CTI 2556-A SIXTEEN CHANNEL

ISOLATED THERMOCOUPLE INPUT MODULE

INSTALLATION AND OPERATION GUIDE

Version 1.2

$25

DOCUMENT DISCLAIMER STATEMENT

Every effort has been made to ensure the accuracy of this document; however, errors do occasionally occur. CTI provides this document on an "as is" basis and assumes no responsibility for direct or consequential damages resulting from the use of this document. This document is provided without express or implied warranty of any kind, including but not limited to the warranties of merchantiblility or fitness for a particular purpose. This document and the products it references are subject to change without notice. If you have a comment or discover an error, please call us toll-free at 1-800-537-8398.

REVISION HISTORY

Version 1.0	6/1/20	Original Release
Version 1.1	10/5/2021	Added Jumper Labels in Figure 15 and info on JP65
Version 1.2	7/20/2023	Corrected designation for JP68 in Figure 16

PREFACE

This ***Installation and Operation Guide*** provides installation and operation instructions for the CTI 2556-A Sixteen Channel Isolated Thermocouple Input Module for CTI's 2500 Series 2500® Processors as well as the legacy SIMATIC® 505 programmable controllers. We assume you are familiar with the operation of CTI's 2500 Series 2500® Processors and SIMATIC® Series 505 programmable controllers. Refer to the appropriate CTI's Series 2500® documentation for Processors and I/O module operation.

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 2556-A 16-Channel Isolated Thermocouple Input Module

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.

TABLE OF CONTENTS

Contents

TABLE OF FIGURES

CHAPTER 1. DESCRIPTION

The Sixteen Channel Thermocouple Input Module is a member of Control Technology's family of I/O modules compatible with the all 2500 Series 2500® Processors and the SIMATIC® 505 Series programmable controllers. The Model 2556-A is designed to translate a J, K, R, S, T, E, and L (DIN J) thermocouple or millivolt input signal into an equivalent digital word which is then sent to the programmable controller (PLC).

The 2556-A Thermocouple Input Module features built-in independent internal cold junction compensation and linearization for each thermocouple input for Types J, K, E, R, S, L, and T. No external cold junction compensation is required.

1.1 Front Panel Description

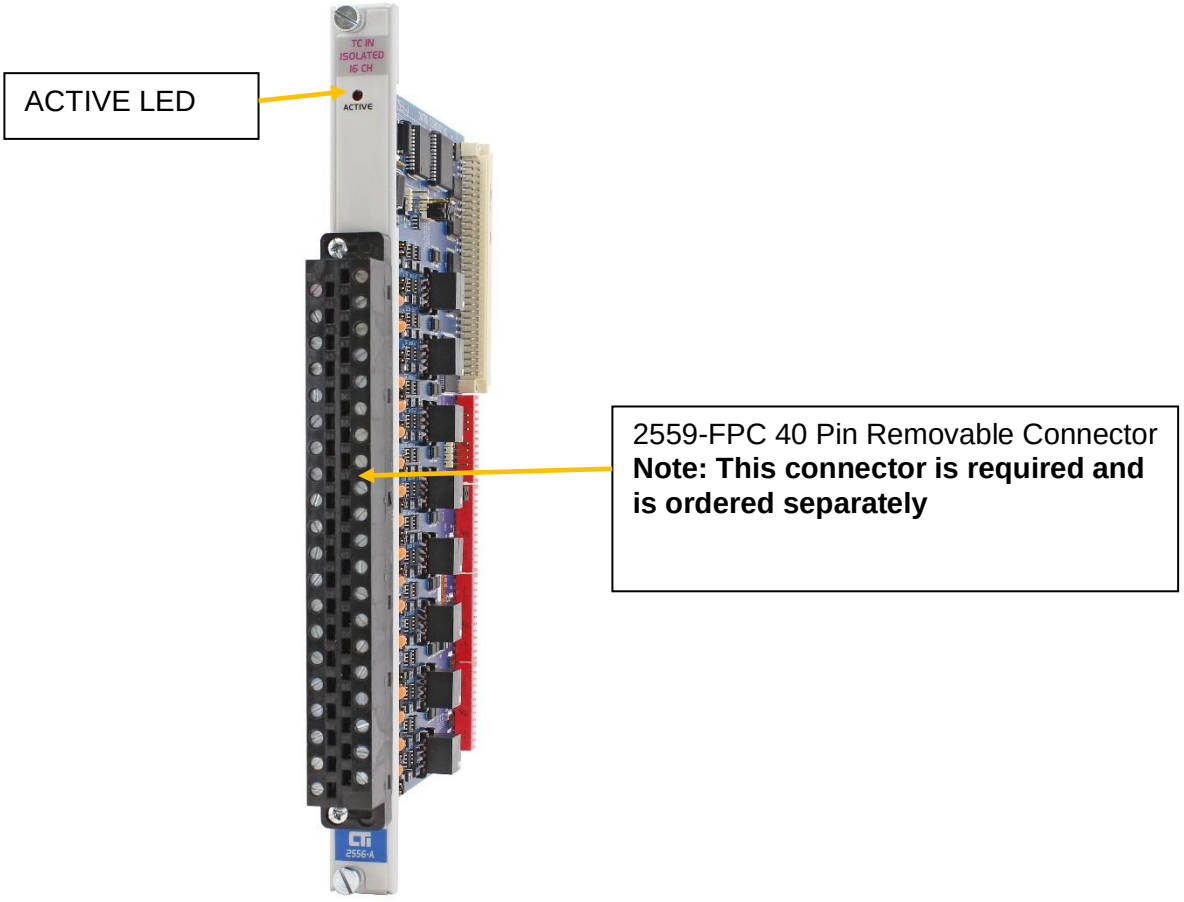

Figure 2 **2556-A Front Panel Description**

1.1.1 Active LED

The Active LED will be illuminated when the module is functioning normally. If the Active LED is not lit, refer to Chapter 3 for troubleshooting.

1.1.2 Input Terminals for Channels 1-16

The Model 2556-A uses CTI's 2559-FPC with Cold Junction Compensation built into the connector. This connector provides wiring terminals for channels 1-16 and is ordered separately.

1.2 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 (24 milliseconds maximum) 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.

1.2.1 Immediate I/O Compatibility

The Model 2556-A has been tested and is compatible with the Immediate Read function of the SIMATIC® 545 and 555 PLC. The Model 2556-A is compatible with 545 and 555 PLCs. It is compatible with the 525 PLCs in 16WX mode only.

1.3 J, K, R, S, T, E, or L Thermocouples and mV

Each of the module's sixteen channels may be configured to receive either J, K, R, S, T, E, or L thermocouple input signals or a DC voltage signal ranging from -55 to +55 millivolts. Selection of thermocouple type or millivolts are made via internal DIP switch settings and hardware jumpers (see Sections 2.4.1 and 2.4.2).

1.4 Digital Word Map

Thermocouple and/or millivolt signals are translated into a 14-bit digital word. Since the PLC requires a 16-bit input word, the 14-bit value from the converter is placed into a 16-bit word for transmittal to the PLC. As shown in the following figure, of the two bits not used for the digital word, one is used to show the sign of the word, while the other is used to note values which are "overrange."

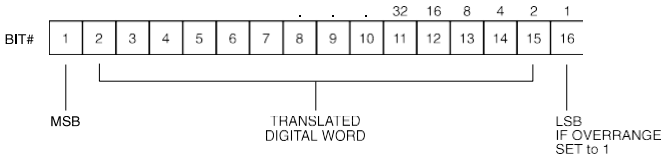

Figure 3 Word Input to the PLC from the Module

1.5 Thermocouple Input to Digital Conversion

1.5.1 Engineering Units

The following equations may be used to calculate the digital word in decimal format which will result from a particular thermocouple input:

Thermocouple Mode, Digital Word (WX) = Degrees X10
Millivolt Mode, Digital Word (WX) = Millivolts X100

As an example, the following figure illustrates the effects of a change in input level going from 0° to 102.4°F in the Thermocouple Input Mode.

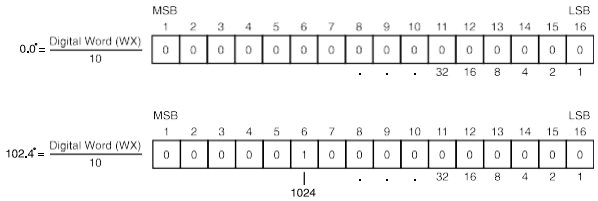

Figure 4 Example Change in Input Level

1.5.2 Scale Units

When data format is selected as SCALE the full temperature range of the thermocouple is scaled as an unsigned integer from 0-32000. The following formula may be used to calculate the scaled integer value.

Scaled Integer = (measured temp - min temp) ÷ (max temp - min temp) x 32000
Scaled Integer = (mV – (-50)) ÷ (50 – (-50)) x 32000 = (mV + 55) ÷ 100 x 32000

For example the scaled integer offset at 0°C for a Type J thermocouple is:

Scaled integer = 0 - (-210) ÷ (760 - (-210)) x 32000 = 6928

For mV mode, the scaled integer at 0mV is:

Scaled integer = (0mV + 50) ÷ 100 x 32000 = 16000

1.6 Effect of Out-of-Range Input Signals

Thermocouple inputs exceeding the ANSI standard of 760 degrees C for Type J, or 1768 degrees C for Type R and S, and 1000 degrees C for Type E will cause the overrange bit to be set and the maximum temperature for that thermocouple type to be returned. Open thermocouples report temperatures that are out of the allowable range. This condition may occur due to failure of the thermocouple or due to the thermocouple wire being cut or disconnected. The Model 2556-A will report an open thermocouple condition within 200 milliseconds.

For mV signals in SCALE mode (0-32000), the module will report >32000 if the input voltage > 50mV and will reach a maximum reported value of 32767 at approximately +52.5mV. For negative inputs <-50mV, the module will report negative values (<0) and will reach a minimum reported value of -2115 at about -56.5mV.

NOTE:

The Model 2556-A uses the least significant bit (16) to indicate an open thermocouple. The value of this bit is set to 1 when this condition occurs. An open thermocouple condition will report within 200 milliseconds.

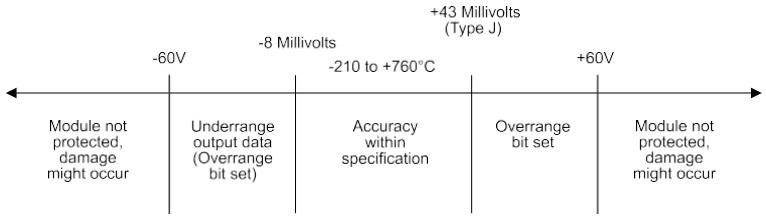

Figure 5 Effect of Voltage Input on Type J Thermocouple

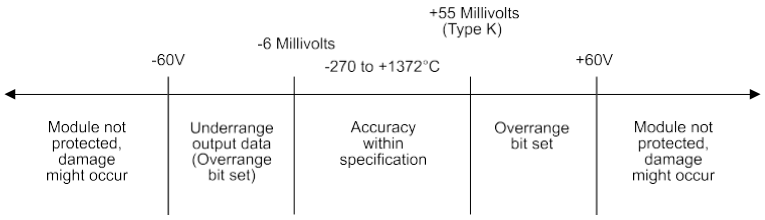

Figure 6 Effect of Voltage Input on Type K Thermocouple

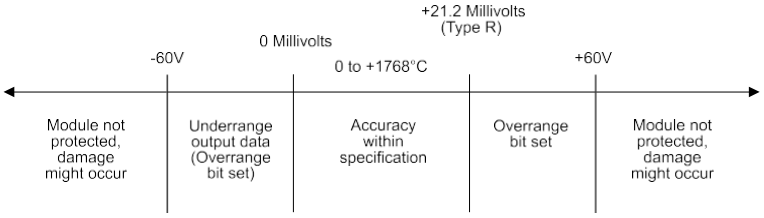

Figure 7 Effect of Voltage Input on Type R Thermocouple

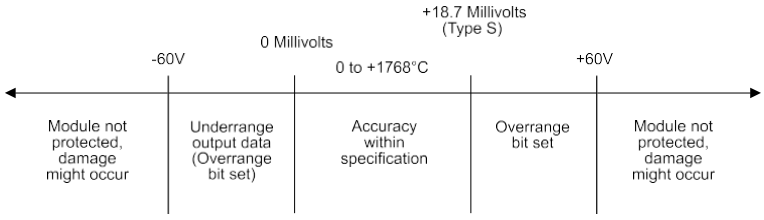

Figure 8 Effect of Voltage Input on Type S Thermocouple

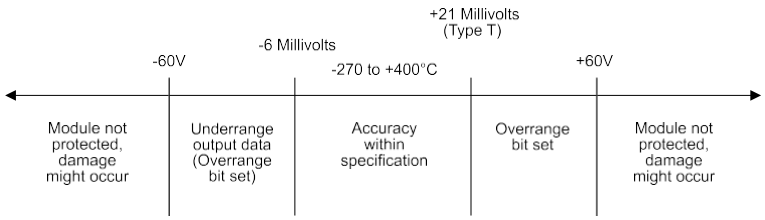

Figure 9 Effect of Voltage Input on Type T Thermocouple

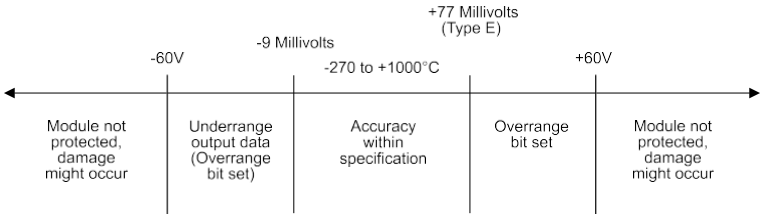

Figure 10 Effect of Voltage Input on Type E Thermocouple

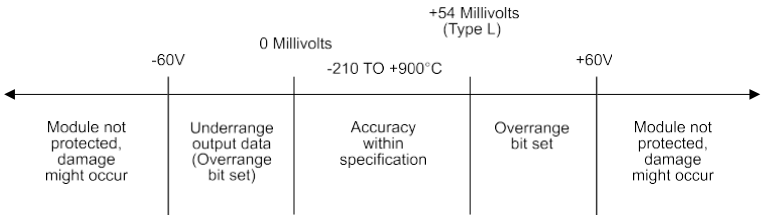

Figure 11 Effect of Voltage Input on Type L Thermocouple

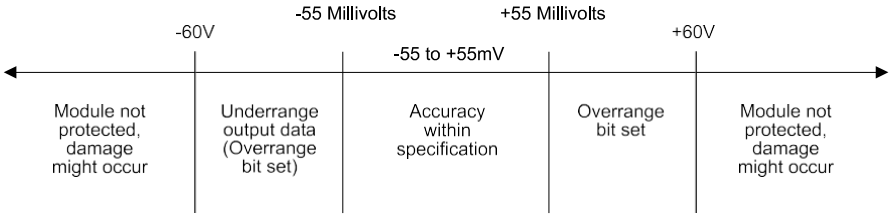

Figure 12 Effect of Voltage Input on Millivolt Range

1.7 Resolution

The module has a resolution of approximately 0.1°C, 0.2°F or 0.01 millivolts.

The chart below shows the corresponding input resolution per step for each of the input configuration modes:

UNITS	DIGITAL COUNTS/STEP	INPUT RESOLUTION PER STEP
Temp Degrees C	2	~ 0.1°C
Temp Degrees F	2	~ 0.2°F
Millivolts	2	0.01 Millivolts

Figure 13 Input Resolution

CHAPTER 2. INSTALLATION

The installation of the 2556-A Sixteen Channel Thermocouple Input Module involves the following steps:

1. Planning the installation
2. Configuring the module
3. Inserting the module into the I/O 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 Model 2556-A requires 5 watts of +5 VDC power from the I/O base. Use these values to verify that the base power supply capacity is not exceeded.

2.3 Unpacking the Module

CAUTION:
HANDLING STATIC SENSITIVE DEVICES
The components on the 2556-A 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. Take the following precautions before removing the module from the bag, when opening the module, and when handling the printed circuit card during configuration.

Discharge any static potential by holding the module in its anti-static bag and touch the metal chassis of the PLC. During the configuration step, hold the printed circuit card only by its edges. Do not touch the circuit card pin connectors, or solder connections.

Open the shipping carton and remove the special anti-static bag which contains the module. After discharging any static build-up, remove the module from the static bag. Do not discard the static bag. You will need it for the following configuration procedure.

2.4 Configuring the Module

The Model 2556-A must be configured for type J, K, R, S, T, E thermocouples or millivolt range and digital filtering/no filtering mode before wiring the input connectors and inserting the module into the I/O base.

> ***NOTE:***
> *As shipped, all input channels are configured for Type J thermocouples (degrees Celsius) and digital filtering enabled, 16 WX mode and engineering units.*

Changing the module input channel configuration involves the following steps:

1. Selecting thermocouple type or millivolt measurement via DIP switch
2. Selecting thermocouple type or millivolt input for each channel via hardware jumpers
3. Selecting digital filtering or no filtering for the module
4. Selecting standard login mode (16WX) or Advanced Operating Mode
5. Selecting degrees Celsius or Fahrenheit
6. Selecting Engr units or SCALE units for module

Logging the configuration jumper settings for future reference

2.4.1 JP65

Unlike the 2556 the 2556-A has a jumper installed at position 1 and 2. This jumper is required for module operation. Do not remove this jumper.

2.4.2 Selecting Thermocouple or Millivolt Measurement via DIP Switch

> ***NOTE:***
> *The ON position is selected by pushing the switch toward the center of the printed circuit board.*

DIP switches 1-4 on the inside edge of the printed circuit board are used to inform the microcomputer of changes in setup in the hardware selection jumpers (see **Figure 16 Configuration Jumper Location**). Each channel has 3 switches to represent the thermocouple type or millivolt measurement that is performed.

Switch Position	BCD Value	Measurement Selected
OFF OFF OFF	0	Millivolt
OFF OFF ON	1	E
OFF ON OFF	2	J
OFF ON ON	3	K
ON OFF OFF	4	L
ON OFF ON	5	R
ON ON OFF	6	S
ON ON ON	7	T

2.4.3 Selecting Thermocouple Type Input via Hardware Jumpers

Locate the hardware Thermocouple Compensation Jumpers corresponding to input channels 1 through 16. These jumpers are located adjacent to the input terminal strip (see **Figure 16 Configuration Jumper Location**). For each input channel, select either millivolt input or thermocouple type by placing the jumper in the correct position.

2.4.4 Selecting PLC Login Mode

Locate JP68 on the printed circuit board to select PLC Login Mode (**Figure 16 Configuration Jumper Location**). Standard login is 16WX registers in the PLC. Advanced Operating Mode logs in as 16X, 16Y, 32WX and 32WY registers. Consult the CTI 255x Sixteen Channel Advanced Function Programming Reference Manual if the advanced operating mode is to be selected.

2.4.5 Selecting Data Format

Locate SCALE jumper JP69 on the printed circuit board (**Figure 16 Configuration Jumper Location**). Select Engr to present data to the PLC as temperature X10 or Millivolt X100. Select SCALE to scale and present data as an unsigned integer from 0-32000.

NOTE:
Engineering Data Format must be selected for millivolt mode.

2.4.6 Selecting Digital Filtering

Locate the Digital Filtering Jumper JP67 (**Figure 16 Configuration Jumper Location**). To enable digital filtering, set the jumper in the "ENABLED" position. Since many analog input signals contain noise, CTI recommends using digital filtering unless maximum response time is required. Digital filtering applies to both thermocouple or millivolt inputs.

The time step for digital filtering is .080 seconds. The filtering technique used provides that the full range of a voltage change reported to the PLC will be accomplished in 5 time steps or .40 seconds. The voltage change will be reported as a continuous exponential function over this time period with values at each time step as indicated at .08 seconds, the value is 63% of full range at .16 seconds, the value is 86% of full range at .24 seconds, the value is 95% of full range, and at .40 seconds, the value is 99% of full range.

2.4.7 Select Degrees Celsius or Fahrenheit

Locate the temperature scaling jumper JP66 on the right hand side of the module (see **Figure 16 Configuration Jumper Location**) and select either degrees Celsius or Fahrenheit by positioning the jumper in the "DEG C" or "DEG F" position.

2.4.8 Factory Settings

CHANNEL NUMBER	HARDWARE SELECTION	DIP SWITCH SELECTION
1	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
2	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
3	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
4	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
5	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
6	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
7	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
8	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
9	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
10	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
11	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
12	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
13	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
14	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
15	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF
16	E, **J** / K, / mV / L / R, S, T	010 OFF / ON / OFF

ALL CHANNELS	FAHRENHEIT / CENTIGRADE SELECT JP66	DIGITAL FILTERING JP67	LOGIN MODE JP68	DATA FORMAT JP69
1-16	**Left - Degrees C** Right - Degrees F	Left - Disabled **Right - Enabled**	**Left - Standard 16WX** Right - Advanced	**Left - Engr (Temp X10)** Right - Scale (0-32,000)

Figure 14 Factory Configuration Jumper and DIP Switch Settings

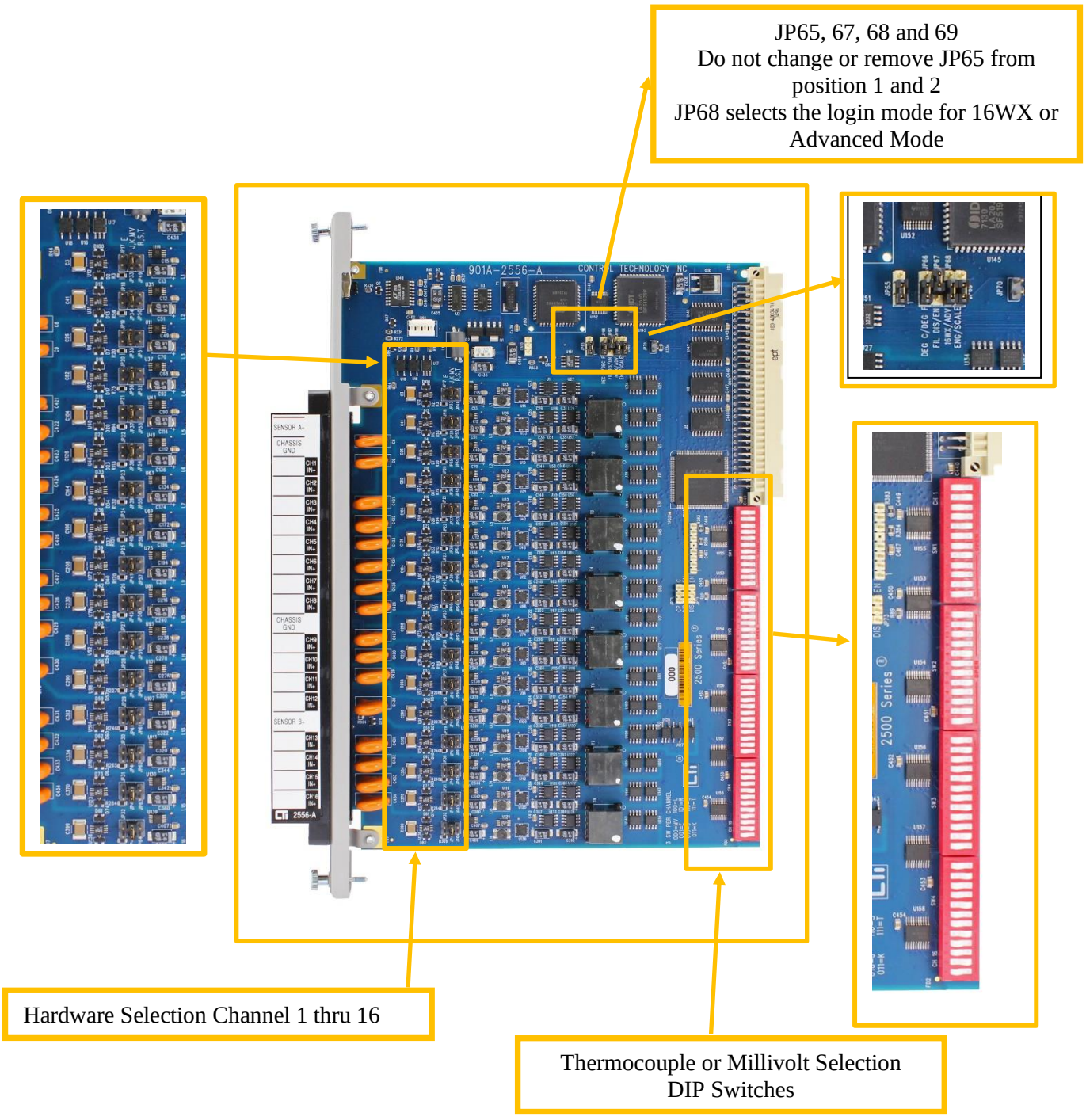

Figure 15 Printed Circuit Board Layout

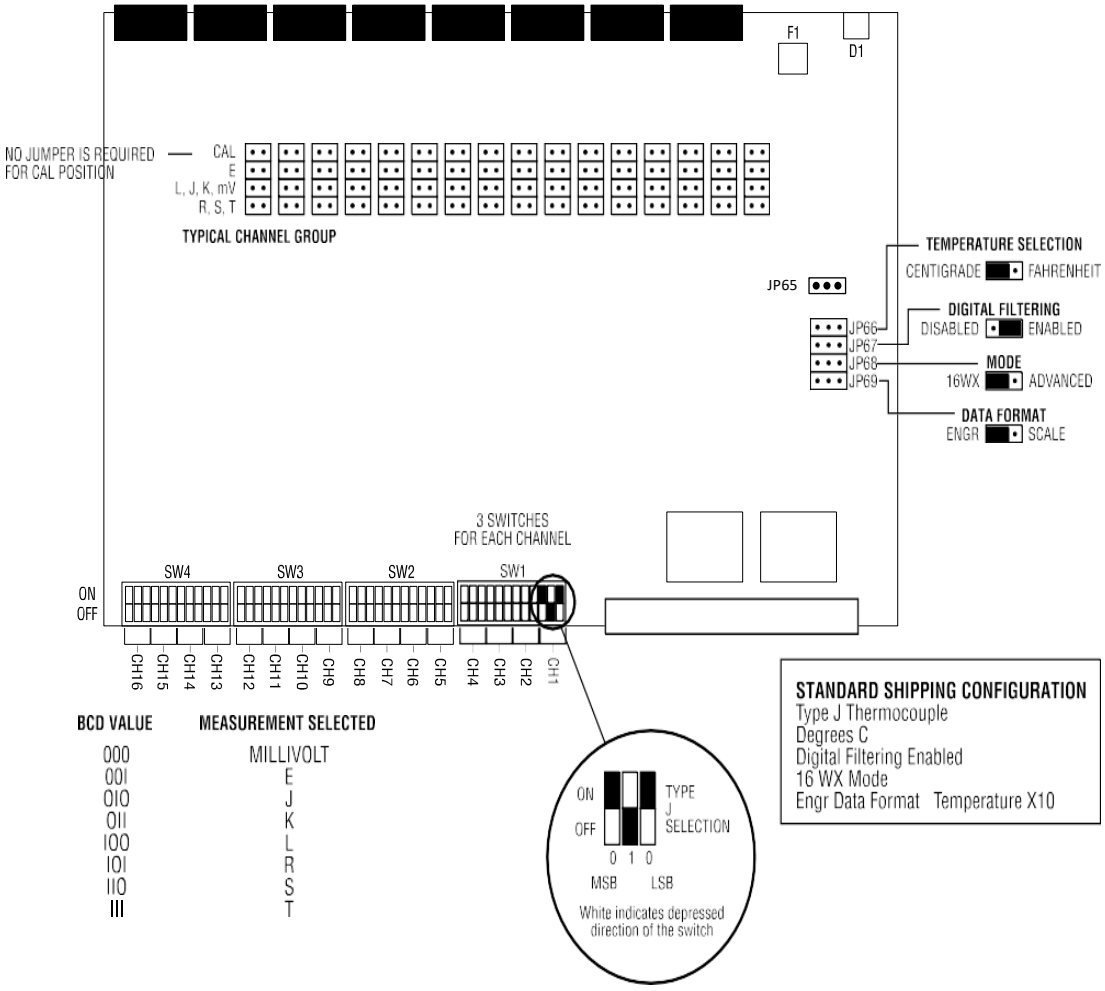

Figure 16 Configuration Jumper Location

> ***WARNING:***
> *Remove power from the I/O base before inserting or removing a module.*

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 the 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

Thermocouple input signals are accepted through a removable connector the 2559-FPC plugged into the front of the module. Consult the thermocouple manufacturer's recommendations for selecting the input wire type and size. The front connector accepts wire from 14 to 22 AWG.

To assign an input to a specific channel, locate the appropriate channel position on the connector as shown in the following figure. Wires must be inserted by pressing the wire into the connector receptacle and tightening the cage clamp screw. To remove the wire unscrew the cage clamp screw then remove the thermocouple wire.

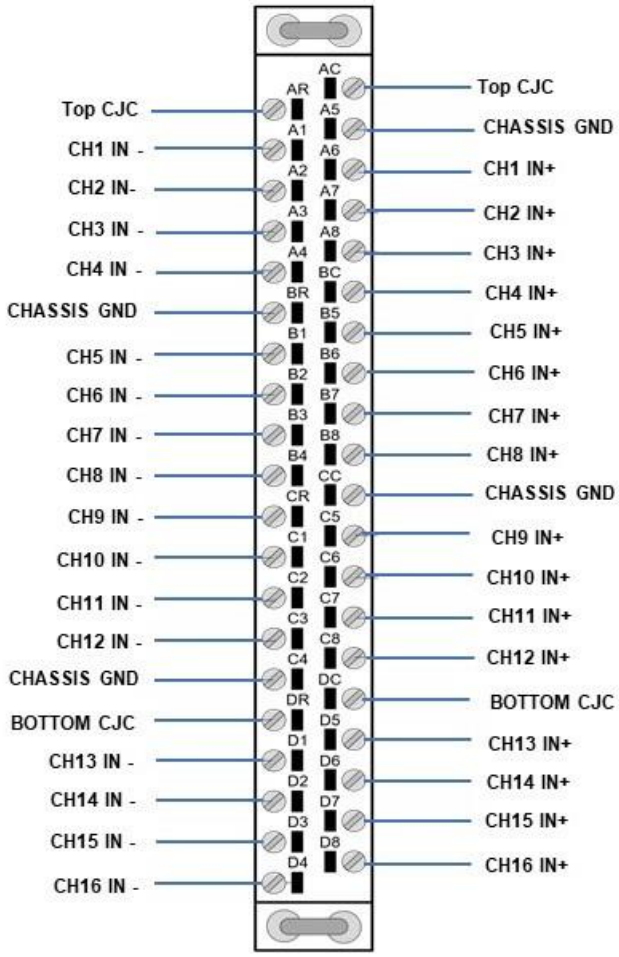

Figure 17 Input Connector Wiring

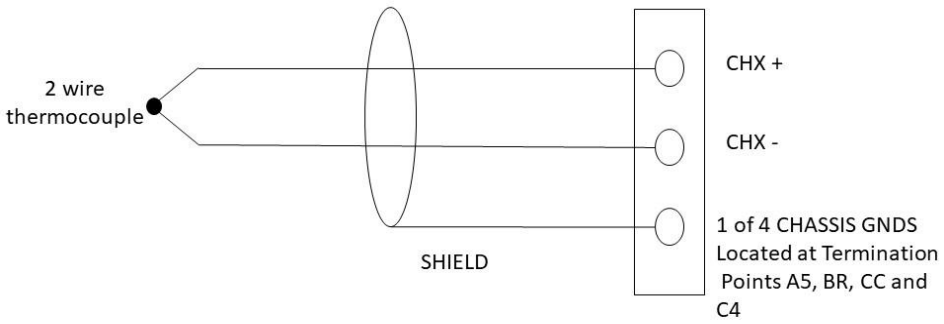

Figure 18 Thermocouple Wiring Application

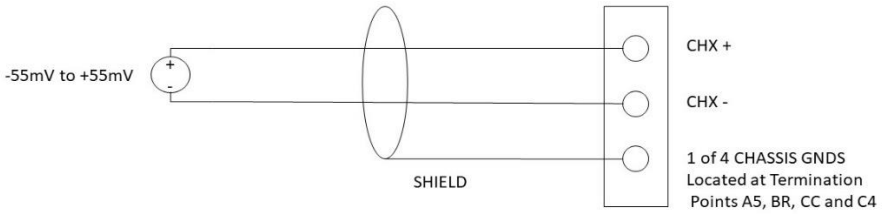

Figure 19 Millivolt Wiring Application

2.6.1 Connecting the Shield Wiring

Control Technology Inc. recommends that all signal wires be shielded twisted-pair with foil wrap shield and a separate drain wire and that they be installed in a metallic conduit. Use Belden cable 8761 or equivalent whcih 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 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 to 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 Chassis Ground terminal which may be used for the shield wire.

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 at the PLC module terminating to the chassis ground screw terminal on the wiring connector. The PLC chassis should then be wired to earth ground with a large current capacity conductor. CTI recommends using a #8 gauge wire from the PLC chassis to the earth ground connection.

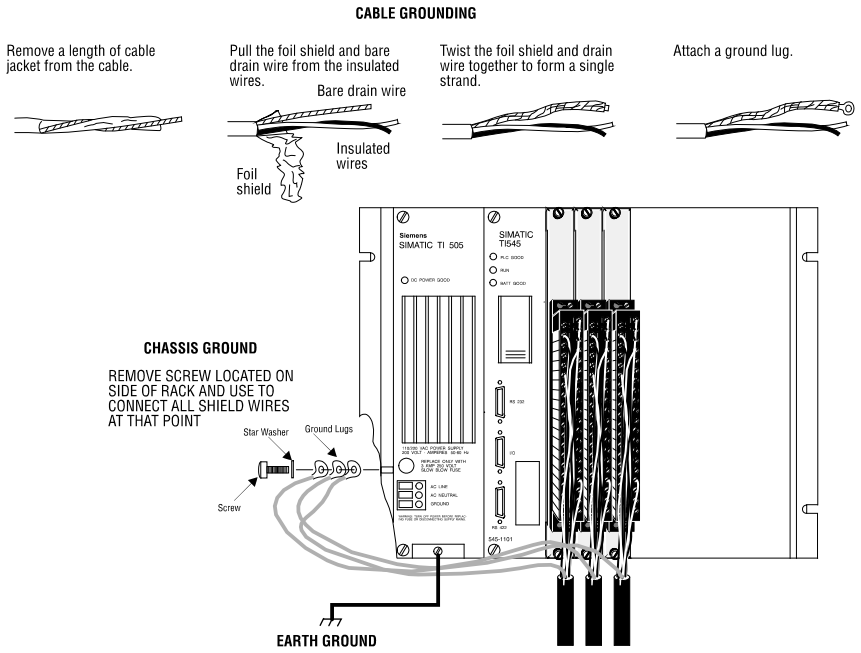

Figure 19 *Cable Grounding*

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 example chart is shown in the Figure 17.

> ***NOTE:***
> *If thermocouples are not available for testing, the module will report ambient temperature by simply jumpering the (CH# +) and (CH# -) terminals with a short wire 14-22 gauge. This will verify that all channels are operating and that the module is logged into the PLC.*

In this example, the Model 2556-A 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, etc. 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 I/O configuration chart again. If the line is still incorrect, contact your local distributor or CTI at 1-800-537-8398 for further assistance.

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

I/O SLOT	ADDRESS	X	Y	WX	WY	SPECIAL FUNCTION
01	0001	00	00	**16**	00	NO
02	0000	00	00	00	00	NO
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
15	0000	00	00	00	00	NO
16	0000	00	00	00	00	NO

Figure 20 Example I/O Configuration Chart

> ***NOTE:***
> *In Advanced Operating Mode the module logs into the PLC as a 16X, 16Y, 32WX and 32 WY.*

NOTE:

Refer to Hewlett-Packard Applications Note 290 or Omega Temperature Handbook, Volume 26, Section T, for "practical thermocouple measurement" applications.

CAUTION:

For proper operation, ensure that the Model 2556-A and the thermocouple wires are not subjected to large temperature gradients during operation.

NOTE:

In the event a CTI analog detects an onboard module failure, the module will assert the module fail line and report the module failure in the I/O Status Word, which is reported to the PLC CPU. CTI strongly recommends the user application monitor the ***I/O Module Status Words*** *which are Status Words 11-26 and apply to SIMATIC® Controllers /545, /555, /560 & 565 and the /575. The I/O Module Status Word can be used to report a module failure for an I/O Module in any of the 505 I/O slots. Please refer to Siemens® SIMATIC® 505 Programming Reference Manual for more information. If a module failure is reported by the status word, the module should be replaced with a working unit and the failed module sent infor repair.*

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.

When it is inconvenient to visually check the status indicator, use the TISOFT "Display Failed I/O" or "Show PLC Diagnostics" support functions.

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.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Indicator is not lit	Base or PLC power is off	Turn base or PLC on
	Wrong connections	Trace wiring to check connections
	Blown fuse	Measure F1 for continuity Short all inputs and verify ambient temperature measurement
Indicator is blinking	No calibration data	Return to CTI for calibration
Incorrect inputs	Wrong addresses for word input	Check program for correct word input addresses
	Not logged-in	Read I/O configuration
	Incorrectly calibrated	Return the module to CTI for calibration. DO NOT CALIBRATE.
	Blown fuse	Measure F1 for continuity Short all inputs and verify ambient temperature measurement
Input does not work with PID loop or analog alarm block	Value is not reported as integer 0-32000	Select SCALE format with JP69
Value is too large	Temperature is reported to PLC as value X10	Divide value by 10 in PLC
Incorrect values to PLC Values off by 10-15 degrees	Compensation jumpers in wrong position or DIP switch not set	Verify position of cold junction compensation jumpers for each channel and corresponding DIP switch for microcomputer

Figure 21 Troubleshooting Matrix

SPECIFICATIONS

Input Channels:
16 isolated thermocouple or millivolt inputs
Thermocouple Types: J, K, R, S, T, E, and L (DIN J). Each channel individually selectable.
Millivolt Input Range: -55 to +55 mV
Millivolt Input Impedance:
>100MΩ@ DC, >10KΩ@ 60 Hz
Millivolt Accuracy: ±0.5% full scale or ±500 µV
Input Overrange Protection:30 VAC/VDC
Measurement Ranges:
J -210°C to +760°C (-350°F to 1400°F)
K -270°C to 1372°C (-450°F to +2500°F)
R, S 0°C to +1768°C (32°F to +3214°F)
T -270°C to +400°C (-450°F to +752°F)
E -270°C to +1000°C (-450°F to +1832°F)
L (DIN J) -210°C to +900°C (-350°F to +1652°F)
Measurement Units:Degrees C or F selectable
Digital Filtering Time Constant:
80 mSec (16 WX mode), 80-6000 mSec
(Advanced mode)
Update Time (all 16 channels):
14 mSec no filtering
15 mSec digital filtering enabled
48 mSec advanced functions enabled
Repeatability: ±0.2°C or °F all thermocouple
types (16 WX mode)
±0.1°C or °F all thermocouple types
(advanced mode)
±50 µV (millivolt inputs)
Accuracy
For measurements above 0°C for types J, K, E, T, L or above 500°C for types R and S:
Types J, K, E, T, L
±0.5°C at 25°C ambient
±1°C from 0°C to 60°C ambient
0°C to full measurement range
±1°F at 25°C ambient
±2°F from 0°C to 60°C ambient
32°F to full measurement range
For measurements below 0°C or 32°F:
Types R, S
±1°C at 25°C ambient for
measurement range 500-1768°C
±2°C from 0°C to 60°C ambient
±2°F at 25°C ambient
±4°F from 0°C to 60°C ambient
Reduced accuracy for measurements below 500C
Millivolt Accuracy: ±50 µV from 0°C to 60°C
Millivolt Temperature Drift: 5ppm / °C
Common Mode Rejection: >130 dB@ >180 dB@ 60 Hz, >80db @ 50 Hz

Input ESD Protection: 2KV
Connector: 2559-FPC
Wire Gauge: 14 to 22 AWG
Module Size: Single wide
Backplane Power Consumption: 5 Watts

Isolation:
1500VDC channel-to-channel
1500VDC channel-to backplane

Shipping Weight: 1.5lbs. (0.68kg)

Additional Product Information:

On CTI's Website you find will links to the 2500 Series Std Environmental Specifications and the UL Agency Certificates of Compliance.

Standard Shipping Configuration:

Type J
Digital Filtering Enabled
Degrees C
16WX mode
Engineering Data Format Temp x 10

NOTE: This module requires a special connector the 2559-FPC. The connector is ordered separately.

JUMPER SETTINGS LOG SHEET

Record the configuration jumper settings on this log for future reference. Make additional copies if necessary.

CHANNEL NUMBER	HARDWARE SELECTION	DIP SWITCH SELECTION
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

ALL CHANNELS	FAHRENHEIT / CENTIGRADE SELECT JP66	DIGITAL FILTERING JP67	LOGIN MODE JP68	DATA FORMAT JP69
1-16	Left - Degrees C Right - Degrees F	Left - Disabled Right - Enabled	Left - Standard 16WX Right - Advanced	Left - Engr (Temp X10) Right - Scale (0 to 32,000)

Figure 22 *Factory Configuration Jumper Settings*

NOTE:

The Model 2556 Thermocouple Input Module is calibrated at the factory. No further calibration is required. All calibration parameters are sorted in non-volatile memory. There are no user adjustments on this product. As shipped there is no jumper required on the CAL input.

THERMOCOUPLE WIRE GUIDE

ANSI Code	Color Code: Thermocouple Grade	Color Code: Extension Grade	Lead Material: + Lead	Lead Material: - Lead	Magnetic Lead	Maximum Useful Temperature Range	EMF(mV) Over Useful Temperature Range
J	WHITE BROWN RED	BLACK RED	IRON Fe	CONSTANTAN COPPER-NICKEL Cu-Ni	IRON (+)	32 to 1382°F 0 to 750°c Ther To fg ,r a de 2 O to 200°c **Extension Grade**	O to 42.283
K	YELLOW BROWN RED	YELLOW YELLOW RED	CHROMEL NICKEL-CHROMIUM Ni-Cr	ALUMEL NICKEL-ALUMEL Ni-Al	ALUMEL(·)	-328 to 2282°F -200 to 1250°c T her To2 fg owa de O to 200°c **Extension Grade**	-5.973 TO 50.633
T	BROWN RED	BLUE RED	COPPER Cu	CONSTANTAN COPPER-NICKEL Cu-Ni	NONE	-328 to 662°F -200 to 350°C Ther _ g g'f1 ,ira de -60 to 100°c **Extension Grade**	-5.602to 17.816
E	PURPLE BROWN RED	PURPLE PURPE RED	CHROMEL NICKEL-CHROMIUM Ni-Cr	CONSTANTAN COPPER-NICKEL Cu-Ni	NONE	-328to 1652°F -200to 900°C Ther To2 fg ,r a de O to 200°c **Extensoi n Grade**	-8.824to 68.783
N	BROWN RED	ORANGE RED	OMEGA-P™ NICROSIL Ni-Cr-Si	OMEGA-N™ NISIL Ni-Si-Mg	NONE	-450 to 2372°F -270 to 1300°C Ther T 2°fg ,r a de O to 200°c **Extension Grade**	-4.345 to 47.502
R	NONE ESTABLISHED	GREEN RED	PLATINUM- 13%RHODUIM Pt-13% Rh	PLATINUM Pt	NONE	-32 to 2642°F 0 to 1450°C Ther T2°fg g ,rade 0 to 150°C **Extension Grade**	Oto 16.741
S	NONE ESTABLISHED	GREEN RED	PLATINUM- 10% RHODIUM Pt-10% Rh	PLATINUM Pt	NONE	-32 to 2642°F 0 to 1450°C T her Tt fg g owad e 0 to 150°C **Extensoi n Grade**	0 to 14.973
B	NONE ESTABLISHED	GREY GREY RED	PLATINUM- 30% RHODIUM Pt-30% Rh	PLATINUM- 6% RHODIUM Pt-6% Rh	NONE	3 2to 3092°F Oto 1700°C Ther To2 fg ,rade O to 100°c **Extensoi n Grade**	Oto 12.426
G	NONE ESTABLISHED	WHITE WHITE- BLUE TRACE RED	TUNGSTEN W	TUNGSTEN- 26% RHENIUM W-26%Re	NONE	-32 to 4208°F 0 to 2320°C Ther T2°fg g ,rade 0 to 260°C **Extension Grade**	O to 38.564
C	NONE ESTABLISHED	WHITE WHITE- RED TRACE RED	TUNGSTEN- 5%RHENIUM **W-5%Re**	TUNGSTEN- 26% RHENIUM W-26%Re	NONE	32 to 4208°F 0 to 2320°C The gug (.(ade 1 0 to 870°C **Extension Grade**	0 to 37.066
D	NONE ESTABLISHED	WHITE WHITE- YELLOW TRACE RED	TUNGSTEN- 3% RHENIUM **W-3%Re**	TUNGSTEN- 25%RHENIUM W-25%Re	NONE	32 to 4208°F 0 to 2320°C Ther Ta fg g, vade 2 0 to 260°C **Extension Grade**	0 to 39.506

USER NOTES

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 (RMA) number 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.