267B
DIGITAL PYROMETER

06252

MDG0795NEBB

CHG	ECO NO	DATE	BY	CHK
M	6669	10 APR 90	MV	LGA

TABLE OF CONTENTS

INITIAL CHECKOUT PROCEDURE

INITIAL CHECKOUT PROCEDURE

See Section 2.1 for Unpacking and Inspection instructions.

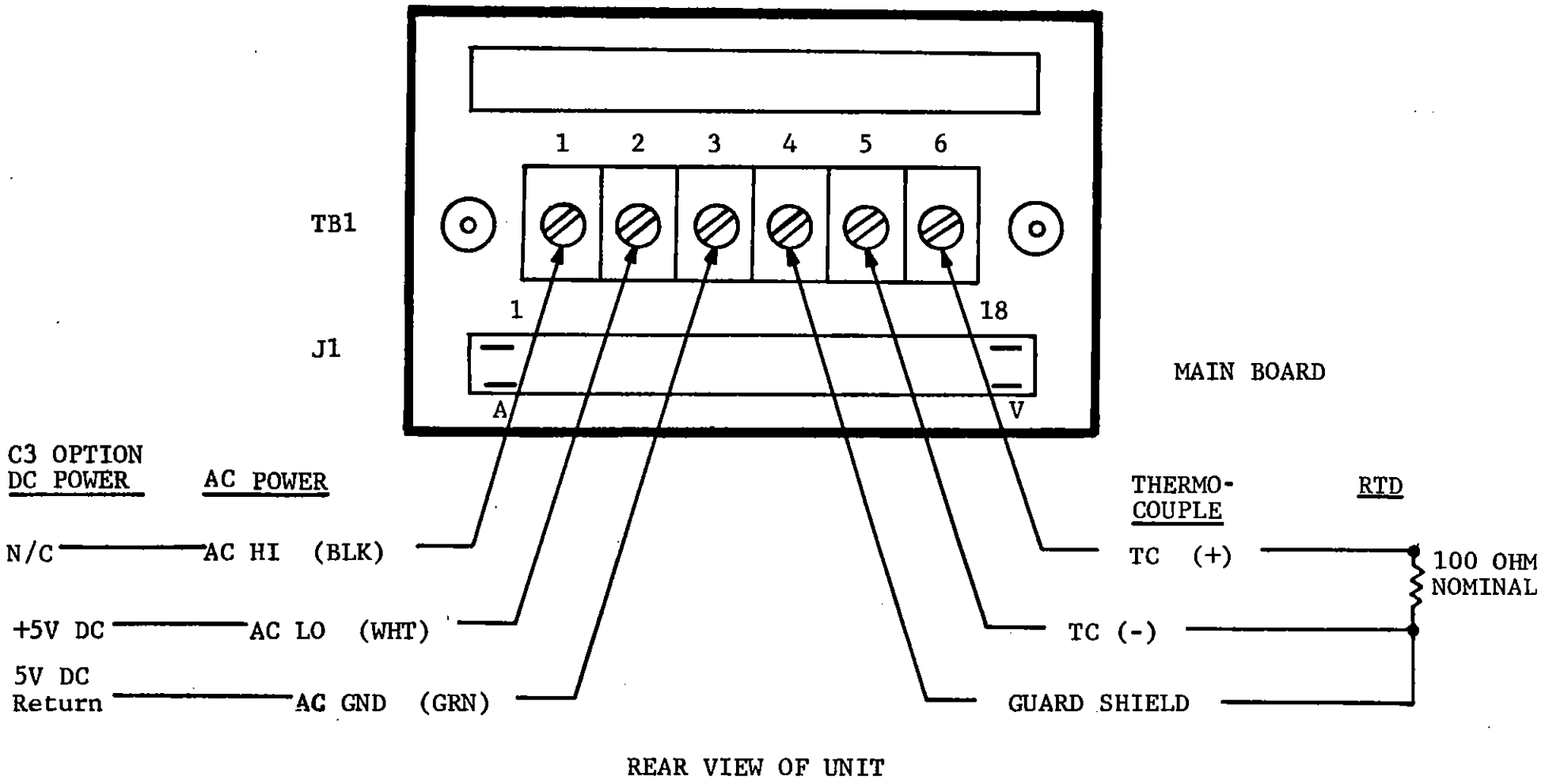
> **CAUTION**
>
> Meters are internally connected for either 115V or 230V AC power, or 5V DC power. Check label on meter for proper supply voltage.

REQUIRED EQUIPMENT

1. 115V or 230V 50-60 Hz power source (6 watts) or 5V DC at 900mA.
2. Three wire AC power cord, or two wire DC power cord.
3. Flat blade screwdriver (1/4" blade).
4. Piece of copper buss wire.
5. 100 Ohm resistor.

TEST EQUIPMENT

1. Connect AC power as follows: (See Figure 1)
   a. AC power HI (Blk) to TB1-1.
   b. AC power LO (Wht) to TB1-2.
   c. AC power GND (Grn) to TB1-3.
2. Connect DC power (Option C3) as follows: (See Figure 1)
   a. +5V DC to TB1-2.
   b. 5V DC Return to TB1-3.
3. For Thermocouple Meters connect a piece of copper wire between TB1-5 and TB1-6.
4. Apply power and examine the display. The readout should show the approximate ambient temperature in ^{o}C or ^{o}F as applicable.
5. For RTD meters connect a 100 Ohm resistor between TB1-5 and TB1-6. Then connect a piece of copper wire between TB1-4 and TB1-5.
6. Apply power and examine the display. The readout should show approximately zero.



REAR VIEW OF UNIT

SECTION 1

DESCRIPTION

1.1 General

The Newport Model 267B Digital Pyrometers are low cost, reliable instruments which digitally display the magnitude of a wide range of thermocouple inputs in degrees of celsius or fahrenheit.

A single plug-in range module contains all the signal conditioning for a specific thermcouple or platinum RTD. Modules are precalibrated at the factory and require no additional calibration when installed on the 267B main board. Less than five minutes is required to change ranges in the field.

The Model 267B is a line-operated meter with 14.2mm high 7 segment LED readout. The housing is an unbreakable thermoplastic case. Zero adjustment is easily accessible with the lens removed.

Accuracy at the low end of each range is not degraded by normal mode noise because the 267B performs true bipolar signal integration around zero.

Data output lines are parallel BCD, compatible with TTL and DTL. External control signals are also TTL and DTL compatible and increase the flexibility and ease of interfacing the Model 267B with other instruments.

1.2 Specifications

1.2.1 Input

Configuration	Potentiometric and isolated.
Polarity	Bipolar with negative sign.
Zero	Automatic with negligible long term drift. Thermal emf's from input terminals, signal conditioning and basic meter is less than 0.5uV/^{o}C.
Full Scale Voltage	20mV to 200mV
Overvoltage Protection	130V RMS for TC or 6Vp for RTD without damage.
Impedance	
RTD	1000 Megohm
TC	100 Megohm
TC Break Detection	66 Nanoamps current source with 100 Megohm impedance.
Lead Resistance	
TC	250 Ohms max for rated TC accuracy.
RTD	10 Ohms Maximum per conductor. Add 0.012% R per Ohm for 0.01^{o} resolution and 0.005% R per Ohm for 0.1^{o} resolution to overall RTD accuracy.
NMR @ 50/60 Hz	60dB
CMR with 250 Ohm Imbalance ...	120dB AC power to Signal low. 120dB Digital Gnd to Signal low.
CMV (DC to 60 Hz).....	500 volts peak.

NOTE: ADDING C3 OPTION INCREASES INPUT NOISE ONE MICROVOLT.

1.2.2 Signal Conditioning

TC Reference Junction	From 10-40°C ambient, 0.03 deg/deg for base metals and 0.05 deg/deg for noble metals with 1 degree resolution. 0.015 deg/deg for base metals with 0.1 resolution. Sensor offset adjusted to zero from front panel.
RTD Bridge Network	From 10-40°C ambient, 0.01 deg/deg for platinum with 0.1 and 1.0 degree resolution and 0.0025 deg/deg for platinum with 0.01 degree resolution. Adjustment of Sensor offset to zero from panel automatically corrects meter calibration for RTD resistance deviations from the nominal 100 Ohm value.
Span Tempco	From 10-40°C
Thermocouple	0.006% R/Deg
RTD	
0.1° and 0.01° Resolution	0.0007% R/Deg
1° Resolution	0.006% R/Deg

1.2.3 Conversion

Technique	TC-Dual Slope, average value RTD-Dual Slope Ratiometric, average value.
Signal Intergration	100ms
Reading Rate	Int. 3-4/sec, Ext 0 to 3-4/sec.
Linearization	POLYLOG (patent applied for)

1.2.4 Display

Type	14.2mm, 7 segment LED
Symbols	-88.8.8
Decimal Points	Any of Three
Overload	3 Least Significant Digits flash.
Leading Zero Blanking	2 Most Significant Digits blank

1.2.5 Digital Signals

Logical '0'	0 to .6V (Input) 0 to .4V (output)
Logical '1'	2.0 to 5.5V (Input) 2.4 to 5.5V (Output)
1 Unit Load	Logical '0' 1.6mA Logical '1' .04mA
$\overline{\text{Hold}}$	'0' = Hold data Input load = 1 Unit load
$\overline{\text{Data Ready}}$	'0' = Valid data Output drive = 3 Unit loads
BCD Parallel Data	'1' = True Output drive = 3 Unit loads
+ Polarity	'1' = Positive Output drive = 1 Unit load
Overload	'1' = Overload output drive = 3 Unit loads

1.2.6 Power

Input Voltage	115V ±10% 50/60 Hz 230V ±10% 50/60 Hz Option C1 100V ±10% 50/60 Hz Option C5 5V DC ±5% @ 900mA Option C3
Input Power	6 watts @ nominal input
Output Voltage	+4.5V to 5.1V @ 50mA without options

1.2.7 General

Operating Temperature	0°C to 50°C
Storage Temperature	-25°C to 70°C
Humidity	Up to 95% at 40°C
Weight	540g or 1.2 lb.
Case Material	Thermoplastic per UL 94V-1
Case Size	
Bezel (W x H x T)	(96 x 48 x 5.08)mm or (3.78 x 1.89 x 0.20) in.
Depth Behind Bezel With Connector	135.4mm or 5.33 in.
Panel Cutout (W x H)	(92 x 45)mm or (3.62 x 1.77) in.
Connectors	Barrier Strip, Signal and Power. 36 Pin connector, BCD output.36 Pin connector options. (SAE SCC 18D/1-2 ELCO 00-6007-036-450-012, TRW/CINCH 251-18-90-160)

1.2.8 Temperature Sensor Ranges & Accuracy at 25°C

SENSOR TYPE	MATERIAL	RANGE	CONFORMITY ERROR	OVERALL ERROR ±1/2 LSD	RESOLUTION	RANGE OPTION
J	Iron Constantan	-120 to +760°C -200 to +1400°F	±0.78°C ±1.0°F	±1.2°C ±1.7°F	1°C 1°F	JC1 JF1
K	Chromel Alumel	-155 to +1370°C -225 to +2500°F	±1.0°C ±1.3°F	±1.7°C ±2.5°F	1°C 1°F	KC1 KF1
T	Copper Constantan	-200 to 0°C 0 to +400°C -90.0 to +400.0°C -150.0 to +750.0°F	±2.0°C ±0.58°C ±0.13°C ±0.19°F	±2.7°C ±0.78°C ±0.33°C ±0.56°F	1°C 1°C 0.1°C 0.1°F	TC1 TC1 TC2 TF2
E	Chromel- Constantan	-145 to +1000°C -100.0 to +400.0°C -250 to +1830°F -110.0 to +400.0°F	±0.95°C ±0.11°C ±1.33°F ±0.1°F	±1.5°C ±0.33°C ±2.2°F ±0.3°F	1°C 0.1°C 1°F 0.1°F	EC1 EC2 EF1 EF2
R	13% Rhodium- Pt vs Pt	-50 to +1750°C -58 to +3180°F	±2.48°C ±5.5°F	±3.4°C ±7.0°F	1°C 1°F	RC1 RF1
S	10% Rhodium- Pt vs Pt	-50 to +1750°C -58 to +3180°F	±2.1°C ±5.5°F	±3.0°C ±7.0°F	1°C 1°F	SC1 SF1
B	Platinum 30% Rhodium vs Platinum 6% Rhodium	+250 to +1800°C +500 to +3300°F	±2.85°C ±4.8°F	±3.8°C ±6.5°F	1°C 1°F	BC1 BF1
W	W5% Re- W26% Re-	0 to +2200°C 0 to +4000°F	±3.6°C ±6.4°F	±4.7°C ±8.5°F	1°C 1°F	WC2 WF2
	Chromel vs Au-0.07 at %Fe	-268.0 to +51.0°C	±0.32°C	±0.55°C	0.1°C	GC1
RTD	DIN NBS DIN NBS Pt US Std 100 Ω US Std NBS NBS US Std US Std DIN	-200.0 to +780.0°C -200.0 to +630.0°C -20.00 to +78.00°C -20.00 to +78.00°C -200.0 to +78.00°C -20.00 to +78.00°C -330 to +1160°F -200.0 to +780.0°F -330 to +1160°F -200.0 to +780.0°F +80.0 to +780.0°K	±0.05°C ±0.05°C ±0.005°C ±0.005°C ±0.05°C ±0.005°C ±0.5°F ±0.05°F ±0.5°F ±0.05°F ±0.2°K	±0.44°C ±0.35°C ±0.044°C ±0.044°C ±0.44°C ±0.044°C ±1.1°F ±0.44°F ±1.1°F ±0.44°F ±0.6°K	0.1°C 0.1°C 0.01°C 0.01°C 0.1°C 0.01°C 1°F 0.1°F 1°F 0.1°F 0.1°K	PC1 PC2 PC3 PC4 PC5 PC6 PF1 PF2 PF3 PF4 PK2

Overall error:	Includes all error sources (basic meter, signal conditioner, linearizer conformity, etc.) at 25°C.
Long Term Stability:	0.05% error/yr for one degree resolution base metal thermocouples and Pt RTD except for 0.01°C resolution RTD.
	0.1% error/yr for fractional degree resolution base metal thermocouples.
	0.2% error/yr for noble metal, tungsten, gold 0.07 at % Fe thermocouples and 0.01°C resolution Pt RTD.

Calibration of RTD Range Options:

1. PC1 and PC3 are calibrated to DIN standard 43760 with Alpha = .00385 .

2. PC2, PC4, PF1 and PF2 are calibrated to IPTS-68 (NBS Monograph 125) with Alpha = .003925 .

3. PC5, PC6, PF3 and PF4 are calibrated to a U.S. standard with Alpha = .003902 .

SECTION 2

RECEIVING AND INSPECTION

2.1 Unpacking and Inspection

Your Model 267B was fully inspected and tested, then carefully packed before shipment. Unpack the meter and inspect for obvious shipping damage.

2.2 Mechanical Installation

The Outline and Mounting drawing illustrates the mounting method for your digital pyrometer. The unit is inserted from the front of the panel and held in place by two slide retainers. The panel thickness may be between .75 mm (.03") and 6.35 mm (.25")

SECTION 3

OPERATING INSTRUCTIONS

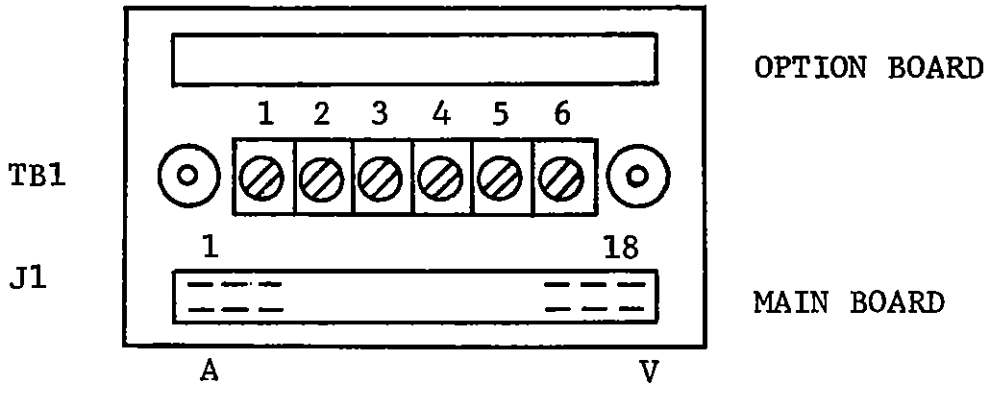
3.1 Pin Assignments

3.1.1 Connector TB1

TB1-PIN	POWER AC OPERATION	5 DC OPERATION
1	AC Power HI	N/C
2	AC Power LO	+ 5 Volts
3	AC Power GND	5V Return

TB1-PIN	FUNCTION TC OPERATION	RTD
4	TC Guard Shield	
5	TC (-) Input*	
6	TC (+) Input*	

*NOTE: For Option GC1 the thermocouple polarity must be reversed.



REAR VIEW OF UNIT

Figure 2

3.1.2 Connector J1

J1-PIN	FUNCTION	J1-PIN	FUNCTION
1	No Connection	A	Spare
2	Spare	B	No Connection
3	No Connection	C	Spare
4	$\overline{\text{Blank}}$	D	1 Bit
5	COMP	E	2 Bit
6	SIG	F	4 Bit
7	Clock	H	8 Bit
8	80 Bit	J	100 Bit
9	40 Bit	K	200 Bit
10	20 Bit	L	400 Bit
11	10 Bit	M	800 Bit
12	1K Bit	N	+ Polarity
13	2K Bit	P	$\overline{\text{Data Ready}}$
14	4K Bit	R	$\overline{\text{Hold}}$
15	+5V	S	Ext $\overline{\text{OL}}$ (In)
16	Signal Gnd	T	Digital Gnd
17	Signal In	U	$\overline{\text{Conv}}$
18	OL	V	REF

Connector Type	ELCO	00-6007-036-450-012
	TRW/CINCH	251-18-90-160
	SAE	SCC18D/1-2

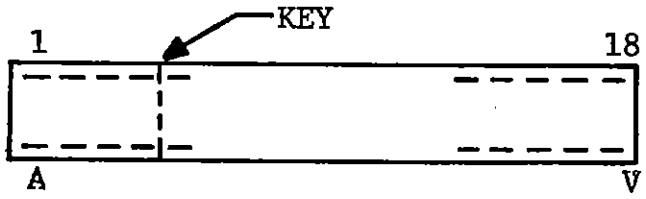


Figure 3
Connector Pin Orientation As Viewed From The Rear Of The Meter

NOTE: For an interconnect cable longer than 6 inches see Section 3.4.1

3.2 Power

3.2.1 Input Voltage

The standard meter operates from 115V ±10% 60 Hz. It consumes about 6 watts. A three wire connection should be used to connect power to the meter. Two conductors provide power to the meter and the third provides a ground for noise rejection.

Option C1 is 230V ±10%, 50 Hz operation. To change the meter in the field, from 115 to 230V operation, use the following procedure. See Figure 4

(1) Remove power lines from meter and remove the meter from the case.

(2) Remove the two jumpers on the transformer W1 and W2.

(3) Add jumper between E6 and E7 on the printed circuit board. The meter is now wired for 230V.

To change the meter from 230V to 115V operation, reverse the above steps.

3.2.2 Input Fuse

The power input to the Model 267B is protected by a carbon composition resistor fuse. If the meter does not light and it is suspected that the fuse has been blown, check the continuity of the primary circuit. The resistance from power Hi to power Lo will be approximately 118 Ohms for a 115V meter and 470 Ohms for the 230V meter. If the fuse is blown, it is imperative that it is replaced by an identical part, failure to do so will void the warranty. The fuse is an Allen-Bradley 1/8W, 10 ohm, ±10% carbon composition resistor Newport part number 8111109.

3.2.3 Output Voltage

The +5V output is a regulated supply with the voltage range 4.5V to 5.1V. A maximum current of 50mA is available for external use when meter is without options 05, 06, F3 or F4.

3.3 Signal Input

3.3.1 Signal

For best results a shielded thermocouple should be used for the input signal, with the shield terminated to Signal Guard at the connector TB1-4.

Signal Guard and Analog Ground are internally connected. Analog Ground and Digital Ground are optically isolated.

3.3.2 Ground Precautions

It is essential that the ground connections to the Model 267B be proper for accurate readings. The input guard is internally connected to Analog Ground through a low internal resistance.

A shielded thermocouple must not have the shield connected at both the thermocouple and at Signal Guard (TB1-4).

3.3.3 Input Range Change

All Model 267B pyrometers are shipped with a single plug-in range module that contains all the signal conditioning for a specific thermocouple or platinum RTD. Range modules are precalibrated at the factory and require no additional calibration when installed on the 267B main board. Less than five minutes is required to change ranges in the field using the following procedure:

a. Remove AC power from meter.

b. Remove lens, two screws, clamp rings and slide retainers shown in Outline and Mounting drawing. (See Dwg. # 06896)

c. Remove top half of case.

d. Locate the range module mounting screw in Figure 4 and remove.

e. Now lift range module straight up being careful not to bend the pins connecting the range module with the main board.

f. For Options PC3, PC4 or PC6 solder jump "C" Decimal #2 on Display Board. (See Figure 4)

g. For Option GC1, cut jumper "A" and solder jump "B" on main board. (See Fig. 4)

h. To install new range module reverse above procedure.

i. It is necessary to rezero the meter when changing sensors.

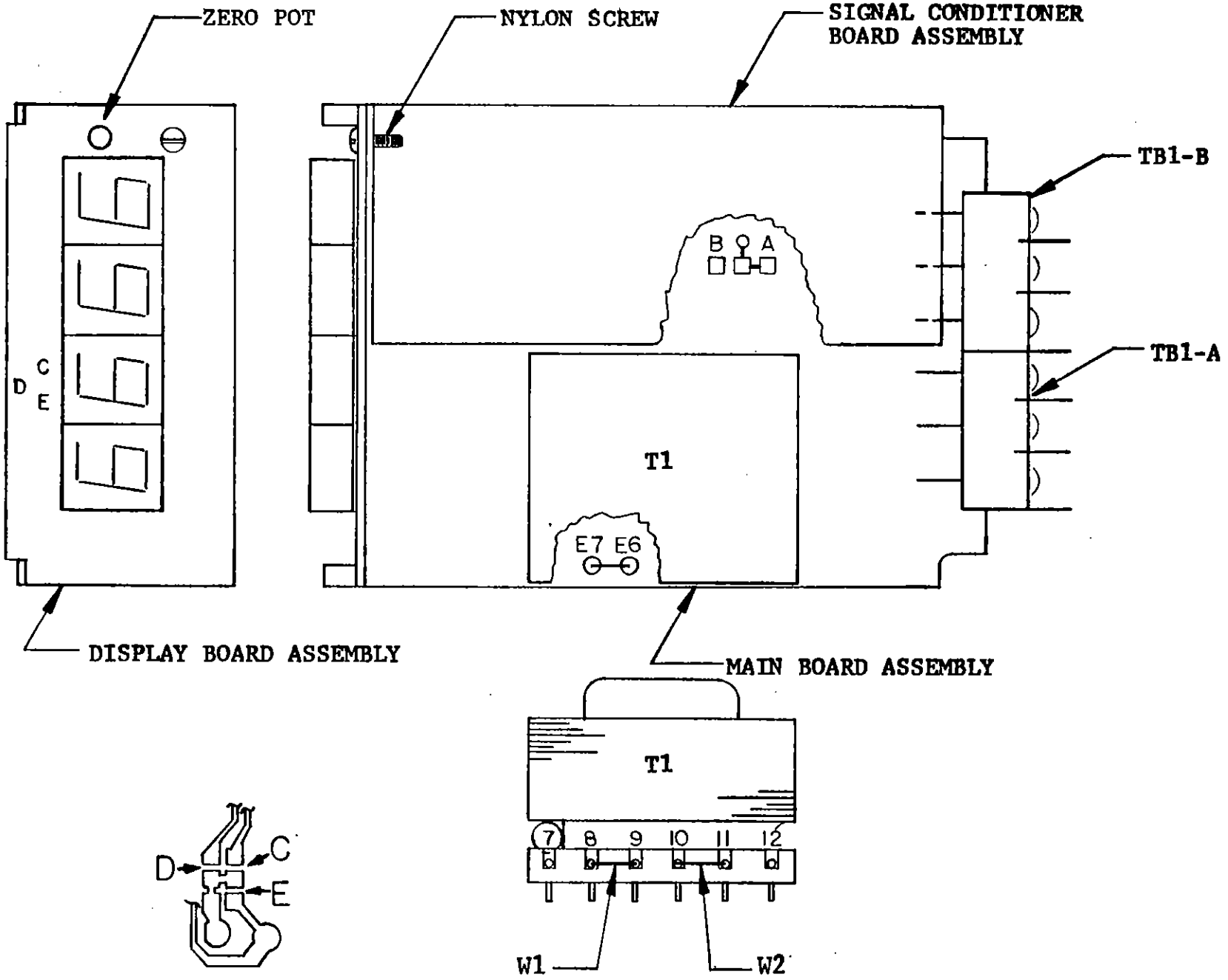

ZERO POT
NYLON SCREW
SIGNAL CONDITIONER BOARD ASSEMBLY
TB1-B
TB1-A
B A
T1
E7 E6
D C E
DISPLAY BOARD ASSEMBLY
MAIN BOARD ASSEMBLY
T1
7 8 9 10 11 12
W1
W2
D
C
E

Figure 4

3.4 Digital Signal Outputs

3.4.1 BCD Parallel

All BCD outputs are TTL and DTL compatible.

Logical '1'	2.4 to 5.1V, source 0.28mA
Logical '0'	0 to 0.4V, sink 4.8mA

The data outputs are parallel BCD. The outputs are stable and valid while Data Ready (pin P) is low. For interconnect cable of up to 3 feet add 4 10K resistors from pin 15 to pin F, 9, L and 14.

3.4.2 + Polarity

Logical '1'	2.4 to 5.1V, source 0.08mA
Logical '0'	0 to 0.4V, sink 1.6mA

The + Polarity output is a logical '1' when the meter indicates a positive reading.

3.4.3 $\overline{\text{Data Ready}}$

Logical '1'	2.4 to 5.1V, source 0.28mA
Logical '0'	0 to 0.4V, sink 4.8mA

$\overline{\text{Data Ready}}$ will go to a logical '0' at the end of a conversion cycle and to a logical '1' at the beginning of a conversion cycle.

3.4.4 Overload

Logical '1'	2.4 to 5.1V source 0.28mA
Logical '0'	0 to 0.4V, sink 4.8mA

Overload will go to a logical '1' if the display is equal to or greater than the BCD bit internally programmed on range module. It is stable while $\overline{\text{Data Ready}}$ is low. The Overload bit will reset during each conversion cycle.

3.4.5 $\overline{\text{Conv.}}$

Logical '1'	2.4 to 5.1V, source 0.32mA
Logical '0'	0 to 0.4V, sink 6.4mA

$\overline{\text{Conv.}}$ will go to a logical '0' at the beginning of a conversion cycle and a logical '1' at the end of a conversion cycle.

3.4.6 Clock

Logical '1'	2.4 to 5.1V, source 0.28mA
Logical '0'	0 to 0.4V, sink 4.8mA

Clock is 80 KHz. It is available during the conversion cycle and if gated off with (SIG) signal time it can be used as a serial BCD output.

3.4.7 SIG

Logical '1'	2.4 to 5.1V, source 0.32mA
Logical '0'	0 to 0.4, sink 8mA

SIG will go to a logical '1' at the beginning of signal intergrate and will go to logical '0' at the end of signal integrate.

3.4.8 REF

Logical '1'	2.4 to 5.1V, source 0.08mA
Logical '0'	0 to 0.4V, sink 1.6mA

REF will go to a logical '1' at the beginning of reference integrate and will go to logical '0' at the end of reference integrate.

3.5 Digital Signal Inputs

3.5.1 $\overline{\text{Hold}}$

Logical '1'	2.0V, source 0.04mA
Logical '0'	0.8V, sink 1.2mA

When a logical '0' is applied to the $\overline{\text{Hold}}$ input, the meter will finish the conversion cycle it is on and will hold that reading. If it is applied before the beginning of a conversion, the meter will not start that conversion. Upon a logical '1' at the $\overline{\text{Hold}}$ input, a new conversion will begin within 360msec.

3.5.2 EXT $\overline{OL}$

Logical '1'	2.0V, source 0.28mA
Logical '0'	0.8V, sink 4.8mA

When a logical '0' is applied to the EXT $\overline{OL}$ input, the three least significant digits will flash if the input is derived from a BCD bit gated with REF.

3.5.3 $\overline{Blank}$

Logical '1'	2.0V, source 0.32mA
Logical '0'	0.8V, sink 6.4mA

When a logical '0' is applied to the $\overline{Blank}$ input, the three least significant digits will go blank.

3.5.4 Comp.

Logical '1'	1.5V, source 0.0mA
Logical '0'	0.8V, sink 4.8mA

When a logical '0' is applied to the Comp. input, the digital logic is forced to readout the programmed overload point.

Note: This input must be interfaced with an open collector device.

3.5.5 Decimal Points

Any of three decimal points can be lighted by connecting the appropriate jumper with a bridge of solder as shown in Figure 4.

Note: Except for .01 degree meters the decimal point is programmed by the plug in range module.

SECTION 4

ADJUSTMENT AND CALIBRATION

4.1 The Model 267B was calibrated at the factory with a precision source. Frequent calibration is not necessary due to the stability and internal accuracy of the meter. All adjustments are sealed except the zero adjustment which is accessible with the lens removed. The user should adjust the zero pot for each thermocouple used.

If the plug-in range module requires calibration, return to the factory for calibration. Be sure to pack in a shipping container of sufficient size to allow ample packing material around unit to prevent damage in shipping.

4.2 Calibration Verification for Thermocouples.

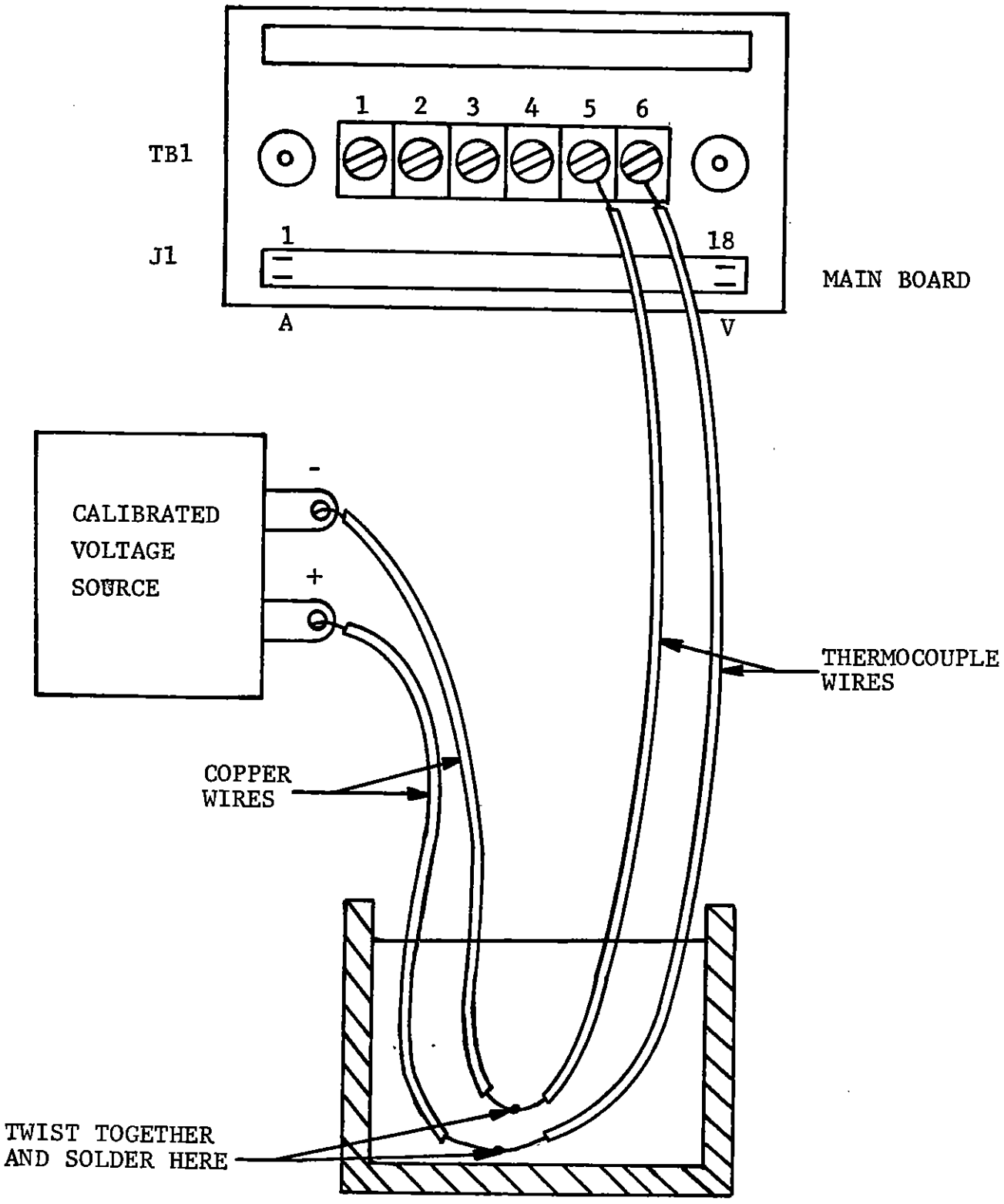
The following procedure should be used to verify the calibration of thermocouple type meters.

1. Connect test cables as shown in Figure 5.
2. Apply power and allow meter to warm up for ten minutes.
3. Apply zero volts from calibrated voltage source and verify readout of $\pm 00^{\circ}C$ or $32^{\circ}F$. Adjust zero pot if required (see Figure 4 for location.)
4. Verify that the 267B is calibrated to the international Practical Temperature Scale, IPTS-68, as published in NBS Monograph 125 issued March 1974 or ASTM E230-72 or ASA C96.2-1973.

4.3 Calibration Verification for RTD's.

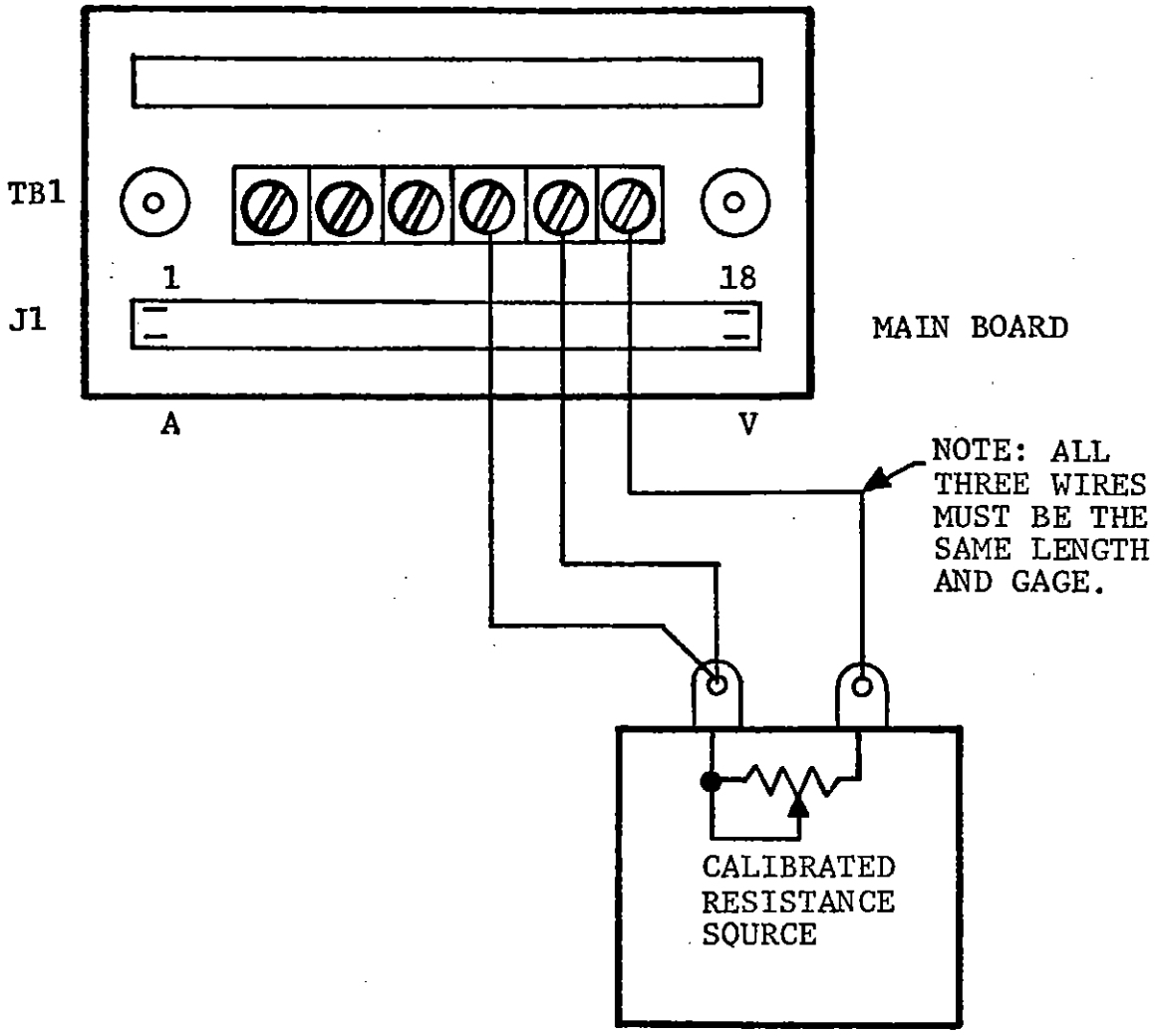
The following procedure should be used to verify the calibration of RTD type meters.

1. Connect test cables as shown in Figure 6.
2. Apply power and allow meter to warm up for ten minutes.
3. Apply appropriate resistance from the calibrated resistance source from one of three standards listed in section 1.2.8.



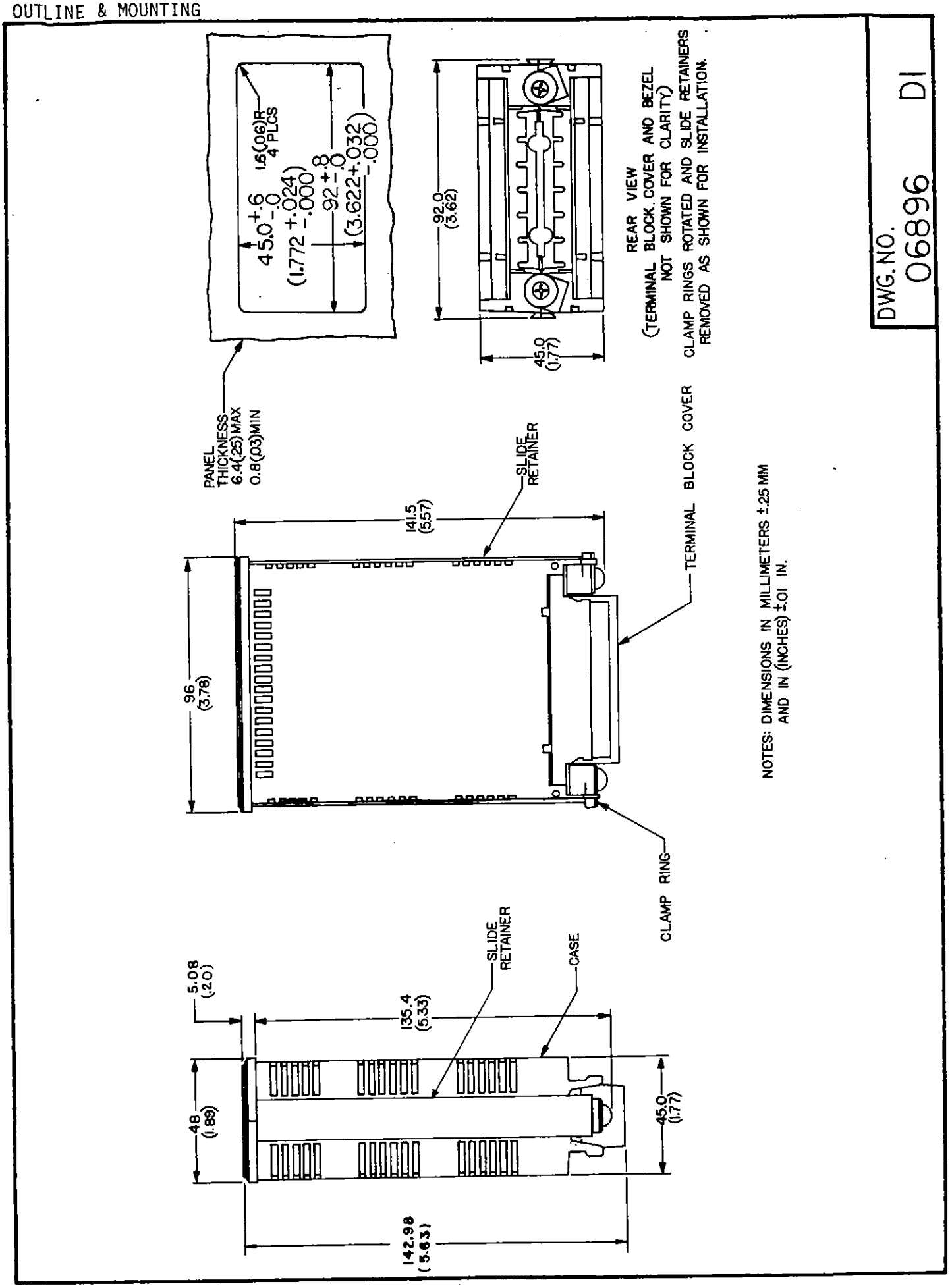
ICE BATH
Figure 5

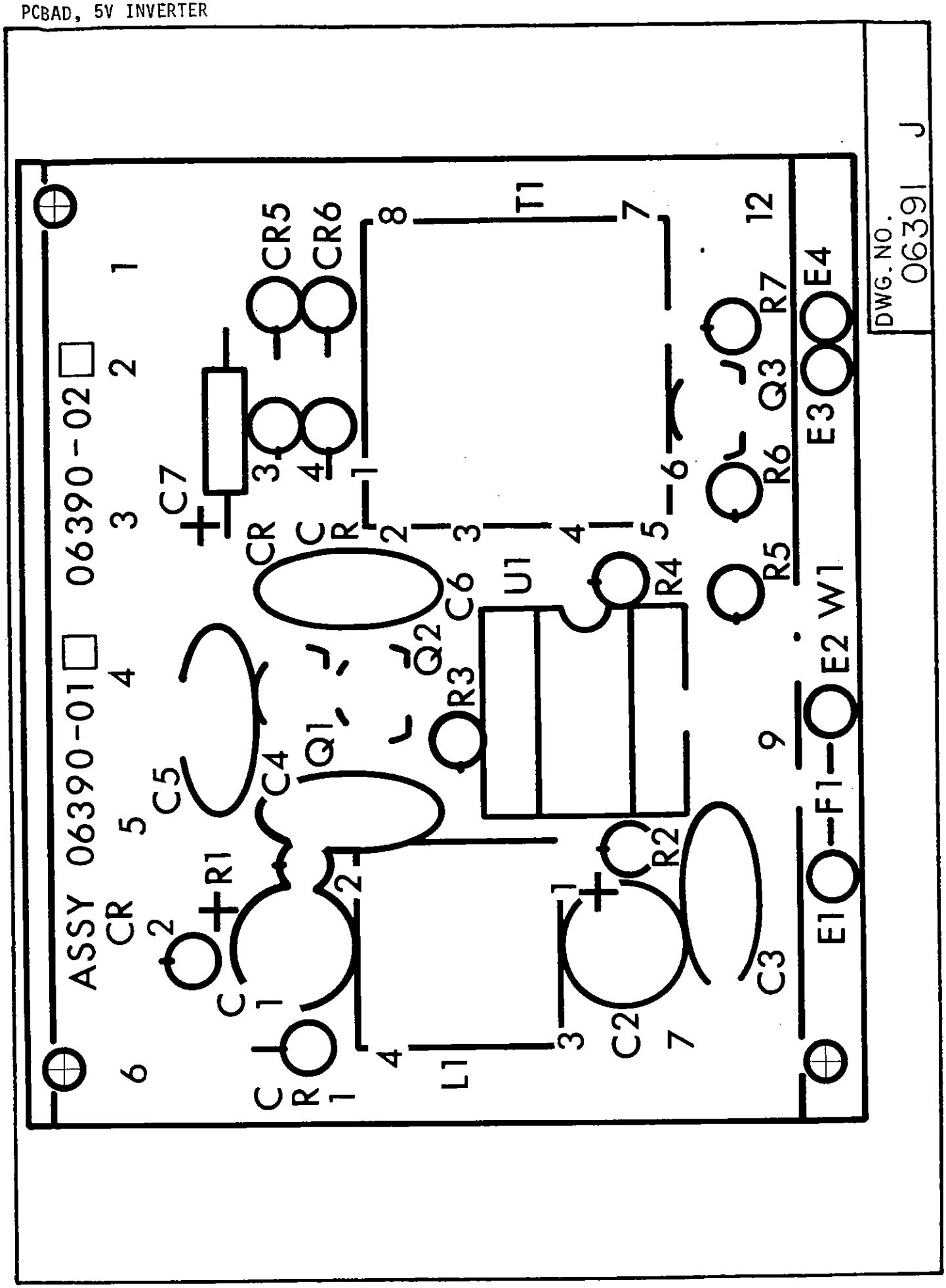
REAR VIEW OF UNIT

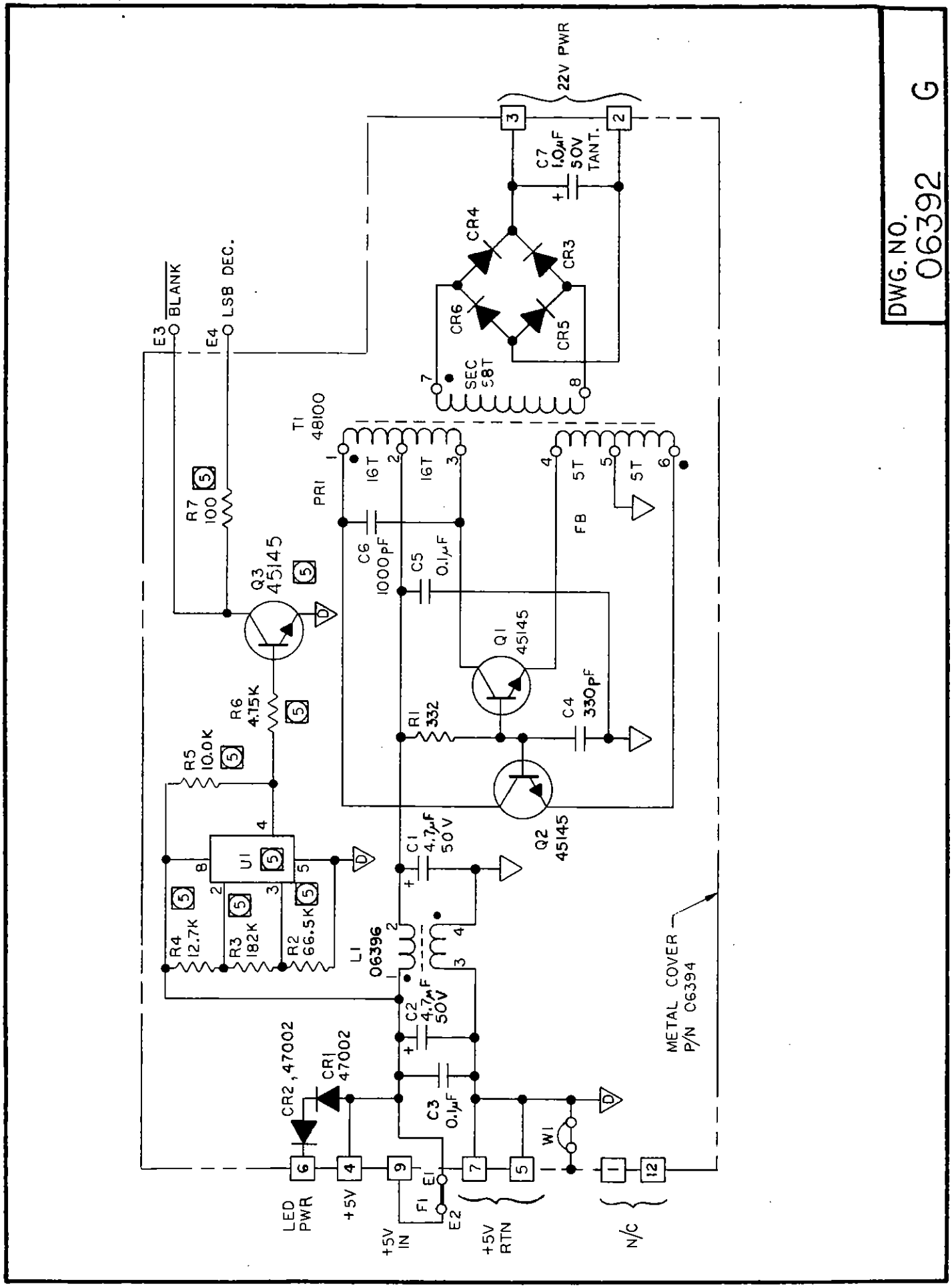


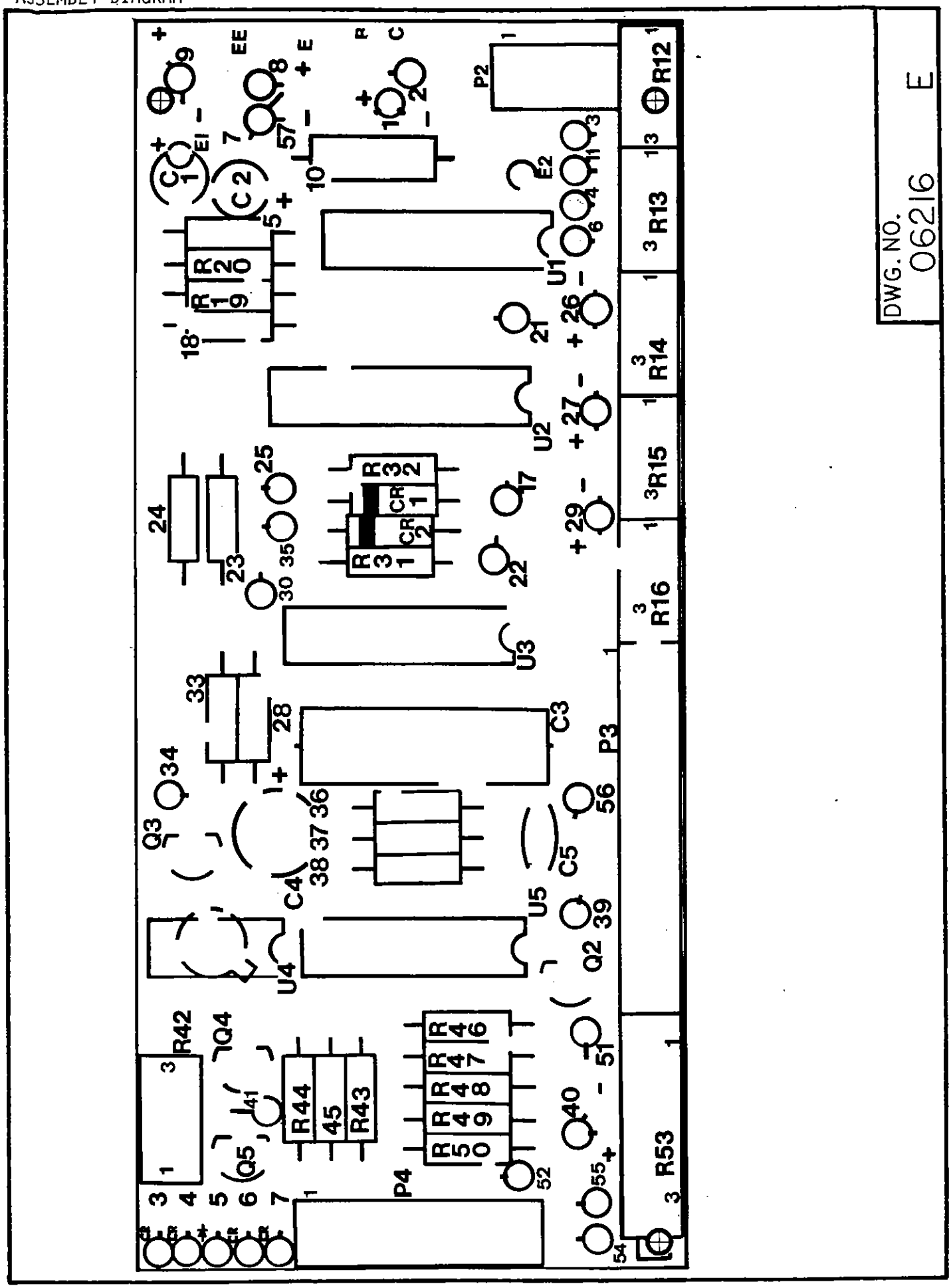
3 WIRE RTD CALIBRATION

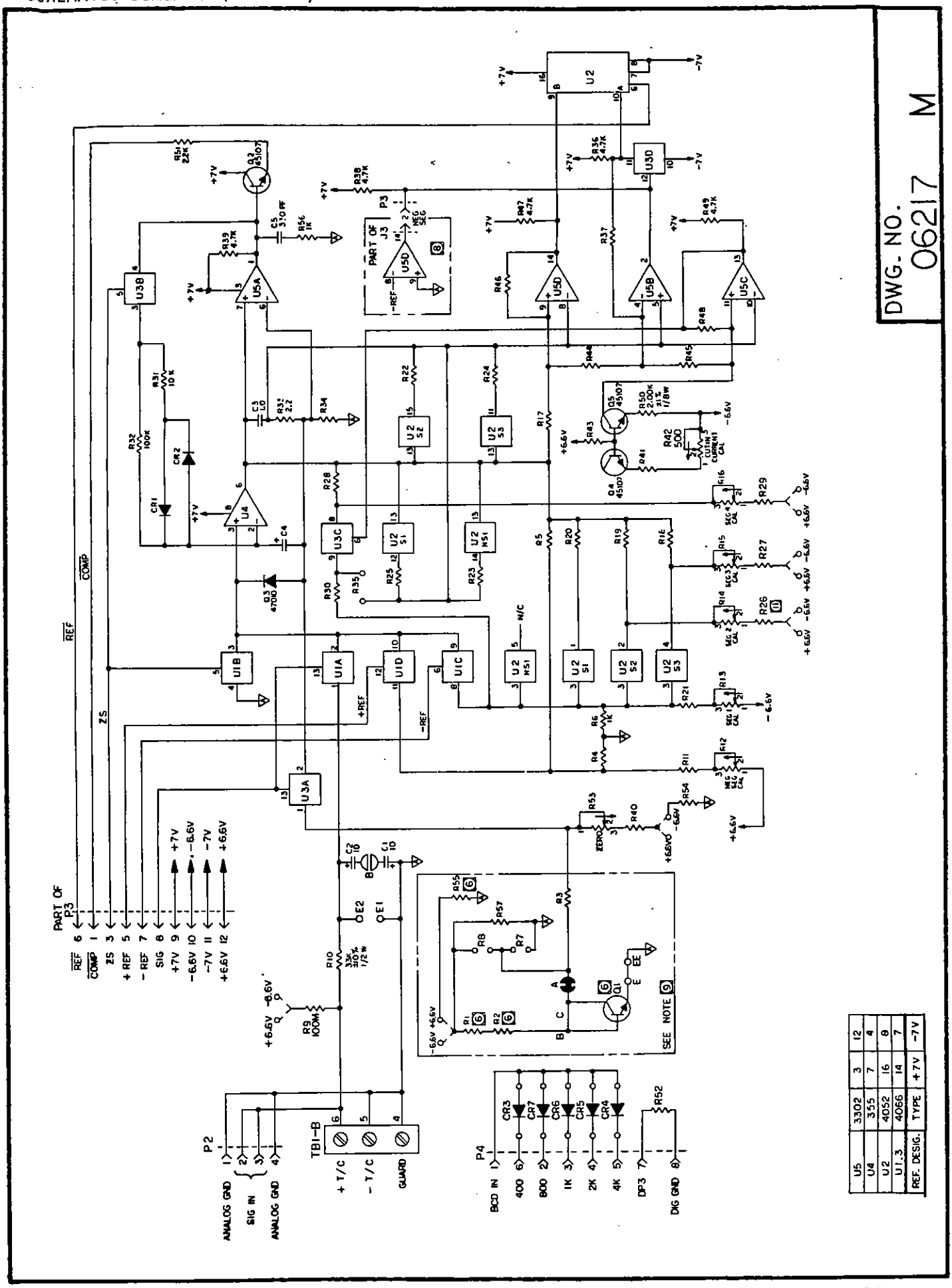
Figure 6


DWG. NO.
06896
D1
45.0 +.6 -.0 (1.772 +.024 -.000)
92 +.8 -.0 (3.622 +.032 -.000)
1.6(.06)R 4 PLCS
PANEL THICKNESS 6.4(.25)MAX 0.8(.03)MIN
92.0 (3.62)
45.0 (1.77)
REAR VIEW (TERMINAL BLOCK, COVER AND BEZEL NOT SHOWN FOR CLARITY)
CLAMP RINGS ROTATED AND SLIDE RETAINERS REMOVED AS SHOWN FOR INSTALLATION.
SLIDE RETAINER
141.5 (5.57)
TERMINAL BLOCK COVER
96 (3.78)
CLAMP RING
NOTES: DIMENSIONS IN MILLIMETERS ±.25 MM AND IN (INCHES) ±.01 IN.
5.08 (.20)
SLIDE RETAINER
CASE
135.4 (5.33)
48 (1.89)
45.0 (1.77)
142.98 (5.63)


ASSY 06390-01 06390-02
DWG. NO. 06391 J
CR
C
R
C7
CR5
CR6
T1
C6
U1
R4
R5
R6
R7
Q3
E3
E4
E2
W1
Q2
R3
C5
C4
Q1
R1
C1
R2
C2
C3
L1
E1
F1
1
2
3
4
5
6
7
8
9
12


DWG. NO. 06392 G
22V PWR
C7 1.0µF 50V TANT.
CR4
CR3
CR6
CR5
SEC 58T
E3 BLANK
E4 LSB DEC.
T1 48100
PRI
16T
16T
5T
5T
FB
R7 100
C6 1000pF
C5 0.1µF
Q3 45145
Q1 45145
R6 4.15K
R5 10.0K
R1 332
C4 330pF
Q2 45145
U1
C1 4.7µF 50V
R4 12.7K
R3 182K
R2 66.5K
L1 06396
C2 4.7µF 50V
CR2, 47002
CR1 47002
C3 0.1µF
W1
METAL COVER P/N 06394
LED PWR
+5V
+5V IN
F1
E1
E2
+5V RTN
N/C

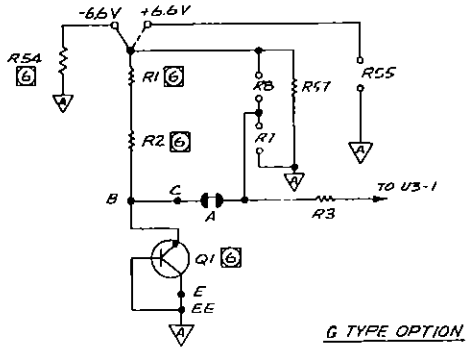

DWG. NO.
06216
E


DWG. NO.
06217
M
U5 3302 3 12
U4 355 7 4
U2 4052 16 8
U1,3 4066 14 7
REF. DESIG. TYPE +7V -7V
SEE NOTE 9
PART OF P3
PART OF J3
P2
P4
TB1-B
ANALOG GND
SIG IN
ANALOG GND
+ T/C
- T/C
GUARD
BCD IN
400
800
1K
2K
4K
DP3
DIG GND

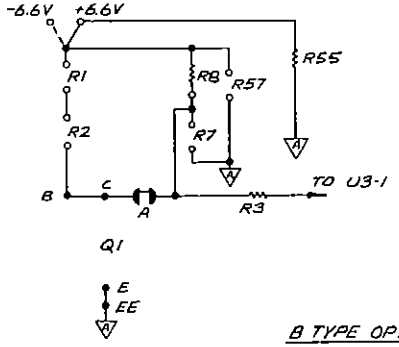
TABULATION BLOCK

REFERENCE DESIGNATOR AND VALUE

OPTION	PARTS LIST NO.	R3	R4	R5	R8	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24	R25	R26	R27	R28	R29	R30	R34	R37	R40	R41	R43	R44	R45	R46	R48	R52	R53	R54	R55	R57	C4
JF1	06215-01	576K	1K	6.34K		25.5K	5K	5K	100K	25K		649Ω		825K		25.5K			40.2K	348K	191K	124K				1.40K	150K	499K	1.15K	7.15K	1.33K	JUMPER	383K			100K	21.5K		13.7K		10μF
JC1	06215-02	576K	3.01K	11.8K		41.2K	5K	2K	50K	25K		715Ω		453K		13.7K			226K	25.5K	137K	59K				140K	205K	536K			1.27K	JUMPER	301K			100K	54.9K		11.8K		
KF1	06215-03	75K	1K	4.75K		30.1K	10K	10K	2M	50K	50K	442Ω	82.5K			30.1K	107K			59K	7.15K	150K	100K	205K	JUMPER	1.4K	499K	619K			1.18K	1.3K	301K	866K		200K	20.5K		12.7K		
KC1	06215-04	976K	3.01K	6.04K		51.1K	10K	5K	1M	25K		665Ω	21K		66.5K	16.2K	2.8M				301K	59K				1.82K	301K	715K			1.15K	JUMPER	412K			500K	51.1K		11.8K		
TC1	06215-05	26.7K	1K	5.76K		17.8K	2K	5K	200K	50K		953Ω				17.8K	10.7K		174K	69.9K	100K	56.2K				511Ω	150K	221K			1.43K		301K			100K	24.9K		16.5K		10μF
TF2	06215-06	2848K	1K	130K		383K	10K	10K	1M	100K		909Ω				383K	187K		309K	115K	3.32M	1.5M				549Ω	357K	261K			1.33K		412K		75Ω	20K	12.7K		9.76K		68μF
TC2	06215-07	35.35K	1K	619K		196K	25K	25K	1M	200K		698Ω				196K	107K		174K	66.5K	182M	845K				681Ω	357K	392K			1.02K		412K		75Ω	50K	13.3K		10K		68μF
EF1	06215-08	698K	3.01K	10K		68.1K	10K	2K	25K	5K		787Ω	66.5K			22.6K	86.6K			18.7K	82.5K	40.2K				2K	150K	562K			1.3K		301K			200K	24.3K		10.5K		10μF
EF2 [11]	06215-09	1295K	1K	243K		249K	10K	10K	1M	1M		1K				249K	178K		261K	143K	11M	2.43M				374Ω	357K	121.5K	1.15K	7.15K	1.47K		499K		75Ω	5K	12.7K		9.53K		68μF
GC1	06215-10	16.4K	1K			357K	25K	25K	500K	10K		2K	71.5K	348K	866K	348K		2.74K			182M	169K				169Ω	866K	160K	2.32K	13K	976Ω		866K		75Ω	10K		3.09K	21.5K		68μF
EC1	06215-11	69.8K	3.01K	5.9K		33.2K	10K	2K	25K	5K		768Ω	33.2K			11K	52.3K			11K	39.2K	20K				2K	150K	475K	1.21K	7.32K	1.33K		301K			500K			12.1K		10μF
EC2	06215-12	25.5K	1K	665K		130K	10K	10K	500K	100K		1.05K				130K	162K		345K	90.9K	1.5M	619K				750Ω	357K	255K	1.05K	7.15K	1.28K		412K		75Ω	20K	12.7K		9.76K		10μF
RF1	06215-13	182K	1K			324K	100K	25K	50K	10K		332Ω				261K	511K		75M	9.31K	412K	169K				511Ω	150K	15M	1.15K		1.82K		301K			500K	11.3K		10K		68μF
RC1	06215-14	178K	3.01K			464K	100K	50K	50K	10K		357Ω				115K	29.4K		1.15M	6.04K	243K	97.6K				511Ω	301K	1.33M			187K		301K			1M	13.7K		10K		68μF
SF1	06215-15	1593K	1K			324K	100K	25K	50K	10K		374Ω	93.1K			25.5K	68.1K			10.7K	499K	200K				453Ω	205K	1M			2.1K		301K			1M	13.3K		10.2K		68μF
SC1	06215-16	162K	3.01K			453K	200K	25K	50K	10K		365Ω	392K			127K	39.2K			6.49K	287K	110K				464Ω	301K	1.15M			2.1K		301K			1M	14.3K		10K		10μF
BF1	06215-17	100K	1K		JUMPER	825K	JUMPER	50K	50K	10K		634Ω				953K	24.9K		113K	97.6K	475K	182K				348Ω	205K	97.6K			1.37K		249K			2K	12.4K	10.2K			68μF
BC1	06215-18	100K	1K		JUMPER	475K	JUMPER	100K	50K	10K		576Ω				475K	13.7K		53.6K	52.3K	261K	105K				348Ω	187K	97.6K			1.37K		301K			5K	12.7K	4.42K			68μF
WF1	06215-19	191K	10K			100K	100K	10K	10K	5K		619Ω	57.6K	110K		107K				22.1K	174K	133K				1.21K	499K	1.5M			1.4K		499K			1M	15.8K		9.76K		10μF
WC1	06215-20	162K	10.7K			37.4K	JUMPER	10K	10K	5K		698Ω	37.4K	75K		56.2K				12.7K	100K	75K				1.02K	499K	1.4M			1.74K		499K			500K	18.7K		11.8K		
WF2	06215-21	187K	2K			137K	JUMPER	10K	10K	10K		649Ω	39.2K	100K		100K				28.7K	187K	97.6K				1.21K	499K	1.5M			1.33K		499K			500K	15.4K		10.2K		
WC2	06215-22	158K	25.5K			1.4M	JUMPER	10K	10K	10K		787Ω	25.5K	61.9K		51.1K				16.9K	102K	51.1K				1.02K	499K	1.4M	1.15K	7.15K	1.58K	JUMPER	499K			500K	20.5K		11.8K		10μF

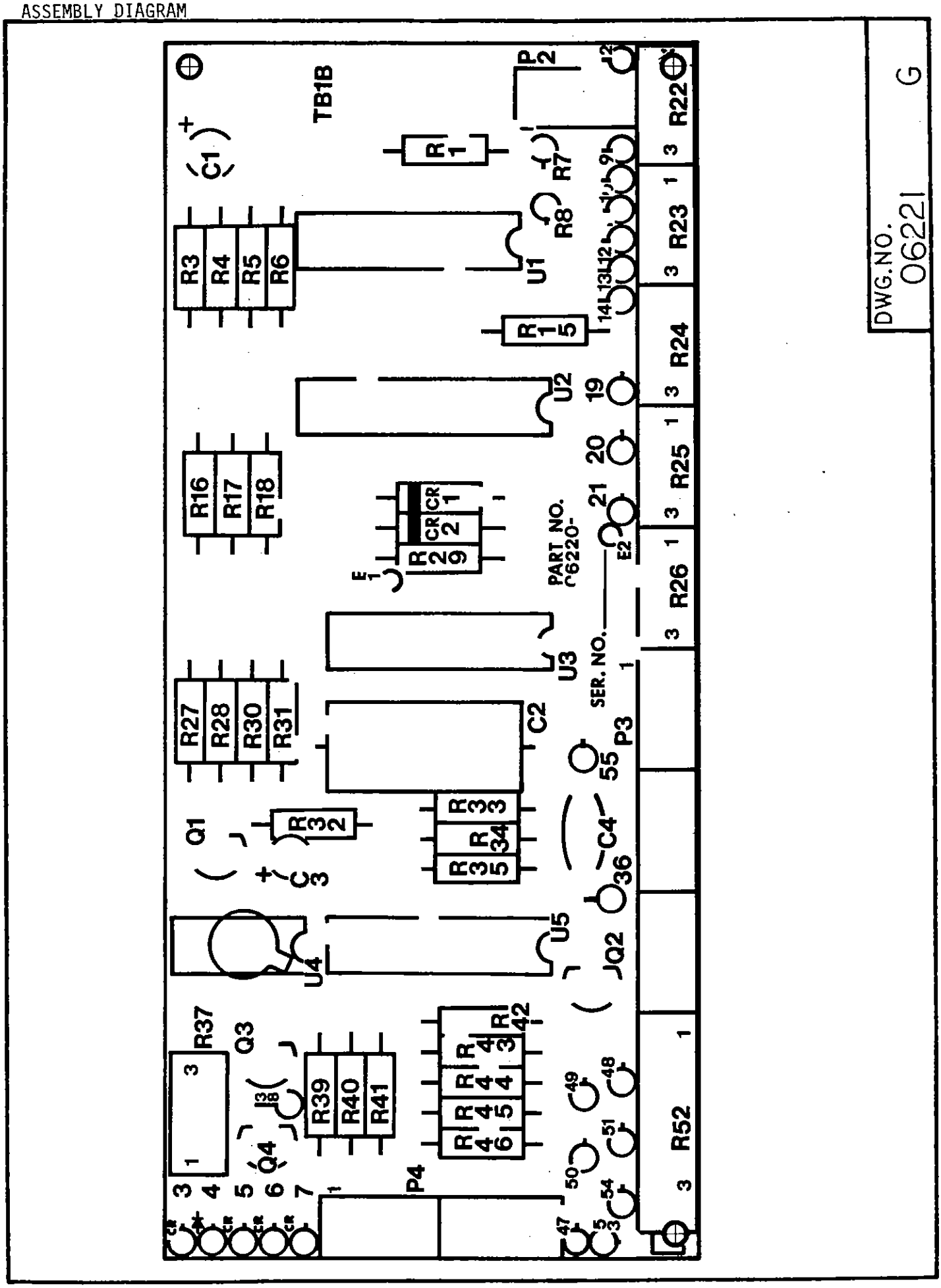


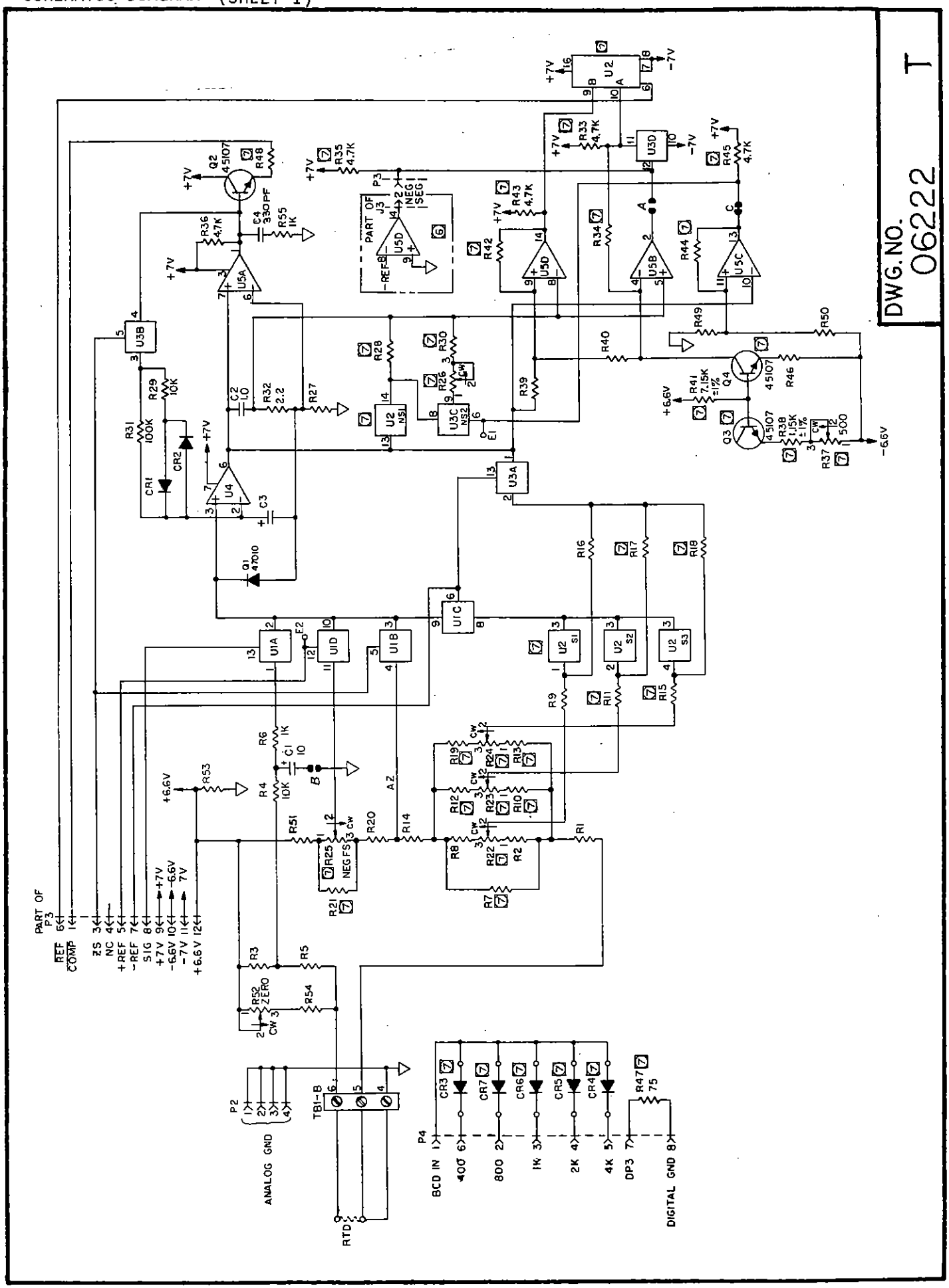
G TYPE OPTION



B TYPE OPTION

DWG.NO.
06217 M


TB1B
C1
R1
R2
P2
R7
R8
U1
R3
R4
R5
R6
R15
R22
R23
R24
R25
R26
R52
U2
R16
R17
R18
R29
R9
E1
E2
PART NO.
06220-
SER. NO.
U3
C2
P3
R27
R28
R30
R31
Q1
R32
C3
R33
R34
R35
C4
U4
U5
Q2
R37
Q3
R39
R40
R41
R42
R43
R44
R45
R46
P4
Q4
DWG.NO.
06221
G

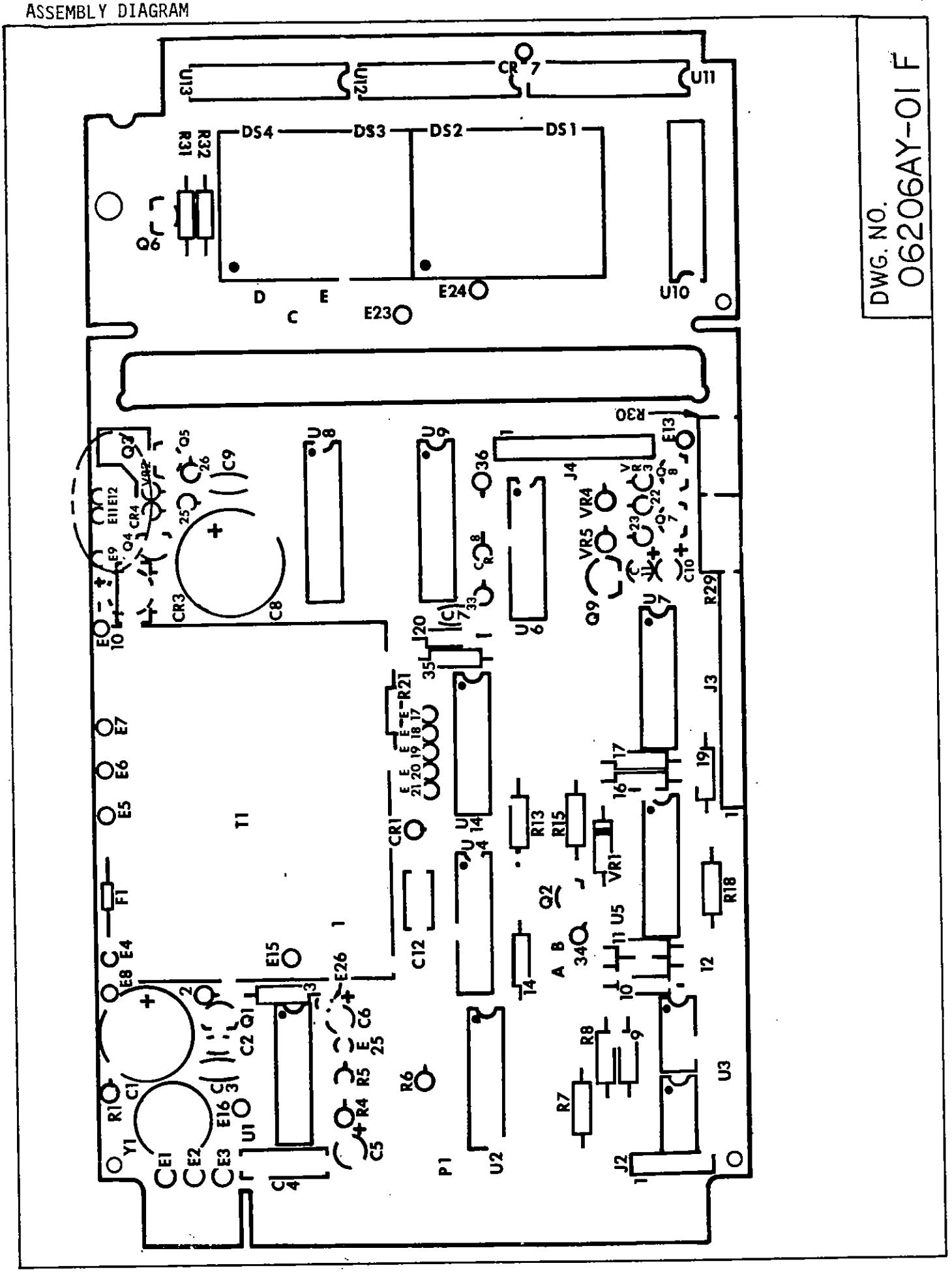

DWG. NO.
06222
T
+7V
-7V
+6.6V
-6.6V
U2
U3A
U3B
U3C
U3D
U5A
U5B
U5C
U5D
U1A
U1B
U1C
U1D
U4
Q1
Q2
Q3
Q4
CR1
CR2
CR3
CR4
CR5
CR6
CR7
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
R48
R49
R50
R51
R52
R53
R54
R55
C1
C2
C3
C4
P2
P3
P4
J3
TB1-B
ANALOG GND
RTD
BCD IN
400
800
1K
2K
4K
DP3
DIGITAL GND
REF
COMP
SIG
NEGFS
ZERO
AZ

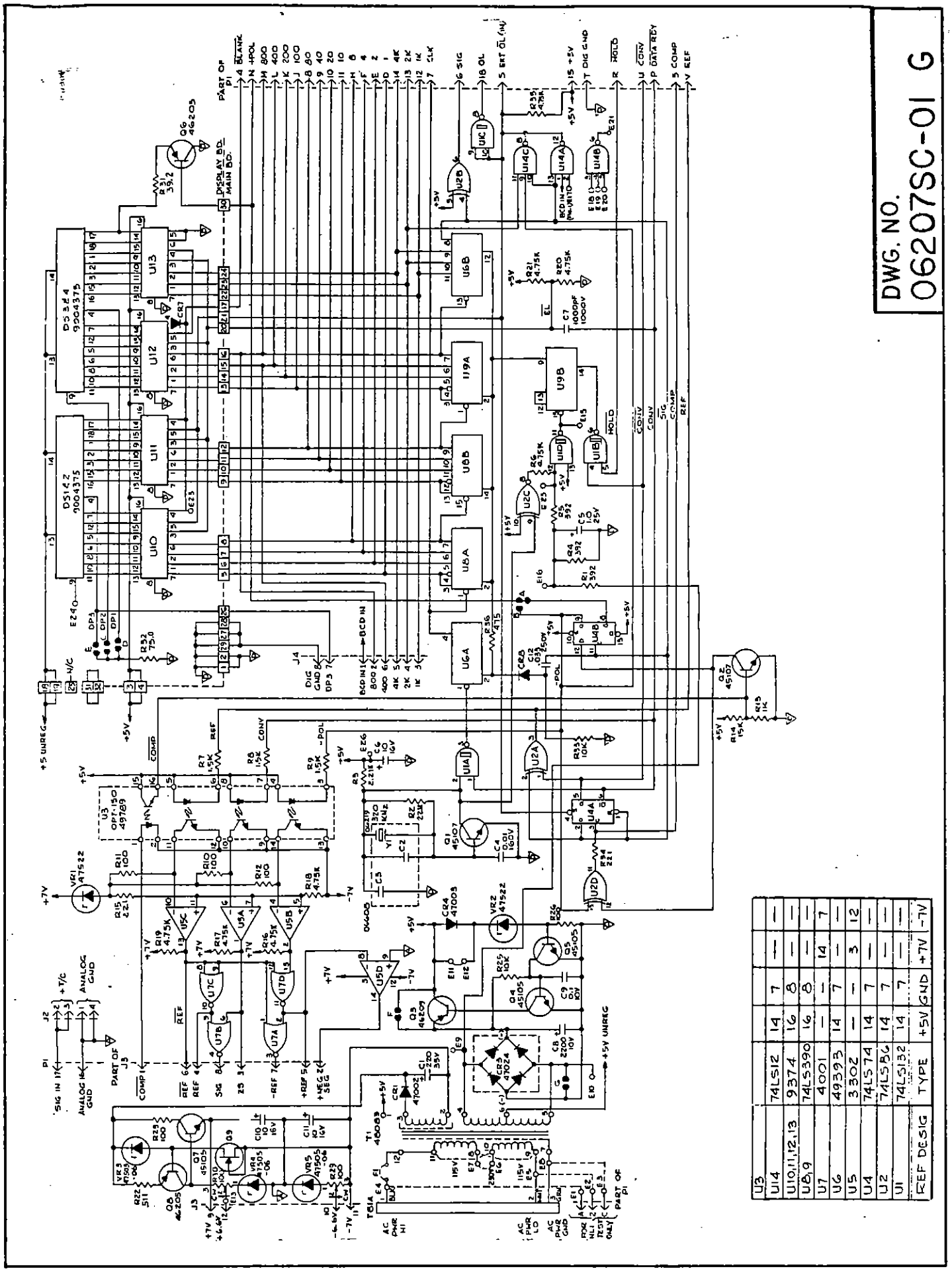
TABULATION BLOCK

REFERENCE DESIGNATOR AND VALUE

OPTION	P/L NO.	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	R48	R49	R50	R51	R52	R53	R54	R55	C3	U.A. PART NO.
PF1	06220-01	200Ω	100Ω	14.3K	10K	2.32K	1K	82.5Ω		16.5K		18.2K	100Ω		1.69K		1 MEG	1 MEG			169K	165Ω	500Ω	500Ω		5K	500K	1.15K	576K	10K	576K	100K	2.2Ω	4.7K			4.7K	4.7K	500Ω	1.15K	2.32K		7.15K	301K	4.7K	1 MEG	4.7K	2.00K		2.2K	487Ω	111	26.7K	1 MEG	5.07K	82.5K	1K		10μF	49743-02
PF2	06220-02	25.5Ω		14.3K	10K	11.8K	1K	9.09K		3.01K		3.09K			22.1Ω		1 MEG	1 MEG			169		20Ω	20Ω		10Ω	2 MEG	1.87K	576K	10K	1 MEG	100K	2.2Ω	4.7K			4.7K	4.7K	500Ω	1.15K	2.43K		7.15K	576K	4.7K	523K	4.7K	2.00K	75Ω	2.2K	511Ω	127K	352K	1 MEG	12.4K	332K	1K		10μF	49743-02
PC1	06220-03	17.8Ω	10Ω	26.1K	10K	2.74K	1K	31.6Ω	10Ω	4.53K	10Ω	5.11K	10Ω		301Ω	5.6K	1 MEG	1 MEG	1 MEG	20Ω	301Ω	21Ω	50Ω	50Ω	50Ω	500Ω	1 MEG	1.82K	412K	10K	412K	100K	2.2Ω	4.7K	475K	4.7K	4.7K	4.7K	500Ω	1.15K	1.33K	412K	7.15K	475K	4.7K	412K	4.7K	2.00K	75Ω	2.2K	750Ω	10.7K	25.5K	2 MEG	6.49K	4.21K	1K		10μF	49804-01
PC2	06220-04	30.9Ω	12.4Ω	26.1K	10K	2.43K	1K	90.9Ω		3.65K	10Ω	4.02K	4.99Ω		309Ω		1 MEG	1 MEG			309Ω	499Ω	20Ω	20Ω		20Ω	1 MEG	1.37K	316K	10K	475K	100K	2.2Ω	4.7K			4.7K	4.7K	500Ω	1.15K	2.67K		7.15K	475K	4.7K	475K	4.7K	2.00K	75Ω	2.2K	1.58K	10K	25.5K	2 MEG	6.98K	4.81K	1K		10μF	49743-01
PC3	06220-05	4.99Ω	2.49Ω	3.32K	10K	1K	0.25Ω	3.09K							30.9Ω		15 MEG				3065Ω	1.0Ω	10Ω			10Ω		715Ω		10K	2.49 MEG	100K	2.2Ω				4.7K				6.65K									3.3K		3.32K	8.35K	2 MEG	4.53K	1.21 MEG	1K	68 μF	49804-01
PK1	06220-06	3.57Ω	1.78Ω	19.6K	10K	365Ω	1K		115Ω	9.31K	19.1Ω	9.76K	49.9Ω	68.1Ω	316Ω	6.65K	1 MEG	1 MEG	1 MEG	75Ω	18.87K		20Ω	20Ω	10Ω			2.37K		10K		100K	2.2Ω	4.7K	205K	4.7K	4.7K	500Ω	1.15K	282Ω	1.18K	7.15K	205K	4.7K		4.7K	2.00K	75Ω	2.2K	11.5K			2 MEG	7.68K	4.75K	1K		10μF	49743-02
PC4	06220-07	44.2Ω	8.92Ω	3.92K	10K		1K	1.02K	115Ω	3.32K					9.53Ω		15 MEG				3.01K	1.0Ω	10Ω			10Ω		715Ω		10K	3.09 MEG	100K	2.2Ω				4.7K				6.65K									3.3K	3.32K	8.35K	2 MEG	4.53K	1.21 MEG	1K	68 μF	49804-01
PK2	06220-08			19.3K	10K	39.2K	1K		115Ω	6.04K	19.1Ω	8.87K	29.4Ω	30.9Ω	316Ω	6.65K	1 MEG	1 MEG	1 MEG	51.1Ω			20Ω	20Ω	10Ω			2.37K		10K		100K	2.2Ω	4.7K	205K	4.7K	4.7K	500Ω	1.15K	422Ω	1.02K	7.15K	205K	4.7K		4.7K	2.00K	75Ω	2.2K	11.5K			2 MEG	7.68K	4.75K	1K		10μF	49743-02
PC5	06220-09	16.5Ω	22.1Ω	4.26K	10K	245.9Ω	1K			4.87K	25.5Ω	5.23K	15Ω		309Ω	5.9K	1 MEG	1 MEG	1 MEG	30.9Ω	301Ω		10Ω	16Ω	20Ω	20Ω	2 MEG	1.82K	249K	10K	4.13K	100K	2.2Ω	4.7K	499K	4.7K	4.7K	5.6Ω	1.15K	1.69K	1.07K	7.15K	499K	4.7K	12.7K	4.7K	2.37K	75Ω	2.2K	1.37K	10K	7.68K	2 MEG	6.34K	6.81K	1K		10μF	49743-01
PC6	06220-10	4.99Ω	2.49Ω	8.92K	10K		1K	0.25Ω		3.48K					31.6Ω		15 MEG				30.9Ω	1.0Ω	10Ω			10Ω		750Ω		10K	3.09 MEG	100K	2.2Ω				4.7K				6.65K									3.3K	3.32K	8.35K	2 MEG	4.53K	1.21 MEG	1K	68 μF	49804-01
PF3	06220-11	20.5Ω	10Ω	14.3K	10K	2.32K	1K	75Ω		16.5K		18.2K	100Ω		1.69K		1 MEG	1 MEG			1.69K	100Ω	50Ω	50Ω		2Ω	500K	1.15K	499K	10K	49.9K	100K	2.2Ω	4.7K			4.7K	4.7K	500Ω	1.15K	2.32K		7.15K	511K	4.7K	20K	4.7K	2.00K		2.2K	76.8Ω	10.5K	2.94K	1 MEG	5.9K	82.5K	1K		10μF	49743-02
PF4	06220-12	22.1Ω		14.0K	10K	12.9K	1K	10Ω		2.80K		3.09K			22.1Ω		1 MEG	1 MEG			169Ω		15Ω	10Ω		10Ω	2 MEG	1.87K	523K	10K	1.5 MEG	100K	2.2Ω	4.7K			4.7K	4.7K	500Ω	1.15K	2.49K		7.15K	499K	4.7K	162K	4.7K	2.00K	75Ω	2.2K	931Ω	10.7K	3.52K	1 MEG	11K	3.32K	1K		10μF	49743-02

DWG.NO.
06222 T


DWG. NO.
06206AY-01 F
DS4
DS3
DS2
DS1
U13
U12
U11
U10
R31
R32
Q6
D
E
C
E23
E24
R30
E13
J4
VR4
VR5
Q9
R29
J3
J20
R21
R13
R15
VR1
R18
U5
Q2
A B
U3
R8
R7
J2
P1
U2
R6
R5
R4
C5
C6
C12
CR1
T1
F1
E4
E8
E15
E26
C1
C2
Q1
R1
Y1
E1
E2
E3
U1
E16
C3
C4
E5
E6
E7
E9
E10
E11
E12
CR4
Q4
Q5
C9
CR3
C8
U8
U9
U6
U7
U14
U4
C10
C11
Q3
Q7
Q8
VR2
VR3
R3
R2
R10
R11
R12
R14
R16
R17
R19
R20
R22
R23
R24
R25
R26
R27
R28
R9
C7
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
C35
C36
CR2
CR5
CR6
CR7
CR8
E14
E17
E18
E19
E20
E21
E22
E25
E27
E28
E29
E30
E31
E32
E33
E34
E35
E36
E37
E38
E39
E40
E41
E42
E43
E44
E45
E46
E47
E48
E49
E50
E51
E52
E53
E54
E55
E56
E57
E58
E59
E60
E61
E62
E63
E64
E65
E66
E67
E68
E69
E70
E71
E72
E73
E74
E75
E76
E77
E78
E79
E80
E81
E82
E83
E84
E85
E86
E87
E88
E89
E90
E91
E92
E93
E94
E95
E96
E97
E98
E99
E100
E101
E102
E103
E104
E105
E106
E107
E108
E109
E110
E111
E112
E113
E114
E115
E116
E117
E118
E119
E120
E121
E122
E123
E124
E125
E126
E127
E128
E129
E130
E131
E132
E133
E134
E135
E136
E137
E138
E139
E140
E141
E142
E143
E144
E145
E146
E147
E148
E149
E150
E151
E152
E153
E154
E155
E156
E157
E158
E159
E160
E161
E162
E163
E164
E165
E166
E167
E168
E169
E170
E171
E172
E173
E174
E175
E176
E177
E178
E179
E180
E181
E182
E183
E184
E185
E186
E187
E188
E189
E190
E191
E192
E193
E194
E195
E196
E197
E198
E199
E200
E201
E202
E203
E204
E205
E206
E207
E208
E209
E210
E211
E212
E213
E214
E215
E216
E217
E218
E219
E220
E221
E222
E223
E224
E225
E226
E227
E228
E229
E230
E231
E232
E233
E234
E235
E236
E237
E238
E239
E240
E241
E242
E243
E244
E245
E246
E247
E248
E249
E250
E251
E252
E253
E254
E255
E256
E257
E258
E259
E260
E261
E262
E263
E264
E265
E266
E267
E268
E269
E270
E271
E272
E273
E274
E275
E276
E277
E278
E279
E280
E281
E282
E283
E284
E285
E286
E287
E288
E289
E290
E291
E292
E293
E294
E295
E296
E297
E298
E299
E300
E301
E302
E303
E304
E305
E306
E307
E308
E309
E310
E311
E312
E313
E314
E315
E316
E317
E318
E319
E320
E321
E322
E323
E324
E325
E326
E327
E328
E329
E330
E331
E332
E333
E334
E335
E336
E337
E338
E339
E340
E341
E342
E343
E344
E345
E346
E347
E348
E349
E350
E351
E352
E353
E354
E355
E356
E357
E358
E359
E360
E361
E362
E363
E364
E365
E366
E367
E368
E369
E370
E371
E372
E373
E374
E375
E376
E377
E378
E379
E380
E381
E382
E383
E384
E385
E386
E387
E388
E389
E390
E391
E392
E393
E394
E395
E396
E397
E398
E399
E400
E401
E402
E403
E404
E405
E406
E407
E408
E409
E410
E411
E412
E413
E414
E415
E416
E417
E418
E419
E420
E421
E422
E423
E424
E425
E426
E427
E428
E429
E430
E431
E432
E433
E434
E435
E436
E437
E438
E439
E440
E441
E442
E443
E444
E445
E446
E447
E448
E449
E450
E451
E452
E453
E454
E455
E456
E457
E458
E459
E460
E461
E462
E463
E464
E465
E466
E467
E468
E469
E470
E471
E472
E473
E474
E475
E476
E477
E478
E479
E480
E481
E482
E483
E484
E485
E486
E487
E488
E489
E490
E491
E492
E493
E494
E495
E496
E497
E498
E499
E500
E501
E502
E503
E504
E505
E506
E507
E508
E509
E510
E511
E512
E513
E514
E515
E516
E517
E518
E519
E520
E521
E522
E523
E524
E525
E526
E527
E528
E529
E530
E531
E532
E533
E534
E535
E536
E537
E538
E539
E540
E541
E542
E543
E544
E545
E546
E547
E548
E549
E550
E551
E552
E553
E554
E555
E556
E557
E558
E559
E560
E561
E562
E563
E564
E565
E566
E567
E568
E569
E570
E571
E572
E573
E574
E575
E576
E577
E578
E579
E580
E581
E582
E583
E584
E585
E586
E587
E588
E589
E590
E591
E592
E593
E594
E595
E596
E597
E598
E599
E600
E601
E602
E603
E604
E605
E606
E607
E608
E609
E610
E611
E612
E613
E614
E615
E616
E617
E618
E619
E620
E621
E622
E623
E624
E625
E626
E627
E628
E629
E630
E631
E632
E633
E634
E635
E636
E637
E638
E639
E640
E641
E642
E643
E644
E645
E646
E647
E648
E649
E650
E651
E652
E653
E654
E655
E656
E657
E658
E659
E660
E661
E662
E663
E664
E665
E666
E667
E668
E669
E670
E671
E672
E673
E674
E675
E676
E677
E678
E679
E680
E681
E682
E683
E684
E685
E686
E687
E688
E689
E690
E691
E692
E693
E694
E695
E696
E697
E698
E699
E700
E701
E702
E703
E704
E705
E706
E707
E708
E709
E710
E711
E712
E713
E714
E715
E716
E717
E718
E719
E720
E721
E722
E723
E724
E725
E726
E727
E728
E729
E730
E731
E732
E733
E734
E735
E736
E737
E738
E739
E740
E741
E742
E743
E744
E745
E746
E747
E748
E749
E750
E751
E752
E753
E754
E755
E756
E757
E758
E759
E760
E761
E762
E763
E764
E765
E766
E767
E768
E769
E770
E771
E772
E773
E774
E775
E776
E777
E778
E779
E780
E781
E782
E783
E784
E785
E786
E787
E788
E789
E790
E791
E792
E793
E794
E795
E796
E797
E798
E799
E800
E801
E802
E803
E804
E805
E806
E807
E808
E809
E810
E811
E812
E813
E814
E815
E816
E817
E818
E819
E820
E821
E822
E823
E824
E825
E826
E827
E828
E829
E830
E831
E832
E833
E834
E835
E836
E837
E838
E839
E840
E841
E842
E843
E844
E845
E846
E847
E848
E849
E850
E851
E852
E853
E854
E855
E856
E857
E858
E859
E860
E861
E862
E863
E864
E865
E866
E867
E868
E869
E870
E871
E872
E873
E874
E875
E876
E877
E878
E879
E880
E881
E882
E883
E884
E885
E886
E887
E888
E889
E890
E891
E892
E893
E894
E895
E896
E897
E898
E899
E900
E901
E902
E903
E904
E905
E906
E907
E908
E909
E910
E911
E912
E913
E914
E915
E916
E917
E918
E919
E920
E921
E922
E923
E924
E925
E926
E927
E928
E929
E930
E931
E932
E933
E934
E935
E936
E937
E938
E939
E940
E941
E942
E943
E944
E945
E946
E947
E948
E949
E950
E951
E952
E953
E954
E955
E956
E957
E958
E959
E960
E961
E962
E963
E964
E965
E966
E967
E968
E969
E970
E971
E972
E973
E974
E975
E976
E977
E978
E979
E980
E981
E982
E983
E984
E985
E986
E987
E988
E989
E990
E991
E992
E993
E994
E995
E996
E997
E998
E999
E1000



U3								
U14	74LS12	14	7	—	—	—	—	—
U10,11,12,13	9374	16	8	—	—	—	—	—
U8,9	74LS390	16	8	—	—	—	—	—
U7	4001	—	—	14	7	—	—	—
U6	49393	14	7	—	—	—	—	—
U5	3302	—	—	3	12	—	—	—
U4	74LS74	14	7	—	—	—	—	—
U2	74LS86	14	7	—	—	—	—	—
UI	74LS132	14	7	—	—	—	—	—
REF DESIG	TYPE	+5V	GND	+7V	-7V			