



lion alcolmeter® SD-400 ENGLISH

User Handbook

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PLEASE...

**Read this handbook carefully – BEFORE
using the instrument for the first time: then
retain it for future reference.**

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Glossary

Terminology

BAC	Blood Alcohol Concentration
BrAC	Breath Alcohol Concentration
Calibration Adjustment	Adjusts the calibration of the instrument
Calibration Check	Checks the calibration of the instrument
Configuration	PC application that sets up the functionality of the instrument
Deep-lung air	Air within the lungs that is in intimate contact with the blood
Analysis Sampling	Most accurate sample method using a mouthpiece and giving a numeric result
Precursory Sampling	A fast indicative method of determining whether breath alcohol is present using a mouthpiece or sample cup
AlcoCal®	Dry alcohol gas of a known concentration provided from a gas cylinder
Operator	Person who is carrying out the breath test
Electronic Dongle	Hardware Key, used to unlock features
Sampling Port	White plastic protrusion in top channel of the instrument that accepts the mouthpiece
Service lock	Time until the next service should be carried out
Subject	Person who is to have a breath test performed upon them
Suck back	Intake of breath by the subject during the sampling routine
Suspicious liquid	Liquid with an unknown alcohol content
Trigger Flow	Minimum air flow speed necessary for automatic sampling
Wet bath	Wet alcohol vapour of a known concentration provided by a simulator

Introduction

The **lion alcolmeter® SD-400** devices are hand-held portable instruments for fast, on the spot determination of a subject's breath (or blood) alcohol concentration level. They are intended for use in the traffic law enforcement, medical and industrial safety applications. The instruments are easy to use, and allow a complete breath test to be completed in about one minute.

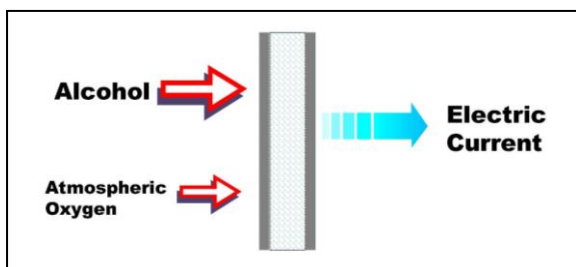
This handbook explains the following aspects of the instrument, so please read it carefully:

- Basic principles of operation.
- How to run a breath test.
- Interpretation of results.
- Care and basic maintenance.
- Calibration checking.
- Calibration adjustment.
- System configuration.
- Basic maintenance.

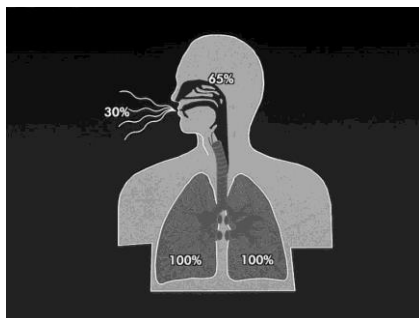
Principle of Operation

The **lion alcolmeter® SD-400** uses an electrochemical fuel cell sensor to measure the concentration of alcohol vapour in the subject's expired breath, a measured amount of which is drawn from the mouthpiece into the fuel cell by means of the sampling system.

In the fuel cell a voltage is generated in proportion to the breath alcohol concentration: it is therefore amplified and displayed in terms of the subject's alcohol level.



The breath sampling system is factory-set to sample deep-lung air; it is the breath from the bottom of the lungs that truly reflects the amount of alcohol in the body.



Technical Details

Factor	Target	Comments
Specificity	Specific to alcohol only	When used correctly, not sensitive to acetone, paint and glue evaporation, food, sweets, methane and all materials without any alcohol content which can be found in human breath
Measurement range	0.00 to 2.00 mg/L (BrAC)	
Measurement Accuracy	± 10 % (BrAC) of the measured value at nominal temperature	
Drift	< 0.02 mg/L (BrAC) of measured value per month	
Sampling time	4 – 12 seconds	
Response time	< 30 seconds at 20°C; < 10 seconds at low alcohol levels	
Recovery time	< 10 seconds at zero alcohol; < 60 seconds at 0.35 mg/L (BrAC)	
Sampling frequency	< 25 seconds	Negative test result
Operating temperature range	-5°C to 40°C	

Ready time	Approx. 15 seconds	From switch on at ambient temperatures
Operating humidity range	10% to 95%	Non-condensing
Storage temperature	-20°C to 70°C	
Measurement methods	Analysis ^{Note 1}	Using mouthpiece, with automatic or manual sampling
	Precursory ^{Note 1}	Using a mouthpiece or sample cup with automatic or manual sampling
Trigger Flow	25 L/min ^{Note 2}	In analysis mode (Default)
	9 L/min ^{Note 2}	In precursory mode
Number of tests	3000 (Alkaline) 1500 (RPU)	Minimum ^{Note 3}
Memory	2000 records	Maximum
Instrument weight	Approx. 517 gm.	Including battery pack and pouch
Audible/Visual Signals	Audible note	Provides audible and visual warning of instrument status
Power supply	a) 5 x 1.5 VDC (AA, LR06 Type) Alkaline batteries b) Sealed 7.4 VDC Lithium-ion rechargeable battery pack 850 mAh. (RPU).	

Electromagnetic Compatibility	Compliance	EN 61326-1:2013 EN 61000-3-2:2014 EN 61000-3-3:2013
Environmental Tests – Vibration and Shock	Compliance	EN 60068-2-27:2009 (Test Ea) EN 60068-2-6:2008 (Test Fc) EN 60068-2-64:2008 (Test Fh) EN 60068-2-31:2008 (Test Ed)
Dust and ingress protection	Compliance	EN 60529:1991/corr:1993/A1:2000/ A2:2013 (IP-44)
Electrical Safety	Compliance	EN 61010-1:2010
Calibration frequency	At least every 6 months	Recommended Calibration Check frequency.

Note 1: These sample methods are configurable and may vary depending upon the customer's requirements.

Note 2: These values are configurable and may vary depending upon the customer's requirements.

Note 3: Testing was carried out by performing tests without alcohol present sequentially at room temperature.

Instrument Features



Please note the following user features of the instrument:

- | | |
|------------------------------|-------------------------|
| 1 – Disposable mouthpiece | 5 – Sampling Port |
| 2 – On/Off button (A) | 6 – Beeper (internal) |
| 3 – Function buttons (B,C,D) | 7 – Communications Port |
| 4 – Display | 8 – Electronic Dangle |

Disposable Mouthpiece

The disposable mouthpiece is supplied packed in individual, hygienic wrappers. It is fitted to the instrument by locking its sampling port into the small hole in the side of the tube: it may be attached either way round, whichever is more convenient to the operator, the subject or the situation. But the subject **MUST** blow through the wide-bore, **lipped** end, or the instrument's automatic sampling system will not operate.



A NEW mouthpiece **MUST** be used for each complete breath test.

Button (A)

The On/Off button (**A**), bearing a power symbol and located below the display and the three other buttons, is On/Off button (**A**). This switches the instrument **ON**: simply press **A** and release.

Button **A** may also be used at certain stages in the lion alcolmeter® SD-400 operation to switch it **OFF**. This function is inhibited to prevent power off during a breath test.

Function Buttons (B, C, D)

Located directly above **A**, the yellow two buttons are Left Button (**B**) and Right Button (**D**). These are used to scroll around the instrument's menus. The middle white button (**C**) is used to select functions from the menus.

Graphics display

The illuminated display instructs the user during breath sampling, indicates the status of the instrument and shows the subject's breath alcohol reading.

Sampling Port

The entrance to the fuel cell and breath flow sensor. This port must **NOT** become blocked or restricted.

Beeper (internal)

Gives audible alerts to instrument status and events.

Communications Port

This port allows the instrument to communicate with a printer or a computer for printing test results, or downloading the results to a spreadsheet for analysis. The port is also used with the Electronic Dongle to access protected functions such as setting the time and date and calibration adjustment.

Electronic Dongle

This is a piece of hardware that when fitted to the communications port allows access to the protected functions for setting the instrument time and date and calibration adjustment.

Power Supply

The power supply is located in the rear of the instrument and is either a battery pack fitted with 5 off disposable AA alkaline batteries or is a rechargeable power unit (RPU). To remove either of these from the main case, press and hold down the release button on the main case, indicated opposite, and then pull down the battery pack or RPU. These should provide enough power for at least 3000 tests, **battery pack**, or 1500 tests, **RPU**, (depending on operating conditions).



The low power warning message appears when there is enough power for about twenty more breath tests (depending on conditions of usage).

Leather Pouch

This protects the instrument from most levels of shock likely to be encountered during operational use, and is fitted with a mouthpiece storage pocket. The instrument should normally be left in place, in its pouch, during use.

Operating Modes

The instrument has the ability to be configured to operate in up to three modes.

Depending on the configuration the operator will have the ability to select the desired operating mode from the available menu or the instrument will power up directly into a single operating mode.

Description of Operating Modes

The three modes which can be used with this instrument, and the possible features of each, are as follows:

Analysis Mode [A]

This is the setting for the most accurate breath alcohol measurement. It is intended for use in such situations where the subject selected for testing is likely to have alcohol in his breath.

The instrument samples breath from the subject using a **disposable mouthpiece**. The response and recovery times are set for utmost analytical accuracy in alcohol measurement.

Breath alcohol readings are given as a numerical value only, and may be printed out.

Each reading is stored in memory, with time and date, together with any information which may be logged by the user.

Precursory Mode [P]

This sample mode is intended for situations where it is required to test as many people as possible, but most of whom will have little or no breath alcohol at all.

The instrument samples breath using a **disposable mouthpiece** for each subject, or, for maximum speed, a **re-usable sample cup**.

Since most subjects will have little or no alcohol, the response and recovery times are firmware controlled to be as short as possible. This mode is indicated by a **P** displayed on the **Provide Sample** screen once selected.

Results can be provided in one of several formats:

- **Numerical** – in the selected units, for example 0.00 mg/L.
- **Banded** – the alcohol level is reported as being in one of up to 5 bands, such as:
 - 0.00 to 0.10 mg/L
 - 0.11 to 0.25 mg/L
 - 0.26 to 0.35 mg/L
 - 0.36 to 0.73 mg/L
 - 0.74 mg/L and above
- **Pass/Fail** – if the reading is below a pre-defined level, **PASS** is displayed. If the result is above that setting, **FAIL** is shown.
- **Combination** – for example, show the result in numerical format up to the **FAIL** limit and then display **FAIL** from there up.

Precursory + Analysis [PA]

The instrument starts operation in **Precursory** mode, see above. However, if the subject's alcohol reading is above the pre-defined **Fail** point, the firmware changes automatically to **Analysis** mode for a further, more accurate test on the same subject.

Once the **Analysis** mode test is complete the firmware automatically reverts back to **Precursory** mode for testing other subjects. Where both **Precursory** and **Analysis** modes are taken on a subject, it is only the **Analysis** test result that is stored.

Selecting the Mode

Switch on the instrument and wait for it to pass through its time/date display and data logging routines (if selected).

There are then three possibilities:

- the instrument will power up in **User Mode Select**, and can be configured to start in one of the three available modes, **P**, **A** or **PA**. The buttons **B** and **D** can be used to scroll through the available modes and a sampling mode is selected using **C**.
- the instrument will power up and provide access to two of the available modes, for example **A** and **PA**.
- the instrument will power up in one mode only as selected in the configuration.

Operation in PA Mode

The instrument starts operation in **P** mode and stays in that mode until the reading for a subject exceeds the **FAIL** point.

After a delay to allow the fuel cell sensor to clear, during which time the instrument cannot be switched off. Use a fresh **mouthpiece** for this part of the test procedure.

Once the **A** test is complete, and the fuel cell sensor is again clear of alcohol, the firmware switches back automatically to **P** mode for further subject testing.

Primary Menu

On switch on the user has access to three primary functions:

- Subject breath test (if enabled, manual sample – button **C**)
- Time and date (button **B**)
- Database (button **D**)

When the instrument is configured to log subject data the time and date function is replaced by a gender selection function.

Subject Breath Test Procedure

Step by Step

STEP 1 – Preliminary questions to the subject

As far as possible, ensure the subject has ***taken nothing*** by mouth (alcoholic or otherwise) in the last twenty minutes, and has not smoked in the last two minutes. ***If necessary, wait.***

STEP 2 – Switch on

Press and release the On/Off button (A).

Diagnostics Test

The display will illuminate and the screen will show an introductory message (This message may vary dependant on the software version). The sampling system is activated and the screen will display the time and date (any inaccuracy with the time and date has no effect on the alcohol measurement accuracy). The display then shows **Please Wait** while the fuel cell is checked to ensure there is no alcohol present from a previous test. Note that if the instrument is configured to accept and store additional data then the operator will be prompted to enter the data at this point (see appendix 3 for more information on this topic).

STEP 3 – Attach Mouthpiece

When the display shows **Provide Sample**, the instrument is ready to perform an Analytical Breath Test. The mouthpiece must be attached in a hygienic manner, or the subject could justifiably object to putting it in their mouth. Tear open the wrapper from the non-lipped end, and peel back far enough to expose the spigot in the side. Now, holding the mouthpiece through the wrapper around the blowing (lipped) end, push the spigot into the sampling port, so it locks firmly into place. The operator may attach it either way round, whichever is more convenient. Now remove the wrapper completely (or have the subject do this himself).

STEP 4 – Instruct the Subject

Tell the subject to take in a deep breath, hold it, then place the lipped end of the mouthpiece in their mouth and seal their lips around it. They must blow **STEADILY [not hard]** and **CONTINUOUSLY** until you say stop, and keep their hands away from the instrument.

STEP 5 – Take the Breath Sample

Instruct the subject to take in a deep breath, and provide a sample. When providing a sample the subject only need blow out a constant, steady flow of air, similar to whistling. Blowing too hard or too softly could result in an invalid sample and the instrument will report this to the operator.

Instruct the subject to form a seal around the lipped-end of the mouthpiece with their lips and then blow.



The sample provided should be blown steadily and continuously until a double beep is heard. They do **NOT** have to blow **VERY HARD**: a **LONG**,

MODERATE BREATH is all that is required. The subject must keep their hands away from the instrument, so they cannot hide the display from the operator's view. Also, if relevant, warn the subject not to try to 'beat the instrument'.

If necessary the user can initiate a manual sample by pressing the button (C), at any point during the routine.

STEP 6 – Note the Alcohol Reading

After **Analysing** the sample, the instrument will give a single tone from the beeper and the value shown on the display at this point is the result of the analytical test. If no alcohol was present this result will appear very quickly; but if alcohol was present it may take up to 30 seconds for the final reading to be displayed. This will then be displayed for a pre-set time.

STEP 7 – Discard Mouthpiece

Following the successful completion of the mouthpiece test, remove and discard the mouthpiece and wrapper responsibly. Do not re-use the mouthpiece, except in the case of a repeat blow by the same subject for the same specimen.

STEP 8 – Prepare for the Next Test

Wait for the **Provide Sample** screen to come back on to the display (which shows that the instrument is now clear of any alcohol from the last sample) before proceeding to test either the same or a different subject. The time taken for this to occur will depend on how much alcohol was present.

STEP 9 – Switch Off

Switch off manually, by pressing and releasing the **On/Off** button (A), the screen will indicate **Please Wait** followed by **Switching Off**, or let it do so automatically after a pre-set time (default 5 minutes).

The breath test procedure summarised

STEP	ACTION
1	Ask Preliminary Questions
2	Switch On the Instrument
3	Attach Mouthpiece
4	Instruct the Subject
5	Take Breath Specimen
6	Note Alcohol Reading
7	Discard Mouthpiece
8	Test Next Subject
9	Switch Off

Invalid breath samples

If the subject does not blow for long enough, blows too gently, or sucks back before the breath specimen is taken into the fuel cell sensor for analysis, then no sample is actually taken. The display shows the warning messages:

INSUFFICIENT SAMPLE

or

SUCK BACK DETECTED

The system will reset itself and then display that it is ready again. You may, at your discretion, allow a further attempt to provide a sample, perhaps after re-instruction.

There is no requirement to change the mouthpiece for this repeat attempt, though the operator may of course do so.

If the subject refuses to provide a sample, the user can record a **Failure To Provide** record of the test by pressing and holding the **On/Off** button (A) until the Failure to Provide message is displayed.

Manual breath sampling

It is possible to take a manual sample of the sample provided by the subject. With the screen in the **Provide Sample** mode, instruct the subject to provide the sample. As the subject blows into the unit, press the button (C).

The unit will carry out the analysis and display the result as detailed previously. This feature may be disabled in the configuration if not needed.

The Over Range Message

If **Error: 2** is displayed after the **ANALYSING** screen is displayed, the breath level of alcohol in the breath sample was too high for accurate measurement. This could be a **genuine** result, but more likely it means **mouth alcohol** was present. The instrument will then switch off.

Clock and Calendar

The alcohol reading from each breath test is stored in memory, with the time and date of the test. To check the accuracy of the time and date function, switch the instrument on and when the **Provide Sample** screen is on the display, press and release button **B**. The time (hh:mm) and date (dd:mm:yyyy) are displayed for approximately 2 seconds before returning to the **Provide Sample** screen.

To **re-set** the time and date, the **Electronic Dongle** is needed to be fitted to the **Communications Port**. Follow the procedure set out below:

1. Fit the **Dongle** into the communications port; switch on and before the diagnostics sequence is complete, press and hold down button **B** until a continuous tone is heard. The instrument is now in the time and date setting menu.
2. Then the display will show Year: XX. The value can be adjusted up and down by pressing buttons **B** and **D**. When set to the required value enter the value by pressing button **C**. The menu will then move to the next item, in the following sequence. Year, Month, Day, Hours, Minutes.
3. When all five periods have been set, the instrument displays the new time and date; then it switches off.

Database

At the **Provide Sample** screen, press button **D**. The display shows the result of the last breath test, with its time and date, the **Test Number** and the remaining **Test Memory**. (See also 'Using the Instrument with a Printer')

To view previous records scroll through the database using the buttons **B** and **D**.

As standard the instrument is supplied with a 2000 test memory, set to **Shunt**...(when the memory is full, the newest test is saved and the oldest deleted).

Using the Instrument with a Printer

The instrument can also be used with a small, portable thermal printer (Able AP863 or Able AP1300), to generate a permanent record of each breath test. The printout shows the instrument serial number, the dates of the last calibration and check; and the breath test result with time and date, along with space for signatures of operator and subject.

To generate a printout, ensure that the printer cable is securely connected to the communications port on the instrument before proceeding with the subject breath test. You do not need to switch the printer on as the instrument will do this automatically at the appropriate time. Follow the **Subject Breath Test** instructions as indicated previously, when the test result is displayed, after a short delay the printer will switch on and print a number of test records dependent on the configuration. After completing printing records the printer cable can be disconnected from the communications port before proceeding with other tasks

Test Record Reprint

To generate a print out of a test record held in the database, access the database using button **D**, see the section on the **Database**, select the

required test record using button **C** and when connected to the printer this generates a printout of the test record.

The printer is powered by its own rechargeable battery, mains and 12 VDC chargers are available. Each printer is supplied with a manufacturer's User Guide.

When the printer is first received, its battery will be disconnected and only carry a token charge. This means that the printer will not operate, even if it is connected to an external power source, until the battery has been fully charged. See the label on the printer battery pack for initial charging time.

Secondary Menu

The Secondary Menu provides access to two maintenance functions and provides a route for the user to selectively conduct a breath test using the data logger routines.

To access the **Secondary Menu** switch on the instrument and then hold down button **C** until a continuous tone is heard; release the button and the display will indicate the software version fitted before proceeding to the **Secondary Menu**. The three secondary functions available are:

- calibration **CHECK**
- **CALIBRATION** adjust (Electronic Dongle Protected)
- **SUPERVISOR** (User selected data logger breath test)

The instrument initially offers the **CHECK** function for selection and the other functions can be arrived at using the buttons **B** and **D** to scroll through the functions. The button **C** is used to select the desired function.

Calibration Checks and Adjustment

Background

The sensitivity of fuel cell to alcohol vapour changes slowly with time. Therefore, to ensure continued optimum instrument operation, it is necessary to **CHECK** its accuracy at regular intervals, and to carry out an appropriate **ADJUSTMENT** when necessary.

It is for the user organization to decide how often the accuracy is checked, but it is **recommended** that a **Calibration CHECK** is carried out on a regular basis. **Calibration ADJUSTMENT** is only required when the reading obtained from the calibration **CHECK** is unacceptable to the organization; for example greater than 5% away from the value of the standard so used.

But of course, a calibration check can also be carried out whenever it is necessary to verify the accuracy of a breath test reading.

AlcoCal® Alcohol Standards

The calibration check and adjustment processes are most conveniently carried out using an **AlcoCal®** alcohol vapour standard. This is a mixture of alcohol vapour in air at a known concentration, contained in a pressurised cylinder.

Provided it is within certain limits, the actual value of the standard is not critical, but it must of course be known.

NOTE: If required the instrument may be configured to use a wet bath simulator for either process: please contact Lion for relevant information, if required.

The type of **AlcoCal®** usually supplied to users is:

AlcoCal®-2AL: a high-pressure **disposable** cylinder fitted with a **re-useable** regulator. It contains sufficient vapour for approximately 300 samples, and is supplied with Connector Tubes for attachment to a mouthpiece as used with the instrument. The stated alcohol concentration is within +/- 3%, and is valid for approximately thirty-four months.

Units of Alcohol Measurement

The alcohol level in **AlcoCal®** standards is normally given in units of **mg/L BrAC** (ie milligrams per Litre **B**reath **A**lcohol **C**oncentration). But if the instrument is reading in some other unit of measurement, the **AlcoCal®** standard will still be suitable for use, since each such standard is supplied with an Explanatory Booklet giving information on how to convert the mg/l BrAC value of the **AlcoCal®** to the units actually used by the instrument.

AlcoCal® Standards and Atmospheric Pressure Effects

The level of alcohol in a subject's breath is completely unaffected by changes in atmospheric pressure; **the information below applies only to the alcohol concentration in the AlcoCal® standard.**

The stated alcohol value of each **AlcoCal®** standard applies only when the cylinder is used at sea level at normal atmospheric pressure (1 bar). At **lower** atmospheric pressures the alcohol vapour concentration will be **lower**; but it will be **higher** at atmospheric pressures **greater than** standard. This change in alcohol concentration due to normal atmospheric pressure changes at sea level is generally so small as to be negligible, but if the **AlcoCal®** is used at high altitude, significant error would be produced if a correction was not made. Finally, if the atmospheric pressure even at sea level is very low [such as during a tropical storm], or is very high, then this must also be taken into account when using an **AlcoCal®**.

Barometric Pressure Correction Look-up Table for AlcoCal®

Atmospheric Pressure mB	AlcoCal® Value mg/L BrAC
650	0.22
700	0.24
750	0.26
800	0.28
850	0.29
900	0.31
950	0.33
1000	0.34
1010	0.35
1050	0.36

Example

A 0.35 mg/L **AlcoCal®** is to be used where the atmospheric pressure is only 952 mB. Standard atmospheric pressure at sea-level is 1013 mB, so the BrAC value of the standard now becomes:

$$\frac{952 \times 0.35}{1013} = 0.32 \text{ mg/L BrAC (rounded down)}$$

But If the atmospheric pressure was **higher** than standard, say 1050mB, then the value of the same **AlcoCal®** would be:

$$\frac{1050 \times 0.35}{1013} = 0.36 \text{ mg/L BrAC (rounded down)}$$

AlcoCal® Standards and Atmospheric Temperature Effects

Large ambient temperature changes will also modify the alcohol level in the vapour leaving an **AlcoCal®** standard. They should therefore be kept away from excess heat and cold, and if they are exposed to excessive temperatures, should be allowed to recover. Ideally, an **AlcoCal®** standard should not be used if it is outside the temperature range 15 – 30°C.

Calibration CHECK

This procedure must be carried out when both the **AlcoCal®** and the instrument are at room temperature in the range 15 – 30°C:

1. Prepare the AlcoCal® Standard

Note the value of the **AlcoCal®** to be used (making allowance for atmospheric pressure and units of measurement, as previously described). Now fit the Connector Tube to the regulator of the **AlcoCal®-2AL**. If the **AlcoCal®-2AL** has not been used within the previous two hours, press and hold down the push-button for about five seconds to flush out of the regulator of any stale and depleted alcohol vapour.

2. Prepare the Instrument

Put it into its **Calibration Check Mode**. (See below) This ensures the instrument is in its correct temperature range; sets up the digital display for use in this function; and stores the check readings in a separate memory to that used for subject tests.

Switch the instrument on and then **IMMEDIATELY** press and hold down button **C**. This **MUST** be done **BEFORE** the diagnostics sequence is complete. When a continuous tone is heard, release **C** and the display shows the software version (e.g. 5.4.12)]. The display will then show the Calibration **CHECK** option along with left and right arrows. To select the calibration check function press function switch **C**. When calibration **CHECK** is selected the display will show **CHC Provide Sample** after a short delay.

3. Take Sample

When the **Provide Sample** display is on the screen, fit a new spigot mouthpiece to the instrument, then push this over the Connector Tube on the **AlcoCal®-2AL** to form an airtight fit. Push down the push-button and allow vapour to flow for at least **six** seconds. After about **five** seconds, but with vapour still flowing, press and release button **C** to take a sample of the vapour into the instrument. Now release the cylinder control to stop gas flow.

4. Note Reading

The reading given should normally be within plus or minus 0.03 mg/L BrAC of the value of the **AlcoCal®** alcohol standard, at the 0.35 mg/L level. In other words, for a 0.35 mg/L standard, the reading should be in the range 0.32 – 0.38 mg/L. Using an **AlcoCal®** at 0.22 mg/L the acceptable range is proportionately lower, at 0.20 – 0.24 mg/L. However, it is emphasised that these stated ranges are for **guidance only**: what constitutes an ‘acceptable’ reading during the check procedure must ultimately be a decision of the user authority, and the method and purpose of use of the instrument itself.

If the reading was outside the acceptable range, wait for **Provide Sample** to be displayed, and then repeat the **Calibration Check** procedure. If the reading is still outside the acceptable range, the instrument requires **Calibration Adjustment**.

Calibration ADJUSTMENT

First, you will need an **Electronic Dongle** to put the instrument into **Calibration Adjustment Mode**.

This procedure must be carried out when both the **AlcoCal®** and the instrument are at room temperature in the range 15 – 30°C:

1. Prepare the AlcoCal® Standard

Note the value of the **AlcoCal®** to be used (making allowance for atmospheric pressure and units of measurement, as previously described). Now fit the Connector Tube to the regulator of the **AlcoCal®-2AL**. If the **AlcoCal®-2AL** has not been used within the previous two hours, press and hold down the push-button for about five seconds to flush out of the regulator of any stale and depleted alcohol vapour.

2. Prepare the Instrument

Put the instrument into its **Calibration Adjustment Mode**. This ensures the instrument is in its correct temperature range; allows an actual resetting of the instrument's analytical function to be made; and ensures the event is not stored in the subject test memory. So insert the **Electronic Dongle** into the **Communications Port** on the side of the instrument.

Switch the instrument on and then press and hold down button **C**. This **MUST** be done **BEFORE** the diagnostics sequence is complete. When a continuous tone is heard, release **C** and the display indicates the software version (e.g. 5.4.12). The display will then show Calibration **CHECK** option along with left and right arrows. To select a calibration adjustment press button **D**. This provides the **CALIBRATION** screen. Select Calibration Adjustment using button **C**. The display will show the default standard value.

3. Enter the Standard Value

You must now tell the instrument the value of the alcohol standard that you are going to use to calibrate it: the instrument will then automatically adjust itself to that value, when you sample the vapour.

The number shown is the standard value, such as 0.35. If this is **not** the value of the **AlcoCal®** to be used, pressing **B** or **D** will raise or lower the number shown. When the displayed value corresponds to the value of the **AlcoCal®** gas standard, then press button **C** to select the value.

4. Take Sample

When the **CAL Provide Sample** is displayed on the screen, fit a new spigot mouthpiece to the instrument, then push this over the Connector Tube on the **AlcoCal®-2AL** to form an airtight fit. Push down the push-button and allow vapour to flow for at least **six** seconds. After about **five** seconds, but with vapour still flowing, press and release button **C** to take a sample of the vapour into the instrument. Now release the cylinder control to stop gas flow.

5. Automatic Calibration

The instrument now calibrates itself automatically, and then switches itself off. You may now remove the **Electronic Dongle**.

6. Confirmation Calibration Check

It is advisable now to carry out a **Calibration Check** to ensure that the calibration was completed properly. You may use the same or a different alcohol standard for this, as you wish. There is no need to allow any delay: Follow the procedure for calibration checks as described previously.

Calibration Error Messages

If the message **Error: 3** is shown during this calibration, it means the fuel cell signal was too low for a proper automatic adjustment to be made. This is most likely due to:

- incorrect sampling: repeat the entire process if you think this might be the reason
- insensitive fuel cell: refer to service support
- faulty sampling system: refer to service support

SUPERVISOR function

The **SUPERVISOR** function allows the user to undertake a breath sample while using the majority of the data collection fields available. As such when the **SUPERVISOR** function is selected the user is prompted to input the data for the following fields:

- OPERATOR CODE (a 4 digit numeric)
- AREA CODE (a 2 digit numeric)
- LOCATION CODE (a 2 digit numeric)
- REASON CODE (a 2 digit numeric)

On completing the fields using the buttons **B** and **D** to change the value and button **C** to select the value; the instrument will display the current date and time followed by the **Provide Sample** screen. The test result will be stored with the data logged and can be retrieved using the PC application **Data®400**.

Care and maintenance

To ensure optimum performance, follow these simple instructions:

Cleaning the instrument

Simply wipe over with a slightly damp cloth.

Do NOT use chemical solvents, abrasives or excess water to clean the instrument; these could damage the case material, and possibly the various internal sensors.

Instrument Power Supply Systems

Disposable Batteries

To replace the batteries, ensure the instrument is switched off, then press the release catch on its back and slide down the battery pack to remove it. Remove all five batteries and replace with five new alkaline ones, ensuring correct polarity, see battery pack label. Now slide the power supply unit into place, ensuring the release catch clicks positively to lock.

Use Only Alkaline AA Batteries

Rechargeable Power Unit

A rechargeable power unit (RPU) is also available. A fully-charged RPU should contain enough power for at least 1,500 breath tests, in continuous operation. Mains and 12volt DC chargers are available. When first received, the RPU will not be fully charged.

To fit the RPU, ensure the instrument is switched off, then press the release catch on the back of the unit and remove the existing power unit. Now fit the RPU, ensuring the release catch clicks positively into place. Connect the RPU to the appropriate charger and leave for about one hour to charge. The batteries are fully charged when the red LED on the RPU goes out.

IMPORTANT - PLEASE NOTE

- Switch the instrument off before removing and refitting either the **PSU** [disposable batteries], or the **RPU**.
- Don't attempt to recharge the AA cells.
- Don't switch the instrument on while the **RPU** is charging.
- Don't attempt to recharge the **RPU** when it is already fully charged.
- Don't leave the instrument with a flat power pack attached.
- Don't carry either the **PSU** or the **RPU** in your pocket. If the contacts were to short-circuit on a key or coin, serious burns to your body could result.

Low Power Warnings

The instrument uses a two-stage low power warning system:

First Stage - Low Battery

Low Battery is shown on the display. Power is low, but the instrument can still be used – with no effect on breath sampling or analytical accuracy. Disposable batteries should be changed as soon as possible once this warning appears: rechargeable battery packs should be charged.

Second Stage - Change Battery.

Change Battery is shown on the display. Battery power is too low for instrument operation, so further use of it is automatically inhibited and the instrument will power down.

Some DOs and DON'Ts

Some Important DOs ...

- DO.. press the **On/Off** button *gently*.
- DO.. store the instrument either with batteries installed or a power pack attached, to avoid discharging the internal battery.
- DO.. change the batteries as soon as possible once the first stage warning appears.
- DO.. switch the instrument off before removing the battery pack.
- DO.. use only genuine Lion mouthpieces and/or sampling cups, or as produced by a Lion approved supplier.
- DO.. use a clean Lion mouthpiece for each subject test.
- DO.. ensure the mouthpiece is properly attached and locked in place between the instruments two upright mouthpiece locators.
- DO.. ensure the subject blows through the wide-bore, lipped end of the mouthpiece.
- DO.. as far as you can, ensure the unit is regularly checked.
- DO.. read this manual carefully, and follow the instructions given!
- DO.. report memory or error (**Error: XX**) messages to your *Supervisor*.
- DO.. keep the communications port fitted with its cover.
- DO.. use only alkaline batteries in the Battery Pack.

And Some Important DON'Ts ...

DON'T.. test the subject if he may have been drinking or eating in the last 20 minutes or smoking in the last 2 minutes.

DON'T.. permit the subject to hyperventilate immediately prior to supplying his or her breath sample.

DON'T.. store the unit in extremes of hot or cold temperatures.

DON'T.. leave the instrument for long periods with no batteries or a power pack attached to it.

DON'T.. subject the instrument to unnecessary shock.

DON'T.. use excessive force on buttons.

DON'T.. clean the case with chemical or abrasive products. These could cause permanent damage.

DON'T.. allow the sampling port to get blocked. If you think it may be blocked or restricted in some way then hand the instrument to a **Supervisor** for checking.

DON'T.. use other than the Lion mouthpieces. These have been carefully designed and are specifically manufactured for use with this instrument.

DON'T.. block the mouthpiece end while the subject is blowing. This may damage the instrument.

DON'T.. reuse mouthpieces, for reasons of health and accuracy.

DON'T.. open the instrument or attempt any repairs. If you think it is not working properly, hand it in for checking.

DON'T.. deviate from the instructions given in this handbook.

Appendix 1: Warning & Error Messages

A1.1 Warning Messages

LOW BATTERY is displayed on screen

This is the first-stage low battery power warning: you may still use the instrument, but batteries should be changed or recharged as soon as possible when this first appears.

CHANGE BATTERY is displayed on screen

This is the second-stage low power warning: use is inhibited until the batteries have been replaced or recharged.

Low Memory Countdown

When the remaining memory is within a preset number of tests of being full, the remaining test number capacity is shown on switch-on, plus three, long-and-short beeps.

A1.2 Error Messages

The following messages will be shown on the digital display in the event of a component or system failure. If any of these messages appears, the instrument is automatically inhibited from further use.

Error: 0	Communications error when PC connected.
Error: 2	The breath alcohol level, as measured, was too high for analysis [probably mouth alcohol].
Error: 3	The fuel cell sensitivity is too low for calibration.
Error: 4	The breath flow sensor output is too low for calibration.
Error: 5	There is a fault with the breath sampling system.
Error: 6	The instrument is either too hot [over +50°C] or too cold [below -10°C] for use in breath testing.
Error: 7	Temperature too low for calibration checking or adjustment.

Appendix 2: Alcohol Concentration Units

This is relevant in the instrument checking and calibration adjustment functions.

Like any other breath alcohol instrument, though it may be read in blood alcohol units, the **lion alcolmeter® SD-400** measures the concentration of alcohol in the expired **breath**. Having made this analysis it is then possible to report the result in **breath alcohol concentration units (BrAC)**.

However, it is also possible to report the reading in terms of an equivalent **blood alcohol concentration (BAC)**. To do this it is necessary to make use of an assumed **blood:breath ratio**

A2.1 Breath Alcohol (BrAC) Units

BrAC Units:	Written As:
milligrams per litre	mg/l or mg/L
micrograms per hundred millilitres	µg/100ml or µg/% or µg/dl
micrograms per litre	µg/l or µg/L
grams per two hundred and ten litres	g/210L

A2.2 Blood Alcohol (BAC) Units

BAC Units:	Written As:
milligrams per hundred millilitres	mg/100ml or mg/% or mg/dl
percent blood alcohol	%BAC
promille [weight/volume]	‰ w/v
promille [weight/weight]*	‰ w/w

A2.3 Blood:Breath Ratios

The true **in-vivo** ratio is close to 2,300:1, as it relates to **pulmonary arterial** blood. The use of values lower than this will cause the breath analysis to

under-read the blood alcohol level. This is sometimes adopted to as to give an allowance to the subject.

A2.4 Units and Ratio Conversion

The following measurements all represent the same absolute concentration of alcohol in an individual's body at some point in time:

Breath alcohol levels as measured absolutely:

$0.35 \text{ mg/l} \equiv 35 \text{ } \mu\text{g}/100\text{ml} \equiv 350 \text{ } \mu\text{g/l}$

These convert to the following blood alcohol concentrations (all figures are rounded down):

Ratio: 2 000:1

$70 \text{ mg}/100\text{ml} \equiv .070 \% \text{BAC} \equiv 0.70 \text{ } \text{‰} \text{ (w/v)} \equiv 0.66 \text{ } \text{‰} \text{ (w/w)}$

Ratio: 2 100:1

$73 \text{ mg}/100\text{ml} \equiv .073 \% \text{BAC} \equiv 0.73 \text{ } \text{‰} \text{ (w/v)} \equiv 0.68 \text{ } \text{‰} \text{ (w/w)}$

Ratio: 2 300:1

$80 \text{ mg}/100\text{ml} \equiv .080 \% \text{BAC} \equiv 0.80 \text{ } \text{‰} \text{ (w/v)} \equiv 0.75 \text{ } \text{‰} \text{ (w/w)}$

Note: the specific gravity of whole blood is about 1.06.

Appendix 3: Data logging options

A3.1 Data logging

This variant of the **lion alcolmeter® SD-400** can be configured to allow some simple data logging functions. This allows data to be gathered into the memory of the instrument. This data can then be up loaded from the instrument using a utility programme called **Data®400**. Uploaded data can then be analysed as a spreadsheet.

A3.2 Data logging records.

In addition to the standard data records held in the memory of the instrument, (date, time, test result and test number), additional data records can be configured. The additional data records can be selected from the following options: Operator Code, Area Code, Location Code, Reason Code and Subject Gender. The format of each of these records is given below:

Operator Code: four digits numerical range 0000 – 9999.

Area Code: two digits numerical range 00 – 99.

Location Code: two digits numerical range 00 – 99.

Reason Code: two digits numerical range 00 – 99.

Subject Gender: Male or Female.

If configured, the operator will be prompted by the instrument, once switched on, to enter data into the enabled record fields.

Appendix 4: Supplier's Details

<i>Lion's exclusive distributor and service support company is:</i>

Appendix 5: Lion Contact Information

Mail

Lion Laboratories Limited
Ty Verlon Industrial Estate
Barry, Vale of Glamorgan, CF63 2BE
Wales United Kingdom

Telephone [main switchboard]

01446 724500

Main Fax

01446 724501

Telephone [technical service]

01446 724502

Telephone [sales]

01446 724504

Telephone [legal and forensic support]

01446 724503

Fax

01446 724593

E-mail

info@lionlaboratories.com

or, for technical service

service@lionlaboratories.com

World Wide Web: www.lionlaboratories.com