Operating and Programming Manual

HP 81534A Return Loss Module

SERIAL NUMBERS

This manual applies to all instruments.

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E1292

Notices

Subject Matter

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Control Serial Number: Edition 1 applies directly to all standard (connector output) instruments.
Edition 2 applies to all instruments (connector and pigtail outputs).
Edition 1 : 1st June 1991 : 81534-90011 : E0691
Edition 2 : 1st November 1991 : 81534-90012 : E1191 Edition 2 : 1st December 1992 : 81534-90012 : E1292

Safety Considerations

Before operation, review the instrument and manual, including the red safety page, for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep it until you have checked the contents of the shipment for completeness and verified the module both mechanically and electrically.

The Performance Tests give procedures for checking the operation of the module. If the contents are incomplete, mechanical damage or defect is apparent, or if a module does not pass the operator's checks, notify the nearest Hewlett-Packard office.

Warning

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, etc.).

Power Requirements

The HP 81534A operates when installed into the HP 8153A Optical Multimeter mainframe.

Operating Environment

The HP 8153A safety information summarizes the HP 81534A operating environment ranges. In order for the HP 81534A to meet specifications, the operating environment must be within the limits specified in this section.

Storage and Shipment

The module can be stored or shipped at temperatures between −40°C and +70°C. Protect the module from temperature extremes that may cause condensation within it.

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The HP 81534A in Measure Mode

This chapter describes the use of the module for making return loss measurements. Theoretical aspects of the measurement are covered at the end of the chapter.

How to Make Return Loss Measurements with the HP 81534A

The HP 81534A includes a sensor and coupler in one module for use in the HP 8153A mainframe for the making of return loss measurements.

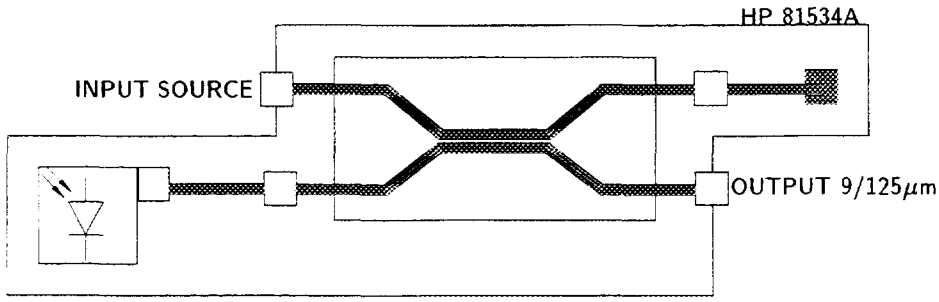

Figure 2-1. The Contents of the HP 81534A Module (Standard Version)

The module is intended for use with a single mode laser source (HP 81552SM 1310nm, HP 81553SM 1550nm, HP 81554SM 1310 and 1550nm, or HP 8155A 1310nm and 1550nm) to make return loss measurements.

Setting up to Make a Return Loss Measurement

The return loss setup described here uses a HP 81553SM source, inserted as a second module in the same mainframe as the return loss module.

Note

This description is for the standard HP 81534A Return Loss Module, not for the pigtail version.

Notes are given where the procedure for the pigtail version may be significantly different.

It is recommended that you attach a patchcord to the return loss module output.

Caution

HP supplies patchcords with a Diamond HMS-10/HP/HRL high return loss connector on one end. These patchcords are necessary so that the connector at the output is not damaged. The the full range of patchcords available are described in Appendix B.

Because of the high return loss connector used and a length of fiber greater than the coherence length of the laser source, the patchcord reduces the disturbance of the source due to reflections.

The setup described uses a fiber with Diamond HMS-10/HP/HRL and Diamond HMS-10/HP connectors throughout.

Opt.001

If you are using the HP 81534A Option 001 it is strongly recommended that you attach a connector or a working fiber to the end of the pigtail so that you can avoid cutting the pigtail as much as possible. (The replacement of the pigtail fiber is not covered by the warranty for the instrument.)

1. Making sure to clean all the connectors, set up the instrument as shown in the figure. Connect the source to the HP 81534A Input. Attach the high return loss connector of the patchcord to the Output. The high return loss connector on these cables is the connector with the orange sleeve. For best results and higher repeatability, fix the cables.

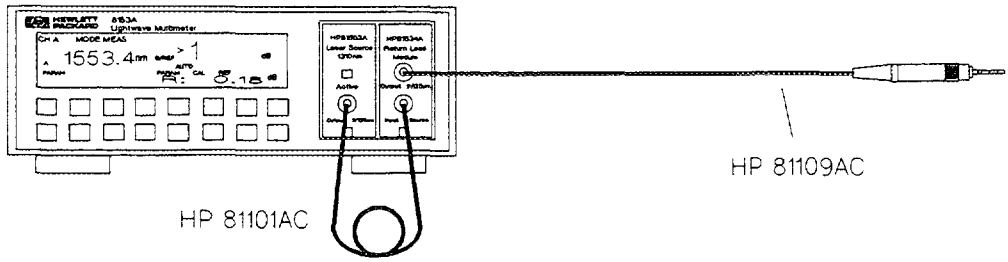

Figure 2-2. Set Up for Return Loss Measurements

2. Make sure the instrument has warmed up.
3. Make sure that the source is inactive and that you have covered the end of the patchcord. Press [Zero] to remove electrical offsets in the instrument.
4. Press [Param] to select the T parameter (the measurement averaging time). Make sure that the selected averaging time is suitable for your measurements. You should use at least 200ms, but you should increase this to at least 1s for return losses greater than 50dB. (Longer averaging times give more accurate results, but decrease the speed at which the instrument measures.)
5. Press [Param] to select the λ parameter. Edit this parameter and set it to the actual wavelength of the source.
6. Enable the source.

Making Calibration Measurements

Whenever the HP 81534A Return Loss Module is in the HP 8153A mainframe, the result field shows return loss. The calibration values used are either the most recently measured, where these are available, or default values.

If you are unsure of one or both of the calibration values you are using, make the appropriate calibration measurements again. If you have changed your measurement setup,

Measuring the Reflection Reference

7. Press [Param] to select the CAL REF parameter. The current value for the known return loss is displayed with R: at the side of the character field.

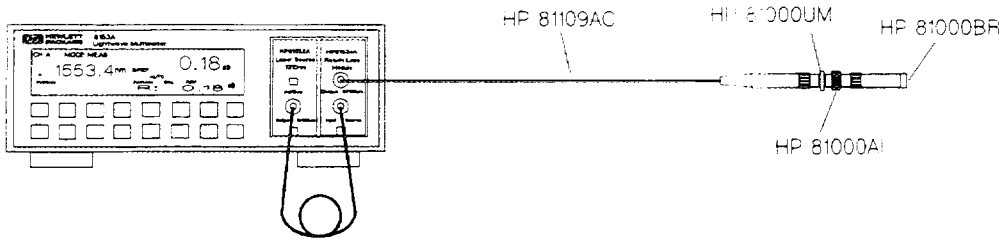

Figure 2-3. Measuring the Reflection Reference

8. Attach a component with a known return loss to the end of the patchcord. The HP 81000BR Back Reflector is such a component, offering a return loss of 0.18±0.1dB.

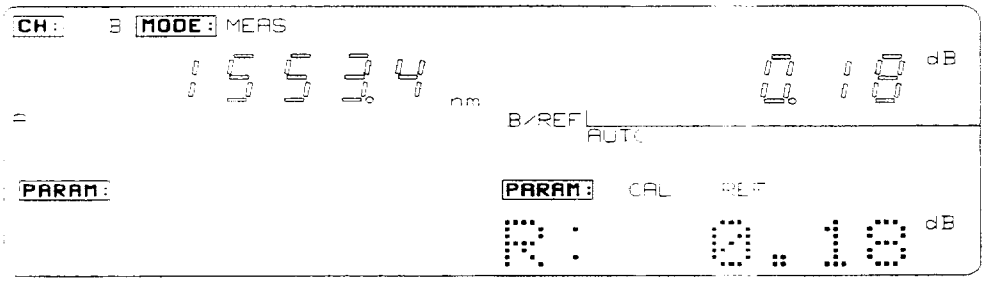

Figure 2-4. Measuring the Reflection Reference

9. Make sure that the value displayed for R: is correct. Set R: to the value of the return loss of the reference reflection you are using. For example, if you are using the HP 81000BR reference reflector, set R: 0.18dB. If not, edit the parameter so that it has the correct value.

Opt.001 If you are using a cleaved fiber end as your reference, the reflection reference is approximately 14.6dB.

---

10. Press (Disp→Ref). The instrument measures the power reflected by the component. The read value should now be the same as the value entered for R:.

Measuring the Termination Parameter

11. Press [Param] to select the REF AUX parameter. T: is displayed at the side of the character field.

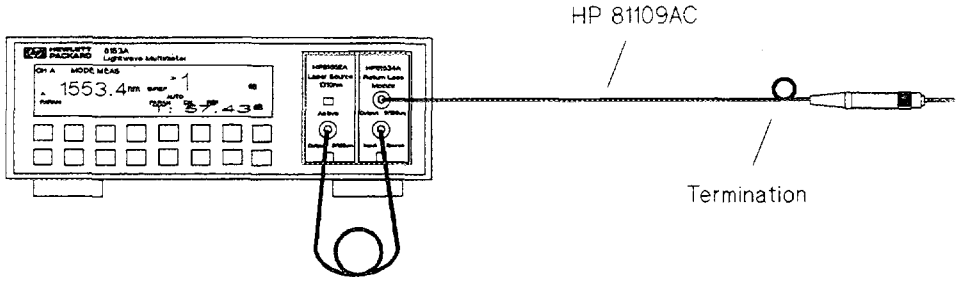

Figure 2-5. Measuring the Termination Parameter

12. Terminate the cable so that there are no reflections coming from the end. You can do this by wrapping the fiber five times around the shaft of a screwdriver (or some similar object with a diameter of around 5mm).

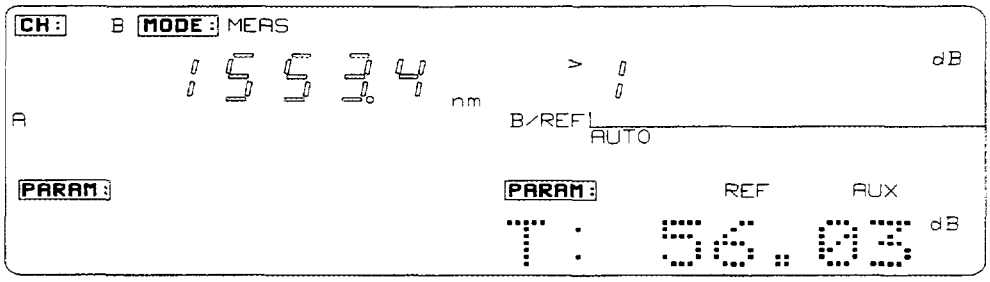

Figure 2-6. Measuring the Termination Parameter

13. Press [Disp→Ref]. The instrument measures and sets the termination parameter.

Measuring the Return Loss

The value shown in the result field is the return loss.

14. Attach the DUT.

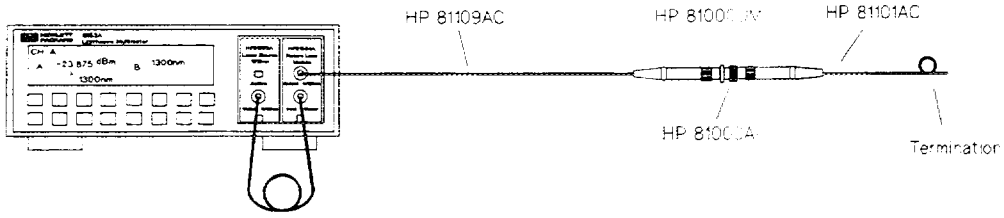

Figure 2-7.
Measuring the Return Loss of the DUT (in this example: a Connector Pair)

Terminate your system close to the DUT to make sure that you are only measuring reflections from the DUT.

It is not necessary to make new calibration measurements for each DUT. You can make the calibration measurements for your system, and then measure the return loss of many devices.

The HP 81534A in Measure Mode - Some Exceptions

The HP 81534A acts like any other sensor module when operating in measure mode with two exceptions.

- The units are fixed at dB. (dB) and (dBm/W) do not have any effect.
- Autoranging cannot be disabled. (Auto), (Up), and (Down) display the selected range while you are pressing them, but otherwise they have no effect.

A Background to Return Loss Measurements with the HP 81534A

When light is incident on an optical component, most of it passes through, or into, the component, some light is absorbed, and some is reflected. In many applications the reflections are unwanted, because they can affect the emission characteristics of any laser in the system. In such applications it is important to have measurements of the reflections for the components in the system.

The reflection factor for a component is a measure of how much light the component reflects. It is the ratio of the power reflected by the device to power incident on the device. More normally we talk about the return loss of a component. The return loss is a value in dB, given by the formula:

$$Return\ Loss[dB] = -10\log(Reflection\ Factor)[dB]$$

or

$$Return\ Loss[dB] = -10\log(\frac{Reflected\ Power}{Incident\ Power})[dB]$$

Return loss can be measured in several ways. A description of the method used by the HP 81534A follows. You can successfully make return loss measurements with the return loss module without reading this description.

The method used requires the following equipment:

- laser source with a stable output,
- a power-sensor, and
- a coupler.

These are connected as shown in the following figure.

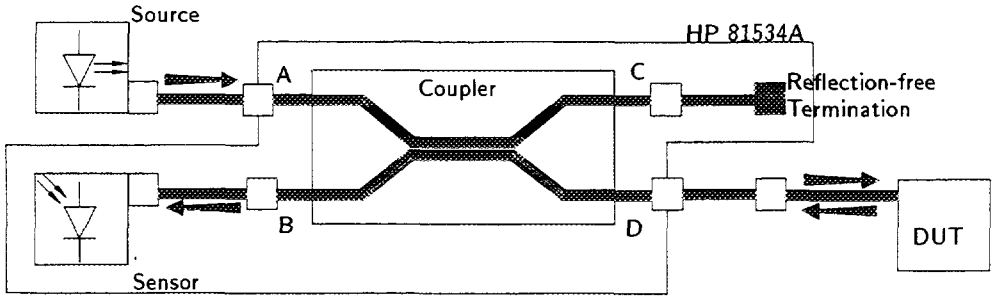

Figure 2-8. Return Loss Equipment

The description starts with measuring the reflection factor. When we have got this figure, we can convert it easily to the return loss.

Taking Calibration Measurements

Before measuring the reflection factor of a device under test (DUT), take some calibration measurements. These eliminate wavelength dependencies, coupler directivity, insertion losses, backscattering and other non-ideal characteristics of the system.

Measuring the Reflected Power from a Component with Known Reflection Factor

First, attach a component with a known reflection factor in place of the DUT, and measure the power reflected. This is our reflection reference.

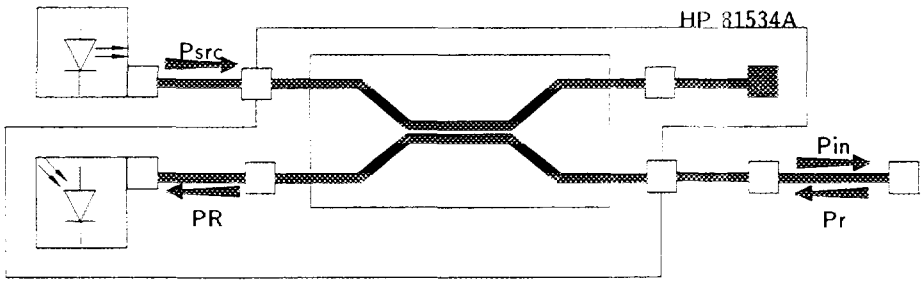

Figure 2-9.
Measuring the Power from a Component with Known Reflection Factor

This measured power from the reflection reference is called P_R. The reflection factor for the component is called R_R. Normally the return loss for the component (RL_R) is specified, but these values are related:

$$RL_R = -10 \log R_R$$

Measuring the Power when there are No Reflections

Next, terminate the cable so that there are no reflections from the end. All the power measured by the sensor now, is due to the non-ideal nature of the measurement system. This is our termination parameter.

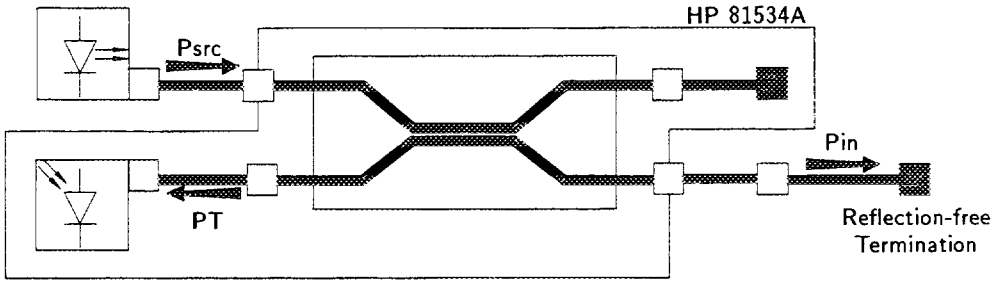

Figure 2-10. Measuring the Power with the Connector Terminated

This measured power for the termination parameter is called P_T.

Using our Measured Powers to get an Equation in Known Terms

The reflected power, measured by the instrument, from the component with the known reflection factor (P_R), is given by the sum of

- the part of the power, reflected by the component, which is transmitted through the coupler, and
- the reflections due to the measurement system.

That is:

$$P_R = kP_r + P_T \quad (1)$$

The constant k is a multiplier giving the proportion of power transmitted through the coupler from the DUT port to the sensor port. In other words, when optical power is input at the DUT port, k times that power is output at the sensor port. It is not necessary to know the value for this constant, it can be eliminated later.

Here, the value for the reflection factor of the component is known. The power reflected by the component is given by multiplying the incident power by the reflection factor. That is:

$$P_r = P_{in}R_R$$

By substituting this into equation number (1) it eliminates the value for the power reflected at the component, which cannot be measured directly. It does introduce another power that cannot be measured directly (the power incident on the component). This value is constant for the measurement system and can be eliminated later.

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The HP 81534A in Menu Mode

The HP 81534A acts like any other sensor module when operating in menu mode with one exception.

- It is not possible to run the Loss application using the HP 81534A.

Note

As with other sensor modules, it is only possible to set the parameters for the module in measure mode. In particular, for the HP 81534A, this means setting the CAL REF (reflection reference) and REF AUX (termination parameter) before changing to menu mode to run an application.

On printouts and plots, when you are using the HP 81534A, the meanings of the parameters are slightly altered.

- The Cal Factor refers to the CAL REF (reflection reference).
- The Reference refers to the REF AUX (termination parameter).

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The HP 81534A HP-IB Commands

The HP 81534A uses all the HP 8153A mainframe HP-IB commands and some HP 8153A sensor commands. The mainframe commands are: the common commands, the status commands, the DISPlay commands, and the SYSTem commands. These mainframe commands are not described here.

Note

The operation of some HP 81534A sensor commands and queries is slightly different from the same commands and queries on the HP 8153A. In particular, the SENSe:POWer:REFerence:STATe command performs a different function.

ABORt Commands

This command relates to the triggering of sensor modules.

Table 8-1. ABORt Command Summary

Command	Parameter
ABORt[1|2]	

Specifying the Channel

You specify the channel by attaching a numeric suffix to the mnemonic. You access channel A by using `ABORt1`, you access channel B by using `ABORt2`. If do not add a suffix to the mnemonic, channel A is assumed.

ABORt

Syntax

ABORt[1|2]

8

Description

This command aborts the measurement you are making.

Related Commands

INIT:IMM, INIT:CONT, INIT:CONT?

Example

```
OUTPUT 722;"ABOR"
```

FETCh Commands

This command relates to measuring signals with the sensor modules.

Table 8-2. FETCh Command Summary

Command	Parameter
FETCh[1|2]	
[:SCALar]	
:POWER	
[:DC]?	

Specifying the Channel

You specify the channel by attaching a numeric suffix to the FETCh mnemonic. You access channel A by using FETCh1, you access channel B by using FETCh2. If you do not add a suffix to the mnemonic, channel A is assumed.

FETCh[:SCALar]:POWer[:DC]

Syntax

FETCh[1|2][:SCALar]:POWer[:DC]?

Response

<value>

Description

This command gets a reading from the module. It does not provide it's own triggering and so must be used with either a continuous or a preceding immediate trigger. The value read back is a floating point number in exponential number (NR3). The units of the number read back are dB.

For the effect of the choice of averaging time, see "FETCh Commands" in Chapter 8 of the HP 8153A mainframe manual.

Related Commands

READ:SCAL:POW:DC?, SENS:POW:REF:STAT, SENS:POW:REF:STAT?, INIT:IMM, INIT:CONT, INIT:CONT?

Example

```
OUTPUT 722;"FETC:POW?"
ENTER 722;A$
```

INITiate Commands

This command relates to the triggering of sensor modules.

Table 8-3. INITiate Command Summary

Command	Parameter
INITiate[1|2]	
:CONTinuous	<boolean>
:CONTinuous?	
[:IMMediate]	

Specifying the Channel

You specify the channel by attaching a numeric suffix to the mnemonic. You access channel A by using INITiate1, you access channel B by using or INITiate2. If you do not add a suffix to the mnemonic, channel A is assumed.

INITiate:CONTinuous

Syntax

INITiate[1|2]:CONTinuous'' <wsp><boolean>

Description

This command initiates the trigger system for continuous trigger operation, that is, measurements are made continuously.

Related Commands

ABOR, INIT:IMM, INIT:CONT?

Example

```
OUTPUT 722;"INIT1:CONT OFF"
```

INITiate:CONTinuous?

Syntax

INITiate[1|2]:CONTinuous?''

8

Response

<boolean>

Description

This command returns whether the triggering system is operating continuously or not. The status is returned as either 0 or 1. 0 means that continuous triggering is not selected. 1 means that continuous triggering is selected.

Related Commands

ABOR, INIT:IMM, INIT:CONT

Example

```
OUTPUT 722;"INIT:CONT?"
ENTER 722;A$
```

INITiate[:IMMediate]

Syntax

INITiate[1|2][:IMMediate]''

Description

This command initiates the trigger system and completes one full trigger cycle, that is, one measurement is made.

Related Commands

ABOR, INIT:CONT, INIT:CONT

Example

```
OUTPUT 722;"INIT2"
```

READ Commands

These commands relate to measuring signals with the sensor modules.

Table 8-4. READ Command Summary

Command	Parameter
READ[1|2]	
[:SCALar]	
:POWER	
[:DC]?	

Specifying the Channel

You specify the channel by attaching a numeric suffix to the or READ mnemonic. You access channel A by using READ1, you access channel B by using READ2. If you do not add a suffix to the mnemonic, channel A is assumed.

READ[:SCALar]:POWer[:DC]

Syntax

READ[1|2][:SCALar]:POWer[:DC]?

Response

<value>

Description

This command gets a reading from the module. This command provides it's own triggering and does not need a triggering command. The value read back is a floating point number in exponential number (NR3). The units of the number read back depend on whether the absolute or relative measurement mode is being used, and which units have been selected. The possible units are Watts, dBm, or dB.

Each new measurement is available after the averaging time.

Related Commands

FETC:SCAL:POW:DC?, INIT, INIT:CONT, INIT:CONT?, SENS:POW:REF:STAT, SENS:POW:REF:STAT?

Example

```
OUTPUT 722;"READ:POW?"
ENTER 722;A$
```

SENSe Commands

Sense commands include most of the functions for setting up and using the module.

Table 8-5. SENSe Command Summary

Command	Parameter	Note
SENSe[1|2]		
:CORRection		
:COLLect		
:ZERO		
:ZERO?		
[:LOSS		
[:INPut		
[:MAGNitude]]]	<value>	cal factor
[:MAGNitude]]]?		cal factor
:POWer		
:ATIME	<value>[<unit>]	
:ATIME?		
:RANGe		
:AUTO?		
[:UPPER]?		
:REFerence?	TOREF|2	
:STATe	<boolean>	
:WAVElength	<value>[<unit>]	
:WAVElength?		

Specifying the Channel

You specify the channel by attaching a numeric suffix to the SENSe mnemonic. You access channel A by using SENSe1, and channel B by using SENSe2. If you do not add a suffix to the mnemonic, channel A is assumed.

SENSe:CORRection:COLLect:ZERO

Syntax

SENSe[1|2]:CORRection:COLLect:ZERO''

8

Description

This command zeros the electrical offsets for the module.

Related Commands

SENS:CORR:COLL:ZERO?

Example

```
OUTPUT 722;"SENS2:CORR:COLL:ZERO"
```

SENSe:CORRection:COLLect:ZERO?

Syntax

SENSe[1|2]:CORRection:COLLect:ZERO?''

Response

<value>

Description

This command returns the status of the most recent zero command. 0 means that the zero succeeded without errors. 1 means that no remote zeroing operation has been performed. Any other value means that the remote zeroing failed, the value is the error code returned from the zero operation. The error codes are listed in Appendix I of the HP 8153A mainframe manual.

Related Commands

SENS:CORR:COLL:ZERO

Example

```
OUTPUT 722;"SENS2:CORR:COLL:ZERO?"
ENTER 722;A$
```

SENSe:CORRection[:LOSS[:INPut[:MAGNitude]]]

Syntax

SENSe[1|2]:CORRection''[:LOSS[:INPut[:MAGNitude]]] <wsp><value>[<unit>]

0dB ≤ value ≤ +99.99dB

unit is DB

Description

This command enters the value of the known return loss for the reflection reference. The value is a floating point number (NRf). The units are dB.

Related Commands

SENS:CORR:COLL:LOSS:INP:MAGN?

Example

```
OUTPUT 722;"SENS2:CORR:COLL:LOSS:INP:MAGN 10DB"
```

SENSe:CORRection[:LOSS[:INPut[:MAGNitude]]]?

Syntax

SENSe[1|2]:CORRection''[:LOSS[:INPut[:MAGNitude]]]?

Response

<value>

Description

This command returns the value of the known return loss for the reflection reference. The value is returned as a floating point number (NR3) in dB. No units are returned in the response message.

Related Commands

SENS:CORR:COLL:LOSS:INP:MAGN

SENSe:CORRection[:LOSS[:INPut[:MAGNitude]]]?

Example

```
OUTPUT 722;"SENS2:CORR:COLL:LOSS:INP:MAGN?"
ENTER 722;A$
```

SENSe:POWer:ATIME

Syntax

SENSe[1|2]:POWer:ATIME'' <wsp><value>[<unit>]

20ms ≤ value ≤ 3600s

unit is S|MS

Description

This command sets the averaging time for the module. The input power-level is read and averaged over this period. You specify the averaging time as a floating point number (NRf). Units can be attached, either seconds or milliseconds can be specified. Seconds are the units used if you do not specify units.

Related Commands

SENS:POW:ATIME?

Example

```
OUTPUT 722;"SENS:POW:ATIME 200MS"
```

SENSe:POWer:ATIME?

Syntax

SENSe[1|2]:POWer:ATIME?''

Response

<value>

20ms ≤ value ≤ 3600s

Description

This command returns the setting for the averaging time for the module. The averaging time is returned as a number in exponential number (NR3). The returned value is in seconds. No units are returned in the response message.

Related Commands

SENS:POW:ATIME

Example

```
OUTPUT 722;"SENS2:POW:ATIME?"
ENTER 722;A$
```

SENSe:POWer:RANGe:AUTO?

Syntax

SENSe[1|2]:POWer:RANGe:AUTO?''

Response

<boolean>

Description

This command returns 1, to indicate that automatic power ranging is being used by the module.

Related Commands

SENS:POW:RANG:UPPER?

Example

```
OUTPUT 722;"SENS2:POW:RANG:AUTO?"
ENTER 722;A$
```

SENSe:POWer:RANGe[:UPPER]?

Syntax

SENSe[1|2]:POWer:RANGe[:UPPER]?''

SENSe:POWer:RANGe[:UPPER]?

Response

<value>

-110dBm ≤ value ≤ +30dBm

Description

8

This command returns the range setting for the module. The range is returned as a signed integer (NR1). The returned value is in dBm. No units are returned in the response message.

Related Commands

SENS:POW:RANG:AUTO?

Example

```
OUTPUT 722;"SENS1:POW:RANG:UPPER?"
ENTER 722;A$
```

SENSe:POWer:REFerence?

Syntax

SENSe[1|2]:POWer:REFerence?" <wsp>TOREF|2

Response

<value>

value ≤ +230dB

Description

This command returns the level that is set for the termination parameter (the reflections with the output terminated reflection-free). The parameter is returned as a floating point number in exponential number (NR3). The returned value is in dB. No units are returned in the response message.

Related Commands

SENS:POW:REF, SENS:POW:REF:STATE

Example

```
OUTPUT 722;"SENS1:POW:REF? TOREF"
ENTER 722;A$
```

SENSe:POWer:REFerence:STATe

Syntax

SENSe[1|2]:POWer:REFerence:STATe'' <wsp><boolean>

Description

This command takes the reference measurements for the reflection reference, and the termination parameter. The reference is specified by a boolean. OFF, or 0, takes the parameter for the reflection-free termination. ON, or any non-zero value, takes the reading for the reflection reference.

Related Commands

SENS:POW:REF?, SENS:CORR:COLL:LOSS:INP:MAGN,
SENS:CORR:COLL:LOSS:INP:MAGN?

Example

```
OUTPUT 722;"SENS1:POW:REF:STATE ON"
```

SENSe:POWer:WAVElength

Syntax

SENSe[1|2]:POWer:WAVElength'' <wsp><value>[<unit>]

850nm $\leq$ value $\leq$ 1700nm.

unit is NM|UM|M

Description

This command sets the wavelength for this module. You specify the wavelength as a floating point number (NRf). The units can be nanometers, micrometers or meters. Meters are the units used if you do not specify units.

Related Commands

SENS:POW:WAVE?

Example

```
OUTPUT 722;"SENS2:POW:WAVE 1310NM"
```

8

SENSe:POWer:WAVElength?

Syntax

SENSe[1|2]:POWer:WAVElength?''

Response

<value>

850nm $\leq$ value $\leq$ 1700nm

Description

This command returns the wavelength setting for the module. The result is returned as a floating point number in exponential number (NR3). The returned value is in meters. No units are returned in the response message.

Related Commands

SENS:POW:WAVE

Example

```
OUTPUT 722;"SENS2:POW:WAVE?"
ENTER 722;A$
```

HP 81534A Accessories

Besides the full range of accessories listed for the HP 8153A, there are some additional accessories that have been developed for use with the HP 81534A Return Loss Module.

Reference Reflector

Model No.	Description
HP 81000BR	Reference Reflector

High Return-Loss Patchcords

Model No.	Description
HP 81102AC	Diamond HMS-10/HP/HRL - Diamond HMS-10/HP/HRL
HP 81102BC	Diamond HMS-10/HP/HRL - Bare Fiber
HP 81102DC	Diamond HMS-10/HP/HRL - Radiall
HP 81102PC	Diamond HMS-10/HP/HRL - FC/APC
HP 81102SC	Diamond HMS-10/HP/HRL - DIN/HRL-10
HP 81109AC	Diamond HMS-10/HP/HRL - Diamond HMS-10/HP

The Diamond HMS-10/HP/HRL connector on these cables has an orange sleeve.

Through Adapters

Model No.	Description
HP 81000UM	Universal Through Adapter

You can screw the through-adapter onto any of the 81000xI connector interfaces. It enables the mating of a Diamond HMS-10/HP connector to Diamond HMS-10/HP, PC, DIN, Biconic, ST, D4, or SC.

HP 81534A Specifications

Specifications describe the instrument's warranted performance. Supplementary performance characteristics describe the instrument's non-warranted typical performance.

Because of the modular nature of the instrument, these performance specifications apply only to this module. You should insert these pages into the appropriate section of the manual.

HP 81534A Specifications

	Standard Version (Connector Output)	Option 001 (Pigtail Output)
Sensor Element	InGaAs	
Wavelength range	1250-1600nm	
Dynamic range[1]	60dB	65dB
Applicable fiber type	9/125μm	
Relative Uncertainty[2][3]	≤±0.25dB (0dB to 50dB) ≤±0.50dB (50dB to 60dB)	≤±0.25dB (0dB to 55dB) ≤±0.50dB (55dB to 65dB)
Total Uncertainty[2][4]	≤±0.40dB (0dB to 50dB) ≤±0.65dB (50dB to 60dB)	≤±0.40dB (0dB to 55dB) ≤±0.65dB (55dB to 65dB)
Dimensions	75mm H, 32mm W, 335mm D(2.8"×1.3"×13.2")	
Weight	net 0.6kg (1.3lbs), shipping 1kg (2.2lbs)	
Recalibration period	1 year	1 year[5]
Warmup time	5 min.	

[1] Measured with source output power of 0dBm.

[2] Measured using an HP 81552SM, HP 81553SM, or HP 81554SM module, an HP 8155A or equivalent laser source

[3] Due to the polarization sensitivity of the coupler. With a mechanically stable setup this can typically be reduced to $\leq \pm 0.05$dB.

[4] Includes relative uncertainty, uncertainty of reference reflector (HP 81000BR or cleaved fiber end) and linearity.

[5] When you are returning a HP 81534A Option 001, make sure to attach a representative connector, or a 1m length of working fiber to the end of the pigtail fiber.

HP 81534A Functional Test

The procedures in this section test the functionality of the instrument. The complete specification to which the HP 81534A is tested are given in Appendix C. All tests can be performed without access to the interior of the instrument. Where not otherwise specified, the test equipment given corresponds to tests carried out with Diamond HMS-10/HP connectors.

Equipment Required

Equipment required for the functional test is listed in the table. Any equipment that satisfies the critical specifications of the equipment given in the table, may be substituted for the recommended models.

Instrument/Accessory	Recommended Model
Multimeter Mainframe	HP 8153A
CW Laser Source	HP 81552SM, HP 81553SM or HP 81554SM or HP 8155A
Power Meter	HP 8153A with HP 81531A, HP 81532A, or HP 81536A
Connector Interface	HP 81000AI 2ea (08154-61701)
Single Mode Fiber	HP 81101AC
Cleaning Kit	HP 15475A

In addition, if you are testing the standard module, and not the Option 001 (pigtailed) module, you also need

Instrument/Accessory	Recommended Model
Optical Attenuator	HP 8158B Opt.002/011, or HP 8157A
Reference Reflector	HP 81000BR
Connector Adapter	HP 81000UM
Connector Interface	HP 81000AI 2ea (08154-61701)
Single Mode Fiber	HP 81109AC (Diamond HMS-10/HP/HRL)
Plastic Cap	5040-9351 2ea

In addition, if you are testing the Option 001 (pigtailed) module, you also need

Instrument/Accessory	Recommended Model
Optical Fiber Jacket Remover	Sumitomo Electric JR-1 Jacket Remover
Optical Fiber Cleaver	Fujikura CT-03 High Precision Fiber Cleaver AND/OR Drukker International 5290 Fiber Optic Cleaving Knife
Coating Remover	RXS Schrumpftechnik-Garnituren GmbH V26824-B408-V14 Präzisions-Absetzwerkzeug
Connector Adapter	HP 81000UM
Connector Interface	HP 81000AI 2ea (08154-61701)
Single Mode Fiber	HP 81109AC (Diamond HMS-10/HP/HRL)
Plastic Cap	5040-9351 2ea

Test Record

Results of the functional test may be tabulated on the Test Record provided after the test procedures. It is recommended that you fill out the Test Record and refer to it while doing the test. Since the test limits and setup information are printed on the Test Record for easy reference, you can also use the record as an abbreviated test procedure (if you are already familiar with the test procedures). You can also use the test record as a permanent record and may be reproduced without written permission from Hewlett-Packard.

Test Failure

If the HP 81534A fails any functional test, return the instrument to the nearest Hewlett-Packard Sales/Service Office for repair.

When you are returning a HP 81534A Option 001, make sure to attach a representative connector, or a 1m length of working fiber to the end of the pigtail fiber.

Instrument Specification

Specifications are the performance characteristics of the instrument that are certified. These specifications, listed in Appendix C, are the performance standards or limits against which the HP 81534A can be tested. Appendix C also lists some supplemental characteristics of the HP 81534A. Supplemental characteristics should be considered as additional information.

Any changes in the specifications due to manufacturing changes, design, or traceability to the National Institute of Standards and Technology, are covered in a manual change supplement, or revised manual. Such specifications supersede any that were previously published.

Functional Test (Standard Module)

Note

Make sure that all optical connections of the test setups given in the procedure are dry and clean. DO NOT USE IMMERSION OIL (see the cleaning procedure with the cleaning kit).

The optical cables from the laser source to and from the HP 8158B Attenuator to the power meter must be fixed on the table to ensure minimum cable movement during the tests.

Caution

Do not connect the HP 81000BR Reference Reflector directly to the HP 81534A Module.

D

I. Parasitic Reflection Test

1. Make sure that all the connectors are clean.
2. Connect the output cable of the laser source to the power meter.
3. Enable the source and set the output power to approximately 0dBm (use the ATT parameter, or an attenuator if required).
4. Set up the instrument as shown in the figure. Connect the source to the HP 81534A Input. Atach the high return loss connector of the patchcord to the Output. The high return loss connector is the connector with the orange

sleeve. For best results and higher repeatability, fix the cables so that they do not move.

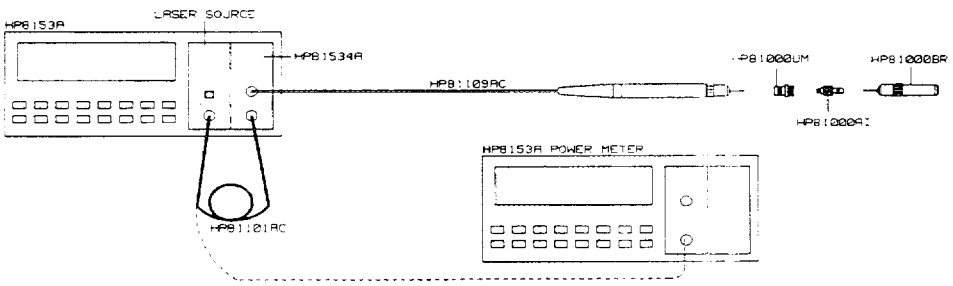

Figure D-1. Parasitic Reflection Test Setup

5. Make sure the instrument has warmed up. Select the channel of the HP 81534A with (Chan)
6. Make sure that the source is inactive and that you have covered the end of the patchcord. Press (Zero) to remove electrical offsets in the instrument.
7. Press (Param) to select the T parameter (the measurement averaging time). Set the averaging time to 1s.
8. Press (Param) to select the λ parameter. Edit this parameter so that you set it to the actual wavelength of the source.
9. Enable the source.
10. Press (Param) to select the CAL REF parameter. Set the calibration reference to 0.18dB
11. Press (Disp→Ref). The instrument measures the power reflected by the reference reflector.
12. Press (Param) to select the REF AUX parameter. T: is displayed at the side of the character field.
13. Terminate the cable so that there are no reflections coming from the end. You can do this by wrapping the fiber five times around the shaft of a screwdriver (or some similar object with a diameter of around 5mm).
14. Press (Disp→Ref). The instrument measures the termination reference, and sets the parameter. Make sure that the display shows a value >55dB.

II. Dynamic Range Test

15. Terminate the cable as described in step 13 again. Check that the HP 8153A displays >60dB.

III. Relative Uncertainty Test

1. Connect the equipment as shown in the figure below.

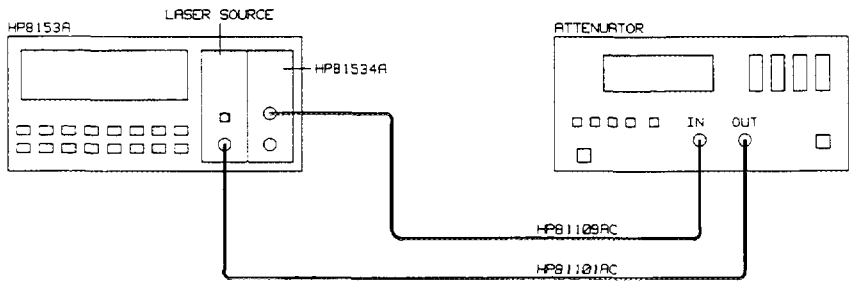

Figure D-2. Relative Uncertainty Test Setup

2. Set the attenuator so that approximately 40dB is displayed on the HP 8153A.
3. Press (Menu) and then (Record) to select the logging application.
4. Press (Edit) and set the number of samples to 50.
5. Press (Edit) again, and then (Execute)
6. Without bending it, move the HP 81109AC cable slightly while the instrument is sampling. The HP 81109AC cable is the cable connecting the HP 81534A output to the attenuator.
7. Press (More) to select the show application. Press (Edit) and then (Next) to select the DIFF parameter. Make sure that the difference is <0.25dB.
8. Repeat steps 2 to 7, with the attenuator set for 55dB on the display of the HP 8153A and check for a relative uncertainty of <0.5dB.

Functional Test (Option 001)

Note

Make sure that all optical connections of the test setups given in the procedure are dry and clean. DO NOT USE IMMERSION OIL (see the cleaning procedure with the cleaning kit).

Opt.001

It is strongly recommended that you attach a connector or a working fiber to the end of the pigtail so that you can avoid cutting the pigtail as much as possible. (The replacement of the pigtail fiber is not covered by the warranty for the instrument.)

I. Parasitic Reflection Test

1. Make sure that all the connectors are clean.
2. Connect the output cable of the laser source to the power meter.
3. Enable the source and set the output power to HP 81534A approximately 0dBm.
4. Set up the instrument as shown in the figure. Connect the source to the HP 81534A Input. For best results and higher repeatability, fix the cables so that they do not move.

D

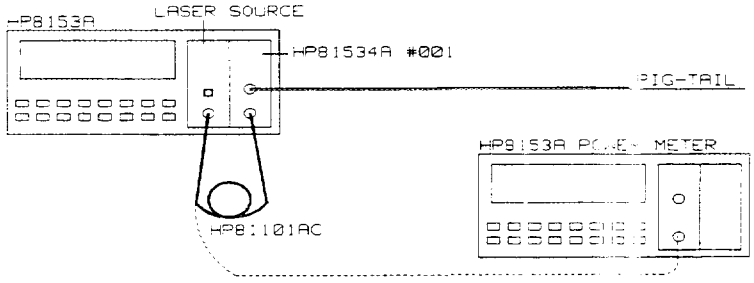

Figure D-3. Parasitic Reflection Test Setup

5. Make sure the instrument has warmed up. Select the channel of the HP 81534A with (Chan)
6. Make sure that the source is inactive and that you have covered the end of the patchcord. Press (Zero) to remove electrical offsets in the instrument.

7. Press (Param) to select the T parameter (the measurement averaging time). Set the averaging time to 1s.
8. Press (Param) to select the λ parameter. Edit this parameter to set it to the actual wavelength of the source.
9. Enable the source.
10. Press (Param) to select the CAL REF parameter. Set the calibration reference to -14.6dB
11. Press (Disp→Ref). The instrument measures the power reflected by the reference reflector.
12. Press (Param) to select the REF AUX parameter. T: is displayed at the side of the character field.
13. Terminate the cable so that there are no reflections coming from the end. You can do this by wrapping the fiber five times around the shaft of a screwdriver (or some similar object with a diameter of around 5mm). Make the termination close to the module (within 20cm of the Output).
14. Press (Disp→Ref). The instrument measures the termination reference, and sets the parameter. Make sure that the display shows a value >60dB.

    The cleave has a great effect on this measurement. It may be necessary to cleave the fiber more than once to get the performance.

II. Dynamic Range Test

15. Terminate the cable as described in step 13 again. Check that the HP 8153A displays >65dB.

III. Relative Uncertainty Test

1. Connect the equipment as shown in the figure below.

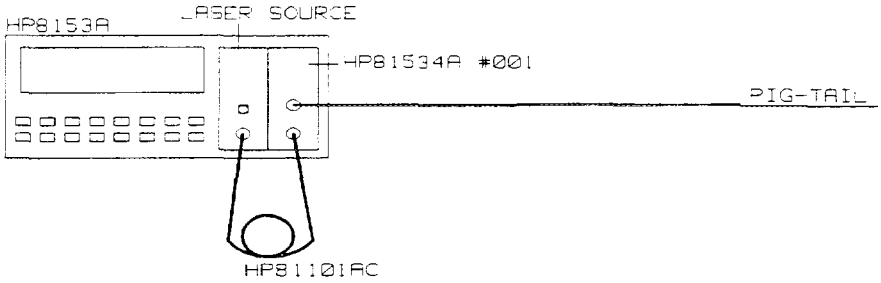

Figure D-4. Relative Uncertainty Test Setup

2. Make sure that you have a good clean cleave. Fix the end of the pigtail fiber so that it cannot move.
3. Press (Menu) and then (Record) to select the logging application.
4. Press (Edit) and set the number of samples to 50.
5. Press (Edit) again, and then (Execute)
6. Without bending it, move the pigtail fiber slightly while the instrument is sampling.
7. Press (More) to select the show application. Press (Edit) and then (Next) to select the DIFF parameter. Make sure that the difference is <0.5dB.

D

Test Record for the HP 81534A

Test Facility:

_____	Report No. _____
_____	Date _____
_____	Customer _____
_____	Tested By _____

Model HP 81534A Return Loss Module

Serial No.	_____	Ambient temperature	_____ °C
Options	_____	Relative humidity	_____ %
Firmware Rev.	_____	Line frequency	_____ Hz

D

Special Notes:

_____

_____

_____

_____

_____

_____

_____

Test Equipment Used:

	Description	Model No.	Serial No.
1.	Lightwave Multimeter	HP 8153A	_____
2a.	CW Laser Source Module	HP 81552SM	_____
2b.	CW Laser Source Module	HP 81553SM	_____
2c.	CW Laser Source Module	HP 81554SM	_____
2d.	CW Laser Source	HP 8155A	_____
3a.	Sensor Module	HP 81532A	_____
3b.	Sensor Module	HP 81534A	_____
3c.	Sensor Module	HP 81536A	_____
D 4a.*	Optical Attenuator	HP 8158B Opt.002	_____
4b.*	Optical Attenuator	HP 8157A	_____
5.*	Reference Reflector	HP 81000BR	_____
6.	Connector Interface	HP 81000AI	_____
7.*	Connector Adapter	HP 81000UM	_____
8.*	Singlemode Fiber	HP 81101AC	_____
9.	Singlemode Fiber Diamond HMS-10/HP/HRL	HP 81109AC	_____
10.	_____	_____	_____
11.	_____	_____	_____

*Not required for Option 001.

Test Record for the HP 81534A

Model HP 81534A Return Loss Module No. _____ Date _____

Test No.	Test Description	Minimum Spec.	Result	Maximum Spec.	
I.	**Parasitic Reflections**		dB		
		55dB	_____		
II.	**Dynamic Range**		dB		
		60dB	_____		
III.	**Relative Uncertainty**		dB		
	at 40dB		_____	0.25dB	
	at 55dB		_____	0.5dB	

D

Test Record for the HP 81534A Option 001

Model HP 81534A Return Loss Module No. _____ Date _____

Test No.	Test Description	Minimum Spec.	Result	Maximum Spec.	
I.	**Parasitic Reflections**		dB		
		60dB	_____		
II.	**Dynamic Range**		dB		
		65dB	_____		
III.	**Relative Uncertainty**		dB		
	at 14.6dB		_____	0.5dB	

D