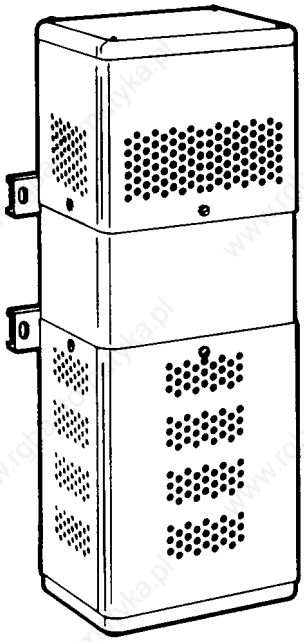
# 50 Hz Mini/Micro
# Computer Regulator (MCR) Series
# Installation and Operation Manual



## Operating & Service Instructions

Sola Minicomputer Regulators
UL White Card Listed – Power Supply Classification
CSA Certified – Transformer Classification

EGS Electrical Group
SOLA/ HEVI-DUTY

Contact Technical Services at (800) 377-4384 with any questions.
Fax-on-Demand: (877) 888-9329, Document #: 8412

## General Description and Specifications

The Sola Micro/Minicomputer regulator provides voltage regulation and isolation from both transverse and common mode noises for any type of load. It also suppresses transients, protects from overloads and serves as a portable dedicated line. It is the ultimate in AC power conditioning equipment.

Two types of units are manufactured. Hardwired units, rated 125 to 1500VA, should be permanently installed by competent electricians. Portable units, rated 150 to 2000VA, are designed for office type environments and have a low 43dB sound level.

| | |
|---|---|
| **Operating Temperature Range:** | -20°C to + 50°C |
| **Phase:** | Single |
| **Input Voltage (Hardwired Models):** | Refer to Table 4 |
| **Input Voltage (Portable Models):** | 220/240 VAC |
| **Output Voltage (Hardwired models):** | 110/120/220/240 VAC |
| **Output Voltage (Portable models):** | 220 or 240 VAC, switch selectable* |
| **Output Voltage Regulation:** | +/-5% for an input line variation of +/-15%. |
| **Output Harmonic Distortion:** | Less than 3% total RMS content at full load with rated input voltage |
| **Efficiency:** | 85% at full load. |
| **Dropout:** | No loss of output for line loss of 3msec. |
| **Common Mode Noise Rejection:** | Greater than 120dB |
| **Transverse Mode Noise Rejection:** | Greater than 60dB |
| **Safety Approvals:** | Designed and built per VDE 0550 and 0806. Specifications (compatible with IEC 380/435) |

* The unit must not be powered while operating this switch. Unplug the unit from the power source before using this switch.

**Safety Notice**
High voltages are present inside all regulators. Do not reach inside a unit when it is energized. To measure voltage, de-energize the unit, connect the meter, and then re-energize the unit.

## Hardwired Units

### Installation – Mechanical

Table 1 shows the physical dimensions of the hardwired units. These units can be mounted with the “This Side Up” designation upwards, or they can be mounted horizontally. Allow 60cm above and 30cm on either side of the regulator during installation.

**Table 1. Hardwired Regulator Dimensions**

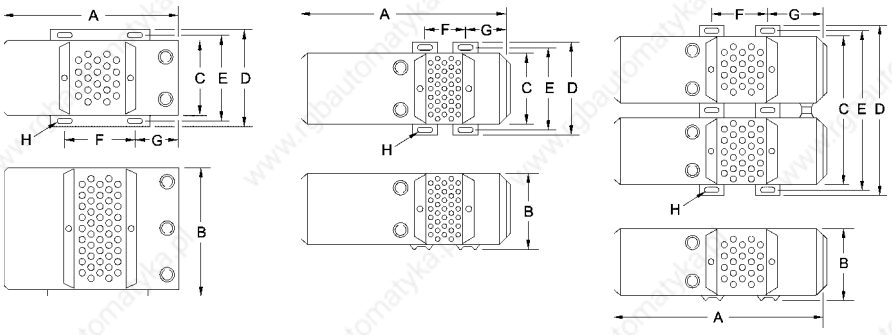
| VA | Catalog Number | Outline Drawing | Dim. A (cm) | Dim. B (cm) | Dim. C (cm) | Dim. D (cm) | Approx. Shipping Weight (kg) |
|---|---|---|---|---|---|---|---|
| 125 | 63-23-612-8 | A | 23,11 | 18,90 | 11,43 | 13,67 | 8,08 |
| 250 | 63-23-625-8 | A | 26,92 | 18,90 | 11,43 | 13,67 | 12,24 |
| 500 | 63-23-650-8 | A | 33,66 | 16,21 | 19,69 | 22.86 | 18,14 |
| 1000 | 63-23-710-8 | A | 45,57 | 16,21 | 19,69 | 22,86 | 28,12 |
| 2000 | 63-23-720-8 | B | 44,65 | 23,72 | 26,82 | 32,38 | 50,81 |
| 3000 | 63-23-730-8 | B | 67,72 | 23,81 | 26,90 | 32,38 | 72,59 |
| 5000 | 63-23-750-8 | B | 76,20 | 23,81 | 26,90 | 32,38 | 109,79 |
| 7500 | 63-23-775-8 | C | 71,12 | 23,81 | 62,23 | 65,55 | 176,94 |
| 10000 | 63-23-810-8 | C | 76,20 | 23,81 | 62,23 | 65,55 | 220,50 |
| 15000 | 63-28-815-8 | * | 76,20 | 23,81 | 91,44 | 97,15 | 349,35 |

| VA | Catalog Number | Outline Drawing | Dim. E (cm) | Dim. F (cm) | Dim. G (cm) | Dim. H (cm) | Approx. Shipping Weight (kg) |
|---|---|---|---|---|---|---|---|
| 125 | 63-23-612-8 | A | 12,07 | 10,48 | 5,53 | 0,79 X 1,75 | 8,08 |
| 250 | 63-23-625-8 | A | 12,07 | 10,48 | 5,53 | 0,79 X 1,75 | 12,24 |
| 500 | 63-23-650-8 | A | 20,64 | 14,30 | 9,12 | 0,79 X 2,06 | 18,14 |
| 1000 | 63-23-710-8 | A | 20,64 | 14,30 | 14,83 | 0,79 X 2,06 | 28,12 |
| 2000 | 63-23-720-8 | B | 29,84 | 10,69 | 12,70 | 1,12 X 1,75 | 50,81 |
| 3000 | 63-23-730-8 | B | 29,84 | 15,39 | 9,29 | 1,12 X 1,75 | 72,59 |
| 5000 | 63-23-750-8 | B | 29,84 | 23,79 | 9,37 | 1,12 X 1,75 | 109,79 |
| 7500 | 63-23-775-8 | C | 63,02 | 18,71 | 9,37 | 1,12 X 1,75 | 176,94 |
| 10000 | 63-23-810-8 | C | 63,02 | 23,80 | 9,37 | 1,12 X 1,75 | 220,50 |
| 15000 | 63-28-815-8 | * | 94,56 | 23,80 | 9,37 | 1,42 X 1,75 | 349,35 |

- Same as (c), but is a triplex assembly.

**Note:** Dimension C includes heat shield around core for all units except 125, 250 and 500VA, which have no shield.

**Figure 1: Hardwired Regulator Dimensions (Refer to Table 1).**
Knockout locations are typical.




**Outline A** **Outline B** **Outline C**

Table 2 shows the recommended bolt size for mounting the hardwired units.

**Table 2. Bolt Sizes**

| Rated VA of Unit | Minimum Recommended Size of Steel Mounting Hardware |
|---|---|
| 125/250 | M6 |
| 500/1000 | M7 |
| 1500 to 10000 | M8 |
| 150000 | M12 |

## Portable Units

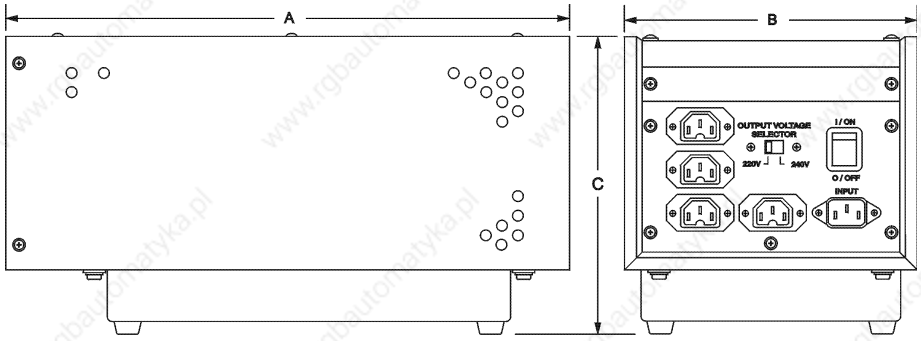
### Installation – Mechanical

These units may be installed in any protected environment. Allow 60 cm above and 30 cm on either side of the installation. Dimensions of the portable regulators are given in Table 3.

**Table 3. Portable Regulator Dimensions**

| Catalog Number | VA | Dim. A (cm) | Dim. B (cm) | Dim. C (cm) | Approx. Shipping Weight (kg) |
|---|---|---|---|---|---|
| 63-13-625-9 | 250 | 33,66 | 19,56 | 17,93 | 15,5 |
| 63-13-650-9 | 500 | 41,27 | 21,60 | 21,59 | 20,0 |
| 63-13-710-9 | 1000 | 41,27 | 21,60 | 21,59 | 28,63 |
| 63-13-720-9 | 2000 | 41,91 | 27,94 | 26,34 | 53,18 |

**Figure 2: Dimensions - Portable Regulators (Refer to Table 3)**




## Hardwired Models

### Installation – Electrical

These regulators may be jumpered for different input and output voltages. The terminal block is at the top of the unit in units 2kVA and smaller. Larger units (3kVA and up) have the terminal block located in the capacitor compartment. Table 4 gives the proper jumper configurations for needed input and output voltages. Figure 3 shows the schematic diagrams of the units.

**Table 4. Wire and Jumper Configurations**

| Unit (VA) | Input Volts | Input Terminals | Jumper Connection | Output Connection |
|---|---|---|---|---|
| 250 to 5000 | 90-130 | H1-H4 | (H1-H3) (H2-H4) | (All Models) 110-X1-X2 or X2-X3 120 X4-X2 or X2-X5 220-X1-X3 240 X4-X5 |
| | 180-260 | H1-H4 | (H2-H3) | |
| | 310-450 | H1-H5 | (H2-H3) | |
| 7500 | 180-260 | H1-H5 | (H1-H3) (H2-H5) | |
| | 310-450 | H1-H4 | (H2-H3) | |
| 10000 to 15000 | 180-260 | H1-H4 | (H2-H3) | |
| | | H1-H5 | (H2-H3) | |

**Figure 3. Hardwired Unit Schematic**

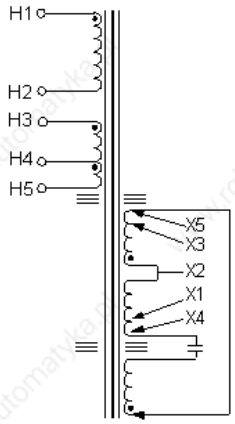



Table 5 shows recommended wire gauges and fusing for the units. However, this table is not meant to supercede local and national wiring codes and standards. Make certain to adhere to local and national code requirements.

**Table 5. Recommended Wire Gauges and Fusing**

| Catalog Number | Rated Volts | Req. Circuit Protection (In Amps, Fast-Blow Fuse) | Min. Gauge 90°C Wire (In Cross Sectional $mm^2$) | Rated Volts | Min. Gauge 90°C Wire (In Cross Sectional $mm^2$) |
|---|---|---|---|---|---|
| 63-23-612-8 | 110-120<br>220-240<br>380-415 | 3<br>1.5<br>0,8 | 1,0<br>1,0<br>1,0 | 110/120<br>220/240 | 1,0<br>1,0 |
| 63-23-625-8 | 110-120<br>220-240<br>380-415 | 6<br>3<br>1 | 1,0<br>1,0<br>1,0 | 110/120<br>220/240 | 1,0<br>1,0 |
| 63-23-650-8 | 110-120<br>220-240<br>380-415 | 10<br>6<br>3 | 1,5<br>1,0<br>1,0 | 110/120<br>220/240 | 1,0<br>1,0 |
| 63-23-710-8 | 110-120<br>220-240<br>380-415 | 15<br>10<br>6 | 2,5<br>1,5<br>1,0 | 110/120<br>220/240 | 1,5<br>1,0 |
| 63-23-720-8 | 110-120<br>220-240<br>380-415 | 30<br>15<br>10 | 6,0<br>2,5<br>1,5 | 110/120<br>220/240 | 4,0<br>1,5 |
| 63-23-730-8 | 110-120<br>220-240<br>380-415 | 45<br>25<br>15 | 16,0<br>4,0<br>2,5 | 110/120<br>220/240 | 6,0<br>2,5 |
| 63-23-750-8 | 110-120<br>220-240<br>380-415 | 80<br>40<br>20 | 25,0<br>10,0<br>4,0 | 110/120<br>220/240 | 16,0<br>4,0 |
| 63-28-775-8 | 220-240<br>380-415 | 60<br>30 | 16,0<br>6,0 | 110/120<br>220/240 | 25,0<br>10,0 |
| 63-28-810-8 | 220-240<br>380-415 | 80<br>40 | 25,0<br>10,0 | 110/120<br>220/240 | 35,0<br>16,0 |
| 63-28-815-8 | 220-240<br>380-415 | 110<br>60 | 50,0<br>16,0 | 110/120<br>220/240 | 45,0<br>25,0 |

## Other Considerations for Hardwired Units

### Three Phase Operation

If operation from a three phase source is required, three hardwired regulators may be wired in delta as shown in Figure 4.

### Note

Required branch circuit protection must be located in the primary of each regulator, not in the three phase line. The outputs must supply three independent single phase loads of the same voltage rating. Do not connect loads phase to phase when the three phase configuration is used.

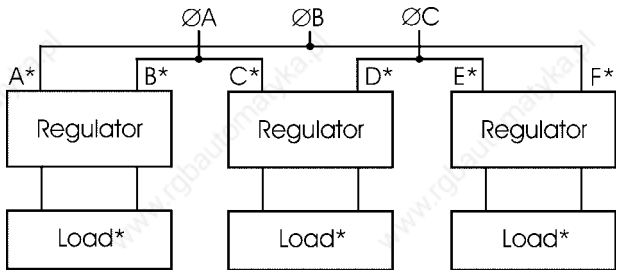
### Multiple Operation

Two or more hardwired models of the same rating may be connected with their input and output in parallel. However, on models smaller than 5kVA, do not parallel both 220VCT (X1-X2-X3) and 240VCT (X4-X2-X5). This may damage the output windings.

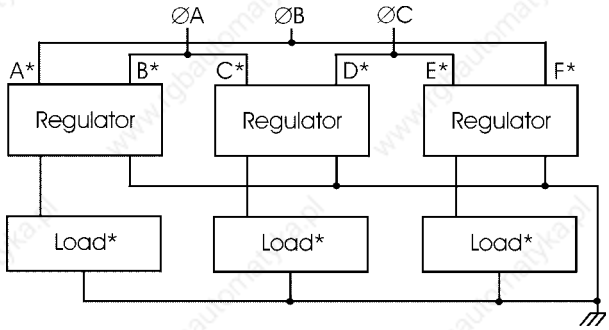
### Input Power Switch

Because the regulators include resonant circuitry that is energized whether or not the unit is serving a load, it is very desirable to install a disconnect switch in the primary circuit.

**Figure 4. Three Phase Connections**




**A: Isolated, Single Phase Loads**




**B: Separate, Single Phase Loads in Grounded Wye**

*Connect per Table 4

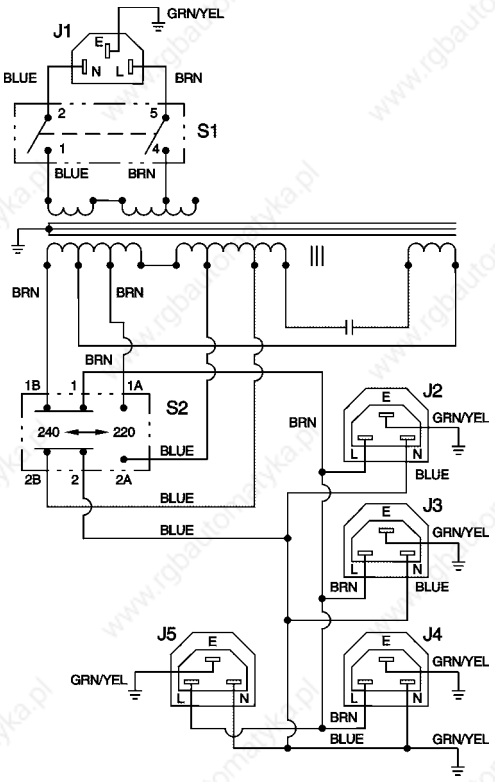
## Installation-Electrical

### Portable Regulators

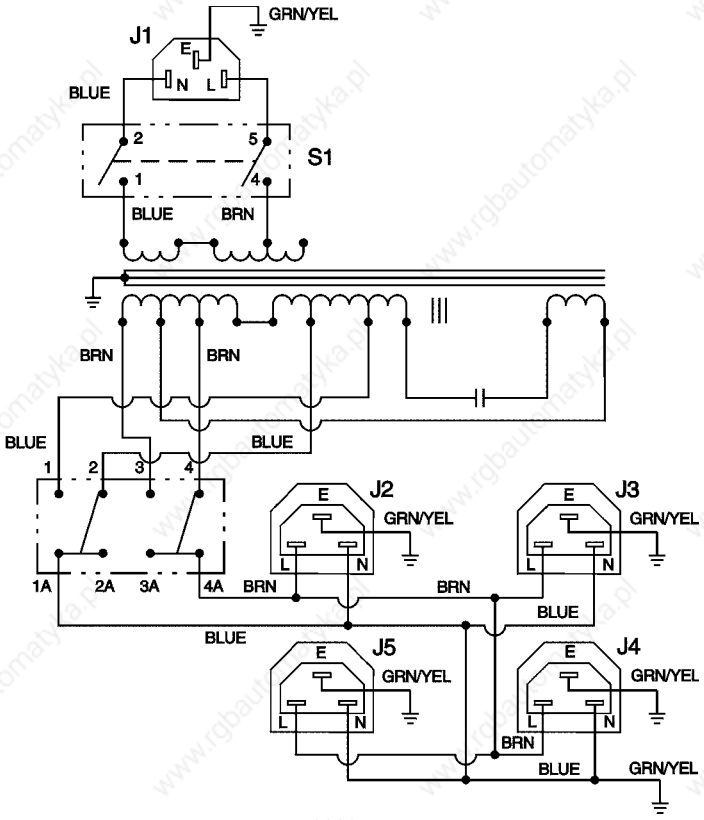
These units are equipped with one input off/on switch and one three-wire, earthing-type input cord. The installer must add the plug ends required for use. Figure 5 shows the portable regulators schematically. Color codes for the supplied line cords are as follows:

| | | |
|---|---|---|
| Brown- Hot | | Black- Hot |
| Blue- Neutral | Or | White- Neutral |
| Green/Yellow – Earth | | Green- Earth |

**Figure 5. Portable Regulator Schematics**




**250-1000 VA (250 VA has two outlets)**




**2000 VA**

There is a switch on the front of the portable regulators that allows the selection of either 220 or 240VAC output.

**Note**

The unit must not be powered while operating this switch. Unplug the unit from the power source before using this switch.

## Physical Characteristics of Operation – All Units

### Operating Temperature

Standard units are designed to operate in ambient temperatures of -20°C to +50°C. In operation, a temperature rise will occur whether or not the transformer is serving a load. Normally, this rise may fall anywhere in the range of 45-100°C. depending on the regulator type and rating. In any case, the maximum operating temperature at an ambient of 50°C is always within safe operating limits.

### Magnetic Fields

In almost all applications, this effect may be disregarded. In certain applications, care should be exercised in the orientation of the core with respect to critical circuits, in order to minimize the effect in the field.

## Electrical Characteristics of Operation – All Units

### Checking with Voltmeters

All checks on output voltages should be made with a true RMS voltmeter. Rectifier type voltmeters will not give accurate readings due to the small amount of output harmonics present.

### Load Regulation

Changes in output voltages resulting from changes in resistive loads from no load to full load (at a 100% power factor) are approximately four percent.

### Effect of Load Power Factor

The median value of output voltage will vary from the nameplate rating if the load has a power factor other than that for which the regulator was designed. Load regulation will also be greater as the inductive load power factor is decreased. However, the resulting median values of output voltage will be regulated against supply line changes at any reasonable load or load power factor.

### Use with Switchmode Power Supplies

If a CVS transformer is used as a source for a switchmode power supply, a slight amount of ringing may be noticed on the sinewave output of the CVS at half cycle intervals for a short duration. This ringing occurs at the point when the switchmode power supply current demand drops to zero. The ringing should not be a cause for concern since it is of relatively low magnitude and frequency. The CVS has been tested with a variety of switchmode power supplies and it has been determined that the ringing never affects the DC outputs, nor does it degrade the components of any switchmode power supply.

### Effect of Temperature

The output voltage will show a small change as the unit warms up to stable operating temperatures at a constant ambient temperature. This change may be about one or two percent depending on the unit's VA rating. At a stable operating temperature, the output voltage will change slightly with varying ambient temperature. This shift is approximately one percent for each 40°C of temperature change.

### Response Time

Transient changes in supply voltage are usually corrected within 1-1/2 cycles or less; the output voltage will not fluctuate more than a few percent.

### Input Characteristics

The regulator transformer includes a resonant circuit that is energized whether it is serving a load or not. Therefore, the input current at no load is approximately 35% of the full-load primary current. Input power factor will average 90-100% at full load but may drop to about 75% at half load and 25% at no load. In any case, it is always leading.

### Current Limitation

When the load is increased beyond the regulator's rated value, a point is reached where the output voltage suddenly collapses and will not regain its normal value until the load is partially released. Under short-circuit conditions, the load current is limited to approximately 150% of the rated full-load value and the input power to less than 10% of normal. The regulator will protect both itself and its load against damage from excessive fault currents. Fusing of load circuits is not necessary.

### Operation on Motor Loads

Because of the current-limiting effect described above, special attention should be given to motor applications. In general, the regulator must have a load rating nearly equal to the maximum power drawn during the starting cycle. This may run from two to either times the normal (running) rating of the motor. In doubtful cases, it is advisable to measure the actual starting current.

## Servicing

### No Routine Maintenance Necessary

Because the Sola Micro/Minicomputer Regulator is a simple, rugged device without moving parts or manual adjustments, no routine servicing or maintenance is needed. In the event of apparent poor performance, check the following points immediately:

**A. Nominal Voltage Too High**

1. The load may be considerably less than full rating. (See: Load Regulation", page 13).
2. The load may have a leading power factor.

**B. Nominal Voltage Too Low**

1. Load power factor may be lagging.
2. Unit may be slightly overloaded. (See Current Limitation", page 14).

**C. Does Not Regulate Closely**

1. Unit may be slightly overloaded. (See Current Limitation", page 14).
2. Actual line voltage swings may be outside the rated range of unit, particularly on low side.
3. On varying loads, a certain amount of load regulation may be mixed with the line voltage regulating action. (See "Load Regulation", page 13).

**D. Output Voltage Very Low**

1. Unsuspected or unplanned overloads of substantial size may occur intermittently (motor-starting currents, solenoid inrush currents, etc.). (See "Current Limitation", page 14).
2. One or more capacitor units in regulator may be defective.

### E. No Output Voltage

1. Check power source beakers or fuses.
2. Check input switch (on portable units).
3. Check continuity between input terminals, and also between output terminals.

### F. Transformer Operating Temperature

1. The transformer used in these regulators is designed to operate at high flux density, and hence, relatively high temperatures. After connection to line for a half- hour or so, the transformer core structure may be too hot to touch with the bare hand. This is normal and should not be a concern.

**Note**

In case the regulator is operating but does not appear to have the correct output, ***it is very helpful to apply the following test***:

1. Disconnect the working load.
2. Connect a dummy load of lamps, heaters, or other resistive load substantially equal to the full-load rating of regulator, directly across its output terminals.
3. Measure the output voltage of the regulator using a true RM type voltmeter directly across its output terminals.

This test will usually establish whether the apparent poor performance is due to a fault in the regulator or to some peculiarity of the working load.

**Factory Test and Inspection**

If the field test suggested earlier indicated that the regulator itself may be faulty, a full report of the difficulty should be communicated to the place of purchase. The Authorized Sola/Hevi-Duty Distributor may then suggest further helpful field tests or authorize return for inspection at once. A Return Authorization Number will be issued. This Number must appear on the outside of the shipping container, otherwise the shipment will not be accepted.

**Field Replacement of Capacitors**

Capacitors used in all regulators are of the highest commercial grade. Nevertheless, there is a certain small percentage of failure. The Sola/Hevi-Duty limited warranty includes free replacement of any capacitor unit that fails within five years of sale. Older units can be replaced for a moderate charge.

Where component technical help is available, it may be possible to test and identify defective capacitors in the field, and to make field replacement with new capacitors. In all such cases, advice and cooperation must be requested in advance.

**Warranties**

Sola/Hevi-Duty warrants its standard catalog products to be free from defects in materials and workmanship and agrees to correct by repair or replacement, at the option of Sola/Hevi-Duty, products that may fail in service provided the product has been installed, operated and maintained in accordance with accepted industry practice.

Warranty begins at the date of manufacture and is according to the following schedule:

1. Standard catalog transformer and single phase, power conditioning products – 10 years plus an additional 2 years if the registration card enclosed with the transformer is completed and returned to Sola/Hevi-Duty within 14 days after installation.

2. Products manufactured to a purchaser's specifications – 1 year.

**Return Policy**

Most instances of initial failure to operate properly can be remedied through a telephone conversation between the user and Technical Service. If it is determined that a product must be returned, contact your local Sola/Hevi-Duty distributor for a Return Authorization. If the distributor is unknown, contact Customer Service at (800) 377-4384 for instructions.

All returns to the Sola/Hevi-Duty factory must have a Return Authorization (R.A.#). The following information required for a Return Authorization (R.A.#):

1. Sola catalog number and/or model number.
2. Serial number.
3. Company name, address, phone number and contact person.
4. Proof of purchase from Distributor.
5. Description of problem.

For proper handling upon receipt at Sola/Hevi-Duty, the R.A.# must be clearly placed in several locations on the outside of the package. Sola/Hevi-Duty is not responsible for damage on returned goods not packaged properly or customer-abused units.

**SOLA – The Power Quality Experts**

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