

Remote Radio Control over IP

RRC101-IP

PRODUCT MANUAL

Rev.: RRC101-IP_EN_100408



® **THIESEN**
HARDWARE
SOFTWARE
DESIGN
G M B H

Im Tiegel 9
36367 Wartenberg
Telephone +49 (0) 66 41 – 979-0 Fax: -299
www.thiesen.com/pmr
pmr@thiesen.com

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1. Introduction

The RRC101-IP implements an RoIP interface and allows operators to connect to a remote radio transceiver via an IP network. Radio over Internet Protocol (RoIP) uses a modified version of Voice over IP (VoIP) to transport analogue payload and control signals in data-packets over an IP network, be it the internet or a private intranet. In the most basic RoIP application, user audio and baseband signals, push-to-talk (PTT) and Squelch, are transported as digital data within VoIP packets over the network. PTT and Squelch are the basic functions required to control and monitor the radio-link.

The key benefit of RoIP is that allows a remote transceiver to be controlled and monitored via existing and cost-effective Intranet/Internet networks such as WAN, LAN, WLAN, removing the need to use dedicated and costly PSTN lines.

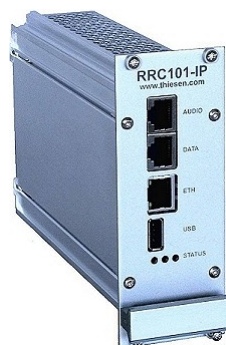
The RRC101-IP allows users to expand on the basic Tx/Rx control functions PTT and Squelch. The RRC101-IP enables a vast range of additional functions and applications through its additional and comprehensive serial and parallel data-transport capability. Users can send and receive selected control-bits, transparent RS-232 and have up to 21 parallel I/O lines available. Operators can readily configure applications to their specific needs, e.g. auxiliary remote radio channel selection, alarm monitoring, radio message de/coding, etc.

The RRC101-IP is available in two form-factors:

- stand-alone **RRC101-IP-B** with mounting flanges



- 19" rack module **RRC101-IP-19**.



The RRC101-IP is readily configured via its web-browser interface. This enables an operator to control, monitor and configure the RRC101-IP basically from any location with access to the Internet.

The RRC101-IP has a well-structured and modular build of both hardware and software. The unit operates a Linux OS on a performance microprocessor. Both software and hardware are flexible and readily upgraded, allowing custom and user-specific implementations as well as ensuring security of investment through cost-efficient extensions and upgrades over the life of the unit. Firmware updates are easily executed with a USB memory-stick. The USB interface can also be used to connect other USB peripherals such as USB storage or audio.

Thiesen is well equipped to provide custom solutions and application for your needs. Please contact us to discuss your specific requirements pmr@thiesen.com.

2. Hardware and accessories

2.1 RRC Units

Order Number	Description
RRC101-IP-B	Remote Radio Control 101 IP, standalone with 4 mounting flanges, 2m (12V) power supply cable, (requires external 12V supply)
RRC101-IP-19	Remote Radio Control 101 IP in 19 inch rack mount
MAB4	Multi-Access Box 4, allows parallel operation of up to three RDU's

2.1.1 Options

Order Number	Description
RRC101-IP-BOS	RRC101-IP with Call 1+ 2, pre-set to 1750 and 2135 Hz, configured via web browser interface
RRC101-IP-600	RRC101-IP with 600Ω, transformer coupled, symmetric Audio In-/Output

2.1.2 Special Options

Thiesen can provide special options for your specific applications. Inquires are most welcome, please contact us at pmr@thiesen.com. Our product development team will gladly assist you.

2.2 RRC Accessories

Order Number	Description
SNT18	Switched power supply, 13.2 V/1.5 A (18 W), for RRC101-IP and RDU
RDU 101	Remote Desktop Unit 101, Control Unit for RRC101-IP, can be connected via multi-wire to a transceiver, includes ext. PTT- and Headset-connectors
FTM 2410	PTT-Foot switch for RDU101, 3.5mm TRS jack, 2.3m cable
RRC-RACK-7	19" Rack enclosure, includes power supply PS12/5 (12V/5A) and back-plane with 8 x VG96-connector, accommodates max. 7/8 RRC101-IP-19

2.2.1 RRC-RACK-7 Enclosure



RRC-Rack-7 Enclosure Picture for illustration purposes only – delivery excludes RRC unit shown here

2.3 IP-Radio Product series

The IP Radio product series provides a pre-configured, fully operational VHF/UHF FM radio with RoIP remote control.



VHF/UHF FM IP controlled Radio in rack-mount

The IP Radio product series integrates an analogue (FM) radio, RRC 101-IP-19 module, power-supply and a backplane providing 3 x VG-96 connectors in a 19" rack-mount enclosure. Units are available in the following frequency bands:

- IP-Radio 66 - 88 MHz
- IP-Radio 136-174 MHz
- IP-Radio 400-470 MHz
- IP-Radio 174-225 MHz
- IP-Radio 470-530 MHz

Key specifications:

- RF Output Power: max. 25 Watt
- Modulation: FM
- Channel Spacing 12.5kHz, 20kHz and 25 kHz
- MIL-STD 810 and ETSI compliant
- Includes RRC-RACK-7: 19" Rack enclosure, includes power supply PS12/8.5 +12V / 8,5A
- More details upon request

Order Number: IP-Radio

3. Specifications RRC 101-IP

General

Voltage / Current / Consumption	+9Vdc to +16Vdc; nominal 12V/ 240mA / 2.5W
Operating temperature	-20°C to + 60°C
Front panel indicators	5 LEDs: Power, Link-Active, 10/100MBit/s, Tx active, Rx active
Dimensions RRC101-IP-B	105mm (W) x 50mm (H) x 185mm (D) (w/o flange) / approx. 560g
Dimensions RRC101-IP-19	H = 3U, W = 10U, D = 86U, approx. 560g
Programming/Configuration	USB, RS-232, Secure Shell, Web interface
Audio Encoder/Decoder	Speex, a-law, μ -law, raw

Audio In

Input impedance	10 k Ω (600 Ω optional)
Input voltage	400mV (70 – 800 mV variable)
Frequency response (flatness)	60Hz to 3400kHz (- 2 dB) Studio-quality input
Signal-to-noise ratio (SNR)	Better than 60dB

Audio Out

Output impedance	min. 20 Ω , nominal 35 Ω (600 Ω optional)
Output voltage	400mV nominal (2.0-1000mV variable)
Frequency response (flatness)	60Hz to 3400kHz (- 2 dB) Studio-quality Input
Signal-to-noise ratio (SNR)	Better than 60dB

TX/RX Control out (PTT > Radio / SQUELCH > RDU)

Output	Solid-State relay; active GND or +12V, pre-configured via jumper
Max. Sink Current	250mA (AC or DC)
Max. Open Circuit Voltage	+/- 250V

TX/RX Control input (PTT < RDU / SQUELCH < Radio)

Input/ Impedance	Opto coupled / 1k Ω
Polarity	Active low or high, configurable via internal jumper
Threshold	+1.5V nominal
Over-voltage protected	+/- 30V

Serial Interfaces

Type	RS-232, asynchronous, full duplex
Data-Rate	4800, 9600, 19200, 38400, 57600, 115200 bps
Ports (lines)	1 front-panel RJ-45 (default:2), one internal 3-pin PCB mounted (2)
Option:	internal RS-232 on PCB (factory use) routed for external access

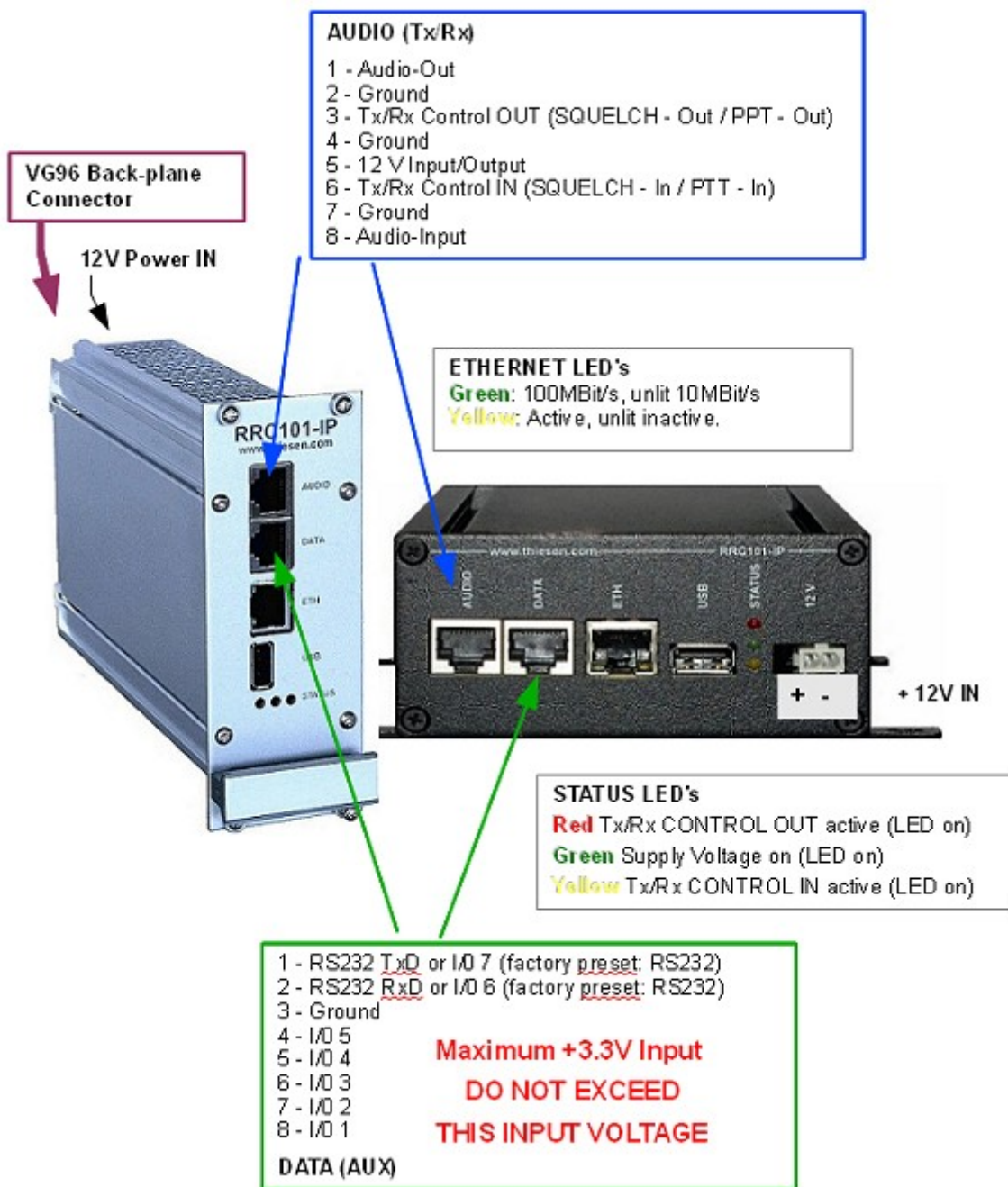
Data I/O (maximum 21 ports)

Input	Tristate: 0V; 3.3V; high-impedance
Output	Tristate: 0V; 3.3V (50 mA); high-impedance
Front-Panel RJ-45	5 lines parallel / 2 lines serial (default) or 7 parallel; GND
RRC101-IP-19 19" rack version	14 I/O on back-plane VG96 (DIN 41.612)

Network Interface

Type	10 BASE-T or 100 BASE-TX Ethernet, RJ-45, auto-detect
Protocol	UDP, TCP/IP, ftp, http, bootp, tftp, ssh (other upon request, e.g. Telnet)

4. Interfaces



4.1 Option -19 (19" rack) Backplane VG96 Connector



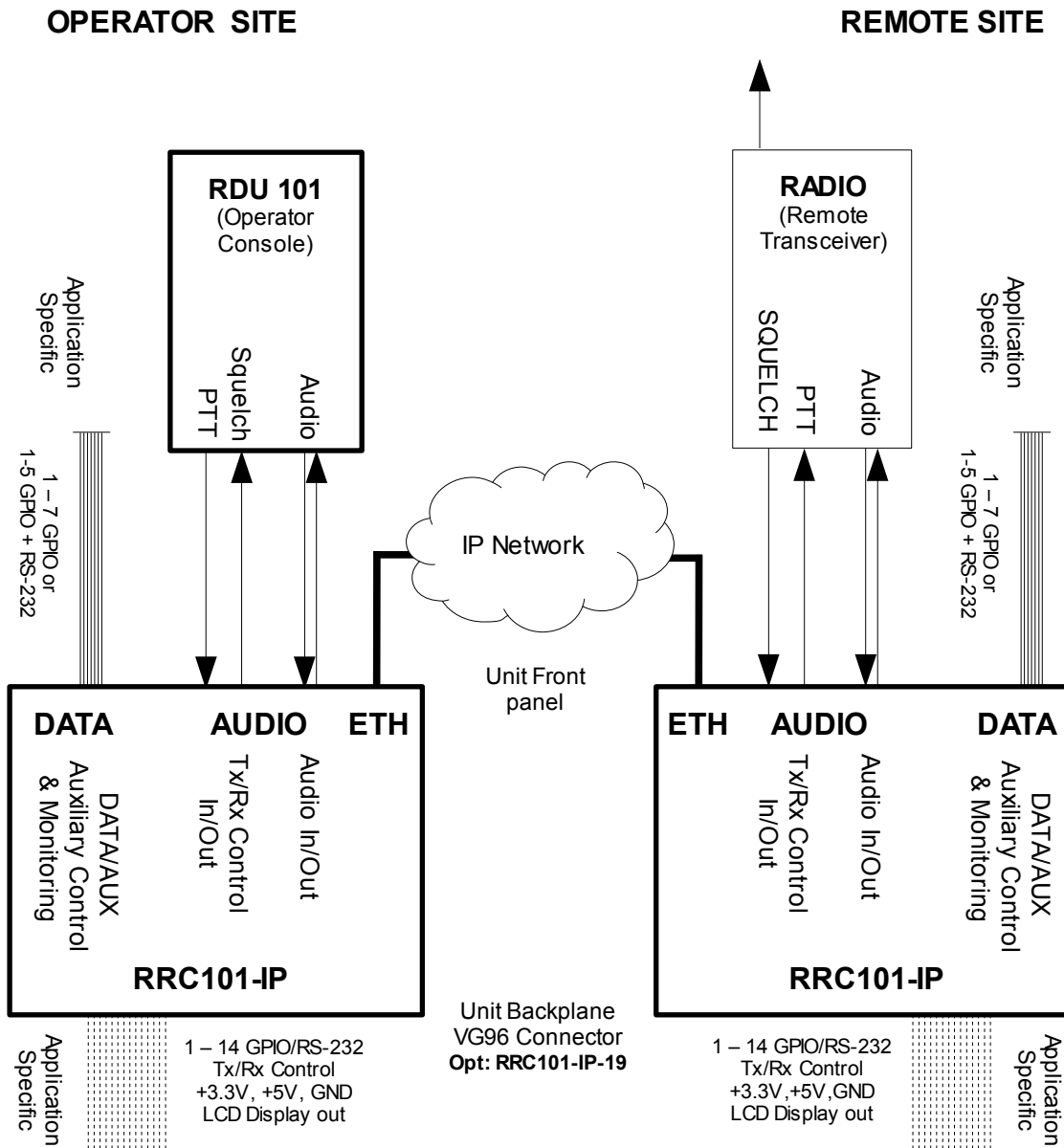
Pin	C	B	A
1	12V	12V	12V
2	Tx/Rx CONTROL IN		
3	Tx/Rx CONTROL OUT		
4	GND	3V3 out	
5	Vee -1V (Option)	GPIO 75	
6	GPIO 76	GPIO 19	
7	GPIO 14	LED+	
8	GPIO 58	GPIO 59	
9	GPIO 60	GPIO 61	
10	GPIO 62	GPIO 63	
11	GPIO 64	GPIO 65	
12			
13	GPIO 77	GPIO 74	
14			
15			
16	3V3 out		
17	GND	GND	GND
18	5V out		
19			
20			
21			
22			
23			
24			
25			
26			
27	TxD		
28	GND		
29	RxD		
30	3V3 out		
31	5V out		
32	GND	GND	GND

*** Note:**

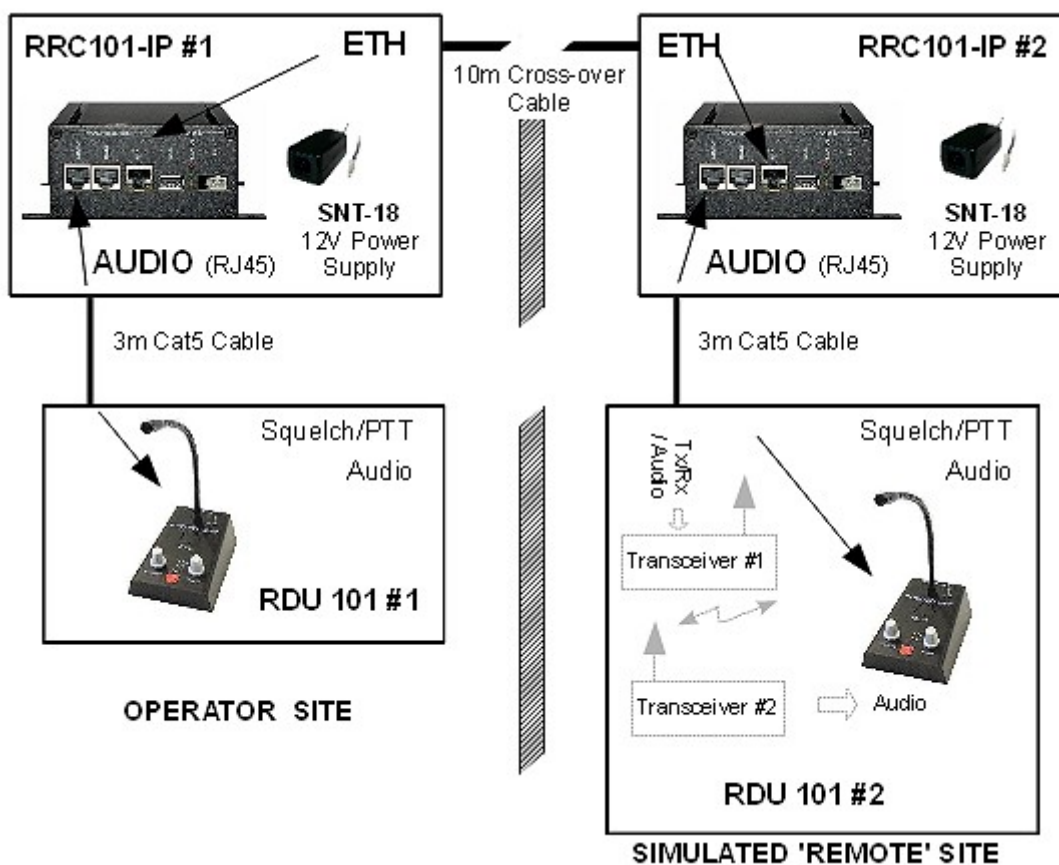
- Pins C 27 to C 29 duplicate the RS-232 available on the Front-panel RJ45 (DATA/AUX)
- GPIO Ports are tristate (0V or 3.3V, or high-impedance)

5. Application Block-Diagrams

5.1 Basic Application



5.2 Test-Application



The evaluation kit RRC101-IP-EVAL allows the user to quickly configure and execute an RoIP simulation. The kit comprises 2 each RRC101-IP interface-units, 2 each RDU101 consoles as well as two SNT18 power-supplies. The set-up shown above requires only a few minutes to configure and no further settings are required to put it to use:

- One each 3m Cat5 cable is used to connect one RDU to one RRC101-IP(AUDIO).
- A 10m cross-over cable connects the two RRC's via their Ethernet (ETH) ports
- Testing is best executed with the RDU's in separate rooms or a sufficient distance

This set-up replicates a simple two-way RoIP (base-band to base-band) connection by replacing the transceiver, the radio-link and the opposite transceiver with a second RDU. The 'remote' RDU simulates the entire bi-directional radio link. The set-up is fully functional in that PTT and Squelch signals as well as base-band audio are transported using the RoIP protocol: Activating 'send' on the RDU transmits the audio from the RDU to the RRC then as VoIP packets over the TCP/IP network to the receiving RRC101-IP and finally as base-band audio to the receiving RDU.

6. Audio transport

The RRC101-IP supports a variety of different audio applications. Users can select from a comprehensive range of audio codec and sampling rates. This section provides a brief background.

Bandwidth considerations

The RRC101-IP requires a minimum bandwidth congruent with a transmission-rate of approximately 20 kbits/s per direction. This is for minimum sampling rate and maximum compression (speex/8kHz). The transmission rate reaches 100kBits/s for uncompressed audio transmission(raw/32kHz).

VoIP Channel

The IP network is designed to deal with packet loss. When packets are missing, the recipient automatically requests retransmission, or the sender automatically transmits unacknowledged packets. Yet this is not ideal for VoIP and can result in a perceivable lag or choppy audio. Packet loss happens most frequently when the network is congested and actual bandwidth is limited. Latency is the time it takes a call to traverse the physical distance between call points. Round trip totals of less than 150ms are acceptable. Jitter is the time variation of the periodic signal or the changing timing-differences between packets. Jitter can incur data-loss and degrade the transmission.

Radio Channel

The radio (RF) channel introduces different and more difficult impairments to the overall transmission. Attenuation (distance, weather), multi-path (flat and frequency selective fading) all impact the QoS.

Given the above, it is important to understand that the actual quality of the audio transmission is not merely a matter of selecting the highest quality coding scheme with the highest sampling rate. In fact, selecting these settings can result in a complete loss of any recognisable audio. Selecting a higher compression and lower sampling rate may at least result in a recognisable audio transmission. The table below gives an overview of the coding schemes.

Codec	Description	Benefits	Costs
raw	uncompressed audio true waveform representation	high voice quality ideal for tones (FMS, 5-Tone)	highest bandwidth needs
speex	speech compression VoIP optimised, CELP encoding 32/16/8kHz	excellent compression low bandwidth needs	minimum voice quality waveform distortion
μ-law	companding algorithm reduces dynamic range of audio	average quality combined with average bandwidth, μ-law is an older technique developed for telephony in USA & Japan	
a-law	improves SNR	average quality combined with average bandwidth, a-law is an older technique developed for telephony in Europe	

Sampling Rate/Codec

	8000Hz	16000Hz	32000Hz
Raw	140kb/sec	270kb/sec	510kb/sec
Speex	025kb/sec	030kb/sec	032kb/sec
mu-law	070kb/sec	135kb/sec	255kb/sec
a-law	070kb/sec	135kb/sec	255kb/sec

We strongly recommend to test the transmission in your 'real-life' environment. We can readily provide the RRC101-IP-EVAL test and evaluation kit for this purpose. Please feel free to request our support.

7. Data-transport

The RRC101-IP provides operators and organisations highly flexible and diverse data-transport capabilities. Each unit provides both serial and parallel data I/O via the front-panel. Opt19 provides 14 additional and highly configurable data ports via the back-plane connector. (See 4. Interfaces and 11. Interface configuration via jumpers)

	SERIAL		PARALLEL	
	DATA (AUX)	DATA(VG96)	DATA (AUX)	DATA(VG96)
Factory default	2 lines	2 lines duplicates DATA(RJ45) lines	5 lines	14 lines
Jumpers 1&7	n/a	n/a	7 lines	
Option	HW Option: Access internal RS232			

DATA (AUX): Front Panel RJ45 connector

DATA(VG96): Backplane VG96 connector (Opt.19)

7.1 Serial Data

The RRC101-IP enables to connect to a radio's RS-232 interface via the internet/intranet. The RRC provides a transparent and bidirectional serial data-transport via an IP-network connection (SW Rev. 0848 onward). We use the term 'transparent' as the data-transport is handled as if the RRC was not there, the information is simply passed through correctly. This enables applications such as remote channel-selection, remote coding/decoding of radio messages, message transport over IP etc.

The RRC101-IP provides up to two independent RS-232 connections. The standard is via the front-panel DATA (AUX). A second (hardware option) RS232-interface can be provided. This option routes an internal RS-232 to the outside of the unit. Both interfaces are standard RS-232 format ($\pm 6V$). The RRC's RS-232 interfaces can be connected directly to a computer via a cable of up to a maximum length of 30 metres (two leads plus ground: TxD, RxD, GND). The RS-232 bus on the front-panel port is enabled via the web-browser interface. Please note that this requires the appropriate jumper-setting.

7.2 Parallel Data

The parallel bus provides for applications and functions beyond the basic Audio and Tx/Rx Control. The include e.g. remote channel selection, alarm functions and application specific data I/O.

Important Note: Parallel ports are limited to +3.3V input/output. Do not exceed a +3.3V input.

The RRC101-IP provides up to two independent parallel data-communications, depending on the type of RRC (standalone/Opt19). The standalone type has one front-panel DATA (AUX). Opt 19 provides front-panel DATA (AUX) and 14 additional GPIO lines on the backplane DATA(VG96).

Configuring the front-panel DATA (AUX) port via the user-interface:

- INPUT: all lines receive data. The units sends this data back over the IP network
- OUTPUT: all lines send data. The unit receives the date to send from the IP network
- DISABLED: Front-panel parallel bus is disabled

Configuring the backplane DATA (VG96) port via the user-interface:

- Level: Each line can be set individually for a High/Low level

Note: Jumper settings override user-interface settings

8. RRC101-IP User-interface

The RRC101-IP User-Interface (UI) is a web-browser based interface. The UI is displayed in the web-browser on a PC. To access the UI, the unit needs to be connected to a PC or LAN. When connected, an operator can control, monitor and configure the RRC101-IP basically from any location in the world that has access to the Internet. When connecting to the RRC for the first time, we recommend to connect the unit (ETH) directly to a PC LAN Port via a cross-over cable. This avoids any potential conflict with IP addresses in the network. A lap-top is ideal for this exercise. Please note the IP settings on the PC may have to be adjusted to match the factory IP-address of the RRC (see below). If the PC's IP address is in a different range than that of the RRC the PC will not be able to recognise the RRC on the network. Once communication is established, the IP-address of the RRC can be changed to an IP setting that is compatible with the network the unit will be deployed.

The RRC101-IP can also be controlled, monitored and configured directly via the unit's serial interface with SSH (secure Shell) protocol for secure access. (Currently a factory-only option)

8.1 Connecting to the Web-browser interface

To connect to the RRC101-IP via the web-browser interface:

- Connect the RRC101-IP to the IP network
- Ensure the RRC101-IP has an IP address in the range 192.168.56.xxx (factory default)
- Ensure that IP addresses 192.168.56.1 and 192.168.56.2 are not assigned otherwise
- Or connect the RRC101-IP directly to a PC via a cross-over cable
- Ensure the PC is in the same IP address range
- Type the IP address of the RRC101-IP (default 192.168.56.x) in the browser location bar
- The RRC101-IP configuration menu will appear

Important Notes:

- **pre-set IP-Address Server: 192.168.56.1**
- **pre-set IP-Address Client: 192.168.56.2**
- **All units must be in the same address-range (e.g. 192.168. 56.x for the pre-set value)**
- **The address-range must not be assigned otherwise within the network**
- **Each unit must have a unique IP address within the range**

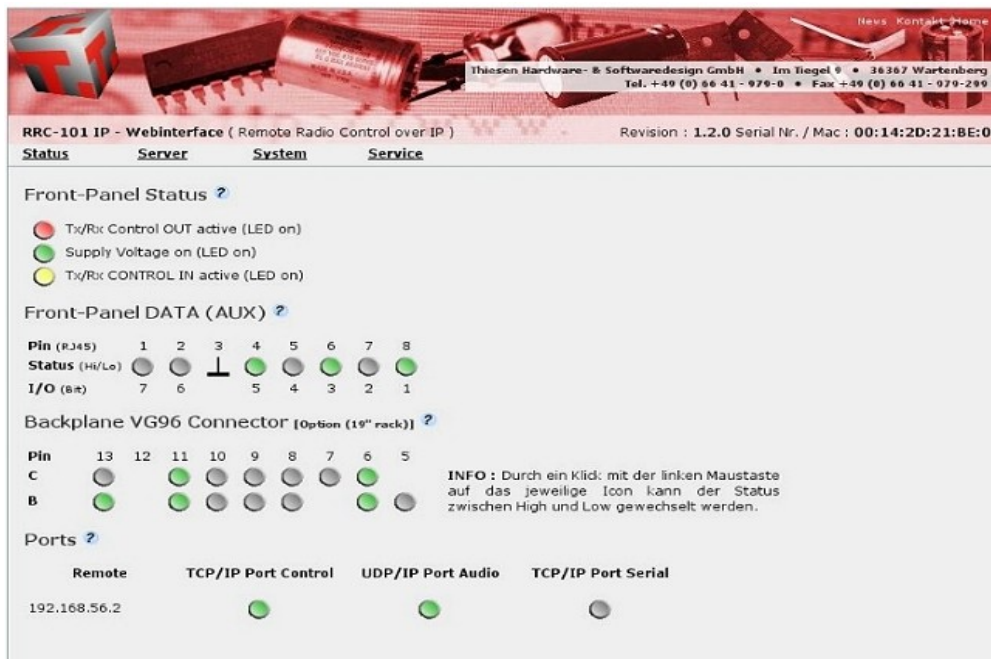
8.2 Accessing the Configuration Menu

The configuration menu is accessed via:

- IP-Address 192.168.56.1 for Server
- IP-Address 192.168.56.2 for Client
- Default login:
 user: admin
 password: admin

We recommend changing this password.

8.3 Status Page



The Status page combines the most commonly used information and settings. The Status page is common to both client and server units and all RRC options.

8.3.1 UI: Front-Panel Status

Provides the operator with a replicated image of the unit's front-panel status LED's:

- ON: Tx/Rx CONTROL OUT Active
- ON: Supply Voltage applied
- ON: Tx/Rx CONTROL IN Active

Tx/Rx Control OUT Active is set to either +12V or GND via the appropriate jumper.

Tx/Rx CONTROL IN Active is set to either HIGH (+1.5V to +30V) or GND via the appropriate jumper.

(See Chapter 11 Interface configuration via jumpers for more information)

8.3.2 UI: Front-Panel DATA (AUX) – Parallel I/O

Front-Panel DATA (AUX) displays the state of the parallel DATA(AUX) lines. This display is only active

Pin#	1	2	3	4	5	6	7	8
Status	○	○	⊥	●	○	○	○	○
Bit-Value	7	6		5	4	3	2	1

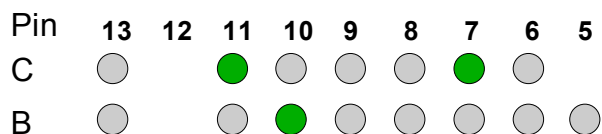
Status for parallel lines: Green: HIGH (+3.3V) / Grey: LOW (0V). Note: If the RRC is configured for Serial n DATA (AUX), pins 1 & 2 will remain greyed out

Important Note:

- DATA (AUX) can only be configured on RRC Units that are designated as a Server
- Jumper settings override UI settings

8.3.3 Back-Plane VG96 Connector – Parallel I/O

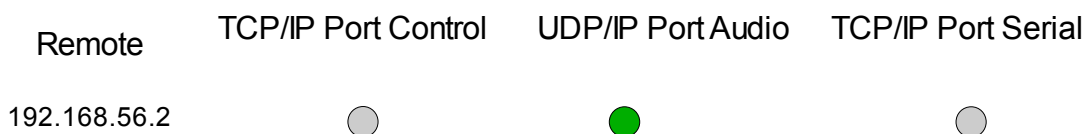
Back-Plane VG96 Connector displays the state of the DATA(VG96) lines. Selecting the PIN allows to toggle the level between High and Low (OV and + 3.3V)



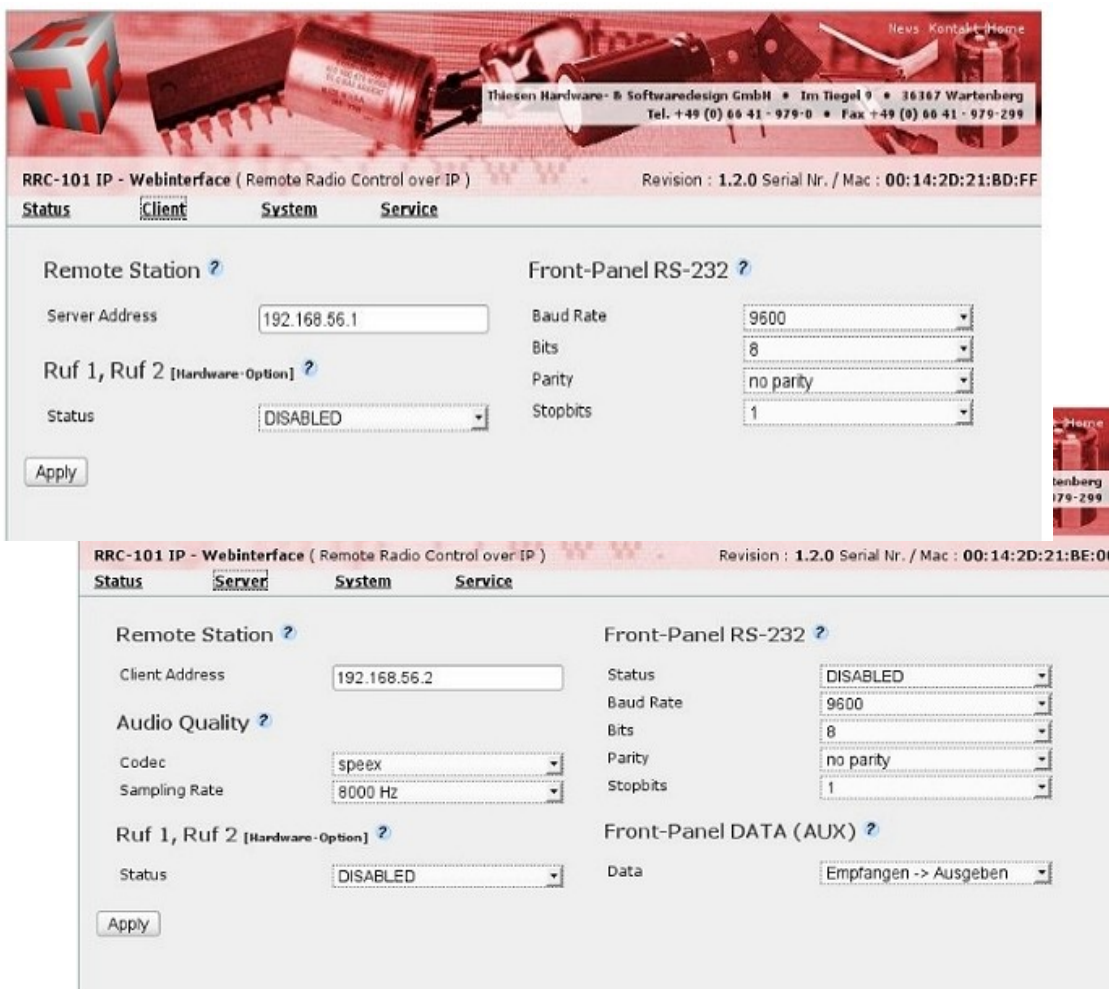
Select to toggle HI/LO

8.3.4 Ports

Ports displays the IP-address of the unit that has established an active communication and the ports currently being used.



8.4 Client Page / Server Page



The screenshot displays two screenshots of the RRC-101 IP Webinterface. The top screenshot shows the 'Client' configuration page, and the bottom screenshot shows the 'Server' configuration page. Both pages include navigation tabs for Status, Client/Server, System, and Service. The Client page features fields for Remote Station (Server Address: 192.168.56.1), Front-Panel RS-232 (Baud Rate: 9600, Bits: 8, Parity: no parity, Stopbits: 1), and an Apply button. The Server page features fields for Remote Station (Client Address: 192.168.56.2), Audio Quality (Codec: speex, Sampling Rate: 8000 Hz), Front-Panel RS-232 (Status: DISABLED, Baud Rate: 9600, Bits: 8, Parity: no parity, Stopbits: 1), Front-Panel DATA (AUX) (Data: Empfangen -> Ausgeben), and an Apply button. The top banner of the interface includes the company logo and contact information: Thiesen Hardware - B Software-Design GmbH, Im Tiegel 9, 36367 Wartenberg, Tel. +49 (0) 66 41 - 979-0, Fax +49 (0) 66 41 - 979-299.

RRC101-IP User-interface

The Client/Server pages are complementary UI pages. Both pages are very similar as they are used to configure the two sides of the client-server communication. The Server page provides the additional functionality required to enable the client-server communication.

8.4.1 Common Settings

Remote Station: IP-Address of the opposite unit

Server page:

Client page:

Enter client IP-Address

Enter server IP-Address or Name-Server

For name-server settings see System > Ethernet> Name-server: <value>

Call 1, Call 2: Special Option – allows to send a tone (sine)

Enable or Disable. Call, Call2 requires a special HW option in both RRC's. Settings must be the same on both client and server.

Client/Server > Ruf 1, Ruf 2: DISABLED | ENABLED

Note: When the option is enabled, the tone can be set between 50Hz and 4kHz. See Service > Services > test tone: <value>

Front-Panel RS232 (DATA AUX): Configure serial data-transport between client and server

Enable via Server > Front-Panel RS232 > Status: ENABLED

Client/Server > Front-Panel RS-232 >

Setting	Server page:	Client page:
Baud Rate	<select>	<select>
Bits	<select>	<select>
Parity	<select>	<select>
Stop bits	<select>	<select>

Note: Ensure values are identical between server and client prior to data-communication

8.4.2 Server Settings

Front-Panel RS232: Enable serial data-transport between client and server

Server > Front-Panel RS232 > Status: ENABLED | DISABLED

Front-Panel Parallel DATA (AUX): Enable parallel data-transport between client and server

Server > Front-Panel RS232 > Status: ENABLED | ETH In → DATA Out | DATA In → ETH Out

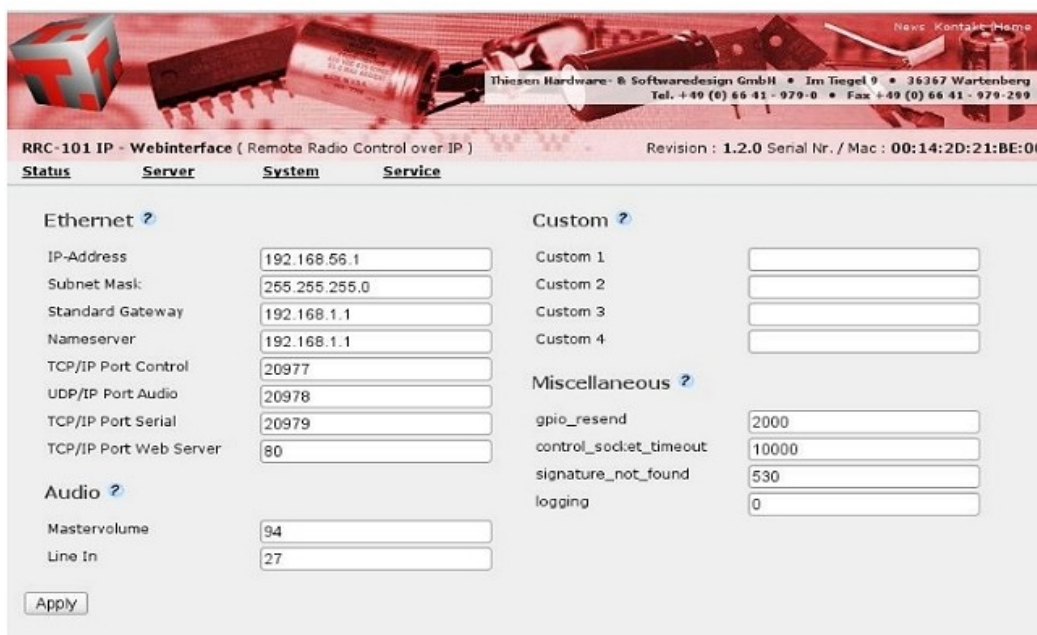
Audio Quality: Configure audio coding schemes and sampling rates (see 6. Audio Transport)

Server > Audio Quality > Codec: raw | speex | μ -law | a-law

Sampling rate: 8000 Hz | 16000 Hz | 32000 Hz

(see 6. Audio Transport)

8.5 System Page



The System page allows the operator to configure the system-settings of the RRC. The System page is common to both client and server units and all RRC options.

8.5.1 Ethernet

Ethernet provides the configuration of all relevant IP and Network settings. See 8.1. Connecting to the Web-browser interface for guidelines and conventions on these settings.

System > Ethernet

IP-Address: Static IP address of the RRC

Subnet Mask: Determines the subnet; devices that have a common IP address routing prefix. We recommend using the default 255.255.255.0. Please contact your system administrator before changing this value.

Standard Gateway: A node (a router) on a TCP/IP Network that serves as an access point to another network. As the RRC will typically connect directly to the network, we recommend to leave this value or use the RRC's IP-Address. Please contact your system administrator before changing the gateway.

Nameserver: The network nameserver. A nameserver allows to use names to identify devices rather IP-addresses. Requires a Nameserver to present in the network. Enter that nameserver here.

Ports: Allows the operator to specify a port on the device with that IP-address. The appropriate router must be configured to port forwarding.

Field	Value	Transport
TCP/IP Port Control	<integer>	Commands
UDP/IP Port Audio	<integer>	Audio
TCP/IP Port Serial	<integer>	Serial Data
TCP/IP Port Web server	<integer>	User Interface

8.5.2 Audio

Mastervolume: Output level of Audio

System > Audio > Mastervolume: <integer> An increment of 1 equals a 1.5dB change in level

Line In: Input level of Audio

System > Audio > Line IN: <integer> An increment of 1 equals a 1.5dB change in level

8.5.3 Custom

Allows to enter a text, e.g. location, description and maintenance contact for this specific device.

System > Custom {1,2,3,4}: <alphanumeric>

8.5.4 Miscellaneous (Advanced)

Allows to alter system-internal settings. We recommend to retain the default values.

8.6 Service Page



The Service page allows the administrator to control the various services (functions) executed by the RRC's internal software and to set a new password.

8.6.1 Services

Activate, deactivate and restart the internal services on the RRC. Send a sinusoidal test tone

Services	Status		
RRC	active	Deactivate	Restart
Test-tone	inactive	Activate	

RRC101-IP User-interface

Service > Services > rrc-server/rrc client: Activate | Deactivate | restart

Activates, deactivates or restarts the following services (functions):

- Serial data
- Parallel data
- Audio transport
- Tx/Rx Control

Note: A restart requires approximately 3 seconds to execute.

Service > Services > test tone: Activate | Deactivate | <integer>

Activate/deactivate the transmission of an sine wave test-tone used to adjust ('calibrate') levels on the RRC. The integer value is the frequency in Hz. Values can be from 50Hz to 10000Hz (10kHz)

Important note: Services must be deactivated before activating.

8.6.2 Password

When in use, the RRC is as present as any other connected device on the open internet. To restrict access, a password must be assigned. The default password is admin.

We strongly recommend to assign a unique password and to keep that password safe.

Setting a new password:

- Enter your current password (default: admin) in Current Password
- Enter a new password in New Password
- Confirm the new password in Re-Enter Password
- Ensure you Apply the new settings

Password conventions:

- at least 5 characters, alphanumeric [A-Z a-z 0-9] and "." and "_"
- "." and "-" are not allowed at beginning or end (E.g. Thiesen_demo01.36337)
- No other special characters such as "/" or "-"

8.6.3 Miscellaneous > Reboot

Reboot the RRC. Please note that reboot ends all current services and sessions and shut downs the operating system (OS). This means that any active communications and data-applications will be terminated. The OS, applications and services are then automatically restarted in the previous (saved) configuration. This process requires approximately 3 minutes.

9. Firmware and Network

9.1 Memory-stick FW update

Firmware updates are easily executed with a USB memory-stick. The updates are simply downloaded from a PC to the memory-stick and then transferred to the RRC101-IP using the RRC101-IP's front-panel USB port. Once the memory-stick is applied, the RRC101-IP automatically downloads and installs the updates. Once the RRC101-IP signals the successful update, the memory-stick is removed.

Ensure the following files are copied onto the USB memory-stick:

- *colibri.jffs2* → Root file system
- *colibri.jffs2.md5* → MD5-Checksum, ensures *colibri.jffs2* is correct
- *colibri.jffs2.rev* → Revision root file systems
- *kernel_rrc* → Kernel
- *kernel_rrc.md5* → MD5-Checksum, ensures *kernel_rrc* is correct
- *kernel_rrc.rev* → Kernel revision
- *gpiotool* → Update status notification

Then proceed as follows:

1. Disconnect RRC101-IP from power supply
2. Insert the USB- memory-stick into the RRC101-IP'S USB port
3. Re-connect the power supply to the RRC101-IP
4. The RRC101-IP will recognise the memory-stick, down-load the files and execute the update automatically
5. The RRC signals it is executing the update through the **alternately flashing** red and yellow front-panel status LED's
6. The RRC signals the successful update (after approximately 3-5minutes) through **simultaneously flashing** red and yellow front-panel status LED's
7. Disconnect RRC101-IP from power supply
8. Remove the memory-stick
9. Re-connect the power supply to the RRC101-IP

9.2 Remote FW update

The RRC FW can also be updated remotely via the IP network. This is currently only possible through the factory. Please contact us for more details.

9.3 Factory Reset

A Factory Reset sets the RRC back into the factory-default settings. The reset is similar to the FW update via USB (memory) stick.

Important note: A factory reset discards all other settings, including passwords and custom entries. Please make note of your settings and password before executing a factory reset

Default IP Address: 192.168.56.1 User: admin

Password: admin

Configuring the memory stick:

Single RRC

Create a file called '**reset**' in the **serial number folder** that is named after the unit's serial number

reset file is **automatically deleted** after the reset

Single and Multiple RRC's

Create a file called '**reset**' in the **root** of folder structure the memory stick

reset file is **not deleted** after the reset

Note: The content of the reset file is irrelevant.

Execute factory reset:

1. Configure / check memory stick
2. Turn off RRC
3. Attach memory stick to USB port
4. Turn on RRC
5. The RRC recognises the reset file and executes a factory reset
6. The reset takes approximately two minutes
7. The RRC signals the completed reset through **simultaneously flashing** red and yellow front-panel status LED's
8. Remove the memory stick
9. The RRC is now available on its default IP address 192.168.56.1
10. If required, connect the RRC via a cross-over cable directly to a PC
11. Start the user-interface by entering the IP address in the browser
12. User and password are admin
13. Re-set the password to your password
14. As needed, re-enter the IP address previously used
15. Apply and re-connect the RRC to designated network
16. Re-start the user-interface to ensure the unit is recognised on the network
17. Re-enter your previous settings

9.4 Firewall and Router settings

The Firewall protects an internal network from unauthorised access and attacks via the external Internet. A firewall can be implemented both in software (application) and hardware (e.g. within a router). A router fundamentally is a device that connects two or more logical subnets, directing and forwarding information. Routers are often used as a residential gateways where multiple computers (multiple IP addresses within an intranet) are connected to a single internet connection, typically with a single IP address.

Firewalls are typically configured to allow local computers to access the internet, while remote access from the internet is blocked. Yet, some applications require devices with their own IP-address to receive unsolicited data from the internet, in other words a remote device may need to be allowed to access a local device without the local device initiating the access.

The RRC Application is such a case. The SW on the RRC automatically seeks to connect to the opposite unit to initiate and maintain the transmission of Audio and Data signals between the two RRC's. Three data-channels are established: One Audio and two for Data, including PTT state, Squelch status, Channel, RSSI (received signal strength indicator), Port 3 setting, etc. Information is transported using User Datagram Protocol (UDP).

The ports used for the UDP/RTP data-transfer must be enabled in the router respectively the firewall. The RRC101-IP uses ports 20977 through 20979 as default. The first port can be configured in the web-browser interface under the menu "service".

Important note: Ports 20977, 20978 and 20979 must be forwarded to the IP Address of the RRC101-IP Server (Router setting)

Tips for configuring the router

Forwarding: Most routers can be configured to forward ports to specific computers (IP-addresses). Ports 20977, 20978 and 20979 must be forwarded to the IP Address of the RRC101-IP Server.

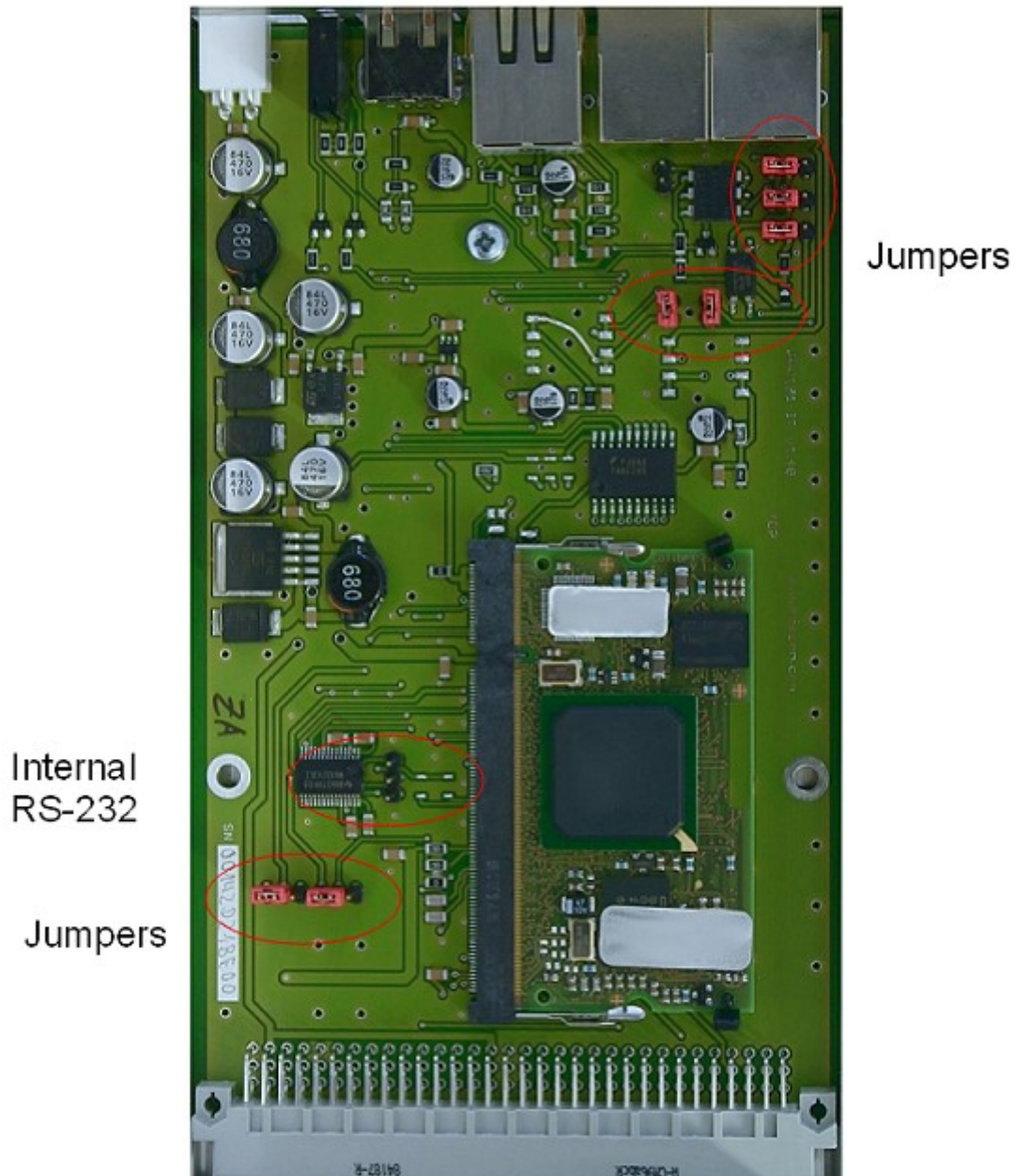
Port triggering: Some routers provide 'intelligent' forwarding whereby the router attempts to forward data to the most-likely IP-address (computer), based on previous requests/initiation sent to the internet by a specific computer.

Routers and firewall applications are offered by many different manufacturers and while they all provide the same basic functionality, they differ in their specific application, implementation and especially in their user-interfaces. For details on how to configure a specific router or firewall application, please refer to the product's documentation and/or the manufacturer's web-site.

10. Product images

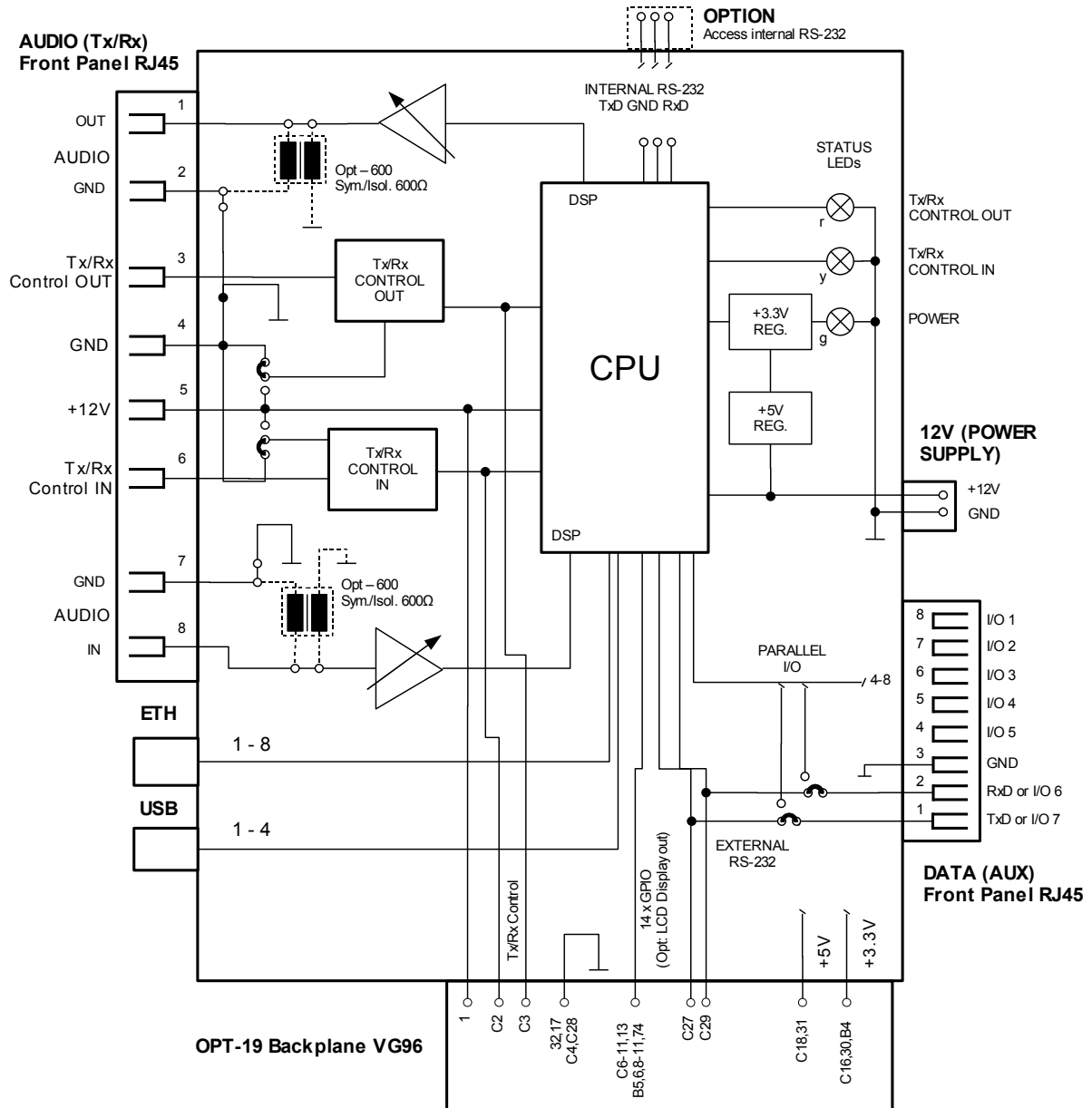
10.1 RRC101-IP internal view

+12V USB ETH DATA (AUX) AUDIO



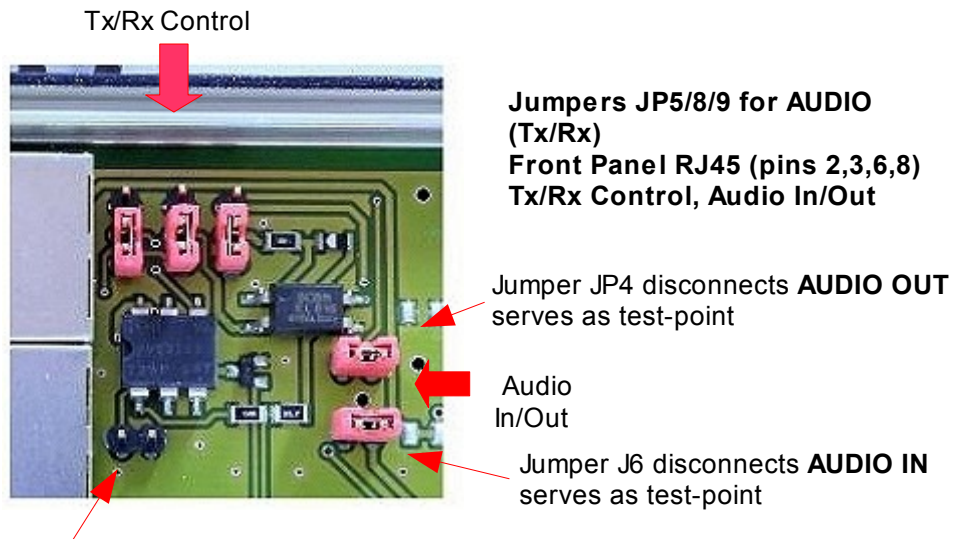
VG96 Backplane Connector

10.2 Block diagram



11. Interface configuration via jumpers

11.1 AUDIO (Tx/Rx) Front Panel RJ45



If Jumper J3 SET, Audio-Signal is continually transmitted by the RRC (external PTT)

Factory settings

- **Tx/Rx Control OUT:** Active OUPUT **+12 V** on **PIN 3**, AUDIO (Tx/Rx) Front Panel J45
- **Tx/Rx Control IN:** Active INPUT **GND** on **PIN 6**, AUDIO (Tx/Rx) Front Panel J45

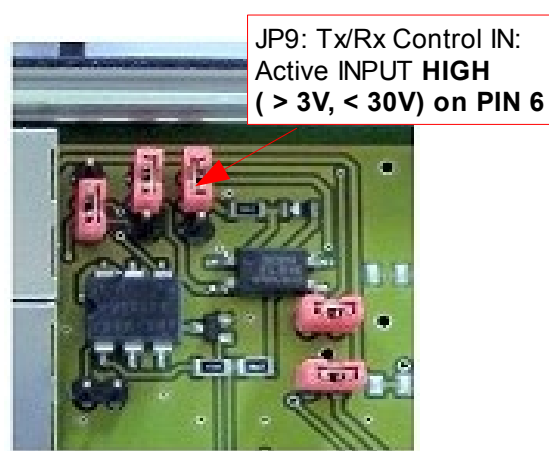
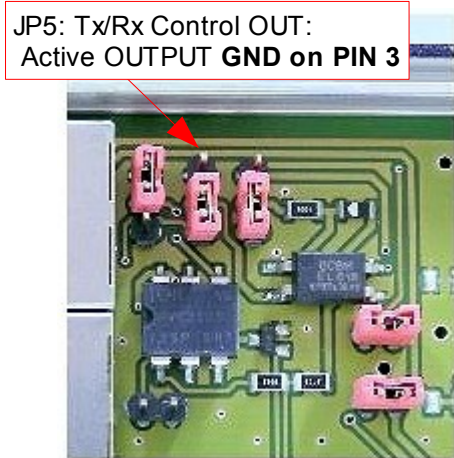
11.2 Test-Mode

- **JP8:** Tx/Rx Control **OUT** and **IN** are **constant active** (yellow status LED on)



Interface configuration via jumpers

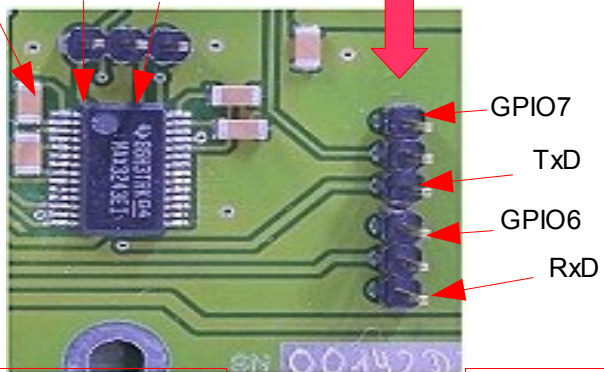
11.3 Tx/Rx Control IN/OUT



11.4 DATA (AUX) Interfaces

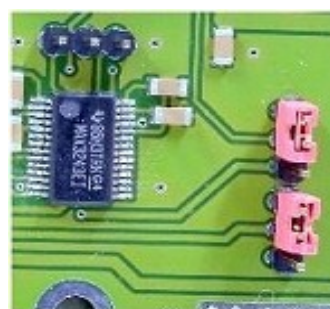
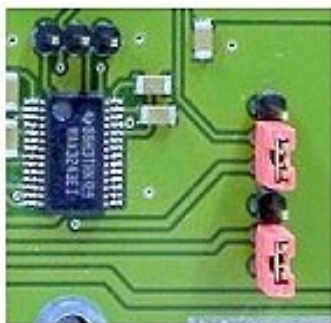
Internal RS-232
RxD GND TxD

Jumpers JP1/7 for DATA (AUX)
Front Panel RJ45 (pins 1&2)
RS-232 or Parallel GPIO6&7



RS-232 on PINS 1&2
DATA (AUX) Front Panel RJ45
(I/O 6&7 disabled)

Parallel GPIO 6&7 on PINS 1&2
DATA (AUX) Front Panel RJ45
(RS-232 disabled)



12. General safety notices

Please read all applicable instructions and user manuals prior to installing and operating the device.

The installation, connection, maintenance and otherwise handling of mains power supply, electrical wiring, telecommunications wiring and apparatus and general electronics and electrics, radio transmitting and receiving devices and installations must be executed in accordance with national and international rules and regulations and is only to be executed by qualified personnel.

The following general safety notices must be adhered to:

- **Always disconnect mains power supply and any external wiring prior to opening the device**
- **All installation, maintenance, repair and associated work is to be done by qualified personnel only**
- Ensure mains power supply and any external wiring are disconnected prior maintenance or repair
- Ensure appropriate safety measures in regards to RF-radiation when executing maintenance or repair in the vicinity of radio transmitters
- **Ensure all covers and safety features are properly installed before connecting the unit to power supply and mains and other wiring**
- Regularly check leads and external wiring. Replace faulty wiring immediately by appropriately qualified personnel
- Regulated and required checks and routine maintenance as specified by applicable national and international regulations must be executed (e.g. VDE 0701, 0702 Germany).
- Specifically ensure that all potentially hazardous voltages are removed and/or discharged before using tools in the vicinity of electrical or electronic components, wiring and/or circuit boards.
- **Important Safety Note:** Capacitors can hold a hazardous charge even after all external voltages have been disconnected. Ensure that capacitors are discharged through safe and appropriate means. DO NOT discharge the capacitor by short-circuiting!
- All specifications regarding voltages, currents, temperature and environment MUST BE adhered to as exceeding the limits for even a short period can damage components beyond repair and may even lead to injury
- The instruments, devices, assemblies, components and otherwise are to be used and operated solely for the intended use as described in this manual.
- Should you have questions or concerns, please do contact Thiesen Hardware- & Software-Design GmbH or the dealer you purchased this unit from

13. Support & Sales

Please feel free to contact us, should have any questions, suggestions or requests via e-mail:

Factory & Headquarters Germany

Monday to Friday, 9:00AM to 4:00PM CET:

International: +49 66 41 / 9 79-0

National: 0 66 41 / 9 79-0

pmr@thiesen.com

14. Return and recycling

Please refer to applicable legislation for your area or contact your authorised dealer and/or distributor.

15. Acronyms and definitions

101	1 0 1	
		Number of channels
		Software Revision (0 = Standard, X = customised)
		Unit/Device Revision (1 = default, first generation)
AC		A lternating C urrent
BOS		Governmental Agencies and Organisations for Security and Safety (Germany)
DC		D irect C urrent
GPIO		G eneral P urpose I nput O utput,
I/O		I nput/ O utput
IN		I nput
IP		I nternet P rotocol → Internet/Intranet
ISDN		I ntegrated S ervices D igital N etwork → Digital Telecommunications standard
MAB		M ulti- A ccess B ox
LF		L ow F requency (baseband)
OUT		O utput
PMR		P rivate M obile R adio also P rofessional M obil R adio
PTT		P ush T o T alk (enables RF on transmitter)
Radio		R adio T ransceiver
RoIP		R adio o ver I nternet P rotocol
RRC		R emote R adio C ontrol
RDU		R emote D esktop U nit
RxD		R eceive data RS232
SCL		C lock I2C-Bus
SDA		D ata I2C-Bus
SSH		S ecure S hell
TETRA		T errestrial T runked R adio
TxD		T ransmit data RS232
Tx/Rx		T ransmit/ R eceive
VoIP		V oice o ver I nternet P rotocol

16. Certifications

16.1 EC Conformity Declaration

The company:

Thiesen Hardware- & Software-Design GmbH
Im Tiegel 9
36367 Wartenberg



declares, that the devices Remote Radio Control over IP (RRC101-IP) and Remote Desktop Unit (RDU101) comply with the following standards and regulations:

DIN / EN 55022	Radiated Emissions up to 1 GHz
	Conducted Emissions
EN / IEC 61000	Conducted Susceptibility
	BURST, SURGE, ESD

16.2 RoHS Conformity Declaration, EC

2002/95/EG/RoHS (Restrictions of Hazardous Substances)

The company:

Thiesen Hardware- & Software-Design GmbH
Im Tiegel 9
36367 Wartenberg

declares, that the devices Remote Radio Control over IP (RRC101-IP) and Remote Desktop Unit (RDU101) is manufactures comply with the Directive 2002/95/EC (RoHS).

Important Note: Adaptation, alteration and improper installation and use of the devices that is not specifically agreed to in writing by senior management of Thiesen Hardware- & Software-Design GmbH voids the above declarations. Installation, operation and maintenance of products and devices must be in accordance with applicable safety guidelines and regulations and the information provided in the user manual and applicable documentation provided.

This declaration is given in responsible representation of the manufacturer Thiesen Hardware- & Software-Design GmbH by:



Wartenberg, 10.06.2008

Jürgen Thiesen, Managing Director

17. Disclaimer

The information in this document is subject to change without notice and does not represent a commitment on the part of the vendor. Images and diagrams in the manual may resemble but not exactly match the actual product and software. No warranty or representation, either expressed or implied, is made with respect to the quality, accuracy or fitness for any particular purpose of this document. The manufacturer reserves the right to make changes to the content of this document and/or the products associated with it at any time without obligation to notify any person or organisation of such changes. In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages arising out of the use or inability to use this product or documentation, even if advised of the possibility of such damages.

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18. Revision control

Date	Changes
09/08/09	Updated and restructured English Version: RRC101-IP_EN090810 <ul style="list-style-type: none">• created one front-panel interface figure and deleted redundant figures• reworked images to reduce file-size• assigned sections to hardware groupings RRC units, accessories, IP radio• consolidated disparate information on data-transport in two sections• created Data transport section• created Audio transport section• cleaned up images and layout in section on jumpers• deleted screen shot section• organised UI screen shots together with description of UI• eliminated redundant information in web-browser chapters• updated table-formats• corrected errors in content• incorporated changes from German version RRC101-IP-Service-Handbuch090720
06/03/09	New English Version: RRC101-IP PRODUCT MANUAL Rev.: RRC101-IP_EN_06/03/09
06/03/09	Rev.: RRC101-IP_EN_06/03/09-2 Minor corrections, added relevant information on QoS, 12. Bandwidth and Quality implications
07/03/09	Rev.: RRC101-IP_EN_07/03/09-2 Minor corrections
09/03/09	Rev.: RRC101-IP_EN_09/03/09 New pictures of 19" version

Configuration Worksheet

The worksheet can be used to submit the details of your device(s) for support or other purposes. Please submit either one sheet per unit, or if configurations are the same for multiple units, please enter their IP addresses under comments. Thank you.

Client

Contact

Telephone

e-mail

Unit

Ser.No.		
Type	<input type="checkbox"/> RRC 101-IP standalone	
	<input type="checkbox"/> RRC 101-IP in 19"	
Options	<input type="checkbox"/> BOS Option, Call 1 and Call 2	
	<input type="checkbox"/> 600 Ω Audio Symmetric In/Out	

HW Configuration

	Tx / Rx Control Out	<input type="checkbox"/> Active GND
		<input type="checkbox"/> Active +12 V
	Tx / Rx Control In	<input type="checkbox"/> Active GND
		<input type="checkbox"/> Active +1.5V to +30V
	Data RJ45	<input type="checkbox"/> 2 RS232 / 5 Parallel
		<input type="checkbox"/> No RS232 / 7 Parallel

SW Configuration

	Software	<input type="checkbox"/> Server	<input type="checkbox"/> Client	
	IP-Address			
	Subnet mask			
	Gateway			
	Remote-Address			
	Ports	Control:	Audio:	Serial:
	Audio Level IN	mV		
	Audio Level OUT	mV		
	Parallel Data Port	RJ45	active <input type="checkbox"/>	inactive <input type="checkbox"/>
VG96		active <input type="checkbox"/>	inactive <input type="checkbox"/>	

Comments