

**DET-200-007**

**PHOTODIODE  
DETECTOR/PREAMPLIFIER**

**USER MANUAL**



**Hinds Instruments, Inc.**  
**P/N: 020-2651-066-07-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
<b>1 Introduction .....</b>	<b>1</b>
<b>Overview .....</b>	<b>1</b>
<b>Accessories .....</b>	<b>1</b>
<b>Supporting Products.....</b>	<b>1</b>
Signaloc™ 2100 Dual-Phase, Analog, Lock-In Amplifier .....	1
SCU-100 .....	2
<b>2 DET-200-007 Front &amp; Rear Views .....</b>	<b>3</b>
<b>DET-200-007 Front View .....</b>	<b>3</b>
DET-200-007 Front View Functional Items .....	3
<b>DET-200-007 Rear View.....</b>	<b>4</b>
<b>3 Initial Set-Up .....</b>	<b>5</b>
<b>Connecting the DET-200-007 .....</b>	<b>5</b>
<b>4 Operating the DET-200-007 .....</b>	<b>7</b>
<b>Operation .....</b>	<b>7</b>
<b>5 Troubleshooting .....</b>	<b>9</b>
<b>Troubleshooting Guide – Symptoms &amp; Possible Remedies .....</b>	<b>9</b>
<b>A Specifications .....</b>	<b>11</b>
<b>DET-200-007 General .....</b>	<b>11</b>
<b>DET-200-007 Input / Output Specifications .....</b>	<b>11</b>
<b>DET-200-007 Performance Specifications .....</b>	<b>13</b>
<b>DET-200-007 Environmental.....</b>	<b>14</b>
<b>DET-200-007 Approvals .....</b>	<b>14</b>
<b>Desktop Power Supply, General .....</b>	<b>14</b>
<b>Desktop Power Supply, Input/Output Specifications .....</b>	<b>14</b>
<b>Desktop Power Supply (and AC cord set), Environmental.....</b>	<b>14</b>
<b>Desktop Power Supply (and AC Cord set), Approvals .....</b>	<b>14</b>
<b>B User Support Information .....</b>	<b>15</b>
<b>Limited Warranty.....</b>	<b>15</b>
Exclusions.....	15
<b>Return for Repair Procedure .....</b>	<b>16</b>
Packing .....	16
Include .....	16
Shipping.....	16
Send to: .....	16
<b>Index .....</b>	<b>19</b>



# ***Table of Figures***

Figure 2.1 DET-200-007 Front View .....	3
Figure 2.2 DET-200-007 Rear View .....	4
Figure 3.1 Example Setup for Detector Test.....	5
Figure A.1 Typical Spectral Response of the Ge Photodiode.....	12



# *Introduction*

---

## **Overview**

The DET-200-007 is an amplified, switchable gain, germanium photodiode detector designed for detection of light signals over an 800-1600nm wavelength range. Its photodiode has an active area of 3mm<sup>2</sup>. It has a ten-position rotary gain switch that allows the user to vary the gain over a 24dB range. The DET-200-007 has a bandwidth of 1MHz at maximum gain, rising to 1.75MHz 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-200-007 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-200-007 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-200-007 Front & Rear Views***

---

### **DET-200-007 Front View**

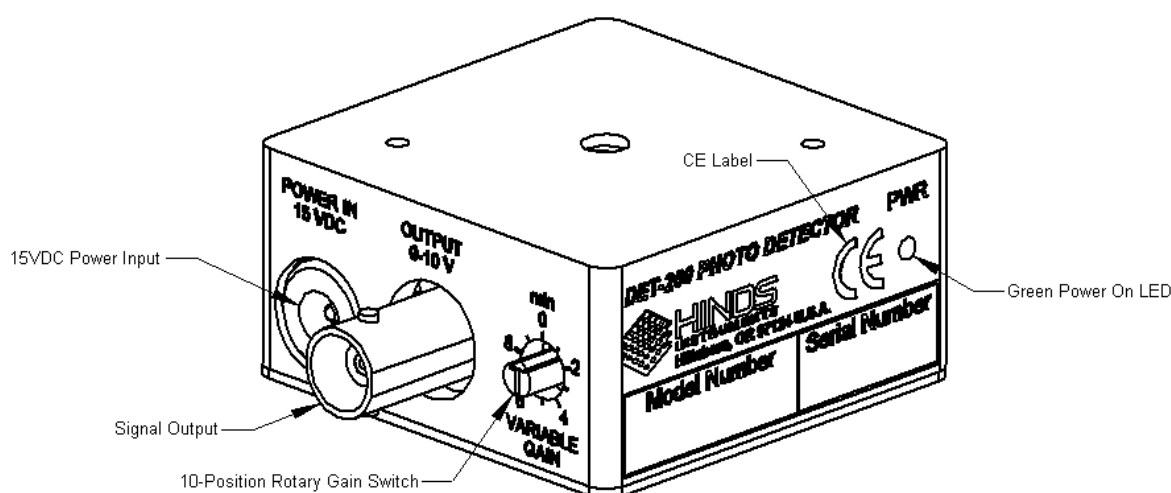


Figure 2.1 DET-200-007 Front View

---

### **DET-200-007 Front View Functional Items**

**15VDC Power Input:** The DET-200-007 package includes a 15VDC desktop power supply, which plugs into the DET-200-007 15VDC power jack. The power supply operates from 100 - 240 VAC line voltage.

**Signal Output:** DET-200-007 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-200-007 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-200-007 Rear View

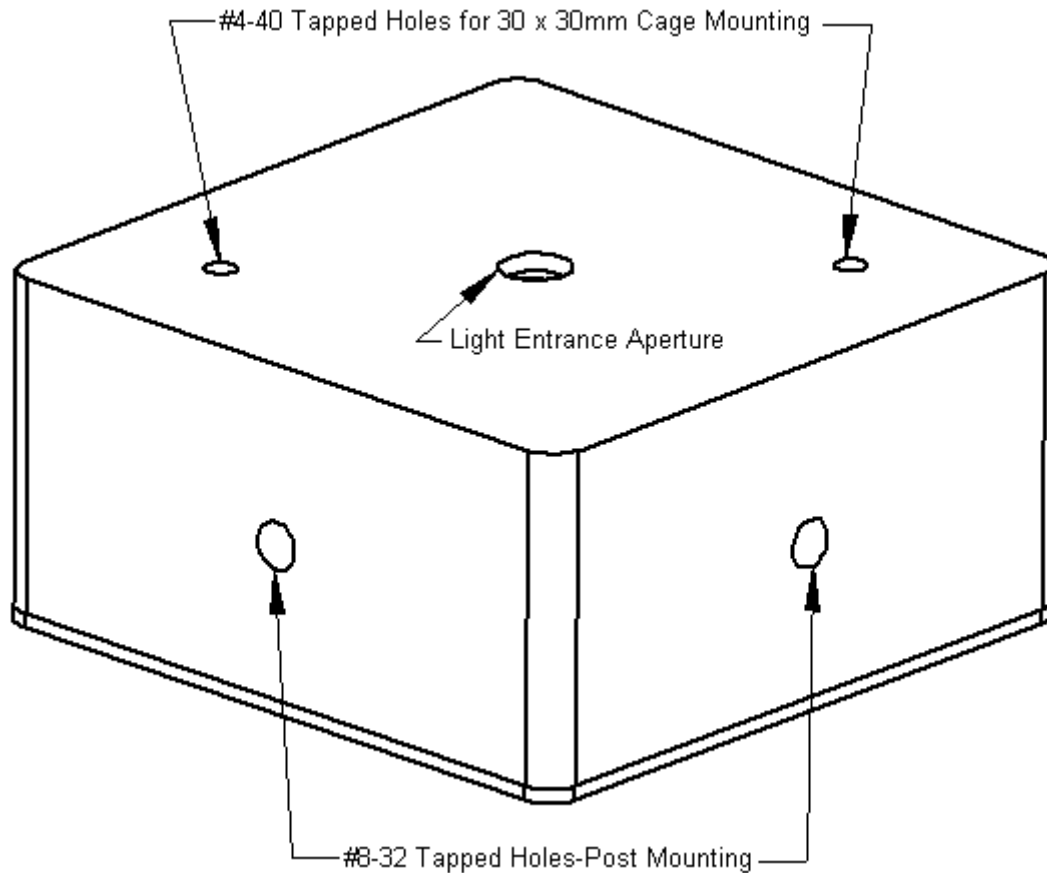


Figure 2.2 DET-200-007 Rear View

**Photodiode Aperture:** The DET-200-007 Photodiode detects a light source striking it via the Photodiode Entrance Aperture.

**#8-32 Tapped Post Mounting Holes:** The DET-200-007 has two orthogonal #8-32 tapped threaded mounting holes provided for post mounting flexibility.

**#4-40 Tapped Holes for 30mm Cage Rods:** The DET-200-007 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-200-007

The figure below shows an example setup where the DET-200-007 might be used. The DET-200-007 is connected as follows:

1. The DET-200-007 is placed with the light source striking the center of the photodiode via the entrance aperture.
2. The DET-200-007 output is connected to an oscilloscope input via a coaxial cable (not provided).
3. Connect the DET-200-007 desktop power supply to line voltage and connect the DC plug to the DET-200-007 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.

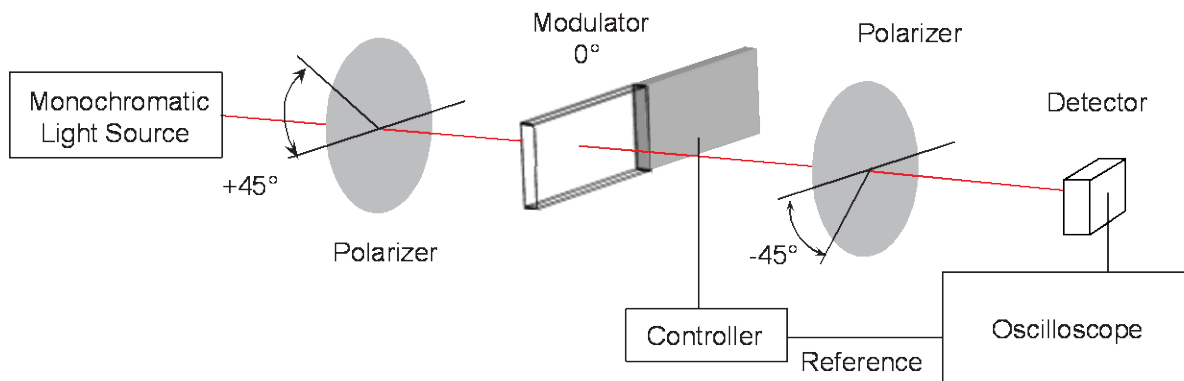


Figure 3.1 Example Setup for Detector Test



# *Operating the DET-200-007*

---

## **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-200-007 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-200-007 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-200-007 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-200-007.

The DET-200-007 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 Guide – Symptoms & Possible Remedies

Problem	
<p><b>Symptom</b></p> <p>No signal output from the DET-200-007.</p>	<p><b>Possible Remedies</b></p> <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-200-007. Make sure the green PWR ON LED is on.</p> <p>Check the cable connection from the DET-200-007 to the measurement instrumentation. Also check that the instrumentation is functioning properly.</p>
<p>The DET-200-007 output signal is distorted or “flat-lined”.</p>	<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-200-007 General**

Model Number	DET-200-007, Hinds Instruments PN: 020-2651-066-07-R
Dimensions	1 inch (H) x 2 inch (W) x 2.53 inch (L) (25.4mm x 50.8mm x 64.26mm)
Weight	DET-200-007 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-200-007 Input / Output Specifications**

Detector	Ge PV (Photovoltaic)
Active Area	3mm <sup>2</sup>
Surface Diameter	2mm
Spectral Range	800-1600nm
Peak Wavelength	1500nm
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 Ge Photodiode.

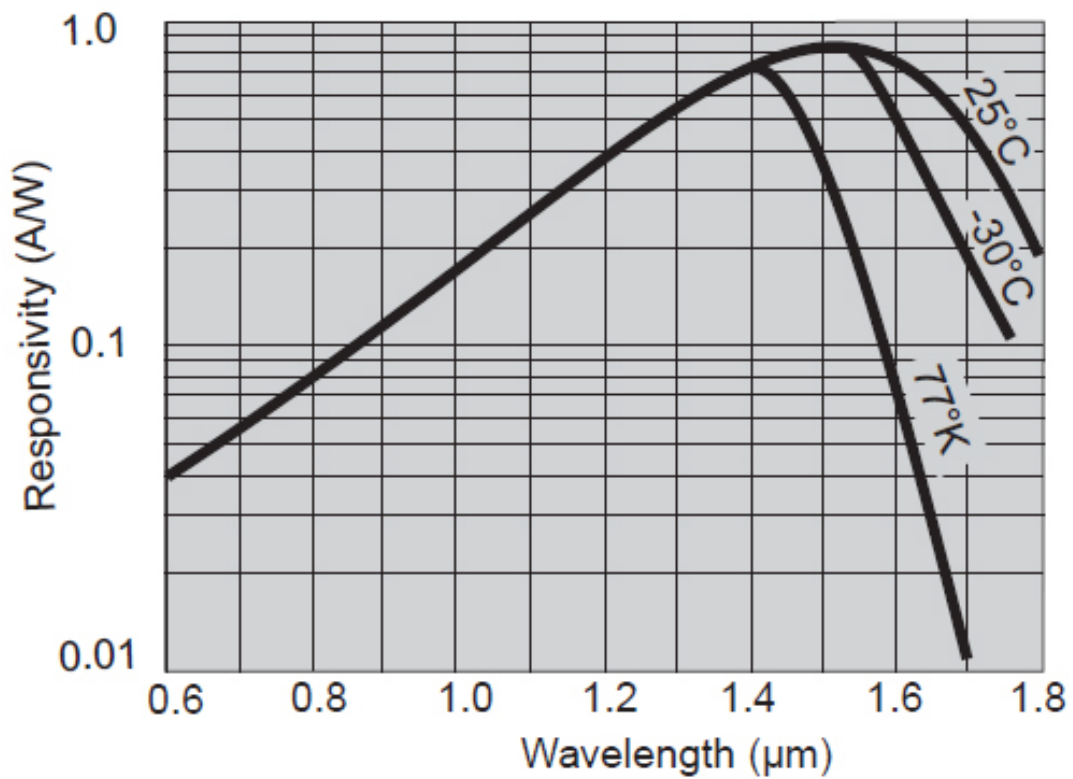


Figure A.1 Typical Spectral Response of the Ge Photodiode

## DET-200-007 Performance Specifications

Performance Specifications			
<b>0 Gain Setting</b>		<b>5 Gain Setting</b>	
Gain (Hi-Z):	$4.05 \times 10^{-3}$ V/A	Gain (Hi-Z):	$3.67 \times 10^{-4}$ V/A
(50Ω):	$2.03 \times 10^{-3}$ V/A	(50Ω):	$1.84 \times 10^{-4}$ V/A
Bandwidth:	1.75MHz	Bandwidth:	1.45MHz
Noise (RMS):	2.07 mV	Noise (RMS):	11.5 mV
NEP (@λ <sub>P</sub> ):	$1.26 \times 10^{-11}$ W/√Hz	NEP (@λ <sub>P</sub> ):	$1.35 \times 10^{-11}$ W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
<b>1 Gain Setting</b>		<b>6 Gain Setting</b>	
Gain (Hi-Z):	$1.05 \times 10^{-4}$ V/A	Gain (Hi-Z):	$4.32 \times 10^{-4}$ V/A
(50Ω):	$0.53 \times 10^{-4}$ V/A	(50Ω):	$2.16 \times 10^{-4}$ V/A
Bandwidth:	1.7MHz	Bandwidth:	1.39MHz
Noise (RMS):	4.34 mV	Noise (RMS):	12.8 mV
NEP (@λ <sub>P</sub> ):	$1.31 \times 10^{-11}$ W/√Hz	NEP (@λ <sub>P</sub> ):	$1.25 \times 10^{-11}$ W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
<b>2 Gain Setting</b>		<b>7 Gain Setting</b>	
Gain (Hi-Z):	$1.71 \times 10^{-4}$ V/A	Gain (Hi-Z):	$4.97 \times 10^{-4}$ V/A
(50Ω):	$0.86 \times 10^{-4}$ V/A	(50Ω):	$2.49 \times 10^{-4}$ V/A
Bandwidth:	1.64MHz	Bandwidth:	1.33MHz
Noise (RMS):	6.49 mV	Noise (RMS):	14.1 mV
NEP (@λ <sub>P</sub> ):	$1.47 \times 10^{-11}$ W/√Hz	NEP (@λ <sub>P</sub> ):	$1.20 \times 10^{-11}$ W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
<b>3 Gain Setting</b>		<b>8 Gain Setting</b>	
Gain (Hi-Z):	$2.36 \times 10^{-4}$ V/A	Gain (Hi-Z):	$5.64 \times 10^{-4}$ V/A
(50Ω):	$1.18 \times 10^{-4}$ V/A	(50Ω):	$2.82 \times 10^{-4}$ V/A
Bandwidth:	1.57MHz	Bandwidth:	1.27MHz
Noise (RMS):	8.29 mV	Noise (RMS):	15.0 mV
NEP (@λ <sub>P</sub> ):	$1.32 \times 10^{-11}$ W/√Hz	NEP (@λ <sub>P</sub> ):	$1.20 \times 10^{-11}$ W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
<b>4 Gain Setting</b>		<b>9 Gain Setting</b>	
Gain (Hi-Z):	$3.02 \times 10^{-4}$ V/A	Gain (Hi-Z):	$6.29 \times 10^{-4}$ V/A
(50Ω):	$1.51 \times 10^{-4}$ V/A	(50Ω):	$3.15 \times 10^{-4}$ V/A
Bandwidth:	1.52MHz	Bandwidth:	1.23MHz
Noise (RMS):	10.0 mV	Noise (RMS):	16.2 mV
NEP (@λ <sub>P</sub> ):	$1.36 \times 10^{-11}$ W/√Hz	NEP (@λ <sub>P</sub> ):	$1.17 \times 10^{-11}$ W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max

---

## **DET-200-007 Environmental**

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

---

## **DET-200-007 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-200-007 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](mailto: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-200-007 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](mailto: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 2<sup>nd</sup> 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-200-007 .....	5

## D

DET-200-007	
accessories .....	2
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-200-007 approvals.....	14
DET-200-007 environmental.....	14
DET-200-007 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](mailto:sales@hindsinstruments.com)  
**[www.hindsinstruments.com](http://www.hindsinstruments.com)**

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