MK:427 Environmental Noise Microphone
Revision 8

Produced by Cirrus Environmental, 28B Priestgate, Peterborough, PE1 1JA

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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. There are DIP switches and adjustment potentiometers that are visible on the circuit board.

These should not be altered or adjusted without first contacting Cirrus Environmental or your local authorised distributor. Altering these settings can affect the calibration and operation of the unit.

Calpot R1 is referred to in the Reference Calibration section on page 15. 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 13, Verification & calibration of the MK:427

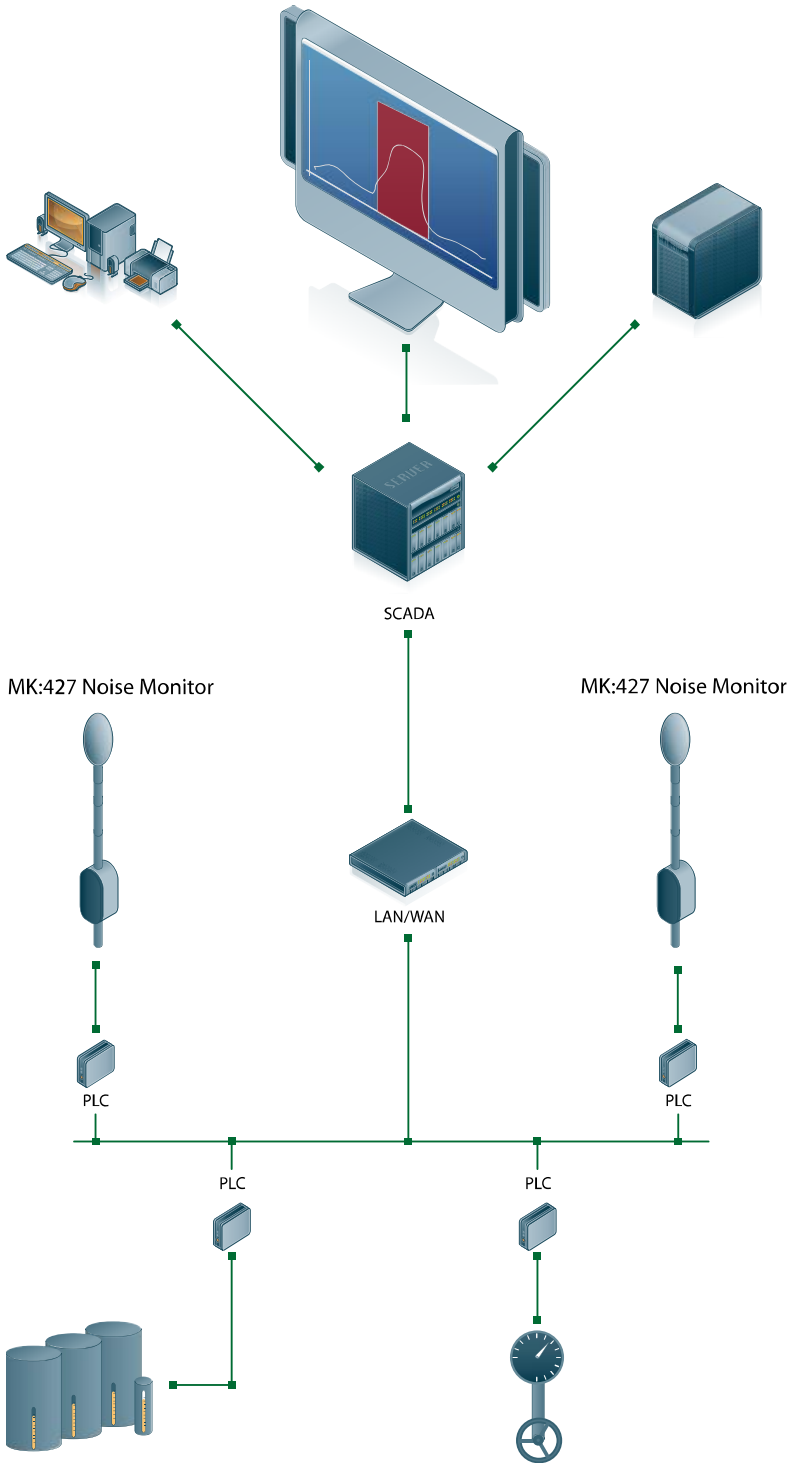
Stage 3

Install the MK:427 externally in a suitable site.

See Page 8, Mounting Information
See Page 10, 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.

Please note that altering the range or time weighting will invalidate the calibration certificate originally supplied with the equipment.

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 13 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 weighting for 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, a current of 7.23mA would represent a noise level, L_A, of 62.3dB(A).

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

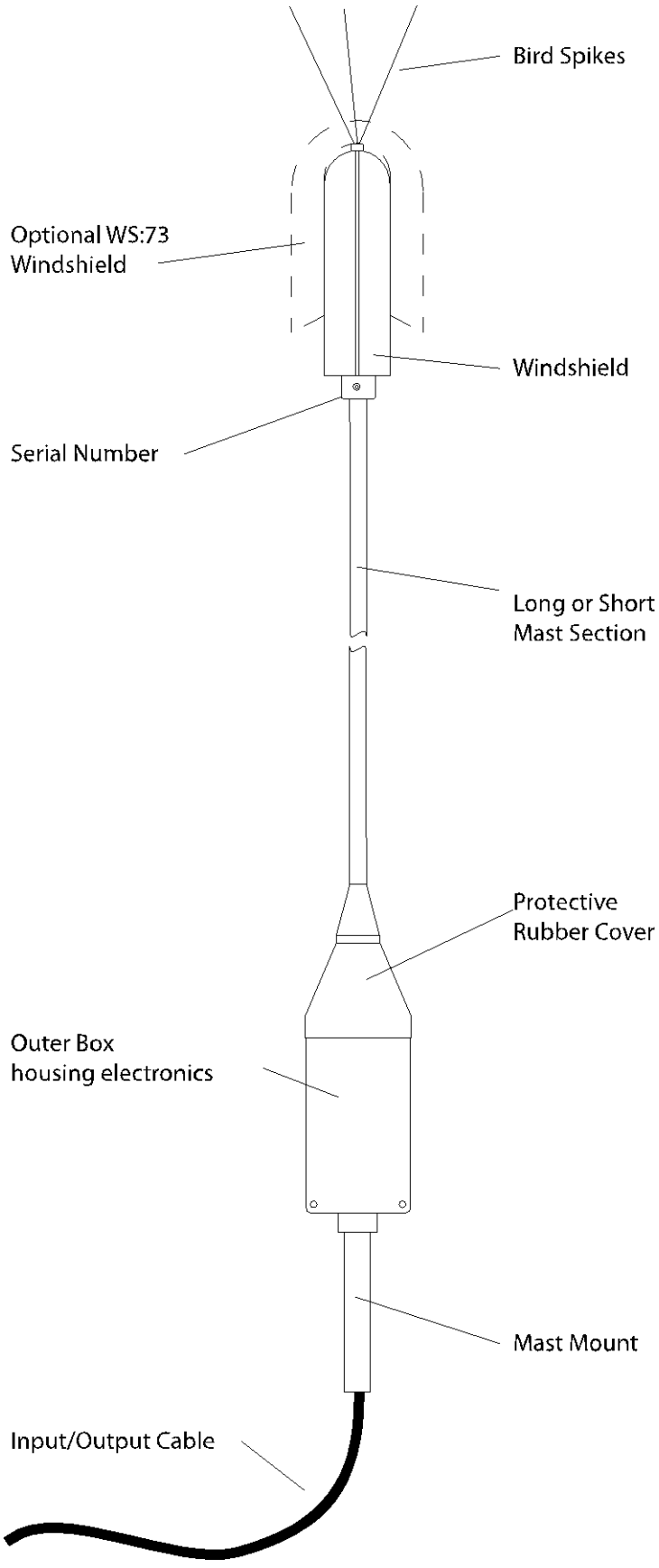
dB(A) = 72.3 – 10

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.commailto:support@cirrus-environmental.com

MK:427 Microphone Unit System Diagram



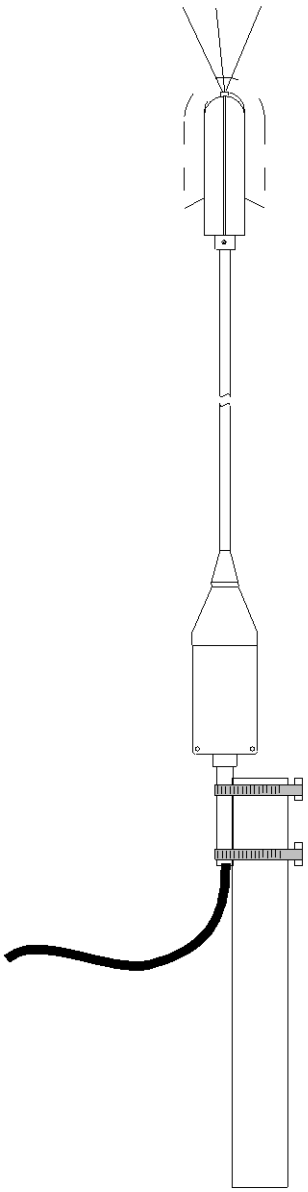
Mounting Information

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

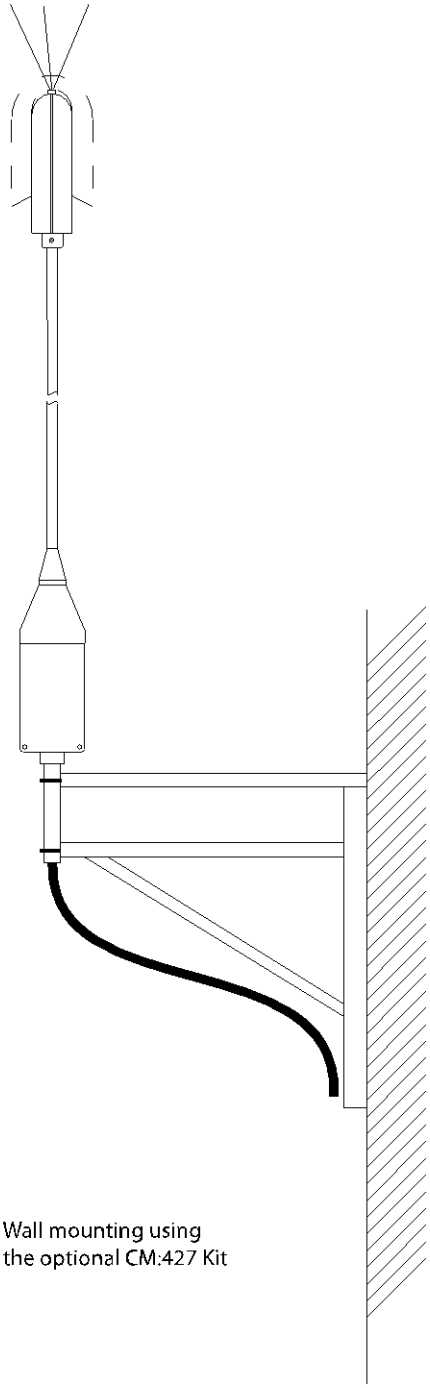
3 x Jubilee clips
2 x U-Bolts with washers & nuts

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

Examples of mountings



Jubilee Clips to secure MK:427
to an existing post or mast



Wall mounting using
the optional CM:427 Kit

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

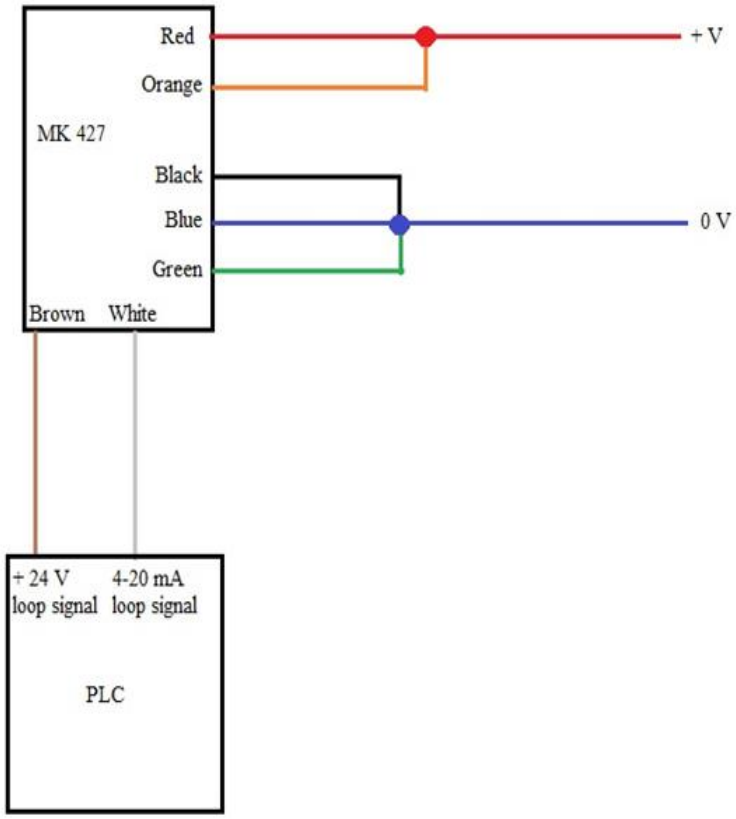
White:	Loop output
Brown:	Loop input

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 this cable is replaced, 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 15.

Please also refer to the section on page 21, **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.

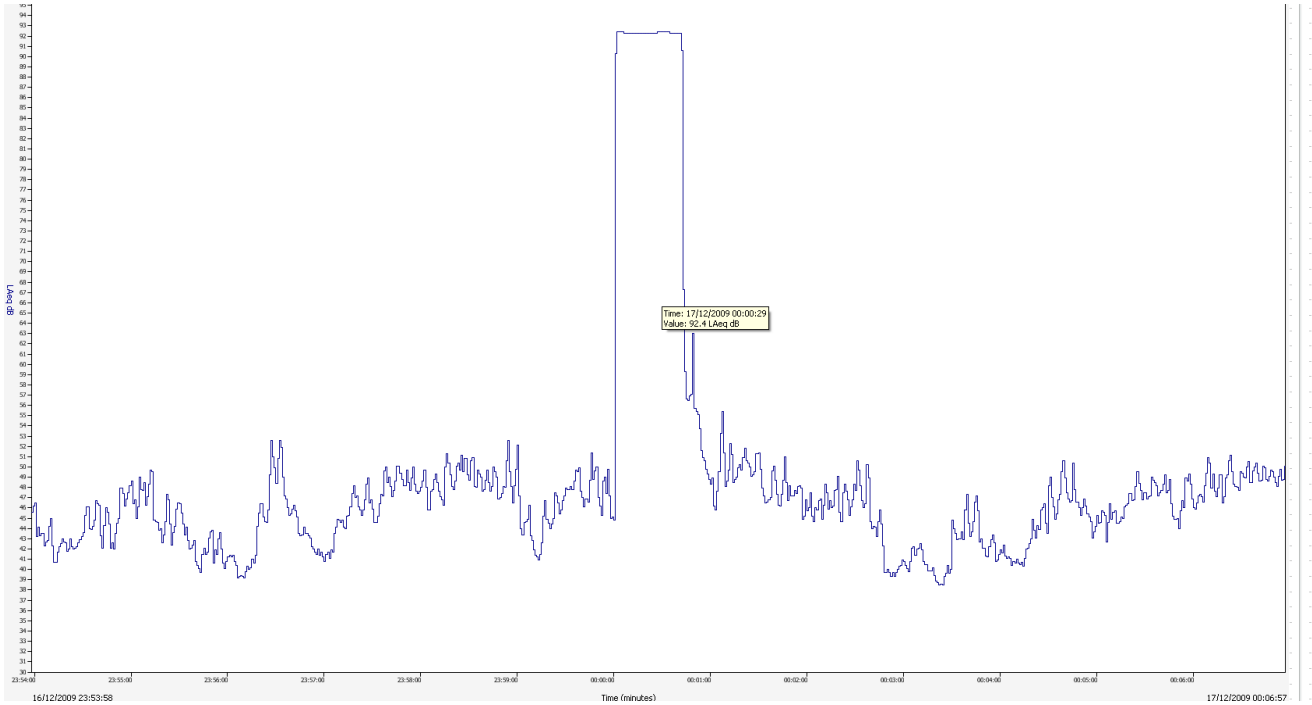
If the level has varied to a level that is unacceptable for your application you should program a correction using your data logging/software system to compensate for this difference.

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.



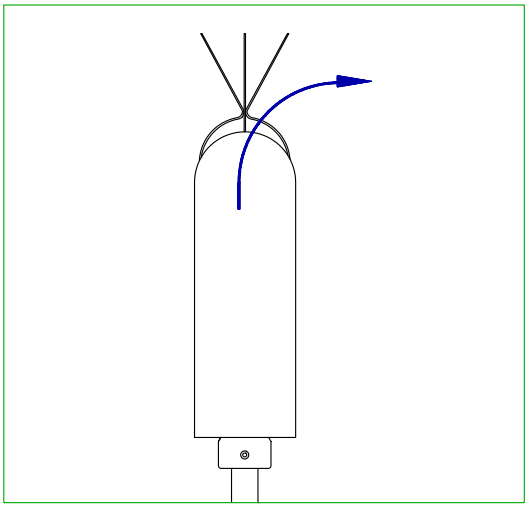
Reference Calibration

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.

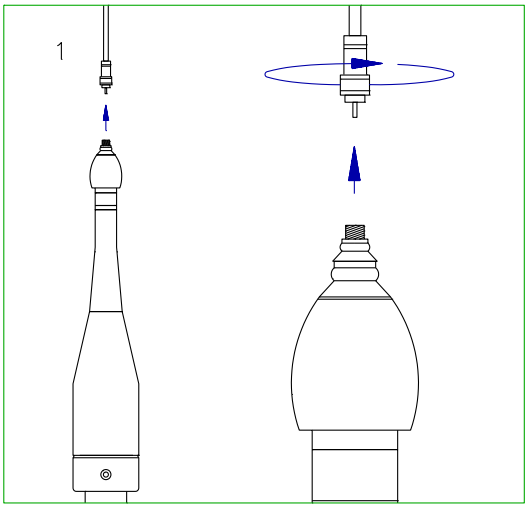
Please note that this procedure should not be carried out unless the overall calibration of the system needs to be verified and is included in this manual for reference only.

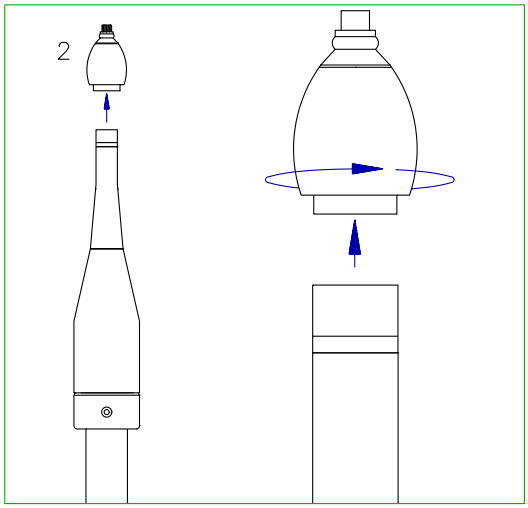
To create a reference calibration follow the steps below:

1. Remove the Windshield from the microphone unit.



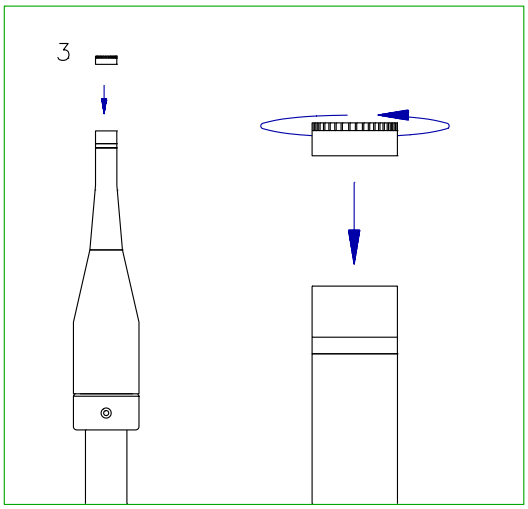
2. Carefully unscrew the electrostatic actuator unit from the microphone capsule



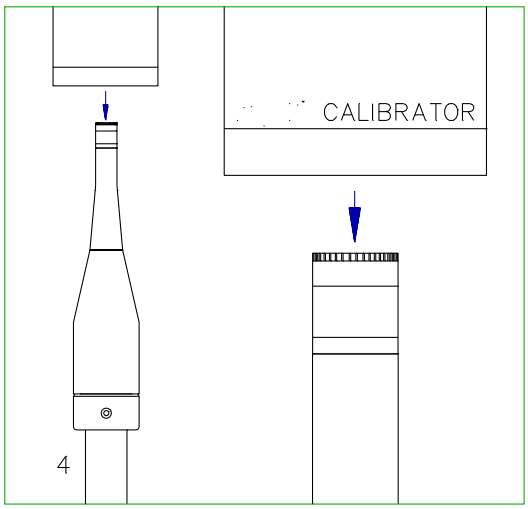


Care must be taken at this step as the diaphragm of the microphone capsule will be exposed and is easily damaged.

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.

11. 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

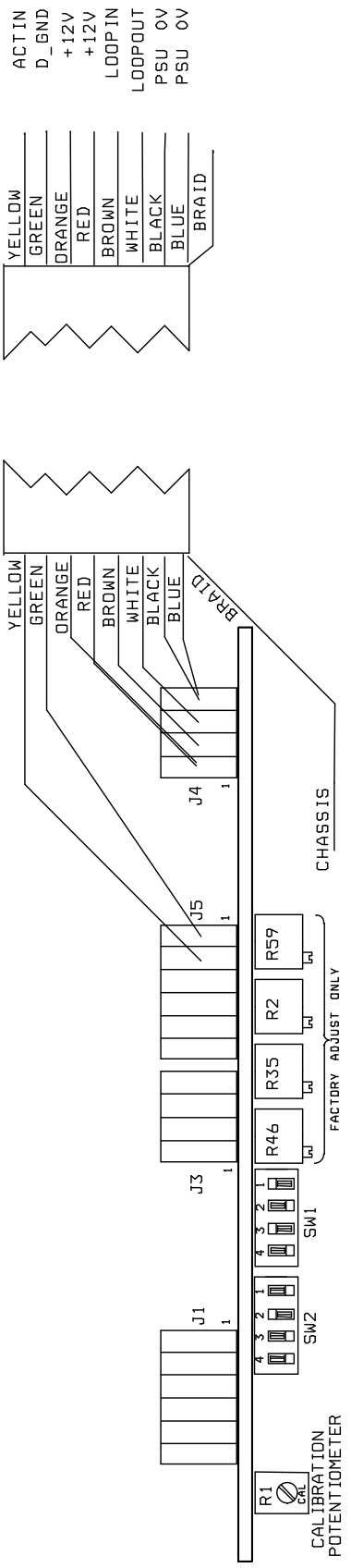
Appendix 1 Internal wiring connections

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.

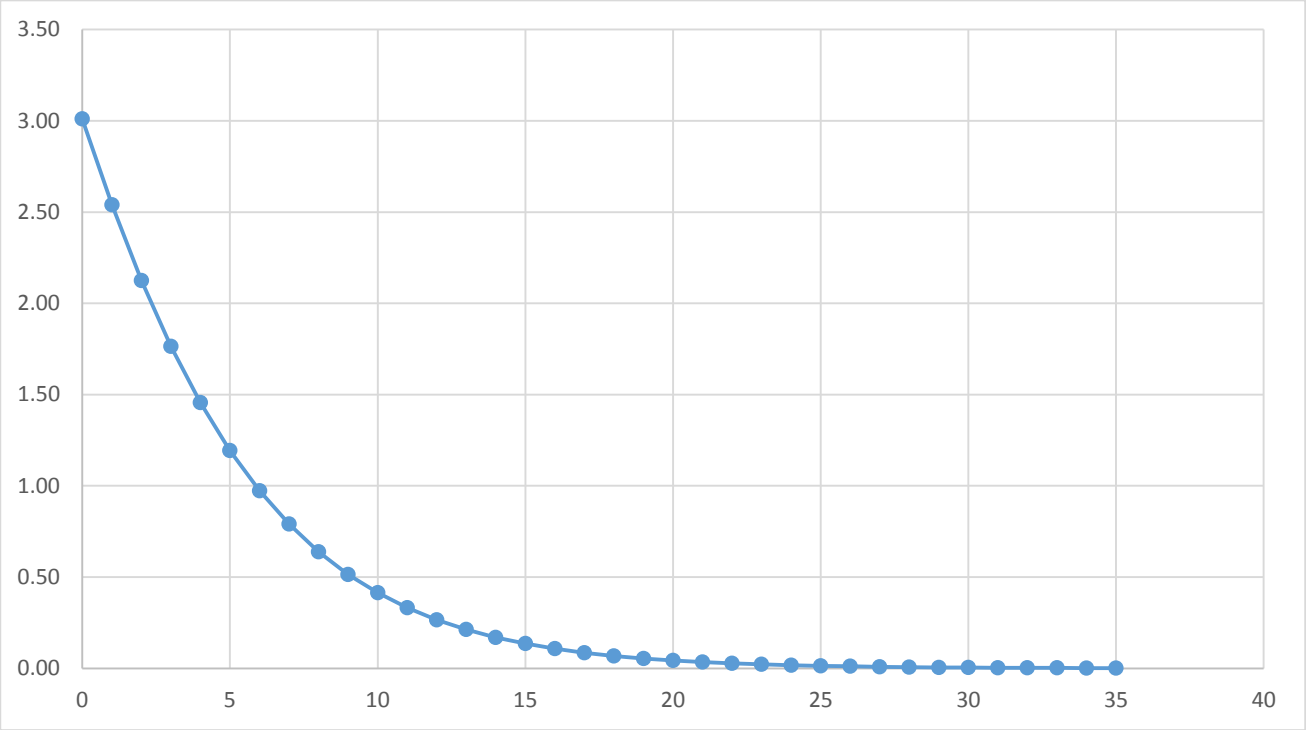
The electrostatic actuation system will typically produce a level between 85dB and 95dB. To ensure that the routine verification and reference calibration can be carried out successfully, it is recommended that these are done in environments where the ambient noise level is less than 70dB(A)

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 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 4 CE Declaration of Conformity

Acoustic Instruments International, Hunmanby UK
CE Certificate of Conformity

CE

Manufacturer: Acoustic Instruments International
Unit 2 Bridlington Road Industrial Estate
Hunmanby, North Yorkshire, YO14 0PH
United Kingdom
Telephone +44 1723 891722

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

Cirrus Environmental

Cirrus Environmental
28B Priestgate
Peterborough
PE1 1JA
United Kingdom

Tel:	01733 667100 +44 1733 667100
Fax:	+44 1733 667101
Email:	sales@cirrus-environmental.com
	support@cirrus-environmental.com
Web:	www.cirrus-environmental.com

Acoustic Instruments International trading as Cirrus Environmental.