

MANUAL

EFMA

BLUETOOTH STRAIN TRANSMITTER

Installation and user manual



Document	Version	Date	Applies to
Installation and user manual	V00x	10/2026	EFMA, strain bridge transmitter in IP67 enclosure

This manual describes installation, connection, configuration, calibration and use of the EFMA Bluetooth strain transmitter in its IP67 enclosure with two AA cells, together with the free app for phones and tablets.



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1 About this manual

This manual applies to the EFMA: a strain bridge transmitter that sends its readings by Bluetooth Low Energy, built into a weatherproof IP67 enclosure with a holder for two AA cells. The same electronics are available without enclosure as the OEM board EFMB, which has its own manual.

Names of app pages, buttons and settings are written as they appear in the app, for example Configure Transmitter or Zero Now. Default values and fixed texts are set in a fixed-width typeface, for example 0000.

1.1 Symbols

Notice	Meaning
Caution	Risk of damage to the device or of incorrect measurement.
Important	Pay particular attention to the following instructions.
Note	Further information.

1.2 Product identification

	EFMA
Design	transmitter in weatherproof enclosure with battery holder for two AA cells
Input	one strain gauge bridge, 4-wire, screw terminals inside the enclosure
Identification of the transmitter	Data Tag on the enclosure label (section 3.2)
Manufacturer type	B24-SSBC-A

2 Safety and warranty

2.1 Safety instructions

- Use only two AA cells in the battery holder. The maximum voltage is 1.8 V per cell (chapter 10 for suitable cell types).
- The enclosure is sealed to IP67 only when cables of the correct diameter (3.0 ... 6.5 mm) are used and the gasket and lid are clean when the lid is closed (section 4.5).
- Keep metallic or RF-conducting material, including wires, at least 15 mm away from the antenna; otherwise the transmission range is reduced (section 4.4).

Note The app needs access to the Bluetooth services, which are part of the location services. You may therefore have to grant the app permission to access the location, although the app does not use any location data.

2.2 Warranty

The transmitter is warranted against defective material and workmanship for a period of one year from the date of dispatch. If it appears to have a defect in material or workmanship or fails during normal use within this period, please contact octogon. When returning the product, please include a note with name, company, address, phone number and a detailed description of the problem, and state whether it is a warranty repair. The sender is responsible for shipping charges, freight insurance and proper packaging to prevent damage in transit.

The warranty does not apply to defects resulting from action of the buyer such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorised modification. Corrective maintenance after the warranty period should be performed by personnel approved by octogon only.

3 Product description

3.1 Overview

The transmitter measures a strain gauge bridge and makes the reading available on a mobile device such as a phone or tablet. The link is Bluetooth Low Energy (BLE), which combines the availability of Bluetooth receivers with the low power consumption of an embedded system. Two modes of operation are used:

Mode	Function	Typical use
Advertising (broadcast)	The transmitter broadcasts its measurement data without a connection. Several receivers can read the same data at the same time. The app uses this mode for the live data on its dashboards.	one to many, many to many
Connected	A mobile device connects directly to the transmitter. One device can be connected to several transmitters at the same time. The app uses this mode for configuration and calibration; other applications can also use it to receive notifications when status or value change.	one to one, many to one

Advert format and encoding as well as details of the connected services are available for the integration of the transmitter into custom iOS and Android apps.

3.2 Basic principles

Topic	Description
Transmission range	The receiver is the user's own phone or tablet, not a dedicated receiver. The quality of its Bluetooth receiver varies widely, and so does the achievable range (chapter 6).
Sensitivity range	Designed for bridge-based sensors; configurable between ± 6 mV/V and ± 48 mV/V in four ranges: ± 6 , ± 12 , ± 24 and ± 48 mV/V.
Data rate	Configurable from 10 readings per second to 1 reading every 10 seconds (section 9.3).
Operation	Between measurements the transmitter disconnects the power from the load cell and the microcontroller sleeps. There are no automatic sleep or wake functions: the transmitter is designed to be set and forgotten and transmits all the time.
Data Tag	The advertising packets are identified by the Data Tag, a four-character hexadecimal identifier. It is printed on the label of the enclosure. The Data Tag can be changed by configuring the transmitter, so a transmitter can be replaced without reconfiguring all receivers that use its data.

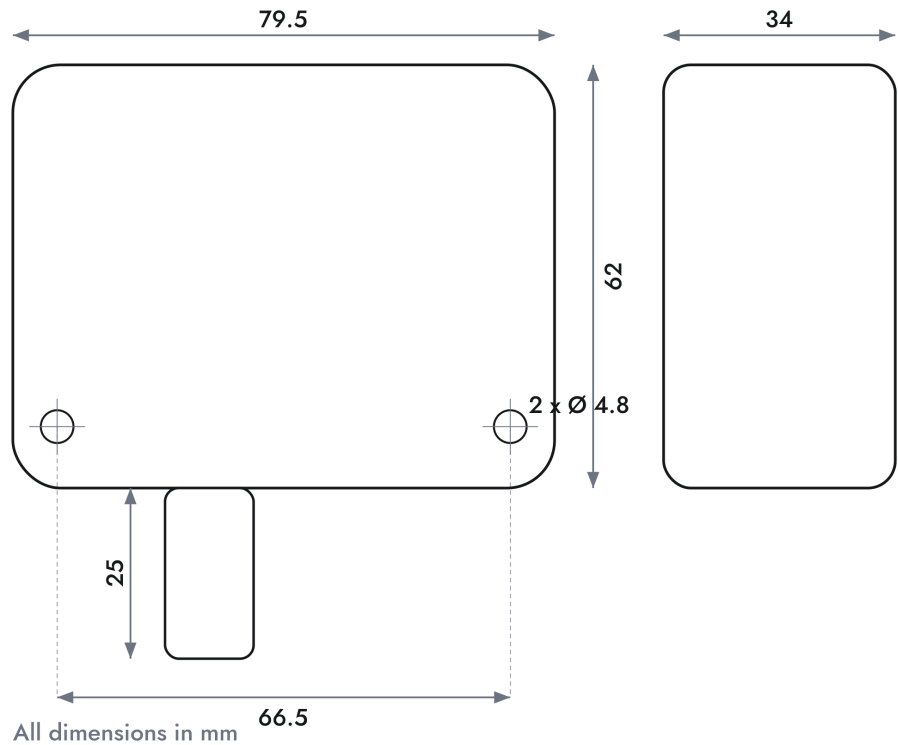
3.3 Technical specifications

Values with a 1000 Ω bridge, 2.5 mV/V, 3 V supply, at 25 °C.

Item	Value
Excitation system	4-wire
Bridge excitation voltage	= supply (battery) voltage, nominal 3 V DC
Bridge resistance	85 ... 5000 Ω
Sensitivity ranges	$\pm 6 \cdot \pm 12 \cdot \pm 24 \cdot \pm 48$ mV/V
Measuring direction	bidirectional, tension and compression
Offset temperature stability	± 5 ppm/°C typical
Gain temperature stability	1 ppm/°C typical, 4 ppm/°C max.
Non-linearity before linearisation	6 ppm of range typical, 15 ppm max.
Internal resolution	24 bit (16 000 000)
Noise-free resolution at 2.5 mV/V	14.25 bit (19 000) ... 16.75 bit (110 000), selectable (section 9.3)
Data rate	10 per second ... 1 every 10 seconds, or Sleep
Radio	Bluetooth Low Energy 4.1, 2.4 GHz, integrated chip antenna
Range	30 ... 90 m line of sight, depending on the receiving device (chapter 6)
Operating temperature	-40 ... +85 °C
Storage temperature	-40 ... +85 °C
Humidity	0 ... 95 % RH, non-condensing
Power supply	2 x AA cells in the enclosure, max. 1.8 V per cell; 2.3 ... 3.6 V DC
Standby current	6 μ A typical, 10 μ A max.
Peak current (1 k Ω bridge)	20 mA typical, 30 mA max.
Battery life	10 months with 2 x AA (3000 mAh) at 1 reading per second and 14.25 bit (chapter 10)
Enclosure	79.5 x 62 x 34 mm, cable gland 25 mm, IP67 with cable diameter 3.0 ... 6.5 mm

4 Installation

4.1 Dimensions



EFMA enclosure, all dimensions in mm. The cable gland extends 25 mm from one long side.

4.2 Opening the enclosure

The lid is secured with 4 × #2 cross-head screws. Remove the four screws and lift the lid. The screw terminals and the battery holder are inside the enclosure.

4.3 Mounting

The enclosure has two mounting holes, Ø 4.8 mm. They are outside the seal but covered by the lid, which gives the fixings some environmental protection. The enclosure can also be fixed through the back of the case; a seal or gasket must then be used to maintain the environmental protection.

4.4 Antenna position

The integrated chip antenna is located near the centre of the enclosure, close to the lid. There should be no metallic (or RF-conducting) material within 15 mm of the antenna. Metallic objects close to the antenna, including wires and enclosures, degrade the transmission range (chapter 6).

4.5 Environmental protection

- The enclosure is sealed to IP67 when the correct cable diameters are used.
- The cable diameter can range from 3.0 mm to 6.5 mm. Cables of a smaller diameter may be used if they are sleeved to increase their diameter.
- The sealing gasket sits in the base. When replacing the lid, make sure that there are no dirt particles on the gasket channel or the lid, as this may reduce the sealing.
- When the enclosure is mounted outdoors, dress the cables to form a drip loop below the cable gland, so that rainwater running down the cable drips off before it reaches the gland.

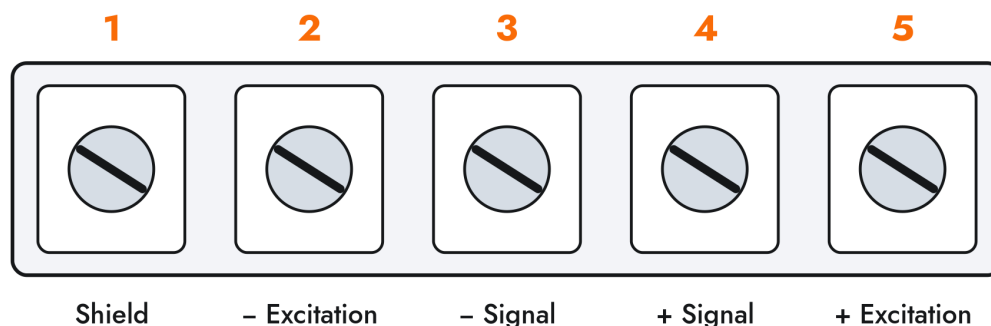
5 Electrical connection

5.1 Power supply

The enclosure accepts two AA batteries. The maximum voltage is 1.8 V per cell. Suitable cell types and the expected battery life are given in chapter 10.

5.2 Sensor connection

The sensor is connected to the five screw terminals on the board inside the enclosure. Lead the cable through the cable gland.



Excitation is the battery voltage, nominally 3 V – not 5 V

4-wire bridge 85 ... 5000 Ω · up to four 350 Ω bridges in parallel

Keep the cable to the gauges below 0.5 m

Power: 2 × AA, 1.8 V per cell maximum

Screw terminals 1 ... 5 of the EFMA.

Terminal	Function
1	Shield
2	– Excitation
3	– Signal
4	+ Signal
5	+ Excitation (battery voltage)

- The resistance of the strain gauge bridge can be between 85 Ω and 5000 Ω .
- Keep the cable between the transmitter and the strain gauges shorter than 0.5 m and generally as short as possible. The measurement is a four-wire connection: the longer the cable, the more the voltage drop in the cable affects the factory mV/V calibration.
- The measurement is bidirectional (tension and compression).

6 Radio range and antenna

6.1 Range

The achievable range depends heavily on the Bluetooth Low Energy receiver of the phone or tablet; each manufacturer specifies different limits for the receive sensitivity of its hardware. Ranges between 30 m and 90 m line of sight can be achieved, depending on the age and quality of the receiving device. Mobile phones less than two years old showed a range between 50 m and 90 m line of sight, with a trend towards greater range as Bluetooth Low Energy has matured on mobile devices.

Maximum range measured on an open field site, transmitter 3.0 m above ground on a plastic pole, phone held 1.5 m above ground and directed towards the transmitter:

Receiver	Transmission distance	Year of release
Apple iPhone 7	> 90 m	2016
Apple iPhone 5s	65 m	2013
Samsung Galaxy S6	65 m	2015
HTC One m8	25 m	2014
HTC One m7	25 m	2013

6.2 Influence of the surroundings

At 2.4 GHz the radio performance depends very much on the operating environment. Any structure within the operating region of the radios has three effects:

Effect	Description
Obscuration	An obstruction masks the line of sight between the radios; the range is reduced.
Aberration of the space patterns	Structures or objects in the near or intermediate field of the antenna distort the horizontal and vertical coverage patterns; range and link quality suffer.
Reflection	Objects in the line of sight of the antenna make signals arrive at the receiver by an indirect path (multipath); the range is reduced or the link quality is poor.

Each of these effects lowers the received signal strength (RSSI), increases the packet loss rate and in extreme cases causes complete loss of signal. If they are considered at the installation stage, a good quality link is obtained.

6.3 Guidelines for installation

- Maintain line of sight between transmitter and receiver.
- Keep objects and structures at least one metre away from the antenna wherever possible.
- A small increase in the height of the transmitter above ground often improves reception.
- Keep metallic material at least 15 mm away from the antenna (section 4.4).

7 The B24 Toolkit app

7.1 Installing the app

The B24 Toolkit app is available free of charge for iOS (version 10.0 and above) from the App Store and for Android (version 5.0 and above) from the Google Play store.

Note The app requires access to the Bluetooth services, which are part of the location services. You may have to grant the app permission to access the location, although it does not use any location data.

In the app you create projects. Each project contains a list of transmitters (linked transmitters) and a dashboard with tiles that show the data of these transmitters in different formats. In run mode the app fills the tiles in real time with the data the transmitters broadcast. For configuration and calibration the app connects to one transmitter at a time (chapter 9).

When the app is started, the splash screen shows the app version number at the bottom of the screen.

7.2 Project list and main menu

The first page after the splash screen is the project list: a scrollable list of all projects, each with its icon, title, date of the last change and number of transmitters. The number of projects is limited only by the memory of the device. After installation the list contains a single project called **Demonstration**. When you have created your own project and deleted the demonstration project, so that only one project exists, the app skips the project list at the next start and opens the project dashboard directly.

Control	Action
Menu (main menu)	Opens the main menu: Projects (back to the project list), Import Projects, Config Transmitters (opens Find Transmitters, chapter 9).
Add Project	Adds a new project (section 7.3).
Project menu	Edit, Export or Delete the project.
Tap a project	Opens the project dashboard; it is blank until tiles are added (chapter 8).

Export: on Android an e-mail client opens with the project data in the message body; send it (or copy the message body) to the target device and paste it into Import Projects. On iOS the project can also be saved to local or cloud storage, and Import Projects can read it with Choose from file.

7.3 Creating and editing a project

New Project and Edit Project have the same settings. They define the project, not the dashboard. Back returns to the project list and asks whether to save or discard changes; Save finishes editing.

Setting	Function
Project Name	Title or description of the project.
Icon	Tap the icon to choose a new one from the icon list, or choose no icon.
View PIN	Must match the View PIN configured in each transmitter of the project; without the correct PIN the data of a transmitter cannot be seen. Default 0000 .
Timeout	Number of seconds without data from a transmitter before it is flagged as Out of Range (section 11.1). Set it to at least 3 × the transmit interval of the transmitters.
Linked Transmitters	Number of transmitters linked to the project; tap to edit the list (section 7.4).

7.4 Linked transmitters

The linked transmitters can be used in the tile expressions of the project. Linking a transmitter does not stop it from being used by other projects, even at the same time on other phones or tablets.

Page / control	Function
Transmitter menu	Edit, configure (chapter 9) or delete the transmitter. A transmitter cannot be deleted while it is used in the expression of a tile.
Add Transmitter	Enter the Data Tag and a description manually, or search with Find Transmitters. The description is the name used in the expression editor.
Find Transmitters	Lists all detected transmitters regardless of their PIN settings, with the number of packets received, the packet rate and the received signal strength. Tap a transmitter to select it.
Edit Transmitter	Changes the description of a linked transmitter (valid only in this project). The Data Tag is shown but cannot be changed here.

8 Dashboard and tiles

8.1 Dashboard

Each project has a dashboard. Tap the menu to add a tile or to enter edit mode. The tiles show the real-time values of their expressions. If errors are detected in any transmitter, an error bar appears at the bottom of the screen (section 11.1).

In edit mode each tile shows controls to edit or delete it. To rearrange the tiles, press and hold a tile for a second or two, then drag it onto the tile it should change places with. On Android leave edit mode through the dashboard menu, on iOS with Save.

8.2 Tile types

Tile	Display	Additional settings
Metric	Numeric value; optionally the maximum or minimum value.	Output (actual, maximum or minimum value), Numeric Format, Action on long press.
Indicator	Coloured circle, up to three colours depending on the value, e.g. for a quick go/no-go check.	Colours and thresholds.
Gauge	Gauge over a user-defined range; the filled part can change colour.	Min, Max, colours and thresholds.
Tank	Filling tank over a user-defined range; the fill can change colour.	Min, Max, colours and thresholds.
Chart	Scrolling trend chart of historic values (no units on the X axis). A long press exports the chart data as a CSV file.	Y Axis Min/Max (or auto scale), History Points (10 ... 10 000), Update Interval, Trace Colour.

8.3 Common tile settings

Setting	Function
Name	Title shown at the top of the tile. Each tile must have a name.
Expression	Defines the displayed value: references to linked transmitters, combined with math functions. It is edited in the expression editor (section 8.4).
Source Units	Engineering units determined from the transmitters in the expression, as long as there is a single transmitter or all share the same unit type. You can enter your own text instead.
Working Units	If the source units are recognised, choose a unit to convert the displayed value to (section 8.5); thresholds, Min/Max and axis limits are then entered in these units. Otherwise choose your own text, or None.
Colours and thresholds	Two thresholds: below the first the first colour is used, from the first up to the second the middle colour, from the second upwards the third colour.
Action (Metric)	Long press on the tile: None; Individual Sources (zeroes the values of all transmitters in the expression – this affects every tile that uses them, but not the value sent by the transmitter); Tile Only (zeroes this tile); Reset Min/Max.

Maximum and minimum values and the chart history are recorded only while the dashboard is displayed.

8.4 Expression editor

The expression editor starts with an empty cell. Tap Transmitter to add a linked transmitter by its description; this alone shows the transmitter value in the tile. To apply a function, select the cell it should act on and tap Function. New items are added after the selected cell: to add something inside a function, select the cell inside it; to add something after a function or bracket pair, select the function name or the left bracket. Example: with the cell of transmitter "Crane 1" inside sqrt(selected, tapping * and 2 gives sqrt(Crane 1 * 2); with sqrt(selected it gives sqrt(Crane 1) * 2.

Button	Function
Transmitter	Inserts a transmitter linked to the project.
Constants	π (≈ 3.14159); e (base of the natural logarithm); time (seconds counter, zeroed when the dashboard is displayed – e.g. for a timer tile).
Functions	acos , asin , atan , cos , cosh , exp , $\ln$ (natural logarithm), $\log$ (base 10), $\text{pow}(x,y)$ (x to the power y), $\sin$, $\sinh$, sqrt , $\tan$, $\tanh$.
Brackets	Places brackets around the selected cell.
Delete	Deletes the selected cell; deleting a left bracket deletes everything inside the bracket pair.
0 ... 9, decimal point, $\pm$	Numbers; $\pm$ toggles the sign of the selected cell or value.
$+$ $-$ $\times$ $\div$	Operators.
Back / Clear / Save	Back to the tile (asks about unsaved changes) / clear the whole expression / save and return.

8.5 Unit conversions

If the calibrated units of the transmitters are known, the app converts automatically between the units of the same group. For other units, use the tile expression for the calculation.

Group	Units (symbols)
Ratiometric	mV/V
Angle	rad, $^{\circ}$, circumference, grade, ' (minutes), " (seconds), rev
Length	m, Å, AU, cm, ch, ell, em, fm, ft, fur, in, km, lea, league, ly, ln, μ (microns), mi n, mi, mm, mil, nm, pc, yd
Mass	kg, dr av, gr, g, mg, oz, pwt, lb, klb, s ap, slug, ton (long), T (metric), tonne, sh tn
Force	N, kN, mN, MN, crinal, dyn, gf, J/cm, kgf, kp, kg ms ² , ozf, lbf, pdl, tonfl, tonfs, tonfm
Pressure	bar, at, atm, dyn/cm ² , ftH ₂ O, inH ₂ O, GPa, hPa, kgf/cm ² , kgf/m ² , μ bar, Pa, N/m ² , oz/in ² , lb/ft ² , psi, T/cm ²
Speed	m/s, cm/s, ft/min, ft/s, km/h, km/min, km/s, kn, m/h, m/min, mph, mpm, mps, n mph, n mpm, n mps
Torque	Nm, m kg, ft lbf, ft pdl, in lbf
Arbitrary	counts

9 Configuration and calibration

9.1 Connecting to a transmitter

Open the main menu, tap Config Transmitters and select Configure in the menu of the transmitter (or select Configure from the transmitter menu of a linked transmitter). Enter the four-digit Configuration PIN set in the transmitter and tap Go. Messages are shown while the connection is established; with a wrong PIN the connection fails. After a successful connection three tabs are available: Identification, Measurement and Calibration. On every tab, Back cancels the changes and Save saves them and returns.

9.2 Identification

Setting	Function
Model	Model number of the transmitter (read only).
Version	Firmware version of the transmitter (read only).
Data Tag	Identifier of the transmitter; change it, for example, when the transmitter replaces an existing one.
Configuration PIN	PIN required to configure this transmitter.
View PIN	PIN required to view the transmitted data (section 7.3).

9.3 Measurement

Setting	Function
Transmit Rate	1 every 10 seconds, 1 every 5 seconds, 1 every 2 seconds, 1 per second, 3 per second, 5 per second, 10 per second, Sleep. The slower the rate, the longer the battery life.
Resolution	Noise-free resolution: 14.25 bits (maximum battery life), 15.25 bits (75 % battery life), 16 bits (50 %), 16.5 bits (37 %), 16.75 bits (30 %). A higher resolution makes the transmitter average its input for longer.
Low Battery Level	Voltage at which the transmitter reports Low Battery.
Actual Battery Level	Measured battery voltage (read only).
Value	Value that will be transmitted: the measured value minus the System Zero.
System Zero	Value subtracted from the measured value; can be entered manually. Has no effect unless a calibration has been performed.
Zero Now	Sets the System Zero so that the transmitted value is zero with the input currently applied.

9.4 Calibration PIN

If the Calibration PIN of the transmitter is set to anything other than the default **0000**, the Calibration tab is locked and the correct Calibration PIN must be entered to open it. To protect the calibration, enter a PIN other than **0000** in the Calibration PIN field of the calibration page.

The transmitter can be calibrated in two ways: by auto calibration with known loads applied to the sensor, or by table calibration with known mV/V values and the corresponding engineering values, often found on the calibration certificate of the sensor.

Caution Changing the Input Sensitivity requires a new calibration.

9.5 Auto calibration

Step / setting	Function
Input Sensitivity	Select the input range that best covers the sensor output.
Low Value	Engineering value of the applied low input (known load).
Acquire Low Input	Apply the low input, let it settle, then tap Acquire. The Acquire High Input button is then enabled.
High Value	Engineering value of the applied high input.
Acquire High Input	Apply the high input, let it settle, then tap Acquire High Input. The calibration is then performed.
Units	Units of the calibration.

Note Even when connected, the transmitter measures only at its data rate. Allow time between applying an input and tapping Acquire so that the change is reflected in the measurement.

9.6 Table calibration

Setting	Function
Input Sensitivity	Select the input range that best covers the sensor output.
Low Input / Low Value	mV/V value of the low point and the engineering value at this input.
High Input / High Value	mV/V value of the high point and the engineering value at this input.
Units	Units of the calibration.
Calibrated Value	Calibrated value that will be transmitted.
Calibrate	Performs the calibration.

9.7 Reset calibration

If the transmitter has already been calibrated, the calibration page shows a Reset Calibration button. It returns the transmitter to the factory mV/V calibration.

10 Batteries and battery life

10.1 Selecting batteries

The EFMA takes two AA cells, maximum 1.8 V per cell. Consider:

- Rechargeable or replacement cells: where the expected life with replacement cells is many years, rechargeable cells are rarely worthwhile.
- Required battery life: mainly determined by the transmit rate and the resolution (section 10.3).
- Operating temperature: the usable capacity of a battery falls with temperature; observe the specified operating range of the battery.
- Self-discharge: batteries have a shelf life; an alkaline cell typically lasts 5 years.

10.2 Battery types

Battery type	Notes
Lithium iron disulphide (Li-FeS ₂)	1.5 V in AA size, a direct replacement for alkaline cells. Low internal resistance and high capacity make them an ideal choice; shelf life around 20 years. Recommended for AA-powered transmitters: Energizer Ultimate Lithium L91.
Alkaline (Zn-MnO ₂)	Pairs of 1.5 V cells are most common. D cells for maximum life, AA cells where space is restricted. Typical capacity 2 Ah. Example: Varta 4006 (AA).
Nickel metal hydride (NiMH)	Most cells 1.2 V, two in series give 2.4 V. Capacity can match alkaline cells, but because of the lower charged voltage the usable capacity is lower; faster self-discharge than alkaline. If charged in circuit, make sure the maximum voltage of the transmitter is not exceeded. Example: GP 270AAHC (AA).
Nickel cadmium (NiCd)	Most cells 1.2 V, two in series give 2.4 V. Lower usable capacity than alkaline; generally useful only if charged regularly. If charged in circuit, make sure the maximum voltage of the transmitter is not exceeded.

10.3 Battery life guide

Expected battery life with 2 × AA Energizer L91 (3000 mAh) and a 1000 Ω load cell, depending on transmit rate and resolution (section 9.3):

Transmit rate	14.25 bit	15.25 bit	16 bit	16.5 bit	16.75 bit
1 every 10 seconds	8 years	6.5 years	4.5 years	3.5 years	3 years
1 every 5 seconds	4 years	3 years	2 years	1.5 years	1 year
1 every 2 seconds	20 months	16 months	11 months	8 months	6 months
1 per second	10 months	8 months	5 months	4 months	3 months
3 per second	3.5 months	2.5 months	2 months	1.5 months	1 month
5 per second	2 months	1.5 months	1 month	26 days	21 days
10 per second	1 month	24 days	17 days	13 days	10 days
Sleep	> 10 years	> 10 years	> 10 years	> 10 years	> 10 years

11 Troubleshooting

11.1 Error bar

In the dashboard view, problems with transmitters are shown in an error bar at the bottom of the page, followed by the Data Tags of the transmitters concerned. The bar is orange if only a low battery is reported, otherwise red. Every error except Low Battery also shows all tiles that use the transmitter concerned in a lighter colour.

Message	Meaning	See also
Battery Low	The transmitter reports a low battery (threshold: Low Battery Level, section 9.3).	chapter 10
Integrity Error	The transmitter has detected a problem with the connected sensor.	chapter 5
Overrange Error	The bridge input is too high.	Input Sensitivity, section 9.4
Out of Range	The app has received no data from the transmitter for longer than the Timeout of the project.	chapter 6; Timeout, section 7.3
Shunt Cal Active	The transmitter is in shunt calibration mode, which affects the transmitted value. The app cannot switch a transmitter into this mode.	—

11.2 Other problems

Problem	Check
No data from a transmitter in a project	The View PIN of the project must match the View PIN of the transmitter (sections 7.3 and 9.2). The Data Tag in the project must be the Data Tag of the transmitter.
Transmitter not found	Find Transmitters lists all detected transmitters regardless of their PIN; check the received signal strength shown there and the range (chapter 6).
Connection for configuration fails	Enter the Configuration PIN of the transmitter (section 9.1).
Calibration tab locked	Enter the Calibration PIN (section 9.4).
Input Sensitivity was changed	A new calibration is required (section 9.4).
Short range	Keep metal away from the antenna, keep line of sight, mount the transmitter higher (chapter 6).

12 Radio specification and approvals

12.1 Bluetooth

Bluetooth low energy v4.1. The module with embedded stack and profile has been qualified in accordance with the Bluetooth SIG qualification rules:

Item	Value
Declaration ID	D028766
Qualified design ID	71984
Product type	End Product
Core specification version	4.1
Product description	Bluetooth low energy v4.1 module

12.2 CE

The product range to which the EFMA belongs is declared in conformity with the Radio Equipment Directive 2014/53/EU, the EMC Directive 2014/30/EU and the RoHS Directive 2011/65/EU, based on the harmonised standards EN 61326-1:2013, EN 61326-2-3:2013 and EN 300328 V1.9.1.

The Bluetooth radio module (SPBTLE-RF) is certified to EN 62479:2010 · ETSI EN 301 489-1 V1.9.2:2011 · ETSI EN 301 489-17 V2.2.1 · ETSI EN 300 328 V1.8.1:2012 · ETSI EN 300 328 V1.9.1 (2015) · EN 60950-1:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2013 + AC:2011. CE expert opinion 0561-ARSP00053; RED certificate of the module No. 0051-RED-0011 REV. 0. Date of the declaration of conformity: 16 January 2019. The declaration of conformity is available from octogon on request.

12.3 USA, Canada and Japan

Region	Approval of the radio module
USA (FCC)	FCC ID: S9NSPBTLERF – modular transmitter according to FCC Part 15
Canada (IC)	IC: 8976C-SPBTLERF – modular transmitter according to RSS-210
Japan (TELEC)	certification number 006-000395; F1D, G1D, 2441 MHz, channel separation 2 MHz / 40 channels, 0.0025 W

This device complies with Part 15 of the FCC Rules and with RSS-210 of the IC Rules. Operation is 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.

This equipment complies with the FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

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

12.4 Regional approvals

Region	Conforms to
Europe	CE
USA	FCC
Canada	IC
Japan	TELEC