



Magic RDS

RDS Encoder

User Manual

Introduction

This dynamic stand-alone RDS encoder is ideal for use in RSL or small FM radio stations. It holds all common functions and meets requirements of most users while maintaining a low price. It can be used with virtually all FM transmitters.

Simple and modern concept of the RDS encoder uses two programmed microcontrollers for clock and data stream generating. Spectral purity around the 57 kHz subcarrier is very good due to digitally generated modulation signal using D/A converter.

Physical characteristics of the output signal are configured internally on the RDS encoder's board. Other features are controlled by software through universal parallel/serial port using standard connection elements. Control software includes MS-DOS and MS Windows versions and in addition to basic functions gives the RDS encoder some advanced possibilities.

Contact and support

Web page: <http://www.pira.cz/rds/>

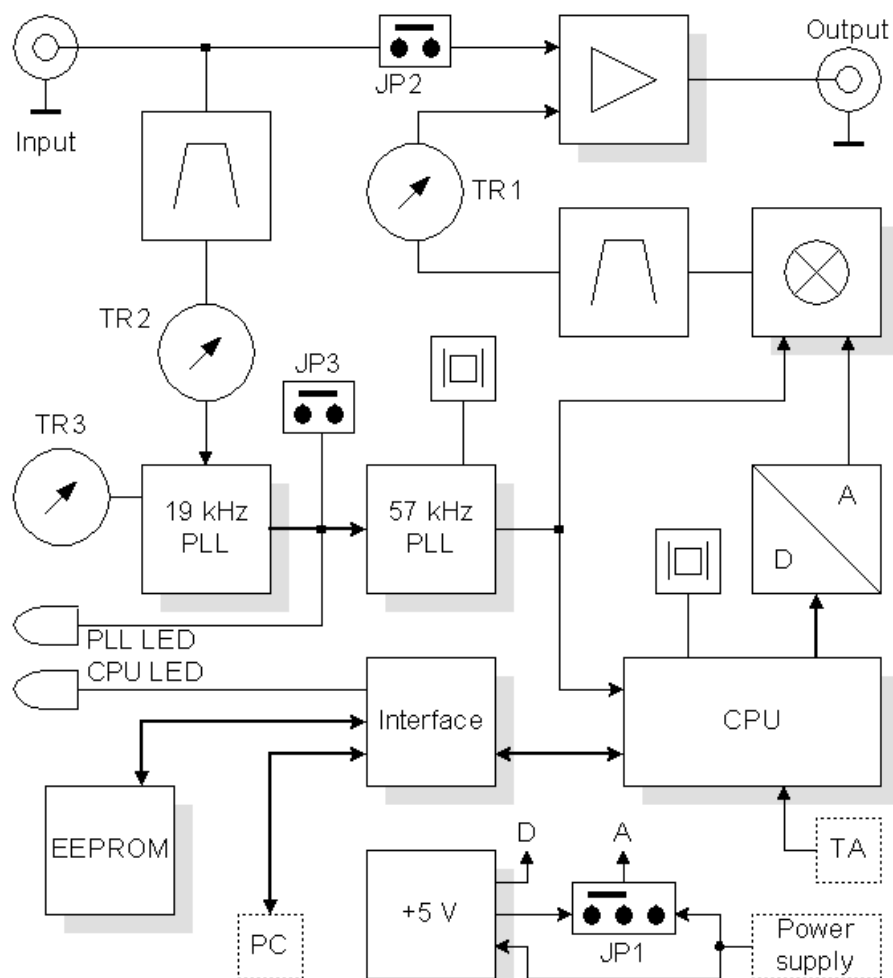
E-mail: mail@pira.cz

The web page includes new software versions, frequently asked questions, schematics etc.

Technical specifications

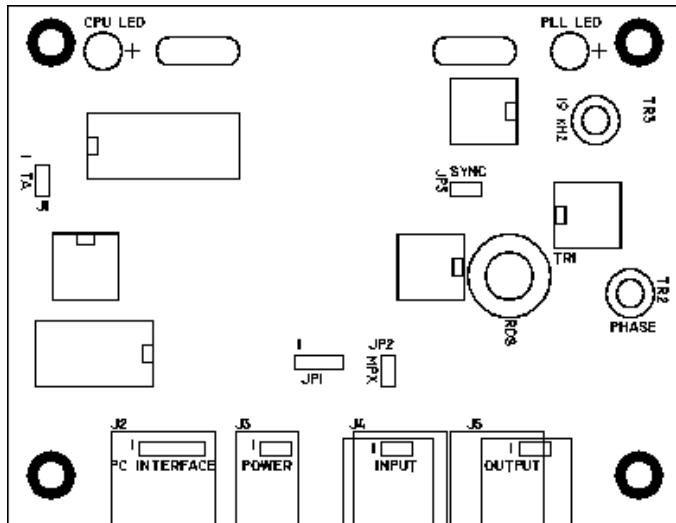
Parameter	Condition	Value
General		
Supply voltage	JP1: 1-2	8 - 20 V
	JP1: 2-3	8 - 16 V stab.
Supply current	12 V	30 mA
Signal connectors	default	unbalanced BNC
Data connector	default	RJ45
TA switching		software or external switch
TA input		TTL with 10 kOhm pull-up
RDS Services supported		PI, PS, PTY, TP, AF, TA, DI, M/S, PIN, ECC, RT, TDC, IH, CT
RDS/RBDS signal		
Subcarrier		57 kHz
Bandwidth		+/- 2.4 kHz (40 dB)
57 kHz carrier suppression	output level 1 V p-p	50 dB
Output level adjust	default	0 - 1.6 V p-p
Phase shift adjust	stereo transmission	0 - 120 degrees
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)
Leadthrough voltage gain	20 Hz - 100 kHz	1 (0 dB)
Pilot tone level		min. 110 mV p-p (-26 dB)
- recommended deviation		6.8 kHz
Pilot frequency		19000 Hz +/- 4 Hz
	recommended	19000 Hz +/- 2 Hz
Output		
Recommended load		> 70 Ohm, < 100 pF
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

Block diagram



Description

Composition



Connectors:

J1 - External TA switch

1: TTL input with 10k pull-up

2: ground

J2 - Data interface

J3 - Power supply (central pin is positive +)

J4 - Audio/MPX/Pilot input

J5 - Output

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 - 57 kHz synchronisation jumper

short: automatic

open: internal

TR1 - Output RDS signal level adjust

TR2 - Phase shift adjust

TR3 - 19 kHz free running oscillator adjust

LED Indicators:

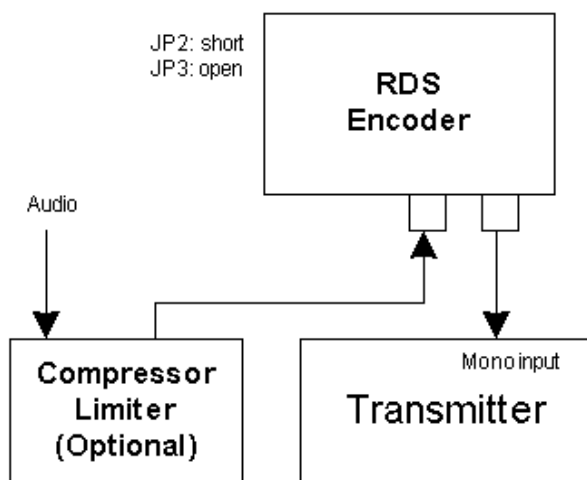
CPU LED - Function indicator (blinking)

PLL LED - Pilot tone present

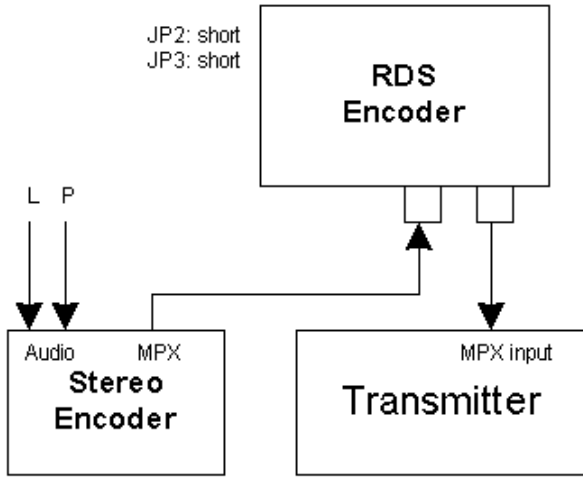
Installation

Connection

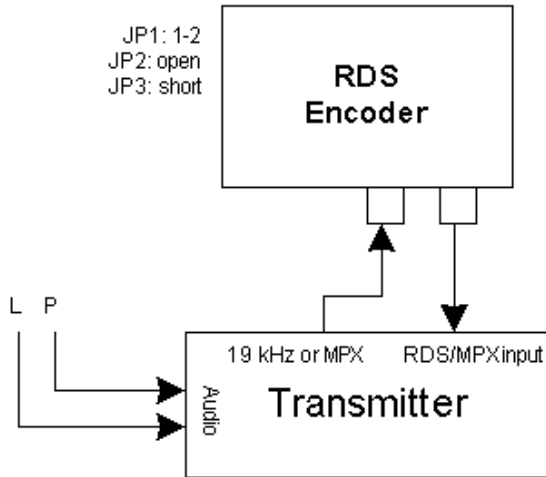
The following figures show various situations and corresponding methods of connection:



Mono transmitter and mono audio source



Mono transmitter with external stereo encoder



Stereo transmitter

If possible, it's recommended to connect the equipment as showed on last figure, where the Audio/MPX signal doesn't go through the RDS encoder. This rule is applied generally.

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 at least 50 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 needed then.

Adjustment

For **mono transmission** there is only one item to adjust - 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.

The JP3 jumper should be open when the RDS encoder is used for mono transmission to set the internal 57 kHz reference.

For **stereo transmission** it's necessary to set the RDS encoder so as the pilot tone and RDS subcarrier are in-phase. This can be done in several steps:

1. Adjust right RDS signal output level.
2. Short the JP3 jumper.
3. Connect the stereo encoder/transmitter to the RDS encoder. The PLL LED should indicate pilot tone present. If not, set the TR3 trimmer to the position where the LED is burning or set 19 kHz on marked pin on the PCB without pilot tone present.

Note: When you receive the RDS encoder, the trimmer TR3 is set to the right position.

4. Adjust right phase shift (0 or 90 degrees phase shift between 19 kHz pilot tone and 57 kHz RDS subcarrier, measured on transmitter input) by trimmer TR2. This adjustment is difficult without an oscilloscope. Never mind, if you don't have this equipment. Simply set the trimmer to min. position. 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 TR2.

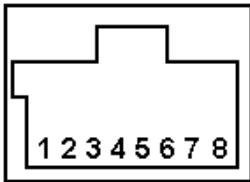
Numerous experiments performed in the field show that the conditions of RDS reception are not affected by this phase criterion. However, similar experiments have shown that right phase shift adjust offers a better behaviour of audio receivers, and notably the residues of audio intermodulation which can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

Connecting to a PC computer

Note: The RDS encoder is designed as stand-alone. It doesn't need a computer to be connected. All the features including dynamic work as well with a computer as without it.

When the RDS encoder is connected to a computer, the interface with the software provides control of the RDS services. The data stays in the RDS encoder even if you switch off the power supply due to using an EEPROM memory.

The RDS encoder is connected to PC via standard Ethernet direct UTP cable terminated by RJ45 plugs. On the PC side standard RJ45 to D-SUB adapter is used. Use the description below to connect the pins inside the adapter. It's also possible to buy the adapter as optional RDS encoder accessories. Advanced users may solder the D-SUB connector directly to UTP cable.



RJ45 female plug (front side)

Meaning	PC			RDS Encoder RJ45
	LPT	COM (9pin)	COM (25pin)	
Data	8	7	4	8
Clock	7	4	20	3
Send enable	12	8	5	7
Ground	25	5	7	6

TA Switching

The TA flag indicates the radio receiver if traffic announcement is on air. It may be controlled from software or using external switch.

The external switch may be controlled manually using a switch connected directly to the J1 pins. TTL levels are also accepted for automated control.