



AC-24 Controller

Motor Current Controller

for the LP-24, VLP-24 and WM 3000-24 MagnaValve®

Instruction Manual



Electronics Inc.

Shot Peening Control

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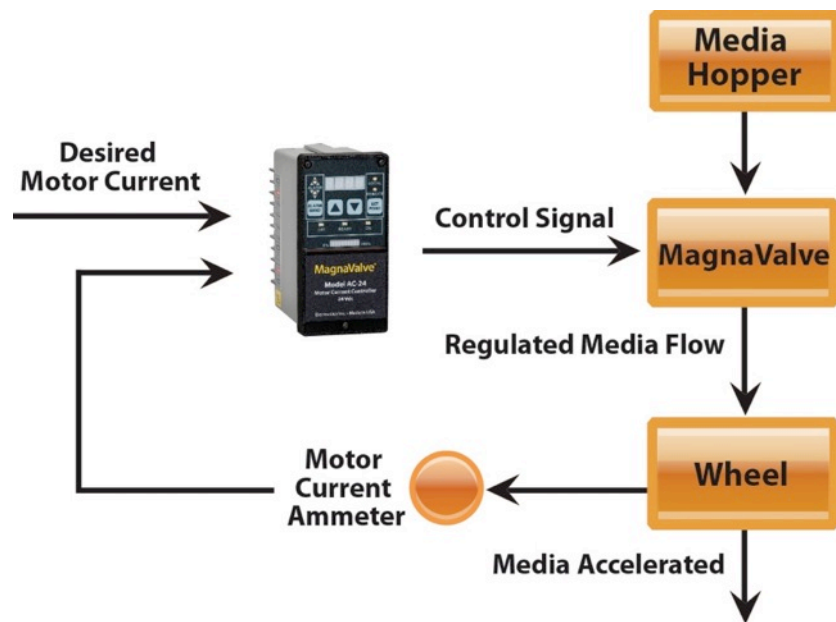
READ INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING THE AC-24 CONTROLLER

Product Overview

The Model AC-24 Controller is used with a MagnaValve® for wheel-blast shot peening and blast cleaning machines to monitor and control the flow rate of steel shot passing through the MagnaValve. A digital display indicates blast wheel motor amps. A 0-10 Vdc output signal proportional to motor amps is available for remote monitoring or data logging. High/low alarms are set to bracket the requested amperage setting.

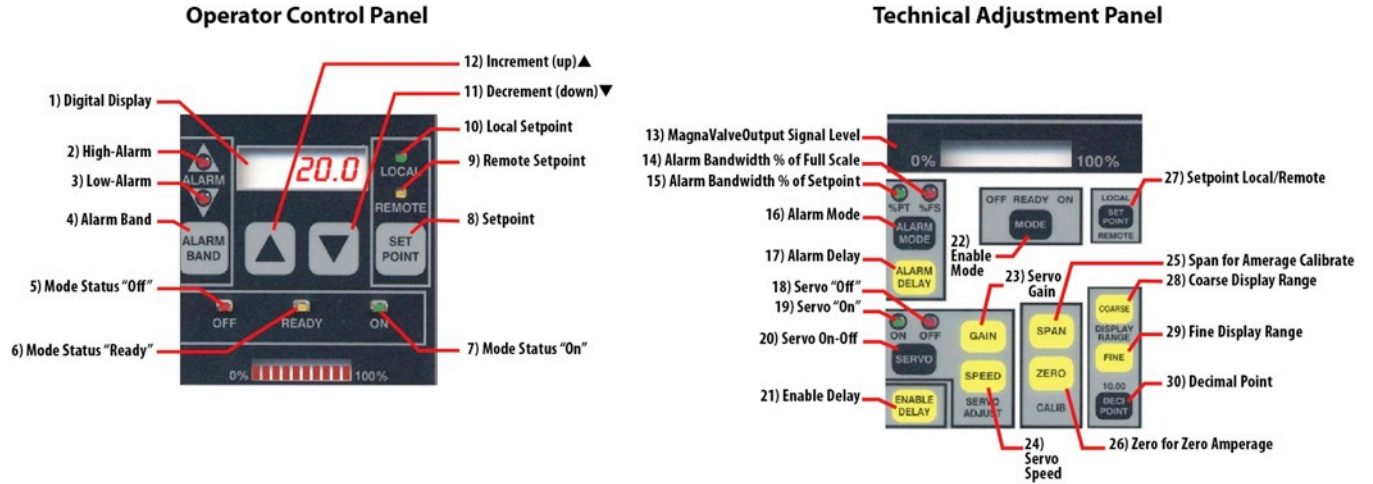
Principle of Operation

The AC-24 Controller modulates the shot flow rate through the MagnaValve based on the blast wheel motor amperage. It will trigger an alarm signal whenever the motor amps are above or below the requested amperage Setpoint. The AC-24 Controller's servo circuit generates the output signal for the MagnaValve by comparing the Setpoint command to the actual motor amps. The motor amps Setpoint may come from a remote source, such as PLC, or it may be entered on the front panel of the AC-24 Controller. The media flow can then be initiated by application of an "Enable" signal from the AC-24 Controller or it may come from a remote source, such as PLC. The diagram below illustrates how the AC-24 Controller and MagnaValve interact with the wheel motor.



Factory Default Settings

Adjustments to the factory default settings can be made at the Operator Control Panel and the Technical Adjustment Panel (located behind the lower panel cover plate).



Default Settings

Button Number	Feature	Factory Default Setting
16	Alarm Mode	%FS (% of Full Scale)
4	Alarm Bandwidth	5%
17	Alarm Time Delay	5 Seconds
21	Enable Delay	0 Seconds
20	Servo ON/OFF	ON
22	Enable Mode	Ready
23	Servo Adjust Gain	65%
24	Servo Adjust Speed	55%
28/29	Full Scale Display	100.0
25	Calibration - Span	1.000
26	Calibration - Zero	0.00 Vdc

Preliminary Settings

Note: Refer to Operator Control Panel and Technical Adjustment Panel diagrams in the “Factory Default Settings” section for location of buttons.

Zero

The digital display (1) should read 0.0 when the motor is off. If it does not read 0.0, push and hold the Zero button (26) and use the down button ▼ (11) or up button ▲ (12) as required to achieve zero.

Full Scale Display Range

The full-scale range is set to match the size of the current transformer from the motor. The full-scale range is usually 100.0 amps. To display the value of Full Scale, press and hold the Coarse or Fine Display Range button (28/29). To change value, press and hold either the Coarse or Fine Display Range button (28/29) and use the down button ▼ (11) or up button ▲ (12) as required.

Alarms

The high- and low-alarm relay contacts react when motor current variation from desired setting is lower or higher than the alarm bandwidth setting. The factory setting is $\pm 5\%$ of full scale (± 5 amps with a full-scale range of 100.0 amps). The center of the Alarm band is the Setpoint Command. To display the range of the alarm band, press and hold the Alarm Band button (4). To change the value, push and hold the Alarm Band button (4) and then use the down button ▼ (11) or up button ▲ (12) as required.

Alarm Delay

The High Alarm LED (2) or Low Alarm LED (3) will illuminate whenever the motor amperage variation is outside of the Alarm Band Setting. These LEDs will get brighter at the expiration of the alarm time delay and the alarm relay contacts will transfer and latch. Press and hold the Alarm Delay button (17) to display the alarm time delay. The factory setting for the alarm time delay is 5 seconds. To change the value, press and hold the Alarm Delay button (17) and push either the down button ▼ (11) or up button ▲ (12) as required.

Alarm Reset

Momentary application of 24 Vdc signal to screw terminal 12 will reset the alarm. Continuous application of 24 Vdc signal to screw terminal 12 will disable the alarm. Application of the next enable signal will also reset the alarm.

Alarm Mode

Push the Alarm Mode button (16) to select either percent of Full-Scale Range “%FS” (14) (most common) or percent of Setpoint “%SP” (15). The factory setting is %FS.

Operation

Note: Refer to Operator Control Panel and Technical Adjustment Panel diagrams in the “Factory Default Settings” section for location of buttons.

Setpoint

The setting for the desired motor current may come from a remote source, such as PLC, or it may be set locally from the front panel of the AC-24 Controller. To set or change the Setpoint, push the Setpoint Local/Remote button (27), select “Local”, then push the Setpoint button (8) to display the value. To change the Setpoint value, push and hold the Setpoint button (8) and use the Down button ▼ (11) or Up button ▲ (12) as required.

Enable

The Mode button (22) will select the enable state. The choices are Off, Ready and On. The On mode will transmit an enable signal to the MagnaValve to commence flow. The Ready mode will transmit the enable signal only when a remote enable signal (from a PLC, for example) is received. The Off mode prevents any operation of the MagnaValve—it will ignore the remote enable command. Note: When in the Ready mode, the Enable Delay button (21) will delay the enable signal to the MagnaValve if set greater than 0 seconds.

Servo

Press the Servo On-Off button (20) to toggle between On and Off. Turn the Servo on for closed-loop operation and ensure the Servo On LED (9) is lit. The dynamic operating parameters of the Servo are set with the Gain (23) and Speed (24) buttons. These are set to typical values by the factory that should give smooth and stable performance. The output signal of the servo command starts at zero media flow and slowly increases until the motor current feedback signal equals the Setpoint current request. The Gain and Speed settings can be changed to help stabilize the media flow rate or to increase the response time of the MagnaValve.

Process Input Signal

The process input signal may come from either a current transformer or from a 0-10 Vdc signal source.

Motor Amperage with Current Transformer

A current transformer, typically rated 100:5, converts the wheel motor current of 100 amps down to five (5) amps. The five (5) amp signal is then considered the “full-scale” process input signal at the AC-24 Controller. The full-scale range of the AC-24 Controller is set at 100.0.

Connect the leads of a 100:5 current transformer to Terminals #7 and # 5. A factory-installed current shunt at those terminals converts the five (5) amp current transformer signal to a 0.05 Vac signal that is then scaled inside the AC-24 Controller to the 0-10 Vdc range.

For smaller wheel motor applications, a smaller current transformer, such as 50:5, may be used. The Full Scale Display Range must be reduced to 50.0 to match the current transformer rating. (See “Full Scale Display Range” in Preliminary Settings in this manual.)

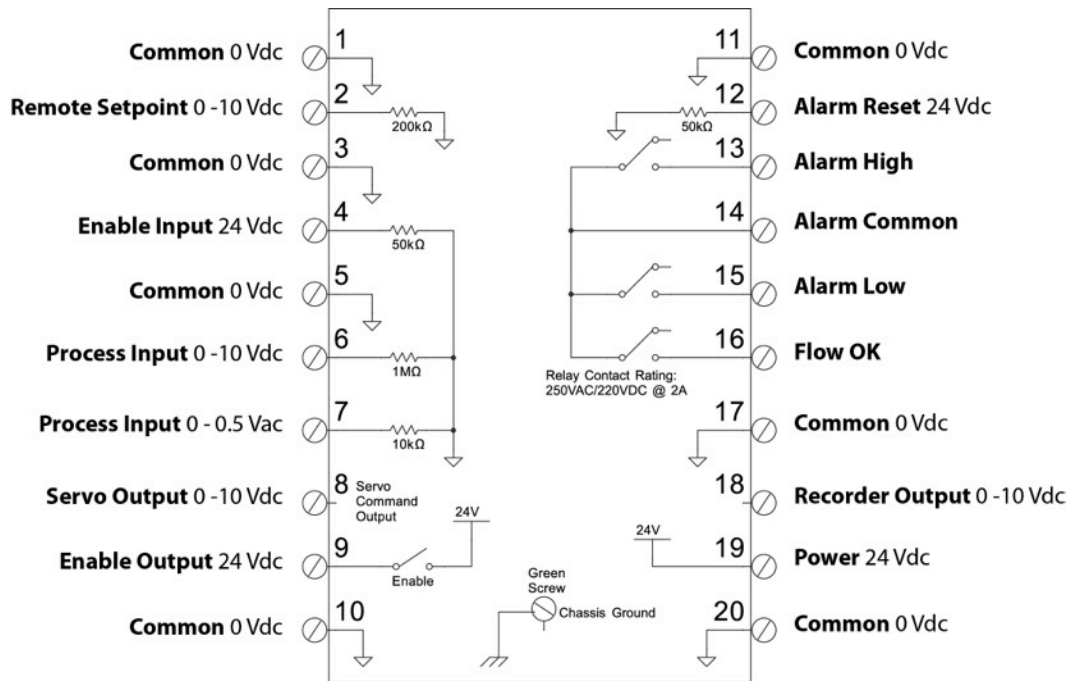
Motor Controller Signal 0-10 Vdc

Current transformers may not reflect actual motor current when a variable frequency motor speed controller is used. The factory-supplied current shunt on Terminal #7 is ignored and a 0-10 Vdc signal is applied to terminal #6.

Verify that the 10 Vdc output from the motor speed control represents 100 amp full-load current. If the full-scale range of the motor speed controller is set at a different value, the AC-24 Controller must be scaled to the same value. (See “Full Scale Display Range” in Preliminary Settings in this manual.)

Wiring

Terminal Schematic



Note: Refer to Operator Control Panel and Technical Adjustment Panel diagrams in the “Factory Default Settings” section for location of buttons and LEDs. Refer to the Terminal Schematic above for the location of the terminals.

Terminal Descriptions

2 - Remote Setpoint

Push the Setpoint Local/Remote button (27) until Remote Setpoint LED (9) is on. Apply a 0 - 10 Vdc analog signal to the Remote Setpoint terminal (2). A zero Vdc signal will correspond to a 0% motor current command and a 10 Vdc signal will correspond to a 100% motor current command. To display the Remote Setpoint command, push Setpoint button (8). The Remote Setpoint command may come from a remote potentiometer or any other 0 - 10 Vdc signal source.

4 - Enable Input (24 Vdc)

When a 24 Vdc signal is applied to the Enable Input terminal and the mode is in the Ready state, the controller will output a 24 Vdc signal on the Enable Output terminal (9) and turn on the Mode Status “On” LED (7). The Enable Output terminal (9) is normally connected to the Enable Input wire of the MagnaValve (blue wire). The Enable Input signal will reset alarms that occurred during the last cycle.

6 - Process Input (0-10 Vdc)

This is the 0-10 Vdc process input. This input is used when a current transformer is not used. This input signal represents the motor amperage where 0 Vdc input represents zero amps and 10 Vdc input represents maximum amps. This signal is displayed on the Operator Control Panel’s digital display (1). When 10 Vdc is applied, the AC-24 Controller will display the number set for the Display Range (28/29). The display range should be set equal to the size of the current transformer. The Process Input terminal (6) is normally connected to the Analog Output of a variable speed drive.

7 - Process Input (0-0.5 Vac)

This is the 0-0.5 Vac process input. This input is used in junction with a current transformer. The input has a factory-installed current shunt attached between terminals 7 and 5. The shunt converts 5 Aac from the current transformer to 0.5 Vac. This input signal represents the motor current where 0 Vac input represents zero motor amps and 0.5 Vac input represents maximum motor amps (that is, the rating of the current transformer). This signal is displayed on the Operator Control Panel's digital display (1). When 5 amps is applied, it is converted to 0.5 Vac and the AC-24 Controller will display the number set for the Display Range (28/29). The display range should be set to match the current transformer. For example: The factory default display range is set to 100.0 for a 100:5 current transformer. If the current transformer rating is 50:5, the display range should be set to 50.0.

8 - Servo Output (0-10 Vdc)

This is the 0-10 Vdc output. The Servo Output terminal (8) is connected to the Analog Input of the attached MagnaValve (orange wire) and controls the flow of media through the MagnaValve. Zero (0) Vdc commands the MagnaValve to flow 0 lb/min and 10 Vdc commands the MagnaValve to flow its maximum capability.

9 - Enable Output (24 Vdc)

- When the mode is in the Ready state and an Enable Input signal is received, an Enable Output signal is generated at terminal #9.
- When the mode is in the On state, an Enable Output signal is generated at terminal #9.
- When the mode is in the Off state, no Enable Output signal is generated at terminal #9.

The Enable Output terminal (9) is normally connected to the Enable Input wire of the MagnaValve (blue wire).

12 - Alarm Reset (24 Vdc)

When a 24 Vdc signal is temporarily applied to the Alarm Reset terminal (12), all alarms will be reset. If a constant 24 Vdc signal is applied to the Alarm Reset terminal (12), the alarms will be held in the reset state, essentially disabling them.

13 - Alarm High

The Alarm High relay contact (13) is a normally open relay contact. The Alarm High relay contact (13) will close if the Process Input (6/7) is higher than the Setpoint value (8) plus the Alarm Band value (4) for a duration longer than the Alarm Delay (17). The Servo On-Off (20) must be on for alarms to work.

14 - Alarm Common

A common connection to all relays.

15 - Alarm Low

The Alarm Low relay contact (15) is a normally open relay contact. The Alarm Low relay contact (15) will close if the Process Input (6/7) is lower than the Setpoint value (8) minus the Alarm Band value (4) for a duration longer than the Alarm Delay (17). The Servo On-Off (20) must be on for alarms to work.

16 - Flow OK

The Flow OK relay contact (16) is a normally open relay contact. The Flow OK relay contact (16) will close if the Process Input (6/7) is at the Setpoint within the Alarm Band (4) and will remain closed for the duration of the blasting/peening cycle. If the Process Input (6/7) goes higher or lower than the Setpoint value (8) plus the Alarm Band value (4) for longer than the Alarm Delay (17), the Flow OK relay contact (16) will open and remain open until the alarms are reset. The Servo On-Off (20) must be on for any of the alarms to work (press the Servo On-Off button (20) and ensure the Servo On LED (9) is lit).

18 - Recorder Output (0-10 Vdc)

This is the 0-10 Vdc analog output. The Recorder Output terminal (18) is typically connected to a PLC or some other monitoring equipment. The output represents the motor amps. Zero (0) Vdc represents 0 Aac on the motor and 10 Vdc represents maximum motor amps.

19 - Power (24 Vdc)

The Power terminal (19) is the power supply input to the AC-24 controller and is connected to the positive terminal of the +24 V power supply.

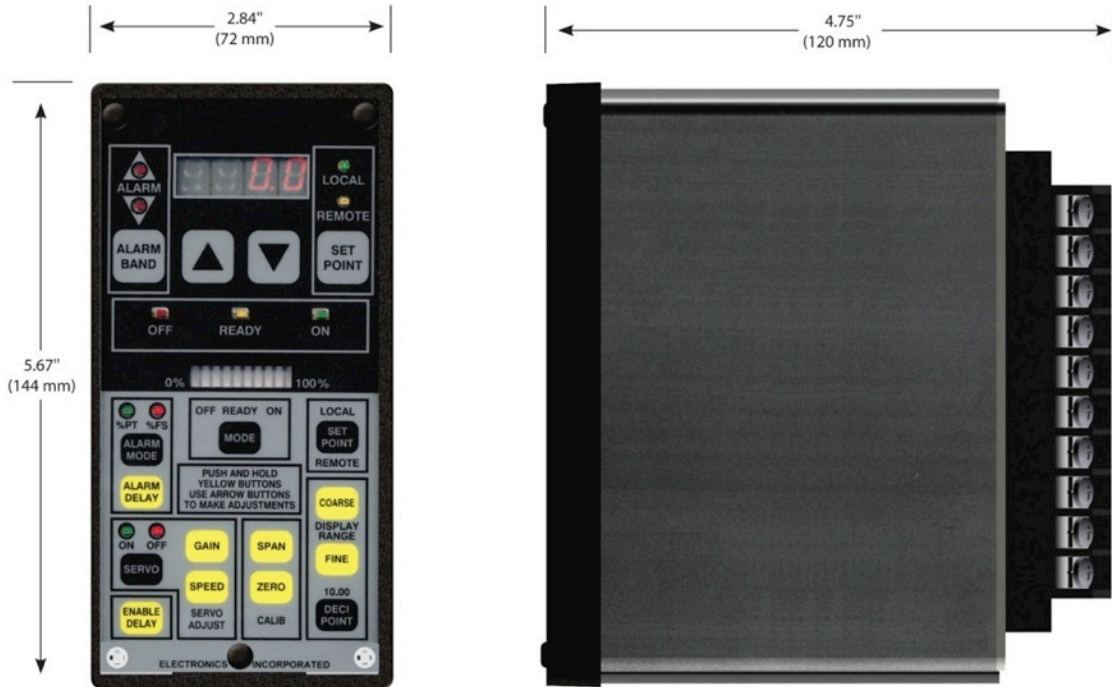
20 - Common (0 Vdc)

The Common Power terminal (20) is the power supply return of the AC-24 controller and is connected to the negative terminal of the +24 V power supply.

Specifications

Power Input	+24 Vdc @ 0.5 A
Motor Current Input	0-5 Aac (with current shunt)
Servo Output Signal	0-10 Vdc to MagnaValve
Flow Enable Input from PLC	24 Vdc
Flow Enable Output to MagnaValve	24 Vdc
Remote Current Input Request	0-10 Vdc
Weight	1.3 lb/.59 kg
Alarm Band	0-50% of full scale
Alarm Delay	0-10 seconds
Enable Delay	0-10 seconds
Temperature Range	0°C - 50°C (32°F - 122°F)

Dimensions

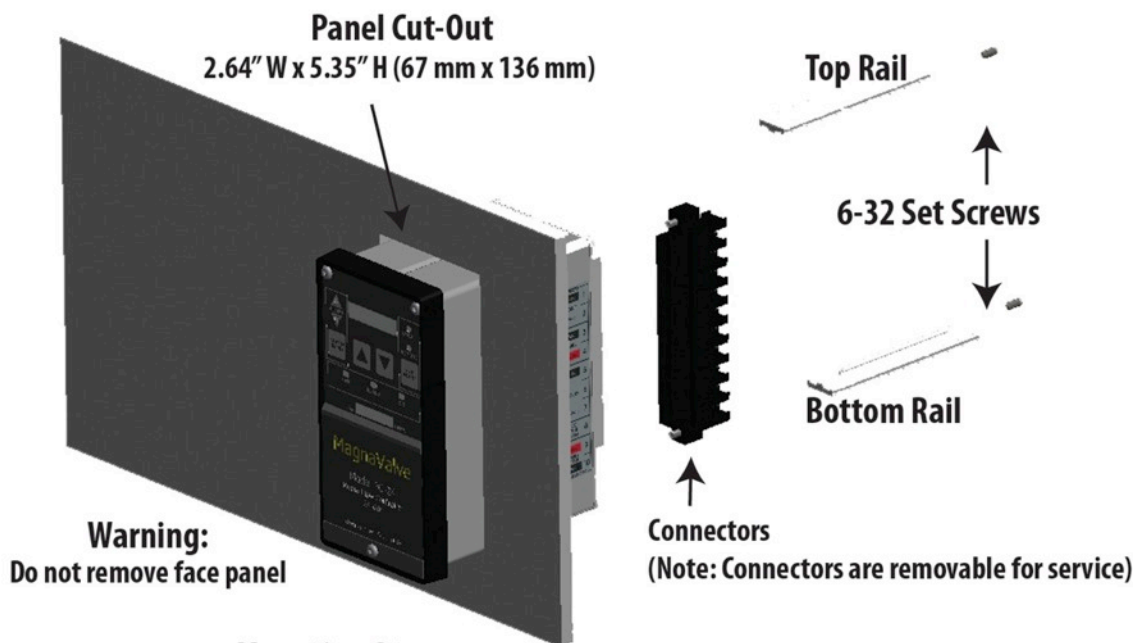


Shown with front panel removed

Panel Cutout Dimensions:
2.64" W x 5.35" H (67 mm x 136 mm)

DIN opening

Installation



Mounting Steps:

- 1) Remove set screws and remove top and bottom rails from controller
- 2) Slide controller into panel from front
- 3) Slide rails back onto controller, reinstall set screws

Electronics Inc. Contact Information

Mailing and Shipping Address

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Telephone

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(574) 256-5222

Website

www.electronics-inc.com

For our warranty terms and shipping instructions, please read the Limited Warranty.

Limited Warranty

AC-24 Controller

The warranty obligations of Electronics Inc. for this product are limited to the terms set forth below.

Length of Warranty Period

This limited warranty lasts one (1) year from the shipping date of this product.

What is Covered

This limited warranty covers defects in materials and workmanship in this product.

What is Not Covered

This limited warranty does not cover any damage, deterioration or malfunction resulting from any alteration, modification, improper or unreasonable use or maintenance, misuse, abuse, accident, neglect, exposure to excess moisture, fire, improper packing and shipping (such claims must be presented to the carrier), lightning, power surges, or other acts of nature. This limited warranty does not cover any damage, deterioration or malfunction resulting from the installation or removal of this product from any installation, any unauthorized tampering with this product, any repairs attempted by anyone unauthorized by Electronics Inc. to make such repairs, or any other cause which does not relate directly to a defect in materials and/or workmanship of this product. This limited warranty does not cover equipment enclosures, cables or accessories used in conjunction with this product.

How to Obtain a Remedy Under this Limited Warranty

To obtain a remedy under this limited warranty, contact Electronics Incorporated by letter, email, fax or telephone with the following information:

- Product name and model
- Product serial number
- Original shipping date (see label on product)
- Company name and location
- Name of contact person for description of symptoms
- Return shipping address and any special instructions

If it is determined that the product must be returned under this limited warranty, a Returned Goods (RG) number, obtained from Electronics Inc., will be required. This product should be properly packed to prevent damage in transit. Cartons not bearing a RG number will require additional processing time and repair service may be delayed.

What Electronics Inc. Will Do Under This Limited Warranty

Electronics Inc. will, at its sole discretion, provide one of the following remedies to whatever extent it shall deem necessary to satisfy a proper claim under this limited warranty:

- 1.) Elect to repair or facilitate the repair of any defective parts within a reasonable period of time, free of any charge for the necessary parts and labor to complete the repair and restore this product to its proper operating condition. Electronics Inc. will pay the shipping costs necessary to return this product once the repair is complete.

2.) If the defective product cannot be repaired, it will be replaced with a new unit and the original warranty period will be extended by six (6) months. Electronics Inc. will pay the shipping costs necessary to replace this product.

If this product is returned to Electronics Inc., the product must be insured during shipment, with the insurance and shipping charges prepaid. If this product is returned uninsured, Electronics Inc. does not assume any risk of loss or damage during shipment. Electronics Inc. will not be responsible for any costs related to the removal or re-installation of this product.

Out-of-Warranty Product

Product that is out-of-warranty will be repaired at customer's request and the cost of repair will be disclosed prior to proceeding with the repair. A purchase order must be received prior to repair. If the product cannot be repaired, Electronics Inc. will provide one of the following remedies:

- 1) New unit at current pricing with a one (1) year Limited Warranty from the shipping date of product.
- 2) Refurbished unit (if available) at a discounted price with a six (6) month Limited Warranty from the shipping date of product.

Limitation on Liability

The maximum liability of Electronics Inc. under this limited warranty shall not exceed the actual purchase price paid for the product. Electronics Inc. is not responsible for direct, special, incidental or consequential damages resulting from any breach of warranty or condition, or under any other legal theory to the maximum extent permitted by law.

Exclusive Remedy

To the maximum extent permitted by law, this limited warranty and the remedies set forth above are exclusive and in lieu of all other warranties, remedies and conditions, whether oral or written, express or implied. To the maximum extent permitted by law, Electronics Inc. specifically disclaims any and all implied warranties, including, without limitation, warranties of merchantability and fitness for a particular purpose. If Electronics Inc. cannot lawfully disclaim or exclude implied warranties under applicable law, then all implied warranties covering this product, including warranties of merchantability and fitness for a particular purpose, shall apply to this product as provided under applicable law.

Rights under State Law

This warranty defines specific legal rights relative to these products provided by Electronics Inc. Legal rights may also vary from state to state.