USER MANUAL

MODEL 5601
PXI SINGLE CHANNEL WIDEBAND AMPLIFIER

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For this product, or any other Racal Instruments product that incorporates software drivers, you may access our web site to verify and/or download the latest driver versions. The web address for driver downloads is:

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If you have any questions about software driver downloads or our privacy policy, please contact us at

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All Racal Instruments, Inc. products are designed and manufactured to exacting standards and in full conformance to Racal's ISO 9001 procedures.

This warranty does not apply to defects resulting from any modification(s) of any product or part without Racal's express written consent, or misuse of any product or part. The warranty also does not apply to fuses, software, non-rechargeable batteries, damage from battery leakage, or problems arising from normal wear, such as mechanical relay life, or failure to follow instructions.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. The remedies provided herein are buyer's sole and exclusive remedies.

For the specific terms of your standard warranty, or optional extended warranty or service agreement, contact your Racal customer service advisor. Please have the following information available to facilitate service.

1. Product serial number
2. Product model number
3. Your company and contact information

You may contact your customer service advisor by:

E-Mail:	Helpdesk@racalinstruments.com	
Telephone:	+1 800 722 3262	(USA)
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RETURN of PRODUCT

Authorization is required from Racal Instruments before you send us your product for service or calibration. Call your nearest Racal Instruments support facility. A list is located in the Product Support section of this manual. If you are unsure where to call, contact Racal Instruments, Inc. Customer Support Department in Irvine, California, USA at 1-800-722-3262 or 1-949-859-8999 or via fax at 1-949-859-7139. We can be reached at:

helpdesk@racalinstruments.com.

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FOR YOUR SAFETY

Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNINGS** and **CAUTION** notices.

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.

Table of Contents

List of Figures

Chapter 1
OVERVIEW

What's in this Chapter

This chapter contains general and functional descriptions of the Model 5601 PXI Wideband Amplifier. It also describes the front panel connectors, operational modes, and all features of the instrument.

Introduction

Model 5601 is a 3U single-slot, PXI-based power amplifier. The amplifier is used for signal amplification purposes. Offering unprecedented signal purity, Model 5601 amplifies signals from DC to over 20 MHz. The unit has a fixed gain of 10. However, one may order the same amplifier with custom gain without jeopardizing signal purity or amplifier performance.

A common problem with PXI equipment is the inability to produce high voltages, which results from low power supply rails. For example, waveform generators, and similar signal source devices, draw power from ±12V rails. Consequently, they cannot produce signals above 16Vp-p. Model 5601 solves this problem by using DC/DC converters to increase rail voltage to ±24V. In turn, the increase of rail voltage, plus custom components and unique design, permits amplification of input signals to 40Vp-p into high impedance loads, or 20Vp-p into 50Ω. The power amplifier draws current only from the +5V rail, leaving the other power supply rails free to supply their full rated current to other devices.

Model 5601 is available with floating input and output connectors. With this option, the amplifier can float from ground level up to 250VDC. The only limiting factor is that both the input and output grounds must connect to the same level. This capability is important in applications where the amplifying device must reside at the same ground level as its source. The floating capability can be added or removed using a user-accessible jumper connection.

The wideband amplifier occupies just one PXI slot. However, its performance is unique and outstanding by any standards. With 40Vp-p and over 20MHz bandwidth, one can use Model 5601 in a wide range of applications.

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.

The following symbol may appear on the product:

CAUTION:
Refer to Accompanying Documents

This refers you to additional information contained in this manual. The corresponding information in the manual is similarly denoted.

5601 Series Feature Highlights

- Single-width PXI card
- Large-signal bandwidth to 20MHz
- Small-signal bandwidth to 50MHz
- Amplitude to 40Vp-p (high impedance)
- Low distortion
- Custom Configuration available for :
  Gain
  Input Impedance
  Output Impedance
  Output Polarity
  Signal Ground

Functional Description

This section provides a detailed functional description of the features, operation, and options for Model 5601. The wideband amplifier may be ordered with different configurations such as input/output impedance and gain. Read the following description carefully and make sure your amplifier is configured correctly for your application before you install and use this card.

Options

Model 5601 must be ordered from the factory already configured for your application. It is not user-configurable except the grounding option (grounded/floating). Optional configurations for Model 5601 include:

Input Impedance – determines the matching impedance at the input connector. Two options are available: 50Ω and 1MΩ.

Output Impedance – determines the output impedance matching for the load impedance. Three options are available: 50Ω, 75Ω, and 600Ω.

Gain – specifies gain magnitude of the input signal. Factory default setting is 10. However, any custom gain up to 100 can be specified. Note that some characteristics of the output section may change for gain settings above 10.

Output Polarity – specifies the phasing of the amplifier. Two options are available: Normal and Inverted.

Circuit Ground – determines if the amplifier ground is floated or tied to case ground. This is the only user-configurable option, and may be changed by adding or removing a jumper connection.

All options must be specified at the time of purchase. Model 5601 is supplied fully configured. Only qualified personnel may do reconfiguration (other than grounding) of fielded cards.

Specifications

Instrument specifications are listed in Appendix A. These specifications are the performance standards or limits against which the instrument is tested. Specifications apply only under the following conditions:

1. Output terminated into matching impedance.
2. 30-minute minimum warm up.
3. Temperature range of 20°C to 30°C. Specifications outside this range are degraded by 0.1% per °C.

Front Panel Connectors

Model 5601 has two BNC connectors on its front panel, designated as Input and Output.

Input

The Input connector accepts signals within the range of DC to over 20MHz and amplifies them by a fixed gain. Input impedance is factory configured at 50Ω or 1MΩ. 1MΩ input impedance can be used for low frequency signals (up to 100KHz). However, higher frequencies require a 50Ω termination at the input of the amplifier to eliminate standing waves and reflections in the input cable, which can cause excessive ringing and aberrations at the output.

WARNING

The amplifier input cannot tolerate high voltage if configured for 50Ω impedance. Therefore, before connecting the cable to the input connector, make sure your signal will not exceed the input rating, as specified in Appendix A.

Output

Depending on the configuration, the amplifier may generate inverted signals. Gain is fixed at 10 (or other gain factor specified at time of purchase). Output source impedance is configured as 50Ω, 75Ω, or 600Ω.

Knowing the source impedance is very important because the output gain is calibrated for a matched impedance. A mismatched load impedance may affect output level accuracy. For example, for a configured gain of 10, and properly terminated signals at the input and output connectors (say 50Ω each), an input of 2Vp-p will generate an output of 20Vp-p. On the other hand, if the load impedance increases by a large factor, the output amplitude increases due to the mismatched load.

40Vp-p is the maximum amplitude level this amplifier can produce into high impedance loads. 20Vp-p is the maximum for loads of 50Ω, 75Ω, or 600Ω

WARNING

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

Grounding Considerations

Understanding how to connect the ground path can be critical to preserving the integrity of your output signal. If you are using a single-ended output, it will probably be safe 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.

WARNING

Input and output grounds are tied together. Do not connect the output ground to a level different from input ground. Failure to adhere to this limitation may damage the 5601 and the surrounding equipment connected to its I/O connectors.

NOTE

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

Operating Instructions

Being an analog device, Model 5601 has no controls or computer-programmed settings. The following procedure is recommended for proper operation of the power amplifier:

1. Make sure your card is configured for the desired 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 PXI system.

WARNING

Model 5601 has no programmable disconnect for its signal output. Therefore, the amplifier output is active immediately after you power up your PXI chassis. Always make sure the load is protected from inadvertent power-up conditions before you turn on your PXI chassis.

Chapter 2
INSTALLATION

Installation Overview

This chapter contains information and instructions necessary for initial inspection, grounding, repackaging for storage or shipment, and installation.

Unpacking and Initial Inspection

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

Safety Precautions

The following safety precautions should be observed before using this product and the associated computer. Although some instruments and accessories are normally 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 5601 operating correctly and safely.

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, or installing or removing cards from the chassis. 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

Model 5601 is intended for operation within a PXI chassis as a plug-in module. Ensure that the PXI chassis being used to host the 5601 fully conforms to the latest PXI specifications.

Model 5601 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 5601 must not be operated in explosive, dusty, or wet atmospheres. Avoid installation of the module close to strong magnetic fields.

The Model 5601 design has been verified to conform to the EN61010-1 safety standard in accordance with the following limits: Installation (Overvoltage) Category I (Measuring Terminals) Pollution Degree 2.

Installation (Overvoltage) Category I refers to the signal level, which applies to equipment measuring terminals that are connected to source circuits in which measures are taken to limit transient voltages to an appropriately low level.

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

Power Requirements

Model 5601 operates within a PXI chassis, which provides DC power to the instrument. Model 5601 requires a variety of DC voltages as outlined in the Specifications section (Appendix A). Ensure that the PXI chassis is capable of delivering the required voltages and current.

CAUTION

Disconnect power to the PXI Chassis before installing or removing Model 5601.

Grounding Requirements

To conform to applicable safety and EMC requirements, ensure that the 5601 instrument panel and the PXI chassis are "earth" grounded.

CAUTION

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

Floating the Input/Output Grounds

The 5601 ground circuit is designed so it can float from case ground. The only limitation is that the input and output grounds must reside at the same ground potential.

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

WARNING

Input and output grounds are tied together. Do not connect input and output grounds to different levels. Failure to adhere to this limitation may damage the 5601 and surrounding equipment connected to its I/O connectors.

The 5601 may be ordered from the factory already configured with the required ground setting. However, you may change the grounding for different applications by means of a simple jumper connection. Use the following procedure to enable/disable the floating ground configuration.

1. Locate LK2 near the bottom of the board, as shown in Figure 2-1.

2. Remove the shorting jumper if you want to float the input/output grounds from case ground.

3. Leave jumper LK2 in place if you want to connect input/output ground to case ground.

NOTE

Normal amplifier operation is recommended with circuit ground connected to case ground (float disabled). This minimizes susceptibility to system noise. Enable the floating-ground configuration only for applications requiring a floating ground.

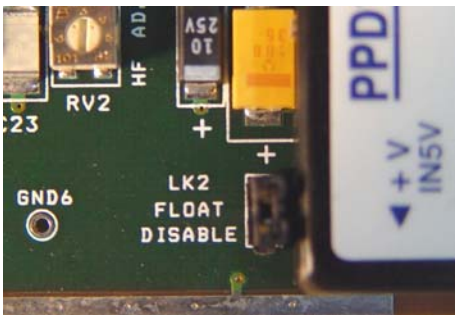

Figure 2-1. Float Enable/Disable Jumper (LK2)

Calibration

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

Abnormal Conditions

Operate the 5601 only as intended by the manufacturer. If you suspect that the 5601 has been damaged, remove it from the PXI Chassis and secure it from unintended operation. Model 5601 protection is probably impaired if, for example, the instrument fails to perform the intended operation or shows visible damage.

WARNING

Any use of Model 5601 in a manner not specified by the manufacturer may impair the protection provided by the instrument.

Preparation For Use

Removing the Instrument from the Bag

Model 5601 is supplied in an anti-static bag. Check the seal on the bag to make sure the bag was not opened in a static-unsafe environment. Place the enveloped card on static-free surface and wear a grounding strap. Then break the seal on the bag and remove the instrument. Hold the 5601 at the metal panel end. Refrain from touching the instrument with your finger at all times.

Installation

CAUTION

Disconnect power to the PXI Chassis before installing or removing the 5601. An attempt to insert or remove the instrument while the power is connected to the chassis will result in severe damage to the instrument and will automatically revoke your warranty.

Slide the 5601 into an empty slot of your PXI chassis. Push it firmly into place as you lift its extractor handle to the horizontal position. The metal panel should make contact with the metal edge of the PXI chassis. Using a suitable screwdriver, tighten the two retaining screws, top and bottom.

CAUTION

Once the 5601 has been installed in the chassis, cover all remaining open slots to ensure proper airflow. Using the 5601 without proper airflow will result in damage to the instrument.

Chapter 3
PRODUCT SUPPORT

Product Support

Racal Instruments has a complete Service and Parts Department. If you need technical assistance, or should it be necessary to return your product for repair or calibration, call 1-800-722-3262, or call 949-859-8999 and ask for Customer Support. You may also contact Customer Support via e-Mail:

helpdesk@racalinstruments.com

If you require parts to repair the product at your facility, call 1-800-722-3262, or 949-859-8999 and ask for the Customer Service Department.

When sending your instrument in for repair, complete the form in the back of this manual. For worldwide support and a listing of offices closest to your facility, refer to the Support Offices section on the following page.

Reshipment Instructions

Use the original packing material when returning the instrument to Racal Instruments for servicing. The original shipping carton and the instrument's plastic foam will provide the necessary support for safe reshipment.

If the original packing material is unavailable, wrap the chassis in anti-static shielding material, and use foam to surround and protect the instrument.

Reship in either the original or a new shipping carton.

Support Offices

RACAL INSTRUMENTS

United States

(Corporate Headquarters and Service Center)
4 Goodyear Street, Irvine, CA 92618
Tel: (800) 722-2528, (949) 859-8999; Fax: (949) 859-7139

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Technologie Park, Friedrich Ebert Strasse, 51429 Bergisch Gladbach, Germany
Tel: +49 (0) 2204 844200; Fax: +49 (0) 2204 844219

REPAIR AND CALIBRATION REQUEST FORM

To allow us to better understand your repair requests, we suggest you use the following outline when calling and include a copy with your instrument to be sent to the Racal Repair Facility.

Model_____ Serial No._____ Date_____

Company Name_____ Purchase Order #_____

Billing Address_____

City

State/Province Zip/Postal Code Country

Shipping Address_____

City

State/Province Zip/Postal Code Country

Technical Contact_____ Phone Number ( )_____
Purchasing Contact _____ Phone Number ( )_____

1. Describe, in detail, the problem and symptoms you are having. Please include all set up details, such as input/output levels, frequencies, waveform details, etc.

2. If problem is occurring when unit is in remote, please list the program strings used and the controller type.

3. Please give any additional information you feel would be beneficial in facilitating a faster repair time (i.e., modifications, etc.)

4. Is calibration data required? Yes No (please circle one)

Call before shipping
Note: We do not accept "collect" shipments.

Ship instruments to nearest support office.

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Appendix A

SPECIFICATIONS

Input Characteristics

Connector	BNC
Impedance	50Ω or 1MΩ, DC coupled
Damage Level	10Vp-p
Frequency Range	DC to 20MHz

Output Characteristics

General

Connector	BNC
Impedance	50Ω, 75Ω, or 600Ω, DC coupled
Protection	Short-circuit, 10 seconds
Gain	x10, fixed (can be ordered from factory with different gain setting)
Polarity	Output normal, or inverted
Amplitude	0 to 20Vp-p into matching impedance (50Ω, 75Ω, or 600Ω) 0 to 40Vp-p into high impedance

Square Wave Characteristics

Transition Time	<15ns
Aberrations	<5%

Sine Wave Characteristics

Small Signal	
Bandwidth	50 MHz (-3dB) at 2Vp-p
Accuracy	±(2% of full-scale amplitude range + 25mV), 1kHz square wave
Flatness (10Vp-p)	±5% of amplitude to 1MHz; ±10% of amplitude to 20MHz
THD	0.1%, 10Hz to 100KHz
Harmonics	<-50dBc, 100KHz to 5MHz <-40dBc, 5MHz to 20MHz (10Vp-p)

General

Physical Size	Single-slot, 3U-high PXI module
Current Consumption	3.5 A maximum at +5V
Power Requirements	7.2W maximum
Signal Ground	Floated to the same level as the source, 250VDC 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 to 50 °C, RH 80% (non-condensing)
Storage Temperature	-30 °C to 80 °C

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