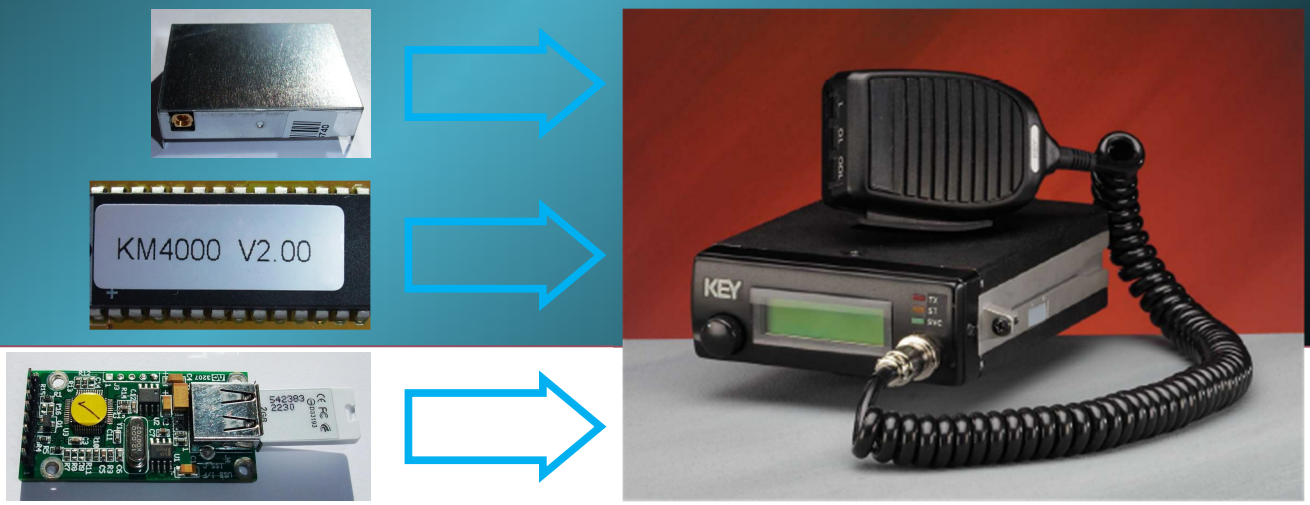
KM4000 Mobile Radio Applications and Features



Single hardware platform for multiple Voice and Data Communications Solutions

- Voice
- Telemetry
- Packet data
- Vehicle and Asset Tracking
- Real Time Information (RTI)
- Vehicle Life Monitoring (VLM)
- Wireless Public Address
- Wireless Security
- Wireless Signage
- Internal data processing

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Index

1. Introduction

Radio Systems, as manufacturer of the Key range of radio equipment, combines in house development expertise with a customer responsive commercial approach. This has inevitably given rise to a range of variants for a number of core products, each fulfilling an exact customer specification.

We are now pleased to announce that for the first time, multiple functionality has been made available, as a number of options, within a single unit. This makes for a cost effective solution, where all immediate requirements can be included but clearly defined future upgrade paths exist without hardware redundancy or financial waste.

The first fleet of two hundred and fifty vehicles that incorporates all features from new is in operational service with a major UK Utility. The primary purposes of the deployment are to improve operational efficiency and save cost, thereby giving a complete return on capital in a short space of time, well within the life of the equipment.

The KM4000 product is based upon tried and tested MPT1327 technology and incorporates voice and data facilities that are unrivalled in a single unit.

Although the KM4000 product is fully MPT1327 compliant and will operate on any manufacture of standard MPT1327 infrastructure, its feature rich potential will always be best exploited when part of the Radio Systems Keynet infrastructure.

2. Hardware Profiles

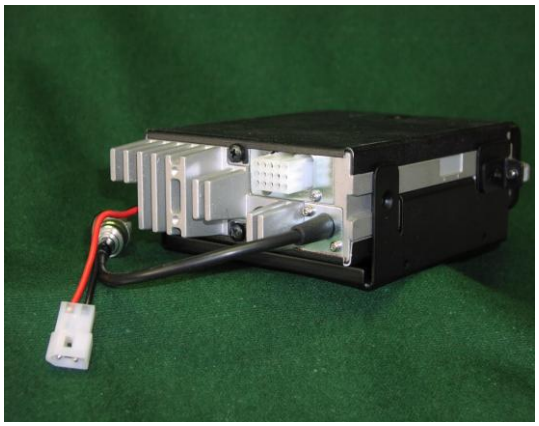
The KM4000 consists of a cast chassis containing radio, logic and optional function PCB's and then a range of front panel and rear interface options, both dictated by application. Illustrations are given of typical formats in some of the following sections.

3. Voice Applications

For voice applications, the KM4000 can either be driver accessible with microphone and speaker or remote from the driver with a handsfree kit. This latter configuration restricts tampering and vandalism, whilst at the same time improving Health and Safety whilst driving.

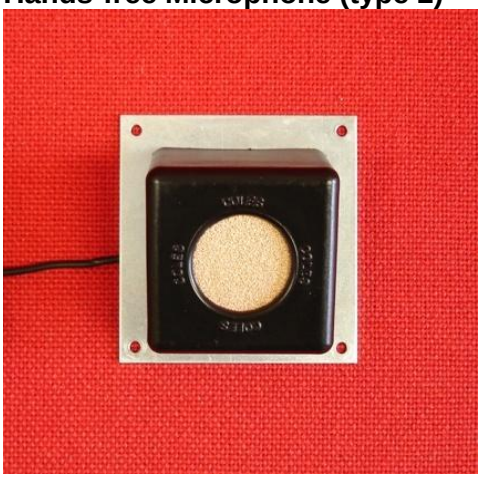
Voice using microphone and speaker

Rear View showing handsfree socket



Hands-free Microphone (type 1)

Hands-free Microphone (type 2)



Hands-free PTT

Footswitch PTT

Emergency Call - Panic Button

3.1 Emergency Voice – Eavesdropping Microphone

Both microphone and handsfree operation include Emergency Calling, which is a call initiated by a single button press to alert Control that the driver is in an Emergency situation.

In the case of Public Service vehicles, which for Health and Safety reasons will be equipped with handsfree, it could be the driver is under duress and a KM4000 feature is 'Eavesdropping Microphone'. Once an Emergency Call is initiated, the microphone stays open without the driver depressing the PTT or send footswitch and Control can overhear in cab conversations.

Where the infrastructure is Radio Systems Keynet and Control has a Keynet Computer Aided Despatcher, in cab conversations can be recorded for evidential purposes.

4. Text Messaging

The KM4000 being MPT1327 compliant has facilities for two way text messaging. In common with other mobile radio devices, it does not have an alphanumeric keypad and short text messages are preprogrammed into the KM4000 memory and selected by simple microphone keypad actions.

Typical are these. Status 1 – Mobile
Status 2 – Arrived
Status 3 – Lunch
Status 4 – Breakdown

Where the infrastructure is Radio Systems Keynet and Control has a Keynet Computer Aided Despatcher, free form text can be sent to the KM4000 and the message received is displayed on any suitable device connected to a serial port.

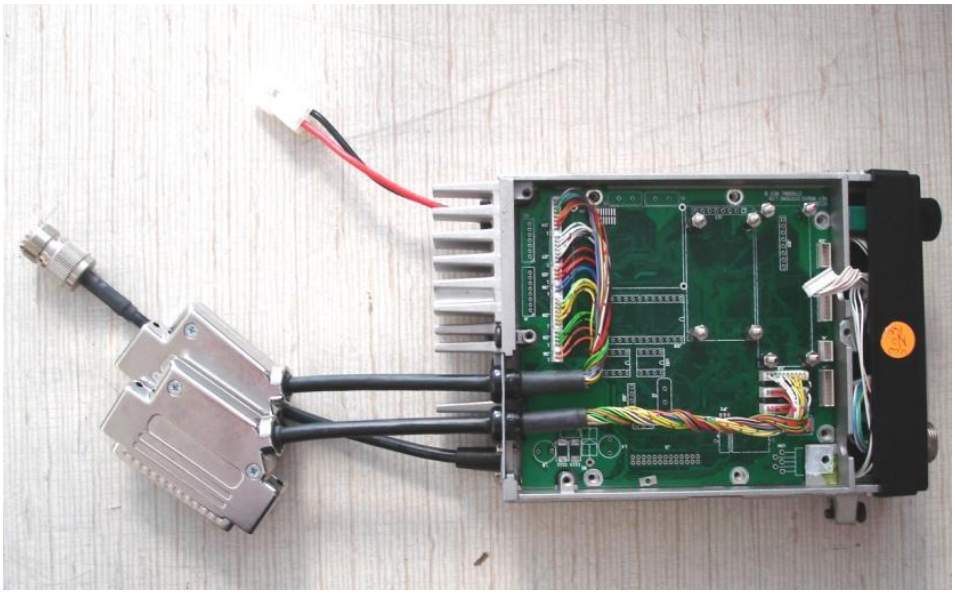
5. Telemetry Applications

The KM4000 is equipped for telemetry applications as standard.
It has eight analogue inputs, eight digital inputs and four analogue outputs.
Typical usage of these is the monitoring and control of vehicle and plant functions in real time.

- Doors open/close operation and detect
- Pressure sensor
- Temperature sensor
- Liquid level sensor
- Valve open/close operation and detect

The Keynet Computer Aided Despatcher can provide the user interface to initiate telemetry commands, monitor telemetry activity and archive all telemetry transactions.

KM4000 hardware variant showing 37way connectors for audio, external I/O, serial data and RS485 connectivity



6. Packet Data

Section 5, telemetry, describes the control and monitoring of a remote devices limited number of states.

Where a more comprehensive information exchange is required to and from remote devices the next step is packet data. This method differs from high speed data streams in that small amounts of information are exchanged but at fast polling rates. Keynet fast polling with the KM4000 as the remote device can complete three hundred packet data transactions per minute on a single data channel.

A typical use of this technique is in Real Time Information, section 8, where data packets contain GPS data, appended with ancillary data bits.

In pure telemetry terms Key mobiles are distributed across three Regional Electricity Companies in the UK to monitor and control thousands of substations and switchgear. The Radio Systems in house software development capabilities have meant that a series of industry standard software modules is available to load into the KM4000 to enable direct interfacing to electricity Remote Termination Units (RTU's).

7. Vehicle and Asset Tracking

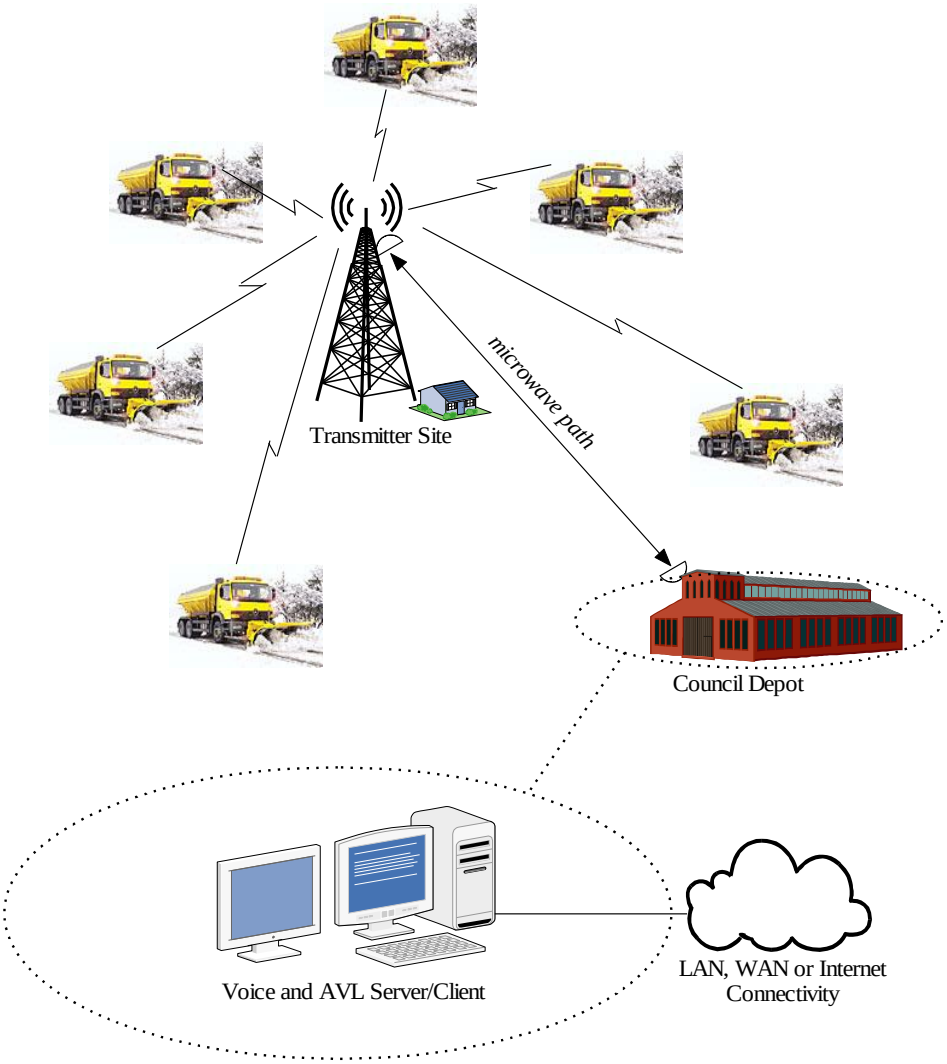
Most people are familiar with Sat Nav systems that use GPS data to fix a moving objects position and display it locally on a map.

The same principles are used commercially, except that the positional data is transmitted back to a central database where multiple vehicle positions are displayed on a PC mapping package.

Radio Systems Keynet, Keynet AVL (Automatic Vehicle Location) Computer Aided Despatcher and the KM4000 form a widely used method of achieving this.

The added advantage in addition to proven technology is that the KM4000 has an internal GPS option for initial or retro fit and does not require any external device other than a GPS antenna.

KM4000 Internal GPS Module



Typical Single Site Voice/AVL/Telemetry System for Gritters

8. Real Time Information

An extension of section 6, Packet Data is Real Time Information (RTI). As the name suggests this is the gathering of information in real time, most widely employed in Public Transport in the UK.

Here, to improve services for the public and to measure schedule adherence, bus positions are monitored every thirty seconds and compared to timetable databases to result in a variance that is used to update street text displays, showing next arrival(s).

Keynet and Key mobiles dominate the data radio bearer market in the UK. Deployment extends to over fifty Keynet sites and seven thousand buses. Over ten million data transactions per day are conducted using Keynet and Key mobiles.

9. Vehicle Life Monitoring (VLM)

The age of the automotive Black Box has arrived with the KM4000 VLM variant. It consists of a vehicle or asset mounted KM4000 and one of a range of back office software packages running on a standard Windows platform.

The concept is that the KM4000 VLM will record a vehicles position, speed and heading every five seconds, using GPS technology and archive the data on a standard USB stick. The archive capacity is approximately five years of vehicle movements without the need to change the stick. The KM4000 remains fully voice and data enabled, as described in other sections of this document but with a USB pcb installed, has this additional VLM feature.

KM4000 USB PCB

Software packages are modular to suit a variety of end user focuses. A Fleet Manager might be interested in daily distances travelled, service interval alerts, tyre wear etc. VLM will add a further element to Tachograph records. Courier companies could well have real time reporting of collection and deliveries but VLM will supplement this data to archive routes travelled and any significant stops between collection and delivery points.

The KM4000 VLM can be fitted to any vehicle, including cars, vans, lorries, tractor units, powered farm machinery, powered yellow plant, motorcycles, in fact any piece of equipment that has battery power, even down to parks maintenance machinery.

An important feature is wherever GPS fixes are available, regardless of radio coverage to report back to Control, the USB stick continues to record data. This means that if for instance a vehicle with London radio coverage travels to Birmingham and back, all route, distance, starts, stops, etc are recorded and time stamped.

The KM4000 configuration can be that it downloads the stored data when returning to radio coverage, in a controlled manner, or the USB stick can be removed and downloaded into a PC through a USB port. Suitable PC packages are available for forensic analysis that will map and interpret the data.

Typical applications include the following

- **Tracking** - in and out of radio coverage
- **Road Traffic Accidents** – location, speed, direction immediately before RTA
- **Fleet Management** – all authorised and non authorised activity recorded. Tachograph and Odometer backup.
- **Recovered Stolen vehicles or yellow plant** – (covert installation) all activity recorded since theft, pointing to location of thieves

10. KM4000 Wireless Security

With the GPS module fitted, other standard features within the KM4000 can be combined to make a powerful anti theft device, whilst again retaining all operational voice and data features.

The standard features engaged are a trembler switch, ignition sense, ring fencing software and optionally the I/O telemetry interface for alerts at the vehicle as well as at Control.

Various configurations are available, examples of which are below.

- GPS position sent at power down.
- Trembler with programmable sensitivity to wake up mobile and send GPS position on activation
- Programmable ring fencing to alert vehicle movement beyond a preset radius.
- Silent alert to Control and/or output to vehicle sounder and/or lights.
- Control configurable autodialler to alert off site personnel via landline or mobile
- USB inclusion to record all events, whether in radio coverage or not.

A major UK Utility has two hundred and fifty vehicles and plant fitted with this configuration and within one month, a stolen JCB digger worth tens of thousands of pounds was tracked and recovered intact by the Police.

11. Wireless Signage and Voice Announcements (RS485 connectivity)

The KM4000 has two RS232 ports as standard but can also be equipped with an RS485 pcb. The RS485 port enables direct industry standard connection to any similarly equipped device.

A common KM4000 application is interconnection to ticket machines on buses, as part of Real Time Information installations. In addition, however, text displays can be driven by the KM4000 and prerecorded audio announcements triggered.

KM4000 RS485 PCB

12. Wireless Public Address

The KM4000 can be used as either a standalone wireless public address or as part of a hybrid wired and wireless system. KM4000 units are used to drive distributed PA amplifiers and can be fixed or mobile.

As with the KM4000 itself, PA configuration has to be commensurate with operational requirements to be cost effective and therefore a range of solutions is offered with increasing complexity.

12.1 Entry Level – PMR point to point

A KM4000 fixed mobile at control is the transmitter and another fixed mobile for the remote site has its receive audio connected to a PA amplifier. Usually a squelch line at the remote is used to key up the PA amp from standby. This stops spurious audio entering the PA amp and being broadcast over the speakers when no signal is being received.

12.2 Level 2 – PMR point to multipoint

This is as 1, above but a single transmitter is received by a number of remotes, each with its own PA amp. There is no zone selection, all remotes broadcast messages simultaneously.

12.3 Level 3 - PMR point to multipoint with manual selective call

The transmitter and remotes can be equipped with selective calling and the Controller then can select individual remotes to call. Static (pre-programmed) Groups can be included in numbering schemes.

12.4 Level 4 - PMR point to multipoint with PC control

As with 3 but a PC selects zones/groups. Usually used for large systems with multiple remotes. Pre-recorded messaging can be included. Outgoing calls are time stamped and logged. They can be recorded as well.

12.5 Levels 1 to 4

The range of these PMR systems can be increased by using a remote talkthrough Repeater.

12.6 Level 5 - MPT1327 point to multipoint manual ID selection

This requires usually a single reverting control channel. An MPT fixed mobile or handportable forms the transmitter and MPT fixed mobiles form the remotes. Operation is similar to 12.3 above. The big advantage of MPT is that it allows system element alarming, e.g. PA amp fail, speaker fail, psu fail, remote radio out of service.

12.7 Level 6 - MPT1327 point to point under PC control

This is similar to 4, above but alarms are monitored and recorded whilst there is a constant health check taking place. At this level groups are still static.

12.8 Level 7 - MPT1327 point to multipoint with Dynamic Grouping

This is as 12.7 but with a more sophisticated software packages. The Operator can assign Group or Zone membership per call.

12.9 Level 8 - MPT with Multipoint Access

Previous systems are all known as Single Point Access, as they have a single transmitter. Multipoint Access systems usually still have a main control but validate access from Muster Points for H & S fire purposes or even from handportables. Infrastructure would consist of more than one channel with a Management Terminal to validate access, for obvious reasons.

12.10 Levels 6, 7 and 8

An Operator friendly MMI is usual for the PC and bespoke touch screen monitors are the norm with user configurable button labels etc. These latter three configurations would normally form the wireless element of a hybrid wired/wireless system to enable full alarm reporting from the wireless to the wired system management function.

12.11 Voice Encryption

For security sensitive sites, a voice encryption pcb is available.

13. Internal Data Processing

Unlike the majority of radio devices on the market, the KM4000 design recognises that a whole variety of other equipment might be interfaced to it and that there could be a demand for an equally diverse range of applications. This is illustrated in the preceding sections where there is no requirement for external ‘interface units.’

The foundation of this principle is the fact that the KM4000 has been designed with excess processing power, which can be used for purposes external to pure radio functionality. Examples are protocol conversion to interface with electrical switchgear and local GPS geofencing.

This processing is available for any application and potential users are encouraged to approach Radio Systems in house development team to investigate the feasibility of any solution requiring remote data processing, combined with an over the air transaction to a control point.

14. Radio Systems Services

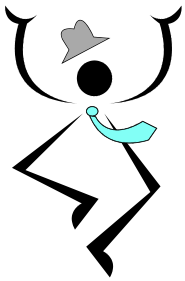
The success and effectiveness of any project is reliant upon a whole range of skills and no matter how good the building blocks of a system might be, without those essential skills, projects can still fail to deliver.

The Radio Systems team is qualified, experienced and moreover understands all the critical steps necessary for a first class delivery.

- Requirements capture and documentation
- Site surveys and propagation studies
- Feasibility studies
- Project Management and Budget Control
- Risk analysis and mitigation
- Preferred component procurement

- In house software and hardware development
- Component manufacturing facilities in ISO9000 environments
- Quality Management and Control
- Factory assembly of systems

- Originating and implementing Factory Acceptance Test Documentation
- Production of Method Statements and Risk Assessments
- Site preparation
- Site installation
- Site commissioning



- Originating and implementing Site Acceptance Test Documentation
- As Built document pack production
- Escrow Agreements
- Warranty
- Maintenance and Support contracts

15. Radio Systems Certification

Radio Systems adheres to all current UK and EU legislation has been certified by NQA and is regularly audited for continued compliance.

ISO9001 Quality Certification

OHSAS18001 Health and Safety Certification

ISO14001 Environmental Certification

Compliant with Waste Electrical and Electronic Equipment Regulations 2006

16. Contacts

The Radio Systems team is always ready to adopt a no obligation consultative sale approach.

For initial discussions, contact details are as below.

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