

**Model 150T
Model 151T
Model 152T
Model 155T
SmartStep™ Programmable Attenuators**

**dc to 18.0 GHz
dc to 4.0 GHz
dc to 26.5 GHz
dc to 8.0 GHz**

Greatly Simplifies OEM & System Design!



Description

Weinschel Corporation introduces a new generation of intelligent programmable step attenuators with a built-in TTL interface (Figure 1). These models are designed to simplify the control and integration of these devices into subsystem and bench applications. These intelligent attenuators offer the same long reliable operation with exceptional accuracy and repeatability as with our other 150 Series Programmable Attenuators. They provide programmable adjustments of RF signal levels in precise steps of 1 dB, 5 dB, 10 dB, or with custom steps available. Each attenuator consists of a cascaded assembly of switched attenuator

cells and a internal TTL interface. 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 of step attenuators uses a reed switching structure that provides rapid switching together with low insertion loss.

BUILT-IN SMARTSTEP DRIVER CIRCUITRY: These SmartStep attenuators feature an internal microcontroller-based driver that provides a TTL-level digital interface for control of the attenuator relays. This card simplifies operation and interfacing requirements, while at the same time providing for greatly enhanced flexibility over past designs. User-selectable modes of operation include both parallel and serial I²C bus. The parallel mode provides a simple, one-bit per relay on/off control with internal pullups for use primarily in single attenuator applications. This mode allows the attenuator to be controlled via a variety of methods, such as a TTL-level digital output port, or mechanical toggle switches. The I²C mode provides a two-wire serial bus structure and protocol for connecting a number of devices to a single host control interface, suitable for use in larger system and sub-system applications. The SmartStep contains non-volatile configuration memory that is used to hold a wide variety of attenuator and driver-dependant parameters, including serial number, attenuator cell dB values, relay configurations, and switching requirements, which are all accessible via the I²C interface. This frees the system designer from such low-level details, allowing faster integration. In either operational mode, the microcontroller enters an idle condition during periods of inactivity, turning off all on-board clocks, reducing EMI concerns, and lowering power consumption. On-board regulation for the digital circuitry allows the SmartStep to operate from a single input supply voltage.

Other features include:

- /// Wide Variety of Frequency & Attenuation Ranges
- /// Broadband Frequency Coverage
- /// High Accuracy and Repeatability
- /// Long Life, 5 Million Cycles Per Cell
- /// Common 14 pin Interface Connector
- /// Custom Attenuation Ranges

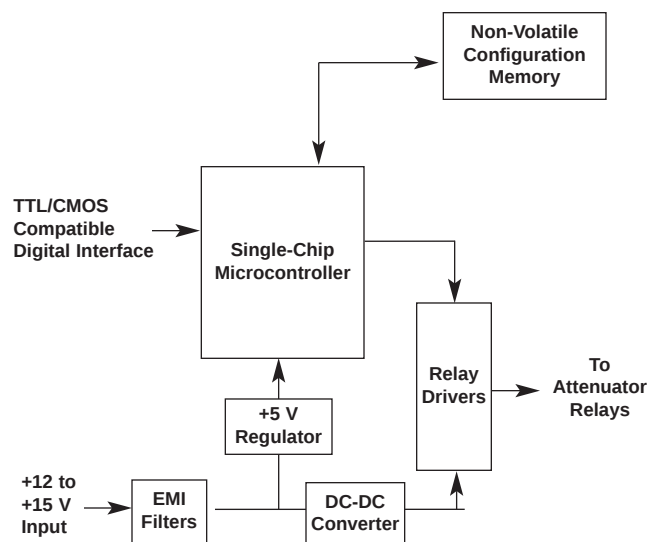


Figure 1. SmartStep Driver Circuitry

For additional information on the 150 Series, visit our website @ www.weinschel.com/programmable.htm



Specifications

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: Model 151T: dc to 4 GHz
Model 150T: dc to 18 GHz
Model 152T: dc to 26.5 GHz
Model 155T: dc to 8.0 GHz

CELL CONFIGURATIONS:

Cell	11	15	31	55	62	70	70	75	90	110
1	1	1	1	5	2	10	10	5	10	10
2	4	8	16	10	32	20	40	40	30	40
3	2	2	2	20	16	20	20	20	20	20
4	4	4	8	20	4	20	--	10	30	40
5	--	--	4	--	8	--	--	--	--	--

DRIVER INTERFACE:

Input Supply Voltage: +12.0 to +15.0V
Control Signals: TTL/CMOS compatible
Interface Modes: parallel/ I²C serial
DC Characteristics (at 25 °C):
Digital Interface:
Parameter Specification
V_{IL} Low Level input: -0.5 min, 0.8V max
V_{IH} High Level input: 2.0 min, 5.25V max
I_{PU} Pullup Current 50 μ A min, 400 μ A max
Power Supply:
V_{IN} Supply Voltage: +12.0 to +15.0V
I_{IN} Supply current: 25 mA
I_{CELL} Supply Current: 150 mA (per cell, switching)

POWER RATING: 1 watt average, 100 watts peak

TEMPERATURE: -20° to +70°C operating
-55° to +85°C nonoperating

TEMPERATURE COEFFICIENT: <0.0001 dB/dB/C

POWER SENSITIVITY: <0.001 dB/dB/ Watt

RATED SWITCH LIFE: 5 million cycles per cell

RF INPUT CONNECTORS: Rugged female 3.5 mm which mate nondestructively with SMA male connectors per MIL-STD-39012.

INTERFACE CONNECTOR: 14 pin .025 square post header on .1 center. Mates with Amp connector 746285-2 or equivalent (one mating connector included with each unit).

SWITCHING SPEED: 20 msec (includes settling time)

CONTROL PULSE WIDTH: 20 msec (minimum)

MAXIMUM SWR (50 Ω Characteristic Impedance):

APPLICABLE MODELS	Frequency (GHz)		
	dc-4	4-18	18-26.5
151T-11, 151T-15, 151T-31, 151-62T, 151T-75, 151T-110	1.50	---	---
150T-11, 150T-15, 150T-31 150T-62, 150T-75, 150T-110	1.50	1.90	---
151T-70 (3 cell)	1.35	---	---
150T-70 (3 cell)	1.35	1.70	---
152AT-70 (3 cell)	1.40	1.70	1.80
152T-11, 152T-15, 152T-55, 152T-70, 152T-90	1.40	1.60	1.80
	dc-3		3-8
155T-11, 155T-90	1.50		1.80
155T-70 (3 cell)	1.35		1.50

MAXIMUM INSERTION LOSS (dB):

APPLICABLE MODELS	Frequency (GHz)		
	dc-4	4-18	18-26.5
151T-11, 151T-15, 151T-75, 151T-110	0.90	---	---
150T-11, 150T-15, 150T-75, 150T-110	0.90	2.20	--
151T-31, 151T-62 (5 cell)	1.10	----	----
150T-31, 150T-62 (5 cell)	1.10	2.60*	----
151T-70 (3 cell)	0.70	---	---
151T-70 (3 cell)	0.70	1.60	---
152AT-70 (3 cell)	0.90	2.00	2.98
152T-11, 152T-15, 152T-55, 152T-70, 152T-90	0.90	2.00	2.98
	dc-3		3-8
155T-11, 155T-90	0.90		1.50
155T-70 (3 cell)	0.70		1.50

*4-12.4 is 1.80, 12.4-18 is 2.60

REPEATABILITY:** $\pm$ 0.01 typical to 18 GHz
 $\pm$ 0.05 dB typical to 26.5 GHz

VIBRATION*: MIL-STD-202F, Method 204D Cond B

ALTITUDE*: MIL-STD-202F, Method 105C Cond B, 50,000 Ft.

SHOCK*: MIL-STD -202F, Method 213B Cond B, except 10G, 6 msec

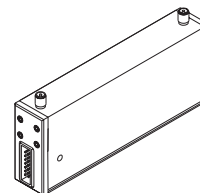
HUMIDITY*: MIL-STD-202F, Method 103B, Cond. B (96 Hrs. @ 95%, RH).

**Specification does not apply to 155T series.

ATTENUATION ACCURACY (+dB with respect to 0 dB reference):

Model 150T/151T/152T-11 & 150T/151T/152T-15:

Frequency Range (GHz)	Attenuation Setting (dB)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
dc-4	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
4-12.4	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7
12.4-18	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
18-26.5	0.5	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1



Model 155T-11:

Frequency Range (GHz)	Attenuation Setting (dB)										
	1	2	3	4	5	6	7	8	9	10	11
dc-3	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5
3-8	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.7

Model 155T-70 & 155-90:

Frequency Range (GHz)	Attenuation Setting (dB)								
	10	20	30	40	50	60	70	80	90
dc-3	0.3	0.5	0.6	0.7	0.8	1.0	1.1	1.1	1.2
3-8	0.4	0.5	0.7	0.9	1.0	1.3	1.5	1.6	1.7

Model 150T/151T-75:

Frequency Range (GHz)	Attenuation Setting (dB)														
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
dc-4	0.2	0.2	0.4	0.4	0.5	0.5	0.7	0.7	0.9	0.9	1.1	1.1	1.2	1.2	1.4
4-12.4	0.3	0.3	0.6	0.6	0.9	0.9	1.2	1.2	1.5	1.5	1.8	1.8	2.1	2.1	2.1
12.4-18	0.4	0.4	0.8	0.8	1.2	1.2	1.6	1.6	2.0	2.0	2.4	2.4	2.8	2.8	2.8

Model 150T/151T-31:

Frequency Range (GHz)	Attenuation Setting (dB)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
dc-4	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5
4-12.4	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7
12.4-18	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Frequency Range (GHz)	Attenuation Setting (dB)														
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
dc-4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8
4-12.4	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	1.1	1.0	1.0	1.0	1.0	1.1	1.1
12.4-18	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3

Model 150T/151T-62:

Frequency Range (GHz)	Attenuation Setting (dB)															
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
dc-4	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
4-12.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8
12.4-18	0.5	0.5	0.5	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.2	1.2

Frequency Range (GHz)	Attenuation Setting (dB)														
	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62
dc-4	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.2
4-12.4	1.0	1.0	1.1	1.1	1.3	1.4	1.4	1.4	1.5	1.6	1.6	1.6	1.8	1.8	1.8
12.4-18	1.4	1.4	1.6	1.6	1.8	1.8	2.0	2.0	2.0	2.2	2.2	2.2	2.4	2.4	2.4

Model 150T/151T-70, 150T/151T-110, 152AT-70:

Frequency Range (GHz)	Attenuation Setting (dB)										
	10	20	30	40	50	60	70	80	90	100	110
dc-4	0.2	0.3	0.5	0.7	0.9	1.0	1.2	1.4	1.6	1.7	1.9
4-12.4	0.4	0.7	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.0
12.4-18	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.0
18-26.5	0.6	0.7	0.9	1.5	1.6	2.2	2.9	---	---	---	---

Model 152T-55:

Frequency Range (GHz)	Attenuation Setting (dB)										
	5	10	15	20	25	30	35	40	45	50	55
dc-4	0.2	0.3	0.4	0.4	0.4	0.6	0.6	0.7	0.7	0.8	1.0
4-12.4	0.3	0.4	0.5	0.5	0.5	0.7	0.8	0.9	0.9	1.0	1.3
12.4-18	0.4	0.4	0.5	0.5	0.5	0.8	1.0	1.1	1.1	1.2	1.6
18-26.5	0.5	0.5	0.6	0.6	0.6	0.9	1.2	1.4	1.4	1.5	2.0

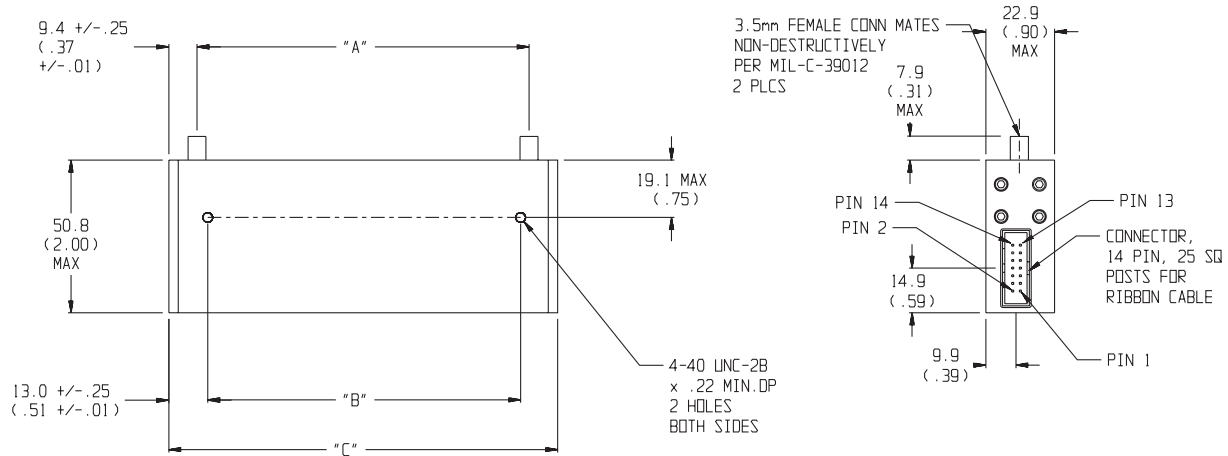
Model 152T-70 152T-90:

Frequency Range (GHz)	Attenuation Setting (dB)									
	10	20	30	40	50	60	70	80	90	
dc-4	0.3	0.5	0.6	0.7	0.8	1.0	1.1	1.1	1.2	
4-12.4	0.4	0.5	0.7	0.9	1.0	1.3	1.5	1.6	1.7	
12.4-18	0.5	0.6	0.8	1.1	1.2	1.4	1.7	1.8	2.1	
18-26.5	0.5	0.6	0.9	1.4	1.5	1.8	2.3	2.4	2.8	



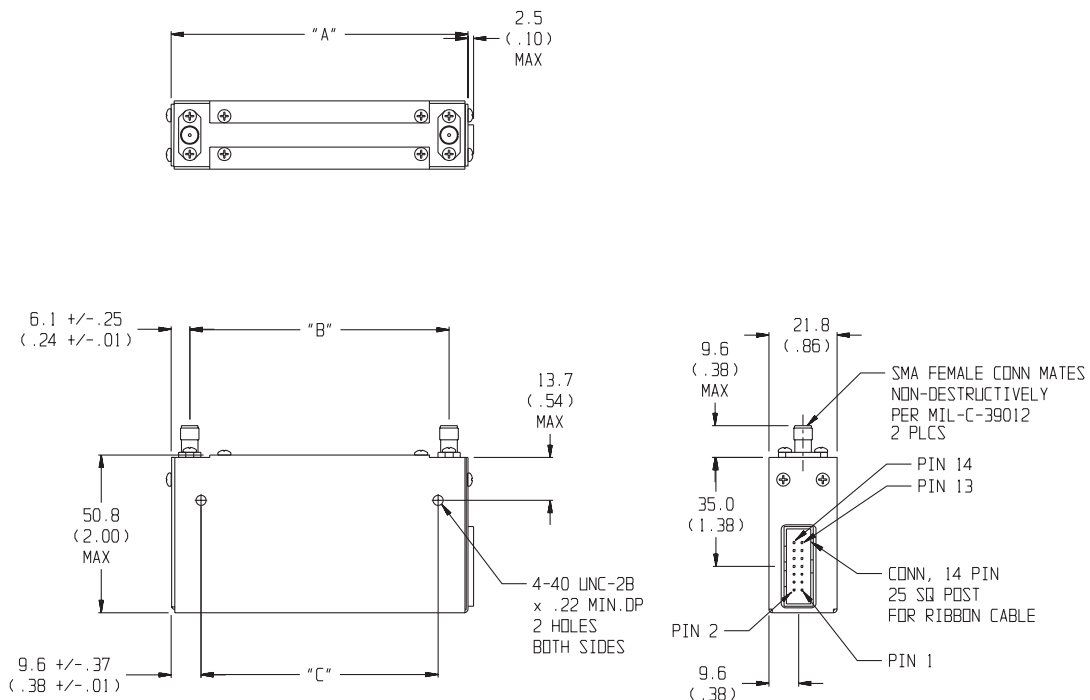
PHYSICAL DIMENSIONS:

Models 150T, 151T, & 152T:



DIM	A	B	C
3 cell	83.0 (3.27)	76.2 (3.0)	101.6 (4.00)
4 cell	110.7 (4.36)	103.6 (4.06)	129.2 (5.09)
5 cell	136.9 (5.39)	129.8 (5.11)	156.2 (6.15)

Model 155T:



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



150T Series Ordering Guide...

Frequency Range	NO. Cells	Attenuator Range/Step Size								
		11/1 dB	15/1 dB	31/1 dB	55/5 dB	62/2 dB	70/10 dB	75/5 dB	90/10 dB	110/10 dB
dc-4 GHz	4	151T-11	151T-15		N/A		151T-70	151T-75	N/A	151T-110
	3									
	5			151T-31		151T-62				
dc-8 GHz	4	155T-11	N/A	N/A	N/A	N/A	155T-70	N/A	N/A	155T-90
	3									
	5									
dc-18 GHz	4	150T-11	150T-15		N/A		150T-70	150T-75	N/A	150T-110
	3									
	5			150T-31		150T-62				
dc-26.5 GHz	4	152T-11	152T-15		152T-55	NA	152T-70	N/A	152T-90	152T-110
	3						152AT-70			
	5									

ACCESSORIES

SmartStep Interface: The Model 8210A **SmartStep** Interface provides a flexible, low cost solution for the operation of programmable step attenuators and other electromechanical devices under computer control. Designed to interface to Weinschel's new line of **SmartStep** programmable attenuators, the 8210A represents a new concept in device control applications for bench test and sub-system designs. The 8210a provides a high-level interface from various industry standard communications interfaces, including IEEE-488 and RS232/RS422/RS485, to the **SmartStep's** serial Driver Interface Bus.

OPTIONAL CALIBRATION DATA: Calibration Data is available at an additional cost for all programmable step attenuator models. This calibration data is generated using a computer controlled Weinschel Attenuation Measurement System. Standard calibration data can be provided in 250 MHz steps for all dc-4 GHz models and in 500 MHz steps for dc-18 and dc-26.5 GHz models. The measurements are traceable to NIST Standards.