Multi-purpose LoRaWAN sensor transmitter

Wireless transmitter for a broad range of industrial sensors

Features

- LoRaWAN™-enabled multi-purpose wireless sensor transmitter.
- Available for a broad range of industrial sensors.
- Device can supply power to an external sensor.
- Place and measure: no setup required.
- Unattended real-time monitoring for several years without replacing batteries.
- Compatible with LoRaWAN™ networks of any provider.
- Robust polycarbonate enclosure: weatherproof, impact-, UV-resistant (IP67).
- Standard alkaline (C-type) batteries: available everywhere.
- CE compliant, Radio Equipment Directive (RED) 2014/53/EU.

Applications

- Remote monitoring of all kinds.
- Air temperature, humidity and precipitation monitoring for weather forecast.
- Soil moisture and temperature monitoring in greenhouses.
- Water level / depth monitoring in running water or in tanks.
- Water depth and temperature monitoring in mining.
- Pressure monitoring in pipes and tanks.
- Snow level monitoring.
- Strain monitoring in buildings and on construction sites.
- Weighing of silos.
- Contactless temperature monitoring.

Description

The device DLR2 is a multi-purpose LoRaWAN sensor reader and transmitter manufactured by Decentlab. It can be configured by the manufacturer for a variety of sensor models. For example, a

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DLR2 can be configured to read a pressure sensor through the integrated RS-485 interface; or a temperature / humidity sensor through the integrated I²C interface; or an ultrasonic rangefinder through the integrated serial (UART) interface.

Sensor data are transmitted in real-time using LoRaWAN™ radio technology. LoRaWAN™ enables encrypted radio transmissions over long distances while consuming very little power. The user can obtain sensor data through Decentlab's data storage and visualization system, or through the user's own infrastructure. Visit http://www.decentlab.com/ for more information about Decentlab's data cloud service.

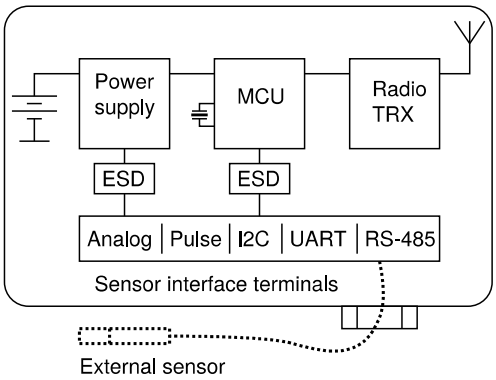

Illustration 1: Device block diagram.

Device specifications

Device logging function

Sampling interval	10 min (configurable through the user interfaces)
Data upload interval	10 min (configurable through the user interfaces)
Transmitted sensor data	External sensor data Device battery voltage
SD-card logging	Optional

External sensor interface

Sensor interface options (configurable by the manufacturer)	Analog input: single-ended / differential (24 bit) Pulse counter, dry contact I²C Serial, UART SDI-12 One-wire RS-485
Data protocols	Various (Modbus, ASCII, proprietary, ...)
Power supply to the sensor	3.0 V (50 mA) 4.5 V (30 mA)

Radio / wireless

Wireless technology	LoRaWAN™
Wireless security	AES-128 data encryption
LoRaWAN device type	Class A end-device
Supported LoRaWAN features	OTAA, ABP, ADR, adaptive channel setup
Wireless range	> 10 km[1] (line of sight), approx. 2 km (suburban)
RF transmit power	14 dBm (25 mW)
Receiver sensitivity	−146 dBm[2]
Frequency bands	868 MHz (EU version), 915 MHz (US version)[3]
Antenna	Integrated antenna

Device power supply

Internal battery type	2 × alkaline C batteries (R14)
Power consumption	≤ 0.9 mW
Battery lifetime (depending on external sensor)	5 – 10 years (example: I^2C pressure / temperature sensor)

Operating conditions

Temperature	−20 to 50 °C
Humidity	0 – 100 % RH

Mechanical specifications

Dimensions	134 × 81 × 70 mm
Weight	400 g including batteries (270 g without batteries)
Enclosure	Polycarbonate; weatherproof, impact-, UV-resistant (IP66/IP67). Cable gland (IP68) for external sensor; pressure equalizer plug with PTFE membrane (IP68).

1 Decentlab reports successful transmissions over 56 km distance
2 Specified by radio chip vendor
3 Contact us for region specific options

Operating instructions

The product usually requires no user interaction. If you open the enclosure, e.g. in order to replace the batteries, unscrew the four plastic screws and carefully open the lid.

CAUTION: Make sure the sensor unit does not drop out of the enclosure while opening! Do not touch the electronic components and sensors!

NOTE: When closing the lid, make sure the lid is fitted the right way, so that the enclosure is properly sealed: A little nose in the enclosure fits a notch in the lid and vice versa.

Replacing batteries

Insert 2 high-quality alkaline C batteries (R14) into the battery holder on the back side of the sensor unit. The device operates until the battery voltage drops to about 2 V. Always replace both battery cells with two identical fresh batteries.

User button and LEDs

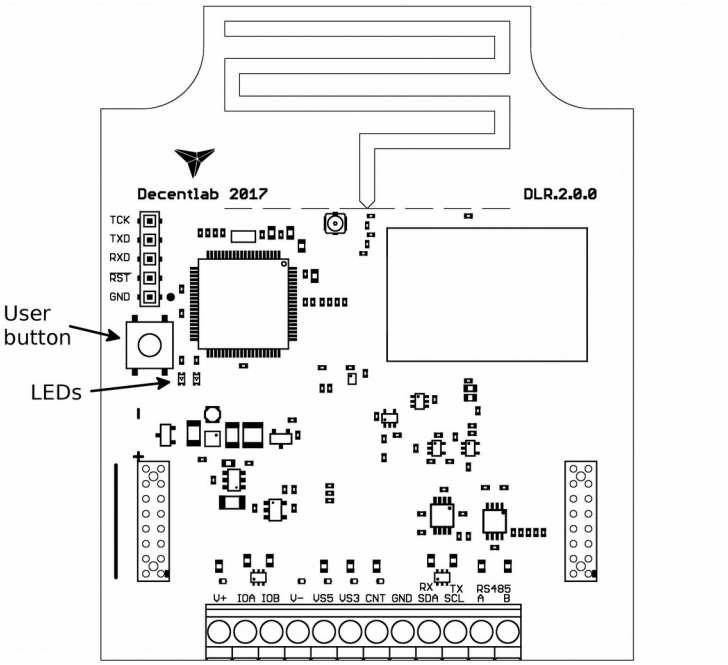

Illustration 2: Sensor unit (top side) showing the user button and the LEDs.

Operating modes

The device has three operating modes:

- Reset: System (re-)start; both LEDs light up for a short time.
- Active mode: Periodic measurements and data transmissions; green LED flashes for each measurement.
- Test mode: Measurements and data transmissions at fastest possible rates; blue LED is on. NOTE: use only momentarily, e.g. for testing the wireless connection.

- Sleep mode: No measurements and data transmissions (power save mode).

Switching between operating modes

The user button allows to switch between the operating modes as shown in Illustration 3. To perform a device reset, switch to sleep mode first (if necessary) by pushing the button for 3 seconds (until LEDs flash three times); wait 3 seconds; then push the button for 3 seconds (until LEDs light up). To switch between active and test mode, push the button for 1 second (blue LED on / off). If the blue LED is off, the device is in active or sleep mode. If the blue LED is on, the device is in test mode. To check whether the device is active or in sleep mode, push the button twice for 1 second; if the blue LED goes on and off, the device is in active mode; otherwise, the device is in sleep mode.

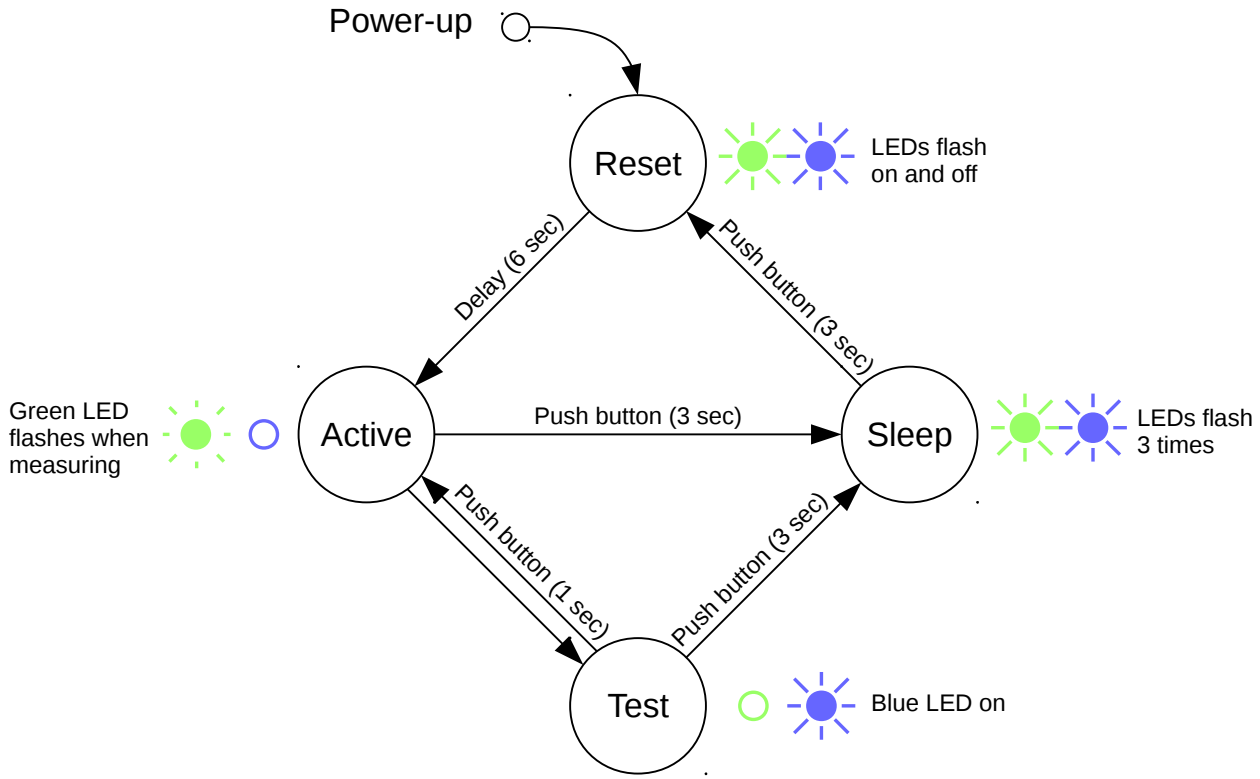

Illustration 3: Device operating mode state diagram.

Measurement cycle (active mode)

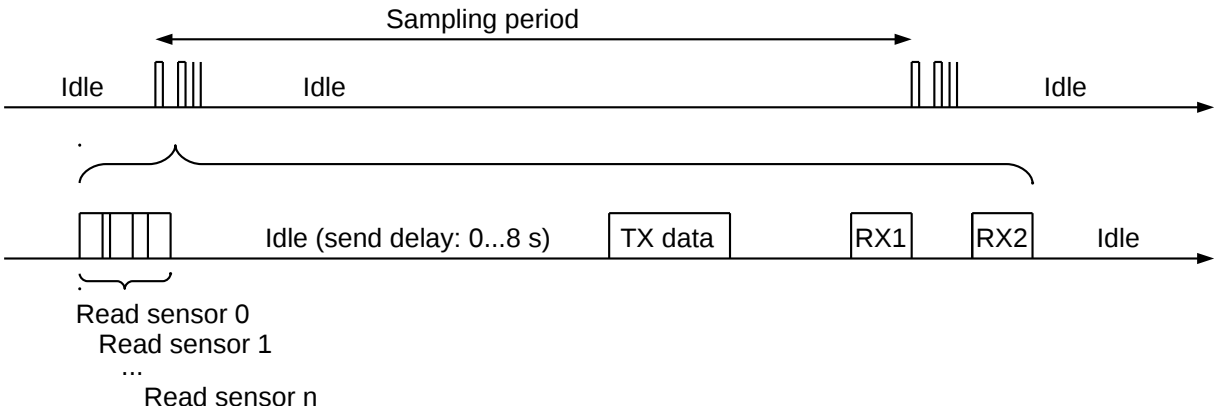

Illustration 4: Device activity during the active mode.

During the active mode, the device periodically reads the sensors (see Illustration 4). After a random delay of 0...8 seconds, the device transmits the sensor data. If the device has not yet joined the LoRaWAN network, it will try to join until it succeeds (maximum 3 attempts per sampling period). Afterwards, it will transmit the data (TX data). Following the data transmission, two receive slots are opened (RX1 and RX2). During these time slots, the device is ready to receive data from the network (downlink messages) as defined in the LoRaWAN™ specification.

As shown in Illustration 4, the device is idle most of the time. During the idle time, the current consumption is extremely low.

LED signaling (active mode)

- Read sensors: green LED flashes once.
- Data sent successfully: green LED flashes 2 times.
- Data could not be sent: green LED flashes 4 times.

SD card logging function (optional)

CAUTION: Before inserting or ejecting the SD card, please make sure that the device is in sleep mode or powered off! Otherwise, there is a risk that the file system gets corrupted! Use only high-quality micro SD cards formatted with a FAT32 file system.

If an SD card is present, the device writes all sensor data to a log file before sending (the green LED is on during the SD card access). If no SD card is present, the device just continues with sending. Log file name: “01234.csv”, where “01234” is the particular device ID. If the log file “01234.csv” is already present on the SD card, new data is appended at the end of the file. Otherwise, a new file named “01234.csv” is created automatically. File format: comma-separated values (CSV) in plain text. Each line shows a time stamp followed by all available sensor data. The time stamp value is the number of seconds passed since the last device reset multiplied by 1024. Example:

```
...
693604601,33146,20838,33148,22937,2897
694219001,33147,20838,33148,22937,2897
...
```

First line:

- Time stamp: 693604601 / 1024 ≈ 677348 s ≈ 188 hours passed since last device reset.
- 5 sensor values; e.g. last value: battery voltage = 2897 mV.

Second line:

- Time stamp advanced by 614400 = 600 s = 10 min since last measurement.
- 5 sensor values: see above.

Mounting instructions

Mount the device in upright position, the cable gland facing downward. Prefer a mounting location which is protected against rain and direct sun radiation.

For best radio performance, position the device in such a way that the device lid faces roughly in the direction of the next gateway. Avoid metallic objects close to the device.

The housing includes 4 threaded bushes (M4) in a 90 × 60 mm rectangle (see Illustration 5). This enables easy installation using standard M4 bolts.

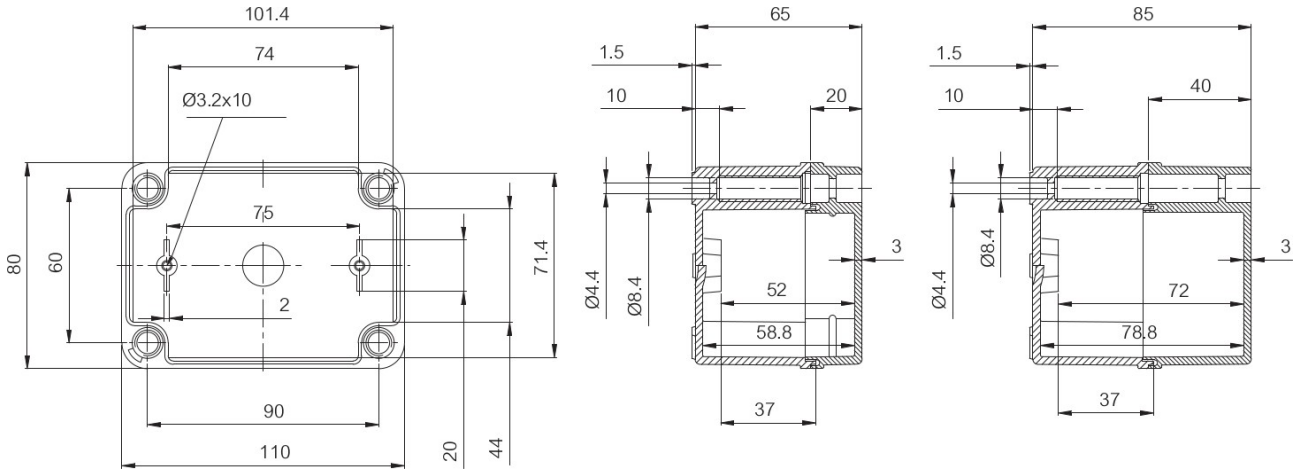

Illustration 5: Housing dimensions. Note: Drawing not including cable gland. Dimensions in mm.