Delta V ECM

Part Number 201-042

Instruction Handbook

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AUDIOTEL

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Preface

To the user!

Thank you for buying Delta V ECM. The operating manual will enable you to get the best out of your Delta V ECM Differential Transmitter Locator

If you have any questions regarding the satisfactory operation of your unit please do not hesitate to contact us direct or alternatively your local agent or supplier.

Should you be visiting our area and can spare an hour or so we will be pleased to meet you and show you our manufacturing and product development site.

Audiotel International prides itself on its after sales service and care. Our address, telephone, telex and fax details are at the front of this manual. I will be delighted to receive any comments you may have regarding our products and services.

Andrew Martin - Managing Director
12 November 1991

Introduction

Delta V ECM is the latest in the series of differential RF field strength detectors from Audiotel. The advantages of this technique lie in the high degree of rejection of distant signal sources regardless of strength. This is achieved by measuring the rate of change in field strength rather than its absolute strength. This technique gives greater discrimination against outside signals so that the transmitting source can be located with considerable accuracy. Delta V ECM is ideal for locating radio bugs, basic RFI/EMC testing and for localising high power illegal broadcast transmitters. Whilst the main application of Delta V ECM is as a stand alone detector and locator it is also an excellent accessory for a spectrum analyser or countermeasures receiver or non linear junction detector where its excellent search characteristics and portability give an operational advantage.

New Features

Much improved high frequency response. Measured response is uniform to 4.2GHz.

Delta V ECM has passive front end for better dynamic range and common mode rejection

Greater dynamic range of click rate indicator

High impedance input gives improvement in pick-up sensitivity

Reduced power consumption

Equipment

Delta V ECM unit
Carrying Case
Pouch
Rod Antennae, nominal 100 mm, 2 supplied
Earphone with 3.6mm Jack Plug
PP3 Alkaline Battery
Spare Battery Connector

Installing the Battery

On the underside of the Delta V ECM is a 'coin-operated' screw which retains the battery cover. Remove the screw to release the cover. You will see the screw has a serrated washer which ensures good electrical contact between the cover and the rest of the chassis. The washer should always be fitted when replacing the screw.

Ensure the unit is switched off as electrical components will be damaged if the battery is connected, even momentarily, incorrectly.

Clip the battery lead onto the new battery and replace the cover and finger-tighten the 'coin-operated' screw. It is not necessary to tighten the screw using a coin, the end of a finger can provide sufficient torque. Avoid over-tightening. Always use good quality Alkaline type batteries.

If the battery lead should fail the lead can be easily removed by gently pulling the plug out of the socket. It is most important to ensure that the new lead is fitted correctly. The red wire on the plug must be furthermost from the battery space.

Basic Operation

The knob on the end panel is a combined ON/OFF and volume control. The unit is off when fully anticlockwise. Rotate clockwise to turn on and adjust the volume to suit. About 10 seconds after switch-on the unit will have settled and the click rate should be very low or absent altogether (although this depends on whether antennae are connected and the level of local radio signals). Before fitting the earpiece provided or other earphones reduce the volume control. Inductive earpiece sets can be used.

If the 'POWER' Light Emitting Diode (LED) does not illuminate then the battery should be changed. If the LED extinguishes during a search the unit can be used for roughly another hour.

Connection of one antenna only (to either socket) provides monopole operation with the unit indicating the absolute radio signal strength level. This typically gives the greatest sensitivity.

When both antennae are connected the unit responds to the gradient of the local radio signal strength and therefore tends to reject signals from distant signals whose local gradient is nearly zero.

Users will develop their own search techniques. One method is to start with one antennae to get a 'feel' for the area and then connect the second antennae to investigate any suspicious results.

Search Techniques

Delta V ECM responds to radio signals by emitting a click whose repetition rate varies with field strength (one antenna connected) or with the rate of change (gradient) in field strength (both antennae connected). From its lowest rate (typically no clicks) to its maximum rate the input power variation is over 55dB. In general the click rate will increase as the transmission source is approached.

Under some conditions peak readings will occur away from the source due to reflections particularly caused by metallic objects. The strongest response will always be at the signal source.

When approaching the signal source there will be wide variations in click rate caused in some orientations by the signal strength being equal or nearly equal at both antennae.

Effective sensitivity is a function of the throroughness of the search and this requires that the Delta V ECM is moved as close as is practical to potential transmission sources. The distance between the Delta V ECM and a source at which it becomes obvious that there is a local transmission depends not only on the power output of the source but also on the strength of other, more distant, sources. Use of both antennae helps reduce the effect of distant sources.

If a powerful source is being located then the click rate may reach a maximum before the source is reached. To reduce the sensitivity across a wide frequency range fit SMA in-line attenuators (available to order).

For location of very low powered sources in environments with low background signal strength an external signal amplifier can be added. (Available to order early 1992.)

Taking Care of Delta V ECM

Points to remember are:

Always turn the unit off before changing the battery and ensure that the polarity is correct. Avoid straining the battery leads. If the unit is not to be used for long periods remove the battery (contact the battery manufacturer if the unit is damaged by a leaking battery)

Do not allow the unit to be immersed or splashed in water or other liquids or contaminants, consult your supplier if this should occur. Operation in humid environments may cause condensation which will result in faulty operation. Allow the unit to dry before re-use

If you need to return the unit for servicing contact the dealer or manufacturer before sending the equipment. When sending ensure that the equipment is adequately packed for transit

Static electrical discharge through the unit will damage components resulting in reduced performance - avoid touching objects with the antennae

If you connect test equipment do not exceed 9 VDC input to the battery contacts, do not apply DC to the antennae inputs and do not apply more

than 200 milliwatts continuous or pulsed RF energy at 25 degrees Centigrade. Derate to 0 W at 150 deg. C above this temperature

The outside of the unit can be cleaned with a water-dampened cloth. Use of polishes or other cleansers is not recommended

Calibration

There is a single internal control - a potentiometer accessible with the battery cover removed. Correct setting is when the click rate is minimised for no signal input. Where the click rate goes to zero the control should be set midway between the two positions where clicks are first heard. A suitable trimming tool must be used and care must be taken to avoid damaging the control.

Principles of Operation

The antennae are connected via high frequency SMA connectors to a pair of matched Schottky barrier diode detectors. The output from the detectors is amplified by a low noise, wide dynamic range DC logarithmic amplifier with automatic drift and offset cancelling. A following logarith-

mic amplifier feeds a precision rectifier to produce a DC voltage proportional to the differential input signal strength. This drives a Geiger type click generator giving a rising tone indication of the location of the hidden transmitter.

With both antennae connected Delta V ECM measures the gradient in the local electromagnetic field between its two antennae rather than the absolute value which is given by a monopole detector. The differential detector in Delta V ECM when compared with a monopole detector discriminates in favour of a transmitter that is nearer.

In free space the magnitude of the electromagnetic field from an isotropic source is given by:

$S = C/r$ where r is the distance from the source and C is a factor that varies only with the strength of the source.

The gradient of the field is:

$$\Delta S = -C/r^2$$

In other words the gradient falls off at a rate proportional to the inverse square of the distance from the source. In practice, the fields from transmitters do not fall off as they would in free space. However, the field strength still diminishes with

distance and the gradient therefore falls off at a greater rate. A differential detector is thus better able to detect a local low power transmitter in the presence of a nearby strong signal source.

Accessories

Accessories to extend the performance and scope of the Delta V ECM will become available early 1992. These include a 25dB gain amplifier with upper frequency exceeding 2 GHz. Special accessories such as filters can be made to special order. SMA attenuators are available to order now.

Specifications

Detection Method
Differential Electromagnetic Field measurement discriminating in favour of local transmitters

Detection Capability
All transmitter types

Measured frequency response
+/- 5dB 10MHz to beyond 4200MHz

Sensitivity
Average -53dBm

Dynamic range
Greater than 50dB, typically -52dBm to +5dBm at 1GHz

Power source
Alkaline 9V PP3 giving 24 hours continuous operation.

Size
122mm x 62mm x 22mm

Weight
245g