



PRINT MOUNT HOT SHOT™
COMBINATION HOT/COLD VACUUM PRESS
ASSEMBLY AND OPERATION MANUAL

The Print Mount Company, Inc.
20 Industrial Drive
Smithfield, RI 02917

Voice: 401/232-0096 • Fax: 401/232-1893

Upon receipt of merchandise, record the following here:

Model # _____ Serial # _____

Temperature Controller Type: E5CSX E5C4 E5C2

Table of Contents

Introduction	1
I. Set Up Procedure	3
II. Press Operation	4
III. Maintenance	6
IV. Mounting Procedures, General Recommendations	7
V. Hints and Suggestions	10
VI. Trouble Shooting Guide	12
Vacuum Pump Model 0523 Instructions	Appendix i
Schematic Diagram, HS/100-BG or HS/64-BG (Black Glass Platen)	Appendix vii
Schematic Diagram, HS/64 w/E5C2 or E5C4 Controller (units built prior to 1992)	Appendix viii
Schematic Diagram, HS/44 w/E5C2 or E5C4 Controller (units built prior to 1992)	Appendix x
Schematic Diagram, HS/64 or /44 w/E5CS-X Controller (units built between 1992 and 1997)	Appendix xii
Omron E5CS-X Instructions	Appendix xiii

Print Mount Hot Shot™

Combination Hot/Cold Vacuum Press

Assembly and Operation Manual

Congratulations on the purchase of your new PRINT MOUNT HOT SHOT™ Combination Hot/Cold Vacuum Press. This hot/cold vacuum press represents the state-of-the-art in vacuum mounting equipment at an affordable price.

This operation manual has been carefully prepared to assist you in the set-up and operation of your HOT SHOT™ Vacuum Press and vacuum mounting in general. It is well worth reading and using as a base reference. Seemingly limitless mounting applications await your professional and creative talents. We welcome your feedback—comments, suggestions or questions regarding the uses, techniques or adaptations of our product(s). Please feel free to consult us at any time. Only by serving you better can we achieve one of the major objectives of our company—customer satisfaction.

We urge you to read this manual through, now, before you begin exploring the highly versatile and profitable realm of vacuum mounting, with and without heat. Please pay particular attention to the sections labeled Mounting Procedures: Hot Vacuum and Maintenance.

Good luck with your new PRINT MOUNT press!

THE PRINT MOUNT COMPANY, INC.

I. SET UP PROCEDURE

A. Before assembling the press, check that the following have been included in the shipment:

1. HOT SHOT™ Vacuum Press
2. Vacuum Pump
3. Moisture Filter Assy (in pump carton)
4. Four (4) Leveling Feet

B. If you have purchased the optional PRINT MOUNT floor stand, assemble it first, following the instructions. In this case, it is important to level the stand, not the press. If you have not purchased a stand, place the vacuum press on a sturdy work bench, allowing room on the right side for access to all pump fittings and electrical connections. *The press must be level and on its feet or stand to draw vacuum.*

C. Electrical Service Requirements (USA/Canada Standard)

MODEL	VOLTAGE	CURRENT	AMPERAGE
HS/100	208-250	AC	40
HS/64	208-250	AC	30
HS/44	208-250	AC	30

Electrical Hook-up: Single Phase, 4-Wire:

Red	Hot
Black	Hot
White	Neutral
Green	Ground

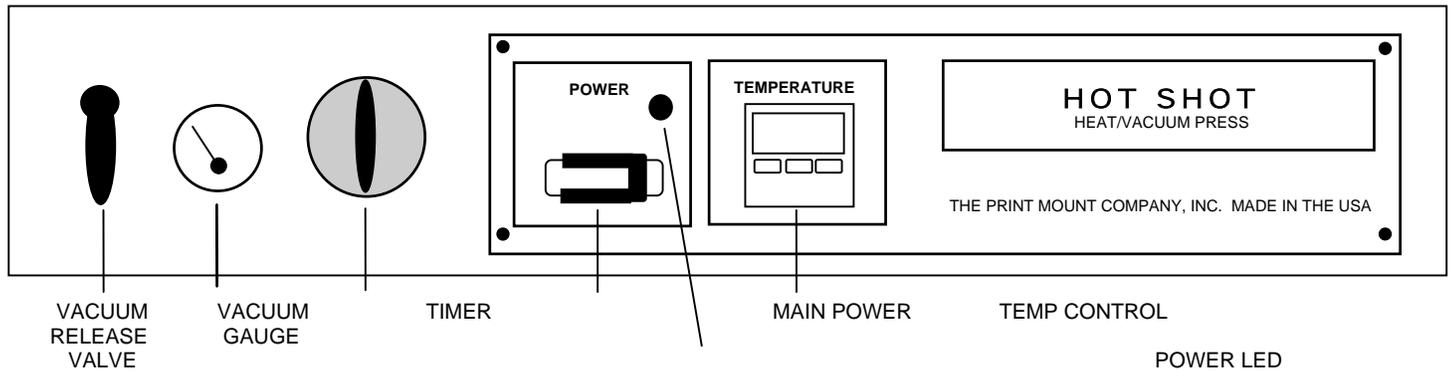
D. Leveling the Press

1. Screw the leveling feet into the threaded corner holes in the press base. *Helpful Hint: Support the press on blocks or hang the press corners over the edge of the work bench to install the feet.*
2. Level the press base using a carpenter's level while adjusting the leveling feet. Level front-to-back, then left-to-right.

E. Connecting Press to Pump

1. Plug the vacuum pump power cord into the receptacle marked **VACUUM PUMP** on the right side of the press.
2. If not installed/attached at factory, fasten the moisture filter assembly to the pump intake stem. The arrow on the top of the filter should point towards the pump.
3. Loosen but do not remove the brass nut attached to the brass elbow secured to the air/moisture filter. Insert the plastic poly-flo tubing (vacuum hose) exiting from the right side of the vacuum press into the brass elbow fitting. Finger tighten.

II. PRESS OPERATION



A. Hot Vacuum Mounting

1. There is a wide range of adhesive and special application products available for use with heat vacuum presses. Most common are mounting tissues and films. There are also sprays and liquids that are applied to the materials that are to be bonded and are left to set or dry before being “re-activated” in the heat press. As with cold vacuum adhesives, each individual adhesive has specific advantages and bonding qualities. Choose the adhesive system that is correct for your application and follow the manufacturer’s instructions.
2. To turn the heat unit of the press on, switch the white lever (circuit breaker) switch (marked **POWER** in the instrument panel) to the **ON** position. The LED indicator located next to the word “POWER” should light immediately. The temperature controller readout should indicate current room temperature.
3. Set the desired mounting temperature by pressing the return key () until the **SP** (set point) indicator lights. Using the up or down arrow, set the temperature. Press the return key to return to present temperature mode.
 - a) On HS/Series presses equipped with OMRON Model E5C2 Temperature Controllers, select the appropriate temperature by depressing the thumbwheel switches.
 - b) On HS/Series presses equipped with analog temperature controls (no digital readout), set dial to appropriate temperature.
4. Due to the tremendous pressure generated by the vacuum system, the temperature needed to satisfactorily use most mounting tissues and laminating films is considerably lower than those recommended for traditional mechanical presses. If there are no suggested heat settings for vacuum heat presses given by the adhesive manufacturer, reduce the recommended temperature setting for mechanical presses by 10-20%. This is suggested as a safety feature—the lower the temperature used in processing, the less chance damage will occur to the artwork due to overheating.

5. The temperature control in the **HOT SHOT** Vacuum Press is highly accurate. The set temperature is reached when the main display reads equal to or slightly above the set point. The press should reach 180-200°F within 10-20 minutes from “cold” start-up.
6. Rotate the timer switch clockwise past the three minute mark (this sets the spring), then set the switch to the appropriate time. Vacuum presses are compatible with a number of different adhesive systems. Please see adhesive manufacturer’s instructions for correct vacuum time.
7. Full vacuum will be reached within 60 seconds (52” x 100” presses may require additional time). The vacuum gauge must read at least 18” Hg to ensure proper vacuum mounting. If press fails to reach full vacuum, consult the **TROUBLE SHOOTING GUIDE**, Section VI.
8. The timer switch will turn the press off automatically. To turn off manually, rotate the timer switch counterclockwise to **ZERO** position.
9. Moisture buildup will occur in the vacuum system and pump due to humidity and pressure changes. This is especially true when hot vacuum mounting. **ALWAYS RUN VACUUM PUMP WITH PRESS TOP OPEN FOR FIVE FULL MINUTES AFTER COMPLETING DAILY MOUNTING TO ASSIST IN DRYING OUT THE VACUUM SYSTEM AND PUMP!** Empty any moisture which may have accumulated in the vacuum line moisture trap.

B. Cold Vacuum (Heat Platen Off) Mounting

1. Turn main power circuit breaker switch to **ON** position. Set temperature on temperature controller to room temperature or below. If the press platen is hot, open press top and allow it to cool for approximately 30 minutes, or until cool enough to touch.
2. Close the press top and fasten the hold-down clamps on the left and right sides of press to ensure vacuum seal.
3. Vacuum controls function as described above in Section II, A., 6-8.
4. Moisture buildup will occur in the vacuum system and pump due to humidity and pressure changes. **ALWAYS RUN VACUUM PUMP WITH PRESS TOP OPEN FOR FIVE FULL MINUTES AFTER COMPLETING DAILY MOUNTING TO ASSIST IN DRYING OUT THE VACUUM SYSTEM AND PUMP!** Empty any moisture which may have accumulated in the vacuum line moisture trap.
5. The time required to reach full vacuum (the air evacuation time) does not constitute “time under vacuum” as prescribed in the adhesive manufacturer’s instructions. To decrease air evacuation time, see **HINTS AND SUGGESTIONS**, Section V.

BEFORE ATTEMPTING ANY MOUNTING, TEST VACUUM PRESS OPERATION BY TURNING TIMER SWITCH ON AND ALLOWING PRESS TO COME TO FULL VACUUM

C. Vacuum Release Valve

1. Located to the left of the vacuum gauge and timer controls, the vacuum release valve is an added feature allowing you to fine-tune your vacuum controls. Most mounting should be done with the valve in its closed position (handle pointing toward the floor in a vertical configuration). Follow instructions below for particular applications.
2. Hot mounting high gloss photographs and prints to mat board (to prevent "orange skin" mottling caused by pressure embossing/transfer of mounting board texture to artwork).
 - a) Before placing materials in press, turn vacuum controls on and allow press to come up to full vacuum (23-25" Hg on gauge).
 - b) Rotate vacuum release valve handle counter-clockwise until gauge reads between 12-15" Hg. For future reference, mark handle position on the press base.
 - c) Turn off the vacuum pump. Leaving valve handle in its new position, place prepared materials in vacuum press. Fasten clamps and set the timer switch for time recommended for mechanical dry mount presses.
 - d) The vacuum press, operating at a lower pressure, still provides sufficient force for successful mounting, without permanently embossing the surface of your artwork.
3. Hot mounting to foam boards (to reduce the effects of compressing the edges of the board. Follow steps (1) to (4) above.
4. Mounting delicate items (RC photos, silks, etc. to reduce the risk of too rapid heating or overheating/scorching).

III. MAINTENANCE

A. Press maintenance

1. Always process materials between two layers of release paper or between release boards.
2. Never place anything inside the press that may scratch or mar the platen surface.
3. Keep press platen free of adhesives by washing with glass cleaner, adhesive release, lighter fluid and/or platen cleaner. Use only soft, lint-free cloths.
4. Daily/weekly clean the flexible rubber diaphragm with glass cleaner and/or adhesive release for optimal mounting conditions.
5. Periodically wipe gasket with ARMOUR ALL™ or similar rubber/vinyl preservative.

B. Pump maintenance

1. Familiarize yourself with your vacuum pump by reading through pump manufacturer's instructions. Instructions are provided in the carton with the pump and in the appendix of this instruction manual.
2. All pump motors are thermally protected and will turn off in the unlikely event of overheating.
3. All pumps are provided with felt filters which protect the pump from airborne dust particle (intake filter) and collect carbon dust generated by normal pump operation (exhaust filter).
 - a) Filters should be inspected every six months and cleaned, if necessary. Clean filters by removing dust particles with a vacuum cleaner or by soaking in a non-flammable "safety solvent" such as rubbing alcohol. **FILTERS MUST BE COMPLETELY DRY BEFORE RE-INSTALLATION.** Refer to pump manufacturer's instructions for access to filters.
 - b) Replace filters once a year under normal operation. Contact **PRINT MOUNT** or your framing distributor for replacement filters.
4. Empty moisture trap filter daily, or as necessary.

IV. MOUNTING PROCEDURES (GENERAL RECOMMENDATIONS)

- A. **PRINT MOUNT** vacuum presses are designed to mount prints and substrates up to 1 ½" (3.8cm) in total thickness. For increased mounting productivity, you may mount multiple layers of prints (**COLD** mounting only) and/or decrease the air evacuation time. It is absolutely necessary to keep the press (aluminum platen and rubber), print and substrate clean to prevent unsatisfactory mounting results. Badly creased or wrinkled prints should be "stress relieved" prior to bonding. Consult the **HINTS AND SUGGESTIONS** (Section V.) of this manual for specific procedures.
- B. Hot Vacuum
1. Preheat press to desired temperature. Select appropriate adhesive for mounting application (see chart below). Prepare materials for mounting and/or laminating per instructions from material manufacturer.

MOUNTING APPLICATION:

SUBJECT ARTWORK	Promount	Economount	Versamount	Safemount
Bark Paintings	Unsuitable	Unsuitable	Excellent	Unsuitable
Brass Rubbings	Good	Good	Good	Excellent
Canvas	Fair	Fair	Excellent	Fair
Clay Coated Papers	Excellent	Excellent	Good	Excellent
Cotton Fabric	Good	Good	Excellent	Good
Fiber Based Photos	Excellent	Excellent	Excellent	Excellent
Linen	Good	Good	Excellent	Good
Lithograph Papers	Excellent	Excellent	Excellent	Excellent
Magazine Papers	Excellent	Excellent	Good	Excellent
Newsprint	Excellent	Excellent	Fair	Excellent
Parchment	Good	Good	Excellent	Excellent
Polyester Fabric	Excellent	Excellent	Good	Excellent
RC Photographs	Excellent	Excellent	Good	Excellent
Release Boards	Unsuitable	Unsuitable	Unsuitable	Unsuitable
Rice Paper	Good	Good	Good	Excellent
Sheepskin	Good	Good	Excellent	Excellent
Silk	Good	Good	Good	Excellent
Standard Posters	Excellent	Excellent	Excellent	Excellent
Textured Papers	Fair	Fair	Excellent	Fair
Watercolor Papers	Good	Good	Excellent	Good

2. Pre-drying of materials, commonly recommended when using a mechanical dry mount press, is unnecessary. The vacuum system extracts excess moisture from materials during the mounting/laminating processes.
3. In the heat mode, only one layer of prints can be mounted or laminated at one time in the press. You may fill the entire working area of the press to achieve maximum productivity from your unit.
4. Cover materials being mounted/laminated with a silicone impregnated release paper or film. Place in press.
5. It is a good idea to always leave two full-size sheets of release paper in the press between which all pressing is done so that the artwork never comes in direct contact with the platen or rubber pad.
6. Close press and fasten hold-down clamps. Activate vacuum controls, setting the timer to the desired increment. The correct pressing time will vary with the adhesive used and the materials being mounted. As a rule, due to the high pressure at which a vacuum press operates, the amount of time required will be less than in conventional mechanical presses.

7. There is one variable which will affect the time cycle. Vacuum presses work on a diaphragm system. The rubber base material actually lifts or rises to the heat surface, then presses with tremendous force (approximately 10lbs/in² or .71kg/cm²). Thus, the print/artwork/adhesive/substrate "sandwich" does not contact the heat platen until full vacuum is achieved.
8. Your press is designed to accommodate 1 1/2" (3.8cm) thickness. Hence, the rubber diaphragm is recessed from the platen surface. An initial period of time, the air evacuation time, is encountered after the vacuum system is activated and before full vacuum is achieved. The air evacuation time may be decreased if you will not be mounting to thick substrates. Since a shorter mounting cycle is desirable for reasons of efficiency, we suggest you adjust your press for the maximum thickness to which you will be mounting in order to shorten this air evacuation time. (See **HINTS AND SUGGESTIONS**, Section V.
9. After the vacuum cycle is completed, open press and remove artwork. It is usually recommended that the mount be placed under weight while the adhesive sets and/or cools. See specific adhesive manufacturer's instructions for details.

C. Cold Vacuum

1. Solvent Based Spray Adhesives

- a) Most solvent-based spray adhesives are very convenient to use. However, they are usually only recommended for use with certain substrates. Make sure you are bonding recommended materials only.
- b) Print and substrate must be stored in the same environment for at least 8 hours prior to bonding. The moisture content of both materials is therefore equalized sufficiently so as not to affect the performance of the adhesive.
- c) Apply sufficient adhesive to ensure adequate bonding. Spray slowly and evenly in a cross-hatched pattern (side to side and up and down).
- d) Allow adhesive to dry to a "dry tack" state (adhesive only slightly sticky when touched with a finger).
- e) Place print and substrate in press, turn timer past three and reset to at least three minutes.
- f) Print should be maintained under full vacuum (gauge reading at least 18" Hg) for no less than 2 minutes.
- g) Allow mounted print to "stabilize" in the same environment for 8-18 hours while the adhesive sets and cures (solvent trapped in the mounting process dissipates and evaporates during this time). Any temperature change during this period may cause bond failure not immediately apparent!

2. Water-Based Adhesive (Spray or Liquid/Paste)

- a) Apply adhesive to the mounting substrate using a roller, brush or spray gun as directed.
- b) Apply adhesive in a thin, even coat to avoid "bleed through" onto the print. For very thin fabrics and tissue paper, allow adhesive to tack/set slightly before joining materials.
- c) Cover materials with a sheet of kraft paper, clean newsprint or unwaxed butcher paper to protect press platen from adhesive, should adhesive extend beyond border lines or print during mounting.
- d) Place materials in press immediately. Set timer switch to allow maintenance under full vacuum for a minimum of one minute. Very glossy prints and plastic coated photographic materials should be kept under full vacuum for 3-5 minutes.

e) Remove materials from press and peel back cover sheet (or cover sheets may be left in place and removed by trimming to edge of print in glass/paper cutter).

f) Allow mounted print to dry completely, preferable under weight, before framing (20-60 minutes depending upon materials).HINTS AND SUGGESTIONS

A. Mounting Large Prints (30 to 40 inches and larger)

1. Form print into "U" shape and lower bottom of "U" to the center of the substrate.
2. Slowly lower one side, checking the alignment, and smooth print from center to edge. Repeat with other side. Two people make the job easier with over-sized prints.

B. Avoiding Bubbling and/or Air Entrapment

1. Follow adhesive manufacturer's instructions.
2. Use a clean, non-flawed mounting substrate.
3. Smooth print from center to edge to removed trapped air.
4. Allow adhesive to set properly after mounting.

C. Avoiding Wrinkling

1. Clean diaphragm and platen often as explained in Section III, A.
2. Change protective release paper or cover sheet when contaminated with adhesive or showing signs of wrinkling itself.

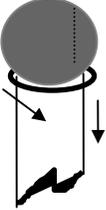
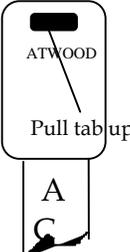
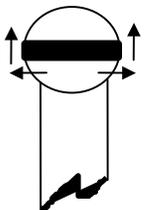
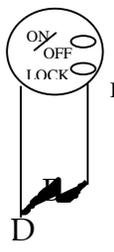
D. Stress Relieving (a technique for smoothing/removing wrinkles and creases prior to bonding; this may be done with or without heat).

1. Preheat press to 180-200°F, if desired.
2. Lay print, image side down, on a clean, smooth mounting board inside the vacuum press.
3. Soak a piece of kraft paper, larger than the print, in water for 2-3 minutes.
4. Wipe excess water from the kraft paper and carefully smooth and flatten it over the print.
5. Close press and draw vacuum for 2-3 minutes.
6. Allow print to air dry before mounting or laminating.

7. Most wrinkles will be smoothed by this process. Paper fibers that may have adhered to the back of the print may be removed with a damp cloth.
- E. Mounting to an Irregularly Surfaced Substrate
1. Place mount upside down with print surface close to rubber diaphragm.
 2. For extremely irregularly surfaced substrates, mount upside down and place open-celled foam between print and rubber diaphragm.
- F. Multiple Layer Mounting (**COLD VACUUM ONLY**)
1. Mount all prints on same sized board (trim after mounting, if necessary).
 2. Stack boards in press alternating with layers of kraft paper or similar paper to absorb glue seepage.
 3. Pad edges, if necessary, to avoid damaging the rubber diaphragm.
 4. Vacuum time will be determined by adhesive (See Section IV).
- G. Mounting to Wood or Heavy/Thick Substrates
1. When mounting to wood or substrates that are thicker or heavier than an average mounting board, pad corners (i.e. with foam or mat board) to prevent damage to rubber diaphragm.
 2. Remove restriction panel from underside of press if you will be routinely mounting to substrates 1 ½" (3.8cm) thick, or if you wish to mount to a 2" (5cm) thick substrate.
- H. Press Performance Options
1. Decrease air evacuation time to obtain vacuum more quickly by placing layers of cardboard, foam board, upholstery foam or similar material between restriction panel and underside of rubber diaphragm.
 2. Create additional workspace
 - a) Fasten a self-healing cutting mat to the top of the press
 - b) Allow a wall-hinged plywood panel to swing down over the press top when not in use.

VI. TROUBLE SHOOTING

PROBLEM	PROBABLE CAUSE	RECOMMENDED ACTION
Power LED does not light.	Unit disconnected from or improperly connected to power supply.	Check power supply connections (See Sec I, C).
	Interruption of electrical service at power supply.	Check fuses/circuit breakers at electrical panel. Replace or reset.
	Broken circuit breaker switch.	Contact factory for replacement.
No digital readout on temperature controller.	Circuit breaker switch has not been turned on.	Verify that switch is in "ON" position and power LED is lit.
	Temperature controller fuse is blown.	Disconnect unit from power source. Remove instrument panel by removing screws in corners and gently extracting panel. Using a multi-meter / continuity test, determine if the 1A fuse is bad. Replace if necessary.
	Faulty temperature controller.	Contact factory for replacement.
	Faulty temperature sensor assembly.	Contact factory for replacement.
Digital temperature controller displays error msg	Faulty temperature sensor assembly.	Contact factory for replacement.
All displays normal but unit fails to heat.	Internal thermal fuse blown.	Contact factory for replacement.
	Faulty power relay.	Contact factory for replacement.
	Faulty temperature controller.	Contact factory for replacement.
	Faulty internal wiring.	Contact factory for replacement.
Overheating (more than 25° above set temperature)	Faulty temperature sensor assembly.	Contact factory for replacement.
	Faulty temperature controller.	Contact factory for replacement.
	Faulty power relay.	Contact factory for replacement.
Vacuum pump does not turn on	Pump disconnected from press.	Attach pump to press in pigtail receptacle marked VACUUM PUMP ONLY .
	Circuit breaker switch off.	Circuit breaker switch must be in "ON" position (power LED light on).
	Broken timer switch.	Plug pump directly into wall outlet/power supply of appropriate voltage (see pump motor plate). Contact factory for replacement timer.
Vacuum pump hums or clicks when engaged	Pump rotor stuck; electric motor unable to spin.	Consult vacuum pump operating and maintenance instructions (Appendix vi)
Vacuum press fails to draw full vacuum (less than 18" Hg on gauge)	Timer switch turns press off prematurely.	Press should draw vacuum within 60 seconds (HS/100 may require 75-90 seconds). Set timer for at least 2 minutes.
	Hold down clamps not fastened.	Fasten clamps on sides of press.
	Rubber gasket misshapen or deformed.	Check for depressions in rubber gasket. Rejuvenate gasket by leaving press top open for an extended period of time. Speed process by massaging gasket while applying heat with a blow dryer or shrink wrap gun, or while dabbing sparingly with paint thinner or other solvent. WARNING! EXCESSIVE HEAT OR SOLVENTS MAY PERMANENTLY DAMAGE THE GASKET!

PROBLEM	PROBABLE CAUSE	RECOMMENDED ACTION
Vacuum press fails to draw full vacuum (less than 18" Hg on gauge) (continued)	Puncture in rubber diaphragm.	Examine rubber diaphragm for puncture holes or rips. Patch from underside as necessary.
	Faulty vacuum pump.	Disconnect vacuum hose from pump. While pump is running, place finger over intake fitting. You should feel significant "pull" on your finger. To accurately check the pump's performance, access the back of the vacuum gauge on the underside of the press. Disconnect the vacuum hose that extends from the gauge to the right rear vacuum port. Using duct tape, package sealing tape or some type of impermeable tape, cover the fitting you have just exposed. Turn timer switch on. You should get an immediate reading on the vacuum gauge of 23-25" Hg. If reading below 18" Hg and/or the pump appears to be operating sluggishly, check the pump's felt filters for excess carbon dust buildup and/or flush the pump per pump manufacturer's instructions. After cleaning filters and/or flushing pump, test pump again as above. Contact factory if gauge reading is still below 18" Hg.
	Vacuum connection leaks. <p style="text-align: center;">TAPE TEST ↗↗↗</p>	Reconnect vacuum hose disconnected above. Using impermeable tape, cover vacuum port (small disks in diaphragm at back of press). Turn timer switch on. You should see an almost instantaneous reading of 23-25" Hg on vacuum gauge. If not, with pump still running, inspect vacuum tubing connections between press and pump, as well as all tubing connections under diaphragm.
Improper seal between gasket and platen due to hinge dislocation during shipment or normal usage. <p style="text-align: center;">BOOKMARK TEST</p> <p style="text-align: center;">HINGE REALIGNMENT PROCEDURE</p>	Cut 20-30 pieces of paper (1/2" x 8 1/2"; 1.25cm x 21.5cm) and lay them over the gasket all around its perimeter. Close press top and attempt to pull the paper strips out from between the gasket and the platen. Paper that is removed without resistance indicates a vacuum leak at that spot. Follow procedure below to adjust hinges:	
	 <p style="text-align: center;">A</p>  <p style="text-align: center;">C</p>  <p style="text-align: center;">D</p>	Support press top in open position. Identify type of gas spring(s) your press has per drawing at left. Disconnect spring safety per drawing. If you have type "B" springs, hyper-extend press opening by exerting upward on press handle. Tap the spring end(s) out, away from side. Close the top.

PROBLEM	PROBABLE CAUSE	RECOMMENDED ACTION
Vacuum press fails to draw full vacuum (less than 18" Hg on gauge) (continued)	Improper seal between gasket and platen due to hinge dislocation during shipment or normal usage (continued).	<p>Loosen all hinge bolts. Hinges are located at the back of the press. It is essential that you secure the nuts underneath the press with a wrench while turning the bolts. Placing the four corners of the press on blocks will allow access to the nuts if not otherwise accessible.</p> <p><u>Do not fasten clamps.</u> Turn the timer switch to 15 min; allow press to come to vacuum. You may have to apply pressure at those points where there was no resistance in the paper strip (bookmark) test.</p> <p>While pump is still running, and press is drawing full vacuum, tighten the bolts.</p> <p>Turn timer switch off. Open press top then close again; fasten clamps. Turn timer switch on again and make sure press again reaches full vacuum.</p> <p>Open press top and reconnect gas spring(s).</p>
Press causes print to wrinkle or bubble immediately upon removal from press	Print catching on platen top or rubber diaphragm due to adhesive or dirt.	Clean platen and/or rubber diaphragm.
	Flawed mounting substrate.	Discard and use new board.
	Too much or too little heat.	Consult adhesive manufacturer's recommendations. Attempt to mount some samples at 15° lower or 15° higher temp.
	Too much adhesive (usually occurs with wet adhesive).	Remove excess adhesive before joining artwork and substrate using a dry brush or roller.
	Wrinkles/creases in cover sheet.	Extend time under vacuum to 5-10 min. Discard and use new sheets.
Bubbling occurs between print and substrate long after removal from press (30 min to 1 year)	Material incompatibility.	Consult adhesive manufacturer's recommendations.
	Adhesive not applied properly.	<p><u>Dry Mounting Adhesives:</u> Follow specific instructions for work preparation and necessary support material (i.e., release paper, tacking iron, etc.)</p> <p><u>Solvent Based Spray Adhesives:</u> Proper adhesive coverage can be accomplished by carefully spraying in a slow, deliberate, cross-hatched pattern. Spray both artwork and substrate when mounting glossy, heavy prints like RC photographs. Allow adhesive to dry to touch before joining artwork to substrate.</p>

PROBLEM	PROBABLE CAUSE	RECOMMENDED ACTION
Bubbling occurs between print and substrate long after removal from press (30 min to 1 year) (continued)	Adhesive not applied properly (continued).	<u>Wet Mounting Adhesives:</u> Make certain entire surface of substrate is coated uniformly. Use wet glue sparingly, as too much glue will cause unsatisfactory results. Hold coated board up to light to verify even sheen across entire surface, indicating adhesive is still wet. Artwork must be joined to substrate while glue is wet.
	Insufficient mounting time.	Please see specific instructions provided by individual adhesive manufacturer. The following general rules apply: Dry Mounting Adhesives: 1-10 minutes Laminating Films: 3-10 minutes Solvent Based Sprays: 2-5 minutes Wet Adhesives: 1-2 min breathable mat'l Wet Adhesives: 5-10 min glossy mat'l
	Insufficient curing/cooling time.	Dry mounted/heat laminated items should be allowed to cool, under weight, upon removal from press. Solvent based sprays require 8-18 hours to "cure". Mounted pieces should remain in the same environment in which they were mounted for a minimum of 8 hours after bonding. Pieces may be framed immediately, but should not be subjected to changes in temperature during this period. Artwork mounted with a wet adhesive, unless left in vacuum press until completely dry, should be allowed to air dry flat, under weight, for 20-60 minutes. The more humid the particular environment, the longer the process. If artwork requires longer than 60 minutes to dry, this indicates the use of excessive adhesive.
Vacuum time too slow	See causes of press failing to come to vacuum above.	Follow recommendations above.
	Rubber diaphragm sags.	A restriction panel is set at 1 1/2" below top of base frame. If this much depth is not needed, the rubber diaphragm may be propped up from below by placing layers of board or foam between the panel and the diaphragm.



MANUFACTURING CORPORATION

P. O. BOX 97, BENTON HARBOR, MICHIGAN 49022
PHONE 616-926-6171

70-290
G375PL

(4-89)

**PARTS LIST and OPERATING
INSTRUCTIONS**

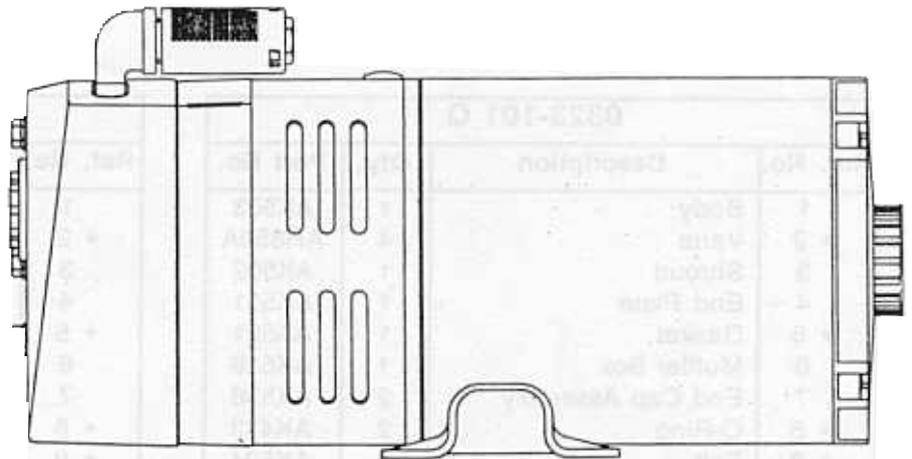
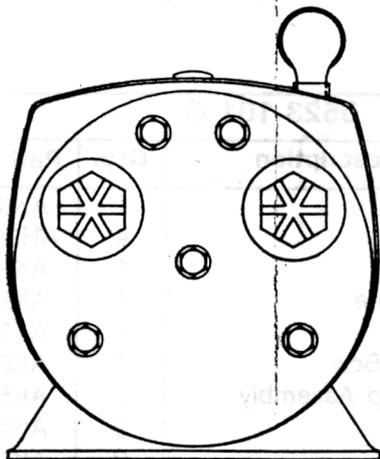
**23 SERIES OILLESS
VACUUM PUMPS AND
COMPRESSORS**

0323

0523

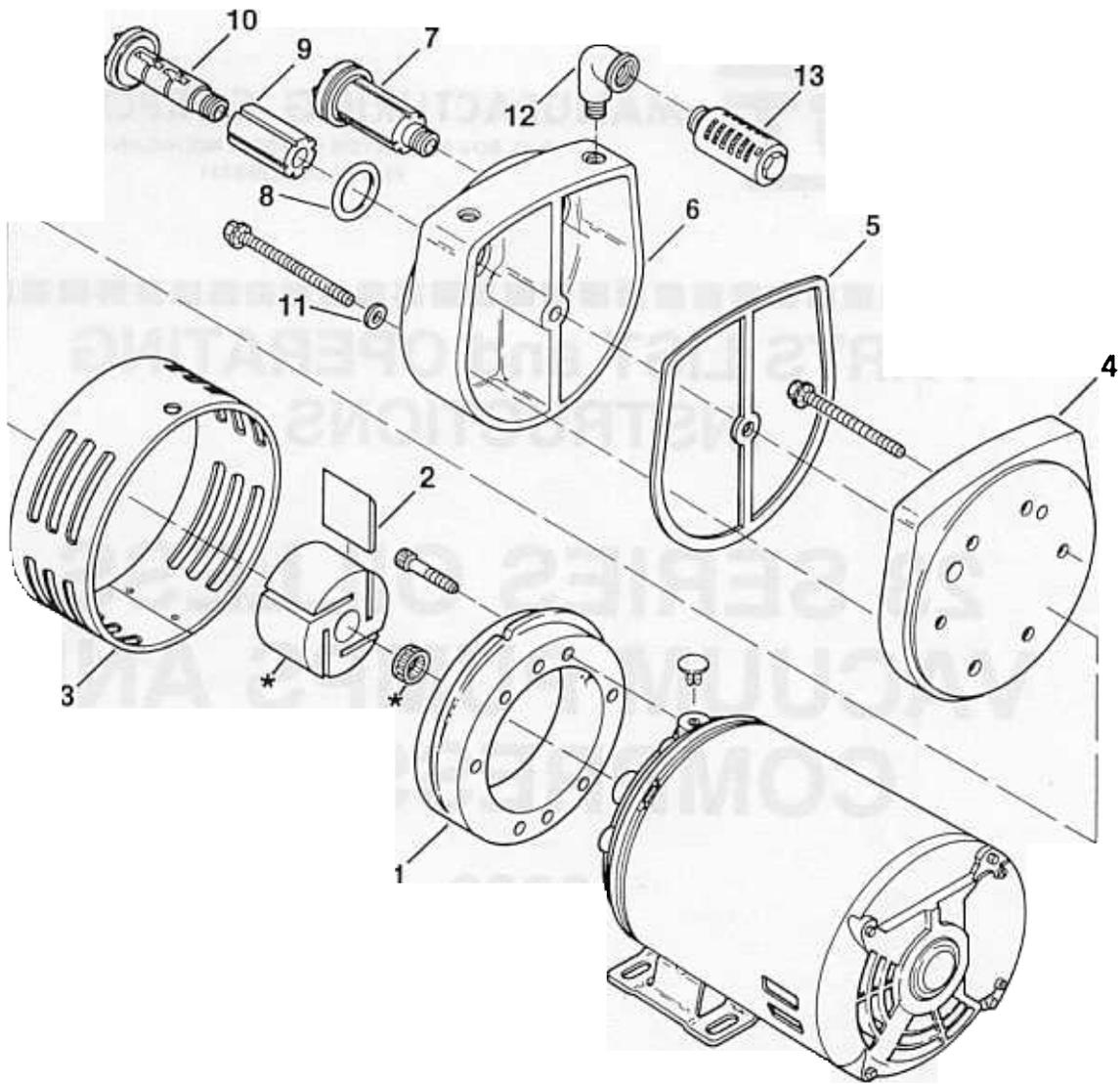
0823

1023



**WARNING: THESE UNITS SHOULD NOT PUMP EXPLOSIVE GASES OR
BE USED IN EXPLOSIVE AMBIENTS.**

Appendix i

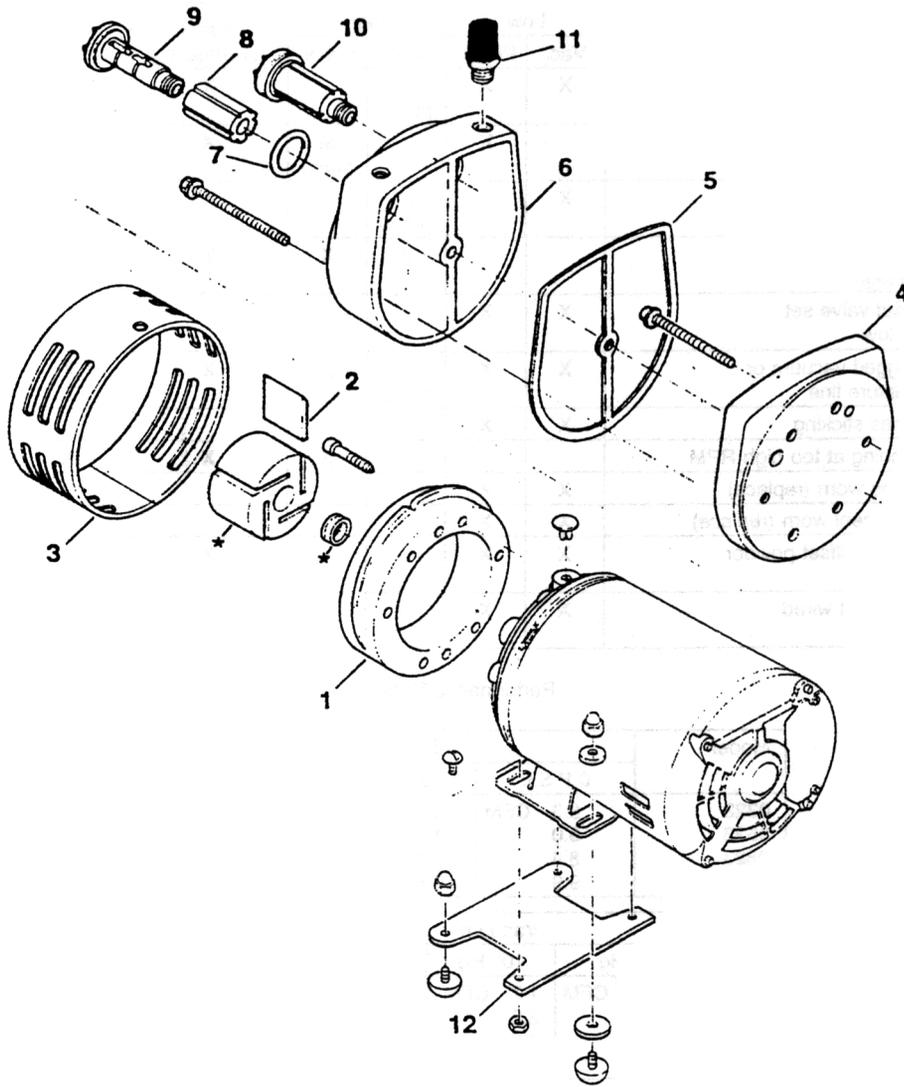


*Rotor and tolerance ring should not be replaced in the field. Parts not numbered are not available individually.

0323-101 Q			
Ref. No.	Description	Qty.	Part No.
1	Body	1	AK503
• 2	Vane	4	AH850A
3	Shroud	1	AK502
4	End Plate	1	AK501
• 5	Gasket	1	AK521
6	Muffler Box	1	AK519
7	End Cap Assembly	2	AK526
• 8	O-Ring	2	AK473
• 9	Felt	2	AK524
10	End Cap	2	AK510
• 11	Bolt Gasket	5	AK523
12	Elbow	1	BA249
13	Muffler	1	AF353
	Service Kit	1	K478

0523-101 Q			
Ref. No.	Description	Qty.	Part No.
1	Body	1	AK505
• 2	Vane	4	AH850A
3	Shroud	1	AK502
4	End Plate	1	AK501
• 5	Gasket	1	AK521
6	Muffler Box	1	AK519
7	End Cap Assembly	2	AK526
• 8	O-Ring	2	AK473
• 9	Felt	2	AK524
10	End Cap	2	AK510
• 11	Bolt Gasket	5	AK523
12	Elbow	1	BA249
13	Muffler	1	AF353
	Service Kit	1	K478

• Denotes parts included in a Service Kit. When corresponding or ordering parts, please give complete model and serial number.



Ref. No.	Description	Qty	0323-101Q	0323-101	0523-101Q	0523-101
1	Body	1	AK503	AK503	AK505	AK505
•2	Vane	4	AH850A	AH850A	AH850A	AH850A
3	Shroud	1	AK502	AK502	AK502	AH502
4	End Plate	1	AK501	AK516A	AK501	AK516A
•5	Gasket	1	AK521		AK521	
6	Muffler Box	1	AK519		AK519	
•7	O-Ring	2	AK473		AK473	
•8	Felt	2	AK524		AK524	
9	End Cap	2	AK510		AK510	
10	End Cap Asm	2	AK526		AK526	
11	Filter/Muffler	1	AK840A		AK840A	
12	Foot Support	1	AC136		AC136	
	Service Kit	1	K478	K478A	K478	K478A

• Denotes parts included in the Service Kit.
 Parts listed are for stock models. For specific OEM models consult the factory.
 When corresponding or ordering parts please give complete model and serial numbers.

TROUBLE SHOOTING GUIDE FOR ROTARY VANE PUMPS

REASONS FOR PROBLEM	Low		High		Pump Overheating	Motor Overload
	Vac.	Press.	Vac.	Press.		
Filter dirty	X	X	at pump		X	X
Muffler dirty		X		at pump	X	X
Vac. line collapsed	X		at pump		X	X
Relief valve set too high			X	X	X	X
Relief valve set too low	X	X				
Plugged vacuum or pressure line	X	X	at pump	at pump	X	X
Vanes sticking	X	X				
Running at too high RPM			X	X	X	X
Vanes worn (replace)	X	X				
Shaft seal worn (replace)	X	X				
Dust or offset powder in pump	X	X			X	X
Motor not wired correctly	X	X			X	

Performance Data

Model	Pressure		
	0 P.S.I.	5 P.S.I.	10 P.S.I.
0323	3.3 CFM	2.9 CFM	2.4 CFM
0523	5.0	4.7	4.0
0823	8.4	7.4	6.6
1023	9.9	9.8	8.8

Model	Vacuum			Maximum Vacuum
	0" Hg	10" Hg	20" Hg	
0323	3.3 CFM	1.7 CFM	.5 CFM	26" Hg
0523	5.0	2.8	1.0	26" Hg
0823	7.8	4.6	1.8	27" Hg
1023	10.0	5.8	2.2	27" Hg

MODEL NUMBER EXPLANATION FOR ROTARY VANE OILLESS VACUUM PUMPS AND COMPRESSORS

0323 - P 101 Q - G18DX

Pump Model No.

0323 0823 Integral Motor
0523 1023 Pump Unit

Indicates Electric Motor is Equipped with

A Thermotector
X Internal Thermotector

Application

P as Compressor
V as Vacuum
No Letter Vacuum or Pressure

Electric Motor Number

Each type & size motor has a specific number found on the specific motor list.

Numbers

1 - 99 Lubricated
100 - 199 Oilless
200 & up Lubricated

Engineering Design Number

Designates any modifications in dimensions, materials or grouping of accessories.

ACCESSORIES

CHECK VALVES—vacuum

AE238	1/4" NPT, male
AE365	1/4" NPT, female
AE365A	3/8" NPT, female

AH326A	3/4" NPT
AH326B	1" NPT

	1/8" 1/2" 3/4" hp, 115V without switch, 10 ft.
	1/2" 3/4" hp, 230V without switch, 10 ft.
	1/8" 1/4" 1/2" hp, 115 V with switch, 10 ft.

	3/8" female NPS, 10 micron
	1/2" male NPS, 10 micron
	3/4" male NPS, 10 micron
	3/8" female NPS, 50 micron
	1/2" male NPS, 50 micron
	3/4" male NPS, 50 micron
	1/4" male NPS, 50 micron
	1/4" male NPS, 50 micron
	1" male NPS, 50 micron

	1/4" NPS, 2 oz., 50 micron
	1/8" NPS, 3/4" oz., 50 micron
	1" NPS, 2 qt., 50 micron
	3/8" NPS, 1 pt., 10 micron
	3/8" NPS, 1 pt., 50 micron
	1/2" NPS, 1 pt., 50 micron
	1/2" NPS, 1 pt., 10 micron
	3/4" NPS, 1 pt., 10 micron
	3/4" NPS, 1 pt., 50 micron
	1/2" NPS, 1 qt., 10 micron
	1/2" NPS, 1 qt., 50 micron
	3/4" NPS, 1 qt., 10 micron
	3/4" NPS, 1 qt., 50 micron
	1/4" NPS, 8 oz., 50 micron
	3/8" NPS, 8 oz., 50 micron
	1/4" NPS, 8 oz., 50 micron

	1/4" NPS, 1/2" pt., 10 micron
	1/2" NPS, 1/2" pt., 10 micron
	3/8" NPS, 1/2" pt., 10 micron
	1/4" NPS, 1/2" pt., 50 micron
	3/8" NPS, 1/2" pt., 50 micron
	3/4" NPS, 1 qt., 10 micron
	3/4" NPS, 1 qt., 50 micron
	1/2" NPS, 1 qt., 50 micron
	1/2" NPS, 1 qt., 10 micron

	1/4" NPS, 2 oz.
	1/8" NPS, 3/4" oz.
	1/4" NPS, 8 oz.
	3/8" NPS, 8 oz.

FLUSHING SOLVENT

AH255	1 qt.
-------	-------

FOOT SUPPORT ASSEMBLIES

AC136	0211, 0322, 0522
AE240	1/4"-3/4" hp piston pumps
AE241	1/2"-3/4" piston pumps
AE245	1/8" hp piston pumps

GAUGES—pressure

AA642	1/8" NPS, 0-30 psi
AA644B	1/4" NPS, 0-30 psi 0-2K/cm ²
AA806	1/4" NPS, 0-160 psi (back mount)
AA807	1/8" NPS, 0-160 psi (back mount)
AF569	1/4" NPS, 0-100 psi (back mount)
AF583	1/4" NPS, 0-100 psi, heavy duty (bottom mount)

GAUGES—vacuum

AA640	1/4" NPS, 0-30" Hg, 0-760 mm Hg
AA641	1/8" NPS, 0-30" Hg

AC174	0211, 0322, 0522
AF555	for 1/2" and 3/4" hp units

	3/8" NPS, 1 pt., 10 micron, for oil-less pumps
	1/8" NPS, 1 pt., 50 micron, for oil-less pumps
	1/2" NPS, 1 pt., 50 micron, for oil-less pumps
	1" NPS, 2 qt., 50 micron
	1" NPS, 2 qt., 50 micron, with fitting for quieter operation
	3/4" NPS, 1 qt., 10 micron, for oil-less pumps
	3/4" NPS, 1 qt., 50 micron, for oil-less pumps
	1/8" NPS, 3/4" oz., 50 micron, for oil-less pumps same as AA922 but iwth silencing tube
	1/8" NPS, 2 oz., 50 micron, for oil-less pumps

	1/2" NPS, 1/2" pt., 10 micron
	1/4" NPS, 1/2" pt., 10 micron
	3/8" NPS, 1/2" pt., 10 micron
	1/2" NPS, 1 qt., 10 micron
	3/4" NPS, 1 qt., 10 micron

AA617H	1/4" NPS, 2 oz.
AA922P	1/8" NPS, 3/4" oz.
V425M	1/4" NPS, 8 oz.
V525G	3/8" NPS, 8 oz.

External thermal protector, specify motor number and make

PAINT

AE564A	Gast blue-gray, 16 oz. aerosol can
--------	------------------------------------

RELIEF VALVES—pressure

AA203	1/8" NPS, flow below 2 cfm
AA205	1/4" NPS, flow below 2 cfm
AA600	3/8" NPS, flow below 10 cfm
AA307	3/4" NPS, flow above 10 cfm
AF570S	1/4" NPS, 0-100 psi
AF720	1/4" NPT, 0-100 psi
AE960	1" NPT, 0-100 psi.

RELIEF VALVES—vacuum

AA204	1/8" NPS, flow below 2 cfm
AA207	1/4" NPS, flow below 2 cfm
AA840A	3/8" NPS, flow from 2-15 cfm
AA308	3/4" NPS, flow above 10 cfm
AE961	1" NPS, for 4565, 5565

SWITCH—vacuum

AE265	1/4" NPS
-------	----------

TRAPS—vacuum

AA672B	1/4" NPS, 8 oz.
AA673	3/8" NPS, 8 oz.
AA675B	1/8" NPS, 2 oz.
AA675C	1/4" NPS, 2 oz.

OPERATING AND MAINTENANCE INSTRUCTIONS

CONSTRUCTION: The end plate, body, rotor and mounting bracket are all cast iron. Consequently any moisture that accumulates in the pump will tend to corrode the interior especially if it stands idle. The muffler box, on the front of the unit, is made of aluminum. The vanes are made of hard carbon and are precision ground. They should last 5,000 to 10,000 hours depending upon the degree of vacuum or pressure at which the pump is run.

STARTING: CAUTION: *NEVER LUBRICATE THIS OILLESS AIR PUMP.* The carbon vanes and grease packed motor bearings require no oil. If the motor fails to start or slows down when under load shut the unit off and unplug. Check that the supply voltage agrees with the motor post terminals and the motor data name plate. CAUTION: ALL DUAL VOLTAGE MOTORS ARE SHIPPED FROM THE FACTORY WIRED FOR THE HIGH VOLTAGE. If the pump is extremely cold allow it to warm to room temperature before starting. If anything appears to be wrong with the motor return the complete pump to an authorized Gast service facility.

To minimize noise and vibration the unit should be mounted on a solid surface that will not resonate. Use of shock mounts or vibration isolation material is recommended. Inlet or discharge noise can be minimized by attaching the enclosed muffler (AF353). The unit should not be allowed to operate in ambient air temperatures in excess of 40°C (104°F). If the motor fails to start or slows down when under load shut the unit off and unplug. Check that the supply voltage agrees with the motor post terminal setup and the motor data name plate.

FILTRATION: Care must be taken to insure that any particles (dirt, chips, foreign material) often found in new plumbing not be allowed to enter the unit. Liquid, moisture vapor, or oil based contaminants will affect pump performance and must be filtered from entering the pump.

Dirty filters restrict air flow and if not corrected could lead to possible motor overload, poor performance and early pump failure. Check filters periodically and clean when necessary by removing felts and washing in Gast flushing solvent (part number AH255). Dry with compressed air and replace.

FLUSHING: Should excessive dirt, foreign particles, moisture, or oil be permitted to enter the pump the vanes will act sluggish or even break. Flushing the pump should remove these materials. There are two options for performing this operation.

Option #1 — You will need two pipe nipples at least 4" long with 3/8" NPT on one end. 1) Remove the filter elements from the front of the muffler box and screw the nipples in through the same holes. 2) With the pump running allow about 2 tbsps. of flushing solvent to be ingested into the vacuum side of the unit. CAUTION: WEAR EYE PROTECTION AND FLUSH IN A WELL VENTILATED AREA. Repeat the flushing procedure. If it does not remedy the situation remove the end plate for further examination.

Option #2 — Remove the filter elements from the front of the muffler box and carefully remove the five bolts that hold the muffler box in place (be careful not to damage the gaskets and it may be necessary to replace them). Tap the box with a small hammer to break it loose. DO NOT PRY WITH A SCREWDRIVER as the gasket will be damaged. This will allow access to the intake and exhaust ports. Follow through with steps 2 & 3 as above.

DISASSEMBLY: If flushing does not eliminate the problem remove the six bolts holding the end plate to the body. Now remove the end plate and the four vanes (do not remove the rotor or loosen any electric motor through bolts). The vanes could be worn or could require further cleaning. The top clearance (between rotor and body) may be adjusted by "LIGHTLY" tapping on the pump body and the rotor should be turned while setting this clearance to assure that all points on the rotor clear the body.

HAZARD PREVENTION:

WARNING: MAKE SURE THE ELECTRIC MOTOR IS PROPERLY GROUNDED AND THE WIRING IS DONE BY A QUALIFIED ELECTRICIAN FAMILIAR WITH NEMA MG2 SAFETY STANDARDS, NATIONAL ELECTRIC CODE AND ALL LOCAL SAFETY CODES.

WARNING: THE ELECTRIC MOTOR MAY BE THERMALLY PROTECTED AND WILL AUTOMATICALLY RESTART WHEN THE PROTECTOR RESETS.

WARNING: WHEN SERVICING ALL POWER TO THE MOTOR MUST BE DE-ENERGIZED AND DISCONNECTED. ALL ROTATING COMPONENTS MUST BE AT A STAND STILL.

WARNING: DO NOT USE KEROSENE OR OTHER COMBUSTIBLE SOLVENTS OR OPERATE PUMP IN EXPLOSIVE AMBIENTS.

Gast Manufacturing Co., Ltd.
Coronation Road, Cressex Estate
High Wycombe, Bucks HP12 3SN
England 23571
FAX 444-943-6588

Gast Manufacturing Corp.
2550 Meadowbrook Road
Benton Harbor MI 49022
616/926-6171
FAX 616-925-8288

Gast Manufacturing Corp.
505 Washington Ave.
Carlstadt NJ 07072
201/933-8484
FAX 201-933-5545

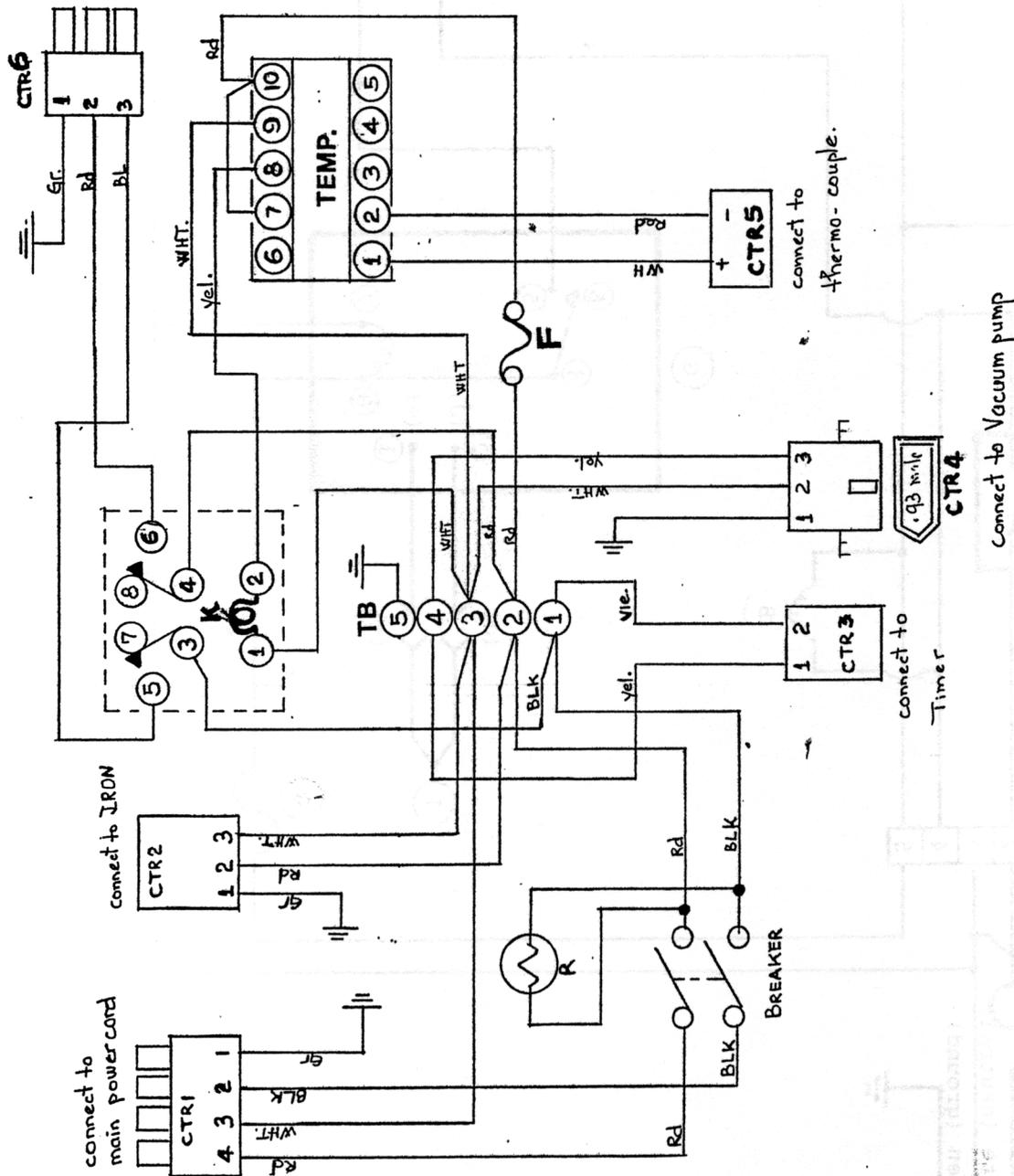
Brenner-Fiedler & Assoc.
13824 Bentley Place
Cerritos, Ca. 90701
213-404-2721
FAX 213-404-7975

Wainbee, Ltd.
121 City View Drive
Rexdale, Ontario, Canada M9W 5A9
416/243-1900
FAX 416-243-2336

Wainbee, LTD.
215 Brunswick Blvd.
Pointe Claire, Montreal
Canada H9R 4R7
514/697-8810
FAX 514-697-3070

Note: All general correspondence should be directed to Gast Mfg Corp, P.O. Box 97, Benton Harbor, MI 49022

connect to Heater.



Appendix vii

CTR1: Connector, male 4 plug 03-12-1046
Use female pin 18-12-1601

CTR2: Connector, female, 3 circuit, WM1332
use female pin .093.

CTR3: Connector, 2 circuit plug, WM1603/19.09.2028
use male pin .093

CTR4: Connector, 3 circuit plug, 03-09-2031
use male pin .093

CTR5: Connector, thermocouple RMJ-J-S

CTR6: Connector, 3 circuit male plug 03-12-1036
use male pin 18-12-2601

F: Fuse TA, 250V, use clip fuse holder

K: Relay: 5X847

R: Red light indicator, 250V/1/3W, 36H

BREAKER: see notes below for model-specific breaker.

TEMP: temperature control, ESCS-RAK5X-F

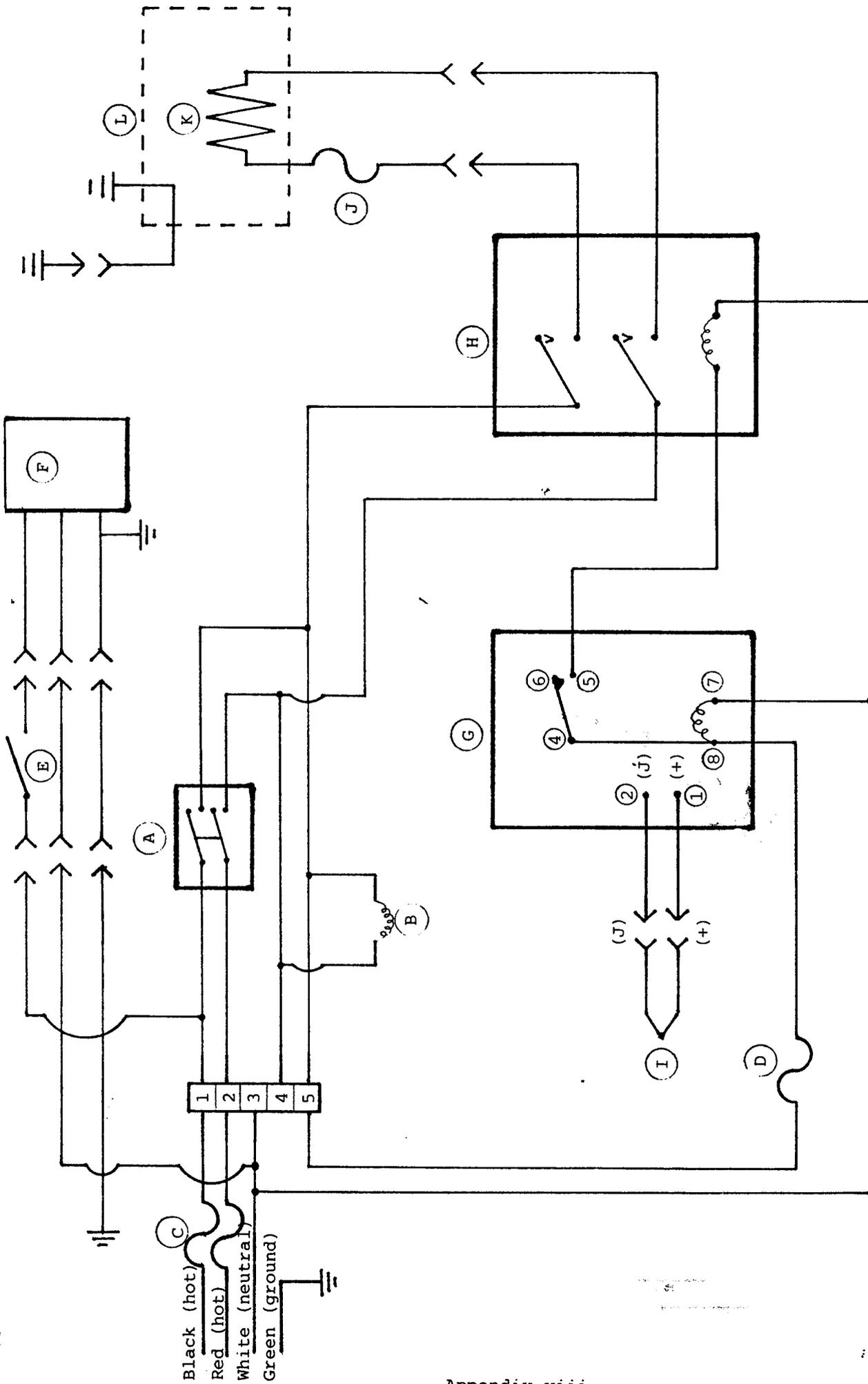
Note: use old box for All H.S

except the length need to be added
2 1/2"

THE PRINT MOUNT CO., INC.
SMITHFIELD, RHODE ISLAND
SEPTEMBER 2003

HS/64-BG (BLACK GLASS PLATEN)
BREAKER: BA2-B0-34-630-111-C, 30A

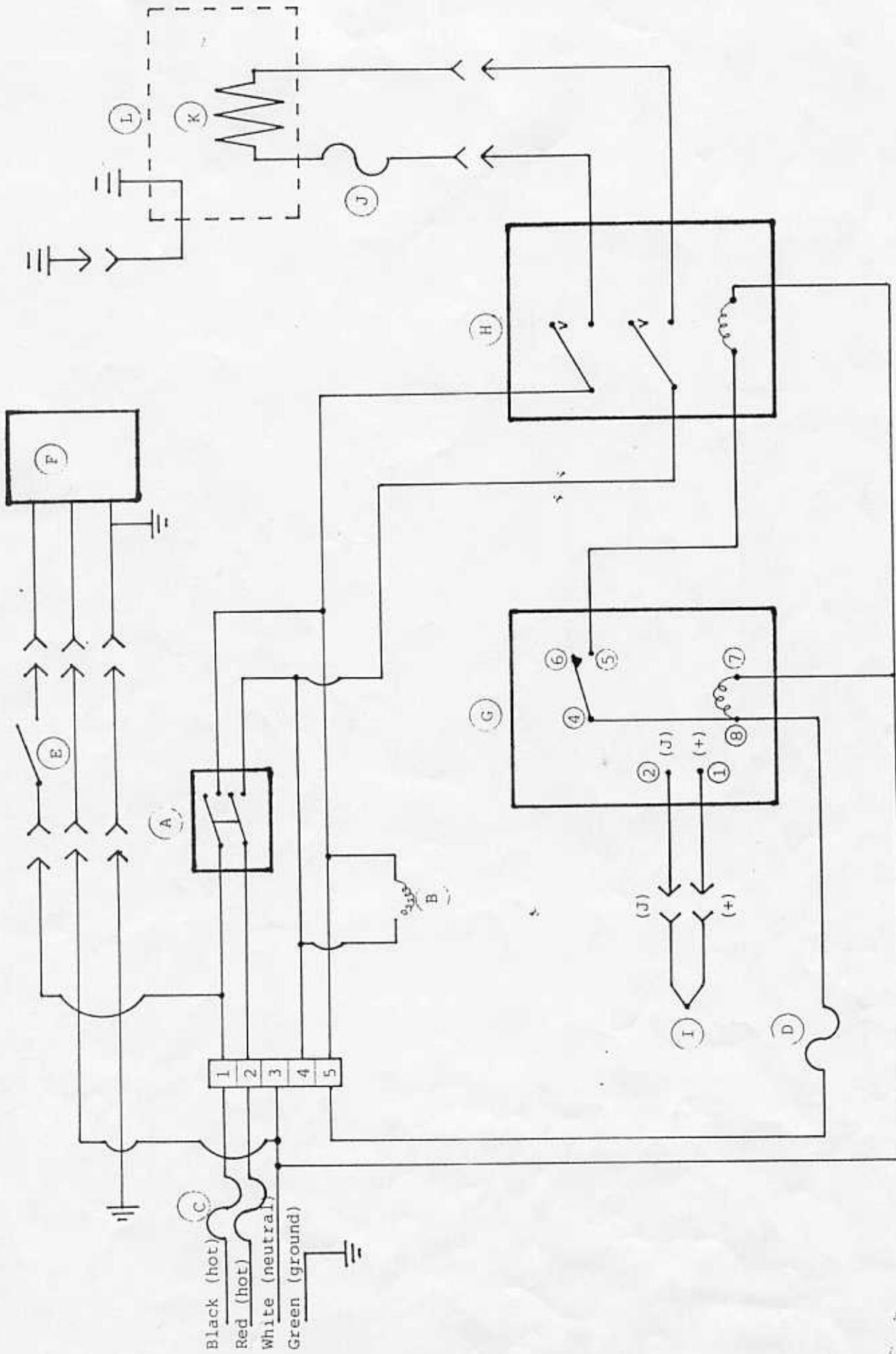
HS/100-BG (BLACK GLASS PLATEN)
BREAKER: AA2-B0-24-640-5G1-C, 40A



Appendix viii

HS/64 x 44 WIRING DIAGRAM KEY TO LETTERED SYMBOLS

- (A) POWER SWITCH, Double Pole, Single Throw, Rated 16A @ 250V-AC
- (B) INDICATOR LAMP, 250V 1/3W
- (C) FUSE, 2 each, 20A
- (D) FUSE, 1 each, 1A
- (E) TIMER SWITCH, Rated 20A @ 240V 1 HP 120
- (F) VACUUM PUMP, 1/4 HP, Single Phase, Rated 5A @ 120V-AC
- (G) TEMPERATURE CONTROLLER, 110/120V-AC, 50/60Hz
- (H) POWER RELAY, Double Pole, Double Throw, Rated 20A @ 120/240V-AC
120V-AC, 23 MA, 2.75 VA
- (I) THERMOCOUPLE, TYPE "J" (iron/constantan)
- (J) THERMAL FUSE, 216°C, One-Time Blow, Rated 20A @ 240V-AC
- (K) HEATER BLANKETS, Left & Right, 1525W each, 3050W Total
Rated 20A @ 240V-AC
- (L) ALUMINUM PLATEN



Appendix x

HS/44 x 34 WIRING DIAGRAM KEY TO LETTERED SYMBOLS

- A POWER SWITCH, Double Pole, Single Throw, Rated 16A @ 250V-AC
- B INDICATOR LAMP, 250V 1/3W
- C FUSE, 2 each, 15A
- D FUSE, 1 each, 1A
- E TIMER SWITCH, Rated 20A @ 240V 1 HP 120V-240V-AC
- F VACUUM PUMP, 1/4 HP, Single Phase, Rated 5A @ 120V-AC
- G TEMPERATURE CONTROLLER, 110/120V-AC, 50/60Hz
- H POWER RELAY, Double Pole, Double Throw, Rated 20A @ 120/240V-AC
120V-AV, 23 MA, 2.75 VA
- I THERMOCOUPLE, TYPE "J" (iron/constantan)
- J THERMAL FUSE, 216^oC, One-Time Blow, Rated 20A @ 240V-AC
- K HEATER BLANKETS, Left & Right, 825W each, 1650W Total
Rated 7.5A @ 220V-AC
- L ALUMINUM PLATEN

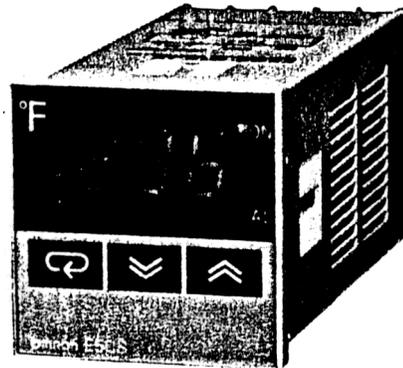
Temperature Controller

E5CS-X

1/16 DIN Sized Multi-range Controller Offers Selectable Control Modes, Built-in Alarm

- ✓ ■ Accurate to ± 0.5% of full scale
- ✓ ■ Multiple scale ranges allows flexibility to match application
- ✓ ■ Field-selectable temperature ranges in °F and °C
- ✓ ■ Selectable ON/OFF and PID control with auto-tuning of proportional band
- X ■ 8-function alarm, standard *
- ✓ ■ Tamper-proof setting, faulty sensor compensation and controller diagnostics
- ✓ ■ Easy-to-read 11 mm high LED display
- ✓ ■ Nonvolatile memory backup

SET F 0-100°
SET "PID" (20 sec)

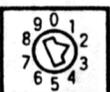


*** ALARM NOT WIRED IN STANDARD HS. OPTIONAL**

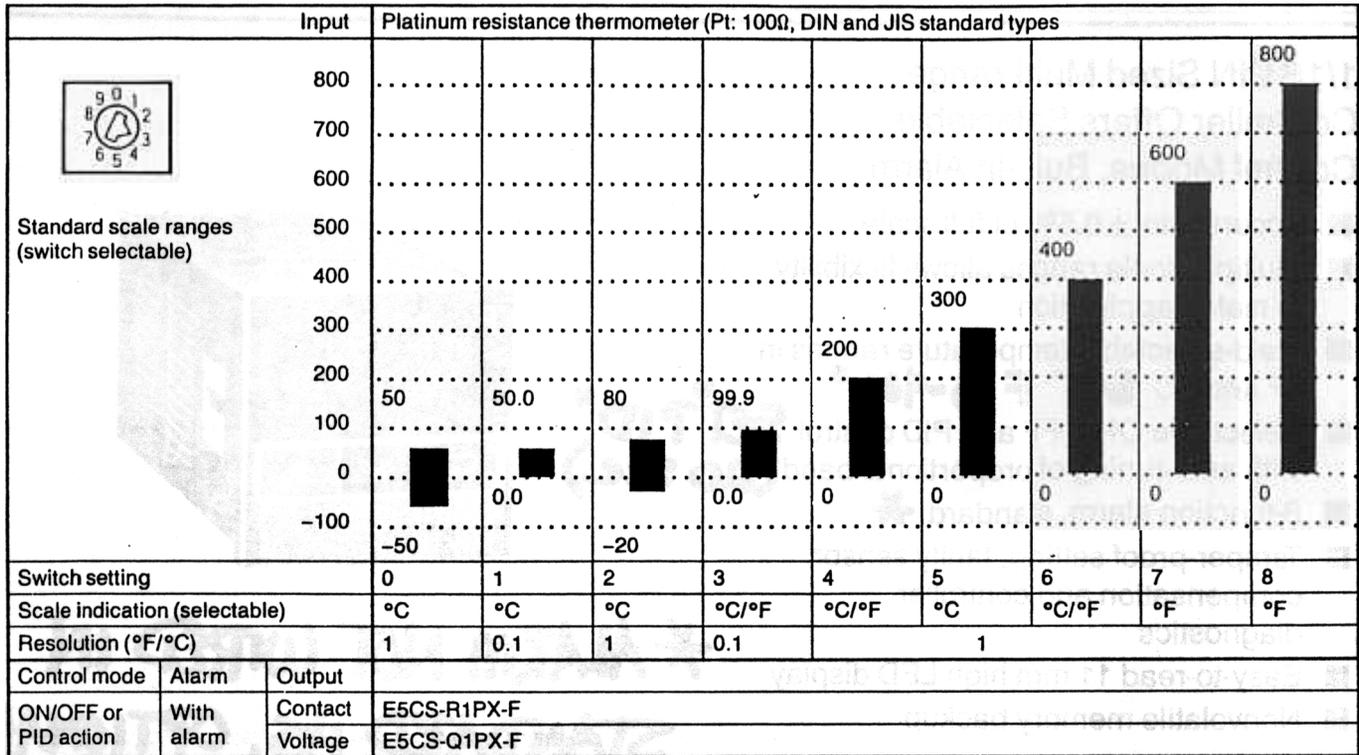
Ordering Information

■ CONTROLLERS

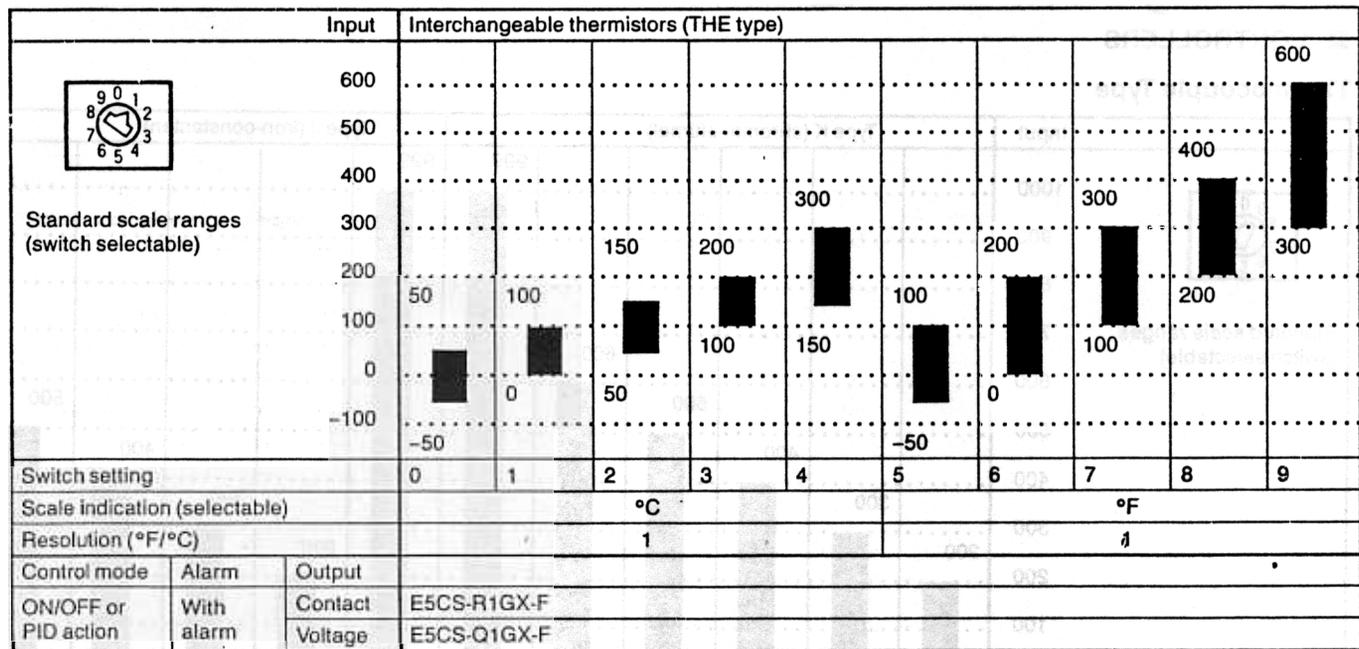
Thermocouple Type

Input	Type K (chromel-alumel)					Type J (iron-constantan)					
	0	1	2	3	4	5	6	6	7	8	9
 Standard scale ranges (switch selectable)	200	300	400	500	600	999	999	200	300	400	500
Switch setting	0	1	2	3	4	5	6	6	7	8	9
Scale indication (selectable)			°C/°F	°C/°F	°C/°F	°C/°F	°F			°C/°F	°C/°F
Resolution (°F/°C)	1					1					
Control mode	Alarm	Output									
ON/OFF or PID action	With alarm	Contact	E5CS-R1KJX-F ✓								
		Voltage	E5CS-Q1KJX-F								

Platinum Resistance Thermometer Type



Thermistor Types



ACCESSORIES

Description	Part number
Protective cover	Hard plastic; protects front panel against dust, dirt and water drops Y92A-48

TEMPERATURE SENSORS

Consult your Omron dealer for full selection and specifications on E52-series temperature sensors.

REPLACEMENT PARTS

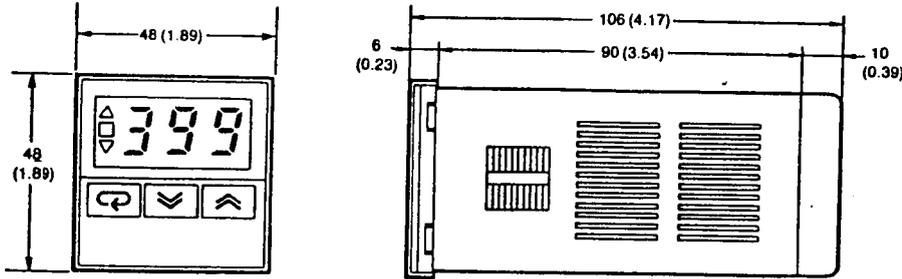
Description	Part number
Adapter for panel mounting (supplied with each unit)	Y92F-30

Specifications

Part number		E5CS-□1□□X-F		
Sensor input type		Thermocouple Type J (IC) and Type K (CA)	Platinum RTD Pt: 100Ω DIN or JIS standard	Thermistor Interchangeable type (THE)
Supply voltage		100 to 240 VAC, 50/60 Hz; operates on 85 to 110% of rated voltage		
Power consumption		Approx. 7 VA		
Control output	Contact	Type		
		Max. load	3 A, 250 VAC (resistive load)	
	Voltage	Logic load	12 VDC, 20 mA with short-circuit protection	
	Hysteresis		0.2% of full scale (during ON/OFF action)	
	Response time	Output	2 seconds for output to change	
		Display	2 seconds for displayed indication to change	
Service life	Mechanical	10 million operations minimum with contact output		
	Electrical	100,000 operations minimum with contact output		
Alarm output		Type	SPST-NO relay	
		Max. load	1 A, 250 VAC (resistive load)	
		Setting range	Absolute value alarm: Same as control output setting range Others: 0 to full scale	
Setting accuracy		± 0.5% of full scale, ± 1 digit max.		
		Set value coincides with indicated value, so no relative error exists		
	Type	ON/OFF and PID with automatic tuning of proportional band, switch selectable		
	Proportional band	3 to 20% (in PID mode) automatically adjusted according to the rise time of the controlled system		
	Reset time	4 minutes, fixed (in PID mode)		
	Rate time	0.4 minutes, fixed (in PID mode)		
	Proportional period	2 or 20 seconds, switch selectable		
	Sampling period	500 ms		
Materials				
Mounting		Fits 1/16 DIN panel cut out; includes panel mounting adapter		
Connections		Plated steel screw terminals		
Weight		170 g (6 oz.) without mounting adapter		
Enclosure ratings	IEC 144	Front panel	IP50	
		Rear panel	IP30	
Approvals		UL	Recognized, File Number E68481	
		CSA	Certified, File Number LR59623	
Ambient temperature		Operating	-10° to 55°C (14° to 131°F)	
		Storage	-25° to 65°C (-13° to 149°F)	
Humidity		35 to 85% RH		
Insulation resistance		20 MΩ minimum at 500 VDC		
Dielectric strength		2,000 VAC, 50/60 Hz for 1 minute between current-carrying terminals of different polarity		
Vibration	Mechanical durability		10 to 55 Hz, 0.75 mm double amplitude in X, Y, and Z directions, for 2 hours each	
	Malfunction durability		2 to 55 Hz, 2 G, in X, Y, Z directions for 10 minutes each	
Shock	Mechanical durability		300 m/s ² , in 6 directions, 3 times each	
	Malfunction durability		100 m/s ² , in 6 directions, 3 times each	

Dimensions

Unit: mm (inch)



Nomenclature

Deviation indicators
 Δ lights when the present temperature is higher than the set temperature, and ∇ light when it is lower. The □ indicator lights in green when the deviation is within ±1% of the full scale.

Main display
 Sequentially displays the present temperature, set temperature, and an alarm value (in that order) each time the return (↻) key is pressed.

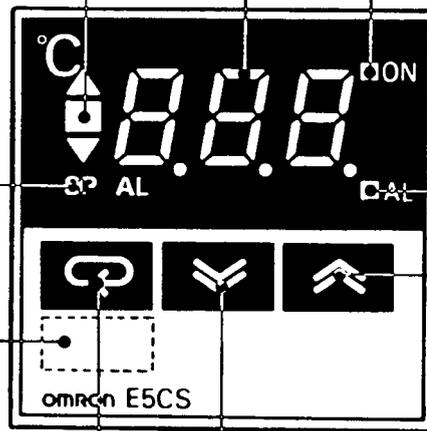
Control output indicator
 Lights while the control output is being produced.

Present data indicator
 SP lights while the set temperature is displayed on the main display, and AL lights while an alarm value is being displayed.

Alarm indicator
 Lights when the alarm output relay is energized.

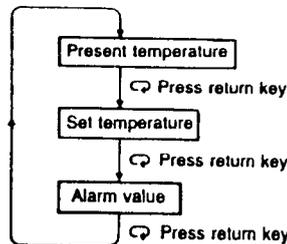
Hidden key
 The "hidden key" provides protection against unauthorized changes to set temperatures and is used in conjunction with the internal "protection" switch. If the internal protection switch is set to ON (pushed inwards in the direction of the white arrow), then to obtain Up and Down operation, the hidden key must be pressed simultaneously with the Up and Down keys. Only authorized personnel aware of the hidden key operation can make changes. If the internal protection switch is set to OFF, changes can be made simply by pressing the Up and Down keys.

Up key
 When pressed, increases the set temperature/ alarm value. Successively increases the value when held down.



Return key
 Each time pressed, changes the value displayed on the main display in the following sequence:

Down key
 When pressed, decreases the set temperature/ alarm value. Successively decreases the value when held down.



Operation

■ WHEN ALL FUNCTIONS HAVE BEEN SELECTED

To Set Temperature

Press the return key until the SP indicator lights. Then set the desired temperature value by using the Up and Down keys.

To Set Alarm Value

Press the return key until the AL indicator lights. Then set the desired alarm value in units of °F or °C. If the present temperature exceeds the set alarm value, the alarm output will be issued.

Neither the set alarm value is displayed nor the AL indicator lights with the internal alarm mode setting switch set to 0 or 9. Be sure to check the alarm mode setting switch, located inside the housing, for proper setting.

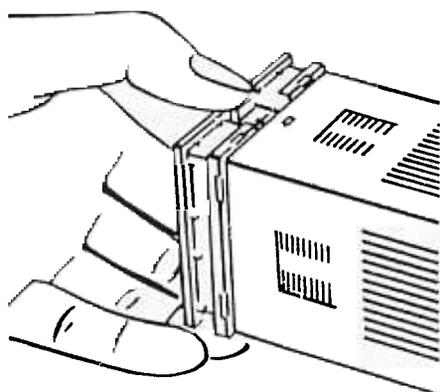
In Case of Sensor Failure

The error message "FFF" or "—" will appear on the main display if the temperature sensor, such as thermocouple or platinum resistance thermometer, short-circuits or breaks. (Refer to Error Messages for details).

■ FUNCTION SETTING

Access to Internal Controls

Various functions of the temperature controller are set by switches located inside. To gain access to these switches, the internal mechanism must be drawn out of the housing. Push the tab on the underside of the housing and pull out the internal mechanism.



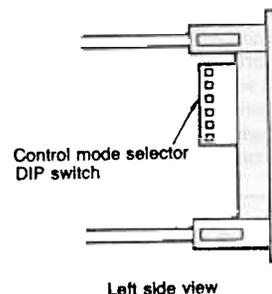
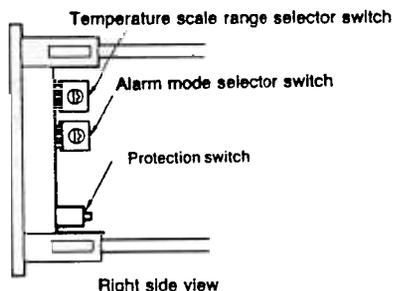
Location of Internal Switches

Select the desired temperature range by using the temperature range selector switch (rotary DIP type). Up to 10 temperature ranges can be selected, depending on the model. The other rotary DIP switch is used to select one of eight alarm functions.

Be sure the set temperature and alarm values are within the new range. Otherwise, the temperature controller automatically shifts these values to the maximum or minimum of the newly-set temperature range.

The protection switch may be used in conjunction with the front panel "hidden key" to prevent unauthorized changes to temperature settings. The switch is ON when it is pushed inwards in the direction of the white arrow.

A 6-pin in-line DIP switch on the other side of the controller mechanism selects °F/°C scale ranges, ON/OFF or PID control mode, input shift function and more.



Control Mode Selector Switches

The control mode selector switch is a 6-pin in-line DIP switch. The following table shows the selections made by each pin position:



Function		1	2	3	4	5	6
Control mode	PID action	ON					
	ON/OFF action	OFF					
Proportional period	2 seconds		ON				
	20 seconds		OFF				
Control output	Normal			ON			
	Reverse			OFF			
Input shift function	Setting enabled				ON		
	Setting disabled				OFF		
Temperature sensor standard for inputs	DIN					ON	
	JIS					OFF	
Scale indication for dual-scale range selections	°F						ON
	°C						OFF

ON/OFF Action

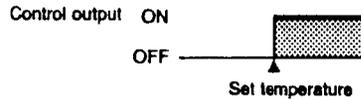
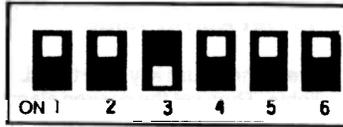
Pin 1 of the control mode selector DIP switch is factory-set to OFF, so the temperature controller performs ON/OFF control action.



Pin 1 OFF: Temperature controller performs ON/OFF action.



Set pin 3 to ON when the temperature controller is used to control a cooling device such as a chiller or freezer.



PID Action

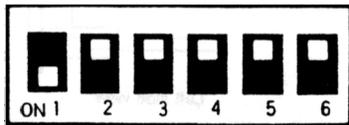
Set pin 1 of the control mode selector DIP switch to ON to make the temperature controller perform PID control action. Follow the steps described below.



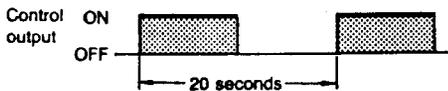
Pin 1 ON: Temperature controller performs PID action

Determining Proportional Period

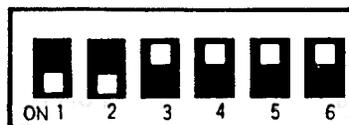
Set pin 2 of the DIP switch to OFF to select a proportional period of 20 seconds. This is used when the PID control action is performed with the contact output of the temperature controller, or when using an external relay or contactor.



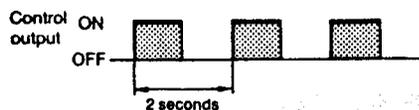
Pin 2 OFF: Proportional period is 20 seconds



When a quick response is required, set pin 2 to ON to select a proportional period of 2 seconds. Even when a solid-state relay (SSR) is used, set the 2-second proportional period only when quick response is essential. Avoid using this setting with a contact output because it will shorten the relay service life.



Pin 2 ON: Proportional period is 2 seconds

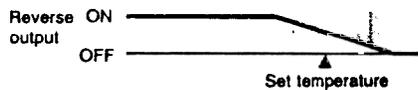


Determining Control Output Operation

If the temperature controller is used to control a heater, the control output can be set to perform a reverse (inverted) operation. Set pin 3 of the control output mode selector switch to OFF.



Pin 3 OFF: Controller performs reverse operation used with heaters



By contrast, if the temperature controller is used to control a cooling device such as a chiller or freezer, set pin 3 to ON.



Pin 3 ON: Controller performs normal operation used with cooling devices



Auto-Tuning of Proportional Band

Upon the initial power-up, the proportional band is set to 3%. The optimum proportional band width, however, is automatically calculated and set within the range of 3 to 20%, according to the changes in the temperature of the controlled system. This automatic adjustment of the proportional band is performed regardless of whether the controlled system is a heating or cooling system.

When the power is turned off once, and then on again, the control action starts with the previous proportional band. However, the new proportional band is automatically calculated and set.

Input Shift Function

The temperature indication can be shifted by setting pin 4 of the control mode selector switch to ON, and pressing the mode key repeatedly until the message "NO" (indicating 0 input shift) is displayed on the main display. Then set the shift value by using the Up or Down key.



Pin 4 ON: Input shift function enabled

Fine adjustment of the temperature indication and the resulting controlled temperature is possible without changing or affecting the set point.

The input shift value can be set within the range from -99° to +99° (F or C). For ranges that have resolution to 0.1°, the input shift value can be set within the range from -9.9° to +9.9° (F or C).

The input shift function may be useful to make small temperature corrections to the control system.

For example:

- correction of known sensor calibration errors
- correction of any known steady temperature offset between the heated work-piece (load) and sensor. This is useful for applications where the sensor cannot be located exactly at the work-piece.
- alignment of temperature indications in a multi-zone/multi-controller application, e.g., at ambient temperature.

Note that the input shift changes the value of the controlled temperature when used in closed loop control. For example, with a set point and indication of 100°C and input shift set at +10°C, the controlled temperature will be 90°C.

Example:

Main display	Temperature measured by sensor	Temperature indication
H 0 (without offset)	100°C	100°C
H 9 (offset by +9°)	100°C	109°C
L 9 (offset by -9°)	100°C	91°C

Note: The offset value remains effective even after pin 4 has been set to OFF. If the compensation action is not needed, be sure to set the offset value to 0.

Matching the Controller to Sensor Standard

Use pin 5 of the control mode selector switch to match the controller to the thermocouple or platinum RTD sensor to be used. With pin 5 in ON, the controller will

accept DIN standard sensors. With pin 5 in the OFF position, the controller accepts JIS standard sensors.

Selecting Scale Indication

Some dual-scale (°F/°C) temperature scale ranges may be selected by rotary DIP switch. To specify the scale indication to be displayed, use pin 6 on the in-line DIP

switch. With pin 6 set to ON, the controller displays Fahrenheit scale. With pin 6 set to OFF, the controller displays Celsius scale.

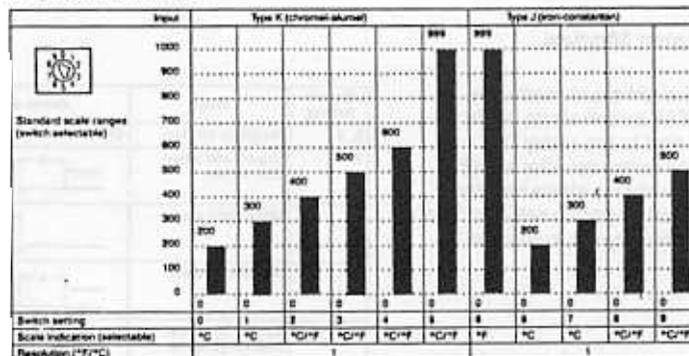
Selecting a Scale Range

Using the rotary DIP switch for temperature scale range, select the appropriate range using the "Switch setting" number from the following tables. The temperature indication range is the set temperature range (full scale) ± 10%, unless otherwise noted.

If the set temperature is shifted outside the temperature scale range as a result of changing the scale range, the set temperature is displayed. It is then automatically changed to the maximum or minimum value of the newly set temperature scale range.

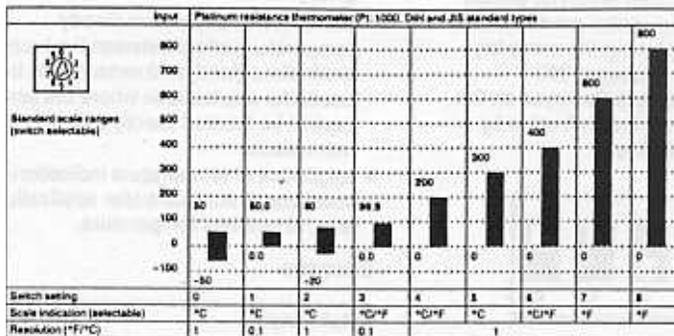
If the alarm value is shifted outside the temperature scale range as a result of changing the scale range, it is automatically changed to the maximum value of the newly set scale range.

Thermocouple Type



**Setting a Scale Range
(continued)**

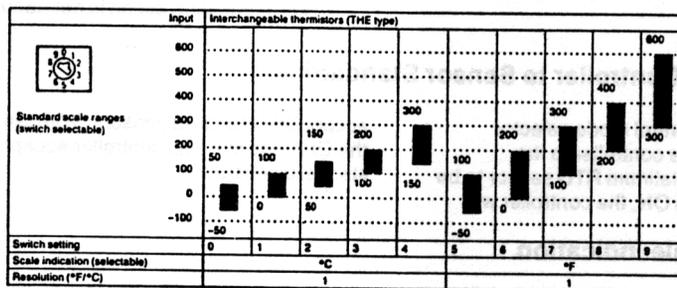
Platinum Resistance Thermometer Type



Note:

1. Do not set the selector switch to position 9. This will cause error message "FFF" or "—" to be displayed.
2. When changing scale ranges where the unit of measure changes from 1° to 0.1° or vice versa, the set temperature also changes to reflect the unit of measure. For example, with a set temperature of 100°, a change from a scale range with 1° resolution to 0.1° makes the set temperature 10°; with a set temperature of 15°, a change from a scale range with 0.1° resolution to 1° makes the set temperature 150°.

Thermistor Type



Note:

1. The temperature indication range for a setting scale of -50° to 50°C is -50° to 60°C. It is the full scale ± 10% with the other setting scale ranges.
2. The temperature scale selector switch is factory-set to position 0. With a temperature range, such as 50° to 150°C that exceeds the setting range, the indication unit is automatically adjusted to the minimum value. The set temperature is displayed upon power application.

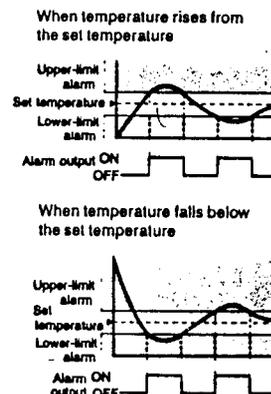
Selecting Alarm Modes

Select one of the eight alarm modes by using the rotary DIP switch alarm mode selector located next to the rotary DIP temperature scale range selector switch. The following table shows alarm functions that can be selected by switch settings. The selector switch is factory-set to position 2.

Switch setting	Mode	Alarm output
0, 9	No alarm function	OFF
1	Upper- and lower-limit alarms	
2	Upper-limit alarm	
3	Lower-limit alarm	
4	Upper- and lower-limit range alarm	
5	Upper- and lower-limit alarms with standby sequence	
6	Upper-limit alarm with standby sequence	
7	Lower-limit alarm with standby sequence	
8	Absolute-value alarm	

Standby Sequence

Alarm functions with standby sequence suppress nuisance alarms when the controller is first powered up. As shown in the temperature charts at right, the alarm output is suppressed until the temperature exceeds the alarm band or alarm limit one time.



Note:

1. When the alarm mode selector switch is set to position 0 or 9, neither the alarm value is displayed nor the AL indicator lights even when the return key is pressed.
2. Alarm value setting range X may be 0 to full scale. Alarm value setting range Y must be within the temperature scale range.
3. If the alarm value is shifted outside the temperature scale range as a result of changing the scale range, it is automatically changed to the maximum value of the newly set scale range.

■ CONTROLLER SELF-DIAGNOSTICS

Error Messages

The temperature controller is provided with self-diagnostic functions, and will display the following error messages to simplify troubleshooting.

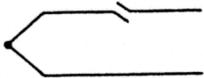
Message	Cause	Control output
FFF	(1) Temperature has risen beyond temperature scale range (2) Thermistor has been short-circuited	OFF during heating (reverse) action ON during cooling (normal) action
---	(1) Temperature has fallen below temperature scale range (2) Thermistor has broken	ON during heating (reverse) action OFF during cooling (normal) action
FFF (blinks)*	(1) Failure has occurred in thermocouple of platinum resistance thermometer (2) Temperature has risen much beyond scale range	OFF
--- (blinks)*	(1) Failure has occurred in platinum resistance thermometer (2) Polarities (positive and negative) of thermocouple have been reversed (2) Temperature has fallen much below scale range	OFF
E11 or E33*	(1) Memory failure (E11 display) (2) Analog-to-digital converter failure (E33 display) Temperature controller must be repaired if recovery is not made by turning power off once and on again.	Both control output the alarm output are OFF

Note:

- *Key operations are disabled.
- When the alarm outputs are used, an alarm output occurs when the "FFF" and "---" messages appear in the display. These displays indicate when the temperature has risen beyond or fallen below the temperature scale range.

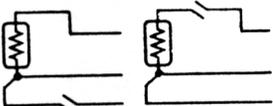
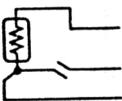
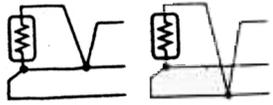
Operation When Sensor Fails

Thermocouple type

Condition	Diagram	Display	Control output
Break in sensor		FFF blinks	OFF

Note: When the input is short-circuited, the ambient temperature is displayed.

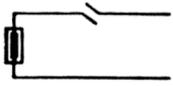
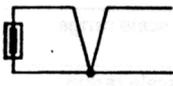
Platinum resistance thermometer type

Condition	Diagram	Display	Control output
Break in sensor		FFF blinks	OFF
		--- blinks	OFF
	Disconnection of two or three wires	FFF blinks	OFF
Short-circuit		--- blinks	OFF

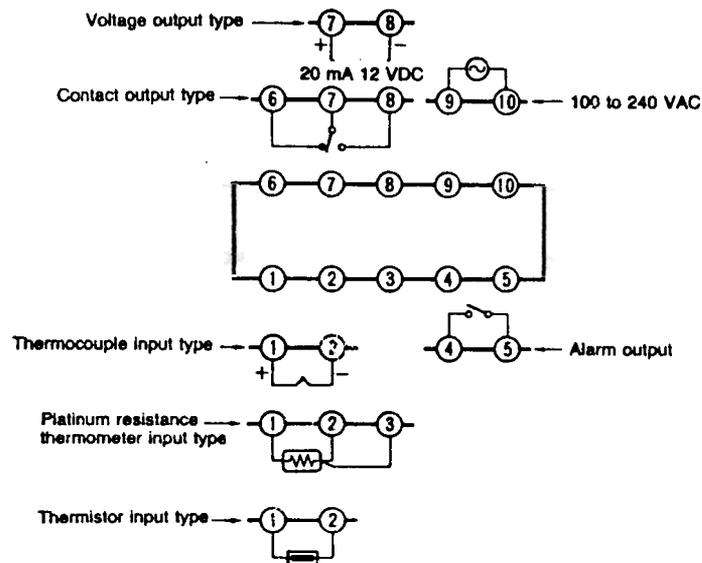
Note: The resistance of the platinum resistance thermometer is 100 ohms at 0°C. It increases to 140 ohms at 100°C.

Bcb

Thermistor type

Condition		Display	Control output
Break in sensor		---	ON during heating (reverse) action OFF during cooling (normal) action
Short-circuit		FFF	ON during heating (reverse) action OFF during cooling (normal) action

Connections



Installation

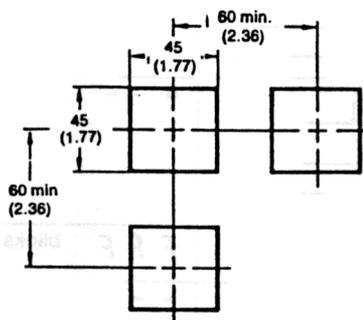
■ MOUNTING

All E5CS-X models conform to DIN 43700 standard. Recommended panel thickness is 1 to 4 mm (0.039 to 0.157 in).

Note:

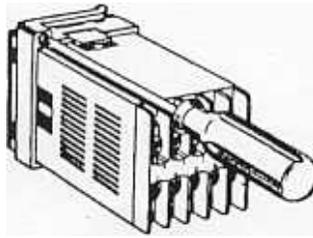
The mounting bracket supplied surrounds the temperature controller, so close side-by-side temperature controller mounting is possible. Provide a center-to-center distance of at least 60 mm (2.362 in) between two adjacent temperature controllers.

Panel cut out



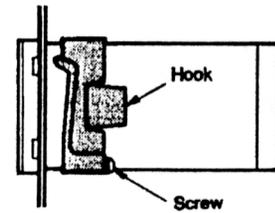
Flush Mounting

Insert the temperature controller, back end first, into the hole in the mounting panel. Mount the adapter (supplied with each unit) by pushing it forward from the back of the temperature controller. Push the adapter as close as possible to the front panel of the temperature controller to eliminate the gap between them. Then, secure the adapter with screws as shown in the figure at right.



Removal

Loosen the screws on the adapter and push the hook open to remove the adapter.



Environment

Do not install the temperature controller in a location where there is a lot of dust or corrosive gases. Also avoid a location where the temperature controller is subjected to heavy vibration, shock, splashes of water or oil, and high temperatures.

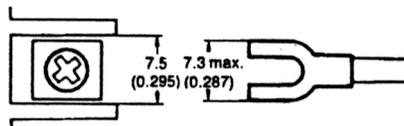
Separate the temperature controller from equipment that generates strong, high-frequency electrical noise such as high-frequency welders.

■ TERMINAL CONNECTIONS

Connection Examples

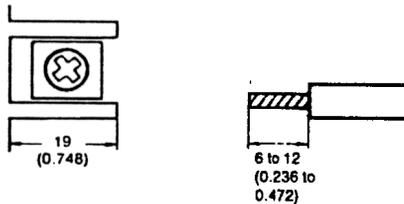
Solderless terminals

Use M3.5 solderless terminals with the temperature controller's M3.5 self-rising pressure plate screws.



Solder-dipped leads

Strip the lead wire 6 to 12 mm (0.24 to 0.47 in) and carefully insert the wire tip. Do not tighten the terminal screw with excessive force.



Sensor Input Connection

The lead wires connecting the resistance thermometer to the temperature controller must be separated from the power lines and load lines wherever possible, to prevent them from being inducted by electrical noise.

Use the specified compensating conductors for the thermocouple input type temperature controllers.

Use lead wires having a small resistance for the platinum RTD type temperature controllers.

Sequence Circuit

Several seconds are required until the relay is turned ON after the power has been applied to the temperature controller. Be sure to take this time lag

into consideration when designing a sequence circuit which incorporates this temperature controller.

DIMENSIONS SHOWN ARE IN MILLIMETERS; THOSE IN PARENTHESES ARE IN INCHES.