



Hays Cleveland  
Div. of UniControl Inc.

Series 9500  
Draft Regulator  
(Type CDR)

Instruction Manual R-09500.01



## **SAFETY WARNINGS**

(Safety symbols and terminology per ANSI Z21.)

Failure to comply in full with the following safety requirements can result in equipment damage and personal injury/death.

1. Read the entire manual to become familiar with the use and operation of this device.
2. Only qualified personnel should attempt to install, wire, commission, startup, service or operate this device.
3. This device is not suitable for use in an explosive ambient atmosphere.
4. Before working on this device, be sure that you understand the processes affected by this device completely.
5. Before working on this device, be sure that any process affected by this device is secure and safe for servicing.
6. Take appropriate precautions to avoid electric shock when working with this device near water.
7. Exercise caution while wiring or working on this device. Multiple voltage sources may be present: take appropriate precautions to avoid electric shock.

# INSTRUCTION MANUAL

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## 1.0 INTRODUCTION

### 1.1 General Description

The Series 9500 Draft Regulator is a combination draft sensor, controller, and actuating motor in a single compact enclosure with a removable cover. It provides automatic modulation of the outlet damper for any balanced draft or positive furnace pressure application. Sequencing models interlock with any UL approved burner management system. Non-sequencing models provide damper modulation only.

All models offer a 6-inch range of travel, 60-second nominal stroke time, 150# starting thrust range (functionally equivalent to 37.50 ft. lbs.). Some models are equipped with a continuous rotation-type handwheel for manual operation of the damper.

The sensing and control functions consist of a large-area dry-type diaphragm and two sensing switches (increase and decrease), plus adjustments for setpoint, proportional band, and sensitivity, and terminals for external wiring. Sample connection is a 1/4" NPT Female fitting. Because the sensing diaphragm is spring-loaded against the open damper position, failure of the draft or accidental rupture of the diaphragm will drive the damper to the wide open position.

Sequencing models are equipped with two interchangeable plug-in relays, and an Automatic/Open-damper Firing selector switch. The open-damper firing position permits soot-blowing without interrupting firing, or firing "on-off" in open damper position under emergency conditions.

The actuator function consists of a high-torque, 72 rpm synchronous stepping motor which precisely positions a drive tube over a linear 6-inch range of travel. Inward and outward end switches shut off power to the motor whenever the drive tube reaches the fully extended or fully retracted position. On sequencing models, an auxiliary outward end switch signals the burner management system that the damper is open, as required by codes. Inherent braking action of the motor prevents overtravel without the wear and stress associated with friction or "DC" braking. The motor can be cycled as often as mechanically possible, and is not damaged as a result of overload stalling. The unit self-locks in the event of power failure.

## 1.2 Operation

### Non-Sequencing Models:

A continuous sample of overfire draft is applied to the sensing diaphragm, actuating the sensing switches to advance, stop, or reverse the drive motor, thus modulating damper position so as to maintain the draft value at the setpoint selected for greatest combustion efficiency.

### Sequencing Models:

These models are equipped with two plug-in relays that permit interlocking with a burner management system. Relay 1 opens the damper. Relay 2 places control on modulation. Specifically:

On call for heat from the boiler operating controls, Relay 1 is energized. This powers the motor, driving the damper to the open position. When the damper is fully open, the auxiliary limit switch closes, permitting the flame programmer to start its cycle. After pilot flame has been proven, and as the main fuel valve is opened, Relay 2 is energized. Power is now put through the sensing switches, which then operate the motor to position the damper in order to maintain the draft at the desired setpoint. Modulation continues until the combustion control system shuts off the burner. When the burner is shut off, both relays are de-energized, causing the damper to go to the fully closed position, and remain closed until the next burner cycle.

## 1.3 Low Draft/High Pressure Cutoff Switch

Cleveland Controls strongly advises the use of a draft switch on all draft control applications as an added safety precaution. The Cleveland AFS-952 low draft cutoff switch or Cleveland AFS-952-55 high pressure cutoff switch is recommended.

# 1.4 SPECIFICATIONS

## PHYSICAL

**Power Requirements:** 120 v AC 50/60 Hz. or 240 v AC 50/60 Hz. models, standard.

**Mounting:** Mount on a flat, rigid surface. Locate and position so that thrust arm is fully retracted when damper lever places damper in fully closed position. Select location where radiant or ambient temperature is not excessive. Mount within six feet of floor to facilitate adjusting and maintenance. **DO NOT MOUNT ON BOILER WALL OR BREECHING.**

**Motor:** 72 RPM stepping motor operated in synchronous mode.

**Sample Connection:** 1/4" NPT female fitting.

**Ambient Temperature Range:** 0 to 140F (-19 to 60C).

**Finish:** Wear-resistant sealed black polyurethane enamel.

**Shipping Weight:** 30 lbs. Carton dimensions: 6.5" x 9.5" x 20.75".

## APPLICATION

**Travel:** Six-inch linear travel.

**Stroke Time:** Nominal 60-seconds full stroke time at 60 Hz.

**Thrust:** 150 lbs. (equivalent to 37.5 ft. lbs.\*).

**End Switches:** High and low end limit switches standard. Auxiliary limit switch on sequencing models.

**Manual Operator:** Continuous rotation-type handwheel optional.

**Set Point:** Adjustable, 0 to +2.0" w.c., or 0 to -2.0" w.c. (field-selectable ranges).

**Damping:** Adjustable, 1.5 to 15 seconds for 90% response to a step change.

**Proportional Band:** Adjustable, 0.03 to 0.2" w.c.

**Dead Band:** Adjustable,  $\pm 0.01$  to 0.08" w.c.

\*Foot-pound ratings in this bulletin indicate equivalent torque developed by a rotary actuator with a 3" lever traveling through 90 degrees. They are included for reference and comparison purposes only.

**Specifications Subject to Change.**

## 1.5 Model Nomenclature

### Series R-09500-B0 DRAFT REGULATOR (replaces Series CDR)

MODEL R-09500-B0

<u>  </u>	<u>  </u>	<u>  </u>	<u>  </u>	2-	B
A-	B	C	D	E-	H
S	M	W	P		VER

#### R-09500

#### Draft Regulator Base Price

#### A Speed vs. Thrust

##### Special

A=1` 30 seconds full stroke (75# thrust; equiv. to 18.75 ft. lbs.)

A=2 60 seconds full stroke (150# thrust; equiv. to 37.5 ft. lbs.)

#### B. Operating Mode

B= 1 Sequencing (Equivalent to **CDR-1F**)

B= 2 Non-sequencing (Equivalent to **CDR-105**)

#### C. Manual Operator Option

C=0 None

C=1 with Manual Handwheel

C=2 Weatherproof Housing

#### D Operating Power

D=1 120 V, 50/60 Hz.

D=2 240 V, 50/60 Hz.

#### E Draft Sensor & Control

E=1 Mechanical Diaphragm Assy NOT OFFERED

E=2 Piezo-Resistive Element and Solid State Controls, 0 to- -2 or  
0 to +2 Range

E=3 Piezo-Resistive Element and Solid State Controls, +1 to 9"  
Range

**Current Model Version = B**

**Typical Model Code** for a Furnace Draft Pressure Regulator; with burner management system interface relays, no Manual Handwheel Operator, is **R-09502-1012-B**.

**As a safety precaution:** an appropriate cut-out switch should be used with draft controls. We recommend the following switches:

Cleveland Controls Model **AFS-952** Switch for Balanced Draft.

Cleveland Controls Model **AFS-952-55** for Positive Furnace Pressures.

## 2.0 INSTALLATION

### 2.1 Mounting

Since the draft regulator positions the outlet damper, it should be located to provide as near a straight line thrust as possible, through at least two feet of linkage, to a damper lever arm.

With the regulator will operate in any position, the unit has been factory-tested and calibrated in the vertical position with the thrust arm extending up, and this is the recommended field-mounting position. If the unit must be mounted horizontally, be sure that the sample connection is on the top.

Mount on a flat, rigid surface. Locate and position the unit so that the thrust arm is fully retracted when the damper is in the fully closed position.

Select a location where the radiant or ambient temperature is not excessive. Mount within 6 feet of the floor to facilitate adjustment and maintenance.

**DO NOT MOUNT THE DRAFT REGULATOR ON THE BOILER WALL OR BREECHING!**

See Dimensions and Suggested Locations drawings included in this manual.



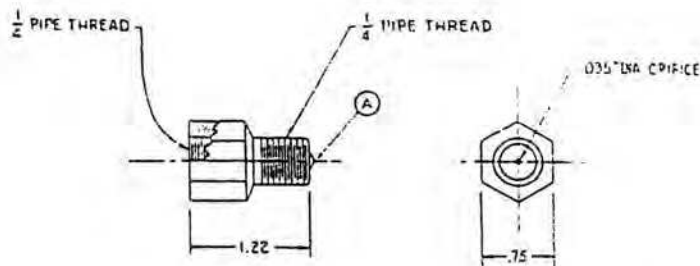
## 2.2 Sample Connection

One (1) P/N 13465 (Pulsation dampener) has been packed with your Series 9500 Draft Regulator.

Insert pulsation dampener in sample fitting on the draft regulator before connecting sample lines,

Orifice as supplied from the factory is sized to give satisfactory signal for most installations.

If excessive pulsation is still present, as evidenced by rapid movement of diaphragm stem or gage pointer, or by overactivity of the drive tube, orifice can be decreased in size by tapping the tip (A) lightly with a ball peen hammer.



If control response is sluggish due to signal lag, orifice can be enlarged with a small drill, sized slightly larger than the opening.

NOTE: P/N 13465 pulsation dampener may also be used to dampen pulsations in sample lines to draft or pressure gage, and some air switches. Available from the factory.

### Induced or Balance Draft Boilers (Negative Pressure)

Connect sample line to combustion chamber as shown in Figure 8.

Where sample line enters boiler, it should be 1-1/2" pipe in 2" sleeve. On new installations, boiler specifications should call for overfire sample line sleeve to accommodate 1-1/2" pipe. On existing installations, a 2" sample line sleeve should be installed through the side wall, close to the center of the furnace and well above the fire. The opening should be chamfered at the inside wall surface and the sample line should end at the chamfer rather than

extend into the firing chamber. The sample line should rise vertically at boiler connection for at least three inches.

#### Forced Draft Pressurized Boilers

Connect sample line to last pass or boiler outlet on boiler side of damper.

#### Sample Piping

Use 3/4" pipe or copper tubing. Total length of pipe must be at least 6 feet. Reduce to 1/4" at control. Provide union close to control. If pipe is used, provide tees at all turns for cleaning.

In all cases, provide a plugged tee connection close to control for test gage.

### 2.3

#### Wiring

Wire must be 14 AWG minimum with moisture-proof insulation suitable for 75°C.

#### EXTERNAL CONNECTIONS

#### INTERNAL CONNECTIONS

	Number Terminals	
Wire to line source, 120v This should be the hot wire.	①	Powers motor through relay and switch contacts.
Wire to line source, 120v This should be the neutral wire.	②	Common for motor.
For optional remote manual station.	③	Energizes motor to retract thrust arm.
For optional remote manual station.	④	Energizes motor to extend thrust arm.
Wire both to start interlock) circuit of flame programmer.)	⑪ } ⑫ }	Electrically isolated open damper switch contact.

	Letter Terminals	
Connect to line source - neutral wire	(A)	One side of R1 coil.
Connect to line source - neutral wire	(B)	One side of R2 coil.
Connect to operating limit	(D)	Other side of R1 coil.
Connect to main fuel valve, side opposite neutral.	(E)	Other side of R2 coil.

All letter terminals and connections are electrically isolated from all others and from all number terminals.

NOTE: The ground screw terminal (Item 20 on Figure 2) is to be wired according to local code and/or approval body requirements.

## 2.4 Linkage

The end bearing on the thrust arm of the Draft Regulator is connected to the boiler outlet damper with the following pieces of linkage:

- 1 Damper Lever Arm (P/N 11372)
  - 2 Clevis Turnbuckle Assemblies (P/N 26908)
- At least 12" length of 1/2" pipe (customer  
furnished)

To install:

1. Place damper in fully closed position
2. Attach lever arm to damper shaft at  $45^{\circ}$  angle to damper as shown in Figure 5.
3. Insert bronze bushing in the lever arm hole that will provide sufficient damper movement for effective draft control. Figure shows the approximate damper travel from each hole. Most applications require the use of the 3rd hole from the end ( $60^{\circ}$ ).
4. Attach one clevis to lever arm with pin through bushing.
5. With damper in fully closed position and regulator thrust arm fully retracted, attach the other clevis to the lever arm with the pin through the bushing.
6. Adjust clevis length so that about 1" of thread extends through the adaptors.
7. Install length of 1/2" pipe between the adaptors. The length of the pipe must be at least 12"; the longer the linkage, the more effective the thrust.
8. Before putting the regulator into service, the linkage should be checked in order to be sure that it moves freely and the damper travels to the required open and closed positions. To do this, remove the pin connecting the clevis to the thrust bar, and remove the cover from the regulator so that the terminal strip is accessible. You will now run the regulator through the full cycle of travel, while holding the clevis and thrust bar in position (as though still connected), and also moving the damper correspondingly. Apply 120 VAC across Terminals 2 and 4, observing that the thrust bar extends until it reaches its outward limit switch, and the damper reaches the desired maximum open position. Then apply 120 VAC across Terminals 2 and 3, observing that the thrust bar retracts until it reaches the inward limit switch, and the damper reaches the fully closed position. When linkage adjustment is satisfactory, reconnect the clevis to the thrust arm.

### 3.0 FIELD ADJUSTMENTS

Check all installation wiring, piping and linkage. Turn on all power switches and place all control switches on automatic. Follow instructions of burner manufacturer for making initial firing start.

After main flame has been established and Draft Regulator is placed in modulation, turn set point adjustment (8 in Figure 2 ) until most effective draft setting has been established.

Control set point has been factory set at minus 0.10" w.c. Clockwise rotation raises set point in positive direction.

A stop has been provided to prevent setting control for zero or positive pressure by mistake. For those installations where control is to maintain a positive back pressure, remove stop to adjust control. DO NOT REMOVE STOP ON NATURAL OR INDUCED DRAFT STACKS FOR ANY REASON.

If excessive pulsation from burner or blower is evidenced by wildly fluctuating draft or abnormal activity of Regulator drive, this can be dampened out by moving the proportional band adjustment (17 in Figure 2 ) toward sensing switches (left) in small increments until condition is corrected. A slight adjustment of the control set point may then be necessary.

If "hunting" is encountered, as evidenced by a continuous back and forth movement of the drive arm, this may be corrected by decreasing sensitivity -- moving the sensitivity adjusting screw (5 in Figure 2) outward gradually until hunting stops.

Hunting may also be encountered when damper is modulating around a very nearly closed position and small movements of the drive arm are extremely effective. This condition may be corrected by reducing the thrust-arm-to-damper movement ratio by removing the clevis at lower arm to a hole farther from the shaft. This means a sacrifice of wide open damper, and linkage should now be re-adjusted for the closed damper position.

## 4.0 MAINTENANCE

### 4.1 Recommended Spare Parts & Accessories

\*For part numbers for 240V applications, please consult factory.

- |  |               |
|--|---------------|
| * 8-pin octal base plug-in relay, 120V     | P/N 26624     |
| Draft Sensing Switch (inc. & dec.)         | P/N 10269     |
| End switch (inward & outward travel limit) | P/N 10999     |
| Auxiliary end switch                       | P/N 10999     |
| Fuse,<br>1 ampere rated                    | P/N 10956     |
| * Motor, 120 V                             | P/N 28035-001 |
| * Motor resistor & capacitor assy.         | P/N 28055     |
| Drive belt                                 | P/N 20594     |
| Pulsation Dampener                         | P/N 13465     |
| <u>LINKAGE:</u>                            |               |
| Clevis Assembly (2 required)               | P/N 26908     |
| Damper Lever Arm                           | P/N 11372     |
| * Low Draft Cutoff Switch                  | AFS-952       |
| * High Pressure Cutoff Switch              | AFS-952-55    |

Hays Cleveland, Div. of UniControl Inc.  
Boyton Beach, Florida  
Tel 561 734-9400, Fax 561 734-8060  
Cleveland, Ohio  
Tel 216 398-0330, Fax 216 398-8558

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## STANDARD TERMS AND CONDITIONS OF SALE

**AGREEMENT OF SALE:** Acceptance by Seller of any order placed for the good described on the reverse side hereof shall be subject to Seller's Standard Terms and Conditions of Sale and is conditioned upon the Buyer's acceptance of these Standard Terms and Conditions.

**TERMS OF CONTRACT:** Any terms or conditions of the Buyer's order which are inconsistent with these Standard Terms and Conditions shall not be binding on the Seller and shall not be considered applicable to the sale or shipment of goods covered by this Acknowledgment or Sales Contract. Unless Buyer shall notify Seller in writing to the contrary within ten (10) days after the mailing of this Acknowledgment or Sales Contract by Seller, acceptance of these Standard Terms and Conditions by Buyer shall be indicated and, in the absence of such notification, the sale and shipment by Seller of the goods covered hereby shall be subject to these Standard Terms and Conditions.

**PRICES:** Prices are subject to change to the extent permissible under applicable federal law. Sales contracts which call for delivery in the future will be billed at prices in effect at the time of shipment. Shipping weights shown are approximate and subject to change without notice. Prices of products do not include supervision of erection or adjustment after installation by Buyer. **MINIMUM BILLING ON ANY ORDER IS \$150.00 U.S. FUNDS.**

**SHIPMENT AND PAYMENTS:** All prices and shipments are F.O.B. the Seller's factory such that the risk of loss and risk of liability during shipment passes to the Buyer upon delivery of the equipment to the carrier. As discussed under the section, "Title and Ownership," the Seller shall retain title to the equipment. No freight is allowed on any shipments. Shipments and deliveries hereunder shall at all times be subject to the approval of Seller's Credit Department, and at any time Seller may require payment in advance or satisfactory security or guarantee that invoices will be promptly paid when due. If Buyer fails to comply with any terms of payment, Seller, in addition to its rights and remedies but not in limitation thereof, reserves the right to withhold further deliveries or terminate this Agreement, and any unpaid amount thereon shall become due immediately. Standard terms of payment are 1% 10 – Net 30 days unless otherwise negotiated prior to placement of order. Special terms of payment shall be as set forth on the quotation, or acknowledgment for order.

Pro rata payments shall become due as shipments are made. If shipments are delayed by the Buyer, payments shall become due on the date when the Seller is prepared to make shipment. If, in the judgment of the Seller, the financial condition of the Buyer at any time does not justify continuance of production or shipment on the terms of payment specified, the Seller may require full or partial payment in advance. Where the Buyer of the plant equipped is outside the territory of the United States of America, all remittances shall be made in U.S.A. funds. If the order is placed with complete specifications and instructions to fabricate, and then shipment is postponed by buyer, the order will be invoiced on date of shipment which was originally scheduled. If held for shipment, a charge may be made for storage in excess of four weeks after scheduled shipping date at the discretion of the Seller.

**PARTIAL SHIPMENTS:** The Seller reserves the right to ship and invoice units as manufacture of unit items is completed. Alternately, invoices may be rendered on net 30 day terms as unit items are completed, the equipment then being held for release by Buyer. It is sometimes necessary for certain instruments and/or controllers, etc., to be specially packed or for other reasons shipped separately, and therefore must be mounted in the panel at the job site. The Seller reserves the right to make exceptions to mounting such equipment in the panel before shipment, even though the Proposal is based on a completely assembled, piped and /or wired panel. The Seller will not accept any charges for labor and/or material required to unpack, mount in the panel, pipe and/or wire equipment shipped separately.

**TITLE AND OWNERSHIP:** The Seller shall retain title, and hold a lien against, the equipment furnished under the terms and conditions of this proposal until the full and final payment shall have been made to the Seller, by the Buyer. In the event of a default by the Buyer on any of the terms, payments or conditions which are on his part to be performed, then the Seller shall have the right, without notice, to repossess any or all of the above mentioned equipment wherever the same may be found, and in doing so, shall not be held as a trespasser.

**DELAYS AND DEFAULTS:** Where date of delivery is given, we will endeavor to make shipments as near the date as possible, but we cannot be held responsible for any loss or inconvenience caused by delay or failure to deliver. Delays or defaults in delivery by Seller of the goods covered by this Sales Contract shall be excused so far as the same is caused by fire, strikes, accident, governmental regulation, or any delays unavoidable or beyond reasonable control of Seller. ***In no event shall Seller be liable for any consequential, special, or contingent damages on account of any default or delay in delivery.***

**ACCELERATED OR DELAYED PAYMENTS:** There will be no reduction in price for payments more favorable to UniControl Inc. than the standard terms. If payments are not made in conformance with the standard terms, the quoted price shall, without prejudice to the right of UniControl Inc. to immediate payment, be increased by an amount equal to the lesser of 1 ½ percent per month or fraction thereof on the unpaid balance or the highest legal rate.

Hays Cleveland, Div. of UniControl Inc.  
Boyton Beach, Florida  
Tel 561 734-9400, Fax 561 734-8060  
Cleveland, Ohio  
Tel 216 398-0330, Fax 216 398-8558

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**NON-CANCELLATION:** Orders are not subject to suspension, reduction, or cancellation, except on terms that will indemnify Seller against loss.

**RENEGOTIATION:** Unless advised by Buyer in writing, Seller understands that Buyer's order and this Sales Contract are not renegotiable under the Renegotiation Act of 1951.

**SPECIFICATIONS:** Seller relies on specifications and other data furnished by the Buyer, an architect, contractor, or consulting engineer in all phases of the work covered by this Sales Contract. Seller shall be responsible to check quantities only. Alterations to or changes in specifications, approval of samples, changes in delivery instructions and all other instructions must be submitted in writing to Seller.

In the event Seller performs design or engineering work at the request of Buyer, an architect, contractor, consulting engineer, or representative in any phase of the work covered by this Sales Contract, ***Seller shall not be responsible for any damages claimed by Buyer as a result of alleged errors or defects in such design or engineering work.***

**WARRANTY AND LIMITATION OF LIABILITY:** The warranty applies to all components except those components which may be destroyed by negligence or abnormal use. Seller warrants that the goods supplied by it have been manufactured in accordance with its standard manufacturing practices and conform to the contract or catalog description for such goods. Seller further warrants that the goods supplied by it are fit for the ordinary purpose or purposes specified in its catalog for which such goods are used when installed in accordance with Seller's recommended installation procedures. Except as stated herein, ***Seller makes no express warranty with respect to goods supplied by it and Seller makes no warranty that the goods are fit for any particular purpose.*** When the use of materials not manufactured by Seller is suggested by Seller's recommended installation procedures or otherwise, ***Seller makes no express warranty with respect to such materials nor that such materials are merchantable or fit for any particular purpose.*** Seller will, at its sole option, credit, repair or replace, any goods supplied by it which its examination shall disclose to its satisfaction are defective in workmanship or material and are returned to it within one year from the date of shipment and any claim not made within this period shall conclusively be deemed waived by Buyer. Credit, repair, or replacement will be preconditioned upon examination of the goods by Seller, and, if requested by Seller, return of the goods to Seller at its direction and expense. In those instances in which a part or product is returned to the Seller, all transportation charges are to be paid by the Buyer. No goods are to be returned to Seller without its written consent. Seller shall not be liable for any expense incurred by Buyer in order to remedy any defect in its goods. ***Seller shall not be liable for any consequential, special, or contingent damage or expense, arising directly or indirectly from any defect in its goods or from the use of any defective goods. The remedies set forth herein shall constitute the exclusive remedies available to Buyer and are in lieu of all other remedies.***

The responsibility for the performance and service of equipment included in this proposal which is not manufactured by the Seller and is not a part of equipment manufactured by the Seller will be the responsibility of the manufacturer of that equipment.

**CLAIMS:** Claims for shortage of goods or for mistakes or errors in billing must be presented within forty-five (45) days from the date of shipment of goods and must state the packing slip number and container number applicable to the claim. Any claim not so presented will be conclusively deemed waived.

**TAXES:** Any federal, state, local or other government tax or charge on the sale, shipment, or installation of the goods covered by this Sales Contract shall be added to the price and paid by Buyer or, in lieu thereof, the Buyer shall furnish Seller with tax-exemption certificates acceptable to the taxing authority. Buyer agrees to reimburse and save Seller harmless from all such state and local taxes, including interest and penalties thereon, which may at any time be payable to any governmental unit with respect to the sale of any goods covered by this Sales Contract.

**CORRECTIONS:** Typographical or clerical errors contained in this Sales Contract, including prices, are subject to correction by Seller.

**FAIR LABOR STANDARDS:** These goods were produced in compliance with all applicable requirements of sections 6, 7, and 12 of the Fair Labor Standards Act, as amended and of the regulations and orders of the United States Department of Labor issued under Section 14 thereof.

**APPLICABLE LAW:** All questions arising out of this Sales Contract, which shall be deemed an Ohio Contract, shall be governed by the laws of the State of Ohio.

**EXCLUSIVE TERMS:** All proposals are based on, and all products are sold on, the terms and conditions contained herein. No other representation by the Seller or its representatives is valid. This Sales Contract shall constitute the complete contract between the parties. No one has authority to depart from the terms and conditions set forth herein, nor to make any representations or arrangements other than those printed hereon unless the same are written on the face of this Sales Contract or are given in writing with it or in pursuance of it, and are fully approved in writing by an officer or authorized employee of the Seller. Others made thereon, or contracts resulting therefrom, are not binding until and unless so accepted.



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## 4.4 Customer Service Information

### Contacts

#### Hays Cleveland Sales Office

1903 South Congress Avenue  
Boynton Beach FL 33426  
Telephone: 561.734.9400  
Fax: 561.734.8060  
email: [salescombustion@unicontrolinc.com](mailto:salescombustion@unicontrolinc.com)

#### Hays Cleveland Customer Service Department

1111 Brookpark Road  
Cleveland OH 44109  
Telephone: 216.398.4414  
Fax: 216.398.8558  
email: [customerservice@unicontrolinc.com](mailto:customerservice@unicontrolinc.com)

Visit us on the WEB! <http://www.hayscleveland.com>

### Repairs

Damaged or defective units may be returned to the factory for repair. However, factory authorization must be obtained before shipping whether warranty or non-warranty service is required, and all units must be shipped prepaid.

A letter of transmittal that includes the following information should accompany the returned instrument:

1. Location, type of service, and length of time in service of the unit.
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 unit.
4. Indicate whether warranty or non-warranty service is requested.
5. Attach Purchase Order for all out-of-warranty repairs.
6. Complete shipping instructions for the return of the repaired instrument.
7. Original purchase order number and date of purchase.
8. Return Goods Authorization number provided by the factory when you called.
9. Clearly label the shipping container:

#### RETURN FOR REPAIR

Model \_\_\_\_\_

RG # \_\_\_\_\_

10. Ship prepaid to:

**HAYS CLEVELAND**  
1111 Brookpark Road  
Cleveland OH 44109-5869  
tel. 216.398.4414



Please follow this procedure. It expedites handling of the returned item, and avoids unnecessary additional charges for inspection and testing to determine the problem before repairing it.

### Service

A Maintenance and Service Contract can ensure trouble-free, economical operation of Hays Cleveland equipment for many years. One-time onsite service by a factory-trained service engineer can also be provided as needed. Contact Hays Cleveland for information on these service options.

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## SERIES 9500 DRAFT REGULATOR

The Series 9500 Draft Regulator is a combination draft sensor, controller, and actuating motor in a single, compact enclosure with removable cover.

The Series 9500 provides automatic modulating control of the outlet damper for any balanced draft or positive furnace pressure application. Sequencing models interlock with a burner management system. Non-sequencing models provide damper modulation only.

Two types of draft sensor/controller assemblies are available for any Series 9500 Draft Regulator:

\* The standard "Upper Section", as supplied on all earlier models of Draft Regulator (CDR's) consists of a diaphragm sensing element with mechanical switches for floating control.

\* The solid state "Upper Section", consisting of piezoresistive draft transducer and electronic time-proportioning controller, offers state of the art precision for any draft control application. There are no moving parts in this design.

The nominal full stroke time/thrust range for all models is 60 seconds/150# at 60 Hz. In all applications, the full, 6-inch travel of the drive tube is used. Linear or non-linear movement of the final control element, as well as its total range of travel, is determined by adjustment of the linkage connecting the regulator to the damper. In all applications, extension of the drive tube opens the damper, and retraction of the drive tube closes the damper. An optional continuous-rotation type hand-wheel is available.

The Series 9500 Draft Regulator has been designed to provide the greatest positioning accuracy and overall reliability possible. Mechanical parts have been kept to a minimum in order to eliminate "lost motion", and to keep maintenance requirements to a minimum. There is no mechanical gearhead. The impedance-protected 72 RPM synchronous stepping motor provides instantaneous stop-start-reverse capability, so that a narrow deadband can be set for improved sensitivity without coasting or hunting. Inherent braking action of the motor eliminates the need for a separate braking apparatus. A toothed timing belt drive provides reliable service.

The unit self-locks when power failure occurs, and is not damaged due to overload stalling. All wiring connections are conveniently accessible under the front cover.

\* This supplement covers nomenclature pertaining to the new optional electronic controller assembly now available on Series 9500 Draft Regulators. For application information on these models, please consult factory.

## A. INTRODUCTION - THEORY OF OPERATION

The Cleveland Solid State Upper Section is a complete electronic sensor and variable speed floating controller assembly designed to replace the standard diaphragm and switch assembly on any former or current models of modulating draft controllers, Series 9500. This compact, self-contained, and easily-installed "Upper Section" retrofit is an economical means of updating any older model of Cleveland modulating Draft Regulator to the best technology available in new draft control systems. When you install the new Cleveland Solid State Upper Section, you will notice a measurable improvement in fuel economy attributable to efficient draft control. You will notice also that routine maintenance is greatly simplified, and repair expenses are reduced due to the elimination of the mechanical switches in the old draft regulator upper section.

The draft sensing element in the Solid State Upper Section is a piezoresistive silicon sensor capable of measuring positive or negative pressures. The sensor is temperature-compensated, and produces an electrical output directly proportional to the differential pressure between atmospheric and the process draft or pressure. Adjustable electronic damping and deadband circuits are incorporated in the controller circuitry to filter out the process noise typical in draft measurement applications.

The process level signal from the draft transducer is compared with the setpoint by an analog amplifier. The resulting error signal is processed by unique analog/digital circuitry to produce integral ("reset") control action completely free of process noise.

Bi-directional line voltage output for electric actuators is presented through zero-crossover-switching solid state plug-in relays. Actuator position feedback is not used. Three LED's are provided to indicate:

1. Process within setpoint deadband.
2. Increase control output.
3. Decrease control output.

## B. LED INDICATORS

Refer to Figure 1 to identify the three LED's, labeled DECREASE (Yellow), INCREASE (Yellow), and SETPOINT (Green).

The Deadband LED lights whenever the draft signal is within the deadband, indicating that no corrective control action is required.

The Increase or Decrease LED will light whenever there is a call for corrective control action, to indicate that either the INCREASE or DECREASE RELAY is energized. Notice that the Increase and Decrease LED's serve only to indicate that the appropriate relay is energized: they do not prove damper movement. In the event of relay failure, no power would reach the actuator motor, but the appropriate relay LED would still light whenever the relay was energized.

## C. AUTOMATIC/OPEN DAMPER SWITCH

The toggle switch located on the side of the regulator enclosure should be placed in the AUTO position for normal operation of your draft control system.

## D. ADJUSTMENTS

Refer to Figure 1 to locate to identify the components discussed in this section.

The Solid State Upper Section Retrofit is factory preset and requires little adjustment in the field.

Potentiometer adjustments for Setpoint, Damping, Deadband, and Proportional Band are accessible from the front of the unit, and are adjusted as follows.

1. Setpoint: The setpoint adjustment potentiometer on the new Solid State Upper Section replaces the dial and red pointer on the old unit. The range of adjustment is factory set for 0 to -2.0" w.c.

If a positive setpoint range is required, locate the draft sensor assembly (mounted on a printed circuit board accessible from the back of the upper section unit).

The sensor has two input connections. Pull the rubber draft tube off the negative pressure input (marked P1), and connect it to the positive pressure input (marked P2).

Setpoint adjustments must be made under firing conditions. The draft controller must be powered, and the toggle switch on the upper section must be set on "Auto". Turn the setpoint potentiometer slowly, in small increments, while observing the draft or pressure gage, and permitting the actuator and damper to "settle out" after each change, until the most effective setpoint is located.

2. Damping: This adjustment is an electronic means of slowing down controller response to the input signal so that minor deviations from the setpoint do not result in a change in controller output. Proper damping keeps the controller from responding to "noisy" draft signals or burner pulsations.

This adjustment is factory-preset to the MINIMUM position. If damping is necessary, rotating the potentiometer in a CLOCKWISE direction increases the damping effect.

Excessive damping may result in a rhythmic "hunting" of the damper which must not be allowed to continue.

3. Deadband: This adjustment establishes a zone of operation above and below the setpoint, within which the draft controller does not recognize and respond to a deviation from setpoint. It establishes the magnitude of the error that results in minimal corrective control action.

The Deadband potentiometer on the Solid State Upper Section is factory-set to  $\pm 0.015$ " w.c. Turning the potentiometer clockwise increases (widens) the deadband. Turning the potentiometer counterclockwise decreases (narrows) the deadband. The adjustment range is  $\pm 0.01$  to  $\pm 0.08$ " w.c.

4. Proportional Deadband: This adjustment replaces the thumbscrew adjustment (sometimes called the "speed" control) on the old upper section. The proportional band control establishes the magnitude of pressure deviation from setpoint required to cause the damper actuator to run at full speed in one direction, plus the opposite deviation required to cause the actuator to run full speed in the opposite direction. Pressure deviations within the proportional band will cause the actuator to run at speeds that are proportional to the amount of deviation. Wide proportional band settings may result in unacceptable pressure deviations under varying operating conditions.

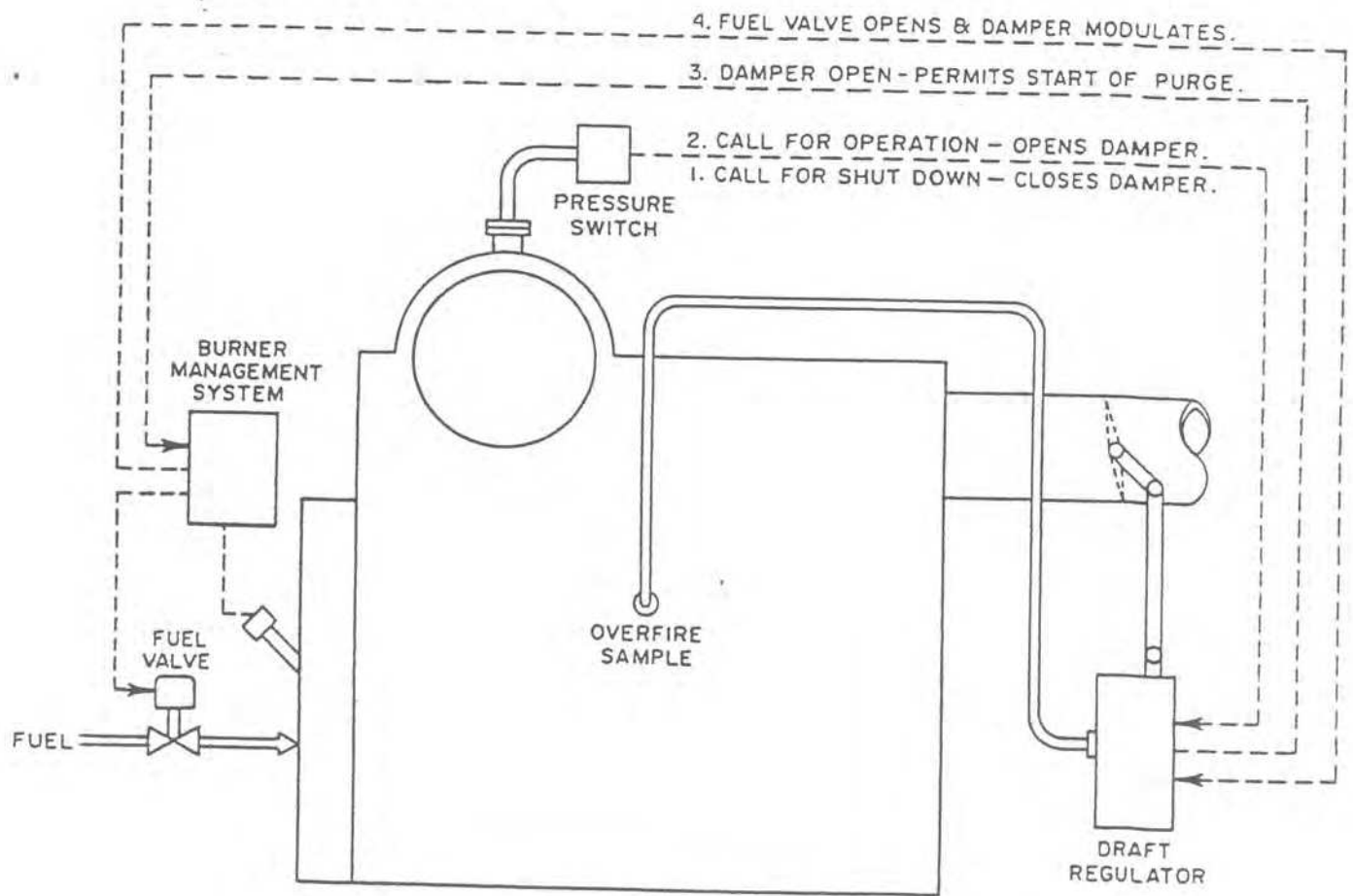
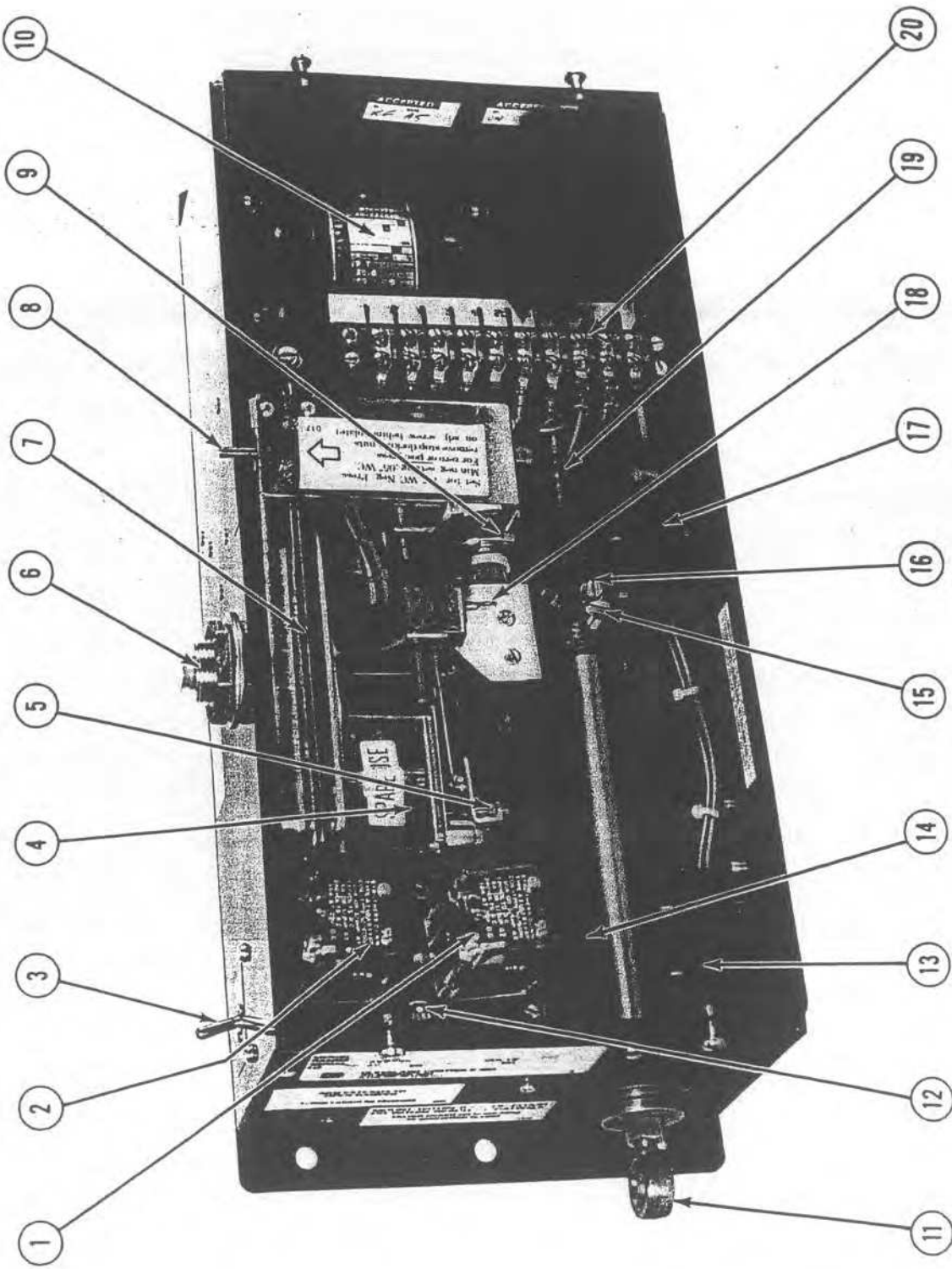


FIGURE 1 - DRAFT REGULATOR OPERATION



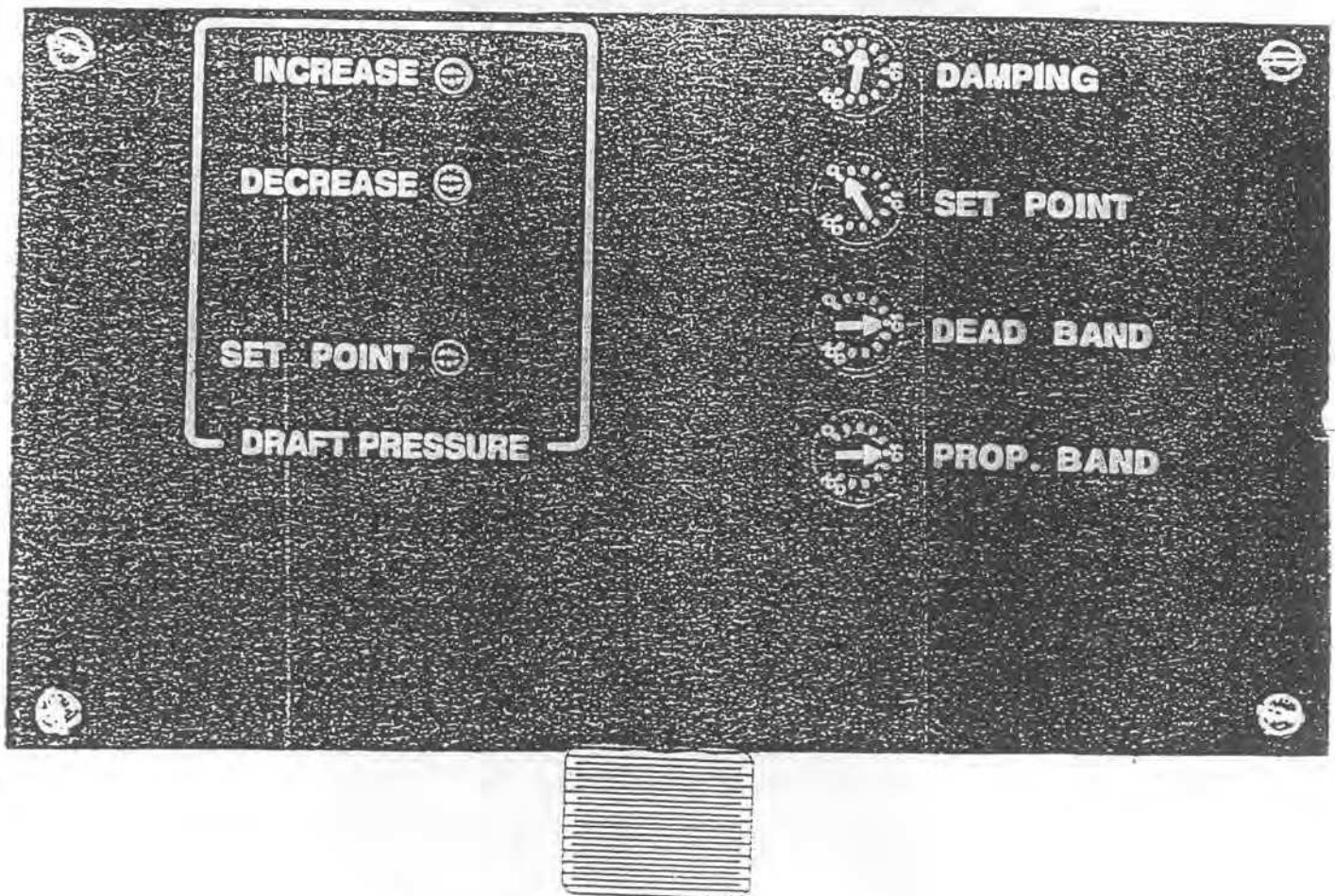


- |                                    |                                 |                            |
|------------------------------------|---------------------------------|----------------------------|
| 1. Relay 1                         | 10. Motor w/Gearhead            | 16. Switch Trip            |
| 2. Relay 2                         | 11. Thrust Arm                  | 17. Inward Limit Switch    |
| 3. Auto/Open-Damper Firing Switch  | 12. Fuse, 1 ampere              | 18. Proportional Band Adj. |
| 4. Sensing Switches (behind plate) | 13. Outward Limit Switch        | 19. Drive Screw w/Coupling |
|                                    | 14. Auxiliary Switch            | 20. Terminal Strip         |
|                                    | 15. Obsolete Stroke Length Adj. |                            |

Selection of a band that is too narrow will result in a rhythmic "hunting" of the damper which must not be allowed to continue.

Functionally, the Deadband and Proportional Band adjustments on the Solid State Upper Section take the place of the Sensitivity (red lever) and Proportional Band (thumbscrew) adjustments on the old Upper Sections.

The "Pulsation Dampener" used with the old mechanical upper section is replaced by the Damping Control of the solid state unit.



Cleveland Draft Regulator Upper Section

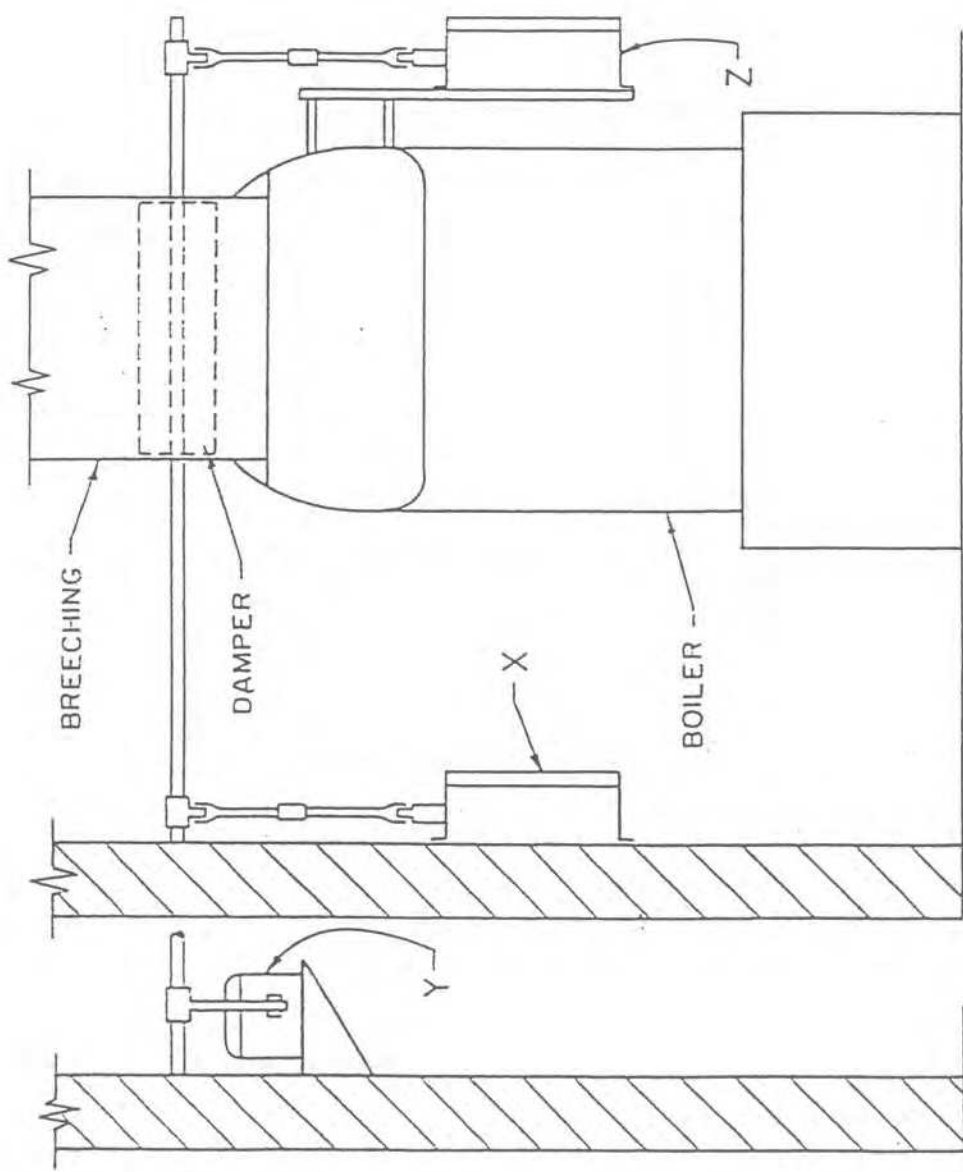


FIG. 4 - SUGGESTED MOUNTING LOCATIONS



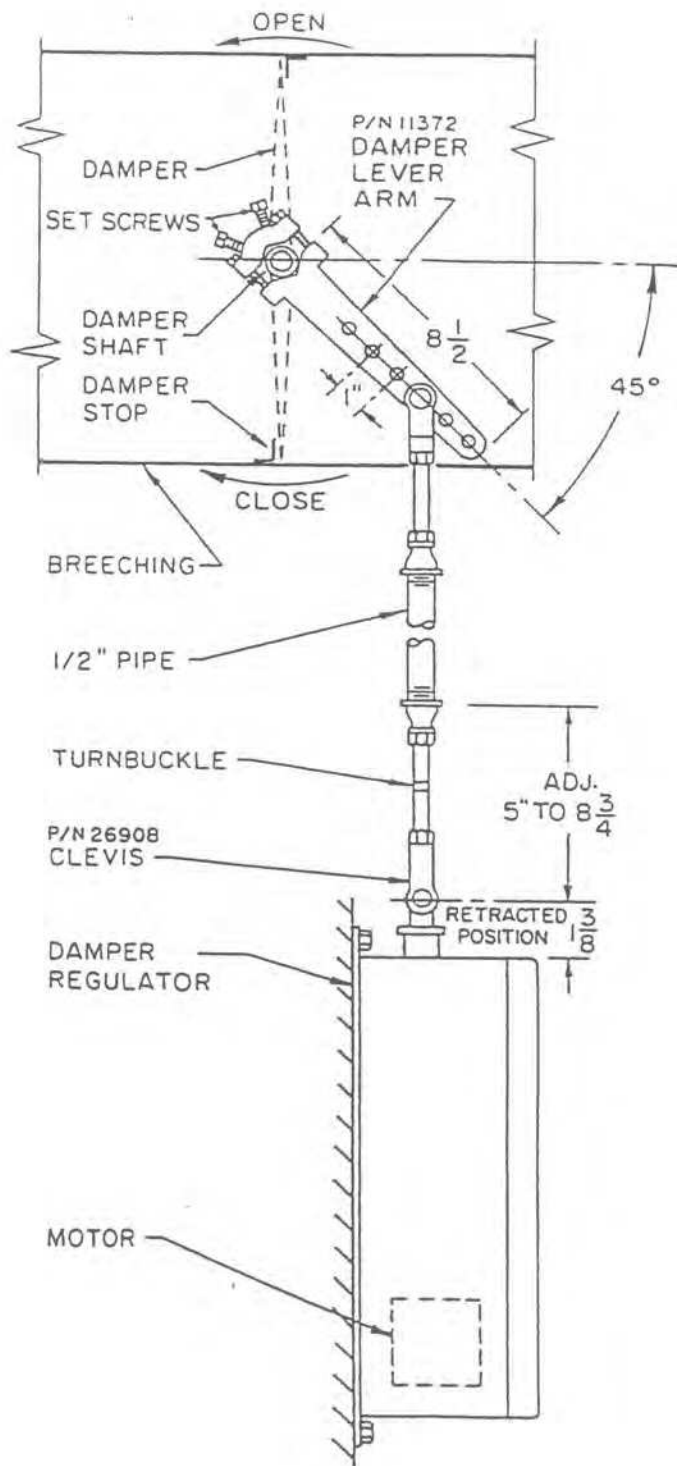


FIGURE 5: LINKAGE FOR VERTICAL MOUNTING

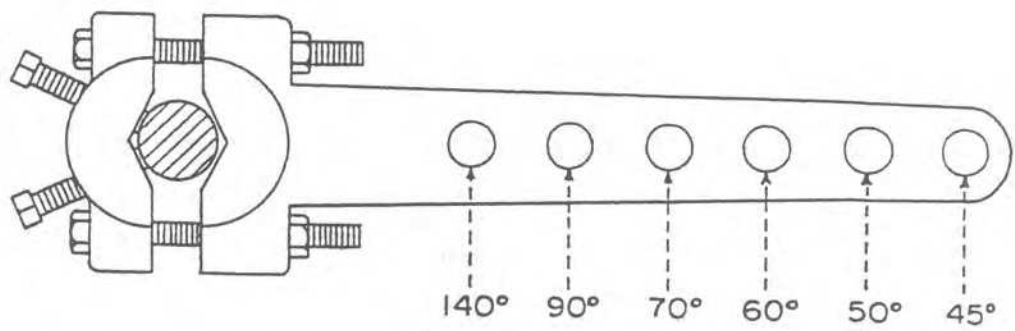


FIGURE 6: DAMPER TRAVEL ADJUSTMENTS

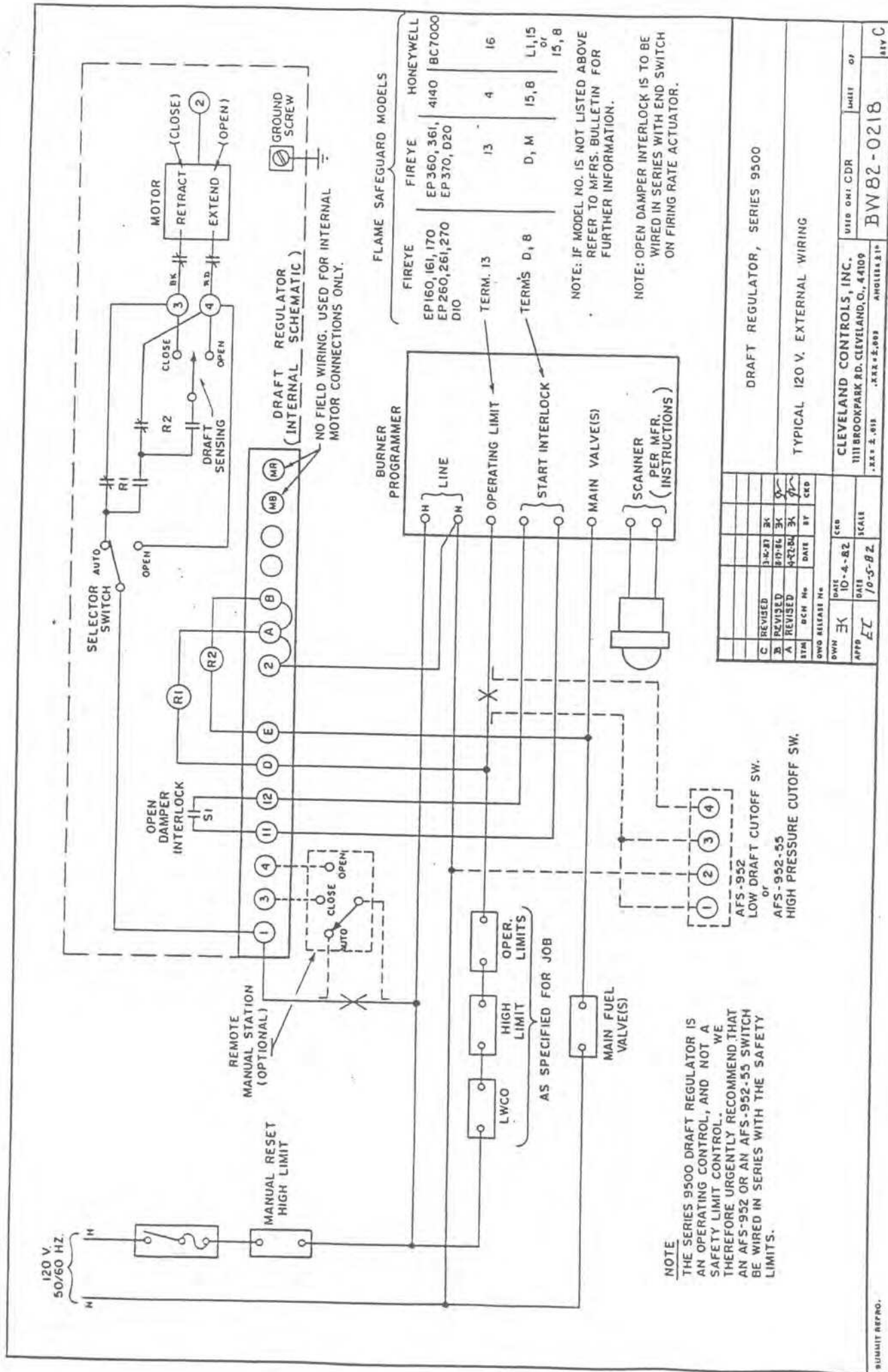
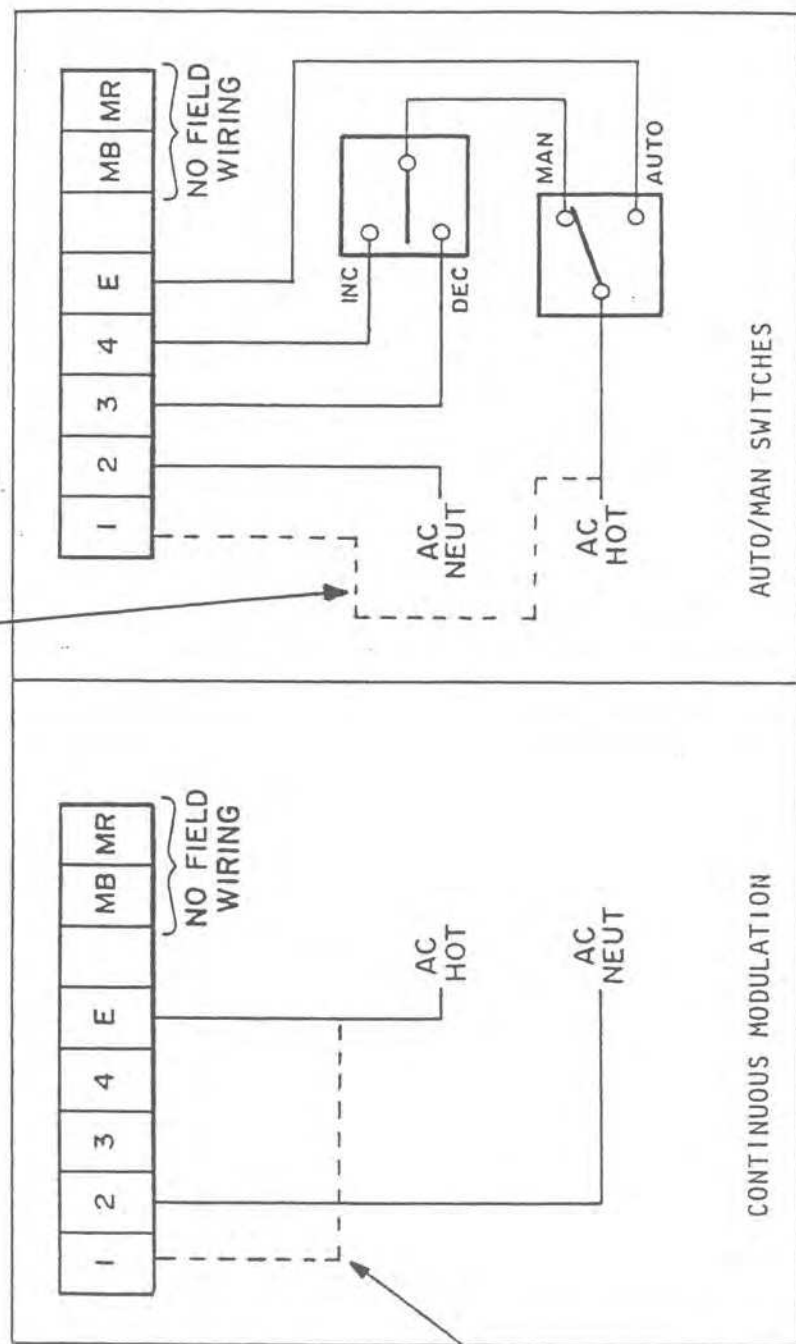


FIGURE 7A - TYPICAL EXTERNAL WIRING SEQUENCING MODELS

ON MODELS WITH SOLID STATE  
UPPER SECTION ONLY



ON MODELS WITH  
SOLID STATE  
UPPER SECTION  
ONLY

SERIES 9500 DRAFT REGULATOR

FIGURE 7B - TYPICAL EXTERNAL WIRING  
NON-SEQUENCING MODELS

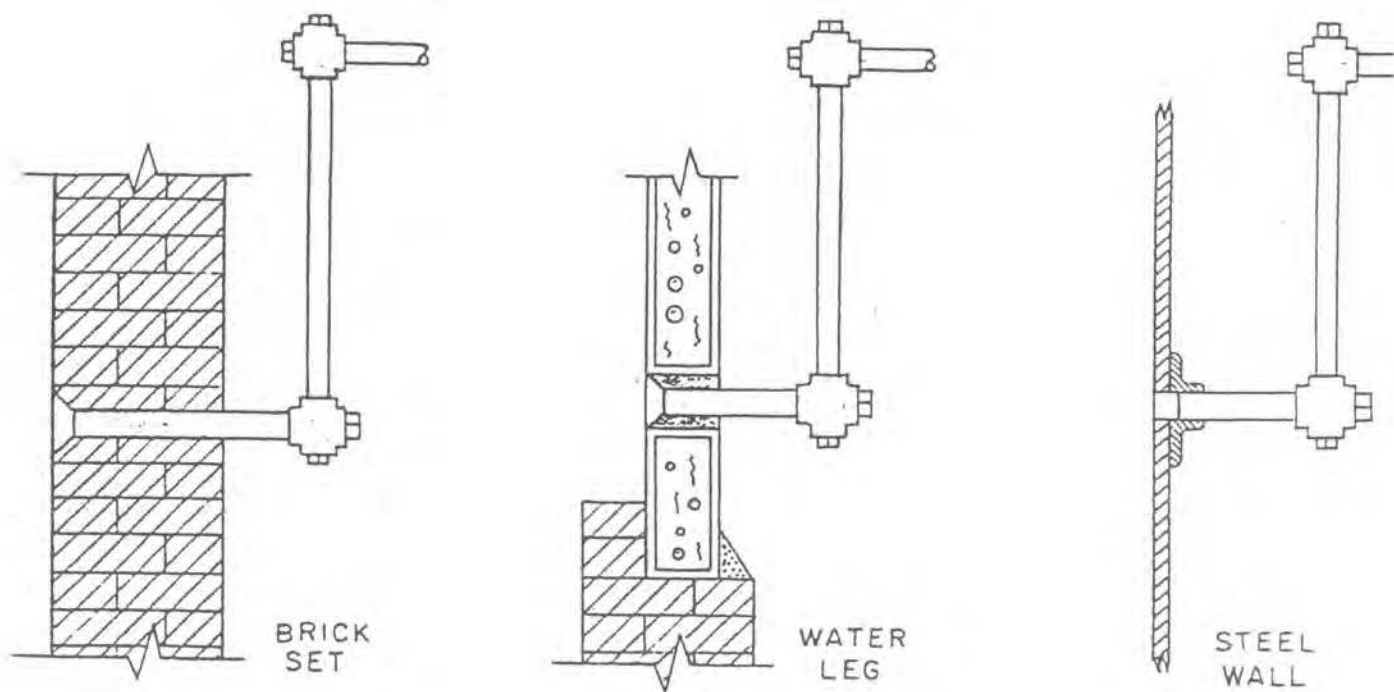
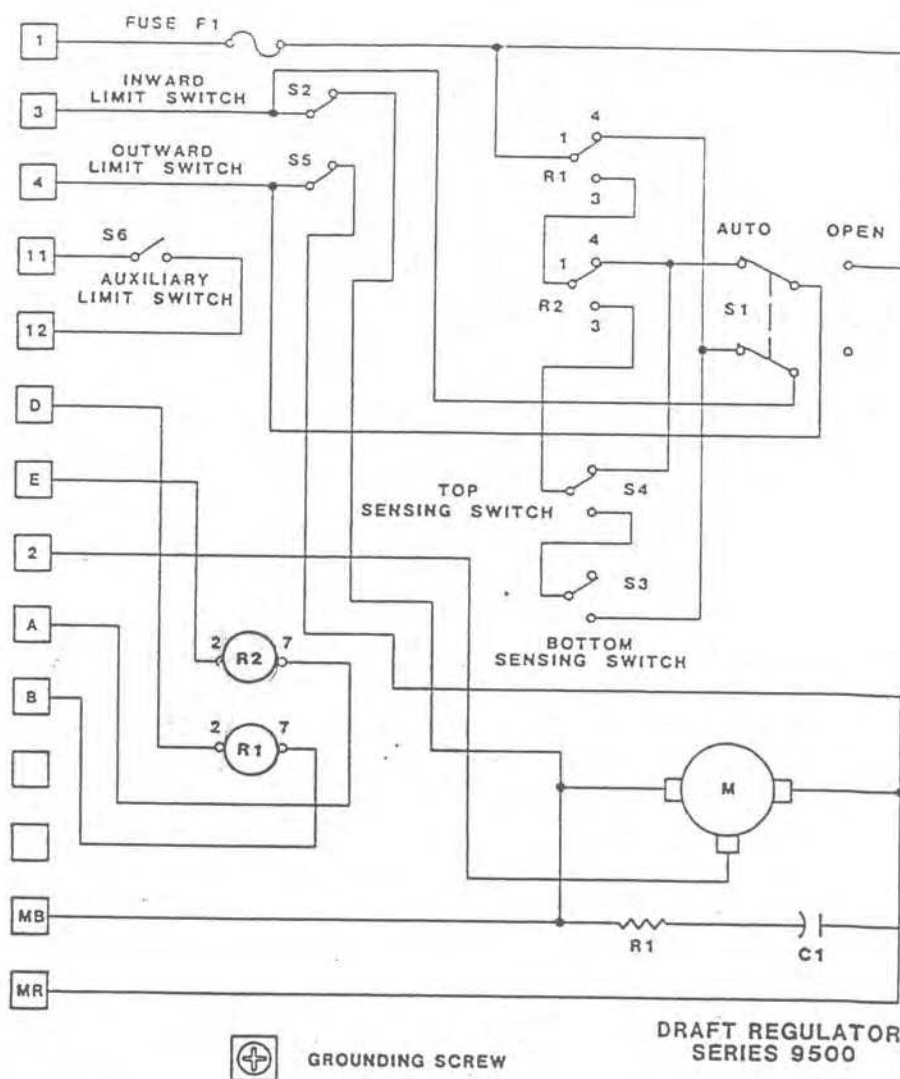


FIGURE 8: SAMPLE CONNECTIONS



NOTES:

1. EXTERNAL WIRING-
  - A. USE WIRE SUITABLE FOR 75° C.
  - B. DO NOT USE ASBESTOS COVERED WIRE.
  - C. USE MOISTURE PROOF #14 MINIMUM.
2. INPUT RATING- 120V., 60HZ., 25VA.
3. LOAD CAPACITY- 150 LBS. MAX., ALL CONDITIONS.
4. AUX. SWITCH- 125VA PILOT DUTY. ( TERMS. 11 & 12 )
5. RELAYS R1 & R2 INTERCHANGEABLE WITH EACH OTHER & ALL CURRENT CLEVELAND RELAYS OF PROPER VOLTAGE.

29061

FIGURE 9: INTERNAL WIRING B





## Converting a Draft Regulator from Negative Pressure(Draft) Measurement to Positive Pressure Measurement.

*This Appendix is applicable to Series 9500 Draft Controllers with Model Nomenclature suffix E = 2 and F = A or B.*

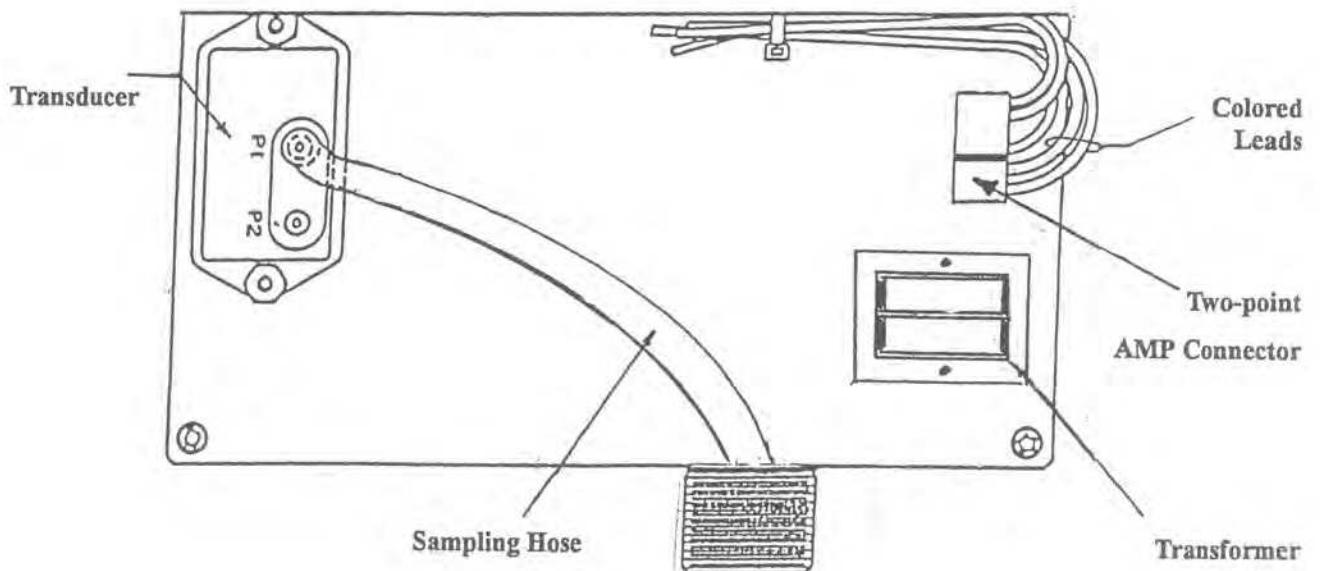
Step A.) Remove Solid State Upper Section from regulator by removing PAL nut and washer.

Step B.) Reposition air pressure sampling hose as required:

- Port P2 for Positive Applications
- Port P1 for Negative Applications

Step C.) Reposition two-point AMP Connector (Female side) as follows:

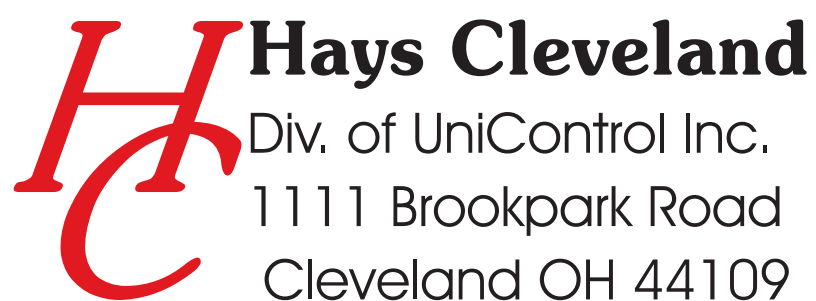
- for Positive Pressure measurement, rotate so that gray lead is closest to transformer.
- for Negative Pressure measurement, rotate so that black lead is closest to transformer.



*Solid State Upper Section Assembly—Back View*







**Hays Cleveland**

Div. of UniControl Inc.

1111 Brookpark Road

Cleveland OH 44109