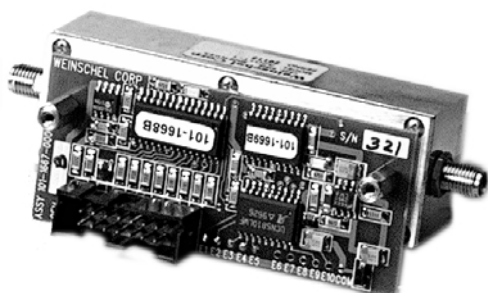# INSTALLATION & OPERATING INSTRUCTIONS

# 3200T, 3230T, 3250T Series SmartStep Programmable Attenuators

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Frederick, Maryland
1996-2003

GENERAL

This manual provides general installation instructions and wiring data to be used as an aid in installing a Weinschel 3200T, 3230T, or 3250T 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.
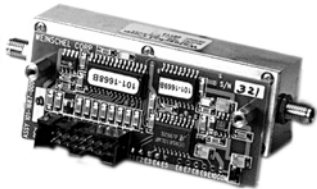
This Series of *SmartStep* Programmable Step Attenuators is designed for use in automatic test equipment and OEM systems operating in the dc to 2 GHz frequency range. Each cell contains a standard TO-5 type double-pole, double-throw relay that provides a minimum loss or attenuated path for the RF signal which is controlled by a built-in digital interface shown in Figure 1.
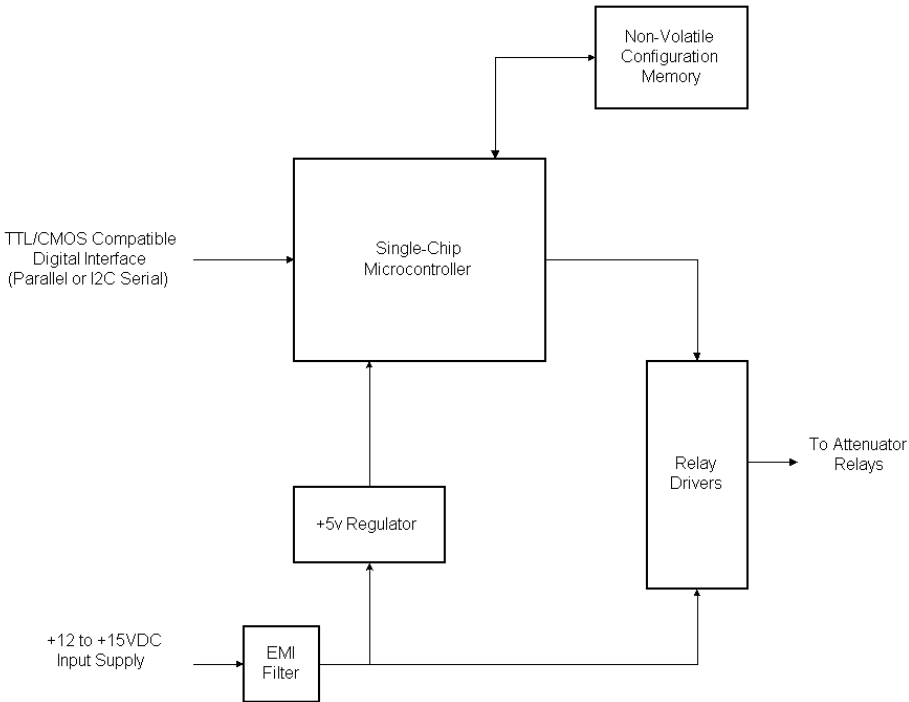

Figure 1. Internal Driver Block Diagram

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The 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 I^{2}C bus. The parallel mode provides a simple, one-bit per relay on/off control with internal pull-ups 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 I^{2}C 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 I^{2}C 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 CONFIGURATIONS

The table below list all the standard attenuation ranges and cell configurations for Weinschel 3200T Series *SmartStep* Programmable Attenuators.

Model	Cells	Range/Step (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
3201T-4	4	1.2/0.1					0.6	0.3	0.2	0.1
3205T-1	4	70/10					20	20	20	10
3205T-2	4	55/5					20	20	10	5
3205T-3 3205T-3E	4	1.5/0.1					0.8	0.4	0.2	0.1
3206T-1	6	63/1			32	16	8	4	2	1
3230T-63	6	63/1			32	16	8	4	2	1
3230T-90	6	90/1			20	20	20	10	10	10
3230T-63.75	8	63.75/0.1	32	16	8	4	2	1	0.5	0.25
3250T-63	6	63/1			32	16	8	4	2	1

*Combined Cells
** Model 3209-1 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. Weinschel recommends a torque value of 7 to 10 inch pounds when connecting any RF cable to the attenuator's SMA connectors.

DEVICE INTERFACE BUS (DIB) CONNECTOR WIRING: Figure 2 shows the connector's contact pin numbering scheme and the signal designator for signal present at each contact pin.
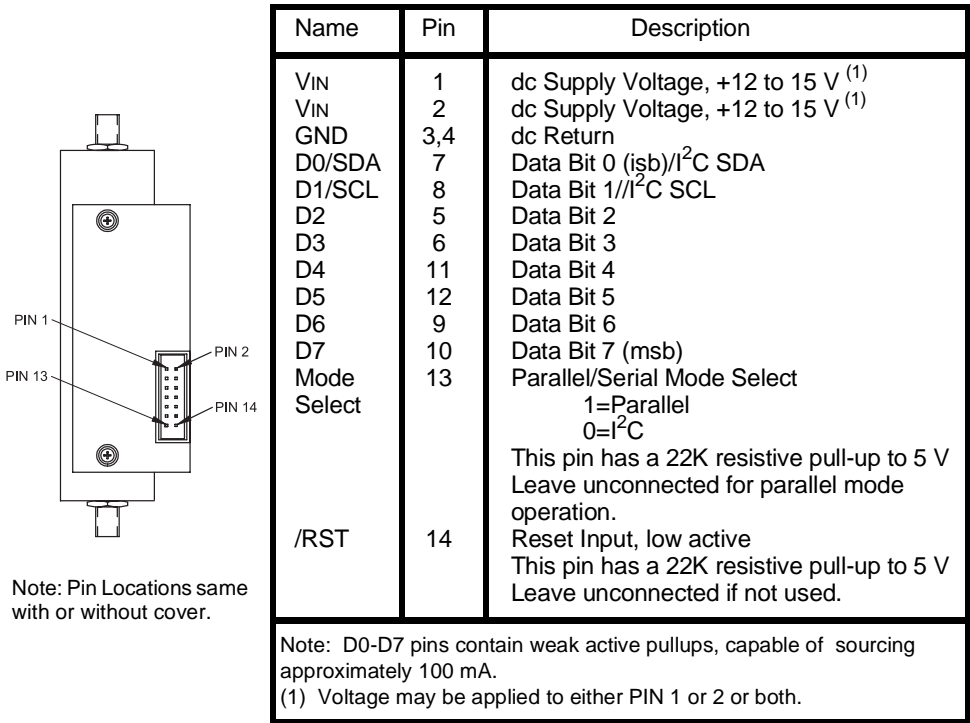
Name	Pin	Description
V_{IN}	1	dc Supply Voltage, +12 to 15 V [1]
V_{IN}	2	dc Supply Voltage, +12 to 15 V [1]
GND	3,4	dc Return
D0/SDA	7	Data Bit 0 (lsb)/I^2C SDA
D1/SCL	8	Data Bit 1//I^2C SCL
D2	5	Data Bit 2
D3	6	Data Bit 3
D4	11	Data Bit 4
D5	12	Data Bit 5
D6	9	Data Bit 6
D7	10	Data Bit 7 (msb)
Mode Select	13	Parallel/Serial Mode Select 1=Parallel 0=I^2C 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 100 mA.
(1) Voltage may be applied to either PIN 1 or 2 or both.

PIN 1
PIN 2
PIN 13
PIN 14

Note: Pin Locations same with or without cover.

Figure 2. DIB Connector Wiring

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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.

I^{2}C MODE OPERATION

In the I^{2}C serial mode of operation, the SmartStep attenuator communicates over a two-wire serial bus to the Weinschel Model 8210 *Smartstep* Interface. The bus uses a clock (SCL) and data (SDA) line to send and receive programming 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-278). 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: 3200T, 3201T, 3205T, 3206T
3209T, 3230T, 3230T

75 Ω: 3250T

FREQUENCY RANGES: dc to 1 GHz: 3250T-X

dc to 1.2 GHz: 3230T-X, 3231-X

dc to 2 GHz: 3200T-1, 3200T-2, 3201T-1, 3201T-2
3204T-1, 3205T-1, 3205T-2, 3205T-3,
3206T-1, 3209T-1

dc to 3 GHz: 3200T-1E, 3200T-2E, 3201T-1E,
3201T-2E, 3205T-3E, 3206T-1E

DRIVER INTERFACE:

Input Supply Voltage: +12.0 to +15.0 V
Control Signals: TTL/CMOS compatible
Interface Modes: Parallel/ I^{2}C serial

DC Characteristics (at 25 °C):

Digital Interface:

Parameter		Specification
V_{IL}	Low Level Input:	-0.5 minimum, 0.8 V maximum
V_{IH}	High Level Input:	2.0 minimum, 5.25 V maximum
I_{PU}	Input Pull-Up Current:	50 μA minimum, 400 μA maximun

Power Supply:

V_{IN}	Supply Voltage:	+12.0 to +15.0 V
I_{IN}	Supply current (digital Section):	25 mA
I_{CELL}	Supply Current (per cell), continuous	15 mA

POWER COEFFICIENT*: < 0.005 dB/dB/watt

INCREMENTAL TEMPERATURE COEFFICIENT*:

30 and 32 dB Cells: 0.00005 dB/dB/°C
All other cells: 0.00002 dB/dB/°C

MAXIMUM INSERTION LOSS:

Frequency Range (GHz)	3200T-1 3200T-2	3200T-1E 3200T-2E	3201T-1 3201T-2	3205T-X 3204T-1	3201T-1E 3205T-3E	3206T-1	3206T-1E	3209-1	3230T-X	3231T-X	3250T-X
dc - 0.5	2.80	2.00	1.80	1.80	1.25	2.00	1.50	3.50	1.75	1.75	2.25
0.5 - 1	3.50	2.70	2.40	2.30	1.75	2.70	2.00	4.50	3.25	4.10	4.75
1.0 - 1.5 (1.2)	4.25	3.00	3.00	2.80	2.25	3.30	2.50	5.60	4.25	4.90	- - -
1.5 - 2	4.75	3.50	3.75	3.30	2.50	4.00	2.80	6.70	- - -	- - -	- - -
2 - 3	- - -	4.30	- - -	- - -	3.40	- - -	3.70	- - -	- - -	- - -	- - -

* Specification not applicable to Models 3230T, 3231T, or 3250T.

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CELL CONFIGURATIONS:

Model Number	NO. Cells	Attenuation Range/Steps (dB)	Cell Increments (dB)
3200T-1 3200T-1E	8	127/1	1, 2, 4, 8, 16, 32, and 64*
3200T-2 3200T-2E	8	63.75/0.25	1, 2, 4, 8, 16, 32, 0.5 and 0.25
3201T-1 3201T-2	5	31/1	1, 2, 4, 8, and 16
3201T-2 3201T-2E	5	120/10	10, 20, 30, and 60**
3204T-1	4	1.2/0.1	0.1, 0.2, 0.3, 0.6
3205T-1	4	70/10	10, 20, 20, 20
3205T-2	4	55/5	5, 10, 20, 20
3205T-3	4	1.5/0.1	0.1. 0.2, 0.4, 0.8
3206T-1 3206T-1E 3231T-63 3250T-63	6	63/1	1, 2,4, 8, 16, 32
3209T-1	10	64.5/0.1	0.1, 0.2, 0.4, 0.8, 1, 2, 4, 8, 16, 32
3230T-63.75	8	63.75/0.25	0.25, 0.5, 1, 2, 4, 8, 16, 32
3231-90	6	90/10	10, 10, 10, 20, 20, 20

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

SPECIFICATIONS *(Con't)*:

INCREMENTAL ATTENUATION ACCURACY:

FREQUENCY RANGE (GHz)	3200T-X, 3201T-X 3205T-X, 3206T-X 3209T-X	3230T-X 3231T-X	3250T
dc - 0.5 0.5 - 1.0 (1.2) 0.1 - 2.0 (3.0)	±0.2 or 0.5% ±0.2 or 1.0% ±0.3 or 2.0%	±0.2 or 2.0% ±0.3 or 2.0% - - -	±0.3 or2.0% ±0.4 or2.0% - - -

MAXIMUM SWR:

Frequency Range (GHz)	3200T-1 3200T-2	3200T-1E 3200T-2E	3201T-1 3201T-2	3205T-X 3204T-1	3201T-1E 3205T-3E	3206T-1	3206T-1E	3209-1	3230T-X	3231T-X	3250T-X
dc - 0.2	1.30	1.20	1.25	1.25	1.20	1.25	1.20	1.35	1.30	1.30	1.20
0.2 - 0.5	1.25	1.20	1.25	1.25	1.20	1.25	1.20	1.35	1.30	1.30	1.20
0.5 - 1	1.25	1.20	1.25	1.25	1.20	1.25	1.20	1.35	1.45	1.45	1.30
1 - 2 (1.2)	1.25	1.20	1.25	1.25	1.20	1.25	1.20	1.35	- - -	- - -	- - -
2 - 3	- - -	1.30	- - -	- - -	1.30	- - -	1.30	- - -	- - -	- - -	- - -

CYCLE RATE: 5 Hz maximum per relay

TEMPERATURE RANGE (Operating): 3200T, 3201T, 3205T: -20 to +70°C
3206T, 3209T
3230T, 3201T, 3250T: -40 to +70°C

MONOTONICITY*: dc to 2.0 GHz

POWER RATING: 1 watt **average** to 25 °C ambient temperature, derated linearly to 0.25 watt @ 70 °C. 50 watts **peak** (5 µsec pulse width; 1% duty cycle)

CONNECTORS: SMA female connectors per MIL-STD-348 interface dimensions - mate nondestructively with MIL-C-39012 connectors.

INTERFACE CONNECTOR: 14 pin .025 square post header on .1 center. Mates with Amp connector 746285-2 or equivalent.

CONSTRUCTION:

3200T Series:	Housing: Connectors:	Aluminum, gold plated Stainless steel body and beryllium copper contacts.
3230T & 3250T Series:	Housing: Connectors:	Aluminum Nickel plated brass body and beryllium copper contacts.

WEIGHT: 3200T-X: 165 g (8.4 oz)
3201T-X, 3205T-X, 3206T-X: 132 g (7.3 oz)
3209T-X: 218 g (9.7 oz)
3230T-X   219 g (5.9 oz)
3231T-X, 3250T-X: 189 g (4.9 oz)

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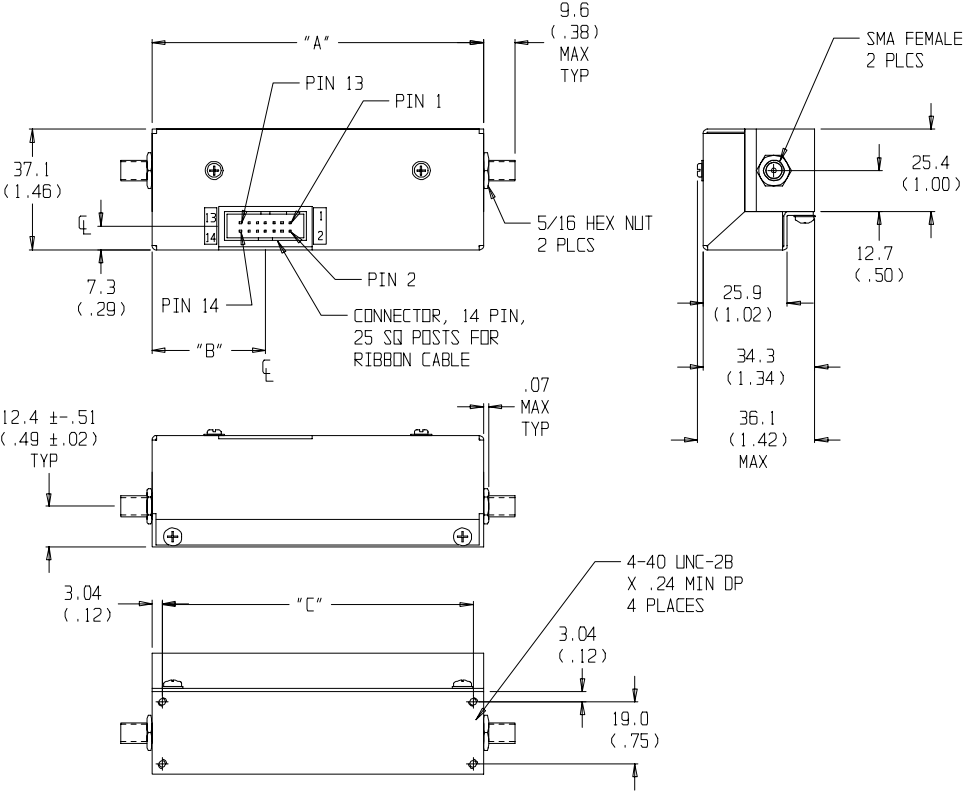
PHYSICAL DIMENSIONS
3200T-X, 3201T-X, 3205T-X, 3206T-X (with no cover):
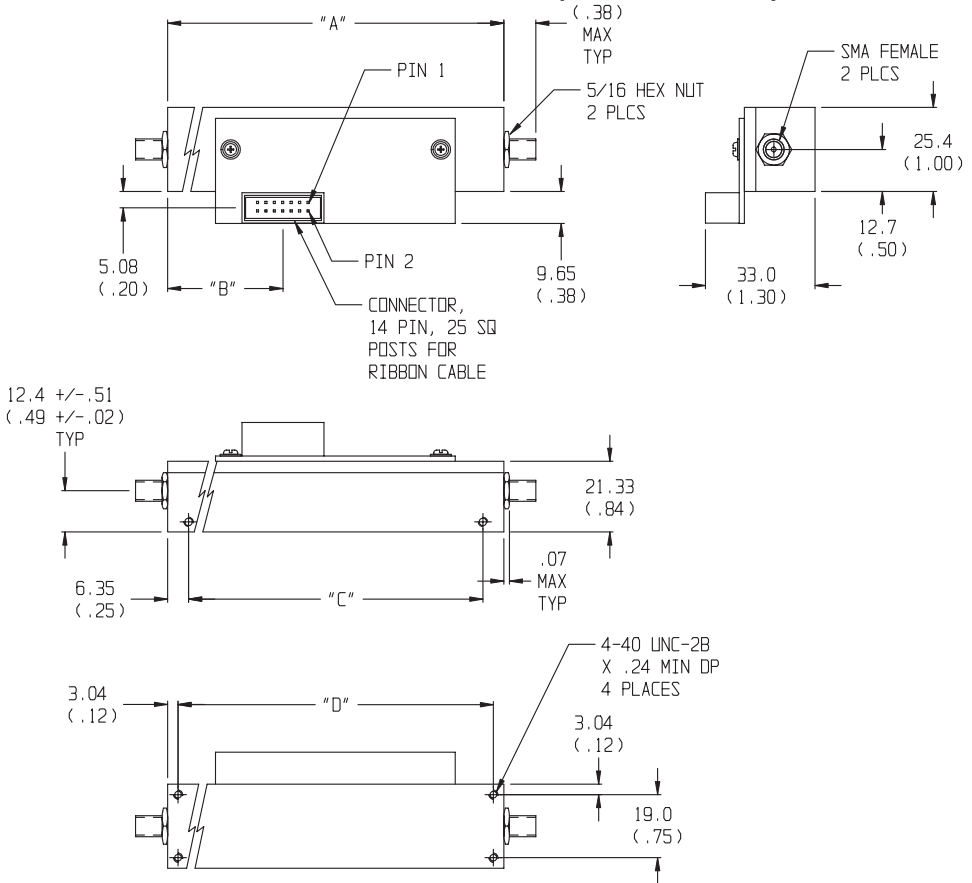
Model No.	No. Cells	A	B	C	D
3200T-X	8	101.6 (4.0)	34.8 (1.37)	88.9 (3.50)	95.2 (3.75)
3201T-X	5/4	76.2 (3.00)	22.1 (0.87)	63.5 (2.50)	69.8 (2.75)
3205T-X	4	58.9 (2.32)	22.1 (0.87)	46.2 (1.82)	52.6 (2.07)
3206T-X	6	81. 3+0.5	24.0 (0.98)	75.18+0.12	75.18 (2.96)

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

5305 Spectrum Drive, Frederick, Maryland 21703-7362
TEL: (301) 846-9222, **800-638-2048** FAX: (301) 846-9116

PHYSICAL DIMENSIONS

3200T-X, 3201T-X, 3205T-X (with cover):

Model No.	No. Cells	A	B	C
3200T-X	8	101.6 (4.0	34.8 (1.37)	95.2 (3.75)
3201T-X	5/4	76.2 (3.00)	22.1 (0.87)	69.8 (2.75)
3205T-X	4	58.9 (2.32)	22.1 (0.87)	52.6 (2.07)

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

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PHYSICAL DIMENSIONS

3209T-X:

CONN	SIGNAL DES
J3-14	N/A
J3-13	N/A
J3-12	N/A
J3-11	N/A
J3-10	N/A
J3-9	N/A
J3-8	N/A
J3-7	N/A
J3-6	N/A
J3-5	N/A
J3-4	GND
J3-3	GND
J3-2	+V
J3-1	+V

SMARTSTEP SYSTEM ONLY
NO PARALLEL MODE OPERATION

15.7
(.62)

12.7
(.50)

4.6
(.18)

PIN 1

14 PIN CONNECTOR,
25 SQ POST, .1 CENTERS

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

PHYSICAL DIMENSIONS

3230T-X & 3231T:
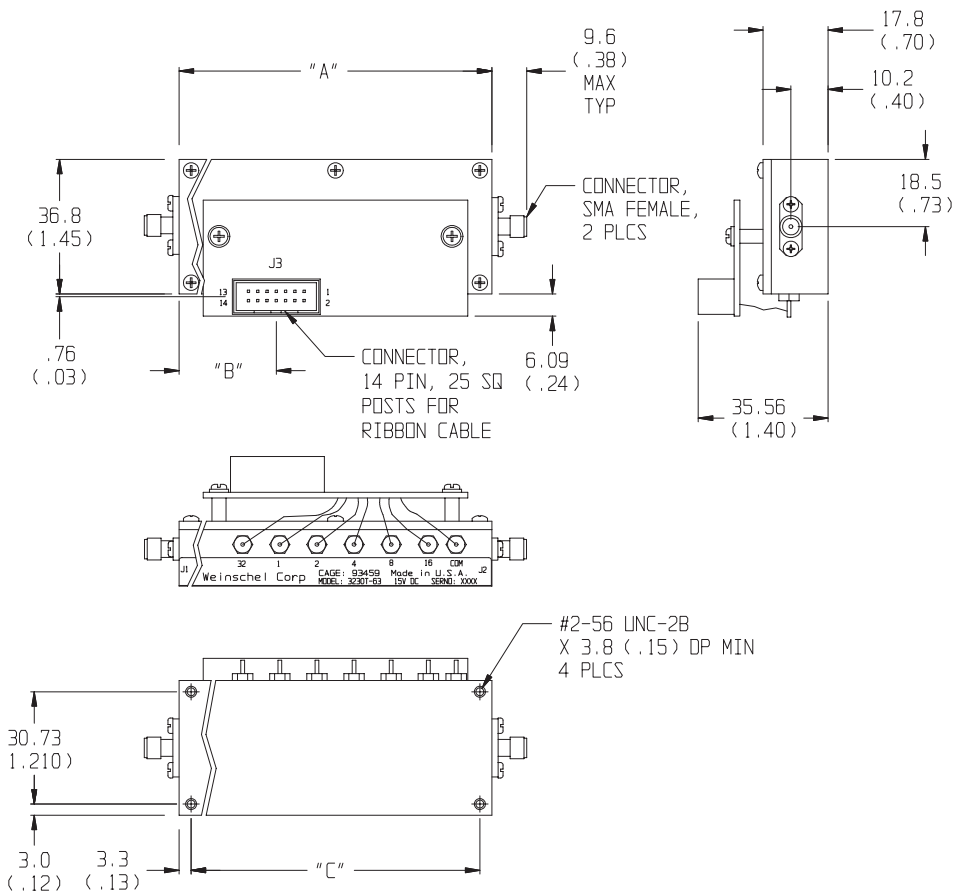
Model No.	No. Cells	A	B	C
3230T-X	6	85.6 (3.37)	24.9 (0.98)	78.99 (3.11)
3231T-X	8	104.6 (4.12)	34.8 (1.37)	98.04 (3.86)

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

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PHYSICAL DIMENSIONS

3250T:
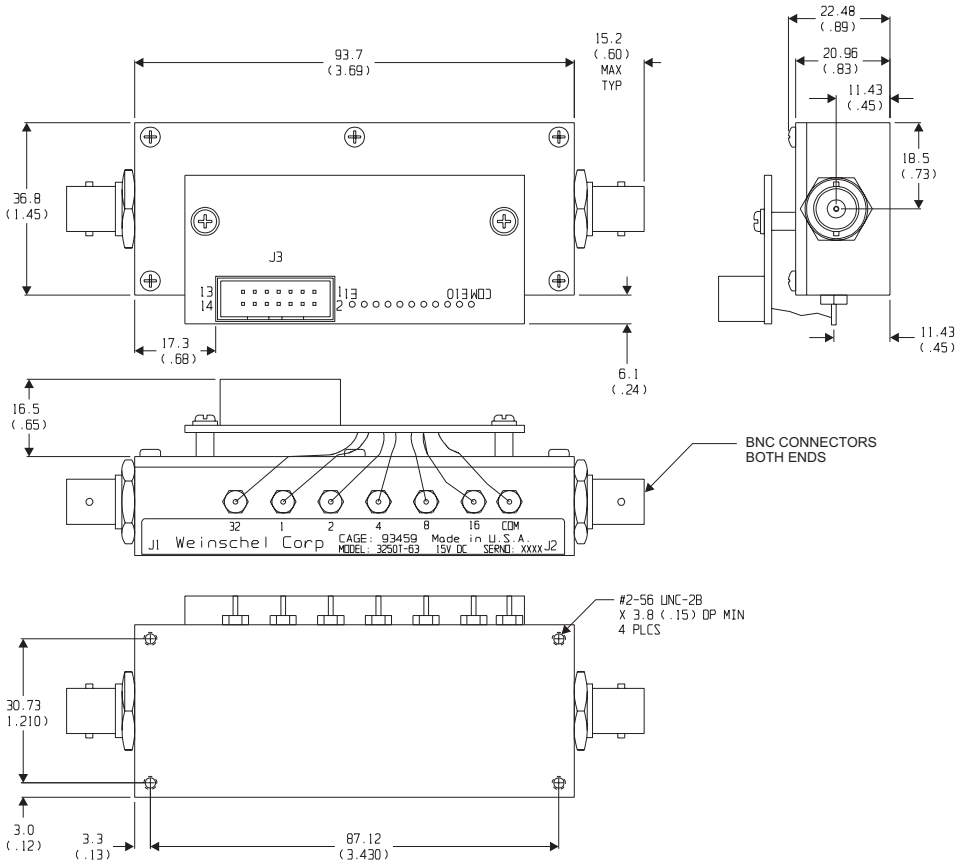
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise specified.

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 8210 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 and RS232/RS422/RS485, to the SmartStep's serial Device Interface Bus. Typical Setup shown below:

SmartStep Programmable Attenuators

PC Controller

Device Interface Bus (I^2C)

IEEE-488/RS232/
RS422/RS485 Bus

8210
Smartstep
Interface
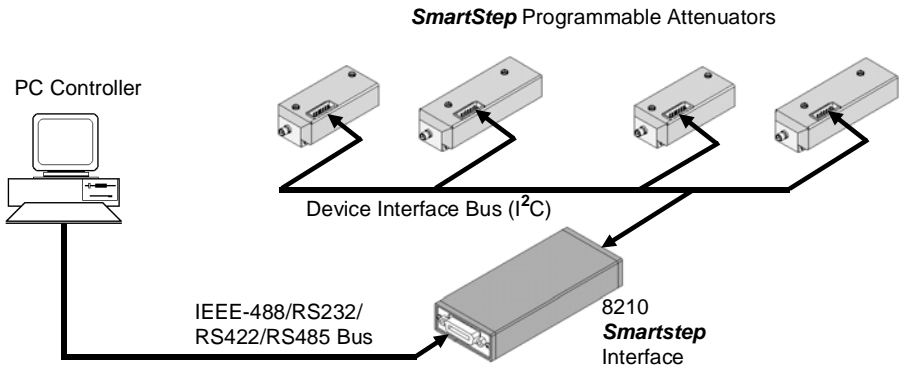
CONTACTING Weinschel Corporation

In the event of an attenuator malfunction, contact Weinschel. An apparent malfunction of an attenuator may be corrected over the phone by contacting the Customer Service Department at Weinschel. DO NOT send the attenuator 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 the Programmable Step Attenuators and/or other Weinschel products, contact the Sales Department at Weinschel.

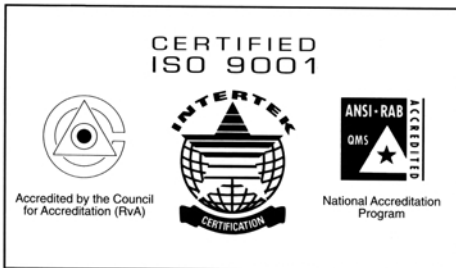# MCE/Weinschel Corporation

MCE/Weinschel Corporation Warranty

PRODUCTS: Weinschel Corporation warrants each product it manufactures to be free from defects in material and workmanship under normal use and service anywhere in the world. Weinschel Corporation'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 Weinschel Corporation by the original purchaser within ONE YEAR from the date of shipment.

The foregoing Warranty does not apply to, and in Weinschel Corporation's sole opinion, products that have been subject to improper or inadequate maintenance, unauthorized modifications, misuse, or operation outside the environmental specifications for the product.

SOFTWARE PRODUCTS: Weinschel Corporation software products are supplied without representation or Warranty of any kind. Weinschel Corporation, 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 authorized by Weinschel Corporation prior to their return.

Weinschel Corporation's Quality System Certified to:

Certificate No. 94-289C

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WEINSCHEL

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Weinschel
C O R P O R A T I O N

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