Nokeval
made to measure

Flex2-Radio-LWEU / Flex2-Radio-LWNA
Flex2-Module-T
Flex2-Module-T-RH
Flex2-Module-CS
Flex2-Module-ES
Flex2-Module-nSens
Manual

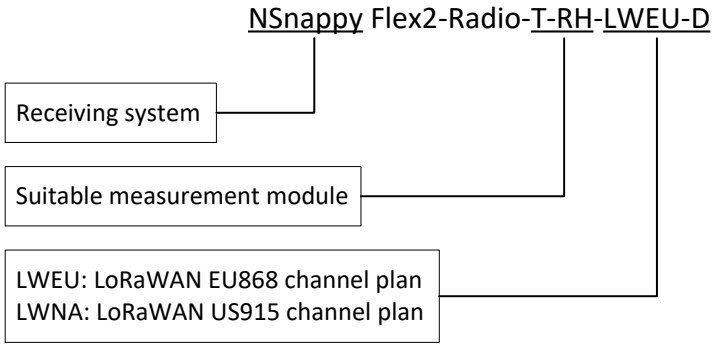
ID12085 V24 6.6.2022
Firmware 1.1-1.2

Contents

Introduction

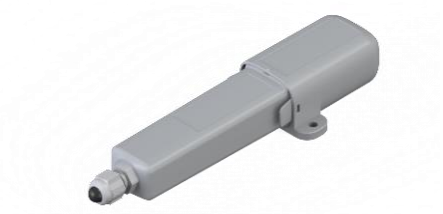
Each Flex2 series transmitter consists of two detachable parts or halves: a measurement (or bottom) module, and a radio (or top) module. The measurement module contains the input, the microcontroller, the calibration data (except for the nSens probe which holds the data of its own), and the battery.

NSnappy versions of the radio module are automatically provisioned for the receiving system upon shipping. For transmitters with a provisioned radio, the measurement module can be replaced without any user actions on the receiving system. This provides an effortless calibration service for the transmitters. Note that the measuring period and the radio service quality may change after the exchange since they are stored in the measurement module. Radio modules are named after their operating conditions, which can be interpreted as follows.



Flex2 transmitters are also shipped without the provisioning and the receiving system. For these versions, the user must manually configure the LoRaWAN radio parameters into the measurement module via USB. With this functionality, the effortless interchangeability of the measurement modules is lost.

Flex2 series consists of several measurement modules. The applicable module must be chosen according to the measured quantities.

Measurement modules		
Flex2-Module-T	Measures the ambient temperature with an internal sensor.	
Flex2-Module-T-RH	Measures the ambient temperature and relative humidity with a polymer sensor in the protruding black part.	
Flex2-Module-CS	Measures temperature with an external sensor connected via an M12 connector (supplied). The sensor is not supplied, but a thermocouple or a RTD sensor can be used.	
Flex2-Module-ES	Measures temperature with an external sensor connected to a spring-loaded connector inside the transmitter. The sensor is not supplied, but a thermocouple or a RTD sensor can be used.	
Flex2-Module-nSens	Measures temperature and humidity using a Novasina nSens probe. The probe is not included.	

Installation

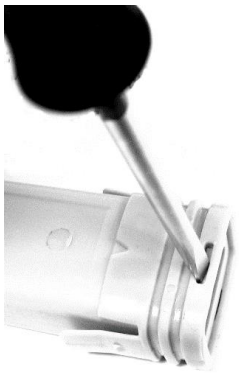
Attaching/Detaching the modules

To detach the two modules, first grasp the measuring module on its locking latches and fully depress them to release the latches. Then pull the measuring module straight out of the radio module. You may need to wiggle the measuring module slightly to more easily overcome the friction caused by the two O-

rings. If necessary, support the radio module by holding it in place with your other hand at the same time when pulling out the measuring module.

To join them, align the small, embossed arrowheads on both modules' housings (when they are aligned, also the labels on both modules are on the same side). Then push the measuring module straight into the radio module until the locking latches catch and click into place. The indicator led will blink shortly after the radio module is detected successfully. Note that, the blink may happen several minutes after the joining due to the power saving feature of the detection algorithm. The radio module should be detected and in operation within 10 minutes from the joining.

Opening the measurement module



Opening the module is necessary only for wiring the internal connector on the ES model.

- Detach the measurement module from the radio module.
- Use a large flat-bladed screwdriver to push the measurement module cover off via the rectangular hole (see picture).
- Pull the circuit board out.

Assemble reversely, taking care that the circuit board sits on the grooves.

Power supplies

The measurement modules are powered with a 3.6V Lithium Thionyl battery pack. The modules are supplied with the battery pack already installed. The radio modules are powered by the measurement module.

Wiring

The wiring of the sensor connector is described in the chapter for each module, where applicable.

Configuring

The default configuration should be sufficient for most of the applications. The connected sensor needs to be configured for the CS and ES models and the non-provisioned versions need LoRaWAN parameters, such as activation keys. To view and change the configuration:

1. Detach the modules.
2. Connect a micro-USB cable to the connector in the measurement module, and the other end of the cable to a computer.
3. Launch the Mekuwin program (available for free at www.nokeval.com).
4. In Mekuwin, choose the correct port. If the port is not visible, try to reconnect the cable to the computer
5. Choose Protocol = Modbus, Address = 1.
6. Click Direct.
7. A new window will open. It has branches for different settings.
8. Adjust the settings, and finally click Save to EEPROM.

The exact contents of the menu depend on the module type. The applicable settings are described in the corresponding chapters. The common settings for all the modules are:

Period: Select the measurement interval in seconds. An unnecessarily short interval will consume the battery and the radio band. Default 900 s.

Quality: Select the reliability of the radio packet delivery:

- Unconfirmed (default): The device will transmit each packet once not expecting any acknowledgement. If the packet is lost due to a collision with another transmission or any disturbance, it is lost.
- Confirmed: After transmitting a packet, the device will listen for an acknowledgement from a receiver and retransmit up to two times if not getting acknowledged. If there is no acknowledgement, the device will discard the packet and decrease the number of retransmit for the next packet. If the device does not get acknowledgement, it will eventually send the packet just once. This setting increases the probability of successful delivery significantly but does not guarantee it.
- Buffering: The device will keep retransmitting each packet until acknowledged. The readings will be buffered until delivered as far as the buffer is not full. The buffer can hold approx. 2000 packets. When the buffer is more than half full, the measurement intervals will be temporarily increased to slow down the filling of the buffer. UTC needs to be set for buffering to work. If UTC is not set, confirmed will be used instead of buffering.

Protecting the settings

To protect the settings from being easily adjusted, the configuration menu provides a password box. The password can be formed using up to 16 characters. From the next MekuWin session, the settings cannot be adjusted without knowing the password.

If the displayed status is “Locked”, changes will not be saved to the device. Write the correct password in the “Password input” field and press enter to unlock.

If displayed status is “Unlocked”, the settings and password can be changed, and the menu will become locked again after menu is closed.

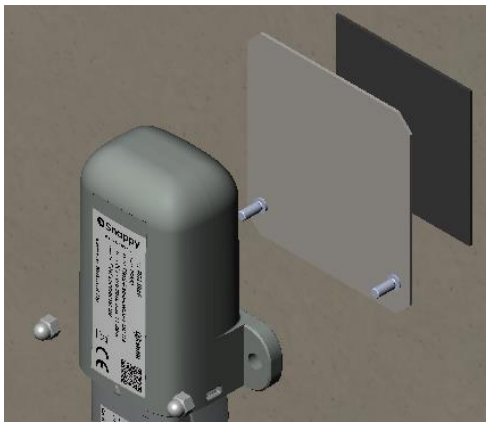
Note that the password cannot be reset by the user. If the password is forgotten, the password reset can only be made by the manufacturer. Please make sure that the password is remembered if changed.

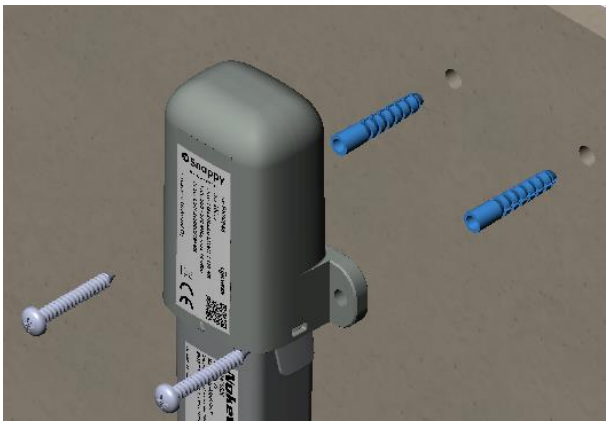
Mounting

Select a good place for the transmitter, avoiding metal surfaces near the radio module.

Fasten the radio module to a surface either with a mounting plate (double-sided tape included) or with two screws 50 mm apart. The maximum diameter of the screws is 4.5 mm. Depending the wall material use the suitable screw anchors.

If not already, join the two modules.





Flex2-Module-T and Flex2-Module-T-RH

The T and the T-RH modules have no external connections as they measure the ambient air. There are no additional configuration settings.

Sensor location		
Model	Temperature sensor	Humidity sensor
T	At the bottom end of the enclosure	-
T-RH	At the bottom end of the enclosure	Inside the protruding filter

Flex2-Module-CS and Flex2-Module-ES

Sensor

The CS and ES models support both RTD and thermocouple. The type and the wiring of the selected sensor must be configured from the ***Temp setup*** menu. Temp setup -menu contains the following settings:

Sensor: Select the used temperature sensor type: RTD or TC. This setting affects the content of the menu.

RTD specific settings include:

Wiring: Select the used wiring: 2-, 3-, 4-wire (default)

RTD type: Select the type of the RTD sensor. Supported types are Pt (default), Ni, Cu.

R0: Set the nominal resistance of the sensor. With a Pt100, it will be 100 (default). With a Pt1000, it will be 1000. If the precise resistance of the sensor is known, e.g., stamped on the sensor, enter it here to remove the sensor error.

Thermocouple specific settings include:

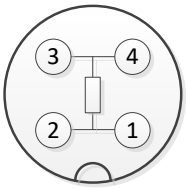
TC type: Select the type of the thermocouple. Supported types are B, C, D, E, G, J, K, L, N, R, S and T

Range: Select the appropriate range depending on the temperatures to be measured. A smaller range gives better resolution. The Low range can be used up to 120 ohms (50 °C with a Pt100). The Mid range can be used up to 240 ohms (380 °C). The High range can be used up to 500 ohms. The Max range can be used up to 2000 ohms (250 °C with a Pt1000).

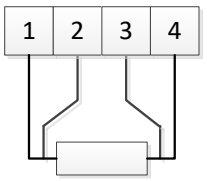
Pts: Point adjust. It is possible to adjust the reading in one or two points if desired. If this is not necessary, set to 0. To adjust in one point, i.e., to use offset correction, set Pts=1, enter the uncorrected reading in Uncal1 and the desired (reference device) reading in Cal1. For a two-point adjustment, set Pts=2 and use Uncal1-2 and Cal1-2 to get two points adjusted.

Code: Allows password protecting this menu. This password should prevent accidental writes to calibration data.

Wiring RTD sensor



In the CS module, the RTD sensor is connected to the M12 connector. The module has a female connector. A compatible male plug with screw terminals is supplied. The plug has small terminal numbers in it.



The ES model has spring loaded connector block inside the enclosure. Open the enclosure as described on page 4. Bring the cable inside the enclosure through the cable gland and connect the sensor wires to the grey block. Push down the buttons if necessary to aid inserting the wires. Then you can choose to tighten the gland or tighten it later. Insert the circuit board back in the enclosure, guiding the cable and wires. Replace the cover.

Connect the wires as follows:

4-wire: Connect sensor's one end to terminals 1 and 2, and the other end to 3 and 4.

3-wire: Same as 4-wire but leave terminal 1 unconnected.

2-wire: With the spring-loaded connector, connect the sensor between terminals 2 and 4. With the M12 connector, correct terminals are 2 and 3.

If possible, a 4-wire sensor should be used to get the best accuracy.

Wiring thermocouple

In both CS and ES modules, the thermocouple is connected to the same connector as a RTD sensor (see previous paragraph). With the spring-loaded connector, connect the positive wire of the thermocouple to terminal 3 and the negative wire to terminal 4. With the M12 connector, the thermocouple must be connected other way around i.e. the positive wire to 4 and the negative to 3.

Flex2-Module-nSens

The measurement module accepts a Novasina nSens-HT-ENS or an nSens-HT-CSS humidity and temperature probe. For that, the measurement module has a three-pole female connector. The Novasina probe can be attached directly to the measurement module, or an up to 2 m extension cable used in between.

The Novasina probe must have a firmware 2.00 or newer. Otherwise, it will not work at all. It is beneficial to have a Novasina hardware version 2.00 or newer, otherwise the current consumption will be much greater.

The probe contains the calibration data of its own. Replacing the probe with a recalibrated one will restore the accuracy. To adjust the Novasina calibration, use tools provided by Novasina, the details falling outside the scope of this manual.

Flex2-Radio modules

LoRaWAN has a regional specification, called Regional Parameters (available free at www.lora-alliance.org), that describes channel plans for different regulatory regions around the world. The radio module should be chosen according to these channel plans.

Before using the radio module, make sure it is legal in your country.

Credentials

All the provisioned radio modules use OTAA activation mode. For each module, the AppEUI and the AppKey are assigned in the factory during manufacturing process. These cannot be modified by the user.

In addition to OTAA, the non-provisioned radio can also use ABP activation. In both cases, the user must provide valid credentials for the measurement module:

OTAA: AppEUI + AppKey

ABP: Device address + AppSKey + NwkSKey

Data rate

All the provisioned radio modules use Adaptive Data Rate. If the device receives no messages from server for 2 subsequent messages, it will lower its data rate by 1 step. Then it will lower the data rate by 1 step after every 2 messages until a message is received or data rate 0 is reached. When the device is connected to server, the MAC layer controls the data rate. Data rate also affects the power consumption of the device. Lower the data rate, higher the consumption.

For the non-provisioned radio, the user controls the data rate parameters: Adaptive Data Rate can be toggled off, fixed data rate can be used, the data rate algorithm can be modified.

Other parameters

The non-provisioned radio provides few other parameters for the user to control.

Port: The LoRaWAN specification provides a Port field. This can be used to distinguish different types of messages. Valid port numbers are between 1 and 223.

Max EIRP: This parameter controls the maximum transmission power of the device. Valid value between 0 and 14 dbm.

Confirmed tx: This parameter controls the number of transmissions per packet if confirmed is selected as a transmission quality. Valid value between 1 and 8.

Uplink payload structure

The following tables and examples describe how the data can be extracted from the uplink payload. This information is only needed when the Flex2 device is integrated into a system that is not provided by Nokeval.

Protocol for EU868 radio module

The payload data format consists of a protocol version field and 1 or more messages in length-type-data format. Example payloads are presented at the end of this chapter for reference.

Size	Name	Meaning
1B	Protocol version	Version=1
XB	1 or more messages	See Message format

Message format

Messages are presented in length-type-data format with optional age field.

Size	Name	Meaning
1B	Message length	Bits 0…6: Message length in bytes, excluding length field and optional age field. Bit 7: If 1, age field is included.
(2B)	Optional age field	Age, uint16 * 60 seconds
1B	Message type	See Message type, e.g. 11 = Flagged utility
XB	Message data	Data, based on message type

Message types

Message types:

- 10 – Formatted measurement data
- 11 – Flagged utility
- 12 – Debug

The device may send other message types but those should be ignored. Start of next record can be found based on the length field at start of every message.

Type 10: Measurement data

Measured readings and status information about them.

Size	Name	Value/Meaning
2B	Measurement format	Format, always 7 for the Flex2 devices
XB	Data by format	See the table below

First comes the time flags to describe the time mode of the measurements. Incoming measurement data can be in real time, or it can be delayed through the buffering in the device. If buffering is used, the packets contain the exact time of the measure.

After the time fields, measurement data is provided. First comes the bit flags to describe which measurement fields are included. If the device failed to measure a value, that field will be missing.

After the measurement flags, the measurement data is provided. Sometimes a conversion may be needed in order to get the reading right. All the needed conversions and the units they provide are described in the table below.

After the measurement data, the message has a status bit flags field describing which status fields are included, similarly to the measurement bit flags. Generally, if the device failed to produce a measurement, it will have a status code to help identify the issue.

Size	Name	Value/Meaning
1B	Time flags	Bit 0: Time mode: 0 = real time (UTC excluded), 1 = UTC included Bits 1…6: Reserved Bit 7: UTC request
4B	UTC	Elapsed seconds since 1970-01-01T00:00:00Z
1B	Measurement flags	Describes which fields are included. E.g. 0000 0011 = T+RH 0000 00**0**1 = Only T
3B	T	Conversion: int24 / 100 (°C)
2B	RH	Conversion: uint16 / 100 (%RH)
1B	Status flags	Tells which of the measurement status fields are included.
1B	T	0: Reserved for future use 1+: error number
1B	RH	-||-

Type 11: Utility

Utility data using bit flags to describe which fields are included in the message, similar to message type 10.

Size	Name	Meaning
1B	Bit flags	0x00: Request to send utility. Otherwise: Describes which fields are included in the message. E.g. 0**1**00 000**1** = device type + serial number
3B	0 – Device type	<0-16777215> Product number of the device.
2B	1 – Firmware ver	<major 0-255> <minor 0-255>
3B	2 – Firmware build	<0-16777215> Build number to identify FW version more precisely.
3B	3 – Firmware ID	<0-16777215> Firmware identifier, for use with firmware update.
1B	4 – Battery info	<number 0-255> Highest bit: Describes whether the device has auxiliary power. Other bits: 127 = no battery attached. 0-100 = main battery empty/full (1% resolution). 101-121 = reserve battery empty/full (5% resolution). 126 = battery can't be measured.
2B	5 – Calibration date	<0-65535> As days after 1.1.2000; 65535 means unknown
XB	6 – Serial number	<symbol> *[1-20], 32-126: Ascii-symbols, 128-227: 2 numbers encoded: "00", "01", "02"… "99"

Type 12: Debug information

Debug information message. This should be skipped when reading the messages.

Example uplinks

Here are some example uplinks to help clarify how the uplink payloads are structured.

Bytes are presented as hex values, numbers are LSBF.
E.g., consecutive bytes 0x01 and 0x23 converted to uint16 equals 0x01 + 0x23*0x100.

Example – normal measurement data

Bytes (hex): **01 0B 0A 07 00 00 03 92 08 00 70 0E 00**

Interpretation:

Bytes (hex)	Name	Meaning
01	Protocol version	Version = 1
0B	Message length	Length = 11, excluding length field. No age field.
0A	Message type	Type 10 = Measurement data
07 00	Measurement format	Format 7 = Flex2
00	Time flags	Measurements in real time
03	Measurement flags	0x03 = 0000 0011, meaning both readings
92 08 00	T	2194 = 21.94 °C
70 0E	RH	3696 = 36.96 %RH
00	Status flags	0x00 = No errors

Example – uplink containing 2 messages

If there are more than 1 message in an uplink, they are simply one after another.

Bytes (hex): **01 0D 0A 07 00 01 2B FE 08 61 01 E1 08 00 00 09 0B 41 57 50 00 50 B1 B5 8D**

Interpretation:

Bytes (hex)	Name	Meaning
01	Protocol version	Version = 1
0D	Message length	Length = 13, excluding length field. No age field.
0A	Message type	Type 10 = Measurement data
07 00	Measurement format	Format 7 = Flex2
01	Time flags	UTC included
2B FE 08 61	UTC	1627979307 = 2021-08-03T08:28:27Z
01	Measurement flags	0x01 = 0000 0001, meaning only T
E1 08 00	T	2273 = 22.73 °C
00	Status flags	0x00 = No errors
09	Message length	Message length 9, excluding length field. No age field.
0B	Message type	Type 11 = Utility
41	Bit flags	0x41 = 0100 0001, fields 0 and 6 are included
57 50 00	0 - Device type	Type = 20567
50 B1 B5 8D	6 – Serial number	Serial number = P495313

Protocol for US915 radio module

The payload data format consists of different types of messages. Each packet can hold one or several messages. Packets that hold only 1 message are in type-data format. Type 100 defines that the packet holds several messages that are in length-type-data format. Example payloads are presented at the end of this chapter for reference.

Type 1 – Utility

The bit flags describe the content of the message. The number of flags risen may vary between consecutive utility packets.

Bytes	Name	Meaning
1	Type	1: Utility
1	Bit flags	Describes which fields are included in the message. E.g. 0001 0011 = device type + firmware version + battery.
3	0 – Device type	<0-16777215>, the product number of the device.
2	1 – Firmware ver	<major 0-255> <minor 0-255>
3	2 – Firmware build	<0-16777215> Build number to identify FW version more precisely.
3	3 – Firmware ID	<0-16777215> Firmware identifier, for use with firmware update.
1	4 – Battery info	<number 0-255>, highest bit describes whether the device has auxiliary power. Other bits: 0-100 = main battery empty/full (1% resolution), 101-121 = reserve battery empty/full (5% resolution), 126 = battery can't be measured, 127 = no battery attached
2	5 – Calibration date	<0-65535> as days after 1.1.2000; 65535 means unknown
X	6 – Serial number	<symbol> *[1-20], 32-126: Ascii-symbols, 128-227: 2 numbers encoded: "00", "01", "02"… "99"

Type 7 – Timestamped RHT measurements (Flex2-LWUS)

Similarly, the flags describe the content of the message. Conversion is needed to get the measurement result. Conversion formulas for each quantity can be found in the table below. Note that some of the range is reserved for status codes.

Bytes	Name	Unit	Notes	Range	Step
1	Type		7: Timestamped RHT		
1	Flags		Bit 7: 1=UTC request[1] Bit 5..6: Reserved Bit 4: 0=Real time measurements[2] 1=UTC timestamp included Bit 2..3: Reserved Bit 1: 1=RH included Bit 0: 1=T included E.g. 0000 0011 = RHT in real time. 1 Cloud should provide UTC in downlink 2 UTC excluded		

4	Timestamp	s	UTC. Elapsed seconds since 1970-01-01T00:00:00Z		
3	T	°C	Conversion: int24 / 100 Status: int24 over 8 388 352	-83 886.08 .. 83 883.52	0.01
2	RH	%RH	Conversion: uint16 / 100 Status: uint16 over 65 280	0 .. 652.80	0.01

Type 100 – Collection of types

This type is used to combine several types into the same uplink packet.

Bytes	Name	Meaning
1	Type	100: Collection packet
1	Length	Length of the following message
X	Data	Message e.g. type 7 message
1	Length	Length of the following message
X	Data	Message e.g. type 1 message

Example uplinks

Here are some example uplinks to help clarify how the uplink payloads are structured.

Bytes are presented as hex values, numbers are LSBF.
E.g., consecutive bytes 0x01 and 0x23 converted to uint16 equals 0x01 + 0x23*0x100.

Example – collection packet

Bytes (hex): **64 05 07 01 A3 08 00 0E 01 73 57 50 00 00 02 5B FF 50 B1 B5 8D**

Interpretation:

Bytes (hex)	Name	Meaning
64	Type	Type 100 = Collection packet
05	Message length	Length = 5, excluding length field.
07	Message type	Type 7 = Timestamped RHT
01	Flags	0x01 = 0000 0001, T measurement in real time.
A3 08 00	T	2211 = 22.11 °C
0E	Message length	Length = 14, excluding length field.
01	Message type	Type 1 = Utility
73	Bit flags	0x73 = 0111 0011, fields 0, 1, 4, 5 and 6 are included
57 50 00	0 - Device type	Type = 20567
00 02	1 – Firmware ver	v0.2
5B	4 – Battery info	0x5B = 91%
FF FF	5 – Calibration date	0xFFFF = Date unknown
50 B1 B5 8D	6 – Serial number	Serial number = P495313

Maintenance

Battery

The measurement module is powered with a 3.6V Lithium Thionyl battery pack. The pack should not be replaced by the user.

Recalibration

It is recommended to recalibrate the measurement module every two years. Detach the measurement module and send it for recalibration. Alternatively obtain a recalibrated module, exchange it to the radio module, and send the old module for recalibration. Normally the recalibration includes replacing the battery.

The calibration certificate for the measurement module can be downloaded from www.nokeval.com.

The nSens module is an exception. As the calibration data is stored in the nSens probe, it is sufficient to recalibrate the probe only.

Cleaning

The enclosure exterior can be wiped with a damp cloth soaked in soapy water or isopropyl alcohol, except that it is not allowed to wipe the humidity probes of the T-RH and nSens modules. The filters of the humidity probes can be manually screwed off, cleaned, dried, and reattached.

Storage

If the device is not used for a while, detach the modules to stop the radio transmissions and store the halves in a dry place. For longer storage, remove the battery.

Specifications

Environment

Operating temperature	-30...+60 °C
Operating humidity	0-100 %RH
Protection class	IP65
Enclosure material	Plastic (PC+ABS)

Measurements

Weight	Radio modules: 35g Measurement modules: 70g (slight variation between models)
Dimensions	Width 60 mm, depth 32.5 mm, height varies according to attached module T: 171 mm T-RH: 212.8 mm nSens: 292.8 mm (probe attached) ES: 197.3 mm CS: 204.7 mm
Cable gland	M12x1.5

Power supply

Batteries	3.6V Lithium Thionyl battery pack
Typical battery life	With a good radio link and 5 min measurement interval, typically 5 years With an average radio link and 30 min measurement interval, typically 5 years With a bad radio link and 30 min measurement interval, typically 3 years

Measuring and data transmission

Measure interval	Configurable: 0…14400s
Radio	LoRa radio technology with Murata ABZ-093 LoRaWAN modem.
Antenna	Internal
Frequency band	EU868: 863-870 MHz / US915: 902-928 MHz
Transmission power	Max +14 dBm E.R.P.
Range, line-of-sight	Depends on installation location and environment, in good conditions 10 km

T module

Sensor type	Semiconductor based internal sensor
Measurement range	-40…+125 °C
Accuracy	±0.5 °C

T-RH module

Temperature sensor type	Semiconductor based internal sensor
Measurement range	-40…+125 °C
Accuracy	±0.5 °C
Humidity sensor type	Capacitive polymer humidity sensor inside a sintered filter
Measurement range	0…100 %RH
Total error band	±5 %RH over 10…90 %RH and +5…+50 °C
Accuracy	Typically ±3 %RH over +0…+50 °C

nSens module

Sensor type	Novasina nSens-HT-ENS or nSens-HT-CSS, not supplied
Cable length	max 2 m
Measurement range	See Novasina’s documentation; max temperature 60 °C for the meas.module
Accuracy	See Novasina’s documentation

ES and CS modules

Sensor type	RTD
Cable length	< 30 m

Measurement range	-200…+650°C
Accuracy	Accuracy 0.05% rdg + 0.2 °C at 25 °C ambient
Thermal drift	0.01 °C/°C
Sensor type	Thermocouple
Cable length	< 30 m
Measurement range	mV: -30…2000mV
(Linearity error)	TcB: 400…1700 °C (0.3 °C)
	TcC: 0…2300 °C (0.5 °C)
	TcD: 0…2300 °C (1 °C)
	TcE: -100…900 °C (0.2 °C)
	TcG: 1000…2300 °C (2 °C)
	TcJ: -160…950 °C (1 °C)
	TcK: -150…1370 °C (0.5 °C)
	TcL: -150…900 °C (0.5 °C)
	TcN: 0…1300 °C (0.1 °C)
	TcR: 0…1700 °C (0.5 °C)
	TcS: 0…1700 °C (0.5 °C)
	TcT: -200…400 °C (1 °C)
Accuracy	Typically ±1.0°C over +0...+100 °C

FCC notices for Flex2-Radio

FCC ID: 2A3B4FLEX21

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation in subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

SDoC for the sensor modules

Supplier's Declaration of Conformity
47 CFR § 2.1077 Compliance Information

Unique Identifier: Flex2-Module-T
Flex2-Module-T-RH
Flex2-Module-ES
Flex2-Module-CS
Flex2-Module-nSens

Responsible Party – U.S. Contact Information:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
Nic Johnson, Technical Manager
4740 Discovery Drive
Lincoln, NE 68521
Tel:1-402-323-6233
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FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation in subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

ISED notices

IC: 28328-FLEX21

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

To comply with RSS-102 RF exposure compliance requirements, a separation distance of at least 20cm must be maintained between the transmitter of this device and all persons.

Pour se conformer aux exigences de conformité CNR-102 RF exposition, une distance de séparation d'au moins 20cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes.

Warnings

The device must not be disposed with household waste. Observe local regulations concerning electronic waste recycling. The device contains a battery.

Manufacturer

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