

DET-200-002

**PHOTODIODE
DETECTOR/PREAMPLIFIER**

USER MANUAL



Hinds Instruments, Inc.
P/N: 020-2651-066-02-R UM Rev B

Copyright © 2010, 2013 by Hinds Instruments, Inc.

THIS DOCUMENT IS PROVIDED “AS IS” WITH NO WARRANTIES WHATSOEVER, INCLUDING ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY WARRANTY OTHERWISE ARISING OUT OF ANY PROPOSAL, SPECIFICATION OR SAMPLE. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form by any means, electronic, mechanical, by photocopying, recording, or otherwise, without the prior written permission of Hinds Instruments, Inc.

Information furnished by Hinds Instruments, Inc. is believed to be accurate and reliable; however, no responsibility is assumed by Hinds Instruments, Inc. for its use; nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent rights of Hinds Instruments, Inc.

In all respects, the English version of this manual is controlling.

Signaloc, Hinds Instruments and the Hinds Instruments, Inc. graphic logo are trademarks of Hinds Instruments, Inc.

*Third-party brands and names are the property of their respective owners.

Table of Contents

| | |
|---|-----------|
| Table of Contents | iii |
| Table of Figures | v |
| 1 Introduction | 1 |
| Overview | 1 |
| Accessories | 1 |
| Supporting Products | 1 |
| Signaloc™ 2100 Dual-Phase, Analog, Lock-In Amplifier | 1 |
| SCU-100 | 2 |
| 2 DET-200-002 Front & Rear Views | 3 |
| DET-200-002 Front View | 3 |
| DET-200-002 Front View Functional Items | 3 |
| DET-200-002 Rear View | 4 |
| 3 Initial Set-Up | 5 |
| Connecting the DET-200-002 | 5 |
| 4 Operating the DET-200-002 | 7 |
| Operation | 7 |
| 5 Troubleshooting | 9 |
| Troubleshooting Guide – Symptoms & Possible Remedies | 9 |
| A Specifications | 11 |
| DET-200-002 General | 11 |
| DET-200-002 Input / Output Specifications | 11 |
| DET-200-002 Performance Specifications | 13 |
| DET-200-002 Environmental | 14 |
| DET-200-002 Approvals | 14 |
| Desktop Power Supply, General | 14 |
| Desktop Power Supply, Input/Output Specifications | 14 |
| Desktop Power Supply (and AC cord set), Environmental | 14 |
| Desktop Power Supply (and AC Cord set), Approvals | 14 |
| B User Support Information | 15 |
| Limited Warranty | 15 |
| Exclusions | 15 |
| Return for Repair Procedure | 16 |
| Packing | 16 |
| Include | 16 |
| Shipping | 16 |
| Send to: | 16 |
| Index | 19 |

Table of Figures

| | |
|---|----|
| Figure 2.1 DET-200-002 Front View | 3 |
| Figure 2.2 DET-200-002 Rear View | 4 |
| Figure 3.1 Example Setup for Detector Test..... | 5 |
| Figure A.1 Typical Spectral Response of the Si Photodiode | 12 |

Introduction

Overview

The DET-200-002 is an amplified, switchable gain, silicon photodiode detector designed for detection of light signals over a 350-1100nm wavelength range. Its photodiode has a large active area of 16.4mm² allowing for easy optical alignment. It has a ten-position rotary gain switch that allows the user to vary the gain over a 24dB range. The DET-200-002 has a bandwidth of 1MHz at maximum gain, rising to 6MHz at minimum gain. The output offset voltage is less than +/- 5mV at all gain settings. Finally, it has a 50-Ohm buffered output that can drive a hi-Z load up to 10V and a 50-Ohm load up to 5V.

The DET-200-002 is housed in a rugged metal enclosure and its small size (1" x 2" x 2") allows it to fit into small spaces. Two orthogonal #8-32 threaded mounting holes are provided for post mounting flexibility. In addition, two #4-40 threaded holes are provided for mounting 30mm Cage Rod optical components. Finally, a green power ON LED shows when power is applied to the device.

The DET-200-002 requires 15VDC to operate and comes with the Photodiode Detector and 15VDC universal power supply.

Accessories.

Post mounts - Hinds P/N 050-2204-001-R

Cage Rotation Mount - Hinds P/N 060-0000-123-R

Cage Assembly Rod - Hinds P/N 060-0000-073-R

Supporting Products

Signaloc™ 2100 Dual-Phase, Analog, Lock-In Amplifier

The Signaloc 2100 is an AC and DC signal recovery instrument made up of the Signaloc 2100 and proprietary Hinds Lock-In Amplifier computer and control display software. Information from the Signaloc 2100 is sent to a computer via RS-232 where it is displayed on a computer monitor. The user can control various settings of the Signaloc 2100 using the software program. Together they measure and display the AC magnitude of the signal in Volts RMS and the DC magnitude of the signal in Volts.

In addition, the user can display one of the following signal parameters:

- Angle of AC component in degrees with respect to reference signal input
- X component of AC signal in Volts RMS
- Y component of AC signal in Volts RMS

Using the computer and control software, the user can select the optimum Gain and Time Constant values for the measurement. In addition, the user can select and/or de-select the Auto Phase function. Data can be logged either by specifying a time window or by specifying the number of data points desired.

The Signaloc 2100 includes the Signaloc 2100, a 15V DC power supply, the Hinds Instruments computer and control software and the user manual

SCU-100

The SCU-100 Signal Conditioning Unit takes an input signal, as from a detector, splits the signal into its broadband AC and low-pass DC signals, amplifies these signals, then applies the amplified signals to AC and DC outputs. The SCU-100 AC output voltage can be determined using a lock-in amplifier and the DC output voltage can be measured with a digital voltmeter. The ratio of the AC to DC voltage is a necessary computation for the measurement of linear and circular dichroism.

The SCU-100 provides 8-level and 9-level amplification controls for the AC and DC gain controls, respectively.

2

DET-200-002 Front & Rear Views

DET-200-002 Front View

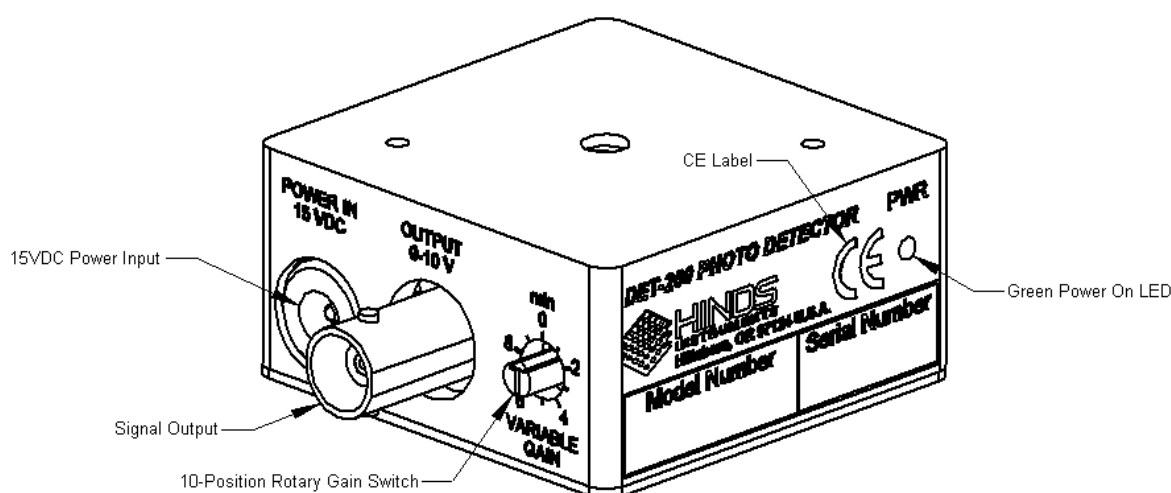


Figure 2.1 DET-200-002 Front View

DET-200-002 Front View Functional Items

15VDC Power Input: The DET-200-002 package includes a 15VDC desktop power supply, which plugs into the DET-200-002 15VDC power jack. The power supply operates from 100 - 240 VAC line voltage.

Signal Output: DET-200-002 signal output is provided via the 'Output' BNC connector. The output can drive a hi-Z load up to 10V and a 50-Ohm load up to 5V.

Green PWR On LED: The green PWR ON LED shows that the unit is powered on.

CE label: The CE label certifies that the DET-200-002 complies with European Union EMC directives.

10-Position Rotary Gain Switch: The 10-position rotary gain switch allows the user to vary the gain over a 24 dB range.

DET-200-002 Rear View

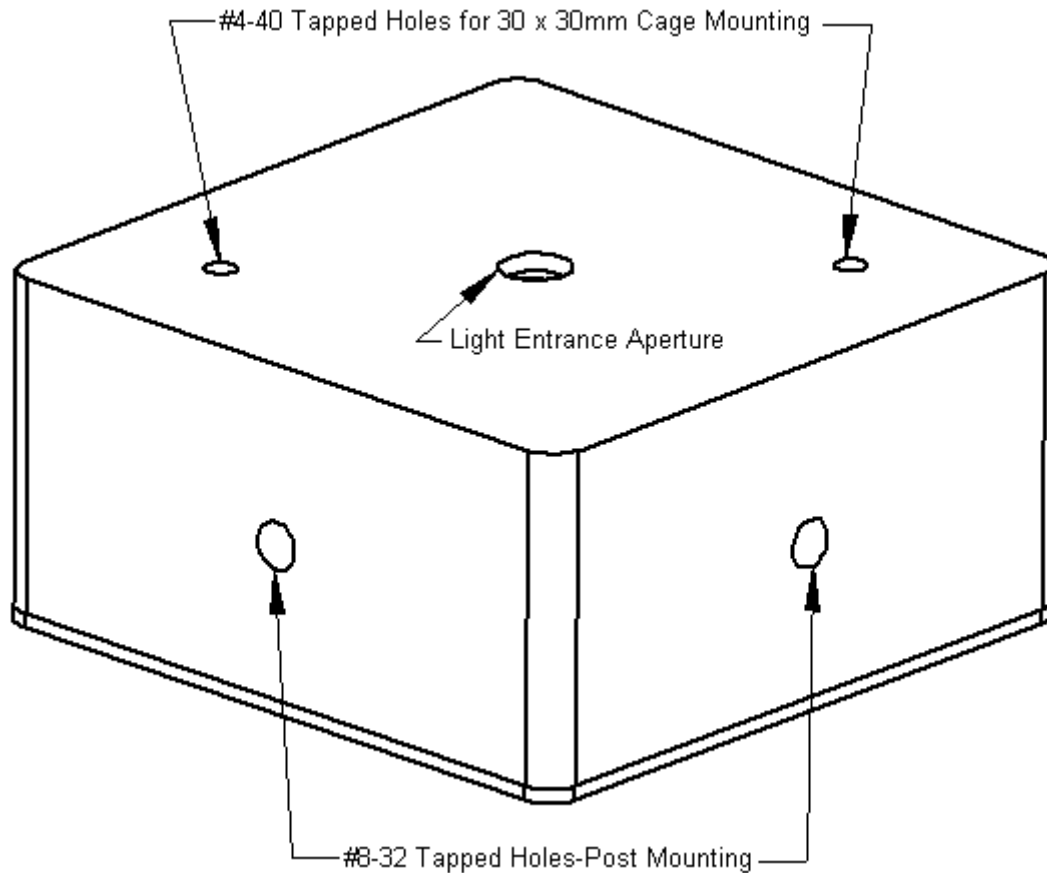


Figure 2.2 DET-200-002 Rear View

Photodiode Aperture: The DET-200-002 Photodiode detects a light source striking it via the Photodiode Entrance Aperture.

#8-32 Tapped Post Mounting Holes: The DET-200-002 has two orthogonal #8-32 tapped threaded mounting holes provided for post mounting flexibility.

#4-40 Tapped Holes for 30mm Cage Rods: The DET-200-002 has two #4-40 tapped threaded holes provided for mounting 30mm Cage Rod optical components. Threaded depth should NOT exceed 1/8 inch.

3

Initial Set-Up

Connecting the DET-200-002

The figure below shows an example set-up where the DET-200-002 might be used. The DET-200-002 is connected as follows:

1. The DET-200-002 is placed with the light source striking the center of the photodiode via the entrance aperture.
2. The DET-200-002 output is connected to an oscilloscope input via a coaxial cable (not provided).
3. Connect the DET-200-002 desktop power supply to line voltage and connect the DC plug to the DET-200-002 15VDC power jack.
4. Verify that the green power LED is on.

A DC level change should be seen on the oscilloscope (with input coupling set to DC) and a sine wave should be seen if the modulator is functioning. Blocking then unblocking the light source while watching the oscilloscope helps to confirm proper operation when detecting low intensity light sources.

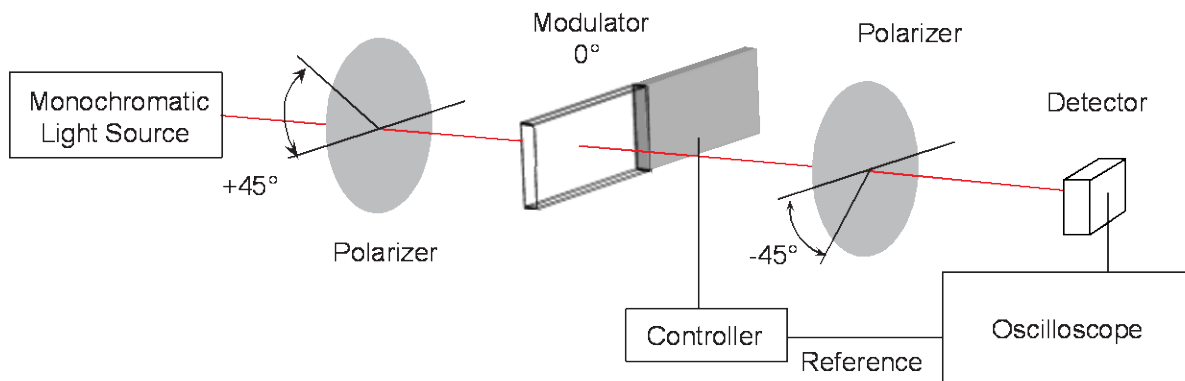


Figure 3.1 Example Setup for Detector Test

Operating the DET-200-002

Operation

The solid-state photodiodes used in Hinds Instruments detectors provide a current signal which is proportional to the intensity of UV/visible/IR light striking the detector. An integrated preamplifier converts the current signal to a voltage signal. A second amplifier performs further voltage amplification via a gain setting 10-position rotary switch.

The user should adjust the gain knob for the highest possible output signal in order to obtain the optimum signal-to-noise ratio. However, if any part of the signal is “flat” (output in voltage limit), the gain should be reduced accordingly. Hinds Instruments recommends that input laser power not exceed 5mW.

The output of the DET-200-002 provides impedance matching to the output coaxial signal cable. It can drive a high impedance load up to 10V and a 50 Ohm load up to 5V.

The DET-200-002 signal output can be routed directly to a Hinds Signaloc 2100 Dual-Phase, Analog, Lock-In Amplifier that, together with an input reference signal, can measure the signal's amplitude and phase.

Alternatively, the output from the DET-200-002 can be routed directly to a Hinds SCU-100 Signal Conditioning Unit which separates out the AC and DC components of the signal. The SCU-100 allows the user to vary the gain of the AC and DC components of the signal.

Note: The ‘Detector Power’ output from the SCU-100 will NOT power the DET-200-002.

The DET-200-002 provides two orthogonal #8-32 threaded mounting holes for post mount flexibility. Post mounts may be purchased from Hinds Instruments (P/N: 050-2204-001-R). For some purposes (e.g., linear or circular dichroism) it may be desirable to rotate the detector about the optical axis. A V-block mount, available from many optical component supplies, would enable this operation.

5

Troubleshooting

Troubleshooting Guide – Symptoms & Possible Remedies

| Problem | |
|---|---|
| Symptom | Possible Remedies |
| No signal output from the DET-200-002. | <p>The AC cord is unplugged from the wall outlet or from the desktop power supply.</p> <p>The desktop power supply DC plug is not fully engaged in the 15VDC receptacle on DET-200-002. Make sure the green PWR ON LED is on.</p> <p>Check the cable connection from the DET-200-002 to the measurement instrumentation. Also check that the instrumentation is functioning properly.</p> |
| The DET-200-002 output signal is distorted or “flat-lined”. | <p>Reduce the gain of the detector using the gain knob.</p> <p>The detector diode may be in saturation, caused by a light source that is too strong. Use neutral density filters or other means to reduce the light intensity.</p> <p>Check that the photodiode entrance aperture is unobstructed and that the light source or beam is striking the center of the detector diode.</p> |

A

Specifications

DET-200-002 General

| | |
|----------------------|--|
| Model Number | DET-200-002, Hinds Instruments PN: 020-2651-066-02-R |
| Dimensions | 1 inch (H) x 2 inch (W) x 2.53 inch (L) (25.4mm x 50.8mm x 64.26mm) |
| Weight | DET-200-002 only - 2.6oz |
| Shipping weight | Includes Photodiode Detector, power supply and packaging – 1 Lbs |
| Power Requirements | 15VDC +/- 5%, 100mA |
| Signal Out Connector | BNC |
| Gain Adjust Switch | 10-position rotary |
| Gain Adjust Range | 24dB |
| Power ON Indicator | Green LED |

DET-200-002 Input / Output Specifications

| | |
|--------------------|-------------------------|
| Detector | Si-PC (Photoconductive) |
| Active Area | 16.4mm ² |
| Surface Diameter | 4.57mm |
| Spectral Range | 350-1100nm |
| Peak Wavelength | 970nm |
| Output Voltage | |
| 50Ω | 0-5V |
| Hi-Z | 0-10V |
| Output Impedance | 50Ω |
| Max Output Current | 100mA |
| Load Impedance | 50Ω to Hi-Z |

The graph below shows the typical spectral response of the Si Photodiode.

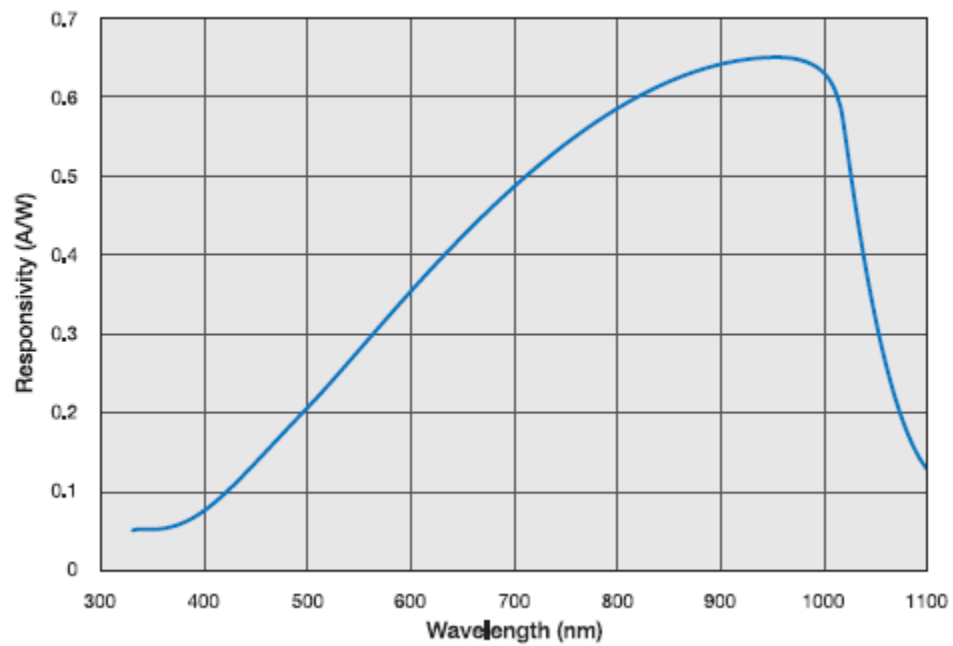


Figure A.1 Typical Spectral Response of the Si Photodiode

DET-200-002 Performance Specifications

| Gain Setting 0 | |
|-----------------------|--|
| Gain (Hi-Z): | 1.00×10^4 V/A |
| (50Ω): | 0.50×10^4 V/A |
| Bandwidth: | 6MHz |
| Noise (RMS): | 1.24 mV |
| NEP (@ λ_P): | 3.83×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 1 | |
| Gain (Hi-Z): | 2.62×10^4 V/A |
| (50Ω): | 1.31×10^4 V/A |
| Bandwidth: | 5.4MHz |
| Noise (RMS): | 2.33 mV |
| NEP (@ λ_P): | 3.54×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 2 | |
| Gain (Hi-Z): | 4.24×10^4 V/A |
| (50Ω): | 2.12×10^4 V/A |
| Bandwidth: | 4.5MHz |
| Noise (RMS): | 3.23 mV |
| NEP (@ λ_P): | 3.17×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 3 | |
| Gain (Hi-Z): | 5.86×10^4 V/A |
| (50Ω): | 2.93×10^4 V/A |
| Bandwidth: | 3MHz |
| Noise (RMS): | 3.79 mV |
| NEP (@ λ_P): | 3.73×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 4 | |
| Gain (Hi-Z): | 7.48×10^4 V/A |
| (50Ω): | 3.74×10^4 V/A |
| Bandwidth: | 2.1MHz |
| Noise (RMS): | 4.24 mV |
| NEP (@ λ_P): | 3.74×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |

| Gain Setting 5 | |
|-----------------------|--|
| Gain (Hi-Z): | 9.10×10^4 V/A |
| (50Ω): | 4.55×10^4 V/A |
| Bandwidth: | 1.6MHz |
| Noise (RMS): | 4.54 mV |
| NEP (@ λ_P): | 3.81×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 6 | |
| Gain (Hi-Z): | 1.07×10^5 V/A |
| (50Ω): | 0.54×10^5 V/A |
| Bandwidth: | 1.4MHz |
| Noise (RMS): | 4.84 mV |
| NEP (@ λ_P): | 3.64×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 7 | |
| Gain (Hi-Z): | 1.23×10^5 V/A |
| (50Ω): | 0.62×10^5 V/A |
| Bandwidth: | 1.2MHz |
| Noise (RMS): | 5.09 mV |
| NEP (@ λ_P): | 3.49×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 8 | |
| Gain (Hi-Z): | 1.40×10^5 V/A |
| (50Ω): | 0.70×10^5 V/A |
| Bandwidth: | 1.1MHz |
| Noise (RMS): | 5.24 mV |
| NEP (@ λ_P): | 3.63×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |
| Gain Setting 9 | |
| Gain (Hi-Z): | 1.56×10^5 V/A |
| (50Ω): | 0.78×10^5 V/A |
| Bandwidth: | 1MHz |
| Noise (RMS): | 5.44 mV |
| NEP (@ λ_P): | 3.55×10^{-12} W/ $\sqrt{\text{Hz}}$ |
| Offset: | +/- 5mV max |

DET-200-002 Environmental

| | |
|-----------------------|---------------------|
| Operating Temperature | 0 to 60 degrees C |
| Storage Temperature | -40 to 80 degrees C |

DET-200-002 Approvals

| | | |
|----|--------------------------|------------------------------|
| CE | Radiated Immunity (3V/m) | AC/DC Output Varies < +/- 5% |
|----|--------------------------|------------------------------|

Desktop Power Supply, General

| | |
|---------------------------------|--|
| Model Number | Hinds Instruments PN: 028-0000-076-R |
| Size, approximately rectangular | 1.220" inch high x 1.969" wide x 3.173" long (31.0mm x 50.0mm x 80.6mm) |
| Weight | Desktop power supply – less than 1 Lb. |

Desktop Power Supply, Input/Output Specifications

| | |
|--------|----------------------------------|
| Input | 100 – 240 VAC, 50 – 60 Hz, 0.35A |
| Output | 15VDC @ 0.8 A |

Desktop Power Supply (and AC cord set), Environmental

| | |
|----------------------------------|--|
| Operating Temperature @ Humidity | 5 to 40 degrees C @ 20 to 80% Humidity |
| Storage Temperature @ Humidity | -10 to 70 degrees C @ 10 to 90% Humidity |

Desktop Power Supply (and AC Cord set), Approvals

CE

User Support Information

Hinds Instruments, Inc. makes every attempt to ensure that the DET-200-002 Photodiode Detector/Preamplifier is a product of superior quality and workmanship. Our service personnel are available to assist you from 8:30 a.m. to 3:30 p.m. Pacific time. You may contact our Service Department at 503.690.2000 (Voice), 503.690.3000 (Fax), or service@hindsinstruments.com.

This section consists of the following items:

- A. One-Year Limited Warranty. Please read this information carefully.
- B. Return for Repair Procedure: This procedure is for your convenience in the event you must return your detector/preamplifier for repair. Follow the packing instructions carefully to protect your instrument in transit.

Limited Warranty

Hinds Instruments, Inc. (Hinds) warrants the DET-200-002 Photodiode Detector/Preamplifier to be free from defects in materials and/or workmanship when operated in accordance with the manufacturer's operating instructions for one (1) year from the date of purchase, subject to the provisions contained herein. Hinds' warranty shall extend to the original purchaser only and shall be limited to factory repair or replacement of defective parts.

Exclusions

This warranty does not cover normal maintenance, damage resulting from improper user or repair, or abuse by the user. This warranty extends only to repair or replacement, and shall in no event extend to consequential damages. In the event of user repair or replacement, this warranty shall cover neither the advisability of the repair undertaken, nor the sufficiency of the repair itself.

THIS DOCUMENT REFLECTS THE ENTIRE AND EXCLUSIVE UNDERSTANDING OF ALL THE PARTIES, AND EXCEPT AS OTHERWISE PROVIDED HEREIN, ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, PARTICULARLY THE WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXCLUDED.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Return for Repair Procedure

In the event of defects for damage to your unit, first call the factory Service Department. Our hours are 8:30 a.m. to 3:30 p.m. Pacific Time, Monday through Friday. You can contact our Service Department at 503.690.2000 (Voice), 503.690.3000 (Fax), or service@hindsinstruments.com.

If factory service is required, return your detector/preamplifier as follows:

Packing

- wrap unit in plastic bag first
- pack in original shipping carton or a sturdy oversized carton
- used plenty of packing material

Include

- Packing List and RMA number emailed to you from the Service Department
- a brief description of the problem with all known symptoms
- your daytime phone number and email address
- your return shipping address (UPS/FedEx will not deliver to a post office box)

Shipping

- send freight prepaid (UPS/FedEx 2nd Day Air recommended)
- insurance recommended (Service Personnel will provide the replacement value of the item(s) being shipped)
- COD shipments will not be accepted

Send to:

Service Department
Hinds Instruments, Inc.
7245 NW Evergreen Pkwy
Hillsboro, OR 97124 USA

If your unit is under warranty, after repair or replacement has been completed, it will be returned by a carrier and method chosen by Hinds Instruments, Inc. to any destination within the continental United States. If you desire some specific form of conveyance or if you are beyond these borders, then you must bear the additional cost of return shipment.

If your unit is not under warranty, we will call you with an estimate of the charges. If approved, your repaired unit will be returned after all charges, including parts, labor, and return shipping and handling, have been paid in full. If not approved, your unit will be returned as is via UPS COD for the amount of the UPS COD freight charges.

Index

C

| | |
|----------------------------------|---|
| CE label | 3 |
| connecting the DET-200-002 | 5 |

D

| | |
|----------------------|---|
| DET-200-002 | |
| accessories | 1 |
| CE label..... | 3 |
| example set-up..... | 5 |
| front view..... | 3 |
| operation | 7 |
| output | 3 |
| overview | 1 |
| power supply | 3 |
| rear view..... | 4 |
| troubleshooting..... | 9 |

L

| | |
|-------------------------------|---|
| light entrance aperture | 4 |
|-------------------------------|---|

P

| | |
|----------------------------------|----|
| performance specifications | 13 |
| power supply specifications | |
| approvals..... | 14 |
| environmental..... | 14 |
| input/output | 14 |

R

| | |
|------------------------|----|
| return for repair..... | 16 |
|------------------------|----|

S

| | |
|--|----|
| SCU-100 signal amplification..... | 2 |
| specifications | |
| desktop power supply | 14 |
| DET-200-002 approvals..... | 14 |
| DET-200-002 environmental..... | 14 |
| DET-200-002 input/output..... | 11 |
| performance..... | 13 |
| supporting products | 1 |
| SCU-100..... | 2 |
| Signaloc™ 2100 Dual-Phase, Analog, Lock-In Amplifier | 1 |

T

| | |
|-----------------------|---|
| troubleshooting | 9 |
| power problems | 9 |

W

| | |
|------------------|----|
| warranties | |
| document | ii |
| exclusions | 15 |
| limited | 15 |



HINDS INSTRUMENTS, INC
7245 NW EVERGREEN PKWY
HILLSBORO, OR 97124 USA
PHONE: 503/690.2000
FAX: 503/690.3000
TOLL FREE: 1.800/688.4463
EMAIL: sales@hindsinstruments.com
www.hindsinstruments.com

COPYRIGHT © 2010, 2013
HINDS INSTRUMENTS, INC All Rights Reserved
MANUFACTURED IN USA UNDER PATENTS &
PATENTS PENDING
PRINTED IN USA