

Technical Manual

SCR Control Panel

Maintenance, Operation, and Installation Instructions



CHROMALOX

Advanced Thermal Technologies

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⚠ WARNING

HIGH VOLTAGE is used in the operation of this equipment, DEATH ON CONTACT may result if personnel fail to observe safety precautions. Learn the areas containing high-voltage connections when installing or operating this equipment. Be careful not to contact high-voltage connections when installing or operating this equipment. Before working inside the equipment, turn power off and ground points of high potential before touching them.

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Foreword

This manual provides operation, installation, and maintenance instructions for the SCR Control Panel(s) manufactured by Chromalox s of La Vergne, Tennessee. This manual is prepared in accordance with Chromalox Standard Operating Procedure (S.O.P.) 9091-12006. The chapters are arranged as follows:

- Chapter 1: General Information and Safety Precautions
- Chapter 2: Operation
- Chapter 3: Description
- Chapter 4: Scheduled Maintenance
- Chapter 5: Troubleshooting
- Chapter 6: Corrective Maintenance
- Chapter 7: Installation

Safety Summary

General safety precautions listed in the plant Safety Manual should be closely complied with to prevent injury to personnel or damage to equipment.

KEEP AWAY FROM LIVE CIRCUIT.

Operating personnel must at all times observe all safety precautions. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potential exists when the power control is off, due to charges retained by capacitors. To avoid electrical shock or injury, always remove power and discharge capacitors before touching a circuit.

DO NOT SERVICE OR ADJUST ALONE.

Under no circumstances should any person reach into an enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery. Contact area supervisor or safety personnel for more information.

The following warnings and cautions appear in this manual and are repeated here for emphasis:

⚠ WARNING

Prior to working on the controller ensure that circuit breaker has been locked in the open (off) position and tagged: "DANGER-SHOCK HAZARD. Do not change position of switch except by direction of NAME

⚠ WARNING

When power is on and the controller door is open, dangerous voltages are exposed. Be careful. Do not touch terminals or bare conductors in cabinet. Contact with high voltages could cause death or injury.

⚠ WARNING

Only one hand should be used when servicing live equipment. Accidental death or severe injury may occur if a current path is created through the body from one hand to the other.

⚠ WARNING

Before handling and connecting any power cable to the equipment, make sure the power supply is turned off. Then check voltage levels on the wiring to ensure the wiring is not carrying hazardous voltage.

⚠ WARNING

Some free standing panels may tend to tip before anchoring. Take due care to avoid tipping.

Chapter 1: General Information and Safety Precautions

1-1 Safety Precautions

All safety precautions necessary for the protection of personnel and equipment are listed in the safety summary. The definition of warning, caution, and note are as follows:

⚠ WARNING

An operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury or death of personnel.

⚠ CAUTION

An operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to, or destruction of, equipment or loss of production.

NOTE

An essential operating or maintenance procedure, condition, or statement, which must be highlighted.

1-2 Introduction

This technical manual provides the necessary data for installation, operation, maintenance, repair, and parts support of the SCR Control Panels.

1-2.1 WARRANTY INFORMATION: The seller warrants all equipment manufactured by it to be free from defects in workmanship or material under normal use and service. If any part of the equipment proves to be defective in workmanship or material and if such part is, within 12 months of the date of shipment from sellers factory, transportation charges prepaid, and if the same is found by the seller to be defective in workmanship or material, it will be replaced or repaired, free of charge, f.o.b. the sellers factory. The seller assumes no liability for the consequences of its use or misuse by the buyer, his employees or others. A defect within the meanfog of this warranty in any part of any piece of equipment shall not, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment. This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations, or liabilities expressed or implied by the seller or its representatives and by statue or rule of law.

l-2.2 REFERENCE DAT A Reference data that applies to the SCR Control Panels is listed in Table 1-1 .

1-3 Equipment Description

The unit(s) described in this manual is/are to be used for industrial heating. These unit(s) is/are designed to control electric heaters. Application is limited by the maximum kilowatt rating of the controller. The heating load is not to exceed this maximum.

1-3.1 MECHANICAL ASSEMBLY The components of the controller are mounted on an open back steel, stainless steel or aluminum panel. The panel is housed in a steel, stainless steel, aluminum or nonmetallic cabinet. Access to the panel is normally through the top, bottom, sides, or front of the cabinets.

Table 1-1 Reference Data

Characteristics

Manufacturer:	Chromalox Precision Heat and Controls
Modes of Operation:	Continuous
Operating Ambient Temperature:	4° F to 122° F (-15° C to 50° C)
Humidity:	0 - 100% Non-condensing

Chapter 2: Operation

Scope

This manual applies to Chromalox SCR Control Panel(s). The first few pages contain general information regarding SCR control panels.

Operation

The Chromalox SCR Control Panel is a complete feed-back/closed loop/control system. The solid state power controller provides accurate temperature control very efficiently. Fast acting fuses are included to protect the solid state devices, (see note). External indications include a "Power On" lamp which illuminates at any time power is applied to the control panel. The temperature controller (if included) provides temperature indication. The overtemp controller (if included) has a setpoint indication and a red LED to indicate the overtemp condition.

NOTE: Fast acting (I²T Fuses) when included in panel, are not intended for wiring protection under overload, for example at 150% of rated fuse load it may take over 15 minutes to clear the fuse. However, the fuse blows very fast to protect thyristors under short circuit conditions (less than one hundredth of a second to clear at 500% rated fuse load).

Chapter 3: Description

Chromalox SCR control panel consists of a power controller, temperature controller or terminals for customer supplied control signal, overtemp controller or terminals for customer supplied shut down signal and a fused control transformer that provides control power for 120 vac devices. Positive power shut down is provided in case of overtemp condition, by using a contactor or shunt trip and a disconnect switch.

The panel is completely wired as shown on the attached assembly drawing. Dashed lines on the assembly drawing indicate customer field connections. All these connections must be made according to the national, state, and local electrical and safety codes.

The manuals for power controller and other instruments used are enclosed in a document package provided with the panel(s).

Chapter 4: Scheduled Maintenance

4-1 Introduction

Preventative maintenance consists of inspections, tests and cleaning of equipment at scheduled intervals. It helps detect and correct conditions that could cause equipment malfunction. The scheduled maintenance instructions in this manual are intended to duplicate those furnished in the Planned Maintenance System (PMS) normally established and provided by the end user. In case of conflicts, the PMS documentation takes precedence. Such conflicts should be reported immediately.

4-2 Safety Precautions

⚠ WARNING

Prior to working on controller ensure that circuit breaker has been locked in the open (off) position and tagged: "DANGER-SHOCK HAZARD. Do not change position of switch except by direction of NAME "

The controllers use high voltage. It is important that only experienced and authorized technicians who observe standard safety precautions perform all phases of installation, operation, and maintenance. Before conducting any preventive maintenance, fully de-energize and ground the equipment. Tag the controller OUT OF SERVICE only after it has been fully deenergized.

4-2.1 SERVICE LIVE EQUIPMENT: If it is necessary to service live equipment, the following general instructions must be followed:

⚠ WARNING

Only one hand should be used when servicing live equipment. Accidental death or severe injury may occur if a current path is created through the body from one hand to the other.

- a. De-energize the equipment. To discharge any capacitors connected to these terminals, temporarily ground the terminals to be measured.
- b. Connect the Multimeter to the terminals to be measured, using a range higher than the expected voltage. Make sure that you are not grounded whenever you adjust equipment or use measuring equipment. Do not use test equipment known to be in poor condition.
- c. Without touching the meter or test leads, energize the equipment and read the meter.
- d. Remove the test leads after de-energizing the equipment.

4-3 Preventative Maintenance Schedule

The schedule for conducting preventative maintenance depends on how much the equipment is used. Table 4-1 lists the suggested maintenance schedule, which is based on average conditions. This schedule should be adjusted for each application as experience dictates.

4-4 Required Tools and Test Equipment

Table 4-2 lists the tools and test equipment required for using the preventive maintenance procedures in this chapter.

4-5 Controller Maintenance

Make sure that inspection will not interfere with presently required on-line operation of equipment. Then remove power as follows:

- a. De-energize all incoming sources of power, discharge capacitors and tag OUT OF SERVICE.
- b. Test equipment with Multimeter to ensure that power is off.

Table 4-1 Preventative Maintenance Schedule

Frequency	Title	Applicable Paragraph
6 months	Enclosure Exterior	4-5.1
6 months	Enclosure Interior	4-5.2
6 months	Wiring and Connections	4-5.3
6 months	Lights and Fuses	4-5.4
1 year	Contactors	4-5.5

Table 4-2 Required Maintenance Tools, Materials, and Test Equipment

Tools	Materials
<ol style="list-style-type: none"> 1. Flashlight 2. Vacuum cleaner with a nonmetallic nozzle 3. Screwdrivers--normal duty (6-inch) and heavy duty (10-inch) 4. Controller crowfoot wrenches, 3/8- and 7/16-inch 5. Fuse extractor 6. Stiff bristle brush 7. Wooden scraper 8. Long handled paint brush (1/4-inch) 9. Plastic scale (6-inch) 10. Needlenose pliers 11. Fine contact file 12. Soldering iron 	<ol style="list-style-type: none"> 1. Safety tags 2. Dry, lint free rags 3. Non residue forming, electrical cleaner/degreaser (CRC Cable Clean, Chemtronics Electro-Wash or equivalent) 4. Medium sandpaper 5. Touch-up paint 6. Machine oil 7. Grease 8. Electrical tape (good grade) 9. Solder
<p>Test Equipment</p>	
<ol style="list-style-type: none"> 1. Multimeter 	

- 4-5.1 ENCLOSURE EXTERIOR Inspect the panel exterior as follows:
- Wipe off all dust, moisture, and oil with a lint free cloth. Remove corrosion with sandpaper.
 - Remove heavy dusts or grease with a wooden scraper.
 - Remove lint.
 - Touch up all bare spots with primer and paint.
 - Inspect door gaskets and replace if worn and/or deteriorated.
 - Oil door hinges and latches with machine oil.

- 4-5.2 ENCLOSURE INTERIOR Clean and inspect the panel interior as follows:
- Remove dust and dirt from electrical

⚠ CAUTION

Do not soak parts such as coils or insulation in electrical cleaner/degreaser use just enough to loosen grease so that it can be immediately wiped off. Failure to comply could damage electrical components.

NOTE: Pay special attention to contact mating and magnet face surfaces because dirt particles can interfere with satisfactory operation. components with a vacuum cleaner.

- Remove sticky dust, grease, and oil with a dry lint free rag or small paint brush with electrical cleaner/-degreaser. Wipe off excess.
- Inspect for corrosion of metal parts. Repair or replace if found .
- Inspect for worn or broken parts. Repair or replace if found .
- Inspect for evidence of dripping water or liquids falling on equipment parts. If found, determine the cause and correct.
- Make sure that moving parts move freely and do not stick.

4-5.3 WIRING AND CONNECTIONS

Check wiring and connections as follows:

- Inspect wiring for wear, fraying, chipping, nicks, and evidence of overheating. Repair minor defects with a good grade of electrical tape, or replace if needed.
- Inspect for loose electrical and mechanical connections. Tighten or replace defective crimp-style lugs. Resolder loose solder connections. Tighten or replace all loose or missing hardware.

4-5.4 LIGHTS AND FUSES.

Check lights and fuses as follows:

- Check indicating lights for burned out lamps. Replace as required.
- Check fuses for correct ratings. Replace as required.

4-5.5 CONTACTORS If contactor(s) is/are used, operate contactors by hand to check that linkages operate freely from mechanical binding in the nonnal operating position.

When released from the energized position, the contactor must drop out to the full deenergized position. If there is a question about these positions, first energize the contactors electrically, then de-energize them and check that the contactor drops out to the full de-energized position. Sticky operation may be improved by cleaning the parts with a non residue forming electrical cleaner/degreaser then applying a light coat of grease to all bearing points.

4-6 On-Line Check

Apply power to the controller and operate. Check for proper operation. Refer to Chapter 2.

4-7 Planned Overhaul and Maintenance

The above preventive maintenance procedures should eliminate the need for planned overhaul maintenance. Under normal service conditions, many of the components should not require replacement parts. Should the need occur for overhaul, see Chapter 6.

Chapter 5: Troubleshooting

5-1 Introduction

This chapter includes troubleshooting tables, for use in repairing the heater power controller. A volt ohmmeter will be required to perform certain steps in the troubleshooting charts.

4-3 Preventative Maintenance Schedule

The schedule for conducting preventative maintenance depends on how much the equipment is used. Table 4-1 lists the suggested maintenance schedule, which is based on average conditions. This schedule should be adjusted for each application as experience dictates.

5-2 Troubleshooting Chart

⚠ WARNING

When power is on and the controller door is open, dangerous voltages are exposed. Be careful. Do not touch terminals or bare conductors in the cabinet. Contact with high voltages could cause death or injury.

5-2.1 When incorrect operation is observed, it is often possible to reduce the overall servicing time by studying all the symptoms and applying the following trouble analysis charts:

5-2.2 To use the troubleshooting charts:

- a. Select the chart that most closely describes the malfunction.
- b. Look for the symptoms listed in the first column.
- c. Take appropriate action listed under immediate action.
- d. Follow the instructions listed under remedy column

Table 5-1 No Output Trouble Analysis

Symptoms	Immediate Action	Probable Cause	Remedy
1. No output voltage thus no heat	1. Check power source and disconnects	<p>1. Loss of source of power</p> <p>2. Blown fuse(s)</p> <p>3. Defective temperature controller or control signal</p> <p>4. Defective control or trigger board(s)</p> <p>5. Defective SCR module</p>	<p>1. Check the system, if there is no source voltage available. Determine the cause of loss of power, then correct and reenergize the unit.</p> <p>2. With power off, check the fuses. If fuse(s) is/are blown, determine the cause of blown fuse, then after correcting the problem, replace the fuse.</p> <p>3. If temperature controller is not providing appropriate control signal, replace as needed.</p> <p>If remote control signal is inadequate or missing, check source and wiring & correct as necessary</p> <p>4. Unplug leads from SCR module (one module at a time). Read DC voltage between red(-) and white(+) leads. If it is not between 0.25 and 5.0 VDC replace trigger board.</p> <p>5. Measure the gating signal as described in step 4. Measure the voltage at input (loine) side of the SCR. If the voltage at the line side is proper and the gate signal is present, replace the defective SCR.</p>

Table 5-2 Full Output Trouble Analysis

Symptoms	Immediate Action	Probable Cause	Remedy
1. Heater stays on 100%.	1. Turn power OFF.	<p>1. Defective sensor</p> <p>2. Defective Control Board</p> <p>3. Defective temperature controller or control signal</p>	<p>1. Check wiring and appropriate signal. Replace or repair as needed.</p> <p>2. If the output stays full ON in measure gate voltage as in step 4 of Table 5-1.</p> <p>If they all read 0 DC, replace the SCR(s); otherwise, replace the control board.</p> <p>3. If panel is equipped with controller check sensor wiring.</p> <p>If sensor was incorrectly wired and was found intact, replace the temperature controller.</p> <p>Check customer supplied control signal correct wiring or source.</p>

Table 5-3 Inaccurate Temperature Control Trouble Analysis

Symptoms	Immediate Action	Probable Cause	Remedy
1. The unit maintains a temperature other than the correct temperature.	1. Turn the power OFF and check all connections and make sure heater is not burnt out or improperly sized.	1. Improper heater size or improper wiring. 2. Blown fuse(s). 3. Loss or drop in incoming voltage. 4. SCR(s) bad. 5. Firing package bad. 6. Temperature controller bad or control loop problem.	1. With power off, check heater size and connections. Correct any error found. 2. Check the fuses. If fuse(s) is/are blown, determine the cause of blown fuses, then after correcting the problem, replace the fuse. 3. Check the incoming voltages. Correct if necessary. 4. With power applied to the control panel, measure voltage from L1 to X1, L2 to X2 and L3 to X3. All phases should read approximately 0 VAC. Any phase that reads high voltage has a bad SCR module. Replace the SCR(s) as required. 5. Measure gate to cathode voltages. All phases should read 0.25 to 5.0 volts. If not, replace the firing package. 6. Refer to controller manual. Or check the control loop and repair wiring or control signal.

Table 5-4 Erratic Output Trouble Analysis

Symptoms	Immediate Action	Probable Cause	Remedy
1. Output of the control panel is unstable	1. Turn the power OFF and check all connections.	1. Loose connection. 2. Blown fuse. 3. Erratic power source. 4. Defective temperature controller or firing package. Or control signal.	1. With power off, check all terminals. Tighten all loose connections. 2. With power off, check the fuses. If fuse(s) is/are blown, determine the ccause of blown fuse, then after correcting the probe, replace the fuse. 3. Check power source for erratic operation. Repair if needed. 4. Check the command signal at the SCR control board input terminals. If command signal is erratic, replace controller otherwise control board. Or rectify temperature control signal or wirings from customer source.

Table 5-5 Contractor Trouble Analysis

Symptoms	Immediate Action	Probable Cause	Remedy
1. Contacts chatter Control panel is unstable.	1. Turn OFF power and check all connections.	1. Poor contact in controller. 2. Low voltage.	1. Check contact wear. Replace worn contacts. 2. Correct voltage source.
1A. Contractor picks up but does not seal.	1. Turn OFF power and check all connections.	1. Defective auxiliary contact. 2. Open wiring of coil or shorted turns.	1. Replace auxiliary contacts. 2. Replace coil.
2. Contractor will not drop out.	1. Turn OFF power and check all connections.	1. Short circuit. 2. Dirty contacts. 3. Interlock problems.	1. Correct short circuit. 2. Clean contacts. 3. Correct interlock problems.
3. Over heating	1. Turn OFF power and check all connections.	1. Insufficient contact pressure. 2. Over load.	1. Replace worn contacts. 2. Reduce load current.

Chapter 6: Corrective Maintenance

6-1 Introduction

6-1 .1 This chapter provides instructions for the adjustment and repair of the SCR control panel.

6-1 .2 Observe all safety precautions and tag all wires to be disconnected.

6-2 Tools, Test Equipment and Material

Refer to table 6-1 for the list of tools, test equipment and material required to maintain the controllers.

Table 6-1
Tools, Test Equipment and Materials

D.C. Milliamp Meter
Adjustable D.C. Power Supply
6" Flat Tip Screwdriver
3/8" Combination Wrench
Fuse Pliers
Thermal Compound or
Thermostrate Material
Unitemp Grease
Lint Free Cloth

Section I. Adjustments and Alignments

6-3 Calibration Check and Adjustment

6-3.1 No maintenance adjustments or calibration are required for SCR controller. Refer to other instrument manuals as necessary

6-4 Maintenance

There is no special maintenance required for the unit. Following are a few simple procedures that describe general maintenance required for long trouble free service.

⚠ CAUTION

DISCONNECT ALL POWER BEFORE SERVICING THIS UNIT.

6-4.1 Accumulated dust should be cleaned off periodically. Conductive build-up may lead to an arcing condition in the highvoltage section.

6-4.2 Check for pitting and corrosion caused by arcing at loose terminal connections. Check wire terminations for secure, tight connections.

6-4.3 Check periodically for rodent damage to wiring and internal materials.

6-4.4 Systems used in a corrosive atmosphere should have the electrical connections periodically inspected and tarnished connections should be cleaned. Due to the simplicity of this unit, a failure can be easily detected. Reference to the schematic and wiring diagrams and logical application of standard trouble-shooting technique should resolve any problems.

6-5 Site and Storage Preparation

The input controller package may be stored in its shipping container until ready for installation. Storage site should be an indoor, cool, dry location.

There are no specific requirements for site preparation. User needs should dictate any site preparations.

6-6 Return of Material

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:
Chromalox Precision Heat and Control
1382 Heil-Quaker Boulevard
Lavergne, Tennessee 37086-3536

Attn: Customer Service Department Contact factory for "Return Authorization" identification number. The packing slip should be marked:
Return for Repair RA- _____
Model _____

The returned material should be accompanied by a letter of transmittal which should include the following information.

1. Location, type of service and length of time in service of the device;
2. Description of the faulty operation of the device and the circumstances of the failure;
3. Name and telephone number of the person to contact if there are questions about the returned material;

4. State as to whether warranty or nonwarranty service is requested;
5. Complete shipping instructions for return of material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device. If the material is returned for out of warranty repairs, a purchase order for repairs should be enclosed.

It is not advisable to attempt to modify any panel without first consulting the factory.

Chapter 7: Installation

Use 3/8" hex bolts to mount the control panel on a wall, bulkhead, or channels. For free standing/floor mounted panels, prepare foundation and use proper anchoring. For proper cooling of the solid state devices do not block the air intakes or exhaust (louvers) by any means. Allow work space and door swing space in front of the panel. Avoid temperature extremes and humid or dusty environments.

Electrical installation requires customer connection of incoming power lines, heater load lines, and sensor leads. (See schematic for connections.) The customer must provide openings for wiring entrance and exit of suitable size and positioned to suit individual needs.

CAUTION

Some free standing panels may tend to tip before anchoring. Take due care to avoid tipping.

Notes and Other Pertinent Information

(This page is left blank for customer notes and pertinent information)

Service Contact

Information

Chromalox is a global supplier, providing the highest level of customer support. If you should have questions concerning your IntelliTRACE™ ITC Controller or need information, you may contact Chromalox at:

Corporate Headquarters Chromalox, Inc.
103 Gamma Drive Pittsburgh, PA 15238 Phone: (412) 967-3800
Customer Service Hotline: 1-800-443-2640

For application questions, you can:

1. Call one of our application engineers for personal assistance at 1-888-996-9258.
2. Visit the technical reference section of our website at www.chromalox.com for downloadable manuals in PDF format.

Limited Warranty:

Please refer to the Chromalox limited warranty applicable to this product at <http://www.chromalox.com/customer-service/policies/termsofsale.aspx>.

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