TRAX

Intelligent Pipeline Technology

EMTx30 Operating Manual

Electromagnetic Transmitter

www.iktrax.com

Scan the QR Code for additional resources and downloads

CONFIGURATION INFORMATION	
SERIAL NUMBER :	
BATTERY TYPE	
PRODUCT CODE :	
FREQUENCY :	
RATE 1 PULSE LENGTH :	
RATE 1 REPETITION RATE :	
RATE 1 BATTERY LIFE AT +5°C :	
*RATE 2 PULSE LENGTH :	
*RATE 2 REPETITION RATE :	
*RATE 2 BATTERY LIFE AT +5°C :	
SPECIFIED ON PRESSURE :	
**SPECIFIED OFF PRESSURE :	

*Rate 2 only applicable when a Dual Rate Endcap is fitted.

**Off pressure only applicable when a non-latching Pressure Switch Endcap is fitted.

CONTENTS **Page**

1. GENERAL DESCRIPTION

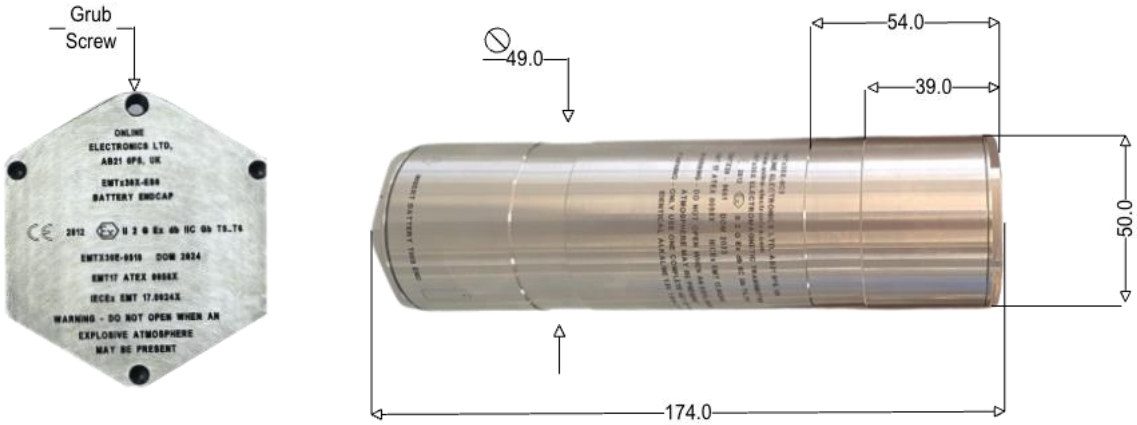
The EMTx30 EM Transmitter is an ATEX/IECEx CERTIFIED electromagnetic transmitter which can be used for pig tracking and locating functions. The transmitter operates effectively in buried pipelines, pipelines carrying gas or liquid and in pipeline bundles where acoustic transmitters are either less effective or ineffective.

The standard transmission frequency is 22.0Hz, however the frequency is factory and user programmable. An inherent EM null spot is detectable when an EM receiver antenna is at 90 degrees to and pointing towards the centre of the transmitter, allowing for centimetre accurate locating of the pig.

Pigging discs can be fitted directly to the transmitter, meaning the transmitter becomes the pig body. This dramatically increases the received EM signal as it no longer needs to propagate through the pig body in addition to the pipeline

Using the IK Trax EMTx Config application (Windows or Android) the transmitter frequency, power and pulse pattern can be configured to optimise performance and battery life.

Received signal strength is dependent on several factors including pipeline diameter, pipeline material, pig design, pig speed, transmitter configuration, receiver equipment and background electromagnetic noise levels. Please contact IK Trax to discuss the most effective transmitter configuration.



1.1. IK TRAX SHORTCUT

IK Trax offers a comprehensive range of resources to support the operation and configuration of the EMTx30 device. To make accessing these materials easier, we've provided a QR code that allows you to instantly connect to our online resource hub using any mobile device. Simply scan the QR code to explore detailed guides, troubleshooting tips, and other essential materials to help you get the most out of your EMTx30.

1.2. ENDCAP OPTIONS

EMTx30 transmitters come fitted with ATEX/IECEx certified Battery and PCB Endcaps as standard. There are several different endcaps options available which add additional functionality to the unit. Refer to Appendix D of this manual for further information. The EMTx30 incorporates an endcap detection circuit that allows it to determine the type of endcap that has been fitted and behave accordingly. As a result, any endcap can be fitted to any EMTx30 housing without having to update any configurations/settings in firmware.

2. OPERATION

The following instructions are for a unit fitted with the standard Battery Endcap and PCB Endcap. For operating instructions relating to a unit fitted with any of the alternative endcaps, please refer to Appendix D of this manual for further information.

⚠ **WARNING**: The Special Conditions for Safe Use as detailed in Appendix C must be followed at all times.

Familiarise yourself with all the rules for the safe operation of this equipment as described in Appendix B

2.1. TOOLKIT

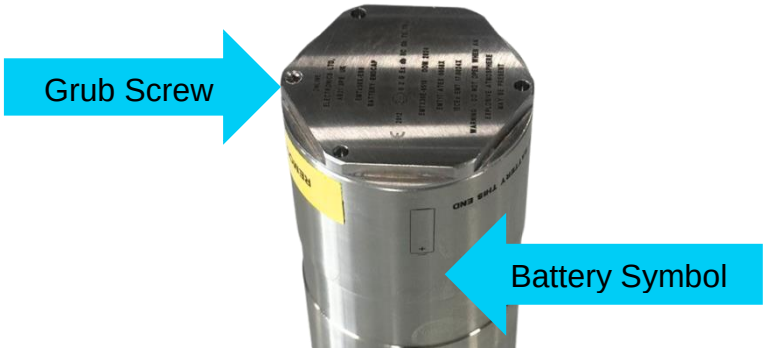
The following tools are provided to perform the endcap removal.

Endcap removal tool.

2.0mm AF Allen key

2.2. TURNING ON

Locate the battery endcap, by finding the battery symbol. Locate the grub screw on top of the endcap that locks the endcap in place. **Do not attempt to remove the battery endcap without having removed the grub screw first, it could cause permanent damage to the device.**



Remove the grub screw and then use the provided tool to turn the battery endcap counterclockwise and remove it.

Remove the isolator from the top of the batteries, and store in a safe place. To be replaced after use.

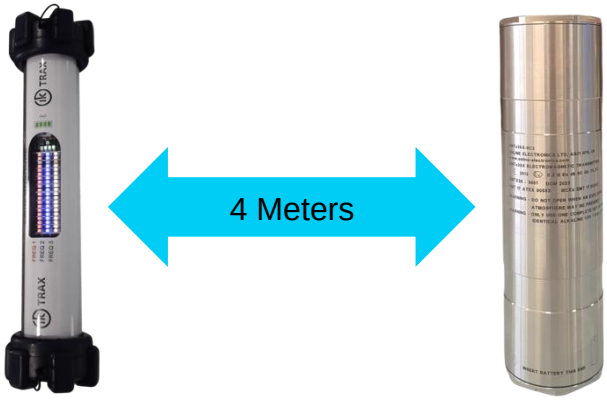
Refit the endcap and the grub screw. Avoid overtightening the endcap or the grub screw, it could damage the device.

The device will start transmitting 15 seconds after the endcap has been fitted.

2.3. FUNCTION TEST

To receive the signal from the transmitter, an EM receiver is required. For optimal performance, it is recommended to use the IK Trax EMRx receiver. Refer to the EMRx manual for instructions on setup and operation.

1. Place the EMRx receiver antenna approximately 4m away and parallel to the transmitter.



2. Confirm that the received signal frequency and pulse rate are as expected.

3. If all results were as expected, then the system is functional.

2.4. TURNING OFF

1. To turn the transmitter off, loosen the locking grub screw on the battery endcap.

2. Remove the battery endcap and place the isolator on top of the batteries.

3. Refit the battery endcap and the grub screw, avoid overtightening which could cause damage to the device.

4. Use the IK Trax EMRx to confirm that the device is off.

3. STORAGE

If the transmitter is to be placed in storage for a long period of time remove the batteries from the transmitter and store separately.

4. CONFIGURATION

To adjust the pulse rate, signal frequency or strength, the device needs to connect to an Android or Windows application via Bluetooth. The Android app is exclusively available on the Google Play Store. To access the app page, click the following link. The windows app is available for a download from the company website via this link. Alternatively, you can refer to the EMTx Config manual for more information on downloading and installing the software.

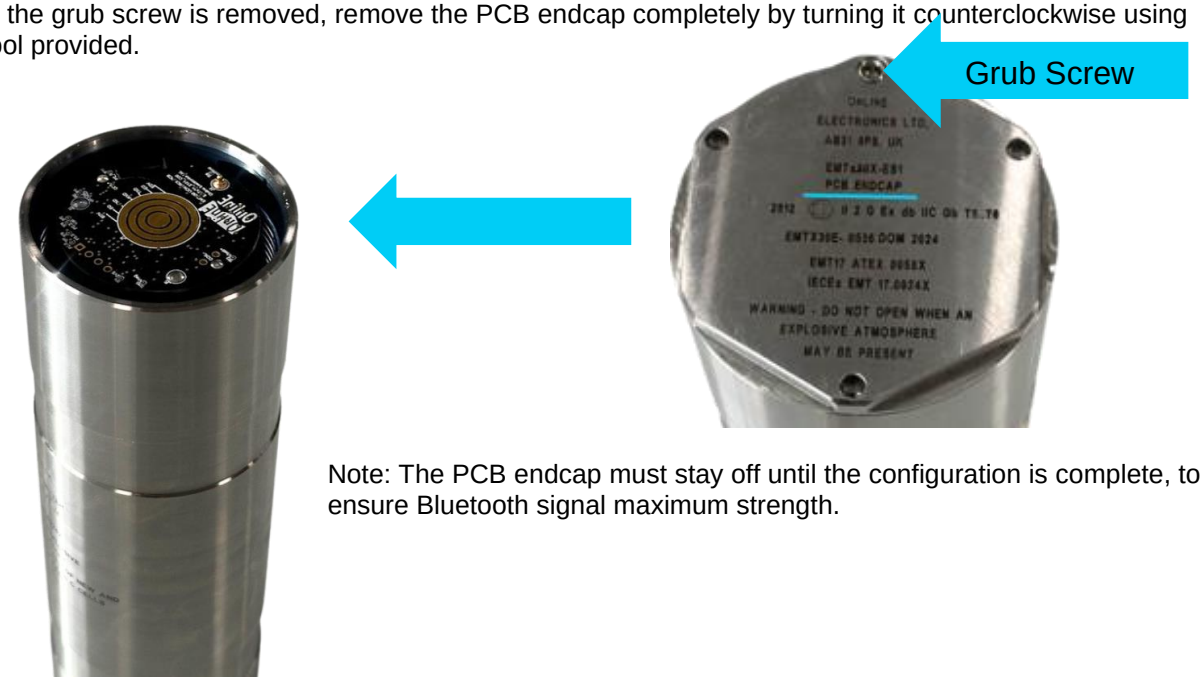
In addition, the following QR code provides quick access to the IK Trax resource hub.
It includes shortcuts to manuals, device downloads, and other essential materials.

4.1. HOW TO CONNECT

Locate the PCB endcap on the EMTx30 transmitter. The PCB endcap has the name engraved on it, as shown in the image.

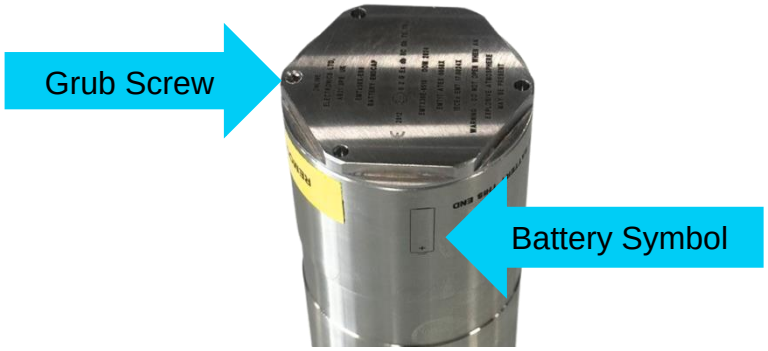
Once the grub screw is located, remove it to unlock the endcap.

Once the grub screw is removed, remove the PCB endcap completely by turning it counterclockwise using the tool provided.



Note: The PCB endcap must stay off until the configuration is complete, to ensure Bluetooth signal maximum strength.

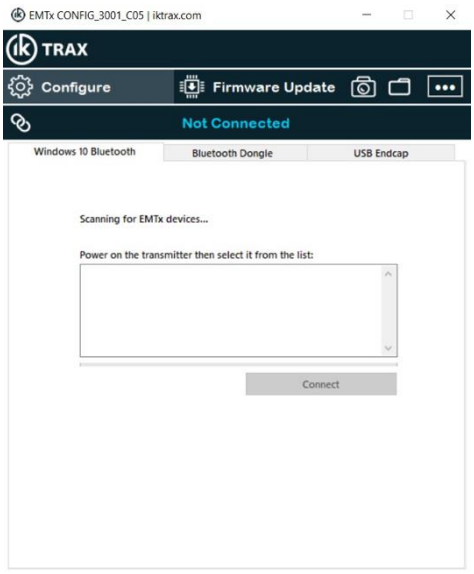
After removing the PCB endcap, locate the battery endcap on the opposite end of the transmitter. **Do not refit the PCB endcap until instructed at the end of this section.**

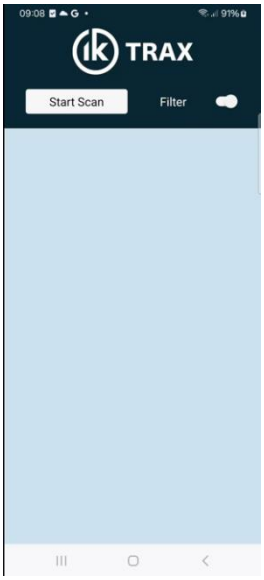


Remove the grub screw, and then use the provided tool to turn the battery endcap counterclockwise and remove it.

Remove the isolator from the top of the batteries.

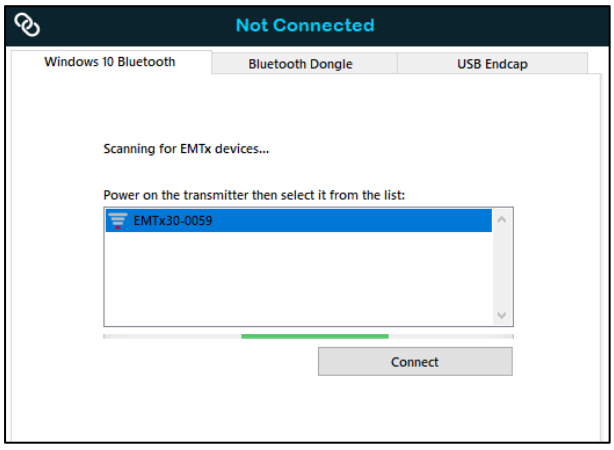
Launch the Android or Windows app on your phone or laptop.

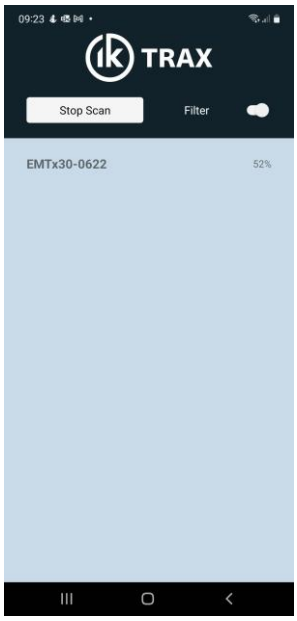




On Android app press “Start Scan” button to initialize the Bluetooth scan. It is not necessary to press anything on Windows app as the scanning happens automatically.

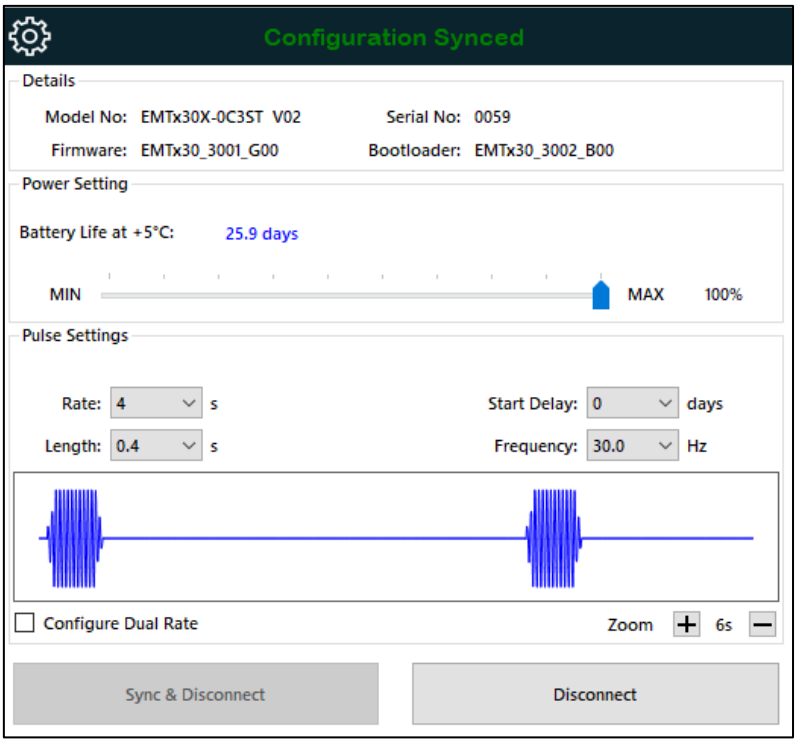
Begin tightening the battery endcap by hand and continue turning it while monitoring the app on your Android device or Windows PC. When the device name appears in the EMTx Config app, continue tightening the endcap for 2 more complete turns to ensure the device remains powered on. Then, tap on the device name in the list on Android, or the “Connect” button on Windows to proceed.

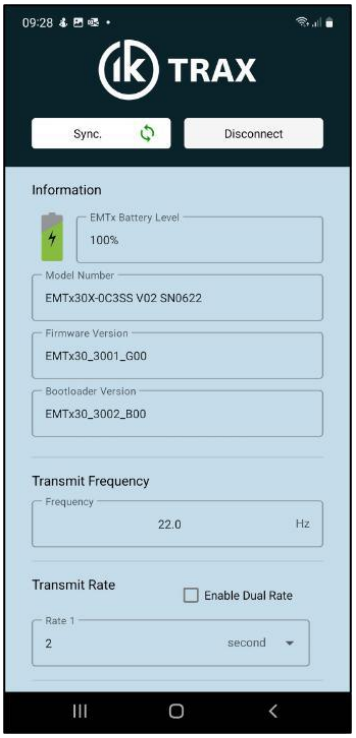




NOTE: The Bluetooth is only discoverable for 15 seconds so be aware that you may have to repeat this process if it doesn’t connect.
Once Connected you will be presented with configurational information from the device.

On the windows app proceed to make the required changes, then press “Sync & Disconnect” to send the new configuration to the device, then the app will disconnect.





After making any changes to the configuration in the Android app, the “Sync” button will change colour to red. Click it to send the updated configuration to the device. Once the process is complete and the button returns to its original colour, the new configuration has been successfully sent. You can then disconnect from the device by clicking the “Disconnect” button.

Once disconnected the device will start transmitting and you may tighten the battery endcap and refit the grub screw. Once the battery endcap is secured, proceed to refit the PCB endcap and grub screw.

To ensure that the device has been configured correctly it is advised to perform a function test with an EMRX receiver.

4.2. DEPLOYMENT

Before each deployment ensure that the following checks have been completed.

1. Ensure that the transmitter has been installed as detailed in Appendix C.
2. Visually inspect all system components to ensure that they are secure and undamaged.
3. Refer to Appendix E of this manual for the expected battery lifetime and ensure that it is adequate for the planned operations.
4. Activate the transmitter.
5. Perform a Function Test (page 7).

5. MAINTENANCE

The EMTx30 EM transmitters are designed to require minimum maintenance. The transmitter should be cleaned using fresh water and cleaning agents as necessary (e.g. WD40). Do not use chemicals which could be damaging to the housing or O-rings.

Check flame paths / threads on the housing body and endcaps for signs of corrosion or damage. If badly pitted or damaged, consult IK Trax for advice on replacing the relevant part.

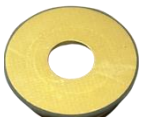
All parts which are replaced must be in accordance with the manufacturers' specifications. Failure to use such components may invalidate the certification/approval and may make the equipment dangerous.

IK Trax can supply redress kits containing a complete set of replacement batteries, washers, O-rings, O-ring grease, thread lubricant and endcap locking screws, contact IK Trax for more information.

5.1. BATTERY REPLACEMENT

Once the grub screw has been removed, remove the battery endcap using the tool provided, by turning it counterclockwise.

Once battery endcap removed, remove the old batteries from the transmitter.



Between the batteries spacers are placed to reduce the shock caused by the vibrations.

As per the diagram start placing the batteries inside the transmitter, one by one.

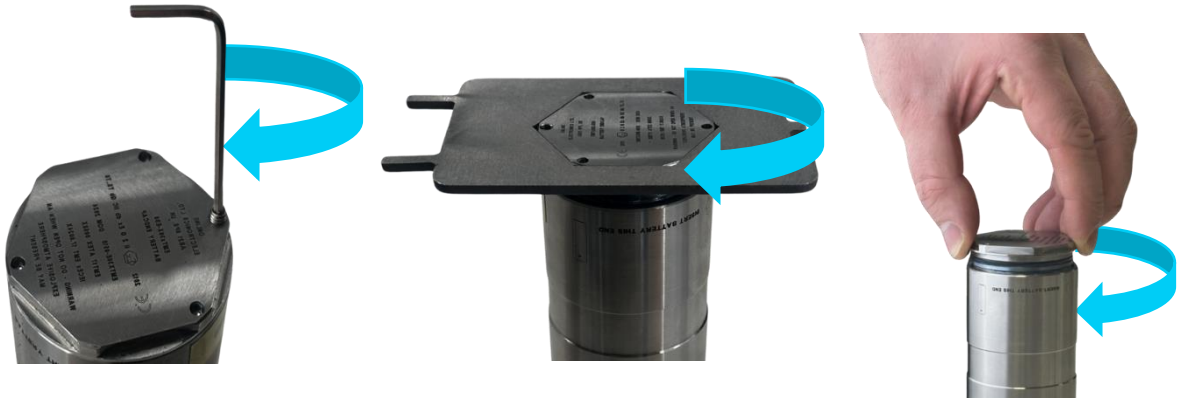
Once batteries have been replaced assess the state of the O rings on the endcap for sign for any damage or dirt. If any is present remove the O ring and clean all the grooves.

Lightly grease the new O ring and place it in the groove.

Apply a small amount of an oil-based thread lubricant such as “Blue Goop” to the endcap threads.

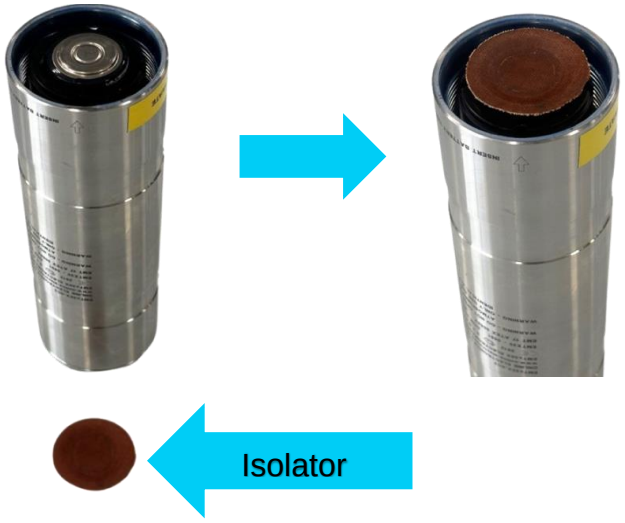
Once greased and assessed the battery endcap can be replaced and tightened using the provided endcap removal tool. Do not overtight the endcap to avoid any damage.

Then add the grub screw and tighten it up to fully secure the endcap.



5.2. TURNING OFF

If you wish to turn off the device after replacing the batteries, place the isolator on top of the batteries before refitting the battery endcap. Then, secure the endcap and the grub screw. This will prevent the device from powering on.



6. DISPOSAL OF UNIT

IK Trax takes its responsibilities under the WEEE Regulations extremely seriously and has taken steps to be compliant in line with our corporate and social responsibilities. In the UK, IK Trax has joined a registered compliance scheme WeeeCare (registration number **WEE/MP3538PZ/SCH**).

Electrical and electronic equipment should never be disposed of with general waste but must be separately collected for the proper treatment and recovery.

The crossed-out bin symbol, placed on the product, reminds you of the need to dispose of it correctly at the end of its life.

When buying a new product, you will have the possibility to return, free of charge, another end-of-life product of equivalent type that has fulfilled the same functions as the supplied equipment. These items may be deposited at:

Online Electronics Ltd
Doing business as IK Trax
Blackburn Business Park
Woodburn Road
Blackburn
Aberdeen
AB21 0PS
UK

Alternatively, to arrange a collection of any waste electrical equipment, obligated to IK Trax please telephone WeeeCare on **0844 800 2004**.

7. SAFETY INSTRUCTIONS

Refer to certificate(s) and section 8DECLARATION OF CONFORMITY.

SPECIAL CONDITIONS FOR SAFE USE:

1. Only use one complete set of new and identical battery cells.

2. Only the following permitted batteries shall be used with the corresponding ambient temperature and temperature class.

CELL MANUFACTURER & PART NUMBER	CELL TYPE	CELL VOLTAGE	OPERATING AMBIENT TEMPERATURE	TEMPERATURE CLASS
DURACELL ID1400	Alkaline	1.5V	-20°C to +50°C	T6
DURACELL MN1400	Alkaline	1.5V	-20°C to +50°C	T6
DURACELL MX1400	Alkaline	1.5V	-20°C to +50°C	T6
ENERGIZER E93	Alkaline	1.5V	-18°C to +50°C	T6
VARTA 4914	Alkaline	1.5V	-10°C to +46°C	T6
SHAFT LSH14C	Lithium	3.7V	-40°C to +76°C	T6
SHAFT LSH14C	Lithium	3.7V	-40°C to +80°C	T5

3. Batteries must be installed into the enclosure in accordance with the orientation detailed on the markings.

4. Repair of flame paths is not permitted by the end user.

5. Do not open when an explosive atmosphere may be present.

6. Units must be installed such that ignition sources due to impact and friction sparks are excluded.

7. Where used, the bleed screw must be tightened to a torque between 4Nm and 8Nm. Do not exceed 8Nm.

8. DECLARATION OF CONFORMITY

This declaration of conformity is issued under the sole responsibility of the manufacturer:

Online Electronics Ltd
Online House
Blackburn Business Park
Woodburn Road
Blackburn
Aberdeen
AB21 0PS
UNITED KINGDOM

Object of declaration:

EMTx30X range of electromagnetic transmitters

With the following markings:


II 2 G Ex db IIC Gb T5…T6

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

ATEX:	ATEX Directive 2014/34/EU
IECEx:	IECEx System
EMC:	EMC Directive 2014/30/EU

The following standard(s) and technical specification(s) have been applied:

ATEX:	EN 60079-0:2012+A11:2013
	EN 60079-1:2014
IECEx:	IEC 60079-0:2011
	IEC 60079-1:2014
EMC:	EN61000-6-4:2007
	EN61000-6-2:2005

As per the certificate(s) below:

ATEX: EU Type Examination Certificate EMT 17 ATEX 0058X issued by Element Materials Technology, Notified Body 2812, under QANTRAC08QAN1047.
Refer to Special Conditions of Safe Use within EMT 17 ATEX 0058X.

IECEx: IECEx Certificate of Conformity IECEx EMT 17.0024X issued by Element Materials Technology, under QAR GB/TRC/QAR11.0002. Refer to Conditions of Certification within IECEx EMT 17.0024X.

EMC: Certificates TBC and TBC issued by York EMC Services Ltd.

The apparatus named above has been designed to comply with the relevant sections of the above referenced specifications and complies with all essential requirements of the Directives and Systems.

APPENDIX A: SPECIFICATIONS

NOTE: THE SPECIFICATIONS BELOW ARE VALID FOR THE STANDARD CONFIGURATION ONLY. REFER TO PAGE 1 OF THIS MANUAL FOR THE CONFIGURATION INFORMATION SPECIFIC TO THE TRANSMITTER BEING USED.

GENERAL

Bump rating 20G

Housing material ..... 316L Stainless Steel or Grade 5 Titanium

Endcap material ..... 2205 Duplex Stainless Steel

O-ring material NBR70

Transmitter weight in 316L Stainless Steel (including batteries) 1.7kg (3.7lbs)

Transmitter weight in Grade 5 Titanium (including batteries) 1.5kg (3.3lbs)

External pressure rating in 316L Stainless Steel 300bar (4351psi)

External pressure rating in Grade 5 Titanium 500bar (7252psi)

Frequency ..... adjustable 10Hz to 30Hz in 0.1Hz increments

Power ..... adjustable 20% to 100% in 10% increments

Pulse length ..... adjustable 0.3 second to 1.0 second in 0.1 second increments

Pulse rate ..... adjustable 1 second to 10 seconds in 1 second increments

ATEX code ..... II 2 G

IECEx code ..... Ex db IIC Gb T5..T6

EU Type Examination Certificate Number EMT17ATEX 0058X

IECEx Certificate Number ..... IECEx EMT 17.0024X

ALKALINE BATTERY:

Battery Type ..... 3x Alkaline DURACELL ID1400 C CELLS

Temperature range ..... See 7 SAFETY INSTRUCTIONS

Lifetime in other configurations..... See Appendix D > 0APPENDIX E: BATTERY LIFETIME

EMTx30 (3 Cell Alkaline) predicted lifetimes (days), 0.4s pulse length, +5°C						
Power Setting	**Cont.**	**1 sec**	**2 sec**	**3 sec**	**4 sec**	**5 sec**
100%	2	5.6	12	19	26	31

LITHIUM BATTERY:

Battery Type .....3xLithium SAFT LSH14 C CELLS

Temperature range ..... see SAFETY INSTRUCTIONS

Lifetime in other configurations..... See Appendix D > 0APPENDIX E: BATTERY LIFETIME

EMTx30 (3 Cell Lithium) predicted lifetimes (days), 0.4s pulse length, +5°C						
Power Setting	**Cont.**	**1 sec**	**2 sec**	**3 sec**	**4 sec**	**5 sec**
100%	5	12.5	25	37.5	50	62.5

APPENDIX B: OPERATION WARNINGS

RULES FOR SAFE OPERATION

⚠ **WARNING**: The Special Conditions for Safe Use as detailed in Appendix C must be followed at all times.

⚠ **WARNING**: Any operation involving pressure is potentially hazardous. No person should use this equipment unless they are fully aware of the potential hazards of working with pressurised vessels. The purchaser of this equipment is responsible for the training and competence of operators and the manner in which it is used. This manual should be read through and understood before installation and commissioning so that the operator is familiar with the equipment. Contact IK Trax immediately should any difficulty arise in the use of this equipment.

⚠ **WARNING**: DO NOT open when an explosive atmosphere may be present. Always use caution when opening equipment which has been in a pressurised environment. It is possible for pressure to leak into the equipment and remain there even after external pressure has been removed. ALWAYS point the end to be opened towards a safe area and away from yourself or others. Contact IK Trax immediately if there is a suspicion that the equipment has become pressurised.

⚠ **WARNING**: Replace all batteries at the same time. NEVER install used batteries. NEVER install a mix of new and used batteries. USE ONLY new batteries from the same package or manufacturing batch. DO NOT mix different brands or types of batteries. ALWAYS observe correct battery polarity. New batteries should be installed before each deployment.

⚠ **WARNING**: Do not expose to aggressive solvents or chemicals which could be harmful to the HOUSING, O-RINGS, CONNECTORS or any other parts of the equipment.

⚠ **CAUTION**: This equipment should only be opened in a clean laboratory environment.

⚠ **CAUTION**: To prevent the formation of condensation within the transmitter, allow the transmitter temperature to stabilise within the laboratory environment at room temperature for a minimum of 6 hours prior to opening.

⚠ **CAUTION**: It is possible for liquids to become trapped in threads and/or gaps around openings. ALWAYS point the end to be opened downwards to allow any trapped liquid to drain out of and not into the equipment

APPENDIX C: PIG INSTALLATION

⚠ **WARNING**: The Special Conditions for Safe Use as detailed in Appendix B must be always followed.

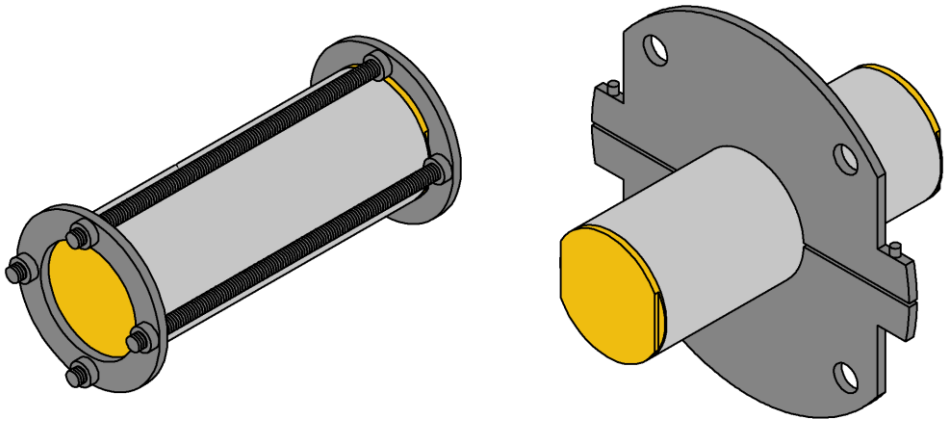
⚠ **WARNING**: The transmitter must be mounted in such a way that no movement or vibration is possible whatsoever (e.g. clamped). If the transmitter is allowed to rattle and/or vibrate within the pig then the resultant hammering effect can exceed the bump rating of the transmitter leading to damage and/or failure. This is particularly important in gas pipelines.

⚠ **WARNING**: Transmitters with the main body manufactured from Titanium, such as the EMTx30X-0C3ST MUST be installed in such a way that ignition sources due to impact and friction sparks are excluded. Refer to the main body markings for the material type supplied.

⚠ **CAUTION**: EM transmitters can experience significant signal strength reduction and decreased battery life when surrounded by conductive or magnetic materials. To minimize these effects:

- Reduce the amount of surrounding conductive or magnetic material and leave as much of the transmitter exposed as possible.
- Avoid using low-resistance metals such as aluminium, including tubes or mounting clamps. Non-conductive materials like plastics are preferred and will not affect signal performance.
- Use materials with high electrical resistance and low magnetic permeability. For instance, 316 stainless steel offers a good balance of properties and cost, while aluminium alloys should be avoided.

For optimal performance, mount the transmitter in a plastic pig body or use plastic guide discs. Alternative arrangements, such as clamping the transmitter between plates or using a clamping disc with limited metal, can also reduce interference. For further guidance on EM transmitter installation, contact IKTRAX.



⚠ **CAUTION**: In extreme circumstances strong magnets in close proximity to EM transmitters may dramatically impact signal and lifetime. Where possible maintain a separation of at least 200mm between the EM transmitter and any magnets.

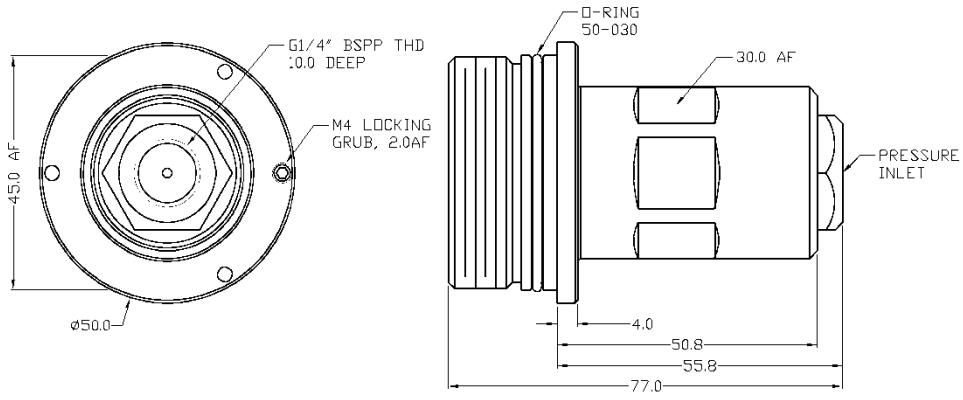
APPENDIX D: ENDCAP OPTIONS

Using the IK Trax EMTx Config application (Windows or Android) the transmitter frequency, power and pulse pattern can be configured to optimise performance and battery life.

PRESSURE SWITCH ENDCAP

The EMTx30 PRESSURE SWITCH ENDCAP is an ATEX/IECEx certified endcap that can be fitted in place of the standard PCB endcap to allow the unit to be activated once the external pressure exceeds a pre-configured ON PRESSURE.

There are six different pressure switch endcaps available that cover both latching and non-latching versions and three different pressure bands: 1-4 bar, 3-10 bar, and 6-18 bar. Transmitters configured with non-latching pressure switches will stop transmitting when the external pressure drops below the ON PRESSURE minus the DEAD BAND, whereas transmitters configured with latching pressure switches will continue transmitting until the batteries are depleted or one of the endcaps is removed.

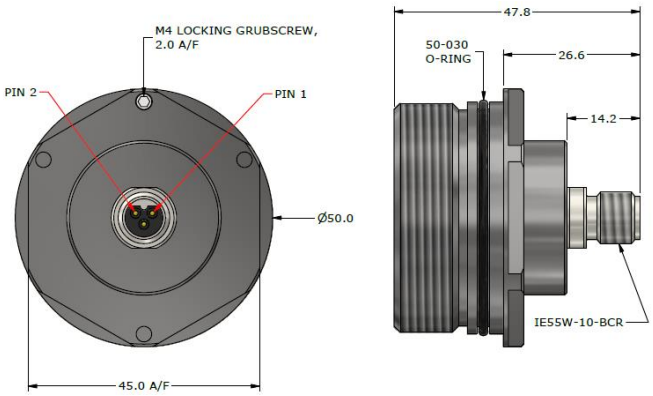


DUAL RATE ENDCAP (NON-CERTIFIED)

⚠ **WARNING**: This endcap is NON-ATEX/IECEx certified. If this endcap is fitted to an ATEX/IECEx certified transmitter body, then the transmitter must NOT be used in an ATEX/IECEx only environment.

DUAL RATE ENDCAP - Can be fitted to an EMTx30 transmitter in place of the PCB endcap to allow an external piece of equipment (e.g. an IK Trax 7000 ARGF) to switch between two pre-configured pulse rates.

LATCHING DUAL RATE ENDCAP –Works in the same way as the DUAL RATE ENDCAP except that the unit will permanently switch from pulse rate 2 to pulse rate 1 when the unit detects an open circuit between pins 1 and 2 on the IE55 connector.



WATER ACTIVATED ENDCAP (NON-CERTIFIED)

⚠ **WARNING**: This endcap is NON-ATEX/IECEx certified. If this endcap is fitted to an ATEX/IECEx certified transmitter body, then the transmitter must NOT be used in an ATEX/IECEx only environment.

WATER ACTIVATED NON-LATCHING ENDCAP - Can be fitted in place of the standard PCB endcap to allow the unit to be activated only in the presence of conductive fluid such as water. The presence of a suitable fluid will activate the transmitter and will deactivate the transmitter when dry.

WATER ACTIVATED LATCHING ENDCAP - Can be fitted in place of the standard PCB endcap to allow the unit to be activated only in the presence of conductive fluid such as water. The presence of a suitable fluid will activate the transmitter and will not deactivate the transmitter when dry.

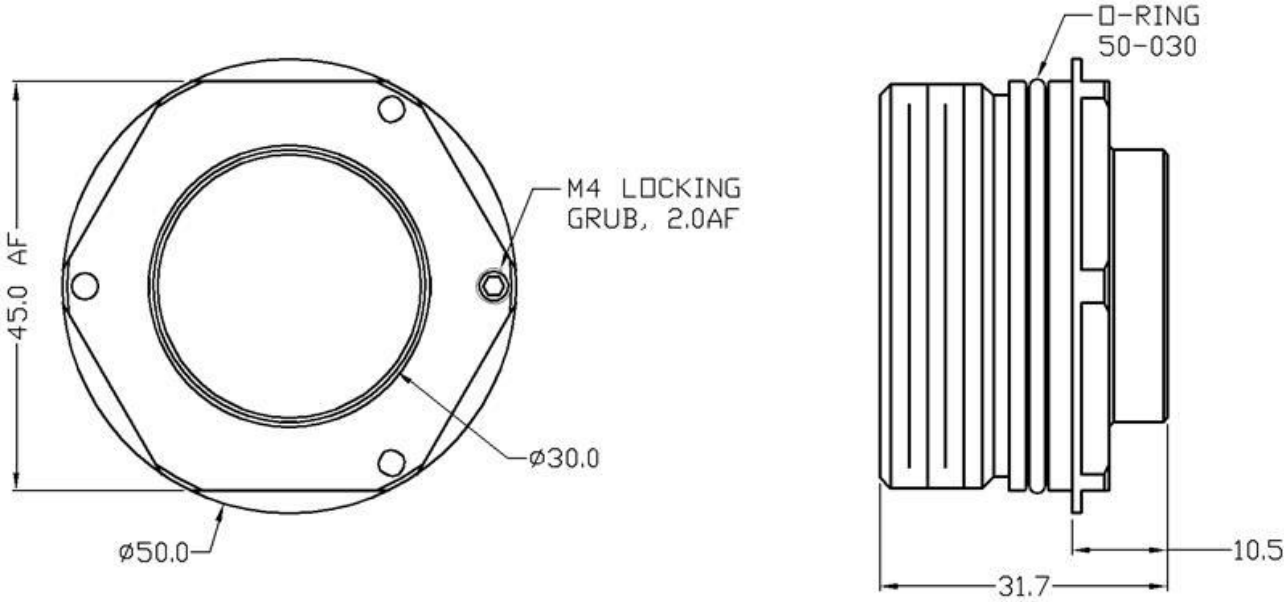
MAGNETIC ACTIVATION ENDCAP

The EMTx30 MAGNETIC ACTIVATION ENDCAP (EMTx30X-EM0) is an ATEX/IECEx certified endcap that replaces the standard PCB endcap, allowing the transmitter to deactivate in the presence of a magnetic field. It is compatible with an Eclipse ring magnet, which will deactivate the unit when placed within 10 mm of the endcap face and aligned within 10 mm of the transmitter's central axis.

It is ideal for use in pig launchers, where the transmitter remains inactive near a mounted magnet and activates automatically once the magnet is removed (e.g., when the pig launches). A MA Mating Cap can also be used to deactivate the unit when attached and activate it when removed.

To power on the transmitter, fully tighten both endcaps using the removal tool—avoid over-torquing. Remove the nylon washer from the battery endcap before activation. The transmitter powers on in about 15 seconds. Confirm operation using an EM receiver.

To turn off, loosen the battery endcap by five full turns and verify shutdown using an EM receiver such as EMRx.



To test magnetic activation, activate the transmitter and bring a magnet (e.g., MA Mating Cap) within 10 mm of the endcap face and aligned within 10 mm of the central axis. Transmission should stop. Remove the magnet to confirm the signal resumes.

SPECIFICATIONS

ENDCAP TYPE	CERTIFIED	ACTIVATION METHOD	ENDCAP MATERIAL	EXTERNAL PRESSURE RATING
EM0	YES	Magnetic	2205 Duplex Stainless Steel	500 bar

Note that the presence of a magnet within the activation range will deactivate the unit. Removing the magnet will reactivate the unit. Always confirm operation using an EM receiver.

APPENDIX E: BATTERY LIFETIME

The operating temperature at which the transmitter is used alters the operating lifetime with colder temperatures typically shortening achievable lifetime.

Transmitter frequency effects lifetime because pulse lengths are restricted to a whole number of cycles of the transmitter frequency. The lifetimes stated in this manual will not vary by more than 10% at other frequencies. The EMTx Config Windows and Android applications include the effects of frequency in their lifetime predictions.

Refer to section 0 within this manual for tips on how to achieve optimum performance from the transmitter with regards to the mounting arrangement.

The tables below show predicted lifetimes for a range of configurations.

Please contact IK Trax to discuss any project specific requirements.

EMTx30-0C3S predicted lifetimes (days), 0.4s pulse length, +5°C						
Power Setting	**Cont.**	**1 sec**	**2 sec**	**3 sec**	**4 sec**	**5 sec**
100%	2.0	5.6	12	19	25	31
50%	4.7	13	29	44	59	73
20%	15	41	91	137	183	229

EMTx30-0C3S predicted lifetimes (days), 0.4s pulse length, +20°C						
Power Setting	**Cont.**	**1 sec**	**2 sec**	**3 sec**	**4 sec**	**5 sec**
100%	2.5	7.0	15.0	23.7	31.2	38.7
50%	5.8	16.2	36.2	55.0	73.7	91.2
20%	18.7	51.2	113.7	171.2	228.7	286.2