TYPE 321A
MOD 128A

This insert has been written to supplement the Instruction Manual furnished with this modified instrument. The information given in this insert will supersede that given in the manual.

TYPE
321A
OSCILLOSCOPE
MOD 128A

TYPE 321A
MOD 128A

The Oscilloscope for which this insert was prepared has been modified to increase the sensitivity of the EXT HORIZ INPUT to approximately 10 times the sensitivity of the standard instrument.

A 10:1 EXT HORIZ ATTEN control has been added to vary the sensitivity of the External Horizontal circuit. Frequency response of the amplifier is maximum when this control is at its maximum setting.

CALIBRATION

Substitute the following for Steps 19 and 20 in the Calibration Procedure as given in the Instruction Manual:

19-S. Check External Horizontal Amplifier Amplitude.

a. Set the TIME/DIV switch to 1mSEC, free-run the sweep, and adjust the HORIZONTAL POSITION control so that the start of the sweep is at the left graticule line. Turn the EXT HORIZ ATTEN fully ccw. Change the TIME/DIV switch to EXT and pull the 5X MAG. The display should be within the 2 major divisions to the right of the graticule center.

b. Connect a jumper lead between CAL OUT and EXT HORIZ INPUT. Turn EXT HORIZ ATTEN fully cw. Check to see that the horizontal deflection of the trace is 5 major divisions (±1 major division).

c. Vary the EXT HORIZ ATTEN control throughout its range. The horizontal amplitude of the display should vary smoothly between 5 major divisions and no deflection.

20-S. Check External Horizontal Amplifier Frequency Response.

a. Set EXT HORIZ ATTEN control fully cw. Connect the Type 190A (or equivalent) through a 50Ω termination to the type 321A EXT HORIZ INPUT connector and set the Generator to produce a 50 KC sine wave with an amplitude of exactly 6 major divisions on the CRT with the 5X MAG knob pulled out. Use the HORIZ POSITION control to position the display on the middle 6 divisions.

b. Change the Signal Generator output frequency to 1.0 MC. The deflection should now be 4.2 major divisions or more.

PARTS LIST

The following parts have been added to this modified instrument. When ordering replacement parts, specify instrument type, serial number and MOD number. Include circuit number, part number, and description of the desired item.

CAPACITORS

C348-S	Add	283-0003-00	.01μf	150v	cer

RESISTORS

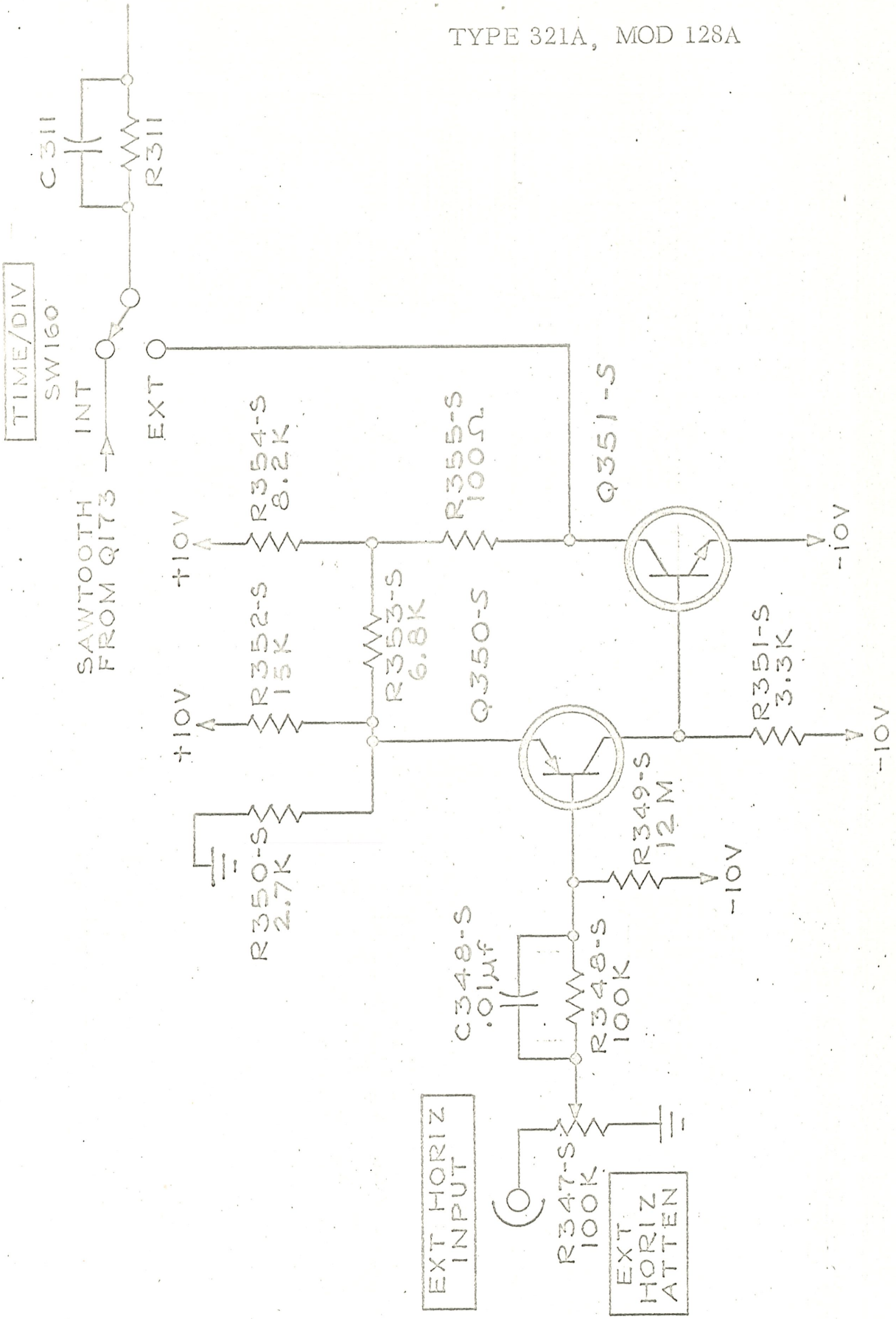
R347-S	Add	311-0347-00	100k	var, EXT HORIZ ATTEN		
R348-S	Add	316-0104-00	100k	1/4w	10%	Comp
R349-S	Add	316-0126-00	12m	1/4w	10%	Comp
R350-S	Add	315-0272-00	2.7k	1/4w	5%	Comp
R351-S	Add	315-0332-00	3.3k	1/4w	5%	Comp
R352-S	Add	315-0153-00	15k	1/4w	5%	Comp
R353-S	Add	316-0682-00	6.8k	1/4w	5%	Comp
R354-S	Add	302-0822-00	8.2k	1/2w	10%	Comp
R355-S	Add	315-0101-00	100Ω	1/4w	5%	Comp

TRANSISTORS

Q350-S	Add	151-0133-00
Q351-S	Add	151-0108-00

MECHANICAL

BRACKET, Transistor	Add	1	A-S-390
KNOB, Gray, 1/8" Shaft	Add	1	336-0270-00
PANEL, Front, Film #2752	Change	1	B-S-296
SCREW, 2-32 x 5/16, Thread Cutting	Add	4	213-0113-00
SOCKET, Transistor	Add	2	136-0095-00
SUBPANEL, Front	Change	1	D-S-174
TERMINAL	Add	2	131-0235-00


C311
R311
TIME/DIV SW160
INT
EXT
SAWTOOTH FROM Q173
R354-S 8.2K
R355-S 100Ω
Q351-S
+10V
-10V
R352-S 15K
R353-S 6.8K
Q350-S
R351-S 3.3K
+10V
-10V
R350-S 2.7K
R349-S 12M
-10V
C348-S .01μf
R348-S 100K
EXT HORIZ INPUT
R347-S 100K
EXT HORIZ ATTEN

km

11305

321 INST TYPE 128A MOD #

Section	Item	# Pages	Dated
A	Correspondence	*******	*****
B	Engineering notes and Spec Parts	_____	_____
C	Control Drawing	_____	_____
D	Cost and Price break-down	_____	_____
E	Build Procedure (includes Parts List and Calibration Procedure)	8	7-10-64
F	Manual Insert	4	10-64

Quoting Notes: _____

SPECIAL QUOTATION

Instrument (or part)	Mod. No.	Date: May 2[illegible], 1961
321	128A	

Contact
Roger Odom

Quoted Shipment Delay:
8 weeks aro

Field Office - Field Engineer
Palo Alto - R.O.

Date of Order:

Customer

Ack. No.:

MODIFICATION and BREAKDOWN

X10 increase in Horizontal Sensitivity
Variable 10:1 attenuator

cn/dvm 5/2/61

Customer Price
Add'l. to standard:

$100.00

Total:

cc: File
Notebook
Marketing
Production Planning

F (Q)

xtra

Roger Odom
Palo Alto

May 2, 1961

Chuck Nolan

Mostly Type 321, Mod. 128A

Dear Roger:

The mod to the 321 which provided the X10 increase in horizontal sensitivity plus a variable 10:1 attenuator is called Mod. 128A and comes for an additional $100. Shipment approximately 8 weeks aro.

You asked about the availability of 125's. As far as I know, we are delivering, and they are on the Product Availability sheets. It would appear you could get one unit either standard, rackmount, or framemount in 4 to 6 weeks, depending on rating.

Best regards,

Chuck

CN/dvm

cc: Ed Bauder
George Edens
Ron Coard
R^3

12-7-60

DUNC DOANE

321 — 128A WANT BRIGHTENED MARKERS

ALSO NEED ① "Z" AXIS. -4.5V SIG AVAIL.
+ WRONG POLARITY

② HOW ABOUT IF HAD AMPLIFIER HOW DO YOU HANDLE OVERDRIVE.

WIDTHS. — .1 μsec TO 1 ms.

LOOK INTO + ADVISE IF HAVE THOTS ON HOW TO DO.

SPECIAL QUOTATION

Instrument (or part) 321

Mod. No. 128A

Date: July 5 , 1960

Contact

Dunc Doane
Field Office - Field Engineer

West L. A. - IOC
Customer

Litton Industries

Quoted Shipment Delay:

4-6 weeks extra
Date of Order:

Ack. No.:

MODIFICATION and BREAKDOWN

Increased sensitivity

Increased horizontal sensitivity + variable 10:1 attenuator

150mv/div.
10:1 var. atten.
200Kc [redacted] bandpass

for 1 unit only - add'l. $100.00
for 10 or more - 50.00

cn/dvm 7/5/60

Customer Price
Add'l. to standard:
1- $100.00
10+ - $50.00
Total:

cc: File
Notebook
Marketing
Production Planning

Dunc Doane
West L. A.

July 5, 1960

Chuck Nolan
Special Products

Type 321 Horizontal Input Modification
Mod. 128A
Your IOC of June 28

Dear Dunc:

I see by your IOC that I have been promoted to Field Engineering.

Now on to the 321 Horizontal Input mod. Almost everything you ask for seems practical. We have performed an experiment on the 321, and find that we can up the horizontal sensitivity to about 50 mv/div. There is compression in the first and tenth divisions, but it looks like it must be there on standard instruments.

The increased sensitivity is not quite as simple to do as you might first imagine. By changing the circuitry around a little and adding a C.F. for the Horizontal Input, it looks like we can meet their requirements. It would require a slight change on the front panel to find room for the Variable attenuator. Incidentally, the method which we propose would provide for positive deflection to the right on the CRT screen. (The 321 seems to be backwards from all of our other instruments.)

I don't feel the CRT mask warrants changing. It doesn't buy anything since the beam cuts off at approximately the limit points of the mask.

To sum it up:

1. We can do the 150 mv/div.
2. We can add a 10:1 variable attenuator.
3. The bandpass would be probably slightly better than 200Kc.
4. We would not change the CRT mask.

The price for one instrument only would be an additional $100. If they should want ten, we could cut this to $50 per instrument. This will be known as Mod. No. 128A. Delivery on this would be 4 to 6 weeks in addition to standard delivery, a.r.o. Should an order materialize, send it through Ron.

Best,

Chuck
CN/dvm

cc: Gordon Allison
Ron Goard
George Edens
R^3

Inter-Office Communication

To: Chuck Nolan - Field Engineering

Date: June 28, 1960

From: Dunc Doane

WEST L. A.

Subject: Type 321 Horizontal Input Modification

Dear Chuck:

Litton Industries is giving serious consideration to the use of our 321 in their Marine Tactical Data System, but one problem bothers them: insufficient sensitivity in the horizontal input. Their question to us is can the sensitivity be upped from 1 & 1/2 volts per division to 150 mv per division, and can we add a 10:1 variable attenuator?

Looking at the schematics, the increased gain seems feasible, however, I don't know whether we could find room for the attenuator. They would not be using this scope for any greater band pass than 200 kc, so we would not have to get fancy on our compensation as far as the attenuator is concerned.

Presumably they might order up to ten of these scopes spread over 6 to 8 months all with this modification.

Another question they asked me, but one that is not very important: can we change the CRT mask to one having a circular opening so as not to obscure any of the CRT face?

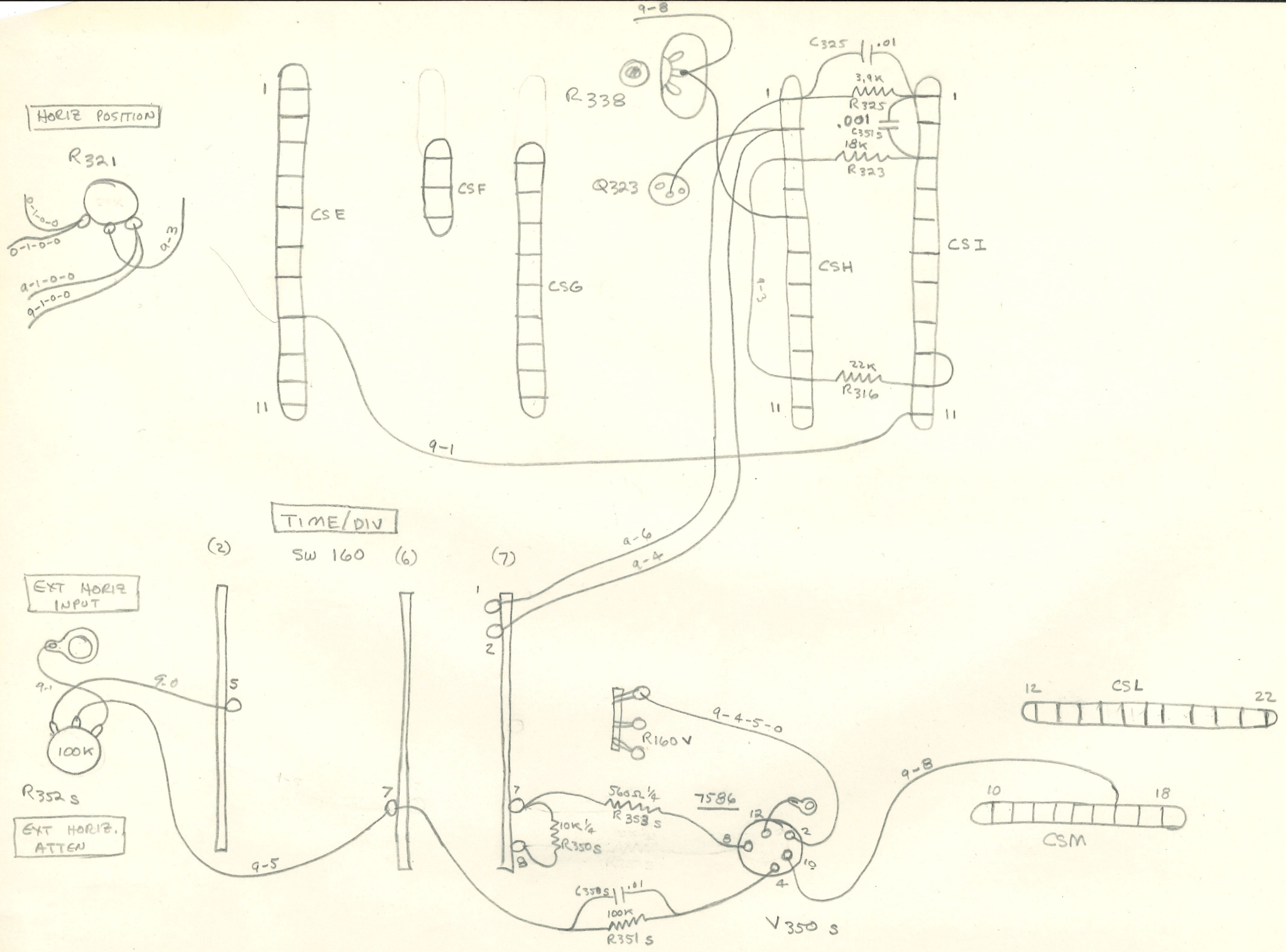
Please let us know what we can do for them, and how much the modification would cost per instrument.

Best regards,

Dunc

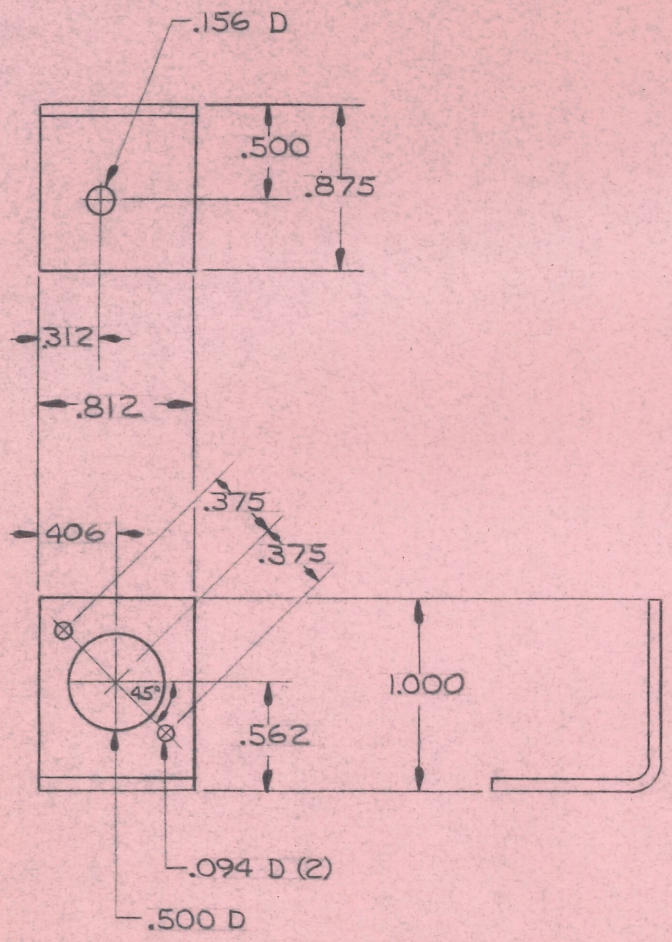
Dunc Doane

DD:mh


HORIZ POSITION
R321
0-1-0-0
0-1-0-0
a-1-0-0
9-1-0-0
a-3
CSE
CSF
CSG
R338
9-8
Q323
C325 .01
3.9K
R325
.001
C351S
18K
R323
CSH
CSI
22K
R316
9-1
TIME/DIV
SW 160
(2)
(6)
(7)
a-6
a-4
EXT HORIZ INPUT
9-1
9-0
5
100K
R352S
EXT HORIZ. ATTEN
9-5
7
1
2
8
R160V
9-4-5-0
560Ω 1/4
R353S
10K 1/4
R350S
7586
12
2
8
10
4
C358S .01
100K
R351S
V350S
9-8
CSL
12
22
CSM
10
18

32 MOD 128A

PART NO.				REV.
REV.	BY	REFER.	DESCRIPTION OF CHANGE	CKD BY / DATE



1. BEND RADII .094.

NOTES:

TEKTRONIX, INC. BEAVERTON, OREGON, U.S.A.	TITLE	BRACKET, NUVISTOR		
	MATERIAL	251-077 AL. SH. .063 ASTM B 209 ALY 5005 H 34		
	FINISH	ETCH & LACQUER		
TOLERANCE UNLESS OTHERWISE SPECIFIED DEC ±.016 ANG ± 2° HOLES +.010 −.002 MM ±	DR. BY J.L.T.	7-7-64	ENGR. I.F.	7-7-64
	CH. BY		PROD	
	SCALE FULL		FIRST USED 321 MOD 128A	
	SIZE A	PART NO. AS-374		REV.

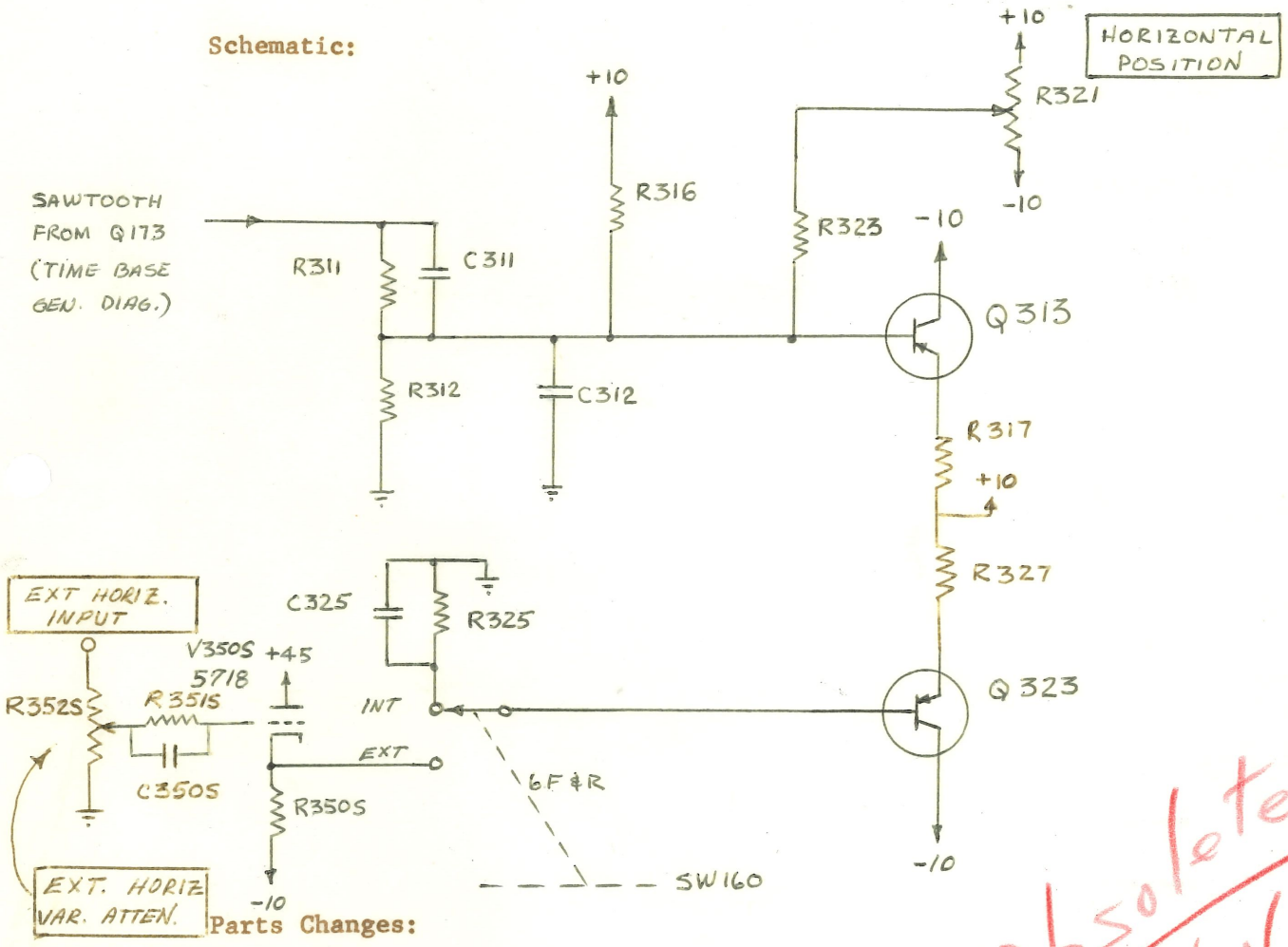
DO NOT SCALE DRAWING

Type 321, Mod. 128A

Due to the nature of this modification, all catalog specifications are not necessarily met. The exceptions will likely occur in the Sweep and Power Requirements specifications.

This modification provides a gain in sensitivity of approximately 10 over the standard instrument. A Variable Gain control provides at least a 10:1 range. Maximum frequency response will occur at maximum gain. Maximum input ±100 total peak AC and DC voltages.

Schematic:



Obsolete 12/20/64

Parts Changes:

Delete:

R300	68K	
C300	10μμf	

Add:

R350s	10K	1/4w
R351s	100K	1/4w
C350s	.01μf	150v
R352s	100K	pot, dual with R160Y special
V350s	5718	subminiature triode

Special Products
RVF/dvm 12/2/60

Mod 128A 11-15-60 BB

Type 321

1) Remove charging chassis
2) Remove bolts from timing cap bracket & from chassis lips just to rear of bracket
3) Remove pennuts from chassis brackets and timing cap bracket
4) Ream chassis brackets & take 6-32 bolt
5) Move timing cap bracket to rear & mount with 6-32 bolts thru chassis brackets
6) Remove variable time/div pot and install special pot
7) Replace 9-2 wire from timing cap (lengthen)
8) Remove R 325 & C325 and remove strap
9) Move base lead of Q 323 outboard on slot
~~10) Strap between R323 slot just emp~~
10) Leave R323 as is but strap between end of R323 from which base of Q 323 was just removed and junction of R311 & R312 & base of Q 313
~~11) Put a 9-4 wire between junction of base of Q323~~
11) Remove 9-1 wire between R311 & switch at switch and reconnect to junction of Q153 & Q173
12) Put a 9-4 wire between switch lug just emptied and base of Q323 running it alongside 9-1 wire just moved
13) Remove completely 9-1 jumper from next lug on switch & front section of switch
14) Remove R300 & C300 from switch
15) Remove 9-5 wire between Ext Horiz. input and switch and replace with longer piece of 9-5 wire between Ext Horiz Input and inboard lug on rear pot of variable control.

16) Rewire mag sw same as original

17) Rewire variable pot same as original

18) Install 10K ¼ w res. from -10 v lead on timing sw. (6R) to other contact on 6R

19) Install 2 new tie points on flange 6R 2 notches over from present unused tie point. These are to be used to support new CF tube being added.

20) Install 3.9K ¼ w res. & .01 discap between contact on 6F and outside lug on horiz atten pot. (side opposite 9-5 wire) ~~Run wire from pot lug to ground lug on R345~~

21) Install strap from +45 v on variable Time/div pot straight forward to new tie point added. (use templeson wire)

22) Install 100K ¼ w res & .01 discap between center lug on pot and the original tie point on wafer 6R

20A) Install ground lug on outside bolt of Time/div switch on rear of bracket.

20B) Run strap from lug & outside lug on Horiz atten pot.

20C) Run wire between ground lug and inboard tie point on wafer 6R just installed.

23) Run 9-64 # 22 solid wire between CRT shield and input switches shield from junction of Pin 6 of V423 and ceramic strip to

24) tie point on Time/Div sw 6F

24) Install 5718 tube on Time/Dw sw.

Pin 8 & +45 V tie point

Pins 2-3-4-7 & grounded tie point

Pin 1 & 100K & .01 disip tie point

Pin 6 & 9-64 wire tie point

Pin 5 & 10K ½ w res contact

25) Bend loop in #18 wire to support tip of 5718 tube & solder & +45 V lug on variable pot

26) Install charging chassis (if applicable)

Finis

F. mod 1128A

11/60

FOCUS

INTENSITY

This change: Lowered main titles.
Added "Variable or ext. horiz. atten."
above "Time/div." dial
Added Mod. slot
Request of Fillinger 11-17-60 HAB

ASTIGMATISM

SCALE ILLUM.

VERTICAL POSITION

HORIZONTAL POSITION

1241

MOD SLOT

VERTICAL AMPLIFIER

VARIABLE VOLTS/DIV.

.5 .2 1 .1 2 .05 5 .02 10 .01 20

CAL. 4 DIV.

CALIB.

AC

DC

INPUT

CAL. OUT 500 MV

DC BAL.

GND.

TIME BASE

VARIABLE OR EXT. HORIZ. ATTEN.

TIME/DIV.

PULL 5X MAG.

MILLI SEC 1 .5 .2 .1 2 50 5 20 10 μSEC 20 10 50 5 .1 2 .2 1 .5 SEC

CALIB.

POWER ON

EXT. HORIZ. INPUT

STABILITY

TRIGGERING

INT. AC SLOPE + −

LEVEL 0 − + +

INPUT

EXT. DC AUTO. FREE RUN

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

SERIAL

VARIABLE

333-566

321 #128A

11/60

FOCUS

INTENSITY

This change: Lowered main titles.
Added "Variable or ext. horiz. atten."
above "Time/div." dial
Added Mod. slot
Request of Fillinger 11-17-60 HAB

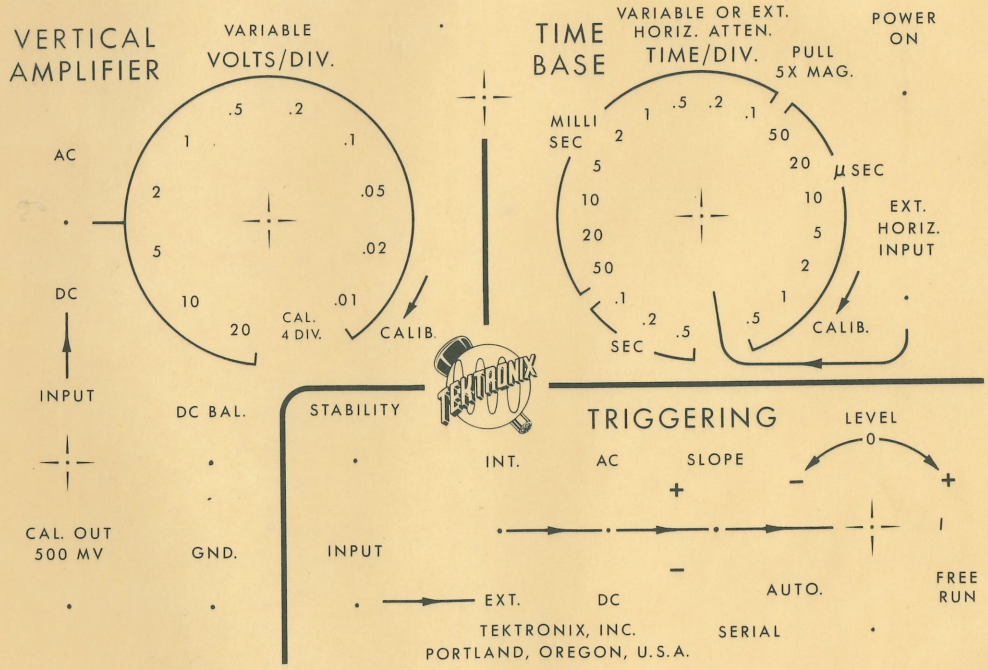
ASTIGMATISM

SCALE ILLUM.

VERTICAL POSITION

HORIZONTAL POSITION

1241



VARIABLE

333-566

[redacted]

D. Kidd

1241

321 A1284

11/60

FOCUS

INTENSITY

This change: Lowered main titles.
Added "Variable or ext. horiz. atten."
above "Time/div." dial
Added Mod. slot
Request of Fillinger 11-17-60 HAB

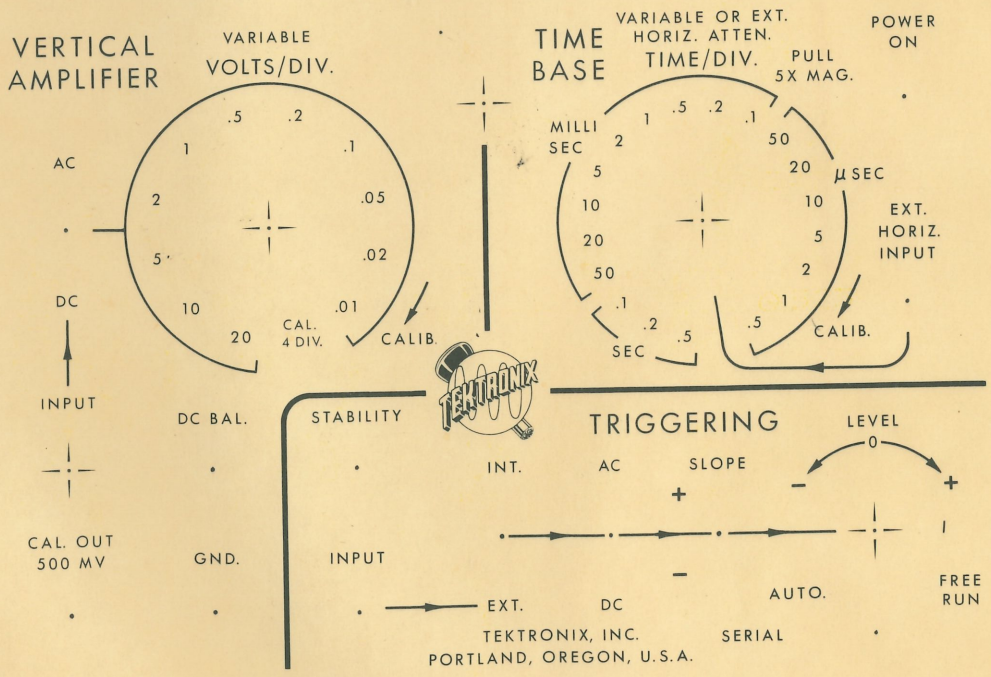
ASTIGMATISM

SCALE ILLUM.

VERTICAL POSITION

HORIZONTAL POSITION

1241

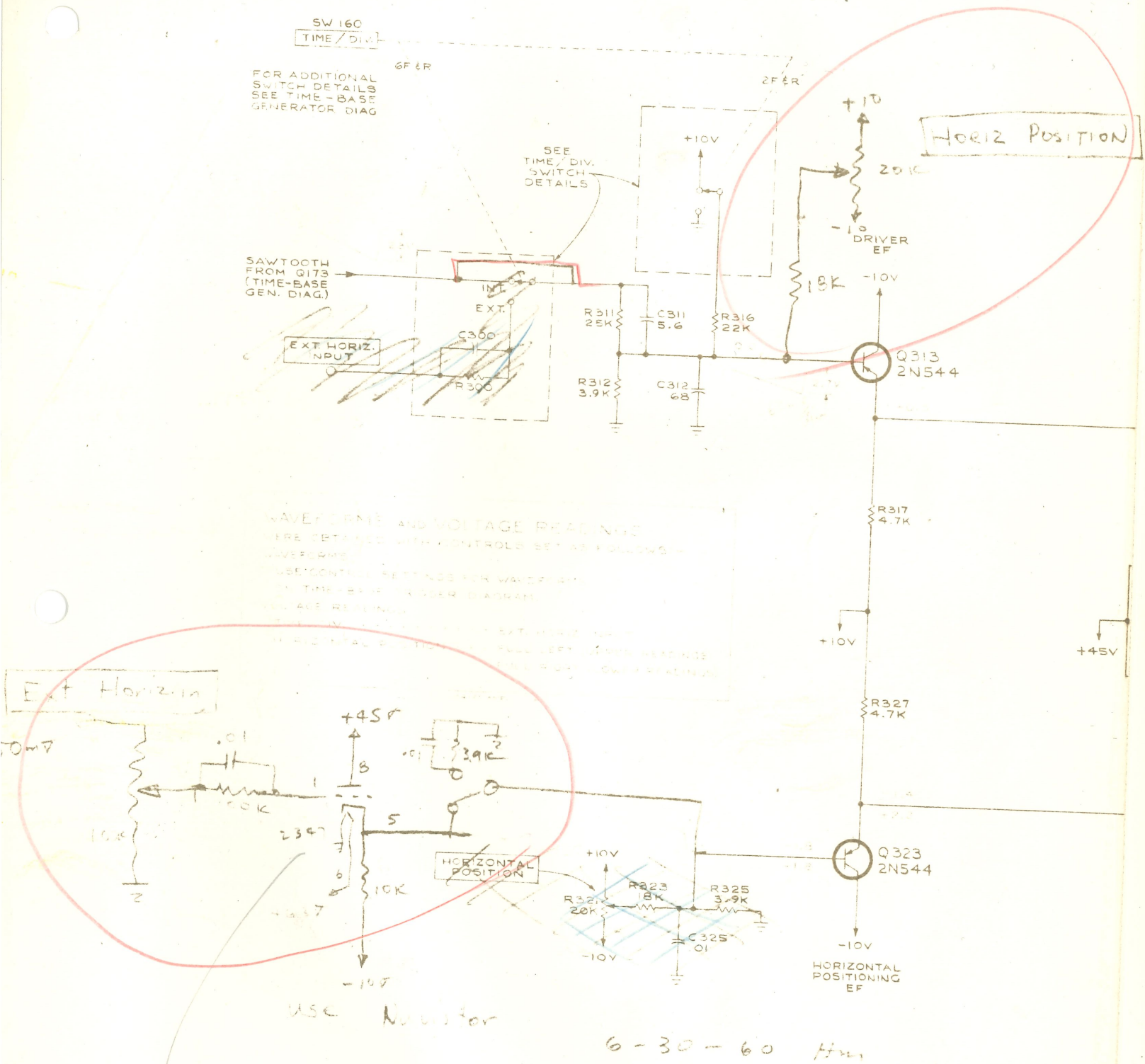


VARIABLE

333-566

[redacted]

P.C



Use Monitor for 6-30-60 Hrs

TYPE 321 OSCILLOSCOPE

Sylvania 5118

321 Ext Horiz Input

50mΩ input

mod. 128A

321 MOD 128A

TEK NO	QTY		
311-347	1	100K POT	R352S
3[illegible]-205	1	KNOB	
316-103	1	10K 1/4W 10%	R350S
316-561	1	560Ω 1/4W 10%	R353S
316-104	1	100K 1/4W 10%	R351S
283-003	1	.01μf 150V DISC	C350S
154-306	1	7586 TUBE	V350S
136-101	1	SOCKET	
210-259	1	LUG	
211-022	2	2-56X3/16 RH	
210-405	2	2-56X3/16 NUT	
210-001	1	#2 INT LOCK	
	1	BRACKET	
211-504	1	6-32X1/4 BH	
210-457	1	6-32 KEPNUT	
	1	FRONT PANEL	
283-000	1	.001μf 500V	C351S

DELETE FROM 321

TEK NO	QTY		
316-683	1	68K 1/4W 10%	R300
281-504	1	10 PF CER	C300

LOW LINE REGULATION CURE
321 MOD 128A

SET THE REGULATED 10V TO 9.5 V

VOLTAGES OUT OF THE CONVERTER ARE AS FOLLOWS.

+45	+43
+10	+9
+6.3 (CAL)	+5.75
+6.3 (DEC)	+5.6
-10	-9.5
-10 (DEC)	-10.6
-10 (TO Q403)	-8.8
-47.5	-44
-45	-42
+45 (DEC)	+41
+3350	+2920
-720	-690

MEASURED WITH LINE @ 117 V AND A 20,000 Ω/V METER

[FULL GRATICULE LIGHTS AND CHARGER ON]

VOLTAGE AT C612	12.0 V
RIPPLE " "	1.2 V P-P (120 N)
VOLTAGE ACROSS Q657	1.4 V
VOLTAGE DROP FROM C612 TO Q657	1.1 V

LOW LINE REGULATION ON 321 MOD 128A

WITH THE ADDED LOAD OF THE HORIZONTAL INPUT C.F. THE 10 VOLT REGULATED SUPPLY GOES OUT OF REGULATION AT ABOUT 107 VOLTS LINE. ADDITIONAL POWER DEMAND REDUCED THE UNREGULATED VOLTAGE TO A POINT WHERE THE PEAK-TO-PEAK RIPPLE OF THE UNREGULATED VOLTAGE BEGINS TO EQUAL THE VOLTAGE DROP ACROSS THE SERIES REGULATING TRANSISTOR, Q657.

BY LOWERING THE 10 VOLT SUPPLY TO 9.5V THIS GIVES AN ADDED ½ VOLT ACROSS THE SERIES TRANSISTOR AND THE REGULATOR CAN MAINTAIN CONTROL OF THE RIPPLE WITH THE LINE AT 105 VOLTS. ALL THE VOLTAGES OUT OF THE CONVERTER WILL BE REDUCED BY THE SAME RATIO.

R 882 IN THE CALIBRATOR NEEDS TO BE CHANGED TO A 5.1 K 5% RESISTOR TO MAINTAIN THE 500 MV TO THE CAL. OUT JACK.

THE REST OF THE SCOPE WAS CHECKED AND PREFORMED WITHIN THE SPECS.

321 MOD 128A

MOD 128A INCREASES THE EXT. HORIZ. INPUT SENSITIVITY TO ABOUT .28 V/DIV WITH MAG. OFF AND ABOUT .056 V/DIV WITH MAG. ON. THE VARIABLE EXT. HORIZ. ATTENUATOR CONTROL GIVES THE COMPLETE RANGE FROM ZERO TO MAXIMUM. SENSITIVITY. MAXIMUM FREQUENCE RESPONCE OCCURES AT MAX SETTING OF EXT HORIZ ATTENUATION. CONTROL.

1.8 mc
2 mc

SPECIAL

Type 321

November 2, 1964

HORIZONTAL INPUT AMPLIFIER

For the Tektronix Type 321 Oscilloscope
Serial numbers - all

DESCRIPTION

The instrument for which this manual was prepared has been modified to provide a gain sensitivity of approximately 10 over standard with a 10:1 variable attenuator control. External horizontal input sensitivity is approximately .23 v/div with the Magnifier off and .045 v/div when the Magnifier switch is turned on. The EXT HORIZ ATTEN control varies the sensitivity of the external horizontal amplifier between zero and maximum rating.

Frequency response of the amplifier is maximum when the EXT HORIZ ATTEN control is at the maximum setting.

PARTS LIST

Quantity	Description	Part Number
1 ea.	Assembly, Transistor bracket, consisting of:	
2 ea.	Socket transistor	136-095
1 ea.	Transistor 2N1302	151-040
1 ea.	Transistor J3138	151-087
4 ea.	Screw, 2-32 x 5/16 BHS thread-forming	213-113
1 ea.	Capacitor, ceramic 0.01µf 150v Disc	283-003
1 ea.	Resistor, comp, 8.2k 10% 1/2w	302-822
1 ea.	Resistor, comp, 100k 10% 1/4w	316-104
1 ea.	Resistor, comp, 12meg 10% 1/4w	316-126
1 ea.	Resistor, comp, 3.3k 10% 1/4w	316-332
1 ea.	Resistor, comp, 470Ω 10% 1/4w	316-471
1 ea.	Wire, #26 solid white-orange 1-3/4 in.	
1 ea.	Wire, #26 solid black-brown-black-black 2 in.	
1 ea.	Bracket, transistor	Special
1 ea.	Assembly, potentiometer, consisting of:	
1 ea.	Capacitor, ceramic 1.0µf 25v Disc	283-059
1 ea.	Potentiometer, comp, 2x20k	311-346
1 ea.	Tubing, plastic #20 black 1/2 in.	(162-504)
1 ea.	Wire, #26 solid white-red 3-1/2 in.	(175-573)
1 ea.	Nut, keps, 6-32 x 5/16	210-457
1 ea.	Screw, 6-32 x 1/4 BHS	211-504
1 ea.	Spool, w/3' silver-bearing solder	214-210
1 ea.	Potentiometer, comp, 100k	311-347
1 ea.	Knob, black	366-205
1 ea.	Panel, front Type 321 Mod 128A	Special
1 ea.	INSERT MOD 128A	Special
1 ea.	Wire, #26 solid white-yellow 9 in.	(175-573)
1 ea.	Wire, #26 solid white-blue 9 in.	(175-573)
1 ea.	Wire, #26 solid white-gray 2 in.	(175-573)
1 ea.	Wire, #26 solid white 1-1/2 in.	(175-573)

INSTRUCTIONS

IMPORTANT: When soldering to the ceramic strips, use the silver-bearing solder supplied with this kit.

A. TO REPLACE THE FRONT PANEL:

( ) 1. Remove the side panels, power connector and battery case.

( ) 2. Unsolder and remove the HORIZONTAL POSITION potentiometer.

( ) 3. Remove the front panel. This is accomplished by unsoldering and removing the pilot light; removing all control knobs, and mounting nuts and washers; removing the INPUT connector and removing all banana jacks.

( ) 4. Position the front panel (from kit) on the instrument and mark the center of the holes for the EXT HORIZ INPUT and ATTEN holes.

( ) 5. Remove the front panel. Center punch and drill a 5/16 in hole for the INPUT hole, and a 1/4 in. hole for the ATTEN hole.

( ) 6. Mount the new front panel, reversing the procedure followed in step A-3.

( ) 7. Mount the 100k potentiometer (from kit) in the EXT HORIZ ATTEN position.

( ) 8. Mount the dual 20k potentiometer in the HORIZONTAL POSITION hole. It may be necessary to loosen or remove Q24 mounting clip. Do not resolder the wires yet.

B. TO MOUNT THE TRANSITOR SOCKET ASSEMBLY:

( ) 1. Locate the Vertical position of the shield between CSL-CSM and the TIME/DIV switch (see Fig. 1).

( ) 2. If there is a hole in this shield, use it to mount the bracket with the 6/32 screw and keps nut (from kit). If there is no hole in the shield, position the bracket on the shield and locate and drill a 5/32 in. (#23) hole in this shield, about 1/4 in below CSM.

( ) 3. Mount the bracket assembly in this hole, using the 6-32 screw and keps nut from the kit.

C. TO MODIFY THE HORIZONTAL INPUT CIRCUITS:

( ) 1. Solder the two white-brown-black-black wires (unsoldered in step A-2) to the clockwise (CW) terminal of the new HORIZONTAL POSITION potentiometer, front section.

( ) 2. Solder the white-orange wire (unsoldered in Step A-2) to the center terminal of the HORIZONTAL POSITION potentiometer, front section.

( ) 3. Solder the two black-brown-black-black wires (unsoldered in step A-2) to the Counter-clockwise (CCW) terminal of the HORIZONTAL POSITION potentiometer, front section.

INSTRUCTIONS (Step C - continued)

NOTE I: The following method is used to identify the TIME/DIV switch terminals:

The wafers are numbered from the front to the rear.

The contact positions are numbered 1 thru 18 relative to the index key as shown in Fig. 2 (although the switch shown in Fig. 2 has only 12 positions).

The contacts have an "F" or "R" suffix which denotes that they are on the front or the rear of the wafer. There are additional holes in the wafers between contact positions which in some cases are used to mount tie points.

EXAMPLE: W2-7R (denoted by * on Fig. 2) is contact #7 on the rear of wafer 2.

NOTE II: If there is a switch location in parentheses in the following steps, it refers to instruments below serial number 720.

( ) 4. Unsolder the 0.0022µf 50v capacitor on the TIME/DIV switch between W1-9F and W2-10R.

( ) Resolder the capacitor between W1-9F and the switch mounting frame (ground).

( ) 5. Unsolder and remove the bare wire strap between W2-10R and the switch mounting frame.

( ) 6. Solder the 1µf capacitor from the HORIZONTAL POSITION potentiometer assembly to W2-5R (ground).

( ) 7. Unsolder and remove the wire connected between W3-1R and W7-1F (W6-7F) on the TIME/DIV switch.

( ) 8. Unsolder the white-brown wire from W7-2F (W6-8F).

( ) Resolder it to CSE-8.

( ) 9. Unsolder and remove the 10pf capacitor and 68k resistor between W6-7F (W5-5F) and W7-7R (W6-6R) on the TIME/DIV switch.

( ) 10. Solder the end of the 8.2k resistor from the transistor bracket assembly to the CCW terminal of the VARIABLE TIME/DIV potentiometer (+10v).

( ) 11. Solder the white-orange wire from the transistor bracket assembly to the TIME/DIV switch W7-7R (W6-6R).

( ) 12. Solder the black-brown-black-black wire from the assembly to W7-8-1/2R (-10v tie point).

( ) 13. Solder the 100k -0.01µf combination from the assembly to W6-7F (W5-5F).

( ) 14. Unsolder the white-green wire from the EXT HORIZ INPUT connector and resolder it to the center terminal of the EXT HORIZ ATTEN potentiometer.

INSTRUCTIONS (Step C - continued)

( ) 15. Solder a short piece of bare wire from the CW terminal of the EXT HORIZ ATTEN potentiometer to the mounting frame of the TIME/DIV switch.

( ) 16. Solder the piece of white wire (from kit) from the CW terminal of the EXT HORIZ potentiometer to the lug of the EXT HORIZ INPUT connector.

( ) 17. Unsolder the bare wire between the Horiz. Gain Adj. potentiometer (R338), center terminal, and CSH-1.

( ) Unsolder the white-gray wire from CSH-1 and resolder it to the center terminal of the Horiz. Gain Adj. potentiometer.

( ) 18. Unsolder and remove the bare wire between CSH-1 and CSH-5.

( ) 19. Solder the white-gray wire (from kit) between the center terminal of the Horiz. Gain Adj. potentiometer and CSH-5.

( ) 20. Unsolder and remove the bare wire between CSH-2 and CSH-3.

( ) 21. Unsolder and remove the bare wire between CSI-1 and CSI-2.

( ) 22. Move the 3.9k resistor and the 0.01μf capacitor from CSH-2 - CSI-2 to CSH-1 - CSI-1.

( ) 23. Solder a piece of bare wire between CSH-1 and CSH-3.

( ) 24. Solder the white-yellow wire (from kit) between the TIME/DIV switch W7-2F (W6-7F) and CSH-2.

( ) 25. Solder the white-blue wire (from kit) between the TIME/DIV switch W7-1F (W6-8F) and CSH-3.

THIS COMPLETES THE INSTALLATION.

( ) Check wiring for accuracy.

( ) Fasten the Manual Insert pages in your Instruction Manual.

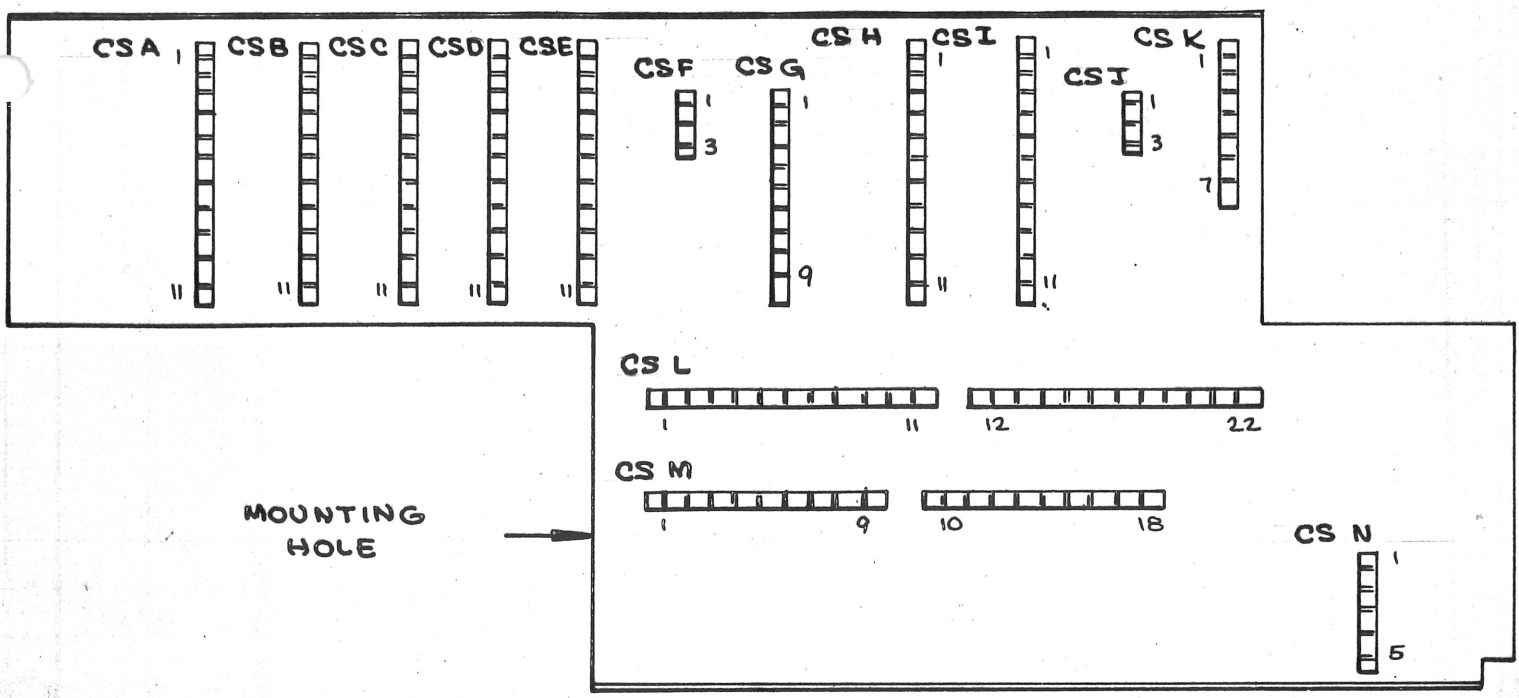

CSA
CSB
CSC
CSD
CSE
CSF
CSG
CSH
CSI
CSJ
CSK
CSL
CSM
CSN
MOUNTING HOLE

FIG. 1

HORIZONTAL INPUT AMPLIFIER

TYPE 321 MOD 128A

The instrument for which this manual was prepared has been modified to provide a gain sensitivity of approximately 10 over standard with a 10:1 variable attenuator control. External horizontal input sensitivity is approximately .23 v/div with the Magnifier off and .045 v/div when the Magnifier switch is turned on. The EXT HORIZ ATTEN control varies the sensitivity of the external horizontal amplifier between zero and maximum rating.

Frequency response of the amplifier is maximum when the EXT HORIZ ATTEN control is at the maximum setting.

PARTS LIST

Parts changed in this modified instrument are listed below. When ordering replacement parts, specify instrument type, serial number and MOD number. For mechanical parts include the part number (or drawing number) and a description of the part. Include the part number and component value when ordering electrical parts.

CAPACITORS

Ckt. No.		Part Number	Description			
C350S	Add	283-002	.01µf	Cer	500v	
C300	Delete	281-504	10pf	Cer	500v	
C351S	Add	283-059	1.0µf	Cer	25v	

RESISTORS

R321A,B	change to	311-346	2x20k	Var.	10%	comp.
R350S	Add	316-822	8.2k	1/4w	10%	comp.
R351S	Add	316-104	100k	1/4w	10%	comp.
R352S	Add	311-347	100k	Var.	10%	comp.
R353S	Add	316-471	420Ω	1/4w	10%	comp.
R354S	Add	316-332	3.2k	1/4w	10%	comp.
R355S	Add	316-126	12meg	1/4w	10%	comp.

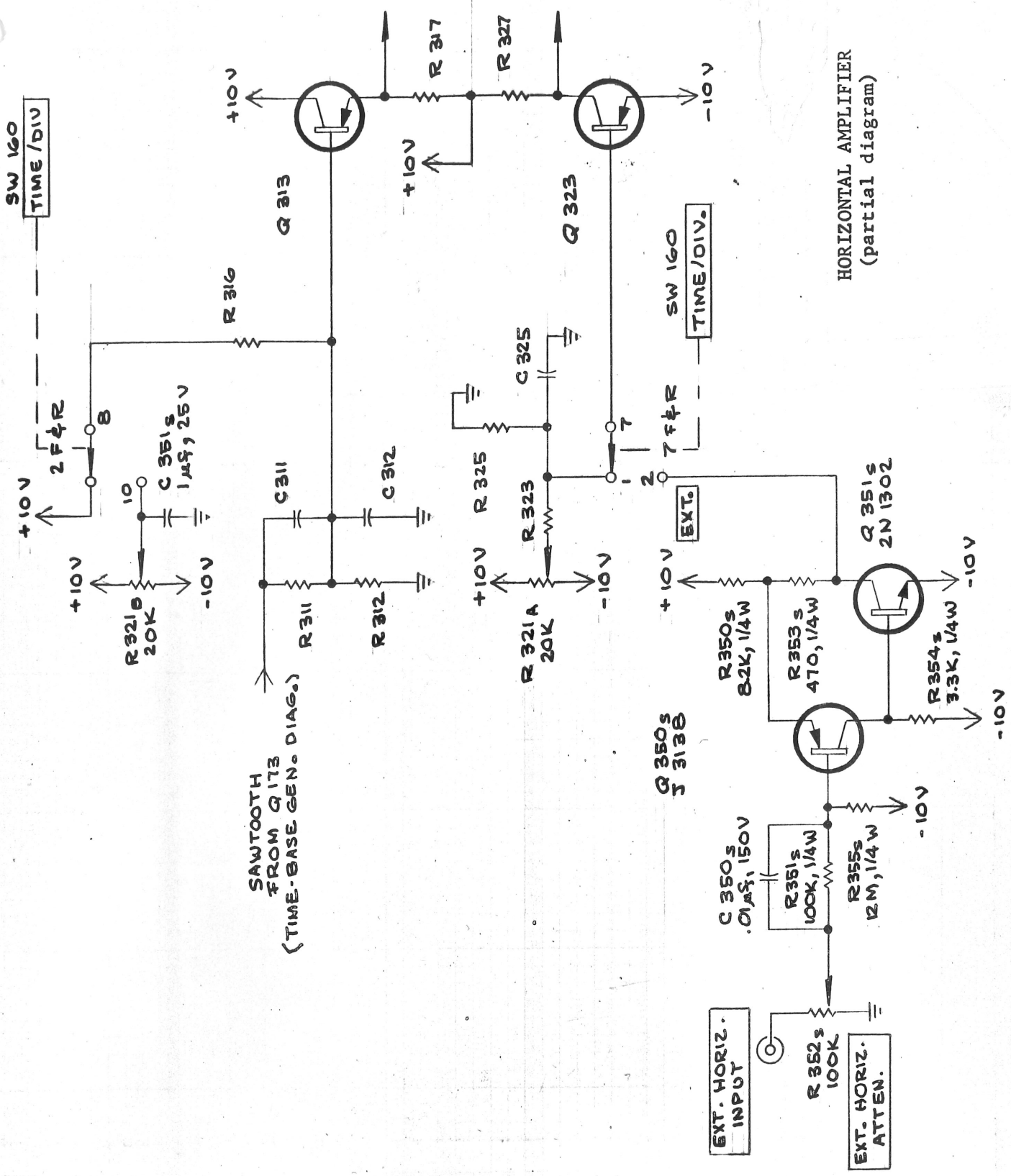
TRANSISTORS

Q350S	Add	151-087	J3138
Q351S	Add	151-040	2N1302

MECHANICAL PARTS LIST:

		PART NUMBER
Bracket, transistor	Add	Dwg A-S-390
Front Panel, film #2516	Add	Dwg B-S-296
Knob, small black	Add	366-205
Screw, 2-36 x 5/16 PHS, thread-forming	Add	213-113
Socket, transistor	Add	136-095

SCHEMATICS:


HORIZONTAL AMPLIFIER
(partial diagram)
SW 160
TIME/DIV
2 FER
8
10
C 351s
1μF, 25V
+10V
-10V
R 321B
20K
R 316
Q 313
R 317
R 327
Q 323
C 311
C 312
R 311
R 312
SAWTOOTH
FROM Q173
(TIME-BASE GEN. DIAG.)
C 325
R 325
R 323
R 321A
20K
7 FER
1
2
EXT.
Q 351s
2N 1302
R 350s
82K, 1/4W
R 353s
470, 1/4W
R 354s
3.3K, 1/4W
Q 350s
JT 3138
C 350s
.01μF, 150V
R 351s
100K, 1/4W
R 355s
12M, 1/4W
R 352s
100K
EXT. HORIZ.
INPUT
EXT. HORIZ.
ATTEN.

321 MOD 128A REV A

TEK No.	QTY		
311-347	1	100K POT	R352S
366-205	1	KNOB	———
136-095	2	TRANS SOCKET	———
213-113	4	2-32x5/16 PH	———
151-087	1	J3138	Q350S
151-040	1	2N1302	Q351S
283-003	1	.01 µf 150V	C350S
316-471	1	470Ω 1/4W 10%	R353S
316-332	1	3.3K	R354S
316-104	1	100K	R351S
316-126	1	12M	R355S
302-822	1	8.2K 1/2W 10%	R350S
———	1	BRACKET A5-390	———
211-504	1	6-32x1/4 BH	———
210-457	1	6-32 KEPNUT	———
———	1	FRONT PANEL (2516)	———
283-000	1	.001 µf 500V	C351S

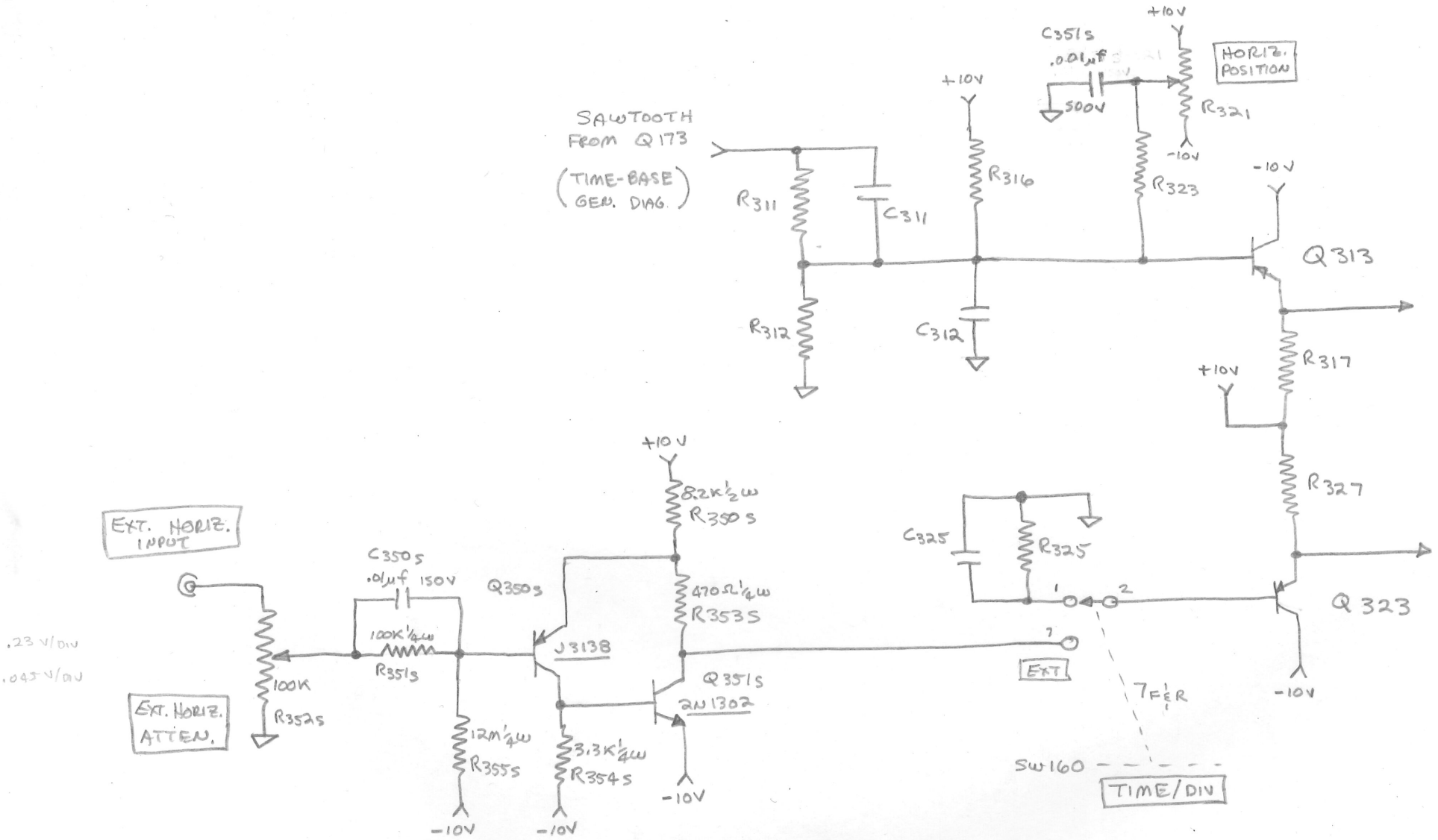
DELETE FROM 321

TEK NO	QTY		
316-683	1	68K 1/4W 10%	R300
281-504	1	10PF CER	C300

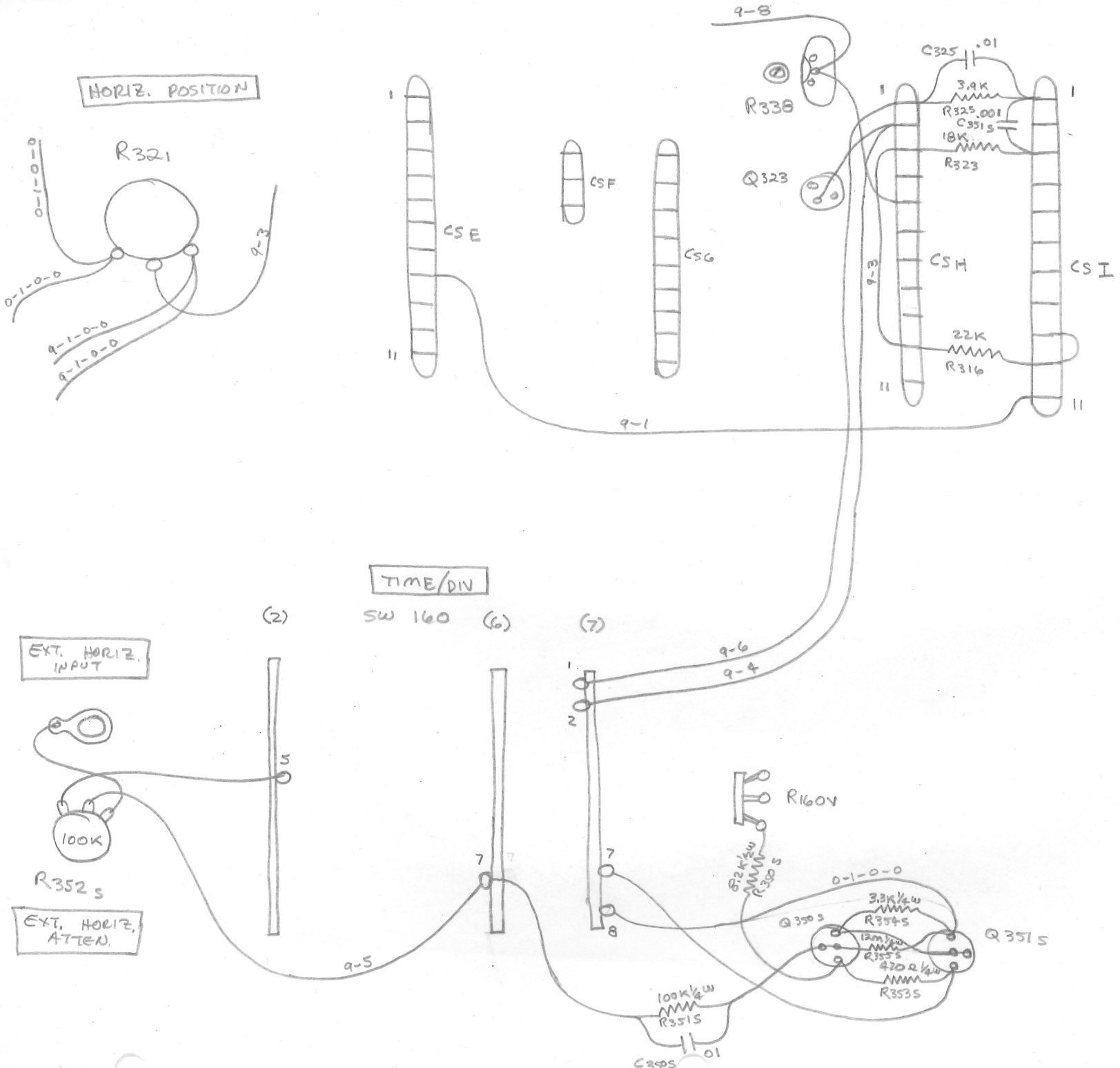
321 MOD 128A REV A

THIS MOD INCREASES THE EXT. HORIZ. INPUT SENSITIVITY TO ABOUT .23 V/DIV WITH MAG. OFF AND ABOUT .045 V/DIV WITH MAG. ON. THE VARIABLE EXT. HORIZ. ATTENUATOR CONTROL GIVES THE COMPLETE RANGE FROM ZERO TO MAXIMUM SENSITIVITY. MAXIMUM FREQUENCY RESPONCE OCCURS AT MAXIMUM SETTING OF EXT. HORIZ. ATTEN. CONTROL.

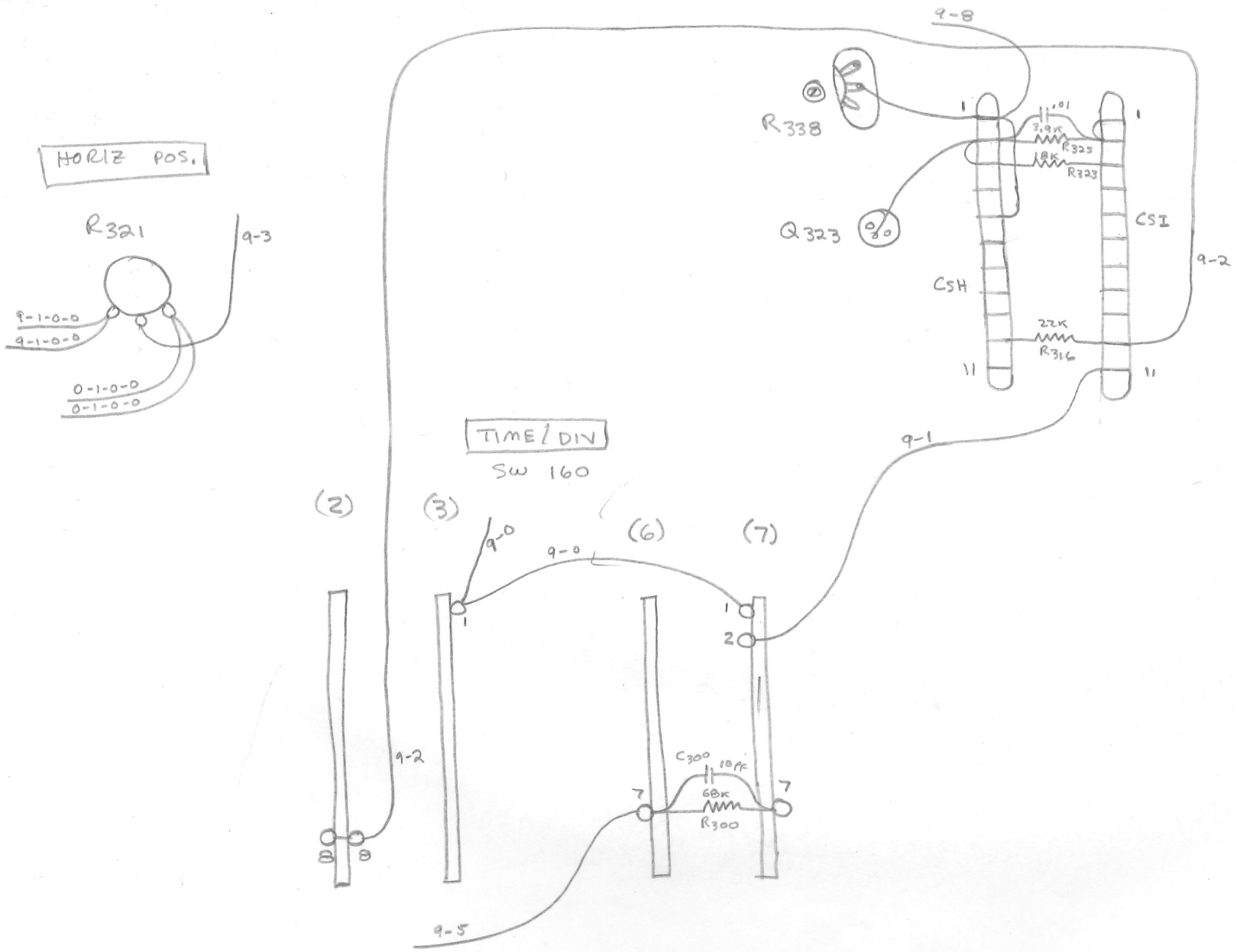
NOTE: IT IS RECOMMENDED THAT "REV. A" BE USED IN FUTURE 128A MODS. THE INPUT TRANSISTORIZED STAGE OF REV A REDUCES THE POWER LOADING ON THE POWER SUPPLIES AS COMPARED WITH THE NUVISTOR LOADING. WITH THE NUVISTOR MOD., THE 10 VOLT REGULATED SUPPLY HAS TO BE LOWERED TO 9.5 VOLTS TO MAINTAIN POWER SUPPLY REGULATION AT 105 VOLTS LINE, AND THE CALIBRATOR CIRCUIT HAS TO BE CHANGED TO MAINTAIN THE 500 MV CAL. SIGNAL. THE ABOVE TWO CHANGES ARE NOT REQUIRED WITH THE TRANSISTORIZED CIRCUIT.



321 OD 128 A REV A



321 MOD 128A REV A


HORIZ POS.
R321
9-3
9-1-0-0
9-1-0-0
0-1-0-0
0-1-0-0
9-8
R338
Q323
.01
3.9K
R325
18K
R323
CSI
CSH
9-2
22K
R316
11
11
9-1
TIME/DIV
SW 160
(2)
(3)
(6)
(7)
9-0
9-0
9-2
C300
10pf
68K
R300
9-5

321

before

321 MOD 128A

REV B

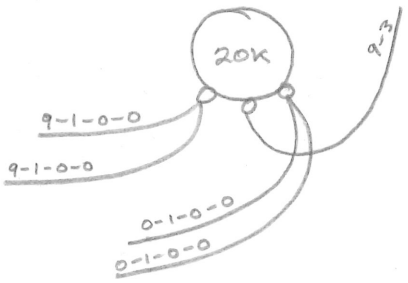
TEK No	QTY		
311-347	1	100K POT	R352S
366-205	1	KNOB	———
136-095	2	TRANS SOCKET	———
213-113	4	2-32x 5/16 PH	———
151-087	1	J3138	Q350S
151-040	1	2N1302	Q351S
283-003	1	.01 μf 150V DISC	C350S
283-059	1	1 μf 25V DISC	C351S
316-471	1	470Ω 1/4W 10%	R353S
316-332	1	3.3K	R354S
316-104	1	100K	R351S
316-126	1	12M	R355S
302-822	1	8.2K 1/2W 10%	R350S
311-346	1	2x 20K POT	R321 A/B
———	1	TRANS BRACKET AS-390	———
211-504	1	6-32x1/4 BH	———
210-457	1	6-32 KEPNUT	———
———	1	FRONT PANEL (2516)	———

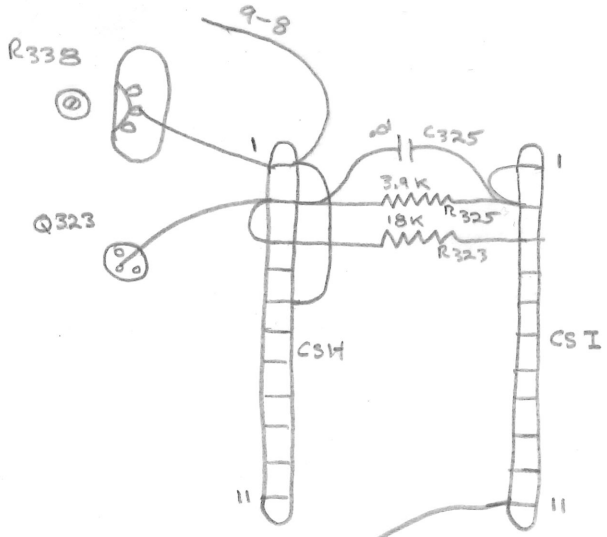
REMOVE FROM 321

TEK NO	QTY		
316-683	1	68K 1/4W 10%	R300
281-504	1	10 PF CER	C300
311-345	1	20K POT	R321

HORIZ POSITION

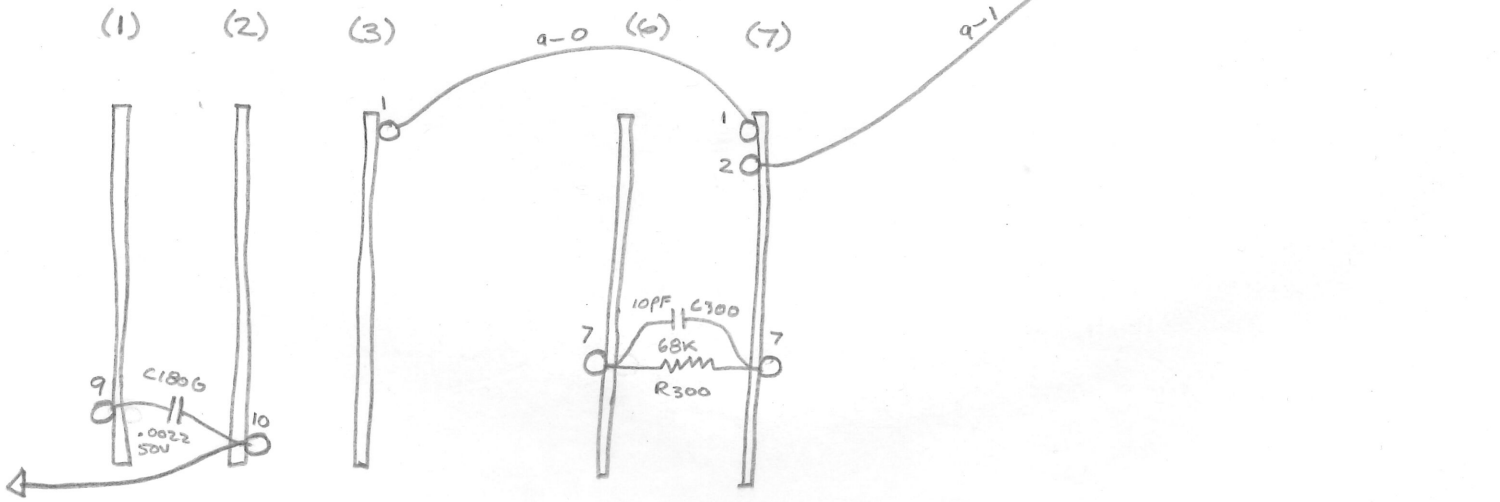
R321



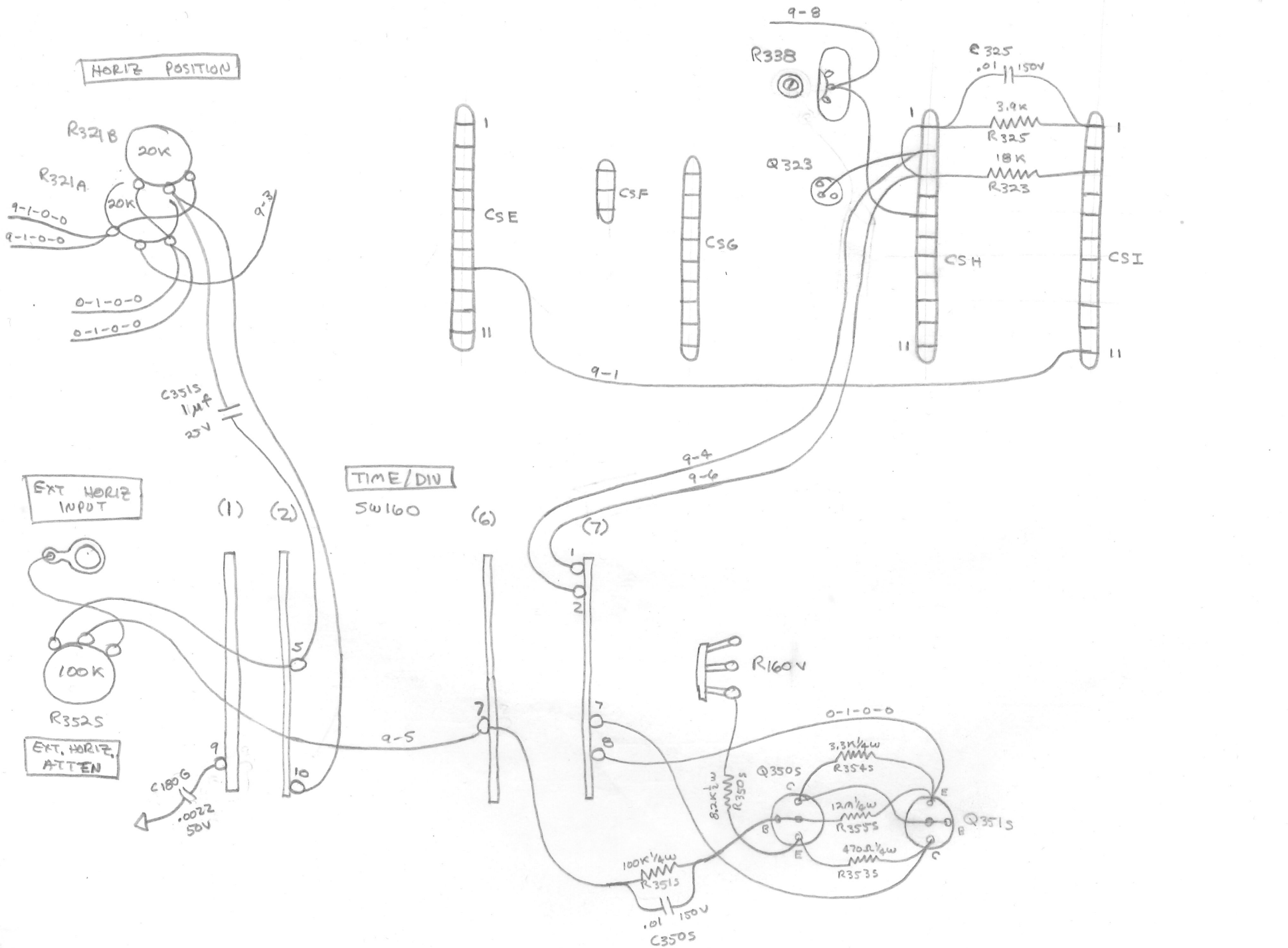


TIME/DIV

SW 160

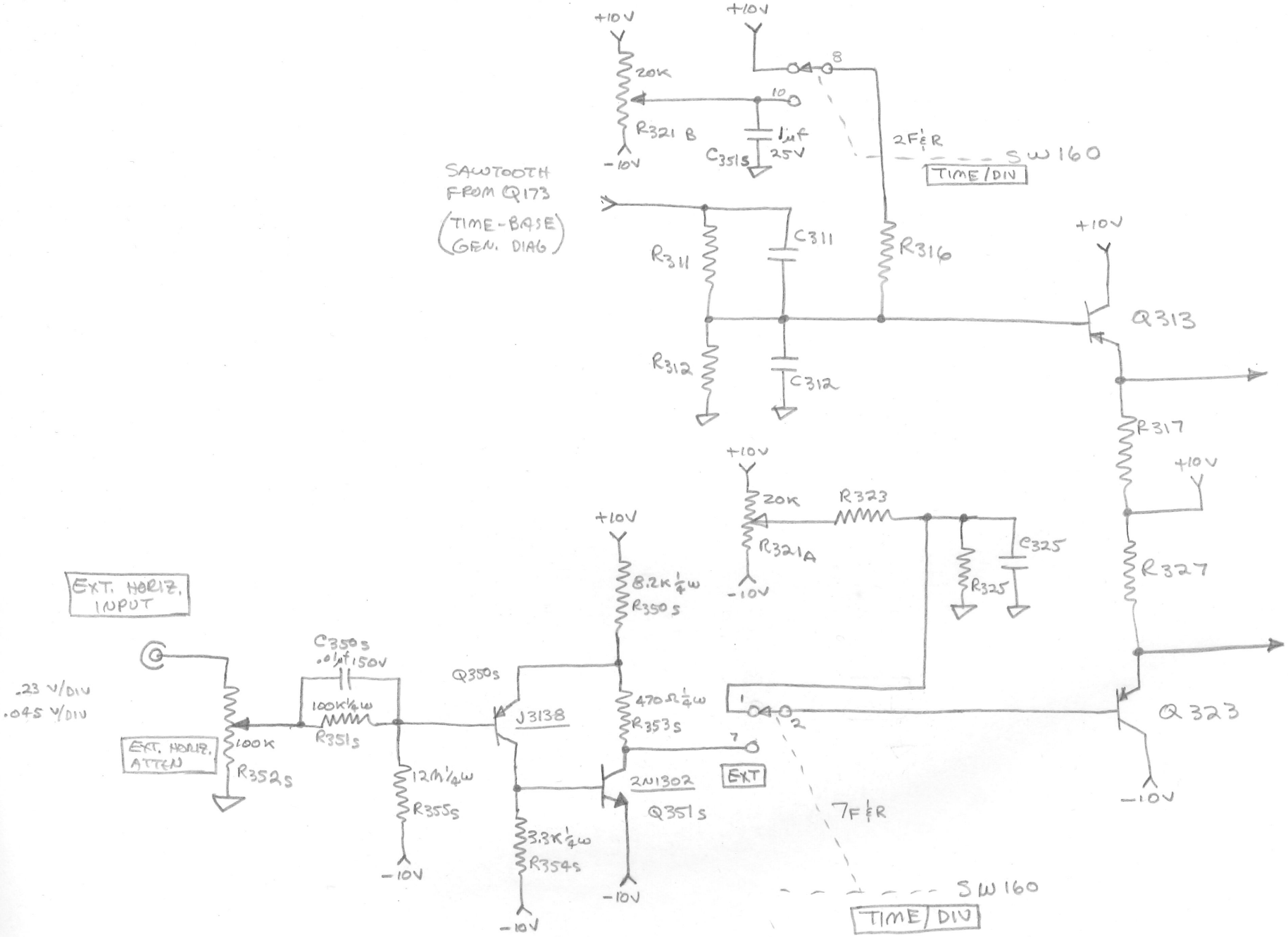


321 BEFORE MOD 128A REV B



321 MOD 128 A

REV B



SW MOD 128A REV B

321 Mod 128A

This mod provides a gain sensitivity of approx. 10 over standard with a 10:1 Var. Attenuator.

PARTS LIST

Qty.	Part/Dwg. No.	Description
1	Dwg. #D-S-174	Subpanel, Front
1	Dwg. #B-S-296	Front Panel, film #2516
1	Dwg.m# A-S-374	Bracket, Nuvistor
1	136-101	Socket, Nuvistor
1	154-306	7586 Nuvistor
1	210-001	#2 Int. Lockwasher
1	210-259	#2 Pee Wee Lug
2	210-405	Nut, 2-56 x 3/16
1	210-457	Nut, 6-32 Kep
2	211-022	Screw, 2-56 x 3/16 RHS
1	211-504	Screw, 6-32 x 1/4 BHS
1	283-003	Discap, .01ufd
1	311-347	Pot, 100K
1	316-103	Res. Comp. 10K 1/4W 10%
1	316-104	Res. Comp. 100K 1/4W 10%
1	316-561	Res. Comp. 560Ω 1/4W 10%
1	366-205	Knob, Black
1	301-512	5.1K 1/2w 5%
1	283-003	.01µf 105v Disc

Ken Hedin/MJT

321 Mod 128A

PROCEDURE

1. Modify the Front Subpanel per dwg. #D-S-174
2. Install the new Front Panel with mod slot.
3. Install the banana jack and the new 100K mini-pot. Use a 366-205 knob on the new pot.
4. Mechanical the nuvistor bracket with socket and pee wee lug. Mount to capacitor shield utilizing the one hole provided. (See picture).
5. Remove 9-2 wire from CSI-10 on the Horiz. Amp. Chassis to 2F & R 11 of the Horiz. Display Switch.
6. Remove the 68K Resistor (R300) and the 10pf Cap. (C300) combination from 6R10 to 7R10 of the Horizontal Display Switch.
7. Re-locate 9-5 wire from 6R10 to the center tap of the added 100K pot instead of banana jack.
8. Remove 9-0 wire from 3R-1 to 7F-1 of the Horizontal Display Switch.
9. Re-locate the 9-1 wire from 7R-2 of the Horiz. Display Sw. to CSI-11, to run from CSI-11 to CSE-8.
10. Remove jumper wire from CSH-1 to the center tap of R338.
11. Remove jumper wire from CSH-1 to CSH-5.
12. Remove jumper wire from CSH-2 to CSH-3.
13. Move 9-8 wire from CSH-1 to the center tap of R338.
14. Remove jumper wire from CSI-1 to CSI-2.
15. Move the .01 discap and 3.9K 1/4W combo from CSH-2 to CSI-2, to run from CSH-1 to CSI-1.
16. Add a 9-3 #26 wire from CSH-3 to CSH-10.
17. Add a jumper wire from CSI-9 to CSI-10.
18. Add a jumper wire from the center tap of R338 to CSH-5.
19. Add a 9-6 #26 wire from CSH-1 to 7F-1 of the Horizontal Display Switch.
20. Add a 9-4 #26 wire from CSH-2 to 7F-2 of the Horizontal Display Switch.
21. Add a 10K 1/4W from 7R-10 to 7R12 of the Horiz. Display Sw.
22. Add a 560Ω 1/4W from 7R-10 of the Horiz. Display Sw. to pin 8 of the added nuvistor socket.
23. Add a 100K 1/4W and a .01 discap parallel combination from 6R10 to pin 4 of the nuvistor socket.

(continued page 2).

page 2. (continued)

321 Mod 128A PROCEDURE

24. Ground pin 12 of the nuvistor socket to pee wee lug on the bracket.

25. Add a 9-450 #26 wire from pin 2 to the matching wire on the pot mounted to the rear of the Horizontal Display Switch. (R160V).

26. Add a 9-8 #26 wire from pin 10 to CSM-16. (Dress behind Chassis and through the grommet to CSM-16).

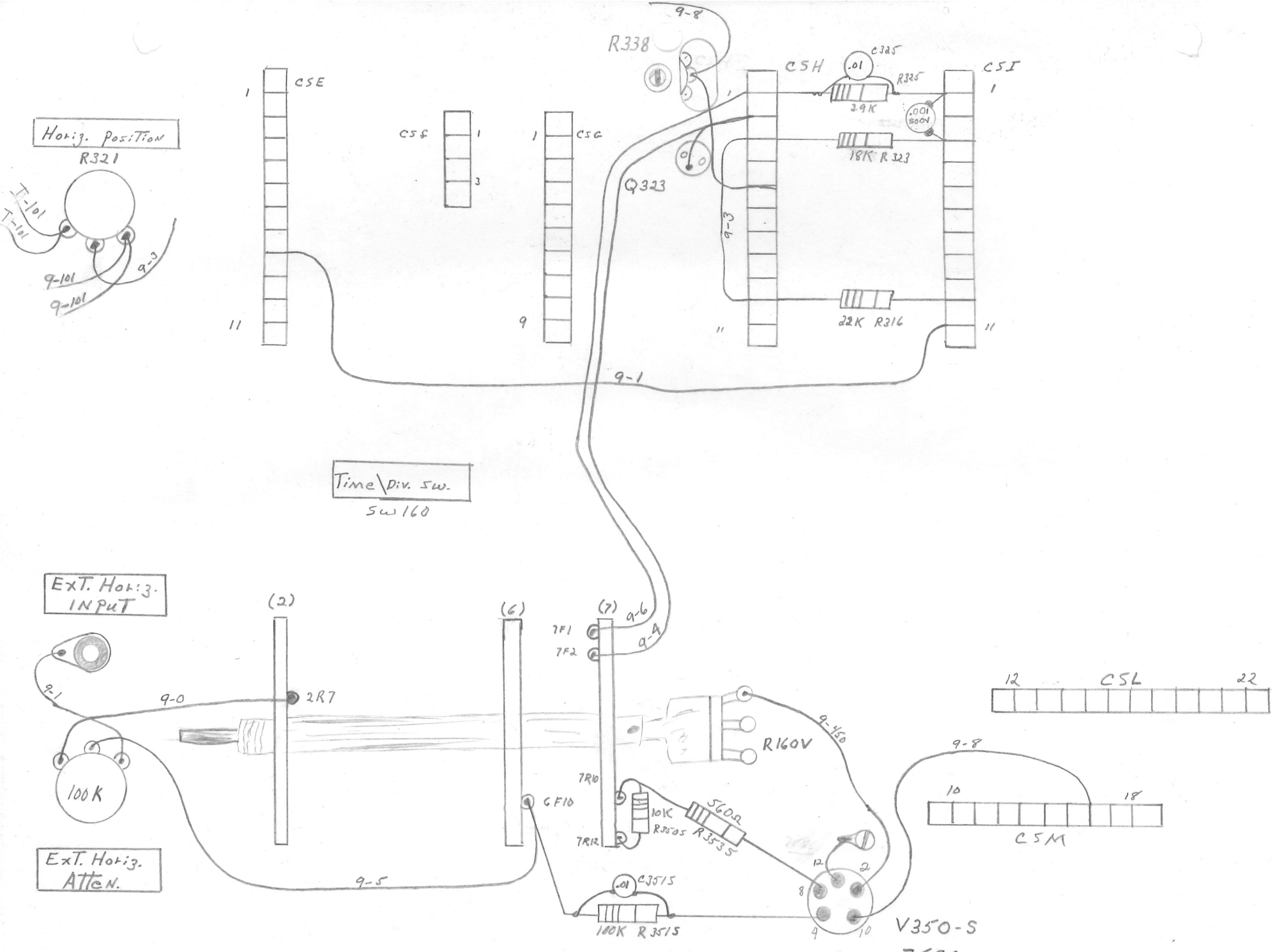
27. Add a 9-0 #26 wire from 2R7 to the outside arm of the new Horizontal Atten. control (100K pot).

28. Add a 9-1 #26 wire from the inside arm of the Horizontal Atten. control (100K pot) to the Horizontal input banana jack.

29. Add a .01 µfd 150v discap between CSI-1 and CSI-3. (Horizontal Amp Chassis).

30. Change the 6.8K 1/2w 5% resistor (R882) from CSI-5 to the Cal Adj. pot (R884) to a 5.1K 1/2w 5% resistor. (Vert. and Power chassis).

Ken Hedin/MJT

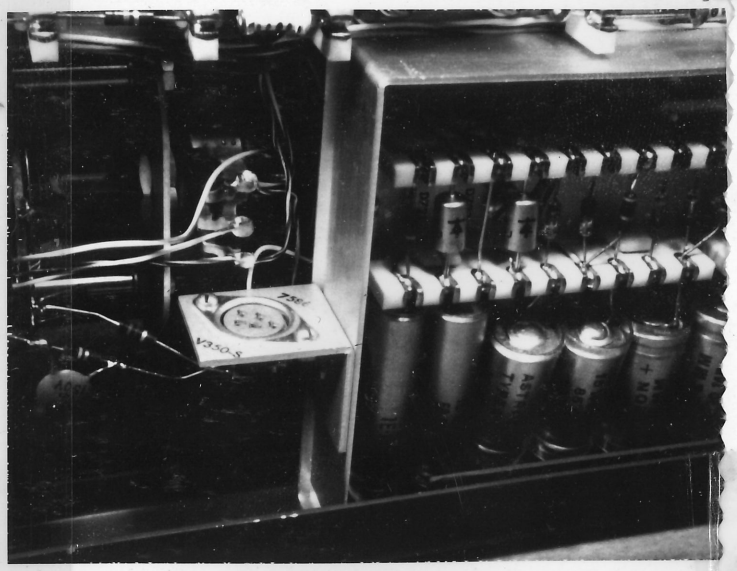


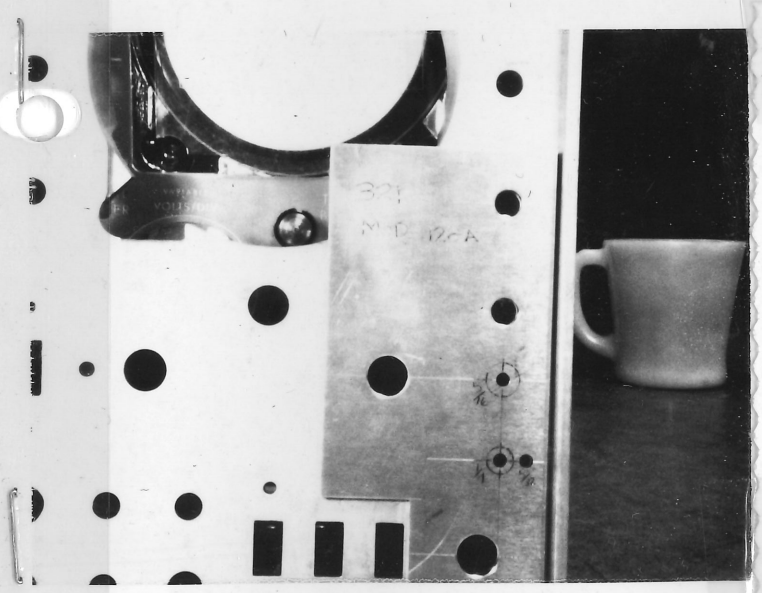
321 Mod 128A

8/20/67

321 MOD 128A 7/22/64

PHOTO'S





FOCUS

INTENSITY

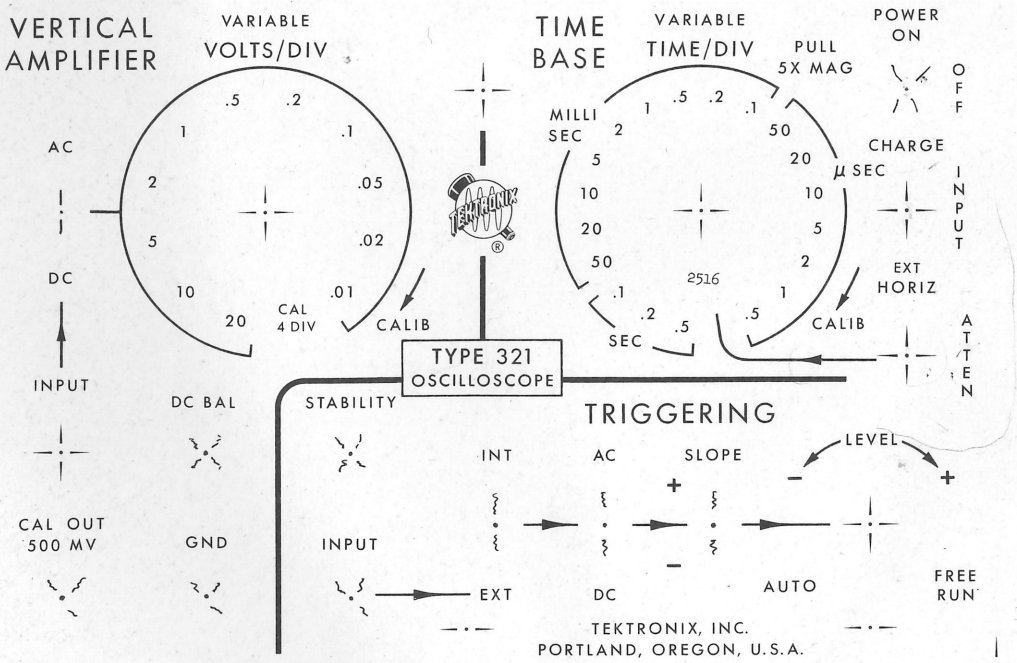
ASTIGMATISM

321 MOD 128
CHANGED "EXT HORIZ"
REQUEST OF MERV 7-9-64 HAB

SCALE ILLUM

VERTICAL POSITION

HORIZONTAL POSITION

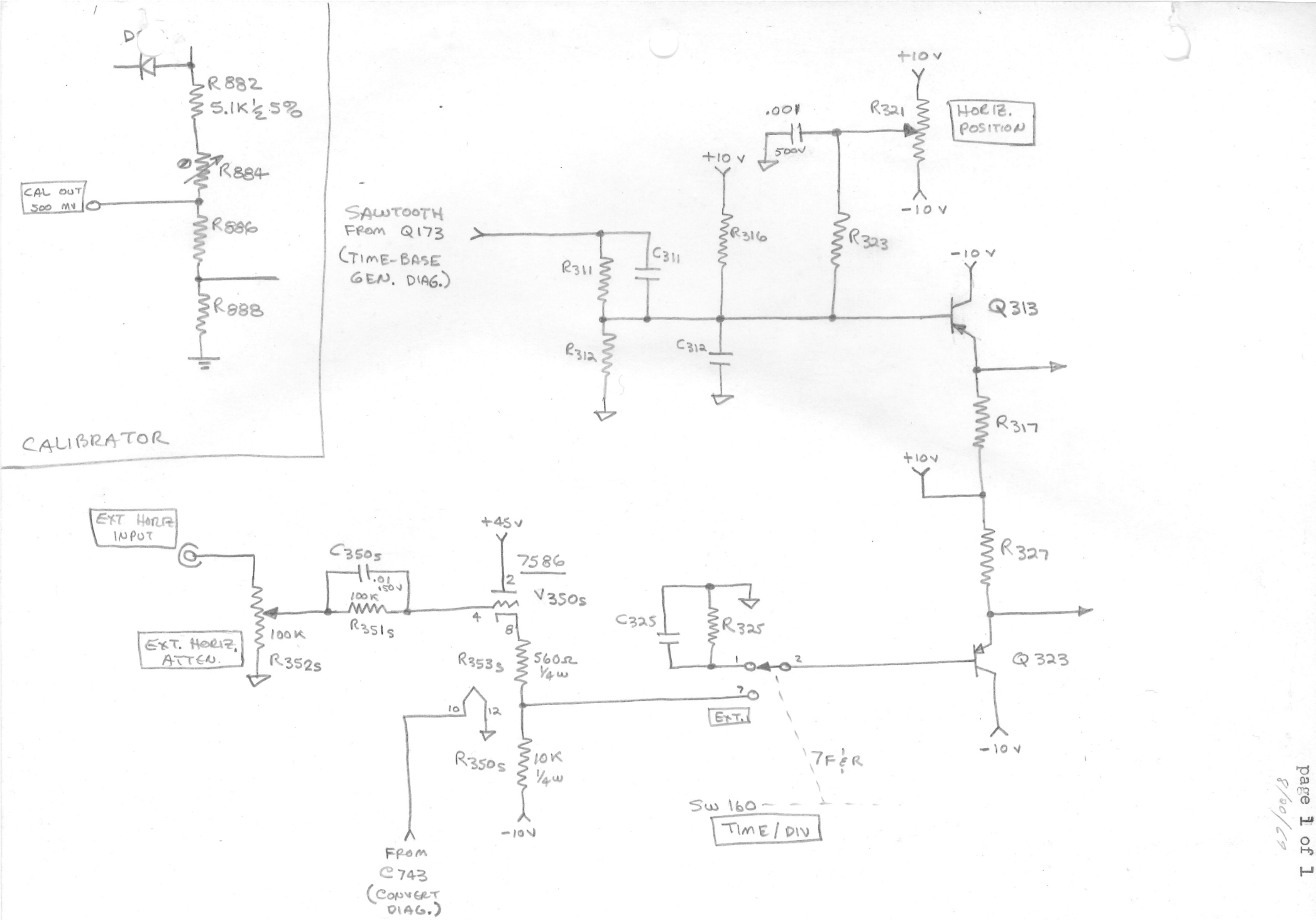


7/20/64

321 MOD 128A

CAL. PROCEDURE

Mod 128A increases the EXT. HORIZ. INPUT,sensitivity to about .28 v/div. with the Mag. off and about .056 v/div. with the Mag. on. The varible EXT. HORIZ. ATTENUATOR, control gives the complete range from zero to maximum sensitivity. Maximum frequency response occures at the maximum setting of the EXT. HORIZ. ATTEN.



321 MOD 128A

HORIZONTAL AMPLIFIER

6/00/8

TYPE 321
MOD 128A

HOW TO USE THIS INSERT

This insert is written to supplement the Instruction Manual furnished with this modified instrument. The information given in this insert will supersede that given in the manual.

10/64

TYPE 321
MOD 128A

The instrument for which this manual was prepared has been modified to provide a gain sensitivity of approximately 10 over standard with a 10:1 variable attenuator control. External horizontal input sensitivity is approximately .28 v/div with the Magnifier off and .056 v/div when the Magnifier switch is turned on. The EXT HORIZ ATTEN control varies the sensitivity of the external horizontal amplifier between zero and maximum rating.

Frequency response of the amplifier is maximum when the EXT HORIZ ATTEN control is at the maximum setting.

CHANGE IN RECALIBRATION PROCEDURE

In Step (1) 10 Volt Adjust, adjust R651 for a reading of exactly 9.5 volts. The voltages at the test points shown in Figures 6-1 and 6-2 should read 5% below the values given.

PARTS LIST

Parts changed in this modified instrument are listed below. When ordering replacement parts, specify instrument type, serial number and MOD number. For mechanical parts include the part number (or drawing number) and a description of the part. Include the part number and component value when ordering electrical parts.

CAPACITORS

C323S	Add	283-003	.01 μf	Cer	150 v
C350S	Add	283-002	.01 μf	Cer	500 v
C300	Delete	281-504	10 pf	Cer	500 v

RESISTORS

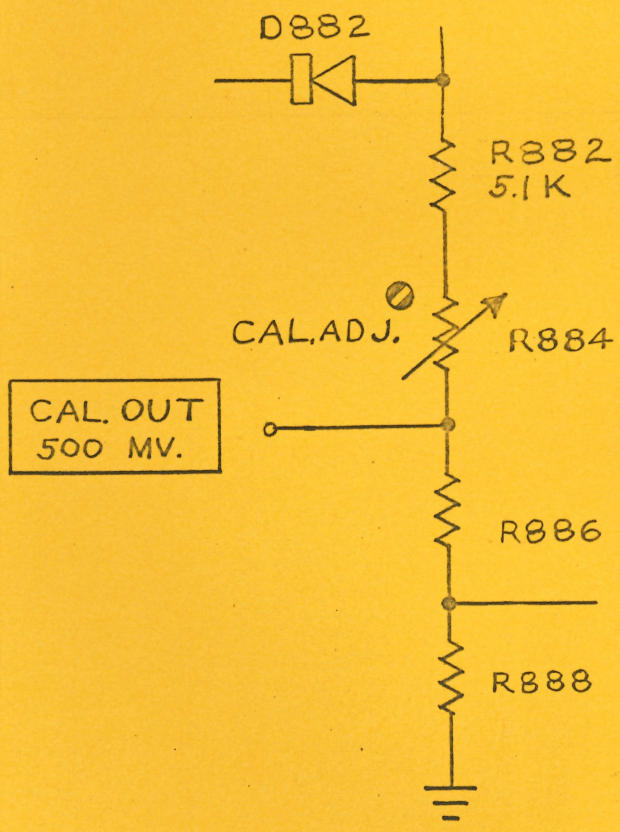
R300	Delete	316-683	68 k	1/4 w	10%	comp.
R350S	Add	316-103	10 k	1/4 w	10%	comp.
R351S	Add	316-104	100 k	1/4 w	10%	comp.
R352S	Add	311-347	100 k	Var.	10%	comp.
R353S	Add	316-561	560 Ω	1/4 w	10%	comp.
R882	Change to	301-512	5.1 K	1/2w	5%	comp.

VACUUM TUBES

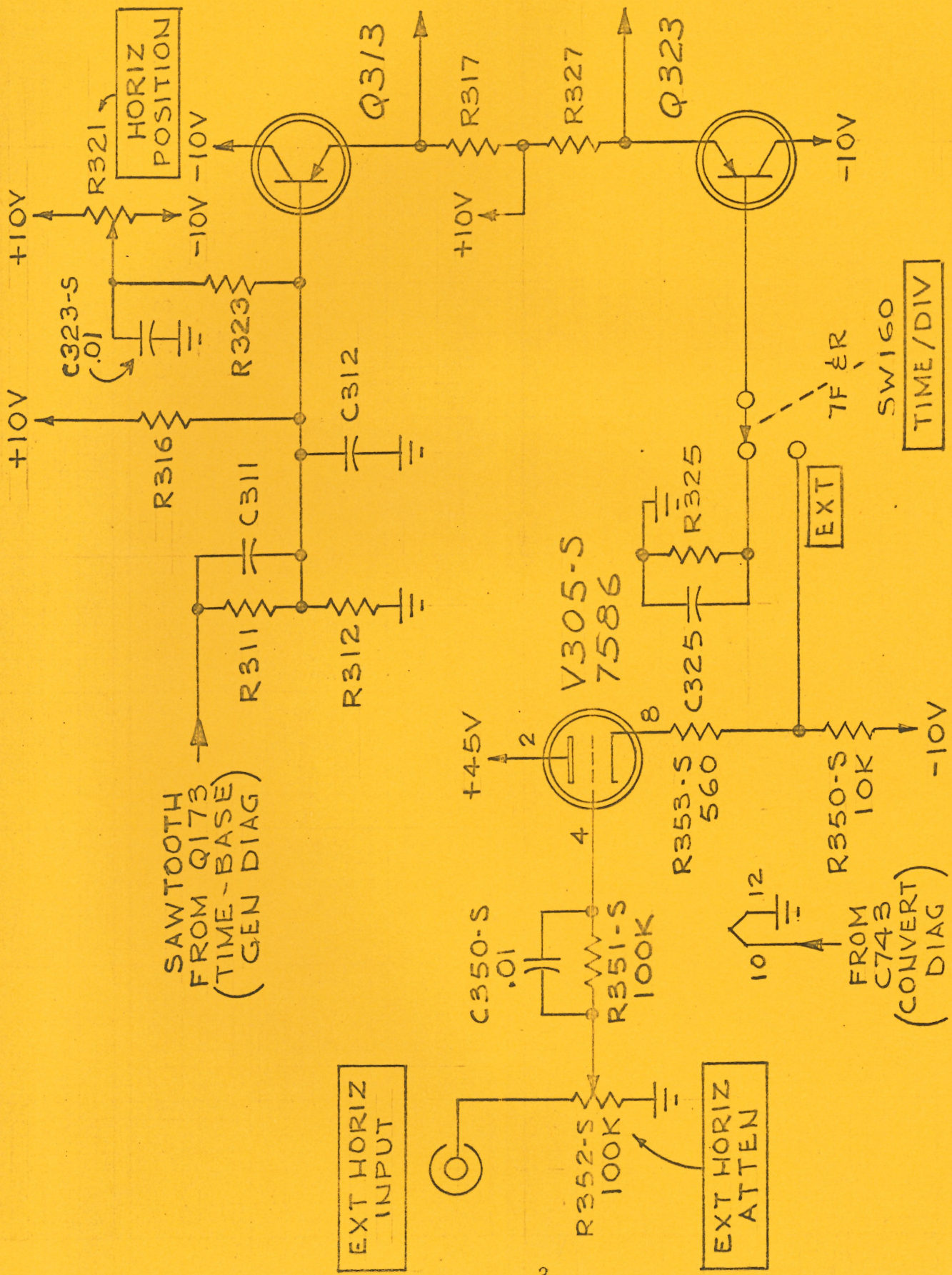
V350S	Add	154-306	7586 Nuvistor

MECHANICAL

BRACKET, Nuvistor	Add	Dwg A-S-374
FRONT PANEL, film #2516	Add	Dwg B-S-296
KNOB, Small Black	Add	366-205
SUBPANEL, Front	Add	Dwg D-S-174
SOCKET, Nuvistor	Add	136-101



CALIBRATOR
PARTIAL DIAGRAM

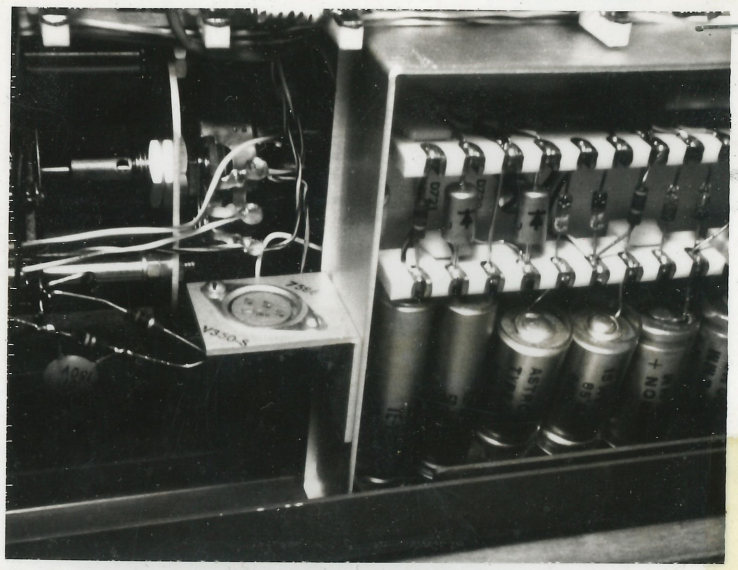


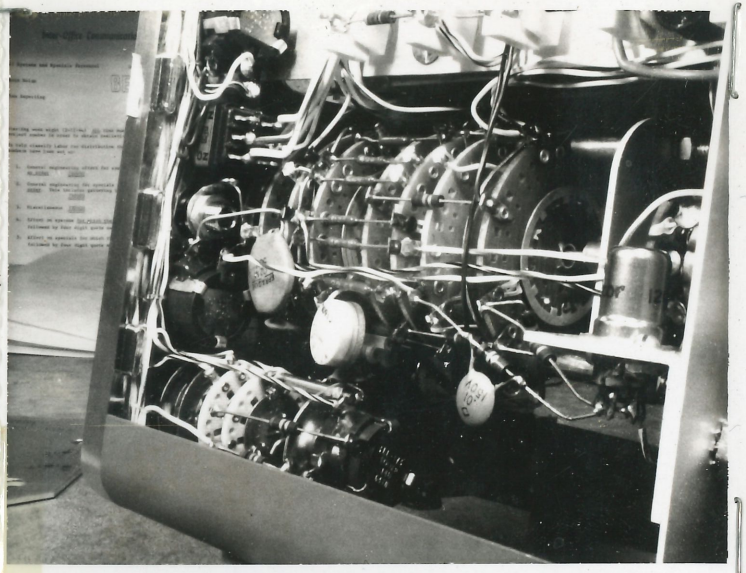
PART HORIZ AMP DIAG

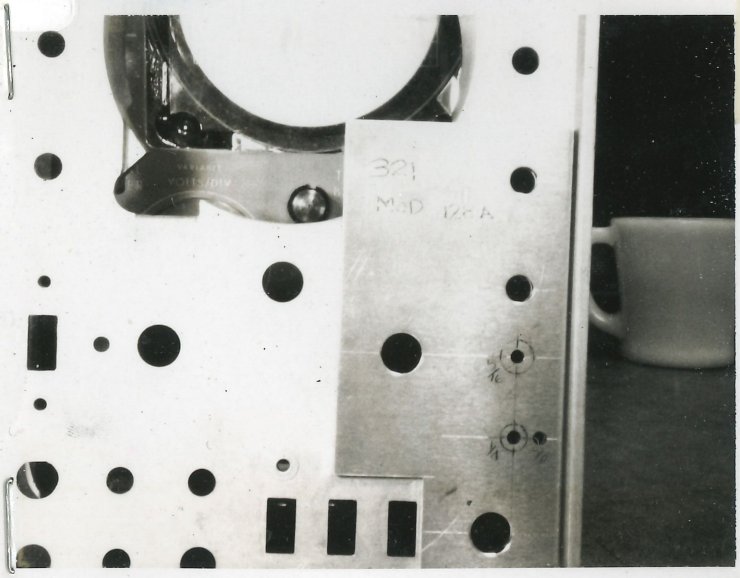
7/22/64

321 MOD 128A

PHOTO'S







CUSTOM MODIFICATION

(322)
INST 321A MOD 128A

BRIEF DESCRIPTION: Ext. Horiz. Input Gain of approx. X10 with a 10:1 variable Attenuator.

Qty.	Part No.	Status	Description
1	030-0390-01	Shop	Bracket, Transistor
1	034-0071-00	Elec. Chem.	Front Panel, film #2752, dwg. 030-0296-02
2	131-0235-00		Connector, Terminal
2	136-0095-00		Socket, Transistor
1	151-0108-00		Transistor, NPN, silicon
1	151-0133-00		Transistor, PNP, silicon
1	210-0202-00		Solder lug, #6 SE
4	213-0113-00		Screw, 2-32 x 5/16 thread forming
1	283-0003-00		Capacitor, .01µfd, 150V discap
1	302-0822-00		Res. Comp. 8.2K 1/2W 10%
1	311-0347-00		Res. Var. 100K
1	315-0101-00		Res. Comp. 100Ω 1/4W 5%
1	315-0153-00		Res. Comp. 15K 1/4W 5%
1	315-0272-00		Res. Comp. 2.7K 1/4W 5%
1	315-0332-00		Res. Comp. 3.3K 1/4W 5%
1	316-0104-00		Res. Comp. 100K 1/4W 10%
1	316-0126-00		Res. Comp. 12M 1/4W 10%
1	316-0682-00		Res. Comp. 6.8K 1/4W 10%
1	366-0270-00		Knob, grey, 1/8" shaft
2	358-0135-00		

REBATCH:

1	333-0830-00	Front Panel

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PARTS LIST
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CUSTOM MODIFICATION

INST. (322) 321A MOD 128A

1. Remove the front panel.

2. Position the new front panel and mark the new holes for Ext. Horiz. Input, and Attenuator.
   (a) Center punch and drill a 5/16" hole for the input, and a 1/4" hole for the attenuator.

3. Mount the new front panel and secure.

4. Add a 100K mini pot for Ext. Horiz. Attenuator. Mount with terminals up.

5. Add a strap from the Ext. Horiz. Input banana jack to the clockwise terminal of the 100K pot (as viewed from rear).

6. Add a strap from 2R7 of the Time/Div. Switch to the counter-clockwise terminal of the 100K pot (as viewed from rear).

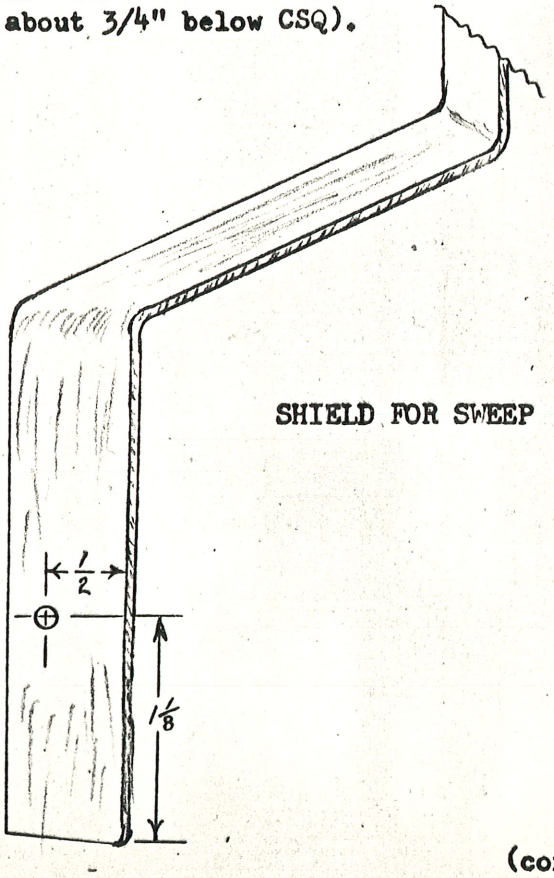
7. Add a 9-4 #26 stranded wire from 6F10 of the Time/Div. Switch to the center terminal of the 100K pot.

8. Remove C300 and R300 (resistor w/ capacitor in parallel), from 6F10 to 7R10 of the Time/Div. Switch.

9. Remove R301 (392K) from 7R7 to 7R10 of the Time/Div. Switch.

10. Mount a #6 solder lug to the rear of the bottom Time/Div. Switch strut screw.

11. Locate and drill a #23 hole for the transistor mounting bracket as follows: (This hole will be located between CSQ and the Time/Div. Switch, and about 3/4" below CSQ).



SHIELD FOR SWEEP

(continued on page 2.)

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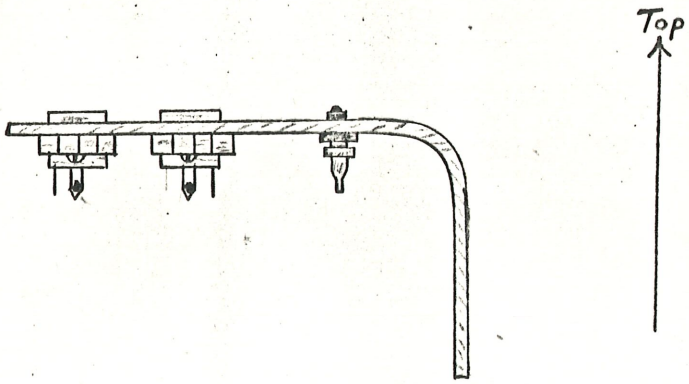
(continued from page 1.)

12. Mount the transistor sockets and tie points on bracket, 030-0390-02 as shown in sketch below:



13. Refer to the sketch in step 14 for each of the following steps:
    (a) Add a 12M resistor between the base of Q350-s and the emitter (-10V) of Q351-S.
    (b) Add a 3.3K resistor between the collector of Q350-s and the emitter (-10V) of Q351-s.
    (c) Add a strap between the collector of Q350-s and the base of Q351-s.
    (d) Add a 9-2 #26 wire between the emitter of Q350-s, and terminal #1.
    (e) Add a 100Ω resistor between collector of Q351-s and terminal #2.
    (f) Add a 6.8K resistor between terminal #1 and terminal #2.

14. Install bracket using hole drilled in step 11.(Mount with transistors up).
    (a) Add a 15K resistor from terminal #1 to the bottom lug of the Var. Time/Div. control (+10V).
    (b) Add a 8.2K 1/2W resistor from Terminal #2 to the bottom lug of the Variable Time/Div. control (+10V).
    (c) Add a 9-0 #26 wire from the collector of Q351-s to 7R10 of the Time/Div. Switch.
    (d) Add a T-100 (-10V) wire from emitter of Q351-s to 7R12 of the Time /Div. Switch.
    (e) Add a 2.7K resistor from the emitter of Q350-s to ground on solder lug on rear of Time/Div. Switch.
    (f) Add a 100K and a .01µfd discap (parallel combination) from the base of Q350-s to 6F10 of the Time/Div. Switch.

SEE SKETCH AT TOP OF PAGE 3.

(continued on page 3.)

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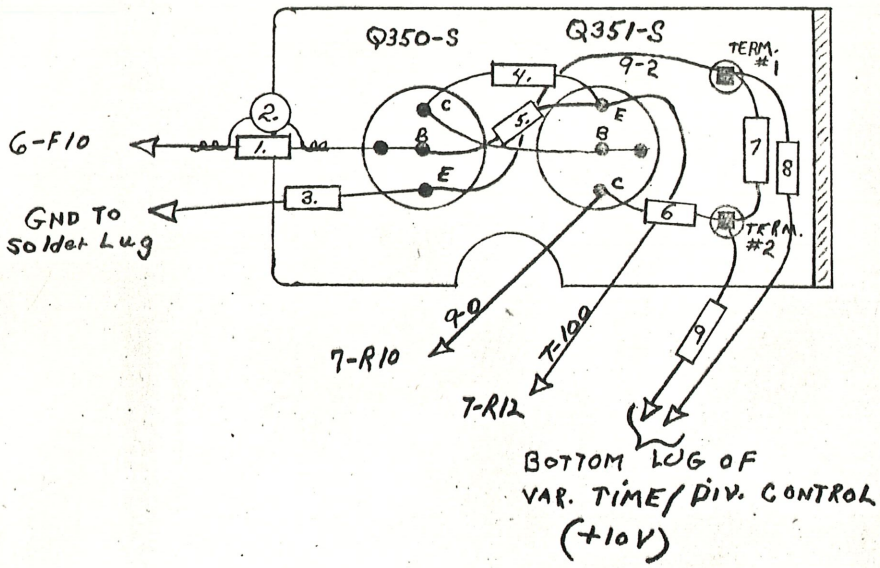
(continued from step 14 page 2.)



CODE

1. 100K 1/4 W 10%
2. .01µfd 150V disc.
3. 2.7K 1/4W 5%
4. 3.3K 1/4W 10%
5. 12M 1/4W 10%
6. 100Ω 1/4W 5%
7. 6.8K 1/4W 5%
8. 15K 1/4W 5%
9. 8.2K 1/4W 10%

Q350-S ...151-0133-00
Q351-S ...151-0108-00

15. Rubber stamp bracket, using correct "Q" numbers.

16. Install 366-0270-00 knob for Var. Horiz. Input.

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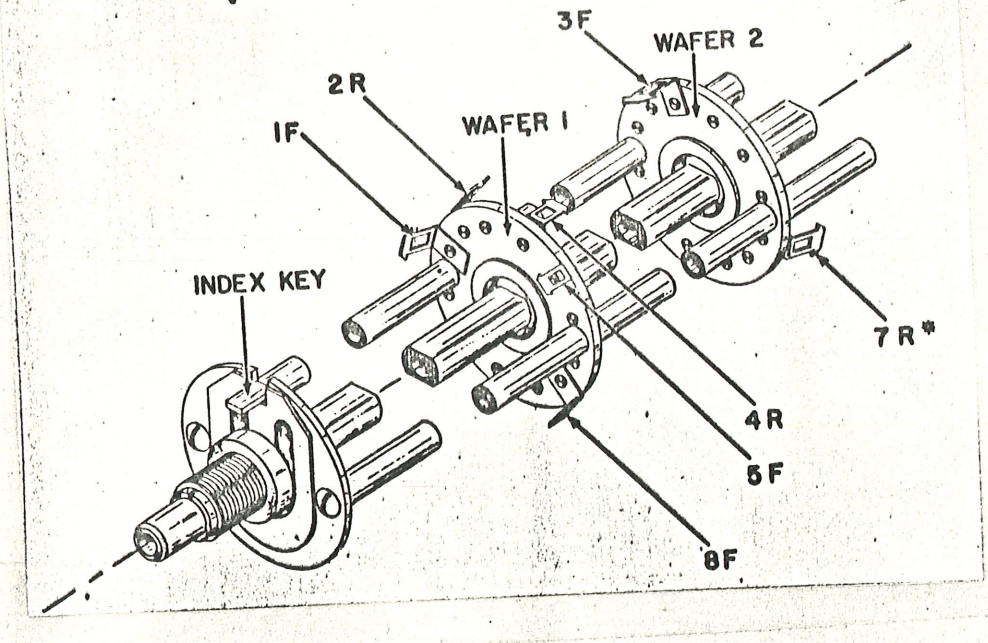
(TYPICAL SWITCH CONFIGURATION)



SHT 1 OF 3	PART/TYPE NUMBER 321A 128A	REV A

PART/TYPE NUMBER 321A 128A REV A

1. Purpose. This drawing is the primary reference document for a standard Tektronix product with modifications as described.

2. Standard Product Characteristics. Except as detailed below, product characteristics not the direct object of modification are the same as for the standard product. Accessories normally furnished with the standard product are included unless otherwise indicated.

3. Reference Documents. Relevant portions of the following documents are incorporated by reference:
   None

NAME		DATE
BY	Geoff Gass	12-13-67
CHK		
ENGR	D.L.O.	12-14-67
PROD		

TEKTRONIX, INC.
P.O. BOX 500
BEAVERTON, OREGON, U.S.A. 97005

[XX] INSTRUMENT [ ] ACCESSORY

FOR USE WITH

PRODUCT NOMENCLATURE: Tektronix Type 321A Mod 128A Oscilloscope

Short Form: Type 321A Mod 128A
Order Number: 321A128A
Nature of Modification: Direct coupled Ext. Horiz. preamp & variable attenuator for 0.1 V/div sensitivity.

SIZE	CODE IDENT. NO.	PART/TYPE NUMBER	REV
A	80009	321A 128A	A

4. Description. The Type 321A Mod 128A is a Tektronix Type 321A Oscilloscope equipped with an External Horizontal Input Preamplifier and Attenuator control providing continuously variable horizontal deflection sensitivity to approximately 0.1 V/div.

5. Requirements.

5.1 External Horizontal Input Preamplifier. A direct-coupled preamplifier shall be added to the External Horizontal Input circuit, providing a maximum sensitivity in the Ext Horiz mode of approximately 0.1 V/div.

5.2 Attenuator. A continuously variable Ext Horiz ATTEN control shall be provided at the front panel, providing usable sensitivity range of 30:1 or greater.

5.3 Instruction Manuals. Furnished instruction manuals shall include addenda for those portions affected by Mod 128A.

6. Characteristics.

6.1 EXT HORIZ INPUT.

6.1.1 Sensitivity. With the Ext Horiz ATTEN control clockwise and the 5X MAG On, input sensitivity is 0.1 V/div ±10%. With the 5X MAG Off, sensitivity is approximately 0.5 V/div.

6.1.2 Bandwidth. Horizontal system bandwidth at maximum sensitivity is dc to 1MHz or greater at the -3dB point. Bandwidth is reduced at mid-range settings of the ATTEN control.

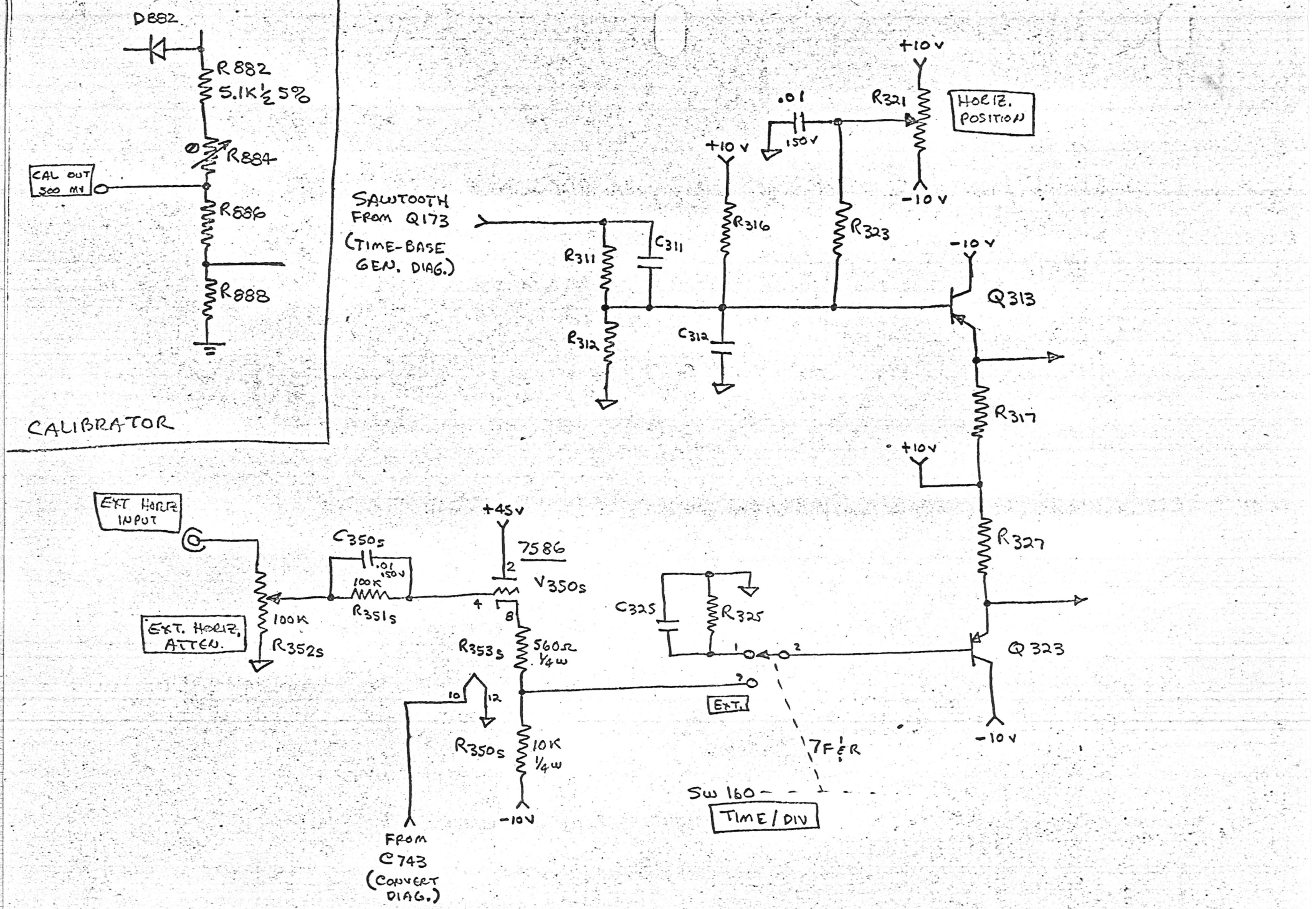
6.1.3 Input RC Characteristic. Small-signal low-frequency input shunt RC characteristic (ATTEN clockwise) is 100kΩ ±25% paralleled by not more than 40pF.

6.1.4 Dynamic Range. Usable input dynamic range is ±10 div deflection or more with the 5X MAG On for low frequencies. With the 5X MAG Off, linear dynamic range is confined to approximately ±3 div. from the quiescent (no input) point.

6.1.5 Maximum Input. With the Ext Horiz ATTEN control clockwise, 10V dc or peak AC input will not damage the equipment.

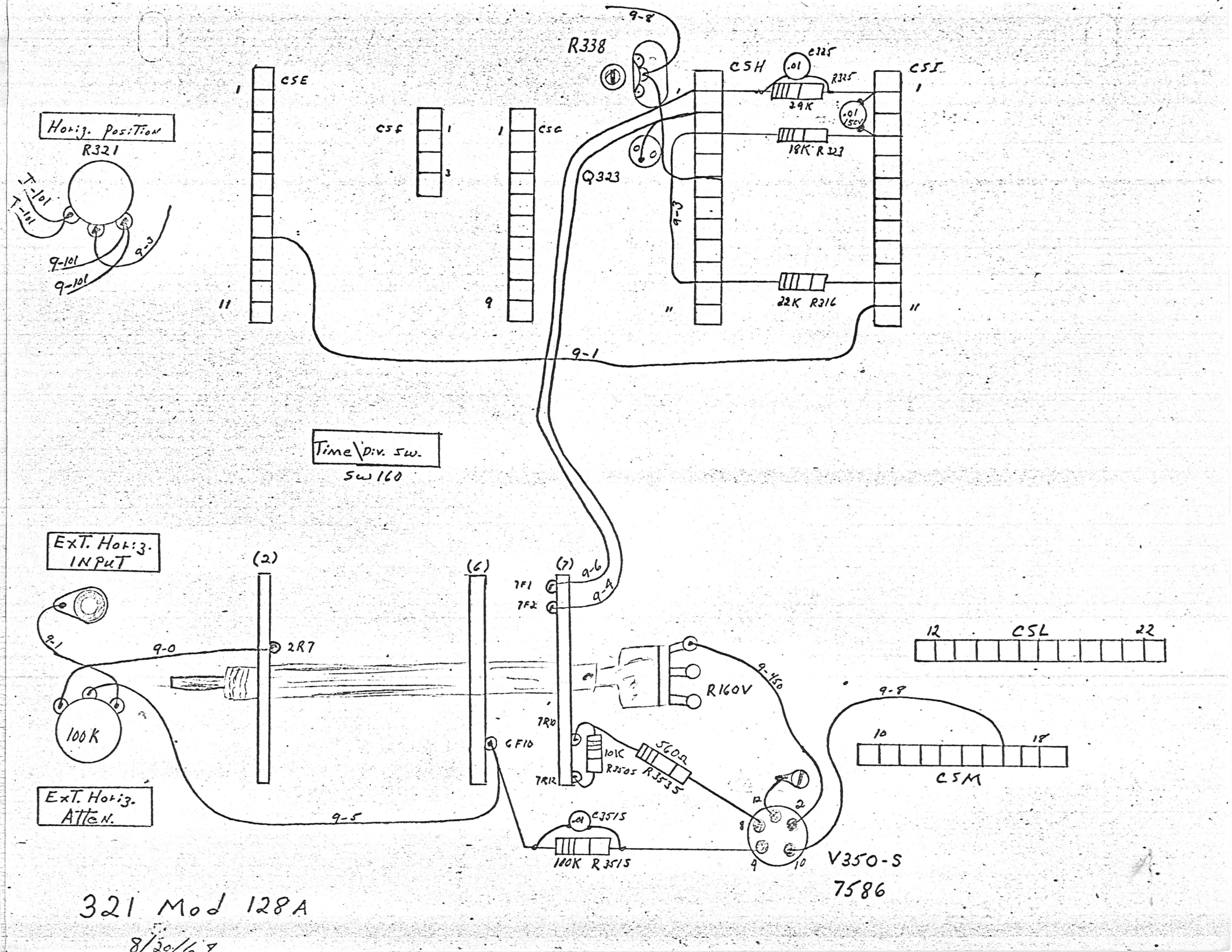
INDEX TO REVISIONS

	ENGR. Date	RELEASED Date
Rev. A Rewritten with added requirements & characteristics detail. Geoff Gass, 12-13-67.		12-14-67



321 MOD 128A

HORIZONTAL AMPLIFIER



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8/20/68