

SINGLE PHASE RESISTANCE WELDER

MICROPROCESSOR CONTROLLER MODEL 105F

OPERATING MANUAL

INTRODUCTION

Interlock Industries Incorporated Resistance Welding Controller Model 105F is the latest in Microprocessor welding control. The sophistication of today's electronics is used to simplify the welders operating procedures and logistic of operations. The computer powers are used to greatly enhance the flexibility of programming and storing programs. In the following pages we well attempt to give the user a working knowledge of the control system and it parameters.

CAUTION: Read carefully the installation instructions, prior to installation.

INTERLOCK INDUSTRIES INCORPORATED WARRANTY

The Model 105F Welding Controller has a limited warranty of one year parts and labor, FOB Santa Ana, California, from the time of installation. During that period, upon prepaid return to the distributor of factory, equipment proving to be defective will be repaired (or at our option, replaced) without charge for either material or labor. No responsibility will be assumed for damage to equipment through improper installation, or through attempt to operate it above its' rated capacity, intentional or otherwise.

The SCR'S used in the IGNITRON firing module or SCR contactors are warranted for 90 days, if correct installation procedures are used.

In addition, the warranty does not cover any customer equipment to which the Model 105F controller is installed.

FRONT PANEL PROGRAM SETTINGS

WELD SCHEDULE #1 - #2 - #3	
FORGE DELAY START	00 - 99 CYCLES
SQUEEZE TIME	00 - 99 CYCLES
IMPULSES	00 - 99
COOL TIME	00 - 99 CYCLES
HEAT TIME	00 - 99 CYCLES
HEAT %	00 - 99
QUENCH TIME	00 - 99 CYCLES
TEMPER TIME	00 - 99 CYCLES
TEMPER %	00 - 99
HOLD TIME	01 - 99 CYCLES
OFF TIME	00 - 99 CYCLES
UPSLOPE STEPS	00 - 99
% HEAT PER STEP	0.0 - 9.9

REPEAT: REPEATITIVE SEQUENCE

WELD: ACTIVATES CONTACTOR DURING WELD SEQUENCE

SEAM: COOL - HEAT SEQUENCE

ROLL SPOT: ROLL SPOT WITH CLUTCH/BRAKE ON/OFF CONTROL

MODES OF OPERATION

1. SPOT
2. SEAM
3. ROLL SPOT

SWITCHABLE FEATURES

1. INTERLOCK SCANNER CONTROL
2. WELD SCHEDULE SELECTION BY FOOT SWITCH

PROGRAMMING

Set toggle switch to Weld Schedule 1. Weld Schedule indicating lamp 1 shall be on. The two digit display window shall be dark. The OFF TIME lamp shall be on. This is a typical STAND BY mode condition.

The position of toggle switches REPEAT - WELD - SEAM/ROLL do not matter for the purpose of setting up a weld schedule.

The keyboard has 10 digits 0 - 9. A * key and a RED key.

The * key returns the program to STAND BY mode, and the RED key steps the sequence from FORGE DELAY START through HEAT PER STEP and back to the STAND BY mode.

By pushing the RED key the first time, sequencer will exit to FORGE DELAY START. It should be noted that the OFF TIME lamp is now off and the FORGE DELAY START lamp is on. Also the two digit display is showing a two digit number. If it does not, a two digit value must be entered.

FORGE DELAY START is a delay starting with the beginning of the first impulse of weld. At the end of that delay, the forge valve is turned on, and remains turned on until the end of HOLD TIME.

FORGE DELAY TIME set to 00 = No FORGE.

IMPULSES must be set to a minimum of one. It is a multiplier for COOL TIME + HEAT TIME.

COOL TIME is used when more than one impulse is required, allowing the weld nugget to cool before it is being reheated again.

HEAT TIME is the length of time the heat is being applied. HEAT % is the amount of heat applied.

Both HEAT TIME and HEAT % can be accessed directly by pushing the keys GREEN and RED located adjacent to these functions. After editing these functions, push the * key to exit back to STAND BY mode.

QUENCH TIME allows weld nugget to cool.

TEMPER TIME and TEMPER % function the same as HEAT TIME and HEAT %. It is used to anneal the weld, in order to prevent cracking.

HOLD TIME is programmable from 1 to 99 cycles.

The minimum of 1 cycle of hold time is for safety reasons. It takes that least amount of time to cool a weld nugget under pressure even on very thin materials.

OFF TIME is programmable to other than zero in REPEAT mode, allowing the electrodes to separate. The operator can position the material for the next weld while the foot switch is held closed.

UPSLOPE STEPS is to be set to zero when slope is not used.

HEAT % PER STEP is to be set to zero when slope is not used.

UPSLOPE PROGRAMMING AND OPERATION

Upslope is defined as a stair step ladder, where HEAT % is incremented from an initial value, in small increments, and over a specified period of time. (See Figure 1)

A unit of time (selected from 1 to 99), is composed of two alternating half cycles of electrical current, one positive and one negative.

A program of 01 HEAT TIME at a heat magnitude of 50%, will cause the welder controller to pass to the welding transformer, one positive and one negative half cycle of electrical current, both with a magnitude of 50%. (See Figure 2)

The welder controller can be programmed to increase an initial value of HEAT % (value set in the first impulse and first cycle of HEAT TIME). The heat will be incremented in one cycle steps for the total amount of steps programmed in UPSLOPE STEPS.

The HEAT % per step can be set in fractions of a % from 0.0 to 9.9.

The total number of UPSLOPE STEPS shall be always equal or less than the total number of heat cycles in HEAT TIME.

The upslope feature cannot be used with TEMPER TIME. The illustration in Figure 3 shows a weld schedule using upslope and the relationship between units of HEAT TIME, IMPULSES, STEPS OF UPSLOPE HEAT INCREASE, and ALTERNATE POSITIVE/NEGATIVE HALF CYCLES OF ELECTRICAL CURRENT. Figure 3 will be used to show how the slope is calculated from basic requirements in easy steps:

1. 3 impulses
3 cycles of heat time per impulse
2 cycles of cool time per impulse
2. Slope shall start at 20% heat, increase in 6 cycles of heat time to 50%, and continue at a constant 50% for remaining of 3 cycles of heat time in the third impulse.
3. Set Up: Set IMPULSE counter to 03
Set COOL TIME counter to 02
Set HEAT TIME counter to 03
Set HEAT % counter to 20
4. Calculate and set UPSLOPE STEPS counter
UPSLOPE STEPS = HEAT TIME in cycles
6 cycles of upslope = 6 UPSLOPE STEPS
Set UPSLOPE STEPS counter to 06
5. Calculate and set HEAT % per step counter.

$$\frac{(\text{Ending HEAT \%}) - (\text{Starting HEAT \%})}{\text{UPSLOPE STEPS}} = \text{HEAT \% PER STEP}$$

$$\frac{(50\%) - (20\%)}{6 \text{ steps}} = \frac{5.0 \% \text{ PER STEP}}{1}$$

Set HEAT % per step to 5.0

SEAM/ROLL SPOT

In the SEAM mode the sequencer will step through SQUEEZE to the first impulse and do a COOL TIME/HEAT TIME sequence continuously until the foot switch is released, then step to HOLD TIME and OFF TIME. .

A motor or clutch/brake on/off control output provides 110 VAC to energize an air valve or relay to control motor or clutch/brake activity.

In SEAM mode the output will energize the motor with the second stage of the foot switch.

In ROLL SPOT mode, the output will energize the motor during Off TIME when the foot switch is depressed.

A retraction relay output is also available to operate a retraction valve for Spot, Seam and Roll Spot. A TIP DRESS relay output is available to provide reduced air pressure for tip dressing in Spot, and also energize motor in Seam or Roll Spot at the same time. A terminal strip is available to connect switches to energize all valves independently during set up. All outputs except for SQL are factory installed options. It is suggested that the controller brain panel and peripheral board be returned to the factory for upgrading, when that becomes a requirement.

INTERLOCK

The controller will interface directly with the 10 station Interlock Scanner Model 375. When enabled, it will wait at the end of squeeze time for an enable signal from the scanner, proceed welding, and at the beginning of HOLD TIME, it will signal the scanner to let the next controller in line to start welding.

WELD SCHEDULE SELECTION BY FOOT SWITCH

Typically weld schedule selection is done by a 3 position toggle switch located on the bezel of the brain panel. Once the weld schedule has been programmed, the switch must be set of WELD SCHEDULE 2, for proper operation.

The foot switches for WELD SCHEDULE 1, 2, and 3 will now control during weld, which weld schedule has been selected.

INSTALLATION INSTRUCTIONS.

Use DWG. 1050-101-34 as reference.

The power transformer T1 has 5 taps on the primary side. A metallic sticker on the transformer shows the tap arrangement and physical location. Taps to set are 200V - 220V - 240V - 440V - 480V.

The transformer 110V secondary output has a total capacity of 150VA to be used with the designated loads as specified for the Model 105. All valves have typically a 110VAC/20VA solenoid coil. If the 110V source is to be used to operate an external load switched on/off by a mechanical switch, a 0.1 MF/600V AC capacitor must be used across the switch. If this is not done, electrical noise generated by the switch will interfere with the controller operation.

CHART OF SOLENOID VALVE INTERCONNECT.

1. SV com	TB2 - 8	Common to all valves
2. SV1	TB2 - 1	Tip Dress Valve
3. SV2	TB2 - 2	Retraction Valve
4. SV3	TB2 - 3	SQ1
5. SV4	TB2 - 4	SQ2
6. SV5	TB2 - 5	SQ3
7. SV6	TB2 - 6	Motor/Clutch Rly
8. SV7	TB2 - 7	Forge Valve

CHART OF SOLENOID VALVE MANUAL TRIGGER SWITCHES

Note: The switches will be switching 5VDC/20MA

1. SW com. (Gnd.)	TB1 - 23
2. SW Retraction valve	TB1 - 24
3. SW Tip Dress Valve	TB1 - 25
1. SW com. (Gnd.)	TB3 - 1
2. SW SQ3 Valve	TB3 - 2
3. SW SQ2 Valve	TB3 - 3
4. SW SQ1 Valve	TB3 - 4

To energize one welding transformer, one firing module is connected to TB1-18 and 19. (Observe Polarity)

PRESSURE SWITCH CONNECTION

Terminal strip TB1-10 and TB1-11 are to be connected to a N.O. pressure switch. After the closure of first stage foot switch FS1, the controller will lock in the squeeze valve until the pressure switch is closed. Then it will allow the sequence to start if FS2 is also closed. If pressure switch closure does not occur, this condition will prevail indefinitely, unless the emergency stop switch (TB1-6/TB1-7) is momentarily opened.

A normally closed temperature switch is connected across TB1-11 and TB1-12. This switch is connected in series with the pressure switch described above.

PERIPHERAL DIAGNOSTICS.

On the brain panel there is a row of red lamps L.E.D. in a rectangular package called LM1.

When either one is lit, it has the following indication:

1. PS/TS Pressure switch and thermal switch are closed.
2. FS1 Foot switch first stage switch is closed.
3. FS2 Foot switch second stage switch is closed.
4. FORGE SOL. Computer is turning on the forge relay.
5. SQ1 SOL. Computer is turning on the squeeze 1 relay.
6. SQ2 SOL. Computer is turning on the squeeze 2 relay.
7. SQ3 SOL. Computer is turning on the squeeze 3 relay.
8. MOTOR Computer is turning on the motor relay.
9. SCAN OUT Computer is turning on the INTERLOCK output.
10. OFF OUT Computer is turning on the OFF TIME output.
11. LED 17 Computer is receiving signal from Interlock scanner to start welding.
12. LED 18 Computer is generating pulses to energize the firing module.

OPERATING MODE SETTING

On the brain panel is a 2 minidip switch module labeled S5 for setting the operating mode.

<u>S5 - 1</u>	:	<u>S5 - 2</u>	:	<u>Operating Mode</u>
OFF	:	OFF	:	SPOT WELD no interlock
	:		:	
ON	:	OFF	:	SEAM / ROLL SPOT no interlock
	:		:	
ON	:	ON	:	SEAM / ROLL SPOT interlock on
	:		:	
OFF	:	ON	:	SPOT WELD interlock on

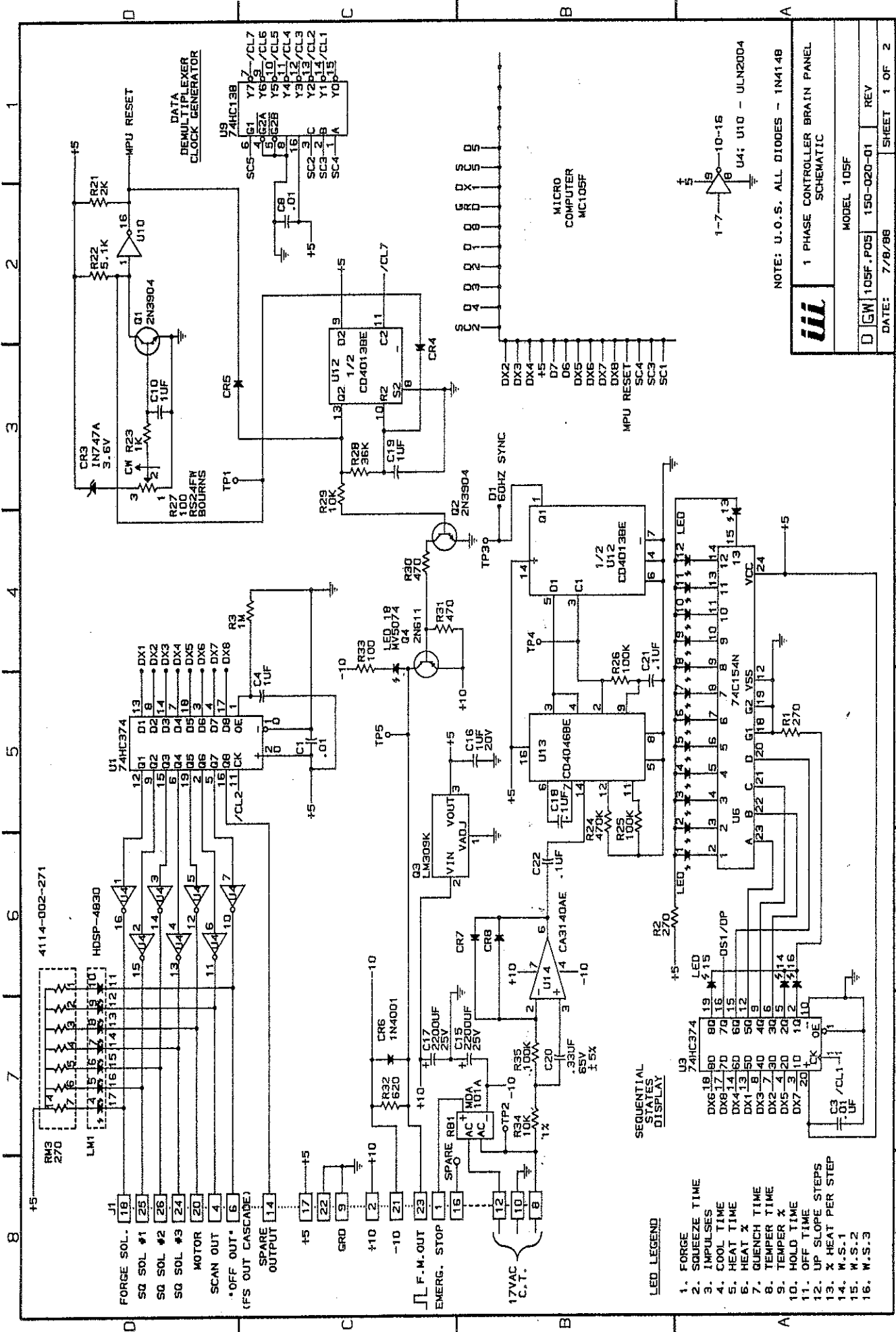
87 DEGREE FIRING LIMIT is active only for the first heat cycle after SQUEEZE TIME.

UNDER VOLTAGE LINE MONITOR

Potentiometer R27 is factory preset to halt the controller, if the line voltage dips below a safe operating limit. Typically there is a 20% line voltage drop margin with no effect on the power line monitor.

POWER UP PROTECTION

The controller's computer monitors the foot switch condition on power up, and if it finds it to be closed, it will inhibit operation. It will also flag the operator by inserting the number 88 in the display window. Simply release foot switch, then proceed welding.



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NOTE: U.O.S. ALL DIODES - 1N4148

1 PHASE CONTROLLER BRAIN PANEL SCHEMATIC

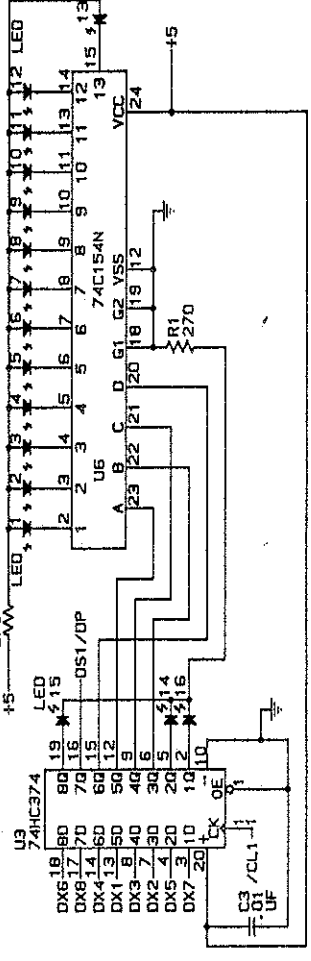
MODEL 105F

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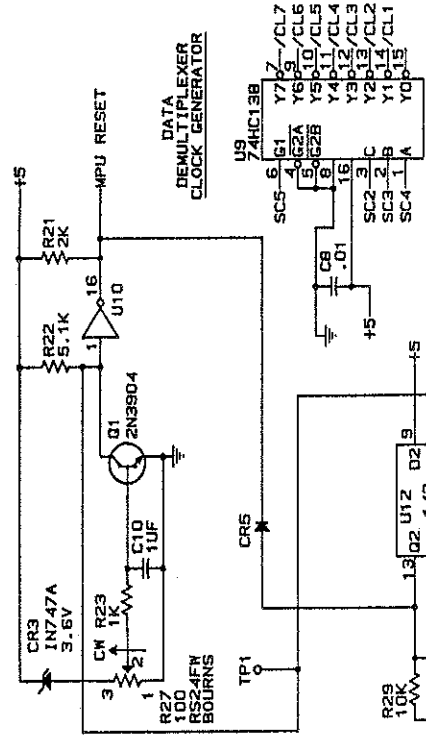
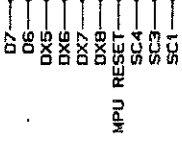
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- LED LEGEND**
1. FORGE
 2. SQUEEZE TIME
 3. IMPULSES
 4. COOL TIME
 5. HEAT X
 6. HEAT X
 7. QUENCH TIME
 8. TEMPER X
 9. TEMPER X
 10. HOLD TIME
 11. OFF TIME
 12. UP SLOPE STEPS
 13. X HEAT PER STEP
 14. W.S.1
 15. W.S.2
 16. W.S.3

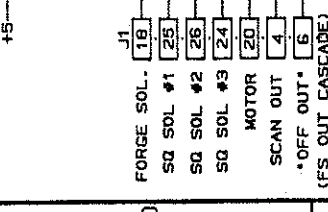
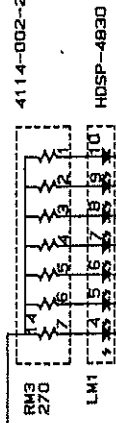
SEQUENTIAL STATES DISPLAY

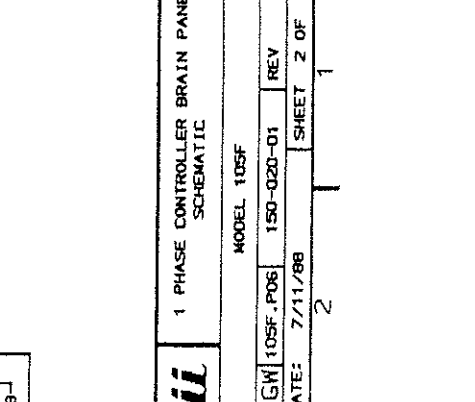
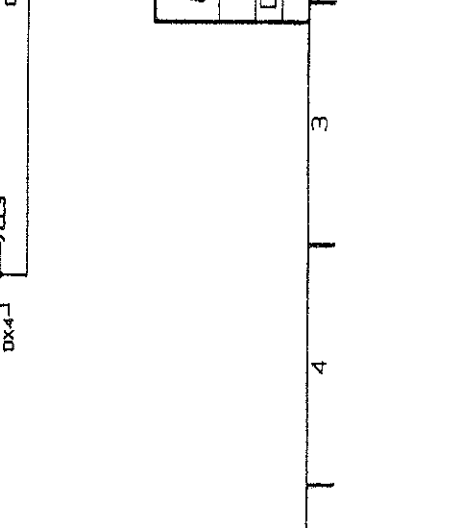
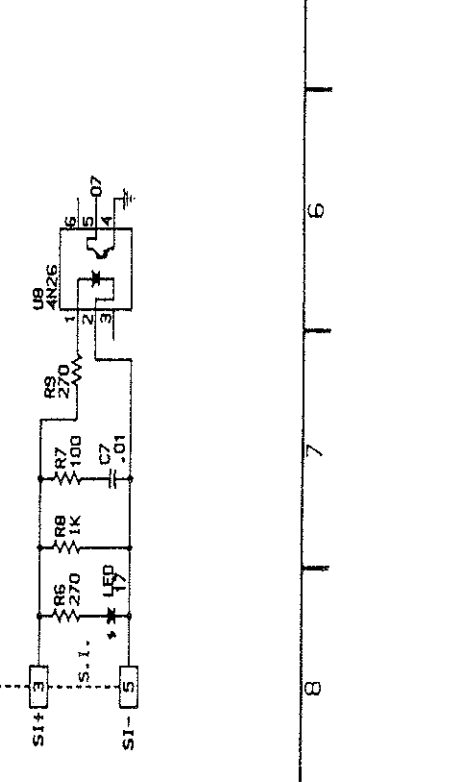
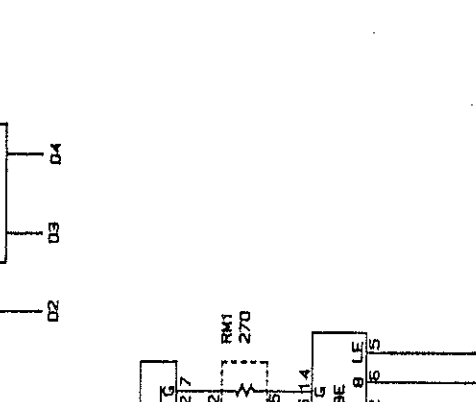
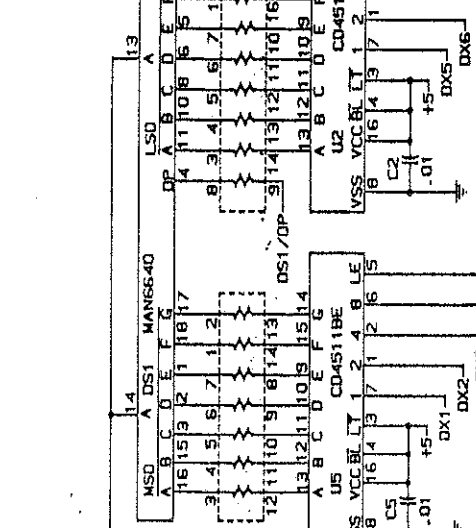
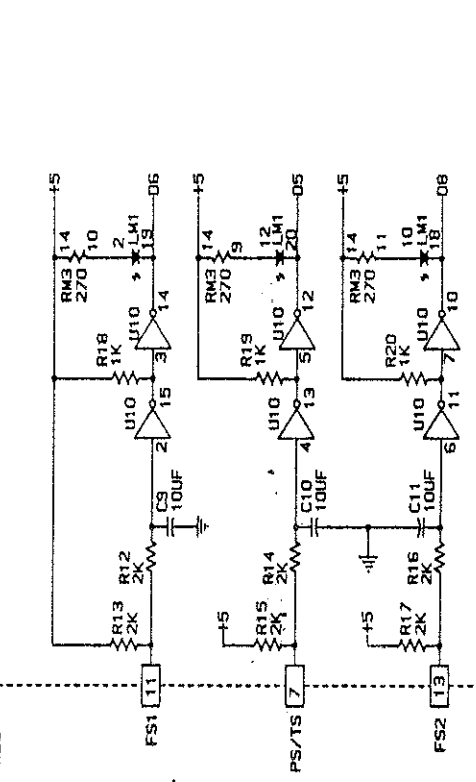
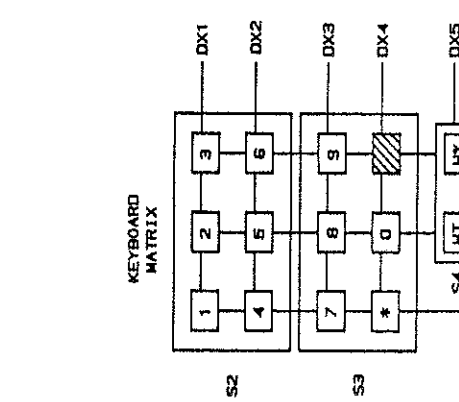
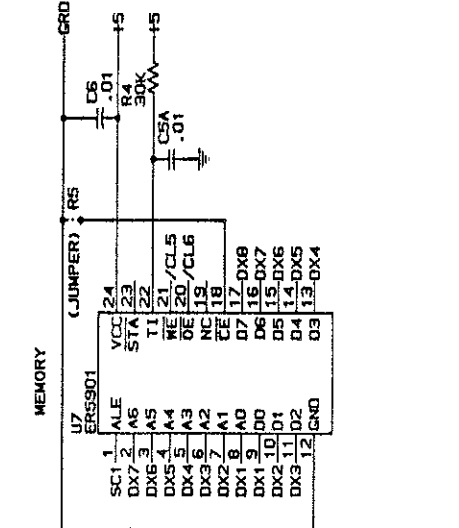
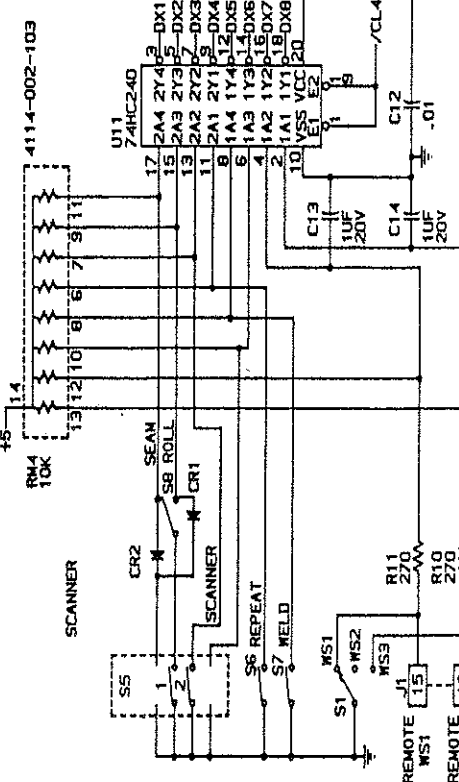


MICRO COMPUTER MC105F



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1 PHASE CONTROLLER BRAIN PANEL
SCHEMATIC

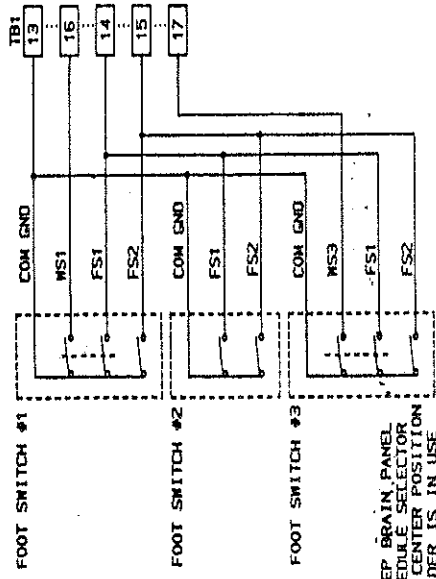
MODEL 105F

GW 105F.P06 150-020-01 REV

DATE: 7/11/88

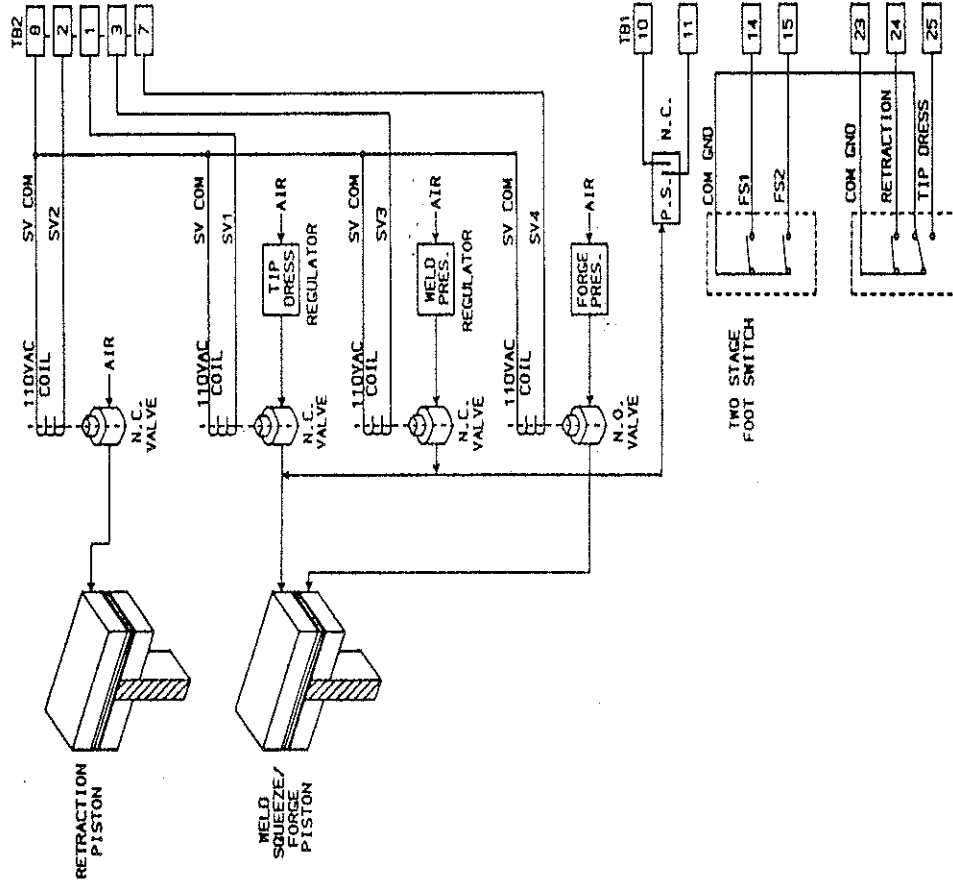
SHEET 2 OF 2

WELD SCHEDULE SELECTION BY FOOT SWITCH CONNECTION



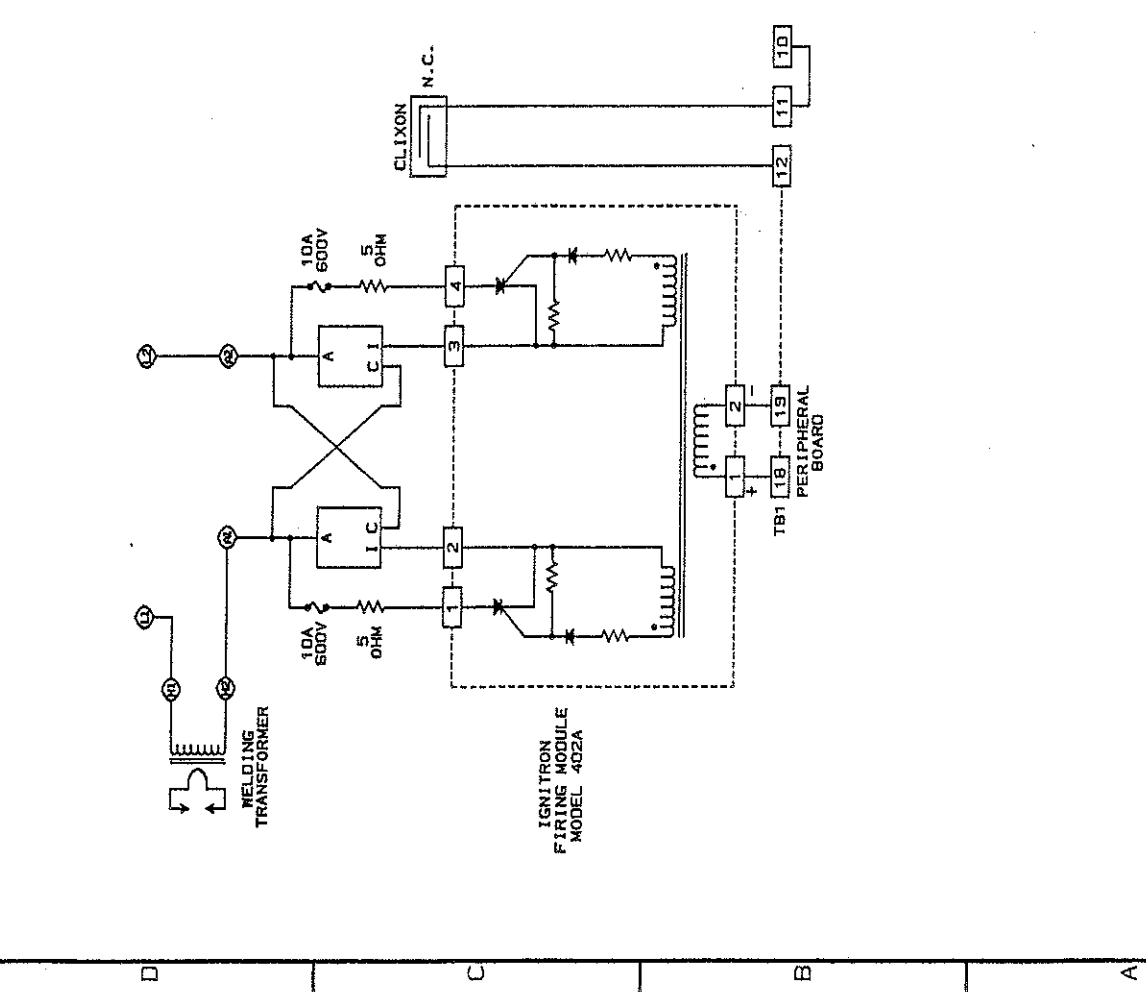
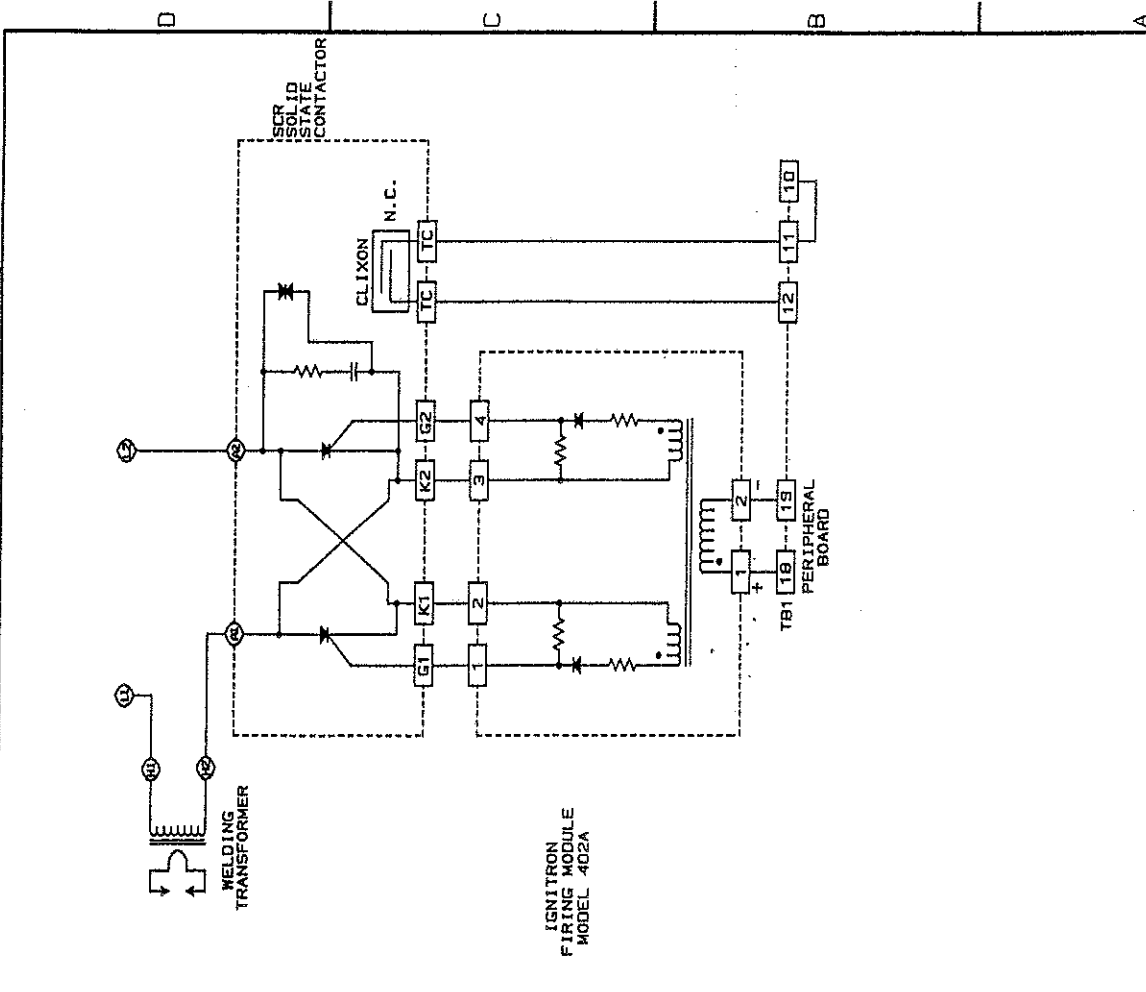
NOTE: KEEP BRAIN PANEL WELD SCHEDULE SELECTOR SWITCH IN CENTER POSITION WHEN WELDER IS IN USE

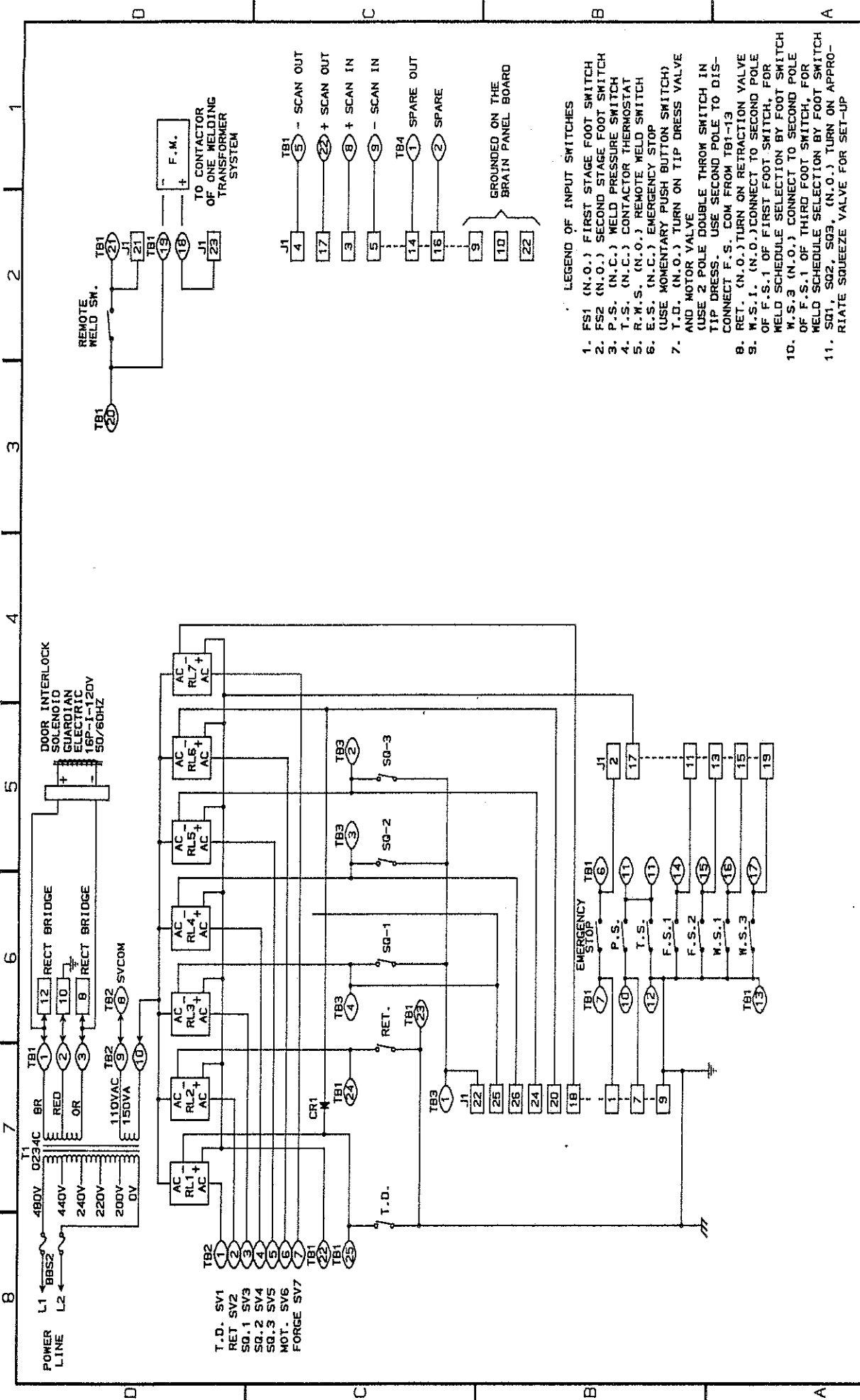
STANDARD SPOT WELD CONNECTION



iii		VALVE AND FOOT SWITCH INTERCONNECT MODEL 105F	
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DATE: 6/25/88		SHEET 1 OF 2	

1 2 3 4 5 6 7 8



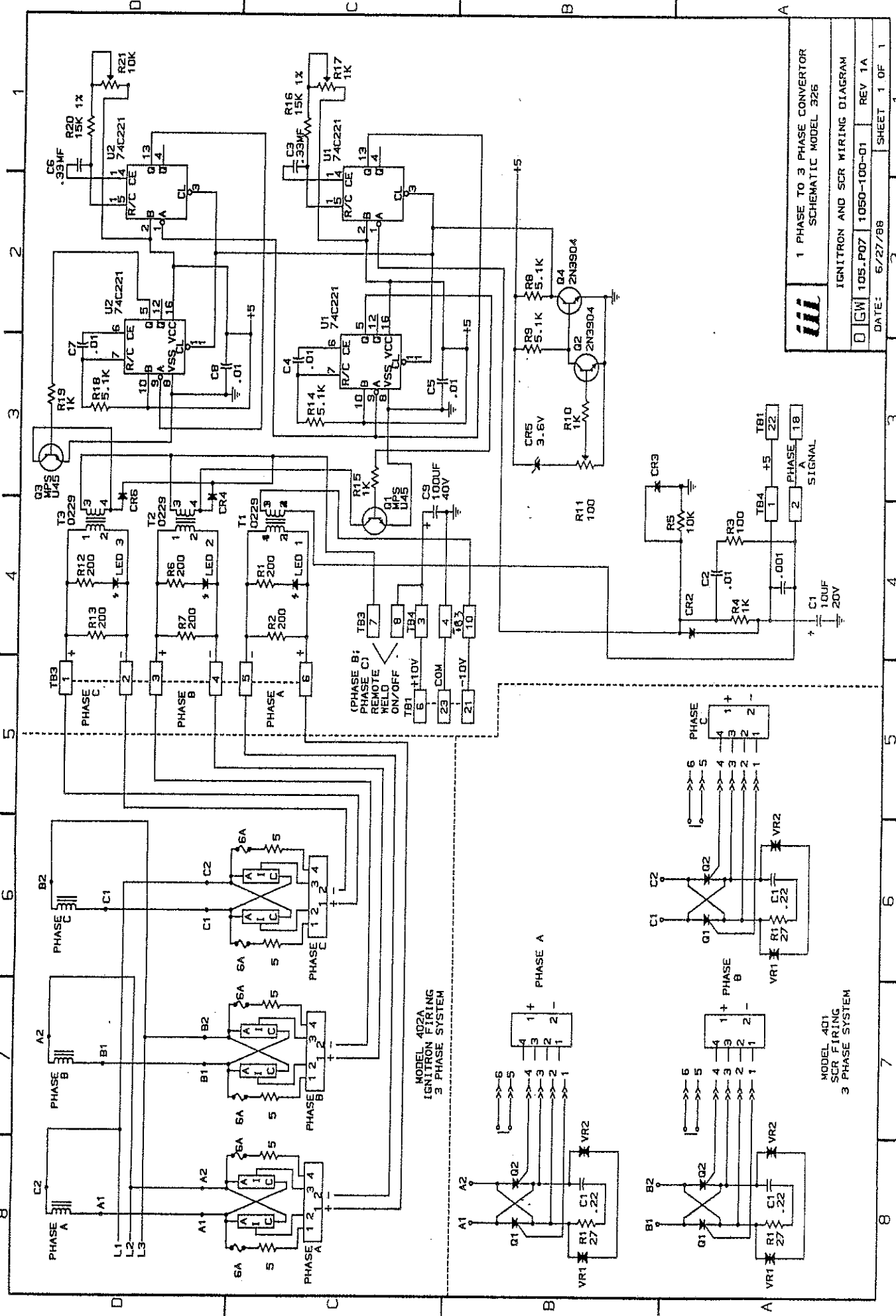


- LEGEND OF INPUT SWITCHES
1. FS1 (N.O.) FIRST STAGE FOOT SWITCH
 2. FS2 (N.O.) SECOND STAGE FOOT SWITCH
 3. P.S. (N.C.) WELD PRESSURE SWITCH
 4. T.S. (N.C.) CONTACTOR THERMOSTAT
 5. R.M.S. (N.O.) REMOTE WELD SWITCH
 6. E.S. (N.C.) EMERGENCY STOP (USE MOMENTARY PUSH BUTTON SWITCH)
 7. T.D. (N.O.) TURN ON TIP DRESS VALVE AND MOTOR VALVE (USE 2 POLE DOUBLE THROW SWITCH IN TIP DRESS. USE SECOND POLE TO DISCONNECT F.S. COM FROM TB1-13)
 8. RET. (N.O.) TURN ON RETRACTION VALVE OF F.S.1 (N.O.) CONNECT TO SECOND POLE WELD SCHEDULE SELECTION BY FOOT SWITCH
 9. M.S.1 (N.O.) CONNECT TO SECOND POLE WELD SCHEDULE SELECTION BY FOOT SWITCH OF F.S.1 OF THIRD FOOT SWITCH, FOR WELD SCHEDULE SELECTION BY FOOT SWITCH
 10. M.S.3 (N.O.) CONNECT TO SECOND POLE WELD SCHEDULE SELECTION BY FOOT SWITCH OF F.S.1 OF THIRD FOOT SWITCH, FOR RIATE SQUEEZE VALVE FOR SET-UP
 11. RIATE SQUEEZE VALVE FOR SET-UP



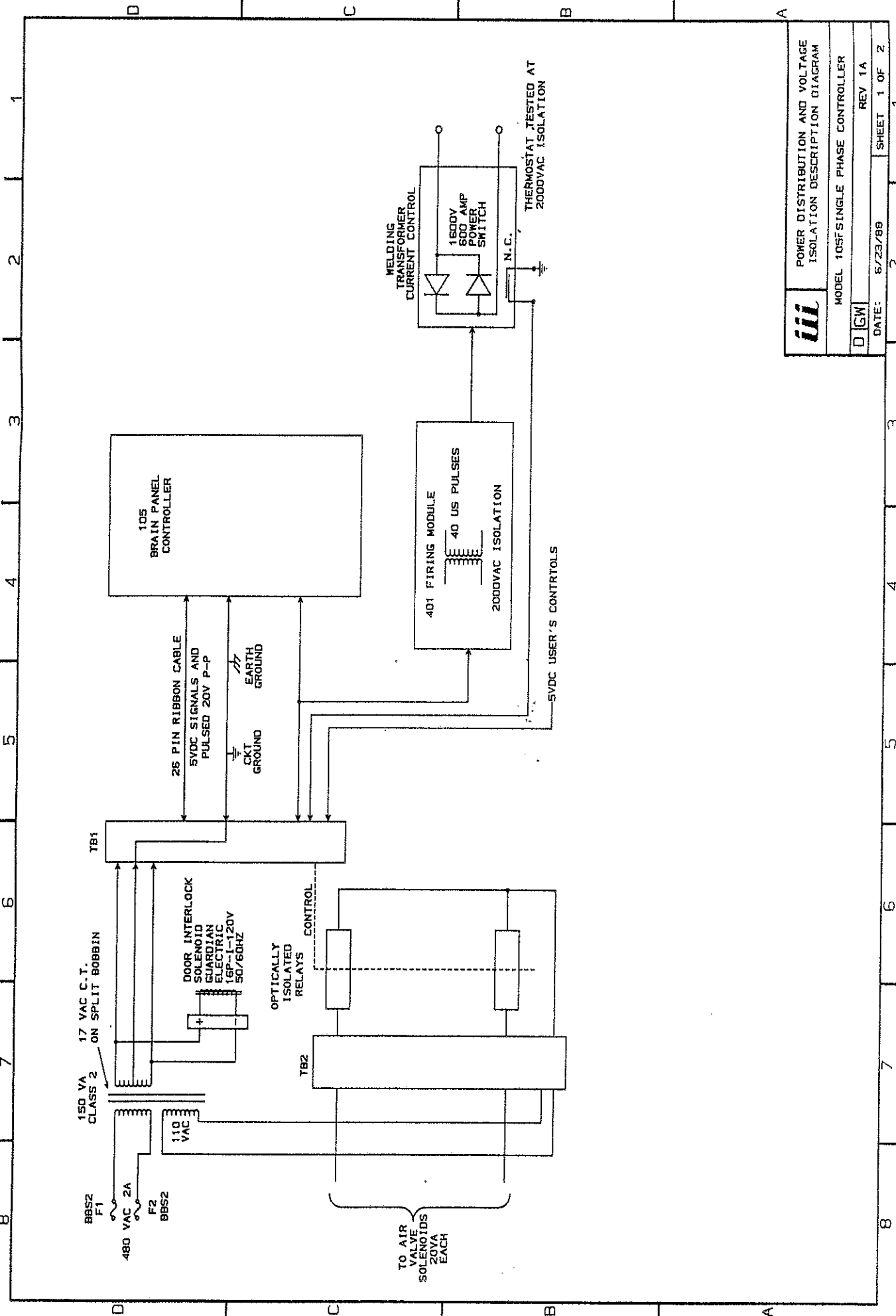
10 CONTROLLER PERIPHERAL BOARD
MODEL 105F

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DATE: 8/24/88 SHEET 1 OF 2



MODEL 402A
 IGNITRON FIRING
 3 PHASE SYSTEM

MODEL 401
 SCR FIRING
 3 PHASE SYSTEM



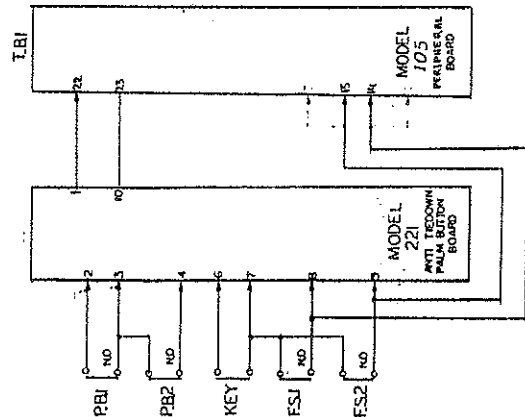
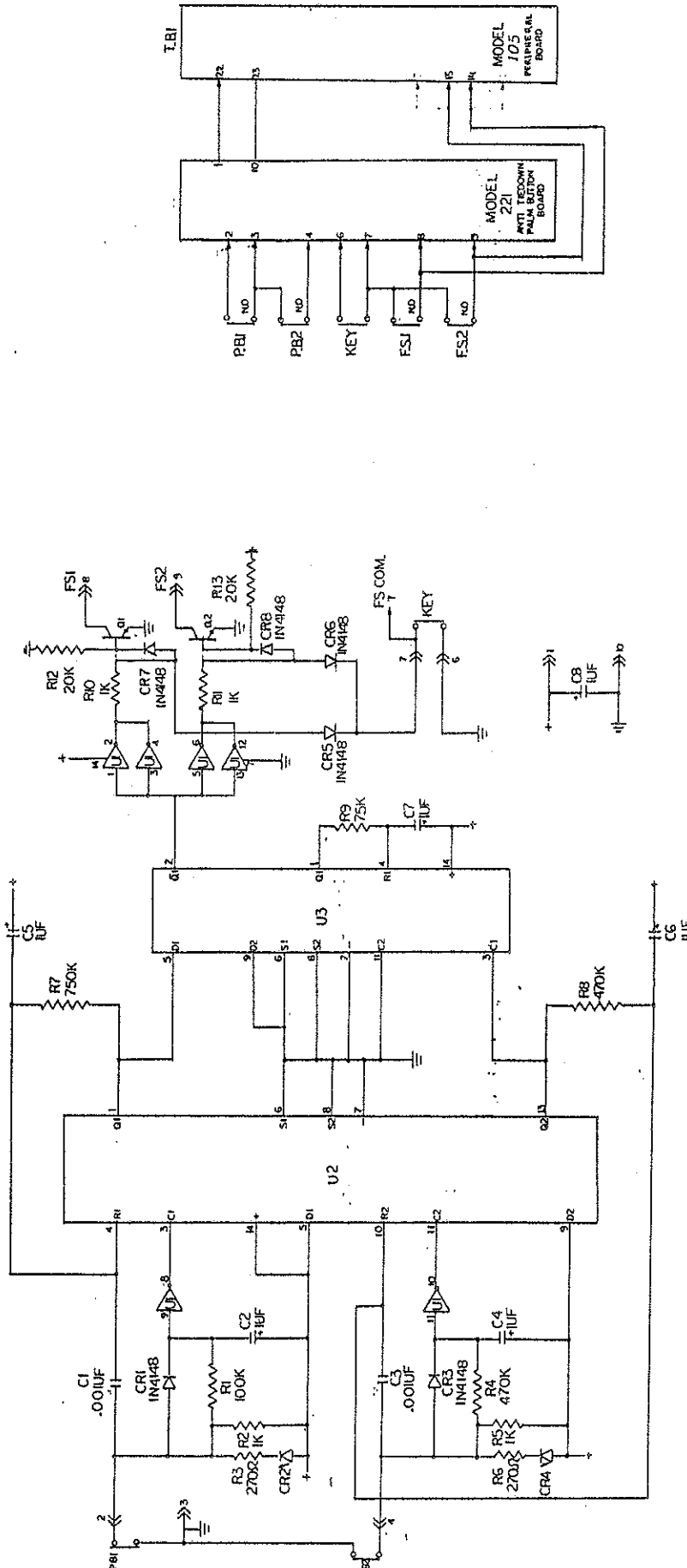
POWER DISTRIBUTION AND VOLTAGE
ISOLATION DESCRIPTION DIAGRAM

MODEL 105 SINGLE PHASE CONTROLLER

REV 1A

DATE: 6/23/88

SHEET 1 OF 2



SCHEMATIC WIRE DIAGRAM

REV	1
DATE	12/24/85
DESIGNER	F. J. ...
CHECKED	
APPROVED	

ANTI TEDOWN PALM BUTTON BOARD
INTERLOCK IND. INC. 1010-53

U1 - MC4584B
U2, U3 - CD4013BE
U4, U5, U6 - 2N3904