SCADA 3000
ANALOG OUTPUT MODULE

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Written and produced by Phonetics, Inc.

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Aston, PA 19014

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www.sensaphone.com

IMPORTANT SAFETY INSTRUCTIONS

Your ANALOG OUTPUT 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 Analog Output 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 Analog Output 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 Analog Output 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.

Analog Output Module Supplement
Contents

Introduction

The SCADA 3000 Analog Output Module is an optional component for use with the SCADA 3000 system. The module features four analog output signals that can be configured as 4-20mA, 0-20mA, or 0-10V. The outputs can be used to control equipment, drive digital displays, or provide information to other computer devices. The individual outputs are capable of driving up to 1000 Ohms. They may be controlled automatically via a ladder program or C-program. 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.

Technical Support

If any questions arise upon installation or operation of the Analog Output 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 Analog Output Module. Correctly installing the unit will ensure proper functioning and maximum service life. Please read the entire chapter before attempting installation.

OPERATING ENVIRONMENT

The Analog Output 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 Analog Output 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 Analog Output Module can operate in is 32°F to 158°F (0°C to 70°C). If you require the Analog Output 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 Analog Output 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 ANALOG OUTPUT MODULE

When you receive the Analog Output 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 Analog Output 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 Analog Output Module in an upright position so that you can easily connect wires to the terminal strips. The dimensions of the full enclosure are: 6.3" x 4.2" x 1.2". See Figure 1.
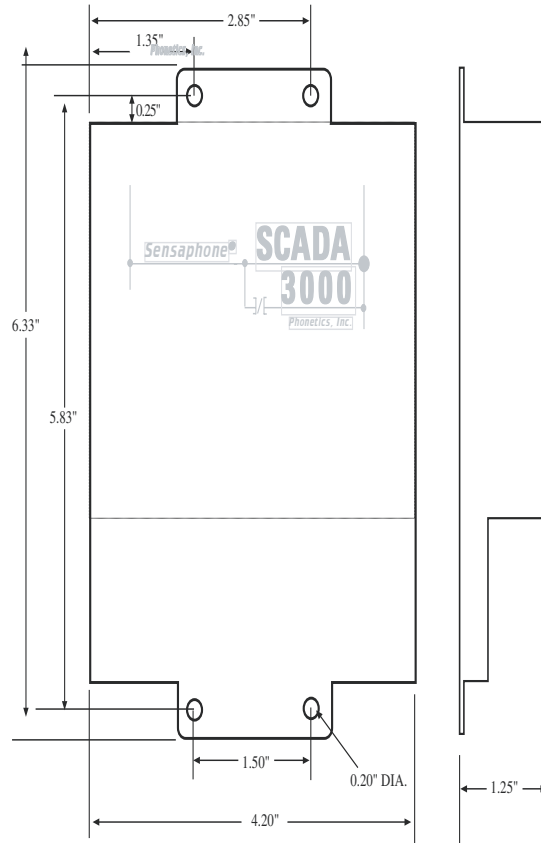
Figure 1: Module Mounting Dimensions

Power Supply and Grounding

The Analog Output 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.
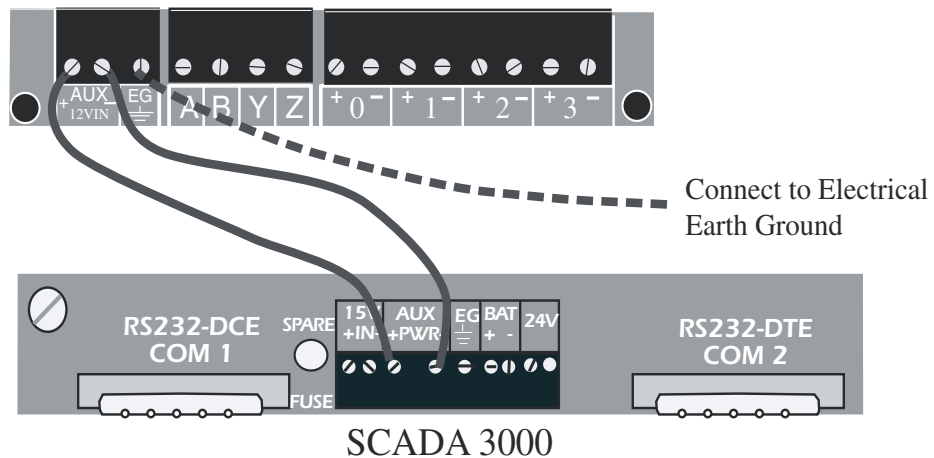

Figure 2: Module powered from main unit

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 Analog Output 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, 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. Note how the wiring is reversed between the first module and the main unit but between modules the wiring is straight-thru. Correct wiring is shown in Figure 3, and incorrect in Figure 4.
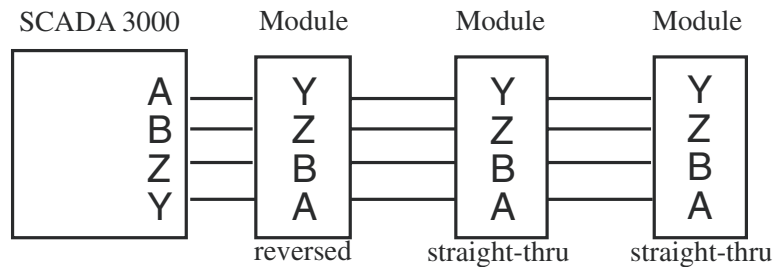

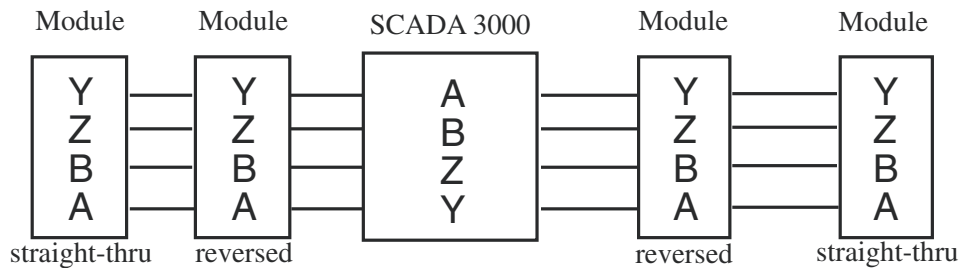Figure 3: **Correct** daisy chain setup: Main unit on the end.

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.

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 best results, use ferromagnetic conduit near critical sources of electrical interference. You can use aluminum conduit in non-critical areas.

MODULE ADDRESS

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.

Address	Jumper Code			
1	A	B	B	B
2	B	A	B	B
3	A	A	B	B
4	B	B	A	B
5	A	B	A	B
6	B	A	A	B
7	A	A	A	B
8	B	B	B	A
9	**A**	**B**	**B**	**A**
10	B	A	B	A
11	A	A	B	A
12	B	B	A	A
13	A	B	A	A
14	B	A	A	A
15	A	A	A	A

BUS ADDRESS

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.
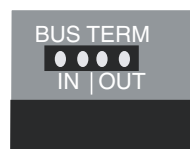
BUS TERM
IN | OUT

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 (plus the main unit) should ever have the termination activated. The diagram below illustrates proper termination of the communications bus.
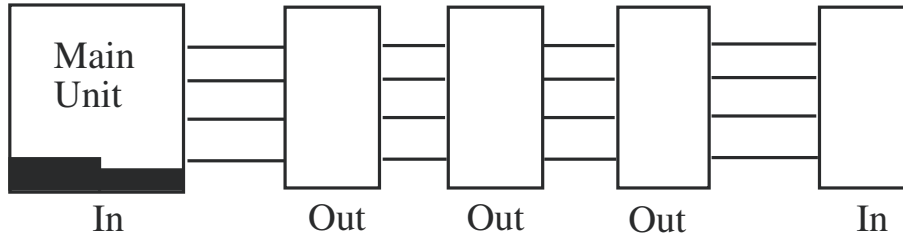

Figure 7: Correct bus termination

Analog Output Wiring Information

The analog output module has four independent outputs which can be configured to produce either 4-20mA, 0-20mA or 0-10V. The output type is selected using the jumpers (J8-J11) above the terminal strip. The output types must be set in pairs. Jumper pair one affects outputs 0 and 1, and pair two affects outputs 2 and 3. This allows you to set, for example, outputs 0 and 1 to 4-20mA, and outputs 2 and 3 to 0-10V. The table below shows how to set the jumpers for each output type.

Outputs 0 & 1		Outputs 2 & 3	
Type	Jumper Settings	Type	Jumper Settings
4-20mA	J8: 4-20, J10: mA	4-20mA	J9: 4-20, J11: mA
0-20mA	J8: 0-20, J10: mA	0-20mA	J9: 0-20, J11: mA
0-10V	J8: 0-20, J10: V	0-10V	J9: 0-20, J11: V

When configured for 4-20mA or 0-20mA, each output can drive a maximum of 1000 Ohms. The output current is sourced directly from the module. No external loop power is required. When configured for 0-10V, be sure to drive only high impedance loads to minimize errors. A typical circuit connection diagram is shown below.
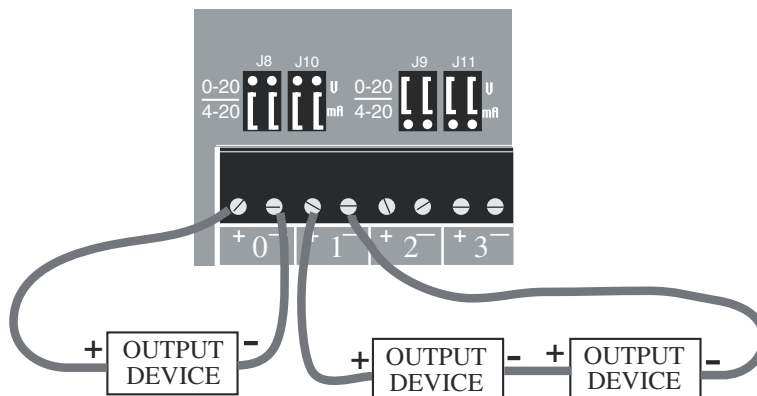

Figure 8: Wiring diagram

The output wiring terminals are designed to accept #14AWG to #24AWG stranded wires. For short distances you may use ordinary 2-conductor cable. Note that if the output device is located far from the module or if you are running cable in an electrically noisy environment, you should seriously consider using shielded cable. This will shield the signal from electrical interference thereby preventing false readings and/or damage to the module. If you are using shielded cable, connect the shield to the EG pin on the module. 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.

The three terminal blocks on the Analog Output 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 below).
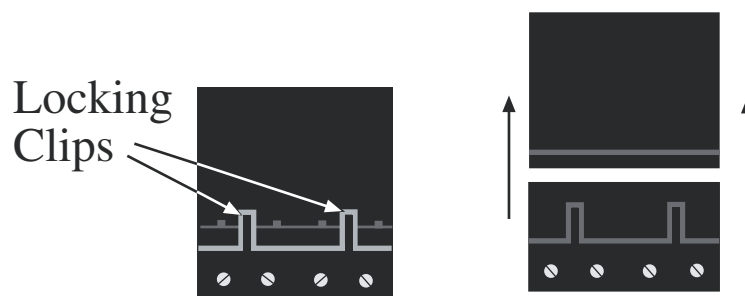

Figure 9: Removing terminal blocks

HOW THE ANALOG OUTPUT MODULE WORKS

The Analog Output Module has four independent outputs that can be used to control equipment, drive digital displays, or provide information to other computer devices. The only requirement is that the equipment be capable of accepting a 4-20mA, 0-20mA or 0-10V signal. The SCADA 3000 CPU sends information to the module telling it how much current or voltage to drive to each of the outputs. The output levels are determined based on the control program you create using the Ladder program, C-program or PID settings. The SCADA 3000 Software allows you to set up a custom table to scale the signal to units that describe your process. For example, say you are using an output to control the position of a valve. In this case 4mA may represent a valve that is 0% open and 20mA may equate to 100% open. By setting low and high table values of 0 and 100 respectively, you can now control the position of the valve from 0 to 100% as opposed to 4-20mA. This can greatly simplify programming as well as viewing the position of the valve from the software. For more information, see the SCADA 3000 CPU manual.

To program the Analog Output Module, click on the Analog Output icon on the main unit form. The icon appears at the corresponding module address and is designated by the letters "AO."

On the I/O Setup tab you can force output values by entering numbers in the Forced Status fields. To remove a forced value, simply delete the number from the forced value field.

On the Table and Cal tab you can enter the table values that correspond to the 4mA and 20mA signal outputs. The Offset is used to calibrate the output by adding or subtracting this value to the output.

Appendix A: Specifications

Number of Outputs	4
Resolution	12 bits
Max. Loop Resistance (mA type)	1000 Ohms
Output Current (sourcing)	0-20mA
Output Types	4-20mA, 0-20mA, 0-10V
Max. Overload (output + to -)	Continuous short circuit
Power-up Status	Output at minimum value (0mA, 4mA, or 0V)
LED Indicators	Power LED & Pulse LED (heartbeat)
Analog Output Protection	1500 Watt transient suppressor on each output
Network Data Rate	153.6 Kbps
Bus Termination Impedance	120 Ohms
Power Requirements	10-15VDC 260mA (max.), 3.9W
Power Fuse Rating & type	500mA 250V, Size TR-5 (Wickmann # 3720500041)
Terminal Block Wire Size	#14AWG to #24AWG
Operating temperature	0 to 70 degrees Celsius (32 to 158 degrees F)
Storage Temperature	-20 to 70 degrees Celsius (-4 to 158 degrees F)
Humidity	5 to 90% non-condensing
Dimensions	4.2" 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 output never seems to get all the way to full scale (20mA).
Solution: Check the loop resistance. It must be no greater than 1000 Ohms. If it is greater the module will not be able to reach the full scale output.
Problem: I have power wired to the Analog Output Module but the green LED is not on.
Solution: Check the power supply terminals to see if 10-15VDC is present. If it is you probably have a blown fuse. Check your wiring and replace the fuse.
Problem: The power light is on but the pulse light is not blinking.
Solution: This means that the module and unit are not communicating. It could be a problem with either device. Check the communications wiring first. Make sure the main unit is on and functioning. Verify that the module address is valid and unique. Try powering up both devices.

Appendix C: Replacement Parts

This appendix provides a list of replacement parts and part numbers for the FGD-3050 Analog Output Module. Contact the Phonetics' Customer Service Department for availability (610)558-2700.

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
CON-0108	4 Position Jumper Shunt
FUS-0005	500 mA 250V TR5 Fuse (Wickmann #3720500041)
HSG-0044	Enclosure Base
HSG-0045	Enclosure Cover
LIT-0035	SCADA 3000 Analog Output Module Owners Manual Supplement

Appendix D: Returning Module for Service

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

1) Record your observations regarding the Analog Output 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	G.A.S. Analytical Systems, Ltd.
100 Covington Crescent	Head Office
Kitchener, Ontario N2N 2X3	Bay V, 1338 36 Avenue NE
(519) 744-9892	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 some-one 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 CON-SEQUENTIAL 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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