



2000 Series Load Bank

User's Guide

Part Number: Manual Toggle Switch

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**AVTRON 2000 SERIES USER MANUAL
MANUAL TOGGLE SWITCH**

PROPRIETARY NOTE

This document contains information PROPRIETARY TO Load Bank products and systems by Avtron Power Solutions, LLC. It is furnished solely to provide information sufficient for instruction, operation, maintenance, evaluation, and testing of the equipment herein disclosed; is not to be used for manufacturing or procurement; and is not to be disclosed to anyone other than persons in the Division, or the Company, or the Government, as the case may be, responsible for action relating to this document without the express written permission of Avtron Power Solutions, LLC.

WARRANTY

The last page of this document contains an express limited warranty. The provisions of this warranty cover any and all rights extended to holders of Load Bank products and systems by Avtron Power Solutions, LLC.

AVTRON POWER SOLUTIONS, LLC
Cleveland, Ohio

**AVTRON 2000 SERIES
LOAD BANK**

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AVTRON 2000 SERIES LOAD BANK

SECTION I

SAFETY CONSIDERATIONS



Throughout this manual, you will find **WARNING** and **CAUTION** statements. Personal injury or death may occur to an operator using or repairing the equipment if a **WARNING** statement is ignored. Damage to the equipment and potentially hazardous conditions for personnel may occur if a **CAUTION** statement is ignored.

Each unit is safety checked for opens and shorts, and the insulation is high potential tested to ensure safe operation. All fuses, safety interlocks, and related safety equipment have been proven reliable as part of the testing procedure of each unit.

As part of your safety program, an initial inspection after receiving the unit(s) and periodic preventive maintenance and safety inspections should be conducted to ensure the reliability and safety built into your equipment.

The Load Bank is an industrial test unit designed to be used indoors. However, because the function of the Load Bank is to dissipate electrical energy, there are inherent dangers to the operator and to the equipment. These dangers shall be outlined in this section.

Electrical energy is transformed into heat by the resistor elements. The heat may be removed from the Load Bank by airflow through the resistor elements. If there are any restrictions or stoppage of airflow, the Load Bank may overheat and may even start a fire. The following recommendations are made:

1. Read the manual before operating the Load Bank.
2. Run an approved ground wire from the Load Bank ground lug located on the customer connection panel to the frame of the power source. Run an approved ground wire from the power source frame to a good earth ground. Size ground wire in accordance with National Electrical Code and any local codes.
3. Do not bypass the temperature sensing switches to prevent nuisance tripping. The switches will drop out the load if insufficient cooling air is reaching the elements.
4. Replace any burned out bulbs on the control panel. Each lamp is an indication that a system is active or has failed and is important to the operation of the unit and safety of the operator.



WARNING

Personal injury from electrical shock may result if all sources of power are not disconnected before servicing. Maintenance work must be done only by qualified personnel.

5. Maintenance should be performed with no power on the unit. The majority of troubleshooting can be performed with an ohmmeter. There are multiple sources of power input to the Load Bank. Ensure each is disconnected.
6. Venting the heated air from the exhaust toward overhead cables, sprinkler systems, or into a room with insufficient volume or "Make-Up" air, is a potential hazard. The Load Bank should be used in a cool, well-ventilated area.
7. Allow cool room air to pass into the unit to cool the elements. Do not allow the unit to be placed where hot exhaust air can recirculate back through the unit causing a constant rise in cooling air temperature.
8. After running a load test, residual heat may be removed from the Load Bank by allowing the blower to operate for a few minutes after load is removed. This procedure is not required for maintaining Load Bank integrity, but it may guard operating personnel from possible burn injuries.
9. The operator should avoid coming in contact with the resistor elements or surrounding covers during and for some time after operation. These portions of the Load Bank become quite hot and may result in a serious burn should contact be made with them.
10. Do not allow objects to enter or block the air intake or exhaust of the Load Bank. A blockage would cause Load Bank overheating. If an object enters the screens, it will cause damage to the resistor elements, possibly shorting them and causing shock and fire hazards.
11. Emergency Shutdown Procedure
 - A. In an emergency, shut down the MASTER LOAD switch, then the power source. The MASTER LOAD switch will allow disconnection of all load steps and still allow for motor to run, cooling any heated elements.
 - B. The POWER ON/OFF switch will disconnect both load steps and fan motor. The power source EMERGENCY OFF switch should be located near the load system.
12. An approved electrical fire extinguisher should be on hand at all times.

13. It is the responsibility of the customer to take diligent care in installing the Load Bank. The National Electrical Code (NEC), sound local electrical and safety codes, and the Occupational Safety and Health Act (OSHA) should be followed when installing the equipment to reduce hazards to persons and property.



14. Read and heed all **WARNING** and **CAUTION** statements in the manual.

SECTION II

DESCRIPTION

The Series 2000 Load Banks are designed for electrically loading and testing power sources. The Load Bank is designed for production line and job site use.

Refer to the schematic for the load bank KW (Current), voltage, phase and frequency rating. Using the toggle switches on the control panel, any combination of the available load steps may be selected to achieve a desired load.

The control panel is integrally mounted on the Load Bank. The controls/metering on the control panel will vary depending on the model and available accessories. Refer to the schematic for specific controls associated with the load bank provided. The general arrangement for the control is:

MODELS 2100/2200

1. MASTER LOAD ON/OFF switch – Applies power to the Load Bank fans and allows the instantaneous connection and disconnection of all switched ON load steps.
2. OVER TEMP/VOLT indicator – Indicates an air failure/insufficient cooling airflow or an over voltage condition.
3. VOLTAGE SELECT switch – Configures load resistor circuit for dual voltage applications if applicable.
4. LOAD STEP switches – Connect and disconnect load steps. Load values are shown above each switch.
5. ANALOG/DIGITAL METERS – Displays Volts and Amps of Load Bank.

MODEL 2400

1. POWER ON/OFF switch – Applies power to the Load Bank and fan. The POWER indicator lights when power is applied.
2. BLOWER FAILURE indicator – Indicates an air failure or insufficient cooling airflow.
3. MASTER LOAD ON/OFF switch - Allows instantaneous connection and disconnection of all switched ON load steps.
4. LOAD STEP switches – Connect and disconnect load steps. Load values are shown above each switch.

MODEL 2500

1. POWER ON/OFF switch – Applies power to the Load Bank and fans.
2. VOLTAGE SELECT switch – Configures load resistor circuit for dual voltage applications if applicable.
3. MASTER LOAD ON/OFF switch - Allows instantaneous connection and disconnection of all switched ON load steps.
4. LOAD STEP switches – Connect and disconnect load steps. Load values are shown above each switch.

MODELS 2600/2700

1. POWER ON/OFF switch – Applies power to the Load Bank and fans. The POWER indicator lights when power is applied.
2. OVER TEMP indicator – Indicates an air failure/insufficient cooling airflow.
3. VOLTAGE SELECT switch – Configures load resistor circuit for dual voltage applications if applicable.
4. MASTER LOAD ON/OFF switch - Allows instantaneous connection and disconnection of all switched ON load steps.
5. LOAD STEP switches – Connect and disconnect load steps. Load values are shown above each switch.

MODELS 2800/2900

1. CONTROL POWER INTEGRAL TRANSFORMER SELECT switch – Configures the internal control transformer to the voltage selected and that matches the UUT voltage.
2. CONTROL POWER INTEGRAL TRANSFORMER ON/OFF pushbuttons – Energizes the configuration relays for the control transformer to the voltage selected above.
3. BLOWER VOLTAGE SELECT INT/EXT switch – Used to select the correct voltage and either from the internal bus or from an external voltage source. If internal, this switch must match the voltage selected with load voltage select switch.
4. LOAD VOLTAGE SELECT switch – Selects the voltage of the UUT.
5. BLOWER START/STOP pushbuttons – Energizes the fan start/stop circuit.
6. FAN ROTATION ABC/CBA – Used to reverse the rotation of the cooling air fan. Turn fan off by depressing the BLOWER STOP pushbutton and allow the fan to come to a complete stop before reversing the fan rotation.

7. BLOWER FAIL indicator - Indicates an air failure or insufficient cooling airflow.
8. MASTER LOAD ON/OFF switch - Allows instantaneous connection and disconnection of all switched ON load steps.
9. LOAD STEP switches - Connect and disconnect load steps. Load values are shown above each switch.

A single phase, 60 Hz power source is required for the control circuit. This power is derived either from an external source or from an internal control power transformer connected to the load bus.

There are some Models that will require a DC source which is provided from the load bus. Refer to schematic diagram.

Fan power is obtained from either the power source under test (connected to Load Bank main load bus) or from a remote source (external power source).

ENCLOSURE

The outside dimensions of the Load Bank are shown on the Outline Drawing. The Load Bank is fabricated of aluminized steel, assembled with SST hardware, and mounted either with feet or casters. Handles may be provided for lifting and transporting the Load Bank.



CAUTION

Do not allow the Load Bank to be placed where hot exhaust air can recirculate back through the unit causing a constant rise in cooling air temperature.

The Load Bank contains fans which provide the necessary cooling air for the load elements. Sensors are provided to monitor the flow of cooling air. These sensors are electrically interlocked with the load application controls and if the fans are not working properly the load steps are disabled.

Air to cool the load elements enters the screened intakes located on one end of the Load Bank. The air passes over the resistive elements and is then discharged through the screened opening at the opposite end of the Load Bank.

The Load Bank contains a control fuse and depending on the model the load circuit will be protected with either branch circuit or main line fusing for short circuit protection.



WARNING

Do not operate the Load Bank with any screen or cover removed. This may expose the operator to high voltage and rotating fan blades.

SECTION III

INSTALLATION

BEFORE INSTALLATION

Inspect the Load Bank for obvious damage such as broken wires, broken or dented panels, cracked ceramic insulators, or any other component breakage that may have occurred in shipment.

LOCATION

The unit is a portable Load Bank, designed for indoor use, and should be used in a cool, well-ventilated area. Cool air must be continually available and the hot exhaust air must be dissipated, not recirculated through the unit. Install the Load Bank so that the inlet and exhaust panels have unrestricted airflow clearance.



CAUTION

Installation must prevent hot exhaust air from recirculating into the air intake. Inlet air temperatures exceeding 120°F may cause damage to the Load Bank. After installation, test the unit at full load and verify that the inlet air temperature does not exceed 120°F.

AIRFLOW CONSIDERATIONS

Even with an ample supply of cooling air, the Load Bank may overheat if it is not properly installed. There are two types of airflow problems that should be avoided:

1. **Recirculating Airflow** - If the hot, exhausted air is permitted to recirculate through the Load Bank, it will reach such a high temperature and low density that it will no longer cool the resistance elements. A Load Bank should not be installed so close to any surface as to reflect the exhausted air back to the air intake. When two or more Load Banks are being used, care must be taken in positioning the Load Banks so that the exhausted air of one unit does not feed the air intake of another.

2. Restriction of Cooling Air - Any obstruction located within two (2) feet of the inlet and four (4) feet of the exhausts (Models 2100/2200), three (3) feet of the inlet and six (6) feet of the exhaust (Models 2400-2700) and four (4) feet of the inlet and eight (8) feet of the exhaust (Model 2800/2900) will restrict the Load Bank's airflow. Airflow is also restricted when two or more Load Banks have air inlets positioned too close to each other. This competition for cooling air causes a low pressure area, restricting adequate airflow.



WARNING

It is vitally important to install the Load Bank properly. Installation errors may result in a catastrophic failure. The overtemperature switches in the Load Bank will guard against some of these problems. If protective circuitry prevents application of the load, determine the source of the problem. **DO NOT DISABLE THE OVERTEMPERATURE SWITCHES.** This causes a safety hazard and voids our warranty. The following installation instructions are critical to the safe operation of the Load Bank. Refer to the SAFETY CONSIDERATIONS section of this manual.

3. The heated exhaust air stream can damage any temperature sensitive items if they are positioned near the exhaust air.
4. Load Banks mounted into a channel, trough, hollow, well, or pit, or exhausting into a full wall or corner, require special considerations even if above conditions are met. In these cases, provide a detailed sketch of site layout for manufacturer to inspect and comment.

POWER REQUIREMENTS

The Load Bank requires a 120 volt, single phase, 60 Hz source of power for operation of the control circuit. Control power may be derived internally from the unit under test with a control power transformer, or from an external source. A power cord for control power may be provided with the Load Bank. Reference the schematic for specific control power requirements and control connections.



CAUTION

If the Load Bank includes a control transformer, never connect a control power line cord to the secondary of the control transformer. This would permanently damage the control transformer.

LOAD CONNECTION

Load power is connected to the Load Bank either through receptacles located on the exterior of the Load Bank or bus bars located within the Load Bank.

For units with receptacles on the exterior, loose connectors may be provided for the load cable to be connected to the load bank.

For internal connection to bus bars, run cables through opening in the Load Bank frame up to bus bars. Reference the outline drawing for the location of the opening. Verify proper phase to phase clearance on cable lugs, mounting hardware, and wiring.

For either load connection, cables to the Load Bank should be of adequate size to handle the maximum rated current according to the National Electric Code and any local codes. The current can be determined by the following formula:

$$\text{Line Current} = \frac{\text{kW} \times 577}{\text{VOLTAGE (Line to Line)}}$$

Lower voltages and different frequencies may be applied to the load circuit of the Load Bank. Frequency change causes no derating of the load; however, the applied kW with a lower voltage is computed by using the following formula:

$$kW_{\text{Applied}} = kW_{\text{Rated}} \times \frac{(\text{Voltage Applied})^2}{(\text{Voltage Rated})^2}$$



WARNING

Do not energize the Load Bank with any covers removed.

GROUNDING

A permanent ground should be connected to the Load Bank enclosure either by a grounded conduit or with a separate ground wire to prevent a potential above ground on the enclosure. No internal ground connections are made to any terminal on the Load Bank.

The ground conductor should be run with the load power conductors to provide the lowest impedance fault path. The ground stud on/within the Load Bank must be connected to both the generator frame and a good earth ground. The ground conductor should be sized per the National Electric Code Table 250.122 if not superseded by local codes.



CAUTION

Never exceed the Load Bank rated voltage as this will cause the Load Bank to overheat.

BLOWER MOTOR CONNECTIONS

For units with blower motor connections separate from the control power circuit, the blower circuit consists of fuses, motor starters, contactors, overload relays, and the fan motor. The blower may be connected in one of two ways.

- A. INTERNAL BLOWER POWER OPERATION: The blower motor is connected to load bus through a relay and fuses. When operating the blower motor from the unit under test, an additional load will be applied. This additional load will be reflected in the meter readings and should be noted on load readings to prevent errors.
- B. REMOTE BLOWER POWER OPERATION: When testing single phase system or systems or a frequency other than 60 Hz, the blower motor must be run from a separate source. First review schematic, set the control panel selector switch to match the external voltage applied and then connect external power. Connect the external blower power source to terminals as shown on the schematic.
- C. NON-STANDARD BLOWER MOTOR FREQUENCY: blower motor will operate between 208 and 250 V (low voltage) and between 416 and 500 V (high voltage) at 3-phase 60 Hz. Connections for 50 Hz operation are identical to 60 Hz, with a motor voltage range of 190 to 220 V (low voltage) and 380 to 440 V (high voltage)



WARNING

When operating at 50 Hz the motor speed (RPM) is reduced which also reduces the cooling of the load bank. Do not exceed 400 V in the 480 V mode or 200 V in the 240 V mode to the input bus when the fans are running at 50 Hz.

SECTION IV

OPERATION

LOAD BANK OPERATION

All tests start with control panel switches in the OFF position.



CAUTION

Before energizing any load, verify that load voltage does not exceed rated voltage of load bank.



CAUTION

Do not attempt operation if the cooling system is not running. Fan inlet and exhaust must be unrestricted. The operation of the fans is vital to the safe operation of this Load Bank. If the safety circuit indicator light comes on and stays on for more than a few seconds without the load dropping out, shut off the power switch at once. Remove all power to the unit and check for proper operation of fan safety circuit. Failure to correct cooling air loss condition will result in destruction of the Load Bank. Refer to the SAFETY CONSIDERATIONS section of this manual.

OPERATING INSTRUCTIONS

1. Place all switches on the control panel to the OFF position.
2. Connect a conductor from the Load Bank ground to the unit under test frame.
3. Ensure the unit under test frame is grounded.
4. Connect the unit under test to the load bank as described in Section III, INSTALLATION.
5. Connect the load bank to a 120 volt, single phase, 60 Hz power source if required.

6. With POWER and MASTER LOAD switches in the OFF position, start the generator.
7. Position the LOAD VOLTAGE SELECT switch and the BLOWER VOLTAGE SELECT switch to the correct voltages (if applicable) to the voltage being applied.
8. Place the POWER switch in the ON position. Verify that the red OVER TEMP lamp momentarily lights. The CONTROL POWER lamp will light.
9. For load banks with a three-phase blower motor. Depress the BLOWER START pushbutton. Verify airflow is in the correct direction. IF not, shut down the blower by depressing the STOP pushbutton. Wait until the fan blade stop rotating then switch fan rotation switch ABC/CBA and restart the blower motor.
10. Position the LOAD STEPS switch(es) to the desired load.
11. Turn on the MASTER LOAD switch to apply desired load. Load steps may be added or deleted at any time.
12. Monitor load applied with analog/digital meter(s), if present.
13. After running tests, remove the load by turning off the MASTER LOAD switch.

After running a load test, residual heat may be removed from the load bank by allowing the blower to operate for a few minutes after load is removed. This procedure is not required for maintaining load bank integrity, but it may guard operating personnel from possible burn injuries.



WARNING

DO NOT touch the exhaust screen during operation. The screen will become hot from the exhausted heat and may cause a serious burn. Refer to the SAFETY CONSIDERATIONS section of this manual.

DO NOT allow objects to enter or block screens.

14. Place the POWER switch to the OFF position.
15. Shut down all power sources connected to the Load Bank.
16. Disconnect the power source cables and the ground connection from the load bank.
17. Disconnect the 120V source that may be to the load bank (if required).

SINGLE-PHASE OPERATION (Dual Voltage/Three-Phase Load Bank)

Single-phase operation is achieved by connection between two phase terminals, one of which is used as neutral.

L1-L3 Connection Mode: The L1-L3 connection mode shown in Figure 4-1 will give approximately 50% loading capacity when the nominal load bank supply voltage is connected. Or 17% load capacity when a single-phase ($\sqrt{3}$) equivalent supply is used.

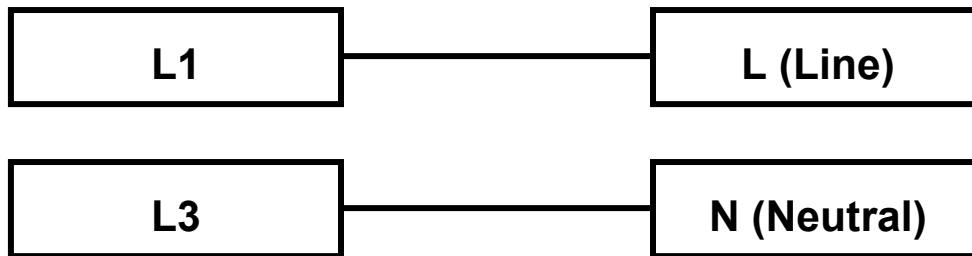


Figure 4-1: L1-L3 Connection for a Single-Phase Supply

NOTE

Place **VOLTAGE SELECT** switch in the low voltage mode.



WARNING

The three phase AC bus and any attached wiring are electrically hot when operating Load Bank in single phase, per Figure 4-1.

L1/L2-L3 Connection Mode: The L1/L2-L3 connection mode shown in Figure 4-2 will give approximately 66% loading capacity when the nominal load bank supply voltage is connected or 22% loading capacity when a single-phase ($\sqrt{3}$) equivalent supply is used.

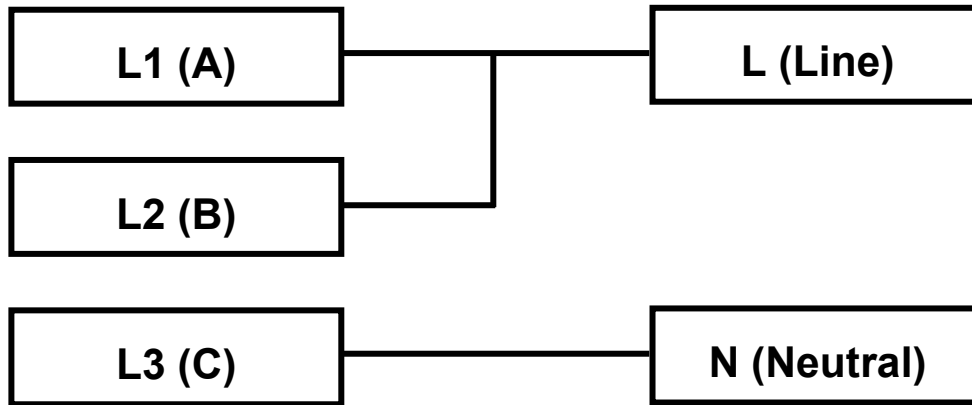


Figure 4-2: L1/L2-L3 Connection for a Single-Phase Supply

NOTE

Place **VOLTAGE SELECT** switch in the low voltage mode.



WARNING

The three phase AC bus and any attached wiring are electrically hot when operating Load Bank in single phase, per Figure 4-2.



ESD PRECAUTIONARY GUIDELINES

CAUTION

Certain circuit card assemblies and their components, typically integrated circuits, may be damaged by seemingly undetectable electrostatic discharge (ESD). Care must be exercised during handling/repair of these items. Use electrostatic discharge precautionary procedures.

The following guidelines are not necessarily all inclusive but rather serve as reminders for good shop practices for the handling/ repair of ESD sensitive circuit card assemblies and devices.

- Store ESD sensitive items in their original containers. These items are often marked with the symbol shown at the top of this page.
- Put on a grounded wrist strap before handling any ESD sensitive item.
- Clear work area of Styrofoam®, plastic, and vinyl items such as coffee cups.
- Handle ESD items by the body, never the open edge connectors.
- Never slide ESD sensitive items over any surface.
- Transport ESD sensitive items in a static shielding container to a static-free work station.
- If a static-free work station is not available, ground the transport container before removing or inserting an ESD item.
- Electric tools used during repair should be grounded. For example, use only anti-static type solder suckers and grounded tip soldering irons. Discharge non-electric tools before use.
- Pack ESD items in static shielding containers before shipping them to Avtron for repair.

* Styrofoam® is a registered trademark of Dow Chemical.

SECTION V

MAINTENANCE

To provide long equipment life and to reduce the chance of electric shock, fires, and personal injury, good maintenance procedures must be used. Before servicing, review the SAFETY CONSIDERATIONS section of this manual.

The following examples of scheduled maintenance procedures are not purported to be all-inclusive, but must be accomplished to maintain the equipment in a good, safe condition. All maintenance work must be done only by qualified personnel.



WARNING

Personal injury from electrical shock or from the moving fan blade may result if ALL sources of power are not disconnected. Refer to the SAFETY CONSIDERATIONS section of this manual.

DAILY

1. Remove any restrictions to airflow through the load bank.
2. Check the screens to make sure that no objects have blocked or entered the openings.
3. Verify that the airflow is in the proper direction.
4. Assure that there is no recirculation of the exhaust air through the load bank.

THREE MONTHS OR 500 HOURS

1. Remove access panels and screens.
2. Inspect the load resistors for mechanical breakdown which is demonstrated by excessive sagging of the elements. Replace with new resistor elements as required.
3. Inspect for broken ceramic insulators. Replace with a new ceramic insulator if any cracks are found.
4. Inspect for loose hardware or loose connections. Tighten where required.
5. Inspect all connections for oxidation or corrosion. Clean the connection or replace the hardware where required.
6. Inspect all magnetic contactors to make sure that the contacts are not severely pitted or corroded. The contacts must move freely and be properly seated.
7. Clean all dirt and debris out of the load bank. This can be accomplished by blowing the inside of the unit with clean, dry compressed air (not to exceed 40 PSI). Eye protection should be worn when cleaning the load bank with compressed air.
8. Inspect all the wiring for any sign of insulation failure.
9. Replace all access panels and screens. Tighten all the fastening hardware securely.
10. Check the indicator lamps on the control panel.

PARTS REPLACEMENT

Access to any component is easily made with the removal of the cover panels. Replaceable components in the unit are listed in the replacement parts list. Manufacturer maintains an inventory of normally used items.

DRAWINGS


PROPRIETARY NOTE


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California Proposition 65 Warning - DINP and DIDP

Advertencia de la Proposición 65 de California - DINP y DIDP

Avertissement concernant la Proposition 65 de Californie - DINP et DIDP

 **WARNING:** This product can expose you to chemicals including DINP, which is known to the State of California to cause cancer, and DIDP which is known to the State of California to cause birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov.

 **ADVERTENCIA:** Este producto puede exponerle a químicos incluyendo DINP, que es (son) conocido(s) por el Estado de California como causante(s) de cáncer y DIDP, que es (son) conocido(s) por el Estado de California como causante(s) de defectos de nacimiento u otros daños reproductivos. Para mayor información, visite : www.P65Warnings.ca.gov.

 **AVERTISSEMENT:** Ce produit peut vous exposer à des agents chimiques, y compris DINP, identifiés par l'État de Californie comme pouvant causer le cancer et DIDP, identifiés par l'État de Californie comme pouvant causer des malformations congénitales ou autres troubles de l'appareil reproducteur. Pour de plus amples informations, prière de consulter: www.P65Warnings.ca.gov.

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California Proposition 65 Warning - Lead and Lead Compounds

Advertencia de la Proposición 65 de California - Plomo y compuestos de plomo

Avertissement concernant la Proposition 65 de Californie - Plomb et composés de plomb

⚠️ WARNING: This product can expose you to chemicals including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov.

⚠️ ADVERTENCIA: Este producto puede exponerle a químicos incluyendo plomo y compuestos de plomo, que es (son) conocido(s) por el Estado de California como causante(s) de cáncer y defectos de nacimiento u otros daños reproductivos. Para mayor información, visite : www.P65Warnings.ca.gov.

⚠️ AVERTISSEMENT: Ce produit peut vous exposer à des agents chimiques, y compris plomb et composés de plomb, identifiés par l'État de Californie comme pouvant causer le cancer et des malformations congénitales ou autres troubles de l'appareil reproducteur. Pour de plus amples informations, prière de consulter: www.P65Warnings.ca.gov.

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Avtron Power Solutions

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Limited Warranty



Loadbank Warranty

This Warranty is given **ONLY** to purchasers who buy for commercial or industrial use in the ordinary course of each purchaser's business.

General

Avtron branded products and systems by Avtron Power Solutions, LLC, are in our opinion the finest available. We take pride in our products and are pleased that you have chosen them. Under certain circumstances we offer with our products the following Two-Year Limited Warranty against defects in material and workmanship.

Please read your Warranty carefully. This Warranty sets forth our responsibilities in the unlikely event of defect and tells you how to obtain performance under this Warranty.

TWO YEAR LIMITED WARRANTY AGAINST DEFECTS IN MATERIAL AND WORKMANSHIP

Terms of Warranty:

As provided herein, the Avtron Power Solutions product is warranted to be free of defects in material and workmanship for a period of two (2) years from the date of shipment. The product shipment date will be determined only from the Avtron Power Solutions bill of lading.

The foregoing Limited Warranty is conditioned upon User's compliance with the following:

1. The Avtron Power Solutions product is deployed in accordance with Avtron Power Solutions specifications and state and local codes and standards, including installation by an electrician licensed in the state where used, if required.
2. The Avtron Power Solutions product is maintained in accordance with Avtron Power Solutions instructions and used under normal conditions for the purposes intended by Avtron Power Solutions.

All warranty field-related repairs, replacements or adjustments must be made by Avtron Power Solutions or its duly authorized representative(s).

Warranty Extends to First Purchaser for Use, Non-transferable:

This Warranty is extended to the first person, firm, association, or corporation for whom the Avtron Power Solutions product specified herein is originally deployed for use (the "User") in the fifty United States or Canada. This Warranty is not transferable or assignable without the prior written permission of Avtron Power Solutions.

Assignment of Warranties:

Avtron Power Solutions assigns to User any warranties which are made by manufacturers and suppliers of components of, or accessories to, the Avtron Power Solutions product and which are assignable, but Avtron Power Solutions makes NO REPRESENTATIONS as to the effectiveness or extent of such warranties, assumes NO RESPONSIBILITY for any matters which may be warranted by such manufacturers or suppliers and extends no coverage under this Warranty to such components or accessories.

Drawings, Descriptions:

Avtron Power Solutions warrants for the period and on the terms of the Warranty set forth herein that the Avtron Power Solutions product will conform to the descriptions contained in the certified drawings, if any, applicable thereto, to Avtron Power Solutions' final invoices, and to applicable Avtron Power Solutions product brochures and manuals current as of the date of product shipment ("Descriptions"). Avtron Power Solutions does not control the use of any Avtron Power Solutions product. Accordingly, it is understood that the Descriptions are NOT WARRANTIES OF PERFORMANCE and NOT WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE.

Warranty Claims Procedure:

Within a reasonable time, but in no case to exceed thirty (30) days, after User's discovery of a defect, User shall contact Avtron Power Solutions product service department at www.avtronpower.com and select the support tab or by phone at (216) 573-7600.

Subject to the limitations specified herein, the Avtron Power Solutions remote support team will first assist User with the defect inquiry for the Avtron Power Solutions product warranted hereunder, without charge. Warranty coverage will apply only after the Avtron Power Solutions support team confirms, either via remote support or, in the discretion of Avtron Power Solutions, an in-person visit, the claimed defect and there are no signs of treatment or use that would void the coverage of this Warranty. If there is a need for in-person visit, Avtron Power Solutions reserves the right to charge for travel, labor and other related costs associated with a visit prior to

visiting User's site in the event warranty coverage does not apply or only applies partially. If warranty coverage applies, Avtron Power Solutions will repair or replace the non-conforming product without charge. All defective products and component parts replaced under this warranty become the property of Avtron Power Solutions.

Warranty Performance of Component Manufacturers:

It is Avtron Power Solutions' practice, consistent with its desire to remedy Warranty defects in the most prompt and effective manner possible, to cooperate with and utilize the services of component manufacturers and their authorized representatives in the performance of work to correct defects in the product components. Accordingly, Avtron Power Solutions may utilize third parties in the performance of Warranty work, including repair or replacement hereunder, where, in Avtron Power Solutions' opinion, such work can be performed in less time, with less expense, or in closer proximity to the Avtron Power Solutions product.

Items Not Covered By Warranty:

THIS WARRANTY DOES NOT COVER DAMAGE OR DEFECT CAUSED BY misuse, improper application, wrong or inadequate electrical current or connection, negligence, inappropriate on site operating conditions, repair by non-Avtron Power Solutions designated personnel, accident in transit, tampering, alterations, a change in location or operating use, exposure to the elements, water, or other corrosive liquids or gases, Acts of God, theft, installation and/or deployment contrary to Avtron Power Solutions' recommendations or specifications, or in any event if the Avtron Power Solutions serial number has been altered, defaced, or removed.

THIS WARRANTY DOES NOT COVER shipping costs, installation costs, or maintenance or service items and further, except as may be provided herein, does NOT include labor costs or transportation charges arising from the replacement of the Avtron Power Solutions product or any part thereof or charges to remove or reinstall same at any premises of User.

REPAIR OR REPLACEMENT OF A DEFECTIVE PRODUCT OR PART THEREOF DOES NOT EXTEND THE ORIGINAL WARRANTY PERIOD.

THE PRODUCTS LISTED IN THIS WARRANTY ARE NOT FOR USE IN THE CONTROL AREA OR ANY REACTOR CONNECTED OR SAFETY APPLICATIONS OR WITHIN THE CONTAINMENT AREA OF A NUCLEAR FACILITY OR FOR INTEGRATION INTO MEDICAL DEVICES.

Limitations:

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

USER'S SOLE AND EXCLUSIVE REMEDY IS REPAIR OR REPLACEMENT OF THE AVTRON POWER SOLUTIONS PRODUCT AS SET FORTH HEREIN.

IF USER'S REMEDY IS DEEMED TO FAIL OF ITS ESSENTIAL PURPOSE BY A COURT OF COMPETENT JURISDICTION, AVTRON POWER SOLUTIONS' RESPONSIBILITY FOR PROPERTY LOSS OR DAMAGE SHALL NOT EXCEED THE NET PRODUCT PURCHASE PRICE.

IN NO EVENT SHALL AVTRON POWER SOLUTIONS ASSUME ANY LIABILITY FOR INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES OF ANY KIND WHATSOEVER, INCLUDING WITHOUT LIMITATION LOST PROFITS, BUSINESS INTERRUPTION OR LOSS OF DATA, WHETHER ANY CLAIM IS BASED UPON THEORIES OF CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, OR OTHERWISE.

Miscellaneous:

NO SALESPERSON, EMPLOYEE OR AGENT OF AVTRON POWER SOLUTIONS IS AUTHORIZED TO ADD TO OR VARY THE TERMS OF THIS WARRANTY. Warranty terms may be modified, if at all, only in writing signed by an Avtron Power Solutions officer.

Avtron Power Solutions obligations under this Warranty are conditioned upon Avtron Power Solutions timely receipt of full payment of the product purchase price and any other amounts due. Avtron Power Solutions reserves the right to supplement or change the terms of this Warranty in any subsequent warranty offering to User or others.

In the event that any provision of this Warranty should be or becomes invalid and/or unenforceable during the warranty period, the remaining terms and provisions shall continue in full force and effect.

This Warranty shall be governed by, and construed under, the laws of the State of New Jersey, without reference to the conflict of laws principles thereof.

This Warranty represents the entire agreement between Avtron Power Solutions and User with respect to the subject matter herein and supersedes all prior or contemporaneous oral or written communications, representations, understandings, or agreements relating to this subject.



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