

DPR500 Dual Pulser-Receiver

Operator Manual



JSR  **Ultrasonics**

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Fuse, Safety, and Technical Support Information

Fuse Information

The DPR500 utilizes .4A 250V 3AG-type slow-blow glass-cartridge fuses.

Warning: Fire Hazard. Replace fuses only with fuses of the same type and rating.
Warning: Shock hazard. Disconnect electric power before replacing fuses. Follow Fuse Replacement procedure found in Section 8 of this manual.

Safety



There are no user serviceable parts in the DPR500, other than the fuse. DPR500 units should be returned to the manufacturer for any repair.



If the DPR500 is not used as prescribed by the manufacturer, the overall safety may be impaired.



Ensure that the power cord is appropriate before connecting the DPR500 to mains power. Use a power cord rated for the mains voltage, preferably a power cord supplied by the equipment manufacturer or authorized agent.

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., Suite 29
Pittsford, NY 14534

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

Please have the following information available before contacting Technical Support:

Model number (e.g.: RP-H2) and Serial number (e.g.: GF0101)
Specific description 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 year from the date of purchase. IMAGINANT will, at its option, repair or replace any of its products, which 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. If, during the 120 day warranty period, a demonstrable defect in the program or documentation should appear, Imaginant will repair or replace the software with functionally equivalent software within 30 days after Imaginant has been notified of such a defect.

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 DPR500 Dual Pulser-Receiver is a modular instrument consisting of two Pulser-Receiver systems in one unit. It is designed to operate under the control of a computer. A software program is provided which allows the user to exercise all instrument functions under the control of a PC or compatible computer. Alternatively, programming information supplied in this manual allows the user to develop custom software programs that control the DPR500.

In a typical application, the DPR500 produces a high voltage electrical excitation pulse on the remote pulser's ECHO connector. Two discrete pulse energy levels are available for adjusting the strength of this excitation pulse. The type of pulser chosen determines the shape of the pulse. An ultrasonic transducer is connected to the ECHO connector via a short 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. Four discrete damping levels in the DPR500 allow the transducer response to be fine-tuned.

With the DPR500 configured for pulse-echo mode of operation, any acoustic echoes reflected from interfaces or from defects within the test material are converted by the transducer into electrical signals to be processed by the DPR500 receiver. These electrical signals are amplified by the preamp in the pulser and then subsequently amplified by the low noise receiver. The signals pass through adjustable high pass and low pass filters and an adjustable gain stage. The DPR500 receiver gain range, bandwidth and filter values are dependant on the type of receiver purchased. The amplified and filtered signals are available on the instrument's Receiver Output connector.

The DPR500 may also be used in transmission mode operation wherein a separate receiving transducer is used to detect acoustic pulses that have propagated through the test material or medium. This second transducer is connected to the DPR500 remote pulser THROUGH connector, and the received signals are processed as described above for pulse-echo mode operation.

The DPR500 also allows external equipment such as A/D digitizer boards or oscilloscopes to be synchronized to the pulser operation. To facilitate this, a narrow pulse is output on the synchronization (Trig/Sync.) connector simultaneously with generation of the excitation pulse when the instrument is configured in Internal Trigger Mode.

Physical

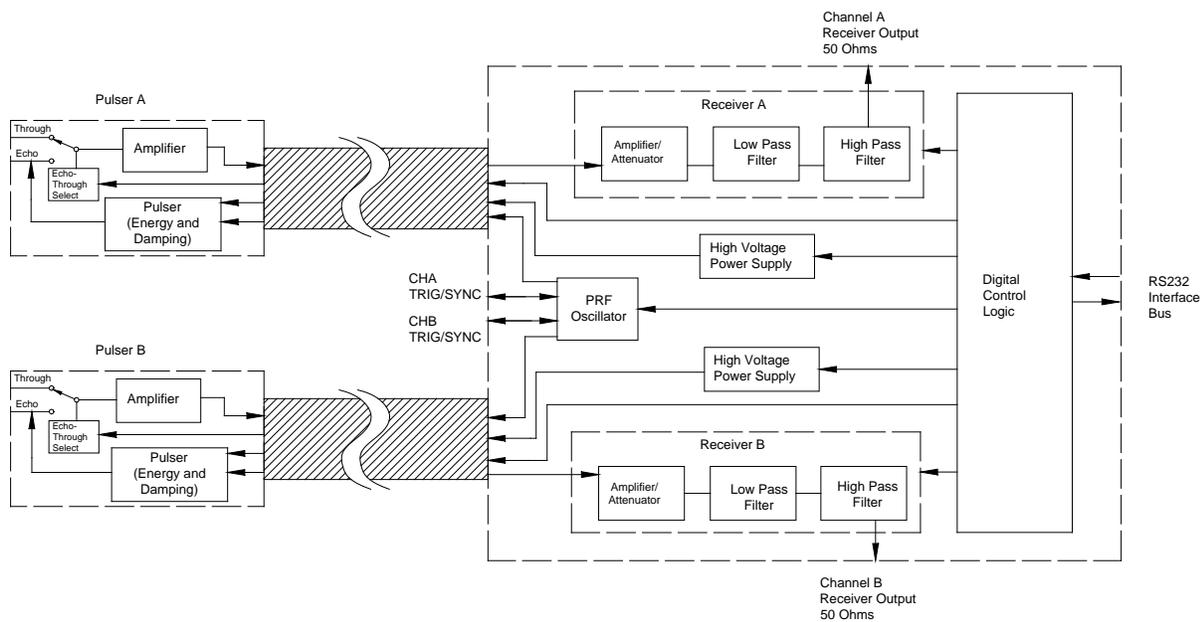
The DPR500 ultrasonic dual Pulser-Receiver system consists of an enclosure with dimensions 12" deep, 8.25" wide, and 3.5" high. This enclosure contains the receiver(s), power supplies and controls for the pulser(s). The pulsers range in size from 2" x 3" x 1.2" to 2" x 3" x 1.52".

Theory of Operation

DPR500 System Blocks and Their Functions

The DPR500 dual Pulser-Receiver is composed of the functional blocks shown in the figure below. The main unit includes the digital control logic and RS-232 interface, high voltage power supply(s), pulser trigger select, PRF oscillator, receiver amplifier(s), receiver low pass filters, and receiver high pass filters. The remote pulser(s) includes the pulser, echo/through select and a pre-amplifier. Instrument control software resides in the remote computer and controls the instrument via the RS-232 serial interface.

DPR500 System Block Diagram



JSR Control Panel Software

Software enables a user to remotely control the DPR500 from a computer. In addition to the control program provided with the DPR500, information is provided in this manual for users that wish to develop custom instrument control programs.

Digital Control Logic and RS-232 Interface

The interface and control logic enables the control of the DPR500 from software running on the host computer. Communication is via an RS-232 interface such as the COM1 or COM2 ports on the remote computer.

High Voltage Power Supply

The precision regulated high voltage supply provides power to the pulser. The DPR500 pulser maintains constant pulse amplitude regardless of changes in either the pulse repetition rate or other instrument controls.

Pulser (Impedance / Energy / Damping)

The pulser generates an excitation pulse upon receipt of a trigger event from a selected source. Pulse energy can be controlled by the Energy control. There may be multiple energy values depending on the type of remote pulser selected. The damping control allows the damping impedance at the pulser output to be set to discrete values allowed by the remote pulser.

Pulser Trigger Control

This control selects between the internal PRF oscillator or an external source applied to the Trig/Sync connector as trigger sources for the DPR500 remote pulser.

PRF Oscillator

Generates repetitive trigger pulses for the remote pulser.

Receiver Amplifier/Attenuator

Controls the amplification or attenuation of signals processed by the DPR500 receiver. The receiver gain is dependent on the type of receiver chosen.

Low Pass Filters

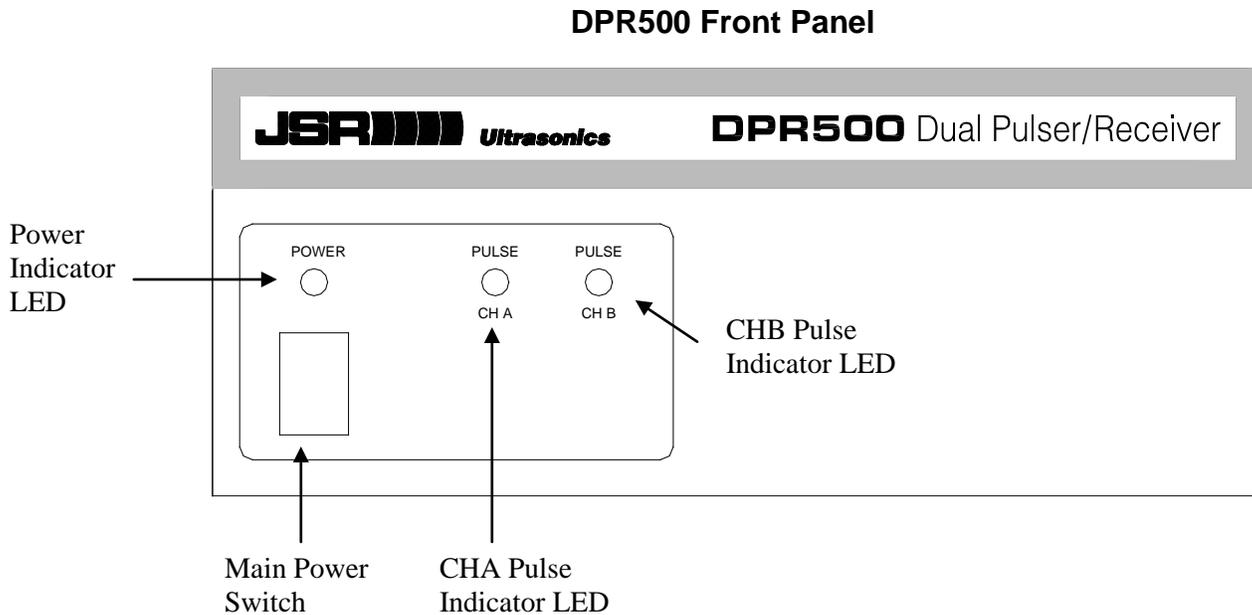
These filters are available for reducing the bandwidth of the DPR500 receiver. Bandwidth limiting can be used to improve the signal to noise ratio for applications that do not require the full receiver bandwidth.

High Pass Filters

These filters are available for eliminating undesirable low frequency energy from the DPR500 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.

Power Switch, Indicators, and Connectors

In this section, the DPR500 Dual Pulser-Receiver controls, indicators, and connectors are described. The diagram below shows the locations of the DPR500 front panel power switch and indicators.



Main Power Switch

This toggle switch is used for turning on/off power to the DPR500.

Power Indicator LED (Power)

This amber-colored LED illuminates to indicate that power is applied to the DPR500. This LED can also be made to blink at a controlled rate by the 'Blink' command described in Section 7.

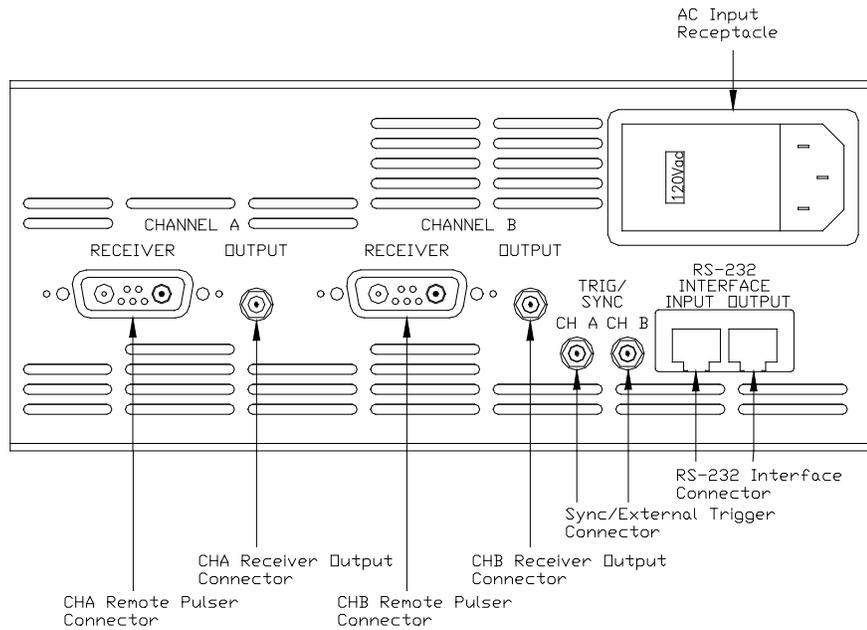
Pulse Indicator LEDs (Pulse)

These are red LED indicators that illuminate when their respective pulsers are firing.

DPR500 Rear Panel Connectors

The diagram below shows the positions of the connectors on the DPR500 rear panel.

DPR500 Rear Panel Connectors



CHA/CHB Remote Pulser Connector

These modular connectors supply power, digital control, high voltage and a 50Ω return path for signals.

CHA/CHB Receiver Output Connector (Receiver Output)

These are SMB receptacles on which output signals from the DPR500 receiver are available. This output signal line should be terminated with a 50Ω load.

CHA/CHB 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 DPR500 internal oscillator is used to trigger the pulser. In this mode, the signal line should be terminated with a 50Ω load.

If the DPR500 pulser is in external trigger mode, then the Trig / Sync connector is used for receiving a positive-going 3-5 V external trigger pulse. Triggering will occur on the rising edge of the trigger pulse.

When triggering the DPR500 pulser from an external source or under software control, it is important to ensure that the pulse repetition frequency does not exceed the maximum PRF rate of the chosen pulser.

RS-232 Interface Connectors

An RS-232 serial interface port on the control computer is connected to the Input RJ45 receptacle using the eight-conductor reversing RJ45 cable and the DB-9 to RJ45 adapter supplied with the DPR500. When control of other DPR500 instruments is desired, they may be added in a daisy-chain fashion by connecting a reversing RJ45 cable from the RS-232 Output connector on one instrument to the RS-232 Input connector of the next instrument.

AC Input Receptacle

This is a standard power receptacle with voltage selector switch and fuses. Available voltage settings are 100VAC, 120VAC, 220VAC, and 240VAC. Note that the fuse value for 100/120VAC is the same as the fuse value for 220/240VAC. Refer to section 8 for instructions on changing the voltage selection.

Instrument Setup

System Components

The following items should be present in your shipment:

- DPR500 Dual Pulser-Receiver Unit
- DB-9 to RJ45 Adapter
- RJ45 Serial Interface Cable
- Power Cord
- CD Rom containing DPR500 software control program, DPR500 Instruction Manual, and text files.
- Voltage selector wheel
- Any remote pulsers and cables that were ordered

Host Computer Requirements

A PC or compatible computer with an available COM1, COM2, or RS-232 serial port can control the DPR500. Alternatively, a USB port and USB to DB-9 adapter can be used in lieu of a serial port.

Ventilation

To help maintain adequate instrument cooling, the cooling vents in the rear of the DPR500 should not be blocked.

Mains Disconnect

The power cord is the mains disconnect device. Position the DPR500 so that the instrument can easily be disconnected from the main power supply when needed.

Earth Ground

Earth ground is connected to the instrument through the power cord.

System Configuration

1. Locate the power receptacle on the rear of the DPR500. The receptacle has a small window through which the main supply voltage selection is displayed. If the displayed voltage is not correct, then the voltage selection must be changed. See Section 8 on how to change the voltage selection.
2. Plug the DB-9 to RJ45 adapter into the COM1, COM2, or RS-232 serial port on the computer that will be used to control the DPR500.
3. Plug one end of the RJ45 serial interface cable into the DB-9 to RJ45 adapter. Be careful not to plug the cable into an Ethernet port on the PC. Plug the other end of the cable into the DPR500 rear connector labeled RS-232 Input.
4. Plug the power cord into the power receptacle on the rear of the DPR500, and plug the other end into a power outlet of the correct voltage. If the power cord that was supplied with the instrument is not available, then a power cord that is rated to 40 W must be used.
5. Plug the Interface extension cable into channel A and/or channel B receiver.
6. Connect the extension cable into the working cable supplied with the remote pulser. If mounting of the interface cable is desired, panel mount locking clips are provided. Contact Imaginant for more information on dimensions of cutouts.
7. Connect the remote pulser to the working cable.
8. Turn on power to the DPR500 with the front panel power switch.
9. Install the JSR Control Panel application from the provided CD ROM.
10. Run the control program.

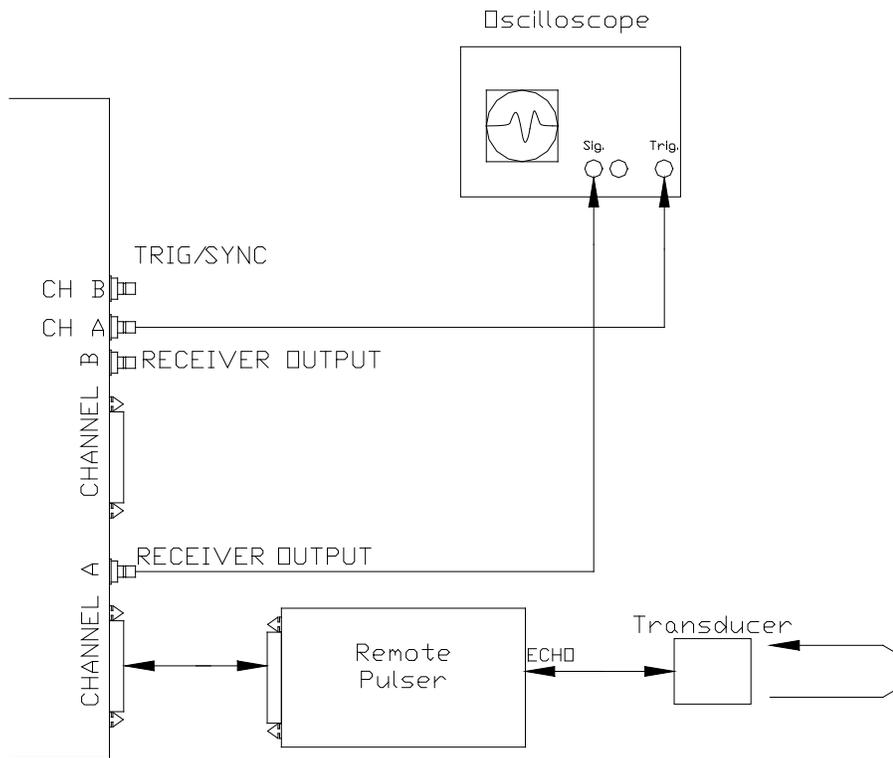
Operation

Pulse-Echo Mode Operation

In the pulse-echo mode of operation, a single transducer is used for both pulse transmission and echo receiving. To configure the DPR500 for pulse-echo operation, the transmit/receive transducer is connected to the Remote Pulser connector labeled ECHO, typically via of a 50Ω coaxial cable.

The DPR500 pulse-echo mode configuration is shown in the following figure.

Pulse-Echo Mode Operation

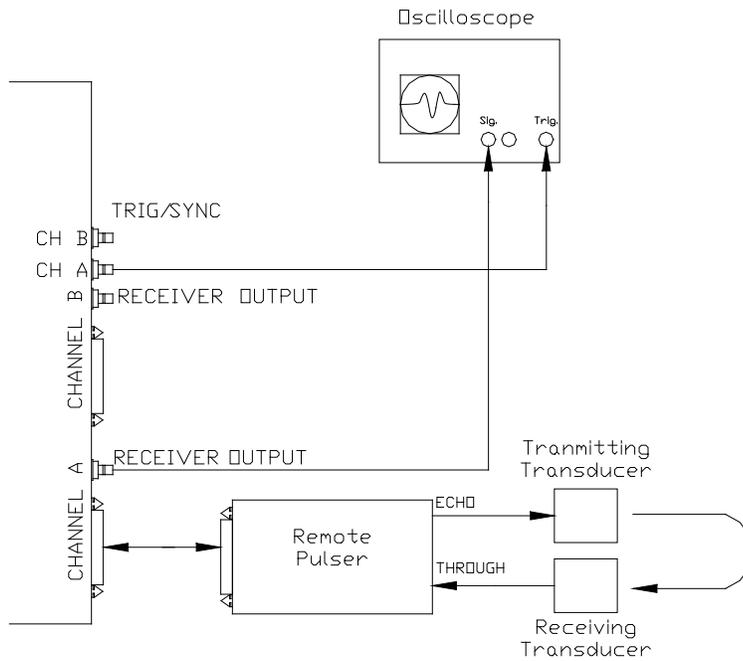


Transmission Mode Operation

For transmission mode operation, separate transmitting and receiving transducers are employed. The transmitting transducer is connected to the DPR500 ECHO connector and the receiving transducer is connected to the THROUGH SMB connector.

The DPR500 transmission mode configuration is shown below.

Transmission Mode Operation



Operating the DPR500

The following sequence of steps describes a typical operating session with the DPR500. The DPR500 should be connected to a control computer, and the control software should be installed on the computer as explained in Section 4 of this manual.

1. Connect a transmit/receive transducer, or separate transmit and receive transducers to the DPR500 as explained above. For contact applications, use a suitable acoustic couplant between the transducer(s) and the sample that is to be tested.
2. Connect the DPR500 SMB connector labeled Receiver Output to the input of an oscilloscope or waveform digitizer. The monitoring oscilloscope or digitizer should have a 50Ω input impedance. If the input has high impedance, then a shunt 50Ω terminator should be added to the input.
3. Using the control software program on the computer, initialize the DPR500 by following the address assignment procedure described in Section 7.
4. Set the pulse trigger control to INT if the DPR500 pulser is to be triggered by the internal PRF oscillator, and connect the DPR500 Trig/Sync connector to the external trigger input of the monitoring oscilloscope. If the DPR500 pulser is to be triggered from an external source such as the Sync signal of a waveform digitizer, then set the pulse trigger control to EXT and connect both the DPR500 Trig/Sync connector and the external trigger input of the oscilloscope to the source of the external trigger signal. The coaxial cable from the trigger source may be connected to high impedance loads such as the trigger input of the oscilloscope, but the final connection should be to the DPR500 Trig/Sync connector. The input impedance of the DPR500 Trig/Sync connector is 50Ω that serves to properly terminate the coaxial cable.
5. Using the control software, the instrument may be configured for the desired operation. The red Pulse indicator located on the DPR500 front panel should illuminate when the pulser is firing. Once the pulser is firing, the pulse repetition frequency (PRF) should be adjusted so that all echoes from any previous excitation pulses have subsided before a new excitation pulse is generated.
6. Adjust the gain control to obtain a signal level between $\pm .2$ and $\pm .5$ V peak into 50Ω at the RECEIVER OUTPUT connector.
7. Adjust the high and low pass filter cutoff frequencies as necessary. High pass filters can be used to speed amplifier recovery from the main excitation pulse or large interface echoes. For the low pass filter, the cutoff frequency can be reduced in order to improve the signal to noise ratio in low frequency applications.

Remote Operation of the DPR500

Overview of Remote Operation

Communication between the control computer and DPR500 is via an RS-232 interface using the COM1 or other RS-232 serial port on a control computer. Commands are issued by the control computer and consist of a sequence of bytes transmitted via the RS-232 interface to the DPR500.

A DPR500 can optionally be connected to the control computer with a USB to RS-232 dongle, with the RS-232 side connected to the DPR500 and the USB side connected to the control computer. The software on the PC will work with either a hardware COM port or a USB to RS-232 dongle configured as a virtual COM port. The software will also work with a combination of both hardware COM ports and USB dongles if more than one instrument is connected.

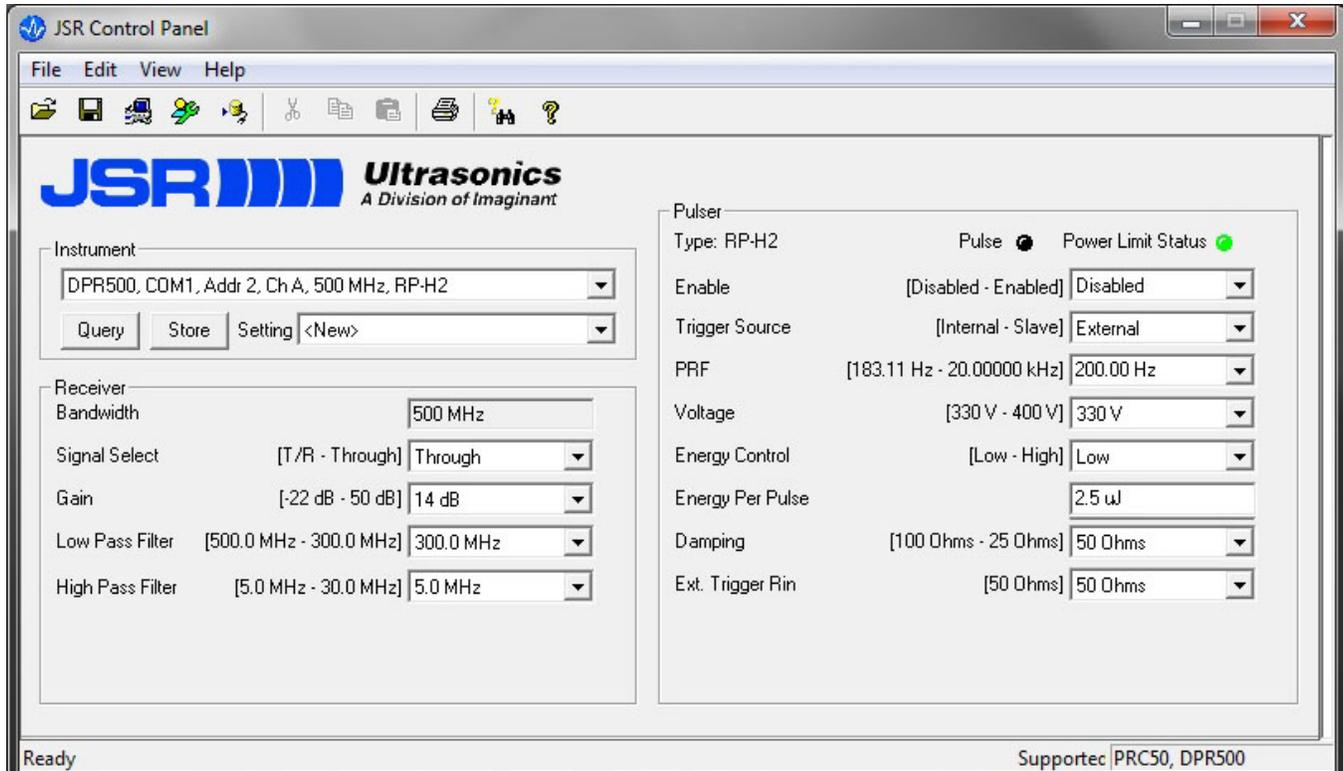
Multiple DPR500 instruments may be connected in a daisy-chain fashion to one serial port on the control computer. If a DPR500 in the daisy chain is turned off, it will not impede communication between the computer and other instruments. Up to 255 instruments may be connected to one serial port. All instruments may be controlled independently through the assignment of individual addresses. A command sent by the computer will be acted upon by only the addressed instrument. DPR500 instruments can be daisy-chained with DPR300's.

Alternatively, each DPR500 could be connected to its own COM port on the control computer.

Imaginant provides several software options for remote PC control of a DPR500 or for the creation of user-developed control software including an SDK. A Dot Net SDK, JSR Control Panel, and JSR Dot Net Control Panel software. An overview of JSR Control Panel software and the JSR Common SDK are provided in the next section. Please refer to the latest software documentation for complete details on software available for control of the DPR500.

JSR Control Panel graphical user interface

JSR Control Panel is a Windows-based application that allows the user to control any number and mix of DPR500, DPR300, and PRC50 instruments.



Features of JSR Control Panel software

- Automatically performs daisy-chain or multiple COM port connection
- Configurations of settings can be named, saved, and restored
- Displays allowed ranges of settings in physical units
- Displays and controls current settings
- Query button allows refresh of all values from front panel changes
- Controls any number and mix of DPR500, DPR300, or PRC50 instruments
- Operates on 32 and 64-bit versions of Windows XP, Windows Vista, or Windows 7 systems.
- Can operate in simulate mode to test before purchasing an instrument.

JSR Common SDK (Software Development Kit)

The JSR Common SDK provides the tools for a programmer to write application-level programs to control DPR500, DPR300, and PRC50 instruments without having to learn the intricacies of the command protocol, features, or control ranges of the instruments.

The JSR Common SDK consists of:

- A set of DLL's

- 32 and 64-bit drivers and files specific to the PRC50 (Windows XP, Windows Vista, Windows 7)

- Header files

- Sample source code and projects

- JSR Common SDK Programmer's Reference Manual

- JSR Common SDK Properties Reference Manual

Features of the JSR Common SDK

- The same DLL's are used by JSR Control Panel, ensuring compatibility
- Controls any number and mix of DPR500, DPR300, or PRC50 instruments
- Baseline controls for all 3 instruments are the same. E.g volts, PRF, damping, etc.
- Extended controls are provided for features unique to a specific model
- Automatically performs daisy-chain or multiple COM port connection
- Allows control and display of settings in physical units
- Range-checks all commands, providing descriptive error messages
- Error messages can be numeric or text strings
- Can operate in simulate mode to allow code development before purchasing an instrument.
- Operates on Windows 2000, Windows XP, Windows Vista, or Windows 7 systems.
- Application code can be in C or C++.

JSR Simple ActiveX object

The JSR Simple ActiveX object is a thin layer of software that can be used between your application code and the JSR Common DLL. It therefore implements the same functionality as the JSR Common DLL , but has a more modern interface that is easier to use.

Features of the JSR Simple ActiveX object

- Application code can be written in any of several languages:

- Visual Basic
 - C# (C Sharp)
 - C++

- Use of ActiveX properties makes coding simpler and easier to read:

For example

```
MyPulser.PRF = 2500;  
VoltsToDisplay = MyPulser.Volts;
```

Remote PC control via serial port commands

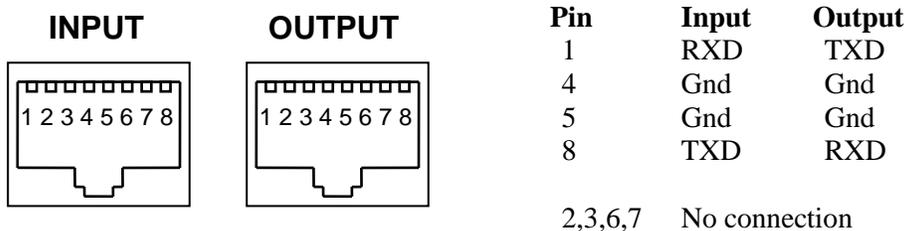
When the DPR500 was first introduced, the JSR Common SDK and JSR Simple ActiveX object did not exist. Application developers had to work with the lowest level serial port protocol, which was complicated and dedicated to the DPR500 only.

Documentation of that protocol is not included in this newer manual in order to encourage developers to use either of the two modern interfaces described above.

If you wish to have a copy of the manual that describes the serial port protocol, please write to TechSupport@JSRUltrasonics.com.

COM Port Configuration

The RS-232 serial port on the control computer should be configured to 4800 baud with 1 start bit, 8 data bits, one stop bit, no parity, and no flow control. An adapter is supplied to convert the DB-9 serial port connector on a PC to an RJ45 receptacle. An RJ45 reversing eight-conductor cable is then used to connect from the serial port to the RS-232 input connector on the DPR500. The pin assignment of the DPR500 rear panel RS-232 interface connectors is shown below.



DPR500 Service



Serviceable Parts

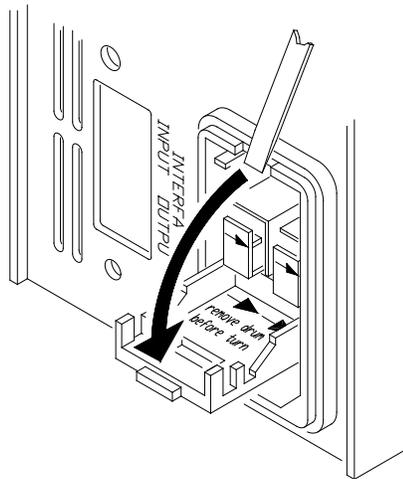
There are no user serviceable parts in the DPR500. The DPR500 units should be returned to the manufacturer for any repair.

Fusing

“CAUTION: Double Pole/Neutral Fusing”. Both +AC and Neutral power supply lines are fused.

Fuse Replacement

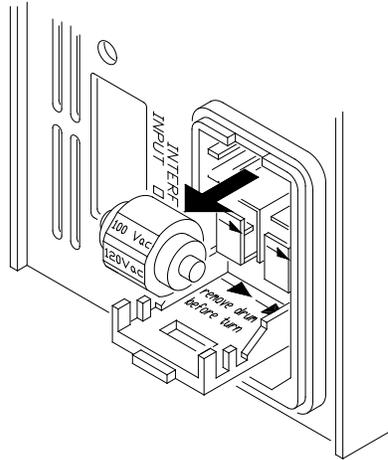
1. Turn off the power switch and remove the power cord from the back of the DPR500.
2. Using a small screwdriver, gently unlatch the fuse holder door from the power inlet module on the back of the DPR500, as shown below.



3. Remove fuse holders from inlet module.
4. Replace with 0.4A 250V slow-blow fuse.
5. Re-install the fuse holder with the arrows pointing in the direction shown on the inside cover of the module.
6. Re-connect the power cord and turn on the power to the DPR500.

Voltage Selection

1. Turn off the power switch and remove the power cord from the back of the DPR500.
2. Using a small screwdriver, gently unlatch the fuse holder door from the power inlet module on the back of the DPR500, as shown above.
3. Remove the voltage selection wheel as shown below.



4. Rotate the voltage selection wheel until the desired voltage is found. Available voltage settings are 100 VAC, 120 VAC, 220 VAC, 240 VAC.
5. Insert the voltage selector wheel back into the power receptacle with the selected voltage facing outward and close the receptacle.

Appendix A: DPR500 Specifications

Pulser

- Excitation Pulse** See separate remote pulser data sheets for specifications on interchangeable remote pulsers.
- Pulser Trigger Source** Internal or external, selectable by computer.
- Ext. Trigger Input** 3-5V positive going pulse. Triggering will occur on leading edge. TTL and CMOS compatible.
- Sync Output** +4V into 50 Ohms (typ), - tr < 10ns, TW = 40ns min.

Receiver

The DPR500 is configured with a combination of one or two of the following receivers:

	<u>500 MHz</u>	<u>300 MHz</u>	<u>50 MHz</u>
Gain	-22 to 50dB in 1 dB steps	-22 to 50dB in 1 dB steps	-13 to 66dB in 1 dB steps
Phase	0° (noninverting)	0° (noninverting)	0° (noninverting)
Input Referred Noise	112uVp-p typ. (500MHz BW, 50dB gain)	101uVp-p typ. (300MHz BW, 50dB gain)	80uVp-p typ. (50MHz BW, 60dB gain)
Bandwidth	5-500 MHz	1 – 300 MHz or 5 – 300 MHz	.01 – 50 MHz
High Pass Filter	5, 30 MHz	1, 5 MHz or 5, 30 MHz	1, 2.5, 5, 7.5, 12.5 MHz
Low Pass Filter	300 MHz	150 MHz	3, 7.5, 10, 15, 22.5 MHz
Input Impedance	50 Ohms	50 Ohms	50 Ohms
Output Impedance	50 Ohms	50 Ohms	50 Ohms
Maximum Receiver Output Power	5.5 dBm	5.5 dBm	5.2 dBm
Linear Output Voltage Range	+/- 500mV into 50 Ohms	+/- 500mV into 50 Ohms	+/- 500mV into 50 Ohms

PC or Compatible Control Computer

Interface	Bi-directional communication via RS-232 serial link using RJ45 type 8-conductor cable. Ships with a standard 6' cable. Other lengths are available.
Software	Windows based GUI control program and SDK are provided. Windows 2000, Windows XP, Windows Vista, and Windows 7.

Environmental Conditions

Operating Temperature	0 to 50 °C
Operating Humidity	0 to 80% RH non-condensing

Miscellaneous

Power	100/120/220/240 VAC, 50/60 Hz, 40 W max.
Dimensions	3.5" High, 8.5" Wide, 12" Deep
Weight	10 lbs (4.5 Kg)

Notes: Specifications are typical, at 25 °C



Revision History