

SCADA 3000
UNIVERSAL INPUT MODULE

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Written and produced by Phonetics, Inc.

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For information on updates to this manual, check our website at
www.sensaphone.com

IMPORTANT SAFETY INSTRUCTIONS

Your UNIVERSAL 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 Universal 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 Universal 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 Universal 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.

Universal Input Module Supplement

Contents

IMPORTANT SAFETY INSTRUCTIONS	3
FCC Requirements	3
INTRODUCTION	5
Technical Support	5
INSTALLATION	6
OPERATING ENVIRONMENT	6
MOUNTING THE UNIT	6
POWER SUPPLY AND GROUNDING	7
COMMUNICATIONS WIRING	7
Bus Termination	9
Sensor/Transducer Wiring	9
General Wiring Considerations	9
Normally Open/Normally Closed Dry Contacts	10
10K Thermistors	10
Analog Voltage Output Transducers (0-5VDC)	11
4-20mA Current Loop Transducers	12
HOW THE UNIVERSAL INPUT MODULE WORKS	13
APPENDIX A: 10K THERMISTOR CURVE DATA	14
APPENDIX B: SPECIFICATIONS	15
APPENDIX C: TROUBLESHOOTING	16
APPENDIX D: REPLACEMENT PARTS	17
APPENDIX E: RETURNING FOR SERVICE	18
WARRANTY	19

Introduction

The SCADA 3000 Universal Input Module is an optional component for use with the SCADA 3000 system. The input channels are identical to those included on the SCADA 3000 main unit. The Universal Input Module features eight channels that can be configured to interface with several different types of sensors and transducers, including: Normally Open/Normally Closed dry contacts, digital logic, Run time Accumulation, 0-5V analog, 4-20mA analog and 10K thermistor (°C & °F). The module features 12-bit resolution, differential inputs, 24V supply for powering 4-20mA loops and low-power operation. Each input is protected by a 1500 Watt transient suppressor. In addition, a microprocessor watchdog circuit is integrated to maintain system reliability. LED indicators are provided to show system power and module operation via a blinking pulse LED.

Technical Support

If any questions arise upon installation or operation of the Universal 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

I. Installation

This chapter provides information necessary to install the Universal 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 Universal 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 Universal 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 Universal Input Module can operate in is 32°F to 158°F (0°C to 70°C). If you require Universal 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 Universal 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 UNIVERSAL INPUT MODULE

When you receive the Universal 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 Universal 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 Universal 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.

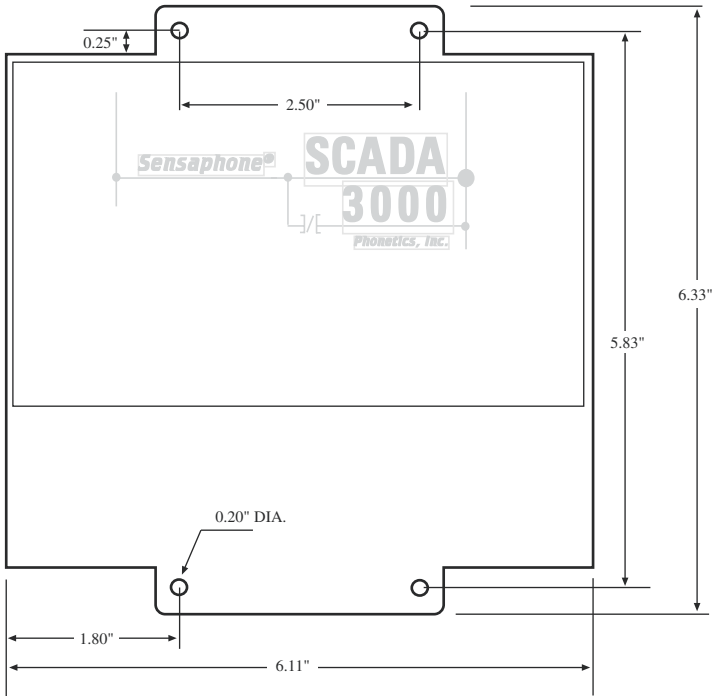


Figure 1: Module Mounting Dimensions

POWER SUPPLY AND GROUNDING

The Universal 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.

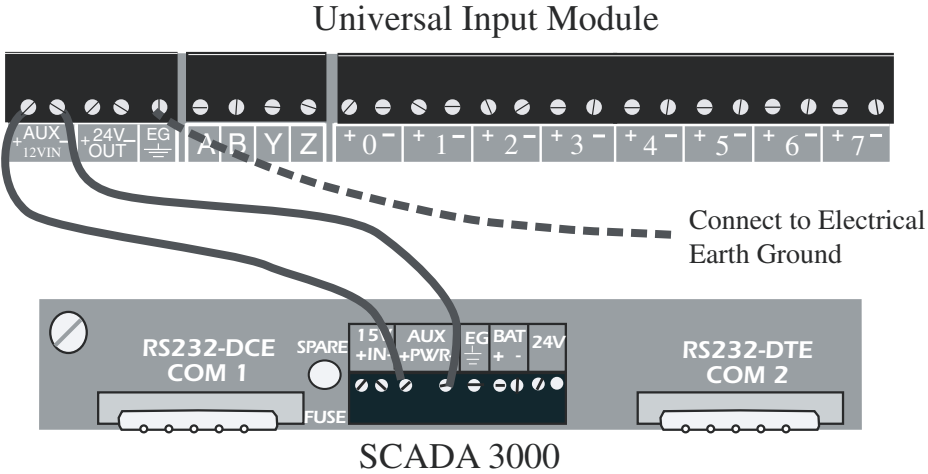


Figure 2: Universal Input Module connected to SCADA 3000

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.

The module generates a 24V power supply for use with 4-20mA transducers. Module power consumption will vary depending on how much power is being drawn from this supply. For estimation purposes add 38mA to the power consumption specification for every 4-20mA loop powered by the module. For example, since the module consumes 100mA by itself, if two 4-20mA transducers are connected to the 24V supply, then the estimated total power consumption should be 176mA.

COMMUNICATIONS WIRING

The Universal 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. Perform all wiring with power to the main unit and modules turned off.

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, Z & Y**. 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 Z & Y. The proper wiring from the main unit to the modules, and from module to module, is shown in Figure 3:

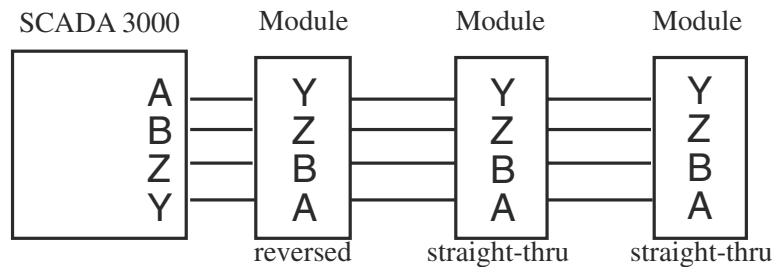


Figure 3: **Correct** daisy chain setup: Main unit on the end.

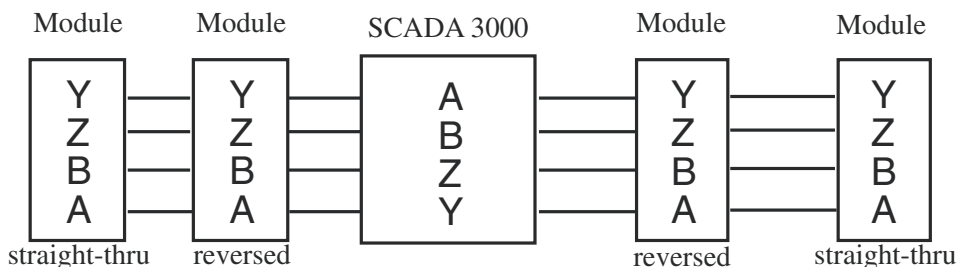


Figure 4: **Incorrect** daisy chain setup: Main unit in the middle of the chain.

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

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.

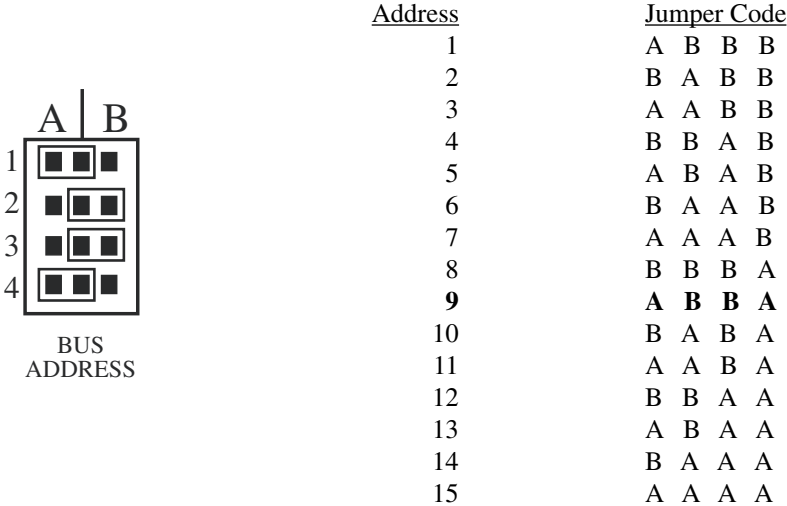


Figure 5: Setting the Bus Address

Bus Termination

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

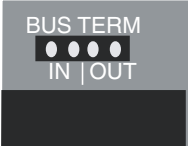


Figure 6: Bus Termination jumper

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.

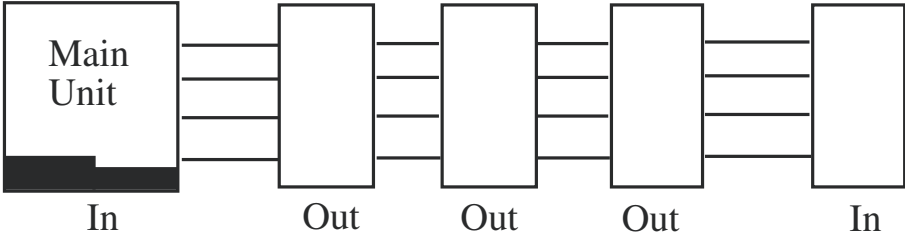


Figure 7: Correct bus termination

Sensor/Transducer Wiring

The Universal Input Module is compatible with a wide variety of electrical signal sources including contacts, 10K thermistors, analog voltage outputs and 4-20ma current sources. Each

type of signal requires the configuration jumpers, located behind the terminal strip, to be installed in the proper position for each type of signal. Follow the instructions below to properly wire and configure the inputs for each type of electrical signal. Note: Needlenose pliers will be required to move the jumpers.

Warning: The inputs are designed to work with low voltage signals from 0-5V. DO NOT connect differential voltages greater than 5V to the inputs. DO NOT connect 120VAC to the inputs. In the 4-20mA jumper position and when no jumper is installed, the inputs are differential and will work with signals that are +/-12V away from power supply ground. This allows the use of multiple 4-20mA circuits on one loop. See circuit schematics for more information.

General Wiring Considerations

Most dry contact sensors can be connected to the module using inexpensive 2-conductor cable as small as #24 AWG. For thermistor, 0-5V and 4-20mA sensors, use the wire chart below as a reference for selecting the appropriate wire gauge. Note that if the sensor is located far from the module or if you are running cable in an electrically noisy environment, you should seriously consider using twisted pair shielded cable. This will shield the signal from electrical interference thereby preventing false readings and/or damage to the module.

<u>Wiring Distance</u>	<u>Minimum Wire Gauge</u>
700'	#24 AWG
1500'	#22 AWG
2500'	#20 AWG

Normally Open/Normally Closed Dry Contacts

Dry contact sources consist of relays or switches that are isolated and have no external voltage applied. These devices can be connected directly to the input terminals without regard for polarity. Choose an input and connect the wires to the corresponding screw terminals for that input. The configuration jumper should be set to the TMP/DRY position. The figure below shows how to connect a dry contact sensor:

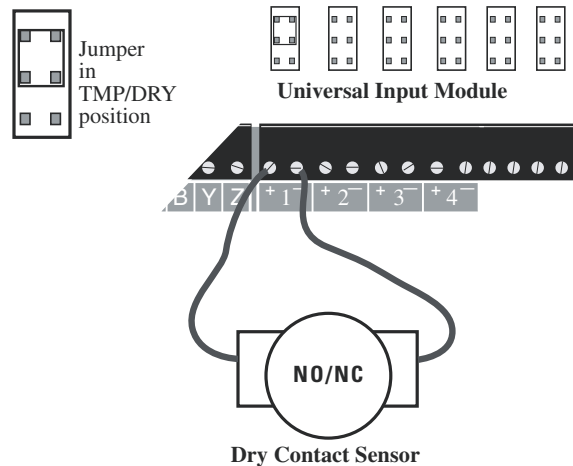


Figure 8: Wiring a Dry Contact Sensor

10K Thermistors

The Universal Input Module is compatible with 10K thermistors that match the curve data listed in the table in Appendix A. The monitoring temperature range of the 10K thermistor is -80 to 300°F (-62° to 149°C). These devices can be connected directly to the input terminals without regard for polarity. Choose an input and connect the wires to the corresponding screw terminals for that input. The configuration jumper should be set to the TMP/DRY position. The figure below shows how to connect a dry contact sensor:

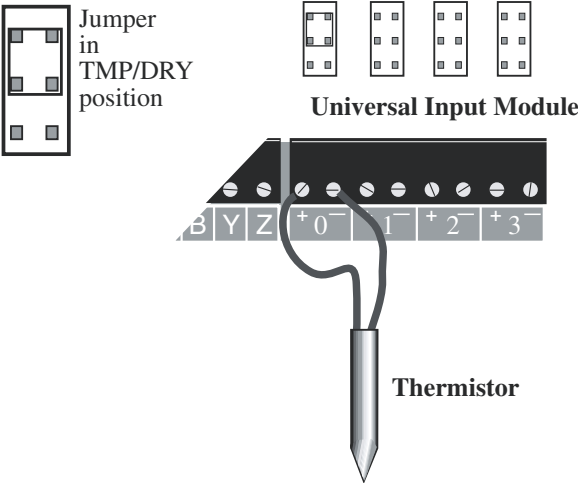


Figure 9: Wiring a Thermistor

Analog Voltage Output Transducers (0-5VDC)

The Universal Input Module is compatible with transducers that produce an analog output of 0 to 5VDC. You can program High and Low table values from the SCADA 3000 Software to scale the signal to the appropriate values.

Analog voltage output devices can be connected directly to the input terminals but be sure to following the polarity markings on the module. Choose an input and connect the wires to the corresponding screw terminals for that input. The configuration jumper should be set to the storage position as indicated in the diagram below:

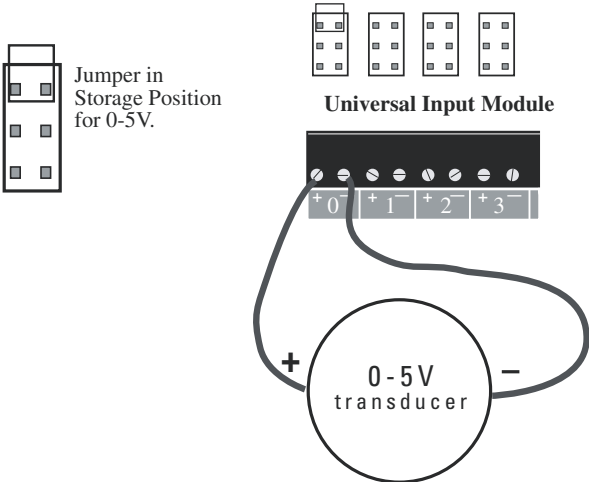


Figure 10: Wiring a 0-5V transducer

4-20mA Current Loop Transducers

The Universal Input Module is compatible with transducers that produce an analog output current of 4 to 20mA. You can program High and Low table values from the SCADA 3000 Software to scale the signal to the appropriate values.

Analog 4-20mA output devices typically require a 24VDC power supply to operate. The Universal Input Module has an internal 24VDC power supply available for this purpose. The 24VDC power supply has enough capacity to power up to eight 4-20mA devices. Follow the wiring diagrams below for connecting a 4-20mA device. The configuration jumper should be set to the 4-20mA position as indicated in the following diagrams:

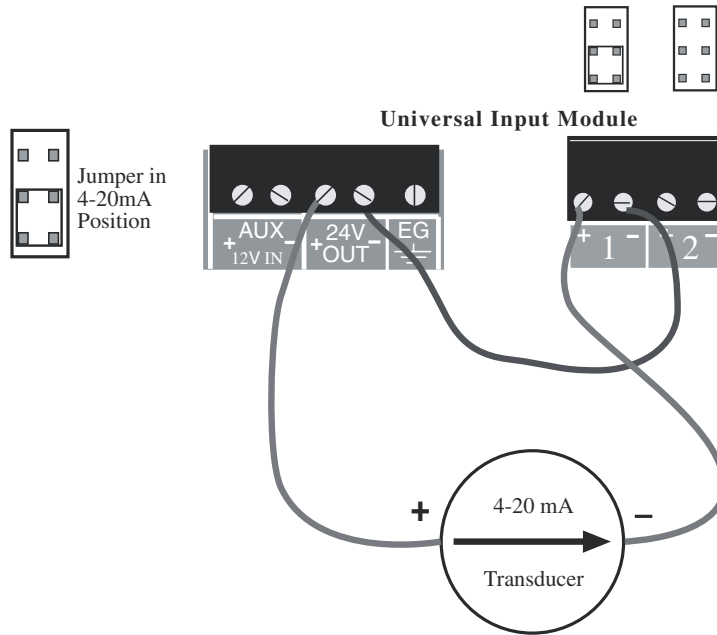


Figure 11: Wiring a 4-20mA device using the internal 24 VDC supply.

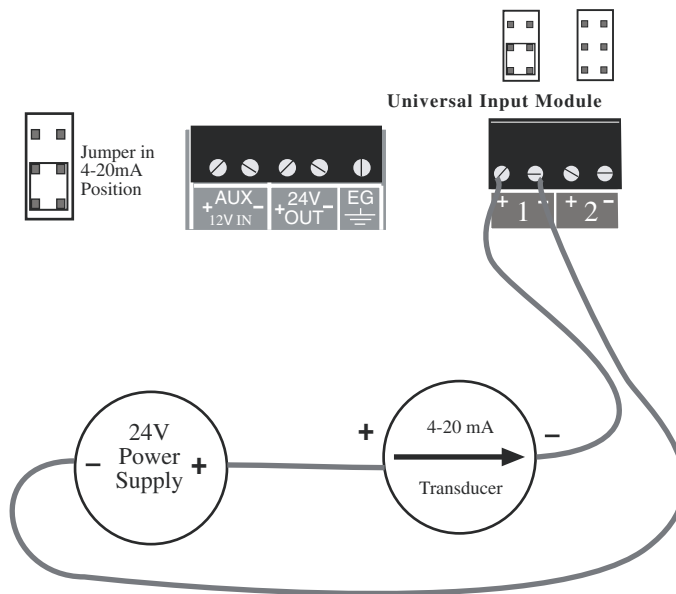


Figure 12: Wiring a 4-20mA device using an external 24VDC power supply.

HOW THE UNIVERSAL INPUT MODULE WORKS

The Universal Input Module provides eight inputs that can be configured for use with a variety of sensors. Each input has a configuration jumper that conditions the signal appropriately based on the attached sensor. The module continuously reads the signal at each input and communicates the value back to the SCADA 3000 via the 4-wire communications bus. The SCADA 3000 will allow you to set customized tables to scale the input accordingly. The value of each input can be used in the ladder program or C-program to perform control functions. You may even choose just to monitor or datalog an input and activate alarms based on high and low set-points. The SCADA 3000 User's Manual provides information on how to take advantage of all the possibilities. Listed below are some of the possible applications for the Universal Input Module:

- Temperature
- Humidity
- Power (Voltage level, Current level, Power consumption)
- Pressure
- Flow
- Gases (Carbon Monoxide, Carbon Dioxide, Oxygen,...)
- Liquid Level
- Refrigerant Leak Detector
- Water Detector
- Weather (wind speed, wind direction, barometric pressure, rainfall)
- Vibration

Sensors to monitor just about any condition are available. See the Accessories listing in Appendix G of the main unit User's Manual or contact Phonetics for more information.

Appendix A: 10K Thermistor Curve Data

DEGREES (Celsius)	DEGREES (Fahrenheit)	RESISTANCE (Ohms)
-37	-35	203.60K
-35	-30	173.60K
-32	-25	148.30K
-29	-20	127.10K
-26	-15	109.20K
-23	-10	94.07K
-21	-5	81.23K
-18	0	70.32K
-15	5	61.02K
-12	10	53.07K
-9	15	46.27K
-6	20	40.42K
-4	25	35.39K
-1	30	31.06K
2	35	27.31K
4	40	24.06K
7	45	21.24K
10	50	18.79K
13	55	16.65K
16	60	14.78K
18	65	13.15K
21	70	11.72K
24	75	10.46K
27	80	9.35K
30	85	8.38K
32	90	7.52K
35	95	6.75K
38	100	6.08K
41	105	5.48K
44	110	4.95K
47	115	4.47K
49	120	4.05K
52	125	3.67K
55	130	3.33K
58	135	3.31K
60	140	2.76K
63	145	2.52K
66	150	2.30K
69	155	2.10K
71	160	1.92K
74	165	1.76K
77	170	1.61K
80	175	1.48K
83	180	1.36K
86	185	1.25K
88	190	1.16K
91	195	1.07K
94	200	0.98K
97	205	0.91K

Appendix B: Specifications

8 Universal Inputs configurable as:	Normally Open/Normally Closed Dry Contact
	Run Time (Dry Contact)
	10K Thermistor
	0-5V Analog Voltage (differential)
	4-20mA Current Loop (differential)
10K Thermistor range	-100° to 300°F (-75° to 150°C)
(+)Input Voltage Vin+:	-12V to +12V
(-)InputVoltage Vin-:	-12V to +12V
Maximum differential voltage (Vin+) - (Vin-):	5V
Input Resolution:	12 bits (1.22mV/count)
Typical A/D Converter error:	±1 LSB
Input Protection:	1500 Watt transient voltage suppressor on each input
Dry Contact/Thermistor sense voltage:	5V through 10K
4-20mA load resistance:	237 Ohms, 0.1%, 1/4W
0-5V input impedance:	10 ¹²
Network Data Rate:	153.6 Kbps
Bus Termination Impedance:	120 Ohms
24V Output Current:	160 mA max.
Power Requirements:	10-15VDC 100mA (typical)/420mA (max.), 1.5W(typ.)/6.3W(max.)
Power Fuse Rating & type:	500mA 250V, Size TR-5 (Wickmann # 19372-041-K)
Operating temperature:	0 to 70 degrees Celsius (32 to 158 degrees F)
StorageTemperature:	-20 to 70 degrees Celsius (-4 to 158 degrees 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 C: Troubleshooting

Problem: I have power wired to the Universal Input Module but the green LED is off.
Solution: You probably have a blown fuse. Check your wiring and replace the fuse.
Problem: The green LED is on but the yellow LED is off.
Solution: This means that the module and main unit are not communicating. It could be a problem with either device. Check the wiring first. Make sure the main unit is on and functioning. Try powering-up both devices.
Problem: My input readings are not correct.
Solution: Make sure the configuration jumper for the input is in the correct position. Make sure the software is configured correctly for your type of sensor.

Appendix D: Replacement Parts

This appendix provides a list of replacement parts and part numbers for the FGD-3010 Universal Input Module. Contact the Phonetics Customer Service Department at (610)558-2700 for availability.

ASY-0052	Universal Input Module Circuit Board
CON-0027	16 Position Terminal Block Plug
CON-0033	2 Position Jumper Shunt
CON-0034	4 Position Terminal Block Plug
CON-0088	5 Position Terminal Block Plug
CON-0108	4 Position Jumper Shunt
FUS-0005	500 mA 250V TR5-style Time-Lag Fuse (Wickmann #3720500041)
HSG-0022	Enclosure Base
HSG-0052	Enclosure Cover
LIT-0034	SCADA 3000 Universal Input Module Owner's Manual Supplement

Appendix E: Returning Module for Service

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

- 1) Record your observations regarding the Universal 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 SCADA 3000 unit 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 June 1999

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901 Tryens Road

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Phone: (610) 558-2700 Fax: (610) 558-0222