

SCADA 3000
THERMOCOUPLE INPUT MODULE

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First Edition, version 1.1, April, 2001.

Written and produced by Phonetics, Inc.

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Aston, PA 19014

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For information on updates to the manual and supplements, check our website at

www.sensaphone.com

IMPORTANT SAFETY INSTRUCTIONS

Your THERMOCOUPLE INPUT MODULE has been carefully designed to give you years of safe, reliable performance. As with all electrical equipment, however, there are a few basic precautions you should take to avoid hurting yourself or damaging the unit:

- Read the installation and operating instructions in this manual carefully. Be sure to save it for future reference.
- Read and follow all warning and instruction labels on the product itself.
- To protect the Thermocouple Input Module from overheating, make sure all openings on the unit are not blocked. Do not place on or near a heat source, such as a radiator or heat register.
- Do not use your Thermocouple Input Module near water, or spill liquid of any kind into it.
- Be certain that your power source matches the rating listed in the specification section of this manual. If you're not sure of the type of power supply to your facility, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.
- Do not overload wall outlets and extension cords, as this can result in the risk of fire or electric shock.
- Never push objects of any kind into this product through ventilation holes as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.
- To reduce the risk of electric shock, do not disassemble this product, but return it to Phonetics' Customer Service, or another approved repair facility, when any service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the unit is subsequently used.
- If anything happens that indicates that your Thermocouple Input Module is not working properly or has been damaged, disconnect it immediately and follow the procedures in the manual for having it serviced. Return the unit for servicing under the following conditions:
 1. Liquid has been spilled into the product or it has been exposed to water.
 2. The unit has been dropped, or the enclosure is damaged.
 3. The unit doesn't function normally when you're following the operating instructions.

FCC Requirements

Part 15: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Thermocouple Input Module Supplement

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Introduction

The SCADA 3000 Thermocouple Input Module is an optional component for use with the SCADA 3000 system. The module features four thermocouple inputs that can be independently configured to accept type E, J, K, T, R, or S thermocouples. The module also features a microprocessor watchdog circuit to maintain system reliability. LED indicators are provided to show system power and module operation via a blinking pulse LED.

What is a thermocouple?

A thermocouple is a temperature measurement sensor, consisting of two dissimilar metals joined together (coupled) at one end (a junction), that produces a small thermoelectric voltage when the junction is heated. The change in thermoelectric voltage is measured by the module and is converted to a temperature reading. Thermocouples are used in industry because of their wide temperature range and low cost. Typically, they are used to measure temperatures of industrial processes that are either very hot (100° to 1600° C) or very cold (0° to -270°C). When using thermocouples it is critically important to use proper wiring techniques because the voltage generated by the thermocouple is extremely small (6-52 μ V per degree C).

Technical Support

If any questions arise upon installation or operation of the Thermocouple Input Module, please contact Phonetics Customer Service Department at the number shown below and have the following information:

- Date of purchase _____
- Serial number _____

Technical support is available from 8:00 AM to 5:00 PM, EST.

You can also contact technical support at any time via e-mail at: support@sensaphone.com

Phonetics, Inc.
 901 Tryens Road
 Aston, PA 19014
 Phone: (610)558-2700
 FAX: (610)558-0222
www.sensaphone.com

INSTALLATION

This chapter provides information necessary to install the Thermocouple Input Module. Correctly installing the unit will ensure proper functioning and maximum service life. Please read the entire chapter before attempting installation.

OPERATING ENVIRONMENT

The Thermocouple Input Module should be mounted and operated in a clean, dry and safe environment. Do not mount the unit where it will be subject to shock and vibration. Do not mount the unit where it will be subject to dirt, dust or moisture. Ideally the unit would be mounted in a steel or a fiberglass NEMA-4 enclosure. Do not mount the unit or the expansion modules close to motor starters, contactors or relays that switch inductive loads. These devices generate large electromagnetic fields that can cause the Thermocouple Input Module to malfunction. Where this is unavoidable, mount the module(s) and main unit in a separate, grounded, steel enclosure. This will shield them from harmful electrical interference.

The temperature range the Thermocouple Input Module can operate in is 32°F to 158°F (0°C to 70°C). If you require Thermocouple Input Module to operate in a below freezing environment, you must take safe and practical measures to keep the module's temperature above 32°F or it will not operate reliably.

CAUTION: The Thermocouple Input Module is a sensitive electronic device. Personnel and work area should be grounded before handling this device. Do not install a SCADA 3000 system near any strong electrostatic, electromagnetic, magnetic or radioactive fields. Do not expose it to fumes or corrosive vapors.

MOUNTING THE THERMOCOUPLE INPUT MODULE

When you receive the Thermocouple Input Module, carefully remove it from the box. On the top and bottom of the enclosure are mounting holes to attach the unit to either a panel or wall. The mounting surface should be sturdy enough to support 2 lbs. The unit should be mounted using four #10-32 bolts where appropriate, or four #10 tapping screws. (The screw kit for the Thermocouple Input Module includes 4 #10-32 screws, 4 #10-32 nuts, 4 #10 lockwashers, and 2 #6-32 screws, 2 #6-32 nuts, and 2 #6 lockwashers. The #6 hardware is for the power supply, if necessary.) When mounting the unit to a wall make sure the mounting screws fully engage a solid member (for example, a stud) of the support structure. Mount the Thermocouple Input Module in an upright position so that you can easily connect wires to the terminal strips. The dimensions of the full enclosure are: 6.1" x 6.3" x 1.2". See Figure 1.

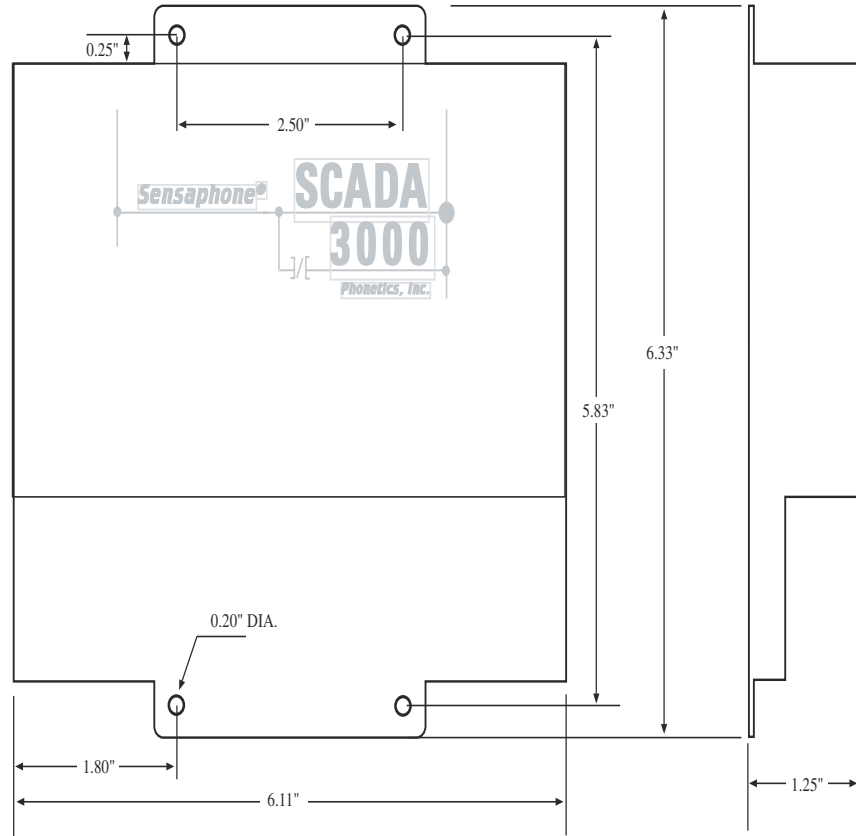


Figure 1: Module Mounting Dimensions

Power Supply and Grounding

The Thermocouple Input Module operates on 10-15VDC. Typically the module is powered from the AUX PWR terminals on the SCADA 3000 main unit. This is preferred because the AUX PWR from the main unit is battery-backed in the event of a power failure, when a battery is connected to the main unit. Alternately, you may connect the module to any 10-15VDC power source. The module requires 1.5 Watts of power.

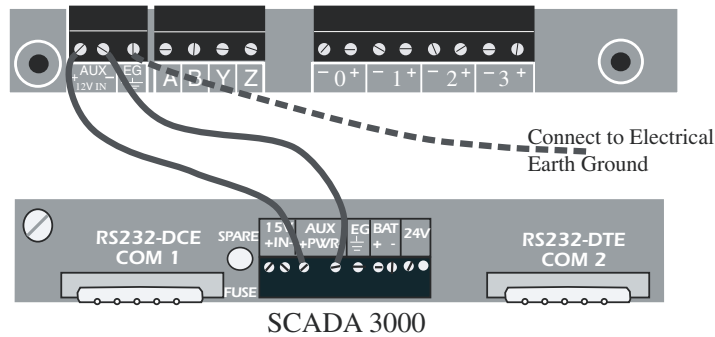


Figure 2. Module powered from the main unit

It is extremely important that the EG pin be connected to a good earth ground. This will prevent communication errors due to differences in ground potential between modules in addition to possible damage due to voltage transients and surges.

The two LED lights in the center of the module, marked *Power* and *Pulse*, indicate that the module is receiving power and operating properly. The Pulse LED will blink at a regular rate, like a heartbeat, once it establishes communication with the main unit.

Communications Wiring

The Thermocouple Input Module communicates with the SCADA 3000 using a high-speed serial communications bus. This 4-wire bus is used to connect up to 15 modules to the main unit to provide additional inputs and/or outputs. The communications cable must be **4-Conductor Twisted Pair**. You may use unshielded cable in electrically quiet environments, but be sure to use shielded cable if your cabling must navigate around electrical machinery or equipment.

Modules may be located a maximum of 2000' away from the main unit and should be connected in a daisy-chain fashion from one module to the next. Each module connects to the next via a 4-wire communications cable connected to the terminals labeled **A, B, Y & Z**. The cable must be **4-Conductor Twisted Pair** (shielded or unshielded) with a nominal impedance of 120Ω (for example, Belden #8132 or 9842 cable). Use one pair for A & B and the other pair for Y & Z. Note how the wiring is reversed between the first module and the main unit but between modules the wiring is straight-thru. The proper wiring from the main unit to the modules, and from module to module, is shown in Figure 3:

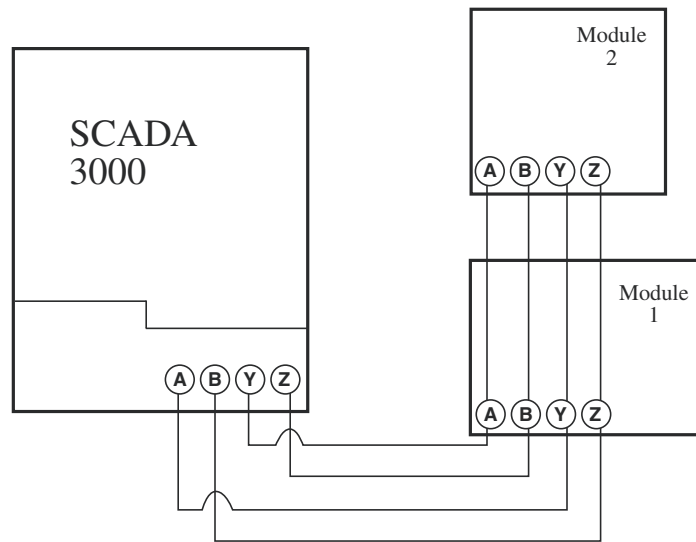


Figure 3: **Incorrect** daisy chain setup: Main unit in the middle of the chain.

The Main Unit should always be on one end of the chain, never in the middle.

Cabling Notes

Follow these guidelines to protect the communications cable from electrical interference.

- Keep the communications cable at least five feet from any electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation.
- If you must run the cable across power lines, run them at right angles to the lines.

- Keep the communications cable at least 6 inches from AC power lines carrying less than 20A, at least 1 foot from lines greater than 20A, and 2 feet from lines greater than 100KVA.
- If you run the cable in a metallic wireway or conduit, keep the communications cable at least 3 inches from AC power lines carrying less than 20A, at least 6 inches from lines greater than 20A, and 1 foot from lines greater than 100KVA.

Running the communications cable through conduit provides extra protection from physical damage and electrical interference. If you route the cable through conduit be sure to ground the entire length by connecting it to the building earth ground. For even best results, use ferromagnetic conduit near critical sources of electrical interference. You can use aluminum conduit in non-critical areas.

Each module must be configured with its own **unique** address using the BUS ADDRESS jumpers. You may mix & match up to 15 modules to suit your application's requirements. The example below shows a Bus Address setting of 9.

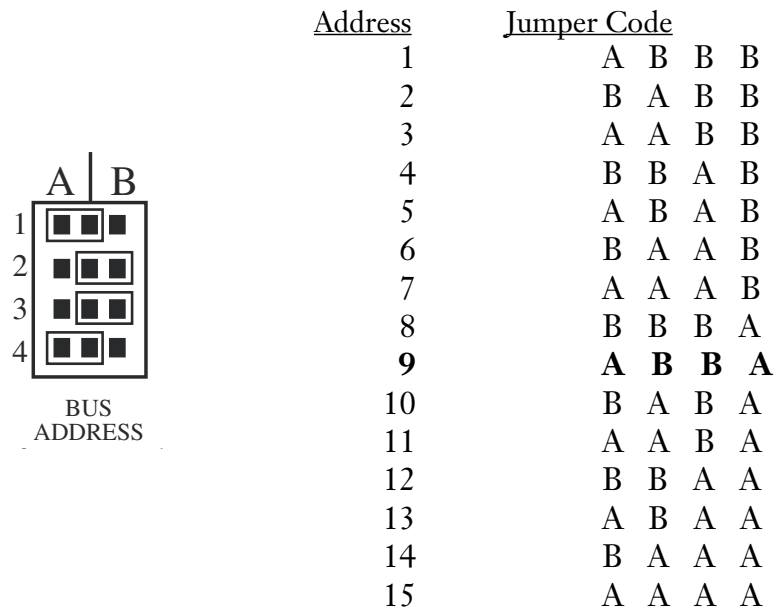


Figure 4: Setting the Bus Address

Bus Termination

Located on each module is a jumper labeled BUS TERM. This jumper is used to terminate the 4-wire communications bus.

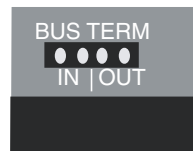


Figure 5: Bus Termination jumper

Termination is required at the extreme ends of the communications network to minimize signal reflections that would otherwise cause data communication errors. To activate the Bus Termination, move the jumper to the IN position. Note that this should only be activated if the module is at the very end of the network. All other modules in between should have the termination set to the OUT position. As a result, only 1 module should ever have the termination activated. The diagram below illustrates proper termination of the communications bus.

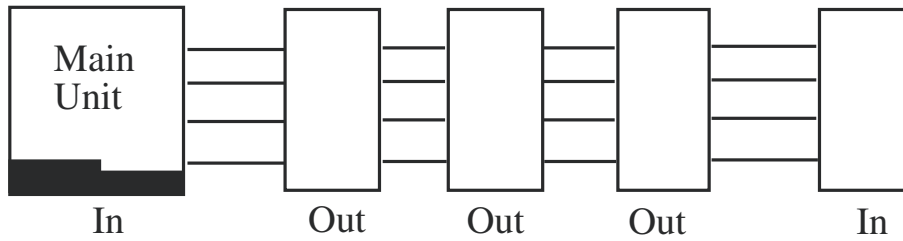


Figure 6: Correct bus termination

Thermocouple Wiring Information

The Thermocouple Input Module features four thermocouple inputs that can be independently configured to accept type E, J, K, T, R, or S thermocouples. The configuration is selected by moving the jumper behind the terminal strip into the appropriate position (see Wiring & Jumpers figure following).

There are thermocouples available for virtually every kind of application (surface measurement, liquid, semi-solids, gas or vacuum, ovens, molds, dies, etc...). Only thermocouples that are type E, J, K, T, R, & S are compatible with the Thermocouple Input Module. Manufacturers of thermocouples can help you select the best thermocouple for your application.

Thermocouples can be connected directly to the input terminals but be sure to match the polarity markings on the module with the thermocouple. In the thermocouple industry, standard practice is to color the negative lead red. Bare wire thermocouples usually make the negative lead shorter than the positive one. On thermocouples with a connector, the large pin is always the negative conductor. When adding extension wire to a thermocouple sensor, you must always use thermocouple alloy wire to assure accurate measurements. The following diagram shows several thermocouples connected to the module:

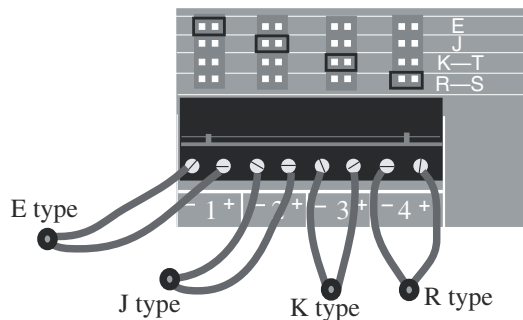


Figure 7: Thermocouple Wiring & Jumpers

To minimize electrical noise coupling between I/O lines, follow the guidelines listed below for routing your wires:

- Route the power supply and communications cables to the module by a separate path from wiring to I/O devices. Where paths must cross, their intersection should be perpendicular.
- Do not run signal or communications wiring and power in the same conduit.

- Segregate I/O wiring by signal type. Bundle wiring with similar electrical characteristics together.
- Allow at least two inches between the module and I/O wiring ducts.

Terminal Blocks

The three terminal blocks on the Thermocouple Input Module are all removable for faster and more convenient wiring of the I/O module. They should only be removed or attached when power to the module is OFF. To remove the terminal blocks use your thumb or forefinger to push the screw section of the terminal block straight out (see Figure 8).

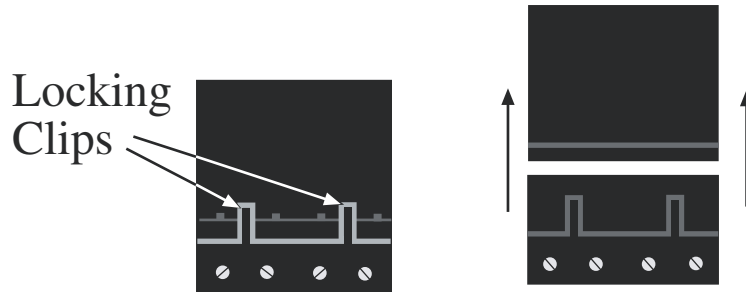


Figure 8: Removing a terminal block

HOW THE THERMOCOUPLE INPUT MODULE WORKS

The Thermocouple Input Module measures the signal produced by the connected thermocouples and transmits this data back to the SCADA 3000 CPU via the 4-wire communications bus. The SCADA 3000 CPU must be configured correctly in software, for the type of thermocouple connected on each input. The temperatures measured from the thermocouples can be used in the ladder program or C-program to perform control functions. You may even choose to just monitor or datalog the temperature and activate alarms based on high and low set-points.

Once the module is properly wired to the main unit and power is turned on to both devices, the main unit will scan the module communications network to determine which modules are connected. Next, default programming will be loaded into each module. When you go on-line with the main unit, the thermocouple module icon will appear on the main unit form, indicating that a thermocouple module was found at the corresponding address.

PROGRAMMING THE THERMOCOUPLE MODULE

To program the Thermocouple Input Module, click on the thermocouple icon on the main unit form. The figure below shows the icon at address 1 and has the letters TH on it.



Figure 9: Main Unit form with Thermocouple

When you click the icon, the Thermocouple programming form will appear (see figure below). This form is similar to the other I/O programming screens. Although you can only measure four thermocouples, eight name locations appear because the module will provide the temperature in degrees Fahrenheit on channels 0 through 3, and in degrees Celsius on channels 4 through 7. Enter names corresponding to the process you will be measuring.

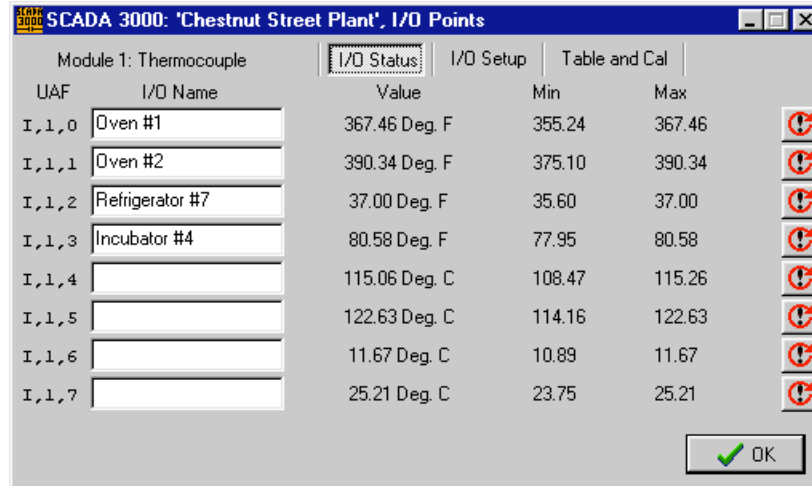


Figure 10: Thermocouple Programming form

To configure the thermocouple types, click on the *I/O Setup* tab. The Setup screen is shown below. Choose the type of thermocouple from the pull-down menu. To calibrate the Thermocouples, click on the *Table and Cal* tab and enter the calibration adjustment (temp ± calibration) accordingly.

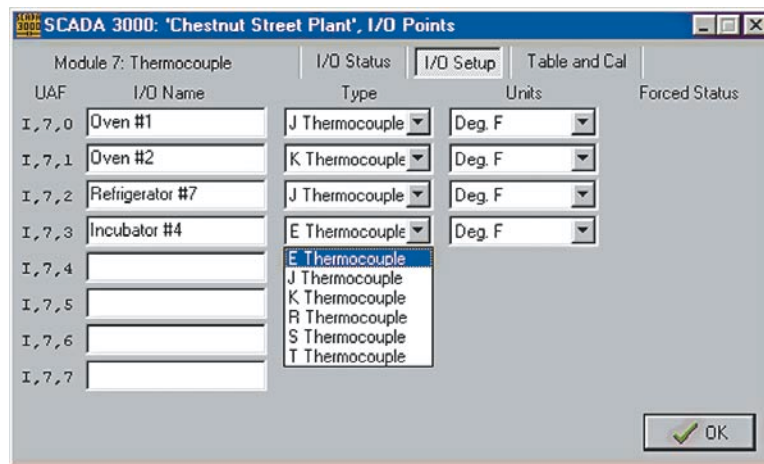


Figure 11: I/O Setup screen

Appendix A: Specifications

Number of Inputs	4 channels
Resolution	16 bits
Thermocouple Type & Temperature Range E type J type K type T type R type S type	-270° to 1000° C (-454° to 1832° F) -270° to 1000° C (-454° to 1832° F) -270° to 1300° C (-454° to 2372° F) -270° to 600° C (-454° to 1112° F) 0° to 1600° C (32° to 2912° F) 0° to 1550° C (32° to 2822° F)
LED Indicators	Power LED & Pulse LED (heartbeat)
Network Data Rate	153.6 Kbps
Bus Termination Impedance	120 Ohms
Power Requirements	10-15VDC 100mA (max.), 1.5W
Power Fuse Rating & type	500mA 250V, Size TR-5 (Wickmann # 19372-041-K)
Terminal Block Wire Size	#14AWG to #24AWG
Operating temperature	0° to 70°C (32° to 158° F)
Storage Temperature	-20° to 70° C (-4° to 158° F)
Humidity	5 to 90% non-condensing
Dimensions	6.1" x 6.3" x 1.2"
Weight	0.75 lbs.
Enclosure	Aluminum housing with integral mounting flanges for wall or panel installation.

Appendix B: Troubleshooting

Problem: The temperature reading is way off.
Solution: Check the configuration jumper on the module. Check the software and make sure it has been configured for the proper thermocouple type. Check the polarity of the thermocouple.
Problem: I have power wired to the Thermocouple Input Module but no lights are on.
Solution: Check the power supply terminals to see if 10-15VDC is present. If it is, you probably have a blown fuse. See the replacement parts list.
Problem: The power light is on but the pulse light is not blinking.
Solution: There is no communication between the Module and the main unit. Check the communication wiring. Make sure the main unit is on and functioning. Make sure the module has a valid and unique address. Try powering up both devices.

Appendix C: Replacement Parts

This appendix provides a list of replacement parts and part numbers for the FGD-3030 Thermocouple Input Module. Contact the Phonetics Customer Service Department for availability (610)558-2700.

ASY-0050	Thermocouple Input Module Circuit Board
CON-0033	2 Position Jumper Shunt
CON-0034	4 Position Terminal Block Plug
CON-0101	8 Position Terminal Block Plug
CON-0106	3 Position Terminal Block Plug
FUS-0005	500 mA 250V TR5-style Time-Lag Fuse (Wickmann #3720500041)
HSG-0022	Enclosure Base
HSG-0047	Enclosure Cover
LIT-0032	SCADA 3000 Thermocouple Input Module Owners Manual Supplement

Appendix D: Returning Module for Service

In the event that the Thermocouple Input Module does not function properly, we suggest that you do the following:

- 1) Record your observations regarding the Thermocouple Input Module malfunction.
- 2) Call the Customer Service Department at (610)558-2700 prior to sending the unit to Phonetics for repair.

If the module must be sent to Phonetics for Servicing, please do the following:

- 1) Disconnect all wiring and unplug the unit.
Note that the terminal blocks can be unplugged from the unit to maintain your input wiring.
- 2) Carefully pack the module to avoid damage in transit. Use the original container (if available) or a sturdy shipping box.
- 3) You must include the following information to avoid shipping delays:
 - a) Your name, address and telephone number.
 - b) A note explaining the problem.
- 4) Ship your package to the address below:

SERVICE DEPARTMENT
Phonetics Inc.
901 Tryens Road
Aston, PA 19014
- 5) Ship prepaid and insured via UPS or US Mail to ensure a traceable shipment with recourse for damage or replacement.

Important Information for Canadian Customers

In the event that your Sensaphone Thermocouple Input Module does not function properly, Canadian customers have the option of shipping the unit to one of the following Phonetics-authorized Canadian Repair facilities:

Microwise Computer Systems
100 Covington Crescent
Kitchener, Ontario N2N 2X3
(519) 744-9892

G.A.S. Analytical Systems, Ltd.
Head Office
Bay V, 1338 36 Avenue NE
Calgary, Alberta T2E 6T6
(403) 253-6576

Please record your observations regarding the unit's malfunction and follow the procedures outlined on the previous page.

For Technical Support questions, you may call Phonetics Technical Service Department at (610) 558-2700, or by E-mail at support@sensaphone.com.

3 YEAR LIMITED WARRANTY

1. **WARRANTOR:** Dealer, Distributor, Manufacturer
2. **ELEMENTS OF WARRANTY:** This Product is warranted to be free from defects in materials and craftsmanship with only the limitations and exclusions set out below.
3. **WARRANTY AND REMEDY: Three-Year Warranty** — In the event that the Product does not conform to this warranty at any time during the time of three years from original purchase, warrantor will repair the defect and return it to you at no charge

This warranty shall terminate and be of no further effect at the time the Product is (1) damaged by extraneous cause such as fire, water, lightning, etc. or not maintained as reasonable and necessary; (2) modified; (3) improperly installed; (4) repaired by someone other than warrantor; (5) used in a manner or purpose for which the Product was not intended; or (6) sold by original purchaser.

WARRANTORS' OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT. THIS WARRANTY DOES NOT COVER PAYMENT OR PROVIDE FOR THE REIMBURSEMENT OF PAYMENT OF INCIDENTAL OR CONSEQUENTIAL DAMAGES.

It must be clear that the warrantors are not insuring your premises or guaranteeing that there will not be damage to your person or property if you use this Product. The warrantors shall not be liable under any circumstances for damage to your person or property or some other person or that person's property by reason of the sale of this product or its failure to operate in the manner in which it is designed. The warrantors' liability, if any, shall be limited to the original cost of the Product. The warrantors assume no liability for installation of the Product and/or interruptions of the service due to strikes, riots, floods, fire, and/or any cause beyond Seller's control.

4. **PROCEDURE FOR OBTAINING PERFORMANCE OF WARRANTY:** In the event that the Product does not conform to this warranty, the Product should be shipped or delivered freight prepaid to a warrantor with evidence of original purchase.
5. **LEGAL REMEDIES:** This warranty gives you specific legal rights, and you may also have other rights which vary from state to state to the extent allowed by law expressly in lieu of any other express or implied warranty, condition, or guarantee.

Effective date: 1 November 1998

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