INSTRUCTIONS FOR THERMAL

& HUMIDITY DATA LOGGERS

Who is LEDRAYS INC?

LEDRAYS is an engineering & manufacturing corporation using advanced processes, techniques and materials to deliver high grade SSL lighting solutions in the industrial, harsh/extreme environment and Hazardous location markets. For example, LEDRAYS has engineered high temperature LED fixtures which can safely operate at an incredible 112°C (233°F) and has created subsea LED luminaires with over 240,000lm output in a package that can comfortably withstand 6,100m (20,000ft) immersion in sea water.

Why do we need to collect data?

LED lighting promises energy savings to meet energy conservation guidelines, better and more controlled illumination, reduction of maintenance expenditures, longevity and smaller form factors. However the overwhelming majority of LED lighting fixtures are designed for normal ambient operating conditions.

Electronics which are not specifically designed for harsh or extreme environments will suffer an early demise based on reaching operational limits for any extended durations. Harsh & extreme environments can include but are not limited to: extreme or high temperatures, high air or water pressure, quantity, type & density of particulate matter, contaminated power delivery, vibration/shock on any or all axis, corrosive substances, exposure to radiation or damaging chemicals, un-damped resonances, etc...

Additionally having multiple combinations of any extreme operational parameter will increase failure modes. Having a clear understanding of the environment thus is necessary to properly design and manufacture industrial LED fixtures capable of hostile operation.

Generally high temperature environments present specific and complex challenges that make it difficult or impossible for electronics to survive. High operating temperatures with the addition of high humidity levels give rise to complex failure modes.

- For solid state lighting (SSL), there exists an inverse relationship between high reliability and lifetime and increased drive current and or operating temperature. Thus understanding the exact nature of the high operating ambient temperature is essential to achieving acceptable robustness and lumen depreciation levels over the product lifetime. Identifying temperature peaks, dips and trends and their location within the operational environment is necessary and part of the due diligence requirement to meet expected overall product performance. By establishing an average temperature where LED luminaires will be operating, engineers can better define the effect high temperatures and or humidity will have on the LED luminaire.

LEDRAYS considers HARSH temperature environments any operation above 45°C (113°F) & below 60°C (140°F).

SEVERE temperature environment is any operation at or above 60°C (140°F) but below 85°C (185°F).

EXTREME temperature environment is any operation at or above 85°C (185°F).

Current "industrial" designs that are intended for higher then 25°C (77°F) ambient temperature applications tend to demonstrate unacceptable failure rates when exposed to elevated temperature environments for any

prolonged use. By having a clear understanding of the expected operating environment LEDRAYS engineers can deliver a perfectly matched LED fixture that is very well suited to the actual ambient temperature.

By the use of special techniques, advanced materials and processes LEDRAYS can provide a long lasting solution with high reliability and no surprises. Data logging allows the engineering and manufacturing of the best designs with the best warranties at the lowest acquisition costs.

Where do you collect data?

Air temperature and humidity data is gathered in the area where the new LED luminaires are intended to operate in a worst case operating scenario. Data loggers should be placed at the same location where the new LED luminaires are expected to operate. Any machinery, equipment or process that generates heat should be fully functional during the active data logger measurement period.

Height and position should be as close as possible to final fixture location however data loggers should not be placed on existing LED or legacy gaseous fixtures such as metal halide or sodium.

How do you collect data?

Typically LEDRAYS will provide the end user with a data logger kit. The kit will include small (less than 5" in length) USB pen type loggers. Data loggers function independently having built in sensors, lithium metal batteries a microprocessor and internal memory. Some loggers are equipped with LCD displays (displays are usually disabled to prolong battery life). The loggers are available in various configurations to accommodate the anticipated environment. K, J or T type external thermocouple loggers are used for extreme temperature operation.

The collected data will be evaluated and shared with the agent/end user and will be used to determine the longest possible warranty period and other important functions and parameters affecting the final design and drive current of the proposed luminaire.

Do I have to activate or program the data loggers?

No, loggers are shipped preprogrammed and require no user activation (unless explicitly stated).

Pushing any of the switches will not alter the preprogrammed settings. The LCD display may briefly illuminate on models having that option. Data loggers are usually preset to start at a future time/date to take into account transit time to the agent/end user. Additionally the data loggers are also preset to log at specific intervals which can range from every five seconds to days based on activity levels and type of plant operations.

What is the duration of measurements?

Typically data logging for 1-2weeks (10-14 operational days) will suffice to acquire good information on the operating environment. Short duration logging (5-60sec. intervals) promotes acquiring shorter thermal peaks and dips at the expense of total log capability. Longer duration logging (1min.- to 12 hrs intervals) is more suitable to detecting periodic activity and trends while somewhat scarifying granularity within the thermal data. Should a duality of such conditions exist, twin loggers can be programmed with each logger dedicated to the required interval span.

Instructions will be emailed once the data loggers ship out regarding the preprogrammed parameters.
Units are shipped with fresh lithium batteries that are capable of logging over a year of measurements.

How many loggers do I need?

Pre-engineering evaluation will determine the quantity of data loggers required. Depending on the environment and for best results we recommend a logger for the areas that will be subject to the highest temperatures. This is usually 2-3 areas each with a single logger. Certain large area applications may require a higher data logger counts to properly represent the expected maximum temperature within the entire location.

What do I have to do?

Unpack the loggers, and locate them as pre agreed at the worst case locations. Worst case locations are the areas that will sustain the highest temperatures for the longest durations.

A floor plan is useful in determining and indicating where loggers are placed. The person assigned to placing the data loggers must provide the following reference:

- ✓ **Start Date/Time**
- ✓ **End Date/Time**
- ✓ **Time Zone** (If different then ET)
- ✓ **Location of data logger serial numbers on floor plan**

This information will allow the LEDRAYS engineering team to evaluate and allocate only the data applicable to the operating environment.

How to attach loggers?

Depending of the type of loggers either a magnetic clip, silicone strap or pivoting quick release bracket will be included. High temperature Aluminum tape typically used for ventilation will also work as long as it is not used on either end of the logger to fasten it to a structure. Kapton® high temp polyimide film tape (Dupont™) is also suitable. Tapes cannot be used on the clear plastic cap, the display section, the status switch or indicator LED or over any housing vents.

Recommended Mounting Methods:

1. **Heat Resistant Silicone Strap**
2. **Magnetic Mount**
3. **Pivoting Quick Release Bracket**
4. **3M® type 431 Aluminum Foil Tape for Temperatures -54°C to 149°C (-65°F to 300°F)**
5. **3M® type 433 Aluminum Foil Tape for Temperatures -54°C to over 316°C (-65°F to over 600°F)**
6. **Kapton® High Temp Polyimide Film Tape (Dupont™) -269°C to over 260°C (-452°F to over 500°F)**

Heat resistant silicone straps are suitable for operation within the same temperature range as the thermal data loggers.

For magnetic mounts, horizontal mounting is preferred as a general rule.
Magnetic mounts can be used in vertical positions if no slippage, shock, vibration/resonance conditions exists.

Regardless of the mounting method employed, loggers should be secured in a fashion that prevents slippage, shock, vibration/resonance and not in direct contact with fire, source of heat such as heaters or exposed to sunlight. Additionally data loggers should not be subject to any type of pressure on the body of the device.

Plastic caps covering displays & indicator LED must remain on loggers. Do not mount loggers to piping, machinery or containers which contain liquids or gases or semi solid material that are at a different temperature then the measured air environment.

High temperature thermal loggers if stated on your kit will function in extreme temperatures with the included thermocouple probes. Please note only the thermocouple probe is suitable for severe and extreme temperatures. Actual logger microprocessor housing must be shielded from direct sources of heat for proper functioning.
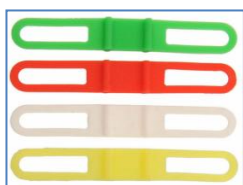
SILICONE STRAPS

MAGNETIC MOUNT

MAGNETIC MOUNTING

3M® TYPE 431 OR 433

KAPTON® TAPE

⚠ DO NOT COVER VENT OPENINGS LOCATED AT THE END OF LOGGER

USERS MUST VERIFY THAT DATA LOGGERS ARE PROPERLY SECURED!

What precautions should I apply?
Data loggers are sensitive electronic devices with sensors, lithium metal batteries and with a microprocessor and memory. Treat it as you would a cellular phone. Do not drop or expose to shock, plastic protective caps must remain on, do not expose to liquids, do not clean with solvents or any cleaning product, do not open, do not plug USB section into PC, do not expose to open flames, do not twist/bend body of data logger. For data loggers with external thermocouple sensors do not place sensor cable under tension, do not expose to extreme magnetic fields and keep pointed tips secured until ready to use.

The humidity measuring element in the humidity data loggers can be contaminated through exposure to a variety of compounds. These products should not be kept in proximity to volatile chemicals such as solvents and other organic compounds. Generally speaking, if a material or compound emits a strong odor you should not keep the humidity data logger in close proximity to it. Additionally loggers must not be pressured washed or exposed to liquids, use of any cleaning product is not recommended.

Keep away from vibration and anywhere loggers could be damaged by machinery or equipment within the environment. There are no user serviceable parts in the data loggers.

Batteries:

Caution: Data loggers contains a single 3.6V ½AA lithium metal battery please follow all safety advice relating to lithium batteries. For important information please read the links below:

https://na.industrial.panasonic.com/sites/default/pidsa/files/downloads/files/panasonic_precautions_and_safety_notes_for_li-ion_batteries.pdf

http://sites.ieee.org/pes-essb/files/2016/06/2015-WM-PN-A-Guide-to-Lithium-ion-safety-Jim-McDowall.pdf

What is the temperature & humidity range of the data loggers?
For over 90% of applications type 1 or type 2 loggers will be suitable.
Please refer to the table below for Type 1 & 2 data logger range based on temperature & humidity variables.
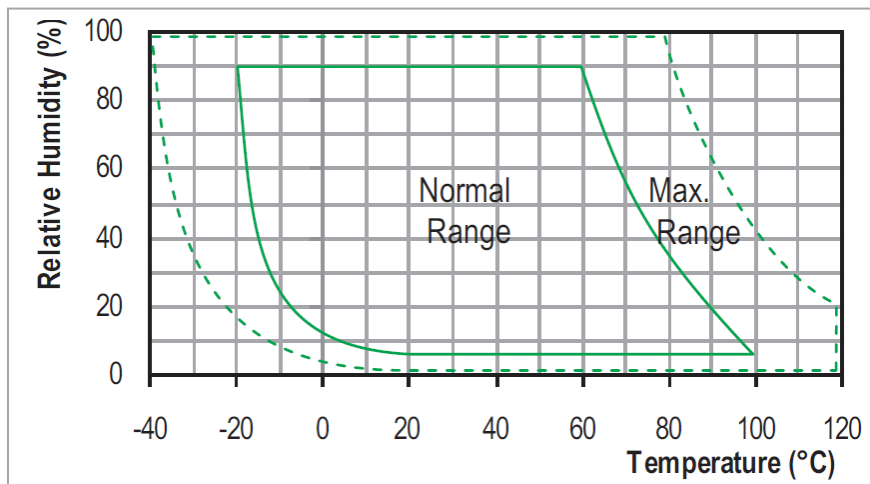
Type 3 data loggers are extreme temperature loggers and employ external sensors and will operate from –200 to 1350°C (–328 to 2462°F) with a K, J or T type sensor.

Data logger types:

Logger	Accuracy	Temperature Range	Humidity Range	LCD Display	Units Series	Dot Color	Total Readings	Temperature & Humidity Sensors	Sensor Types	Battery Type	Battery Life*
Type 1	Very High Accuracy (VHA) ±0.3ºC (±0.6ºF) ±2.0%RH	-35 to +90°C (-31 to +194°F)	0 to 100%RH With Dew Point	YES Multi Function	001 002	White Blue	16,000	Internal	Precision	3.6V ½ AA Lithium Metal	1 Year
Type 2	High Accuracy (HA) ±0.5ºC (±1ºF) ±3.0%RH	-35 to +80°C (-31 to +176°F)	0 to 100%RH With Dew Point	YES Multi Function	003 004	Green Brown	16,000	Internal	Precision	3.6V ½ AA Lithium Metal	1 Year
Type 3	Very High Range (VHR) ±1ºC (±2ºF)	−200 to 1350ºC (−328 to 2462ºF)	NO	NO	005 006	Red Yellow	32,510	Temperature External only	Precision K, J or T	3.6V ½ AA Lithium Metal	6 Months

*Depending on logging rate, ambient temperature, and use of alarm LEDs.

The LCD display is showing something, what does it mean?

Please refer to LCD status indications below:

Display	Logger Status
d5	Delayed Start
P5	Push to Start
lo9	Logging
- - -	Stopped

How do I know the logger is active?

Type 1, 2 & 3 data loggers feature two green/red LEDs, one to represent temperature measurement and the other to represent humidity measurement. Each is clearly marked on the logger. To save power, the status indication alternates between the two channels every 10 seconds. First you will see the status of the temperature channel and 10 seconds later you will see the status of the RH channel and so on. A flashing LED every 10 seconds confirms the logger is actively recording measurements.

LED display indicators:
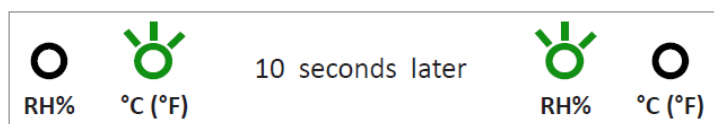
The LEDs are active but flashing a sequence, why?

The internal processor is indicating a specific operating state. Unless the loggers do not flash at all or indicate a dual red flash (for type 1 & 2 data loggers) or single orange (for type 3 data loggers) every 60 seconds as shown below next to the 2 arrows all other LED indications are acceptable.

For Type 1 & 2 data loggers please refer to table below:

	Green double flash The data logger is not currently logging, but is primed to start at a later date and time (delayed start)
	Green single flash The data logger is currently logging. No alarm on the channel
	Red single flash The data logger is currently logging. Low alarm on the channel
	Red double flash The data logger is currently logging. High alarm on the channel
	Green triple flash The data logger is full and has stopped logging. No alarm on the channel
	Red triple flash The data logger is full and has stopped logging. Alarm (high, low or both) on the channel
	No LEDs flash The data logger is stopped, the battery is empty or there is no battery
	Dual Red flash (every 60 seconds) The data logger battery is running low as it's voltage has dropped below 2.9V
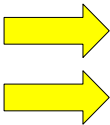
For Type 3 data loggers please refer to table below:

Green double flash
 Delayed start

Red double flash
 High alarm

Orange double/single flash
 Memory full

Green single flash   Logging, no alarm

Red single flash
 Low alarm

Orange single flash every 60 sec
 Low battery

No LEDs flash
 Logger stopped or battery empty
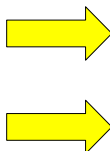
What responsibility does the agent/end user have?

The end user typically operates the space. Thus the end user must be diligent by helping to acquire accurate information which reflects the actual operating environment. This is crucial to meet expectations of a product that has both a long life and high levels of reliability.

Additionally loggers are shipped from LEDRAYS INC warehouse either in the USA or Canada with freight prepaid and must be returned at agent's or customer's expense on agreed due date using the equivalent or better ship method including insurance to the same location as shipped from, unless otherwise stated. Individual requesting data logger(s) assumes full responsibility once LEDRAYS INC. hands over to initial carrier. This includes the data loggers, sensors, accessories and shipping containers.

Data loggers must be returned in the same condition as received less normal wear and tear. All accessories, hardware and packaging must be present for the return to be accepted.

IMPORTANT: LEDRAYS reserve the right to reject and invoice agent or customer for data loggers, sensors, accessories and shipping containers which have been damaged, inappropriately installed, show signs of abuse, are past due date or are shipped incomplete.

Where do I ship back the data logger kit?

Data loggers, accessories (such as magnetic clips, silicone bands, quick release assemblies etc…), sensors and transport cases must be returned to:

LEDRAYS INC CANADA
C/o ENGINEERING LAB
125 Gagnon, Suite 200
St Laurent, QC
Canada, H4N 1T1
888.533.5227

Who do I call if I have a technical question?

Please call **888.LEDLABS (888.533.5227)** and ask for engineering.

You can also send a request to: info@ledrays.com

USA Sales & Operation

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