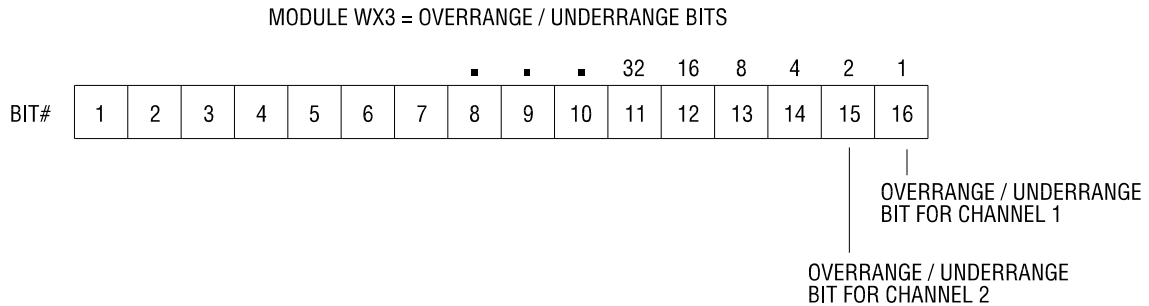


Figure 3 Overage/Underrange Bits

INPUT FREQUENCY	DATA REGISTER	OVERRANGE/UNDERRANGE BIT
< 2 Hz	0	0
2 - 75 Hz	0	1
75 Hz - 65535 Hz	77 - 65535	0
> 65535 Hz	65535	1

Figure 4 Overage/Underrange Truth Table

NOTE:
A failed pickup or an open circuit may be detected by examining the data register and the overrange/underrange bit. If both are zero then there is no longer any input signal on the 2553 connector.

1.5 Resolution

The 2553 has a resolution of ± 1 Hz.

CHAPTER 2. INSTALLATION

The installation of the Two Channel MAG METER Input Module involves the following steps:

1. Planning the installation
2. Configuring the module
3. Inserting the module into the base
4. Wiring the module input connector
5. Checking module operation

The steps listed above are explained in detail in the following pages.

2.1 Planning the Installation

Planning is the first step in the installation of the module. This involves calculating the I/O base power budget and routing the input signal wiring to minimize noise. The following sections discuss these important considerations.

2.2 Calculating the I/O Base Power Budget

The 2553 requires 2.5 watts of +5V power from the I/O base. Use this figure to verify that the base power supply capacity is not exceeded.

2.3 Unpacking the Module

Open the shipping carton and remove the special anti-static bag which contains the module.

CAUTION:

HANDLING STATIC SENSITIVE DEVICES

The components on the Model 2553 module printed circuit card can be damaged by static electricity discharge. To prevent this damage, the module is shipped in a special anti-static bag. Static control precautions should be followed when removing the module from the bag, when opening the module, and when handling the printed circuit card during configuration.

After discharging any static build-up, remove the module from the static bag. Do not discard the static bag. Always use this bag for protection against static damage when the module is not inserted into the I/O backplane.

2.4 Configuring the Module

The Model 2553 must be configured to operate in normal counting mode or N-Tooth counting mode. The module must also be configured to report the measurements in "Frequency" or "Period" and digital filtering/no filtering mode before inserting the module into the I/O base. As shipped, the module is configured for normal counting mode, "Frequency" and digital filtering disabled (see Figure 5).

Changing the module input channel configuration involves the following steps:

1. Select Normal or N-Tooth Counting mode for each channel.
2. Select the number of teeth on the wheel (N-Tooth mode only).
3. Select frequency or period measurement for the module.
4. Select digital filtering or no filtering for the module.
5. Select proper input signal conditioning.

Each of these steps is described in the following sections.

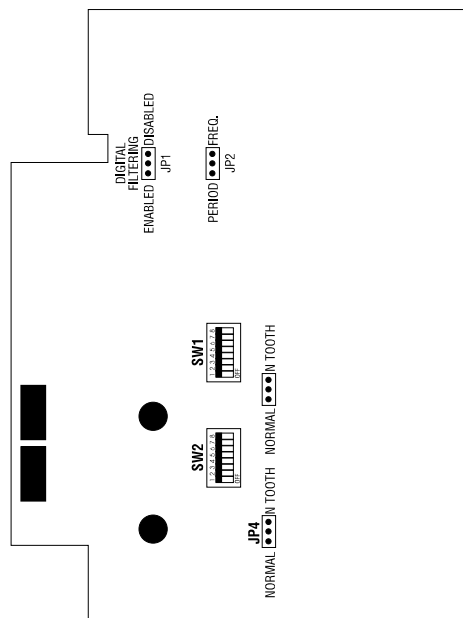


Figure 5 Jumper Locations

2.4.1 Selecting Normal Count Mode or N-Tooth Count Mode

Locate the Normal/N-Tooth jumpers (see Figure 5). Each channel can be independently configured for either counting mode. Jumper JP3 is used for channel 1, jumper JP4 is used for channel 2.

2.4.2 Selecting the Number of Teeth on the Wheel (N-Tooth Mode Only)

Dip switches SW1 and SW2 are used to tell the module how many teeth are on the wheel being measured. For proper internal scaling in the module, **enter 1 less than the number of teeth on the wheel**. Dip switch SW1 is used for channel 1, dip switch SW2 is used for channel 2.

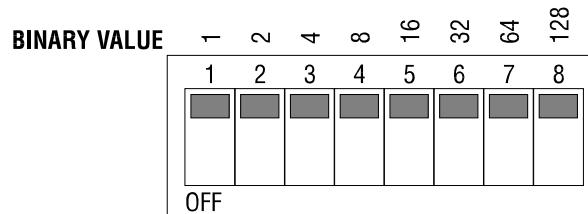


Figure 6 Dip Switch Settings

2.4.3 Selecting the Frequency or Period Reporting

Locate the Period/Frequency jumper JP2 (see Figure 5). To select frequency measurement, set the jumper in the **FREQ** position. To select period measurement, set the jumper in the **PERIOD** position.

2.4.4 Selecting Digital Filtering

Locate the Digital Filtering jumper JP1 (see Figure 5). To enable digital filtering, set the jumper in the **ENABLED** position. Since many signals have timing jitter, CTI recommends using digital filtering unless maximum response is required.

2.4.5 Selecting Input Signal Conditioning

Each of the inputs of the Model 2553 may be configured to support bipolar, positive pulse, negative pulse or open collector applications. Jumpers JP5 for Channel 1 and JP7 for Channel 2 allow each channel to be independently configured.

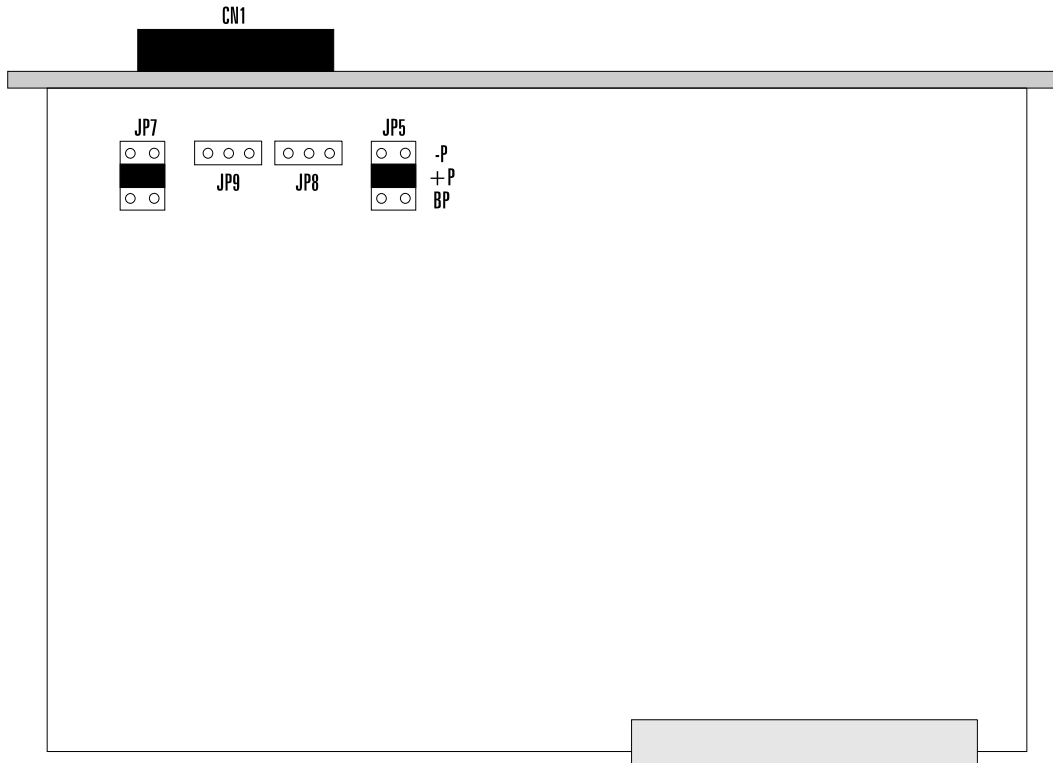


Figure 7 *Jumper Locations*

-P, Negative Pulse: Devices that generate a negative pulse between ground and a negative voltage.

+P, Positive Pulse: Devices that generate a positive pulse between ground and a positive voltage.

BP, Bipolar: Devices that generate a sinusoidal or bipolar (square wave) output.

2.4.6 Open Collector Conditioning

Each input channel may be driven by an external device with open collector output drive. Jumpers JP8 and JP9 are used to configure the input channels for open collector operation.



Figure 8 *Open Collector Selection*

When selecting open collector operation the 2553 input is connected through a 10kΩ resistor to +15VDC board. No power supply is

internally on the circuit pullup resistor or required.

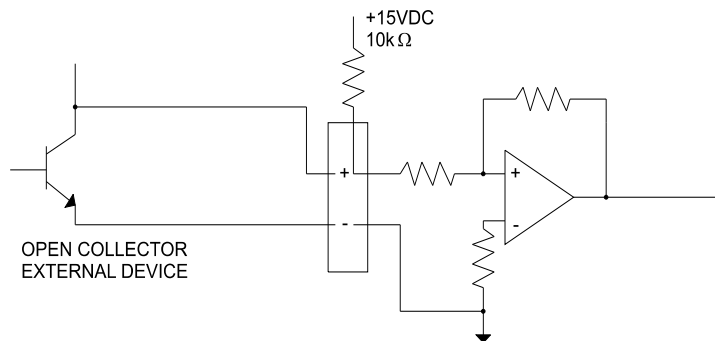


Figure 9 *Open Collector External Device*

2.4.7 Standard Shipping Configuration

The Model 2553 is shipped from the factory with both channels configured for normal operation and with bipolar signal conditioning.

WARNING:
The module must not be inserted into the I/O rack while power is applied.

2.5 Inserting the Module into the I/O Base

Insert the module into the I/O base by carefully pushing the module into the slot. When the module is fully seated in the slot, tighten the captive screws at the top and bottom to hold the module in place. To remove the module from the I/O base, loosen captive screws, then remove the module from the I/O base. Be careful not to damage the connector card at the back of the module when inserting or removing the module.

2.6 Wiring the Input Connectors

Mag Meter input signals are accepted through removable screw terminal connector blocks located on the front of the module (see Figures 7 and 8).

Input signal wiring must be shielded, twisted-pair cable.

Always use the shortest possible cables

Avoid placing low voltage wire parallel to high energy wire (if the two wires must meet, cross them at a right angle).

Avoid bending the wire into sharp angles.

Use wireways for wire routing.

Avoid placing wires on any vibrating surface.

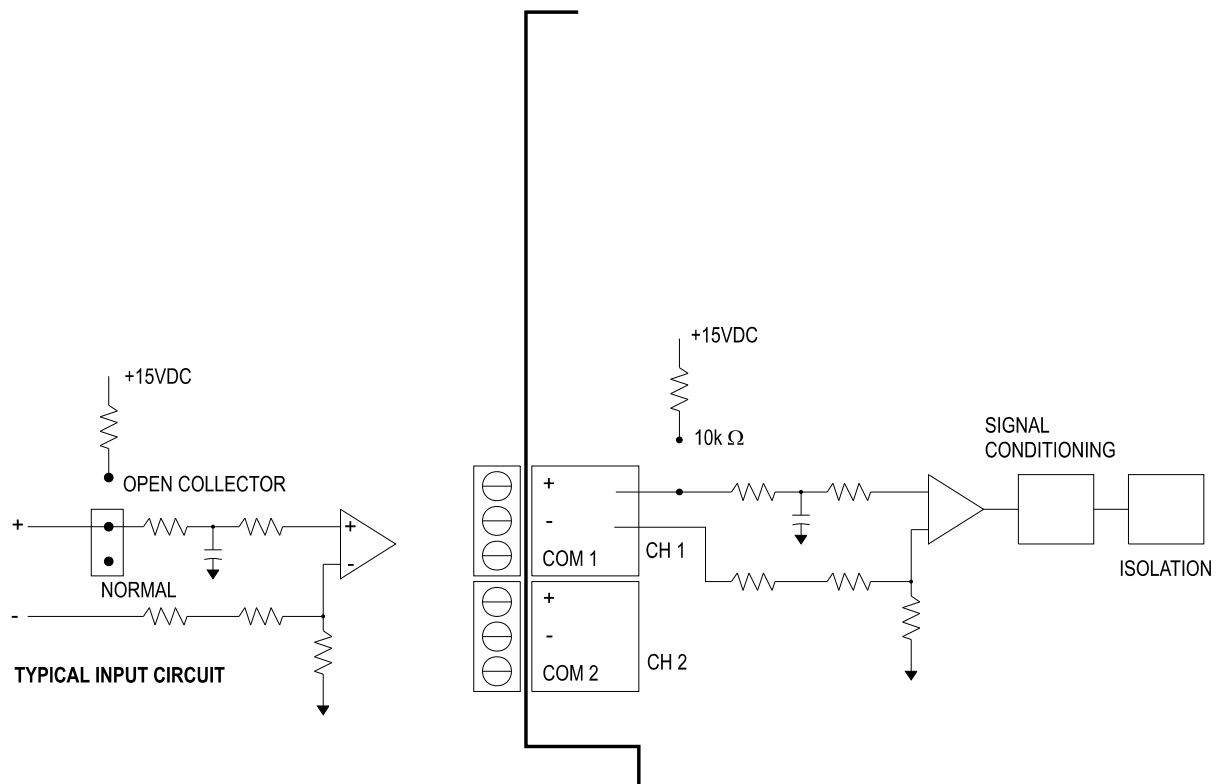


Figure 10 Input Connectors

2.6.1 Connecting the Shield Wiring

Control Technology Inc. recommends that all wires be shielded twisted pair with a foil wrap shield and a separate drain wire and that they be installed in a metallic conduit. Use Belden cable 8761 or equivalent which contains a foil wrap shield and a separate drain wire. The shield and the foil wrap should be twisted together and should be terminated at only one end. The other end should be left in an open circuit condition. CTI recommends that the shield be terminated at the PLC end of the signal wire. Special components are installed on the module to aid in the rejection of noise.

When entering the industrial cabinet the shield wires should be routed from the main terminal strip all the way to the PLC. Signal leads that do not maintain a shield from the terminal strip of the PLC act as antennas and are susceptible to radiated and conducted emissions in the cabinet. Unprotected cables may introduce measurement errors in the module.

The front connector on the module contains a COM terminal which may be used for the shield wire if the installation is in a noise free environment. If the installation is in an extremely noisy environment CTI strongly recommends that the shielded wires be terminated to the PLC chassis ground.

CTI has exhaustively tested this product to maximize its ability to reject noise from inductive sources as well as showering arcs, fast transients and other high frequency generators and has determined that the best performance results from connecting all shield wires together at the PLC module and terminating this single wire to the chassis ground with a large current capacity conductor. The PLC chassis should then be wired to earth ground with a large current capacity conductor. CTI recommends using a #8 gauge wire or larger from the PLC chassis to the earth ground connection.

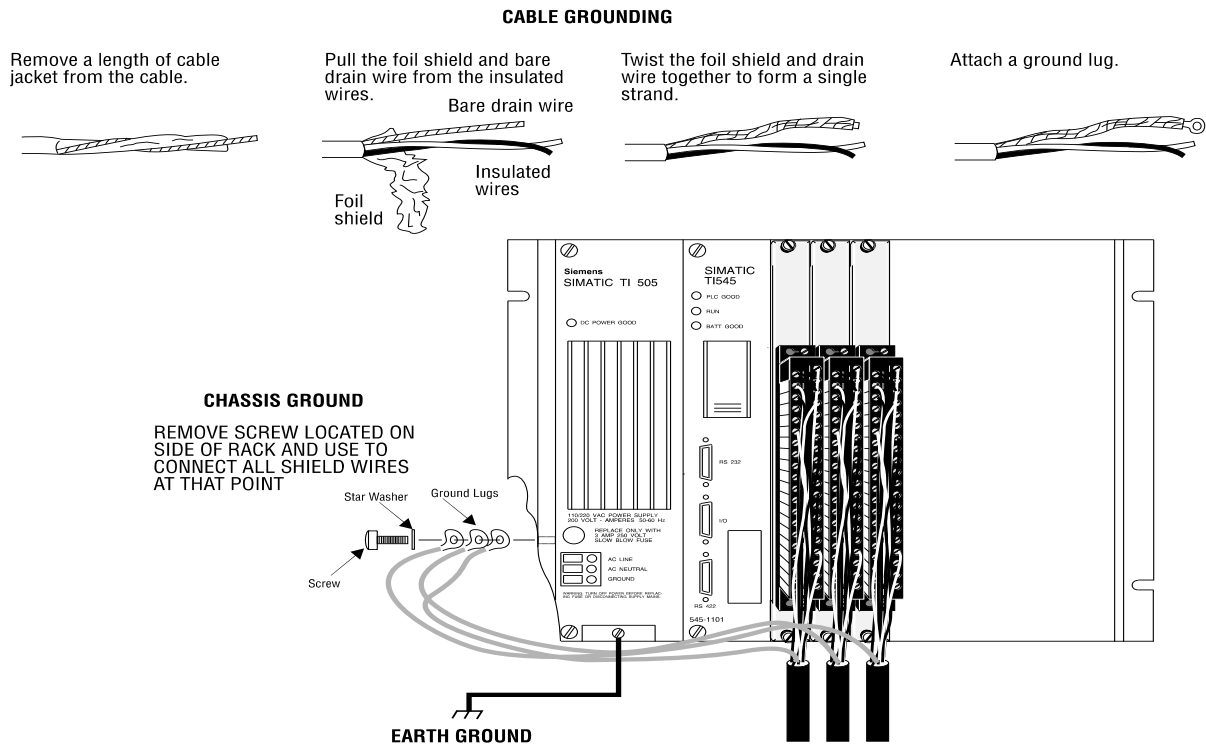


Figure 11 Shield Wire Termination

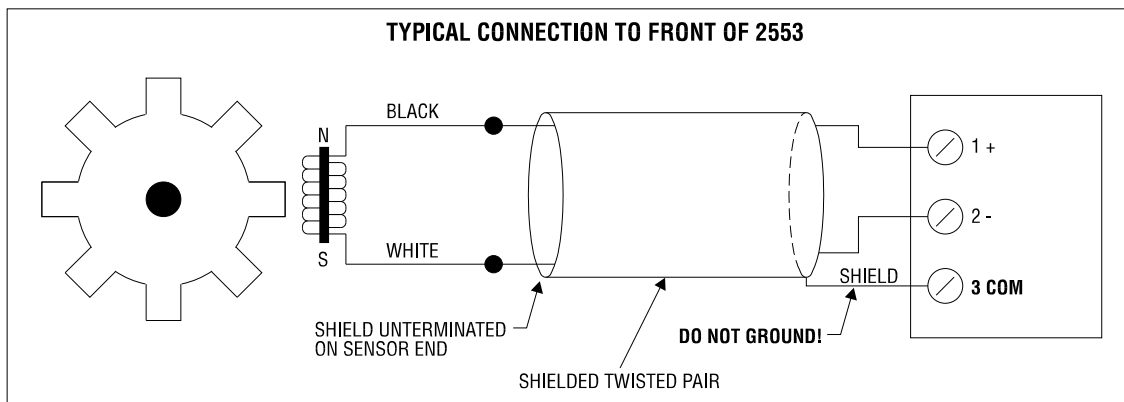


Figure 12 *Typical Wiring Diagram*

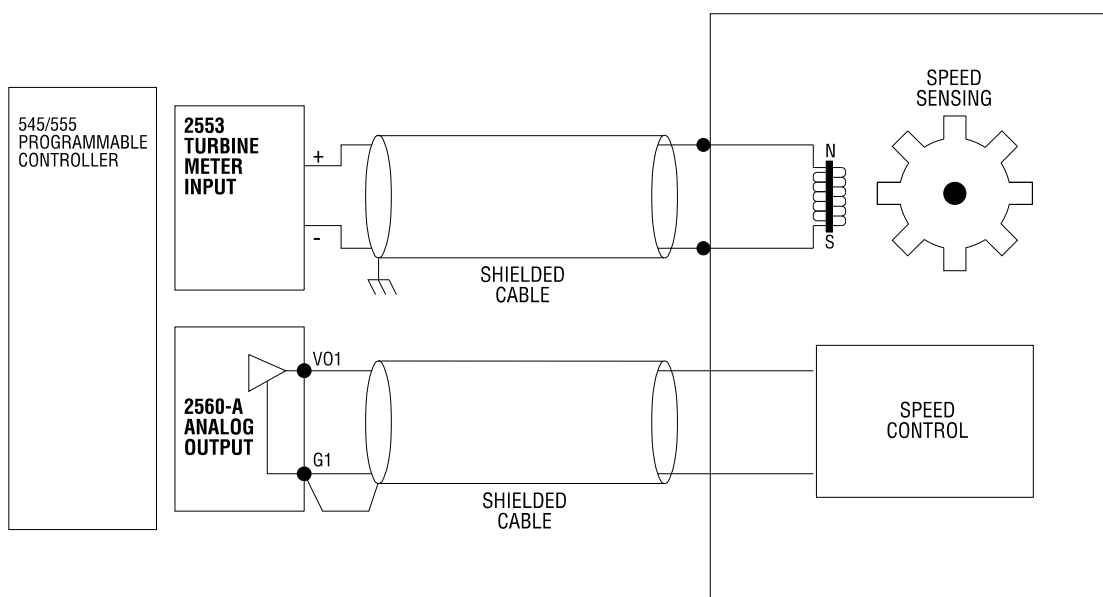


Figure 13 *Typical Application*

2.7 Checking Module Operation

First turn on the base supply power. If the module diagnostics detect no problems, the status indicator on the front of the module will light. If the status indicator does not light (or goes out during operation), the module has detected a failure. For information on viewing failed module status, refer to your SIMATIC® TISOFT user manual. To diagnose and correct a module failure, refer to the next section on troubleshooting.

You must also check that the module is configured in the memory of the PLC. This is important because the module will appear to be functioning regardless of whether it is communicating with the PLC. To view the PLC memory configuration chart listing all slots on the base and the inputs or outputs associated with each slot, refer to your SIMATIC® TISOFT Programming Manual. An

```

I/O MODULE DEFINITION FOR CHANNEL ... 1  BASE ..... 00

      I/O  NUMBER OF BIT AND WORD I/O  SPECIAL
      SLOT ADDRESS          X  Y  WX  WY  FUNCTION
01 .... 0001 ..... 00 .. 00 .. 08 .. 00 ..... NO
02 .... 0000 ..... 00 .. 00 .. 00 .. 00 ..... NO
      .
      .
      .
15 .... 0000 ..... 00 .. 00 .. 00 .. 00 ..... NO
16 .... 0000 ..... 00 .. 00 .. 00 .. 00 ..... NO

```

EXIT-F1 SHOW-F2 READDK-F3 WRITDK-F4 READPC-F5 WRITPC-F6 READBS-F7 CLRBS-F8

Figure 14 I/O Configuration

example chart is shown in the following figure.

In this example, the 2553 module is inserted in slot 1 in I/O base 0. Data for channel 1 appears in word location WX1, data for channel 2 appears in word location WX2. Overrange/Underrange bits appear in word location WX3. WX4 thru WX8 are unused. For your particular module, look in the chart for the number corresponding to the slot occupied by the module. If word memory locations appear on this line, then the module is registered in the PLC memory and the module is ready for operation.

If the line is blank or erroneous, re-check the module to ensure that it is firmly seated in the slots. Generate the PLC memory configuration chart again. If the line is still incorrect, contact your local distributor or CTI at 1-800-537-8398 for further assistance.

CHAPTER 3. TROUBLESHOOTING

If the module provides improper readings or the status indicator is not on, use the following chart to determine the appropriate corrective action.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Indicator is not lit	Base or PC power is off Defective module	Turn base or PC on Return to CTI for repair
Incorrect inputs	Wrong addresses for word input Not logged-in Incorrect jumper settings signal conditioning, open collector	Check program for correct word input addresses Read PLC I/O configuration Refer to Section 2.4 of this Installation and Operation Guide for jumper settings

If after consulting the chart above, you are unable to diagnose or solve the problem, contact your local distributor or CTI at 1-800-537-8398 for further assistance.

SPECIFICATIONS

Channels Per Module:	2 (two)
Size:	Single wide 505 module
Input Voltage Range:	
Sinusoidal:	140 mV to 50 VRMS (differential input into 10 K Ω) 200 mV to 70 V peak
TTL:	Maximum input \pm 28VDC
Positive	less than 0.8 = 0
Negative	greater than 2.4 = 1
Bipolar	
Input Frequency Range:	78 Hz to 65 KHz
Data Reporting:	Reports in frequency (Hz) or period (mSec) (User selectable)
Frequency Roll-Off:	3 dB @ 20 KHz 6 dB per octave
Input Protection:	50 VRMS continuous 20,000 Volts ESD
Digital Filtering:	User enabled (50 mSec Time Constant)
Update Time:	7 mSec (in normal counter mode)
Accuracy:	\pm 1 Hz
Module Power from Base:	2.5 Watts @ +5 VDC
Isolation:	1500 VDC channel-to-channel 1500 VDC channel-to-PLC
Field Wiring Connector:	Removable, accepts 12-26 AWG
Mechanical:	Size single-wide 505 module

Operating Temperature:	0° to 60°C (32° to 140°F)
Storage Temperature:	-40° to 85°C (-40° to 185°F)
Humidity, Relative:	5% to 95% (non-condensing)
Shipping Weight:	1.5 lbs. (0.68 Kg)
Agency Approvals Pending:	UL, UL for Canada FM Class 1 Div 2, CE

Specifications subject to change without notice.

LIMITED PRODUCT WARRANTY

CTI warrants that this CTI Industrial Product shall be free from defects in material and workmanship for a period of one (1) year after purchase from CTI or from an authorized CTI Industrial Distributor. This CTI Industrial Product will be newly manufactured from new and/or serviceable used parts which are equal to new in the Product.

Should this CTI Industrial Product fail to be free from defects in material and workmanship at any time during this one (1) year warranty period, CTI will repair or replace (at its option) parts or Products found to be defective and shipped prepaid by the customer to a designated CTI service location along with proof of purchase date and associated serial number. Repair parts and replacement Product furnished under this warranty will be on an exchange basis and will be either reconditioned or new. All exchanged parts or Products become the property of CTI. Should any Product or part returned to CTI hereunder be found by CTI to be without defect, CTI will return such Product or part to the customer.

This warranty does not include repair of damage to a part or the Product resulting from: failure to provide a suitable environment as specified in applicable Product specifications, or damage caused by an accident, disaster, acts of God, neglect, abuse, misuse, transportation, alterations, attachments, accessories, supplies, non-CTI parts, non-CTI repairs or activities, or to any damage whose proximate cause was utilities or utility like services, or faulty installation or maintenance done by someone other than CTI.

Control Technology Inc. reserves the right to make changes to the Product in order to improve reliability, function, or design in the pursuit of providing the best possible Product. CTI assumes no responsibility for indirect or consequential damages resulting from the use or application of this equipment.

THE WARRANTY SET FORTH ABOVE IN THIS ARTICLE IS THE ONLY WARRANTY CTI GRANTS AND IT IS IN LIEU OF ANY OTHER IMPLIED OR EXPRESSED GUARANTY OR WARRANTY ON CTI PRODUCTS, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND IS IN LIEU OF ALL OBLIGATIONS OR LIABILITY OF CTI FOR DAMAGES IN CONNECTION WITH LOSS, DELIVERY, USE OR PERFORMANCE OF CTI PRODUCTS OR INTERRUPTION OF BUSINESS, LOSS OF USE, REVENUE OR PROFIT. IN NO EVENT WILL CTI BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

REPAIR POLICY

In the event that the Product should fail during or after the warranty period, a Return Material Authorization number (RMA) can be requested verbally or in writing from CTI main offices. Whether this equipment is in or out of warranty, a Purchase Order number provided to CTI when requesting the RMA number will aid in expediting the repair process. The RMA number that is issued and your Purchase Order number should be referenced on the returning equipment's shipping documentation. Additionally, if under warranty, proof of purchase date and serial number must accompany the returned equipment. The current repair and/or exchange rates can be obtained by contacting CTI's main office at 1-800-537-8398.

When returning any module to CTI, follow proper static control precautions. Keep the module away from polyethylene products, polystyrene products and all other static producing materials. Packing the module in its original conductive bag is the preferred way to control static problems during shipment. **Failure to observe static control precautions may void the warranty.** For additional information on static control precautions, contact CTI's main office at 1-800-537-8398.