

PRC50 Pulsar-Receiver Card

Operator Manual

VERSION 1.1.1



JSR **Ultrasonics**
A Division of Imaginant

Copyright © 2006. All Rights Reserved

000003100007

Table of Contents

PRC50 PULSER-RECEIVER CARD 1

TABLE OF CONTENTS 2

SAFETY AND TECHNICAL SUPPORT INFORMATION 4

Safety4

Technical Support4

WARRANTY AGREEMENT 5

Instrument Limited Warranty5

Software Limited Warranty5

Application Disclaimer.....5

GENERAL DESCRIPTION 6

Description6

PRC50 System Blocks and Their Functions.....7

 JSR Control Panel.....8

 Control Logic and PCI Interface8

 High Voltage Power Supply8

 Pulser/ Energy/Damping8

 Receiver Amplifier8

 Low Pass Filters8

 High Pass Filters.....8

PRC50 RECEIVER BLOCK DIAGRAM 9

INDICATORS AND CONNECTORS..... 10

 Output Connector10

 Through Connector.....10

 T/R Connector10

 Trig/Sync Connector11

 Pulse Indicator (Pulse).....11

INSTRUMENT SETUP 12

System Components12

Host Computer Requirements.....12

Ventilation.....12

PRC50 Pulsar-Receiver Card

PRC50 Installation	12
To install the PRC50:	12
Installing the JSR Control Panel software and PRC50 card.....	12
Additional Instructions for Windows XP Users	13
OPERATION	14
T/R Mode Operation	14
Through Transmission Mode Operation.....	15
Simultaneous T/R and Through (Both) Mode Operation.....	16
Operating the PRC50	17
JSR CONTROL PANEL	18
PROGRAM CONTROL OF THE PRC50	19
PRC50 Program Control Overview	19
Programmers Reference Manual	19
Properties Reference Manual	19
PRC50 DEFAULT VALUES	20
PRC50 SIGNAL AND CONTROL CABLES	21
CBL-150 Transducer Cable.....	21
CBL-400 Trigger/Output Cable	21
APPENDIX A.....	22
PRC50 SPECIFICATIONS	22
Pulsar	22
Receiver	23
PC or Compatible Control Computer	23
Environmental Operating Conditions	23
Miscellaneous	23

Safety and Technical Support Information

Safety



There are no user serviceable parts in the PRC50. PRC50 units should be returned to the manufacturer for any repair.



If the PRC50 is not used as prescribed by the manufacturer, the overall safety may be impaired.



Disconnect electric power from the PC before installation or removal of the card.



SHOCK HAZARD – Do not touch the circuitry of the PCI card while the unit is running.

Technical Support

The answers to most questions regarding the use of the equipment are contained in this manual. Please use this as your first source of information. If you cannot find an answer in this manual, please contact technical support at Imaginant.

Imaginant Inc.
3800 Monroe Ave.
Pittsford, NY 14534

Voice: +1 585 264 0480
Fax: +1 585 264 9642
E-mail: techsupport@jsrultrasonics.com or techsupport@imaginant.com

Please have the following information available before contacting Technical Support:

Model number (i.e.: PRC50) and Serial Number (i.e.: MB0101)
Specific nature of the problem

Technical support is available Monday through Friday from 8:00AM to 5:00PM EST.

Warranty Agreement

Instrument Limited Warranty

Imaginant Inc. warrants that its instruments will be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. Imaginant will, at its option, repair or replace any of its products that prove to be defective during the warranty period without charge for parts and labor.

To obtain service under this warranty, the Customer must obtain a Return Material Authorization (RMA) number from Imaginant before shipping the product to Imaginant with the shipping charges prepaid. The Customer is responsible for packaging the product, preferably in the original packaging materials.

This warranty does not apply to any defect, failure, or damage caused by improper usage, handling, care, or tampering. Neither will this warranty apply to any equipment damaged from attempts by personnel other than Imaginant to repair or modify the product.

Imaginant disclaims any warranty, either express or implied, as to the applicability or fitness of its hardware or software for a particular purpose or application. Imaginant will not be liable for any indirect, incidental, or consequential damages related to the use of its' products irrespective of whether Imaginant received any advance notice of the possibility of such damages.

Software Limited Warranty

Imaginant Inc. warrants for a period of 120 days from the date of delivery, that its instrument software will perform under normal usage and without unauthorized modification substantially in accordance with the specifications published in the documentation and those set forth in Imaginant advertising material; that, under normal use, the media upon which this program is recorded is not defective; and that the user documentation is substantially complete and contains the information Imaginant deems necessary for using its software.

Imaginant disclaims any warranty, either express or implied, as to the applicability or fitness of its software for a particular purpose or application. Imaginant will not be liable for any indirect, incidental, or consequential damages related to the use of its products irrespective of whether Imaginant received any advance notice of the possibility of such damages.

Application Disclaimer

This product is not intended or designed for use in medical or other devices or systems where malfunction of this product can reasonably be expected to result in personal injury. Imaginant customers using or selling this product for use in such applications do so at their own risk and agree to fully indemnify Imaginant against any damages resulting from such improper use or sale.

General Description

Description

The PRC50 Pulser-Receiver Card is a versatile single-channel ultrasonic pulser-receiver on a half-length PCI card for use in a host computer. All card functions and configurations are under the control of the host computer. A Windows-based turnkey control software program is provided to enable you to control the PRC50. Alternatively, programming information supplied in this manual and in the included Software Developers Kit (SDK) and Programmer's Manual allows you to develop custom software programs for controlling the PRC50.

In a typical application, the PRC50 produces a high voltage electrical excitation pulse, which is available on the card's T/R connector. Seven discrete pulse energy levels and a variable power supply are available for adjusting the strength of this excitation pulse to the transducer. An ultrasonic transducer is connected to the T/R connector via a length of 50Ω coaxial cable, and the transducer converts energy from the electrical excitation pulse into an ultrasonic pulse that is propagated into a test material or medium. Eight discrete damping levels in the PRC50 allow the transducer response to be fine-tuned.

With the PRC50 configured for Transmit/Receive mode of operation, any acoustic echoes reflected from interfaces or from defects within the test material are converted by the transducer into an electrical signal to be processed by the PRC50 receiver. This electrical signal passes through a user-adjustable gain stage and the amplified signal then passes through adjustable high and low pass filters. After filtering, the processed signal is available at the Output connector. The use of a second receiving transducer enables the detection of ultrasonic pulses that propagate through the test material or medium. This second transducer is connected to the PRC50 receiver using the THROUGH connector on the card, and the received signal is processed as it is for transmit/receive mode operation.

The wide-bandwidth low-noise PRC50 receiver has inputs for T/R (Transmit/Receive) and Through transducer signals. The receiver can amplify either input signal while maintaining excellent isolation from the other signal. In addition, the PRC50 receiver can independently amplify both input signals, and output the sum of the amplified signals. Following amplification, the receiver output signal passes through selectable High-Pass and Low-Pass filters. The output signal is then provided on the PRC50 Output connector.

The PRC50 is ideal for use in PC-based ultrasonic testing and inspection systems, and its small size and low power consumption enable systems to be implemented using portable computers. Power to operate the card is drawn from the host PC. The PRC50 can be combined with A/D Boards or other signal detection and processing instrumentation, which gives system integrators the flexibility to optimize system cost and performance. Connections are easily made between the PRC50 and other hardware using 50W coaxial cables. The four interface connectors on the PRC50 are SMA female coaxial connectors. The PRC50 Pulser synchronizes easily to other system hardware by producing or accepting trigger pulses on the PRC50 Trig/Sync connector.

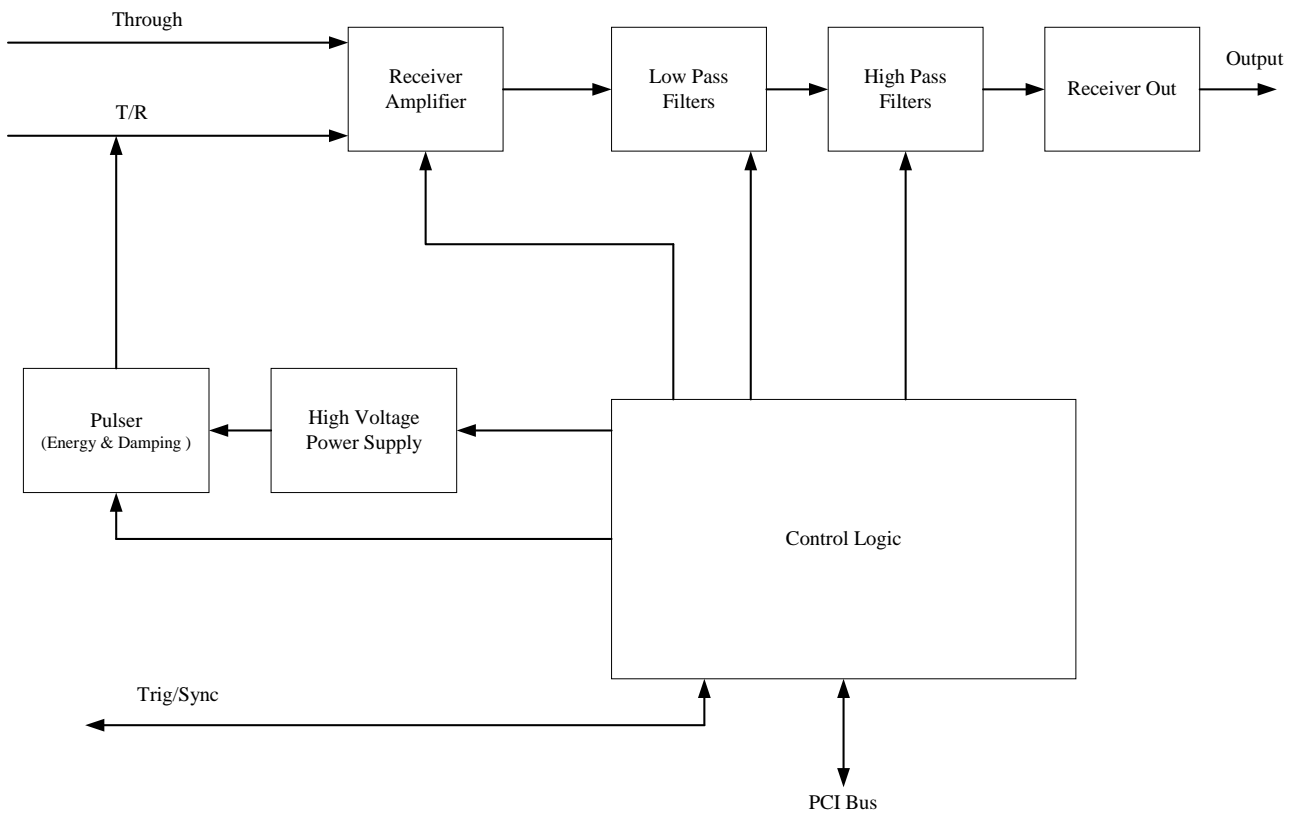
The full-featured PRC50 is an excellent choice for PC-based ultrasonic system applications including flaw detection, quality assurance, material characterization, transducer testing, and time of flight measurements.

Theory of Operation

PRC50 System Blocks and Their Functions

The PRC50 Pulser-Receiver Card is composed of the functional blocks shown in the figure below. These are the Control Logic and PCI interface, High Voltage Power supply, Pulser, Receiver Amplifier, Receiver Low Pass Filters, and Receiver High Pass Filters. JSR Instrument Control Panel software resides in the host computer and controls the instrument via the PCI interface.

PRC50 System Block Diagram



Copyright Imaginant 2006

JSR Control Panel

This software enables a user to remotely control the PRC50 from a host computer. In addition to the JSR Control Panel program provided with the PRC50, SDK information is provided in this manual for users that wish to develop custom instrument control programs.

Control Logic and PCI Interface

The interface and control logic enables the control of the PRC50 from software running on the host computer. Communication is via the PCI bus within the host computer.

High Voltage Power Supply

The high voltage supply provides power to the pulser. The PRC50 pulser produces constant pulse amplitude regardless of the pulse repetition rate or other instrument parameters within the specified range of PRC50 operation. The JSR Control Panel software and SDK software provide “power limit status” indications that warn the user when the PRC50 Pulsar may be operating outside of the normal range of operation.

Pulsar/ Energy/Damping

The pulser generates a transducer excitation pulse upon receipt of a trigger event from a selected source. The Pulsar Energy, Voltage and Damping controls control pulser parameters such as pulse duration, energy and peak amplitude. There are seven energy and eight damping impedance values provided by the PRC50. The Voltage Control is adjustable in 1V steps from 100 to 475 Volts.

Receiver Amplifier

Controls the amplification of signals presented to the PRC50 receiver. The receiver gain can be varied from -14 dB to +60 dB. The PRC50 Receiver has an input impedance of 128Ω.

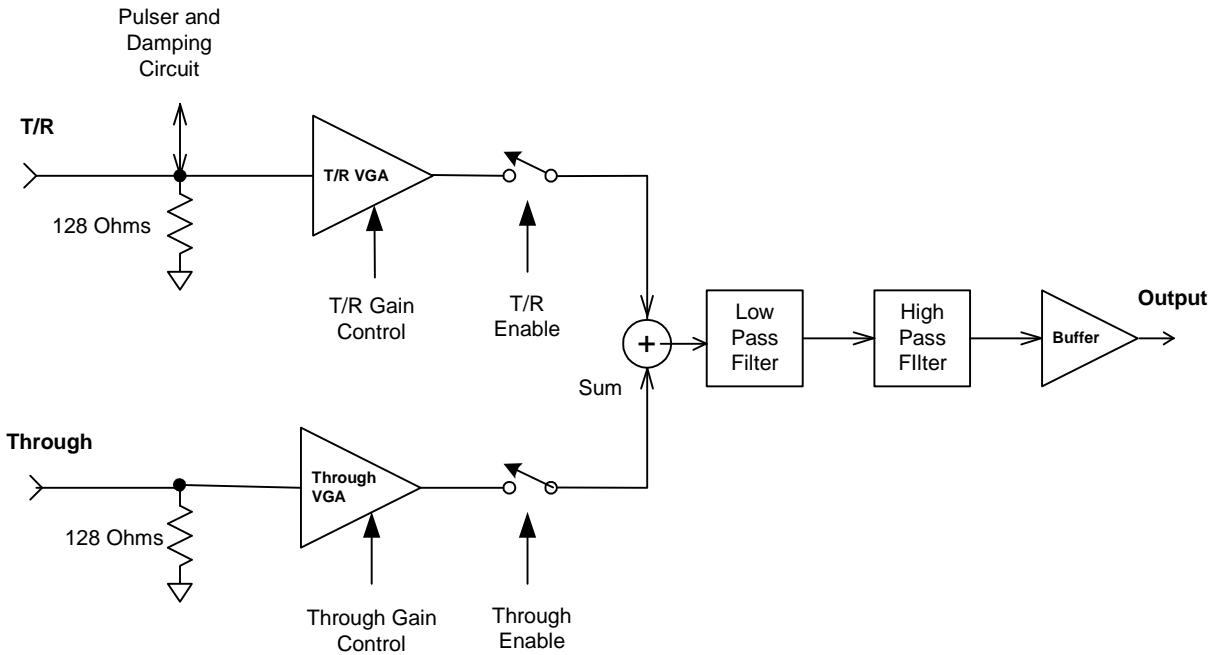
Low Pass Filters

This filter is available for reducing the bandwidth of the PRC50 receiver. High frequency bandwidth limiting can be used to improve the signal to noise ratio for applications that do not require the full receiver bandwidth. Four user selectable low pass filter values are available.

High Pass Filters

This filter is available for eliminating undesirable low frequency energy from the PRC50 receiver signal. High pass filtering can be used as a means of providing faster receiver recovery from strong signals such as the excitation pulse or strong interface echoes. Four user selectable high pass filter values are available.

PRC50 Receiver Block Diagram

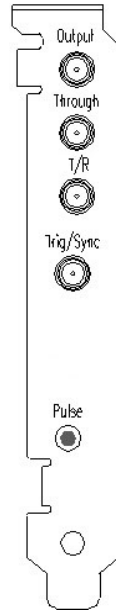


The PRC50 allows independent gain control of the T/R and Through receiver signal paths. Setting the JSR Control Panel software to “T/R” mode enables the T/R signal path and allows the user to perform Transmit/Receive measurements. Selecting “Through” mode enables the Through signal path and allows the user to perform Through measurements. Selecting “Both” mode enables both the T/R and Through signal paths so that simultaneous Transmit/Receive and Through measurements can be made.

Indicators and Connectors

In this section, the PRC50 Pulsar-Receiver card indicators and connectors are described. The diagram below shows the positions of the connectors on the PRC50 end bracket.

PRC50 End Bracket Indicator and Connectors



Output Connector

The PRC50 receiver output signal is present on this SMA connector. The PRC50 can provide an output signal of up to $\pm 1V$ into a 50Ω load. This output signal should be terminated with a 50Ω load to prevent reflections in any coaxial cable connected to this connector.

Through Connector

A receiving transducer is connected to this SMA connector during Through and Both mode operation.

T/R Connector

The transmit/receive transducer is connected to this SMA connector during T/R mode operation. A transmitting transducer is connected to this connector during Through mode operation.

Trig/Sync Connector

This connector provides a positive polarity sync pulse signal that can be used to trigger an oscilloscope or other signal monitoring/recording instrument when the PRC50 internal oscillator is used to trigger the pulser. In this mode, the signal line should be terminated with a 50 Ω load.

If the PRC50 pulser is set to external trigger mode, then the Trig/Sync connector is used for receiving a 3V to 5V external trigger pulse. Software controls select whether the Pulser will trigger on the rising edge or falling edge of the trigger pulse.

When triggering the PRC50 pulser from an external source or under software control, it is important to ensure that the average pulse repetition frequency does not exceed the 5 kHz maximum PRF rate.

Pulse Indicator (Pulse)

This red LED illuminates whenever the pulser is firing. This indicator may be cycled to create a blinking indicator. The Pulse Indicator is located on the PRC50 card below the Trig/Sync connector.

Instrument Setup

System Components

The following items should be present in your shipment:

- PRC50 Pulsar-Receiver Card
- CD containing JSR Instrument Control Panel software, PRC50 Instruction Manual and the JSR Common API Software Development Kit.
- Quick Start Guide

Host Computer Requirements

A Personal Computer or compatible computer running Windows 2000 or XP with an available PCI slot is required as Host for the PRC50.

Ventilation

To maintain adequate instrument cooling, the host computer should allow convection driven airflow or should possess a cooling fan.

PRC50 Installation

Do not install the PRC50 card until the JSR Instrument Control Panel software is installed. **Note that Administrator privileges are required to install this software.** It is recommended that only qualified personnel install the PRC50 card into the host computer.

To install the PRC50:

You will need the following:

- PC running Windows 2000 or Windows XP with an available PCI slot.
- Philips (Cross-point) Screwdriver suitable for the screws in your PC case.

Installing the JSR Control Panel software and PRC50 card

1. Close all open Windows 2000 or Windows XP applications.
2. Insert the JSR Control Panel software CD and follow the on-screen instructions.
 - a. In the event that the setup program does not run automatically, the program can be run from Windows Explorer by browsing the CD-ROM contents and double-clicking the file 'JSR Control Panel Installer_3.1.10.EXE, or from the Start menu by selecting Start->Run->Browse and then browse the CD-ROM contents, selecting the file 'JSR Control Panel Installer_3.1.10.EXE.
3. Remove the JSR Control Panel software CD.
4. Disconnect the PC's power and remove the PC case cover.

5. Important: To avoid electrostatic damage, wear a grounding strap or ground yourself by touching the computer's framework before you install any components or touch any parts inside the computer.
6. With the PC case cover removed, locate an empty PCI slot on the motherboard.
7. Remove the 'blank' slot cover from the back of the case by removing the screw that holds the cover in place.
8. Align the PRC50 with the slot and gently push the card into the connector on the computer motherboard.
9. Once the PRC50 is seated firmly in place, replace and tighten the fixing screw.
10. Check to make sure no other PCI boards have been loosened during PRC50 installation, and that no other boards are in contact with the PRC50 card.
11. Replace the PC case cover.
12. Reconnect power and restart the PC.

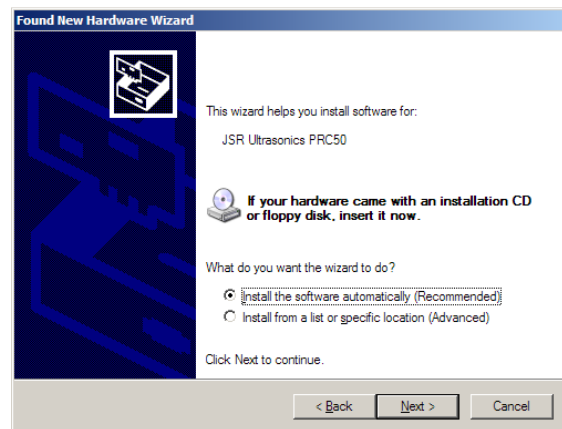
Additional Instructions for Windows XP Users

After restarting the PC with the PRC50 installed, it is possible that 'Found New Hardware Wizard' setup screens may appear similar to those shown below.

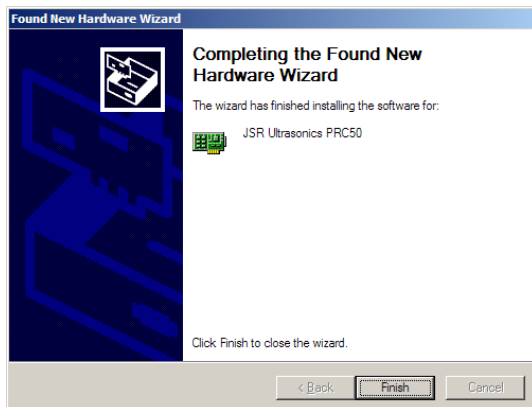


If the screen shown at left appears click on the 'No, not this time' button and then click 'Next' to continue forward.

If the screen below appears, click on the 'Install the Software automatically' button and then click 'Next' to continue on.



Click "Finish" to complete the "Found New Hardware Wizard" application.



At this point, the PRC50 installation is complete.

Operation

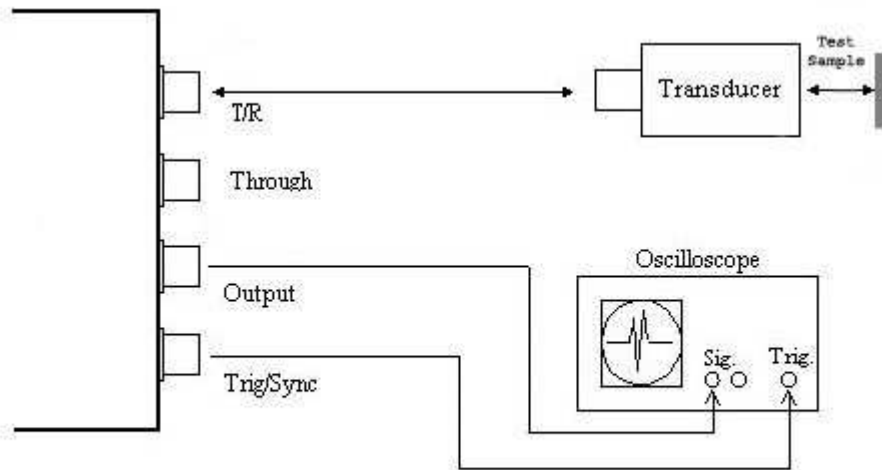
T/R Mode Operation

In the T/R mode of operation, a single transducer is used for both pulse transmission and echo receiving. Ultrasonic energy is echoed back from the test object and changes in time between echoes are taken as indications of variations in material continuity.

To configure the PRC50 for T/R operation, the transmit/receive transducer is connected to the SMA connector labeled T/R, typically via a 50Ω coaxial cable.

The PRC50 T/R mode configuration is shown in the following figure.

T/R Mode Operation



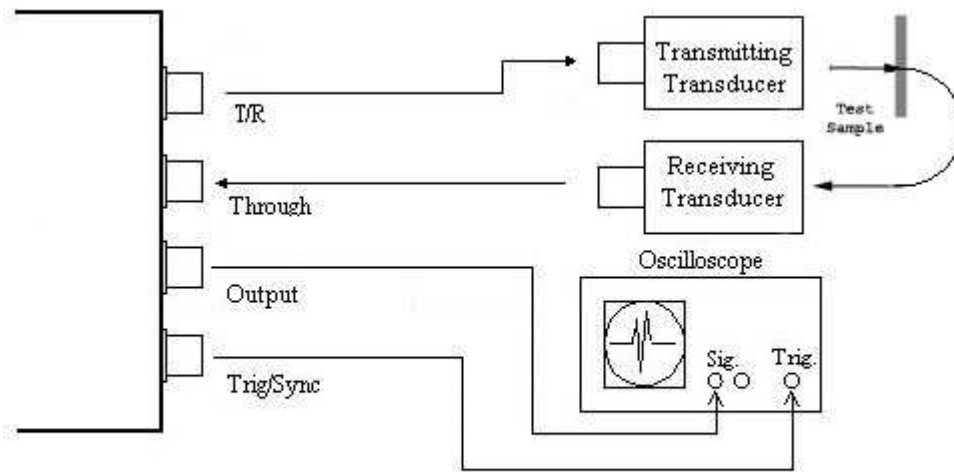
Through Transmission Mode Operation

For Through transmission mode operation, separate transmitting and receiving transducers are employed.

The transmitting transducer is connected to the PRC50 T/R SMA connector and the receiving transducer is connected to the THROUGH SMA connector.

The PRC50 Through transmission mode configuration is shown below.

Through Transmission Mode Operation



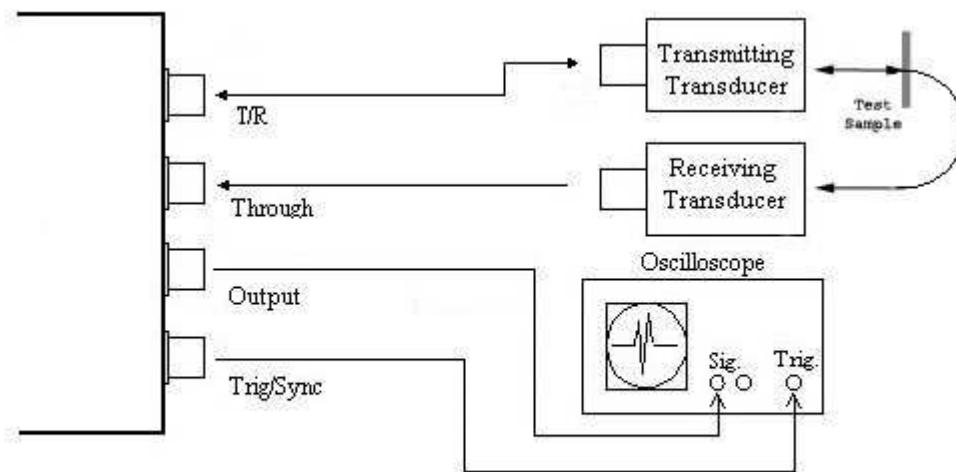
Simultaneous T/R and Through (Both) Mode Operation

For simultaneous T/R and Through (Both) mode operation, both transmitting and receiving transducers are employed.

The transmitting transducer is connected to the PRC50 T/R SMA connector and the receiving transducer is connected to the THROUGH SMA connector.

The PRC50 'Both' mode configuration is shown below.

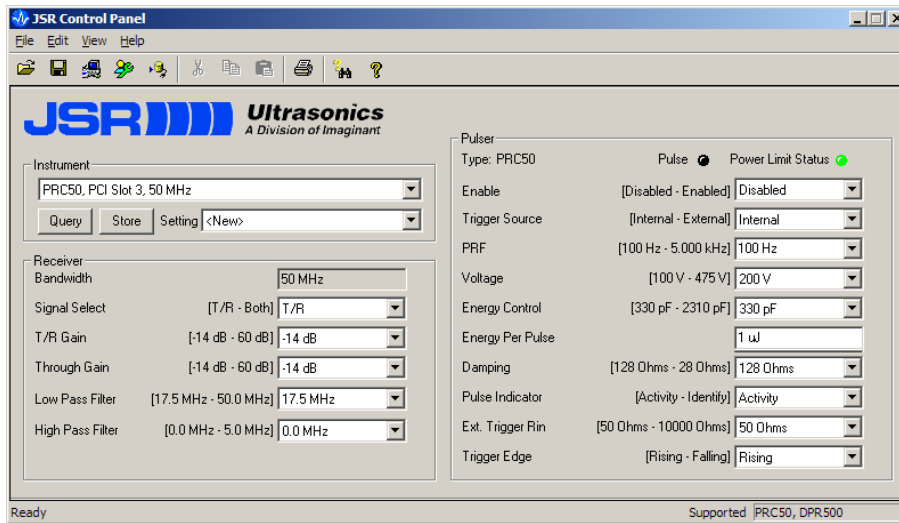
'Both' Mode Operation



Operating the PRC50

The following steps describe an operating session with the PRC50.

1. Using 50Ω SMA to Microdot cables, connect a transducer to the PRC50 T/R connector, or connect two transducers to the PRC50 Through and T/R connectors.
2. Using a 50Ω SMA to BNC cable, connect the PRC50 card SMA connector labeled ‘Output’ to an oscilloscope or waveform digitizing instrument. The oscilloscope or digitizer should have a 50Ω input impedance. If the instrument has a high input impedance value, a shunt 50Ω terminator should be used at the input of the instrument.
3. Double click on the JSR Control Panel icon to launch the software. Once launched, it will appear as shown below.



4. Set the Receiver Signal Select to “T/R”, “Through” or “Both” as desired.
5. Set the Pulsar Enable to “Enabled”.
6. Set the Trigger Source to ‘Internal’ or ‘External’ as applicable.
 - Set the Trigger Source to Internal if the PRC50 pulser is to be triggered by the PRF timing source. In addition, connect the PRC50 Trig/Sync connector to the external trigger input of the monitoring oscilloscope or waveform digitizer using a 50Ω SMA to BNC cable.
 - Set the Trigger Source to ‘External’ if the PRC50 pulser is to be triggered from an external source such as a waveform digitizer. The PRC50 Trig/sync connector and the external trigger input of the oscilloscope or digitizer should be connected to the source of the external trigger signal with one instrument set to high impedance and the other having a 50Ω input impedance. For convenience, the PRC50 Trig/Sync connector terminating impedance is selectable between 50Ω and 10kΩ. The instruments should be connected in the following sequence using 50Ω coaxial cable: Trigger Signal source → High Input Impedance Instrument → 50Ω Input Impedance Instrument.
7. The red LED located below the Trig/Sync connector will illuminate to indicate that the pulser is firing.
8. Adjust the Gain control to obtain a signal level no greater than ± 1 Volts_{p-p} into 50Ω at the Output connector.
9. Adjust the High-Pass and Low-Pass Filter cutoff frequencies as desired.

Note: When you exit the JSR Control Panel application, the PRC50 will continue operating. If you do not wish the PRC50 to continue functioning, go to the Enable drop down menu and click ‘Disabled’ before exiting the JSR Control Panel.

JSR Control Panel

Please refer to the JSR Control Panel Operator Manual as found on the software CD that is included with the PRC50.

This Windows-based control program should be installed on a PC running either the Windows 2000 or the Windows XP operating systems.

The JSR Control Panel offers an easy-to-use interface to the PRC50 Pulser-Receiver Card.

The following Receiver related adjustments could be made using the JSR Control Panel:

1. Selection T/R, Through or “Both” receiver modes
2. Independent T/R and Through Signal Path Gains
3. Selection of four (4) Low Pass Filter values
4. Selection of four (4) High Pass Filter values

The following Pulser adjustments can be made using the JSR Control Panel:

1. Pulser Enable / Disable
2. Pulser Trigger Source select
3. PRF (Pulse Repetition Frequency value
4. Pulser Voltage
5. Energy Control
6. Damping
7. Pulse Indicator
8. Ext. Trigger Input Impedance (R_{in})
9. External Trigger Edge, Rising or Falling

Program Control of the PRC50

This section describes the PRC50 communications interface and the various commands used to configure and control the instrument.

PRC50 Program Control Overview

Communication between the control computer and PRC50 is via the PCI interface.

For users who wish to create a Windows application to control the PRC50 a Software Developers Kit is included with the PRC50. Application software will use C or C++ calls to a provided DLL that will function with several JSR products. The DLL can also simulate a PRC50 to allow application development without requiring the PRC50 card to be installed in the host computer.

There are two reference manuals found on the CD included with the PRC50. These manuals, described below, are included with the JSR Common API Library Software Development Kit.

Programmers Reference Manual

This manual is intended as a reference for persons designing and writing a Windows Application that interfaces with the JSR Common API Library in order to control one or more JSR Pulsar-Receiver instruments, such as the PRC50.

Properties Reference Manual

This document is a list of Property ID's in the JSR Common API Library (JSR Library). It describes values, settings, data types, and other relevant info, and provides notes on their usage. This document is designed to be a reference to the Properties only; it is not a complete overview of the JSR Library.

The JSR Common API Library is based on the 'Objects with Properties' interface model, which is explained in detail in Programmers Reference Manual.

For further programming details, please refer to these manuals.

PRC50 Default Values

Upon power-up the very first time the PRC50 defaults to the following values:

PRC50 Attribute	Default
Receiver Bandwidth	50 MHz
T/R Gain	-14dB
Through Gain	-14dB
Low Pass Filter	50 MHz
High Pass Filter	0.3 MHz
Receiver Mode	T/R
Trigger Enable	Disabled
Trigger Source	Internal
PRF	100 Hz
Voltage	200V
Energy Control	330 pf
Damping	50Ω
Pulse Indicator	Activity
External Trigger R _{in}	50Ω
Trigger Edge	Rising

It is important to note that the JSR Control Panel application always saves your most recent settings. When the PRC50 is restarted all of your saved control values except for Trigger Enable will be restored. Trigger Enable will always initialize to “Disabled”.

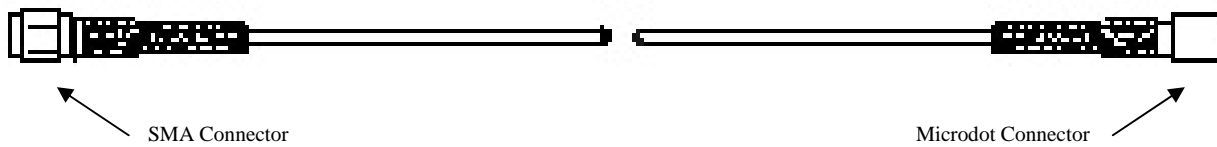
PRC50 Signal and Control Cables

In order to ensure solid connections and to minimize noise pickup, it is recommended that high quality coaxial cables and connectors be used.

To connect the PRC50 card to a transducer (via T/R) or to multiple transducers (via T/R and THROUGH) the following cable is recommended:

CBL-150 Transducer Cable

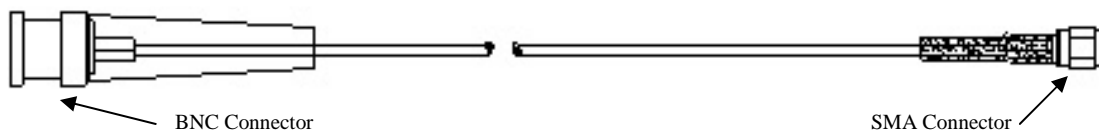
This cable is 1.22 meters (4') long and is manufactured using RG174/U Coaxial Cable with an SMA Coax connector on one end and a Microdot Coax connector on the opposing end.



To connect the PRC50 card to an oscilloscope or waveform digitizer (OUTPUT and/or TRIG/SYNC) or Signal Generator (TRIG/SYNC) the following cable is recommended:

CBL-400 Trigger/Output Cable

This cable is 1.22 meters (4') long and is manufactured using RG174/U Coaxial Cable with a BNC Coax connector on one end and an SMA Coax connector on the opposing end.



The CBL-150 and CBL-400 cables can be ordered directly by contacting JSR Ultrasonics at sales@jsrultrasonics.com or by calling +1 585 264-0480. Contact JSR for quotes on special lengths or customized cables.

Appendix A

PRC50 Specifications

Pulser

Pulse Type	Negative spike pulse on T/R Connector
Pulser Supply Voltage	Adjustable 100V to 475V
Initial Transition	6ns typical (10-90% Fall Time).
Pulse Amplitude	-180V into 50 Ω typical. Amplitude varies with Energy and Damping control settings, and load impedance.
Pulse Duration	25 – 150ns FWHM typical with 50 Ω external load. Pulse duration varies with the Energy and Damping control settings.
Damping	Eight discrete damping values; 28, 31, 36, 42, 50, 63, 85 and 128 Ω .
Internal Triggering	100 Hz – 5 kHz trigger rate. Synchronization pulse appears on Trig/Sync Connector. Sync Pulse +5Vmax into 50 Ω load, 20ns max risetime, 200ns width typical. Rising edge of sync pulse is synchronous with the initial pulse transition on T/R connector.
External Triggering	0 Hz – 5 kHz trigger rate. Trigger Pulse applied to Trig/Sync Connector Trig/Sync input impedance is selectable as either 50 Ω or 10k Ω Triggering may be selected to occur on either the rising or falling edge of the trigger pulse.

Receiver

Gain	-14 to +60 dB noninverting.
Input Modes	T/R, Through or 'Both' Receiver Modes.
Through Trans. Isolation	60 dB typical between Through and T/R receiver paths at 10 MHz.
Input Impedance	Through Input Connector: 128 Ω T/R Input Connector: Impedance varies with Damping Value.
Bandwidth	0.3 MHz to 50 MHz minimum (-3 dB).
High Pass Filter	0.3, 1.0, 5.0 or 12.5 MHz.
Low Pass Filter	7.5, 15, 25 or 50 MHz.
Noise	Typically 145 μ V _{p-p} input referred (measured at 60 dB gain, 50 MHz -3 dB BW)
Output Impedance	50 Ω
Output Voltage Swing	\pm 1V into 50 Ω load

PC or Compatible Control Computer

Interface	PCI bus.
Software	Turnkey software for Windows 2000 and Windows XP. Software Developers Kit provided.

Environmental Operating Conditions

Temperature	0 to 45°C
Humidity	0 to 80% RH non-condensing

Miscellaneous

Power	7.5 W maximum.
Dimensions	3.875" High by 6.875" Wide, (98.4 x 174.6mm) not including SMA and PCI edge connectors.
Weight	0.63 lbs (0.29 Kg)

Notes: Specifications are typical, at 25°C