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

Operating & Service Instructions
Sola Minicomputer Regulators
UL White Card Listed – Power Supply Classification
CSA Certified – Transformer Classification

General Description and Specifications
The Sola Micro/Minicomputer Regulator (MCR) provide virtually instantaneous voltage regulation, and isolation from both transverse and common mode noises for any type of load. It also suppresses transients with ferroresonant, protects overloads, and serves as a dedicated line. It is the ultimate in AC power conditioning equipment.

Operating Temperature Range: -20° to +50°C.

Phase: Single

Input Voltage and Frequency: See Table 3

Output Voltage and Frequency: 110/120/220/240 VAC

Output Voltage Regulation: +3% for an input line variation of +15%

Output Harmonic Distortion: Less than 3% total RMS content at full load.

Efficiency: 85% or 90% at full load typical. No loss of output for line loss of 3 msec.

Noise Reduction: Common mode noise rejection exceeds 120dB.
Transverse noise rejection exceeds 60dB.

Voltage Surge Suppression: Meets ANSI/IEEE C62.41 Category A and B waveforms (formerly IEEE 587-1980).

Installation

All regulators generate considerable heat and depend on the natural draft air circulation for adequate cooling.
It is important that ventilation openings not be obstructed. Mounting in a confined or poorly ventilated space should be avoided unless special provisions have been made for ventilation.

Hard-Wired Voltage Regulators

Hard-wired voltage regulators vary in size according to the output power and may be mounted in either a horizontal or vertical position. If mounted in a vertical position (on a wall, for example), steel mounting hardware must be selected in accordance with Table 1 for a secure installation. The wiring compartment should be at the top. Regardless of position, the regulator should be located where contact with the hot surface of the transformer is unlikely.

For proper ventilation, allow a minimum of 12 inches of clearance above the unit and a minimum of 6 inches of clearance on each side. Dimensions of the regulators and the morning brackets are presented in Figures 1, 2, 3, and 4. The specifications for the figures are listed in Table 3.

Table 1: *Bolt Sizes*

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

Hard-wired regulators must be connected to a branch circuit in accordance with local and national electrical codes. Electrical connections are diagrammed in Figure 5. Proper wiring is determined by the Figure indicated from the regulator specifications in Table 3.

If operation from a 3-phase source is required, three hard-wired regulators may be wired in delta as shown in Figure 10.

Table 2 gives the proper jumper configurations for needed input and output voltages. Table 2 also defines the regulator connections in relation to the points diagrammed in Figure 6. Fusing and wire gauge size are detailed in Table 3.

Note: Branch circuit protection must be located in the primary of each transformer! **Not** in the three-phase operation, fuses must be connected in the primary of each unit, not in the three-phase lines.

On 7.5 and 10 kVA models, the terminal block is located in the right unit. Use only the front or right side knockouts of the right unit for conduit connections. On 15 kVA models, the terminal block is located in the middle unit. Use only the front knockouts of the middle unit for conduit connections.

Two or more models of the same rating may be connected with their input and output in parallel. However, on models smaller than 5 kVA, do not parallel both 208 V (X4-X5) and 240 VCT (X1-X2-X3). This may damage the output windings.

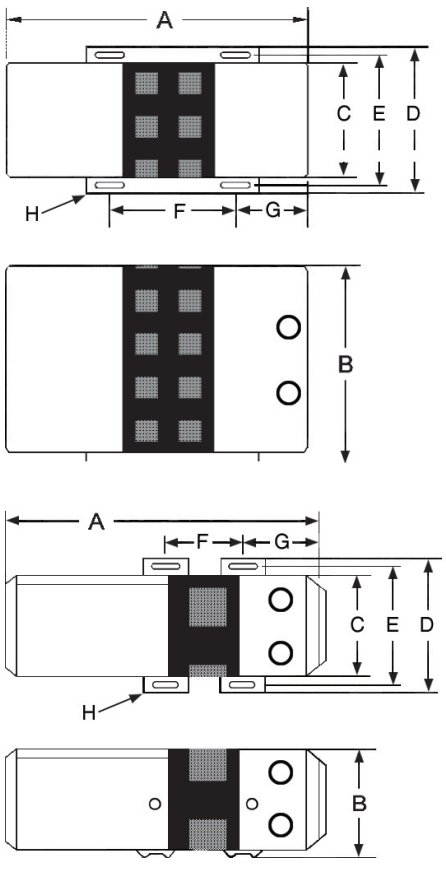


Figure 1: *Outline Drawing 1*

Figure 2: *Outline Drawing 2*

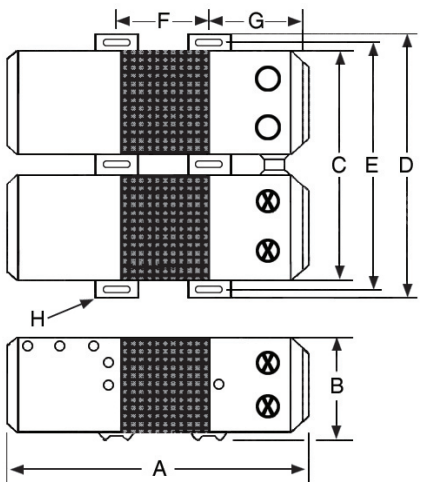


Figure 3: *Outline Drawing 3*

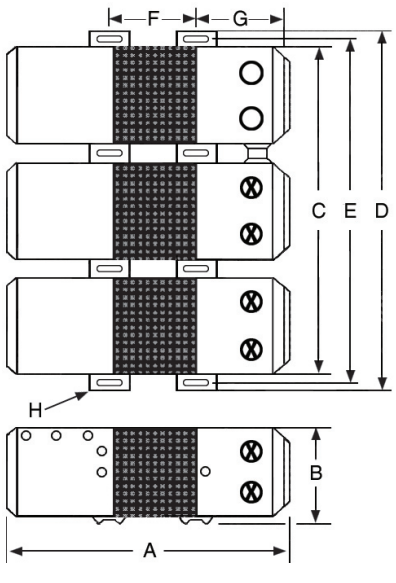
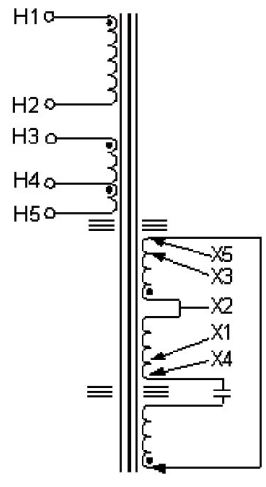


Figure 4: *Outline Drawing 4*

Figure 5: *7500 VA and 10000–15000 VA Electrical Connections*



Primary Voltage	Interconnect	Connect Lines To
220-240	H1 to H3 H2 to H5	H1 & H5
380-415	H2 to H3	H1 & H4
Secondary Voltage	**Interconnect**	**Connect Lines To**
110		X1 & X2 or X2 & X3
120		X4 & X2 or X5 & X2
220		X1 & X3
240		X4 & X5

MCR 50 Hz 7500 VA

Primary Voltage	Interconnect	Connect Lines To
220-240	H2 to H3	H1 & H4
380-415	H2 to H3	H1 & H5
Secondary Voltage	**Interconnect**	**Connect Lines To**
110		X1 & X2 or X3 & X2
120		X4 & X2 or X5 & X2
220		X1 & X3
240		X4 & X5

MCR 50 Hz 10000 - 15000 VA

Table 2: *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 6.
3-Phase Connections
* Connect Per Table 2

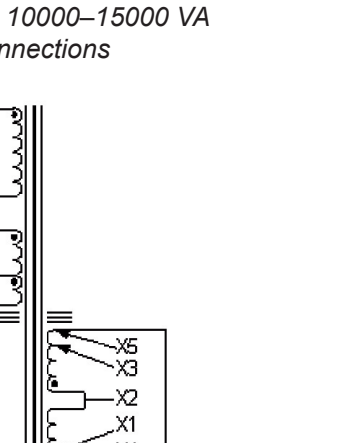


Table 3

VA	Voltage Input	Voltage Output	Catalog Number	OD	Dimensions								Approx. Shipping Weight (kg)	Input Voltage					Output Voltage		
														Required Circuit Protection / Minimum Gauge 90° C WIRE					Minimum Gauge 90° C WIRE		
					Dim. A (cm)	Dim. B (cm)	Dim. C (cm)	Dim. D (cm)	Dim. E (cm)	Dim. F (cm)	Dim. G (cm)	Dim. H (cm)		110-120	220-240	380-415	110-120	220-240	380-415	110-120	220-240
120	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-612-8	A	23,11	18,90	11,43	13,67	12,07	10,48	5,53	0,79 X 1,75	8,08	3	1.5	0.8	1, 0	1, 0	1, 0	1,0	1,0
250	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-625-8	A	26,92	18,90	11,43	13,67	12,07	10,48	5,53	0,79 X 1,75	12,24	6	3	1	1, 0	1, 0	1, 0	1,0	1,0
500	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-650-8	A	33,66	16,21	19,69	22.86	20,64	14,30	9,12	0,79 X 2,06	18,14	10	6	1	1, 5	1, 0	1, 0	1,0	1,0
1000	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-710-8	A	45,57	16,21	19,69	22,86	20,64	14,30	14,83	0,79 X 2,06	28,12	15	10	3	2, 5	1, 5	1, 0	1,5	1,0
2000	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-720-8	B	44,65	23,72	26,82	32,38	29,84	10,69	12,70	1,12 X 1,75	50,81	30	15	10	6, 0	2, 5	1, 5	4,0	1,5
3000	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-730-8	B	67,72	23,81	26,90	32,38	29,84	15,39	9,29	1,12 X 1,75	72,59	45	25	15	16,0	4,0	2,5	6,0	2,5
5000	110, 120, 220, 240, 380, 415	110, 120, 220, 240	63-23-750-8	B	76,20	23,81	26,90	32,38	29,84	23,79	9,37	1,12 X 1,75	109,79	80	40	20	25,0	10,0	4,0	16,0	4,0
7500	220, 240, 380, 415	110, 120, 220, 240	63-23-775-8	C	71,12	23,81	62,23	65,55	63,02	18,71	9,37	1,12 X 1,75	176,94	-	60	30	16,0	6,0	-	25,0	10,0
10000	220, 240, 380, 415	110, 120, 220, 240	63-23-810-8	C	76,20	23,81	62,23	65,55	63,02	23,80	9,37	1,12 X 1,75	220,50	-	80	40	25,0	10,0	-	35,0	16,0
15000	220, 240, 380, 415	110, 120, 220, 240	63-28-815-8	D	76,20	23,81	91,44	97,15	76,20	23,81	91,44	97,15	349,35	-	110	60	50,0	16,0	-	45,0	25,0

Operating Notes and Data

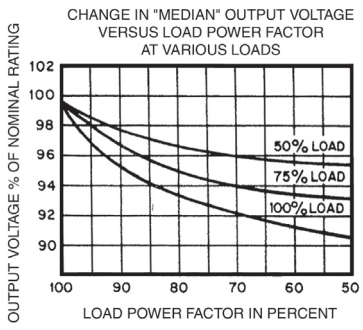
Safety Notice
High voltages are present inside the MCR. Do not reach inside the unit while it is energized. To measure voltage, de-energize the unit, connect the meter, and then re-energize the unit. These units contain no user-serviceable parts.

Checking with Voltmeters
All input and output voltage measurements should be made with a true RMS-responding voltmeter. A certain amount of harmonics in the output may cause other types – particularly rectifier types – to give inaccurate indications.

Rating and Characteristics
The MCR series are built for several VA ranges. See the silkscreen of each regulator for appropriate data.

Load Regulation
Changes in output voltage resulting from changes in resistive loads from no load to full load (100% P.F.) are approximately four percent.

Effect of Load Power Factor
"Median" value of output of voltage will vary from silkscreen rating if the load has a power factor other than that for which the transformer 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.



Operation With Switchmode Power Supplies
If an MCR is used as a source for a switchmode power supply, a slight amount of ringing may be noticed on the sine wave output of the MCR 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 need not be a cause for concern since it is of relatively low magnitude and frequency. Both series have been tested with a variety of switchmode power supplies and it has been determined that the ringing never affected the DC outputs, nor has it been found to degrade the components of any switchmode power supply.

Effect of Frequency
Changes in the frequency of the supply voltage will be directly reflected in the output voltage. A change of about 1.8% in output voltage will occur for every 1% change in input frequency, and in the same direction as the frequency change.

Response Time
An important advantage of the Sola principle of static magnetic regulation is its exceedingly fast response time compared with other types of AC regulators. Transient changes in supply voltage are usually corrected with 1-1/2 cycles or less; the output voltage will not fluctuate more than a few percent.

Input Characteristics
The MCR regulator transformer includes a resonant circuit, which is energized whether it is serving load or not. Therefore, the input current at no load is approximately 35% of the full-load level, even at light or no load. 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 MCR 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 twice of the rated full-load value, and the input power to less than 10% of normal. The MCR will protect both itself and its load against damage from excessive fault currents. Fusing of load circuits is not necessary.

Operation With 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 eight times the normal (running) rating of the motor. In doubtful cases, it is advisable to measure the actual starting current.

Operating Temperature
Standard units are designed to operate in ambient temperatures of minus 20°C to plus 50°C. In operation, a temperature rise will occur whether or not the transformer is serving load. Normally, this rise may fall anywhere in the range of 45°C to 110°C, depending on the regulator type and rating. In any case, the maximum operating temperature at an ambient of 50° is always within safe operating limits for the class of insulating material used.

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 on 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.

Servicing
Because the Sola MCR is a simple, rugged device without moving parts or manual adjustments, no routine servicing or maintenance is needed. In case of apparent poor performance, the user is urged to check the following points immediately:

Troubleshooting

A. Nominal Voltage Too High
1. The load may be considerably less than full rating. (See "Load Regulation", Page 10).
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 12).

C. Does Not Regulate Closely
1. Unit may be slightly overloaded. (See "Current Limitation", Page 12).
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 10).

D. Output Voltage Very Low (20-60V)
1. Unsuspected or unplanned overloads of substantial size may occur intermittently (motor-starting currents, solenoid inrush currents, etc.). See "Current Limitation, Page 12.
2. One or more capacitor units in the regulator may be defective.

E. No Output Voltage
1. Check power source breakers or fuses.
2. Check input switch.
3. Check continuity between input terminals, and also between output terminals.
4. For units with output circuit breaker, reduce load and reset circuit breaker.

F. Transformer Operating Temperature
1. The transformer used in the 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 bare hand. This is normal and need give no concern.

Note
In case regulator is operating but does not appear to have 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 RMS 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.

Field Replacement of Capacitors
Capacitors used in all regulators are the highest commercial grade. Each one is given a rigid acceptance test upon receipt. Nevertheless, as with all capacitors, there is a certain small percentage of failure. The Sola guarantee includes free replacement at the factory of any capacitor unit which fails within one year of sale. Older units can be replaced at moderate charge.

Where competent technical help is available, it may be possible to test and identify defective capacitors in the field, and to make replacement with new capacitors shipped from the factory. In all such cases, factory 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.#).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.

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