

**C5985 Series
Plug-in Modules
User's Guide**

HAMAMATSU

55470-094-003

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Chapter 1

Before Using the C5985 Plug-in

This chapter explains how to install the C5985 plug-in and provides basic information which will be necessary to use the C5985 plug-in.

Installing the Plug-in

This section explains how to install the C5985 plug-in.

Before you begin using the C5985 plug-in, first **make a backup copy of the plug-in disk** and keep the original stored in a safe place.

1. Turn the power on your Macintosh.
2. Insert a copy of original disk into a floppy disk drive.
3. Find a folder on the floppy disk called "**C5985 Photoshop plug-in**", or "**C5985 IPLab extension**" and open the folder.
4. **For IPLab (Extension)**



C5985-IPLab

Drag the "C5985-IPLab" Plug-in icon and "C5985.init" file icon into a folder which is placed the IPLab Spectrum application icon.

For Photoshop



C5985-Photo

Drag the "C5985-Photo" Plug-in icon and "C5985.init" file icon into the Photoshop plug-in folder.

5. Drag the floppy disk to the "Trash" to eject it.

Installed plug-in is loaded when application software starts. If application software is running when you install the plug-in, you must quit and restart the program.

This concludes the process of installing the software.

Execute the Plug-in

IPLab Spectrum : Choose the "C5985-IPLab" from the Ext. menu.

Photoshop : Choose the "C5985-Photo" from the Input Plug submenu in the File menu.

C5985Control

By choosing the "C5985-IPLab" or the "C5985-Photo", the "Control Dialog" appears. The "Control Dialog" is used to control the C5985 and to acquire images into your Macintosh. All functions are similar as those executed via front panel of C5985. (Refer to the "C5985 Series Instruction Manual" for more information.)

C5985 Control

Current Condition: Live

Auto Transfer

Exposure Time/Gain

Auto Time 0.03sec Gain 1

Back Ground Subtraction

Status ROM Version

Intensity 1.47

Focus Mode On/Off

Image Show a Preview

Live

Displays the current image on your monitor.

Freeze

Freezes the image in the image memory and displays it on your monitor.

Status Intensity

Chooses a status intensity from pull down menu.

Focus Mode ON/OFF

When the checkbox is checked, Focus Mode is active.

Show a Preview

When the checkbox is checked, you can preview how an image will acquire.

ROM Version

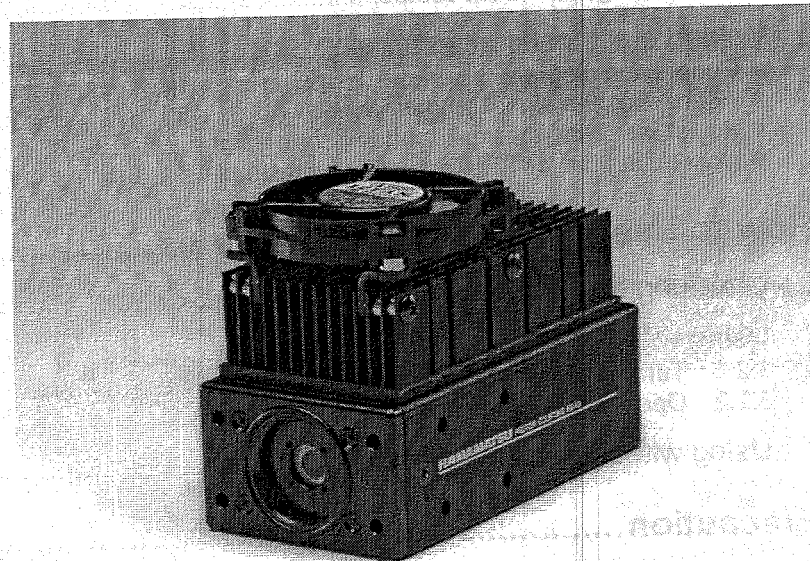
Displays the version of the ROM in the C5985.

The Watch of Processor State

The C5985 plug-in always watches the state on the C5985 during the control dialog is opened. As the state (Current condition, Exposure time, Gain, etc...) is changed on the C5985, the state is displayed in the control dialog.

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.

HAMAMATSU

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

Follow the authorized disposal methods if discarding this product.



Must DO

The photomultiplier tube photocathode used in the H7422/H7422P-40/-50 contains a small amount of arsenic (As). Arsenic is harmful to human body and therefore must be disposed of in an authorized facility. If such a facility is not located near you, please ship it back to our sales office for proper disposal.

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.

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

(H7422-01/02/20: 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 890nm.

The H7422-01/02/20 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.

H7422-01/02/20 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 ...**

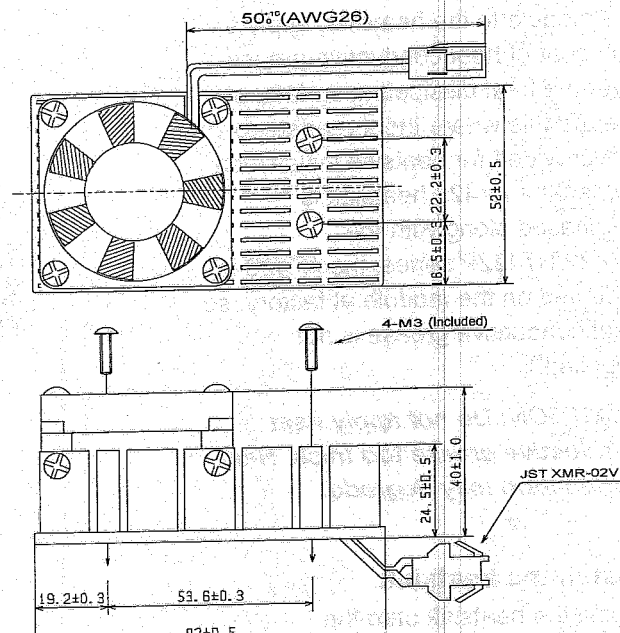
a heat exchange element that serves as a heat pump when a DC current flows through it. Heat is absorbed at the one side and dissipated at the other side so that temperature control can be performed.

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)



■Configuration

Part Name	Q'ty
Heatsink	1
Fan	1
Heatsink mounting screws (M3 L=5)	4
Fan mounting screws (M3 L=12)	4
Spacer	4
* Heat conductive grease	1
Instruction manual	1

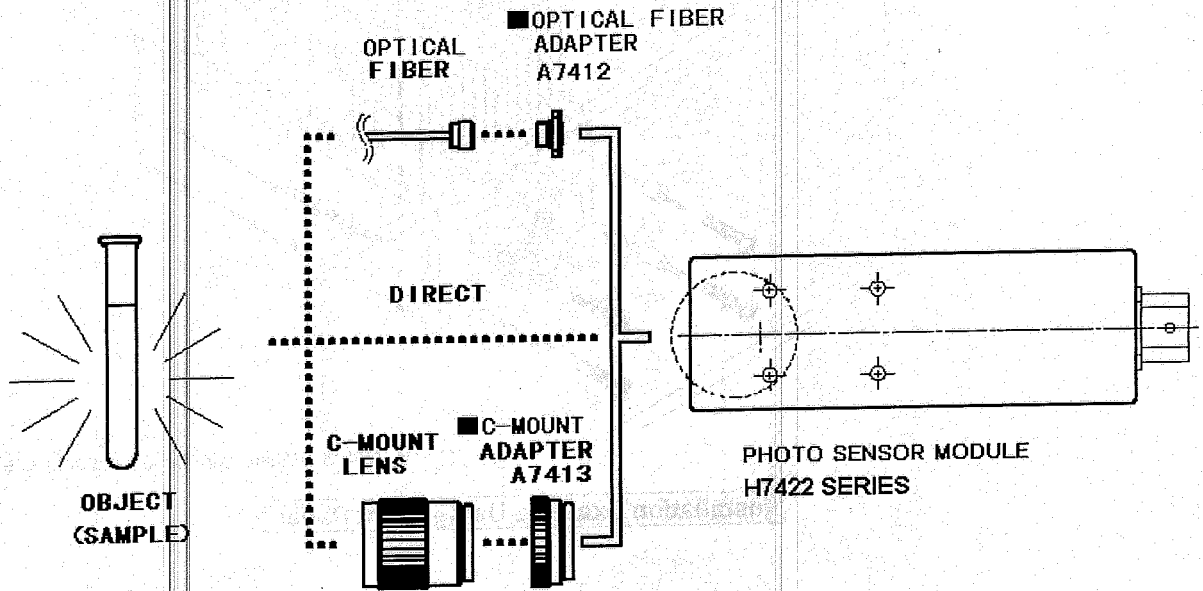
* When the A7423 heatsink is purchased along with the H7422/H7422P series photo sensor module, the A7423 is mounted on the module at the factory, so heat conductive grease is not supplied.

■Specifications

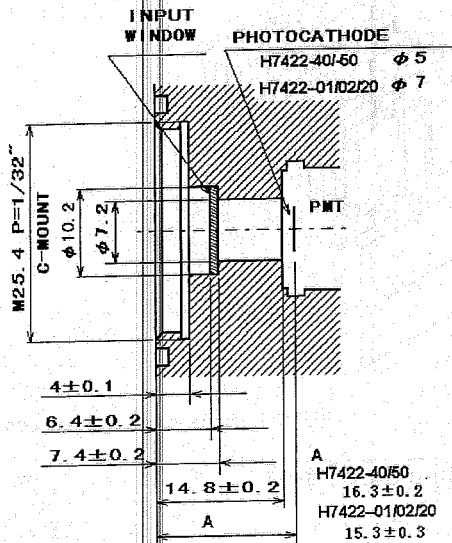
Parameter	Value	Unit
Input voltage	12	V dc
Input current	During operation	0.09
	Maximum	0.14
Input voltage range	10.2 to 13.8	V dc
Weight	Approx. 110	g

2.2 Connecting the optical systems

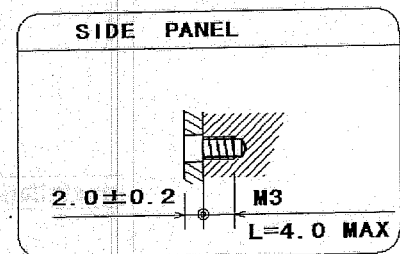
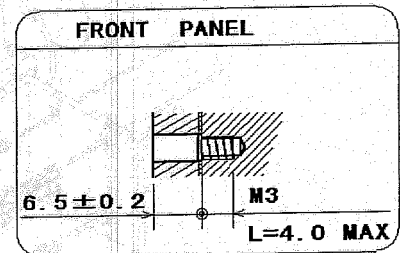
The front panel of the H7422/H7422P series was designed for efficient connection to an O-ring, optical fiber and C-mount components. When connecting such a component, make sure that no light leaks through the fastening points. The structure of the H7422/H7422P series photo sensor module is illustrated 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

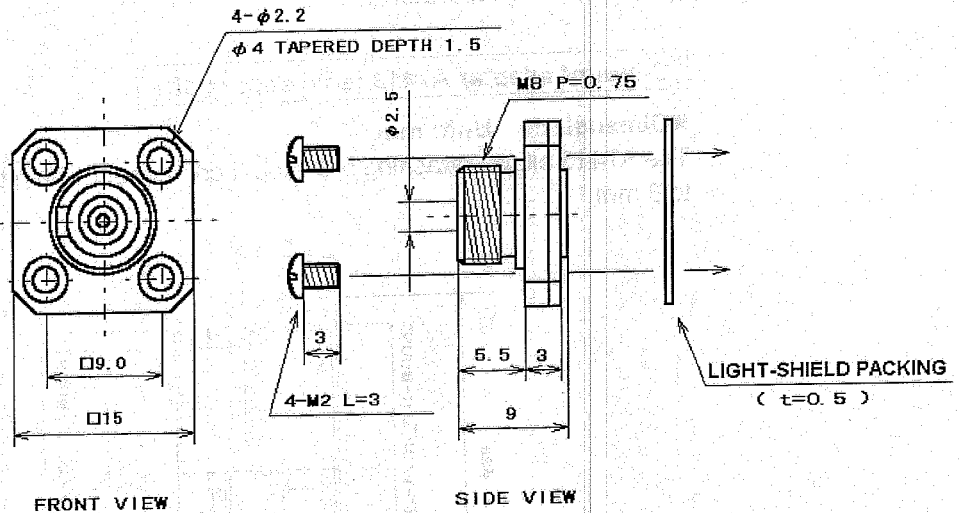
● When using an optical fiber

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)

■ Dimensions

Unit: mm

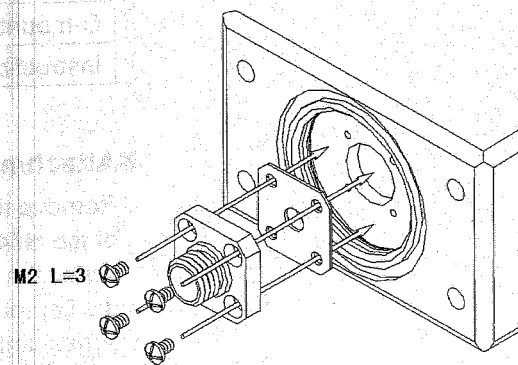


■ Configuration

Part Name	Q'ty
Optical fiber adapter (FC type)	1
Mounting screws (M2, L=3)	4
Light-shield packing	1
Instruction manual	1

■ 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.



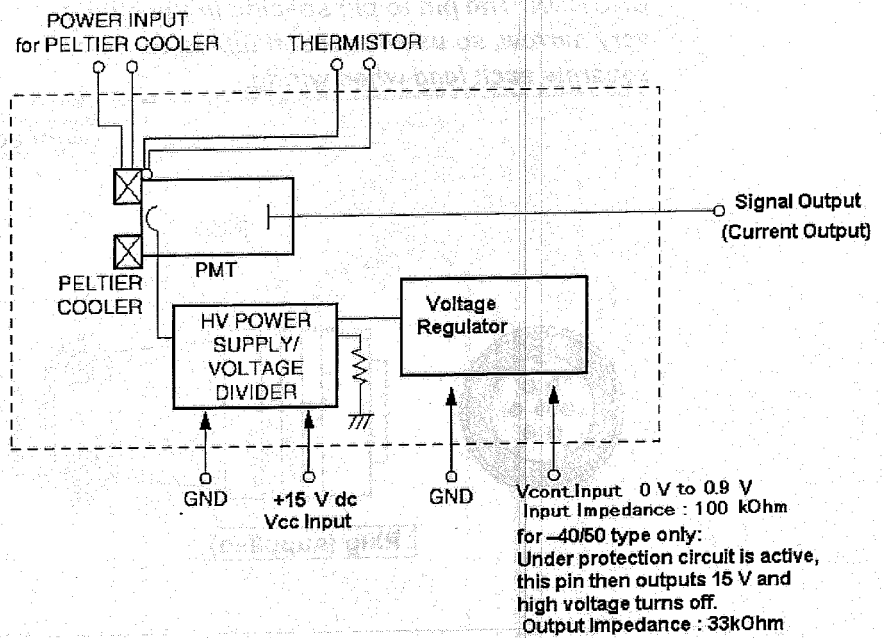
CAUTION: Always use the specified screws. Using other than the specified screw may damage the module or may cause a poor installation.

Installing the A7412

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.

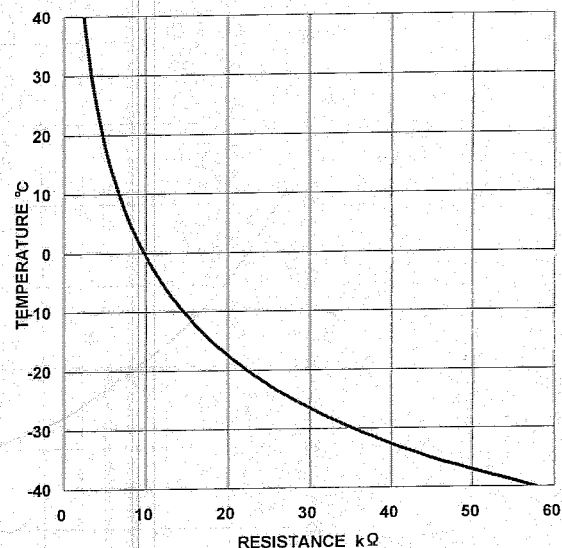
Thermistor

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)

at 25 °C

Resistance	4 kOhm
Tolerance	±3 %
Maximum allowable power	3.5 mW



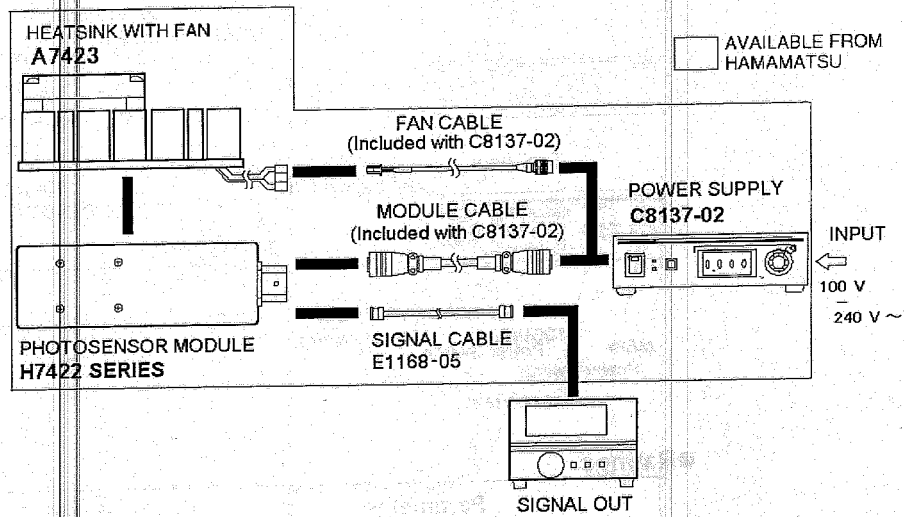
Peltier element

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.

● 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.

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 PHOTOSENSOR 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 PHOTOSENSOR 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.

Sample Measurement

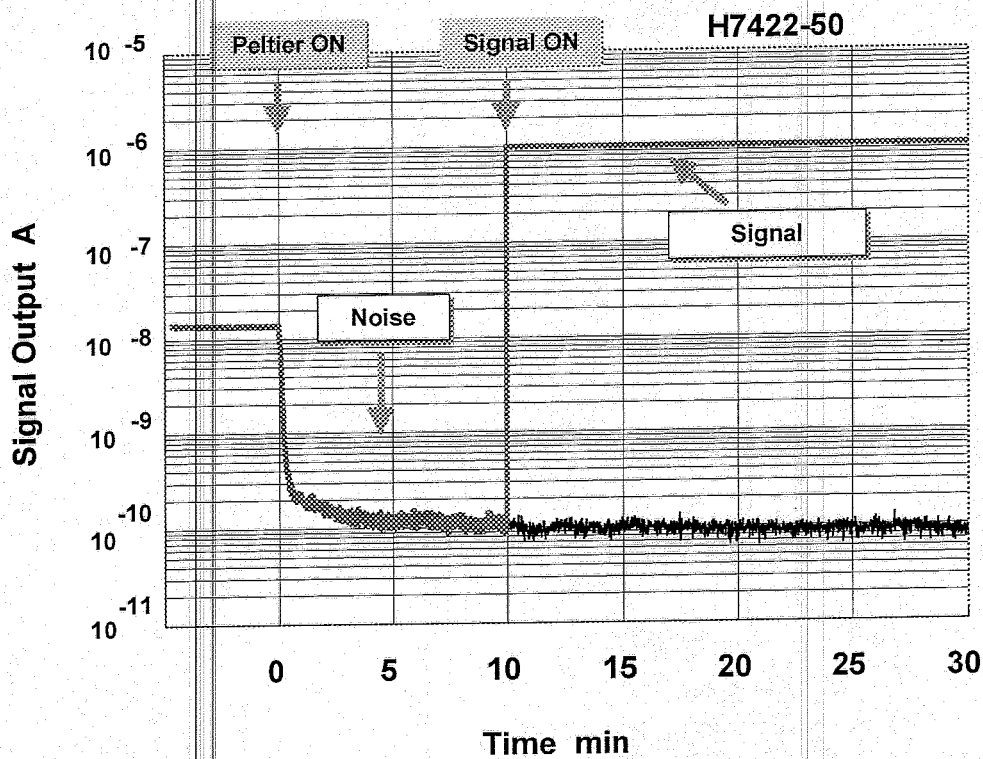
Noise reduction

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 $2\ \mu\text{A}$. The H7422-01/02/20 is capable of handling a signal output up to $100\ \mu\text{A}$. 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 $2\ \mu\text{A}$. Keep signal output under $2\ \mu\text{A}$.



Ambient temperature: $25\ ^\circ\text{C}$
Peltier element input current: $2.0\ \text{A}$
A7423 heatsink with fan is used.

4.3 Troubleshooting

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

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

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.)

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.)

5. Specifications

●H7422/H7422P Series Maximum Ratings

Parameter	-40/50	-01/02/20	Unit
Main unit input voltage	+18		V dc
Peltier element input current	2.2		A
Peltier element input voltage	2.6		V dc
Operating temperature	+5 to +35		°C
Storage temperature	-20 to +50		°C
Operating altitude	2000		m
Output Current	2	100	μA
Control Voltage (Vcontrol)	+0.9(Input impedance for Vcont. is 100 kΩ)		V

●H7422/H7422P Series General Specifications

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

*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

Parameter		(Ta = 25 °C)					Unit	
		-40	-50	-01	-02	-20		
H7422	Radiant Sensitivity	at 420 nm	5.4	0.8	2.8	2.0	2.0	Typ. ×10 ⁴ A/W
		at 550 nm	8.8	2.5	1.8	2.8	3.6	
		at 800 nm	-	4.5	0.06	0.32	2.3	
H7422	Dark Current ^{(A) (B)}	Typical	0.4	0.5	0.03	0.08	0.1	nA
		Maximum	1.0	1.3	0.08	0.2	0.25	
H7422P	Radiant Sensitivity	at 420 nm	10.8	1.5	-	-	-	Typ. ×10 ⁴ A/W
		at 550 nm	17.6	5.0	-	-	-	
		at 800 nm	-	9.0	-	-	-	
H7422P	Dark count ^{(C) (B)}	Typical	100	125	-	-	-	s ⁻¹
		Maximum	300	375	-	-	-	
Induced Ripple in Signal (Measured across 1 MOhm / 22 pF load)		0.6					Maximum mV p-p	
Anode Pulse Rise Time ^(A)		1.0		0.78		ns		
Recommended Control Voltage Range Vcontrol		+0.50 to +0.80		+0.25 to +0.80		V		

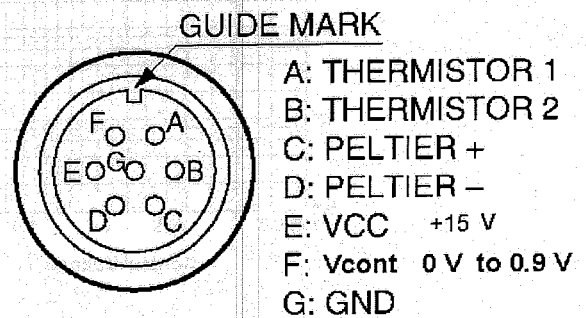
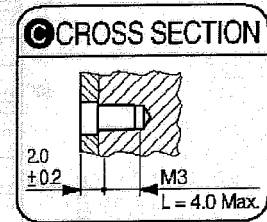
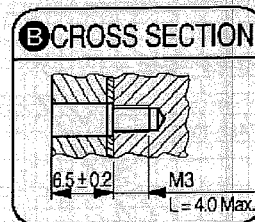
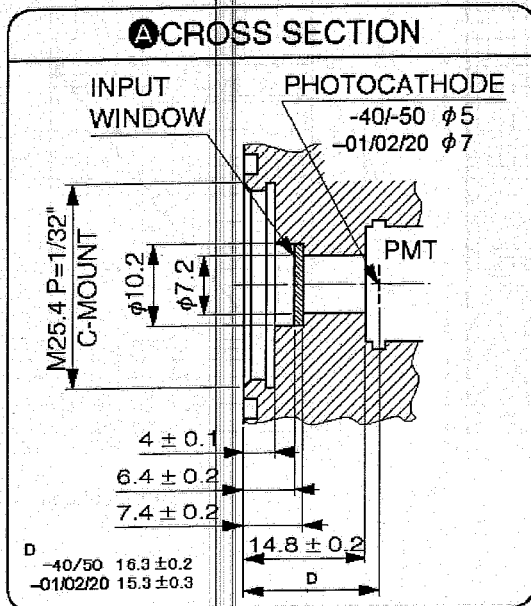
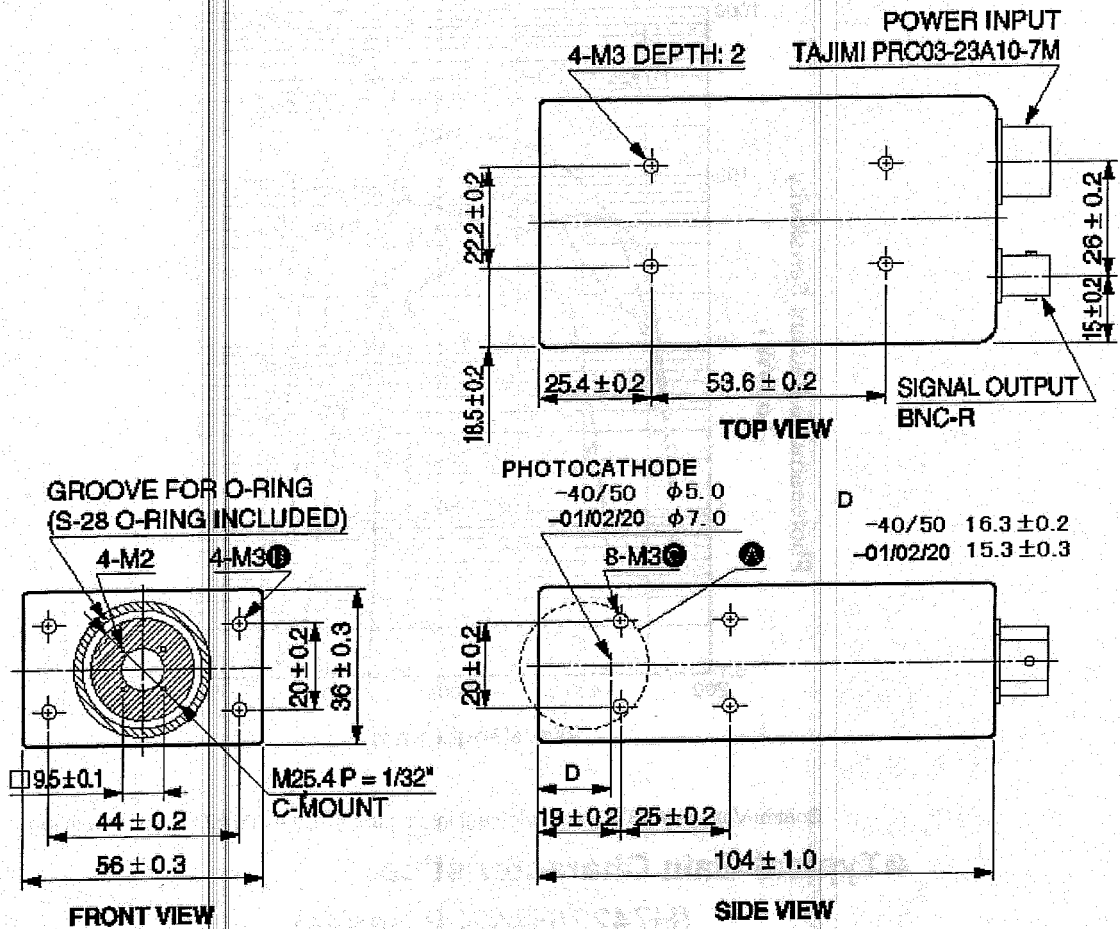
(A) Control Voltage +0.8 V ; Temp setting 0 °C; A7423 heatsink with fan is used.

(B) After 30 min storage in darkness.

(C) Control Voltage:Plateau Voltage ; Temp setting 0 °C; A7423 heatsink with fan is used.

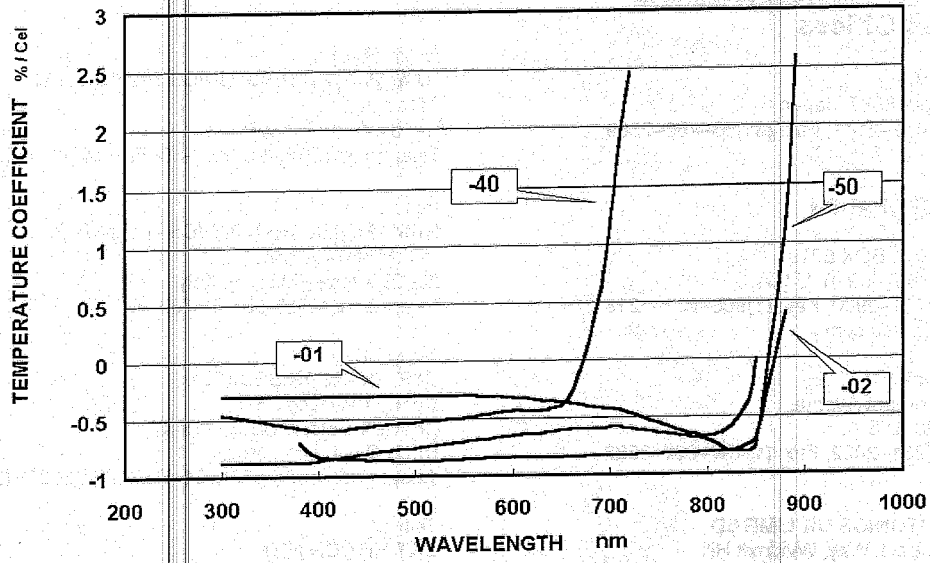
●Dimensions

Unit : mm



TAJIMI PRC03-23A10-7M

● Temperature Coefficient



Aug.2002

First edition