ORION RADIO MODEM WITH I/O
OPERATING INSTRUCTIONS
1892 1335

THIS IS A DRAFT VERSION OF THE MANUAL. THERE MAY BE ERRORS OR OMISSIONS IN IT, AND YOU USE IT AT YOUR OWN RISK.

Figure 1 - Orion Radio Modem

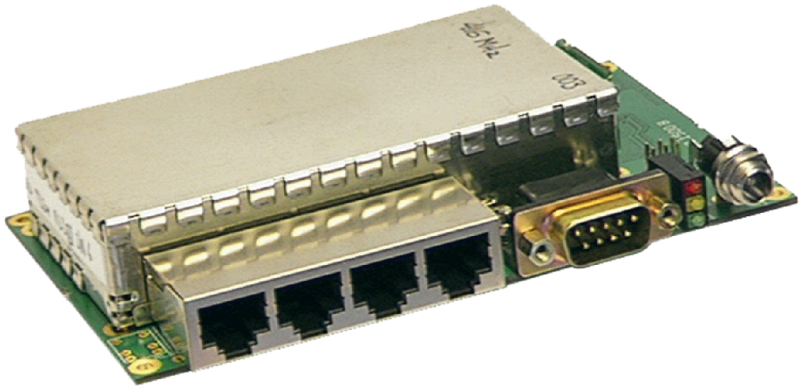


Figure 2 - Orion Radio Modem - OEM PCB version

OVERVIEW

The Orion is a radio modem with on-board telemetry inputs and outputs. It is available in a number of different versions to suit different applications, and has many user-programmable features, which may be locally or remotely set. It is supplied with a Graphical User Interface (GUI) program which runs under Windows on a PC, and can be used both to configure the Orion and as an interface to control and display the telemetry inputs and outputs.

Figure 3 shows the Orion in block diagram form.

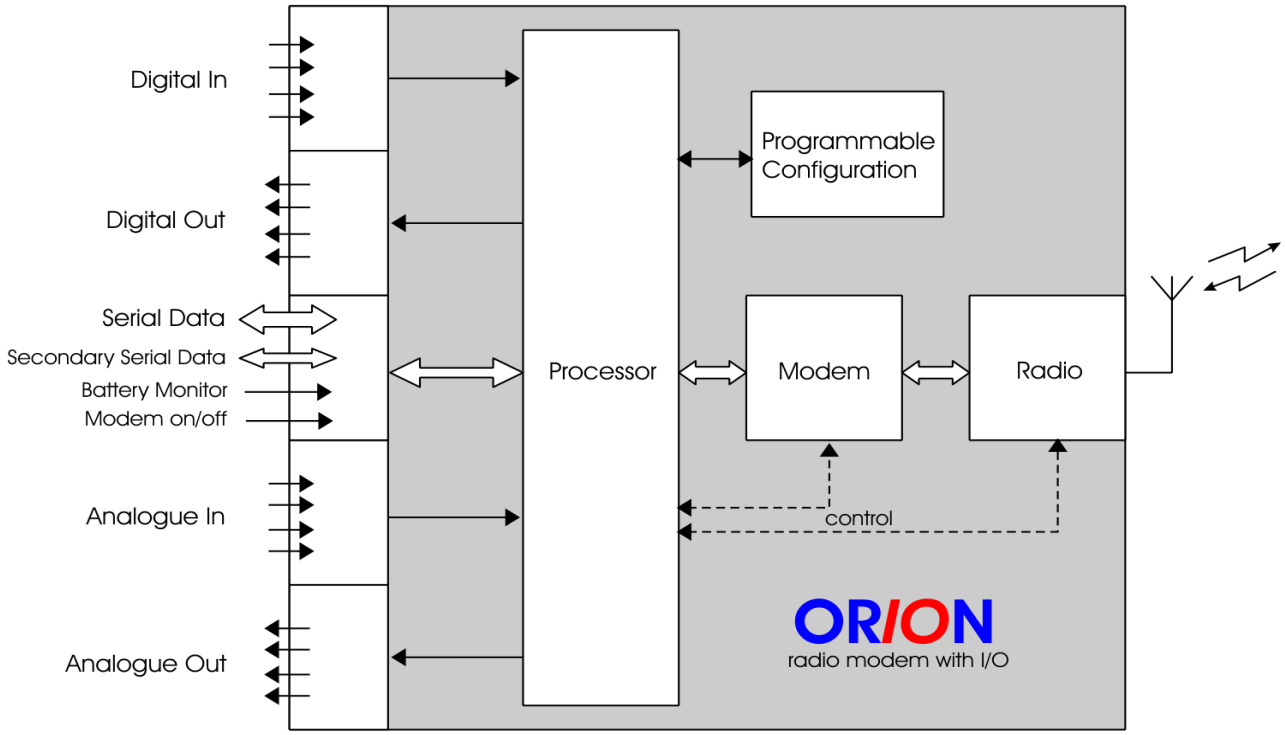


Figure 3 - Orion block diagram

Summary of notable features and options:

- Four digital inputs*
- Up to four digital outputs
- Counter input
- Up to four analogue inputs (current loop or voltage)
- Up to four analogue outputs (voltage)
- Floating relay digital output/fail warning option
- RS232/RS422/485 asynchronous data. Secondary channel with RS232.
- Sampling mode transmits any data format
- Unidirectional or half-duplex link, choice of error correction
- Choice of frequency band and power
- AT command set, local or remote programming of most features

- One-to-one or master + outstations configuration
- Outstations can be polled, or volunteer data when thresholds are reached (‘alarms’).
- GUI for simple programming and operation

*The four analogue inputs can also be used to transmit digital data if required

OPTIONS WHEN ORDERING

Many options are user-programmable, but the options below must be specified when ordering so that the correct version of the Orion can be supplied:

OEM PCB version

The Orion is available uncased as a PCB for mounting in OEM equipment.

In/Out capability

The Orion is also available as a straight radio modem without the telemetry in/out capability.

Frequency band of operation

The Orion can be supplied to operate in the VHF, UHF and higher (e.g. 868MHz) bands. The radio module in each Orion is built to operate over a certain range of frequencies (its *switching bandwidth*) under software control, for example 450-458MHz. Consult Sales at Wood & Douglas for available frequency bands.

RF Power

The RF power can be chosen from very low powers up to 5W, depending on the radio module.

Data rate

The Orion can operate at up to 19,200 baud maximum. If a lower data rate, up to 9,600 baud, is acceptable, a version which uses less radio spectrum (12.5kHz rather than 25kHz) can be ordered. (Transmitters and receivers must match.)

RSSI output

Analogue output 1 can be configured as a Received Signal Strength Indication (RSSI) output.

Serial port mode

The serial port can be configured for RS232, RS422 or RS485 protocols. Serial baud rate can be adjusted up to 38,400 baud maximum, hardware flow-controlled using RTS/CTS.

INSTALLATION

Physical

The cased version may be used freestanding or fixed using the four holes provided:

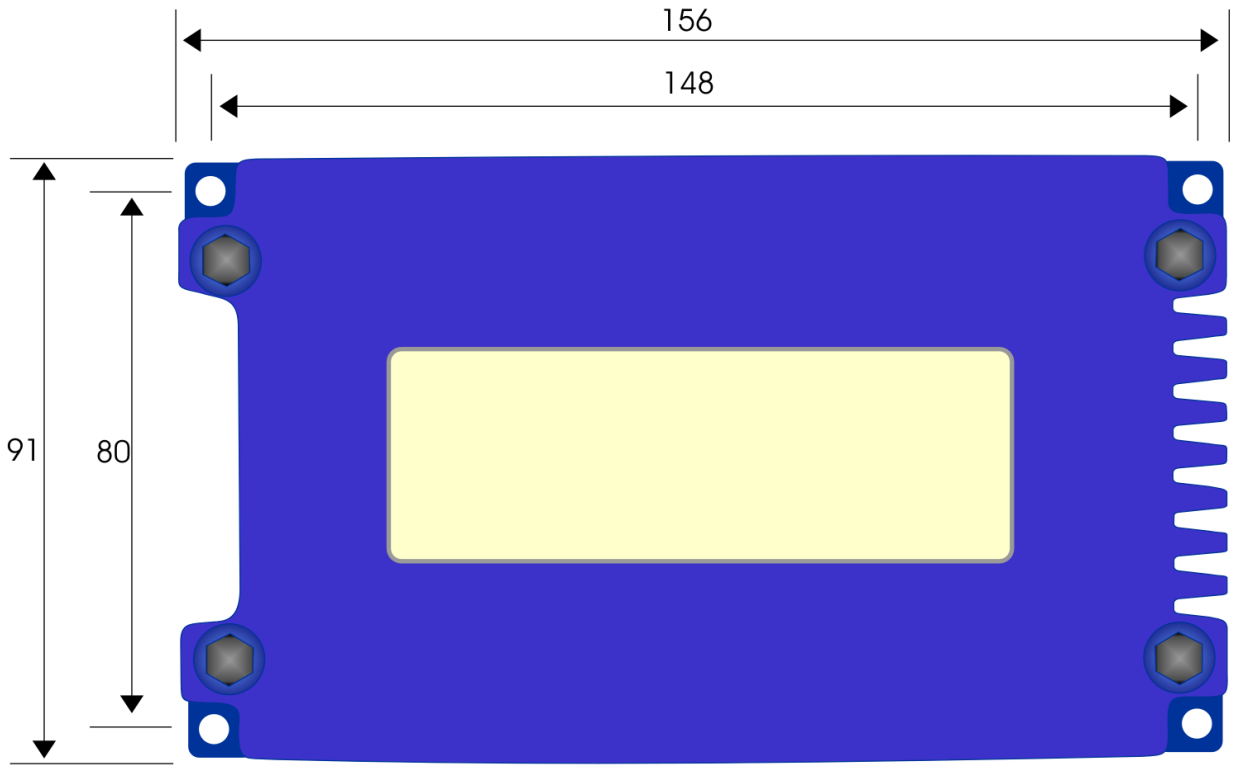


Figure 4 - Orion (cased) dimensions and mounting (mm)

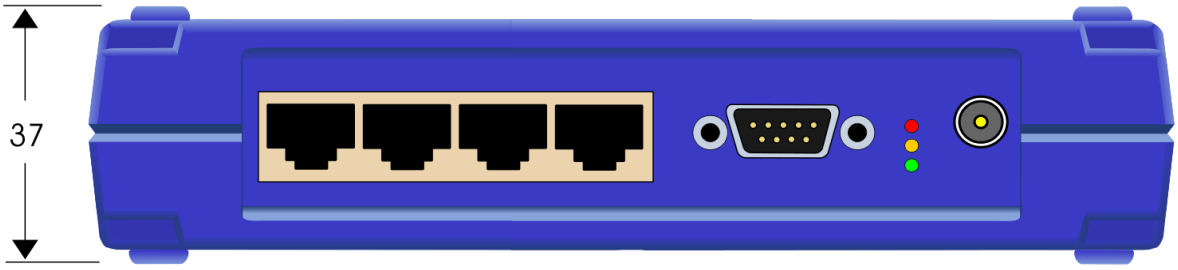


Figure 5 - Orion (cased) clearance (mm)

The PCB version should be mounted using the holes provided, and requires clearances as shown overleaf.

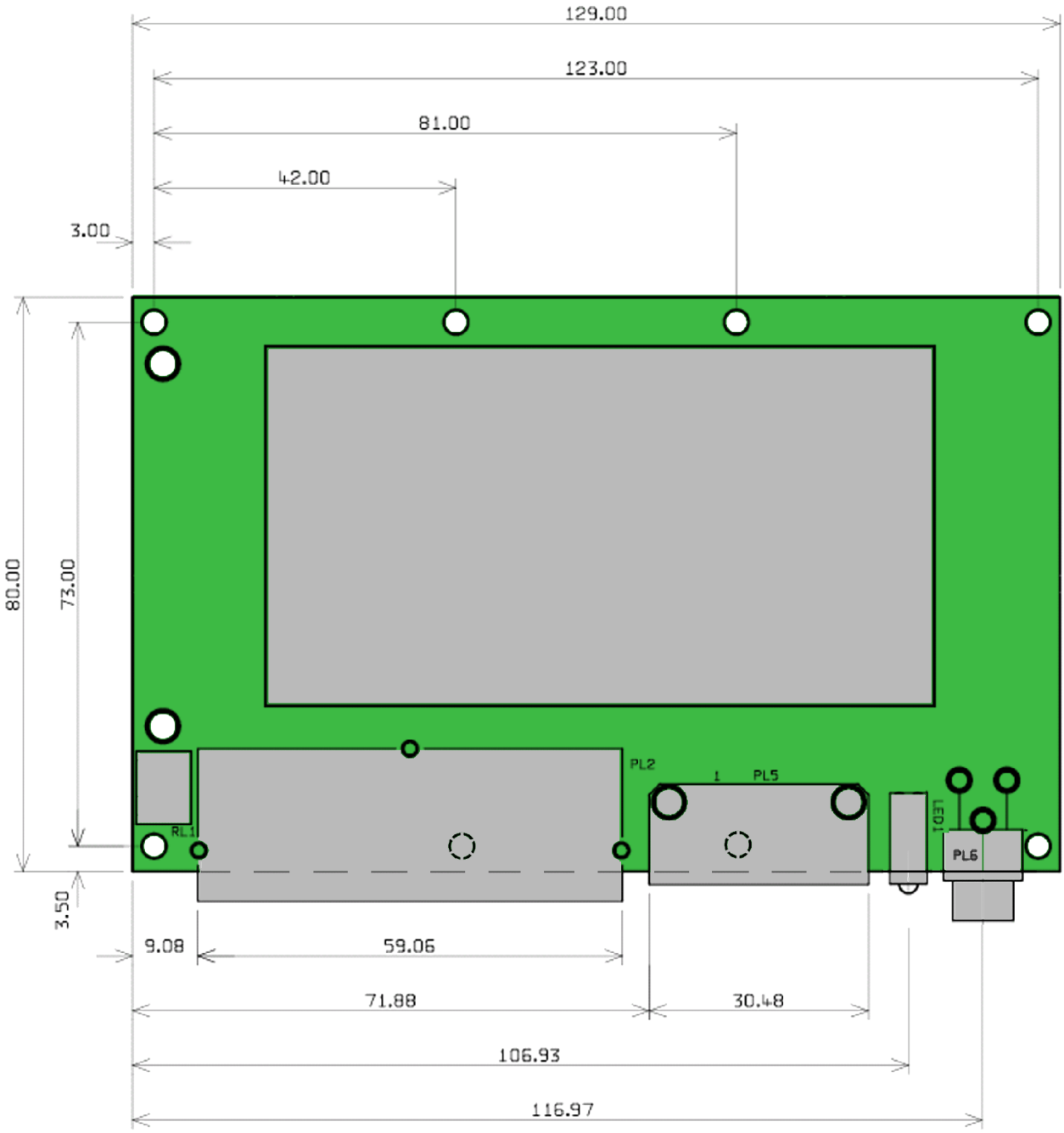


Figure 6 - Dimensions of Orion PCB (mm)

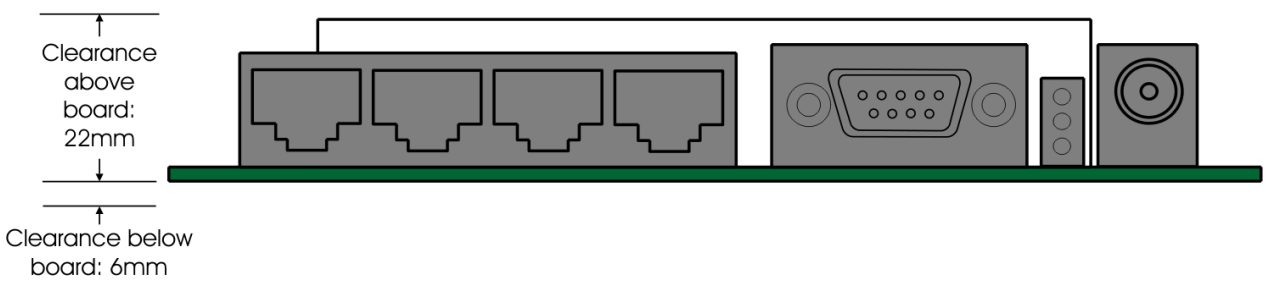


Figure 7 - Required mounting clearances for Orion PCB

Connections

Power

Front panel, locking power plug, 2 pole with 2.1mm centre pin.

Centre conductor: +9 to +15V DC

Outer conductor: 0V (connected to unit ground)

Antenna

Female BNC, 50Ω

Antenna connection for both transmit and receive. The antenna will typically be mounted directly onto this connector; otherwise the connection to the antenna should be as short as possible and made in high-quality low-loss coaxial cable.

- **Caution: do not power the Orion without an antenna or dummy load connected, or the unit may be damaged.**

Telemetry Ports (when fitted)

Four RJ45 8-way female connectors:

RJ45 Pin No.	**Port 1 Digital In**	**Port 2 Digital Out**	**Port 3 Analogue In**	**Port 4 Analogue Out**
1	0V	Relay NC	0V	0V
2	Digital input 1	Relay Common	Analogue input 1	Analogue output 1 or RSSI output
3	0V	Relay NO	0V	0V
4	Digital input 2	Digital output 2	Analogue input 2	Analogue output 2
5	0V	0V	0V	0V
6	Digital input 3	Digital output 3	Analogue input 3	Analogue output 3
7	0V	0V	0V	0V
8	Digital input 4	Digital output 4	Analogue input 4	Analogue output 4

Serial Port

9-way D-type male connector - NOT a standard serial port

- Protocol (RS232, RS422 or RS485) is fixed by soldered links. See page 10.

Pin No	RS232		RS422		RS485	
1	SHDN	Modem on/off input If < 0.6V, Modem = OFF If o/c (internal pull-up to +5V) Modem = ON				
2	RXD	Receive Data output	$\overline{OP}$	Receive Data inverting output	$\overline{IO}$	Inverting input/output
3	TXD	Transmit Data input	IP	Transmit Data input	NC	No function
4	TXB	Secondary Transmit Data input	NC	No function	NC	No function
5	0V					
6	VSENSE External Battery Monitor input +50VDC max					
7	RTS	RTS input	$\overline{IP}$	Transmit Data inverting input	NC	No function
8	CTS	CTS output	OP	Receive Data output	IO	Non-inverting input/output
9	RXB	Secondary Receive Data output	NC	No function	NC	No function

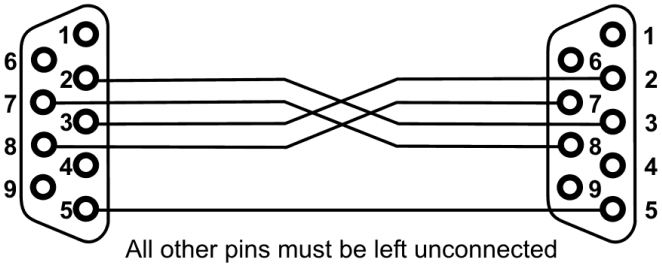
Graphical User Interface (GUI)

The GUI is a program which runs on a PC under Windows, and provides a simple and convenient way to set up local or remote units before use. It can also be used in conjunction with the telemetry inputs and outputs as a display and control console (mimic panel) during normal operation. It is connected to the serial port of the local or master unit.

- The Orion can also be interrogated and controlled using your own equipment and software. Again, a connection to the serial port of the local or master unit is required. AT commands (detailed in Appendix A on page 21) are used for local units and over-air commands (detailed in Appendix B on page 27) for remote units.

Serial Connection

If the Orion is configured for RS232 serial data, a cable of this pattern should be used to connect the COM port of the PC which will run the GUI to the serial port of the Orion:



9-way female D-type to serial port of PC

9-way female D-type to RS232 serial port of Orion

If the Orion is configured for RS422 or RS485 working, the PC must communicate with it using the matching protocol, and be connected to it with the corresponding serial port connections shown in the table on page 8.

Software Installation

The GUI software is provided on a CD-ROM with an automatic installer. Insert the CD-ROM in the PC's CD drive to auto-run the program which installs the GUI software on your computer.

- If auto-run is disabled, you should run the file SETUP.EXE in the root directory of the CD to install the software.

Follow the on-screen instructions to complete the software installation.

The GUI is now ready to run. Keep the CD in a safe place in case it is needed again.

SETTING UP AN ORION

The Orion has some options which are chosen when it is ordered (see page 4) and many which you can configure yourself with hardware links, or soft-configure using data commands. The best way to set up the soft-configurable options is to connect the supplied Graphical User Interface (GUI) to the unit, although it is also possible to use your own equipment using the commands described in Appendix A (page 21) and Appendix B (page 27).

Hardware Link Settings

In order to change the links, open the case using the four screws, one at each corner, to access the PCB.

You will need a fine-tipped soldering iron to make links, and a removal tool or aid to break links.

- This equipment is made with lead-free solder to comply with the RoHS directive, and you should use lead-free solder when making links.

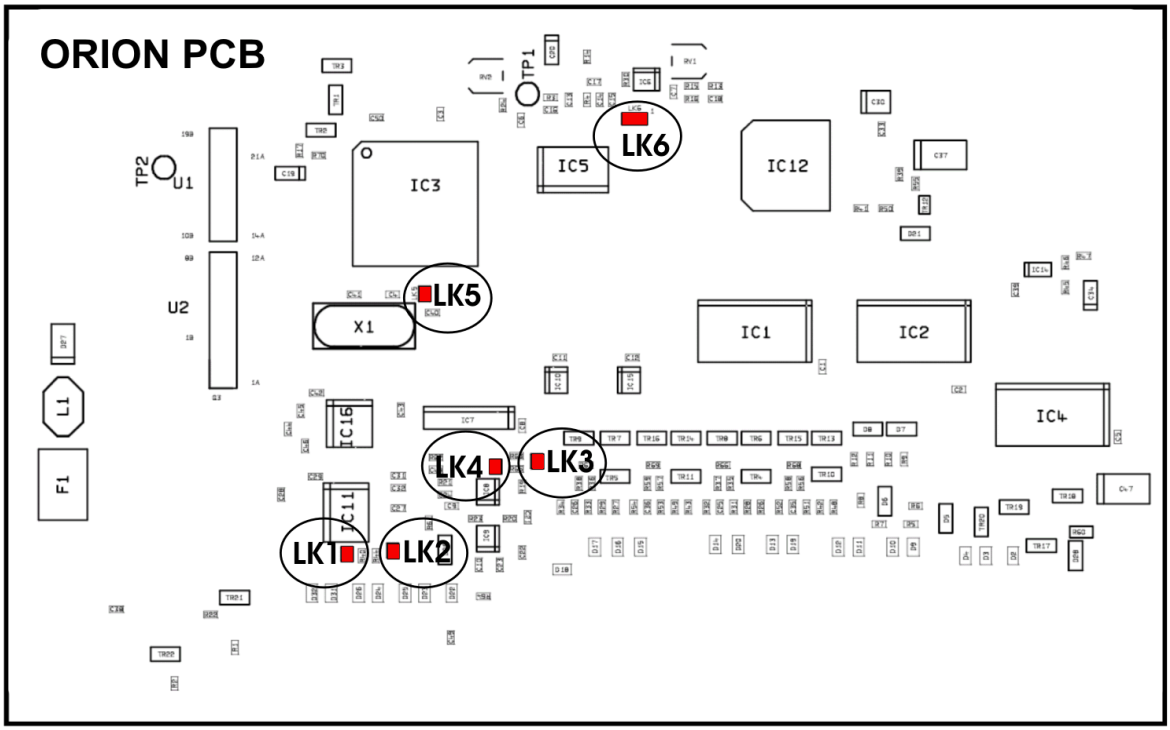


Figure 9 - Link locations

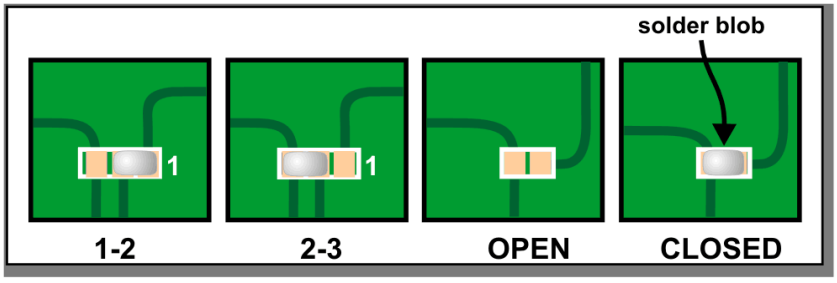


Figure 10 - Making links

Links can be closed with a solder blob as shown in **Figure 10** to select these options:

Option	Choice	Links	
Protocol	RS232	LK1 open	
	RS422/RS485	LK1 closed	
Duplex	Full duplex	LK2 open	
	Half duplex	LK2 closed	
In/Out mode	Full I/O + modem	LK5 open	
	Modem only	LK5 closed	
Use of Analogue Out 0	Analogue user output	LK3 open, LK4 closed, LK6 1-2 open	For GMAX radios, LK6 2-3 closed. Power level is preset HI or LO. For other radios, don't care.
	RSSI output	LK3 closed, LK4 open, LK6 1-2 open	
	Variable power control (GMAX radios only)	LK3 open, LK4 open, LK6 1-2 closed, LK6 2-3 open	

Using the GUI

Ensure that the serial comms port of the PC which is used to run the GUI program is connected to the Orion using a suitable cable as described on page 9. The type of cable depends on whether your Orion's serial port uses RS232, RS422 or RS485.

- Note that this is NOT a standard serial cable, which must not be used.

The GUI must have been installed on the PC as described on page 9.

Switch on power to the Orion.

Start the GUI, typically by double-clicking the icon on the desktop, or selecting Start, Programs, Wood & Douglas, Orion GUI. You should see a display similar to the following, depending on whether you are currently able to connect to an Orion and what options are in force:

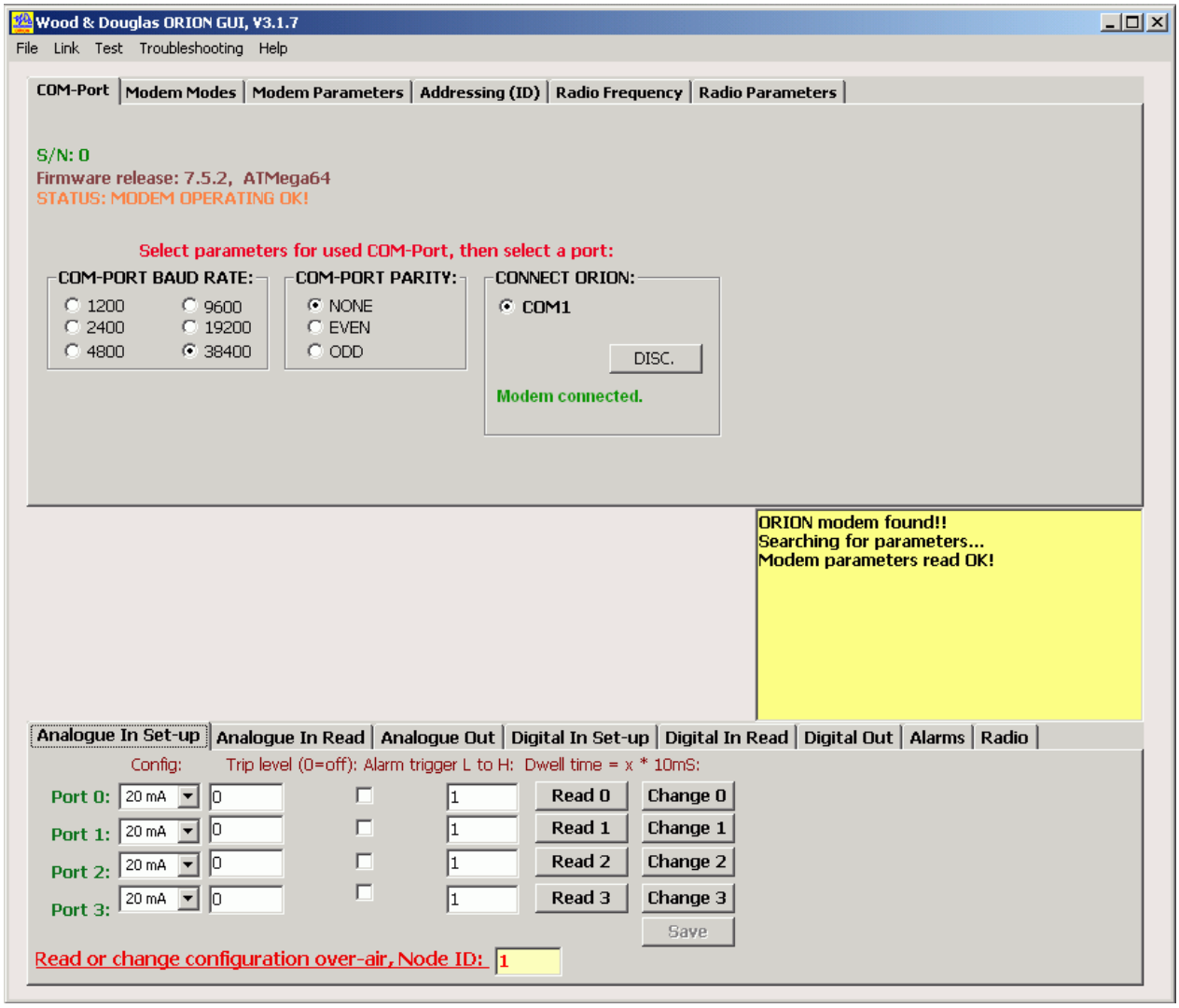


Figure 11 - Orion GUI window

Note the set of tabs at the top which set the Orion up.

The tabs at the bottom are used to set up in/out functions, and also to monitor and control during operation. These tabs may be modified or absent on your display, depending on the mode that the Orion is currently in and whether their parameters are relevant or not.

- This section of the manual deals with setting up - see page 20 for details of operation.

COM Ports and General Status

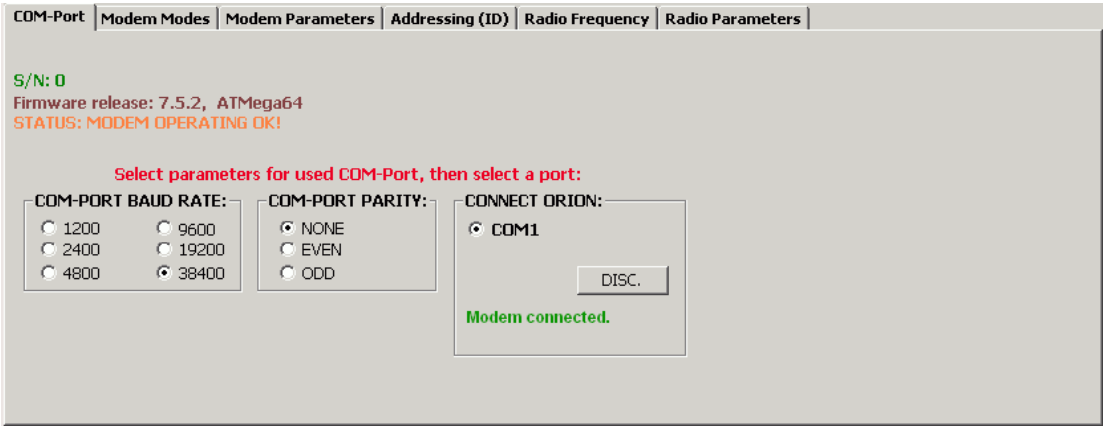


Figure 12 - COM Port tab

This tab is the first one which the GUI presents to you, because the GUI must be set to the same baud rate and parity as the port on the Orion in order to communicate with it.

If the message Modem connected does not appear immediately, select the correct baud rate and parity, then click the COM*n* radio button (even if it is already selected), where *n* is the number of the port to which the Orion is connected. The message Modem connected appears.

To change the baud rate or parity, select the values you want, then select Link, Write Parameters from the menu bar. A successful outcome is reported in the yellow message area.

- The baud rate and/or parity do not actually change at the GUI until you click the one of the COM radio buttons.
- The baud rate and/or parity do not actually change at the Orion until you disconnect from it.

To disconnect from the Orion, click the DISC button.

Modem Status

You can also read the unit serial number, firmware release and general status on this tab.

If one or more errors exist, this will be displayed together with a single code number which you can give to Wood & Douglas technical support.

Some possible errors are listed below.

- NO VALID PARAMETERS IN MODEM! (Error code 2)

When the factory set-up was uploaded to the modem FLASH and EEPROM memories, a parameter check sum was also written. If the check sum calculated by the modem does not match the written check sum, this error will be generated, indicating that the FLASH and EEPROM memory contents are corrupt. You can use menu item Troubleshooting, Reprogram with Factory Settings to correct the parameters, or upload your own custom settings to the modem in the normal way.

- FLASH FACTORY SETTINGS CORRUPT! (Error code 4)

When the modem was first programmed at the factory, a backup factory settings table was written in the FLASH memory. This is used if it is necessary to invoke the Reprogram with Factory Settings command. You can write your own custom settings into this backup table if you wish, using menu item Link, Factory settings, Write, which is password protected.

If this is corrupt, please consult Wood & Douglas technical support for assistance.

- PLL NOT IN LOCK! (Error code 16)

If the radio PLL does not lock, the radio module might be damaged. Turn off power to the unit, and power it up again. If this does not clear the error, please consult Wood & Douglas technical support for assistance.

Modem Modes

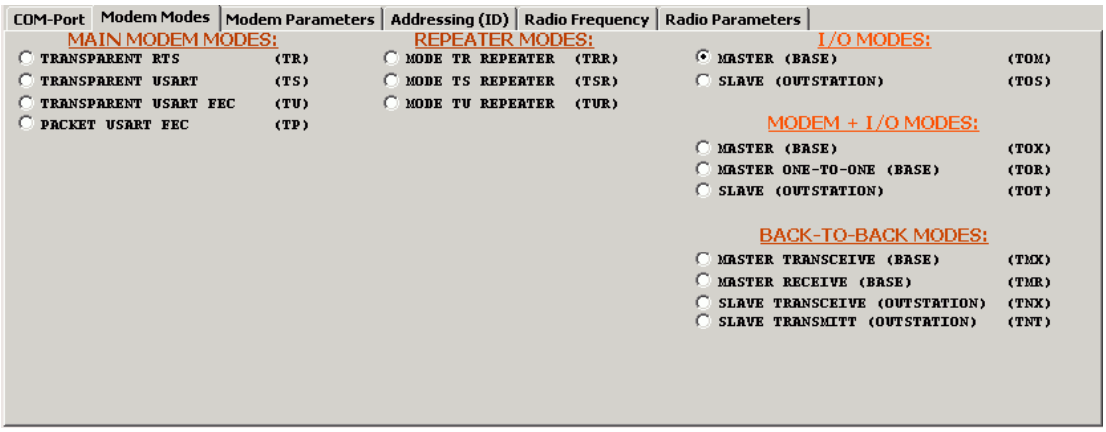


Figure 13 - Modem Modes tab

Orion units can 'talk' to each other in a number of ways to suit your application and the conditions. This section lists the options and tells you which mode you need to select.

Choose the Modem Modes tab in the GUI, and click to select options.

- The set of tabs at the bottom of the window may change or disappear depending on the option you choose, and whether or not they are relevant.

Normal Data Modem

The Orion makes an excellent data modem without using its built-in telemetry capabilities. It has four data modes, which allow for different kinds of data and different levels of error correction depending on your application. As you might expect, the more error correction you select, the lower the maximum throughput. (See specifications for figures.)

These modes provide a point-to-point, half-duplex link.

TR caters for non-standard data formats by sampling the input and recreating it at the other end. Any format can be sent, but no error correction can be provided. The RTS line must be active as long as data is to be transmitted.

TS is the basic two-way link for asynchronous RS232 data. It has no error correction.

TU also provides a two-way asynchronous RS232 data link, but it has Feed-forward Error Correction (FEC) so that many errors can be corrected.

TP provides a two-way asynchronous RS232 data link with both FEC and requests for repeat transmission of corrupt packets to provide an error-free link.

TRR
TSR
TUR configure a modem as a simplex repeater, retransmitting received data to extend the range of the radio link. They are used in conjunction with the corresponding TR, TS and TU modes. (Repeater mode is not available for mode TP.)

Several repeaters can be used in the same network, because the repeater will only re-transmit the same message once if received several times.

Telemetry Options

These modes communicate only telemetry information, not user data.

TMR
TNT The simplest telemetry link is where the inputs at one end are mimicked at the other end. By configuring the master station as TMR, and the outstation as TNT, the inputs at the outstation are relayed to the master's outputs.

TMX
TNX This is a similar link, but two-way. By configuring the master station as TMX , and the outstation as TNX, the inputs at either end are relayed to the outputs at the other. Hence this could be used for control as well as data acquisition.

TOM
TOS This configuration allows one master to control and acquire data from many (up to 255) outstations. The master is configured as TOM, and each outstation as TOS, with an ID number so that it can be individually addressed. External equipment (the GUI for example) is needed at the master to supervise the operation and receive data. The master's telemetry inputs and outputs are not used.

If a repeater is needed for any of these modes, configure it as **TUR**.

Combination Options

The Orion is capable of passing both user data and telemetry information between the outstation(s) and the master.

TOR
TOT

Single outstation. The master is configured as TOR, and the outstation as TOT. Data input at the outstation is output at the master's normal data port, I/O ???and alarm messages are output on the secondary data port. External equipment (the GUI for example) is needed at the master to supervise the operation and receive data.

TOX
TOT

The master is configured as TOX, and each outstation as TOT, with an ID number so that it can be individually addressed. When it is polled by the master, data input at the outstation is output at the master's normal data port, and I/O data and alarm messages are output on the secondary data port. The secondary data port operates at a fixed data rate of 19200 baud. External equipment (the GUI for example) is needed at the master to supervise the operation and receive data.

Modem Parameter Configuration

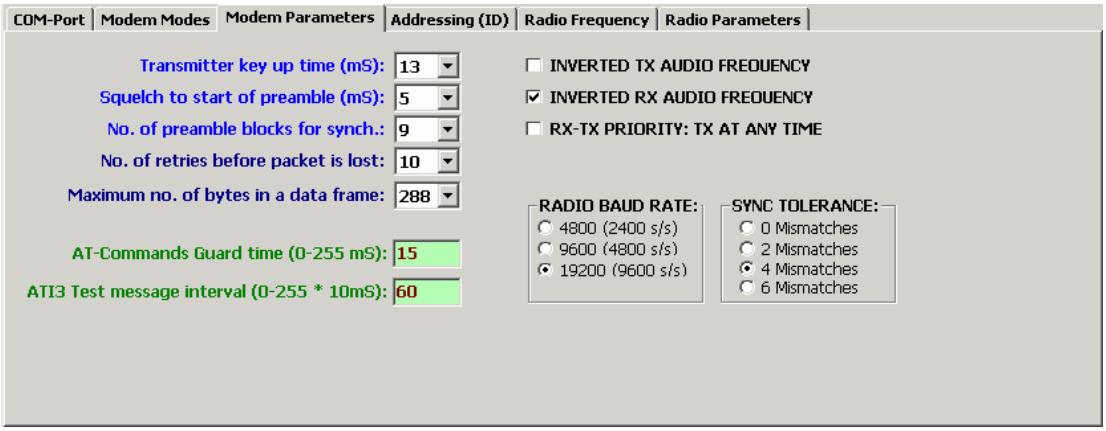


Figure 14 - Modem Parameters tab

Transmitter key-up time

This time is allowed to elapse before any data is sent, to ensure that the radio is ready. The value depends on the particular radio fitted.

Squelch to start of preamble

During receive, the modem allows this period to elapse after the squelch has operated before reporting a missing preamble.

No of preamble blocks

The number of preamble blocks which will be sent after the key-up time. Too few will not allow the remote receiver to establish sync, too many will waste transmission time. 9 is a typical value.

No. of retries (TP mode only)

If a received packet fails its CRC check, the receiving modem will ask for retransmission. For each packet, this will be repeated until either a good copy is received, or the number of retries set here has been reached. A typical setting is 10 - 15.

Max no. of bytes in a data frame (TP mode only)

The maximum number of bytes in each packet as it is transmitted. Select a value from the drop-down list, which are the only values available. A high value ensures maximum data throughput where there is a good signal path, whereas a low value is the best compromise where there is a poor signal path.

RX-TX Priority

Normally, the Orion will not transmit if the squelch indicates that there is already a transmission on frequency. However, where there is interference, this box may be checked to transmit regardless.

Inverted TX audio, Inverted RX audio

Some radio modules invert the audio (modem) TX and/or RX signal. Using these checkboxes, the signal can be restored to the original polarity by correcting the inversion.

Radio Baud Rate

Selects an over-air baud rate appropriate to the radio bandwidth and the data rate you propose to send over the air. 19200 bps can be used with a 25kHz channel, and 9600 or 4800 bps in a 12.5kHz channel.

Sync Tolerance

Regular sync frames of known content are sent over the link. Sometimes they are imperfect, but because of forward error correction this does not indicate that the data is unusable. This value indicates the number of imperfections which can be tolerated, and is usually set at 4.

AT Commands Guard Time

Sets the minimum time in ms required to elapse either side of the '+++' AT command string for it to be recognised as such. 15ms is a typical value. See p.21 for details.

ATI3 Test Message Interval

The time which is allowed to elapse in between transmissions of the test string in response to the AT I 3 command, in tens of milliseconds.

This space reserved for additional material

Telemetry Option Configuration

Depending on which mode you are using the Orion unit in, you may need to set up other options such as alarm levels.

- These options are not relevant if you are using the unit as a straight modem.

Analogue Input Setup

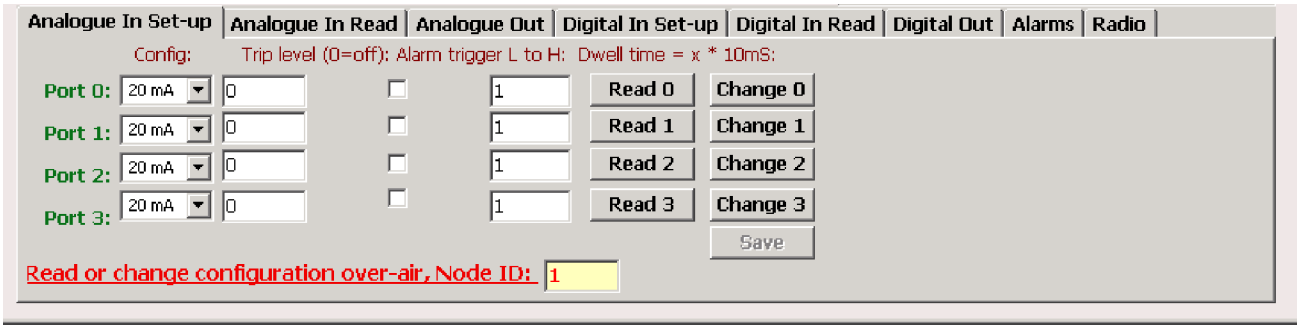


Figure 15 - Analogue In Set-up

For each input, select:

Type:	20mA input
	0 to +5V input
	0 to 10V input
Alarm threshold:	1 to 1023 - proportion of full scale (0 = never alarm)
Alarm validation period:	1 to 255 - time for which condition must persist (in 10ms blocks)
Alarm condition:	Greater than or less than threshold level

Digital Input Setup

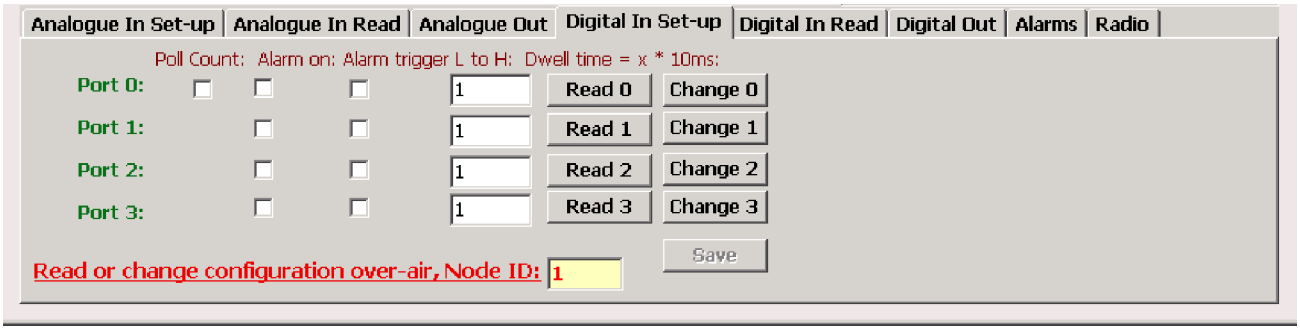


Figure 16 - Digital In Set-up

For each input, select:

Alarm:	enable
	disable
Alarm validation period:	1 to 255 - time for which condition must persist (in 10ms blocks)
Alarm condition:	low-high transition
	high-low transition

Alarm Behaviour

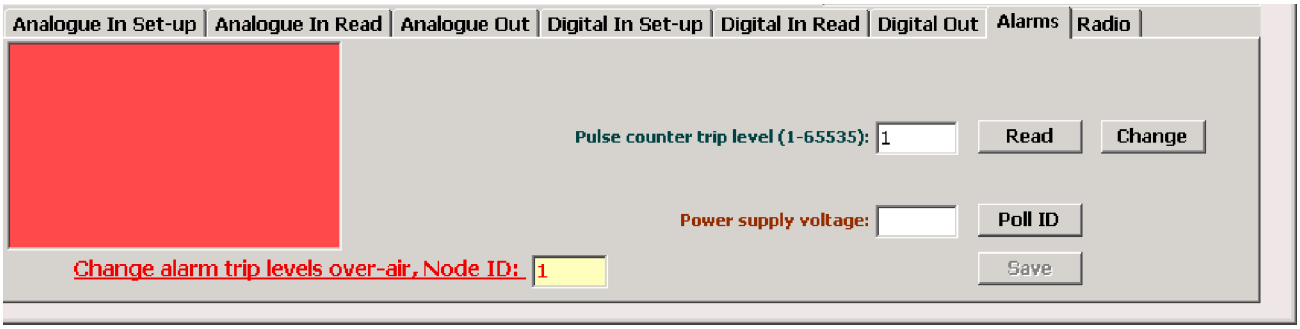


Figure 17 - Alarms

Alarm repeat:	1 to 1023 - alarm is repeated at this interval (in 10ms blocks) during alarm condition
	0 - alarm is sent once when condition first occurs
Alarm retry:	1 to 1023 - when link is unidirectional, alarm will be sent this number of times to ensure that it gets through.

This space reserved for additional material

LED Indications

Three LED indicators are visible on the front panel, with the following meanings:

Yellow	Status	Slow blink (every 2 seconds) indicates normal operation. Fast flash (5Hz) indicates one of the following: • the receiver is detecting carrier with no data modulated on it • the modem is in AT command mode • the radio module is reporting a lock error • the modem is not configured
Green	RX	Steady on state indicates valid data reception or communication with the GUI software.
Red	TX	On when the radio is transmitting.

APPENDIX A: AT COMMAND CODES

Normally the GUI is the best way to configure, control and interrogate a local Orion unit. However, if you want to use your own equipment and software to do this, you can use the serial port to send ASCII AT commands and receive replies, which are listed in this Appendix.

The modem is configurable via the same port as is normally used for data. To configure it, you need to connect a terminal or equivalent to the port, and to switch the modem into Command Mode by sending a special code. The next three sections explain how to enter Command Mode, the syntax used during configuration, and how to exit Command Mode and return to sending and receiving data normally. The remaining sections list the commands in detail.

In this part of the manual, characters which are sent or received literally through the port are shown thus: ATB0. Non-printing characters such as the Enter key, or the carriage return and line feed characters, are shown thus: <enter>, <CR>, <LF>.

Where <enter> is shown, the modem expects to receive the characters <CR><LF> (codes 0A 0D hex). Most terminals send these codes in response to the <enter> key, but the keystrokes <ctrl+M><ctrl+J> are equivalent.

Important: **Any configuration changes made will only be saved to the non-volatile memory when you issue a write command** (AT&W). Otherwise, the modem will return to its former settings when it is powered down.

Entering Command Mode (+++)

Command Mode is activated with the string

[wait]+++*[wait]*<enter>

where *[wait]* is a period when no data is sent to the modem. It must be at least the period set by ATS154=, default value 10ms.

The modem responds with:

OK<CR><LF>

The modem is now ready to be configured.

- Transmission and reception are blocked during Command Mode.

In order to be recognised as the Command Mode instruction rather than data, these conditions must be fulfilled:

- The RTS line must be set
- No data must be sent to the modem for at least the time set by register S154
- The symbol + must be sent three times consecutively immediately following the wait period.
- Again, no data must be sent to the modem for at least the time set by ATS154=
- The next data received by the modem must be <CR><LF> (usually sent from a terminal by keying <enter>)

If any of these conditions is not fulfilled, then the string "+++" will be transmitted as normal data. Note that one or more consecutive “+” characters in the input data will be held in the modem until it is determined that it is not a Command Mode instruction.

Command Syntax

Once in Command Mode, commands are issued by sending a code consisting of several ASCII characters starting with AT and terminated with <enter>. The modem then responds with the characters OK or the information requested, followed by <CR><LF>. Alternatively, any error is indicated by ERROR<CR><LF>.

For example, the parity type can be set to even using:

ATB1=1<enter>

to which the modem responds

OK<CR><LF>

The current value of most parameters can be found out by adding a question mark to the end of the code which sets it, for example:

ATB1?<enter>

to which the modem responds

1<CR><LF>

Capital letters **MUST** be used for all command instructions. A space after AT is optional, so the commands AT B1? and ATB1? are functionally identical.

Ending Command Mode (ATO**)**

- Before ending Command Mode, make sure that you save any changes you wish to keep by issuing the AT&W command.

Command Mode is ended by inputting the string

ATO<enter> (letter O)

The modem responds with

OK<CR><LF>

The modem is now ready for normal data transmission, and if a new baud rate was set, it now comes into effect.

Commands

Command	Description	Values	Note
<*wait*>+++<*wait*>	Start Command Mode		<wait> period set by ATS154=
ATO	End Command Mode		letter 0, not zero

AT&F=	Set operating frequency directly	xxxx.xxxxxxx	MHz
AT&F?	Read operating frequency		
AT&W	Save to EEPROM		
AT&Y8	Restore factory parameters		
ATB0=	Set serial baud rate	1	4800
		2	9600
		3	19200
ATB0?	Read baud rate	4	38400
		5	1200
		6	2400
ATB1=	Set parity	1	even
		2	odd
ATB1?	Read parity	3	none
ATFC?	Read channel spacing (comparison frequency)	0	FC = 6.25 kHz
		1	FC = 10.0 kHz
		2	FC = 12.5 kHz
		3	FC = 20 kHz
		4	FC = 25 kHz
ATFIF?	Read IF frequency	±xx.xxxxxxx	frequency in MHz + indicates IF osc above operating frequency, – indicates below
ATFLB?	Read min operating frequency	xxxx.xxxxxxx	MHz
ATFHB?	Read max operating frequency	xxxx.xxxxxxx	MHz
ATM=	Set Orion mode	TS, TU, TP, TR, TRR, TSR, TUR, TMR, TNT, TMX, TNX, TOM, TOS, TOR, TOT, TOX	See explanation of codes on page ?
ATM?	Read Orion mode		
ATI2=	Output Preamble (Test mode)	0 or 1	off or on
ATI3=	Output test message (Test Mode) in TU mode	0 or 1	off or on
ATI6=	Transmit unmodulated carrier	0 or 1	off or on
ATI7=	Output Random Data (Test mode)	0 or 1	off or on
ATIn?	Report on ATIn test status	0 or 1	off or active
ATI9?	Output software information	text string	

ATI10=0	Turn all test modes off		
ATI10?	Return whether any test is active	0 or 1	0 = no tests active 1 = one or more tests active
ATO	End command mode		(Letter O, not zero).
ATPF=n	Set packet length in TP mode	n=1 to 52	n*12 bytes
ATPF?	Get packet length in TP mode	12 to 624	bytes
ATPRT=	Set number of retries in TP mode	2 to 19	
ATPRT?	Get number of retries in TP mode		
ATPT=	Set TX delay	2 to 29	ms
ATPT?	Read TX delay		
ATRXOFF=	Set TX to RX frequency offset	±xx.xxxxxx	MHz + for TX higher than RX – for TX lower than RX
ATRXOFF?	Get TX to RX frequency offset		
ATS154=	Guard time	0 to 255	ms
ATS154?	Read Guard time		
ATS155=	Set centre frequency	nnn.nnnnn	MHz
ATS155?	Read centre frequency		
ATS156?	Get RSSI	0 to 1023	RSSI
ATS157=	Set Channel number	±0 to 99	Channels
ATS157?	Get Channel number		
ATS158?	Get data quality	??? (XXX if not available	Data Quality
ATS160=	Set Power level	0 or 1	0=Low, 1= High power (meaning depends on radio fitted)
ATS160?	Get Power level		
ATS161=	Set Channel step (spacing)	0	6.25kHz
		1	10kHz
		2	12.5kHz
ATS161?	Get Channel step	3	20kHz
		4	25kHz
ATS162=	Set test message repeat period	1 to 255	n*10ms
ATS162?	Get test message repeat period		
ATS163=	Set Symbol rate	1	symbols/s 2400 / baud/s 4800
		2	4800 / 9600
ATS163?	Get Symbol rate	3	9600 / 19200
ATS165=	Set Number of preambles	1 to 9	
ATS165?	Get Number of preambles		
ATS166=	Set Sync tolerance	0	0 mismatches
		1	2 mismatches

ATS166?	Get Sync tolerance	2	4 mismatches
		3	6 mismatches
ATS167=	Set Inverted Symbol	0	None invert
		1	TX invert
ATS167?	Get Inverted Symbol state	2	RX invert
		3	Both invert
ATS168=	Set Squelch delay	1 to 255	ms
ATS168?	Get Squelch delay		
ATS169=	Set Destination ID	001 to 249	Master/slave modes only
ATS169?	Read destination ID		
ATS170=	Set Unit ID	001 to 249	Master/slave modes only
ATS170?	Read Unit ID		
ATS172=	Set Low battery threshold	0 - 1023	Proportion of full charge
ATS172?	Get Low battery threshold		
ATS175n=m	Set Analogue input n type	m = 1	0 to 20mA
		m = 2	0 to 5V
ATS175n?	Read Analogue input n h/w configuration	m = 3 (default)	0 to 10V
ATS176n=a	Set Analogue output n to DAC value a	0 to 1023 (Default = 0)	ADC level
ATS176n?	Read Analogue input n level		
ATS177n=l , d , s	Set parameters of analogue input 'n' (Defaults = 0, 0, 0)	l = 0 to1023	trip level 1 – 1023 0 = no alarm
		d = 1 - 255	d = dwell time*10ms
ATS177n?	Read Analogue input n setup	s = 0 or 1	transition causing alarm: s = 0, high to low s = 1, low to high
ATS178n=m	Set Digital O/P n high or low (Default = 1)	m = 0	Output = Low
		m = 1	Output = High
ATS178?	Read Digital I/Ps 0 - 3	value = 0	Input = Low
		value = 1	Input = High
ATS179n=t , d , s	Set parameters of digital input 'n' (Defaults = 0, 0, 0)	t = 0 or 1	t = 0, no alarm t = 1, alarm
		d = 1 - 255	d = dwell time*10ms
ATS179n?	Read digital input status	s = 0 or 1	s = 0, high to low s = 1, low to high
ATS180=	Set RX-TX priority	0 or 1	0 =TX waits for squelch 1 =TX at any time
ATS180?	Read RX-TX priority		
ATS181=	Set Pulse Count input on/off (input 0 only)	0 or 1	1 = on 0 = off
ATS181?	Read Pulse Count & reset to 0	0 to 65535	counts since last reset

ATS182=	Set power supply trip level	0 to 1023	ADC level
ATS182?	Read power supply level		
ATS183=	Set delay after last packet	0 to 65535	delay *100ms
ATS183?	Read delay after last packet		
ATS184=	Set no. of TX packets sent	1 to 7	
ATS184?	Read no. of TX packets sent		
ATS186=xxx	Set delay period to wait before transmitting	0 to 255	xxx = delay in units of 10ms
ATS187=x	Set max number of delays to wait before transmitting	0 to 7	
ATS185=xx	Set no. of packets missed before alarm		xx = no of missing packets
ATT?	Display all parameters	comma-separated text string	See Appendix C on page 34 for details.

APPENDIX B: OVER-AIR COMMAND CODES

Normally the GUI is the best way to configure, control and interrogate a remote Orion unit. However, if you want to use your own equipment and software to do this, you can use the serial port of the local Orion to send over-air commands and receive corresponding replies, which are listed in this Appendix.

Introduction

In the sections listing the various commands the following abbreviations etc are used:

Pulse Count Input	=	2 byte value which is state of counter from last poll or power-on
Analogue input	=	10 bit ADC value sent as 2 bytes
Analogue output	=	10 bit ADC value sent as 2 bytes
IDS	=	ID bytes (1 digit ID number) of source
IDD	=	ID bytes (1 digit ID number) of destination Note that base station will always be ID = 0
CH	=	CHECKSUM additive sum of bytes in message where CH is the low order byte of the sum of all the bytes in the message, apart from the first three. i.e. for an 04 IDS IDH 20 message, CH = the sum of 20.
nn	=	1 byte data
mmmm	=	2 byte data

After a set command is sent, the unit will reply with a confirmation message. All I/O config will be stored in EEPROM until an AT&W command is issued (serial port) or store config over-air message (`04 IDS IDD 27 CH`) is received, when it will transfer it to non-volatile storage.

Messages from Base Station to Outstation:

`04 IDS IDD 20 CH`	Poll outstation IDD Note: IDS = 0 for base station
`04 IDS IDD 21 nn tt dd ss CH`	Set input trigger state for digital input port nn Logic 1 in byte tt = send alarm message, 0 = don't Dwell time dd, (1 -255)*10ms, (0 = no dwell time) Logic 0 in byte ss indicates a High to Low change Logic 1 in byte ss indicates a Low to High change
`04 IDS IDD 22 nn cc llll dd ss CH`	Set analogue input set by bit in byte nn to: Analogue input type: cc = 1, 20mA; cc = 2, 0 - 5V; cc = 3; 0 - 10V ADC trip level ll, 1 - 1024, (0 = no trip level) Note: if trip level = 0, no alarm message sent Dwell time dd, (1 -255)*10ms, (0 = no dwell time) If bit 0 in byte ss = 1 then alarm sent if above trip level If bit 0 in byte ss = 0 then alarm sent if below trip level
`04 IDS IDD 23 nn mmmm CH`	Set analogue output port nn to ADC value mmmm
`04 IDS IDD 24 nn CH`	Set digital outputs: Logic 0 in byte nn indicates output = Low Logic 1 in byte nn indicates output = High
`04 IDS IDD 25 pp dd CH`	Enable/Disable pulse count input: If pp = 1, enable pulse count (Input bit 1) with Dwell time dd, (1 - 255)*10ms, (0 = no dwell time) If bit 0 of pp = 0, disable pulse count (Input bit 1)
`04 IDS IDD 26 bbbb CH`	Set battery trip level to ADC value bbbb (1 to 1023, where 1023 = 50VDC)
`04 IDS IDD 27 CH`	Store config in EEPROM
`04 IDS IDD 28 aa ff CH`	Set channel of outstation to value ff (0 to 99) where aa is + or - from centre frequency. Channel change will occur after acknowledge message received.
`04 IDS IDD 29 bb CH`	Set TX power to level bb If bb = 0 then LOW, if bb = 1 then HIGH
`04 IDS IDD 30 bbbb CH`	Set Pulse Counter alarm trip level (1 to 1023)
`04 IDS IDD 31 nn CH`	Read setup for digital input port nn
`04 IDS IDD 32 nn CH`	Read setup for analogue input port nn
`04 IDS IDD 33 CH`	Read Pulse Counter alarm level
`04 IDS IDD 40 CH`	Read analogue input ADC level for all ports
`04 IDS IDD 41 CH`	Read state of digital inputs
`04 IDS IDD 42 nn CH`	Read analogue input ADC value for port nn

`04 IDS IDD 45 CH`	Read pulse count (which will reset counter)
`04 IDS IDD 46 CH`	Read radio channel and TX setting
`04 IDS IDD 47 nn CH`	Read Analogue output level for port nn
`04 IDS IDD 48 CH`	Read Digital output states
`04 IDS IDD 49 CH`	Read RSSI Value (for last message received)

Messages from Outstation to Base Station

`04 IDS IDD 50 bbbb CH`	Reply to poll with bbbb = battery ADC level (reply to 20 command)
`04 IDS IDD 51 nn tt dd ss CH`	Setup status of digital input (set by bit in byte nn) (reply to 21 or 31): If tt = 0 then don't send alarm message If tt = 1 then= send alarm message If tt = 2 and port = 00 then poll counter is used Dwell time dd, (1 -255)*10ms, (0 = no dwell time) Logic 0 in byte ss indicates a High to Low change Logic 1 in byte ss indicates a Low to High change
`04 IDS IDD 52 nn cc llll dd ss CH`	Setup status of analogue input (set by bit in byte nn) (reply to 22 or 32 command: Analogue input type: cc = 1, 20mA; cc = 2, 0 - 5V; cc = 3; 0 - 10V ADC trip level ll, 1 - 1023, (0 = no trip level) Dwell time dd, (1 -255)*10ms, (0 = no dwell time) If bit 0 in byte ss = 1 then alarm sent if above trip level If bit 0 in byte ss = 0 then alarm sent if below trip level
`04 IDS IDD 53 nn mmmm CH`	Analogue output port nn ADC value mmmm (reply to 23 command)
`04 IDS IDD 54 nn CH`	Digital outputs state (reply to 24 command): Logic 0 in byte nn indicates output = Low Logic 1 in byte nn indicates output = High
`04 IDS IDD 55 pp dd CH`	Pulse count status (reply to 25 command) If pp = 1 pulse count enabled with Dwell time dd
`04 IDS IDD 56 bbbb CH`	Battery trip level bbbb (reply to 26 command)
`04 IDS IDD 57 CH`	Config stored in Flash (reply to 27 command)
`04 IDS IDD 58 ffff CH`	New channel ffff (1 to 400) of outstation (reply to 28 command) Channel change to occur after this acknowledge message
`04 IDS IDD 59 bb CH`	TX power set to level bb (reply to 29 command)
	Power change to occur before this acknowledge message

`04 IDS IDD 60 aaaa bbbb cccc dddd CH`	Analogue input levels (reply to 40 command) aaaa = ADC level of analogue input 0, 1 - 1023 bbbb = ADC level of analogue input 1, 1 - 1023 cccc = ADC level of analogue input 2, 1 - 1023 dddd = ADC level of analogue input 3, 1 - 1023
`04 IDS IDD 61 nn CH`	Digital input levels (reply to 41 command or after an alarm) Logic 0 in byte nn indicates output = Low Logic 1 in byte nn indicates output = High
`04 IDS IDD 62 nn aaaa CH`	Analogue input level for port nn (reply to 42 command or after an alarm) aaaa = ADC level of analogue input nn 1 - 1023
`04 IDS IDD 65 nn cccc CH`	Pulse counter value (reply to 45 command) cccc = 1 - 1023
`04 IDS IDD 66 cccc pp CHCH`	Used channel and power setting (reply to 46 command) cccc = channel 1 - 400 pp = 0, low power and pp = 1, high power
`04 IDS IDD 67 nn aaaa CH`	Analogue output level for port nn (reply to 47 command) aaaa = 1 - 255 with 16 bit reserved
`04 IDS IDD 68 nn CH`	Digital output status (reply to command 47) Logic 0 in byte nn indicates output = Low Logic 1 in byte nn indicates output = High
`04 IDS IDD 69 bbbb CH`	Power supply battery trip level (reply to command 49) bbbb = alarm trip level 1 - 1023
`04 IDS IDD 70 bbbb CH`	Pulse counter alarm trip level (reply to commands 30 and 33) bbbb = 1 - 1023
`04 IDS IDD 73 bbbb CH`	Poll counter alarm trip level (reply to command 30) bbbb = 1 - 1023
`04 IDS IDD 74 aaaa CH`	RSSI level for last received message (reply to command 48) aaaa = 1 - 1023
`04 IDS IDD 91 nn bb CH`	Digital input alarm for port nn 00 in byte bb indicates output = Low FF in byte bb indicates output = High
`04 IDS IDD 92 aaaa CH`	Analogue input alarm for port nn aaaa = 1 - 1023
`04 IDS IDD 93 aaaa CH`	Pulse count alarm when pulse count > alarm trip level aaaa = 1 - 1023

APPENDIX C: ATT? PARAMETER STRING STRUCTURE

The modem responds to the ATT? command by sending a comma-separated list of all available parameters used for the selected modem mode. The structure of this string is as follows:

RS232 baud,

RS232 parity,

Guard time,

Centre frequency,

Channel number,

Channel step,

TX frequency,

RX offset,

RX frequency,

RX IF,

Radio baud,

Inverted symbol,

Squelch delay,

TX delay,

Preambles,

Frame sync tolerance,

RSSI,

Data quality,

Group ID,

Base ID,

Node ID,

Regenerator (always 0)

Low battery level (ADC value 0-1023) (always 0),

Battery level (ADC value 0 -1023),

Modem mode,

”Analogue”, port no, level, h/w config, trip level, dwell time, edge type (port0 input),

”Analogue”, port no, level, h/w config, trip level, dwell time, edge type (port1 input),

”Analogue”, port no, level, h/w config, trip level, dwell time, edge type (port2 input),

”Analogue”, port no, level, h/w config, trip level, dwell time, edge type (port3 input),

“Analogue”, port no, level (port0 output),

“Analogue”, port no, level (port1 output),

“Analogue”, port no, level (port2 output),

“Analogue”, port no, level (port3 output),

“Digital”, port no, logic, alarm enabled, dwell time, edge type, poll counter enabled, poll counter trip level (port0 input),

“Digital”, port no, logic, alarm enabled, dwell time, edge type (port1 input),

“Digital”, port no, logic, alarm enabled, dwell time, edge type (port2 input),

“Digital”, port no, logic, alarm enabled, dwell time, edge type (port3 input),

“Digital”, port no, logic (port0 output),

“Digital”, port no, logic (port1 output),

“Digital”, port no, logic (port2 output),

“Digital”, port no, logic (port3 output)

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