MSE16 / MSE19 / RDE19
STEREO & RDS ENCODERS

RDS SECTION MANUAL

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1 Introduction

The RDE19 RDS encoder is a result of more than 10 years experience collecting and meets requirements of most regional, local, RSL, LPFM and other medium- and small-coverage radio stations. It's also highly suitable for service and development purposes.
Fully digital concept and uniquely effective design ensures high reliability, excellent signal characteristics and gives the user many advanced features while maintaining low acquisition costs. RDE19 brought a new price/performance standard to this kind of equipment.

1.1 Main Highlights

- Fully dynamic stand-alone RDS encoder
- RS-232 control interface based on a set of simple ASCII commands; UECP supported
- Control software includes powerful Windows GUI application
- Amazing text features, 25 kB of memory reserved for text messages (equivalent to more than 3200 PS strings)
- Excellent compatibility with Broadcast Automation Systems
- Advanced weekly scheduling
- Easy and fast set-up

1.2 Other Features

- Excellent spectral purity, direct digital RDS signal synthesis at sampling rate of 361 kHz (oversampled); compliant with EN 50067 / EN 62106
- Addressing feature - individual or common control of more than 64000 encoders in a network
- External TA and Program switch
- MPX loopthrough mode
- Internal real-time clock incl. backup battery, showing real-time also as PS
- No special 19 kHz input needed - pilot tone carefully recovered from incoming MPX signal
- Digital 57 kHz phase locked loop - rock stable RDS subcarrier in all cases

CE conformance notice:
This device complies with the requirements of the EEC Council CE marking and EMC directives.
Harmonized standards applied: EN 55022 (B ITE class), EN 55024.

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

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

The equipment has been thoroughly tested and found to be in proper operating condition when shipped. The manufacturer is not liable for any damages, including but not limited to, lost profits, lost savings, or other incidental or consequential damages arising out of the use of this product.

Information in this document is subject to change without notice.

Revision 2012-05-08

2 RDS Technical Specifications

Parameter	Condition	Value
General		
Data connector		RS-232 (DTE, 9 pins), bi-directional
Communication speed		software switchable 1200, 2400, 4800, 9600, 19200 bps
Communication mode		1 stop bit, 8 data bits, no parity, (no flow control), ASCII or UECP (SPB 490)
TA switching		software or external switch
TA/EON1TA input		TTL with 10 kΩ pull-up, level or falling edge activated
Program switching		software or external switch
Program input		TTL with 10 kΩ pull-up, level controlled
RDS Services directly supported		PI, PS, PTY, TP, AF, TA, DI, M/S, PIN, RT, RT+ TMC, EON, PTYN, ECC, LIC, TDC, IH, CT, ODA
RDS signal		
Subcarrier frequency		57 kHz
Sampling rate		361 kHz
Bandwidth		± 2.4 kHz (50 dBc)
Output level adjust	default	150 - 480 mV p-p on RDS only output or when Mpx is adjusted to + 10dBm (7.0Vpp)
Phase shift adjust	stereo transmission	Full range, in 9.5 deg. steps
Audio/MPX/Pilot input		
Recommended load impedance	mono	< 10 kΩ
	stereo MPX	< 2 kΩ
Recommended MPX voltage		2.2 - 10 V p-p
Passthrough voltage gain	dc - 100 kHz	1 (0 dB)
Pilot tone level		min. 120 mV p-p (-26 dBu)
Recommended FM deviation		6.8 kHz
Pilot PLL capture range		8 Hz
Stereo encoder pilot frequency required	stereo transmission	19000 Hz ± 2 Hz
Output		
Output impedance		100 Ω
Recommended load impedance		> 70 Ω, < 1 nF, no DC offset
Max. output voltage (RDS + MPX)		> 15 V p-p on 2kohm load
Recommended RDS level		2 - 5 % of MPX

Notes: ***p-p - peak-to-peak value***
The unit can operate with mono transmitter as well.

3 SEXC30RDS RDS Generator Board - Block diagram

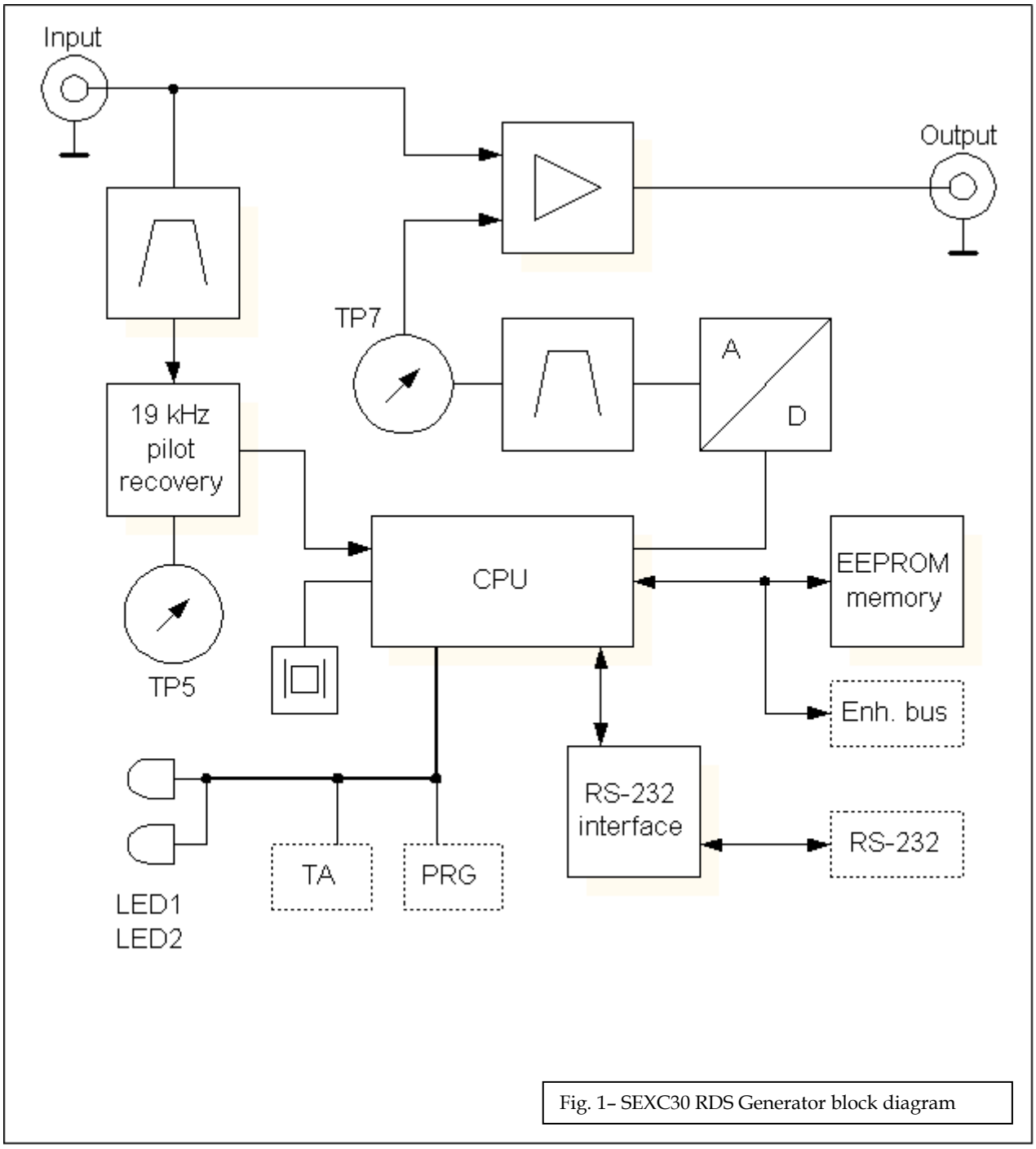


Fig. 1– SEXC30 RDS Generator block diagram

4 SEXC30RDS RDS Generator Board - Physical Description

4.1 Board Layout

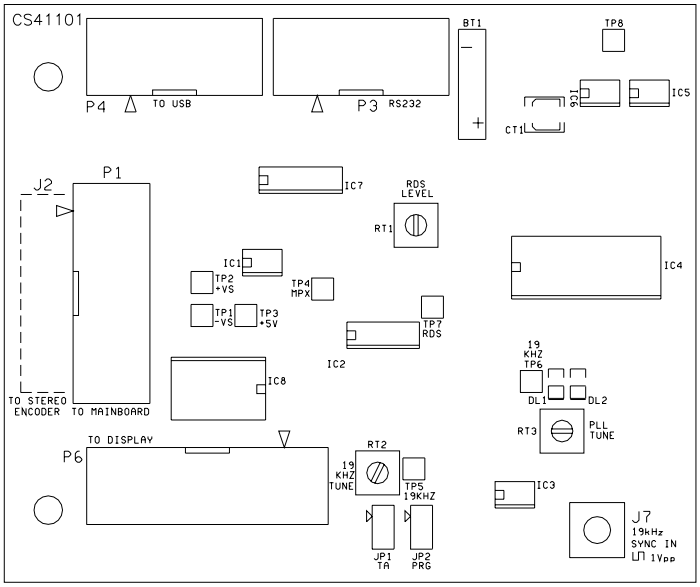


Fig. 2 – SEXC30 RDS Generator board layout

4.2 Connectors

P1 RDS & MPX output to Mainboard

J2 MPX input from Stereoencoder

P3 RS232 I/O port

P4 To USB interface port

P6 Display port

JP1 External TA/EON1TA switch
1: TTL input with 10k pull-up
2: Ground

JP2 External Program switch
1: TTL input with 10k pull-up
2: Ground

4.3 LED Indicators

LED1 - Operation / Receive data / Error

LED2 - Pilot tone indication / Firmware update

4.4 Adjustable Elements

RT1 RDS output level

RT2 19kHz filter tune
(***not to be adjustable by the user***)

RT3 19kHz PLL tune
(***not to be adjustable by the user***)

CT1 RTC clock adjust (***factory trimmed***)

4.5 Others

BT - Lithium battery 3 V for real time backup
Estimated endurance is 10 years.
Note: EEPROM memory that is used for RDS data storage does not require any voltage to hold the data.

Please note that SEXC30RDS is not a stand-alone unit but a plug-in board which must be mounted on a supporting System Board like in the RDS19 (self-standing RDS Generator unit), the MSE19 (Stereo Encoder +RDS Generator) or the MSE16 (LF Multiplex Changeover + Stereo Encoder & RDS Generator).

5 Installation and Setting-up

5.1 LF Connection to the Transmitter

Basic rules:

- The RDS signal must be fed into modulation signal of the Transmitter. If the Multiplex signal (Mpx) is not internally generated like in the MSE16 or MSE19, this may be done internally in the RDS Generator (loop-through or chained) or externally in the Transmitter.
- If the transmission is externally Stereo coded, a pilot tone source must be sent to the RDS Generator.
- The RDS Generator does not need a dedicated "pure" pilot input signal but may extract the pilot tone from the externally generated Stereo Mpx signal if this is not singly available.

Following figures show various situations and corresponding methods of connection with various SIELCO equipments. In particular the RDS19 is a self-standing RDS Generator unit, the MSE19 is Stereo Encoder which incorporates the RDS Generator and the MSE16 is a Stereo Multiplex LF changeover which incorporates an internal Stereo Encoder + an RDS Generator.
The EXC19 is an STL FM Transmitter but any other FM Transmitter like SIELCO's EXC30 or EXC25 line with the same inputs/outputs or else other manufacture's units may be used

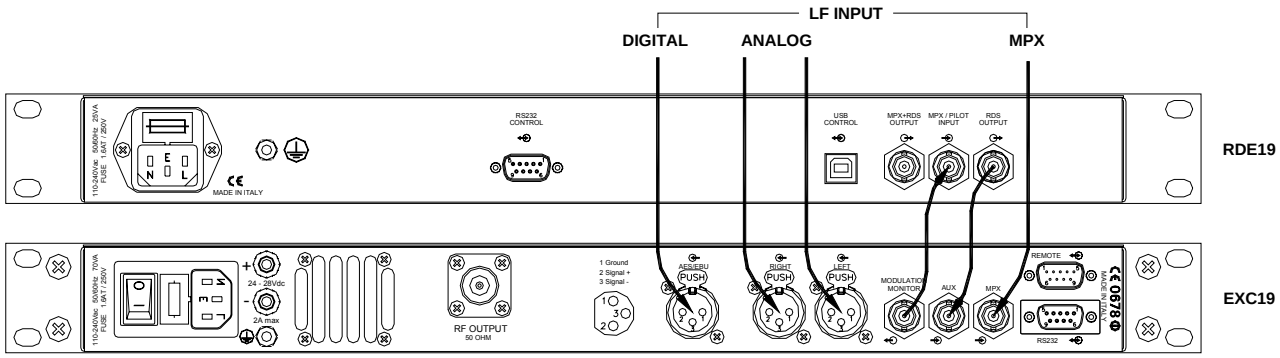


Fig. 3: RDE19: RDS signal added in the Transmitter to a locally or externally generated Mpx signal, in a parallel fashion. This is the preferred method whenever possible. In case of Monophonic transmission there is no need to connect the Transmitter's "Modulation Monitor" output to the "Mpx/Pilot" input of the RDS Generator

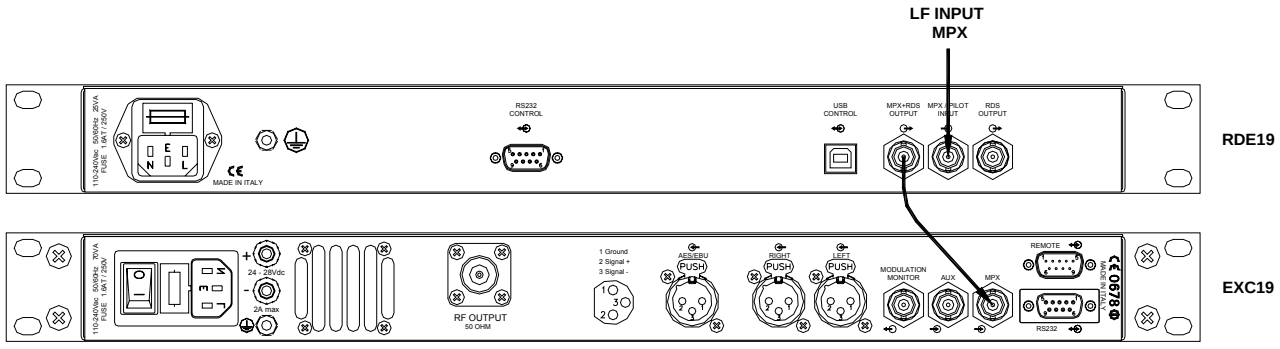


Fig. 4 - RDE19: RDS signal added in the RDS Generator to an externally generated Mpx signal in a chained fashion. While the solution in Fig. 1 is theoretically preferable if possible, this one is simpler and the very high quality of the RDE19 (and of the SIELCO's Transmitters LF input circuitry) assures a very good, artifact-free result which is not distinguishable by ear from the former.

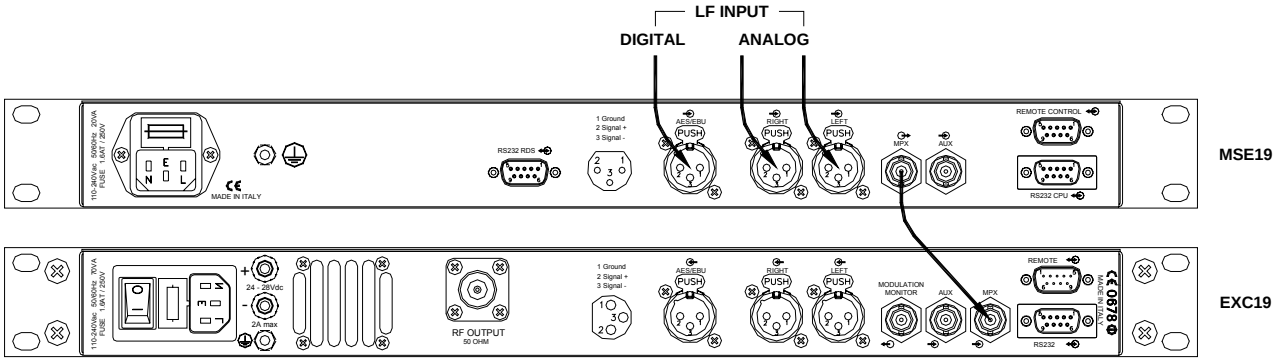


Fig. 5 - MSE19: The RDS signal is generated and added internally to the Mpx signal in the Stereo Encoder.

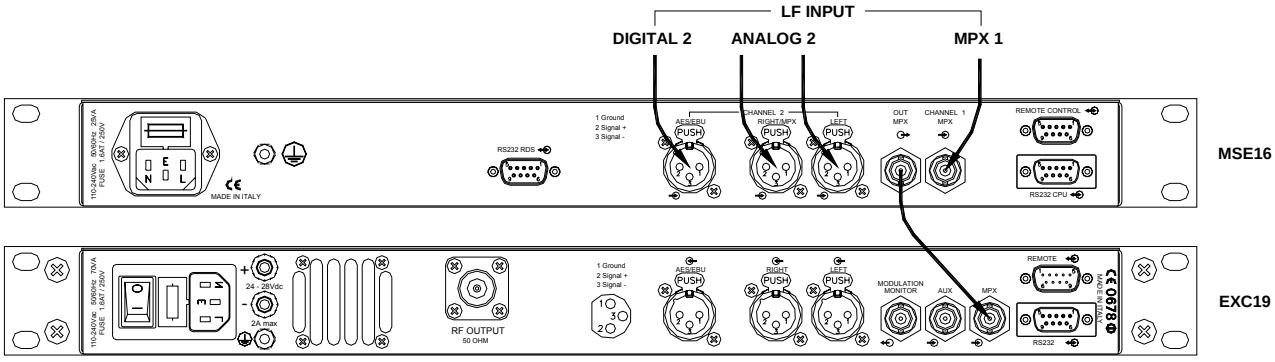


Fig. 6 - MSE16: The RDS signal is generated and added internally to the signal from the Stereo Encoder on channel 2 of the Mpx Encoder /Changeover.

5.2 Level and Phase Adjustment

5.2.1 RDS signal output level

Note: There is no universal setting for the RDS level. Due to different input sensitivity of different FM broadcast equipment and the Station policy on the Transmitter modulation, it is always advisable to check and adjust the RDS level.

The right level as suggested by the RDS Forum should be comprised between 1.4 and 10 % of the audio multiplex signal, peak-to-peak values. Recommended value is 2.7 % (IEC 62106 / CENELEC EN50067), which results in 2.0 kHz deviation of the FM carrier. In many situation a higher level may be preferred or advisable but we suggest not to trespass 3-4kHz deviation due to the RDS signal only. Don't forget that the maximum total FM carrier deviation with RDS and MPX signal is 75 kHz: a higher RDS level similarly reduces the dynamic room for the aural modulation!

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**.

5.2.2 How to adjust the RDS level

The RDS level generated on the SEXC30RDS board is not electronically adjustable but may be varied only by physically adjusting the internal trimmer RT1 on it. To adjust the RDS percentage on the overall Multiplex signal of the transmitter you may be forced to act on this trimmer or on the auxiliary channel sensitivity of the Transmitter. There are mainly to cases:

- RDS Generator as a self-standing unit (RDE19) wired as in figure 3.
  In this case the absolute output level of the RDS Generator is not particularly relevant. The User is suggested to adjust the RDS injection level on the deviation by acting on the Transmitter auxiliary channel sensitivity. The total deviation may usually be easily and accurately measured on the dedicated scale of the Transmitter

- RDS Generator as a self-standing unit (RDE19) wired as in figure 4 or in a "combo unit" (MSE16, MSE19).
  In this case the Transmitter sensitivity channel adjustment cannot be used for the RDS signal only and the User is forced to act on the internal trimmer located on the RDS Generator board, RT1 (ref. to figure 2 on previous paragraphs). The output deviation of the overall Modulation may be measured either on the Stereo Encoder / RDS unit or on the Transmitter main deviation meter. In this case the precision is not as high as in the previous case, being the meter scale higher and the resolution and accuracy lower. To measure the RDS level alone, **either the LF input must be absent and the Stereoencoder must be set to "Mono" during the measurement**.

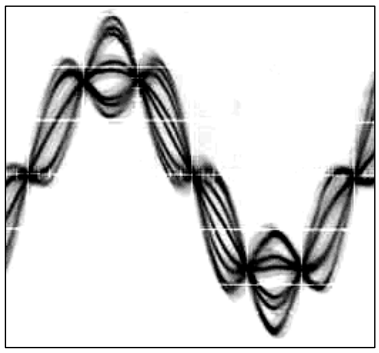
5.2.3 RDS to Pilot tone phase adjustment for stereo transmission

The phase adjustment is usually made using the Windows control software. It may also be adjusted from RS232 control using the "`PHASE=`" command. In this case 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).

1. Fetch pilot or MPX signal to the RDS encoder. The LED2 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. Never mind if you don't have this equipment. It's also possible to set very low RDS level (when the signal strength is near error limit) and set the minimal error rate by adjusting the phase.
   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 behavior of audio receivers, and notably the residues of audio intermodulation which can sometimes be observed, but with the aid of professional instruments only. Whenever possible SIELCO suggests to adopt 90° synchronization which permits a slightly lower overall modulation on the resulting Mpx signal at the same RDS injection level. This is the factory preset.

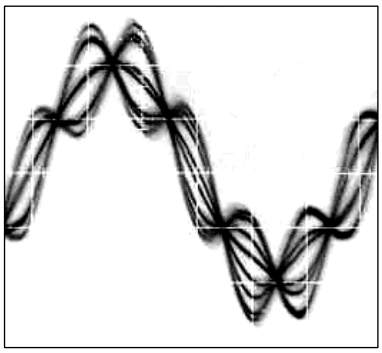
Conclusion: The phase adjustment is mostly optional and you may skip this step. Make sure the pilot tone is indicated on the RDS encoder by the LED2 if there is not a front panel LED.

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.

5.3 Setting Basic RDS Data

Before getting on-air with the RDS signal, you will need to decide on the settings to be used. The following RDS services must be set as the first. Use the Windows control software and its GUI. For more experienced users or those without a Windows PC, any terminal programme can be used (see chapter 11).

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

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

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

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

5.3.2 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.

5.3.3 PTY (Program Type)

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

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

5.3.4 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.

5.3.5 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.

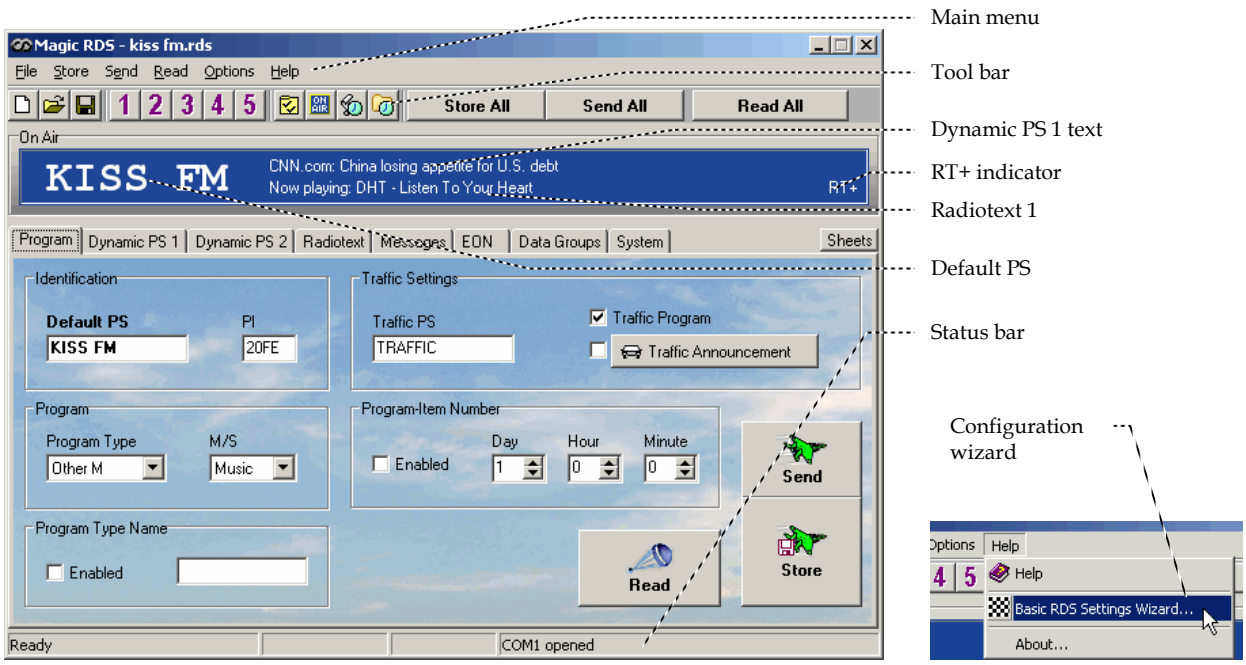
5.3.6 AF (Alternative Frequencies)

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

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

5.3.7 Windows control software - First steps

1. In the case of USB connection install the USB driver first. Pure RS232 connection requires no driver.
2. Make sure the RDS encoder is connected and powered, all connectors are seated completely and where possible, use screws to fix the connection.
3. Open the Preferences (Options - Preferences) and set up the connection parameters. 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.
4. Close the Preferences. You should see "Connected" or "Opened" in the status bar. Now you are ready. The settings are saved automatically.
5. 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.**
6. 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.
7. 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 - Buttons.
If the user forgets to store the data into EEPROM, the settings will be lost when the power is disconnected.

6 Dynamic PS Text

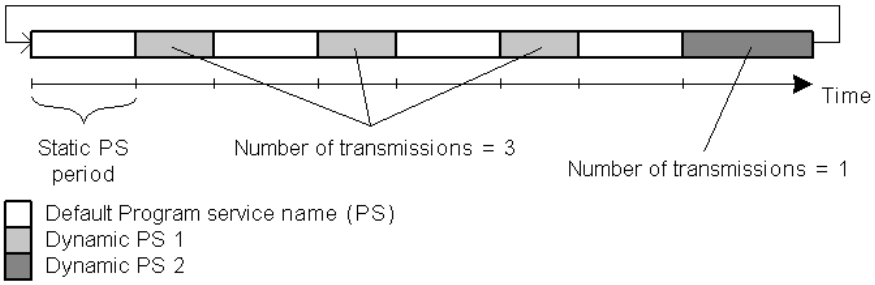
Standard RDS enabled receiver disposes of 8-character LCD display but we usually need to show pile of information and commercials. So small display on the one hand and so much demands on the other hand. The RDE19 solves it by unique system of text messages showing. Although Radiotext service is defined 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 RDE19 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

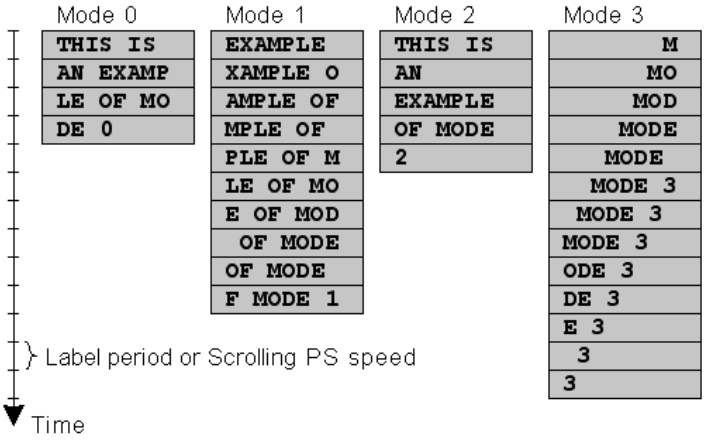
Example of full dynamic PS use:



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 (see sections 12.2 and 12.9). 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.

7 Alternative Frequencies

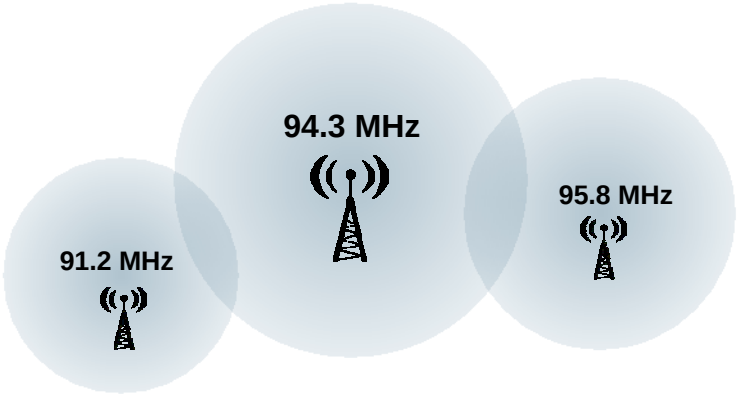
The list of alternative frequencies gives information on the various transmitters broadcasting the same program in the same or adjacent reception areas. It allows switching to another frequency of the same station when leaving the actual frequency coverage. This facility is particularly useful in the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

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

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 transmitting AFs 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.



7.1 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

7.2 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 to 12) 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
`*AF=4`	Store the termination
`AF=B`	Switch back to method B – start cycling through the lists
`*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

Notes:

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.

8 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 RDE19 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.

8.1.1 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 RDE19. The first EON link TA flag can be also controlled by external TA/EON1TA switch.
The situation described is illustrated on the example below:

8.1.2 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**

PI=20F1
PS=KISS FM
TP=0, TA=1
Frequency: 90.2 MHz

Station 1 EON Data:
EON1PI=2501
EON1PS=CITY
EON1TA=(controlled by external switch)
EON1AF=93.7

Station 2: **City Radio**

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)

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.

9 Weekly Scheduling

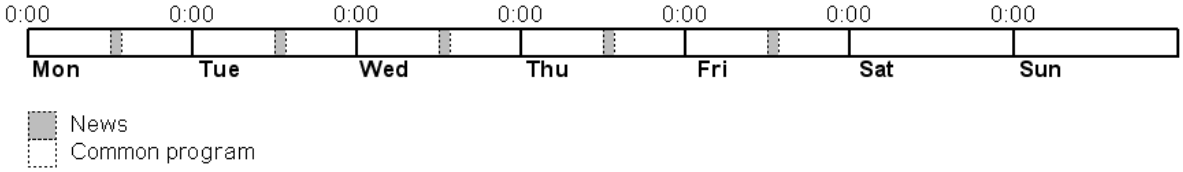
This feature allows scheduling of text messages, program type names and any other commands in hourly, daily and weekly program. The scheduling is provided directly by the RDE19 unit. Once set, it works with no more support from PC or control application. This is especially useful when the RDS encoder is placed on remote site or where reliability is important.

9.1.1 Key features

- The scheduling feature is fully implemented in the RDE19 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

9.1.2 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

9.1.3 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 Message, for example Message 01.
2. In the Scheduling call the message number, for example RT2MSG=1 or DPS2MSG=1.

The Windows control application provides easy GUI for this case.

9.1.4 Troubleshooting

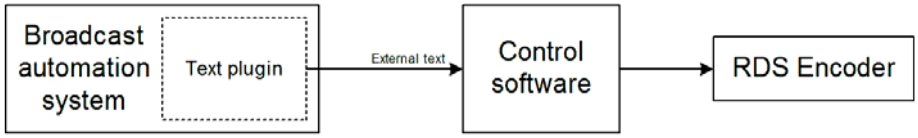
If the scheduling doesn't work as expected, check the following points:

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

10 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 RDE19. The link may be either indirect or direct.

10.1 Indirect Link



Default Windows control software for the RDE19 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 more information about how to configure the broadcast automation system text output read its documentation or contact the vendor.

10.2 Direct Link

10.2.1 Recommended procedure step-by-step

1. For the present turn off the RDS encoder support in the broadcast automation system.
2. Connect the RDS encoder and configure all basic parameters like PI, default PS, text setup, individual text features enable settings etc. using the Windows control software or terminal application and command line. **Store** all setting into EEPROM. Exit the Windows control software or the terminal.
3. Find out the baudrate (speed) that is used by the broadcast automation system for communicating with the RDS encoder. If this parameter is not clear from the documentation and no baudrate control is provided in the broadcast automation system, configure the RDS encoder for the default value (2400 bps).
4. Turn on the RDS encoder support in the broadcast automation system.

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

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

10.2.2 Compatibility commands

To reach the best possible compatibility with broadcast automation systems, the RDE19 includes a special set of compatibility commands. In the systems where the RDE19 is not directly supported (or the system is older version) the user may try to select another RDS encoder model to send text messages. Where possible, set the communication as unidirectional. The most frequent communication speed in this case is 9600 bps.

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

Moreover the RDS encoder includes UECP support (see chapter 14).

10.2.3 Radiotext Plus (RT+)

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 the RT+ function either by means of user defined groups or by the command `RTP=` (see section 12.7 for more details). In other cases the Windows control software used in the indirect link configuration can provide the RT+ service.

10.2.4 No header communication

By default, entering a text into the RDS encoder requires appropriate command header, for example:

```
RT1=Now playing: Junior Jack – My Feeling
```

Some broadcast automation systems provide direct serial text output (song info, commercials) without ability to add the `RT1=` or `DPS1=` prefix (typically satellite-streamed text feeds). For this case the RDS encoder provides special no header communication option enabling direct connection. When this option is active, any text incoming through the serial interface (including any control commands!) and followed by <Enter> will be automatically parsed and will appear as Radiotext 1, Dynamic PS 1 or both. Control of other RDS services is not allowed until deactivating the no header option.

To activate the no header communication:

1. Configure all RDS services as desired.
2. Enter the command `*NOHDR=1`.
3. The no header communication is indicated by front panel LED (see chapter 13).

To deactivate the no header communication, press the keyboard <Escape> key three times and then press <Enter>. The RDS encoder will respond by '+' indicating that it is back in standard communication mode.

Configuration	Text appears in
`EQTEXT1=0` `DPS1EN=1`	Dynamic PS

`EQTEXT1=1`
`RT1EN=1`
`DPS1EN=0`
	Radiotext

`EQTEXT1=1`
`RT1EN=1`
`DPS1EN=1`
	Both Radiotext and Dynamic PS

Notes:

1. ***The ESC key scan code is 27 (0x1B).***
2. ***It is not allowed to enter the no header communication if the RDS encoder addressing feature is in use. Thus the RDS encoder address must be either 0 or 255.***
3. ***If the no header communication is active, the unit does not accept UECP commands although the UECP is enabled.***
4. ***If the no header communication is active, the unit does not confirm the text entered.***

11 COM Port Communication

11.1 Connecting the RDS Encoder to a PC

For configuration and control requirements a PC is connected to the RDS encoder via standard RS-232 interface Male-Female straight connection cable provided with a D-SUB9 male connector on the RDS encoder side. On the PC side locate an unused COM port. On old Computers with 25-pin connector use a standard D-SUB25 female to D-SUB9 male adapter. For USB or Ethernet connection appropriate commercially available adapter will apply.
This kind of cable is commonly available on any PC shop as a "RS232 cable extender". Do not use crossed serial "lap-link" cable or so-called "null-modem cable". Following figure represents the full connection diagram:

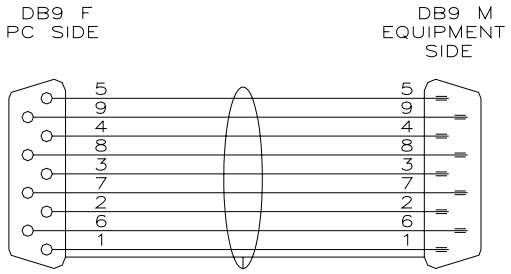


Fig. 7 – RS232 Straight connection extender cable

11.2 Working with a Terminal Application

On the PC, run an application or program emulating or possessing an ASCII terminal. For example Windows HyperTerminal presents all the characteristics to easily communicate in ASCII mode with the RDS encoder. If you desire a higher level interface, user-friendly applications are available. The RDE19 basic control is also implemented in familiar broadcast automation systems.

If you wish to continue with the terminal application, configure the communication parameters as follows:

Transmission speed	2400 bps (default, see note)
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Parity checking	***No***
Carrier detection	***No***

Note: Generally any speed of 1200, 2400, 4800, 9600 or 19200 bps is possible if previously set and stored in the RDS encoder EEPROM memory.

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 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. Take a note that entirely all functions and settings of this RDS encoder can be controlled via the terminal making this device fully independent on the operating system or computing platform.

11.3 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.

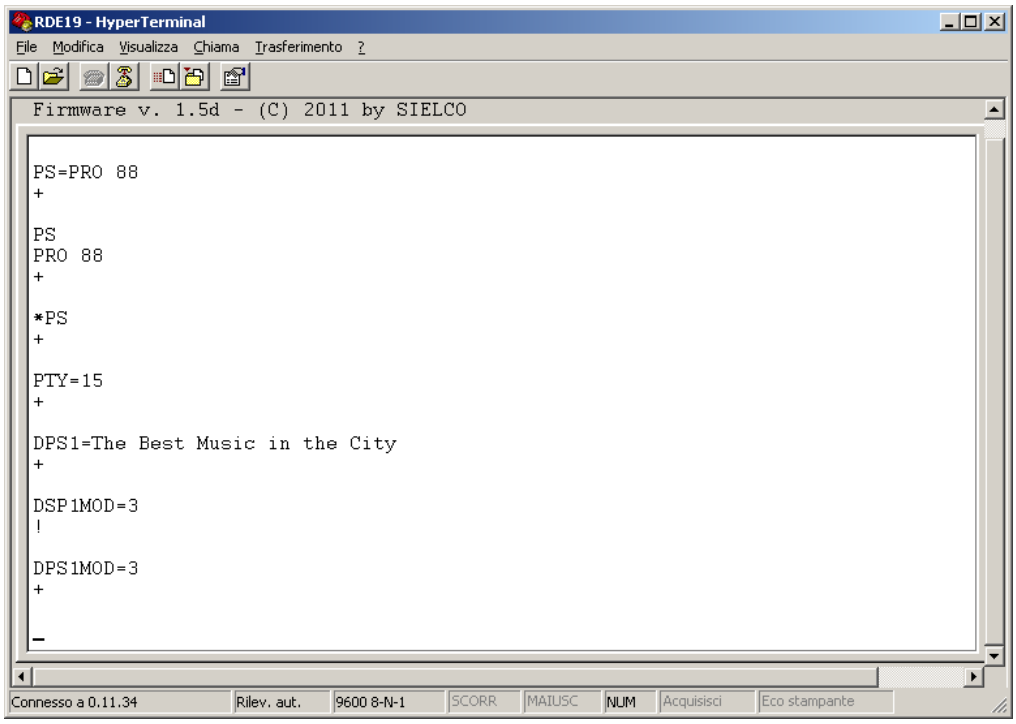
Not all methods are available for all commands, see Command Summary section.

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!



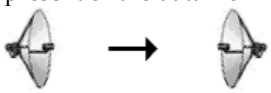
Example of Windows Hyperterminal control: note the erroneous penultimate command

11.4 Additional Information

This additional information provides all details required for implementation of the RDE19 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.

11.4.1 Unidirectional or bidirectional – What is the difference?

The RDE19 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

11.4.2 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 (the RX buffer length is 48 bytes).

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)

11.4.3 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 COM port time-out is 2 minutes. If no character is received during this time, the command line is internally cleared.

12 List of Commands

12.1 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
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
EONxAFCH	EONxAFCH=		EON x Frequency channels
EONxEN	EONxEN=		EON x Enable
EONxPI	EONxPI=		EON x Program Identification
EONxPIN	EONxPIN=		EON x Program Item Number
EONxPS	EONxPS=		EON x Program Service name
EONxPTY	EONxPTY=		EON x Program Type number
EONxTA	EONxTA=		EON x Traffic Announcement
EONxTP	EONxTP=		EON x Traffic Program
		*EON	Store all EON data into EEPROM

x is in range 1-4

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

Messages:

MSGxx			*MSGxx=	Text Message
MSGxxD			*MSGxxD=	Message Destination
MSGLIST				List of Messages
DPS2MSG	DPS2MSG=	*DPS2MSG		Dynamic PS 2 Message Number
RT2MSG	RT2MSG=	*RT2MSG		Radiotext 2 Message Number

xx is in decimal range 01-99

Scheduling:

S				List of Scheduling Items
SxxC			*SxxC=	Scheduling Item Command
SxxD			*SxxD=	Scheduling Item Days
SxxP			*SxxP=	Scheduling Item PTY
SxxT			*SxxT=	Scheduling Item Times
SEN	SEN=	*SEN		Scheduling Enable

xx is in decimal range 01-48

System:

COMSPD	COMSPD=	*COMSPD		COM Port Speed
CT	CT=	*CT		Clock Time and Date
	DATE=	*DATE		Date
ECHO	ECHO=	*ECHO		Terminal Echo
EXTSYNC	EXTSYNC=	*EXTSYNC		External Pilot Synchronization
LEVEL	LEVEL=	*LEVEL		RDS Signal Level
LTO	LTO=	*LTO		Local Time Offset
MJD	MJD=	*MDJ		Modified Julian Day
PHASE	PHASE=	*PHASE		RDS Signal Phase
PILOT				Pilot Tone Present
RDSGEN	RDSGEN=	*RDSGEN		RDS Generator
RESET				Reset
SPEED	SPEED=	*SPEED		COM Port Speed
STATUS				RDS Encoder Status
TIME	TIME=	*TIME		Time
VER				Firmware Version

Advanced:

ADR			*ADR=	Encoder Address
CC			*CC=	Conditional Command
ECC	ECC=	*ECC		Extended Country Code
ECCEN	ECCEN=	*ECCEN		ECC and LIC Enable
	G=			Group
GRPSEQ	GRPSEQ=	*GRPSEQ		Group Sequence
LIC	LIC=	*LIC		Language Identification Code
NOHDR			*NOHDR=	No Header Communication
PIN	PIN=	*PIN		Program Item Number
PINEN	PINEN=	*PINEN		PIN Enable
PROGRAM	PROGRAM=	*PROGRAM		Program Set
PSW				PS Window
RTP	RTP=			Radiotext Plus Tagging Data
RTPRUN	RTPRUN=			Radiotext Plus Running Bit
	SEL=			Select Encoder
SHORTRT	SHORTRT=	*SHORTRT		Short Radiotext
SITE			*SITE=	Site Address
UDG1	UDG1=	*UDG1		User Defined Groups 1
UDG2	UDG2=	*UDG2		User Defined Groups 2
UECP	UECP=	*UECP		UECP Enable
>xxxxxxx				Assign Last Value

xxxxxxx is any command from the second column without '='

12.2 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 by RDS standard)	
`AF=108.0`	Not allowed (108.0 MHz not defined by RDS standard)	

AFCH	**Alternative Frequency Channels**	**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	
`AFCH=00`	Not allowed (87.5 MHz not defined by RDS standard)	
`AFCH=CD`	Not allowed (108.0 MHz not defined by RDS standard)	

DI	**Decoder Identification**	**(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

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. Alternatively used in conjunction with ***Messages Commands***.	
`DPS2=Hello World`	Sets the DPS2 text
`DPS2=`	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		
`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

```
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 set.
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 set 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. If RT+ service is active, the RT+ running bit is cleared.
Default text means the RT1 text that is stored in EEPROM memory using `*RT1`.
1-254 – Timeout in minutes.
0 – Function disabled.

```
DTTMOUT=10
```

EQTEXT1	Equal Text 1	(0, 1)

If set to 1, any update of RT1 updates also DPS1 and vice versa. Does not apply to UECP control.

```
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`	Speech program
`MS=1`	Music program

PI	Program Identification	H (1000-FFFF)

Identification code of the radio station. Always contains four hexadecimal digits.

`PI=20FE`	OK
`PI=0F55`	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	(0-31)

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 etc. Car radios usually don't support this service, Dynamic PS can be used instead.

```
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***. Car radios usually don't support this service, Dynamic PS can be used instead.		
`RT2=Hello World`		

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

RT2TYPE	**Radiotext 2 Type** (obsolete, use **RTTYPE** instead)	(A, B)
This command is obsolete and its support is no longer guaranteed.		

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`	Sets the period to 10 min.	
`RTPER=0`	Sets the period to 0.5 min.	

RTTYPE	Radiotext Type	(0-2)
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. 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. Apply for example if new blank EEPROM is placed on the board or if the RDS encoder was previously used for another station.	
`INIT`	Initialize the program bank that is actually selected.

`*CC=`
`PROGRAM=2`
`INIT`
`*ALL`
`PROGRAM=1`
`INIT`
`*ALL`
`TIME=`*`HH`*`:`*`MM`*
`DATE=`*`DD`*`.`*`MM`*`.`*`YY`*
	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: Options – Special – Initialize.

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

HELP	Help
Shows all commands available.	
`HELP`	

12.3 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.		
`EON1AF=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`	

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.***		
`EON1TA=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

12.4 Messages Commands

These commands are provided for working with the bank of 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 or dynamic PS.

MSGxx	**Text Message**
Specifies the message text. Since there is a place for 99 messages in the memory, the number xx must be in range 01-99.	
`MSG01=Hello World`	

MSGxxD	**Message Destination**	**(0-3)**
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		
`MSG01D=1`		

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

12.5 Scheduling Commands

S	List of Scheduling Items
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.	
S	

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	
*S03C=RT2MSG=12	
*S04C=	Clears (disables) the command for the item 04.

SxxD	Scheduling Item Days	(1-7)
Specifies the days for which the item is valid. Monday = 1.		
*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

12.6 System Commands

COMSPD	COM Port Speed	(0-4)

Specifies the COM port speed. If changed, any valid command must be sent to the RDS encoder on the new speed otherwise the speed will be set back to its previous value during following minute. This prevents setting an incorrect speed not supported by the communication channel that can result in connection lost.
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.
The time value stored into EEPROM memory is used on next power up if no battery backup circuit is connected to the IIC bus.

`DATE=30.11.05`	30th of November 2005
`DATE`	Not implemented, use `MJD` instead.

ECHO	Terminal Echo	(0, 1)

Determines if the RDS encoder sends an echo (1) of each character or not (0), that it receives via COM 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.
Note: This command will apply only if appropriate hardware is integrated on the RDS encoder board. In other cases use the on-board trimmer for adjust the RDS signal 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

OSCDEV

This command is no longer supported.

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`

SPEED	COM Port Speed	(1200, 2400, 4800, 9600, 19200)

Specifies the COM port speed. If changed, any valid command must be sent to the RDS encoder on the new speed otherwise the speed will be set back to its previous value during following minute. This prevents setting an incorrect speed not supported by the communication channel that can result in connection lost.
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.
The time value stored into EEPROM memory is used on next power up if no battery backup circuit is connected to the IIC bus.

`TIME=16:40`
`TIME=09:24:10`

VER	Firmware Version

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

`VER`

12.7 Advanced Commands

ADR	Encoder Address	(0-255)

Assigns an address to the RDS encoder. Allows establishing a network of more RDS encoders connected to the same communication channel and controlling them independently. Up to 255 (ASCII control) or 63 (UECP control) unique addresses are possible. For large networks the number of unique addresses can be expanded using the site address (command `SITE`).
Addresses 0 and 255 are special case. Encoder with address 0 or 255 (default) is automatically active after reset for unlimited time, i.e. after power-up the addressing feature is disabled for that encoder.
Encoder with address in range 1 to 254 is not active after reset and can be controlled only if it's selected by the `SEL` command.
See chapter 13.6 and 14 for more details.

`*ADR=255`	Sets the encoder address to 255 (disables the addressing feature).
`*ADR=3`	Sets the encoder address to 3.
`ADR`	Returns (shows) the encoder address.

CC	Conditional Command

Executes specified command when specified condition occurs. Optional ELSE command supported.

Syntax:
*CC=[aa]bcc:dddddddd
*CC=ELSE:eeeeeeee
where is:
aa - memory address pointer (00-FF)
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)
dddddddd - the command executed if the condition is fulfilled
eeeeeeee - the command executed if the condition is not fulfilled (optional)

Max. command length is 31 characters. Once the command is executed, next execution is stopped until the condition fulfilment changes. In other words, the command is executed only at the condition fulfilment 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
BE: COM port timeout counter in minutes
C3: selection (SEL) 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)
E9: COM port speed (0-4)

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.*

Note: the Conditional Command execution is temporarily stopped when typing any command via the RS232.

`*CC=[BE]<08:GRPSEQ=0220XY` `*CC=ELSE:GRPSEQ=022`	Switches off the user defined groups transmission when there are no data on COM port for last 8 minutes. Useful to avoid transmitting of out-of-date information if the data link crashes for any reason.
`*CC=[CC]B03:PS=RADIO` `*CC=ELSE: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 select a text Message for the Dynamic PS 2. (If `PROGAM` is set to 0, the status bit is always 0.)

`PTYN=Football`
`*CC=[13]=04:PTYNEN=1`
`*CC=ELSE:PTYNEN=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:RT2EN=0`	Enables RT2 for the duration of traffic announcement (TA)
`*CC=[E9]!01:COMSPD=1`	Does not allow to set COM port 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=[C3]>05:SEL=254`	If address of the unit is different from 254: Decreases the selection timeout from default 20 minutes to 5 minutes. If address of the unit is equal to 254: Disables the selection timeout.
`*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`
`*CC=ELSE:`
`*CC=`
	Shows actual CC settings.
	Disables the ELSE command.
	Completely disables the Conditional Command feature.

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`		

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.
For more details about the group coding see section 15.2.
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 (+).

`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+)
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 or UECP.

`GRPSEQ=02222`	Four groups 0A followed by four groups 2A (very high Radiotext transmission rate), other services are disabled.
`GRPSEQ=`	Sets the groups sequence to default (022E1022EA022XYR).
`GRPSEQ=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

NOHDR	No Header Communication	(1)

If activated, any text incoming through the serial interface and followed by <Enter> will be automatically parsed and will appear as Radiotext 1, Dynamic PS 1 or both. Control of other RDS services is not allowed until deactivating the no header option.
To deactivate the no header communication, press the keyboard <Escape> key three times and then press <Enter>. This sequence is equivalent to *`*NOHDR=0`*, which – of course – cannot be directly inserted.
See chapter 10 for more details.

```
*NOHDR=1
```

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	(0-2)

Specifies the program bank. RDS services in selected program bank are transmitted by the RDS encoder and can be modified and stored into EEPROM memory. 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).
1 - Program 1 is selected (default)
2 - Program 2 is selected
0 - External program switch selects the program

```
PROGRAM=1
```

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.

```
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
```

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
```

>	Assign Last Value

This command is useful for ASCII terminal control. It allows to handover texts between most commands or services. See the examples below.
If the last value is empty or not available (cleared by launching a Scheduling or `CC` item), nothing will happen.
Note: This command is not recommended for automated control.

```
PS=RADIO 88      Sets the 'RADIO 88' program service name
>TPS            and uses the same name also for Traffic PS

MSG01           Shows the Message 01 text
>*MSG02         and copies it to Message 02

DPS1            Shows the Dynamic PS 1 text
>RT2            and copies it to Radiotext 2
```

SEL	Select Encoder	(0-255[,0-254]), ALL

Selects encoder(s) with specified encoder address and optional site address.
Only selected encoders can accept ASCII commands. Other encoders listening on the same channel are unselected immediately.
Note: Encoder addresses 0 and 255 are special case. Encoder with address 0 or 255 (default) is automatically active after reset for unlimited time, i.e. the addressing feature is disabled for that encoder and thus no selection is required.
For encoder address range 1 to 254 the unit is selected for 20 minutes (selection timeout) or until another encoder is selected.
If the optional site address is not specified, it is expected to be 0.
Address 0 is a "global" address, i.e. selecting an address 0 works as a 'wild card' and it selects encoders with any address. See chapter 13.6 for more details.
Note: This command has no effect on UECP reception which uses individual method of selection included in each record.

`SEL=0,0`
`SEL=0`
`SEL=ALL`
	Selects **all** encoders that are listening on the communication channel (or also an encoder with unknown address).
	Notes: These three entries are equivalent, all use a 'wild card'. Due to safety reasons user is not allowed to change encoder address or site address if the encoder has been selected using the wild card.

`SEL=3`	Selects encoders with address 3 on all sites
`SEL=3,0`	Selects encoders with address 3 on all sites (the same as above)
`SEL=3,25`	Selects encoder with address 3 on site 25
`SEL=0,25`	Selects all encoders on site 25
`SEL=ALL`	Using a wild card for encoder selection...
`*ADR=4`	Forbidden! You cannot change the encoder address if a wild card has been used.
`SEL=3,25`	Using exact address values...
`*ADR=4`	OK, encoder address changed from 3 to 4.

SITE	Site Address	(0-254)

Assigns a site address to the RDS encoder. Useful for large networks.
A site address of 0 means that the encoder will accept the ASCII communication only if site address is 0 (or not specified) in the selection (command `SEL`).
See chapter 13.6 and 14 for more details.

```
*SITE=25
```

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. For more details about the group coding see section 15.2.
When entering new group(s), previous groups are removed from the UDG1 buffer.

`UDG1=80001A961C97`	Sets TMC group 8A containing 00 1A96 1C97
`UDG1=`	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. For more details about the group coding see section 15.2.
When entering new group(s), previous groups are removed from the UDG2 buffer.

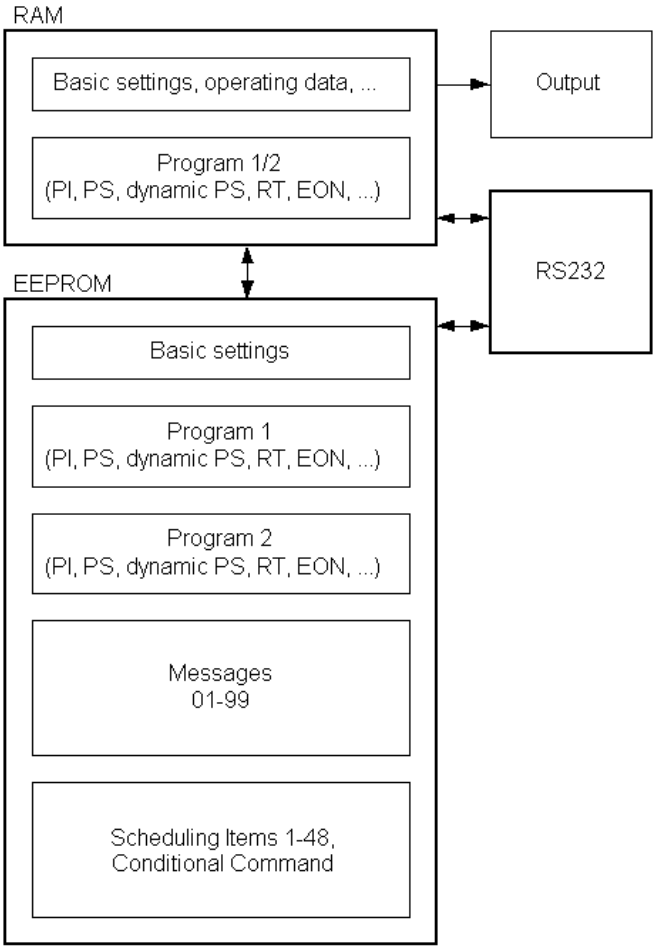
`UDG2=380215D1A531,38058DB3B61E`	Sets two UDG2 groups
`UDG2=`	Clears the UDG2 groups

UECP	UECP Enable	(0, 1)

Enables (1) or disables (0) the UECP support. ASCII commands are accepted regardless of this value.
Disabled by default.

```
UECP=1
```

12.8 Memory Organization



12.9 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

13 Further Features

13.1 LED Indication

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

	LED 1	LED 2	Status
Start-up	off	**on**	Initialization
	on	off	Firmware update in progress
Operation	· · · · · (1 sec.)		Normal operation, unit selected
	· · · (2 sec.)		Normal operation, unit unselected or no header communication is active
	- - - - - (1 sec.)		An error occurred, unit selected
	- - - (2 sec.)		An error occurred, unit unselected
	on		Receiving data from RS-232
		on	External pilot synchronization is active
		off	Internal clock source is selected
		- - - - -	Stereo encoder error - pilot tone present but does not meet the specification required (chapter 2). Switch the RDS encoder to internal clock source.

13.2 External Program Switch

External program switch input allows you to select one of two program banks available by an external device. This device can be a simple switch or a device with digital output. The `PROGRAM` parameter must be set to 0 to enable this feature. The program input is level controlled, the switch shut-off or logical 1 selects the Program 1, the switch closure or logical 0 selects the Program 2.
Alternatively the switch input can be used for selecting a text message or for control of other RDS service or setting. For more details see chapter 12.7 - Conditional Command.

Please note that this feature is not usually brought out from the RDS Generator board and its implementation depends on the actual equipment which incorporates the RDS Generator board.

13.3 External TA/EON1TA Switch

External TA/EON1TA switch input allows you to control the Traffic Announcement parameter by an external device. This device can be a simple switch or a device with digital output. The TA input is level or edge activated, as specified by the `TATMOUT` command.

- If level controlled, the switch closure or logic 0 activates the TA (sets to 1). The switch shut-off or logic 1 deactivates the TA (sets to 0).
- If edge activated, a falling edge (logic 1 to logic 0 transition) activates the TA. Then the TA is deactivated after the duration specified by the `TATMOUT` command. Optionally a rising edge may deactivate the TA if occurs first.

The `TATMOUT` command doesn't affect the EON1TA switching. If EON1TA is controlled using the external switch, the control is always based on the level.

The switch function table:

TP (local)	EON1 Enabled	Switch function
1	don't care	TA
0	1	EON1TA
0	0	Switch disabled

Like before this feature is not always brought out from the RDS Generator board and its implementation depends on the actual equipment which incorporates the RDS Generator board.

13.4 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.

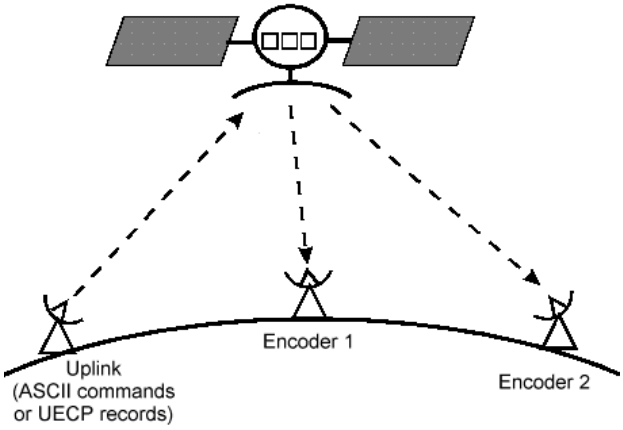
13.5 Addressing

13.5.1 Why use addressing?

If only one RDS encoder unit is connected to the RS-232, USB or Ethernet port, there is no need to use the addressing feature and you should simply ignore it.
If more encoders are connected to one communication channel and the user needs to control the encoders independently, then the addressing feature is very useful. You can communicate only with selected encoder(s). A good example of this application is remote control via satellite when one satellite uplink is used to distribute RDS control commands to many transmitter sites and each transmitter may then carry different RDS data.

13.5.2 Establishing a simple network of RDS encoders

Let's assume the simplest network possible with only two encoders. For addressing in that network we can use the encoder address only and leave the site address set to 0.



1. Set the encoder's addresses before final installation:

   Encoder 1: `*ADR=1` and `*SITE=0`
   Encoder 2: `*ADR=2` and `*SITE=0`

2. Install the encoders on the remote site.

3. The uplink communication may look like this (setting common PI but different PS):

   ASCII control:
   ```
   SEL=0
   PI=26F8
   SEL=1
   PS=ENCODER1
   SEL=2
   PS=ENCODER2
   ```

   UECP control:
   ```
   FE 00 00 00 05 01 00 00 26 F8 CC 8A FF
   FE 00 01 00 0B 02 00 00 45 4E 43 4F 44 45 52 31 E9 2D FF
   FE 00 02 00 0B 02 00 00 45 4E 43 4F 44 45 52 32 54 ED FF
   ```

13.6 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.

13.7 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.

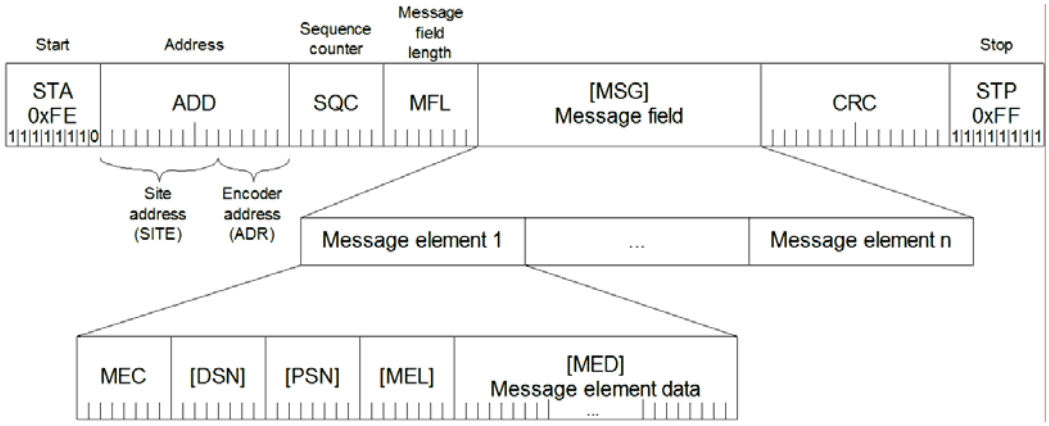
14 Universal Encoder Communication Protocol (UECP)

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 must be considered as a complementary method of the RDS encoder control. Its implementation in the RDE19 is only partial. It should provide a possibility of basic RDS services control for the UECP based systems whereas other services have been set in advance using the way described on previous pages.

14.1.1 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.
3. Find out and set the right baudrate (speed). For example `SPEED=9600` and `*SPEED`.
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.

14.1.2 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).

14.1.3 UECP addressing

The address field comprises two elements, these are:

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

For a message to be acceptable to a particular encoder both the site address and the encoder address must match the respective address of the RDS encoder. Additional exceptions apply:

If the Site address in the UECP record is set to 0, any Site will accept that record. If the Encoder address in the UECP record is set to 0, any Encoder on the site will accept that record.

If the Site address (`SITE`) of the RDS encoder is set to 0, UECP records with any Site address will be accepted. If the Encoder address (`ADR`) of the RDS encoder is set to 0 or 255, UECP records with any Encoder address will be accepted.
Thus an encoder with Encoder address set to 0 or 255 and Site address set to 0 will accept **all** UECP frames.

The UECP addressing work independently of the ASCII commands addressing, e.g. it's not important for the UECP record processing if the RDS encoder is selected or not (command `SEL`).

14.1.4 The UECP implementation in the RDE19, its characteristics and limitations

MEC	Meaning	Notes
01	PI	
02	PS	
03	TA/TP	
04	DI/PTYI	
05	MS	
07	PTY	
0A	RT	1
0D	Real time clock	
13	AF	2
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

Field	Handling
ADD	Site address 0-255, Encoder address 0-63, note 7.
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.
DSN, PSN	Ignored
CRC	If CRC does not match, the UECP frame is considered as corrupted and it's discarded.

Notes:

1) Text transferred to RT1. Control bits 1 to 7 are ignored.
2) Start location ignored.
3) Buffer size 4 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.
   Important: If using any of the MEC 24, 30, 40 or 42, the space for ASCII command `UDG2` is automatically limited to max. 3 groups.
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's recommended not to insert more than one Message element inside each Message field to maintain general compatibility.
9) The RDS encoder address list can contain only two items for the Site address and two items for the Encoder address. One of these items is always set to 0, the second can be set using the commands `*SITE=` and `*ADR=`.

The UECP communication is always unidirectional. There are no responses sent to the UECP records.

When the UECP is enabled, the RDS encoder accepts any mixture of ASCII commands and UECP records on the same communication port.

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 260 characters
- COM 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.

14.2 Traffic Message Channel (TMC) Application Notes

14.2.1 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).

14.2.2 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 baudrate. Configure the RDS encoder and TMC data provider baudrate.
4. Configure the Site and Address values.

14.2.3 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
...			

Notes:

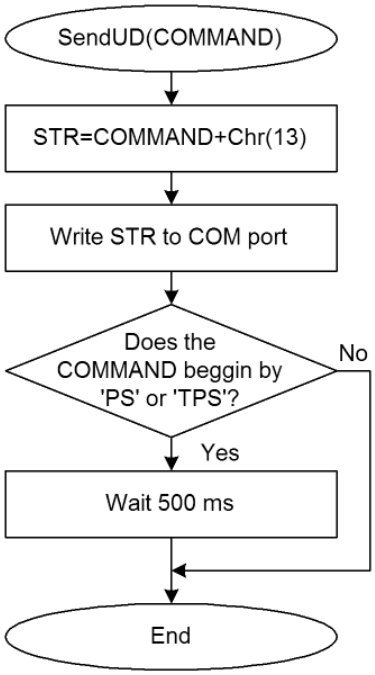
1) Any group inserted using the UECP elements 24, 30, 40 or 42 is not affected by the Group sequence. Instead of this the group is put in the UECP FIFO buffer and transmitted as soon as possible. Thus the TMC data providing application has full control over the TMC transmission.

15 Annexes

15.1 Communication Protocol Implementation Flowcharts

Following flowcharts allow the developer to implement the RDE19 ASCII protocol to any application easily.

15.1.1 Unidirectional Communication



Note: This flowchart applies to firmware versions 1.4a and later. Older firmware versions require additional delay behind all commands if two or more commands are sent in one sequence. This delay duration should be at least 50 ms. If the application doesn't include this additional delay, it should inform the user that firmware version 1.4a or later is recommended. The firmware upgrade utility is free for download from the website.
The bidirectional communication flowcharts apply to all firmware versions.

Send command basic flowchart (unidirectional communication).

15.1.2 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=Chr(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
```

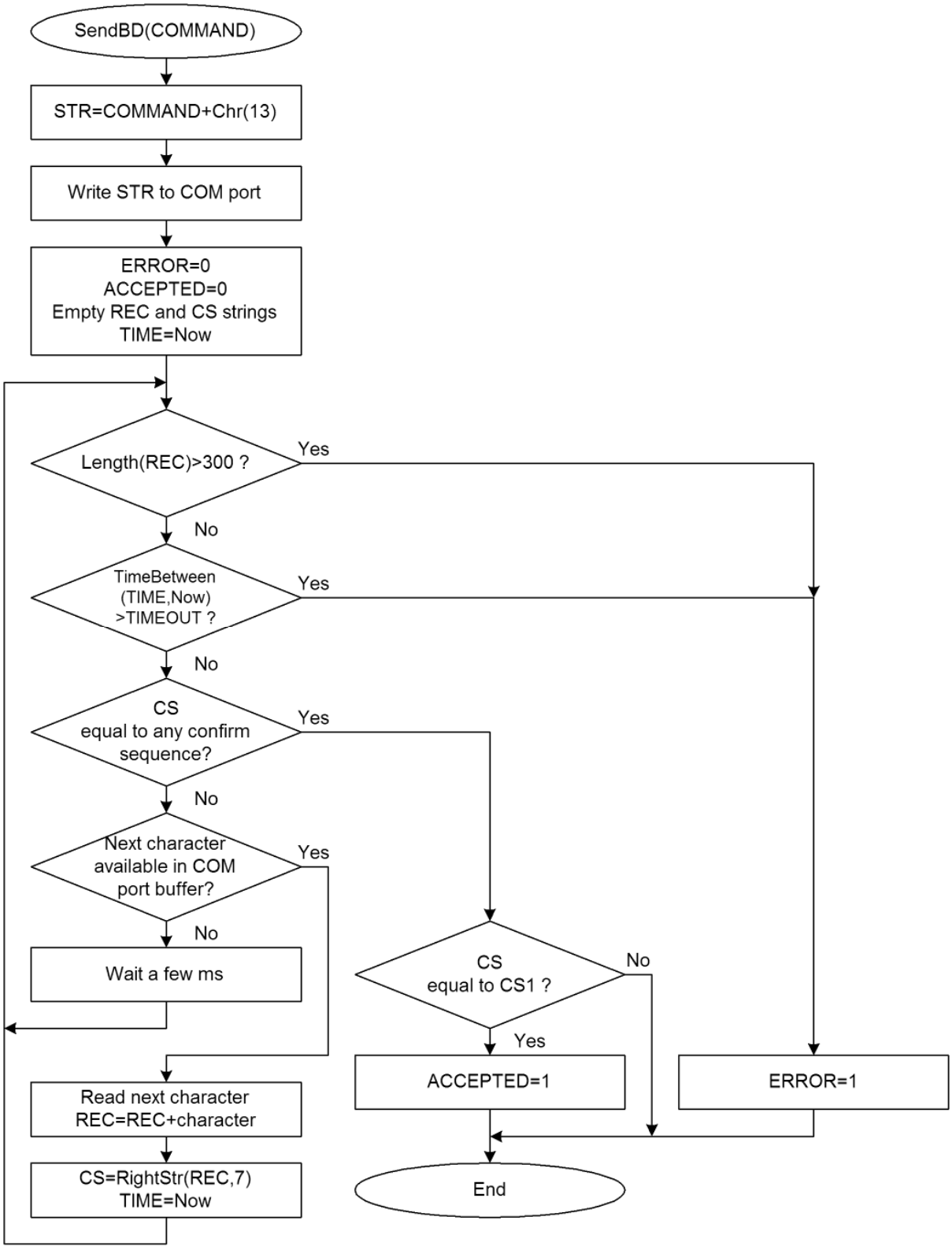
Other values:

```
TIMEOUT: COM port timeout, usually ≥400 milliseconds
```

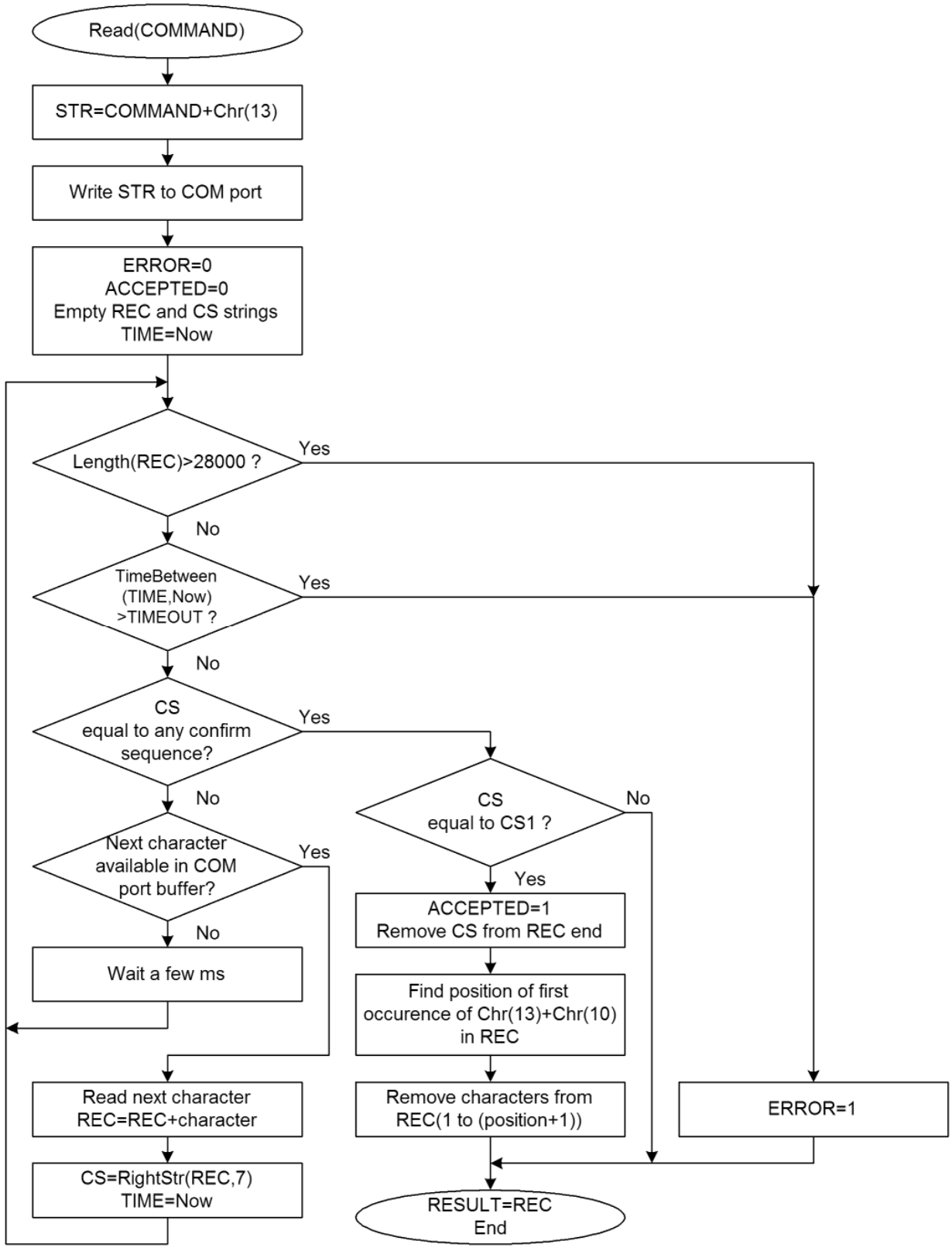
Calling examples:

```
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).



Read value flowchart.

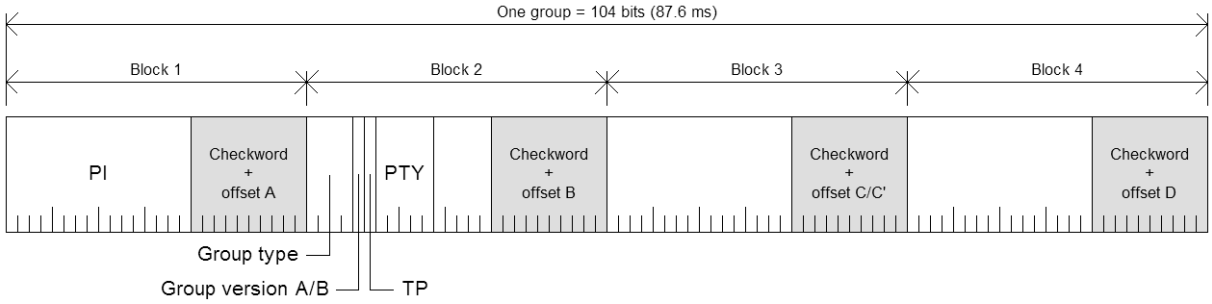
15.2 RDS Group Format

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.

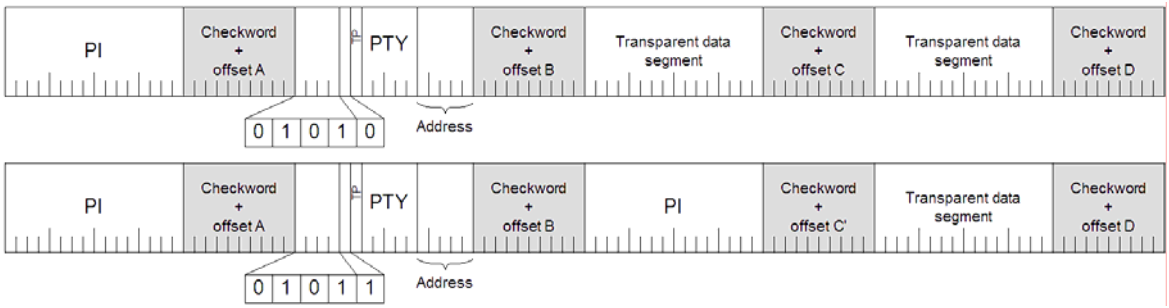
15.2.1 Basic principles and rules

- 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.

15.2.2 Remarks

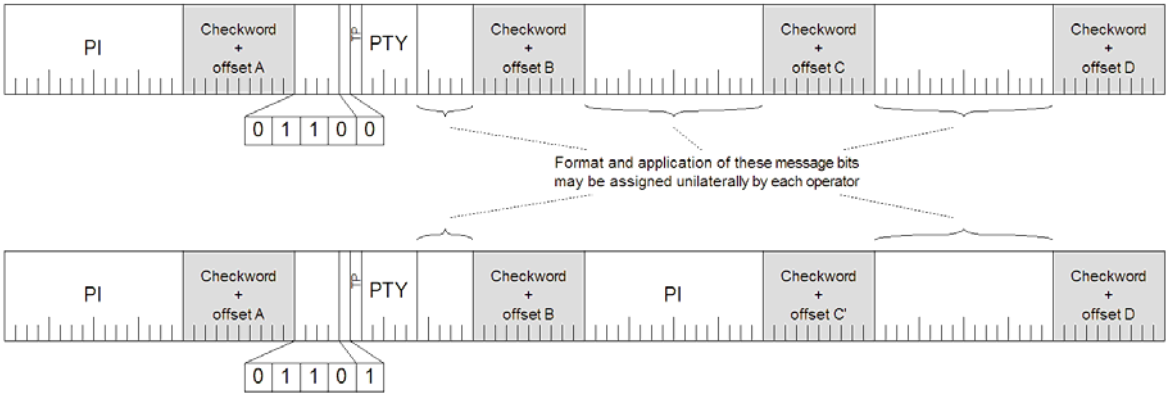
- One complete PS label consists of 4 groups. So one PS takes 350 ms of the transmission time. It may be found from experience that any RDS text should be transmitted at least twice to improve reception reliability. With regard to other services included in the RDS the repetition rate of dynamic/scrolling PS usually cannot be lower than one second.
- Checkwords and offsets are always computed 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.

15.2.3 TDC group coding (5A, 5B)



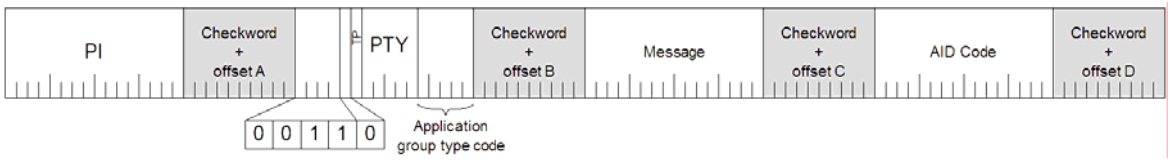
Group format in hexadecimal representation (version A): `50BBCCCCDDDD`,
group format in hexadecimal representation (version B): `58BB0000DDDD`,
where BB, CCCC and DDDD represent the contents of the block 2 (bits 4 to 0), block 3 and block 4.

15.2.4 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.

15.2.5 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.

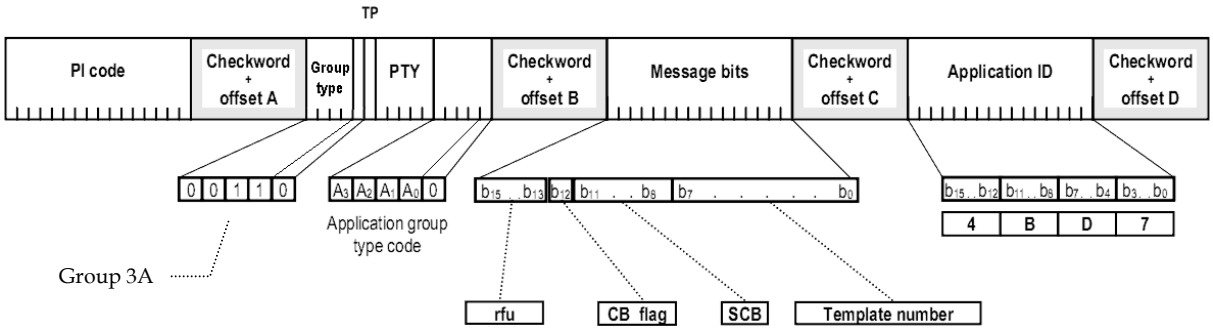
Since the 3A groups usually carry fixed static content, they may be inserted using either the `UDG1=` or `UDG2=` command for automatic cyclic transmission while the ODA application groups may be inserted by any command or method (`G=`, `UDG1=`, `UDG2=` or UECP MEC 24 or 42).

15.2.6 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`

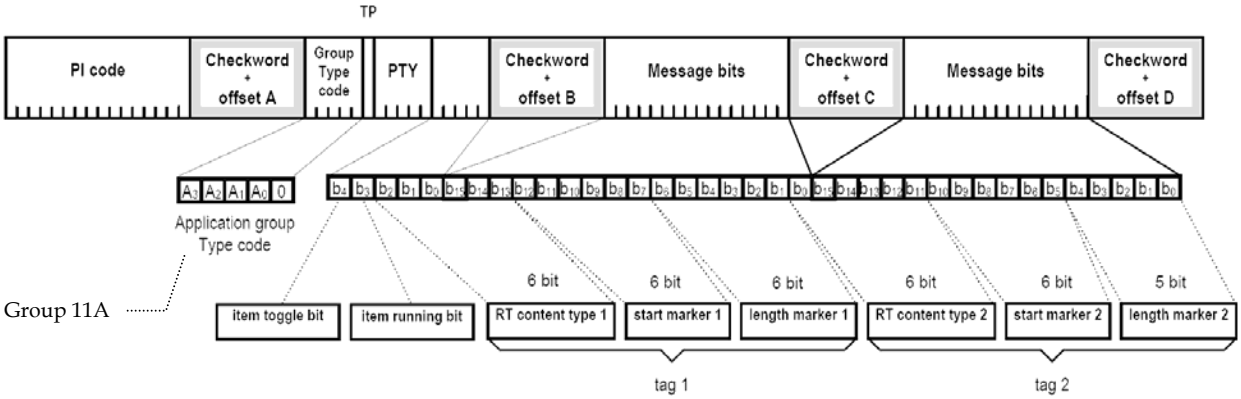
Appropriate 3A and 11A groups have following structure and coding:



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 (see section 12.7).

15.3 Troubleshooting

The RDS encoder has been designed to make its use as easy and painless as possible. However, success depends upon a number of settings and things working together correctly. While correcting problems is usually quite simple, the difficulty lays in knowing where to look.

Factory default settings assure right operation after first power-on. This section of the manual is designed to assist you in determining the cause of problems that may occur so they can be fixed quickly.

<table>
<tr><th rowspan="2">Problem</th><th rowspan="2">Section related</th><th colspan="2">Solution / Check</th></tr>
<tr><th>Windows control software</th><th>Terminal</th></tr>
<tr><td>No RDS output, no LED indication.</td><td>5.3</td><td colspan="2">Power supply problem.</td></tr>
<tr><td rowspan="2">No RDS output, LED indicates operation.</td><td rowspan="2">5.1
5.4.1
13.2</td><td colspan="2">RDS output connected to right input of the transmitter?
Adjust higher RDS level or higher input sensitivity on the transmitter.
RDS generator switched on?</td></tr>
<tr><td>Options – Special – Switch on RDS</td><td>RDSGEN=1</td></tr>
<tr><td rowspan="3">The unit does not communicate with PC and the LED on board does not indicate data receive. *)</td><td rowspan="3">5.5.7
11.1
13.2</td><td colspan="2">Make sure all connectors are seated completely and where possible, use screws to fix the connection.
Make sure you have selected right COM port.</td></tr>
<tr><td>Options – Preferences – List...</td><td></td></tr>
<tr><td colspan="2">Try the unit with different cable and different PC.</td></tr>
<tr><td rowspan="2">The unit does not communicate with PC but the LED indicates that data are received. *)

* Try after disabling the bidirectional mode in Preferences and clicking on any Send button or using Hyperterminal and typing a series of <Enter>.</td><td rowspan="2">10.2.4
11.2
12.6
12.7
13.2</td><td colspan="2">• Baudrate differs from the unit configuration.
• Addressing is enabled and the unit is unselected.
• No header communication is active.</td></tr>
<tr><td>Enable Bidirectional and Autodetect port speed options (Options – Preferences)
Options – Special – Assign unit address – Disable, override
Options – Special – No Header mode – Switch off</td><td>Try on each baudrate:
SEL=ALL
<ESC><ESC><ESC><Enter></td></tr>
<tr><td rowspan="2">Radiotext stopped working although I'm sure that it's enabled and entered correctly.</td><td rowspan="2">12.7</td><td colspan="2">The RT service is not included in the Group sequence. This may occur also after firmware update to version 1.5b. The Group sequence is a new feature that needs to be initialized.</td></tr>
<tr><td>Options – Special – Group sequence – Default, Store.</td><td>GRPSEQ=</td></tr>
<tr><td>Pilot tone is fed to the unit but it is not indicated.</td><td>5.1
5.4.3</td><td>System sheet – Clock Source: Auto, Store</td><td>EXTSYNC=1</td></tr>
<tr><td>The unit loses time and date after power off.</td><td>4.1
4.2</td><td colspan="2">Replace the on-board battery.</td></tr>
<tr><td>The audio is distorted.
There is a whistling in the audio.</td><td>5.1
5.2
5.4.1</td><td colspan="2">• The RDS level considerably exceeds maximum value allowed. Adjust lower RDS level. Use an FM analyzer for the best result.
• Applied input of the transmitter is not suitable for RDS. Follow the transmitter documentation.</td></tr>
<tr><td>No audio on air</td><td>5.1
5.2</td><td colspan="2">Applied input of the transmitter is not suitable for MPX. Follow the transmitter documentation.</td></tr>
</table>