Spark® 704-ATEX Noise Dosimeter

Technical Reference Manual

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A PCB PIEZOTRONICS DIV.

Larson Davis

Spark® 704-ATEX

Personal Noise Dosimeter

Technical Reference Manual

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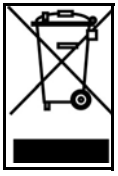

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CHAPTER

1 Introduction

Congratulations on your purchase of the Spark® 704-ATEX Personal Noise dosimeter. The Spark® 704-ATEX is among the smallest, most powerful noise dosimeters available today. The rugged construction will provide you with years of trouble-free operation.

The 704-ATEX is a full-featured dosimeter and sound level meter. It is completely configurable and controllable via the keypad.

We invite you to read this brief manual to get the most out of your Spark® 704-ATEX.

About This Manual

This manual has 2 chapters and 3 appendices covering the following topics:

- Chapter 1 - Introduction: user manual overview and an introduction to the functionality and measurement capabilities of the 704-ATEX.
- Chapter 2 - This chapter reviews operation of the 704-ATEX via it's built in keypad and on-board user interface.
- Appendix A – 704-ATEX specifications
- Appendix B – Glossary
- Appendix C – Intrinsic Safe Approvals

About This Chapter

Specifically, this introductory chapter covers the following topics:

- Formatting Conventions: explanation of the fonts and other formatting conventions used in this manual
- Getting Started: instructions for unpacking, inspecting, and initially assembling the 704-ATEX.

Formatting Conventions

This manual uses the following formatting conventions:

In step-by-step directions, the process (what you do) is shown in the right column, and the rationale (why you do it) with other cautions and comments are shown in the left column. Especially important information is shown in italics.

Spark® Family Features

The Larson Davis Spark® family of products meet all national and international requirements for dosimeter standards. The family is segmented into 7 instruments. The 703-ATEX, 703+ATEX, 704-ATEX, 705-ATEX, 705+ATEX, 706-ATEX, and 706RC-ATEX. Each instrument has unique features that will fit the needs of a wide variety of users.

Spark® 706 RC Features

- The 706RC-ATEX has the ability to connect to the 703+ATEX, 705+ATEX, 706-ATEX and other 706RC-ATEX units. The Remote Control functionality allows manual setup and control of the remote instrument. The 706RC-ATEX can also download and store data from several other Spark® units.
- Stand Alone capability. In addition to the Remote Control functions, the 706RC-ATEX is a fully functional Noise Dosimeter, having all the functionality of a standard 706-ATEX instrument.
- Measurement range of 40 dB to 143 dB (rms), in four ranges.
- Peak detector range of 80 to 146 in four ranges.
- Leq, Max, and Peak levels stored at 1, 5, 15, 30, or 60 second time intervals. 4 user defined time weighted average levels or calculations are also stored, as well as Lmin.
- Ln statistics (1 – 99 in 0.5 dB resolution) stored at 5 minute intervals.

- Automatic detection of Microphone Failure. Spark® instruments will detect and display a warning message if the microphone is disconnected. (Microphone failure is also recorded in the status byte of each time history record).
- 4 Megabytes of nonvolatile memory.
- Compatible infrared interface providing transfer rates to the PC at up to 115,000 bits per second.
- User-programmed daily start/stop times.
- PC-based setup, dose calculation, report generation, and graphics.
- Manual setup of instrument functions. (Timers and Clock can only be set from the Blaze® software).
- Slow or Fast rms detection using A or C weighting.
- Calculation of noise exposure in percentage dose, projected dose, SE (Pa^2 hours), and Pasques (Pa^2 seconds) units using a variety of exchange rates, threshold, and criteria values.
- Continuous display of SPL level. The instrument will continue to display the current SPL level, even when the instrument is not running. During this time the instrument will not be logging data, the value is only being displayed on the screen.
- Noise Floor (typical) of 35 dBA (A-weighted) Slow/Fast (using 30 dB gain).
- Frequency Response of A and C weighting meets ANSI and IEC Standards.
- Detector accuracy: True RMS; less than 0.7 dB error from 40 to 143 dB.
- Two standard AA internal alkaline batteries provide greater than 100 hours of continuous battery life.

Spark® 706-ATEX Features

- The 706-ATEX is a fully functional Noise Dosimeter.
- Measurement range of 40 dB to 143 dB (rms), in four ranges.
- Peak detector range of 80 to 146 in four ranges.
- Leq, Max, and Peak levels stored at 1, 5, 15, 30, or 60 second time intervals. 4 user defined time weighted average levels or calculations are also stored, as well as Lmin.
- Ln statistics (1 – 99 in 0.5 dB resolution) stored at 5 minute intervals.
- Automatic detection of Microphone Failure. Spark® instruments will detect and display a warning message if the microphone is disconnected. (Microphone failure is also recorded in the status byte of each time history record).
- 4 Megabyte of nonvolatile memory.
- Compatible infrared interface providing transfer rates to the PC at up to 115,000 bits per second.
- User-programmed daily start/stop times.
- PC-based setup, dose calculation, report generation, and graphics.
- Manual setup of instrument functions. (Timers and Clock can only be set from the Blaze® software).
- Slow or Fast rms detection using A or C weighting.
- Calculation of noise exposure in percentage dose, projected dose, SE (Pa^2 hours), and Pasques (Pa^2 seconds) units using a variety of exchange rates, threshold, and criteria values.
- Continuous display of SPL level. The instrument will continue to display the current SPL level, even when the instrument is not running. During this time the instrument will not be logging data, the value is only being displayed on the screen.
- Noise Floor (typical) of 35 dBA (A-weighted) Slow/Fast (using 30 dB gain).
- Frequency Response of A and C weighting meets ANSI and IEC Standards.

- Detector accuracy: True RMS; less than 0.7 dB error from 40 to 143 dB.
- Two standard AA internal alkaline batteries provide greater than 100 hours of continuous battery life.

Spark® 703+ATEX/705+ATEX Features

NOTE: The 703+ATEX and 705+ATEX are identical in operation and features. The 705+ATEX offers an extruded metal housing and runs on a single AA battery. The 703+ATEX offers a tough but lightweight housing and runs on two AA batteries.

- Maximum security with full functionality in an extremely durable case. Faceless instrument provides indicators on face for Run Status and Battery life.
- Measurement range of 40 dB to 143 dB (rms), in four ranges.
- Peak detector range of 80 to 146 in four ranges.
- Leq, Max, and Peak levels stored at 1, 5, 15, 30, or 60 second time intervals. 4 user defined time weighted average levels or calculations are also stored, as well as Lmin.
- Ln statistics (1 – 99 in 0.5 dB resolution) stored at 5 minute intervals.
- Automatic detection of Microphone Failure. Spark® instruments will detect and display a warning message if the microphone is disconnected. (Microphone failure is also recorded in the status byte of each time history record).
- 4 Megabyte of nonvolatile memory.
- Compatible infrared interface providing transfer rates to the PC at up to 115,000 bits per second.
- User-programmed daily start/stop times.
- PC-based setup, dose calculation, report generation, and graphics.
- Manual setup possible with the 706RC-ATEX.
- Slow or Fast rms detection using A or C weighting.
- Calculation of noise exposure in percentage dose, projected dose, SE (Pa^2 hours), and Pasques (Pa^2 seconds) units using a variety of exchange rates, threshold, and criteria values.
- Noise Floor (typical) of 35 dBA (A-weighted) Slow/Fast (using 30 dB gain).

- Frequency Response of A and C weighting meets ANSI and IEC standards.
- Detector accuracy: True RMS; less than 0.7 dB error from 40 to 143 dB.
- (703+ATEX only) Two standard AA internal alkaline batteries provide greater than 100 hours of continuous battery life.
- (705+ATEX only) One standard AA internal alkaline battery provides greater than 35 hours of continuous battery life.

Spark® 703-ATEX/705-ATEX Features

NOTE: The 703-ATEX and 705-ATEX are identical in operation and features. The 705-ATEX offers an extruded metal housing and runs on a single AA battery. The 703-ATEX offers a tough but lightweight housing and runs on two AA batteries.

- Maximum security with full functionality in an extremely durable case. Faceless instrument provides indicators on face for Run Status and Battery life.
- Measurement range of 40 dB to 143 dB (rms), in four ranges.
- Peak detector range of 80 to 146 in four ranges.
- Leq, Max, and Peak levels stored at 1, 5, 15, 30, or 60 second time intervals. 4 user defined time weighted average levels or calculations are also stored, as well as Lmin.
- Ln statistics (1 – 99 in 0.5 dB resolution) stored at 5 minute intervals.
- Automatic detection of Microphone Failure. Spark instruments will detect and display a warning message if the microphone is disconnected. (Microphone failure is also recorded in the status byte of each time history record).
- 4 Megabyte of nonvolatile memory.
- Compatible infrared interface providing transfer rates to the PC at up to 115,000 bits per second.
- User-programmed daily start/stop times.
- PC-based setup, dose calculation, report generation, and graphics.
- Slow or Fast rms detection using A or C weighting.

- Calculation of noise exposure in percentage dose, projected dose, SE (Pa^2 hours), and Pasques (Pa^2 seconds) units using a variety of exchange rates, threshold, and criteria values.
- Noise Floor (typical) of 35 dBA (A-weighted) Slow/Fast (using 30 dB gain).
- Frequency Response of A and C weighting meets ANSI and IEC standards.
- Detector accuracy: True RMS; less than 0.7 dB error from 40 to 143 dB.
- (705-ATEX only) One standard AA internal alkaline battery provides greater than 35 hours of continuous battery life.
- (703-ATEX only) Two standard AA internal alkaline batteries provide greater than 100 hours of continuous battery life.

Spark® 704-ATEX Features

- Measurement range of 40 dB to 143 dB (rms), in four ranges.
- Peak detector range of 80 to 146 in four ranges.
- Leq, Max, Min, and Peak levels.
- Manual Start and Stop functions.
- Manual setup from the instrument front panel, with control of weighting, dose parameters and start and stop functions.
- Slow or Fast rms detection using A or C weighting.
- Automatic detection of Microphone Failure. Spark® instruments will detect and display a warning message if the microphone is disconnected. (Microphone failure is also recorded in the status byte of each time history record).
- Calculation of noise exposure in percentage dose, projected dose, SE (Pa^2 hours), and Pasques (Pa^2 seconds) units using a variety of exchange rates, threshold, and criteria values.
- Noise Floor (typical) of 35 dBA (A-weighted)
- Slow/Fast (using 30 dB gain).

- Frequency Response of A and C weighting meets ANSI and IEC standards.
- Detector accuracy: True RMS; less than 0.7 dB error from 40 to 143 dB.
- Two standard AA internal alkaline batteries provide greater than 100 hours of continuous battery life.

Spark® 704-ATEX

NOTE: The 706RC-ATEX, 706-ATEX, and 703+ATEX can also be controlled by the 706RC-ATEX.

The 704-ATEX is a fully functioning dosimeter that is controlled independently via it's own keypad and display.

Figure 1- 1 ***704-ATEX***

The 704-ATEX, shown in Figure 1- 1 includes a 3/8 in. (10.6mm) diameter piezoelectric microphone.

Getting Started

This section outlines the steps to follow when you first unpack the 704-ATEX. The following topics are covered:

- Unpacking and Inspection
- Assembling the 704-ATEX
- Standard and Optional Accessories
- Installing the Batteries
- Environmental Considerations

You will then be ready to use the 704-ATEX for actual measurements (as described later in Chapter 2 of this manual).

Unpacking and Inspection

Your Spark® 704-ATEX has been shipped in protective packaging. Please verify the package contents with the list of Accessories and Optional Equipment in this chapter, and retain the product packaging for safe shipment at a future date. Report any damage or shortage immediately to PCB Piezotronics, Inc. at (888) 258-3222. If you have not already done so, please record your instrument's serial number (located on the label on the back of the 704-ATEX) and the purchase date at the beginning of this manual (see the copyright page). You will be asked to give this information in any future communications you may have with Larson Davis.

The following system diagram (Figure 1-2) illustrates the standard configuration of the Spark® 704-ATEX.

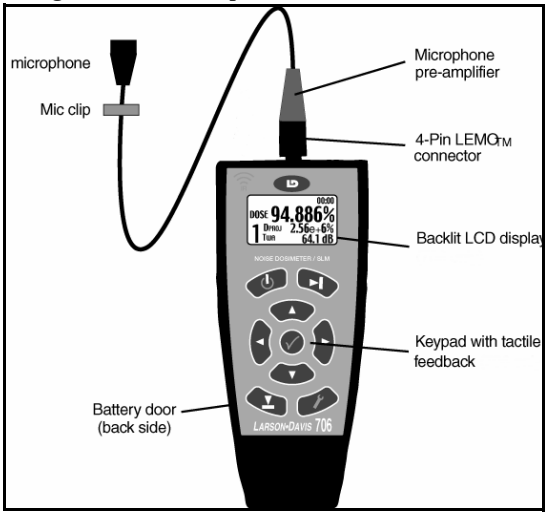


Figure 1- 2 ***Spark® 704-ATEX***

Assembling the Spark® 704-ATEX

First time assembly of the 704-ATEX is quick and easy.

Remove the microphone and preamplifier from its protective packaging. The windscreen and microphone clip should already be attached.

Figure 1- 3 ***Integrated microphone and preamplifier (MPR001) shown on left. 3" cylindrical mast type preamp for use as SLM (MPR002) shown on right***

Step 1 Align the red dots of the microphone connector plug (on cable) and the microphone connector receptacle (on the 704-ATEX).

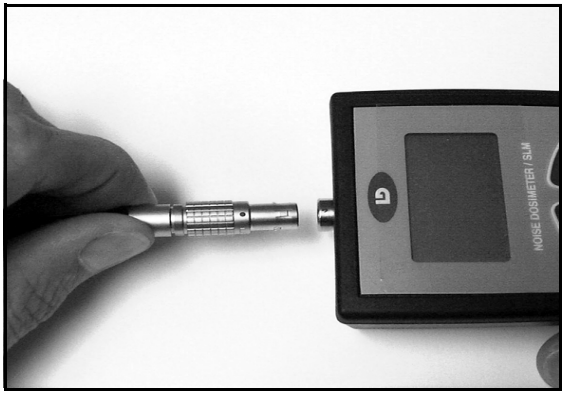


Figure 1- 4 ***Aligning the microphone connectors***

Step 2 Carefully push microphone connector plug all the way into the connector receptacle on the 704-ATEX.

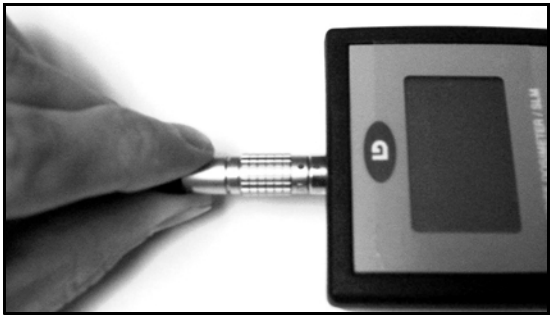


Figure 1- 5 ***Connecting the microphone***

Step 3 If you wish to use the protective carrying case (recommended), slide the 704-ATEX into the conforming pouch and secure the Velcro® strap.

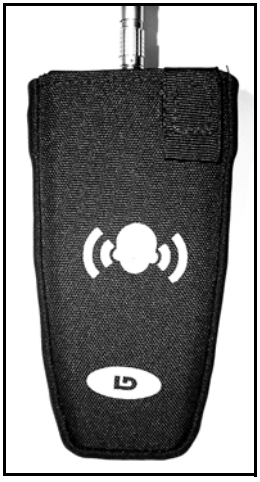


Figure 1- 6 ***The CCS018 protective case***

Important*: When removing the 704-ATEX from the pouch, do not pull microphone connector. This can cause damage. Instead, please push the 704-ATEX at the bottom of the pouch while firmly holding the sides.*

Spark® 704-ATEX Standard and Optional Accessories

Your Spark® 704-ATEX was delivered with a number of additional items. Please make sure that you have received the following equipment with your 704-ATEX:

Standard Accessories

- Spark® 704-ATEX dosimeter
- Detachable 3/8 in. (10.6 mm) microphone and preamp with integrated 3 ft. (1 m) cable. (MPR001)
- AA alkaline batteries (2)
- Windscreen
- CCS018 nylon pouch
- Microphone clip

If you are missing any of these items, please contact your Larson Davis sales representative, or contact Larson Davis directly.

Optional Accessories

The following optional equipment is also available:

- CAL150 Type 2 precision microphone calibrator
- MPR002 3" cylindrical mast type preamp for use as SLM

Installing the Batteries

NOTE: Only AA type batteries can be used in the Spark instruments.

To insert the two AA batteries in the 704-ATEX, remove the battery cover on the back of the instrument.

WARNING! Do not replace the batteries in an explosive environment.

Step 1 Move the sliding tab towards the bottom (away from the microphone end) of the 704-ATEX.

Figure 1- 7 ***Moving the battery door sliding tab***

Step 2 Grasp the battery door by the sides (towards the top of the 704-ATEX) and pull outward to remove.

Figure 1- 8 ***Opening the battery door***

Step 3 If there are existing batteries in the unit, gently remove and replace them with new AA batteries. Replace the door by first inserting the bottom side of the battery cover in the 704-ATEX case.

Figure 1- 9 ***Re-inserting the battery door***

Step 4 Move the top side of the battery cover flush against the 704-ATEX case. Then move the sliding switch to its original “up” position.

Figure 1- 10 ***Locking the battery door***

Internal battery life varies, depending on the operating mode. Operating continuously, the 704-ATEX will last beyond 100 hours. Using the backlight will reduce the battery life.

Using Rechargeable Batteries

NOTE: Only AA type batteries can be used in the Spark instruments.

Note: The instrument should not be operated in an explosive environment if using any batteries other than those approved and listed in Appendix C.

The 704-ATEX can provide up to 40 hours continuous operation with NiCad and NiMH rechargeable batteries. If you wish to use rechargeable batteries rather than alkaline batteries, we recommend the following batteries and battery chargers which are universally available.

Radio Shack Rechargeable Batteries:

Catalog Number	Description
23-149A	NiCd 1000mAH AA, 2-pack
23-525	NiMH 1200mAH AA, 2-pack

Table 1-1 **Rechargeable battery recommendation**

Radio Shack Battery Chargers:

Catalog Number	Description
23-405	NiCd/NiMH 1 Hour Charge
23-406	NiCd/NiMH 5 Hour Charge

Table 1-2 **Battery charger recommendation**

Environmental Considerations

The 704-ATEX dosimeter can be used and stored in a wide range of temperature and non-condensing humidity conditions. However, some precautions should be taken. For example, allow the dosimeter ample time to adjust to abrupt temperature changes. Condensation may form inside a cold dosimeter if it is brought into a warm room or vehicle, and may persist long after the outside case has adjusted to the ambient temperature.

Also, temperatures inside closed vehicles can reach excessive levels. Therefore, do not leave the instrument in direct sunlight inside a vehicle. A simple safeguard is to keep the instrument inside a sealed foam insulated case or

bag with desiccant silica gel, available at photographic equipment stores or from Larson Davis (LD part number DSC001).

Data Retention

The measurement data gathered by the 704-ATEX is not stored. The data will be lost if the batteries expire. Good measurement practice is to replace the batteries when they are running low.

CHAPTER

2 Operation of the Spark® 704-ATEX

Spark® 704-ATEX – Quick Reference

Congratulations! You now have your hands on the most powerful, smartest noise dosimeter available. It is also one of the smallest and lightest. We at Larson Davis thank you for your purchase of the Spark® 704-ATEX, and hope you receive many years of good service from it. This section has been developed to guide you through the operation of the 704-ATEX.

Overview

This manual is best used with the instrument at your side. You will be guided through a step by step tour of the Spark® 704-ATEX. The appropriate keypad button will be shown on the page. The resultant 704-ATEX display will then be presented to verify that you have performed the correct action.

You will likely find the user interface of the Spark® 704-ATEX to be fairly intuitive. This section is intended to give you a tour of the 704-ATEX's capabilities, and insights to its operation. You will navigate through the 704-ATEX's simple interface and make measurements immediately. You may find that it will also be useful to refer to this guide when trying something new with the 704-ATEX.

User Interface

Navigation within the 704-ATEX display is achieved using the keypad. The keypad allows the user to maneuver through the 704-ATEX's simple menu structure, change settings, and view data.

Keypad Functions

The keypad functions are as follows:

⏻ – this key is used to power the 704-ATEX on or off.

⏯ – this is the RUN/STOP key. It initiates or ends a measurement

⏏ – the RESET key performs a reset of the current measurement. The measurement screen will clear and a new measurement can be acquired. RESET is also used to exit from menus/screens.

🔧 – the TOOLS key is used to access various system functions of the 704-ATEX such as calibration, setting the 704-ATEX locking feature, changing the instrument setup, viewing the firmware version, viewing battery capacity, and adjusting the contrast of the display.

The arrow keys: ◀ , ▶ , ▲ , ▼ , provide a variety of different navigation operations within the 704-ATEX operating system. This includes maneuvering through menus and displays. Typically, the up and down arrows move the user up and down through displays and menus. The up and down arrows are also used to navigate through menu choices. The left and right arrows move the user from one related screen to another.

✓ – this is used to select an option or choice from a 704-ATEX menu.

704-ATEX Icon Descriptions

The 704-ATEX's graphical display also has its own icons that provide status information.

Battery

The Battery icon provides information with respect to the remaining battery voltage of the 704-ATEX. Notice that there are 3 bars within the battery graphic. When all 3 sectors are present, the battery voltage is greater than 2.8 (3.0 volts is full power). Two bars indicate that the voltage is greater than 2.4. With one bar illuminated, the voltage is greater than 2.2 volts. If the voltage is greater than 2.0, only the outlined battery will appear. When the voltage drops

below 2.0, the outlined battery will begin to flash. At 1.8 volts, the 704-ATEX will shut itself off.

Run Indicator

When the instrument is running, this bar graph will be animated, rolling from left to right. When the instrument is in the stopped mode, the icon will not be present.

Overload

The alarm icon indicates that measurement overloads have occurred. This can happen when extremely loud noise levels occur, or if the microphone was bumped.

The icon will remain visible until a reset ⏬ of the 704-ATEX has been performed. During an overload event, the alarm icon will flash.

The bell Icon will also come on and flash during a microphone fault. After the microphone is connected, the bell will remain on until the Spark® instrument is reset.

Run-Time Clock

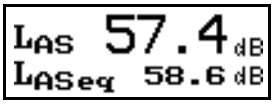
The clock icon is always present in the top right corner of the 704-ATEX display. It indicates the total running time of the current measurement. This time can be set to zero by pressing the reset ⏬ button on the 704-ATEX. During the first hour of run time, the clock will display in minutes and seconds (mm:ss). After completion of the first hour, the clock display will adjust to show hours and minutes (hh:mm). After 99 hours, the clock will start over again, although the actual run time (in hh:mm:ss) will always be maintained internally.

Powering up the Spark® 704-ATEX

If you have not already done so, turn the 704-ATEX on by pressing the On/Off key: ⏻

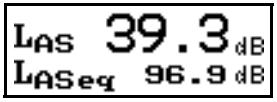
The instrument will move through a short start up cycle, where it briefly flashes the 704-ATEX ID screen. Immediately following, the 704-ATEX will stabilize to its ready state. The screen that will be displayed will be the same screen which was active at the previous power down.

If you are in a menu, press ⏏ one or more times to exit to a measurement display. The press ▲ or ▼ until you see the following screen.

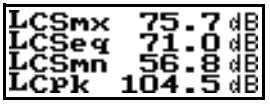


Navigating through the 704-ATEX Displays

Step 1 Press ⏯ to start a measurement. Notice that the current sound pressure level and Leq are currently being displayed.



Step 2 Press ▼ to view the next display screen. This shows the current Lmax (maximum sound pressure), Leq (equivalent sound pressure level or "average"), Lmin (minimum sound pressure level), and Lpk (the largest peak sound pressure level).

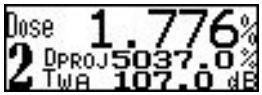


Step 3 Press ▼ to view the current SE (sound exposure), the 8 hour projected SE, and the 40 hour projected SE in units of Pa^2H.

Step 4 Press ▼ to view the noise dose data for Dose 1. The 704-ATEX will log four simultaneous doses. These dose computations can have independent dose variables such as exchange rates, threshold levels, criterion levels, and criterion times. This

display shows the current dose value, the projected 8 hour dose, and the TWA (Time Weighted Average).

Step 5 Press ▼ to view the current dose data for Dose 2.

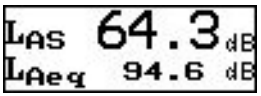


Step 6 Press ▼ to view the current dose data for Dose 3.

Step 7 Press ▼ to view the current dose data for Dose 4.

Step 8 Press ▼ to view the SPL 1 Exceedance data. The instrument counts the number of times the SPL 1 Exceedance level was exceeded, and also records the amount of time for which the level was exceeded.The Hysterisis is 2 dB, i.e. the level must fall 2 dB below the exceedance level, before a new exceedance will be recorded.

Step 9 Press ▼ to return to the sound pressure level screen.



Step 10 Press ▶ to move to the sound pressure level setting screen. Here you will see the current 704-ATEX settings for the gain, rms weighting, peak weighting, and detector rate.

Step 11 Press ▼ twice to advance to the SE data display.

Step 12 Press ▶ to view the SE data in Pa^2S (Pasques), the 8 hour projected Pa^2S and the 40 hour projected Pa^2S.

Step 13 Press ▼ to advance to the Dose 1 display.

Step 14 Press ▶ to inspect the Dose 1 settings for the criterion time, criterion level, exchange rate, criterion time, rms detector, and rms weighting.

If you are measuring to OSHA regulations, the following is a list of appropriate settings:

- RMS Weighting – A
- Peak Weighting – Unweighted
- Detector Rate – Slow
- Exchange Rate – 5 dB
- Threshold Level – 80 dB

- Criterion Level – 90 dB
- Criterion Time – 8 hours

Step 15 Press ▼ to inspect the Dose 2 settings. As stated, independent dose settings for all four of the 704-ATEX's simultaneous dose measurements can be established.

Step 16 Press ▼ three times to move to the SPL 1 Exceedance display.

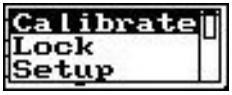
Step 17 Press ▶ to examine the SPL 2 Exceedance values. This feature allows you to measure and view a second sound pressure level (RMS) exceedance. It counts the number of times the SPL 2 Exceedance level was surpassed, and the total time the RMS sound levels were above the threshold (120 dB).

Step 18 Press ▶ again to view the Peak Exceedance data. The instrument counts the number of times the Peak Exceedance level was exceeded, and also records the amount of time for which the level was exceeded.The Hysterisis is 2 dB, i.e. the level must fall 2 dB below the exceedance level (140), before a new exceedance will be recorded.

Tools

The Tools area is where you go to change settings in the 704-ATEX. Let's tour the Tools menu.

Step 1 Press on the 704-ATEX keypad.



A number of sub menus are available within the Tools menu including Calibration, Lock, Setup…

Step 2 Press to move to the next set of Tools sub menus.

…About, Power…

Step 3 Press to move to the last set of Tools sub menu.

Display. We will learn more about each of these sub menus in upcoming sections.

Step 4 Press a few times in the Tools menu to highlight Calibrate.

Calibration of the 704-ATEX

Step 1 To calibrate the 704-ATEX, enter the Tools menu and highlight Calibrate.

NOTE: The Spark® 704-ATEX will monitor the calibration signal to make sure it is within an acceptable range. If the calibration tone is too high or low, the Spark® 704-ATEX will not perform the calibration change.

If you need to change the Cal Level to reflect a different calibrator output level, go to Step 2. If the Cal Level is already set to the correct value (the output signal in dB of your calibrator), press ✓ and proceed to Step 8.

Step 2 Press ✓ to enter the Calibrate tools menu.

If you are using a Larson Davis Model CAL250, this should be set to 114.0. If you are using a Larson Davis CAL150 or CAL200, the value could be set to either 94.0 or 114.0 depending on the setting of the calibrator's adjustable level switch.

Step 3 Press ▼ to highlight the Cal Level. Then press ✓ to enable editing the Cal Level.

Step 4 Use ◀ or ▶ to highlight the number(s) you wish to change.

Step 5 Then use ▲ or ▼ to increment/decrement to the desired number.

Step 6 When you have the correct calibrator output level entered, press ✓ to accept.

Step 7 Press ▲ to highlight Perform Cal.

Step 8 Insert the 704-ATEX microphone into the calibrator opening. Switch the calibrator on.

Step 9 Press ✓ to initiate the calibration

During the calibration, notice the circle building on the left side of the display.

When the calibration is finished, the completed circle changes to a check √.

Step 10 Press ⓥ to accept the calibration.

Step 11 Press ⓥ again to keep this calibration. You will be returned to the Calibrate menu.

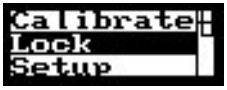
Step 12 Press ⓧ to return to the Tools menu.

Using the Lock Feature

The 704-ATEX has a very useful keypad Lock feature. When the Lock is activated, the 704-ATEX's display and keypad are disabled. This renders the 704-ATEX virtually tamper proof during operation. The Lock is activated, and deactivated by way of a 4-digit user defined Lock code.

Activating the Lock

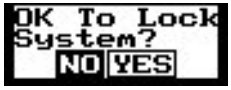
Step 1 From with the Tools menu, press ⓓ to highlight Lock.



Step 2 Press ⓥ to bring up the Lock combination screen.

Step 3 Type in any four-digit combination using ◀ and ▶ to move between number fields and ▲ and ▼ to increment and decrement the numbers.

Step 4 Press ✓ to enter the combination code. The following message/warning will appear.



Step 5 Press ▶ to highlight YES.

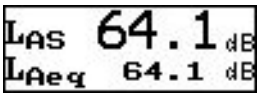
Step 6 Press ✓ to activate the Lock.

Deactivating the Lock

Step 1 To deactivate the lock, press any key on the 704-ATEX keypad to bring up the Lock combination entry screen.

Step 2 Using ◀ and ▶ to move between number fields and ▲ and ▼ to increment and decrement the numbers, enter the 4-digit Lock combination you defined earlier.

Step 3 Press ⓥ to enter the combination code and deactivate the Lock. You will be returned to the display screen prior to entering the Tools menu.



Setting up the 704-ATEX

Step 1 Press ⓕ on the 704-ATEX keypad to enter the Tools menu.

Step 2 Press ⓓ to highlight Setup.

Step 3 Press ⓥ to enter the Setup menu.

Within the Setup menu, you can access the 704-ATEX setup functions such as Gain, Frequency Weighting, Peak Weighting, Detector setting, Dose 1 settings, Dose 2 settings, Dose 3 settings, and Dose 4 settings. The choices for these different setup functions are:

- Gain (0, 10, 20, or 30 dB)
- Frequency Weighting (A or C)
- Peak Weighting (Unweighted or C)
- Detector Setting (Slow or Fast)
- Dose 1 (Threshold Level, Exchange Rate (3, 4, 5, 6), Criterion Time, Criterion Level)
- Dose 2 (Threshold Level, Exchange Rate (3, 4, 5, 6), Criterion Time, Criterion Level)

- Dose 3 (Threshold Level, Exchange Rate (3, 4, 5, 6), Criterion Time, Criterion Level)
- Dose 4 (Threshold Level, Exchange Rate (3, 4, 5, 6), Criterion Time, Criterion Level)

Changing the Gain

Changing the Gain of the 704-ATEX will alter the measurement range of the instrument. An increase in Gain will enable the 704-ATEX to measure lower noise levels. It will also reduce the upper measurement range of the 704-ATEX. To change the Gain:

Step 1 Verify that Gain is the highlighted choice in the Setup menu.

Step 2 Press ✓ to enter the Gain selection menu.

Step 3 Press ▲ to increment through the four Gain choices (use ▼ to return to the previous selections).

Step 4 Press ✓ to enter the new Gain value.

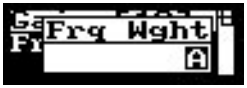
The new Gain selection is now active.

Changing the Frequency Weighting

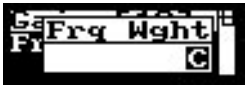
The choices are either A or C weighting, although A is the most common setting.

Step 1 Step 1 To change the RMS frequency weighting, first highlight Frq Wght by pressing ⓥ in the Setup menu.

Step 2 Press ⓥ to enter the Frequency Weighting edit field.



Step 3 Press ⓐ or ⓥ to move your desired weighting value.



Step 4 Press ⓥ to accept the new choice.

Changing the Peak Weighting

This function is used to change the weighting of the 704-ATEX's Peak Detector. The choices here are either C or U (Unweighted). Peak weighting is independent of the RMS weighting.

Step 1 To change the Peak weighting, first highlight Pk Wght by pressing ▼ in the Setup menu.

Step 2 Press ✓ to enter the Peak Weighting edit field.

Step 3 Press ▲ or ▼ to move to the desired weighting value.

Step 4 Press ✓ to accept the new choice.

Changing the Detector

This function is used to change the rate of the 704-ATEX's rms (root-mean-square) detector which is used to collect data. This is normally set to Slow for dosimetry applications, however you need to verify this with your particular countries regulations. Choices are either S (Slow) or F (Fast).

Step 1 To change the Detector rate, first highlight Detector by pressing ▼ in the Setup menu.

Step 2 Press ✓ to enter the Detector edit field.

Step 3 Press ⏶ or ⏷ to move to your desired Detector rate.

Step 4 Press ⓥ to accept the new choice.

Changing the Dose Measurement Settings

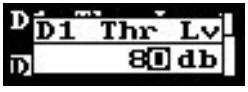
The 704-ATEX has the facility to measure 4 simultaneous dose measurements. These are denoted as Dose 1, Dose 2, Dose 3, and Dose 4. Each of these Dose measurements can have independent settings, and thus be set with different Threshold Levels, Exchange Rates, Criterion Levels, and Criterion Times.

Step 1 To change the Dose 1 settings, highlight Dose 1 by pressing ⏷ in the Setup menu.

Step 2 Press ⓥ to enter the Dose 1 Settings menu.

Changing the Threshold Level

Step 3 Press ⓥ to enter the Dose 1 Threshold Level edit field.



Step 4 Press ◀ and ▶ to move between number fields and ▲ or ▼ to move the number to your choice of Threshold Level.

Step 5 Press ✓ to accept the new choice.

Changing the Exchange Rate

Step 6 Press ▼ to highlight the Dose 1 Exchange Rate.

Step 7 Press ✓ to enter the Dose 1 Exchange rate edit field.

Step 8 Press ▲ or ▼ to cycle to your desired Exchange Rate (3, 4, 5, or 6).

Step 9 Press ✓ to accept this Exchange Rate choice.

Changing the Criterion Time

Step 10 Press ▼ to highlight the Dose 1 Criterion Time.

Step 11 Press ⓥ to enter the Dose 1 Criterion Time edit field.

Step 12 Press ◀ and ▶ to move between number fields and ▲ or ▼ to move the number to your choice of Criterion Time.

Step 13 Press ⓥ to accept the new Dose 1 Criterion Time.

Changing the Criterion Level

Step 14 Press ⓥ to enter the Dose 1 Criterion Level edit field.

Step 15 Press ◀ and ▶ to move between number fields and ▲ or ▼ to increment/de-increment the numbers to your Dose 1 Criterion Level of choice.

Step 16 Press ⓥ to accept this new Dose 1 Criterion Level.

Changing the Dose 2, Dose 3, and Dose 4 measurement setup is achieved in the same manner as shown with Dose 1.

The values that were entered in this tutorial do not necessarily reflect desirable or accurate dose settings. Please ensure that your 704-ATEX contains the settings that are pertinent

to your particular country's regulatory requirement. For OSHA these values are: RMS Weighting – A; Peak Weighting – Unweighted; Detector Rate – Slow; Exchange Rate – 5 dB; Threshold Level – 80 dB; Criterion Level – 90 dB; Criterion Time – 8 hours.

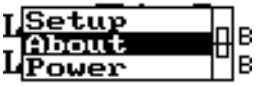
Step 17 Press ⏬ to return to the Setup Menu

Step 18 Press ⏬ again to exit to the Tools Menu

About

About screen contains the firmware version and serial number of your 704-ATEX.

Step 1 Press ▼ to highlight About.



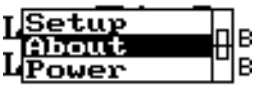
Step 2 Press ✓ enter the About Screen.

The firmware version of the 704-ATEX is displayed.

Step 3 Press ▼ to see the 704-ATEX serial number.

The704-ATEX's serial number appears.

Step 4 Press ⏬ to exit to the About Screen.



The Power Menu

Step 1 Press ▼ to highlight Power.

Step 2 Press ✓ to enter the Power menu.

The first displayed value is the Battery Time. This indicates the remaining time run time on the current batteries. This run time is dependent on a proper battery type selection.

Step 3 Press the ▼ to see the battery type being used. Press the ✓ key to select the type of battery you wish to use.

WARNING! In explosive environments, only approved alkaline batteries can be used in this instrument. (See page A-7 for approved batteries.)

Step 4 Press ▼ until Auto-Off is highlighted.

Step 5 Press ▼ until Volts is highlighted.

The Volts value displayed, reflects the remaining voltage in the batteries. New alkaline batteries will yield 1.5V each for a total displayed battery voltage value of about 3V. Fully charged NiCad's or NiMH's should indicate roughly 2.4V.

If you are using rechargeable batteries (NiCad or NiMH), it may take a few moments for the battery voltage value to stabilize.

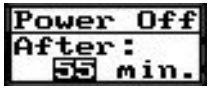
Auto-Off

The Auto-Off feature allows you to set a time whereby the 704-ATEX automatically powers off. If a 704-ATEX key has not been pressed during this Auto-Off period, the 704-ATEX automatically shuts off to conserve power.

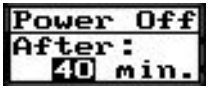
The maximum time that can be set is 60 minutes. The minimum is 1 minute. Selecting the "Never" option disables this feature, leaving the 704-ATEX power on indefinitely, or until the unit is powered off using ⏻.

Auto-Off is disabled during a manual start (run) until the unit is stopped.

Step 1 Press ✓ to edit the Auto-Off time.



Step 2 Press ▼ to cycle through the Auto-Off times.



Step 3 When you have highlighted your Auto-Off time, press ✓ to accept.

Step 4 Press ⏻ to exit to the Power menu.

Display

Display allows you to adjust the contrast of the 704-ATEX display, adjust the brightness of the display backlight, and establish a backlight shutoff time to conserve battery power.

Step 1 Press ▼ to highlight Display.

Step 2 Press ✓ to enter the Display menu.

Contrast adjusts the contrast of the 704-ATEX screen. The larger the percentage, the darker the screen will appear. To adjust the contrast, highlight the contrast menu item, press the ✓ key, and use the ▲ and ▼ arrows to adjust to the desired level. When finished, press the ✓ key to return to the display menu.

Step 3 Press ▼ to highlight BL Bright (Backlight Brightness).

This adjusts the brightness of the backlit display of the 704-ATEX. A value of 0% turns the backlight off. This maximizes the battery life of the 704-ATEX.

Step 4 Press ▼ to highlight BL Save (Backlight Save).

The Backlight Save feature allows you to set a time whereby the 704-ATEX screen backlight automatically powers off. If a 704-ATEX key has

not been pressed during this Auto-Off period, the backlight is automatically turned off to conserve power.

Step 5 Press ⏻ to exit to the Display menu.

APPENDIX

A

Spark® 704-ATEX Specifications

Specifications are subject to change without notice. Numerical values given are typical. Refer to specific calibration or test results for accurate data on a specific unit.

General Characteristics

Type Precision

The Larson Davis Spark® series meters with attached MPR001, combined preamplifier, 3/8" microphone cable and connector, is a Type 2 combination personal noise dosimeter and personal noise exposure meter.

Reference Direction

The reference direction is perpendicular to the plane of the microphone diaphragm.

Typical Measurement Ranges

RMS Detector

- Dynamic Range > 75 dB
- Primary Indicator Range > 70 dB

Measurement Ranges			
Gain = 30dB	Gain = 20dB	Gain = 10dB	Gain = 0dB
43 - 113 dBA	53 - 123 dBA	63 - 133 dBA	73 - 143 dBA

- Crest Factor Limit > 50
- Pulse Range = 70dB

The instrument's Noise Floor, Lower Limit, and Overload Level, vary, depending upon the sensitivity of the attached microphone. Typical values for a MPR001 or MPR002 3/8" microphone are listed in the table below.

Typical Noise Floor **A-Weighted**	**Typical Lower Limit** A-Weighted	**Typical Overload**	**Typical Max Peak Level**
Gain = 30dB	Gain = 30dB	Gain = 0dB	Gain = 0dB
35.0 dBSPL	40.0 dBSPL	143.0 dBSPL	146.0 dBSPL

Worst Case			
Noise Floor **A-Weighted**	**Lower Limit** **A-Weighted**	**Overload**	**Max Peak Level**
Gain = 30 dB	Gain = 30 dB	Gain = 0 dB	Gain = 0 dB
40 dB SPL	45 dB SPL	140 dB SPL	143 dB SPL

Peak Detector

- Dynamic Range > 40 dB
- Primary Indicator Range > 35 dB
- Measurement Range is approximately 80 to 146 dBSPL Peak in 4 ranges

Calibration Reference Level

The reference level is 114.0 dBSPL.

Frequency Weightings

The available frequency weightings for the Model 704 are described in the following table.

Detector	**A Weight**	**C Weight**	**Flat Weighting**
RMS	√	√	
Peak		√	√

The typical frequency response of the Peak detector with FLAT weighting is shown in the following table.

Nominal Frequency Hz	Unweighted Peak FLAT Weighting - dB	Nominal Frequency Hz	Unweighted Peak FLAT Weighting - dB	Nominal Frequency Hz	Unweighted Peak FLAT Weighting - dB
10	–0.4	160	0.0	2500	0.0
12.5	–0.3	200	0.0	3150	0.0
16	–0.3	250	0.0	4000	0.0
20	–0.2	315	0.0	5000	0.0
25	–0.2	400	0.0	6300	–0.1
31.5	–0.1	500	0.0	8000	–0.1
40	–0.1	630	0.0	10000	–0.1
50	0.0	800	0.0	12500	–0.2
63	0.0	1000	0.0	16000	–0.2
80	0.0	1250	0.0	20000	–0.2
100	0.0	1600	0.0		
125	0.0	2000	0.0		

Detector Time Weightings

The available RMS detector time weightings are FAST and SLOW.

Operating Temperature Range

The SPL level varies ≤ 0.5 dB when the complete instrument is tested over the -10° C to 50° C temperature range. The reference reading, for this test, is taken at 20° C and 36% relative humidity (RH); the input signal is at 1000 Hz at 114.0 dB SPL.

Effects of Humidity

The SPL level varies ≤ 0.5 dB when the complete instrument is tested over the 30% to 90% RH range. This test is performed at 40° C, with an input signal of 1000 Hz at 114.0 dB SPL.

Storage Temperature

Permanent damage can occur when stored or operated above 60° C or below -20° C. Condensation of moisture will make readings inaccurate but will be correct when moisture has dissipated.

Effects of Magnetic Fields

The SPL level varies ≤ 0.5 dB when the complete instrument is tested in an 80 A/m, 60 Hz magnetic field (worst case orientation). Even at a field strength of 240 A/m the SPL level variation is still ≤ 0.5 dB.

Effects of Strong Acoustic Fields

With the microphone replaced by an equivalent electrical impedance, the instrument was placed in a sound field of 100 dBSPL. The acoustic signal (sine wave) was swept from 31.5 Hz to 8000 Hz at a 0.1 octave/second rate. The strong acoustic field did not affect the reading on the instrument.

CE

Compliance with Electromagnetic Compatibility Standards

CE Standard	Description
IEC 61326-1 (2005)	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements. Consisting of the tests below.
IEC 61000-4-2 (2008)	Electrostatic discharge immunity test. (±4kV contact, ±8kV air discharge).
IEC 61000-4-3 (2006)	Radiated, radio-frequency, electromagnetic field immunity test. AM at 1 kHz, 80%. 26 MHz to 1.0 GHz (10 V/m), 1.4 GHz to 2.0 GHz (3 V/m), 2.0 GHz to 2.7 GHz (1 V/m). Δ<±2 dB from 85 dB SPL.
IEC 61000-4-8 (2001)	Power frequency magnetic field immunity test. 80 A/m. Δ<±2 dB from 85 dB SPL.

Effects of Mechanical Vibration

The entire instrument (including the microphone and preamplifier) was sinusoidally vibrated at an acceleration of 1 m/s^2 at 1/3 octave frequencies from 10 Hz to 1000 Hz. The results of this test are shown in the following tables.

X Axis: Acceleration parallel to the mic diaphragm (mic/preamp body was laid on its side on the shaker)

Nominal Frequency Hz	Instrument Reading (10 sec Leq) dB(C) SPL	Nominal Frequency Hz	Instrument Reading (10 sec Leq) dB(C) SPL
10	66.1	160	73.9
12.5	66.5	200	73.2
16	68.0	250	70.5
20	69.2	315	76.9
25	70.7	400	76.0
31.5	71.7	500	76.2
40	72.6	630	75.2
50	73.2	800	75.6
63	73.7	1000	75.9
80	74.1		
100	74.4		
125	74.1		

Y Axis: Acceleration perpendicular to the mic diaphragm (mic/preamp body was laid on its side on the shaker)

Nominal Frequency Hz	Instrument Reading (10 sec Leq) dB(C) SPL	Nominal Frequency Hz	Instrument Reading (10 sec Leq) dB(C) SPL
10	68.4	160	80.6
12.5	69.6	200	80.5
16	72.1	250	79.6
20	73.9	315	81.8
25	75.7	400	81.6
31.5	77.5	500	81.5
40	78.8	630	82.5
50	79.6	800	83.2
63	80.2	1000	84.3
80	80.4		
100	80.7		
125	80.7		

Z Axis: Acceleration perpendicular to the top surface of the MRP001 cap

Nominal Frequency Hz	Instrument Reading (10 sec Leq) dB(C) SPL	Nominal Frequency Hz	Instrument Reading (10 sec Leq) dB(C) SPL
10	66.1	160	66.1
12.5	66.1	200	66.1
16	66.1	250	66.1
20	66.1	315	66.1
25	66.1	400	66.1
31.5	66.1	500	66.1
40	66.1	630	66.1
50	66.1	800	66.1
63	66.1	1000	66.6
80	66.1		
100	66.1		
125	68.5		

Microphone Extension Cables

Microphone extension cables cannot be used with the Spark series meters.

Calibration Procedure

The calibration procedure for the Spark series meters is described on page 2-9 of this manual.

Reference Frequency

The reference frequency is 1000 Hz.

Stabilization Time

At power-on, the Spark series meters will not proceed to a running condition until it is allowed to stabilize. A short stabilization time (approx. 5 seconds) is also invoked when certain settings (Weighting, Gain, etc.) are changed.

Microphone Electrical Impedance

The Larson Davis ADP046 should be substituted for the MPR001 microphone when performing electrical tests on the Spark series meters.

Functions Measured

- Dose, Projected Dose, Time Weighted Average (TWA), and Leq
- Exposure in Pa^2S and Pa^2H, (including the E8 and E40 calculations)
- SPL, Lmax, Lmin, and Lpeak
- Exceedance count and duration for 115 and 120 dBSPL (RMS), and 140 dBSPL (Peak)

Data Storage

- No data storage capability

Data Communications

- Infrared serial interface for computer communications
- Data Rate: 115,000 bits per second

Digital Display

- 97 x 32 pixel, graphical LCD display
- Icons for displaying battery life, run time, overload, IrDA activity and Microphone Disconnect

Digital Display Resolution

- dB levels: 0.1 dB
- Dose: 0.001%
- Elapsed Time: 1 second
- Update rate: 5 times/second

Real-time Clock/Calendar

- Accuracy: 0.02% (-10 to 50 degrees C)
- 24 hour clock: hh:mm:ss
- 1 second resolution
- Year 2000 compliant

Run-time Clock

- One second resolution
- Format: mm:ss, (switches to hh:mm after 59 minutes and 59 seconds and colon flashes to indicate seconds)
- 99 hours and 59 minutes

Standards Met

- IEC60651 - 1979 (including amendment 1 - 1993)
- IEC60804 - 1985 (including amendment 1 - 1985, and amendment 2 - 1993)
- IEC61252 - 1993 (including amendment 1-2000)
- ANSI S1.4 - 1983
- ANSI S1.25 - 1991

Power Supply

- Operates with 2 AA alkaline batteries, approximately 100 hour operation
- Operates with 2 NiCd or NiMH batteries, run time is reduced to approximately 40 hour operation
- Current draw when unit is off is approximately 800µA (batteries will drain down in about three months)

- Actual run-times vary depending on operating conditions
- Battery-life indication selected from keyboard or computer program

Dimensions/Weight (with Microphone, Preamplifier, and Battery, and Case)

- Width: 2.5 inches (6.4 cm)
- Length: 5.6 inches (14 cm) - without MPR001 (Microphone, Preamplifier, cable and connector combination.)
- Depth: 1.25 inches (3.2 cm)
- Weight: 8.4 ounces (238 gm)

Approved Battery Types

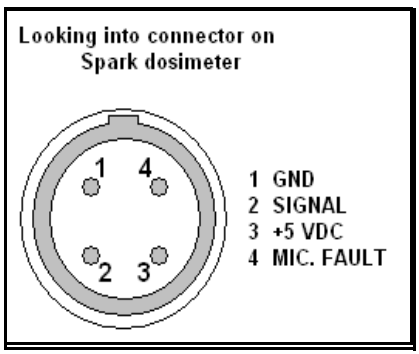
To comply with the intrinsic safety rating of this instrument, one of the following battery types must be used when this instrument is operated in an explosive environment.

- Duracell® MN1500 AA Alkaline
- Eveready® Energizer® E91 AA Alkaline

WARNING! Do not replace batteries in an explosive environment.

In NON-explosive environments, NiCd or NiMH rechargeable batteries may be used. See "Using Rechargeable Batteries" on page 1-15 for recommended rechargeable batteries,

Microphone Pinout



APPENDIX

B Glossary

A-weight A standard frequency weighting to simulate the response of the human ear.

Calibration Adjustment of the system so that the measured sound level agrees with a reference sound source.

Calibration Check A check for variations between the measured level and a reference level - no adjustment is made to the system.

Criterion Duration Criterion duration is the time required for a continually applied sound of the selected criterion level to produce a dose of 100%. Criterion duration is typically 8 hours.

Criterion Level It is the level of a sound which will produce a dose of 100% if continually applied for the criterion time. The current OSHA criterion level is 90 dB.

C-weight A standard frequency weighting that simulates the response of the human ear to high amplitude (loud) noise.

Daily Personal Noise Exposure (LEP,d) $L_{EP,d}$ is the level, expressed in dB, of a constant sound over a specified normalization time period (T_n) that contains the same energy as the actual (unsteady) sound measured over a stated measurement period (T_2 - T_1). The measurement period is generally shorter, so the actual noise exposure is spread out (or normalized) over the normalization time period.

$$L_{EP,d} = 10Log_{10}\left(\frac{1}{T_n}\int_{T_1}^{T_2}\frac{P^2(t)}{P_0^2}dt\right)dB$$

OR

$$L_{EP,d} = Leq + 10Log_{10}[(T_2 - T_1)/Tn]\ dB$$

Leq = frequency weighted (A or C), equivalent-continuous sound pressure level in dB

P(t) = instantaneous, frequency weighted (A or C), sound pressure in pascals

P_0 = reference sound pressure, 20 μPa

T_n = normalization period (Criterion Duration)

T_2 - T_1 = measurement period (Run Time)

Detector Rate See Frequency and Exponential-Time Weighted Sound Level.

Dose See Noise Dose.

Exchange Rate Exchange rate is defined in ANSI S1.25 as "the change in sound level corresponding to a doubling or halving of the duration of sound level while a constant percentage of criterion exposure is maintained". Possible values for this field are 3, 4, 5, or 6. The current OSHA exchange rate is 5. A value of 3 will produce Leq-like levels.

Equivalent-Continuous Sound Level or Leq Leq is the level of a constant sound, expressed in dB, which in a given time period (T= T_2 - T_1) has the same energy as does a time varying sound. For the Spark dosimeters, an Leq value is recorded for 2 different time intervals. First, an Leq is recorded for the entire record's Run Time. Second, an Leq is recorded for each individual time history sample.

On the Spark dosimeters, Leq is annotated as L_{Aeq} or L_{Ceq} (A or C frequency weighted Leq)

$$Leq = 10Log_{10}\left(\frac{1}{T}\int_{T_1}^{T_2}\frac{P^2(t)}{P_0^2}dt\right)dB$$

P(t) = instantaneous, frequency weighted (A or C), sound pressure in pascals

P_0 = reference sound pressure, 20 μPa

T = measurement period (Run Time or time history interval), $T = T_2 - T_1$

Equivalent Time Weighted Average or TWA(x)

The level of a constant sound, expressed in dB, which if measured for a time period equal to the criterion duration, will produce the currently measured noise dose. The x in TWA(x) represents the criterion duration.

For example, suppose a worker is exposed to a noise environment with a TWA of 90 dB. Also, assume that the exchange rate is 5, the criterion level is 90 dB, and the criterion duration is 8 hours. After 1 hour, the worker's noise dose will be 12.5%, the TWA(8) will be 75.0 dB, and the TWA will be 90.0 dB. A TWA(8) of 75 dB indicates that if the worker is instead exposed to a noise environment with a TWA of 75 dB, then the noise dose after 8 hours will be 12.5%.

$$TWA(x) = TWA + q\log_{10}\left[\frac{T}{T_C}\right]$$

TWA = time weighted average sound level in dB

T = measurement period (Run Time)

T_C = criterion duration

q = exchange rate constant

if exchange rate = 3, q = 10
if exchange rate = 4, q = $4/\text{Log}_{10}(2) \approx 13.29$
if exchange rate = 5, q = $5/\text{Log}_{10}(2) \approx 16.61$
if exchange rate = 6, q = 20

Frequency & Exponential-Time Weighted Sound Level or *Lw*τ

*Lw*τ is the frequency and exponential-time weighted sound level in dB. *Lw*τ is sometimes referred to as the "rms sound level". Similarly the A or C frequency weightings are sometimes referred to as the "rms frequency weighting" (rms is an acronym for root-mean-square).

The Detector Rate setting on a Spark dosimeter corresponds to an exponential time constant of SLOW (1 second) of FAST (0.125 seconds), which is designated as τ in the equation below. These time constants are required by both ANSI and IEC standards.

In the *Lw*τ symbol, the *w* designates the frequency weighting (A or C) and the τ designates the exponential time constant (SLOW or FAST). **For example, on the Spark dosimeters, L_{AS} signifies the A weighted, SLOW expo-**

nential-time weighted sound level. Similarly, L_{CF} signifies the C weighted, FAST level.

$$Lw\tau = 10Log_{10}\left(\frac{1}{\tau}\int_{-\infty}^{t}\frac{P^2(\xi)e^{-(t-\xi)/\tau}}{P_0^2}d\xi\right)dB$$

$Lw\tau$ = frequency and exponential-time weighted sound level in dB

w designates the frequency weighting (A or C)

τ designates the exponential time constant (SLOW or FAST)

ξ = dummy variable of time integration

P(t) = instantaneous, frequency weighted (A or C), sound pressure in pascals

P_0 = reference sound pressure, 20 μPa

t = time of observation

τ = exponential time constant SLOW (1 second) or FAST (0.125 seconds)

Frequency Weighting See Frequency and Exponential-Time Weighted Sound Level

LEP,d See Daily Personal Noise Exposure.

Lmax Lmax is the maximum value, expressed in dB, of the frequency and exponential-time weighted sound level ($Lw\tau$) in a given time interval. For the Spark dosimeters, an Lmax value is recorded for 2 different time intervals. First, an Lmax is recorded for the entire record's Run Time. Second, an Lmax is recorded for each individual time history sample.

On the Spark display, the Lmax annotation includes the current settings for frequency weighting and exponential-time weighting. **For example, on a Spark dosimeter L_{ASmx} signifies the maximum, A weighted, SLOW level. Similarly, L_{CFmx} signifies the maximum, C weighted, FAST level.**

Lmin Lmin is the minimum value, expressed in dB, of the frequency and exponential-time weighted sound level ($Lw\tau$) in a given time interval. For the Spark dosimeters, the time interval is the record's Run Time.

On the Spark display, the Lmin annotation includes the current settings for frequency weighting and exponential-time weighting. **For example, on a Spark dosimeter L_{ASmn} signifies the minimum, A weighted, SLOW level. Similarly, L_{CFmn} signifies the minimum, C weighted, FAST level.**

Ln An Ln is the frequency and exponential-time weighted sound level ($Lw\tau$) that is exceeded n percent of the time in a give time interval. For example, L10 is that sound level, expressed in dB, which was exceeded for 10% of the total Run Time. The default Ln percentages are 10, 30, 50, 70, 90.

Noise Dose Noise dose is the percentage of time that a person is exposed to noise that is potentially damaging to hearing. Zero represents no exposure and 100 or more represents complete exposure. It is calculated by dividing the actual time of exposure by the allowed time of exposure. The allowed time of exposure is determined by the Criterion Duration and by the sound level (the higher the level, the shorter the allowed time). The sound levels must be measured with A-weighting in frequency and slow-exponential weighting in time.

$$Dose = (100/T_c)\int_{T_1}^{T_2} 10^{[(L_{AS}-L_c)/q]}dt$$

OR

$$Dose = (100T/T_c)\cdot 10^{[(TWA-L_c)/q]}$$

L_{AS} = frequency (A) and exponential-time (SLOW) weighted sound level in dB
(in the formula above, if the sound level is less than the user specified threshold level, then $L_{AS} = -\infty$)

L_c = criterion level in dB

T_c = Criterion duration in hours (8 hours typical)

T = Measurement period (Run Time), $T = T_2 - T_1$

TWA = time weighted average in dB

q = exchange rate constant
if exchange rate = 3, q = 10
if exchange rate = 4, $q = 4/\text{Log}_{10}(2) \approx 13.29$
if exchange rate = 5, $q = 5/\text{Log}_{10}(2) \approx 16.61$
if exchange rate = 6, q = 20

Peak The maximum value of the instantaneous, frequency weighted (C or Unweighted), sound pressure in a given time interval. For the Spark dosimeters, a Peak value is recorded for 2 different time intervals. First, a Peak is recorded for the entire record's Run Time. Second, a Peak is recorded for each individual time history sample. Note, the Peak metric is not an integrated or averaged value, and it is measured with a separate peak detector circuit, which has a very fast rise time (see specifications for more details).

Peak Frequency Weighting It is the frequency weighting of the peak detector. Possible selections are C(weighted) or U (unweighted). Peak weighting is independent of the RMS frequency weighting.

Projected Noise Dose The Noise Dose assuming that the current rate of noise dose exposure continues for the duration of a work shift. **On the Spark display, projected dose is shown as D_{PROJ}.**

$$ProjectedDose = (100/T)\int_{T_1}^{T_2} 10^{[(L_{AS}-Lc)/q]}dt$$

OR

$$ProjectedDose = 100 \cdot 10^{[(TWA-Lc)/q]}$$

L_{AS} = frequency (A) and exponential-time (SLOW) weighted sound level in dB

(in the formula above, if the sound level is less than the user specified threshold level, then $L_{AS} = -\infty$)

L_c = criterion level in dB

TWA = time weighted average in dB

q = exchange rate constant

if exchange rate = 3, q = 10

if exchange rate = 4, $q = 4/\text{Log}_{10}(2) \approx 13.29$

if exchange rate = 5, $q = 5/\text{Log}_{10}(2) \approx 16.61$

if exchange rate = 6, q = 20

Projected Sound Exposure

Projected sound exposure shows what the actual sound exposure will be (for a specified time period) if the current equivalent-continuous sound level (Leq) remains at its current level. The Spark dosimeters calculate an 8 hour and a 40 hour projected sound exposure. **On the Spark display, these values are shown as E_{A8} and E_{A40} (A frequency weighting) or E_{C8} and E_{C40} (C frequency weighting).**

$$E_8 = \frac{8}{T}\int_{T_1}^{T_2} P^2(t)dt \quad \text{and} \quad E_{40} = \frac{40}{T}\int_{T_1}^{T_2} P^2(t)dt$$

P(t) = instantaneous, frequency weighted (A or C), sound pressure in pascals

$T_2 - T_1$ = measurement period (Run Time)

Sound Exposure (SE)

Sound Exposure is the total sound energy of the actual sound in a given time interval. For the Spark dosimeters, the time interval is the record's Run Time. The units for sound exposure are Pa^2S (pascal squared seconds) or Pa^2H (pascal squared hours).

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$$E = \int_{T_1}^{T_2} P^2(t)\,dt$$

P(t) = instantaneous, frequency weighted (A or C), sound pressure in pascals

$T_2 - T_1$ = measurement period (Run Time)

Threshold Level

ANSI S1.25 defines threshold as "a sound level below which the dosimeter produces little or no dose accumulation as specified in this stand." The threshold should be selected to be within the measurement range of the instrument which is between 70 dB and 140 dB for the Spark. The current OSHA threshold is 80 dB.

Time Weighted Average (TWA)

The level of a constant sound, expressed in dB, which in a given time period ($T = T_2 - T_1$) would expose a person to the same noise dose as the actual (unsteady) sound over the same period. ANSI S1.25-1991 refers to the time weighted average as L_{av} or average sound level.

The Spark dosimeters simultaneously calculate 4 separate TWA values. The user specifies the exchange rate, criterion level, criterion duration, and threshold level for each TWA. These 4 separate TWA values are recorded for 2 different time intervals. First, 4 TWAs are recorded for the entire records record's Run Time. Second, 4 TWAs are recorded for each individual time history sample.

$$TWA = q \cdot \log_{10}\left[\frac{1}{T}\int_{T_1}^{T_2} 10^{(L_{AS})/q}\,dt\right]$$

L_{AS} = frequency (A) and exponential-time (SLOW) weighted sound level in dB
(in the formula above, if the sound level is less than the user specified threshold level, then $L_{AS} = -\infty$)

T = measurement period (Run Time or time history interval), $T = T_2 - T_1$

q = exchange rate constant

if exchange rate = 3, q = 10
if exchange rate = 4, $q = 4/\text{Log}_{10}(2) \approx 13.29$
if exchange rate = 5, $q = 5/\text{Log}_{10}(2) \approx 16.61$
if exchange rate = 6, q = 20

APPENDIX

C Intrinsic Safety Approvals

This appendix presents details of the Spark®704-ATEX instrument instrinsic safe approval.

ATEX

Classification	Applicable Standards
Group II Category 2G Sub-Group IIB Ɛx II 2G EEx ib IIB T4 Ambient Temperature –10 to 40 °C	EN 60079-0:2004 EN 50020:2002

NOTES:
Group II: Non-Mining
Category 2G: Non-mining, explosive air/gas mixture is likely to occur
ib: Intrinsically safe with 1 countable fault and all non-countable faults
Group IIB: Ethylene
Maximum surface temperature produced under fault conditions at an ambient temperature of 40ºC
T4: 135ºC

Intertek Intrinsic Safety Approval: ITS 05 ATEX 25065X

Warning! For safe operation, Do not replace batteries in an explosive atmosphere.

To comply with the intrinsic safety rating of this instrument, one of the following battery types must be used when this instrument is operated in an explosive environment.

o Duracell MN1500 AA Alkaline

o Eveready Energizer E91 AA Alkaline

Warning! To reduce the risk of explosion do not mix old batteries with new batteries, or mix batteries from different manufacturers.

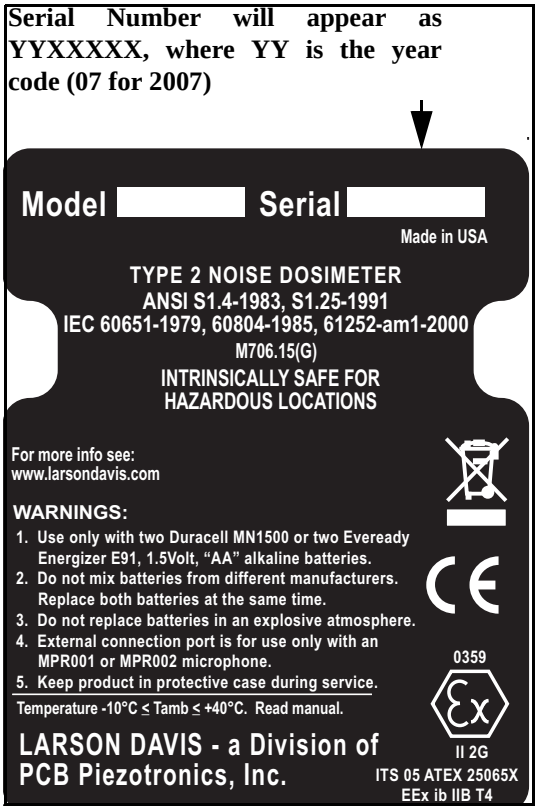
NOTE: The 704-ATEX must remain in the protective case during service. The user should replace the protective pouch when it shows signs of deterioration.

Back Panel Label

This section presents the intrinsic safe label which appears on the back of the Spark® 704-ATEX.

Note that the year of manufacture is provided in the year code, which is part of the serial number, as indicated in the following figure.

704-ATEX



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