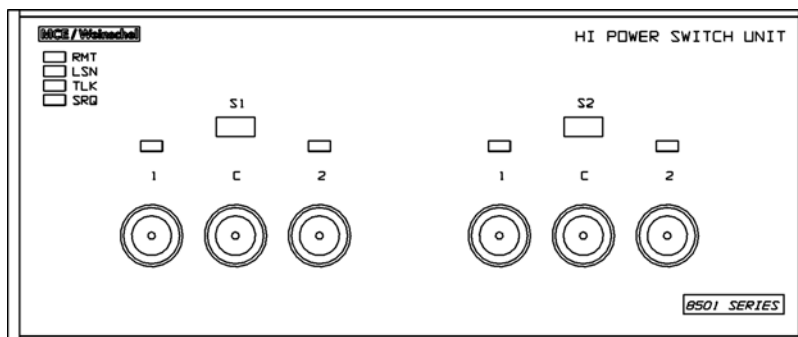# Operation & Installation Manual

Model 8501
SmartStep™ High Power Switch Unit
(P/N 193-8091-X)

*This documentation may not be reproduced in any form, for any
purpose unless authorized in writing by API/Weinschel Corporation.*

api
technologies corp.
› WEINSCHEL

© API/Weinschel Corporation
Frederick, Maryland
2002

SAFETY SUMMARY

DEFINITIONS.

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this manual.

⚠ **WARNING**

An operating or maintenance procedure, practice, statement, condition, etc., which, if not strictly observed, could result in injury and/or death of personnel. Do not proceed beyond a WARNING symbol until all the indicated conditions have been fully understood and/or met.

⚠ **CAUTION**

An operating or maintenance procedure, practice, statement, condition, etc., which, if not strictly observed, could result in damage or destruction of the equipment or long-term health hazards to personnel. Do not proceed beyond a CAUTION symbol until all the indicated conditions have been fully understood and/or met.

NOTE

An essential operating or maintenance procedure, condition, or statement that must be highlighted.

GENERAL PRECAUTIONS.

The following are general precautions that are not related to any specific procedure and, therefore, do not appear elsewhere in this publication. These are precautions that personnel must understand and apply during various phases of instrument operation or service.

⚠ **WARNING**

- Potentially lethal voltages are present in this instrument. Serious shock hazards from voltages above 70 volts may exist in any connector, chassis, or circuit board. Observe the following precautions:

- 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 at a grounded power outlet. If using a 3-2 wire adapter be sure to connect the ground lead to earth ground.

- Use the buddy system any time work involving active high voltage components is required. Turn OFF the power before making/breaking any electrical connection. Regard any exposed connector, terminal board, or circuit board as a possible shock hazard. DO NOT replace any component or module with power applied.

- If test conditions to live equipment are required, ground the test equipment before probing the voltage or signal to be tested.

- Personnel working with or near high voltage should be familiar with modern methods of resuscitation.

- DO NOT wear jewelry (rings, bracelets, metal watches, and/or neck chains) while working on exposed equipment. Be very cautious about using hand tools near exposed backplanes, bus bars, and/or power supply terminals. Use properly insulated tools. When making test connections to the power supply terminals and bus bars, use only insulated probe tips.

- Verify that the instrument is set to match the available line voltage and the correct fuse is installed.

- DO NOT install substitute parts or perform any unauthorized modification to this instrument. Contact Weinschel Corporation to acquire any information on replacement parts or returning the instrument for repair. Unauthorized modification can cause injury to personnel and/or destruction of the instrument.

- Operating personnel must not remove instrument covers. Component replacement or adjustments MUST BE performed by qualified service personnel.

- DO NOT operate the instrument near or in the presence of flammable gases or fumes.

DETAILED PRECAUTIONS.

The following WARNINGS, CAUTIONS and NOTES appear throughout the text of this manual and are repeated here for emphasis.
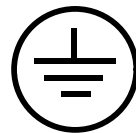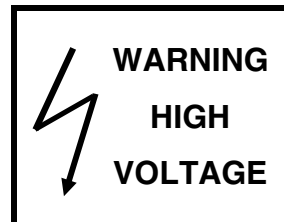
CAUTION

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

- 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.

- 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 of 15 psi to avoid personal injury.

- Under no circumstances should a wire brush, steel wool, or abrasive compound be used on any surface. Using these items will cause extensive damage to the instruments surface.

NOTE

DO NOT return any instrument or component to Weinschel Corporation without receiving prior factory authorization.

SAFETY SYMBOLS.

The following symbols are used to identify safety hazards found throughout this publication and/or located on the instrument.

CAUTION
HIGH VOLTAGE

WARNING

HIGH

VOLTAGE

ii

TABLE OF CONTENTS

1. GENERAL INFORMATION:

1-1 PURPOSE: This manual contains setup and operation information for the API/Weinschel's 8501 Series of S*martStep*™ High Power Switch Units. The manual also provides component location, reference designators, part numbers, and nomenclature to identify all the assemblies and sub-assemblies of the Switch unit.

1-2 SCOPE: This manual is to be used in conjunction with the operation and maintenance of the 8501 Series S*martStep*™ High Power Switch 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 EQUIPMENT DESCRIPTION: API/Weinschel's 8501 Series SmartStep High Power Switch Units represents a new concept in switch operation for higher power bench test and subsystem applications. Standard Model 8501 designs house and control either one or two high power switches via front panel controls or standard communications interfaces including GPIB (IEEE-488) and RS-232/RS-422/RS485. Special configurations may also exist where the RF section is designed to specific customer requirements, which can contain other coaxial devices such as power combiners, directional couplers, and filters creating single or multi-channel subsystems. Some 8501 configurations can contain a separate programmable attenuator channel.

1-4 USING THE 8501: The 8501 Series provides front-panel and computer control for up to two channels of RF switching, or other functions (Figure 1). The Model 8501 combines the features of the API/Weinschel 8210A Device Controller with a front panel user interface to form a flexible, easy to use solution for higher power switching applications. Most 8501 Series are single or dual channel configurations where RF signal is routed through either the front or rear mounted switch port connectors labeled 1, C, 2. For specialized configurations refer to supplemental information in the front of this manual for details.

Model Number Index:

8501 - X - F

Basic Model Number | Number of Switch Channels | Connector Options F = Front Connectors R = Rear Connectors
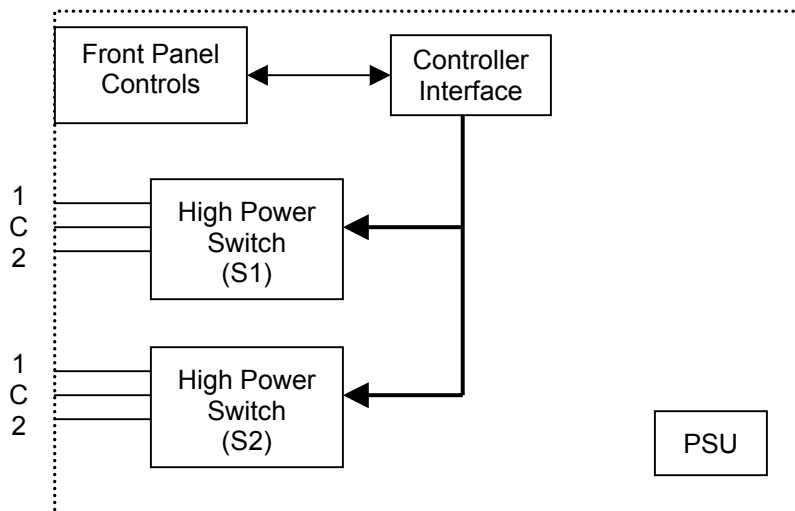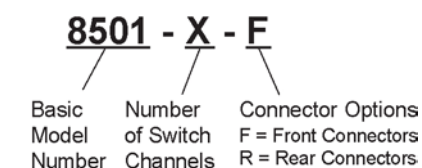
Figure 1. System Diagram

1-5. 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

d. 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 API/Weinschel Corporation until a claim for damages has been established.

2-6. 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. Ship to:

> **API/Weinschel Corporation**
> Attn: Customer Service Department
> 5305 Spectrum Drive
> Frederick, MD 21703-7362
> or to an authorized sales representative.

1-7. STORAGE: Storage of the Model 8501 Series *SmartStep*™ Switch unit is possible for extended periods without incurring damage to internal circuitry if the 8501 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

1-8. RELATED MANUALS: The following manuals contain information that may be used in conjunction with this manual to operate, service, or calibrate this instrument.

<u>Manual</u>   <u>Title</u>

H4-1 and H4-2   Federal Supply Code for Manufacturers Cataloging Handbook

1-9. 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 accepted ESDS device handling 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.

1-10. ABBREVIATIONS AND ACRONYMS: The following list contains abbreviations used throughout this manual. Abbreviations and acronyms that are not listed conform to MIL-STD-12D.

DUT   Device Under Test
ESDS   Electrostatic Discharge Sensitive
DIB   Device Interface Bus
TBD   To Be Determined

1-11. SAFETY CONSIDERATIONS: The Switch 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 Switch unit.

1-12. POWER REQUIREMENTS: API / 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 Switch 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**.**

1-13. 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.

2. SPECIFICATIONS:

2-1. GENERAL SPECIFICATIONS:

Input Power Requirements	ac 100 to 240 Vac, 50/60 Hz, 50 Watts			
Environmental	Operating Temperature 0 to +50°C Storage Temperature: 67° to +167 °F (-55° to +75°C) Humidity: 96% Altitude: 40,000' (12,192M)			
IEEE-488 Bus[1]	Connector: 24-pin per IEEE-488.1 Protocols: per IEEE-488.2 Indicators: Remote (RMT), Listen (LSN), Talk (TLK), SRQ (SRQ)			
RS-232 Bus[2]	Connector: 9-pin male D Signals: TXD, RXD, RTS, CTS, DTR, GND Baud Rates: 2400, 9600, 19200, and 38400 Data Bits: 8 Handshaking: None, RTS/CTS, XON/XOFF Parity: None, Odd, Even Indicators: Tx (Transmit) and Rx (Receive)			
RS-422 Bus[3] RS-485 Bus[4]	Connector: 9-pin male D Signals: TXD+, TDX-, RXD+, RTX-, RTS+, RTS-, CTS+, CTS-, and signal GND Baud Rates: 2400, 9600, 19200, and 38400 Data Bits: 8 Handshaking: None, RTS/CTS, XON/XOFF Parity: None, Odd, Even Indicators: Tx (Transmit) and Rx (Receive)			
RF Characteristics	Frequency Range: DC to 13 GHz			

RF Characteristics detail:

	DC to 3	3 to 5	5 to 11	11 to 13
SWR (maximum):	1.25	1.45	1.70	1.70
Insertion Loss (dB maximum):	0.25	0.30	0.50	0.65
Isolation (dB maximum):	70	60	50	50

RF Average Power Handling (CW):   100 W to 3 GHz
                                        50 W to 13 GHz

Hot Switch Cycling: 100K @ 100 Watts CW @ 2 GHz

Port Connectors: Type N Female

NOTES:
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.

2-2. PHYSICAL DIMENSIONS:
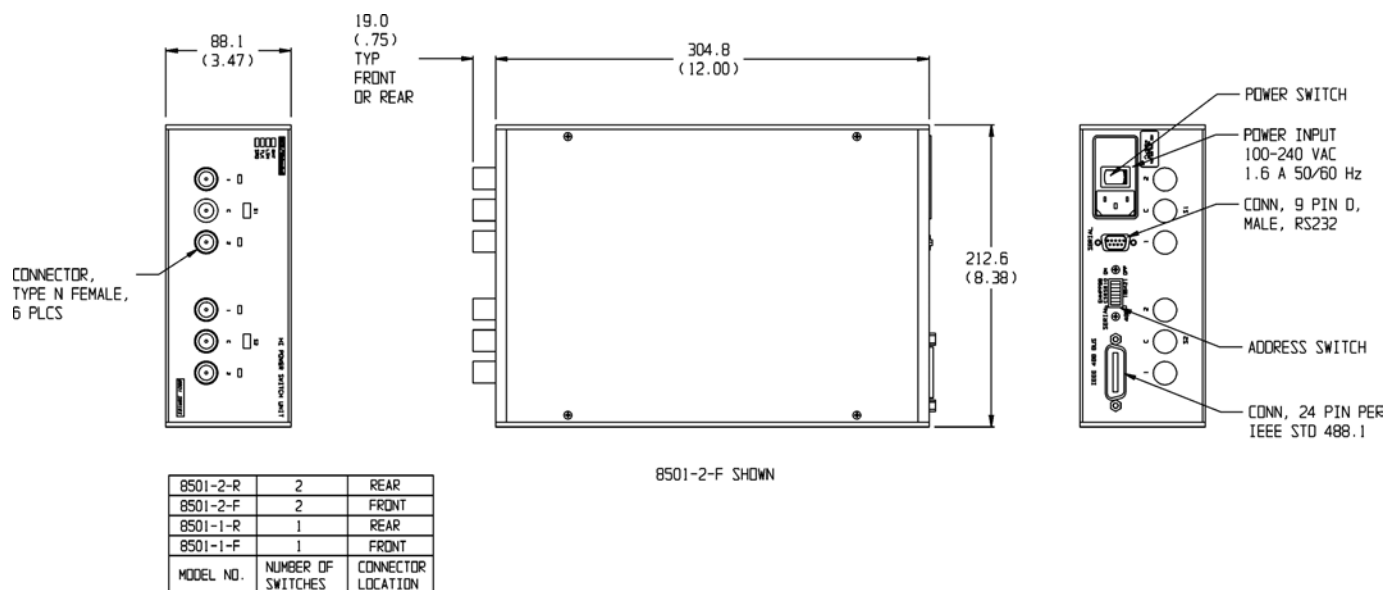
NOTE: All dimensions are given in mm (inches) and are maximum, unless otherwise

3. INSTALLATION:

3-1. RACKMOUNTING: Standard 8501 High Power Switch 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 instruments. The Model 8501 can also be rack mounted as a single unit using Rack Mounting Kit (P/N 193-8033-1) or two Model 8501's can be mounted together using Rack Mounting Kit (P/N 193-8033-2). Using these kits will allow the Model 8501 to be mounted in any rack or cabinet that is designed according to EIA RS-310 or MIL-STD-189.

3-2. INITIAL SETUP: The following initial setup procedures should be performed prior to operating the Switch unit.

    a.   Perform inspection paragraph 1-5 prior to connecting the 8501 Series to any power source.

    b.   Check that the external power source outputs to the 8501 Series are in accordance with Section 2, Specifications.

    c.   Install the 8501 Series into a cabinet or rack, if desired.

    d.   Using the supplied power cord connect the 8501 Series to the external power source.

    e.   Setup the IEEE-488 bus address or RS-232 Communications options for your application using paragraph 5.

3-3 INPUT/OUTPUT OPTIONS: The following paragraphs provide a description of the connections that can be made to the 8501 Series Switch 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 instrument power cord is DISCONNECTED before attempting to change fuses.
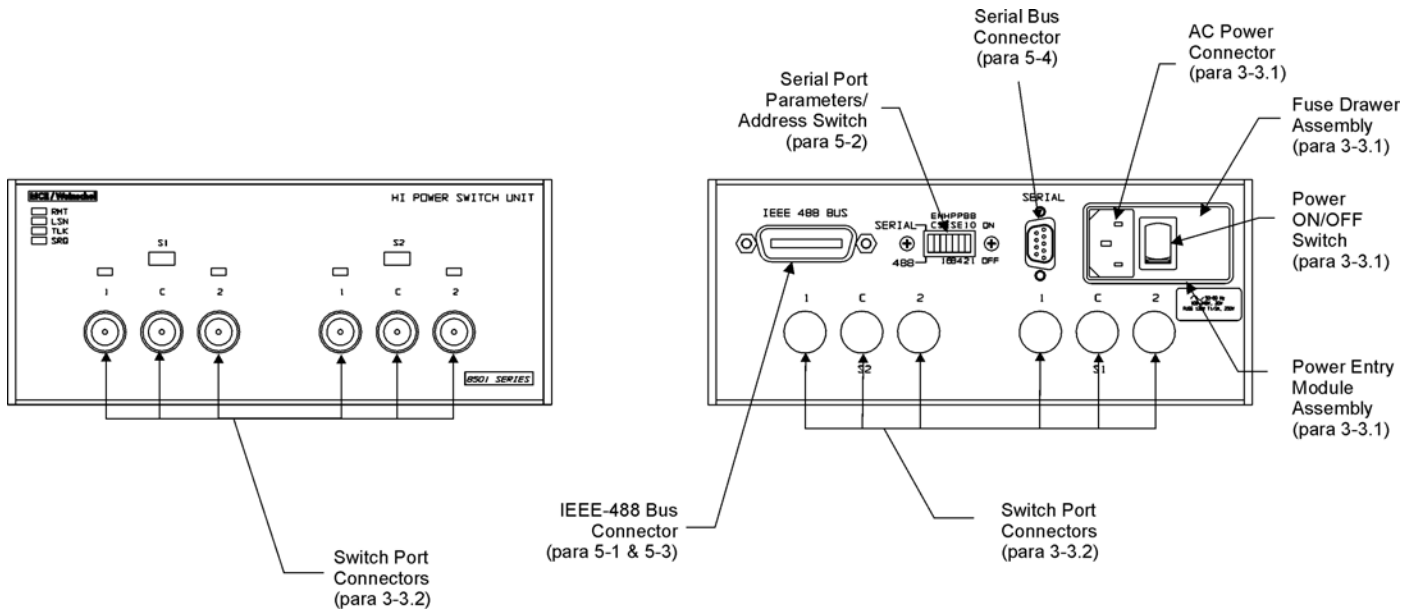
Figure 1. Front & Rear Panel Connectors

3-3.1 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 8501 uses a T 1.5A, 250 Vac fuse which is 5 x 20 mm in size. Refer to paragraph 6-4 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 Switch unit. This connector also grounds the chassis of the Switch unit when 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 8501.

3-3.2. SWITCH PORT CONNECTORS: A typical 8501 Series Switch unit contains six standard type N holes on the front and rear panel allowing for single or dual switch configurations. Standard Model 8501's are supplied with Type N female connectors that can be 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 8501 (Connector location specified by customer when ordering).

4. FRONT PANEL CONTROLS & INDICATORS:

The following paragraphs provide setup and general guidelines for operating the 8501 Series *SmartStep* Switch unit and its different bus configurations.
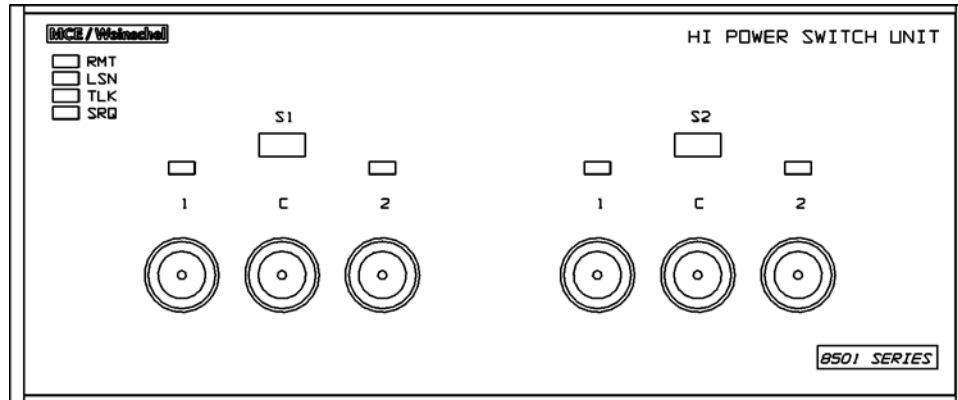
Figure 2. 8501 Series Front Panel

4-1. FRONT PANEL LEDS: The front panel contains four LED indicators that are used to provide communication and status information. The LED usage is as follows:

LED	DESCRIPTION
RMT	Remote/Local Status On : Remote Off : Local
LSN	Listen (also Serial RX) Flashes when data is received
TLK	Talk (also Serial TX) Flashes when data is transmitted
SRQ	Service Request On : Requesting service Off : Not requesting service

4-2. SWICH CONTROLS & LEDS: Each switch contains a front panel switch labeled S1 or S2. When using the Model 8501 in the manual mode this switch allows the user to toggle between ports 1 and 2 of the selected switch. When illuminated the switch LEDs indicate which port is selected.

5. REMOTE OPERATION:

The following paragraphs provide setup and general guidelines for operating the Model 8501 using an external controller.

5-1. IEEE-488 INTERFACE BUS CONNECTOR: Joining the Model 8501 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.

IEEE 488 BUS
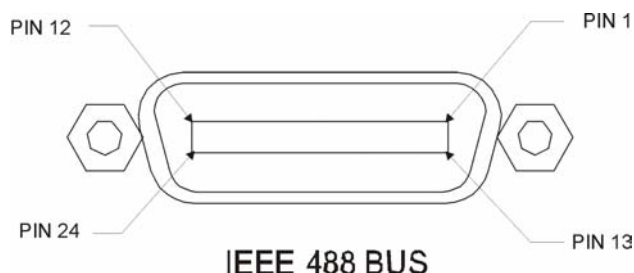
PIN No.	SIGNAL LINE	PIN No.	SIGNAL LINE
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI (24)**	17	REN (24)**
6	DAV	18	GND (6)*
7	NRFD	19	GND (7)*
8	NDAC	20	GND (8)*
9	IFC	21	GND (9)*
10	SRQ	22	GND (10)*
11	ATN	23	GND (11)*
12	SHIELD	24	GND, LOGIC
* GND (N) refer to the signal ground return of the referenced pin. ** Return pin on pin 24.			

Figure 3. IEEE-488 Interface Bus Pin Locations

5-2. 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 below (Figure 4).
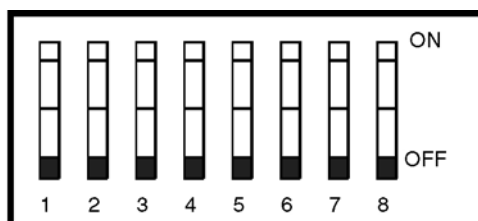
Note: All switches are shown in the OFF position.

GPIB	SW1	Serial	Serial Parameters

SP	1	SP	Mode Select
			  On = Serial parameters
			  Off = GPIB address

- - -	2	Echo	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 BR2	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

5-3. IEEE-488 (GPIB) Bus Operation

The internal functions of Model 8501 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 8501 *SmartStep* Interface's IEEE-488 bus operation. During bus operation a flashing LSN indicates that the Model 8501 is receiving. The RMT indicator is illuminated when the Model 8501 is in the remote state.

The table below summarizes the IEEE-488.1 interface functions that are implemented by the Model 8501.

Interface Function	Subset	Description
Source Handshake	SH1	Fully implemented
Acceptor Handshake	AH1	Fully implemented
Talker	T6	All basic Talker functions No extended addressing
Listener	L4	All basic Listener functions. 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 drivers

The GPIB interface of the 8501 is IEEE-488.2 compliant. The 8501 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 8501 program message units may be divided into two syntax groups: commands and queries. Refer to the section on command syntax for more information.

5-4. Serial Operation: The serial interface (RS232/RS422) provides a means of remotely programming the 8501 via external computer. The 8501 provides for user-selectable communications parameters via a DIP switch (SW1), including baud rate, data format, and handshaking method. LED indicators are provided for transmit (TX) and receive (RX) activity. Selection between RS232/RS422 mode is controlled via an internal 4 position DIP switch SW2, which also provides for user-selectable 120 ohm terminations for the RS422 receiver lines. The RS422 mode transceivers are electrically compatible with RS485.

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

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 use, echoing may be enabled, in which the 8210A will echo all characters received back to the terminal.

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 8210A may be terminated with either an ASCII CR (0x0D) or ASCII LF (0x0A) character. By default, all responses from the 8210A are terminated in an ASCII CR/LF sequence (0x0D followed by 0x0A).

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 8501 unasserts the RTS signal while command execution is in progress.

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.

5-4.1. RS-232 Operation: The RS-232 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 8501.

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.

RS232
9-pin DB9
Pinout
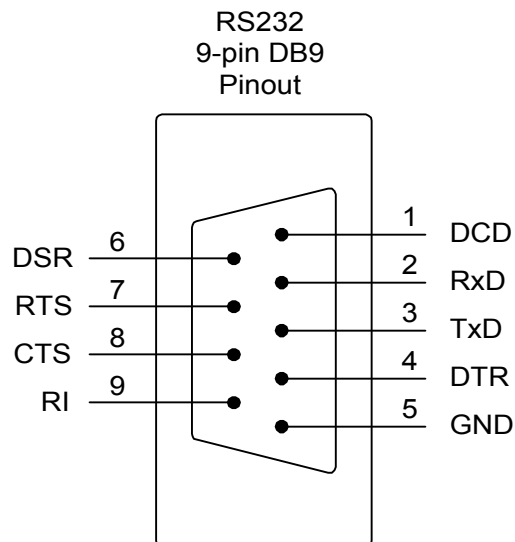
Null Modem Cable
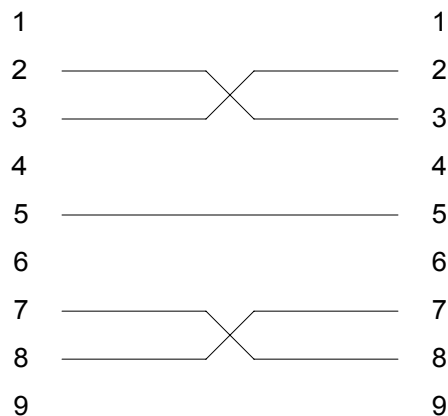
5-4.2. RS-422/485 Operation: The RS-422/RS-485 Serial mode is useful in applications requiring long cable lengths (up to 5000 ft at 9600 baud), or in electrically noisy environments. All communication parameters available for the RS232 port are also available under RS-422 operation (baud rate, handshaking, etc). Full Duplex operation is supported. The RS-422 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 8501.

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

RS422
9-pin DB9 Pinout
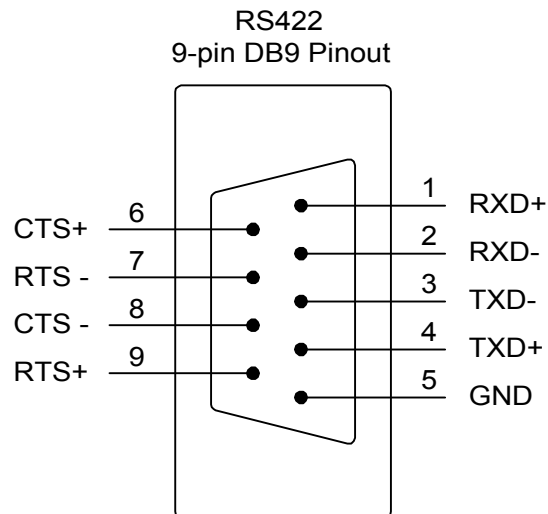
5-5. Status Reporting

The 8501 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 (SRE) 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. The SRE Register is set to 0 at power-on, disabling all events.

Status Byte Register/ Service Request Enable Register Formats

D7	D6	D5	D4	D3	D2	D1	D0
	RQS	ESB	MAV		EEQ		

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.
2	EEQ	Error/Event Queue: This bit is true when there is Error/Event data available in the Error/Event 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. The ESE Register is set to 0 at power-on, disabling all events.

Standard Event Status Register/ Standard Event Status Enable Register Formats

D7	D6	D5	D4	D3	D2	D1	D0
ON	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 implemented)
0	OPC	Operation Complete: This bit is generated in response to an *OPC command. It indicates that the ITS 2000 has completed all pending operations.

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

5-6. GENERAL SYNTAX STRUCTURE: The following paragraphs outline the general syntax and command structure for the Model 8501. This structure is common to all bus flavors of the Model 8501.

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.

5-6.1 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?"

5-6.2 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 8501 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)

5-6.3 OUTPUT DATA FORMAT: Output data from the Model 8501 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.

5-6.4 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.

5-8. 488.2 COMMON COMMANDS

*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,8501 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

*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 the8501 Series from executing any further commands or queries until there are no pending operations. The8501 Series executes all commands sequentially, and does not allow overlapping commands.
　　　　　Return Value:　none
　　　　　Example(s):　*WAI

5-9. SWITCH CONTROL COMMANDS

SWITCH	**Function:**	Set switch value
	Syntax:	SWITCH *name setting* (specific form) or
		SWITCH *setting* (non-specific form)
	Argument(s):	*name* string10 switch name
		setting integer16 desired switch setting
	Remarks:	This function sets the outputs of switch *name* to *setting*. This command may be used with both physical and virtual switch devices supporting the SwitchProtocol. The parameter *name* must have been previously assigned using either the ASSIGN or ASSIGN SWITCH command. The non-specific form of this command will set all switch devices found during the configuration process to the value *setting*. It may be used to initialize the system, or as an easy method of programming systems that contain a single switch. Also, this form allows the value of atten to be specified as -1, which results in each device being programmed to it's maximum attenuation value.
	Return Value:	none
	Example(s):	SWITCH S1 1

SWITCH?	**Function:**	Read switch setting
	Syntax:	SWITCH? *name* (specific form) or
		SWITCH? (non-specific form)
	Argument(s):	*name* string10 switch name
	Remarks:	In the specific form, this function reads the setting of switch *name*. This command may be used with both physical and virtual switch devices supporting the SwitchProtocol. The parameter *name* must have been previously assigned using either the ASSIGN or ASSIGN SWITCH command. The non-specific form may be used in systems where there is only a single switch.
	Return Value:	*setting* integer16 setting
	Example(s):	SWITCH? S1 returns '1'

SWITCH? GETCAP	**Function:**	Reads the capability of a switch
	Syntax:	SWITCH? GETCAP *name*
	Argument(s):	*name* string10 switch name
	Remarks:	This function reads the capability information of switch *name*. This command may be used with both physical and virtual switch devices supporting the SwitchProtocol. The parameter name must have been previously assigned using either the ASSIGN or ASSIGN SWITCH command. The capability information includes the switch mask value of the device, and the operational mode.
	Return Value:	*mask* integer16 switch output mask
		mode integer operational mode (0=encoded, 1=decoded)
	Example(s):	SWITCH? GETCAP S1 returns '7, 1'

6. MAINTENANCE:

The following paragraphs provide general inspection and maintenance guidelines for the 8501 Series *SmartStep* High Power Switch Units.

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

6-2. PREVENTIVE MAINTENANCE: While the 8501 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 6-3 (special cleaning instructions). The following paragraphs provide the preventive maintenance that is to be performed on the 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 6-3. 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.

6-3. SPECIAL CLEANING INSTRUCTIONS: The cleaning procedures for 8501 are divided into five general groups: microwave coaxial cable assemblies, circuit card and modules; machined surfaces and hardware, chassis cleaning, and connector cleaning.

6-3.1. 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.

6-3.2 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.

a. Briskly brush isopropyl alcohol onto area to be cleaned with fiber-bristle brush.

b. Carefully remove residue with a clean lint-free cloth 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).

6-3.3 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 onto area to be cleaned with a fiber-bristle brush.

c. Remove residue with lint-free cloth 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.

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

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

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

6-3.4 CHASSIS CLEANING: Clean chassis using a lint-free cloth moistened with water and mild detergent. For harder to clean areas, such as inside corners of chassis, use a vacuum cleaner.

6-3.5 CONNECTOR CLEANING: Where small amounts of rust, corrosion, and/or oxide deposits are present on connectors, clean externally with a soft-bristle brush, aluminum wool, or internally with an acid brush; then wash with a non-corrosive 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.

6-4. LINE VOLTAGE FUSE REPLACEMENT: The following steps provide procedures to replace the line voltage Fuse Assembly. This unit accepts a F1.5A, 250 Vac fuse for 115 Vac.

> ⚠ **WARNING**

Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the instrument 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 a small screwdriver to carefully open the Fuse Drawer.

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

d. Remove defective fuse and replace with the correct fuse (Refer to applicable parts list for fuse part number).

e. Snap the Fuse Drawer shut and re-connect ac power cord.

7. REPLACEABLE PARTS LIST:

This section lists and describes the parts located in Standard 8501 Series SmartStep High Power Switch Units (P/N 193-70XX-X). The Replaceable Parts Lists (RPL) is intended for use in identifying, locating, and requisitioning assemblies and components for the Model 8501.

7-1 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, please include the following information:

- API / 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).

8-3 DRAWING NUMBER: The API / 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.

7-4 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.

7-4.1 REFERENCE DESIGNATOR: This column contains reference designations arranged in alphanumerical sequence. The letters A thru Z have precedence, followed by numerals 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.

7-4.2 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.

7-4.3 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.

7-4.4 VENDOR 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 Weinschel by the Weinschel part number.

7-4.5 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.

7-4.6 ASSEMBLY AND COMPONENT LOCATION: The assembly/component location and schematic diagrams for the different 8501 series models are located in rear of this manual by the drawing number. Drawing find numbers have also been included to help locate components or hardware.

Model 8501-1-F & R High Power Switch Unit Assembly Replaceable Parts List (P/N 193-8091-1):

Find No.	Part Number	Description	Quantity Used	Reference Designator	CAGE Code	Vendor Part Number
1	193-8090	ENCLOSURE, MODIFIED	1	NA		
2	193-8089	OVERLAY	1	NA		
3	193-8092	SUPPORT, SWITCH	1	NA		
4	193-8093	CHASSIS	1	NA		
5	193-8095-000	ASSY, PCB, DUAL HIGH-POWER SWITCH	1	A3		
6	193-9252	ASSY, CABLE, DC TO POWER SUPPLIES	1	W5		
7	193-8103	ASSY, CABLE, 15V PSU TO CONTROLLER/ HI PWR SWITCH	1	W4		
8	193-8070	ASSY, SWITCH	1	S1		
9	193-8023-001	ASSY, PCB, CONTROLLER, W/IEEE CONN	1	A1		
10	193-9126-000	ASSY, PCB, ADDRESS SWITCH	1	A5		
11	193-9612	CLAMP, ADDRESS CABLE	1	NA		
12	193-8005-1	ASSY, CABLE RS232, CONT TO R/P	1	W3		
13	001-400-15	PSU SWITCHER, +15V DC, 3.3A	1	A2	60975	GLC50-15
14	001-400-28	PSU SWITCHER, +28 VDC, 1.8 AMP	1	A6	60975	GLC50-28
15	193-9159	ASSY, CABLE, GND	1	W1		
16	051-40	FUSE HOLDER, POWER INPUT, W/SWITCH	1	XF1	5245	PSOSXSS6B
17	193-9193	ASSY, CABLE, CONTROLLER TO FRONT PANEL DISPLAY	1	W6		
18	074-761-2	HOLE PLUG 5/8 HOLE, NYLON BLK	9	NA	83330	393
19	052-1-1/5	FUSE 1.5 AMP, 250V	1	F1	75915	312.01.5
20	062-184-5	CONN SCREW LOCK, FEMALE	2	NA	71468	D20418-2
21	068-39-2	CABLE ASSY, 16 COND RIBBON, 6 INCH LG	1	W2	D-KEY	A8PPG-1606M-ND
22	193-8075-1	ASSY, CABLE 28V DC POWER	1	W7		
23	068-21	CORD PWR 3-CONDUCTOR DTCH 7.5FT 10A-125V NEMA5-15P/IEC320-C13	1	NA	16428	17250
24	062-380-1	SCREW LOCK, HARDWARE KIT, METRIC, #6-32 UNC-2A EXT THDS	1	NA	779	554808-1
25	090-285	*NAMEPLATE HIGH VOLTAGE	1	NA		
26	090-353	* LABEL GROUND	1	NA		
27	090-467	*LABEL, POWER INPUT	1	NA		
28	090-301-1	* LABEL STD 1.0 X .50 IN	1	NA		
30	MS51957-17	SCR PAN HD 4-40 X 1/2 LG	11	NA		
31	MS15795-803	WASHER FLAT .125 ID .250 OD	16	NA		
32	MS35338-135	WASHER LOCK #4	22	NA		
33	MS51957-14	SCR PAN HD 4-40 X 5/16 LG	9	NA		
34	MS24693-C3	SCR FLAT HD 4-40 X 5/16 LG 100	6	NA		
35	MS35649-244	NUT HEX #4	3	NA		
36	MS51957-15	SCR PAN HD 4-40 X 3/8 LG	2	NA		
37	MS51859-2	WASHER FLAT #4 NYLON	2	NA		
38	MS51957-22	SCR PAN HD 4-40 X 11/4 LG	2	NA		
40	074-965	SPACER, ROUND, UNTHREADED .937 LG X .141 ID, .187 OD	2	NA	4729	S337-M07-F09-G
41	074-170-2	CABLE TIE	1	NA	6383	SST2S
49	193-8094	WIRING DIAGRAM, MODEL 8501	0	NA		
50	089-3557	ICD, HI POWER SWITCH, 8501	0	NA		
73	090-445	* LABEL, REFERENCE INSTRUCTION MANUAL	1	NA		
74	090-354	* LABEL WARNING, HIGH VOLTAGE	1	NA		

Refer to API/Weinschel Drawing 193-8091 for parts location.

Model 8501-2-F & R High Power Switch Unit Assembly Replaceable Parts List (P/N 193-8091-2):

Find No.	Part Number	Description	Quantity Used	Reference Designator	CAGE Code	Vendor Part Number
1	193-8090	ENCLOSURE, MODIFIED	1	NA		
2	193-8089	OVERLAY	1	NA		
3	193-8092	SUPPORT, SWITCH	1	NA		
4	193-8093	CHASSIS	1	NA		
5	193-8095-000	ASSY, PCB, DUAL HIGH-POWER SWITCH	1	A3		
6	193-9252	ASSY, CABLE, DC TO POWER SUPPLIES	1	W5		
7	193-8103	ASSY, CABLE, 15V PSU TO CONTROLLER/ HI PWR SWITCH	1	W4		
8	193-8070	ASSY, SWITCH	2	S1, S2		
9	193-8023-001	ASSY, PCB, CONTROLLER, W/IEEE CONN	1	A1		
10	193-9126-000	ASSY, PCB, ADDRESS SWITCH	1	A5		
11	193-9612	CLAMP, ADDRESS CABLE	1	NA		
12	193-8005-1	ASSY, CABLE RS232, CONT TO R/P	1	W3		
13	001-400-15	PSU SWITCHER, +15V DC, 3.3A	1	A2	60975	GLC50-15
14	001-400-28	PSU SWITCHER, +28 VDC, 1.8 AMP	1	A6	60975	GLC50-28
15	193-9159	ASSY, CABLE, GND	1	W1		
16	051-40	FUSE HOLDER, POWER INPUT, W/SWITCH	1	XF1	5245	PSOSXSS6B
17	193-9193	ASSY, CABLE, CONTROLLER TO FRONT PANEL DISPLAY	1	W6		
18	074-761-2	HOLE PLUG 5/8 HOLE, NYLON BLK	6	NA	83330	393
19	052-1-1/5	FUSE 1.5 AMP, 250V	1	F1	75915	312.01.5
20	062-184-5	CONN SCREW LOCK, FEMALE	2	NA	71468	D20418-2
21	068-39-2	CABLE ASSY, 16 COND RIBBON, 6 INCH LG	1	W2	D-KEY	A8PPG-1606M-ND
22	193-8075-1	ASSY, CABLE 28V DC POWER	1	W7		
23	068-21	CORD PWR 3-CONDUCTOR DTCH 7.5FT 10A-125V NEMA5-15P/IEC320-C13	1	NA	16428	17250
24	062-380-1	SCREW LOCK, HARDWARE KIT, METRIC, #6-32 UNC-2A EXT THDS	1	NA	779	554808-1
25	090-285	*NAMEPLATE HIGH VOLTAGE	1	NA		
26	090-353	* LABEL GROUND	1	NA		
27	090-467	*LABEL, POWER INPUT	1	NA		
28	090-301-1	* LABEL STD 1.0 X .50 IN	1	NA		
30	MS51957-17	SCR PAN HD 4-40 X 1/2 LG	11	NA		
31	MS15795-803	WASHER FLAT .125 ID .250 OD	16	NA		
32	MS35338-135	WASHER LOCK #4	24	NA		
33	MS51957-14	SCR PAN HD 4-40 X 5/16 LG	9	NA		
34	MS24693-C3	SCR FLAT HD 4-40 X 5/16 LG 100	6	NA		
35	MS35649-244	NUT HEX #4	3	NA		
36	MS51957-15	SCR PAN HD 4-40 X 3/8 LG	2	NA		
37	MS51859-2	WASHER FLAT #4 NYLON	2	NA		
38	MS51957-22	SCR PAN HD 4-40 X 11/4 LG	4	NA		
40	074-965	SPACER, ROUND, UNTHREADED .937 LG X .141 ID, .187 OD	4	NA	4729	S337-M07-F09-G
41	074-170-2	CABLE TIE	1	NA	6383	SST2S
49	193-8094	WIRING DIAGRAM, MODEL 8501	0	NA		
50	089-3557	ICD, HI POWER SWITCH, 8501	0	NA		
73	090-445	* LABEL, REFERENCE INSTRUCTION MANUAL	1	NA		
74	090-354	* LABEL WARNING, HIGH VOLTAGE	1	NA		

Refer to API/Weinschel Drawing 193-8091 for parts location.

9. ACCESSORIES:

Part Number	Description
193-8033-1	Rack Mounting Kit, Single 8501
193-8033-2	Rack Mounting Kit, Dual 8501

10. CONTACTING API/WEINSCHEL:

In the event of a malfunction, contact API/Weinschel Corporation. An apparent malfunction of an instrument or component may be diagnosed over the phone by first contacting the Customer Service Department at API/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 provides further information regarding preparation of a unit for reshipment. Contact Weinschel Corporation Customer Service Department as follows:

Via mail: API / 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.apitech.com

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

11. API / WEINSCHEL WARRANTY:

PRODUCTS - API/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. API/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 API/Weinschel Corporation by the original purchaser within ONE YEAR from the date of shipment.

The foregoing Warranty does not apply API/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- API/Weinschel Corporation software products are supplied without representation or Warranty of any kind. API/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 API/Weinschel Corporation prior to their return.

API/Weinschel Corporation's Quality System Certified to:

Certificate No. 94-289D

	REVISIONS		
REV.	DESCRIPTION	DATE	APPROVED
A	ERN 02-142		
B	ECN 02-294	GT	9-17-02

30 6 PLCS
32 6 PLCS
31 6 PLCS
5 A3

42 4 PLCS
32 4 PLCS
30 4 PLCS
3 ASSEMBLE ITEM 3 TO SWITCH BEFORE INSTALLING

NOTES:
1. POWER CORD, ITEM 23, SUPPLIED BUT NOT SHOWN.
2. AFTER ASSEMBLY, CONFIGURE AND TEST.
3. SEE CORRESPONDING PARTS LIST FOR QUANTITIES OF ITEMS 8, 18, 30, 32 AND 40.
4. MODEL NUMBERS ENDING IN -R ARE TO BE INSTALLED OUT THE REAR OF THE UNIT.

VIEW A

DETAIL B
ENLARGED

8501-2-R	193-8091-2
8501-2-F	193-8091-2
8501-1-R	193-8091-1
8501-1-F	193-8091-1
MODEL NO.	PARTS LIST

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
			PARTS LIST	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS DECIMALS ANGLES
± 1/64   XX ± .01   ± 1/2°
         .XXX ± .003

API/Weinschel Corporation

ASSY, HI POWER SWITCH UNIT, MODEL 8501

		8501-2-R		
		8501-2-F		
		8501-1-R		
		8501-1-F		
NEXT ASSY	USED ON			
APPLICATION		DO NOT SCALE DRAWING		

DRAWN G. THOMAS 9-5-02
CHECKED
ENGR KNILL 9-5-02
ISSUED

SIZE C   FSCM NO 93459   DWG. NO 193-8091 THRU -2   REV. B
SCALE 1/2   SHEET 1 OF 1

WIRING DIAGRAM
MODEL 8501

API/Weinschel Corporation

NOTES:
1 SWITCH S2 TO BE INSTALLED ON 2
CHANNEL UNIT ONLY.

DO NOT SCALE DRAWING

DRAWN HOPKINS 9/9/02
ENGR KNILL 9/02

SIZE D   FSCM NO 93459   DWG NO 193-8094   REV
SCALE NONE   SHEET 1 OF 1

193-8091-X   8501

REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
A	ERN 02-142		

88.1
(3.47)

19.0
(.75)
TYP
FRONT
OR REAR

304.8
(12.00)

212.6
(8.38)

POWER SWITCH

POWER INPUT
100-240 VAC
1.6 A 50/60 Hz

CONN, 9 PIN D,
MALE, RS232

ADDRESS SWITCH

CONN, 24 PIN PER
IEEE STD 488.1

CONNECTOR,
TYPE N FEMALE,
6 PLCS

8501-2-F SHOWN

SPECIFICATIONS

FREQUENCY RANGE: DC TO 3   3 TO 5   5 TO 11   11 TO 13 GHz
SWR (MAX): 1.25:1   1.45:1   1.70:1   1.70:1
INSERTION LOSS (dB MAX): 0.25   0.30   0.50   0.65
ISOLATION (dB MAX): 70   60   50   50
RF AVERAGE PWR HANDLING (CW): 100W TO 3 GHz
50W TO 13 GHz
HOT SWITCH CYCLING: 100K AT 150 WATTS CW @ 2 GHz
BUS: IEEE 488, PROTOCOLS PER IEEE 488.2
RS232

MODEL NO.	NUMBER OF SWITCHES	CONNECTOR LOCATION
8501-2-R	2	REAR
8501-2-F	2	FRONT
8501-1-R	1	REAR
8501-1-F	1	FRONT

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

INTERFACE CONTROL DRAWING

QTY REQD	FSCM NO.	PART OR IDENTIFYING NO.		NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION

PARTS LIST

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS   DECIMALS   ANGLES
± 1/64   .XX ± .01   ± 1/2°
     .XXX ± .003

CONTRACT NO.

MATERIAL

FINISH

API/Weinschel Corporation

ICD, SWITCH UNIT,
MODEL 8501

	APPROVALS	DATE
DRAWN	G. THOMAS	9-5-02
CHECKED		
ENGR	KNILL	9-5-02
ISSUED		

193-8090	8501
NEXT ASSY	USED ON

APPLICATION

DO NOT SCALE DRAWING

SIZE	FSCM NO.	DWG. NO.	REV.
C	93459	089-3557	A

SCALE 1/2   SHEET 1 OF 1

APPENDIX A
CARE AND HANDLING OF MICROWAVE COAXIAL CABLE ASSEMBLIES

A-1   CARE AND HANDLING OF ASSEMBLIES.

To ensure accurate measurements and optimal performance of Weinschel products, the microwave coaxial cable assemblies used in system and test setups must be properly used and maintained. Proper connections, routine inspection of all cables, and cleaning of the connectors are extremely important procedures which can prolong the longevity and accuracy of equipment.

A-2   CABLE INSPECTION.

Routinely check external cables for signs of cracked insulation, dents, twists, flattening, signs of jacket abrasion, or other signs of abuse. Wrinkles in the jacket indicate that the minimum bend radius has been exceeded. Most often, this occurs near the marker tubes and connectors.

Also inspect the connector interfaces for the following:

- Bent pins (male).
- Bent or missing tines (female).
- Worn or chipped plating.
- Damaged or displaced dielectric inserts.
- Thread damage.
- Folded or mushroomed outer interface rims.
- Mushroomed pin shoulders (male) or tine ends (female).
- Score lines on pins and outer interface rims visible to the unaided eye.
- Recessed or protruding pins.

It is advisable to clean the connectors prior to inspection to make subtle damage more apparent. If any of the above is noted, replace the assembly before its further use results in equipment damage. Also inspect the mating connectors for similar damage.

Inspect the connector interface for signs of debris. Debris may be in the form of:

- Plating chips or other metal particles.
- Dust or dirt.
- Oily films.
- Other miscellaneous foreign particles.

If signs of debris are present, clean the connector interface as directed in Paragraph A-6.

A-3   MAKING INITIAL CONNECTIONS.

Exercise caution when mating cables. Poor connections lead to poor system performance. They can also damage not only the cable assembly, but more significantly, front or rear panel connectors on the equipment itself which may be more difficult to repair.

A-3.1   ALIGNING CONNECTORS. Align the center lines of two connectors before actual mating. Male retaining nuts contain a small amount of necessary play which may make it possible to mate the threads without the pins being properly aligned. Pin misalignment can damage pins and dielectric inserts.

A-3.2   MATING CONNECTORS. Gently mate the connectors by hand, taking care not to force the coupling nut at the slightest resistance. It is often possible to feel whether or not the pins are mated. If the coupling nut is difficult to turn, either the pins are not mated, the coupling nut is cross-threaded, or one of the connectors has been damaged by excess torque.

Never hold a male connector coupling nut stationary while screwing a female connector into it. This rotation can erode the plating and damage both the outer interface rim as well as the pin. If the pins become locked, serious damage can result to both the equipment and the cable assembly.

A-4   ENSURING PROPER CONNECTOR TORQUE.

A-4.1   OVERTORQUING. Once connectors have been properly mated, apply only the proper amount of torque. Overtorquing damages both connectors involved. Also, a connector which has been damaged by overtorquing, in turn, damages every connector to which it is subsequently mated. It usually leads to poor system performance as well. Overtorque can cause:

- Bent pins.
- Recessed or protruding pins.
- Recessed or protruding dielectrics.
- Chipped plating.
- Damaged coupling threads.
- Coupling nut retaining ring damage.
- Mushroomed outer interface shells.
- Mushroomed pin shoulders.

A-4.2 HEX-NUT TYPES. To mate a connector of the hex-nut type, always use a torque wrench set to the correct torque value. Tighten the connector slowly until the wrench snaps. Tightening too quickly can cause the wrench to exceed its set limit. Do not snap the wrench more than once as this also causes overtorque.

A-4.3 KNURLED NUTS. Tighten connectors with knurled nuts by hand. If this does not provide sufficient tightness use a hex-nut connector and torque wrench instead. Never use pliers to tighten a connector. Table A-1 recommends torque specifications for the various types of connectors.

Table A-1. Recommended Torque Values

Connector	Recommended Torque
GPC-7 (7mm) w/hex nut	14 in/lbs ± 1 in/lbs
Type N w/hex nut	14 in/lbs ± 1 in/lbs
SMA, 2.92mm, 3.5mm 2.4mm, WPM, WPM-3 WPM-4	7.5 in/lbs ± 0.5 in/lbs
Type N & TNC (knurled)	Hand-tight
BNC (knurled)	Hand-tight

A-5 PROPER CABLE HANDLING.

Never exceed the minimum bend radius specified for a cable. Guard against tight bends at the end of connector strain relief tubing, or at the ends of marker tubing where they may be less noticeable. Although cable bend may seem slight, the actual radius of the bend at the point of angular departure may be far smaller than the acceptable radius.

Never pinch, crush or drop objects on cable assemblies. Also, do not drag a cable over sharp edges as this will pinch it and cause it to exceed the minimum bend radius.

Never use a cable assembly to pull a piece of equipment. Cables and connectors are not designed to support or move equipment.

A-5.1 SECURING CABLES. Use toothed, rubber-lined "P-clamps" to hold cables in place. If it is necessary to use tie-wraps, use the widest possible wrap and the lowest setting on the gun to ensure the minimum pressure on the cable.

A-5.2 STORING CABLES. When storing cables, minimize cable "set" by coiling them in large diameters (1 or 2 feet). Unroll the cable properly when it is ready to be used; do not pull the loops out hastily. Similarly, re-roll them when storing them away again.

A-6 CLEANING CONNECTOR INTERFACES.

Use the following guidelines in cleaning connector interfaces:

a. Do not use chlorinated solvents including common tap water. These solvents are extremely penetrating and sometimes ruin otherwise good devices and assemblies.

b. Moisten a cotton swab with isopropyl alcohol. Roll the swab on a paper towel to remove excess.

c. Use the moistened cotton swab to wipe away debris. Do not try to dissolve the debris by overwetting the swab.

d. Repeat the cleaning process using additional swabs as necessary. If metallic particles are embedded in the dielectric, use an eyeglass and a sharp pick in an attempt to dislodge them. Swab again.

e. When satisfied that the interfaces are clean, blow them dry with dry compressed air, or preferably dry nitrogen (pressurized spray cans work well). Do not use breath.

f. Clean the mating connectors. These may be the source of the debris.