



SPECIALIST RF DESIGNS

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**HERMES RADIO MODEM  
OPERATING INSTRUCTIONS**

(1892 1300)

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## 1 INTRODUCTION

This document describes the operation of the Wood and Douglas Hermes Radio Modem.

The Hermes modems provide a transparent data link for a wide range of applications. The internal modem can be used with a range of Wood & Douglas RF products to give great choice in the operating frequency and transmit power. Two enclosure types are available to suit different applications.

The Hermes uses 4-Level Frequency Shift Keying (FSK) technology to achieve a RF link data rate of 19,200 baud in a 25kHz channel spacing and 9,600 baud in a 12.5kHz channel spacing.

One of the radio transceivers (the G-Max family) used inside the Hermes is designed for harsh environments and operates over a wide temperature range and a high vibration environment.

The standard Hermes is fitted with the SXn50 range of transceivers. This family has products at VHF, UHF and 868MHz, with a maximum transmit power of 500mW.

## 2 CONNECTIONS & INDICATIONS

### 2.1 RS232 Connector

The RS232 connections are made via a 9 way D female with the following connections:

Pin No.	Function
1	CD Output Set (+ve) when a RF signal above a certain level is present at the RF connector. The threshold is programmable over 10 levels that are defined in section 5.13
2	RXD RS232 data level data output
3	TXD RS232 level data input
4	DTR RS232 level input When set (+ve) by the DTE (host processor) the modem and transceiver is turned on. The max/min levels are: DTR Vin Min. (off state) = -15V DTR Vin Max. (off state) = +2.5V DTR Vin Min (on state) = +5V DTR Vin Max (on state) = +15V DTR Iin Max(on state) = 4mA
5	Signal Ground
6	DSR RS232 level output Set (+ve) after power is applied to the modem or when the DTE (host processor) sets DTR +ve. The output is active when the modem is ready to receive data. The time taken for the output to become active is <50ms from when DSR or power is applied to the modem.
7	RTS RS232 level input The RTS input must be set (+ve) for both data and configuration. Data is ignored when RTS is clear (-ve).
8	CTS RS232 level output Set (+ve) if the transmit RS232 data into the modem can be accepted and the RTS input is set, it is cleared (-ve) otherwise. Clearing of this signal indicates that the input transmit buffer is nearly full .The RS232 data must be stopped within 10 bytes of this signal being cleared. After this point the data is ignored. The CTS signal is set again if there is room for more than 10 bytes.
9	n/c

Table 1 Data Connections

## 2.2 Power Connector

The power and ancillary connections are made via a 9 way D male connector. The power supply input is fully isolated from the chassis of the module.

**Note:** The power supply cannot be used as an RS232 input line.

Pin No.	Function
1	RSSI Received Signal Strength Output Analogue output proportional to the level of the RF input Level at -110dBm input = ~0.6V and at -60dBm = ~2.1V
2	n/c
3, 4	+ve Supply Input (9 - 36VDC) Receive current <100mA at 24VDC input Transmit current <400mA at 1000mW RF output, 24VDC input (reverse voltage protection with re-settable "polyfuse")
5	Power Supply Ground (isolated from enclosure)
6	I <sup>2</sup> C Bus Clock (engineering use only)
7	0V (chassis of enclosure)
8	I <sup>2</sup> C Bus Data (engineering use only)
9	Power Supply Ground (isolated from enclosure)

Table 2 Power Connections

## 2.3 RF Connector

The RF connection to the modem is a female TNC bulkhead connector.

## 2.4 Front Panel Indications

There are 3 LED indicators which show the operation of the unit as follows:

- P** Green Power On when DC supply input present and DTR input is high (> 3V)
- S** Orange Status Flashes orange when the transceiver is switched to transmit or receive. Continuous orange if the transceiver goes "Out Of Lock" (OOL) which happens on failure, or when an invalid frequency is programmed into it.
- T** Red TX On when the transmitter is turned on.

These LEDs are next to the connectors on both types of enclosure.

## 3 MODEM OPERATION

### 3.1 Introduction

The internal modem power supply system is turned on/off with the DTR input. The modem is ready after an initialisation period. The modem enters receive mode using the last set of configuration parameters (RF channel, squelch level etc).

The modem starts the transmit sequence after the first data byte is received from the RS232 port. The incoming data is stored while the transmitter is turned on and the preamble output. The start, stop and parity (if 8 bit data) are stripped off the input data stream and the data stored as 8 bits only.

The transmission is ended when the input buffer is empty. After the transmission is complete and the transmitter turned off, the modem switches back to receive mode. Transmission has priority over reception so the user has to check by means of the CD handshake line if the radio channel is free before inputting data.

The timing of the power, handshaking and data transfer is shown in Figure 1 for the G-MAX radio (running at 9600 baud over-air in a 12.5kHz channel) and for the SXn50 series of radios (running at 19,200 baud over-air in a 25kHz channel).

### 3.2 Handshaking Operation During Transmit and Receive

The DTE must set the RTS input for the modem to accept data. The RTS input can be set continuously if no hardware handshake lines are available on the DTE. The CTS line must be monitored for data packets greater than 256 bytes to ensure that input buffer overflow does not occur. If the data input is not stopped within 10 characters from the point of buffer overflow, the input data will be discarded.

Handshaking is also required during the code loading.

The modem starts transmitting when the data is input, regardless of the state of the CD output. The DTE must check the CD output prior to data transmission. When the CD output is set this indicates that a RF signal is present at the antenna. This output is only active when the modem is not transmitting.

### 3.3 Data Transfer Modes

In FEC mode every byte of the data, including the "end-of-file" string is scrambled within the modem to ensure that the error correction mechanism operates over non-consecutive bits in the data stream. The frame sync pattern is not scrambled.

In non-FEC (High Speed) mode the data is scrambled to minimise problems that could occur with many consecutive 1's or 0's in the input data stream.

### 3.4 RS232 Data Handling

The over-air data rate is faster than the input data rate because only the 8 data bits of the input character of 11 bits are transmitted. To ensure that no data is lost at the output, and for the modem to transmit the data in one continuous packet it is essential that the input and output data rates are set to at least 2 x the over-air-baud rate. The default over-air baud rate for this modem working in a 12.5kHz channel is 9600 baud. For this set the input and output RS232 data rates to 19,200. For a 25kHz channel, with an over-air baud rate of 19,200, set the data rates to 38,400 baud.

Some applications running under the Windows™ operating system output the data with gaps between single or groups of characters. In some cases this can reduce the character rate below the over-air data rate. When this occurs, the system will assume that the input data has finished and will turn the transmitter off when the input data buffer is empty.

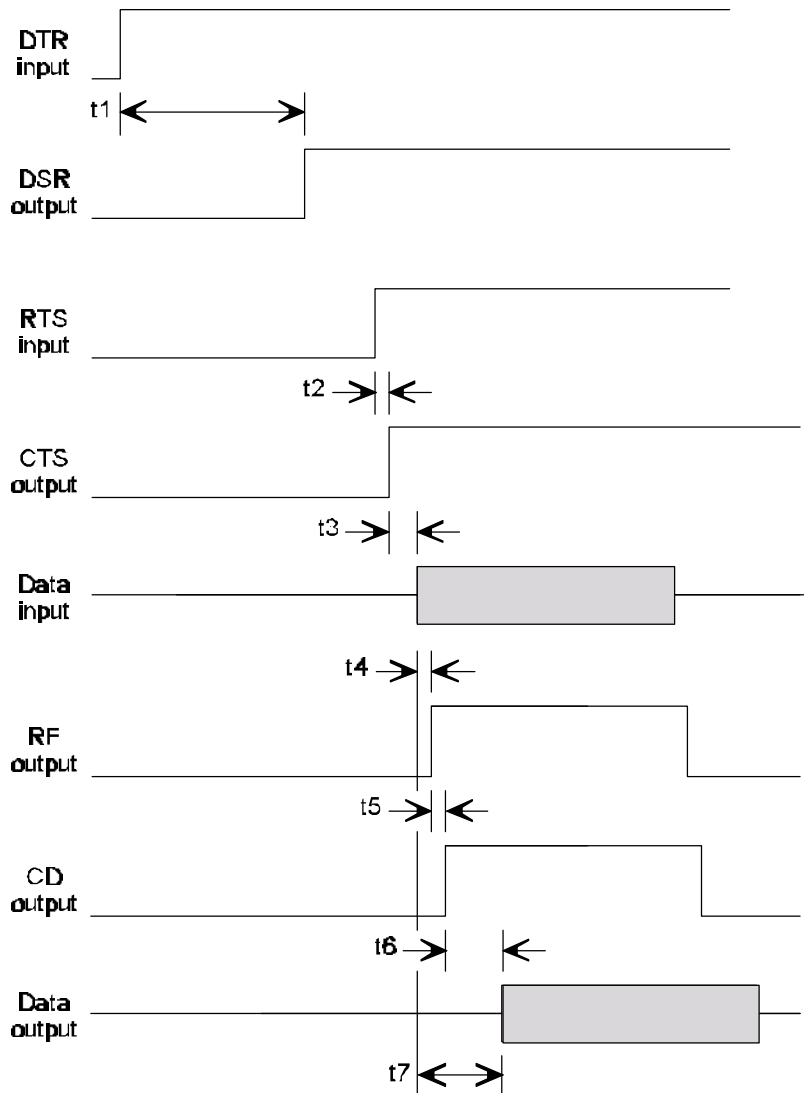
If more characters are input to the modem while the transmitter is being turned off, the transmit process will re-start. This will appear as bursts of RF close together. At the receive end, the timing of the data will change as there will be gaps in the received data stream.

This mode of operation ensures that small data packets are transmitted in as short a time as possible to reduce the on-air time to a minimum.

### 3.5 Receive-to-Transmit Turnround

After the last character of a packet of data is output from the receiver, the receive system is still processing the "end-of-packet" data. This takes ~5ms when in non-FEC mode and ~10ms in FEC mode. During this period the processor does not accept any input data. The figures apply for default settings: 19,200 baud rate and 4800 symbol/sec over-air baud rate





**Figure 1** Timing Information

Function	Description	Time (ms)	
		G-MAX (9600 baud)	SXn50 (19200 baud)
t1	DTR input-to-modem DSR output	<90	<90
t2	RTS input to CTS output	<0.5	<0.5
t3	CTS output to Data input	>0.1	>0.1
t4	Data input to RF output (non-FEC mode)	<25	<25
	Data input to RF output (FEC mode)	<25	<25
t5	RF output to CD output (at RX end)	<5	<2.5
t6	CD output to data output (non-FEC mode)	<30	<30
	CD output to data output (FEC mode)	<50	<45
t7	Data input to Data output (non-FEC mode)	<50	<45
	Data input to Data output (FEC mode)	<75	<55

**Table 3** Timing Data

## 4 LIST OF COMMANDS:

### 4.1 Command Mode

The modem is configurable through the RS232 port. The Command Mode has to be activated to do this, as detailed in the following paragraphs:

#### 4.1.1 Activation of the Command Mode:

The Command Mode is activated with the string:

```
<wait>+++<wait> <CR><LF>
```

Where <wait> is a programmable period after transmitting data (which is set by register S154) which has a nominal value of 10ms.

The modem responds with:

```
OK<CR><LF>
```

The modem is now ready to be configured. Transmitting or reception is blocked during Command Mode.

If the "+++" string is input without a <CR><LF> then the string is transmitted as normal data. Note that one or more consecutive "+" characters in the input data are held in the modem until it is determined that it is not a "+++" string.

The configuration mode is only accepted if the RTS line is set. The "+++" string is only accepted if this string is the first three characters and there has been no data for greater than the time set by register S154.

The +++ string is only transmitted over the air if embedded in a data string as described above.

Important: any configuration changes made are only saved to the non-volatile memory after a write command (AT &W).

Note that the communication parameters (baudrate etc) are the programmed parameters.

#### 4.1.2 Ending of Command Mode

The command mode is ended by inputting the string:

ATO<CR><LF>

The modem responds with:

OK<CR><LF>

The modem is now ready for normal modem operation.

Note that the communication parameters (baudrate etc) are the programmed parameters.

## 4.2 **Command Syntax**

4.2.1 **Note:** Capital letters **MUST** be used for all command instructions.

4.2.2 All syntax commands with multiple 'n' 's accept multiple formats. For example, if 'nnn' is specified in the command string, then the following will be valid:

1	or	+1
01	or	+01
001	or	+001

4.2.3 The commands for reading registers have the form:

AT S158?<CR><LF>

The answer to this query is:

nnn<CR><LF>

4.2.4 After setting a parameter the modem responds with:

OK<CR><LF>	if a valid entry and
ERROR<CR><LF>	if an invalid entry

### 4.3 Baud Rate (AT B0)

When the baud rate is changed, the change is made after the Command Mode is ended (with the AT O command).

The baud rate is set with the following command:

Baud Rate	AT B0=n <CR><LF>
Where:	n = 1 4800 n = 2 9600 n = 3 19200 n = 4 38400
Default:	n = 3 for 12.5kHz radios n = 4 for 25kHz radios
Read:	AT B0?<CR><LF>
Note:	this shows the new value, even though the change is not implemented until the Command Mode is exited.
Read Return:	n<CR><LF>
Example:	AT B0=2<CR><LF> for 9600 baud

### 4.4 Parity (ATB1)

The number of data bits is fixed to 8. Parity at the RS232 input to the transmitter has no effect and is not transmitted. The 8 data bits can be used to transmit 7 data bits + 1 parity bit. In this case the modem has to be set to no parity.

The number of stop bits at the RS232 input to the transmitter can be 1 or more. The number of stop bits at the receiver RS232 output is fixed at 1. This is to avoid congestion of the output data.

When the parity is changed, the change is made after Command Mode is ended (with the AT O command).

The parity is set with the following command:

Parity	AT B1=n<CR><LF>
Where:	n = 1 even n = 2 odd n = 3 none
Default:	3
Read:	AT B1?<CR><LF>
Note:	this shows the new value, even though the change is not implemented until the Command Mode is exited.
Read Return:	n<CR><LF>
Example:	AT B1=n<CR><LF>

#### 4.5 Format Mode (AT F)

This command turns the Forward Error Correction (FEC) mode on and off. The over-air format allows for higher speed operation, but with reduced Bit Error Rate (BER) performance with the FEC turned off, or lower speed, improved BER with the FEC turned on.

Figure 1 and the associated table give the timing information for both modes of operation.

The command is:

Format mode	AT F=n<CR><LF>
Where	n=0 mode with FEC n=1 high speed mode without FEC
Default:	n=1 (non-FEC mode)
Read:	AT F?<CR><LF>
Read Return:	n<CR><LF>
Example:	AT F=1<CR><LF>

## 4.6 Engineering Test Modes (AT In)

### Format modes:

To enable the function AT In=1 <CR><LF>  
To disable the function AT In=0 <CR><LF>  
Modem responds with OK <CR><LF>  
Read status: AT In?<CR><LF>  
Modem responds with m <CR><LF> where m=0, not active  
m=1, active

Where n = 2 Output Continuous Preamble (used for checking transmitter and receiver). The preamble is transmitted until stopped by the ATl2=0 or AT l=10 commands, or ending the command mode. **Note:** for a G-Max, this test must not be run for >10 minutes as damage to the transceiver may occur.

n = 3 Output a series of 49 byte long data packets with a programmed period between each packet set with register S162. The message data sent is: "The quick brown fox jumps over the lazy dog.<CR><LF>" Each line of data is pre-ceded by "XX " where XX is a line number which increments from 00 - 99.

The data is transmitted until stopped by the ATl3=0 or AT l=10 commands, or ending command mode.

n = 4 Adds the Output Data quality and Signal level data to the end of each received data packet. This is ended by the ATl4=0 or AT l=10 command. The data format is:

R:XX, D:XXX<CR><LF>

where XX = 1 - 10 and XXX = 66 - 256 as defined in paragraphs 5.10 and 5.12

Note: if data is received before the values have been read then R:XX, D:XXX<CR><LF> will be output.

n = 9 Gives information about the software version (refer to paragraph 5.7).

n = 10 Turn off test modes

#### 4.7 Software Version Information (AT I9)

This command tells the modem to output information about the software version.

Example:        AT I9=1<CR><LF>        return software version  
          or        AT I9<CR><LF>  
Return:        'an ASCII string detailing the ID and versions of the  
                  internal processors' <CR><LF>

An example of the return data is as follows:

Files:

Main micro:"QL3z10", Ver.:1.01.05, Date:31/10/2001

Slave micro:"Slave", Ver.:0.00.02, Date:12/11/20001

Flash Programmer:"karfl3", Ver.:1.00.03, Date:24/10/2001

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#### 4.8 Command Mode Guard Time (AT S154)

To enable the transmission of the command sequence within a packet of data, a guard time is placed around the command sequence. If the gap between the characters in the command mode string is less than this guard time, then the data string is assumed to be part of the data. This includes the gap between the last received data byte and the first "+". The command is:

                  AT S154=nnn<CR><LF>  
Where            nnn =0 to 255 ms  
Default:         10  
Read:            AT S154?<CR><LF>     read the setting  
Read Return:     nnn<CR><LF>  
Example:         AT S154=10<CR><LF>   set 10 msec time delay

#### 4.9 Centre Radio Frequency (AT S155)

The channel change system for the Hermes is based around a centre frequency. The Hermes is programmed with a factory set centre frequency that is the centre of the RF switching band. The channel change is carried out by programming a channel step size (typically 12.5kHz) and setting 00-99 above or 00-99 channels below the centre frequency. The centre frequency can be changed and stored in EEPROM for moving the programmed channels. A temporary change can also be made by storing a new centre frequency in RAM. This is not restored if power is lost to the unit.

The centre radio frequency of the modem is set as follows:

Where: AT S155=nnn.nnnnnn<CR><LF>  
nnn.nnnnnn is the format of the input string for the frequency in MHz  
Default: current centre frequency.  
Read: AT S155?<CR><LF>  
Read Return: nnn.nnnnnn<CR><LF>  
Example: AT S155=458.5<CR><LF> sets 458.5MHz  
AT S155=458.500000<CR><LF> sets 458.5MHz

Note that frequencies in multiples of either 12.5kHz or 10kHz only are acceptable. If a whole number of MHz is entered a "." must be entered before the <CR><LF>.

If the wrong centre frequency is entered the modem will respond with the following error message and the entry will be ignored:

ERROR<CR><LF>

#### 4.10 Received Signal Strength Indication (RSSI) (AT S156)

This request to the modem gives a response of nn <CR><LF>, where the nn is the value of the Received Signal Strength of the radio carrier present at the antenna at that time. The returned value of RSSI is in the range of 1 to 10. The level of RF level of each value is given in the following table:

RSSI Level	Level at RF Input ( dBm $\pm$ 2dB)
01	-114 to -120
02	-108 to -114
03	-102 to -108
04	-96 to -102
05	-90 to -96
06	-84 to -90
07	-78 to -84
08	-72 to -78
09	-66 to -72
10	> -66
XX	Not available

Table 4 RSSI Levels



The RSSI level is requested with the command:

```
AT S156?<CR><LF>
Read Return:  nn<CR><LF>
```

The data can be added to the end of each received packet as defined in paragraph 5.6.

#### 4.11 Radio Channel (AT S157)

The radio transceiver is programmed with a centre frequency (using the AT S155 command). This frequency is set up in the factory at the centre of the RF switching bandwidth. Once programmed with this frequency a Channel Step Size (using AT S161 command) can be programmed.  $\pm 99$  channels can then be set with this command to give a total of 199 frequencies.

The command for setting the radio channel is

```
AT S157=n<CR><LF>
Where:      n =  $\pm 0$  to  $\pm 99$ 
Default:    0 (which is printed on screen as +00)
Read        AT S157?<CR><LF>
Read Return:  $\pm nn$ <CR><LF>
Example:    AT S157=-10<CR><LF> sets the channel to -10
```

#### 4.12 Data Quality (AT S158)

This request for data gives an indication of the quality of the data reception. The signal quality is read from the modem system at the end of each received packet and stored to give a consistent result when the quality is requested. The value is in the range 64 to 255, the larger the value, the higher the quality. The command for requesting the data quality is

```
AT S158?<CR><LF>
Read Return:  nnn<CR><LF>
```

If no data has been received, XXX is returned.

The data can be added to the end of each received packet as defined in paragraph 5.6.

#### 4.13 Squelch (AT S159)

This command sets the squelch threshold to one of 10 pre-set levels as shown in the Table 6.

This command enables the user to reduce the chances of local interference showing the channel to be busy which could reduce the occupancy of the system.

Squelch Level	Level at RF Input ( dBm $\pm$ 2dB)
1	< -112
2	-110 to -112
3	-108 to -110
4	-105 to -108
5	-103 to -105
6	-101 to -103
7	-99 to -101
8	-97 to -99
9	-95 to -97
10	> -95

Table 6 Squelch Levels

The command for setting the squelch is

AT S159=n<CR><LF>  
Where: n = squelch threshold with value 1 to 10  
Default: 2  
Read AT S159?<CR><LF>  
Read Return: nn<CR><LF>  
Example: AT S159=10<CR><LF> sets the squelch to 10

#### 4.14 Transmission Power (AT S160)

The command enables the RF transmit power to be modified. Different RF units have different capabilities and may change, depending on what is supplied.

The SXn50 range of transceivers have 2 levels only. The levels for the 1W and 2W versions of the G-MAX are shown in Table 7. Table 8 shows the 2 levels for the SXn50 range.

Power Level	Output Power for 1W G-MAX			Output Power for 2W G-MAX		
	mW (nominal)	dBm (nominal)	Tolerance (dB)	mW (nominal)	dBm (nominal)	Tolerance (dB)
1	16	12	±3	31	15	±3
2	25	14	±3	50	17	±3
3	40	16	±3	79	19	±3
4	63	18	±1.5	126	21	±1.5
5	100	20	±1.5	200	23	±1.5
6	158	22	±1.5	316	25	±1.5
7	251	24	±1.5	500	27	±1.5
8	398	26	±1.5	794	29	±1.5
9	631	28	±1.5	1260	31	±1.5
10	1000	30	±1.5	2000	33	±1.5

Table 7 Power Levels for G-MAX Radios

Power Level	Output Power		
	mW (nominal)	dBm (nominal)	Tolerance (dB)
1	5	7	±3
2	500	27	±1.5

Table 8 Power Levels for SXn50 Radios

The power is set with the command:

AT S160=n<CR><LF>  
Where: sets the power threshold <1 to 10>  
Default: 10  
Read: AT S160?<CR><LF>  
Read Return: nn<CR><LF>  
Example: AT S160=-10<CR><LF> sets the power level to 10

#### 4.15 Channel Step Size (AT S161)

This command sets the channel step size. The basic reference frequency for the radio is either 12.5KHz or 10KHz, giving possible frequency channel steps of 10kHz, 12.5kHz, 20kHz and 25kHz. The Channel Step Size is set with the command:

AT S161=n<CR><LF>  
Where: n=1 10 kHz  
n=2 12.5 kHz  
n=3 20 kHz  
n=4 25 kHz  
Default: n=2 (12.5 kHz)  
Read: AT S161?<CR><LF>  
Read Return: n<CR><LF>  
Example: AT S161=1<CR><LF> sets 10 kHz channel step

If a channel step size is entered which is not a multiple of the centre frequency an error is returned and the entry ignored. This is to ensure that only valid frequencies on multiples of the channel step size are allowed based on the centre frequency entered. The error message is of the form:

ERROR<CR><LF>

#### 4.16 Test Message Period (AT S162)

This command sets the period between sending the test message. The command is:

AT S162=n<CR><LF>  
Where: n=1 - 255 in 10ms steps  
Default: n=10 (100ms)  
Read: AT S162?<CR><LF>  
Read Return: nnn<CR><LF>  
Example: AT S162=100<CR><LF> sets 1 second period

#### 4.17 Over-Air Symbol Rate (AT S163)

**Note: engineering function only.**

This command sets the over-air baud rate to enable the modem to be used with different radios and channel spacings. The command format is:

```
AT S163=n<CR><LF>
Where:    n = 2    4800 symbols/sec
          n = 3    9600 symbols/sec
Default:  n = 2    4800 for 12.5kHz radios
          n = 3    for 25kHz radios
Read      AT S163?<CR><LF>
Read Return: n<CR><LF>
Example:  AT S163=3<CR><LF>  sets 9600 symbols/sec
```

#### 4.18 Preamble Period (AT S165)

**Note: engineering function only.**

This command enables the number of preamble blocks (each block equals 6 bytes) that are transmitted before each data packet to be changed. This preamble allows for the rise time of the transmitter as well as the minimum number of blocks required by the receiver. This allows the system performance to be changed to enable the modem to be used with different transceiver equipment. The command format is as follows:

```
AT S165=n<CR><LF>
Where:    n = 1 - 10 blocks
Default:  n = 2
Read      AT S165?<CR><LF>
Read Return: nn<CR><LF>
Example:  AT S165=10<CR><LF>  sets a preamble of 11 blocks
```

Note that a symbol period depends on the RF baud rate (as set by paragraph 4.17).

For the G-MAX radio at 9600 symbols per second n = 2.

For the SXn50 radio at 19200 symbols per second n = 14.

#### 4.19 Frame Synch Tolerance (AT S166)

**Note: engineering function only.**

This command controls a receive function within the FX929 modem IC within the modem.. The command format is as follows:

```
AT S166=n<CR><LF>
Where:  n = 0    0 mismatches allowed in frame synch.
          pattern
          n = 1    2 mismatches allowed in frame synch.
          pattern
          n = 2    4 mismatches allowed in frame synch.
          pattern
          n = 3    6 mismatches allowed in frame synch.
          pattern
Default: n = 0    0 mismatches allowed in frame synch.
          pattern
Read     AT S166?<CR><LF>
Read Return: n<CR><LF>
Example: AT S166=2<CR><LF>  sets 4 mismatches allowed
```

#### 4.20 Invert Symbol (AT S167)

**Note: engineering function only.**

This command controls the polarity of the transmit and receive audio between the FX929 modem IC and the transceiver and allows for different transceivers to be used with the modem. The command format is as follows:

```
AT S167=n<CR><LF>
Where:  n = 0    RX non-inverted and TX non-inverted
          n = 1    RX non-inverted and TX inverted
          n = 2    RX inverted and TX non-inverted
          n = 3    RX inverted and TX inverted
Default: n = 0    RX non-inverted and TX non-inverted
Read     AT S167?<CR><LF>
Read Return: n<CR><LF>
Example: AT S167=1<CR><LF>  RX non-inverted and TX
                               inverted
```

#### 4.21 Squelch Delay (AT S168)

**Note: engineering function only.**

This command changes the delay between the Squelch being received and the FX929 modem IC looking for preamble in the receive audio. This allows the modem to be used with different transceivers. The command format is as follows:

```
AT S168=n<CR><LF>
Where:      n = 1 - 255 (ms)
Default:    n = 10
Read:       AT S168?<CR><LF>
Read Return: nnn<CR><LF>
Example:    AT S168=10<CR><LF> 10ms delay between squelch
                                         and preamble
```

#### 4.22 Enable/Disable Receive Output Data (AT &D)

This command disables output of any received data.

Note that the CD output continues to operate when the data output is disabled. The command is of the format:

```
AT &D=n<CR><LF>
Where:      n=0 disable output
            n=1 enable output
Default:    n=1 (enabled)
Read:       AT &D?<CR><LF>
Read Return: n<CR><LF>
Example:    AT &D=1<CR><LF> enables receiver data output
```

#### 4.23 Enable/Disable Input Echo Data (AT &E)

This command enables/disables input echo on the screen. The command is of the format:

```
AT &E=n<CR><LF>
Where:      n=0 disable echo
            n=1 enable echo
Default:    n=1 (enabled)
Read:       AT &E?<CR><LF>
Read Return: n<CR><LF>
Example:    AT &E=1<CR><LF> enables echo input
```

#### 4.24 Radio Frequency (AT &F)

The Hermes is programmed with a factory set centre frequency that is the centre of the RF switching band. A new frequency can be entered directly within the  $\pm 99$  channels of the centre frequency using this command. The channel number is re-calculated for the frequency entered using this command.

The radio frequency of the modem is set as follows:

	<code>AT &amp;F=nnn.nnnnnn&lt;CR&gt;&lt;LF&gt;</code>
Where:	<code>nnn.nnnnnn</code> is the format of the input string for the frequency in MHz
Default:	none
Read:	<code>AT &amp;F?&lt;CR&gt;&lt;LF&gt;</code>
Read Return:	<code>nnn.nnnnnn&lt;CR&gt;&lt;LF&gt;</code>
Example:	<code>AT &amp;F=458.5&lt;CR&gt;&lt;LF&gt;</code> sets 458.5MHz <code>AT &amp;F=458.500000&lt;CR&gt;&lt;LF&gt;</code> sets 458.5MHz

Note that frequencies in multiples of either 12.5kHz or 10kHz only are acceptable. If a whole number of MHz is entered a "." must be entered before the `<CR><LF>`.

If the frequency entered is outside the  $\pm 99$  channels, or the frequency is invalid, the modem responds with the following error message and the entry is ignored:

`ERROR<CR><LF>`

#### 4.25 Save parameters (AT &W)

To permanently store any parameter changes, the parameters are saved in non-volatile memory. The command for this is:

`AT &W<CR><LF>`

#### 4.26 Restore defaults (AT &Y8)

To quickly check the operation of the modem, the factory settings can be loaded. If required the AT &W save command can be used to save the defaults. The command for this is:

`AT &Y8<CR><LF>`



#### 4.27 Display parameters (ATT?)

Displays all the AT settings. The command for this is:

```
ATT?<CR><LF>
```

The modem responds with:

```
2, 3, 0, 010, 429.850000, XX, +00, XXX, 02, 05, 2, 020, 2, 08, 0, 0,
050, 1, 429.850000 <CR><LF>
```

The order of the data is:

2	baud rate
3	parity
0	format mode
010	command mode guard time
429.850000	centre frequency
XX	RSSI (if no received data, 1 - 10 otherwise)
+00	radio channel
XXX	data quality (if no received data, 66 - 256 otherwise)
02	squelch
05	power
2	channel step size
020	test message period
2	over air baud rate
08	preamble blocks
0	frame synch. tolerance
0	invert symbol
050	squelch delay
1	enable/disable receive data output
429.850000	radio frequency

Note: where no data has been received to provide the data, or the command has not been enabled, X is displayed.

#### 4.28 Code Loader (AT S2000)

**Warning**      **once activated, a code load must be carried out**  
**DO NOT enter unless you wish to carry out a code load**

This command enables the firmware contained within the modem to be upgraded using a simple terminal program. The baud rate for the link is fixed at 19,200 baud with no parity.

The command for this is:

AT S2000<CR><LF>

The modem responds with:

Flash Programmer:"karfl3", Ver.:1.00.03, Date:24/10/2001

To update firmware, upload Hermes upgrade \*.hex file using  
a terminal program that can send 8 bit binary data.

Hermes®, © 2001, Wood & Douglas Ltd.

When this message has been output the code loader software is ready for the new code data to be uploaded. As each line of code is accepted the modem responds with one of 4 responses:

“.”      line written into program memory successfully  
“.”      line written into EEPROM memory successfully  
“P”      attempt to write into protected memory area, no action taken  
“E”      error in writing to memory area

A typical programming sequence display is as follows:

```
PPPPP.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP  
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP.....:  
:
```

Flash Programming Successful!!

Hermes®, © 2001, Wood & Douglas Ltd.

Apply a DC reset to the modem before using the modem.

If an error in the data is received the modem responds with:

Flash Programming Failed!!

Hermes®, © 2001, Wood & Douglas Ltd.

If power is lost or some other problem occurs before the upload is completed, the next time the modem is powered on it automatically requests new data by outputting the above message. This repeats until the code load is successful.

## 5 HARDWARE SPECIFICATION

### 5.1 Introduction

The hardware of the modem part of the system is based on the FX929B modem chip from Consumer Microcircuits Ltd (CML). The radio part of the system can be either the G-MAX "rugged" transceiver, or the lower power SXn50 range of transceivers. The interface between the outside world and modem chip is controlled by a microprocessor.

The two types of transceiver are separate modules which is mounted onto the modem PCB.

The Hermes is supplied in 2 different mechanical versions. One of these uses a rugged enclosure suitable for wall mounting. The second version is housed in a 3U high "euro" cassette for mounting in a standard 19" rack.

### 5.2 RS232 Port Parameters

The communication with the host processor is via a standard RS232 port. The data levels are as per the RS232 specification with logic '0' being a positive voltage.

The programmable parameters for the transmit and receive ports are:

Baud rates	4800/9600/19200/38400
Data bits	8 (note that 7data bits plus parity = 8 data bits with no parity)
Parity	Odd, Even or None
Stop bits	Receiver output = 1 Input to transmitter = 1 or more

### 5.3 Radio Specifications

The transceiver specifications are detailed in the appropriate handbook for the SXn50 family and the G-Max. Throughout the handbook, the differences between the two types of transceiver have been highlighted.

A brief summary of the main characteristics are listed below:

Parameter	G-Max	SXn50	
TX Power	500mW with 100% duty cycle 1W with maximum duty cycle of <50% 2W with maximum duty cycle of 20% (10 programmable levels)	Hi Power setting 500mW with 100% duty cycle  Lo Power setting = 5mW	
Operating Frequencies	340 - 360MHz 400 - 470MHz	SX150	140 - 200MHz
		SX450	390 - 490MHz
		SX850	868 - 870MHz
Switching bandwidth (frequency range over which unit can operate without adjustment)	8MHz	SX150	4 MHz
		SX450	8 MHz
		SX850	2 MHz
Alignment bandwidth (frequency range over which unit can operate with adjustment)	20MHz	SX150	20 MHz
		SX450	20 MHz
		SX850	2 MHz

## 6 MECHANICAL SPECIFICATION

### 6.1 Enclosures

#### 6.1.1 Casting Enclosure

The casting enclosure is shown in Figure 2. The enclosure has 4 off M4 fixings. There are raised bosses on the base of the unit to enable water to run underneath the unit when mounted on a vertical surface. Figure 3 shows the connector layout under the protective casting overhang which prevents any water ingress when mounted vertically. The lid has an IP65 rated gasket to ensure no water ingress. The outline dimensions of the casting are:

169.3 x 129.2 x 38.5mm (6.67" x 5.09" x 1.52")

The weight of the unit using a G-MAX radio is ~612g (21.6oz).

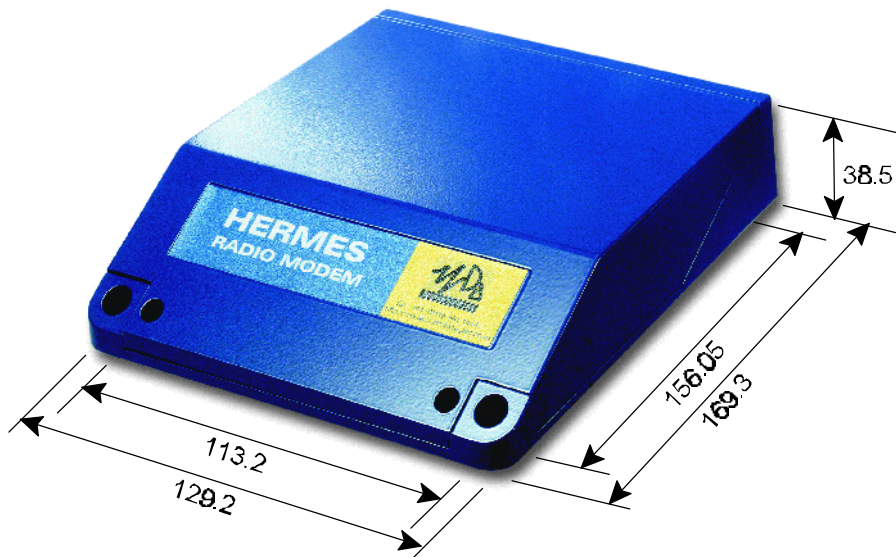
The weight of the unit using a SXn50 radio is ~600g (21oz).

#### 6.1.2 3U Rack Mounting Enclosure

The modem can also be supplied in a 3U high, 5HP wide by 101mm, rack mount enclosure, as shown in Figure 4.

The weight of the unit using a G-MAX radio is ~580g (20.5oz).

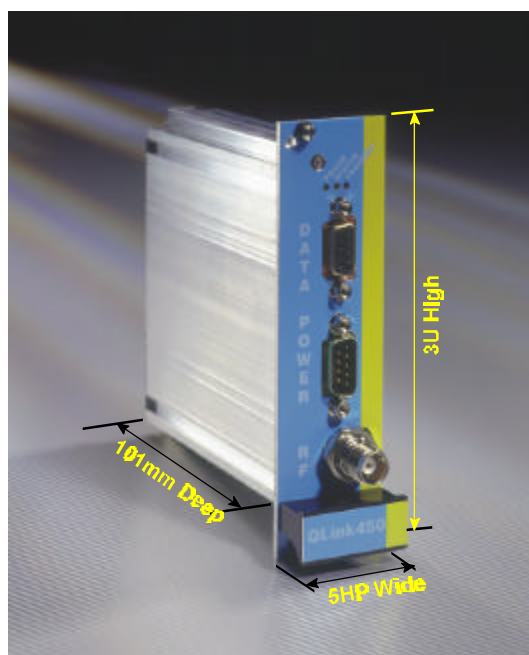
The weight of the unit using a SXn50 radio is ~560g (20oz).



**Figure 2** Front View of Casting



**Figure 3** Rear View of Casting



**Figure 4** 3U Enclosure

## 6.2 **Operating conditions**

Operating temperature: -25 - + 55° C  
Storage temperature: - 30 - + 70° C  
Relative humidity: 20- 80% non-condensing

## 6.3 **Vibration Specifications:**

When the G-MAX transceiver is used the casting version of the modem meets the MIL-STD-810E:514.4 specification.

## 6.4 **Type Approvals**

The equipment meets the requirements of the following specifications:

EMC: ETS 300 279  
Type Approval: ETS 300 113.  
Low Voltage Directive: Directive 73/23/EEC

A Technical Construction File is being prepared which will be reviewed by a Notified Body to ensure that all the requirements of the R&TTE directive have been met.



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