

# **DIESELTUNE**

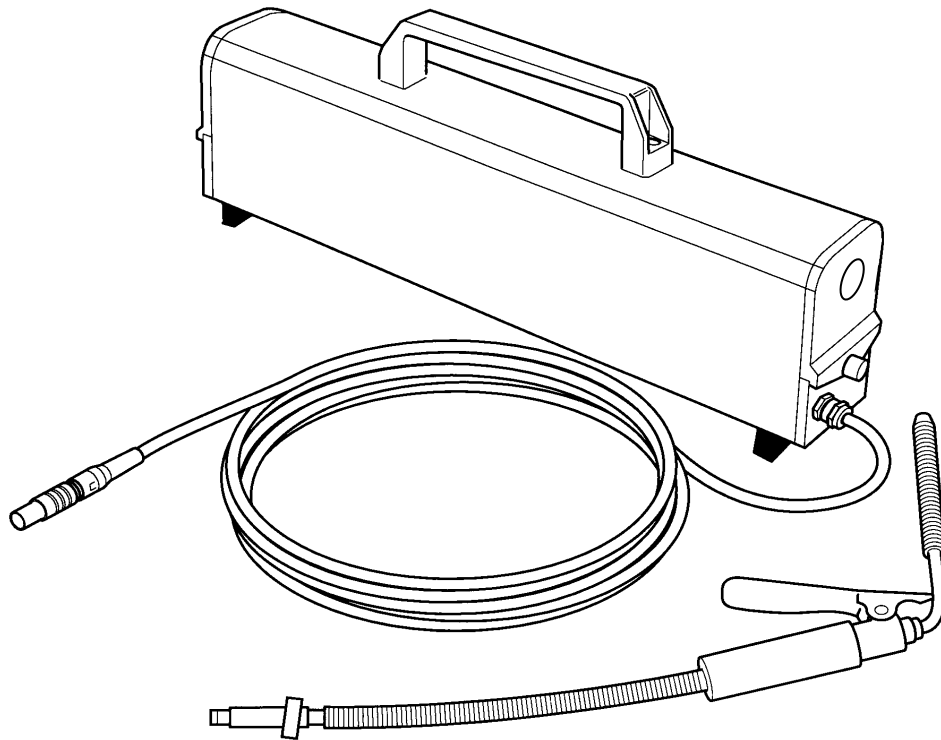
## **SMOKEMETER DX211/DX211BT**



## **OPERATORS MANUAL**

IN2049/G  
June 2005

# DX211 & DX211BT SMOKEMETER



## SPECIFICATION

Dieseltune has a programme of continued product development and therefore reserves the right to amend product specifications without prior notice.

While every effort is made to ensure the accuracy of the particulars contained in this instruction book, the Manufacturers and the Authors shall not in any circumstances be held liable for any inaccuracy or the consequences thereof. E. & O. E.

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## PATENTS

This product is covered by one or more of the following Patents or Patent applications: GB - 2257515, 2268805. EU - 0521725, 0650586. US - 5353629, 5596155

## CONTENTS

|                                                   | Page |
|---------------------------------------------------|------|
| INTRODUCTION                                      |      |
| Regulatory Notice.....                            | 4    |
| Health & Safety.....                              | 5    |
| Introduction & General description.....           | 6    |
| Smoke measurement questions and answers.....      | 8    |
| OPERATION                                         |      |
| Connections.....                                  | 10   |
| Software update.....                              | 11   |
| Warm up.....                                      | 12   |
| Wireless Smokemeter operation (DX211BT only)..... | 12   |
| Battery charging (DX211BTonly).....               | 13   |
| Sampling head and pipes .....                     | 15   |
| Engine speed adapter.....                         | 17   |
| Oil temperature probes.....                       | 18   |
| Remote Indicator Handset.....                     | 19   |
| Paper replacement.....                            | 20   |
| MAINTENANCE                                       |      |
| Serial numbers.....                               | 21   |
| Cleaning sampling pipes.....                      | 21   |
| Calibration.....                                  | 21   |
| Lens cleaning.....                                | 22   |
| Sampling head cable renewal.....                  | 23   |
| CONSUMABLE SPARES .....                           | 24   |
| OPTIONAL EQUIPMENT .....                          | 25   |
| SPECIFICATION.....                                | 26   |
| SERVICE CONTACT.....                              | 28   |

NOTE: This manual only describes the Smokemeter hardware.  
For details of software controlled procedures, refer to the  
appropriate software manual IN2050.

## REGULATORY NOTICES

### EUROPEAN

This equipment complies with the essential requirements of the following European Directives:

| Directive                                         | Applied Standard                              |
|---------------------------------------------------|-----------------------------------------------|
| EMC 89/336/EEC<br>(Electromagnetic Compatibility) | EN61000-6-3:2001      EN61000-6-2:2001        |
| LVD 73/23/EEC<br>(Low Voltage)                    | EN61 01 0-1      Electrical Safety Regs. 1994 |

## IMPORTANT SAFETY INSTRUCTIONS

- Read all instructions.
- Care should be taken as burns can occur from touching hot parts.
- Do not operate equipment with a damaged cord or if the equipment has been dropped or damaged until it has been examined by a qualified serviceman.
- Do not let cords hang over edge of table, bench or counter or come in contact with hot manifolds or moving fan blades.
- If an extension cord is necessary, a cord with a current rating equal to or more than that of the equipment should be used. Cords rated for less current than the equipment may overheat. Care should be taken to arrange the cord so that it will not be tripped over or pulled.  
Always unplug equipment from electrical outlet when not in use. Never use the cord to pull the plug from the outlet. Grasp plug and pull to disconnect.
- Let equipment cool completely before putting away. Loop cord loosely around equipment when storing. To reduce the risk of fire, do not operate equipment in the vicinity of open containers of flammable liquids (gasoline).
- Adequate ventilation should be provided when working on operating internal combustion engines.
- To reduce the risk of electric shock, do not use on wet surfaces or expose to rain.  
Use only as described in this manual. Use only manufacturers recommended attachments.

Every reasonable effort has been made to ensure that information within these Operating Instructions is correct at the time of release, but Dieseltune cannot accept-responsibility for any errors that may occur.

The information in these Operating Instructions is subject to change without notice, and does not represent a commitment on the part of Dieseltune.

**WARNING: Do not attempt to operate this equipment unless you have read and understood these instructions.**

## HEALTH AND SAFETY

1. The equipment is not weatherproof and should not be used outside in rain or snow.
2. The internal circuits and components of the smokemeter should not be tampered with. No internal parts are operator serviceable.
3. Operators should exercise due caution with regard to the engine fan and associated belts.
4. Always provide ventilation by using an exhaust gas extraction system or by having an adequate supply of fresh air.
5. Before starting an engine, ensure that the gear selector is in neutral or park.
6. Care should be taken with regard to scalding from the cooling system, burns from the exhaust system.
7. Position the mains cable and sampler pipe in such a manner that they do not present a hazard to anyone.
8. The earth lead of the mains supply cable **MUST ALWAYS** be connected to a good earth point.
9. Operators should not allow themselves to come into contact with water or other similar conductors when using the equipment.
10. Equipment should be sited in an area designated and clearly marked:

**'FOR USE BY AUTHORISED PERSONNEL ONLY'**

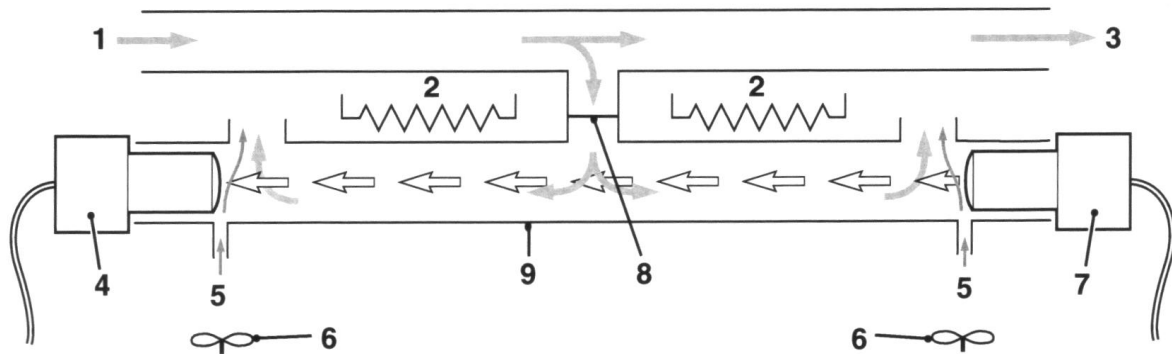


**WARNING:** The power supply and PC are not weather protected and for the safety of both the operator and the equipment, these parts **MUST** be kept under cover in inclement weather conditions.

## INTRODUCTION

### GENERAL DESCRIPTION

The Smokehead is a partial flow opacimeter suitable for Free Acceleration and Full Load testing of all sizes and types of diesel vehicles. It consists of two main items, a smoke sampling head and a control unit.



#### Schematic diagram of smoke sampling head

|   |             |   |                    |
|---|-------------|---|--------------------|
| 1 | Smoke inlet | 6 | Fan                |
| 2 | Heater      | 7 | Green LED          |
| 3 | Bypass      | 8 | Temperature Sensor |
| 4 | Photo diode | 9 | Measuring tube     |
| 5 | Purge air   |   |                    |

The smoke sampling head operates at low voltage (24V DC), and is suitable for use in all weather conditions and at temperatures down to -15°C.

It consists of a green LED and a photodiode mounted at opposite ends of a measuring tube, such that the effective light path length through the smoke is 250 mm.

The measuring tube and the LED / Photodiode assemblies are heated such that their minimum temperature is 70°C, thereby preventing condensation of the oil and water content of the smoke.

The temperature of the smoke is measured at the inlet to the measuring tube so that, if necessary, an automatic correction can be applied to the opacity readings for smoke temperatures other than 100°C.

The smoke sampling head contains a fan to draw the smoke sample into the measuring tube via a by-pass system, so that the pressure inside the tube cannot normally exceed ambient by more than 7.5 mbar. This provides for rapid response and fast clearance of the smoke sample after testing.

The lenses are protected by an air curtain which reduces sooting. In addition, the sampling head has an autorange feature which can provide a step change in LED intensity to compensate for dirtiness.

The measuring tube contains rings to eliminate reflection, and the LED is pulsed so that the detection system can ignore any ambient light level. Mid-point calibration is provided by automatically interrupting this pulse train to provide (for example) 3 pulses out of 8 to give a calibrated light level of 3/8 or 37.5% (patented).

Sampling pipes are available to suit most exhaust systems including mid-chassis and vertical. Extension poles are available for very high vertical exhausts.

The smokehead interfaces with the control unit either via a single cable of up to 20m in length or via cableless (Bluetooth®) communications. The cable carries power to the head and data in both directions, for the cableless system the smokehead derives its power from internal rechargeable batteries.

Information is sent to the control unit via a single RS232 link. This link also carries the control commands from the computer to the Smokemeter system.

Oil temperature measurement is routed to the computer directly from the DX210-26 Probe and its adapter cable (DX211-11) or via the cableless (Bluetooth®) DX211-11BT Adapter.

Depending on national requirements, various tamperproof security systems may be included, ranging from self-adhesive labels to special screws to take a wire seal.

In addition, the sampling head has its serial number stored in permanent memory and the sampling head contains a clock that provides information for the printout and also to control the calibration interval.

This equipment will operate from a mains supply of 100-240Va.c. single phase 50/60 Hz. If the equipment is required to operate from a different supply to this it is essential that the equipment is ordered for your requirement.

The equipment should be stored and kept in a dry condition.

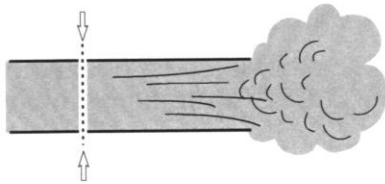
The DX211/DX211BT is supplied with all main parts of the console (i.e. Computer, TFT Screen, Keyboard, Mouse etc.) fitted, The console can be used as a stand-alone or wall-mounted control desk, or fitted to its optional purpose designed pedestal. The Smokehead is packed separately and will need to be offered up to the Smokehead cradle on the pedestal (for the DX260BT Bluetooth Smokehead the cradle may be pedestal mounted or wall mounted. The DX260BT Smokehead will need to be mounted on its cradle in order to charge the Smokehead batteries).

Carefully unpack all items and examine for damage. Check contents against the packing list enclosed for any loss or discrepancy. Report any loss, breakage or discrepancy to the supplier immediately.

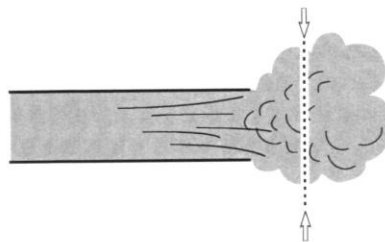
**IMPORTANT NOTE** Do not disconnect or reconnect any leads between the various parts of the DX211/DX211BT without first SWITCHING OFF the mains supply; this does not include any connections to the vehicle under test.

## SMOKE MEASUREMENT QUESTIONS AND ANSWERS

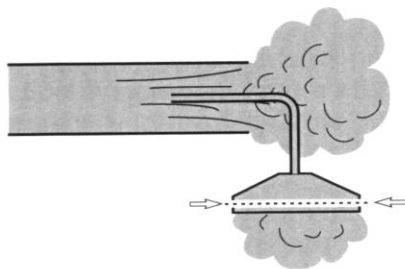
- Q) Why is only diesel smoke measured when petrol engines normally have an emissions test?
- A) It is more difficult and much more expensive to measure diesel emissions. This is because carbon monoxide levels are much lower; the hydrocarbon content cannot be measured by the normal infra-red technique and for reliable results a chassis dynamometer is desirable.
- Q) What are Particulates?
- A) The particulate part of a vehicle exhaust is any substance present as a liquid or solid (i.e. not a gas). For a diesel, carbon forms at least half the particulate content, the remainder being made up of hydrocarbons (e.g. unburnt fuel droplets and lubricating oil), sulphates (from the diesel fuel's sulphur content) and water.
- Q) What is an Opacimeter?
- A) A Smokemeter working on the principle of shining a light beam through the exhaust smoke to determine its 'density' or 'opacity'.
- Q) What is a partial flow system?
- A) The three opacimeter systems are as follows:



**FULL FLOW.** The light beam shines through the exhaust smoke as it flows through a specially adapted tailpipe. Potentially it is an accurate system, because the measurement is taken across the entire exhaust flow. However, high temperatures can be encountered and specially adapted exhaust systems are required.



**FREE FLOW.** The light beam shines through the exhaust smoke as it comes out of the tailpipe. It is relatively easy to fit, but the accuracy of the readings is severely affected by variations in exhaust plume diameter.



**PARTIAL FLOW.** A sample of the smoke is taken from the tailpipe for analysis in a separate chamber. It is easy to fit to a wide range of tailpipe sizes, but care must be taken to achieve a representative sample of smoke in the measuring chamber. Most smokemeters for testing vehicles in service use the partial flow system.

- Q) Why are there so many different smoke measurement scales ?
- A) Some scales relate to measurements by methods different to the opacimeter system, for example the Filter Smoke Number (sometimes known as the Bosch Smoke Number). The other scales are because not all opacimeters use the same path length. As the path length is increased, the amount of light obscured by a given density of smoke will also increase.

Opacimeters normally calculate their answer on a percentage scale; clean air is taken to be 0%, and totally black smoke is called 100%. But this percentage scale will be different for every opacimeter having a different light path length. It is normal therefore for the answer to be given in k, the 'coefficient of light absorption' where:

$$k = -\frac{1}{L} \log_e \left[ 1 - \frac{N}{100} \right]$$

Where      N      =      the percentage of light obscuration  
                 L      =      light path length in metres  
and      k has the units 'per metre', usually written as 1/m or m<sup>-1</sup> or m<sup>-1</sup>

- Q) What is pressure and temperature compensation ?
- A) Diesel exhaust smoke is made up of lots of tiny particles of carbon. If pressure is applied to the smoke it will be compressed and the carbon particles made to occupy a smaller space, thereby making the smoke appear denser.

Similarly, if the temperature is increased the smoke will expand and appear less dense.

It is important therefore that either the pressure and temperature are carefully controlled, or alternatively they are measured and a correction factor is applied to the smoke value obtained.

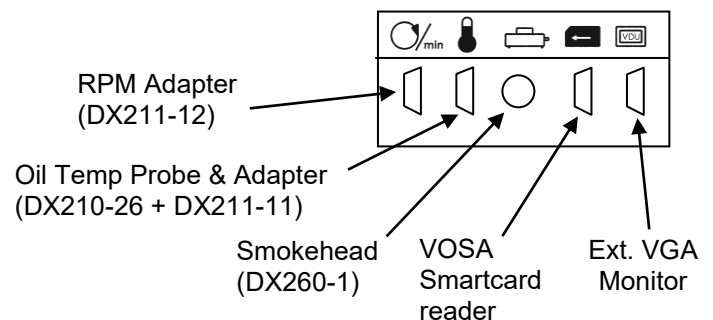
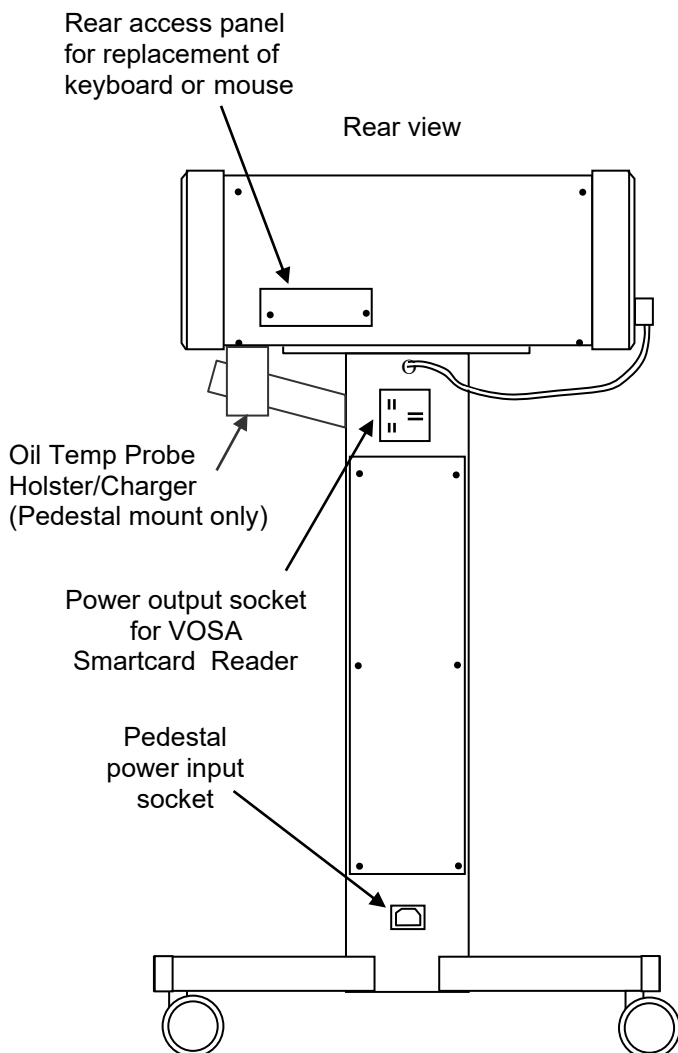
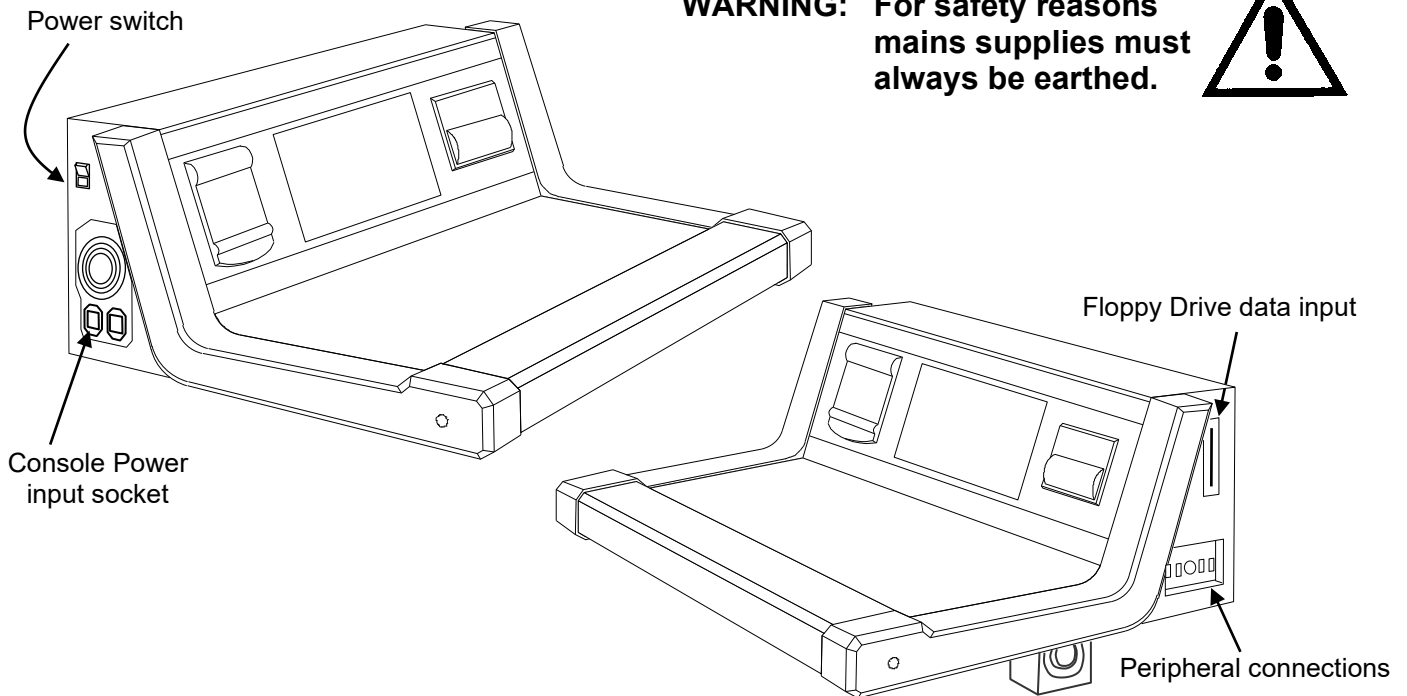
- 0) What does 'Response Time' mean ?
- A) When operating under free acceleration conditions, the speed at which a smokemeter reacts is the key to the answer obtained.

The 'puff' of smoke caused by increasing an engine momentarily to maximum speed is of very short duration, but it takes time for this 'puff' to find its way down the sample pipe and into the smokemeter, and this can cause 'damping' of the result. After that, the speed at which the meter can measure the smoke inside it will also affect the answer obtained.

It is essential therefore that all smokemeters have a defined 'Response Time', and normally this is specified in national legislation, e.g. EEC directive 72 306, SAE J1667 etc.

## CONNECTIONS

**WARNING:** For safety reasons mains supplies must always be earthed.



## FITTING THE KEYBOARD AND MOUSE

In the event of replacement mouse or keyboard being necessary, follow the procedure detailed below, observing the correct sequence of actions:

Remove the rear access panel by unscrewing the 2 earth nib Philips screws.

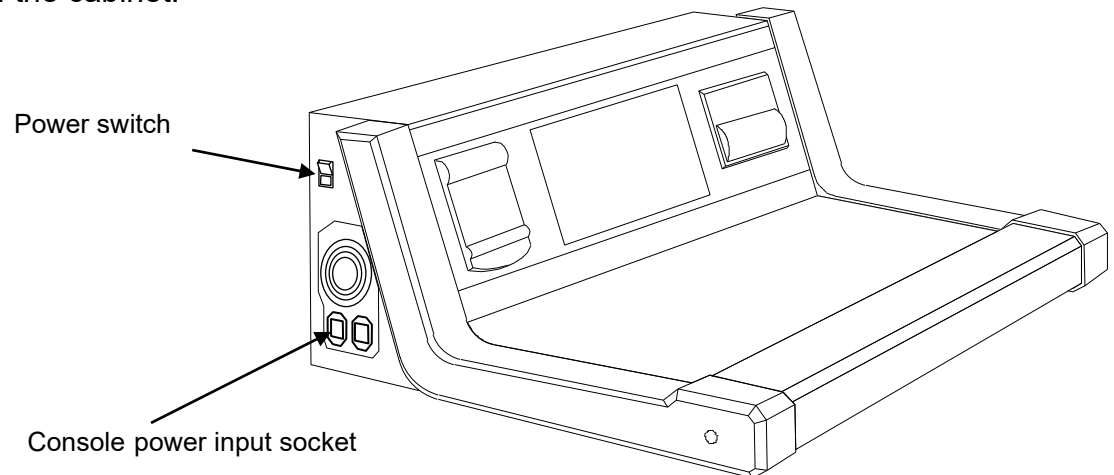
Feed the cables through the hole at the front of the tray and through the access port at the rear of the console.

Once the connectors are visible pull them free so that they can be unplugged from the splitter cable. Retrieve the mouse/keyboard cable through the cable aperture on the front panel. Replacement of the new mouse/keyboard is by reversal of the above procedure.

## OPERATION

Before activation, ensure that there is power connected to the console power input socket directly from a mains source or via the DX211 pedestal. Ensure the floppy disk drive is empty so that the in-built computer uses the hard disk as its program source.

The DX211/DX211BT is then switched ON using the rocker switch situated on the left hand side of the cabinet.

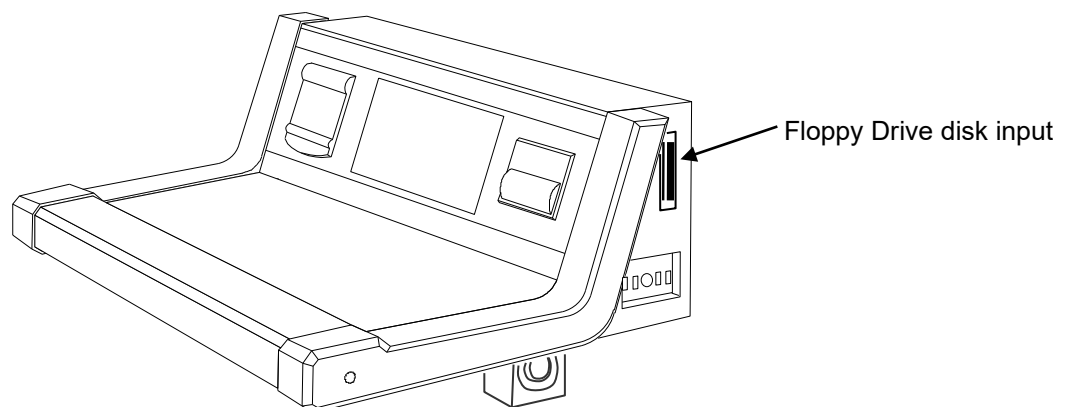


## SOFTWARE UPDATE

### INSERTING A FLOPPY DISK

An application manual will accompany additional software packs chosen for use with the DX211/DX211BT. This should be unpacked and put into the application section of this binder.

Carefully unpack the programme floppy disks and make sure they are fully inserted into the disk entry slot. When correctly inserted the disk will 'click' and lock in the holder. At the same time the release button will move outward. To remove the disk, press the release button next to the disk drive slot and slide out the disk.



## SAFE DISK HANDLING

Once programmed, the protected floppy disk will give trouble-free use provided that reasonable care is taken in handling and general usage.

1. Ensure that the disk is not placed close to strong magnetic fields.
2. Do not expose the disk to excessive high or low temperatures, or leave in direct sunlight.
3. Do not leave the disk in a wet environment.
4. Do not allow the disk to lie in an exposed position where it can collect dust.
5. Keep the disk as clean as possible.

## WARM-UP

Switch on the main On/Off switch at the side of the console unit. The 'Power On' warning light will illuminate.

There is a warm-up time of 5 to 20 minutes dependent on the outside temperature. During this time the Smokemeter will not function.

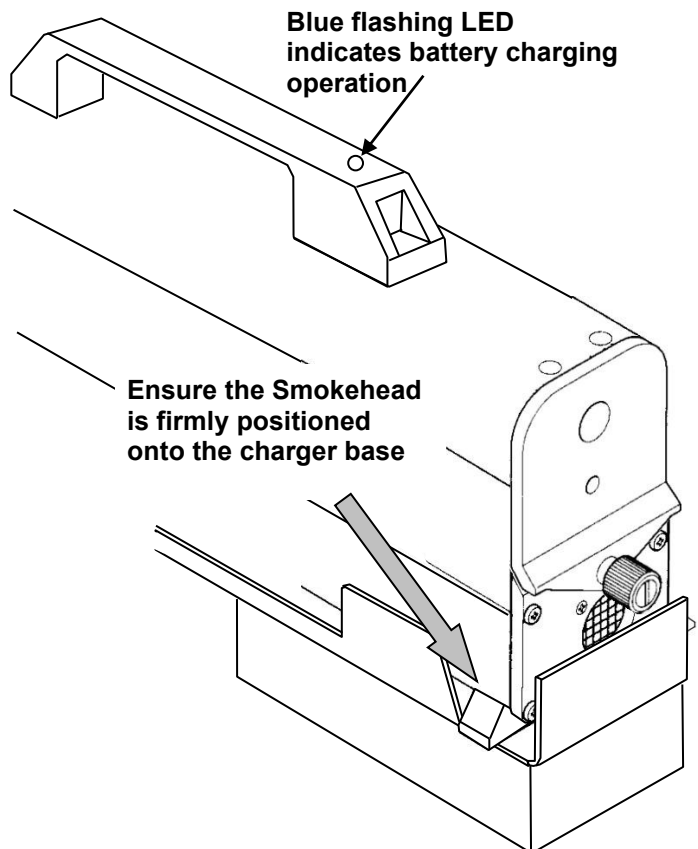
**NOTE:** For details of software controlled procedures, refer to the appropriate software manual.

## CABLE-LESS BLUETOOTH® SMOKEHEAD OPERATION (DX260-1BT)

For cable-less (Bluetooth®) systems the operation of the equipment is identical but a Bluetooth® enabled Smokehead (DX260-1BT) is utilised.

When the equipment is first switched on the smokehead should be firmly positioned onto its charging base and the unit should be allowed to charge for a minimum of five to six hours (or preferably left overnight) to fully charge the batteries.

The equipment screen will prompt the user to return the smokehead to its charging base between tests. This must be obeyed in order to proceed further. Failure to return the smokehead will result in depletion of the battery charge and may result in a shortened lifespan. The test will not continue until the smokehead has been returned.



It is strongly advised that the Charger Cradle be left permanently switched ON with the Smokehead in situ overnight to ensure full operational usage at beginning of the working day.

Please note that rechargeable batteries have a finite lifespan, therefore the battery pack will need to be replaced periodically if the smokehead is no longer sustaining sufficient charge for correct operation. Please contact a Service Engineer through Product Support.

The DX260-1BT Bluetooth® Smokehead contains a Multi-Cell Rechargeable Battery designed to give a maximum of 1.5 hours endurance from a full charge.

To recharge, the Smokehead must be correctly located on its charging cradle. The Smokehead must always be replaced on the charging cradle in between tests. This will maximise the battery endurance and is also necessary for test results to be printed.

On the handle of the Smokehead is a highly visible Blue Light emitting Diode (LED). This LED gives indication of the status of the Smokehead whether or not it is on its charging Cradle.

## **Battery Endurance and Charging Modes:**

The nominal endurance of the internal Battery pack is 1.5 hours continuous use from a full charge and cold start. This will vary according to ambient temperature. For optimum useage and battery life, the smokehead should be removed from the charging cradle for the minimum amount of time and returned to the charger immediately after testing as prompted by the smoke test Software.

The rate of charging is dependant on a combination of Battery Voltage and Battery Temperature. If the Smokehead has seen reasonable use the charger will switch to 'Fast Charge', taking approximately 1.5 hours to fully recharge. Once full terminal Voltage has been reached, the battery charging rate is reduced to 'Trickle Charge'. When charging for a protracted period, for example overnight, a trickle charge of 15 hours will completely recharge the internal battery. A blue LED on the Handle indicates the Charging Status.

### LED Indication

#### **1. Smokehead removed from Charging Cradle:**

LED 'On' continuously: Smokehead is running on internal Battery.

LED pulsing 'ON' for 2 seconds, 'OFF' for 0.5 seconds: Smokehead battery has reached a Low Voltage condition, and has less than 10 minutes life left before Auto-shutdown.

LED 'OFF' : Low Voltage condition. Smokehead will Auto Shut down. No more testing possible untill Smokehead battery has been recharged.

If the Smokehead has received no Communication from Host Computer for over 6 minutes it will go into into 'Sleep' Mode. Return the Smokehead to the Charging Unit to invoke a response.

If the Smokehead is taken outside its maximum operating range of about 100 metres, and Bluetooth® communication is no longer possible, after 6 minutes the Smokehead will go into 'Sleep' mode.

To recover from 'Sleep' mode, the Smokehead should be put back in its Charging Cradle, and the LED function observed.

## 2. Smokehead returned to Charging Cradle:

### FAST CHARGE:

LED Flashing quite rapidly (2.5 times per second): This shows the Smokehead is in 'Fast Charge' Mode. The battery should be fully charged within 1.5 hours.

### SLOW CHARGE:

LED Flashes ON/OFF (On for 1 second, Off for 1 second) The Smokehead battery is in 'Slow Charge' mode, the charging rate determined by either Terminal Voltage or, Battery Cell temperature.

### TRICKLE- CHARGE:

LED Flashing ON/OFF (On for 1 second, Off for 2 seconds) The Smokehead battery is in 'Trickle-Charge' mode indicating that the batteries are fully charged.

## Fault Diagnosis:

**No LED Lit on Smokehead:** Return the Smokehead to Charging Cradle. LED should display according to Charging level required.

**No LED lit on Smokehead after returning Smokehead to Charging Cradle:** Check that the Smokehead is correctly seated on the charging Cradle. The Smokehead has twin connectors on each insulated foot, and may be connected either way round.

Check the Charging Cradle is connected to the 240 V AC Mains.

Check that the sprung connectors that transmit the Charging Current on the Charging Cradle are clean and not stuck in a depressed condition.

Check that the Charging Connectors on the insulated mounts on underside of the Smokehead are clean and free of dirt and obstructions.

To check the charging Voltage at the Charging Cradle: Connect a Digital Multimeter set to measure up to 30V DC to the two charging Connectors on the charging Cradle, and depress the Central Charging Sensor. A Voltage of 28 V to 30 V DC should register on the Multimeter Display.

The internal battery pack has a finite lifespan and will need to be replaced periodically. This can only be carried out by a qualified Service Engineer.

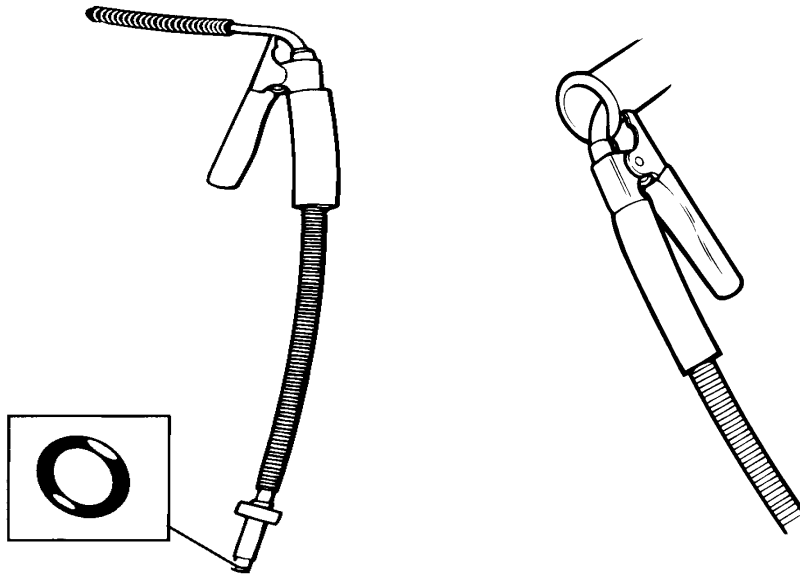
There are no user serviceable parts in the Smokehead.

**Important:** Please note that some models will utilize BLUETOOTH® technology. Whilst the radio modules used have a designed maximum range of 100m in free space conditions, the actual reliable working range achieved will depend on the conditions prevalent at the time and location of use, therefore no guarantee or warranty of usable working range is given or implied.

BLUETOOTH® is a registered trademark of Bluetooth SIG Inc. and is used by Crypton Technology Group under licence.

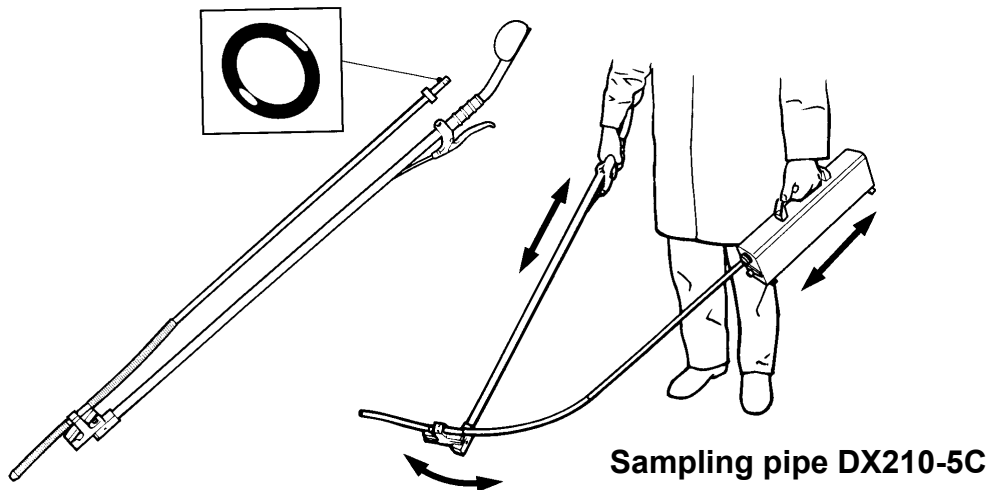
## SAMPLING HEAD AND PIPES

Various sampling pipes are available according to requirements. Connect the appropriate sampling pipe to the sampling head.



### Sampling pipe DX210-4A

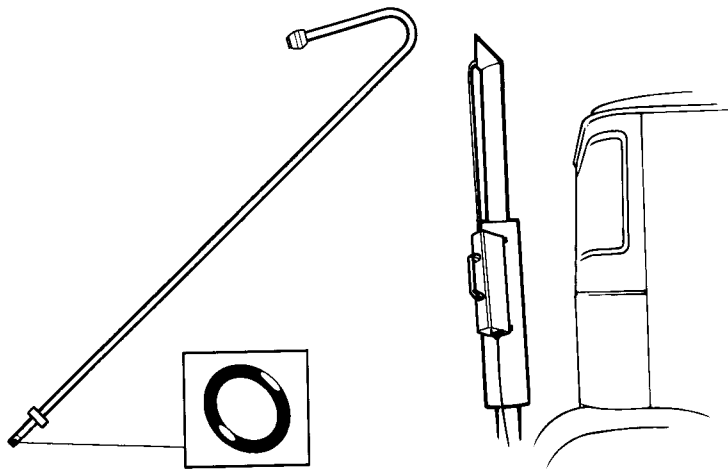
The sampling pipe DX210-4A can be used for all vehicles, but for convenience of use alternative pipes are available.



The sampling pipe DX210-5C has remote control and is used to access mid-chassis exhausts on large commercial vehicles. To use, hold the sampling pipe and the sampling head as shown in the illustration with the armrest under the forearm. The head of the pipe has a pivoting action so that moving one arm forwards or backwards relative to the other arm can change the 'aim' of the pipe.

Use the hand lever to operate the jaws and clamp the pipe in position, then allow the remote control and the sampling head to rest on the floor.

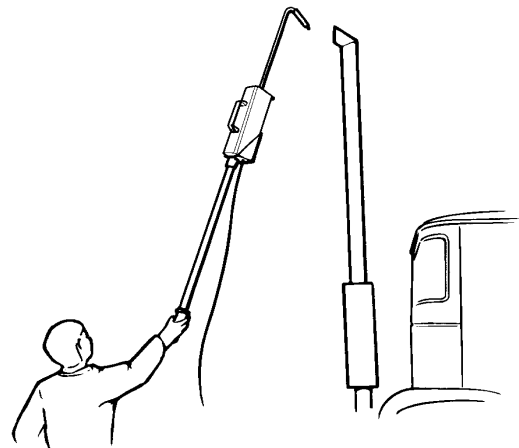
(Sampling Pipes continued)



**Sampling pipe DX210-6**

Sampling pipe DX210-6 is used for vertical exhausts. Hang the sampling pipe and the sampling head as shown in the illustration.

For very high exhausts, an extension Pole 1.5 m or 2 m length may be fitted to the sampling head using an Extension kit DX260-160L (1.5m) or DX260-160H (2.0m) as illustrated.



**Using extension pole**

**NOTE:** Before fitment of a sampling pipe, inspect its 'O' ring for damage and renew if necessary (order part number DX210-5/60). Periodically apply a smear of grease to the 'O' ring to assist fitment of the sampling pipe to the sampling head.

**CAUTION:** The results of free acceleration testing will be affected by changes in sampling pipe diameter and / or length. Only genuine pipes must be used and their design must not be altered in any way.

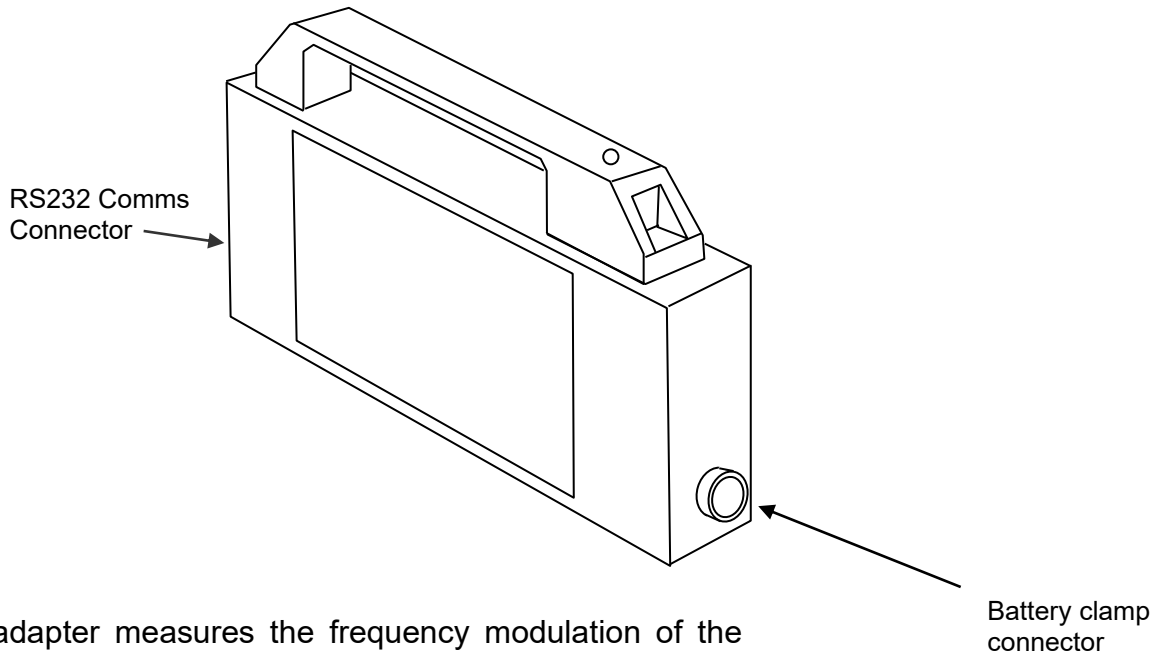


**WARNING:** Sampling pipes can get very hot, take care when disconnecting from the sampling head.

## ENGINE SPEED ADAPTERS

Engine speed for the DX211/DX211BT can be derived via a battery sensing tachometer – DX211-12 RPM Adapter or cable-less (Bluetooth®) RPM Adapter DX211-12BT.

### DX211-12 RPM Adapter



This adapter measures the frequency modulation of the alternator across the battery terminals, and converts this information into engine speed.

### Operation

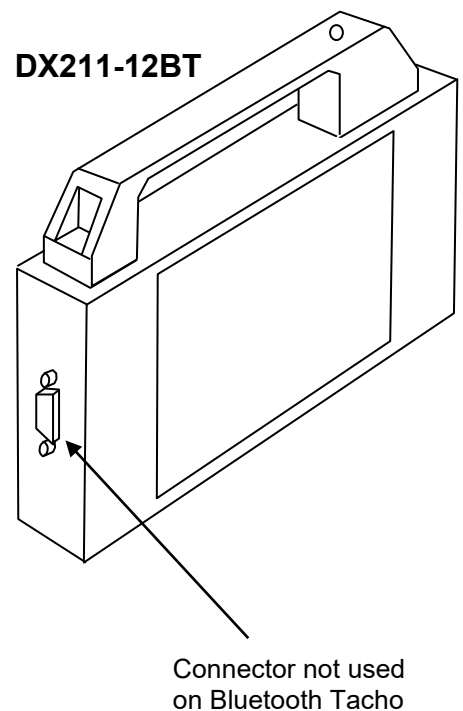
Ensure the battery clamp leads are connected to the DX211-12. Start the engine, turn on the vehicle lights, and allow engine to idle. Ensure all other vehicle accessories; internal blower, screen heater etc. are off. Attach the DX211-12 clips to the battery noting the correct polarity. When prompted by the smokemeter programme, set the correct number of cylinders of the vehicle engine.

### BEWARE ROTATING PARTS.

Allow the engine to idle while the DX211-12/DX211-12BT initialises (this may take up to 15 seconds). When complete the unit will indicate the engine speed on the console screen.

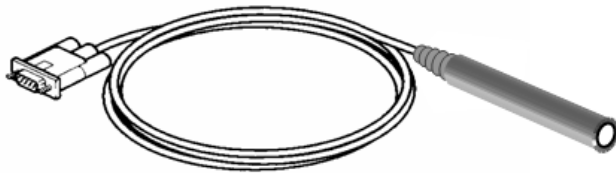
If the speed appears to be incorrect reset the DX211-12/ DX211-12BT by disconnecting and then reconnecting one of the battery leads.

For further details, please refer to the instructions provided with the adapter.



## OIL TEMPERATURE PROBE

The DX211-11 and DX211-11BT Temperature Probe Adapters are used in conjunction with the DX210-25A/26 oil probes for engine temperature measurements. The DX211-11 is hard-wired to the smokemeter; the DX211-11BT communicates via Bluetooth® wireless technology.



DX211-11

Wired Temperature Probe Adapter



DX211-11BT

Wireless Temperature Probe Adapter

### Connection to the Smokemeter

The DX211-11 utilises an RS232 communications cable for connection to the Smokemeter. The unit connects to the smokemeter via the 9-way 'D'-type socket on the side of the unit. When not in use the flexible probe must be stored in the holster on the underside of the DX211 workstation. It is not necessary to disconnect the two component parts when stored.

The DX211-11BT is a wireless device that will communicate with a Bluetooth® Smokemeter via Bluetooth® wireless technology. A dedicated holster is fitted to the underside of the DX211, which should be used to store and charge the unit when not in use. The DX211-11BT batteries will be charging at all times whilst stored in the holster, indicated by the status indication light at the end of the unit glowing red.

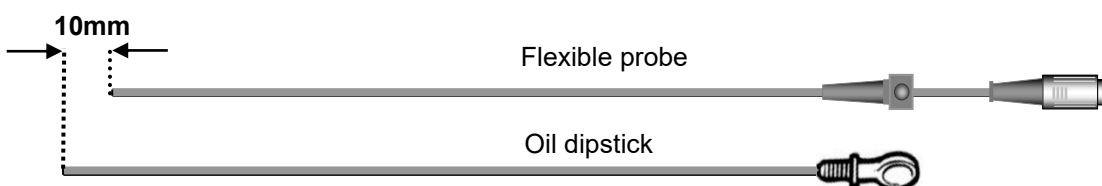
### Oil temperature probe connections

To measure oil temperature a flexible probe is plugged into the adapter (DX210-25A/26). Connect the flexible oil probe to the socket on the DX211-11/11BT. This connector includes a snap-lock feature that ensures a reliable connection between the two devices.

### Adjusting oil temperature probe length

Before testing, the probe must be adjusted to the correct length as follows:

Lay it alongside the vehicle dipstick (see illustration) and adjust the position of the depth stop until the effective length of the probe is approximately 10mm shorter than the dipstick.



**WARNING: ENSURE THAT THE OIL TEMPERATURE PROBE IS SET TO THE CORRECT DIPSTICK LENGTH AND THAT IT IS CLEAN FROM DEBRIS BEFORE INSERTING INTO THE ENGINE. FAILURE TO DO SO MAY RESULT IN SERIOUS DAMAGE TO THE PROBE AND/OR ENGINE.**

## Operation of Oil Temperature Probe

The DX211-11 will communicate directly with the smokemeter via the RS232 Serial communications signal cable.

The DX211-11BT communicates with a suitable Bluetooth® smokemeter via Bluetooth® wireless technology and will have been set up and configured to the smokemeter equipment.

Before operation of the DX211-11/11BT ensure that the oil probe length has been set correctly (see previous section) prior to deploying the probe on the vehicle.

When prompted by the smoke test program remove the temperature probe assembly from the smokemeter and insert the oil probe into the dipstick. In the case of the DX211-11BT, the blue status light will activate, indicating that the adapter has made the Bluetooth® connection with the smokemeter. Whilst under the engine bay do not rest any part of the DX211-11/11BT on any hot surfaces as serious damage is likely to occur to the unit.

When the test is complete ensure that the probe and adapter are cleaned thoroughly and stored appropriately.

## REMOTE INDICATOR HANDSET (where used)

The DX211-13BT communicates throttle command instructions to the vehicle tester, allowing the ability to follow the correct testing sequence without the need to be in visual range of the host display screen. The DX211-13BT communicates via the latest Bluetooth® wireless technology to the DX211BT and has a range (in free air) of approximately 100 metres.

### Switching on

To switch on the handset, momentarily press the power button – the blue Power/ Function LED indicator will illuminate and flash

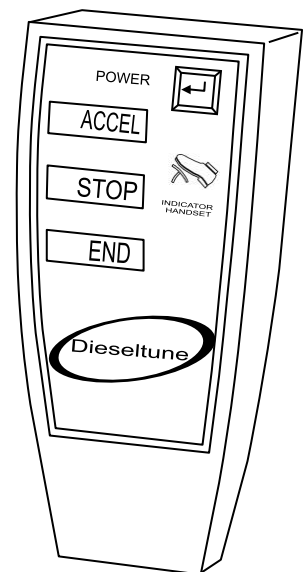
Slow flash - 1 flash/second – normal  
Fast flash - 5 flashes/second – battery low

Once communication has been established between the handset and the DX211BT the LED indicator stops flashing and remains steady on.

### Switching Off

The handset will switch off automatically under the following conditions:

Test sequence completed  
No communications established within 30 seconds  
No commands received within 5 minutes  
Low battery on power-up (fast flash for 3 seconds)



### **Starting the test**

Once the handset is switched on the test sequence can be initiated by briefly pressing the Power/Function button

- the Power/Function LED will blink twice and the test sequence will start.

### **Aborting the test**

To abort the test press the Power/Function button three times quickly (within 1 second).

- the Power/Function LED will blink twice and the test sequence will abort.

### **The test sequence**

Once the user has switched the handset on and initiated the test sequence (see 'Starting the test'– above) the command instructions on the handset follow the sequence determined by the test programme:

- |                                                                                                |                                                |
|------------------------------------------------------------------------------------------------|------------------------------------------------|
|  <b>ACCEL</b> | - Fully depress the accelerator pedal and hold |
|  <b>STOP</b>  | - Release the accelerator pedal and wait       |
|  <b>END</b>  | - Test completed – return to console           |

### **Battery level warning**

If the battery power depletes below the required level during operation the Power/Function LED starts blinking steadily (1 blink every 2 seconds) the batteries should be recharged or replaced as soon as possible.

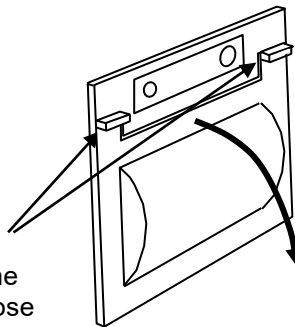
If the battery power level has depleted on switch-on and communication has not yet been established the Power/Function LED will flash rapidly (5 flashes/ second) and the handset will automatically switch off after 3 seconds. The batteries should be recharged or replaced immediately. Note: the handset will not power down during a test sequence but the batteries should be replaced as soon as the current test has been completed.

## **PRINTER**

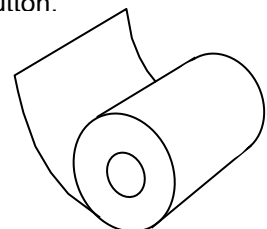
### **Printer paper replacement**

The printer will periodically require paper replacement. Use a standard 57.5mm thermal roll with a maximum diameter of 50mm.

Press down tabs and tip the front cover forward to expose the roll compartment



Insert paper roll this way round, close printer front panel and press the feed button.

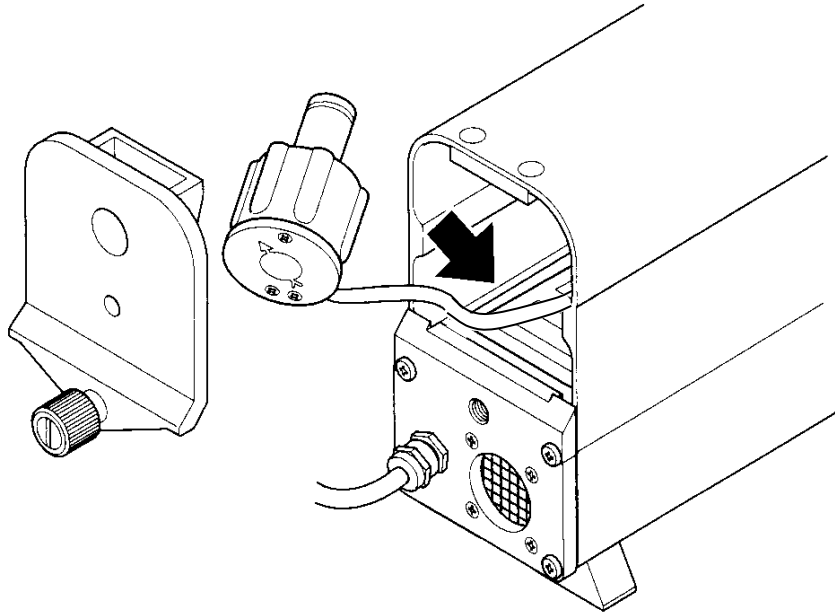


## MAINTENANCE

### SERIAL NUMBERS

Serial number locations are as follows:

- Sampling head - Underneath the lens housing (remove end cap for access).
- Control unit - Rear panel of unit.



**Sampling head serial number**

### CLEANING SAMPLING PIPES

If a sampling pipe becomes restricted with deposits, test results can be affected.

To clean a sampling pipe, disconnect from the sampling head and blow through with compressed air.



**WARNING:** Wear eye protection, and provide a suitable container to catch the soot that will be blown out.

Under normal circumstances the sampling head does not require cleaning.

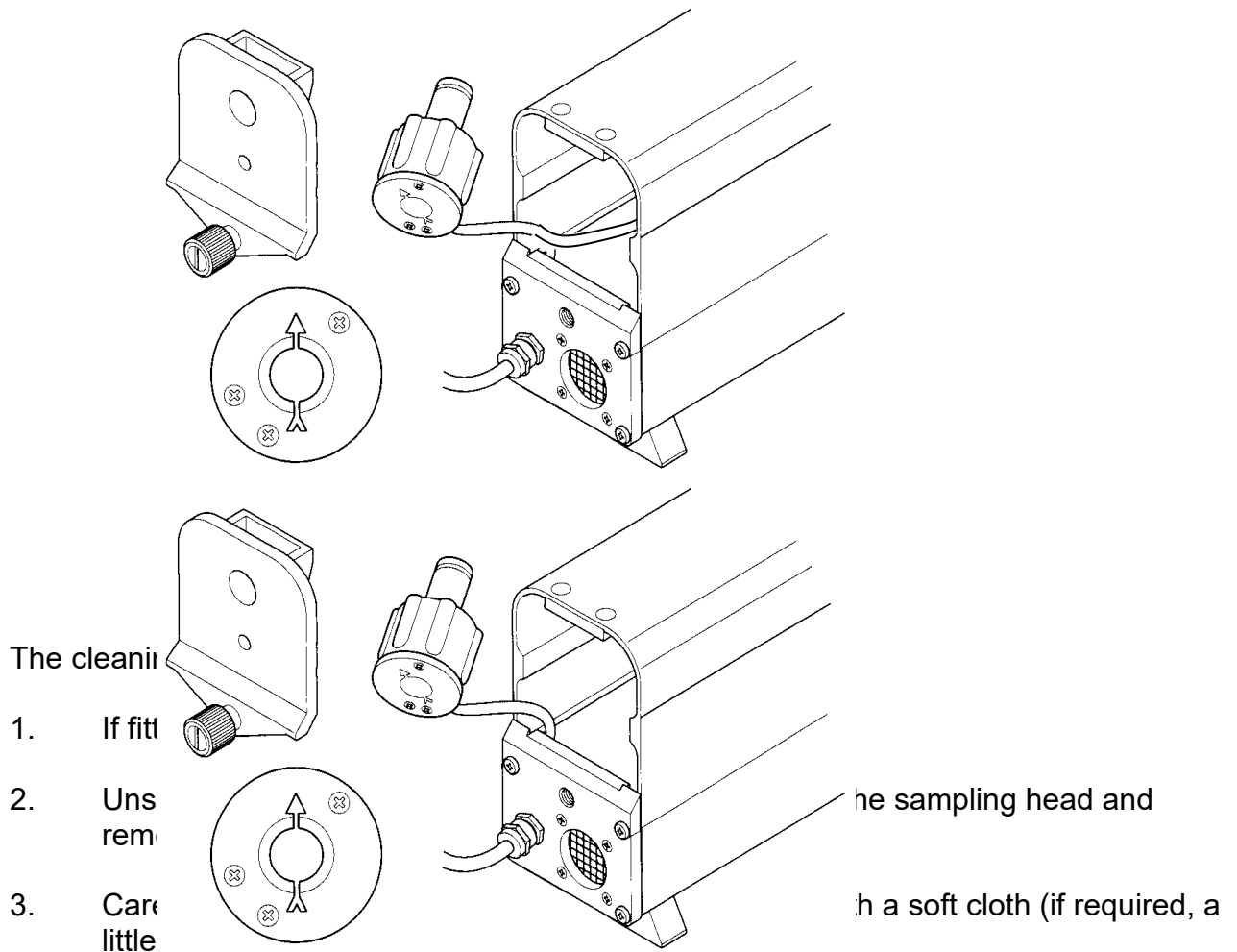
### CALIBRATION

For calibration procedures please refer to the appropriate software manual.

## LENS CLEANING

Two lenses are fitted in the sampling head, one at either end.

The Smokemeter checks the cleanliness of the lenses at the start of each test, and the PC will provide a warning when cleaning is required.

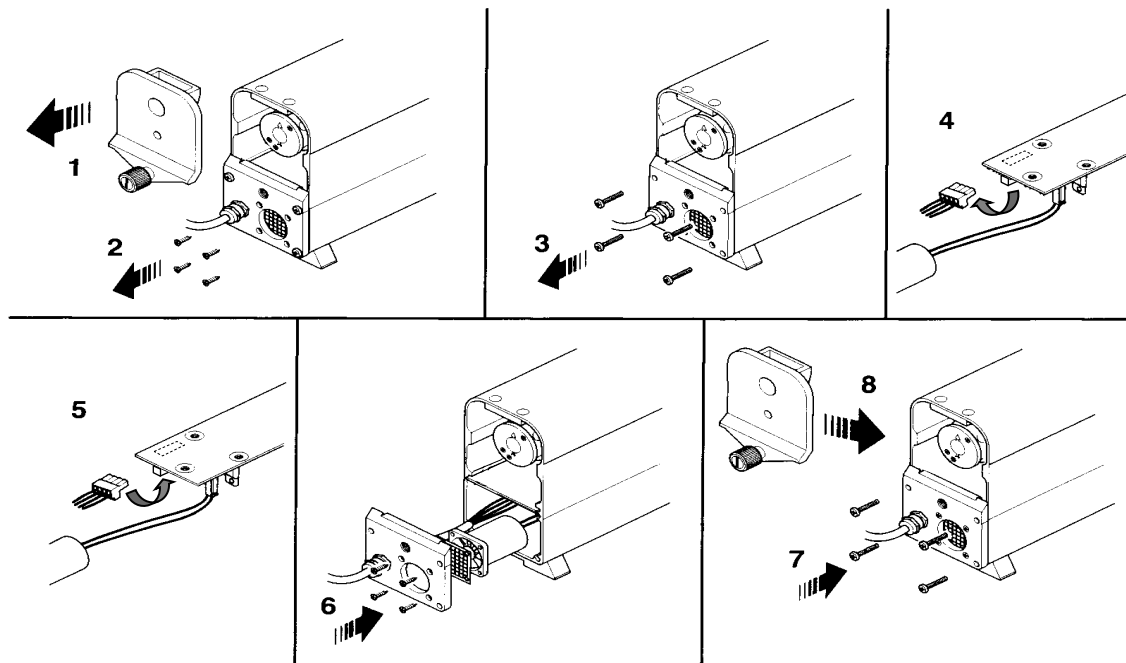


4. Refit the lens housing with the arrow pointing upwards (a little silicon grease on the 'O' ring will assist fitment).
5. Refit the end cap and tighten the knurled knob.

**NOTE:** Ensure the end cap locates fully against the body of the sampling head before tightening the knob. If not correctly located, the lens housing is probably not fully home.

6. Clean the lens at the other end of the sampling head in the same way.

**NOTE:** The end cap for the sampling pipe must be fitted at the end away from the sampling head cable.

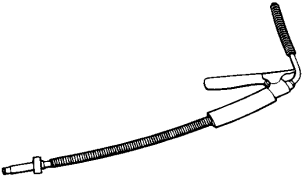
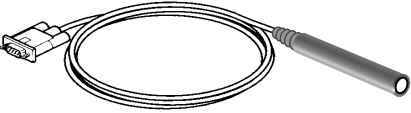
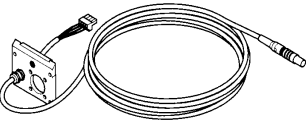
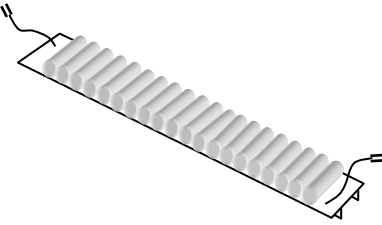
**SAMPLING HEAD CABLE RENEWAL (DX260-1 only)**

Should the cable become damaged and require renewal, the procedure is as follows.

1.     Unscrew the knurled knob (1) and remove the end cap.
2.     Remove the four countersunk screws (2) which secure the internal fan and grille to the sampling head end plate.
3.     Remove the four panhead screws (3) securing the end plate and carefully ease the plate clear of the housing.
4.     Disconnect the 4-pin multiplug (4). Do not disconnect the 2-pin plug to the fan.  
To fit the replacement cable:
5.     Connect the 4-pin multiplug.
6.     Carefully fit the fan and fan grille to the end plate (4 countersunk screws) without disturbing the fan supply wires.
7.     Locate the end plate to the sampling head (cable on left hand side) and loosely secure with 4 panhead screws.
8.     Check that the lens housing is fully in, then fit the end cap and secure with the knurled knob. Fully tighten the knurled knob then slacken half a turn.
9.     Push the end plate upwards as far as it will go, and then fully tighten the 4 panhead screws.
10.    Fully tighten the knurled knob on the end cap.

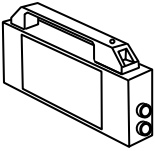
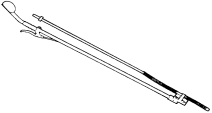
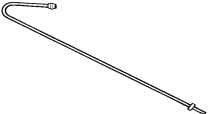
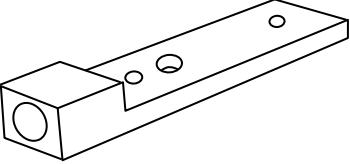
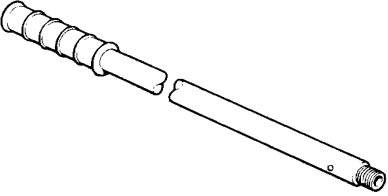
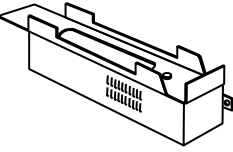
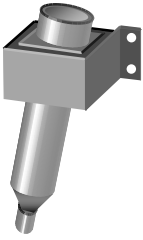
## CONSUMABLE SPARES

A range of items that are considered as consumables and will need replacing by the operator at regular interval, depending on number of vehicles tested.

|                                                                                     |                                                                                                                                  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
|    | <b>DX210-4A Sampling pipe</b>                                                                                                    |
|    | <b>Oil Temperature Probe</b><br>(For use with DX211-11 Adapter)<br><b>DX210-25A</b> - 2.5 metre<br><b>DX210-26</b> - 0.75 metre  |
|   | <b>DX211-11 Probe Adapter – 5m cable</b>                                                                                         |
|  | <b>DX211-11BT Wireless Probe Adapter</b>                                                                                         |
|  | <b>Cable – head to interface</b><br><b>DAS00281</b> 10m Standard<br><b>(DAS00282</b> 20m Optional)                               |
|  | <b>DX260-1BT/01 Battery Pack</b><br>(For use with DX260-1BT Head only)<br><br>Service Engineer fit only (recalibration required) |
|  | <b>PAPR0023 Thermal Printer paper</b><br><br>1 roll of 57.5mm x 50mm x 30M                                                       |

## OPTIONAL EQUIPMENT

A range of specially designed options are available for the Smokemeter to enable it to be used on a wide range of applications. These are detailed on the following pages.

|                                                                                     |                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>DX211-12     RPM Adapter</b><br/>Battery sensing type</p> <p><b>DX211-12BT     (Wireless variant)</b></p>                                                                                                                                        |
|    | <p><b>DX210-5C Sampling pipe</b><br/>With remote control, for use with mid-chassis exhausts</p>                                                                                                                                                        |
|    | <p><b>DX210-6     Sampling pipe</b><br/>For vertical stack exhausts</p>                                                                                                                                                                                |
|   | <p><b>DX260-160L Bracket kit</b><br/>Includes 1.5m Extension Pole (DX210-145)</p> <p><b>DX260-160H Bracket kit</b><br/>Includes 2.0m Extension Pole (DX210-146)</p> <p>Fits to DX260-1 &amp; 1BT sampling head.<br/>Use with DX210-6 Sampling Pipe</p> |
|  | <p><b>Additional Extension pole</b> for vertical exhausts</p> <p><b>DX210-145</b> Length 1m5 for exhaust outlets approx. 4m above ground level.</p> <p><b>DX210-146</b> 2m for use up to 4m5 above ground level.</p>                                   |
|  | <p><b>DX260-CH Wall Mount Charger</b><br/>(For use with DX260-1BT head only)</p>                                                                                                                                                                       |
|  | <p><b>DX211-13BT Indicator Handset</b><br/>For use with Bluetooth® enabled equipment<br/>(Requires software version v1.1.5.0 or later)</p>                                                                                                             |
|  | <p><b>DX211-11CH Wall mount Temp Probe Holster/Charger</b><br/>For use with Bluetooth® enabled equipment</p> <p>Allows remote mounting &amp; charging of the DX211-11BT Bluetooth Temperature Probe</p>                                                |

## TECHNICAL SPECIFICATION

### A. SMOKE SAMPLING HEAD

|                               |                                                                                                                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sampling type                 | Partial flow.                                                                                                                                                                                                       |
| Light source                  | Green LED, wave length 560 nm.                                                                                                                                                                                      |
| Light intensity               | 8-step autorange for optimum light level                                                                                                                                                                            |
| Effective optical path length | 250 mm.                                                                                                                                                                                                             |
| Physical response time        | Less than 0.4 seconds (varies with gas velocity).                                                                                                                                                                   |
| Range                         | 0 - 100% opacity, 0 - 10.00 Km <sup>-1</sup> .                                                                                                                                                                      |
| Accuracy                      | 1.0% full scale (static).                                                                                                                                                                                           |
| Measuring cell temperature    | 70°C min.                                                                                                                                                                                                           |
| Warm-up time                  | 10 minutes approx. at - 15°C ambient                                                                                                                                                                                |
| Operating conditions          | - 15° to + 40°C. 10 to 90% relative humidity (non-condensing).                                                                                                                                                      |
| Operating range (DX260-1BT)   | Up to 100 metres (in ideal conditions)                                                                                                                                                                              |
| Smoke temperature             | Checked at the inlet to the measuring cell.                                                                                                                                                                         |
| Smoke pressure                | Controlled at ambient $\pm$ 3.75 mbar.                                                                                                                                                                              |
| Sampling pipes                | Flexible stainless steel, internal diameter 10 mm, lengths 875 mm (standard) and 1,255 mm (under-chassis and vertical exhausts).                                                                                    |
| Lens cleaning                 | Wipe with soft cloth every 250 vehicle tests approx.                                                                                                                                                                |
| Calibration                   | Electronic (patented).<br>Manual (using neutral density filters).                                                                                                                                                   |
| Security                      | Sampling head serial number and software version held in permanent memory.                                                                                                                                          |
| Fault diagnosis               | Condition monitoring for: <ul style="list-style-type: none"><li>- Dirty lenses.</li><li>- Calibration failure.</li><li>- Incorrect measuring cell temperature.</li><li>- Excessive smoke temperature etc.</li></ul> |
| Power                         | 24V DC, 75W. (DX260-1)<br>30V DC, 90W max (DX260-1BT)                                                                                                                                                               |
| Housing                       | Aluminium extrusion with aluminium die cast end caps.                                                                                                                                                               |
| Finish                        | Grey textured polyester paint (other colours/finishes to special order).                                                                                                                                            |
| Protection                    | IP22.                                                                                                                                                                                                               |
| Size                          | 450 x 200 x 80 mm.                                                                                                                                                                                                  |
| Weight                        | 3.2 kg. (DX260-1); 3.9 Kg. (DX260-1BT)                                                                                                                                                                              |

**B.      CONNECTING CABLE - SAMPLING HEAD TO POWER SUPPLY (DX260-1)**

|              |                                               |
|--------------|-----------------------------------------------|
| Construction | 4-core screened.                              |
| Sheath       | Polyurethane (for low temperature operation). |
| Length       | 10 m (standard). 20 m max. (optional).        |

**C.      POWER SUPPLY**

|                         |                                                                |
|-------------------------|----------------------------------------------------------------|
| PSU (Main equipment)    | 100 – 250V AC, 50 / 60 Hz, 3.2A max @100V, full load.          |
| PSU (DX260-1BT Charger) | 100 – 250V AC, 50 / 60 Hz, 1.2A max                            |
| Operating conditions    | 0 to + 40°C.<br>10% to 90% relative humidity (non condensing). |

**D.      CONNECTIONS**

|            |                                                                                      |
|------------|--------------------------------------------------------------------------------------|
| Inputs     | Smoke sampling head.<br>DX211-12 RPM Adapter RS232<br>Smart card reader RS232        |
| Outputs    | RS232, 9-way 'D' (opacity, smoke temp) 9,600 BAUD.<br>External VGA 15-way Hi-density |
| Security   | Interface unit serial number and software version<br>held in permanent memory.       |
| Protection | IP20.                                                                                |

**E.      OIL TEMPERATURE PROBE ADAPTER**

|                      |                                                                                                        |
|----------------------|--------------------------------------------------------------------------------------------------------|
| Measurement range    | 7°C – 116°C                                                                                            |
| Accuracy             | ±5°C below 45°C<br>±1°C above 45°C                                                                     |
| Response             | <1 Second                                                                                              |
| Handle Dimensions    | 22mm Ø x 170mm Length (DX211-11 - Wired)<br>35mm Ø x 130mm Length (DX211-11BT - Wireless)              |
| Cable Length (Wired) | 5 Metres                                                                                               |
| Wireless Range       | Class 1 Bluetooth® Module provides approximately 100 metres<br>maximum range outdoors – line of sight. |

## AFTER SALES SERVICE

Apart from the routine maintenance and adjustments stipulated in this manual the equipment must not be tampered with in any way. All further servicing must be carried out only by an engineer from an Authorised Agent. Failure to observe these conditions will invalidate the Guarantee.

### On-Site Service / Overhaul / Spare Parts

If you require a Service Engineer to attend ON SITE, either due to an equipment fault, or for machine calibration, or if the equipment covered by this manual requires to be sent back for factory overhaul, or if you need spare parts, please contact our Product Support Helpline at the following number.

Tel: +44(0)1278 436252 Fax: +44(0)1278 450567

### Overseas

Service abroad is provided by the agent from whom your equipment was purchased.

### Helplines

Dieseltune run an Equipment Helpline during normal office hours.

Tel: 01278 436252 Fax: 01278 450567

Email: [support@dieseltunetechnology.com](mailto:support@dieseltunetechnology.com)

### Service & Warranty

The reliability of this equipment is fully supported by our service agents, with repair workshops and field service engineers to provide a full range of After-Sales Care, including installation, contract maintenance, factory overhaul and emergency repairs on site. Please refer to the page at the end of manual for full details.

**Note:** Your attention is drawn to our Terms & Conditions of Sale, particularly paragraph 2. If a service engineer is called out under service warranty where, upon inspection and test the equipment is found to be in full working order and no fault found, the user is liable to be charged the cost incurred for this call out. Before calling out an engineer, ensure your equipment is faulty by checking its operation, particularly mains supply and fault codes/self test if applicable.

### Software Licence

Further to our general Terms & Conditions of Sale, the software described in these Operating Instructions is furnished under the following Software Licence Agreement:

1. Licence: You may use the program on the machine provided. You may not copy, duplicate or transmit the program in any form, in whole or in part, without the express prior written permission of Dieseltune.
2. Term: The licence is effective until terminated. You may terminate the licence by destroying the program together with all copies, or returning the program to Dieseltune.
3. Dieseltune does not warrant that the program will meet your requirements or that its operation will be uninterrupted or error free.
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Website: [www.cryptontechnology.com](http://www.cryptontechnology.com)

