



## **RT25-2 RDS Encoder**

### **Quick Installation Guide**



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Web: <http://www.radio-tecnica.es>

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# 1 Using This Guide

## 1.1 Purpose

This guide covers RT25-2-based RDS encoders (both module and boxed versions). It provides the information needed to install the equipment and set basic RDS services in order to get your station RDS enabled quickly in a few steps.

**Please read this entire guide and familiarize yourself with the controls before attempting to use this equipment.**

Where not otherwise indicated, any information mentioned in relation to the **RDS** (Radio Data System) applies in full also to the **RBDS** (Radio Broadcast Data System).

If you have any questions or comments regarding this document, please contact us via email.  
We welcome your feedback.

## 1.2 Additional Documentation

Browse the installation CD or visit the Website for the latest documentation version and the following additional documentation:

- RT25-2 Communication Ports and Internet Functions
- RT25-2 RDS Encoder Technical Manual (includes troubleshooting on the last page)

## 1.3 Disclaimer

The equipment has been thoroughly tested and found to be in proper operating condition when shipped. The manufacturer is not liable for any damages, including but not limited to, lost profits, lost savings, or other incidental or consequential damages arising out of the use of this product. No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or information storage and retrieval systems, for any purpose other than the purchaser's personal use. Information in this document is subject to change without notice.

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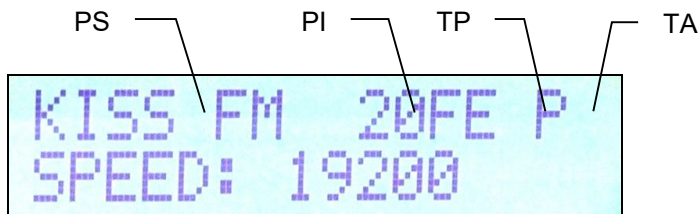
## 2 Physical Description

### 2.1 Front Panel

#### 2.1.1 Status LCD

The LCD area is divided into two lines.

The first line shows key RDS services which require quick access. These services are PS (incl. dynamic), PI, TP and TA.



The second line shows the most important status values and RDS services in a loop. Depending on the configuration, some values may be omitted. For example if the internal clock source is set for the RDS subcarrier, the PILOT value is not showed. Some events may affect the order. For example if Radiotext changes, it's showed in the next cycle regardless of previous order.

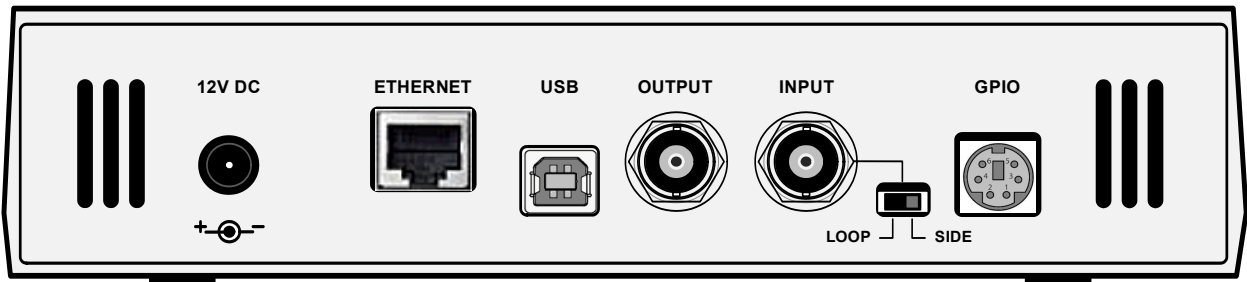
Order	Status value or RDS service	Meaning	Default value
1	RDSGEN	ON = RDS generator enabled (1), OFF = no RDS output (0).	ON
2	LEVEL	Output RDS signal level (0 = min., 255 = max.).	255
3	PROGRAM	Actual program set selected.	1
4	PTY, MS, DI	Program Type code; Music/Speech; Decoder Identification code.	
5	ADR	The UECP address list.	0,0
6	SITE	The UECP site list.	0,0
7	UECP	ON = The RDS encoder accepts both ASCII and UECP commands, OFF = the RDS encoder accepts ASCII commands only.	OFF
8	IPA	Shows actual IP address of the encoder, assigned either manually or by the DHCP function.	
9	SPEED	Actual USB port speed on which the control commands are expected.	
10	PILOT	ON = pilot tone present, OFF = no pilot tone.	
11	CT	ON = CT enabled, OFF = CT disabled; RDS encoder's local time.	
12	GRPSEQ	First 16 items of RDS group sequence.	022E1022EA022XYR
13	RT	Actual Radiotext (sequence of 4 x 16 characters).	

### 2.1.2 LED indicators

Two LED diodes are used to indicate operating status of the RDS encoder:

	Operation LED	Pilot LED	Status
Start-up	off	on	Initialization
	on	off	Firmware update in progress
Operation	. . . . .		Normal operation
	- - - - -		An error occurred (encoder's hw failure)
	on		Receiving data on some port
		on	External pilot synchronization is active
		off	Internal clock source is selected
			- - - - -

## 2.2 Rear Panel



Connector or element	Description
12V DC Power Supply	Power supply connector. See section 3.3 for details.
Ethernet	Ethernet RJ-45 connector. Use a standard (direct) cat 5 Ethernet cable for connection to the Ethernet switch, router or wall-socket. The Ethernet control includes internal website (referenced as "Port 2") and two independent user configurable general purpose ports (referenced as "Port 3" and "Port 4") designated for remote control via TCP or UDP protocol. The encoder operates also with no cable connected.
USB	USB standard B type connector. This port is referenced as "Port 1". Use the USB for initial setup of the encoder or for its local control. The encoder operates also with no cable connected.
Output BNC	RDS signal output, modulated at 57 kHz subcarrier. If the Loop/Side switch is set to the LOOP position, the Output is a sum of the RDS signal and the signal fed to the Input BNC connector.
Input BNC	Optional input for synchronization to the pilot tone or for mixing the RDS signal with existing modulation signal.
Loop/Side switch	Allows the <i>input</i> signal to be added to the <i>output</i> signal. See sections 3.1 and 3.2 for details.
GPIO	Optional logical inputs for direct control of some RDS services (TA, PROGRAM). See the Technical manual for details. The connector is a standard 6-pin PS/2 type.

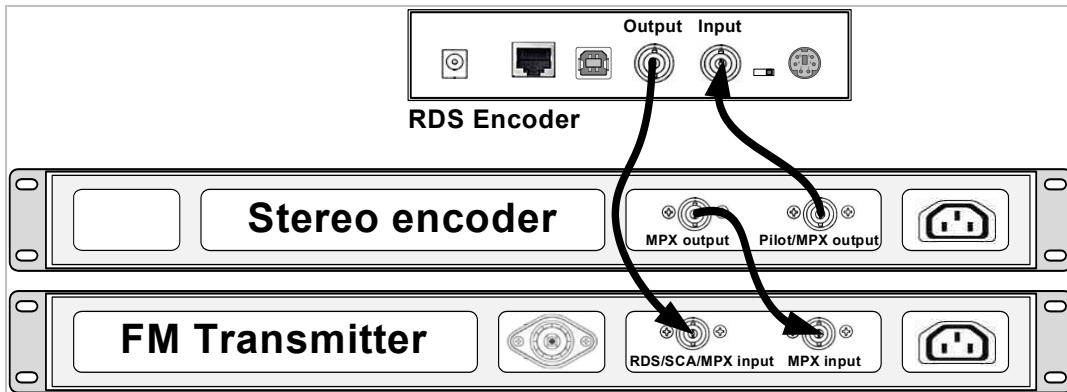
### 3 Hardware Installation

#### 3.1 Connecting the RDS Encoder

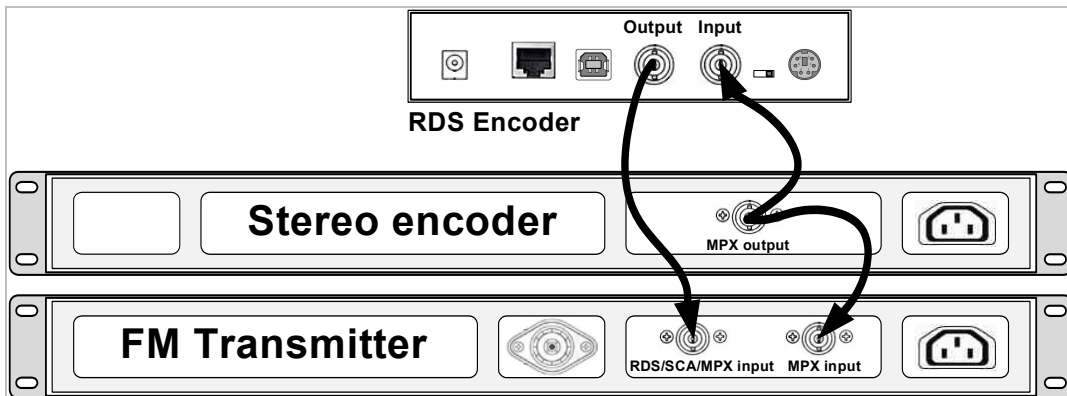
Basic rules applying for any RDS encoder's connection:

- The RDS signal must be fed into modulation input (added to MPX signal if stereo encoder is used).
- If stereo encoder is used, one of its outputs (MPX or pilot tone) must be fed into the RDS encoder input to meet the synchronization requirement.

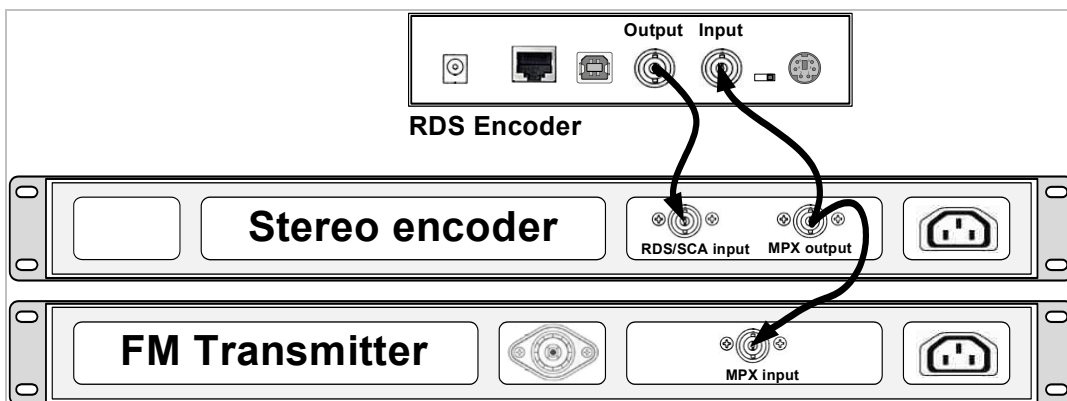
Following figures show various situations and corresponding methods of connection. Use shielded cables (e.g. RG58) terminated by BNC male connectors. The cables should be kept short in length. Where necessary, use a BNC 'T-piece' for splitting the signal.



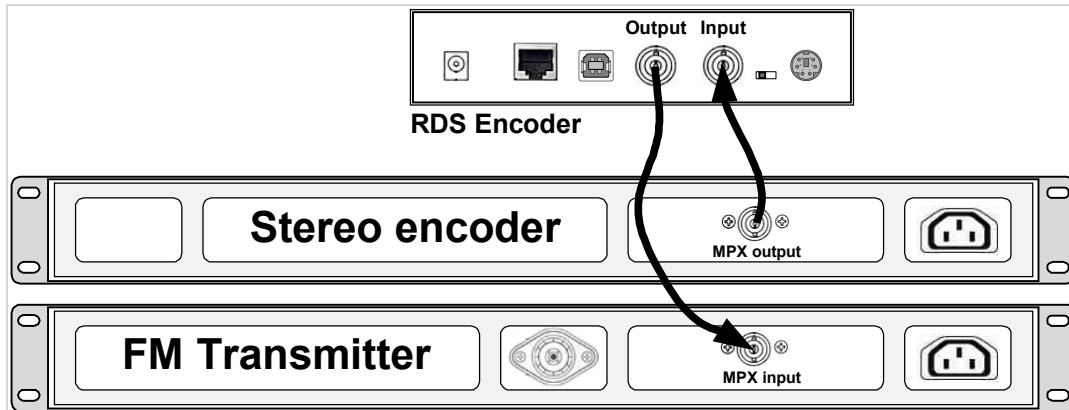
Separate stereo encoder - default connection.



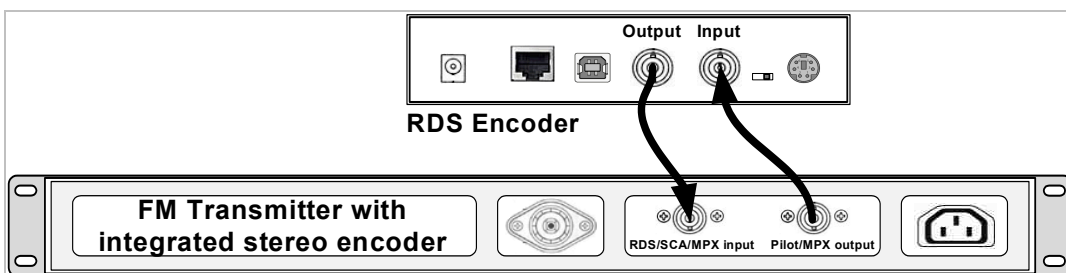
Stereo encoder with only one MPX output provided.



FM transmitter with only one MPX input provided.



Both stereo encoder and FM transmitter with only one MPX connector provided - loopthrough mode.  
Use this mode only if no of the previous connection is possible.



FM transmitter with integrated stereo encoder.

In case of **mono** transmission (no stereo encoder used) the RDS encoder input may be left unconnected (since there is no need of external synchronization) or it may be used for the audio signal injection in the case that the FM transmitter has only one input connector.

## 3.2 Hardware Settings

### 3.2.1 On-board adjustable elements

Due to completely DSP-based solution there's no adjustable element on the board affecting the RDS or MPX signal.  
User is not allowed to open the encoder's case.

### 3.2.2 Loop/Side switch

Select the LOOP position only if it's necessary to pass the input signal to the output of the RDS encoder (loopthrough mode).  
**In all other cases the switch must be fixed in the SIDE position!**

**Always make sure that the switch is securely fixed in the position desired and eliminate possibility of unwanted change of its state!**

### 3.3 Power Supply

The RDS encoder can be supplied from any power supply, which delivers a stabilized 12 V voltage and a current of at least 500 mA and no more than 2 A. Commonly available switching wall adapters are usually suitable for that purpose. The RDS encoder has polarity protection. The central conductor of the power supply connector is positive (+).

*Note: After first power-up, there is no need to configure anything to turn on the RDS subcarrier. The RDS encoder will immediately start to generate the RDS signal with factory default values (PS: \* RDS \*, PI: FFFF, RDS level: 4000 mV p-p).*

### 3.4 Connecting the RDS Encoder to a Local PC

For the purpose of initial configuration and local control requirements the RDS encoder is equipped with standard USB interface provided on the rear panel of the RDS encoder. This connector allows direct connection to a PC using USB cable type A-B.

USB driver must be installed prior to start communicating. Virtual COM port feature provides seamless compatibility with broadcast automation software. After successful installation a new COM port will appear in Windows Control Panels / Device Manager.

### 3.5 RDS Level Adjustment

**Important note:** *There is no universal setting for the RDS level. Due to different input sensitivity of different FM broadcast equipment it's necessary to check and adjust the RDS level!*

The correct level should be between 2 and 11 % of the audio multiplex signal, measured by oscilloscope in peak-to-peak values on the modulator input. Recommended value is such that results in 3.4 kHz deviation of the FM carrier. Don't forget that the maximum total FM carrier deviation with RDS and MPX signal is 75 kHz. It is much easier to use any FM broadcast analyzer for setting the RDS level precisely.

The deviation range of the FM carrier caused by RDS/RBDS is **1.0 to 7.5 kHz**.  
 The deviation range of the FM carrier caused by stereo pilot tone is **6.0 to 7.5 kHz**.  
 The overall peak frequency deviation shall not exceed **75 kHz**.

The RDS level can be adjusted after establishing a connection to the encoder, using one of these two methods:

#### In the Windows software

Go to *Options – Preferences – Control* and check the item 'Enable RDS level control'. Now the control is available on the System sheet in the main window.

The software allows adjusting the RDS level in range 0.4 to 100 %. In the RT 25-2encoder, that range is proportional to the output level range of 15.6 to 4000 mV p-p. Confirm the setting by Store button.

#### In the embedded website

Click on menu item Setup – Signal Control and enter the RDS level directly in mV p-p unit.

#### In terminal, using ASCII command **LEVEL=**

The RT 25-2encoder allows direct adjusting of the RDS level in 256 steps, in range 0 to 255, by assigning a corresponding value to the LEVEL parameter. Each step represents approx. 15.6 mV increase.

Desired step count can be calculated as

$$LEVEL = \left( 256 \times \frac{\text{Output RDS level}}{4000} \right) - 1$$

Actual output RDS level (in **mV p-p**) can be calculated as

$$\text{Output RDS level} = \frac{LEVEL + 1}{256} \times 4000$$



## 4 Software Installation

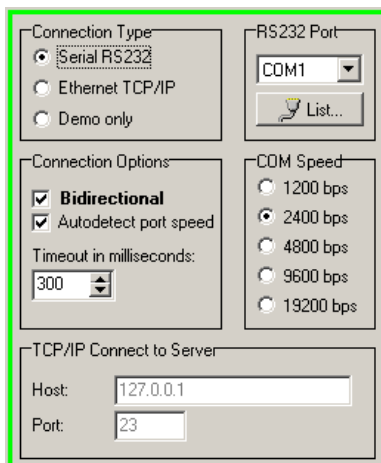
### 4.1 Establishing a First Communication with the RDS Encoder

The RDS encoder should be configured via local port (port 1) before first use. Alternatively, the configuration can be made using the embedded website.

The encoder comes initialized from the factory. The Ethernet is pre-configured in order to obtain IP address from DHCP. Thus, in the DHCP enabled environment, the first connection with the encoder can be established using a web-browser and typing the assigned IP address into the address field. See more details in section 3.1 of the document 'RT 25-2Encoder – Communication Ports and Internet Functions'.

For local configuration via port 1, please follow these steps:

1. Install the Windows control software called 'rdsRT25-2.exe', run the setup exe file and go through the simple installation wizard.
2. In the case of USB connection install the USB driver now.  
*TIP: Latest operating systems already come with the USB driver included.*
3. Make sure the RDS encoder is connected and powered, and all connectors are seated completely.
4. Run the Magic RDS software using Windows Start button.
5. Open the Preferences (Options - Preferences) and set up the connection parameters. Choose the Serial RS232/USB connection type and select the COM port the RDS encoder is connected to. If the RDS encoder is connected via USB and was recognized correctly in Windows, you may find/change the COM port number in Windows Control Panels - System - Hardware - Device Manager or simply click on the List button.



6. Close the Preferences. You should see "Connected" or "Opened" in the status bar. Now you are ready. The settings are saved automatically.
7. The status bar at the bottom of the window shows whether the data was sent successfully. If Communication Error! is shown, check the connection to the RDS encoder, its power supply and that the correct COM port is selected in the Preferences dialogue box.
8. Follow the instructions from the application Help.

*Note: The RDS encoder contains two types of memory. These are marked as RAM and EEPROM. Like any other computing system the RAM holds all operational data which are also used for transmission whilst the EEPROM is used for the data storage during power-off. By default the button Send will fill the RAM only. The button Store will fill the RAM and also stores the data into EEPROM. The Store button behavior can be changed in Options - Preferences - Controls.*

*If the user forgets to store the data into EEPROM, the settings will be lost when the power is disconnected.*

## 4.2 Remote Configuration of the RDS Encoder

### 4.2.1 Finding out actual RDS encoder's IP address

Knowing of the RDS encoder's IP address is necessary for its remote configuration. By default, in typical network, the RDS encoder obtains IP address automatically via DHCP function.

Actual IP address can be determined from several sources, including front panel LCD display, Device Setup dialogue box in Magic RDS or your network router's configuration website, section 'DHCP, List of clients'.

If the IP address is unknown or not assigned (indicated as 'No LAN' on the LCD), follow the section 4.1 and 4.3.

### 4.2.2 Remote configuration of the RDS encoder using internal website

The RDS encoder includes HTTP server and a complex web-based user interface. An internet browser may be directed to the encoder's IP address to bring up the encoder's configuration website.

To access the embedded website, type the RDS encoder's IP address into the web-browser:



### 4.2.3 Remote configuration of the RDS encoder using the Windows control software

The RT 25-2 RDS control software supports remote control of the RDS encoder over TCP protocol. The RDS encoder must be configured first (either via local port or using the embedded website):

1. Configure either port 3 or port 4 as follows: Enabled, TCP Protocol – Server, TCP port as required.
2. Confirm the settings and reset the device.
3. In Magic RDS, open the Options – Preferences, select Ethernet connection type and fill the encoder's IP address and TCP port from the step 1.

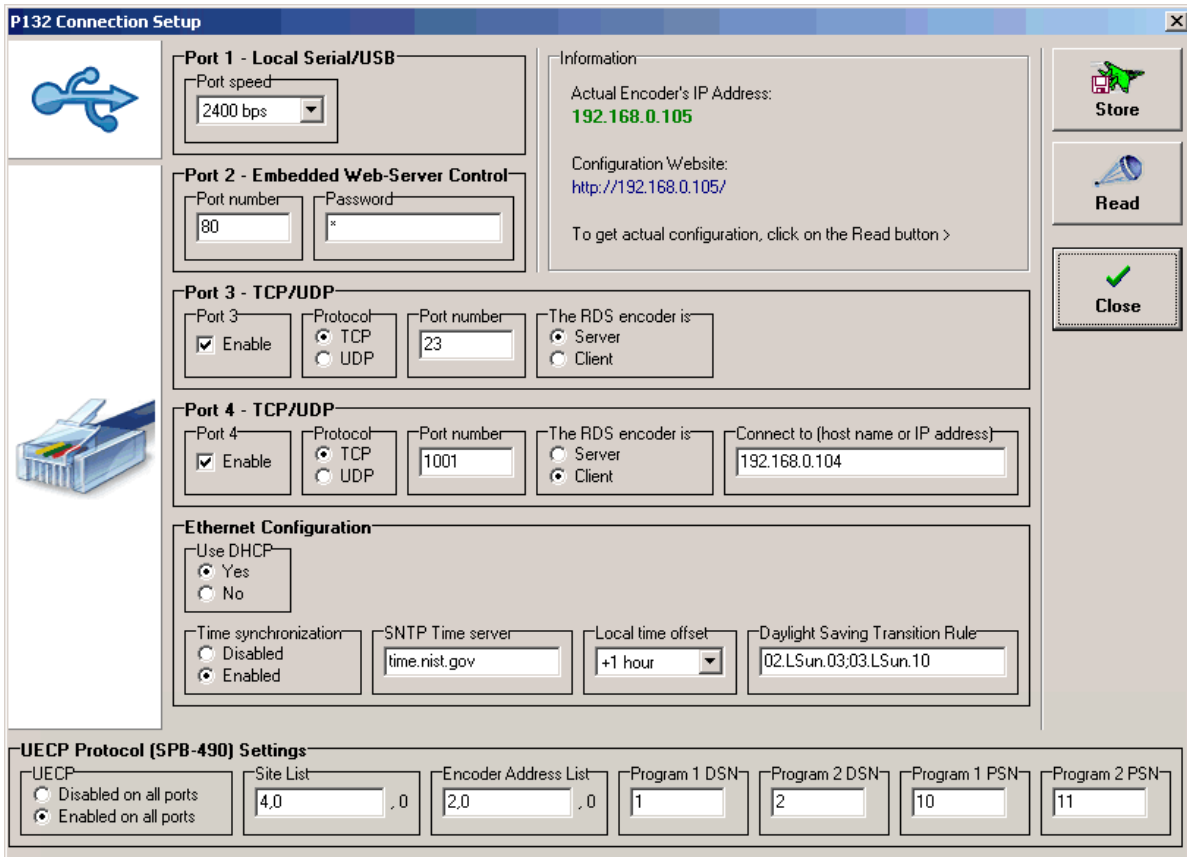
#### LAN Settings – Port 3

Note: Device reset is required for these settings to take effect.

## 4.3 Device Setup

### 4.3.1 Device Setup from TR25-2 RDS

Open the Device Setup dialogue box (Options – Device Setup). If previous steps have been done right, you'll see the following window:



Here's the port setup, Ethernet setup and UECP setup at one place. A description of each item follows:

#### Port 1

Port speed	Setting the Port 1 speed is required to maintain compatibility with older software or terminal application. Due to virtual COM port included in the USB driver the older software can access the RDS encoder the same way like in case of standard serial port. Default speed is 2400 bps.
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#### Embedded Web-Server Control (Port 2)

Port number	Specifies the embedded web-server port number. Default port number is 80. Such number may be omitted when typing the URL in web browser.
Password	If a password is filled, it is required in order to enable any configuration changes using the embedded website. Default password is * (that means 'no password required').

### Ethernet Configuration

Use DHCP	Embedded DHCP client allows for automated configuration of the Ethernet parameters like IP address or DNS server. This option should be set to Yes. Choose No if you want to enter the parameters manually or if there's no DHCP function contained in your network.
Time synchronization	Enable this option in order to keep the RDS encoder's internal time accurate, using the SNTP server specified. Disable this option if internet is not accessible from your network or if there's other time keeping method applied (for example via UECP commands).
SNTP time server	Fill an active SNTP server. Default value is <code>time.nist.gov</code>
Local time offset	Your local time offset (the value added to UTC).
Daylight saving transition rule	Leave empty if there's no daylight saving time applied in your country or if this function is not required. Follow the instructions in the document 'RT 25-2Encoder - Communication Ports and Internet Functions'.

### UECP Settings

UECP Enable/Disable	Enable the UECP if your broadcast automation system or RDS data provider uses this protocol. Leave disabled otherwise.
Site List	Up to two site address numbers in range 0 to 1023, separated by comma.
Encoder Address List	Up to two encoder address numbers in range 0 to 63, separated by comma.
Program 1/2 DSN	The RDS encoder contains two independent programs (data sets). Selected program controls the output RDS data. Specifying the DSN (Data Set Number) for each program allows switching between two programs using appropriate UECP command. If only one program has to be on-air all the time, fill 255 as a DSN for both programs. This effectively disables the switching via UECP.
Program 1/2 PSN	Specifies the PSN (Program Service Number) for program set 1 or 2.

*Note: The DSN and PSN settings have effect for UECP control only. Selectable DSN and PSN for each program set allow easier integration of the RDS encoder into existing networks.*

## 4.4 Setting Basic RDS Data

Before getting on-air with the RDS signal, you will need to decide on the settings to be used. The following RDS services must be set as the first. Use the Windows control software and its GUI. For more experienced users or those without a Windows PC, any terminal programme or integrated web site can be used as well.

### 4.4.1 PI (Program Identification)

*Tip: The RT 25-2 RDS control software includes a wizard that calculates the PI automatically.*

This is very important information that enables the receiver to distinguish between countries, areas in which the same program is transmitted, and the identification of the program itself. The code is not intended for direct display and is assigned to each individual radio program, to enable it to be distinguished from all other programs.

The PI code consists of four characters (hexadecimal numbers).

The first character identifies the country:

0	<b>Cannot be assigned.</b>	8	PS, BG, LV, PT
1	DE, GR, MA, IE, MD	9	AL, DK, LI, LB, SI
2	DZ, CY, CZ, TR, EE	A	AT, GI, IS
3	AD, SM, PL, MK	B	HU, IQ, MC, HR
4	IL, CH, VA	C	MT, GB, LT
5	IT, JO, SK	D	DE, LY, YU
6	BE, FI, SY, UA	E	RO, ES, SE
7	RU, LU, TN, NL	F	EG, FR, NO, BY, BA

The second character identifies the program type in terms of area coverage:

0	Local	Local program transmitted via a single transmitter only during the whole transmitting time.
1	International	The same program is also transmitted in other countries.
2	National	The same program is transmitted throughout the country.
3	Supra-regional	The same program is transmitted throughout a large part of the country.
4 to F	Regional	The program is available only in one location or region over one or more frequencies, and there exists no definition of its frontiers.

The third and fourth characters are used to clearly identify different stations within the area of coverage.

*Important note: Meaning of some PI digits may be different for US RBDS.*

*Important note: If the station has only one transmitter, second PI digit must be zero (x0xx).*

*Important note: Factory default PI value is FFFF and it's needed to change it as soon as possible to avoid the situation that two different stations with common area of coverage have the same PI. For each station in the same location the unique PI must be assigned. Stations that carry different program must be unambiguously identified by the last two PI digits. In other case they are recognized as one station by car radios, regardless of any other service settings. If the broadcaster hasn't received the 4-digit PI from regulatory office, he must choose such number that is not in conflict with other stations in the location.*

### 4.4.2 PS (Program Service name)

The PS name is max. 8 character long radio station name that will be shown most of the time on the radio display. Advanced use of the PS (Dynamic/Scrolling PS) is discussed in Technical Manual or Windows software Help.

### 4.4.3 PTY (Program Type)

The PTY code defines the type of the programme broadcast within 31 possibilities. See chapter 12.2 of the Technical Manual for a complete list. This code could be used for search tuning.

*Important note: PTY number 1 (News) should never be left on all the time. Use PTY number 3 (Info) for this purpose.*

#### **4.4.4 TP (Traffic Program)**

This is a flag to indicate that the tuned program carries traffic announcements. The TP flag should only be set on programs which dynamically switch on the TA identification during traffic announcements. The flag shall be taken into account during automatic search tuning.

#### **4.4.5 MS (Music/Speech)**

This is a two-state signal to provide information on whether music or speech is being broadcast. The signal would permit receivers to be equipped with two separate volume controls, one for music and one for speech, so that the listener could adjust the balance between them to suit his individual listening habits.

#### **4.4.6 AF (Alternative Frequencies)**

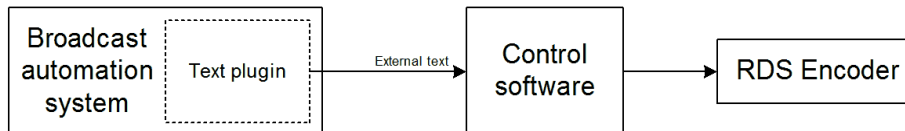
The Alternative Frequencies are used to tell receivers what frequencies they can receive the radio station on. This facility is particularly useful in the case of car and portable radios. For this to work, each transmitter must have RDS with the same PI code.

*Important note: If second PI digit is set to zero (x0xx), this indicates that the station has only one transmitter and the AF list is ignored on most receivers.*

## 5 Broadcast Automation System Link-up

To send dynamic data via the RDS it's very useful to link the RDS encoder with your broadcast automation system. This usually results in a possibility of sending commercials, actual song information, program announcements and more. Almost any broadcast system can be linked with the P132. The link may be either indirect or direct.

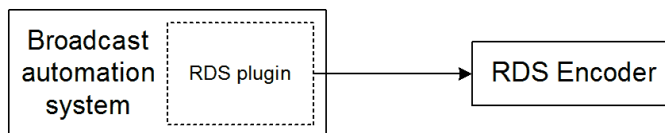
### 5.1 Indirect Link



Default Windows control software for the RT25-2 RDS encoder is the **rdsRT25-2**. This application, including documentation and examples of use, can be downloaded from the Website, section Software.

Since probably hundreds of automation systems are used around the world and new versions are released often, information in this document cannot be full-scale. For more information about how to configure the broadcast automation system text output, read its documentation or contact the vendor.

### 5.2 Direct Link



#### 5.2.1 Recommended procedure step-by-step

1. For the present turn off the RDS encoder support in the broadcast automation system.
2. Connect the RDS encoder and configure all basic parameters like PI, default PS, text setup, individual text features enable settings etc. using the Windows control software or terminal application and command line. **Store** all setting into EEPROM. Exit the Windows control software or the terminal.
3. Find out the baudrate (speed) or network protocol that is used by the broadcast automation system for communicating with the RDS encoder. Configure the connection parameters, using Device setup dialogue box or a terminal. Follow the instructions in the document '**RT25-2 RDS Encoder - Communication Ports and Internet Functions**'.
4. Reset the RDS encoder if necessary for the network settings to take effect.
5. Turn on the RDS encoder support in the broadcast automation system.

**Important note: By default only one software application can access one communication port at the same time!**

For more information about how to control the RDS encoder contact the broadcast automation system vendor.

#### 5.2.2 Compatibility commands and UECP

To reach the best possible compatibility with broadcast automation systems, the RT25-2 includes a special set of compatibility commands as well as UECP support. In the systems where the RT25-2 or compatible RT25 is not directly supported (or the system is older version) the user may try to select another RDS encoder model to send text messages. Where possible, set the communication as unidirectional. The most frequent communication speed in this case is 9600 bps.