

OPERATING INSTRUCTIONS

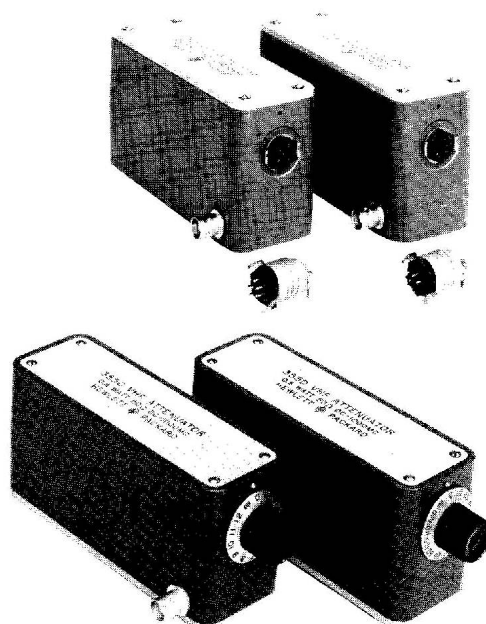
VHF ATTENUATORS

355C

355D

355E

355F



GENERAL INFORMATION

The Model 355C/D/E/F is a direct-reading step attenuator usable from dc to 1000 MHz. The Model 355C/E provides 0 to 12 dB attenuation in 1 dB steps, and the Model 355D/F provides 0 to 120 dB in 10 dB steps. Connected, the Models 355C/E and D/F provide a range of attenuation of 0 to 132 dB in 1 dB steps. SWR, error, and residual attenuation are low at all settings. Input and output connectors are female type BNC. Input and output impedances are 50 ohms, nominal.

Specification 355E/F (Figure 2) is a standard HP Model 355C/D in which the standard shaft with cams which normally activate the microswitches has been replaced by four solenoids to allow remote programmable operation. The solenoids operate the microswitches to proper combinations to obtain the desired degree of attenuation. The solenoids are push type, continuous duty and each solenoid draws approximately 1/10 amp at 15 volts dc.

Programming is achieved through a connector in the housing.

Figure 3 shows the wiring schematic of the solenoids, Table 3 indicates the program of attenuation versus solenoid actuation. The elimination of the dial and knob has decreased the overall length of the instrument by 9/16 inch, while a special cover plate has resulted in a 1/8 inch increase in height.

The 355C/D is compact, rugged, and well-shielded. The design, indicated in Figure 1, has resulted in an

accurate and convenient attenuator with excellent electrical characteristics.

The 355C/D drive mechanism, controlled from the front panel, is a single rotary shaft which mounts four cams. The cams drive eight microswitches, in pairs. The microswitches set up connections, in the proper sequence, to obtain the desired degree of attenuation, to four π -type attenuator pads.

The Model 355C/E has pads of 1, 2, 3, and 6 decibels which allow a range of 0 to 12 dB in 1 dB steps; the Model 355D/F has 10, 20, 30 and 60 dB pads which allow a range of 0 to 120 dB in 10 dB steps.

OPTIONS

Table 2 lists the options available for the Model 355 C/D/E/F.

OPERATION

The Model 355C/D/E/F is designed to dissipate a maximum average power of 0.5 watt and accommodate pulses up to 350 volts maximum. The attenuator will be damaged if overloaded. A dc resistance list for overload damages is given under MAINTENANCE.

The input may be applied to either connector, and the output taken from the other, except in the case of the 355D/F driven from a low impedance source. In this one case, the leaf switch (Figures 1 and 2) may be closed before the micro-switch opens when the dial is switched from 50 dB to 60 dB. Should this occur, a momentary

Table 1. Specifications

MODEL 355C/E	
Attenuation Range:	0 to 12 dB.
Attenuation Steps:	1 dB.
Overall Accuracy:	0.1 dB at 1000 Hz. 0.25 dB, dc to 500 MHz. 0.35 dB, dc to 1000 MHz.
MODEL 355D/F	
Attenuation Range:	0 to 120 dB.
Attenuation Steps:	10 dB.
Overall Accuracy:	at 1000 Hz, 0 to 120 dB, ± 0.3 dB; below 1000 MHz, 0 to 90 dB, ± 1.5 dB; 90 to 120 dB, ± 3 dB.
MODELS 355C/E and 355D/F	
Frequency Range:	dc to 1000 MHz.
Impedance:	50 ohms (nominal).
Maximum SWR (input and output):	1.2 below 250 MHz; 1.3 below 500 MHz, 1.5 below 1000 MHz.
Maximum Residual Attenuation:	Less than 0.25 dB to 100 MHz; less than 0.75 dB to 500 MHz, less than 1.5 dB to 1000 MHz.
Maximum Power Dissipation:	0.5 watt, average.
Maximum Pulse Voltage:	350 volts, peak.
Connectors:	BNC, female.
Dimensions:	J (355C/D): 152 mm long, 97 mm wide, 68 mm high (6 in x 2-13/16 in x 2-11/16 in) I (355E/F): 139 mm long, 97 mm wide, 97 mm high
Weight:	1-1/2 lb (0.67 kg) (5-7/16 in x 2-13/16 in x 2-13/16 in)
Accessories Available:	
	803A-16E Cable Assembly. Solid shield 50 ohm cable, 15 inches long (381.0 mm) with male BNC connectors.
	803A-16D Cable Assembly. RG-55/U cable, 2 feet long, (609.6 mm) with male type N connector on one end, male BNC connector on other end.

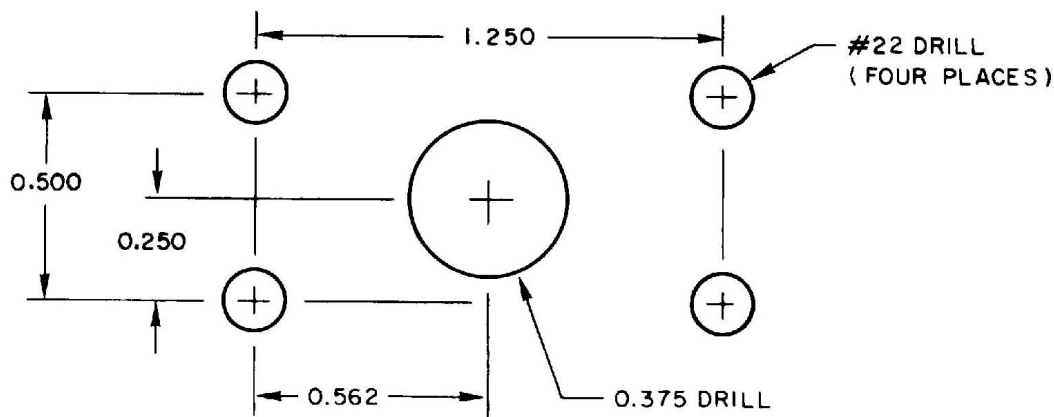
Table 2. Model 355C/D/E/F Options

Model 355C/D

- Option 001 - Type "N" input and output connectors.
- Option 003 - Modifies the 355C/D to provide panel mounting capability by incorporating the following changes:
1. The attenuator shaft is 3/16" longer, thereby allowing the instrument shaft to protrude through a 3/16" panel.
 2. Four 6-32 holes are drilled and tapped in the instrument casting to allow the instrument to be mounted to a panel.
 3. A 1 3/4" dial is added.

NOTE

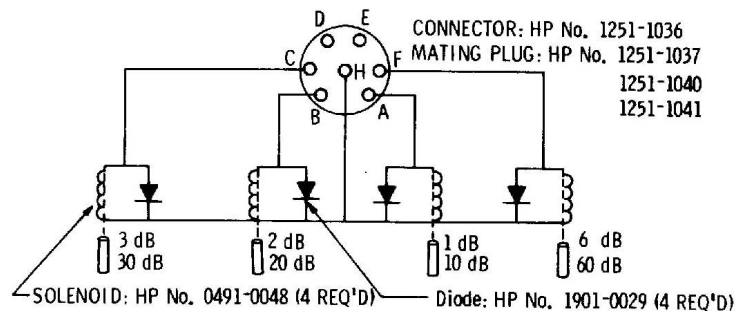
Panel drilling detail for mounting
Option 003 is as follows:



- Option 005 - Type TNC input and output connectors.

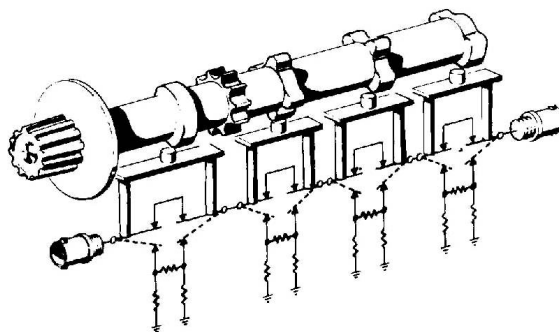
Model 355E/F

- Option 007 - Adds transistor driver protection circuitry as follows:

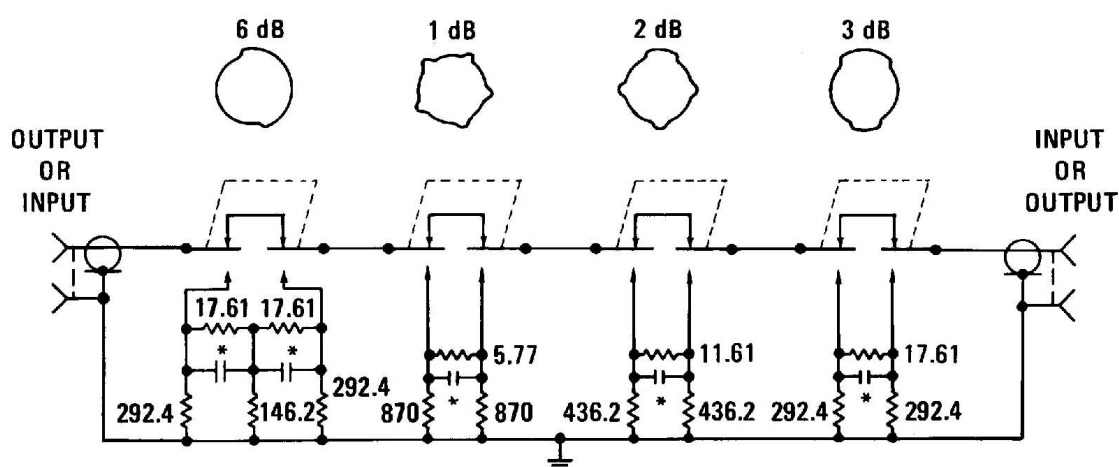
**NOTE**

Pin H must be positive with respect
to the other pins.

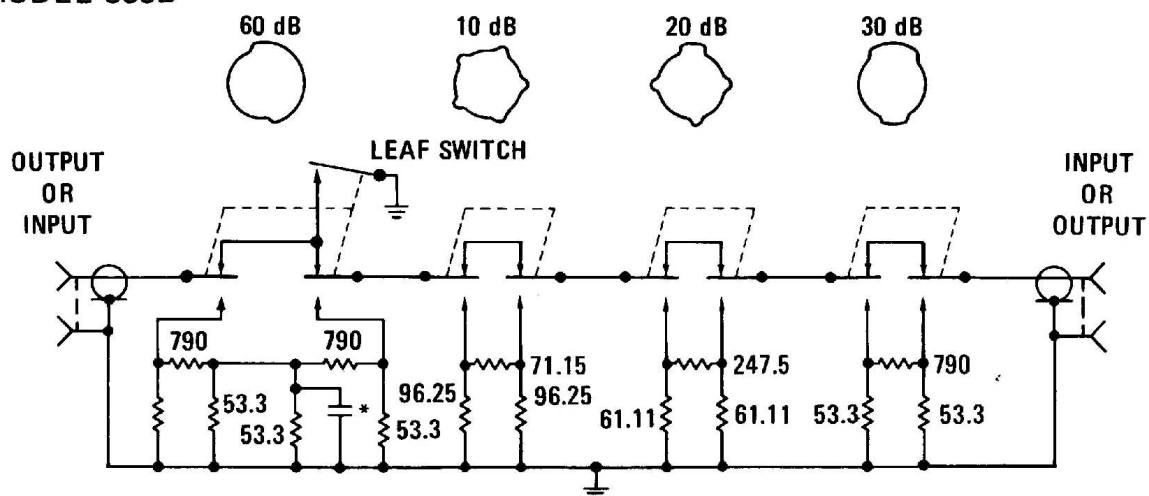
MODELS 355C AND 355D



MODEL 355C



MODEL 355D

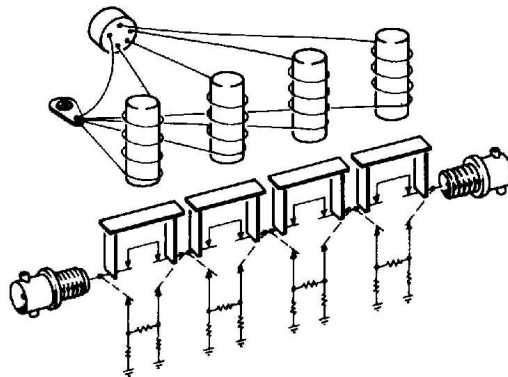


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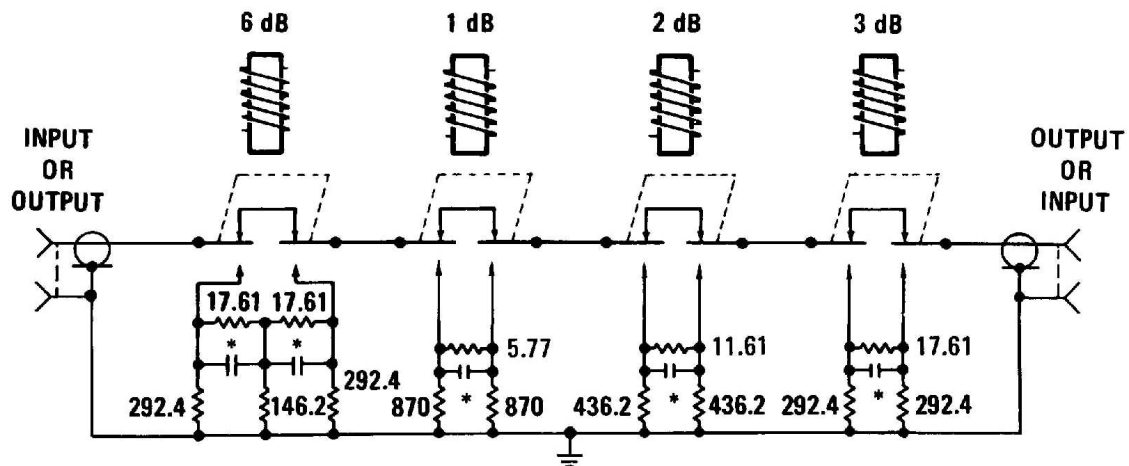
1. Microswitches shown in 0 dB position.
2. Resistances in ohms ($\pm 1/2\%$).
3. Capacitance values factory-adjusted.
4. *Asterisk denotes factory selected value.

Figure 1. Schematic Diagrams, Models 355C and 355D

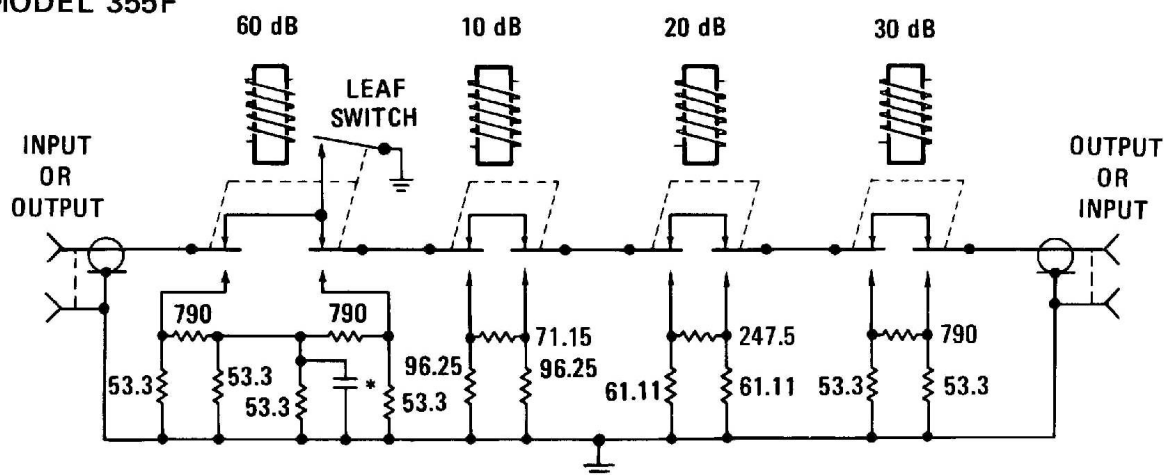
MODELS 355E AND 355F



MODEL 355E



MODEL 355F



NOTES

1. Microswitches shown in 0 dB position.
2. Resistances in ohms ($\pm 1/2\%$).
3. Capacitance values factory-adjusted.
4. *Asterisk denotes factory selected value.

Figure 2. Schematic Diagrams, Models 355E and 355F

short is placed across the connector, inviting damage to either the microswitch or the signal source. If the signal source is capable of delivering more than 10 amperes, use the rear connector for the input. This pads the momentary short with 50 dB of isolation.

Up to 132 dB attenuation in 1 dB steps is available by connecting the Model 355C/E to the Model 355D/F. The connector location on the 355D/F is the mirror image of the connector location on the 355C/E, which permits the two attenuators to be mounted side by side with a short connection between them. A standard UG-491A/U male-to-male BNC adapter or an HP 803A-16E Cable Assembly may be used to connect the two units.

Note

The HP 803A-16E Cable Assembly, a solid (low leakage) coaxial cable, is recommended over flexible coaxial cable.

The Model 355C/D may be operated by remote control since it is switched by rotating one shaft.

CIRCUIT

The schematic for the Model 355C/D is shown in Figure 1 and that of the Model 355E/F in Figure 2. With the exception of the solenoids, the Model 355E/F is electrically identical to the Model 355C/D.

CAUTION

The solenoids in the 355E/F have been precisely adjusted at the factory. No attempt should be made to replace them except by factory approved service representatives. The operation of the attenuators will be unreliable if plungers are not kept with their proper solenoids. Do not interchange or "swap" them.

Lubrication

The cam shaft of the Model 355C/D should be lubricated occasionally with a light lubricant such as Lubriplate No. 105V. Lubrication once a year should be sufficient. The Model 355E/F requires no lubrication.

Resistance Measurements

If overload power has been applied and damage to the unit is suspected, make dc resistance measurements as follows: (A Wheatstone bridge or very accurate digital voltmeter is necessary for these measurements.)

a. Terminate either connector with 50 ohms $\pm 1\%$.

b. Connect the measuring device to the other connector and measure the dc resistance at each step. Resistance measured should be close to 50 ohms.

c. Reverse the connections to the attenuator and again measure the dc resistance at each setting of the dial. Resistance measured should be close to 50 ohms.

d. If the reading on any step is not near 50 ohms the unit has been damaged.

Repair

CAUTION

The Model 355C/D/E/F attenuators are calibrated with the top and bottom covers installed. Removing either cover destroys the calibration and voids the instrument warranty.

The precision performance of the Model 355C/D/E/F is due in part to the fact that the instrument is held to tight electrical and mechanical tolerances during manufacture. To maintain the precision performance of the Model 355C/D/E/F it is recommended that it be returned to your nearest Hewlett-Packard Sales and Service Office for repair.

The following parts, however, are replaceable without removing any cover.

Replacing these parts is recommended if necessary. **355C**

Glide (feet) 4 each HP 0403-0026
Dial Assembly HP 355A-40G
Dial Assembly (Option 003) HP 00355-00001

355D

Glide (feet) 4 each HP 0403-0026
Dial Assembly HP 355A-40H
Dial Assembly (Option 003) HP 00355-00002

355E/F

Glide (feet) 4 each HP 0403-0026
Connector, 7 pin (male) HP 1251-1037

Test	Operation
1	SWR
2	RF Attenuation (355C/E only)
3	RF Attenuation (355D/F only)
4	RF Attenuation at 1 kHz
5	Residual Attenuation

Table 4. Test Equipment and Accessories Recommended

Instrument	Critical Specifications	Test	Model or Part No.
UHF Signal Generator	Frequency Range: 500 to 1000 MHz	1, 2, 3, 5	HP 612A
VHF Signal Generator	Output: 100 MHz	5	HP 608E/F
Sweep Generator	Frequency Range: 250 to 1000 MHz	1	HP 8690B/ 8699B
Oscilloscope	Vertical Deflection: 1 mV/cm Horizontal Deflection: 1 V/cm	1	HP 130C
SWR Meter	Bolometer bias provided ± 0.1 dB accuracy	2, 3, 4, 5	HP 415E
Oscillator	Frequency: 1 kHz Output Balance: 1%	3, 4	HP 200CD
Microwave Amplifier	Frequency Range: 800 to 1000 MHz Power: 1 watt out for 1 mW in at 800 MHz	3	HP 489A
Leveler Amplifier	Leveled Power Constant: ± 0.05 dB	3	HP 8404A
Power Meter	Measurement Capabilities: -5 mW Accepts Coaxial Mount	3	HP 432A
AC Voltmeter	Measure: 5 volts rms	4	HP 400E
Dual Directional Coupler	Range: 250 to 1000 MHz Directivity: 35 dB	1	HP 778D
Dual Directional Coupler	Range: 450 to 940 MHz (Adequate for detection at 1000 MHz)	3	HP 765D or HP 755D
Bolometer Mount	Input Impedance: 50 ohms Maximum SWR: 1.25	2, 3, 5	HP 476A
Low Pass Filter	Cut-off Frequency: 1200 MHz Residual Attenuation: Less than 3 dB	1, 2, 3, 5	HP 360B
Coaxial Thermistor Mount	Frequency Range: 800 to 1000 MHz SWR: Less than 1.3	3	HP 478A
Coaxial Termination Mount (2 needed)	Input Impedance: 50 ohms SWR: 1.5	1, 3	HP 908A

Table 4. Test Equipment and Accessories Recommended (Cont)

Instrument	Critical Specifications	Test	Model or Part No.
VHF Attenuator (2 needed)	Calibrated in 10 dB steps SWR: 1.5	1, 2, 4, 5 (one only for check No. 1)	HP 355C
VHF Attenuator	Calibrated in 10 dB steps SWR: 1.5	1, 3	HP 355D
Output Transformer	Impedance Match: 600 ohms to 50 ohms	4	HP 9120-0021
Crystal Detector (2 needed)	0.01 to 12.4 GHz	1	HP 423A
Power Supply	Output Voltage: 0 to 25 Vdc Output Current: 0 to 400 mA	1	HP 6216A
Accessories			
Number Required	Description	Type No. or HP Part No.	
2	Adapter — male BNC to male BNC	UG-491A/U	
2	Adapter — male N to male BNC	UG-1034U/N	
1	Adapter — female N to female N	UG-29B/U	
1	Adapter — female N to male BNC	UG-348A/U	
2	Adapter — male N to female BNC	UG-201A/U	
1	Adapter — male BNC to dual banana post	HP 10110A	
1	Resistor	(66.7 ohms) HP 0730-003	

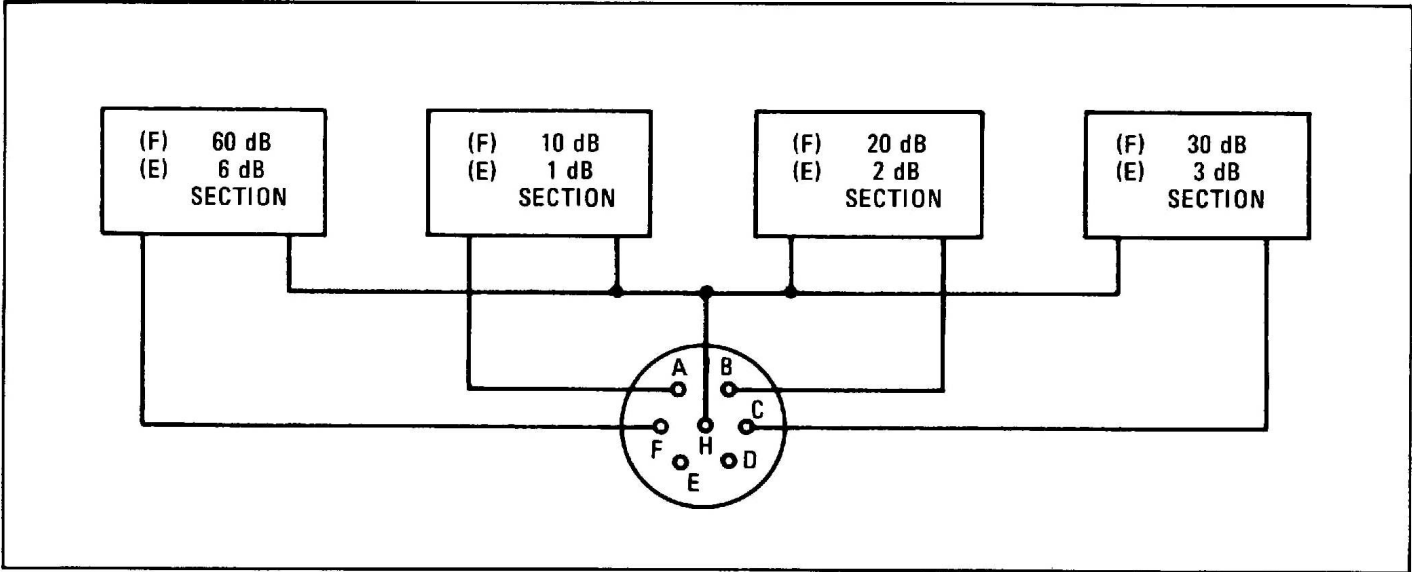


Figure 3. 355E/F Solenoid and Connector Wiring

Table 5. 355E/F Attenuation Program

To obtain attenuation settings given below, apply 18 volts dc between Pin H (common) and Pins:						
355E	355F	Pins		355E	355F	Pins
1 dB	10 dB	A		7 dB	70 dB	F, A
2 dB	20 dB	B		8 dB	80 dB	F, B
3 dB	30 dB	C		9 dB	90 dB	F, C
4 dB	40 dB	C, A		10 dB	100 dB	F, C, A
5 dB	50 dB	C, B		11 dB	110 dB	F, C, B
6 dB	60 dB	F		12 dB	120 dB	F, C, B, A

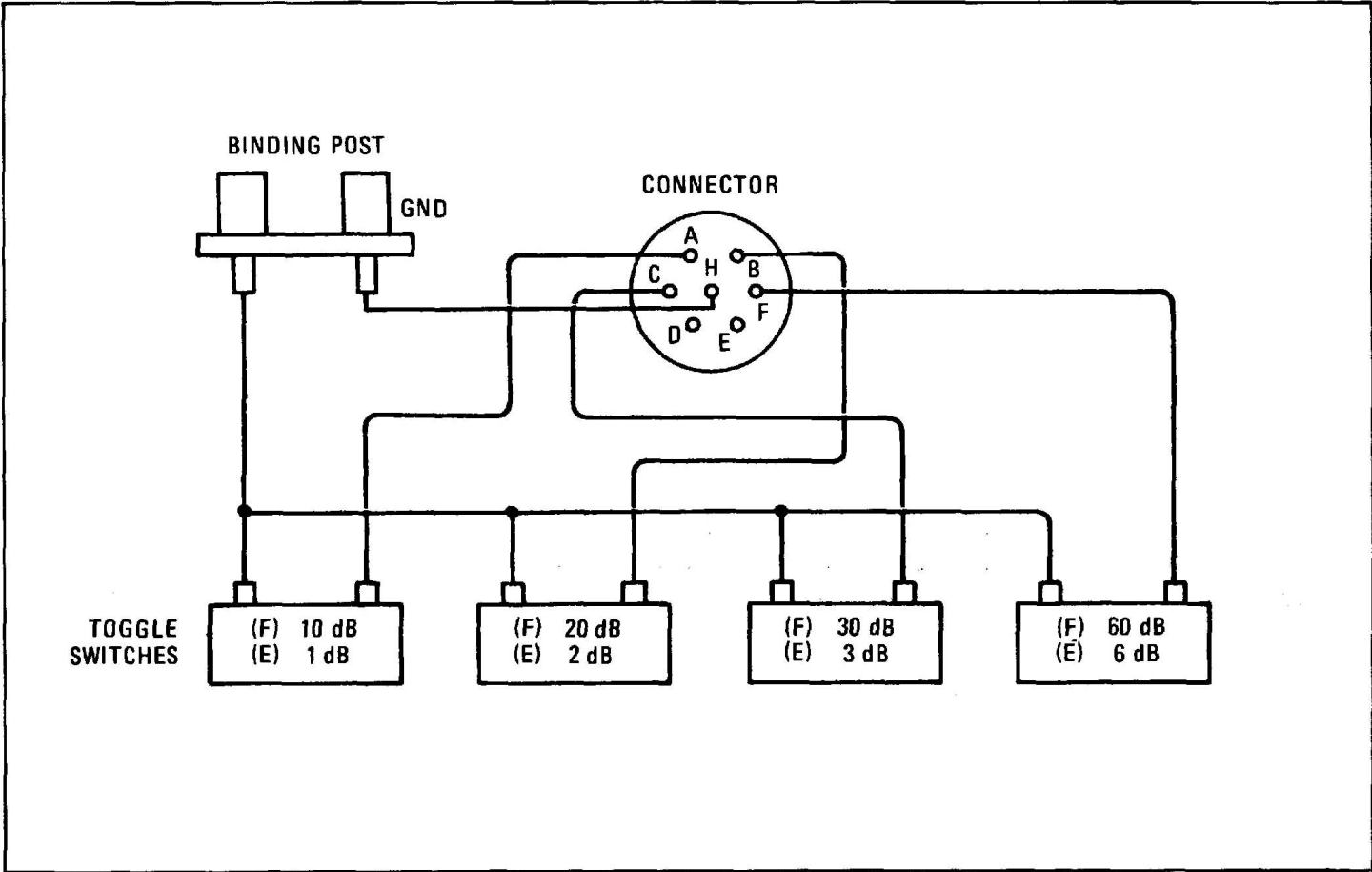


Figure 4. Model 355E/F Programming Switch Test Setup