

# ESI Installation and Instruction Manual



## EminoX Electronic Service Indicator

### Installation and Instruction Manual

LITM004





# ESI Installation and Instruction Manual

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**The ESI has NOT been certified for use on vehicles carrying dangerous goods, i.e. it is NOT approved to 94/55/EC (ADR Directive) nor to Statutory Instrument 2004/568: The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2004 (The Carriage Regulations).**

**The CPU, sensor and wiring harness are matched together before leaving the factory, therefore, they must always be used together and NOT separated.**

# ESI Installation and Instruction Manual

## Introduction

The Eminox Electronic Service Indicator (ESI) is designed for use with the Eminox CRT® or SCRT® System. Its purpose is to measure the back pressure status of a vehicle's CRT® or SCRT® System and indicate when additional servicing of the filter module is necessary.

For the rest of the manual, the use of CRT® implies CRT® or SCRT®.

Fitting an Electronic Service Indicator does NOT increase the service intervals of the CRT® System. Customers should continue to service Filters at the intervals recommended by Eminox at the time of purchase.

Details of the servicing processes and intervals are given in the CRT® System Operation and Maintenance Manual.

## Section 1 – Technical Description

Power supply (as supplied)	12 to 24V DC Ignition
Supply fused at	1A
Voltage for repeater LEDs	Supply voltage
Max power loading from repeater LEDs	13.2W (6 off 2.2W LEDs)
Series resistors required if LEDs used	2.7k, 0.5W, 5% Metal oxide
Measuring range	0 - 750 mbar
Sensor burst pressure	3000 mbar (3 bar)
CPU temperature range	-20 to 105°C
Sensor temperature range	-40 to 125°C
Display Shut down temperature	80°C
Fixing Bolts for Sensor	M5
Fixing Bolts for CPU	M6
Ingress Protection	IP 69 Rating
CPU markings (topside)	Part Number, Type Approval Marks and Recycling Codes
Sensor markings (Underside)	Orientation and Part Number

## Section 2 - Identification of Parts

The Service Indicator consists of three major components:



Figure 1 CPU and Sensor



1 Central Processor Unit (CPU) with power supply and auxiliary display connectors and a magnet



2 Back pressure sensor



3 Pipe Kit

The Electronic Service Indicator is supplied with the sensor and CPU connected as shown in Figure 1. These are matched and must remain as a pair.

The back pressure sensor (Figure 1 Item 2) is an automotive-standard black plastic unit approximately 90 x 50 x 40 mm. It is connected to the central processor unit via the wiring harness.

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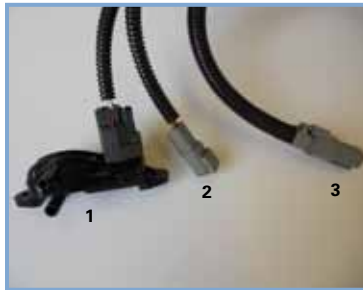


Figure 2 Detail of Sensor and Connectors



1 Pressure Sensor



2 Power Supply 12 or 24 VDC



3 Repeater Display Connector  
Colour coded wiring for  
optional repeater LEDs



Figure 3 Detail of CPU



1 Connector for wiring  
harness



2 Connector for downloading data



3 Magnet position for reset

The central processor unit (CPU) is an automotive-standard sealed plastic box approximately 100 x 140 x 30 mm. Three LEDs (red, amber and green) and a digital display allow the operator to monitor the system's back pressure. A blue LED indicates the unit's status.

A magnet is used to reset the unit's displays after an overload or before taking a maximum static back pressure reading. To reset the unit, place the magnet in the position shown in Figure 3. All of the LEDs, including the blue, will illuminate briefly. This will reset the Mxxx maximum value to M000 and illuminate the green LED.

The display shows the current back pressure in the format Cxxx and the maximum back pressure seen since the last reset as Mxxx (Figure 4). The display alternates between these two formats automatically whilst the unit is turned on.



Figure 4 Max Pressure Display

The repeater display connector (Figure 2, Item 3) is provided for customers who wish to have repeater LEDs installed elsewhere on the vehicle. The supply of repeater LEDs; if necessary, series resistors; and the cabling from the CPU to the cab is the responsibility of the customer. Colour coded cables from the CPU to the connector make correct connection straight forward.

The CPU has a connection port for linking to a laptop computer so that values retained in its memory can be downloaded.

The sensor is connected to the CRT® System using the pipe kit shown, Figure 5. This is supplied with the Service Indicator.



Figure 5 Complete Pipe Kit (QM1180)

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## Section 3 – Wiring of Connectors

Connectors are supplied to connect the unit to the power supply and, if required, the repeater display. All wiring is the responsibility of the customer.

Each connector has the following:



Figure 6 Power Supply Connector Components

- 1 Connector mounting
- 2 Pins
- 3 Retaining Insert
- 4 Wire Cover

### Wiring Details

The power leads are colour coded:

Pin 1: Brown –Positive (12 or 24V)

Pin 2: Black –Ground

The repeater display leads are colour coded:

Grey – Common Ground

Green – Positive Green LED

Yellow – Positive Amber LED

Red – Positive Red LED

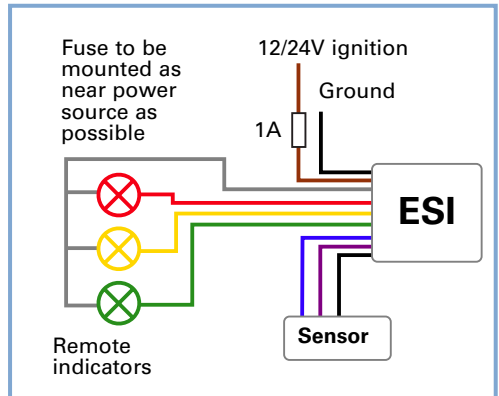


Figure 7

**Note:** Each LED circuit must also be fitted with a series resistor with the following specification:

Series resistors required if LEDs used

2.7k, 0.5W, 5% Metal oxide

## Section 4 - Installation into Vehicle

### The central processing unit



Figure 8 CPU Mounting Points

7.4 mm Hole for an M6 bolt

The CPU should be mounted to the vehicle using the fixing holes shown in Figure 8. It should be mounted so that the connections are on the left hand side to ensure the unit is the correctly orientated.

Select a suitable position where:

- 1 The unit is protected from road debris during normal running conditions
- 2 The display is easily visible
- 3 The unit can be reset with a magnet
- 4 The communications cable can be connected
- 5 Temperature remains below 80°C at all times

## The pressure sensor

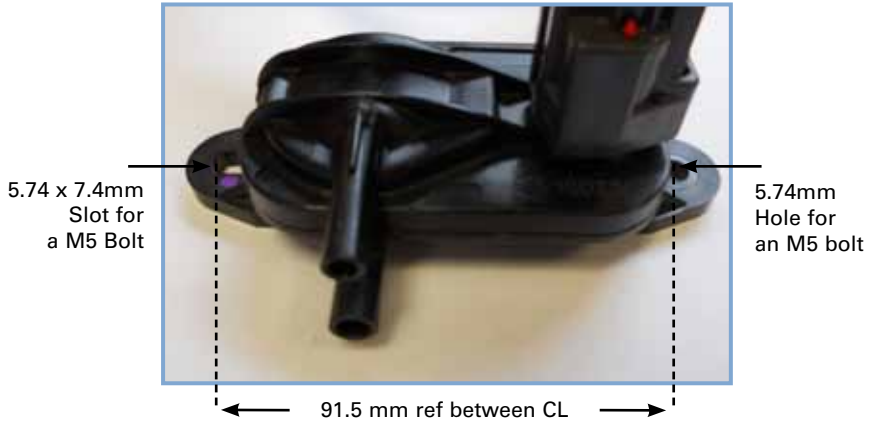


Figure 9 Sensor Mounting Points

Attach the pressure sensor so that:-

- 1 It is protected from road debris during normal running conditions
- 2 The ports of the sensor point down ( $\pm 10^\circ$  to vertical) as shown in Figure 10
- 3 The cable easily reaches the CPU
- 4 Temperature remains below  $80^\circ\text{C}$  at all times
- 5 The unit is higher than the CRT<sup>®</sup> System to allow a continuous downwards slope of the pipe-work to the CRT<sup>®</sup> System.



Figure 10 Connection to Sensor

### Connection of Sensor to CRT<sup>®</sup> System using QM 1180

When connecting the pipe from the CRT<sup>®</sup> System to the sensor, the pipe should run in a continually rising path to allow condensation to run out and prevent build up of soot. There should be no horizontal runs or loops.

The rubber hose (QM 1177) connects to the rear (larger) port of the sensor and is secured using an O clip (QM 804), as shown in Figure 10. This port is marked [HI]; the open port is marked [REF].



QM 804



QM 1180  
Pipe Kit (Part)



QM 910

Figure 11

The rubber hose is connected to the PTFE tube (QM 910) via the compression fitting, using the integral ferrule. The PTFE tube should be cut to length to suit each application. Once installed, it should be securely cable-tied every 0.5m to prevent damage. Do not allow the PTFE tube to come in contact with hot surfaces. Chassis clips (QM 900) as shown in Figure 12 may be used.



Figure 12 QM900 Chassis Clip



A QM 957 is used to connect the PTFE tube to the stainless steel braided hose as indicated in Figure 13.

Figure 13 QM 1180 Pipe Kit (Part)

The braided hose should be connected to the appropriate port, using either the elbow fitting (Figure 14) or straight fitting (Figure 15), depending on the space available. It must be supported to prevent its weight damaging the connection to the CRT® System.



Figure 14 Elbow Fitting



Figure 15 Straight Fitting

**Caution:** Jointing compounds must NOT be used.

### Connection to the CRT® System

The connection to the CRT® System is at the smoke port either on the inlet pipe to the CRT® System or on the CRT® System itself. Figure 16 and 17 show the smoke port locations.



Figure 16 Smoke Port on Inlet Pipe



Figure 17 Smoke Port on a CRT



Figure 18 Boss for connection to service indicator

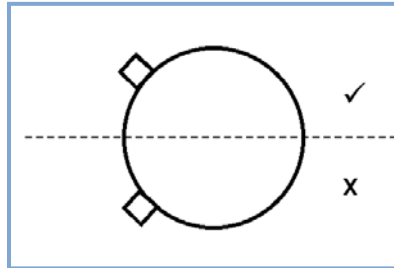


Figure 19 Acceptable and unacceptable positions of bosses

It may be necessary to fit an additional BP boss on the pipe-work (Figure 18) if access constraints mean that the standard smoke port location can not be used for this purpose.

The smoke port or boss **MUST** be positioned in the upper area as shown in Figure 19 so that any condensation in the pipework drains into the CRT® System.

### Powering Up the Unit

The ESI will run on power supplies of 12-24V DC. The connections should be made such that when the vehicle is not in operation, the ESI is not powered. However it should also be possible to power the ESI without running the vehicle. On buses, wiring the positive side of the circuit to the post isolator circuit will achieve this. On trucks wiring to the first stage of the key switch will be sufficient. On specialist vehicles, advice should be sought. On all vehicle types the manufacturer's advice should be sought for the exact location of suitable connection points. Note: for ease of reference this is referred to as the "isolator switch" through out this manual.

Once the unit has been fitted, the power should be connected. The display will briefly show the software version installed and illuminate the red, amber and green LEDs to check that they are working.

**The magnet must not be in the reset position when switching on power to the unit. Failure to comply will invalidate the warranties for both the unit and the CRT® System.**

### Repeater Display

The repeater display connector is provided for customers who wish to have repeater LEDs installed elsewhere on the vehicle. The power supply to the repeater lamps and the necessary cabling from the CPU to the repeater circuit is the responsibility of the customer. A customer can choose to have any combination of red, amber and green LEDs repeated. Colour coded cables from the CPU to the connector make correct connection straight forward.

## Section 5 – Continuous Monitoring

The CPU contains a micro-processor and a memory. Three LEDs indicate the current state of the CRT® System – green that the unit is on and working, amber that back pressure has risen to a value above normal, red that the back pressure has risen to a critical level.

During normal vehicle operation, the green LED will illuminate and the digital display will alternate between the current back pressure value, Cxxx and the highest back pressure value, Mxxx, that has been reached since the last reset (see Figure 4).

The maximum back pressure seen during a vehicle's working cycle is referred to as the maximum dynamic (or loaded) back pressure. This can be checked at any time after the vehicle's return to depot. The vehicle does not need to be started in order to retrieve this information, but the power to the ESI unit must be on.

Resetting the maximum level to zero must be carried out with the engine off and the power to the unit on. Place the magnet in the reset position shown in Figure 3 until all four LEDs illuminate. Remove the magnet. The display will now read M000.

Back pressure rising above normal (amber LED illuminates) is due to a build up of soot and/or ash in the filter. This may be the result of the engine producing more soot, burning lubrication oil etc. A maximum static back pressure test (see Section 6) should be carried out as soon as possible to assess the problem. The performance checks listed in the CRT® System Operating and Maintenance Manual should also be carried out to find the cause. All necessary repairs must be carried out. The system can then be reset to continue monitoring.

If the back pressure rises to a critical level (red LED illuminates), immediate action must be taken to prevent irreparable and non-warrantable damage to the filter.

The CPU retains the back pressure trace history of the vehicle. This can be downloaded by an Eminox Technician for analysis. Resetting the unit with the magnet does not erase the memory.

## Section 6 - Procedure for Measuring Maximum Static Back Pressure

Eminox Ltd always uses a maximum static back pressure value to decide if a CRT® System needs servicing. A maximum static back pressure test can be carried out using the Electronic Service Indicator unit. The unit is reset, the test carried out and the maximum value read from the unit by the operator performing the test.

The maximum dynamic pressure should be recorded as part of the standard maintenance and safety inspection programme and before taking a maximum static back pressure reading.

If the vehicle is fitted with a throttle limiter this must be removed before the test. Maximum static (or unloaded) back pressure readings are taken as follows:

- 1 Stop the engine
- 2 Record the maximum dynamic pressure
- 3 Reset the display so that it reads M000
- 4 Ensuring the vehicle is in neutral and the parking brake applied, start the engine
- 5 With the engine at normal operating temperature, bring to maximum engine speed
- 6 Hold the full throttle position for approximately 15 seconds and release
- 7 Stop the engine
- 8 The value displayed as Mxxx is the maximum static back pressure reading. This must be entered into the CRT® System Service Record

### IMPORTANT NOTICE

**The ESI display must be checked daily before the vehicle leaves depot to ensure red and amber warning lights are not displayed. If warning lights show, please check CRT as damage could be caused to the filter. If warnings are ignored, this could affect your warranty.**

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## Section 7 - System Codes

The CPU displays a number of different codes using the LEDs. The codes are listed in the following table together with the reason that they are displayed and the action the customer must take in response. Where a longer explanation of the action is required, it can be found in the appropriately numbered section on page 15.

Code	Significance	Action
Green LED illuminated ● ○ ○	System on and BP at acceptable levels	None
Amber LED illuminated ○ ● ○	BP above acceptable levels. Filter may require servicing	Take max static BP. Check Engine. <sup>1</sup>
Red LED illuminated ○ ○ ●	Filter requires immediate servicing	Service Filter immediately. <sup>2</sup>
Display not Illuminated	Unit not powered	Turn on isolator switch. <sup>3</sup> Check power cables and fuse(s).
Display not Illuminated Blue LED flashes	Working temperature has risen above 80°C. Display has shut down	Allow to cool before taking reading. Change mounting position to a lower temperature area. <sup>4</sup>
LEDs Flash ● ○ ● ○ ● ○ ● ○ ●	Sensor has not registered any pressure during the last 12 hours of operation	Carry out pipe-work checks. <sup>5</sup> Run vehicle for approximately 5 minutes. <sup>6</sup>
LEDs Flash ● ● ● ○ ○ ○ ● ● ●	Sensor is disconnected from the CPU	Check wires. Reconnect. Reset using magnet. <sup>7</sup>

## Details of Actions

### 1 Engine Checks

Take Max Static Back Pressure reading  
Check smoke opacity  
Check for abnormal oil usage  
Refer to CRT® System Operation and Maintenance Manual  
Report the problems and results to Eminox Ltd

### 2 Service Filter

Details of this are given in the CRT® System Operation and Maintenance Manual. Customers should continue to service the CRT® System Filter at the intervals recommended by Eminox. The Service Indicator will show whether more frequent servicing is required.

### 3 Turn on Isolator Switch

This will power up the ESI unit.

**The magnet must not be in the reset position when switching on power to the unit. Failure to do this will invalidate the warranties for both the unit and the CRT® System.**

### 4 Temperature Range Exceeded

If the temperature rises above 80°C the unit will shut down the display, when the temperature drops the display will start to work again. This is to protect the electronic components in the display at high temperatures. It does not affect the operation of the unit or LEDs.

### 5 CRT® System Checks

If the unit has been switched on and no pressure has been detected for over 12 hours, all the LEDs on the unit will flash in this sequence: red and green together alternating with amber on its own. If the LEDs are flashing and the vehicle has been run, this signifies either that there is a blockage in the pipe-work; a break or leak in the pipe-work; or the hose has been connected to the wrong sensor port.

After checking for and rectifying the problem, the vehicle should be run for approximately 5 minutes to reset the system and stop the LEDs flashing.

### 6 Unit Powered, Engine Off

This fault code will also be seen if the vehicle is left for more than 12 hours with the unit powered but engine not running, i.e. the isolator switch is left on, whilst the sensor sees no pressure. In this case, running the vehicle for approximately 5 minutes will reset the system.

### 7 Sensor Disconnected

If the sensor is disconnected, all the LEDs flash together. When the sensor is reconnected, the CPU automatically displays a critical (red LED) signal and maximum back pressure level higher than the unit normally registers. This can be removed by resetting the display with the magnet as described earlier.

## Section 8 - Summary of Important Points

### Installation

- 1 The processing unit must be mounted with the connectors to the left hand side
- 2 The sensor must be mounted so that the ports face vertically down ( $\pm 10^\circ$ )
- 3 The rubber hose must be connected to the rear port of the sensor (marked [HI])
- 4 The pipe work run must rise continually from the CRT<sup>®</sup> System to the sensor
- 5 The PTFE tube must be supported at least every 0.5m to prevent failure
- 6 The PTFE tube must be routed away from sources of heat
- 7 The braided hose must be supported at connections to prevent failure of this component. The hose itself must be free to move as designed
- 8 The back pressure port on the CRT<sup>®</sup> System or inlet pipe must point upwards
- 9 The power supply must have a 1 Amp fuse
- 10 The ESI must not be powered when the vehicle is not in use, but power must be available to the ESI without the engine running

### Operation

- 1 A green LED means that the system is on and operating correct
- 2 An amber LED means that the back pressure has risen above normal levels and that the system and engine operating conditions must be checked
- 3 A red LED means that the back pressure has risen to unacceptable levels. The filter must be serviced immediately
- 4 Other combinations of LEDs indicate error codes



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