

SERIES 50 AIR / WATER COOLED MODEL 506



IMPORTANT _ SAVE THESE INSTRUCTIONS -PLEASE READ THIS
MANUAL BEFORE USING EQUIPMENT



CAUTION

The following symbol indicates that caution should be taken when performing the process required in this manual. Damage to the unit or personal harm could happen if proper precautions are not taken.



SHOCK HAZARD

The following symbol indicates that there is a risk of electrical shock if proper precautions are not followed. Only qualified personnel should perform the actions required in this manual.

ABOUT THIS MANUAL

When viewing electronically, click on the subject to jump to that page. Clicking the header on the front page will launch the Controlled Power web site. Clicking anywhere else on the front page will also jump to the Table of Contents. Clicking any blue text will take you to that section of our website.

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INTRODUCTION

Experience, Quality, And Field Reliability

Trystar engineers and manufactures the industry's highest quality industrial DC power supplies (rectifiers), capitalizing on over 50 years of expertise. This quality is reflected in the design, material, workmanship, and operating performance of each rectifier we build. The result is a rugged, reliable rectifier system that will stand up to the rigors of 24x7 operation, even in harsh industrial environments.

Our rectifiers' durability and performance maximize end-user productivity and minimize downtime. If / when field service is necessary, Trystar will provide available parts and service for the life of each rectifier we manufacture, which is often 20+ years!

Trystar is ISO 9001:2015 certified, assuring quality and customer satisfaction from order entry to system start up, and beyond.

OEM's And System Integrators Modular Expandability

As a leading manufacturer of **industrial DC power supplies (rectifiers)**, Trystar understands and strictly adheres to each OEM's and system integrator's rectifier specifications. A custom rectifier design reflects job-specific requirements including voltage and current levels, NEMA ratings, monitoring and controls, dimensions / footprint, and product weight. OEM specific features often include air filters, 24VDC control circuitry, color coded wires, custom paint color, top or bottom entry of AC and DC power cables, and PLC control.

Each rectifier is designed and manufactured for simple installation, start-up, and service. Input and output terminations, component placement, and wiring connectivity are all configured to keep installation costs to a minimum, and to eliminate the need for any field customization during the installation process.

Many design methods are available to help the engineer integrate the high voltage rectifier into the production line, with proper personnel safety. This includes fail-safe emergency power off logic to DC disconnect switches for safe, quick, and convenient isolation of power from production areas.

Trystar's staff of design and application engineers work together to make sure job requirements are satisfied. In addition, expertise is always on-hand to assist with future expansions, and help implement control improvements or monitoring enhancements..

Customer Support And Field Service

All Trystar industrial DC power supplies (rectifiers) are designed and manufactured to have a low MTTR (mean time to repair). Components and sub-assemblies can be easily field-tested, removed, and serviced without excessive and costly hours of maintenance and downtime.

Each Trystar rectifier is backed by 24x7 customer support and service. Experienced, knowledgeable staff and technicians are familiar with

e-coating and other metal finishing applications, and are ready to assist with service contracts, rectifier startup, training, and phone support. Replacement parts and components can be quickly and easily shipped to a customer's site. When requested, a factory technician is dispatched and can most-often be onsite within 24 hours.

Trystar's "Series 50" Rectifier reflects a single transformer, secondary thyristor design, and is the preferred choice for electrocoating and other metal finishing applications which require 100VDC or higher. The "Series 50" Rectifier is available in both 6- and 12-pulse standard models. Compatible with current advanced manufacturing processes, this rectifier is designed for optimum, reliable performance in harsh industrial environments.

E-COAT RECTIFIER FEATURES AND BENEFITS

Input Breaker Protection - Standard main input AC circuit breaker, complete with a door-interlocked safety mechanism.

Cabinet Design - Available in NEMA 1, NEMA 2, and NEMA 4X enclosures, each "Series 50" Rectifier is designed and constructed to endure the harsh industrial environments associated with e-coating and metal finishing processes. NEMA 1 and NEMA 2 enclosure designs are industrial-grade, welded steel construction, with a durable, scratch-resistant powder coat finish. Specially-formulated, corrosion-resistant paint is also available for caustic environments. NEMA 4X enclosure designs are constructed with high-grade stainless steel, and are available with or without a powder coat finish.

Transformers - Designed for high efficiency, low inrush current, durability, and dynamic loading, the "Series 50" Rectifier transformers are constructed from high-grade steel and copper to ensure maximum conductivity and minimal loss. These transformers have a low temperature rise, and are mechanically and electrically designed to withstand the stress that occurs under fault conditions.

Controls And Monitoring - Standard analog metering and local controls on every "Series 50" Rectifier include:

- Output Voltage and Current Meters
- AC Power On and DC On Lights
- Output Voltage and Current Control Potentiometers
- Voltage or Current Regulation Mode Switch
- Voltage or Current Limit Control Potentiometer
- Automatic DC Overload Shut Off

Optional local or remote controls are available to suit almost every application.

Cooling - "Series 50" Rectifiers offer a choice of cooling methods to help minimize cost or increase longevity in

Air Cooled - Outside ambient air is drawn into the rectifier using a long-life fan, and directed over the semiconductor devices. The power transformer is convection cooled, but rectifiers with high power ratings also incorporate a fan in the transformer section to assist with heat removal

from the enclosure. Replaceable air filters are available for all air inlets. With proper maintenance, long rectifier life will result in typical painting environments or protected electrical closets. Low power rectifiers are available with all-convection cooling to minimize dust/debris entry.

Water Cooled - Heated air from power semiconductors is drawn into an air-to-water heat exchanger. Thermal transfer effectively reduces the air temperature, and then circulates the cooled air back into the semiconductor area. This air circulation also removes heat from the power transformer. An internal thermostat is adjustable to maintain the water cycle for proper cooling, while minimizing internal condensation. Direct water-cooled semiconductor designs are also available and can help lower the component ratings to reduce costs. This method of cooling insures long rectifier life for extreme operating environments.

DC Transfer Switch - Available on all Controlled Power rectifiers, either directly attached to the rectifier or in a separate enclosure. This transfer switch is used in applications which have two rectifiers, a primary and a backup. The 2- pole, double-throw design allows the user to seamlessly transfer the DC power from one rectifier to another, without disconnecting any wires or modifying the system. If the primary rectifier fails, the user can switch to the backup rectifier with very little (if any) downtime. When the transfer switch is in the “Off” position, the DC power from each rectifier is isolated from the tank and the rectifier can be locked-out for safety purposes. An optional Kirk key can be integrated to interlock the switch with the e-coat tank doors to ensure that DC power never reaches the e-coat tank when the tank doors are open.

Adjustable Voltage / Current Ramping - Ramping or “Sloping” the DC output at a user-adjustable time rate to control the application of paint and prevent imperfections. In addition, this option relieves surge current stresses on the rectifier and prevents premature current limits from being reached.

Command Two-Level Control / Holding Voltage - Provides two (2) standard voltage levels at which the rectifier will operate. When a customer provided contact closes, the DC will fall to a low holding voltage. When the contact returns to its open state, the DC will rise to the maximum voltage setting. This feature is necessary for conveyor operations.

Automatic Average Current Density (AACD) - In both continuous conveyor and batch e-coat processes, larger parts require more voltage to achieve proper paint thickness and smaller parts require less voltage. The AACD is a PLC-based, rectifier controller that automatically adjusts the output voltage of the rectifier, based on the size of the parts that are in the e-coat tank. Whether integrated into the “Series 50” Rectifier or installed externally, the AACD reduces paint film deviations, reduces part rejections, and achieves paint cost savings.

Ripple Meter - An integral or remote digital meter which measures and displays the percentage of AC output ripple. This meter can be programmed to sound an alarm when the ripple voltage exceeds 5%, and also includes a DC voltage meter. DC voltage levels above or below the prescribed voltage can be monitored. The main benefit is to determine the “rectifier health” and annunciate an alarm that the e-coat process may be compromised.

Amp-Hour Meter - Digital meter that counts the number of DC amp-hours pertaining to energy management and/ or paint consumption.

Amp-Hour Meter With 2-Pump Control And Optional Stroke Feedback Counter - Digital amp-hour meter with 2-pump control for ecoat systems with a 2-part paint feed. Automatically turns on paste and resin pumps, based upon the number of amp-hours or amp-minutes elapsed. Also programmable to turn on the pumps for a set number of strokes, per pre-programmed parameters as well as mixing ratios. Optional ability to receive confirming pump signals to verify that the stroke took place.

AnodeMON™ — Anode Cell Current Monitoring And Distribution - PLC-based, anode cell current monitoring and power distribution system. Anode current and anode life data can be monitored and recorded from an HMI screen, and/or downloaded to a USB flash drive for further analysis. Certain AnodeMON configurations feature anode power distribution with fusing, fuseblown indication, and blocking diodes for protection. Consult factory for additional product information.

Job Design Specific Options - Air filters, 24VDC control circuitry, digital meters, color-coded wiring, safety switch and door interlocks, DC disconnect and transfer switches, Kirk key interlocking, NEMA 12 control cabinets, custom paint color, top or bottom entry of AC and DC power cables, and external or integrated PLC control, including touchscreen graphics are all available to meet specific needs..

Model 506

The Model 506 is a 6-pulse, secondary thyristor rectifier used in e-coating and other metal finishing applications that require DC power > 100VDC. Available in output voltages ranging from 100VDC to 1000VDC, and in current ratings ranging from 100A to 5000A, the Model 506 incorporates a single transformer design, with thyristor semiconductors for rectification and regulation of DC power. In e-coating and other metal finishing applications where low ripple is required, the Model 506 incorporates an L/C ripple filter to smooth the pulsating DC and to effectively reduce the AC RMS voltage ripple.

Model 5012

The Model 5012 is a 12-pulse, secondary thyristor rectifier used in “low ripple, high current” e-coating and other metal finishing applications. Available with or without ripple filtering, the Model 5012 brings the output percent ripple to < 1% with filtering. The Model 5012 offers a significant advantage over the Model 506, in that it reduces input current harmonics, and delivers a smoother DC output. In large e-coating applications where the voltage is > 300V and the current is >1500A, the Model 5012 is often the best solution.

Performance Specifications

Input Voltage: Standard 208V, 240V, 480V, or 600V; 3 phase. (Other voltages available. Consult factory.)

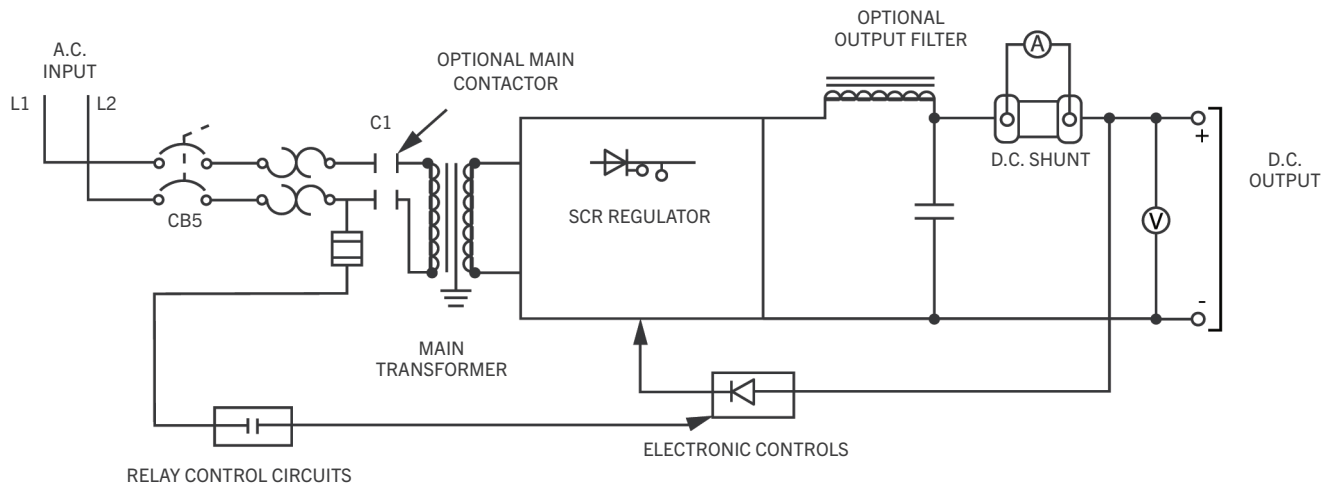
- Input Line Variation: $\pm 5\%$ from nominal. (Optional wider ranges available. Consult factory.)
- Frequency: 60 Hz. Optional 50 Hz.

- Efficiency: 95% typical, size dependent.
- Power Factor: 90% typical at full output.
- % AC Output Ripple:
 - Model 506** - 5% (full voltage and current). Optional filter provides 5% when operating within 25% to 100% of full voltage and current.
 - Model 5012** - 3% (full voltage and current). Optional filter provides 1% when operating within 25% to 100% of full voltage and current.
- Reliability: 65,000+ hours MTBF
- Voltage Regulation: $\pm 0.5\%$
- Current Regulation: $\pm 0.5\%$
- Ambient Temperature: 0° C (32° F) to 40° C (104° F) maximum, 50° C optional.
- Humidity: 95% non-condensing.
- Elevation: Maximum elevation 1524 meters (5000 feet) without de-rating.
- Storage: -20° C (-4° F) to 50° C (122° F)

THEORY OF OPERATION

The basic function of a D.C. Power Supply is to take A.C. power and convert it to D.C. power.

BASIC BLOCK DIAGRAM



A.C. input power is supplied to the main disconnect. The control circuit consists of relay logic and monitoring devices that provide means for starting/stopping, temperature monitoring, automatic cycle timers, emergency stop, fault warnings, cooling fans, etc.... The main transformer once energized, isolates the primary line voltage and steps the secondary voltage up or down to achieve the required A.C. voltage that is to be rectified. The secondary A.C. voltage is fed into the silicon controlled rectifier (SCR) assembly which is configured as a full wave bridge for A.C. to D.C. conversion. The SCR assembly provides (2) functions; (1) it rectifies the A.C. power and (2), it provides phase control allowing the D.C. output to be controlled from "0" to its rated output voltage. The output voltage is controlled and monitored by the "Electronic Regulator" which consists of electronic circuit boards and acts as the "brain" of the system. The electronic regulator constantly monitors the D.C. output and sends signals to the SCR assembly which turns on the SCR's for your desired D.C. output.

The SCR assembly converts A.C. to D.C. leaving an A.C. component known as "A.C. Ripple" riding with the D.C. output. The "A.C. Ripple" is filtered with an inductive/capacitive circuit to provide a more pure D.C. before the final output is transferred to your loads. A typical "A.C. Ripple" specification is no more than 5% A.C. ripple on 25-100% D.C. output range. To verify A.C. ripple on your system, a true RMS multimeter can be used with the following formula to measure the amount of A.C. ripple on your D.C. output.

$$(A.C. / D.C.) 100 = \text{ ______ } \% \text{ A.C. Ripple}$$

RECEIVING THE UNIT

INSPECTION

Upon receipt of the unit, visually inspect for shipping damage. If any damage is found, the Purchaser must contact the Carrier immediately and file a shipping damage claim.

If any damage has occurred that could affect the operation of the unit, please contact Trystar.

Call -1-800-521-4792 Ext. 222.

IMPORTANT NOTICE

This shipment has been carefully inspected, checked and properly packaged at our company.

When it was delivered to the carrier it was in good condition and technically it became your property at that time. Thus, any damage, whether obvious or hidden, must be reported to the transportation company within FIVE days of receipt of the shipment at your premises to avoid forfeiting claims for damages.

FOR ALL SHIPMENTS DAMAGED IN TRANSIT

Leave the items, packing material and carton "AS IS". Notify your carrier's local office and ask for immediate inspection of the carton and contents.

After inspection has been made by the carrier, and you have received acknowledgment in writing as to the damage, notify our Customer Service Department to make any required repair arrangements.

It is your responsibility to follow the above instructions or the carrier will not honor any claims for damage. Also, if there are any shortages or questions regarding this shipment, please notify us within FIVE days.

Please note that we cannot be responsible for any service work or back-charges unless authorized by us in writing, before the work is performed.

STORAGE

If it is necessary to store the unit for a period of time before it is installed, be sure to place the unit in a clean, dry area. To prevent excessive dust from accumulating on the unit, it is advisable to protect it by replacing it in the original container (if possible). If the original container is not available it is recommended that all openings that lead internally into unit are covered so that dust, water or any other substance cannot enter the system. The unit must be handled at all times with the same care you would give to any piece of precision electrical equipment.

REMOVING THE UNIT FROM THE SKID

Please take special care when removing the unit from the pallet and/

or container. Proper equipment must be used when lifting and moving. Safety precautions should be taken. Larger sizes should be lifted with a pallet jack or a fork lift.

When removing the unit from the pallet and/or container, be sure to take proper safety precautions. Serious injury and/or unit damage can result from not taking proper precautions. Extreme care must be exercised when handling the unit. The weight distribution and center of gravity varies with the type and size of the unit.

SAFETY PRECAUTIONS

IMPORTANT SAFEGUARDS, READ AND FOLLOW ALL SAFETY INSTRUCTIONS. SAVE THESE INSTRUCTIONS.

WARNING

There are dangerously high voltages within the dc power supply enclosures. under no circumstances should anyone open access doors to the dc power supply or the tank while the system is energized. only qualified, trained, electrical personnel should service and maintain this equipment. lockout procedures must be enforced while servicing or maintaining the power supply.

- Follow all standard and local electrical codes.
- Be sure input power to the power supply is properly grounded.
- Do not allow water or foreign objects to get inside the power supply.
- Do not place objects or liquids on top of the power supply.
- Do not mount near gas or electric heaters.
- Equipment should be mounted in locations and at heights where it will not readily be subjected to tampering by unauthorized personnel.
- The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition.
- Do not use this equipment for other than intended use.
- Keep unauthorized personnel away from the power supply.
- Read and follow all safety instructions. Save these instructions.

PRELIMINARY INSTALLATION

SELECTING A LOCATION

The D.C. power supply has been completely inspected and extensively operated under various load conditions prior to shipment. Care in locating the unit will assure long, trouble-free operation.

INSTALLATION CONSIDERATIONS

AIR COOLED UNITS

Install in a clean, dry and ventilated area with at least 24 inches of clearance on the air intakes and exhaust.

Allow clearance for door swings. Do not install near furnaces, radiators or other heat generating sources. It is desirable to locate the unit in a separate room adjacent to the operating area, thus isolating it from the poor environmental conditions which may exist.

If the unit is located in an operating area, precaution should be taken to protect it from splashing, fumes, vapor from the tanks, and dripping from overhead pipes. Do not install units in a location where they are subject to airborne dirt. Optional air filters are available and should be installed if the unit is operated in a dusty environment.

WATER COOLED UNITS

Water cooled units are sealed so that internal parts are protected from the plant atmosphere. However, when locating these units, keep in mind that people will have to maintain them and will need tolerable working conditions. It is critical that the water supply is clean, filtered and always available within the water specifications typically located on a tag near the water connections. The door seals must be checked annually and replaced if harsh outside environmental conditions are leaking into the power supply.

- Ventilation
- Weight Load
- Audible Noise Requirements
- Clean Environment
- Accessibility.
- Proper Ground Techniques
- Input Source Voltage
- Distribution of Power
- Room Temperature
- Clearances

ELECTRICAL INSTALLATION AND TYPICAL DATA PLATE

Check the data plate to be sure that the rated input voltage, frequency, and AC line current match the available power. The D.C. Power Supply should not be connected under any circumstances to a power source which does not match the data plate rating. which does not match the data plate rating.

SAMPLE DATA PLATE

 TRYSTAR			
RXPO SERIES 50 POWER SUPPLY			
SYSTEM NO.: E-7-12127 -18			
A.C. INPUT		D.C. OUTPUT	
VOLTS:	480	VOLTS:	400
PHASE:	3	AMPS:	300
HERTZ:	60	RIPPLE:	5%
KVA:	137	(25-100% OUTPUT)	
CONTROL CIRCUIT VOLTAGE: 120			
AMBIANT RANGE: 0-40C			
ELECTRICAL DIAGRAM: #427720			
SERVICE : 248-528-3700			

SYSTEM NO. : Used as a Serial Number to identify the unit. It should be referenced when service or spare parts are required.

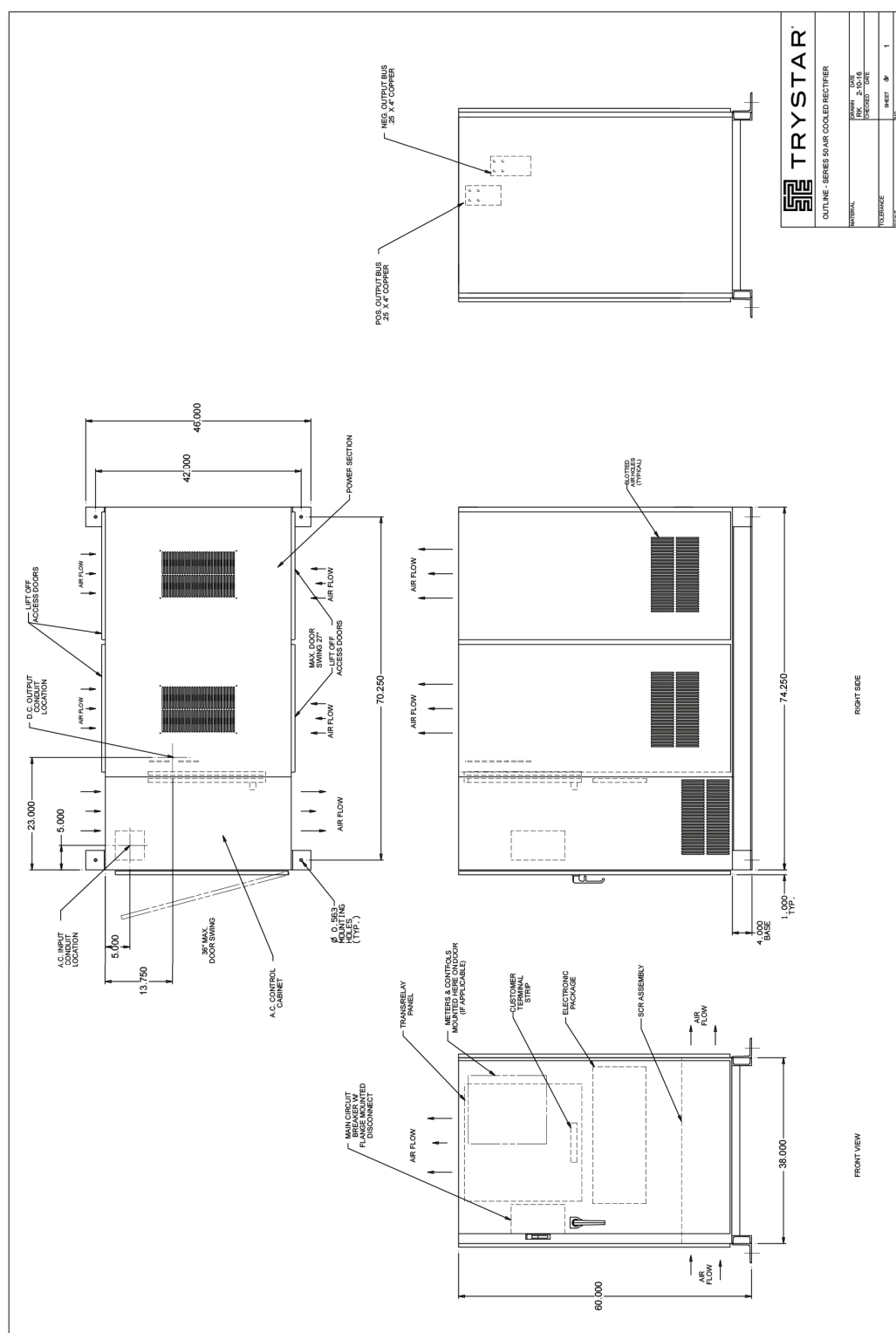
AC INPUT

Volts:	Input Voltage to System.
Phase:	Number of Phases Required.
Hertz:	Frequency Design of System.
KVA:	Input KVA Required.
Ambient Range:	Outside Operating Temperature.

DC OUTPUT

Volts:	Units Rated D.C. Voltage.
Amps:	Units Rated D.C. Amps.
Ripple:	Percentage of Ripple Defined as RMS Value of Peak-to Peak Voltage at Full Output.
Control Circuit Voltage:	Voltage for Control Circuitry.

CABINET OUTLINE - AIR COOLED



FRONT VIEW

Dimensions: 60,000 (width), 38,000 (height), 1,000 (base), 1,000 (top), 74,250 (total height), 1,000 (base offset).

Labels: MAIN AC INPUT, TRANSFORMER, TRANSFORMER TERMINAL STRIP, ELECTRONIC PACKAGE, INTERNAL & EXTERNAL MOUNTED HERE ON DOOR (IF APPLICABLE), TRANSFER PANEL.

TOP VIEW

Dimensions: 42,000 (width), 46,000 (depth), 70,250 (total depth), 1,000 (base offset).

Labels: D.C. OUTPUT CONNECTION POINT LOCATION, A.C. INPUT LOCATION, 30" MAX DOOR SWING, BREAKER ACCESS HOLE COVER, A.C. CONTROL CABINET, 6" O.D. HOLES 60 SPACING (1" DIA.), POWER SECTION, LIFT OFF ACCESS DOORS MAX DOOR SWING 27", LIFT OFF ACCESS DOORS MAX DOOR SWING 27".

RIGHT SIDE VIEW

Dimensions: 4,125 (width), 4,313 (height), 7,375 (base offset), 1,000 (top offset).

Labels: POS. OUTPUT BUS 25 X 1" COPPER, NEG. OUTPUT BUS 25 X 1" COPPER, WATER INLET 1/2" NPT, WATER OUTLET 1/2" NPT.

TRYSTAR

OUTLINE - SERIES 50 WATER COOLED RECTIFIER

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INSTALLATION

AC INPUT CONNECTION

The primary input connections can be made through the top of the cabinet in the area of the starter panel or as specified in circuit drawings that accompany the unit. When cutting or drilling conduit entry holes, care must be exercised to keep all debris, **especially metallic**, out of the cabinet. The unit wiring must conform to National Electrical Code standards and/or local codes as required. Make sure to inspect the input circuit breaker terminals and match your wire size to the terminals supplied. Torque input wires as specified on the breaker terminals.

The input is phase sensitive and the phase rotation must be wired as labeled on the load-side wires of the main input circuit breaker.

Customers primary disconnect (fuses) or circuit breaker should be rated at least 25% greater than full KVA stamped on the data plate and calculated as follows:

$$\text{Circuit Breaker or Fuse Size} = 1.25 \times \frac{\text{KVA} \times 1000}{1.73 \times \text{Input Voltage}}$$

REMOTE CONTROL WIRING (OPTIONAL)

D.C. Power Supplies have optional remote control panels that interface with the main unit. The remote control typically includes output meters, potentiometer controls, start/stop push buttons and other special controls as required per order.

It is important to use the proper interface wire, size, color and type as described:

Note: Use #14 gauge wire for distances up to 100 ft.

Use #12 gauge wire for distances up to 200 ft.

Consult the National Electrical Code for longer lengths.

Three types of interface signals must be run in separate conduits as listed. Refer to the units circuit diagram for interconnecting wire diagram information.

1. 0-7.5 VDC signals interface the voltmeter, ammeter, and output control potentiometers. Use blue #14 or #12 gauge wire as noted above.
2. 120 VAC signals interface the start/stop pushbuttons and other controls as specified on the circuit diagram. Use red #14 or #12 gauge wire as noted above.
3. (Optional) PLC interface use 0-10 VDC or 4-20 mA signals. Use 2 wire with ground shielded cable in accordance with NEC guidelines.

Note: some units remote ammeter wire directly from the 0-50 mvdc shunt signal-check your circuit diagram supplied

with your unit and use the chart below for wire size. Run this wire in separate conduit.

Wire Size	Maximum Length of Wire
#14	15 Ft.
#12	25 Ft.
#10	40 Ft.
#8	60 Ft.
#6	100 Ft.

DC OUTPUT CONNECTION

The D.C. output connection will vary in size depending on the rated D.C. output. Refer to your unit's circuit diagram and the unit's data plate to obtain the D.C. output rating. Follow guidelines as specified in the National Electric Code. Make sure to inspect the units D.C. output connections in order to choose the proper terminals and wire size. Make sure to connect your output to the load side of the shunt typically located on the positive D.C. output leg.

Refer to your unit's circuit diagram for D.C. output wiring information.

WATER COOLING SYSTEM (Optional)

The D.C. Power Supply is a totally sealed cabinet that circulates air in the power section of the cabinet via a fan motor. The fan draws air through a radiator. The radiator receives water from a customer supplied source. The water flow is controlled by a solenoid and air temperature thermostat located in the power section. As the temperature rises, the thermostat enables the solenoid allowing cool water to circulate in the radiator which then has air flow passed through the radiator in order to circulate cool air inside the cabinet. Normal thermostat setting is 85°F and should not be any cooler as condensation may build up inside the cabinet. The SCR regulator is thermally protected and will shut down the rectifier in the event of a cooling fan failure or water flow failure. Some units have an optional water flow switch to monitor proper water flow.

It is critical that the water supply is clean, filtered and always available within the water specifications typically located on a tag near the water connections. The door seals must be checked annually and replaced if harsh outside environmental conditions are leaking into the power supply.

MINIMUM WATER REQUIREMENTS FOR WATER COOLED RECTIFIERS

- pH of 7.0 to 9.0
- Chloride content of not more than 20 parts per million (PPM)
- Nitrate content of not more than 10 PPM
- Sulphate content of not more than 100 PPM
- Solids content of not more than 250 PPM

- Total hardness of not more than 150 PPM
- Maximum conductivity 1500 Micro Ohms.

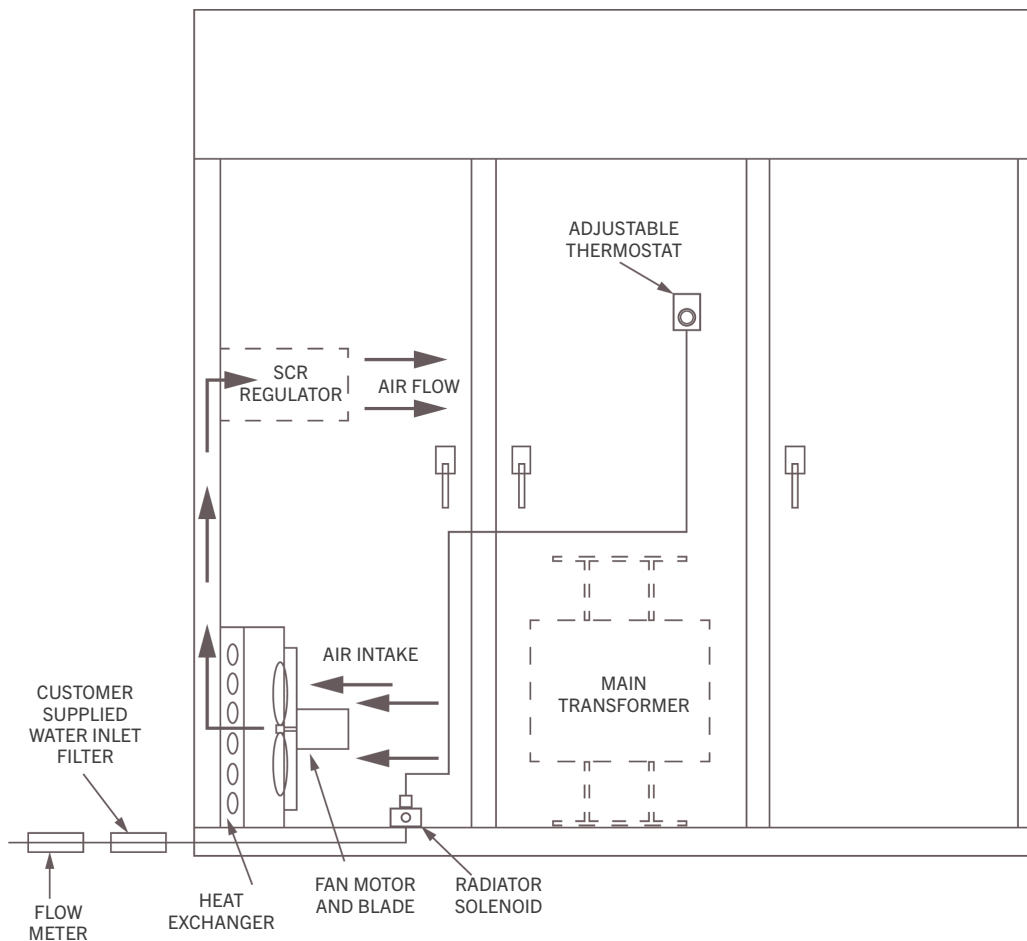
PREFERRED EQUIPMENT

- A 150 micron filter on the system.
- Valves (Ball Cock) on inlet and outlet.
- Flow meter.
- Pressure gauge

Note: The water solenoid valve is located on the inlet line so water is turned off in the event of a leak. In order to prevent the water from draining during normal operation.

Note: The water solenoid valve is located on the inlet line so water is turned off in the event of a leak. In order to prevent the water from draining during normal operation.

- Connect the water outlet to a closed loop system (pressurized).
- “Loop” the water outlet line to the height of the D.C. Power Supply cabinet.

WATER COOLING SYSTEM (Optional)
CONTINUED


AIR / WATER FLOW DIAGRAM

COMPONENT DESCRIPTION

INPUT BREAKER

The main input breaker serves as a total disconnect from primary power and also protection from overloads.

MAIN CONTACTOR (Optional)

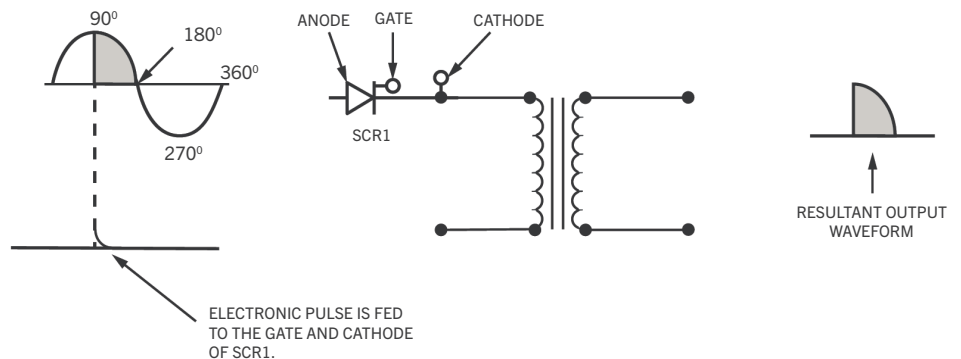
Primary power passes through a main contactor into the primary of the main transformer. The contactor is utilized to turn D.C. power on and off automatically, also to automatically shut off the D.C. power in the event of detecting various emergency shutdown devices.

SILICON CONTROLLED RECTIFIER (SCR)

SCR's are used to regulate the output voltage of the DC Power Supply. This device allows current flow in one direction only (from anode to cathode).

SCR's (sometimes called thyristors), come in "Hockey-Puck" type and "Power Module" type, which is a pre-packaged set of 2 SCR's back to back on an isolated base. Both types are mounted to heat sinks and proper mounting is very important. Overheated SCR's are a major cause of power supply failure.

An example of how a SCR works is explained below.



On the positive half-cycle of the input waveform, the anode of SCR1 is positive with respect to the cathode. At any time during the positive half-cycle, a positive pulse between the gate and cathode of SCR1 will cause conduction to the end of the positive half-cycle. This occurs at 90° in the illustration above. The voltage on SCR1 will reach zero at 180°, and SCR1 will stop conduction since the anode is now negative with respect to the cathode.

By time shifting the gate pulse with respect to input waveform, the output voltage of the power supply can be controlled. The resultant output is now D.C. since the negative half-cycle will not conduct through the SCR. SCR's are used in a variety of single phase and three phase configurations. Refer to the circuit diagrams for the type of SCR configuration used in the unit.

FAN AND MOTOR

Used to pull air through the SCR assembly, main transformer, filter choke and circulate air inside the cabinet.

RADIATOR (Optional).

Cool water runs through the radiator in order to exchange heat generated inside the cabinet.

MAIN TRANSFORMER

The main transformer is an isolation type and it transforms the input voltage to the desired output voltage to be fed into the SCR assembly.

On request, transformers are provided with secondary taps for maximum voltage adjustment. This arrangement allows the system to operate more efficiently for power factor and ripple conditions when operating voltage is considerably lower than the high transformer tap. The transformer tap chosen should be close as possible to the output operating voltage.

After selection of voltage taps, jumpers should be re-connected per job print.

Note: When changing from a higher tap to a lower tap, the output adjust potentiometer will reach full D.C. output prior to being turned fully clockwise.

DC SHUNT

The DC shunt is mounted on either the positive or negative output buss and provides a 0-50 millivolt signal proportional to the DC output current. This signal is used to monitor the output current as well as by the electronic controls for current control, DC overload and current limit.

CONTROL TRANSFORMER

Provides power for the control circuit boards, PLC, relays and indicator lights.

ELECTRONIC PACKAGE

All electronic package adjustments are pre-set at Trystar. Any questions when attempting to re-calibrate should be referred back to Trystar. A certified electronic technician is available if re-calibration is desired. Technical training seminars are also available to train your personnel. The function of the electronic package is to supply trigger pulses to the SCR regulator module, which in turn gives the proper voltage and current versus load relationships. The electronic package is made up of electronic circuit cards to control and monitor the D.C. output.

PROTECTIVE DEVICES

Protection for the D.C. Power Supply is provided by the following means:

1. **Main Circuit Breaker** - The main input AC power is protected with a circuit breaker. If any excessive current is drawn through the main breaker, it will trip and remove all power to the rectifier. The breaker must be reset to turn DC power back on.
2. **Thermal Overloads** - Thermal overloads are used to sense the operating temperature of the SCR's. If these items exceed safe temperature limits, the power supply is shut down. Note: Optional thermal overloads may also be supplied on the main transformer, filter choke, cabinet, etc. ...
3. **DC Overload** - If the DC output current exceeds the rating of the rectifier, the fast acting DC overload circuit will shut off the rectifier output. This will occur three times before final shutdown at which time the main A.C. contactor will turn off and the "Start" button must manually be depressed to restart the unit. Note: D.C. overload is dip switch selectable for 1, 2 or 3 tries.
4. **DV/DT Protection** - An electronic RC network (snubber) is used to provide DV/DT (voltage spike) and DV/DT (current surge) protection for the SCR's.
5. **Leak Detection (Optional)** - A water leak detection circuit is located on the bottom of the cabinet. In the event of a water leak, the D.C. Power Supply will shutdown.
6. **A.C. Over Current (Optional)** - Monitors A.C. input current and if a phase is lost on the primary or an SCR malfunctions, the D.C. output will shutdown instantly.

FAULT DEVICES.

Various faults will either disable the D.C. output or give a visual/audio alarm. Refer to the circuit diagrams to verify how your system is equipped.

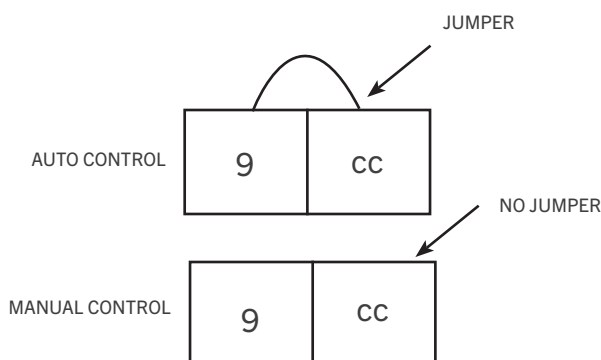
The following are typical faults:

- SCR fuse failure..
- SCR overtemp.
- Transformer overtemp
- Water leak detected.
- D.C. overload.
- Under voltage detect.
- Filter choke overtemp.
- D.C. output fuse failure.
- Cabinet door open.
- Tank door open

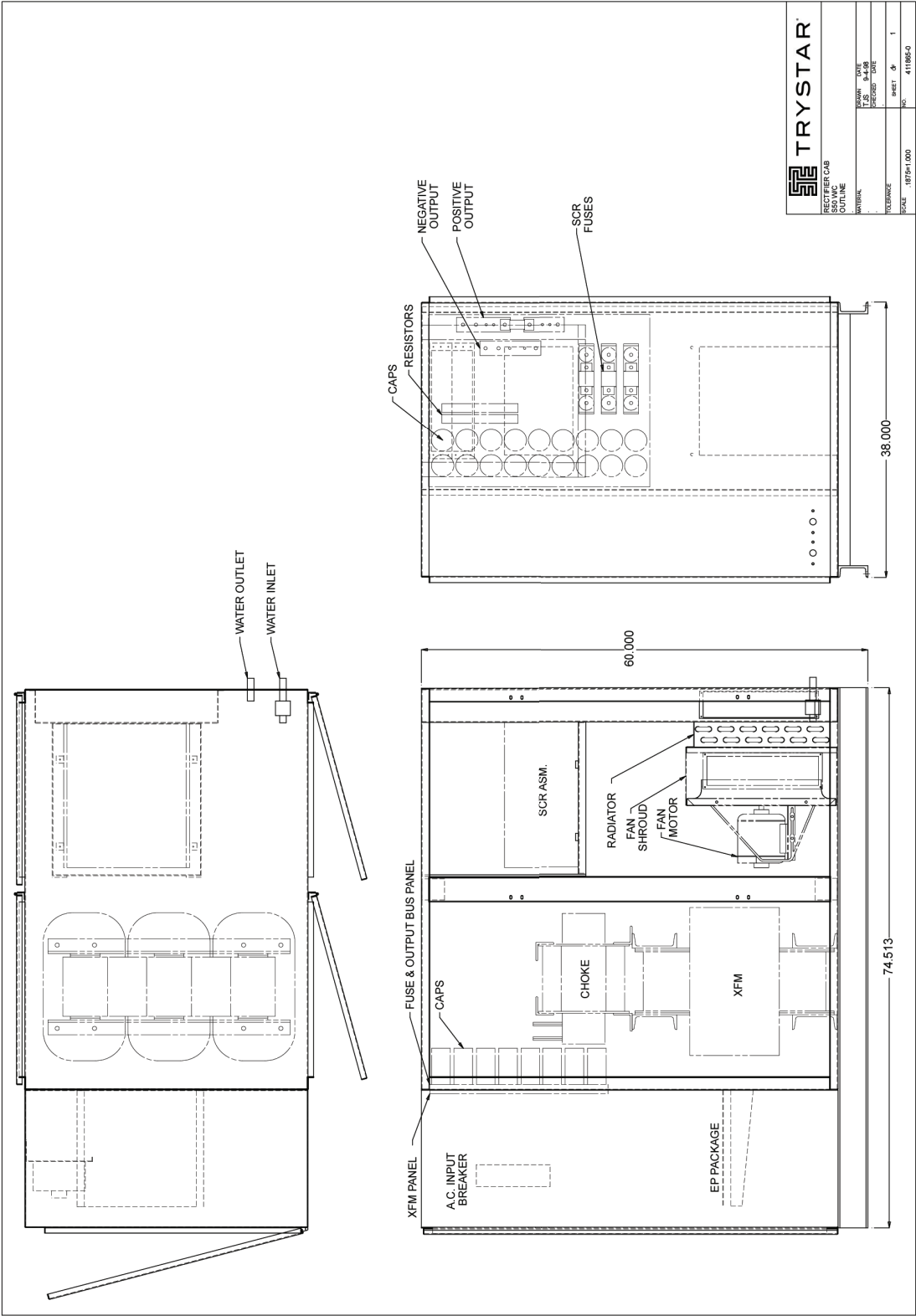
AUTOMATIC CONTROL AND MONITOR OPERATION (Optional)

A unit with automatic control typically has an auto/manual selector switch. To run the unit automatically, simply place the selector switch in the “Auto” position. If your unit does not have an auto/manual selector switch, then 2 terminals are supplied on the electronic package that requires a wire jumper to select auto or manual mode as shown below. Once in auto mode, the unit is automatically controlled through a PLC. The PLC is interfaced to the D.C. Power Supply through our “Omni Isolated Interface Board”, which provides isolated signals to monitor both voltage and current output signals from your rectifier. Both a 0-10 volt D.C. or 4-20 milli amp D.C. signal is available that is proportional to the rectifiers output current and voltage. Additionally, two more circuits provide automatic rectifier voltage and current control with either a 0-10 volt D.C. or 4 –20 milli amp D.C. input signal from a PLC.

The “Omni Isolated Board” is an excellent interface circuit board for applications utilizing PLC or other automated devices with a Trystar rectifier.



TYPICAL COMPONENT LOCATION DIAGRAM



START UP PROCEDURE

START UP PROCEDURE

1. RECTIFIER WARM UP - Verify outside temperature, if the temperature is below 40°F then turn on the main AC input circuit breaker and allow the rectifier to warm up for at least 1 hour before turning the DC on. The internal heater and thermostat automatically run at temperatures below 40° F. DO NOT OPERATE THE RECTIFIER BELOW 40° F WITHOUT WARMING UP THE UNIT. THIS CAN CAUSE DAMAGE TO THE RECTIFIER.
2. All doors and panels on the D.C. Power Supply must be closed. All tank doors and other emergency interlocks must be secure.
3. Set all control knobs to zero (fully counter-clockwise).
4. Press the “Start” push-button and the “D.C. On” light should turn on.
5. Check the circuit diagram and make sure any optional interlocks are correctly interfacing with D.C. Power Supply control circuits. For example, if there is a conveyor interlock signal, it must provide a relay contact to enable the “High Output” adjust knob.

TURN OFF PROCEDURE

1. Press the “Stop” push-button and the “D.C. On” light will turn off and disable the D.C. output.
2. Some systems have an optional “Emergency Stop” push button that when depressed will shunt trip the main A.C. circuit breaker. The breaker must be reset in order to restart the unit.

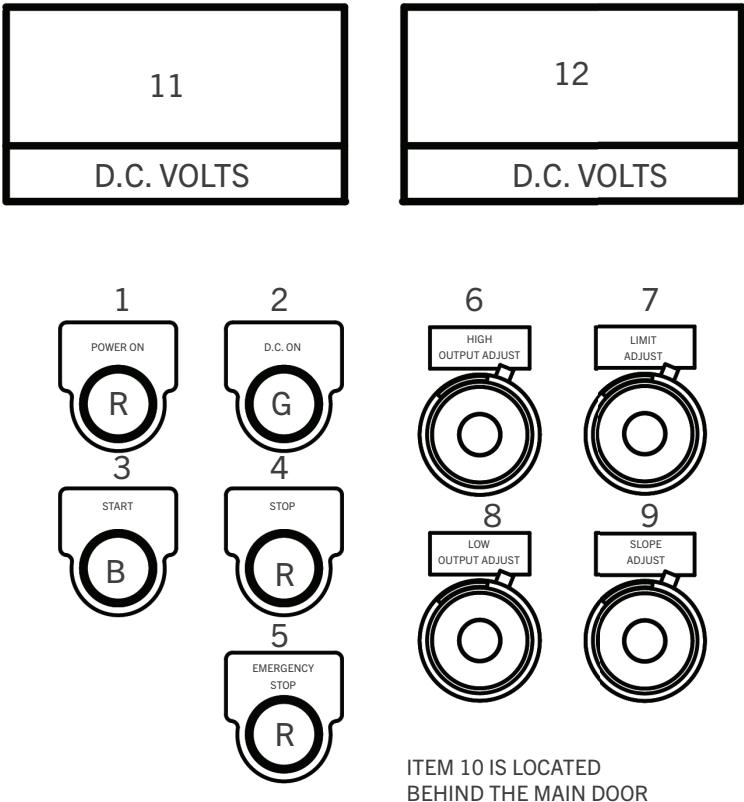
OPERATION

Note: Output adjust knobs are typically located on the front door and inside the front door directly behind any exterior adjust knobs. The volts/amp switch (when provided), is located inside the front door also.

CONTROL FUNCTION

Each D.C. Power Supply is equipped with output adjust knobs, and various control circuits. Please reference your circuit diagrams to verify all the controls equipped with your system. The output adjust knobs are described in this section.

Note: Output adjust knobs are typically located on the front door and inside the front door directly behind any exterior adjust knobs. The volts/amp switch (when provided), is located inside the front door also.



- 1. **Power On** - Light to indicate that the main circuit breaker is energized.
- 2. **DC On** - Light to indicate that the AC contactor (where applicable) is energized and power is supplied to the rectifier electronics.
- 3. **Start** - Energizes the AC contactor (where applicable) and turns the DC output on..
- 4. **Stop** - De-energizes the AC Contactor (where applicable) shutting off the DC output.
- 5. **Emergency Stop** - opens the main AC input circuit breaker cutting power to the rectifier.

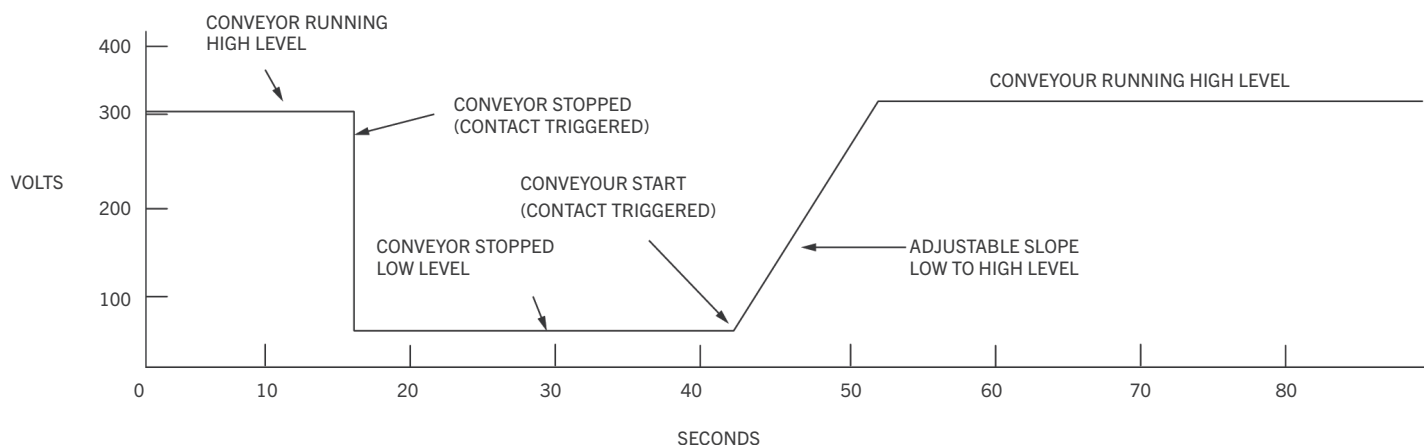
6. **Voltage High Output Adjust (Output Adjust)** - This control maintains the DC output voltage constant when the volt/amp switch is in “Volts” position at a level set by the output adjust knob. For example, the operator may adjust the DC voltage of a 400 volt (max) rectifier to 300 volts. The control will adjust the firing of the SCR’s as needed to keep the voltage at constant 300 volts.

If your load exceeds the current limit setting, the voltage control will be over-ridden and the voltage will drop to a level determined by the load while the current will maintain its maximum or limit setting.

7. **Current Output Adjust (Limit Adjust)** - This control maintains the DC output current constant when the volt/amp switch is in the “Amps” position at a level set by the “output adjust” knob. For example, the operator may adjust the DC current of a 1000 ampere (max) rectifier to 800 amperes. The control will adjust the firing of the SCR’s in order to maintain the current constant at 800 amperes.

The DC output voltage will not be allowed to exceed its rating or it will go into automatic voltage limit.

8. **Low Output Adjust or Holding Voltage (Optional)** - This control typically interfaces with a relay contact controlled by a conveyor running or conveyor stopped signal. When the conveyor stops, the “Low Adjust” or “Holding Voltage” knob takes control of the D.C. output and is typically set at a lower level than the “High Adjust” knob. When the conveyor starts, the D.C. output will slope up from the low adjust level to the high adjust level.

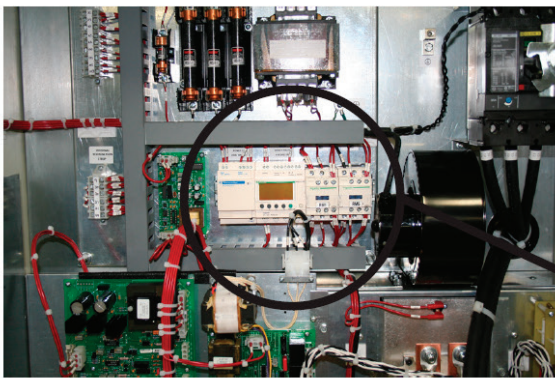


9. **Slope Adjust (Optional)** - This control slope time of the D.C. output from its low adjust level to its high adjust level. The slope circuit is triggered by a relay contact. The contact open enables the low adjust level, and the contact held closed slopes the D.C. output from low adjust to high adjust. The slope adjust is variable from 0-2minutes or an optional 0-20 minute setting. The slope adjust knob turned fully counter clockwise is the fastest output slope time. Clockwise is the slowest.

10. **Volt/Amps Switch** (Not Shown) This switch is located behind the output adjust knob and allows the rectifier to operate in either constant volts or a constant amps mode. In the volts position, the output adjust knob controls and regulates the rectifiers volt age. In the amps position, the output adjust knob controls and regulates the rectifiers current.
Note: In the amps position, a load is required otherwise the output may run out of control.
11. **D.C. Voltmeter** - D.C. Output Voltage reading.
12. **D.C. Amperes** - D.C. Output Amps reading.

OPTIONAL SMART RELAY OPERATION AND PROGRAMMING.

Relay Location: Inside main control section



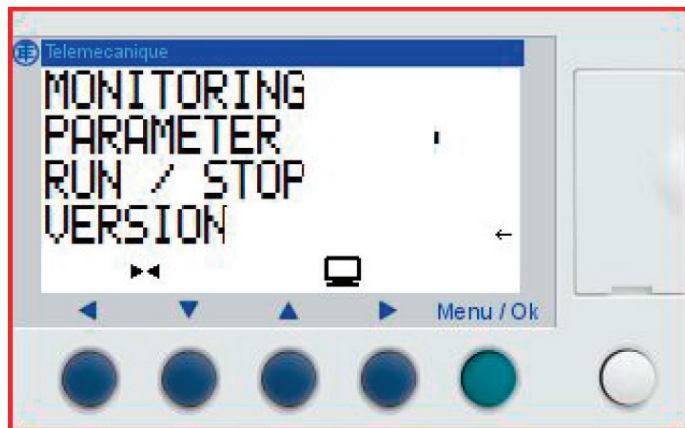
Adjusting the undervoltage alarm settings

Step 1

Make sure the DC power is ON. The DC ON Light will illuminate on the front door. If DC Power is off, press the “Start Button” on the front door of the rectifier.

Step 2

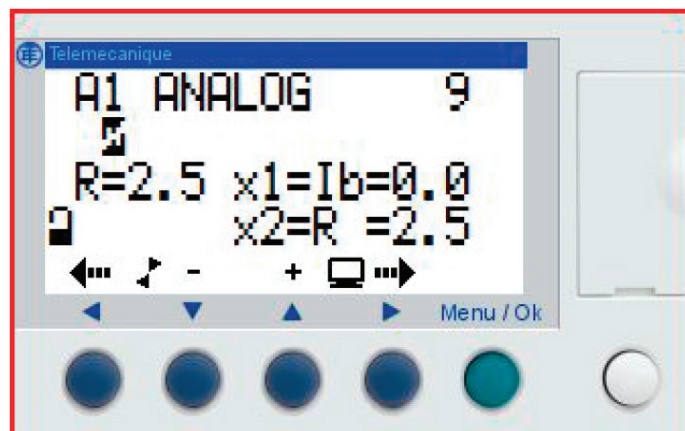
From the home screen of the smart relay device press the “Menu/Ok” button in the lower right hand corner. The following screen will be displayed:.



Using the up and down arrow keys select “Parameter” and press the “Menu/Ok” button.

Step 3 - Changing the Under Voltage Setpoint

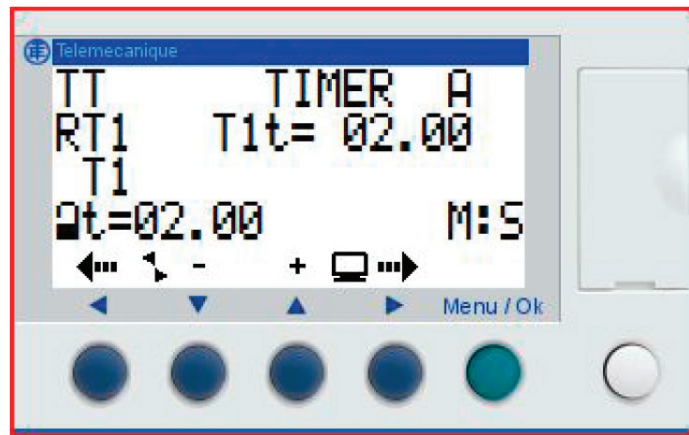
To adjust the under voltage setpoint, press the left or right arrow keys to highlight the “R=” parameter. Once the value is highlighted it will flash. Using the up and down arrow keys select the scaler value that represents the undervoltage alarm setpoint. To calculate a scaler value, multiply the desired low voltage setpoint by 0.025.



Once the desired value is set, press the “Menu/Ok” button. The device will ask you to confirm changes, select “Yes” using the up/down arrow keys then press the “Menu/Ok” button..

Step 4 - Changing the time delay setting to close the contact.

To change the time delay, follow the instructions in Step 2 to get to the parameters screen. Press the up arrow key to access the time delay setting screen (Note that the cursor must be on the “A1” parameter to be able to switch to the time delay setting screen) Using the right and left arrow keys highlight the “t=xx.xx” parameter at the bottom, Once it is highlighted it will flash. Use the up and down arrow keys to adjust the number of minutes and seconds of delay . When finished, press the “Menu/Ok” button and confirm the changes.



OPTIONS

11860 Remote Control Panel : The remote operators control panel allows operation of the power supply from a location away from the main power supply cubicle. The enclosure is constructed to NEMA 12 standards and is custom built for your operation with any variety of start/stop, cycle times, multi level output control, emergency stop etc....

11870 Timed Automatic Cycle Control : The timed automatic cycle control consists of a heavy-duty timer that is initiated when the “start” button is depressed. The timer is configured as a count-up timer. Upon completion of the preset elapsed time the unit will shut down (or drop to holding voltage with slope option). The timer range may be set in seconds, minutes or hours. The values of three digits with a moveable decimal point may be set.

Note: See option #11871 “Audible Alarm with Pilot Light and Silence Switch” for cycle end annunciation.

Note: See option #11871 “Audible Alarm with Pilot Light and Silence Switch” for cycle end annunciation.

11871 Audible Alarm with Pilot Light and Silence Switch : This option is used with Option #11870 (Cycle Timer) to provide an audible and visual indication of the end of cycle. When the timer times out a “cycle end” light will illuminate, and an audible alarm will sound. An alarm silence button is provided to silence the alarm and extinguish the light. At the end of the cycle, it is optional to allow the unit to operate or turn-off. A jumper wire determines which function is operational.

Note: The audible alarm may be a bell, horn or buzzer, to distinguish the rectifier from other equipment. Please specify when ordering.

Note: The audible alarm may be a bell, horn or buzzer, to distinguish the rectifier from other equipment. Please specify when ordering.

11890 Command Two-Level Control : The command two-level control allows the adjustment of one level before a command signal and a second level after the command signal is applied. The command signal from the customer, is a potential free contact. This control consists of two, ten turn, adjustment potentiometers with locking dials. When the command

Note: If this option is used in conjunction with the Slope Control (option 11970) the unit output will slope (ramp) up from the low output level to the high output level when the command signal is closed. The unit will immediately return to the low output level when the command signal is opened.

signal is open, the low output potentiometer controls the output of the unit. When the command signal is closed, the high output potentiometer controls the output of the unit. When the command signal opens again, the unit will immediately switch to the low output level.

Note: If this option is used in conjunction with the Slope Control (option 11970) the unit output will slope (ramp) up from the low output level to the high output level when the command signal is closed. The unit will immediately return to the low output level when the command signal is opened.

11900 Command On/Off Control : The command on/off control allows the rectifier to be started from an external command contact closure and stopped when the external contact is opened. This circuit includes start and stop push buttons and a ready light.

Operation: Once the rectifier's main breaker is energized and the "start" button is depressed the "ready" light will illuminate, indicating the rectifier is ready for the command start signal. A contact closure on the command signal will start the DC output. Upon a command signal opening the rectifier will return to the ready state and await the next command start signal. Depressing the "stop" button will remove the rectifier from the ready state.

11960 Cumulative Ampere-Hour Meter : The totalizing ampere-hour meter is microprocessor based and has a 12 digit, non-resettable display of the accumulated ampere-hour (or ampere-minute) product and a 12 digit, resettable, cumulative ampere-hour (or ampere-minute) display. See the additionally provided manual for more information on this option.

11961 Cumulative Ampere-Hour Meter with Preset, Time Based Control for Two Pumps : The totalizing ampere-hour meter with preset, time based control for two pumps is microprocessor based. See the additionally provided manual for more information on this option.

11962 Automatic 2 Pump Feeder for Paint / Chemical Adder with Pre-Set Pump Stroke Counters (Two Pump Operation) : The automatic solids or brightener adder and pre-set pump stroke counters is microprocessor based. See the additionally provided manual for more information on this option.

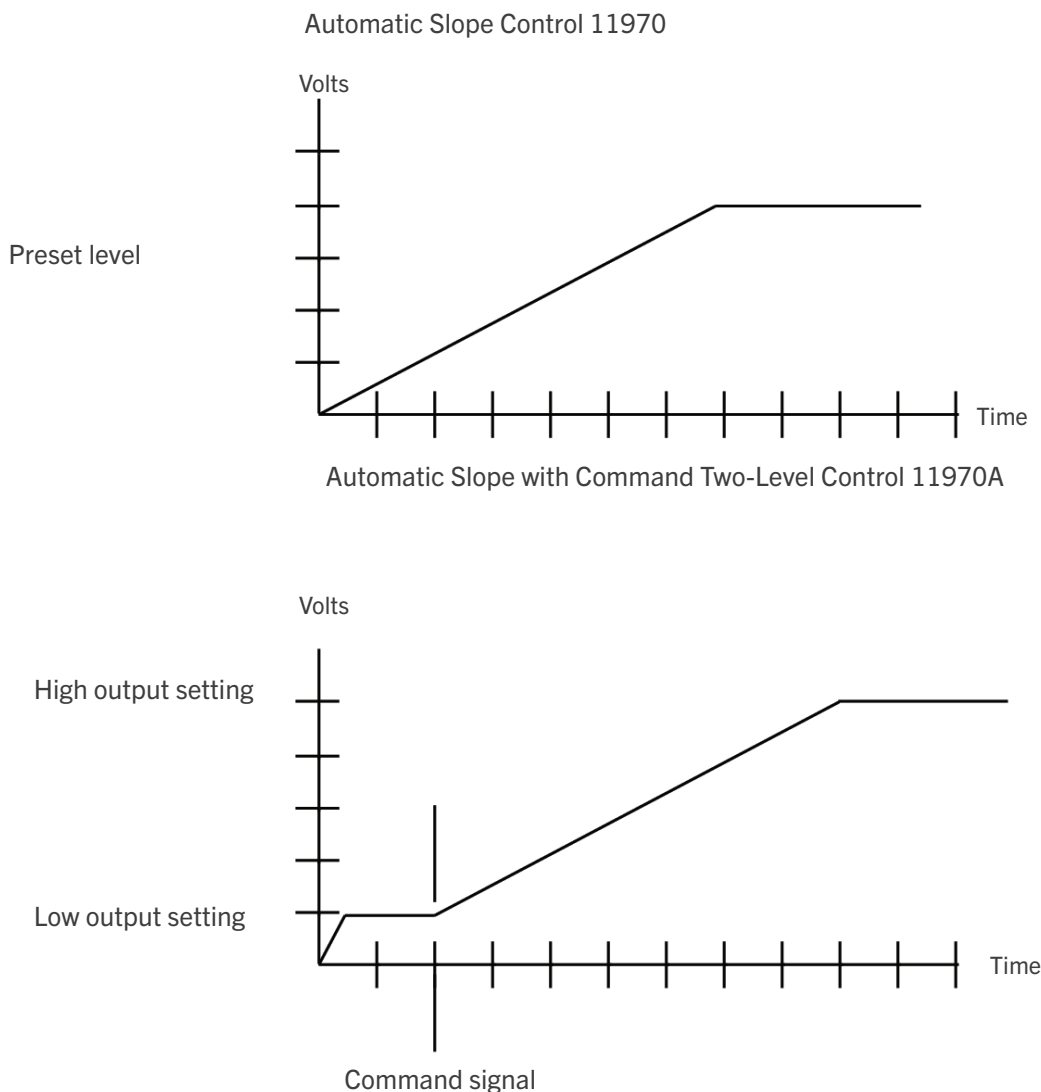
11970 Automatic Slope Control : The automatic slope control provides a step less increase in the voltage or current from zero (0) to a preset level. The slope is completely adjustable with a ten-turn potentiometer to give a linear rate of rise. The slope is initiated with the "start" button. The time ranges when going from zero (0) to full output are adjustable over two (2) ranges:

Short Duration: 3 seconds to 2 minutes maximum.

Long Duration: 3 seconds to 20 minutes maximum.

For extended times beyond 20 minutes consult factory.

11970A Used in conjunction with the "Command Two-Level Control" (option 11890) the unit will slope up from the low output setting to the high output setting after a command signal (potential free contact) is given.



12020 Parallel Control: The paralleling control allows the operation of (2) two or more units in direct parallel. One unit will be selected as master and will be operated as a voltage source and be responsible for the voltage control. The master unit will send a signal to all other units connected in parallel, which will operate as current sources to balance the load current between all units.

12231 Single Channel Computer Interface Board (29950): The single channel computer interface board (29950) is used in conjunction with the Omni Control board (408101). The single channel computer interface board can be configured to provide or accept isolated interface signals of 0 to 10 volts or 4 to 20 milliamps. The isolation devices have a “dielectric withstand voltage” of 750 volts maximum. The card may be used for an isolated output signal for voltage or current monitoring, or an isolated input signal for voltage or current control. One card is required for each signal to be used. When using input signals for control, only 1 signal is needed to control either voltage or current.

*The other signal can be internally wired to achieve maximum rated output level.

12235 Ripple Filtering: The Ripple Filter consists of a Choke (L) and a capacitor (C). A bleed resistor (BR) is utilized to discharge the capacitor in approximately five (5) seconds when the power is turned off. The LC filter will provide 5% or less RMS ripple over the range of 25% to 100% output.

12236 Fuse Blown Indication: The fuse blown indication may be used for any fuse in the rectifier. The blown fuse indication may be relay contact, pilot light, horn, buzzer or any combination.

12238 Ripple Meter with Under/Over Voltage Alarm: The Ripple meter is a microprocessor based voltage meter. The DC and AC rms voltage is monitored and displayed on the LCD. The processor automatically calculates and displays the percentage of ripple.

The meter can also be programmed to monitor the DC voltage, and provide an alarm indication if it is over or under the alarm setpoints. The alarm circuit will activate for out-of specified voltage or ripple levels.

The alarm parameters for ripple and voltage are fully programmable using a simple 2-key “membrane” type keypad. A time delay adjustment is also included to prevent false alarms during initial power-on of the DC power supply.

An indicator light and a “potential-free” contact are provided as alarm signals. A jumper wire provision is included in the rectifier to automatically shut the DC off in the event of an alarm (remove jumper). An audible horn, bell, or buzzer may be provided as an option. See the additionally provided manual for more information on this option.

GENERAL TROUBLESHOOTING GUIDE

WARNING

There are dangerously high voltages within the dc power supply enclosures. under no circumstances should anyone open access doors to the dc power supply or the tank while the system is energized. only qualified, trained, electrical personnel should service and maintain this equipment. lockout procedures must be enforced while servicing or maintaining the power supply.

PROBLEM	PROBABLE CAUSE
Unit will not start.	1. Check fault circuits. Refer to circuit diagram.
	2. Check DC on -holding circuits. Refer to circuit diagram.
Main circuit breaker tripping.	1. Check for transformer ground fault. Check for shorted output.
	2. Refer to SCR assembly test procedure.
	3. Replace circuit boards.
	4. Bad shunt trip or breaker.- Replace.
DC turns on then shuts off.	1. Check fault alarms.- Refer to circuit diagram.
	2. Check SCR's. Refer to SCR test procedure.
	3. Replace circuit boards.
High temp warning.	1. Possible fan failure.
	2. Air intakes blocked.
	3. Outside air temp. excessive.
	4. No water flow. - Check solenoids, radiator, thermostat and water temperature.
Power on with no output voltage.	1. Check output adjust setting.
	2. Check DC on holding circuit. Refer to circuit diagram.
	3. Check PLC interface board.
	4. SCR fuse failure or SCR failure. Refer to SCR test procedure
	5. Replace circuit boards.
No lights on control console.	1. Check primary incoming AC power.
	2. Check console fuses.
Output voltage with no current.	1. No load in tank.
Output current with no voltage.	1. Check for shorts on output.
Output current with not enough voltage.	1. Check current limit. Adjust.
	2. Check for load increase.
	3. Circuit boards out of adjustment.

Excessive output ripple.	1. Check SCR's. Refer to SCR test procedure.
	2. Replace gate board.
	3. Check filter capacitors and fuse.
Main input A.C. current unbalanced.	1. Check SCR's and SCR gate/cathode connections.
	2. Check SCR fuses.
	3. Replace gate board.

MAINTENANCE AND TROUBLESHOOTING

**WARNING**

There are dangerously high voltages within the dc power supply enclosures. under no circumstances should anyone open access doors to the dc power supply or the tank while the system is energized. only qualified, trained, electrical personnel should service and maintain this equipment. lockout procedures must be enforced while servicing or maintaining the power supply.

Frequency - Preventive maintenance should be performed annually and in harsh environments, perhaps 2-3 times annually. Training seminars are available for entire rectifier trouble shooting, operation, adjustments and preventive maintenance. Please contact the factory for more information.

Preparation - A shutdown period must be scheduled to complete maintenance of your rectifier. After the maintenance is complete, test loads should be applied and normal operation of the rectifier verified before using in a production situation.

Check off each item on the “Rectifier Performance Checklist” located at the end of this section as you go through this procedure.

EQUIPMENT

Digital multimeter, wire brush or emery cloth, safety glasses, common screwdrivers and wrenches, vacuum cleaner and A.C. current clamp.

INSPECT & TIGHTEN CONNECTIONS

1. Turn off all power to the rectifier including the utility feed breaker that supplies AC input power.
2. Remove any load from the output.
3. Open all doors and panels and visually check for loose connections, burnt, frayed or broken wires. Use the applicable screwdriver or wrenches to tighten all connections. Refer to the “Rectifier Performance Checklist” and check off each item in Section 1. Vacuum any debris accumulated inside the unit.
4. Correct and note any loose connections on the checklist, replace any physically burned or broken components. Use extreme care when

replacing components to assure correct installation. Take apart and clean any corroded connections with a wire brush or emery cloth. Use electrical grease when re-assembling high current connections.

CIRCUIT BOARD CHECKS

Circuit boards are very sensitive and should only be handled using electrostatic safe procedures. Special adjustment procedures and training is required to complete circuit board check out in accordance with the “Rectifier Performance Checklist”. Contact the factory for more information.

1. Inspect each circuit board closely for any loose connections or burned components. Correct or replace any bad circuit boards.

CIRCUIT BOARD CHECKS CONTINUED

2. Clean off any accumulation of dust or debris on the circuit boards. Use pre-packaged compressed air especially formulated for electronic circuit boards, available at any electronic distributor. If a circuit board is extremely dirty or corroded, send back to the factory for evaluation and cleaning.

OPERATION CHECKS

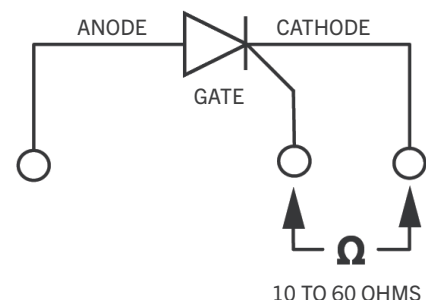
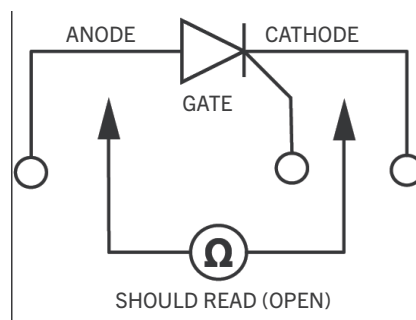
Follow the “Rectifier Performance Checklist” and the circuit diagram for the unit under test. Note: All items on the checklist may not apply to your unit. Verify that each item functions as it should in accordance with this manual and the circuit diagram for your rectifier. Make sure all cooling fans are working, verify all overtemp circuits, safety interlocks, emergency stops, output control knobs, etc....Make note of any item that is not working properly on the checklist and correct as required.

FINAL CHECKS

Place a test load on the system and verify that the rectifier functions normally before placing it into production.

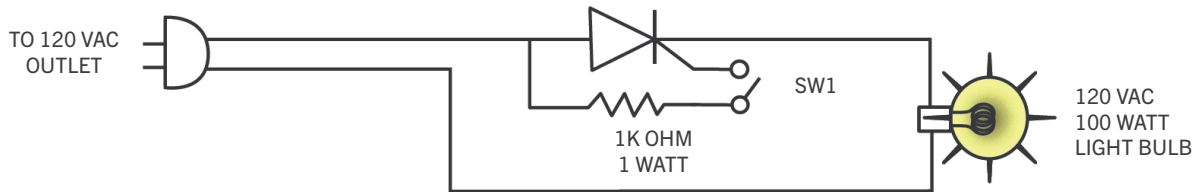
SCR TESTING -Refer to your units circuit diagram to confirm how the SCR's are configured in your unit.

1. SCR under test must be isolated from the rectifier.
2. Hockey puck style SCR's must be clamped across the anode and cathode or left in its heat sink assembly when checking the SCR. Make sure the clamp does not damage the SCR surface and that the anode and cathode are not shorted by the clamping device.
3. With an ohm meter, measure as shown below:.



Note: Occasionally an ohm check may not detect a faulty SCR. A working test circuit can be easily constructed to insure a properly functioning SCR as follows:

Note: Occasionally an ohm check may not detect a faulty SCR. A working test circuit can be easily constructed to insure a properly functioning SCR as follows:



There should be no light with SW1 open and with SW1 closed, the lamp will glow with approximately $\frac{3}{4}$ brilliance.

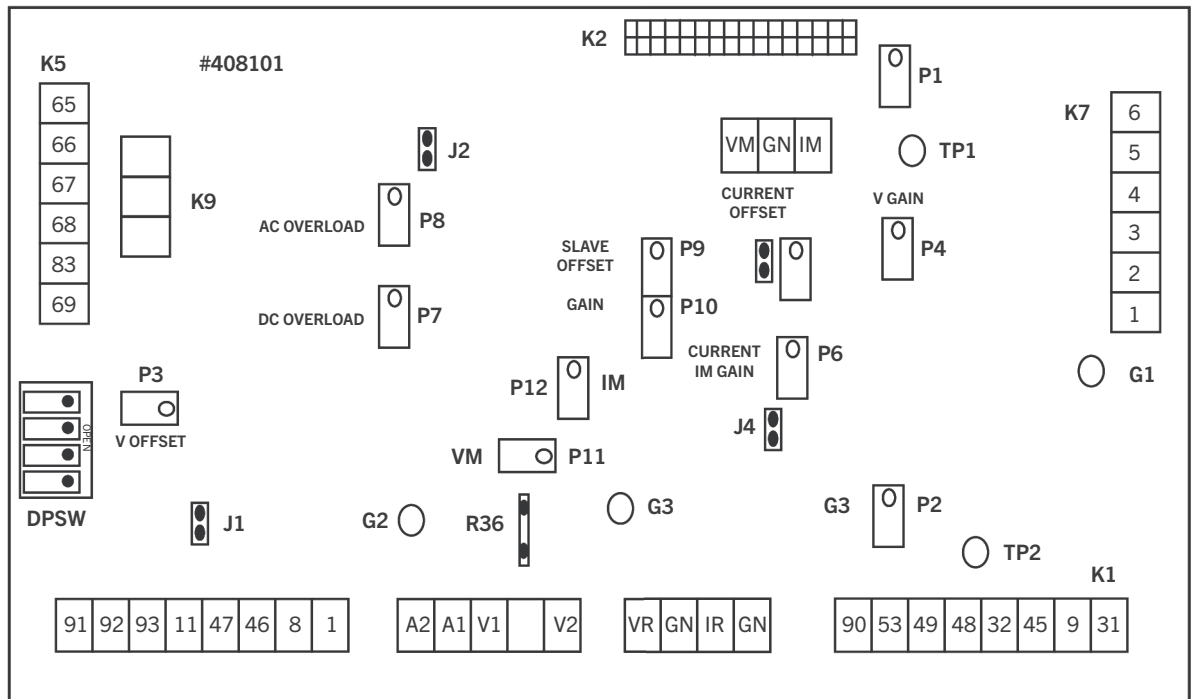
SCR INSTALLATION

Proper alignment and torque of a hockey puck style SCR is required to obtain correct thermal impedance between the SCR junction and the heat sink.

1. Apply a thin coating of semi-conductor thermal compound to each side of the SCR.
2. Align the hockey puck with the centering pins on the heat sinks.
3. Tighten each bolt evenly on the clamp assembly.
4. With each bolt finger tight, additionally tighten each bolt in half turn increments for a total of $1 \frac{1}{2}$ turns.

ELECTRONIC PACKAGE CHECKS AND ADJUSTMENTS

OMNI CONTROL #408101



CONNECTORS

K1-9 & 31-120 VAC Supply.

K1-32 & 45-Relay contact for D.C. on holding circuit.

K1-48 circuit common.

K1-49 reference 7.5 VDC regulated.

K1-53- D.C. disable (contact triggered).

K1-90 slave output signal 0-7.5 VDC.

K2-GN-circuit common.

K2-IR-output current PLC interface monitor signal.

K2-VR-output voltage PLC interface monitor signal.

K3-V2 & V1-D.C.output voltage feedback.

K3-A2 & A1-0-50 MVDC D.C. output current feedback.

K4-1 & 8 module derating interface.

K4-46-0-7.5 VDC current control.

K4-47-0-7.5 VDC voltage control.

K4-11-0-5 VDC gate drive.

K4-91, 92, 93 A.C. current transformer signals.

K5-65 & 66- slope enable (contact activated).

K5-67 low output adjust 0-7.5 VDC.

K5-68-slope input 0-7.5 VDC.
K5-69- slope output 0-7.5 VDC.
K5-83- slope adjust 0-7.5 VDC.
K6- optional signal monitoring.
K7-1-output voltage interface.
K7-2-amp hour output current interface.
K7-3-power supply + 14 VDC.
K7-4- power supply-14 VDC.
K7-5-circuit common.
K7-6 – power supply +5 VDC.
K8-IM-0-7.5 VDC current output meter signal.
K8-VM-0-7.5 VDC voltage output meter signal.
K8-GN-circuit common/K9-1-digital auxiliary input.
K9-2-analog auxiliary input.

ADJUSTMENTS

P1-+5-CW increases.
P2-Ref-CW increases.
P3-V offset-CCW raises DC output.
P4-V gain-CW decreases DC output.
P5-I offset-CW-makes signal more neg. @ 1.
P6-I-gain CW lowers DC output I.
P7-DCOL CCW de-senses.
P8-ACOL CW de-senses.
P9-slave offset CCW more positive @ 90.
P10-slave gain- CCW raises gain.
P11-VM CW increases.
P12-AM CCW increases.

OMNI CONTROL #408101

TEST POINTS, JUMPERS, DIP SWITCH (DPSW), R36 (SCALE RESISTOR).
TP1 & G1-Regulated 5 VDC power supply for microprocessor.
TP2 & G1-Regulated 7.5 VDC reference.
G2-Isolated common for current feedback circuit.
G3-Isolated common for voltage feedback circuit.
N.O. Jumper-jump for normally open contact in D.C. on holding circuit @ connector K1-32 & 45.
N.C. Jumper-jump for normally closed contact in D.C. on holding circuit @ connector K1-32 & 45.

J1-Install jumper when using derating circuit on modular design units (2 or more modules), otherwise remove jumper.

J2-Install jumper to de-sensitize D.C. overload circuit.

J3-Remove jumper to increase current feedback gain.

J4-Remove jumper to increase slave signal gain.

Connector K7 terminal 5 (common) to 4=-14 VDC regulated.

Connector K7 terminal 5 (common) to 3=+14 VDC regulated.

Connector K1 terminal 9 & 31=120 VAC supply voltage.

DPSW-4 position dipswitch controls D.C. overload retry circuit and slope circuit. Position 1 & 2 controls the number of tries the D.C. overload will disable D.C. output power before final shutdown which requires a manual restart. Position 3 determines either a 0-2 min. slope cycle or 0-20 minute slope cycle. Either slope cycle is controlled by a users slope adjust knob. Position 4 is not used.

HOW TO PROGRAM "DPSW"

OVERLOAD TRIES	DIP SWITCH	
	POSITION 1	POSITION 2
3	0	0
2	0	1
1	1	0
0	1	0

SLOPE TIME	DIP SWITCH
	POSITION 3
0-2 MINUTES	1
0-20 MINUTES	0

R36 Scale Resistor – Used to scale voltage feedback signal at connector K3-V1 & V2.

Formula: (Rated D.C. Output Voltage –2.5) x 1000 = R36.

ADJUSTMENTS OMNI CONTROL #408101

1. Place DCVM on TP1 and G1, adjust P1 so the meter reads 5 VDC, clockwise increases voltage.
2. Place DCVM on TP2 and G1, adjust P2 so the meter reads 7.5 VDC, clockwise increases voltage.
3. Disconnect J3 connector from gate card part # 401600.
4. Turn output adjust knob to “0”.
5. Turn P3 completely clockwise (note this is a 10 turn pot). Place DCVM on terminals 48 and 11 and you should read-.5 VDC. While watching DCVM, slowly turn P3 counter clockwise until you see the signal on your DCVM start to go positive, STOP turning P3 now! While watching your DCVM, turn P3 SLOWLY until the DCVM starts to go negative. STOP turning P3 now! The DCVM should keep going negative until it is at about -.5 VDC again. This is an offset adjustment to set up your gate drive to “0”.
6. Reconnect J3 connector on the gate card #401600.
7. Place DCVM on connector K3 terminals V2 & V1. With no load on output, dial output adjust knob to maximum and adjust P4 (V Gain) to the units rated D.C. output. Clockwise decreases D.C. output.
8. With unit running at rated voltage output, place DCVM on connector K8 terminals GN & VM. Adjust P11 (Volt Meter Gain) so DCVM reads 7.5 VDC. Clockwise increases signal.
9. Place a load on the output that will draw full output current continuously. Turn output adjust to “0”. Place DCVM on terminals 48 and 1 and adjust P5 (Current Offset) until DCVM reads -.05 volts. Clockwise makes signal go negative.
10. Turn P7 (D.C. Overload) completely counter clockwise. Calculate your maximum D.C. shunt signal by using this formula:

.050	/	Shunt Size	x	Units Rated	=	Maximum Shunt
(Rated Shunt Signal)		(In D.C. Amperes)		Output Current		Signal @ A1, A2 in Millivolts.
Example: .050	/	1000	x	800	=	.04 or 40 Millivolts.

Place D.C. millivolt meter on connector K3 terminals A1 and A2. Turn output adjust to maximum and adjust P6 (Current Gain) to the calculated millivolt signal.

11. With unit running at rated current, place DCVM on connector K8 terminals GN and IM. Adjust P12 (Current Meter Gain) so DCVM reads 7.5 VDC. Counter clockwise increases signal.
12. With unit running at full current, turn P7 (D.C. Overload) clockwise until the D.C. output goes to “0”. STOP TURNING P7 NOW! Turn P7

counter clockwise 4 turns to desensitize D.C. overload about 5% of rated current and 6 turns for about 10%.

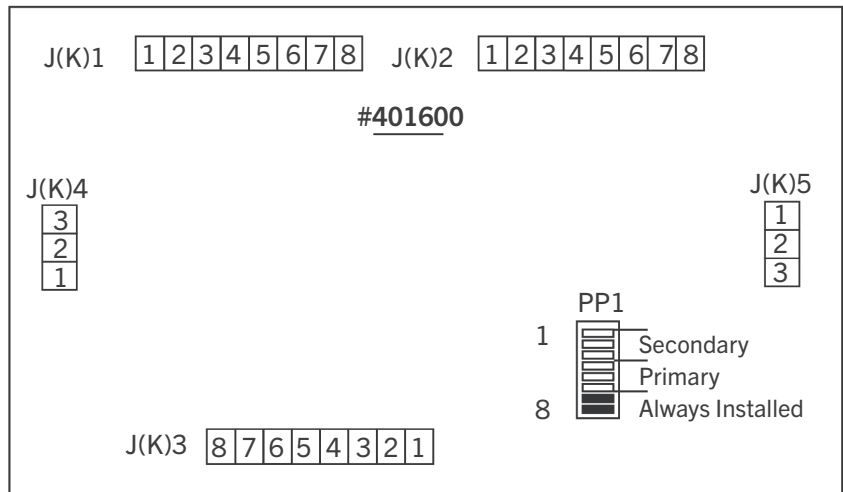
13. Place DCVM on 48 and Pin 3 of component A13. Adjust P8 (A.C. Overload) so DCVM reads 9-10 VDC. Clockwise raises signal.

ADJUSTMENTS OMNI CONTROL #408101 CONTINUED

14. For units with slave option only:

- A. Turn output adjust to “0”. Place DCVM on terminal 48 and 90, adjust P9 (Slave Offset) so DCVM reads “0”. Clockwise makes signal go negative.
- B. Turn output adjust to maximum and with unit running at full current continuously adjust P10 (Slave Gain) so DCVM @ 48 and 90 reads 7.5 VDC. Counter clockwise raises signal.

OMNI GATE BOARD #406100



CONNECTORS, TEST POINTS:

- J(K)1-1 SCR #1 Gate
- J(K)1-4 SCR #3 Gate
- J(K)1-7 SCR #5 Gate
- J(K)1-2 SCR #1 Cathode
- J(K)1-5 SCR #3 Cathode
- J(K)1-8 SCR #5 Cathode
- J(K)2-1 SCR #2 Gate
- J(K)2-4 SCR #4 Gate
- J(K)2-7 SCR #6 Gate
- J(K)2-2 SCR #2 Cathode
- J(K)2-5 SCR #4 Cathode

J(K)2-8 SCR #6 Cathode

J(K)3-1 Current Common

J(K)3-4-0-5 VDC Gate drive

J(K)3-6-12 VDC

J(K)3-2 Jumper to J3-6

J(K)4-1 & 3 –120 VAC J(K)5-1, 2 & 3 –16-18 VAC

J(K)6-7 Circuit Common

J(K)6-7 & TP2 -5 VDC

J(K)6-7 & 6 –5 VDC regulated

J(K)6-7 & 9 –12 VDC regulated

J(K)6-7 & 10 –30 VDC unregulated

PD1-LED when on, indicates phase loss at connector J(K)5 and disables the gate board. This is a 3 phase A.C. signal to synchronize gate pulses to the incoming A.C. line voltage and should be about 16-18 VAC across J(K)5 terminals 1, 2 & 3

PD2-LED when on, indicates gate card is disabled. Connector J(K)3 terminal 2 & 6 must be jumped. Verify 12 VDC signal from J3-1 & 6, J3-1 & 2.

PERFORMANCE CHECKLIST

 TRYSTAR® S-1800 AND S-2400 RECTIFIER PERFORMANCE CHECKLIST					
SRO #:				DATE:	
COMPANY:					
SYSTEM NUMBER:					
RATED DC VOLTS:		RATED DC AMPS:			
COOLING: DRAW OUT AIR					
PROCESS: BATCH					
	OK	NOT OK	N/A	EXPLANATION OF ITEMS CHECKED "NOT OK"	
ENVIRONMENTAL CHECKS					
COMMENTS					
CLEANLINESS (inside unit)	✓				
VENTILATION	✓				
AIR FILTERS	✓				
ROOM TEMP (Record Actual)					
CONNECTIONS TIGHTEN & INSPECT:					
COMMENTS					
A.C. BREAKER - LINE SIDE	✓				
A.C. BREAKER - LOAD SIDE	✓				
FAN MOTORS AND BRACKETS	✓				
MAIN A.C. CONTACTOR	✓				
MODULE TRANSFORMERS	✓				
CONTROL TRANSFORMERS	✓				
TERMINAL STRIPS	✓				
ELECTRONIC PACKAGE	✓				
SCR ASSEMBLY	✓				
SCR SNUBBER	✓				
DC CAPACITORS	✓				
CHOKE	✓				
RELAYS	✓				
DC BUSS	✓				
SCR FUSES	✓				
FUSE BLOCKS	✓				
D.C. SWITCH	✓				
CIRCUIT BOARD CHECKS					
CONTROL BOARD					
ACTUAL VALUE					
POWER SUPPLY (+5VDC)	✓				
POWER SUPPLY (+14VDC)	✓				
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POWER SUPPLY (-14VDC)	✓			
REFERENCE	✓			
DC OVERLOAD	✓			
R SCALE	✓			
GATE BOARD				ACTUAL VALUE
POWER SUPPLY (+5VDC)	✓			
PULSE TRANSFORMER (1)	✓			
PULSE TRANSFORMER (2)	✓			
PULSE TRANSFORMER (3)	✓			
PULSE TRANSFORMER (4)	✓			
PULSE TRANSFORMER (5)	✓			
PULSE TRANSFORMER (6)	✓			
SCR (1) G-K (1)		A-K (1)		
SCR (2) G-K (2)		A-K (2)		
SCR (3) G-K (3)		A-K (3)		
SCR (4) G-K (4)		A-K (4)		
SCR (5) G-K (5)		A-K (5)		
SCR (6) G-K (6)		A-K (6)		
CIC BOARDS				ACTUAL VALUE
VOLTAGE CONTROL	✓			
VOLTAGE MONITOR	✓			
CURRENT CONTROL	✓			
CURRENT MONITOR	✓			
EP VOLTAGE CHECKS				ACTUAL VALUE
SLOPE (48-83)	✓			
SLOPE IN (48-68)	✓			
SLOPE OUT (48-69)	✓			
GATE DRIVE (48-11)	✓			
SLAVE (48-90)	✓			
VOLTAGE (48-47)	✓			
CURRENT LIMIT (48-46)	✓			
OPERATIONAL CHECKS				
SAFETY CIRCUITS	✓			COMMENTS
TRANSFORMER OVERTEMP	✓			
FILTER CHOKE OVERTEMP	✓			
SCR OVERTEMP THERMAL	✓			
SCR HIGH TEMP WARNING THERMAL	✓			
DOOR INTERLOCK	✓			
MAIN SHUNT TRIP	✓			
EMERGENCY STOP	✓			
DE-RATING CIRCUIT	✓			
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CONTROL CIRCUITS		✓			COMMENTS	
DC ON		✓				
DC OFF		✓				
HOLDING VOLTAGE		✓				
SLOPE CONTROL		✓				
UNDER VOLTAGE		✓				
RIPPLE METER		✓				
AC CONTACTOR		✓				
MISC					COMMENTS	
VOLTMETER		✓			CALIBRATED?	NO
AMMETER		✓			CALIBRATED?	No
SLAVE CONTROL		✓				
MASTER CONTROL		✓				
CABINET FANS		✓				
SCR FANS		✓				
FUSES					COMMENTS	
CONTROL FUSES		✓				
SCR FUSES		✓				
DC FUSES		✓				
FILTER FUSES		✓				
OUTPUT RIPPLE					COMMENTS	
VAC		VAC				
VDC		VDC				
RIPPLE		% RIPPLE				
AMPS DC		AMPS DC				
CAPS		VAC				
INPUT MEASUREMENTS					COMMENTS	
PHASE ROTATION		✓				
ØA - ØB	VOLTS	✓				
ØB - ØC	VOLTS	✓				
ØC - ØA	VOLTS	✓				
ØA	AMPS	✓				
ØB	AMPS	✓				
ØC	AMPS	✓				
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WATER COOLED				COMMENTS
LEAK SENSOR	✓			
RADIATOR	✓			
THERMOSTAT	✓			
WATER SOLENOIDS	✓			
WATER LEAKS	✓			
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CUSTOMER SUPPORT

Contact Trystar

PRODUCT SUPPORT SERVICES

Trystar offers total Customer Support that assures your critical equipment is maintained properly for trouble free operation.

SPARE PARTS

DC power supplies are made to order and do not always share the same parts. To obtain a complete parts list please contact Trystar's Customer Support Department at 1-800-521-4792 or 1-248-528-3700. We highly recommend that spare parts are purchased for your stock since your rectifier controls a critical part of your operation. Any down time will surely exceed the cost of a simple part if it is not available when needed. When ordering parts please obtain the units system number located on the specification tag typically located on the inside door near the main AC input breaker.

EMERGENCY SERVICE.

Call our 24 hour hotline at 1-800-521-4792 or 1-248-528-3700 for emergency service or to dispatch our field technicians.

TRAINING SEMINARS

Trystar offers hands on training at our factory in Troy, Michigan or at your site on your equipment.

PREVENTIVE MAINTENANCE

Scheduled preventive maintenance assures that your equipment is running 100% keeps your maintenance personnel familiar with the equipment, and makes sure your spare parts are working or in need of replenishing.

Call 1-800-521-4792 or 1-248-528-3700 for more information on any of our services.

WARRANTY

This Warranty applies only to the original purchaser who must properly register the product within thirty (30) days of receipt.
<https://controlledpwr.com/customer-support/warranty-registration/>

Trystar warrants that our products and their components will remain free from defects in material and workmanship for the period of one (1) year from the date of shipment and agrees to replace, F.O.B. its factory, any parts which fail through defect in material or workmanship during such period.

1. This Warranty shall be effective only if and so long as the system is installed and operated in the manner specified in the manual which accompanied the product, and is operated within the ratings on the nameplate of the system.
2. This Warranty shall be effective provided the purchaser pays the cost of transporting the faulty component(s) to and from Trystar's factory at the purchaser's own expense. There is no cost for installation of the replacement component(s) when done at the factory. Otherwise installation of the replacement component(s) are the responsibility of the purchaser. If after inspection the faulty component has been caused by misuse or abnormal conditions in the judgment of Trystar, the purchaser will be charged for repairs based on parts and labor required. This Warranty does not cover fuses, light bulbs, and other normally expendable items. Trystar service personnel are not included in this warranty.
3. This Warranty shall be void if any alteration is made to the system, or any of its components are altered by anyone other than an authorized Trystar service person, without the written permission of Trystar.
4. This Warranty is in lieu of all other warranties, expressed or implied. Trystar neither assumes, nor authorizes any person to assume for it, any liability other than that specifically set forth in this Warranty. Except for its obligations, Trystar assumes no liability or responsibility for personal injury, loss of life, consequential or other damages resulting from defects in, or failure of, the system or any of its components.

<https://controlledpwr.com/customer-support/warranty-registration/>

NOTES

