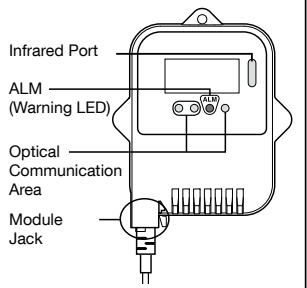


Thermo Recorder Mini RU-21 User's Manual

**Outline of RU-21**  
**External Input Module Type**  
**Splash proof (rated for use in daily life)**  
RU-21 is a Thermo Recorder designed to measure and record different items depending on the Input Module to be connected: temperature (Thermocouple/Pt), voltage, 4-20mA, and pulse count. The body is splash proof (rated for use in daily life), which can be placed in an environment between -40 and 80°C. Recorded data can be collected from the RU-21 to PC by using a Thermo Recorder Mini Base or Thermo Collector (sold separately). The data can then be viewed in graph and table form as well as printed out by using the supplied software.

Package Contents:  
Thermo Recorder (RU-21), Tubed Lithium Battery (LS14250), Input Module(\*), Strap, User's Manual (this manual including warranty)  
\* The Input Module included in the package differs depending upon which "set model" has been purchased.

Part Names



Device Name	RU-21
Measurement Item (*1)	Temperature / Voltage / 4-20mA / Pulse Count
Logging Capacity	16,000 readings
Recording Interval	Select from 15 choices: 1, 2, 5, 10, 15, 20, 30 sec. or 1, 2, 5, 10, 15, 20, 30, 60 min.
Recording Mode	Endless (Overwrite oldest data when capacity is full) or One Time (Stop recording when capacity is full)
Communication Interfaces	Optical Communication (proprietary protocol) Infrared Communication (IrPHY 1.2 low power)
Power	Lithium Battery: LS14250 (*2)
Battery Life (*2)	See "Estimated Battery Life" in this manual.
Dimensions	H 62 mm x W 47 mm x D 19 mm (excluding protrusions and Input Module)
Weight	About 55 g (including battery / excluding Input Module)
Operating Environment	-40 to 80 °C
Waterproof Capacity (*3)	IP64: Splash proof (rated for use in daily life) Note: Input Module is not water resistant.
Data Collection Devices	Thermo Recorder Mini Base: RT-23B, RT-22B Thermo Collector: RTC-11

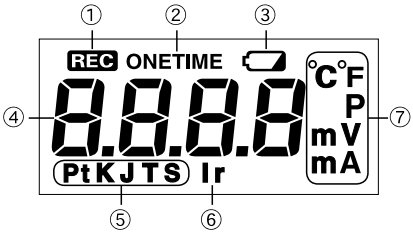
\*1: See "Input Module User's Manual" for detailed information including measurement range and accuracy for the Input Module being used.  
\*2: Battery life varies depending upon the ambient temperature in which it is used, the recording interval, the frequency of communication, and the battery performance. All estimates are based on operations carried out with a new battery and are in no way a guarantee of actual battery life. When infrared communication function is enabled, battery life may be shortened if the Unit is used under the inverter type fluorescent lighting.  
\*3: This is the waterproof capacity of the Thermo Recorder unit with an input module connected.

The specifications listed above are subject to change without notice.

3. How to Read the LCD Display

❶ When being used in very hot or cold environments the display may become difficult to read. This is not a malfunction.

Basic LCD Display



- ❶ [REC] Mark: The recording status is shown as below.  
ON: Recording in progress  
BLINKING: Waiting for programmed start  
OFF: Recording stopped
- ❷ [ONETIME] Mark: When the recording mode is set to "One Time", this mark appears. The factory default setting is "Endless" and this mark will not appear.
- ❸ Battery Warning Mark: When it is time for the battery to be replaced, this mark will appear.
- ❹ Measurement and Message Area: Measurements or operational messages are shown here.
- ❺ Sensor Type: The type of sensor connected to or set in the Unit is shown here.  
Thermocouple: Type K, J, T, S  
Platinum Thermal Resistance Sensor: Pt (Pt100), PtK (Pt1000)
- ❻ [Ir] Mark: The infrared communication status is shown as below.  
ON: Permitting infrared communication  
OFF: Forbidding infrared communication
- ❼ Unit of Measurement: The unit of measurement for the display is shown here.

Battery Replacement

1. When it is time for the battery to be replaced, a battery warning mark will appear.



Please change the battery as soon as possible if this mark appears.

2. After removing the battery, wait for about three seconds until [bAtt] appears in the Measurement and Message Area. Once this appears, please insert the new battery as quickly as possible.



- Make sure that [bAtt] is displayed before changing the battery; otherwise the battery warning mark may remain even after battery replacement.
- If you change the battery at this point, all recorded data will be saved.

3. If the battery is further left unchanged, the display will automatically shut off.

If, at this time, a new battery is placed in the Unit, [CHEC] will appear on the display after which recording will begin again using the previously set recording conditions. Note however that all previously recorded data will have been lost.

Estimated Battery Life

The battery warning mark will appear based upon the calculation of battery use. This mark may not appear correctly if the same battery is taken out and put in, therefore do not remove the battery until it can be replaced with a new one. If infrared communication is set to be permitted, battery life will be shortened.

When communication frequency is 4 times a month:				
Set Model Number	Infrared Communication: OFF		Infrared Communication: ON	
	Rec Interval = 1 sec.	Rec Interval ≥ 10 sec.	Rec Interval = 1 sec.	Rec Interval ≥ 10 sec.
RU-21-TC	About 6.5 months	About 14 months	About 5.5 months	About 10 months
RU-21-Pt	About 10 months	About 24 months	About 7.5 months	About 14 months
RU-21-V	About 16 months	About 16 months	About 11 months	About 11 months
RU-21-mA	About 16 months	About 16 months	About 11 months	About 11 months
RU-21-P (Input: Open)	About 24 months		About 18 months	
RU-21-P (Input: Short)	About 16 months		About 11 months	

- When the recording method is set to "average value" for the RU-21-V or RU-21-mA, the battery life will be the same as when the recording interval is one second regardless of the actual recording interval.
- The battery warning mark may appear sooner than noted above.
- Battery life will be shortened when: downloading data very often, setting the recording interval at less than ten seconds, or measuring in an environment below -20°C or above 60°C.

❶ Notes about Changing the Battery

- Before replacing a battery, please make sure to download any necessary data and proceed with changing the battery.
- If + (plus) and - (minus) are mistaken, or if the battery terminals + and - are shorted, the recorded data that is stored in the Unit will be lost.
- Downloading of data cannot occur while the battery is removed.

Example of Display

Display varies depending upon the model being used.

RU-21-TC (Thermocouple)



Temperature measurement (°F / °C) will be displayed. Sensor type will be displayed under the measurement; the factory default setting is Type K. By using the software included with the Thermo Recorder Mini Base or Thermo Collector, you can change the sensor type.

RU-21-Pt (Pt100 / Pt1000)



Temperature measurement (°F / °C) will be displayed. Sensor type will be displayed under the measurement; the factory default setting is Pt100. By using the software included with the Thermo Recorder Mini Base or Thermo Collector, you can change the sensor type.

RU-21-V (Voltage)



Voltage measurement (Unit: V / mV) will be displayed. Due to the wide measurement range, the Unit has been set by default to adjust the decimal point automatically to display the measurement in V. By using the software included with the Thermo Recorder Mini Base or Thermo Collector, you can change the unit of display.

RU-21-mA (4-20mA)



4-20mA measurement (Unit: mA) will be displayed.

RU-21-P (Pulse Count)

There are two display methods for the pulse measurement. By using the software included with the Thermo Recorder Mini Base or Thermo Collector, you can change the method of display.



**Pulse Rate (Max: 61439)**  
The most recent pulse count (Unit: P) for the recording interval period will be displayed. The display will be refreshed every one-sixtieth of the recording interval (at minimum of every one second). 31,500 pulse count will be displayed as [31.50KP], in units of 10 pulse for display.



**Total Pulse Count**  
The cumulative number of pulses (Unit: P) will be displayed from 0 to 9999. The displayed count will be refreshed every one second, and upon exceeding 9999, the count will start over again from 0.

Other Marks or Messages on Display

Logging Capacity FULL



When Recording Mode has been set to "One Time" and the Unit reaches its logging capacity of 16,000 readings, recording will automatically stop and in the LCD the measurement and the word [FULL] will alternately appear.

Estimation of time until [FULL] is displayed

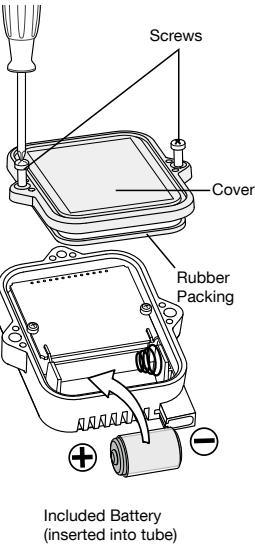
Recording Interval	1 second	30 seconds	1 minute	10 minutes	60 minutes
Period	About 4 hours	About 5 days	About 11 days	About 111 days	About 1 year and 10 months

Check



If this appears, all data that was stored in the Unit will have been erased. This message will appear under the following conditions:  
- The first time a battery was inserted after purchase  
- When the battery is replaced after having been taken out for a long period  
- If the battery is replaced after the battery power has been lost.

1. Installing the Battery



1. Remove the screws and open the cover.  
Make sure to use the proper size and type of screwdriver. (Phillips head #1 screwdriver is recommended.)

2. Insert the supplied battery with tube into the case as shown in the diagram below.

3. Check the rubber packing for any cuts or scratches and close the cover as it was when opened.

- Dust or defects on the packing can adversely affect the waterproof capacity; in this case, remove the dust or replace the packing if it is damaged.
- Be sure to completely close the cover.
- Make sure not to over tighten the screws. (Appropriate Tightening Torque: 20N·cm to 30N·cm(2Kg·fcm to 3Kg·fcm))

❶ Notes about Battery Installation

- After inserting the battery for the first time, nothing may appear or occur for about 10 seconds; this is not a malfunction.
- If a new battery has been installed and nothing appears in the display, please remove and reinsert the battery.
- When inserting a battery, make sure no water or foreign objects get inside the case.
- Make sure that + and - are in the correct direction.

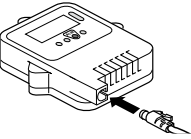
❶ About Lithium Batteries

- Please store the lithium battery LS14250 in a place that is 20 °C or less.
- When using lithium batteries other than LS14250 produced by SAFT, such as CR2, product specifications cannot be guaranteed nor can the performance of some functions, such as the battery warning function.
- Please avoid using the CR2 in the following situations:  
Using the unit in an environment below 0 °C or above 60 °C  
Exposing the CR2 to continuous vibration such as in transportation  
- When using a CR2 lithium battery, the tube is not necessary.
- To maintain waterproof capacity, when changing batteries also change the rubber packing and the drying agent (silica gel). When using a CR2 lithium battery, please purchase the optional Maintenance Set (TR-00P1) to replace the rubber packing and silica gel.

2. Connecting an Input Module

Insert an Input Module into the module jack. Once the Unit recognizes the module, the LCD display will change as shown below and recording will start. (If you have purchased an RU-21-P, the Unit has been set by default to start recording upon installation of the battery.)

\* The factory default settings are as follows: Recording Interval at 10 minutes, Recording Start at Immediate Start, Recording Mode at Endless, Infrared Communication at Forbid.



Make sure that the module is completely inserted until you hear a "click" sound.

Set Model Number	Measurement Items	Input Module	LCD Display Items (detailed in "How to Read the LCD Display" section)
RU-21-TC	Temperature (Type K, J, T, S)	Thermocouple Module (TCH-1010)	Measurement, Unit of Measurement, Sensor Type, Operational Status
RU-21-Pt	Temperature (Pt100, Pt1000)	PT Module (PTH-1010)	Measurement, Unit of Measurement, Sensor Type, Operational Status
RU-21-V	Voltage	Voltage Module (VIH-1010)	Measurement, Unit of Measurement, Operational Status
RU-21-mA	4-20mA	4-20mA Module (AIH-1010)	Measurement, Unit of Measurement, Operational Status
RU-21-P	Pulse Count	Pulse Input Cable (PIH-1010)	Measurement, Unit of Measurement, Operational Status



### 3. How to Read the LCD Display (continued from previous page)

#### Input Module Unrecognized (factory default)



This will appear if, after purchasing, the Input Module has never been connected to the Unit. (Unit of Measurement not displayed)

Note that a RU-21-P has been set to measure pulse count by default, therefore the unit "P" will be displayed.

#### Input Module Unconnected or Damaged



This will appear if the Unit cannot confirm a connection with the Input Module after having recognized it. (Unit of Measurement displayed)

If nothing is displayed after reconnecting the sensor to the Unit, there is a possibility that the sensor or the Unit has been damaged.

#### Sensor Unconnected or Damaged



This will be displayed when a sensor has not been connected to the module or the wire has been broken. Recording is in progress and so is battery consumption.

If nothing appears on display after reconnecting the sensor to the Unit, there is a possibility that the sensor or the Unit has been damaged.

#### Measurement Range Exceeded



[OL] will appear if a measurement exceeds the measurement range.

#### Display Range Exceeded



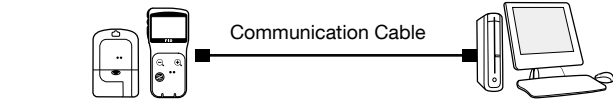
When measuring voltage in "mV range", the measurement in the LCD display will flash if it exceeds the display range of the Unit.

### 4. Communicating with your Computer

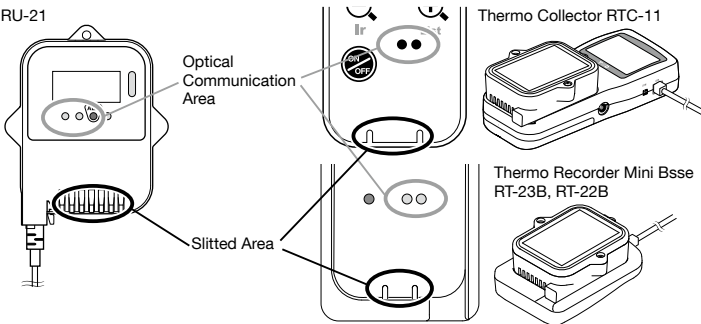
- In order to change settings in the Unit such as recording settings, download recorded data from the Unit to your computer, or communicate with your computer, it is necessary to purchase separately a Thermo Recorder Mini Base (RT-23B/22B) or Thermo Collector (RTC-11).
- By using the software "THERMO RECORDER for Windows " supplied with the Thermo Recorder Mini Base or Thermo Collector, it is possible to carry out communication with a PC. For details about how to make recording settings, download data and other operations, please see the User's Manual that comes with the Thermo Recorder Mini Base or Thermo Collector.
- The latest version of "THERMO RECORDER for Windows" can be downloaded free of charge from our website. (RU-21 can be used with Ver. 1.80E or later.)

#### How to Communicate with the Computer

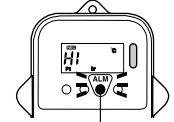
- Follow directions as issued in the software to connect the Thermo Recorder Mini Base or Thermo Collector to your PC.



- Place the Thermo Recorder on the Thermo Recorder Mini Base or Thermo Collector making sure to align the optical communication areas and slitted areas.



#### Warning (Set Limit Exceeded)



Warning LED (flashing)

Using the software that comes with the Thermo Recorder Mini Base or Thermo Collector, you can make settings for the Upper / Lower Limits and Warning Judgement Time. If a measurement exceeds one of the set limits, the warning LED and a message will be displayed.



#### Upper Limit Exceeded

If a measurement exceeds the set upper limit, the measurement and [HI] will alternately appear on the LCD screen.



#### Lower Limit Exceeded

If a measurement exceeds the set lower limit, the measurement and [LO] will alternately appear on the LCD screen.

#### Starting the Warning Monitoring Function

If these settings are made in an environment where one of the limits is being exceeded and recording is started, the monitoring function will enter "wait" mode. Once a measurement returns to within the set limits, the monitoring function will begin to operate.

#### How to Turn Off a Warning

- Restart recording from the software.
- In the software use [Clear Warning] (only with RT-23B and RT-22B)
- Download the recorded data (only when successfully completed).
- Produce a condition so that [CHEC] is displayed.

#### Using a PC allows the following:

It is possible to change recording settings in the Unit, download recorded data to a PC, and view downloaded data.

#### Recording Settings for the Unit

The factory default settings are as follows: Recording Interval at 10 minutes, Recording Start at Immediate Start, Recording Mode at Endless, Infrared Communication at Forbid.

Recording Interval	Select from 15 choices: 1, 2, 5, 10, 15, 20, and 30 seconds or 1, 2, 5, 10, 15, 20, 30, and 60 minutes
Recording Start	Immediate Start: Recording will start immediately upon installation of the battery. Programmed Start: Recording will start at the set date and time.
Recording Mode	One Time: Upon reaching logging capacity of 16,000 readings, recording will automatically stop. (The word [FULL] and the measurement will alternately appear on the LCD screen.) Endless: Upon reaching capacity of 16,000 readings, the oldest data will be overwritten and recording will continue.
Infrared Communication Function	Permit: Infrared Communication will be possible. Forbid: Infrared Communication will not be possible.

#### Notes about Optical Communication

- Proper communication may not be possible in the following situations:
  - where temperatures are very high or very low, in an environment with intense brightness (higher than 5,000lx), or when the remaining battery life for the Unit is very low.

#### Notes about Communication Devices

- When using a Thermo Collector, you can download recorded data, view the data in graph form, and make all necessary recording settings without connecting to a PC.

#### Notices about this User's Manual

In order to properly use this product, please carefully read this manual before using.

- ESPEC MIC Corporation accepts no responsibility for any malfunction of the and/or trouble with this product or with your computer that is caused by the improper handling of this product and will deem such trouble or malfunction as falling outside the conditions for free repair outlined in the attached warranty.
- All rights of this Introductory Manual belong to ESPEC MIC Corporation. It is prohibited to use, duplicate and/or arrange a part or whole of the manual without the permission of ESPEC MIC Corporation.
  - All registered trademarks, company names, product names and logos mentioned herein or for products being used are the property of ESPEC MIC Corporation or of their respective owners.
  - Specifications, design and other contents outlined in the manual are subject to change without notice due to continual improvements.
  - Please follow the safety precautions outlined in the manual carefully. We cannot guarantee nor are we responsible for safety if this product is used in any manner other than was intended.
  - On-screen messages in this manual may vary slightly from the actual messages.
  - Please notify the distributor from which you purchased this product or ESPEC MIC Corporation of any mistakes, errors or unclear explanations in this manual. ESPEC MIC Corporation accepts no responsibility for any damage or loss of income caused by the use of our product.
  - This product has been designed for private or industrial use only. It is not for use in situations where strict safety precautions are necessary such as in connection with medical equipment, whether directly or indirectly.
  - We are not responsible for any malfunction or trouble caused by the use of our product or for any problem caused by the use of measurement results of our product. Please be fully aware of this before using our product.
  - This Introductory Manual cannot be reissued, so please keep it in a safe place.
  - Please read the warranty and provisions for free repair carefully.

#### Safety Precautions and Instructions

The following items should be strictly obeyed for the safe usage of this product, and for protecting yourself and other people from bodily harm and/or damage to property. To ensure the proper use of this product, we ask that before using it you carefully read, understand and follow the safety rules and precautions as outlined below.

	<b>⚠ DANGER</b>
	<b>Do not disassemble, repair or modify the Unit.</b> It may result in malfunction or unexpected accidents.
	<b>Do not use any other batteries than those that are specified in this manual.</b> It may cause fire or malfunction.
	<b>If water or a foreign object enters the case, immediately remove the battery and cease using it.</b> It may result in malfunction or unexpected accidents.
	<b>Store the Unit and accessories out of the reach of children.</b> Not doing so may cause an unexpected accident.
	<b>If any smoke or strange smells are emitted from the Unit, immediately remove the battery and stop using.</b> Continued use may cause fire or electrocution.
	<b>Please be careful not to touch the Unit during or after use in overly hot or cold environments.</b> It may cause burns or frostbite.

	<b>⚠ CAUTION</b>
	<b>This Unit has been designed for private and/or industrial use only. It is not for use in situations where strict precautions are necessary such as in connection with medical equipment, where directly or indirectly.</b>
	<b>Harmful gases or chemicals may cause corrosion and/or other danger to the Unit. Also, by coming in contact with hazardous substances, harm may occur to the people handling the Unit. Therefore, do not use or store the Unit in any environment that is exposed to chemicals and harmful gases.</b>
	<b>Battery life varies depending upon measuring environment, frequency of communication, Unit settings, and battery performance.</b>
	<b>When using the Unit in unusually high or low temperature environments, the battery power will be depleted more quickly than when using under normal temperature conditions.</b>
	<b>Battery terminals may provide insufficient contact due to age or vibration.</b> This may lead to data loss.
	<b>The Unit becomes splash proof (rated for use in daily life) only after the Input Module has been connected.</b> Without the module connected, neither the module jack nor the connector part of the temperature sensor on the Unit is water resistant; make sure not to get wet.

- If the Unit is not to be used for a long period of time, store it in a place where it is not exposed to high temperature and high humidity.**  
If the Unit has condensation on the inside, it may cause malfunction and damage.
- Do not remove or reinsert the battery once it has been set; continue using until battery power is depleted. Always use a new battery for replacement.**  
Not doing so may result in improper operation.
- To maintain waterproof capacity, we suggest periodically changing the parts inside the case.**  
If the rubber packing should be damaged or deteriorated, please replace it along with the drying agent.
- If the Unit is subjected to significant temperature change while wet, it may cause condensation inside the case.**  
Especially be careful with temperature changes from high to low; if the Unit has condensation on the inside, it may cause malfunction, damage, and/or unexpected accidents.
- Do not drop or expose the Unit to a strong impact.**  
It may cause damage or malfunction.
- Do not put fingers or foreign objects into the modular jack.**
- Do not use or store the Unit in places such as listed below. It may result in malfunction or unexpected accidents.**
  - Areas exposed to direct sunlight
  - Areas exposed in water or high-pressure water flow
  - Areas exposed to organic solvents and corrosive gas
  - Areas exposed to strong magnetic fields
  - Areas exposed to static electricity
  - Areas near fire or exposed to excessive heat
  - Areas exposed to excessive dust, dirt and smoke

	<b>⚠ Contact with oil may cause cracks to appear in the casing of the Unit. When using this Unit in environments where such oils are present, please insure that it is protected from contact through use of a polyethylene bag or other means.</b>
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	<b>⚠ Notices about Infrared Communication</b>
<b>Do not place the unit in areas exposed to direct sunlight or incandescent light, or near other infrared devices. It may cause communication to not work properly.</b>	
<b>Proper communication may not be possible if the infrared port becomes covered with dirt and/or dust. If it gets dirty, wipe it with a soft cloth.</b>	
<b>Do not touch the infrared port with your finger during infrared communication.</b>	

	<b>⚠ Notices about using the Input Modules</b>
<b>When using THERMO RECORDER for Windows to make "Adjustment Settings", the adjustment values will be saved to the Input Module. Therefore, when an Input Module is replaced, it is necessary to re-make any desired adjustment settings to be written into the newly connected module.</b>	

	<b>⚠ Compliance Information</b>
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#### Radio, EMC and Safety Regulations

This device complies with Part 15 of the Federal Communications Commission (FCC) rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

#### FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To comply with the limits for the Class B digital device, pursuant to Part 15 of the FCC Rules, this device must be installed in computer equipment certified to comply with the Class B limits. All cables used to connect the computer and peripherals must be shielded and grounded. Operation with non-certified computers or non-shielded cables may result in interference to radio or television reception.

**Caution:**  
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### Thermo Recorder RU-21 Warranty

Guarantee Period	1 year from date of purchase
Date of Purchase	
Customer's name	
Address	
Phone No.	
Distributor's name	
Address	
Phone No.	
Object of Repair	Main Unit (excluding Input Modules and any other options.)
Method of Repair	Send in for Repair

#### Provisions for Free Repair

- If the Unit does not work properly despite the fact that the customer used it properly and in line with the manual, the Unit shall be repaired free of charge through the distributor which sold the Unit.
- If the customer requests free repair because of trouble within the warranty period, bring or send the Unit along with the warranty to the distributor.
- If you have moved after purchasing, or there are difficulties contacting the distributor from which you purchased the Unit, please contact ESPEC MIC directly for service.
- Free repair is not available in the following cases even though it is within the warranty period:
  - Trouble or damage was caused by careless operation, natural disaster, fire, public pollution, or use of a power source other than specified.
  - If repair, adjustment, disassembly or modification of the Unit has been carried out by a person other than a ESPEC MIC authorized engineer.
  - Trouble or damage was caused by transportation, movement or dropping of the Unit after purchase.
  - Failure to submit the Warranty or failure to fill in all items required in the Warranty.
  - The Warranty cannot be reissued.This Warranty only promises customers free repair within the period and conditions clarified in this Warranty. Therefore, the customer's legal rights will not be limited by this Warranty. For further information on repair and other service questions after the termination of the warranty period, contact your distributor.