INSTALLATION & OPERATING INSTRUCTIONS
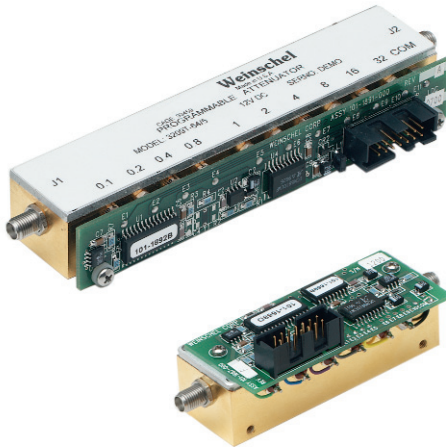
Model 3200T, 3201T, 3205T, 3206T, 3209T Series *SmartStep*® Programmable Attenuators

api

technologies corp.
› WEINSCHEL

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Frederick, Maryland
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GENERAL

This manual provides general installation instructions and wiring data to be used as an aid in installing a API / Weinschel 3200T, 3201T, 3205T, 3206T or 3209T Series SmartStep Programmable Attenuator into any system or application. Also included are specifications and other technical data to help in the installation and operation of your 3200T Series Smartstep Programmable Attenuator.
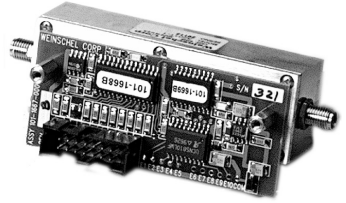
This Series of SmartStep Programmable Step Attenuators is designed for use in automatic test equipment and OEM systems operating in the dc to 2/3 GHz frequency range. Each cell contains a standard TO-5 type double-pole, double-throw relay that provides a minimum loss or attenuated path for the RF signal which is controlled by a built-in digital interface shown in Figure 1.
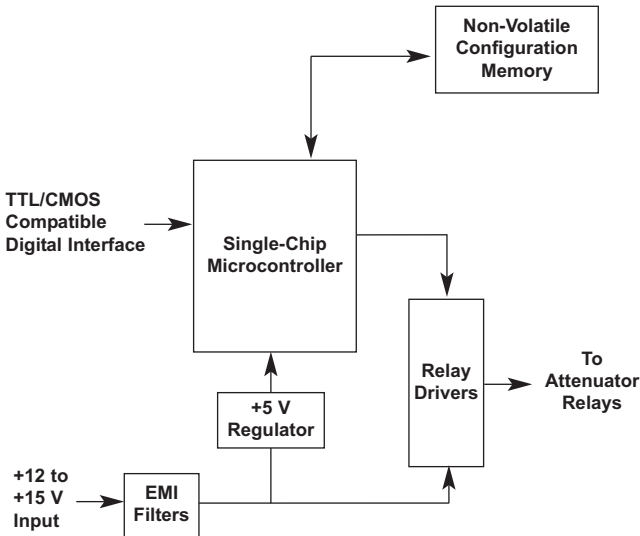
Figure 1. SmartStep Driver Circuitry

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 Smartstep 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 Smartstep 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-dependent parameters, including serial number, attenuator cell dB values, relay configurations, and switching requirements, which are all accessible via the Smartstep 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.

CELL CONFIGURATION

The table below list all the standard attenuation ranges and cell configurations for API / Weinschel 3200T Series Smartstep Programmable Attenuators (Models 3200T, 3201T, 3205T, 3206T, 3209T). Note the dash number is the attenuation value of your attenuator.

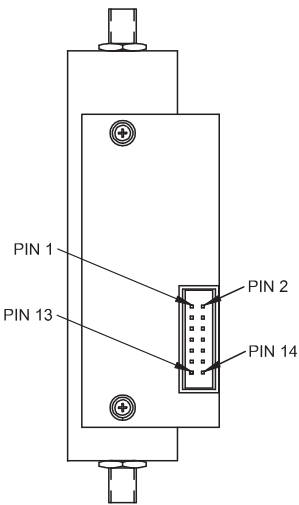| Model No.	Cell No.	Range/ Step Size (dB)	Data Bit-Cell Value (dB)							
			D7	D6	D5	D4	D3	D2	D1	D0
3200T-1 3200T-1E	8	127/1	32*	16	8	4	32*	2	1	32
3200T-2 3200T-2E	8	63.75/0.25	32	16	8	4	2	1	0.5	0.25
3201T-1 3201T-1E	5	31/1				16	8	4	2	1
3201T-2	5	120/10				30*	20	30*	10	30
3205T-1 3205T-1E	4	70/10					20	20	20	10
3205T-2 3205T-2E	4	55/5					20	20	10	5
3205T-3E 3205T-3E	4	1.5/0.1					0.8	0.4	0.2	0.1
3206T-1 3206T-1E	6	63/1			32	16	8	4	2	1

* Combined Cells

** Model 3209T-1 & 3209T-1E can only be operated in the serial mode with the 8210A.

INSTALLATION

MOUNTING: Each Programmable Step Attenuator is supplied with four mounting holes (4-40 UNC-2B x 0.24 MIN DP) located on the bottom side of the attenuator.

RF CABLE INSTALLATION: Care should be taken to prevent strain on the interconnecting cables, since damage here may not always be apparent. Check the attaching RF cables and the SMA connectors for signs of cracked insulation and/or bent or worn pins prior to connection. Tests show that connectors must be clean for accuracy and stability. This requires an inspection and cleaning of each connector immediately before use.   When cleaning precautions are observed regularly, connectors can maintain their stability for over several thousand connection cycles. API / Weinschel recommends a torque value of 7 to 10 inch pounds when connecting any RF cable to the attenuator's RF connectors.

DEVICE INTERFACE BUS (DIB) CONNECTOR WIRING: Figure 2 shows the connectors contact pin numbering scheme and the signal designator for signal present at each contact pin.

Name	Pin	Description
VIN	1	dc Supply Voltage, +12 to 15 V [1]
VIN	2	dc Supply Voltage, +12 to 15 V [1]
GND	3,4	dc Return
D0/SDA	7	Data Bit 0 (isb)/I^2C SDA
D1/SCL	8	Data Bit 1//I^2C SCL
D2	5	Data Bit 2
D3	6	Data Bit 3
D4	11	Data Bit 4
D5	12	Data Bit 5
D6	9	Data Bit 6
D7	10	Data Bit 7 (msb)
Mode Select	13	Parallel/Serial Mode Select 1=Parallel 0=Serial This pin has a 22K resistive pull-up to 5 V. Leave unconnected for parallel mode operation.
/RST	14	Reset Input, low active This pin has a 22K resistive pull-up to 5 V Leave unconnected if not used.

Note: D0-D7 pins contain weak active pullups, capable of sourcing approximately 150 mA.
(1) Voltage may be applied to either PIN 1 or 2 or both.

NOTE: Pin locations same with or without cover.

Figure 2. DIB Connector Wiring

PARALLEL MODE OPERATION:

In the parallel mode of operation, the Smartstep attenuator accepts TTL-level parallel data on the D0-D7 input data lines. Each data line controls a separate attenuation cell, where a logic 1 input (TTL high) engages the attenuation cell, and a logic 0 input (TTL low) bypasses the cell, providing a through path. The data lines have a weak active pull-up to +5V, and therefore if the pin is left unconnected (or floating), will engage the attenuation cell. The on-board microcontroller debounces the data lines and generates the proper timing and control sequence for operation of the relays. The data line inputs are not latched, and must be driven with a constant level to keep the desired attenuation setting.

SERIAL MODE OPERATION:

In the serial mode of operation, the Smartstep attenuator communicates over a two-wire serial bus to the API / Weinschel Model 8210A Smartstep Interface. The bus uses a clock (SCL) and data (SDA) line to send and receive program-ming and configuration information. The messages sent over the bus use the software protocol as defined in the ACCESS.bus™ V2.2 specification (Base Protocol) with Weinschel-specific extensions to support the control of step attenuators (StepAttn Protocol). These protocols and operating instructions can be located in the Model 8210 instruction manual (IM-288). The ACCESS.bus™ messages have the following format:

Byte#	D7	D6	D5	D4	D3	D2	D1	D0	Description
1	D7	D6	D5	D4	D3	D2	D1	0	Destination address
2	S7	S6	S5	S4	S3	S2	S1	0	Source address
3	P	L6	L5	L4	L3	L2	L1	L0	Protocol flag & Msg Length
4									msg body- 0 to 127 bytes
Length+4	X7	X6	X5	X4	X3	X2	X1	X0	Checksum

For an indepth discussion of the hardware and software operation, refer to the ACCESS.bus™ specification.

SPECIFICATIONS

NOMINAL IMPEDANCE: 50 Ω

FREQUENCY RANGE: dc to 2.0 GHz: 3200T-1, 3200T-2, 3201T-1, 3201T-2, 3205T-X, 3206T-1, 3209T-1

dc to 3.0 GHz: 3200T-1E, 3200T-2E, 3201T-1E, 3205T-XE, 3206T-1E, 3209T-1E

DRIVER INTERFACE:

Input Supply Voltage: +12.0 to +15.0V

Control Signals: TTL/CMOS compatible

Interface Modes: parallel/ I^2C 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 μA min, 400 μA max

Power Supply:

V_{IN}	Supply Voltage:	+12.0 to +15.0V
I_{IN}	Supply current:	25 mA
I_{CELL}	Supply Current:	15 mA (2 GHz Units)
	(per cell, continuous)	30 mA (3 GHz Units)

POWER RATING: 1 watt average to 25°C ambient temperature, derated linearly to 0.25 watt @ 71°C. 50 watts peak (5 μsec pulse width; 1% duty cycle)

POWER COEFFICIENT: < 0.005 dB/dB/watt

RATED SWITCH LIFE: 5 million cycles operations per cell @ 0 dBm

CYCLING RATE: 5 Hz maximum per relay

SWITCHING TIME: 6 mSEC maximum @ nominal rated voltage

RELEASE TIME: 3 mSEC maximum

TEMPERATURE: 3200T, 3201T: -20° to +70°C
3205T, 3206T, 3209T

MONOTONICITY: 3200T, 3201T: 10 MHz to 2.0 GHz (minimum of 1 dB change)
3205T, 3206T, 3209T

3200T-1E, 3200T-2E, 3201T-1E: 10 MHz to 3.0 GHz
3205T-XE, 3206T-1E, 3209T-1E

INCREMENTAL TEMPERATURE COEFFICIENT:

30 & 32 dB cells: 0.0005 dB/dB/°C
All other cells: 0.0002 dB/dB/°C

CELL CONFIGURATIONS:

Model Number	NO. Cells	Attenuation Range/Steps (dB)	Cell Increments (dB)
3200-1 3200-1E	8	127/1	1, 2, 4, 8, 16, 32, 64*
3200-2 3200-2E	8	63.75/0.25	0.25, 0.5, 1, 2, 4, 8, 16, 32
3201-1 3201-1E	5	31/1	1, 2, 4, 8, 16
3201-2	5	120/10	10, 20, 30, 60**
3205-1 3205-1E	4	70/10	10, 20, 20, 20
3205-2 3205-2E	4	55/5	5, 10, 20, 20
3205-3 3205-3E	4	1.5/0.1	0.1, 0.2, 0.4, 0.8
3206-1 3206-1E	6	63/1	1, 2, 4, 8, 16, 32
3209-1 3209-1E	10	64.5/0.1	0.1, 0.2, 0.4, 0.8, 1, 2, 4, 8, 16, 32

*64 dB cell comprised of two 32 dB cells
*60 dB cell comprised of two 30 dB cells

MAXIMUM SWR:

Freq Range (GHz)	3200-1 3200-2	3200-1E 3200-2E 3201-1E	3201-X 3206-X	3205T-XE 3206-1E	3209-1	3209-1E
dc - 0.2	1.30	1.25	1.30	1.25	1.35	1.35
0.2 - 0.5	1.25	1.25	1.25	1.25	1.35	1.35
0.5 - 1	1.25	1.25	1.25	1.25	1.35	1.35
1 - 2	1.35	1.25	1.35	1.25	1.35	1.35
2 - 3	- - -	1.40	- - -	1.40	- - -	1.45

INCREMENTAL ATTENUATION ACCURACY:

Frequency Range (GHz)	3200T, 3201T, 3205T, 3206T, 3209T
dc - 0.5	+ 0.2 dB or 0.5%
0.5 - 1	+ 0.2 dB or 1.0%
1 - 3	+ 0.3 dB or 2.0%

MAXIMUM INSERTION LOSS (dB):

Frequency Range (GHz)	3200T-1 3200T-2	3200T-1E 3200T-2E	3201-1 3201-2	3201T-1E	3205T-X	3205T-XE	3206T-1	3206T-1E	3209T-1	3209T-1E
dc - 0.5	2.75	2.50	1.80	1.70	1.80	1.50	2.00	1.50	3.50	3.00
0.5 - 1.0	3.40	3.20	2.40	2.20	2.30	1.75	2.60	2.00	4.50	3.50
1.0 - 1.5	4.00	3.50	3.00	2.50	2.80	2.00	3.10	2.50	5.60	4.00
1.5 - 2.0	4.50	4.00	3.75	2.80	3.30	2.25	3.50	2.80	6.70	4.50
2.0-3.0	- - -	4.70	- - -	3.25	- - -	2.60	- - -	3.70	- - -	5.50

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).

CONSTRUCTION:

	Housing:	Aluminum
	Connectors:	Stainless steel body and beryllium copper contacts.

WEIGHT:

|	3200T	165 g (8.4 oz)
	3201T	132 g (7.3 oz)
	3206T	132 g (7.3 oz)
	3205T	132 g (7.3 oz)
	3209T	218 g (3.5 oz)

CONTACTING API / Weinschel

In the event you're having difficulty or believe that the components are defective, please contact Weinschel immediately. An apparent malfunction may be corrected over the phone by contacting the Customer Service Department at Weinschel. DO NOT send the product back to the factory without prior authorization (RMA number). When it is necessary to return an item, state the symptoms or problems, catalog and type number of the attenuator, and date of original purchase. Also write the company name, your name, and phone number on an index card. Then attach the card to the attenuator to be returned.

For more information or any questions about your Programmable Step Attenuators and/or other Weinschel products, contact the Sales Department at API / Weinschel.

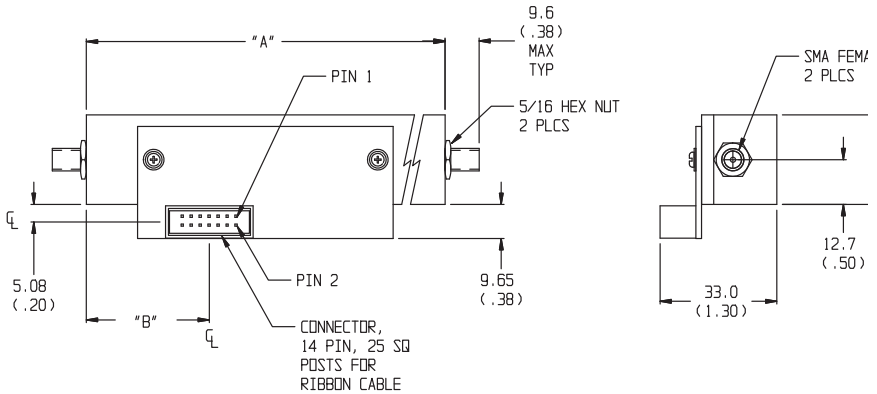# *Physical Dimensions:*

Model 3200T, 3201T & 3206T:
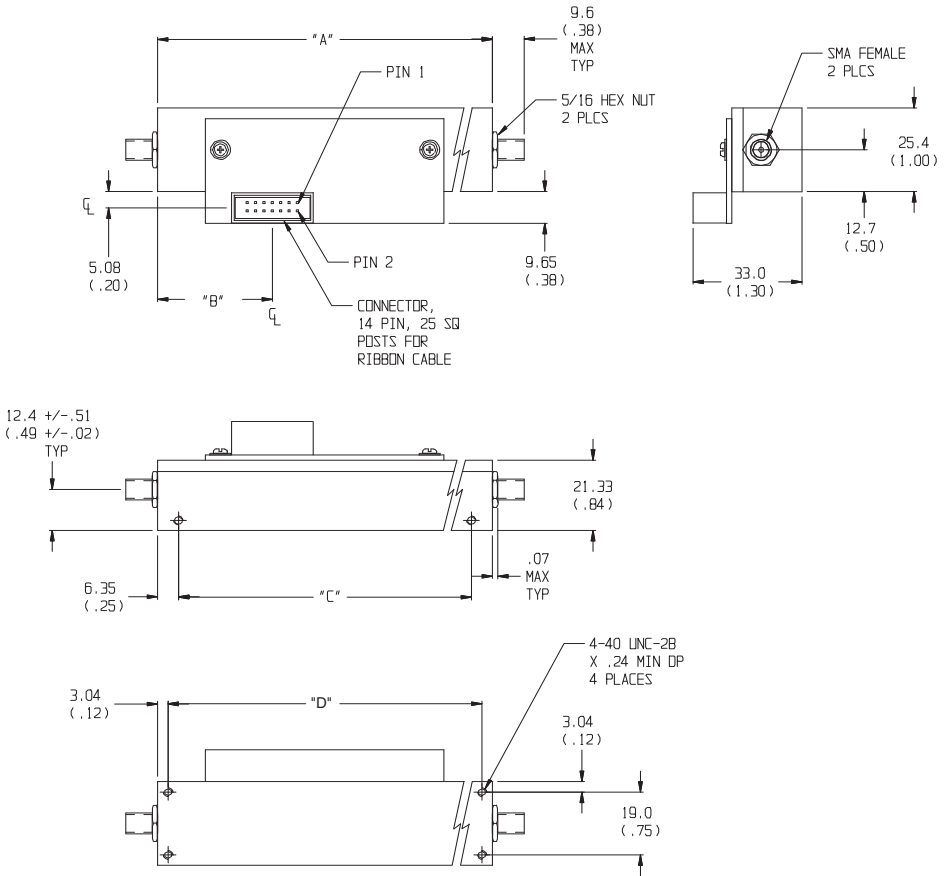
Model No.	No. Cells	A	B	C	D
3200T-X	8	101.6 (4.0)	31.8 (1.25)	88.9 (3.50)	95.2 (3.75)
3201T-X 3205T-X	5/4	76.2 (3.00)	19.1 (0.75)	63.5 (2.50)	69.8 (2.75)
3206T-X	6	81. 3+0.5 (3.20+0.02	21.46 (0.85)	68.6 (2.70)	75.18 (2.96)

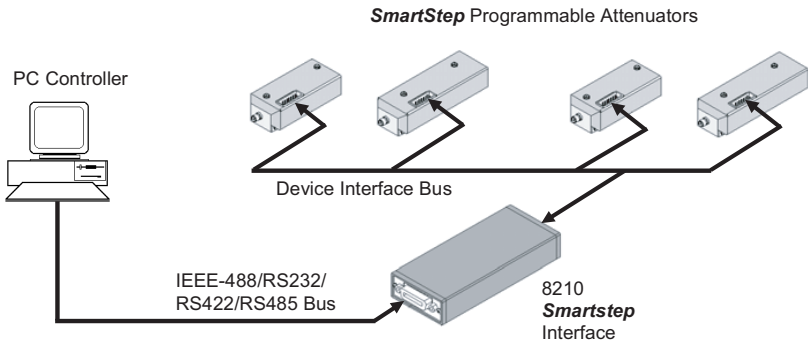NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

PHYSICAL DIMENSIONS:

Model 3209T:

ACCESSORIES

Model 8210A 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 subsystem designs. The 8210A provides a high-level interface from various industry standard communications interfaces, including IEEE-488/RS232/RS422/RS485, to the Smartstep's serial Device Interface Bus. Typical Setup shown below:

SmartStep Programmable Attenuators

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

API / Weinschel Warranty

PRODUCTS: API / Weinschel warrants each product it manufactures to be free from defects in material and workmanship under normal use and service anywhere in the world. API / Weinschel's only obligation under this Warranty is to repair or replace, at its plant, any product or part thereof that is returned with transportation charges prepaid to API / Weinschel by the original purchaser within ONE YEAR from the date of shipment.

The foregoing Warranty does not apply to, and in API / Weinschel's sole opin-ion, products that have been subject to improper or inadequate maintenance, unauthorized modifications, misuse, or operation outside the environmental spec-ifications for the product.

SOFTWARE PRODUCTS: API / Weinschel software products are supplied without representation or Warranty of any kind. API / Weinschel, therefore, assumes no responsibility and will not accept liability (consequential or otherwise) arising from the use of program materials, disk, or tape.

The Warranty period is controlled by the Warranty document furnished with each product and begins on the date of shipment. All Warranty returns must be author-ized by API / Weinschel prior to their return.

API / Weinschel's Quality System Certified to:

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5305 Spectrum Drive, Frederick, Maryland 21703-7362
TEL: (301) 846-9222, 800-638-2048, FAX: (301) 846-9116
Web: www.weinschel.apitech.com, E-mail: weinschel-sales@apitech.com