RDS PRO-1 RDS / RBDS Encoder

Technical Manual

Issue 4.4 - October 2012

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1./ Contents

2./ Introduction

The RDS PRO-1 RDS encoder is a result of more than 9 years of RDS design experience and meets requirements of most national, regional, local, RSL, LPFM and other radio stations.

Fully digital concept and uniquely effective design ensures high reliability, excellent signal characteristics and gives the user many advanced features while maintaining an attractive price point and simple, intuitive operation!

2.1. Main highlights

- Fully dynamic stand-alone RDS / RBDS encoder
- RS-232 and USB control interface based on a set of simple ASCII commands
- Control software includes powerful Windows GUI application and HTML based system
- Amazing text features
- Advanced weekly scheduling
- Fast, easy set-up
- ***NEW**: UECP support enables dynamic Traffic (TMC) and Tagging (RT+) applications*
- ***NEW**: AF Method B for networks with split content now fully supported*

2.2. Other features

- Excellent spectral purity, direct digital RDS signal synthesis at sampling rate of 361 kHz (oversampled); tested for broadcast standards compliance
- Firmware updates are free
- Addressing feature - independent or common control of up to 255 units in a network
- Bypass relay (switchable), high reliability
- External TA and Program switch
- Switchable MPX loopthrough mode
- Internal real-time clock including backup battery - *accurately calibrated at factory!*
- No special 19 kHz input needed - pilot tone carefully recovered from MPX signal
- Digital 57 kHz phase locked loop - rock stable RDS subcarrier in all cases.
- PLL bandwidth software-selectable 5Hz (default) or 2Hz
- 'Show real time as PS' option

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

This equipment has been thoroughly tested before despatch. 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.

Revision 2012-10-30

3./ Physical Description

3.1. General Arrangement – Front Panel

RDS / RBDS level controlled by recessed screwdriver adjustment

USB port can be optionally locked out by setting a DIP switch on the Rear panel.

3.2. General Arrangement – Rear Panel

MPX Connections	BNC (50 Ohm type)
MPX modes supported:	19kHz input – RDS output MPX sample input – RDS Output Loop-through MPX (power off) Loop-through MPX and add RDS Loop-through MPX, add RDS, bypass if AC power fails
RS-232 port - Serial mode:	Standard DB-9 Female connector Standard serial port uni- or bi-directional 1200, 2400, 4800, 9600, or 19200 bps (factory setting 9600)
RS-232 port - GPI mode :	Pin 1 can be pulled low to activate RDS TA flag Activate by GPI (closing contact or open collector etc). Pin 9 can be pulled low to activate Program Bank 2.

N.B: RS-232 port can support both modes simultaneously with suitably wired 'D' connector.

DIP Switches:	1.Sample & Generate mode (off) or Loop-through mode (on) 2.Bypass Relay disabled (off) or active (on) 3.USB Enable (USB can override RS232 & IP when plugged in) 4.Not used in this model, leave set to OFF.
Power supply:	The RDS encoder uses a wide-range universal input AC power supply designed for 110VAC and 230VAC nominal systems. There is no need to adjust the power supply.

4./ RDS PRO-1 Quick Setup Guide

4.1. Basic RDS Data – what it's called, what it does, etc

If you already know what your PI code, PS name, PTY code, Radio Text, AF, TP/TA flag etc are and what they do, skip to section 4.2.

Before setting up the RDS-Pro RDS encoder, you will need to decide on the settings to be used. The absolute minimum settings required are the PI code and PS name.

PI Code
The PI code is the serial number for the radio station. Getting this wrong can cause a lot of inconvenience for listeners if it has to be changed later. It must be unique, such that no other station in the country has the same code. PI codes may be allocated by the licensing authorities or broadcaster's trade association. In many countries however, there is no formal system for allocating the codes, so stations must choose their own. The PI code consists of 4 hexadecimal characters. The first of which defines the country. See the end of this document for a list of country codes.

The second digit can have the following values:

0	For a local service with only one transmitter
1	An international service available in different countries
2	A national service available throughout the country
3	A regional service available over a large part of the country.
4-F	Local radio services

The 3rd and 4th digits should be unique to the station and can be any hexadecimal numbers.

N.B: IMPORTANT - See the note about Generically linked PI Codes in Annex 4 - page 65

PS Name
The PS Name is the 8 character radio station name that will be shown on the radio display. The 8 characters can be upper or lower case and should be an ASCII character. Spaces count as characters. Dynamic (scrolling names) is discussed later. NB some radios display the PS Name as all uppercase characters even if you programme some lowercase or mixed.

PTY Code
The PTY code defines the type of programmes broadcast. It is a number between 0 and 31. See the end of this document for a list of the codes.

Radio Text
Radio Text is a 64 character message that can be displayed on most home receivers, although often not on car radios. It is typically used to show the name of a song or just a promotional message about the station. The 64 characters should be ASCII and spaces count as characters. You can store many Radio Text messages in the RDS PRO-1 and schedule them without having to leave a computer permanently connected. See later in the manual.

AF
The Alternate Frequencies are used to tell receivers what frequencies they can receive the radio station on. This is most useful for car 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.

4.1. RDS Data (continued)

TP/TA
Travel Programme is used to show that the radio station carries traffic information. This is used by some car radios when searching for radio stations. Traffic Announcement shows that a traffic information bulletin is being broadcast right now. It is used to pause a CD, cassette or other source. N.B: TA should never be left on all the time.

CT
Clock Time is used to transmit the time and date. If it is enabled, the clock on the RDS-Pro must be checked and adjusted regularly, especially when Summertime/Daylight saving changes state. With firmware version 1.5 and above, the RDS clock is regularly synchronised with the battery-backed RTC and checking once every one or two months should be sufficient.

4.2. Programming using the RDS PRO GUI application

There are two ways to programme the RDS-Pro. The best way for the inexperienced is to use the Windows RDS-PRO-1 GUI programme. For more experienced users, or those without a Windows PC, a terminal programme (such as Hyperterminal) can be used (see section 4.3).

Note that if you already have Audessence software for ALPS or PodBlaster installed on your PC, you can skip the following step (installing USB drivers for FT243 UART and Virtual Com Port), as they will have already been installed to your PC for the other product.

If using USB you will need to install drivers for the USB. The driver files are included on the product CD in the 'USB' directory. Power up the RDS PRO-1 and plug the USB into your PC. If the drivers are not already present on the PC, Windows will display the 'Found New Hardware' dialog. Follow the steps in this dialog to install the drivers, either automatically off the internet (if an internet connection is available), or from the product CD.

RDS-PRO GUI is a standard Windows (9x, ME, 2000 , XP, Vista and 7) application. It does not need to be installed, just copy the RDSPRO-1.EXE file from the CD to a convenient location on your hard drive, and run it.

Note: if you minimise the GUI, it goes to the task tray (at the bottom of the screen and over on the right) not to the main taskbar.

When running the GUI for the first time, or if your connections have changed, **select the required COM port in the Options/Preferences dialogue box.** If it is a USB connection, then there will be a virtual COM port for that. Do not change any other settings in this dialogue box yet. Click the Close button.

N.B: If USB connection is to be used, check that the USB Enable switch on the RDS-Pro rear panel is set to ON. (Otherwise set it to OFF, which locks out the front panel USB port).

You can check if the connection is working by pressing the big 'Read' button near the bottom of the GUI. Observe the status bar at the bottom left of the GUI. You should see 'Reading data' briefly displayed here if the connection is OK. Otherwise you will see some speed options being tried, then 'Communication Error!' in the status bar.

N.B: Overwhelmingly the most common reason for communications not working is simply incorrect selection of serial port! In the absence of a valid COM port, the GUI defaults to 'demo' mode, which appears to work but is not communicating with the hardware. Check the COM status in the bottom right corner of the GUI – does it show 'COM x opened' or 'Not Connected'?

You could use Windows 'Control Panel' to determine the COM port number. Look in Windows 'Control Panel' \ 'System' \ 'Hardware' [tab] \ 'Device Manager' \ 'Ports (COM & LPT)'. Alternatively, there is a button in the RDS PRO GUI that takes you directly to Device Manager: go to Options \ Preferences \ General [tab], there is a section here called 'RS-232 Port', under the drop-down list of COM ports is the button, labelled 'List…'.

Physical RS-232 ports should be listed here along with their COM numbers. If using USB, look at 'Ports' with the USB disconnected, close Device Manager, connect USB between your PC and your RDS PRO-1, and then open 'Device Manager' \ 'Ports (COM & LPT)' again. You should now see an entry for 'USB Serial Port' that was not there before, along with the COM port number for it.

N.B: If the connection to the encoder still appears not to work, make sure UECP addressing is turned off - see Page 24 for more details.

4.3. Programming using the RDS PRO GUI application - Help Wizard

If you look in the 'HELP' menu, you will find a 'Basic RDS Settings Wizard' that can guide you through the basic setup of your RDS PRO-1.

4.4. Programming using the RDS PRO GUI application without using the Wizard

There are a number of tabs in the main RDS-PRO GUI RDS window, starting with Program.

In the PI box, set the 4 character hexadecimal PI code.

In the Default PS and Traffic PS boxes set the 8-character station name.

Choose Program Type from the drop down list.

If traffic announcements are to be broadcast, set the check mark next to Traffic Program.

Click the Send button. The status bar at the bottom of the GUI window shows whether the data was sent successfully. If Communication Error! Is shown, check the connection to the RDS-Pro, the power to the RDS-Pro and that the correct COM port is selected in the GUI 'Preferences' dialogue box.

Click 'Store' to save the settings into the RDS-Pro's permanent memory:

Note: The RDS encoder contains two types of memory. These work as RAM and EEPROM. Like any other computing system the RAM holds all temporary operational data, which is also used for transmission moment by moment, whilst EEPROM is used for data storage during power-off. By default the 'Send' button sends to RAM only. The 'Store' button fills the RAM and also copies the data into EEPROM. (The default Store button behaviour can be changed in Options\Preferences\Buttons). If the user forgets to **'Store'** the data into EEPROM, those settings will be lost when the power is disconnected!

Now select the Radiotext tab. Type your 64 character Message in the Radiotext 1 box. Make sure Radiotext 1 Type is set to Type A. Click 'Send' then 'Store'.

Now select the System tab. Click the Set now button to set the RDS-Pro clock to the time on the PC. Select Enable CT if you want to broadcast the time. Select Summertime if your time zone has summer/daylight saving time now.

Under the Decoder Information heading, select Stereo if your transmission is stereo.

In the Alternative Frequency section, build your list of transmitter frequencies.

Click 'Send' then 'Store'.

Finally save the information on your PC as a backup, using File/Save.

As a **final check**; shut down the GUI, disconnect USB cable (if any), and power down the RDS PRO-1. Wait 10 seconds, re-establish power and USB, re-start GUI, **then click on 'Read All'** on the toolbar and check all of the settings on the Program, Radiotext and System tabs are all correct. This guarantees that you 'Stored' everything correctly!

Your RDS-Pro is now setup with the basic information it needs to operate.

4.5. Programming using a terminal programme (e.g. HyperTerminal)

N.B: This is for the experienced user - if you are unsure, go back to section 4.2 about GUI control, which is an easier mode to use.

NB: IF THE CONNECTION TO THE ENCODER APPEARS NOT TO WORK, MAKE SURE UECP ADDRESSING IS TURNED OFF! [See Page 24 for more details].

In the terminal programme, select whichever COM port is connected to the RDS-Pro. If it is a USB connection, then there will be a virtual COM port for that. Also check that the USB Enable switch is set to ON on the RDS-Pro rear panel if USB is to be used. Otherwise set it to OFF.

The default port settings are 9600, 8N1 with no flow control.

Press ENTER(▫), then HELP▫ The RDS-Pro should respond with a list of commands. When anything is entered, the RDS-Pro responds with + if it is accepted or ! If there is an error.

PI=xxxx▫	Sets the PI code to xxxx where xxxx is the hex PI code
PS=xxxxxxxx▫	Sets the PS to xxxxxx where xxxxxxxx is the 8 character name
PTY=xx▫	Sets the PTY to xx where xx is the PTY from 0 to 31
RT1=y▫	Sets the Radio Text to y, where y is a 64 character message
AFCH=xx,yy,zz...▫	Sets the alternative frequency list. Values are in hexadecimal format.
	87.6MHz=01, 87.7=02, 93.4=3B etc.
TP=x	Sets the TP flag to x where x is 0 or 1
TA=x	Sets the TA flag to x where x is 0 or 1
TIME=xx:yy▫	Sets the time to xx hours and yy minutes (24 hour clock)
DATE=dd.mm.yy▫	Sets the date to dd day of mm month of yy year
CT=x▫	Enables time broadcast if x is 1 or disables if x is 0
MS=x▫	Sets the Music flag to music if x is 1 or speech if x is 0
DI=x▫	Sets the transmission to stereo if x is 1 or mono if x is 0
***ALL▫**	***Saves all settings to EEPROM. Very important! If you forget to do this, your settings will be lost when the power is disconnected.***

4.6. Connecting to the transmitter

Before connecting the RDS-Pro, turn the front panel level control to minimum (fully counter clockwise). This control is a multi-turn type and will require several turns to get to minimum.

There are two ways to connect the RDS encoder to a transmitter. The best is to connect it to a dedicated RDS or SCA input on the transmitter or audio processor/stereo encoder. In this case the input of the RDS encoder will require a pilot reference (which could be either a 19kHz Sync signal, or complete the multiplex/composite signal) if the transmission is stereo. Also in this case, the rear panel DIP switches 1 & 2 should be set to OFF/up.

If the transmitter does not have a dedicated SCA/RDS input, then the RDS-Pro must be connected into the multiplex/composite input of the transmitter - between the audio processor/stereo encoder and the transmitter input. Some transmitters have an external multiplex/composite loop which can be used. In this case, the RDS-Pro rear panel DIP switches 1 & 2 should be set to ON/down for 'Loop-through' mode.

4.7. Setting the RDS level

The best way to set the RDS level is with an oscilloscope. If that is not available, then an RDS test set is the next best option. Failing that a modulation meter or the transmitters own deviation meter (… neither of these likely to be very accurate).

RDS is a highly robust system and does not need more than about 2kHz (2.7%) deviation, except where special services (ODA, TMC etc.) are used. The easiest way to set this is to adjust the peak level on an oscilloscope to be 1/3rd that of the 19kHz pilot, assuming stereo transmission. The pilot will normally be 6.75kHz (9%). Switching the stereo pilot and RDS off alternately will make this easy. The same approach can be used with a modulation meter, but it may be difficult to accurately measure the RDS level.

The RDS-Pro should now be operating and producing the basic RDS features. For many situations, this will be adequate.

4.8. LED Indications

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

	'Data'	**'Pilot'**	**Status indicated**
Start-up	off	**on**	Booting
	on	off	Firmware update is in progress
Operation	· · · · · (1 sec.)	x	Normal operation; unit selected
	· · · (2 sec.)	x	Normal operation; unit unselected, or no-header mode is active
	- - - - - (1 sec.)	x	An error occurred, unit selected
	- - - (2 sec.)	x	An error occurred, unit unselected
	on	x	Receiving data from RS-232
	x	**on**	RDS carrier locked to ext input
	x	off	No pilot at sync input, or encoder is set to local sync only
		- - - - -	Pilot present at sync input but encoder can't lock, 19k out of spec?

4.9. Advanced setup

The RDS-Pro has many advanced features, such as EON, dynamic radio text with many stored messages etc. These are detailed later in the manual.

In some situations, it may be desirable to set the RDS sub-carrier phase. Particularly for classical music stations or where higher than normal RDS level is used. This is described later in the manual. N.B: The phase setting is relative, a nominal setting of around 100-120 degrees is usual for 90 degrees (quadrature) actual result.

4.10. Rear Panel 'D' Connector pin-outs

A combination of RS-232 and GPI operation can be carried out through the 9-pin D connector as shown below.

For direct connection to a PC, use a 'straight-through' 9-pin Male to 9-pin Female serial cable (pin 1 to pin 1, pin 2 to pin 2, pin 3 to pin 3, etc) – ***NOT*** a 'null modem' serial cable.

'PC Control' Connector pin-outs (9-pin 'D' / 'D-sub' connector)	
PIN	**FUNCTION**
1	GPI 'TA Now' (pull low to activate)*
2	RS-232 OUT
3	RS-232 IN
4	n/c
5	GND
6	n/c
7	n/c
8	n/c
9	GPI 'Select Programme [Bank 2]' (pull low to activate)

* NB: For most configurations (**i.e. those <u>not</u> involving EON**) TP flag must be set to 1 for the TA flag to work!

4.11. Rear Panel 'DIP' switch details

DIP switch functions are as shown in the table below:

DIP-switch Functions			
DIP-switch #	**FUNCTION**	**OFF / UP**	**ON / DOWN**
1	MPX Loop-through mode	No loop-through	Loop-through ON(*)
2	MPX Loop relay bypass	No Bypass	Bypass (loop) if AC power fails
3	USB enable	Front panel USB port is inoperative	Front panel USB port overrides RS-232 if / when USB is plugged in
4	Not used	Leave set to OFF	***!NO!***

(*) In this mode, any signal applied to the encoder's "19k sync/MPX IN" port will appear at the encoder's "RDS OUT" port, with the RDS signal mixed in.

5./ Technical Specifications

Parameter	Condition	Value
5.1. General		
Supply voltage	230V AC nom	Wide range input AC power supply (CE RoHS)
	110V AC nom	[supply rated 85 – 264 V AC maximum range]
Supply current	32mA typ	At 230V (7.4VA)
Signal connectors		unbalanced BNC
Data connector		RS-232 (9 pins female), bi-directional
Communication speed		software switchable 1200 - 19200 bps, 9600bps factory default setting
Communication mode		1 stop bit, 8 data bits, no parity, (no flow control)
TA switching		Software or external contact
TA/EON1TA input		TTL with 10 kOhm pull-up, level or edge activated
Program [Bank] switching		software or external switch
Program [Bank] input		TTL with 10 kOhm pull-up, level controlled
RDS Services directly supported		PI, PS, PTY, TP, AF, TA, DI, M/S, PIN, EON, PTYN, ECC, LIC, RT, RT+, TDC, IH, CT, ODA
5.2. RDS/RBDS signal		
Subcarrier frequency fc		57 kHz
Sampling rate		361 kHz
Bandwidth		± 2.4 kHz (-50 dBc)
Output level adjust		50mV - 2.0V p-p guaranteed range (35mV-2.1V typ)
Phase shift adjust	stereo transmission	0 - 180 deg. in 9.5 deg. steps
5.3. Audio/MPX/Pilot input		
Recommended load	mono	< 10 kOhm, >70 Ohm
	stereo	< 5 kOhm, > 70 Ohm
Recommended MPX i/p voltage		1.0 … 10 V p-p (equiv -7dBu to +13dBu)
Passthrough voltage gain	2 Hz-100 kHz	1.00 (0.0 dB) +/- 0.1dB abs max (typ +/- 0.01dB)
Pilot tone level		min. 55 mV p-p (-32 dBu)
- recommended pilot deviation		6.75 kHz
Pilot input frequency (..xtal PLL)	max	19000 Hz ± 4 Hz
	recommended	19000 Hz ± 2 Hz
5.4. Output		
Output impedance		75 Ohm
Recommended load		> 70 Ohm, < 1 nF
Max. Total MPX output voltage swing (RDS+Audio/MPX)		12.32 V p-p / +15dBu
RDS / RBDS level		3 - 11 % of Audio/MPX.

Notes:
p-p - peak-to-peak value

6./ Adjustment

6.1. RDS signal output level

The correct RDS injection level should be between 2 and 11 % of the audio / MPX signal, measured in peak-to-peak values. Recommended value is 3% to 5 %, or 2.0 to 3.75 kHz deviation of the FM carrier. Don't forget that maximum FM carrier deviation with RDS and audio / MPX signal is 75 kHz.

6.2. Phase adjustment for stereo transmission

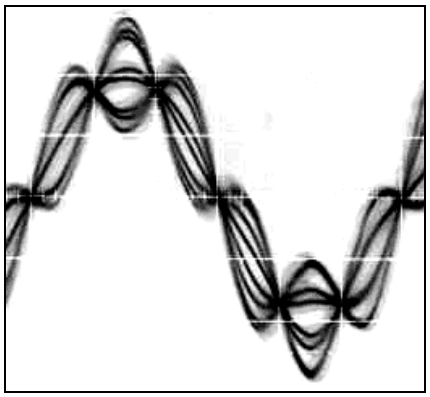
A. Connect the stereo encoder/transmitter to the RDS encoder. The 'Pilot' LED should indicate RDS locked to pilot tone.

B. Adjust for correct 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). Use for example the PHASE command in a terminal application (see below). Phase adjustment would be difficult without an oscilloscope. 90 degrees phase shift is recommended.

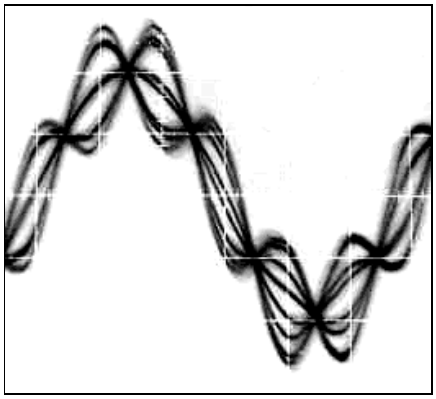
C. Some experiments performed in the field show that RDS reception is not much affected by the phase criterion. However, similar experiments have shown that correct phase shift adjustment offers a better behaviour of audio receivers, possibly reduced residues of audio intermodulation which can sometimes be observed, but only with the aid of professional instruments.

D. Using the 90 degree phase relationship will allow minimum deviation of the signal due to addition of the RDS component, i.e. it will make the received audio ***very slightly*** louder for the same overall peak deviation (…please note, it would ***never*** be enough difference to be audibly louder).

Oscillograms



Pilot and RDS in-phase
(0 degrees phase shift)



Pilot and RDS in quadrature
(90 degrees phase shift)

Note: Due to additional filtering employed in the Audessence RDS encoder, the numbers for phase are relative, not absolute. For perfect external circuitry, default phase shift is +113 degrees.

7./ Further Features

7.1. 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 logical 0 activates the TA (sets to 1). The switch shut-off or logical 1 deactivates the TA (sets to 0).
- If edge activated, any logical level change activates the TA. Then the TA is deactivated after the time specified by the TATMOUT command.
-

The TATMOUT command doesn't affect the EON1TA switching.

N.B. whilst this input normally controls the TA flag or the main FM programme fed by the RDS PRO-1, it has an alternate function as detailed below.

In brief, if the TP flag of the main programme is set to 0 (i.e. 'OFF', or 'This programme is NOT a Traffic Programme'), then the input will control the status of the TA flag in EON# 1 instead. By this means, listeners to the non-TP enabled service can get travel alerts from associated EON programme 1. N.B: Implementing this properly does mean that the data to know when EON#1 has TA flag active has to be available at the location of RDS PRO-1.

Switch function table:

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

External TA Switch is found on the 9-pin 'D' connector, **Pin 1.**

Please note that some PCs when connected to the D-connector for RS-232 control of the RDS (via Telnet session or via the windows GUI via) a standard cable with all pins connected, can cause the TA flag to be raised unexpectedly because they pull pin 1 low.

7.2. External Program [Bank] Switch

The External Program switch input allows you to select one of two program banks available via an external device. This device can be a simple switch or a device with digital logic output. **NB: 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.

External Program Switch is found on the 9-pin 'D' connector, **Pin 9.**

7.3. Real-time backup

A battery-powered RTC circuit provides real-time backup in case of mains power supply interruptions ('blackouts').

Use TIME and DATE commands to set the time and date information or simply use the Windows control software.

7.4. Firmware Update

The RDS encoder has a firmware update capability. This allows easy implementing of new features in the future. When a new firmware version is released, a simple Windows application provides the firmware update. Updates are provided at no additional cost.

Please refer to the Audessence website for more information.

7.5. Showing Real Time in Dynamic PS

It is 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.

7.6. Raise TA flag by DTMF Tone Sequence (NB: low cost optional extra)

This is an optional extra feature that can be specified at the time of ordering the RDS PRO-1 from the factory (it requires an extra circuit board inside the RDS PRO-1).

It allows the Traffic Announcement (TA) flag of the RDS to be controlled from the studio without using any separate data circuit to send commands to the RDS encoder at a remote site. It does this by sending a brief coded 'touch-tone' sequence over the audio programme circuit. The normal mode of operation is to embed the tones into traffic jingles that are played before and after each traffic bulletin. Decoding is very rugged and not disturbed by heavy audio processing.

The tone sequences are very brief (approx 290 milliseconds) and can be edited tightly into jingles, although during the actual three tones (duration of each is 70 milliseconds) a silent background is preferable; any background should be at least 23dB below the tones.

A safety timer will automatically turn the TA flag off, if it is left on for more than 3 minutes.

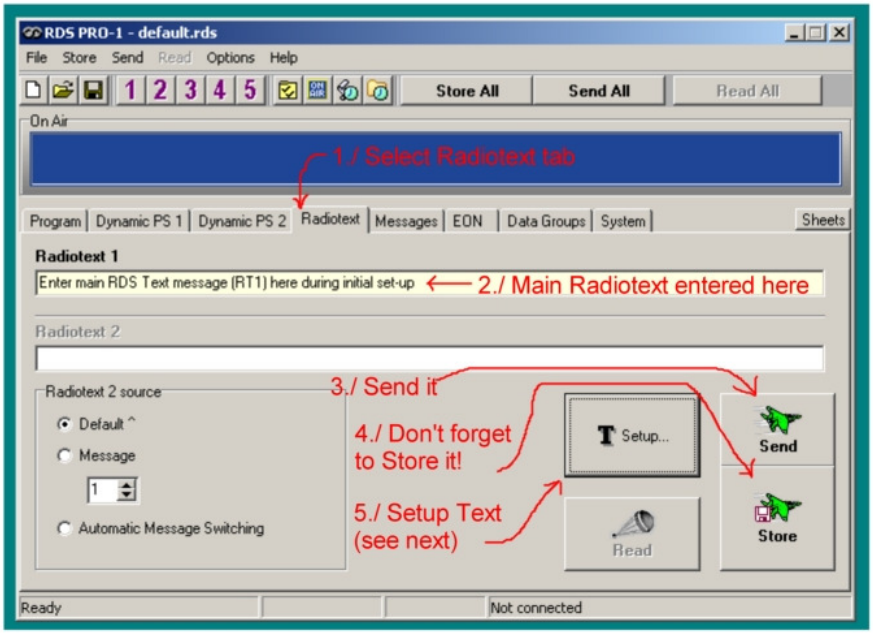
Tones are extracted from the BNC Input to the RDS encoder. It is therefore necessary to supply this input with the complete MPX signal rather than just a 19kHz pilot reference signal. All necessary filtering is integral to the DTMF daughter board. Any level between –12dBu and +12dBu (195mV to 3.09V rms), (550mV to 8.7V peak-to-peak) at the BNC is suitable.

The DTMF tone sequences are 51# for ON and 510 for OFF. The tone sequences can be found as WAV files on the CD supplied with the unit or downloaded from the Audessence website.

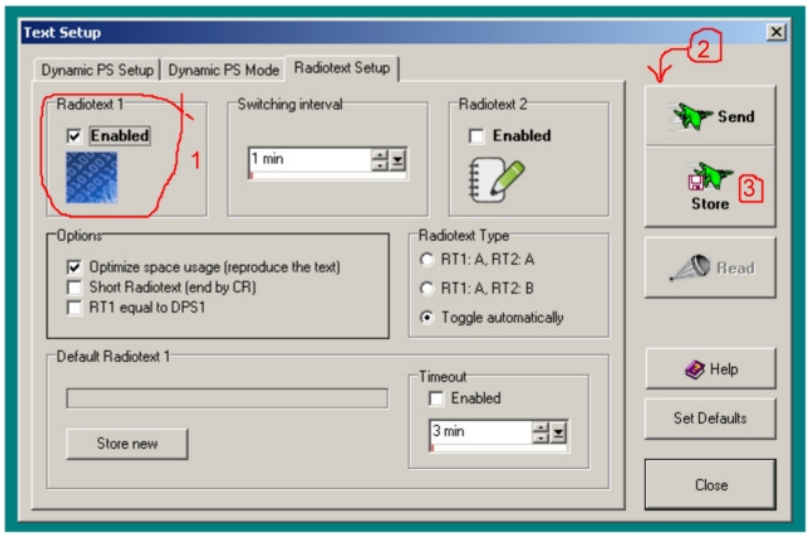
N.B: TATMOUT must be set to zero and this setting saved in order for the DTMF to work properly. If you are driving the unit with the GUI, go to the 'System' tab and set 'TA Timeout' to DISABLED, then STORE the system tab.

7.7. Radiotext – Basic and Advanced options

Select the Radiotext tab as shown below to enter your basic radiotext message; this was covered in the quick-start guide (section 4.4) of this manual:



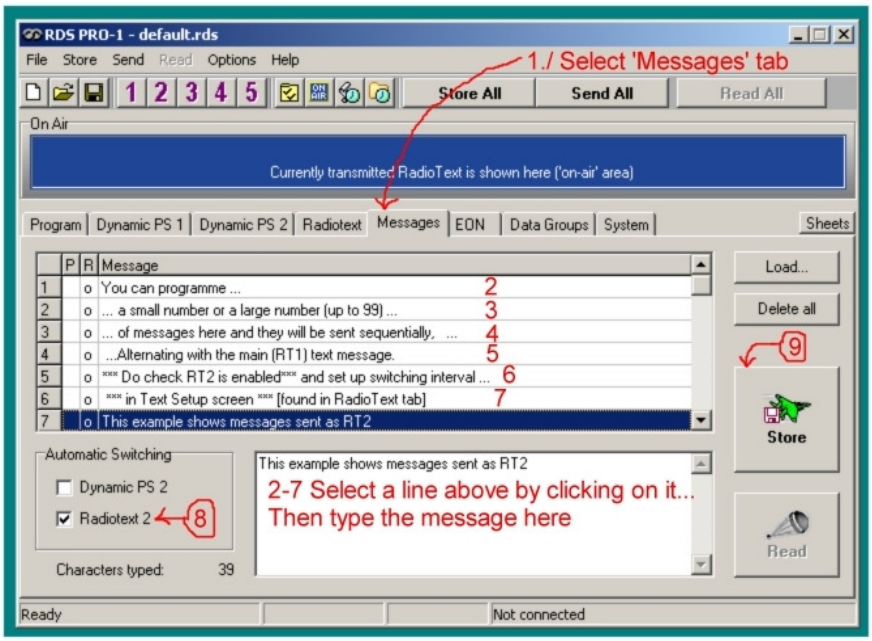
In GUI versions 3.5.d and above, you may also need to check that the 'Text Setup' options are set correctly. Radiotext 1 is your main Radiotext message and will be enabled as factory default, see below. If you ever need to change these settings, don't forget to 'Send' [wait, the Text Setup window will re-appear], then 'Store' to save that setting to non-volatile memory.



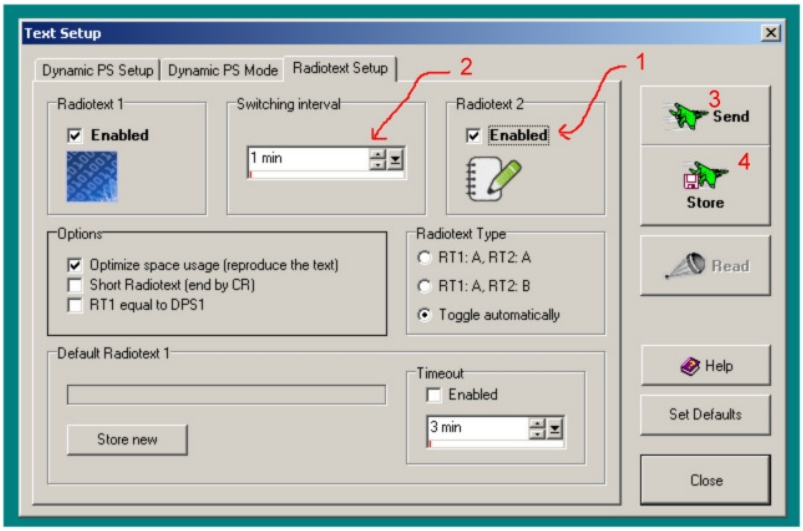
If there is any doubt about current settings in RDS PRO-1 you can of course also 'Read'. We often do this as a final check that everything is set the way it should be.

The RDS PRO-1 offers numerous ways of sequencing additional radiotext messages, either under control of the GUI programme, or by saving them in the RDS PRO-1 and having it sequence them automatically. We will cover perhaps the most widely-used method here, saving additional pre-programmed messages in the RDS PRO-1 and having it interleave them with the main radiotext message (see Radiotext 1 on previous page) automatically.

1./ Select 'Messages' tab;
2./ ++++./ Click on the lines in the table starting at the top, and enter your messages
You can have up to 99 messages!
8./ For **each** line, select the check-box for 'RadioText 2' before going on to the next line
9./ When all the messages (or a group of them) are ready, press 'Store'
There is no 'Send' function for messages, you only 'store' them. (Storing takes a while):



Then you need to revisit 'Text Setup' to activate the Radiotext 2. Go back to the 'RadioText' tab and click 'T Setup' (see previous page for screen). You also need to set the switching interval. 1 min is normally OK, or experiment. Don't forget to 'Send' and 'Store':



7.8 Alternative Frequencies- Methods A and B

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 coverage provided by the transmitter currently tuned. This facility is particularly useful in the case of car and portable radios.

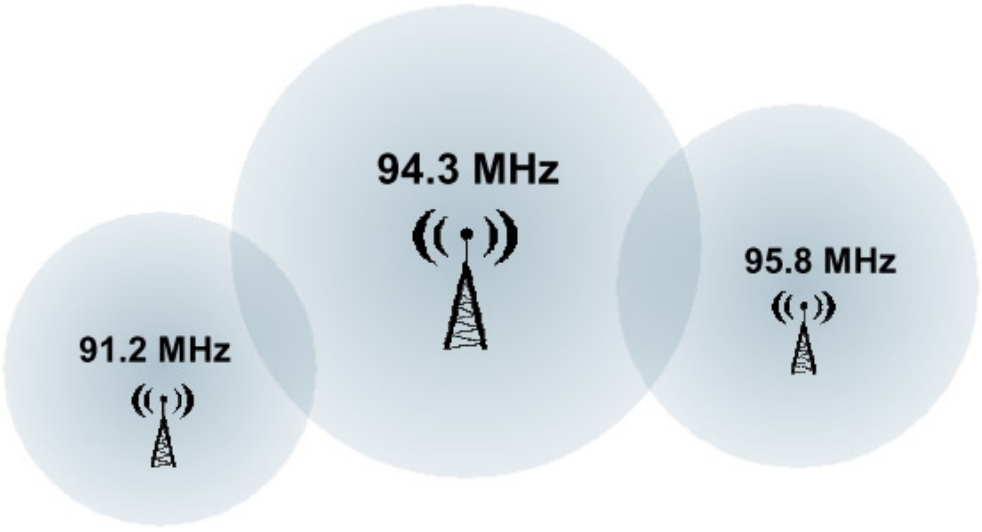
Important note: If second PI digit is set to zero (x0xx), this indicates that the station has only one transmitter - and the AF list is ignored on most receivers.

Ideally the AF list at each transmitter site should only comprise frequencies of neighbouring transmitters or repeaters. The entire AF set should be as small as possible to allow the receiver to find the strongest frequency quickly. This will improve the listener's experience via quicker retuning and more reliable selection of best frequency to receive. Thus within larger networks, it is likely that each encoder will have a unique AF list, although some frequencies will be listed by many sites.

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 and / or different programs are sometimes broadcast across the network.

Let's look at a simple example, composed of just three transmitters:



7.8.1 Method A

This is the default method, and recommended for most stations.

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

Note: Requires only one RDS encoder for entire network (common STL carrying MPX / Composite, or one main transmitter plus two repeaters fed with MPX from re-broadcast receivers). The list must contain all frequencies on which the signal from the RDS encoder is carried:

ASCII Commands used	Notes
AF=94.3,95.8,91.2	Entering the list
*AF	Storing the list to non-volatile memory

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:

ASCII Commands used	Notes
AF=91.2,94.3	Entering the list Include the transmitter's frequency in the AF list
*AF	Storing the list to non-volatile memory

94.3 MHz:

ASCII Commands used	Notes
AF=91.2,94.3,95.8	Entering the list Include the transmitter's frequency in the AF list
*AF	Storing the list to non-volatile memory

95.8 MHz:

ASCII Commands used	Notes
AF=94.3, 95.8	Entering the list Include the transmitter's frequency in the AF list
*AF	Storing the list to non-volatile memory

7.8.2 Method B

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 (and may also at other times carry a common programme); both conditions can be accommodated using method B.**

The maximum total capacity of the Method B system is: up to 8 lists, each of up to 12 AF pairs.

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 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 will assure the correct order automatically).

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

ASCII Commands used	Notes
AF=A	Switch to method A to allow editing of the AF lists
AF=94.3,91.2,94.3,95.8	Entering the first list (for 94.3MHz) Include the transmitter's frequency in the AF list **! NB:** List the frequencies in **descending** order **if** it is a network that carries splits
*AF=1	Storing the first AF list to non-volatile memory
AF=95.8,94.3,95.8	Enter the second list (for 95.8 MHz)
*AF=2	Storing the second AF list to non-volatile memory
AF=91.2,91.2,94.3	Enter the third list (for 91.2 MHz)
*AF=3	Storing the third AF list to non-volatile memory
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:

ASCII Commands used	Notes
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 current (first) list
AF=2	Load the second list
AF	Read the current (second) list
AF=3	Load the third list
AF	Read the current (third) list
AF=4	Load the fourth list
AF	Read the current (fourth) 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, should be signalled 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./ Simplistic [non-UECP] Addressing

8.1. Why use addressing?

If only one RDS encoder unit is connected to the RS-232 COM port, there is no need to use the addressing feature and you can simply ignore it.

If more units are connected to one COM port channel and the user needs to control the units independently, then the addressing feature is very useful. You can communicate only with selected unit(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. Of course there are many other possible different applications.

8.2. What does the addressing feature allow?

It allows connecting multiple encoders to one serial data stream and then controlling them independently, up to 255 unique addresses are available (unit addresses 0 and 255 are equivalent). Units with addresses in the range 1-254 will no longer respond to general commands on the COM port. They can then only be controlled if selected by the SEL command. For address range 1-254 the unit is selected for up to 20 minutes (selection timeout). For address 0 and 255 the unit is selected for an unlimited time.

If a unit is selected, other units are unselected immediately. Unselected units "listen" on the port for selection of their address. Other commands are ignored.

The addressing feature is controlled by ADR and SEL commands or simply by Windows control software.

Note: If only one unit is connected to the port and has address 0 or 255 (default), there is no need to use SEL command, the addressing feature is disabled, and needn’t to be taken into consideration.

9./ Universal Encoder Communication Protocol (UECP)

9.1. Introduction

The UECP protocol 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 should be considered as a complementary method of the RDS encoder control.

Its implementation in the RDS PRO-1 is only partial. This provides the possibility of basic RDS services control for dynamic data using UECP-based systems where most of the other RDS services have been set-up in advance using the methods described in previous pages of this manual. Alternatively, an external software application can be used to create a dynamic UECP data stream including all required elements.

At the time of writing, UECP control is used primarily for TMC (Traffic information services) and RT+ or 'Song Tagging'.

9.2. Enabling UECP support

A./ Configure all encoder-stored RDS services and settings as required.

B./ Where required, configure the RDS encoder address and Site address using the commands *ADR= and *SITE=

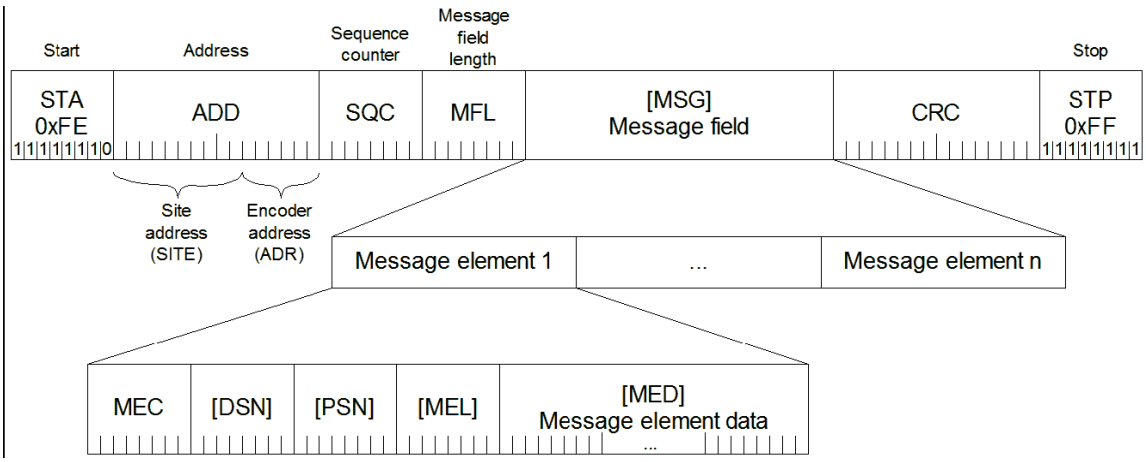
Or using the Windows control software:
[Go to … Options menu\Special\Assign Unit Address]

C./ Find out and set the right baudrate (COM port speed) for the incoming UECP data stream.

D./ UECP support is **dis**abled by default: Type UECP=1 in Text command or use the Windows control software to turn on UECP support.
[Found in the 'System' tab or Sheet - underneath 'Decoder Information'].

E./ Turning UECP OFF when no longer required: Type UECP=0 in Text command or use the Windows control software to turn off UECP support.
[Found in the 'System' tab or Sheet - underneath 'Decoder Information'].

9.3. General UECP frame format



Note: More information about UECPcan be found in the document "SPB 490 Universal Encoder Communication Protocol" (published by 3rd party; RDS Working Group).

9.4. UECP addressing

The address field comprises two elements spread across two data bytes, these are:

- Site address, 10 bits (most significant) [range 0 - 1024]
- Encoder address, 6 bits (least significant) [range 0 - 64]

For a message to be acceptable to a particular encoder both the site address and the encoder address must be contained within the respective address lists of the RDS encoder.

If the Site Address is set to 0, any Site will accept the record.

If the Encoder Address is set to 0, any Encoder in the Site will accept the record.

(N.B: UECP reception is not affected by the SEL command [Basic addressing] of the RDS encoder).

9.5. UECP implementation in the RDS PRO-1 and its 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	Notes
ADD	Site address 0-255, Encoder address 0-63	7
SQC	Ignored	
DSN	Ignored	
PSN	Ignored	

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 MEC 24, 30, 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. When inserting more TMC groups at once, the encoder automatically ensures 3 group long gap between two different TMC groups in the data transmitted.
6) Timeout & buffer configuration settings 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) Other MEC's are ignored, incl. all possible Message elements that may follow within the same Message field. Due to a complication in the UECP specification (unknown Message element length in general) it is recommended **not** to insert more than one Message element inside each Message field to maintain best compatibility with RDS PRO-1.
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 (the default broadcast address) is always set to 0, … the second (individual address for specific coder) can be set using the commands *SITE= and *ADR=.

N.B: UECP communication is always unidirectional; there are no responses sent to the UECP records.

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

NB: 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 [FE in Hex] within an ASCII command when UECP is enabled, or data will be lost.

9.6. Traffic Message Channel (TMC) Application Notes

9.6.1. Basic requirements

The TMC service can work only if there is an application that we will call 'TMC data provider'. The TMC data provider collects all related information and translates it into 8A type RDS groups. The output of the TMC data provider must be either by means of ASCII command G= or (more often) coded as a UECP command with MEC 30. We will deal with the second case in the 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 UECP with MEC 24. The 3A groups typically carry fixed content so in some cases they can be inserted into the RDS encoder also in a one-time manner by using the command UDG1= or UDG2= and then storing.

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).

9.6.2. Preparing for TMC transmission

1. Configure all static parameters of the RDS encoder. Then enable the UECP and store this (UECP=1¤ and *UECP¤).

2. Where required, store the fixed 3A groups using the commands UDG1= or UDG2= and then store
(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 on the communication baudrate. Configure the RDS encoder and TMC data provider baudrate.

4. Configure the Site and Address values.

9.6.3. 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	RTC 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 UECP elements 24, 30, 40 or 42 is not affected by the Group Sequence. Instead of being controlled by the specified Group Sequence, the group is put in the UECP FIFO buffer and transmitted as soon as possible.

10./ Dynamic PS text

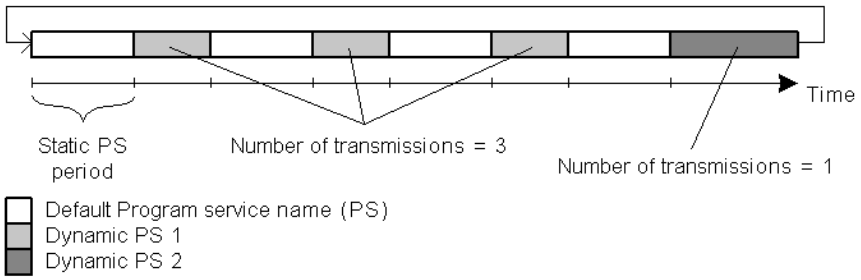
N.B: Using dynamic/scrolling PS is restricted and illegal in some countries. NB: We are not responsible for incompetent or illegal use of this feature! Check with your licensing authority first!

N.B: The results achieved will vary depending on individual receiver characteristics.

Standard RDS enabled receivers use an 8-character LCD display but in some cases there is a need to show more information and even to include commercials. The RDS PRO-1 offers a uniquely flexible and easy-to-use system of showing 'text messages' in the PS data field. Although Radiotext service is defined in the RDS standard, this service is not present on most receivers (including many car radios) and has some other limitations. According to the broadcasters needs, the PS (Programme Service) or 'station name'- one of the basic RDS services supported by all receivers - can be used to give sequential information. This has become known as 'Dynamic PS' or 'Scrolling PS'.

The RDS PRO-1 RDS encoder offers advanced implementation of Dynamic PS / Scrolling 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

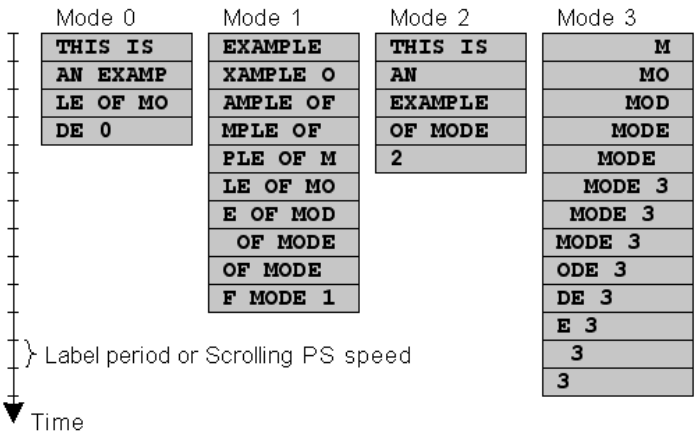


The number of transmissions is specified for each Dynamic PS text. It has effect only if both DPS1 and DPS2 are set or if Automatic Messages Switching is enabled for DPS2. The Static PS period (delay between text loops) specifies the time between two repeats of the Dynamic PS text loops. Default PS is displayed during this time.

Continued on next page…

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

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



Additional differences exist between Dynamic PS 1 and Dynamic PS 2. In general 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, i.e. providing a set of fixed messages.

11./ 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.

EON is especially useful for linking two or more stations of the same owner. Most of EON featured receivers gives priority to stations linked by EON when seek function is activated. Since the RDS PRO-1 can store four EON links, up to 5 stations can be linked together.

Stations that do not carry traffic announcements can refer to a station that does. This application is described below. For more information see appropriate section in the List of Commands or in the RDS PRO-1 GUI control software help.

11.1. 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.

A station which uses the code TP=0, TA=1 must refer to at least one program service which carries traffic information, and has the flag TP=1. When a particular program service begins a traffic announcement, the station that cross-references this service via the EON feature will broadcast a switch signal by setting the appropriate EON TA flag to 1.

The EON TA flags can be controlled by software for all four EON links in the RDS PRO-1. The first EON link TA flag can be also controlled by external TA/EON1TA switch.

The situation described is illustrated in an example, below:

11.2. 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 on 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 90.2 and 93.7 MHz transmitters of are located at the same site.

12./ Weekly Scheduling

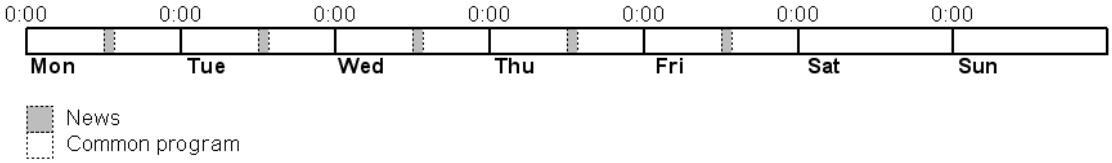
This feature allows scheduling of text messages, program type names and any other commands in hourly, daily and weekly program. The scheduling is provided directly by the RDS PRO-1 unit. Once set, it works with no further support from PC or control application. This is especially useful when the RDS encoder is placed on remote site or where reliability is important.

12.1. Key features

- Scheduling feature is fully implemented in the RDS PRO-1 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 (wildcard supported on hour place), program type (PTY) info, and from over 60 other commands

12.2. 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

12.3. Text messages scheduling

Although it's possible to directly change the Dynamic PS and Radiotext (using a 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 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.

12.4. Troubleshooting

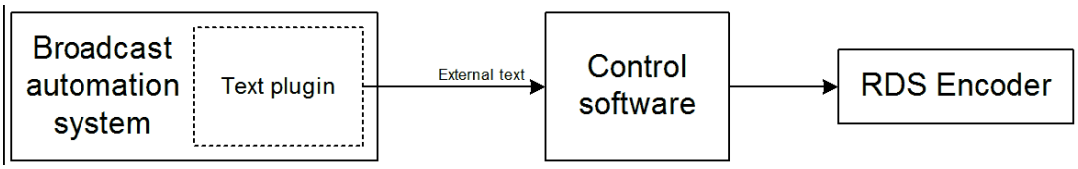
If the scheduling doesn't work as expected, check the following points:

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

13./ Broadcast Automation System Link-up

To send dynamic data via the RDS it is very useful to link the RDS encoder with your broadcast automation / PC play-out system. You can then automatically send commercials, current song information, program announcements and more. Almost any broadcast system can be linked with the RDS PRO-1. The link may be either indirect or direct.

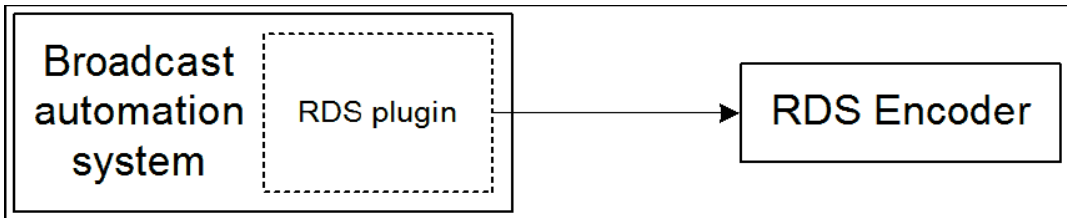
13.1. Indirect Link



Default Windows control software for the RDS PRO-1 RDS encoder is the Audessence RDS PRO GUI. This application is supplied on CD with every unit.

Since a very large number of different automation systems are used around the world and new versions are released all the time, information in this manual cannot be detailed for every case. For more information about how to configure the broadcast automation system text output read its documentation or contact the vendor.

13.2. Direct Link



Recommended step-by-step procedure

A./ To begin with, turn off the RDS encoder support in the broadcast automation system.

B./ 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.

C./ 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 (9600 bps).

D./ 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.

Compatibility commands

To achieve the best possible compatibility with broadcast automation systems, the RDS PRO-1 includes a special set of legacy compatibility commands. In the systems where the RDS PRO-1 is not directly supported (or the system is older version), you could try selecting 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.

Received Command	Is automatically translated to
TEXT=	RT1=
DPS=	DPS1=
PS_SCROLL=	DPS1ENQ=

Moreover the RDS encoder includes basic UECP support (see chapter 13).

13.3. 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, already 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 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 Annex 1 for more details). In other cases the Windows control software used in the indirect link configuration can provide the RT+ service.

13.4. 'No-Header' communication

By default, entering a text into the RDS encoder requires appropriate command header, for example RT1= in the command below:

<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 a 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:

- Configure all RDS services as desired.
- Enter the command *NOHDR=1.
- The no header communication is indicated by front panel LED (see chapter 12).

To deactivate the no header communication, press the keyboard <Escape> key three times and then press <Enter>.

The RDS encoder will respond with <+> 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.

14./ COM Port Communication

14.1. 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 provided by the D-SUB9 female connector on the RDS encoder side, or (often easier) by using USB via the front panel.

Note that a DIP switch setting at the rear panel of the RDS can lock out the USB connection. Set DIP switch #3 to DOWN (ON), if USB access is desired (the DIP switch settings are indicated by a legend on the back panel for easy reference).

Note that if DIP#3 is 'on' (USB selected), then text commands are also echoed to the RS-232 port as well. In other words when in USB mode you can also monitor, (but **not** command) via the RS-232.

The RS-232 'D' female connector on the RDS PRO-1 is designed for direct connection to a PC, using a straight-through (pin-to-pin) D-9 serial cable (NOT a 'null modem' cable).

USB cable required is a standard USB 'A' to 'B' cable.

14.2. 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 RDS PRO-1 basic control is also implemented in familiar broadcast automation systems. Please refer to the web site for more information.

If you wish to use a Terminal application, configure the communication parameters as follows:

Transmission speed	9600 kbps (default) (Generally one of 1200, 2400, 4800, 9600 or 19200 bps speed is possible if previously set and stored into the RDS encoder memory.)
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Parity checking	*No*
Carrier detection	*No*

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, DO try again a second time, otherwise, check the following points:

- RDS encoder turned on?
- Cable used (does the 'Data' LED indicate incoming characters?)
- Configuration of the terminal application (Baud rate etc. see above).
- Ensure Addressing and UECP are both set to 0 or 'OFF'.

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 in EEPROM memory, type *ECHO and press <Enter>.
To display actual parameter value, type ECHO and press <Enter>.
Having made these first steps with the RDS encoder command interpreter, see further information in the next section…

15./ 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 any argument, e.g: 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.

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 RDS encoder is case sensitive. All **commands** must be written in **UPPER CASE**.

If you wish to retain change of any parameter value during power off, don't forget to store it into non-volatile memory using *[COMMAND], e.g. *ALL!

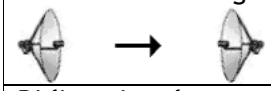
16./ Additional Information

This additional information provides all details required for implementation of the RDS PRO-1 protocol into your application (broadcast automation system, messaging system, TMC data source etc.).

Please see also Annex 3 - Communication Protocol Implementation Flowcharts.

Unidirectional or bidirectional – What is the difference?

The RDS PRO-1 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 are ignored) 	✓ Easier to implement × No direct feedback from the unit × Unsuitable for higher user data rates
Bidirectional (both channels are used, recommended mode) 	✓ Reliable remote control ✓ High user data rates possible due to real command sync. × Backward channel may be hard to realize in some cases

Command synchronisation

16.1. 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. RX Buffer length is 48 bytes.

Command	Execution time
PS=, TPS=	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	<1 ms (typ.)

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

16.2. 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)	+	¤	¤	¤	¤	

Useful notes

- ASCII character 9 (TAB) is converted to character 32 (SPACE).
- In addition to the <Enter> (char. 13, CR) used for command validating, character 26 (EOF) can be used. This allows insertion of 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.

Annex 1./ Command Listing

Basic:

AF	AF=	*AF	
AFCH	AFCH=	*AFCH	
DI	DI=	*DI	
DPS1	DPS1=	*DPS1	
	DPS1ENQ=		
DPS2	DPS2=	*DPS2	
DPS1MOD	DPS1MOD=	*DPS1MOD	
DPS2MOD	DPS2MOD=	*DPS2MOD	
DPS1REP	DPS1REP=	*DPS1REP	
DPS2REP	DPS2REP=	*DPS2REP	
EQTEXT1	EQTEXT1=	*EQTEXT1	Equal Text 1
LABPER	LABPER=	*LABPER	
MS	MS=	*MS	
PI	PI=	*PI	
PS	PS=	*PS	
PTY	PTY=	*PTY	
PTYN	PTYN=	*PTYN	
PTYNEN	PTYNEN=	*PTYNEN	
RT1	RT1=	*RT1	
RT1EN	RT1EN=	*RT1EN	
RT2	RT2=	*RT2	
RT2EN	RT2EN=	*RT2EN	
RT2TYPE	RT2TYPE=	*RT2TYPE	
RTPER	RTPER=	*RTPER	
RTTYPE	RTTYPE=	*RTPER	RadioText Switching Period
RSTDPS	RSTDPS=	*RSTDPS	
SCRLSPD	SCRLSPD=	*SCRLSPD	
SPSPER	SPSPER=	*SPSPER	
TA	TA=	*TA	
TATMOUT	TATMOUT=	*TATMOUT	
TP	TP=	*TP	
TPS	TPS=	*TPS	
INIT			
		*ALL	
HELP			

EON:

EONxAF	EONxAF=	
EONxAFCH	EONxAFCH=	
EONxEN	EONxEN=	
EONxPI	EONxPI=	
EONxPIN	EONxPIN=	
EONxPS	EONxPS=	
EONxPTY	EONxPTY=	
EONxTA	EONxTA=	
EONxTP	EONxTP=	
		*EON

x is in range 1-4

Messages:

MSGxx			*MSGxx=
MSGxxD			*MSGxxD=
MSGLIST			
DPS2MSG	DPS2MSG=	*DPS2MSG	
RT2MSG	RT2MSG=	*RT2MSG	

xx is in decimal range 01-99

Scheduling:

S			
SxxC			*SxxC=
SxxD			*SxxD=
SxxP			*SxxP=
SxxT			*SxxT=
SEN	SEN=	*SEN	

xx is in decimal range 01-48

System:

ADR			*ADR=
COMSPD	COMSPD=	*COMSPD	
CT	CT=	*CT	
	DATE=	*DATE	
ECHO	ECHO=	*ECHO	
EXTSYNC	EXTSYNC=	*EXTSYNC	
LEVEL	LEVEL=	*LEVEL	RDS Level
LTO	LTO=	*LTO	
MJD	MJD=	*MDJ	
OSCDEV			
PHASE	PHASE=	*PHASE	
PILOT			
RDSGEN	RDSGEN=	*RDSGEN	
RESET			
	SEL=		
STATUS			
TIME	TIME=	*TIME	
VER			Firmware Ver.

Advanced:

CC			*CC=
ECC	ECC=	*ECC	
ECCEN	ECCEN=	*ECCEN	
	G=		
GRPSEQ	GRPSEQ=	*GRPSEQ	Group Sequence
LIC	LIC=	*LIC	Language Identification Code
NOHDR		*NOHDR=	No-Header mode
PIN	PIN=	*PIN	
PINEN	PINEN=	*PINEN	
PROGRAM	PROGRAM=	*PROGRAM	
PSW			PS Window
RTP	RTP=		RadioText Plus Tagging Data
RTPRUN	RTPRUN=		RT= Running bit
SHORTRT	SHORTRT=	*SHORTRT	
SITE		*SITE=	UECP Site Address
UDG1	UDG1=	*UDG1	
UDG2	UDG2=	*UDG2	
UECP	UECP=	*UECP	UECP format enable
>xxxxxxx			

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

A1.1. Basic Commands

AF	Alternative Frequencies	(87.6-107.9)
List of alternative frequencies in MHz representation in range of 87.6-107.9 MHz. Up to 25 items allowed.		
AF=103.5,98.0	Sets the alternative frequencies to 103.5 and 98.0 MHz	
AF	Shows current AF list	
*AF	Stores the AF list into EEPROM	
AF=87.5	Not allowed (87.5 MHz)	
AF=108.0	Not allowed (108.0 MHz)	

AFCH	Alternative Frequency Channels	H (01-CC)
List of alternative frequency channels in hexadecimal representation in range of 01-CC (87.6-107.9 MHz). Up to 25 items allowed.		
AFCH=01,3B	Sets the alternative frequencies to 87.6 and 93.4 MHz	
AFCH=00	Not allowed (87.5 MHz)	
AFCH=CD	Not allowed (108.0 MHz)	

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	(0-255)
Specifies number of repeating for the DPS1 text message. Has effect only if DPS2 is set. Number of repeating = number of transmissions - 1.		
DPS1REP=1		

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		

EQTXT1	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.		
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 is illegal)	

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 synchronisation with RDS group order.	
PS=OCEAN 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 32 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	
PTY=10	Sets the Pop Music Program Type	

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 – WHERE LEGAL (**not** in UK / most of Northern Europe).	
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	([A,B]
This is now **obsolete** - support is no longer assured. Use RTTYPE instead. See below.		

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. Requiredfor 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	Reset Dynamic PS	(0, 1)
1 – When the Dynamic PS text is changed and no Dynamic PS running, it will start immediately. 0 – The SPSPER command drives Dynamic PS start, regardless of whether the Dynamic PS text was changed		
RSTDPS=0		

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. Therefore Fast speed is not recommended.		
SCRLSPD=0		

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 (depending on how Group sequence is set up). 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.		
SPSPER=4	Sets the period duration to about 11 seconds.	

TA	Traffic Announcement	(0, 1)
Indicates instantaneous presence (1) of Traffic Announcement sending. 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. *NB: In some cases the RDS encoder drives TP and TA flags automatically, mainly if EON feature is enabled. This ensures that the flags are set correctly under all conditions.*		
TA=1		

TATMOUT TA Timeout (0-255)

1-255 - Specifies a maximum duration in minutes during which the TA parameter can remain at one (1). Then the TA flag is set back to zero (0). External TA switch is edge activated.
0 - Disables the TA timeout feature. External TA switch is level controlled.
Note: The TATMOUT command doesn't affect the EON1TA switching. If TP=0, the TA Timeout is always set to 0.
*NB: TATMOUT **must** be set to 0for DTMF control to work (requires optional DTMF board)!*

TATMOUT=1

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	Dispalys: "Traffic" on radios when TA is raised
TPS=	Disables the Traffic PS

INIT Initialization

Sets most parameters and services in selected Program to its default values.
Apply for example if new blank EEPROM is placed on the board.
NB does not clear messages or schedules

INIT

```
*CC=                Complete initialization procedure. Replace the HH:MM
PROGRAM=2           with actual time and the
INIT                DD.MM.YY with actual date.
*ALL                Note: This initialization sequence must always be
PROGRAM=1           applied if new blank EEPROM is placed on the board in
INIT                production process.
*ALL                Alternatively use the Windows control software:
TIME=HH:MM          Options\Special\Initialize.
DATE=DD.MM.YY
```

ALL Store All

Stores all settings into EEPROM memory.

*ALL

HELP Help

Shows all commands available.

HELP

A1.2. 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 1 also causes a series of 14B group to be transmitted*		
EON1TA=1		

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

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

x is in range 1-4

A1.3. Messages Commands

MSGxx	Message
Specifies the message text. Since there is a place for 99 messages in 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 - This message 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 - One of the messages 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

A1.4. 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

A1.5. System Commands

ADR	**Unit Address**	**(0-255)**
Assigns an address to the RDS encoder. Allows connecting more units to one COM port and controlling them independently (up to 255 addresses possible). Unit addresses 0 and 255 are equivalent. Default address value is 0 (255). Unit with this address is automatically active after reset for unlimited time. Unit with address in range 1-254 is not active after reset and can be controlled only if it's selected by the SEL command. See page 23 onwards for more details on addressing.		
*ADR=0	Sets the unit address to 0.	
*ADR=3	Sets the unit address to 3.	
ADR	Returns (shows) the unit address.	

COMSPD	**COM Port Speed**	**(0-3)**
Specifies the COM port speed. Has the same effect as SPEED command, just different format. 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 2 - 4800 bps 3 - 9600 bps (default) 4 – 19200 bps		
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 date value stored in memory is used on next power up.	
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 Synchronisation**	**(0, 1)**
0 - Forced internal clock source (for mono transmission only) 1 - Automatic external synchronisation if pilot tone present		
EXTSYNC=1		

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=00D1C8 30th of November 2005

OSCDEV **Oscillators frequency deviation**

N.B: No longer supported in firmware 1.5 onwards

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. In firmware 1.5 onwards has NO OTHER effect N.B: Option 2 is no longer supported)

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 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. Command has the same effect as COMSPD but different input format.

SPEED = 9600

STATUS **RDS Encoder Status**

Shows the most important operating values of the RDS encoder. […or type **??** for shortcut]

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 the battery is dead.

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

VER **Firmware Version Number**

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

VER

A1.6. Advanced Commands

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) / 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
34: number of DPS1 characters
68: timer 0-8A, reset every minute
6A: Dynamic PS status byte (bit 00 - last dynamic PS; bit 01 - DPS2 is running; bit 02 - DPS1 is running)
76: static PS counter
78: DPS number of repeats counter
A8: error number
BE: COM port timeout counter in minutes
C3: selection (SEL) counter
C6: scheduling item number waiting (0, 1-48)
CC: timer 0-FF, increased approx. every 0.5 sec.
E4: local hour (0-23)
E5: local minute (0-59)
E9: COM port speed (0-3)

Important note: The CC is a very powerful command. Due to the theoretical possibility of bad setting that could cause the unit to 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: Conditional Command execution is halted whilst typing any command via the RS232.

*CC=[BE]>08:DPS1=	Clears the DPS1 text when there are no data on COM port for last 7 minutes. Useful to avoid showing of out-of-date information when DPS1 is used for song title showing and the broadcast automation system link crashes for any reason.
*CC=[CC]B04:PS=RADIO *CC=ELSE:PS=PRO 88	Periodically switches the PS between 'RADIO' and 'PRO 88'.
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	Shows current CC settings.
*CC=ELSE:	Disables the ELSE command.
*CC=	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	Unknown or not applicable	
ECC=E2	[ExampleECC setting]	

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 Annex 5. Using this command, 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 is disabled.
GRPSEQ=X	The RDS content is fully controlled via UDG1 (and possibly G command).

LIC Language Identification Code H (00-FF)

Indicates spoken language currently being broadcast

LIC=00	Unknown or not applicable
LIC=09	English

NOHDR No Header (Text stream) Comms Mode (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 after 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 section 13.4 (page 36) 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 Bank selection	(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.
1 - Program 1 is selected (default)
2 - Program 2 is selected
0 - External program switch selects the program
N.B: If Program is set to zero (0), most 'Store' operations are not allowed.

PROGRAM=1

PSW	PS Window

Returns current 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 current 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

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

Selects encoder(s) with specified encoder address and optional site address.
Only selected encoders will accept ASCII commands. Any other encoders receiving the same serial data stream are immediately unselected and thus will not respond to commands intended for other encoders.
N.B: Encoder addresses 0 and 255 are special cases. An 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 with SEL.
If the optional site address is not specified, it is assumed 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 section 8 on page 23 for more details.
Note: This command has no effect on UECP reception which uses individual method of encoder 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 SEL=3,0 SEL=3,25 SEL=0,25	Selects encoders with address 3 on all sites Selects encoders with address 3 on all sites (the same as above) Selects encoder with address 3 on site 25 Selects all encoders on site 25
SEL=ALL *ADR=4	Using a wild card for encoder selection... Forbidden! You cannot change the encoder address if a wild card has been used to select it.
SEL=3,25 *ADR=4	But using exact address values... OK, encoder address is changed from 3 to 4

SHORTRT	Short Radiotext	(0, 1)

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

SITE	UECP Site Address	(0-255)

Assigns a site address to the RDS encoder that is used only for UECP. A value of 0 means that any site address can apply. See Section 9 (page 24) for more details.
*SITE=2

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 Annex 5.
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 14.2.
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.

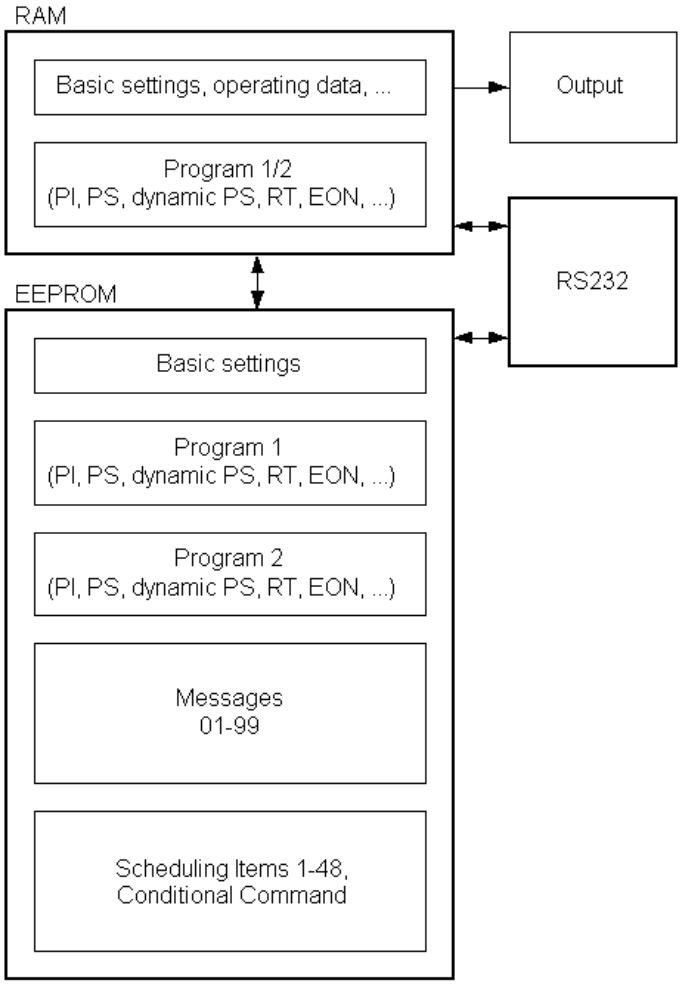
UECP=1

> **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, nothing will happen.

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

Annex 2./ Memory Organisation



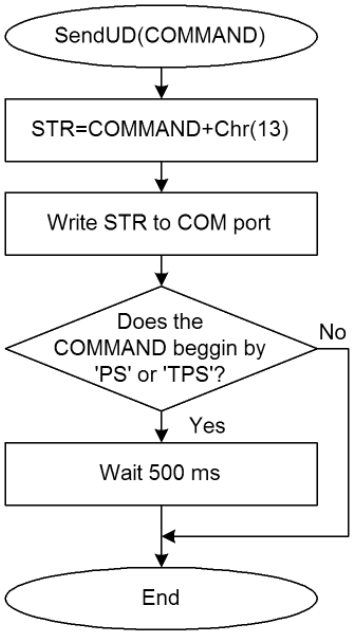
Dynamic PS 1/2 Summary

	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 Messages transmission	no	yes

Annex 3./ Communication Protocol Implementation Flowcharts

Following flowcharts allows the developer to integrate the RDS PRO-1 protocol with any application easily.

A3.1. 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).

A3.2. Bidirectional Communication

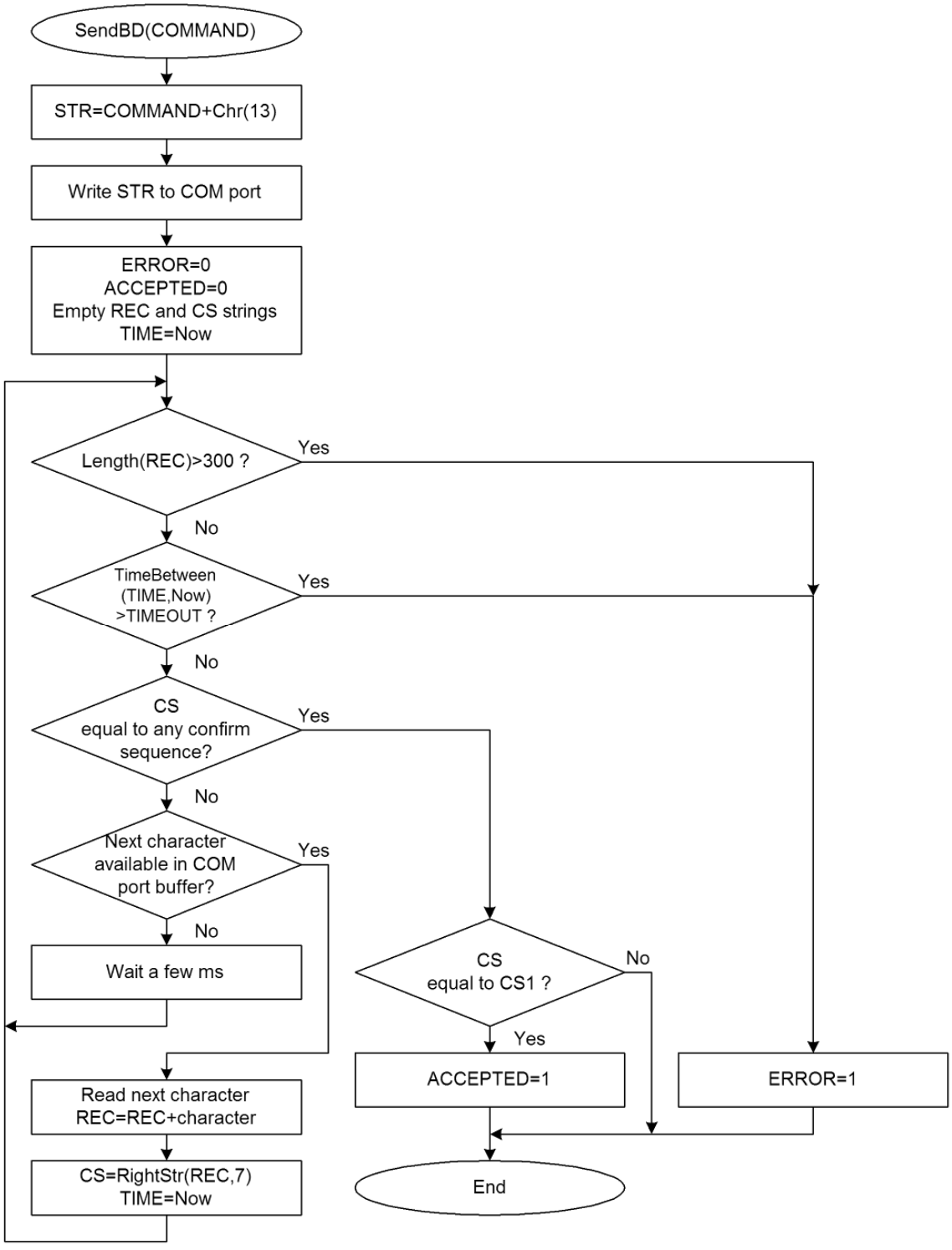
Confirm sequences definition:
CS1=Chr(13)+Chr(10)+'+'+Chr(13)+Chr(10)+Chr(13)+Chr(10)
CS2=Chr(13)+Chr(10)+'!'+Chr(13)+Chr(10)+Chr(13)+Chr(10)
CS3=Chr(13)+Chr(10)+'-'+Chr(13)+Chr(10)+Chr(13)+Chr(10)
CS4=Chr(13)+Chr(10)+'/'+Chr(13)+Chr(10)+Chr(13)+Chr(10)

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

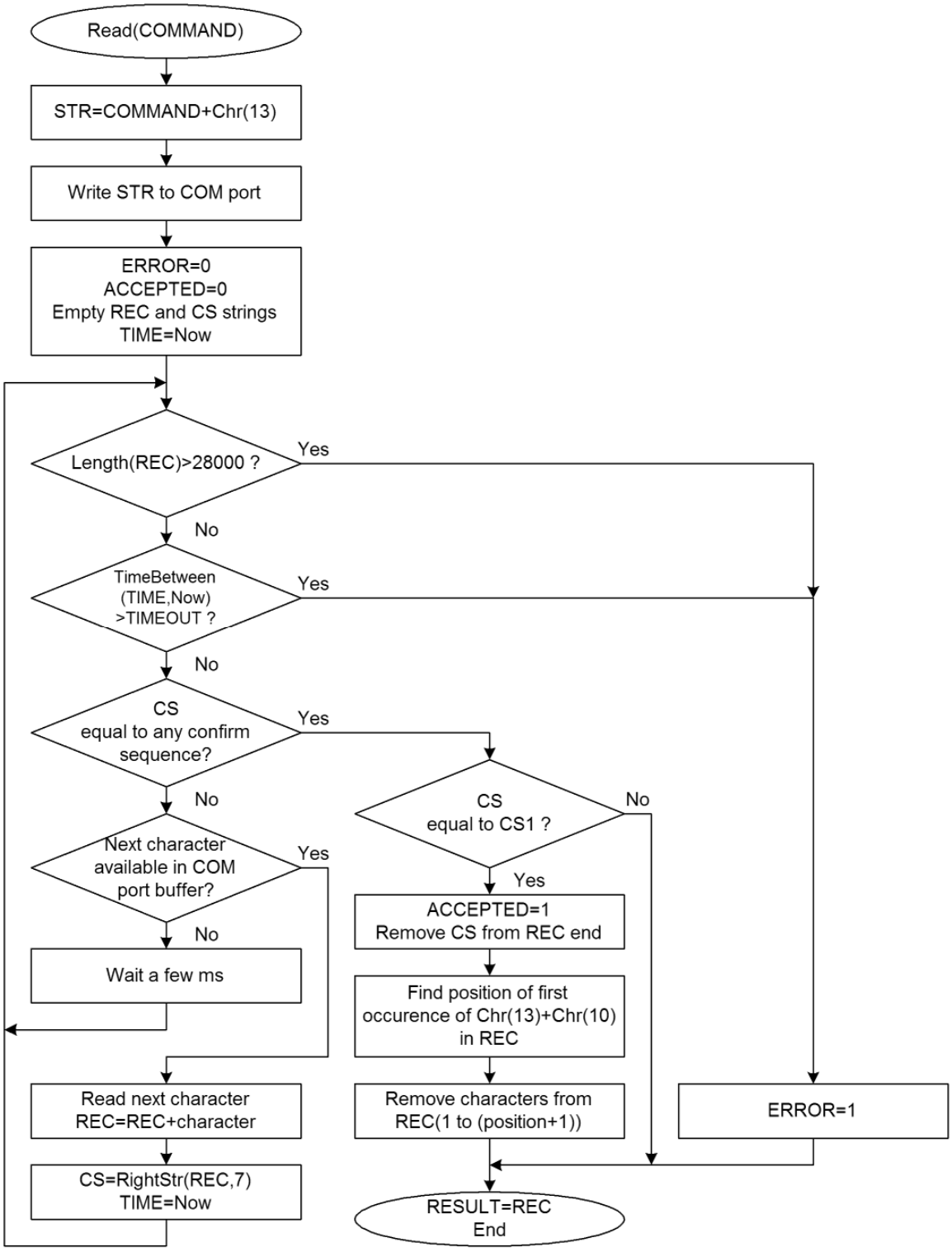
Other values:
TIMEOUT: COM port timeout, usually ≥400 milliseconds

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.

Annex 4./ PI Code Structure

The PI Code is very important information that enables FM receivers 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 programme**, to enable it to be distinguished from all other programmes.

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	E.G., 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→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 (*0**).

Important note: Factory default PI value should be changed as soon as possible to avoid the situation that two different stations with common area of coverage have the same PI. For each station audible in any one location, unique PI codes **must** be assigned.

N.B. VERY IMPORTANT: The last two digits of the PI Code effectively carry a hidden encoding; they are **'GENERICALLY LINKED'**. Stations that carry different programme **must** be unambiguously identified **by the last two PI digits**, **otherwise they will be recognized as the same station** by RDS radios (e.g. car radios). In other words, RDS-enabled radios can switch between their two frequencies when one signal gets weaker, **regardless of any other settings!** If the broadcaster hasn't received his 4-digit PI from a regulatory body, he **must** choose the PI code, **and these last two digits in particular**, such that the PI code is not in conflict with other stations audible in the same location.

Annex 5./ RDS Data Groups

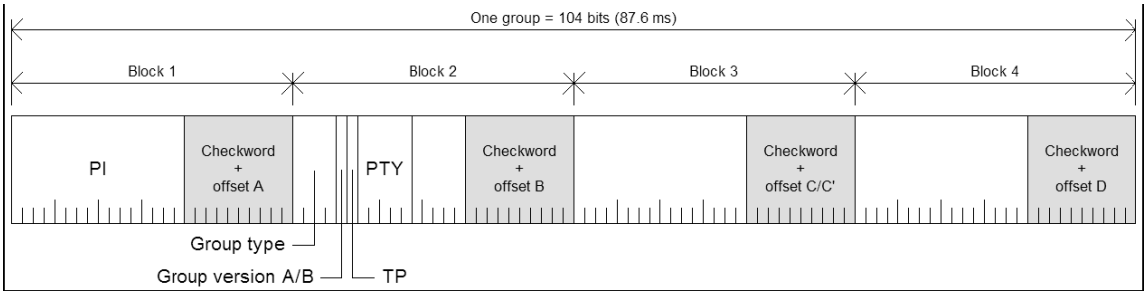
The following information is provided for better understanding to the RDS principles and the user defined group coding

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:



A5.2.1. Basic principles and conditions

- 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.

A5.2.2. Remarks

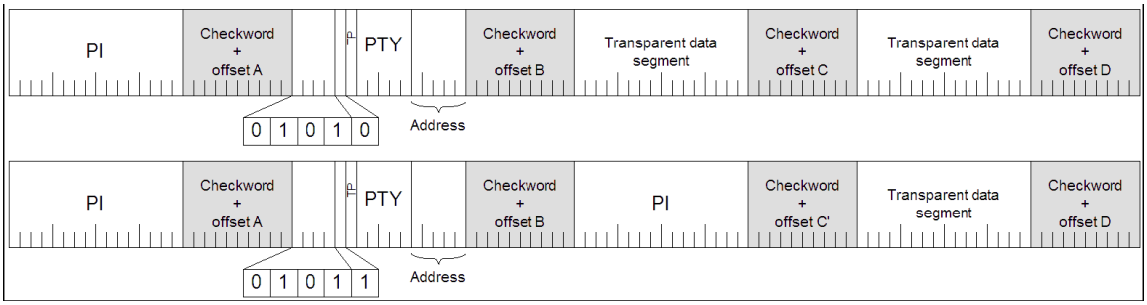
- One complete PS label consists of 4 groups. So one PS takes 350 ms of the transmission time. It may be found from experience that any RDS text should be transmitted at least twice to improve reception reliability. With regard to other services included in the RDS the repetition rate of dynamic/scrolling 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.

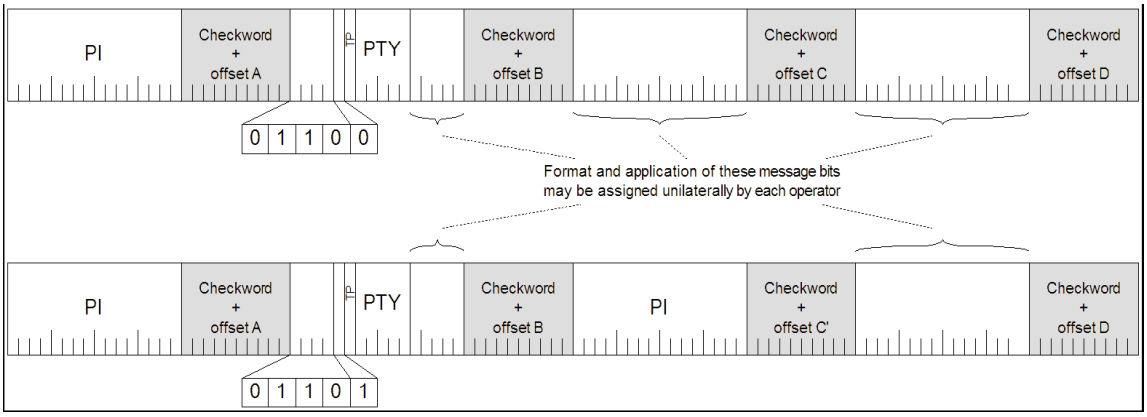
- TP and PTY are always inserted automatically by the RDS encoder using OR method (logical sum) on the appropriate bit positions.

A5.2.3. TDC group coding (5A, 5B)



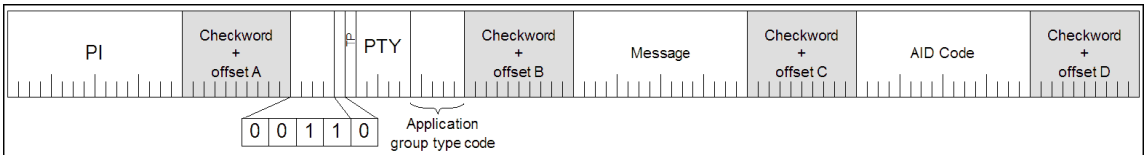
Group format in hexadecimal representation (version A): `50BBCCCCDDDD`,
group format in hexadecimal representation (version B): `58BB0000DDDD`,
where BB, CCCC and DDDD represent the contents of the block 2 (bits 4 to 0), block 3 and block 4.

A5.2.4. 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.

A5.2.5. 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.

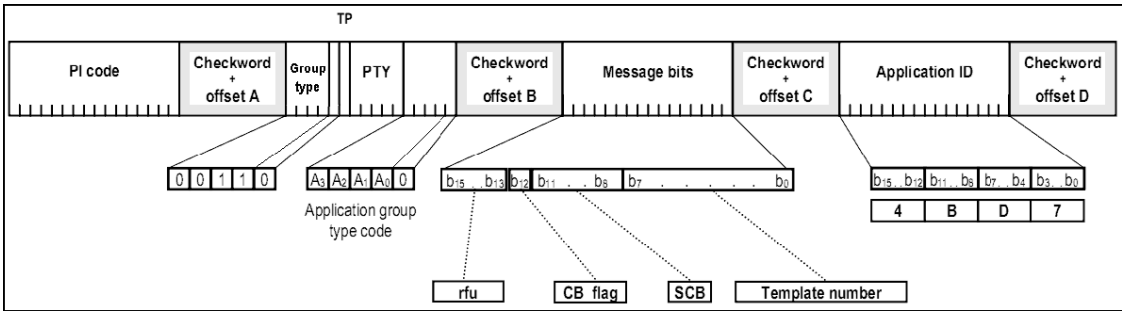
Since the 3A groups usually carry fixed static content, they may be inserted using either the `UDG1=` or `UDG2=` command for automatic cyclic transmission while the ODA application groups may be inserted by any command or method (`G=`, `UDG1=`, `UDG2=` or UECP MEC 24 or 42).

A5.2.6. Example of ODA user defined group coding (Radiotext Plus)

Here we show an example group coding for 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

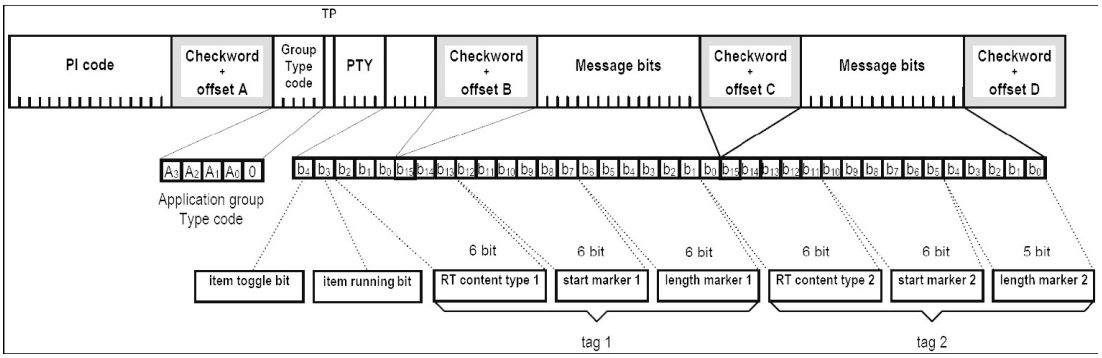
Appropriate 3A and 11A groups have following structure and coding:



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: T*his example is for illustration only. The RT+ feature is now directly supported by the RDS encoder (see section 11.7).*

[ends]./