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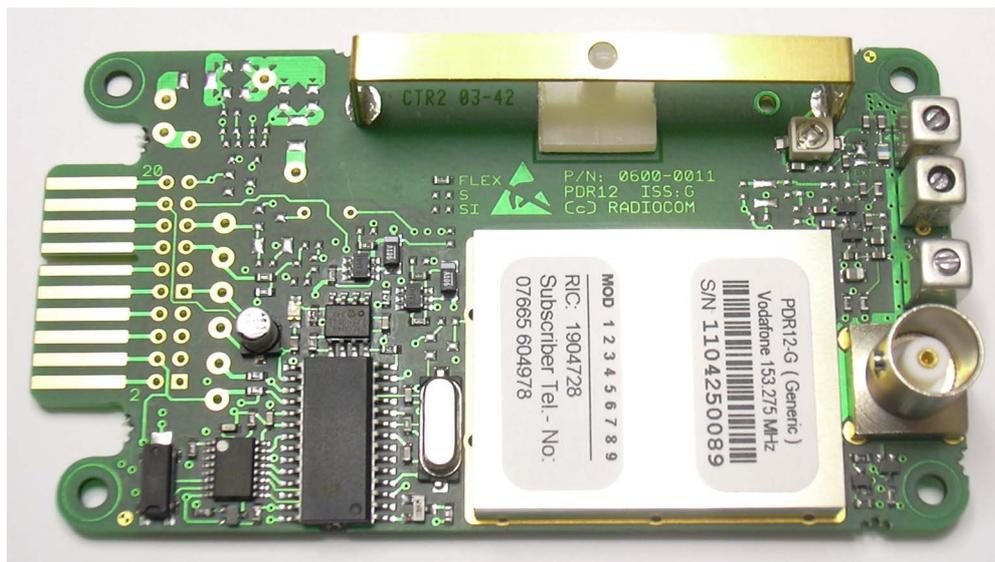


# PDR12 POCSAG Pager Module

( Issue - G )

## User Guide

Version 1.2 June 2005



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## 1. Quickstart

The PDR12 can be connected to a PC for testing using a cable that can be easily made up to the following specification:

PDR12 (P1, 20 way connector)	PC (9-way D-Type socket)
Pin 7 (RXD)	Pin 3, (TXD)
Pin 8 (TXD)	Pin 2, (RXD)
Pin 1 (GND)	Pin 5, (GND)

No RS-232 level converter is necessary as a MAX3221 driver is fitted to the pager module already.

Connect the PDR12 to the PC and start a standard terminal program like Windows Hyperterminal. Configure it to 8 data bits, 1 start bit, 1 stop bit, no parity, no handshaking and 9600 baud (default).

Next, apply power to the PDR12 as follows:

PDR12 (P1, 20 way connector)	Supply Voltage
Pin 9 (VCC)	+3.3 V to 14.0 VDC absolute max.
Pin 1 (GND)	0V

A 9V PP3 battery is ideal for first evaluation.

Upon power-up the PDR12 will output its configuration summary:

Example: (remarks in blue)

```

PDR12 (c)Radiocom
VER 6.15-G GENERIC           (Firmware version and board revision)
S/N 1104250089              (Serial number)
FRQ 153.275 [1200,N]        (Receive frequency and POCSAG baud rate, polarity)
NET Vodafone Select         (Paging Network)
RIC 1904728,A---            (RIC, message type and function bits)
TEL 07665604978            (Subscriber telephone number)
PSW 1234                    (Pin/Password for switching functions)
ID TEST PAGER-1            (User selectable pager module ID)
OPT P1 G1 L1 H0 S0 B5=9600 (Option settings, as per command table)
    
```

A message can now be sent and after typically 1 minute the message should be received by the PDR12 and be displayed within the Hyperterminal window.

The Status will LED flicker briefly when a messages is being received.

## 2. Command line interface

The PDR12 can be directly controlled from a standard terminal program such as Windows Hyperterminal. Make sure both terminal and pager are set to the same baud rate and configure the terminal as follows (default):

```

9600 baud
8 Data bits
No Parity
1 Start bit
1 Stop bit
No Handshaking
Echo off
    
```

A character sent from the terminal to the pager will wake it up and the command prompt '>' is sent back to the terminal indicating that the pager is ready to receive a command. If no characters are sent within 5 seconds the pager responds with 'timeout...' and enters sleep mode.

Any unrecognised inputs are responded to with '...invalid cmd!' and sleep mode is entered.

Below is a summary of available commands when using the command line interface. All commands must be followed by a carriage return ( ASCII 13 or hex 0x0D).

**Command Table** ( All characters can be upper or lower case. )

Command	Function
<b>B?</b>	Pager outputs active RS-232 baud rate [0..6] 0: 300 1: 600 2: 1200 3: 2400 4: 4800 5: 9600 (default) 6: 19200
<b>Bx</b>	Set serial port (RS-232) baud rate to x = [0..6] (see under <b>B?</b> for values of x )
<b>D1</b>	Set POCSAG baud rate to 1200
<b>D2</b>	Set POCSAG baud rate to 2400
<b>D5</b>	Set POCSAG baud rate to 512
<b>DI</b>	Decode inverted POCSAG data
<b>DN</b>	Decode normal POCSAG data
<b>GO</b>	Disable greeting message after power-up
<b>G1</b>	Enable greeting message after power-up
<b>HO</b>	Disable handshaking
<b>H1</b>	Enable handshaking ( CTS / RTS )
<b>IS</b>	Run receive signal strength test. PDR12 listens for POCSAG transmissions and outputs 'SYNC!' + RSSI value upon detection of sync codeword. Any key press aborts.

<b>ID:</b>	Set module ID Example: ID:Test Pager #1
<b>L0</b>	Disable Status LED
<b>L1</b>	Enable Status LED
<b>P?</b>	Pager outputs power save mode setting [0,1,D]  0: off (radio receiver permanently on; no message reception)  1: on (radio receiver is switched on when needed; default for receiving messages)  D: down (radio receiver permanently off)
<b>P0</b>	Pager sets power save mode = 0
<b>P1</b>	Pager sets power save mode = 1
<b>PD</b>	Pager sets power save mode = D
<b>PW:</b>	Set Pin/Password ( up to 8 digits / characters ) Examples:  PW:12345678 ( pin ) PW:ABCD ( password )
<b>RT</b>	Software Reset
<b>SO</b>	Store most recent message in RAM
<b>S1</b>	Store most recent message in EEPROM memory (non-volatile)
<b>SI</b>	Output PDR12 configuration report
<b>SM</b>	Pager outputs most recent message from EEPROM memory (if enabled )
<b>TN:</b>	Set subscriber telephone number Example:  TN:07665604978

### 3. Status LED

The status LED can be enabled (L1) or disabled (L0) using the command line interface. It is recommended to leave it enabled (default) as it will only be on for very short durations of activity and provide the user with information as to what is happening. Whenever the PDR12 is powered up or when the onboard microcontroller is woken up, either by an incoming pager message or by RS232 data, the status LED will be on. Also, during message reception it will flicker briefly indicating incoming data.

## 4. Message output control and RTS/CTS handshaking

In applications where the user device is in sleep mode itself or mostly busy with other tasks it is necessary to implement a form of signalling and handshaking to transfer messages only from the pager to the user device when the latter is ready for it.

In order for this to work the user has to set the pager to RTS/CTS handshaking mode. This can be done via the command line interface (command: H1).

After a message has been received, the state of CTS is read. If it is active (logic 1 = +3.3V) the message is output in ASCII format. If CTS is not active (logic 0 = 0V), i.e. the user device is not ready to receive the message from the PDR12, the pager sets RTS high (logic 1 = +3.3V) to indicate a waiting message and then enters sleep mode. Upon CTS being set active (logic 1 = +3.3V) by the user device, the pager wakes up and outputs the latest message. RTS is then set inactive (logic 0 = 0V).

Note: RTS / CTS handshaking is not implemented on the PDR12 for other data exchange i.e. command line interface. It is intended to provide the user with a means to control the output of messages.

## 5. Switching Functions

The PDR12 can control up to 4 switching outputs. These outputs connect directly to a PIC microcontroller. An output is on when the voltage on the pin is 3.3 V and off when 0V is present.

Although each output can sink and source up to 25 mA, it is recommended to limit output current to not more than 5 mA as the PDR12 performance specifications cannot be guaranteed otherwise. If higher loads need to be driven consider the use of bipolar or MOSFET transistors.

The following table shows the four available channels and how to access them:

Switching Channel	Signal	Interface
1	RA5	Connector P1, Pin 11
2	RB6	Connector P1, Pin 10
3	RB7	Connector P1, Pin 5
4	RB1	Connector P1, Pin 12

### 5.1 Interfacing the PDR12 switching outputs to a relay

Appendix C shows an example circuit of a typical relay driver.

## 5.2 Sending Switching messages

To prevent switching due to accidentally misdialled pager calls, a PIN / Password has to precede the actual switching string.

The default for the PIN / Password is '1234'.

To change the PIN / Password the PDR12 Programmer software is used. The maximum PIN / Password length is 8 characters. Characters can include all of those, which can be sent through the paging network (letters, digits and some special characters. Avoid spaces. For numeric pagers only digits can be used as the PIN / Password.

The format of a typical switching command message is as follows:

```
'12341001'
| | | | | | | |
PPPP| | | |      P = PIN/Password (up to 8 chars)
      CCCC      CH1...CH4 = outputs
      HHHH
      1234
```

In order to perform switching the PIN / Password is entered followed by a:

- '1' for switching CH on
- '0' for switching CH off
- any other digit will leave the output unchanged.

The following are valid examples:

```
12341000 // switches CH1 on, CH2..4 off
12341    // switches CH1 on, CH2..4 unchanged
12341111 // switches all on
12340000 // switches all off
12347891 // switches CH4 on, CH1..3 unchanged
```

It is also possible to send more than one switching string within a paging message allowing for more complex transitions (e.g. a RESET pulse).

Example:

```
1234100012340000 // switches CH1 first on and then off again
| | | | | | | | | |
AAAAAAAAA| | | | | | // switching string A (CH1 on)
          BBBB| | | | // switching string B (CH1 off again)
```

The length of the above positive pulse can be extended by adding more 'fill' characters between the two switching strings.

## 6. Antenna Options

The PDR12 can be used with an integral antenna or an external antenna connected to the standard BNC socket (other types of RF connectors i.e. SMA, SMB, etc. are optional).

### Integral loop antenna

The PDR12 is fitted with an on-board loop antenna which is tuned for best sensitivity. This antenna is recommended for use in plastic enclosures.

### External antenna

An external antenna ( i.e. Dipole, directional Yagi, etc.) can be connected to the pager via the RF connector. Use this type of antenna when the pager is to be integrated in a metal housing or when the antenna needs to be located a long distance away from the pager.

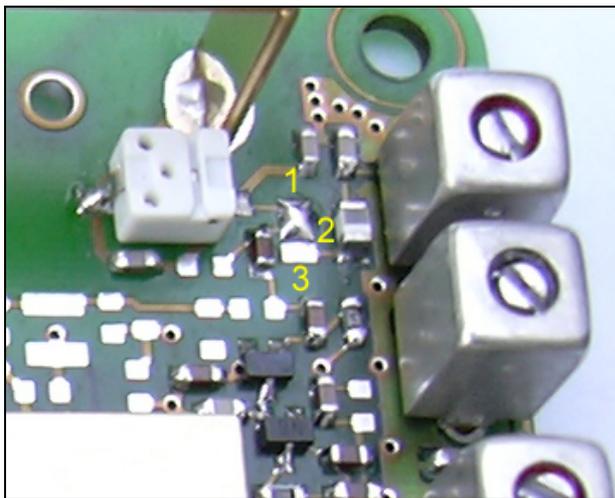
### Antenna Select Solder Link

The choice of antenna can be configured on the module through a solder link which is located near the top right fixing hole in between the white trimmer capacitor and the tuned band pass filter (receiver front end).



**PLEASE NOTE:**

**Observe antistatic precautions by ensuring that user and solder iron tip are earthed to prevent damage to RF front end semiconductors.**



- Link 1-2: On-board magnetic loop antenna
- Link 2-3: External antenna via BNC connector

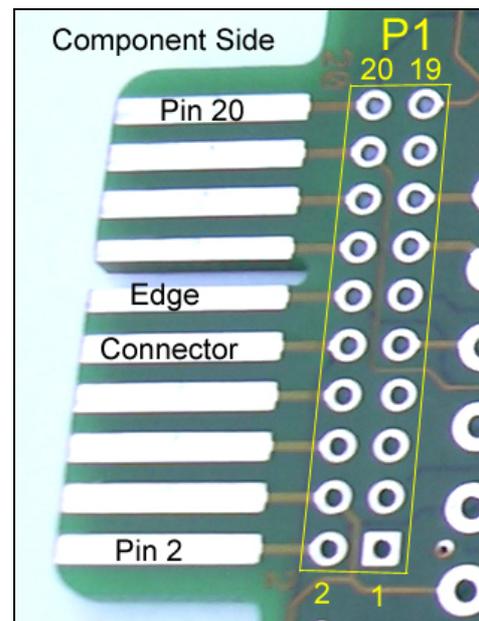
## 7. Electrical Interface

A single 20-way connector (P1) is used to interface the PDR12 pager module to the user application. This connector (0.1" spacing pin header / socket or IDC connector) can be fitted by the user to either side of the pcb to allow for maximum versatility for integration.

Alternatively a 20-way edge connector can be used which is connected in parallel to connector P1.

### 8.1 Connector P1 (20-way header or IDC, fitted by user):

- |    |   |
|----|---|
| 1  | GND   |
| 2  | TXD (LVTTTL)                                  |
| 3  | do not use (production test)                  |
| 4  | RXD (LVTTTL)                                  |
| 5  | Switching output (Channel-3) or RTS, (LVTTTL) |
| 6  | VDD (+3.3V = internal rail)                   |
| 7  | RXD (EIA-232 compliant)                       |
| 8  | TXD (EIA-232 compliant)                       |
| 9  | VCC (positive supply, 3.3 V... 14.0 V DC)     |
| 10 | Switching output (Channel-2) or CTS, (LVTTTL) |
| 11 | Switching output (Channel-1), LVTTTL          |
| 12 | Switching output (Channel-4), LVTTTL          |
| 13 | do not use                                    |
| 14 | Reset (pull low to reset)                     |
| 15 | do not use                                    |
| 16 | I2C (SDA) - custom firmware only              |
| 17 | I2C (SCL) - custom firmware only              |
| 18 | Status LED output                             |
| 19 | do not use                                    |
| 20 | do not use                                    |



Note: LVTTTL = low voltage TTL (low=0V , high=+3.3V)

### 8.2 Connector P2 (External antenna, BNC socket as standard):

- |   |                                      |
|---|--------------------------------------|
| 1 | RF - Input, external antenna ( 50Ω ) |
| 2 | GND                                  |

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**Appendix A: Technical Specifications****POWER SUPPLY**

Supply voltage:	Minimum:	+ 3.3 V DC
	Absolute maximum:	+14.0 V DC
Supply current:	Mode P1 ( receiver pulsed on/off ):	320 $\mu$ A average ( receive mode )
	Mode P0 ( receiver on ):	2.2 mA
	Mode P0 ( receiver on ) + LED on:	9.6 mA

**RADIO PERFORMANCE**

Frequency Range:	VHF: 138 to 174 MHz ( crystal oscillator, fixed frequency )
	UHF: not currently available
Channel Spacing:	25kHz
Sensitivity (1200 baud):	Conducted ( BNC input, ext. antenna ): -123 dBm
	Radiated ( on-board antenna ): 8 $\mu$ V / m
Intermodulation Rejection:	better than 50 dB (typ. 56 dB)
Adjacent channel sensitivity:	better than 60 dB (typ. 73 db)
Spurious emission <1GHz:	2nW max.
Antenna selection:	user selectable ( solder link )
Antenna types:	on-board integral magnetic loop antenna
	External antenna ( 50 $\Omega$ ) connected to BNC socket
	( MMCX, SMA, SMB optional )
RF input filtering:	Bandpass ( external antenna input )

**FUNCTIONS**

Code format:	POCSAG ( CCIR RPC No.1 )
Baud rates:	512, 1200, 2400
Polarity Options:	Inverted or normal POCSAG data
Message type:	Alphanumeric (text) and numeric
Number of RICs:	1 ( standard, user programmable via command line )
Total number of RICs:	8 ( optional, factory programmable )
Serial Interface:	Full EIA-232 (RS-232) compliant ( TXD and RXD only )
	CMOS ( +3V3, 0V )

Number of switching outputs: 4 CMOS ( +3V3, 0V )

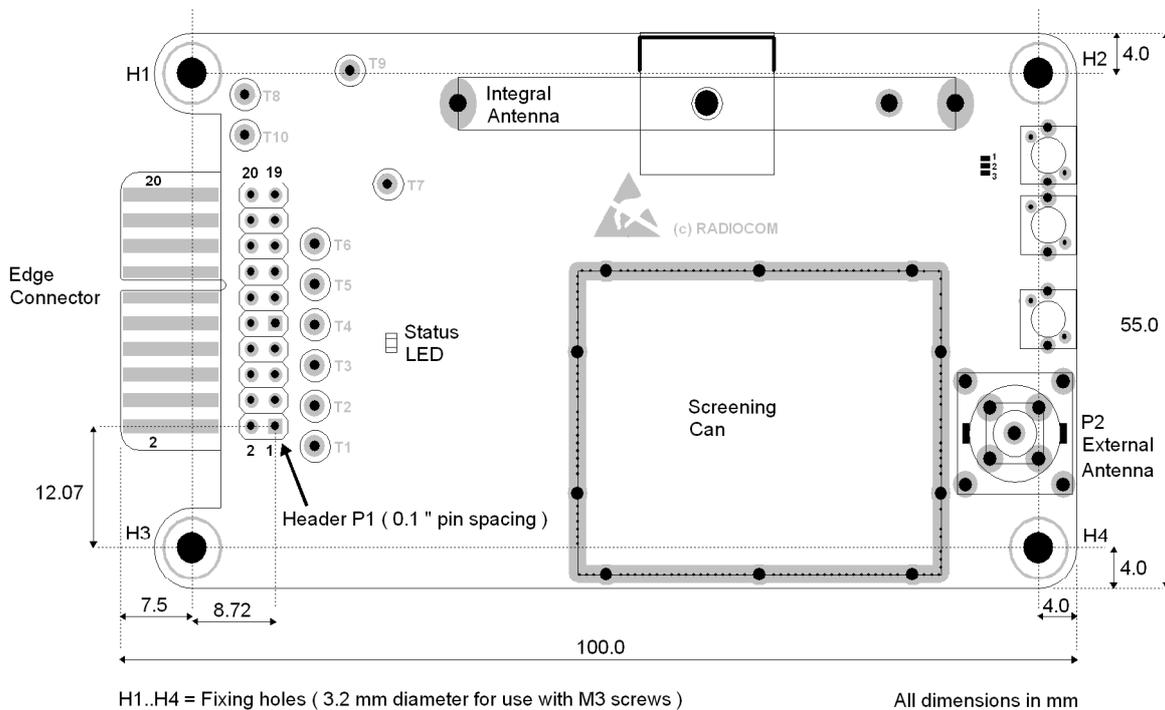
**ENVIRONMENTAL**

Operating temperature: -10  $^{\circ}$ C to +55  $^{\circ}$ C

**PHYSICAL**

Module length x width:	100 x 55 mm
Module height:	18 mm maximum ( on-board antenna fitted )
	20 mm maximum ( BNC socket fitted )
Module weight:	35 g

Appendix B: Mechanical drawing of PCB



Board height: 18 mm maximum (incl. integral antenna and solder joints)

**Integration tips:**

- Keep the integral antenna as far away as possible from metal objects as these can shield and/or detune the antenna and reduce receiver sensitivity.
- Keep pager antenna away from DC-DC converters, switch mode power supplies and other sources of radio interference to maximise receiver sensitivity.
- For maximum receiver sensitivity orientate the pager so that the area enclosed by the integral loop antenna is not parallel to the surface of the earth. This is valid for vertically polarised transmissions like the public paging networks i.e. U.K. Vodafone, PageOne, etc.

Appendix C: Example circuit of a typical relay driver

