H7422/H7422P Series
Photo Sensor Module
INSTRUCTION MANUAL

H7422 with A7423 / A7423 Heatsink with fan (sold separately)

- Before installing and using this product, be sure to read the "Safety Precautions".

- This instruction manual is written on condition that to operate with the power supply unit Hamamatsu C8137–02. How to use without the C8137–02, contact your Hamamatsu sales office.

- This product undergoes complete in-house testing before shipment. However, unpack it carefully and check that all components and accessories are included and that there is no damage on the exterior or operational failure. If any components are missing or operational failure is suspected, contact your Hamamatsu sales office.

- This product is warranted for a period of one year from the date of delivery. If any failure is found in the workmanship or materials within this warranty period, Hamamatsu will repair or replace the defective parts without charge.

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1. Before Using This Product

1.1 Safety precautions (Always ensure safety!)

This product was designed with safety and reliability in mind. However, like most electrical products, improper handling or misoperation may cause fire or electrical shock, resulting in accidents that may include serious injury or death. Be sure to observe the precautions listed in this manual or on the warning labels to prevent accidents.

Observe caution items for safety

Read the caution items described in this manual carefully and follow the instructions.
These caution items include general precautions relating to this product.

If any abnormality occurs ...

For example, if smoke, an unusual sound or odor is sensed, immediately turn off the power supply.

- Warning information in this manual is shown classified into the following items and by the extent of danger or damage that may result if the product is improperly used.

| WARNING | Failure to follow WARNING instructions could result in serious injury or death to the operator or person servicing the product |
| CAUTION | Failure to follow CAUTION instructions may result in injury to the operator or the person servicing product, or damage to the product or peripheral equipment. |

- Warning symbols used in this manual are classified as explained below. Make sure that you thoroughly understand the meaning of each symbol and follow the instruction. (These symbols are just examples.)

| CAUTION | Symbols showing a caution or warning you must pay attention to |
| Must NOT do | Symbols showing what you must NOT do |
| Must DO | Symbols showing what you must DO |
WARNING

Do not allow water or foreign matter to enter the product.

- Fire
- Electrical Shock
- Must NOT do

Avoid placing any containers holding water near the equipment. If water spills and enters the interior of the equipment, immediately turn off the power supply, then contact your Hamamatsu sales office for correct servicing.

Do not disassemble or alter any part of this product.

- Fire
- Electrical Shock
- Do NOT disassemble

Do not open the case of this product. A high voltage is applied to some internal parts of this product. Touching them may cause fire, electrical shocks or injury.

If smoke, an unusual odor or noise is coming from the product, immediately disconnect the power cable plug.

- Fire
- Electrical Shock
- Must DO

Continuous operation may generate heat due to electrical shorts or insulation failure, resulting in fire or electrical shocks. Immediately turn off the power switch and disconnect the power cable plug.

Stop using the power cable if damaged and disconnect the power cable plug.

- Fire
- Electrical Shock
- Must DO

Continuous operation may generate heat due to electrical shorts or insulation failure, resulting in fire or electrical shocks. Immediately turn off the power switch and disconnect the power cable plug.

Remove any dust on the power cable plug.

- Fire
- Electrical Shock
- Must DO

Dust or metallic chips adhering to the power cable plug may cause due to electrical shorts or insulation failure by moisture, resulting in fire or electrical shocks. If they are deposited, disconnect the plug and wipe off with dry cloth. Check to see if dust and foreign matter adhere to the plug occasionally.
Follow the authorized disposal methods if discarding this product.

⚠️ Must DO

The material in the H7422/H7422P series contains Lead and Cadmium. The material in the H7422/H7422P-40/-50 contains Lead, Cadmium and Arsenic. Please follow the applicable regulations regarding disposal of hazardous materials and industrial wastes in your country, state, region or province.

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Do not touch the power cable plug with wet hands.

⚠️ Electrical Shock

🚫 Must NOT do

Electricity conducts through water so touching the power cable plug with wet hands may result in electrical shocks.
CAUTION

Avoid installing this product in locations subject to excessive soot, steam, humidity, dust and vibration.

- Fire
- Must NOT do

Soot, steam, humidity, dust, corrosive gases and inflammable gases may harm this product. Especially, if dust adheres to the input window of this product, optical transmittance may degrade significantly.

Do not tug on the power cable to unplug it.

- Fire
- Electrical Shock
- Must NOT do

Tugging on the power cable may damage the cable. Continuous operation with a damaged cable may generate heat by due to electrical shorts or insulation failure, resulting in fire or electrical shocks.

Unplug the power cable for safety during maintenance or long-term storage.

- Fire
- Electrical Shock
- Must DO

Touching an internal part by mistake may result in electrical shocks. Storing the product left energized for extended periods of time may cause fire.

Read this manual thoroughly and follow the instructions.

- Fire
- Electrical Shock
- Must DO

Failure to take necessary safety measures or mishandling not following the instructions in this manual may result in serious accidents.

Use a relay ring that matches the C-mount component to be attached to the input window.

- Must DO

If you want to attach a C-mount component which requires a threaded portion longer than 4 mm, then use a commercial C-mount relay ring having a correct length or the Hamamatsu A7413 C-mount adapter available as an option (sold separately).

If you attempt to forcefully attach a C-mount component which does not match the threaded portion, that component or the light input window of the H7422/H7422P series might be damaged. Always use a proper C-mount adapter.

Avoid using this product in a vacuum.

- Fire
- Electrical Shock
- Must NOT do

If this product is used in a vacuum, an internal component at a high voltage may cause discharge, resulting in fire or electrical shocks.

Do not give the excessive light while power to the H7422 head was supplied.

- Must NOT do

It may harm this product to enter excessive light while power to the H7422 head was supplied.
1.2 Features

The H7422/H7422P series is a photo sensor module incorporating a high sensitivity photomultiplier tube along with a thermoelectric cooling element (Peltier element).

High detectivity (H7422/H7422P–40: GaAsP photocathode)
Wide spectral response
(H7422/H7422P–50: GaAs photocathode)
Wide Dynamic Range
(H7422–01/02/04/20: S–20/S–25/SS–25 photocathode)

The H7422/H7422P–40/50 uses a photomultiplier tube having a semiconductor photocathode with high quantum efficiency. This type of photocathode delivers higher detectivity than that obtained with alkali metal photocathodes which are widely used. The H7422/H7422P–40 offers high detectivity in a spectral range of 300 nm to 720 nm, while the H7422/H7422P–50 allows measurement with a high S/N ratio over a wide spectral range from 380 nm to 890 nm.
The H7422–01/02/04/20 uses a photomultiplier tube having an alkali metal photocathode. This type of photocathode delivers wide dynamic range.

Wide sensitive area
The H7422/H7422P series has a large sensitive area to facilitate the design and connection of the optical systems.
H7422/H7422P–40/50 5 mm dia.
H7422–01/02/04/20 7 mm dia.

Temperature monitor output from the thermistor
The H7422/H7422P series uses a thermoelectric cooling element* (Peltier element) that reduces thermal noise to deliver a higher S/N ratio. A thermistor is also integrated with the Peltier element to sense the operating temperature. Stable output can be maintained by monitoring the output from the thermistor and controlling the Peltier element current, even when the ambient temperature fluctuates.

Protection for excessive light input (H7422/H7422P–40/50)
Prepare for the accidental excessive light input while the H7422/H7422P–40/50 photo sensor module is operating, the H7422/H7422P–40/50 has protection circuit. The H7422/H7422P–40/50 monitors photomultiplier tube’s output current and cuts off high voltage power supply when output current over the threshold.

A wide variety of accessories provided
Various useful accessories are available for the H7422/H7422P series to make measurement more effective and reliable.

* Thermoelectric cooling element (Peltier element) is ...
a heat exchange element that serves as a heat pump when a DC current flows through it. Heat is absorbed at the one side and dissipated at the other side so that temperature control can be performed.
1.3 Part names and accessories

When the product is delivered to you, unpack it carefully and check that there is no damage on the exterior and that all components and accessories are included.

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**Accessories**

- * Connector (TAJIMI PRC03-12A10-7F10.5)  
  1 piece
- O-ring  
  1 piece
- Instruction manual (this manual)  
  1 vol.
- Test data sheet  
  1 copy

*A power cable is supplied instead of this connector when the power supply is purchased along with the H7422/H7422P photo sensor module.*
A: Power input connector (7-pin connector)
   This is for power input to the H7422/H7422P series photo sensor module, monitor output from the thermistor and power input/output for the Peltier element. For more details on cable connection, see Chapter 2, "Connections".

B: Signal output connector (BNC connector)
   Connect a signal output cable to this connector.

C: Heatsink mounting threaded holes (heat dissipation surface)
   Use these threaded holes to mount a heatsink in order to dissipate heat generated from inside the case to the outside air. A heatsink (A7423) equipped with a fan is available as an option. A heatsink must be attached on this surface with threaded holes. See Chapter 2, "Connections", for more details on how to attach the heatsink.

D: Side panel installation threaded holes
   Use these threaded holes when installing the photo sensor module while on its side to equipment.

E: Light input window
   Light enters the sensitive area through this window.

F: Front panel installation threaded holes
   Use these threaded holes when installing the photo sensor module while on its front side onto equipment or when attaching an optical unit.

G: Optical fiber attachment threaded holes
   Use these threaded holes when attaching an A7412 optical fiber adapter (sold separately as an option). See Chapter 2, "Connections", for more details on how to attach the adapter.

H: C-mount
   This is a standard screw-threaded mount and allows attaching various C-mount components such as a lens, diaphragm and shutter. If you want to attach a C-mount component which requires a threaded portion longer than 4 mm, then use a commercial C-mount relay ring having a correct length or the Hamamatsu A7413 C-mount adapter available as an option (sold separately). If you attempt to forcefully attach a C-mount component which does not match the threaded portion, that component or the light input window of the H7422/H7422P series might be damaged. Always use a proper C-mount adapter.

I: O-ring
   Fit an O-ring in place on the front panel to prevent light leaks when directly connecting the H7422/H7422P series photo sensor module to the light guide port on your equipment. This O-ring (S-28) is supplied with the H7422/H7422P series.
2. Connections

However, some setups are required before beginning measurement. This section explains how to make setups for measurement in the following points.

1. Installing a heatsink
2. Connecting optical systems
3. Connecting cables

2.1 Installing a heatsink

- Effect of heatsink

The H7422/H7422P series uses a Peltier element to cool the photomultiplier tube and improve the S/N ratio. The Peltier element generates heat when in operation and this heat may degrade the cooling performance and cause fluctuations in the photomultiplier tube detectivity. Always provide heat dissipation from inside the photo sensor module to suppress the rise in temperature. To easily allow efficient heat dissipation from the module, Hamamatsu provides the A7423 heatsink with a fan (sold separately). The graph below shows typical temperature characteristics of the H7422/H7422P series using the A7423 heatsink.

![Graph showing temperature characteristics](image)

Operating without A7423 —— Operating with A7423

Ambient temperature: 25 °C   Peltier element input current: 2.0 A

When the H7422/H7422P series is used in a small, sealed measurement chamber, heat dissipation from the module may be insufficient as the ambient temperature rises, and degrade the cooling performance. In this case, provide ventilation as needed.
A7423 Heatsink with Fan (sold separately)

To easily allow efficient heat dissipation from the module, Hamamatsu provides the A7423 heatsink with a fan (sold separately). The A7423 heatsink consists of a highly efficient heatsink and a miniature fan.

**A7423 Heatsink with fan (sold separately)**

- **Dimensions (Unit: mm)**

![Heatsink Diagram]

- **Configuration**

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Q'ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heatsink</td>
<td>1</td>
</tr>
<tr>
<td>Fan</td>
<td>1</td>
</tr>
<tr>
<td>Heatsink mounting screws (M3 L=5)</td>
<td>4</td>
</tr>
<tr>
<td>Fan mounting screws (M3 L=14)</td>
<td>4</td>
</tr>
<tr>
<td>Spacer</td>
<td>4</td>
</tr>
<tr>
<td>* Heat conductive grease</td>
<td>1</td>
</tr>
<tr>
<td>Instruction manual</td>
<td>1</td>
</tr>
</tbody>
</table>

* When the A7423 heatsink is purchased along with the H7422/H7422P series photo sensor module, the A7423 is mounted on the module at the factory, so heat conductive grease is not supplied.

**Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>12</td>
<td>V dc</td>
</tr>
<tr>
<td>Input current</td>
<td>During operation: 0.09 A</td>
<td>Maximum: 0.14 A</td>
</tr>
<tr>
<td>Input voltage range</td>
<td>10.2 to 13.8 V dc</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 110 g</td>
<td></td>
</tr>
</tbody>
</table>
• Installing the A7423 heatsink

Install the A7423 heatsink to the H7422/H7422P photo sensor module by using the following procedure.
This procedure is not necessary when you purchased the A7423 along with the H7422/H7422P series since the A7423 was already installed at factory. You can skip this section.

1. Apply heat conductive grease.
To allow good heat conduction from the module to the heatsink, apply a thin coat of heat conductive grease over the heat dissipating surface of the module where the threaded holes are provided for heatsink installation. (When the A7423 heatsink is purchased along with the H7422/H7422P series, the A7423 is mounted on the module at factory, so heat conductive grease is not supplied.)

CAUTION: Do not apply heat conductive grease too thick. Heat conduction may degrade.

2. Install the heatsink.
Install the heatsink onto the H7422/H7422P series module by tightening the four screws supplied with the module. If a screw is lost, use a 4mm long M3 screw. Using a screw with a different size may damage the module or cause a poor installation. Use sufficient caution not to deform the heatsink fins when tightening the screws.

3. Install the fan.
Place a spacer (supplied) between each threaded hole on the heatsink and the through hole on the fan. Using the four screws (M3, L=14; supplied), secure the fan to the heatsink. The fan must be set with the label facing up so that it blows air towards the heatsink. Use caution not to overtighten the screws.

4. Connect the power cable.
The connector on the power cable coming from the fan mates with the connector on the Hamamatsu C8137-02 power supply unit (sold separately). If you use a commercially available power supply to drive the fan, you will have to cut off the connector from the cable and make the necessary connections. In this case, use caution not to avoid making misconnections. Lead color coding: red (+), black (-)
2.2 Connecting the optical systems

The front panel of the H7422/H7422P series was designed for efficient connection to an O-ring, optical fiber, and C-mount components. When connecting such a component, make sure that no light leaks through the fastening points. The structure of the H7422/H7422P series photo sensor module is illustrated below, showing the cross section from the light input window to the photomultiplier tube photocathode. Use this illustration as your reference when designing the optical systems. To install the H7422/H7422P series module on its side panel or front panel to your equipment, use screws with a correct length so that they tighten properly in the threaded hole on the inner side of the panel.

H7422/H7422P Series Optical Systems Setup

Cross Section of Light Input Window Unit: mm | Threaded Hole Position and Length Unit: mm

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13
• When directly connecting to equipment

Fit an O-ring in place on the front panel to prevent light leaks when directly connecting the H7422/H7422P series photo sensor module to the light guide port on your equipment. If the installation surface of the equipment is uneven or the light-shielding on the mounting holes is inadequate, light leaks may occur through the fastening points, so carefully install the module and tighten the screws securely. The O-ring is supplied with the H7422/H7422P series module.

NOTE: A7423 heatsink with fan is sold separately.

Installation Example Using Front Panel

NOTE: L-shape bracket is not supplied.

Installation Example Using Side Panel

CAUTION: The O-ring is a replacement part subject to wear, so check for light leaks occasionally. Replace it if light leaks are found. The O-ring standard is “S-28”.

When using an optical fiber

An FC type optical fiber can be easily connected to the H7422/H7422P series photo sensor module, by using an A7412 optical fiber adapter (sold separately).

**Optical Fiber Adapter A7412 (sold separately)**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Unit: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-φ2.2</td>
<td></td>
</tr>
<tr>
<td>φ4 TAPERED DEPTH 1.5</td>
<td></td>
</tr>
<tr>
<td>M8 P=0.75</td>
<td></td>
</tr>
<tr>
<td>4-M2 L=3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
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</table>

**Configuration**

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Q'ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical fiber adapter (FC type)</td>
<td>1</td>
</tr>
<tr>
<td>Mounting screws (M2, L=3)</td>
<td>4</td>
</tr>
<tr>
<td>Light-shield packing</td>
<td>1</td>
</tr>
<tr>
<td>Instruction manual</td>
<td>1</td>
</tr>
</tbody>
</table>

**Installation method**

Install the optical fiber adapter while sandwiching the light-shield packing as shown at the right. Tighten the four screws (M2, L=3) supplied, to fasten the optical adapter to the light input side of the H7422/H7422P series module. Do not overtighten the screws. If a screw is lost, use a 3 mm long M2 screw.

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**CAUTION:** Always use the specified screws. Using other than the specified screw may damage the module or may cause a poor installation.
• When using a C-mount component

The H7422/H7422P series photo sensor module has a C-mount that connects to a variety of C-mount interchangeable components. This C-mount on the front panel of the H7422/H7422P series has a threaded portion of 4 mm depth, so any C-mount components with a threaded end shorter than 4 mm can be attached directly to the front panel of the H7422/H7422P series module. If you want to attach a C-mount component which requires a threaded portion longer than 4 mm, then use a commercial C-mount relay ring or the Hamamatsu A7413 C-mount adapter available as an option (sold separately).

**C-mount adapter A7413 (sold separately)**

**Dimensions** Unit: mm

The A7413 allows attaching a C-mount component with a threaded end up to 8 mm.

```
<table>
<thead>
<tr>
<th>Part Name</th>
<th>Q'ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-mount adapter</td>
<td>1</td>
</tr>
<tr>
<td>Instruction manual</td>
<td>1</td>
</tr>
</tbody>
</table>
```

**Attachment method**

Remove the O-ring from the front panel of the H7422/H7422P series, and then screw the A7413 C-mount adapter into the C-mount of the H7422/H7422P series until the A7413 flange makes contact with the front panel of the H7422/H7422P series. If you use the H7422/H7422P series in locations where vibrations may occur, it is advisable to apply a "screw lock agent" to prevent the screw from loosening.

**CAUTION:** Avoid installing the H7422/H7422P series module by using only the C-mount.
2.3 Making electrical connections

The photomultiplier tube incorporated in the H7422/H7422P series is a high-sensitivity device designed for low-light-level detection. If a voltage is input to the H7422/H7422P series while the photomultiplier tube is exposed to excessive light, this may damage the photomultiplier tube or electrical circuitry. Before making electrical connections, be sure that no excessive light is incident on the input window of the H7422/H7422P series.

• Connection diagram

- Connecting the signal output connector
  The signal output connector is a BNC type.
Power input and thermistor output connections

The POWER IN connector on the rear of the H7422/H7422P series is used to supply power to the H7422/H7422P series and extract the thermistor output. To connect to this POWER IN connector, align the guide mark on the plug (supplied) with the POWER IN connector, and insert it into position while holding the plug end. To disconnect, hold the ring on the plug and pull outwards.

**CAUTION:** The pin to pin spacing in the plug is very narrow, so use insulation tubing to separate each lead when wiring.

Pin No. | Signal Name | Description
---|---|---
A | Thermistor 1 | Internally connected to the thermistor to provide a monitor output. The photomultiplier tube temperature can be controlled by feedback of this monitor output to the Peltier element current. Use the thermistor within the maximum allowable power, which is 3.5 mW. For thermistor characteristics, refer to the graph on the next page.
B | Thermistor 2 | These are current input terminals used to operate the Peltier element. A recommended current is 2.0 A so connect a constant current power supply that matches this capacity. If a current in excess of the rated value flows into the Peltier element, this may degrade cooling performance and damage the cooling element. It is therefore advisable to operate the cooling element within the recommended current or less.
C | Peltier element (+) | Power supply input terminal. Input a DC voltage of +11.5 V to +15.5 V to this terminal. Since an input current of 50mA will be needed during the maximum signal output, connect a power supply that matches this capacity.
D | Peltier element (-) | Adjust the control voltage to set the output. The control voltage must be under +0.9 V. For -40/50 type, approx. 15 V appears when protection circuit is active.
E | DC +15 V | This is a ground terminal and must be grounded.
**Thermistor**

The H7422/H7422P series uses a Peltier element that reduces thermal noise to provide a higher S/N ratio. A thermistor is also incorporated with the Peltier element to sense the operating temperature. Stable output can be maintained by monitoring the output from the thermistor and controlling the Peltier element, even when the ambient temperature fluctuates. Use the thermistor within the maximum allowable power, which is 3.5 mW. When using temperature controller, set the cooling temperature while taking into account the cooling capacity and ambient temperature conditions. In particular, use caution so that a current larger than the rated value will not flow into the Peltier element. The resistance vs. temperature characteristics for the thermistor are shown in the graph below.

**Thermistor Type: 402ET (SEMITEC)**

<table>
<thead>
<tr>
<th>Resistance</th>
<th>4 kOhm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance</td>
<td>±3 %</td>
</tr>
<tr>
<td>Maximum allowable power</td>
<td>3.5 mW</td>
</tr>
</tbody>
</table>

**Peltier element**

As mentioned, the Peltier element reduces thermal noise and thereby provides a better S/N ratio.

A recommended current of 2 A is required to operate this Peltier element, so connect a constant current power supply that matches this capacity. If current in excess of the rated value flows into the Peltier element, this may degrade cooling performance and damage the Peltier element. It is therefore advisable to operate the Peltier element within the recommended current.
Precautions when handing the Peltier element

Do not allow a current higher than the recommended value to flow through the Peltier element.

Recommended current: 2.0 A, Maximum rated current: 2.2 A

Use sufficient caution when handling the H7422/H7422P series. Drop impacts or shocks may cause damage or adverse effects on the Peltier element.

Do not apply a DC voltage higher than 50 V to the Peltier element, for any purpose including isolation tests, etc.

Use a power supply with ripple less than 10 %.

If you perform both cooling and heating by switching the current flow, switch off the power and wait at least 30 s and then switch on the power to allow a reverse current flow, in order to prevent a sudden change in temperature.

**Cooling capacity vs. supply current**  **Voltage vs. current characteristics**
Connecting the C8137–02 power supply unit

When the H7422/H7422P series photo sensor module is used with an A7423 heatsink with fan, four power inputs are required to operate the H7422/H7422P photo sensor module, Peltier element and the A7423 heatsink with fan. The C8137–02 power supply unit provides module, peltier element and fan power inputs with commercial AC input. The C8137–02 is designed to control the Peltier element current to maintain stable output and noise level in the H7422/H7422P series, even when the ambient temperature fluctuates.

Connection example using the C8137–02

If you don't use the C8137–02, contact your Hamamatsu sales office.
C8137-02 Power Supply Unit (sold separately)

### Dimensions

- **Top View**
  - Module Cable
  - Fan Cable
  - AC Power Cable
  - FAN Connector
  - MODULE Connector
  - AC Connector
  - Fuse Box
- **Side View**
  - Module Cable
  - Main Power Switch
  - Display Meter
  - Control Voltage Adjustment Dial

### Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rated Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power voltage</td>
<td>100 to 240</td>
<td>V ac</td>
</tr>
<tr>
<td>Input power frequency</td>
<td>50 / 60</td>
<td>Hz</td>
</tr>
<tr>
<td>Maximum power consumption</td>
<td>30</td>
<td>VA</td>
</tr>
<tr>
<td>Main unit output voltage</td>
<td>+13.5 to 16.5</td>
<td>V</td>
</tr>
<tr>
<td>Maximum control voltage</td>
<td>0.9</td>
<td>V</td>
</tr>
<tr>
<td>Maximum output current for Peltier element</td>
<td>2.2</td>
<td>A</td>
</tr>
<tr>
<td>Output voltage for cooling fan</td>
<td>10.2 to 13.2</td>
<td>V</td>
</tr>
<tr>
<td>Cooling temperature setting</td>
<td>0</td>
<td>°C</td>
</tr>
<tr>
<td>(preset at factory prior to shipping)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>0 to +40</td>
<td>°C</td>
</tr>
<tr>
<td>Ambient operating humidity</td>
<td>30 to 80</td>
<td>% Rh</td>
</tr>
<tr>
<td>Maximum operating altitude</td>
<td>2000</td>
<td>m</td>
</tr>
<tr>
<td>Performance-guaranteed temperature</td>
<td>+5 to +35</td>
<td>°C</td>
</tr>
<tr>
<td>Performance-guaranteed humidity</td>
<td>30 to 80</td>
<td>% Rh</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>20 to +50</td>
<td>°C</td>
</tr>
<tr>
<td>Storage humidity</td>
<td>10 to 85</td>
<td>% Rh</td>
</tr>
<tr>
<td>Maximum Ripple Noise</td>
<td>Main unit 100</td>
<td>mV p-p</td>
</tr>
<tr>
<td>(at maximum load)</td>
<td>Peltier element 30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooling fan 100</td>
<td></td>
</tr>
<tr>
<td>Protective circuit</td>
<td>Excess current protection</td>
<td>–</td>
</tr>
<tr>
<td>Overvoltage category (per: IEC1010–1)</td>
<td>II</td>
<td>–</td>
</tr>
<tr>
<td>Pollution degree (per: IEC1010–1)</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td>Dimensions (excluding projecting parts)</td>
<td>160(W) × 212(D) × 46(H)</td>
<td>mm</td>
</tr>
<tr>
<td>Weight (excluding cables)</td>
<td>Approx. 1.1</td>
<td>kg</td>
</tr>
</tbody>
</table>

* No condensation
3. How to Use the H7422/H7422P Series

3.1 Checking the connections

Before turning the power on, check the following points.

Connection of optical systems:
Check the connections of the optical systems. If the connections are incomplete and light leaks, accurate measurement can not be performed and this may even cause damage to equipment.

Grounding:
Check that the power supplies and monitors(ammeter/counter) are properly grounded.

3.2 Using with the C8137–02

3.2.1 Turning the power on or off

To turn the power on:
1. Check that the upper window of the control voltage adjustment dial reads "0". If not at "0", turn the dial counterclockwise to return it to "0".
2. Turn on the POWER switch of the C8137–02. The POWER switch LED lights up and power is supplied to the Peltier element in the H7422 series and to the cooling fan.
3. Wait about 3 minutes until the unit sets to standby.
4. Turn on the PHOTORECORDER power switch on the C8137–02. The switch LED lights up and the switch is in the down position.
5. While viewing the CONTROL VOLTAGE display meter, turn the CONTROL VOLTAGE adjustment dial clockwise to adjust the sensitivity of the H7422 series.

To turn the power off:
1. Turn the control voltage adjustment dial counterclockwise to return it to "0".
2. Turn off the PHOTORECORDER switch of the C8137–02. The switch LED also turns off and the switch is now in the up position.
3. Turn off the POWER switch of the C8137–02. The POWER switch LED also turns off.
3.2.2 Operation of protection circuit (−40/50 only)

Condition of operating protection circuit
When excessive light entered to the H7422/H7422P−40/50 and output current exceeded threshold, protection circuit operates and stops supplying high voltage to the photomultiplier tube. When protection circuit is operating, all LED segments of control voltage display meter are blinking.

Returning from protection
Turning the power off to reset protection circuit. After waiting a few seconds, turning the power on. (See 3.2.1 “Turning the power on or off”)

3.3 Using without the C8137–02

Contact your Hamamatsu sales office.

CAUTION:
• Always implement heat dissipation by attaching a heatsink to the H7422/H7422P module.
• Do not supply current to the Peltier element without operating the heatsink on the H7422/H7422P module.
• Threshold current of protection circuit of the H7422/H7422P−40/50 varies by change of ambient temperature or control voltage value.
Sample Measurement

Noise reduction
Noise (thermal noise) will usually decrease about 5 min after Peltier element operation has started. If noise does not decrease, there is a problem so check the connections.

Maximum signal output
The H7422/H7422P–40/50 is capable of handling a signal output up to 2 μA. The H7422–01/02/04/20 is capable of handling a signal output up to 100 μA. If the input light level is high and the signal output exceeds this maximum current, then adjust the diaphragm aperture or use a neutral density filter to reduce the input light level so that the signal output is within the maximum current.

CAUTION: However the H7422/H7422P–40/50 has protection circuit, its threshold signal output is above 2 μA. Keep signal output under 2 μA.

Ambient temperature: 25 °C
Peltier element input current: 2.0 A
A7423 heatsink with fan is used.
4. Precaution

4.1 Be sure to observe this precaution:

When this product is not to be used for long periods of time, place a plastic cover over it and store in a place with low humidity not exposed to light. Bright light, if allowed to fall on the photocathode of the photomultiplier tube, may cause photocathode deterioration and increased noise. This may occur even if the power to the H7422/H7422P series is off.

4.2 Handling

Use sufficient caution to keep the input window clean. If dust or dirt gets on the window, use a soft cloth moistened with ethyl alcohol and gently wipe it off. Avoid using organic solvents other than ethyl alcohol.
# 4.3 Troubleshooting

If you encounter trouble when using the H7422/H7422P series, please check the following points.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>What's probably wrong</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>No output appears</td>
<td>Power supply connection has problem.</td>
<td>Check electrical connections. (p.17, 23)</td>
</tr>
<tr>
<td></td>
<td>- Connector is loose or disconnected.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Misconnection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- No adjust the control voltage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optical systems connection has problem.</td>
<td>Check optical systems connections. (p.13, 29, 32)</td>
</tr>
<tr>
<td></td>
<td>- Light is not focused on the photocathode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Wavelength of input light is not correct.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protection circuit is active.</td>
<td>Remove a cause and turn power off to reset protection circuit. (p.24)</td>
</tr>
<tr>
<td></td>
<td>- Excessive light entered while power to the H7422/H7422P module was supplied.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Photomultiplier tube is defective.</td>
<td>Contact us for repair. (p.13, 23)</td>
</tr>
<tr>
<td></td>
<td>- Excessive light entered while power to the H7422/H7422P module was supplied.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Left on at high temperatures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power Supply Circuit is defective.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Excessive voltage was applied to H7422/H7422P.</td>
<td></td>
</tr>
<tr>
<td>Large output fluctuation</td>
<td>Light leaks</td>
<td>Check optical systems connections. (p.13)</td>
</tr>
<tr>
<td></td>
<td>- Light leaks are occurring in optical systems.</td>
<td></td>
</tr>
<tr>
<td>Dark noise does not decrease</td>
<td>Ambient temperature fluctuation</td>
<td>Keep ambient temperature at a constant level. (p.10, 19)</td>
</tr>
<tr>
<td></td>
<td>- Output signal may vary if ambient temperature fluctuates.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply voltage variation</td>
<td>Check power supply output. (p.29)</td>
</tr>
<tr>
<td></td>
<td>- Output signal may vary if supply voltage is unstable.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Misconnection of Peltier element</td>
<td>Check connections. (p.17)</td>
</tr>
<tr>
<td></td>
<td>- Peltier element was operated with wrong connection.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Light leaks</td>
<td>Check optical systems connections. (p.13)</td>
</tr>
<tr>
<td></td>
<td>- Light leaks are occurring in optical systems.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peltier element is defective.</td>
<td>Contact us for repair. (p.17)</td>
</tr>
<tr>
<td></td>
<td>- Peltier element was damaged by wrong connection or excessive current input.</td>
<td></td>
</tr>
</tbody>
</table>

If the problem is not corrected even after you check the above items, contact us with the specific symptom and detailed description of the trouble, as well as the production serial number.

(See page 34 for our sales office address.)

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**CAUTION:** Pay strict attention to packing in order to prevent damage from occurring during shipment. (Use the packing box in which this product was shipped to you or pack ample amounts of cushioning material in a slightly oversized box.)
4.4 Warranty

This product is warranted for a period of one year from the date of delivery. If any failure is found in the workmanship or materials within this warranty period, Hamamatsu will repair or replace the defective parts without charge. The warranty shall not apply to failure in the following cases.

(1) Failure or trouble was caused by misoperation, mishandling, or not following the instructions and precautions described in this manual.
(2) The product has been modified electrically or mechanically by the customer.
(3) Failure was caused by accidents such as natural or man-made disasters.
(4) Warranty period has expired for components with a specified operating life (e.g. photomultiplier tube).

The warranty is limited to repair or replacement.

4.5 Aftersales service

If a failure has occurred after extended periods of operation, which was caused by breakage or wear of replaceable parts, ship the product back to us for repair, replacement and adjustment. (This cost will be charged to you.)
# 5. Specifications

## •H7422/H7422P Series Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>-40/50</th>
<th>-01/02/04/20</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main unit input voltage</td>
<td>+18</td>
<td>V dc</td>
<td></td>
</tr>
<tr>
<td>Peltier element input current</td>
<td>2.2</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Peltier element input voltage</td>
<td>2.6</td>
<td>V dc</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>5 to +35</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20 to +50</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Operating altitude</td>
<td>2000</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>Output Current</td>
<td>2</td>
<td>100</td>
<td>µA</td>
</tr>
<tr>
<td>Control Voltage (V_{control})</td>
<td>+0.9 (Input impedance for V_{control} is 100 kΩ)</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

## •H7422/H7422P Series General Specifications

<table>
<thead>
<tr>
<th>Parameter (Ta = 25 °C)</th>
<th>-40</th>
<th>-50</th>
<th>-01</th>
<th>-02</th>
<th>-04</th>
<th>-20</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral response</td>
<td>300</td>
<td>380</td>
<td>300</td>
<td>300</td>
<td>185</td>
<td>300</td>
<td>nm</td>
</tr>
<tr>
<td>High voltage power supply and Voltage</td>
<td>-720</td>
<td>-890</td>
<td>-860</td>
<td>-880</td>
<td>-850</td>
<td>-890</td>
<td>V dc</td>
</tr>
<tr>
<td>Regulator Supply voltage range</td>
<td>+11.5</td>
<td>to +15.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High voltage power supply and Voltage</td>
<td>62</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Regulator Supply Current Requirement (Maximum)</td>
<td>1:50</td>
<td>1:10^4</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Supply Adjustable Range (Relative Sensitivity)</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s</td>
</tr>
<tr>
<td>Protection circuit operation anode average</td>
<td>5</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mm</td>
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<tr>
<td>output current</td>
<td>Approx. 6</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>Effective Area (dia.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>per: IEC1010-1</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>per: IEC1016-1</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 400</td>
<td>g</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1) Stabilized time in the control voltage adjustment from +1.0 V to +0.5 V.
*2) At control voltage +0.8.

## •H7422/H7422P Series Characteristics

<table>
<thead>
<tr>
<th>Parameter (Ta = 25 °C)</th>
<th>-40</th>
<th>-50</th>
<th>-01/-04</th>
<th>-02</th>
<th>-20</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H7422</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant Sensitivity</td>
<td>at 420 nm</td>
<td>5.4</td>
<td>0.8</td>
<td>2.9</td>
<td>2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Dark Current (A)(B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td>0.4</td>
<td>0.5</td>
<td>0.03</td>
<td>0.08</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>1.0</td>
<td>1.3</td>
<td>0.08</td>
<td>0.2</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td><strong>H7422P</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant Sensitivity</td>
<td>at 420 nm</td>
<td>10.8</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dark count (C)(B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical</td>
<td>17.6</td>
<td>5.0</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maximum</td>
<td>100</td>
<td>125</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Induced Ripple in Signal (Measured across 1 MOhm / 22 pF load)</td>
<td>0.6</td>
<td>Maximum</td>
<td>mV p-p</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode Pulse Rise Time (C)(D)</td>
<td>1.0</td>
<td>0.78</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended Control Voltage Range</td>
<td>+0.50 to +0.80</td>
<td>+0.25 to +0.80</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(A) Control Voltage +0.8 V; Temp setting 0 °C; A7423 heatsink with fan is used.
*(B) After 30 min storage in darkness.
*(C) Control Voltage:Plateau Voltage; Temp setting 0 °C; A7423 heatsink with fan is used.
## Cooling Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>H7422/H7422P</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling method</td>
<td>Thermoelectric cooling</td>
<td>-</td>
</tr>
<tr>
<td>Cooling temperature (ΔT)</td>
<td>25</td>
<td>°C</td>
</tr>
<tr>
<td>Cooling time</td>
<td>Approx. 5</td>
<td>min</td>
</tr>
<tr>
<td>Peltier element input current</td>
<td>2.0</td>
<td>A</td>
</tr>
</tbody>
</table>

Peltier element input current: 2.0 A; A7423 heatsink with fan is used.
• Typical Spectral Photocathode Radiant Sensitivity
(H7422/H7422P Series)

Control Voltage +0.8 V Peltier element input current: 2.0 A; A7423 heatsink with fan is used.

• Typical Gain Characteristics
(H7422/H7422P Series)

Control Voltage input current: 2.0 A; A7423 heatsink with fan is used.