Product: Data Point

Description: Long Range Wireless Sensor

Revision History

Revision	Date	Reason	Edited By
A	16/03/23	Created	Lee Fleck
B1	29/09/23	Push button ergonomics simplified	Lee Fleck

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1. Specifications

Storage and Use	-40°C to + 60°C 0 -100 %RH
Lifetime	MTBF 10 years (Mean Time Between Failure)
Size	92mm (High) x 58mm (Width) x 25mm (Depth)
Weight	77 grams
Measurement Range	-40°C to + 60°C [internal] -273°C to +999°C [external] 0 -100 %RH
Response Time $t_{63\%}$	Internal Thermistor Sensor 15 seconds Internal Digital Temperature/Humidity 6 seconds External thermocouple 5 seconds
Typical Accuracy **See [1] below**	Internal Thermistor Sensor +/- 0.3°C Internal Temperature/Humidity +/- 0.2°C ; +/- 1.8%RH External thermocouple +/- 0.5°C [-20°C to + 120°C]
Resolution	Internal Thermistor Sensor +/- 0.1°C Internal Temperature/Humidity +/- 0.1°C ; +/- 0.1%RH External thermocouple +/- 0.1°C
Light Detection threshold	Default setting 25 LUX [Typical Office Lighting is 500 LUX]
Check Interval	Settable from 1 minute to 24 hours
Recording Interval	Settable from 1 minute to 24 hours
Record Capacity	34,000 (individually time stamped)
Battery Lifetime **See [2] below**	4 years
Dust and Water Ingression	IP66 (IP55 for Humidity version)

Note [1] Final accuracies will depend on the calibration process used. Values shown are typical for out of the box un calibrated.

Note [2] Depends on intensity of use. Values are given for 2AHr battery capacity with a 5 minute CHECK interval, a 30 minute LOG interval, a 60 minute transmission interval and 2 manual push button reads per day.

2. Features and accessories

The Data Point is a temperature and humidity wireless sensor packaged for industrial use. It is housed in an injection molded case and comes with a wall mounting bracket. It is sealed to IP66 for use in aggressive environments from -40°C to +65°C.

The Data Point has been ergonomically designed so that an unskilled person can install, use and maintain the device.

Features

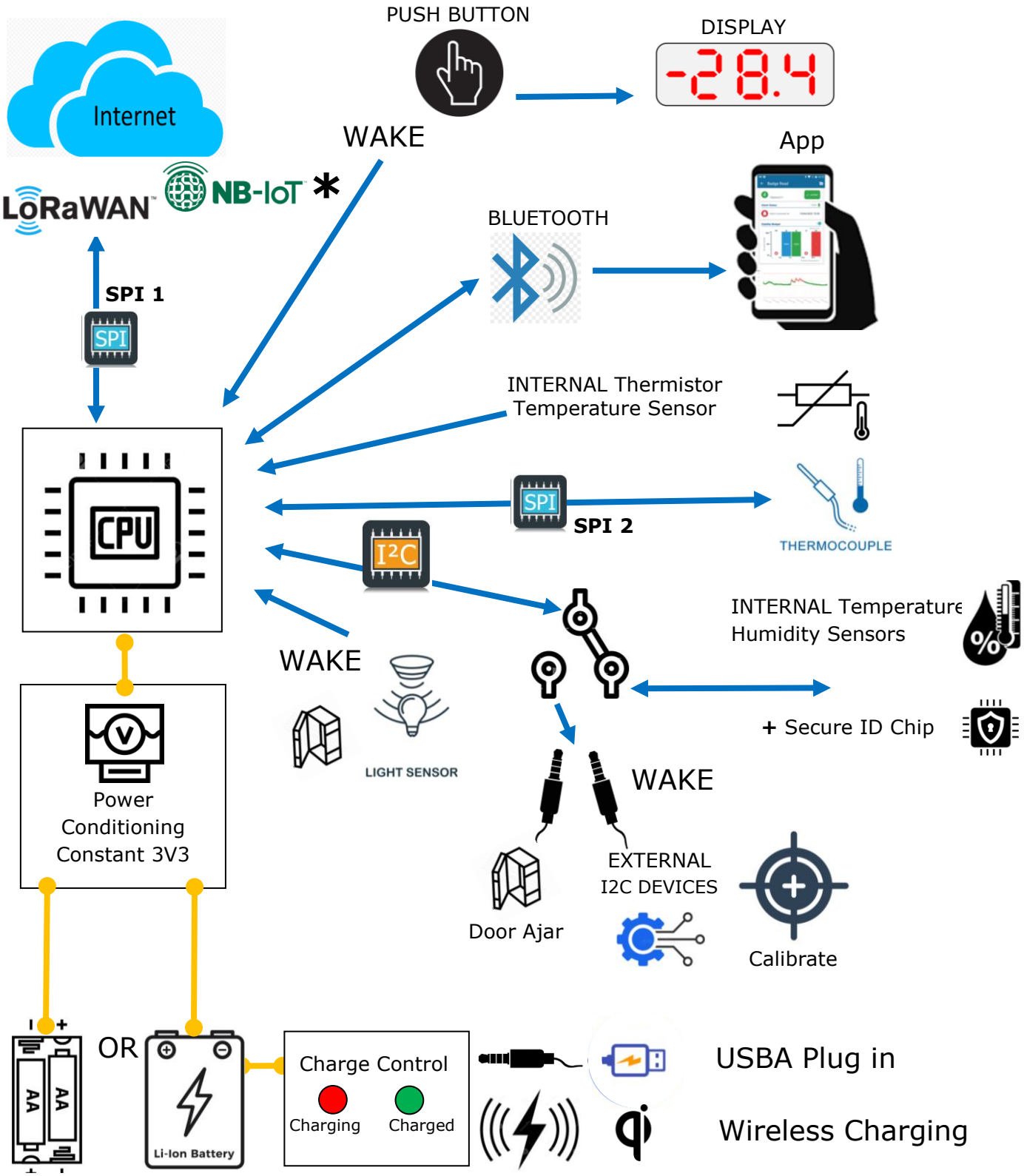
- Three digit LED display [readable at all temperatures and light levels]
- Push Button to check in and read temperature
- Short Range Bluetooth LE radio and a smart phone App.
- Data Logging with measurements recorded and stored at periodic intervals
- Long Range LoRaWAN (NB-IOT*) radio with a web GUI. Connections to public (Actility) or private (installed on site) internet gateways.
- Optic sensor to monitor door and package openings.
- Powered by 2 x AA standard batteries
  (can be disposed of in general waste).

Plug in Accessories

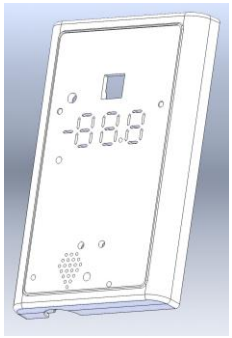
- External Temperature and Humidity Sensor (I^2C)
- External Type K or T Thermocouple probe (-273°C to +999°C)
- Door Ajar magnetic reed switch. (for wired door switches)
- LiPOL rechargeable battery.
- External high gain antenna
- Calibration dongle.
- Alarm Beacon. (Availability TBA)
- Infra Red Temperature probe (Availability TBA)

(*in development)

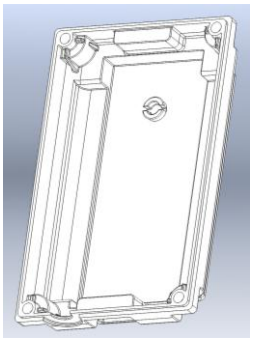
3. Block Diagram



4. Enclosure



FRONT



REAR

BRACKET

Sealing plug for jack

The injection moulded cases are manufactured in Medical Grade ABS plastic (with anti bacterial additive). (MAGNUM ABS 8391) which complies with U.S.FDA FCN 1525. The colour is - RAL7035 - Light Grey.

The front of the Data Point is sealed with a membrane keypad which integrates the push button. The 3.5mm jack is sealed with a removable rubber bung.

5. Sensors

1) Internal Thermistor Sensor

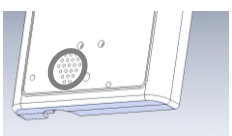
The most common application is temperature monitoring only. A thermistor sensor is fitted on all Data Points. This sensor is pre calibrated with a 128 point LUT (look up table) giving it an out of box reproducible accuracy of +/- 0.3°C from -30°C to +50°C.

2) Internal Temperature and Humidity Sensor

For applications requiring Humidity, a Sensirion digital sensor is fitted

SHT43-Digital humidity sensor with ISO17025 certification (sensirion.com)

A protective filter cap clips over the sensor on the internal PCB. [SF2] Humidity sensing requires direct air exposure to the environment. A 10mm circular hole is punched into the front membrane keypad to reveal a grid of vent holes.



3) External Sensor Options (These do not reduce the IP rating)

In applications where the Data Point is mounted outside the monitoring volume, then external flying lead sensors are available. The Data Point is typically wall mounted and the push button is used for recording check point actions and displaying the current sensor values.

A 4 pole 3.5mm jack socket is available to power and connect either a standard door ajar switch or an external I^2C sensor.

An IEC mini thermocouple socket is available

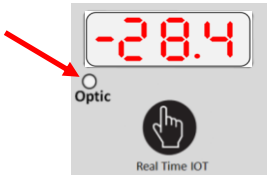
Type K
Thermocouple Socket

Colour coding is Green for Type K and Brown for Type T.

Typically, Type K is for the Food Industry and Type T for Cryogenics.

4) Optic Sensor

A window at the bottom left of the display is used for light detection. When enabled, the Data Point records light events. Convenient as a door ajar switch for storage areas such as closed refrigeration cabinets.



The light detection threshold is 25 LUX. [EN 12464 standard for office work is 500 LUX]
When a light event occurs, the Data Point display will momentarily show OPEN or CLOSED.

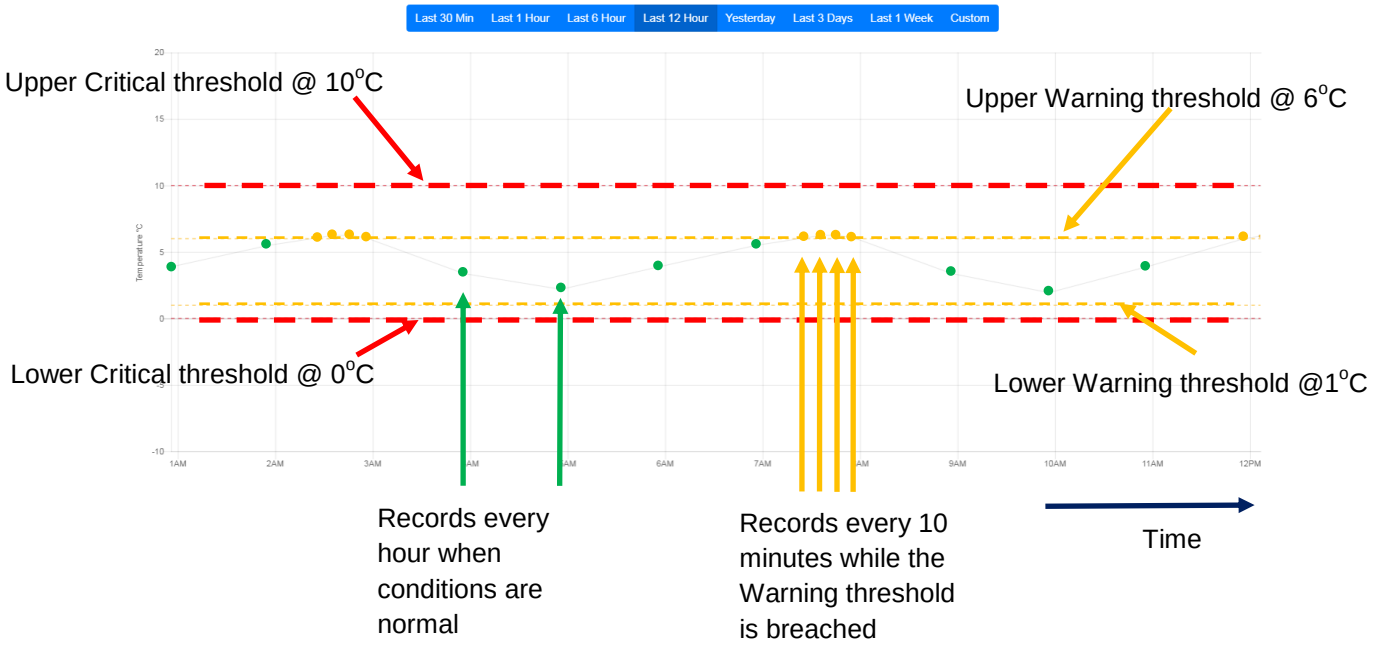
6. Modes of Operation

1) RUN Mode [ACTIVE]

This is the deployment mode where the Data Point spends most of its time in low power sleep mode. Periodically, the Data Point wakes to **CHECK** its sensor values against preset alarm limits. Should any value be outside these limits, a log record will be created and the Data Point will immediately transmit an alert. This **exception reporting feature** guarantees that the temperature has been intensively monitoring without undue battery or memory use.

At a separate interval, the Data Point wakes and **LOG**s its sensor values into local memory.

The exception reporting feature is shown in a sample data log below:



The above is color coded with Normal in **GREEN**, Warning in **AMBER** and Critical in **RED**.

At another interval, the Data Point makes a LoRaWAN type A transmission containing the above LOG records. It then listens for a response. It then either makes a further transmission or returns to low power sleep mode.

The Data Point can also be woken at any time by a number of interrupts:

a) The push button is pressed.

b) An optic event occurs.

c) A wired door ajar event occurs.

d) An external device is plugged in.

2) BLUETOOTH Mode [ACTIVE]

In this mode, the Bluetooth module is ON and advertising to solicit connections from a local device. The QR code on the front label of the Data Point provides an easy means to install the Bluetooth App and connect to the Data Point.

The Bluetooth App provides access to all Data Point settings and with the correct permissions a user may customize the settings.

Bluetooth is also used to flush log records, update the firmware and control calibration.

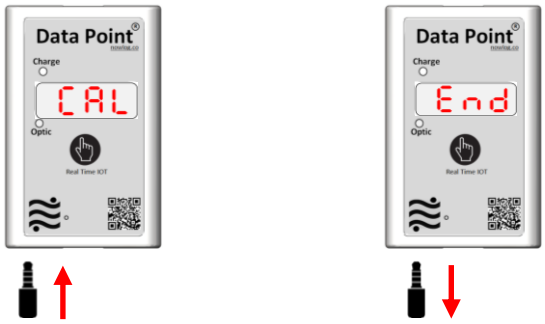
Fail Safe - Note that if a Bluetooth connection is terminated or never made then after a short **timeout**, the Data Point automatically returns to **RUN** mode.

3) OFF Mode [INACTIVE]

In this mode, everything is **OFF** except the push button. The shelf life in OFF mode is 8 -10 years depending on battery type.

In this mode, **a shipping lock** can be applied by pressing the push button 20 times. When the shipping lock is ON, a power cycle reboot caused by temporary battery disconnection during transport **cannot** cause the Data Point to **activate**.

4) CALIBRATION Mode [ACTIVE]



The calibration dongle contains an I^2C sensor and a memory device. The memory device holds calibration certificate information for the dongle as well as parameters controlling the calibration. When a calibration dongle is plugged in, Data Point automatically enters calibration mode. The Data Point follows instructions read from the dongle and performs a custom calibration procedure accordingly. When equilibration of both the Data Point and dongle sensors has been reached, a calibration point is acquired by the Data Point. The system allows up to 10 calibration points to be acquired.

The Data Point uploads the calibration data to an internet database and renews its digital certificate.

This automated procedure can be easily performed by an end user. This removes the cost of returning devices for annual recalibration. A single dongle can calibrate multiple site Data Points

NOTEs

Fail Safe - the calibration procedure has a timeout and any Data Point automatically returns to RUN mode even if the dongle is left in place.

5) PUSH BUTTON mode [ACTIVE and INACTIVE]

A push button on the front of the Data Point activates the display and is used to read the sensors, check wireless connections and switch between modes. The push button has a "click and pause" interface. Each button press increments the click count shown on the display. When button presses stop, the Data Point acts on the click count as described below.

In RUN mode:

Click count = **1**. READ, CHECK IN or BLUETOOTH connect. The display shows the temperature (e.g. **-20C** or **– 4F**), the humidity (e.g. **H77**) and the battery voltage (e.g. **2.7**). If enabled in settings, a time stamped log record is also written. This is used when a log of operator **check point** actions is required. The Bluetooth module is enabled and advertising for connections.

Click count = **2**. TEST WIRELESS CONNECTION. The display shows **SEn** to indicate a transmission and the **signal strength** returned is indicated as a %age (from 0-100) (e.g. **45%**)**.** If there is no reply from the network, the display shows **nOC**. (no connection).

Click count = **10** (or greater). HIBERNATE. The mode is toggled to **OFF** and the display shows **OFF**.

In OFF mode:

Click count = **10 - 20**. TOGGLE into RUN mode. The mode is toggled into **RUN** and the display shows **run**. Click count = **1 -10**. The display shows **OFF** and the Data Point remains in hibernation.

Click count = **20** (or greater). TOGGLE into LOCK mode. The **shipping lock** is applied and the display shows **LOC**. When in LOCK mode then for click counts from **1-20** button presses, the Data Point remains locked. When the click count is **20** (or greater), the Data Point is unlocked and the display shows **OFF**.

In **CALIBRATION mode**:

The push button is inactive.

7. Components and Certifications

1) The CPU uses an STM32L series microcontroller from ST Micro

2) The LoRaWAN radio is a pre certified module based on a Semtech SX1276

https://www.semtech.com/products/wireless-rf/lora-connect/sx1276

The CE, FCC, Canadian and Japanese certificates are available on request.

3) The NB-IOT modem is in development

4) The Bluetooth radio is a pre certified module based on a Nordic® Semiconductor nRF52810 solution.

https://www.nordicsemi.com/products/nrf52810

The CE, FCC, Canadian and Japanese certificates are available on request.

5) Batteries

DISPOSABLE

Two AA batteries may be used to power the Data Point. The Data Point has power conditioning which guarantees a constant 3.3V supply down to an input voltage of 0.35V per battery. This means that all sensor measurements remain accurate and wireless transmission power is constant as the batteries discharge. Standard AA batteries are both readily available worldwide and may be disposed of into general waste.

RECHARGEABLE

The Lithium Polymer rechargeable battery option is certified to IEC62133-2:2017 and is CE marked. This can be recharged either from a USBA cable or using Qi wireless charging. The Lithium battery option is best if the Data Point is in temperatures below -25°C .

The Data Point logs and reports its battery voltage regularly and the power conditioning circuitry allows for early warning alerts to be issued well in advance of battery depletion. Coulomb counting is used to track the % of battery remaining according to temperature.