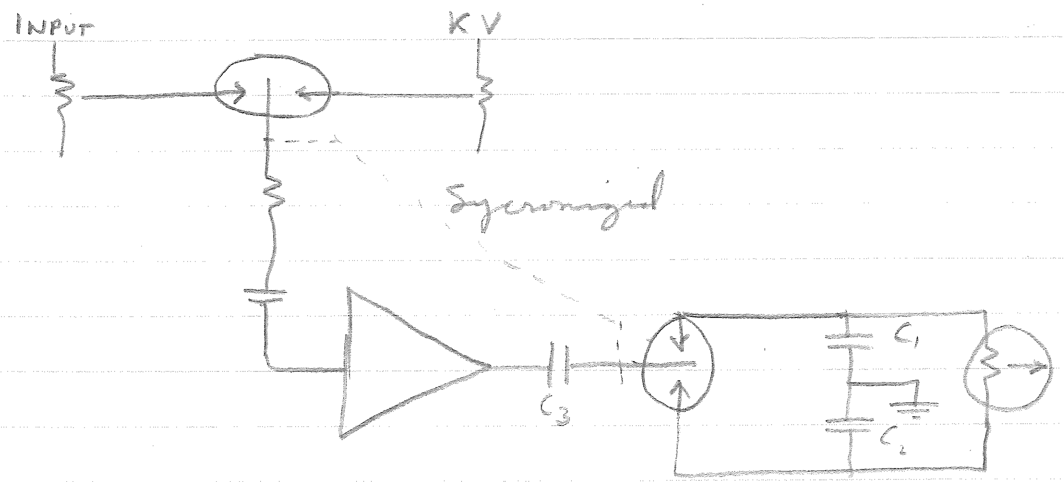
DC VOLTAGE BRIDGE
DATA

BOB ROSS

Various Techniques for attaching meter to DCVB to observe null.

I

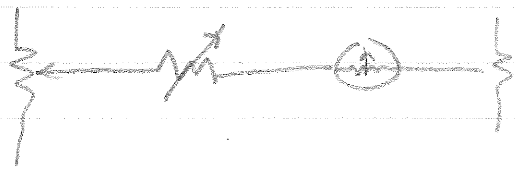


Advantages
(1) Signal from input + KV through same amplifier
(2) effective infinite Z at Input
(3) Direction of unbalance indicated on meter

Disadvantages
(1) 2 choppers or equivalent
(2)

Problems
(1) C_1, C_2 large (~1000 μF) in order to prevent discharge through small meter resistance (~2K) and therefore C_3 must be large.

II



Advantages

(1) Simplicity offsets cost of complex circuitry
(2) Direction of unbalance indicated
(3) Infinite Z at null
(4) No choppers or power supplies

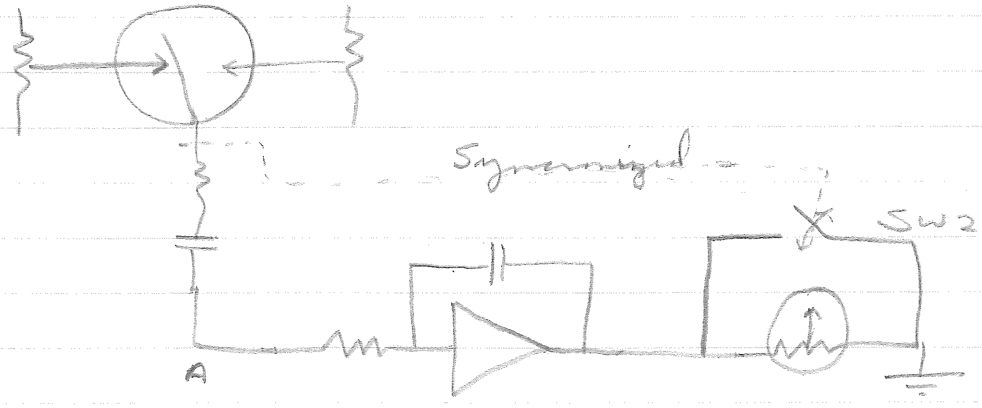
Disadvantage

(1) Protection circuitry may be complicated and be source of error.

Problem

(1) No compact, highly sensitive voltmeter found.

III



Theory

(1) When chopper swings to KV Voltage, output of Integrator and meter is shorted setting A to proper level. When chopper swings to input attenuator, Voltage at A is changed and Integrator output deflect null meter in proper direction.

Advantages

(1) High effective gain with integrator
(2) KV + Unknown Voltage through same Amplifier
(3) SW 2 could be transistor switch activated by 6.3V coil

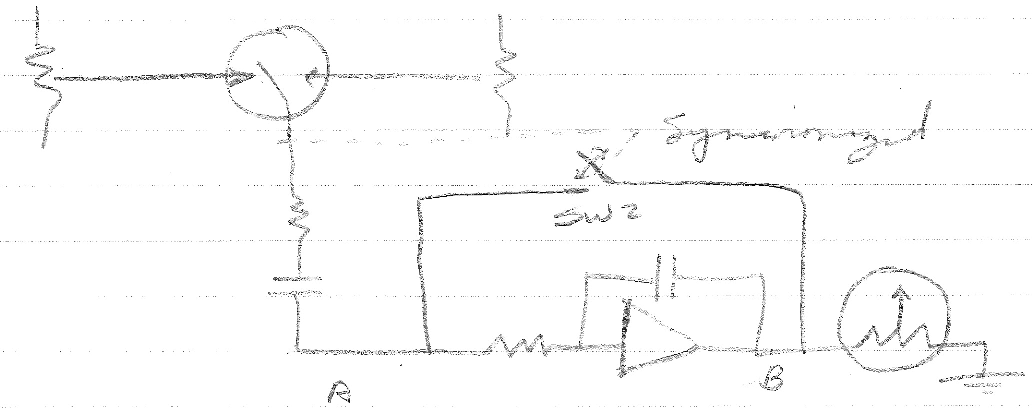
Disadvantages

(1) 1 chopper, 1 reed relay or equivalent
(2)

Problems

(1) Drift of Amplifier is a problem.
(2) Impedance at A is low ?
(3)

IV

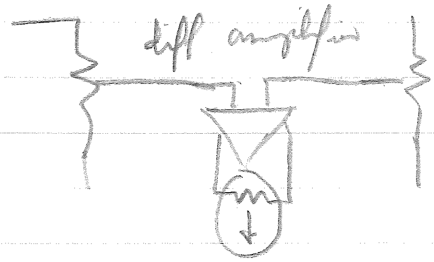


Advantages
(1) Negligible drift of meter
(2) KV + Unknown Voltage through same Amplifier.

Disadvantages
(1) SW 2 "floating"
(2) 1 chopper, 1 SW.2 required.

Problems
(1) At null, output B is square wave instead of zero volts. Thus there is frequency dependence of null. Multi required.
(2) Input Z at A is low due to Quiescent non zero levels.

I



Advantages

(1) No chopper

(2)

Disadvantages

(1) Protection complicated

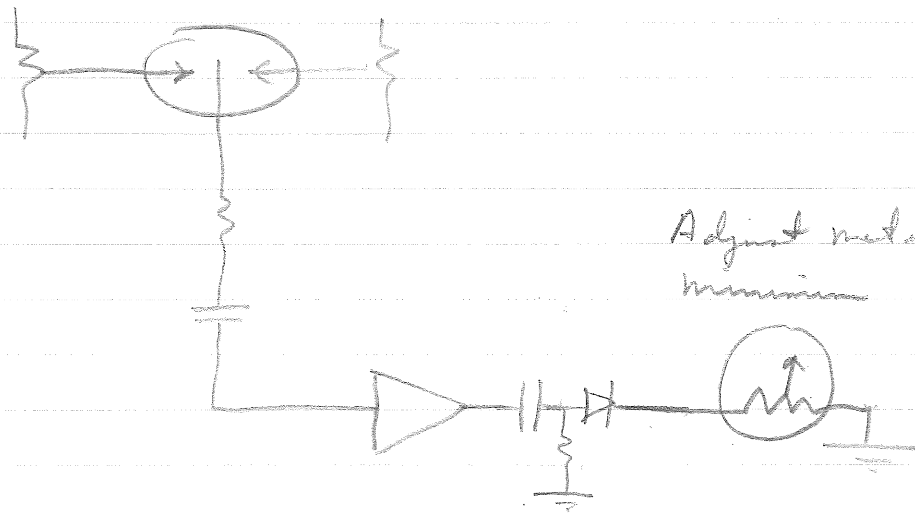
(2) Probably need zero adjustment.

(3)

Problems

(1) Differential Amplifier Unbalance and drift critical because of high sensitivity of readings required.

VI



Adjust meter for minimum

Advantages

(1) simulates scope operation
(2) Infinite Z at input at balance
(3) KV + Input signal through same amplifier
(4)

Disadvantages

(1) Direction of unbalance not indicated
(2) Additional circuitry required if means for indicating direction of unbalance is required
(3) Chopper required

Problems

(1) Chopper spikes may result in measured null different than actual null

DC VOLTAGE BRIDGE

Characteristics

1. Temperature Range for Stated Accuracy

   15°C to 35°C (59°F to 95°F)

2. Line Voltage Range

   105 to 125 vac

3. Measurement Accuracy

Voltage Range	Accuracy
0 to 1 v	± 1 mv
1 to 1100 v	± 0.1% of indicated voltage
High Voltage Input	
1.1 to 4 kv	± % error = number of kv times ½
over 4 kv	± % error = number of kv minus 2

4. Input Resistance

Input Range	Input Resistance
11 v	≥ 100 megohms at null
110 v	≥ 1 megohm
1.1 kv	≥ 1 megohm
11 kv	≥ 100 megohms

DC VOLTAGE BRIDGE

User Specifications:

3. Measurement Accuracy:

Input voltage Range	Accuracy
0-1 volt	± 1 mV
1-1100 volts	± 0.1 % of indicated voltage

High Voltage Input:

1.1-4KV	% error (±) = number of KV times $\frac{1}{2}$
over 4KV	% error (±) = number of KV minus 2

1. Temperature range for stated accuracy:
   15°C-35°C (59°F-95°F)

2. Line voltage range for stated accuracy:
   105V-125V.

4. Input Resistance:

Input Range	Input Resistance
11V	>100MΩ at null
110V	1MΩ
1.1K	1MΩ
11KV	100MΩ

RANGE
POLARITY
− OFF +

110 V (1 MΩ)
1.1 KV (1 MΩ)
11 V (R→∞)
11 KV (100 MΩ)

CAUTION

± HV INPUT

INPUT VOLTAGE
(SET FOR NULL)

2385

RIPPLE CHECK

CHOPPED
NULL SIGNAL

DC VOLTAGE BRIDGE

SERIAL

± INPUT

GND

POWER
ON

NULL SIGNAL

OUTPUT

RIPPLE CHECK

TEKTRONIX, INC., PORTLAND, OREGON, U.S.A.

PROOF.

#2895 DC Voltage Bridge 14 brun. 6-1-65

PROOF

RANGE

POLARITY

− OFF +

110V (1MΩ)

1.1KV (1MΩ)

centered

11V (R→∞)

11KV (100MΩ)

1.1V (R→∞)

CAUTION

± HV INPUT

INPUT VOLTAGE

(SET FOR NULL)

3010

DC VOLTAGE BRIDGE

SERIAL

POWER ON

NULL SIGNAL

OUTPUT

± INPUT

GND

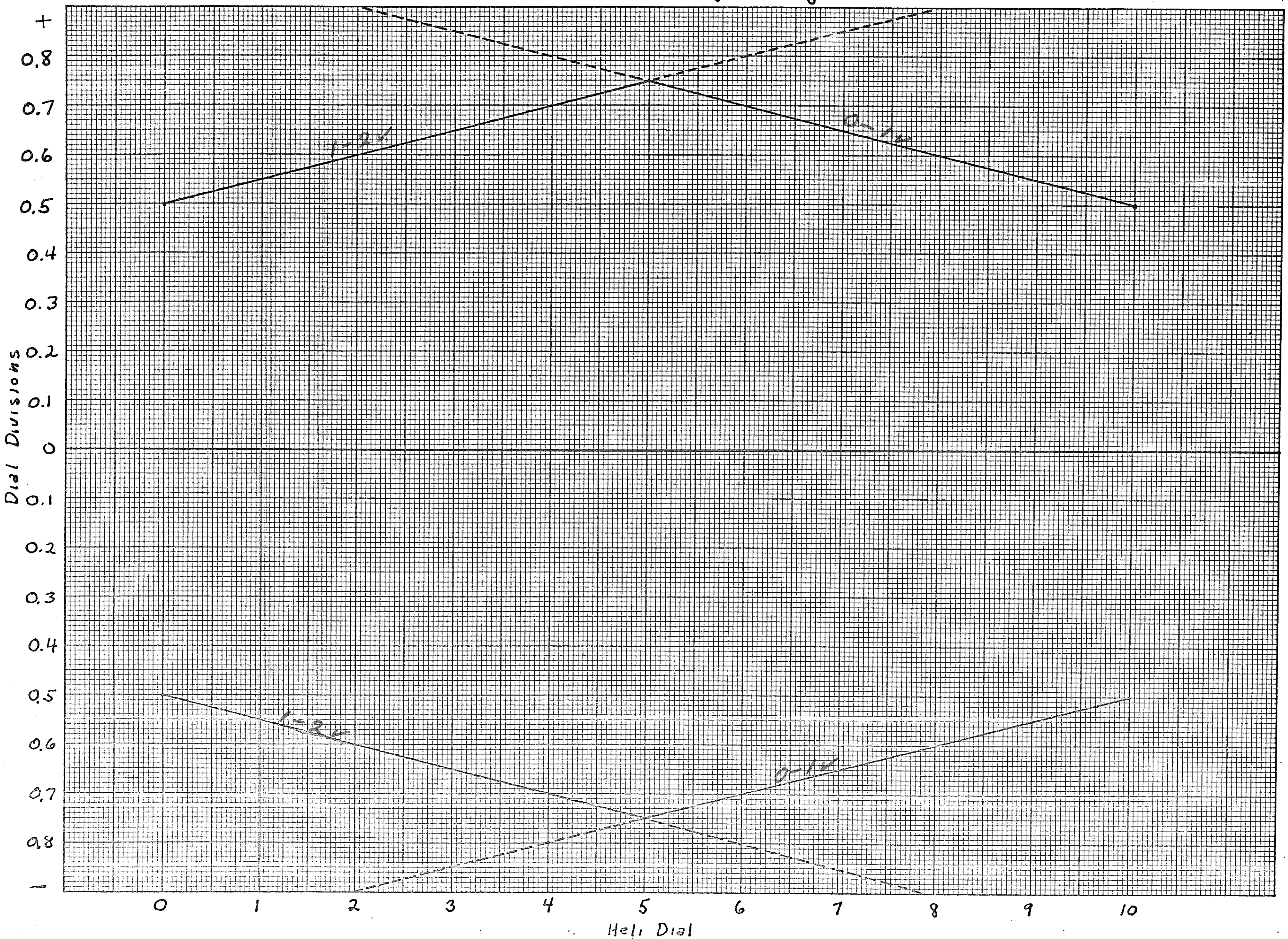
RIPPLE CHECK

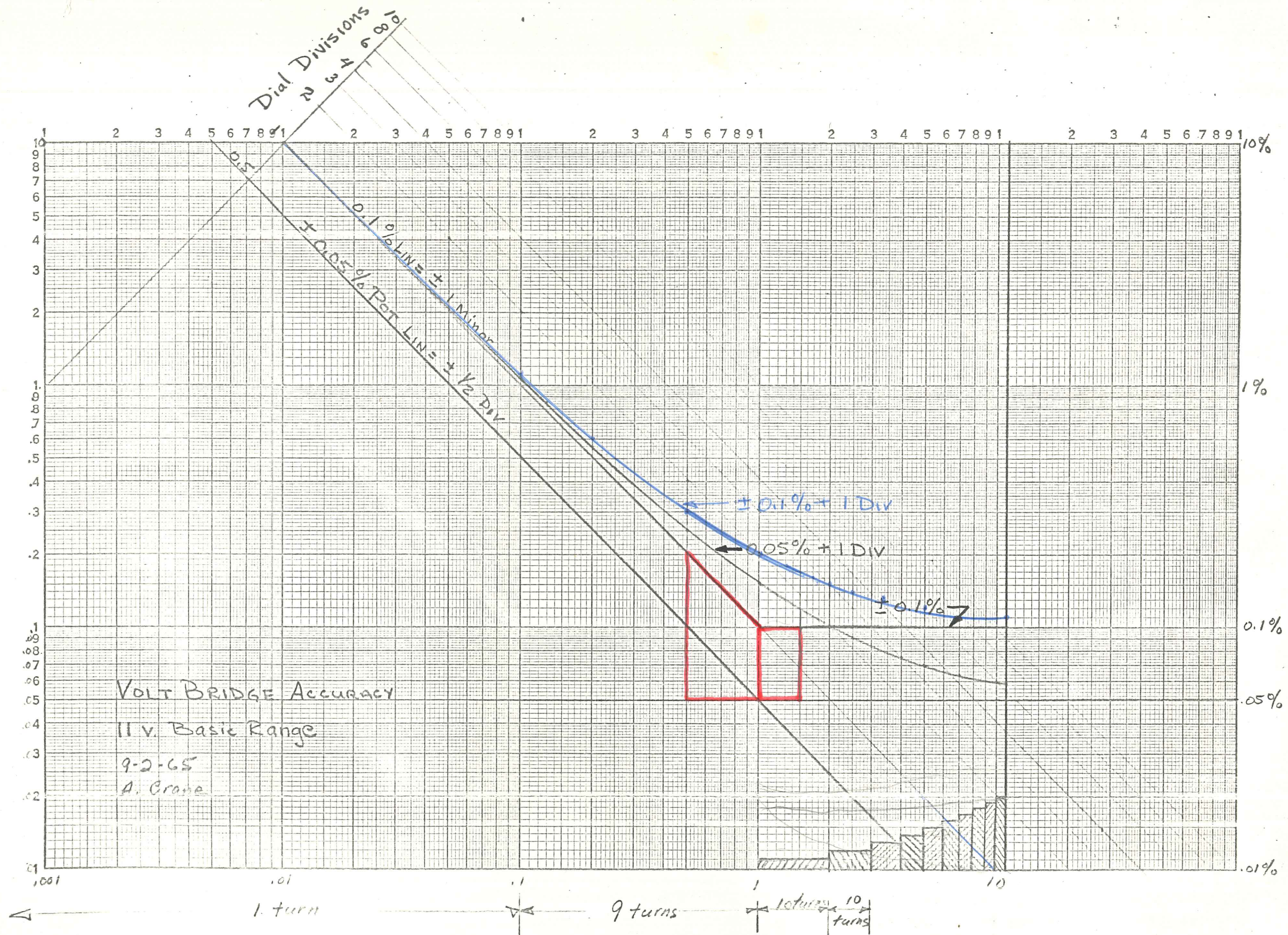
TEKTRONIX

TEKTRONIX, INC., PORTLAND, OREGON, U.S.A.

#3010 D.C. Voltage Bridge 14 Brun 30 Jun 65

Helipot Linearity
TEK D.C. Voltage Bridges





← 1ST Decade set on zero →

FIG 1

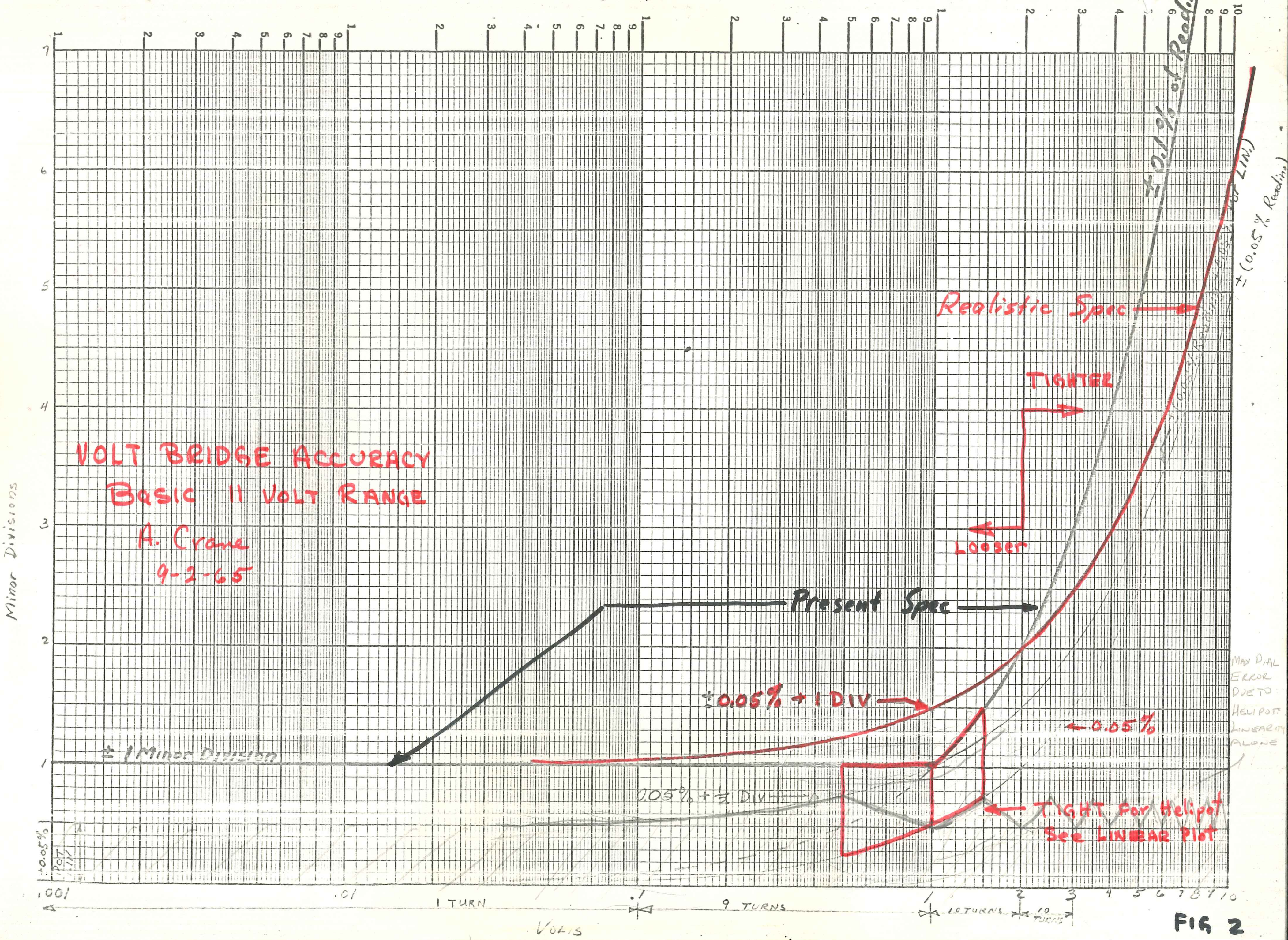

VOLT BRIDGE ACCURACY
Basic 11 Volt Range
A. Crane
9-2-65
Present Spec
Realistic Spec
TIGHTER
Looser
± 0.1% of Reading
±(0.05% Reading)
±0.05% + 1 DIV
± 1 Minor Division
.05% + ½ DIV
0.05%
TIGHT For Helipot
See LINEAR Plot
MAX DIAL
ERROR
DUE TO
HELIPOT
LINEARITY
ALONE
Minor Divisions
.001
.01
.1
1
10
1 TURN
9 TURNS
10 TURNS
VOLTS

FIG 2

10-15-65

DCVB STICKER

BOB ROSS X 305

CORP NO. 039700
0410-20-621

RANGE ACCURACY

VOLTAGE READING	MAXIMUM ERROR OF INDICATED VALUE
0 - 1100V	± (0.05% PLUS ONE MINOR DIVISION)
1.1 - 4KV	± 0.5% FOR EACH KV
4 - 11KV	± (1% FOR EACH KV MINUS 2%)

RANGE ACCURACY

VOLTAGE READING	PER CENT ERROR OF INDICATED VALUE
.1—1100V	± .1%
1.1—4KV	± .5% FOR EACH KV
4—11KV	± (1% FOR EACH KV MINUS 2%)

RANGE ACCURACY

VOLTAGE READING	MAX. ERROR OF INDICATED VALUE
0—1100V	± (0.05% PLUS ONE MINOR DIVISION)
1.1—4KV	± 0.5% FOR EACH KV
4—11KV	± (1% FOR EACH KV MINUS 2%)

RR 7-7-65

-509 $7.20

$2.36

Lorne Hofeld - Switch

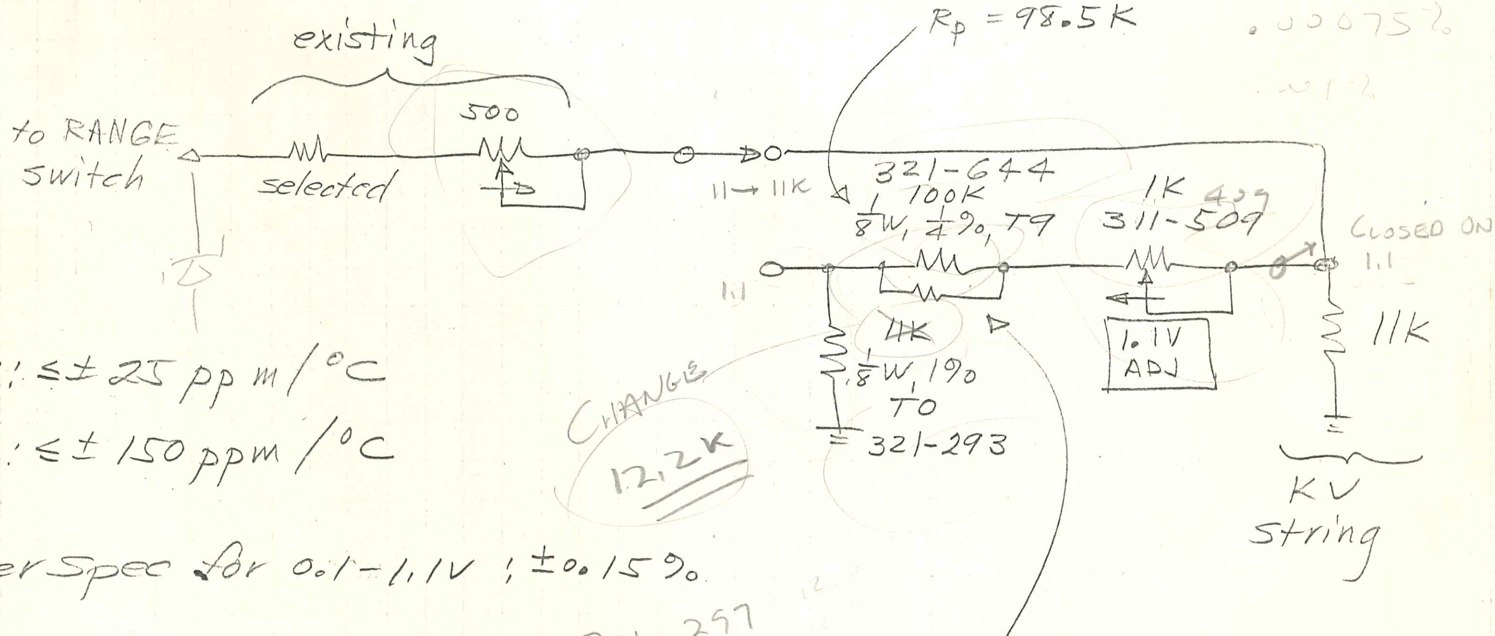
331

DCVB

1.1 VOLT MOD:

1. Front panel switch (11V-1.1V) affects all ranges.
2. Diode isolation of chassis not safe enough.
3. SAC or 55WC should do 100mV measurement job.

Recommended form of mod.:



T9: ≤ ± 25 ppm/°C

T0: ≤ ± 150 ppm/°C

User Spec for 0.1-1.1V ; ±0.15%

25
15
40 ppm/°C voltage error for 1.1V.

12.1 K = 321-~~293~~ 297

BILL NELSONS

BYRON WHIT

Bob Moulds

~~Atwells~~

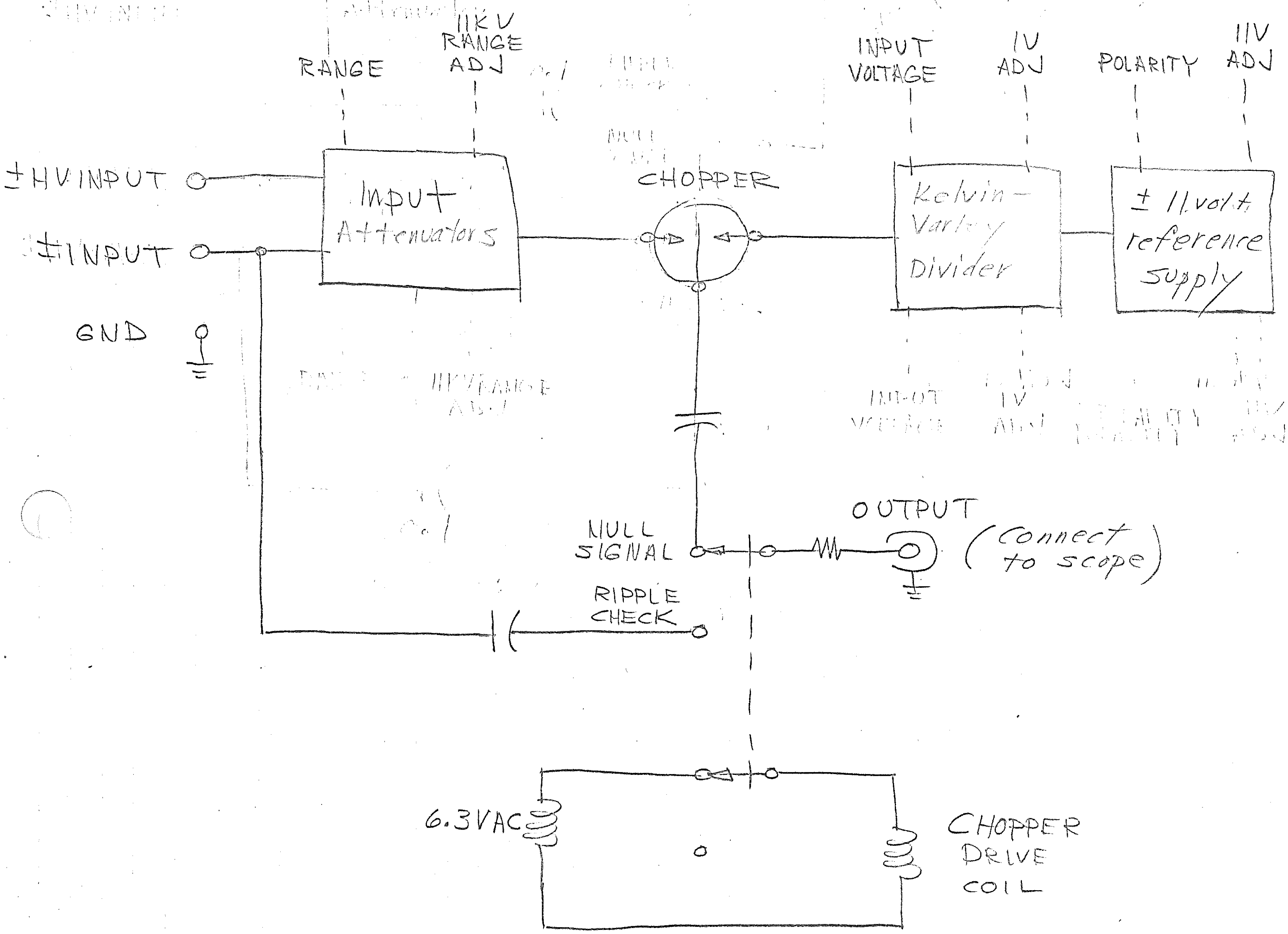
$409 ½%

20 ppm/°C

.075% ± 20 ppm

DCVB

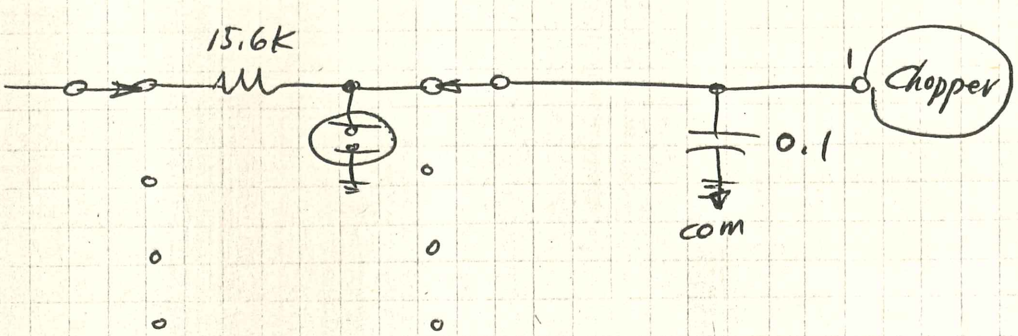
Block Diagram:



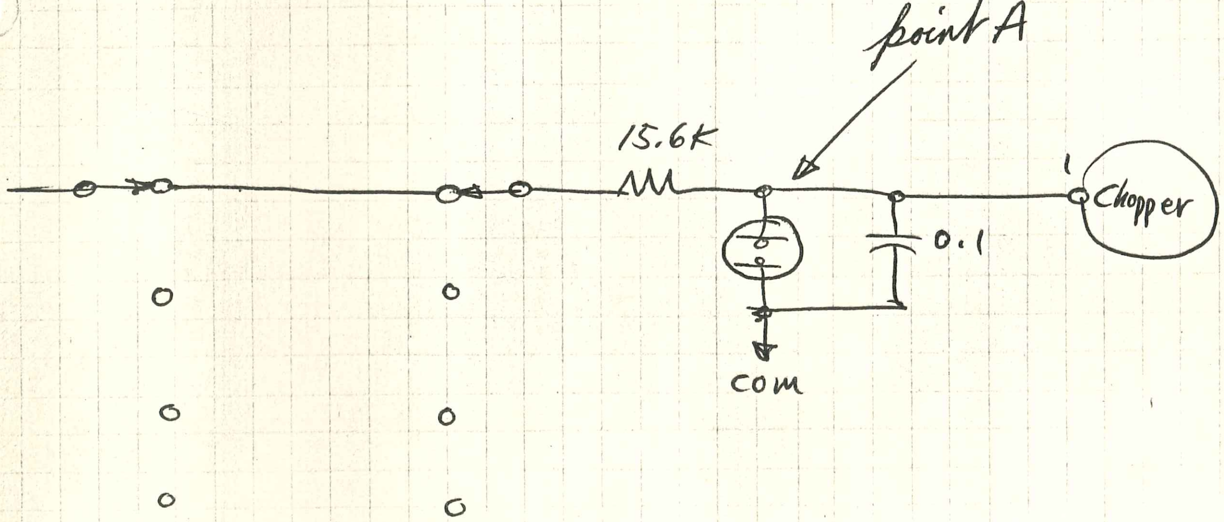
18 June 65
Thc

Leon,
~~Doug,~~

On the DC Voltage Bridge, the resistor (15.6K) on the Range switch is shorted by the switch contacts. Accordingly, we are changing the circuit.



BEFORE



AFTER

In performing calibration, check the input attenuator to ±0.01% taking into account possible leakage current through the neon. In other words, check the attenuator outputs at point A above. We have measured neon leakage currents at 11V and observed an equivalent resistance of more than 3×10^{10} ohms. This would cause a worst case input attenuation error of 0.0003%. So, unless you get a leaky neon you shouldn't have any trouble.

Tom C.

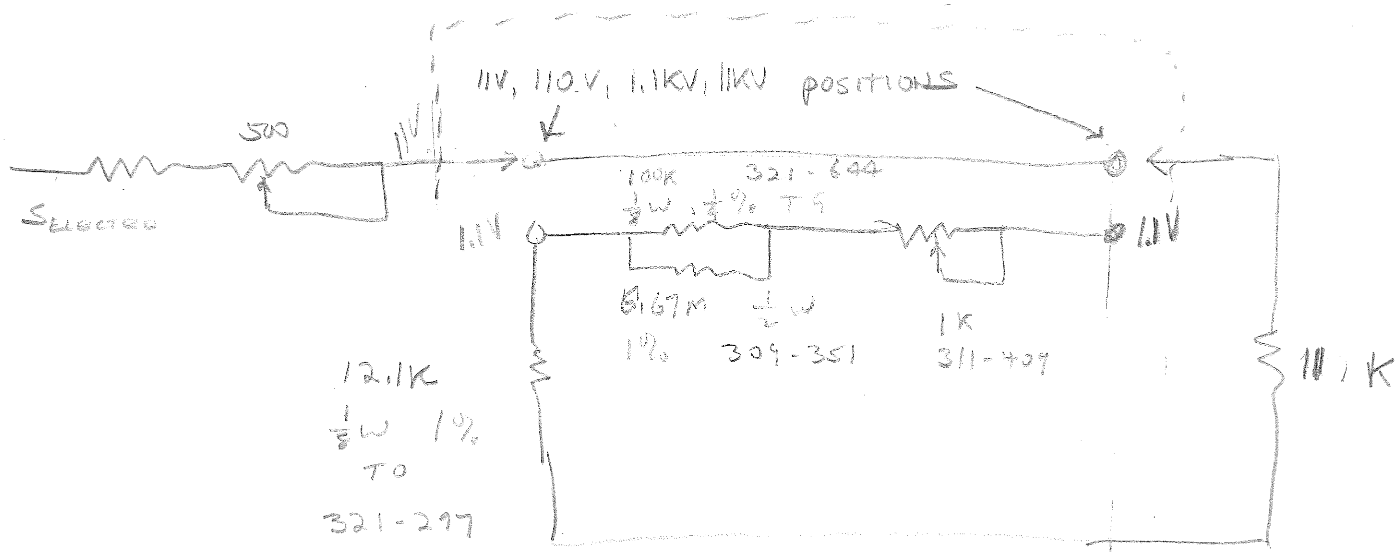
note: if RT2-32-1A neons are used, they must be hand picked for less than 500 μμa leakage at 10 volts. Many of the neons in stock go as high as 8000 μμa at 10.5 v.

We are waiting for some NE86's that are due July 9, 1965. These are coated inside and out for low leakage. We will test a handful of these when they come in. They are probably all below 100 μμa at 10.5 volts

John Carson
July 1, 1965

Rel K

1.1 V SWITCH

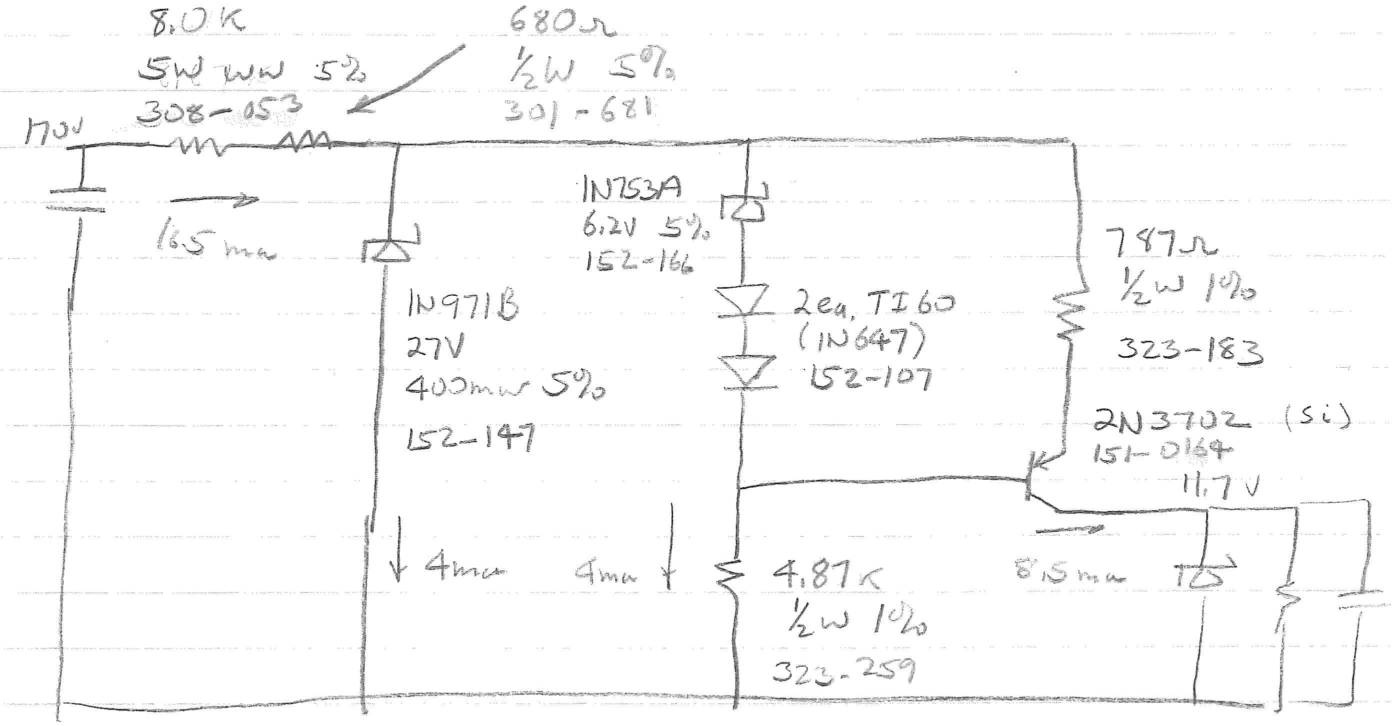


ADDITIONAL PARTS

12.1K	1/8 W	1%	321 - 297
6.67 M	1/2 W	1%	309 - 351
100 K	1/8 W	1/4 %	321 - 644
1K pot			311 - 409

SWITCH

PNP Regulator Using 27 V Zener:



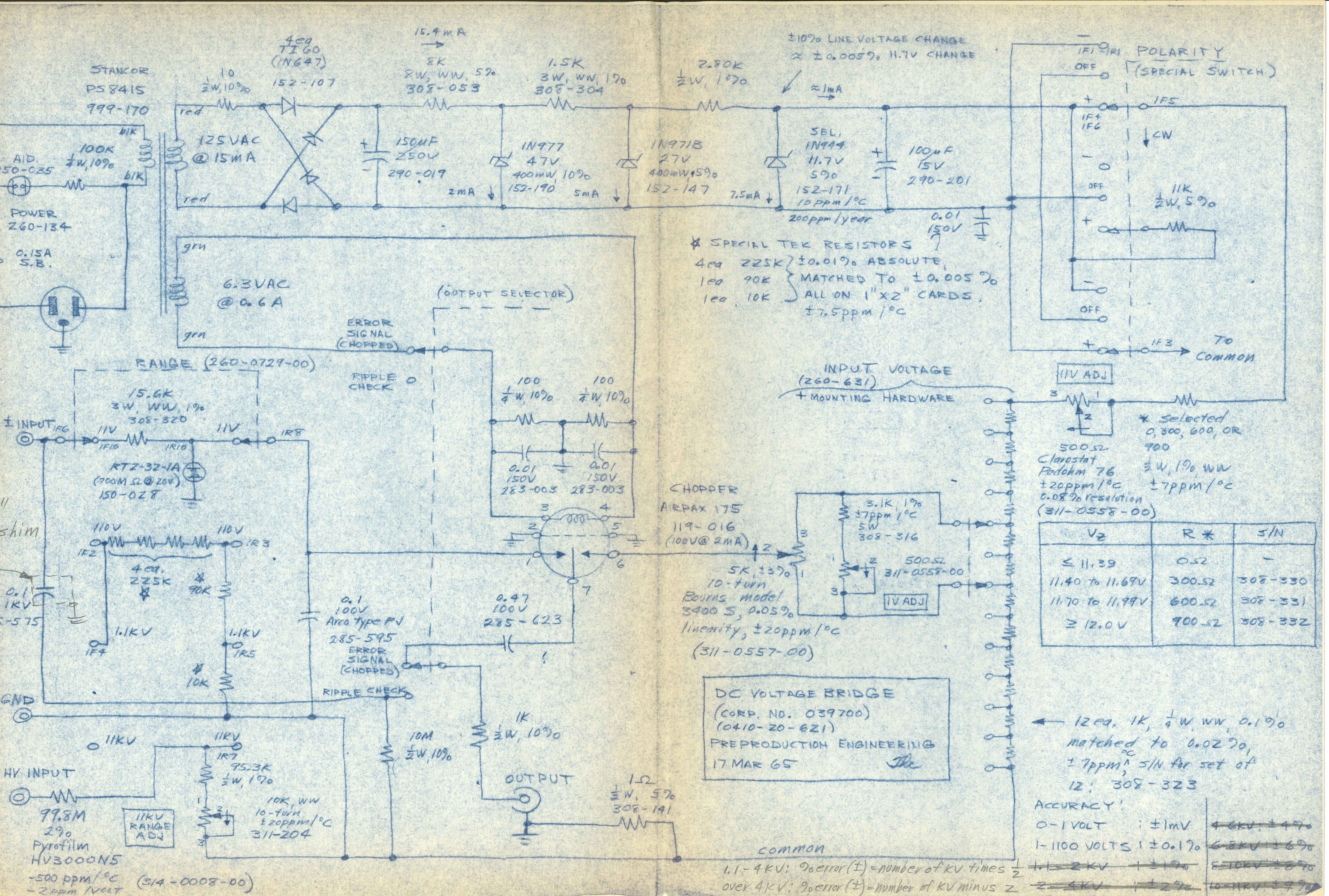
~~Regulation:~~

$$\sim \frac{50}{8.7} \times \frac{10}{4.9\times10^3} \times \frac{30}{790} = .45\ \mu v$$

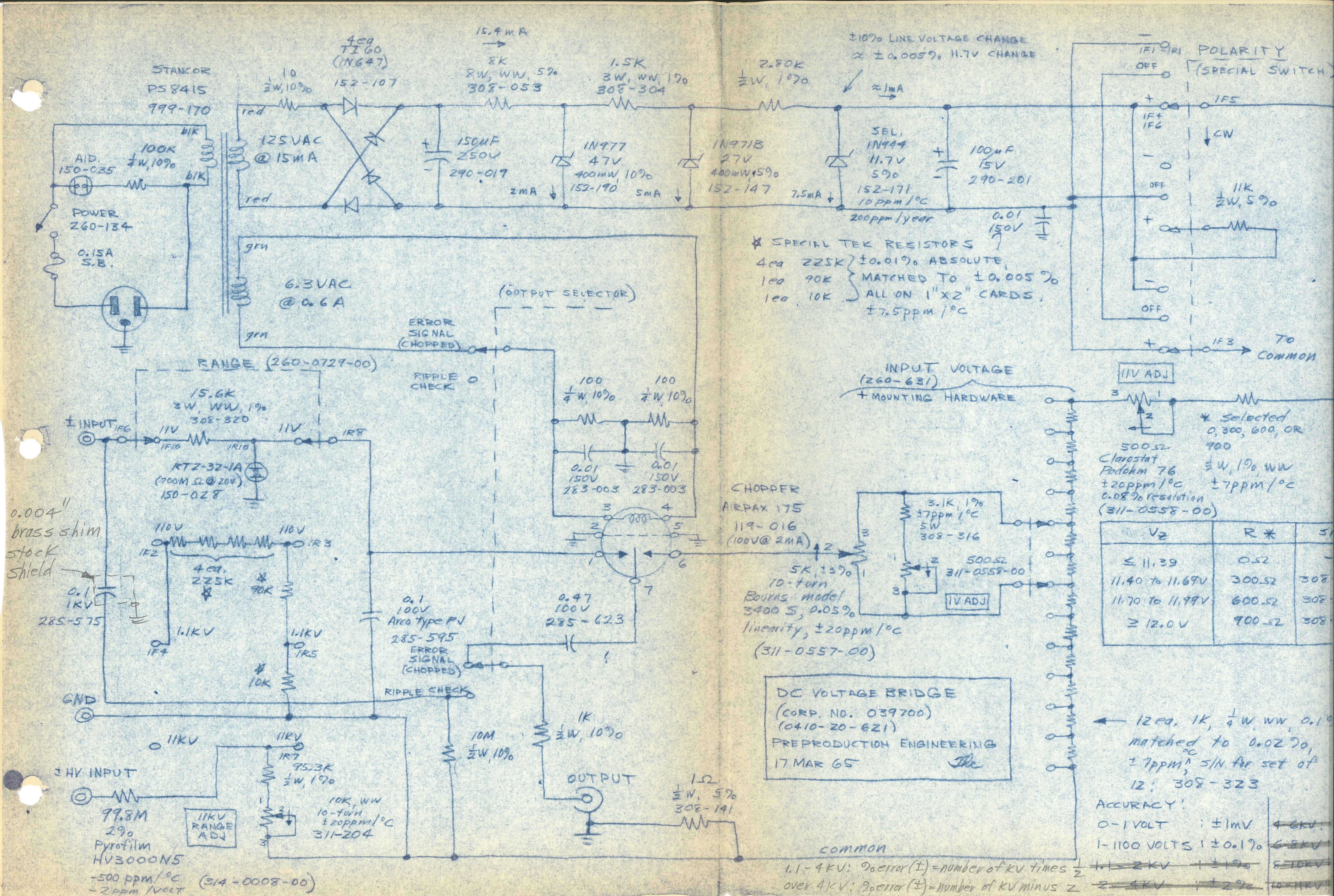
Or ~ ~~(7.6 μv / 10 v line change)~~

Worst case — no problem with 5% zener,

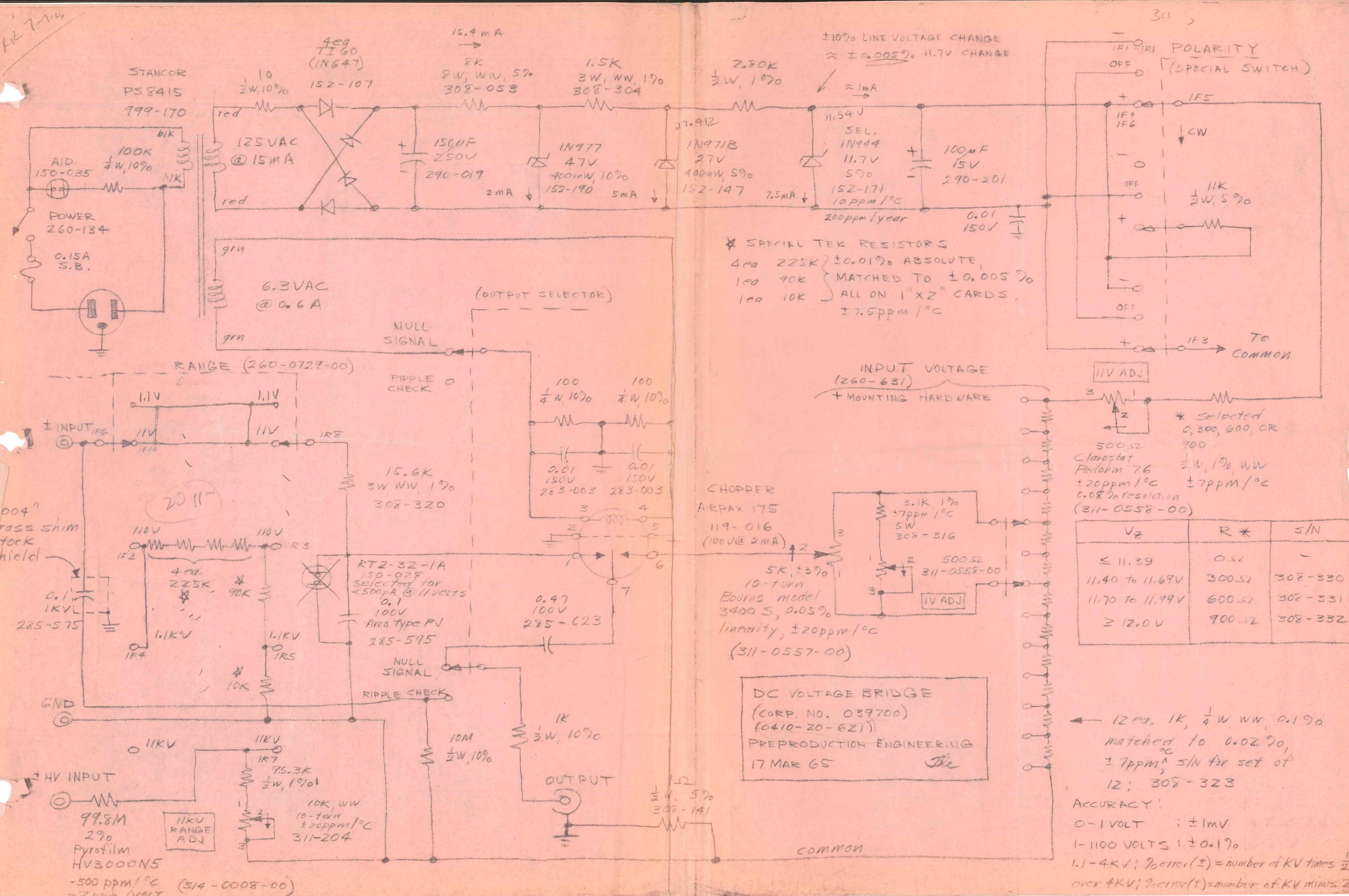
Temp — dependent almost entirely on 11.7 V zener.



V_Z	R *	S/N
≤ 11.39	0Ω	–
11.40 to 11.69V	300Ω	308-330
11.70 to 11.99V	600Ω	308-331
≥ 12.0V	900Ω	308-332

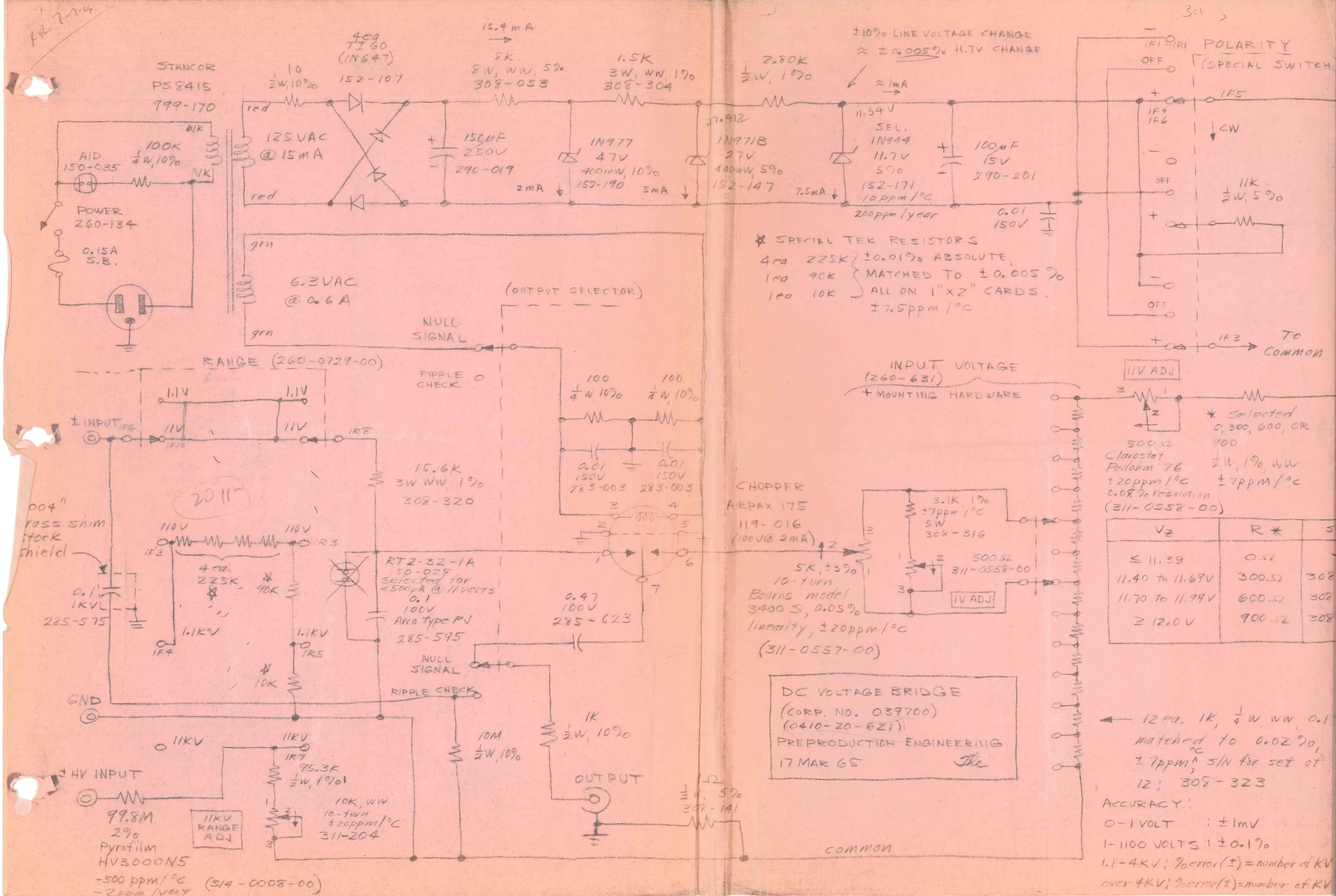


Vz	R*	
≤ 11.39	0Ω	
11.40 to 11.69V	300Ω	308
11.70 to 11.99V	600Ω	308
≥ 12.0V	900Ω	308

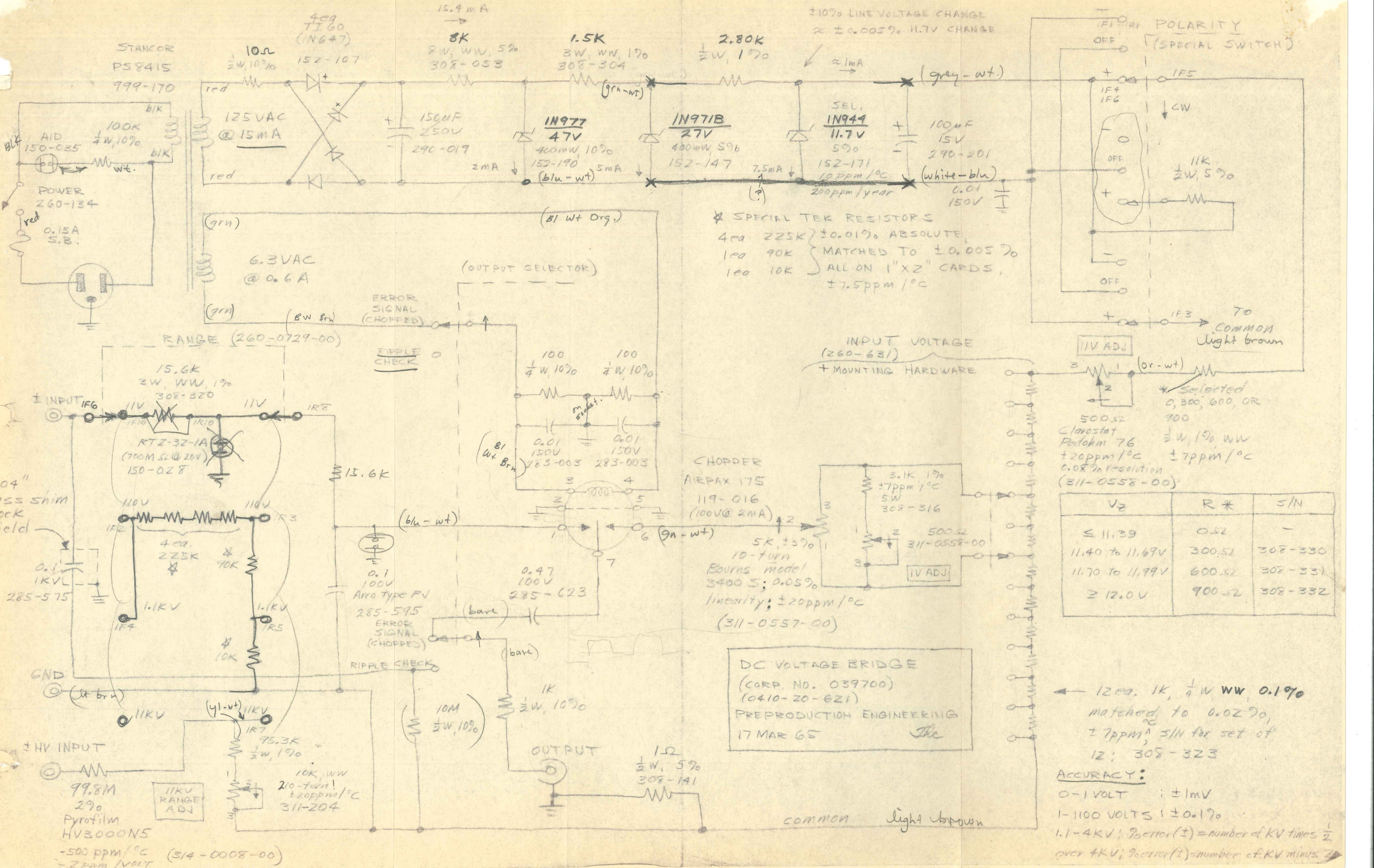


Vz	R *	S/N
≤ 11.39	0 Ω	–
11.40 to 11.69V	300 Ω	308-330
11.70 to 11.99V	600 Ω	308-331
≥ 12.0 V	900 Ω	308-332

ACCURACY:
0-1 VOLT : ±1mV
1-1100 VOLTS : ±0.1%
1.1-4KV; %error(±) = number of KV times 1/2
over 4KV; %error(±) = number of KV minus 2



V_Z	R ✱	S
≤ 11.39	0Ω	
11.40 to 11.69V	300Ω	308
11.70 to 11.99V	600Ω	308
≥ 12.0V	900Ω	308

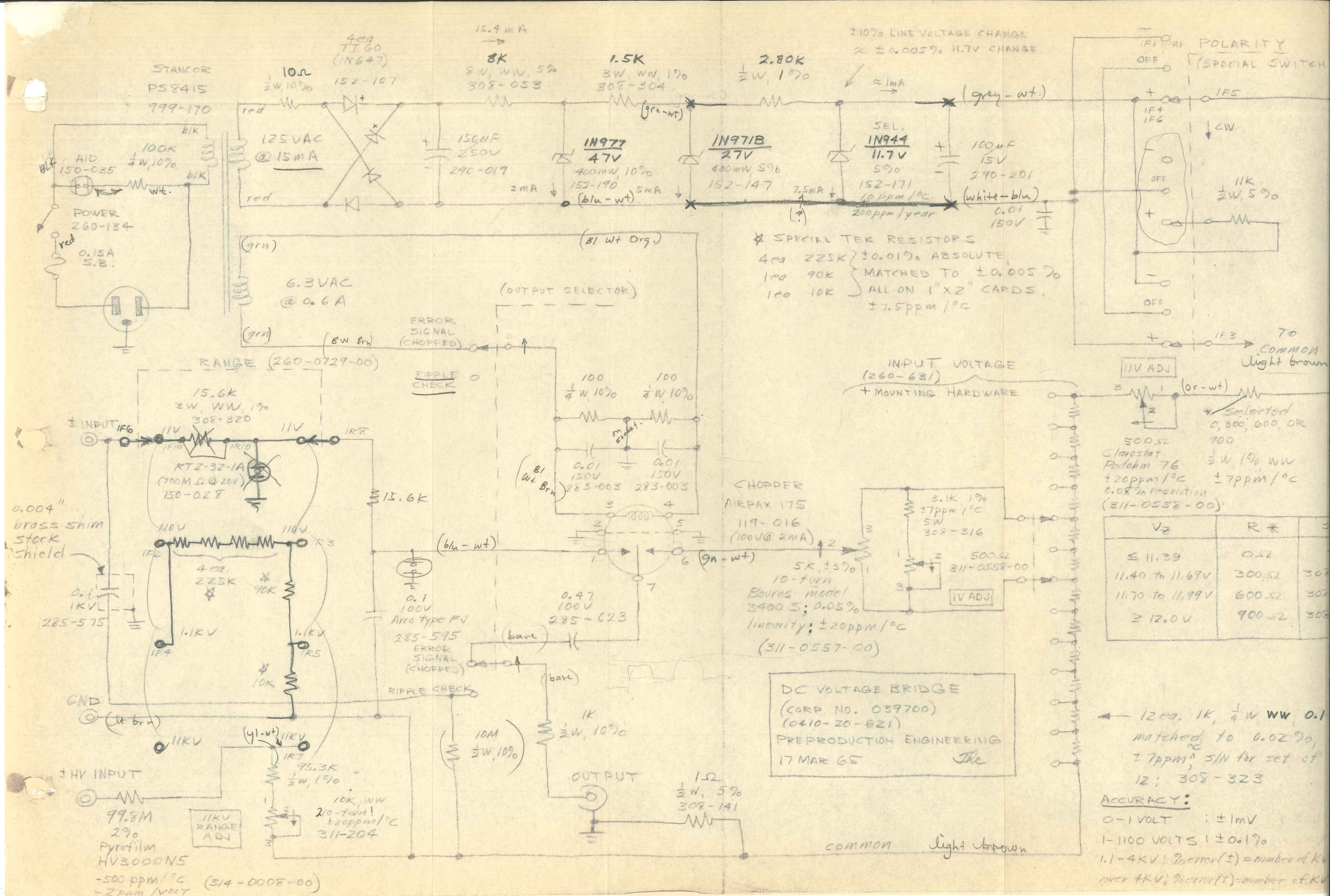


V_Z	R *	S/N
≤ 11.39	0Ω	—
11.40 to 11.69V	300Ω	308-330
11.70 to 11.99V	600Ω	308-331
≥ 12.0V	900Ω	308-332

DC VOLTAGE BRIDGE
(CORP. NO. 039700)
(0410-20-621)
PREPRODUCTION ENGINEERING
17 MAR 65

ACCURACY:

0-1 VOLT : ±1mV
1-1100 VOLTS : ±0.1%
1.1-4KV : % error (±) = number of KV times 1/2
over 4KV : % error (±) = number of KV minus 2



V_z	R *	
≤ 11.39	0Ω	
11.40 to 11.69V	300Ω	30[illegible]
11.70 to 11.99V	600Ω	30[illegible]
≥ 12.0V	900Ω	30[illegible]

Bob Rose

CALIBRATION PROCEDURE FOR

TEKTRONIX DC VOLTAGE BRIDGE

1. Parameters Checked and Adjusted:

1.1 Helidial mechanical zero.
1.2 11V Reference voltage.
1.3 11V Reference voltage regulation.
1.4 1 volt adj.
1.5 Kelvin/Varley linearity.
1.6 Input Attenuation.

2. Specifications:

2.1 Helidial mechanical zero --- ±0.1 minor division.
2.2 11V Reference voltage (at 115VAC input) --- ±0.001%.
2.3 11V Reference voltage regulation (115 ±10 VAC) --- ±1mv.
2.4 1.1 volt setting (at 115 VAC input) --- ±0.001%.
2.5 Helipot linearity --- ±0.04% (±0.4 div).
2.6 Decade ratio accuracy --- ±0.02%.
2.7 110V and 1.1KV input attenuation --- ±0.01%.
2.8 11KV input attenuation (at 1KV input) --- ±0.05%.

3. Equipment Required:

3.1 Fluke Power Supply; type 301E.
3.2 Tektronix Fluke Calibrator.
3.3 L & N Potentiometer; type K-3.
3.4 ESI Resistors; type SR1010; 1K/Step, 10K/Step, 100K/Step.
3.5 Tektronix Oscilloscope; type D Plug-in.
3.6 Tektronix Variac; type 76 TU.
3.7 Auxiliary Helipot; 1KΩ, 10 turn.

4. Helidial Mechanical Zero:

4.1 Check that Decade switch and Helipot mounting hardware are tight.
4.2 Check Helidial index for less than 0.1 minor division play. This may be reduced by removing Helidial and carefully spreading Helidial alignment bracket.
4.3 Set Helipot fully counter-clockwise and tighten Helidial with dial set to 0.000 ±0.1 minor division.

5. 11V Reference and 1.1V Adjust:

5.1 Set line voltage to 115 VAC.
5.2 Set RANGE to 11V, POLARITY to (+), OUTPUT SELECTOR to 10.X (10.X is Decade switch set to 10 and Helidial set to 1.000).
5.3 Connect Fluke calibrator from pin 2 of Helipot to COMMON.
5.4 Set 11V ADJ. for 11 volts, ±0.001%.
5.5 Reset Decade switch to 0 (leave Helipot set to 1.000).
5.6 Set 1V ADJ. for 1 volt, ±0.001% between pin 2 of Helipot and COMMON.

NOTE: 11V ADJ. and 1V ADJ. interact slightly. It may be necessary to repeat steps 5.2 thru 5.6 several times.

6. 11V Reference Voltage Regulation:

6.1 Set INPUT VOLTAGE to 10.X.
6.2 Vary input voltage from 105VAC to 125VAC.
6.3 11V Reference should not change more than ±1mv.
6.4 Reset input voltage to 115VAC, and leave for remainder of calibration.
6.5 Connect Fluke calibrator to junction of 11V ADJ. pot. and divider.
6.6 Measure this voltage (slightly higher than 11 volt).
6.7 Rotate Decade switch from 0 thru 10 and note any change in voltage observed in step 6.6. This change should be less than ±0.1mv. Record maximum positive and maximum negative change.
6.8 Reverse Fluke calibrator connections and set POLARITY switch to (-) and note any change in voltage observed in step 6.6. This change should be less than 0.1mv.
6.9 Reset POLARITY to (+).

7. Helipot Linearity:

7.1 Connect Fluke Power Supply, SR1010, 1K/Step, K-3 and auxiliary potentiometer as in figure 1.

7. Helipot Linearity: (continued)

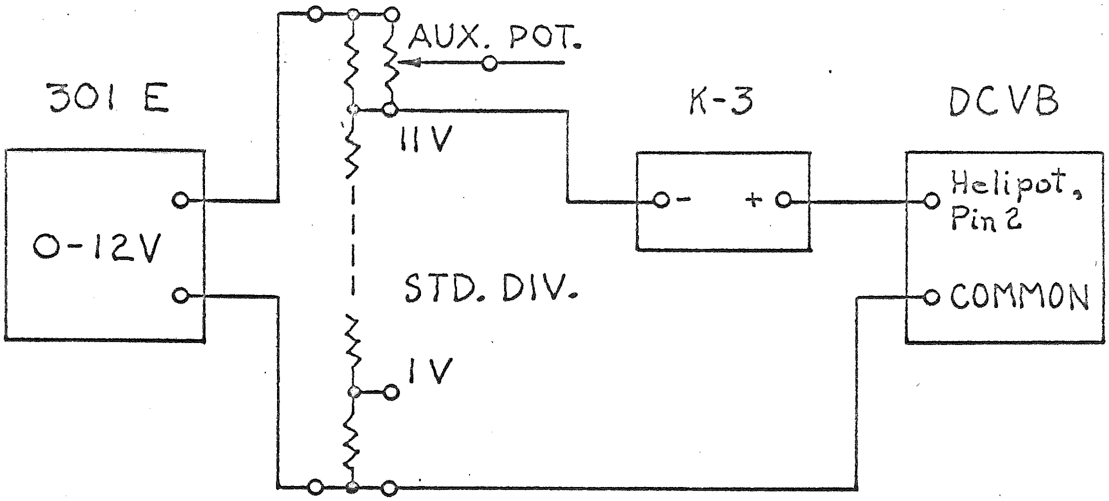


Figure 1

7.2 Set INPUT VOLTAGE to 10.X.
7.3 Set Fluke 301E power supply so that pin 2 of Helipot and 11V tap of standard divider are at same potential.
7.4 Connect center tap of auxiliary potentiometer to junction of 11V ADJ. pot and divider.
7.5 Adjust auxiliary pot. so that pin 2 and 11V tap are again at the same potential. Do not disturb auxiliary pot. during remainder of linearity test.
7.6 Connect K-3 potentiometer, (-) terminal to COMMON and set INPUT VOLTAGE to 0.000.
7.7 Measure voltage at pin 2 at cardinal points of Helipot and record voltage deviation from nominal. Error should be less than 0.4mv (0.4 minor division).

NOTE: It may be necessary to reset 1V ADJ. so that all cardinal point errors are less than 0.4mv.

8. Kelvin Varley Ratio Accuracy:

8.1 Set INPUT VOLTAGE to 1.000, and connect K-3 (-) terminal to 1V tap on standard divider.

8.2 Measure and record difference between pin 2 and standard divider. This error voltage should be less than ±0.02% of nominal, i.e., 0.2mv at 1V, etc.

8.3 Repeat step 8.2 for all Decade switch positions.

8.4 Reset INPUT VOLTAGE to 0.X, 1.X, etc., and repeat step 8.2 for all Decade switch positions.

9. 110V and 1.1KV Divider:

9.1 Connect circuit as shown in figure 2.

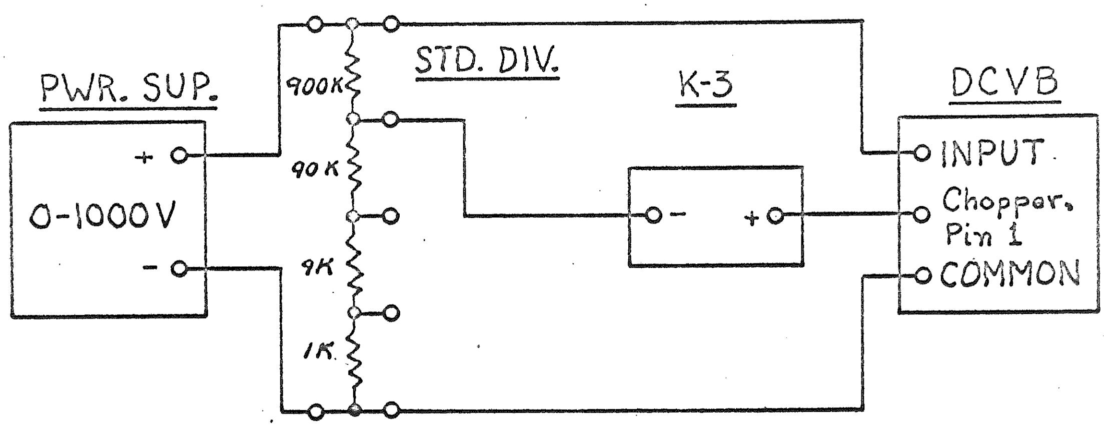


Figure 2

9.2 Set RANGE to 110V, POLARITY to (+) and OUTPUT SELECTOR to RIPPLE CHECK.

9.3 ADJUST Power Supply to 100 volt, ±5%, and connect K-3 (-) terminal to junction of 900K and 90K of standard divider.

9.4 Measure and record voltage difference. It should be less than ±1mv.

9. 110V and 1.1KV Divider: (continued)

9.5 Set RANGE to 1.1KV.
9.6 Adjust Power Supply to 1000 volt, ±5%, and connect K-3 (-) terminal to junction of 90K and 9K of standard divider.
9.7 Measure and record voltage difference. It should be less than ±1mv.

10. 11KV Divider:

10.1 Connect circuit as shown in figure 2, using HV INPUT jack.
10.2 Set RANGE to 11KV.
10.3 Adjust Power Supply to 1000 volt, ±5% and connect K-3 (-) terminal to junction of 9K and 1K of standard divider.
10.4 Adjust 11KV RANGE ADJ. for K-3 voltage difference of less than ±0.5mv.

11. Functional Check:

11.1 Connect Tektronix oscilloscope and plug-in of 1mv/cm vertical sensitivity to OUTPUT.
11.2 Set OUTPUT SELECTOR to ERROR SIGNAL.
11.3 Apply various known voltages (plus and minus) for each range and insure that DCVB indicates within the following tolerance:

INPUT VOLTAGE	TOLERANCE
0 - 1V	±1mv
1 - 1.1KV	±0.1% of indicated voltage
1.1 - 4KV	$\pm(\frac{KV}{2})\%$
4KV - 11KV	$\pm(KV-2)\%$

Bob R[illegible]

Page 1

PRE- Cal. Procedure for DC Voltage Bridge

Sandy Lincoln
Test - Plant 3.

Pre-checks:

1. 0.15 Slow Blow fuse.
2. Insulation over front end of 99.8 Meg resistor should extend 1/4" to 3/8" from end of resistor and should cover mounting nut.
3. Check for <u>no</u> <u>sharp point</u> at connection of the 99.8 Meg resistor to solder lug. If sharp point exists, re-solder connection.
   <u>Note</u>: Do not touch 99.8 Meg res. with bare fingers. Oil from fingers will affect electrical operation of resistor.
4. Wires adjacent to 99.8 Meg. res. should be dressed away from res. body at least 1/2".
5. Zero Duodial & check heli-pot for binding. If binding occurrs, check to see that key on switch plate is in key-way. Also loosen heli-pot or mounting plate nuts & re-position.
6. Check Power Supply voltage resistances to ground.

   Measure with negative ~~polarity~~ lead grounded. ~~(the V-Ω-A lead on Triplett multimeters, the neg. lead on Simpson multimeters)~~

   a. Resistance at positive terminal of 150 μf 250V cap should be approx. 2.3 KΩ
   b. Resistance at cathode of 47V zener should be approx. 1.5 KΩ
   c. Resistance at cathode of 27V zener should be approx. 1.3 KΩ
   d. Resistance at cathode of 11.7V zener should be approx. 1.1 KΩ
   ~~e. Check resistance across 150 μf cap. + ohmmeter lead to + side of cap. Resistance should be approx. 2 KΩ.~~
   ~~f. Check that the 6K (8W, ww), 1.5K (3W, ww) & 2.80 K (1/2W ww 1%) resistors are wired in correctly.~~

~~0414-30~~

Calibration:

Caution: Select proper range before applying voltage to input.
~~Over loading may cause 15.6K res. at input to burn up.~~

1. Check DC voltages on Pwr. Supply.
   a. Voltage at positive terminal of 150 μf-250V cap should be 170 V (±20V)
   b. Voltage at cathode of 47 V Zener should be 47 V (±5V)
   c. Voltage at cathode of 27V Zener should be 27V (±1.5V)
2. Check Ripple.
   a. Check positive terminal of 150 μf-250V cap for 120 cps. Approx 0.5V peak-to-peak
   b. Ripple at cathode of 11.7V Zener should be less than 1 mv peak-to-peak.①
3. Select resistor in series with 11V Adj. Pot.
   a. Measure voltage (V_Z) at cathode of the 11.7 Volt Zener, using Fluke or DCVB.
   b. Select proper series resistor from table below:
   c. V_Z should read 11.7V ± 0.6V

V_Z	R	P/N
≤ 11.39V	0Ω	—
11.40 to 11.69V	300Ω	308-330
11.70 to 11.99V	600Ω	308-331
≥ 12.0V	900Ω	308-332

Note: The selected resistor should be installed in notches #1 & #4 of the 4-notch ceramic strip located forward of chopper.

4. Set [11 V ADJ.] using DCVB or Fluke.
   a. Set dial on instrument under test to 11V. (Duodial & outer dial knob set to 10.0)
   b. Set voltage on rear contact of heli-pot to 11V by adjusting ~~front~~ screw on front pot mounted on back of Polarity Switch.

① Measure by connecting the probe ground clip to the anode and the probe tip to the cathode.

5. Set [1V ADJ] using DCVB or Fluke.
   a. Set dial on instrument under test to 1V. (Leave duodial at 10.0 & set outer dial knob to 0.)
   b. Set voltage on rear contact of heli-pot to 1V by adjusting ~~rear~~ screw on rear pot mounted on back of Polarity Switch
   c. Re-check 11V and 1V adjustments to correct changes due to inter-ation.

6. Check Chopped Wave form Error Signal
   a. With switch in Chopped mode, Polarity switch to 0, ground input & check wave form. Positive & negative portions of the signal should be symmetrical & approx. equal in amplitude.

7. Check 11V Range
   a. Apply +10V from Standard Amplitude Calibrator to Input. Connect cable from Output to test scope input. Set dial on instrument under test to 10V, Polarity Sw. to positive.
   b. Set duodial for null signal on test scope. ~~by fine adjusting the Duodial.~~ Voltage reading on dial should be 10V ± 0.5% (50 minor divisions on dial or 50mv.)
   c. Switch polarity on bridge & SAC to negative & check for no change of amplitude of error signal on test scope.

   d. Sw. Polarity of bridge to Zero & check for approx. 10V square wave on test scope.

e. Check overload neon at Input by applying 100V momentarily to Input with Range Sw. to 11V. Neon mounted on under side of Polarity Sw. should light.

8. Check 110V Range
   a. Switch range to 110V
   b. Set dial to 100V & apply +100V SAC to Input; Polarity Sw. to positive
   c. Check accuracy to ±0.5% (500mv or 50 minor div. on dial.)
   d. Switch to negative polarity and check as in step 7c.

9. Check 1.1KV Range.
   a. Switch range to 1.1KV
   b. Set dial to 100V & apply +100V SAC to Input; Polarity Sw. to positive
   c. Check accuracy to ±0.5% (±500mv or ±5 minor div. on dial)
   d. Switch to negative polarity & check as in step 7C.
   e. Switch mode to "Ripple Check". Ripple should be visible on test scope (2) Return mode to "Chopped Error Signal".

(2) and chopper should turn off.

10. Set 11KV Range Adj.
   a. Switch range to 11KV & apply +100V SAC signal to "± HV Input" with Polarity sw. to positive.
   b. Set dial to 100V & adjust 11KV Range Adj pot for null signal on test scope (Pot is located on upper *left* side of chassis below the 99.8 Meg resistor.)
   C. Sw. to negative polarity & check as in 7c

Outline of Calibration Procedure
DC Voltage Bridge

These are the steps to be performed by the MQA Standards Lab. The following is an outline only; the Standards Lab. has a detailed procedure

A. Set AC line voltage to 115V.

B. Adjust Voltages. 1. Set 10-turn dial to read 000 at mechanical zero (< ± 0.2 minor division)

2. Set INPUT VOLTAGE knob at 10, 10-turn dial at 100. Adjust the 11V ADJ pot for 11 volts (± 0.001%) between the wiper of the 10-turn pot and COMMON. (OVER) (A)

3. Set INPUT VOLTAGE knob at 0. Adjust the 1V ADJ pot for 1 volt (± 0.001%) between the wiper of the 10-turn pot and COMMON.

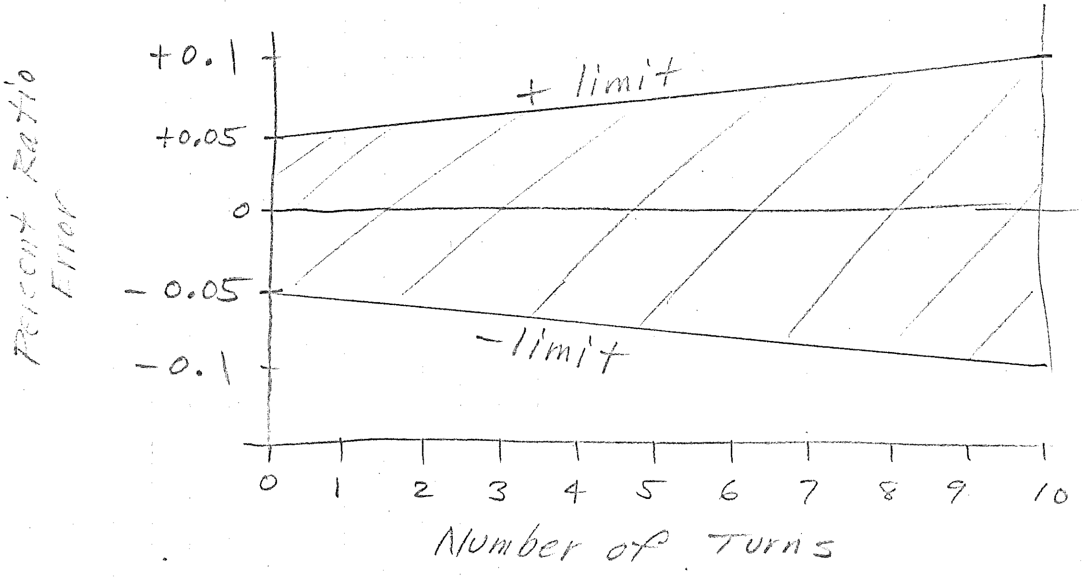
4. The 11 volt and 1 volt adjustments will interact so that several settings of each may be necessary

5. Check that changing POLARITY from + to − doesn't affect accuracy of the 11 volt

C. Measure linearity of 10-turn pot.

1. Measure ratio accuracy at 10 points.).

2. Plot results on a graph as in Fig. 1.



(A)

Check regulation:

a. Set $V_{LINE} = 105V$; the 11V should decrease $\leq 1mV$ from its value at $V_{LINE} = 115V$.

b. Set $V_{LINE} = 125V$; the 11V should increase $\leq 1mV$ from its value at $V_{LINE} = 115V$.

3. If necessary, increase or decrease the 1 volt across the pot in order to keep all plotted points within the shaded area of Fig. 1. However, if an increase or decrease of more than 1 millivolt is necessary, replace the pot.

D. Check the Kelvin-Varley divider for a ratio accuracy of ±0.02%.

E. Check the input attenuators on the 110V and 1.1KV ranges for a ratio accuracy of ±0.01%.

F. Apply 1000 volts to the ± HV INPUT jack and adjust the 11KV RANGE ADJ for proper attenuation (± 0.05%).

G. Perform appropriate functional checks.

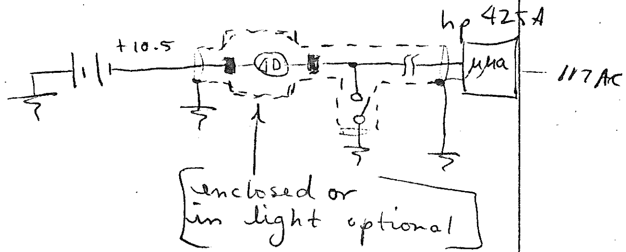
[illegible] + [illegible] POLARITY [illegible]

note - to zero the μμammeter, first open S1, then zero the meter with open circuit (no neon in clips)
avoid bi-metal contact

RT2 - 32 - 1A

John Carson
June 4, 1964

neon bulb leakage check at 10.5 volts.
using hp 425A μμa ammeter.



(A) 54 μμa initial in dark
80 μμa initial in light

115 μμa in dark imediatly after 30 sec of 7 ma current
75 μμa in dark after waiting ≃ 10 minutes
125 μμa in ligth after 30 sec of 7 milliamps

(B) 1350 μμa initial in dark
1365 μμa initial in light

3000 μμa (dark) after 30 sec of 7 ma current
1500 μμa (dark) after waiting ≃ 2 minutes (de ionization)

(C) 3 μμa initial in dark
46 μμa initial in light

10 μμa (dark) after 30 sec @ 7 ma.
60 μμa (light) after " " "

25 μμa (dark) after 90 sec additional at 7 ma
11 μμa (dark) after waiting for ≃ 4 minutes

(D) 3000 μμa initial in dark
≃ 3015 μμa initial in light
8000 μμa after 30 sec @ 7 ma (back down to 4000 μμa)

(E) 465 μμa initial in dark
480 μμa initial in light
1700 μμa after 30 sec at 7 ma (dark) (→ 620 after 10 minutes)
2500 μμa after 2 minutes at 7 ma (dark) (→ 520 after 2 minutes)

(F) 6000 μμa initial in dark
15,000 μμa after 30 sec at 7 ma (dark)
back down to 2000 μμa in ≃ 60 seconds

evaluation - handpick or use NE86 instead

TEKTRONIX

MEMO

DATE: Aug 17, 1965

TO: Bob Ross DEPT: PEM

FROM: John Carson DEPT: PEM

SUBJECT: NE86 to replace RT2-32-1A Neon Lamp in the DC Voltage Bridge

The RT2 Neons used to protect the chopper were found to be leaky way beyond the minimum allowable. Tom Charles figured the min. to be 1 n amp at 11 volts. Many have gone to 6 n amps

The NE86 is coated inside and out with a silicone dri-film. The leakage of about 14 NE86's tested (100 in stock) were consistantly less than 2 p. amps in dark and less than 20 pa in light.

NE86 test for effects of current:

unit	initial dark	initial light	after 2 intervals of 5 sec at about 70 ma dark	after 2 intervals of 5 sec at about 70 ma light
1	<2 pa	<20 pa	<2 pa	230 pa & 110 pa
2	<2 pa	<20 pa	<2 pa	70 pa & 18 pa above depends on polarity
3	<2 pa	<20 pa	<2 pa	225 pa & 160 pa
4	<2 pa	<20 pa	<2 pa	50 pa & 20 pa depending on polarity

NE86 recommended to replace RT2 neon. Many RT2's have already been removed by people in calibration.

John Carson

#3 and 4 after 3 intervals at 120 ma until electrodes were red hot

I-774

MEMO

000-125

Leon Department PE&M Date 27 Oct 65

Subject DCVB

Attached is Byron Witts' report on the 99.8M resistor (314-008) used in the DC Voltage Bridge.

It looks like we have no long term worries about its stability.

Name Tom Charters Dept. Sampling

PREPRODUCTION ENGINEERING PROJECT REPORT

File Topic	Resistors
PE Report No.	750128
Corporate No.	

Title: Load-Life Test

Report By: Byron M. Witt	Requested By: Tom Charters
Department: CMA 800	Department: Sampling
Date: Received: 6-21-65	Delivery Station: 81-679
Tent. Comp.: 7-21-65	Account Number:
Actual Comp.: 9-24-65	Subject: (Inst. Type, P/N, etc.)
Additional Routing: Warren Collier, Glenn Pelikan, Bill Sedig, Bill Walker	Pyrofilm HV3000N5 99.8M, 2% carbon film resistors. 314-0008-00

PROBLEM/OBJECT:

Perform load-life test under the following conditions: 11,000 VDC, at room temperature for 1000 hours.

CONCLUSION:

The greatest change in resistance was 0.4%. Manufacturer's specification is 0.5%. In the intended application we should experience no difficulty.

DETAILS OF PROCEDURE:

Four units were tested. 11,000 volts DC was applied to the units at room temperature for 1000 hours. The resistors were measured on the ESI model 231 bridge before and after the test. The usual buildup of dust occurred on the negative end of each resistor.

Byron M. Witt

Byron M. Witt
Component and Material Application

PE-110A

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory
TEST REPORT

TO: Engineering

Device: DC Voltage Bridge
Ser # 100

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) 10-1 & 100-1 Divider for 110V & 1100V range has 90K & 10K Resistors installed in interchanged position.

(2) Heli pot Bad

DATE: 14 July 65

Ambient Temperature

Relative Humidity

Reported by K. Jacobs

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory
TEST REPORT

TO: Engineering

Device: D.C. Voltage Bridge
Ser # 101

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) 10-1 & 100-1 Divider out of Tolerance

(2) Bad Helipot

DATE: 14 July 65

Ambient Temperature

Relative Humidity

Reported by K. Jacobs

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory
TEST REPORT

TO: Engineering

Device: D.C. Voltage Bridge
Ser #102

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) 10-1, 100-1 Divider for 110 & 1100 V range out of tolerance

(2) Helipot Bad

DATE: 14 Jul 65

Ambient Temperature

Relative Humidity

Reported by: H. Jacobs

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory

TEST REPORT

TO: Engineering

Device: DC Voltage Bridge
Ser# 104

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) 10-1 & 100-1 Divider for 110V & 1100V Range out of Tolerance

DATE: 14 July 65

Ambient Temperature ______

Relative Humidity ______

Reported by K. Jacobs

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory
TEST REPORT

TO: Engineering

Device: D.C. Voltage Bridge
Ser # 106

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) 10-1 & 100-1 Voltage Divider for 110 & 1100V range out of Tolerance

DATE: 14 July 65

Ambient Temperature

Relative Humidity

Reported by S. Jacobs

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory
TEST REPORT

TO: Engineering

Device: D.C. Voltage Bridge
Ser# 108

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) 10-1 & 100-1 Divider for 110V & 1100V Range out of Tolerance

(2) Helipot out of Tolerance

DATE: 14 July 65

Ambient Temperature ________

Relative Humidity ________

Reported by K. Jacobs

MANUFACTURING QUALITY ASSURANCE
Measurement Standards Laboratory
TEST REPORT

TO: Engineering

Device: D.C. Voltage Bridge
Ser ~~#~~ 109

This device has been tested in our laboratory with instruments and standards traceable to the National Bureau of Standards. The recorded values are for the device at the time of measurement and under specified laboratory conditions. No specification of stability is made and accuracy under other conditions should not be assumed.

(1) Wire & post on pilot Lamp holder broken off

DATE: 14 July 65

Ambient Temperature ____________

Relative Humidity ____________

Reported by K. Jacobs

Rich R.
10-21-65

Bourns Helipot

F.S. = 1000 divisions

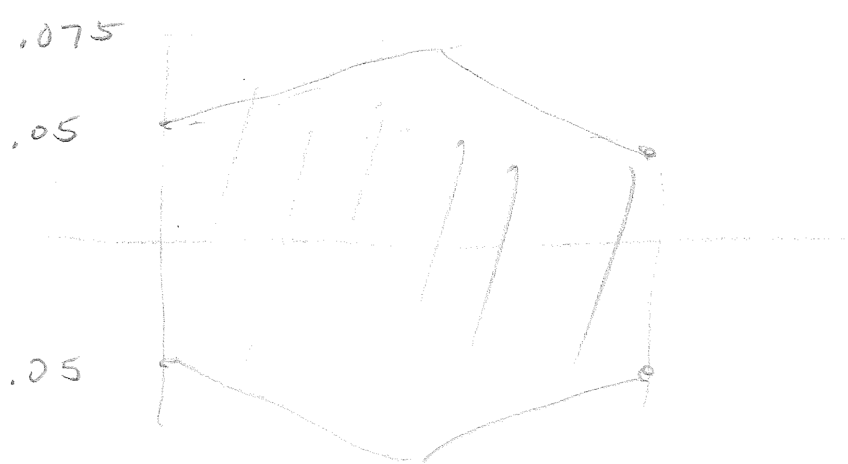
.1% = 1 div

.05% = .5 div

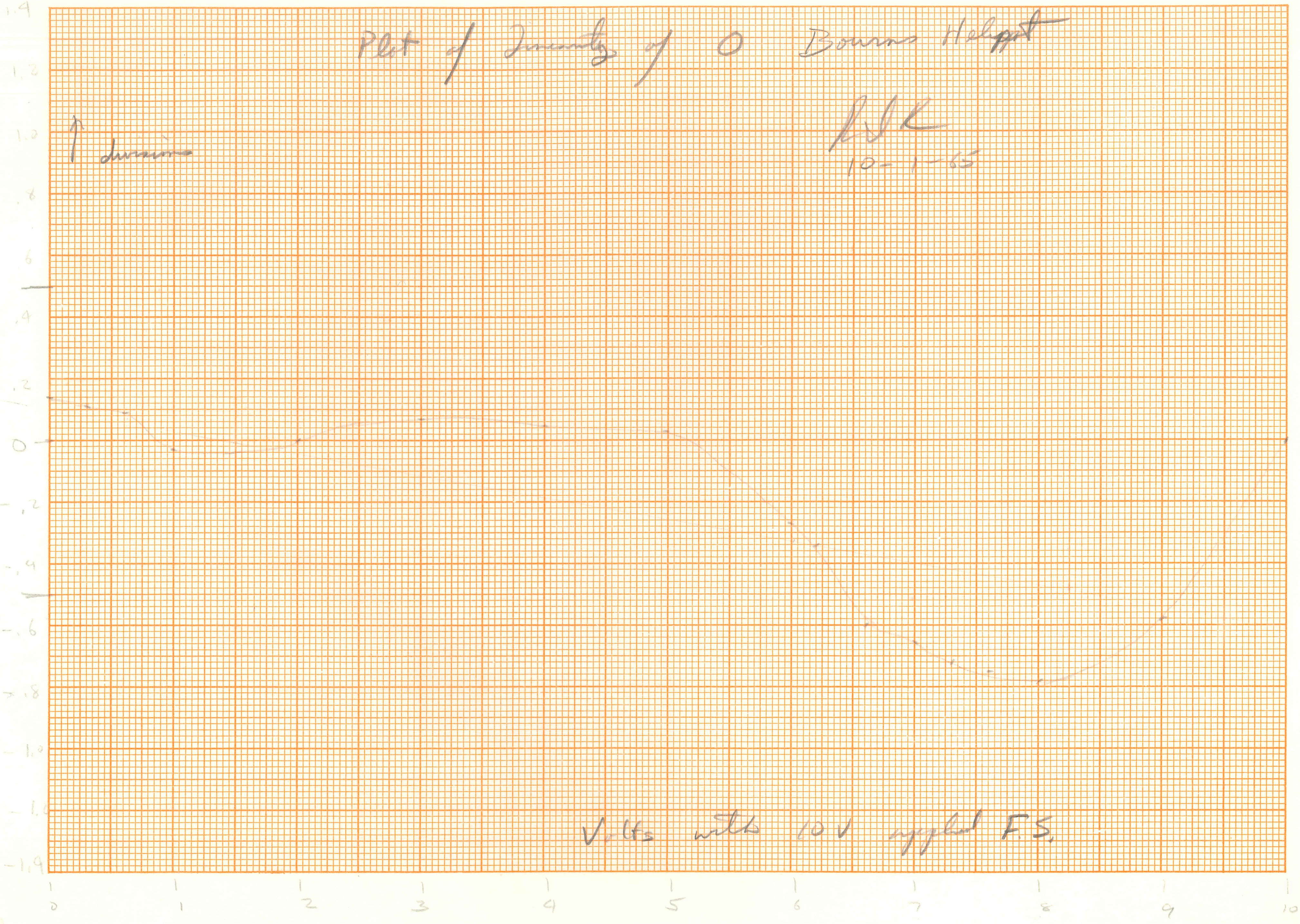
Manufacturer Spec

.05% Indep Linearity

Our Spec



O


Plot of linearity of O Bourns Helipot
R J K
10-1-65
↑ divisions
1.4
1.2
1.0
.8
.6
.4
.2
0
-.2
-.4
-.6
-.8
-1.0
-1.2
-1.4
0
1
2
3
4
5
6
7
8
9
10
Volts with 10 V applied F.S.

1000 turn
1 turn = .1%
.5 turn = .05%

TEST RECORD

INSTRUMENT Bourns Helipots
SERIAL NO.
LOCATION
DATE
WEEK DUE
STANDARDS

CAL. FREQ. DC
CERT. ISSUED
RATED ACCURACY
CALIBRATOR John Carson
July 19, 1965

peak deviation is starred *

	.69 max shift down A	.18 ok B OK	.55 ok C OK	1.10 FOOEY Mfg'r D	.40 ok E OK	ok F OK	
0.0	.15	.17	~~.18~~ .26	.47	+.01	<.01	
0.3	.28	.02	-.43	.74	-.13	-.17	
0.6	.34	.10	-.53 *	.85	-.08	-.26	
1.0	.29	.06	-.44	.87	+.02	-.30	
1.3	.43	.12	-.38	+1.10 *	-.06		
1.6	.43	.18 *	-.49		-.14		
2.0	.30	-.06	-.46		-.05	-.37 *	
2.3	.49	.00	-.53		-.19		
2.6	.59	.10	-.55 *		-.21		
3.0	.40	.01	-.46		-.18	-.26	
3.3	.69 *	.13	-.35		-.28		
3.6	.64	.10	-.36		-.40 *		
4.0	.46	.00	-.45		-.38	-.16	
4.3	.69 *	.00	-.29		-.33		
4.6	.58	.03	-.38		-.40		
5.0	.44	-.08	-.35		-.18	-.06	
5.3	.58	-.07	-.41		-.22		
5.6	.58	-.13	-.35		-.20	+.13	
6.0	.37	-.10	-.33		-.08	-.20	
6.3	.62	-.03	-.21		-.10		
6.6	.55	-.03	-.27		-.10		
7.0	.37	-.03	-.23		+.02	+.01	
7.3	.56	-.02	-.12				
7.6	.50	.05	-.10				
8.0	.35	-.02	-.16		+.03	+.01	
8.3	.48	.07	+.04				
8.6	.38	.16	-.03				
9.0	.19	.00	-.12		-.02	-.12	
9.5	.39	.15	+.03		-.17		
10.0	set 0.00	set .00	set —	set —	set —	set	

TEST RECORD

INSTRUMENT
SERIAL NO.
LOCATION
DATE
WEEK DUE
STANDARDS

CAL. FREQ. DC
CERT. ISSUED
RATED ACCURACY
CALIBRATOR John Carson - PEM

July 20, 1965

peak deviation is starred *

	.66 ? ok G	.54 OK ok H	.48 ok ok I	.60 ? ok J	.57 ? ok K	.58 ? ok L	
0.0	.27	.01	.15	.01	.15	.01	
0.3	.27	.05	.07	.08	.26	.03	
0.6	.09	-.02	.06	-.04	.11	-.05	
1.0	-.14	-.04	-.23	-.02	-.05	-.30	
1.3	-.15						
1.6	-.30		-.26				
2.0	-.40	-.06	-.48 *	+.05	-.20	-.09	
2.3	-.29		-.46				
2.6	-.45		-.47		-.18		
3.0	-.48	-.15	-.31	+.04	-.33	-.25	
3.3	-.42				-.18		
3.6	-.66 *	-.38			-.28		
4.0	-.54	-.43	-.12	-.07	-.37	-.14	
4.3	-.41	-.43			-.31		
4.6	-.54	-.50		-.26	-.44		
5.0	-.47	-.54 *	-.18	-.35	-.36	+.20	
5.3	-.41	-.45		-.48	-.47	+.40	
5.6	-.49	-.51		-.43	-.47	+.47	
6.0	-.40	-.50	-.22	-.60 *	-.48	+.48	
6.3	-.18	-.40		-.45	-.48	+.52	
6.6		-.30		-.45	-.44	+.37	
7.0	-.16	-.35	-.14	-.48	-.57 *	+.43	
7.3				-.31	-.40	+.58 *	
7.6				-.35	-.49	+.52	
8.0	-.12	-.04	+.04	-.25	-.40	+.25	
8.3				-.17	-.39	.33	
8.6					-.40		
9.0	+.05	+.05	.00	-.04	-.29	.05	
9.5					-.10		
10.0	set —	set	set —	set —		set —	

TEST RECORD

INSTRUMENT
SERIAL NO.
LOCATION
DATE
WEEK DUE
STANDARDS

CAL. FREQ. DC
CERT. ISSUED
RATED ACCURACY
CALIBRATOR John Carson

(July 21, 1965)

peak deviation starred *

	.57 at 0.3 ? M	.39 at 4.0 OK N	.78 at 8.0 NO O	.50 div at 8.0 OK P	.48 at 6.6 OK Q	.24 max OK! R	
0.0	.48	.17	.14	.15	.02	.01	
0.3	.57 *	.17	.11	.24	−.10	.24 *	
0.6	.53	.14	.09	.20	−.02	−.05	
1.0	.39	.06	−.03	.16	−.18	−.03	
1.3	.45						
1.6	.47						
2.0	.40	−.15	.00	.00	−.20	+.16	
2.3	.42						
2.6	.41						
3.0	.34	−.26	.07	−.07	−.18	+.09	
3.3							
3.6							
4.0	.23	−.39 *	.05	−.27	−.31	+.05	
4.3		−.35					
4.6					−.17		
5.0	−.03	−.19	.03	−.17	−.24	+.10	
5.3							
5.6				−.41			
6.0	−.29	+.19	−.27	−.42	−.37	+.04	
6.3			−.34	−.38	−.35		
6.6			−.60	−.30	−.48 *		
7.0	−.34	+.30	−.66	−.41	−.43	+.08	
7.3			−.72		−.35		
7.6			−.75	−.42	−.43		
8.0	−.35	+.17	−.78 *	−.50 *	−.30	+.08	
8.3				−.38	−.17		
8.6	−	+.02			−		
9.0	−.20	+.05	−.58	−.36	−.21	−.11	
9.5							
10.0	set	set	set	set	set ✓	set ✓	

~~INSTRUMENT~~ TYPE Bournes 5K helipots

July 22, 1965
by John Carson PEM

SERIAL NUMBER
CALIBRATION DATE
LOCATION standards lab
CALIBRATOR
~~CERTIFICATE ISSUED~~ (* = max deviation)

TEMPERATURE
REL. HUMIDITY

setting	.37 div max S	.51 div max T	.48 div max U	.62 div at 6.0 set V	.77 div at 6.6 set W	.23 max X
	OK	OK	OK	OK	NO	OK!
0.0	.04	.14	.01	.35	.05	.01
0.3	.12	.31	-.11	.36	.06	-.02
0.6	.20	.24	-.12	.25	-.06	-.16
1.0	.08	.14	-.19	.18	-.05	-.08
1.3						
1.6						
2.0	.25	.10	-.35	.03	-.14	+.13
2.3			-.21			
2.6			-.42			
3.0	.31	.02	-.45	-.12	-.23	+.23 *
3.3			-.30			
3.6			-.46			
4.0	.18	-.07	-.48 *	-.27	-.25	+.20
4.3			-.30	-.30		
4.6			-.36	-.43		
5.0	.04	-.16	-.31	-.51	-.39	+.16
5.3				-.45	-.30	
5.6		-.25		-.47	-.61	
6.0	-.10	-.38	-.38	-.62 *	-.56	+.16
6.3		-.40		-.53	-.54	
6.6		-.50		-.64	-.77 *	
7.0	-.16	-.51 *	-.34	-.54	-.65	+.14
7.3		-.49		-.46	-.65	
7.6	-.18	-.36		-.56	-.66	
8.0	-.35	-.46	-.25	-.48	-.62	+.20
8.3	-.37 *	-.31			-.50	
8.6	-.12	-.29				
9.0	-.34	-.26	-.04	-.31	-.37	+.20
9.5	-.15	-.02				
10.0	set ✓	set ✓	set ✓	set ✓	set ✓	set ✓

STANDARDS USED:

Dekavider RV622
10 KΩ .0010% linear

7272 (or 7401-?)

~~INSTRUMENT~~ TYPE Bourns 5K helipot
SERIAL NUMBER
CALIBRATION DATE July 22, 1965
LOCATION standards lab
CALIBRATOR John Carson
~~CERTIFICATE ISSUED~~ (* = max deviation)
TEMPERATURE
REL. HUMIDITY

	.40 max dev.	.26 div max	.27 div max	.41 div max	.62 div at 2.0	.55 at 0 div
setting	Y	Z	AA	BB	CC	DD
	OK	OK	OK	OK	?	NO
.0.0	.01	.01	.05	.36	.16	.55
.0.3	-.04	-.40	.27 *	.40	.24	.48
.0.6	+.06	-.18	.14	.41 *	-.07	.40
1.0	.00	-.13	.16	.31	-.18	.52
1.3						
1.6						
2.0	.00	-.09	.26	.33	-.62 *	.48
2.3					-.60	
2.6					-.59	
3.0	+.05	+.02	.18	.16	-.57	
3.3						
3.6						
4.0	-.08	+.08	-.05	.08	-.47	
4.3						
4.6						
5.0	-.16	+.26 *	-.07	-.12	-.40	
5.3						
5.6						
6.0	-.26	+.21	-.01	-.16	-.30	
6.3						
6.6						
7.0	-.40	+.16	+.08	-.16	-.08	
7.3						
7.6	-.40 *					
8.0	-.40	-.06	+.01	-.21	-.09	
8.3						
8.6						
9.0	-.27	-.24	-.10	-.14	-.19	
9.5		+.10				
10.0	set ✓	set ✓	set ✓	set ✓	set ✓	

STANDARDS USED:

RV622 Dekavider
MV-07C Micro Ammeter

INSTRUMENT TYPE Bourns 5K helipot
SERIAL NUMBER
CALIBRATION DATE July 22, 1965
LOCATION standards lab
CALIBRATOR John Carson
~~CERTIFICATE ISSUED~~ (* = max deviation)

TEMPERATURE
REL. HUMIDITY

setting	EE	FF	GG	HH	II	JJ
	.60 div. at 4.3	.75 div at 2.3	.51 at 3.6	.26 at 5.0	.36 at 2.3	.70 at 00.3
	OK	NO!	ok	OK	OK	NO
0.0	.01	.01	.15	.11	.14	.46
0.3	-.29	-.04	.05	.05	.26	.70 *
0.6	-.45	+.27	-.03	.08	.22	.51
1.0	-.35	.28	-.04	.02	.15	.56
1.3	-.46	.43				
1.6	-.50	.53				
2.0	-.50	.59	-.15	-.07	.22	.45
2.3	-.50	.75 *			.36 *	
2.6		.70			.32	
30.	-.57	.60	-.28	-.15	.17	.45
3.3	-.57	.55	-.40		.32	
3.6	-.58	.60	-.51 *		.17	
4.0	-.57	.62	-.41	-.23	.17	.40
4.3	-.60 *	.58	-.37		.36	.27
4.6	-.48	.57	-.47		.16	.27
5.0	-.45	.51	-.51	-.26 *	.16	.31
5.3	-.51	.40	-.40		.26	
5.6	-.50	.37	-.51		.06	
6.0	-.47	.21	-.47	-.25	.09	.15
6.3	-.56				.11	
6.6	-.50				.00	
7.0	-.36	-.02	-.34	-.02	-.03	.10
7.3	-.45				+.13	
7.6	-.46				.01	
8.0	-.46	-.10	-.24	+.10	-.01	.13
8.3	-.35				+.08	
8.6	-.25				-.03	
9.0	-.29	.00	-.13	+.16	.00	.09
9.5	-.15				.00	
10.0	set ✓	set ✓	set ✓	set ✓	set ✓	set ✓

STANDARDS USED:

RV622 Dekavider
MV-07C Micro Ammeter

INSTRUMENT TYPE Bourns 5 K helipot
SERIAL NUMBER
CALIBRATION DATE July 23, 1965
LOCATION standards lab
CALIBRATOR John Carson
~~CERTIFICATE ISSUED~~ * indicates max deviation
TEMPERATURE
REL. HUMIDITY

setting	.52 at 05.0 EK	.68 at 03.3 LL	-.78 on 06.0 MM	.86 at 06.0 NN	.55 at 07.3 OO	.48 at 04.0 set PP
	ok	? shift	NO shift?	NO	ok	ok
0.0	.15	.03	<.01	<.01	.01	<.01
0.3	.27	.24	-.12	-.09	-.10	.05
0.6	.07	.24	-.14	-.01	.00	.21
1.0	.05	.37	-.19	-.10	+.10	.04
1.3		.52				
1.6		.49				
2.0	.12	+.45	-.16	-.19	-.14	-.27
2.3		.59 ←				
2.6		.60				
3.0	.08	.51	-.44	-.48	+.01	-.12
3.3		.68 *	-.38	-.48	+.32	
3.6		.54	-.52	-.54		-.28
4.0	-.21	.50	-.62	-.55	.08	-.48 *
4.3	-.31	.50	-.55	-.63		-.34
4.6	-.33	.38	-.74	-.73		-.17
5.0	-.52 *	.33	-.75	-.75 *	-.02	-.33
5.3	-.46			-.75		-.25
5.6	-.49		-.78	-.70	-.24	+.20
6.0	-.51	.20	-.78 *	-.86 *	-.30	+.14
6.3	-.47					
6.6	-.44					
7.0	-.42	.10	-.58	-.82	-.33	-.18
7.3					-.55 *	
7.6					-.42	
8.0	-.20	.08	-.10	-.57	-.39	+.03
8.3					-.25	
8.6					+.05	
9.0	-.03	-.02	-.12	-.31	+.17	+.06
9.5				-.20		
10.0	set ✓	set ✓	set ✓	set ✓	set ✓	set ✓

STANDARDS USED:

RV 622 Dekavider
MV-07C Micro Micro Ammeter

TEKTRONIX

Inter-Office Communication

To: Jerry Shannon

Date: August 2, 1965

BEAVERTON

From: Ken Jacobs

Subject: Test Results on DC Voltage Bridges.

Enclosed are test results on 6 Tektronix DC Voltage Bridges at High Voltage.

The ratio was adjusted to within 0.02% of nominal at 1000V. Tests were then conducted at 5000V and 10,000V DC. Results show errors after the divider appeared to have reached equilibrium. (The divider drifts for several minutes.)

The results are believed to be accurate within 0.005% at 1000V, 0.1% at 5000V, and 0.2% at 10,000V.

Kenneth D Jacobs

TEST RECORD

INSTRUMENT TEK D.C. Voltage Bridges
SERIAL NO.
LOCATION Engineering
DATE 30 July 65
WEEK DUE
STANDARDS
CAL. FREQ.
CERT. ISSUED
RATED ACCURACY
CALIBRATOR S. Jacobs

	Ser #		error 5000V	SPEC	error 10,000V	SPEC	Recovery Time
	000100		+0.96%	3%	+3.33%	±8%	8'55"
	000104		+0.70%		+2.26%		10'35"
	000126		+0.88%		+3.02%		Not Measured
	000138		+0.76%		+2.53%		9'40"
	000144		+0.99%		+3.86%		Not Measured
	00149		+0.65%		+2.23%		Not Measured

Note: Plus error indicates that the instrument will read high.

Recovery time is time required for divider to return to within 0.1% of initial adjustment at 1000V after removal of 10,000 Volts.