MK:427 Environmental Noise Microphone

Revision 9

Produced by Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH, United Kingdom.

Reference Number 10/16/MK427/09

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Important information

Each MK:427 unit will have its own output levels and electrostatic actuator output levels. Please refer to the factory calibration setup information for details for your specific instrument.

The MK:427 is supplied with the configuration preset to meet those ordered from the factory.

Calpot R1 is referred to in the Reference Calibration section on page 14. This is the only setting that should be altered, if required, by the user during a Reference Calibration.

First Steps

Once you have received shipment of your new MK:427 Noise Sensor unit, we would recommend the following stages to setup and install the equipment.

Stage 1

Understand the contents supplied with the MK:427.

See page 7, MK:427 Microphone Unit System Diagram

Stage 2

Integrate the unit with your own systems in 'test conditions' to ensure the unit is correctly communicating information and measuring and calibrating effectively.

See Factory Configuration Information Sheet
Page 5, Overview
Page 12, Verification & calibration of the MK:427

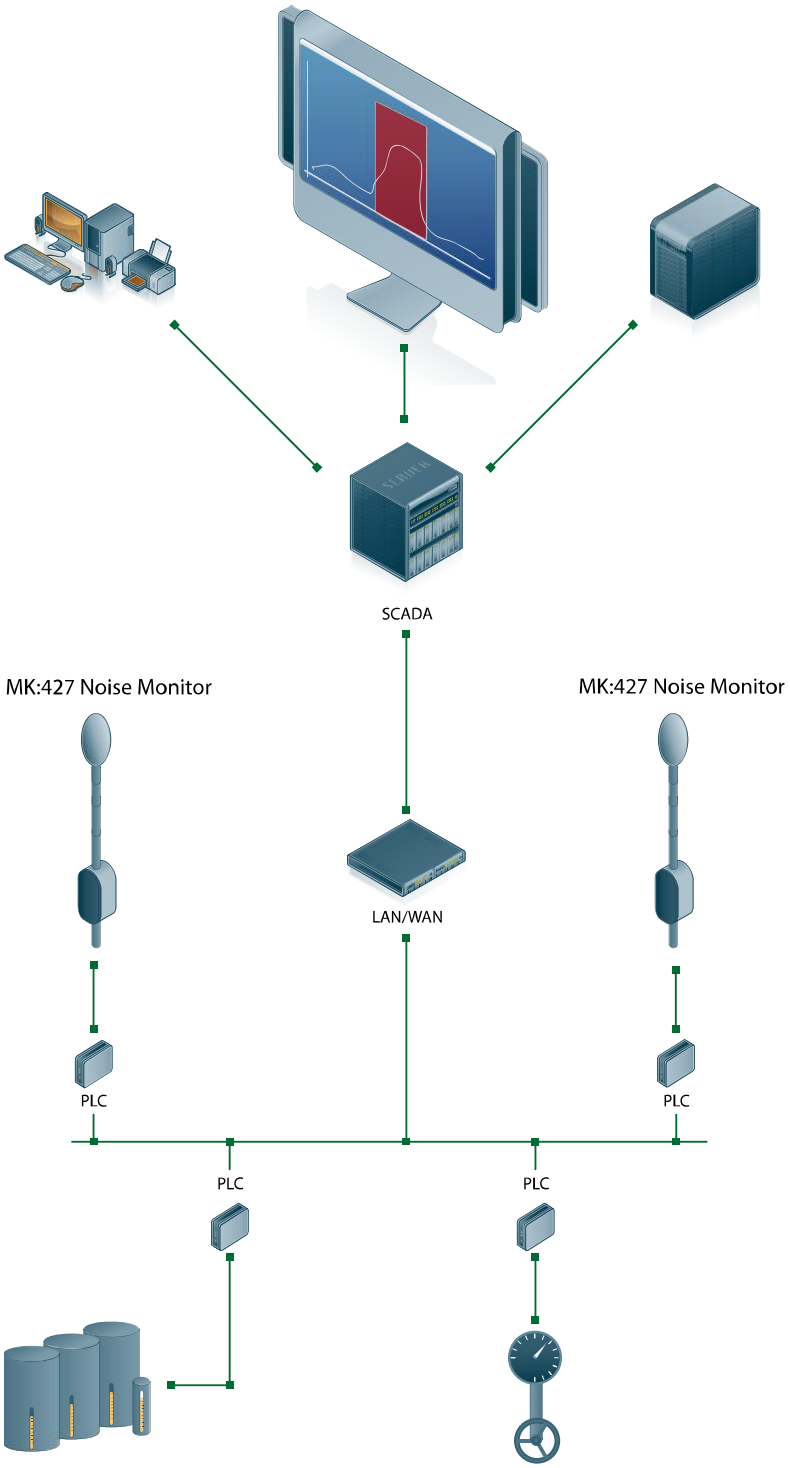
Stage 3

Install the MK:427 in a suitable site.

See Page 8, Mounting Information
See Page 9, Positioning your MK:427 Noise Sensor

Overview

Thank you for choosing the MK:427 outdoor noise sensor. This high quality outdoor environmental noise microphone system is ideal for integrating with other data logging and external measurement systems.



The mechanical and acoustic design of the MK:427 has been field proven over many years in a range of differing environments worldwide.

The standard version of the MK:427 has a 4-20mA current loop which outputs a current level, expressed in milliamperes that is proportional to the sound level with either a 'Fast' or 'Slow' Time Weighting. The choice of time weighting is a factory set option made at the time of purchase.

The MK:427 has, as standard, an electrostatic actuation system which allows for remote, automatic and regular verification of the system performance to ensure accurate measurements. See the Calibration section of the manual on page 12 for more details.

This manual details a version of the MK:427 with both the 4-20mA loop output and the electrostatic actuator option fitted.

The output is always weighted with the 'A' frequency weighting which is the most commonly used frequency weighting for the measurement of environmental and industrial noise levels.

The 4-20mA current loop output is ideal for integration to many process measurement and control systems where your own system loggers and software can provide an accurate representation of the 'live' noise levels and also store data.

Your own interface system will need programming with a simple formula which is outlined on your Factory Configuration Information sheet.

For Example:

For a unit with a range of 34 to 104 dB

Sound Pressure Level | dB = (10 x I)-10

(Where I is the output current in mA)

Therefore, in this example an output current of 7.23mA would represent a noise level, L_A, of 62.3dB(A) as shown below:

dB(A) = (10 x 7.23) -10

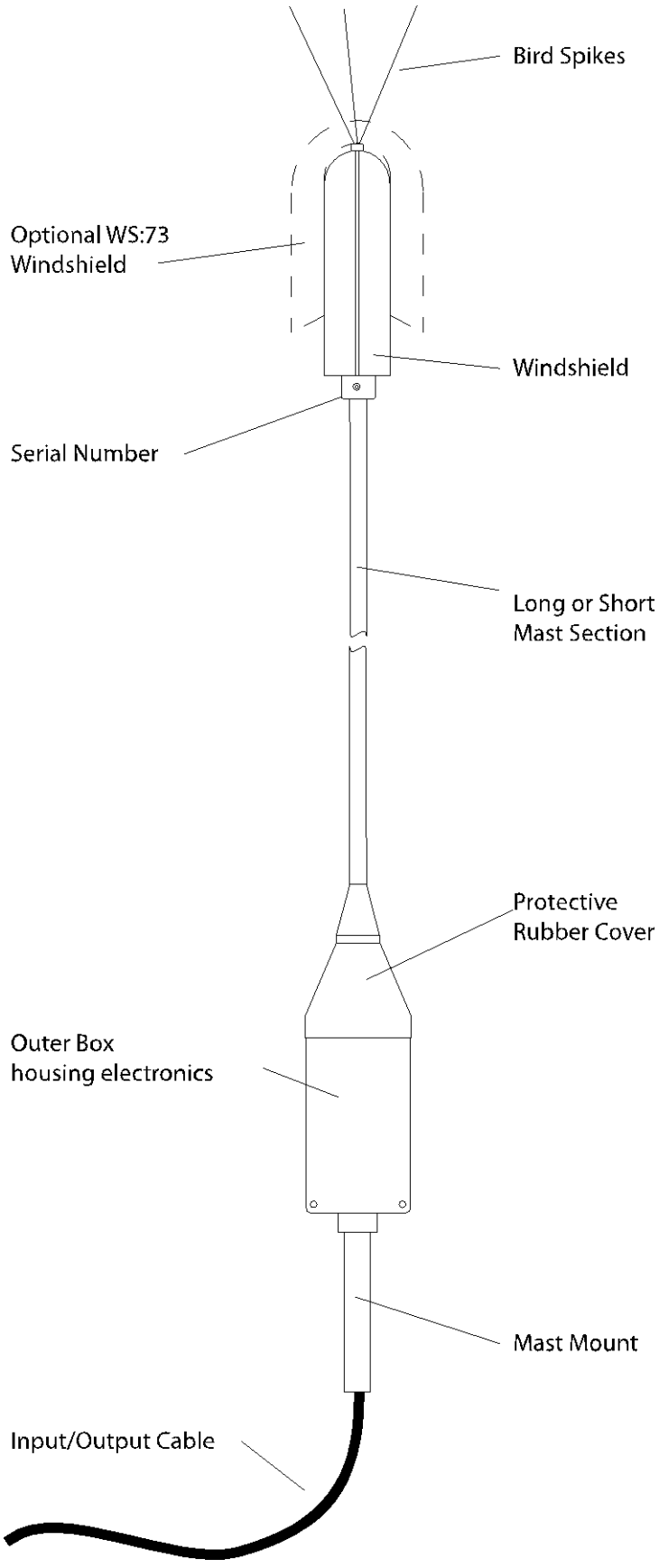
dB(A) = 72.3 – 10

dB(A) = 62.3

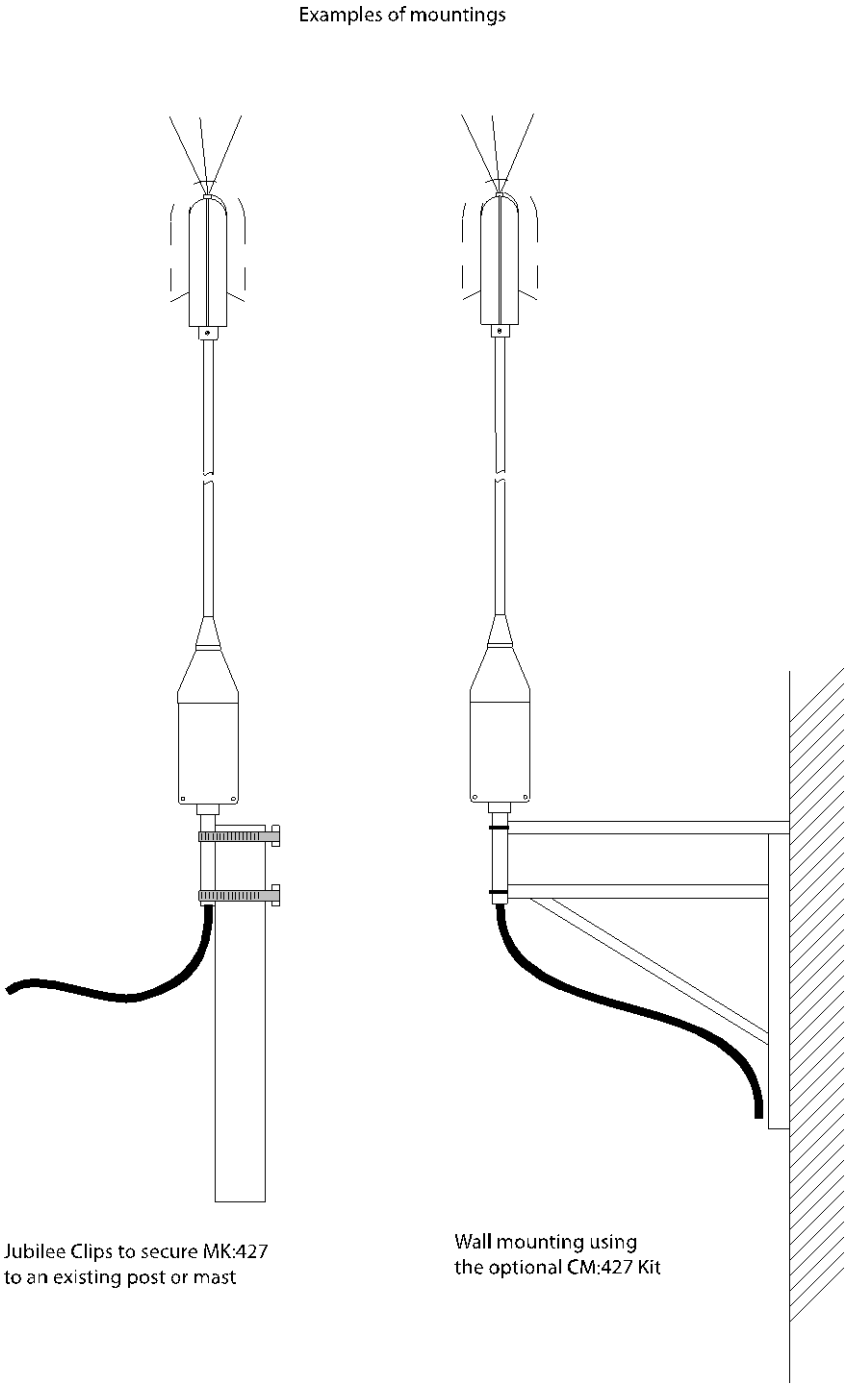
Please check with our technical department if you need confirmation as to the settings of your equipment or if you need any other technical guidance.

Tel: + 44 1733 667100
email: sales@cirrus-environmental.com

MK:427 Microphone Unit System Diagram



Mounting Information



The unit is supplied with a standard mounting kit to enable the unit to be fixed to a pole or similar.

3 x Jubilee clips
2 x U-Bolts with washers & nuts

The optional CM:427 mounting kit can be used to mount the MK:427 onto a building or other fixed structure.

General Guidance

Positioning your MK:427 Noise Sensor

Every site and application is different but here are some basic guidelines for effective positioning of your Noise Sensor:

- It is usually worth conducting a noise survey, or referring to measurement data from a recent noise survey to understand the noise profiles for the area.
- Install the sensor at a location nearby to where the environmental noise is most likely to cause annoyance to neighbouring residential areas or other sites.
- Legislation often specifies where measurements should be made, for example at property boundaries or at a complainant's property.
- Try to mount the unit away from obstacles and building walls.
- The microphone should always be a minimum of 1.2 – 1.5m above the ground level.
- Avoid, where possible, overexposed areas where high wind speeds will affect the noise level readings.

Operation

External Connections

External connection to the MK:427 is made via the supplied 10m cable with the following wiring connections:

Power Supply

Red & Orange:	Nominally +12VDC
Black & Green & Braid & Blue:	Power Ground (0V)

Notes:
The nominal power supply voltage is +12VDC.
The MK:427 can operate with a power supply within the range of +9VDC to +36VDC
The maximum current for normal operation is 75mA.
The power supply for the unit must be independent of the isolated loop circuit.

Isolated Loop circuit

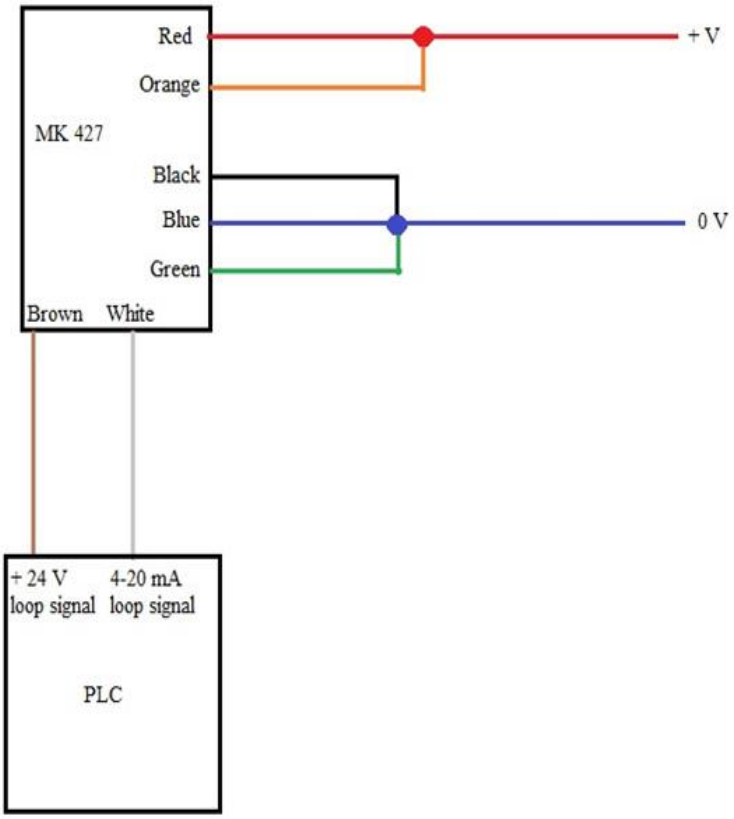
White:	Loop output
Brown:	Loop input

Notes:
The nominal output current is 0.1mA/dB over the range of the instrument.
The maximum allowable loop voltage is 30V.

Actuator control

The electrostatic actuator is

Yellow:	Any voltage of between +5V to +12V = Actuator on Any voltage of between 0V to +0.3V = Actuator off
Green:	Ground (0V). Connect to power supply ground (0V)



If the installation requires that the factory supplied 10m cable must be replaced then please refer to Appendix 1 Internal wiring connections for the connection details onto the internal PCB.

Verification & calibration of the MK:427

The standard MK:427 unit is fitted with an electrostatic actuation system that allows the output of the system to be verified by generating a known sound level.

The system can also be calibrated by using a reference acoustic calibrator and this process is described on page 14.

Please also refer to the section on page 20, **Appendix 3 The influence of the background noise level on calibration and verification**.

Routine verification using the electrostatic actuator system

To carry out a routine verification using the electrostatic actuator system, the MK:427 must have all of its connections, as specified in the section **External Connections**.

To activate the electrostatic calibration system, apply any voltage of between +5v and +12v level to the **yellow coloured wire.** The 0v of this voltage source must be connected to the **green coloured wire**.

This voltage needs to be applied during the entire actuation period.

We would recommend waiting for around 20 seconds to ensure the electrostatic actuation system has time to settle properly before reading the value electrically.

When this voltage level is applied, the actuator 'excites' the microphone to a specific level, which is shown on the Factory Configuration Information sheet that is supplied with your MK:427.

The output level from the MK:427 will increase to the calibration level which can be used to calibrate your data logging system.

To end the calibration process, return the voltage on the **yellow wire** to less than **+0.3v**.

The electrostatic actuation level will vary between different MK:427 sensors. Refer to page the Factory Configuration Information sheet for the exact output levels for this instrument.

Explanatory Note – The principle of electrostatic actuation

In an electrostatic actuation system, the level at the microphone membrane level is determined by the distance between the actuator plate and the microphone capsule membrane, and will vary between all units.

Once the output calibration current level has been established this should be within ±0.5dB of the designated level given on the Factory Configuration Information sheet.

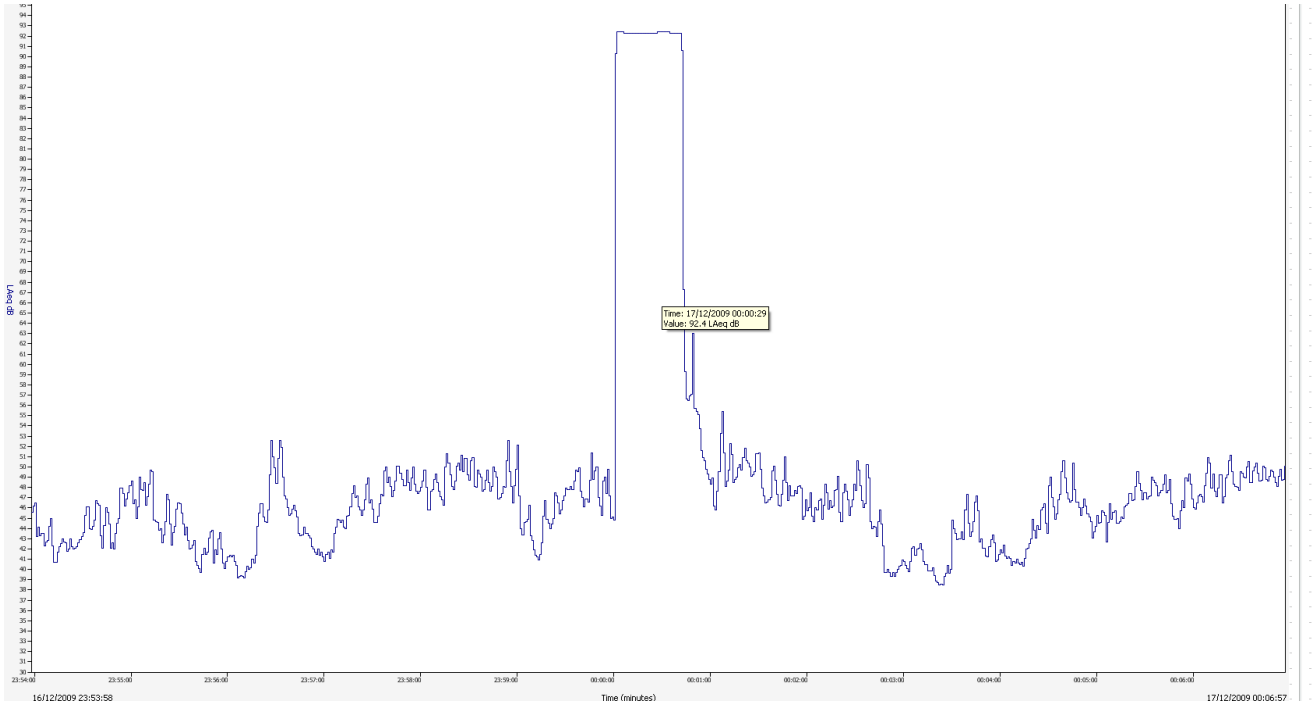
If the level has varied to a level that is unacceptable for your application, you should program a correction into whatever data logging/software system that you are using to receive the analog signal from the MK:427.

Example
Actuation output measured = 89.9 dB
Actuation level on Factory Configuration Sheet = 90.6 dB

So, difference between output and factory tested setting = 0.7dB or 0.7/10 = -0.07mA

Typical time history trace during using the electrostatic actuation process

The picture below shows the effect of the actuation process upon the output level produced by the MK:427.



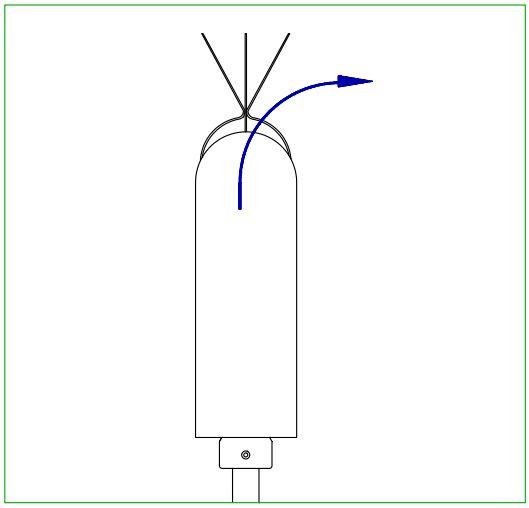
Reference Calibration

The output levels of the MK:427 can be adjusted using a Cirrus CR:515 or CR:514 Acoustic Calibrator as a reference source with the electrostatic actuator providing for routine verification.

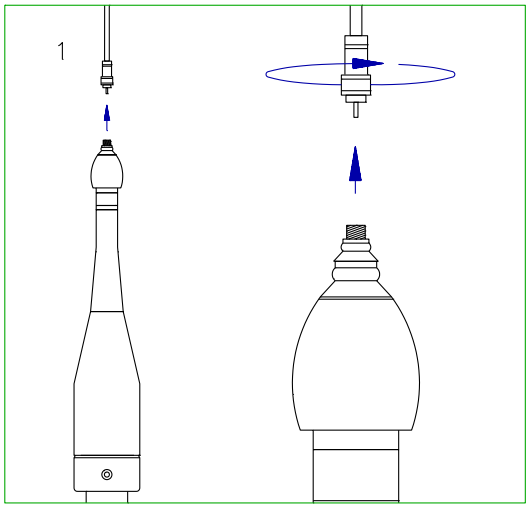
Please note that this procedure should not be carried out unless the overall calibration of the system needs to be verified and is included in this manual for reference only.

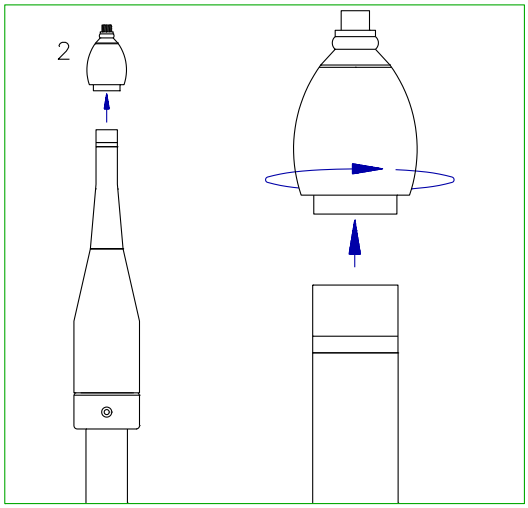
To create a reference calibration follow the steps below:

1. Remove the Windshield from the microphone unit.



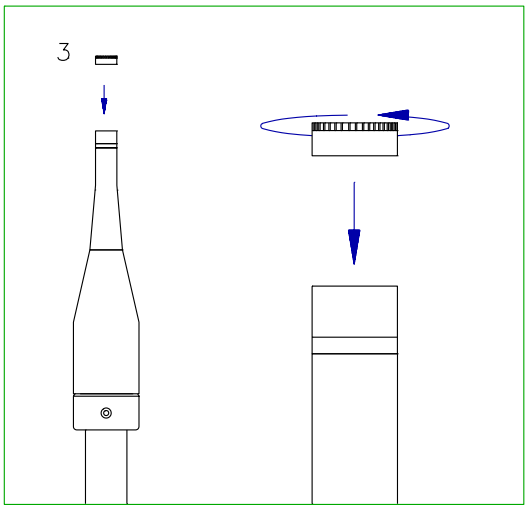
2. Carefully unscrew the electrostatic actuator unit from the microphone capsule



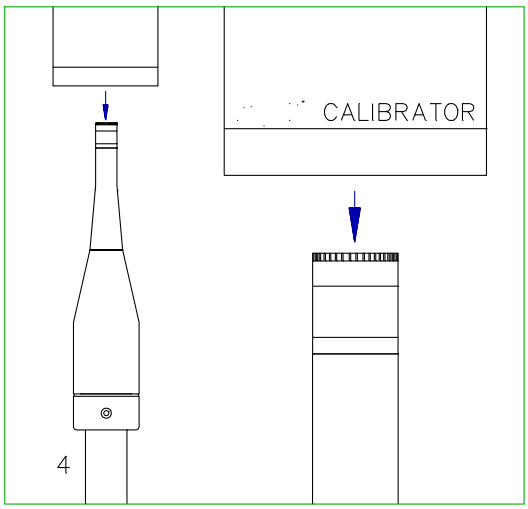


Care must be taken at this step as the diaphragm of the microphone capsule will be exposed and is easily damaged.

3. Attach the microphone grill to the microphone capsule



4. Connect the acoustic calibrator and select the 94dB level.



5. Adjust the calibration level using Calpot R1 for the output current given in the table below.

This provides a reference calibration level so that the current output is now proportional to the noise level. The current will depend upon the range of the instrument.

Range	Calculation	Current for 94dB Calibrator
74 – 144 dB	dB = (10 x I) + 30	6.4mA
64 – 134 dB	dB = (10 x I) + 20	7.4mA
54 – 124 dB	dB = (10 x I) + 10	8.4mA
44 – 114 dB	dB = (10 x I)	9.4mA
34 – 104 dB	dB = (10 x I) – 10	10.4mA
24 – 94 dB	dB = (10 x I) – 20	11.4mA

Example

For the range of 34 to 104dB

dB = (10 x I) – 10, where I is the current output in mA.

The current output for a known dB level is therefore

I = (dB +10) /10

6. Carefully remove the acoustic calibrator

7. Remove the microphone grill

8. Re-attach the electrostatic actuator and cable

9. Activate the electrostatic actuator system by applying a voltage of between +5v and +12 to the **Yellow** wire. The **Green** wire should be connected to 0V of this voltage source.

10. Record the output current across the loop to obtain the actuator output level

    Please note that the level produced by the electrostatic actuator is dependent upon the position of the actuator drive plate above the microphone grill and will vary slightly depending upon how tightly it has been screwed down.

    Very small changes in position can produce significant differences in the level produced by the actuator system.

    The actual level produced by the electrostatic calibration system is not important, only that it produces the same reference level each time.

Example

The level produced by the actuator is calculated from dB = (10 x I) – 10 for an instrument with the range of 34-104dB, i.e. an output current of 8.75mA corresponds to an actuator level of 77.5 dB(A)

Barometric pressure and outside temperature will have small effects on the actuator level and so small variations up to 0.5dB are not uncommon between day and night conditions or between low and high pressure days.

Specifications

Current Loop Output:	See the Factory Configuration Information sheet
Minimum loop voltage	+10V
Maximum loop voltage	+30V
External Power	See the Factory Configuration Information sheet

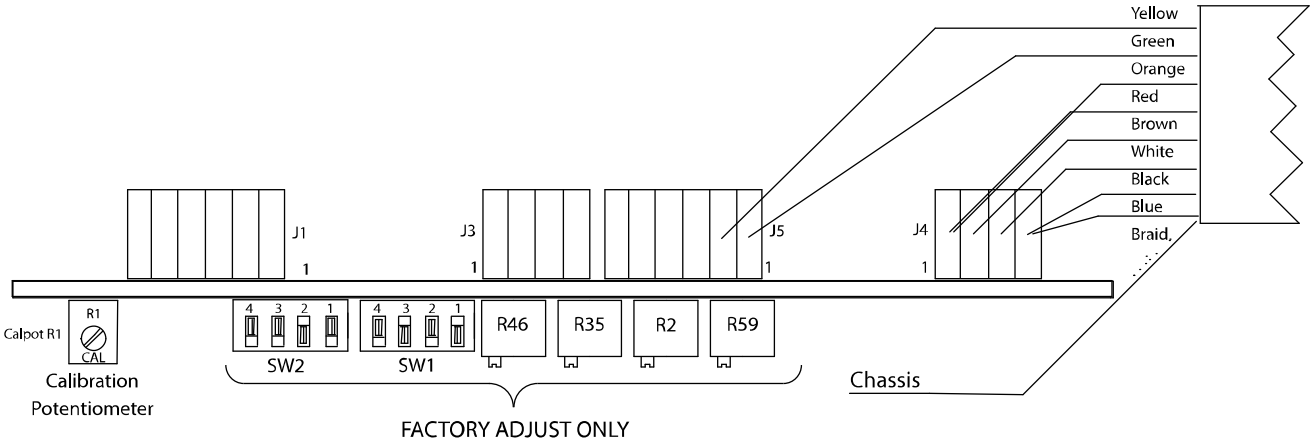
Optional Extras

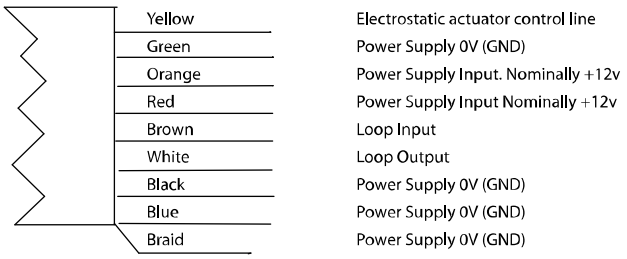
Winter Windshield:	WS:73
Wall mounting Kit:	CM:427

Appendix 1 Internal wiring connections

Please note that the position of the following potentiometers and switches in the diagram below are for **indication only** and may be different on a specific MK:427 unit depending upon the configuration of the unit:

R59, R2, R35, R46, SW1, SW2, R1





Cable Connections

Yellow	Electrostatic actuator control line
Green	Power Supply 0V (GND)
Orange	Power Supply Input. Nominally +12v
Red	Power Supply Input Nominally +12v
Brown	Loop Input
White	Loop Output
Black	Power Supply 0V (GND)
Blue	Power Supply 0V (GND)
Braid	Power Supply 0V (GND)

Appendix 2 DC Voltage output option

To convert the 4-20mA output current to a DC voltage output, connect LOOPOUT to the Loop Power Input Ground via a 100ohm resistor for a voltage across the resistor of 10mV/dB.

Appendix 3 The influence of the background noise level on calibration and verification

High background noise levels can affect the calibration of any noise measurement system.

It is recommended that both the routine verification and reference calibration are carried out in environments where the ambient noise level is more than 15dB below that of the calibration level.

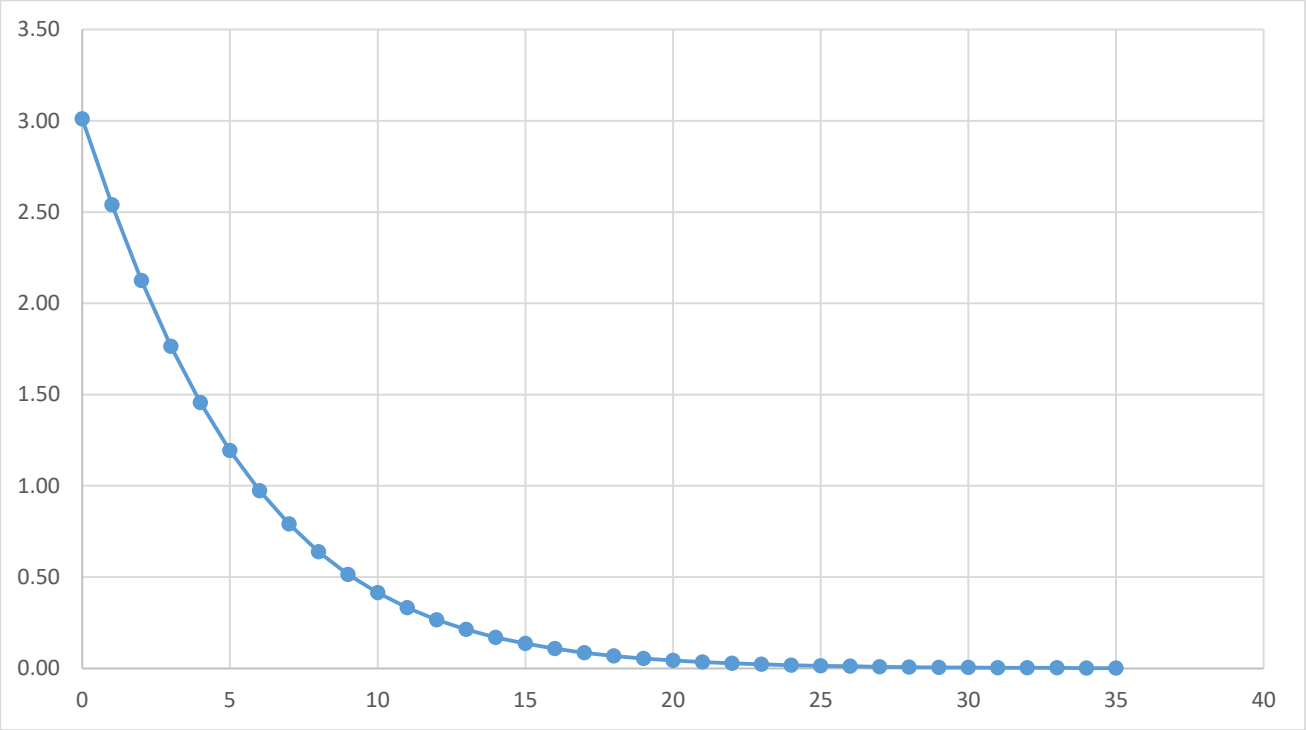
The electrostatic actuation system will typically produce a level between 85dB and 95dB. To ensure that the routine verification and reference calibration can be carried out successfully, it is recommended that these are done in environments where the ambient noise level is less than **70dB(A)**

As an example, if the electrostatic actuation system is generating a level of 90dB and the ambient level is 85dB, the resulting level will be 91.1dB. It is also likely that the background noise level will vary and so this will result in an unstable output level.

If the electrostatic actuation system is generating a level of 85dB and the background noise level is 75dB, the resulting level will be 85.4dB.

If the electrostatic actuation system is generating a level of 85dB and the background noise level is 70dB, the resulting level will be 85.1dB.

The chart below shows difference between two noise levels across the x axis and on the y axis the level that should be added to the higher value. This shows the effect of the background noise upon the calibration level. As the difference reaches 15dB, the effect becomes insignificant.



Appendix 2 CE Declaration of Conformity

Cirrus Research plc Hunmanby UK
CE Certificate of Conformity

CE

Manufacturer: Cirrus Research plc
Acoustic House, Bridlington Road
Hunmanby, North Yorkshire, YO14 0PH
United Kingdom
Telephone +44 1723 891655

Equipment Description

The following equipment manufactured after 1st January 2009

MK:427 Environmental Noise Microphone

Along with standard accessories

According to EMC Directives 89/336/EEC and 93/98/EEC

meet the following standards

EN 61000-6-3 (2001)

EMC : Generic emission standard for residential, commercial and light industrial environments.

EN 61000-6-1 (2001)

EMC : Generic immunity standard for residential, commercial and light industrial environments.

Signed Dated 1st January 2009

S. O'Rourke
Director

Warranty Information.

1. This document is a summary of the full warranty document and explains the Cirrus Research plc warranty in ordinary English; not in legal or complex terms.
2. The warranty covers any acoustic instrument such as a sound level meter, acoustic calibrator, real time acoustic analyser or personal sound exposure meter (dosemeter) manufactured by Cirrus Research plc after September 1st 2011.
3. The warranty covers all faults on, and minor accidental damage to, the instrument except the microphone capsule for the period defined in para (5) below.
4. Minor accidental damage does not include blatant miss-use, damage caused by the use of any accessories or components not specified or recommended by Cirrus, damage caused through non-Cirrus modification, continued use outside of Cirrus' recommended procedure or conditions or use contrary to the any advice provided by Cirrus.
5. The initial period of the warranty is 2 (two) years or 104 weeks from the date of purchase as a new instrument from Cirrus Research plc or their formally approved distributors OR 130 weeks from the date the instrument passed its final manufacturing inspection at Cirrus Research plc - whichever is the shorter.
6. A shorter 1 (one) year or 52 week warranty is offered for used, ex-demo or ex-rental equipment unless a special arrangement is made and a written confirmation of the special warranty is given by Cirrus Research plc.
7. Any rechargeable battery only has the battery manufacturer's one year warranty, however there will be a reduced charge for their replacement during the annual "Traceable Calibration."
8. On completion of the annual "Traceable Calibration" by Cirrus Research plc, or an official Cirrus Calibration Centre, the instrument will automatically be given an additional free one year warranty.
9. It follows that should the instrument be calibrated by Cirrus Research plc, or an official Cirrus Calibration Centre every year, the warranty is effectively continuous to a maximum of 15 (fifteen) years from the date of purchase.
10. There will be a charge for this "Traceable Calibration" and the price is published in the Calibration Price List. The customer is responsible for all shipping, duty and other charges relating to the annual "Traceable Calibration".
11. Where a repair service is conducted under warranty, Cirrus Research plc will cover the shipping, duty and other costs relating to the repair of the instrument.
12. Cirrus Research endeavors to ensure stocks of instrument components for the full fifteen year period but do not guarantee to do so as certain components do become obsolete or discontinued.
13. If a sub-component becomes obsolete and stocks are depleted then Cirrus Research will endeavor to facilitate a repair but will not offer the same length warranty.
14. In the event of any dispute on the terms of the warranty Cirrus Research plc will accept pendulum arbitration by the United Kingdom Institute of Acoustics Ltd.
15. The warranty does not in any way reduce any legal right of the buyer or user of the sound level meter; it is in addition to all legal rights determined by the European Union.
16. Cirrus Research plc reserves the right to amend or update these terms and conditions without prior notice.

Warranty Terms 2.5 May 2012

Cirrus Research Offices

The addresses given below are the Cirrus Research plc offices. Cirrus Research plc also have approved distributors and agents is many countries worldwide. For details of your local representative, please contact Cirrus Research plc at the address below. Contact details for Cirrus Research authorised distributors and agents are also available from the Internet Web site at the address shown below.

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