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M3185/1098

# User's Guide

OMEGA
An OMEGA Technologies Company
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# RH31
# Handheld Temperature/ Humidity Indicator

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## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 25 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal two (2) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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## NOTES



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## SECTION 1 INTRODUCTION

The OMEGA® RH31 Handheld Temperature / Humidity Indicator has broad applications in air conditioning services, food management, process engineering, and many uses in experimental and research facilities.

The built-in digital display is accurate to ±0.6˚ F (0.3˚ C) and ±3% RH, and reads out in either degrees F / C.

Three probe types are available for use with the RH31 and all are interchangeable through a connector located on the RH31 Indicator:

RH31-1 General Purpose Probe for Laboratory and Warehouses
RH31-2 Thin Type Probe for Tanks and Narrow Gaps
RH31-3 Remote Mounted Probe with Cable

The ultra sensitive composite sensor element in the probes is composed of a temperature and humidity sensor formed into a single unit. The humidity sensor is an electrostatic capacitance type polymer-film, and the temperature sensor is a platinum resistance RTD.

A calibration kit (part number RH30-CAL) is also available for recalibrating the RH31 Indicator and RH31-1 General Purpose Probe.

Obtain new sensor, if temperature / humidity sensor has become defective. No adjustment is necessary after exchange, because the sensor is interchangeable.

If the response time is delayed in the general type sensor, remove the cap from the sensor tip, and remove the filter. (Screw in the cap as before after removing the filter.) In this case, the sensor is apt to be contaminated with dust or the like, and its service life may shorten.

The battery assembled at the delivery time from the factory is used for test so that its life may be shorter than the nominal value.

**Power auto-off function**
A power auto-off function is provided and the battery life is longer than 400 hours in continuous use at normal temperature.

The RH31-RS232 has a memory function and is also able to collect up to 1500 points of data (temp., humidity). The measuring interval is 10 minutes.

**Temperature-humidity sensor exchange**
The temperature-humidity sensor is interchangeable, and it can easily be replaced, if it has been broken or it has deteriorated.

**Handling of temperature-humidity sensor**
Handle this precise unit carefully so as not to drop or strike it, otherwise a trouble may occur. This unit is not water-proof. Don't dip it into water or moisten it.



## SECTION 6 SPECIFICATIONS

**RH31 METER**

| | |
|---|---|
| **Measuring range:** | Temperature: -10 to 60˚ C<br>Relative humidity: 0 to 100% RH |
| **Accuracy rating:** | Temperature: ±(0.1% of measured value +0.2˚ C)<br>Relative humidity: ±(0.1% of measured value +0.2% RH)<br>Dew-point temperature: ±1.0˚ C<br>Wet-bulb temperature: ±0.8˚ C<br>(at temperature 25˚ C and relative humidity 50% RH) |
| **Temperature coefficient (per 10˚ C):** | Temperature: ±(0.2% of measured value +0.1˚ C)<br>Relative humidity: ±(0.2% of measured value +0.1% RH) |
| **Display:** | $3^{1}/_{2}$ digits LCD (Liquid crystal) digital display<br>Temperature, relative humidity, dew-point temperature, wet-bulb temperature, unit, battery shortage mark |
| **Resolution:** | Temperature: 0.1˚ C / 0.1˚ F<br>Relative humidity: 0.1% RH |
| **Memory function:** | **Data:** 1500 data each of temperature and humidity<br>**Content:** Temperature, humidity<br>**Measurement Time Interval:** 10-minute |
| **Communications Interface:** | RS-232C<br>(with communication cable) |
| **Working temperature range:** | 0 to 50˚ C (32 to 122˚ F) |
| **Working humidity range:** | 0 to 85% RH (no dew condensation is allowed) |
| **Power Voltage:** | Exclusive lithium battery 1 piece (7.2 Vdc) |
| **Battery life:** | Approx. 400 hours<br>(at normal temperature and humidity) |
| **Weight:** | Approx. 180 g (6.3 oz) (without memory function)<br>Approx. 190 g (6.7 oz) (with memory function) |

**RH31 SENSORS**

| | |
|---|---|
| **Measuring range:** | Temperature: -10 to 60 ˚ C (14 to 140˚ F)<br>Relative humidity: 0 to 100% RH |
| **Accuracy rating:** | Temperature: ±0.15˚ C (at 0˚ C), ±(0.15+0.002[t])˚ C,<br>t: Measured temperature (˚ C)<br>Relative humidity: ±3% RH (at 25˚ C, 0 to 90% RH) |
| **Temperature coefficient:** | Relative humidity: ±1% RH (Reference 25˚ C, per 10˚ C) |
| **Response:** | **Without filter:** Approx. 1 minute (90% response)<br>**With filter:** Approx. 3 minutes (90% response) |
| **Sensor element:** | Temperature: Platinum resistance thermometer (JIS Class A)<br>Humidity: Capacitance type high polymer film |
| **Cable length:** | Standard 1m (3'), Maximum 5m (16') |
| **Weight (with 1m of cable):** | RH31-1: Approx. 60 g (2.1 oz)<br>RH31-2: Approx. 70 g (2.5 oz)<br>RH31-3: Approx. 100 g (3.5 oz) |

## HUMIDITY CALIBRATION KIT

The OMEGA® RH30-CAL Humidity Calibration Kit is needed to perform the humidity calibration of the RH31 Indicator and RH31-1/RH31-2 Probe assembly.

The Calibration Kit consists of two salt chambers held in a styrofoam base. One chamber contains a saturated salt solution of Lithium Chloride (to simulate 11% relative humidity). The other chamber contains a saturated salt solution of Sodium Chloride (to simulate 75% RH).

The RH31-3 cannot be field calibrated. No adapters are available.

## INSTRUCTIONS TO DISASSEMBLE THE HUMIDITY PROBES

The potentiometer (pots) necessary for the humidity calibration procedures are located in the RH31-1/RH31-2 probes.

Each probe is slightly different, thus disassembly will vary. Perform the following procedures while referring to the corresponding steps pictured in the Figure for your particular probe type.

## RH31 HUMIDITY/TEMPERATURE ADJUSTMENT

1. Please have RH30 Kit which OMEGA Engineering provide (30% RH).
2. Potential meter for adjustment is located about middle of handle portion of probe. (Only 1 potential meter)
3. As on Fig. 3 and 4, remove label covering potential meter.

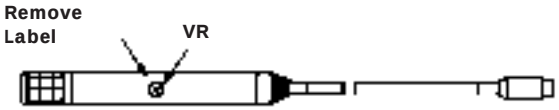



**Fig. 3. RH31-1 Probe**

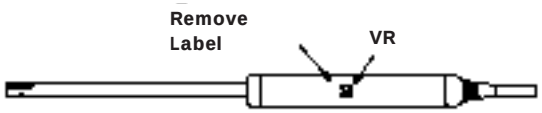



**Fig. 4. RH31-2 Probe**

4. Enter probe to calibration kit.
5. Turn potential meter to meet calibration kit reading. Once display is same or close to calibration kit, adjustment is done.
6. No calibration for temperature.



**Figure 1. RH31 and RH31-1, RH31-2, RH31-2 Probes**

## SECTION 2 UNPACKING

Remove the packing list and verify that all equipment has been received. If there are any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

**NOTE:**
The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

Please note that the following items are in the box:

RH31 INDICATOR:
- RH31 Temperature / Humidity Indicator
- 9 volt Battery
- Transparent vinyl case for Indicator
- Operator's Manual

RH31 PROBES (refer to Figure 2):
- RH30-1, -2, -3, Humidity / Temperature Probe
- Plastic Bag to hold probe assembly
- Operator's Manual



## SECTION 5 HUMIDITY CALIBRATION

**PRECAUTIONS**

Due to its design, and ease of access, the humidity sensor must be handled with care. AVOID ANY CONTACT with fingers, atmosphere, or products which could be harmful to the sensor. The sensor must not come in contact with dirt or other foreign material. Incorrect readings can be caused by build-up of material, which can increase or decrease the RH reading.

During measurements, the following precautions should be taken:

1. When the temperature, at the location being measured, changes drastically, allow at least 10 minutes for the measurement to stabilize.
2. The sensor response will vary greatly depending on the air flow in the vicinity being measured, the heat capacity of materials surrounding the probe, and the thermal conductivity. Alllowing for the response time of 30 seconds or so, keep the probe at a distance from the body, when the probe is held in ones hand, to eliminate the effects of body heat.
3. Always turn the unit OFF after measurements are completed. When the meter is not in use for extended periods of time, remove and store the battery.

**HUMIDITY SENSOR CLEANING**

Use no solvents stronger than DISTILLED WATER to clean the sensors. If necessary, rinse the sensors with distilled water, being careful not to touch it with your fingers. After rinsing, the sensors should air dry for at least 24 hours (prefereably over an air flow register).

**DISPLAY CODES**

-OVER: Measured values are displayed on the $3^{1}/_{2}$ digit LCD. For temperatures over 212˚ F (100˚ C) and humidity over 99.9%, the message "OVER" is displayed.

-BATT: When the battery is low, the message "BATT" appears on the display and the batttery must be replaced.

**HUMIDITY CALIBRATION**

The RH31 Indicator and probes are calibrated at the factory and do not usually need to be recalibrated. The warranty is void if the unit is tampered with while still under warranty. Contact OMEGA Engineering for service information.

The following procedures are necessary only if the unit is operating out of specification and is no longer under warranty. These procedures should be performed by a qualified technician.

Only the RH31-1 general purpose probe & RH31-2 can be field calibrated.

**Figure 1. RH31 Indicator**

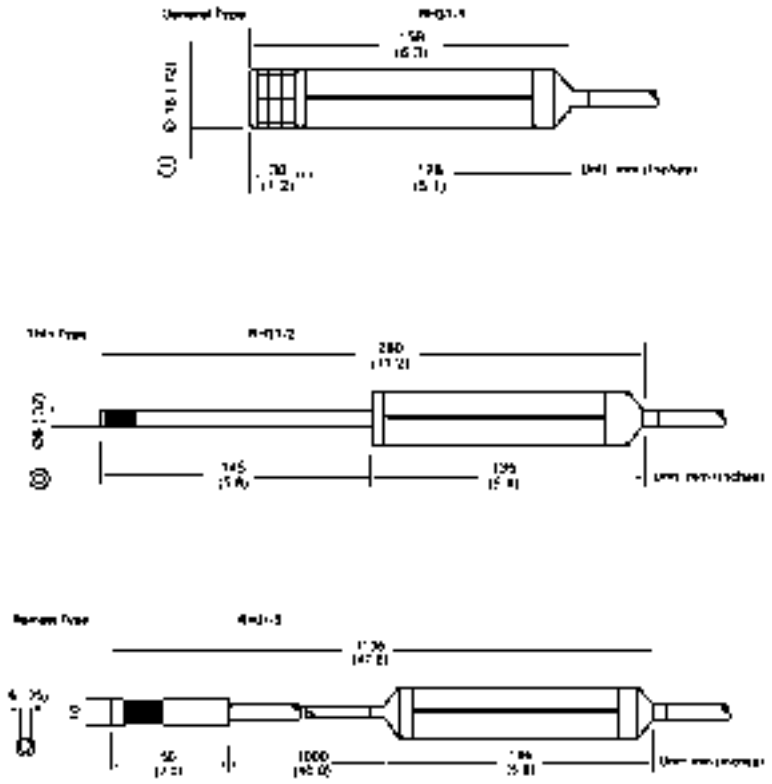


**Figure 2. Probe Assemblies for the RH31**

## SECTION 3 ASSEMBLY

### 3.1 Battery Installation

**BATTERY EXCHANGE METHOD**

1. How to open the case
The case can be opened by removing two screws on the rear panel of the case.

In this case, the case can be opened easily be pulling the hand strap in the open direction, while pressing the upper case.

2. How to remove the battery
Insert a screwdriver to the bottom of the battery connector while holding the battery connector by fingers, and disconnect the connector by pushing it upward.

3. Battery exchange
Connect the battery connector to the connector on the PC Board. In this case, a confirmation chime sounds to show the end of the exchange.

Never disassemble, short, charge, throw into a fire, or heat the used battery nor directly solder it to the battery body, otherwise a rupture accident or an electrolyte leak failure may occur.

4. How to close the case
Insert the battery cord to the guide of the upper case without protruding it out of the case. Mount the hand strap.

Fit the upper and lower cases to each other and fasten two screws.

### 3.2 RH31 Indicator Assembly

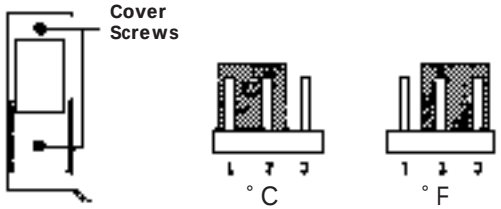
Slide the RH31 indicator into the vinyl case provided in order to protect the case during use. Plug in the probe that is best suited for your application (see Figure 2 above for probe selection). The temperature / humidity probes are plugged into the socket located on the top of the indicator. Be sure to line up the "keys" on each connector before plugging in the probe.

### 3.3 How To Switch From ˚F/˚C

1. Remove 2 back cover screws.

2. Jumper pins 1 & 2 for ˚C, pins 2 & 3 for ˚ F.

3. Put back lower case and tighten screws.






### 4.3 Key Operation

Names of keys Contents
ON-OFF The power supply is turned on by pressing this key once and turned off by pressing this key again.
A confirmation chime sounds after turning on the power supply, and the power supply turns off automatically after about 3 minutes.
For canceling the auto off function, press [ON-OFF] key together with [CLEAR] key.
A confirmation chime sounds three times.
For turning off the power supply, press [ON-OFF] key.
•CLEAR By pressing this key, a confirmation chime sounds, the display setting functions (hold, humidity operation selection) are canceled, and the unit returns to the initial condition.
When the memory function is provided, (1) data collection is stopped by pressing this key halfway during data collection (2) data readout is stopped by pressing this key halfway during data readout, and also (3) the unit is reset to the last settting by pressing this key halfway during the time setting.
•HOLD The measured values of temperature and humidity are held by pressing this key and the unit is set to the measuring condition (the hold condition is canceled) by pressing this key once more.
During the hold of measured values, ˚ C(˚ F) flickers.
•SEL The indicating value is switched in the order of [relative humidity → dew point → wet-bulb temperature].
Relative humidity: %RH
Dew point: ˚C(˚ F)
Wet-bulb temperature: ˚C(˚ F) flickering
•READ Press this key for advancing the numeric stepwise when setting the present time or data collection time.
Press this key when transmitting collection data to the personal computer.
•WRITE Press this key for switching the setting items such as year, month, day, hour, and minute when setting the present time and data collection time.

**TROUBLESHOOTING**

Symptoms Check contents
No display appears – Problem 1
Are the indicator and temperature-humidity sensor connected to each other securely?– Check
Has the battery life come to an end? – Check
Is the battery set correctly? – Check
Display remains unchanged – Problem 2
Is the [HOLD] key pressed? (˚ C (˚ F) flickers in this case) – Check
Measured values are abnormal – Problem 3
[Is the unit correct?] – Check
Bar display appears in the upper column. – Problem 4
[Over-range]
Bar display appears in the lower column – Problem 5
[Under-range]

4. Sample program

Prepare a data file in advance.

(1) In case of N88BASIC (A hard disc is used)

```
60 “232-C CIRCUIT”
110 ’DATA STORAGE
```

(2) In case of N88BASIC (a floppy disc is used)

```
80 “232-C Circuit”
100 FOR A = 0 TO 50000!
‘’SELECT THE FINAL VALUE TO CONFORM TO PC.
200 DATA STORAGE
220 IF 1=0  THEN PRINT
‘’COMMUNICATION IS IMPOSSIBLE”: END
```

**Communication Protocol for RH31-RS232C**

| | |
|---|---|
| Start-Stop System | |
| 3 line system | : Talk only |
| Transmission Speed | : 1200 bps |
| Start bit | : 1 bit |
| Data Length | : 8 bits |
| Stop bit | : 1 bit |
| Character code | : ASCII code |
| Data transmission Procedure | : Non-procedure |

RH31-RS232C does not have any communication formats because this output measuring data at a stroke.

5. Maintenance

For cleaning it, wipe it off with a dry soft cloth without fail.
Never use benzene, thinner, or the like, otherwise a color change, deformation, deterioration of sensor, or other troubles may occur.

**Storage of temperature-humidity sensor**

For storing the sensor for a long time, seal it into a clean vinyl bag together with a desiccant like silica gel, and store it at a cool dark palce.

**Filter exchange**

The general type temperature-humidity sensor (RH31-1) filter can be replaced if it has become dirty. Remove the cap from the sensor tip by turning it counter-clockwise, and draw out the filter carefully to as not to damage the sensor.

Insert new filter with due care so as not to damage the sensor, and screw in the cap.

**Measurement in a very wet atmosphere and moistening**

In a very wet atmosphere of higher than 90%RH, dew may be formed due to a slight drop of the ambient temperature.
Even if dew is formed on the humidity sensor, no characteristic change occurs. However, it may cause an abnormal measured value. If dew has been formed on the sensor, dry it at 60 to 70˚ C for about one hour in a thermostatic oven or the like. Don’t dry it up abruptly. It takes longer than 12 hours to dry up the sensor at room temperature.



# SECTION 4 OPERATING INSTRUCTIONS

## 4.1 Display Codes

(1) Connection joint:
Connect the exclusive temperature-humidity sensor to top of unit.

(2) AM / PM indication Note):
Indicated when the present time or preset data collection time is set.

(3) Battery shortage indication:
The battery shortage mark lights when the battery life comes to an end.

(4) [ON-OFF] key:
Turns on and off the power supply.
The power auto-off function is reset by [CLEAR] key + [ON-OFF] key.

(5) [HOLD] key:
Press this key when holding a measured value.

(6) [READ] key Note):
Press this key when transmitting data to a personal computer.

(7) [WRITE] key Note):
Press this key when setting the preset time or preset data collection time or when transmitting date to a personal computer.

(8) Measured temperature value and unit:
Indicates the measured temperature value and unit (˚ C or ˚ F).

(9) Measured humidity value and unit:
Indicates the measured humidity value and unit (%RH (relative humidity) ˚C (˚ F) (dew point), ˚ C (˚ F) flickering (wet-bulb temperature).

(10) [CLEAR] key:
Press this key when resetting the indication setting (hold, humidity unit selection).

(11) Unit indication mark:
Indicates the displayed humidity measuring unit.
%RH: relative humidity ˚C (˚F) (DP)lighting: Dew point ˚C (˚ F)(WB) flickering: Wet-bulb temperature.

(12) [SEL] key:
Press this key when changing the measuring unit of humidity.

**OPERATION METHOD**

**Preparation for measurement**

1. Assembly of battery

The battery is assembled at the delivery time from the factor and it is employable as it is. However, the battery life is not guaranteed due to the use for test. If the battery shortage mark is indicated, replace the battery.

For the method of replacing the battery, refer to [Maintenance].

2. Sensor connection

Connect the sensor securely to the circular connector at the upper part of the indicator, while taking care of the sensor correction direction.

**Measurement**

Display appears by pressing the [ON-OFF] key after the unit has been ready for measurement.

The power supply turns off automatically about 3 minutes after the last key operation has been finished. For canceling the auto off function, press [ON-OFF] key together with the [CLEAR] key when the power supply is turned off. In this case, a confirmation chime sounds three times.
After several seconds, the sensor number is displayed as shown in (2).
(Note) The display number may change from 01 to 09 according to the kinds of sensor, etc. However, it does not affect any measurement at all.
After several seconds, a measured temperature value is indicated in the upper column, while a measured humidity value is indicated in the lower column as shown in (3).
The initial value of the humidity unit shows a relative humidity. It changes in the order of %RH (relative humidity) → ˚ C (˚ F) (dew point) → ˚ C (˚ F)flickering (wet-bulb temperature) → %RH → ...
(4) shows an example of the dew point indication, while (5) shows an example of the wet-bulb temperature indication. This display turns to %RH indication when pressing the [CLEAR] key.
For finishing the measurement, press [ON-OFF] key. The power off function is set automatically when turning on the power supply next.

**KEY OPERATION METHOD WHEN THE UNIT IS PROVIDED WITH A MEMORY FUNCTION**

**Data Collection**

1. Present time setting
Display flickers when pressing [WRITE] key.
[Year] flickers when pressing [READ] key and it advances stepwise, each time [READ] key is pressed once.
When a desired [Year] has been displayed, press the [WRITE] key to define the year.
For [Month], [Day], [Hour], and [Minute], press [READ] key until they reach a desired value respectively and press [WRITE] key to define them.
By pressing [CLEAR] key, the setting returns to the last one.

2. Setting of the data collection start time
Set the data collection start time.
After setting the present time, display flickers.
[Year] flickers when pressing [READ] key and it advances stepwise, each time [READ] key is pressed once.
When a desired [Year] has been displayed, press the [WRITE] key to define the year.
For [Month], [Day], [Hour], and [Minute], press [READ] key until they reach a desired value respectively and press [WRITE] key to define them.
By pressing [CLEAR] key, the setting returns to the last one. Set the reservation time ahead from the present time without fail.



3. Collection and stop
When the reservation time has been set, the confirmation chime sounds.
After about 3 minutes, the display appears, and the data collection is started from the reservation time.

For stopping the data collection, press [ON-OFF] key to display the measured value, and then, press the [CLEAR] key.
When the data collection start time has already been set, data collection is executed at the preset time even if the power supply is turned off.

4. Memory
Data can be collected by [temperature, humidity] x 1500.
Data collection is stopped when the memory capacity is fully filled with data.
The measuring interval is fixed to 10 minutes.
If data collection was interrupted halfway, past data are valid, but subsequent old data become invalid. (Preset 1000 data are valid, but the 500 data collected last become invalid.)

## 4.2 RS232 Communications

**DATA READ**

1. Connection to personal computer
Prepare an NEC PC98 series personal computer.
Connect RH31 to the personal computer by using the attached cable.
Attached RS-232C cable
Personal computer

2. Setting of personal computer
Set RS-232C of the personal computer as follows.
Transfer speed: 1200 bps
Character length: 7 bits Parity: None
Stop bit: 2 bits X parameter: None

3. Data read and stop
Data are transmitted to the personal computer by pressing the [READ] key.
In this case, data are transmitted in the units of humidity selected by [SEL] key.
Data read is stopped by pressing [CLEAR] key.
Read data (text format) are as shown below
Specify the delimiters of data by comma [,], and use the table calculation software (EXCEL, Lotus123, etc. for example). Measured values are described on the cell numerically.
a. Collection interval b. number
c. Temperature d. Humidity
e. Measurement start year, month, day, and hour
%RH: Relative humidity C(F): Dew point
$C($F): Wet-bulb temperature