User Manual

Model 9100 (single-channel)
Model 9200 (dual-channel)

HIGH VOLTAGE
WIDEBAND AMPLIFIER

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Tabor Electronics Ltd.

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This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.

Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.

Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuit points.

Before operating this instrument:

1. Ensure the proper fuse is in place for the power source to operate.
2. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until, performance is checked by qualified personnel.

DECLARATION OF CONFORMITY

We: Tabor Electronics Ltd.
9 Hatasia Street, Tel Hanan
ISRAEL 36888

declare, that the 300Vp-p Signal Amplifiers

Models 9100 and 9200

meet the intent of Directive 89/336/EEC for Electromagnetic Compatibility and complies with the requirements of the Low Voltage Directive 73/23/EEC amended by 93/68/EEC, according to testing performed at ORDOS/E.M.I TEST LABs (#5TBR984SX, Dec. 2005). Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:

Safety:
IEC/EN 61010-1 2nd Edition:2001+ C1, C2

EMC:
EN 50081-1 Emissions:
EN 55022 - Radiated, Class B
EN 55022 - Conducted, Class B
EN 50082-1 Immunity:
IEC 801-2 (1991) - Electrostatic Discharge
IEC 801-3 / ENV50140 (1993) - RF Radiated
IEC 801-4 (1991) - Fast Transients

Models 9100 and 9200 are built on the same platform and share specifications and features except the 9100 is a single channel version and while the 9200 has two channels. The tests were performed on a typical configuration.

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Chapter 1
PORTRAYAL

What's In This Chapter

This chapter contains general and functional description of the Models 9100 and 9200 – high voltage wideband amplifier series. It also describes the front panel connectors and operational modes and provides description of all features available with the instrument.

Introduction

The Model 9100 is shown in Figure 1-1 and the 9200 is shown in Figure 1-2. Both instruments are built on the same platform and share specifications and features except the 9100 is a single channel version and while the 9200 has two channel.

NOTE

This manual is common to both the 9100 and 9200. Description is given for the Model 9200 only. Ignore references to the second channel if you use model 9100.

The 9200 is a 2U, ½ rack size, bench-top power amplifier. The amplifier is used for general-purpose signal amplification purpose. Offering unprecedented signal purity, the 9200 amplifies signals from dc to over 500 KHz. The unit has a fixed gain of x15 however; one may order the same amplifier with custom gain without jeopardizing signal purity and amplifier performance.

The 9200 is intended to operate as an amplifying buffer for signals such as available from waveform, function, or pulse generators. Most of these generators can produce signals that are limited to 20Vp-p into high impedance; The 9200 can be used to convert these voltages to levels as high as 300Vp-p.

The amplifier has a drive capability of over 100mA from a 0.1Ω source. While the output can drive small capacitive or inductive loads, for full high speed potential it is recommended that the load characteristics should be mainly resistive. Load capacitance and inductance up to 100pF and 0.5 mH, respectively, can be tolerated without performance deterioration.

The 9200 is supplied with floating input and output connectors. Therefore, the signal can float from ground level up to ±250Vdc. The only limiting factor is that both input and output grounds must connect to the same level. This capability is extremely important in applications where the amplifying device should reside on the same ground level as its source. The floating capability can be added or removed using a simple, user-accessible, jumper connection.

The amplifier case was designed to stack on top or below other Tabor products. It also can be mounted next to a Tabor generator in a standard 19" rack. The waveform-amplifier combination is a perfect fit for almost every high-voltage, wide bandwidth application. .

Figure 1-1. Model 9100 – Single channel High Voltage Amplifier

Figure 1-2. Model 9200 – Dual Channel high Voltage Amplifier

Conventions Used in this Manual

The following conventions may appear in this manual:

NOTE

A Note contains information relating to the use of this product

CAUTION

A Caution contains information that should be followed to avoid personal damage to the instrument or the equipment connected to it.

WARNING

A Warning alerts you to a potential hazard. Failure to adhere to the statement in a WARNING message could result in personal injury.

9200 Feature Highlights

- High voltage output to 300Vp-p (±150V)
- Output current to 100 mA per channel (150 mA in 9100)
- Wideband range to over 200 KHz
- Slew rate to 200V/μs
- Low distortion
- Low cost
- Custom configuration of:

  Gain

  Signal Ground

Functional Description

Detailed functional description of the features, operation and options available with the 9200 is given in the following paragraphs. The high voltage amplifiers can be ordered with different configurations such as output impedance, gain, etc. therefore read the following description carefully and make sure your amplifier is configured correctly for your application before you start operating the amplifier.

Options

Model 9200 must be ordered from the factory already configured for your application. There will be no schematics, nor instructions how to modify the amplifier for other configurations as any configuration change may affect the amplifier performance.

Below, you'll find a list of optional configurations for the wideband amplifier:

Gain – specifies gain magnitude of the input signal. Factory default setting is 15 however, any custom gain from 10 to 20 can be specified. Note that some characteristics of the output may change for gain setting above 15.

Circuit Ground – determines if the amplifier ground is floated or tied to case ground. Note that this is the only option that is user accessible and may be changed by adding or removing two jumper connection.

As explained above, all options must be specified at the time of your

purchase and the 9200 is supplied fully configured.

Specifications

Instrument specifications are listed in Appendix A. These specifications are the performance standards or limits against which the instrument is tested. Specifications apply under the following conditions: output terminated into matching impedance, after 30 minutes of warm up time, and within a temperature range of 20°C to 30°C. Specifications outside this range are degraded by 0.1% per °C.

Front Panel Connectors

The 9200 has 4 BNC connectors on its front panel, designated as INPUT and OUTPUT. These connectors are described below.

Input

The input connector accepts signals within the range of DC to over 500 KHz and amplifies them by a fixed gain. Input impedance is 1MΩ

The amplifier input can not tolerate high voltage therefore, before applying the cable to the input connector, make sure your signal does not exceed input rating, as specified in Appendix A of this manual.

Output

The output connector outputs amplified signals. The output connector may generate inverted signals, depending on the amplifier configuration. Gain at this output is fixed at 15 (or another gain factor that was specified at the time of your purchase). Output source impedance is 0.1Ω.

WARNING

Applying the output signal on inductive or capacitive loads may damage the amplifier.

Grounding Considerations

Understanding how to connect your ground path could be critical to preserving the integrity of your output signal. If you are using a single-ended output then it will probably be safe for you to connect the circuit ground to case ground. However, in applications requiring floated ground connection, it is imperative that the amplifier ground be made floating as well. In this case, refer to Chapter 2 and Figure 2-1 for instructions how to float the circuit ground. Always bear in mind the following warning:

WARNING

Input and output grounds are tied together and therefore, it is absolutely forbidden to connect the output ground to a different level than the input ground. Failure to adhere to this limitation may damage the TE3322 and the surrounding equipment connected to its I/O connectors.

Also note:

NOTE

Normal amplifier operation is recommended with circuit ground connected to case ground (float disabled), thus minimizing susceptibility to system noise. Enable float configuration for floated application only.

Operating Instructions

Being a passive device, there are no controls, nor computer programming required to operate the 9200. The following procedure is recommended for proper operation of the high voltage power amplifier:

1. Make sure your amplifier is configured for input and output impedance, gain and grounding

2. Follow the installation instructions given in Chapter 2 of this manual

3. Connect the output terminal to your load
4. Connect the input terminal to your source
5. Turn on power to your 9200

WARNING

There is no switch control to tunr amplification on and off and therefore, the amplifier is active immediately after you power it up. Always make sure your load is protected from inadvertent power up conditions before you turn on your 9200.

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Chapter 2
INSTALLATION

Installation Overview

This chapter contains information and instructions necessary to prepare the 9200 for operation. Details are provided for initial inspection, grounding requirements, repackaging instructions for storage or shipment and installation information.

Unpacking and Initial Inspection

Unpacking and handling of the generator requires normal precautions and procedures applicable to handling of sensitive electronic equipment. The contents of all shipping containers should be checked for included accessories and certified against the packing slip to determine that the shipment is complete.

Safety Precautions

The following safety precautions should be observed before using this product and associated computer. Although some instruments and accessories would normally be used with non-hazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified persons who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. The following sections contain information and cautions that must be observed to keep the 9200 operating in a correct and safe condition.

CAUTION

For maximum safety, do not touch the product, test cables, or any other instrument parts while power is applied to the circuit under test. ALWAYS remove power from the entire test system before connecting cables or jumpers. Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always keep your hands dry while handling the instrument.

Operating Environment

The 9200 is intended for indoor use and should be operated in a clean, dry environment with an ambient temperature within the range of 0 °C to 40 °C.

WARNING

The 9200 must not be operated in explosive, dusty, or wet atmospheres. Avoid installation of the module close to strong magnetic fields.

The design of the 9200 has been verified to conform to EN 61010-1 safety standard per the following limits: Installation (Overvoltage) Category I (Measuring terminals) Pollution Degree 2

Pollution Degree 2 refers to an operating environment where normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation must be expected

Power Requirements

The 9200 operates from one of the following nominal ac sources: 100V, 115V, or 230V ac. Voltage selection is done using the rear-panel power line selector switch. The instrument operates over the power mains frequency range of 47 to 63 Hz. Always verify that the operating power mains voltage is the same as that specified on the rear panel voltage selector switch.

The 9200 is supplied with the correct power line setting. If this setting needs to be change, use a flat-head screwdriver to set the Line Selector switch on the rear panel to the required position.

The instrument is not intended for operation from two phases of a multi-phase ac system or across the legs of a single-phase, three-wire ac power system. Crest factor (ratio of peak voltage to rms.) should be typically within the range of 1.3 to 1.6 at 10% of the nominal rms mains voltage.

WARNING

DO not connect the line cord to the 9200 before you verify the correct power line setting. Failure to switch the instrument to match the operating line voltage will damage the instrument and may void the warranty.

Grounding Requirements

To conform to the applicable safety and EMC requirements, ensure that the 9200 instrument panel and the PC chassis is “earth” grounded.

CAUTION

The outer shells of the front panel terminals (Input, Output) can float from case ground. Refer to Figures 2-1, 2-2 and the instructions in this manual to disconnect/connect the circuit ground from/to case ground.

Floating the Input/Output Grounds

The 9200 ground circuit is designed so it can float from case ground. The only limitation is that the input and output grounds must reside on the same ground level.

Looking at the front panel, you will notice that the BNC connectors are housed in plastic material and therefore are isolated from the front panel metal. The amplifier circuit is also floated from the backplan power supply ground through isolating transformer and therefore the amplifier ground circuit can be configured to float from case ground in applications requiring isolation from circuit to case grounds.

WARNING

Input and output grounds are tied together and therefore, it is absolutely forbidden to connect the output ground to a different level than the input ground. Failure to adhere to this limitation may damage the amplifier and the surrounding equipment connected to its I/O connectors.

The 9200 can be ordered from the factory already configured with the required ground setting however, ground can be configured differently for various applications using simple jumper connections. Use the following procedure to enable/disable floated ground configuration.

1. Locate LK1 at the left side of the board, as shown in Figure 2-1
2. Locate LK2 at the right side of the board, as shown in Figure 2-2
3. Remove both shorting jumpers if you want to float the input/output grounds
4. Leave the jumpers on LK1/LK2 if you want to connect circuit ground to case ground

NOTE

Normal amplifier operation is recommended with circuit ground connected to case ground (float disabled), thus minimizing susceptibility to system noise. Enable float configuration for floated application only.

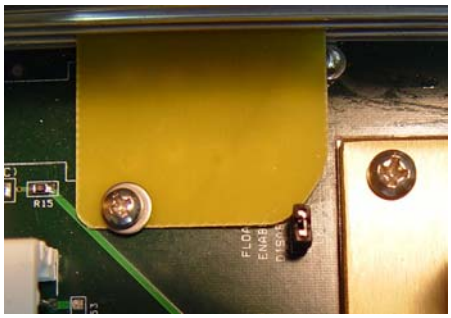

Figure 2-1. Float Enable/Disable Jumper LK1

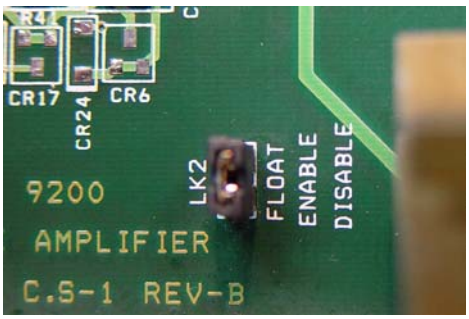

Figure 2-2. Float Enable/Disable Jumper LK2

Calibration

The recommended calibration interval is three years. Calibration should be performed by qualified personnel only.

Abnormal Conditions

Operate the 9200 only as intended by the manufacturer. If you suspect the product has been impaired, remove the power cord and secure against any unintended operation. The 9200 protection is likely to be impaired if, for example, the instrument fails to perform the intended operation or shows visible damage.

WARNING

Any use of the 9200 in a manner not specified by the manufacturer may impair the protection provided by the instrument

Long Term Storage or Repackaging For Shipment

If the instrument is to be stored for a long period of time or shipped immediately, proceed as directed below. If you have any questions, contact your local Tabor representative or the Tabor Customer Service Department.

1. Repack the instrument using the wrappings, packing material and accessories originally shipped with the unit. If the original container is not available, purchase replacement materials.
2. Be sure the carton is well sealed with strong tape or metal straps.
3. Mark the carton with the model and serial number. If it is to be shipped, show sending and return address on two sides of the box.
4.

NOTE

If the instrument is to be shipped to Tabor for calibration or repair, attach a tag to the instrument identifying the owner. Note the problem, symptoms, and service or repair desired. Record the model and serial number of the instrument. Show the returned authorization order number (RMA) as well as the date and method of shipment. ALWAYS OBTAIN A RETURN AUTHORIZATION NUMBER FROM THE FACTORY BEFORE SHIPPING THE INSTRUMENT TO TABOR.

Preparation For Use

Preparation for use includes removing the instrument from the box, the bag and installing the 9200 either on the beck or in a 19” rack.

Bench Installation

The 9200 is fully solid state and dissipates only a small amount of power. No special cooling is required. However, the instrument should not be operated where the ambient temperature exceeds 50 °C, when the relative humidity exceeds 80% or condensation appears anywhere on the instrument. Avoid operating the instrument close to strong magnetic fields, which may be found near high power equipment such as motors, pumps, solenoids, or high power cables. Use care when rack mounting to locate the instrument away from sources of excessive heat or magnetic fields. Always leave 4 cm (1.5 inches) of ventilation space on all sides of the instrument.

Rack Mounting

The 9200 can be rack mounted inside a standard 19” rack. It can be mounted using one of two configurations: 1) single, or 2) side-by-side. Tabor offers rack-mounting ears for both options. Consult the factory for the appropriate part number.

Using the single rack mounting option, the 9200 is supplied with a blank panel that covers the empty side. The case can be mounted either on the left or the right of the rack with the blank panel covering the empty space.

Side-by-side option is available only with other Tabor products. In this case, the two boxes are latched in the middle and side ears connect the assembly to the rack. Figure 2-3 shows how the 9200 can be mounted next to a dual-channel arb – Model 8026.

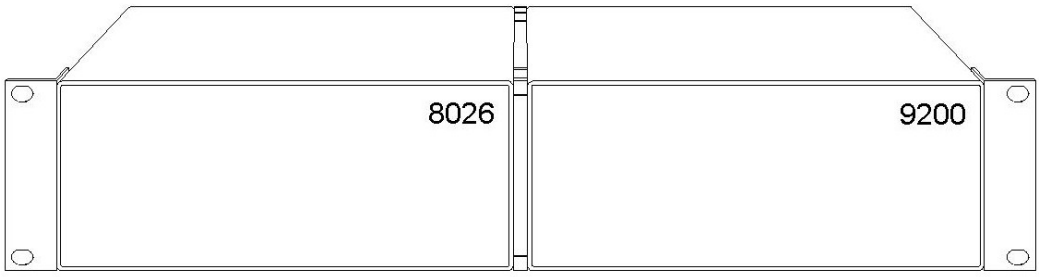

Figure 2-3. Dual Rack Mounting Option

Chapter 3

PERFORMANCE CHECKS and ADJUSTMENTS

What's in This Chapter

This chapter provides performance tests necessary to troubleshoot the Model 9100/9200 – single/dual-channel, wideband power amplifier.

WARNING

The procedures described in this section are for use only by qualified service personnel. Many of the steps covered in this section may expose the individual to potentially lethal voltages that could result in personal injury or death if normal safety precautions are not observed.

CAUTION

ALWAYS PERFORM PERFORMANCE TESTS IN A STATIC SAFE WORKSTATION.

Performance Checks

The following performance checks verify proper operation of the instrument and should normally be used:

1. As a part of the incoming inspection of the instrument specifications;
2. As part of the troubleshooting procedure;
3. After any repair or adjustment before returning the instrument to regular service.

Environmental Conditions

Tests should be performed under laboratory conditions having an ambient temperature of 25°C, ±5°C and at relative humidity of less than 80%. If the instrument has been subjected to conditions outside these ranges, allow at least one additional hour for the instrument to stabilize before beginning the adjustment procedure.

Warm-up Period

Most equipment is subject to a small amount of drift when it is first turned on. To ensure accuracy, turn on the power to the 9200 and allow it to warm-up for at least 30 minutes before beginning the performance test procedure.

Recommended Test Equipment

Recommended test equipment for troubleshooting, calibration and performance checking is listed in Table 3-1 below. Test instruments other than those listed may be used only if their specifications equal or exceed the required characteristics.

Table 3-1, Recommended Test Equipment

Equipment	Model No.	Manufacturer
Oscilloscope	LT342	LeCroy
Distortion Analyzer	6900B	Krohn Hite
Digital Multimeter	2000	Keithley
Waveform Generator	WW1072	Tabor Electronics
100:1 High voltage Probe	6498	Pomona Electronics
1.5 kΩ/20W Load Resistance	For Model 9200	Tabor Electronics
1 kΩ/20W Load Resistance	For Model 9100	Tabor Electronics

Test Procedures

Use the following procedures to check the Models 9100 and 9200 against the specifications. A complete set of specifications is listed in Appendix A. The following paragraphs show how to set up the instrument for the test, what the specifications for the tested function are, and what acceptable limits for the test are. If the instrument fails to perform within the specified limits, the instrument must be calibrated or tested to find the source of the problem.

WARNING

The output connectors of the power amplifier produce voltages up to 300Vp-p. The procedures described in this section are for use only by trained and qualified service personnel. Many of the steps covered in this section may expose the individual to potentially lethal voltages that could result in personal injury or death if extreme safety precautions are not observed. Do not attempt to perform any of the following tests except if you were trained and advised specifically on the hazards involve. Never have your hands on the cables while performing the test procedures.

Amplifier Gain Accuracy

Amplifier gain accuracy checks the gain accuracy of the power amplifier. Each channel has its own power amplifier and therefore, the accuracy is tested on each channel separately.

NOTE

The 9100/9200 is normally supplied with gain of 15. However, it can be ordered with with the factory with different gain setting. The test procedures in the following paragraphs apply to all gain configurations and therefore, the factor "k" must be used and amplitude value calculated in case the amplifier under test has different gain settings, other than the standard x15. For example, for an amplifier gain of x20, replace the 2 V level in Table 3-2 by the value computed from 2x(15/Gain) = 2 x 15 / 20 = 1.5 V

Gain Accuracy Tests

Equipment**:** DMM, Arbitrary Waveform Generator, Load Resistance

Preparation:

1. Configure the DMM as follows:
   Function: ACV
   Range: 200V
2. Connect the 9200 Channel 1 output to the DMM input. Attach the load resistance at the input terminals of the DMM
3. Configure the Waveform Generator as follows:
   Frequency: 1kHz
   Output: On
   Amplitude: As required for the test
4. Connect the waveform generator to Channel 1 input

Test Procedure

1. Perform Gain Accuracy tests on channel 1 output using Table 3-2
2. Use the same procedure to check channel 2

Table 3-2, Gain Accuracy Tests

Arb Amplitude Setting	Error Limits	DMM Reading		Pass	Fail
		CH1	CH2		
2(x15/Gain) V	21.20 V, ±0.4 V				
4(x15/Gain) V	42.40 V, ±0.8 V				
8(x15/Gain) V	84.85 V, ±1.7 V				
10(x15/Gain) V	106.1 V, ±2.1 V				

Amplifier Bandwidth

Amplifier bandwidth checks the bandwidth of the output. Each channel has a different response and therefore, the bandwidth is tested on each channel separately. The amplifier responds differently to small and large signals and therefore its bandwidth is checked for each type of level

Bandwidth, Large Signals

Equipment**:** Oscilloscope, Arbitrary Waveform Generator, Load Resistance, x100 high voltage probe

Preparation:

1. Configure the Oscilloscope as follows:
   Time Base: 200 μs/div
   Amplitude: 50 V/div
2. Connect the 9200 Channel 1 output to the load resistance
3. Connect the x100 high voltage probe across the load resistance
4. Configure the Waveform Generator as follows:
   Amplitude: 10(x15/Gain) V
   Output: On
   Frequency: As required for the tests
5. Connect the waveform generator to Channel 1 input

Test Procedure

1. Using the variable vertical adjustment on the oscilloscope, adjust the vertical trace to show exactly 6 vertical divisions
2. Perform bandwidth, large signals tests on channel 1 output using Table 3-3
3. Use the same procedure to check channels 2

Table 3-3, Output Bandwidth, Large Signals Tests

Arb Frequency Setting	Error Limits	Oscilloscope Reading		Pass	Fail
		CH1	CH4		
1 kHz	6 Divisions				
100 kHz	6 ±1.8 Divisions				
400 kHz	6 ±1.8 Divisions				
520 kHz	6 ±1.8 Divisions				

Bandwidth, Small Signals

Equipment**:** Oscilloscope, Arbitrary Waveform Generator, Load Resistance, 50Ω feedthrough terminator

Preparation:

1. Configure the Oscilloscope as follows:
   Time Base: 200 μs/div
   Amplitude: 5 V/div
2. Connect the 9200 Channel 1 output to the Oscilloscope input. Attach the load resistance at the input terminals of the oscilloscope
3. Configure the Waveform Generator as follows:
   Amplitude: 1(x15/Gain) V

Output: On
Frequency: As required for the tests

4. Connect the waveform generator to Channel 1 input. Terminate the waveform generator using the 50Ω feedthrough terminator at the 9200 input

Test Procedure

1. Using the variable vertical adjustment on the oscilloscope, adjust the vertical trace to show exactly 6 vertical divisions
2. Perform bandwidth, small signals tests on channel 1 output using Table 3-4
3. Use the same procedure to check channels 2

Table 3-4, Output Bandwidth, Small Signals Tests

Arb Frequency Setting	Error Limits	Oscilloscope Reading		Pass	Fail
		CH1	CH2		
1 kHz	6 Divisions				
500 kHz	6 ±1.8 Divisions				
800 kHz	6 ±1.8 Divisions				
1.2 MHz	6 ±1.8 Divisions				

Amplifier Pulse Response

Amplifier pulse response checks the aberrations, which include rise and fall times, overshoot and undershoot. Each channel has a different response and therefore, the pulse response is tested on each channel separately.

Rise/Fall Time Tests

Equipment**:** Oscilloscope, Arbitrary Waveform Generator, Load Resistance, x100 high voltage probe

Preparation:

1. Configure the Oscilloscope as follows:
   Time Base: 500ns
   Amplitude: 100 V/div
2. Connect the 9200 Channel 1 output to the load resistance
3. Connect the x100 high voltage probe across the load resistance
4. Configure the Waveform Generator as follows:
   Amplitude: 10(x15/Gain) V
   Function: Square wave
   Output: On
   Frequency: 50 kHz
5. Connect the waveform generator to Channel 1 input

Test Procedure

1. Using the variable vertical adjustment on the oscilloscope, adjust the vertical trace to show exactly 6 vertical divisions
2. Perform rise/fall time tests on channel 1 output using Table 3-5
3. Use the same procedure to check channels 2

Table 3-5, Rise/Fall Time Tests

Parameter Tested	Error Limits	Oscilloscope Reading		Pass	Fail
		CH1	CH2		
Rise Time	<1.5 μs				
Fall Time	<1.5 μs				

Overshoot Tests

Equipment**:** Oscilloscope, Arbitrary Waveform Generator, Load Resistance, x100 high voltage probe

Preparation:

1. Configure the Oscilloscope as follows:
   - Time Base: 500ns
   - Amplitude: 100 V/div
2. Connect the 9200 Channel 1 output to the load resistance
3. Connect the x100 high voltage probe across the load resistance
4. Configure the Waveform Generator as follows:
   - Amplitude: 8(x15/Gain) V
   - Function: Square wave
   - Output: On
   - Frequency: 50 kHz
5. Connect the waveform generator to Channel 1 input

Test Procedure

1. Using the variable vertical adjustment on the oscilloscope, adjust the vertical trace to show exactly 6 vertical divisions
2. Perform overshoot tests on channel 1 output using Table 3-6
3. Use the same procedure to check channels 2, 3 and 4

Table 3-6, Overshoot Tests

Parameter Tested	Error Limits	Oscilloscope Reading				Pass	Fail
		CH1	CH2	CH3	CH4		
Overshoot	15%						

Amplifier Distortion

Amplifier distortion checks the quality of the output against pure sine waveforms characteristics. Each channel has a different response and therefore, the distortion is tested on each channel separately.

Distortion Tests

Equipment**:** Distortion Analyzer, Arbitrary Waveform Generator, Load Resistance, x100 high voltage probe, 50Ω feedthrough terminator

Preparation:

1. Connect the 9200 Channel 1 output to the load resistance

2. Connect the x100 high voltage probe across the load resistance
3. Connect the high voltage probe to the distortion analyzer input
4. Configure the Waveform Generator as follows:
   Amplitude: 10(x15/Gain) V
   Function: Sine wave
   Output: On
   Frequency: As required for the tests
5. Connect the waveform generator to Channel 1 input. Terminate the waveform generator using the 50Ω feedthrough terminator at the 9200 input

Test Procedure

1. Perform Aberrations tests on channel 1 output using Table 3-7
2. Use the same procedure to check channels 2, 3 and 4

Table 3-7, Distortion Tests

Arb Frequency Setting	Error Limits	Distortion Meter Reading		Pass	Fail
		CH1	CH2		
5 kHz	<0.1%				
10 kHz	<0.1%				
100 kHz	<0.5%				
200 kHz	<1.2%				

Adjustments Procedure

WARNING

The procedures described in this section are for use only by qualified service personnel. Many of the steps covered in this section may expose the individual to potentially lethal voltages that could result in personal injury or death if normal safety precautions are not observed.

Introduction

This section contains the calibration procedure for the 9200 – high voltage quad power amplifier. A list of specifications is given in Appendix A of the Operations Manual. The adjustments that are described in this document are for use by qualified service personnel only. Do not perform these procedures unless qualified to do so. This procedure is intended to be used once before complete and final performance verification to verify that the 9200 meets its published specifications.

Performance Checks

Do not attempt to calibrate the amplifier before you verify that there is no problem with the functionality of the product. A complete set of specification is listed in Appendix A. If the instrument fails to perform within the specified limits, the instrument must be tested to find the source of the problem.

In case there is a reasonable suspicion that an electrical problem exist within the 9200, perform a complete performance checks as given in this chapter to verify proper operation of the instrument.

Environmental Conditions

The 9200 can operate from 0°C to 40°C. Calibration should be performed under laboratory conditions having an ambient temperature of 25°C, ±5°C and at relative humidity of less than 80%. Turn on the power to the 9200 and allow it to warm up for at least 15 minutes before beginning the adjustment procedure. If the instrument has been subjected to conditions outside these ranges, allow at least one additional hour for the instrument to stabilize before beginning the adjustment procedure.

Required Equipment

Recommended equipment for calibration is listed in Table 3-1. Instruments other than those listed may be used only if their specifications equal or exceed the required minimal characteristics. Also listed below are accessories required for calibration.

Initial Checks

Proper calibration depends on healthy functionality of the 9200. These initial checks are performed with the cover removed so take extra precautions not to touch components or metal parts inside the 9200. Always turn the power off and remove the power cord from the rear panel Mains receptacle, if you are not sure or feel safe with any part you are about to touch.

Before you perform the adjustments, verify that the 9200 operates within the following conditions:

1. Turn Power on and observe that the power light turns on and the fan is rotating and blowing air. Air is normally circulated from the inside of the box.

2. Identify J1. Using a DMM measure the voltage drop across the two terminals of this connector. Measurement should verify 12 Vdc, ±5%

3. Lift the front panel high voltage protection latch and turn on the high voltage. Note that the High Voltage light turns on.

4. Identify C43, and C32. Using a DMM measure the voltage drop across these capacitors. Measurement should verify 170 Vdc, ±3%

5. Identify C48 and C35. Using a DMM measure the voltage drop across these capacitors. Measurement should verify -170 Vdc, ±3%

6. Close the covers and allow the 9200 to stabilize its operating voltage conditions.

Calibration Procedures

Use the following procedures to calibrate the Model 9200. The following paragraphs show how to set up the instrument for calibration and what the acceptable calibration limits are. Calibration must be performed with the high voltage turned on. To turn the high voltage on, lift the protective latch and flip the high voltage switch ON.

Gain Adjustment

Equipment: Waveform Generator, DMM, Load Resistance

Preparation (use the same procedure for channels 1 and 2):

1. Configure the DMM as follows:

Function: ACV
Range: 200 V

2. Connect the 9200 Channel 1 output to the DMM input. Terminate the signal with the load resistance at the DMM input
3. Configure the waveform generator as follows:
   Waveform: Sine
   Frequency: 1 kHz
   Amplitude: 10(x15/Gain) V
4. Connect the waveform generator output to the 9200 Channel 1 input. Use 50Ω feedthrough terminator at the 9200 input

Adjustment:
1. Identify the trimmers for each channel and make the adjustments below for a DMM reading of 106.07 Vac, ±1%
2. For channel 1, adjust RV1
3. For channel 2, adjust RV2

Bandwidth Adjustment

Equipment: Waveform Generator, Oscilloscope, x100 high voltage probe, Load Resistance, 50Ω feedthrough terminator

Preparation (use the same procedure for channels 1 and 2:
1. Configure the oscilloscope as follows:
   Time Base: 100 ns/div
   Amplitude: 10 V initially, then use variable mode to adjust to 6 vertical divisions
2. Connect the 9200 Channel 1 output to the load resistance. Connect the oscilloscope using the x100 probe across the load resistance
3. Configure the waveform generator as follows:
   Waveform: Square
   Frequency: 50 kHz
   Amplitude: 10(x15/Gain) V
4. Connect the waveform generator output to the 9200 Channel 1 input. Use 50Ω feedthrough terminator at the 9200 input

Adjustment:
1. Identify the trimmers for each channel and make the adjustments below for rise/fall time of <1.2 μs
2. For channel 1, adjust C21
3. For channel 2, adjust C44

Appendix A

SPECIFICATIONS

Channels

9100	1
9200	2

Input Characteristics

Connector	BNC
Impedance	1MΩ, DC coupled
Damage Level	50Vp-p
Frequency Range	DC to 500KHz

Output Characteristics

General

Connector	BNC
Impedance	0.1Ω, DC coupled
Protection	Short-circuit, 10 seconds
Gain	x15, fixed (can be ordered from factory with different gain setting)
Polarity	Output normal
Amplitude	0 to 300Vp-p (±150V)

Square Wave Characteristics

Transition Time	<1.5μs
Aberrations	<15%

Sine Wave Characteristics

Small Signal	
Bandwidth	1MHz, at 20Vp-p (-3dB)
Large Signal	
Bandwidth	500KHz, at 300Vp-p (-3dB)
Accuracy	±(2% of full-scale amplitude range + 25mV), Square wave at 1KHz
THD	<0.1%, 10Hz to 10KHz
	<1.2%, 10KHz to 200KHz

General

Physical Size	Single-slot, 2U high, half rack size metal case
Power Requirements	100V/115V/230V, 47-63Hz, <60W
Signal Ground	Floated to the same level as the source, 250V dc maximum
EMC Certification	CE marked
Reliability	MTBF per MIL-HDBK-217E, 25 °C, Ground Benign
Safety	Designed to meet IEC EN61010-1, UL 3111-1
Workmanship Std.	Conform to IPC-A-610D

Environmental

Operating Temperature	0 °C - 50 °C, RH 80% (non-condensing)
Storage Temperature	-30 °C - 80 °C

Ordering Information

Model 9100-15-G High Voltage Wideband Amplifier, standard configuration
| |
| ------- Signal Ground: G = Tied to Ground; F = Floated Ground
---------- Gain: 10 through 20, fixed (*)

Model 9200-15-G High Voltage Wideband Amplifier, standard configuration
| |
| ------- Signal Ground: G = Tied to Ground; F = Floated Ground
---------- Gain: 10 through 20, fixed (*)

(*) Custom gain from x10 to x20 can be ordered however, bandwidth cannot be maintained. Consult the factory before ordering gain above 15.