

INSTRUCTION MANUAL
TC 953A/TC 954A
HIGH VOLTAGE POWER SUPPLY

Oxford Instruments Inc
Analytical Systems Division
Nuclear Measurements Group

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N953A/954AMT00F00

WARRANTY

Oxford Instruments Inc warrants that the products or components manufactured by it shall be free from defects in material or workmanship for a period of one year from the date of delivery to purchaser. If such product or component is determined to be defective by Oxford Instruments Inc, its sole **warranty** obligation shall be limited to either replacing or repairing such defective product or component or allowing credit, at Oxford's option. Such warranty is further conditional upon the purchaser giving prompt notice of any such defect and satisfactory proof thereof to Oxford's Customer Service Manager. Thereafter upon Oxford's approval, the purchaser shall return such defective product or component to Oxford's factory at Oak Ridge, Tennessee* all transportation charges prepaid. Oxford shall be responsible only for transportation charges incurred in returning such product or component to purchaser. All customs, brokerage and duty charges shall be at the expense of the purchaser. Damage in transit due to inadequate packaging will be repaired at the purchaser's expense. Any repairs or replacements by the purchaser without Oxford's approval, any willful abuse or any evidence that the product or component was not properly used and maintained would automatically void this warranty.

Oxford Instruments Inc makes no **warranty** whatsoever in respect to products or components not manufactured by it, but instead, the applicable warranties, if any, of the respective manufacture thereof shall apply. Likewise fuses, batteries, and field effect transistors in low-noise preamplifiers are specifically excluded from this warranty.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS.

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1.0 INTRODUCTION

The TENNELEC/NUCLEUS TC 953A dual and TC954A single high voltage power supply (HVPS) provide a well-regulated, low-noise, dc voltage source capable of supplying up to 20 μA load current in a single-width NIM module. The TC 953A/TC 954A offers two output voltage ranges, 0 to ± 100 volts or 0 to ± 1000 volts at 0 to 20 μA load current with a digital multimeter (DMM) for display of either current or voltage. The TC 953A dual supply has totally independent controls and displays for each channel. The TC 953A/TC 954A current display is 19.99 μA full scale. The 0.01 μA resolution is especially useful in alpha spectroscopy applications as it allows for easy compensation of the voltage drop in the bias detector network due to detector leakage current.

The TC 953A/TC 954A can be disabled via an externally generated signal or by excessive load current. In either situation, the TC 953A/TC 954A VOLTAGE control must be cycled to OFF and then back to ON for the output voltage to recover from zero.

In the event of a power failure, the TC 953A/TC 954A will be DISABLED when power is reapplied if the VOLTAGE control is preset to ON. Output voltage will not be produced until the VOLTAGE control is cycled to OFF and then back to ON.

The output voltage of the TC 953A/TC 954A may be controlled via a remote input. A 0 to +10 volt dc signal will produce a full-scale output on the TC 953A/TC 954A. A remote disable input is available to reduce the output voltage to zero regardless of the front-panel control settings.

2.0 SPECIFICATIONS

2.1 PERFORMANCE

OUTPUT VOLTAGE 0 to $\pm 100\text{V}$ or 0 to $\pm 1000\text{V}$.

OUTPUT CURRENT 0 to 20 μA .

OUTPUT POLARITY Positive or negative, selectable through left side shield.

OUTPUT RIPPLE $\leq 1.0\text{mV}$ peak to peak, 5Hz to 50 MHz; typically $< 300\mu\text{V}$ at full load.

OUTPUT REGULATION $\leq 0.001\%$ or 1mV (whichever is greater) variation in output voltage

for load and bin supply variations within operating range (0 to 20 μA output current and $\pm 1\%$ variation in bin supply voltages).

OUTPUT INACCURACY $\leq \pm 0.25\%$ of full scale due to nonlinearity of potentiometer; typically $\leq \pm 0.1\%$ of setting.

TEMPERATURE INSTABILITY $\leq \pm 30\text{ppm}/^\circ\text{C}$, 0 to 50 $^\circ\text{C}$; typically $\leq \pm 10\text{ppm}/^\circ\text{C}$.

LONG-TERM INSTABILITY $\leq 0.001\%$ per 24 hour period at constant line, load, and temperature.

RESOLUTION 0.5V or better on 1000 volt range; 0.05V or better on 100 volt range.

RESETTABILITY Resettable¹ to within 1V on 1000 volt range; resettable to within 0.1V on 100 volt range.

DISPLAY RANGES 0 to 100.0V in 0.1V steps on the 100V range. 0 to 1000V in 1V steps on the 1000V range. 0 to 19.99 μA in 0.01 μA steps for current.

DISPLAY INACCURACY $\leq \pm .05\% \pm 1/2$ least significant digit for voltage; $< \pm 1.0\% \pm 1/2$ least significant digit for current.

DISPLAY TEMPERATURE INSTABILITY $\leq \pm 50\text{ppm}/^\circ\text{C}$, typically $\leq \pm 30\text{ppm}/^\circ\text{C}$.

OPERATING TEMPERATURE 0 to 50 $^\circ\text{C}$.

2.2 CONTROLS

2.2.1 FRONT-PANEL CONTROLS

DISPLAY Two-position toggle switch selects V (output voltage) or μA (output current) for display on DMM.

VOLTAGE Ten-turn precision potentiometer with linear calibration from 0.0 to 1000 corresponding to output voltages of 0 to 1000 volts or 0 to 100.0 volts depending on range selected.

RANGE Two-position locking toggle switch selects either 1000V or 100V full scale.

VOLTAGE Two-position toggle switch enables or disables the high voltage output. When in the OFF position, the high voltage circuit is disabled; however, power is applied to the low voltage section allowing the precision voltage reference to remain at a stable operating temperature. When

the VOLTAGE switch is set to ON, the high voltage section is enabled.

2.2.2 INTERNAL CONTROLS

POLARITY Two-position switch (accessible through the module's left side shield) selects either positive (POS) or negative (NEG) high voltage polarity. Refer to **Section 3.2** for instructions on changing the high voltage polarity. The TC 953A/TC 954A is shipped with the POLARITY switch in the PO5 position.

INT/EXT Two-position jumper selects either internal (INT) output voltage control or external (EXT) output voltage control. When the INT mode is selected, no external voltage control input is accepted. If the EXT mode is selected, the output voltage is determined by the external control voltage. The front panel VOLTAGE control dial is not functional in the EXT mode. The TC 953A/TC 954A is shipped with the INT/EXT jumper in the INT position.

2.3 CONNECTORS (Rear Panel)

OUTPUT SHV type connector provides 0 to $\pm 100V$ or 0 to $\pm 1000V$ output voltage. The connector is isolated from the TC 953A/TC 954A chassis to aid in the prevention of ground loops.

DISABLE BNC type connector accepts a NIM positive logic zero or a short to ground through a resistance of 100 ohms or less to disable the high voltage section. A NIM positive logic high, or an open circuit, is used to enable the high voltage section.

REMOTE BNC type connector accepts an external control signal to allow remote control of the TC 953A/TC 954A OUTPUT voltage. The external control voltage should not exceed +10.0V. The REMOTE input is protected for voltages exceeding +12V and negative voltages. The input impedance of the REMOTE input is 10k ohms. Note that only positive voltages are accepted and the OUTPUT polarity is controlled by the internal POLARITY switch.

2.4 INDICATORS

2.4.1 FRONT-PANEL INDICATORS

NEG Red LED indicator is illuminated when the TC 953A/TC 954A POLARITY switch is set to NEG.

POS Red LED indicator is illuminated when the TC 953A/TC 954A POLARITY switch is set to POS.

ON Red LED indicator is illuminated when the TC 953A/TC 954A VOLTAGE switch is set to ON.

DIS Red LED indicator is illuminated when the TC 953A/TC 954A high voltage section is disabled. The disable signal can be generated externally and applied to the DISABLE input or internally generated. The internal signal can be generated by an overload condition, by setting the VOLTAGE switch to OFF, or by application of NIM bin power when the TC 953A/TC 954A VOLTAGE switch is set to ON.

2.4.2 DIGITAL DISPLAY

The TC 953A/TC 954A digital display is a 3 1/2 digit multimeter (DMM) that monitors either the output voltage or the output current.

The voltage inaccuracy of the DMM is $.05\% \pm 1/2$ least significant digit. This results in a worse case error of $\pm 1.0V$ at full scale on the 1000V range and a worse case error of $\pm .10V$ at full scale on the 100V range. The temperature instability of the DMM is not as low as the temperature instability of the output voltage. Any drift in the output voltage, as indicated by the DMM, is probably due to the temperature instability of the DMM. Typically, the TC 953A/TC 954A output voltage temperature instability is less than 10ppm/ $^{\circ}C$ and the DMM is typically less than 30ppm/ $^{\circ}C$.

The current measurement inaccuracy of the DMM is $\pm 1.0\% \pm 1/2$ least significant digit. This results in a worse case error of $\pm 0.205\mu A$ at full scale.

2.5 POWER REQUIREMENTS (TC 953A, same load both channels)

TC 953A (1000V, 20 μA)	
+24V, 40mA	+12V, 140mA
-24V, 30mA	-12V, 60mA

TC 954A (1000V, 20 μA)	
+24V, 20mA	+12V, 70mA
-24V, 15mA	-12V, 60mA

2.6 OTHER INFORMATION

TC 953A	
Shipping	5.0 lbs. 2.3 kg.
Net	3.0 lbs. 1.4 kg.

TC 954A	
Shipping	4.5 lbs. 2.1 kg.
Net	2.5 lbs. 1.2 kg.

DIMENSIONS Standard single-width NIM module (1.35 x 8.714 inch) per TID 20893 (Rev).

INSTRUCTION MANUAL One provided with each instrument ordered.

3.0 INSTALLATION

3.1 POWER CONNECTION

The **TC953A/TC 954A HVPS** requires a NIM standard bin and power supply, such as the **TENNELEUNUCLEUS TB4/TC 911**, for operation. The bin provides mechanical mounting and power supply distribution. Always turn the bin power supply **OFF** when inserting or removing any modules. The **TENNELEUNUCLEUS** bin provides power supply test points on the control panel for monitoring the dc voltage levels.

3.2 POLARITY SELECTION

The **polarity** of the output voltage is selected by a pushbutton switch accessible through the left side shield (viewed facing the front panel). The switch positions are labeled on the side shield and the printed circuit board. When changing the output polarity always follow the procedure below. Failure to do so is potentially dangerous and may damage the **TC 953A/TC 954A**.

TO CHANGE THE OUTPUT POLARITY:

- 1) **REDUCE DIAL SETTING TO ZERO.**
- 2) **SET VOLTAGE SWITCH TO OFF.**
- 3) **VERIFY OUTPUT VOLTAGE IS ZERO AS INDICATED BY THE FRONT-PANEL DISPLAY.**
- 4) **REMOVE MODULE FROM NIM SIN.**
- 5) **SET HIGH VOLTAGE POLARITY SWITCH TO CORRECT POSITION.**

3.3 OUTPUT CONNECTIONS

The **TC 953A/TC 954A HVP5** is compatible with all **TENNELEUNUCLEU5** preamplifiers that include provisions to accept the high voltage bias for the detector. The output cables will require **SHV** type connectors at each end (For example, **TENNELEUNUCLEUS** model **NC-595-12** cable).

4.0 OPERATION

4.1 FIRST TIME OPERATION

Users will find it helpful to familiarize themselves with the **TC 953A/TC 954A HVPS** by conducting a few simple tests.

4.1.1 CONTROL SETTINGS

Set the **TC 953A/TC 954A** controls as follows:

FRONT PANEL	
VOLTAGE SWITCH	OFF
VOLTAGE RANGE	1 00v
VOLTAGE DIAL	0.0 (FULLY COUNTER CLOCKWISE)
DISPLAY	V
INTERNAL CONTROLS (Factory Settings)	
POLARITY	POS
INT/EXT	INT

4.1.2 POWER SUPPLY OPERATION

Install the **TC 953A/TC 954A** in the bin and apply power. The digital display should momentarily indicate **888.8** and then indicate **000.0**. The **888.8** indication is the **POWER ON DISPLAY TEST**. Upon application of bin power, the display will indicate **8888** when in the **1000V** range. Verify that the **POS** and **DIS** LED's are illuminated.

Set the **VOLTAGE** switch to **ON**. Verify that the **DIS** LED is not illuminated and the **ON** LED is illuminated. Increase the **VOLTAGE** dial to the desired value and observe the increase in output voltage indicated by the display. Set the **DISPLAY** switch to μ A. The display should indicate **00.00 μ A**.

To verify operation of the power on reset mode, verify that the **TC 953A/TC 954A** is operating, the **ON** LED is illuminated and the **DIS** LED is not illuminated. Set the **BIN POWER** control to **OFF** for approximately 5 seconds. Return the **BIN POWER** control to **ON**. The **TC 953A/TC 954A ON** and **DIS** LEDs should be illuminated and no output

voltage indicated on the DMM. Cycle the TC 953A VOLTAGE control to OFF, then to ON, to restore the output voltage.

4.1.3 EXTERNAL CONTROL

Verification of operation using an external voltage source requires a stable, low-ripple, dc voltage source. Any low frequency noise present in the external control voltage will be amplified by a factor of 100 when operating the TC 953A/TC 954A on the 1000V range and by 10 when operating on the 100V range.

To operate under external voltage control, the TC 953A/TC 954A POLARITY switch must be set for the desired output polarity and the INT/EXT jumper set to EXT. The control voltage must be positive. The TC 953A/TC 954A is basically an operational amplifier with a gain of 10V/V or 100V/V. Note that the front panel VOLTAGE dial is disabled when operating in the EXT mode; however, setting the VOLTAGE dial to 0.0 is recommended. Setting the dial to zero will help prevent accidental application of bias when returning to INT control.

4.1.4 REMOTE DISABLE

The TC 953A/TC 954A rear-panel DISABLE input is designed to provide normal operation for a NIM or TTL positive logic one or an open input. The DISABLE input will inhibit operation of the TC 953A/TC 954A for a short to ground, a NIM positive logic zero, or a TTL logic zero. Operation of the DISABLE input can be verified by shorting the DISABLE input to ground using a BNC terminator such as a 50 ohm or 100 ohm terminator. To restore operation after external disable requires the VOLTAGE control be cycled to OFF then to ON. The VOLTAGE control functions as a RESET switch when the TC 953A/TC 954A has been disabled, thus preventing premature reapplication of bias voltage.

4.2 DETECTOR CONNECTION

ALWAYS VERIFY THAT THE TC 953A/TC 954A OUTPUT VOLTAGE, AS INDICATED ON THE DMM, IS ZERO BEFORE CONNECTING THE HIGH VOLTAGE OUTPUT TO A PREAMPLIFIER OR CONNECTING THE DETECTOR TO THE PREAMPLIFIER. CONSULT THE PREAMPLIFIER MANUAL FOR ANY NECESSARY PRECAUTIONS AND THE DETECTOR DATA SHEET FOR THE PROPER POLARITY, LEVEL OF BIAS VOLTAGE,

AND ANY SPECIAL PRECAUTIONS FOR APPLYING BIAS AND HANDLING PROCEDURES.

For initial application of bias voltage, it is recommended that the VOLTAGE dial be set to 0.0 and the voltage gradually increased until the proper operating point is reached.

4.3 DETECTOR LEAKAGE CURRENT MEASUREMENT

The TC 953A/TC 954A DMM can be used to measure the detector leakage current directly in μA . The full-scale current range is $19.99\mu\text{A}$ with 10 nA resolution. The 10 nA current resolution, combined with the $19.99\mu\text{A}$ full-scale range allows accurate detector load current measurements for silicon surface barrier detectors or ion-implanted detectors.

4.4 LOADING EFFECTS

The TC 953A/TC 954A is, in effect, an operational amplifier and has a low output impedance. The feedback signal is taken directly at the output and the output impedance is approximately zero. The output voltage is essentially independent of load, with less than .001% variation (typically less than .0003%) for a 0 to 20 μA change in output current.

To determine the actual voltage on a detector, the resistance between the output of the TC 953A/TC 954A and the detector itself must be identified. Since the bias voltage is usually supplied through a detector load resistor in the preamplifier and then to the detector, the resistance can usually be determined from the preamplifier schematic diagram. The actual detector voltage (V_{DET}) can be determined by

$$V_{\text{DET}} = V_{\text{HVPS}} - I_{\text{DET}}R_L$$

where V_{HVPS} is the TC 953A/TC 954A output voltage, I_{DET} is the detector leakage current as indicated by the TC 953A/TC 954A display in the μA mode, and R_L is the detector load resistance. The TC 953A/TC 954A provides a direct reading of the detector leakage current down to the 10 nA level. Note that the actual voltage setting of the TC 953A/TC 954A (V_{HVPS}) will be higher than the detector operating voltage (V_{DET}) by the voltage drop across the detector load resistor ($I_{\text{DET}}R_L$).

5.0 MAINTENANCE

The TC 953A/TC 954A is a highly stable, precision power supply. Periodic calibration or adjustment is not necessary and is not recommended as a routine procedure. Precise measurement of the TC 953A/TC 954A's performance requires specialized and expensive test equipment. If trouble should arise, it is strongly recommended that the unit be returned to TENNELEC/NUCLEUS for repair. If it is impossible to return the unit to TENNELEC/NUCLEUS for repair, a detailed Test Procedure is available upon request. Observe the following procedure before removing the TC 953A/TC 954A side shields.

CAUTION

DANGEROUS VOLTAGES EXIST **INSIDE** THIS INSTRUMENT. BEFORE REMOVING THE SIDE **SHIELD:**

- 1) REDUCE DIAL SETTING TO ZERO.
- 2) SET VOLTAGE SWITCH TO OFF.
- 3) VERIFY OUTPUT VOLTAGE IS ZERO AS INDICATED BY THE FRONT PANEL DISPLAY.
- 4) REMOVE FROM NIM BIN.
- 5) WAIT 10 SECONDS BEFORE REMOVING SIDE SHIELDS.

THE HIGH VOLTAGES PRESENT IN **THIS** INSTRUMENT ARE HAZARDOUS. DO NOT ATTEMPT ANY ADJUSTMENTS OR **MAINTENANCE UNLESS** YOU ARE EXPERIENCED WITH HIGH VOLTAGE **CIRCUITS.**

6.0 SHIPPING DAMAGE

Upon receipt of the instrument, examine it for shipping damage. Damage claims should be filed with the carrier. The claims agent should receive a full report: a copy of that report should be sent to Oxford Instruments Inc, P.O. Box 2560, Oak Ridge, Tennessee 37831-2560. The model number and serial number of the instrument must be included in the report. Any remedial action taken by Oxford Instruments Inc will be based on the information contained in that report.

7.0 SERVICING

In the event of a component failure, replacement may be done in the field or the instrument may be returned to our plant for repair. There will be no charge for repairs that fall within the warranty.

6.0 WARRANTY

In connection with Oxford's warranty, Oxford suggests that if a fault develops, the customer should immediately notify the Oxford Instruments Inc Customer Service Manager. He may be able to prescribe repairs and send replacement parts which will enable you to get the instrument operating sooner and at less expense than if you return it.

Should return prove necessary, the Oxford Customer Service Manager must be informed in WRITING, BY CABLE OR FAX of the nature of the fault and the model number and serial number of the instrument. Pack the instrument well and ship PREPAID and INSURED to Oxford Instruments Inc, 601 Oak Ridge Turnpike, Oak Ridge, Tennessee 37830. As stated in the warranty, **DAMAGE IN TRANSIT WILL BE REPAIRED AT THE SENDER'S EXPENSE** as will damage that obviously resulted from abuse or misuse of the instrument.

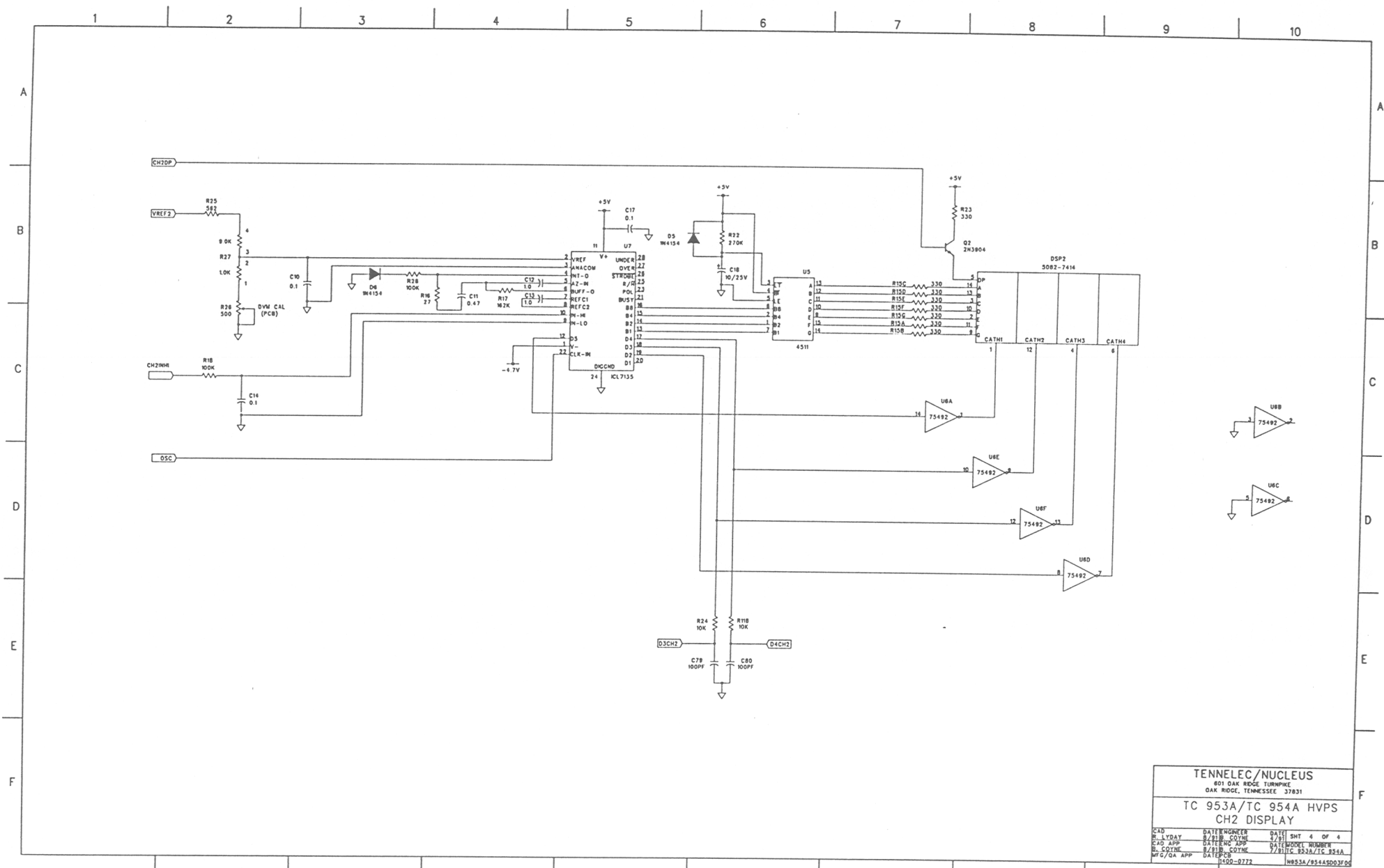
Quotations for repair of such damage will be sent for your approval before repair is undertaken.

The Oxford Instruments Inc Quality Assurance Program requires that each and every instrument be fully aged, vibrated, and electronically checked.

Should the user require a copy of the Quality Control Procedure and Test Record, please call the Customer Service Department of Oxford Instruments Inc. Both model number and serial number are required.

MANUAL REV. 0

7/91- Engineering and component improvements may be made after date of printing.

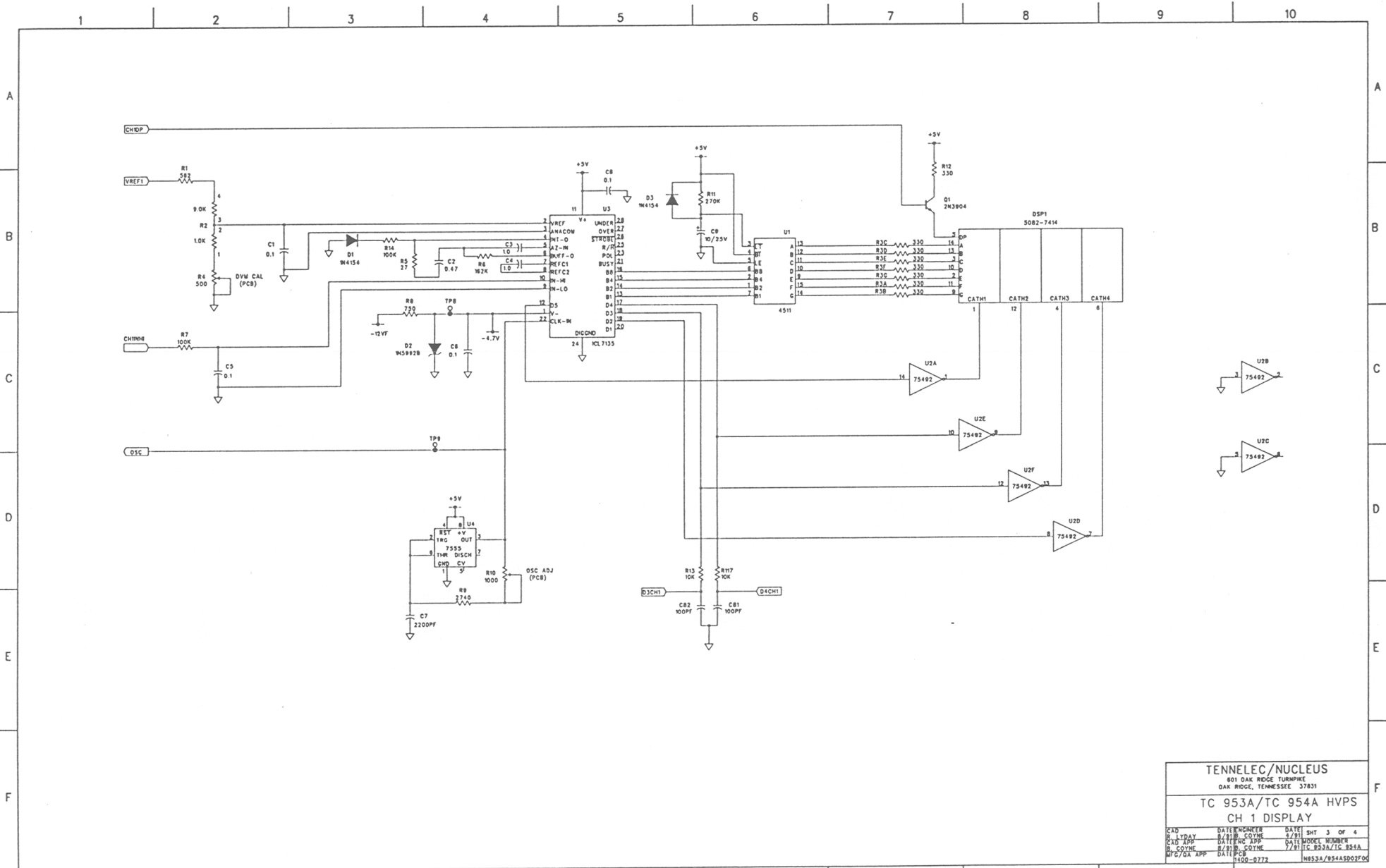


TENNELEC/NUCLEUS
 601 OAK RIDGE TURNPIKE
 OAK RIDGE, TENNESSEE 37831

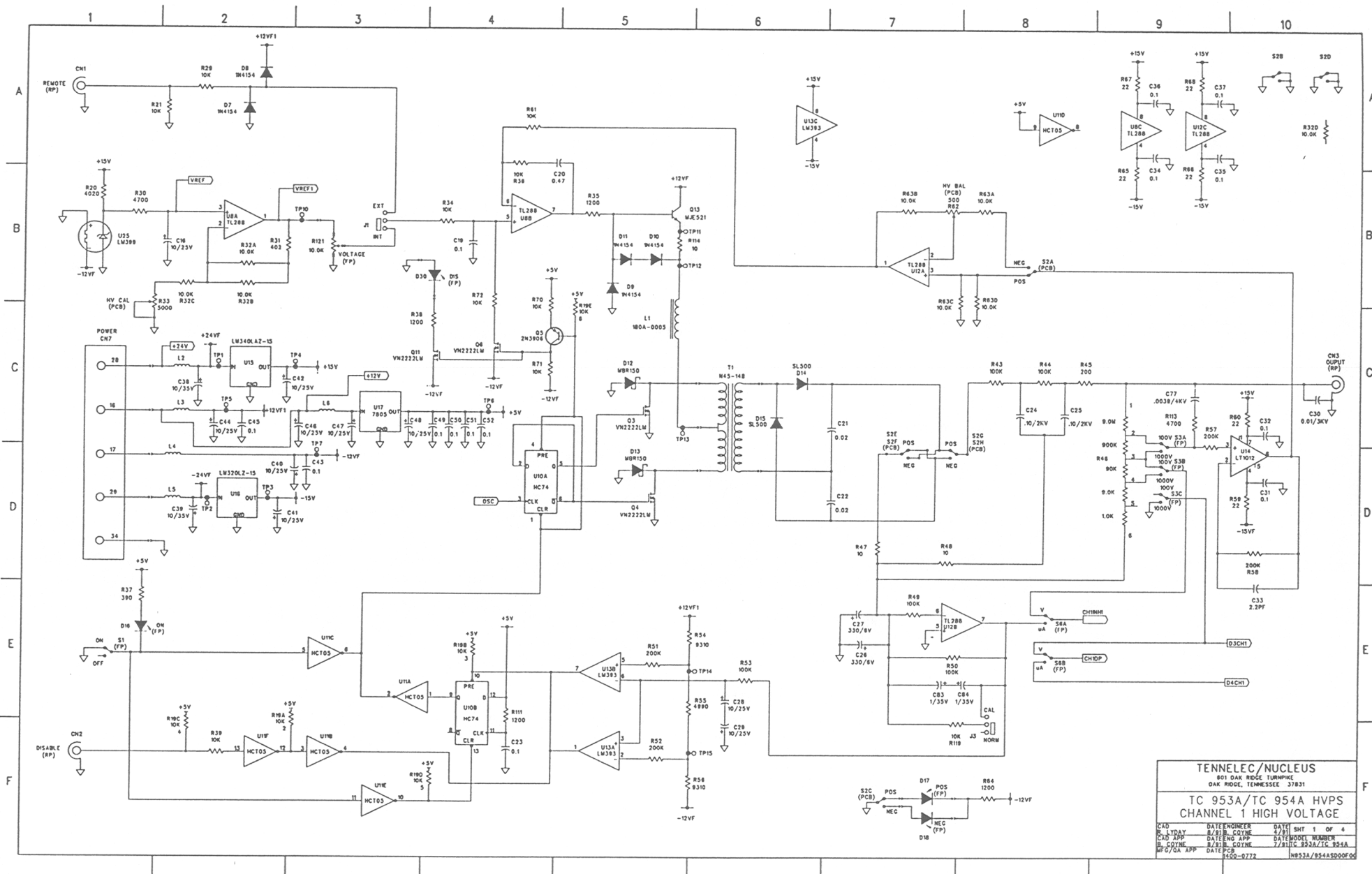
TC 953A/TC 954A HVPS
 CH2 DISPLAY

CAD	DATE/ENGINEER	DATE	SHEET
R. LYDAY	B/SIB COYNE	7/81	4 OF 4
CAD APP	DATE/ENG APP	DATE/MODEL NUMBER	
B. COYNE	B/SIB COYNE	7/81/TC 953A/TC 954A	
W/C/OA APP	DATE/PA		

100-0772 N883A/854AS003F00



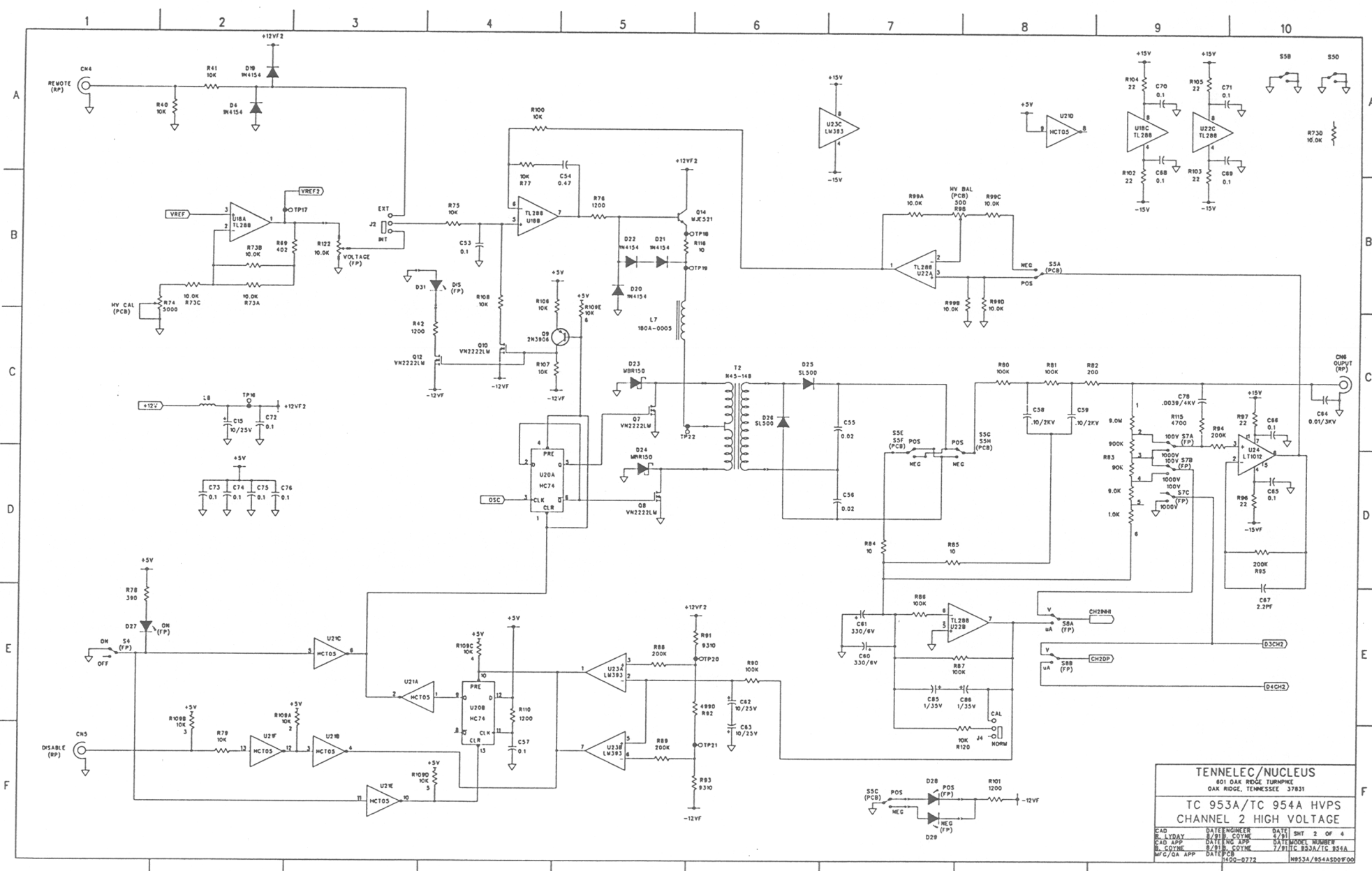
TENNELEC/NUCLEUS			
801 OAK RIDGE TURNPIKE OAK RIDGE, TENNESSEE 37831			
TC 953A/TC 954A HVPS CH 1 DISPLAY			
REV	DATE/ENGINEER	DATE/SHI	3 OF 4
1	8/91 B. COYNE	4/91	
2	8/91 B. COYNE	7/91	TC 953A/TC 954A
3	8/91 B. COYNE	7/91	TC 953A/TC 954A
4	8/91 B. COYNE	7/91	TC 953A/TC 954A
5	8/91 B. COYNE	7/91	TC 953A/TC 954A
6	8/91 B. COYNE	7/91	TC 953A/TC 954A
7	8/91 B. COYNE	7/91	TC 953A/TC 954A
8	8/91 B. COYNE	7/91	TC 953A/TC 954A
9	8/91 B. COYNE	7/91	TC 953A/TC 954A
10	8/91 B. COYNE	7/91	TC 953A/TC 954A
11	8/91 B. COYNE	7/91	TC 953A/TC 954A
12	8/91 B. COYNE	7/91	TC 953A/TC 954A
13	8/91 B. COYNE	7/91	TC 953A/TC 954A
14	8/91 B. COYNE	7/91	TC 953A/TC 954A
15	8/91 B. COYNE	7/91	TC 953A/TC 954A
16	8/91 B. COYNE	7/91	TC 953A/TC 954A
17	8/91 B. COYNE	7/91	TC 953A/TC 954A
18	8/91 B. COYNE	7/91	TC 953A/TC 954A
19	8/91 B. COYNE	7/91	TC 953A/TC 954A
20	8/91 B. COYNE	7/91	TC 953A/TC 954A
21	8/91 B. COYNE	7/91	TC 953A/TC 954A
22	8/91 B. COYNE	7/91	TC 953A/TC 954A
23	8/91 B. COYNE	7/91	TC 953A/TC 954A
24	8/91 B. COYNE	7/91	TC 953A/TC 954A
25	8/91 B. COYNE	7/91	TC 953A/TC 954A
26	8/91 B. COYNE	7/91	TC 953A/TC 954A
27	8/91 B. COYNE	7/91	TC 953A/TC 954A
28	8/91 B. COYNE	7/91	TC 953A/TC 954A
29	8/91 B. COYNE	7/91	TC 953A/TC 954A
30	8/91 B. COYNE	7/91	TC 953A/TC 954A
31	8/91 B. COYNE	7/91	TC 953A/TC 954A
32	8/91 B. COYNE	7/91	TC 953A/TC 954A
33	8/91 B. COYNE	7/91	TC 953A/TC 954A
34	8/91 B. COYNE	7/91	TC 953A/TC 954A
35	8/91 B. COYNE	7/91	TC 953A/TC 954A
36	8/91 B. COYNE	7/91	TC 953A/TC 954A
37	8/91 B. COYNE	7/91	TC 953A/TC 954A
38	8/91 B. COYNE	7/91	TC 953A/TC 954A
39	8/91 B. COYNE	7/91	TC 953A/TC 954A
40	8/91 B. COYNE	7/91	TC 953A/TC 954A
41	8/91 B. COYNE	7/91	TC 953A/TC 954A
42	8/91 B. COYNE	7/91	TC 953A/TC 954A
43	8/91 B. COYNE	7/91	TC 953A/TC 954A
44	8/91 B. COYNE	7/91	TC 953A/TC 954A
45	8/91 B. COYNE	7/91	TC 953A/TC 954A
46	8/91 B. COYNE	7/91	TC 953A/TC 954A
47	8/91 B. COYNE	7/91	TC 953A/TC 954A
48	8/91 B. COYNE	7/91	TC 953A/TC 954A
49	8/91 B. COYNE	7/91	TC 953A/TC 954A
50	8/91 B. COYNE	7/91	TC 953A/TC 954A



TENNELEC/NUCLEUS
 801 DAK RIDGE TURNPIKE
 OAK RIDGE, TENNESSEE 37831

**TC 953A/TC 954A HVPS
 CHANNEL 1 HIGH VOLTAGE**

CAD	DATE/ENGINEER	DATE	SHT 1 OF 4
R. L. DAY	R. B. B. COYNE	1/78	
CAD APP	DATE/ENG APP	DATE/MODEL NUMBER	
R. COYNE	R. B. B. COYNE	7/81/TC 953A/TC 954A	
NO./CN APP	DATE/PCB	NO./CN APP	
	1400-0772		NB953A/954A0000F00



TENNELEC/NUCLEUS
 801 OAK RIDGE TURNPIKE
 OAK RIDGE, TENNESSEE 37831

**TC 953A/TC 954A HVPS
 CHANNEL 2 HIGH VOLTAGE**

CAD	DATE/ENGINEER	DATE	SMT	2	OF	4
E. LUDAY	3/78	COYNE	2/78			
CAD APP	DATE/ENG	APP	DATE/MODEL	NUMBER		
B. COYNE	8/78	COYNE	7/78	TC 953A/TC 954A		
W/C/DA APP	DATE/PCB					
		1400-0772	MPS3A/854AS0P00			