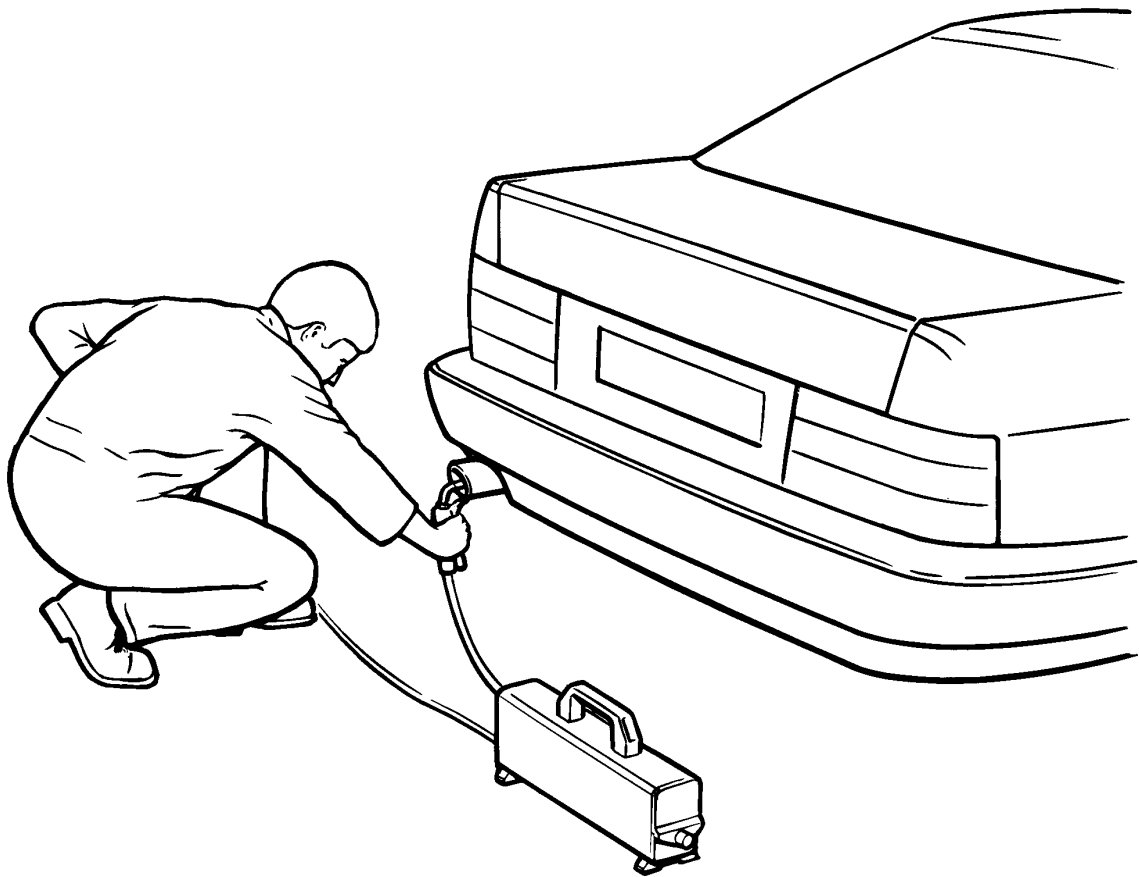


DIESELTUNE

Technology Limited



DX230 SMOKEMETER PROGRAM

OPERATING INSTRUCTIONS

IN1762

DEC2002

IMPORTANT

Every reasonable effort has been made to ensure that information within these Operating Instructions is correct at the time of release, but Crypton 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 Crypton.

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 this manual for full details.

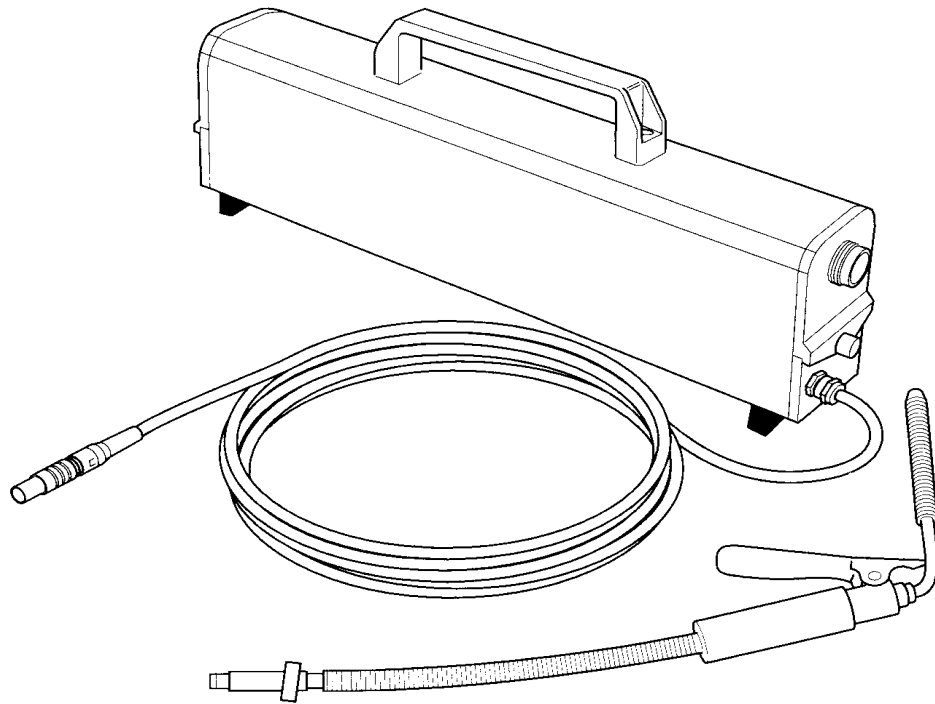
Note:

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.

WARNING:

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

DX230 SMOKEMETER



SPECIFICATION

Dieseltune Technology Ltd. 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.

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PATENTS

These products are covered by one or more of the following Patents or Patent Applications: GB - 2257515, 2268805. EU - 0521725, 0650586.

US - 5353629, 5596155

M.O.T. TESTING

The DX.230 Diesel Smokemeter, when used with the software described in this manual, is approved by the Vehicle Inspectorate Executive Agency for M.O.T. testing of the following classes of vehicle:

Category A Cars, Light Commercial Vehicles and Private Buses
(M.O.T. classes 4, 5 and 7)

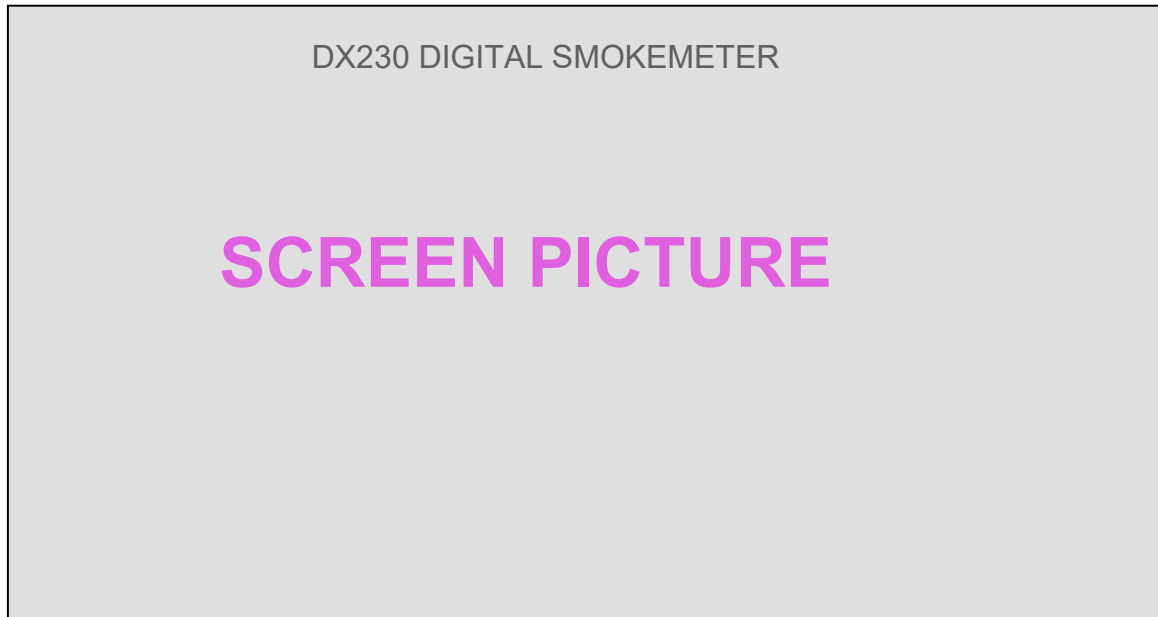
Category B Public Service Vehicles, Heavy Goods Vehicles

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NOTE: This manual only describes the software
 controlled procedures. For all other information,
 refer to the DX.230 Smokemeter 'Operators Manual'.

COMPUTER DISPLAY



1. Software version number e.g. GB 1.00, GB 1.01 etc.
2. Instruction Text box.
3. Ready box.
4. Display box (Prompts, Smoke and Oil values).
5. Engine Speed values
6. Function buttons
The function keys on the keyboard (F1 to F10) control the function buttons on the display as follows:

F1	To select test type.	F7	To select 'Plot'.
F2	To select test units.	F8	To select 'Print'.
F3	To select engine type.	F9	To select 'Low Smoke Test' (see M.O.T. test procedure, note 'D').
F4	To exit program (use with 'ALT').	F10	To continue.
F5	To select 'Special Functions'.		
F6	To select 'Set Zero' (automatic calibration).		
7. Modes / Units / Engine Type panel.
Press F1 to select the required test type:

MOT Class 4/7	M.O.T. test of class 4/7 vehicles.
MOT HGV/PSV	M.O.T. test of HGWPSV vehicles.
ACTUAL	Continuous or dynamometer testing.
PEAK	Single acceleration test.

COMPUTER DISPLAY

Press F2 to select the required test unit:

- km⁻¹ Coefficient of Light absorption, with temperature correction to 100°C.
HSU Hartridge Smoke Units (i.e. equivalent to an optical path length of 0,43 m),
with temperature correction to 100°C.
FSN Filter Smoke Number (Bosch or Bacharach scale), with temperature
correction to 100°C.
mg/m³ Milligrams of soot per cubic metre of exhaust gas, with temperature
correction to 100°C.
Cal % Opacity % for this Smokemeter (i.e. Optical Path Length = 0,25 m),
not corrected for temperature.
Used for calibration - see section 'Calibration'.

Scale range 0-6.22 FSN and 0-844 mg/m³ If scale range is exceeded, display box will
show 'OVER'.

Press F3 to select type of vehicle to be tested:

- | | |
|-----------|---|
| Non turbo | Selects pass/fail limit for non turbo vehicles. |
| Turbo | Selects pass/fail limit for turbo vehicles. |

START UP / SHUT DOWN PROCEDURE

NOTE: The following instructions assume that the Smokemeter software has already been installed on the computer using the instructions supplied with the software, and that the user is familiar with the operation of Windows 95 / 98.

Start up

Connect the equipment as described in the DX.230 'Operators Manual'.

1. To start the Smokemeter programme:
Start Windows 95 / 98.
Option 1 Select the 'DX230' icon.
Option 2 If the 'DX230' icon is not shown: - Select 'Start Menu'.
- Select 'Programs'.
- Select Smokemeter.
- Select 'DX230'.
2. The Smokemeter display will now be built up in a series of stages until the Instruction Text box displays:
SAMPLING HEAD, TEMPERATURE STABILISATION []
PLEASE WAIT

The number inside the brackets [] is an indication of the temperature of the sampling head. It should stabilise at approximately 128 after 5 to 20 minutes, dependent on ambient conditions.

The Instruction Text box will then display: CALIBRATION CHECK
PLEASE WAIT

The Smokemeter now carries out an automatic calibration check (see section 'Calibration' for details).

If an equipment fault is detected, the appropriate message will appear in the Instruction Text box. Press F10 (Continue) to proceed.

Use keys F1, F2, and F3 to select the required test mode, test unit and engine type.

The equipment is now ready to carry out an MOT test, or an Actual Mode or Peak Mode test as designated.

Shut down

Press ALT and key F4 simultaneously.

'Close Program ? Yes / No' box will appear. Select 'Yes'.

IMPORTANT: Follow the correct Windows 95 / 98 shut down procedure before turning the computer off.

NOTE. If the program does not respond to ALT + F4, refer to Windows 95 98 operating instructions and use keys CTRL + ALT + DEL simultaneously.

M.O.T. TEST PROCEDURE

1. Prepare the Smokemeter for M.O.T. testing (see section 'Start Up Shut Down Procedure').
2. Warm the vehicle's engine to normal operating temperature.
IMPORTANT: Leave the engine running until the test sequence described below is completed.

WARNINGS:



- If carrying out tests in a workshop the area should be well ventilated. Alternatively, outdoor testing is permissible (see 'Outdoor Testing' in the 'DX.230 Operators Manual').
- Ensure that the vehicle is parked on level ground with handbrake applied and gear lever in neutral or park position.
- Turbocharged engines should be allowed to idle for 10 to 15 seconds before switching off to ensure maximum turbocharger life.

3



WARNING: It is recommended that prior to carrying out the M.O.T. test the engine speed governor is checked as follows:

Fit the engine speed adaptor (see section 'Engine Speed Adaptors' in the DX.230 Operators Manual').

SLOWLY raise the engine speed and check that the engine manufacturer's maximum speed cannot be exceeded.

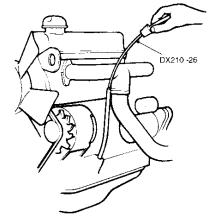
Do not proceed further if the engine speed exceeds the manufacturer's figure.

NOTES:

- A. The following procedure is for Category 'A' vehicles i.e. M.O.T. classes 4, 5 & 7 Cars and Light Commercial Vehicles. Where the M.O.T. test for Category 'B' vehicles differs, i.e. HGV's (Heavy Goods Vehicles) and PSV's (Public Service Vehicles), these differences will be highlighted thus - (Category 'B' vehicles).
- B. The measurement of oil temperature does not apply to all categories of vehicle. Where permitted by the Vehicle Inspectorate, the test may be conducted without connecting the oil probe.

4. Ensure the appropriate 'MOT Class and Non Turbo 1 Turbo options have been selected. The Display box should then read 'HOLD'.
5. Press F10 (Continue) on the keyboard (or press the remote reset control button if being used).
The Smokemeter will initiate a further self-calibration check and then the Display box will read 'OIL'.
NOTE: If HGV/PSV selected, Display box will read 'PIPE'. If so, go to

6. Remove the dipstick and insert the oil probe (see section 'Oil Temperature Probes' in the DX.230 Operators Manual').



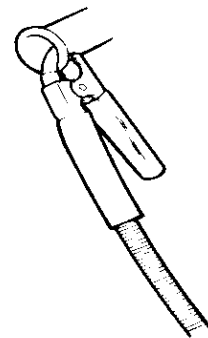
Press F10 (Continue).

The oil temperature will now be displayed.

Check that it is above the recommended minimum.

7. If satisfactory press F10 (Continue).
This will store the oil temperature and initiate a self-calibration check. The Display box will now read 'PIPE'.
8. Remove the oil temperature probe and replace the dipstick.

9. Clamp the sampling pipe to the vehicle exhaust.
Do not allow the sampling head to be located in a smoky area at any time or false readings could occur, and the service life of the fan in the sampling head may be reduced.



10. Press F10 (Continue) again.
The Display box will now read '----' and the Ready box will illuminate 'READY'.
If the remote reset control is being used, its LED will illuminate.

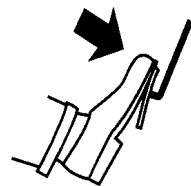
NOTE: The above sequence (operations 7 to 10) must be followed precisely or the calibration of the Smokemeter will be affected.

- 11 The MOT procedure consists of carrying out a number of free acceleration tests, with the Smokemeter analysing each test individually.

Carry out the test sequence as follows:

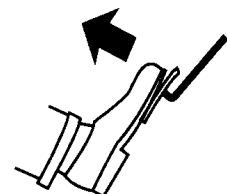
Watch the Ready box (or the LED on the remote reset control if being used).

When 'READY' is shown (or the remote LED illuminates), fully depress the accelerator pedal as quickly as possible and hold it at maximum rpm.



As soon as 'READY' (or the LED) goes out, release the accelerator pedal and allow the engine to idle.

NOTE: If 'READY' does not go out, release the accelerator pedal after holding the engine at maximum speed for approximately 2 seconds (see Note 'D').



During de-acceleration, the Display box will flash a read-out of the test result (e.g '2.02') for 2 seconds and then revert to (-----)

Repeat this test sequence two more times (three more times for Category 'B' vehicles).

After the last of these accelerations, the Display box will briefly show a steady read-out of the average of all the tests (see notes 'A' and 'B'). The Smokemeter will compare this average reading with the pre-programmed statutory limit value for smoke emission.

If the average figure is within the prescribed limits the vehicle has passed, and the Display box will change to 'PIPE'.

If the average is outside limits, the Ready box will illuminate. Carry out one further free acceleration test.

The Display box will flash the result of this test for 2 seconds and will then change as before to briefly show a steady read-out. The read-out is again the average of the last 3 tests (average of the last 4 tests for Category 'B' vehicles).

The Smokemeter will again compare this average reading with the statutory limit value. If within limits the vehicle has passed and the Display box will change to 'PIPE'.

If this average reading is still outside limits, carry out further free acceleration tests until: Either - the average displayed is less than the statutory value, in which case the vehicle has passed the test.

Or until a total of 6 tests have been completed (10 tests for Category 'B' vehicles).

If test 6 (test 10 for Category 'B' vehicles) is completed without achieving a satisfactory result test, the Smokemeter will NOT accept further tests and the vehicle has failed. The Display box will show 'PIPE'.

When 'PIPE' is displayed, proceed as follows:

- a. Remove the sampling pipe from the exhaust.
- b. Press the F10 key (or remote reset control).
This sequence ('a' and 'b') must be carefully followed or the calibration will be affected (see note 'C' overleaf).

12. The 'CUSTOMER DETAILS' screen will now be displayed. Enter the information requested.

NOTE: 1. Use the 'Tab' key to move the cursor between boxes.
2. Information may be left blank if desired.
Press FI.

13. The 'PRINT CERTIFICATION TEST REPORT' screen will now be displayed. Select 'YES' or 'NO' as appropriate.

The Ready box will display PASS or FAIL, and the Display box will show the test result.

14. Press F8 for additional test copies if required.
Press F10 to return to the start.

15. The Smokemeter is ready to test another vehicle when the FI 0 key is pressed.

NOTE: Do NOT press the FI 0 key until you are ready to start the next test, as the automatic re-calibration process will be activated prematurely and may affect the test results.

See M. 0. T. Test Procedure notes and sample test report overleaf

NOTES

A If, prior to test 6 (test 10 for category 'B' vehicles), the last three readings (four readings for Category 'B' vehicles) include one that is less than 75% of the average value, this is considered to be an 'Invalid Average'. If it is not shown, the display reverts to ----- and a further acceleration is necessary. This does not apply if all readings are less than 2.00m-1.

B If tests 4 to 6 (tests 7 to 10 for Category 'B' vehicles) contain a reading or readings less than 75% of the average value, the average is re-calculated from the remaining readings and this 'Re-calculated Average' is displayed instead.

C Operation of the 'FI O' key at the end of the test sequence causes a check on the zero drift of the equipment, and this is shown on the print-out under the heading 'Zero Check'.

If the Zero Check is less than or equal to 0.2m-1, and if 6 tests were completed (10 tests for Category 'B' vehicles), then the zero drift is automatically subtracted from the average value to give a 'Corrected Average'.

A Zero Check greater than 0.2m^{-1} should only occur if excessive smoke (e.g. 5.0 m^{-1} or more) causes sooting of the lenses. In this situation, the test result is higher than it should be by the amount of the zero drift. The Display box will flash 'CAL' and the print-out will include the statement 'WARNING, ZERO DRIFT'.

If this warning frequently appears when vehicles have smoke levels below the statutory limit, it is a possible indication of an equipment fault.

D If a vehicle has no visible smoke, the Smokemeter cannot recognise that the engine has been accelerated and 'READY' will not go out. Proceed as follows:

1. Release the accelerator pedal and check that the sampling pipe has not fallen from the exhaust.
2. Press 'F9' to select 'Low Smoke Test'. The Smokemeter will now run on an internal timebase which is independent of smoke level.
3. Accelerate the engine **immediately** 'READY' is shown.
4. Release the accelerator as soon as 'READY' goes out.

This method allows the test to be completed even if there is no visible smoke: i.e. the displayed and printed result can be 00.00 m^{-1} .

ABORTING A TEST

If it is necessary to terminate an M.O.T. test before completion, use the Mode select button 'F1' to scroll through all the test modes and return to M.O.T. Test. Any results previously recorded will be lost and the test must be re-started from the beginning.

Test Print-out - The following is a typical FAIL print out.

V.I. SMOKE TEST				
Morris Motors (1) Station Street Anytown				
CUSTOMER VEHICLE REGISTRATION No. ODOMETER TEST TYPE ENGINE TYPE OIL TEMPERATURE		Mr Graham VW Golf M350 UEP 66,650 MOT Class 4/7 NONTURBO 65°C (2)		
Test No.	Smoke m⁻¹	min.	Speed (3) max.	Time (4) sec.
1	2.83	0800	5105	1.20
2	2.90	0800	5105	1.10
3	2.89	0805	5104	1.30
4	2.91	0805	5103	1.10
5	2.92	0800	5105	1.00
6	2.93	0800	5105	1.20
TEST RESULT ZERO CHECK		2.83 m⁻¹ (5) 0.09 m⁻¹ (6)		FAIL

NOTES:

- 1 See section 'Special Functions 'for procedure to enter Garage name and address.
- 2 Oil temperature will be printed as ----- °C if the oil temperature probe is not fitted
- 3 Min. Speed engine speed when 'READY' comes on.
Max. Speed engine speed when 'READY' goes out
The speed columns will read 0 if an engine speed adaptor is not fitted.
- 4 Time taken to accelerate from minimum RPM to maximum RPM.
Column entries will read 0.00 if an engine speed adaptor is not fitted.
- 5 This test result is the average of tests 3 to 6 less the ZERO CHECK figure. The result is a PASS for the vehicle.
- 6 If the ZERO CHECK value is higher than 0.2m⁻¹, the statement 'WARNING, ZERO DRIFT 'will appear in the print-out, and the Display box will flash 'CAL'.

OTHER TEST MODES

'Actual' Mode

This is a continuous opacity test mode facility, with particular application for engine test beds / chassis dynamometers etc.

To prepare the Smokemeter for the 'Actual' mode, see section 'Start-up Procedure'.



WARNING: During the test the smoke temperature in the sampling head must NOT exceed 150°C, or internal damage could occur. If 150°C is exceeded, a warning will be displayed in the Instruction Text box. The Smokemeter should be left switched on.

Once the temperature has fallen below 125°C, the machine will re-calibrate and revert to the test mode previously selected.

The sampling pipe can be lengthened to allow adequate cooling of the smoke before it enters the sampling head. This extension pipe should be made of copper or stainless steel, and have a minimum internal diameter of 10 mm.

However pipes should not be lengthened if free acceleration testing is to be carried out, since the change will affect Smokemeter response time and therefore the test results.

To carry out the test, use keys 'F1' and 'F2' to select 'Actual' mode and the preferred test units. The display will continuously show the smoke output of the engine at whatever speed and load is chosen.

If key 'F8' is pressed at any time during the test, the resultant print-out will show the results of the smoke being measured at that moment.

EXAMPLE - Typical 'Actual' mode print-out

ACTUALTEST		
Morris Motors Station Street Anytown		
CUSTOMER VEHICLE REGISTRATION No. ODOMETER		
OPACITY	1.13 m ⁻¹	
ENGINE SPEED	4510 RPM	(#)
OIL TEMPERATURE	80°C	(#)

(#)The engine speed and/or oil temperature will only be given if an engine speed adaptor and/or oil temperature probe is fitted.

OTHER TEST MODES

'Peak' Mode

This opacity mode enables a single free acceleration smoke test to be carried out. To prepare the Smokemeter for the 'Peak' mode, see section 'Start-up Procedure'.

To carry out the test, fit the sampling pipe to the vehicle exhaust and then use keys 'F1' and 'F2' to select 'Peak' mode and the preferred test units. When 'READY' is illuminated, quickly depress the throttle to maximum.

Release the throttle as soon as 'READY' goes out and allow the engine to return to idle. The test result will be shown in the Display box.

A print-out of the displayed result can be obtained (if required) by pressing key 'F8'.

A new test can be started as soon as 'READY' is displayed.

NOTE: For convenience, the remote reset control DX.210-14 (see DX.230 'Setting Up' manual) may be used instead of the 'READY' display on the screen. The control incorporates a 'READY' light.

EXAMPLE - Typical 'Peak' mode print-out

PEAKTEST	
Morris Motors Station Street Anytown	
CUSTOMER VEHICLE REGISTRATION No. ODOMETER	
PEAK OPACITY	2.23 m ⁻¹
ENGINE SPEED MIN	842 RPM
ENGINE SPEED MAX	5124 RPM
OIL TEMPERATURE	98°C

The engine speed will only be given if an engine speed adaptor is fitted.

Min Speed engine speed when 'READY' is displayed.

Max Speed engine speed when 'READY' goes out.

The oil temperature will only be given if an oil temperature probe is fitted.

CALIBRATION

Vehicle Inspectorate Calibration Checks

It is a Vehicle Inspectorate requirement that all makes of smokemeter used for M.O.T. testing are calibrated at intervals specified by them. Currently these are:

- A) At least once a week
Because the automatic calibration check described below occurs every time the Smokemeter is switched on there is no requirement for a weekly check.
- B) Once a year
A manual calibration check must be carried out by an approved technician; please contact the manufacturer for this service.

Automatic Calibration Check (electronic method)

The Smokemeter takes its smoke readings on a percentage scale; 0% denotes clean air (i.e. no smoke at all), and 100% denotes total obscuration of the light beam (i.e. totally black smoke). These two values are set automatically; the first by having the light beam in clean air, and the second by switching the beam out so that the sensor sees no light at all.

As an extra precaution, the light level is checked at a 'mid point' of 37.5% (equivalent to $k = 1.88\text{m}^{-1}$). No optical filters are used for this check; the light level is electronically generated by special circuitry (patented).

It is necessary for the calibration to be checked regularly since it can be affected by any soot which may land on the lenses during use. For this reason, the Smokemeter automatically checks its calibration at the start of each test, or at any time that F6 (Set Zero) is pressed.

The tolerance on the 'mid point' calibration check is 34.4% to 40.5% (equivalent to $k = 1.88 \pm 0.2\text{ m}^{-1}$). If it fails outside this limit, a warning is displayed and the 'MOT' test modes will be disabled. If this situation occurs - contact the manufacturer.

CALIBRATION

Manual Calibration Check

Equipment required: Neutral density filter(s) - see 'Equipment' section.

NOTE: Users of Smokemeters for M.O.T. testing must contact the manufacturer for this check. Other users may wish to carry out the check themselves as follows.

1. Prepare the Smokemeter for calibration (see section 'Start-up Procedure'). Allow an extra 10 minutes warm-up time for complete stabilisation to occur.
2. Use keys F1 and F2 to select 'Actual' and 'Cal %' modes.
3. Press key F6 (Set Zero). The value of the automatic calibration check will now be displayed.
4. Press key F1 0 (Continue) and observe that the display reads 0.0 / 0.2. (if the reading is outside these limits, press F6 again.)
5. Remove the sampling pipe (if fitted), loosen the knurled knob at the sampling pipe end of the sampling head and remove the end cap.
6. Pull out the photo diode lens housing.
7. Examine the inside of the measuring tube and, if excessively dirty, use a bottle brush to clean soot from the tube ONLY AS FAR AS THE FIRST ANTI-REFLECTION RING (approximately 60 mm). Allow the soot to fall out, taking care not to disturb the ring.
8. Invert the sampling head and fit one of the calibration filters into the area just cleaned.
9. Refit the photo diode lens housing. Refit the end cap and secure with the knurled knob. Note the reading shown on the display; compare this value with the known filter value.
10. Remove the end cap and the photo diode lens housing again. Remove the filter.
11. Repeat the check with other calibration filters if require

If there appears to be a calibration error, contact the manufacturer.

NOTES

- A It is advisable not to remove the LED lens housing (at the cable end of the sampling head), since this is held at a stable temperature.
- B. Take care not to contaminate the calibration filters. Inspect for cleanliness before using.

- C. The 'Cal' scale must be used, as all the other scales automatically adjust the displayed reading according to the gas temperature inside the sampling head.
- D. Refit the end cap each time to ensure correct location of the lens housing; 'a small misalignment can affect calibration results.

SPECIAL FUNCTIONS

Garage Name and Address

To enter your garage name and address on print-outs, proceed as follows.

1. Press key F5 (Special Functions).
The Special Functions display will appear.
2. Press key F5 (Garage name).
The Garage Name box will appear.
3. Use the Tab key to move the cursor into the Garage Name box.
4. Delete the previous entry if any, and type in the new requirement (10 lines maximum).

NOTE: a) Only the first 10 lines entered will appear on the print-out.
 b) A 'space' must be entered if a blank line is required.

5. When complete, press FI (OK) to exit Garage Name.
6. Press FI again to exit Special Functions.
7. Shut down and re-start the Smokemeter program to store the information just entered.

System Data

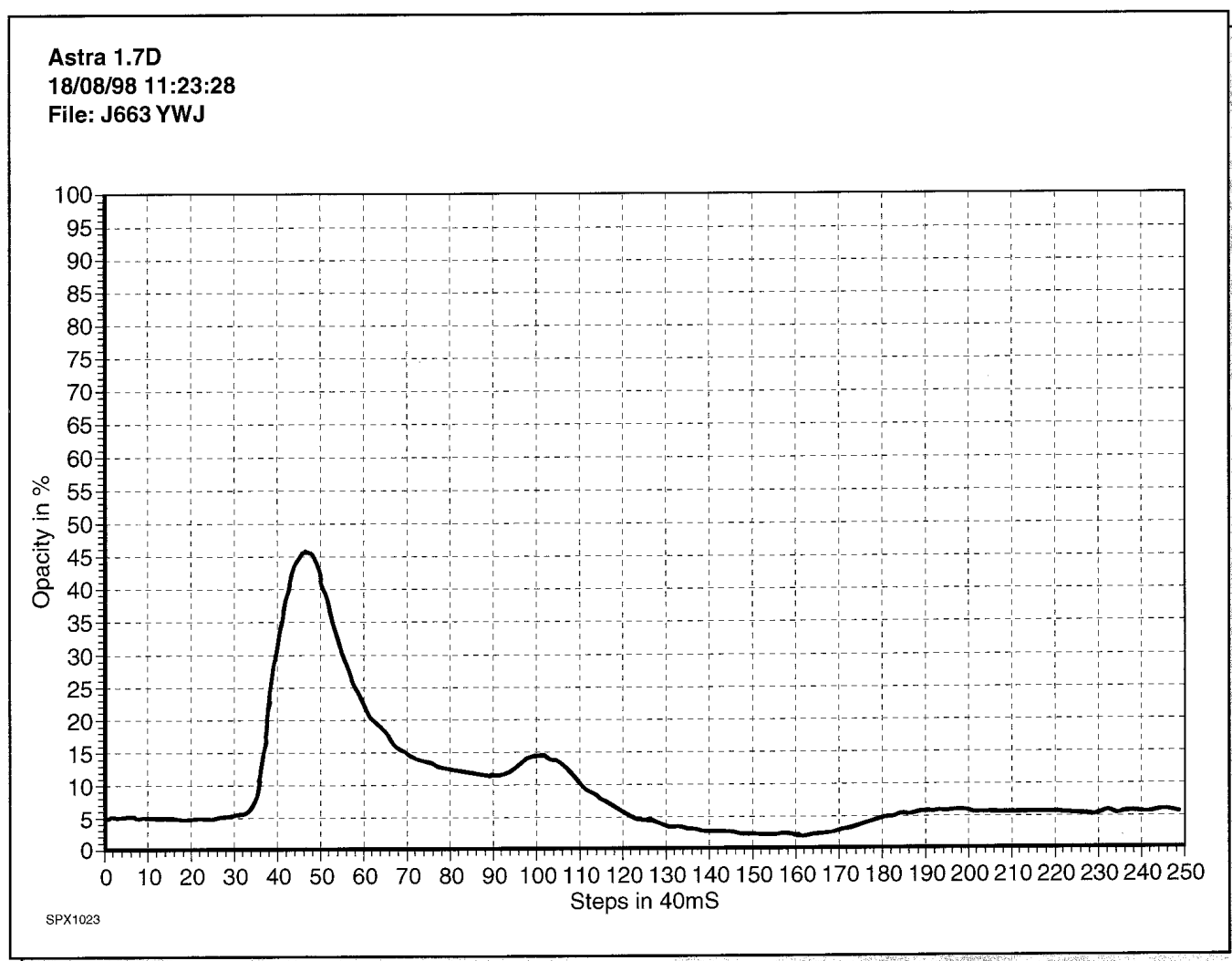
Operating system parameters and pass / fail limits etc. are preprogrammed into this area. It is not possible to amend this information without a password.
In the event that any modification is required, the manufacturer will provide the necessary service.

PLOT

The Plot mode provides a graph which will show the shape of the smoke curve (currently active in Peak mode only).

A graph can be originated as follows.

1. Carry out a Peak test.
2. Press 'F7' (Plot).
The smoke curve is now displayed. The file name may be amended and/or comments added if required.
3. Press 'F1' to close.
Press 'F5' to print.
Press 'F6' to save as an Excel file in c:\program files\dx230\peaklog



Typical vehicle smoke curve
CONVERSION CHART

Conversion chart for k, HSU, FSN and mg/m@.

(Extracted from MIRA Report No. 1965/10, Nuneaton 1965, AG Dodd and Z Holubecki.)

k coefficient of light absorption m-1	Hartridge Smoke Units HSU	Filter Smoke Number FSN	Mg/m ³	Cal % (*)
0,25	10	1,10	33	6.1
0,27	11	1,20	38	6.5
0,30	12	1,30	42	7.2
0,32	13	1,40	47	7.7
0,35	14	1,48	52	8.4
0,38	15	1,57	57	9.1
0,41	16	1,67	62	9.7
0,43	17	1,75	66	10.2
0,46	18	1,84	71	10.9
0,49	19	1,93	76	11.5
0,52	20	2,02	81	12.2
0,55	21	2,10	86	12.8
0,58	22	2,18	91	13.5
0,61	23	2,26	96	14.1
0,64	24	2,34	101	14.8
0,67	25	2,42	106	15.4
0,70	26	2,50	111	16.1
0,73	27	2,57	117	16.7
0,76	28	2,64	122	17.3
0,80	29	2,71	127	18.1
0,83	30	2,77	133	18.7
0,86	31	2,83	138	19.3
0,90	32	2,89	144	20.1
0,93	33	2,96	150	20.7
0,97	34	3,02	156	21.5
1,00	35	3,08	162	22.1
1,04	36	3,14	168	22.9
1,07	37	3,20	174	23.5
1,11	38	3,26	181	24.2
1,15	39	3,31	187	25.0
1,19	40	3,37	193	25.7
1,23	41	3,42	199	26.5
1,27	42	3,47	206	27.2
1,31	43	3,53	213	27.9
1,35	44	3,59	220	28.6
1,39	45	3,64	227	29.4
1,43	46	3,70	234	30.1
1,48	47	3,75	241	30.9
1,52	48	3,80	248	31.6
1,57	49	3,86	256	32.5

(*) i.e. optical path length, L = 0,25 m

NOTE: For the DX.230, all scales except 'Cal %' include compensation for the temperature of the smoke. Hence the Smokemeter's conversion from 'Cal %' to the other units will only follow this table if the smoke temperature is exactly 100°C

CONVERSION CHART

k coefficient of light absorption m-1	Hartridge Smoke Units HSU	Filter Smoke Number FSN	Mg/m ³	Cal % (*)
1,61	50	3,91	264	33.1
1,66	51	3,96	272	34.0
1,71	52	4,01	281	34.8
1,76	53	4,07	290	35.6
1,81	54	4,12	299	36.4
1,86	55	4,17	308	37.2
1,91	56	4,22	317	38.0
1,96	57	4,27	326	38.7
2,02	58	4,32	335	39.6
2,07	59	4,37	345	40.4
2,13	60	4,42	355	41.3
2,19	61	4,47	365	42.2
2,25	62	4,52	375	43.0
2,31	63	4,57	385	43.9
2,38	64	4,62	395	44.8
2,44	65	4,67	406	45.7
2,51	66	4,72	416	46.6
2,58	67	4,76	428	47.5
2,65	68	4,81	439	48.4
2,72	69	4,86	450	49.3
2,80	70	4,91	462	50.3
2,88	71	4,96	475	51.3
2,96	72	5,01	489	52.3
3,04	73	5,07	501	53.2
3,13	74	5,12	514	54.3
3,22	75	5,17	529	55.3
3,32	76	5,23	544	56.4
3,42	77	5,28	559	57.5
3,52	78	5,34	575	58.5
3,63	79	5,40	591	59.6
3,74	80	5,45	609	60.7
3,86	81	5,51	626	61.9
3,99	82	5,57	648	63.1
4,12	83	5,65	669	64.3
4,26	84	5,72	691	65.5
4,41	85	5,80	712	66.8
4,57	86	5,87	737	68.1
4,74	87	5,95	760	69.4
4,93	88	6,04	786	70.8
5,13	89	6,13	815	72.3
5,35	90	6,22	844	73.7

TERMS AND CONDITIONS OF SALE

GUARANTEE

We guarantee our products as free from defects due to faulty material or bad workmanship for a period of 12 calendar months for all products. The period of the guarantee commences from the date of delivery to the Purchaser, either by us or by our distributor. Our liability is limited to the replacement of parts found defective and making good defects found within the prescribed period arising solely from faulty material or bad workmanship, in the products of our own manufacture, properly used solely for the purposes for which they were intended, and not due to wear and tear, misuse, neglect or improper adjustment.

Any product alleged to be defective shall be forwarded to us, carriage paid, immediately the alleged defect is discovered, for identification, examination and report or if not capable of being so forwarded, notice in writing shall be sent to us immediately. The Purchaser will be charged for engineers time and travelling expenses if a warranty repair is carried out on site, other than for fixed items of equipment such as brake testers. If we accept liability the repaired or new product, in replacement, will be delivered free from our works. We give no guarantee in respect of any proprietary electrical or other equipment made by other manufacturers, and supplied with our products, but will so far as possible, transfer the benefit of such guarantee, if any, given by such other manufacturers. We are in no circumstances liable for any consequential or other loss or damage arising through any defect in our product. In lieu of any express or implied statutory or other warranties, guarantees, conditions or liabilities (whether as to fitness, quality, standard of workmanship or otherwise) which are hereby excluded, the following provisions shall apply:

- (a) The Purchaser shall not be entitled to rescind the contract or to claim damages on the grounds of any statement whatsoever as to the suitability of the goods for any particular purpose, and the Purchaser assumes responsibility for the capacity and performance of the goods being sufficient and suitable for his purpose, and for his premises being suited to the installation and operation of the plant and machinery. The Purchaser agrees and confirms that apart from the express terms of the contract, no statement or representation has been made by the Company relating to the goods to be supplied under the contract or, if any has been made, he has not relied on it.
- (b) The Company's liability in respect of any defect whether quality, suitability or performance or otherwise in any goods supplied or for any loss, injury or consequential damage attributable thereto is limited to the terms of this guarantee and the Purchaser hereby acknowledges:
 - (i) that if purchased the goods in a competitive market and that the bargaining strength of the Company was in no way a relevant factor in the purchase of the goods from the Company.
 - (ii) that the Purchaser knows the extent of the meaning of this Condition and the limitations thereby imposed by it under Sections 13, 14 and 15 of the Sale of Goods Act 1979.

Our guarantee does not apply should equipment be operated or stored under adverse conditions e.g. outside installations or in areas used for steam cleaning or pressure washing, etc., unless otherwise specified in the relevant equipment manual.

The above guarantee is given in lieu of all other terms, conditions, warranties, guarantees, undertakings and representations, express or implied, statutory or otherwise, which, except to the extent that this provision is held to be void or unenforceable under or by virtue of any provision contained in the Sale of Goods Act 1979 or the Unfair Contract Terms Act 1977 or any statutory modification or re-enactment thereof for the time being in force, are hereby expressly excluded.

DESIGN We reserve the right to alter the design or construction of equipment at any time without notice.

LAW OF CONTRACT

All contracts for the sale of the Company's products shall be deemed to be made and executed in England, and the same shall be construed, performed and enforced in accordance with English Law and the parties submit to the jurisdiction of the English Courts. The application of the Uniform Laws of International Sales shall be excluded. This condition shall not prevent the Company instituting proceedings in the Courts of any other country to enforce such contract against the customer.

DELIVERY

Delivery dates, given in good faith, are approximate and reflect conditions prevailing at that time.

No liability can be accepted arising from delays in delivery, irrespective of the cause of any such delay.

CANCELLATION AND VARIATION

Orders once accepted by us are binding and cannot be cancelled or varied unless we at our discretion accept the cancellation or variation. We will make every effort to meet our Purchasers in this respect but

- (a) we cannot accept cancellation for non-standard products; and
- (b) we cannot accept cancellation changes in delivery dates or other variations notified to us later than the end of the penultimate month prior to the month fixed for delivery; and in such circumstances and any other cancellations or variations to which we have not agreed we shall enforce our contractual rights and/or impose an appropriate charge.

TERMS

Quotations given are open for acceptance within 14 days and are subject to revision should the state of the raw material market or other circumstances render this action necessary.

Orders, whether received as a result of a quotation or not, can only be accepted for execution at prices ruling at date of despatch.

Payment - except where otherwise stated in our invoice, or agreed in writing, our terms are nett cash and payment is due on presentation of invoice. Where we have agreed to open an account with the Purchaser invoices are due for payment by the 25th of the month following month of invoice and interest will be charged on overdue accounts at the prevailing County Court rate.

VALUE ADDED TAX

VAT is not included in our prices and will be shown separately on all invoices at the rate ruling at date of despatch and subject to current legislation.

CARRIAGE

Carriage is paid to destinations on the mainland of England, Scotland and Wales on all orders of £500 Nett or over, except accessories, spare parts and repairs. Where carriage is chargeable its cost is added to the invoice value at current rates.

PACKING AND UNLOADING

Damages or shortages must be signed for as such and claim made on the carriers, in writing, within three days of delivery. Where Company vehicles are used the driver must be notified at the time of unloading and the consignment note marked to indicate the damage or shortage. The practice of signing for the goods "not examined" does not absolve the Purchaser from this condition. The consignee is responsible for unloading. Packing cases and slings, when used, are charged extra but credited in full on return, carriage paid and in good condition.

LOSS IN TRANSIT

Public Transport Companies and the Post Office only accept claims for loss in transit made within a limited period. If goods are not received within 14 days of the date of our invoice, we must be advised immediately otherwise neither the carriers nor ourselves will be liable for any loss involved.

PASSING OF RISK

The risk in the goods shall remain in us until delivery to the Purchaser or his agent. In the absence of written notice from the Purchaser to us and the carriers, as prescribed above, the goods shall be deemed to have been delivered complete and in satisfactory condition.

PASSING OF PROPERTY

Until such time as all sums due to the Company from the Purchaser whether in respect of goods delivered by the Company to the Purchaser or otherwise have been paid the provisions of this Condition shall have effect:

- (a) All goods delivered by the Company to the Purchaser will remain the property of the Company to the intent that the whole legal and beneficial interest therein shall remain that of the Company.
- (b) If the Purchaser becomes or threatens to become insolvent or being a body corporate has a Receiver appointed or passes a resolution for winding up or if a Court makes an Order to that effect or being an individual or partnership makes any composition or arrangements with his or their creditors or has a receiving order made against him or them or if the Purchaser shall be in breach of these Conditions, then the Company shall be at liberty to forthwith remove and repossess all goods which remain the property of the Company in accordance with this Condition and enter upon any property to do so or to inspect goods to identify the Company's goods.
- (c) The Purchaser shall only be at liberty to resell the goods purchased from the Company prior to the passing of title on the understanding that if it does not resell the goods then it will hold on trust for the Company so much of the proceeds of sale received by it under contracts which include any of the goods hereby sold either in their original or altered state as are necessary to discharge payment in full to the Company.
- (d) No provision of this Condition shall be deemed to cause a Mortgage or Charge of the Property or undertaking of the Purchaser or any part thereof to have been created by the Purchaser in favour of the Company.

SEPARABILITY

Any failure by us in respect of one delivery shall not entitle the Purchaser to treat the contract as repudiated, each delivery being, for such purpose, deemed a separate contract.

INSTALLATION

The Purchaser is responsible for the preparation of the site, where such a site is necessary, together with the provision of any supplies and services that may be required. The specifications and the responsibilities of agents, distributors and end-users are clearly set forth in separate leaflets, available on the various products concerned.

If failure to fulfil this responsibility extends the time taken to commission equipment or results in extra visits by engineers the Purchaser is fully liable for the extra cost. If installation of equipment is unduly delayed, the Company reserves the right to pass on cost inflation as a supplementary charge.

REFUSAL

Goods consigned to the order of end-users and/or distributors render them liable for all carriage and handling charges incurred, if delivery of the goods is refused on arrival at destination.

RETURNED EQUIPMENT

In exceptional conditions, subject to agreement in writing, and the equipment being of current standard design, new equipment in good condition will be accepted, carriage paid to factory, subject to a handling charge. Any costs incurred in making the equipment as new will be charged in addition to the handling charge.

SPARES AND AFTER SALES SERVICE

Spare parts and service are available through our service agents. Initial contact should be made via the Crypton Product Support Helpline on 01278 436225. All spare parts purchases are subject to minimum order values.

RIGHT TO TERMINATE

If the Purchaser breaks any of these conditions or becomes insolvent or subject to any law relating to bankrupts or being a corporation goes into liquidation, whether voluntary or compulsory or has a receiver appointed over its assets, we may suspend deliveries or, by notice to the Purchaser, terminate the contract and such termination shall be without prejudice to any other rights or remedies to which we may be entitled.

All quotations and tenders are given and contracts are made by the Company subject to the above terms and conditions and unless previously agreed in writing by an authorised officer of the Company:

- (i) no verbal, written or other addition hereto or variation hereof including (without prejudice to the generality of the foregoing) any representation or warranty relating to the goods or services to be provided by the Company shall be effective; and
- (ii) these terms and conditions supersede any other terms and conditions appearing elsewhere and shall prevail over and exclude any course of dealing established between the Company and the Purchaser and any other terms and conditions stipulated or incorporated or referred to by the Purchaser or his agent or any third party; and
- (iii) it shall be a pre-condition of the Company giving any quotation or tender or entering into any agreement for the supply of any goods or services that such agreement be made subject to these terms and conditions.

DIESELTUNE
Technology Limited

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Website: www.cryptontechnology.com

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 our Authorised Agents. 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: 01278 436225 Fax: 01278 436238

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

Crypton provide information and contracts covering:

Car Data, Fault Code Information, Diagnostic Information, Technical Topics, Software Support Contracts, Software Updates & Accessories

Helplines Crypton run an Equipment Helpline during normal office hours.

Tel: 01278 436225 Fax: 01278 436238

email: support@CryptonTechnology.com

A fully comprehensive Product Support Contract is also available which provides additional assistance with equipment / technical support. Please contact Product Support on the above Helpline no. for further details.

Training Centre

The Crypton Training Centre offers a full range of courses, from training on the practical use of new equipment, to the vehicle electrical / electronic systems likely to be encountered. For details of courses or for further information please contact:

The Secretary, Crypton Training Centre, Bristol Road, Bridgwater, Somerset TA6 4BX.

Tel: 01278 436224 Fax: 01278 436230

email: Training@CryptonTechnology.com