

***Transceiver-software for CCIR Radiopaging Code No. 1  
(Recommendation 584, Genf 1982, POCSAG Code)***

**POCSAG Protocol En/Decoder V1.0 for Windows 95 and Windows NT**

**©1997 by D. Fliegl, DG9MHZ**



What does POCSAG mean?

POCSAG is an abbreviation of Post Office Code Standard Advisory Group. This group has developed the most common protocol for paging-systems. A pager is a little box with a receiver and decoder for POCSAG signals. Every paging-system has its own frequency and every pager its own address. There are 3 different types of pagers:

- Beepers, without display, can only beep in different ways,
- Numerical pagers, with LCD to display up to 20 digit numbers,
- Alphanumeric pagers, same as above, but facility to display 180 digit ASCII messages.

Most paging-systems use all 3 kinds of pagers on the same frequency, which makes it necessary to decide upon the type of message encoding (beep, numeric, alpha). This is done by the lower 2-bits (function bits) of the pager-address. There is no general recommendation of the function mapping, so you will find different ones for every pager-system. The POC32 software provides an individual setup for the function bits, so you will not have any problems to adapt this universal decoder to any paging-system. Automatic detection of bitrates and functionbits is possible too.

For all German users there are presets for our paging-serviceproviders: TMOBIL, QUIX and TelMi. The program is even ready for the new service SKYPER of TMOBIL which uses an encrypted ASCII character set.

How to install the software:

Remove all old installations of the POC32.EXE and POC.VXD files. Please unpack the .ZIP file into any directory you want. Running Win95 the file POC.VXD should be copied to the \windows\system directory. On Win NT there is no need for this file yet.

If you do not have the runtime libraries MFC.DLL and MSVCRTL.DLL installed, an error window appears for each file missing. You can download these files from

**<http://www.lrz.de/~-/mfc40.zip>**

These files belong to the \windows\system (On NT: \winnt\system32) directory. Please remember: This software only works on windows 95 and Windows NT, but not on Windows 3.11 (even not if you have installed Win32s) !

If you still do not have a program to unpack .ZIP archives you should go to: **<http://www.winzip.com>** and obtain a shareware version of this very useful program.

All you have to do is to start the POC32 program and select **En-/Decoder - Settings - Hardware**. Now you can choose your desired port and interrupt of an unused COM-Port. If you have a soundcard installed in your system you can use it too - it is the best choice for non-hardware experienced users. You can select a 2 channel mode, when your soundcard is stereo, to decode 2 different POCSAG signals.

So together with a COM-port decoder you are able to decoder up 3 different POCSAG sources... funny, isn't it?

While POC32 is running on a COM-port, no other application should use the POC32 COM-port. If you have got a PCI-bus board with on-board COM-ports please do not remove the Windows95 COM-port driver. Since it is removed the COM-port will be disabled completely!

The Usage of a COM-port decoder is only possible on Win95!

**TIP:** If you are using a HAMCOM Modem you can choose **En-/Decoder - Settings - Decoder - RX-Dataline - DSR** to use it without modifications.

NOTE: With some newer PCI motherboards it's not possible to use the COM-port decoder. The reason for that is the serial controller chip, which cannot be programmed for sampling POCSAG data.

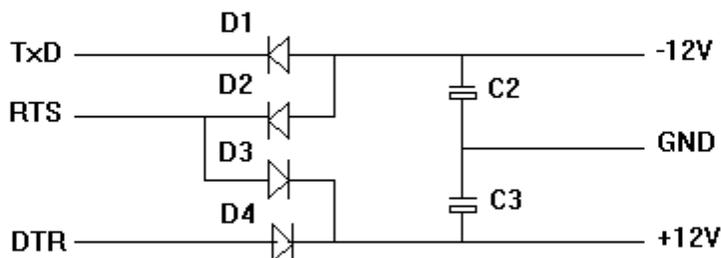
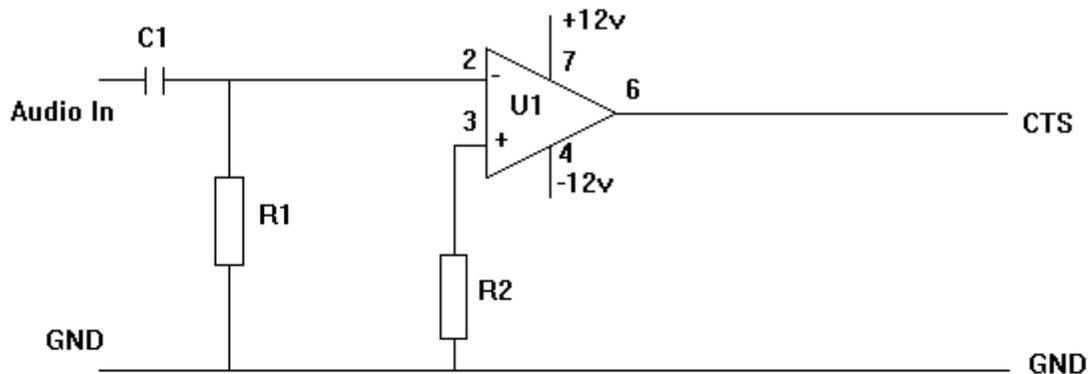
### ***Using POC32 with other charactersets:***

POC32 creates on first startup the file default.tbl which contains a character translation table. All you have to do is changing the assignment between charactercode and resulting character. Have a look on it with notepad.exe (or another windows texteditor) and you will understand! If you have written such a translation table for your country please send it to me via email together with some lines comment.

## Radio interface, modulation and demodulation:

Coding : binary, NRZ (non-return-to-zero)  
 Modulation : Frequency Shift Keying (FSK)  
 Deviation : +4,0KHz (logical "0") and -4,0KHz (logical "1")  
 Channel width : 20KHz  
 Bitrate : 512Bit/s, 1200Bit/s and 2400Bit/s  
 Computer Interface :

RADIO	RS232	9 PIN	25 PIN
PTT	RTS	7	4
TXDATA	DTR	4	20
RXDATA	CTS	8	5
GND	GND	5	7

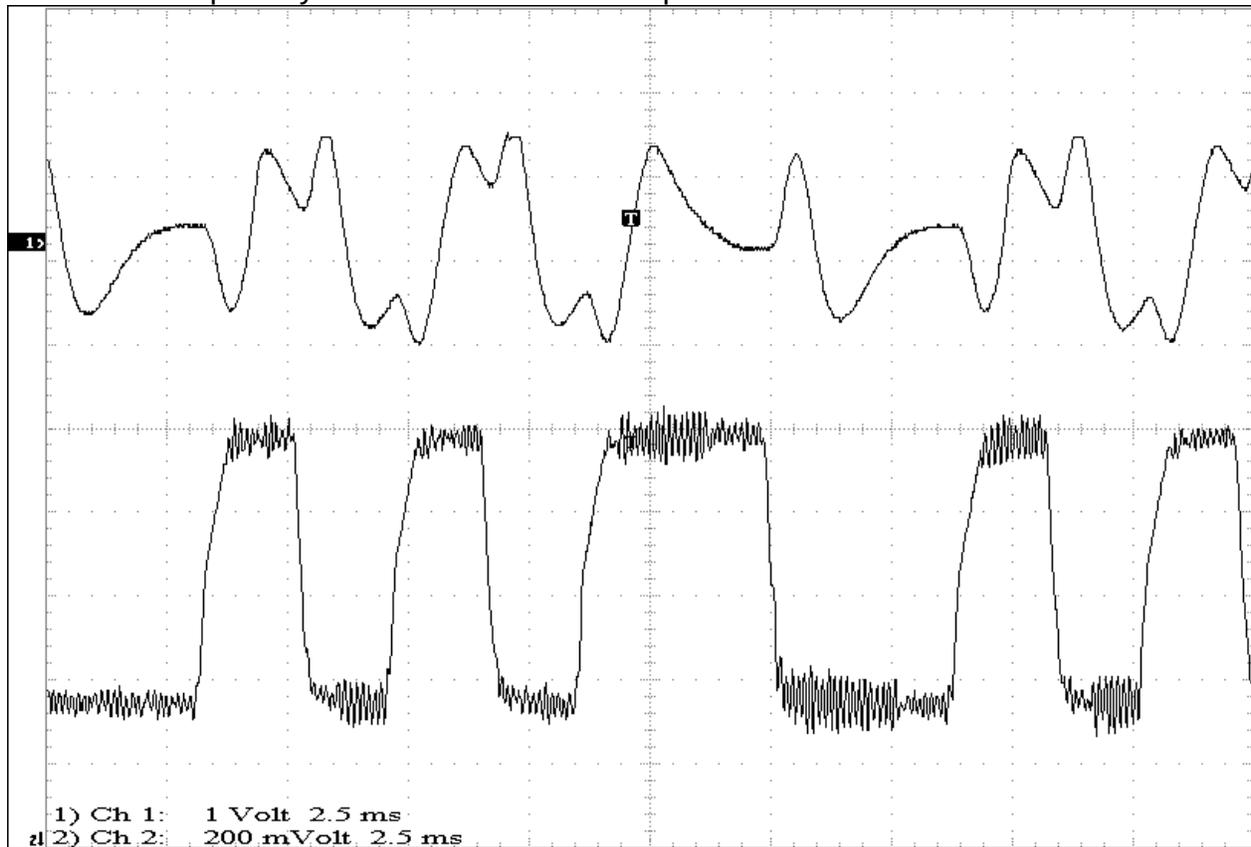


Parts List:		COM Port:	25way	9way
U1	741	CTS	5	8
R1	100K	GND	7	5
R2	10K	TxD	2	3
		RTS	4	7
C1	0.1uF	DTR	20	4
C2-3	10uF, 16v	DSR	6	6
D1-4	1N4148 or 1N914			

## How to decode signals?

If you have got a soundcard simply connect your receiver discriminator output signal to an input of it. If you do not own a soundcard: Just build this little decoder like shown above - it fits easily in a RS232 plugcase!

It is very important to use an unfiltered DC-coupled discriminator-output of a receiver to decode FSK signals properly. To prove the difference between a discriminator- and a normal AF-output to you I made this oscilloscope-screenshot:



The upper curve shows the AF-output of my receiver: there are no clearly defined slopes and reliable decoding of logical states is not possible.

The lower curve shows the unfiltered discriminator output, which carries still some IF-parts, but the slopes are very clear.

In case you are using a soundcard: Please take the volume control of Win95 or NT (or any other mixer tool) to set the input level. The best setting is, when the peaks of a data signal hardly reach the 100% audio level.

An automatic bitrate detection is possible too, but due to the decoding hardware there is just a double oversampling possible. This means that the detection procedure is done by bitpattern recognition: the software switches automatically to the bitrate where the received pattern is most likely to make sense. OK, this may not be satisfying for all purposes, because the maximum error probability is about 5%. This mainly depends on

the quality of the reception: If there is less noise and a very clear signal the decoding should always be successful.

Every decoded POCSAG packet is displayed in the monitor window. The contents can be saved, loaded, printed and copied onto the clipboard. If you want to copy one or more lines onto the clipboard, simply mark the icon on the left of the line and then press the copy button on the toolbar.

How to transmit:

POCSAG transmission is only possible on Win 95!

Simply connect the TX-DATA line over a voltage divider (100kOhm variable resistor) directly to the modulation input of your transmitter. Now adjust the deviation and change the polarity of the TX-DATA line, if necessary, by accessing the **settings**-dialog-box, choosing **Encoder** and selecting **Invert Lines/Transmit Data**. To generate a calibration signal you may set the TX-Delay to 100 or more. Now you can begin transmission by pressing the transmit-button on the toolbar: A dialog window appears, where you can enter all necessary data. After pressing the OK button the POCSAG packet is transmitted. Tip: If there is already data in the monitor window you can select one line for transmission by clicking on the icon on the left side of the line.

If you are using a PLL-transmitter with a close coupled loop it may not be possible to transmit data. This happens because then the lowest transmittable frequency is higher than the lowest slope-change-rate of the data signal.

### ***What you may want to know about German paging-services***

You can find the POCSAG paging services of TMOBIL (Deutsche Telekom AG) on these three frequencies: f1=465.97MHz, f2=466.075MHz, f3=466.230MHz.

They are called	Cityruf	(f1 + 512Bit/s),
	Euromessage	(f2 + 1200Bit/s + in western Europe),
	Inforuf	(f3 + own sync. word + stock exchange information),
	SCALL	(f3 + 1200Bit/s)
	Skyper	(f1 + 1200Bit/s encrypted ASCII table).

Since the middle of 1995 the MINIRUF GmbH provides a countrywide service named QUIX on the frequency 448.475MHz with 1200 and 2400Bit/s mixed.

Since the beginning of 1996 the Deutsche Funkruf GmbH provides the countrywide service TelMi on the frequency 448.425MHz with 512 and 1200 Bit/s mixed.

Since the middle of 1996 there is the information and paging service SKYPER of Deutsche Telekom AG on f1 with 1200Bit/s.

## ***How to find out the address of a (German) pager***

On the backside of every German pager there is a ID-number which generally looks like this:

ID XYZ-AAAAAAA-HH-P

X: 1 Single-destination-receiver (personal pager)  
2 Group-receiver

Y: 0 Beeper  
1 Numerical  
2 Alphanumeric  
3 International numeric  
4 International alphanumeric

Z: 0 Cityruf, f1  
1 Cityruf or SCALL, f2  
2 Euromessage, f2  
3 Cityruf oder SCALL, f3  
4 Inforuf, f3

A: This is the pager address in decimal notation

H: Manufacturer

P: Check code

This information can also be found on my homepage  
**<http://www.lrz.de/~-/>**

For further amateur radio specific questions feel free to send me an email:  
**[deti@lrz.de](mailto:deti@lrz.de)**

**If you have problems with POC32 please never forget to write:**

- The exact POC32 version,
- The brand and type of your motherboard (COM-decoder) or of your soundcard.
- The used operating system.

**If you like this software and you would like to support further developments don't hesitate to spend as much money for it as you like!**