

INSTRUCTION MANUAL

700003A

EN200 SERIES CONTROLS

NEMA TYPE S2HX

BINARY COUNT WELD SEQUENCE CONTROLS

All Solid State Resistance
Welding Controls With
Solid State Thyristor Contactors
And Ignitron Contactors

Wiring Diagram 420010 S Cabinet
420020 C & M Cabinet
420709 R Cabinet
420972 T Cabinet
420318 L Cabinet

Logic Diagram 420019

ENTRON

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T. J. SNOW CO., INC.

*Resistance Welding Equipment & Supplies • Robots & Automated Arc Welders
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If you have any questions about resistance welding machinery, need service, supplies, training, or other resistance welding related services, feel free to contact us to see how we can be of further help.

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EMERGENCY STOP - This is a connection which allows all control functions to be reset upon opening of an external Emergency Stop Switch. Control will not be reinitiated automatically upon release of the switch and must be reinitiated through the normal initiation circuit. Remove the jumper from ES1/ES2 and install a Normally Closed Switch. Switch is not furnished with the control. If the Emergency Stop function is not desired, the jumper must be left in place.

VALVE CONTROL TRANSFORMER - This transformer provides the necessary voltage for powering the welding machine solenoid valve. Standard input voltages may be either 230 VAC or 460 VAC (see customer wiring diagram or instructions on page 8). Output is 115 VAC (optional low voltage transformer for certain operations provides a 24/48VAC output). See CAUTION below.

Style "S" Sub-Compact Cabinet 50VA transformer Only.

Other Cabinet Styles 150VA transformer standard.
(250VA or 500VA optional
in some cabinets).

CAUTION

When external valve power is used, valve transformer **MUST** be disconnected at X1 and X2. Caution must be used to properly insulate the X1 and X2 leads after removing from transformer terminals.

CONTROL FUNCTIONS

FRONT PANEL - The front panel switches and lights, which are included in the basic unit, without options, provide the following functions:

POWER "ON" LIGHT - The red indicator lamp on the front panel is lit when power is applied to the control unit.

VALVE LIGHT - The amber indicator lamp is connected directly across the solenoid valve coil and will light when current flows to the solenoid valve.

WELD LIGHT - The clear indicator lamp is connected directly across the welding transformer and will light when voltage is applied to the welding transformer. The brilliance of this lamp is controlled by the Percent Current Selector and therefore, provides a visual indication of the percent of RMS voltage supplied to the welding transformer.

DIGITAL PERCENT CURRENT SELECTOR (PHASE SHIFT) - This is a digital current control that allows the operator to adjust the welding current in 1% steps from 20 to 99% of the selected transformer tap setting. (50 to 99% adjustment is optional).

CAUTION

Do not set current control below 40% for 230 volt operation when control is furnished or used with ignitron tube contactor.

This control is equipped with a **DIGITAL AUTOMATIC POWER FACTOR EQUALIZATION** circuit which automatically corrects for current variations due to a change in the power factor of the welding machine. This control can be used on any welding machine, for which the control contactor is properly sized, without special power factor adjustments.

FUNCTION COUNT SELECTOR - These direct reading thumbwheel switches adjust the function counts in one cycle steps. The 0-0 switch setting of any function count selector also results in a count of 1 cycle.

<u>MODEL SERIES</u>	<u>FUNCTION</u>	<u>COUNT ADJUSTMENT</u>
EN200	Squeeze Count	1 to 99 cycles
	Weld Count	1 to 99 cycles
	Hold Count	1 to 99 cycles
	Off Count	1 to 99 cycles

NOTE: NO ADJUSTMENT is required for power factor or timing to change from 60 to 50 Hz operation.

X

WELD/NO-WELD SWITCH - In NO-WELD, this switch provides a means of initiating the control sequence without passing current through the welding transformer. When the switch is at WELD, the contactor will close to pass current to the welding transformer when the control sequence is initiated.

NON-REPEAT/REPEAT SWITCH - In the NON-REPEAT Position, this switch provides a means for allowing the control to be initiated for only one sequence. In the REPEAT Position, after initiation, the control is internally reinitiated for as long as the initiation switch is closed.

INITIATION - This control can be initiated by the closure of a two stage pilot switch. First stage is connected to FS1 and FS2 and second stage is connected to FS3 and FS4 (customer terminal strip). Once the control is initiated, the switch need not remain closed. The initiation circuit is automatically clamped to prevent re-initiation until after the control has completed its sequence. In the Repeat Mode the control will continue to sequence as long as the initiation switch remains closed.

When a single stage pilot switch is used, the switch is connected to FS3 and FS4 only. No connection is made to FS1 and FS2. Please see wiring diagram.

COUNT FUNCTIONS

SQUEEZE COUNT - The time duration after initiation required to allow the welder electrodes to close and build up pressure before Weld Count begins.

WELD COUNT - The time duration after Squeeze Count, or closure of a pressure switch when used, that current will flow through the welding transformer.

HOLD COUNT - The time duration after Weld Count that the welding electrodes remain in contact with the work to allow the weld to congeal.

OFF COUNT - In the Repeat Mode, the time duration between Hold Count and Squeeze Count to allow the work to be repositioned.

CAUTION

WHEN THE WELDING CONTROL AND/OR WELDING MACHINE WAS SHIPPED, THE VOLTAGE AT WHICH IT WAS SET WAS MARKED ON THE TAG ATTACHED TO THE CONTROL TERMINAL BLOCK.

THIS WELDING CONTROL IS A MULTIPLE VOLTAGE UNIT WHICH CAN BE CHANGED FROM ONE VOLTAGE TO ANOTHER BY RE-ARRANGING JUMPERS ON THE TERMINAL STRIP (TS1) AND THE VALVE TRANSFORMER (T3) FOUND INSIDE OF THE UNIT. THE DIAGRAM FOUND ON PAGE 8 OF THIS BOOKLET WILL EXPLAIN VOLTAGE CHANGES. IF THE CONTROL IS USED ON A VOLTAGE OTHER THAN THE ONE FOR WHICH IT IS WIRED, SERIOUS DAMAGE CAN RESULT.

REFER TO CUSTOMER WIRING DIAGRAM
or CUSTOMER HOOK-UP DIAGRAM, Page 8.

230 Volt Operation Jumpers

Customer Terminal Strip TS1:

Jumper H1/H3 and H2/H4

CTH1/CTH3 and CTH2/CTH4

Valve Transformer:

Jumper H1/H3 and H2/H4

460 Volt Operation Jumpers

Customer Terminal Strip TS1:

Jumper H3/H2

CTH3/CTH2

Valve Transformer:

Jumper H3/H2

(208V, 380V and 575V Operation is Optional, Consult Factory)

CAUTION

PROVIDE A GOOD "WATER PIPE" GROUND AT THE TERMINAL MARKED "GND" ON THE CONTROL TERMINAL STRIP.

FUSING

CONTROL FUSE - F1 - This fuse, BBS-6/10, is used to protect the control circuit. The fuse is located on the rear panel, or it may be inside the cabinet, behind the terminal strip. The fuse is located in the upper left corner of the contactor door opening of the "C", "M", "R", & "T" Cabinets and on the rear panel in "L" Cabinets.

VALVE FUSE - F3 - This fuse, BBS-4, is used to protect the valve circuit. The fuse is located on the rear panel, or it may be inside the cabinet, behind the terminal strip. The fuse is located in the upper left corner of the contactor door opening of the "C", "M", "R", & "T" Cabinets and on the rear panel in "L" Cabinets.

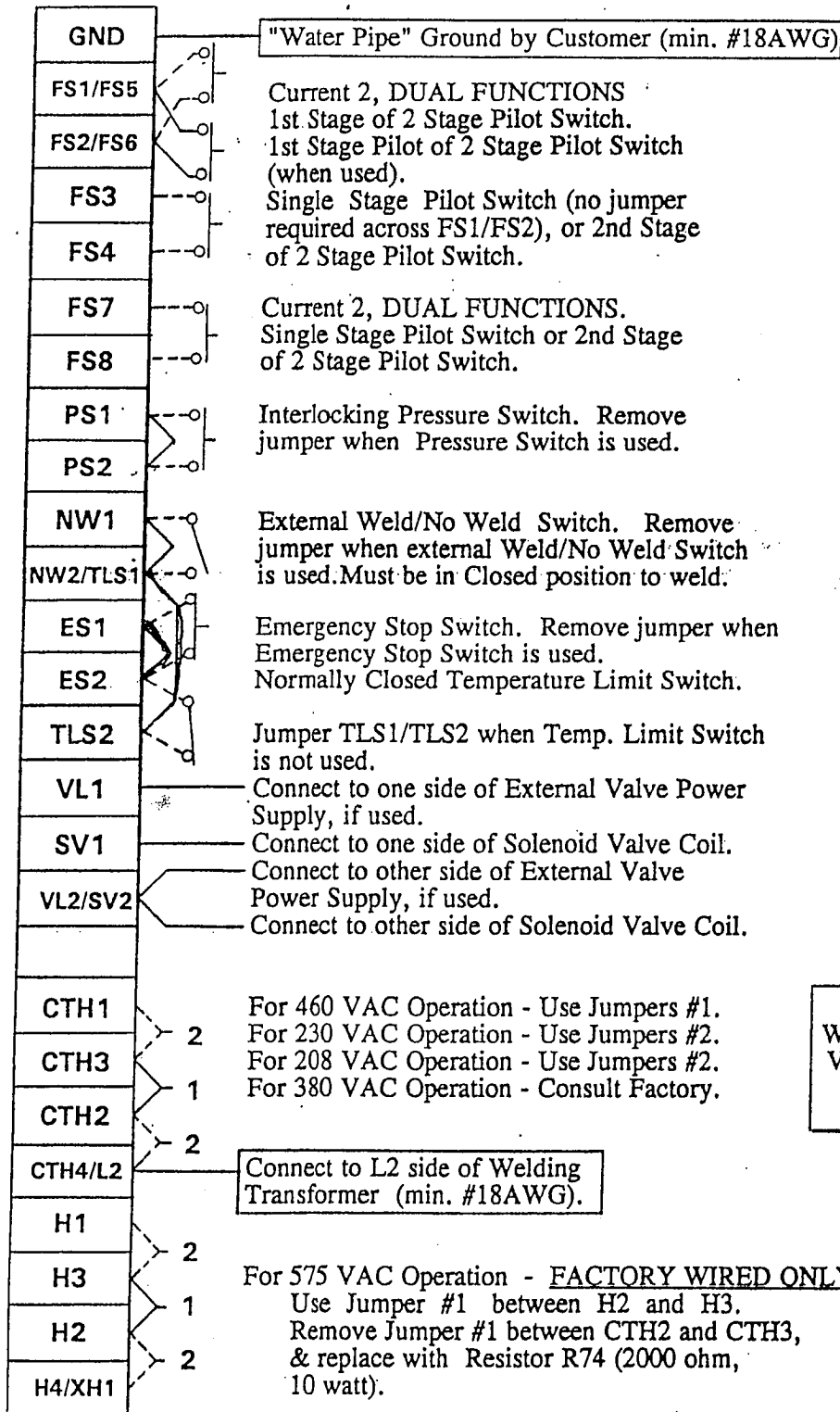
IGNITOR FUSES - F4 & F5 - (Supplied when control is used to operate with ignitron tube contactors only). These two fuses, BAF-6, are used to protect the ignitor circuits to the ignitron tubes. Fuses are located inside the cabinet, behind the terminal strip in "S" Cabinets, in the upper left corner of the contactor door opening of the "C", "M", "R", & "T" Cabinets and on the rear panel in "L" Cabinets.

NOTE: Prior to January 1976, in "L" enclosures, the fuses were located in the door below the control operators.

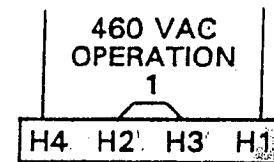
CUSTOMER TERMINAL STRIP CONNECTIONS

See Description - Pages 9 and 10

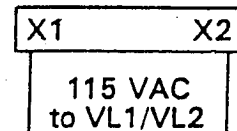
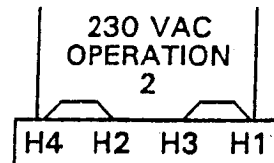
SEE WIRING DIAGRAMS 420010, 420020, 420709, 420972, 420318



STANDARD 230/460 VAC VALVE TRANSFORMER CONNECTIONS



OR



DISCONNECT THESE WIRES WHEN EXTERNAL VALVE POWER SUPPLY IS USED. SEE CAUTION ON PAGE 3

NO CALIBRATION OR CHANGE REQUIRED FOR OPERATION ON EITHER 50 OR 60 Hz.

CUSTOMER TERMINAL STRIP CONNECTIONS

- GND Connect "Water Pipe" Ground.
- FS1/FS2 Used to connect First Stage of two Stage Pilot.
- FS3/FS4 Used to connect Second Stage of two Stage Pilot. Or to connect Single Stage pilot (no jumper required across FS1/FS2).
- FS5/FS6 Used to connect First Stage of second Two Stage Pilot for DUAL FUNCTIONS.
- FS7/FS8 Used to connect Second Stage of second Two Stage Pilot for DUAL FUNCTIONS. (No jumper required across FS5/FS6).
- PS1/PS2 Used to connect Pressure Switch. Remove jumper and install normally open Pressure Switch. Weld Count begins immediately after pressure switch closure or end of Squeeze Count, whichever is longer.
- NW1/NW2 Used to connect External Weld/No Weld switch. Remove jumper and install single pole switch. Switch must be in closed position to weld. Do not open and re-close while weld current is flowing.
- ES1/ES2 Used to connect Emergency Stop Switch. Remove jumper and install normally closed, momentary type switch.
- TLS1/TLS2 Used to connect normally closed Over-Temperature Limit Switch. Jumper if TLS is not used. Over Temperature Limit Switch is standard on controls with Ignitron Tube Contactors, and on some SCR Contactors.
- VL1 Used to connect one side of External Valve Power* (24 VAC to 230 VAC MAX.)
- SV1 Used to connect one side of Solenoid Valve Coil.
- VL2/SV2 Used to connect other side of Valve Power* and the other side of Solenoid Valve Coil.
- (VL1&VL2) (Wiring is factory installed with internal valve transformer).

CAUTION

If valve power is supplied from an external source, X1 and X2 leads on the valve transformer MUST be disconnected to avoid damage to control and transformer. Be sure to properly insulate X1 and X2 leads after removing from transformer terminals.

*VL2/SV2 Internally wired when control valve power supply is used.
Customer Connection only when external valve power is used.

CTH1/CTH3 Used to properly jumper for input voltages to the Control
CTH2/CTH4 Transformer.

For 208/230 VAC Operation - jumper CTH1 to CTH3 and
CTH2 to CTH4.

For 460 VAC Operation - jumper CTH3 to CTH2 ONLY.

L2 Used to provide control power. Connect wire (min. 18AWG)
from one side of line common to the L2 welding transformer lead.

H1/H3 Used to properly jumper input voltage to the Digital Automatic
H2/H4 Power Factor Equalization transformer.

For 208/230 VAC Operation - jumper H1 to H3
and H2 to H4.

For 460 VAC Operation - jumper H3 to H2 ONLY.

SCR OR IGNITRON TUBE CONTACTORS

CAUTION

When power is ON, all exterior surfaces of
the ignitron tubes and SCR's carry line
voltages of 230V or 460V. Contact with these
devices may cause serious or fatal injuries.

1. For your convenience, many electrical and mechanical connections
have been performed at the factory.

2. Connect the L1 lead from incoming power to the L1 connection
located on the contactor. Connect the H1 lead from the welding trans-
former to the H1 connection located on the contactor assembly.
Follow welding machine manufacturer's recommended wire size for
installation.

On some controls with 70Ampere, 150Ampere and 300Ampere air cooled SCR
contactors, the L1 and H1 connections are made to TS2-L1 and TS2-H1 in the
contactor area. On the newer (available March 1990) 300 Ampere air cooled
SCR contactors and 600 Ampere water cooled contactor the L1 and H1 connec-
tions are made directly on a terminal board on the contactor.

MANUFACTURER'S RECOMMENDED SOLID STATE COOLING REQUIREMENT

70, 150 & 300 Ampere contactor--air cooled - be sure openings
in cabinet are kept free from
obstructions.

600/1200 Ampere contactor-- 1 GPM at 40°C (104°F) maximum
inlet water temperature.

TUBE MANUFACTURER'S COOLING RECOMMENDATIONS

This chart shows typical cooling requirements at 500VAC operation in GPM.
Maximum water temperature 50°C (122°F)

WATER INLET TEMPERATURE	IGNITRON TUBE SIZE			
	B	C	C½	D
15°C (59°F)	1/4	3/8	1	1-1/2
30°C (86°F)	1/2	1/2	1-1/2	2
40°C (104°F)	1-1/2	1-1/4	1-1/2	3

Be sure power to an electronic contactor is turned off when water is turned off.
With a voltage applied, most water will ionize and begin to conduct current between tubes. This current is sufficient to heat the water past the boiling point, creating steam and possibly causing the rubber hose to burst. The water spraying over the high voltage circuit can cause considerable damage to the contactor and, most likely, the control circuitry as well. Never use metallic or other conductive tubing to plumb a water cooled resistance welding contactor. Heater hose has a very high carbon content and should not be used for contactor plumbing. A low carbon, reinforced hose (such as the hose originally supplied with the unit), no less than 18" long, must be used to connect the tubes to each other and to the bulkhead fitting on the inside wall of the cabinet, see plumbing instructions on wiring diagram.

The 600 Ampere water cooled contactor in the new EN200-"S" Cabinet (Available After March 1990) is electrically isolated from the electrical circuit within the contactor. All water connections are made external to the control cabinet. No minimum length of water hose is required for electrical isolation of the contactor. It is still recommended to turn power off when the control is not in use.

**WATER OFF - POWER OFF
POWER ON - WATER ON**

For all water cooled contactors, be sure water is turned ON before placing welder in operation. An open drain is recommended for best operation. If a closed return system is used, be sure return line is properly sized so that back pressure will not reduce water flow below recommendations. A sight flow indicator is recommended.

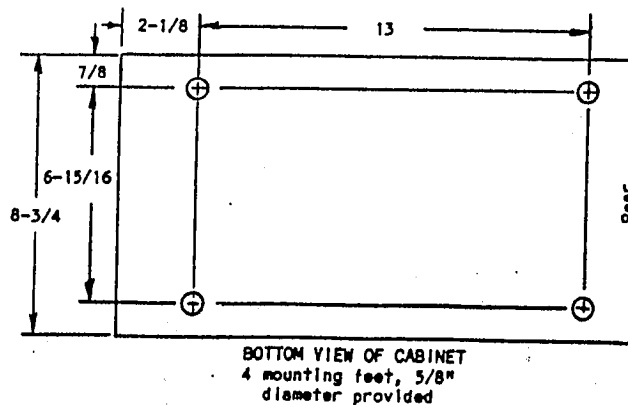
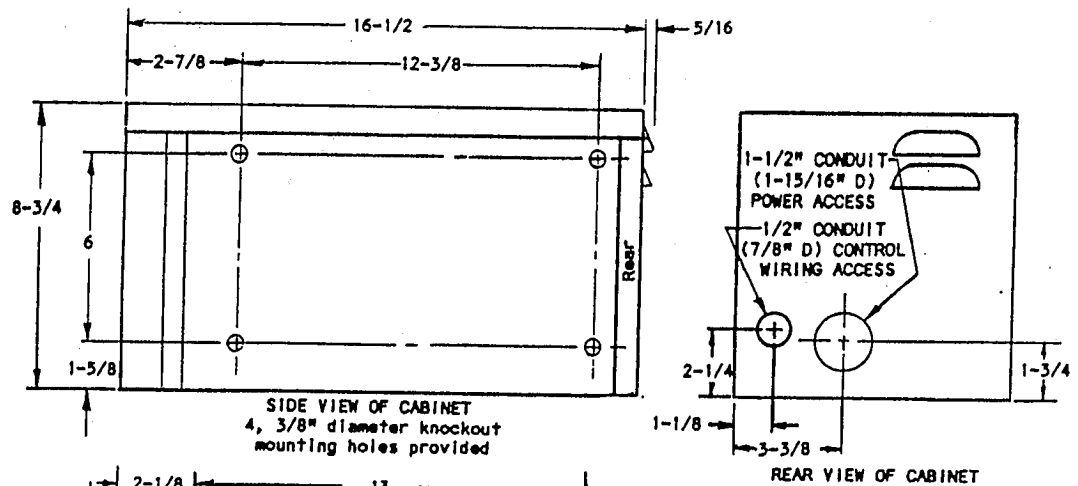
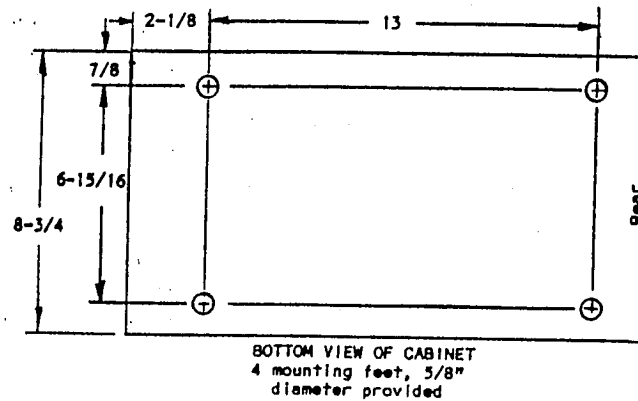
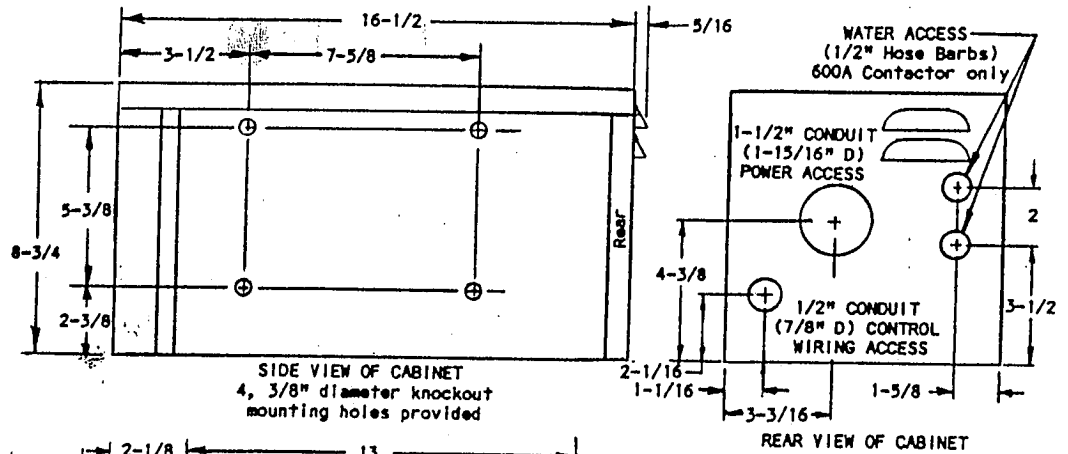
INSTALL PROPERLY SIZED FUSES IN SERVICE DISCONNECT SWITCH. CHECK WELDING MACHINE MANUFACTURER'S RECOMMENDATIONS.

This control is equipped with
DIGITAL AUTOMATIC POWER FACTOR EQUALIZATION.

No power factor or current control adjustment
or calibration is ever required.

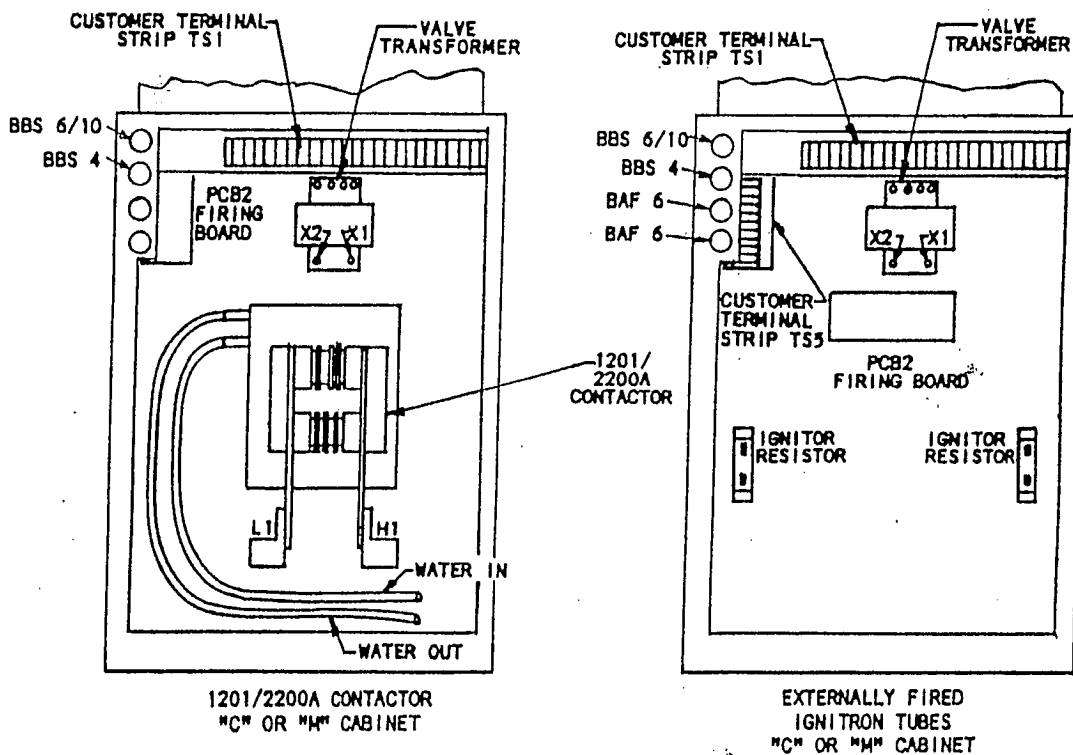
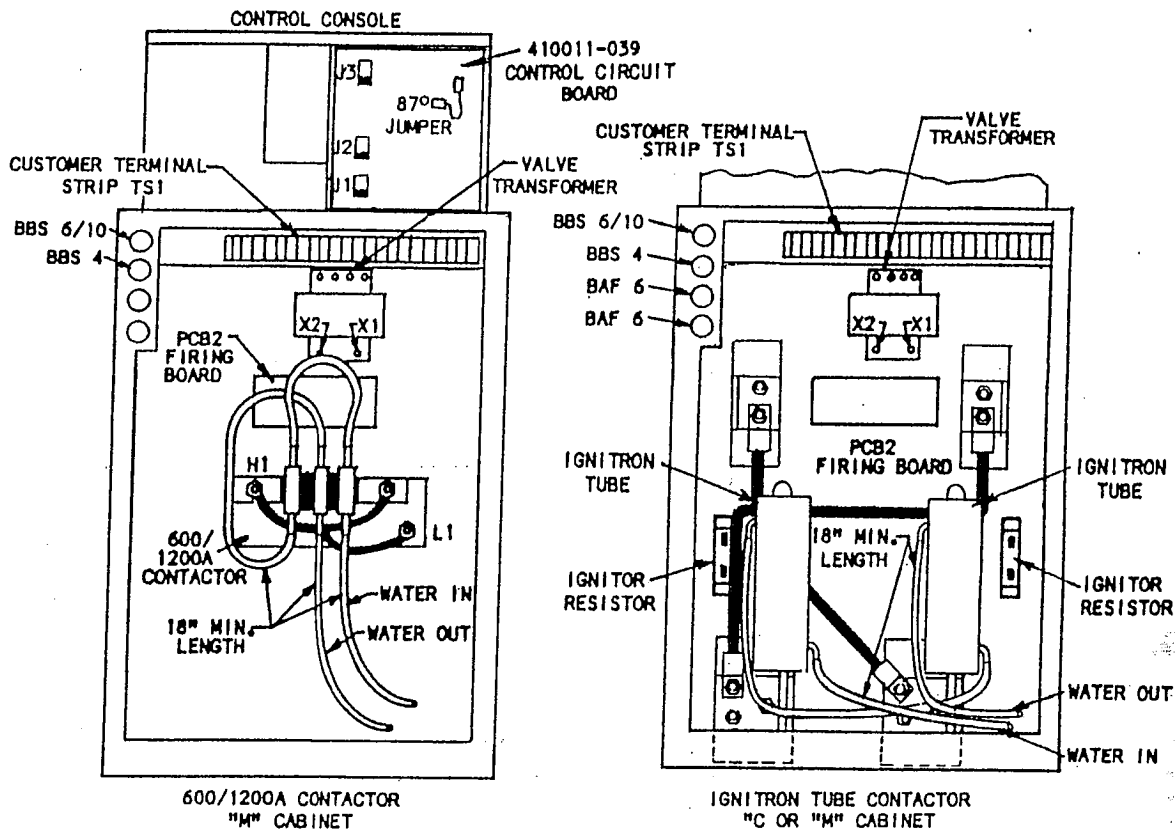
INSTALLATION DIAGRAMS

MOUNTING DIAGRAM "S" CABINET 440055



INSTALLATION DIAGRAMS

WIRING DIAGRAM "M" CABINET 420020
LOGIC DIAGRAM 420019

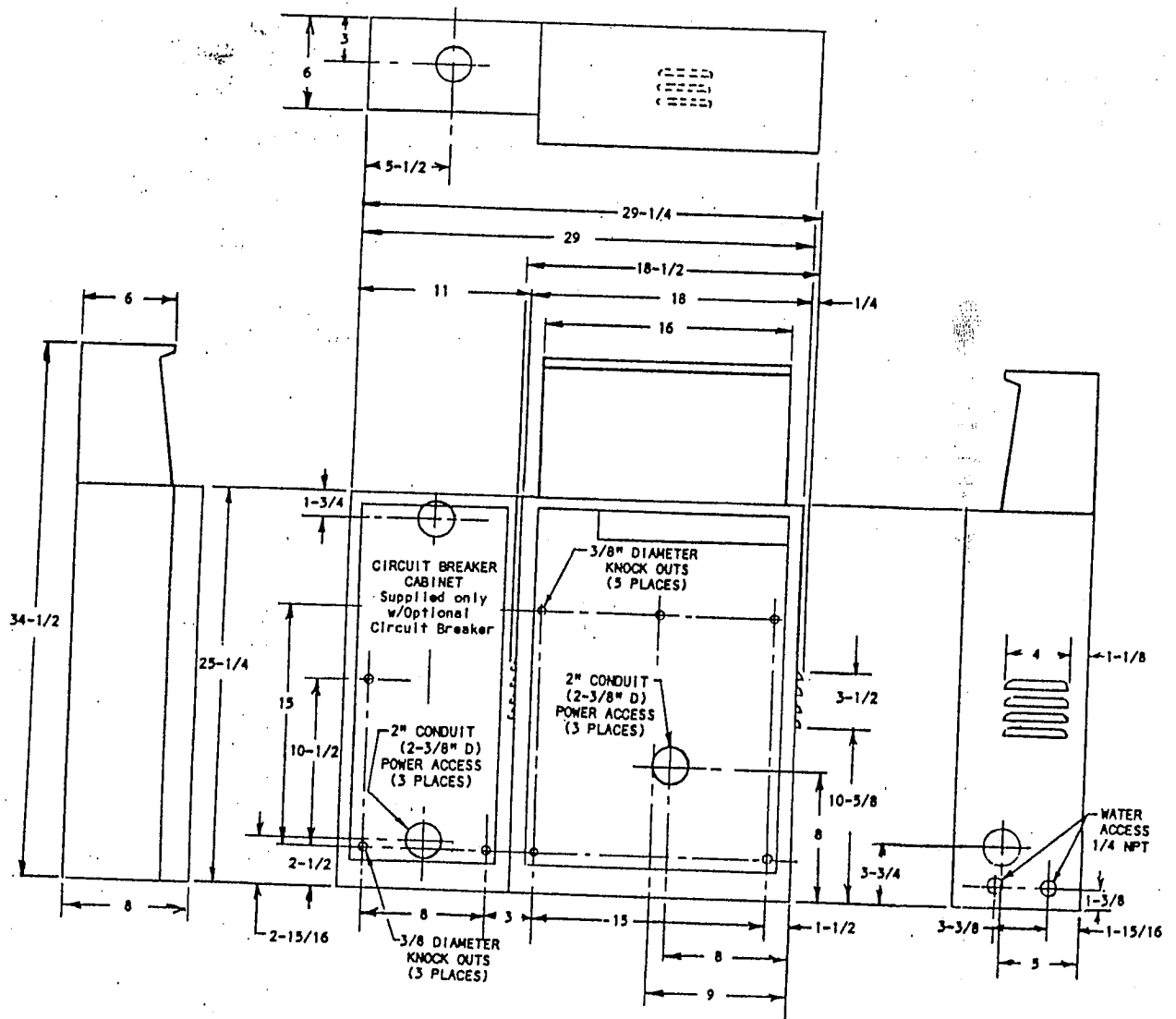


See Page 20 for "C" Cabinet Information
See Page 15 for Mounting Information

NOTE: When a Circuit Breaker is provided with the "M" Cabinet, the Circuit Breaker is mounted in an add on cabinet affixed to the left side of the "M" Cabinet. See Mounting Detail, Page 15, for the additional mounting dimensions.

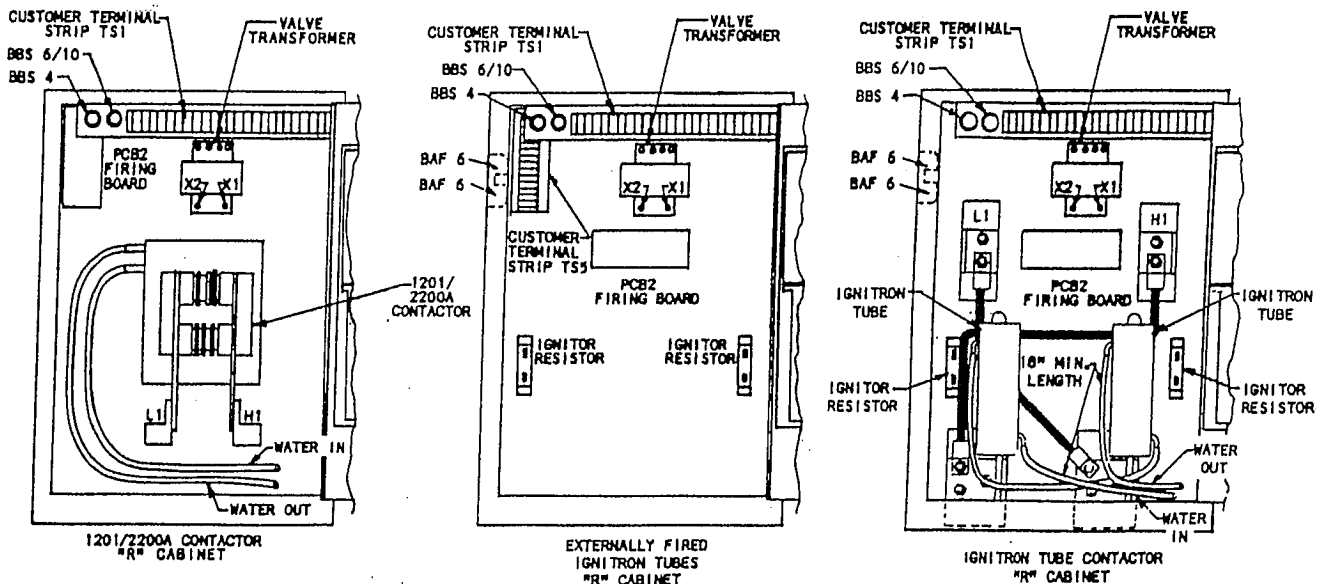
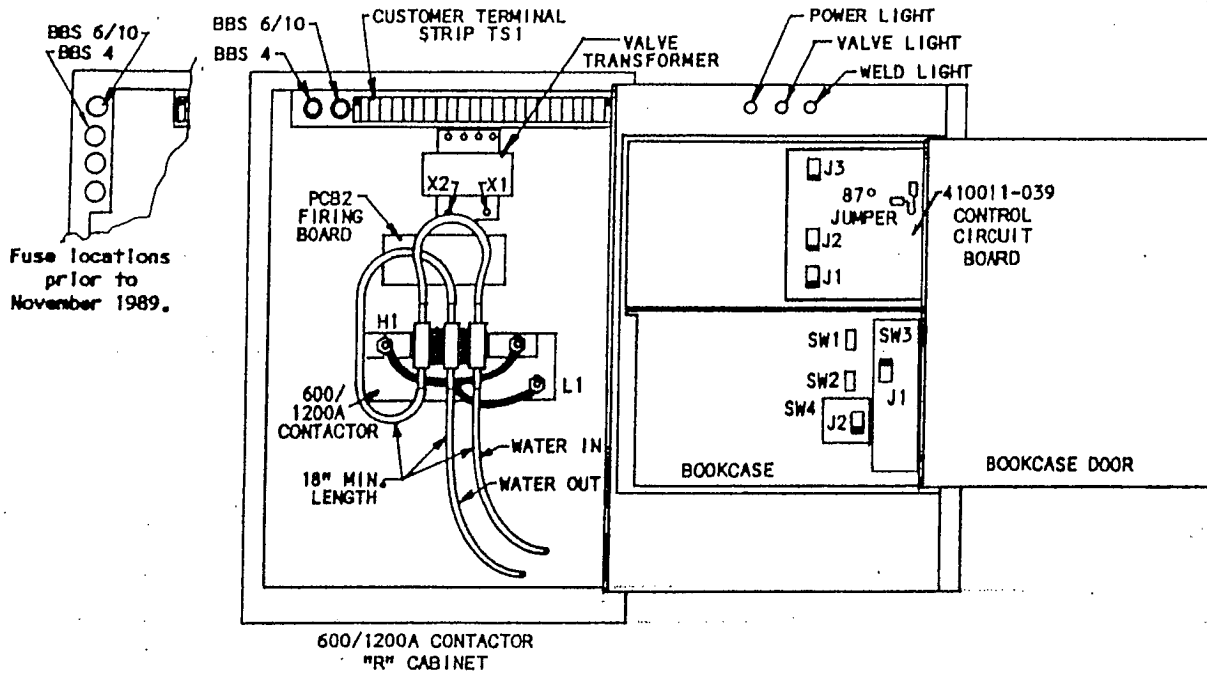
INSTALLATION DIAGRAMS

MOUNTING DIAGRAM "M" CABINET 440084



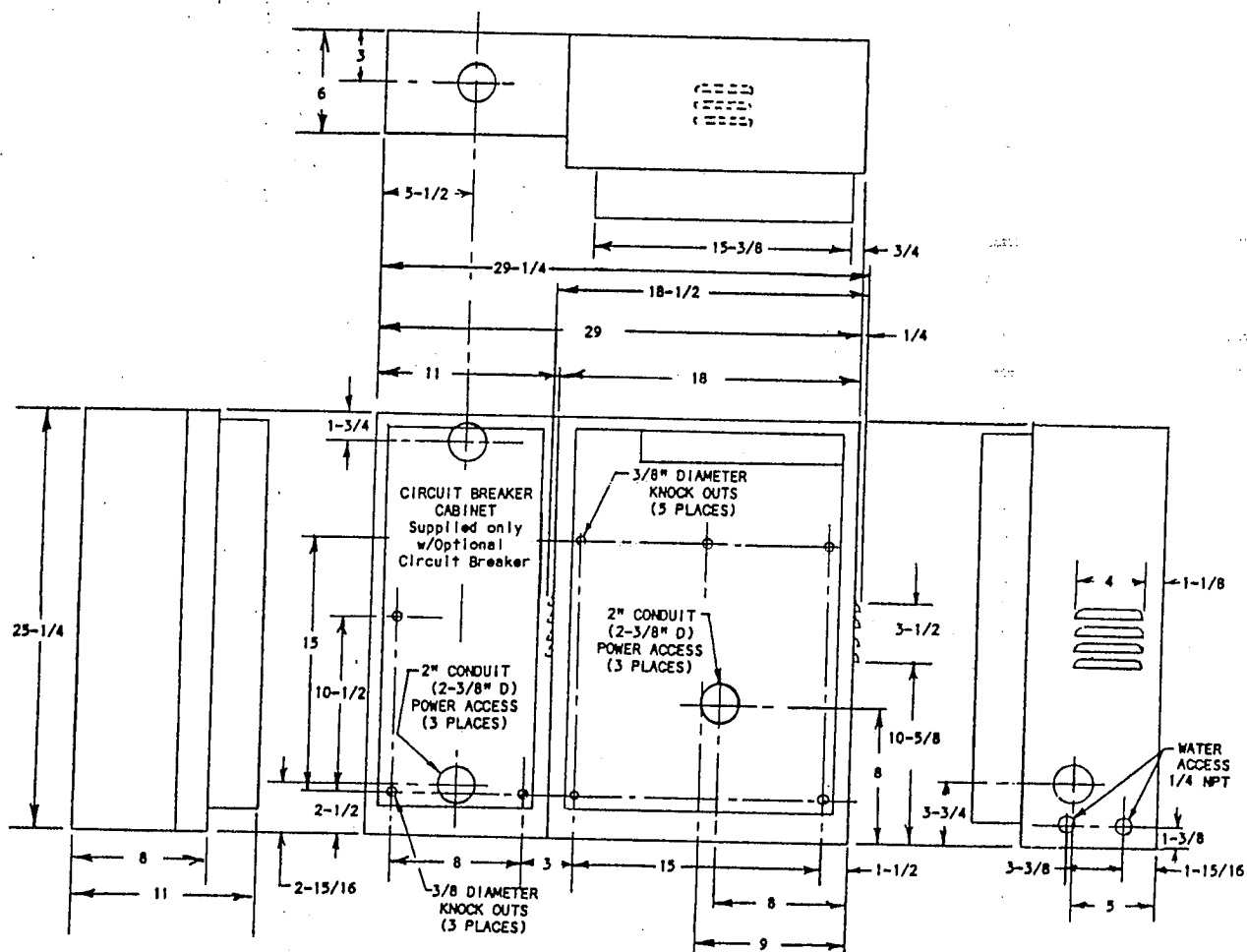
INSTALLATION DIAGRAMS

WIRING DIAGRAM "R" CABINET 420709
 LOGIC DIAGRAM 420019



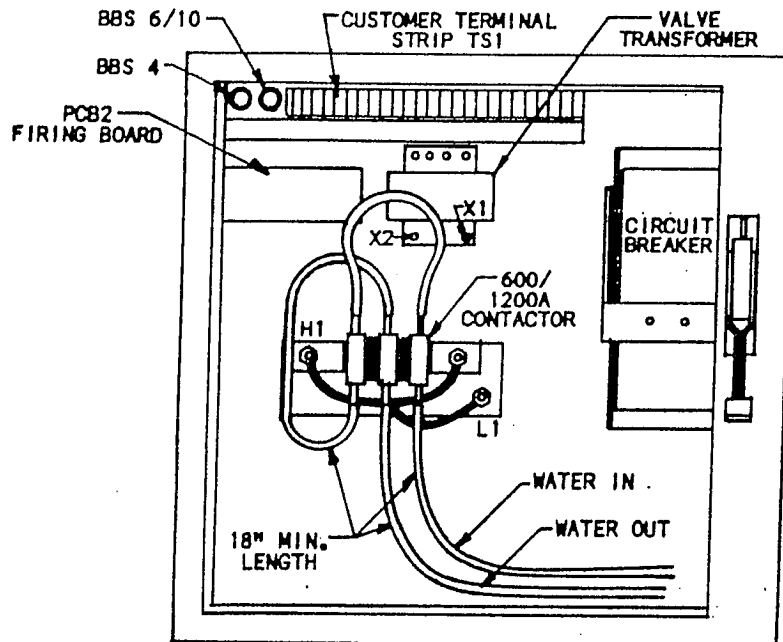
NOTE: When a Circuit Breaker is provided with the "R" Cabinet, the Circuit Breaker is mounted in an add on cabinet affixed to the left side of the "R" Cabinet. See Mounting Detail, Page 17, for the additional mounting dimensions.

MOUNTING DIAGRAM "R" CABINET 440296



INSTALLATION DIAGRAMS

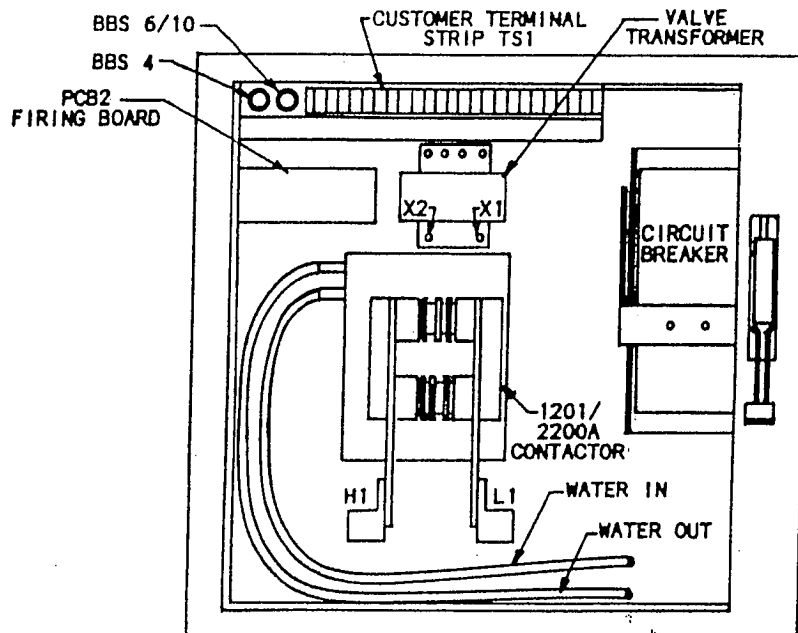
WIRING DIAGRAM "T" CABINET	420972
WIRING DIAGRAM "L" CABINET	420318
LOGIC DIAGRAM	420019



600/1200A CONTACTOR
"T" CABINET

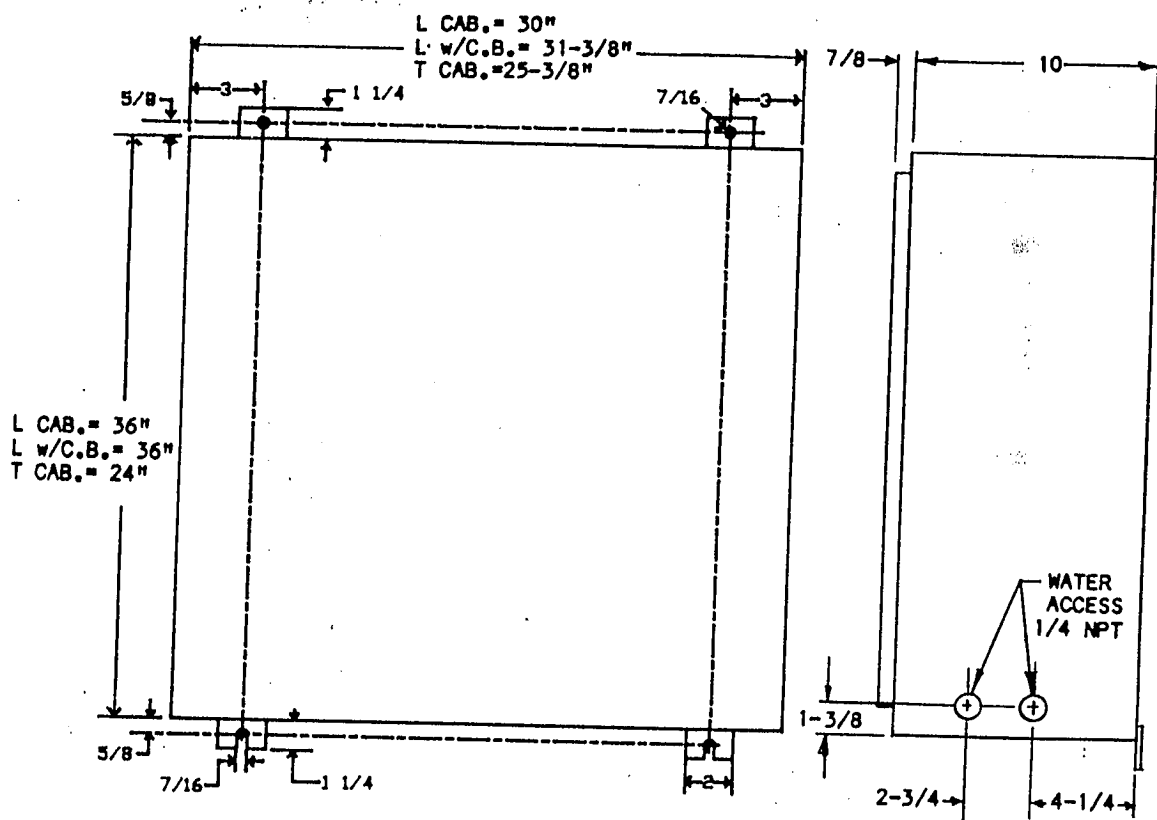
NOTE: See INSTALLATION DIAGRAM "R" CABINET, Page 16, for location of circuit boards.

See Page 19 for Mounting Information.



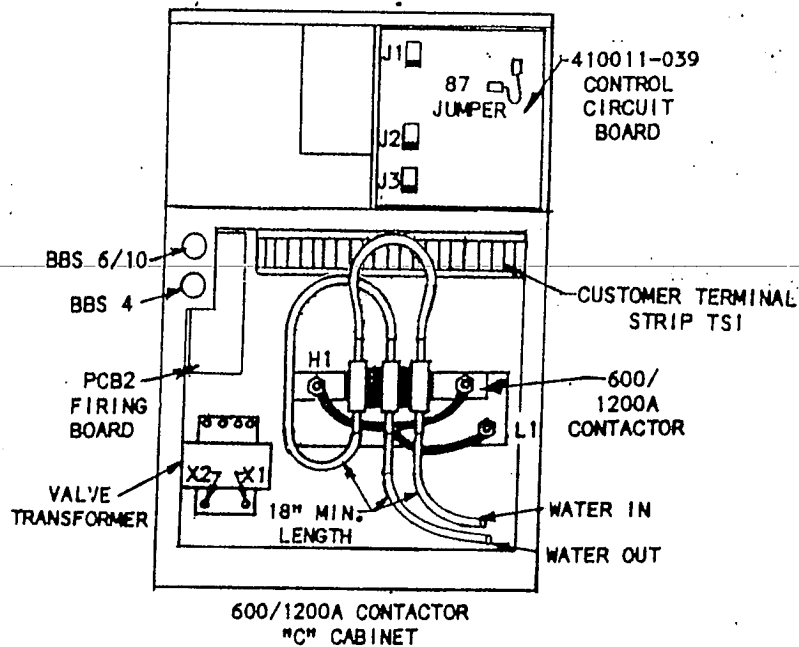
1201/2200A CONTACTOR
"T" CABINET

INSTALLATION DIAGRAMS MOUNTING DIAGRAM "T" & "L" CABINETS



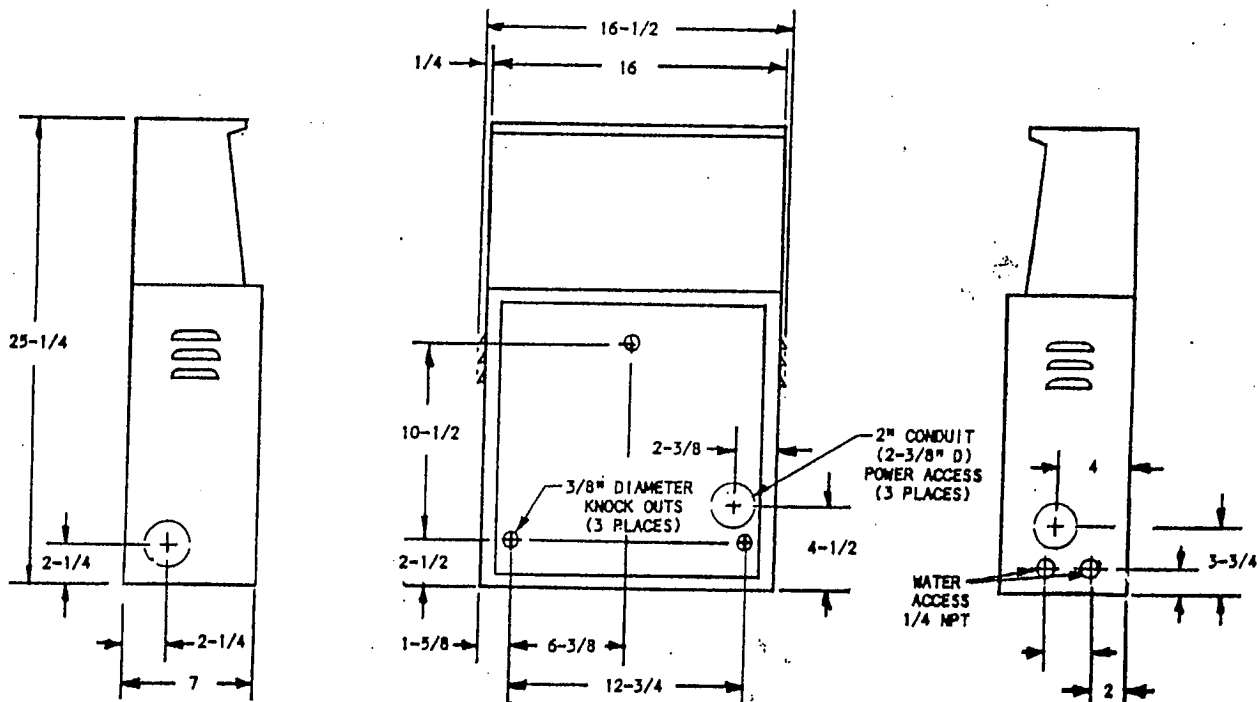
INSTALLATION DIAGRAMS

WIRING DIAGRAM "C" CABINET 420020
LOGIC DIAGRAM 420019



See Page 14 for "M" Cabinet Information.

MOUNTING DIAGRAM "C" CABINET 440038



GENERAL OPERATING INSTRUCTIONS

1. Be sure all electrical connections are properly made and that all fittings are securely tightened. Loose electrical connections can cause faulty or erratic operation of the control and welding machine.
2. If air operated machine, turn on air to machine. Set machine manufacturer's recommended air pressure.
3. Turn on water. Be sure water is flowing freely in drain. (On closed systems check flow gauge for water flow).
4. Place WELD/NO-WELD Switch on Control (or external Weld/No Weld Switch) in the NO-WELD position.
5. Place NON-REPEAT/REPEAT Switch on control to NON-REPEAT position.
6. Set Count Functions for initial machine start-up. For Spot Welding:
 - Set Squeeze Count to 30 to 60 counts.
 - Set Weld count to 2 to 3 counts.
 - Set Hold Count to 10 or 15 counts.
 - Set OFF Count to 50 or 60 counts (for Repeat operation).
 - Set Percent Current to 70% to 80%.
7. Set Welding machine transformer tap to LOW or a low tap switch position.
8. Turn on power. Red Power On light on the control will light.

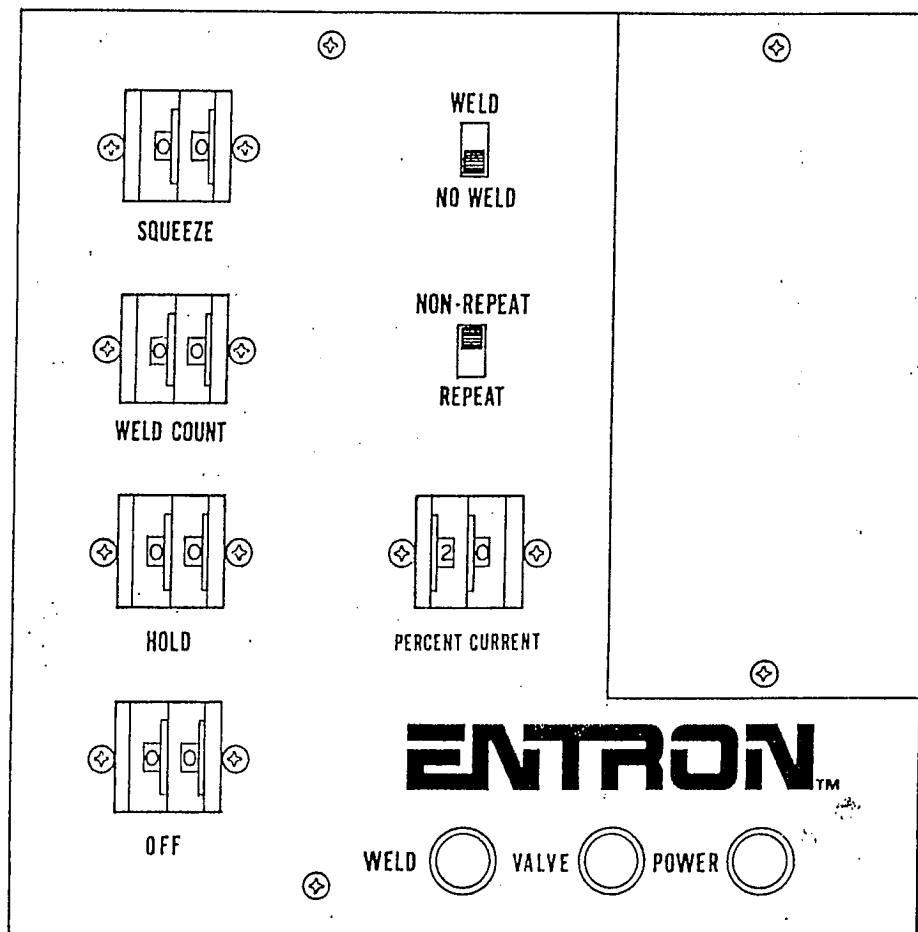
Be sure welding machine head or upper arm is fully retracted before turning on Power.
9. Initiate control. On installations with two stage pilot, depress first stage only. Welding machine head or arms will close. Control will not sequence. Be sure welding electrodes are properly aligned and have closed together. Depress pilot to second stage, control will sequence, but will not weld, and head or arms will retract at the end of the sequence. On single stage operation, closure of the pilot switch will sequence machine. On foot operated machines only, a switch on the mechanical linkage of the machine will initiate a Weld Sequence.

CAUTION

KEEP HANDS, ARMS, OTHER PORTIONS OF THE BODY, CLOTHING AND TOOLS AWAY FROM THE MOVING PARTS OF THE MACHINE.

10. Set Count Functions as recommended by machine manufacturer or RWMA Standards for work to be performed. Place work in machine. Place WELD/NO-WELD Switch to WELD position. Machine is now ready to weld.
11. If no standards have been set*, it is recommended to use a short Weld Count for initial welding. Weld Count can be increased; welding machine tap switch setting can be increased and Percent Current Setting can be adjusted for best weld. The most efficient use of the control and welding machine will generally be made at the lowest welding transformer tap, the highest Percent Current Setting and the shortest Weld Count.
12. On Repeat operations, place NON-REPEAT/REPEAT Switch in REPEAT position. As long as pilot remains closed, control will continue to sequence and re-initiate the machine.

FRONT PANEL FUNCTION SWITCHES



EN200 SERIES
View Typical of "S" Cabinet

* Also refer to Resistance Welder Manufacturers' Association, Resistance Welding Manual or American Welding Society, Recommended Practices for Resistance Welding.

TROUBLE SHOOTING

Please refer to other manual pages and wiring diagrams for location of fuses, terminal strips, etc
Please refer to Wiring & Logic Diagrams for Bills of Material.

TROUBLE	POSSIBLE CAUSE	REMEDY
Power On Light will not light.	I. Fuse F1, type BBS 6/10, control fuse blown.	1. Check that control is wired for proper input line voltage. (H1, H2, H3 and H4 and CTH1, CTH2, CTH3 and CTH4 jumpers on customer terminal strip.
	II. Defective Power On Light.	1. Replace Power On Light.
	III. Main welder disconnect fuses may be blown.	1. Check that fuse is of sufficient size for KVA demand of welding transformer.
	IV. L2 wire to customer terminal strip missing.	1. Add L2 wire (minimum 18 AWG).
Control will not initiate.	I. Initiation switch(s) defective.	1. Replace switch(s).
	II. Loose or broken wire(s) at initiation switch.	1. Check for loose or broken wire(s) at initiation switch(s) and at customer terminal strip (FS1, FS2, etc.)
	III. Fuse F3, type BBS4, valve fuse blown.	1. Check Solenoid coil for short. 2. Check for proper solenoid coil voltage.
	IV. Plug J3 to control board is not seated properly.	1. Check for proper seating and pin alignment.
	V. Defective Control Board.	1. Replace board with another board stamped with the same Assembly Number.
Control initiates, valve light comes on, but electrodes <u>do not</u> close.	I. Solenoid valve circuit mis-wired or broken wires.	1. Check terminals VL1, SV1 and SV2, and associated wiring. (see wiring diagram)
	II. No air or blocked air line.	1. Be sure air is on. 2. Repair or replace air accessories.

TROUBLE	POSSIBLE CAUSE	REMEDY
Control does not initiate, but welder head or arms close.	I. Mis-wired for single stage operation.	1. Check pilot switch between FS3 and FS4.
	II. Second stage pilot switch open.	1. Check for proper operation of pilot switch. Be sure first stage closes before second stage.
	IV. Defective Control Board.	1. Replace board with another board stamped with the same Assembly Number.
Control initiates, but stays in Squeeze.	I. Pressure Switch.	1. Check for defective or malfunctioning pressure switch connected to PS1/PS2. 2. If no pressure switch is used, jumper PS1 and PS2.
	II. Defective Control Board.	1. Replace board with another board stamped with the same Assembly Number.
Control initiates and sequences properly, but <u>soleno</u> <u>id</u> valve chatters.	I. Solenoid valve coil.	1. Check that valve supply voltage is not varying below tolerance, -15%. 2. Check if valve coil is proper voltage. 3. Defective or missing valve load resistor on customer terminal strip (2000Ω, 10 W). 4. Insufficient air pressure. 5. Loose connections in valve wiring.
	II. Defective Control Board.	1. Replace board with another board stamped with the same Assembly Number.
	III. Defective firing Board.	1. Replace board. See wiring diagram for correct Assembly Number.
	IV. L2 wire to customer terminal strip missing.	1. Add L2 wire (min. 18 AWG).

TROUBLE	POSSIBLE CAUSE	REMEDY
Control sequences but will not weld.	I. External Weld/No-Weld Switch, or Weld/No-Weld Switch on front panel of control.	1. Check both for proper operation and/or loose wires on NW1/NW2. 2. If no external Weld/No-Weld Switch is used, connect jumper across NW1/NW2.
	II. Open Temperature Limit Switch.	1. Contactor overheated, causing Limit Switch to open. 2. Defective Limit Switch. Replace Limit Switch. 3. Connect jumper across TLS1/TLS2 if TLS is not used.
	III. Ignitor leads reversed on control used with existing ignitron tube contactor.	1. Interchange leads.
	IV. Welding transformer tap switch in OFF position.	1. Set to ON or at one of the tap positions.
	V. Welding transformer secondary open. (Weld light may light.)	1. Check for corroded or open connections. Be sure welding electrodes close on work.
	VI. Defective firing circuit board.	1. Replace board. See wiring diagram for correct Assembly Number.
	VII. Defective Control Board.	1. Replace board with another board stamped with the same Assembly Number.
Weld light on continuously with Weld/No Weld Switch in NO WELD position.	I. Shorted ignitron tube or thyristor (SCR).	1. Check that mercury in ignitron tube has not splashed up (tap tube lightly) <u>CAUTION: turn power off.</u> 2. Replace defective tube* or SCR.
	II. Ignitor circuit of ignitron tube shorted to ground.	1. Check ignitor leads.
	III. Defective Firing Circuit.	1. Replace Board. See wiring diagram for correct Assembly Number.

*NOTE: It is a good practice to replace both ignitron tubes or the defective tube with a tube of approximately the same service life as the remaining tube.

TROUBLE	POSSIBLE CAUSE	REMEDY
Half cycle during weld time.	I. One ignitor circuit open.	1. Check connections to ignitor resistor. 2. Check ignitor lead connection to tubes. 3. Check for open ignitor fuse. (F4 and F5, BAF6).
	II. One ignitron tube or thyristor does not conduct.	1. Check tube or thyristor for open. Replace.
	III. Defective Firing Circuit Board.	1. Replace Board. See wiring diagram for correct assembly number.
Weld too cool or too small.	I. Line voltage drop.	1. KVA demand for welding transformer too high for input power line.
	II. Excessive pressure at electrodes.	1. Check air supply.
	III. Weld transformer set low.	1. Increase transformer tap setting.
	IV. Weld Count too short.	1. Increase Weld Count duration.
	V. Percent Current too low.	1. Increase value of Percent Current.
	VI. Electrode face too small.	1. Select correct electrode face diameter.
	VII. Excessive tip "mushrooming".	1. Properly dress tips.
	VIII. Defective Count or current switch.	1. Replace switch assembly. Call factory.
"HOT" Welds	I. Insufficient air pressure.	1. Check air supply and accessories.
	II. Weld transformer set high.	1. Reset tap to lower setting.
	III. Weld Count set too high.	1. Reduce Weld Count duration.
	IV. Percent Current set too high.	1. Decrease value of Percent Current.
	V. Electrode diameter too small.	1. Dress or replace tip with proper size.
	VI. Defective count or current switch.	1. Replace switch assembly. Call factory.