

Keysight 11713B/C Attenuator/Switch Driver

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Certification

Keysight Technologies certifies that this product met its published specifications at the time of shipment from the factory. Keysight Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of the other International Standards Organization members.

Safety Considerations

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

BEFORE APPLYING POWER

- Verify that the correct fuse is installed.
 - Ensure the mains supply voltage fluctuation do not exceed $\pm 10\%$ of the nominal supply voltage.
-

WARNING

GROUND THE INSTRUMENT

This product is a Safety Class I instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the AC power supply mains through a three-conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury. If the instrument is to be energized via an external autotransformer for voltage reduction, be certain that the autotransformer common terminal is connected to the neutral (earthed pole) of the AC power lines (supply mains).

WARNING

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE OR WET ENVIRONMENTS

Do not operate the device around flammable gases or fumes, vapor, or wet environments.

WARNING

DO NOT OPERATE DAMAGED OR DEFECTIVE INSTRUMENTS

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

WARNING

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Keysight Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

WARNING

USE THE POWER CORD PROVIDED

Use the device with the power cord provided with the shipment.

WARNING**USE THE DEVICE AS SPECIFIED**

If the device is used in a manner not specified by manufacturer, the device protection may be impaired.

WARNING

Keysight 11713B/C attenuator/switch drivers are designed for indoor use and in an area with low condensation.

CAUTION**CLEAN WITH SLIGHTLY DAMPENED CLOTH**





Clean the outside of the instrument with a soft, lint-free, slightly dampened cloth. Do not use detergent, volatile liquids, or chemical solvents.

CAUTION






The instrument is designed for use in Overvoltage Category II and Pollution Degree 2.

Safety Symbols

The following symbols on the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.		This symbol indicates that the instrument requires alternating current (ac) input.
	This symbol indicates the protective earth (ground) terminal.		This symbol indicates the Fuse.

Regulatory Markings

	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.		The CSA mark is a registered trademark of the Canadian Standards Association.
ISM 1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).	ICES/NMB-001	ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.		This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.
 KCC-REM-ATI-WN11713B	<p>This symbol is a South Korean Class A EMC Declaration.</p> <p>This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.</p> <p>이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.</p>		

South Korean Class A EMC Declaration

Information to the user:

This instrument has been conformity assessed for use in business environments. In a residential environment, this equipment may cause radio interference.

This EMC statement applies to the equipment only for use in business environment.

사용자 안내문

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

사용자 안내문은 "업무용 방송통신기자재"에만 적용한다.

Safety and EMC Requirements

This instrument is designed to comply with the following safety and EMC (Electromagnetic Compatibility) requirements:

- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU

Waste Electrical and Electronic Equipment (WEEE) Directive

This instrument complies with the WEEE Directive marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit

<http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/11713
(product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
(worldwide contact information for repair and service)

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1 Introduction

Key Features of Keysight 11713B/C Attenuator/Switch Drivers	16
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This chapter provides an overview of the Keysight 11713B/C attenuator/switch drivers which includes the instruments' functions and capabilities, compatibility with Keysight switching components, and physical appearances.

Key Features of Keysight 11713B/C Attenuator/Switch Drivers

The 11713B attenuator/switch driver is a GPIB compatible instrument that concurrently drives up to two four-section programmable step attenuators and two microwave coaxial switches, or up to 10 SPDT switches. The 11713B is fully backward compatible with 11713A in terms of functionality and fit. Connectivity using USB and LAN are optional.

The 11713C attenuator/switch driver is a GPIB/USB/LAN compatible instrument that concurrently drives up to four four-section programmable step attenuators and four microwave coaxial switches, or up to 20 SPDT switches. The 11713C comes with tri-voltage selection of +5 V, +15 V and +24 V and also permits user-defined voltage supply capability.

NOTE

The 11713B/C attenuator/switch drivers output continuous current and do not support pulse drive. Please ensure your switching devices can withstand continuous current or have a built-in current interrupt feature.

Table 1-1 Key features of 11713B/11713C

Key features	11713B	11713C
Manually-controlled using front panel push buttons	Yes	Yes
Automatically-control through:		
– GPIB	Yes	Yes
– USB	Optional	Yes
– LAN	Optional	Yes
Integrated LCD display	Yes	Yes
Self-contained power supply with current limiting	Yes	Yes
Common terminal supplies of:		
– +5 Vdc	No	Yes
– +15 Vdc	No	Yes
– +24 Vdc	Yes	Yes
– User-defined ^[a]	No	Yes
TTL control ^[b]	No	Yes

[a] For 11713C, maximum user-defined voltage supply is 30 Vdc.

[b] This TTL specification is 2.4 V at 1 mA.

Compatible Keysight Attenuators and Switches

The 11713B/C attenuator/switch drivers are designed to drive the following Keysight attenuators and switches. If you are using attenuators and switches made by another supplier, check the switching characteristics against those specified in [Chapter 3, "Specifications"](#). Refer to *Keysight 11713B/C Configuration Guide*, literature number 5989-7277EN, for the most updated list.

Table 1-2 Compatible Keysight switches

Keysight model number	Description ^[a]
8761A/B, 8765A/B/C/D/F (33314A/B/D), N1810UL	SPDT, unterminated
8762A/B/C/F (33311A/B/C), N1810TL	SPDT, terminated
8763A/B/C (33312A/B/C), N1811TL	Bypass, 4-port, terminated
8764A/B/C (33313A/B/C), N1812UL	Bypass, 5-port, unterminated
8766K (33366K)	SP3T, unterminated
8767K (33367K), 8767M, L7204A/B/C	SP4T, unterminated
87104A/B/C/D/E, 87204A/B/C/D/E, L7104A/B/C	SP4T, terminated
8768K (33368K), 8768M	SP5T, unterminated
8769K (33369K), 8769M, L7206A/B/C	SP6T, unterminated
87106A/B/C/D/E, 87206A/B/C/D/E, L7106A/B/C	SP6T, terminated
87222C/D/E, L7222C	DPDT (transfer), unterminated
87406B	Matrix, 4-port, terminated
87606B	Matrix, 6-port, terminated
U9397A/C	SPDT, terminated, solid state

[a] * Electromechanical switches unless specified

Table 1-3 Compatible Keysight attenuators

Keysight model number	Description
8494G/H (33320G/H), 84904K/L/M (33324K/L)	11 dB, 1 dB steps
8495G/H/K (33321 G/H/K), 84907K/L (33327K/L)	70 dB, 10 dB steps
8496G/H (33322G/H)	110 dB, 10 dB steps
8497K (33323K), 84906K/L (33326K/L)	90 dB, 10 dB steps
84905M	60 dB, 10 dB steps
84908M	65 dB, 5 dB steps

Connecting Accessories

Various types of connecting accessories are available to drive Keysight attenuators and switches using the 11713B/C attenuator/switch drivers. [Table 1-4](#) lists available accessories.

Table 1-4 Connecting accessories for Keysight 11713B/11713C

Connecting accessories	Description
11716A	Interconnect kit (Type-N connectors) ^[a]
11716C	Interconnect kit (SMA connectors) ^[a]
11713B-001 11713C-001	11764-60004, Viking connector to 10-pin DIP connector, 60 inches long
11713B-101 11713C-101	8120-2703, Viking connector to Viking connector, 60 inches long
11713B-201 11713C-201	5061-0969, Viking connector to 12-pin conductor cable, bare wire (for five switches), 60 inches long
11713B-301 11713C-301	11761-60001, Viking connector to (4) ribbon cables, connect up to four switches, 60 inches long
11713B-401 11713C-401	11713-60042, dual Viking connector to 16-pin DIP connector, 60 inches long
11713B-501 11713C-501	11713-60043, Viking connector to (4) 9-pin Dsub connectors, connect up to four switches, 60 inches long
11713B-601 11713C-601	11713-60044, Viking connector to 16-pin DIP connector, 60 inches long
11713B-701 11713C-701	5064-7848, Viking connector to 14-pin DIP connector, 60 inches long
11713B-801 11713C-801	11713-60047, Viking connector to (4) 10-pin DIP connectors, connect up to 4 switches, 50 inches long
11713B-908 11713C-908	5063-9240, rack mount kit for one instrument
11713B-909 11713C-909	5061-9694 & 5063-9212, rack mount kit for two instruments

[a] Order this kit to connect two programmable step attenuators in series

Refer to *Keysight 11713A/B/C Attenuator/Switch Driver Configuration Guide*, literature number 5989-3703EN, for configuration details.

11713B Front and Rear Panels at a Glance

This section briefly describes the function of the front panel keys of 11713B.

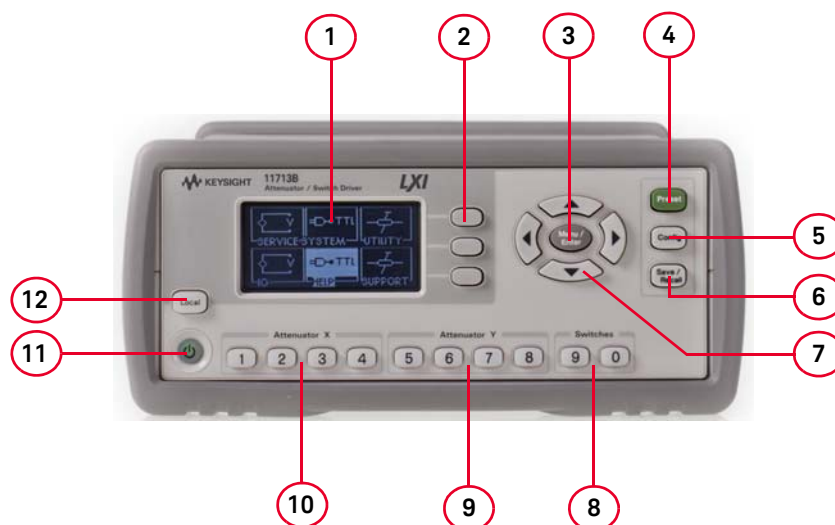


Figure 1-1 11713B front panel features

- 1 LCD screen.**
- 2 Softkeys.** These unmarked keys are referred to by the text on display next to them.
- 3 Menu/Enter.** Press this key to select the highlighted parameter On/Off or select the highlighted field or go back to the main menu.
- 4 Preset.** Press this key to preset the driver.
- 5 Config.** Press this key to access the configuration menu. You can set the attenuator type, supply voltage, and TTL condition through this menu.
- 6 Save/Recall.** Press this key to save current settings or recall saved settings.
- 7 Navigation buttons.** The arrow keys are used to navigate parameters displayed on the LCD screen or change parameters such as GPIB address.
- 8 Switches.** In the local mode, pushbutton switches 9 and 0 change the position of a coaxial switch connected to rear panel banana jacks S9 A/B and S0 A/B respectively.
- 9 Attenuator Y.** In the local mode, pushbuttons 5, 6, 7, and 8 change the attenuation setting of an attenuator or change the position of coaxial switch(es) connected to the ATTEN Y connector on the rear panel.
- 10 Attenuator X.** In the local mode, pushbuttons 1, 2, 3, and 4 change the attenuation setting of an attenuator or change the position of coaxial switch(es) connected to the ATTEN X connector on the rear panel.
- 11 On/Standby.** Press this key to switch between on and standby. When power is supplied, the background LED is red. Pressing the key once switches the driver on and the background LED turns to green.
- 12 Local.** Press this key to control the driver from the front panel when it is operating via the remote interfaces.

This section briefly describes the function of the rear panel connectors of 11713B.

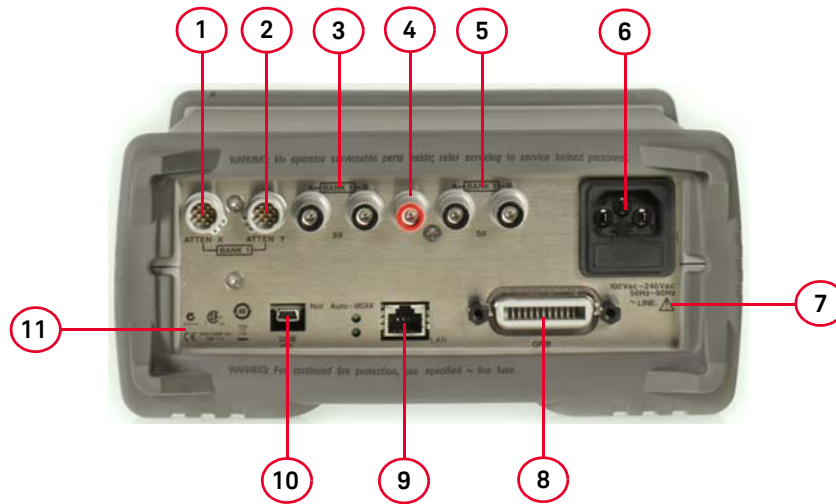


Figure 1-2 11713B rear panel features

- 1 **ATTEN X.** Viking connector for connection to attenuator or switch(es).
- 2 **ATTEN Y.** Viking connector for connection to attenuator or switch(es).
- 3 **S9 A/B.** Banana jack connectors for connection to coaxial switch.
- 4 **24 VDC COM.** Banana jack connector to provide common +24 Vdc in driving the coaxial switches connected to S9 and/or S0.
- 5 **S0 A/B.** Banana jack connectors for connection to coaxial switch.
- 6 **Receptacle.** Matches transformer primary to line voltage via power cable.
- 7 **Alert symbol.** This symbol is used to point out a necessary reference for the user.
- 8 **GPIB connector.** The interface connector from a source device to a listening device for the remote mode of operation.
- 9 **LAN connector.** The interface connector for LAN cable (option LXI only).
- 10 **USB connector.** The interface connector for Type mini B 5-pin USB cable (option LXI only).
- 11 **Instrument markings.**

11713C Front and Rear Panels at a Glance

This section briefly describes the function of the front panel keys of 11713C.

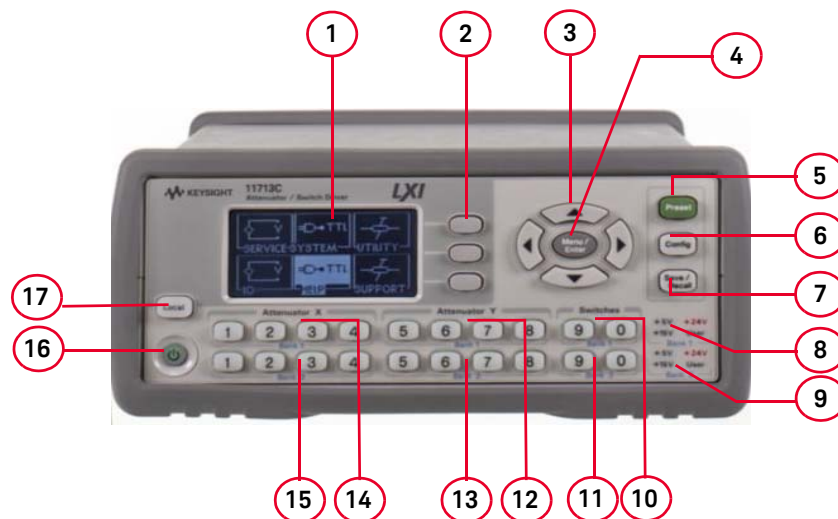


Figure 1-3 11713C front panel features

- 1 LCD screen.**
- 2 Softkeys.** These unmarked keys are referred to by the text on display next to them.
- 3 Navigation buttons.** The arrow keys are used to navigate parameters displayed on the LCD screen or change parameters such as GPIB address.
- 4 Menu/Enter.** Press this key to select the highlighted parameter On/Off or select the highlighted field or go back to the main menu.
- 5 Preset.** Press this key to preset the driver.
- 6 Config.** Press this key to access the configuration menu. You can set the attenuator type, supply voltage, and TTL condition through this menu.
- 7 Save/Recall.** Press this key to save current settings or recall saved settings.
- 8 Supply Voltage for Bank 1.** Indicates supply voltage setting (background LED in red) for bank 1.
- 9 Supply Voltage for Bank 2.** Indicates supply voltage setting (background LED in red) for bank 2.
- 10 Switches for Bank 1.** In the local mode, pushbutton switches 9 and 0 change the position of a coaxial switch connected to rear panel banana jacks S9 A/B and S0 A/B respectively, for bank 1.
- 11 Switches for Bank 2.** In the local mode, pushbutton switches 9 and 0 change the position of a coaxial switch connected to rear panel banana jacks S9 A/B and S0 A/B respectively for, bank 2.
- 12 Attenuator Y for Bank 1.** In the local mode, pushbuttons 5, 6, 7, and 8 change the attenuation setting of an attenuator or change the position of coaxial switch(es) connected to the ATTEN Y connector on the rear panel, for bank 1.

- 13 Attenuator Y for Bank 2.** In the local mode, pushbuttons 5, 6, 7, and 8 change the attenuation setting of an attenuator or change the position of coaxial switch(es) connected to the ATTEN Y connector on the rear panel, for bank 2.
- 14 Attenuator X for Bank 1.** In the local mode, pushbuttons 1, 2, 3, and 4 change the attenuation setting of an attenuator or change the position of coaxial switch(es) connected to the ATTEN X connector on the rear panel, for bank 1.
- 15 Attenuator X for Bank 2.** In the local mode, pushbuttons 1, 2, 3, and 4 change the attenuation setting of an attenuator or change the position of coaxial switch(es) connected to the ATTEN X connector on the rear panel, for bank 2.
- 16 On/Standby.** Press this key to switch between on and standby. When power is supplied, the background LED is red. Pressing the key once switches the driver on and the background LED turns to green.
- 17 Local.** Press this key to control the driver from the front panel when it is operating via the remote interfaces.

This section briefly describes the function of the rear panel connectors of 11713C.

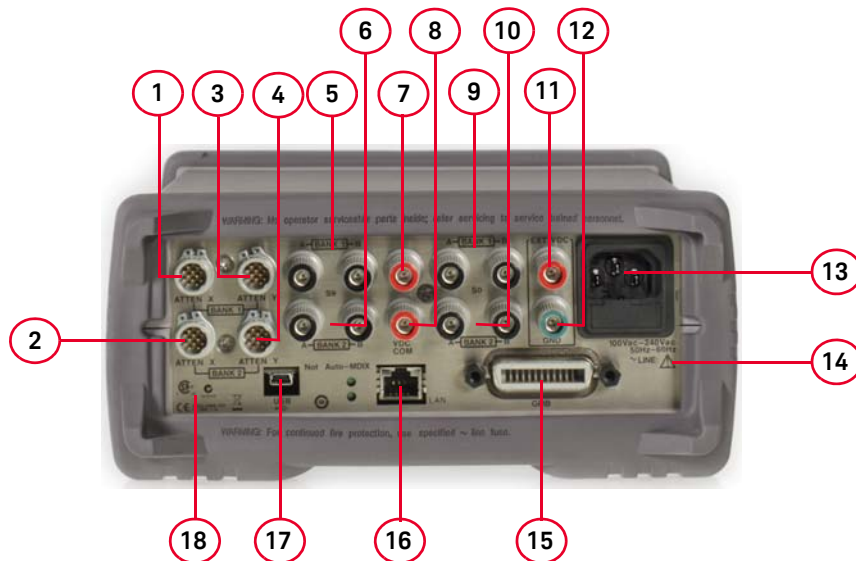


Figure 1-4 11713C rear panel features

- 1 ATTEN X Bank 1.** Viking connector for connection to attenuator or switch(es), for bank 1.
- 2 ATTEN X Bank 2.** Viking connector for connection to attenuator or switch(es), for bank 2.
- 3 ATTEN Y Bank 1.** Viking connector for connection to attenuator or switch(es), for bank 1.
- 4 ATTEN Y Bank 2.** Viking connector for connection to attenuator or switch(es), for bank 2.
- 5 S9 A/B Bank 1.** Banana jack connectors for connection to coaxial switch, for bank 1.
- 6 S9 A/B Bank 2.** Banana jack connectors for connection to coaxial switch, for bank 2.
- 7 VDC COM Bank 1.** Banana jack connector to provide common Vdc in driving the coaxial switches connected to S9 and/or S0, for bank 1.
- 8 VDC COM Bank 2.** Banana jack connector to provide common Vdc in driving the coaxial switches connected to S9 and/or S0, for bank 2.
- 9 S0 A/B Bank 1.** Banana jack connectors for connection to coaxial switch, for bank 1.
- 10 S0 A/B Bank 2.** Banana jack connectors for connection to coaxial switch, for bank 2.
- 11 External VDC.** Banana jack connector to provide user-defined Vdc, for both banks.
- 12 Ground.** Banana jack connector to provide grounding, for both banks.
- 13 Receptacle.** Matches transformer primary to line voltage via power cable.
- 14 Alert symbol.** This symbol is used to point out a necessary reference for the user.
- 15 GPIB connector.** The interface connector from a source device to a listening device for the remote mode of operation.
- 16 LAN connector.** The interface connector for LAN cable.
- 17 USB connector.** The interface connector for Type mini B 5-pin USB cable.
- 18 Instrument markings.**

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This chapter provides you important information on how to unpack and check your instrument, how to prepare your instrument for bench operation, and tips on configuring the 11713B/C with Keysight attenuators and switches.

Initial Inspection

- 1** Unpack and inspect the shipping container and its contents thoroughly to ensure that nothing was damaged during shipment. If the shipping container or cushioning material is damaged, the contents should be checked both mechanically and electrically.
- 2** If the contents are damaged or defective, contact your nearest Keysight Technologies Service and Support Office. Refer to **“Sales and Technical Support”** on page 7. Keysight Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier's inspection.
- 3** If you are returning your instrument for service, repackaging the attenuator/switch driver requires original shipping containers and materials or their equivalents. Keysight Technologies can provide packaging materials identical to the original materials. Refer to **Sales and Technical Support** for the Keysight Technologies nearest to you.

Preparing for Use

Bench operation

Pull the handle outwards, and adjust it into one of the two positions illustrated in **Figure 2-1**.

- (Top) Handle placed underneath the instrument to assure self- alignment of the instruments when stacked.
- (Bottom) Handle tilted to raise the front of the instrument for easier viewing of the front panel.



Figure 2-1 Handle positioning for bench operation

Rack mounting one instrument (Option 908)

- 1 Remove the handle and front/rear bumpers.
- 2 Fit the rack mount flanges (part number 5063-9240).
- 3 Ready for installation.



Figure 2-2 Illustrations of steps 2 and 3

CAUTION

When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Rack mounting two instruments (Option 909)

- 1 Remove the handle and front/rear bumpers.
- 2 Fit one small mounting flange to opposite sides of each instrument (part numbers 5061-9694 and 5063-9212).
- 3 Fit two front linking plates to each instrument.
- 4 Engage the linking plates at the front of the instruments.
- 5 Attach the rear linking brackets.
- 6 Ready for installation.



Figure 2-3 Illustration of completed setup

CAUTION

When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Connecting to Keysight Attenuators and Switches

The 11713B/C attenuator/switch drivers can be used to drive various switches and attenuators. [Table 2-1](#) shows the summary of switches and attenuators connections to the 11713B/C, with various interface cables for point-to-point connection. [Table 2-2](#) shows the properties of 11713B/C's front panel and rear panel.

For configuration details, please refer to *Keysight 11713B/C Configuration Guide*, literature number 5989-7277EN.

Table 2-1 Summary of switches and attenuators connections to 11713B/C

Switches/attenuators	11713B/C cable option ^[a]	# of channels required ^[b]	Controlled by ATTEN X (1-4) ATTEN Y (5-8)	Controlled by SWITCHES (9/0)
Switches – 8761A/B	201	1	No	Yes
Switches – 8762A/B/C/F – 8763A/B/C – 8764A/B/C	201	2	Yes	Yes
Switches – 8765A/B/C/D/F	201, 301	2	Yes	Yes
Switches – 8766K	001, 101	2	Yes	Yes
Switches – N1810UL/TL ^[c] – N1811TL ^[c] – N1812UL ^[c]	201, 501	2	Yes	Yes
Switches – 87222C/D/E – L7222C	201, 801	2	Yes	No
Switches – 8767K Attenuators – 8495G/H	001, 101	3	Yes	Yes
Switches – 8767M Attenuators – 84905M – 84907K/L	001	3	Yes	Yes

Table 2-1 Summary of switches and attenuators connections to 11713B/C (continued)

Switches/attenuators	11713B/C cable option ^[a]	# of channels required ^[b]	Controlled by ATTEN X (1-4) ATTEN Y (5-8)	Controlled by SWITCHES (9/0)
Switches – 8768K				
Attenuators – 8494G/H – 8496G/H – 8495K, 8497K	001, 101	4	Yes	Yes
Switches – 8768M				
Attenuators – 84904K/L/M – 84906K/L – 84908M	001	4	Yes	Yes
Switches ^[d] – 87104A/B/C/D – 87204A/B/C – L7104A/B/C – L7204A/B/C	201, 601	4 ^[e]	Yes	Yes
Switches – 8769K	101	5	Yes	Yes
Switches – 8769M	701	5	Yes	Yes
Switches – 87106A/B/C/D – 87206A/B/C – L7106A/B/C – L7206A/B/C – 87406B, 87606B	201, 401	6 ^[f]	Yes	Yes

[a] Type of interface cable required depends on the DC connector on the switching device

[b] One channel represent control with one pushbutton

[c] Ensure switch is equipped with current interrupt (option 403) to protect switch from overheating and destruction as this switch cannot withstand continuous current

[d] For switches with option 161, ground pin 16 opens all path. Use S9 for Attenuator X or S0 for Attenuator Y. Do not close any path and ground pin 16 simultaneously as this makes the switch buzz.

[e] If option 601 is used, number of channels required is 5, to cater for open all path function controlled via S9/S0

[f] If option 401 is used, number of channels required is 7, to cater for open all path function controlled via S9/S0

Table 2-2 11713B/C front panel and back panel properties

Front panel pushbuttons ^[a]			Rear panel connectors	
Pushbutton number		Pushbutton LEDs	Pin numbers	Wire color code ^[b]
			1	Red (Vcc)
			2	White/Brown (Gnd)
SWITCHES				
9		ON	ATTEN X-3 (S9-A)	Gray
		OFF	ATTEN X-4 (S9-B)	White/Red
0		ON	ATTEN Y-3 (S0-A)	Gray
		OFF	ATTEN Y-4 (S0-B)	White/Red
ATTENUATORS				
X	Y			
1	5	OFF	5	Violet
		ON	6	Yellow
2	6	OFF	7	Black
		ON	8	Green
3	7	OFF	9	Orange
		ON	10	Blue
4	8	OFF	11	Brown
		ON	12	White

[a] The ON/OFF status of the pushbutton LEDs indicates which cable wire or pin on the rear panel connector is grounded. As an example, if ATTENUATOR X pushbutton 3 is illuminated, pin 10 of the ATTEN X connector (blue wire from cable) is grounded and pin 9 floats at a high impedance. For SWITCHES, if pin 3 is grounded (LED on), pin 4 is connected to +Vcc.

[b] With reference to interface cable option 201 (Viking connector to 12-pin bare), consists of 12 color-coded wires

Driving four-section attenuators and switches

- To use one four-section attenuator assembly, connect an attenuator interface cable either to the ATTN X output (A6J1) or ATTN Y output (A6J2). Connect all outputs (two for 11713B and four for 11713C) to have more than four attenuator segments.
- A typical connection for a programmable four-section attenuator to 11713B is illustrated in [Figure 2-4](#), together with pin number for each connector.
- Using these same connections to Keysight 8762 or 8765 series coaxial switches, control can be extended to number of switches in multiple of four. If S9 and S0 outputs are utilized, 11713B and 11713C can drive up to 10 switches and 20 switches respectively.

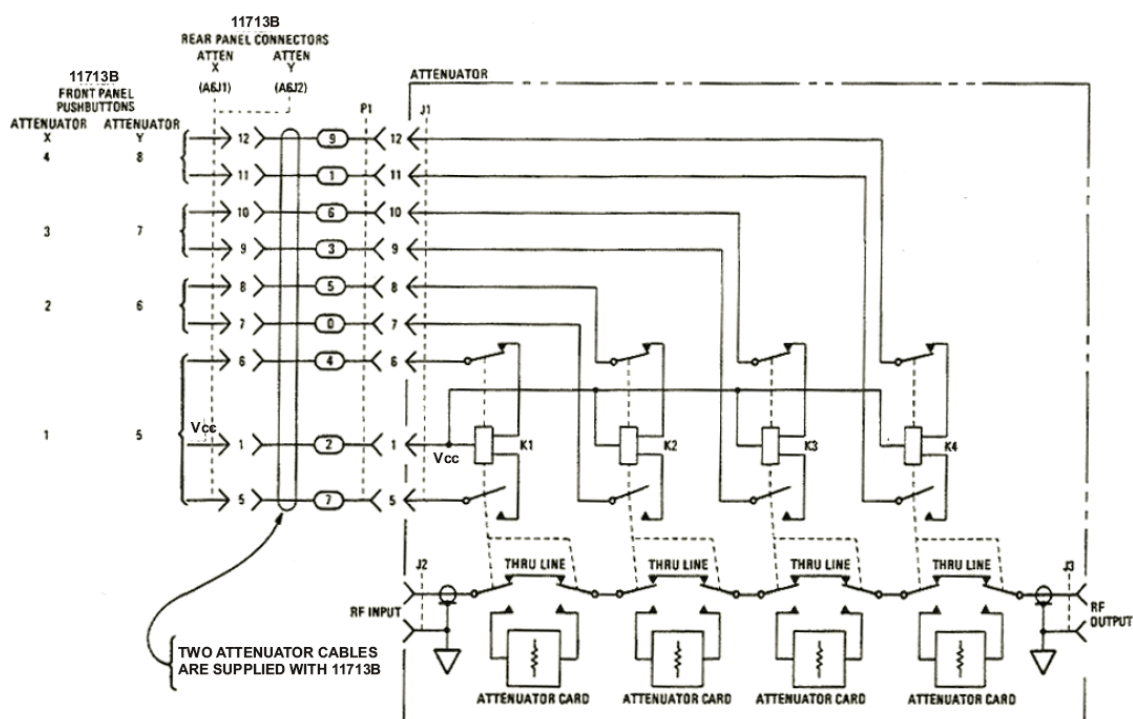


Figure 2-4 Typical connection for a programmable four-section attenuator

Driving additional coaxial switches

- Make switch connections to S0 outputs, S9 outputs, or to rear panel ATTN X output or ATTN Y output.
- [Figure 2-5](#) below shows the rear panel connections to S0 outputs and the corresponding switch positions reflected by pushbutton indicators.
- Connections to Keysight 8762 or 8765 series coaxial switches can also be made to the ATTN X output or ATTN Y output as illustrated in [Figure 2-4](#).

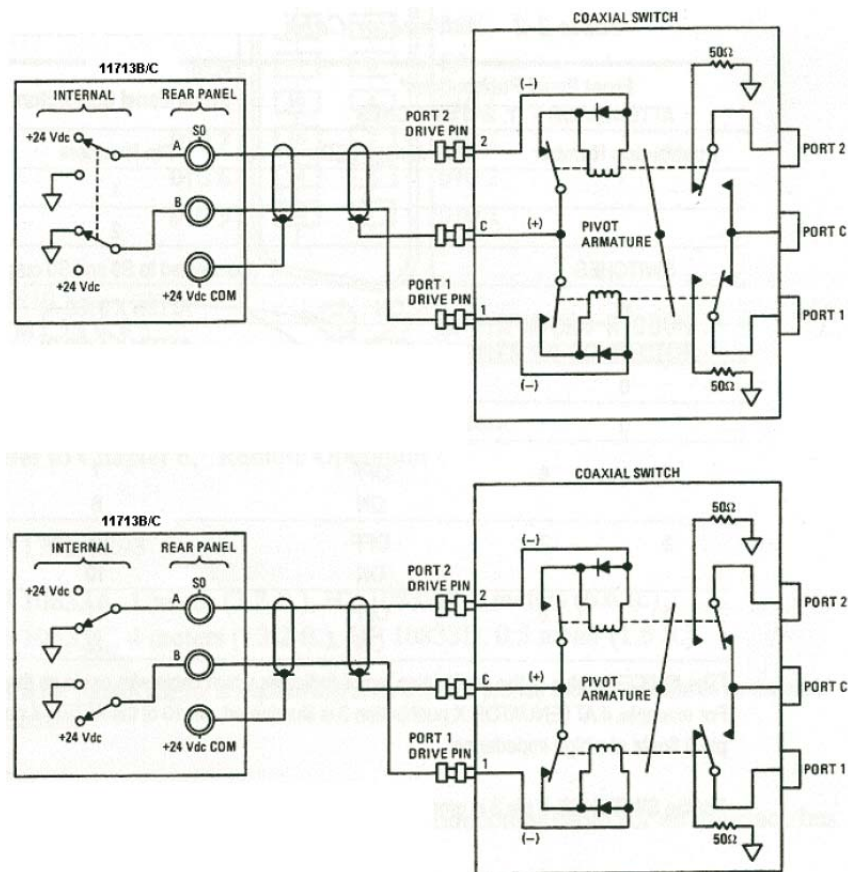


Figure 2-5 Typical connection for 8762 and 8765 series coaxial switches

- Connections to Keysight 8761 series coaxial switches can only be made to S0 outputs and S9 outputs.
- [Figure 2-6](#) illustrates the rear panel connections to S9 outputs and the corresponding switch positions reflected by pushbutton indicators.

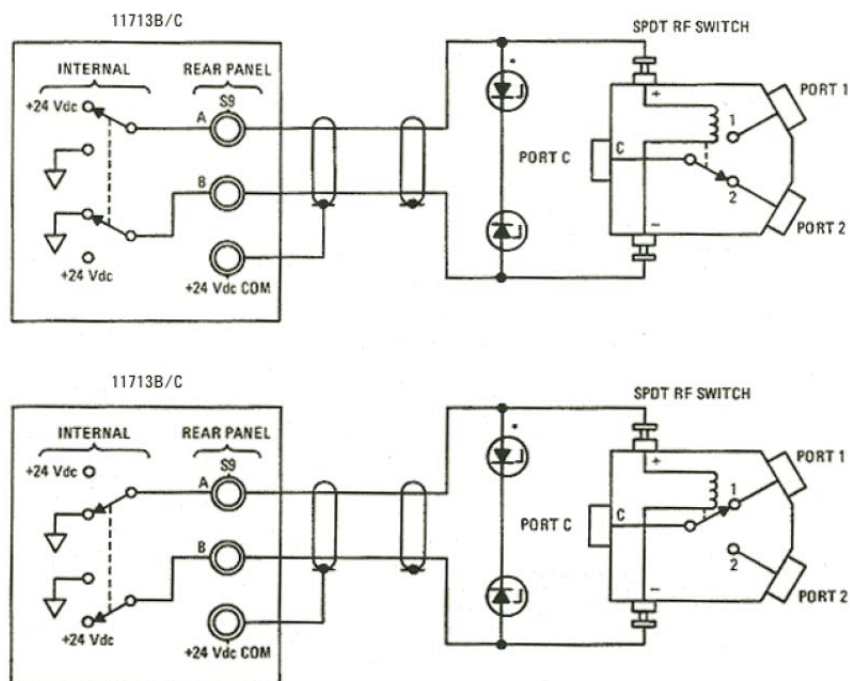


Figure 2-6 Typical connection for 8761 series coaxial switches

Driving relays

- To drive ten devices for 11713B, connect attenuator cables at ATTEN X and Y and switch cables to S9 and S0.
- A total of 10 relays may be on at one time if the total current is less than 1.7 A. However, since there are dual transistor and relay drivers, where one driver is on while the other is off, a total of 20 relays may be controlled.

NOTE

11713C is capable of driving double the amount of devices that 11713B can. However, the total load current that can be consumed is still 1.7 A.

CAUTION

If the total load current of 1.7 A is exceeded, damage may result.

- Figure 2-7 below shows the connections for a simplified relay driving circuit. The circuit is adaptable for simple non-latching relays.

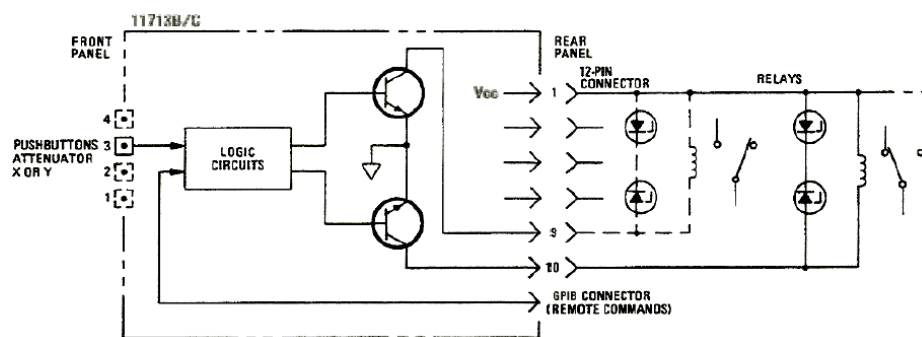


Figure 2-7 Typical connection for relay driving circuit

NOTE

It is also recommended that two 28.7 V zener diodes be connected back-to-back across the relay coils to reduce voltage transients.

3 Specifications

General Specifications	38
Environmental Specifications	39

This chapter provides you the specifications of Keysight 11713B/C attenuator/switch drivers.

General Specifications

Supplemental characteristics

Supplemental characteristics are intended to provide useful information and are typical but non-warranted performance parameters.

Table 3-1 11713B/C supplemental characteristics

Line power	100 to 240 Vac, automatic selection, 50/60 Hz 100 VA maximum
Current	1.7 A maximum continuous current Contact pairs 1 through 8, 9, and 0, maximum current of 1.7 A continuous through all contacts (< 0.7 A per contact)
Response time	100 μ s maximum for contact pairs 1 through 8 20 ms maximum for contact pairs 9 and 0
Driver life	>2,000,000 switchings at 0.7 A for contact pairs 9 and 0
Maximum load inductance	500 mH
Maximum load capacitance	< 0.01 μ F for contact pairs 9 and 0

Physical specifications

Net weight	3.2 kg (7.1 lbs)
Dimensions (H x W x D) with handle and rubber bumper	103.8 mm x 261.3 mm x 378.7 mm (4.1 inches x 10.2 inches x 14.9 inches)
Dimensions (H x W x D) without handle and rubber bumper	88.3 mm x 212.7 mm x 364.0 mm (3.5 inches x 8.4 inches x 14.3 inches)

Remote programming characteristics

Interface	GPIB interface operates to IEEE 488.2 and IEC 65 10/100 BaseT LAN interface USB 2.0 interface
Command language	SCPI standard interface commands (Keysight 11713A backward compatible)
GPIB compatibility	SH0, AH1, T0, TE0, L2, LE0, SR0, RL1, PP0, DC0, DT0, C0

Environmental Specifications

Keysight 11713B/C attenuator/switch drivers are designed to fully comply with Keysight Technologies' product operating environmental specifications as shown in the table below.

Table 3-2 11713B/C environmental specifications

Temperature	
– Operating	0 °C to +50 °C
– Storage	–40 °C to +70 °C
Humidity	
– Operating	95% RH up to 40 °C, decreases linearly to 45% RH at 50 °C, non-condensing, 95% RH at 40 °C, 5 days cyclic
– Storage	90% RH at 65 °C, 24 hours
– Condensing	95% RH at 40 °C, 5 hours (condensation 15 minutes)
Shock	
– End-user handling	Half-sine: 2 to 3 ms duration, 60 in/s (1.6 ms) delta-V
– Bench handling	Half-sine: 11 ms duration, 30 grms
– Functional	Trapezoidal: 18-22 ms duration, 337 in/s (8.56 ms) delta-V
– Transportation	Per MIL-PRF-28800F
Vibration	
– Operating (Random)	0.21 Grms, 5 to 500 Hz, 10 min/axis
– Survival (Random)	2.09 Grms, 5 to 500 Hz, 10 min/axis
– Swept-sine	0.5 Grms, 5 to 500 Hz, 10 min/axis
Altitude	
– Operating	< 4,000 meters (13,080 feet)
– Non-operating	< 15,300 meters (50,000 feet)

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4 Verification

Operator's Check for Local Operation	42
Operator's Check for Remote Operation	43

This chapter provides you simple instructions to verify Keysight 11713B/C attenuator/switch drivers' functionality in both local operation and remote (GPIB/USB/LAN) operation.

Operator's Check for Local Operation

Recommended test equipment

Table 4-1 lists the test equipment required for performance test verification and equipment troubleshooting. Equipment other than the recommended models can be used, provided minimum specifications are satisfied.

Table 4-1 Recommended test equipment

Instrument type	Critical specifications	Use ^[a]
Digital voltmeter	0 to +30 Vdc	T
Attenuators (2 required)	Programmable, 4 sections	P, T
Switches (2 required)	+5 Vdc, +15 Vdc, or +24 Vdc drive source	P, T

[a] P = Performance, T = Troubleshooting

Procedure

- 1 Configure the switching system as illustrated in Figure 4-1 by following all steps described in Chapter 5, "Local Operations".

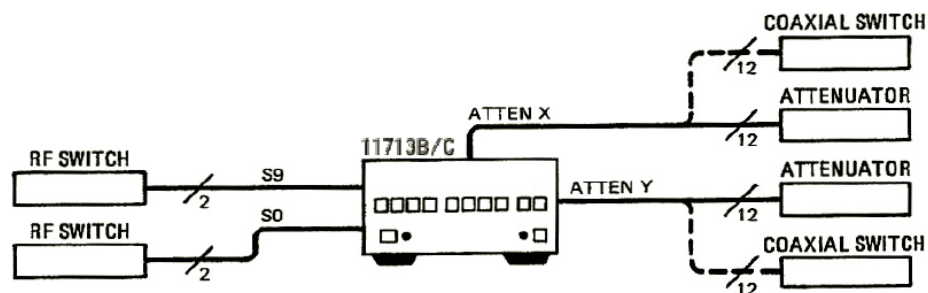


Figure 4-1 Switching system for verification

- 2 Once configuration is completed, press and depress the 10 numbered pushbuttons on the driver front panel. Each LED should alternate between off and on as each key is pressed.
- 3 In addition, if any switching devices is connected (attenuators, relays, or switches), an audible click should be heard from the unit actuated. Pressing any numbered pushbutton should not cause any other pushbutton to change state.

Operator's Check for Remote Operation

These procedure verify that the driver can be controlled remotely using GPIB, USB, and/or LAN.

- 1 Refer to [Chapter 7, "Remote Interface Configurations"](#), to connect the 11713B/C to your computer through GPIB, USB, and/or LAN.
- 2 Once remote connection is available, send the following SCPI commands to the driver and note the changes on front panel LEDs.

Description	Command	Observation
Close switching paths from channel 1 to channel 4 (bank1)	ROUTe:CLOSe (@101:104)	LEDs for pushbuttons 1 to 4 light ON
Open switching paths from channel 5 to channel 8 (bank 1)	ROUTe:OPEn (@105:108)	LEDs for pushbuttons 5 to 8 light OFF
Query status on channel 2 (bank 1)	ROUTe:CLOSe? (@102)	Return value "1" (LED for pushbutton 2 light ON)
Query status on channel 7 (bank 1)	ROUTe:CLOSe? (@107)	Return value "0" (LED for pushbutton 7 light OFF)

If the above checks are successful, the driver's remote operation is working correctly. These procedures do not check all of the driver's program codes that can be executed. However, if the driver work correctly from the front panel, there is a high probability that the driver will respond to all the program codes.

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5 Local Operations

Getting Started with the 11713B/C	46
Main Menu of the 11713B/C	52
Save/Recall State Menu	59

This chapter outlines some simple steps to start using the 11713B/C in local operations. Also, functionality of all menus are described to assist operations using the 11713B/C.

Getting Started with the 11713B/C

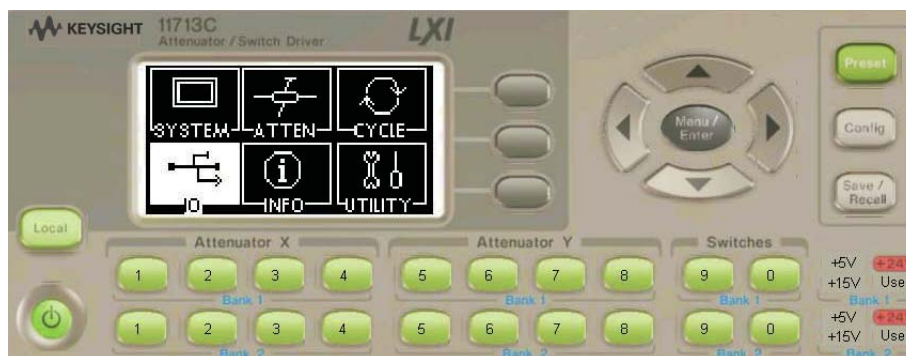
The Keysight 11713B/C attenuator/switch driver can be easily configured to drive programmable attenuators and/or switches through the front panel operations. The following three simple steps will guide you through the configuration of the 11713B/C.

Step 1: Turn on the 11713B/C

NOTE

For Step 1, all details on the 11713C are applicable to the 11713B.

- 1 Connect the AC power supply to the 11713B/C. You should see:
 - the background LED of the power button is red which indicates that the 11713B/C is in the standby mode.
- 2 Press the power button once to turn on the 11713B/C. You should see:
 - the background LED turns green.
 - six menus are displayed on the LCD screen.
 - all numbered buttons are lighted up^[1].



- 3 Ensure the **Local** button is lighted up to enable operation through the front panel. If not, press the button once.
- 4 Now, you are ready to configure the 11713B/C.

Step 2: Configure the 11713B/C settings to drive attenuators and switches

To drive programmable attenuators

NOTE

Step 2 – To drive programmable attenuators, only item 2 is applicable to the 11713B. When the **Config** button is pressed, the next screen is **CONFIGURATION MENU**.

[1] At factory default setting. Last state is followed if instrument was configured before shutdown.

Item	Action	Illustration
1 Select bank (only for 11713C)	<p>a Press Config button.</p> <p>b At SELECT BANK screen, you can see two softkey selections: BANK1 and BANK2.</p> <p>c Press BANK1 softkey to select bank 1.</p> <p>d Press BANK2 softkey to select bank 2.</p>	
2 Select attenuator type	<p>a At CONFIGURATION MENU screen, press ATTEN TYPE softkey.</p> <p>b At ATTENUATOR MODEL screen, scroll to highlight the desired attenuator model number using the navigation keys.</p> <p>c Once the attenuator model is determined, press ATTEN X or ATTEN Y softkey to assign the selected attenuator model.</p> <p>d Repeat steps b and c if needed.</p> <p>e Model assigned to ATTEN X and ATTEN Y is marked <X> (e.g. 8494G/H) and <Y> (e.g. 8496G/H) respectively.</p> <p>f To return to the previous screen, press BACK softkey.</p>	 

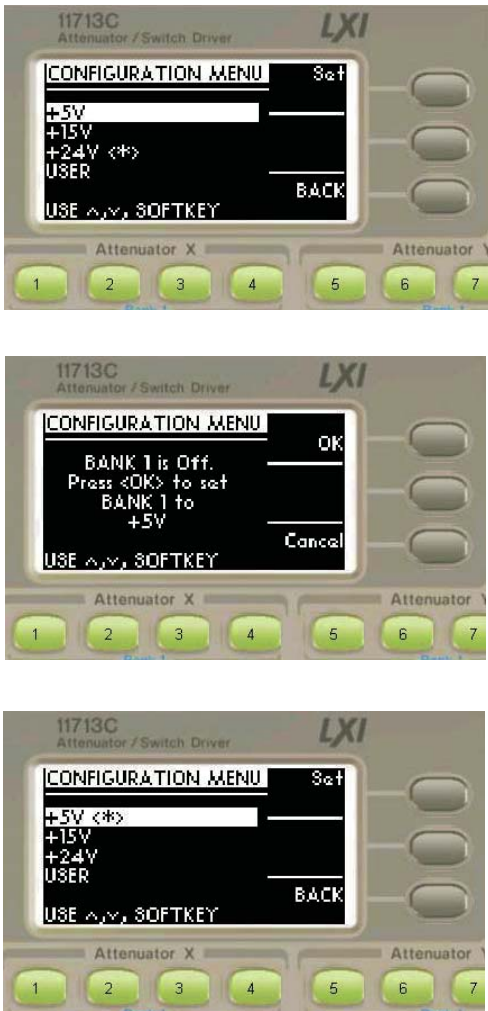
Item	Action	Illustration
3 Select voltage type (only for 11713C)	a At CONFIGURATION MENU screen, press Voltage LEVEL softkey.	
	b At OUTPUT VOLTAGE screen, scroll to highlight the desired voltage (e.g. +5V).	
	c Press SET softkey to assign highlighted voltage.	
	d At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.	
	e Output voltage assigned is marked <*>.	
	f To exit this screen, press BACK softkey.	

To drive switches

NOTE

Step 2 – To drive switches, only applicable to the 11713C as the 11713B is predefined with +24 Vdc supply and no TTL drive.

Item	Action	Illustration
1 Select bank (only for 11713C)	a Press Config button.	
	b At SELECT BANK screen, you can see two softkey selections: BANK1 and BANK2.	
	c Press BANK1 softkey to select bank 1.	
	d Press BANK2 softkey to select bank 2.	
2 Select voltage type (only for 11713C)		
	a At CONFIGURATION MENU screen, press TTL ON/OFF softkey.	
	b At TTL MODE ON/OFF screen, scroll to highlight the TTL OPTION or Non TTL (e.g. TTL OPTION).	
	c Press SET softkey to assign highlighted voltage.	
	d At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.	
	e Selection is marked <*>.	
	f To exit this screen, press BACK softkey.	

Item	Action	Illustration
3 Select voltage type (only for 11713C)	a At CONFIGURATION MENU screen, press Voltage LEVEL softkey.	
	b At OUTPUT VOLTAGE screen, scroll to highlight the desired voltage (e.g. +5V).	
	c Press SET softkey to assign highlighted voltage.	
	d At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.	
	e Output voltage assigned is marked (*).	
	f To exit this screen, press BACK softkey.	

Step 3: Configure the 11713B/C connections to attenuators and switches

- 1 Determine the interface cable option of the 11713B/C.
- 2 Determine the DC connector option of the attenuator(s) or switch(es).
- 3 Check for compatibility using Table 11 for programmable attenuators and Table 12 for switches:

Table 5-1 Connection between the 11713B/C and programmable attenuators

11713B/C	Attenuators (Option)
Option 001	8494G/H, 8495G/H, 8496G/H, 8495K, 8497K (Option 016) 84904K/L/M, 84905M, 84906K/L, 84907K/L, 84908M (No option)
Option 101	8494G/H, 8495G/H, 8496G/H, 8495K, 8497K (Option 060)

Table 5-2 Connection between the 11713B/C and switches

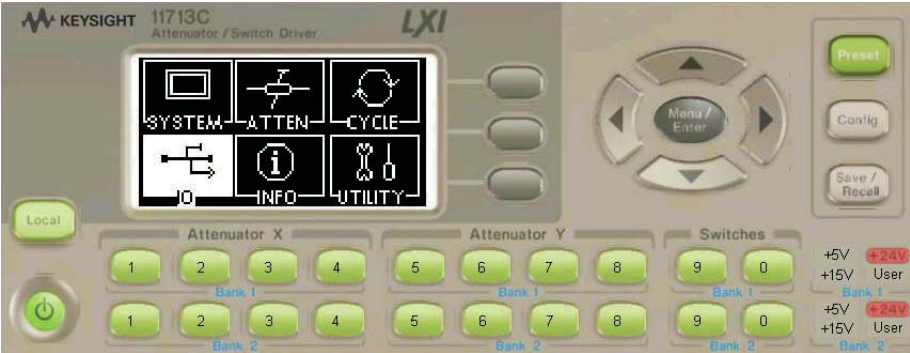
11713B/C	Switches (Option)
Option 001	8766K, 8767K/M, 8768K/M (Option 016)
Option 101	8766K, 8767K/M, 8768K/M, 8769K/M (Option 060)
Option 201	8763A/B/C, 8764A/B/C, 8761A/B, 8762A/B/C/F (No option) 8765A/B/C/D/F (Option 305/310/315/324) N1810UL/TL, N1811TL, N1812UL (Option ^[a] 202) 87104A/B/C/D, 87204A/B/C, 87106A/B/C/D, 87206A/B/C (Option 100) L7104A/B/C, L7204A/B/C, L7106A/B/C, L7206A/B/C (Option 100) 87406B, 87606B (Option 100) 87222C/D/E, L7222C (Option 100)
Option 301	8765A/B/C/D/F (Option 005/010/015/024)
Option 401	87106A/B/C/D, 87206A/B/C (Option 161) L7106A/B/C, L7206A/B/C (Option 161) 87406B, 87606B (Option 161)
Option 501	N1810UL/TL, N1811TL, N1812UL (Option ^[a] 201)
Option 601	87104A/B/C/D, 87204A/B/C (Option 161) L7104A/B/C, L7204A/B/C (Option 161)
Option 701	8769K/M (Option 016)
Option 801	87222C/D/E, L7222C (Option 161)

[a] If TTL is required, include Option 401. Must order switch with Option 403 (current interrupt) as switch cannot withstand continuous current supplied by 11713B/C.

- 4 For more details, refer to the *11713B/C Configuration Guide*, literature number 5989-7277EN.

Main Menu of the 11713B/C

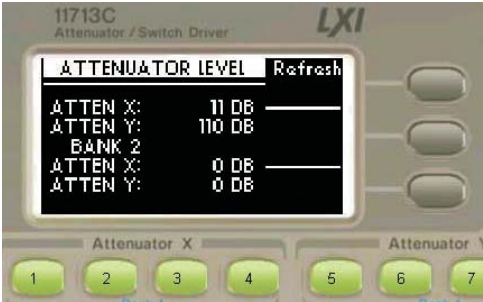
The main menu can be displayed on the LCD screen by pressing the **Menu/Enter** button. The six submenus, each with their own functionality, are described in the subsequent sections.



SYSTEM menu

Function	Action	Illustration
Display attenuator type(s) configured for 11713B/C	<p>a Navigate to the SYSTEM icon using the navigation keys.</p> <p>b Press Menu/Enter button when SYSTEM icon is highlighted.</p> <p>c On display are attenuator models assigned to ATTEN X and ATTEN Y for each bank (e.g. 8494G/H, 8496G/H, N/A, N/A).</p> <p>d Press Menu/Enter button again to return to main menu.</p>	

ATTEN menu



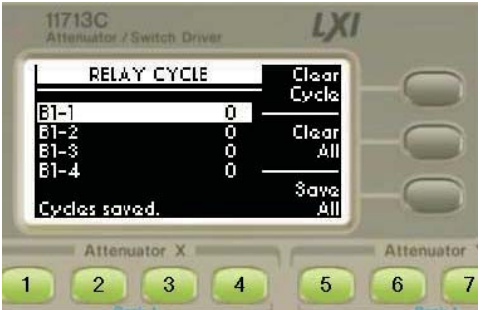
Function	Action	Illustration
Display attenuation levels of each bank	<div><div>a</div> Navigate to the ATTEN icon using the navigation keys.</div> <div><div>b</div> Press Menu/Enter button when ATTEN icon is highlighted.</div> <div><div>c</div> On display are attenuation levels for ATTEN X and ATTEN Y (e.g. 11 dB, 110 dB, 0, 0).</div> <div><div>d</div> Press Menu/Enter button again to return to main menu.</div>	

Attenuation value on display changes according to the input from the front panel pushbuttons or through the virtual web interface:

- Pushbutton LED ON – attenuation card selected (attenuation applied) on corresponding attenuator section
- Pushbutton LED OFF – thru path selected (attenuation lifted) on corresponding attenuator section

CYCLE menu


Function	Action	Illustration
Display number of cycles of switching path for each channel – 10 channels for 11713B (CH1 to CH9, CH0) – 20 channels for 11713C (B1-1 to B1-10, B2-1 to B2-10)	<p>a Navigate to the CYCLE icon using the navigation keys.</p> <p>b Press Menu/Enter button when CYCLE icon is highlighted.</p> <p>c On display are number of relay cycles for each channel.</p> <p>d Press Menu/Enter button again to return to main menu.</p>	
Clear cycle for selected channel(s)	<p>a Scroll to the desired bank-channel (e.g. B1-1) using the navigation keys.</p> <p>b Press CLEAR CYCLE.</p> <p>c At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.</p> <p>d. Note that relay cycle for B1-1 is 0 and below screen indicates CLEARED.</p>	

Function	Action	Illustration
Clear cycle for all channels		
	<p>a Press Clear All.</p> <p>b At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.</p> <p>c. Note that relay cycle for all channels is 0.</p>	
Save cycle for all channels		
	<p>a Press Save All.</p> <p>b At the next screen, Cycles saved. appears and this confirms all channels' cycles are saved.</p>	

IO menu

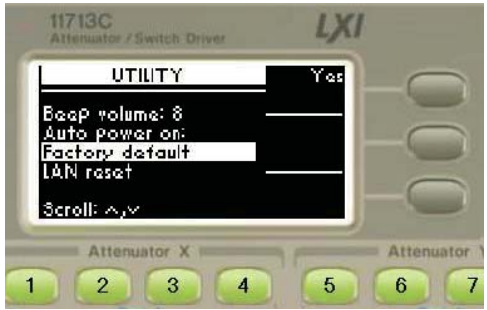
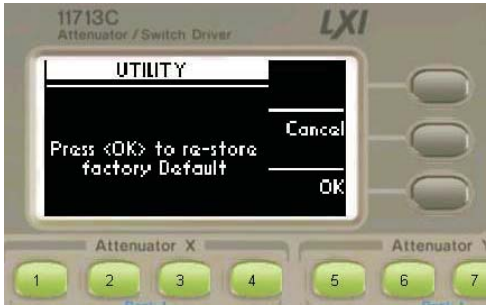
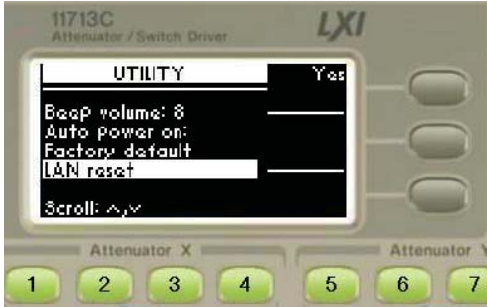
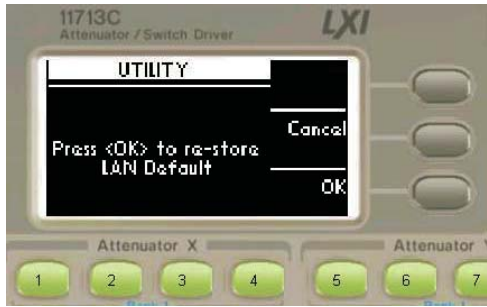
Refer to [Chapter 7, "Remote Interface Configurations"](#).

INFO menu

Function	Action	Illustration
Display system info for 11713B/C		
– Model	a Navigate to the INFO icon using the navigation keys.	
– Serial number	b Press Menu/Enter button when INFO icon is highlighted.	
– Firmware revision	c Press Menu/Enter button again to return to main menu.	
– GPIB address		
– LAN IP		
– USB address		
– MAC address		

UTILITY menu

Function	Action	Illustration
Display system utility settings for 11713B/C and adjust beep volume. Beep volume range from 0 (mute) to 8 (loudest).	<p>a Navigate to the UTILITY icon using the navigation keys.</p> <p>b Press Menu/Enter button when UTILITY icon is highlighted.</p> <p>c Scroll to highlight Beep volume using the navigation keys.</p> <p>d Adjust beep volume using Volume up and Volume down softkeys.</p> <p>e Press Menu/Enter button again to return to main menu.</p>	
To enable Auto-Power on	<p>a Scroll to highlight Auto-Power on using the navigation keys, then press Enable softkey.</p> <p>b Factory default is set as Disable for this feature.</p> <p>c The status shows Enable.</p> <p>d There are three possible outcome for standby mode as follows:</p> <ul style="list-style-type: none">– Select unit on standby, the unit will remain on standby.– When unit is on standby, unplugging the unit <i>within</i> 5 s and then replugging it will cause the unit remain on standby mode.– When unit is on standby, unplugging the unit <i>after</i> 5 s and then replugging it will cause the unit to auto power on. <p>e Recommendation: To enable the auto power on, it is recommended to use “Save Cycles” (via LCD display or SCPI remote command) to save the cycle count before powering the unit off.</p>	

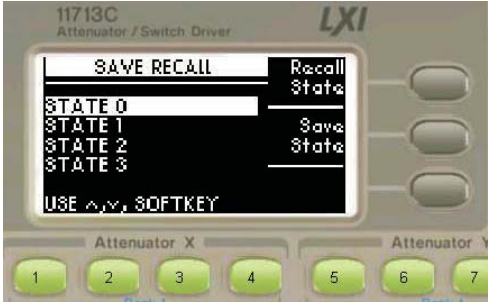
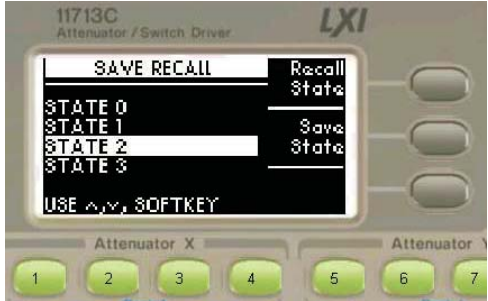
Function	Action	Illustration
Set factory default – For more information: “List of default values” on page 60	<p>a Scroll to highlight Factory default using the navigation keys, then press Yes softkey.</p> <p>b At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.</p>	 
Reset LAN	<p>a Scroll to highlight LAN RESET using the navigation keys, then press Yes softkey.</p> <p>b At the next screen, press OK softkey to confirm decision or press Cancel softkey to cancel.</p>	 

Preset menu

The preset function is used to apply full attenuation or open all switching paths (all LEDs light ON). For more information: “List of default values” on page 60.

Save/Recall State Menu

The save state function is important to enable you to store up to four different configurations and the recall state function allows you to re-instate one of the four saved states for use. This greatly helps to minimize the amount of work required to make “standard” configuration changes.

Function	Action	Illustration
To save state	<div><div>a Press Save/Recall button.</div><div>b Scroll to the desired state to store configuration (e.g. <i>STATE 0</i>) using the navigation keys.</div><div>c Press Save State softkey to store configuration.</div><div>d Press Menu/Enter button again to return to main menu.</div></div>	
To recall state	<div><div>a Press Save/Recall button.</div><div>b Scroll to the desired state to recall configuration (e.g. <i>STATE 2</i>) using the navigation keys.</div><div>c Press Recall State softkey to reinstate configuration.</div><div>d Press Menu/Enter button again to return to main menu.</div></div>	

List of default values

Key operation	Factory-shipped setting	Factory default key	Preset (*RST)	Backup	Save/Recall	Available means of defining a setting
Channel	All Lights ON ^[a]	<< ^[b]	<<	*	*	K/C ^[c]
Attenuator Type	N/A	<<		*	*	K/C
Supply Voltage	+24V	<<		*	*	K/C
TTL	OFF	<<		*	*	K/C
Beep Volume	8	<<		*		K
GPIB Address	28	<<		*		K
IP Config	AUTO	<<		*		K
Manual IP Addr	"192.168.1.101"	<<		*		K
Manual Gateway	"0.0.0.0"	<<		*		K
Manual Subnet Mask	"255.255.255.0"	<<		*		K

[a] When channel light is ON, it means attenuation is being applied (when attenuator is connected) or switch path is open (when switch is connected).

[b] "<<" symbol shows that the setup is the same as that in the box to the left.

[c] K = Using front panel. C = Using SCPI command.

Definition

Factory Default	All data that the user can set are cleared. The relay cycle count is not cleared.
Preset	Status when you press Preset key.
*RST	Status when you execute *RST in your program.
Backup	Settings that are backed up (set state not affected by turning power ON/OFF). In the table, a setting that is automatically backed up is denoted in the following manner: *: Backup operation performed. Blank: Backup operation not performed.
Save/Recall	Settings that permit Save/Recall of a setup state. In the table, states that can be saved/recalled are denoted in the following manner: *: Save/Recall can be performed. Blank: Save/Recall cannot be performed.

6 Remote Operations

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SCPI and Legacy Commands Compatibility	70

This chapter provides the programming guide for the 11713B/C in SCPI commands and legacy commands.

Configuring Remote Interface

This section briefly describes how to configure the GPIB, USB, and LAN remote interfaces.

NOTE

For more detailed information on remote interface connectivity configuration, refer to the *Keysight Technologies USB/LAN/GPIB Interfaces Connectivity Guide*. If you have installed the IO Libraries Suite, you can access the Connectivity Guide via the Keysight IO Libraries Control icon. Alternatively, you can access the Connectivity Guide via the Web at www.keysight.com/find/connectivity.

NOTE

The latest version of Keysight IO Libraries Suite can be downloaded from www.keysight.com/find/iosuitedownload. The Keysight Instrument Control DVD, with the above software, is no longer shipped with Keysight instruments. If you require a Keysight Instrument Control DVD, it can be ordered by contacting your local Keysight Customer Contact Center.

Interface selection

You can choose to control the 11713B/C remotely using the GPIB, USB, or LAN interfaces.

For information on selecting and configuring the remote interface manually from the driver front panel or remotely via virtual front panel, refer to [Chapter 5, "Local Operations"](#).

NOTE

It is expected that most users will use the front panel keys to set up the remote interfaces. The remote interface commands are provided for completeness (for front panel operation).

GPIB configuration

Each device on the GPIB (IEEE-488) interface must have a unique address. You can set the 11713B/C's address to any value between 0 and 30. The attenuator/switch driver is shipped with a default address set to 28. The GPIB address is stored in non-volatile memory and does not change when the driver is switched off or after a remote interface reset.

For information on setting the GPIB address manually from the front panel, refer to ["Connecting over GPIB"](#) on page 72.

USB configuration

The USB interface requires no front panel or remote configuration. The USB cannot be changed – it is set at the factory and is unique for each 11713B/C.

NOTE

For further information on USB configuration, refer to ["Connecting over USB"](#) on page 73.

NOTE

Before connecting the USB cable, make sure that I/O software is installed on your computer.

NOTE

For more information about *Keysight IO Libraries software*, refer to the Connectivity Guide. If you have installed other I/O software, refer to the documentation that accompanies the software.

LAN configuration

The 11713B/C has three LAN operating modes:

- Dynamic mode (Dynamic Host Configuration Protocol or DHCP)
- Auto IP mode (Local PC Control or isolated LAN)
- Static mode (Manual mode)

Refer to “[Connecting over LAN](#)” on page 75 to configure the above LAN operating modes.

Control using Keysight IO Libraries Suite

The Keysight IO Libraries Suite is a collection of libraries that provides you the ability to use your instruments from a test and measurement program. [Figure 6-1](#) shows an example of controlling via Keysight IO Libraries Suite (when the I/P address of the 11713C is 10.74.73.33). Please ensure the remote instrument name is selected.

Add a LAN device [X]

Select from List | **Enter Address**

Set LAN Address:

Hostname or IP Address:

TCP/IP Interface ID:

Set Protocol:

☒ Instrument (VXI-11) Remote Name:

☐ HiSlip Remote Name:

☐ Socket Port Number:

Verify Connection:

☒ Allow *IDN Query

TCPIP0::10.74.73.33::inst0::INSTR Verified

View Web Page:

Figure 6-1 Example of control using Keysight IO Libraries Suite

Programming Guide (SCPI)

SCPI command syntax

The following conventions are used for SCPI command syntax for remote interface programming.

- Square brackets ([]) indicate optional keywords or parameters
- Braces ({ }) enclose parameter choices within a command string
- Angle brackets (< >) enclose parameters for which you must specify a value
- A vertical bar (|) separates multiple parameters

Rules for using a channel or scan list

Many of the SCPI commands include a channel list or scan list parameter which allows you to specify one or more channels. The channel number has the form (@*bnn*), where *b* is the bank number and *nn* is the channel number.

Channel list is from 101 to 110 for bank 1 and 201 to 210 for bank 2.

NOTE

The 11713B has only one bank. Therefore, by default, *b* = 1.

You can specify a bank, a single channel, multiple channels, or a range of channels as described below.

- The following command closes a single channel (channel 4) on bank 1:
ROUTe:CLoSe (@104)
- The following command closes multiple channels on modules in banks 1 and 2:
ROUTe:CLoSe (@104,107, 201, 206)
- The following command closes a range of channels. When you specify a range of channels, the range may contain invalid channels (they are ignored), but the first and last channel in the list must be valid:
ROUTe:CLoSe (@101:109)

Commands relevant to attenuators

To configure attenuator type

The commands below set the attenuator type (model number) for corresponding attenuators.

- **:CONFigure:[BANK1]:X**
{NA|AG8494g|AG8495g|AG8495k|AG8496g|AG8497k|AG84904k|AG84905m|AG84906k|AG84907k|AG84908m}
- **:CONFigure:[BANK1]:Y**
{NA|AG8494g|AG8495g|AG8495k|AG8496g|AG8497k|AG84904k|AG84905m|AG84906k|AG84907k|AG84908m}

- :CONFigure:BANK2:X
{NA|AG8494g|AG8495g|AG8495k|AG8496g|AG8497k|AG84904k|AG84905m|AG84906k|AG84907k|AG84908m}
- :CONFigure:BANK2:Y
{NA|AG8494g|AG8495g|AG8495k|AG8496g|AG8497k|AG84904k|AG84905m|AG84906k|AG84907k|AG84908m}

NOTE

For AG849xh, use AG849xg. For AG84904l/m, use AG84904k. For 84906l, use AG84906k. For AG84907l, use AG84907k.

To set attenuation level

The commands below are used to set the attenuation level of corresponding attenuator(s).

- ATTenuator:[BANK1]:X <attenuation value in dB>
- ATTenuator:[BANK1]:Y <attenuation value in dB>
- ATTenuator:BANK2:X <attenuation value in dB>
- ATTenuator:BANK2:Y <attenuation value in dB>

To query attenuation level

The commands below return the current attenuation value for corresponding attenuator(s).

- ATTenuator:[BANK1]:X?
- ATTenuator:[BANK1]:Y?
- ATTenuator:BANK2:X?
- ATTenuator:BANK2:Y?

To set supply voltage

The commands below set the supply voltage for each bank.

- CONFigure:BANK1 {OFF|P5v|P15v|P24v|USER}
- CONFigure:BANK2 {OFF|P5v|P15v|P24v|USER}

To query supply voltage

The commands below query the supply voltage set for each bank. Value to be returned: OFF, P5, P15, P24, or USER.

- CONFigure:BANK1?
- CONFigure:BANK2?

To query number of relay cycles

The command below query the number of relay cycles for each channel. Value to be returned: number of cycles.

- DIAGnostic:RElay:CYCles? <channel list>

To clear relay cycles

The commands below clear relay cycle for selected or all channels.

- `DIAGnostic:RElay:CLEAr <channel list>`
- `DIAGnostic:RElay:CLEAr:ALL`

Commands relevant to switches**To open/close switch**

The commands below close/open switching path(s).

- `[:ROUTe]:CLOSe <channel list>`
- `[:ROUTe]:OPEn <channel list>`
- `[:ROUTe]:CLOSe:ALL`
- `[:ROUTe]:OPEn:ALL`

To query switch status

The commands below query the status of switching path(s). Value to be returned: “1” if true and “0” if false.

- `[:ROUTe]:CLOSe? <channel list>`
- `[:ROUTe]:OPEn? <channel list>`

To set supply voltage

The commands below set the supply voltage for each bank.

- `CONFigure:BANK1 {OFF|P5v|P15v|P24v|USER}`
- `CONFigure:BANK2 {OFF|P5v|P15v|P24v|USER}`

To query supply voltage

The commands below query the supply voltage set for each bank. Value to be returned: OFF, P5, P15, P24, or USER.

- `CONFigure:BANK1?`
- `CONFigure:BANK2?`

To set TTL ON/OFF

The commands below set TTL ON/OFF for each bank.

- `CONFigure:BANK1:TTL {OFF|ON}`
- `CONFigure:BANK2:TTL {OFF|ON}`

To query TTL status

The commands below query the supply voltage status for each bank. Value to be returned: “1” if true and “0” if false.

- **CONFigure:BANK1:TTL?**
- **CONFigure:BANK2:TTL?**

To query number of relay cycles

The command below query the number of relay cycles for each channel. Value to be returned: number of cycles.

- **DIAGnostic:RElay:CYCles? <channel list>**

To clear relay cycles

The commands below clear relay cycle for selected or all channels.

- **DIAGnostic:RElay:CLEAr <channel list>**
- **DIAGnostic:RElay:CLEAr:ALL**

Programming Guide (Legacy)

Data message input format

NOTE

Legacy commands cannot be utilized to control Bank 2 of the 11713C.

The programming data string for the driver consists of a string of ASCII-coded characters composed of one or both of the following fields:

[Adm] [Bdn]

where: **A** or **a** = general ON command; **B** or **b** = general OFF command

dm = any digits 0 through 9 (excluding dn)

dn = any digits 0 through 9 (excluding dm)

The driver responds to an alphanumeric data string such as “**A12B34**” when the driver is in the remote state and addressed to listen.

NOTE

The alpha characters in the data string can be either upper or lower case.

NOTE

The maximum number of characters in a data string is 12.

The data string is further defined as follows:

- **Ax Bx** = data string for ATTEN X (x can be none, one or more of digits 1, 2, 3, or 4)
- **Ay By** = data string for ATTEN Y (y can be none, one or more of digits 5, 6, 7, or 8)

NOTE

If **Ax (Ay)** uses a digit, then that digit may not be used in **Bx (By)**.

- **A/B 9** = legacy command for switch S9
- **A/B 0** = legacy command for switch S0

SCPI and Legacy Commands Compatibility

Front panel		Rear panel connector	Connector pin number	Command result	
Pushbutton number	Pushbutton LED ^[a]			(Legacy) A (SCPI) [:ROUTe]:CLOSe: <channel list>	(Legacy) B (SCPI) [:ROUTe]:OPEn: <channel list>
1	ON	ATTEN X	5	H	L
	OFF		6	L	H
2	ON		7	H	L
	OFF		8	L	H
3	ON		9	H	L
	OFF		10	L	H
4	ON		11	H	L
	OFF		12	L	H
5	ON	ATTEN Y	5	H	L
	OFF		6	L	H
6	ON		7	H	L
	OFF		8	L	H
7	ON		9	H	L
	OFF		10	L	H
8	ON		11	H	L
	OFF		12	L	H
9	ON	S9	A (3)		+Vcc
	OFF			G	
	ON		B (4)	+Vcc	
	OFF				G
0	ON	S0	A (3)		+Vcc
	OFF			G	
	ON		B (4)	+Vcc	
	OFF				G

[a] Note:

LED lights on = attenuation applied (for attenuators)/switching path opened (for switches).

LED lights off = no attenuation (for attenuators)/switching path closed.

Legends

H = Open (Low) L = Closed (High)

G = Connected to ground

7 Remote Interface Configurations

Connecting the 11713B/C to your Computer	72
Exploring the 11713B/C Web Interface over LAN	79

This chapter provides you information and steps to establish remote connections with the Keysight 11713B/C attenuator/switch drivers via GPIB, USB, and LAN. You will also be introduced to the 11713B/C web interface over LAN.

Connecting the 11713B/C to your Computer

NOTE

To easily connect the 11713B/C to your PC, configure and verify your connection, you can use the Keysight IO Libraries Suite, the E2094M Keysight IO Libraries for Windows, or and equivalent.

- Keysight IO Libraries Suite for Windows 98/2000/ME/XP.
- E2094M Keysight IO Libraries Suite for Windows 98/NT/2000/ME/ XP. You can find information and install this application via the Web at www.keysight.com/find/iolib.
- You can also access other information about Keysight IO Libraries at www.keysight.com/find/iolib.

NOTE

The procedures in this section refer to the *Keysight Technologies USB/LAN/ GPIB Interfaces Connectivity Guide*. If you have installed the IO Libraries Suite, you can access the Connectivity Guide via the Keysight IO Libraries Control icon. Or, you can access the Connectivity Guide via the Web at www.keysight.com/find/connectivity.

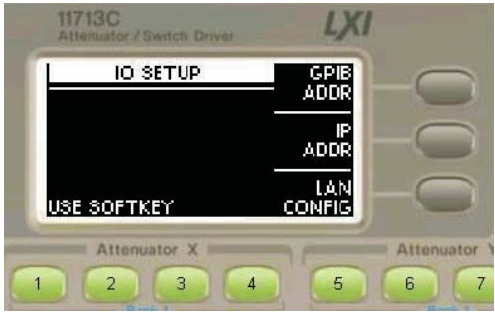
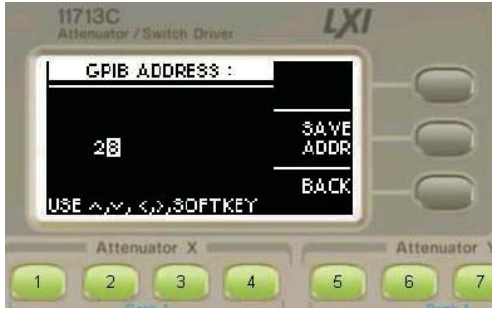
Connecting over GPIB

- 1 Make sure you have installed the required I/O software on your computer.
- 2 Follow the instructions included with your GPIB interface card to install the GPIB hardware in your computer.
- 3 Connect the GPIB cable (not provided) between the computer and the 11713B/C.
- 4 Make sure power is applied to your computer and verify that the operating system is fully booted. Then apply power to 11713B/C.
- 5 Configure your GPIB hardware as instructed by the documentation provided by the hardware vendor.
- 6 Use the *Connection Expert* utility of the Keysight IO Libraries Suite to add the 11713B/C and verify a connection.

NOTE

If you have installed any other I/O software, refer to the documentation included with that software.

- 7 The 11713B/C is shipped from the factory with a default GPIB address of **28**. To change the address, refer to table below:

Step	Action	Illustration
1 Changing GPIB address (integer between 0 to 30)	a At IO SETUP screen, press GPIB ADDR softkey.	
	b Current GPIB address is displayed on screen (default address is 28).	
	c Use navigation keys to change value.	
	d Press SAVE ADDR to save and GPIB ADDR SAVED is displayed at the bottom of LCD.	
	e Press BACK softkey to return to IO SETUP.	

8 Now you can use various programming environments to control the 11713B/C. For an overview on programming instruments via GPIB, refer to the *Connectivity Guide*.

Connecting over USB

The USB interface requires no front panel configuration.

NOTE

Before connecting the USB cable, make sure that I/O software is installed on your computer. See **“Connecting the 11713B/C to your Computer”** on page 72 for more information on installing the Keysight IO Libraries software.

- 1 After the I/O software is installed on your computer, connect a 11713B/C to your computer using a Type Mini-B 5 pin USB cable.
- 2 Make sure power is applied to your computer and verify that the operating system is fully booted. Then apply power to the 11713B/C.
- 3 The *Found New Hardware Wizard* will automatically start and guide you through configuring the 11713B/C as a USB device. To install the software automatically, accept all defaults.

NOTE

If you have installed the Keysight I/O Libraries Software, this also installs the required low-level software drivers. Therefore you do not need to insert the CD when the Found New Hardware Wizard instructs you to do so.

NOTE

If you have installed any other I/O interface software, refer to the documentation included in that software.

- 4 Use the *Connectivity Expert* utility of the Keysight I/O Libraries Suite to verify that the 11713B/C is displayed under the USB interface.
- 5 Now you can use various programming environments to control the 11713B/C. For an overview on programming instructions via USB, refer to the *Connectivity Guide*.

Connecting over LAN

The 11713B/C has two LAN operating modes:

- Auto mode
- Manual mode

Selecting the LAN network type

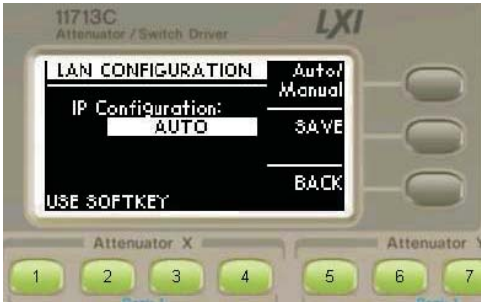
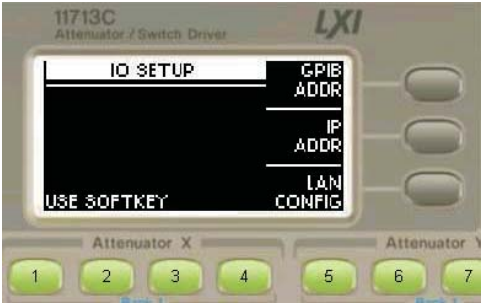
You can connect and configure your 11713B/C for site LAN or isolated (non-site) LAN operation.


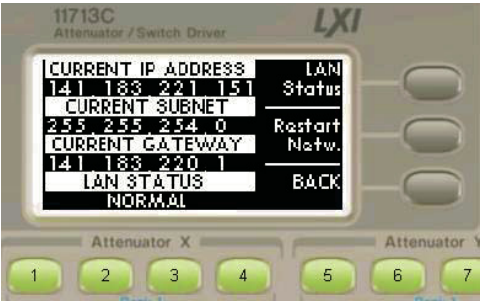
- A *Site LAN* network is defined as a local area network (LAN) in which computers and LAN-enabled instruments are connected to a site LAN (workgroup LAN, Intranet, or enterprise LAN) via optional routers, hubs, and/or switches.
- An *Isolated LAN* network is defined as a local area network (LAN) in which computers and LAN-enabled instruments are not connected to a site LAN.

Auto mode

This mode is used when you are connecting 11713B/C via site LAN. In auto mode, the IP Address, Subnet Mask, and Default Gateway values are obtained from the DHCP server or automatically assigned and the values cannot be configured from the front panel.

To prepare the 11713B/C for auto mode,

Step	Action	Illustration
1	Ensure your computer and 11713B/C are turned on and connected to LAN	<div><div><div>a Connect your computer and 11713B/C to LAN outlets using standard LAN cable.</div><div>b Make sure power is applied to your computer and verify that the operating system is fully booted.</div><div>c Apply power to 11713B/C and background LED color turns red, indicating standby mode.</div><div>d Allow 11713B/C to warm up for 15 seconds, then press the ON button (LED turns from red to green).</div></div></div>
2	Verify 11713B/C LAN configuration is ready for auto mode	<div><div><div>a Press Menu/Enter button on the front panel of 11713B/C.</div><div>b Select IO using navigation keys and press Menu/Enter.</div><div>c At IO SETUP screen, press LAN CONFIG softkey.</div><div>d At LAN CONFIGURATION screen, ensure IP Configuration is AUTO.</div><div>e If needed, press Auto/Manual softkey until AUTO is displayed and SAVE.</div><div>f Press BACK softkey to go back to IO SETUP screen.</div></div><div></div></div>

Step	Action	Illustration
3 Verify LAN status on 11713B/C	<p>a At IO SETUP screen, press IP ADDR softkey.</p> <p>b At IP ADDRESS screen, select LAN STAT softkey.</p> <p>c Verify values CURRENT IP ADDRESS, CURRENT SUBNET, and CURRENT GATEWAY are valid.</p> <p>d Ensure LAN STATUS is NORMAL.</p> <p>e If LAN STATUS is FAULT, check your LAN connection and then press Restart Netw softkey and wait.</p> <p>f Press BACK softkey to go back to IP ADDRESS screen.</p>	 

Now you can use the 11713B/C Web Browser Interface to access and control the instrument. See [“Exploring the 11713B/C Web Interface over LAN”](#) on page 79.

If you plan to program the instrument over LAN or use such programs, make sure you have installed the required I/O software on your computer.

Use the *Connectivity Expert* utility of the Keysight IO Libraries Suite to add the 11713B/C and verify a connection. When identifying the instrument, it is easiest if you use the IP address noted in step 3 above.

NOTE

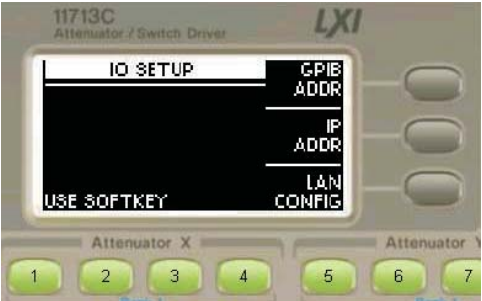
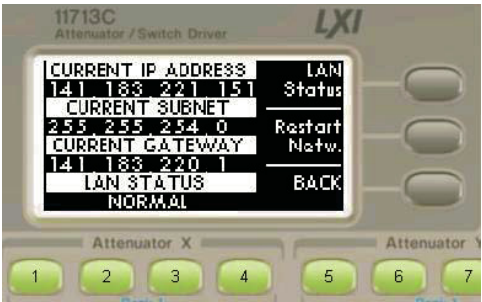
If you have installed any other I/O software, refer to the documentation included with that software.

Now you can use various programming environments to control the 11713B/C. For an overview on programming instructions via USB, refer to the *Connectivity Guide*.

Manual mode

In a manual mode, you must set up the IP Address, Subnet Mask, and Default Gateway that are compatible with your network infrastructure. If it is not correctly set up, the 11713B/C will not be visible on your network.

To prepare the 11713B/C for manual mode,

Step	Action	Illustration
4 Verify LAN status on 11713B/C	<p>a At IO SETUP screen, press IP ADDR softkey.</p> <p>b At IP ADDRESS screen, select LAN STAT softkey.</p> <p>c Verify values CURRENT IP ADDRESS, CURRENT SUBNET, and CURRENT GATEWAY are valid.</p> <p>d Ensure LAN STATUS is NORMAL.</p> <p>e If LAN STATUS is FAULT, check your LAN connection and then press Restart Netw softkey and wait.</p> <p>f Press BACK softkey to go back to IP ADDRESS screen.</p>	
		

Now you can use the 11713B/C Web Browser Interface to access and control the instrument. See [“Exploring the 11713B/C Web Interface over LAN”](#) on page 79.

If you plan to program the instrument over LAN or use such programs, make sure you have installed the required I/O software on your computer.

Use the *Connectivity Expert* utility of the Keysight IO Libraries Suite to add the 11713B/C and verify a connection. When identifying the instrument, it is easiest if you use the IP address noted in step 3 above.

NOTE

If you have installed any other I/O software, refer to the documentation included with that software.

Now you can use various programming environments to control the 11713B/C. For an overview on programming instructions via USB, refer to the *Connectivity Guide*.

Exploring the 11713B/C Web Interface over LAN

You can use the 11713B/C's Web Browser Interface for remote access and control of the instrument via a Java™-enabled Web browser, such as Microsoft Internet Explorer. Using the Web Interface, you can configure, troubleshoot, and monitor your system remotely. This section provides an overview of the 11713B/C Web Interface.

NOTE

The following tasks assume you have configured the 11713B/C for LAN communication and have verified connection to a LAN network. See [“Connecting over LAN”](#) on page 75 for more information.

Launching the web interface

- 1 Open your Internet browser from your computer.
- 2 From the **Tools > Internet Options** menu, navigate to **Connections** (exact navigation depends on your browser), and then select **LAN Settings**.
- 3 From the LAN Settings dialog, select/activate bypass proxy server for local addresses (exact terminology depends on your browser).
- 4 Exit the Options window.
- 5 Enter the IP address of the 11713B/C in the Address field and press return. Use the 11713B/C's front panel utility menu to read the IP address.
- 6 After entering the appropriate IP address, the 11713B/C Web Interface's Welcome Window should appear.

NOTE

The procedure in this section will help you understand tasks commonly performed using the 11713B/C Web Interface. For additional help on using the interface, click the **? Help with the Page** tab on the lower-left corner of the Web Interface window.

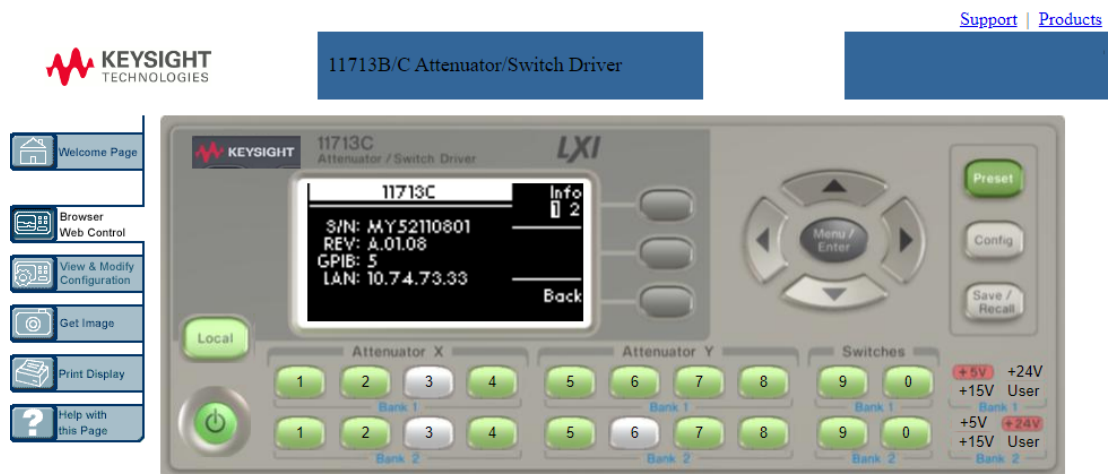


Figure 7-1 11713B/C Web Interface's Welcome Window

Navigation bar



Welcome page Display various setting information

Browser Web Control Virtual front panel and sending/reading SCPI commands

View & Modify Configuration Displays and modifies various setting information

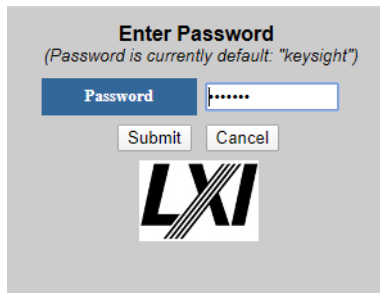
Get Image Receives image

Print Display Calls the printing function of the browser

Help with this Page Displays the Help file

Displaying the browser web control page

- 1 From the Welcome Window, click the **Browser Web Control** tab on the left side of the window.
- 2 You will notice a pop-up window, requesting for password.
- 3 Enter password (default password is “keysight”) and click submit.



- 4 You can view the virtual front panel of the 11713B/C.
- 5 Now, you can control the switching devices remotely, similar to the front panel of the actual instrument.

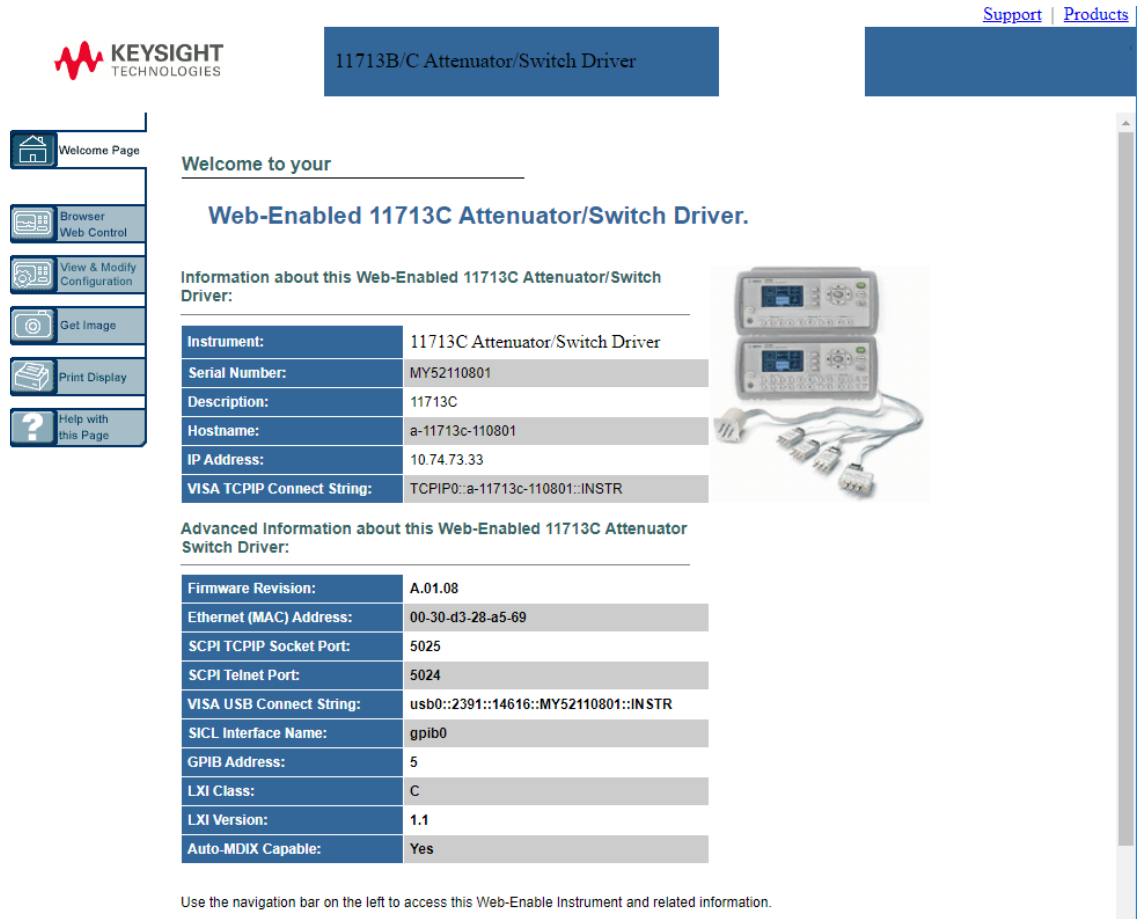


Figure 7-2 11713B/C Browser Web Control Interface

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8 Servicing the Attenuator/Switch Driver

Preparing a Static-Safe Workstation	84
Maintenance and Adjustments	86

This chapter provides the procedures for removal and replacement of major assemblies in the 11713B/C and the list of replaceable parts.

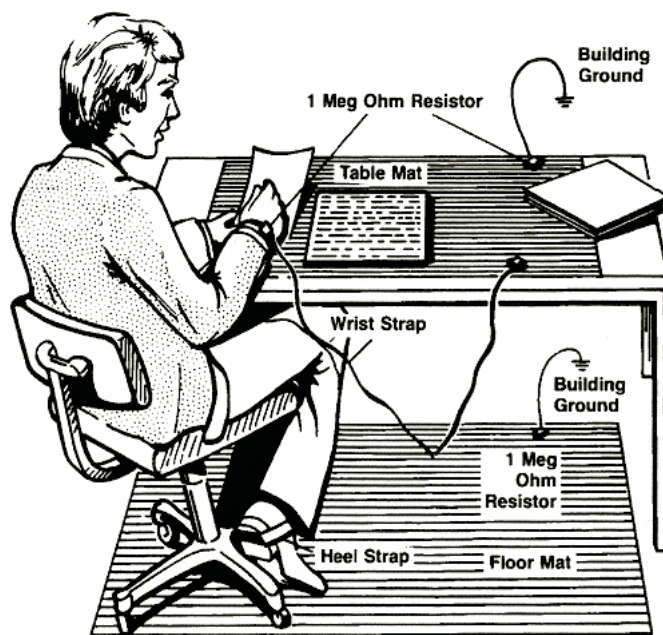
Preparing a Static-Safe Workstation

Electrostatic discharge (ESD) can damage or destroy electronic components. All works performed on assemblies consisting of electronic components should be done at a static-safe workstation.

An example of a static-safe workstation is shown below using two types of ESD protection:

- conductive table mat and wrist strap combination, and
- conductive floor mat and heel strap combination

The methods may be used together or separately. A list of static-safe accessories and their part numbers is given in the table below.



Keysight part number	Description
9300-0797	Set includes: <ul style="list-style-type: none"> – 3M static control mat 0.6 m x 1.2 m (2 ft x 4 ft) – 4.6 m x (115 ft) ground wire The wrist-strap and wrist-strap cord are not included. They must be ordered separately.
9300-0865	Ground-wire, 4.6 m (15 ft)
9300-0980	Wrist-strap cord, 1.5 m (5 ft)
9300-1367	Wrist-strap, color black, stainless steel, without cord, has four adjustable links, and a 7 mm post-type connection
9300-1308	ESD heel-strap (reusable 6 to 12 months)

The above can be ordered by contacting any Keysight Sales Office.

Reducing ESD damage

To help reduce the amount of ESD damage that occurs during installation, testing, or servicing instruments, use the following guidelines:

- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.
- Personnel should be grounded with a resistor-isolated wrist-strap before touching the center pin of any connector and before removing any assembly from the instrument.
- Before connecting any coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductor of the cable.
- Handle all PC board assemblies and electronic components only at static-safe workstations.
- Store or transport PC board assemblies and electronics components only in static-shielding containers.
- PC board assembly edge-connector contacts may be cleaned by using a lint-free cloth with a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. This should be performed at a static-safe workstation.

Maintenance and Adjustments

Fuse removal/replacement

User maintenance is limited to replacement of the rear panel fuse. The main ac line fuse is located on the rear panel in the line power module. *Please ensure that the fuse is 250 V, T3.15 A.*

Use the following procedure to replace fuse.

- 1 Remove the fuse holder using a tweezer.
- 2 You will see two fuses – the one on the left is the active fuse and the other is backup.



- 3 Remove fuse and replace with one of the correct rating and type for your selected input ac line voltage.

NOTE

Be sure to select the correct fuse rating for the selected line voltage. Do not use repaired fuses or short circuited fuse-holders. To do so could cause a shock or fire hazard.

Adjustment

The 11713B/C attenuator/switch driver has no internal electrical or mechanical adjustments.

