PIRA32 RDS Encoder

Technical Manual

Version 1.4a

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Introduction

The PIRA32 RDS encoder is a result of more than 8 years experience collecting and meets requirements of most regional, local, RSL, LPFM and other medium- and small-coverage radio stations. It's also highly suitable for service and development purposes.
Fully digital concept and uniquely effective design ensures high reliability, excellent signal characteristics and gives the user many advanced features while maintaining a low price. We can say the PIRA32 brought new standard to this branch.

Main highlights

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

Other features

- Excellent spectral purity, direct digital RDS signal synthesis at sampling rate of 361 kHz (oversampled); tested for broadcast standards compliance
- Firmware updates for free
- Addressing feature - independent or common control of up to 255 units in a network
- Bypass relay, high reliability
- External TA and Program switch
- Switchable MPX loopthrough
- Internal real-time clock incl. backup battery, showing real-time also as PS
- 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, the PLL will never lock to a pilot frequency outside the functional range!

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

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

Information in this document is subject to change without notice.

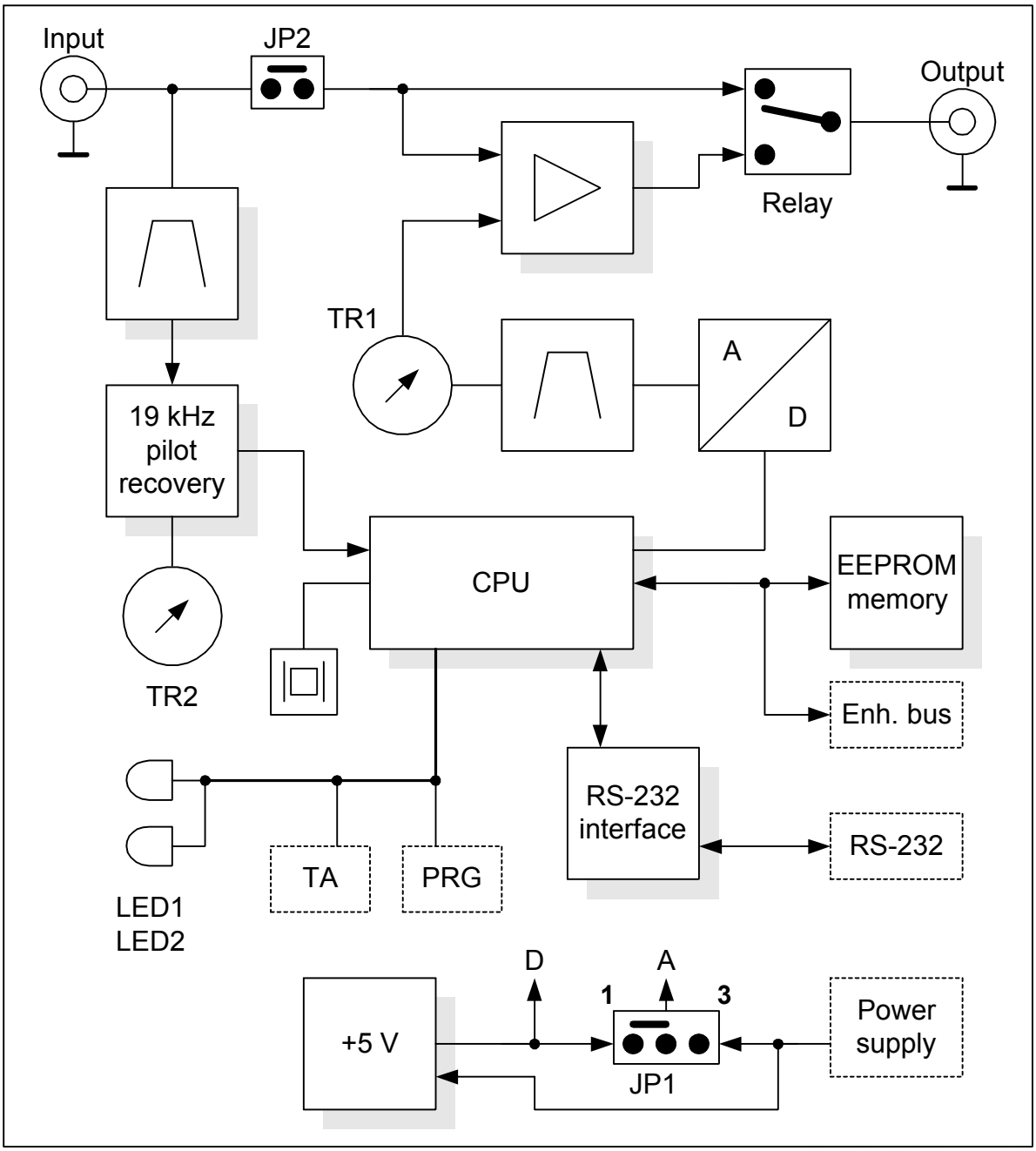
Revision 2008-05-29

Technical Specifications

Parameter	Condition	Value
General		
Supply voltage	JP1: 1-2	8 - 20 V
	JP1: 2-3	8 - 16 V stab.
Supply current	12 V	70 mA
Signal connectors		unbalanced BNC
Data connector		RS-232 (DTE, 9 pins), bi-directional
Communication speed		software switchable 1200 - 9600 kbps
Communication mode		1 stop bit, 8 data bits, no parity, (no flow control)
TA switching		software or external switch
TA/EON1TA input		TTL with 10 kOhm pull-up, level or edge activated
Program switching		software or external switch
Program input		TTL with 10 kOhm pull-up, level controlled
Expansion bus type		IIC, 400 kHz
RDS Services directly supported		PI, PS, PTY, TP, AF, TA, DI, M/S, PIN, EON, PTYN, ECC, RT, TDC, IH, CT, ODA
RDS/RBDS signal		
Subcarrier frequency fc		57 kHz
Sampling rate		361 kHz
Bandwidth		± 2.4 kHz (50 dBc)
Output level adjust	default	0 - 1.4 V p-p
Phase shift adjust	stereo transmission	0 - 180 deg. in 9.5 deg. steps
Audio/MPX/Pilot input		
Recommended load	mono	< 10 kOhm
	stereo	< 5 kOhm
Recommended MPX voltage	JP1: 1-2	1.1 - 3.4 V p-p (-6 - 4 dB)
	JP1: 2-3, 12 V	1.1 - 8.0 V p-p (-6 - 9 dB)
Passthrough voltage gain	2 Hz - 100 kHz	1 (0 dB)
Pilot tone level	min.	110 mV p-p (-26 dB)
	recommended	0.12 - 1.20 V p-p
- recommended FM deviation		6.8 kHz
Pilot frequency		19000 Hz ± 4 Hz
	recommended	19000 Hz ± 1 Hz
Output		
Output impedance		100 Ohm
Recommended load		> 70 Ohm, < 1 nF
Max. output voltage (RDS+Audio/MPX)	JP1: 1-2	3.6 V p-p
	JP1: 2-3, 12 V	9.0 V p-p
Recommended RDS level		3 - 11 % of Audio/MPX

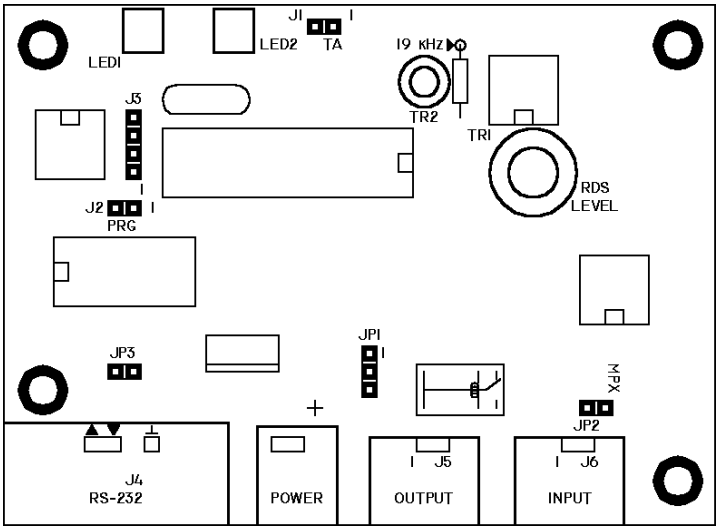
Notes:
p-p - peak-to-peak value

Block Diagram



Physical Description

Composition



Connectors

J1 - External TA/EON1TA switch
1: TTL input with 10k pull-up
2: Ground

J2 - External Program switch
1: TTL input with 10k pull-up
2: Ground

J3 - Expansion IIC bus
1: SDA (Serial Data)
2: SCL (Serial Clock)
3: Ground
4: +5 V

J4 - RS-232 Interface
9pin D-SUB male (DTE) connector:
1: Not used / +5 V
2: Receive Data (RDS encoder)
3: Transmit Data (RDS encoder)
4: Connected to pin 6
5: Ground
6: Connected to pin 4
7: Connected to pin 8
8: Connected to pin 7
9: Not used

POWER - Power supply connector (2.1 mm)
Central pin is positive (+)

J5 - Output

J6 - Input

Adjustable Elements

JP1 - Analogue part power supply jumper
1-2: +5 V internally stabilized
2-3: Full power supply voltage

JP2 - MPX loopthrough jumper
short: on
open: off

JP3 - RS-232 pin 1 +5 V power supply for external device
short: on
open: off

TR1 - Output RDS signal level adjust
TR2 - 19 kHz free running oscillator adjust

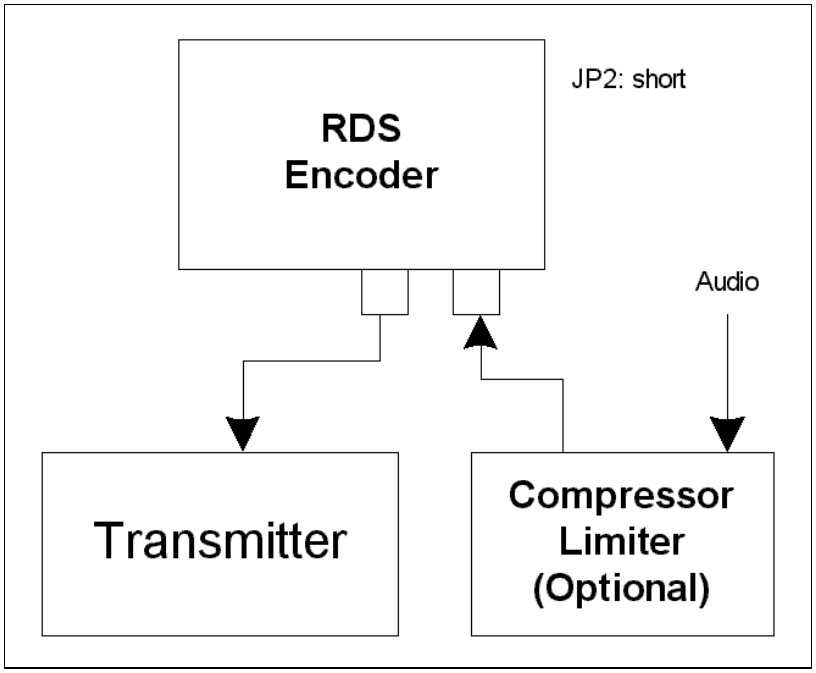
LED Indicators

LED1 - Operation / Receive data / Error indication
LED2 - Pilot tone indication / Firmware update mode

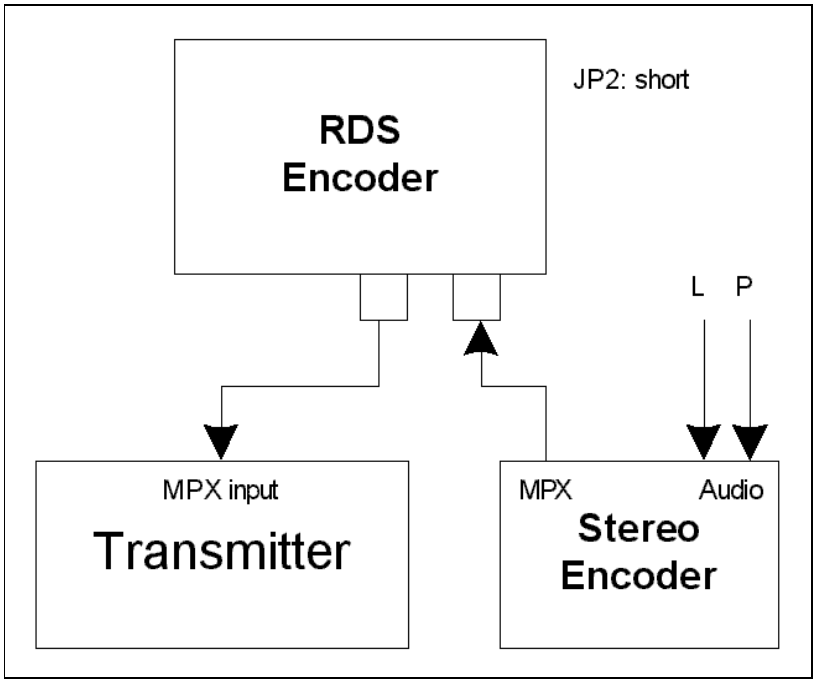
Installation

Connection

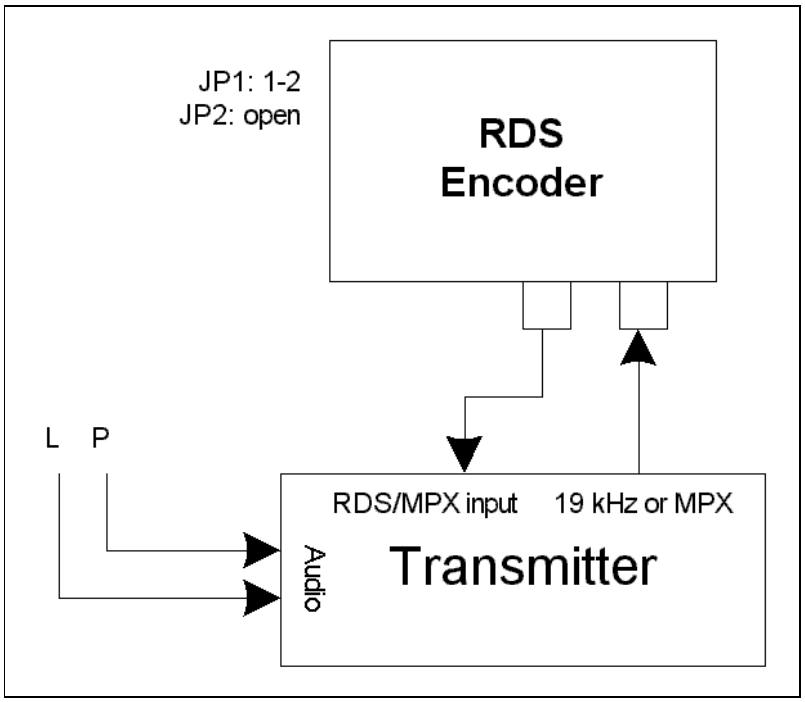
The following figures show various situations and corresponding methods of connection:



Mono transmitter and mono audio source



Mono transmitter with external stereo encoder



Stereo transmitter

Power supply

The RDS encoder can be supplied from any power supply, which delivers a voltage between 8 and 20 V DC and a current of at least 200 mA. The RDS encoder has polarity protection and own voltage stabilizer. The central conductor of the power supply connector is positive (+).
The JP1 jumper affects the analogue part supply voltage. The higher supply voltage the higher signal level can be processed. Ever if the output level is below 3.6 V p-p or the JP2 is open, set the JP1 to 1-2. In other cases set it to 2-3. Stabilized power supply and **care about right polarity** is required if the **JP1** is set to **2-3**.

Adjustment

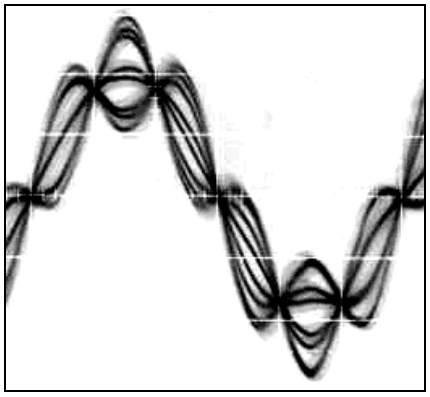
RDS signal output level

The right level should be between 3 and 11 % of the audio signal, measured in peak-to-peak values. Recommended value is about 6 %, which results in 4 kHz deviation of the FM carrier. Don't forget that maximum FM carrier deviation with RDS and audio signal is 75 kHz.

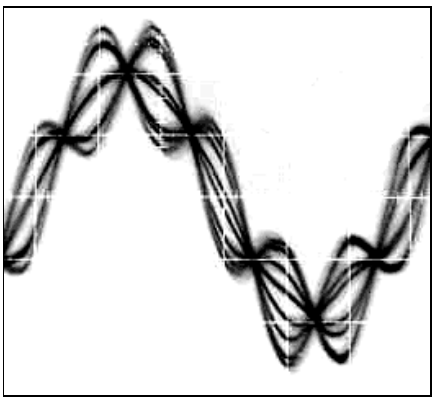
Phase adjustment for stereo transmission

1. Connect the stereo encoder/transmitter to the RDS encoder. The LED2 should indicate pilot tone present. If not, set the TR2 trimmer to the position where the LED is burning or set 19 kHz (±100 Hz) on marked pin on the PCB without pilot tone present.
   Note: When you receive the RDS encoder, the trimmer TR2 is set to the right position so the RDS encoder requires no tuning.
2. Adjust right phase shift (0 or 90 degrees phase shift between 19 kHz pilot tone and 57 kHz RDS subcarrier, measured on transmitter input, see the oscillograms). Use for example the `PHASE` command in a terminal application (see below). The phase adjustment could be difficult without an oscilloscope. Never mind if you don't have this equipment. It's also possible to set very low RDS level (when the signal strength is near error limit) and set the minimal error rate by adjusting the phase.
   Some experiments performed in the field show that the conditions of RDS reception are not too much affected by the phase criterion. However, similar experiments have shown that right phase shift adjust offers a better behaviour of audio receivers, and notably the residues of audio intermodulation which can sometimes be observed, but with the aid of professional instruments only.

Oscillograms



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



Pilot and RDS in quadrature
(90 degrees phase shift)

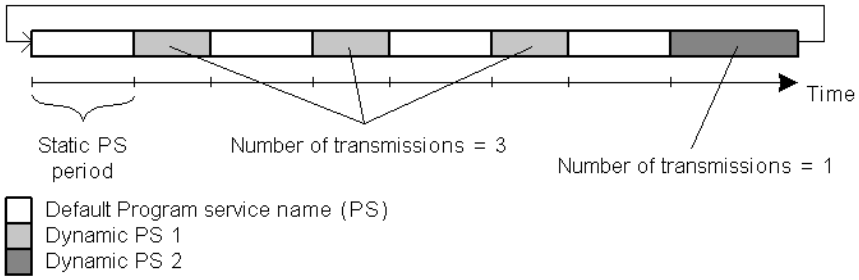
Dynamic PS text

Standard RDS enabled receiver disposes of 8-character LCD display but we usually need to show pile of information and commercials. So small display on the one hand and so much demands on the other hand. The PIRA32 solves it by unique system of text messages showing. Although Radiotext service is defined in the RDS standard, this service is not present on most receivers (incl. all car radios) and has some other limitations. According to the broadcasters needs, the PS service - one of the basic RDS services supported by all receivers - came to be used to give sequential information. We talk about the Dynamic PS.

Note: Using the dynamic/scrolling PS is restricted in some countries. We are not responsible for incompetent use of this feature.

The PIRA32 RDS encoder offers advanced implementation of the Dynamic PS service. Basic text message length is up to 255 characters (mode independent). Two varieties of the Dynamic PS are present: Dynamic PS 1 (DPS1) and Dynamic PS 2 (DPS2). Both varieties are configurable independently from each other.
Basic configurable parameters are:

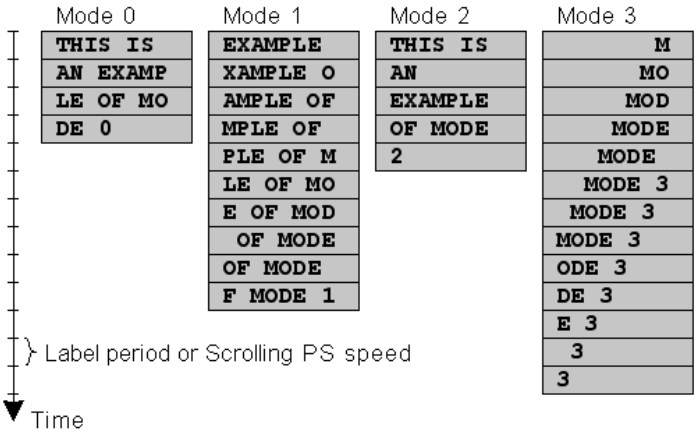
- Text content/text source
- Display mode
- Label period or scrolling speed
- Number of transmissions



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.

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

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



Additional differences exist between Dynamic PS 1 and Dynamic PS 2 (see pages 18, 23 and 30).

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.

The EON is especially useful for linking two or more stations of the same owner. Most of EON featured receivers gives priority to stations linked by EON when seek function is activated. Since the PIRA32 can store four EON links, up to 5 stations can be linked together.

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

Traffic Program and Traffic Announcement codes

The coding to be used is as follows:

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

Station which uses the code TP=0, TA=1 must refer to at least one program service which carries traffic information, and has the flag TP=1. When a particular program service begins a traffic announcement, the station that cross-references this service via the EON feature will broadcast a switch signal by setting the appropriate EON TA flag to 1.
The EON TA flags can be controlled by software for all four EON links in the PIRA32. The first EON link TA flag can be also controlled by external TA/EON1TA switch.
The situation described is illustrated on an example below:

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.

Weekly Scheduling

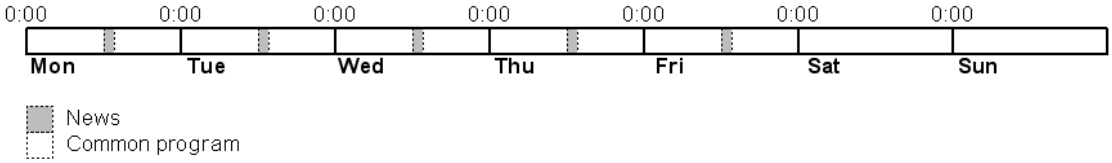
This feature allows scheduling of text messages, program type names and any other commands in hourly, daily and weekly program. The scheduling is provided directly by the PIRA32 unit. Once set, it works with no more support from PC or control application. This is especially useful when the RDS encoder is placed on remote site or where reliability is important.

Key features

- The scheduling feature is fully implemented in the PIRA32 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 is supported on hour place), program type (PTY) information and any from more than 50 commands

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

Text messages scheduling

Although it's possible to change directly 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.

Troubleshooting

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

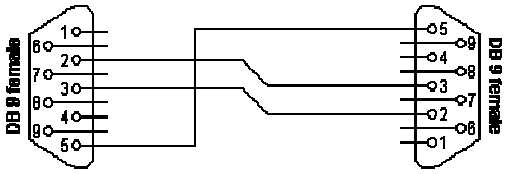
- Scheduling enabled?
- Date and Time actual?
- Commands typed right?

COM Port Communication

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 D-SUB9 male connector (DTE) on the RDS encoder side. On the PC side locate an unused COM port. If the free port exists in the form of a 25-pin connector, use a standard D-SUB9 (male) to D-SUB25 (female) adapter.
It's preferable to use standard crossed serial "lap-link" cable also called as "null-modem cable" with two female connectors for the connection. Following table represents the full connection diagram. In most cases (no flow control) the three highlighted wires are enough for the connection.

RDS Encoder	PC
2 (RxD)	**3 (TxD)**
3 (TxD)	**2 (RxD)**
4 (DTR)	6 (DSR)
5 (GND)	**5 (GND)**
6 (DSR)	4 (DTR)
7 (RTS)	8 (CTS)
8 (CTS)	7 (RTS)



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 PIRA32 basic control is also implemented in familiar broadcast automation systems. Please refer to the web site for more information.

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

Transmission speed	2400 kbps (default) (Generally one of 1200, 2400, 4800 or 9600 kbps 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, try again a second time, otherwise, check the following points:

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

To display the commands entered at the keyboard on the screen, type the command `ECHO=1` followed by <Enter>.
If all characters written are displayed twice, type `ECHO=0` and press <Enter>.
To store this parameter in EEPROM memory, type `*ECHO` and press <Enter>.
To display actual parameter value, type `ECHO` and press <Enter>.
Now you made first steps with the RDS encoder command interpreter.

Command Interpreter

The RDS encoder command interpreter meets the following rules:

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

There are several methods of use for the commands:

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

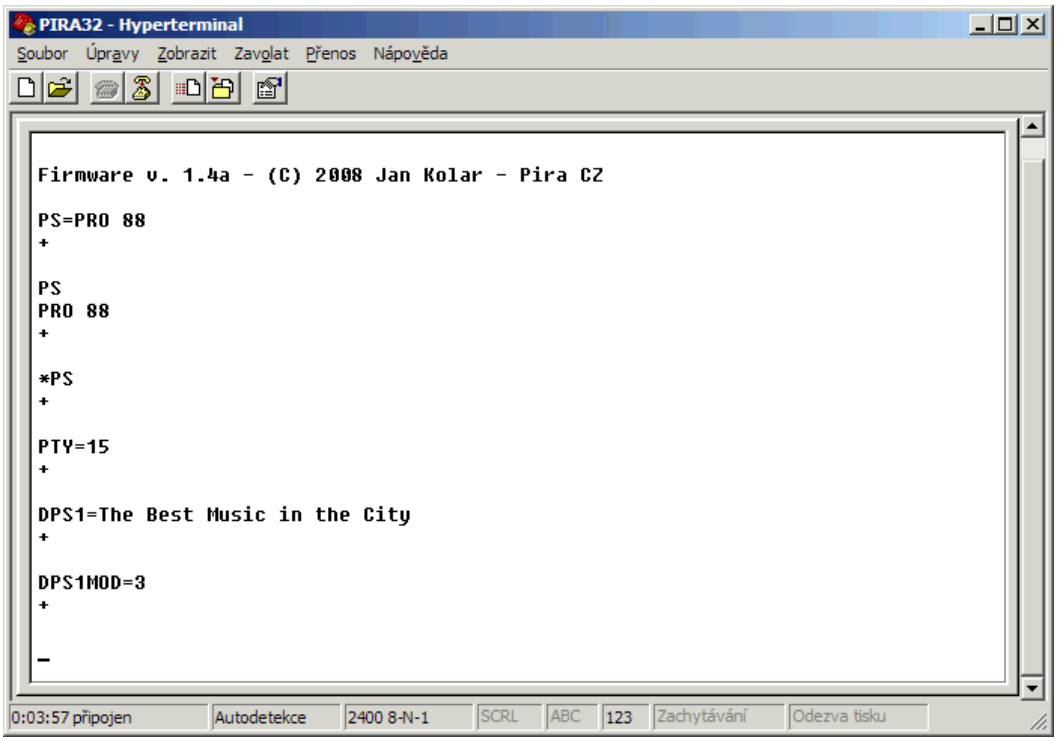
Not all methods are available for all commands, see Command Summary.

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 memory!



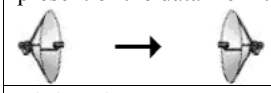
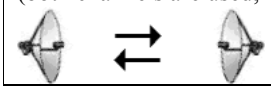
Windows Hyperterminal control.

Additional Information

This additional information provides all details required for implementation of the PIRA32 protocol into your application (broadcast automation system, messaging system, TMC data source etc.).
Please see also the Annex A - Communication Protocol Implementation Flowcharts. Some source code examples are provided on the website.

Unidirectional or bidirectional – What is the difference?

The PIRA32 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

Unidirectional communication:

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

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

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

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

- In addition to the <Enter> (char. 13, CR) used for command validating, character 26 (EOF) can be used. This allows to insert the validating character on platforms where char. 13 (CR) is not accepted. The RDS encoder 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 4 minutes. If no character is received during this time, the command line is internally cleared.

List of Commands

Command Summary

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
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
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=
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	
LTO	LTO=	*LTO	
MJD	MJD=	*MDJ	
OSCDEV			
PHASE	PHASE=	*PHASE	
PILOT			
RDSGEN	RDSGEN=	*RDSGEN	
RESET			
	SEL=		
STATUS			
TIME	TIME=	*TIME	

Advanced:

CC			*CC=
ECC	ECC=	*ECC	
ECCEN	ECCEN=	*ECCEN	
	G=		
PIN	PIN=	*PIN	
PINEN	PINEN=	*PINEN	
PROGRAM	PROGRAM=	*PROGRAM	
SHORTRT	SHORTRT=	*SHORTRT	
UDG1	UDG1=	*UDG1	
UDG2	UDG2=	*UDG2	
>xxxxxxx			

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

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`		

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=0xxx`	Not allowed (0 as first digit)	

PS	**Program Service name**
Static name of radio station that is displayed on receiver. Max. 8 characters long. The PS= command requires additional processing time of up to 400 ms for internal 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) 1 - News 2 - Affairs 3 - Info 4 - Sport 5 - Education 6 - Drama 7 - Cultures 8 - Science 9 - Varied Speech 10 - Pop Music 11 - Rock Music 12 - Easy Music 13 - Light Classics Music 14 - Serious Classics 15 - Other Music 16 - Weather 17 - Finance 18 - Children 19 - Social Affairs 20 - Religion 21 - Phone In 22 - Travel 23 - Leisure 24 - Jazz Music 25 - Country Music 26 - National Music 27 - Oldies Music 28 - Folk Music 29 - Documentary 30 - Alarm Test 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.	
`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)**
A - RT2 type is the same as RT1. Each switching between RT1 and RT2 will cause the previous message to be overwritten on most receivers. B - RT2 type is different from RT1. Receivers usually leave both RT1 and RT2 texts displayed.		
`RT2TYPE=B`	Sets type B for the RT2	

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

RSTDPS	**Reset Dynamic PS**	**(0, 1)**
1 - All new Dynamic PS texts will immediately start from begin 0 - Only changing of current Dynamic PS text (DPS1/DPS2) transmitted will cause its start from begin		
`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.		
`SCRLSPD=1`		

SPSPER	**Static PS Period**	**(0-255)**
Specifies the time between two repeats of the Dynamic PS text. Static PS (PS/TPS) is displayed during this time. Increasing the value by 1 increases the period by approx. 2.7 seconds. 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 information during broadcasting. When this value is set to 1 by external TA switch, the value specified by TA command has no effect. When this value is set to 1 by TA command, the value set by external TA switch has no effect. *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.*		
`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.*		
`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`	
`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.	
`INIT`	

ALL	**Store All**
Stores all settings into EEPROM memory.	
`*ALL`	

HELP	**Help**
Shows all commands available.	
`HELP`	

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.		
`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

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

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

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 26 for more details.		
`*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. 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 kbps 1 - 2400 kbps (default) 2 - 4800 kbps 3 - 9600 kbps		
`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, 3)**
0 - Forced internal clock source (for mono transmission only) 1 - Automatic external synchronisation if pilot tone present, PLL bandwidth: 19000 +/- 5 Hz (default) 3 - Automatic external synchronisation if pilot tone present, PLL bandwidth: 19000 +/- 2 Hz		
`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**

A special function of the digital PLL. Shows a percentage frequency deviation between the RDS encoder and stereo encoder oscillators, compensated by the PLL. Resolution: 0.0002 %. The value should be always less than 0.02 % in common operation.
To measure and show the value, the EXTSYNC must be set to 1 and pilot tone must be present.

`OSCDEV`

PILOT **Pilot Tone Present**

Indicates if pilot tone is present (1) or not (0).

`PILOT`

RDSGEN **RDS Generator** **(0, 1, 2)**

Disables (0) or enables (1) the RDS subcarrier generator.
Value 2 is reserved for special purpose. It switches off the 0A groups transmission if any UDGx group is set. This is useful for special RDS rebroadcast cases.

`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`

SEL **Select Unit** **(0-255, ALL)**

Selects unit(s) with specified address. Unit addresses 0 and 255 are equivalent. Only selected units accept other commands. For address range 1-254 the unit is selected for 20 minutes (selection timeout). For address 0 and 255 the unit is selected for unlimited time. If a unit is selected, other units are unselected immediately.
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 and the addressing feature needn't to be taken into consideration.

`SEL=0`	Selects unit(s) with address 0 and 255.
`SEL=3`	Selects unit(s) with address 3.
`SEL=ALL`	Selects all units on the port (or also unit with unknown address).

STATUS **RDS Encoder Status**

Shows the most important operating values of the RDS encoder.

`STATUS`

TIME **Time**

Specifies the actual local time in HH:MM format. Sets the seconds to 00.
The time value stored in memory is used on next power up if no battery backup circuit is connected to the IIC bus.

`TIME=16:40`

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)

`*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 actual 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=E2`		

ECCEN	ECC Enable	(0, 1)
Enables (1) or disables (0) the ECC feature.		
`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 B, block C and block D in hexadecimal expression. The RDS encoder calculates the CRC automatically. The block A has not been specified as it is always the PI code programmed with the `PI` command. The PTY and TP services set by the `G` command are ignored and are substituted according to the internal configuration of these services of the RDS encoder. Using this command, the RDS transmission can then be partially or fully controlled by an external application. For full RDS stream control, 9600 kbps com. speed should be used. Next Group can follow after previous command success characters (+).		
`G=380215D1A531`	Group 3B containing 02 15D1 A531	

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	(0-2)
Specifies the program bank. RDS services in selected program bank are transmitted by the RDS encoder and can be modified and stored into EEPROM memory. If Program is set to zero (0), most of store operations is not allowed. 1 - Program 1 is selected (default) 2 - Program 2 is selected 0 - External program switch selects the program		
`PROGRAM=1`		

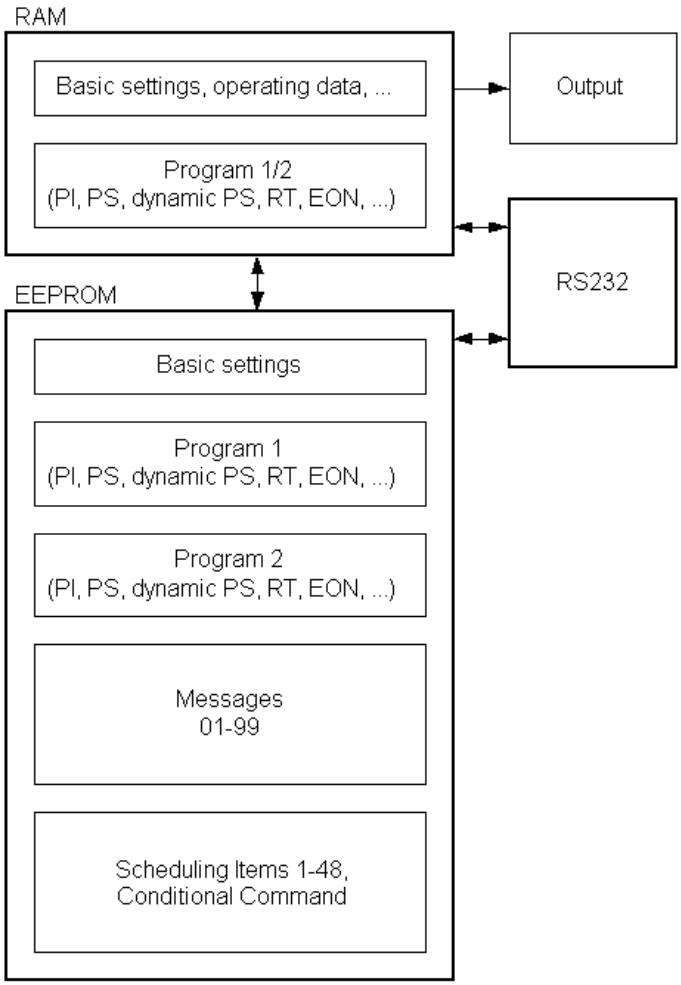
SHORTRT	Short Radiotext	(0, 1)
If enabled (1), all new inserted Radiotexts shorter than 60 characters will be followed by Carriage Return and the remaining spaces will be cut. Default value is 0.		
`SHORTRT=1`		

UDG1	**User Defined Groups 1**
Specifies up to 8 groups in BBBBCCCCDDDD format, which are repeatedly transmitted by the RDS encoder. BBBB, CCCC and DDDD represent the contents of the block B, block C and block D in hexadecimal expression.	
`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 by the RDS encoder. BBBB, CCCC and DDDD represent the contents of the block B, block C and block D in hexadecimal expression.	
`UDG2=380215D1A531,38058DB3B61E`	Sets two UDG2 groups
`UDG2=`	Clears the UDG2 groups

>	**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

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

Other Features

Bypass Relay

The RDS encoder board includes a bypass relay providing an alternative way for the audio signal on power supply failure.

LED Indication

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

	LED 1	LED 2	Status
Start-up	off	**on**	Initialization
	on	off	Firmware upgrade in progress
Operation	· · · · · (1 sec.)	x	Normal operation, unit selected
	· · · (2 sec.)	x	Normal operation, unit unselected
	- - - - - (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**	Pilot tone present
	x	off	Pilot tone not present

Showing Real Time in Dynamic PS

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

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.

Switch function table:

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

External Program Switch

External program switch input allows you to select one of two program banks available by an external device. This device can be a simple switch or a device with digital output. The `PROGRAM` parameter must be set to 0 to enable this feature. The program input is level controlled, the switch shut-off or logical 1 selects the Program 1, the switch closure or logical 0 selects the Program 2.

Addressing

Why to use the 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 should 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 useful. You can communicate only with selected unit(s). Example of use is remote control via satellite when one satellite uplink is used to distribute RDS control commands to more transmitter sites and each transmitter may carry different RDS data. Of course we may find many other examples.

What allows the addressing?
It allows connecting more units to one COM port and controlling them independently (up to 255 addresses possible). Unit addresses 0 and 255 are equivalent. Unit with address in range 1-254 is not active after reset and can be controlled only if it's selected by `SEL` command. Only selected units accept commands. For address range 1-254 the unit is selected for 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 and addressing feature needn't to be taken into consideration

Expansion IIC Bus

The expansion IIC bus provided on connector J3 allows connect varied devices in future respecting the customer needs. For example LCD display, expansion I/O ports, memories etc.

Real-time backup

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

Firmware Update

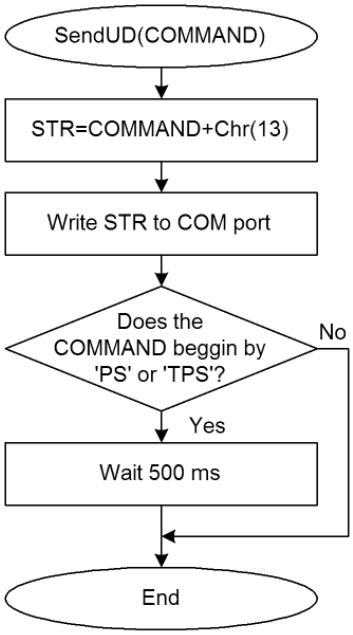
The RDS encoder has a firmware update capability. This allows easily implementing of new features in future. When a new firmware version will be released, special simple Windows application will provide the firmware update. The firmware updates are provided at no costs.
Please refer to the web site for more information.

Annexes

A - Communication Protocol Implementation Flowcharts

Following flowcharts allow the developer to implement the PIRA32 protocol to any application easily.

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).

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
```

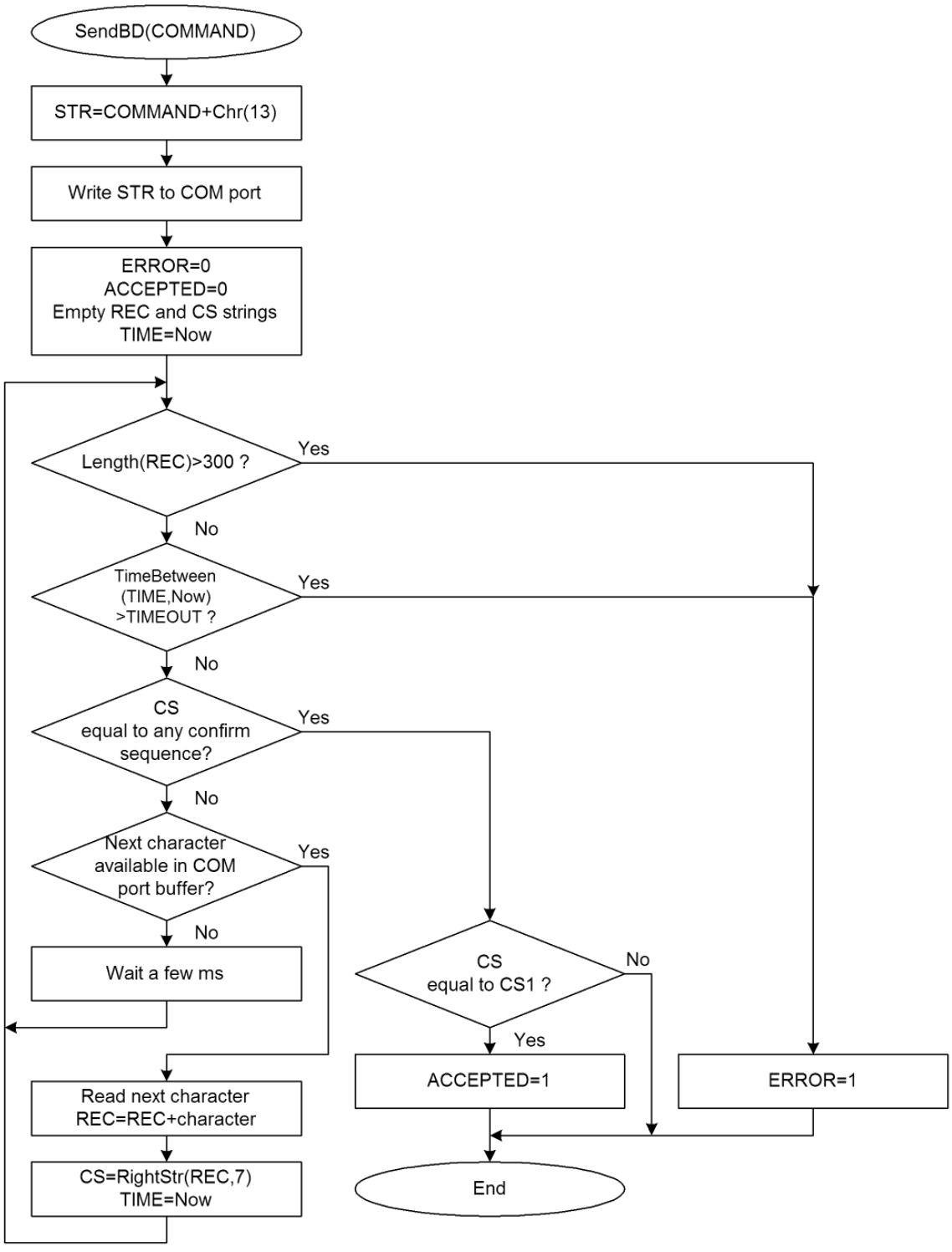
Other values:

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

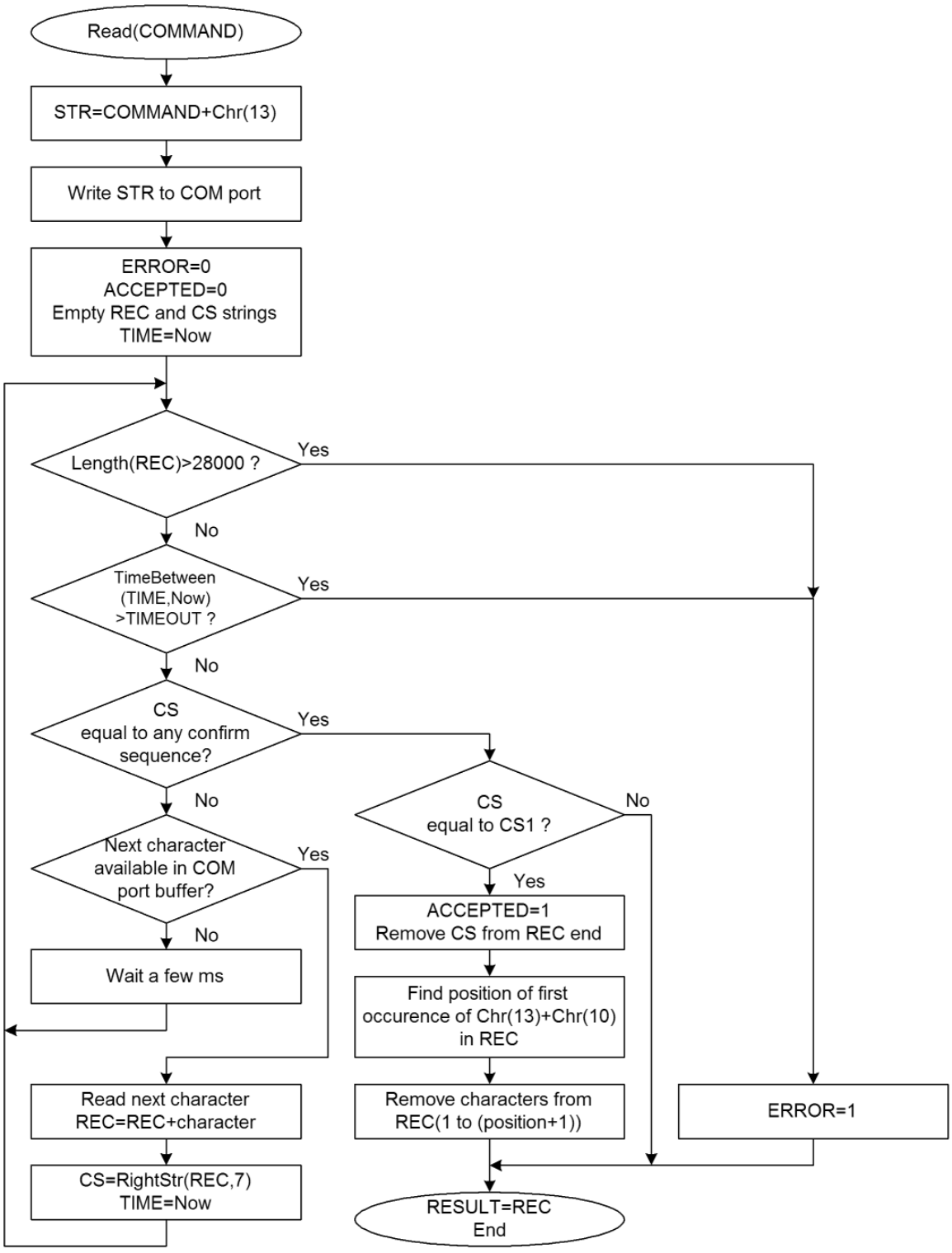
Calling examples:

```
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.