

Errata

Title & Document Type: 354A Coaxial Step Attenuator Operating Note

Manual Part Number: 00354-90001

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HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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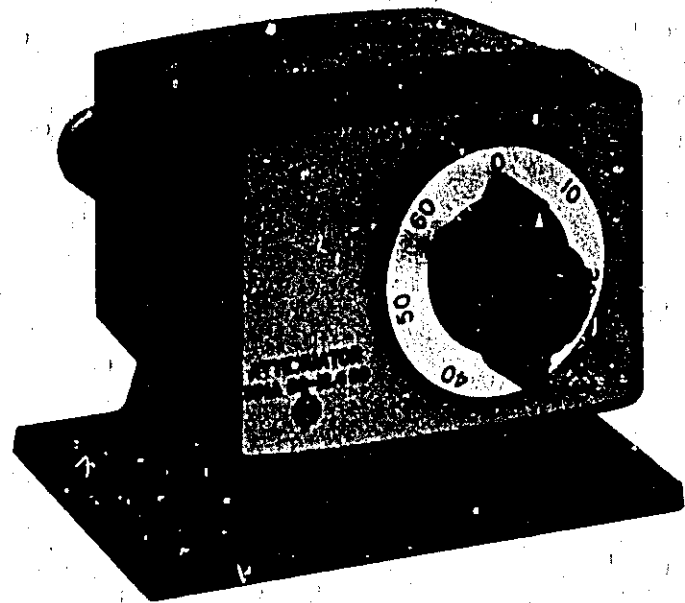
Agilent Technologies

HP 354A

OPERATING NOTE

COAXIAL STEP ATTENUATOR

354A



SEPTEMBER 1974

HEWLETT  PACKARD

HP 354A

DESCRIPTION

The Hewlett-Packard Model 354A is a turret-type coaxial attenuator which provides 0 to 60 dB of attenuation in 10 dB steps. The attenuator is operated with a simple knob rotation, i.e., no pull-turn-push sequence is required.

The attenuator is supplied complete with base. The base is removable for easy conversion to a panel mount and incorporation into a system by removing two screws.

Input and output connectors, both Type N female, are located on the back.

INITIAL INSPECTION

Mechanical Check

If damage to the shipping carton is evident, ask that the carrier's agent be present when the instrument is unpacked. Inspect the attenuator for mechanical damage, such as scratches or dents. Also check the cushioning material for signs of severe stress (compacting).

Performance Test

The electrical performance of the 354A should be verified as soon as possible after receipt. A performance check suitable for incoming inspection is given under PERFORMANCE TEST.

Claim for Damage

If the 354A is mechanically damaged or fails to meet specifications on receipt, notify the carrier and the nearest Hewlett-Packard office. Retain the shipping carton and the padding material for the carrier's inspection. The office will arrange for repair or replacement of your attenuator without waiting for the claim against the carrier to be settled.

INSTALLATION

To convert the attenuator for panel mounting, remove the base by removing two screws in the base. Remove knob and mount with panel bushing in 0.38 inch diameter hole.

OPERATION

For best impedance matching on the 10 dB and above ranges use the left-hand (when facing the front of 354A) connector on the rear as the input.

Table 1. Specifications

Frequency Range:	dc to 12.4 GHz.
Incremental Attenuation:	0 to 60 dB in steps.
Accuracy (including repeatability and frequency response):	± 2 dB.
Residual Attenuation:	Less than 1.5 dB.
Impedance:	50 ohms nominal.
Reflection Coefficient:	
0 to 8 GHz:	Less than 0.2 (1.5 SWR, 14 dB return loss).
8 to 12.4 GHz:	Less than 0.273 (1.75 SWR, 11.2 dB return loss).
Life:	> 20,000 operations.
Maximum Power:	2W average, 100W peak.
Connectors:	Type N female, stainless steel.
Dimensions (maximum envelope):	
4 in. wide, 2-1/8 in. high, 4-1/2 in. deep (102 x 79 x 114 mm);	
panel mount, 3-1/16 in. wide, 2-5/16 in. high,	
3-3/4 in. deep behind panel (78 x 59 x 95 mm).	
Weight (with base):	Net, 2-3/4 lb (1, 2 kg).

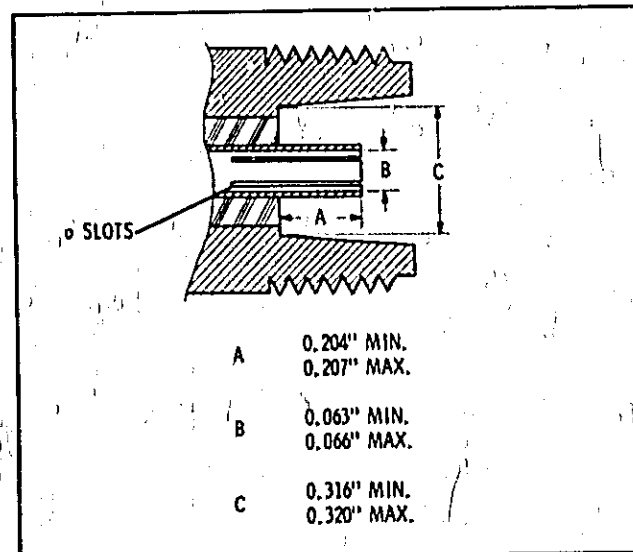


Figure 1. Connector Dimensions

Connectors

The connectors on this attenuator mate with all connectors whose dimensions conform to MIL-C-71 and MIL-C-39012. These connectors are made of stainless steel for longer wear. Figure 1 gives the dimensions.

CAUTION

Do NOT mate with Type N male connectors having a pin diameter greater than 0.066 inches, as larger diameter male pins may damage the female connector.

Power

Do NOT exceed 2 watts average power or 100 watts peak power.

Setting Attenuation

Turn the knob on the 354A to the desired attenuation. Rock the knob back and forth in the detent of the desired position to ensure good contact.

NOTE

The attenuator cannot be switched between the 0 and 60 dB positions because of a stop.

PERFORMANCE TEST

Introduction

The performance test procedures test the instrument's electrical performance using the specifications of Table 1 as the performance standards. All tests can be performed without access to the interior of the instrument.

tions of Table 1 as the performance standards. All tests can be performed without access to the interior of the instrument.

Equipment Required

Equipment required for the performance tests is listed in Table 2, Recommended Test Equipment. Any equipment which satisfies the critical specifications given in the table may be substituted for the recommended model(s).

Test Record

Results of the performance tests may be tabulated on the Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting, and after repairs or adjustments.

Table 2. Recommended Test Equipment

The following equipment is recommended for testing the 354A. Other equipment may be substituted, provided their specifications equal or exceed the specifications given under Critical Specifications.		
Instrument	Critical Specifications	HP Model Number
Sweep Oscillator	Frequency: band of interest Automatic Level Control: on negative voltage proportional to RF	8690A,B with 8691-4A,B plug-ins
Reflection-Transmission Test Unit	Frequency: to 12.4 GHz Directivity: 30 dB Impedance: 50 ohms	8743A
Network Analyzer	No substitute	8410A/8411A with 8412A and 8414A plug-ins
Air Line Extension	Frequency: to 12.4 GHz Impedance: 50 ohms	11567A
Sliding Load	Frequency: to 12.4 GHz Impedance: 50 ohms	905A, 907A
Adapters	APC-7 to Type N male Type N female-to-female	11525A 1250-0777
Attenuator	Attenuation: 3, 20, 30 dB Impedance: 50 ohms	8492A Opt. 003, 020, 030
Flexible Arm	Frequency: to 12.4 GHz SWR: <1.25 Insertion Loss: <2.5 dB Impedance: 50 ohms	11605A
Coaxial Short	Connectors: APC-7	11565A

PERFORMANCE TESTS

Reflection Coefficient

SPECIFICATIONS:

- 0 to 8 GHz: Less than 0.2 (1.5 SWR, 14 dB return loss).
- 8 to 12.4 GHz: Less than 0.273 (1.75 SWR, 11.3 dB return loss).

DESCRIPTION: SWR is measured using the HP Model 8410A Network Analyzer, Model 8414A Polar Display Unit, and a Model 8743A Reflection-Transmission Test Unit. The test setup is calibrated for a reflection coefficient of 1. Gain is inserted in the test channel to obtain full-scale calibration equal to the test limits plus the ambiguity due to the Reflection-Transmission Test Unit directivity. A swept-frequency measurement of the 354A return loss is made. If the sum of the 354A return loss and Test Unit directivity is less than 15.0 dB, 0 to 8 GHz; or 12.5 dB, 8 to 12.4 GHz, single-frequency measurements are made with the Test Unit directivity calibrated out.

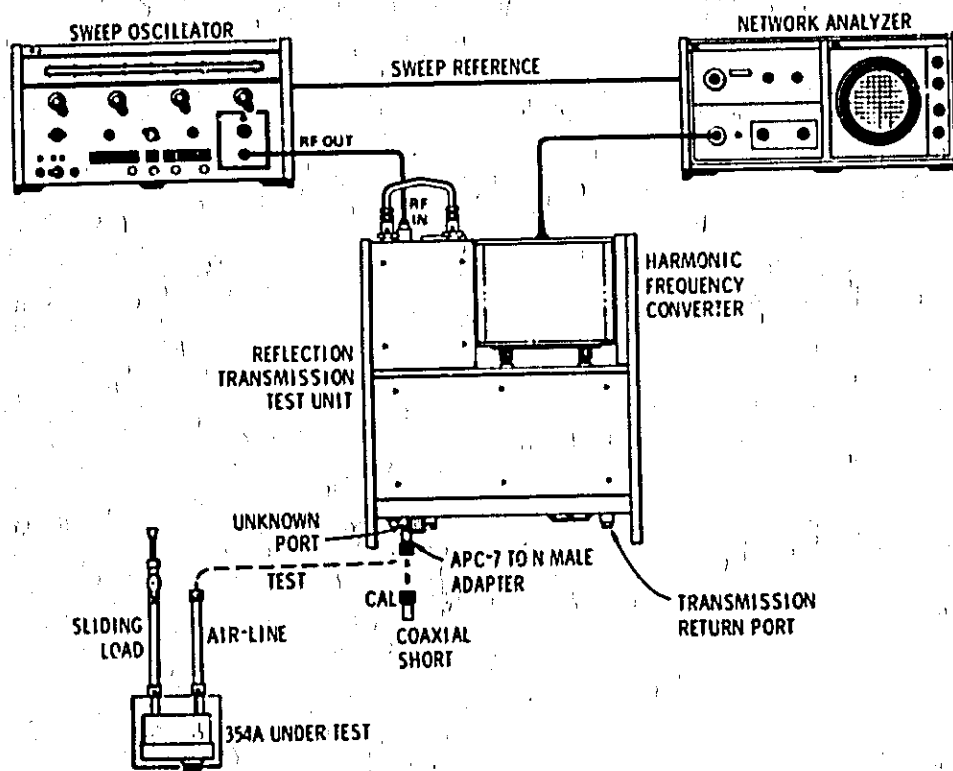


Figure 2. SWR Test Setup

EQUIPMENT:

SWEEP OSCILLATOR	HP Model 8690A/B with 8699B RF Unit
REFLECTION-TRANSMISSION TEST UNIT	HP Model 8743A
NETWORK ANALYZER	HP Model 8410A/8414A
HARMONIC FREQUENCY CONVERTER	HP Model 8411A
COAXIAL SHORT	HP Model 11565A
APC-7 to N ADAPTER	HP Model 11525A
AIR LINE, EXTENSION	HP Model 11567A
SLIDING LOAD	905A Sliding Load

PERFORMANCE TESTS**Reflection Coefficient (cont'd)****PROCEDURE:****Calibration:**

- a. Connect equipment as shown in Figure 2 with 10-cm air-line, APC-7 to Type N adapter, and coaxial Type N short connected to Reflection-Transmission Test Unit UNKNOWN port.
- b. Phase lock the Network Analyzer over the desired frequency band.
- c. Push and hold the 8414A BEAM CTR pushbutton and adjust the horizontal and vertical position controls to place the dot in the center of the graticule.
- d. Adjust the Network Analyzer test channel gain and amplitude vernier controls to place the trace on the outer graticule circle.
- e. Adjust the Reflection-Transmission Test Unit for minimum phase change versus frequency.
- f. Adjust the Network Analyzer phase vernier, test channel gain and amplitude vernier controls to place the dot or cluster at a reference indication of $\Gamma = 1/180$ degrees.
- g. Increase the Network Analyzer test channel gain 16 dB from 0 to 8 GHz or 13 dB from 8 to 12.4 GHz. The 8414A is now calibrated for a full-scale reflection coefficient equal to the specification limits plus the ambiguity due to Test Unit directivity.

Measurement:

- h. For swept-frequency measurements, proceed as follows: Remove the coaxial short and connect the 354A under test to the APC-7 to Type N adapter. Terminate the unused port on the 354A with a 50-ohm load. The displayed trace (combination of 354A reflection and Test Unit directivity) should be within the outer graticule circle. If the trace is within the circle, turn the 354A knob out of and back into the detent to test for repeatability. Repeat measurement at other attenuation positions. Reverse 354A and repeat measurements on other port. If the displayed trace is outside the outer graticule circle at any frequency, make single-frequency measurements with Test Unit directivity calibrated out as follows.
 - i. For single-frequency measurements with Test Unit directivity calibrated out, proceed as follows:
 1. Set the sweep oscillator for CW operation at frequency in question.
 2. Remove the 354A under test and connect the sliding load with a Type N connector to the APC-7 to Type N adapter.
 3. Slide the load and adjust the 8414A horizontal and vertical position controls until the circle rotates about the center of the CRT.
 4. Remove the sliding load and reconnect the 354A.
 5. The displayed dot must be within the outer graticule circle.

PERFORMANCE TESTS

Residual Attenuation and Attenuation Accuracy

SPECIFICATIONS:

- Residual Attenuation: Less than 1.5 dB
- Attenuation Accuracy:¹ ±2 dB.

DESCRIPTION: Residual attenuation and attenuation accuracy is measured using the 8410A Network Analyzer. The Network Analyzer System is calibrated for a transmission measurement using the Flexible Arm and appropriate adapters to form a through path. The through path is opened, the 354A (set to 0 dB) is inserted in this path and its residual attenuation is then indicated on the Network Analyzer display indicator.

The display is then repositioned so the 354A 0 dB step response can be used as the reference for the attenuation accuracy test. Attenuation accuracy is then measured by increasing the 354A attenuation, one step at a time, while increasing the Network Analyzer test channel gain a like amount. The displayed trace on each 354A setting will then indicate attenuation accuracy.

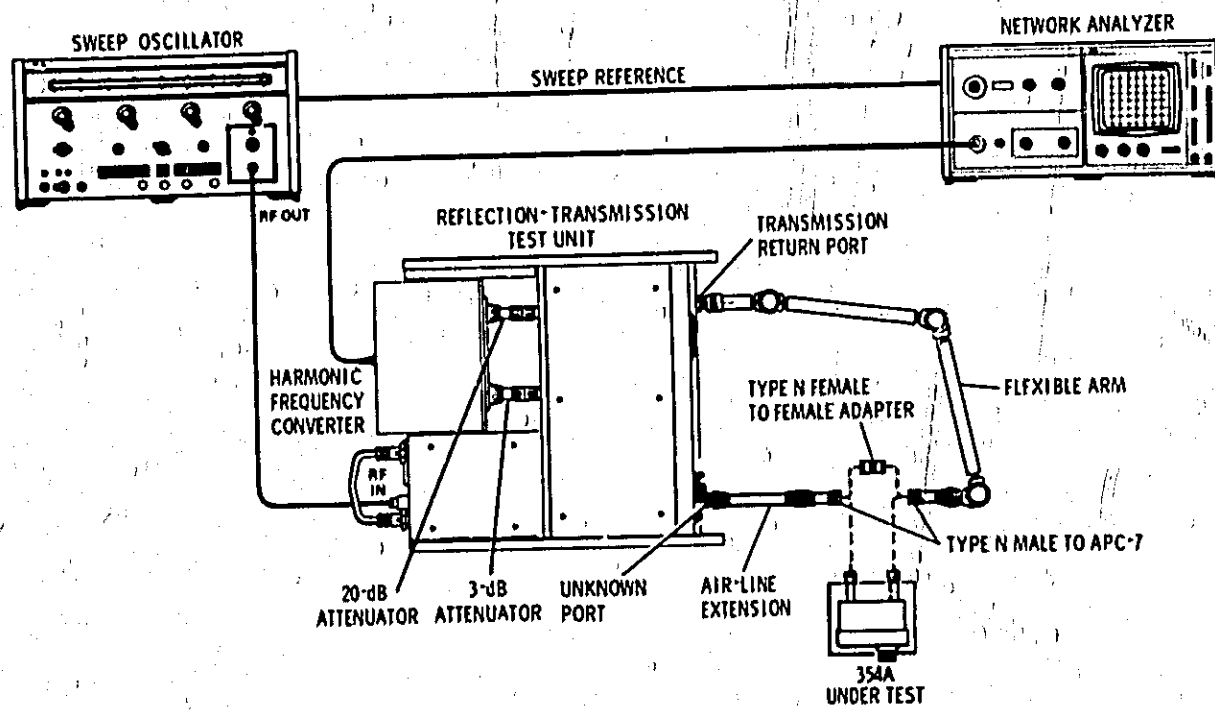


Figure 3. Residual Attenuation Test Setup

EQUIPMENT:

- SWEEP OSCILLATOR HP Model 8690A/B with 8691-4A/B plug-ins
- REFLECTION-TRANSMISSION TEST UNIT HP Model 8743A

¹Includes repeatability and frequency response.

PERFORMANCE TESTS

Residual Attenuation and Attenuation Accuracy (cont'd)

HARMONIC FREQUENCY CONVERTER	HP Model 8411A
NETWORK ANALYZER	HP Model 8410A with 8412A plug-in
FLEXIBLE ARM	HP Model 11605A
3 dB ATTENUATOR	HP Model 8492A, Opt. 003
20 dB ATTENUATOR	HP Model 8492A, Opt. 020
AIR-LINE EXTENSION	HP Model 11567A
TYPE N MALE TO APC-7 ADAPTER	HP Model 11525A
TYPE N FEMALE TO FEMALE ADAPTER	HP Part No. 1250-0777 (UG-29B/U)

PROCEDURE:

Calibration:

- a. Connect the equipment for calibration, as shown in Figure 3, with a through path (consisting of the Flexible Arm, appropriate adapters, and 10-cm air-line) connected to the Reflection-Transmission Test Unit.
- b. Set the Sweep Oscillator to sweep the 8.2 to 12.4 GHz band. Adjust Network Analyzer for a stable display over the entire band being swept.
- c. Set the Model 8412A for AMPL mode and 1.0 DB/DIV sensitivity. Set BW (kHz) to the 0.1 position.
- d. Adjust Network Analyzer test channel gain to position trace on the 8412A center graticule line. Draw over this trace with a grease pencil.

Measurement:

- e. Open Flexible Arm by removing Type N female to Type N female adapter and insert 354A as shown at "TEST" in Figure 3. Be sure to support weight of 354A under test independently.
- f. Set the 354A for 0 dB attenuation.
- g. The trace on the Model 8412A should be within 1.5 cm of the grease pencil line on the CRT for all frequencies. If the 354A is not within specifications, rock the knob on the 354A back and forth in the 0 dB detent while observing the trace.
- h. Adjust Network Analyzer test channel gain to position trace on center graticule line.

NOTE

Redraw grease pencil line, if necessary.

- i. Set the 354A to the 10-dB position and increase the Network Analyzer test channel gain by 10 dB. The Model 8412A trace should be within 2 cm (2 dB) of the grease-pencil line at all frequencies.
- j. Set the 354A to the 20 dB position and increase the Network Analyzer test channel gain by 10 dB (20 dB total). The Model 8412A trace should be within 2 cm (2 dB) of the grease pencil line at all frequencies.
- k. Set the 354A to the 30 dB position and increase the Network Analyzer test channel gain by 10 dB (30 dB total). The Model 8412A should be within 2 cm (2 dB) of the grease-pencil line at all frequencies.
- l. Set the 354A to the 40 dB position and increase the Network Analyzer test channel gain by 10 dB (40 dB total). The Model 8412A trace should be within 2 cm (2 dB) of the grease pencil line at all frequencies.

PERFORMANCE TESTS

Residual Attenuation and Attenuation Accuracy (cont'd)

- m. For greater accuracy, recalibrate using a higher test channel signal as follows:
 1. Draw a line with a grease pencil of the 40-dB response on the CRT.
 2. Remove the 20-dB attenuator in the reference channel between the Reflection-Transmission Test Unit and the Harmonic Frequency Converter. Insert a 30-dB attenuator in its place.
 3. Adjust the Sweep Oscillator output power for sufficient output to cause the Network Analyzer to remain phase locked with the lowest Network Analyzer REF CHAN LEVEL meter indication.
 4. Adjust the Network Analyzer test channel gain and amplitude vernier controls to relocate the trace on the grease-pencil line drawn in step 1. Erase the grease-pencil line drawn in step 1.
- n. Set the 354A to the 50 dB position and increase the Network Analyzer test channel gain by 10 dB (50 dB total). The Model 8412A trace should be within 2 cm (2 dB) of the grease-pencil line at all frequencies.
- o. Set the 354A to the 60 dB position and increase the Network Analyzer test channel gain by 10 dB (60 dB total). The Model 8412A trace should be within 2 cm (2 dB) of the grease-pencil line at all frequencies.

Table 3. Performance Test Record

Hewlett-Packard Model 354A Coaxial Step Attenuator		Tested by _____		
Serial No. _____		Date _____		
Test		Results		
		Min	Actual	Max
Reflection Coefficient	(0-8 GHz)	15.6 dB	_____	
	(8-12.4 GHz)	12.5 dB	_____	
Residual Attenuation				1.5 dB
Attenuation Accuracy	10 dB	8 dB	_____	12 dB
	20 dB	18 dB	_____	22 dB
	30 dB	28 dB	_____	32 dB
	40 dB	38 dB	_____	42 dB
	50 dB	48 dB	_____	52 dB
	60 dB	58 dB	_____	62 dB

TROUBLESHOOTING

To locate a source of trouble in the 354A, use a Time Domain Reflectometer (TDR), such as the Hewlett-Packard Model 1415A in a Model 140A Oscilloscope. With a TDR the location as well as a malfunction can be determined. Refer to the TDR Operating and Service Manual for further information.

PERIODIC MAINTENANCE

The Model 354A should be thoroughly cleaned every 5,000 operations. To clean, proceed as follows:

1. Disassemble the Model 354A as instructed under Turret Removal.
2. Remove any loose polyiron particles and dust by spraying the inside of the housing and the turret assembly with an aerosol Freon¹.
3. Using a soft pencil eraser, lightly rub both ends of each attenuator cartridge to remove any polyiron buildup. Pay particular attention to the center-conductor sliding contact.
4. Remove any particles of eraser from the turret and reassemble, using the Turret Assembly procedure.

REPAIR

Turret Removal

To remove the 354A turret proceed as follows:

- a. Rotate turret to defective position for identification.
- b. Remove dial knob.
- c. Remove panel bushing (19) Figure 4.
- d. Remove base by removing two screws.
- e. Loosen setscrew holding right-hand connector (when viewed from the rear).

NOTE

Remove or loosen screws only as directed. If other screws are loosened, alignment of parts will be affected and turret may jam. If this occurs, the attenuator must be returned to the factory because special jigs are used for alignment.

- f. Push the loose right-hand connector toward front panel. Front panel will come loose.

¹Registered trademark, Du Pont Co., Wilmington, Delaware.

g. Remove four screws and washers around rim of turret cover. Do NOT remove or loosen two screws in the alignment plate or alignment will be lost.

h. Remove the turret noting the defective position as marked in step a.

CAUTION

Steel balls and springs in the turret assembly are now loose.

Turret Assembly

To assemble the 354A turret proceed as follows:

- a. Make sure all springs and steel balls are in their proper place.
- b. Replace turret cover making sure alignment plate hole fits over alignment pin.
- c. Replace four screws and washers around rim of turret cover while pushing down on cover.
- d. Rotate turret over its entire range to be sure everything still works freely.
- e. Insert right-hand connector into 354A shell until it protrudes the same distance as the other connector. Tighten setscrew which holds right-hand connector.
- f. Attach base by inserting two screws.
- g. Install front-panel over attenuator shaft.
- h. Fit panel bushing on shaft and screw bushing on with 1/2 inch open-end wrench.
- i. Replace knob and tighten setscrews.

Attenuator Cartridge Replacement

To replace an attenuator cartridge remove turret as directed under Turret Removal as follows:

- a. Clamp the rotor shaft of the turret in a vise with the attenuator cartridges facing up.
- b. Rotate defective cartridge so that open end of retaining C-ring faces shaft.
- c. Pry off the C-ring by placing two screwdrivers, one each simultaneously against each open end of the C-ring and the hub, and twisting. If correct-size screwdrivers are not available, place both screwdrivers in position and move one to the outside rapidly while holding the other rigid.

d. Slide C-ring on one end of new attenuator cartridge, insert cartridge in turret and twist cartridge to be sure it rotates freely.

e. Slide C-ring on other end of new attenuator cartridge. Replace turret in 354A as instructed under Turret Assembly.

Cable Sliding Contact Replacement

If the repeatability of the attenuator is not within specifications, the center-conductor contacts which touch the attenuator cartridges may need replacement. To replace the contact, remove the turret assembly as instructed under Turret Removal and proceed as follows:

a. Remove the detent plate (11) Figure 4, with the cable assembly (14) Figure 4. The cable assembly need not be removed from the detent plate.

CAUTION

Springs and steel balls are now loose.

b. Loosen the cable nut (12) Figure 5, with 7/16-inch wrench.

c. Pull the cable assembly from the connector body, twisting the cable if necessary.

CAUTION

Bead surrounding contacts is now loose.

d. Unscrew the center conductor contact assembly and replace with a new assembly.

e. Disassembly beyond this point by the customer is not considered practical. If the bead insulator surrounding the contact assembly comes loose, be sure to replace bead with shoulder on bead facing toward the cable. Reassemble the cable assembly in the connector body.

f. Assemble turret as instructed under Turret Assembly to the point of replacing the base.

g. Assemble knob on turret shaft, tighten knob setscrews, and rotate turret. Turret should rotate freely. In addition, the turret should have a slight looseness when in a detent position in both rotational and front-to-back directions. If not, make the adjustment in the next paragraph. If the turret has a slight amount of looseness, reassemble as instructed under Turret Assembly.

Adjusting Cable Connector Spacing

To adjust the cable connector spacing proceed as follows:

a. First remove the turret as instructed under Turret Removal.

b. Hold the turret against the cable connector with your fingers. Insert a .008 inch feeler gauge between the retaining ring (33) in Figure 4 and the turret body (5).

c. Move turret to an adjacent position and repeat step b using the same feeler gauge, but slide the gauge to keep it in the position of step b also.

d. Move the turret between the two positions in steps b and c.

e. Loosen setscrew (8) holding cable connector.

f. Move cable connector until it just touches the two attenuator cartridges. This adjusts the front connector so the cartridges are set to the middle of the turret body when they are seated against the cable connector.

g. Replace turret as instructed under Turret Assembly to the point of replacing the base.

h. Replace knob on turret shaft, tighten knob setscrews, and rotate turret. Turret should rotate freely. In addition, the turret should have a slight looseness when in detent position in both rotational and front-to-back directions. If not, make the adjustment slightly looser. If the turret has a slight amount of looseness, reassemble as instructed under Turret Assembly.

Replacing Cable Connector Finger Washers

To replace the finger washers on the cable connector which contact the attenuator cartridge proceed as follows:

a. Remove the turret as instructed under Turret Removal.

b. Loosen the cable nut (12), Figure 5, from the connector body with a 7/16 inch wrench. Pull cable loose.

c. Loosen the setscrews (8) Figure 4, in the detent plate.

d. The connector body is now loose but removal depends upon removing the nearest steel ball (24) Figure 4, first. Push the connector body

toward the attenuator cartridges. The steel ball should now be loose and should be removed. Finish the removal of the connector body by pulling it from the detent plate in either direction.

e. If the outer conductor finger-washer or flat washer in the connector body needs replacement, proceed as follows:

1. Replace the connector body with a new assembly, HP Part No. 00354-614.
2. Push connector body in until circular slot in body is opposite cavity for steel ball.
3. Push steel ball into cavity. Assembly of this connector is the reverse of disassembly. An adjustment is necessary when reassembling. See Type N Connector Insertion Adjustment paragraph.

f. Replace the turret as instructed under Turret Replacement.

Replacing Contacts in Type N Cartridge Contacting Connector

The preceding paragraphs give instructions for replacing the sliding contact on the connector which contacts the attenuator cartridges on the cable side. This paragraph gives instructions for replacing parts on the Type N connector which contacts the attenuator cartridges on the other side.

- a. Loosen the setscrew holding left-hand connector of 354A (when viewed from the rear).
- b. Remove the Type N connector assembly.
- c. Clamp a pair of plastic-jawed pliers on the brass connector body.
- d. Unscrew the steel connector body with a 9/16 inch wrench. Remove center-conductor assembly.
- e. If the center conductor is defective, unscrew the center conductor assembly using pin vises, and replace the defective part.

NOTE

Assembly of this connector is the reverse of disassembly. An adjustment is necessary when reassembling. See the next paragraph for this adjustment.

f. If the outer conductor finger-washer or flat washer needs replacement, proceed as follows:

1. Remove the center contact assembly.
2. Replace the connector body with a new assembly, HP Part No. 00354-60020.

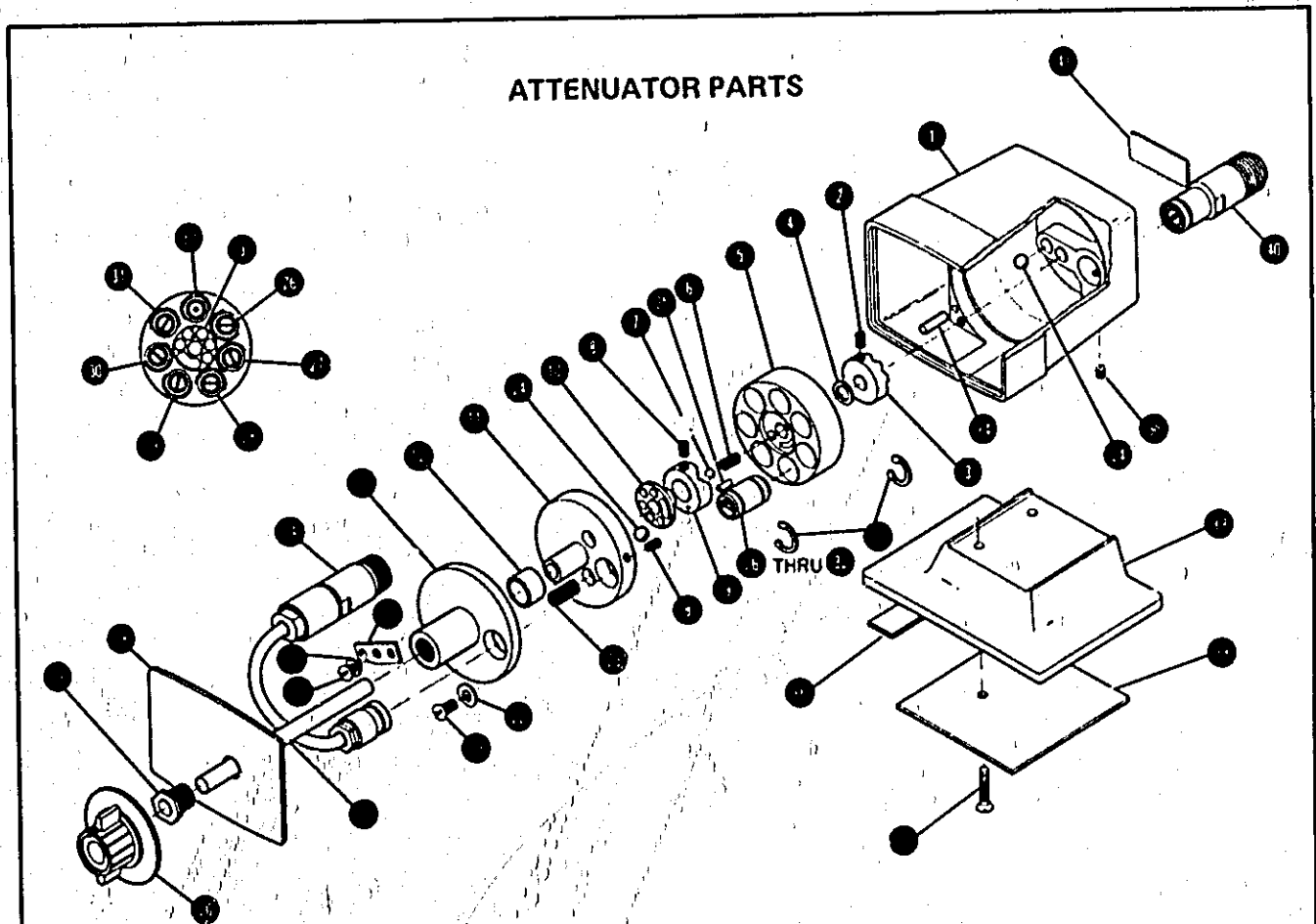
NOTE

Assembly of this connector is the reverse of disassembly. An adjustment is necessary when reassembling. See the next paragraph for this adjustment.

Type N Connector Insertion Adjustment

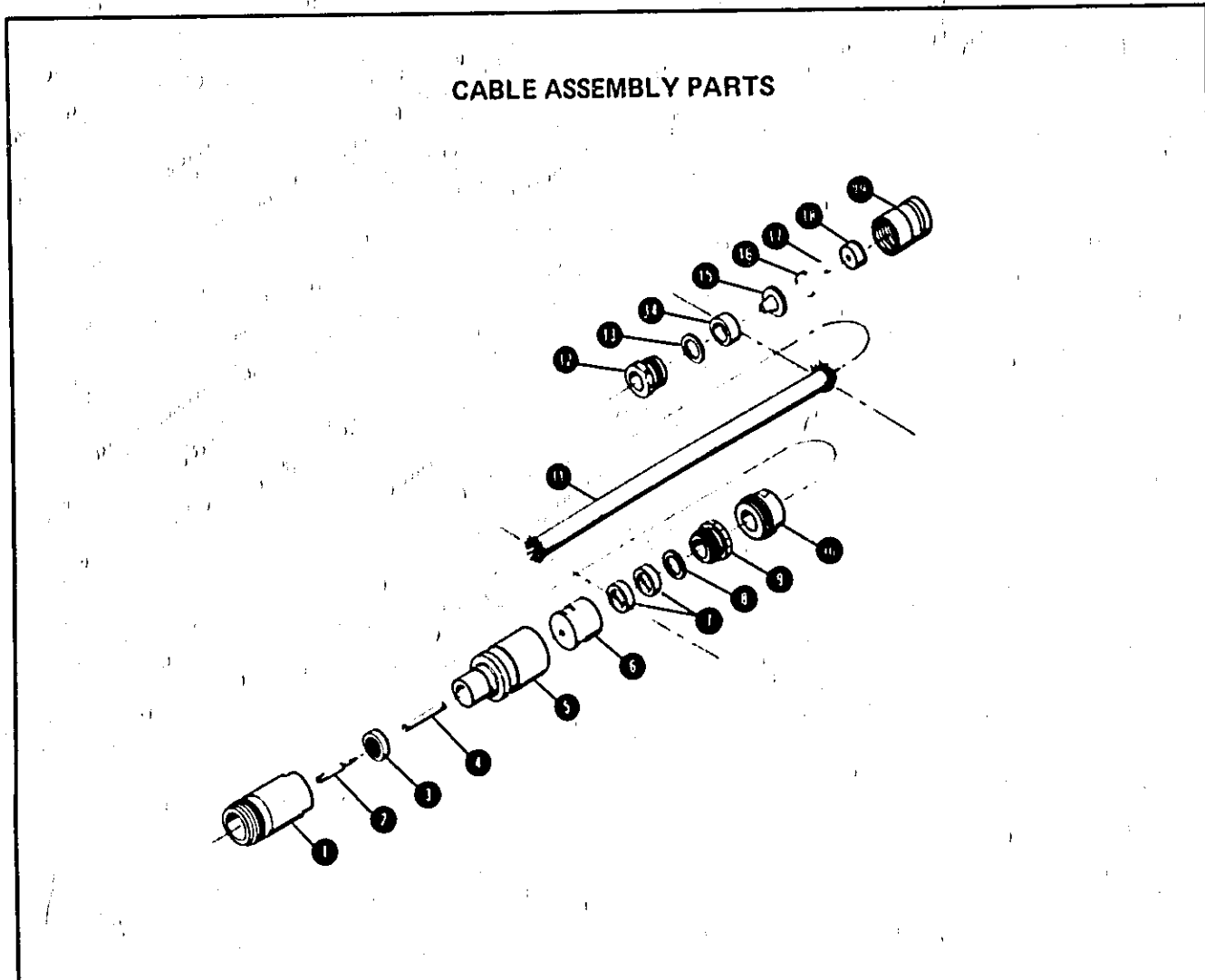
This adjustment concerns only the Type N connector which contacts the attenuator cartridges. To adjust the insertion of this connector assembly, proceed as follows:

- a. Assemble the entire 354A without this connector.
- b. Rotate the turret until it is between detent positions.
- c. Push the connector in until it lightly touches two adjacent attenuator cartridges.
- d. Tighten the setscrew to hold the connector.
- e. Rotate the turret to all positions to see that it rotates freely but stays in the detent when the knob is rotated against the stop. In addition, the turret should have a slight looseness when in a detent position in both rotational and front-to-back directions. If not, repeat the above adjustment but set looser.



Item No.	HP Part No.	Description	Item No.	HP Part No.	Description
1	00354-20037 00354-200	Housing (Moss-gray) Housing (Textured blue enamel, Opt. X95)	21	5020-0352	Stainless steel shaft, 3-5/8 long
2	3030-0033	Setscrew, 6-32 x 3/16	22	3050-0105	Flat washer, No. 4
3	00354-224	Rear detent	23	1460-0092	Main spring
4	3050-0156	Flat washer, 1/4 ID x 3/8 OD	24	1410-0013	Steel ball, 1/4 dia.
5	08551-4005	Turret	25	1480-0012	Roll pin for center collar 5/64 OD x 1/4 long
6	1460-0158	Centering spring	26	00345-613	Cartridge assembly, 60 dB
7	1410-0075	Steel balls 5/32 dia	27	00354-612	Cartridge assembly, 50 dB
8	3030-0033	Setscrew, 6-32 x 3/16	28	00354-611	Cartridge assembly, 40 dB
9	00354-219	Centering collar	29	00354-610	Cartridge assembly, 30 dB
10	00354-220	Detent	30	00354-609	Cartridge assembly, 20 dB
11	00354-235	Detent plate	31	00354-608	Cartridge assembly, 10 dB
12	1410-0743	Bushing, 3/8 ID x 3/8 long	32	00354-607	Cartridge bead assembly (straight-through)
13	00354-236	Cover	33	0510-0219	Retaining ring
14	00354-616	Cable assembly (see Figure 5) (includes cable and 2 connectors)	34	1480-0017	Dowel pin
15	00354-203	Alignment plate	35	3030-0020	Setscrew, 8-32 x 3/16
16	2190-0003	Split lockwasher, No. 4	36	0460-0020	Cork-rubber tape
17	2200-0003	Round head stainless steel screw, 4-40 x 1/4	37	2370-0001	Flat-head stainless steel screw, 6-32 x 1
18	00354-00005 00354-001	Panel (Moss-gray) Panel (Textured blue enamel, Opt. X95)	38	00354-003	Base cover
19	1410-0110	Panel bushing	39	00354-20038 00354-201	Base casting (Moss-gray) Base casting (Textured blue enamel, Opt. X95)
20	00354-617	Dial-knob assembly	40	00354-615	Connector assembly (see Figure 6)
			41	7120-1246	Name plate

Figure 4. Attenuator Replaceable Parts

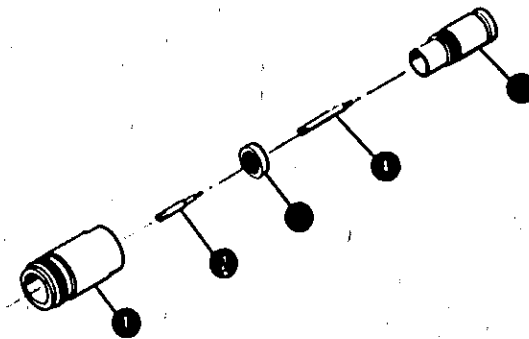


CABLE ASSEMBLY PARTS

Item No.	Description	HP Part No.
1	Connector body: for female Type N	1250-0914
2	Center contact: female Type N	1250-0915
3	Insulator: bead	5040-0306
4	Conductor: center	00354-229
5	Connector body: Type N connector to cable	00354-227
6	Outer conductor	00354-228
7	Gasket: rubber (2)	1250-0007
8	Washer: flat	5040-0146
9	Nut: clamp	5040-0142
10	Nut: retaining	5050-0147
11	Cable: coaxial	8120-0083
12	Nut: clamp	5040-0142
13	Washer: flat	5040-0146
14	Collar: clamping	00354-231
15	Wedge: coaxial	00354-230
16	Disk	08551-2126
17	Spring center conductor assembly	08551-2130
18	Insulator: bead	08551-2127
19	Body: connector assembly	00354-614
	Entire cable assembly with both connectors	00354-616

Figure 5. Cable Assembly Replaceable Parts

CONNECTOR ASSEMBLY PARTS



Item No.	Description	HP Part No.
1	Connector body: for female Type N	1250-0914
2	Inner conductor pin: female	1250-0915
3	Insulator: bead	5040-0306
4	Inner conductor contact assembly	00354-60019
5	Outer conductor contact assembly	00354-60020

Figure 6. Connector Assembly Replaceable Parts