

Installation and Configuration Manual

RT-800

Wideband Precision Direction Finder RHOTHETA Elektronik GmbH



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Note

The manufacturer reserve the right to make modifications at any time and without previous information of the here described product.

Content

1	Antenna Installation Considerations	6
1.1	General Information	6
1.2	Installation Recommendation	7
1.3	Line of Sight and Fresnel Zone	8
1.4	Reduced Bearing Accuracy Caused by Reflections	9
1.5	Lightning Protection	10
1.6	North Alignment	11
1.7	Antenna Connection	11
2	Interfaces.....	12
2.1	Overview.....	12
2.2	Device Ports	13
2.2.1	Antenna Unit Port (Connecting Cable DCU ⇔ AU).....	13
2.2.2	GPS / RS422 Port.....	14
2.2.3	Fuse F3.....	14
2.3	Remote Control and IP-Audio Encoder Ports.....	15
2.4	Power Supply.....	16
2.5	Service & Maintenance Ports	17
2.5.1	Power Supply and Optional Connections	17
2.5.2	NMEA Bus (RS 232)	18
2.5.3	Test / Program	19
3	Configuration	20
3.1	Configuration Considerations of “Menu – Setup”	20
3.1.1	Menu Interface	20
3.1.2	Menu System	22
3.2	Configuration of Remote Control over IP	23
3.2.1	Introduction / Concept.....	23
3.2.2	NPort Administrator	23
3.2.3	Configuration.....	24
3.3	Configuration of Audio over IP.....	28
3.3.1	Introduction / Concept.....	28
3.3.2	DCU Configuration of Audio IP Settings	28
3.3.3	Configuration of IP-Audio to Line-Audio Converter at Remote Site	31
4	Appendix	36
4.1	List of abbreviation.....	36

List of figures

Fig. 1 Antenna Mounting.....	7
Fig. 2 Line of Sight and Fresnel Zone.....	8
Fig. 3 Illustration of Reflections at fixed locations.....	9
Fig. 4 North Marking of Antenna Unit	11
Fig. 5 Overview of Interfaces	12
Fig. 6 Connecting cable DCU ⇔ AU	13
Fig. 7 NMEA-Talkmode Settings	20
Fig. 8 NMEA-Baudrate Settings.....	21
Fig. 9 System – Audio Line Output Setting	22
Fig. 10 System – Antenna Offset Settings	22
Fig. 11 Setup-File of NPort Administrator	23
Fig. 12 Location of Instreamer 100 Documentation	30
Fig. 13 IP-Audio to Line-Audio Converter BARIX Exstreamer	31
Fig. 14 Location of Exstreamer 100 Documentation	35

1 Antenna Installation Considerations

1.1 General Information

For static bearing applications like e.g. VTS (vessel traffic service), a high bearing accuracy is demanded, with small tolerable bearing errors. For this purpose the antenna unit possibly has to be calibrated in order to compensate minor unbalances in rotation, but especially the antenna position at the installation site has to be chosen properly for bearing purposes.

In case of perturbing site conditions resp. restrictions caused by the building or the environment, the bearing accuracy might be disturbed. This physical effect generally is valid for all bearing systems.

1.2 Installation Recommendation

The quality of the bearing results depends largely on the position of the antenna. So, an antenna position has to be found, where the transmitter's wavefield can reach the bearing antenna as undisturbed as possible.

In order to obtain very good bearing results, no metallic resp. RF-conducting obstacles may be around the antenna unit (in an angle of $\pm 45^\circ$ towards the horizontal). The only exception is a correctly installed Lightning Protection Rod, optional available by RHOTHETA.

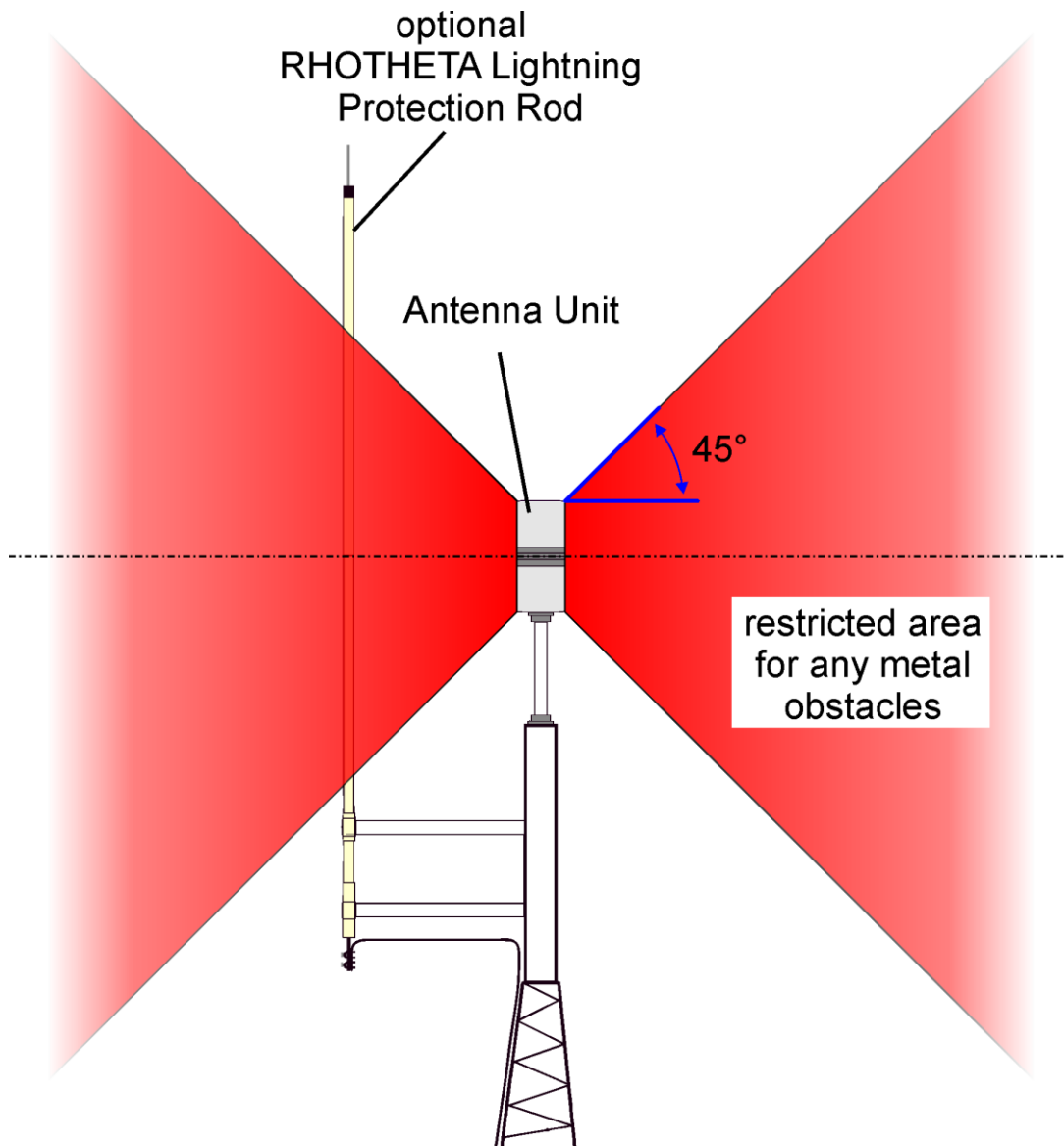


Fig. 1 Antenna Mounting

Objects being in the “restricted area” will disturb the arriving wave field. Reflections will arise which might decrease bearing accuracy.

1.3 Line of Sight and Fresnel Zone

There must be a direct line of sight between the transmitter (ship) and the antenna unit. Furthermore the Fresnel Zone (http://en.wikipedia.org/wiki/Fresnel_zone) must be free of any obstacles.

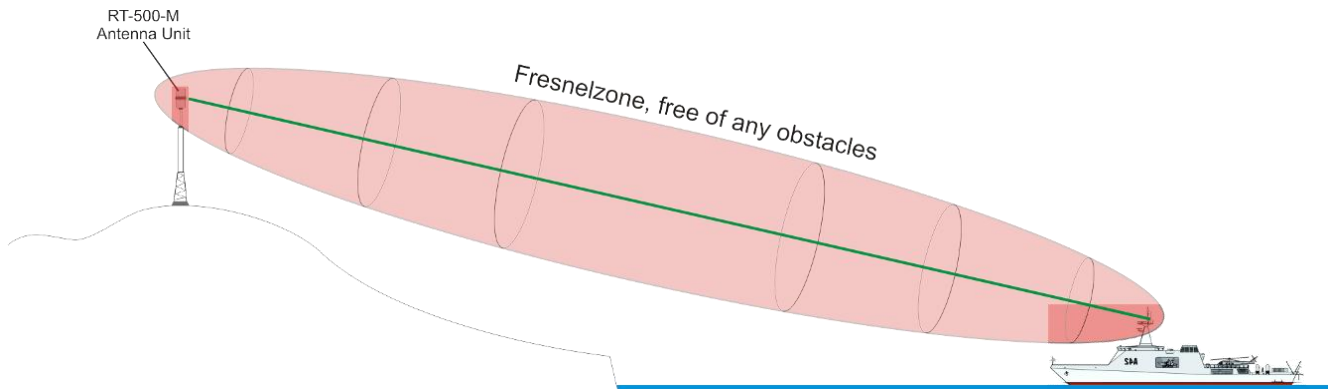


Fig. 2 Line of Sight and Fresnel Zone

In case of obstacles within the Fresnel zone, the direct RF-signal will be weakened and possibly reflections will be more noticeable.

1.4 Reduced Bearing Accuracy Caused by Reflections

Big natural reflectors in the antenna unit's surrounding are especially critical! (e. g. mountains in the back-side of the antenna, sharp rocky coasts or forests) Especially if the directly arriving wave field is very weak due to a remote transmitter, high mountains can cause reflections by receiving the signal better (due to their height) and therefore also causing stronger reflections.

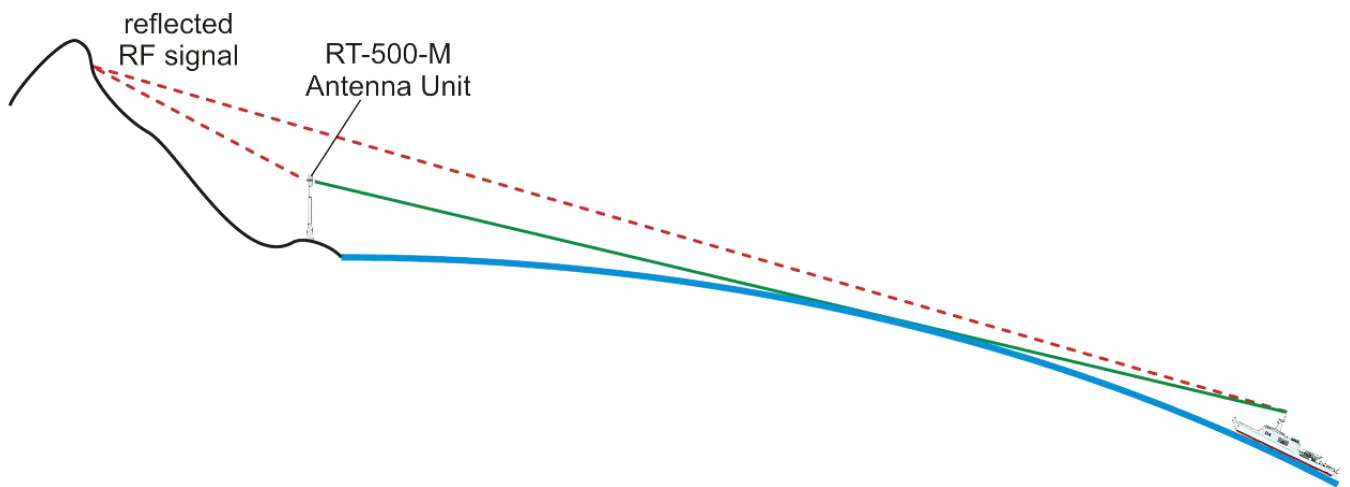


Fig. 3 Illustration of Reflections at fixed locations

1.5 Lightning Protection

When installing the RT-800 (AU) at fixed coastal locations, precautions must be taken regarding lightning protection.

For this reason RHOTHETA Elektronik GmbH offers an optional Lightning Protection Rod (LPR).

The Lightning Protection Rod for precision direction finders is designed to protect direction finders from RHOTHETA against the effects of direct lightning strokes into a direction finder system.

Normal lightning protection rods are simple metallic structures which have a large influence on the direction finding accuracy of a direction finder due to reflecting radio waves, so as any other metallic structure in proximity of the direction finder. The practical limits are in contradiction to the requirements of an efficient lightning protection system.

The RHOTHETA Lightning Protection Rod uses special technologies to reduce those reflections. This reduces the effects of the protection rod to an acceptable level, but will not completely avoid any influence.

For detailed advice on mounting the Lightning Protection Rod please refer to the Installation Manual of Lightning Protection Rod!

1.6 North Alignment

Bearing values of RT-800 are always displayed and output *relatively* to the north marking of the antenna unit.

This implies that the north marking must be aligned to North in order to display absolute, north related values!



Fig. 4 North Marking of Antenna Unit

1.7 Antenna Connection

For details about the connection between the RT-800 DCU and Antenna Unit please look at page 13 (Chapter 2.2.1 Antenna Unit Port (Connecting Cable DCU ↔ AU))!

2 Interfaces

2.1 Overview

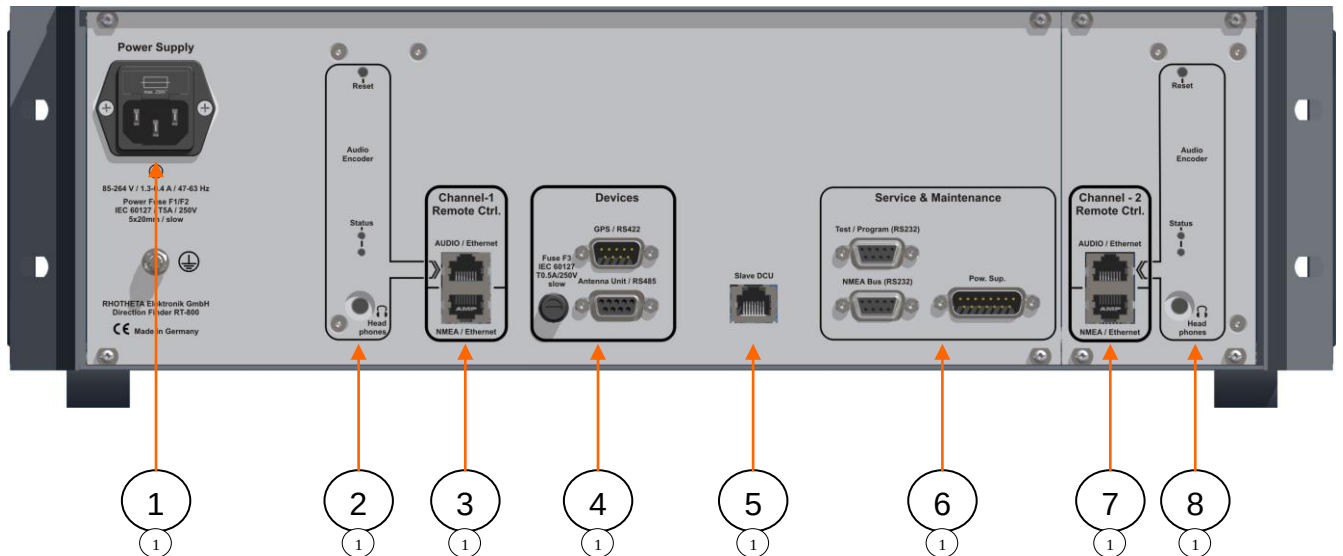
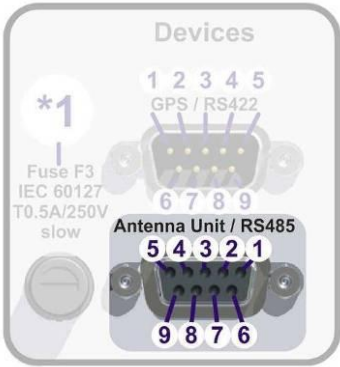


Fig. 5 Overview of Interfaces

Pos.	Designation	Meaning	See page
1	Power Supply	Power supply connector with replacable fuse	16
2	IP-Audio Encoder (Channel-1)	Audio Output for DF and ecoder cofiguration	15
3	Remote Control Channel-1	Ethernet ports for remote control (NMEA / Ethernet) and IP-Audio (AUDIO / Ethernet)	15
4	Devices	Connector ports for AU (antenna unit) and optional GPS-connector for the option "UTC Time Base"; fuse for AU / GPS power supply	13
5	Slave DCU	Ethernet connector for factory use only	---
6	Service & Maintenance	Ports for optional connections, SW-Update and local NMEA-Output	17
7	Remote Control (Channel-2)	Option: "2 nd Channel Remote Control" Ethernet ports for remote control (NMEA / Ethernet) and IP-Audio (AUDIO / Ethernet)	---
8	IP-Audio Encoder (Channel 2)	Option: "2 nd Channel Remote Control" Audio Output for DF and ecoder cofiguration	---

2.2 Device Ports

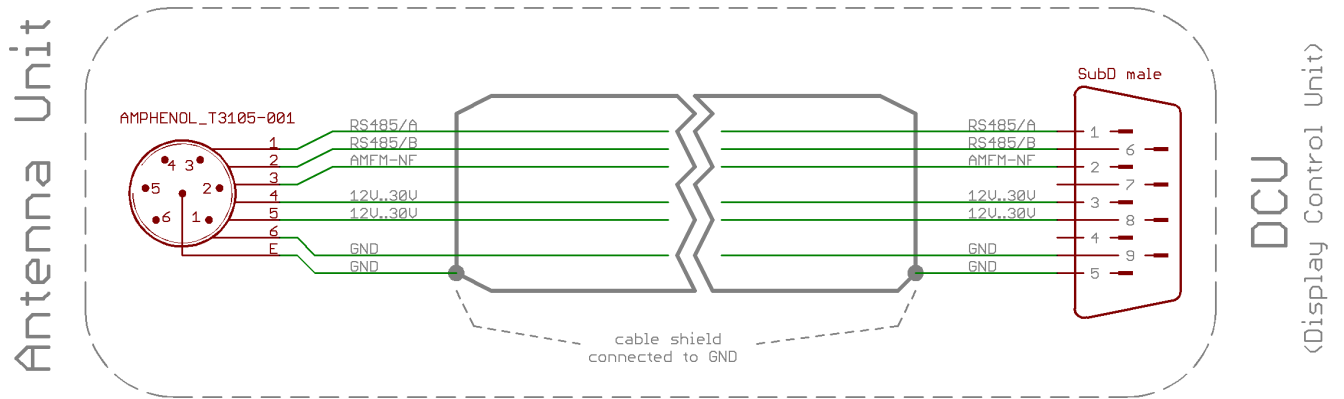
2.2.1 Antenna Unit Port (Connecting Cable DCU ⇔ AU)



Contact / Pin Signal

3	+24 V _{DC}	Output power supply to Antenna Unit
8		
5	GND	
9		
1	RS485 A	Serial data connection DCU ⇔ AU (9600 Baud / semi-duplex / receive and transmit)
6	RS485 B	
2	NF	Input audio signal resp. analog Test/Service

Connecting cable DCU ⇔ AU



Connection
Antenna Unit
Connector type:
Amphenol T3105-001

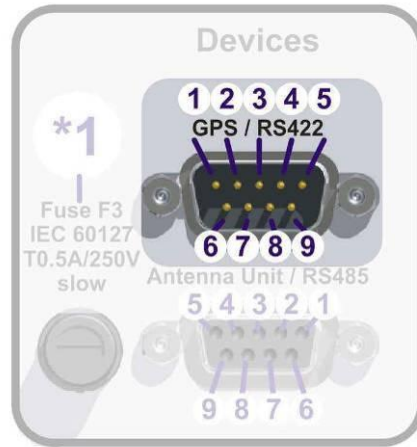
connecting cable 6-poled with shield
length 1 to 50 m: cross section of conductor min.
6 x 0.38 mm²
length 50 to 100 m: cross section of conductor min.
6 x 0.50 mm²

Connection
Display Control Unit
Connector type:
SubD 9-poled male

Fig. 6 Connecting cable DCU⇔AU

2.2.2 GPS / RS422 Port

This optional (Build-To-Order Option) input is used to connect an external GPS-device to set the internal system clock. This is required for synchronisation of the bearing values if several direction finders are connected together by a command and control center.



**Contact
/ Pin**

Signal

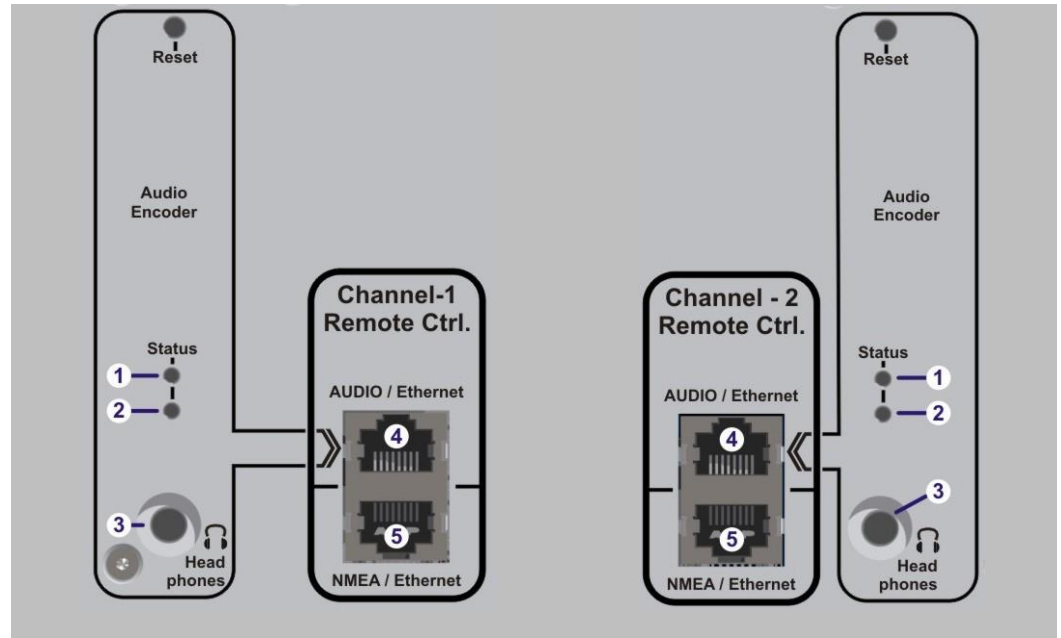
6	RS422 Rx / A	Input of serial GPS data with RS422 level
1	RS422 Rx / B	
5	GND	Output power supply for external GPS
9	+24V_{DC}	

2.2.3 Fuse F3



This protection fuse covers the power supply of antenna unit as well as external GPS.

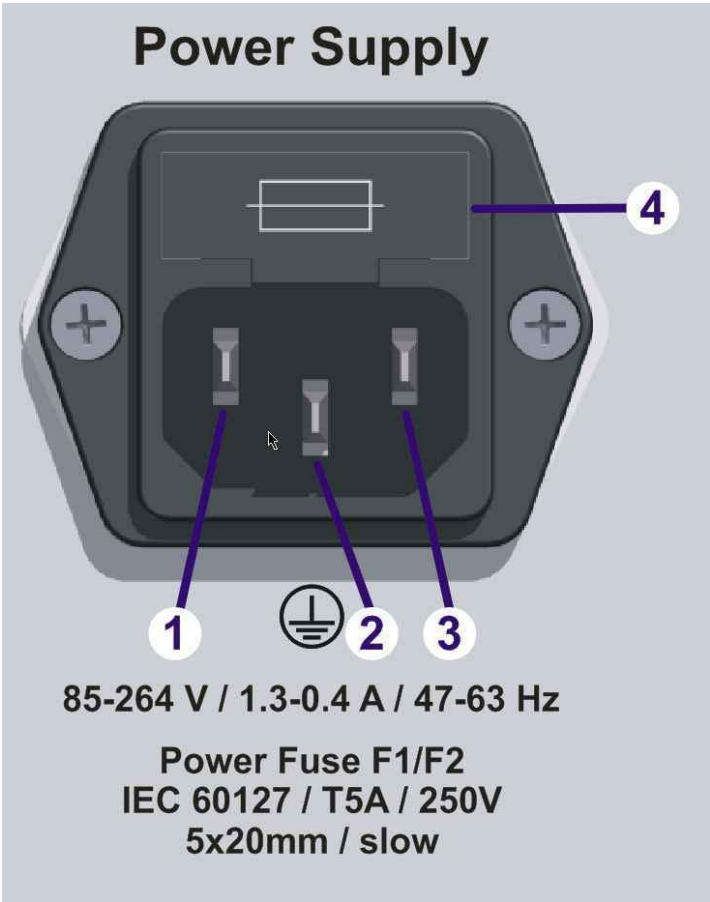
2.3 Remote Control and IP-Audio Encoder Ports



Item	Marking	
1	Status LED (red)	Blinks during boot process of IP Audio Encoder
2	Status LED (green)	Blinking: IP Audio Encoder is sending On: IP Audio Encoder is not sending
3	Head phones	After switching on the DCU, the current IP-address of the IP Audio Encoder is output to connected headphones. (This is only used during configuration process!)
4	Audio / Ethernet	Ethernet connection of IP Audio Encoder must be connected to LAN!
5	NMEA / Ethernet	Ethernet connection of NMEA remote control must be connected to LAN!

If the option “2nd Remote Control Channel” is used, so it has the same connectors as the Channel-1

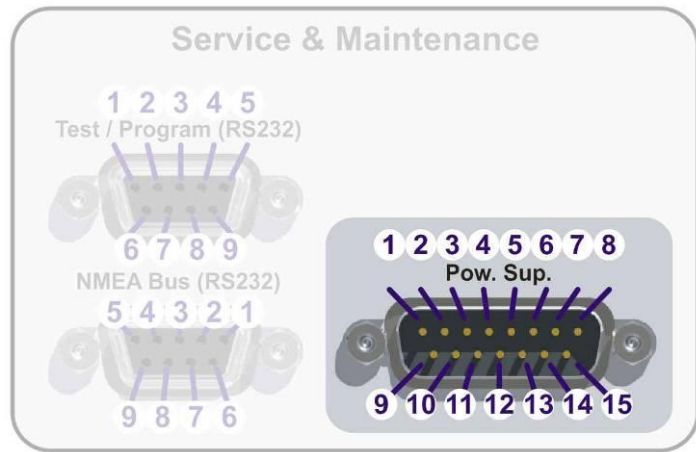
2.4 Power Supply



Item / Pin	Marking	
1	N (Neutral)	IEC 60320 / C14 inlet for use of power cords with IEC 60320 / C13 plugs. 85 – 264 Volts / 1.3 – 0.4 Ampere / 47 – 63 Hz
2	PE (protective earth)	
3	L (Line)	
4	Built-In Fuse (replacable)	Embedded replaceable Fuse of type IEC 60127 / T5A / 250V / 5x20mm / slow

2.5 Service & Maintenance Ports

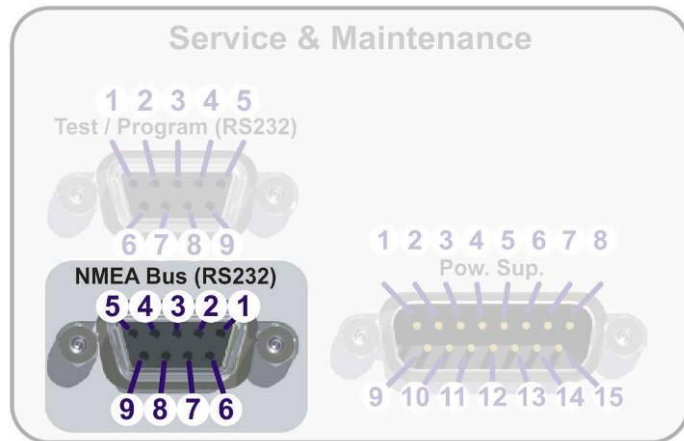
2.5.1 Power Supply and Optional Connections



Contact / Pin	Signal	
15	+12 V to +30 VDC	No connections required (internally connected)!
8	GND (Ground)	
7	Permanent Operation	No connections required (internally connected)!
14	PTT / SBS	Optional input in order to suppress self bearing. When connecting input PTT/SBS (Self Bearing Suppression) to Ground, self bearing is suppressed
6	GND	
12	Squelch Out	Optional output for audio connection. When receiving a signal this pin is connected to ground by the means of an Open Collector output.
4	GND	
1	Alarm Relay	Optional alarm contact (mechanical relay as NOC, Normal Open Contact) max. 1 A at 30 V _{DC} resp. max. 0.3 A at 125 V _{AC}
9		
3	Speaker +	No Connection required, because this ports are connected to the internal speaker!
11	Speaker -	
13	Audio Line Out	Connection not recommended, because this port is connected to the IP Audio Encoder! Audio output (connected to ground with fixed level. Adjustable in menu, from 200 mV _{SS} at 10% to max. 2 V _{SS} at 99%
5	GND	

2.5.2 NMEA Bus (RS 232)

This is an additional NMEA interface of the DCU. It is recommended to use it only for local tests, because commands sent to the DCU may be interfere with commands sent through NMEA - Ethernet interface!



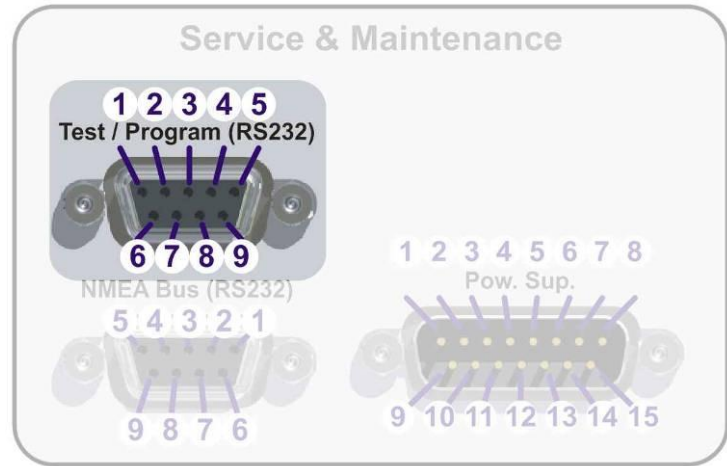
**Contact
/ Pin**

Signal

2	RS232 Tx	Output of serial data with RS232 level
3	RS232 Rx	Input of serial data with RS232 level
5	GND	GND level for RS232 connection

2.5.3 Test / Program

Port for service or test operation (Software and new firmware upload).



**Contact
/ Pin**

Signal

2	RS232 Tx	Output serial data with RS232 level
3	RS232 Rx	Input serial data with RS232 level
5	GND	GND level for RS232 connection

3 Configuration

3.1 Configuration Considerations of “Menu – Setup”

Within this manual there are described only a couple of the internal settings of “Menu – Setup” which are related to remote control and IP Audio.

For description of the other settings please refer to “*Operating and Installation Manual Part I*”!

3.1.1 Menu Interface

Menu Interface contains settings related to remote control using NMEA-Sentences.

3.1.1.1 NMEA Talk-Mode

There are basically two operation modes for getting standard bearing data from the RT-800.

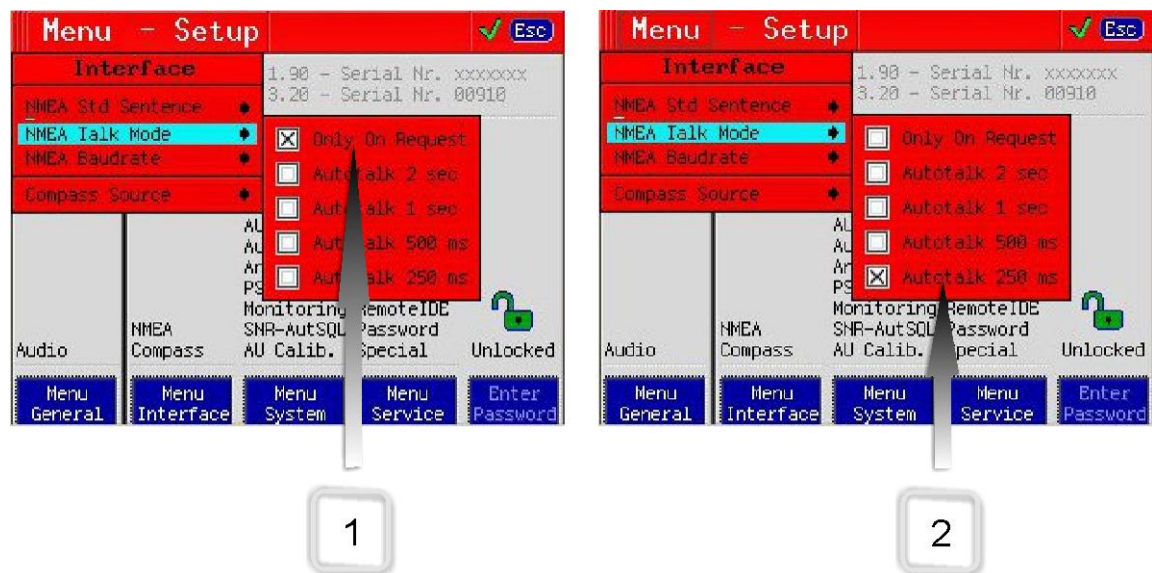


Fig. 7 NMEA-Talkmode Settings

1. On Request: The RT-800 sends the data only on request.
2. Autotalk: The RT-800 sends out the standard bearing data cyclically

Which mode to choose depends on the user supplied software controlling the RT-800!

3.1.1.2 NMEA Internal Baudrate

Internally the control panel of the RT-800 (display with buttons) is connected to a serial-to-ethernet converter by a serial line.

This implies that the **same** serial configurations must be used in both, the control panel and the serial-to-ethernet converter. Configuration of serial-to-ethernet converter is described on page 23 in chapter 3.2 Configuration of Remote Control over IP!

Standard configuration is: 4800Baud / 8 databits / 1 stopbit / no parity / no flow control

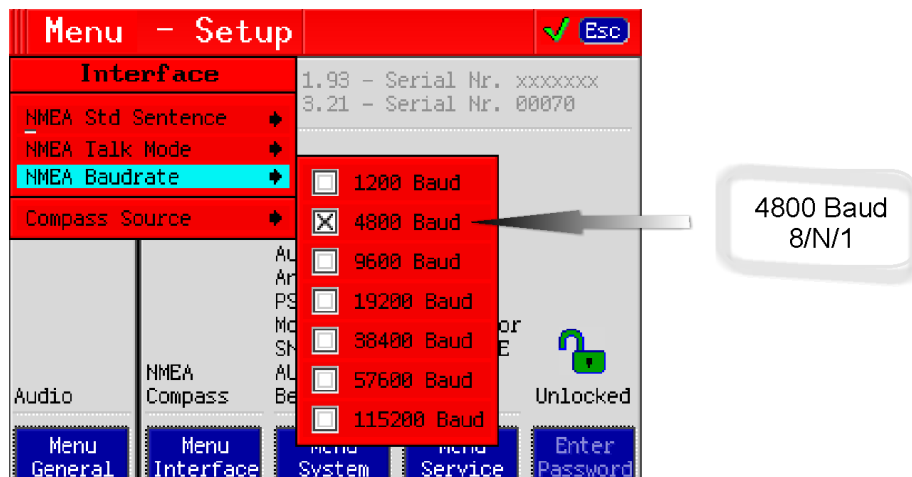


Fig. 8 NMEA-Baudrate Settings

3.1.2 Menu System

3.1.2.1 Audio Line Output

RT-800 control panel audio output consists of two parts:

1. The first audio output is connected directly to the internal speaker and its volume can be controlled by the “Volume”-Dialogue of the control panel.
2. The second audio output is connected to the input of the IP Audio converter. With the “Audio Line Output”-Setting of control panels “System Menu” the level of this audio signal can be adjusted from 200 mV_{SS} at 10% to max. 2 V_{SS} at 99%.

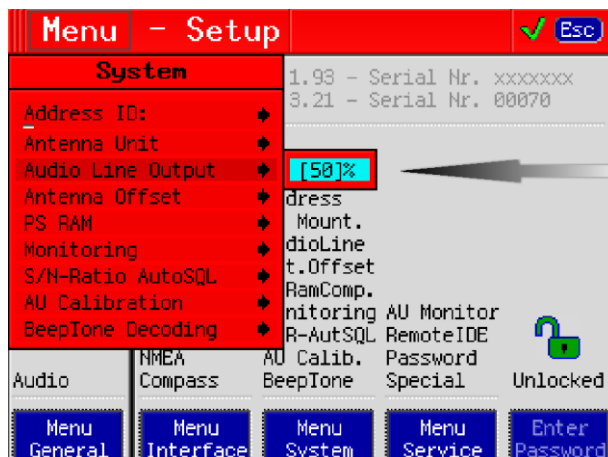


Fig. 9 System – Audio Line Output Setting

3.1.2.2 Antenna Offset

If a fixed bearing offset is present after mechanical installation of the RT-800 AU (i.e. Antenna Unit is not exactly aligned with North), this offset could be compensated using the “Antenna Offset” setting of control panel’s “Menu System”.

An offset of 0 – 359° can be entered, what means if you need to correct -5°, you enter 355°!

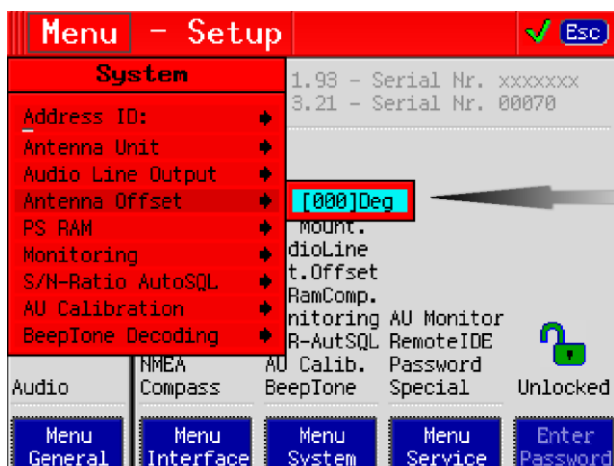


Fig. 10 System – Antenna Offset Settings

3.2 Configuration of Remote Control over IP

3.2.1 Introduction / Concept

As stated before, the control panel is internally connected to a serial-to-ethernet converter by a serial line. So it is crucial that the serial settings of the converter match the settings of the control panel. Once the serial side is set up correctly, the converter itself offers several possibilities of IP configuration. First of all the IP settings must be done.

Default Settings for the converter after delivery:

- IP Address: static 192.168.77.230
- Operating Mode: TCP Server Mode (Local TCP Port = 4001)
- Serial Settings: 4800,N,8,1, No flowctrl

The next chapter describes the configuration of this ethernet converter. It can be set also to DHCP or any custom specific IP address.

You have to connect the “NMEA / Ethernet” port to a LAN. Then you can use a provided tool (NPort Administrator) to configure the settings of the remote control connection.

3.2.2 NPort Administrator

The provided „NPort Administrator“ is used to configure the serial-to-ethernet converter. You find the setup of NPort Administrator on the RT-800 companion CD provided with the device.

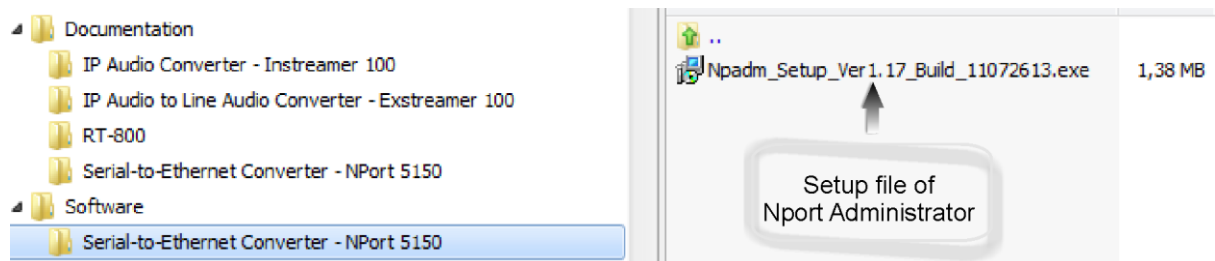
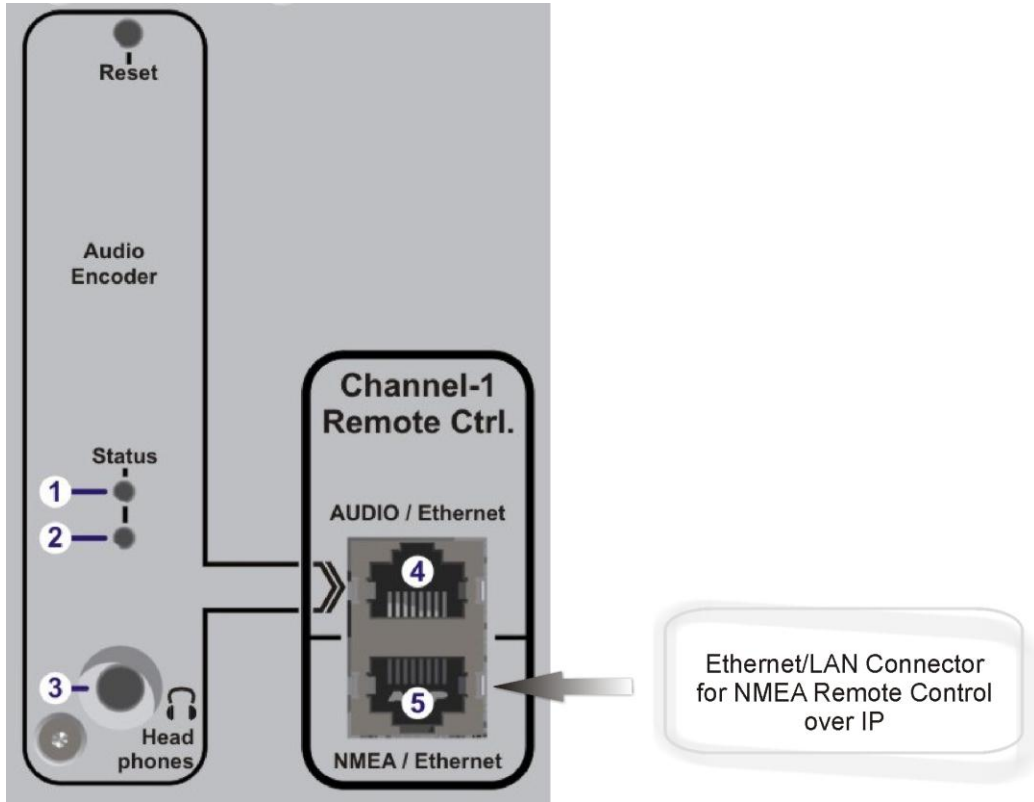
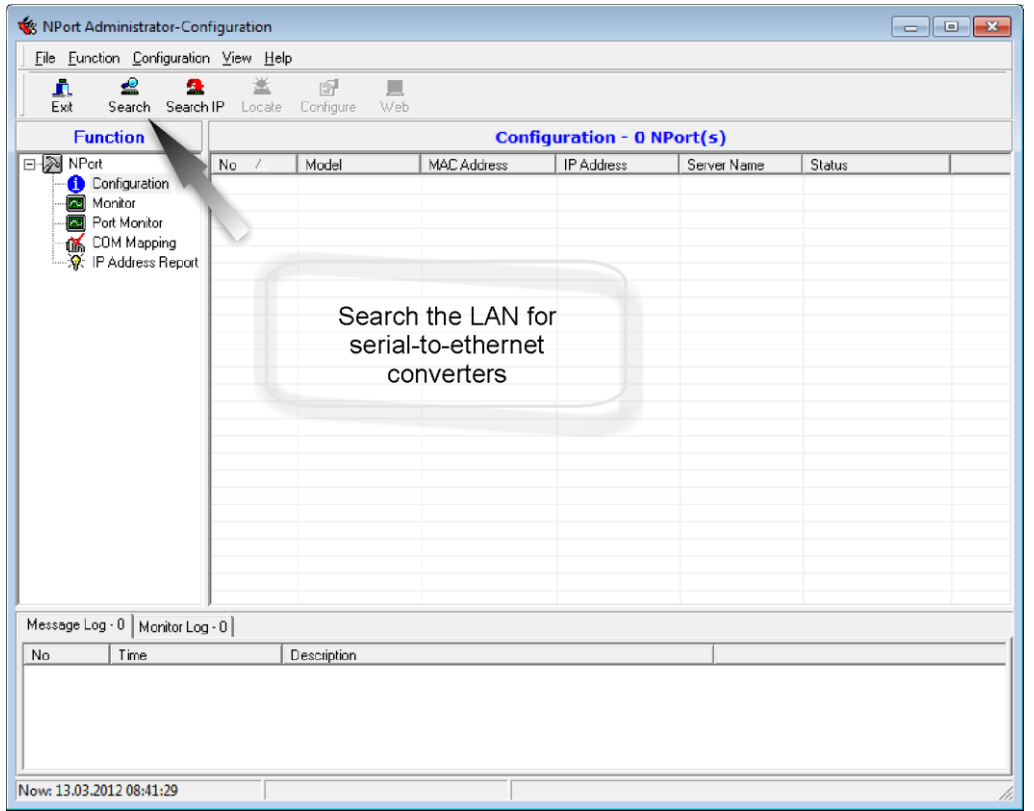


Fig. 11 Setup-File of NPort Administrator

To install NPort Administrator please start the setup “Npadm_Setup_Ver1.17_Build_11072613.exe” and follow the instructions of the setup wizard.

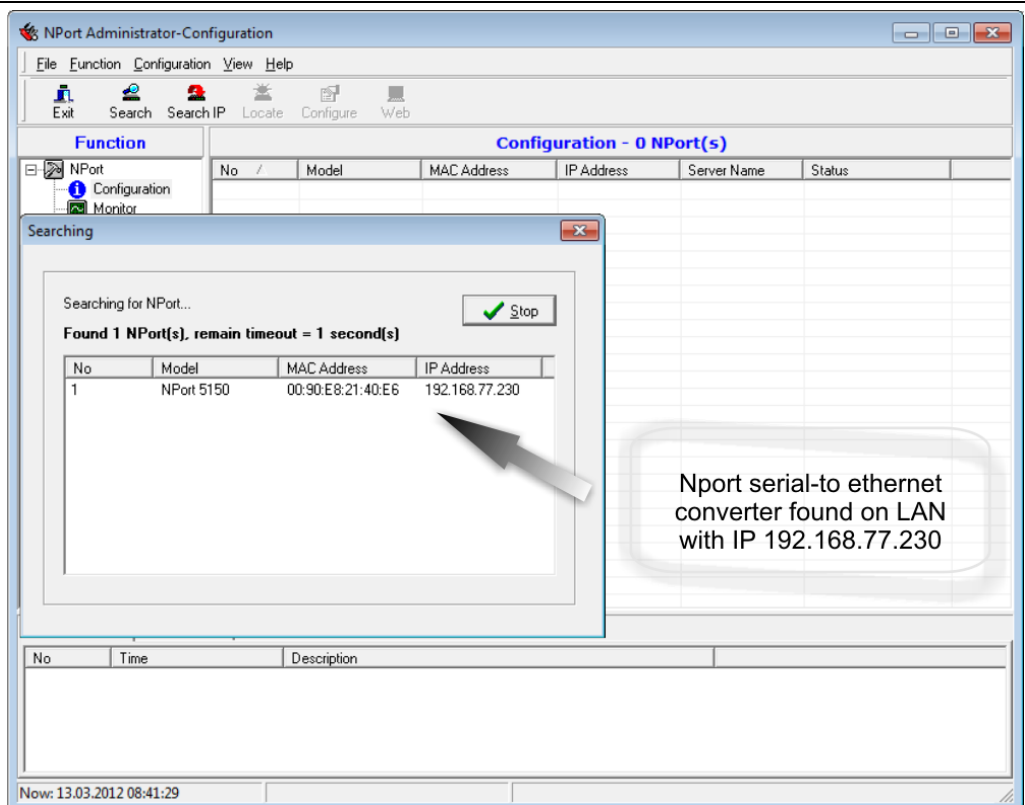
Now follow the step by step instructions to finish the configuration of the IP remote connection.

3.2.3 Configuration

Step	Description	Screenshots
1.	Please connect the NMEA / Ethernet port to the LAN using a standard LAN cable	
2.	Start the NPort Administrator application and click on the button "Search"	

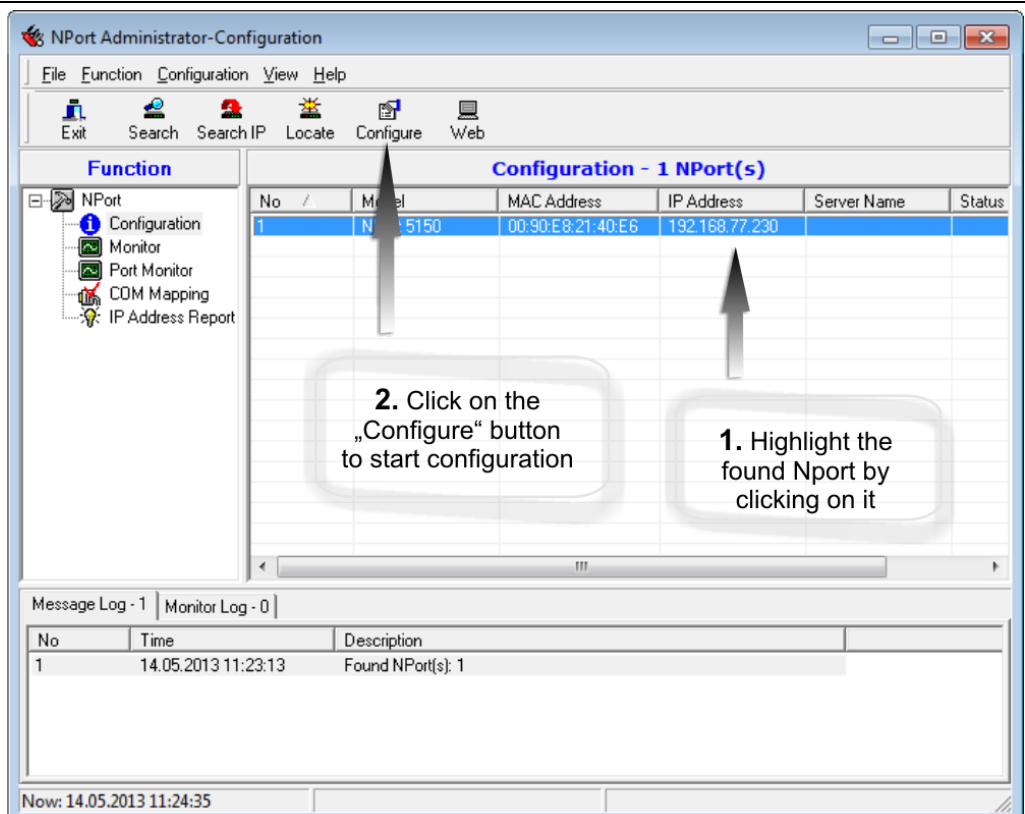
3.

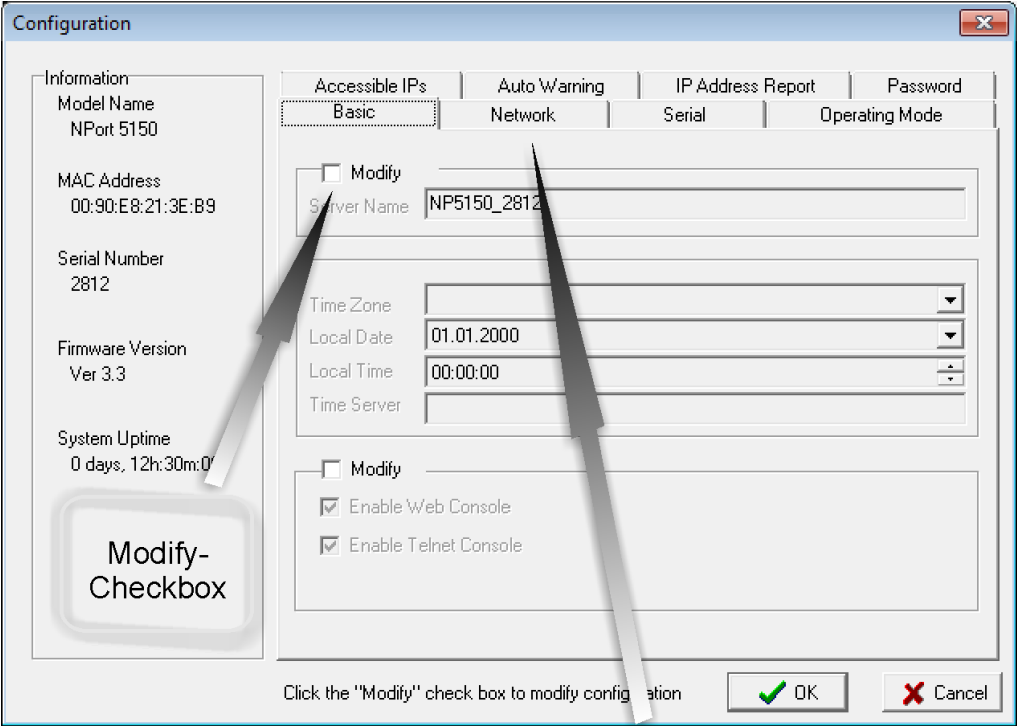
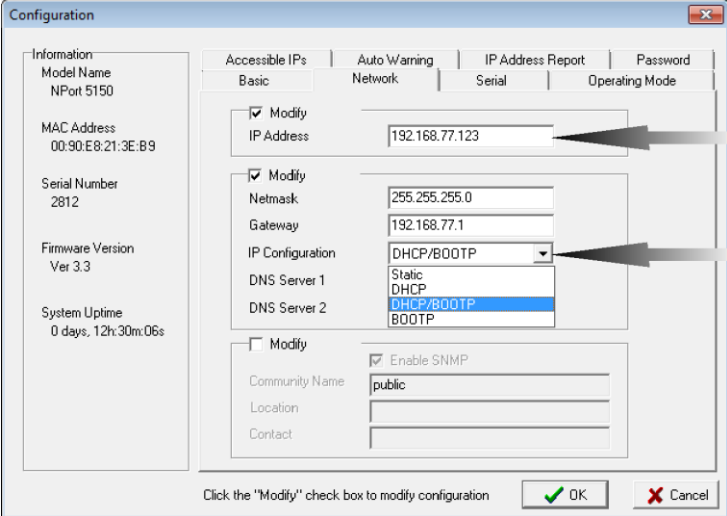
Now the NPort should be found on the LAN

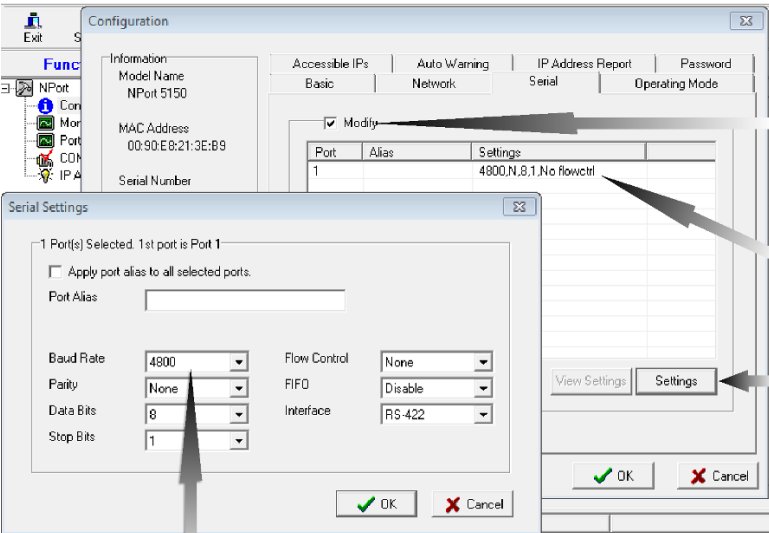
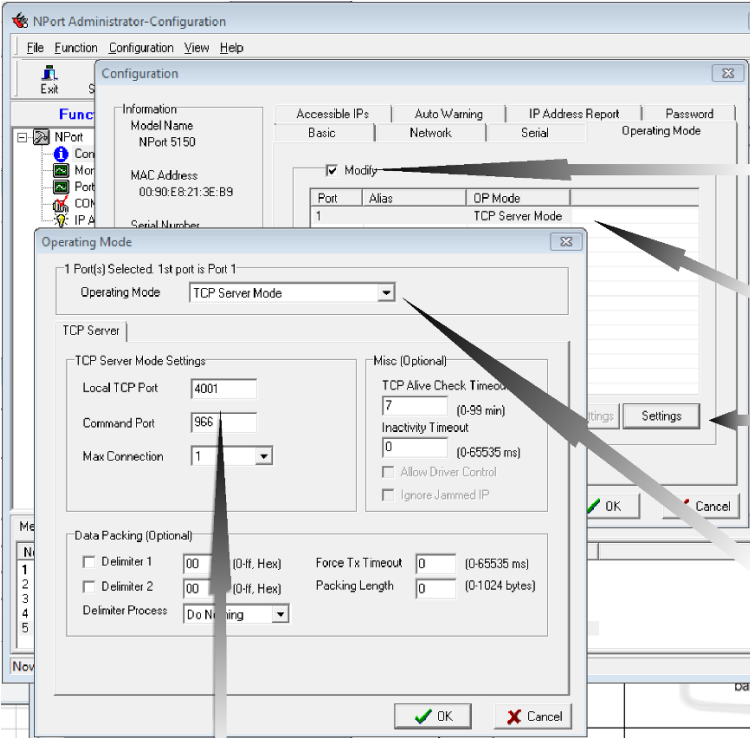


4.

Now select the found NPort and click "Configure" to open the configuration dialogue



5.	Now click on the "Network" panel to start IP configuration! TIP: To modify any values in the configuration dialogues select the item and check the corresponding "Modify"-Checkbox!	 Click on Network panel
6.	REMARK:	If an error is reported and the configuration dialogue does not show up in most cases the NPort was assigned an IP address of a different subnet. In this case use the provided Ethernet crossover cable and connect the NMEA / Ethernet port DIRECTLY to the PC running the NPort Administrator. Please set the PC that is running NPort Administrator to a static IP address of the same subnet! Then restart the NPort Administrator and repeat the steps 2 – 5!
7.	Now please configure the IP settings according to the network guidelines of your organisation! You may have to ask your system administrator for details about the configuration!	 Current IP Address (either entered static IP or aquired by DHCP) IP Address Assignment Mode

8.	The Serial settings are shown here only for reference! It is strictly recommended to leave the values as shown here! If you like to change the Baudrate, don't forget to change the corresponding Baudrate in the control panel of RT-800 as well!!	 1. Click Modify Checkbox 2. Select Port 1 3. Press Settings Button 4. Only change the baudrate!
9.	Now it is time to select the desired IP operation mode of the converter. It depends on the software application which is used on the remote site. RHOTHETA uses the converter as TCP-Server. Our client application opens a TCP Connection as client and then reads and writes NMEA Data from/to the converter!	 1. Click Modify Checkbox 2. Select Port 1 3. Press Settings Button 4. Select desired Mode 5. Change desired Parameters of the selected Mode
10.	DONE!	Now the configuration of the NMEA Ethernet port converter is done! If the option "2nd Remote Control Channel is installed, so do the analog configuration for the second control channel.

3.3 Configuration of Audio over IP

3.3.1 Introduction / Concept

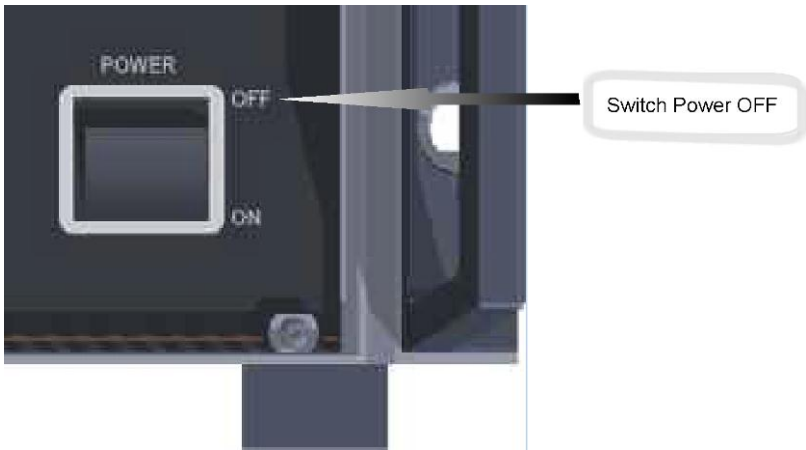
Beside the internal speaker of the RT-800 the LF-Audio signal could be accessed through the IP-Audio encoder “BARIX Instreamer”. This device offers a lot of possibilities to transmit the audio signal over IP-Networks.

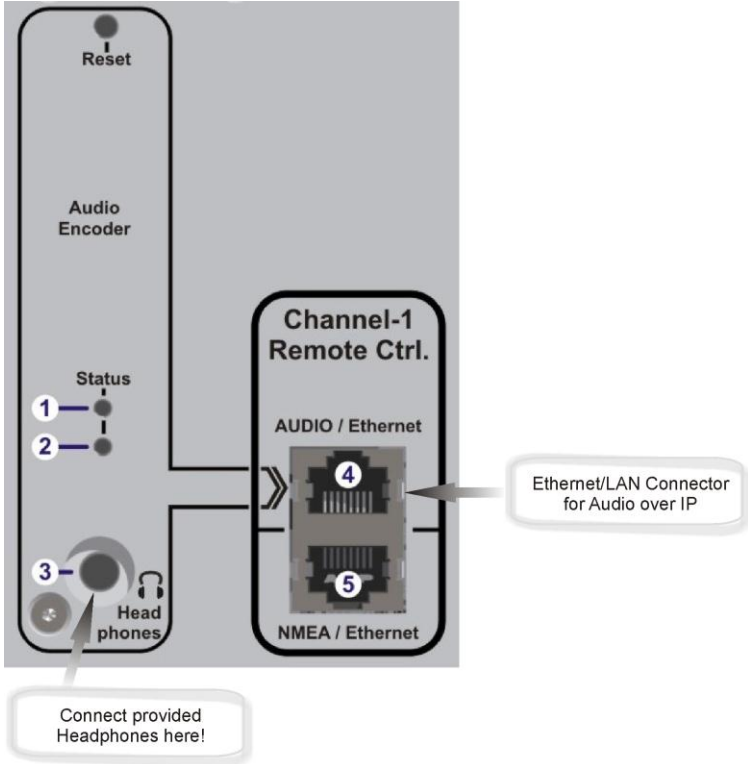
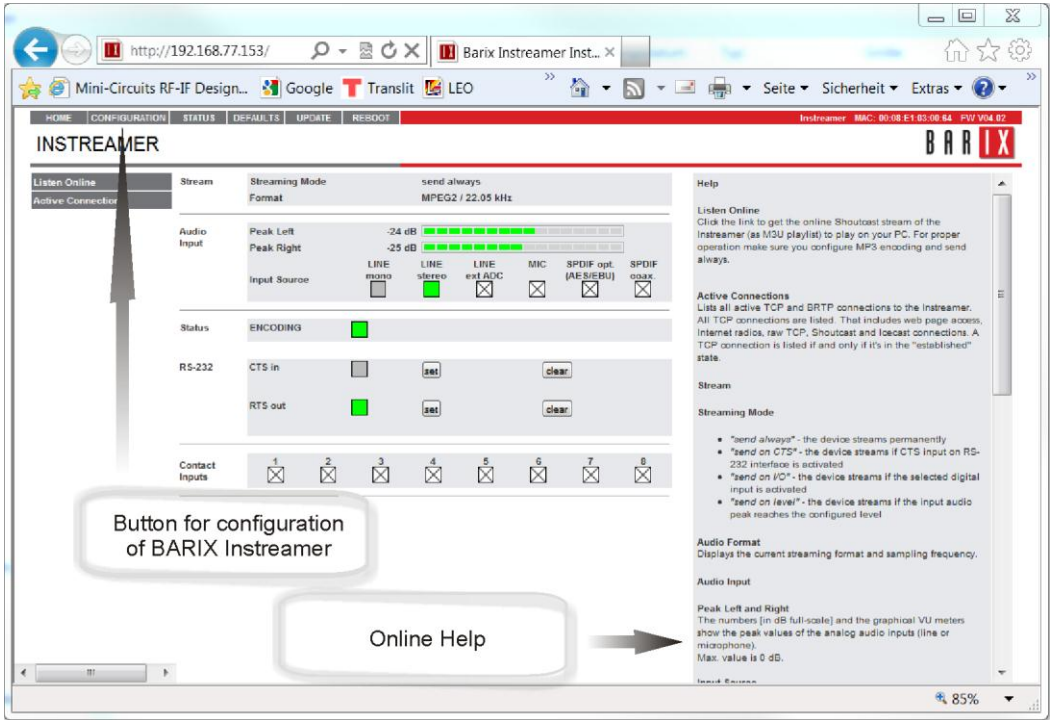
We provide the counterpart of “BARIX Instreamer” optionally, the “BARIX Exstreamer” so the setup and configuration for this standard scenario will be described within this manual!

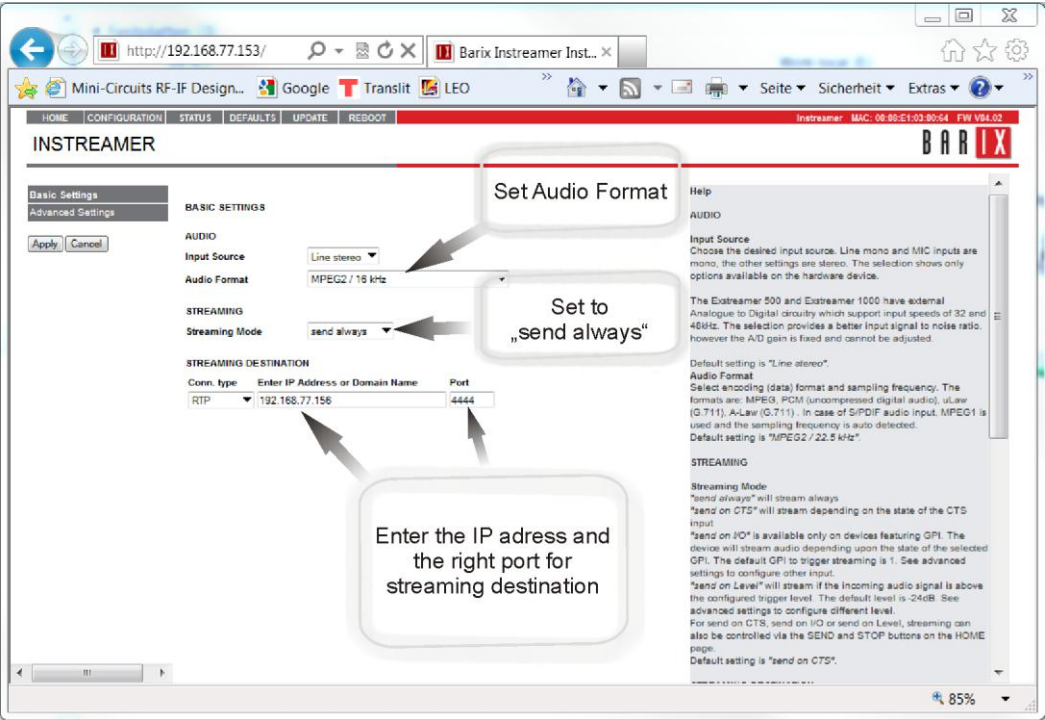
If you want to setup the IP-Audio encoder in a different way, please refer to the online help within the setup pages or to the user manuals of the IP-Audio converter provided on the RT-800 software CD.

3.3.2 DCU Configuration of Audio IP Settings

First of all the IP configuration must be done. The converter can also configured to use DHCP which means you have to connect the “Audio / Ethernet” port to a LAN which provides a DHCP server.

Step	Description	Screenshots
1.	Make sure that the RT-800 is switched off!	

2.	Please connect the AUDIO / Ethernet port to the LAN using a standard LAN cable. Then connect the provided headphones to the headphone connector (4).	
3.		Now put on the headphones and switch on the RT-800! The IP address acquired by DHCP will be announced over the headphones! Please write down the IP address!
4.	Open a browser and enter the IP address of the IP Audio converter in the address bar of the browser. The start page of the converter is shown up! On the right side online Help is provided for every configuration item! To start the configuration click the "Configuration" button below the logo.	

5.	Specify Audio Format to MPEG2 16kHz; Specify streaming mode to "send always" Specify the IP address of streaming destination and the port For static IP address go to "Advanced Settings" or ask your network administrator After changing the settings please press "Apply" button.	
6.	DONE!	Now the configuration of the IP-Audio converter of RT-800 is done! INFO: Additionally you can configure other streaming targets or streaming modes! For configuration details please refer to the online help on the right or the provided documentation on the RT-800 software CD! If the option "2nd Remote Control Channel" is installed, so do the analog configuration of the second audio channel.

For further configuration details of the converter, please refer to the corresponding User Manual on the RT-800 Software CD!

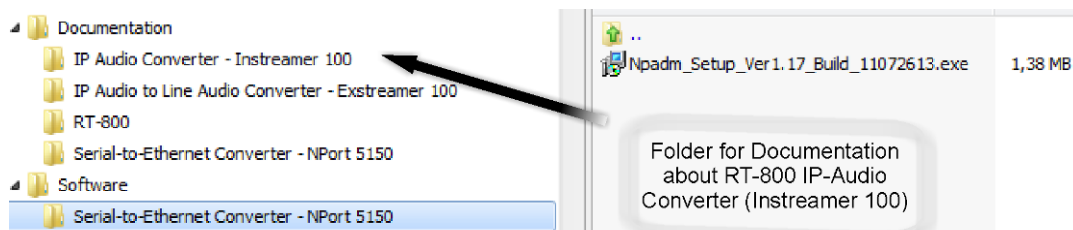


Fig. 12 Location of Instreamer 100 Documentation

3.3.3 Configuration of IP-Audio to Line-Audio Converter at Remote Site

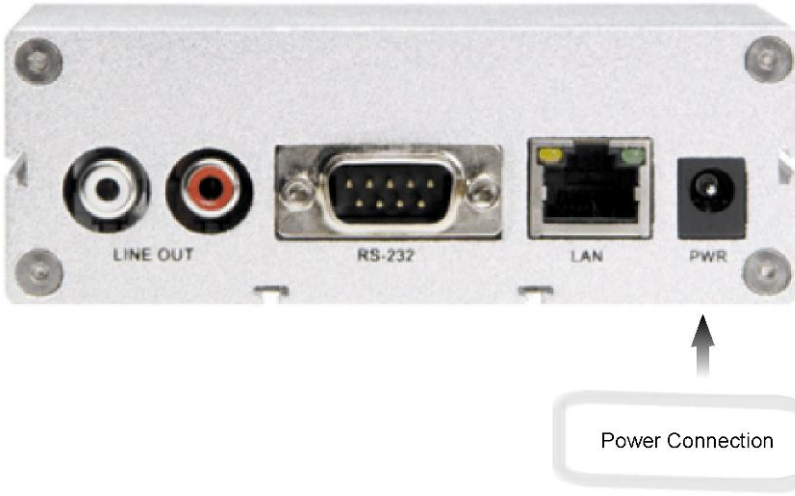
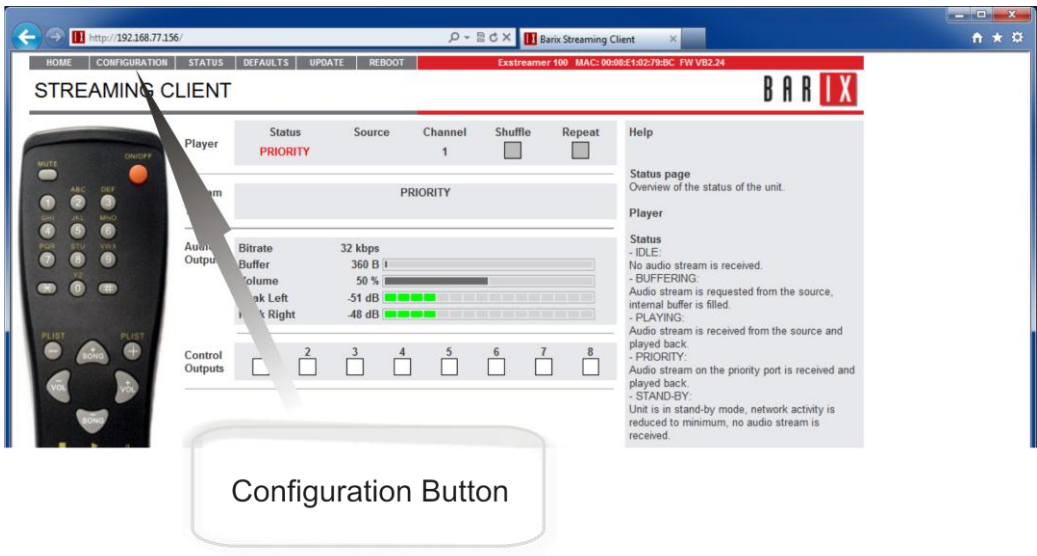
At the remote site RHOTHETA Elektronik GmbH provides optionally a receiver for the conversion of the IP-Audio stream back to LineAudio.



Fig. 13 IP-Audio to Line-Audio Converter BARIX Exstreamer

The following steps describe the configuration of the IP-Audio to Line Audio converter.

Step	Description	Screenshots
1.	Make sure that the BARIX Exstreamer is not powered!	---
2.	Please connect the LAN port of the converter to the LAN using a standard LAN cable	

3.	Now connect the provided headphones to the headphone jack of the converter.	 Connect headphones to this jack
4.	Put on the headphones, prepare for writing down the announced IP address and connect the power plug now. IMPORTANT: The IP-Address of this device must be configured at the IP-Audio-converter of RT-800!	 Power Connection
5.	Open a browser and enter the IP address of the IP Audio converter in the address bar of the browser. The start page of the converter is shown! On the right side online Help is provided for every configuration item! To start the configuration click the small "Configuration" button on top.	 Configuration Button

6.

Now the IP settings must be configured. It is recommended to use a static IP address because the IP address must be configured at the IP-Audio-converter of RT-800!

If you continue to use DHCP for IP configuration just leave the provided settings.

After changing the settings please press "Apply" button and enter the new IP address in the browser.

The screenshot displays the 'STREAMING CLIENT' configuration interface for a BARIIX device. The 'CONFIGURATION' tab is active, showing a sidebar with 'Basic Settings' and 'Advanced Settings'. Under 'Advanced Settings', the 'Network' section is selected. The 'NETWORK SETTINGS' panel includes a 'Use SonicIP' toggle (set to 'Yes'), an 'IP Address' field (192.168.77.156), a 'Netmask' field (0.0.0.0), a 'Gateway IP Address' field (0.0.0.0), 'Primary DNS' and 'Alternative DNS' fields (both 0.0.0.0), a 'DHCP Host Name' field, a 'Web Server Port' field (80), an 'HTTP Proxy URL' field, and a 'User Agent' field. An arrow points from a text box below to the IP Address field. The right sidebar contains a 'Help' section with instructions for 'Use SonicIP', 'IP Address', 'Netmask', and 'Gateway IP Address'. The browser address bar shows 'http://192.168.77.156/'.

example for IP address
corresponding to
INSTREAMER settings
(for DHCP use address 0.0.0.0)

7.

The default settings of the streaming page are preconfigured to match the settings of the RT-800.

Just check, if the current settings of the device match the settings noted here!

After changing the settings please press "Apply" button!

STREAMING CLIENT

Basic Settings
Advanced Settings

Apply Cancel

BASIC SETTINGS

STREAMING

1. URL

2. URL

3. URL

AUDIO AND PLAYBACK

Volume %

Bass

Treble

Shuffle ☐ On ☒ Off

USB Autoplay ☒ On ☐ Off

Help

Streaming

1. URL ... 3. URL
Up to three independent audio sources (URLs) can be set. Each may contain a full address of a playlist, file or a stream. The three entries have different priorities, the first one has the highest priority and the last one has the lowest priority. The Barix Extreamer processes the sources in a loop and tries to connect to the highest priority source available.
Default for 1. URL: "rtsp://0.0.0.0:4444"
Default for 2. URL: "http://www.barix.com/radio.m3u"
Default for 3. URL: "playlist.m3u"

URL syntax
The general URL syntax is:
protocol://user:password@address:port/path.
If the protocol is omitted the file:// is assumed.
User and password fields are optional and depending on the protocol the port may be specified. Refer to the manual for a full description.
The address field specifies the destination address to connect to. For RTP protocol it is the source address filter of the incoming stream (0.0.0.0 accepts any incoming RTP stream). See the manual for more details.

Set RTP-Port to 4444 (same as DCU)

STREAMING CLIENT

Basic Settings
Advanced Settings

Apply Cancel

PRIORITY STREAM SETTINGS

RTP Port

RTP delay ms

Priority Message Volume %

Triggered Playlist

Help

PRIORITY STREAM SETTINGS

RTP Port
Configure the RTP streaming listen port on which the device will listen for a priority stream. The playback of the current stream or file is interrupted during the playback of the Priority Stream. Enter "0" to disable.
Default: "0"

RTP delay
The RTP decoder keeps constant decoding latency within one frame accuracy. Set the required delay in milliseconds. To synchronize multiple receivers to the same stream, set all to the same value.
The delay value should be set large enough to cope with network jitter (difference in packets delivery time) and possible packet loss. Increase the value if you are experiencing audio dropout.
Default: "300" ms

8.

Finally you can adjust the Audio settings of the audio outputs to meet your requirements!

After changing the settings please press "Apply" button!

STREAMING CLIENT

Basic Settings
Advanced Settings

Apply Cancel

AUDIO SETTINGS

Volume %

Min Volume %

Max Volume %

Volume Offset dB

Balance

Bass

Treble

Shuffle ☐ On ☒ Off

USB Autoplay ☒ On ☐ Off

Decoding Speed Correction ppm

Help

AUDIO SETTINGS

Volume, Bass, Treble
Select the preferred output volume, bass and treble that will be adjusted at power up.
Default volume: 50%
Default bass/treble: 0

Balance
Select the preferred balance that will be adjusted at power up.
Negative values pan the sound center to the left, positive values to the right. Value 0 centers the balance.
Default: 0 (center)

Minimum and Maximum Volume
In certain installations it is desirable to limit the audio volume that the user can set. Adjust the volume if needed.
The Maximum Volume can be used also as ear protection.
Please note that the Minimum Volume is also the mute volume.
Default: Min 0%, Max 100%

Volume Offset
Output gain offset to compensate for different hardware types. Manual setting can be used to adjust the encoder-decoder path to dB. "Auto" presets the gain automatically according to the hardware.
Default: "auto"

Set Audio Settings according to your Application

9.	The received audio signal is output to two terminals: Line Out on the back and headphone jack on the front. Use the connector which is suitable for you application.	
10.	DONE!	Now the configuration of the IP-Audio to Line-Audio converter on the remote site is done!

For further configuration details of the converter, please refer to the corresponding User Manual on the RT-800 Software CD!

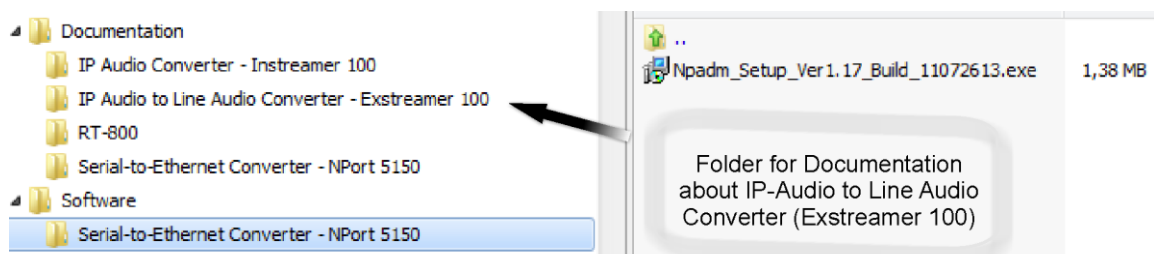


Fig. 14 Location of Exstreamer 100 Documentation

4 Appendix

4.1 List of abbreviation

Abbreviation	Meaning	Remarks
AU	Antenna Unit	
CP/SS	Cospas-Sarsat	
DCU	Display & Control Unit	
DF	Direction finder	
Deg	Degree (° = 60')	
ELT	Emergency Locator Transmitter	
GND	Ground	
GPS	Global Positioning System	
ID	Identification	
IP	Internet Protocol	
LAN	Local Area Network	
LCD	Liquid Crystal Display	
LED	Light-Emitting Diode	
MOB	Man-Over-Board	
MSSI	Maritime Mobile Service Identity	Ship's Ident. No.
NF	Audio Frequency	
NMEA (0183)	National Marine Electronics Association	Interface- and data telegram standard
PLB	Personal Locator Beacon	
PS RAM	Averaging Random Access Memory	
PTT/SBS	Push-To-Talk/ Self Bearing Suppression	
RAM	Random Access Memory	
Rx	Receiver	
S/N	Signal to Noise	
SAR	Search And Rescue	
SNR	Signal to Noise-Ratio	
SQL	Squelch	
TFT	Thin Film Transistor (see also LCD)	
Tx	Transmitter	
V	VTs Version	AU-Variant V
VDC	Volts of Direct Current	
VTs	Vessel Traffic Service	