VHF Pulse Transmitter

MANUAL

TUNING AND LOCAL OPERATION

Set Up and General Information

Prior to any other procedures, the transmitter side panels should be removed and the transmitter unit inspected. All loose hardware and connectors should be tightened. All connectors in the controller compartment MUST BE FIRMLY SEATED for the unit to work.

Also, check that the RF tubes are firmly seated in their sockets. Replace both side panels. The transmitter will not function if the side panels are not installed, and the RF side must have all of its screws in to ensure the proper flow of ground currents. Please use only the #10-32 x 1/4" stainless steel pan head screws supplied with the unit.

Once these steps are complete, the transmitter may be connected to the AC line (208-240 VAC). The antenna or dummy load may be connected to the RF OUTPUT. The high-voltage switch should be set at 3 KV whenever the unit is set up following shipment or long periods of disuse. For initial tuning it is important to use 3 KV to limit power during mismatches. When the RF signal is attached to the transmitter for tuning, a pulse of less than 20 microseconds and a duty cycle of less than 0.1% should be used for the same reason.

Filament/Cathode Bias Setup

The primary of the Filament/Cathode Bias transformer has taps for 200, 210, 220, 230 and 240 VAC. This facilitates choice of primary to best match the local power distribution network and establishes an appropriate filament voltage.

Measure the local line voltage and adjust the transformer primary tap to most closely match it.

WX-49 Primary Pin Assignments

Pin	Function
1	Common
2	Blower Autotransformer 120 VAC
3	200 V tap
4	210 V tap
5	220 V tap
6	230 V tap
7	240 V tap

Initial Checks

Move the circuit breaker to the ON (up) position to turn on the microcontroller and the interface circuitry. The controller will respond with four horizontal bars in the center of the display. The keyboard is used for manual control of the transmitter and for monitoring various operating parameters. When the remote/local switch is set to remote, the parameters may be monitored locally, but the unit cannot be controlled manually. The switch must be set to local for tuning and testing. Transmitter parameters can be monitored by keying in the following sequence: A (for analog), the channel number, and E (for execute).

In the following table, SSD is the Solid-State Driver.

ANALOG CH. NO.	PARAMETER	UNIT
0	High Voltage 1 (8 KV)	Volt
1	High Voltage 2 (4 KV)	Volt
2	Cathode Bias Voltage, Final	Volt
3	Cathode Bias Voltage, Drive	Volt
4	Cathode Current, Final	Milliamp
5	Cathode Current, Driver	Milliamp
6	SSD Final, Supply Current	Amp
7	SSD Driver, Supply Current	Amp
8	SSD Final, Supply Voltage	Volt
9	T/R Duty Cycle	%
10	Microcontroller Supply Voltage (+5)	Volt
11	Relay Supply Voltage (+28)	Volt
12	Filament Voltage, Final	Volt,RMS
13	Exhaust Air Temperature	Degrees C
14	RF Output Pulse Power Forward	Kilowatt
15	RF Output Pulse Power, Reflected	Kilowatt
16	VSWR	

Check each parameter at each stage of the initial transmitter tuning. At machine state 0, there should be values displayed for channels 10, 11, and 13. If these are correct, then the procedure may continue.

PARAMETERS

Expected Limits

#	Label	State 0	State 1	State 3	State 4
0	High Voltage 1 (8KV)	na	na	2-8KV(1)	nc
1	High Voltage 2 (4KV)	na	na	1-4KV(1)	nc
2	Cathode Bias Voltage,Final	na	58-75V	nc	nc
3	Cathode Bias Voltage,Driver	na	42-54V	nc	nc
4	Cathode Current, Final	na	40-60mA	nc	40-600mA(2)
5	Cathode Current, Driver	na	35-40mA	nc	35-160mA(2)
6	SSD-Final, Current	na	<100 mA	nc	0-3A(2)
7	SSD-Driver, Current	na	<50mA	nc	0-1A(2)
8	SSD-Final, Voltage	na	14.8-16.5V	nc	nc
9	T/R Duty Cycle	na	na	na	8.0%(2)
10	+5 Supply Voltage	4.9-5.05V	nc	nc	nc
11	+28 Supply Voltage	24-32V	nc	nc	nc
12	Filament Voltage,RMS,Final	na	9.8-10.7V	nc	nc
13	Temperature of Exhaust Air	0-60°C	nc	nc	nc
14	RF Output, Forward	na	na	na	0-65KW(2)
15	RF Output, Reflected	na	na	na	0-7KW(2)
16	VSWR	na	na	na	1-2.0/1(2)

na - Not Active - These channels should be zero or near it.
nc - No Change
(1) - Depends on setting.
(2) - Depends on plate voltages, duty cycle, tuning, and load.

All limits reflect values which one may encounter in normal operation. The actual limits differ somewhat to allow for orderly behavior during shutdowns. Metering is intended to monitor the transmitter performance and is not intended as an exact measure of any parameter.

MACHINE STATES AND BRINGING THE TRANSMITTER UP

The transmitter has five machine states, four of which are called up by the operator from the keyboard.

Machine state 0 is power applied to the controller and its support.

Machine state 1 turns on the fan, cathode bias supplies, filament supplies, and the solid-state driver supplies.

Machine state 2 is the intermediate step start position to high-voltage. The step-start limits the inrush current when the high-voltage supply is turned on.

Machine state 3 is the high-voltage supply turned on.

Machine state 4 enables the input switch, allowing RF into the unit.

At each stage, the controller will register a fault if the parameter values are out of limits. The controller will return to the preceding machine state or will not allow the operator to proceed without correcting and clearing the error.

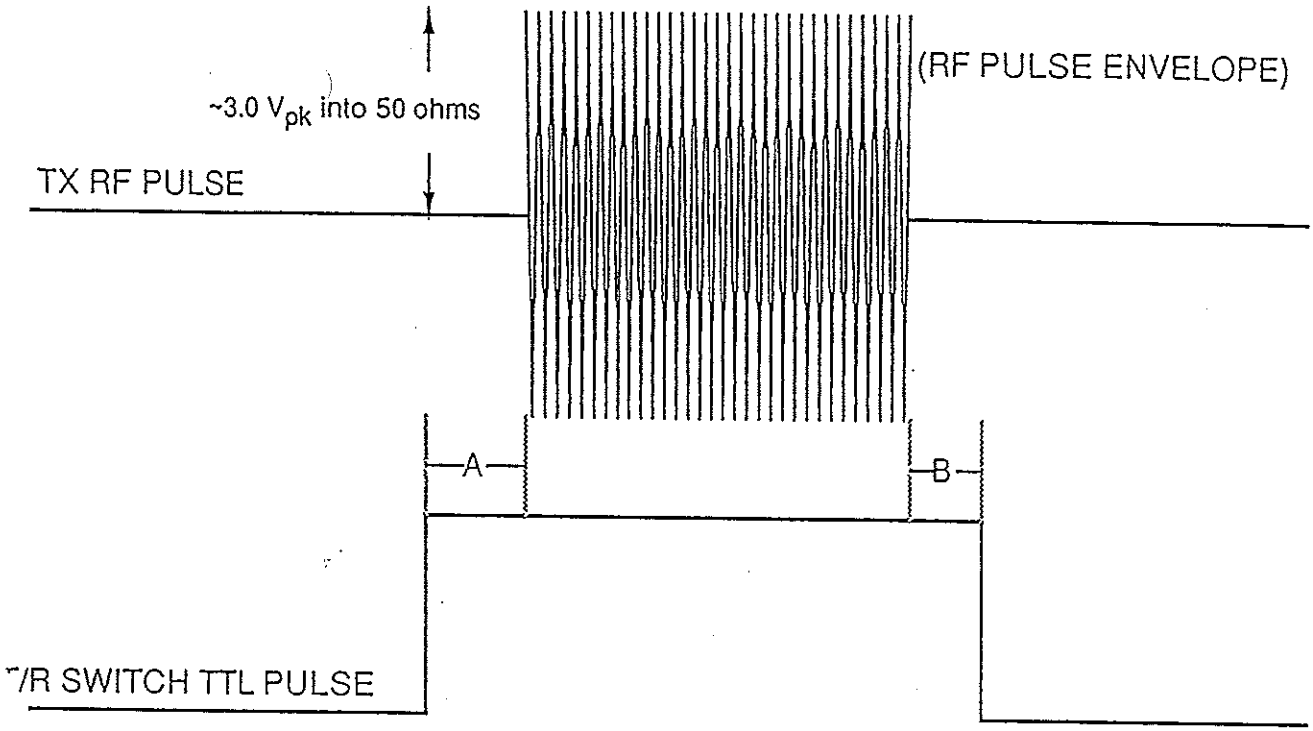
The error codes are:

0	No error
1	Analog parameter error at state 0
2	Machine state 2 requested
3	Air pressure failure
4	Analog parameter error at state 1
5	High-voltage fuse failure
6	Analog parameter error at state 3
7	Analog parameter error at state 4
8	High-voltage step-start aborted for parameter error

The keying sequence for changing machine states is: F (for functions, machine state number, and E (for execute). If the parameters in state 0 were correct, machine state 1 may be brought up by keying in F1E. The controller will respond with three bars in the first column of the display.

NOTE: The display is a bar graph. The center bar represents state available, the lower bar represents state called and the upper bar represents state active. The graph allows quick visual determination of current machine state.

The analog parameters should be reviewed again while the unit is in machine state 1. The cathode bias parameters, the solid-state driver parameters, the filament voltage, the microcontroller voltage, the relay voltage supply, and the temperature reading should now be valid. At this point, if the transmitter is requested to proceed to another state, or is shut off, the controller will remain in state 1 for 300 seconds, as long as the parameters are within preset limits.



The T/R switch ttl pulse is active high.
It must lead the RF pulse by at least 2μsec (A)
and lag the RF pulse by at least 1μsec (B).

If the machine state 1 parameters are acceptable, machine state 3 (high voltage) may be requested by keying in F3E. The display will show state 3 called, and the transmitter will proceed through state 2 to state 3. The analog parameters will show high voltage present, with the rest of the parameters unchanged from machine state 1.

RF and Tuning

Connect an oscilloscope to the forward directional coupler port on the front of the transmitter. Terminate the cable in 50 ohms at the scope end. The scope can also monitor the RF input signal.

If the parameters in state 3 are correct, the RF input signal may be connected to the unit. For initial tuning, confirm that the high-voltage switch is on 4 KV, with the input signal on a short pulse and low duty cycle. The transmitter will not put out RF until it is in machine state 4. As a precaution, confirm the analog parameters, and that the load or antenna is properly attached.

Key in F4E to enable the input RF switch. Initial tuning should be done with the final stage load and tune. These two frequently affect each other nonlinearly, so they must be adjusted together. Adjust until the signal level from the directional coupler achieves a maximum. Adjust the final stage input tuning. Return to the output tuning after finding the maximum with the input. Adjust the load and tune of the driver stage and return to the preceding adjustments to verify them. Finally, adjust the driver input tuning and return by stages to the output, adjusting each stage for maximum throughout the procedure.

The amplifier stages are class C, so that if one stage is badly out of tune on an early stage, there may be very little RF output. This should not happen if using the factory test settings. If, however, there is no signal on the forward directional coupler when beginning the adjustment procedure, adjust the driver input tune.

If the tuning is satisfactory, the higher voltages may be called up as required. Adjust the voltage using the rotary switch to the right of the breaker.

NOTE: If the voltage setting is changed during transmitter operation, it must be done quickly because the switch is noncontacting between settings, and slow adjustment will give an analog parameter error. In order to eliminate this possibility, it is best to return the transmitter to machine state 1 for voltage adjustments. Be sure to retune the transmitter at each voltage setting to maximize the signal output.

Normal Local Operation

Once the transmitter is properly tuned, the input signal may be adjusted within the specification limits (of pulse width and duty cycle). Some retuning may be required for changes.

During normal use, the desired machine state may be requested immediately. State 4 may be called up directly from state 0, or state 0 from state 4. Once again,after a period of disuse or if the transmitter shows an error, a parameter check should be done and the transmitter should be retuned. As the tubes age, there may be a need for periodic retuning.

Remote Operation

The transmitter can be operated by remote control through the RS-232C serial port. The Remote/Local switch must be set to Remote. A description of the protocol and the command list are included in the Transmitter Control Command & Data Format Summary. This includes a command summary for both local and remote operations.

Errors

The transmitter will operate error-free as long as the external parameters remain within specification (e.g. line voltage, duty cycle, pulse amplitude and pulse length, antenna VSWR, etc.)

Should an error occur, read the parameter number. If it is an analog error, switch to remote operation and poll the controller LIFO (last-in first-out buffer) through the RS-232C port to find the parameter that is out of bounds. A Ctrl E, D at the terminal will dump the LIFO until a Ctrl E, X is received. The output displayed at the terminal shows the 17 parameters in hex, one spare, and the status registers. Each data point represents machine status in 0.1 second intervals going back from the error.

Most errors after shipment will be due to fuses or loose connectors. Loose connectors usually show up as anomalous values (which will sometimes vary) among the analog parameters. Once again, the connectors must be firmly seated and correctly oriented. Connectors which are incorrectly oriented or which are otherwise plugged in incorrectly can damage the control circuitry.

FUSE REPLACEMENT

The transmitter must be OFF when fuses are changed.

Fuses 1 through 6 are type 3AG. They are accessible on the back panel, with values marked on the panel.

Fuses 7 and 8 are high-voltage fuses. In order to replace them, remove the panel on the rear of the power supply section. (This panel is identified by the "Danger High Voltage" sign.)

NOTE: Remove only the six screws on the panel periphery. DO NOT remove the center screws - they attach parts of the interlock. With the panel off, remove the fuses from their clips. The Tycho fuse tube may be reused by first cleaning the residue and then installing #38 bare copper wire diagonally inside the tube, with the wire ends under the hose clamps and the clamps tightened. #38 magnet wire with the ends stripped may be used in place of the bare copper wire. Buss brand HVL fuses may also be used. Place the fuses in the appropriate clips and replace the cover. The transmitter will not operate without the cover panel in place.

LOCAL KEYPAD/DISPLAY

Display:

1. When not otherwise engaged, the 4-digit 7-segment local display shows a quasi-bargraph representation of the actual and requested machine states:

```
POW  HV1  HV2  RFD
____ ____                    <- ACTUAL STATE
____ ____ ____ ____          <- POSITION INDICATOR
____ ____ ____               <- REQUESTED STATE
^    ^    ^    ^
ON   ON   REQ  OFF
```

2. Displays of analog parameters are scaled and have a radix point appropriately positioned to indicate actual value.

3. Displays of memory addresses or contents are 2 or 4 digit hexadecimal integers as appropriate.

Keypad:

1. Local machine control and parameter display is accomplished by entering single or multiple character commands at the hexadecimal keypad.

GENERAL MNEMONICS

FIRST CHR.	A	Analog
	B	(future use)
	C	Clear
	D	Display Internal Memory
	E	Display External Memory
	F	Function

LAST CHR.	C	Clear
	E	Enter

TRANSMITTER CONTROL COMMAND & DATA FORMAT SUMMARY

SERIAL PORT

Hardware:

1. RS-232C levels, DTE data direction.
2. Interface is a 25-pin D-type female panel-mounted connector with the following pin assignments:

PIN	FUNCTION
1	Chassis Ground
2	Data Out
3	Data In
7	Signal Ground
All Others	NC

Protocol:

1. Rate: 1200 bits/s.
2. Bits per frame: 11

First	0	start
	D0	ASCII chr.
	D1	
	D2	
	D3	
	D4	
	D5	
	D6	
	D7	parity: 0 on transmit, ignored on receive
	1	stop
last	1	stop

328-7686

2. These basic data units (above) are combined to form the Parameter Group (PG), consisting of [16 AP's, 2 SB's, CR, LF]. This is sent by the controller to the host in the following order:

PARAM. NO.	PARAMETER	SCALE
0	High Voltage 1 (8KV)	50.0 V
1	High Voltage 2 (4 KV)	50.0 V
2	Cathode Bias Voltage, Final	0.5 V
3	Cathode Bias Voltage, Driver	0.5 V
4	Cathode Current, Final	2.0 mA
5	Cathode Current, Driver	1.0 mA
6	SS Final, Supply Current	20.0 mA
7	SS Driver, Supply Current	10.0 mA
8	SS Final, Supply Voltage	0.1 V
9	T/R Duty Cycle	0.1%
10	+5 Supply Voltage	0.05 V
11	+28 Supply Voltage	0.2 V
12	Heater Voltage, RMS, Final	0.05 V
13	Temperature of Exhaust Air	0.5 Deg. C
14	RF Output, Forward RMS Voltage	10.0 V
15	RF Output, Reflec. RMS Voltage	10.0 V
16	VSWR	0.0625:1
17	(Future Use)	
18	Status Register 0	
19	Status Register 1	

NOTE: Each actual parameter is (N x S) where N is the 3-digit PG integer (range 0-255), and S is the appropriate Scale Factor from the above table.

3. The Status Registers (see PG parameters 19, 20 above) have the following bit assignments:

	7	6	5	4	3	2	1	0
SR0	LOC	FUH	FUL	AIR	FRD	HV2	HV1	POW

All bits are High True and have the following interpretation:

POW Main Power ON
HV1 High-Voltage Step 1 ON
HV2 High-Voltage Step 2 ON
RFD RF Drive ON
AIR Cooling Air Pressure above Threshold
FUL 4 KV Fuse OK
FUH 8 KV Fuse OK
LOC Local/Remote Switch set to LOCAL.

	7	6	5	4	3	2	1	0
SR1	0	0	0	0	ER3	ER2	ER1	ER0
	Future Use				Error Code			

Currently implemented error codes are as follows:

0	No error.
1	Analog parameter error at State 0.
2	Machine State 2 requested.
3	Air pressure failure.
4	Analog parameter error at State 1.
5	HV fuse failure.
6	Analog parameter error at State 3.
7	Analog parameter error at State 4.
8	Step-start of HV aborted for parameter error.

Command Summary:

COMMAND	ACTION BY CONTROLLER	REPLY FROM CONTROLLER
SOH P SOH H SOH R	Turn ON Main Power Turn ON HV1, HV2 Turn ON RF Drive	ACK (W) ACK (W) ACK
ESC R ESC H ESC P ESC K	Turn OFF RF Drive Turn OFF HV Turn OFF Main Power Immediate Full Shutdown	ACK ACK (W) ACK ACK
ENQ S ENQ P ENQ D ENQ X	Send Status Send most recent PG Dump Parameter LIFT Abort Dump	ACK CR LF SR0 SR1 CR LF ETX ACK CR LF PG ETX ACK CR LF PG(N) ETX ...PG(0) ETX EOT ...PG(n) ETX EOT
ESC C ESC E ESC RS	Clear & Reset LIFO Clear Error Reg. (SR1) Warm Restart Controller	ACK ACK ACK BEL H CR LF
invalid command any chr	none (If controller in (LOCAL)	NAK L NAK
	Error Detected Power-ON Restart (Cold) Switch LOCAL to REMOTE	BEL E CR LF BEL C CR LF BEL H CR LF

NOTE: The optional W is sent before ACK if a time delay must finish before the command can be completed. In this case the ACK is not delayed until command completion. If the host system requires knowledge of the instant of command completion, it must repetitively interrogate SR0 using the ENQ S command.

MULTI CHARACTER COMMANDS

FORMAT	ACTION	PARAMETERS
A X(X)E	Display Analog Chan. XX.	X(X) is a one or two digit decimal number in the range 0-17.
D H H E	Display in HEX the contents of internal RAM address HH.	HH is a two digit hexadecimal number in the range 00 - 7F.
E HHHH E	Display in HEX the contents of external RAM address HHHH.	HHHH is a four digit HEX number in the range 0000 - 1FFF.
F H E	Perform Function per parameter H.	H is a one digit hex. number: 0 Main Power OFF. 1 Main Power ON. 3 HV ON. 4 RF Drive ON. B Send BEL to serial port (test). C Clear error condition. D Reset parameter LIFO. E Display Error code.

NOTES:

1. The C key cannot be used to clear a partial address entry in the D or E commands because C must be considered a valid hex. digit. The C key will, however, clear a partially entered A command.

2. The C key will restore the bargraph status display if pressed during the display of an analog parameter or memory contents.

Local display of analog parameters is in decimal, with the decimal point positioned so as to provide direct reading in the following units:

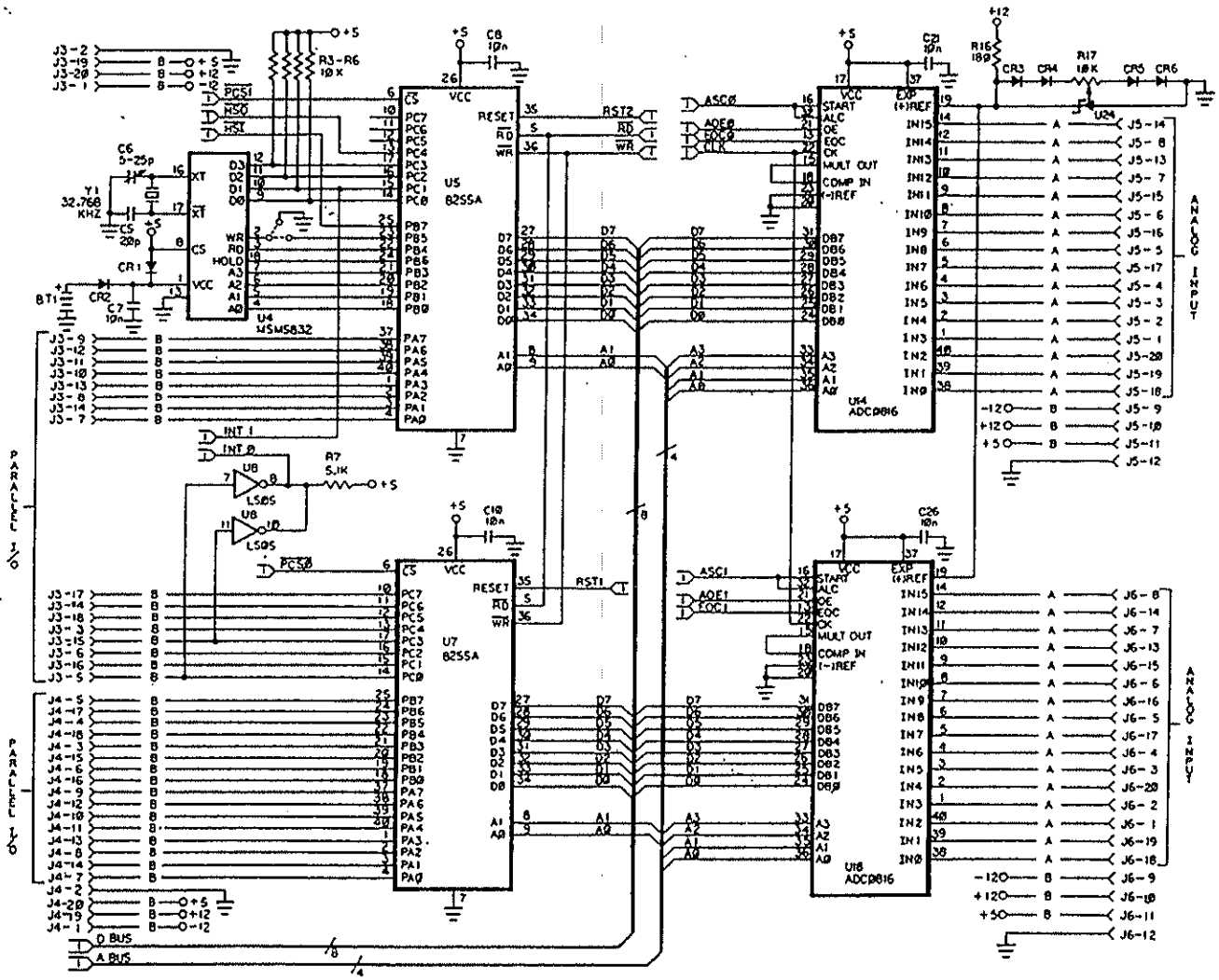
ANALOG CH. NO.	PARAMETER	UNIT
0	High Voltage 1 (8KV)	VOLT
1	High Voltage 2 (4 KV)	VOLT
2	Cathode Bias Voltage, Final	VOLT
3	Cathode Bias Voltage, Driver	VOLT
4	Cathode Current, Final	MILLIAMP
5	Cathode Current, Driver	MILLIAMP
6	SS Final, Supply Current	AMP
7	SS Driver, Supply Current	AMP
8	SS Final, Supply Voltage	VOLT
9	T/R Duty Cycle	%
10	+5 Supply Voltage	VOLT
11	+28 Supply Voltage	VOLT
12	Heater Voltage, Final	VOLT,RMS
13	Temperature of Exhaust Air	DEG. C
14	RF Output Pulse Power, Forward	KILOWATT
15	RF Output Pulse Power, Reflected	KILOWATT
16	VSWR	
17	(Future Use)	

ACTUAL LOWER AND UPPER LIMIT TABLE

PARAMETER	STATE 0	STATE 1	STATE 2	STATE 3	STATE 4
00	000,001	000,140	040,140	040,160	040,160
01	000,001	000,070	020,070	020,080	020,080
02	000,108	068,108	068,108	068,108	068,108
03	000,108	084,108	084,108	084,108	084,108
04	000,050	000,050	000,050	000,100	000,250
05	000,100	000,100	000,100	000,100	000,160
06	000,025	000,025	000,025	000,025	000,150
07	000,050	000,050	000,050	000,050	000,100
08	000,165	130,165	130,165	130,165	130,165
09	000,160	000,160	000,160	000,160	000,160
10	095,105	095,105	095,105	095,105	095,105
11	120,180	120,180	120,180	120,180	120,180
12	000,214	196,214	196,214	196,214	196,214
13	000,120	000,120	000,120	000,120	000,120
14	000,022	000,180	000,180	000,180	000,180
15	000,022	000,060	000,060	000,060	000,060
16	000,255	000,255	000,255	000,255	000,032
17	000,255	000,255	000,255	000,255	000,255

These are parameter limits for TXCON 1.25F 31 March 1987.
Channel 17 is inactive.

REVISION			
REV	DESCRIPTION	DATE	APPR
A	ADVANCE RELEASE	[redacted]	



1 ALL CAPACITORS ARE 100V.

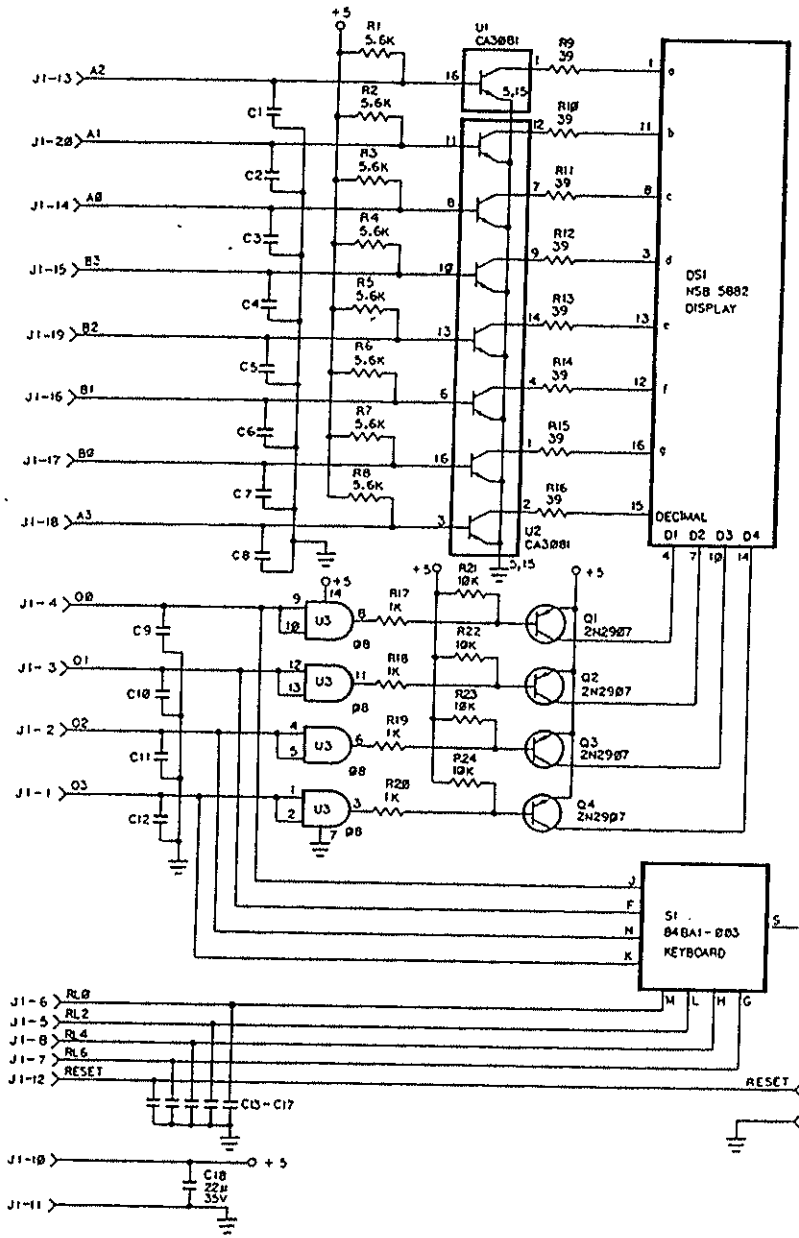
NOTES: UNLESS OTHERWISE SPECIFIED

[redacted]

8031 MICROCONTROLLER

SIZE D | SHEET 2 OF 2 | REV A

REVISION			
REV	DESCRIPTION	DATE	APPR
A	ADVANCE RELEASE	[redacted]	



SEGMENT CODE

KEYBOARD DISPLAY	GOES TO	MICROCONTROLLER
J1 - 1		J1 - 17
J1 - 2		J1 - 14
J1 - 3		J1 - 16
J1 - 4		J1 - 15
J1 - 5		J2 - 19
J1 - 6		J2 - 21
J1 - 7		J2 - 7
J1 - 8		J2 - 22
J1 - 9		N.C.
J1-10		J1 - 1
J1-11		J1 - 2
J1-12		J1 - 3
J1-13		J1 - 4
J1-14		J1 - 5
J1-15		J1 - 25
J1-16		J1 - 24
J1-17		J1 - 7
J1-18		J1 - 27
J1-19		J1 - 6
J1-20		J1 - 26

KEYBOARD MATRIX

KEY	Q	RL
0	0	0
1	0	2
2	0	4
3	0	6
4	1	0
5	1	2
6	1	4
7	1	6
8	2	0
9	2	2
A	2	4
B	2	6
C	3	0
D	3	2
E	3	4
F	3	6

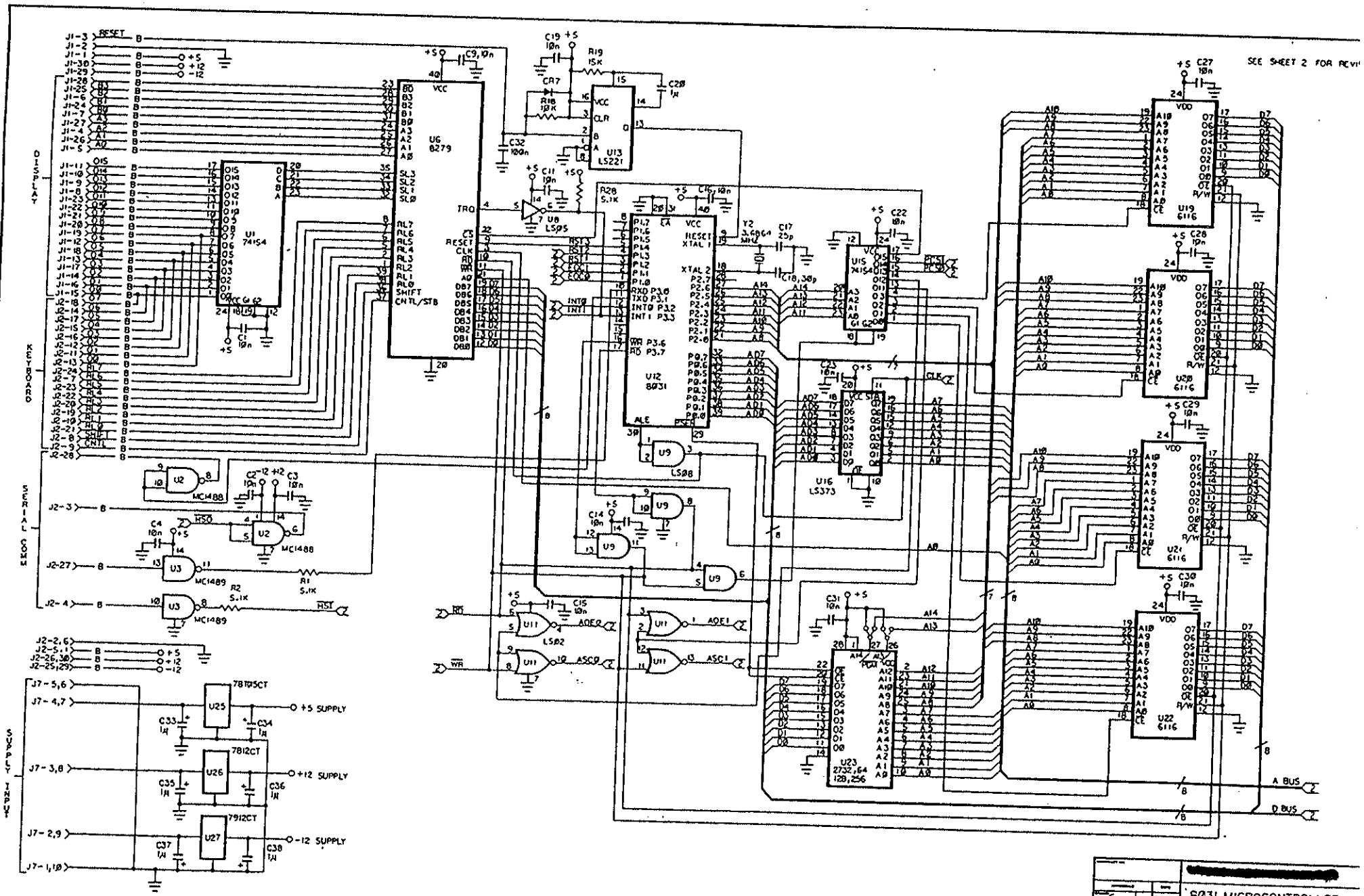
NOTES: UNLESS OTHERWISE SPECIFIED

1. C1-C17 ARE 10n, 100V CAPACITOR.

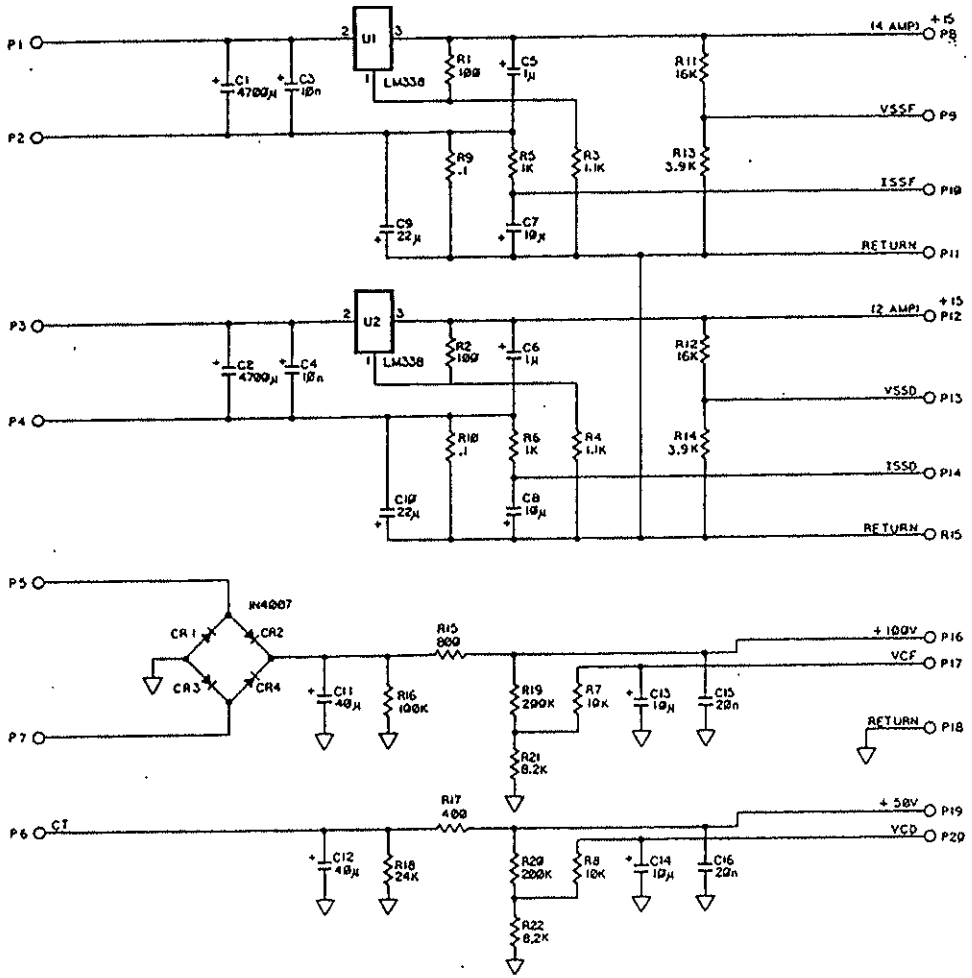
[redacted]

8031 MICROCONTROLLER KEYBOARD DISPLAY

SIZE D | REV A | SHEET 1 OF 1


DISPLAY
KEYBOARD
SERIAL COM
SUPPLY FROM
RESET
U6 8279
U1 74154
U12 8031
U13 LS221
U8 LS05
U9 LS08
U11 LS02
U16 LS373
U15 74154
U19 6116
U20 6116
U21 6116
U22 6116
U23 2732,64 128,256
U2 MC1488
U3 MC1489
U25 78T05CT
U26 7812CT
U27 7912CT
+5 SUPPLY
+12 SUPPLY
-12 SUPPLY
A BUS
D BUS
SEE SHEET 2 FOR REV
8031 MICROCONTROLLER
SHEET 1 OF 2

REVISION			
REV	DESCRIPTION	DATE	APPROVED
A	ADVANCE RELEASE	[illegible]	[illegible]



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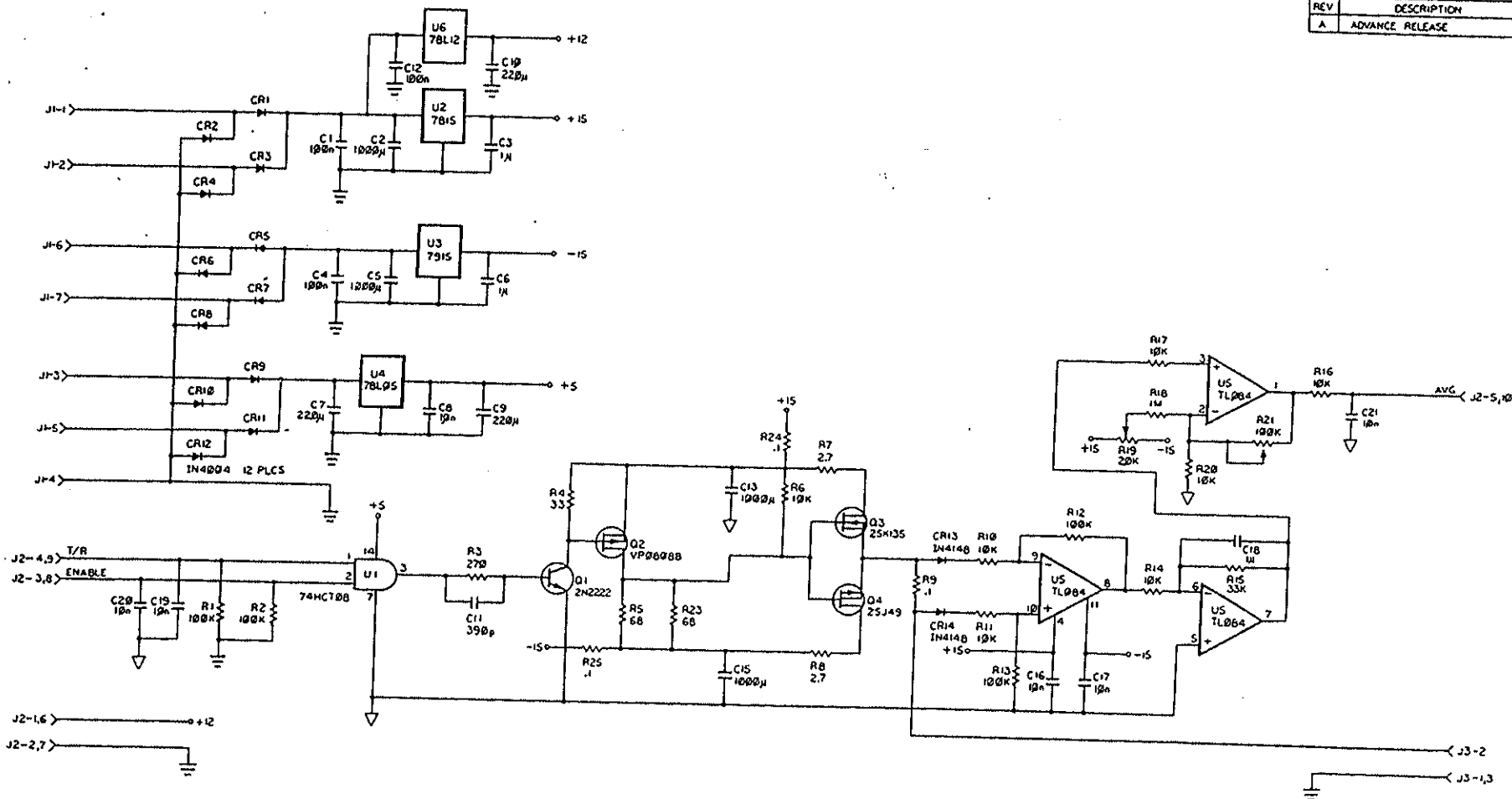
TRANSMITTER – LOW VOLTAGE POWER SUPPLY

SIZE D | DRAWING NO | REV A

REVISION			
REV	DESCRIPTION	DATE	APPR
A	ADVANCE RELEASE	[redacted]	



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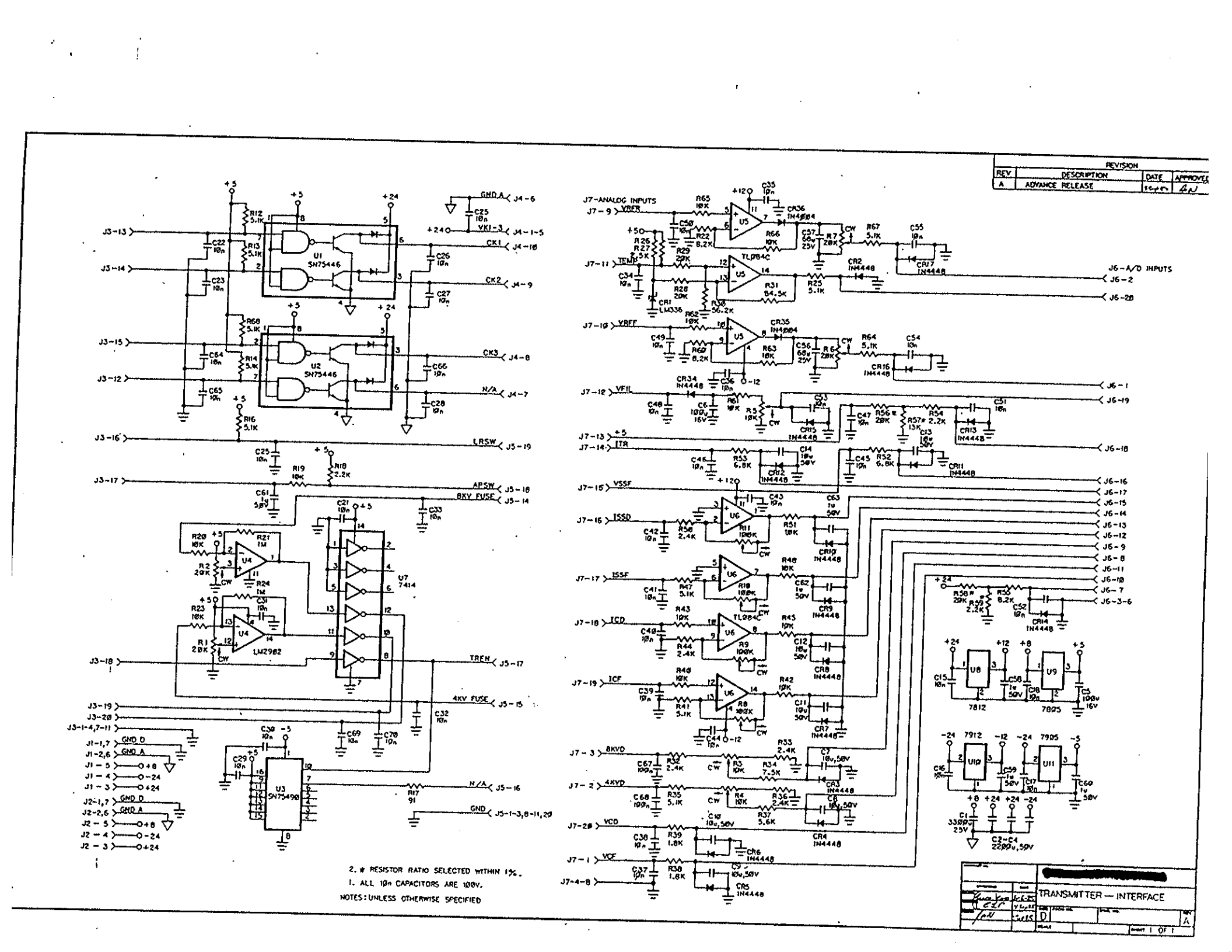
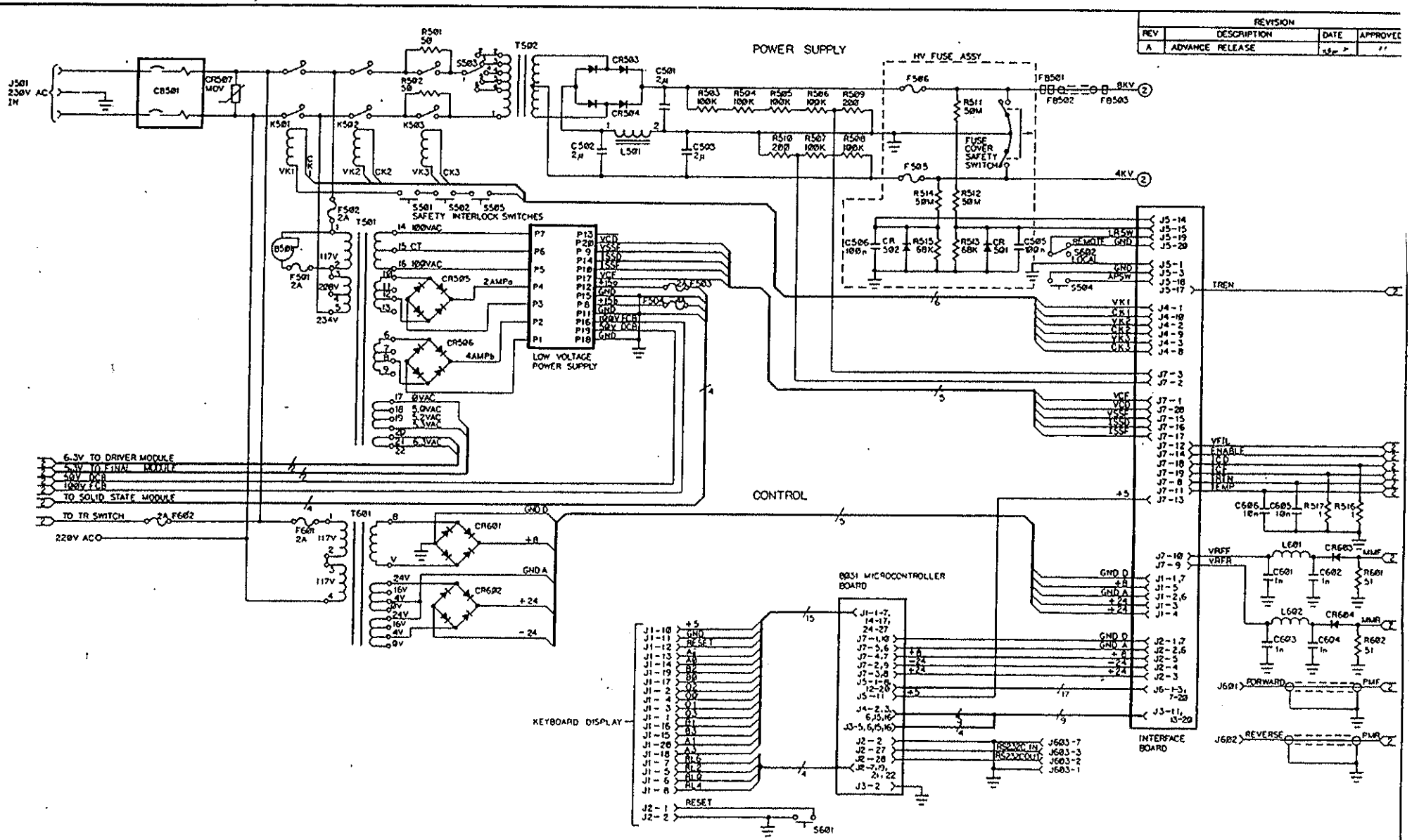
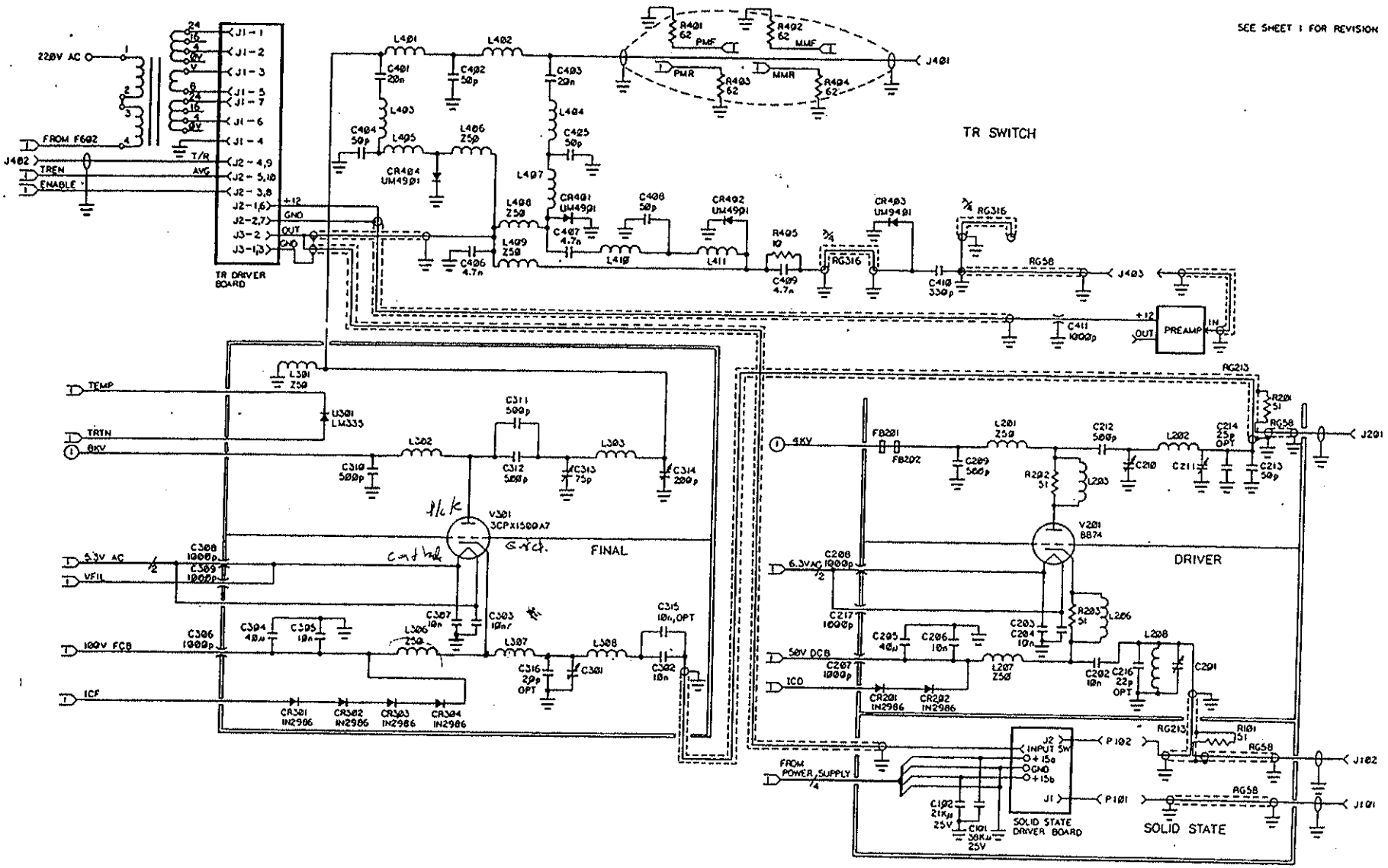
TRANSMITTER — TR DRIVER

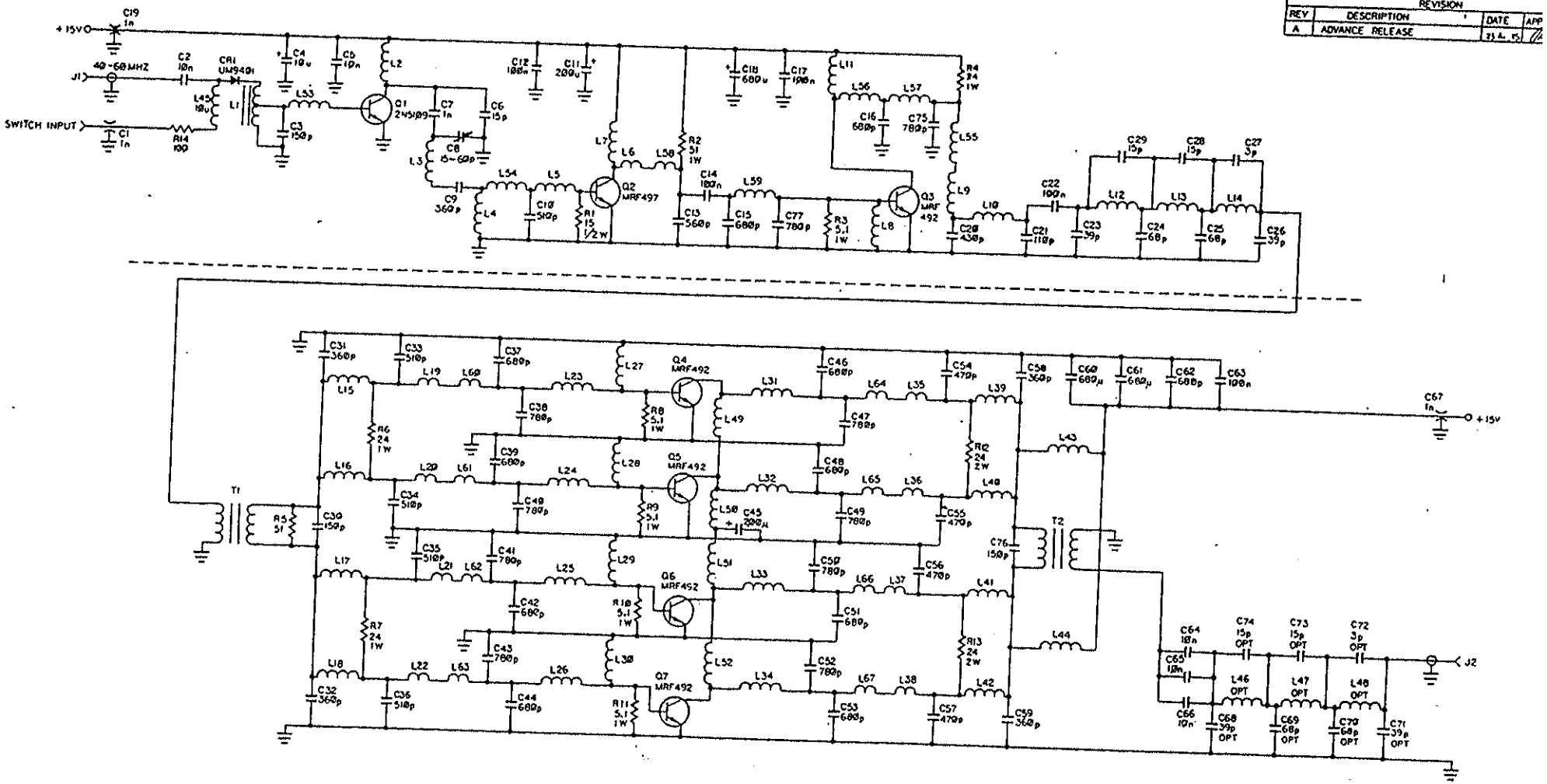
D

A


REVISION
REV
DESCRIPTION
DATE
APPROVED
A
ADVANCE RELEASE
TRANSMITTER — INTERFACE
SIZE
D
SHEET 1 OF 1
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL 10n CAPACITORS ARE 100V.
2. * RESISTOR RATIO SELECTED WITHIN 1%.
U1 SN75446
U2 SN75446
U3 SN75490
U4 LM2902
U5 TL084C
U6 TL084C
U7 7414
U8 7812
U9 7805
U10 7912
U11 7905
J7-ANALOG INPUTS
VREF
TEMP
VREF
VFIL
ITR
VSSF
ISSD
ISSF
ICD
ICF
8KVD
4KVD
VCO
VCF
J3-13
J3-14
J3-15
J3-12
J3-16
J3-17
J3-18
J3-19
J3-20
J3-1-4,7-11
J1-1,7 GND D
J1-2,6 GND A
J1-5 +8
J1-4 -24
J1-3 +24
J2-1,7 GND D
J2-2,6 GND A
J2-5 +8
J2-4 -24
J2-3 +24
GND A J4-6
VK1-3 J4-1-5
CK1 J4-10
CK2 J4-9
CK3 J4-8
N/A J4-7
LRSW J5-19
APSW J5-18
8KV FUSE J5-14
TREN J5-17
4KV FUSE J5-15
N/A J5-16
GND J5-1-3,8-11,20
J6-A/D INPUTS
J6-2
J6-20
J6-1
J6-19
J6-18
J6-16
J6-17
J6-15
J6-14
J6-13
J6-12
J6-9
J6-8
J6-11
J6-10
J6-7
J6-3-6
C1 3300μ 25V
C2-C4 2200μ,50V


POWER SUPPLY
CONTROL
HV FUSE ASSY
LOW VOLTAGE POWER SUPPLY
SAFETY INTERLOCK SWITCHES
FUSE COVER SAFETY SWITCH
INTERFACE BOARD
8031 MICROCONTROLLER BOARD
KEYBOARD DISPLAY
6.3V TO DRIVER MODULE
24V TO FINAL MODULE
50V PCB
100V FCB
TO SOLID STATE MODULE
TO TR SWITCH
220V AC0
J501 230V AC IN
CB501
CR507 MOV
T502
T501
T601
CR503
CR504
CR505
CR506
CR601
CR602
L501
L601
L602
F506
F505
F502
F501
F601
F602
FB501
FB502
FB503
8KV
4KV
TREN
VFIL
ENABLE
VRFF
VRFR
FORWARD
REVERSE
RESET
S501
S502
S503
S504
S505
S601
TRANSMITTER— POWER SUPPLY, CONTROL, TR SWITCH, FINAL, DRIVER, SOLID STATE.
REVISION
REV
DESCRIPTION
DATE
APPROVED
A
ADVANCE RELEASE


SEE SHEET 1 FOR REVISION
TR SWITCH
TR DRIVER BOARD
FINAL
DRIVER
SOLID STATE
SOLID STATE DRIVER BOARD
PREAMP
TRANSMITTER — POWER SUPPLY, CONTROL, TR SWITCH, FINAL, DRIVER, SOLID STATE



REVISION			
REV	DESCRIPTION	DATE	APP
A	ADVANCE RELEASE	23 4. 15	

[redacted]

TRANSMITTER
SOLID STATE DRIVER

D

A

CON-8031: TRANSMITTER CONTROL COMMAND & DATA FORMAT SUMMARY

SERIAL PORT

Hardware:

1. RS232-C levels, DTE data direction.
2. Interface is a 25-pin D-type female panel mounted connector with the following pin assignments:

PIN	FUNCTION
1	Chassis Ground
2	Data Out
3	Data In
7	Signal Ground
all others	NC

Protocol:

1. Rate: 1200 bits/s.
2. Bits per frame: 11:

First	0	start
	D0	
	D1	
	D2	
	D3	ASCII chr.
	D4	
	D5	
	D6	
	D7	parity: 0 on transmit, ignored on receive.
	1	stop
Last	1	stop

Character Set:

1. The ASCII character set used by the serial port includes the printing characters 0-9 and A-Z and the following control characters:

MNEMONIC	VALUE	DEC	CNTRL-
SOH	01H	1	A
ESC	1BH	27	[
ENQ	05H	5	E
ACK	06H	6	F
NAK	15H	21	U
BEL	07H	7	G
ETX	03H	3	C
EOT	04H	4	D
CR	0DH	13	M
LF	0AH	10	J
RS	1EH	30	^

Data Formats:

1. In response to certain commands (see below) the transmitter controller will send, to the host computer, data formatted as follows:

   Analog Parameter (AP): D D D SP (4 ASCII chrs.)

   where D = decimal digit (0-9)

   Status Byte (SB): H H SP (3 ASCII chrs.)

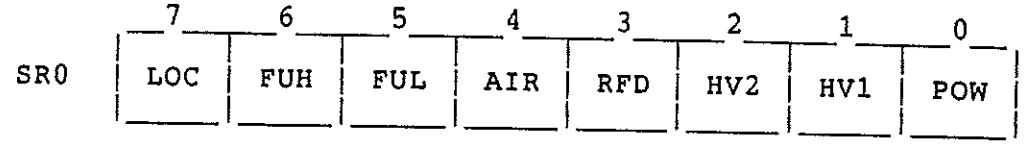
   where H = hex digit (0-F)

2. The above basic data units are combined to form the Parameter Group (PG), consisting of {16 AP's, 2 SB's, CR, LF}. This is sent by the controller to the host in the following order:

PARAM. NO.	PARAMETER	SCALE
0	High Voltage 1 (8 KV)	50.0 V
1	High Voltage 2 (4 KV)	50.0 V
2	Cathode Bias Voltage, Final	0.5 V 1.0V
3	Cathode Bias Voltage, Driver	0.5 V
4	Cathode Current, Final	2.0 mA
5	Cathode Current, Driver	1.0 mA
6	SS Final, Supply Current	20.0 mA
7	SS Driver, Supply Current	10.0 mA
8	SS Final, Supply Voltage	0.1 V
9	SS Driver, Supply Voltage	0.1 V
10	+5 Supply Voltage	0.05 V
11	+28 Supply Voltage	0.2 V
12	Heater Voltage, RMS, Final	0.05 V
13	Temperature of Exhaust Air	0.5 Deg. C
14	RF Output, Forward RMS Voltage	10.0 V
15	RF Output, Reflec. RMS Voltage	10.0 V
16	VSWR	0.0625:1
17	(Future Use)	
18	Status Register 0	
19	Status Register 1	

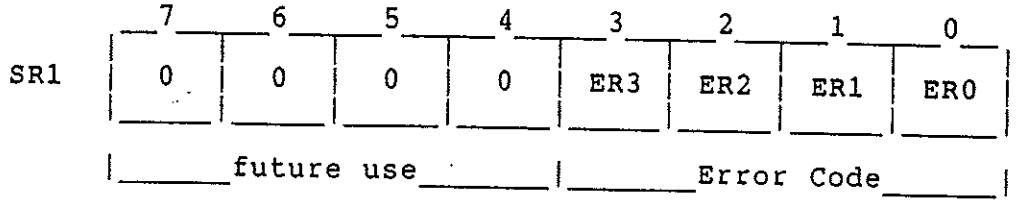
NOTE: Each actual parameter is (N x S) where N is the 3-digit PG integer (range 0-255), and S is the appropriate Scale Factor from the above table.

3. The Status Registers (see PG parameters 19,20 above) have the following bit assignments:



All bits are High True and have the following interpretation:

POW	Main Power ON
HV1	High Voltage Step 1 ON
HV2	High Voltage Step 2 ON
RFD	RF Drive ON
AIR	Cooling Air Pressure above Threshold
FUL	4 KV Fuse OK
FUH	8 KV Fuse OK
LOC	Local Remote Switch set to LOCAL.



Currently implemented error codes are as follows:

0	No error.
1	Analog parameter error at State 0.
2	Machine State 2 requested.
3	Air pressure failure.
4	Analog parameter error at State 1.
5	HV fuse failure.
6	Analog parameter error at State 3.
7	Analog parameter error at State 4.
8	Step-start of HV aborted for parameter error.

Command Summary:

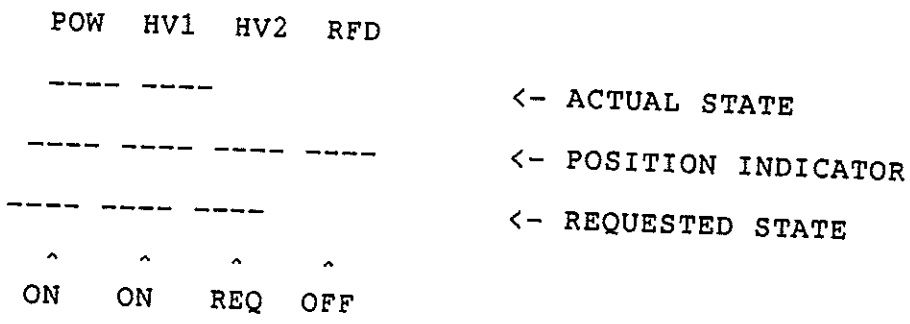
COMMAND	ACTION BY CONTROLLER	REPLY FROM CONTROLLER
SOH P SOH H SOH R	Turn ON Main Power Turn ON HV1, HV2 Turn ON RF Drive	ACK (W) ACK (W) ACK
ESC R ESC H ESC P ESC K	Turn OFF RF Drive Turn OFF HV Turn OFF Main Power Immediate Full Shutdown	ACK ACK (W) ACK ACK
ENQ S ENQ P ENQ D ENQ X	Send Status Send most recent PG Dump Parameter LIFO Abort Dump	ACK CR LF SR0 SR1 CR LF ETX ACK CR LF PG ETX EOT ACK CR LF PG(N) ETX PG(N-1) ETX... ...PG(0) ETX EOT ...PG(n) ETX EOT
ESC C ESC E ESC RS	Clear & Reset LIFO Clear Error Reg. (SR1) Warm Restart Controller	ACK ACK ACK BEL H CR LF
invalid command any chr	none (If controller in LOCAL)	NAK L NAK
	Error Detected Power-On Restart (Cold) Switch LOCAL to REMOTE	BEL E CR LF BEL C CR LF BEL H CR LF

NOTE: The optional W is sent before ACK if a time delay must finish before the command can be completed. In this case the ACK is not delayed until command completion. If the host system requires knowledge of the instant of command completion, it must repetitively interrogate SR0 using the ENQ S command.

LOCAL KEYPAD/DISPLAY

play:

1. When not otherwise engaged, the 4-digit 7-segment local display shows a quasi-bargraph representation of the actual and requested machine states:



2. Displays of analog parameters are scaled and have a radix point appropriately positioned to indicate actual value.

3. Displays of memory addresses or contents are 2 or 4 digit hexadecimal integers as appropriate.

pad:

1. Local machine control and parameter display is accomplished by entering single or multiple character commands at the hexadecimal keypad.

GENERAL MNEMONICS

FIRST CHR.	A	Analog
	B	(future use)
	C	Clear
	D	Display internal memory
	E	display External memory
	F	Function

LAST CHR.	C	Clear
	E	Enter

MULTI CHARACTER COMMANDS

FORMAT	ACTION	PARAMETERS
A X(X)E	Display Analog Chan. XX.	X(X) is a one or two digit decimal number in the range 0-17.
D H H E	Display in HEX the contents of internal RAM address HH.	HH is a two digit hexadecimal number in the range 00 - 7F.
E HHHH E	Display in HEX the contents of external RAM address HHHH.	HHHH is a four digit hexadecimal number in the range 0000 - 1FFF.
F H E	Perform Function per parameter H.	H is a one digit hex. number: 0 Main Power OFF. 1 Main Power ON. 3 HV ON. 4 RF Drive ON. B Send BEL to serial port (test). C Clear error condition. D Reset parameter LIFO. E Display Error code.

NOTES:

1. The C key cannot be used to clear a partial address entry in the D or E commands because C must be considered a valid hex. digit. The C key will, however, clear a partially entered A command.

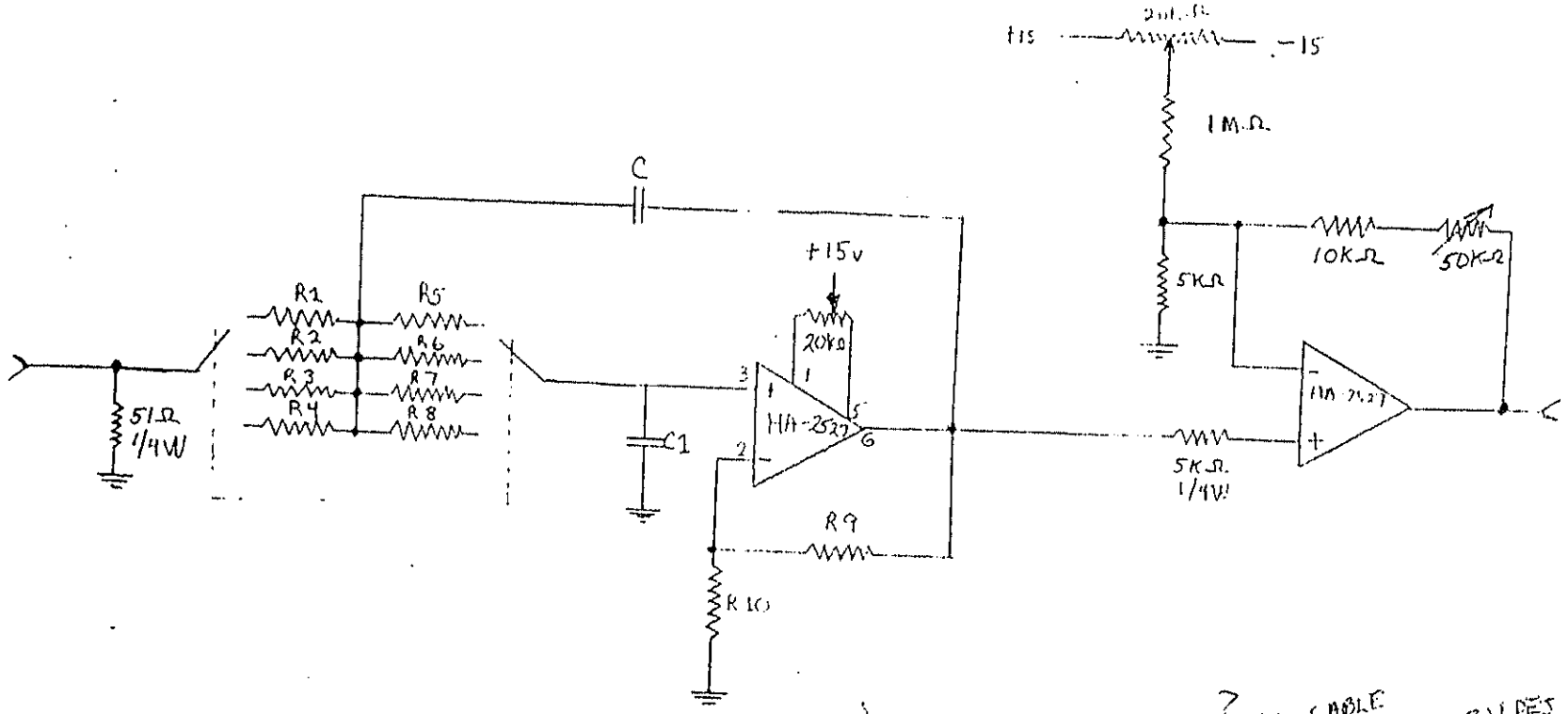
2. The C key will restore the bargraph status display if pressed during the display of an analog parameter or memory contents.

3. Local display of analog parameters is in decimal, with the decimal point positioned so as to provide direct reading in the following units:

ANALOG CH. NO.	PARAMETER	UNIT
0	High Voltage 1 (8 KV)	VOLT
1	High Voltage 2 (4 KV)	VOLT
2	Cathode Bias Voltage, Final	VOLT
3	Cathode Bias Voltage, Driver	VOLT
4	Cathode Current, Final	MILLIAMP
5	Cathode Current, Driver	MILLIAMP
6	SS Final, Supply Current	AMP
7	SS Driver, Supply Current	AMP
8	SS Final, Supply Voltage	VOLT
9	SS Driver, Supply Voltage	VOLT
10	+5 Supply Voltage	VOLT
11	+28 Supply Voltage	VOLT
12	Heater Voltage, Final	VOLT,RMS
13	Temperature of Exhaust Air	DEG. C
14	RF Output Pulse Power, Forward	KILOWATT
15	RF Output Pulse Power, Reflected	KILOWATT
16	VSWR	
17	(Future Use)	

800116
800225

MST RADAR BESSEL FILTER AND AMP



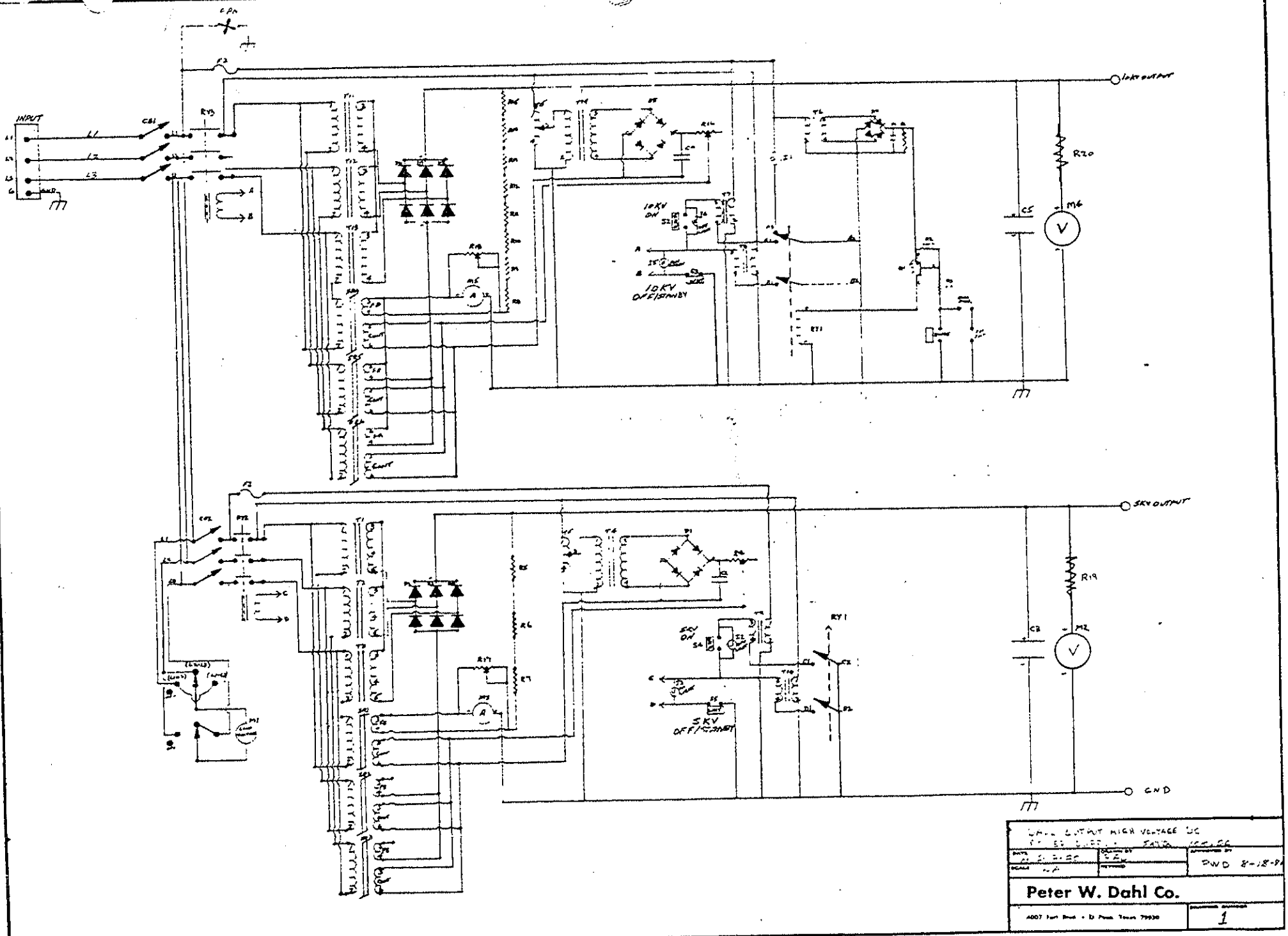
Pulse width	C	C1	Resistors	
2μsec	200pf	701pf	R1 = 2KΩ	R5 = 2KΩ
4μsec	200pf	701pf	R2 = 4KΩ	R6 = 4KΩ
8μsec	200pf	701pf	R3 = 8KΩ	R7 = 8KΩ
16μsec	200pf	701pf	R4 = 16KΩ	R8 = 16KΩ

R9 = 8250Ω } 1W CABLE
R10 = 2000Ω } RADAR

330801 PES

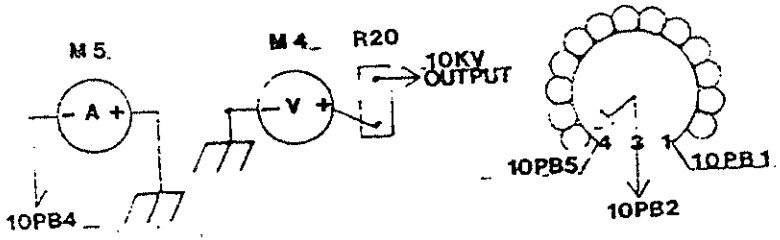
Min Gain = 23.7 dB

Max = 36.5 dB

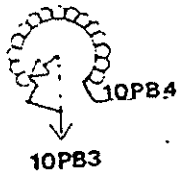

INPUT
L1
L2
L3
GND
CB1
RY3
F2
10KV OUTPUT
R20
M6
V
C5
10KV ON
10KV OFF/STANDBY
RY1
SKV OUTPUT
R19
M2
C2
SKV ON
SKV OFF/STANDBY
RY1
GND
Peter W. Dahl Co.
PWD 8-18-94
1

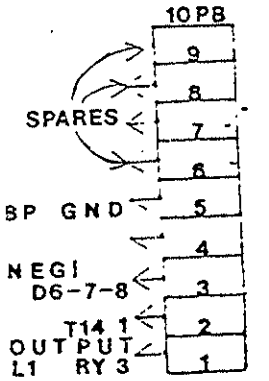
TOP PANEL

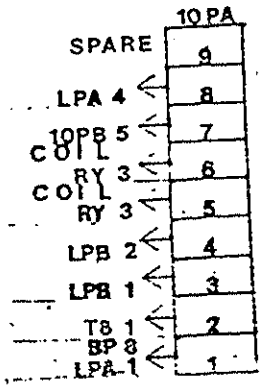
T15 (10KV VARIAC)

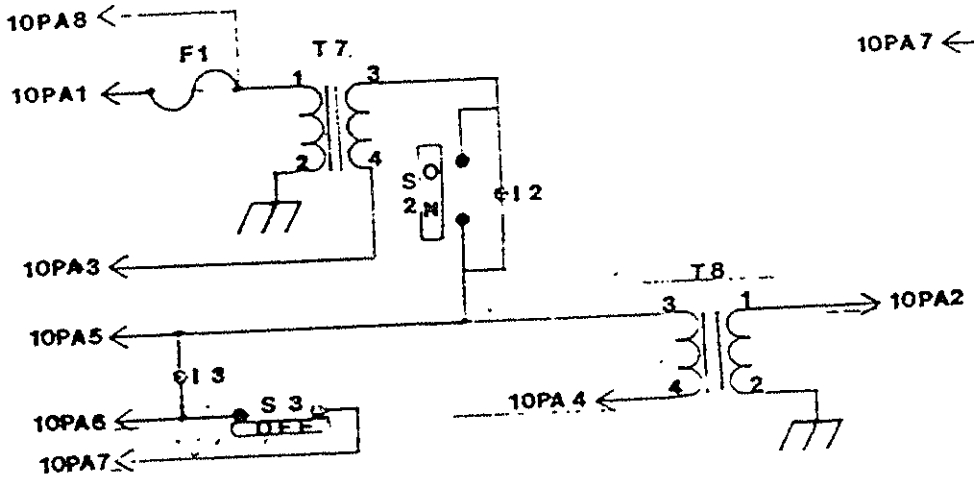


R18 (10 KV FEEDBACK POT)



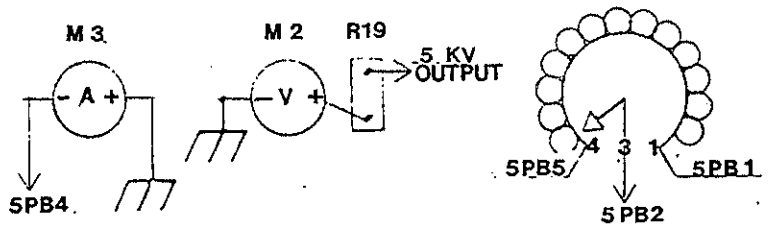




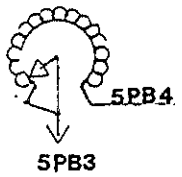


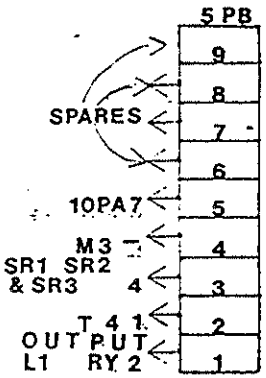
MIDDLE PANEL

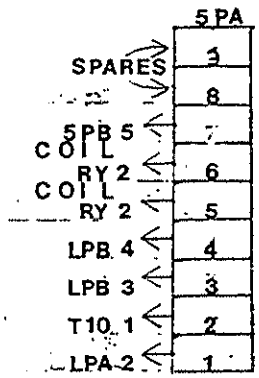
T 5 (5 KV VARIAC)

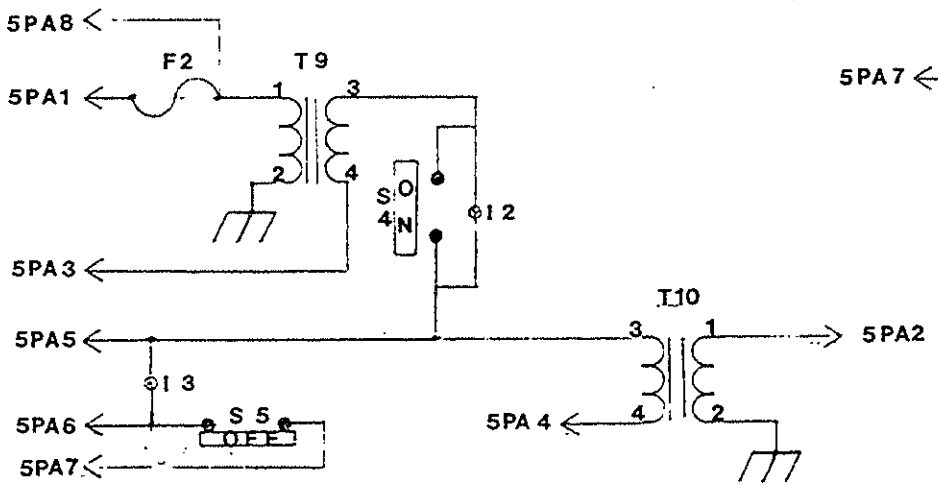


R17 (5 KV FEEDBACK POT)

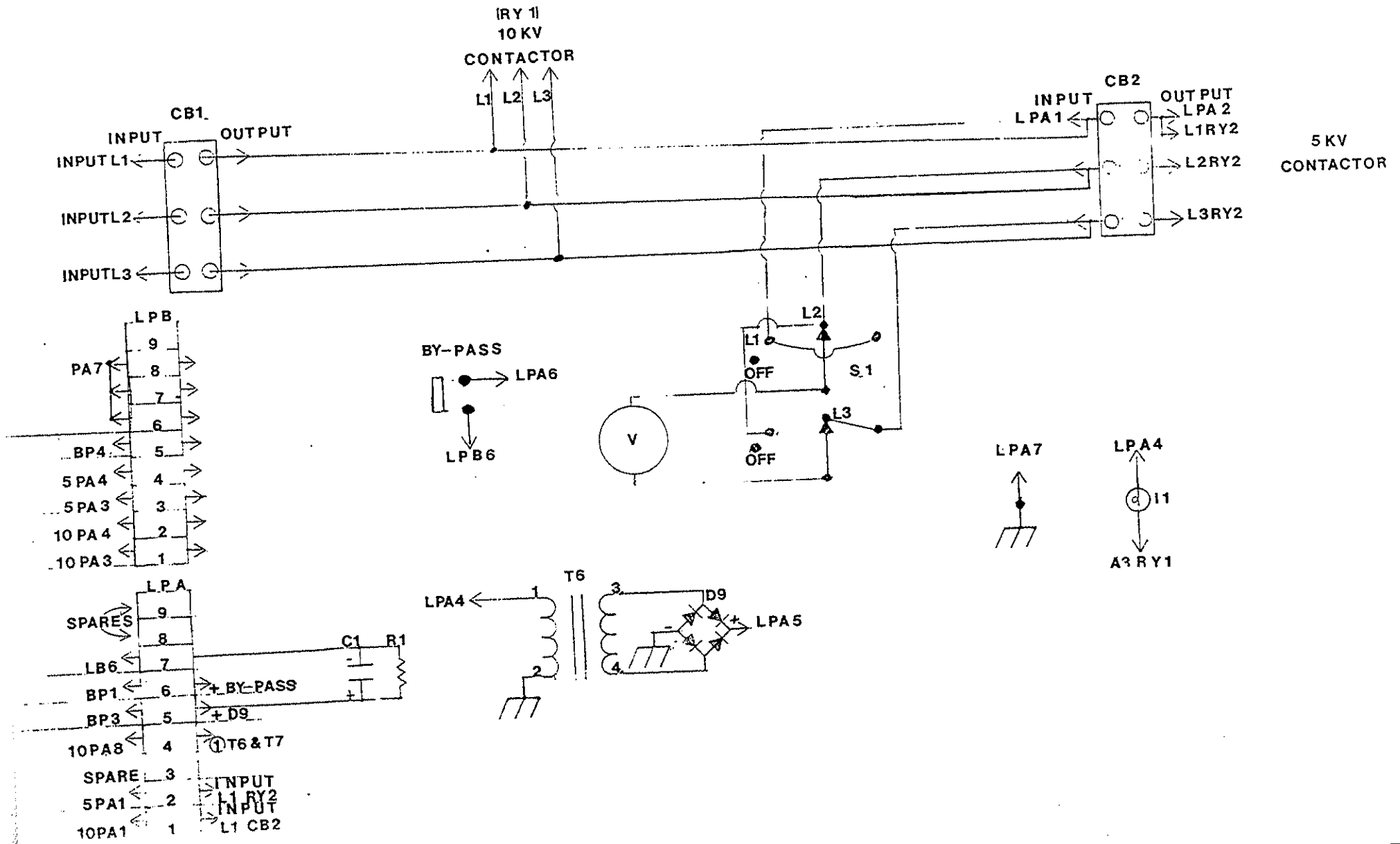


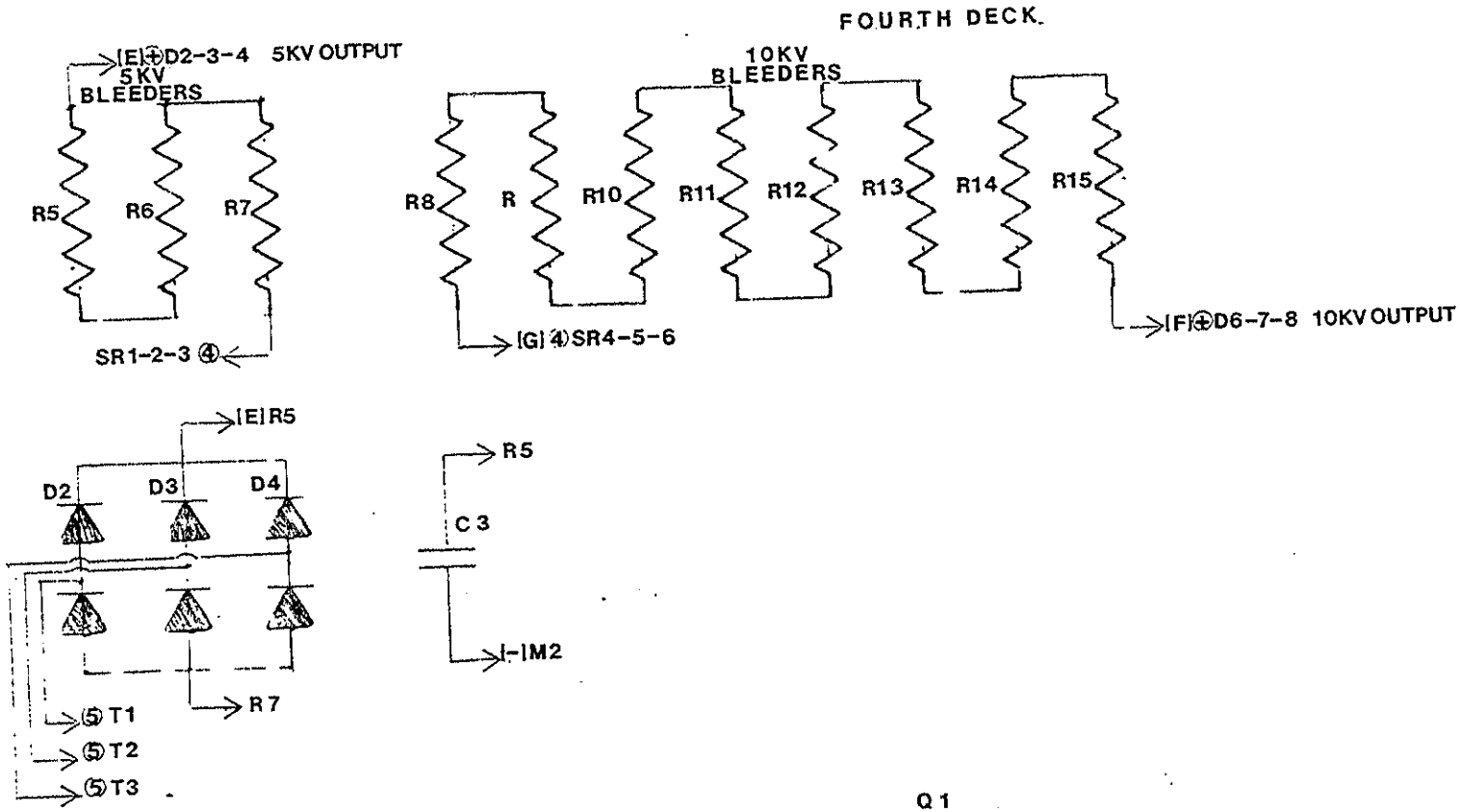




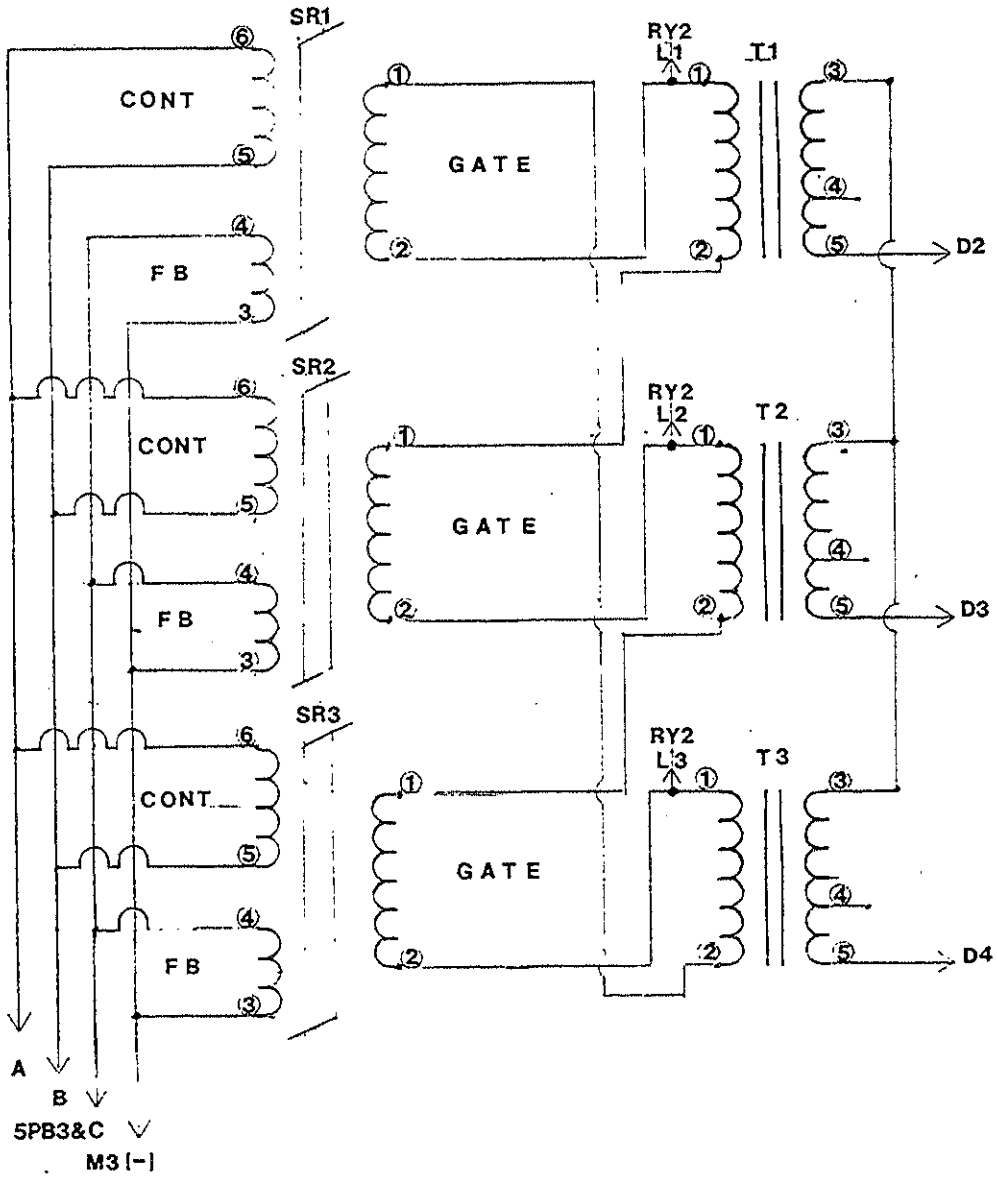


BOTTOM PANEL

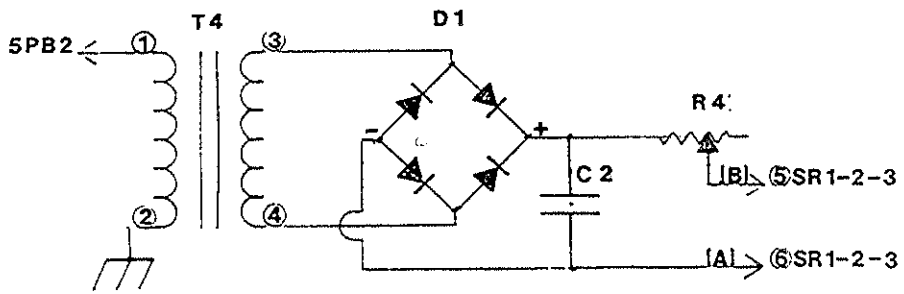



FOURTH DECK.
[E]⊕D2-3-4 5KV OUTPUT
5KV BLEEDERS
R5
R6
R7
SR1-2-3 ④
10KV BLEEDERS
R8
R
R10
R11
R12
R13
R14
R15
[G] ④SR4-5-6
[F]⊕D6-7-8 10KV OUTPUT
[E] R5
D2
D3
D4
C 3
R5
I-IM2
R7
⑤ T1
⑤ T2
⑤ T3
INPUT
GND
L 1
L 2
L 3
L 1 CB1
L 2 CB1
L 3 CB1
Q 1
FAN
REAR DOOR S 6
EXT INTERLOCK
BP5
BP5
OUTPUT
FUSE WIRE
5 KV
10 KV
R5
R15
9
8
7
6
5
4
3
2
1
10PA
LPA5
LPA5
LPA6
R2
R3

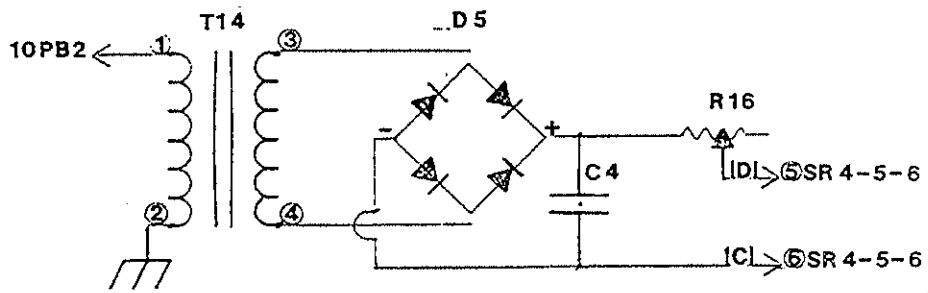
THIRD DECK

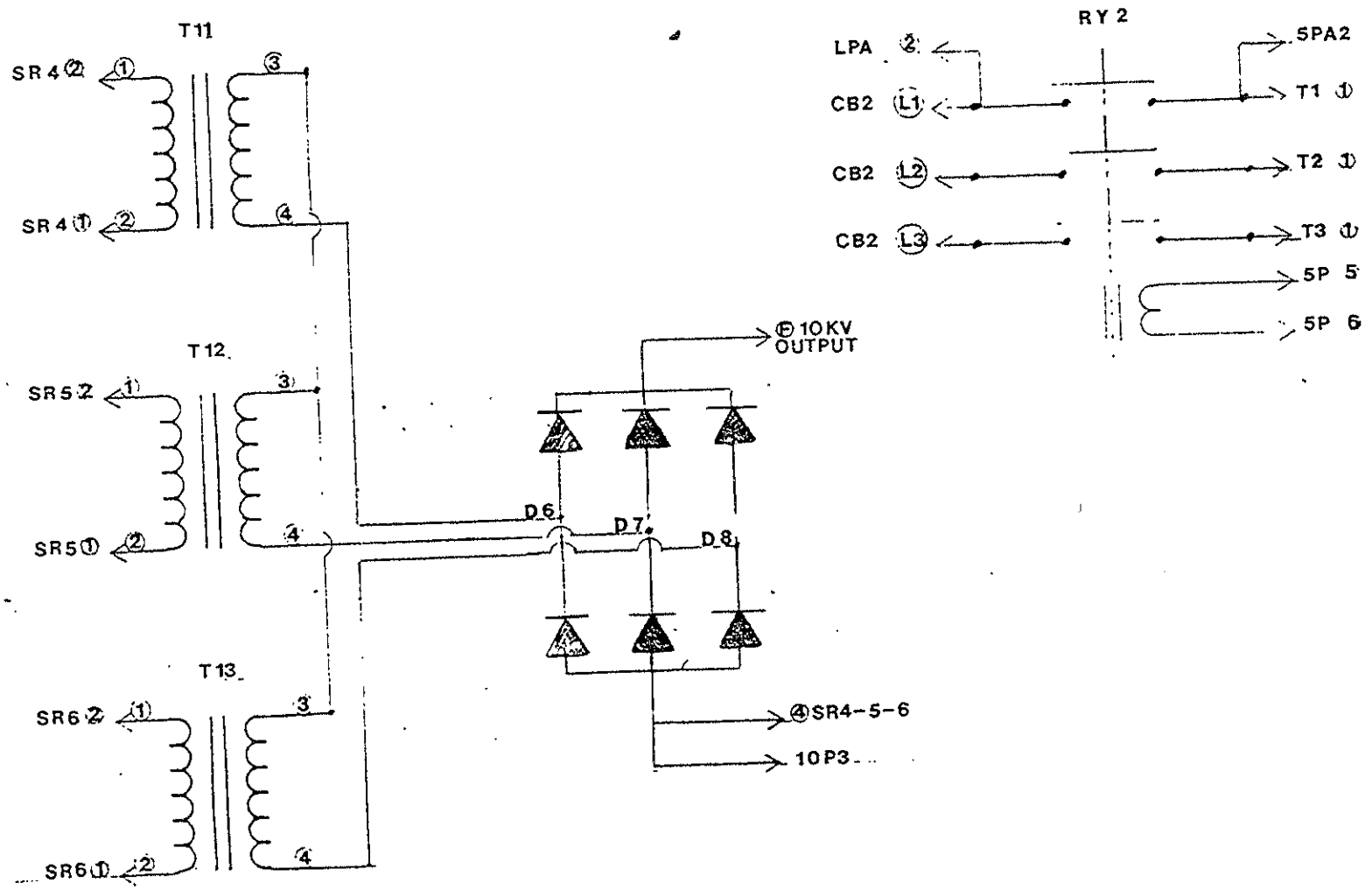


5KV CONTROL CIRCUIT

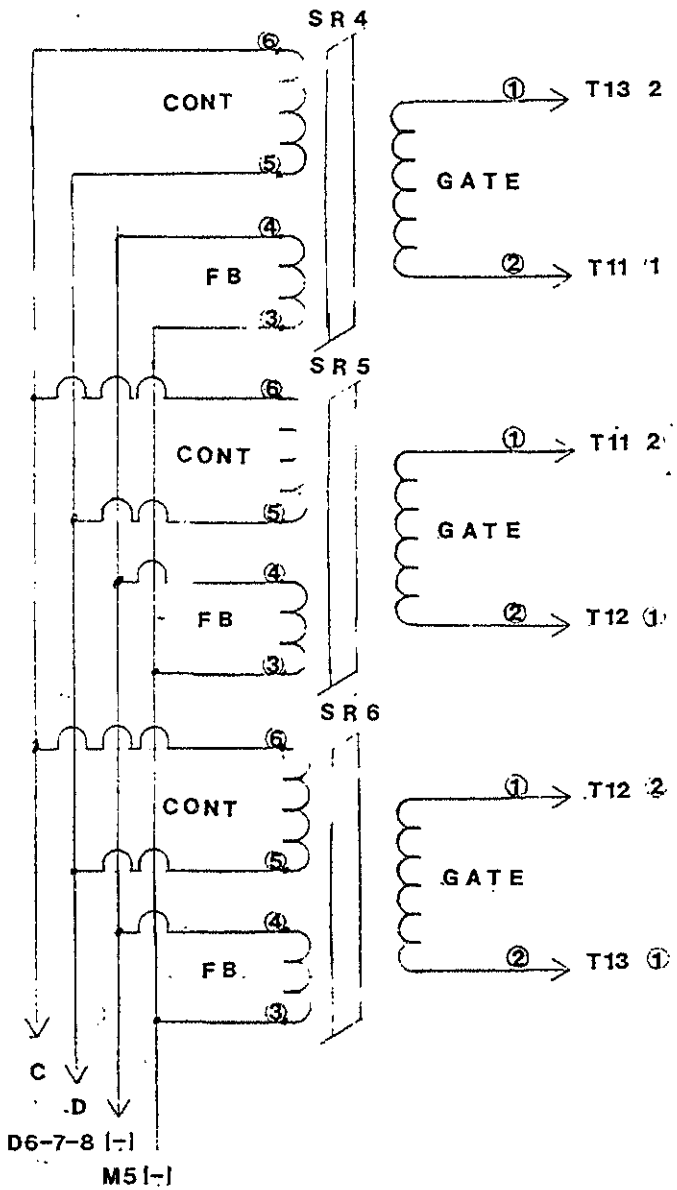


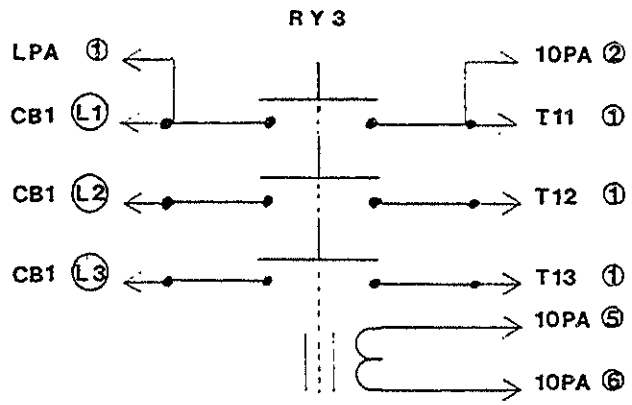
10KV CONTROL CIRCUIT

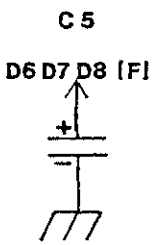


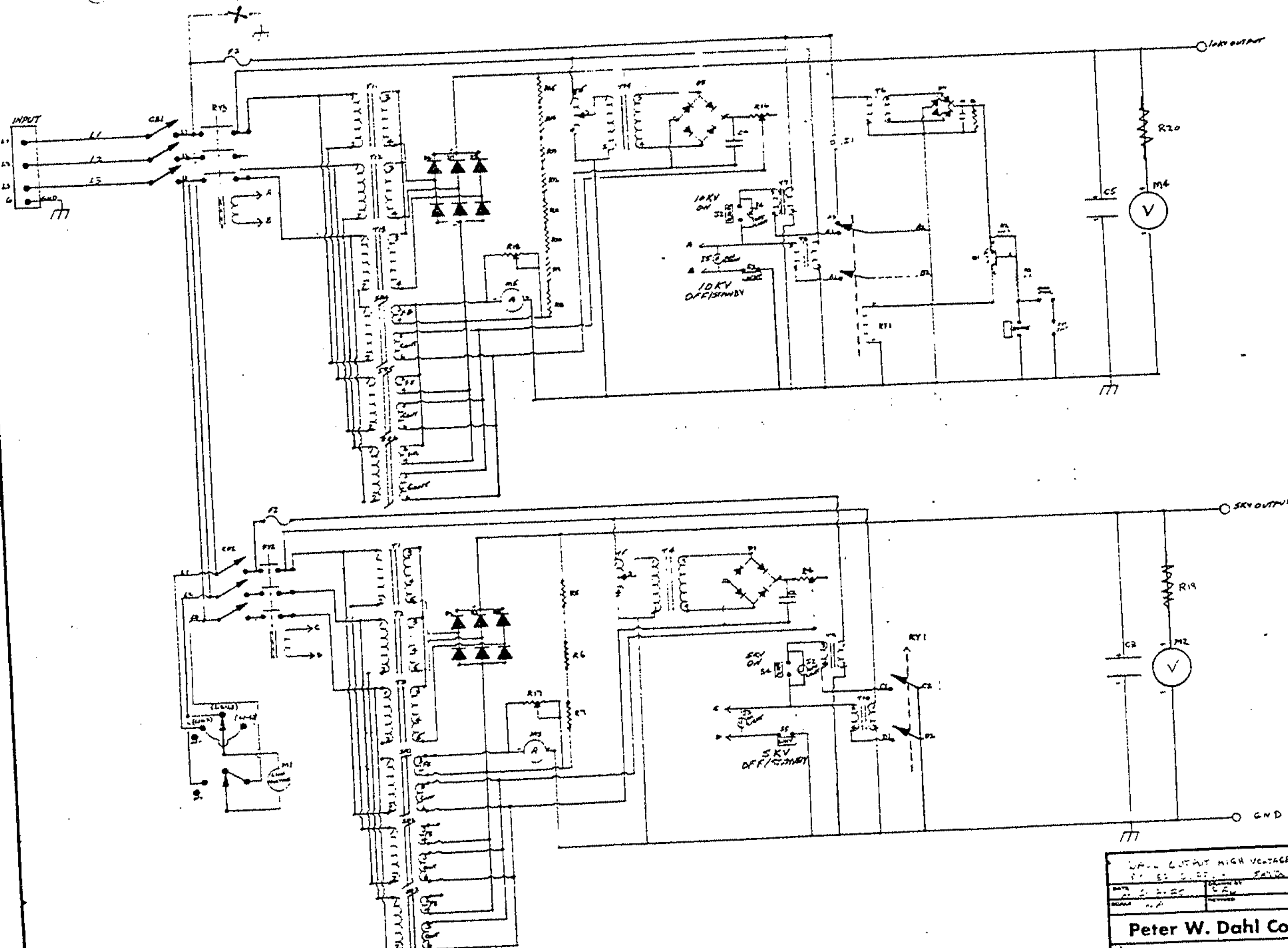

T11
SR4 ②
①
③
SR4 ①
②
④
T12
SR5 ②
①
③
SR5 ①
②
④
T13
SR6 ②
①
③
SR6 ①
②
④
D6
D7
D8
⑮10KV OUTPUT
④SR4-5-6
10P3
RY 2
LPA ②
CB2 L1
CB2 L2
CB2 L3
5PA2
T1 ①
T2 ①
T3 ①
5P 5
5P 6

BOTTOM DECK


SR 4
CONT
⑥
⑤
FB
④
③
①
T13 2
GATE
②
T11 1
SR 5
CONT
⑥
⑤
FB
④
③
①
T11 2
GATE
②
T12 ①
SR 6
CONT
⑥
⑤
FB
④
③
①
T12 2
GATE
②
T13 ①
C
D
D6-7-8 [-]
M5 [-]


RY 3
LPA ①
CB1 L1
CB1 L2
CB1 L3
10PA ②
T11 ①
T12 ①
T13 ①
10PA ⑤
10PA ⑥


C 5
D6 D7 D8 [F]
+
-



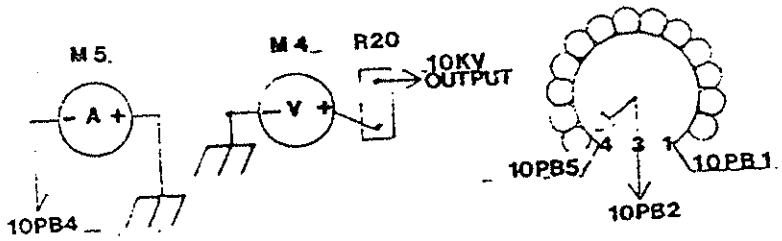
Peter W. Dahl Co.

PWD 8-18-8

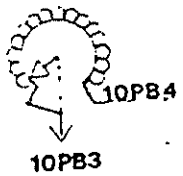
1

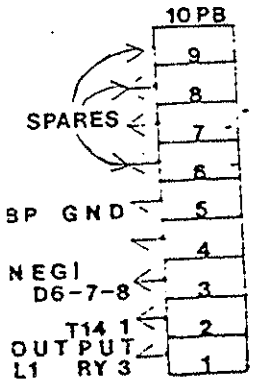
TOP PANEL

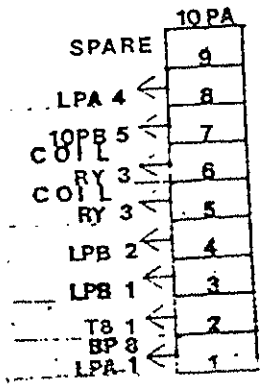
T15 (10KV VARIAC)

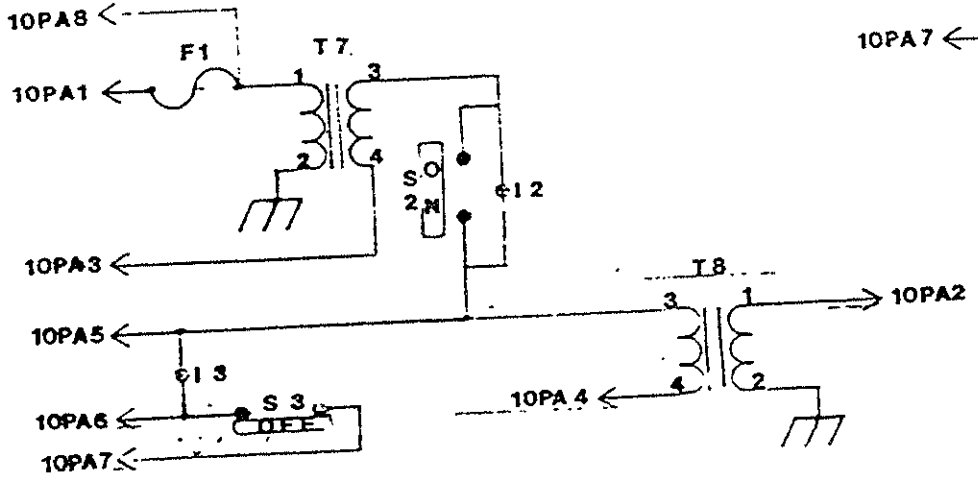


R18 (10 KV FEEDBACK POT)



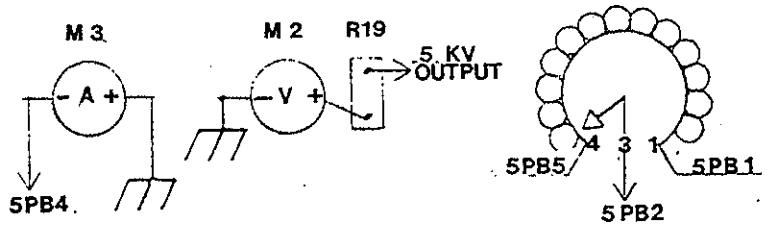




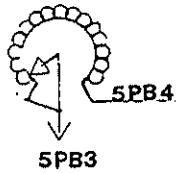


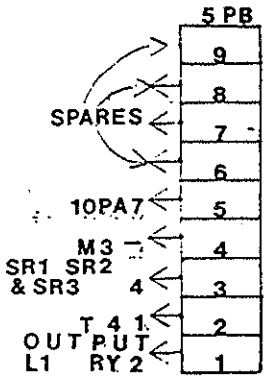
MIDDLE PANEL

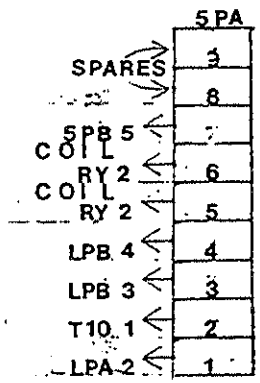
T5 (5KV VARIAC)

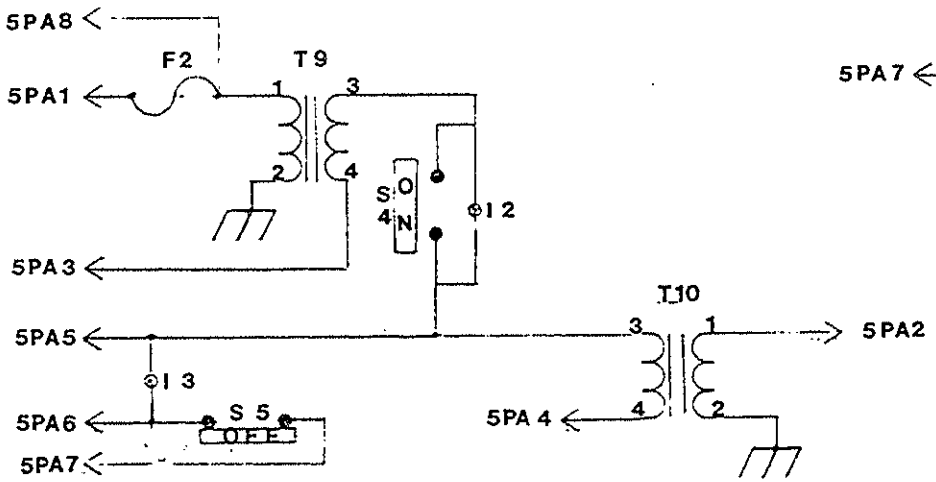


R17 (5KV FEEDBACK POT)

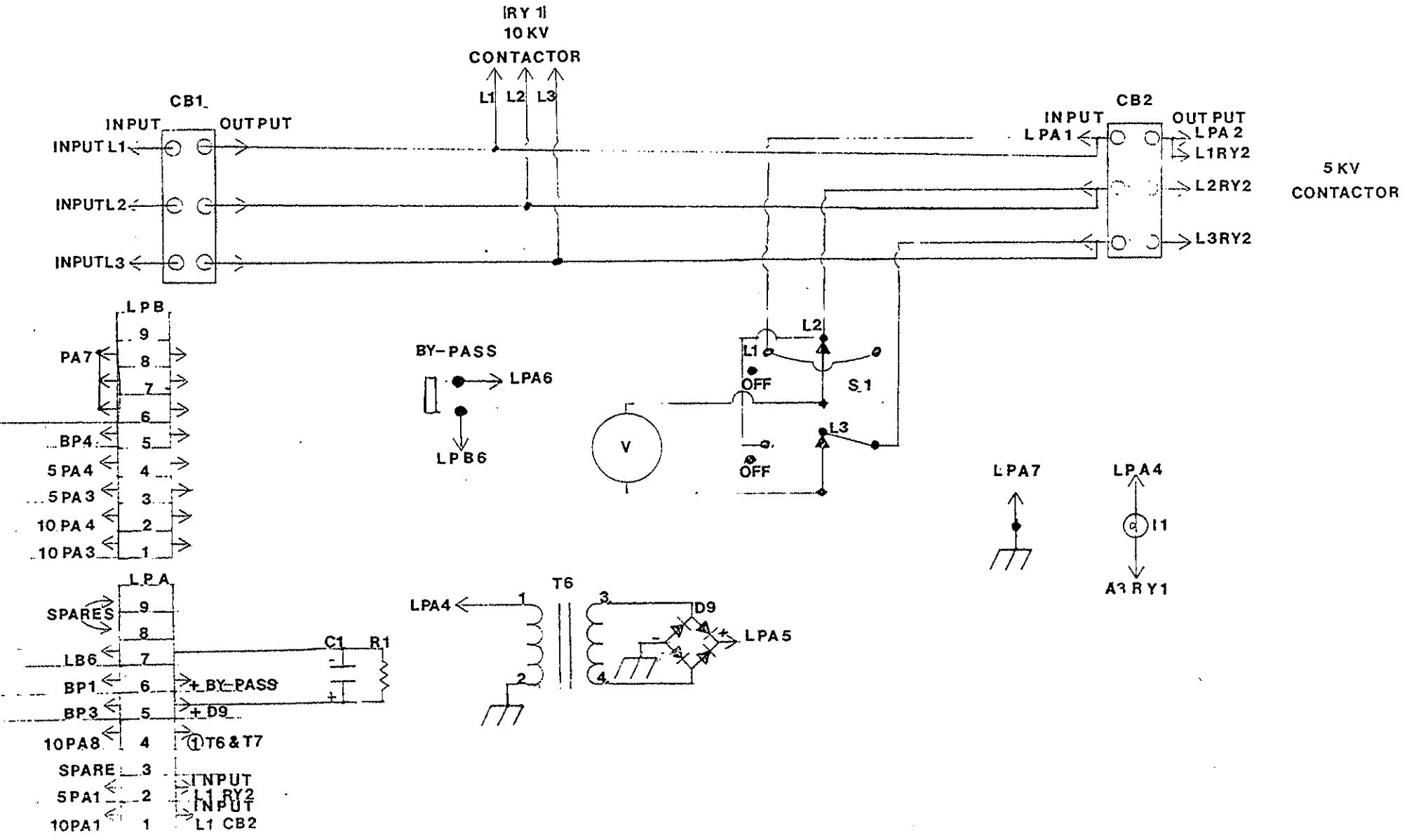




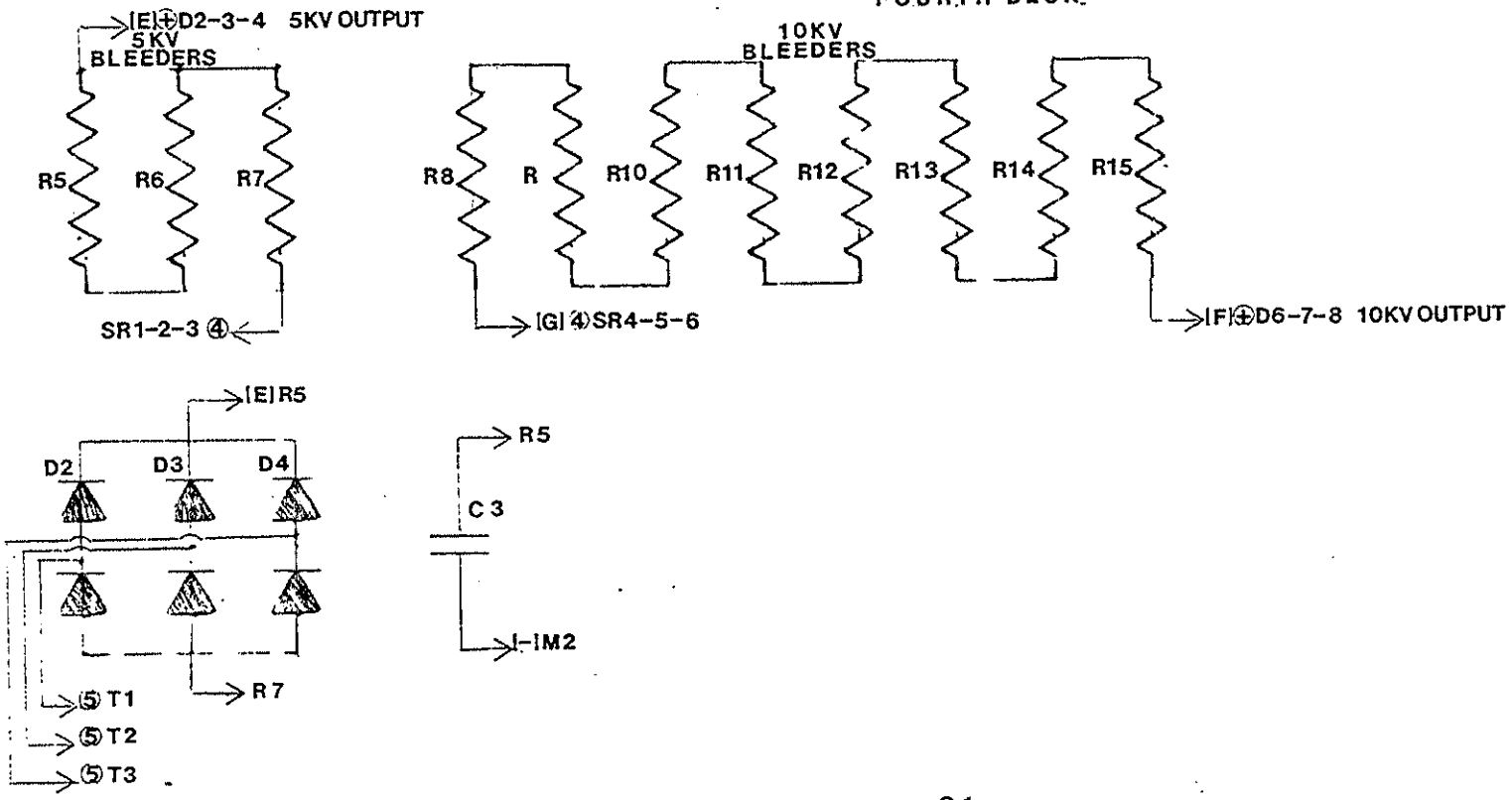


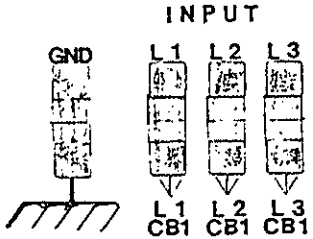


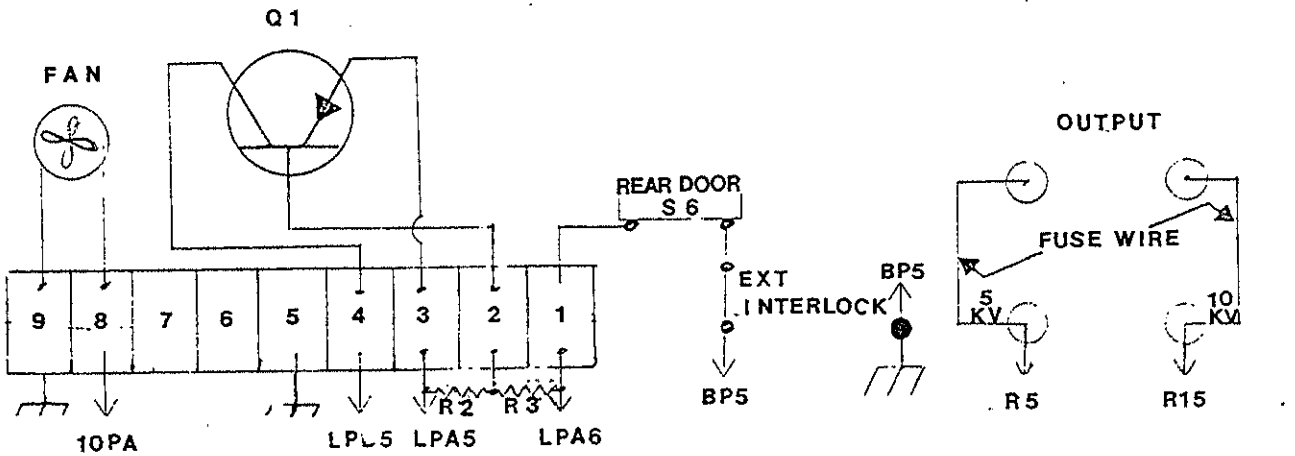
BOTTOM PANEL



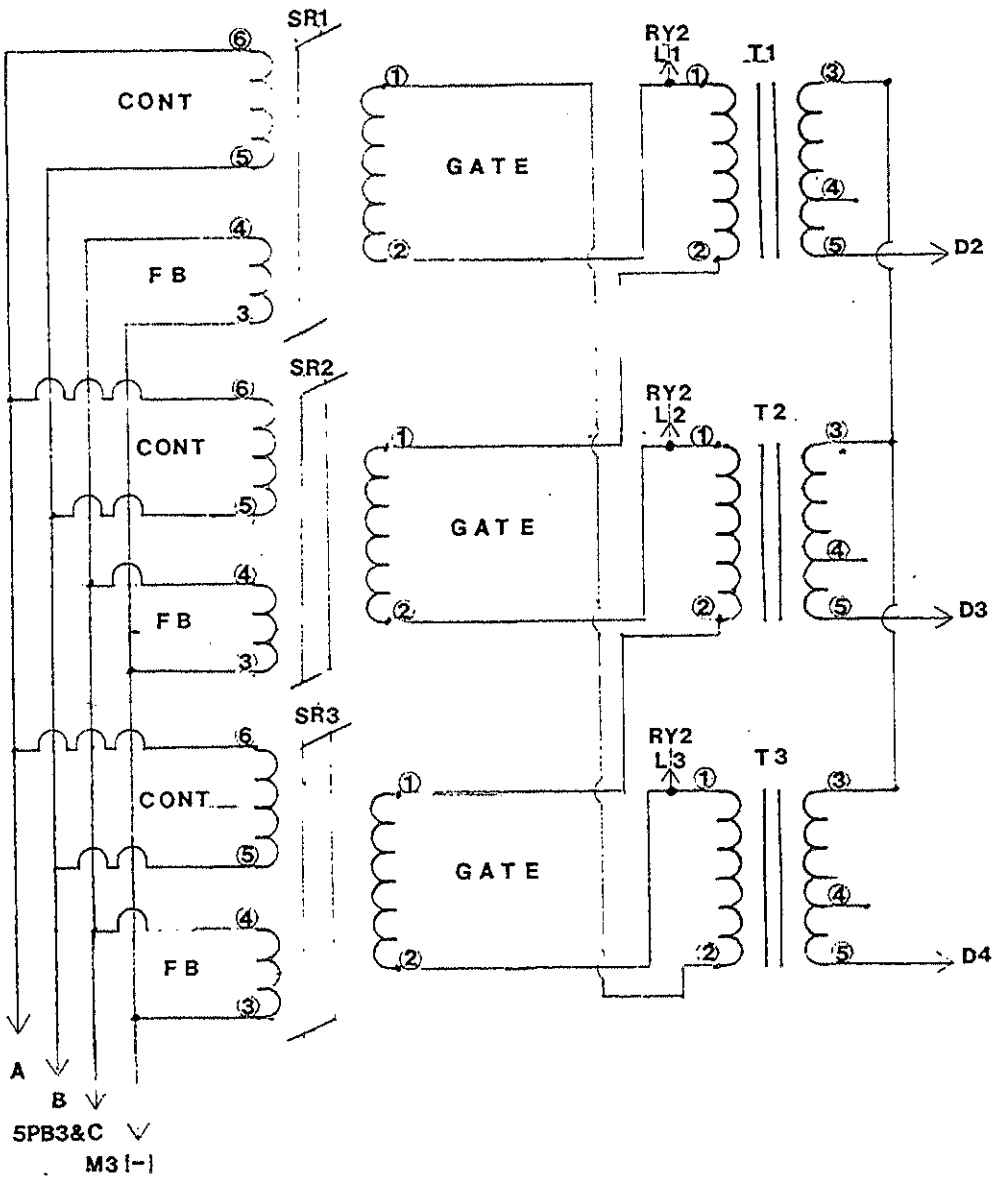
FOURTH DECK


[E]⊕D2-3-4 5KV OUTPUT
5KV BLEEDERS
R5
R6
R7
SR1-2-3 ④
10KV BLEEDERS
R8
R
R10
R11
R12
R13
R14
R15
[G] ④SR4-5-6
[F]⊕D6-7-8 10KV OUTPUT
[E]R5
D2
D3
D4
C3
R5
[-]M2
R7
⑤T1
⑤T2
⑤T3

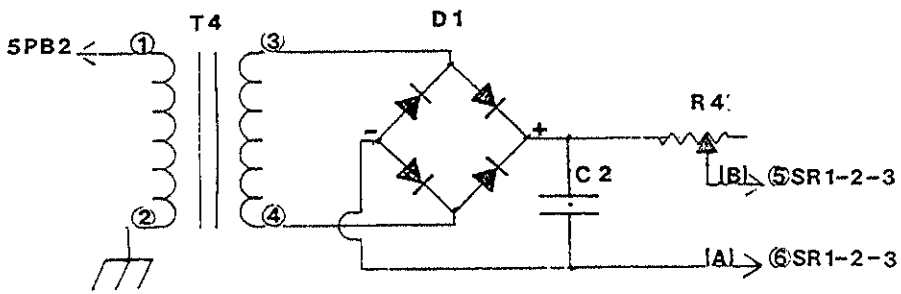

INPUT
GND
L1
L2
L3
L1 CB1
L2 CB1
L3 CB1


Q1
FAN
REAR DOOR S6
EXT INTERLOCK
BP5
BP5
OUTPUT
FUSE WIRE
5 KV
10 KV
R5
R15
9
8
7
6
5
4
3
2
1
R2
R3
10PA
LPA5
LPA5
LPA6

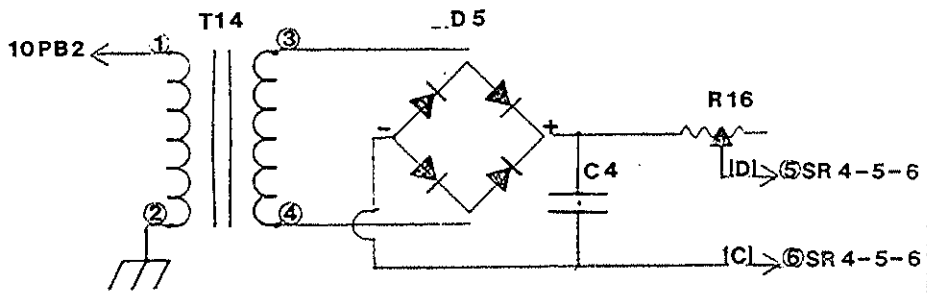
THIRD DECK

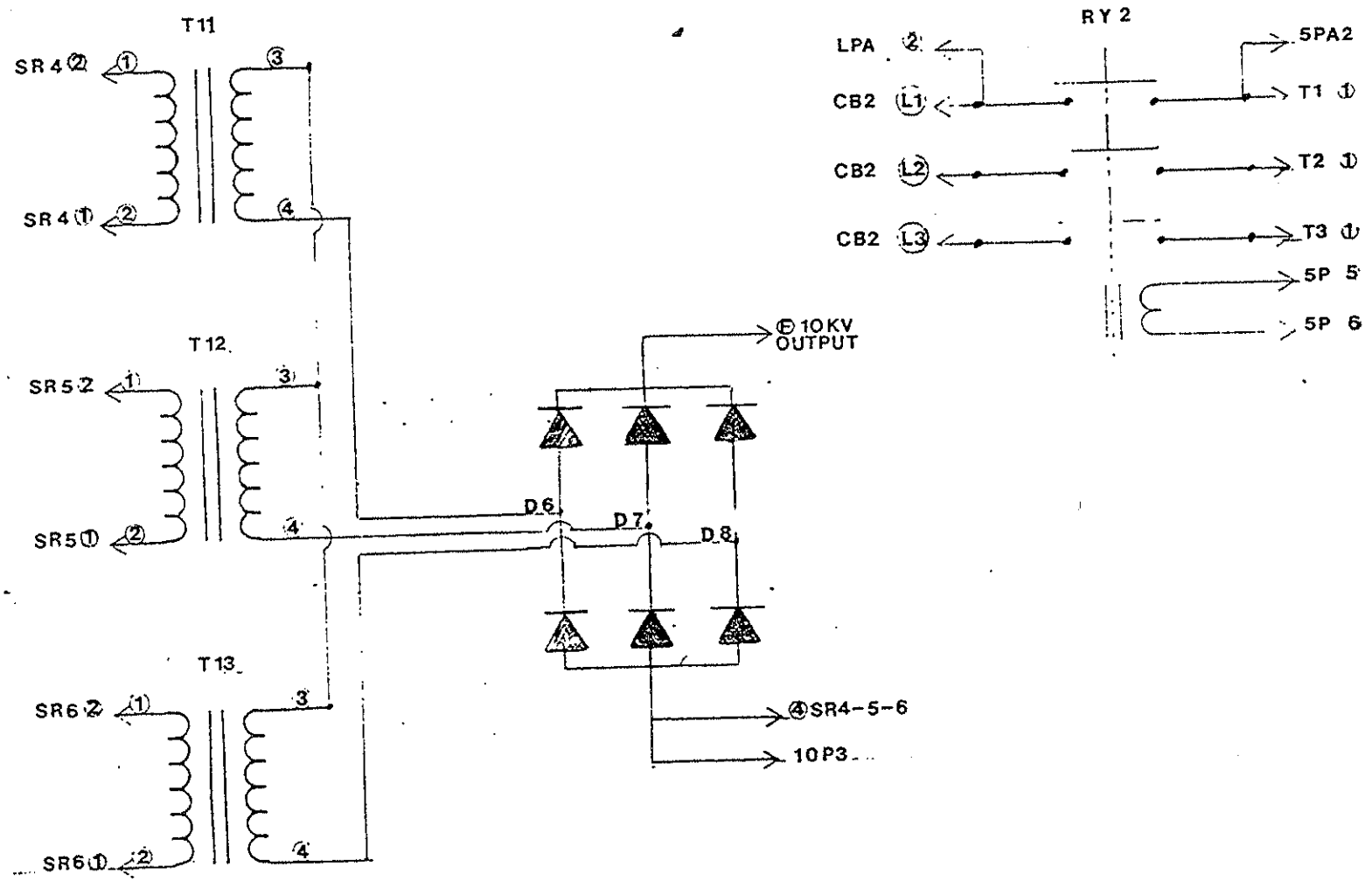


5KV CONTROL CIRCUIT

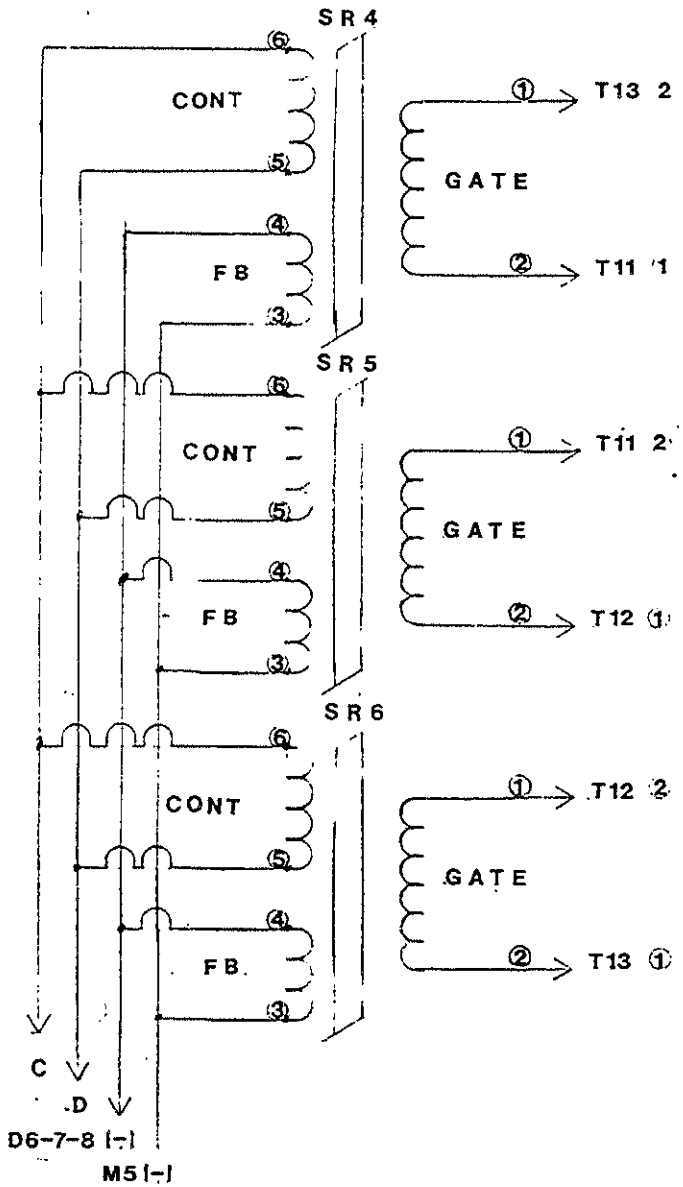


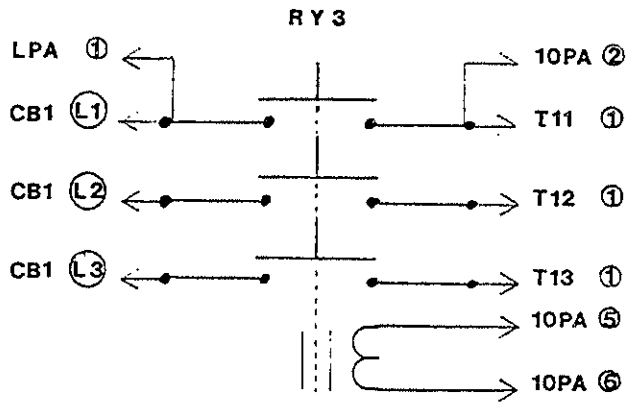
10KV CONTROL CIRCUIT

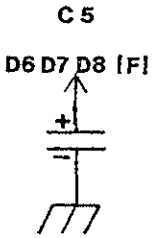



T11
SR4 ②
①
③
SR4 ①
②
④
T12
SR5 ②
①
③
SR5 ①
②
④
T13
SR6 ②
①
③
SR6 ①
②
④
D6
D7
D8
⑤10KV
OUTPUT
④SR4-5-6
10P3
RY 2
LPA
②
CB2
L1
CB2
L2
CB2
L3
5PA2
T1 ①
T2 ①
T3 ①
5P 5
5P 6

BOTTOM DECK


SR 4
CONT
FB
GATE
T13 2
T11 1
SR 5
CONT
FB
GATE
T11 2
T12 1
SR 6
CONT
FB
GATE
T12 2
T13 1
C
D
D6-7-8 (-)
M5 (-)


RY 3
LPA 1
CB1 L1
CB1 L2
CB1 L3
10PA 2
T11 1
T12 1
T13 1
10PA 5
10PA 6


C 5
D6 D7 D8 (F)
+
-