

# **EMTx20 - AA3 Range EM Transmitter Operating Manual**

The EMTx 20 transmitter is an electromagnetic transmitter that can be used for pig tracking and locating functions, intended for use in pipeline diameters of 6" to 8"



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<b>CONFIGURATION INFORMATION</b>	
SERIAL NUMBER :	
PRODUCT CODE :	
FREQUENCY :	
OUTPUT SIGNAL STRENGTH :	
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 :	

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

<b>EMTx20_5002</b>			
<b>Rev</b>	<b>Date</b>	<b>By</b>	<b>Summary of change</b>
A00	14/06/16	BG	Initial release, includes CR00325.
A01	14/06/16	BG	Minor updates and corrections.
A02	22/06/16	BG	Updates as per CR00330.
A03	10/10/16	BG	Section 1: ATEX CERTIFIED added and graphic updated. Section 4.7 and 5.1: Graphic updated. EMTx20X-ES0 endcap corrected to EMTx20-ES0 endcap throughout.
A04	03/02/17	MC	Battery lives reduced. Power added to list of configurable parameters. Various minor changes to wording/spelling.
A05	06/07/17	MC	CR0485: New address. CR00499: New front page. Endcap Options added.
A06	03/10/17	GH	Email address corrected on cover page. Section 2: USB endcap added to endcap table. Section 2: USB endcap description added. Section 2: Transmitter version reference changed from RevB to V03.
A07	25/01/18	MC	Added mounting groove dimensions to externals graphic. Updated the battery lives for the new version. Washers added between cells.
B00	06/02/20	TL	Email Address & Notified Body number updated
B01	14/10/20	TL	CR00947: New Front Page
<b>COMMENTS:</b>			

**CONTENTS**

**Page**

1. GENERAL DESCRIPTION ..... 4

2. ENDCAP OPTIONS..... 4

3. SPECIFICATIONS:..... 6

4. RULES FOR SAFE OPERATION ..... 7

5. OPERATION ..... 8

    5.1. TURNING ON..... 8

    5.2. TURNING OFF ..... 8

    5.3. FUNCTION TEST ..... 8

    5.4. DEPLOYMENT ..... 9

    5.5. INSTALLATION ..... 9

    5.6. BATTERY LIFETIME ..... 10

    5.7. BATTERY REPLACEMENT ..... 11

6. MAINTENANCE ..... 12

    6.1. O-RING REPLACEMENT..... 12

7. ROUTINE MAINTENANCE AND STORAGE..... 13

8. DISPOSAL OF UNIT ..... 14

9. WARRANTY ..... 14

10. CERTIFICATION APPENDIX ..... 15

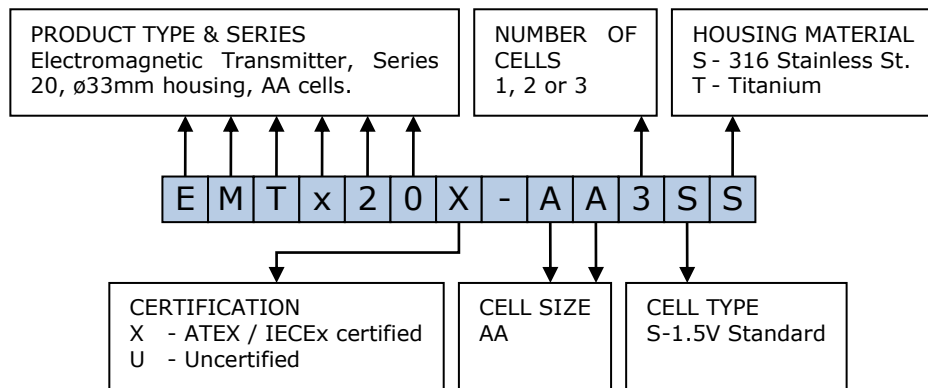
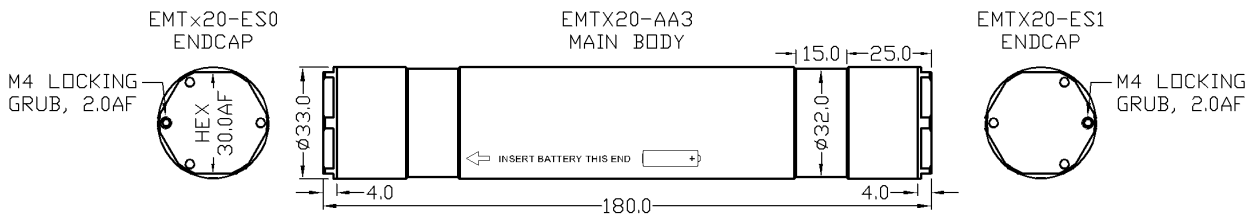
# 1. GENERAL DESCRIPTION

The EMTx20X-AA3 transmitter is an ATEX CERTIFIED electromagnetic transmitter that 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 settable over the frequency range of 15Hz to 38Hz. 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.

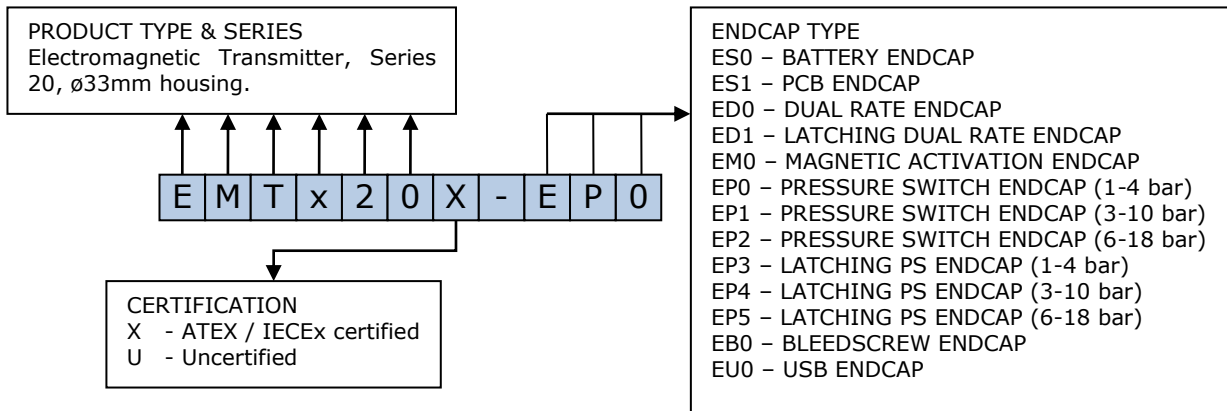
The EMTx20X transmitter signal can be detected through pipeline walls. Signal strength is dependent on several factors including pipeline diameter, pipeline material, pig design, pig speed and background EM noise levels. The transmitter power level can be adjusted to achieve the optimum balance between signal strength and battery life. Pulsed signalling can also be utilised to extend battery life. Please contact OEL to discuss the most effective configuration.

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.



# 2. ENDCAP OPTIONS

In addition to the standard Battery Endcap (EMTx20X-ES0) and PCB Endcap (EMTx20X-ES1), there are a number of different endcaps available that add additional functionality to the unit. The EMTx20 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 EMTx20 housing (providing it is a version V03 or later) without having to update any configurations/settings in firmware.



**BLEEDSCREW ENDCAP (EMTx20X-EB0)** – The Bleedscrew Endcap is ATEX rated and replaces the Battery Endcap. When fitted the unit is activated/deactivated by screwing/unscrewing the Bleedscrew rather than the Endcap itself. The Bleedscrew incorporates a HEX socket for a 5mm (AF) Allen Key so that any internal pressure can be released, and the unit can be activated/deactivated when access to the endcap is limited. Please see the separate Bleedscrew Endcap Manual for more information.

**MAGNETIC ACTIVATION ENDCAP (EMTx20X-EM0)** – The Magnetic Endcap is ATEX rated and can be fitted in place of the PCB ENDCAP to allow the unit to be deactivated when placed in a suitable magnetic field. Please see the separate Magnetic Activation Endcap Manual for more information.

**PRESSURE SWITCH ENDCAPS (EMTx20X-EP0 to EMTx20X-EP5)** – EMTx20 Pressure Switch endcaps are ATEX certified endcaps that can be fitted to any EMTx20 series transmitter (from V03 onwards) in place of the standard PCB Endcap and 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. The standard pressure switches will stop transmitting when the external pressure drops below the ON PRESSURE minus a DEAD BAND, whereas the latching pressure switches will continue transmitting until the batteries are depleted or one of the endcaps is removed.

**DUAL RATE ENDCAP (EMTx20U-ED0 to EMTx20U-ED1)** – The Dual Rate Endcap is **NOT** ATEX rated and can be fitted in place of the PCB Endcap. **WARNING – Fitting this endcap to an ATEX body means that the unit is no longer ATEX.** With a Dual Rate Endcap fitted, the unit will transmit at pulse rate 2 when pins 1 and 2 on the IE55 Connector are shorted together and at pulse rate 1 when the contacts are open circuit. This allows the pulse rate to be controlled by an external piece of equipment, e.g. a BWGP (Break-Wire-Gauge-Plate). Please see the separate Dual Rate Endcap Manual for more information. A Latching Dual Rate Endcap is also available that works in the same way as the standard 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. Please see the separate Dual Rate Endcap Manual for more information.

**USB ENDCAP (EMTx20U-EU0)** - The USB endcap enables the EMTx20 transmitter to be connected to a Windows PC running the EMTx Config application, allowing the user to view and edit various parameters such as the power level and pulse rate. To connect the EMTx20 transmitter to a PC, the USB endcap is fitted to the PCB end of the transmitter and then connected to the PC using a Mini-USB to USB cable. When connected, the transmitter is powered through the USB port, meaning the transmitter can be operated without batteries and any batteries that are fitted will not lose any of their charge.

### 3. SPECIFICATIONS:


**NOTE THAT 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.**

#### BATTERY LIFETIMES:

Battery Lifetimes at 50mVpp / 80mVpp Signal Strength at 1m.

Battery lifetime in continuous mode at +5°C <sup>(1)</sup> .....	6.5 days / 3 days
Battery lifetime at 1s pulse rate (0.4s ON / 0.6s OFF) at +5°C <sup>(1)</sup> .....	17 days / 8.5 days
Battery lifetime at 2s pulse rate (0.4s ON / 1.6s OFF) at +5°C <sup>(1)</sup> .....	34 days / 17 days
Battery lifetime at 3s pulse rate (0.4s ON / 2.6s OFF) at +5°C <sup>(1)</sup> .....	51 days / 26 days
Battery lifetime at 4s pulse rate (0.4s ON / 3.6s OFF) at +5°C <sup>(1)</sup> .....	68 days / 34 days

#### GENERAL:

Standard Battery Type .....	3x Alkaline AA DURACELL ID1500 CELLS
Standard signal at 1m with OEL reference antenna at +20°C in air <sup>(1)</sup> .....	50mVpp / 80mVpp
Standard frequency <sup>(1)</sup> .....	22Hz
Temperature range.....	See section 10 CERTIFICATION APPENDIX
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) .....	0.9kg
Transmitter weight in Grade 5 Titanium (including batteries) .....	0.7kg
External pressure rating in 316L Stainless Steel .....	300bar
External pressure rating in Grade 5 Titanium .....	500bar
ATEX code .....	 II 2 G
IECEX code .....	Ex db IIC Gb T6
EU Type Examination Certificate Number.....	EMT 16 ATEX 0011X
IECEX Certificate Number .....	IECEX EMT 16.0009X

(1) Parameters such as Power, Lifetime, Frequency, ON time and OFF time can be customised, please contact Online Electronics Ltd to discuss your project requirements. In addition, units with the Titanium Housing will have approximately 15% longer battery life than the standard SS versions.

## 4. RULES FOR SAFE OPERATION

**⚠ WARNING:** The Special Conditions for Safe Use as detailed in Section 10 CERTIFICATION APPENDIX must be followed at all times.

**⚠ WARNING:** Any operation involving pressure is potentially hazardous. No person should use this equipment unless 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 Online Electronics Ltd 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 Online Electronics 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:** Opening of the equipment should take place 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 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.



## **5. OPERATION**

Familiarise yourself with all of the rules for the safe operation of this equipment as described in Section 4 RULES FOR SAFE OPERATION. Note: The following instructions are for a unit fitted with the standard Battery Endcap (EMTx20X-ES0) and PCB Endcap (EMTx20X-ES1). For operation instructions relating to a unit fitted with any of the alternative endcaps, please refer to the relevant endcap manual.

### **5.1. TURNING ON**

1. To turn the transmitter on, fully tighten the EMTx20-ES0 ENDCAP using the supplied ENDCAP REMOVAL TOOL. Do not use excessive torque. The transmitter takes approximately 5 seconds to turn on. Note that the transmitter is shipped with a Nylon washer inside the EMTx20-ES0 ENDCAP to prevent accidental activation during transport. This must be removed before the transmitter can be turned on.
2. Use an EM receiver system to confirm that the transmitter is functioning properly at the expected pulse rate.

### **5.2. TURNING OFF**

1. To turn the transmitter off, loosen the EMTx20-ES0 ENDCAP 5 full turns using the supplied ENDCAP REMOVAL TOOL.
2. Use an EM receiver system to confirm that the transmitter has turned off.

### **5.3. FUNCTION TEST**

An OEL EM receiver system is required to receive the signal from the EMTx20X transmitter. Refer to the relevant EM receiver manual for instruction on setup and operation of the EM receiver system.

1. Place the EM receiver antenna approximately 4m away and parallel to the transmitter.
2. Activate the transmitter as detailed in Section 5.1 TURNING ON.
3. Confirm that a clear signal is received and the pulse rate is as expected.
4. Switch the transmitter between OFF and ON a few times to ensure that the signal received reacts as expected.
5. An inherent null spot is detectable when the antenna is at 90 degrees to and pointing at the centre of the transmitter allowing accurate positioning of a pig. Refer to the relevant EM receiver manual for further information.
6. Turn OFF the transmitter as detailed in Section 5.2 TURNING OFF.
7. If all results were as expected then the system is functional.

## 5.4. DEPLOYMENT

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

1. Ensure that the transmitter has been installed as detailed in Section 5.5 INSTALLATION.
2. Visually inspect all system components to ensure that they are secure and undamaged.
3. Refer to Page 1 of this manual for the expected battery lifetime and ensure that it is adequate for the planned operations.
4. Activate the transmitter as detailed in Section 5.1 TURNING ON.
5. Complete a Section 5.3 FUNCTION TEST.

## 5.5. INSTALLATION

**⚠ WARNING:** The Special Conditions for Safe Use as detailed in Section 10 CERTIFICATION APPENDIX must be followed at all times.

**⚠ 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.

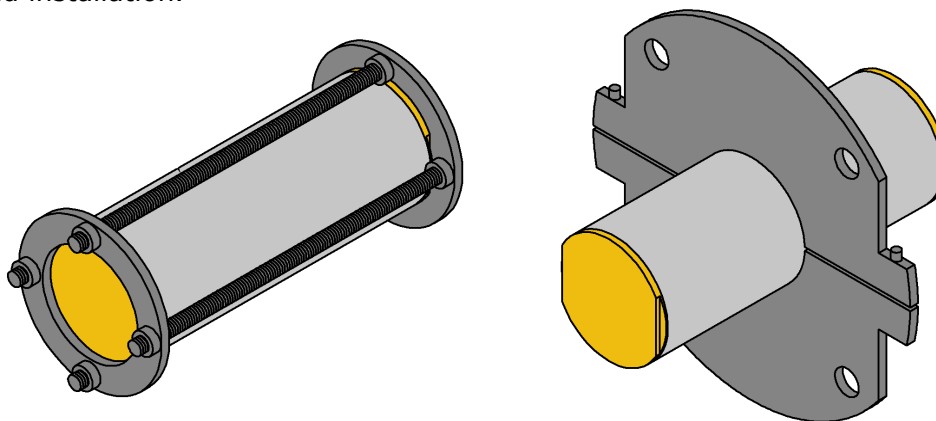
**⚠ WARNING:** Transmitters with the main body manufactured from Titanium, such as the EMTx20X-AA3ST MUST be installed in such a way that ignition sources due to impact and friction sparks are excluded. Refer to the main body markings for the material type supplied.

**⚠ CAUTION:** All EM transmitters will induce electrical currents in any conductive materials closely surrounding them which can result in a severe reduction in signal strength and/or battery lifetime. This effect can be minimised by reducing the amount of conducting material surrounding the transmitter and leaving as much of the transmitter exposed as possible. Any slits or apertures which can be made in the surrounding material will help. Use materials with as high resistance as possible. Non-conducting materials such as plastics will not suffer from this effect. EM transmitters must not be surrounded by low resistance metals such as aluminium (including tubes or mounting clamps) under any circumstances.

**⚠ CAUTION:** Any magnetic material surrounding the transmitter will tend to block the EM signal from the transmitter and reduce the received signal strength outside the pipeline. This effect can be minimised by reducing the amount of magnetic material surrounding the transmitter and leaving as much of the transmitter exposed as possible. Any slits or apertures which can be made in the surrounding material will help. Use materials with as low magnetic permeability as possible. Non-magnetic materials such as plastics will not suffer from this effect. The table below shows the typical characteristics of several potential pig and mounting materials with the best choice at the top, and the worst choice at the bottom. 316 stainless steel provides a good balance of properties and cost. An aluminium alloy would be a very poor choice because of the very low resistivity and should not be used under any circumstances.

MATERIAL	RESISTIVITY ( $\mu\Omega.m$ )	MAGNETIC PERMEABILITY
PLASTIC	$\infty$	1.000
316 STAINLESS STEEL	0.75	1.008
2205 DUPLEX SS	0.80	>25.0
1005 STEEL	0.20	>100
ALUMINIUM ALLOYS	0.04	1.000

For optimum performance the transmitter should be clamped inside a plastic pig body or plastic guide discs should be clamped around the transmitter to form a pig. The advantage of these methods is the fact that there is no metal around the transmitter apart from the pipeline itself. Two alternative mounting arrangements are shown below. The first uses several lengths of threaded studding to clamp the transmitter between two plates. The second uses a clamping disc. The advantage of these arrangements is that they have limited amounts of metal around the transmitter and will therefore have limited effect on the transmitter performance. Please contact Online Electronics for further information and guidelines regarding EM transmitter mounting and installation.



## 5.6. BATTERY LIFETIME

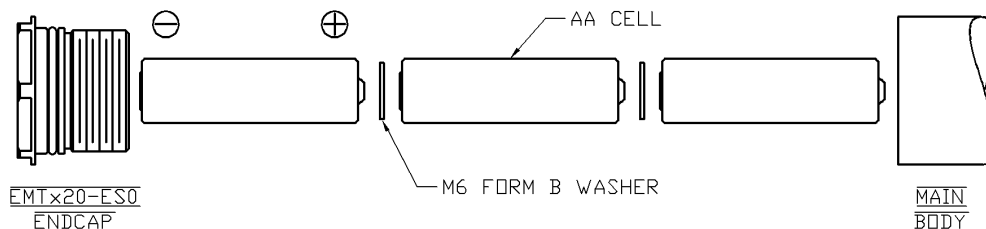
The operating temperature which the transmitter is used at alters the operating lifetime. Typically colder temperatures will shorten the stated lifetime.

Note that upon customer request, the transmitters can be adjusted at Online Electronics Ltd to provide a stronger signal at the expense of lifetime or extended lifetime at the expense of signal, contact Online Electronics Ltd for more details and to discuss your requirements.

In extreme circumstances the transmitter operating lifetime may be reduced by how the transmitter is installed on a pig. Refer to section 5.5 INSTALLATION within this manual for tips on how to achieve optimum performance from the transmitter with regards to the mounting arrangement.

## 5.7. BATTERY REPLACEMENT

1. Familiarise yourself with all warnings given at the start of Section 4 RULES FOR SAFE OPERATION.
2. Loosen the M4 locking grub screw on the EMTx20-ES0 ENDCAP by 3 turns, using a 2.0mm AF Allen key.
3. Loosen the ENDCAP 5 full turns using the supplied ENDCAP REMOVAL TOOL to release any internal pressure and to turn the transmitter off.
4. Fully remove the ENDCAP using the supplied ENDCAP REMOVAL TOOL.
5. Remove all DURACELL INDUSTRIAL ID1500 cells and M6 Form B Washers. Visually inspect the cells, contact Online Electronics Ltd immediately if there are any signs of damage or electrolyte leakage. Dispose of them in a responsible way.
6. Observing correct battery orientation as shown below, insert 3x new DURACELL INDUSTRIAL ID1500 AA Alkaline cells into the battery compartment POSITIVE END first with Stainless Steel M6 Form B Washers between the cells (note that the washer will self-locate once inside the unit).



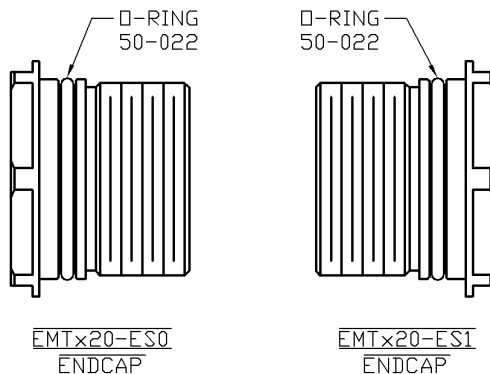
7. Once all cells are installed ensure that it is the FLAT, NEGATIVE END of the cells which you see when looking into the open end of the transmitter.
8. Examine the O-ring seals for any signs of contamination or damage, replace and/or re-grease if necessary. Refer to Section 6.1 O-RING REPLACEMENT for guidance.
9. Replace the ENDCAP using the supplied ENDCAP REMOVAL TOOL. Do not use a vice or spanner, it only needs to be hand tight. Damage may occur if over tightened.
10. Tighten the M4 grub screw (until the grub screw engages with the housing to lock the ENDCAP). Note that very little torque is required. Damage may occur if over tightened.
11. Fully tighten the EMTx20-ES0 ENDCAP to turn on the transmitter. Using an EM receiver, confirm transmitter function and correct transmission rate.
12. If the transmitter is not to be used immediately after battery replacement, loosen the EMTx20-ES0 ENDCAP 5 full turns to switch the transmitter off.

## 6. MAINTENANCE

Familiarise yourself with all of the rules for the safe operation of this equipment as described in Section 4 RULES FOR SAFE OPERATION.

### 6.1. O-RING REPLACEMENT

1. Using a 2.0mm AF Allen key fully unscrew the M4 locking grub screw on both ENDCAPS by 3 turns.
2. Loosen the EMTx20-ES0 ENDCAP at this end 5 full turns using the supplied ENDCAP REMOVAL TOOL to release any internal pressure and to turn the transmitter off.
4. Using the supplied ENDCAP REMOVAL TOOL, fully remove this ENDCAP, any batteries and then the other ENDCAP.
5. Referring to the figure below, remove all O-rings and clean all sealing surfaces on all parts.



6. Examine all surfaces for signs of corrosion, scoring, and other damage. If there is excessive damage the mechanical parts may need to be replaced.
7. Lightly grease all sealing surfaces using a suitable grease (e.g. DOW CORNING MOLYKOTE 111 COMPOUND).
8. Lightly grease each O-ring with a suitable grease (e.g. DOW CORNING MOLYKOTE 111 COMPOUND) before fitting.
9. Apply a small amount of an oil-based thread lubricant such as "Blue Goop" to the endcap threads.
10. Referring to Section 5.7 BATTERY REPLACEMENT re-insert the batteries, then refit the EMTx20-ES0 ENDCAP to the BATTERY end of the housing and the other ENDCAP to the PCB end of the housing using the ENDCAP REMOVAL TOOL. Do not use a vice or spanner, the endcaps only need to be hand tight. Apply lubrication to the threads of both ENDCAPS if required, to assist the re-fitting.
11. Tighten the M4 grub screw on each ENDCAP (until the grub screw engages with the housing to lock each endcap in place). Note that very little torque is required. Damage may occur if over tightened.

## **7. ROUTINE MAINTENANCE AND STORAGE**

Familiarise yourself with all of the rules for the safe operation of this equipment as described in Section 4 RULES FOR SAFE OPERATION.

All Online Electronics Ltd transmitters are designed to require minimum maintenance. The housing 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, replace the relevant component.

All components that 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.

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

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

As a minimum the EMTx20-ES0 ENDCAP must be loosened 5 full turns to switch the transmitter off.

## 8. DISPOSAL OF UNIT

Online Electronics Ltd 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, OEL 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  
Online House  
Blackburn Business Park  
Woodburn Road  
Blackburn  
Aberdeen  
AB21 0PS  
UK

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

## 9. WARRANTY

Online products are guaranteed for one year from the date of purchase. Goods should be returned transportation prepaid to Online Electronics Limited.

There is no charge for parts or labour should any product require repair due to a manufacturing deficiency during the guarantee period.

In the event of a manufacturing deficiency the inward transportation costs will be repaid to the client.

## 10. CERTIFICATION APPENDIX

**EQUIPMENT:** EMTx20X 1V5 range of electromagnetic transmitters

**MANUFACTURER:** **Online Electronics Ltd**  
 Online House  
 Blackburn Business Park  
 Woodburn Road  
 Blackburn  
 Aberdeen  
 AB21 0PS  
 UK  
 Tel: +44 (0) 1224 714 714  
 Web: www.online-electronics.com

**NOTIFIED BODY NUMBER:** 2812

**ATEX CERTIFICATE:** EMT16ATEX0011X

**IECEX CERTIFICATE:** IECEX EMT 16.0009X

**MARKINGS:**  II 2 G Ex db IIC Gb T6

**APPLICABLE STANDARDS:** EN 60079-0:2012/A11:2013  
 EN 60079-1:2014  
 IEC 60079-0:2011  
 IEC 60079-1:2014

### SPECIAL CONDITIONS FOR SAFE USE:

1. Only use one complete set of new and identical 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 ID1500	Alkaline	1.5V	-20°C to +50°C	T6
DURACELL MN1500	Alkaline	1.5V	-20°C to +50°C	T6
DURACELL MX1500	Alkaline	1.5V	-20°C to +50°C	T6
ENERGIZER EN91	Alkaline	1.5V	-18°C to +51°C	T6

3. Batteries must be installed into the enclosure in accordance with the orientation detailed on the markings.
4. Repair of flamepaths is not permitted by the end user.
5. Do not open when an explosive atmosphere may be present.
6. Enclosures manufactured from titanium 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 4 Nm and 8 Nm. Do not exceed 8 Nm.