/RDS-TEX-E-2HE & /RDS-TEX-E-3HE

USER MANUAL

Additional Manual for TEX-LCD series and TEX-LIGHT series

BROADCAST EQUIPMENT

Manufactured by R.V.R ELETTRONICA Italy

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/RDS-TEX-E-2HE & /RDS-TEX-E-3HE - User Manual
Version 1.1

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1. Introduction

The RDS Encoder is well suited for most regional, local, RSL, LPFM and other medium- and small-coverage radio stations which use serial RS-232 channel for dynamic RDS data distribution or which settle for static RDS content. It's also highly suitable for service and development purposes.

Fully DSP concept and effective design ensures high reliability, excellent signal characteristics and gives the user many advanced features while maintaining low acquisition costs.

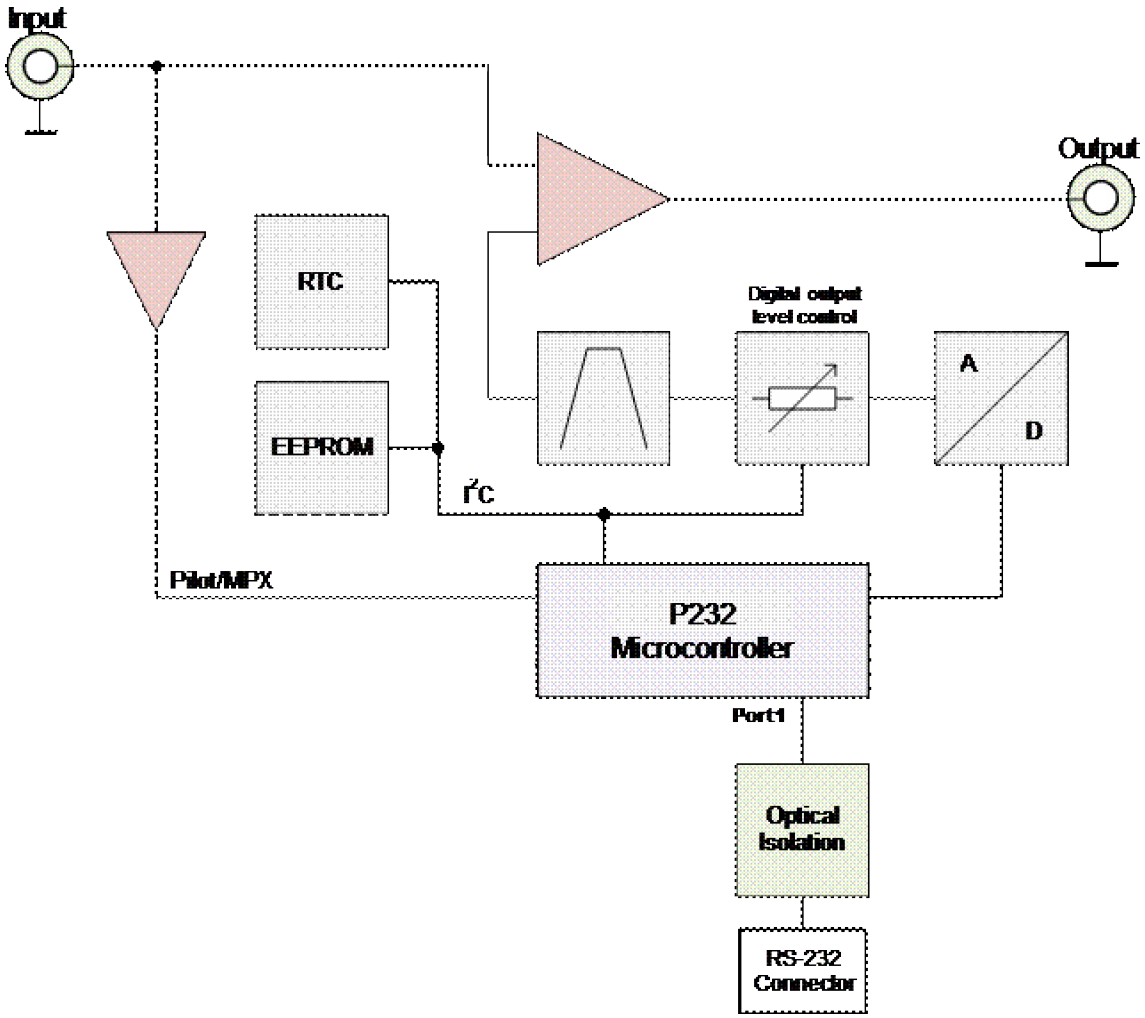
1.1 Main Highlights

- Fully dynamic FM broadcast RDS encoder with up to two independent communication ports
- Control interface based on ASCII commands and UECP protocol
- Text features include dynamic PS, parsing, scrolling, tagging, fixed messages and scheduling
- Excellent compatibility with broadcast automation systems
- Control software includes powerful Windows GUI application
- Easy and fast set-up

1.2 Other Features

- Excellent spectral purity, direct digital RDS signal synthesis; compliant with EN 50067 / EN 62106
- Firmware updates are free
- Two switchable program sets (with optional DSN and PSN setting)
- Internal real-time clock incl. backup battery

1.3 Block Diagram

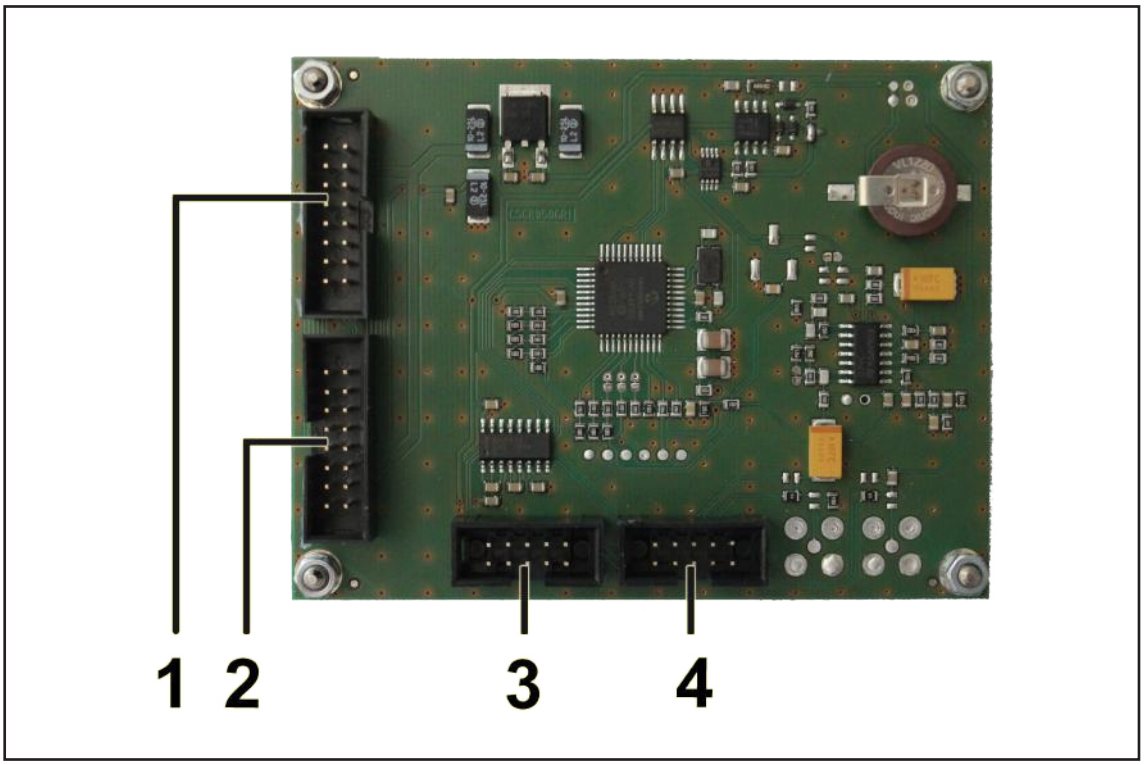


2. Technical Specifications

			/RDS-TEX-E-2HE & /RDS-TEX-E-3HE
Parameters		***U.M.***	***Value***
GENERAL			
RDS Output	Standards		Cenelec 50067 Specification
	Frequency	kHz	57 +/- 0,3Hz (internal reference)
	Bandwidth	kHz	+/- 2,4 (-50dB)
	Level	mVpp	2.200
	Phase / Pilote	Deg.	Adjustable from 0 to 360 in 0.33 increments
	Connector		IDC 10p Mas.
	Impedance	ohm	50
PILOTE input	Sync frequency	kHz	19 +/- 2Hz
	Input level	dBu	from –30 to +4 (sinusoidal or TTL)
	Connector		IDC 10p Mas.
Primary Serial Port	Speed in continuous flow	bps	
	Programming speed	bps	
	Transmission format		8 bit – no parity – 1 stop bit
	Connector		IDC 10p Mas.
Auxiliary Serial Port	Speed in continuous flow	bps	19200
	Programming speed	bps	19200
	Transmission format		8 bit – no parity – 1 stop bit
	Connector		IDC 10p Mas.
Elaboration	D/A conversion		8 bit (Dynamic range 30 dB)
	DSP		16 bit , fixed point
Ambient working temperature		°C	0 to + 50
Ambient Working Humidity		%	85 (Without condensing)
RDS SERVICES			
Services			
Programs	DSN		2
	PSN		
Specifications	PS (custom)		
	AF		
	RT		
	EON		
	IH,TDC,TMC		
	EWS		
	Groups		
	Addresses		
Programming	Command formats		
	Custom functions		
POWER REQUIREMENT			
DC Power Input	DC Supply Voltage	V	
	DC Current	A	
MECHANICAL DIMENSIONS			
Phisical Dimensions	Width	mm	
	Depth	mm	
Weight		g	
OTHER CONNECTORS			
STANDARD COMPLIANCE			
Safety			
EMC			

3. Physical Description

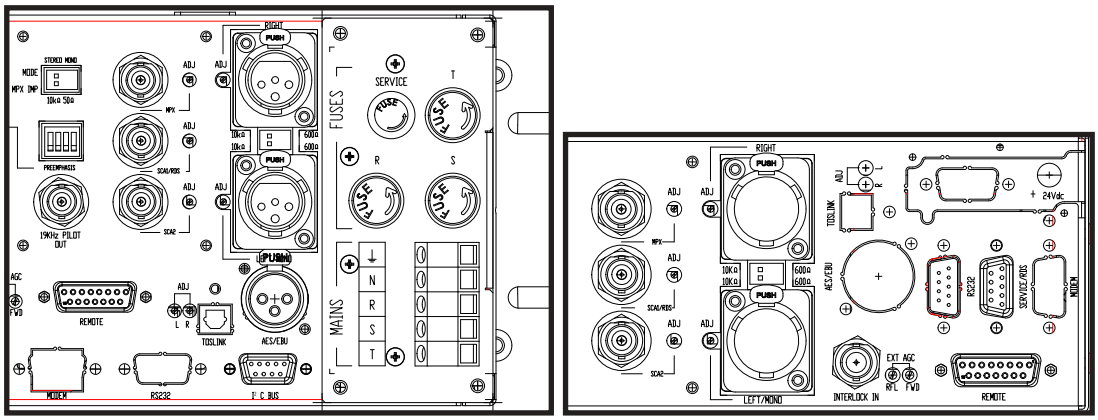
3.1 Board Layout



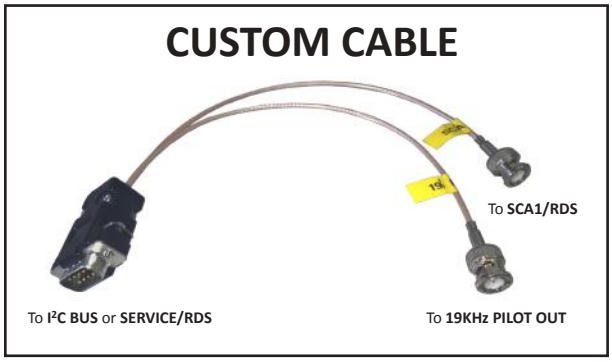
[1]	INPUT	Connector for data exchange from the modulator panel board.
[2]	OUTPUT	Connector for data exchange to the modulator panel board.
[3]	SERIAL 1	Connector for data exchange to the RS232 connector on rear panel + RDS output + Pilot input.
[4]	SERIAL 2	Not used.

4. Installation and Setting-up

4.1 Connection



- Connect the DB9 connector to the **I²C BUS** or **SERVICE/RDS** (depending on model) of **/RDS-TEX-E** option to the two BNC ouputs named **19KHZ PILOT OUT** (synchronization signal) and **SCA1/RDS** (RDS signal) always present in the back of the machine itself. If the connecting device is different, identify an equivalent.



Note : *For programming you need to connect it directly to a PC by using an RS232 cable or an USB-RS232 converter. This is a pre-requisite to ensure the proper operation of the equipment. Disconnect the DB9 connector from the* ***I²C BUS*** *or* ***SERVICE/RDS*** *input and then connect it to your PC.*
After programming, disconnect the RS232 data cable and then reconnect the custom cable to the ***I²C BUS*** *or* ***SERVICE/RDS*** *input.*

4.2 On-board Controls

4.2.1 On-board adjustable elements

Due to completely DSP-based solution there's no adjustable element on the board affecting the RDS or MPX signal.

4.2.2 MPX loopthrough switch

Set the switch to LOOP position only if you want to pass the input signal to the output of the RDS encoder (loopthrough mode). **In all other cases the switch must be set to SIDE position!**

4.3 Level and Phase Adjustment

4.3.1 RDS signal output level

IMPORTANT Note: *There is no universal setting for the RDS level. Due to different input sensitivity of different FM broadcast equipment it's preferred always 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.

Adjusting higher RDS level results in better RDS reception in areas covered with weak signal. This is especially important if using scrolling PS or sending a lot of text information. However consider following aspects before adjusting higher RDS level:

- the MPX (audio) level must be decreased a little to meet the overall FM deviation limit,
- automatic tuning using alternative frequencies (AF) will appear slower – the receiver will rate the signal reception as good although there may be a reason to tune to another frequency.

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 – Controls* 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 **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** RDS encoder, that range is proportional to the output level range of 15.6 to 4000 mV p-p. Confirm the setting by Store button.

In terminal, using ASCII command LEVEL=

The **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** RDS encoder 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 = [256 x (Output RDS level / 4000)] - 1

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

Output RDS level = [(LEVEL +1)/256] x 4000

4.3.2 Phase adjustment for stereo transmission

The phase adjustment between RDS subcarrier and pilot tone is an optional procedure applicable for stereo transmission (for mono there's nothing to adjust). The adjustment is made using the Windows control software or using the PHASE= command. Make sure the external synchronization is enabled (check the command EXTSYNC or the item Clock source on the System card in the Windows control software which must be set to Auto).

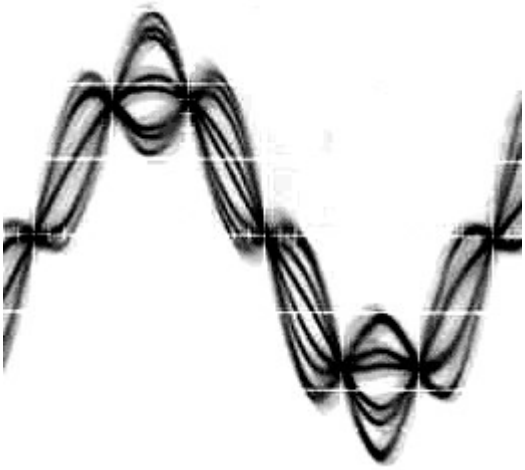
From factory the phase shift is already set to 0 degrees so user may skip this chapter.

1. Fetch pilot or MPX signal to the RDS encoder. The PILOT LED will indicate that the pilot tone is present.
2. Adjust right phase shift (0 or 90 degrees phase shift between 19 kHz pilot tone and 57 kHz RDS subcarrier, measured on transmitter input, see the oscillograms). The phase adjustment would be difficult without an oscilloscope or specialized measuring instrument.

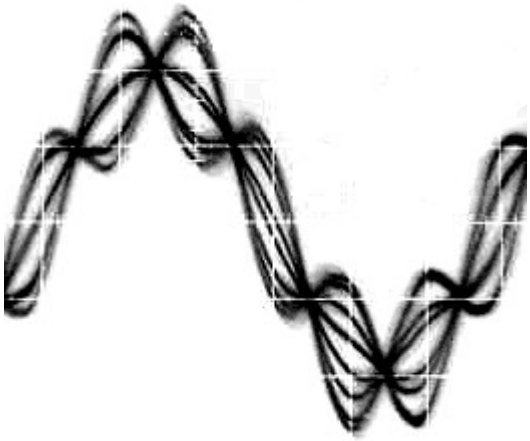
Some experiments performed in the field show that the conditions of RDS reception are not too much affected by the phase criterion. However, similar experiments have shown that right phase shift adjust offers a better behaviour of audio receivers, and notably the residues of audio intermodulation which can sometimes be observed, but with the aid of professional instruments only.

Conclusion: The phase adjustment is only optional and you may skip this step. Make sure the pilot tone is indicated on the RDS encoder by the PILOT LED.

Oscillograms



Pilot and RDS in phase (0 degrees phase shift)



Pilot and RDS in quadrature (90 degrees phase shift)

Measuring conditions: Two-channel analogue oscilloscope, CH1: pilot (or MPX without audio), CH2: RDS output, trigger source: CH1, vertical function: CH1+CH2, horizontal: 5 µs/div.

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 application can be used.

Note: *When attempting to set-up a unit that was already placed in operation before, the user should apply the initialization first (Windows control software help).*

4.4.1 PI (Program Identification)

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 country:

0	***Cannot be assigned.***	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 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: *Meaning of some PI digits may be different for US RBDS.*

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

IMPORTANT: *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 authority, he must choose such number that is not in conflict with other stations in the location.*

Tip: *The Magic RDS control software includes a wizard that calculates the PI automatically.*

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 later.

4.4.3 PTY (Program Type)

The PTY code defines the type of the programme broadcast within 31 possibilities. This code could be used for search tuning.

IMPORTANT: *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)

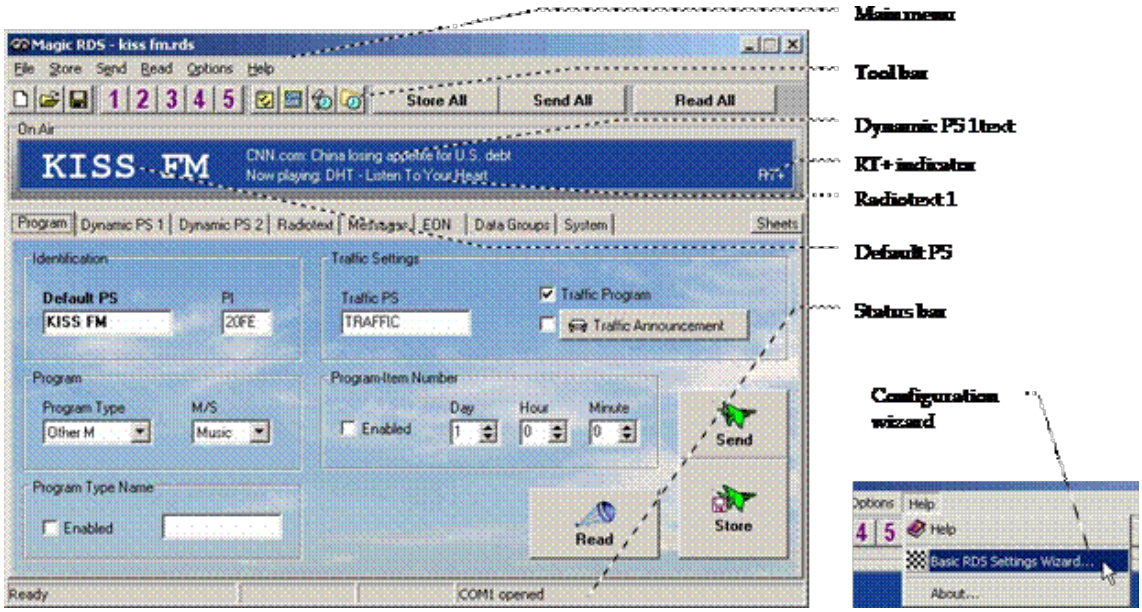
The Alternative Frequencies are used to tell receivers what frequencies they can receive the radio station on. This facility is particularly useful in the case of car and portable radios. For this to work, each transmitter must have RDS with the same PI code.

IMPORTANT: *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. For complete RDS service description visit the website, section Support.*

4.4.7 Windows control software - First steps

1. In the case of USB connection install the USB driver first. After this the communication port is accessible like any standard serial RS-232 port, using COMx name, where x is the port number assigned in operating system. The virtual COM port driver ensures compatibility also with older software although the connection is physically realized via USB cable. Pure RS-232 connection requires no extra driver or settings.
2. Make sure the RDS encoder is connected and powered, all connectors are seated completely. 3. Run the Magic RDS software using Windows Start button.
4. 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.
5. Close the Preferences. You should see “Connected” or “Opened” in the status bar. Now you are ready. The settings are saved automatically.
6. Configure the basic RDS settings mentioned above. You will find them on cards Program and System. Then click Store. **For beginners there’s a very useful configuration wizard under menu item Help.**
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 in the application Help.



Magic RDS 3 - default Windows control software.

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.

5. Dynamic PS Text

Standard RDS enabled receiver disposes of 8-character LCD display but we usually need to show pile of information and commercials. So small display on the one hand and so much demands on the other hand. The **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** solves it by unique system of text messages showing. Although Radiotext service is defined in the RDS standard, this service is not present some receivers (especially older car radios) and has some other limitations. According to the broadcasters needs, the PS service - one of the basic RDS services supported by all receivers - can be usually used to give sequential information. This has become known as 'Dynamic PS' or 'Scrolling PS'.

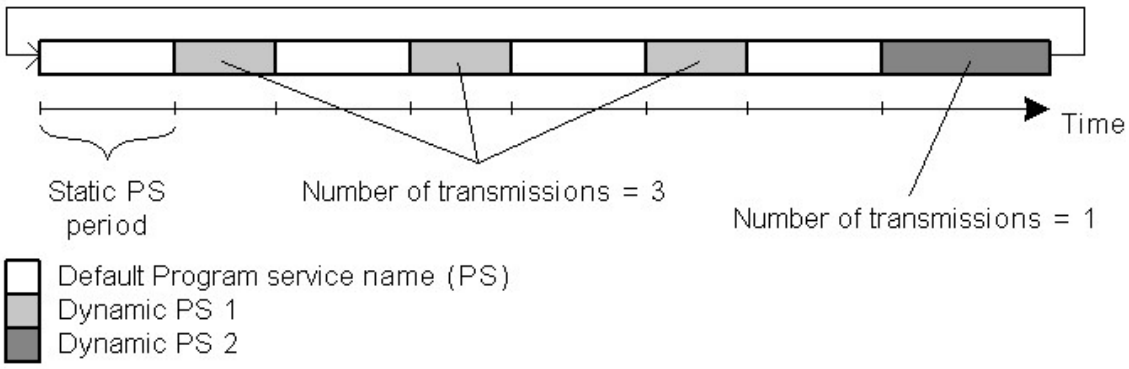
Note: *Using the dynamic PS is restricted in some countries and it's fully prohibited by the RDS standard!*
The manufacturer is not responsible for incompetent use of this feature. Some receivers may not display the dynamic PS properly for reasons that lie entirely on their side. Never provide traffic information inside the Dynamic PS text!

The **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** RDS encoder offers advanced implementation of the Dynamic PS service. Basic text message length is up to 255 characters (mode independent). Two varieties of the Dynamic PS are present: Dynamic PS 1 (DPS1) and Dynamic PS 2 (DPS2). Both varieties are configurable independently from each other.

Basic configurable parameters are:

- Text content/text source
- Display mode
- Label period or scrolling speed
- Number of transmissions Example of full dynamic PS use:

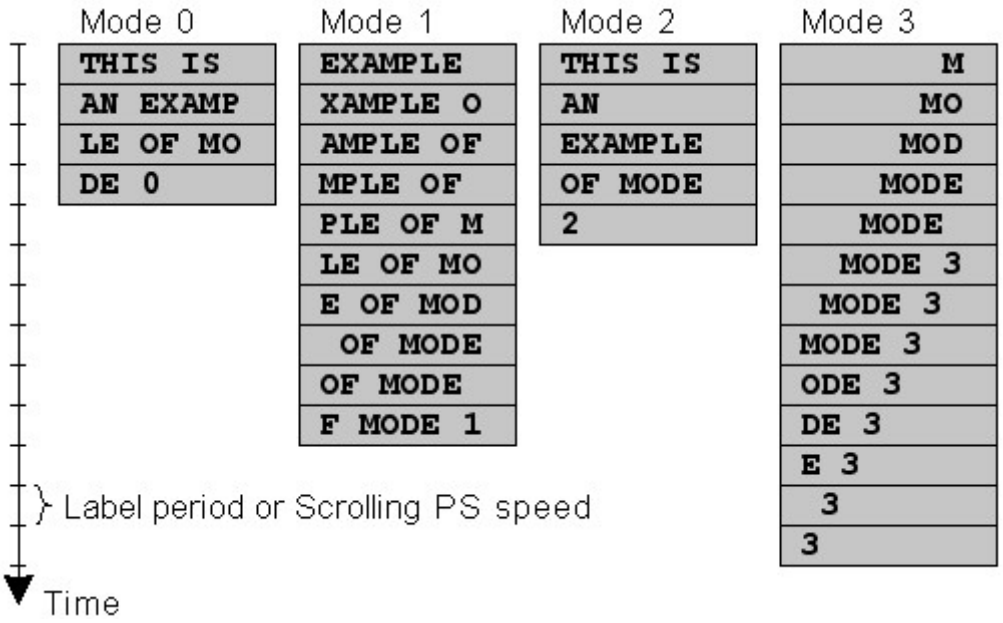
Example of full dynamic PS use:



The number of transmissions is specified for each Dynamic PS text. The Static PS period (delay between text loops) specifies the time between two repeats of the Dynamic PS text loops. Default PS is displayed during this time.

Four display modes are provided. The mode is switchable 'on the fly', without need to re-enter the text message.

- Mode 0 - Scrolling by 8 characters
- Mode 1 - Scrolling by 1 character
- Mode 2 - Word alignment scrolling
- Mode 3 - Scrolling by 1 character, text separated by spaces at begin and end



Additional differences exist between Dynamic PS 1 and Dynamic PS 2. In general the DPS1 should be used if on-line connection is available between your studio and the RDS encoder while the DPS2 should be used if the RDS encoder is placed on a site without on-line connection providing set of fixed messages.

6. Alternative Frequencies

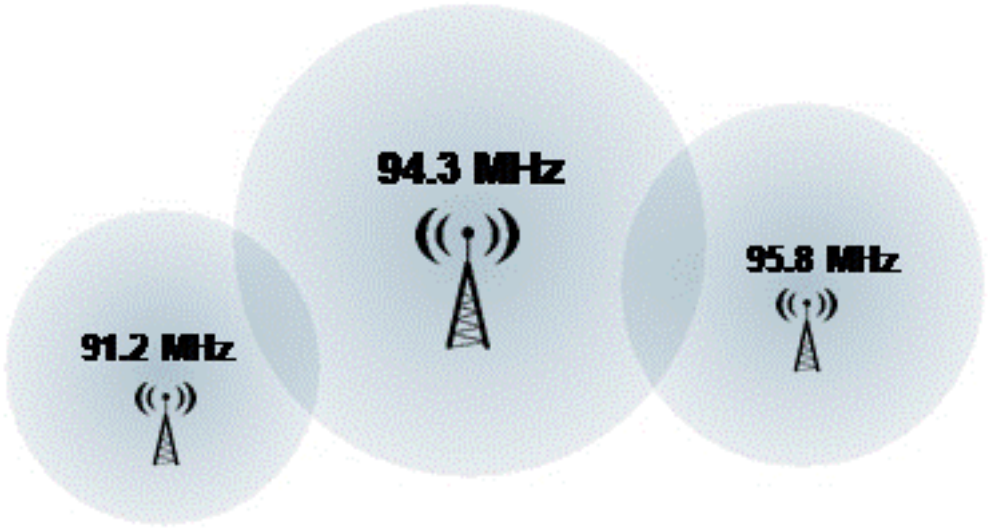
The list of alternative frequencies gives information on the various transmitters broadcasting the same program in the same or adjacent reception areas. It allows switching to another frequency of the same station when leaving the actual frequency coverage. This facility is particularly useful in the case of car and portable radios.

IMPORTANT: *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.*

Ideally the AF list should only comprise frequencies of neighboring transmitters or repeaters. Entire AF set should be as tiny as possible to allow the receiver to find the strongest frequency quickly. This will improve the listener's experience. Thus there should be more RDS encoders using individual AF sets within larger networks.

Two methods of AF transmitting are possible:

- AF method A is used for stations carrying the same program on all their transmitters. The list may contain up to 25 frequencies.
- AF method B is used for larger lists or when splitting areas or different programs are broadcast.



6.1 Method A

This is a default method recommended for most of stations.

To establish a common list of AF-A using a terminal:

Note: *Requires only one RDS encoder for entire network (common STL or one main transmitter and two repeaters). The list must contain all frequencies on which the signal from the RDS encoder is carried.*

AF=94.3,95.8,91.2 *AF	Enter the list Store the list

To establish a separate list of AF-A for each transmitter:

Note: *Requires separate RDS encoder for each transmitter.*

Note: *All RDS encoders must be using the same PI (Program Identification).*

91.2 MHz:

AF=94.3 *AF	Enter the list Store the list

94.3 MHz:

AF=95.8,91.2 *AF	Enter the list Store the list

95.8 MHz:

AF=94.3 *AF	Enter the list Store the list

6.2 Method B

Total capacity: up to 8 lists, up to 12 AF pairs each

Method B AF coding is a more complex method that is used where the number of AFs used by a transmitter and its associated repeater stations exceed 25, or where it is required to indicate frequencies which belong to different regions which at times carry different programs.

More than one transmitter or associated repeaters of the station broadcast the same set of different AF lists in sequence. Total number of AF lists used within entire network is in general identical to the number of transmitters and repeater stations in the network so as to provide a unique list for each transmitting station. In this method the alternative frequencies are individually addressed by transmitting the tuning frequency paired with one alternative frequency. Each list starts with the tuning frequency for which the list is valid, e.g. 94.3. All remaining pairs (up to12) give the tuning frequency together with a valid AF.

For the transmission of the frequency pairs within one block the following convention is used. They are generally transmitted in ascending order (F1 < F2), e.g. 94.3,95.8 or 91.2,94.3. In special cases they are transmitted in descending order, if they belong to different regions, or carry from time to time different programs. If you use the Windows control software, this assures right order automatically.

To establish a common set of AF-B lists using a terminal:

Note: *For illustration purpose only. If the network contains only a few frequencies like in this example, the method A is more effective.*

AF=A	Switch to method A to allow editing of the AF lists
AF=94.3,94.3,95.8,91.2,94.3	Enter the first list for 94.3 MHz
*AF=1	Store the list
AF=95.8,94.3,95.8	Enter the second list for 95.8 MHz
*AF=2	Store the list
AF=91.2,91.2,94.3	Enter the third list for 91.2 MHz
*AF=3	Store the list
AF=	Terminate the set of AF lists Store the termination
*AF=4	Switch back to method B – start cycling through the lists
AF=B	
*AF	Store the method setting

To read the set of AF-B lists:

AF	Read the AF method being used (A/B)
AF=A	Switch to method A to allow reading of the AF lists
AF=1	Load the first list
AF	Read the list
AF=2	Load the second list
AF	Read the list
AF=3	Load the third list
AF	Read the list
AF=4	Load the fourth list
AF	Read the list, no AF here, terminating
AF=B	Switch back to method B

Note: *If the number of AFs of a station is larger than 12, the list must be split into two or more lists. These lists are transmitted directly one after the other.*
Broadcasters using splitting of a network during certain hours of the day should use AF method B, and not AF method A. The lists should be static, i.e. the AFs included in the list, carrying a different program during certain hours of the day, shall be signaled by transmitting in the descending order (F1 > F2). Their PI shall differ in the second digit of the code (using regional variant 4 to F) and may also be static. Switching the second digit of the PI to 1, 2 or 3 informs the receiver that now even AFs transmitted in descending order carry the same program and the receiver may use them for switching.

7. Enhanced Other Networks information (EON) control

The EON feature is used to update the information stored in a receiver about program services other than the one received. Alternative frequencies, the PS name, Traffic Program and Traffic Announcement identification as well as Program Type and Program Item Number information can be transmitted for each other service. The relation to the corresponding program is established by means of the relevant Program Identification (PI).

The EON is especially useful for linking two or more stations of the same owner. Most of EON featured receivers gives priority to stations linked by EON when seek function is activated. Since the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** can store four EON links, up to 5 stations can be linked together.

Station that doesn't carry traffic announcements can refer to a station that does. This situation is described below. For more information see appropriate section in the List of Commands or in the Magic RDS control software help.

7.1.1 Traffic Program and Traffic Announcement codes

The coding to be used is as follows:

Traffic Program (TP)	Traffic Announcement (TA)	Applications
0	0	This program does not carry traffic announcements nor does it refer, via EON, to a program that does.
0	1	This program carries EON information about another program that gives traffic information.
1	0	This program carries traffic announcements but none are being broadcast at present and may also carry EON information about other traffic announcements.
1	1	A traffic announcement is being broadcast on this program at present.

Station which uses the code TP=0, TA=1 must refer to at least one program service which carries traffic information, and has the flag TP=1. When a particular program service begins a traffic announcement, the station that cross- references this service via the EON feature will broadcast a switch signal by setting the appropriate EON TA flag to 1. The EON TA flags can be controlled by software for all four EON links in the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE**. The first EON link TA flag can be also controlled by external TA/EON1TA switch.

The situation described is illustrated on the example below:

7.1.2 Example

Kiss FM is a small station that doesn't carry traffic announcements but refers via EON to City Radio, which is regional station of the same owner that carries the traffic announcements. If the Kiss FM listener has activated the EON feature on his receiver, he will be automatically tuned to City Radio for the duration of traffic announcements.

Station 1: **Kiss FM**	Station 2: **City Radio**
PI=20F1 PS=KISS FM **TP=0, TA=1** Frequency: 90.2 MHz	PI=2501 PS=CITY **TP=1, TA=(controlled by external switch)** Frequencies: 93.7 and 106.2 MHz (only 93.7 can be received in the area covered by Kiss FM)
Station 1 EON Data: EON1PI=2501 EON1PS=CITY **EON1TA=(controlled by external switch)** EON1AF=93.7	

Both TA/EON1TA switch connectors can be wired together and controlled by only one switch or device if the transmitters of 90.2 and 93.7 MHz are placed on the same site.

8. Weekly Scheduling

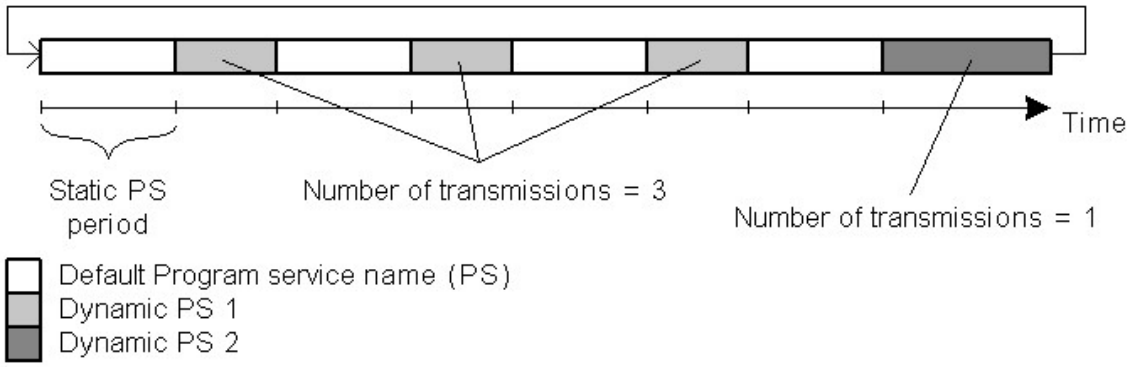
This feature allows scheduling of text messages, program type names and any other commands in hourly, daily and weekly program. The scheduling is provided directly by the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** unit. Once set, it works with no more support from PC or control application. This is especially useful when the RDS encoder is placed on remote site or where reliability is important.

8.1.1 Key features

- The scheduling feature is fully implemented in the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** unit and works independently
- Almost any RDS service or control command can be scheduled
- Up to 48 scheduling items
- Each item may contain any combination of days in week, up to 12 times (a wildcard is supported on the hour place), program type (PTY) information and any from more than 60 commands

8.1.2 First steps

Let's say that our radio station called 'PRO 88' broadcasts news from Monday to Friday at midday. The news duration is 40 minutes. During the news the PS is set to 'HOT NEWS' and the PTY is set to 1 (News). In common program the PTY is set to 3 (Info).



Scheduling item 01:
Days: Monday, Tuesday, Wednesday, Thursday, Friday
Times: 12:00
PTY: 1 (News)
Command: PS=HOT NEWS

Scheduling item 02:
Days: Monday, Tuesday, Wednesday, Thursday, Friday
Times: 12:40
PTY: 3 (Info) Command: PS=PRO 88

8.1.3 Text messages scheduling

Although it's possible to change directly the Dynamic PS and Radiotext (using an appropriate command, for example RT2=The best music in the city), the maximum text length is limited since maximum command length in each Scheduling item is 35 characters. For longer texts you may use indirect method based on the bank of Messages:

1. Store the text as a Fixed Text Message, for example Message 01.
2. In the Scheduling call the message number, for example RT2MSG=1 or DPS2MSG=1or XCMD=<rds><msg>1</msg></rds>.

The Windows control application provides easy GUI for this case.

8.1.4 Troubleshooting

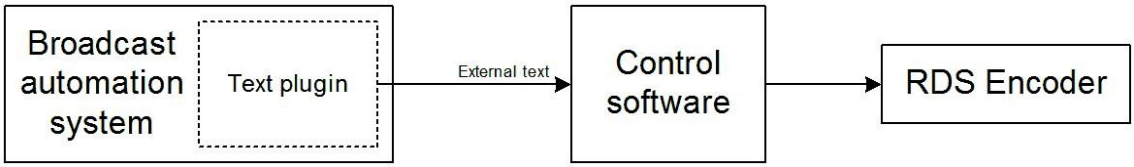
If the scheduling doesn't work as expected, check the following points:

- Scheduling enabled?
- Date and Time actual?
- Commands typed right?

9. 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 **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE**. The link may be either indirect or direct.

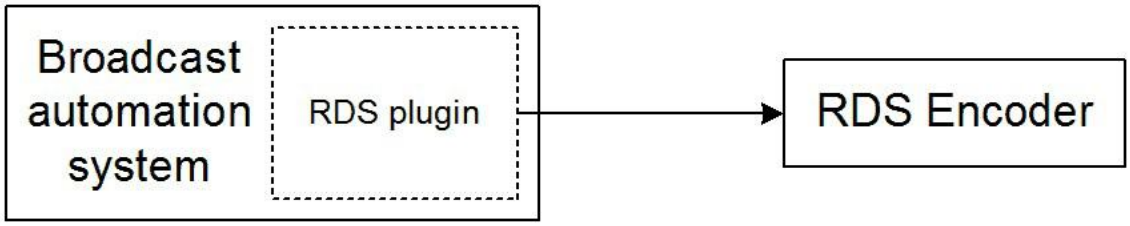
9.1 Indirect Link



Default Windows control software for the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** RDS encoder is the Magic RDS 3. 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 manual cannot be full-scale. For specific information about how to configure the broadcast automation system text output please follow its documentation or contact the software vendor.

9.2 Direct Link



9.2.1 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, enable appropriate text services (usually Radiotext 1). Use the Windows control software or a terminal application. Store all setting into EEPROM. Exit the Windows control software or the terminal.
3. Find out the baudrate (speed) 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.
4. Turn on the RDS encoder support in the broadcast automation system.

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

For detailed information about how to control the RDS encoder contact your broadcast software vendor.

9.2.2 Data format

The **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** RDS encoder supports several formats (protocols) for input data and it's designed to be compatible with all broadcast automation software which allows direct RDS encoder control.

The support includes:

- ASCII commands
- UECP protocol (format given by UECP specification)
- X-Command (described later in this chapter) Basic data format for ASCII command is as follows:

Prefix (ASCII command): RT1=
Terminating character8: <CR> (Carriage return). <CR><LF> accepted as well.

Example:
RT1=Now Playing: Julia Michaels - Issues8

9.2.3 Compatibility commands

To reach the best possible compatibility with broadcast automation systems, the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** includes a special set of compatibility commands. In the systems where the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** 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.

Command	Translated to
TEXT=	RT1=
DPS=	DPS1=
PS_SCROLL=	DPS1ENQ=

9.2.4 Radiotext Plus (RT+ tagging)

The RT+ feature is designed to let the listener take additional benefit from the Radiotext service by enabling receivers to offer direct access to specific elements of Radiotext. Typically the RT+ feature supports song artist and song title elements. These elements anyway carried in the Radiotext, are identified by their class type,

length and location within the Radiotext. The receiver must be equipped with the RT+ function (also called “tagging”) to take advantage of this feature.

The RDS encoder includes full support for the RT+ and its handling is highly automated. For direct use your broadcast automation system must support X-Command or the RT+ function either by means of user defined groups or by the command RTP= . In other cases the Windows control software used in the indirect link configuration can provide the RT+ service.

9.2.5 X-Command for RDS encoders

The X-Command is the newest and preferred method how to forward text information (incl. tagging) from the broadcast automation system to the RDS encoder. It is based on simplified markup language. The X-Command is fully supported by the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** RDS Encoder.

Example:

XCMD=<rds><item><dest>3</dest><text>Now Playing: <artist>Julia Michaels</artist> -

<title>Issues</title></text></item></rds>8

For more details follow the information in the document ‘X-Command for RDS Encoders’.

10. Communication Ports

10.1 Overview

For configuration and control requirements this RDS encoder is equipped with two communication ports. These ports include individual buffers and work in complete independence, i.e. both ports can be used at one time by different applications.

The port overview is given in following table:

Physical plug	Ports reference	Port type	Description and purpose
 RS-232 / USB	**Port 1**	Physical (external)	This port is dedicated especially for local connection or for connection with satellite receiver. A USB to RS-232 adapter can be connected as well. The port is accessible like any standard serial RS-232 port from the computer, using COMx name, where x is the port number assigned in operating system. Primary configuration of the equipment is typically made via this port. The port baudrate is configurable in range 1200-19200 bps.
 RS-232 TTL	**Port 2**	Physical (external)	This port allows controlling of the encoder from a microcontroller or embedded computer inside the equipment via internal serial bus. A USB to RS-232 or Ethernet to RS-232 module can be connected as well. The port baudrate is fixed at 19200 bps. Note: Depending on the product variant, the Port 2 may not be accessible to the end user.

All ports are universal so they accept complete set of ASCII commands, a connection from the Windows control software and UECP records (depending on setup).

10.1.1 External RS-232 connector pin diagram (Port 1)

To comply with UECP specification (SPB 490), the RS-232 interface is designed as a DTE (Data Terminating Equipment) and therefore the connector is a male type 9-pin.

Pin Number	Meaning	Note
1	NC	No internal connection
2	TxD	Transmit data input
3	RxD	Receive data output
4	NC	No internal connection
5	GND	Ground
6	NC	No internal connection
7	NC	No internal connection
8	RDS	
9	19 kHz	

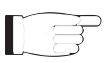
For a connection to the computer or to a standard USB to RS-232 adapter, a crossed cable is required, usually known as null-modem cable or laplink cable.

10.2 Working with a Terminal Application

This section explains how to make the settings above from a terminal application (and also from embedded web- server).

All RDS encoder's settings and configuration incl. text messages etc. can be made from a terminal using a set of ASCII commands. (Any Windows GUI based application effectively does the same; it translates the user's data into the ASCII commands.)

1. In the case of USB connection install the USB driver now.
2. Make sure the RDS encoder is connected and powered, and all connectors are seated completely.
3. On the PC, run an application or program emulating or possessing an ASCII terminal. For example Windows HyperTerminal in Windows XP presents all the characteristics to easily communicate in ASCII mode with the RDS encoder.



Note: *Latest Windows versions unfortunately no longer contain terminal application. That needs to be installed additionally from public resources. Suitable replacement for the Windows HyperTerminal is the PuTTY client that is available for free download at http://www.putty.org.*

4. For USB connection configure the communication parameters as follows:

Transmission speed	2400 bps (default, see note)
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Note:If the RDS encoder was previously in use, there may remain any speed from 1200, 2400, 4800, 9600 or 19200 bps. Actual speed is showed on the encoder's LCD display or can be retrieved via internal website.

Once configured, the terminal can be used. To check if the hardware and logic configuration work as planned, type for example HELP and press <Enter> to display the list of all commands. If no or unknown characters are displayed on the screen, try again a second time, otherwise, check the following points:

- RDS encoder turned on?
- Cable used (does the LED1 indicate incoming characters?)
- Configuration of the terminal application

To display the commands entered at the keyboard on the screen, type the command ECHO=1 followed by <Enter>. If all characters written are displayed twice, type ECHO=0 and press <Enter>.

To store this parameter into a non-volatile EEPROM memory, type *ECHO and press <Enter>. To display actual parameter value, type ECHO and press <Enter>.

Now you made first steps with the RDS encoder command interpreter.

10.3 Command Interpreter

The RDS encoder command interpreter meets the following rules:

Any instruction sent to the RDS encoder must be validated by <Enter>. Before validating you may correct the characters by pressing <Backspace>.

There are several methods of use for the commands:

- Query or command without argument, ex. HELP
  Shows the parameter value or performs the operation.
- Command with argument, ex. ECHO=1
  Assigns the value to the parameter.
- Memory store command, ex. *ALL
  Stores the parameter value(s) into the non-volatile EEPROM memory.
- Memory store command with argument, ex. *MSG01=
  Assigns the value to the parameter and stores it immediately into the non-volatile EEPROM memory.

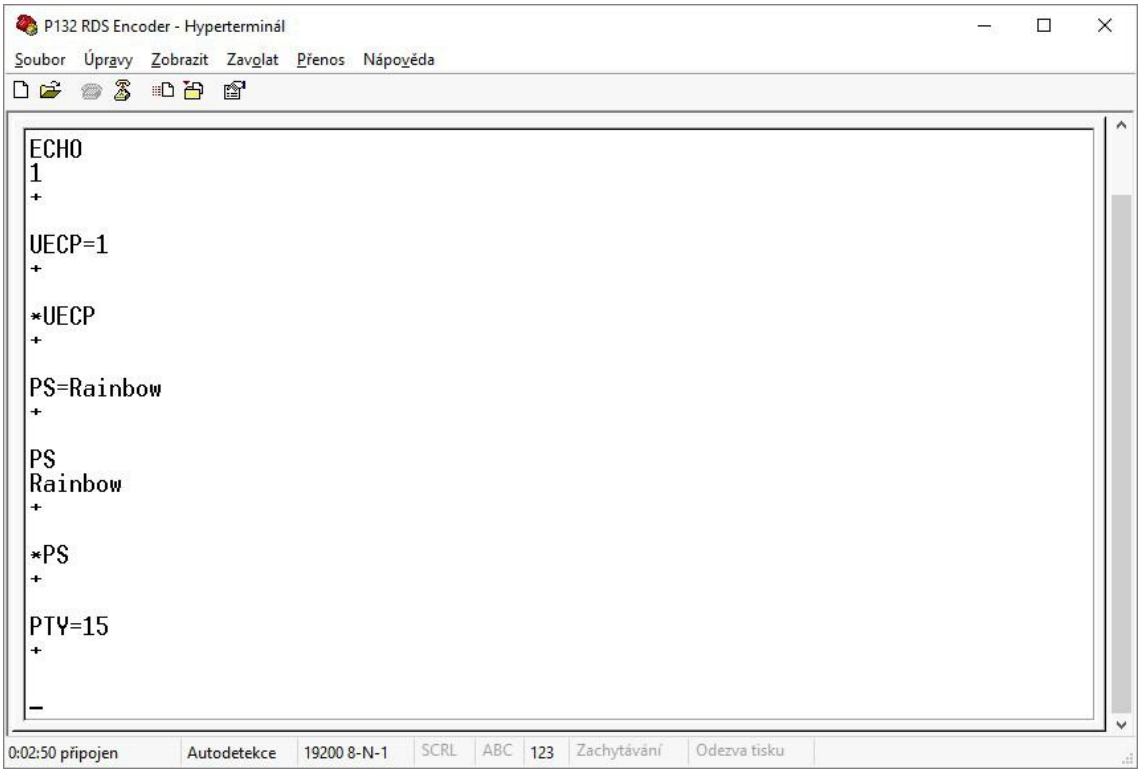
Not all methods are available for all commands, see Command Summary section.

Depending on the command processing success, several characters (followed by two pairs of carriage return and line feed characters) can be returned by the RDS encoder:

+	Command processed successfully
!	Unknown command
-	Invalid argument
/	Command processed partially

The command interpreter is not case sensitive. But it's recommended to write all commands in UPPER CASE to maintain backward compatibility with older firmware versions.

If you wish to retain change of any parameter value during power off, don't forget to store it into EEPROM memory!



Windows Hyperterminal control.

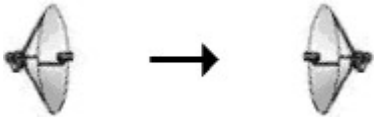
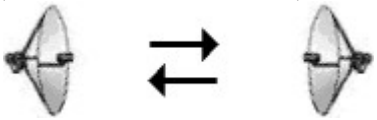
10.4 Additional Information

This additional information provides all details required for implementation of the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** protocol into your application (broadcast automation system, messaging system, TMC data source etc.).

Please see also the Annex 1 - Communication Protocol Implementation Flowcharts. Some source code examples are provided on the website.

10.4.1 Unidirectional or bidirectional – What is the difference?

The **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** supports both unidirectional and bidirectional communication modes. Nothing is required to be set, the mode of operation results only from the method of communication.

Unidirectional (backward channel from the RDS encoder is not present or the data from this channel is ignored) 	✓ Very simple to implement ✓ Low cost data link × No direct feedback from the unit
Bidirectional (both channels are used) 	▯ Reliable remote control ▯ Backward channel may be hard to realize in some cases ▯ Unsuitable for larger networks

10.4.2 Command synchronization

Unidirectional communication:

If sending more commands in sequence, the execution times must be taken into consideration. In other case some commands may be discarded after internal buffer filling.

Command	Execution time
PS=, TPS=, DPSx=	up to 400 ms
G=	up to 200 ms
*ALL	200 ms
*EON, *DPSx, *MSGxx=	50 ms
Other store commands, SEN=	10 ms
All other commands	0 ms (typ.)

The times result from the EEPROM write cycle duration or from the requirement of internal synchronization with RDS data group order. Most of commands require no perceptible delay due to internal RX line buffering.

TX	P	S	=	P	R	O	␣	8	8	←	(execution time)	(next command may follow)

Legend:
TX – data sent to the RDS encoder, ← - CR (char. 13, <Enter>)

Bidirectional communication:

Next command can be sent after receiving confirm sequence from previous command. This ensures right timing and optimal channel usage in all cases. There is no need to consider any timing or delays.

TX	P	S	=	P	R	O	␣	8	8	←									(next command may follow)
RX (ECHO=1)		P	S	=	P	R	O	␣	8	8	(exec. time)	---	↓	+	←	↓	←	↓	
RX (ECHO=0)											(exec. time)	←	↓	+	←	↓	←	↓	

TX	P	S	←																(next command may follow)
RX (ECHO=1)		P	S	←	↓	P	R	O	␣	8	8	←	↓	+	←	↓	←	↓	
RX (ECHO=0)				←	↓	P	R	O	␣	8	8	←	↓	+	←	↓	←	↓	

TX	*	P	S	←									(next command may follow)
RX (ECHO=1)		*	P	S	(exec. time)	←	↓	+	←	↓	←	↓	
RX (ECHO=0)					(exec. time)	←	↓	+	←	↓	←	↓	

Legend:
TX – data sent to the RDS encoder, RX – data read from the RDS encoder, ← - CR (char. 13), ↓ - LF (char. 10)

10.4.3 Useful notes

- ASCII char. 9 (TAB) is converted to char. 32 (space).
- In addition to the <Enter> (char. 13, CR) used for command validating, character 26 (EOF) can be used. This allows to insert the validating character on platforms where char. 13 (CR) is not accepted.
- The command interpreter ignores other characters in ASCII range 0-31.
- Space characters (char. 32) are ignored if typed behind validating character on a new line. In this case, the space characters may be used to realize a delay between two commands.
- The port time-out is 2 minutes. If no character is received during this time, the command line on that port is internally cleared.
- For automated control (machine to machine), if getting a response from the encoder, the block of echoed characters should be entirely ignored. That is, after starting to send the command, the control application should ignore all characters received until the application receives first CR+LF from the encoder. This ensures receiving of correct data regardless of the echo state.

11. List of Commands

11.1 Command Summary

Basic:

AF	AF=	*AF	*AF=	Alternative Frequencies
AFCH	AFCH=	*AFCH		Alternative Frequency Channels
DI	DI=	*DI		Decoder Identification
DPS1	DPS1=	*DPS1		Dynamic PS 1
	DPS1ENQ=			Dynamic PS 1 Enqueue
DPS2	DPS2=	*DPS2		Dynamic PS 2
DPS1EN	DPS1EN=	*DPS1EN		Dynamic PS 1 Enable
DPS2EN	DPS2EN=	*DPS2EN		Dynamic PS 2 Enable
DPS1MOD	DPS1MOD=	*DPS1MOD		Dynamic PS 1 Mode
DPS2MOD	DPS2MOD=	*DPS2MOD		Dynamic PS 2 Mode
DPS1REP	DPS1REP=	*DPS1REP		Dynamic PS 1 Number of Repeating
DPS2REP	DPS2REP=	*DPS2REP		Dynamic PS 2 Number of Repeating
DTTMOUT	DTTMOUT=	*DTTMOUT		Default Text Timeout
EQTEXT1	EQTEXT1=	*EQTEXT1		Equal Text 1
LABPER	LABPER=	*LABPER		Label Period
MS	MS=	*MS		Music/Speech
PI	PI=	*PI		Program Identification
PS	PS=	*PS		Program Service name
PTY	PTY=	*PTY		Program Type number
PTYN	PTYN=	*PTYN		Program Type Name
PTYNEN	PTYNEN=	*PTYNEN		PTYN Enable
RT1	RT1=	*RT1		Radiotext 1
RT1EN	RT1EN=	*RT1EN		RT1 Enable
RT2	RT2=	*RT2		Radiotext 2
RT2EN	RT2EN=	*RT2EN		RT2 Enable
RTPER	RTPER=	*RTPER		Radiotext Switching Period
RTTYPE	RTTYPE=	*RTTYPE		Radiotext Type
RSTDPS	RSTDPS=	*RSTDPS		Restart Dynamic PS
SCRLSPD	SCRLSPD=	*SCRLSPD		Scrolling PS Speed
SPSPER	SPSPER=	*SPSPER		Static PS Period
TA	TA=	*TA		Traffic Announcement
TATMOUT	TATMOUT=	*TATMOUT		TA Timeout

TP	TP=	*TP		Traffic Program
TPS	TPS=	*TPS		Traffic PS
INIT				Initialization
		*ALL		Store All
HELP				Help

EON:

EONxAF	EONxAF=	EON x Frequencies	*AF=	Alternative Frequencies
EONxAFCH		EON x Frequency channels		Alternative Frequency Channels
EONxEN	EONxEN=	EON x Enable		Decoder Identification
EONxPI	EONxPI=	EON x Program Identification		Dynamic PS 1
EONxPIN	EONxPIN=	EON x Program Item Number		Dynamic PS 1 Enqueue
EONxPS	EONxPS=	EON x Program Service name		Dynamic PS 2
EONxPSN	EONxPSN=	EON x Program Service Number		Dynamic PS 1 Enable
EONxPTY	EONxPTY=	EON x Program Type number		Dynamic PS 2 Enable
EONxTA	EONxTA=	EON x Traffic Announcement		Dynamic PS 1 Mode
EONxTP	EONxTP=	EON x Traffic Program		Dynamic PS 2 Mode
	*EON	Store all EON data into EEPROM		Dynamic PS 1 Number of Repeating

x is in range 1-4

Note: Almost all commands have their equivalent in the Windows control software, accessible through its GUI.

Fixed messages:

MSGxx		*MSGxx=	Text Message	Alternative Frequencies
MSGxxD		*MSGxxD=	Message Destination	Alternative Frequency Channels
MSGLIST			List of Messages	Decoder Identification
DPS2MSG	DPS2MSG=	*DPS2MSG	Dynamic PS 2 Message Number	Dynamic PS 1
RT2MSG	RT2MSG=	*RT2MSG	Radiotext 2 Message Number	Dynamic PS 1 Enqueue

xx is in decimal range 01-99

Scheduling:

SLIST			List of Scheduling Items	Alternative Frequencies
SxxC		*SxxC=	Scheduling Item Command	Alternative Frequency Channels
SxxD		*SxxD=	Scheduling Item Days	Decoder Identification
SxxP		*SxxP=	Scheduling Item PTY	Dynamic PS 1
SxxT		*SxxT=	Scheduling Item Times	Dynamic PS 1 Enqueue
SEN	SEN=	*SEN	Scheduling Enable	Dynamic PS 2

xx is in decimal range 01-48

System:

COMSPD	COMSPD=	*COMSPD	Port 1 Speed	Alternative Frequencies
CT	CT=	*CT	Clock Time and Date	Alternative Frequency Channels
DATE	DATE=		Date	Decoder Identification
ECHO	ECHO=	*ECHO	Terminal Echo	Dynamic PS 1
EXTSYNC	EXTSYNC=	*EXTSYNC	External Pilot Synchronization	Dynamic PS 1 Enqueue

LEVEL	LEVEL=	*LEVEL	RDS Signal Level	Dynamic PS 2
LTO	LTO=	*LTO	Local Time Offset	Dynamic PS 1 Enable
MJD	MJD=		Modified Julian Day	Dynamic PS 2 Enable
PHASE	PHASE=	*PHASE	RDS Signal Phase	Dynamic PS 1 Mode
PILOT			Pilot Tone Present	Dynamic PS 2 Mode
RDSGEN	RDSGEN=	*RDSGEN	RDS Generator	Dynamic PS 1 Number of Repeating
RESET			Reset	Dynamic PS 2 Number of Repeating
SETFEAT	SETFEAT=	*SETFEAT=	Special Features	Default Text Timeout
SPEED	SPEED=	*SPEED	Port 1 Speed	Equal Text 1
STATUS			RDS Encoder Status	Label Period
TIME	TIME=		Time	Music/Speech
VER			Firmware Version	Program Identification

Advanced:

ADR		*ADR=	Encoder Address List	Alternative Frequencies
CC		*CC=	Conditional Command	Alternative Frequency Channels
	EAS=		Send EAS Text Message	Decoder Identification
	EASTIME=		Set EAS Timer	Dynamic PS 1
DSNx		*DSNx=	Program 1/2 Data Set Number	Dynamic PS 1 Enqueue
ECC	ECC=	*ECC	Extended Country Code	Dynamic PS 2
ECCEN	ECCEN=	*ECCEN	ECC and LIC Enable	Dynamic PS 1 Enable
	G=		Group	Dynamic PS 2 Enable
GRPSEQ	GRPSEQ=	*GRPSEQ	Group Sequence	Dynamic PS 1 Mode

LIC	LIC=	*LIC	Language Identification Code	Dynamic PS 2 Mode
PAC y,zz	PAC y,zz=	*PAC	Port Access Control	Dynamic PS 1 Number of Repeating
PIN	PIN=	*PIN	Program Item Number	Dynamic PS 2 Number of Repeating
PINEN	PINEN=	*PINEN	PIN Enable	Default Text Timeout
PROGRAM	PROGRAM=	*PROGRAM	Program Set Selection	Equal Text 1
PSNx		*PSNx=	Program 1/2 Service Number	Label Period
PSW			PS Window	Music/Speech
RTP	RTP=		Radiotext Plus Tagging Data	Program Identification
RTPRUN	RTPRUN=		Radiotext Plus Running Bit	
	SETSPY=		Set RDS Monitoring Counter	
SHORTRT	SHORTRT=	*SHORTRT	Short Radio-text	
SITE		*SITE=	Site Address List	
UDG1	UDG1=	*UDG1	User Defined Groups 1	
UDG2	UDG2=	*UDG2	User Defined Groups 2	
UECP	UECP=	*UECP	UECP Enable	
	XCMD=		X-Command for RDS encoders	

x is in range 1 to 2
y is in range 0 to 4
zz is in range 00 to FF (hex)

11.2 Basic Commands

AF	Alternative Frequencies	(87.6-107.9), A, B, (1-8)
Actual list of alternative frequencies in MHz representation in range of 87.6-107.9 MHz. Up to 25 items are allowed in the list. In addition this command switches between AF method A and B and allows working with different AF lists for the method B. For more details about the method B follow the section 7. From factory the AF method is set to A.		
AF=103.5,98.0	Sets the alternative frequencies to 103.5 and 98.0 MHz (method A)	
AF	Shows actual AF list. Returns “B” if method B is active.	
*AF	Stores the AF list into EEPROM (default space for method A)	
*AF=1	Stores the AF list into EEPROM (to a space used by method B)	
AF=87.5	Not allowed (87.5 MHz not defined in RDS standard)	
AF=108.0	Not allowed (108.0 MHz not defined in RDS standard)	

AFCH	Alternative Frequencies	H (01-CC)
Actual list of alternative frequency channels in hexadecimal representation in range of 01-CC (87.6-107.9 MHz). Up to 25 items are allowed in the list.		
AFCH=01,3B	Sets the alternative frequencies to 87.6 and 93.4 MHz Not allowed (87.5 MHz not defined by RDS standard)	
AFCH=00		
AFCH=CD	Not allowed (108.0 MHz not defined by RDS standard)	

DI	Alternative Frequencies	(0-15)
Identification of the decoder to be used by the receiver.		
DI=1	Standard transmission - stereo.	
DI=0	Standard transmission - automatic stereo/mono set depending on pilot tone presence.	

DPS1	Dynamic PS 1	
Up to 255 characters long text message to be displayed on receiver instead of static PS name. Primarily used for song titles streaming etc.		
DPS1=Hello World	Sets the DPS1 text	
DPS1=	Clears the DPS1	

DPS1EN	Dynamic PS 1 Enable	(0, 1)
Enables (1) or disables (0) the Dynamic PS 1 text.		
DPS1EN=1	Enables the DPS1 text.	

DPS2EN	Dynamic PS 2 Enable	(0, 1)
Enables (1) or disables (0) the Dynamic PS 2 text.		
DPS2EN=1	Enables the DPS2 text.	

DPS1ENQ	Dynamic PS 1 Enqueue	
Advanced version of the DPS1 command. Places the text to a one level deep queue. New text will not be displayed on the receiver until old text reaches its end. Applies only to text length <128 characters.		
DPS1ENQ=Hello World	Sets the following DPS1 text	

DPS2	Dynamic PS 2	
Up to 255 characters long text message to be displayed on receiver instead of static PS name. Alternativelyused in conjunction with *Messages Commands*.		
DPS2=Hello World DPS2=	Sets the DPS2 text Clears the DPS2	

DPS1MOD	Dynamic PS 1 Mode	(0-3)
Display mode for the DPS1 text. 0 - Scrolling by 8 characters 1 - Scrolling by 1 character 2 - Word alignment scrolling 3 - Scrolling by 1 character, text separated by spaces at begin and end *Note: In mode 3 the maximum text length is limited to 240 characters.*		
DPS1MOD=3		

DPS2MOD	Dynamic PS 2 Mode	(0-3)
Display mode for the DPS2 text. 0 - Scrolling by 8 characters 1 - Scrolling by 1 character 2 - Word alignment scrolling 3 - Scrolling by 1 character, text separated by spaces at begin and end *Note: In mode 3 the maximum text length is limited to 240 characters.*		
DPS2MOD=3		

DPS1REP	Dynamic PS 1 Number of Repeating	(0-127)[,CLR]
Specifies number of repeating for the DPS1 text message. Optionally the DPS1 text is then cleared. Without the optional CLR parameter specified the command has effect only if DPS2 is enabled. Number of repeating = number of transmissions - 1.		
DPS1REP=1 DPS1REP=2,CLR		

DPS2REP	Dynamic PS 2 Number of Repeating	(0-255)
Specifies number of repeating for the DPS2 text message. Has effect only if DPS1 is enabled or if DPS2MSG value is AUTO. Number of repeating = number of transmissions - 1.		
DPS2REP=0		

DTTMOUT	Default Text Timeout	(0-254)
Specifies a timeout in minutes for Radiotext 1. If no RT1 has been received during the period, the RT1 text is replaced by default text. Default text means the RT1 text that is stored in EEPROM memory using *RT1. Following exceptions apply: For Program 1, if Message 91 contains a valid X-Command, it is launched on the Default Text timeout event. For Program 2, if Message 92 contains a valid X-Command, it is launched on the Default Text timeout event. 1-254 – Timeout in minutes. 0 – Function disabled.		
DTTMOUT=10		

EQTEXT1	Equal Text 1	(0, 1)
If set to 1, any update of Radiotext 1 via any port updates also Dynamic PS1 and vice versa. Applies also to UECP control. Has no effect for X-Command.		
EQTEXT1=1 DPS1=Hello World RT1		

LABPER	Label Period	(0-255)
Label Period used in DPS Mode 0 and 2. Increasing the value by 1 increases the period by approx. 0.54 seconds (exact value depends on Group Sequence).		
LABPER=4	Each label is displayed for about 2 seconds.	

MS	Music/Speech	(0, 1)
Music/Speech switch.		
MS=0 MS=1	Speech program Music program	

PI	Program Identification	H (1000-FFFF)
Identification code of the radio station. Always contains four hexadecimal digits.		
PI=20FE PI=0F55	OK Not allowed (0 as first digit)	

PS	Program Service name	
Static name of radio station that is displayed on receiver. Max. 8 characters long. The PS= command requires additional processing time of up to 400 ms for internal synchronization with RDS group order.		
PS=KISS FM		

PTY	Program Type number	

An identification number to be transmitted with each program item, intended to specify the current Program Type within 31 possibilities.

Program type codes (Europe):

0 - (none)	16 - Weather
1 - News	17 - Finance
2 - Affairs	18 - Children
3 - Info	19 - Social Affairs
4 - Sport	20 - Religion
5 - Education	21 - Phone In
6 - Drama	22 - Travel
7 - Cultures	23 - Leisure
8 - Science	24 - Jazz Music
9 - Varied Speech	25 - Country Music
10 - Pop Music	26 - National Music
11 - Rock Music	27 - Oldies Music
12 - Easy Music	28 - Folk Music
13 - Light Classics Music	29 - Documentary
14 - Serious Classics	30 - Alarm Test
15 - Other Music	31 - Alarm

Program type codes (US RBDS):

0 - (none)	16 - Rhythm and Blues
1 - News	17 - Soft Rhythm and Blues
2 - Information	18 - Foreign Language
3 - Sports	19 - Religious Music
4 - Talk	20 - Religious Talk
5 - Rock	21 - Personality
6 - Classic Rock	22 - Public
7 - Adult Hits	23 - Leisure
8 - Soft Rock	24 - College
9 - Top 40	25 -(unassigned)
10 - Country	26 - (unassigned)
11 - Oldies	27 - (unassigned)
12 - Soft	28 - (unassigned)
13 - Nostalgia	29 - Weather
14 - Jazz	30 - Emergency Test
15 - Classical	31 - Emergency

PTY=10	Sets the Pop Music Program Type (EU)

PTYN	**Program Type Name**	
Allows further description of the current Program Type, for example, when using the PTY code 4: SPORT, a PTYN of “Football” may be indicated to give more detail about that program.		
PTYN=Football		

PTYNEN	**PTYN Enable**	**(0, 1)**
Enables (1) or disables (0) the PTYN service.		
PTYNEN=1	Enables the PTYN service	

RT1	**Radiotext 1**	
Up to 64 characters long text message to be displayed on receiver in Radiotext format. Primarily used for song titles streaming, commercials etc.		
RT1=Hello World.		

RT1EN	**RT1 Enable**	**(0, 1)**
Enables (1) or disables (0) the Radiotext 1.		
RT1EN=1	Enables the RT1	

RT2	**Radiotext 2**	
Up to 64 characters long text message to be displayed on receiver in Radiotext format. Alternatively used in conjunction with *Messages Commands*.		
RT2=Hello World.		

RT2EN	**RT2 Enable**	**(0, 1)**
Enables (1) or disables (0) the Radiotext 2.		
RT2EN=1	Enables the RT2	

RTPER	**Radiotext Switching Period**	**(0-255)**
Specifies the time in minutes between two switching of the Radiotext. The switching can occur between RT1 and RT2 or between messages specified for RT2 (command RT2MSG=AUTO).		
RTPER=10 RTPER=0	Sets the period to 10 min. Sets the period to 0.5 min.	

RTTYPE	Radiotext Type	(0-3)
Specifies Radiotext type for RT1 and RT2 0 - A/A. Any Radiotext is always the same type. 1 - A/B. RT1 is always type A, RT2 is always type B. 2 - Automatic. Any change/update of the Radiotext causes the A/B flag to toggle. Default option. Required for proper RT+ function. 3 - Same as 2 but also overrides UECP A/B flag control. If the receiver detects a change in the A/B flag, then the whole Radiotext display is usually cleared and the newly received Radiotext message segments are written into the display. If the receiver detects no change in the A/B flag, then the received text segments or characters are written into the existing displayed message. Some receivers have two memory spaces for the Radiotext, one for type A and one for type B. Then they display both messages consecutively in the loop.		
RTTYPE=2		

RSTDPS	Restart Dynamic PS	(0, 1)
1 – When the Dynamic PS text is changed and no Dynamic PS is running, it will start immediately. 0 – The SPSPER command drives the Dynamic PS start regardless of the fact that the Dynamic PS text was changed. *Changing a Dynamic PS text (1 or 2) that is actually running will always cause its restart. This rule does not apply to the DPS1ENQ command.*		
RSTDPS=1		

SCRLSPD	Scrolling PS Speed	(0, 1)
Sets high (1) or low (0) speed of scrolling PS transmission. Although setting high speed gives the result looking better, remember that on some receivers or under bad reception conditions the text may be unreadable. The reason is absolutely outside the RDS encoder and comes out from the fact that scrolling PS has never been included in RDS standard. Due to this the high speed is not recommended.		
SCRLSPD=1		

SPSPER	Static PS Period	(0-255)
Specifies the time between two repeats of the Dynamic PS text. Static PS (PS/TPS) is displayed during this time. Increasing the value by 1 increases the period by approx. 2.7 seconds (exact value depends on Group Sequence). If value 255 is set, the Dynamic PS will be displayed only once if changed. RSTDPS parameter must be set to 1 in this case. *If both DPS1 and DPS2 are enabled, the SPSPER cannot be zero (0).*		
SPSPER=4	Sets the period duration to about 11 seconds.	

TA	Traffic Announcement	(0, 1)
Indicates instantaneous presence (1) of traffic information during broadcasting. When this value is set to 1 by external TA switch, the value specified by TA command has no effect. When this value is set to 1 by TA command, the value set by external TA switch has no effect. Switching the PROGRAM causes clearing of the TA flag. *Note: In some cases the RDS encoder drives the TP and TA flags automatically, especially if EON feature is enabled. This ensures that these flags are set correctly under all conditions.*		
TA=1		

TATMOUT	TA Timeout	(0-127) [+128]
Specifies a maximum duration in minutes during which the TA parameter can remain active. 0 - Disables the TA timeout feature. External TA switch is level controlled (logic 0 means TA=1). 1-127 - Specifies a maximum duration in minutes during which the TA parameter can remain active (1). Then the TA flag is set back to zero (0). External TA switch is activated by falling edge. Rising edge is ignored. +128 - Adding 128 results in the same behavior as above except that also rising edge can set the TA back to zero (if detected before the timeout). *Note: The timeout is synchronized with real time clock minutes, i.e. the timeout event can only occur in whole minutes.* *Note: The TATMOUT command doesn't affect the EON1TA switching. The External EON1TA switch can be level controlled only.* *Note: If TP=0, the TA Timeout is always set to 0.*		
TATMOUT=0	No timeout. Logic 0 on the TA switch input results in TA=1, logic 1 or no connection results in TA=0.	
TATMOUT=2	TA is activated (set to 1) on falling edge on the TA switch input (logic 1 to logic 0 transition). After 2 minutes the TA is set back to 0. Rising edge is ignored so may occur anytime.	
TATMOUT=130	TA is activated on falling edge on the TA switch input. The TA is set back to 0 on either the rising edge or after 2 minutes timeout, depending on which event occurs first	

TP	Traffic Program	(0, 1)
This is a flag to indicate that the tuned program carries traffic announcements. The TP flag must only be set on programs that dynamically switch on the TA identification during traffic announcements. The signal shall be taken into account during automatic search tuning. *Note: In some cases the RDS encoder drives the TP and TA flags automatically, mainly if EON feature is enabled. This ensures that these flags are set correctly under all conditions.*		
TP=1		

TPS	Traffic PS	
Static text displayed on receiver during traffic announcements. Max. 8 characters long. The TPS= command requires additional processing time of up to 400 ms for internal synchronisation with RDS group order.		
TPS=TRAFFIC TPS=	Disables the Traffic PS	

INIT	Initialization	
Sets most parameters and services in actually selected Program to their default values. Does not clear Messages and Scheduling items. Does not clear port and network settings. Apply for example if new blank EEPROM is placed on the board or if the RDS encoder was previously used for another station.		
INIT *CC= PROGRAM=2 INIT *ALL PROGRAM=1 INIT *ALL TIME=HH:MM DATE=DD. MM.YY	Initialize the program set that is actually selected. Complete initialization procedure. Replace the HH:MM with actual time and the DD.MM.YY with actual date. **Note: This initialization sequence must always be applied if new blank EEPROM is placed on the board in production process. Alternatively use the Windows control software: RDS Encoder – Special – Initialize.**	

ALL	Store All	
Stores all settings into the non-volatile EEPROM memory.		
*ALL		

HELP	Help	
Shows all commands available.		
HELP		

11.3 EON Commands

EONxAF	EON x Frequencies	(87.6-107.9)
List of Other Network frequencies that can be received in the area covered by linking station. Each item is in MHz representation in range of 87.6-107.9 MHz. Up to 25 items allowed.		
EO- N1AF=98.0,99.3	Sets 98.0 and 99.3 MHz frequencies for Other Network 1	

EONxAFCH	EON x Frequency channels	H (01-CC)
List of Other Network frequency channels that can be received in the area covered by linking station. Each item is in hexadecimal representation in range of 01-CC (87.6-107.9 MHz). Up to 25 items allowed.		
EON1AFCH=01,3B	Sets 87.6 and 93.4 MHz frequencies for Other Network 1	

EONxEN	EON x Enable	(0, 1)
Enables (1) or disables (0) the link to the Other Network.		
EON1EN=1		

EONxPI	EON x Program Identification	H (0000-FFFF)
Identification code of the Other Network. Always contains four hexadecimal digits.		
EON1PI=24F1		

EONxPIN	EON x Program Item Number	
The code in DD,HH,MM format should enable receivers and recorders designed to make use of this feature to respond to the particular program item(s) that the user has preselected.		
EON1PIN=12,16,40		

EONxPS	EON x Program Service name	
Program Service name of the Other Network.		
EON1PIN=12,16,40		

EONxPSN	EON x Program Service Number	(1-255)
Program Service Number assigned to the Other Network. Applies only if the operator requires changing of EON information via UECP.		
EON1PSN=1		

EONxPTY	EON x Program Type number	(0-31)
Program type number of the Other Network.		
EON1PTY=3		

EONxTA	EON x Traffic Announcement	(0, 1)
If set to 1, switches the receiver to corresponding Other Network for duration of the traffic announcement. Can't be set to 1 if: • corresponding Other Network has TP=0 • corresponding Other Network is not enabled The EON1TA flag can be also controlled by external TA/EON1TA switch. *Note: Setting any EON TA to is also signalized to the receiver by a series of group type 14B.*		
EON1PSN=1		

EONxTP	EON x Traffic Program	(0, 1)
Traffic Program flag of the Other Network.		
EON1TP=1		

*EON	Store all EON data into EEPROM	
Stores all EON data into EEPROM. TA flags are not stored.		
*EON		

x is in range 1-4

11.4 Messages Commands

These commands are provided for working with the bank of fixed text messages that is useful especially for offline operation of the RDS encoder or in conjunction with the scheduling feature. Using these commands you may enter the text messages and assign them to Radiotext, Dynamic PS or X-Command.

MSGxx	Text Message	
Specifies the fixed message text. Since there is a place for 99 messages in the memory, the number xx must be in range 01-99. For Program 1, if Message 91 contains a valid X-Command, it is launched on the Default Text timeout event. For Program 2, if Message 92 contains a valid X-Command, it is launched on the Default Text timeout event.		
*MSG01=Hello World		

MSGxx	Text Message	
Specifies the fixed message text. Since there is a place for 99 messages in the memory, the number xx must be in range 01-99. For Program 1, if Message 91 contains a valid X-Command, it is launched on the Default Text timeout event. For Program 2, if Message 92 contains a valid X-Command, it is launched on the Default Text timeout event.		
*MSG01=Hello World		

MSGxxD	Message Destination	(0-4)
Specifies the destination of the message used for automatic message switching. The number xx must be in range 01-99. 0 - Message not used for automatic switching 1 - DPS2 2 - RT2 3 - DPS2 and RT2 4 - X-Command Timer.		
*MSG01D=2		

MSGLIST	List of Messages	
Shows all messages present in the memory and its destination.		
MSGLIST		

DPS2MSG	Dynamic PS 2 Message Number	(0-99, AUTO)
0 - Default DPS2 text specified by DPS2 command or last DPS2MSG command is selected. 1-99 - The message of the number is selected for the DPS2. AUTO - Messages are selected automatically in ascending order. Only messages chosen by the MSGxxD command are selected.		
DPS2MSG=AUTO		

RT2MSG	Radiotext 2 Message Number	(0-99, AUTO)
0 - Default RT2 text specified by RT2 command or last RT2MSG command is selected. 1-99 - The message of the number is selected for the RT2. AUTO - Messages are selected automatically in ascending order. Only messages chosen by the MSGxxD command are selected.		
RT2MSG=1		

xx is in decimal range 01-99

11.5 Scheduling Commands

SLIST	List of Messages	
Shows all scheduling items. Items with no day specified are not showed. Each item is represented by the following order: Item No., Days, Times, Command, PTY.		
SLIST		

SEN	Scheduling Enable	(0, 1)
Enables (1)/disables (0) the scheduling feature.		
SEN=1	Enables the scheduling feature.	

SxxC	Scheduling Item Command	
Specifies the command to execute. Max. command length is 35 characters. Only commands from the second column of the Command Summary are allowed.		
*S01C=RDSGEN=0	Schedules the item 01 to switch off the RDS subcarrier	
*S03C=RT2MSG=12	Schedules the item 03 to show Message 12 in Radiotext 2	
*S04C=	Clears (disables) the command for the item 04.	
*S05C=XCMD=<rds><msg>40</msg></rds>	Schedules the item 05 to process X-Command stored in Message 40.	

SxxD	Scheduling Item Days	(1-7)
Enables (1)/disables (0) the scheduling feature.		
*S03D=12367		

SxxP	Scheduling Item PTY	(0-31)
Allows including optional Program Type information so that the Command may be used for another RDS service change.		
*S03P=15	Sets the PTY to 15 (Other M)	
*S04P=	Clears (disables) the PTY option for the item 04.	

SxxT	Scheduling Item Times	
Specifies the times in 24-hours HH:MM format at which the item command is executed. Wildcard XX can be used instead of hour number meaning that the item will be executed each hour in specified minute. If more items are scheduled for the same time, all these items are executed in ascending order. Up to 12 times allowed for each item.		
*S03T=XX:30, 12:00		

xx is in decimal range 01-48

11.6 System Commands

COMSPD	Port 1 Speed	(0-4)
Specifies the Port 1 speed (baudrate). 0 - 1200 bps 1 - 2400 bps (default) 2 - 4800 bps 3 - 9600 bps 4 - 19200 bps This command has the same effect as SPEED but the format of input is different.		
COMSPD=1		

CT	Clock Time and Date	(0, 1)
Enables (1) or disables (0) time and date transmission in CT format.		
CT=1		

DATE	Date	
Specifies the actual date in DD.MM.YY format.		
DATE=30.11.05	30th of November 2005	

ECHO	Terminal Echo	(0, 1)
Determines if the RDS encoder sends an echo (1) of each character or not (0), that it receives via the port.		
ECHO=1		

EXTSYNC	External Pilot Synchronization	(0, 1)
0 - Forced internal clock source (for mono transmission) 1 - Automatic external synchronization if pilot tone is present.		
EXTSYNC=1		

LEVEL	RDS Signal Level	(0-255)
Sets the RDS signal level, directly affects the injection of the RDS signal into the FM transmitter. 0 = minimum level, 255=maximum level.		
LEVEL=120		

LTO	Local Time Offset	±(0-24)
Specifies the offset between the local time and the universal time (UTC). Expressed in multiples of half-hours.		
LTO=+2		

PHASE	RDS Signal Phase	(0-18)
Fixes the relative phase shift between the pilot tone and the RDS signal. Changing the value by one results in 9.5 degrees phase shift change. The value serves only as a scale, it may not provide real phase shift value.		
PHASE=8		

MJD	Modified Julian Day	H (000000-FFFFFF)
Day, Month and Year coded as Modified Julian Day. To find D, M and Y from MJD: Y' = int [(MJD - 15 078,2) / 365,25] M' = int { [MJD - 14 956,1 - int (Y' × 365,25)] / 30,6001 } D = MJD - 14 956 - int (Y' × 365,25) - int (M' × 30,6001) If M' = 14 or M' = 15, then K = 1; else K = 0 Y = Y' + K M = M' - 1 - K × 12 To find MJD from D, M and Y: If M = 1 or M = 2, then L = 1; else L = 0 MJD = 14 956 + D + int [(Y - L) × 365,25] + int [(M + 1 + L × 12) × 30,6001] Y', M', K, L - intermediate variables.		
MJD=00D7CD	18th of February 2010	

PILOT	Pilot Tone Present	
Indicates if pilot tone is present (1) or not (0).		
PILOT		

RDSGEN	RDS Generator	(0, 1)
Disables (0) or enables (1) the RDS subcarrier generator. Does not affect any other functions.		
RDSGEN=0		

RESET	Reset	
Provokes a hardware reset of the RDS encoder and is equivalent to an "off-on" cycle of the RDS encoder		
RESET		

SETFEAT	Special Features	H (0000–3FFF)
This is a 16-bit Hex value bitmap which holds enabling bits for special RDS encoder features: Bit 0: Dynamic group sequence. If enabled (1), temporarily doubles the 2A group rate after the RT is changed. Bit 1: RT+ group type 11A/13A. Selects group type for RT+ service. Applies to RTP and XCMD commands. Bit 2: reserved, set as 0. Bit 3: X-Command Timer Message – resume (0) or reset (1). Bits 4 to 15: reserved, set as 0. *Note: The '*' prefix may be omitted for this command.*		
SETFEAT=0001 SETFEAT=0003 SETFEAT=0000	Enables dynamic group sequence, sets group type 11A for RT+ Enables dynamic group sequence, sets group type 13A for RT+ Factory default value	

SPEED	Port 1 Speed	(1200, 2400, 4800, 9600, 19200)
Specifies the port 1 speed (baudrate). This command has the same effect as COMSPD but the format of input is different.		
SPEED=2400		

STATUS	RDS Encoder Status	
Shows the most important operating values of the RDS encoder. You may also type ??.		
STATUS ??		

TIME	Time	(00:00-23:59, 00:00:00-23:59:59)
Specifies the actual time in HH:MM format (sets the second counter to 00) or in HH:MM:SS format. The time value specified is a local time valid in the area of coverage.		
TIME=16:40 TIME=09:24:10		

VER	Firmware Version	
Returns the firmware version that is actually present in the RDS encoder.		
VER		

11.7 Advanced Commands

ADR	Encoder Address List	(0-63[,0-63])
Up to two encoder address numbers in range 0 to 63, separated by comma. Applies to UECP control.		
*ADR=56		
*ADR=12,35		

CC	Conditional Command	

Executes specified command when specified condition occurs. Optional ELSE command supported.
Syntax:
*CC=[aa]bcc:ddddddd
*CC=ELSE:eeeeeeee where is:
aa - memory address pointer (00-FFF) b - condition operator
< - lower than
> - greater than
= - equal
! - not equal
B - bit cc of [aa] is set (numbered from LSB to MSB) cc - value to compare (00-FF) or bit number (00-07)
ddddddd - the command executed if the condition is matched
eeeeeeee - the command executed if the condition is not matched (optional)
Max. command length is 31 characters. Once the command is executed, next execution is stopped until the condition matching changes. In other words, the command is executed only at the condition matching change. Both numbers aa and cc are in hexadecimal representation. Only one CC item is allowed. Only commands from the second column of the Command Summary are allowed.
List of some applicable memory addresses:
13: PTY number (0-31)
15: number of DPS2 characters 28: Message counter (RT2)
29: Message counter (DPS2) 34: number of DPS1 characters
68: timer 0-8A, reset every minute
6A: one of the status bytes (bit 02 - DPS2 is running; bit 03 - DPS1 is running, bit 06 - external program switch) 71: Dynamic PS counter (points to the character that is actually transmitted on the first PS position)
76: static PS counter (0-SPSPER) 78: DPS number of repeats counter 8B: Group Sequence counter
C6: Scheduling item number waiting (0, 1-48)
CC: timer 0-FF, increased on each end of PS transmission (approx. once per 0.5 sec. by default) E4: local hour (0-23)
E5: local minute (0-59).
To check visually what value is on each address, type MEM xx where xx is the address desired.
*Important note: The CC is a very "strong" command. Due to a theoretical possibility of bad setting that may cause the unit stop responding (please don't ask for an example) the Conditional Command is not active after power-up for up to 30 seconds. This gives the user a time to type *CC= to disable the Conditional Command before it becomes active.*

*CC=[CC] B03:PS=RADIO *CC=EL-SE:PS=PRO 88	Periodically switches the PS between 'RADIO' and 'PRO 88'.
*CC=[6A]B06:-DPS2MSG=01 *CC=ELSE:-DPS2MSG=02	If PROGRAM is set to 1 or 2, the external program switch will selecta text Message for the Dynamic PS 2. (If PROGAM is set to 0, the status bit is always 0.)
PTYN=Football *CC=[13]=04:P-TYNEN=1 *CC=ELSE:P-TYNEN=0	Sets PTYN name to 'Football'. When PTY code 'Sport' is on-air, additional PTYN name is included.
*CC=[4E] B06:RT2EN=1 *CC=ELSE:R-T2EN=0	Enables RT2 for the duration of traffic announcement (TA)
*CC=[E9]!01: COMSPD=1	Does not allow to set port 1 speed other than 2400 bps.
*CC=[E4]>0B:-DPS2=Good afternoon *CC=ELSE:-DPS2=Good morning	Different DPS2 text for hours in range 0-11 and 12-23. Scheduling feature can be used as well.
*CC=[71]<20:-DPS1MOD=1 *CC=ELSE:-DPS1MOD=2	Shows first part of DPS1 in mode 1, then switches to mode 2 for the rest of the text.
CC	Shows actual CC settings. Disables the ELSE command.
*CC=ELSE:	
*CC=	Completely disables the Conditional Command feature.

DSNx	**Program 1/2 DSN**	(1-255)
Specifies optional DSN (Data Set Number) for program set 1 or 2. The RDS encoder contains two independent programs (data sets). Selected program controls the output RDS data. Specifying the DSN for each program also 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. *Note: This command has effect for UECP control only. Selectable DSN for each program set allows easier integration of the RDS encoder into existing networks.*		
*DSN1=12 *DSN2=63	DSN 12 for program 1 DSN 53 for program 2	

EAS	Send EAS Text Message	
Activates the EAS (US Emergency Alert System) mode of operation: Loads the text message to Radiotext 1 and Dynamic PS 1. Sets PTY to 31 (Alert). Sets the EAS timer to 180 seconds. *Other commands changing the Radiotext or Dynamic PS are not accepted during the EAS session.*		
EAS=	Hurricane conditions are expected within your area	

EASTIME	Set EAS Timer	(0-999)
Number of seconds that the EAS text message should be transmitted. Typically, this command is sent after the EAS command. If the timer is set to 0 (or has been decremented to 0), then the RDS encoder will function in its normal mode of operation.		
EASTIME=300 EASTIME=0	Extends the EAS mode duration to 5 minutes. Immediately terminates the EAS mode of operation.	

ECC	Extended Country Code	H (00-FF)
Uniquely determines the country in conjunction with the first digit of PI.		
ECC=00 ECC=E2	Unknown/not used/not applicable.	

ECCEN	ECC and LIC Enable	(0, 1)
Enables (1) or disables (0) the ECC and LIC features.		
ECCEN=1	Extends the EAS mode duration to 5 minutes. Immediately terminates the EAS mode of operation.	

G	Group	H (000000000000-FFFFFFFFFFFF)
Orders the RDS encoder to send directly RDS groups whose contents are free. The Group content is in BBBBCCCCDDDD format where BBBB, CCCC and DDDD represent the contents of the block 2, block 3 and block 4 in hexadecimal expression. The RDS encoder calculates the CRC automatically. The block 1 has not been specified as it is always the PI code programmed with the PI command. Using this command, the RDS transmission can then be partially or fully controlled by an external application. For full RDS stream control, 9600 bps or higher com. speed should be used. Next Group can follow after previous command success characters (+). Opposite to UECP control, groups inserted via G command are not buffered.		
G=-380215D1A531	Group 3B containing 02 15D1 A531.	

GRPSEQ	Group Sequence	
Defines the RDS group sequence. Allows the user to control the group order and adjust repetition rate of individual RDS services. Max. 24 items are allowed. The services and groups are represented by following symbols: 0 - Four groups 0A (MS, TA, DI, AF, one complete PS) 1 - Group 1A (ECC, LIC, PIN) 2 - Group 2A (RT) A - Group 10A (PTYN) E - Group 14A and 14B (EON) X - Group from UDG1 Y - Group from UDG2 R - Group 3A/11A (RT+) U – One group from the UECP buffer. If the 'U' symbol is not present in the Group Sequence, any possible groups from the UECP buffer are transmitted as fast as possible, usually making a continuous sequence of groups until the UECP buffer flushes completely. This is a default configuration. Services, which are not placed in the sequence, are disabled regardless of their individual settings. Services, which are placed in the sequence and are disabled by their individual settings, are ignored (skipped). Inserting a nonsense string will result in the same effect as inserting a single 0. Inserting an unknown symbol will cause ignoring the rest of the string. It's a good practice to assure that at least one 0 is present in each consecutive 6 symbols. It is recommended not to place more than 4 same symbols consecutively. Take into consideration that RDS does not know anything like empty groups or delays between groups. There must be still some groups sent to the output. The GRPSEQ command does not affect: group 4A (CT), user groups inserted using the G command.		
GRPSEQ=02222	Four groups 0A followed by four groups 2A (very high Radiotext transmission rate), other services are disabled.	
GRPSEQ= GRPSE=	Sets the groups sequence to default (022E1022EA022XYR).	
022E10XYYY	High transmission rate of UDG2. PTYN and RT+ is disabled.	
GRPSEQ=X	The RDS content is fully controlled via UDG1 (and possibly G command).	

LIC	Language Identification Code	H (00-FF)
Enables a broadcaster to indicate the spoken language he is currently transmitting.		
LIC=00	Unknown/not applicable	
LIC=09	English.	

PAC	Port Access Control	
This command is described in the document 'P132 RDS Encoders – Communication Ports and Internet Functions'.		

PIN	Program Item Number	
The code in DD,HH,MM format should enable receivers and recorders designed to make use of this feature to respond to the particular program item(s) that the user has preselected. Use is made of the scheduled program time, to which is added the day of the month in order to avoid ambiguity.		
PIN=12,16,40		

PINEN	PIN Enable	(0, 1)
Enables (1) or disables (0) the PIN service.		
PINEN=1		

PROGRAM	Program Set Selection	(0-2)
Selects the program set – copies the program data from EEPROM memory to operational memory. RDS services in selected program set are transmitted by the RDS encoder and can be modified and stored back into EEPROM memory. 1 - Program set 1 is selected (default) 2 - Program set 2 is selected 0 - External switch selects the program *Note: If PROGRAM is set to zero (0), most of store operations are not allowed to protect the data (since the destination in EEPROM is undefined in general).*		
PROGRAM=1		

PSNx	Program 1/2 PSN	(1-255)
Specifies optional PSN (Program Service Number) for program set 1 or 2. Note: This command has effect for UECP control only. Selectable PSN for each program set allows easier integration of the RDS encoder into existing networks.		
*PSN1=11 *PSN2=12	PSN 11 for program 1 PSN 12 for program 2	

PSW	PS Window	
Returns actual Program Service name that is being sent by the RDS encoder. The value returned is an output of internal real-time RDS decoder so it's affected also by Dynamic PS and user defined groups.		
PSW		

RTP	Radiotext Plus Tagging Data	(00-31; 00-31; 00-31; 00-31; 00-31; 00-15)
Six 2-digit decimal numbers of RT+ tagging data in this order: Tag 1 type, tag 1 start, tag 1 length, tag 2 type, tag 2 start, tag 2 length. Start marker 00 means the first character in the Radiotext. Length marker gives the number of characters following the first character at the start position. The tagging data must be associated with actual Radiotext 1. The tagging data are transmitted as groups 3A (RT+ ODA AID) and 11A (RT+ Tagging Data). On each enter of the tagging data internal Toggle bit automatically changes its state from 0 to 1 or from 1 to 0. First entering of the tagging data automatically enables the internal RT+ feature until power off or reset. The RT+ is active only if symbol 'R' is present in the Group sequence. If both tag 1 type and tag 2 type are set to 00, internal RT+ running bit is temporarily hold low until at least one valid tag type is entered. *Note: Consider using of the XCMD command.*		
RT1=Now playing: Novaspace – Time After Time RTP=04,13, 08,01,25,14		

RTPRUN	Radiotext Plus Running Bit	(0, 1, 2)
0 - Bit set low (RT1 no longer contains RT+ data), automatically set to 1 on next RTP= entry. 1 - Bit set high (actual RT1 contains RT+ data) 2 - Disable internal RT+ feature This command is not required for common use since the running bit is set automatically.		
RTPRUN=1		

SETSPY	Set RDS Monitoring Counter	
This command is described in the document 'P132 RDS Encoders – Communication Ports and Internet		

SHORTRT	Short Radiotext	(0, 1)
If enabled (1), all new inserted Radiotexts shorter than 60 characters will be followed by Carriage Return and the remaining spaces will be cut. Default value is 0.		
SHORTRT=1		

SITE	Site List	(0-1023[,0-1023])
IUp to two site address numbers in range 0 to 1023, separated by comma. Applies to UECP control.		
*SITE=16 *SITE=125,1022		

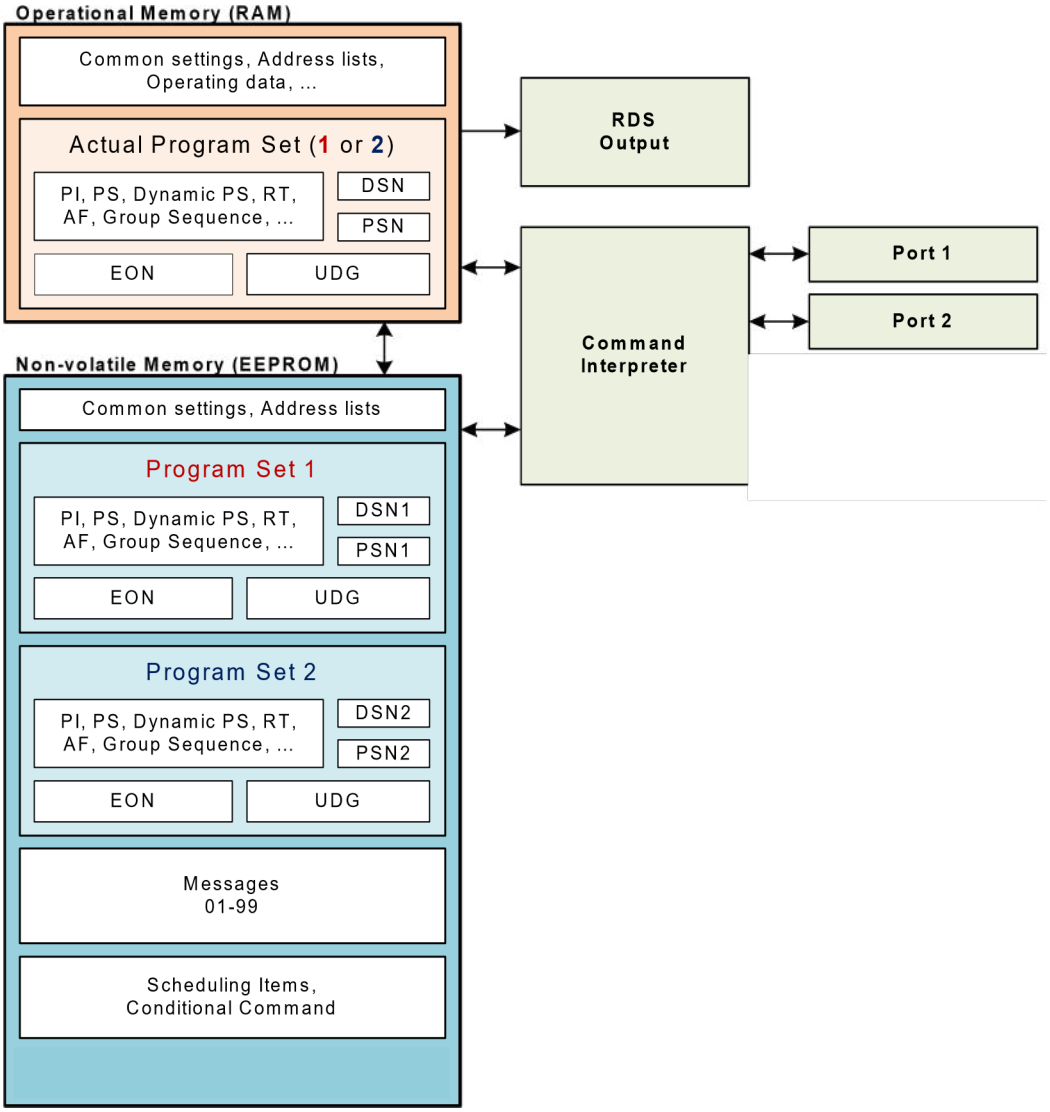
UDG1	User Defined Groups 1	
Specifies up to 8 groups in BBBBCCCCDDDD format, which are repeatedly transmitted in sequence by the RDS encoder. BBBB, CCCC and DDDD represent the contents of the block 2, block 3 and block 4 in hexadecimal expression. When entering new group(s), previous groups are removed from the UDG1 buffer.		
UDG1= 80001A961C97 UDG1=	Sets TMC group 8A containing 00 1A96 1C97 Clears the UDG1 groups	

UDG2	User Defined Groups 2	
Specifies up to 8 groups in BBBBCCCCDDDD format, which are repeatedly transmitted in sequence by the RDS encoder. BBBB, CCCC and DDDD represent the contents of the block 2, block 3 and block 4 in hexadecimal expression. When entering new group(s), previous groups are removed from the UDG2 buffer.		
UDG2= 380215D1A531, 38058DB3B61E UDG2=	Sets two UDG2 groups Clears the UDG2 groups	

UECP	UECP Enable	(0, 1)
Enables (1) or disables (0) the UECP support for all ports. ASCII commands are accepted regardless of this value.		
UECP=1		

XCMD	X-Command for RDS encoders	
This command is described in the document ‘X-Command for RDS encoders’.		
XCMD=<rds><item><dest>3</dest><text>Now playing: <artist>Raw Spirit</artist> - <title>Back In Town</title></text></item></rds> Updates RT1 and RT+ with specified text and tags.		

11.8 Memory Organization



11.9 Dynamic PS 1 and Dynamic PS 2 Summary

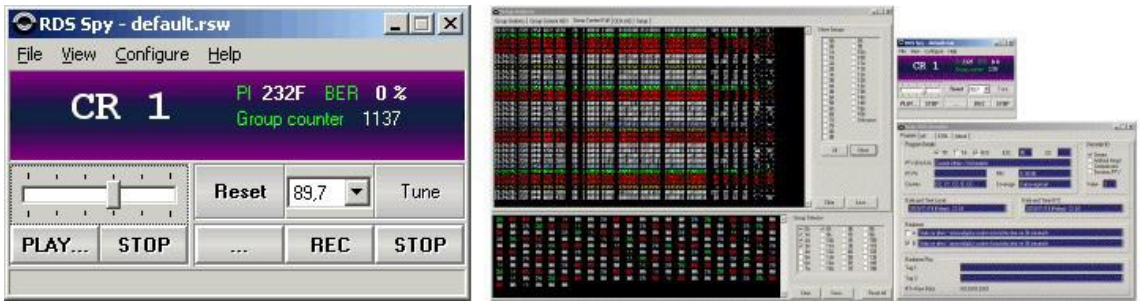
	Dynamic PS 1	Dynamic PS 2
Real time showing capability	yes, in mode 0 and 2	yes, in mode 0 and 2
Display modes available	4	4
Text queue available	yes	no
Max. text length	255	255
Max. queued text length	127	N/A
Removing redundant spaces from the text end	yes, in mode 2 and 3	no
Allows transmission of Messages	no	yes
Typically used for	Commercials, news and	
"on-air" texts	Fixed texts from the Messages bank	

12. Further Features

12.1 RDS Output Monitoring

Want to see or verify the RDS output data? The encoder supports direct complete RDS output monitoring on any free port in real time using a desktop application. This unique feature allows complete RDS output analysis without need of a receiver or special equipment.

RDS data is provided as ASCII coded RDS groups in raw format at the RDS group rate (11.4 groups per second). The group content provided is equal to the group content being sent to output of the RDS encoder. This format of data is directly supported by some easy to use applications (for example freeware RDS Spy).



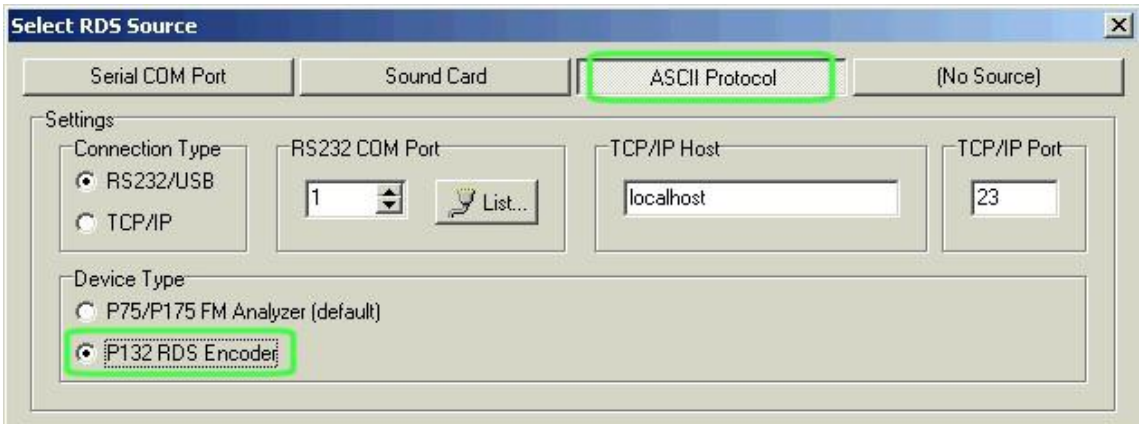
RDS Spy - Real-time freeware Radio Data System decoder and analyzer for Windows.

12.1.1 Monitoring the RDS Output Step-by-Step

1. Configure the RDS encoder's port that will be used for monitoring. You need a free port for this purpose.

For monitoring via port 1, set the port speed to 19200 bps.

2. Download and install the RDS Spy software (http://rdsspy.com), run the setup exe file and go through the simple installation wizard.
3. Run the RDS Spy and open the RDS Source dialogue box (Configure – Select RDS Source). 4. In this window select ASCII G Protocol and P132 RDS Encoder type:



5. Configure the connection parameters.
6. Confirm by pressing OK. The real-time RDS content will appear immediately.

12.2 Showing Real Time in Dynamic PS

It's possible to show real time in Dynamic PS in mode 0 and 2. To show the time, the text must contain %HH-MM%% string and this string must exactly fill the 8-character window. Then on each string occurrence place the real time will be displayed. The separator between hours and minutes is user selectable.

12.3 Real-Time Backup

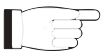
A battery-powered RTC circuit provides real-time backup for case of mains power supply interruption or switch off. Use TIME and DATE commands to set the time and date information or simply use the Windows control software.

12.4 Firmware Upgrade

The RDS encoder has a firmware upgrade capability. This allows easily implementing of new features in future. When a new firmware version is released, special simple Windows application provides the firmware upgrade. The firmware upgrades are provided at no costs. Please refer to the website for more information.

12.5 On-line Support

Not sure how to set-up the unit? Some RDS related feature is missing? Feel free to contact us via the email!



IMPORTANT: *Before sending an email please make sure you have read entire content of this manual (incl. section 14.4), control software help file and also forum, F.A.Q. and tips on the website. Your question may be already answered in this extensive knowledge base.*

13. Universal Encoder Communication Protocol (UECP)

The UECP protocol (SPB 490) is an industrial standard for RDS encoder control to facilitate the inter-working of various RDS systems components regardless of the supplier. Due to the fact that it cannot handle specific functions and characteristics of a particular model, it is usually considered as a complementary method of the RDS encoder control. It provides a possibility of frequent RDS services control for the UECP based systems whereas other services have been set in advance using the way described on previous pages.

The UECP implementation in the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** is only partial. Especially the overall architecture proposed by the UECP specification is largely replaced by an alternative solution which better suits to typical areas of use. UECP commands and functions that do not comply with the **/RDS-TEX-E-**2HE **& /RDS-TEX-E-3HE** concept, are rarely used or potentially insecure, are not implemented.

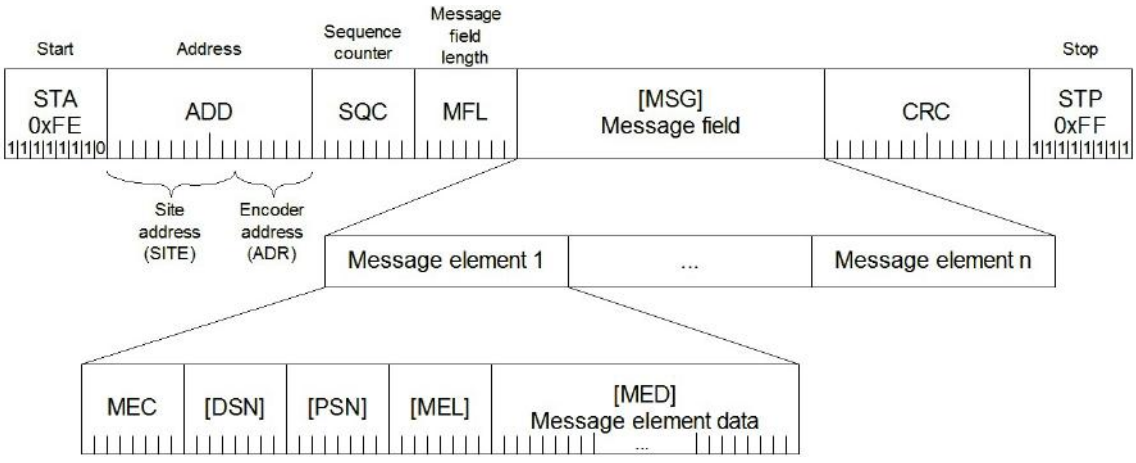
13.1.1 To turn-on the UECP support

1. Configure all RDS services and settings as required.
2. Where required, configure the RDS Encoder address and Site address using the commands *ADR= and *SITE=

or using the Windows control software (RDS Encoder – Device Setup).

3. Find out and set the right baudrate (speed) or network settings of the RDS encoder's port.
4. The UECP support is disabled by default. Type UECP=1 and *UECP or use the Windows control software to turn-on the UECP support.

13.1.2 General UECP frame (record) format



Note: *Read more information about the UECP in the document "SPB 490 Universal Encoder Communication Protocol" (published by RDS Forum).*

13.1.3 UECP addressing

The address field of each UECP record comprises of two elements. These are:

- Site address, 0-1023 (most significant 10 bits)
- Encoder address, 0-63 (least significant 6 bits)

The RDS encoder incorporates two address lists; one of acceptable Site addresses (SITE) and the other of acceptable Encoder addresses (ADR). A UECP record is acceptable to a particular encoder only if the site address is contained within its site address list and the encoder address is contained within its encoder address list.

It is expected that many UECP commands will be sent to all encoders. For this reason a “global” address of 0 is defined for both the site and encoder addresses. Thus the address lists always consist of addresses defined by user and the “global” address of 0. Messages bearing the site address of 0 are deemed to be acceptable at all sites in the system. Messages bearing the encoder address of 0 are deemed to be acceptable by all encoders at sites specified by the accompanying site address.

13.1.4 The UECP implementation in the /RDS-TEX-E-2HE & /RDS-TEX-E-3HE, its characteristics and restrictions

List of UECP commands accepted:

	Meaning	Notes
01	PI	
02	PS	
03	TA/TP	
04	DI/PTYI	
05	MS	
07	PTY	
0A	RT	1
0D	Real time clock	
1C	Data set select	
24	Free-format group	3, 4
30	TMC	3, 5
40	ODA configuration and short message command	3, 6
42	ODA free-format group	3, 7

Special fields in the UECP frame:

Field	Handling
ADD	Site address 0-1023, Encoder address 0-63, note 2.
SQC	Sequence counter – if consecutive UECP records have the same SQC value, only the first correctly received record is applied. Except exists for records with SQC of 0x00 which are always accepted.
MFL	Message field length – In order to maintain overall robustness the MFL value must be exact, otherwise the UECP frame is considered as corrupted and it's discarded!
DSN	DSN must be 0 or 255 or equal to the DSN of actual program set. Otherwise the command is discarded.
PSN	PSN must be 0 or equal to the PSN of actual program set or equal to any of the EON PSN in actual program set. Otherwise the command is discarded.
CRC	If CRC does not match, the UECP frame is considered as corrupted and it's discarded.

Note:

1) Supports RT buffering for up to two radiotexts – edits either the Radiotext 1 or Radiotext 2.
If using only one radiotext (most frequent case), at least the RT1 must be enabled (RT1EN=1). Beyond the UECP specification, the radiotext may be optionally showed as Dynamic PS 1 (see the command EQTEXT1), in that case the RT1 may be disabled.
If using two radiotext, both RT1 and RT2 must be enabled (RT1EN=1, RT2EN=1).
Control bits handling:
Bit 7 Ignored.
Bit 6 0: destination is RT1; 1: destination is RT2.
Bit 5 Ignored.
Bits 4..1 Ignored. The RDS encoder switches between two radiotexts using real-time base (see the command RTPER) rather than using a number of transmissions for each radiotext.
Bit 0 0: do not toggle A/B flag; 1: toggle A/B flag.
*2) The RDS encoder address list can contain up to three items for the Site address and up to three items for the Encoder address. One of these items is always fixed to 0, the remaining two items can be changed using the commands *SITE= and *ADR=.*
3) Buffer size 16 groups (FIFO type), shared by all ODA, TMC and free-format Message elements. Number of repeats is assigned to each group in the FIFO buffer so one group occupies one position in the buffer regardless of number of repeats.
4) Buffer configuration bit 5 ignored. Buffer configuration bit 6 meaning: 0 – no repeat, 1 – repeat the group one time, then clear.

5) Full support except the priority and buffer configuration. The encoder automatically assures at least 3-group long gap between any TMC groups in the data transmitted.
6) Timeout and buffer configuration ignored. Always inserts one group through the FIFO buffer.
7) Priority, mode and buffer configuration ignored. Always inserts one group through the FIFO buffer.
8) MEC's not included in the list above are ignored, incl. all possible Message elements that may follow within the same Message field. Due to mistake in the UECP specification (unknown Message element length in general) it may be impossible to detect following Message element within the same Message field. It's strongly recommended for the UECP data providers not to insert more than one Message element inside each Message field to maintain general compatibility and to keep the UECP really 'universal'

When the UECP is enabled, the RDS encoder accepts any mixture of ASCII commands and UECP records on the same communication port. The UECP communication is always unidirectional. There are no responses sent to the UECP records.

Any characters which follow the UECP start byte (0xFE) will be ignored by the ASCII command interpreter until one of the following conditions occurs:

- reception of the UECP stop byte (0xFF)
- reception of up to 260 characters
- port timeout (2 minutes)

For this reason take care not to send the UECP start byte within an ASCII command when the UECP is enabled.

13.1.5 UECP buffer for user-defined RDS groups

In order to simplify the RDS encoder's control and fit it to current applications, the device incorporates one global UECP buffer for all groups inserted via MEC 24, 30, 40 and 42. This buffer is a FIFO type and its capacity is 16 groups.

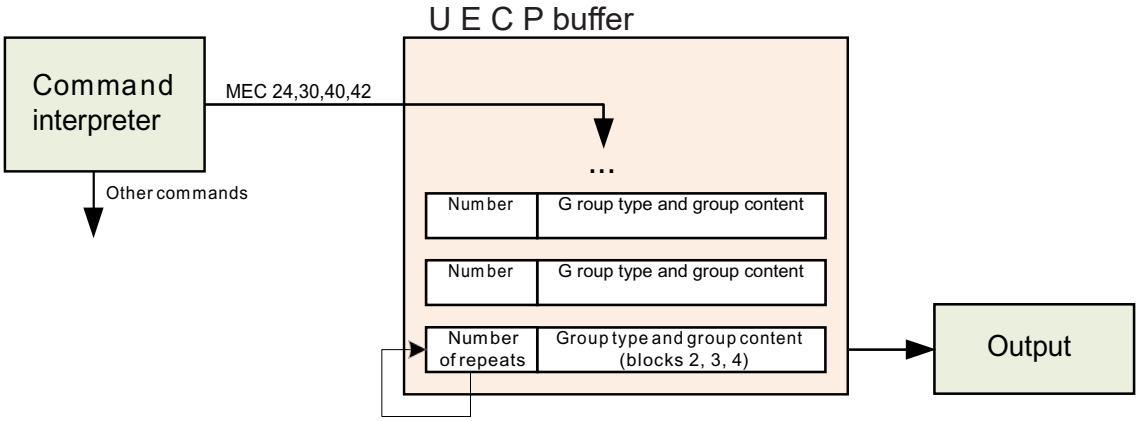
Transparent UECP buffer

If there's no symbol 'U' in the Group sequence, the UECP buffer is flushed into output stream as soon as possible, taking higher priority above any other group (excluding time groups 4A generated by the RDS encoder). This is a default configuration.

Batch UECP buffer

If there's at least one symbol 'U' present in the Group sequence, the buffer inserts one group into the output stream on the occurrence of the 'U' symbol. This makes a possibility to limit the speed of the buffer flushing but the groups may be delayed on the output.

The UECP buffer scheme is as follows:



Note: The UECP buffer applies only to user-defined RDS groups inserted via UECP protocol. The UECP buffer has no meaning for other that those UECP MECs: 24, 30, 40 and 42.

13.2 Traffic Message Channel (TMC) Application Notes

13.2.1 Basic requirements

The TMC service can work only if there is an application that we can call 'TMC data provider'. The TMC data provider collects all related information and translates it into RDS groups 8A type. The output of the TMC data provider must be either by means of ASCII command G= or (more often) coded as UECP command with MEC 30. We will deal with the second case in following text.

Nowadays the TMC service is coded as an ODA application. Thus there must be ODA AID groups 3A transmitted in addition to the 8A groups. This can be done for example using the UECP MEC 24. The 3A groups typically carry fixed content so in some cases they can be inserted into the RDS encoder also one-time using the command UDG1= or UDG2=.

The Address and Site fields are optional. When the TMC data provider drives one RDS encoder only, these fields are usually set to zero. However there can be more RDS encoders connected with various Address and Site values. Each encoder will accept only the UECP records that match the Address and Site criteria. This configuration has been tested successfully simulating a network of more than 60 encoders (equivalent to full load of one 9600 bps channel).

13.2.2 Preparing for the TMC transmission

1. Configure all static parameters of the RDS encoder (PI, PS, CT etc.). Enable the UECP (UECP=1↵ *UECP↵). 2. Where required, store the fixed 3A groups using the commands UDG1= or UDG2=
(for example: UDG1=30100646CD46,30104080CD46↵ *UDG1↵).

In this case make sure the UDG groups are included in the Group sequence (symbols X or Y).

3. Decide for the communication settings. Configure the RDS encoder and TMC data provider ports.
4. Configure the Site and Address values.

13.2.3 Application example

This application example shows TMC data and ODA AID information inserted by UECP commands 30 and 24.

Time	Group	UECP command	Comment
...			
9:27:58	3A: 8A 0646 CD46	FE 00 00 D0 07 24 06 10 06 46 CD 46 B9 68 FF	ODA AID variant 0
9:27:58	8A: 07 C801 4689	FE 00 00 D1 08 30 06 06 07 C8 01 46 89 94 54 FF	TMC 8A, two repeats
9:27:59	8A: 07 4984 6000	FE 00 00 D2 08 30 06 06 07 49 84 60 00 F2 5C FF	TMC 8A, two repeats
9:27:59	3A: 8A 4080 CD46	FE 00 00 D3 07 24 06 10 40 80 CD 46 49 7E FF	ODA AID variant 1
9:28:00	-	FE 00 00 D4 09 0D 0A 0C 10 09 1C 00 00 02 60 F3 FF	Encoder time adjust
9:28:00	8A: 01 883D 1A74	FE 00 00 D5 08 30 06 06 01 88 3D 1A 74 5F DC FF	TMC 8A, two repeats
9:28:00	3A: 8A 0646 CD46	FE 00 00 D6 07 24 06 10 06 46 CD 46 E3 E0 FF	ODA AID variant 0
9:28:01	8A: 02 8F50 15DD	FE 00 00 D7 08 30 06 06 02 8F 50 15 DD D3 6E FF	TMC 8A, two repeats
9:28:01	8A: 02 5404 ABD4	FE 00 00 D8 08 30 06 06 02 54 04 AB D4 1D E6 FF	TMC 8A, two repeats
9:28:01	3A: 8A 4080 CD46	FE 00 00 D9 07 24 06 10 40 80 CD 46 A6 E6 FF	ODA AID variant 1
9:28:02	8A: 05 497C 8000	FE 00 00 DA 08 30 06 06 05 49 7C 80 00 A6 D5 FF	TMC 8A, two repeats
...			

Note:
1) Any RDS group inserted using the UECP elements 24, 30, 40 or 42 is put into the UECP buffer. For TMC transmission it is recommended to leave the UECP buffer as transparent so the TMC data providing application has full control over the TMC transmission. The encoder automatically ensures at least 3-groups long gap between TMC groups.

14. Annexes

14.1 Character set and code-table conversions

The RDS system, as defined by the standards, does not support Unicode character set. Default character set (G0) used within the RDS

0x	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		0	@	P	`	p	á	â	ª	º	Á	Â	Ã	ã
1	!	1	A	Q	a	q	à	ä	α	¹	À	Ä	Å	å
2	"	2	B	R	b	r	é	ê	©	²	É	Ê	Æ	æ
3	#	3	C	S	c	s	è	ë	‰	³	È	Ë	Œ	œ
4	¤	4	D	T	d	t	í	î	Ğ	±	Í	Î	ŷ	ŵ
5	%	5	E	U	e	u	ì	ï	ě	İ	Ì	Ï	Ý	ý
6	&	6	F	V	f	v	ó	ô	ň	ń	Ó	Ô	Õ	õ
7	'	7	G	W	g	w	ò	ö	ő	ű	Ò	Ö	Ø	ø
8	(	8	H	X	h	x	ú	û	π	µ	Ú	Û	Þ	þ
9	)	9	I	Y	i	y	ù	ü	₤/€	¿	Ù	Ü	Ŋ	ŋ
A	*	:	J	Z	j	z	Ñ	ñ	£	÷	Ř	ř	Ŕ	ŕ
B	+	;	K	[	k	{	Ç	ç	$	°	Č	č	Ć	ć
C	,	<	L	\	l	|	Ş	ş	←	¼	Š	š	Ś	ś
D	-	=	M	]	m	}	β/ß	ğ	↑	½	Ž	ž	Ź	ź
E	.	>	N	^	n	~	¡	ı	→	¾	Đ	đ	Ŧ	ŧ
F	/	?	O	_	o		IJ	ij	↓	§	Ŀ	ŀ	ð	

Basic set | Extended set

Example of use:

Character ‘é’ can be found in the table on coordinates 8, 2. Thus it converts to ASCII character 0x82 (HEX) or 130.

A conversion is required for all characters outside the basic set region. If you use MagicRDS control software, the characters are converted automatically between Windows ANSI coding and RDS character set. Setting for that feature can be made in Preferences - Local settings. Embedded internet functions are based on UTF-8 coding – conversion is made automatically inside the RDS encoder.

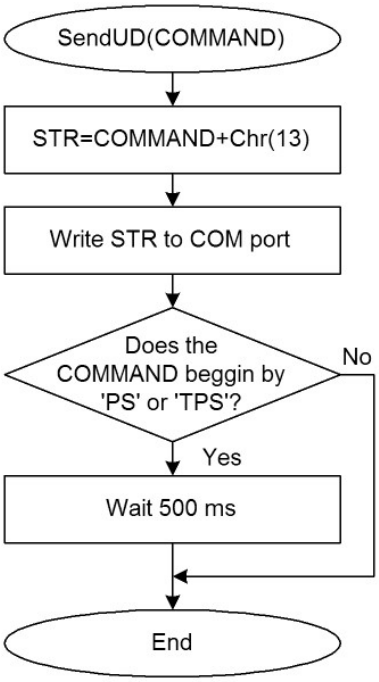
Note:

- *Many commercially available receivers use 14-segment LCD displays. These receivers are able to display only a limited part of the basic character set (green framed) and do not support the extended set at all. All lower-case characters are showed as upper-case.*
- *The EBU Latin basic set is compatible with most of other systems so conversion is not required for this region.*
- *Since many receivers contain no support for the extended character set, it is recommended to keep all characters in all text messages in the basic set region.*
- *Auxiliary code-tables (G1, G2) are not discussed in this manual as they are not intended for common use due to lack of support on most receivers and incorrect interpretation of repertoire control characters on such receivers.*

14.2 Communication Protocol Implementation Flowcharts

Following flowcharts allow the developer to implement the **/RDS-TEX-E-**2HE **& / RDS-TEX-E-3HE** ASCII protocol to any application easily.

14.2.1 Unidirectional Communication



Send command basic flowchart (unidirectional communication).

14.2.2 Bidirectional Communication

Confirm sequences definition:

CS1=Chr(13)+Chr(10)+'+'+Chr(13)+Chr(10)+Chr(13)+Chr(10)
CS2=Chr(13)+Chr(10)+'!'+Chr(13)+Chr(10)+Chr(13)+Chr(10)
CS3=Chr(13)+Chr(10)+'-'+Chr(13)+Chr(10)+Chr(13)+Chr(10) CS4=C
hr(13)+Chr(10)+'/'+Chr(13)+Chr(10)+Chr(13)+Chr(10)

Variables used:

STR, REC, CS, COMMAND: string ACCEPTED, ERROR: integer/ boolean TIME: time/float

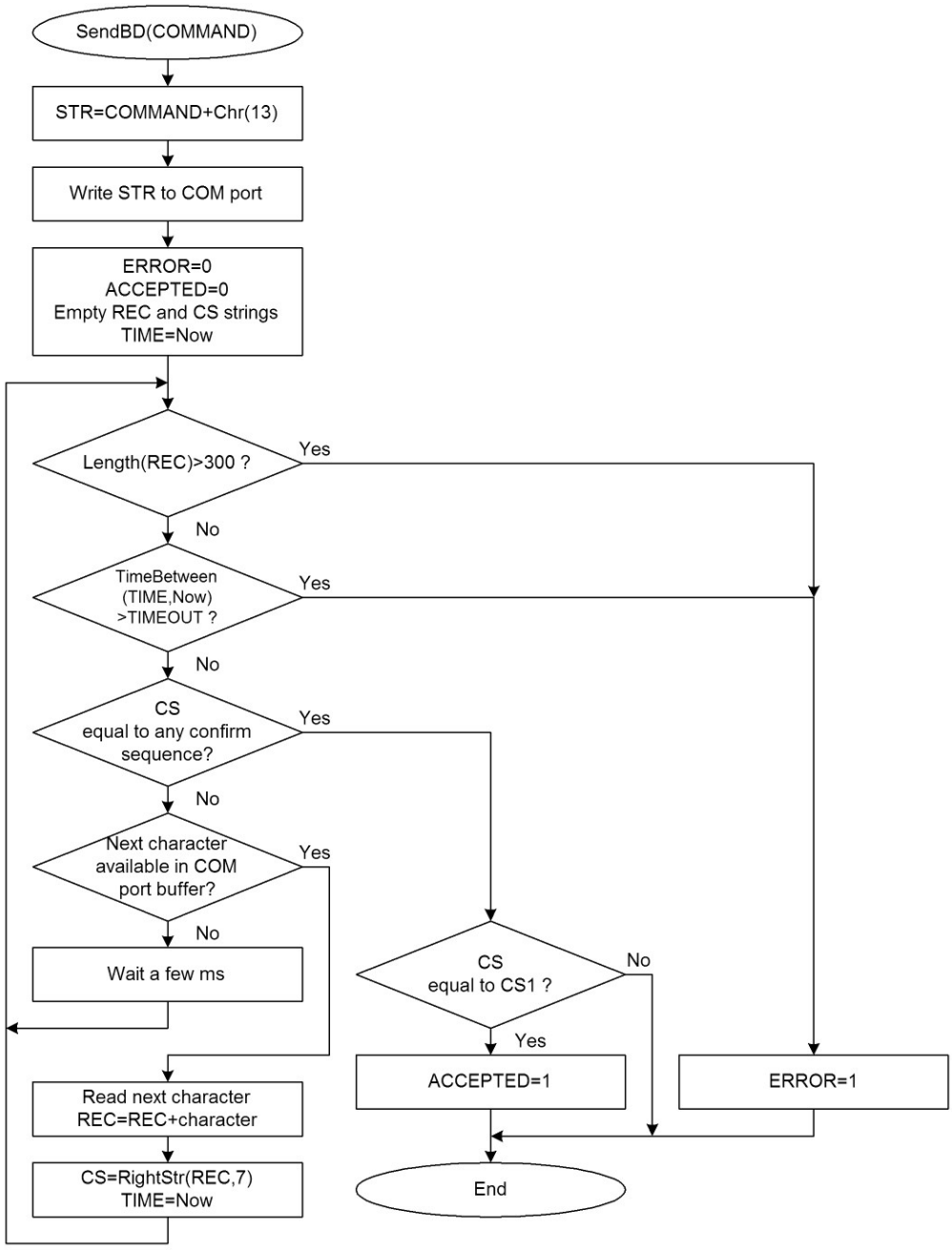
Other values:

TIMEOUT: COM port timeout, usually ≥400 milliseconds

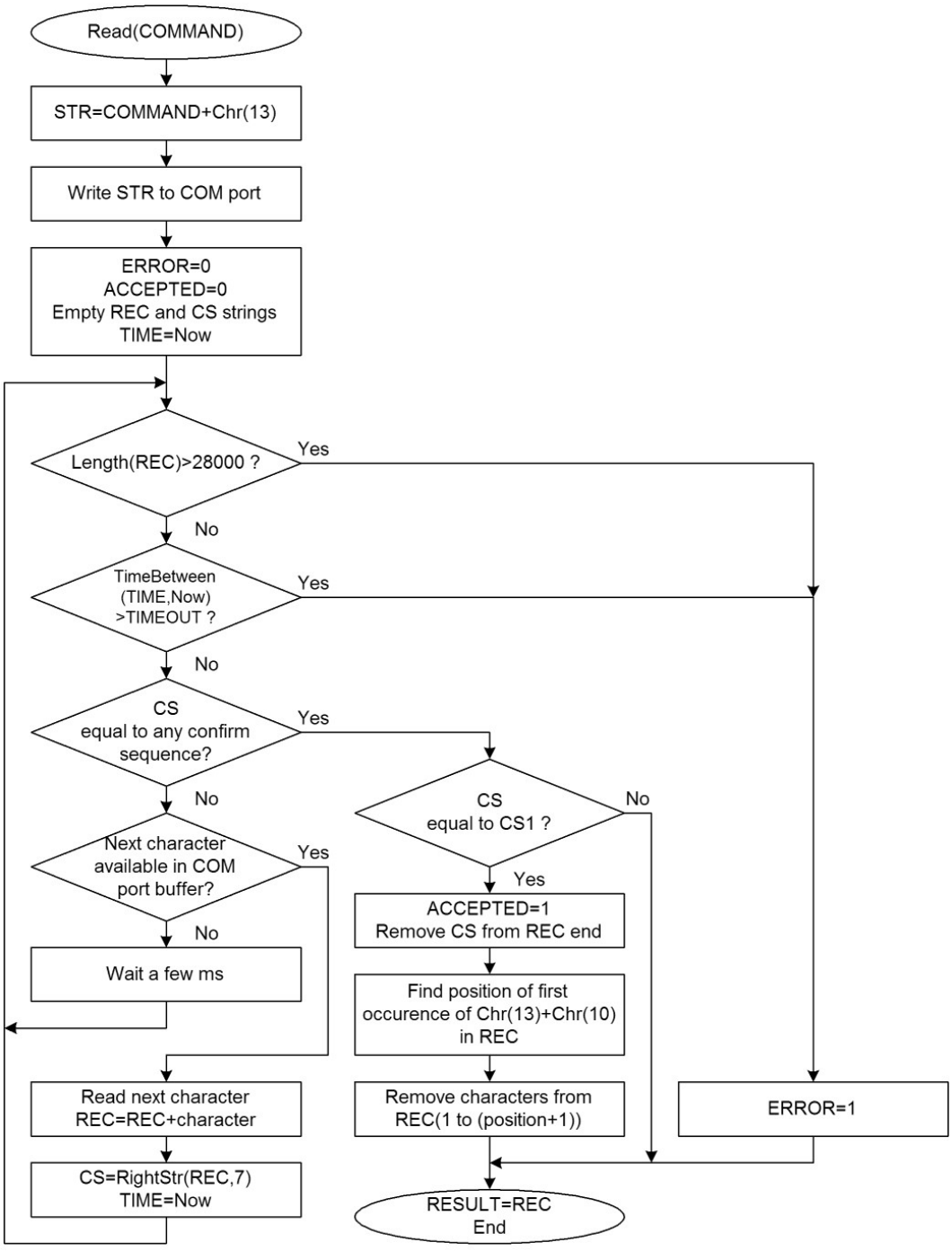
Calling examples::

SendBD('PS=PRO 88')
if ERROR or not ACCEPTED then write('Error')
S=Read('PS')
if ERROR or not ACCEPTED then S=''

Note: *The flowcharts are valid for any ECHO value.*



Send command flowchart (bidirectional communication).



Send command flowchart (bidirectional communication).

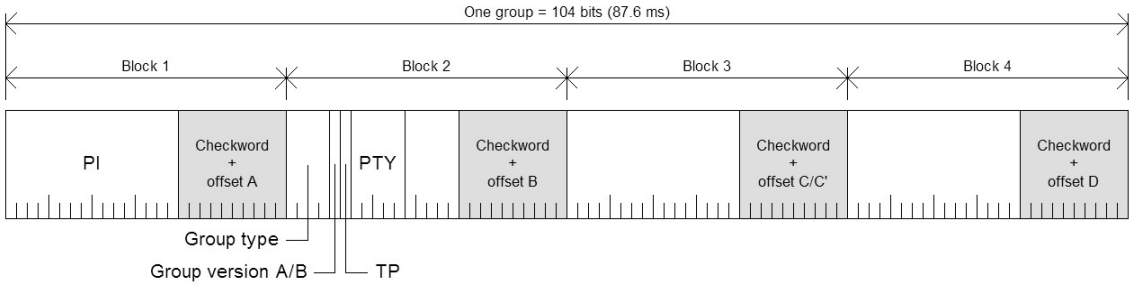
14.3 RDS Group Format

Following information is provided for better understanding to the RDS principles and the user defined group coding.

The largest element in the RDS coding structure is called a “group” of 104 bits each. Each group comprises 4 blocks of 26 bits each. Each block comprises an information word and a checkword. Each information word comprises 16 bits. Each checkword comprises 10 bits.

All information words, checkwords, binary numbers or binary address values have their most significant bit (MSB) transmitted first.

The data transmission is fully synchronous and there are no gaps between the groups or blocks. The basic data-rate of the system is 1187.5 bit/s. Thus transmission of one group takes about 87.6 ms and about 11.4 groups are transmitted per one second.



General RDS group format.

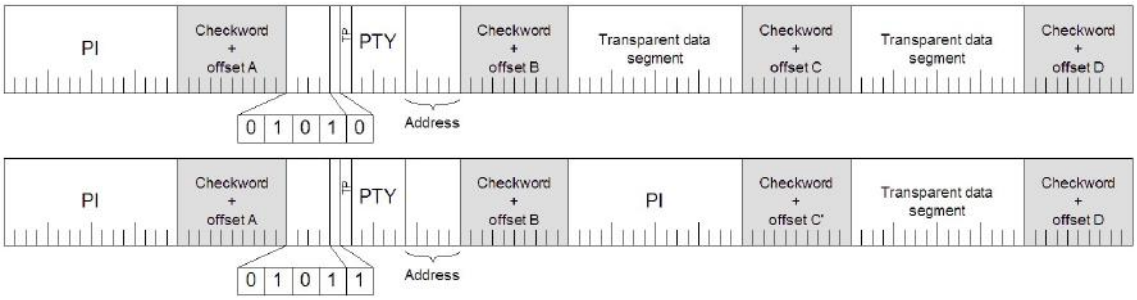
14.3.1 Basic principles and rules

- The services which are to be repeated most frequently, and for which a short acquisition time is required (PI, TP, PTY), in general occupy the same fixed positions within every group.
- There is no fixed rhythm of repetition of the various types of group, i.e. there is ample flexibility to interleave the various kinds of message to suit the needs of the users at any given time.
- The first four bits of the second block of every group are allocated to a four-bit code which specifies the application of the group - group type. Groups are referred to as types 0 to 15.
- For each type (0 to 15) two “versions” can be defined. The “version” is specified by the fifth bit of block 2: 0 = version A, 1 = version B.
- For all groups of version B the PI is inserted also in block 3 so this block cannot carry any other information when version B of the group is used.

14.3.2 Remarks

- One complete PS label consists of 4 groups. So one PS takes 350 ms of the transmission time. It may be found from experience that any RDS text should be transmitted at least twice to improve reception reliability. With regard to other services included in the RDS the repetition rate of dynamic/scrolling PS usually cannot be lower than one second.
- Checkwords and offsets are always calculated and inserted automatically by the RDS encoder.
- PI is always inserted automatically by the RDS encoder in block 1, and also in block 3 for version B of the group. Due to this the block 1 is never specified when inserting any user defined group.
- TP and PTY are always inserted automatically by the RDS encoder using OR method (logical sum) on the appropriate bit positions.

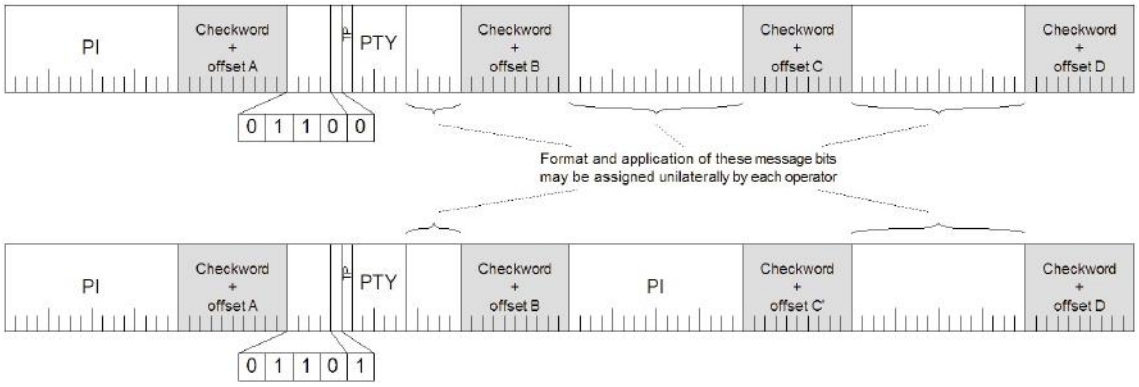
14.3.3 TDC group coding (5A, 5B)



Group format in hexadecimal representation (version A): 50BBCCCCDDDD, group format in hexadecimal representation (version B): 58BB0000DDDD,

where BB, CCCC and DDDD represent the contents of the block 2 (bits 4 to 0), block 3 and block 4.

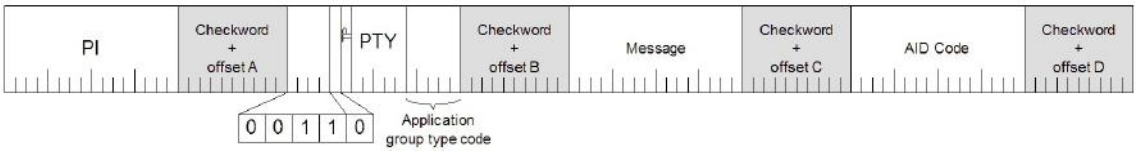
14.3.4 IH group coding (6A, 6B)



Group format in hexadecimal representation (version A): 60BBCCCCDDDD, group format in hexadecimal representation (version B): 68BB0000DDDD,

where BB, CCCC and DDDD represent the contents of the block 2 (bits 4 to 0), block 3 and block 4.

14.3.5 AID for ODA group coding (3A)



Group format in hexadecimal representation: 30BBCCCCDDDD, where BB, CCCC and DDDD represent the contents of the block 2 (bits 4 to 0), block 3 and block 4.

These groups are used to identify the Open Data Application in use, on an RDS transmission. The type 3A group conveys, to a receiver, information about which Open Data Applications are carried on a particular transmission (AID Code) and in which groups they will be found (Application group type code).

The Application group type code and the AID Code are obligatory, while the Message field is optional and should be set to zeros if not used.

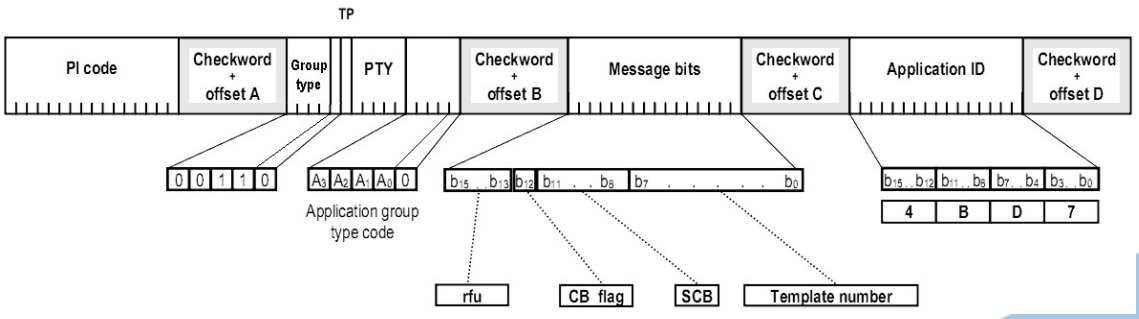
Since the 3A groups usually carry fixed static content, they may be inserted using either the UDG1= or UDG2= command for automatic cyclic transmission while the ODA application groups may be inserted by any command or method (G=, UDG1=, UDG2= or UECP MEC 24 or 42).

14.3.6 Example of ODA user defined group coding (Radiotext Plus)

Let's show the group coding example on the popular RT+ service. We need to insert group type 3A (Application identification for ODA) to the RDS stream pointing to the RT+ service which is – in this example - carried in group 11A.

Let's assume following RT content: Enigma - The Eyes of Truth

Appropriate 3A and 11A groups have following structure and coding:

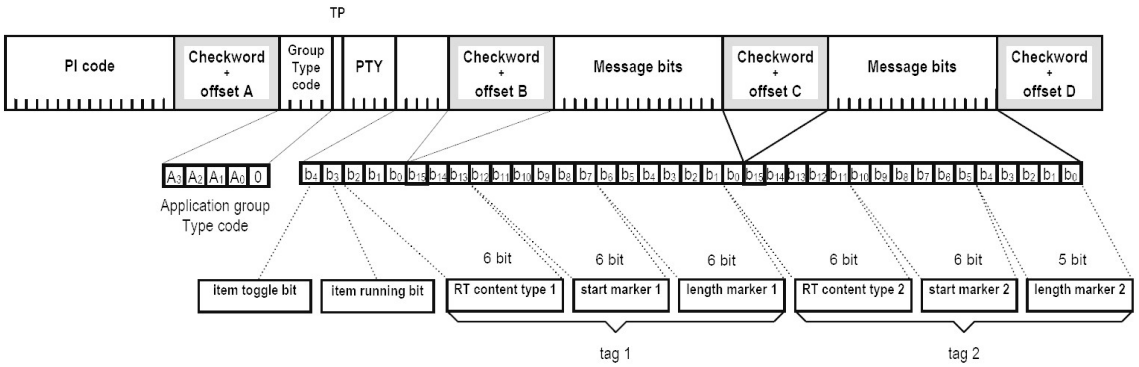


Let's assume following variable values:

AGT: group type 11, version A (0), rfu: reserved, set as zeros, CB flag: 0, SC flag: 0, TN: N/A, set as zeros, AID code is 4BD7 for the RT+ service.

Blocks 2 to 4 in binary representation:
0011 0000 0001 0110 | 0000 0000 0000 0000 | 0100 1011 1101 0111

Blocks 2 to 4 in hexadecimal representation:
3016 | 0000 | 4BD7



Let's assume following variable values:
AGT: group type 11, version A (0), ITG: 0, IRB: 1, RTCT1: 1 (Title), SM1: 9 (10th RT character), LM1: 16 (17 characters long), RTCT2: 4 (Artist), SM2: 0 (first RT character), LM2: 5 (6 characters long).

Blocks 2 to 4 in binary representation:
1011 0000 0000 1000 | 0010 0100 1010 0000 | 0010 0000 0000 0101

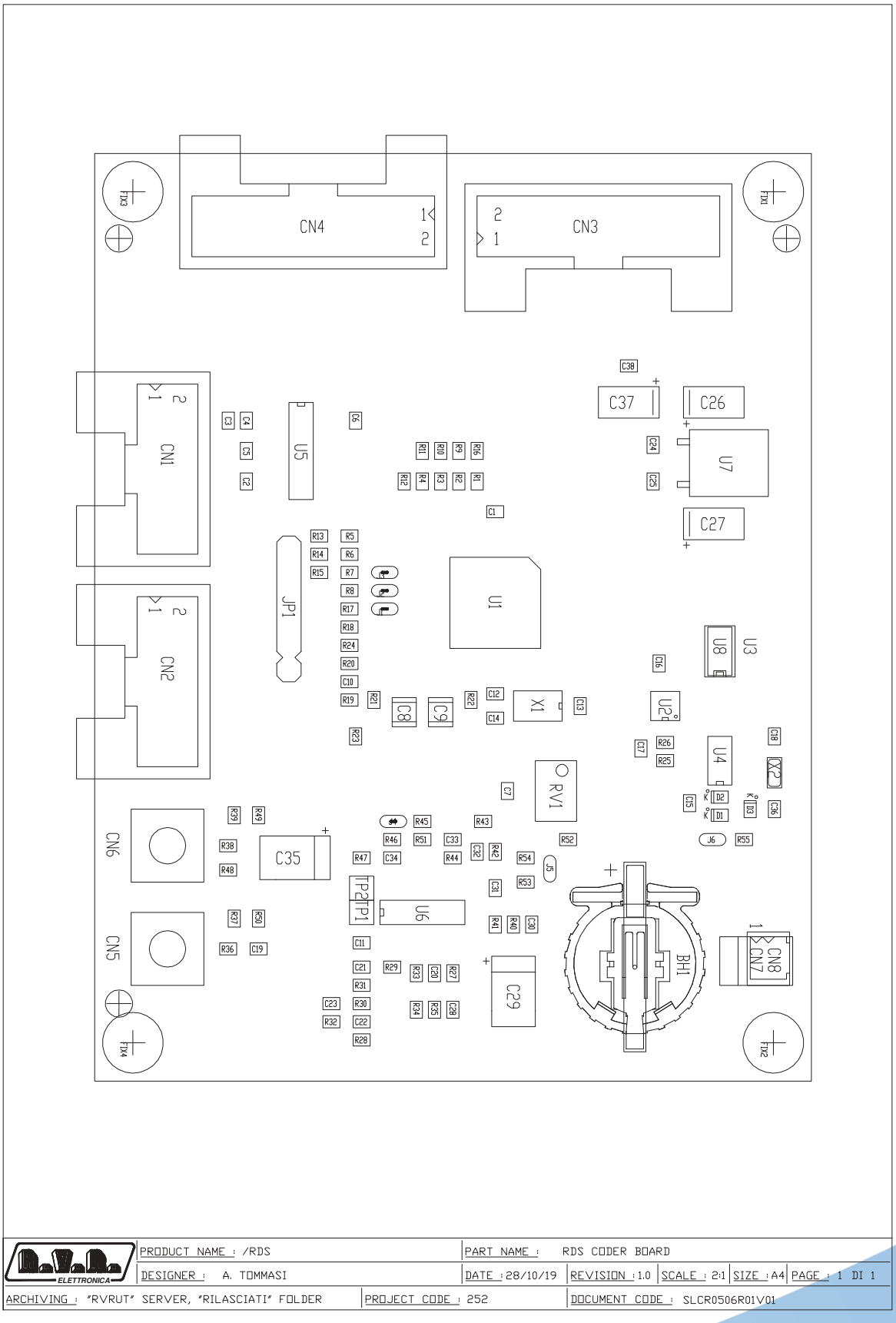
Blocks 2 to 4 in hexadecimal representation:
B008 | 24A0 | 2005

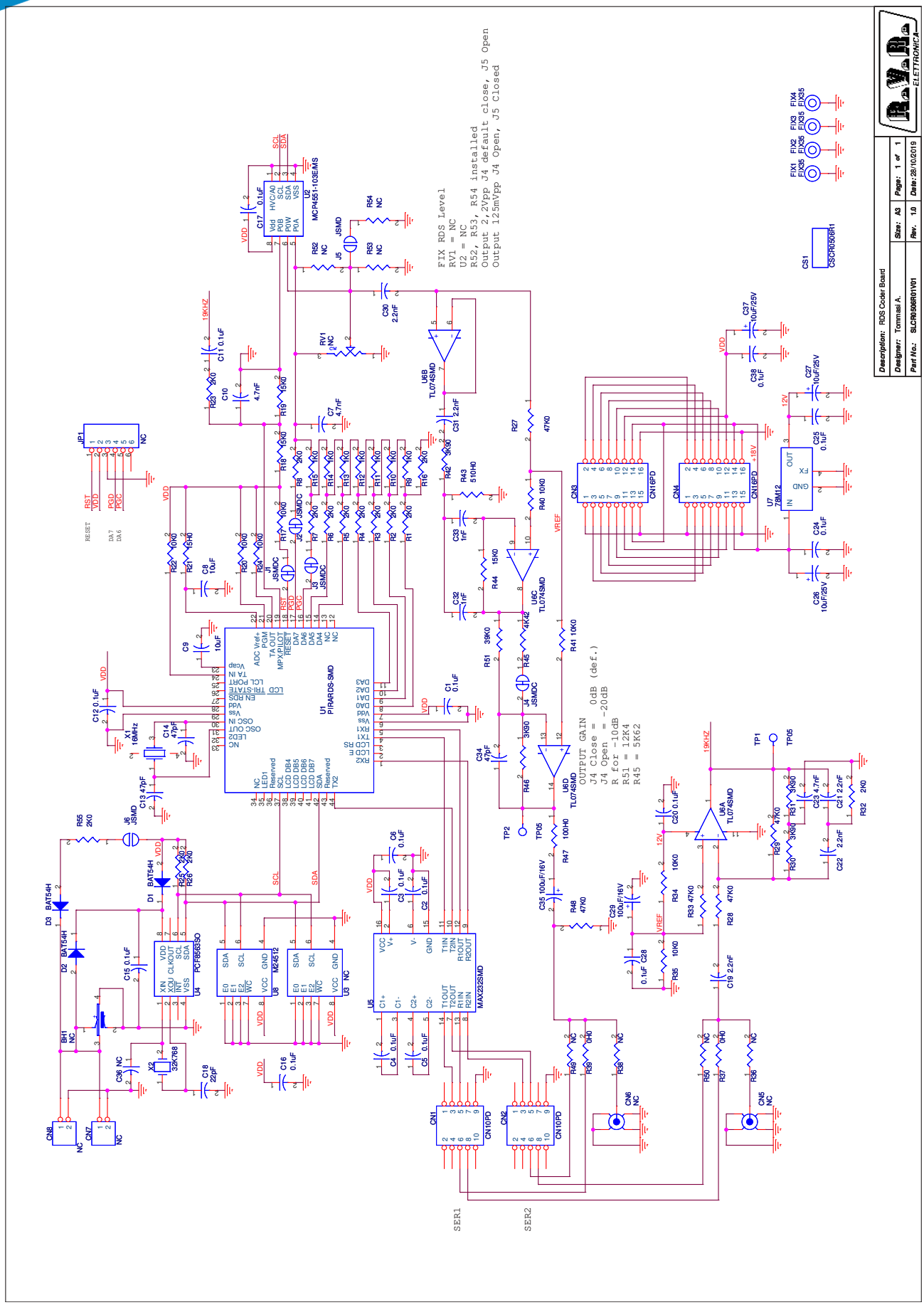
Inserting the RT+ groups using the UDG1 command:
UDG1=301600004BD7,B00824A02005

Note: *This example is for illustration only. The RT+ feature is directly supported by the RDS encoder.*

15. Technical Annex

15.1 RDS board - SLCR0506R01V01




FIX RDS Level
RV1 = NC
U2 = NC
R52, R53, R54 installed
Output 2,2Vpp J4 default close, J5 Open
Output 125mVpp J4 Open, J5 Closed
OUTPUT GAIN
J4 Close = 0dB (def.)
J4 Open = -20dB
R for -10dB
R51 = 12K4
R45 = 5K62
Description: RDS Coder Board
Designer: Tommasi A.
Part No.: SLCR05R6101V01
Size: A3
Rev. 1.0
Page: 1 of 1
Date: 28/10/2019
SER1
SER2

RDS Coder Board Revised: 28/10/2019
SLCR0506R01V01 Revision: 1.0
Tommasi A.

Item	Quantity	Reference	Part	Description
1	1	BH1	NC	CR1220 SMD Battery holder
2	2	CN1, CN2	CN10PD	10 way pcb conn. with holder
3	2	CN3, CN4	CN16PD	16 way pcb conn. with holder
4	2	CN5, CN6	NC	SMB pcb conn.
5	1	CN7	NC	2 way Mascon conn.
6	1	CN8	NC	Molex 2 way pitch 2mm
7	1	CS1	CSCR0506R1	Printed Circuit board
8	16	C1, C2, C3, C4, C5, C6, C11, C12, C15, C16, C17, C20, C24, C25, C28, C38	0.1uF	0805 SMD capacitor
9	3	C7, C10, C23	4.7nF	0805 SMD capacitor
10	2	C8, C9	10uF	1210 SMD capacitor
11	3	C13, C14, C34	47pF	0805 SMD capacitor
12	1	C18	22pF	0805 SMD capacitor
13	5	C19, C21, C22, C30, C31	2.2nF	0805 SMD capacitor
14	3	C26, C27, C37	10uF/25V	SMD tantalium cap. size C
15	2	C29, C35	100uF/16V	SMD tantalium cap. size D
16	2	C32, C33	1nF	0805 SMD capacitor
17	1	C36	NC	0805 SMD capacitor
18	3	D1, D2, D3	BAT54H	SOD323 SMD Diode
19	4	FIX1, FIX2, FIX3, FIX4	FIX35	3.5mm Fixing hole
20	1	JP1	NC	Male strip 6 pin
21	4	J1, J2, J3, J4	JSMDC	3 pad SMD jumper half closed
22	2	J5, J6	JSMD	2 pad SMD jumper
23	1	RV1	NC	Trimmer Rg V 3269W SMD
24	14	R1, R2, R3, R4, R5, R6, R7, R8, R16, R23, R25, R26, R32, R55	2K0	0805 SMD res.
25	7	R9, R10, R11, R12, R13, R14, R15	1K0	0805 SMD res.
26	8	R17, R20, R22, R24, R34, R35, R40, R41	10K0	0805 SMD res.
27	3	R18, R19, R44	15K0	0805 SMD res.
28	1	R21	15H0	0805 SMD res.
29	5	R27, R28, R29, R33, R48	47K0	0805 SMD res.
30	4	R30, R31, R42, R46	3K90	0805 SMD res.
31	2	R37, R39	0H0	0805 SMD res.
32	1	R43	510H0	0805 SMD res.
33	1	R45	4K42	0805 SMD res.
34	1	R47	100H0	0805 SMD res.
35	1	R51	39K0	0805 SMD res.
36	7	R36, R38, R49, R50, R52, R53, R54	NC	0805 SMD res.
37	2	TP1, TP2	NC	Test point
38	1	U1	PIRARDS-SMD	SMD RDS IC Coder
39	1	U2	MCP4551-103E/MS	Single 127 step dig. pot.
40	1	U3	NC	IIC Bus 512Kb EEPROM
41	1	U4	PCF8563SO	RTC IIC Bus
42	1	U5	MAX232SMD	RS232 Driver SMD SO16
43	1	U6	TL074SMD	Quad Op. SMD SO14
44	1	U7	78M12	Voltage reg. SMD DPAK
45	1	U8	M24512	IIC Bus 512Kb EEPROM
46	1	X1	16MHz	SMD Crystal NX5032SA
47	1	X2	32K768	SMD Crystal 3.2x1.5 mm

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