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Radio-over-IP Network Devices

- **RG Series RoIP Gateways (RoIP Interface Units)**
- **RG Series Radio Server**
- **RG Series Network Repeater**

» Further your two-way radio network - to your needs, budgets and schedule
» Maximise availability, utilisation and access across your network
» Respond quickly and decisively to unforeseen needs and situations
» Simplify administration and maintenance
» Safeguard investment and extend use of existing assets and infrastructure
» Be prepared for new applications

Contents

1. Introduction

Radio-over-IP (RoIP) allows us to connect radios and transport two-way radio communications over an IP-network. RoIP is essentially Voice over IP (VoIP) with Push-To-Talk (PTT), but with the ability to provide much more than simple two-way speech. With RoIP, users no longer need a physical radio to communicate via a radio network. An IP-enabled radio can be accessed from any where with access to an IP-network, be it from within an organisation's own intranet or via the internet. RoIP is by nature interoperable as radios are simply nodes on an IP-network, regardless of standard, frequency and RF-interface.

Radio over Internet Protocol sends analogue and digital 'radio payload' via IP-packets across a LAN or WAN. The sending node converts the payload into digital, organises the data into packets and sends these packets to the receiving node - much like goods in a shipping container. At the receiving end packets are reassembled into a constant flow of user data and as needed reproduced into an analogue signal. In a RoIP network, at least one node of a network is an IP-enabled radio: A radio in combination with an RoIP Interface Unit (RIU). The IP-Radio is the interface between IP-network (Internet) and the RF environment. The other nodes are typically an operator PC with a RoIP/VoIP based speech and control console, but can be basically any IP-capable device.

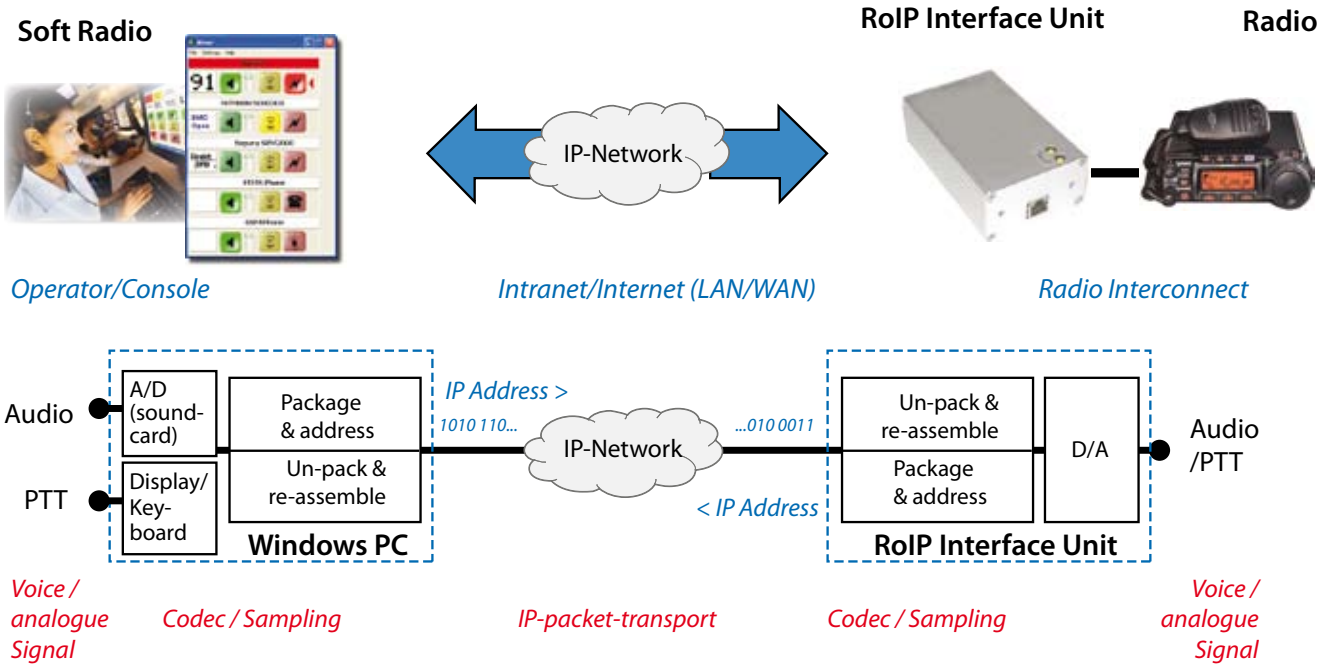


Figure 1. Basic Radio-over-IP Channel

The RoIP channel connects the operator to a remote radio via an IP-network and in turn via the radio to a mobile radio user. At the operator end SoftRadio, a Windows based RoIP/VoIP application provides the console and the interface between operator-PC and RoIP-Network. On the remote or radio side a dedicated RoIP/Radio Interface Unit (RIU) connects the radio to the IP-network.

To send from the operator, the SoftRadio on the PC converts the audio, PTT and any control signals to IP-compatible data and sends these to the IP-address of the remote RIU/Radio. This can include any applicable digital payload for the radio. The RIU then converts these back to the analogue and digital signals and formats required by the radio. Sending from the RIU to the operator is the same, simply in reverse. At the SoftRadio, the IP-packets are converted back into the payload and control content and displayed respectively reproduced into audio using the PC's sound card.

The key to building an efficient and effective RoIP Radio Network is the RoIP (Radio) Interface Unit, or Network Interface and its seamless integration with the operator-side applications.

2. RG-Series RoIP Interface Unit

The RG-Series RIU adapts many different types of radios, analogue and digital and their inherent radio capabilities for use over an IP-Network. A generic RIU provides the basic IP-Network interface for basically any type of radio: Audio and PTT. Radio-specific RIU's allow operators to access additional radio-features over the RoIP network.

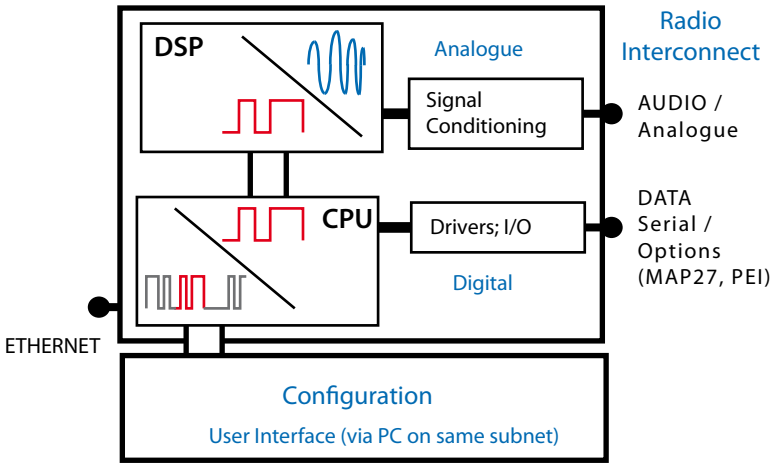


Figure 2. Principle block-diagram of the RoIP Interface Unit

The RIU is an IP-interface for a two-way radio. The interconnect between RIU and radio carries the basic audio ('speaker'/'microphone'), PTT and Squelch. Depending on the type of radio and RIU, it can further carry Alarms, Off-hook, Control-Data, Data-Messages and general purpose data I/O. The network connection is a standard 10/100 base-T Ethernet connection. In a local sub-net, up to 99 operators can access the RIU/Radio in parallel and via a UDP transport. Over a WAN network, one operator can connect at a time using TCP transport. A typical audio channel (transport) requires approximately 80kbyte/s when is active. When there is no audio, only a "keep alive" status burst is sent out every second to identify each RIU to the network.

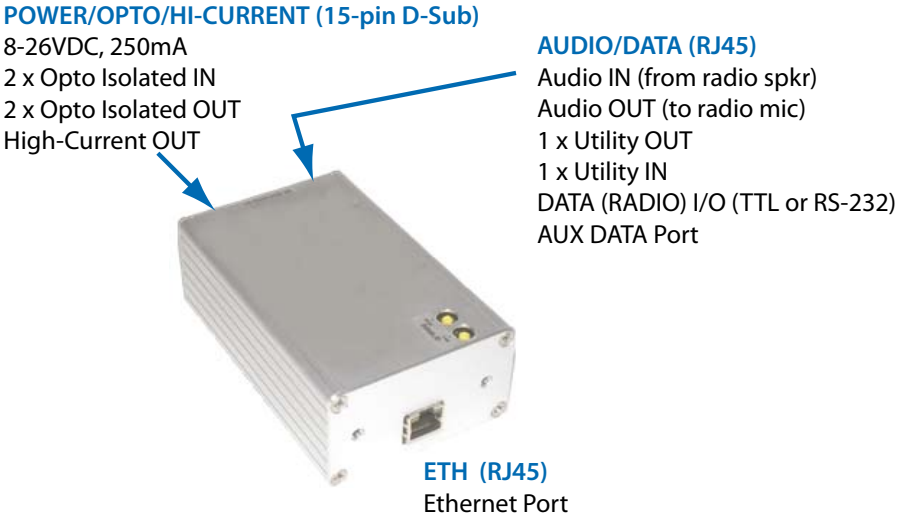


Figure 3. Interfaces/Interconnects on the RoIP Interface Unit

The RIU's design is structured and flexible, allowing the unit to be configured and customised to fit almost any radio including mobile radios and base stations. RG-Series RIU's can be provided pre-configured and -adjusted for use with specific radios. These RIU's allow operators to remotely access radio functions that are normally accessed manually via a control head. The RIU 'delivers' theses features and functions via the RoIP channel to an operator's SoftRadio console. Special RIU applications provide further functionality such as Phone Connect and Intercom. All these functions and features are provided within the same user-interface.

3. A basic RoIP Radio Network

A basic two-way radio network consists of multiple mobile radio users connected via one or more radio base-stations to one or more operators or dispatchers. In a RoIP based two-way radio network, base-stations and radio-sites are connected to an IP-network via RoIP Interface Units (RIU). Radio and RIU create an IP-enabled radio, or IP-Radio, identified via the IP-Address assigned to the RIU. The RIU provides a RoIP-Channel between operator and radio. In a LAN, RoIP transport is via UDP and in a WAN, via TCP. The SoftRadio connects an operator to an IP-Radios via that RoIP channel. SoftRadio can administer and access up to 8 RoIP channels, be it radios or other RoIP applications such as a phone-connect.

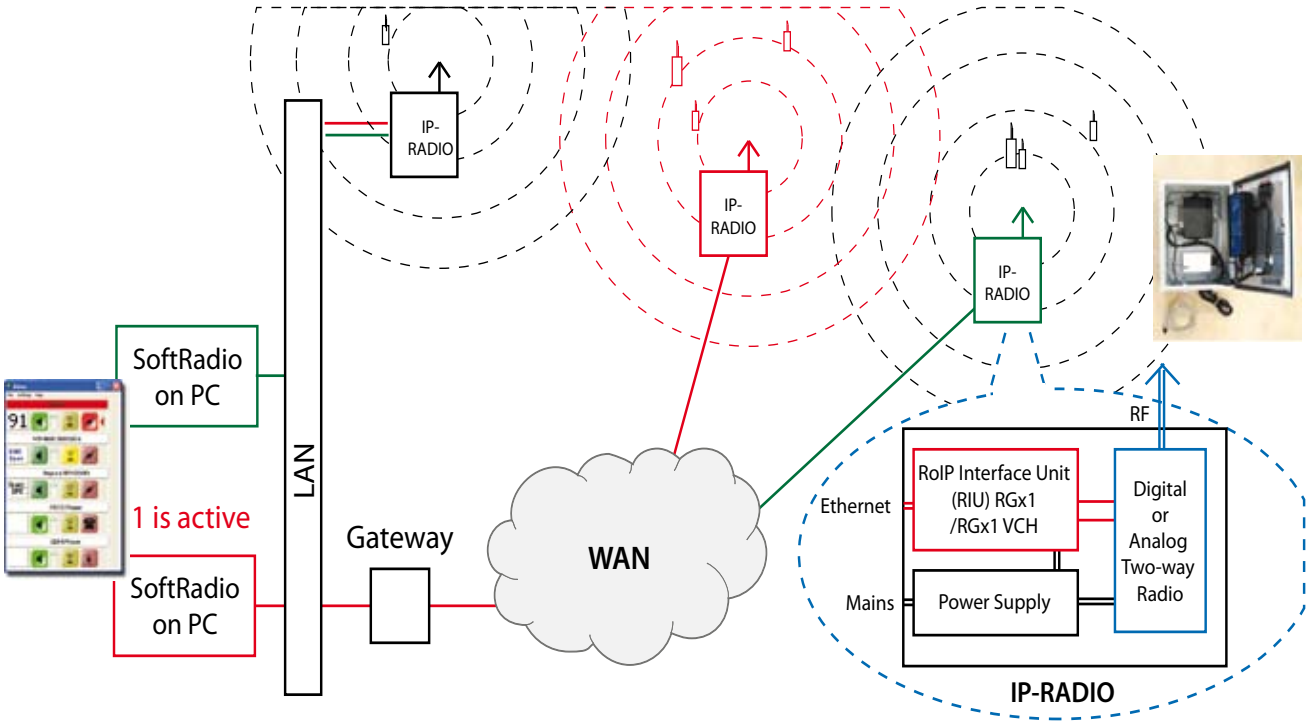


Figure 4. Basic RoIP Network with mixed UDP/TCP RoIP channels

There are two basic RoIP channels. In smaller RoIP networks, the operators access radios via the same local sub-net (LAN). Here UDP is used and the RIU can support up to 99 SoftRadios accessing its radio. Access is granted in order of PTT. The first PTT occupies the RIU. The the radio is 'released' when PTT ends.

In larger and more distributed two-way radio networks, operators and radios connect via the Internet or a larger Intranet (WAN). Here TCP transport is used and the RIU supports a 1-to-1 connection to a SoftRadio console. In essence, the RoIP channel is 'make-break-make', the connection with one SoftRadio needs to be completely released before another operator can access the RIU and radio. The RoIP channel is static rather than dynamic. On the operator end, SoftRadio maintains connections with up to 8 (available) RIU's. Its monitors the incoming traffic on all channels while transmitting on one.

4. Deploying the RG-Series RIU

Deploying the RoIP Interface Unit consists of two distinct set-ups: The radio interconnect and the network configuration. The RIU is deployed at the radio site and connected to the radio using the audio ports and the PTT-signal. For specific radio-types, the control bus between for the radio's control head is also connected to the RIU, enabling Virtual Control Head and radio-specific functions to be accessed via the RoIP channel. The signals from the radio are digitised, structured and 'packaged' and then sent over the network via UDP or TCP. The RIU is connected to the network via the Ethernet port. Prior to deploying the unit, the RIU must be configured via a PC connected over the same sub network as the network interface.

4.1 Connecting the RIU to a two-way radio

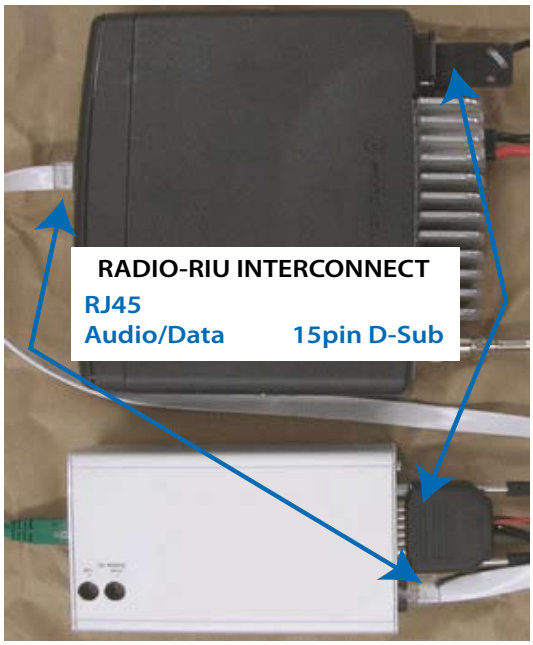
The RoIP Interface Unit provides two levels on connectivity with the radio:

- **Generic** interconnect provides the RoIP channel for basic Voice and PTT functions for any type of radio
- **Advanced** interconnect adds radio-specific functionality to the RoIP channel and transport

The generic interconnect accesses audio via the radio's speaker and microphone access and PTT is connected to the appropriate I/O on the radio. Ready made cable kits are available for the generic interconnect.

The advanced interconnect allows the operator remotely access a radio's specific features, e.g. channel-control, selective calling and enhanced display. Advanced interconnect uses special capabilities built in to the RoIP Interface Unit that allow it to access and connect with the control bus between radio and control head. This enables SoftRadio to provide a remote Virtual Control Head (VCH) for the radio. VCH enables a local operator to access functions and features of the remote radio beyond audio and PTT, e.g. including key presses and display. The advanced interconnect requires a type-specific cable kit to access the radio's control bus between the radio and the standard control head. These kits include the generic interconnect to the radio's speaker, microphone and PTT and for some radio types also to the external alarm output of the radio.

We can provide a range of integration and customisation for Radio and RIU builds and installations.



The currently available VCH versions are:

- Generic Interface (RJ45 Audio/PTT only)
- Advanced Interface (RJ45 & 15 D Sub):
  - Motorola MotoTrbo, DM3600/DM3601
  - Motorola GM360/GM380/GM1280
  - Motorola MTM700/MTM800
  - Ericsson Aurora / Niros TRX300
  - ICOM IC-F1610/2610
  - Sepura SRM2000 / SRM3500 / SRG3500

(Current as of 04/10) New versions are continually being added. Please contact us with your requirements.

Figure 5. Radio<>RIU Interconnect (Example Motorola GM380 with remote control head kit)

4.2 Connecting the RIU to the IP-Network

The RIU is connected to a network via a standard 10/100 Base-T Ethernet port. The Interface Unit can be connected to various networks, such as an existing LAN, a dedicated LAN just for RoIP/Radio operations and directly to an Internet connection using e.g. ADSL, WiFi or other types. Each RIU in the network requires a unique ID-number and IP-address.

4.2.1 RG-Series Set-Up

The RIU Set-Up Menu is accessed from a PC that is connected to the same sub network as the RIU.

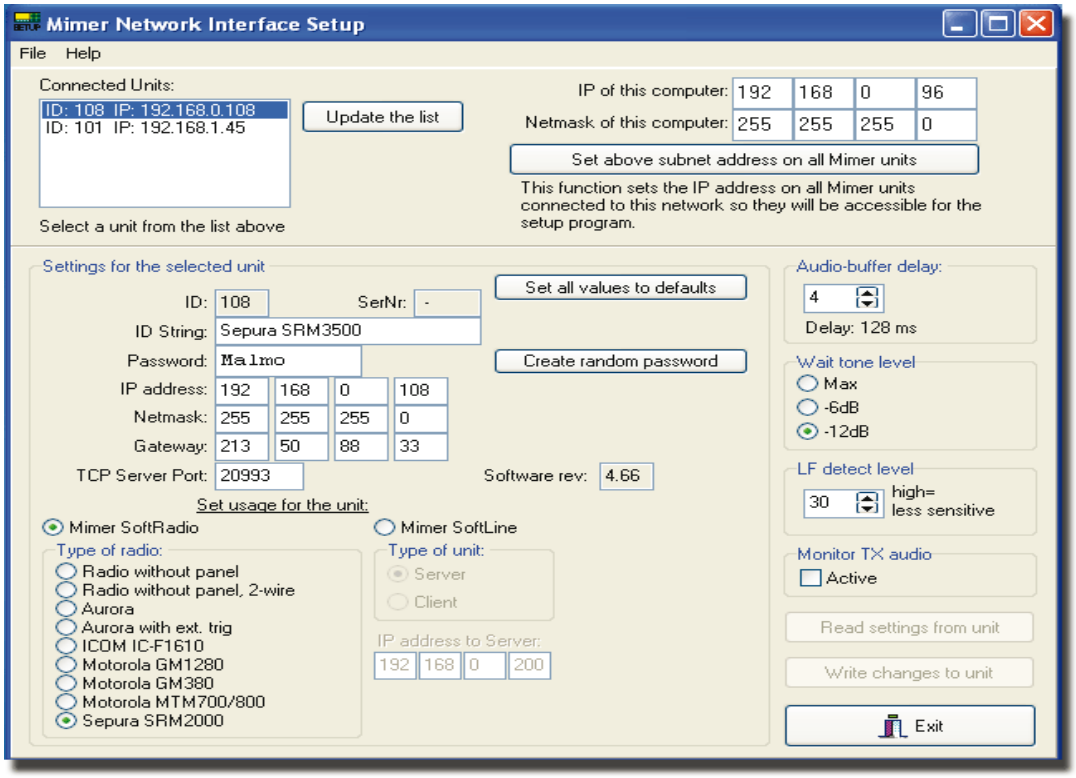


Figure 6. RoIP Interface Unit Set-Up

Connected Units: RoIP Interface Units found on the network. Select one to bring forward it's settings
Settings:

- **ID**: The value set by the rotary selectors on the interface unit
- **SerNr**: The unit's serial number
- **ID String**: The name displayed in SoftRadio
- **Password**: Required when using TCP over the Internet
- **IP-Address, Netmask, Gateway - Settings** for the IP-network (the interface requires a fixed IP address)
- **TCP Server Port**: Used to provide access to the unit in networks with a firewall
- **SoftRadio**: Sets the type of radio - ***should only be changed by trained technicians***
- **SoftLine**: For use as SoftLine - ***should only be changed by trained technicians***
- **Audio Buffer Delay**: Used to improve the quality of the received audio
- **Wait Tone Level**: Sets the level of the wait-tone sent to mobile users
- **LF Detect Level**: Sets the threshold at which audio is detected (the radio's squelch-signal is not used)
- **Monitor Tx Audio**: When 'Active' the outgoing audio of each operator is broadcast to all operator consoles (used for operators at different locations, not when they are in the same control-room, can cause feedback)

NOTE: Ensure **"Write changes to unit"** is executed to save changes.

4.2.2 RG-Series Virtual Control Head

The Virtual Control Head allows the operator to remotely control a radio using the functions and interface of the radio's standard control head. The SoftRadio VCH panel replicate the radio's standard control head. Buttons can be pushed via the mouse, via a touch screen or via the computers keyboard. Operators can use a remote just as if he/she is sitting in front of the radio. As with the standard SoftRadio interface, multiple dispatchers can operate and share the same radio. Hence they need to bear in mind that changes made to the radio-setting by one operator will affect all users since they share the same radio.

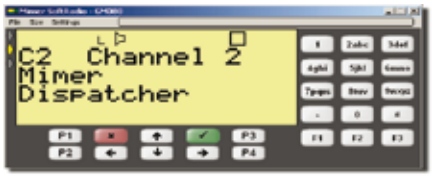
The key to the Virtual Control Head (VCH) is the extra functionality built into the RoIP Interface Unit that allows the RIU to connect to the radio's control bus between radio and control head. The RIU interfaces with the control bus and sends respectively receives the control-data as part of the RoIP data-transport to the operator's SoftRadio console.

On the console, a type-specific VCH-interface creates the display and reproduces the radio's state, e.g. channel selection and operating mode. In turn, the VCH-interface takes the operator's control-input from mouse, touch-screen and/or keyboard and sends the control-input via the RoIP-Channel to the remote RIU and radio.

Ericsson Aurora / Niros TRX3001
(Standard control head will work in parallel)

Motorola GM360
(Should also work with GM660, CDM1550, GM338 and GM160 - yet not factory-tested)

Icom IC-F1610 / F2610
(Standard control head will work in parallel)



Motorola GM380 (also works with GM398)

Sepura SRM2000 / SRM3500 / SRG3500
(Standard control head will work in parallel)

Motorola GM1280

Motorola MTM700 / MTM800
(Motorcycle Control Head)

Motorola MotoTrbo, DM3600/DM3601

Figure 7. Radio specific Virtual Control Heads

5. Enhancing and 'growing' the Radio Network

Two-way radio is about connecting users in a way that suits their needs and environment: Direct communication between mobiles, group-talk, broadcast, or as is often the case, connecting to mobile users from a central dispatch centre. Operating a network obviously requires more than just voice communication. The network needs to be configured, controlled and maintained. Radio stations at remote sites need to be administered. Usage, configuration and payload needs to be optimised. Applications need to be updated and integrated. Interoperability is an increasingly important requirement. Staff and indeed organisations need to respond quickly and decisively to new and often unforeseeable situations. While radio networks are built on common technologies and standards, the organisations that use them have their own unique practices and structures. It is essential that any 'solutions' retain and further that competence. Only then can the variety of challenges, day-to-day, mid- and long-term be met efficiently and effectively.

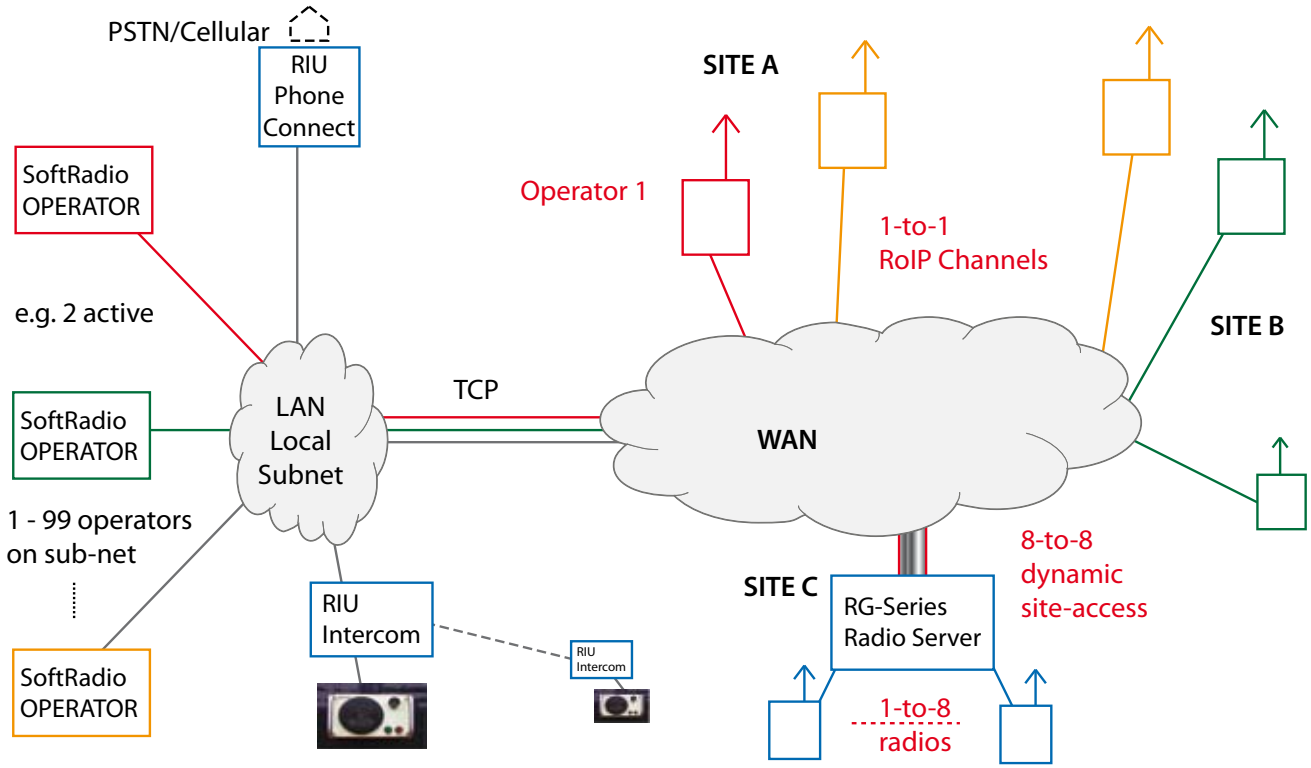


Figure 8. Enhanced RoIP Two-Way Radio network

All this is realised with a structured and flexible operations 'platform' that utilises the variety of existing resources and technologies efficiently while adding and enabling the addition of capabilities - without the need for expansive 're-design'. A platform that comprises the elements and interworkings that can grow with the operation's needs, rather than an expensive and proprietary 'closed' system. A modular, structured and open platform with distributed resources:

- Capabilities are embedded, flexible and expendable
- System-architecture supports the 'evolution' of new capabilities
- The platform is 'upward' compatible and supports lateral integration

On the operator side, SoftRadio makes the most of the inherent flexibility in a PC based application and infrastructure. The RIU itself is built on a structured and flexible platform, enabling new applications with a minimum of development. A smart network significantly simplifies administration and integration. Elements are simply nodes on a network. Operators can readily add and extend functionality, without necessarily changing the physical network-elements. SW-Applications can be readily added to consoles and control-centres, simply by installing compatible application building-blocks: The 'soft-functions'. This structured approach is not new. What is new is the means to do this efficiently; 'smart' RoIP network elements such as RIU and SoftRadio. It simply makes sense to take full advantage of their inherent capabilities.

5.1 Special Applications of the RoIP Interface Unit

The RG-Series RoIP Interface Units are quite purposely based on a structured and flexible design and platform. The units are indeed 'smart' RoIP Network Interfaces and it only makes sense to take advantage of their capabilities for applications beyond pure two-way radio over IP.

5.1.1 RG InterCom

It is not always possible to communicate via an RF-Interface. Some situations prohibit the use of radio-transmissions, e.g. in RF-sensitive areas e.g. in emergencies involving gasses, or where security concerns forbid any 'over-the-air' exchange of information. In other cases, RF simply doesn't work well enough, e.g. in tunnels, or in areas of severe interference. The RG InterCom is a specialised version of the RG-series RIU. The unit allows operators to connect external wire-line intercom devices (portable 'Intercom Boxes') to the RoIP Network and communicate with operators and radios. Several intercom boxes can be connected to the same wire line.

Figure 9. InterCom devices and cable-kit

InterCom adds a display-bar (panel) to the SoftRadio display including SEND, volume control et al. To transmit to an external intercom device, the operator simply uses send as with any other device. InterCom functions as a talk-group for operators and external intercom users. The audio from an intercom transmission is broadcast to all users and SoftRadio operators. CrossPatch allows intercom calls to be routed to a two-way radio and/or phone line, effectively extending radio coverage and the PSTN/Cellular network. InterCom is ideally suited to command & control vehicles, both as a central InterCom and to connect C&C vehicles.

5.1.2 RG SoftLine

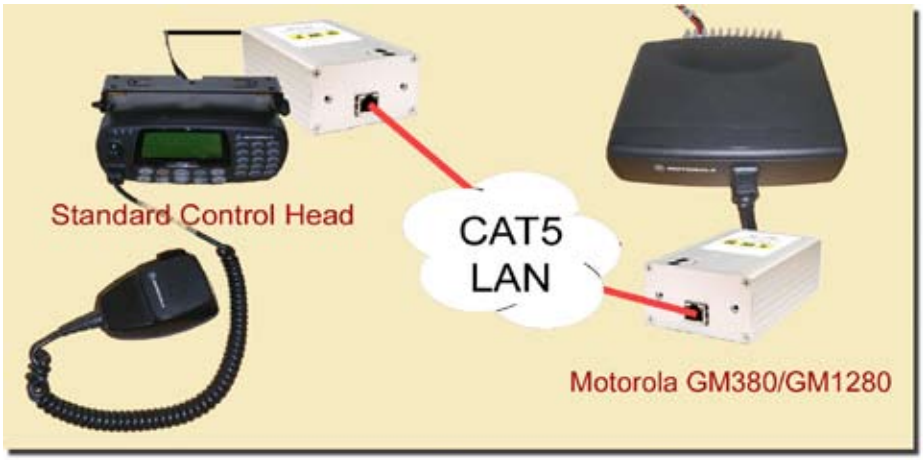
Networks, operations and special applications at times require to send audio and/or data via wire-line and over long distances. This can be because of the history of the installed systems, the nature of the operation, or for security purposes. Sending audio, data or control (logic I/O) via leased lines or similar infrastructure can be expensive and inefficient, especially compared to the ubiquitous IP-Networks. RG SoftLine is a specialised version of the RG-series RIU. It allows operations to replace dedicated transport methods with IP-transport by using two RG SoftLine units. The SoftLine interfaces create a channel that replicates a two- or four-wire wire-line connection. The 'virtual wire line' provides an audio line, a RS232 connection and a number of generic I/O-ports.

- 1 virtual 2 -or 4-wire line for audio
- 1 RS232 transparent data connection
- 2 optical I/O's

SoftLine is ideal to connect older type base stations or dispatchers to radio switches. It can also be used for alarms and especially client-specific applications and connections.

SoftLine can also be used to install a remote radio's standard control head locally and connect to the remote radio via an IP-Network. The SoftLine in essence extends the radio's control-bus indefinitely by transforming the control signals for an IP-based transport. This is ideal for applications where a single radio is at a remote site and the users key requirement is to use the radio via its standard control-head. No PC or other SW infrastructure is required, only access to an IP-Network. The radio and the control head can be separated by a standard CAT5 cable of up to 150m. Using a standard LAN or even WAN allows operators to extend further.

5.1.3 Motorola SoftLine - Motorola GM-series analogue radios

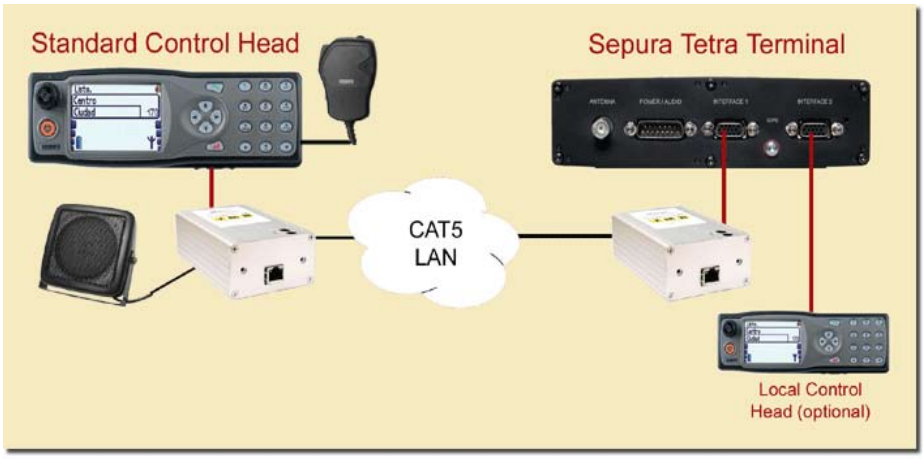


A Motorola GM-series radio connected via SoftLine to the standard control head.

At the control head side, the standard speaker and microphone can be used.

The RG SoftLine Interface has a built in speaker amplifier allowing to adjust for the correct audio level.
Figure 10. Motorola SoftLine

5.1.4 Sepura SoftLine - Sepura TETRA radios



A Sepura TETRA radio connected via SoftLine to the standard control head.

At the control head side, the standard speaker and microphone can be used.

The RG SoftLine Interface has a built in speaker amplifier allowing to adjust for the correct audio level.
Figure 11. Sepura SoftLine

5.1.5 Phone Connect

Analogue (PSTN, conventional) Phone: The physical connection to the phone-line (PSTN) is made via the RoIP Interface Unit. The RIU connects to a standard two wire, DTMF phone line. A fixed cellular phone with PSTN access/interface, a GSM-modem and even a satellite phone with a PSTN interface can be connected. (See also SoftRadio PhoneConnect)

Digital Phone (VoIP Phone): The connection to a VoIP-Phone or VoIP switch (SIP) is made via LAN with a Network Repeater as a gateway. (A RIU is not required when connecting via a Network Repeater) (See also SoftRadio PhoneConnect)

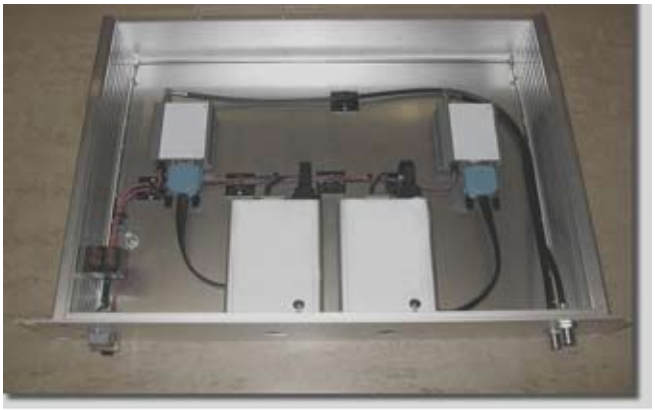


Figure 12. Two GSM modules combined with RoIP Interface Units to create a interconnect from a two-way radio network to a GSM cellular network (provides two independent phone channels) This example is used in a command and control vehicle.

5.1.6 Specials

Selective call routing with Tone Decoder
A tone en-/decoder in the RoIP Interface Unit encodes the analogue signalling-tones as data messages and sends these to the SoftRadio console(s). SoftRadio is pre-set to react/respond to the different codes.

Base station Tone PTT/ Base station DC-Keying
In some systems base-stations are connected via a 2- or 4-wire telephone line (land-line). Here the RoIP Interface Unit can provide PTT over the land-line by sending a single tone (Tone PTT) or a DC-Current (DC-Keying) over the line to initiate transmission.

6. Extending the RoIP Network and Access

As discussed in section 3, there are two basic network configurations: WAN and LAN. In smaller RoIP networks, the operators access radios that are connected via RoIP Interface Units that are on the same local sub-net (LAN) as the operator's PC. Here the RIU supports up to 99 SoftRadios accessing its radio via UDP. In larger networks, operators and radios connect via the Internet (WAN). Here TCP transport is used. The difference is that TCP (WAN) allows only a 1-to-1 connection between one SoftRadio console and one RIU (radio).

In figure 8 we introduced an expanded RoIP radio-network. This network was 'grown' by adding more RoIP Interface Units and more SoftRadio consoles. It is not always possible or sensible to create more capacity by adding more individual nodes. It is often more efficient and effective to improve and extend access to the already installed assets and infrastructure, thereby increasing utilisation. This can be done in two ways, or stages. The first stage is to allow multiple operators dynamic access to multiple radios at one radio-site.

6.1 Radio-Server extension for a Radio-Site

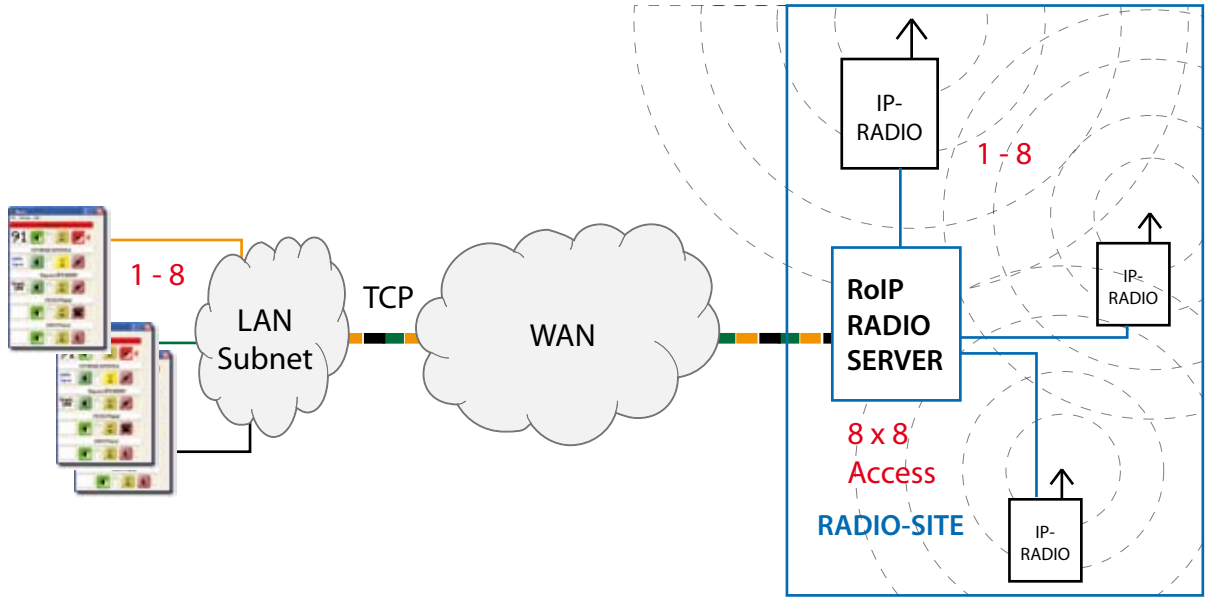


Figure 13. Basic RoIP Radio Server function

Example:
A network has 3 distributed radio-sites, each with 4 IP-radios (RIU & two-way radio) and 3 operators at the control site. One radio-site is situated in an urban environment and has a heavy traffic-load with many frequent calls, but only at peak times. The other two radio-sites are in suburban and rural areas with fewer calls, but with a wider coverage area using directional antennas. The network operator needs to improve capacity and usage for the site with heavy traffic. We can safely assume that the radio-site provides sufficient radio-capacity. The bottleneck is at the dispatch centre: The network was originally set-up with one operator responsible for one radio-site. Each operator has a SoftRadio console which allows him/her to access the radios on his/her site. The operator on the urban site though can become overwhelmed with calls at peak times.

The solution is quite simple: Provide all operators access to the urban site so that they can assist the main operator in peak times. This is easy to implement, all that is required is to install a radio-server at that site. The SoftRadios of all operators can then access all radios at that site through the radio-server. The set-up is also expandable. In this case described here, up to 4 more RIU/radio pairs can be added, doubling the radio-capacity. Up to 5 more SoftRadio consoles can access all 4 (8) radios on that specific site as well.

6.2 RG 8x8 RoIP Radio Server

The RG 8x8 RoIP Radio Server extends operator access to the IP-Radios (RIU/Radio) installed at one site. The radio-server manages the dynamic access to the RIU's and radios. The RG 8x8 RoIP Radio Server enables up to 8 radio/RIU pairs to be shared between 8 SoftRadio consoles. The RoIP Radio Server can also be installed at a dispatcher central to allow users dynamic access to radio resources form anywhere on a WAN (Internet). This is ideal for operations that need to change or shift dispatch and operation, e.g. a taxi company with local operators during the day and remote operators at night. An enhanced version with 64 configurable ports is in development. Here ports can be assigned as needed to RIU's/radios and SoftRadio consoles: E.g. 50 operators can access 14 IP-Radios, or 32 operators can access 32 radios, and so on. The RoIP Radio Server is a self-contained Linux PC operating on 5VDC. It can be installed with a power-supply back-up. The unit auto-starts after a power failure. It has low power consumption and is easy to install

6.3 RG nxn RoIP Network Repeater extension for WAN's

As discussed, RIU's using TCP (WAN) allows only a 1-to-1 connection to a console, while on a LAN up to 99 different consoles can access one RIU. The RoIP Network Repeater essentially 'interprets' a Wide Area Network as a LAN (local) network. The SoftRadio consoles access the Network Repeater using UDP rather than the WAN using TCP which in turn allows each remote RIU's to support access of up to 99 SoftRadio consoles.

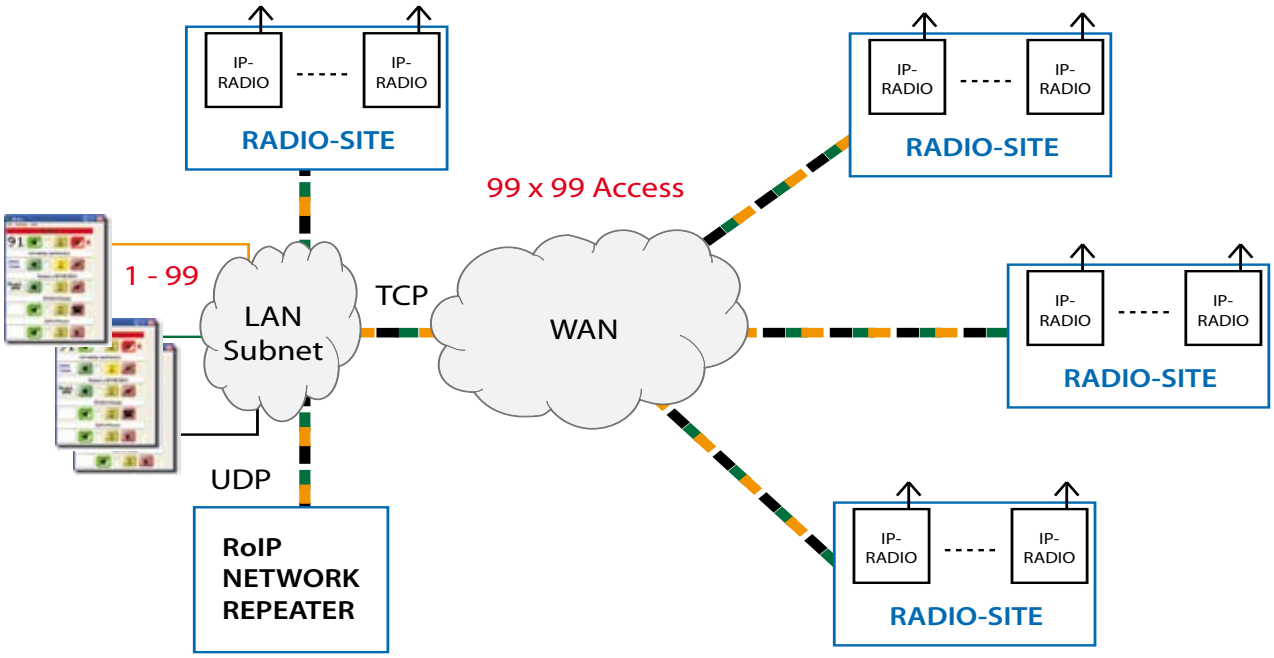


Figure 14. Basic RoIP Network Repeater function

Simply put, the Network Repeater makes all the remote IP-Radios (RIU's + radio) look like nodes on a local network. A very desirable 'side-effect' of using a Network Repeater is the substantial reduction in network traffic. Since all SoftRadios and RIU's are connected via a virtual local network, they no longer need to each establish a dedicated RoIP-Channel across the WAN. Further, using a Network Repeater eliminates the need to install RoIP Radio Servers at the radio-sites. Hence it is prudent to consider the configuration and growth of the radio-network when choosing between Radio Server Network Repeater. When in doubt, it is best to select a Network Repeater. Network Repeater operates on most Windows computers or Servers. The Network Repeater can also be used to connect the two-way radios to an IP-phone system with SIP-protocol. A further option uses the Network Repeater to 'intercom' between operators. (Please refer to InterCom)

7. Key Specifications - RGx1/ RGx1 VCH Series RoiP Interface Units

Specifications

General				
Voltage / Current / Consumption		+8 to +26Vdc; nominal 12V/ 250mA		
Operating temperature		-10°C to + 50°C		
Connectors		RJ45 (ETHERNET; AUDIO, DATA & UTILITY) 15-PIN D-SUB (female) PWR, OPTO I/O, HI-CURRENT OUT		
Dimensions		78mm (W) x 44mm (H) x 120mm (D) plus connectors		
Audio IN				
Input impedance		600Ω nom. DC coupled to GND, can be customised via alt. components		
Input voltage (max. signal level)		0.7V-13Vpp (0.25-4.5Vrms) (adjustable) extendable via alt. components		
Frequency range		300-3000Hz		
Audio OUT				
Output impedance		600ohm transformer coupled, can be customised via alt. components		
Output voltage (max. signal level)		0-1.1Vpp (adjustable) extendable via alt. components		
Frequency range		300-3000Hz		
Optical INPUT (opto-isolated)				
Input Voltage Range ON		3.0-30V	Input Voltage Range OFF	0-1.2V
Input current		> 0.15mA for active input, 8.2kohm in series with Opto coupler input		
Reference options		Internal references to ground or +5V		
External references		LOW: typically external GND	HIGH: typ. ext. , e.g. +12V or +24V	
Active Level (optocoupler setting) active state draws current		Active HIGH: + to IN; - to low ref (current drain when IN high)	Active LOW: + high ref; - to IN (current drain when IN low)	
Optical OUTPUT (opto-isolated)				
Voltage	max. 30V	Current (protected via 100Ω in series, configurable)		max. 30mA
Reference options		Internal references to ground or +5V		
External references		LOW: typically external GND	HIGH: typ. ext. , e.g. +12V or +24V	
Active Level (optocoupler setting)		Active HIGH: + to OUT; - to low ref	Active LOW: + high ref; - to OUT	
High Current Output				
Voltage (Limited by Zener diode protection)		max. 16V	Current	Max 500mA
Active level:		Sinks current to ground when active. Intended for operating relays etc.		
Utility Input (Active High)				
Voltage	3-30V	Impedance	5.6kΩ pull-up to +5V; 47kΩ to trans. input, configurable	
Utility Output (Sinks to ground when active. Collector output via 330 ohm series resistor)				
Voltage		max. 30V	Current	Max 10mA
Data I/O for radio				
TTL or RS232 compatible in/outputs. (Output positive only, but works well with RS232 input if cable is <2m)				
Baud rate adapts to each particular radio type. For general purpose use 2400-19200 Baud is available.				
AUX DATA Port (Use of this port requires custom software. Contact the manufacturer)				
Typical use is for MAP27 or PEI protocols in trunked or digital radio systems				
TTL or RS232 compatible in/outputs. (Output positive only, but works well with RS232 input if cable is <2m)				
Baud rate 2400-19200Baud				
ETHERNET				
10/100 base-T Ethernet				
TCP and UDP network protocols are available				

Specifications are subject to change without notice

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