This service guide contains the following information.

1. Front Panel Checkout and Adjustment Procedure
2. Determination of Factory Selected Components
3. Troubleshooting Tips
4. Most Frequent Problems
5. Recommended Service Notes and Production Memos

1. The Front Panel Checkout and Adjustment Procedure is given in Table 1.

2. Determination of Factory Selected Components.

		Low	Normal	High
C2	Prevent high frequency oscillations during Phase Lock. See Service Note 3302A-3.	30 pF	47 pF	120 pF
R10	Prevent free run with START/STOP PHASE set at ±90°. Decrease value of R10 if START/STOP Phase cannot be adjusted to +90°. Increase value if 3300A free funs or produces more than one cycle in single cycle mode. Also, see Service Note 3302A-1.		56 Ω	68 Ω
A1C5	Adjust PHASE dial at 100 kHz	390 pF	460 pF	680 pF
A1R7	Adjust plus and minus trigger levels.	900 K	1 M	1.5 M
A1R21	Improve triggering characteristics of Schmitt trigger circuit.	--	47.5 K	56.2 K
A1R37	Adjust range of R2, 180° Phase Adjust.	215 K	221 K	---
A1R67	Adjust trigger amplitude level and prevent free running in single or multiple cycle mode. See Service Note 3302A-1.	3 M	5.1 M	8 M

3. Troubleshooting Tips. Hidden wire crimping cuts. If the crimping machine was not correctly adjusted, a few removals of female pin connector (especially if not performed with pliers) results in intermittent contact in the female connector. If unit is not locked firmly into mainframe, the single and multiple cycle modes may trigger with light jars on the front panel.

4. Most Frequent Problems.

a.	Distortion on 10 Kc range.	C25 bad
b.	Fifth and tenth harmonics of 1000 cps very difficult to lock on.	C19 bad

(OVER)

Table 1. Front Panel Checkout and Adjustment Procedure

Check	Test Equip	3300A Settings	3302A Settings	Prod Spec	Com Spec	Adjustment
Free Run	Scope dc to 20 Mc	A & B Amp cw for all checks All functions	Free run			3300A free runs
Single and Multiple Cycle	Scope and Oscillator	Frequency > oscillator	Single then multiple			Check input phase switch
Trigger	0 - ±1.5V supply		Multiple External, input phase + then -	Between 0 and ±100 mV	Between 0 and ±1 V	
Freq Dial Calibration	Oscillator and Scope	SINE, Range X100; Freq dial 1 for R5 Adj; Freq dial 10 for R6 Adj. Adj osc. in same manner.	Phase Lock Cal, < 50 Kc Input Phase +			Adj. R5 to center phase lock meter when dial on 1. Adj R6 to center phase lock meter when dial on 10
Phase Lock Dial	Oscillator and Scope	SINE, Range X100; dial 10 (Osc. set as 3300A) After phase check, set 3300A to X10 range and dial at 1 and recheck.	No change Input phase -		±10° to 10 KHz ±20°, 10 KHz to 100 KHz	With dial at 0° and phase locked, adj R3 for coincident osc. & 3300A waveforms. With dial at 180° & phase locked, adjust R2 for coincident wave forms.
Distortion	Distortion Analyzer	Check all ranges with dial at 1 and at 100 Kc	Still phase locked	Introduced distortion	1% to 10 Kc 3% 10 Kc -100 Kc	None
Overshoot (C28) Adj	Scope and Oscillator 10 Kc	100 Kc, Sine	Single cycle External, Input phase +, > 50 Kc			Adjust C28 for no sag or overshoot at end of single wave.

4. Most Frequent Problems (cont'd).

c. Free runs when in single cycle at 100 Kc only.	C14 open
d. ± trigger level off at 100 cps, okay other frequencies.	Phase lock bad C11 open
e. No output when in SINGLE MODE and -INPUT PHASE.	CR1 open
f. 10 cps distortion and bad lock on X10 range.	C17 open
g. 3302A makes 3300A power supply oscillate.	A1C3
h. Intermittent distortion	A1R1
i. Won't phase lock on square wave, slips out of phase lock.	A1Q12, A1Q14, A1Q15

5. Service Notes and Production Memos.

The attached Service Notes and Production Memos help 3302A's, with the appropriate serial number, to function much better.

NOTE

Service Note 3302A-1 also prevents multiple cycles when in single cycle mode. In other words, it will prevent two or three cycle output when only one is desired.

-hp- Model 3302A Trigger Phase Lock Plug-in
Serial Numbers 540-00600 and below

MODIFICATION TO PREVENT FREE RUNNING IN SINGLE OR MULTIPLE CYCLE OPERATION

Here is a modification for your Hewlett-Packard Model 3302A Trigger Phase Lock Plug-in to prevent free running in single or multiple cycle operation. If your Model 3302A has serial number 540-00601 or above, it was modified at the factory.

A high speed electric drill and a number 55 bit are the only special tools required for this modification.

PARTS REQUIRED.

	-hp- Part No.
1 each R67 5.1 MΩ ±5%, 1/4 w	0698-5094
1 each R68 10 KΩ ±5%, 1/4 w	0683-1035

MODIFICATION PROCEDURE.

1. Removal of printed circuit board A1.

   a. Disconnect the brass single pin female connectors from printed circuit board A1. The connectors should be removed by using a pair of needle-nose pliers. Since the connectors are held tightly to the pins, care should be taken to restrain the pliers from striking the chassis when the pins come loose. The pull should be straight (not at an angle) to prevent damage to the pins.

   b. Remove the four screws securing printed circuit board to chassis.

2. Location and drilling of holes.

   a. Position A1 board with component side up and pins 1 through 23 across the top. See Figure 1 below; locate points A, B, and C. These points are in the upper left hand corner of the board.

   b. Place the printed circuit board on a piece of cardboard to provide a solid base for drilling. Position drill points A, B, and C in the center of the etched conductors. Drill holes using a number 55 bit in a high speed electric drill.

3. Installation of R67 and R68.

   Referring to Figure 1, install R67 and R68. Solder points A, B, and C. Points A and C should be soldered on both sides of the board. Clean flux from solder joints.

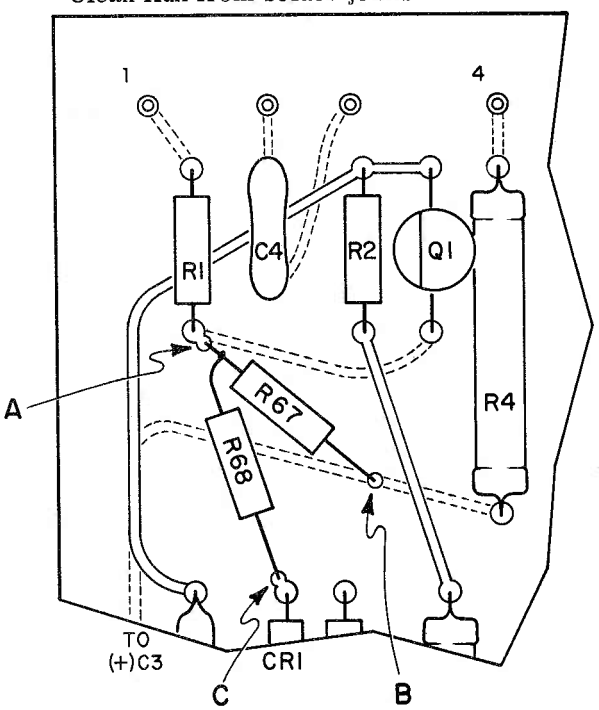

Figure 1. Board Location of R67 and R68

4. Reinstallation of printed circuit board.

   By using the printed circuit board layout in the Maintenance Section of your 3302A Operating and Service Manual, reconnect female connectors to pins. Reinstall four screws.

3/66-9

5. Performance Check.

   Plug the 3302A into the 3300A. Perform the Trigger Amplitude Check outlined in the Maintenance Section of your 3302A Operating and Service Manual.

6. Adjustment.

   a. With the input phase switch set to - (minus), the 3300A/3302A should start and stop oscillating between 0 and -500 millivolts. If oscillation does not occur between 0 and -500 millivolts, increase the value of R67.

   b. With the input phase switch set to + (plus), the 3300A/3302A should start and stop oscillating between 0 and +500 millivolts. If oscillation does not occur between 0 and +500 millivolts, decrease the value of R67.

   c. The final value of R67 should be between 3 megohms and 8 megohms.

7. Change the schematic diagram in your 3302A Operating and Service Manual as shown in Figure 2 below.

This completes the modification.

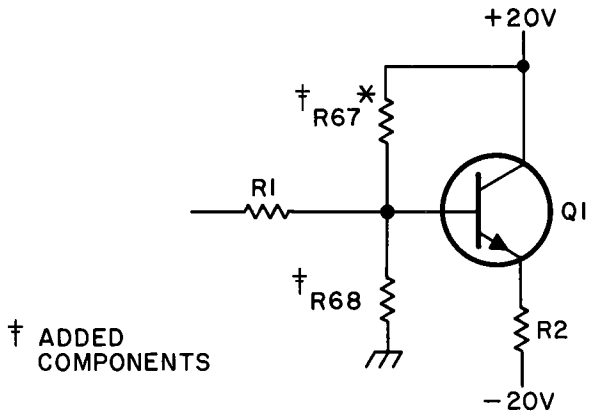

Figure 2. Circuit Location of R67 and R68

-hp- Model 3302A Trigger Phase Lock Plug-In
(Instruments with Top Covers)

The following modification will prevent the top cover of the Hewlett-Packard Model 3302A from shorting the case ⏚ to the inner chassis ▽ through the lock-range meter bracket screws. The top cover can be either removed completely or modified.

The modification merely involves cutting out two half circles in the top cover directly above the meter bracket screw heads. This can be done easily by using a 1/4" rat tail file or a sheet metal punch.

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-hp- Model 3302A Trigger Phase Lock Plug-in
Serial Numbers 540-00312 and below, and
540-00320, 00336, 00348, 00359, 00383,
00385, 00393, and 00394

SPURIOUS OSCILLATION IN PHASE LOCK OPERATION

If your Hewlett-Packard Model 3302A Trigger Phase Lock Plug-in tends to shift phase in phase lock mode, of if phase dial tracking is off at the higher frequencies, perform the following check for high frequency oscillations.

HIGH FREQUENCY OSCILLATION CHECK.

Set up the 3300A/3302A as follows:

3300A

RANGE X10K
CHANNEL A . . . . . SINE
AMPLITUDE . . . . . full CCW

3302A

MODE . . . . . Phase Lock
FREQUENCY . . . . . > 50 KHz

Monitor a single cycle of Channel A output with an oscilloscope as the RANGE dial is slowly rotated from 1 to 10. If high frequency oscillation is present, install (C2*) a fixed mica capacitor, 300 vdcw, across pins 7 and 8 of S4BR MODE switch. See Figure 1 for location. The required capacitance will be between 30 pf and 120 pf. Select the smallest possible value which eliminates oscillations.

After installation of the capacitor, perform the Frequency Dial Check outlined in the Maintenance Section of your Operating and Service Manual and, if necessary, adjust R5 and R6 (LOW and HIGH) FREQUENCY DIAL ADJUSTMENTS. Include the capacitor in your schematic diagram.

Instruments with serial numbers 540-00313 and above, except those indicated in this service note, have the capacitor factory installed.

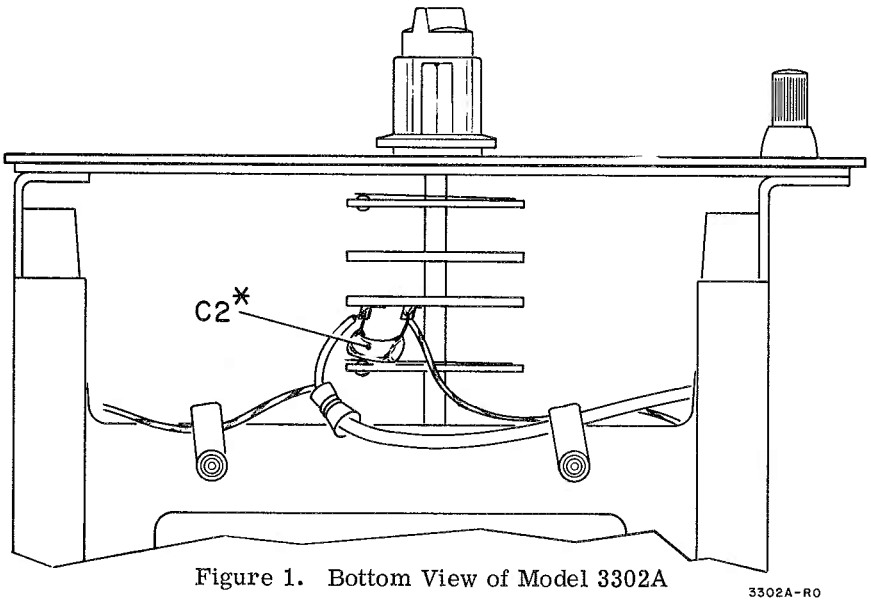

Figure 1. Bottom View of Model 3302A

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-hp- Model 3302A Trigger/Phase Lock Plug-in
Serial No. 650-01000 and below

MODIFICATION TO PREVENT LOW AMPLITUDE OSCILLATION IN FREE RUN MODE

Here is a modification for your Hewlett-Packard Model 3302A Trigger/Phase Lock Plug-in to eliminate high frequency oscillation on square wave function when amplitude control is turned to low end. This modification should be made only if high frequency oscillations are present. If your Model has serial number 650-01001 or above, it was modified at the factory.

PARTS REQUIRED

One resistor A1R69	1.0 KΩ, ±5%, 1/4 w	-hp- Part No. 0683-1025

MODIFICATION PROCEDURE

1. Removal of printed circuit board A1.

   Disconnect the brass single pin female connectors from printed circuit board A1 by using a pair of needlenose pliers.

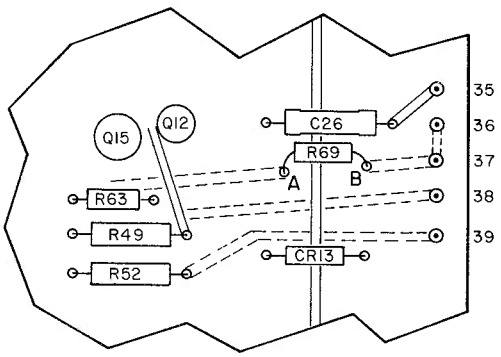
   Remove the four screws secruing printed circuit board to chassis.

2. Location and drilling of holes.

   Position A1 board with component side up and pins 26 through 51 down the right side. See figure below; locate points A and B in the center of the etched conductors. Drill holes using a number 55 bit in a high speed electric drill.

3. Installation of A1R69.

   Refer to figure for installation of A1R69. Solder points A and B, and clean flux from solder joints. Scrape off etched connector between resistor leads.



4. Reinstallation of printed circuit board A1.

   Use the printed circuit board layout in the Maintenance Section of your 3302A Operating and Service Manual to reconnect female connectors to pins. Reinstall four screws. After installtion of A1R69, there is normally no special check or recalibration necessary.

March 1967-9

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HEWLETT hp PACKARD

PRODUCTION MEMO

3302A-1-66

FROM: -hp- Loveland Division

SUBJECT: Reducing Phase Jitter; Cleaner Waveforms; Stability Improvements in Single, Multiple and Phase Lock Mode

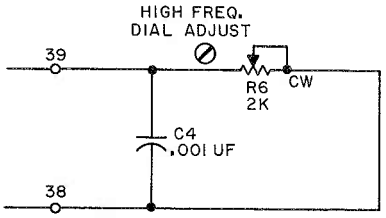
INSTRUMENTS: -hp- Model 3302A Trigger/Phase Lock Plug-in Serial Number 617-00700 and below

The following improvements should be done on customer's demand. Please note that some changes dictate others.

1. REDUCING PHASE JITTER.

To reduce phase jitter in Phase Lock Mode, install a capacitor C4, 0.001 μF ±20%, 250 vacw, -hp- Part No. 0160-0195, in parallel with R6, High Frequency Dial Adjust Potentiometer. Instruments with serial numbers 624-00701 and above have this capacitor installed at the factory. Locate C4 on the terminals of R6.

Change schematic as shown below.



2. REDUCING PHASE JITTER AND IMPROVING PHASE LOCK STABILITY.

To reduce phase jitter in Phase Lock Mode and to improve phase lock stability, change A1R21 to 47.5 k Ω ±1%, 0.5 w, -hp- Part No. 0757-0852. This change improves the triggering characteristics of the Schmitt Trigger Circuit.

Instruments with the following serial numbers have the 47.5 k Ω resistor factory installed.

540-00597 and above	540-00525	540-00558
540-00502	540-00527	540-00560
540-00506	540-00528	540-00562
540-00507	540-00530	540-00563
540-00511	540-00532	540-00565
540-00512	540-00533	540-00568
540-00516	540-00539	540-00572
540-00517	540-00541-45	540-00575
540-00519	540-00547-49	540-00577
540-00521	540-00551	540-00579-82
540-00524	540-00552	540-00584-89
	540-00555	540-00593-95

There are no readjustments necessary after A1R21 is changed.

3. CLEANER WAVEFORMS.

Where cleaner waveforms are required from the 3300A/3302A combination, install R8 and R9, which help reduce amplitude of switching transients on output waveforms. Model 3302A's with serial numbers 617-00601 and above were modified at the factory.

NOTE

If modification 3 is required, modifications 4 and 5 will also be required.

PARTS REQUIRED FOR MODIFICATION

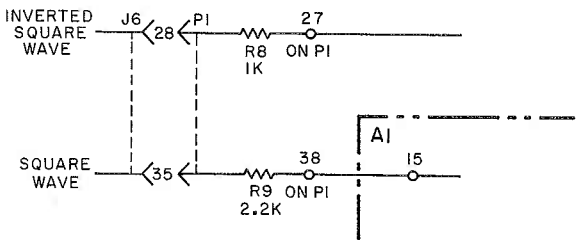
Qty	Ckt Ref	Description	-hp- Part No.
1	R8	1000 Ω ±5%, 1/4w	0683-1025
1	R9	2200 Ω ±5%, 1/4w	0683-2225

NOTE

1/2 w resistors can be used for 1/4 w resistors. -hp- Part No. 0686-1025 and 0686-2225.

Move the gray wire on the 50 pin connector on the rear panel from pin 28 to 27 and solder R8 between pins 27 and 28. Move the white/gray wire on the 50 pin connector from pin 35 to 28 and install R9 between pins 35 and 38.

Change the schematic as shown below.



There are no readjustments necessary, however, perform modifications 4 and 5 which follow.

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4. IMPROVING RELIABILITY OF SINGLE CYCLE OPERATION.

To reduce the tendency of the 3302A to produce more than one cycle in single cycle mode, replace A1C13 and A1C16 with -hp- Part No. 0140-0216 (120 pF ±2% 300 vdcw).

Instruments with serial numbers 624-00701 and above already have been modified at the factory. It is recommended that this modification be performed at least on instruments modified per paragraph 3 and on instruments with serial numbers between 617-00601 and 617-00700.

There are no readjustments necessary. This is the same modification as in Service Note 3302A-4, paragraph 3.

5. IMPROVING MANUAL TRIGGER OPERATION.

To assure reliable manual trigger operation in single and multiple cycle mode, change A1R23 to 820 Ω ±5%, 1/4 w, -hp- Part No. 0683-8215.

Only instruments modified per Modification 3 above and instruments with serial numbers between 617-00601 and 617-00700, except 617-00612, 619, 622, 661, 665, 667, 673, 679, 685, 687, and 688 require this change. Instruments with serial numbers 624-00701 and above are modified at the factory.

-hp- Model 3302A Trigger/Phase Lock Plug-in
Serial Number 624-00700 and below, except those listed

MODIFICATIONS TO IMPROVE STABILITY IN SINGLE AND MULTIPLE CYCLE MODE

Here are two modifications for the Model 3302A Trigger/Phase Lock Plug-in.

1. ASSURE OSCILLATIONS WITH START/STOP PHASE FULLY CCW.

To assure oscillations in single and multiple cycle mode with the START/STOP PHASE control R4 in ccw position (-90^{O}), install an additional resistor R7, average value 100 Ω±10%, 1/2 w, -hp- Part No. 0687-1011 in series with R4 and -20 V supply.

Model 3302A's with serial numbers 617-00601 and above were modified at the factory.

To install R7, move both white/brown/violet wires from solder lug (A) on the front half of R4 to the free solder lug (B) on the upper side of the rear half of R4. Install R7 between lugs A and B. Solder.

Check START/STOP PHASE at -90^{O}. If START/STOP PHASE cannot be adjusted to -90^{O} or less, decrease the value of R7. If no signal is produced by the Model 3300A with START/STOP PHASE control R4 in ccw position (-90^{O}), increase the value of R7.

2. PREVENT FREE RUNNING WITH START/STOP PHASE FULLY CW.

To prevent free running in single or multiple cycle mode with the START/STOP PHASE control R4 in cw position ($+90^{O}$), connect an additional resistor R10, average value 56 Ω ±10%, 1/2 w, -hp- Part No. 0687-5601, in series with R4 and circuit ground.

Model 3302A's with the following serial numbers have been modified at the factory.

624-00701 and above
617-00612
617-00619
617-00622
617-00661
617-00665
617-00667
617-00673
617-00679
617-00685
617-00687
617-00688

To install R10, remove and discard the white/black wire between R4 and the three-lug terminal on the left side chassis. Move the remaining white/black wire from R4 to the other white/black wires on the described terminal.

Install R10 between the white/black wires on the three lug terminal and the lug on R4, where the white/black wires have been previously removed. Solder all connections.

Check START/STOP PHASE at $+90^{O}$. If START/STOP PHASE cannot be adjusted to $+90^{O}$, decrease the value of R10. If the Model 3300A free runs or produces more than one cycle when triggered in single cycle mode, increase the value of R10.

Bill Lewis:sd October 1966-9

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FROM: -hp- Loveland Division

SUBJECT: Modification to Reduce the DC Drift of the Baseline in Single and Multiple Cycle Mode as a Function of Frequency

INSTRUMENT: -hp- Model 3302A

This modification will be useful to those customers who use their 3300A/3302A as a driving function for a mechanical system (i. e. to drive a hydraulic system that will cycle stress on a member until it breaks). These customers are only interested in the low frequencies because of the frequency response of a mechanical system. A system of this type is made by MTS Systems Inc. of Minneapolis, Minnesota.

NOTE

This modification will cause high distortion of the waveforms at frequencies above 50 KHz.

Typical Baseline Drift as a Function of Frequency

3302A in single/multiple cycle mode. 3300A amplitude control set for maximum.

Frequency Decade of 3300A	Baseline Drift Over a Frequency Decade	
	Before Mod.	After Mod.
X. 01 & X. 1	200 mV	13 mV
X1 & 10	760 mV	130 mV

NOTE: The above figures are typical only and are not guaranteed.

INSTRUCTIONS FOR MAKING MODIFICATION

1) Remove A1R58 (discard).
2) Replace A1R59 with -hp- Part No. 0683-3925, 3.9 KΩ, 1/4 watt, 5% resistor.
3) Replace A1Q9 with transistor -hp- Part No. 1854-0071.
4) After making these changes, make the performance checks as contained in your Operating and Service Manual to determine adequate high frequency response for the application.

This Production Memo may be given to customers.

Ray Baribeau:jb October 66-9

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HEWLETT hp PACKARD

PRODUCTION MEMO

3302A-4-66

TO:

FROM: -hp- Loveland Division

INSTRUMENT: -hp- Model 3302A, Serial Number 624-00900 and below

SUBJECT: Modification to Ensure Proper Manual Operation in Multiple Cycle Manual Mode

All Model 3302A's which display abnormal operation as described below should receive this modification. Instruments with serial number 624-00901 and above have been factory modified.

With the Model 3302A set up as follows,

EXTERNAL - MANUAL . . MANUAL

MODE . . . . . MULTIPLE

the following conditions exist for (1) Normal Operation, and (2) Abnormal Operation:

1. Normal Operation (At all frequencies)

The 3300A will oscillate while the MANUAL TRIGGER button is depressed. Oscillations will stop when button is released. See Figure 1.

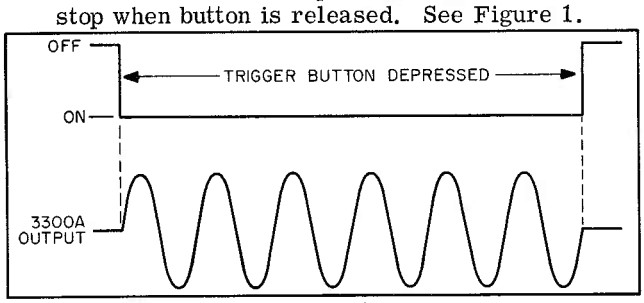

Figure 1

2. Abnormal Operation

a. At low frequencies, approximately 60 cps, the 3300A will generate only one cycle after the MANUAL TRIGGER button is depressed. See Figure 2.

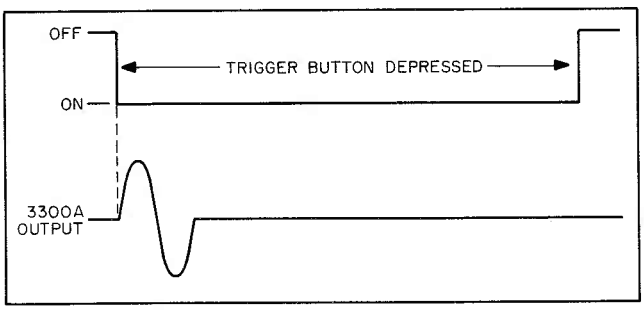

Figure 2

b. At high frequencies, above 1 kHz, the 3300A will generate one cycle immediately after the MANUAL TRIGGER button is depressed and then it will shut off momentarily. Approximately 10 ms later, the 3300A will start oscillating again, this time continuously as long as the MANUAL TRIGGER is depressed. See Figure 3.

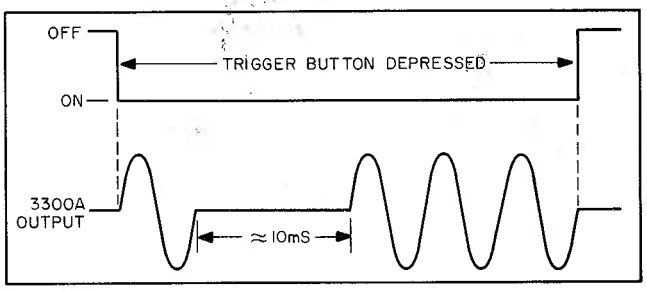

Figure 3

NOTE

On a malfunctioning instrument, the MANUAL TRIGGER button may have to be depressed several times before abnormal operation is observed.

The following modification to the 3302A will correct abnormal operation.

1. Change A1R10 from 2.2 kΩ to 1.2 kΩ, 1/4 W ±5% (-hp- Part No. 0683-1225).

2. Install C3, .1 μF 50 vdcw capacitor (-hp- Part No. 0150-0084), between -20 V supply located on START/STOP phase pot (junction of wht/brn/vio wires) and circuit ground solder terminal located on left side of instrument. There are three solder lugs on this terminal; do not solder to blank lug.

3. Remove and discard wht/brn/vio wire which is connected between MANUAL TRIGGER button and S4BR4. Note there is still one wht/brn/vio wire connected to MANUAL TRIGGER button.

Bill Lewis:sd

December 1966-9

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4. Install R11, a 1 kΩ ±5%, 1/4 W resistor (-hp- Part No. 0683-1025) in place of the wire which was discarded in step 3 (between S4BR4 and MANUAL TRIGGER button).

5. Move remaining wht/brn/vio wire on MANUAL TRIGGER button to S4BR4.

6. Solder all connections. This completes the modification.

Customers whose instruments receive this modification should be instructed to change their Operating and Service Manual as shown below.

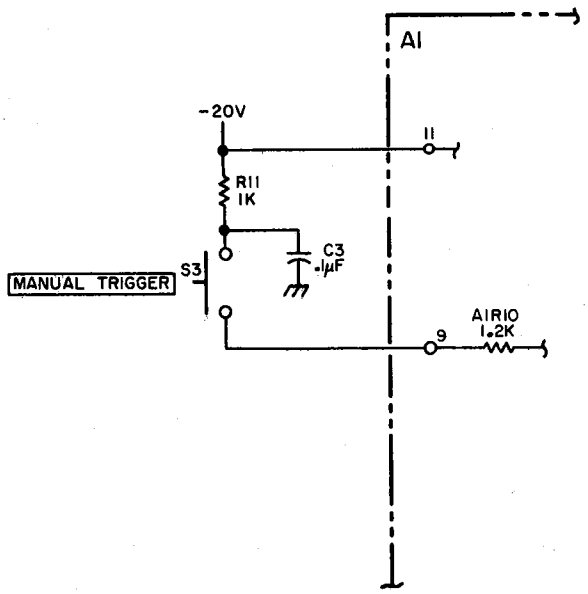
Replaceable Parts List Change:

Change A1R10 from 2.2 kΩ ±5%, 1/4 W (-hp- Part No. 0683-2225) to 1.2 kΩ ±5%, 1/4 W (-hp- Part No. 0683-1225).

Add R11, 1 kΩ ±5%, 1/4 W (-hp- Part No. 0683-1025)

Add C3, .1 μF capacitor, 50 vdcw (-hp- Part No. 0150-0084)

Schematic Diagram Change:



HEWLETT hp PACKARD

PRODUCTION MEMO

3302A-4-66
Rev A

FROM: -hp- Loveland Division

INSTRUMENT: -hp- Model 3302A, Serial Number 624-00900 and below

SUBJECT: Modification to Ensure Proper Manual Operation in Multiple Cycle Manual Mode

All Model 3302A's which display abnormal operation as described below should receive this modification. Instruments with serial number 624-00901 and above have been factory modified.

With the Model 3302A set up as follows,

EXTERNAL - MANUAL . . MANUAL

MODE . . . . . MULTIPLE

the following conditions exist for (1) Normal Operation, and (2) Abnormal Operation:

1. Normal Operation (At all frequencies)

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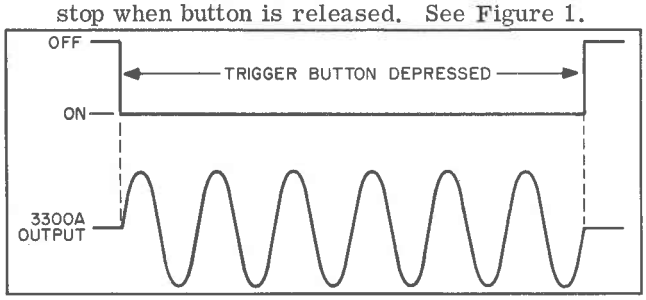

Figure 1

2. Abnormal Operation

a. At low frequencies, approximately 60 , the 3300A will generate only one cycle after the MANUAL TRIGGER button is depressed. See Figure 2.

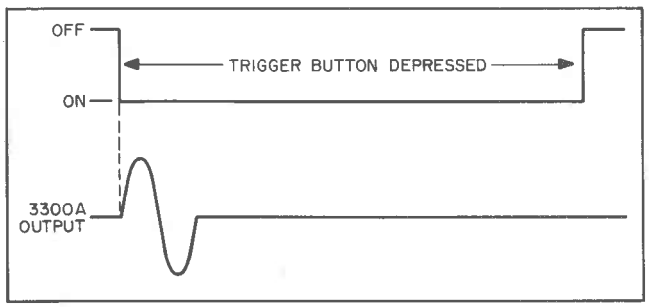

Figure 2

b. At high frequencies, above 1 kHz, the 3300A will generate one cycle immediately after the MANUAL TRIGGER button is depressed and then it will shut off momentarily. Approximately 10 ms later, the 3300A will start oscillating again, this time continuously as long as the MANUAL TRIGGER is depressed. See Figure 3.

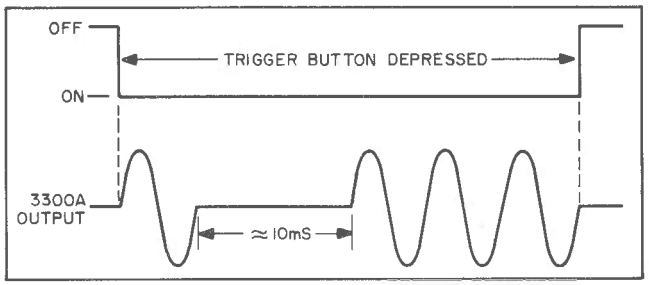

Figure 3

NOTE

On a malfunctioning instrument, the MANUAL TRIGGER button may have to be depressed several times before abnormal operation is observed.

The following modification to the 3302A will correct abnormal operation.

1. Change A1R10 from 2.2 kΩ to 1.2 kΩ, 1/4 W ±5% (-hp- Part No. 0683-1225).

2. Install C3, .1 μF 50 vdcw capacitor (-hp- Part No. 0150-0084), between -20 V supply located on START/STOP phase pot (junction of wht/brn/vio wires) and circuit ground solder terminal located on left side of instrument. There are three solder lugs on this terminal; do not solder to blank lug.

3. Remove and discard wht/brn/vio wire which is connected between MANUAL TRIGGER button and S4BR4. Note there is still one wht/brn/vio wire connected to MANUAL TRIGGER button.

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4. Install R11, a 1 kΩ ±5%, 1/4 W resistor (-hp- Part No. 0683-1025) in place of the wire which was discarded in step 3 (between S4BR4 and MANUAL TRIGGER button).

5. Move remaining wht/brn/vio wire on MANUAL TRIGGER button to S4BR4.

6. Solder all connections. This completes the modification.

Customers whose instruments receive this modification should be instructed to change their Operating and Service Manual as shown below.

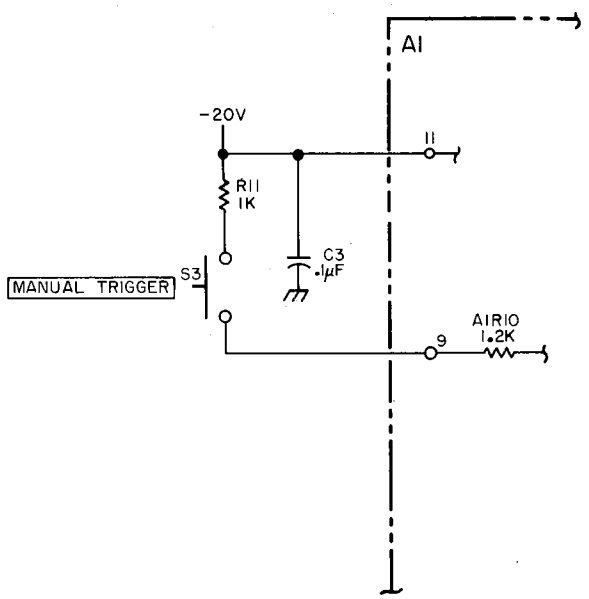
Replaceable Parts List Change:

Change A1R10 from 2.2 kΩ ±5%, 1/4 W (-hp- Part No. 0683-2225) to 1.2 kΩ ±5%, 1/4 W (-hp- Part No. 0683-1225).

Add R11, 1 kΩ ±5%, 1/4 W (-hp- Part No. 0683-1025)

Add C3, .1 μF capacitor, 50 vdcw (-hp- Part No. 0150-0084)

Schematic Diagram Change:



Rod Village/mb May 1969