N1911A/N1912A P-Series Power Meters

KEYSIGHT

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Notices

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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 Standard and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standard Organization members

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Equipment Operation

Personal safety considerations

This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited. If this instrument is not used as specified, the protection provided by the equipment could be impaired. This instrument must be used in a normal condition (in which all means of protection are intact) only.

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers. For continued protection against fire hazard, replace the line fuse(s) only with fuses of the same type and rating (for example, normal blow, time delay, etc.). The use of other fuses or material is prohibited.

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.

	Caution, risk of danger (refer to this manual for specific Warning or Caution information)		Alternating current (AC)
	This symbol indicates the operating switch for 'Stand-by' mode. Note, the instrument is NOT isolated from the mains when the switch is pressed. To isolate the instrument, the mains coupler (mains input cord) should be removed from the power supply.		Direct current (DC)
	Both direct and alternating current		Three-phase alternating current
	Earth (ground) terminal		Protective earth (ground) terminal
	Frame or chassis (ground) terminal		Equipotentiality
	On (mains supply)		Off (mains supply)
	Equipment protected throughout by double insulation or reinforced insulation		Caution, risk of electric shock
	Caution, hot surface		In position of a bi-stable push control
	Out position of a bi-stable push control		

General 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 for 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 this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

CAUTION Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

Recommended Calibration Interval

Keysight Technologies recommends a two years calibration cycle for the N1911A and N1912A P-Series power meter.

Environmental Conditions

This instrument is designed for indoor use. The table below shows the general environmental requirements for this instrument.

Environmental condition	Requirement
Temperature	Operating condition – 0 °C to 55 °C Storage condition – –40 °C to 70 °C
Humidity	Operating condition – Up to 95% RH at 40 °C (non-condensing) Storage condition – Up to 90% RH at 65 °C (non-condensing)
Altitude	Up to 3000 m
Pollution degree	2

Regulatory Information

The N1911A/1912A P-Series power meters comply with the following safety and Electromagnetic Compatibility (EMC) compliances:

Safety compliance

- IEC 61010-1:2010/EN 61010-1:2010 (3rd Edition)
- Canada: CAN/CSA-C22.2 No. 61010-1-12
- USA: ANSI/UL 61010-1 (3rd Edition)

EMC compliance

- IEC 61326-1:2005/EN 61326-1:2006
- CISPR11:2003/EN 55011:2007, Group 1 Class A
- Canada: ICES/NMB-001:Issue 4, June 2006
- Australia/New Zealand: AS/NZS CISPR 11:2004

Regulatory Markings

	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives. 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. ISM GRP.1 Class A indicates that this is an Industrial Scientific and Medical Group 1 Class A product.		The CSA mark is a registered trademark of the Canadian Standards Association.
	This symbol is a South Korean Class A EMC Declaration. This is a Class A instrument suitable for professional use and in electromagnetic environment outside of the home.		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.		This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instrument complies with the WEEE Directive (2002/96/EC) 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/powermeter
  (product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
  (worldwide contact information for repair and service)

Table of Contents

List of Figures

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1 Specifications

This chapter provides the power meter's specifications.

Specifications and Characteristics

For the characteristics and specifications of the N1911A/1912A, refer to the data sheet at http://literature.cdn.keysight.com/litweb/pdf/5989-2471EN.pdf.

2 Performance Tests

This chapter contains procedures which allow you to test the power meter's electrical performance to its specifications.

Introduction

The performance tests described in this chapter test the power meter's electrical performance against the specifications detailed in Chapter 1. They are used for incoming inspection, the calibration cycle (also called periodic maintenance), or after repairs have been made.

NOTE

- This document does not provide a complete breakdown for these tests; it only gives a brief overview of each, in line with Keysight's recommendation that the Keysight N7832A calibration software should be used at all times.
- Performance testing is limited to the measurement and verification of warranted specifications.
- Some tests cannot be performed manually, and so the N7832A calibration software is essential.
- Measurement uncertainty will not be addressed in this document (this is handled by the N7832A software).

The following performance tests are described in this chapter:

- 1 mW Power Reference Level Test
- Output Standing Wave Ratio (SWR) Test (Power Reference Output)
- Time Base Frequency Accuracy
- Zero Set (Average Path)
- Zero Set (Peak Path)
- Linearity (Average Path)
- Linearity (Peak Path)
- Rise/Fall Time (Peak Path)

Complete Equipment List

Instrument	Critical specifications	Recommended Keysight model number	Alternative Keysight model number
Analyzers			
Network analyzer		N3383A	N3381A N3382A 8753ES/ET
Counters			
Universal counter	Frequency: 10 MHz Gate time: 10 seconds	53132A	53131A
Meters			
Power meter	Dual channel Absolute accuracy: ±0.5% Power reference accuracy: ±0.9% – (a best capability measurement is required for the Power Reference Output – the power level must be accurately measured, and the uncertainty of this measurement must also be known)	E4419B	E4419A
Power sensor 2 required	Frequency: 50 MHz Amplitude range: –70 dBm to –20 dBm SWR: ≤1.15 at 50 MHz	8481D	
Power sensor	Frequency: 50 MHz Amplitude range: –30 dBm to +20 dBm SWR: ≤1.1 at 50 MHz	8482A	

Instrument	Critical specifications	Recommended Keysight model number	Alternative Keysight model number
Attenuators			
20 dB fixed attenuator	Type-N (m,f)	8491A (Option 020)	
30 dB fixed attenuator	Type-N (m,f)	11708A	
Miscellaneous devices			
10 MHz frequency standard			
Pulse/data generator 81131A output modules required		81130A	
Power splitter required	Frequency: DC to 6 GHz Insertion loss: 6 to 7 dB, ≤3 GHz SWR: <1.1 10 MHz to 2 GHz <1.3 2 GHz to 3 GHz	11667A (Option 001)	
BNC cable	Frequency: DC to 10 GHz 50 Ω coax BNC (m), both ends 120 cm (48 in)	10503A	
Calibration test cable required for N1912A		N1912-61017	
Sensor cable required		11730A	
N-Type calibration kit		85032B	
Assorted accessories (cables and adapters) required			

1 mW Power Reference Level Test

Description

The 1 mW power reference is used for the calibration of 8480 Series, N8480 Series and E-Series power sensors, and is traceable to national standards. This test uses an 8482A power sensor to transfer the power measured on an accurately calibrated E4419B or E4417A power meter to the DUT reference.

Equipment

- Required test equipment:

  1 unit of E4419B or E4417A dual channel power meter

  1 unit of 8482A power sensor

  11730A power sensor cable

- Either of these E4419B or E4417A power meters can be used. This specific power sensor model must be used.

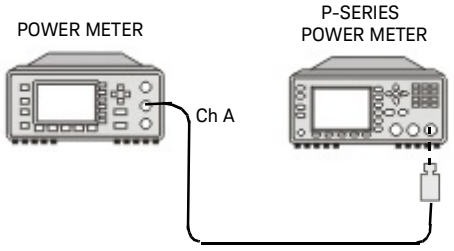

Figure 2-1 1 mW power reference level test setup connection diagram

NOTE For rear panel options, the connections will differ from the illustration shown here. Refer to the connector identification markings on the rear panel for further details

Test method

1. Enter the recorded measurement uncertainty of the E4419B or E4417A 1 mW power reference
2. Using the E4419B or E4417A power meter and the 8482A sensor, measure the 1mW power reference of the E4419B or E4417A
3. Using the E4419B or E4417A power meter and the 8482A sensor, measure the 1 mW power reference of the DUT
4. Using all of these values, the N7832A software will calculate the power reference level of the DUT

NOTE

- The 1 mW reference of the E4419B or E4417A power meter must be precisely calibrated at a standards accredited lab, and the uncertainty of this measurement known.
- Anyone who has a basic understanding of metrology should be able to perform this test manually; it is simply the transfer of known power level with a known calibration uncertainty to the DUT.

Output Standing Wave Ratio (SWR) Test

Description

Connector mismatch is the largest single contributor to measurement uncertainty, so this specification must be warranted to provide assurance of instrument accuracy. The 1 mW power reference level test must be carried out prior to this test, as the VSWR specification is only valid at 1 mW. This test measures VSWR by equating relative powers (measured by the test system power meter and its sensors) when the power reference is exercised under different load conditions.

Equipment

- Required test equipment:

  1 unit of 8753ES/ET network analyzer

  1 unit of 85032B Type N calibration kit

  1 unit of E4419B or E4417A dual channel power meter

  2 unit of 8481D power sensor

  2 unit of 11667A #001 power splitter

  1 unit of 20 dB pad, male to female (e.g. 8491A)

  1 unit of 30 dB pad (e.g. 11708A reference attenuator)

  2 unit of 11730A power sensor cable
- An alternative network analyzer can be used, as long as it can measure S11 in the 45 MHz-55 MHz range
- Either of these E4419B or E4417A power meters can be used
- These specific models of power sensors and power splitters must be used
- Any type of pad can be used (as long as there are no additional mating connections, or differing pad values)
- 1 unit of 11667A, 1 unit of 8481D and the 30 dB pad combine to create the ‘Calibration System’
- 1 unit of 11667A, 1 unit of 8481D and the 20 dB pad combine to create the ‘Measurement System’

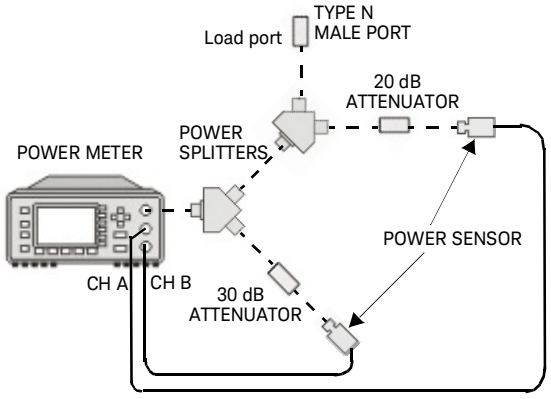

Figure 2-2 System calibration connection diagram

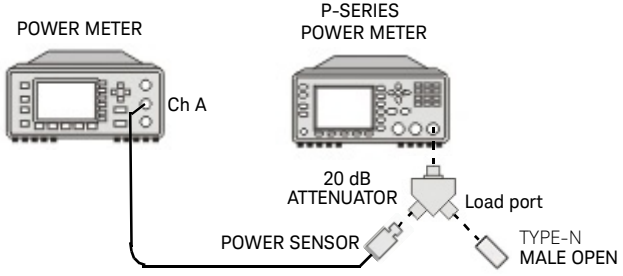

Figure 2-3 Output SWR test setup - open connection diagram

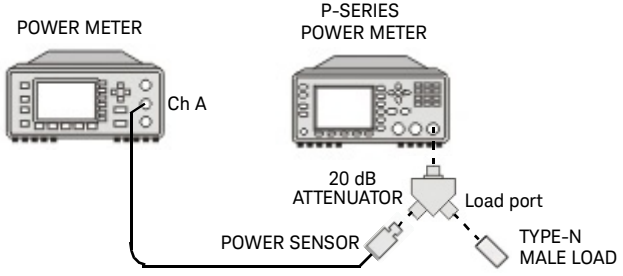

Figure 2-4 Output SWR test setup - load connection diagram

NOTE For rear panel options, the connections will differ from the illustration shown here. Refer to the connector identification markings on the rear panel for further details.

Test method

1. Obtain the S11 parameter of the calibration system.
2. Connect the measurement system to the calibration system and obtain its S21 (load) and S21 (open) parameters.
3. Using only the measurement system, terminated with the OPEN connector from the 85032B calibration kit, measure the 1 mW power reference level of the DUT.
4. Remove the OPEN connector from the measurement system, terminate it with the 50 R load from the 85032B calibration kit, and repeat the 1 mW power reference level measurement.
5. Using all of these values, the N7832A software will calculate the VSWR of the power reference output.

NOTE

- This test cannot be performed manually, due to the complexity of the equipment calibration procedure, and the complexity of the measurement algorithm.
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").

Time Base Frequency Accuracy

Description

The accuracy of the 100 MHz sample clock determines the accuracy of all measurements that are based on samples taken over time. This test measures the time base by dividing the sample clock by 10 (within the meter) and feeding it out of the trigger output connector, where it can be directly measured by a frequency counter.

Equipment

- Required test equipment:

  1 unit of 53132A frequency counter

  10 MHz frequency standard

  1 unit of 10503A BNC cable

- An alternative frequency counter can be used, as long as it has the appropriate bandwidth (> 10 MHz)

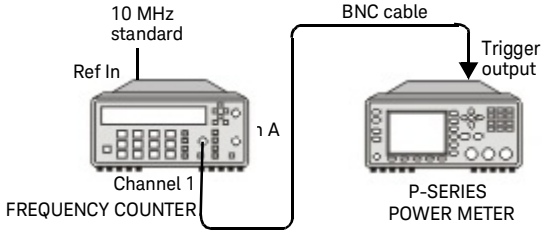

Figure 2-5 Time base test setup connection diagram

NOTE For rear panel options, the connections will differ from the illustration shown here. Refer to the connector identification markings on the rear panel for further details.

Test method

1. Enable the path that routes the time base signal to the trigger output connector.
2. Using the 53132A, measure the frequency of the signal at the trigger output connector.

NOTE

- This test can be configured manually via the command `SERV:BIST:TBAS:STAT ON`, which enables the 10 MHz feed to the trigger output connector (refer to the programming guide for further details on the use of this command).
- This test can also be configured manually via the front panel; access the Service menu, select Self Test, and select Time Base to enable the 10 MHz feed to the trigger output connector.
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").

Zero Set (Average Path)

Description

Zero set is defined as the amount of residual offset error that is present following a zero operation. This offset error is caused by contamination from several sources, including circuit noise. This test measures the effectiveness of zero set by performing 15 back-to-back zero operations of the average path (with no sensor attached), after which the standard deviation of the results is calculated and returned as the measured value.

Equipment

- No test equipment required

Test method

1. Execute the internal zero set measurement procedure for channel A.
2. Read back the result of the measurement from the DUT.
3. If the DUT model number is N1912A, then repeat this procedure for channel B.
4. The test will take a few minutes to complete.
5. The measurement result should be less than 0.0000175. The smaller the measurement result, the smaller the amount of residual offset error.

NOTE

- This test can be performed manually via the commands:

  `SERV:BIST:PEAK[1|2]:ZSET`

  `SERV:BIST:CW[1|2]:ZSET:NUM?`

  (Refer to the programming guide for further details on the use of these commands)
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").

Zero Set (Peak Path)

Description

Zero set is defined as the amount of residual offset error that is present following a zero operation. This offset error is caused by contamination from several sources, including circuit noise. This test measures the effectiveness of zero set by performing 15 back-to-back zero operations of the peak path (with no sensor attached), after which the standard deviation of the results is calculated and returned as the measured value.

Equipment

- No test equipment required

Test method

1. Execute the internal zero set measurement procedure for channel A.
2. Read back the result of the measurement from the DUT.
3. If the DUT model number is N1912A, then repeat this procedure for channel B.
4. The test will take a few minutes to complete.
5. The measurement result should be less than 0.015. The smaller the measurement result, the smaller the amount of residual offset error.

NOTE

- This test can be performed manually via the commands:

  `SERV:BIST:PEAK[1|2]:ZSET`

  `SERV:BIST:PEAK[1|2]:ZSET:NUM?`

  (Refer to the programming guide for further details on the use of these commands)
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").

Linearity (Average Path)

Description

Linearity over the full input voltage range of the measurement path iswarranted to provide assurance of instrument accuracy. This test measures linearity by using a calibration DAC and a calibration ADC (built into the DUT) to stimulate and compare performance of the average path against the measurement ADC, returning the worst case percentage error.

Equipment

- No test equipment required

Test method

1. Execute the internal linearity measurement procedure for channel A.
2. Read back the result of the measurement from the DUT.
3. If the DUT model number is N1912A, then repeat this procedure for channel B.
4. The test will take a few minutes to complete.
5. The measurement result should be less than 0.5 and greater than –0.5. The optimum measurement result for this test is 0.

NOTE

- This test can be performed manually via the commands:

  `SERV:BIST:CW[1|2]:LIN`

  `SERV:BIST:CW[1|2]:LIN:PERR?`

  (Refer to the programming guide for further details on the use of these commands)
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").

Absolute Accuracy Test (Average Path)

Description

The absolute accuracy test checks the ability of the power meter to accurately measure the power sensor voltage and display the appropriate power level.

Equipment

- Required test equipment:

  1 unit of 3458A digital multimeter

  1 unit of 33250A function generator

  1 unit of 11683A (Option H01) range calibrator

  1 unit of 11730A power sensor cable

  2 units of 10503A BNC cable

  1 unit of BNC T-joint connector (BNC female, male, female)

  1 unit of BNC (female) to dual banana connector

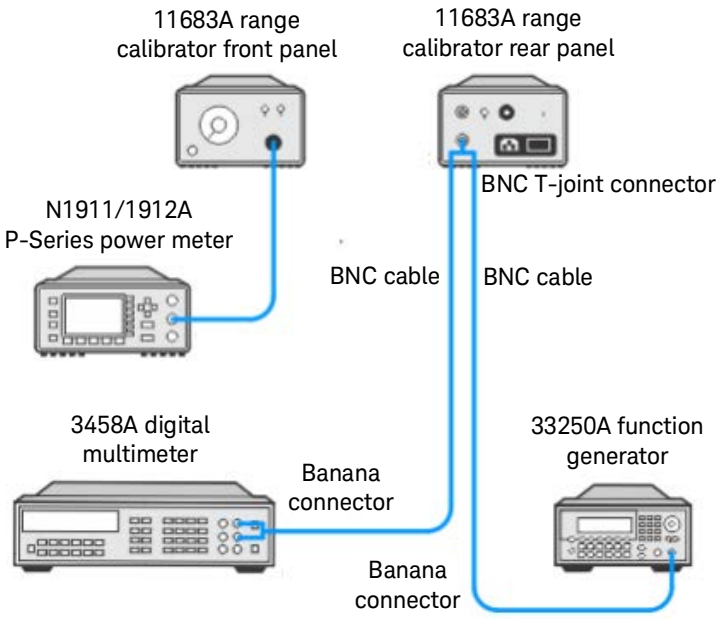

Figure 2-6 Absolute accuracy test setup

NOTE The procedure details the key presses required on the Keysight N1911A P-Series power meter. For the Keysight N1912A P-Series power meter, the equivalent key presses should be performed on both channels.

Test Method

1. Connect the equipment as shown in Figure 2-6.
2. Unplug the power cord from the range calibrator. Eliminate ground loops to enable the 11683A (Option H01) range calibrator to operate properly.

Disconnect the power cord to stop the operation of the range calibrator as the range calibrator will continue to operate with no power applied.

NOTE When switching the range calibrator to STANDBY, allow enough time for the range calibrator to settle to its zero value before attempting to zero the Keysight N1911A/1912A P-Series power meter. This settling would appear on the Keysight N1911A/1912A P-Series power meter display as downward drift. When the drift has reached minimum, (typically less than 60 seconds), the range calibrator is settled.

3 Turn on the voltmeter and allow it to warm up for 4 hours.

4 Turn on the DC source and allow it to warm up. Set the output voltage to 0 V.

5 Turn on the DUT and allow it to warm up for 30 minutes.

6 Ensure the range calibrator is not plugged-in or powered on.

7 Connect the range calibrator to the DUT using the power meter interconnect cable.

8 Connect the DC source to the range calibrator external voltage input and the voltmeter using cables and a BNC T-joint connector at the range calibrator.

9 Configure the DUT as shown below.

Parameter	Value
Filter/Averaging	On
Filter Mode/Measurement Average	Manual
Filter Length/Average Number	16
Resolution	4 digits

NOTE All other settings use the default setup settings. The *RST command sets the default setup.

10 Configure the voltmeter using the default setup settings.

11 Perform a power meter zero on the DUT. The voltage of the range calibrator is assumed to be 0 V.

12 Set the DC voltage to 89.6056 mV as measured by the voltmeter.

13 Perform a power meter calibration on the DUT.

14 Measure and record the absolute accuracy of the N1911A/1912A in a table as shown below.

Effective power	DC voltage	Voltmeter range	Power meter filter / voltmeter NRDNS	CH A % error	CH B % error	Specification
-12 dBm	0.00565 V	0.1 V	256			±0.5%
-5 dBm	0.02834 V	0.1 V	64			±0.5%
5 dBm	0.28400 V	1 V	64			±0.5%
8 dBm	0.56700 V	1 V	16			±0.5%
10 dBm	0.90100 V	1 V	16			±0.5%
12 dBm	1.43500 V	10 V	16			±0.5%
14 dBm	2.29000 V	10 V	16			±0.5%
16 dBm	3.66700 V	10 V	16			±0.5%
17 dBm	4.65200 V	10 V	16			±0.5%
18 dBm	5.91500 V	10 V	16			±0.5%
19 dBm	7.53000 V	10 V	16			±0.5%
20 dBm	9.62300 V	10 V	16			±0.5%

Linearity (Peak Path)

Description

Linearity over the full input voltage range of the measurement path is warranted to provide assurance of instrument accuracy. This test measures linearity by using a calibration DAC and a calibration ADC (built into the DUT) to stimulate and compare performance of the peak path against the measurement ADC, returning the worst case percentage error.

Equipment

- No test equipment required

Test method

1. Execute the internal linearity measurement procedure for channel A.
2. Read back the result of the measurement from the DUT.
3. If the DUT model number is N1912A, then repeat this procedure for channel B.
4. The test will take a few minutes to complete.
5. The measurement result should be less than 0.8 and greater than –0.8. The optimum measurement result for this test is 0.

NOTE

- This test can be performed manually via the commands:

  ```
  SERV:BIST:PEAK[1|2]:LIN 0
  ```

  ```
  SERV:BIST:PEAK[1|2]:LIN:PERR?
  ```

  (Refer to the programming guide for further details on the use of these commands)
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").
- For external traceability of the peak path linearity verification please refer to the Keysight N7832A Test Management Environment (TME) Software in http://cal.software.keysight.com/ for further information.

Rise/Fall Time (Peak Path)

Description

The rise and fall time performance of the instrument path has to be quantified accurately. The 81130A pulse generator is used to supply the appropriate pulse with defined rise and fall time. The instrument measures and processes the known signal which is then compared with defined acceptance limits. Overshoot, settling time and pulse recovery are also characterized.

Equipment

– Required test equipment:

1 unit of 81130A pulse/data generator mainframe

2 unit of 81131A output modules (installed in 81130A)

2 unit of N1912-61017 calibration test cable

2 unit of 10503A BNC cable

2 unit of adapter, BNC to SMC

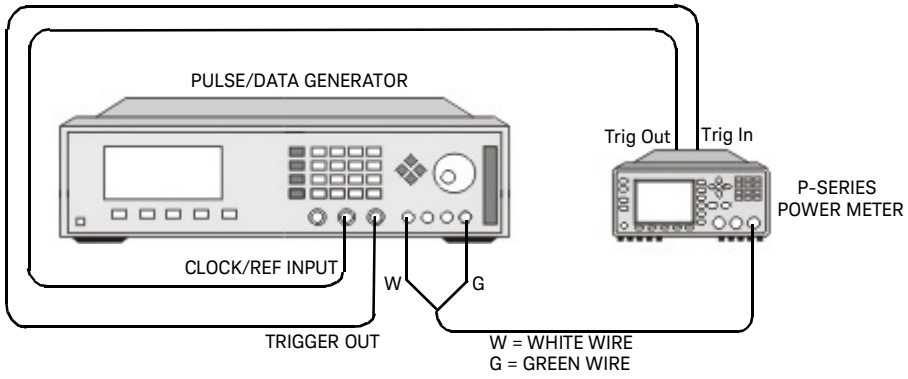

Figure 2-7 Rise/fall time test setup connection diagram

NOTE For rear panel options, the connections will differ from the illustration shown here. Refer to the connector identification markings on the rear panel for further details.

Test method

1. Capture a train of 10 pulses with very fast rise/fall times.
2. Combine the sample data to create an equivalent pulse with 10 unit of the sample resolution of the DUT.
3. Analyze the equivalent pulse to determine the 10% and 90% voltage levels of the risign/falling edges.
4. Analyze the equivalent pulse to determine when the 10% and 90% crossover points occur for both edges.
5. Using the times obtained for the 10% & 90% crossovers, the N7832A software will calculate the rise/fall time performance of the DUT.

NOTE

- Only 1 cable is required if the DUT is an N1911A.
- This test cannot be performed manually, due to the complexity of the pulse analysis algorithm.
- No adjustment is available for this test if it fails (see Chapter 4, "Troubleshooting Guide").

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3 Theory of Operation

This chapter describes how each of the power meter's individual assemblies operate.

PPMC Assembly

Purpose

- Provides the main processor and memory for the power meter
- Provides external interfaces for LAN and USB
- Stores the power meter firmware in flash EEPROM
- Stores the power meter serial number and option data

Inputs

- Power supplies [from PSU, via main board]
- Control and data lines [from main board, DAP(s), and front panel]
- LAN/ USB communications [from external equipment]
- GPIB communications [from external equipment, via main board]

Outputs

- Control, address, and data lines [to main board, DAP(s), and front panel]

Main Board Assembly

Purpose

- Provides the average measurement path(s)
- Provides the peak measurement path(s) to the DAP(s)
- Provides external trigger input/ output and recorder output(s)
- Provides the driver and the LVDS serialiser for the LCD display
- Provides signal routing between the PPMC, DAP(s), and front panel

Inputs

- Power supplies [from PSU]
- Sensed power level(s) [from sensor flexi(s)]
- Trigger input [from external equipment]
- Control, address, and data lines [from PPMC]

Outputs

- Processed average path measurement [to PPMC]
- Unprocessed peak path measurement samples [to DAP(s)]
- Trigger output & recorder output(s) [to external equipment]
- LVDS LCD display contorl lines [to front panel]
- Control and data lines [to PPMC]

DAP Assembly

Purpose

- Provides data acquisition and processing for the peak measurement path of a channel

Inputs

- Power supplies [from PSU, via main board]
- Unprocessed peak path measurement samples [from main board]
- Control, address, and data lines [from PPMC]

Outputs

- Processed peak path measurement data [to PPMC, via main board]
- Control and data lines [to PPMC, via main board]

Calibrator Assembly

Purpose

- Provides a 1 mW (0 dBm) power reference level at 50 MHz

Inputs

- Power supplies [from PSU, via main board]
- Control, address, and data lines [from PPMC]

Outputs

- 1 mW (0 dBm) power reference [to external equipment]
- Control and data lines [to PPMC, via main board]

Front Panel Assembly

Purpose

- Provides a keyboard as the manual user interface
- Provides an LCD display to assist with manual setups and measurements
- Provides mounting for the sensor and power reference connectors (option 101)

Inputs

- Power supplies [from PSU, via main board]
- Front panel control interface [from the PPMC LVDS LCD control lines, via main board]

Outputs

- Keypress data [to PPMC, via main board]
- Information on the LCD display
- Control and data lines [to PPMC, via main board]

PSU Assembly

Purpose

- Provides various DC power supplies

Inputs

- 100 Vac ~ 240 Vac, 50 Hz ~ 60 Hz, 150 VA Max [from an external source]
- Control lines [from front panel, via main board]

Outputs

- +12 Vdc [to main board]
- +5 Vdc [to main board]
- –5 Vdc [to main board]
- –12 Vdc [to main board]

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4 Troubleshooting Guide

This chapter contains troubleshooting flow charts designed to isolate faults in the Rmt I/O, GP-IB and RS232/422 interface ports.

Introduction

This chapter enables qualified service personnel to diagnose suspected faults with the power meter Rmt I/O (Remote Input/Output) signal lines and RS232/422 serial port.

If there is a problem when attempting to use the RS232/422 serial interface or the remote I/O functions, consult the user's guide and confirm that all the user setups are correct before proceeding with the following fault finding flowcharts.

Power-Up Problems

Basic external checks

- Check the mains power source is live
- Check the mains fuse is operational
- Check the mains cable for any obvious damage
- Check the line module fuse in the instrument is operational

Basic internal checks

- Check/reseat the cable between the line module and the PSU
- Check/reseat the cable between the PSU and the main board
- Green LED DS1: If this is off, then the PSU may be faulty
- Green LED DS4: This should come on when the power button is pressed
- Green LEDs DS2/DS3: These will flash on and off during normal operation

Possible faults

- PSU
- Main board
- Front panel (defective keymat, key flex circuit, or display)
- Loose front panel cable (connection to main board)

Instrument Self-Test

Instrument	Purpose	Debug tips	Possible faults
Test point voltages	Checks that all of the supply voltages are present	Replace the PSU to see if this clears the faults	PSU (low probability) Main board (high probability)
Calibrator	Verifies that the calibrator is working (Note: This test does not check that the calibrator meets its specifications)	Check/reseat that cable between the Calibrator Assembly and the Main board Attempt to adjust the 1 mW Power Reference Level	Calibrator assembly (high probability) Main board (low probability)
Fan	Verifies that the fan is working	Check/reseat the cable between the Fan Assembly and the Main board Check visually to see whether or not the Fan is working	Fan assembly (high probability) Main board (low probability)
Battery	Checks that the lithium manganese battery on the main board is working	Replace the battery to see if this clears the fault (Note: It is recommended for the battery to be replaced at the Keysight service center every five years)	Lithium manganese battery (high probability) Main board (low probability)
Peak path/ChA peak path	Verifies that the peak path of channel A is working (Note: This does not prove that the peak path meets its specifications)	Replace the DAP Assembly for Channel A to see if this clears the fault	DAP assembly, channel A (low probability) Main board (low probability)
CW path/ChA CW path	Verifies that the average path of channel A is working (Note: This does not prove that the average path meets its specifications)	Not applicable	Main board
DAP check/ChA DAP check	Executes an internal self-test procedure on the DAP assembly for channel A	Replace the DAP assembly for channel A to see if this clears the fault	DAP assembly, channel A (high probability) Main board (low probability)

Instrument	Purpose	Debug tips	Possible faults
ChB peak path	Verifies that the peak path of channel B is working (Note: This does not prove that the peak path meets its specifications)	Replace the DAP assembly for channel B to see if this clears the fault	DAP assembly, channel B (low probability) Main board (high probability)
ChB CW path	Verifies that the average path of channel B is working (Note: This does not prove that the average path meets its specifications)	Not applicable	Main board
ChB DAP check	Executes an internal self-test procedure on the DAP assembly for channel B	Replace the DAP assembly for channel B to see if this clears the fault	DAP assembly, channel B (high probability) Main board (low probability)

Extended Self-Test

Instrument	Purpose	Debug tips	Possible faults
Keyboard	Verifies the operation of every key (apart from the power button)	Not applicable	Front panel (defective keymat or key flex circuit)
Bitmap display	Verifies that all pixels in the display can be illuminated in various colors	Not applicable	Front panel (defective display, display interface board, or inverter board)
Time base	Provides a means to measure time base frequency accuracy	Check that the BNC cable being used is not damaged Check that the BNC is connected to 'Trig Out', not 'Trig In'	Main board

Performance Test

Type of failures	Debug tips	Possible faults
1 mW power reference level failures	Attempt to adjust the 1 mW power reference level	Calibrator assembly (high probability) Main board (low probability)
VSWR failures	Not applicable	Calibrator assembly
Time base frequency accuracy failures	Check that the BNC cable being used is not damaged Check that the BNC is connected to 'Trig Out', not 'Trig In'	Main board
Zero set (average Path) failures	Not applicable	Main board
Zero set (peak path) failures	Not applicable	Main board
Linearity (average path) failures	Not applicable	Main board
Linearity (peak path) failures	Replace the DAP assembly for the channel to see if this clears the fault	DAP assembly (low probability) main board (high probability)
Rise/fall time (peak path) failures	Check/reseat the sensor flex RF connections	Sensor flex assembly (low probability) DAP assembly (low probability) Main board (high probability)

Power Reference Level Adjustment Problems

Possible faults

- Calibrator assembly (high probability)
- Main board (low probability)

Communication Interface Failures

Type of communication	Debug tips	Possible faults
GPIB communication	Check/reseat the ribbon cable connecting the PPMC to the main board	Ribbon cable (low probability) PPMC assembly (low probability) Main board (high probability)
LAN/USB communication	Check visually to see whether or not the connector is obstructed/damaged	PPMC assembly

Additional Diagnostic Tests

Type of functionality	Reason	Recommended test method	Possible faults
USB/LAN functionality	The N7832A software only tests functionality over GPIB	Check the DUT responds when ***RST** is sent to it via the USB/LAN interfaces	PPMC assembly
Sensor functionality	The N7832A software does not prove both paths of the sensor flex assembly	Connect an E4412A sensor to the DUT and ensure it can be zeroed/calibrated	Sensor flex assembly

5 Repair Guide

This chapter details the power meter's replaceable parts. It also explains how to assemble and disassemble the power meter.

Introduction

This chapter contains details of some of the higher level components and assemblies which can be ordered from Keysight Technologies. It also details how to assemble and disassemble the power meter for repair. The contents included are:

1. Replaceable Parts
2. Tools Required
3. Disassembly Instructions
4. Reassembly Instructions
5. Disassembly vs Part Replacement
6. Front Panel Disassembly Instructions
7. Front Panel Reassembly Instructions
8. Additional Repair Notes
9. Replacing the PPMC Assembly
10. Replacing the Calibrator Semi-Rigid/Split Ferrite

To order parts contact your local Keysight Technologies Sales and Service Office.

To return your power meter for servicing at a qualified service center refer to Chapter 6, "Contacting Keysight Technologies".

Replaceable Parts

Front panel assembly

Main assembly

The standard P-Series power meter has the reference calibrator at the front panel. Option is available to move the reference calibrator to rear panel.

Keysight part number	Description	Visual
N1912-61804	Front panel assembly (front calibrator option)	
N1912-61805	Front panel assembly (rear calibrator option) **Note:** – The front panel assembly must be customized to suit the hardware configuration of the unit being repaired – Refurbished front panel assemblies are not available	

Customization details

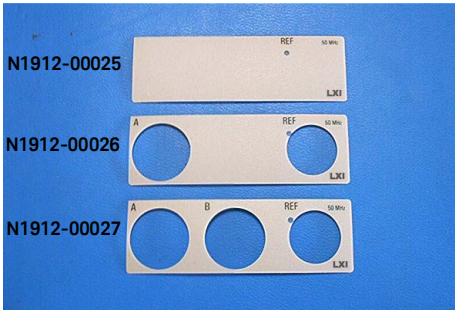
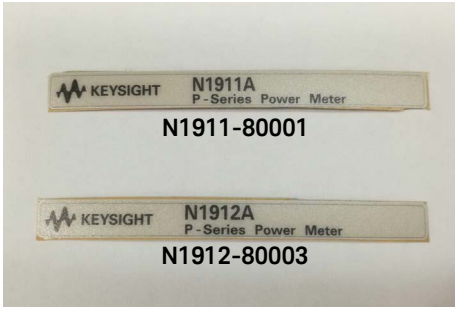
The standard P-Series power meters have the input sensor connector(s) and reference calibrator connector on the front panel. Option 003 is available to move the input sensor connector(s) and reference calibrator connector to the rear panel. Below are the customization details on front panel assembly.

Connector option	Details	Part number
N1911A (front connectors option)	1 unit of sensor flex assembly	N1912-61806
	1 unit of calibrator plug	N1912-21003
	1 unit of front panel plug (large)	N1912-21004
	1 unit of N1911A font panel dress label	N1912-00026
	1 unit of N1911A nameplate	N1911-80001
N1911A (front connectors option)	2 unit of front panel plug (large)	N1912-21004
	1 unit of front panel Plug (small)	N1912-21005
	1 unit of blank front panel dress label	N1912-00025
	1 unit of N1911A nameplate	N1911-80001
N1912A (front connectors option)	2 unit of sensor flex assembly	N1912-61806
	1 unit of calibrator plug	N1912-21003
	1 unit of N1912A front panel dress label	N1912-00027
	1 unit of N1912A nameplate	N1912-80003
N1912A (front connectors option)	2 unit of front panel plug (large)	N1912-21004
	1 unit of front panel plug (small)	N1912-21005
	1 unit of blank front panel dress label	N1912-00025
	1 unit of N1912A nameplate	N1912-80003

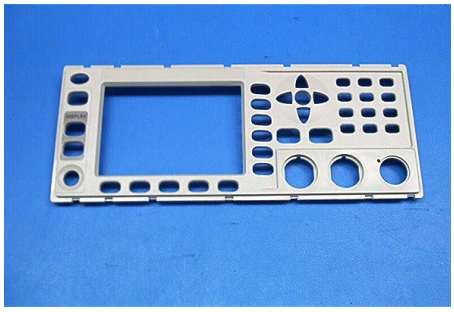
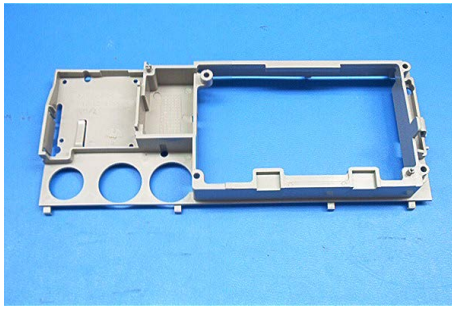
Photos on items above are available in next section.

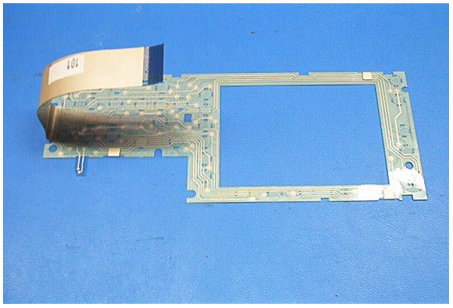
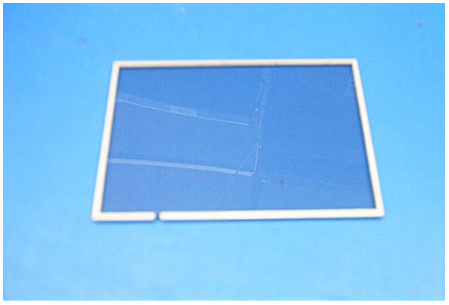
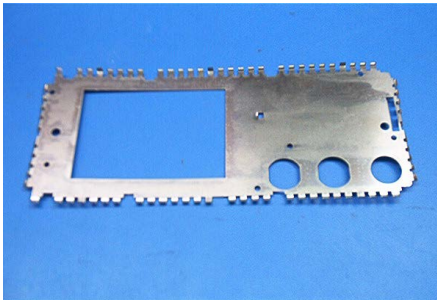
Customization parts

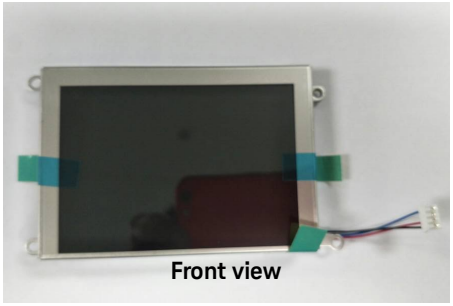
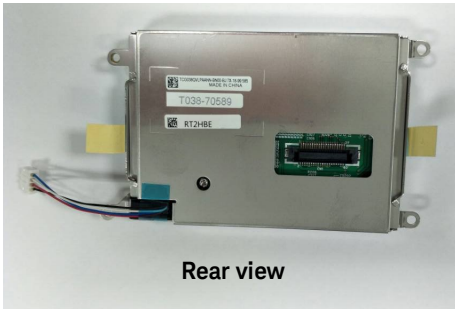
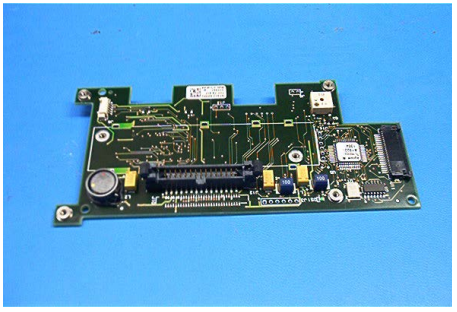
Keysight part number	Description	Visual
N1912-61806	Sensor flex assembly **Note:** – The same assembly is used for all four sensor positions – The kit includes a spacer, required for fitting the flex to the rear panel – The sensor flex assembly is supplied straight, and so it must be folded to match the assembly being replaced (see "Additional Repair Notes" on page 109)	
N1912-21003	Calibrator plug	
N1912-21005	Front panel plug (small)	

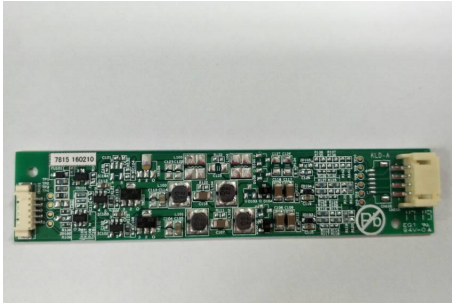
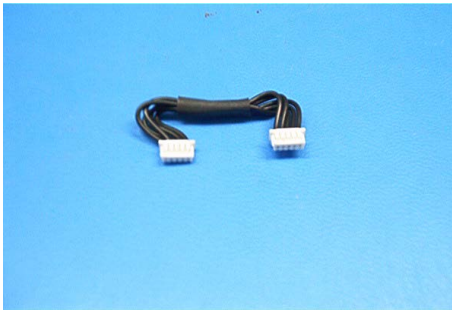
Keysight part number	Description	Visual
N1912-00025 N1912-00026 N1912-00027	Blank front panel dress label N1911A front panel dress label N1912A front panel dress label	
N1911-80001 N1912-80003	N1911A nameplate N1912A nameplate	

Replaceable parts

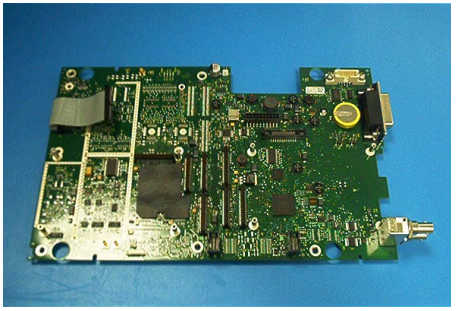
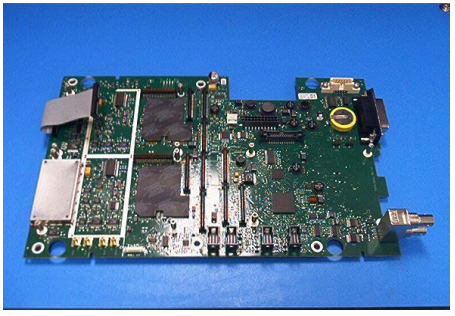
Keysight part number	Description	Visual
N1912-40003	Front panel sub-frame **Note:** – This front panel sub-frame is used on all variants of the front panel assembly	
N1912-40002	Display support molding **Note:** – This display support molding is used on all variants of the front panel assembly	
N1912-40001	Keymat **Note:** – This keymat is used on all variants of the front panel assembly	

Keysight part number	Description	Visual
N1912-66502	Key flex circuit **Note:** – This key flex circuit is used on all variants of the front panel assembly	
N1912-20005	EMI shielded window **Note:** – This EMI shielded window is used on all variants of the front panel assembly	
N1912-00002	EMI screen **Note:** – This EMI screen is used on all variants of the front panel assembly	

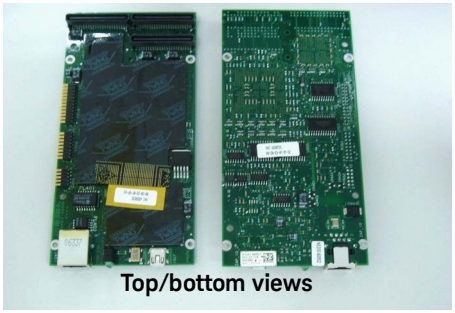
Keysight part number	Description	Visual
2090-1101	Display **Note:** – This display is used on all variants of the front panel assembly and must be ordered together with the DC to DC converter (0950-5724)	 **Front view**  **Rear view**
N1912-60002	Display interface board **Note:** – This display interface board is used on all variants of the front panel assembly	

Keysight part number	Description	Visual
0950-5724	DC to DC converter **Note:** – This DC to DC converter is used on all variants of the front panel assembly and must be ordered together with the display (2090-1101)	
N1912-61002	Backlight cable assembly **Note:** – This backlight cable assembly is used on all variants of the front panel assembly	
N1912-00038	Split washer **Note:** – This split washer is used on all variants of the front panel assembly	

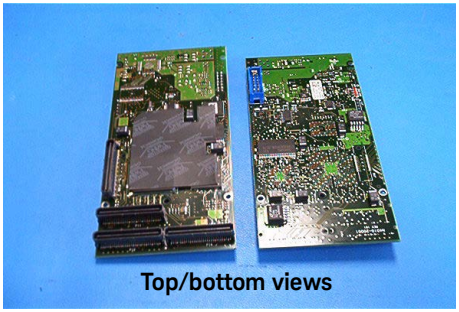
Main board assembly

Keysight part number	Description	Visual
N1911-61801 (non-video output option)	N1911A main board assembly [new]	
N1911-66501 (video output option)	N1911A main board assembly – video output option (Option H01)	
N1912-61801 (non-video output option)	N1912A main board assembly [new]	
N1912-66501 (video output option)	N1912A main board assembly – video output option (Option H01) **Note:** – Refurbished main boards are not available – The part number for the lithium manganese battery (Upper-right of both photographs) is 1420-0394	

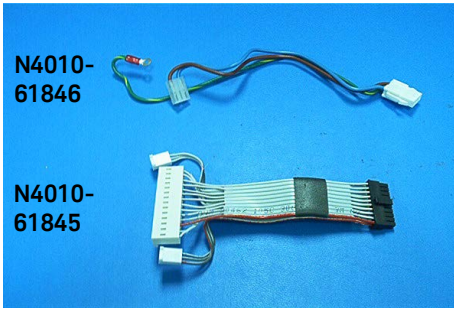
PPMC (processor PCI mezzanine) assembly

Keysight part number	Description	Visual
N1911-66500 (single-channel PPMC PCA) N1912-66500 (dual-channel PPMC PCA)	PPMC PCA **Note:** – The same assembly is used for both N1911A and N1912A models – N1911-66500 (single-channel PPMC PCA) comes pre-programmed with N1911A firmware – N1912-66500 (dual-channel PPMC PCA) comes pre-programmed with N1912A firmware – Refurbished PPMC assemblies are not available – The PPMC assembly must be programmed once it has been installed (see "Additional Repair Notes" on page 109) – Ribbon cable 8121-1076 is supplied separately.	 Top/bottom views  8121-1076

DAP (digital acquisition & processing) assembly

Keysight part number	Description	Visual
N1912-60004 (old) replaced by N1912-61811 (New)	Measurement board **Note:** – The same assembly is used for both N1911A and N1912A models – Two identical DAP assemblies are fitted to the N1912A model – Refurbished DAP assemblies are not available	 Top/bottom views

PSU (power supply unit)

Keysight part number	Description	Visual
N1912-61808	Power supply assembly kit [new] **Note:** – The same assembly is used for both N1911A and N1912A models – Refurbished PSUs are not available – Cables N4010-61846 and N4010-61845 are supplied separately	 

Rear panel assembly

Main assembly

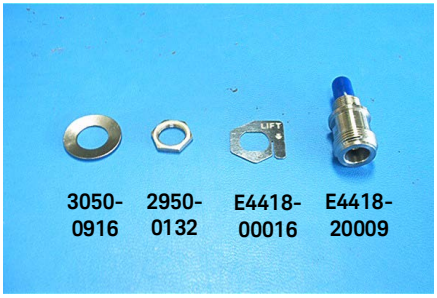
Keysight part number	Description	Visual
N1912-61007	Rear panel assembly [new]	
N1912-61031	Revised rear panel assembly [new]	
	Note: – The rear panel assembly must be customized to suit the hardware configuration of the unit being repaired – Refurbished rear panel assemblies are not available – Parts N1912-61007 and N1912-61031 differ slightly with regards to the connector cutout positions – The revision of the main board can be used to help determine which rear panel assembly is in use (see “Additional Repair Notes” on page 109) – The same assemblies are used for both N1911A and N1912A models	 N1912-61007 / N1912-61031

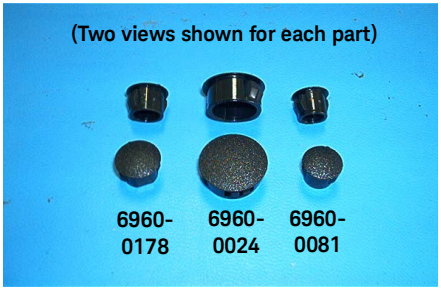
Customization details

The standard P-Series power meters have the input sensor connector(s) and reference calibrator connector on the front panel. Option 003 is available to move the input sensor connector(s) and reference calibrator connector to the rear panel. Below are the customization details on rear panel assembly.

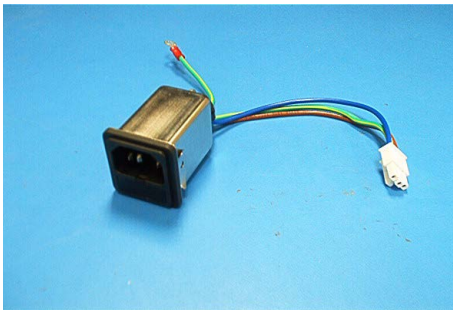
Connector option	Details	Part number
N1911A (front connectors option)	1 unit of rear panel plug (BNC)	6960-0081
	2 unit of rear panel plug (Sensor)	6960-0024
	1 unit of rear panel plug (Calibrator)	6960-0178
N1911A (front connectors option)	1 unit of sensor flex assembly	N1912-61806
	1 unit of N-Type connector	E4418-20009
	1 unit of lock washer	E4418-00016
	1 unit of hex nut	2950-0132
	1 unit of washer	3050-0916
	1 unit of rear panel plug (BNC)	6960-0081
	1 unit of rear panel plug (Sensor)	6960-0024
N1912A (front connectors option)	1 unit of Recorder Output Cable	E4418-61015
	2 unit of rear panel plug (Sensor)	6960-0024
	1 unit of rear panel plug (Calibrator)	6960-0178
N1912A (front connectors option)	2 unit of sensor flex assembly	N1912-61806
	1 unit of N-Type connector	E4418-20009
	1 unit of lock washer	E4418-00016
	1 unit of hex nut	2950-0132
	1 unit of washer	3050-0916
	1 unit of recorder output cable	E4418-61015

Customization parts

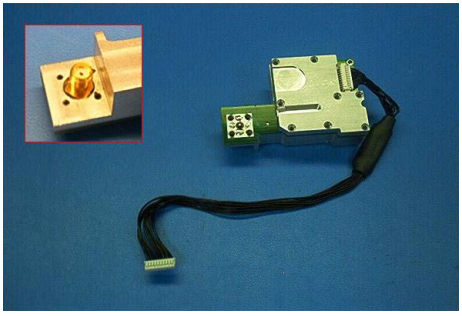
Keysight part number	Description	Visual
E4418-20009	N-Type connector	
E4418-00016	Lock washer	
2950-0132	Hex nut	
3050-0916	Washer	
N1912-61806	Sensor flex assembly	
E4418-61015	Recorder output cable	

Keysight part number	Description	Visual
6960-0081	Rear panel plug (BNC)	
6960-0024	Rear panel plug (sensor)	
6960-0178	Rear panel plug (calibrator)	

Additional spare parts

Keysight part number	Description	Visual
N1912-61036	Line module	
N4010-21025	Service connector cable	

Calibrator assembly

Keysight part number	Description	Visual
N1911-61001	Calibrator assembly (front connectors option). For more information on the improved calibrator assembly, refer to "Improved calibrator assembly" on page 79.	
N1911-61002	Calibrator assembly (rear connectors option) **Note:** – Semi-rigid cable N1912-61004 is not included with assembly N1911-61002; if this is required, it is available as a separate item	

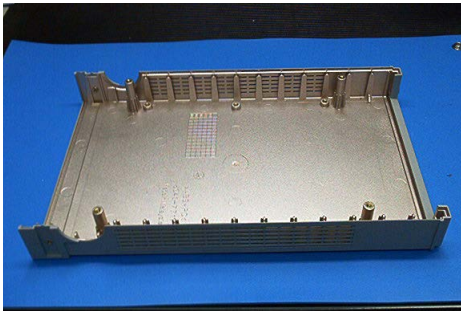
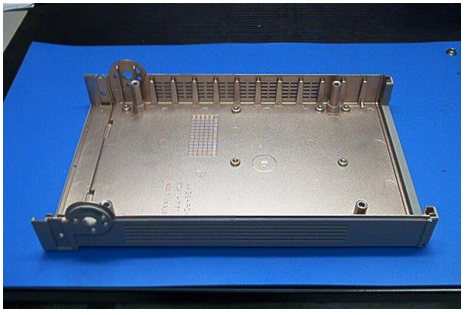
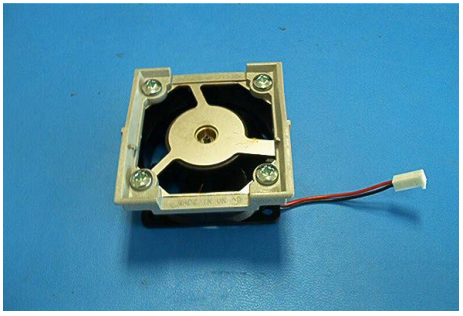
Improved calibrator assembly

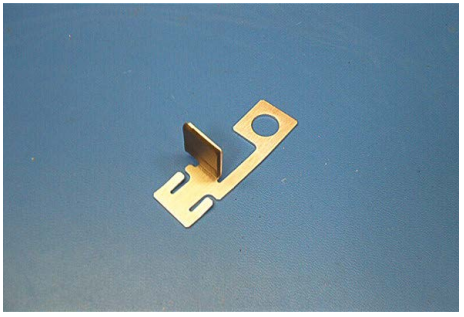
The N1911A/N1912A calibrator assembly is improved with a new type-N calibrator connector for a better fit with the front panel assembly as shown in Figure 5-1. The calibrator plug (N1912-21003) will not be needed with the improved calibrator assembly.

NOTE **The N1911A/N1912A performance will not be affected with the improved calibrator assembly.**

Figure 5-1 Calibrator assembly and improved calibrator assembly

Outer housing components

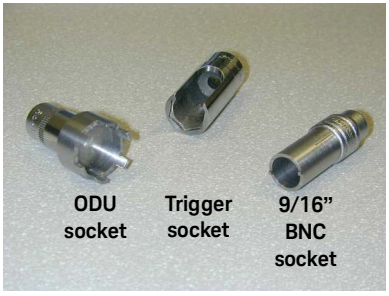
Keysight part number	Description	Visual
5041-7717	Clamshell (top)	
5041-7718	Clamshell (bottom)	
N1912-61005	Fan assembly	

Keysight part number	Description	Visual
N1912-61025	Cable clamp	
34401-86020	Bumper kit	
34401-45021	Handle	

Sundries

Keysight part number	Description	Visual
N1911-61004	Calibrator semi-rigid cable (rear option)	
N1912-80005	Split ferrite **Note:** – If the semi-rigid cable is replaced, then the split ferrite must be positioned correctly (see "Additional Repair Notes" on page 109)	
2110-0957	Line module fuse, 3.15 A/250 V (non-time-delayed)	

Tools Required

Keysight part number	Description	Visual
N1911-61004 N1912-80005	– 3 unit of ¼” drive torque wrenches – 1 unit of calibrated to 2.37 Nm (21 lb-in) – 1 unit of calibrated to 1.02 Nm (9 lb-in) – 1 unit of calibrated to 0.68 Nm (6 lb-in) – 3 unit of torque screwdrivers – 1 unit of calibrated to 2.37 Nm (21 lb-in) – 1 unit of calibrated to 0.56 Nm (5 lb-in) – 1 unit of calibrated to 0.34 Nm (3 lb-in) – T6, T8, T10, & T20 Torx screwdriver bits – 7/16” break spanner, calibrated to 2.37 Nm (21 lb-in) – 5/16” break spanner, calibrated to 1.02 Nm (9 lb-in) – 9/32” socket	
N1912-61807	Special tooling kit – Contains: – ODU socket – Trigger socket – 9/16” BNC socket – Sockets must be used in conjunction with a ¼” drive torque wrench, calibrated to 2.37 Nm (21 lb-in) – The 9/16” BNC socket is required to remove the Trig In/Out fasteners for the majority of N1911A/12A power meters – The trigger socket is required to remove the Trig In/Out fasteners for a minority of N1911A/12A power meters	

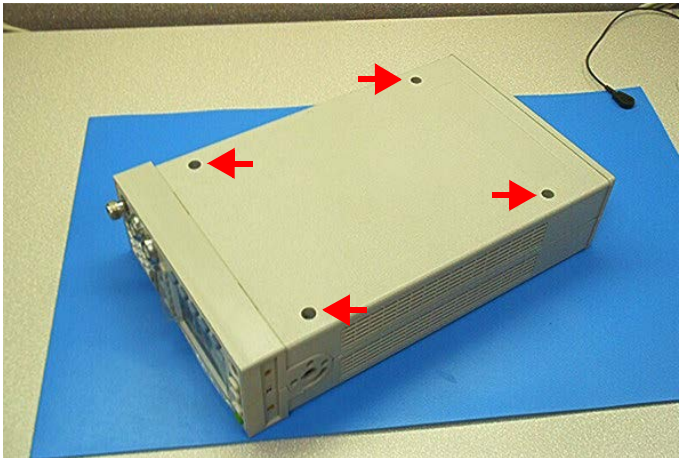
Required Torque Values for Fasteners

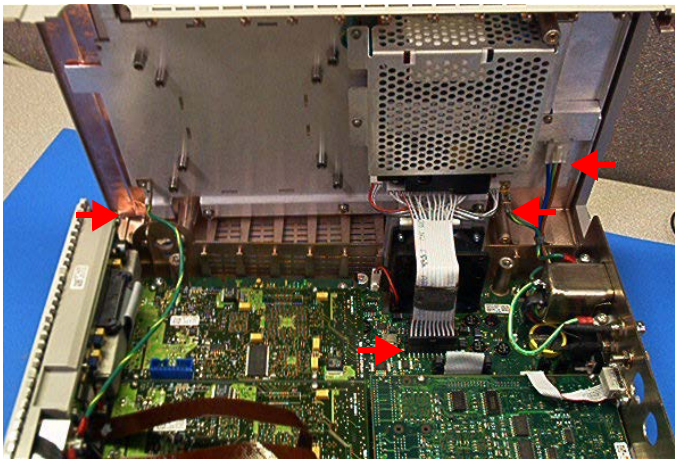
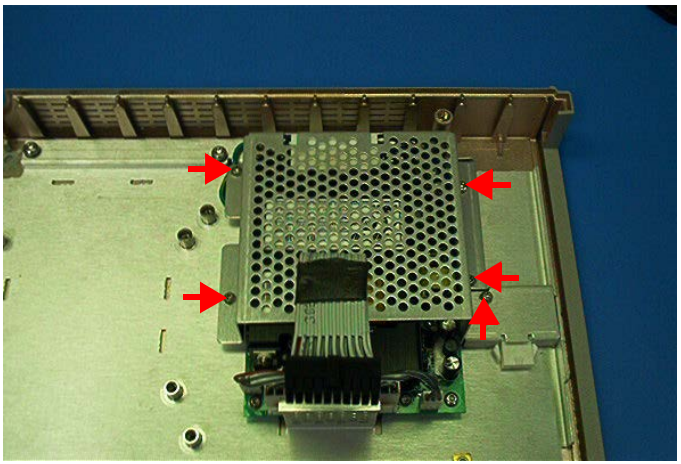
Required tools and torque values for fasteners are listed below:

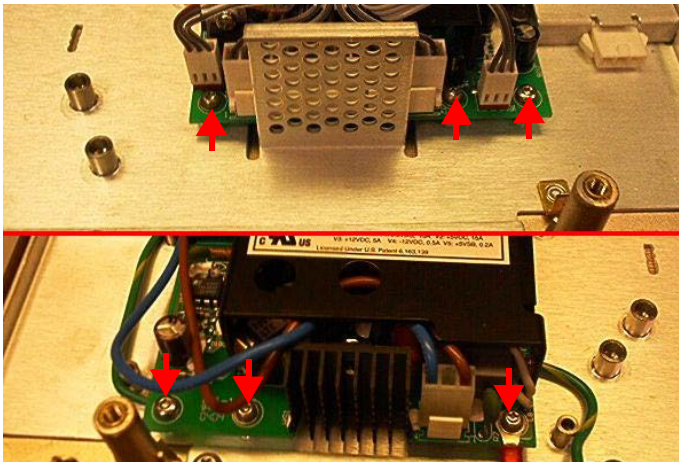
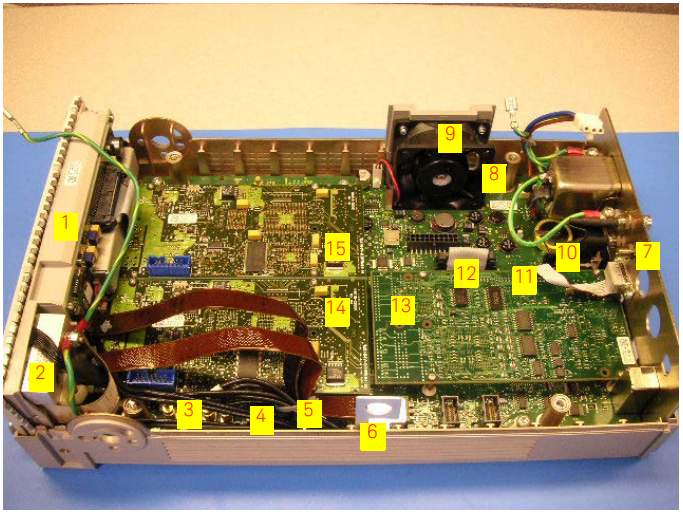
Item	Description/Default	Range of values
Fit rear panel GPIB standoffs	9/32” socket	0.68 Nm
Fit rear panel Trig In/Out connectors	Special tooling kit (N1912-61807)	2.37 Nm
Fit rear panel recorder output connectors	7/16” spanner	2.37 Nm
Attach main board to clamshell	T20 screwdriver	2.37 Nm
Attach PPMC/DAP assemblies to main board	T8 screwdriver	0.56 Nm
Fit calibrator semi-rigid, both ends (Option 003)	5/16” spanner	1.02 Nm
Attach earth wires (Nut)	9/32” socket	1.02 Nm
Attach earth wires (Screw)	T20 screwdriver	2.37 Nm
Attach top clamshell to bottom clamshell	T20 screwdriver	2.37 Nm
Fit sensor connector	Special tooling kit (N1912-61807)	2.37 Nm
Fit PSU/PSU safety cover	T10 screwdriver	2.37 Nm
Fit display to display support moulding	T6 screwdriver	0.56 Nm
Fit calibrator to display support moulding	T6 screwdriver	0.34 Nm
Fit display interface board to inverter board	T6 screwdriver	0.56 Nm

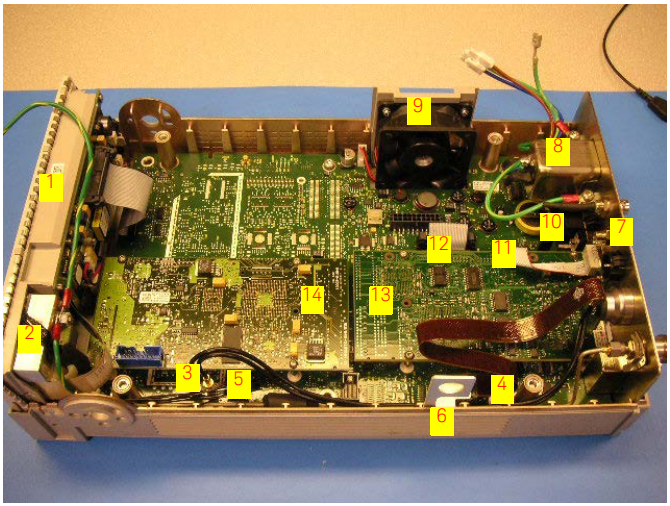
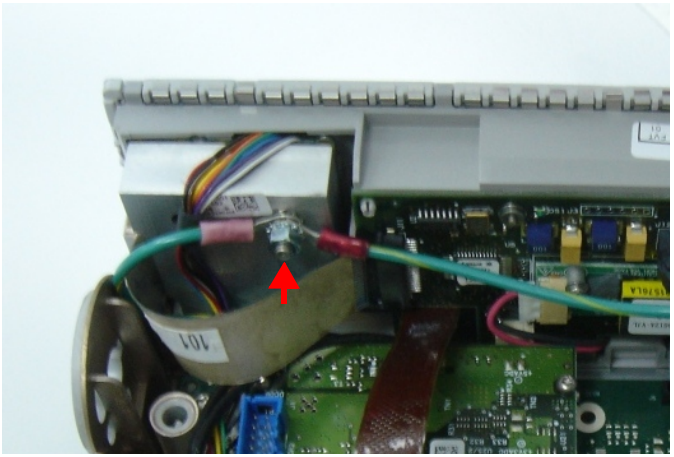
Disassembly Instructions

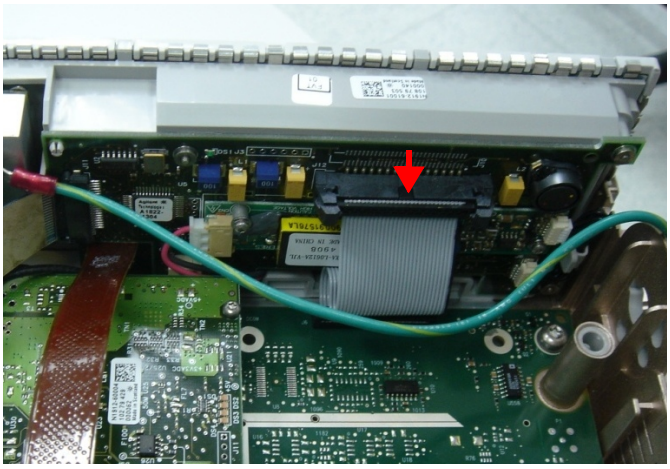
The guidelines in this section describe the disassembly of the major assembling in the Keysight N1911A and N1912A power meters.

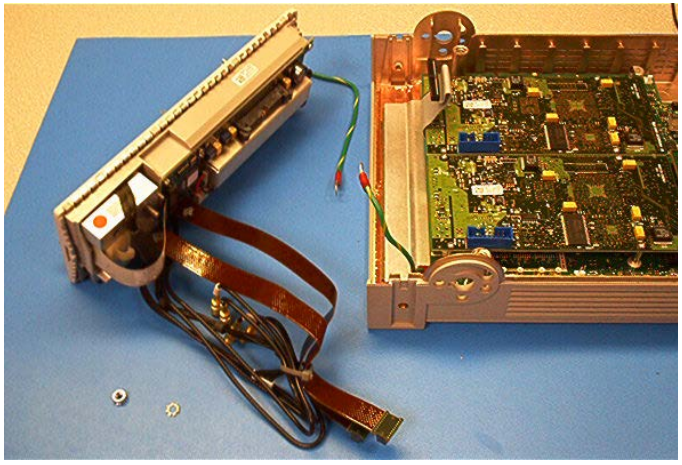
Instructions	Visual
– This procedure focuses primarily on model N1912A, Option 101 (i. e. dual channel, with front panel sensor and power reference connectors) – Additional information is provided to assist in the disassembly of Option 003 units (i. e. with rear panel sensor and power reference connectors)	 N1912A, Option 101  N1911A, Option 003
– Remove the handle: Rotate it to the vertical position. Pull both sides outwards from the body of the unit. – Remove the front/rear bumpers: Pull one side of the bumper outwards to disengage it. Pull it away from the unit. – Separate the clamshells (Figure 5-2): Use the T20 Torx screwdriver bit to loosen the 4 captive screws.	 **Figure 5-2**

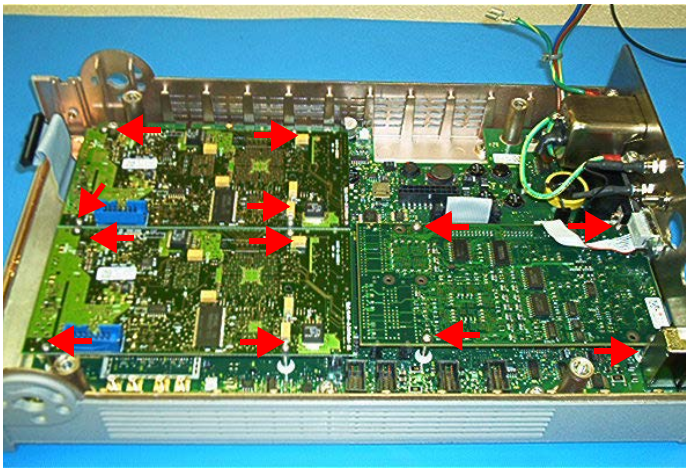
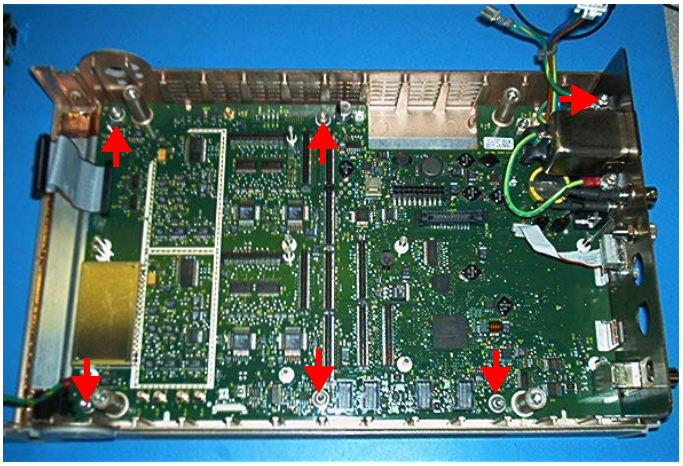
Instructions	Visual
– Remove the top clamshell (Figure 5-3): Disconnect the mains power connector from the top clamshell. Disconnect the ribbon cable from the main board. Disconnect both earth spade connectors from the top clamshell. Remove top clamshell.	 **Figure 5-3**
– Remove the PSU safety cover (Figure 5-4): Use the T10 Torx screwdriver bit to remove the 4 screws attaching the PSU safety cover to the top clamshell. Lift and remove the safety cover. – Remove the PSU cable guide (Figure 5-4): Use the T10 Torx screwdriver bit to remove the screw attaching the cable guide to the top clamshell. Lift and remove cable guide.	 **Figure 5-4**

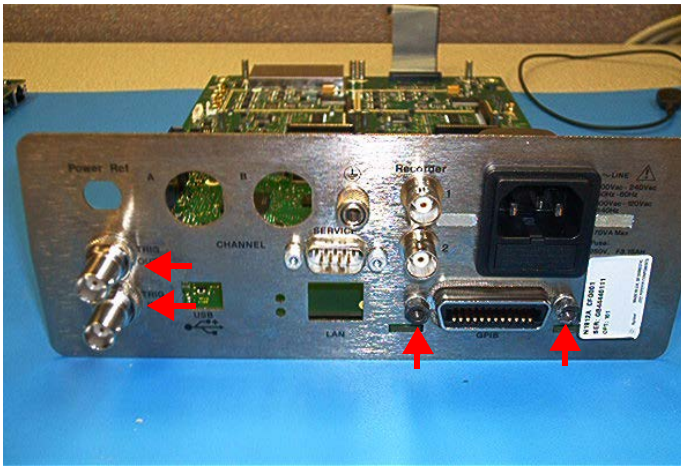
Instructions	Visual
– Remove the PSU (Figure 5-5): Use the T10 Torx screwdriver bit to remove the 6 screws attaching the PSU to the top clamshell. Lift and remove the PSU.	 **Figure 5-5**
– Key to Figure 5-6 and Figure 5-7: **1** Front panel assembly **2** Calibrator assembly **3** Sensor RF connections **4** Sensor flex connection(s) **5** Calibrator cable connection **6** Cable clamp **7** Rear panel assembly **8** Line module **9** Fan assembly **10** Analog recorder output connection(s) **11** Service connector cable **12** Ribbon cable **13** PPMC assembly **14** DAP assembly (Channel A) **15** DAP assembly (Channel B)	 **Figure 5-6**

Instructions	Visual
– With reference to Figure 5-6 and Figure 5-7: – Lift and remove the cable clamp. – Disconnect the cable attaching the fan assembly to the main board. – Lift and remove the fan assembly – Disconnect the sensor RF connections from the main board. – Disconnect the sensor flex connection(s) from the main board. – Disconnect the calibrator cable connection from the main board. – Disconnect the analog recorder output connection(s) from the main board.	 **Figure 5-7**
– Remove the EMI earth wires (Figure 5-8): Use the 9/32” Socket to remove the hex nut attaching the EMI earth wires to the calibrator assembly. Remove the earth wires and washers, taking note of the assembly order.	 **Figure 5-8**

Instructions	Visual
– Disconnect the front panel cable (Figure 5-9): Depress both sides of the connector holding the ribbon cable to eject it.	 **Figure 5-9**
– Disconnect the semi-rigid cable (Figure 5-10): **Note:** – This only applies to Option 003 units. Use the 5/16" spanner to disconnect the semi-rigid cable from the N-Type connector on the rear panel.	 **Figure 5-10**

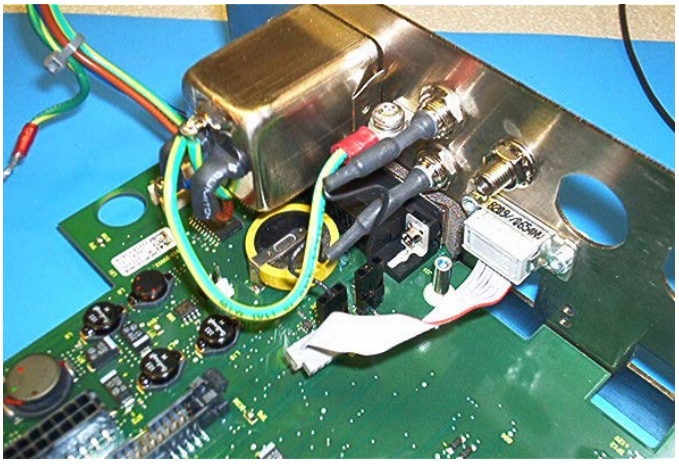
Instructions	Visual
– Remove the front panel (Figure 5-11): Carefully lift and remove the front panel assembly.	 **Figure 5-11**
– Disconnect PPMC cables (Figure 5-6/Figure 5-7): Disconnect the service connector cable from the PPMC assembly. Disconnect the ribbon cable from the main board, whilst leaving it connected to the PPMC assembly.	

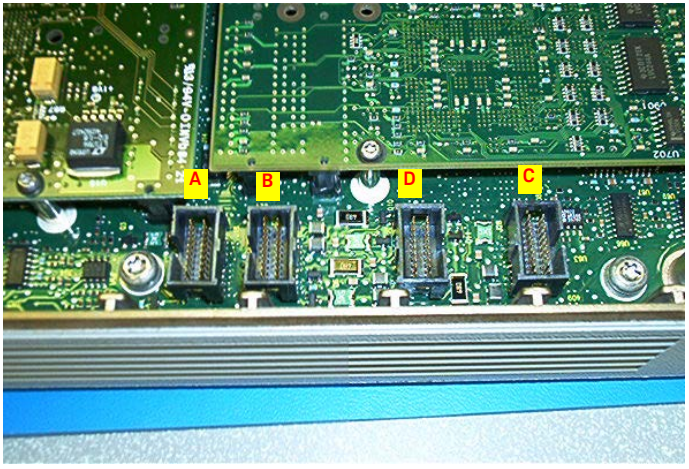
Instructions	Visual
– Remove DAP/PPMC (Figure 5-12): Use the T8 Torx screwdriver bit to remove the screws attaching the DAP and PPMC assemblies to the main board. Carefully remove the PPMC assembly by lifting the end closest to the DAP assembly. Carefully remove each DAP assembly by lifting the end closest to the rear panel.	 **Figure 5-12**
– Remove the main board (Figure 5-13): Use the T20 Torx screwdriver bit to remove the 5 screws attaching the main board to the bottom clamshell. Use the T20 Torx screwdriver bit to remove the screw attaching the earth wires to the line module. Remove the earth wires and washers, taking note of the assembly order. Lift & remove the main board.	 **Figure 5-13**

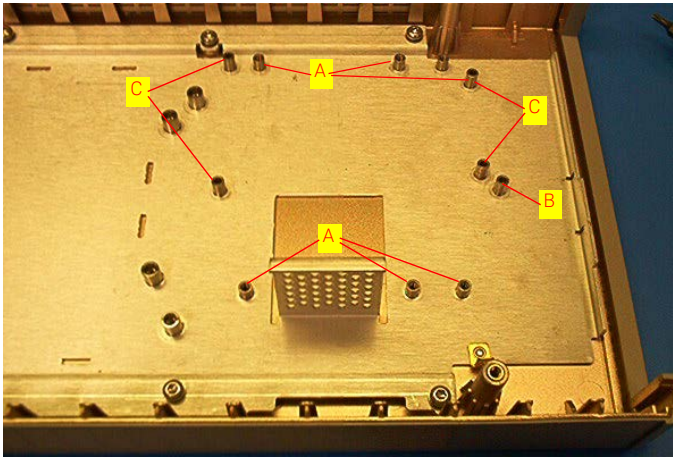
Instructions	Visual
– Remove the rear panel (Figure 5-14): Use the N1912-61807 special tooling kit to remove the fasteners on the trigger connectors. Use the 9/32” socket to remove the GPIB standoffs. Carefully pull the rear panel away from the main board.	 **Figure 5-14**

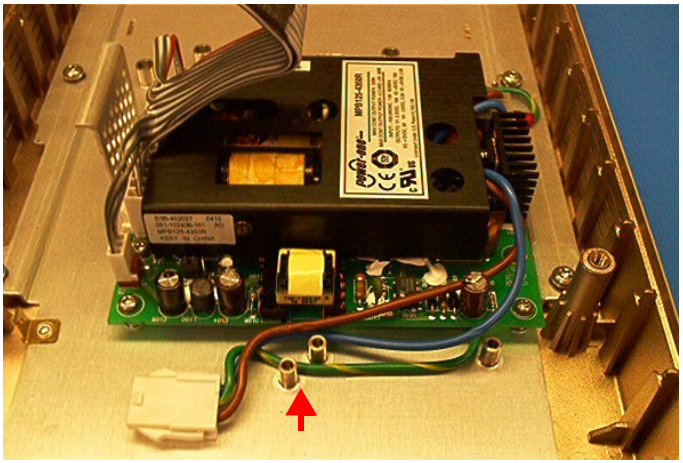
Reassembly Instructions

Instructions	Visual

– The reassembly process is simply the reverse of the disassembly process. However, there are various points to be aware of:
  – USB/LAN connectors must rest on top of the rear panels' EMC spring fingers.
  – The position of the cable clamp depends on whether option 101 or 003 is fitted.
  – The main board connector from the PSU must be pushed firmly to fully engage it.
  – Take care not to trap any cables when fitting the top clamshell.
– Analog recorder output connections (Figure 5-15): Ensure recorder 1 is plugged into the rear connector. Where applicable, recorder 2 is plugged into the connector nearer the front.
	
	Figure 5-15

– Sensor flex connections (Figure 5-16): A – Front, Channel A (for Option 101) B – Front, Channel B (for Option 101) C – Rear, Channel A (for Option 003) D – Rear, Channel B (for Option 003)	 **Figure 5-16**

Instructions	Visual
– Sensor RF connections (Figure 5-17): E – Channel A(+), Black cable F – Channel A(–), Black/White cable G – Channel B(+), Black cable H – Channel B(–), Black/White cable **Note:** – Only connect E and F for N1911A – Connect E, F, G, H for N1912A	 **Figure 5-17**
– PSU screw locations (Figure 5-18): A – Attach PSU to clamshell (6 screws) B – Attach PSU cable guide (1 screw) C – Attach PSU safety cover (4 screws)	 **Figure 5-18**

Instructions	Visual
– PSU cable routing (Figure 5-19): Ensure the PSU cables are positioned such that the cable guide does not trap them or pinch them.	 **Figure 5-19**

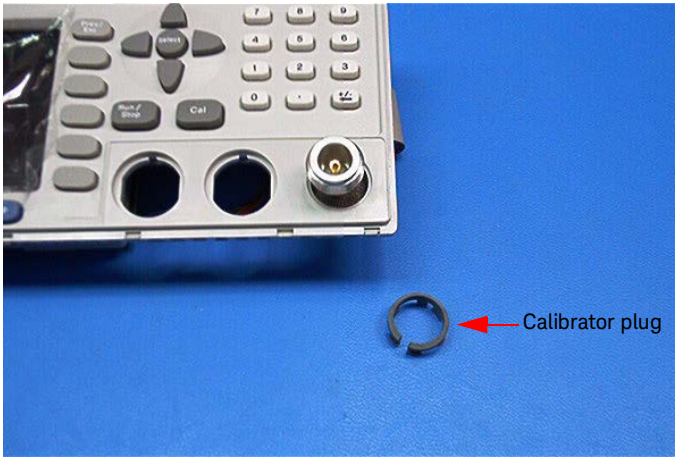
Disassembly vs Part Replacement

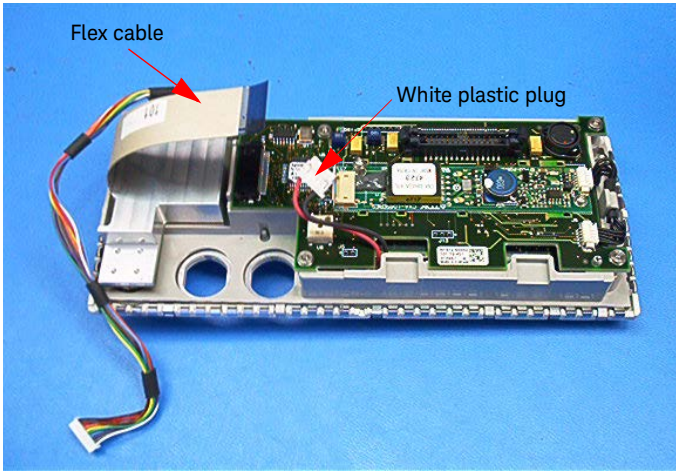
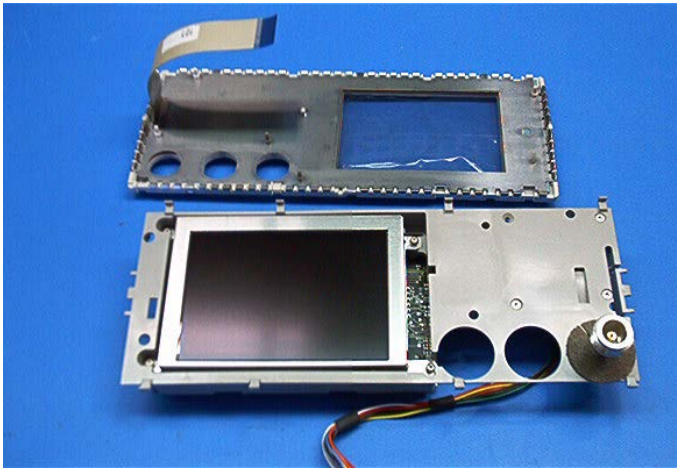
Disassembly of replacement part	Instructions
Main board / Rear panel assembly / Bottom clamshell	– Full strip-down required
PSU / Top clamshell	– Remove handle, bumpers, and top clamshell (including PSU) – PSU can now be removed from the top clamshell
Fan assembly	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect fan assembly from the main board – Fan assembly can now be removed
PPMC assembly (front connectors option)	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect the main board ribbon cable from the PPMC – Disconnect the service connector cable from the PPMC – Remove the 4 screws securing the PPMC to the main board – PPMC assembly can now be removed
PPMC assembly (rear connectors option)	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect the sensor flex connection(s) from the main board – Disconnect the main board ribbon cable from the PPMC – Disconnect the service connector cable from the PPMC – Remove the 4 screws securing the DAP assembly to the main board – PPMC assembly can now be removed

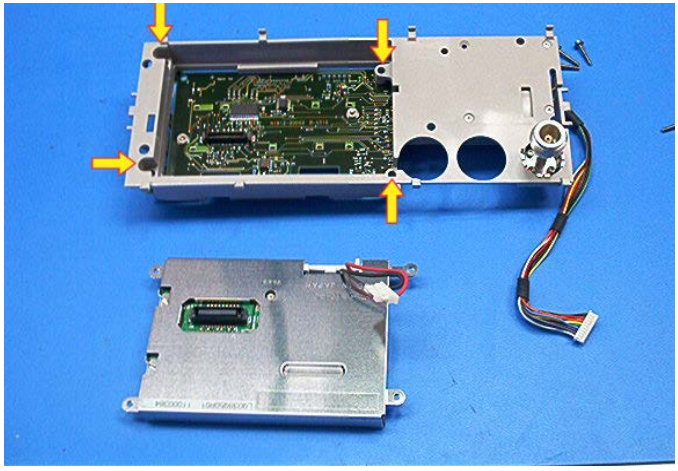
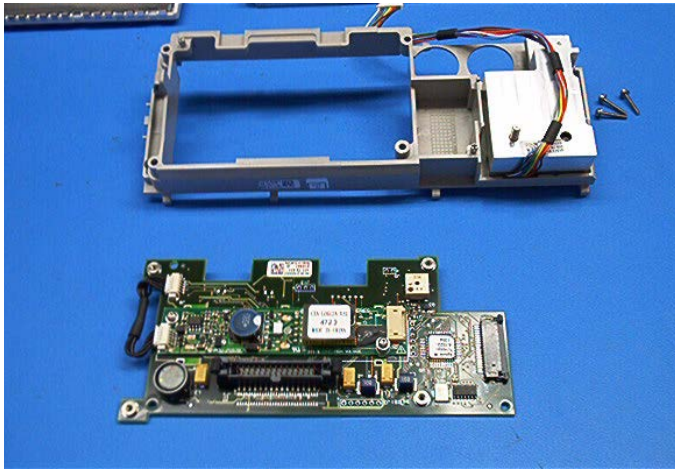
Disassembly of replacement part	Instructions
DAP assembly, Channel A (front connectors option)	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect the sensor RF connections from the main board – Disconnect the sensor flex connection(s) from the main board – Remove the 4 screws securing the DAP assembly to the main board – DAP assembly can now be removed
DAP assembly, Channel A (rear connectors option)	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect the sensor RF connections from the main board – Remove the 4 screws securing the DAP assembly to the main board – DAP assembly can now be removed
DAP assembly, Channel B	– Remove handle, bumpers, and top clamshell (including PSU) – Remove the 4 screws securing the DAP assembly to the main board – DAP assembly can now be removed
Front panel assembly (front connectors option)	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect the sensor RF connections from the main board – Disconnect the sensor flex connection(s) from the main board – Disconnect the calibrator assembly cable connection from the main board – Disconnect the EMI earth wires from the calibrator assembly – Disconnect main board ribbon cable from the front panel – Front panel assembly can now be removed

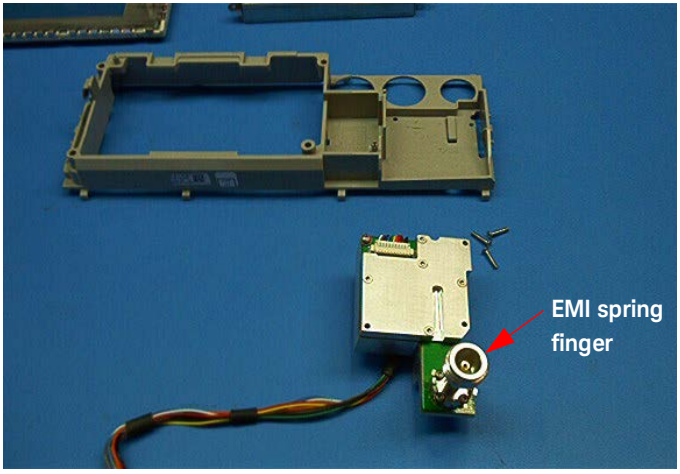
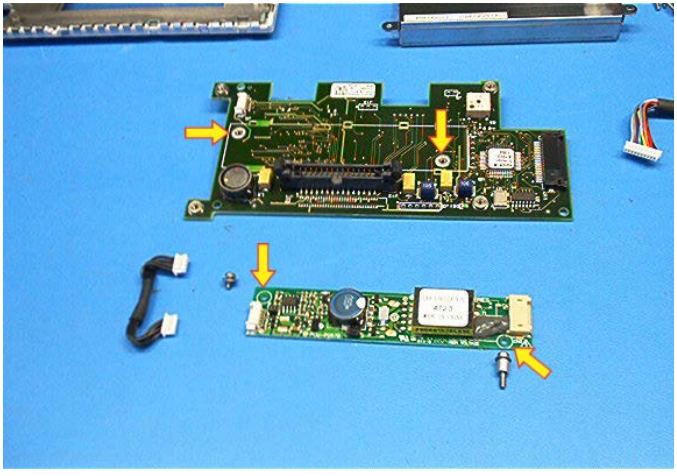
Disassembly of replacement part	Instructions
Front panel assembly (rear connectors option)	– Remove handle, bumpers, and top clamshell (including PSU) – Disconnect calibrator semi-rigid from the rear panel assembly – Disconnect the calibrator assembly cable connection from the main board – Disconnect the EMI earth wires from the calibrator assembly – Disconnect main board ribbon cable from the front panel – Front panel assembly can now be removed
Sensor flex assembly (front connectors option)	– [Remove front panel assembly as previously described] – Use the N1912-61807 special tooling kit to remove the sensor flex assembly
Sensor flex assembly (rear connectors option)	– Remove handle and front/rear Bumpers – Remove top clamshell (including PSU) – Disconnect the sensor RF connections from the main board – Disconnect the sensor flex connection from the main board – Use the N1912-61807 special tooling kit to remove the sensor flex assembly

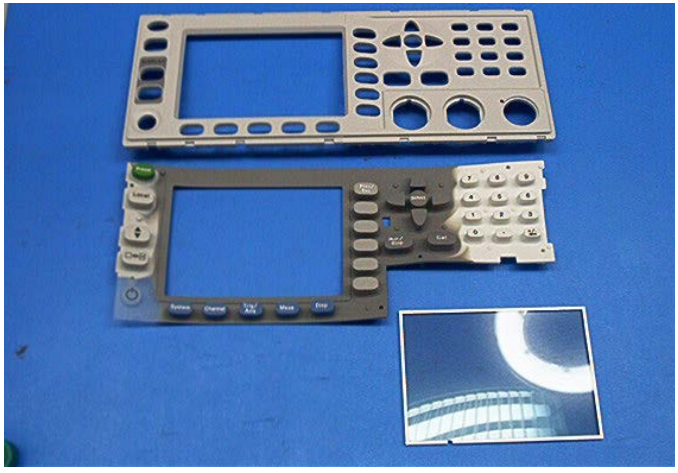
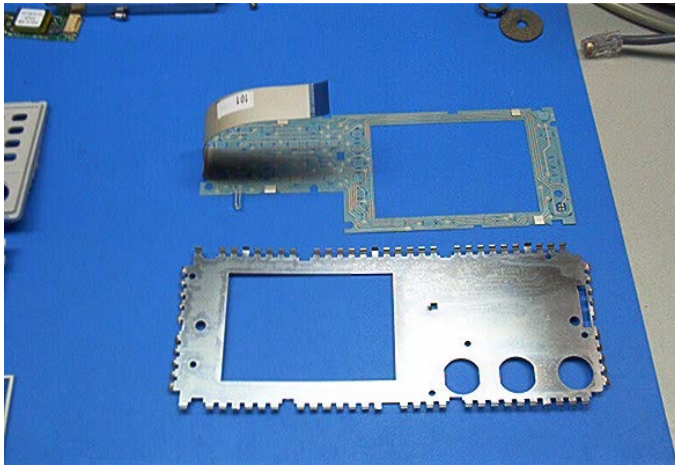
Front Panel Disassembly Instructions

Instructions	Visual
IMPORTANT NOTE: – The front panel assembly should only be repaired in a clean and dust-free environment. – Failure to do so may introduce contamination between the EMI shielded window and the display. – Also note that it may not be necessary to completely disassemble the front panel in order to repair or replace some of its parts. As such, this procedure should be tailored to suit the specific repair requirements.	
Step 1: – Carefully lift and remove the calibrator plug [This step does not apply to units with rear-panel connectors] – This step is only applicable for calibrator assembly with the calibrator plug. – For more information on the improved calibrator assembly, refer to "Improved calibrator assembly" on page 79.	

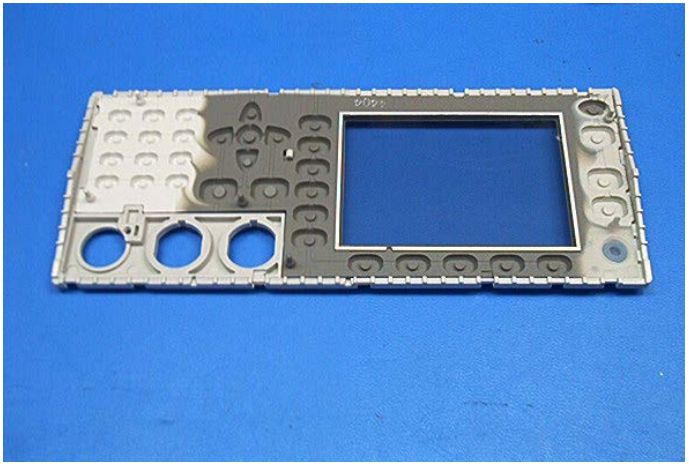
Instructions	Visual
Step 2: – Use ODU socket to remove N1912-61806 sensor flex assembly – Release the tab holding the flex cable to the display interface board, and then disconnect it **Step 3:** – Disconnect the white plastic plug from the display interface board	
Step 4: – Unlock the main plastic clip that holds the front panel sub-frame and display support molding together (situated beside the key flex circuit), and carefully pull them apart to separate them	

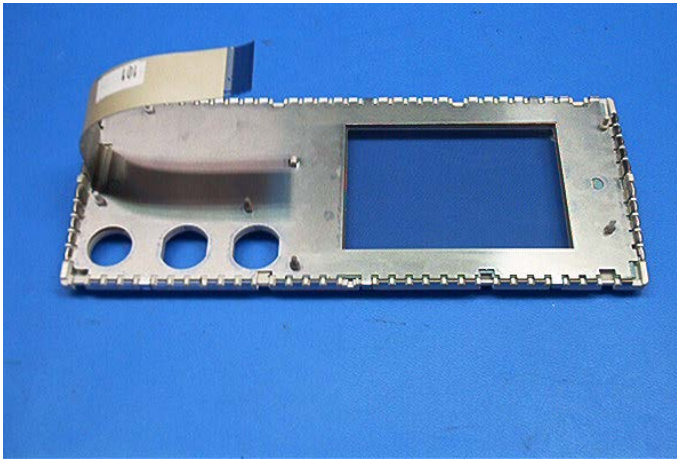
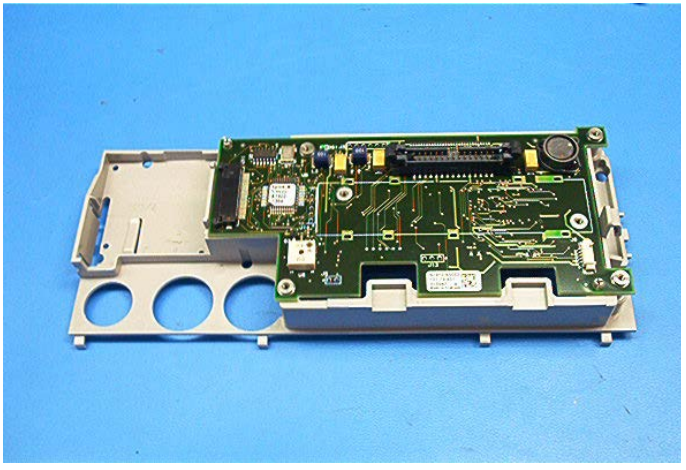
Instructions	Visual
Step 5: – Remove the 4 screws that attach the display to the display support molding, and then disconnect it from the display interface board	
Step 6: – Lift the display interface board off of the plastic mounting lugs on the display support molding to separate them from one another	

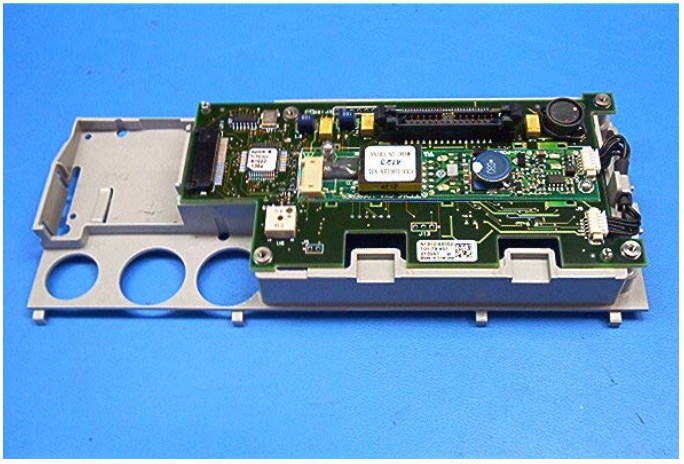
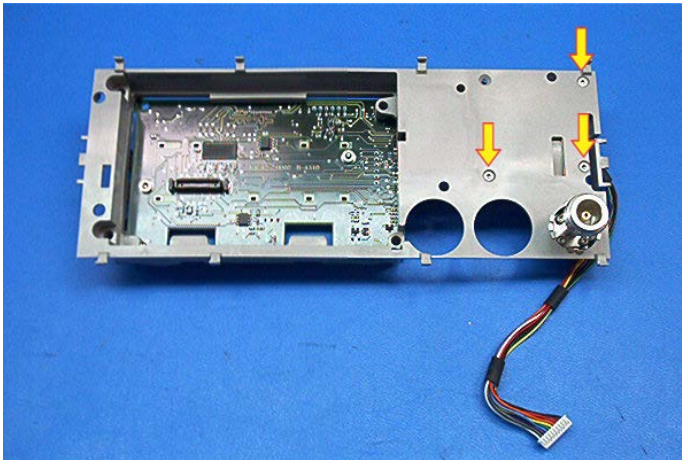
Instructions	Visual
Step 7: – Remove the 3 screws that attach the calibrator assembly to the display support molding, and separate them from one another **Note:** – Take care not to damage the EMI spring fingers on the calibrator assembly	
Step 8: – Disconnect the backlight cable assembly from the display interface board and inverter board **Step 9:** – Remove the 2 screws that attach the display inter face board to the inverter board, and separate them from one another	

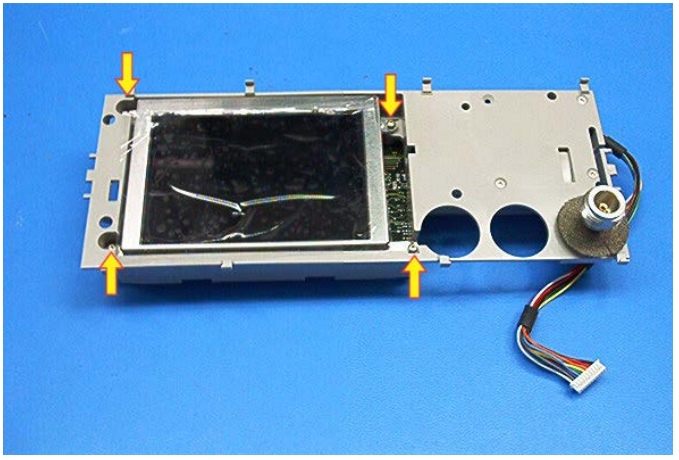
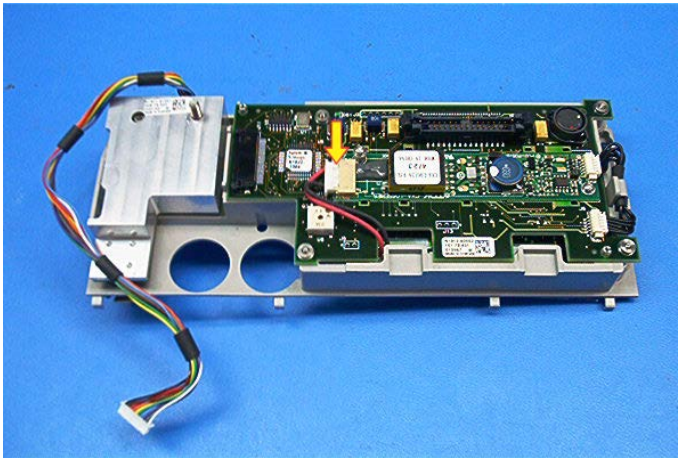
Instructions	Visual
Step 10: – Release the metal tabs holding the EMI screen to the front panel sub-frame, and separate them from one another **Step 11:** – Disengage the rubber tabs that attach the key flex circuit to the keymat, and carefully lift it out	
Step 12: – Remove the EMI shielded window and the keymat from the front panel sub-frame	

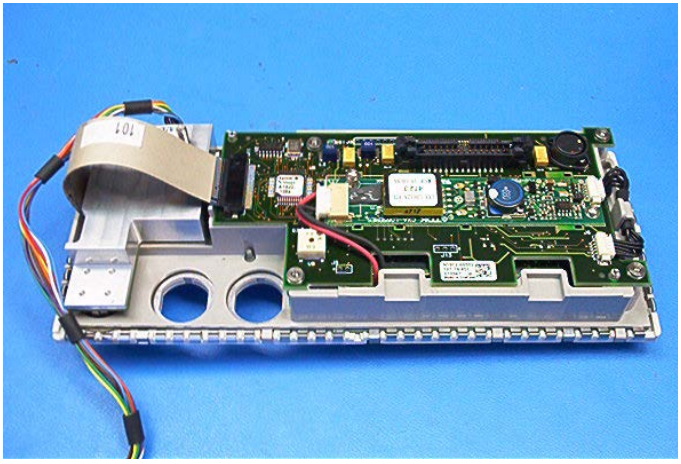
Front Panel Reassembly Instructions

Instructions	Visual
Step 1: – Insert the keymat into the front panel Sub-frame **Step 2:** – Insert the EMI shielded window into the keymat, ensuring that it is clean and free from fingerprints	
Step 3: – Overlay the key flex circuit onto the keymat, ensuring that all of the rubber lugs are engaged to hold it securely	

Instructions	Visual
Step 4: – Overlay the EMI screen onto the key flex circuit, ensuring that all of the metal tabs are engaged to hold it securely	
Step 5: – Fit the display interface board onto the plastic mounting lugs on the display support molding	

Instructions	Visual
Step 6: – Attach the inverter board to the display interface board using the 2 screws removed earlier **Step 7:** – Connect the inverter board to the display interface board using the backlight cable assembly **Note:** – The cable must be tucked under the plastic clip to prevent any fouling	
Step 8: – Attach the calibrator assembly to the display support molding using the 3 screws removed earlier **Step 9:** – Carefully spread the EMI fingers outwards, ensuring they extend beyond the edges of the hole in which the calibrator assembly is fitted	

Instructions	Visual
Step 10: – Fit the split washer to the calibrator assembly **Step 11:** – Attach the display to the display interface board using the 4 screws removed earlier	
Step 12: – Connect the white plastic plug to the display interface board	

Instructions	Visual
Step 13: – Attach the front panel sub-frame to the display support moulding, ensuring that all plastic clips are engaged to hold it securely **Step 14:** – Connect the flex cable to the display interface board, and then tighten the locking tab	
Step 15: – Re-fit the calibrator plug – This step is only applicable for calibrator assembly with the calibrator plug. – For more information on the improved calibrator assembly, refer to "Improved calibrator assembly" on page 79.	

Additional Repair Notes

Replacing a sensor flex assembly:

- The sensor flex assembly is supplied straight
- Create a sharp bend (Figure 5-20): The flex circuit must be bent at a right-angle where it meets the printed circuit board. It can only be bent after heat has been applied to it (i.e. using a hot-air gun, or a similar device)

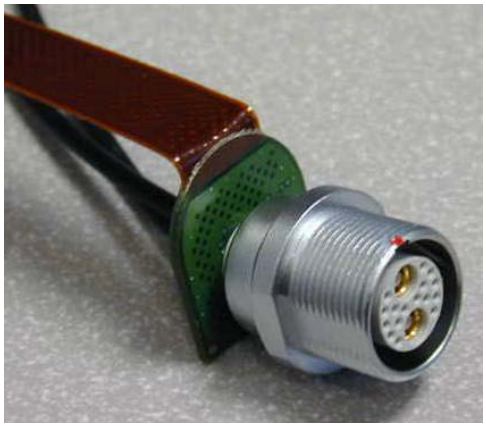
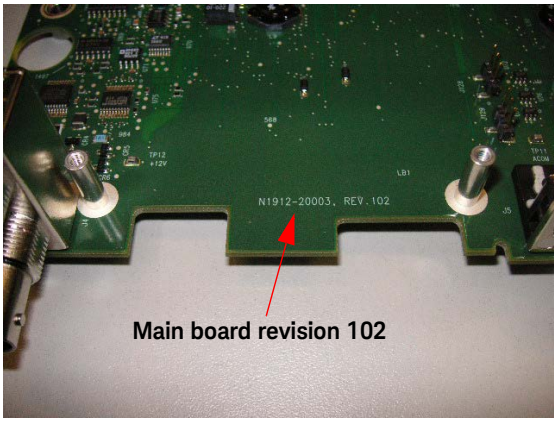
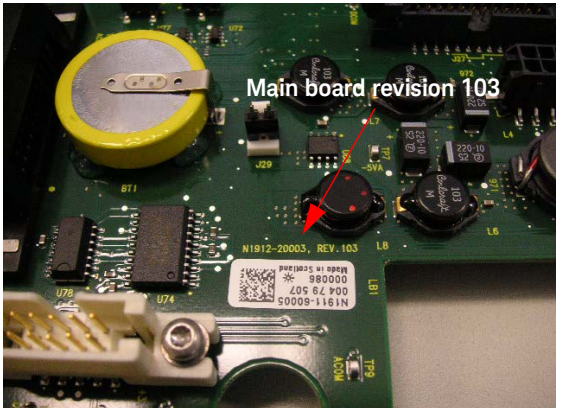


Figure 5-20 Creating a sharp bend

NOTE

- Once this sharp bend has been created, the flex should not be bent at this point again; to do so may break the tracking within the flex.
- Route and connect the sensor flex assembly: once the sensor flex assembly has been attached to the power meter; it should be folded to match the route taken by the assembly being replaced. Heat may be used to assist the folding of the flex.

Main board vs. rear panel assembly

Instructions	Visual
– Due to a difference in the connector positions for main board revision 102 and revision 103, there are TWO different rear panels – Revision 102 main boards are not available as spares – all spare main boards will be revision 103 (or newer) – When replacing a revision 102 main board, take note that the rear panel will need to be replaced – Figure 5-21 and Figure 5-22 show where to find the main board revision markings	 **Figure 5-21**  **Figure 5-22**

Replacing the PPMC Assembly

- The PPMC assembly is pre-programmed with N1912A firmware
- Always perform a firmware upgrade to the instrument if the PPMC assembly has been replaced

NOTE

- **Fitting a PPMC assembly that has been pre-programmed with N1912A firmware to an N1911A power meter will generate errors; these errors will disappear once the firmware upgrade procedure has been carried out.**

- Instrument serial number:

  This can be stored in the PPMC assembly via the command:

  `SERV:SNUM <CHARACTER DATA>`

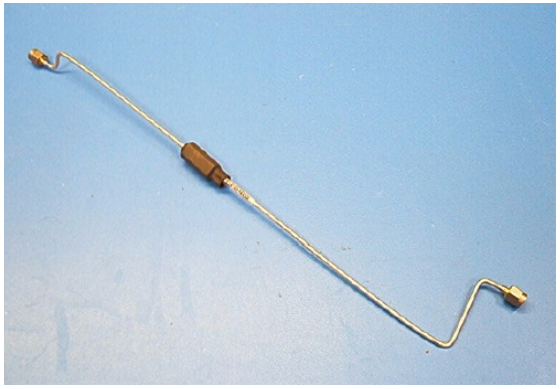
- Instrument option(s):

  This/these can be stored in the PPMC assembly via the command:

  `SERV:OPT “<CHARACTER DATA>”`

Refer to the *Programming Guide* for further details on the use of these commands.

Replacing the Calibrator Semi-Rigid/Split Ferrite

Instructions	Visual
– Separate the two halves of the ferrite (Figure 5-23) – Position the ferrite such that it's furthest edge is 120 mm (4 ¾") from the bend of the semi-rigid (Figure 5-24) – Hold the ferrite in place by applying a coating of silicone or silicone-rubber compound (e. g. RTV) along that 20 mm (¾") section of the semi-rigid – Join both halves of the ferrite, keeping the mating surfaces free of the silicone compound if possible	 **Figure 5-23**  **Figure 5-24**

6 Contacting Keysight Technologies

This chapter details what to do if you have a problem with your power meter.

Introduction

Contacting Keysight Technologies

This section details what to do if you have a problem with your power meter. If you have a problem with your power meter, first refer to the page titled "Before Calling Keysight Technologies" on page 115. This section contains a checklist that helps identify some of the most common problems. If you wish to contact Keysight Technologies about any aspect of the power meter, from service problems to ordering information, refer to "Sales and Technical Support" on page 10. If you wish to return the power meter to Keysight Technologies, refer to the section titled "Returning Your Power Meter for Service" on page 118.

Before Calling Keysight Technologies

Before calling Keysight Technologies or returning the power meter for service, please make the checks listed in "Check the Basics" on page 116. If your power meter is covered by a separate maintenance agreement, please be familiar with the terms.

Keysight Technologies offers several maintenance plans to service your power meter after warranty expiration. Call your Keysight Technologies Sales and Service Center for full details.

If the power meter becomes faulty and you wish to return the faulty instrument, follow the description on how to return the faulty instrument in "Returning Your Power Meter for Service" on page 118.

Check the Basics

Problems can be solved by repeating what was being performed when the problem occurred. A few minutes spent in performing these simple checks may eliminate time spent waiting for instrument repair. Before calling Keysight Technologies or returning the power meter for service, please make the following checks:

- Check that the line socket has power.
- Check that the power meter is plugged into the proper ac power source.
- Check that the power meter is switched on.
- Check that the line fuse is in working condition.
- Check that the other equipment, cables, and connectors are connected properly and operating correctly.
- Check the equipment settings in the procedure that was being used when the problem occurred.
- Check that the test being performed and the expected results are within the specifications and capabilities of the power meter.
- Check the power meter display for error message.
- Check operation by performing the self tests.
- Check with a different power sensor.

Instrument Serial Numbers

Keysight Technologies makes frequent improvements to its products to enhance their performance, usability and reliability. Keysight Technologies service personnel have access to complete records of design changes for each instrument. The information is based on the serial number and option designation of each power meter.

Whenever you contact Keysight Technologies about your power meter have a complete serial number available. This ensures you obtain the most complete and accurate service information. The serial number can be obtained by:

- Querying the power meter over a remote interface (via the `*IDN?` Command).
- From the front panel (via the Service menu).
- From the serial number label.

The serial number label is attached to the rear of each Keysight Technologies instrument. This label has two instrument identification entries. The first provides the instruments serial number and the second provides the identification number for each option built into the instrument.

The serial number is divided into two parts: the prefix (two letters and the first four numbers), and the suffix (the last four numbers).

The prefix letters indicate the country of manufacture. This code is based on the ISO international country code standard, and is used to designate the specific country of manufacture for the individual product. The same product number could be manufactured in two different countries. In this case the individual product serial numbers would reflect different country of manufacture codes. The prefix also consists of four numbers. This is a code identifying the date of the last mojor design change.

The suffix indicates an alpha numeric code which is used to ensure unique identification of each product throughout Keysight Technologies.

Returning Your Power Meter for Service

Use the information in this section if you need to return your power meter to Keysight Technologies.

Packaging the power meter for shipment to Keysight Technologies for service

- Fill in a blue service tag (available at the end of most hardcopy *Keysight Service Guides*) and attach it to the power meter. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
  - Any error messages that appeared on the power meter display.
  - Any information on the performance of the power meter.

CAUTION **Power meter damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the power meter or prevent it from shifting in the carton. Styrene pellets cause power meter damage by generating static electricity and by lodging in the rear panel.**

- Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the power meter and allow at least 3 to 4 inches on all sides of the power meter for packing material.
- Surround the power meter with at least 3 to 4 inches of packing material, or enough to prevent the power meter from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap TM from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1-1/4 inch air filled bubbles. Use the pink Air Cap to reduce static electricity. Wrap the power meter several times in the material to both protect the power meter and prevent it from moving in the carton.
- Seal the shipping container securely with strong nylon adhesive tape.
- Mark the shipping container “FRAGILE, HANDLE WITH CARE” to ensure careful handling.
- Retain copies of all shipping papers.

Useful Web Pages

- Main product page

  www.keysight.com/find/wideband_powermeters

- Product manuals

  www.keysight.com/find/pseriesmanuals

- Product firmware

  www.keysight.com/find/pseriesfirmware

- Performance test & calibration software

  www.cal.software.keysight.com

- Service notes

  N1911A

  https://servicenotes.literature.keysight.com/litapp/SearchSN.do?method=openExternalSNSearch&prodNum=N1911A

  N1912A

  https://servicenotes.literature.keysight.com/litapp/SearchSN.do?method=openExternalSNSearch&prodNum=N1912A

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