

# Programmable Attenuators



## Model 153 Programmable Step Attenuator

dc to 40.0 GHz  
1 Watt

*Advanced Technology & Performance*



### Features

- /// Higher Frequency range to 40 GHz.
- /// Choice of Attenuation Ranges
  - 0 to 70 dB in 10 dB steps
  - 0 to 110 dB in 10 dB steps
- /// Lowest insertion loss & Excellent Repeatability
- /// Life of 5 million operations
- /// Small rugged construction & light weight

### Description

This series of Programmable Step Attenuators provide attenuation from 0-70 dB or 0-110 dB in 10 dB steps. These attenuators provide programmable adjustments of RF signal levels in precise steps of 10 dB and consist of a cascaded assembly of switched attenuator cells (Figure 1). The attenuator elements located in the attenuator cell are created by a thin-film process which provides exceptional long-term stability, low power and temperature coefficients. This series uses a reed switching structure that provides rapid switching together with low insertion loss. The 153 series is available in three cell (153-70) and four cell (153-110) configurations.

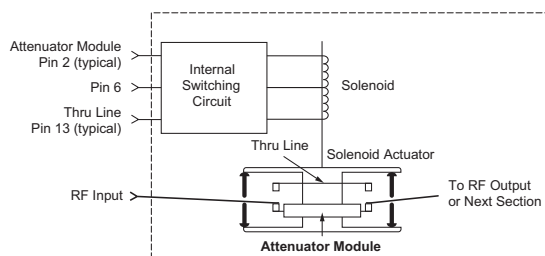


Figure 1. Cell Schematic

All models use in-line, female SMK (2.92mm) Connectors and contain a 14 pin Dip control connector that is plug-compatible with other competitive units.

**PROGRAMMABILITY:** In each programmable step attenuator, solenoid are used to switch the internal resistor card of each cell into and out of the circuit. With positive voltage applied to the common pin (#6) the state (attenuator card or thru line) of a particular section is determined by connecting it's attenuator card or thru pin to ground. Once the cell is switched, the solenoid is magnetically latched into position and is able to withstand extreme shock and vibration. Internal circuitry is included to interrupt the coil current after switching is complete. This reduces power dissipation even if power is continuously applied. The switching time for each cell is rated at 20 msec maximum which includes the contact settling time.

Also integrated in the design is solid state dc switching circuitry that avoids the relatively high failure rate of mechanical DC switches. Each attenuator section is controlled by its own driver circuit, which requires +24V nominal, 125 mA.

### Specifications

**NOMINAL IMPEDANCE:** 50  $\Omega$

**FREQUENCY RANGE:** dc to 40.0 GHz

#### MAXIMUM SWR (50 $\Omega$ Characteristic Impedance):

| Frequency Range (GHz) | SWR  |
|-----------------------|------|
| dc - 8                | 1.30 |
| 8 - 12                | 1.50 |
| 12 - 20               | 1.60 |
| 20 - 26.5             | 1.80 |
| 26.5 - 40             | 2.10 |

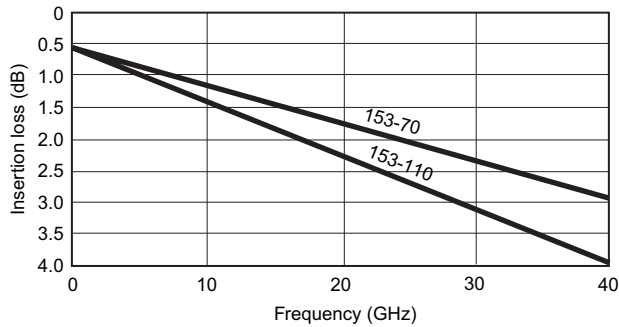
#### CELL CONFIGURATIONS:

| Model Number | NO. Cells | Attenuation Range/Steps (dB) | Cell Increments (dB) |
|--------------|-----------|------------------------------|----------------------|
| 153-70       | 3         | 70/10                        | 10, 20, 40           |
| 153-110      | 4         | 110/10                       | 10, 20, 40, 40       |

*For additional information on the 150 Series, visit our website @ [www.aeroflex.com/AW/programmables.htm](http://www.aeroflex.com/AW/programmables.htm)*

## Specifications - Con't

### MAXIMUM INSERTION LOSS (dB):



### ATTENUATOR ACCURACY ( $\pm$ dB):

| Frequency Range (GHz) | Attenuation (dB) |     |     |     |     |     |     |        |
|-----------------------|------------------|-----|-----|-----|-----|-----|-----|--------|
|                       | 10               | 20  | 30  | 40  | 50  | 60  | 70  | 80-110 |
| DC - 8                | 0.3              | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | 1.1 | 1.4    |
| 8 - 12                | 0.4              | 0.5 | 0.7 | 0.9 | 1.0 | 1.3 | 1.5 | 2.0    |
| 12 - 20               | 0.5              | 0.6 | 0.8 | 1.1 | 1.2 | 1.4 | 1.7 | 2.2    |
| 20 - 26.5             | 0.7              | 0.8 | 1.0 | 1.5 | 1.6 | 1.9 | 2.3 | 2.8    |
| 26.5 - 40             | 0.9              | 1.0 | 1.2 | 1.7 | 1.9 | 2.3 | 2.6 | 3.2    |

**SWITCHING SPEED:** 20 msec. maximum

**OPERATING VOLTAGE:** +24V nominal, +20V minimum; +30V maximum

**SWITCHING CONTROL CURRENT:** 125 mA typical per cell @ +24V nominal, Model 153-70 (3 cells) and 153-110 (4 cells).

**SOLENOID COIL IMPEDANCE:** 190  $\Omega$

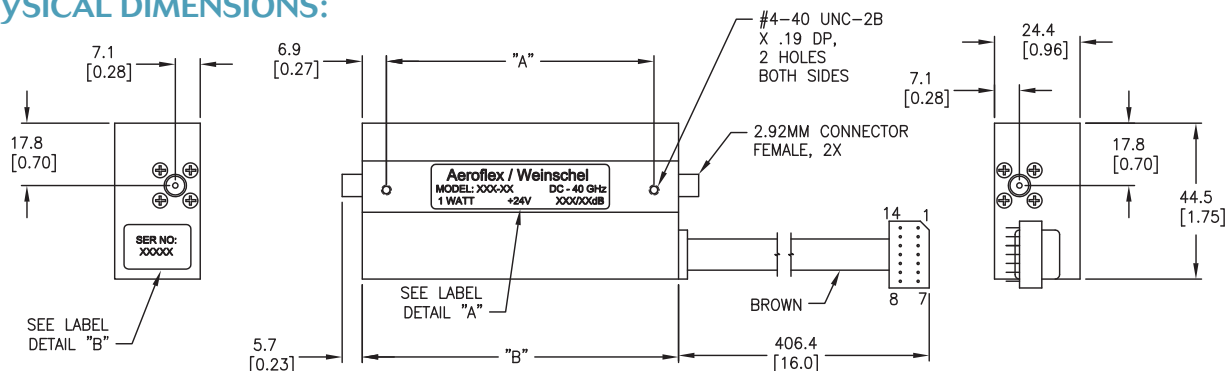
**SOLENOID COIL INDUCTANCE:** 65 mH

**POWER RATING:** 1 watt average, 100 watts peak (5  $\mu$ sec pulse width, 0.5% duty cycle)

**RF POWER SENSITIVITY:** 0.001 dB/dB/W

**SWITCH LIFE:** 5 million (minimum operations per cell)

### PHYSICAL DIMENSIONS:



| Model No. | No. Cells | A            | B           |
|-----------|-----------|--------------|-------------|
| 153-70    | 3         | 76.2 (3.0)   | 90.2 (3.55) |
| 153-110   | 4         | 102.9 (4.05) | 115.8 (4.6) |

NOTE: All dimensions are given in mm (inches) and are nominal, unless otherwise specified.

## Programmable Attenuators

### REPEATABILITY:

$\pm 0.03$  dB to 18 GHz  
 $\pm 0.05$  dB to 26.5 GHz  
 $\pm 0.08$  dB to 40 GHz

### TEMPERATURE RANGE:

Operating:  $-0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$   
Non-Operating:  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

**ALTITUDE:** Operating: 4.6 km (440 mm Hg)  
Non-operating: 15 km

**SHOCK:** Operating: 10g, 6 ms, on 6 sides, 3 blows  
Non-operating: 500 g, 1.8 ms, in 6 directions

**HUMIDITY:** 0 to 95% relative humidity

**EMC:** MIL-STD-461, Method RE02, VDE 0871, CISPR#2

**TEST DATA:** Test data is available at additional cost.

**CONNECTORS:** 2.92mm connectors - mate nondestructively with SMA connectors per MIL-C-39012, 3.5mm, SMK, and other 2.92mm connectors.

**CONTROL CONNECTOR:** 14 conductor 16" ribbon cable with connector (shown below):

| Pin Number | Wire Color | 153-70                | 153-110                 |
|------------|------------|-----------------------|-------------------------|
| 1          | ---        | ---                   | ---                     |
| 2          | White      | 10 dB Cell Attenuator | 10 dB Cell Attenuator   |
| 3          | Violet     | 40 dB Cell Thru Line  | 40 dB Cell 1 Thru Line  |
| 4          | Green      | ---                   | 40 dB Cell 2 Thru Line  |
| 5          | Orange     | 20 dB Cell Attenuator | 20 dB Cell Attenuator   |
| 6          | Brown      | +24Vdc                | +24Vdc                  |
| 7          | ---        | ---                   | ---                     |
| 8          | ---        | ---                   | ---                     |
| 9          | Red        | 40 dB Cell Attenuator | 40 dB Cell 1 Attenuator |
| 10         | Yellow     | ---                   | 40 dB Cell 2 Attenuator |
| 11         | Blue       | 20 dB Cell Thru Line  | 20 dB Cell Thru Line    |
| 12         | Grey       | ---                   | ---                     |
| 13         | Black      | 10 dB Cell Thru Line  | 10 dB Cell Thru Line    |
| 14         | ---        | ---                   | ---                     |

**WEIGHT (Typical):** 153-70: 170 g (6 oz)  
153-110: 213 g (7.5 oz)