

# SEIKO

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## PHOTO BEAM UNIT

## PBU-2000

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# OPERATING MANUAL

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Thank you for purchasing SEIKO Photo Beam Unit PBU-2000.  
Before using your SEIKO Photo Beam Unit, please read this manual  
carefully for its proper use and care.  
Keep this manual handy for ready reference.





SEIKO TIME SYSTEMS INC.

## CAUTION

- (1) This manual may not be copied or reproduced in any form, in whole or in part, without the express written consent of SEIKO.
- (2) This manual may be subject to change without prior notice.
- (3) This manual has been prepared carefully to provide you with complete information for the operation of this product. For the purpose of constant improvement in this manual, your suggestions and comments on the descriptions included herein are highly appreciated.
- (4) SEIKO shall not be liable for any failure of this product or direct or indirect damages resulting from such failure if such failure is caused due to abuse or misuse of the product, failure to observe instructions herein or neglect of other reasonable care, or servicing, changes, modifications or alterations performed by other than SEIKO or a servicing contractor authorized by SEIKO.

## SAFETY ALERT SYMBOLS

The following symbols and terms used in this manual have the meaning as explained below. They are intended to attract special attention of the users to the descriptions attached with them so that they can use the product properly to prevent personal injuries and property damages. Before reading this manual, be sure to understand what they mean.









 <b>WARNING</b>	This pictorial symbol with <b>WARNING</b> is used to indicate a potentially hazardous situation which is likely to cause death or severe personal injury if the instructions attached with them are not followed correctly.
 <b>CAUTION</b>	This pictorial symbol with <b>CAUTION</b> is used to indicate a potentially hazardous situation which is likely to cause personal injury or property damage if the instructions under attached with them are not followed correctly.
	This pictorial symbol indicates what must <b>NOT</b> be done.
	This pictorial symbol indicates what must be done.











## — TABLE OF CONTENTS —

1	SAFETY PRECAUTIONS .....	1
2	INTRODUCTION .....	4
2.1	Overview.....	4
2.2	System Configuration .....	4
3	NAMES AND FUNCTIONS OF PARTS.....	5
3.1	Photo Beam Transmitter PBU-2000TX.....	5
3.2	Photo Beam Receiver PBU-2000RX.....	7
4	PHOTO BEAM RECEIVER SETTING .....	10
4.1	Contact Signal Output Time.....	10
4.2	Masking Time.....	10
4.3	Status Data Output Interval.....	11
4.4	Status Data Output Baud Rate.....	11
5	INFORMATION ON LED DISPLAY.....	12
5.1	Initial Display .....	12
5.2	Display during Operation.....	12
6	STATUS DATA OUTPUT .....	13
6.1	Communication Specifications.....	13
6.2	Data Format .....	13
7	SPECIFICATIONS .....	14
7.1	Photo Beam Transmitter PBU-2000TX.....	14
7.2	Photo Beam Receiver PBU-2000RX.....	15

# 1 SAFETY PRECAUTIONS

The following precautions must be strictly observed for the safety of yourself and your fellow workers and for the protection of property from loss and damages.

 <b>WARNING</b>	<p>If the Product is giving out smoke or burnt smell, or showing other abnormal symptoms, stop using it. Then, checking that no more smoke is given out, call your nearby SEIKO dealer or agent for repair service.</p>	
	<p>Unless you are a qualified electrician, never try to disassemble, repair or modify the Product. Unauthorized disassembly, repair or modification may cause an electric shock or fire.</p>	
	<p>Do not let any foreign matter such as pin and a piece of metal enter into the inside of the Product. In case this has occurred, stop using it. If the Product is used continuously without being reconditioned, an electric shock or fire may result. Call your nearby SEIKO dealer or agent for repair.</p>	
	<p>Never operate the Product with wet hands. An electric shock or malfunction may result.</p>	
	<p>Do not expose the Product to splashes of water. An electric shock, malfunction or fire may result.</p>	
	<p>Do not direct the Product toward the sun. An excessive heat generation, malfunction or fire may result.</p>	
	<p>Do not use or keep the Product at following places, as this may cause an electric shock, malfunction or fire:</p> <ul style="list-style-type: none"><li>• Places under extremely high temperatures (such as those exposed to direct sunlight);</li><li>• Dusty places;</li><li>• Places exposed to frequent vibrations; and</li><li>• Places subject to static electricity.</li></ul>	

 <b>CAUTION</b>	<p>Do not drop the Product, or hit it strongly against hard objects. A malfunction or injury may result.</p> 
	<p>When connecting the Product with any optional or other device, check that the connection is performed properly and securely. A malfunction or failure may result.</p> 
	<p>Install the batteries properly, checking that their (+) and (-) terminals are properly aligned. A malfunction or failure may result.</p> 
	<p>Do not use batteries of different types together. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product.</p> 
	<p>Do not use old and new batteries together. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product.</p> 
	<p>Use only batteries of the same make, type and size. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product.</p> 
	<p>Use the batteries only within their specified operational temperature range. Otherwise, they may not perform as specified, and a malfunction of the Product may result.</p> 
	<p>If you decide not to use the Product for a long time, take out the batteries. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product.</p> 
	<p>To power the photo beam unit with an external battery, be sure to connect it with a battery with a voltage of DC 11 to 14 V. Otherwise, a malfunction, fire or injury may result.</p> 



CAUTION

Do not expose the case of the Product to solvents such as alcohol and gasoline, spray of cosmetics or the like, cleaners, adhesives, or paints. They may discolor, deteriorate or damage the case due to chemical change.



## **2 INTRODUCTION**

### **2.1 Overview**

The SEIKO Photo Beam Unit PBU-2000 detects the passing of a person or an object through the light it projects.

PBU-2000 is composed of a Photo Beam Transmitter PBU-2000TX and a Photo Beam Receiver PBU-2000RX. The Transmitter projects light, and the Receiver receives it. When a person or an object passes between them, the Receiver detects the interception of the light, and outputs a contact signal.

### **2.2 System Configuration**

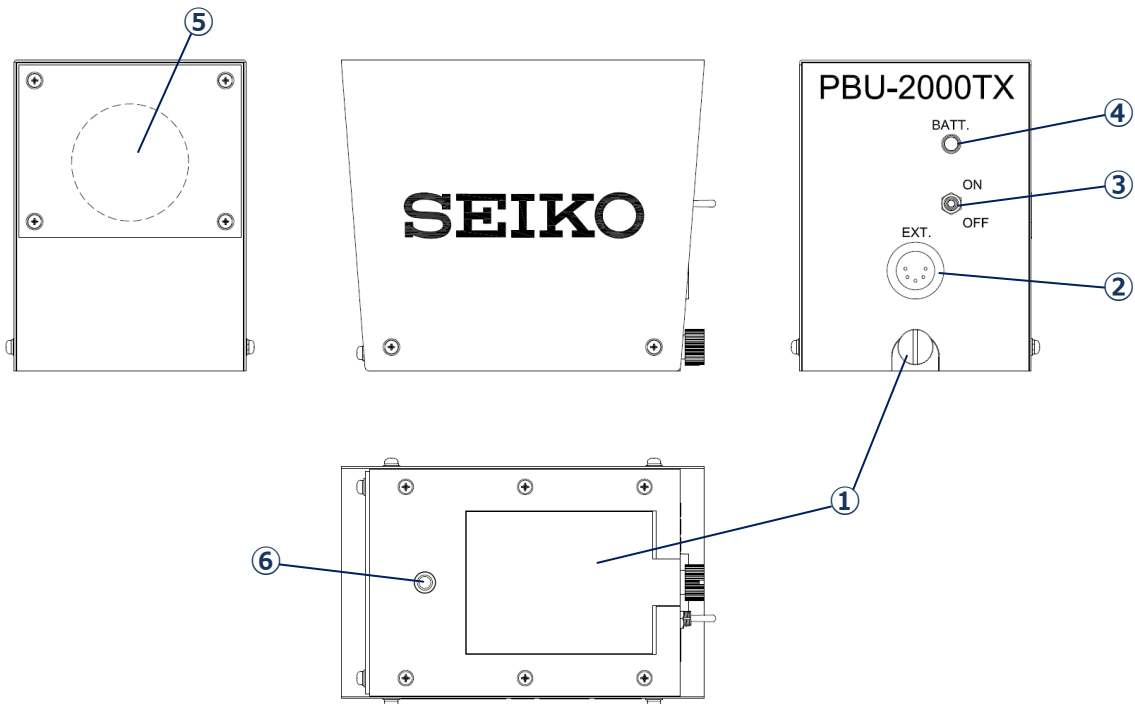
- |                                     |        |
|-------------------------------------|--------|
| ① Photo Beam Transmitter PBU-2000TX | 1 unit |
| ② Photo Beam Receiver PBU-2000RX    | 1 unit |
| ③ Operating Manual (this booklet)   |        |

※ The batteries to be used with PBU-2000 are not included with it, and need to be purchased separately.

Transmitter and Receiver use four batteries each, and a total of eight batteries are required.






### 3 NAMES AND FUNCTIONS OF PARTS

#### 3.1 Photo Beam Transmitter PBU-2000TX





① Battery cover / battery holder

Turn the knurled screw to open the battery cover, and insert four LR6 (AA) alkaline dry batteries or HR06 (AA) Ni-MH rechargeable batteries into the battery holder, checking that their (+) and (-) terminals are properly set.

 <b>CAUTION</b>	Install the batteries properly, checking that their (+) and (-) terminals are properly aligned. A malfunction or failure may result. 
	Do not use batteries of different types together. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product. 
	Do not use old and new batteries together. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product. 
	Use only batteries of the same make, type and size. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product. 





 <b>CAUTION</b>	<p>Use the batteries only within their specified operational temperature range. Otherwise, they may not perform as specified, and a malfunction of the Product may result.</p>	
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② External connection connector

It is a connector for connecting an external battery.

- ※ If an external battery is connected while dry or rechargeable batteries are inserted, PBU-2000TX is powered by the external battery on a priority basis.

 <b>CAUTION</b>	<p>To power the photo beam unit with an external battery, be sure to connect it with a battery with a voltage of DC 11 to 14 V. Otherwise, a malfunction, fire or injury may result.</p>	
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③ Power switch

It is a switch to turn on PBU-2000TX.

④ Power reserve indicator LED

It indicates the status of the power reserve of the alkaline dry batteries or Ni-MH rechargeable batteries.

LED indicator	Power reserve status
Lighted	Sufficient power reserve remains.
Flashing	Power reserve nears its end. Replace the batteries with new ones.
Unlighted	Power reserve has been depleted. Replace the batteries with new ones immediately.

- ※ When an external battery is used, the power reserve indicator LED does not indicate the status of the power reserve accurately.

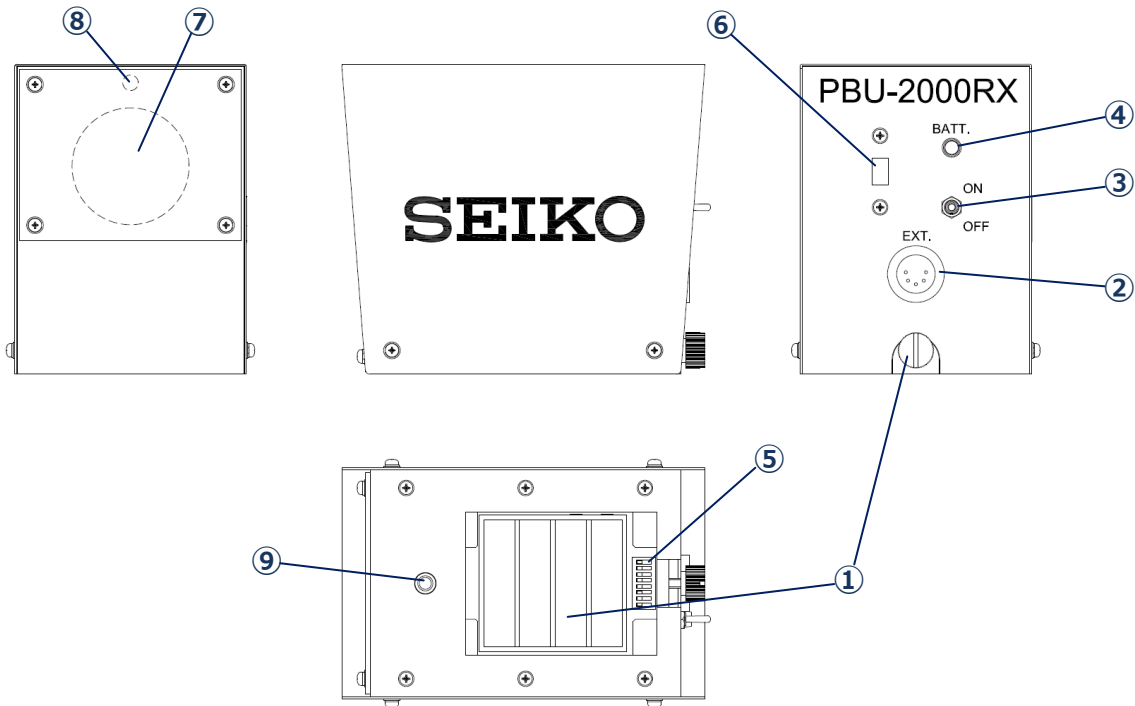
⑤ Light projection surface

It is a surface from which the light is projected. When installing the Transmitter, make sure that this surface is directed toward the Photo Beam Receiver PBU-2000RX.

⑥ Screw hole for fixing PBU-2000TX on a pan head of a tripod






To mount PBU-2000TX on a pan head of a tripod or the like, use this screw hole to fix it.



### 3.2 Photo Beam Receiver PBU-2000RX



#### ① Battery cover / battery holder

Turn the knurled screw to open the battery cover, and insert four LR6 (AA) alkaline dry batteries or HR06 (AA) Ni-MH rechargeable batteries into the battery holder, checking that their (+) and (-) terminals are properly set.



 <b>CAUTION</b>	Install the batteries properly, checking that their (+) and (-) terminals are properly aligned. A malfunction or failure may result. 
	Do not use batteries of different types together. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product. 
	Do not use old and new batteries together. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product. 
	Use only batteries of the same make, type and size. Otherwise, heat generation or electrolyte leakage of the batteries may result and cause damage to the Product. 

 <b>CAUTION</b>	<p>Use the batteries only within their specified operational temperature range. Otherwise, they may not perform as specified, and a malfunction of the Product may result.</p>	
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② External connection connector

It is a connector for battery input, contact signal output and status data output

- ※ If an external battery is connected while dry or rechargeable batteries are inserted, PBU-2000RX is powered by the external battery on a priority basis.

 <b>CAUTION</b>	<p>To power the photo beam unit with an external battery, be sure to connect it with a battery with a voltage of DC 11 to 14 V. Otherwise, a malfunction, fire or injury may result.</p>	
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③ Power switch

It is a switch to turn on PBU-2000RX.

④ Power reserve indicator LED

It indicates the status of the power reserve of the alkaline dry batteries or Ni-MH rechargeable batteries.

LED indicator	Power reserve status
Lighted	Sufficient power reserve remains.
Flashing	Power reserve nears its end. Replace the batteries with new ones.
Unlighted	Power reserve has been depleted. Replace the batteries with new ones immediately.

- ※ When an external battery is used, the power reserve indicator LED does not indicate the status of the power reserve accurately.

⑤ DIP switch

It is a switch for setting contact signal output time, masking time, status data output interval, and status data output baud rate.

- ※ For details, see "4 PHOTO BEAM RECEIVER SETTING" on P. 10

⑥ LED display

It displays various information including light reception level.

- ※ For the details of the displayed information, see "5 INFORMATION ON LED DISPLAY" on P. 12

⑦ Light reception surface

It is a surface to receive the light. When installing the Receiver, make sure that this surface is directed toward the Photo Beam Transmitter PBU-2000TX.

⑧ Light reception monitor LED

It lights up when the light projected from the Transmitter is received on the light reception surface.

⑨ Screw hole for fixing PBU-2000RX on a pan head of a tripod

To mount PBU-2000RX on a pan head of a tripod or the like, use this screw hole to fix it.

## 4 PHOTO BEAM RECEIVER SETTING

Use the DIP switch of the Photo Beam Receiver PBU-2000RX to set contact signal output time, masking time, status data output interval, and status data output baud rate.

- ※ When changing the existing settings, be sure to turn OFF the power. While the power is turned ON, operating the DIP switch will not change the settings.
- ※ Before turning ON the power, be sure to check that the DIP switch is set properly.

### 4.1 Contact Signal Output Time

Set the output time of a contact signal which is output when the Receiver detects the passing of a person or an object.

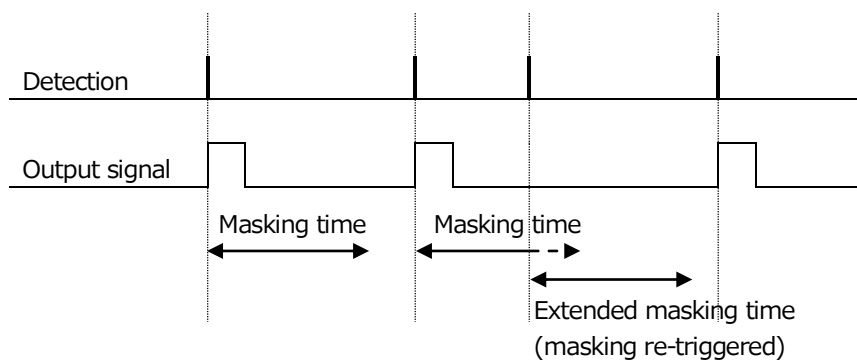
Switch No.		Contact signal output time
1	2	
OFF	OFF	15 milliseconds
ON	OFF	45 milliseconds (default setting)
OFF	ON	45 milliseconds (reserved)
ON	ON	45 milliseconds (reserved)

### 4.2 Masking Time

Set the time period after detection of a passing of a person or an object until the next detection is made effective.

Switch No.		Masking time
3	4	
OFF	OFF	Nil
ON	OFF	0.1 seconds (default setting)
OFF	ON	0.5 seconds
ON	ON	1.0 second

The Receiver uses a "re-trigger system" in which the masking time is extended if a passing of a person or an object is detected during the masking time.



### 4.3 Status Data Output Interval

Set the interval at which the status data (power reserve of the Transmitter and Receiver, light reception level and setting status of DIP switch) is output.

The status data is output in RS-422 format.

Switch No		Status data output interval
5	6	
OFF	OFF	1 second
ON	OFF	10 seconds (default setting)
OFF	ON	60 seconds
ON	ON	60 seconds (reserved)

### 4.4 Status Data Output Baud Rate

Set the baud rate at which the status data is output in RS-422 format.

Switch No		Status data output baud rate
7	8	
OFF	OFF	9.6 kbps (default setting)
ON	OFF	19.2 kbps
OFF	ON	38.4 kbps
ON	ON	38.4 kbps (reserved)

## 5 INFORMATION ON LED DISPLAY

Various information is displayed on the LED display on the rear of the Photo Beam Receiver PBU-2000RX.

### 5.1 Initial Display

When the power is turned on, the firmware version and the setting status of the DIP switch are displayed.

Display item	Setting	Display
Firmware version		F 1.00
Contact signal output time	15 milliseconds	o 15
	45 milliseconds	o 45
Masking time	Nil	n 0
	0.1 seconds	n 0.1
	0.5 seconds	n 0.5
	1.0 second	n 1.0
Status data output interval	1 second	c 1
	10 seconds	c 10
	60 seconds	c 60
Status data output baud rate	9.6 kbps	b 9.6
	19.2 kbps	b 19.2
	38.4 kbps	b 38.4

※ The firmware version display in the above table indicates "Ver. 1.00."

### 5.2 Display during Operation

While the Receiver is in operation, the light reception level and other information is displayed.

Displayed information	Display
Light reception level 5 (maximum level)	5
Light reception level 4	4
Light reception level 3	3
Light reception level 2	2
Light reception level 1	1
Measurement of light reception level is still in process.	o
No light is received.	-
Contact signal output and masking are in process.	≡
Power reserve of the batteries has been depleted.	P (flashing)

※ It is recommended that the Photo Beam Unit PBU-2000 be so installed that the light reception level is " 4" or more.

## 6 STATUS DATA OUTPUT

Power reserve of the Transmitter and Receiver, light reception level and setting status of the DIP switch are output as status data.

### 6.1 Communication Specifications

Item	Details
Interface	RS-422
Synchronization method	Start-stop synchronous communication
Data speed	To be selected from 9.6 kbps, 19.2 kbps and 38.4 kbps
Data bit length	8 bit
Parity	None
Stop bit length	1 bit
Flow control	None

### 6.2 Data Format

No.	Data type	Value	Details
1	Header	0x23	
2		0x53	
3	Number of remaining bytes	0x0A	Number of bytes from product code to CRC
4	Product code	0x01	Code indicating product type PBU-2000
5	Encryption code	0x00	Code indicating encryption method No encryption
6	Command	0x01	Status data output
7	Serial No.	0x**	
8		0x**	
9	Power reserve	0x**	Four higher-order bits and four lower-order bits indicate power reserve of Transmitter and Receiver, respectively. 2 : Sufficient power reserve remains. 1 : Power reserve nears its end. 0 : Power reserve has been depleted (for Transmitter only) F : Power reserve is unknown (for Receiver only)
10	Light reception level	0x**	0x00 : No light is received. 0x01~0x05 : Values indicating light reception level 0x10 : Measurement of light reception level is still in process. 0xF0 : Contact signal output and masking are in process.
11	DIP switch	0x**	The highest-order bit corresponds to No. 8 of DIP switch.
12	CRC	0x**	CRC-16-CCITT(CRC-ITU-T)
13		0x**	Generating polynomial : $X^{16}+X^{12}+X^5+1$

※ When an external battery is used, the power reserve indicator LED do not indicate the status of the power reserve accurately.



## 7 SPECIFICATIONS

### 7.1 Photo Beam Transmitter PBU-2000TX

Photo beam wavelength	670 nm (red)	
Operable distance	Up to 100 m	
Power supply	1. LR6 (AA) alkaline dry batteries or HR06 (AA) Ni-MH rechargeable batteries, 4 pcs 2. External battery (DC 12 V)	
Operable time	72 hours or more (under the temperature of +25° C)	
External connection connector	Connector	NC5MPR-HD (Neutrik)
	Pin assignment	1 : GND 2 : Reserved 3 : Reserved 4 : Reserved 5 : External power input (DC 12 V)
Operational temperature range	During operation	-20 °C ~ +50 °C (non-condensing) ※ +5 °C ~ 45 °C when alkaline dry batteries are used
	During storage	-25 °C ~ +55 °C (non-condensing)
Water resistance	IPX2 (drip-proof type II)	
External appearance	Dimensions	97 (W) × 130 (H) × 152 (D) mm (excluding protrusions)
	Material	Stainless steel
	Treatment	Painting (cover: yellow, body: black)
Weight	Approx. 1.5 kg (excluding batteries)	

## 7.2 Photo Beam Receiver PBU-2000RX

Operable distance		Up to 100 m
Power supply		1. LR6 (AA) alkaline dry batteries or HR06 (AA) Ni-MH rechargeable batteries, 4 pcs 2. External battery (DC 12 V)
Operable time		24 hours or more (under the temperature of +25 °C)
External connection connector	Connector	NC5MPR-HD (Neutrik)
	Pin assignment	1 : GND, contact signal output (-) 2 : Contact signal output (+) 3 : Status data output (-) (RS-422) 4 : Status data output (+) (RS-422) 5 : External power input (DC 12 V)
Contact signal	Method	Make contact, rating: 30 V 500 mA
	Output time	15 milliseconds or 45 milliseconds
Masking time		None, 0.1 seconds, 0.5 seconds or 1 second
Operational temperature range	During operation	-20 °C ~ +50 °C (non-condensing) ※ +5° C ~ 45 °C when alkaline dry batteries are used
	During storage	-25 °C ~ +55 °C (non-condensing)
Water resistance		IPX2 (drip-proof type II)
External appearance	Dimensions	97 (W) × 130 (H) × 152 (D) mm (excluding protrusions)
	Material	Stainless steel
	Treatment	Painting (cover: yellow, body: black)
Weight		Approx. 1.5 kg (excluding batteries)



If you have any question, inquiry or request for repair regarding the Photo Beam Unit PBU-2000, please contact your SEIKO dealer or agent.

**SEIKO TIME SYSTEMS INC.**

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## **GUARANTEE**

Thank you very much for purchasing SEIKO Photo Beam Unit PBU-2000.

We certify that the Product is guaranteed against defects in material and workmanship according to the guarantee conditions specified herein.

If the Product malfunctions under normal use as described in this Operating Manual within one year from the date of purchase, it will be repaired without charge.

To qualify for the services under the guarantee, you must present your SEIKO Photo Beam Unit PBU-2000 to the retailer from whom it was purchased, or a service facility designated by us. Packaging and transportation charges are to be paid by the owner of the Product. Even within the guarantee period, repair services will be provided at cost in the following cases:

- (1) Failure or damage caused by misuse or carelessness;
- (2) Failure or damage caused by improper repair or modification;
- (3) Failure or damage caused by improper handling such as dropping of the Product during transportation after purchase;
- (4) Failure or damage caused by natural disasters such as fire, flood, earthquake and lightning, and other factors beyond the control of us such as smoke and other air pollution and extraordinary atmospheric pressure;
- (5) Scratches, cracks or other damage on the case caused by use over time;
- (6) If the name of the retailer and the purchase date are not indicated in the space below, or if such information has been rewritten; and
- (7) If this Guarantee is not submitted together with the Product.

Date of purchase:

Retailer:

Please note that this Guarantee is valid only if the name of the retailer and the date of purchase are properly entered by the retailer from whom your SEIKO Photo Beam Unit PBU-2000 was purchased.