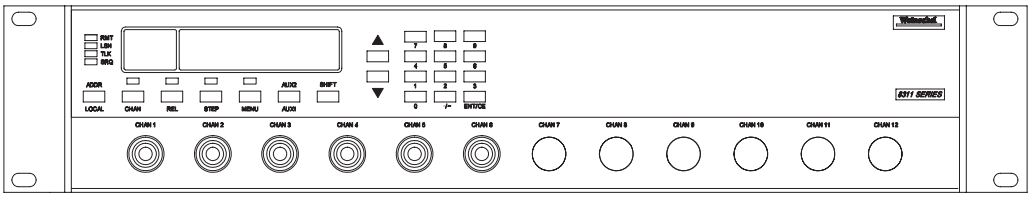
OPERATION & INSTALLATION MANUAL

SmartStep™ Attenuator Unit (8311 Series)



Frederick, Maryland
1999

Firmware Ver. 2.00
Manual Rev. 12/99

Weinschel CORPORATION

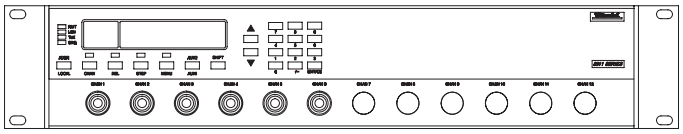
1. GENERAL:

1-1 PURPOSE: This manual contains setup and operation information for the Weinschel Corporation 8311 Series of *SmartStep*™ Attenuator Units (P/N 193-8XXX-X). The manual also provides component location, reference designators, part numbers, and nomenclature to identify all the assemblies and sub-assemblies of the Attenuator Unit.

1-2 SCOPE: This manual is to be used in conjunction with the operation and maintenance of a 8311 Series *SmartStep*™ Attenuator Unit. The manual also provides a description of each assembly; assembly parts list; block diagrams: and general maintenance procedures to maintain the instrument.

1-3 ARRANGEMENT: The information contained in this manual is tabulated and organized as follows:

1-4 EQUIPMENT DESCRIPTION: Weinschel 8311 Series SmartStep Attenuator Units represents a new concept in programmable attenuation for bench test and subsystem applications. Standard 8311 designs house and control various Weinschel Programmable Attenuator Models (3200T, 150T, and 4200 Series) via front panel controls or standard communications interfaces including GPIB (IEEE-488) and RS-232/RS-422 /RS485. Special configurations also exsist where the RF section is designed to specific customer requirements which can contain to multiple programmables attenuations used inconjuction with other coaxial devices such as switches, power combiners, directional couplers, and filters creating single or multichannel subsystems.



1-5 USING THE 8311: The 8311 Series provides front-panel and computer control for up to 12 channels of attenuation, RF switching, or other functions. The 8311 combines the features of the Weinschel 8210A Device Controller (IM-288 for more details) with a front panel user interface to form a flexible, easy to use solution. Most 8311 Series are multi-channel configurations where RF signal is routed through either the front or rear mounted channel connector to a single or multiple Weinschel programmable attenuators thus creating a channel. For specialized configurations refer to supplemental information in the front of this manual for details.

Typically Weinschel programmables are bi-directional and the RF signal can be applied to either Channel connector. Channels can be selected byselecting the front panel CHAN button. When selected, as indicated by the CHAN indicator, a new attenuation value may be entered using the INCR and DECR keys. The main display will show the current attenuation setting of the channel. A new attenuation setting in dB may be entered using the INCR/DECR or ENTRY keys. The front panel STEP key allows the user to define the attenuation step size used by the INCR and DECR keys. Remember that the attenuation step size (resolution) is limited to the physical size of the internal attenuator cells. For example a 0-70 unit with 10 dB steps can only be adjusted in 10 dB increments but larger increments such as 20, 30, 40 dB can be set using this key.

The REL key allows the user to set relative mode for attenuators. When turned on, the currently displayed attenuation value is used as a reference value from which the attenuation may be set. In this mode, attenuation values may be positive or negative from the reference setting. When REL is turned off, the display returns to the actual attenuation setting for the channel. Refer to Section 5 for more detailed information about the front panel keys and indicators. All 8311 Series functions can also be controlled via standard communications interfaces including GPIB (IEEE-488) and RS-232/RS-422 /RS485. Refer to Section 6 for bus setup and operating instructions when using the 8311 Series in the remote mode.

1-6 UNPACKING AND INSPECTION: Upon unpacking the equipment, retain the shipping container and packing material for future shipment for recalibration. Perform the following initial inspection:

a. Carefully look at the outside of the shipping container for discoloration, stains, charring, or other signs of exposure to excessive heat, moisture, or liquid chemicals. Check for any physical damage to the shipping container such as dents, snags, rips, crushed sections or areas, or similar signs of excessive shock or careless handling.

b. With the equipment and any accessory package removed from the shipping container, check each item against the packing list or Items Supplied List. If any items are missing, contact the Weinschel Corporation Customer Service Department.

c. Carefully inspect the equipment looking for dents, deep scratches, damaged or loose connector, or any other signs of physical abuse or careless handling.

If damage is found, forward an immediate request to the delivering carrier to perform an inspection and prepare a concealed-damage report. DO NOT destroy any packing material until it has been examined by an agent of the carrier. Concurrently, report the nature and extent of damage to Weinschel Corporation, giving equipment model and serial numbers, so that necessary action can be taken. Under U.S. shipping regulations, damage claims must be collected by the consignee; DO NOT return the equipment to Weinschel Corporation until a claim for damages has been established.

1-5.1 RESHIPMENT: Use the best packaging materials available to protect the unit during storage or reshipment. When possible, use the original packing container and cushioning material. If the original packing materials are not available, use the following procedure:

a. Wrap the storage cases in sturdy paper or plastic;

b. Place the wrapped storage cases in a strong shipping container and place a layer of shock-absorbing material (3/4 inch minimum thickness) around all sides of the unit to provide a firm cushion and to prevent movement inside the container.

c. If shipping the unit for service, attach a tag to indicate:

1. model and serial numbers
2. service required
3. description of malfunction
4. return address
5. authorization to conduct repairs
6. return authorization number

d. Thoroughly seal the shipping container and mark it FRAGILE.

e. Ship to: **Weinschel Corporation**
Attn: Customer Service Department
5305 Spectrum Drive
Frederick, MD 21703-7362

or to an authorized sales representative.

1.5.2 STORAGE: Storage of the Model 8311 Series *SmartStep* Attenuator Unit is possible for extended periods without incurring damage to internal circuitry if the 8311 Series is packaged according to the instructions above. The safe limits for storage environment are as follows:

Temperature:	67° to +167 °F (-55° to +75 °C)
Humidity:	less than 95% without condensation
Altitude:	Up to 40,000 feet

1-6. RELATED MANUALS: The following manuals contain information that may be used in conjunction with this manual to operate, service, or calibrate this instrument.

Manual	Title
H4-1 and H4-2	Federal Supply Code for Manufacturers Cataloging Handbook
IM-211	Quality Assurance Manual, Weinschel Corporation
IM-275	Operating & Installation Instructions for 3200T & 3201T Series ***SmartStep*** Programmable Attenuators
IM-275	Operating & Installation Instructions for 150T, 151T, 152T, & 152T Series ***SmartStep*** Programmable Attenuators
IM-288	Model 8210 Controller, Operation & Installation Instructions
IM-296	Operating & Installation Instructions for 4206, 4208, 4216, & 4218 Series Solid-State Programmable Attenuators

1-7 ELECTROSTATIC DISCHARGE SENSITIVE: The equipment documented in this manual contains certain Electrostatic Discharge Sensitive (ESDS) components or parts. Therefore, certain procedures/steps are identified by the use of the symbol . This symbol is used in two ways:

CAUTION

All procedures and/or steps identified as must be followed exactly as written and according to ESDS device handling procedures in IM-211 or other accepted ESDS procedures. Failure to comply **WILL RESULT** in ESDS damage.

a. When the ESDS symbol is placed between a paragraph number and title, all of that paragraph, including all subparagraphs, is considered ESDS device handling procedure.

b. When the ESDS symbol is placed between a procedure/step number and the text, all of that procedure is considered an ESDS device handling procedure.

1-8 ABBREVIATIONS AND ACRONYMS: The following list contains abbreviations used throughout this manual. Abbreviations and acronyms that are not listed conform with MIL-STD-12D.

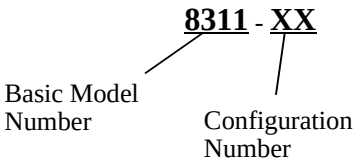
DUT . . . . . Device Under Test
ESDS . . . . . Electrostatic Discharge Sensitive
DIB . . . . . Device Interface Bus

1-9 SAFETY CONSIDERATIONS: The Attenuator Unit and all related documentation must be reviewed for familiarization with safety markings and procedures before any operation and/or service. Refer to the SAFETY SUMMARY located at the beginning of this manual for a summary of safety information and procedures. Following these simple safety precautions will ensure safe operation and service of the Attenuator Unit.

1-10 POWER REQUIREMENTS: Weinschel supplies a detachable power cable (P/N 068-21) to connect an 100 to 240 Vac power source with a frequency between 50 to 60 Hz to the Attenuator Unit. To minimize shock hazard, the instrument chassis must be connected to an electrical ground. Using the supplied three-conductor power cable ensures that the instrument can be firmly connected to the ac power source and electrical ground (safety ground) at a grounded power outlet. Refer to paragraph 4-2 (Initial Setup) before applying any power to the instrument**.**

1-11 ENVIRONMENTAL REQUIREMENTS: This instrument performs best within its specifications when operated within a controlled environment having an ambient temperature of 0°± 50°C, Relative Humidity of up to 95% non condensing, and a altitude of less than 40,000 feet. Operating beyond these limits can affect the accuracy and performance of the instrument and damage internal circuitry.

1-12 MODEL NUMBER DESCRIPTION:



2. SPECIFICATIONS:

SPECIFICATION	DESCRIPTION	
Input Power Requirements	**ac**	100 to 240 Vac, 50/60 Hz, 50 Watts
Environmental	**Operating Temperature** **Storage Temperature:** **Humidity:** **Altitude:**	0 to +50 °C 67° to +167 °F (-55° to +75 °C) 96% 40,000' (12,192M)
IEEE-488 Bus	**Connector:** **Protocols:** **Indicators:**	24-pin per IEEE-488.1 per IEEE-488.2 Remote (RMT), Listen (LSN), Talk (TLK), SRQ (SRQ)
RS-232 Bus	**Connector:** **Signals:** **Baud Rates:** **Data Bits:** **Handshaking:** **Parity:** **Indicators:**	9-pin male D TXD, RXD, RTS, CTS, DTR, GND 2400, 9600, 19200, and 38400 8 None, RTS/CTS, XON/XOFF None, Odd, Even Tx (Transmit) and Rx (Receive)
RS-422/RS-485 Bus	**Connector:** **Signals:** **Baud Rates:** **Data Bits:** **Handshaking:** **Parity:** **Indicators:**	9-pin male D TXD+, TDX-, RXD+, RTX-, RTS+, RTS-, CTS+, CTS-, and signal GND 2400, 9600, 19200, and 38400 8 None, RTS/CTS, XON/XOFF None, Odd, Even Tx (Transmit) and Rx (Receive)
RF Characteristics*	See Model Configuration Tables (pg 5).	

1. GPIB/IEEE-488 model allows user-selectable addresses

2. RS-232 can be used with standard PC serial port for short and medium distances (up to approximately 50 ft).

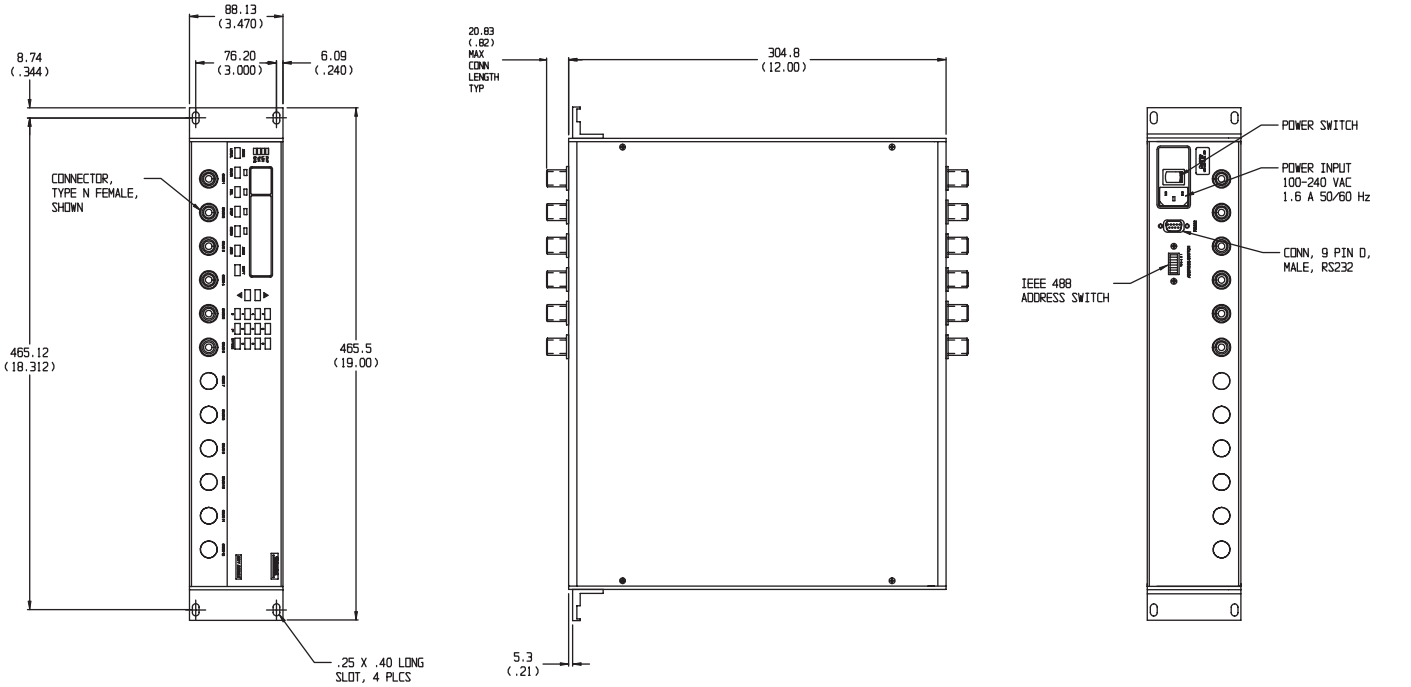
3. RS-422, designed for very long distance communications (4000 ft) and & optimized as a single node protocol, typically with one device connected to a single port.

4. RS-485, designed for very long distance communications (4000 ft) & optimized for multi-drop connections that can used to create a low cost network.

Table 5. Standard 8311 Configurations

Model No Value (dB)	Attenuation Range (GHz)	Frequency (maximum)	Insertion Loss (Maximum)	SWR Channels	No of Model No.*	Attenuator Type	Connector Location	Conn
TBD								

3. PHYSICAL DIMENSIONS:



Connector Type	DIM A
N	29.2 (1.15)
SMA	8.6 (0.34)
BNC	18.8 (0.74)

NOTES:
1. ALL DIMENSIONS GIVEN IN MM (INCHES)

4. INSTALLATION:

4-1 RACK MOUNTING: Standard 8311 Attenuator Units are shipped with four plastic feet mounted to the bottom cover, this allows the user to place the instrument on any bench or to stack the with other Weinschel Corporation instruments. The Model 8311 can also be rack mounted using Rack Mounting Kit (P/N 193-8033-2). This kit allows the Model 8311 to be mounted in any rack or cabinet that is designed according to EIA RS-310 or MIL-STD-189.

4-2 INITIAL SETUP: The following initial setup procedures should be performed pior to operating the Attenuator Unit.

a. Perform inspection paragraph 1-5 prior to connecting the 8311 Series to any power source.

b. Check that the external power source outputs to the 8311 Series are in accordance with Section 2, Specifications.

c. Install the 8311 Series into a cabinet or rack, if desired.

d. Using the supplied power cord connect the 8311 Series to the external power source.

e. Setup the IEEE-488 bus address or RS-232/422 Communications options for your application using paragraph 4-2.6. If using the RS-422 serial configure the selectable signal pair terminations using paragraph 5-3.

f. Connect the desired controller to the 8311 Series's bus connector. For specfic connector details reference the following:

Bus Type	Paragraph
IEEE-488	6-1
RS-232	6-5
RS-422	6-6

e. Using paragraphs 5 through 7 to set up the 8311 Series for system operation.

4-3 INPUT/OUTPUT OPTIONS: The following paragraphs provide a description of the connections that can be made to the 8311 Series Attenuator Unit. Figure 1 shows the location of these connectors and switches.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the Model 8311 power cord is DISCONNECTED before attempting to change fuses.

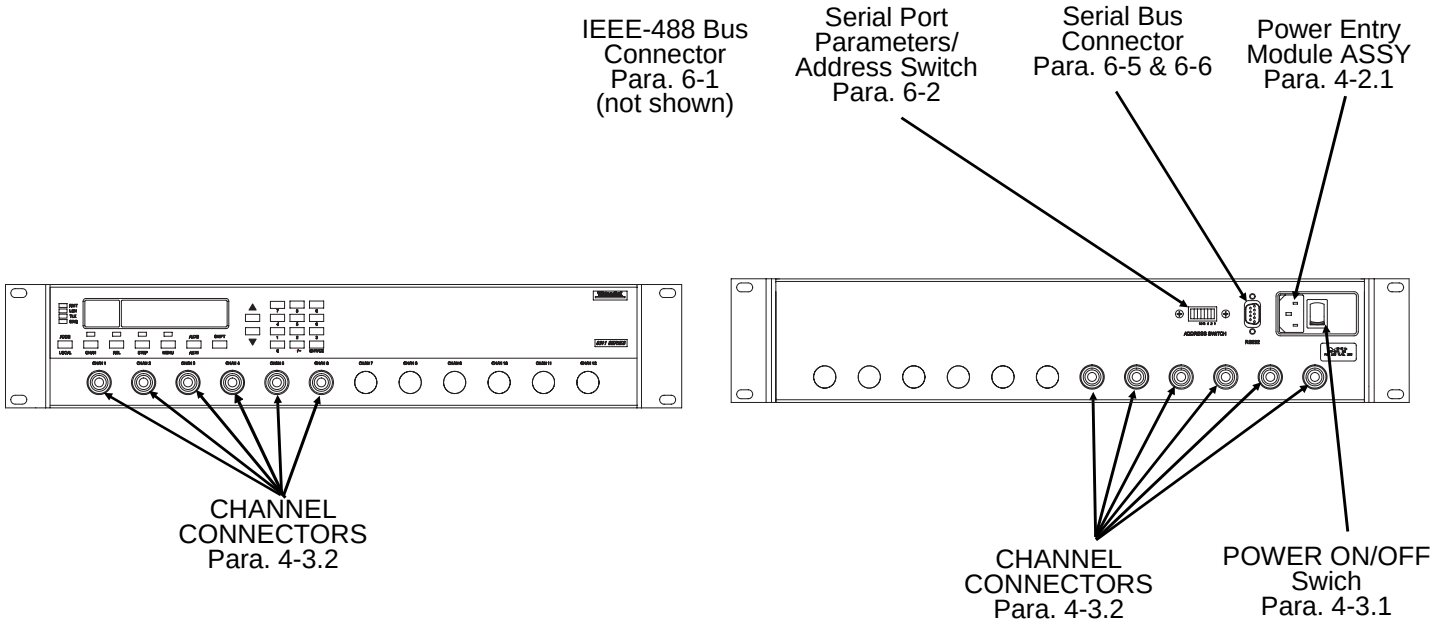


Figure 1. Front & Rear Panel Connectors

4-3.1 POWER ENTRY MODULE ASSEMBLY: The Power Entry Module Assembly located on the rear panel contains a three-prong ac power input connector and a fuse drawer assembly (Figure 1).

The **Fuse Drawer Assembly** contains the line voltage fuse (Weinschel P/N 052-1-1.5). The Model 8311 uses a T 1.5A, 250 Vac fuse which is 5 x 20 mm in size. Refer to paragraph 8-4.1 for replacement of the fuse.

The **AC Power Connector**, located on the left side of XF1 (Figure 1), is a plug-type, prong insert connector with three conductors for connection of the power cord (P/N 068-21) to the Power Supply Assembly located within the Attenuator Unit. This connector also grounds the chassis of the Attenuator Unit when the the ac power cord is connected to a grounded wall outlet. If necessary, use a three prong to two prong adapter and connect the adapter's ground lead to the outlet plate retaining screw.

The **Power ON/OFF Switch** is located on the rear panel and in part of the Power Entry Module Assembly. Placing the POWER ON/OFF switch in the ON position applies power to the instrument.

CAUTION

When applying an RF signal to the RF INPUT connector, DO NOT exceed the maximum allowable power level specifications of the Model 8311.

4-3.2 CHANNEL CONNECTORS: A typical 8311 Series Attenuator Unit contains 12 standard D holes on the front and rear panel allowing for single or multichannel configurations. Standard Model 8311's are supplied with two PLANAR CROWN® Type N connectors that can be mounted mounted on the front or rear panel. These connectors provide a input and output port where various types of RF signals can be applied to the devices internally mounted in the Model 8311 (Connector location specified by customer when ordering). Some special configurations could contain Weinschel's Model 1568 SMA Panel Adapters or other types of crowns (see accessories for other types).

NOTE

The use of the PLANAR CROWN® connectors provide the user with easy exchange of connector types, which eliminates the need for adapters and other devices that would create additional insertion loss. This type of connector also provides quick removal and replacement of defective connectors. For more information about the PLANAR CROWN® connectors contact the Sales Department at Weinschel Corporation.

5. FRONT PANEL OPERATION:

The following paragraphs provide setup and general guidelines for operating the 8311 Series ***SmartStep*** Attenuator Unit and its different bus configurations. Also provided is a general description of the internal circuitry of the 8311.

ENTRY keys: The numeric entry keys allow the user to directly enter numeric values. When using the keypad, values are not updated until the ENT (enter) key is pressed. The Minus (-) and CE (clear entry) functions may be accessed via first depressing the SHIFT key.

INCR & DECR : The INCR and DECR keys allow settings to be scrolled from their current value. Unlike the ENTRY keys, the new setting is updated immediately without the use of the ENT key.

CHAN: Allows the selection of the current channel. When turned on, as indicated by the CHAN indicator, a new value may be entered using the INCR and DECR keys. Using the INCR and DECR keys allow the user to scroll through all available channels, while viewing their current settings. Once the desired channel is reached, the CHAN function must be turned OFF. Using the ENTRY key allows direct entry of the desired channel number, with the CHAN function automatically turing off when the ENT key is depressed.

REL: This key control allows the use of a relative mode for attenuators, as indicated by the REL mode indicator. When turned on, the currently displayed attenuation value is used as a reference value from which the attenuation may be set. In this mode, attenuation values may be positive or negative from the reference setting. When REL is turned off, the display returns to the actual attenuation setting for the channel.

STEP: This key allows the user to change the attenuation step size used by the INCR and DECR keys. When turned on, as, indicated by the STEP indicator, the current step size is displayed in the main display, and a new value may be entered using the INCR/DECR or ENTRY keys. The step size may be set to any multiple of the intrinsic step size for the currently selected channel.

MENU: Invokes the menu functions. Menu selections may be made via the INCR and DECR keys. (No menu selections installed as of 3/8/99)

(NOTE: menu functions are currently not implemented).

AUX1/AUX2: The function of these keys is user-programmable via remote operation. They invoke any currently defined AUX1 and AUX2 macros. Refer to the macro programming section for information on creating macro definitions.

LOCAL: This key places the 8311 in local operation mode, unless the key function has been overridden via an IEEE-488.2 local lockout or execution of the LOCKOUT command.

ADDR: This key displays the current IEEE-488.2 address. The address may be changed from the front-panel, however, the initial setting at power on is derived from the rear-panel address switch.

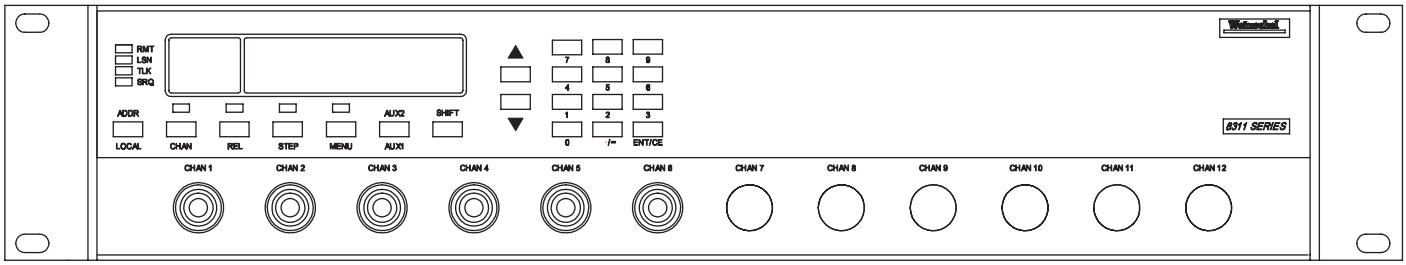
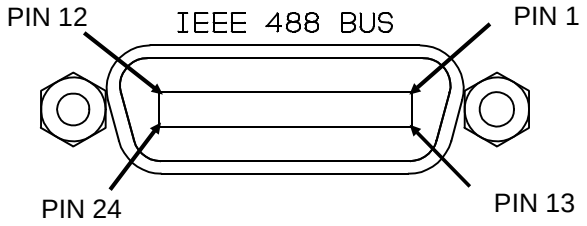


Figure 2. 8310 Series Front Panel

6. REMOTE OPERATION:

The following paragraphs provide setup and general guidelines for operating the Model 8311 using an external controller.

6.1 IEEE-488 INTERFACE BUS CONNECTOR: Joining the Model 8311-1 to a system controller requires the connection of IEEE-488 control bus cable to the IEEE-488 INTERFACE BUS connector located on the rear panel. Figure 3 shows the connector's contact pin numbering scheme and lists the signal designator for signal present at each contact pin.



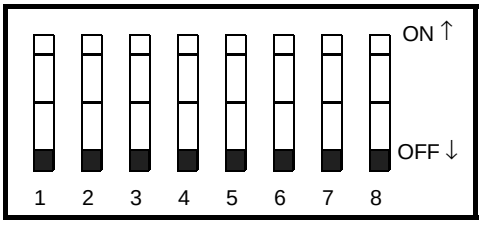
Pin No.	Signal Line	Pin No.	Signal Line
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI (24)**	17	REN (24)**
6	DAV	18	GND (6)*
7	NRFD	19	GND (7)*
8	NDAC	20	GND (8)*
9	IFC	21	GND (9)*
10	SRQ	22	GND (10)*
11	ATN	23	GND (11)*
12	SHIELD	24	GND, LOGIC

* GND (N) refer to to the signal ground return of the referenced pin.
** Return pin on pin 24.

Figure 3. IEEE-488 Interface Bus Pin Locations

6-2. GPIB ADDRESS/SERIAL COMMUNICATIONS SETTINGS: The GPIB Bus Address and Serial Communications options are programmed via an internal 8 position DIP switch SW1 which is located on the rear panel. The switch is shared between the two functions, with SW1-1 controlling the selection. When SW1-1 is OFF, the remaining switches set the GPIB bus address. Likewise, when SW1-1 is ON, the switches are used to select the various serial options, including baud rate, parity, and handshaking. Refer to Figure 4 for switch location.

To configure the IEEE-488 bus address or serial communications parameters, select the appropriate switch setting using the tables located in Figure 4.



Note: All switches are shown in the OFF position.

GPIB	SW1	SERIAL	Serial Parameter
SP	1	SP	Mode Select On = Serial parameters Off = GPIB address
---	2	Echo	Echo Enable On = Echo received data Off = No echo
---	3	HndshkSel	Handshaking Select On = RTS/CTS Off = XON/XOFF
A4 (16)	4	HndshkEna	Handshake Enable On = Enabled Off = Disabled
A3 (8)	5	ParitySel	Parity Select On = Odd Off = Even
A2 (4)	6	ParityEna	Parity Enable On = Enabled Off = Disabled
A1 (2) A0 (1)	7 8	BR1 BR0	BaudRate Select (see below) BaudRate Select BR1 BR0 RATE 0 0 2400 0 1 9600 1 0 19200 1 1 38400

Note: The GPIB Bus address is selectable from 0 to 30 via the rear panel dip switch. This switch is factory set to 10.

IEEE-488 Address Truth Table

Switch Number	4	5	6	7	8
Decimal Weight	16	8	4	2	1
Address:					
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
20	1	0	1	0	0
30	1	1	1	1	0

Figure 4. Internal Dip Switch (SW1)

6-3 IEEE-488 BUS OPERATION: The internal functions of Model 8311 are controlled via an IEEE-488 bus and an external controller. The front panel LSN and RMT indicators (Figure 2) are used as status indicators for the Model 8311 ***SmartStep*** Interface's IEEE-488 bus operation. During bus operation a flashing LSN indicates that the Model 8311 is receiving. The RMT indicator is illuminated when the Model 8311 is in the remote state.

Table 1 summarizes the IEEE-488.1 interface functions that are implemented by the Model 8311.

Table 1. 488.1 Interface Functions

Interface Function	Subset	Description
Source Handshake	SH1	Fully implemented.
Accepter Handshake	AH1	Fully implemented.
Talker	T6	All basic Talker functions are implemented. No extended addressing.
Listener	L4	All basic Listener functions are implemented. No extended addressing.
Service Request	SR1	Fully implemented.
Remote Local	RL1	Fully implemented.
Parallel Poll	PP0	No Parallel Poll capability.
Device Clear	DC1	Fully implemented.
Device Trigger	DT0	No Trigger.
Controller	C0	No Controller functions.
Electrical Interface	E2	All Tri-state I/O buffers.

The GPIB interface of the 8311 is IEEE-488.2 compliant. The 8311 recognizes instructions and data sent via the GPIB interface in the form of program messages comprised of ASCII characters. A program message is comprised of a sequence of program message units separated by semicolons and terminated by a line terminator (LINE END). A line terminator takes the form of an ASCII LF character (0AH), or an EOI signal asserted with the last data byte, or both. The 8311 program message units may be divided into two syntax groups: commands and queries. Refer to the section on command syntax for more information.in the Model 8311.

6-4. GENERAL SERIAL OPERATION: The serial interface (RS232/RS422) provides a means of remotely programming the 8311 via external computer. The 8311 provides for user-selectable communications parameters via an onboard DIP switch (SW1), including baud rate, data format, and handshaking method (refer to paragraph 6-2). The 8311 provides LED indicators for transmit (TX) and receive (RX) activity (Refer to Figure 6 for location). Selection between RS232/RS422 mode is controlled via a 4 position DIP switch SW2 (Figure 4 for location), which also provides for user-selectable 120 ohm terminations for the RS422 receiver lines. The RS422 mode transceivers are electrically compatible with RS485. Refer to Table 2 when setting SW2 switch parameters.

The data format includes a start bit, eight data bits, and one stop bit (N81). The Baud Rate may be set to 2400, 9600, 19200, or 34800. Parity selections include settings for None, Even, or Odd parity. Handshaking may be enabled, if desired, and the method may be set to either hardware (RTS/CTS) or software (XON/XOFF). For interactive terminal uses, echoing may be enabled, in which the 8311 will echo all characters received back to the terminal. The 8311, as shipped from the factory, is set to RS232 mode, 9600 baud, no parity, 8 data bits, 1 stop bit, no handshaking, and echo off.

All data and commands are encoded using the ASCII character set. The syntax for commands is the same as for GPIB operation, and uses the syntax structure defined by IEEE 488.2, with the exception of the command termination rules. Commands sent to the 8311 may be terminated with either an ASCII CR (0x0D) or ASCII LF (0x0A) character. By default, all responses from the 8311 are terminated in an ASCII CR/LF sequence (0x0D followed by 0x0A), however this End Of String (EOS) sequence may be changed via program control to any user-selectable sequence (see CONFIG SERIAL EOS command).

Software handshaking uses the XON/XOFF scheme in which an ASCII DC3 (0x13) character is transmitted by the receiver to indicate that data transmission should be halted (XOFF), and an ASCII DC1 (0x11) character is transmitted to indicate that data transmission may continue (XON). Hardware handshaking utilizes the RTS and CTS lines. When the RTS output signal is asserted true, the unit is ready for data. This signal should be connected to the external computer's CTS input signal, so that when the receiver is ready, the transmitter may send data. When the unit is not ready for data, it unasserts the RTS signal, halting data transmission. Likewise, the unit monitors the CTS input signal during data transmission, halting transmission if the external computer unasserts it's RTS signal. In addition, the 8311 unasserts the RTS signal while command execution is in progress.

NOTE: It is highly recommended that you implement RTS/CTS hardware handshaking in your application. While this may have a slight effect on the data transfer rate, it prevents data from being lost and input buffers overflowing due to the asynchronous nature of serial communications. If it is not possible to implement handshaking, synchronization between the 8311 and computer may be accomplished by adding an "*OPC?" Operation Complete query to the end of each command, and wait for the 8311 to transmit its response.

For those systems incorporating local front panel controls, the serial port can lockout local users, providing a Remote/Local function similar to that of GPIB operation (see LOCKOUT command).

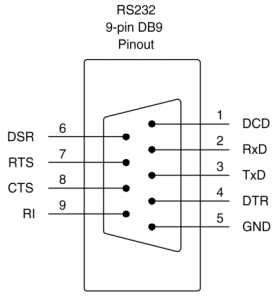
Table 2. Serial Mode Selection Switch (SW2)

SW2	RS232	RS422 RS485	Description
1	OFF	User Select	CTS Termination On = Termination Off = No Termination
2	OFF	User Select	RXD Termination On = Termination Off = No Termination
3	OFF	ON	RI/RTS Select
4	ON	OFF	Serial Mode On = RS232 Off = RS422/485

6-5. RS-232 OPERATION: The RS232 Serial port is a 9-pin connector that is compatible with the pin-out of the serial port on a PC. It allows the use of a null-modem style cable. The pin-out for the connector is show below. For clarity, the signal names and directions are relative to the 8311 shown below.

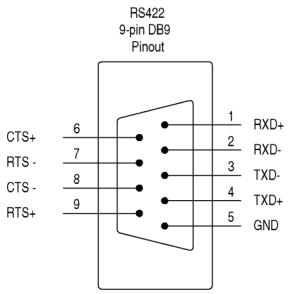
Pin	Signal Name	Description	Direction
1	DCD	unused	---
2	RxD	Receive data	input
3	TxD	Transmit data	output
4	DTR	Signals DTE is on-line	output
5	GND	Ground	---
6	DSR	unused	---
7	RTS	Signals DTE is ready	output
8	CTS	Signals DCE is ready	input
9	RI	unused	---

The DTR signal is asserted when power is on, indicating that the unit is ready.



6-6. RS-422/RS485 OPERATION: The RS422/RS485 Serial mode is useful in applications requiring long cable lengths (up to 5000 ft at 9600 baud), or in electrically noisy environments. All communication parameters available for the RS232 port are also available under RS422 operation (baud rate, handshaking, etc). Full Duplex operation is supported. The RS422 port utilizes a 9-pin connector. The pin-out for the connector is show below. For clarity, the signal names and directions are relative to the 8311. The signals are electrically compatible with either RS-422 or RS485.

Pin	Signal Name	Description	Direction
1	RxD+	Receive data	input
2	RxD-	Receive data	input
3	TxD-	Transmit data	output
4	TxD+	Transmit data	output
5	GND	Ground	---
6	CTS+	Clear To Send	input
7	RTS-	Request To Send	output
8	CTS-	Clear To Send	input
9	RTS+	Request To Send	output



6-7. STATUS REPORTING: The 8311 implements the 488.2 Status Reporting Structure, which utilizes the IEEE488.1 status byte with additional data structures and rules. The Status Byte Register can be read with either a serial poll (IEEE-488 operation only) or the *STB? common query command. The Service Request Enable Register allows the user to select which bits in the Status Byte Register may cause service requests. A bit value of one indicates that the corresponding event is enabled, while a bit value of zero disables an event. The Service Request Enable Register may be accessed with the *SRE and *SRE? common commands. The Status Byte Register may be cleared with the *CLS common command, with the exception of the MAV bit, which is controlled by the operation of the Output Queue.

Status Byte Register/ Service Request Enable Register Formats

D7	D6	D5	D4	D3	D2	D1	D0
	RQS	ESB	MAV				

Bit	**Mnemonic**	**Description**
6	RQS	Request Service: This bit, if set, indicates that the device is asserting the SRQ signal.
5	ESB	Event Status Bit: This bit is true when an enabled event in the Event Status Register is true.
4	MAV	Message Available: This bit is true when there is valid data available in the output queue.

The Standard Event Status Register is used to report various IEEE 488.2-defined events. The register contents may be accessed with the *ESR? command. An Event Status Enable Register allows the user to select which bits in the ESR that will be reflected in the ESB summary message bit of the Status Byte Register. The Event Status Enable Register may be accessed with the *ESE and *ESE? common commands. The Event Status Register is cleared by an *ESR? query or *CLS common command.

Standard Event Status Register/Standard Event Status Enable Register Formats

D7	D6	D5	D4	D3	D2	D1	D0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Bit	**Mnemonic**	**Description**
7	PON	Power On: This bit indicates that the device has powered-on.
6	URQ	User Request: This event bit indicates that a local control is causing a User Request
5	CME	Command Error: The parser has detected a syntax error in the current command.
4	EXE	Execution Error: The command could not be properly executed due to an illegal input range, or other inconsistent data.
3	DDE	Device Dependent Error: A command could not properly complete due to some device specific error.
2	QYE	Query Error: This bit indicates that either an attempt has been made to read data when there was none present, or that data in the Output Queue has been lost.
1	RQC	Request Control: The device is requesting control (not inplemented).
0	OPC	Operation Complete: This bit is generated in response to an *OPC command. It indicates that the 8311 has completed all pending operations.

The Status Reporting Registers may be used for RS-232 operation, with certain limitations. The Status Byte Register can only be read via the *STB? query command, as the RS-232 port does not provide for a serial poll operation. Also, as data in the the Output Queue is sent automatically during serial operation, the MAV message available bit in the STB serves no purpose.

6-8. GENERAL SYNTAX STRUCTURE: The following paragraphs outline the general syntax and command structure for the Model 8311. This structure is common to all bus flavors of the Model 8311.

NOTE

In the descriptions that follow, the term whitespace is used to define a sequence of one or more combinations of ASCII Space (20h), Carriage return (0Dh), or Tab (09h) characters.

6-8.1 SYNTAX OF QUERIES: A query message unit is made up of a query header ending in an ASCII question mark character '?' (3FH), followed by optional whitespace, and ended by a program message terminator. To form a multiple query, separate the individual program message units with a semicolon.

Examples :

"ATTN?"
"ASSIGN?"

b. Multiple Query Commands:

"ATTN?; ASSIGN?"

6-8.2 SYNTAX OF COMMANDS: A command message unit is made up of a command header, optionally followed by an argument and units, and ended by a program message terminator. If multiple commands are made on the same program line, separate the individual command messages with a semicolon.

Arguments - The 8311 supports a variety of argument types that can be used in program commands. These types are:

- Character Program Data
- Integer Numeric Program Data
- Real Numeric Program Data

Each data type has its own rules of syntax. The following paragraphs provide the syntax rules for each of the argument types listed above.

Character Program Data-This data type is comprised of the set of printable ASCII characters (excluding those used as delimiters). Character program data represents alpha or alphanumeric strings. The use of alpha characters is case-insensitive. If the first character of the string is not an alpha character, then the string must be delimited with either the ASCII single-quote (') or double-quote (") character in order to distinguish the string from a numeric data type.

Examples: ATTEN1
ON
"150T"

Integer Numeric Program Data-This data type is used to represent integer, binary, or hexidecimal numeric information, all of which may be used interchangeably. Integer data is comprised of the numeric digits '0'-'9', binary data is comprised of the digits '0' and '1' preceded by the characters '#B', and hexidecimal data is comprised of the digits '0'-'9', and the letters 'A'-'F', preceded by the characters '#H' or the C language style prefix '0x'.

Examples: 123 (integer)
#H55 (hex)
0xAA (hex)
#B1010 (binary)

Real Numeric Program Data-This data type includes decimal numbers containing a sign, decimal point, and/or an exponent. The format is as follows: [sign]digits[.[digits][E[sign]digits]]

Examples: 2
2.5
-35.25E+2

In the command descriptions that follow, argument types are also described using the following additional conventions to indicate the relative size of the parameter:

byte - used to indicate an 8-bit unsigned integer
word - used to indicate a 16-bit unsigned integer
int8 - 8-bit integer
int16 - 16-bit integer
int32 - 32-bit integer
string - character data, including the max number of characters allowable. (i.e., string8 has a max of 8 chars)

6-8.3 OUTPUT DATA FORMAT: Output data from the Model 8311 consists of a series of ASCII digits and message strings, terminated with an ASCII Line-Feed character (0AH), in response to a program message that contains one or more query commands. In the case of multiple query commands in the same program message, the data resulting from each of the individual message units will be separated by an ASCII comma (2CH) character.

6-8.4 COMMANDS & QUERIES: Tables 3 and 4 provide a list of the commands and queries for the Model 8311.

6-8.5 NOTATIONAL CONVENTION.

[ ] Brackets indicate optional arguments or parameters.

{ } One and only one of the enclosed entries must be selected unless the field is also surrounded by brackets, in which case it is optional.

... Ellipses indicate that the preceding argument or parameter may be repeated.

[,...] The preceding item may be repeated, but each repetition must be separated by a comma.

Table 3. 488.2 Common Commands--Part I

Mnemonic	Description
***CLS**	**Function:** Clears the Status Byte and Event Status Registers. **Syntax:** *CLS **Argument(s):** none **Remarks:** This function is used to clear the Status Byte and the Event Status Registers. **Return Value:** none **Example(s):** *CLS
***ESE**	**Function:** Sets the Event Status Enable Register. **Syntax:** *ESE *mask* **Argument(s):** *mask* integer bitmask **Remarks:** This function is used to set the Event Status Enable Register to the value specified by mask. **Return Value:** none **Example(s):** *ESE 255
***ESE?**	**Function:** Reads the Event Status Enable Register. **Syntax:** *ESE? **Argument(s):** none **Remarks:** This function is used to read the Event Status Enable Register. **Return Value:** *mask* integer register mask **Example(s):** *ESE? returns the following '255'
***ESR?**	**Function:** Reads the Event Status Register **Syntax:** *ESR? **Argument(s):** none **Remarks:** This function is used to read the Event Status Register. Reading the register clears it. **Return Value:** *reg* integer register **Example(s):** *ESR? returns the following '128'
***SRE**	**Function:** Sets the Status Byte Enable Register **Syntax:** *SRE *mask* **Argument(s):** *mask* integer bitmask **Remarks:** This function is used to set the Status Byte Enable Register to the value specified by *mask*. **Return Value:** none **Example(s):** *SRE 255
***SRE?**	**Function:** Reads the Status Byte Enable Register. **Syntax:** *SRE? **Argument(s):** none **Remarks:** This function is used to read the Status Byte Enable Register. **Return Value:** *mask* integer register mask **Example(s):** *SRE? returns the following '255'
***STB?**	**Function:** Reads the Status Byte Register. **Syntax:** *STB? **Argument(s):** none **Remarks:** This function is used to read the Status Byte Register. **Return Value:** reg integer register **Example(s):** *STB? returns the following '96'
***IDN?**	**Function:** Reads the system identification information. **Syntax:** *IDN? **Argument(s):** none **Remarks:** This function is used to read the system identification information, which is a string consisting of the following data: manufacturer, model, serial number, and firmware version. **Return Value:** *mfg* integer count of devices **Example(s):** *IDN? returns the following 'Weinschel,8311 Series, 123, 1.00A'
***RST**	**Function:** Performs a device reset. **Syntax:** *RST **Argument(s):** none **Remarks:** This function is used to reset the device. **Return Value:** none **Example(s):** *RST

Table 3. 488.2 Common Commands--Part II

Mnemonic	Description
***OPC**	**Function:** Operation complete service request. **Syntax:** *OPC **Argument(s):** none **Remarks:** This function generates the Operation Complete message (OPC) in the Standard Event Status Register when all pending device operations have finished. **Return Value:** none **Example(s):** *OPC
***OPC?**	**Function:** Operation complete query **Syntax:** *OPC? **Argument(s):** none **Remarks:** This function loads a '1' into the output queue when the Program Message Unit is executed. Its primary use is to provide an indication of command completion by including the command as the last one in a series of commands. **Return Value:** 1 integer command completed **Example(s):** SAVE ASSIGN; *OPC? returns a '1' when the SAVE ASSIGN command completes.
***WAI**	**Function:** Wait To Continue **Syntax**: *WAI **Argument(s):** none **Remarks:** This function prevents the8311 Series from executing any further commands or queries until there are no pending operations. The8311 Series executes all commands sequentially, and does not allow overlapping commands. **Return Value:** none **Example(s):** *WAI

Table 4. General Commands--Part I

Mnemonic	Description
CHAN	**Function:** Selects the currently active channel **Syntax:** CHAN *chnum* **Argument(s):** *chnum* integer channel number **Remarks:** This function is used to select the currently active channel. **Return Value:** none **Example(s):** CHAN 1
CHAN?	**Function:** Reads the current channel number **Syntax**: CHAN? **Argument(s)**: none **Remarks:** This function is used to read the currently active channel number **Return Value:** *chnum* integer current channel number **Example(s):** CHAN? returns '1'
ATTN	**Function:** Set attenuation **Syntax:** ATTN *atten* **Argument(s):** atten real desired value, in dB **Remarks:** This function sets the attenuation of the currently selected channel to atten. **Return Value:** none **Example(s):** ATTN 63 ATTN 12.25 ATTN 45.0
ATTN?	**Function:** Read attenuation **Syntax:** ATTN? **Argument(s):** none **Remarks:** This function reads the attenuation of the currently selected channel. **Return Value:** *atten* real attenuation value, in dB Example(s): ATTN? returns '63.00'
REL	**Function:** Sets relative display mode for the current channel **Syntax:** REL *mode* **Argument(s):** *mode* integer relative mode on/off **Remarks**: This function is used to set the relative display mode of operation for the current channel. A value of 0 for the parameter mode will turn relative mode off, while a value of 1 will turn relative mode on. **Return Value:** none **Example(s):** REL 1
REF	**Function:** Sets reference **Syntax:** REF **Argument(s):** none **Remarks:** This function sets the reference value for the active channel to the current attenuation setting. This command is used for the REL and RELATTN functions. **Return Value:** none **Example(s):** REF; REL 1 sets the reference, and turns on relative mode
REF?	**Function:** Read reference setting **Syntax:** REF? **Argument(s):** none **Remarks:** This function reads the reference setting of the currently selected channel. **Return Value:** *refatten* real reference attenuation value, in dB **Example(s):** REF? returns '30.00'
RELATTN	**Function:** Sets attenuation relative to the reference setting **Syntax:** RELATTN atten **Argument(s):** *atten* real desired value, in dB **Remarks:** This function sets the attenuation of the currently selected channel to atten, relative to the reference value set when the REL command was executed. **Return Value:** none **Example(s):** RELATTN 10 increases the attenuation setting 10dB from the reference setting RELATTN -10 decreases the attenuation setting by 10dB from the reference setting

Table 5. General Commands--Part II

Mnemonic	Description
RELATTN?	**Function:** Read relative attenuation of the current channel **Syntax:** RELATTN? **Argument(s):** none **Remarks:** This function reads the relative attenuation of the currently selected channel. **Return Value:** relatten real relative attenuation value, in dB Example(s): RELATTN? returns '-10.00'
STEPSIZE	**Function:** Sets attenuation stepsize for the current channel **Syntax:** STEPSIZE atten **Argument(s):** *atten* real desired stepsize value, in dB **Remarks:** This function sets the attenuation stepsize for the INCR and DECR commands for the current channel to atten. The default value of the attenuator's stepsize is the intrinsic resolution of the attenuator, ie a 127dB/1dB step attenuator has a default stepsize of 1dB. **Return Value:** none **Example(s):** STEPSIZE 10 changes the stepsize to 10dB
STEPSIZE?	**Function:** Read attenuation stepsize **Syntax:** STEPSIZE? **Argument(s):** none **Remarks:** This function reads the attenuation stepsize of the current channel. **Return Value:** atten real attenuation stepsize value, in dB **Example(s):** STEPSIZE? returns '10.00'
INCR	**Function:** Increments attenuation **Syntax:** INCR **Argument(s):** none **Remarks:** This function increments the attenuation setting of the current channel by the value of the attenuator's programmed stepsize (see STEPSIZE command). **Return Value:** none **Example(s):** INCR
DECR	**Function:** Decrements attenuation **Syntax:** INCR **Argument(s):** none **Remarks:** This function decrements the attenuation setting of the current channel by the value of the attenuator's programmed stepsize (see STEPSIZE command). **Return Value:** none **Example(s):** DECR

7. GENERAL CIRCUIT DESCRIPTION:

This section contains general descriptions and systematic explanation of the Model 8311's design and internal circuitry. Standard 8311 Series SmartStep Attenuator Units contain internal circuitry to control a variety of Weinschel Corporation programmable attenuators (3200T, 150T, and 4200 Series) via front panel controls or standard communications interfaces including GPIB (IEEE-488) and RS-232/RS-422 /RS485. Figure 5 provides a simplified block diagram of the 8311's internal circuitry.

7-1 POWER SUPPLY ASSEMBLY: The Model 8311 contains a high-efficiency switching type Power Supply Assembly (A3) which will operate with a 100 to 240 Vac input power source. The input power source is routed thru the Power Entry Module Assembly (XF1) before being applied to the Power Supply Assembly. The Power Entry Module Assembly allows the user to select between the two operational voltage ranges that can be accepted by the Power Supply Assembly. This Switching Power Supply provides the Model 8311 with +15 ±0.75 V @ 3.3 A outputs. These outputs are then routed to the SmartStep Interface Assembly for distribution to the other assemblies located in the Model 8311. Figure X shows the actual power distribution for all assemblies and modules located in the 8311.

5-11.2 STATUS DISPLAYS AND SWITCH CONTROL ASSEMBLY. This assembly located behind the the front panel contains a group of LED's that indicates the status of bus operation and channel/port selection . The Switch/LED Status PCB Assembly contains control switches which are used to set the GPIB address information, selected desired port/channel, select the mode of operation (Local or Remote) and manually control and enter parameters for devices installed in the Model 8311. These control switches operate in a toggle fashion, ie, push for ON and push for OFF. Refer to Section 5 for an operational description of each LED and switch located on the front panel.

5-11.3 *SmartStep* INTERFACE ASSEMBLY: This assembly is responsible for programming and control of the Driver PCB Assembly, GPIB bus operation, and front panel Switch/LED control. The ***S***martstep Interface Assembly provides a high-level interface from a standard communications interface including GPIB (IEEE-488) and RS-232/RS-422/RS485, to the 8311 SmartStep's serial Driver Interface Bus.

The Device Interface Bus (DIB) is a system for connecting a number of relatively low-speed I/O devices to a host, providing a simple, uniform, and inexpensive way to control a variety of devices via a single port. The DIB is based on the two-wire I^2C serial bus and several software protocol layers that allow the *Smartstep* Interface Assembly to address the internal devices, with serial data rates of up to 100 KHz. The DIB may also be used to supply DC power to other devices that may be installed in custom applications, resulting in a simple, low-cost interconnection system.

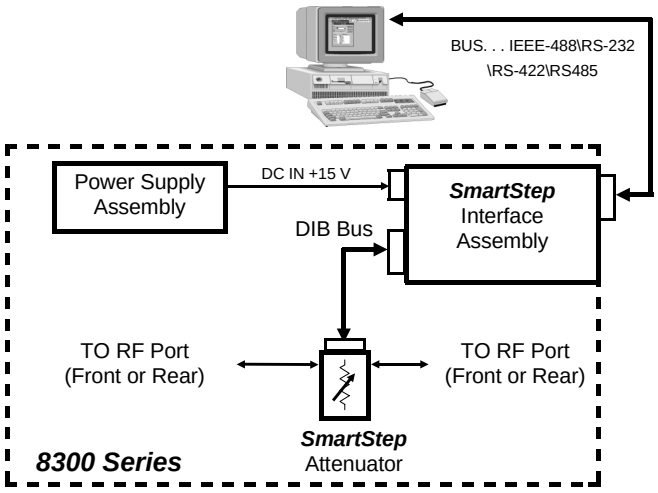


Figure 5. 8311 Series Simplifed Block Diagram

5-11.4 RF SECTION: The 8311 Series provides front-panel and computer control for up to 12 channels of attenuation, RF switching, or other functions. The 8311 combines the features of the Weinschel 8210A Device Controller (IM-288 for more details) with a front panel user interface to form a flexible, easy to use solution. Most 8311 Series are multi-channel configurations where RF signal is routed through either the front or rear mounted channel connector to a single or multiple Weinschel programmable attenuators thus creating a channel. For specialized configurations refer to supplemental information in the front of this manual for details.

Typically Weinschel programmables are bi-directional and the RF signal can be applied to either Port connector. Refer to the individual data sheets located in the Appendix C for detailed and specific specifications pertaining to the internal mounted attenuators. Refer to the replacable parts list for actual programmable attenuator part/model number.

Special configurations exsist where the RF section is designed to specific customer requirements which can contain signal programmable attenuators with custom attenuation ranges and step sizes to multiple programmables used inconjuction with other coaxial devices such as switches, power combiners, directional couplers, and filters creating single or multichannel subsystems. All specialized 8311 series units will contain a supplement located in the front of this manual that outlines detailed configuration, operation and parts list for these Atttenuator Units.

8. MAINTENANCE:

The following paragraphs provide general inspection and maintence guide lines for the 8311 Series ***SmartStep*** Attenuator Units.

8-1 INSPECTION: Perform a visual inspection (Table 6) in conjunction with the maintenance activities schedule when a malfunction is suspected, or whenever an assembly is removed or replaced.

8-2 PREVENTIVE MAINTENANCE: While the 8311 Series *SmartStep* Attenuator Unit requires very little preventive maintenance, it should not be subjected to physical abuse, severe mechanical shock, high humidity, or operating temperatures outside the specification range. The instrument should be kept free of excessive dirt and dust, since these can interfere with connector functions and with normal heat dissipation. For cleaning instructions refer to paragraph 8-3 (special cleaning instructions). The following paragraphs provide the preventive maintenance that is to be performed on the Attenuator Unit.

Care should be taken to prevent strain on the interconnecting cables, since damage here may not always be apparent. Occasionally check the external cables and connectors for signs of cracked insulation and/or bent or worn pins. Tests show that connectors must be clean for accuracy and stability. This requires an inspection and cleaning of each connector immediately before use. For connector cleaning instructions, refer to paragraph 8-3. When cleaning precautions are observed regularly, connectors can maintain their stability for over several thousand connection cycles. Refer to Appendix A for more information about cables and connectors.

8-3 SPECIAL CLEANING INSTRUCTIONS: The cleaning procedures for Model 8311 Attenuator Unit are divided into five general groups: microwave coaxial cable assemblies, circuit card and modules; machined surfaces and hardware, chassis cleaning, and connector cleaning. Table 1-3 provides a list of consumables recommended to perform these procedures.

8-3.1 MICROWAVE COAXIAL CABLE ASSEMBLIES: Appendix A (located at the end of this manual) provides all the necessary procedures for care, cleaning, and handling of microwave coaxial cable assemblies.

8-3.2 CIRCUIT CARDS AND MODULES: A protective coating is applied to circuit cards for protection from moisture, arcing, short-circuiting, and abrasion. To remove light dirt from circuit cards and modules proceed as follows:

CAUTION

- DO NOT use a nylon bristle brush in the solvent as the bristles may dissolve and cause damage to the circuit card or component.
- DO NOT use ultrasonic cleaning on parts or assemblies containing electrical or electronic components.
- DO NOT bend pins of electrical connectors when using fiber-bristle brush (1, Table 7).

a. Briskly brush isopropyl alcohol (4) onto area to be cleaned with fiber-bristle brush (1).

b. Carefully remove residue with clean lint-free cloth (5) and repeat step "a" as a rinse.

WARNING

Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles/ faceshields should be worn. DO NOT direct air stream towards self or other personnel. Pressure should be restricted to a maximum 15 psi to avoid personal injury.

c. When parts are thoroughly clean, dry parts using 5 psi of clean moisture free compressed air or preferably dry nitrogen (pressurized spray will work well).

8-3.3 MACHINED SURFACES AND HARDWARE: To remove light dirt and dust from mechanical parts such as castings, covers and other hardware proceed as follows:

WARNING

Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles/faceshields should be worn. DO NOT direct air stream towards self or other personnel. Pressure should be restricted to a maximum 15 psi to avoid personal injury.

CAUTION

- Under no circumstances use a wire brush, steel wool, or abrasive compound. Using these items will cause extensive damage to the instrument's surface.
- DO NOT use a nylon bristle brush in solvent as the bristles may dissolve and cause damage to the circuit card or component.

a. Use 5 psi of clean, moisture-free compressed air or preferably dry nitrogen to blow loose dirt and dust from surface of item.

b. Briskly brush isopropyl alcohol (4, Table 7) onto area to be cleaned with a fiber-bristle brush (1).

c. Remove residue with lint-free cloth (5) and repeat step "b" as a rinse.

d. When parts are thoroughly clean, dry parts using 5 psi of clean, moisture-free compressed air or preferably dry nitrogen.

Table 5. Inspection

ITEM	INSPECTION
Capacitors	Cracked, blistered, or dented; broken or loose seals or leads; signs of leakage (polarized tantalum capacitors); loose or missing mountings.
Castings, Housings	Dents, cracks, scratches, or other damage; loose or missing handles, brackets, or mounting hardware; damaged mounts; corrosion or excessive dirt.
Connectors	Bent , broken or corroded pins; Cracked or broken inserts; cracked or broken shell; loose or missing mounting nuts, washers, or screws; improper saddle clamp installation.
Diodes	Signs of overheating; cracked or broken case; broken seals or leads.
Hardware	Stripped threads, missing washers, corrosion, or other signs of damage.
Integrated Circuits	Signs of overheating; cracked or broken case; broken leads.
Internal Wiring	Frayed, broken, or abraded insulation; improperly dressed or tied cables; broken, corroded, or poorly soldered conductors at the terminals; missing or damaged sleeving at connector terminals.
Painted Surfaces	Scratches, chips, or peeling.
Preformed Packing	Nicks, burrs, or foreign materials present.
Printed Circuit Boards	Broken or loose wires; damaged circuit traces (clad); damaged components or chassis; loose, missing, or damaged wires, cables, or hardware; poorly soldered connections; bent or broken connector pins.
Relays	Damaged castings; loose or missing terminals or connectors.
Resistors	Cracked, broken, blistered, or charred body; broken or corroded leads; loose or missing mountings.
Switches	Signs of overheating; loose or broken terminals; lack of positive action.
Terminal Boards	Cracked, broken, blistered, or charred body; broken, loose, or corroded leads.

Table 6. Recommended Consumable Materials

Item Number	Nomenclature	Material	Specification Number	MGR Part Number
1	Acid Brush (Fiber-Bristle)		H-B-643 Type II CLASS 1	
2	Aluminum Wool		MIL-A-4864A	
3	Brush, Soft-Bristle		H-B-420 Type II	
4	Cleaner/Solvent	Isopropyl Alcohol	TT-1-735A (3)	
5	Cloth, Lint Free		MIL-C-85043 Type IIA	
7	Permanent Polymer Coating (Solder Mask)		IPC-SM-840 Class III	

e. Clean smaller mechanical parts or hardware by dipping into a container of isopropyl alcohol (4). Remove dirt by brushing with fiber-bristle brush (1) after parts have been immersed for several hours.

f. Remove parts from isopropyl alcohol (4) and rinse by immersing into a different container of isopropyl alcohol (5).

g. When parts are thoroughly cleaned, dry parts using 5 psi of clean, moisture-free compressed air or preferably dry nitrogen.

8-3.4 CHASSIS CLEANING: Clean chassis using a lint-free cloth (5, Table 7 moistened with water and mild detergent. For harder to clean areas, such as inside corners of chassis, use a vacuum cleaner.

8-3.5 CONNECTOR CLEANING: Where small amounts of rust, corrosion, and/or oxide deposits are present on connectors, clean externally with a soft-bristle brush (3, Table 3), aluminum wool (2), or internally with an acid brush (1); then wash with a noncorrosive solvent. MIL-C-83112 is recommended. Exercise care to ensure no metal filing or residue remains inside the connector and the connector is thoroughly dry. Where rust, corrosion, and/or oxide deposits are present in large quantities, replace the connector.

8-4 REPAIR AND REPLACEMENT: The following notes and cautions are provided as a guide line when removing assemblies from the Model 8311.

WARNING

- Ensure the facility power is removed before removing or installing any component.
- Soldering and/or unsoldering can cause burns to personnel. Provide adequate ventilation. Avoid breathing the fumes of solder and flux. Personnel should wear approved safety equipment.

CAUTION

- All procedures and/or steps identified as must be followed exactly as written and according to ESDS device handling procedures in IM-211 or other accepted ESDS procedures. Failure to comply WILL RESULT in ESDS damage.
- DO NOT use excessive heat when soldering. The use of a low wattage pencil-type soldering equipment is recommended.
- When removing a assembly from the instrument, DO NOT over extend wires/cables beyond their physical limits.

NOTE

- Before installing any component or assembly into the instrument, inspect it in accordance with Table 6.
- To facilitate installation, bag and mark all mounting hardware and tag all wires/cables during removal with sufficient information to allow reconnection. Then remove tag after installation. This is recommended to ensure proper installation of the component or assembly.
- For consumables, refer to Table 7.
- Refer to Replaceable Parts List, Section 9, for replacement part number information.

8-4.1 LINE VOLTAGE FUSE REPLACEMENT: The following steps provide procedures to replace the line voltage Fuse Assembly. Model 8311 accepts a T0 1.5A, 250 Vac Slo-Blo fuse which is 5 x 20 mm in size.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the Model 8311 power cord is DISCONNECTED before attempting to change fuses.

CAUTION

DO NOT connect or apply power to this instrument until the Power Entry Module Assembly has been adjusted to the operational line voltage.

a. Disconnect the power cord from the Power Entry Module Assembly.

b. Use small screwdriver to pry open the Fuse Drawer.

c. Slide out Fuse Drawer located in the center of the Power Entry Module Assembly.

d. Remove the defective fuse and replace with the correct fuse (Weinschel P/N 052-19-3/15).

e. Snap the Fuse Drawer shut and reconnect ac power cord.

9. REPLACEABLE PARTS LIST:

This section lists and describes the parts located in Standard 8311 Series SmartStep Attenuator Units (P/N 193-80XX-X). The Replacable Parts Lists (RPL) are intended for use in identifying, locating, and requisitioning assemblies and components for the Model 8311.

9-1 UNDERSTANDING REFERENCE DESIGNATORS: All assemblies and electrical parts are identified by standard reference designators (resistors R1, for example). Reference designators are used in parts lists and on parts identification drawings. The title of a parts list or drawing contains the reference designator or the assembly or subassembly to which it applies. The designators in the parts list, as a prefix, but omitted from the list to make it easier to locate a specific part. To complete a reference designator in a parts list, precede the designator for the specific part (DS1, for example) with the designator in the title (A6, for example) to form a complete reference designator for the part (in this case, A6DS1).

7-2 ORDERING INFORMATION: When ordering parts from Weinschel Corporation please include the following information:

- Weinschel part number.
- Description of the component or part.
- Model and serial number of the instrument.
- Assembly number and assembly revision (if any) from the assembly (this information is on the component side of the PCB).

9-3 DRAWING NUMBER: The Weinschel part number consists of a basic number with a dash number. The basic number should cross reference to a drawing number for most of the items. For those items that do not have a drawing number, the manufacturers part number is provided.

9-4 REPLACEABLE PARTS LIST (RPL): This RPL contains a breakdown of the instrument into its major assemblies and detailed parts. The following paragraphs describe the contents of each column of the RPL.

9-4.1 REFERENCE DESIGNATOR: This column contains reference designations arranged in alphanumerical sequence. The letters A thru Z have precedence, followed by numberals 0 thru 9. In addition to the reference designators that are listed, some mechanical parts are also listed. These items lack reference designators and are included because they are considered subject to wear and/or breakage, or because they are custom (non-standard) hardware or parts that might become lost or damaged. This column contains the word N/A for those items or parts not having a reference designator.

9-4.2 DESCRIPTION: This column contains the nomenclature located in the title block of the engineering drawing by the designing activity. The noun name is listed first, followed by modifiers and descriptive information to completely identify the part or assembly.

9-4.3 WEINSCHEL PART NUMBER: This column contains the Weinschel part number assigned to an assembly, sub-assembly, or detailed part. This also includes Weinschel numbers for specification control, source control, and altered items drawings.

9-4.4 MFG PART NO.: This column contains manufacturers part numbers for those parts Weinschel purchases, as off the shelf items and assigns Weinschel part numbers for internal control only. These parts may be ordered through the manufacturer or through Weinschel by the Weinschel part number.

9-4.5 CAGE CODE: This column provides the Commercial and Government Entity (CAGE) code on the same line as the applicable part number. Codes, names, and addresses of venders with an assigned CAGE are listed in Cataloging Handbook H4-1 and H4-2. Vendors that have not been assigned CAGE codes by the government are identified by the word NONE in this column. The names and addresses of these venders can be obtained from Weinschel. Part numbers that have no CAGE numbers listed are manufactured or altered by Weinschel.

CAUTION

This instrument contains items identified as  . When handling or shipping these items, the ESD Handling must be performed in accordance with ESD device handling procedures in IM-211 or other accepted ESD procedures. Failure to comply **WILL RESULT** in ESD damage

9-4.6 ASSEMBLY AND COMPONENT LOCATION: The assembly/component location and schematic diagrams for the different 8311 series models are located in Figures X-X (listed below). Drawing find numbers have also been included to help locate components or hardware.

Diagram Number	Title	Page

To be provided! *Table 7. Model 8311-XX-X Attenuator Unit (P/N 193-XXXX-X)*

FIND NO.	REF DES	DESCRIPTION	WEINSCHEL PART NO.	MFG. PART NO.	CAGE
		To be provided			

Notes: Refer to Figure 7 for component location.

10. APPLICATIONS:

Applications for the8311 Series range from providing control of a single ***SmartStep*** Attenuator in a bench test/lab environment using a PC and a terminal emulator, to complex system applications where the 8311 Series is employed to control many devices to create custom/semi-custom subsystems to reduce overall design cost. Weinschel can provide a variety of custom designed driver interfaces for various devices, such as RF switches, relays, pin attenuators, motorized step attenuators, displays, and other devices, as well as complete subsystem design and integration services. Contact us with your specialized needs.

11. ACCESSORIES:

Part Number	Description
193-8033-1	Rack Mounting Kit, Single 8311
193-8033-2	Rack Mounting Kit, Dual 8311
7005-X	PLANAR CROWNS® ···refer to data sheet in Appendix C for model numbers and applicable crown specifications.

10. CONTACTING WEINSCHEL CORPORATION:

In the event of a malfunction, contact Weinschel Corporation. An apparent malfunction of an instrument or component may be diagnosed over the phone by first contacting the Customer Service Department at Weinschel Corporation. DO NOT send the instrument or component back to the factory without prior authorization. When it is necessary to return an item, state the symptoms, catalog and type number of the instrument or component, and date of original purchase. Also write the Company name and your name and phone number on a card and tape the card to the item returned. Page 2 provides further information regarding preparation of a unit for reshipment. Contact Weinschel Corporation Customer Service Department as follows:

Via mail: **Weinschel Corporation**
5305 Spectrum Drive
Frederick, MD 21703-7362
U.S.A.

Via Telefax: **301-846-9116**

Via Phone: **Call TOLL FREE 800-638-2048**
Toll call # 301-846-9222

Via Website: **www.weinschel.com**

Via e-mail: **sales@weinschel.com**

12. WEINSCHEL WARRANTY:

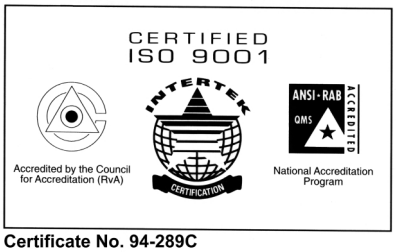
PRODUCTS - Weinschel Corporation warrants each product it manufactures to be free from defects in material and workmanship under normal use and service anywhere in the world. Weinschel Corporation's only obligation under this Warranty is to repair or replace, at its plant, any product or part thereof 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 Weinschel Corporation's sole opinion to 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

APPENDIX B - 488.2 Required Documentation

Number	Required Item	Implementation
1	Interface Function Subsets Implemented	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0
2	Device behavior when the address is set outside of the 0-30 range	The 8311 address is set to 10
3	When is a user address changed recognized?	When the DIP switch setting is changed
4	Description of settings at power-on	User programmable via macro
5	Message exchange options a. Size and behavior of input buffer b. Queries that return more than one <RESPONSE MESSAGE UNIT> c. Queries that generate a response when parsed d. Queries that generate a response when read e. Commands that are coupled	a. The GPIB input buffer is 2048 bytes in length. When the Input Buffer becomes full it processes the messages currently received before accepting additional messages. All data bytes received will be stored in the Input Buffer until 'end of message' is detected. The message(s) received are the processed in the order received. b. The 8311 contains no Query commands that return more than one <RESPONSE MESSAGE UNIT> c. All valid queries generate a response when parsed. The reply is generated at the time the Query message is received. d. none e. none
6	Functional elements used in construction of device specific commands	<PROGRAM MESSAGE> <PROGRAM MESSAGE TERMINATOR> <PROGRAM MESSAGE UNIT> <PROGRAM MESSAGE UNIT SEPARATOR> <COMMAND MESSAGE UNIT> <QUERY MESSAGE UNIT> <COMMAND PROGRAM HEADER> <QUERY PROGRAM HEADER> <PROGRAM HEADER SEPARATOR> <PROGRAM DATA SEPARATOR> <PROGRAM DATA> <DECIMAL NUMERIC PROGRAM DATA> <CHARACTER PROGRAM DATA>
7	Buffer size limitations for block data	not implemented
8	<PROGRAM DATA> elements that may appear within an expression	none
9	Response syntax for queries	see command table
10	Description of device to device message transfer traffic that does not follow the rules for <RESPONSE MESSAGES>	none
11	Size of block data responses	none
12	Common commands and queries that are implemented	*IDN?, *RST, *OPC, *OPC?, *CLS, *SRE, *SRE?, *ESE, *ESE?, *STB, *TST?, *WAI
13	State of the 8311 following completion of the CAL? Query	not implemented
14	Max length of the trigger macro block	not implemented
15	Macro parameters	not implemented (device specific forms used)
16	Response to *IDN?	<Weinschel, 8311, Serial Number, Software Revision> Manufacturer string length = 16 chars max Model Number string length = 8 chars max Serial number string length = 16 chars max Software Revision string length = 8 chars max
17	*DDT implementation	not implemented
18	Size of *RDT/*RDT? resources	not implemented
19	States affected by *RST, *LRN, *RCL, and *SAV	*RST resets the Parser, Input Buffer, and Output Queue. *LRN, *RCL, and *SAV are not implemented
20	Scope of the self test performed by the *TST?	a. checks non-volatile memory contents b. checks Device Interface Bus c. checks front-panel interface
21	Additional status data structures used in status reporting	none
22	Commands overlapped/sequential	All commands are sequential
23	Functional criteria met with an operation complete message is generated in response to that command	Command is finish executing
24	Descriptions used for infinity and Not-A-Number (NAN)	N/A