DET-200-004

PHOTODIODE DETECTOR/PREAMPLIFIER

USER MANUAL

Hinds Instruments, Inc.
P/N: 020-2651-066-04-R UM Rev B

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Introduction

Overview

The DET-200-004 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 16.4mm^2 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-200-004 has a bandwidth of 1MHz at maximum gain, rising to 1.65MHz 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-200-004 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-200-004 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-200-004 Front & Rear Views

DET-200-004 Front View

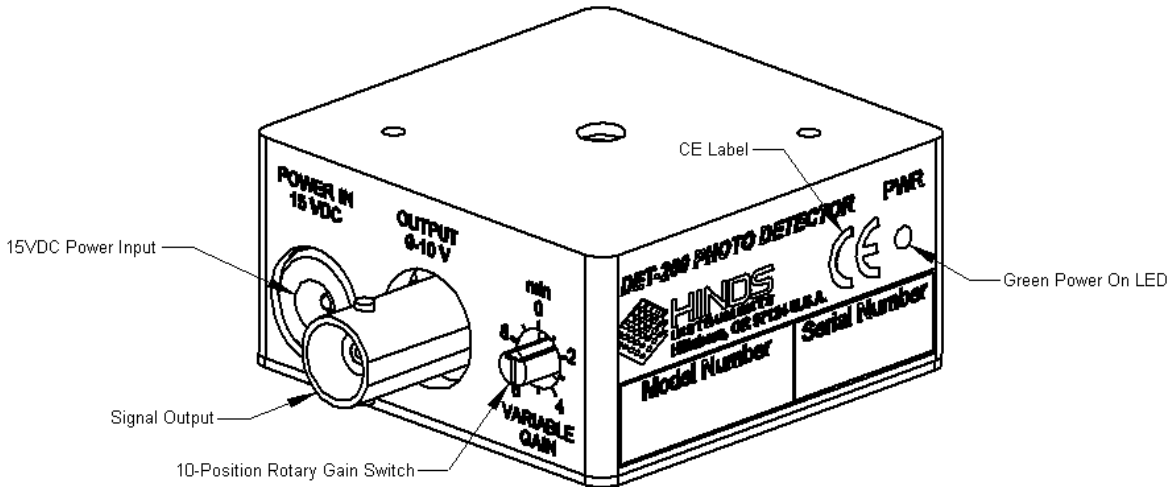


Figure 2.1 DET-200-004 Front View

DET-200-004 Front View Functional Items

15VDC Power Input: The DET-200-004 package includes a 15VDC desktop power supply, which plugs into the DET-200-004 15VDC power jack. The power supply operates from 100 - 240 VAC line voltage.

Signal Output: DET-200-004 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-200-004 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-200-004 Rear View

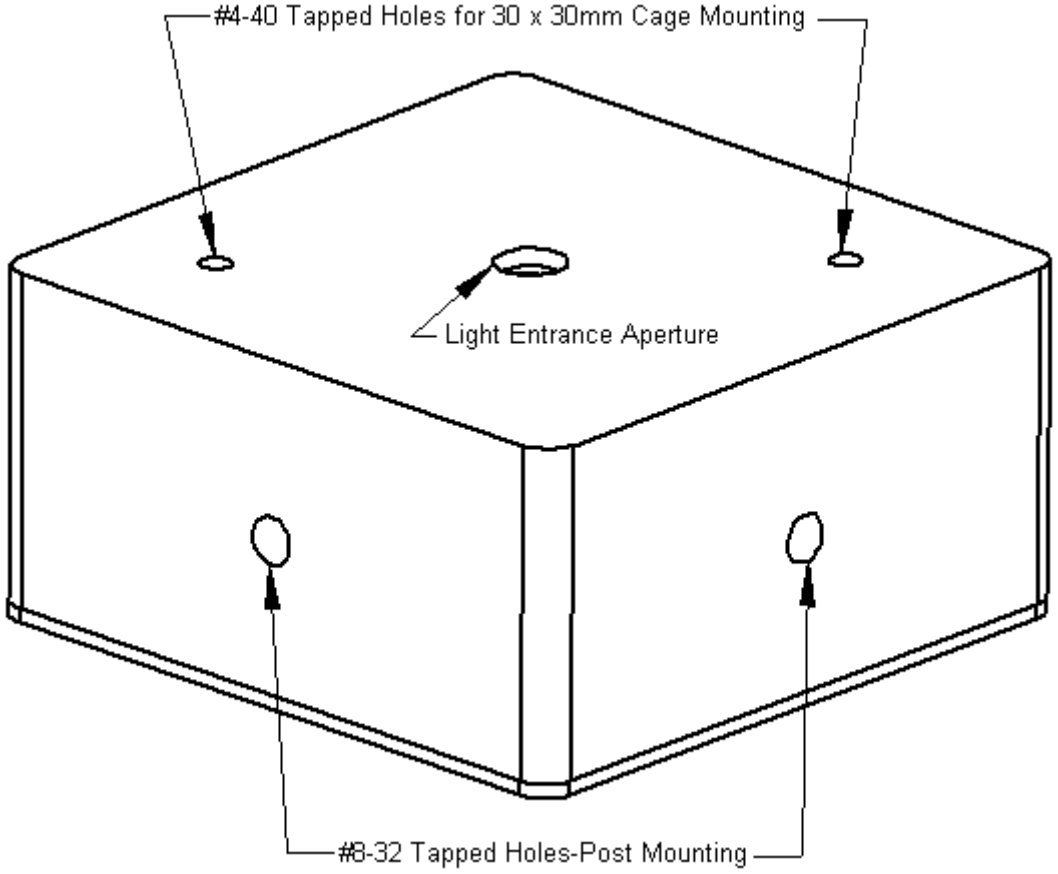


Figure 2.2 DET-200-004 Rear View

Photodiode Aperture: The DET-200-004 Photodiode detects a light source striking it via the Photodiode Entrance Aperture.

#8-32 Tapped Post Mounting Holes: The DET-200-004 has two orthogonal #8-32 tapped threaded mounting holes provided for post mounting flexibility.

#4-40 Tapped Holes for 30mm Cage Rods: The DET-200-004 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-200-004

The figure below shows an example setup where the DET-200-004 might be used. The DET-200-004 is connected as follows:

1. The DET-200-004 is placed with the light source striking the center of the photodiode via the entrance aperture.
2. The DET-200-004 output is connected to an oscilloscope input via a coaxial cable (not provided).
3. Connect the DET-200-004 desktop power supply to line voltage and connect the DC plug to the DET-200-004 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.

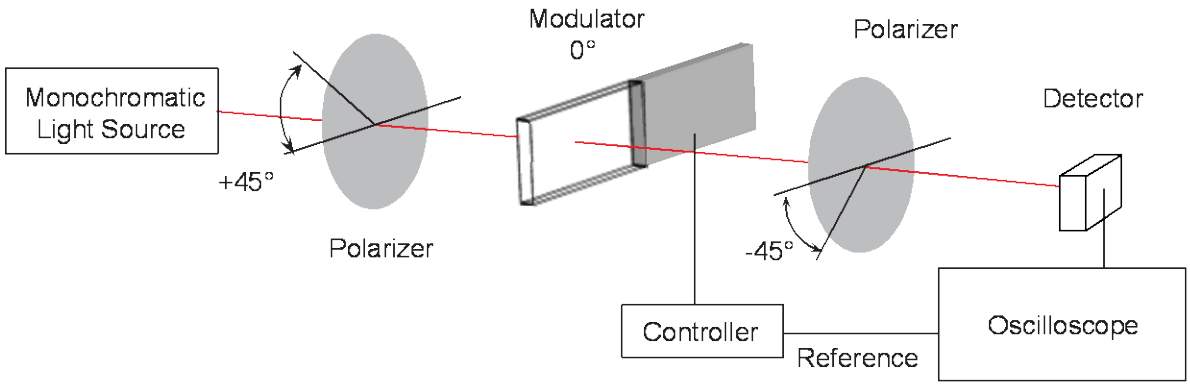


Figure 3.1 Example Setup for Detector Test

4
Operating the DET-200-004

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-200-004 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-200-004 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-200-004 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-200-004.

The DET-200-004 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-200-004.	The AC cord is unplugged from the wall outlet or from the desktop power supply. The desktop power supply DC plug is not fully engaged in the 15VDC receptacle on DET-200-004. Make sure the green PWR ON LED is on. Check the cable connection from the DET-200-004 to the measurement instrumentation. Also check that the instrumentation is functioning properly.
The DET-200-004 output signal is distorted or “flat-lined”.	Reduce the gain of the detector using the gain knob. 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. Check that the photodiode entrance aperture is unobstructed and that the light source or beam is striking the center of the detector diode.

A
Specifications

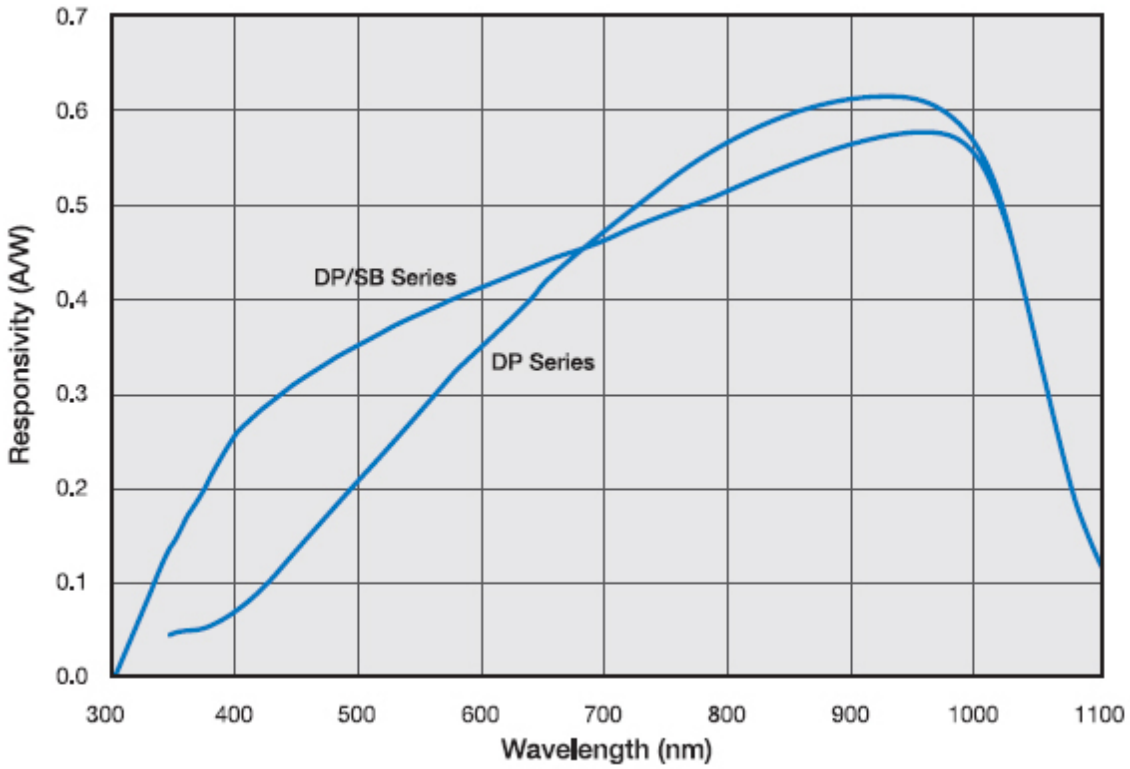
DET-200-004 General

Model Number	DET-200-004, Hinds Instruments PN: 020-2651-066-04-R
Dimensions	1 inch (H) x 2 inch (W) x 2.53 inch (L) (25.4mm x 50.8mm x 64.26mm)
Weight	DET-200-004 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-200-004 Input / Output Specifications

Detector	Si PV (Photovoltaic)
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.



Note: DET-200-004 refers to DP Series curve.

Figure A.1 Typical Spectral Response of the Ge Photodiode

DET-200-004 Performance Specifications

Performance Specifications			
0 Gain Setting		**5 Gain Setting**	
Gain (Hi-Z):	5.02×10^{3} V/A	Gain (Hi-Z):	4.55×10^{4} V/A
(50Ω):	2.51×10^{3} V/A	(50Ω):	2.28×10^{4} V/A
Bandwidth:	1.65MHz	Bandwidth:	1.4MHz
Noise (RMS):	1.97 mV	Noise (RMS):	12.5 mV
NEP (@λ_P):	7.70×10^{-12} W/√Hz	NEP (@λ_P):	7.84×10^{-12} W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
1 Gain Setting		**6 Gain Setting**	
Gain (Hi-Z):	1.31×10^{4} V/A	Gain (Hi-Z):	5.36×10^{4} V/A
(50Ω):	0.66×10^{4} V/A	(50Ω):	2.68×10^{4} V/A
Bandwidth:	1.62MHz	Bandwidth:	1.32MHz
Noise (RMS):	4.69 mV	Noise (RMS):	14.0 mV
NEP (@λ_P):	7.65×10^{-12} W/√Hz	NEP (@λ_P):	7.65×10^{-12} W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
2 Gain Setting		**7 Gain Setting**	
Gain (Hi-Z):	2.12×10^{4} V/A	Gain (Hi-Z):	6.17×10^{4} V/A
(50Ω):	1.06×10^{4} V/A	(50Ω):	3.09×10^{4} V/A
Bandwidth:	1.56MHz	Bandwidth:	1.25MHz
Noise (RMS):	7.14 mV	Noise (RMS):	15.1 mV
NEP (@λ_P):	6.69×10^{-12} W/√Hz	NEP (@λ_P):	7.84×10^{-12} W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
3 Gain Setting		**8 Gain Setting**	
Gain (Hi-Z):	2.93×10^{4} V/A	Gain (Hi-Z):	6.99×10^{4} V/A
(50Ω):	1.47×10^{4} V/A	(50Ω):	3.50×10^{4} V/A
Bandwidth:	1.5MHz	Bandwidth:	1.14MHz
Noise (RMS):	9.00 mV	Noise (RMS):	16.2 mV
NEP (@λ_P):	8.03×10^{-12} W/√Hz	NEP (@λ_P):	7.87×10^{-12} W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max
4 Gain Setting		**9 Gain Setting**	
Gain (Hi-Z):	3.74×10^{4} V/A	Gain (Hi-Z):	7.80×10^{4} V/A
(50Ω):	1.87×10^{4} V/A	(50Ω):	3.90×10^{4} V/A
Bandwidth:	1.45MHz	Bandwidth:	1.05MHz
Noise (RMS):	11.0 mV	Noise (RMS):	17.3 mV
NEP (@λ_P):	8.02×10^{-12} W/√Hz	NEP (@λ_P):	7.99×10^{-12} W/√Hz
Offset:	+/- 5mV max	Offset:	+/- 5mV max

DET-200-004 Environmental

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

DET-200-004 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

B
User Support Information

Hinds Instruments, Inc. makes every attempt to ensure that the DET-200-004 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-200-004 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.

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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 though 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 competed, 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.

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