HR1200

Version 1.00
ATIM RADIOCOMMUNICATION

Contact Information

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1 Introduction

The HR1200 is intended primarily for data communications.
It has an RS-232 interface, line level buffering, power supply and an interface for a speaker/microphone.

Operating at 1200 baud on air speed, it is suitable for stand-alone use in point-to-point or point-to-multipoint data communications, as a telemetry unit in Scada Systems, or for system integrators.

Over the air data rate:	1200 Baud
Audio port:	9 way D-range for FFSK signalling, with flat or pre/de-emphasised audio selectable
Serial data port:	Standard 5 wire (hardware handshaking) RS232 (RXD, TXD, RTS,CTS, GND) DCE type
Speaker/microphone:	A 3.5mm and 2.5mm phone jack combination
Input voltage:	9 to 30V DC
Low Voltage protection:	Automatic restart on power down/up cycling
EMC protection:	On all I/O
Power up mode:	The radio modem will power up on the last selected channel
Channel selection:	16 channels internally selectable via SW1 DIP switch
	8 channels externally selectable through audio port pins

1.1 Configurations

With both audio and RS232 type interfaces, the radio modem can operate in two configurations:

- As a Radio Modem

To use the HR1200 as a modem, connect the unit directly to any RS232 computer terminal equipment, via the RS232 port.

The HR1200 is always in transparent mode and radio acts as a modem, automatically transmitting in FFSK format the serial data received from the computer terminal equipment.

- As a Voice Radio (testing purposes only)

In all operating modes a speaker microphone can be used for normal voice operation of the radio, to check the RF link between radios.

1.2 Specifications

The performance figures given are typical figures, unless otherwise indicated, for equipment tuned with the maximum switching band and operating at standard room temperature.
Where applicable, the test methods used to obtain the following performance figures are those described in the European specification ETS 300-086.

General Specifications

Modulation Types		FM
Frequency Increment		5, 6.25kHz
Supply Voltage:		
	Operating Range	9V to 30V DC
	Standard Test Voltage	13.8V DC
	Polarity	negative earth
	Polarity Protection	internal crowbar diode
	Overvoltage Protection	internal crowbar zener <10A
Current Consumption:		@12/24V: 75mA / 50mA
Operating Temperature Range		-30C to +60C ambient

Dimensions		
	Length	145mm
	Width	65mm
	Height	35mm
Weight		270g

Receiver Performance

Sensitivity:		
	12dB Sinad	< -117dBm
	20dB psophometric	7-114dBm

Signal-to-Noise Ratio	40dB psophometric
Selectivity	Better than 66dB (12.5kHz), 70dB (25kHz)
Spurious Response Attenuation	70dB

Spurious Emissions		-57dBm (Conducted and radiated to 1GHz)
Intermodulation		Better than 65dB
Blocking		Better than 94dB
Hum and noise		40dB
RSSI		
	Range	-120 to -40dBm
	Slope	28.65 mV/dB (typical)
Squelch		
	City	16dB
	Country	12dB
Line output level		-10dBm (factory set)

Transmitter Performance

Power Output (duty cycle 100%):		
	400-520MHz	1W (low)
		2.5W (medium)
		4W (high)
Duty cycle		20% 1 minute transmitting, 4 minutes receiving at max temp and voltage.
Spurious Emissions:		-36dBm (Conducted and radiated to 1GHz)
Adjacent Channel Power:		60dBc
Deviation Limiting:		±2.5kHz (narrow) ±5kHz (wide)
Audio:		
	Input for 60% line deviation	-10dBm (factory preset)
	Distortion	<5% at 1kHz
	Hum and Noise	narrowband 40dB, wideband 45dB
Mismatch Capability:		
	Ruggedness	2 minutes transmission into infinite VSWR
	Stability	VSWR 5:1 (all phase angles)

2 Installation and Setup

2.1 Internal Settings

SW1 DIP Switches

The SW1 back of DIP switches can be used to select the channel, set data parameters and control the audio response.

Switch	Function	Setting
1	Channel select 1	(see “Channel Selection”)
2	Channel select 2	(see “Channel Selection”)
3	Channel select 3	(see “Channel Selection”)
4	Channel select 4	(see “Channel Selection”)
5	Audio In pre-emphasis/flat response	flat = off
6	Factory calibration only	leave set to off
7	Inverts RTS and CTS handshaking lines	invert lines = off
8	Inverts Rx and Tx data	invert data = off

2.2 Channel Selection

Channels can be selected internally, using SW1 DIP switches 1-4, or externally, by connecting the audio port to a set of switches.

Selecting Channels Internally

The following table shows the SW1 channel selector switch settings for each channel.

Channel	Switch 1	Switch 2	Switch 3	Switch 4
1	Off	Off	Off	Off
2	On	Off	Off	Off
3	Off	On	Off	Off
4	On	On	Off	Off
5	Off	Off	On	Off
6	On	Off	On	Off
7	Off	On	On	Off
8	On	On	On	Off
9	Off	Off	Off	On
10	On	Off	Off	On
11	Off	On	Off	On
12	On	On	Off	On
13	Off	Off	On	On
14	On	Off	On	On
15	Off	On	On	On
16	On	On	On	On

Selecting Channels Externally

1. Open the radio modem and switch SW1 DIP switch channel selectors 1,2,3 and 4 OFF
2. Connect Audio Port pins 7,8 and 9 to 3 external switchs 1,2,3 (switch to the 0V)
3. Connect Audio Port pin 4 to ground (0V)
4. Connect Audio Port pin 5 to the power supply (+)
5. Select the channel required with the 3 switchs 1,2,3 (pins 7,8,9) - [CH1-8]
6. An additional 8 channels can be accessed by opening the radio modem and switching SW1 DIP switch selector 4 ON. [CH9-16]

2.3 Audio Port & Power Supply

Pin	Function	Comment
1	Data audio in (unbalanced)	-10dBm for 60% deviation
2	Data audio out (unbalanced)	-10dBm for 60% deviation
3	PTT	Default: active low
4	**Ground**	
5	**DC power input**	9-30 V
6	Carrier Detect (Rx Gate)	Set to active high
7	Channel Select 1 (LSB)	Refer to Channel Selection table above
8	Channel Select 2	
9	Channel Select (MSB)	

3 Radio Modem Operation

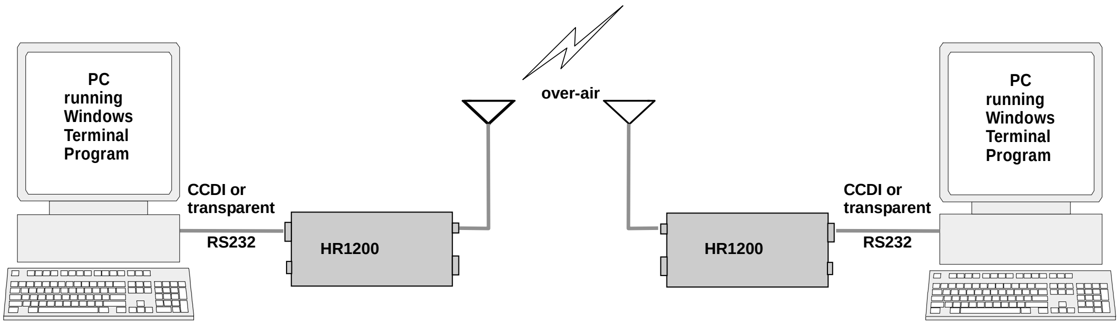
With both RS232 and Audio Port interfaces, the HR1200 can operate in two configurations:

- as a radio modem
- as a voice radio - used for testing only

When operating as a radio modem, the HR1200 is connected directly to computer terminal equipment via the RS232 port.

The data flow is controlled by CTS and RTS signalling, selectable via the programming software (default: disabled).

Transparent mode can use 1200, 2400, 4800 or 9600.



The table below indicates the RS232 port pin designations.

Pin	Function	Description
1	Not used	
2	RXD	Data from radio modem
3	TXD	Data to radio modem
4	Not used	
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request to Send
8	CTS	Clear to Send
9	Not used	

Note
RS232 pin labelling can be misleading.
RS232 signals are named for the DTE. In this system, the radio Modem is the DCE (Data Circuit-terminating Equipment) and the other device (PC) is the DTE (Data Terminal Equipment).
At the rear of the radio modem, pin 2 of the 9-pin RS232 socket is called RXD but is used for outgoing data transfer and pin 3 of the 9-pin RS232 socket is called TXD but is used for incoming data. According to the EIA RS232 Specification, RXD is on pin 2 and TXD is always on pin 3 regardless of signal direction.

3.1 Before Operating

Before operating, set the following:

1. The radio modem programming: (Already done by ATIM)

2. Channel selection
Selected internally or externally via the SW1 DIP Switches (see “Channel Selection”).

3. Power up the radio modem.
On power up the radio modem will select its default channel and operate in transparent mode.

4. Power, Tx and Rx LED indicators are helpful to establish proper operation. The speaker microphone can be used to listen to data coming in.

Note In accordance with RS232 specifications, the radio modem should be within 15m of the computer equipment for optimum performance.

Data flow is controlled either by the customer’s embedded computer system or by a PC running a data-sending application such as “Hyperterminal”.

3.2 Transparent Mode

In Transparent mode, the radio acts as a modem, automatically transmitting in FFSK format the serial data received from the PC. In this mode the data exchange between the computer equipment and the radio modem is selectable from 1200, 2400, 4800 and 9600 bps, but the over-the-air data rate is always at 1200 bps. The serial data input buffer size is set to 60 bytes to adequately cope with the data flow.

Communication in Transparent mode is free-format, with protocol determined entirely by the PC and the modem.

Transmission Format

The Transparent Mode transmission format is as follows:

Single Data Block

LID	preamble 2 bytes	sync 2 bytes	size 2 bytes	FFSK data max 46 bytes	CRC 2 bytes	Tail Time
	H E	A D	E R			

Multiple Data Blocks

LID	HEADER 6 bytes	FFSK data max 46 bytes	CRC 2 bytes	....	HEADER 6 bytes	FFSK data max 46 bytes	CRC 2 bytes	Tail Time

Effective Data Rate

Data rate varies depending on the quantity of data. For example, assuming 460 byte data is being sent, with a lead in delay of 100ms and tail time of 20ms. Note that these calculations are theoretical only as there are other real-life factors not being considered.

Bytes really sent:

460 bytes / 46 bytes per data block = 10 data blocks

2 bytes preamble + 2 sync + 2 size + 2 CRC = 8 bytes for Header and CRC per data block

8 bytes overhead x 10 data blocks = 80 total overhead bytes

460bytes of data + 80 bytes overhead = 540 total bytes sent

540 bytes sent x 10 bits per bytes = 5400 bits sent over-air (start and stop bit added to each byte)

Time taken: 5400 / 1200 = 4.5 seconds time to send bits

4.5seconds + 120ms = 4.62 seconds including lead in delay and tail time

Data Rate (effective):

460 bytes x 8 bits = 3680 bits to be sent

3680 bits / 4.62 seconds = 876 bits / second

If 461 bytes are sent, then the number of data blocks rounds up to 11.
This reduces the effective data rate significantly to 784 bits / second.