

# DATA LOGGER



## USER MANUAL

DLT-01	Temperature Data Logger
DLT-01-Pt	Temperature Data Logger with External Temperature Probe
DLT-02	Humidity and Temperature Data Logger

## Contents

1. DESCRIPTION AND DEVICE OPERATION .....	3
1.1. Purpose .....	3
1.2. Specifications .....	3
1.3. Additional Specifications .....	4
1.4. Package .....	5
1.5. Design and operating .....	5
1.6. Control Functions and Indication .....	7
2. DATA LOGGER SETUP .....	10
2.1. Logging Interval .....	10
2.2. Logging Modes .....	10
2.3. Options for starting Logging .....	10
2.4. Delayed Start .....	10
2.5. Alarm Processing .....	10
2.6. Alarm Conditions .....	10
2.7. Disable alarms .....	11
2.8. High/Low Limits Alarm Settings .....	11
2.9. Multilevel Value Scale .....	11
2.10. Restrictions of Control Buttons .....	11
3. BATTERY LIFE TIME .....	12
4. RECOMMENDATIONS FOR THE CR 2032 BATTERIES SELECTION .....	13
5. MARKING .....	13
6. PACKAGING .....	13
7. SAFETY REQUIREMENT .....	13
8. OPERATING INSTRUCTIONS .....	13
9. SERVICE .....	14
10. STORAGE .....	15
11. TRANSPORT .....	15
12. PRODUCT WARRANTY .....	15
13. RECYCLING INFORMATION .....	15

This user manual is designed to acquaint maintenance personnel with the DLT-01(-02) Data Logger and its variations, including the DLT-01-Pt (hereinafter Data Logger). It provides information about the device's design, specifications, components, and includes instructions for its proper and safe operation, and guidelines for storage and transportation.

## 1. DESCRIPTION AND DEVICE OPERATION

### 1.1. Purpose

1.1.1. The Data Logger is designed for climate control and the logging of measurement results in various settings, including manufacturing and laboratory facilities, museums, warehouses, greenhouses, and during the transportation of perishable products and materials.

### 1.2. Specifications

1.2.1. Main specifications of Data Logger are shown in Table 1.

Table 1. Main Specifications of Data Logger.

Characteristic	Value
Voltage Supply, V (Li element CR2032)	3,0
Logging Interval, sec	60...3600
Interface for PC Connecting	USB 2.0
Activation and Operating Mode Indication	LED
Battery Life (in normal conditions, with logging interval more than 60 sec without indication), years	1
Electromagnetic environment, class <ul style="list-style-type: none"> <li>• for DLT-01, DLT-02 (without external sensor)</li> <li>• for DLT-01-Pt t (with external sensor)</li> </ul>	E2 E1
Protection Class	IP 54
Dimensions, max, mm	75,0x25,8x10,9
Weight, max, g	17

Table 1.1. Specifications of DLT-01 Data Logger.

Characteristic	Value
Temperature Range, °C	-20...+60
Basic Absolute Temperature Accuracy, °C	±0,5
Temperature Resolution, °C	0,1
Sensor Response Time (63%), min	12
Records in the Memory	48000

Table 1.2. Specifications of DLT-01-Pt Data Loggers.

Characteristic	Value
Temperature Range measured by Internal Sensor, °C	-20...+60
Basic Absolute Accuracy of temperature measurement by Internal Sensor, °C	±0,5
Temperature Resolution of Internal Sensor, °C	0,1
Response Time (63%) of Internal Sensor, min	12
Number of External Temperature Probes	1
Sensor Type of External Temperature Probes	Pt1000
Temperature Range measured by External Probe, °C	-50...+100 <sup>1</sup>
Probe connection cable length, m, max	2
Absolute Accuracy of temperature measurement by External Probe, °C	±0,4+0,002  t  <sup>2</sup>
Records in the Memory	32000

Table 1.3. Specifications of DLT-02 Data Logger.

Characteristic	Value
Humidity Measurement Range Rh, % (without condensation)	0...100
Temperature Range, °C	-20...+60
Basic Absolute Accuracy of temperature measurement by Internal Sensor, °C	±0,5
Temperature Resolution, °C	0,1
Basic Absolute Humidity Accuracy, %	
• in the range (0...10) %	±4
• in the range (10...90) %	±3
• in the range (90...100) %	±4
Humidity Resolution, %	0,1
Internal Sensor Response Time (63%), min	
• Humidity	15
• Temperature	12
Records in the Memory, no less	32000

1.2.2. Data Logger is intended for use in the following conditions:

- Ambient temperature from -20 °C до +60 °C.
- Atmospheric pressure from 84 to 107 kPa.
- Relative humidity (non-condensing) from 0 to 99 %.

### 1.3. Additional Specifications

Data logging mode: CYCLIC and TILL THE MEMORY FULL. Operating life duration, average – not less than 15000 hours.

<sup>1</sup> The operating range is determined by the design of external probe.

<sup>2</sup> In set with external Probe.

#### 1.4. Package

Data Logger .....	1 pc
Software .....	1 pc
Passport .....	1 copy
Consumer packaging .....	1 pc
External Temperature Probe <sup>1</sup> .....	1 pc

#### 1.5. Design and operating

1.5.1. Data Logger's design and dimensions are shown in Figure 1.

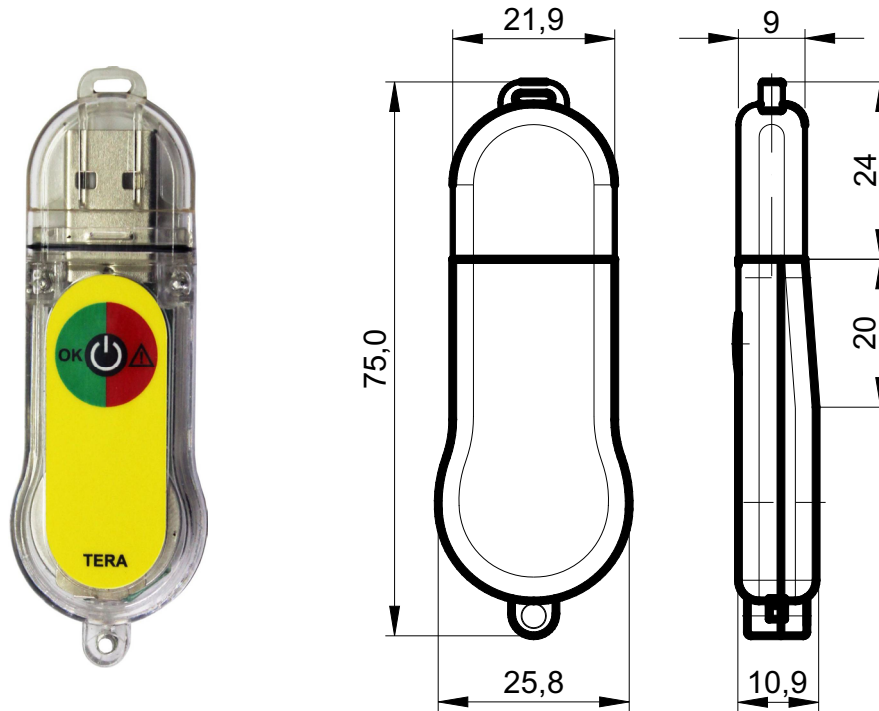


Figure 1. Data Logger's Design.

1.5.2. The Data Logger is offered in three different versions, each varying in the number of measurement channels. Modifications of the logger are shown in Table 2.

Table 2. Modifications of the Data Logger.

Modification	Internal Temperature Sensor	External Temperature Probe	Humidity Sensor
DLT-01	✓	✗	✗
DLT-01-Pt	✓	✓	✗
DLT-02	✓	✗	✓

<sup>3</sup> the selected type of the external temperature probe while ordering.

1.5.3. The Data Logger block diagram is shown in Figure 2.

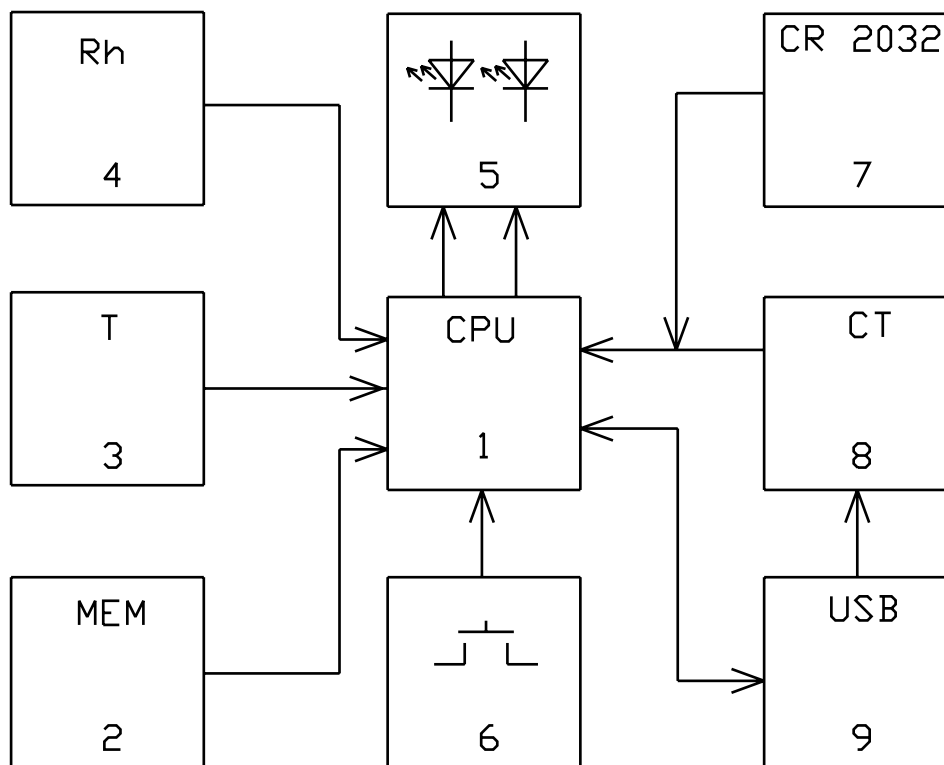


Figure 2. Data Logger block diagram.

1. Microprocessor.
2. Memory.
3. Temperature sensor.
4. Humidity sensor.
5. LEDs.
6. Pushbutton.
7. Voltage supply element CR 2032.
8. Voltage regulator.
9. USB port.

The heart of the logger is a microprocessor (1) responsible for controlling sensor power, collecting data from sensors, processing and logging temperature, humidity, and alarm information. It also indicates the operational or alarm status of the logger and facilitates data transfer to a PC through the USB port.

Temperature (3) and humidity (4) sensors have their own built-in controllers and communicate with the microprocessor via separate data buses. Depending on the model, an external Pt1000 type temperature sensor can be connected to the logger's USB port. The temperature range of this input is determined by the external sensor's measuring range and is configured along with the external temperature sensor.

During normal operation, the logger is powered by a CR2032 lithium battery (7). When connected to a PC for firmware updates or data retrieval, the logger automatically switches to power from the USB port (9) via a voltage stabilizer (8).

All electronic components, sensors, and the battery are housed in a durable, transparent plastic case. A removable cover protects the USB connector, and the case includes a flexible strap for hanging.

## 1.6. Control Functions and Indication

1.6.1. A single control button is used to manage the logger's modes. The set parameters and operation modes are displayed through two LEDs: one red and one green. The button's functionality is algorithmically tied to the displayed indicators.

1.6.2. The buttons serve the following functions of the logger:

- Calling up the indication during sleep.
- Switching the mode when connecting to the PC "FLASH drive - COM port".
- Logging START.
- Alarm ON/OFF.

Table 3 displays the button press sequences corresponding to the data logger functions listed above.

Table 3. Description of the algorithm for pressing the button and performing the functions of the logger.

Algorithm	Function description
Short button press (less than 1 sec)	Indication follows Table 5 or shifts to COM Port mode if the data logger is connected to the computer within 5 seconds after pressing and releasing the button
Double quick button press (with a pause between presses up to 0.5 sec)	Indication in accordance with the table 6. Low battery charge indication (Table 7)
Long button press (5 sec)	Logging Start (first press). Alarm ON/OFF (all subsequent pressing)

1.6.3. The LEDs on the logger indicate the following states of the data logger:

- Low battery charge.
- Data transfer to the PC (when the data logger is connected to the USB port).
- The data logger is in bootloader mode.
- Logging is turned off.
- Delay before logging starts.
- Logging has started.
- Logging with alarm statistics collection disabled.
- Logging during the alarm statistics collection delay.
- Logging and alarm statistics collection.
- Memory is full (logging is disabled).
- The logger's status based on alarm statistics.

**Low battery charge** is indicated when the remaining capacity falls below 5% of the initial capacity (under normal conditions). To trigger this indication, press the button twice in quick succession. The indication will appear immediately after the button is pressed, followed by a 1-second pause, and then the indication will follow the pattern outlined in table 6.

**Data transfer to the PC** ("Flash drive mode" and "The data logger is under bootloader control") only occurs when the data logger is connected to the USB port of a PC.

**Logging is turned off** indication is activated after a single short button push.

The **“Logging delay”** indication can occur in the following situations::

- After a delayed start of logging.
- After a short button push.

The **“Logging start”** indication occurs at the first moment of logging. Depending on the initial state of the alarms collection, it can be one of the following:

- Logging with disabled alarms statistics collection.
- Logging during alarm statistics collection delay.
- Logging and alarm statistics collection.

The **“Logging with disabled alarms statistics collection”** indication occurs in the following situations:

- When logging starts (or after logging delay) if the initial state of the alarms collection is “disabled.”
- When alarms are turned ON / OFF.
- After a short button push.

The **“Logging during alarm statistics collection delay”** indication occurs in the following situations:

- When logging starts (or after logging delay) if the initial state of the alarms collection is “disabled,” but the set alarm delay is non-zero.
- When alarms collection is turned ON with the set alarm delay being nonzero.
- After a short button push.

The **“Logging and alarm statistics collection”** indication occurs in the following situations:

- When logging starts (or after logging delay) if the initial state of the alarms collection is “enabled.”
- When alarms collection is turned ON.
- After a short button push.

The **“Memory full”** indication occurs in the following situations:

- At the moment when the memory is completely filled, leading to the cessation of logging.
- After a short button push.

The indication labeled as **“The result of the logger based on alarm statistics”** appears after two short button presses.

The LED signals corresponding to the logger’s state are detailed in Tables 4, 5, 6, and 7.

Table 4. Indication of Data Transfer to PC (when data logger is plugged into USB port).

Indication	Description
Continuous <b>green</b> LED light	Data logger is in Flash drive mode
Continuous <b>red</b> LED light	Data logger is in Com-port mode
<b>Red</b> and <b>green</b> LED flash alternately (flash duration 100 - 5000 ms without pauses)	Data logger is under the bootloader control. (Logging stopped)

Table 5. Indication after one short button push .

Indication	Description
<b>Green</b> LED flash (1 sec)	No alarms during logging
<b>Red</b> LED flash (1 sec)	Alarms during logging (measuring value is out of range)



Table 6. Indication after two short button push.

Indication	Description
Short flash of <b>red</b> and <b>green</b> LEDs at the same time (duration 100 ms)	Logging disabled
Short flash of <b>red</b> and <b>green</b> LEDs at the same time (duration 100 ms), then <b>green</b> LED flash (1 sec)	Logging delay (after logging start)
Short flash of <b>red</b> and <b>green</b> LEDs at the same time (duration 100 ms), then <b>red</b> LED flash (1 sec)	Memory full (Logging disabled)
<b>Green</b> LED flashes 3 times (flash and pause duration 200 ms)	Logging with disabled alarms statistics collection
<b>Green</b> LED flashes 3 times (flash and pause duration 200 ms), <b>red</b> LED is ON	Logging during alarm statistics collection delay
<b>Green</b> and <b>red</b> LEDs flash synchronously 3 times (flash and pause duration 200 ms)	Logging and alarm statistics collection

Table 7. Low battery charge indication.

Indication	Description
<b>Red</b> and <b>green</b> LED flash alternately 3 times (flash duration 200 ms without pauses)	Low battery charge

## 2. DATA LOGGER SETUP

The Data Logger is configured using the LoggerSoft PC software. Please refer to the User's Manual section on "Data Logger Setup" and "Data Logger Settings" for guidance. You can initiate the Data Logger setup either during the configuration process or by using the buttons on the device. Below, we highlight some additional features of the Data Logger setup that may not be explicitly mentioned in the LoggerSoft software or the User's Manual.

### 2.1. Logging Interval

The Data Logger setup allows for configuring valid logging intervals, which can range from 1 to 60 minutes. Here is a list of valid values for logging intervals: 1, 2, 3, 5, 10, 15, 20, 30, 60 (minutes).

### 2.3. Logging Modes

- **TILL THE MEMORY FULL:** logging starts from the moment it is launched and continues until the memory is completely filled. Once the memory is full, logging stops, and it can only be restarted after reconfiguration
- **CYCLIC:** the logger continuously records data, overwriting the oldest data with new data when the memory is full. This mode allows for continuous data recording without the need for manual intervention.

### 2.3. Options for starting Logging

- **AFTER SETTING:** Logging starts immediately after the Data Logger is set up, requiring no user intervention.
- **BY BUTTON:** Logging can be manually initiated by pressing a button on the Data Logger.
- **AT SPECIFIC TIME:** Logging can also be scheduled to start at a specific predetermined time. For the "After Setting" and "By Button" options, there is also the Delayed Start feature available.

**Note:** Before selecting an option to start logging, it is necessary to synchronize the time (LoggerSoft, User's Manual, Data Logger Setup, Time Synchronization). Please note that performing time synchronization will stop the current logging.

### 2.4. Delayed Start

There are two types of Delayed Start:

- **LOGGING DELAY:** This is the delay from the moment logging starts (see paragraph 2.3 Options for starting Logging) until the actual commencement of logging.
- **ALARM STATISTICS DELAY:** This is the delay after the alarm is activated by pressing the button before the actual commencement of alarm statistics collection

### 2.5. Alarm Processing

When data is being logged, the Data Logger operates in one of two states:

- **ALARM ON:** In this state, the Data Logger measures sensor readings, archives them, and maintains alarm statistics according to the settings.
- **ALARM OFF:** In this state, the Data Logger measures sensor readings, archives them, but does not maintain alarm statistics.

The initial state of the logger after logging starts is configured in the Data Logger Setup. Subsequently, you can toggle the alarm ON/OFF by pressing the button. Multiple toggles between ON and OFF during data collection (for various purposes) are possible.

### 2.6. Alarm Conditions

The Data Logger offers three types of alarm conditions:

- **DISABLED**
- **HIGH/LOW**
- **MULTILEVEL** (Only applicable to the internal temperature channel).

Please note that alarms can only be reset through reconfiguration.

## 2.7. Disable alarms

When alarms are disabled, alarm statistics are not collected.

## 2.8. High/Low Limits Alarm Settings

Under this condition, the High and Low limits, alarm delay, and method of recording trigger delay (for each violation or total for all violations) are set. If the sensor readings are within the specified limits or briefly go beyond the limit values, the alarm does not activate. However, if any of the limits is violated for a duration longer than the specified delay, the alarm is triggered.

## 2.9. Multilevel Value Scale

The scale of values is divided into six zones by five limits, numbered from top to bottom as Zones 1 to 6. Zone 4 represents acceptable values, while the other zones have the following characteristics:

- Alarm delay.
- Method of recording trigger delay (for each violation or total for all violations).
- Allowable number of limit violations.

Additionally, there is an "3 + 5" option, which combines zones 3 and 5, extending the permissible values to zones 3, 4, and 5. Zones 1, 2, and 6 can be disabled as needed.

## 2.10. Restrictions of Control Buttons

- **BUTTONS INACTIVE:** Only Flash Drive/COM Port mode switching and indication call are available.
- **START ONLY:** In addition to the functions in option 1, you can also start logging.
- **ONLY ONE USE:** All functions from option 2 are available, as well as the ability to turn the alarm ON/OFF. However, you can activate the alarm only once.
- **MULTIPLE USE:** Similar to option 3, you have access to all functions, including multiple ON/OFF cycles for the alarm.

### 3. BATTERY LIFE TIME

3.1. The lifespan of the logger depends on the CR2032 battery's lifespan. Several factors can reduce the battery's lifespan, including:

- Self-discharge of the battery.
- Battery discharge during logger operation.
- Operating temperature in the environment

3.2. Self-discharge and operational battery discharge, occurring within the allowable temperature range, lead to an irreversible reduction in the battery's capacity. By considering the average operating current, average self-discharge current of the battery, and the battery's operational duration, we can predict the remaining capacity of the battery or the time it will continue to operate under normal conditions until complete discharge.

A CR2032 battery is considered fully discharged when the voltage at its terminals, under the rated current load, drops to less than or equal to 2 volts. The ambient temperature plays a significant role in battery life. At low temperatures, there is a reversible increase in the battery's internal resistance, which affects its performance. Consequently, the battery's operational time at the rated load current is notably shorter at negative temperatures compared to normal conditions. This is because the supply voltage to the load drops to the minimum acceptable value earlier due to increased voltage loss caused by the battery's internal resistance. However, this reduction in capacity only consumes a small portion of the battery's total capacity.

If the battery is subsequently returned to normal conditions and allowed to reach the ambient temperature, the internal resistance of the battery will return to its nominal value, and the remaining capacity of the battery will be restored. At negative or low temperatures, it is possible to carry out N operating cycles, using the battery's capacity to its fullest extent before it is fully exhausted.

3.3. Table 8 provides estimates for the Data Logger's expected operational time at various temperatures, considering different logging intervals, and when equipped with a fresh RENATA battery.

Table 8. Estimation for battery lifespan.<sup>1</sup>

Nnn	T, °C	Operating time before battery replacement (archiving period)		
1	+20	~1 year (1 min)	~4 years (5 min)	~4,3 years (60 min)
2	+10	~200 days (1 min)	~1 year (5 min)	~1,3 year (60 min)
3	0	~60 days (1 min)	~260 days (5 min)	~285 days (60 min)
4	-10	~20 days (1 min)	~80 days (5 min)	~89 days (60 min)
5	-20	~6 days (1 min)	~25 days (5 min)	~27 days (60 min)

<sup>1</sup> **Note:** The estimated operational time of the logger is calculated based on the battery's self-discharge current, assuming that the logger is stored for 25% of the year at an ambient temperature above 25 °C (during the summer period). For more detailed information, please refer to LoggerSoft, User's Manual, Data Logger Setup, Changing Logging Interval.

#### 4. RECOMMENDATIONS FOR THE CR 2032 BATTERIES SELECTION

The information provided in this manual is specific to CR 2032 batteries manufactured by RENATA. Please note that CR 2032 batteries from different manufacturers may have varying characteristics, including initial battery capacity and discharge curves at low temperatures. Table 9 illustrates factors that can be used to estimate the reduction in continuous operation time for CR 2032 batteries from several well-known manufacturers.

Table 9. Battery lifespan correction factors.

Nnn	Manufacturer	Factor
1	RENATA	1
2	VARTA	0,85
3	PANASONIC	0,7
4	DURACELL	0,7
5	Unknown	0,5

Using batteries with a correction factor of less than 0.6 is strongly discouraged and not recommended.

#### 5. MARKING

The Data Logger housing features the following markings:

- Manufacturer's trademark.
- Symbol.
- Serial number (can be stored in internal memory).
- Date of manufacture: year, month (can be stored in internal memory).
- QR code.

#### 6. PACKAGING

The Data Logger is packaged in consumer packaging.

#### 7. SAFETY REQUIREMENT

7.1. Avoid exposing the internal electronic and radio components of the logger to moisture.

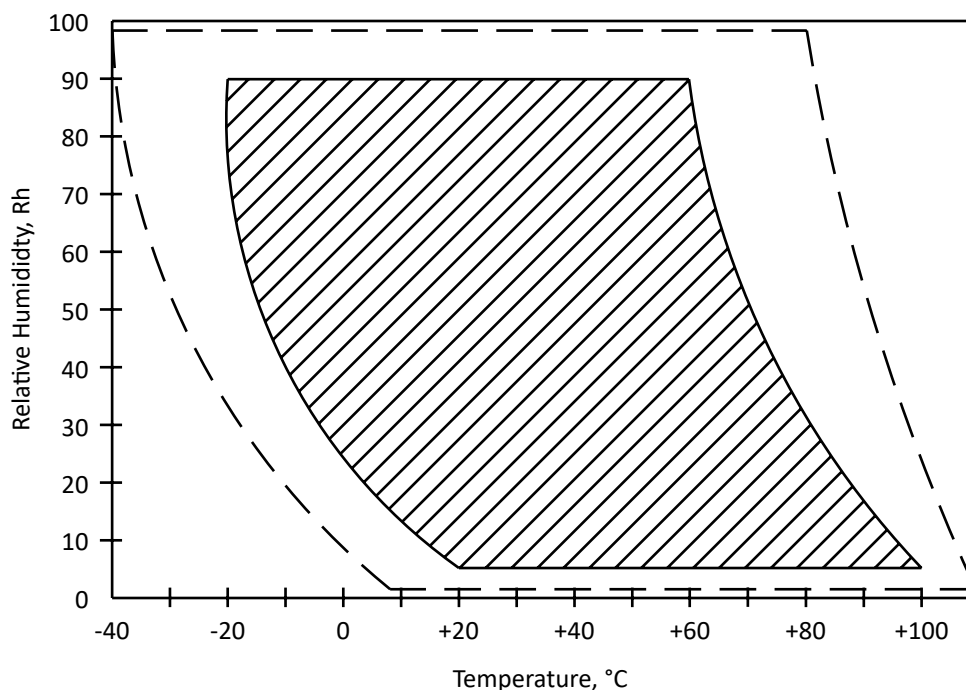
7.2. Do not use the device in a corrosive environment with acids, alkalis, oils, etc., present in the atmosphere.

7.3. Operation and maintenance of the logger should only be performed by qualified personnel who have thoroughly read this manual.

#### 8. OPERATING INSTRUCTIONS

8.1. Before operating, connect the Data Logger to the PC in "COM Port" mode and configure the logger using the Logger Soft software.

8.2. Figure 3 displays the operating range for Data Loggers with a Humidity Sensor.



*Figure 3. Operating range for Data Logger.*

The shaded area represents the recommended operating range of the Data Logger for measuring the Relative Humidity of ambient air, while the dotted area indicates the maximum permissible operating range for measuring relative humidity of ambient air.

If the Data Logger operates outside of the permissible range, errors may increase, and in the worst case scenario, the humidity sensor may fail (as shown on the right side of the picture).

8.3. In the modifications of loggers with a humidity measuring channel, the humidity sensor is protected by a filter that prevents direct water ingress or condensation on the sensitive element. If water still manages to reach the sensitive element, or if the logger has been operated for an extended period (several days) at 100% humidity, it is necessary to dehydrate the sensor. To do this, place the logger in an air environment with a temperature of 20 to 30 °C and humidity not exceeding 55%, and leave it for at least 24 hours.

## **9. SERVICE**

9.1. The device should undergo servicing at least once every three months.

9.2. During maintenance, remove any dust and dirt, inspect the quality of external connections, and check the device's operation.

9.3. If necessary, replace the battery. To do this, follow these steps:

- Remove the cover from the connector.
- Carefully loosen the three screws securing the logger covers to each other and separate them.
- Gently shift and remove the used battery.
- Install a new battery in its place, taking care not to use force.
- Place the board back in the logger case and tighten the screws.

## **10. STORAGE**

10.1. Store the Data Logger in closed, well-heated rooms, inside the consumer packaging, within a temperature range of 0 to 40°C. Maintain a relative humidity of maximum 80% at a temperature of 15°C or a relative humidity of maximum 98% at 25°C.

10.2. Ensure that the air is free from dust, acidic and alkaline vapors, as well as corrosive gases.

10.3. When starting to use the Data Logger after it has been stored at low temperatures (for at least one month), follow these steps:

- Place it in a heated room with an ambient temperature of +20°C inside the packaging for at least one hour.
- After unpacking, allow it to sit for at least one hour to naturally remove any possible condensation.

## **11. TRANSPORT**

11.1. When transporting the Data Logger inside its packaging, it is permissible to transport it at temperatures ranging from -20°C to 60°C, with a relative humidity of less than 98% at 35°C.

11.2. Transport the Data Logger in its original packaging using all types of covered vehicles, following the applicable shipping regulations for this type of transport.

11.3. Ensure that the logger is transported only in the manufacturer's designated shipping container.

## **12. PRODUCT WARRANTY**

12.1. The manufacturer guarantees that the Data Logger complies with all technical requirements when operated, transported, and stored following the specified guidelines.

12.2. The warranty period is 18 months from the date of sale, or in the absence of sales data, from the date of issue. Please note that the warranty does not cover the CR 2032 battery.

12.3. The average warranty period for storing a logger with a battery is 2 months from the date of issue. If the logger is stored for a longer period, the battery must be removed and reinstalled when the logger is put into operation.

12.4. If the Data Logger experiences a failure during the warranty period while being used in accordance with the prescribed guidelines for operation, transportation, and storage, the manufacturer is obligated to provide free repair or replacement.

12.5. The warranty does not cover logger failures resulting from improper operation or mechanical damage.

12.6. The Data Logger has a lifespan of 15 years from the date of manufacture or sale. This lifespan can be extended based on the results of tests, verifications, or calibrations.

## **13. RECYCLING INFORMATION**

When the Data Logger reaches the end of its operational life, it must be disposed of in accordance with established hygiene requirements for handling industrial waste and determining their safety classification for public health.