Installation and Operating Handbook

RTR50 Tracking Receiver

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EN 55022 CLASS B EN 50082-1 EN 60950



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IMPORTANT NOTE: THE INFORMATION AND SPECIFICATIONS CONTAINED IN THESE DOCUMENTS SUPERSEDE ALL PREVIOUSLY PUBLISHED INFORMATION CONCERNING THESE PRODUCTS

REVISION HISTORY

Revision	Change
1.00	Original
1.01	Removed text for 10MHz and DC output options (options not currently available)
1.02	Figure 3 : Circular Connectors Added 12 way circular connector option for Ethernet and serial communication.
1.03	Address change
1.04	Serial messages 21,22 now match PTR series of units
1.05	Corrected error Table:2
1.06	Corrected Instruction 22 in the remote control
1.07	Corrected Pinout on Fig.3
1.08	Corrected Serial message instruction 40, length was wrong

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CUSTOMER CARE

Contact the Peak Communications support department for:

- Froduct operation, application support or training requests
- Information for returning or upgrading a product
- Comments or suggestions on any supplied literature

Contact Information

Peak Communications Ltd Attention: Sales Department Unit 1, The Woodvale Centre Woodvale Road Brighouse West Yorkshire HD6 4AB UK Tel. +44 (0) 1484 714200 Fax +44 (0) 1484 723666 E-mail <u>support@peakcom.co.uk</u>

You can also contact us via our website at <u>www.peakcom.co.uk</u>

To return a Peak Communications product for repair:

- 1. Contact the Peak Communications support department and request a Return Material Authorisation (RMA) number.
- 2. You will be required to provide to our support representative the model number, serial number and a detailed description of the problem.
- 3. To prevent any damage to the product during shipment we recommend that the unit is returned in its original packaging or if this is not available the packaging used must be of an equal standard.
- 4. Return the product back to Peak Communications and advise shipment details to sales representative for tracking purposes. (Any shipping charges should be prepaid)

For information regarding our warranty policy see Appendix 1 Terms and conditions of sale.

1. PRODUCT COMPLIANCE

1.1 Safety

To ensure safety of operator the RTR50 has been designed to comply with the following safety standard;

EN 60950: Safety of information technology equipment, including electrical business machines.

Operation of the equipment in a non standard manner will invalidate compliance to this standard.

The equipment MUST BE OPERATED WITH ITS LID ON AT ALL TIMES.

If it is necessary to remove the lid for any purpose then it is essential that the lid is fitted back correctly before normal operation.

DANGEROUS VOLTAGES ARE PRESENT AROUND THE POWER SUPPLY AND PRECAUTIONS MUST BE TAKEN.

1.2 EMC

The RTR series of Receivers have been designed to comply with the following standards;

Emissions: EN 55022 Class B; Limits and methods of measurement of radio interference characteristics of Information Technology Equipment.
 Immunity EN 50082 Part 1; Generic immunity standard, part 1: Domestic, commercial and light industrial environment.

Mechanical damage to the chassis will also invalidate compliance; please contact the factory under these circumstances for advice on continued operation.

Interfaces to the RTR50 must be made with suitably screened connectors and double screened coaxial cable. Data cables must be double screened.

Installations which do not comply with this requirement will invalidate the EMC specifications.

2. INTRODUCTION

2.1 General Product Overview



Figure 1 : RTR50 L-band Tracking Receiver

This Manual covers the installation and operation of the RTR50 Remote Mounted 'CW' Beacon Tracking Receiver. A specification for the RTR50 L band Tracking receiver is incorporated in this manual but is not guaranteed to be the latest specification so please visit our website <u>www.peakcom.co.uk</u> for up to date specifications.

The RTR50 Tracking Receivers are housed in a rugged 250 x 145 x 30mm IP66 rated weatherproof enclosure. They are designed to connect between a Block conversion stage, and provide a DC voltage proportional to the signal being received. The RTR/PTR family of units are under constant development and new features may not be included in this manual. Model covered in this manual:-RTR50 L-Band Tracking Receiver

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The RTR50 units have a high stability internal 10 MHz reference signal and can provide 16v DC power to an external Block Downconverter. The RTR series of receivers have an Ethernet interface with the option of selectable RS232/485 serial communications. Customer supplied DC at 20V to 24V is internally fused and internally re-regulated to supply required voltages to the RF and supervisory circuitry

A form C summary alarm connection is available for monitoring the RTR50 unit via a M&C system.

2.2 Functional Description

The RTR50 will down convert an L-Band signal to an IF of 70 MHz. The tracking function then uses a coherent detector to lock to the CW beacon and measure the power of the beacon signal. The unit also incorporates a switchable, single sweep digital anti sideband detector to prevent the unit locking to beacon sidebands.

The unit features Ethernet web based menu driven software for control and configuration of the unit. The units have built in 1:1 redundancy control and can be remotely controlled via a RS232/485 port (option).

The RTR is fully software controlled; there are no links or switches used to configure the unit. This enables all control and configuration to be programmed either locally or by remote control. All the configuration parameters are stored in non-volatile memory that will retain data for a minimum of 5 years with no power applied.

2.3 Operating Suggestions

The following are suggested set points to enable the customer to get the best use out of the unit with the minimal of time:

Tracking sweep range of \pm 50KHz Sweep time of 5KHz/s (Fast acquisition available up to 240kHz/s) Log output of 2dB/V

The Coherent detector works best with a post downconverter level of between – 60dBm to –90dBm so by using the variable gain of the downconverter section the optimum level can be achieved i.e. with an expected signal of –100dBm the downconverter should be set towards its maximum gain of 30dB and with an expected signal of –70dBm the gain should be set towards the minimum of 0dBm

The ASB function is active for a single sweep when the unit has first locked, the downconverted spectrum is swept and monitored for a higher signal and if one is found then the main receiver is forced to check the rest of the spectrum. This results in the unit locking to the highest-level signal in its sweep range. Due to the digital analysis of the bandwidth the ASB will take <10 minutes to complete a full sweep. It is suggested

that when the unit is used on a non-sideband beacon the ASB function should remain off.

3. RTR50 SPECIFICATIONS

This specification is provided to show typical values and explain the parameters involved. The specification may change so please refer to our website <u>www.peakcom.co.uk</u> for the latest up to date specifications.

3.1 Tracking Function

Input Connector	950-2150 MHz N-Type Female	
Frequency resolution Input Level Max	1 KHz -60dBm	
Sweep Range	User selectable +20KHz +50KHz +100KHz +	-200KHz +500KHz
Sweep Rate	User Selectable 2.5KHz/s, 5KHz/s, 10KHz/s, 80KHz/s, 240KHz/s.	20KHz/s, 40KHz/s,
Output Post Detection (Time Consta Connector Scale	± 10V DC ant) 150ms TNC Female User selectable 1dB/V 2dB/V 5dB/V 10dB/V	
Impedance Adjustment Range	0Ω ideal voltage source max Output adjustable to 0V DC from -60dBm to -100dBm at	x current 5mA for input power levels
PLL Noise Bandwidth	2KHz	
Threshold for Reacquisition Average Search Time	<40dBc/Hz for Sweep Rate <1s (±100KHz at 240KHz/s	s < 80kHz/s TBC)
ASB Threshold ASB sweep Rate	3dB 80Hz/s nom.	
3.2 General		
Reference frequency Frequency Stability	Internal 10 MHz frequency (±0.3 ppm	manual trim option available)
Ageing	<±2 ppm (1 st year)	
Mechanical	250 x 145 x 30mm weather	proof enclosure
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Weight	< 850 g.
IP Rating	Designed for IP66.
Environmental	Operating temperature range 0 to 50 ⁰ C
EMC	Compliance to EN 55022 part B and EN 50082-1, safety to EN 60950 (TBC)
Power supply	DC 20-24v <850mA
Remote Control	Ethernet and RS 232/ RS 485 port

3.3 Downconverter Input

950 MHz to 2150MHz full L-Band downconversion the selected frequency is passed to the Tracking section with a bandwidth of \pm 1MHz.

3.4 Downconverter resolution

1 KHz Tracking frequency step size. On the Ethernet web configuration page this is 0.001MHz if the L-Band frequency is viewed or 0.000001GHz if the SHF LO addition feature is switched on.

3.5 Downconverter Conversion Gain

Adjustable down conversion gain is available for best noise performance

Input Attenuator Level 0 to 30dB stepped 0.5dB

1st IF Attenuator Level 0 to 30dB stepped 0.5dB

The finite gain set is specified to be within 2dB of the setting and the step size is 0.5dB. The tolerance of the step size is not specified but should not exceed 5% of total attenuation value. RF level output (dBm) indication is automatically adjusted to reflect attenuation levels.

3.6 Auxiliary DC output *(option)*

Present on RF Input connector, 16v volts via a resettable fuse rated at @ 0.5 amp, software switchable.

This facility is used for driving an external SHF Block Down Converter or an LNB. This voltage is integrated with the L-Band signal (and 10MHz TBD). This voltage is derived from a DC-DC step down converter with thermal shutdown for overload protection.

3.7 10MHz reference output *(option)*

Present on RF Input connector, software switchable from an internal high grade 10MHz TCXO reference.

3.8 Tracking Section

3.8.1 Tracking Output

DC voltage proportional to the received signal strength at the required dB/V and offset using the DC offset menu to between -10V to +10V DC

3.8.2 Tracking Level

Maximum Tracking signal level is –60dBm nominal is –70dBm minimum is the determined by the noise level on the carrier though the unit will become nonlinear below –110dBm

3.8.3 Sweep Range

Five user selectable sweep widths to allow for drifts on the required signal whilst searching, it is suggested to leave on the narrower settings as this will speed up acquisition of lock. Settings available: ± 20 KHz ± 50 KHz ± 100 KHz ± 200 KHz and ± 500 KHz. It is suggested to use the narrowest setting if possible.

3.8.4 Sweep Rate

Six user selectable sweep rates allow user the choice to speed up the acquisition of lock. The user must be aware that the lower the signal to noise ratio the slower the sweep rate needs to be to guarantee lock detection. The settings available are 2.5KHz/s (Slowest Acquisition), 5KHz/s, 10KHz/s, 20KHz/s, 40KHz/s, 80KHz/s, 120 kHz/s and 240kHz (Fastest Acquisition). It is suggested 5KHz/s as a starting point.

3.8.5 Post Detection Time Constant

This is the smoothing on the DC output and is factory set to the value of 150ms.

3.8.6 Log Output Scale

Four User selectable settings for the DC Logarithmic output voltage. The settings available are 1dB/V 2dB/V 5dB/V 10dB/V.

3.8.7 DC Output Adjustment

User adjustable offset of the Log output adjustable to 0V DC for input power levels from -60dBm to -100dBm at 2dB/V

3.8.8 PLL Noise Bandwidth

This is factory set to 2 kHz

3.8.9 Threshold for Reacquisition

The unit will lock with a threshold of <40dBc/Hz for sweep rates <80 kHz/s (Slower sweep rates will result in better performance)

3.8.10 **ASB Sweep Rate**

The ASB when enabled will analyse the tracking band searching for a higher signal and if one is detected will enable the tracking lock circuit to release lock and search for this higher signal. The sweep rate on the ASB is around 80Hz/s (TBC).

3.8.11 **ASB** Threshold

When the ASB is searching it is looking for a signal which is at least 3 dB higher than the current locked signal level.

3.8.12 **Reference Frequency**

Internal high grade TCXO at 10MHz. Frequency Stability ±0.3 ppm, <±2 ppm (1st year) Ageing

3.9 **General Mechanical Description**

The PTR Series of converters are housed in a rugged 250 x 145 x 30mm weather proof enclosure designed for IP66. **IP66**

Solid Particle Protection: Dust tight

Liquid Ingress Protection: Powerful water jets

Unit should be mounted with connectors at bottom of unit, to maximise environmental protection



3.10 Bottom Panel Description

All of the connectors necessary for the user to interface the RTR series to other equipment are located at the bottom of the unit.



Ethernet & Serial RS232/485 Option:



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3.11 Connectors

3.11.1 Power/Alarms

This connector is a 5 pin circular socket (See Figure 3) Power and Ground: DC 20 to 24 v Current Consumption < 850mA at lowest Vin. Diode reverse polarity protection with internal PCB mounted Fuse (Factory Fit). ALWAYS REPLACE THE FUSE WITH ONE OF THE SAME TYPE AND RATING.

Alarms: Common (C), Normally Open (NO) and Normally Closed (NC), which provides access to the various form 'C' relay contacts to indicate alarm conditions.

Faults shown in table below will activate the SUMMARY ALARM on the unit, this will force a change-over if used in a normal redundant system.

Fault Name	Summary Alarm
PSU Fail	Yes
Internal VCO1 'unlocked'	Yes
Internal VCO2 'unlocked	Yes
Beacon 'Out-of Lock'	Yes

 Table 1: Summary Alarms

3.11.2 DC Out

This connector is a 50 Ω TNC female connector. CAUTION DC is present on this connector at all times within the range of -10V to +10V.

3.11.3 RF Input

This connector is a 50 Ω N-type female connector.

Input Frequency : 950 to 2150MHz

Return Loss: > 15 dB (typical)

DC Feed (LNB/BDC): Switchable 16v 0.5amp (resettable fuse) (option)

10MHz Ref: *TBC* dBm switchable (option)

The use of high quality cables and connectors for L-band signals is strongly recommended. Cables and connectors should be rated for operation up to 2200MHz. Care should be taken when handling these cables, avoiding stress to connections, tight bend radii and damage from sharp objects, all of which can degrade system performance.

3.11.4 Ethernet /Remote

This connector is a 8 pin circular socket (See Figure 3) Ethernet (±Tx/±Rx) circular connector will connect to standard RJ45 (8pin) EIA-568B wiring:

Std EIA 568B	Connector RJ45(8)	Wiring
Tx+	Pin#1	(Orange/White)
Tx-	Pin#2	(Orange)
Rx+	Pin#3	(Green/White)
Rx-	Pin#6	(Green)

Table 2: EIA-568B Wiring



Figure 4 : RJ45 Connector (EIA568B)

4. INSTALLATION

4.1 Care of Your Product

4.1.1 Handling

Single products, when fully packaged for transport weigh < 2kg's, but packaging may weigh more when multiple devices are to be delivered but would not normally exceed 20 Kg's. Care must be taken when attempting to lift or carry these packages. The shipping carton is qualified for transit of these products and has been used successfully for many years. It will protect against shock and vibration encountered during normal carrier transportation.

PLEASE RETAIN ALL PACKING MATERIALS, including the foam insets. Should the unit need to be returned, return to the address on the front of the manual USING THE ORIGINAL PACKING CARTON, unless it has been seriously damaged. Avoid subjecting the packaged or unpackaged product to severe shocks.

4.1.2 Unpacking and Inspection

When the product is first received, the outer pack should be inspected for signs of damage. If damage to the outer pack is evident, contact the Carrier immediately and submit a damage report. The equipment should then be removed and inspected for signs of damage, retaining all packing materials. Any visible signs of damage to the equipment should be reported immediately to Peak Communications (electronic photos of the pack and equipment can help with any subsequent insurance claims). If the equipment appears undamaged, it should be tested for correct operation and again any abnormalities reported to Peak Communications.

When first removing the product from its transit pack, take care to retain all documentation and associated hardware. These products are typically provided with the following items;

- RTR series product.
- Operation Manual.
- Test Results.
- Cable Kit (option)

If you suspect that any item is missing, please contact Peak Communications immediately.

4.1.3 Storage

Store the product in the normal horizontal orientation, in its outer carton until it is required for use. Do not use the products to support the weight of other items whilst in storage.

Storage temperature range is typically from -40°C to +80°C, avoid exceeding these extremes otherwise damage may result.

Unit enclosure is designed for IP66 rated environments, but it is best to avoid exposing the packaged or unpackaged product to extremes of humidity or moisture (including condensation) prior to installation. In the event that this does occur, the product should

be left at room temperature for in excess of 5 hours to dry naturally before application of prime power.

4.2 Mechanical Installation Considerations

4.2.1 Mounting

The product is housed in a rugged 250 x 145 x 30mm IP66 rated weatherproof enclosure, with connectors mounted on the bottom face. Connector mating parts with cable bend radii, plus space to uncouple connectors, can add a further 80mm (3.15Inches) to this depth & should be considered when designing the installation. When several products are to be mounted on top of one another, they should not be stacked without individual support. Stacking of units without adequate mechanical support and isolation can degrade performance of the overall system and hamper maintenance activities.

4.2.2 Mounting Kit

Mounting Kit at customers request

4.2.3 Cooling

RTR50 product dissipates ≈25W internally, and relies on convection cooling through the enclosure. Although these products have been designed to operate in an outdoor environment at an operational ambient temperature up to 50°C, it is best practise to minimise significant heat transfer from adjacent equipment, through either conduction or convection.

A thermal sensor is fitted to the unit which provides an over temperature alarm (possible option > 90°C)

4.3 Prime Power Supply & Connection

This product can **only** be operated from DC supply of 20-24Vdc.

Unit **should not** be connected to **any** mains AC supply.

Current consumption at 20-24v is < 900mA, although switch-on inrush current will be higher.

4.3.1 Fuses

The equipment is provided with an internal (factory fit) short circuit fuse protection on the primary positive dc supply. The RTR50 unit has a reverse polarity dc protection diode, but unit will be non-functional with dc reverse polarity.

Internal (Factory fit) reset-able fuse is present on Auxiliary DC Output (Section 3.6) when option enabled on RF Input connector.

5. ETHERNET CONTROL

The RTR50 primary control function utilizes an in built web page controlled over Ethernet (TCP or SNMP) with the choice of dynamic or static allocation of IP addresses.

5.1 Pre-Assigned Static IP Address

This is required to be factor set.

Static IP Address : 192.168.000.150 (Example)

🧲 🕣 🙋 http://	/192.168	ak Communi	cations	×		6 🔂 🛱
COMMI	Peak Communications Ltd. Kirklees House, 22, West Park Street, Brighouse. W.Yorks. HD6 1DU. England Tel: S (+44) 1484 714200 Website: www.peakcom.co.uk					
	Status			Co	onfigure	
Unit	Serial Communications	SNMD	TOP	Ethernet		
Dillo	Serial Communications	SIMIF		Luiemer		
DHC	P					
IPv4	Address		192.168.	000.150		
Subn	et Mask		255.255.	255.000		
Gate	way		000.000.	000.000		
Peak Communic	Submit Reset					
r our oominume	alions Etd. 2010					🔍 100% 🔻 🔡

Figure 5 : Ethernet – Static IP Addressing

From Web Browser (eg Internet Explorer)

http://192.168.0.150 (example)

Initial Web page from which 'Status' and 'Configure' screens can be accessed



Figure 6 : Web Page – Initial Menu Screen

The webpage is essentially split into two screens, Status and Configure, each one accessible via the links part way down the screen.

5.2 Dynamic (DHCP) IP Address

Due to a lack of front panel on these units, it is not possible to display the IP address and other Ethernet settings to the user easily. In order to discover the IP address and other Ethernet settings.

Initially (only) the 'Peak Discovery' windows programme needs to be run.

This software is available off the Peak website:

http://www.peakcom.co.uk/

[Support > Downloads > Peak Discovery Program]

When run it lists the units on the network, and allows the user to view and modify, if necessary, the Ethernet settings to suit the user's network.

Tasks:	Devices:				
Configure IP Settings	IP Address 192.168.0.119	MAC Address 00:40:9d:6b:b6:0b	Name	Pro Pe	oduct eak Communications
Device Info Reboot Device			Set	IP Address	ess, subnet mask and gateway to your our network administrator if you do not on.
				Product: MAC Address: Automatically Manually cor	Peak Communications Ltd. 00:40:9d:6b:b6:0b v obtain network settings via DHCP
Close				IP Address:	
gure 7 : Peak Dis	covery Applica	tion		Subnet Mask: Default Gateway	192 . 168 . 0 . 1
				Password:	y Cancel

In this case IP address has been dynamically assigned "192.168.0.119"

Confirm MAC address of RTR50 with unit documentation (Test Results) Example 00:40:9d:6b:b6:0b

The webpage is displayed by entering the unit's IP address into a normal web browser.

5.3 Configure Page



Figure 8 : Configure Screen

5.4 Status Page

PEAK	Peak Communications Ltd. Kirklees House, 22, West Park W.Yorks. HD6 1DU. England Tel: (+44) 1484 714200 Website: www.peakcom.co.uk	Street, Brighouse.
Status	<u></u>	nfigure
Unit		Current Sweep Rate - 240
	Beacon	
Sweep Rate	240 kHz/s	
Sweep Width	100 kHz 🔨	
Log dB/Volts	0.5 dB	Current Sweep Width - ±1
ASB	OFF _ '	
Beacon Lock	Locked	E
DC Offset Analogue Log Output	0	
(internal) ADC voltage	1.31 V	Vout Scale - 0 5dB/Vout
Rx Level	-78.4 dBm	
	Down Converter	
Operating Frequency	1.475123400 GHz	ASB Function - 'disabled'
Input Attenuation Level	5.0 dB	ASD Function - disabled
1st IF Attenuation	10.0 dB	
DC Feed	OFF	
Unit Temperature	42.2 C	
Local/Remote	Remote	
Unit Type	RTR50	
Serial Number	80 1 0	
Software Version	1.11	
Alarms		
Summary Alarm	OK	
Serial Communications		
RS232/RS485	RS485	
Address	32	

Figure 9 : Status Screen

6. WEB PAGE CONFIGURATION

All facilities are accessed from the Web page, via the Configure screen system, With a series of pull down menu's or keyboard entry

6.1 Configure Screen - Beacon Settings:

6.1.1 Sweep Rate

The 'Sweep Rate' defines the frequencies the tracking system covers per second inside the frequency range set by the sweep width (Section 6.1.2). In this case the sweep rate is 240 kHz/s, (Fast acquisition setting. See Figure 8) To select the sweep rate use the 'pull down' on the web page menu. Press "submit" key to invoke the change.

6.1.2 Sweep Width

The 'Sweep Width' defines the frequency range in which the beacon tracking system is looking for a beacon signal. The sweep width centred on the Rx frequency (being \pm 100 kHz in this case, (See Figure 9) given a total frequency span of 40 kHz starting at the frequency Rx frequency less 20 kHz.

To change the sweep width use the 'pull down' on the web page menu. Press "submit" key to invoke the change.

6.1.3 Log dB/V

The output voltage on the 'DC out' connector is dependent on the received RF signal and 'Log dB/Volts' scaling ratio selected (See Figure 8 : Configure Screen and Figure 9 : Status Screen) .

To change the DC out dB/Volt scaling use the 'pull down' on the web page menu. Press "submit" key to invoke the change.

6.1.4 ASB

The ASB check box, when activated invokes the Anti-Sideband (ASB) feature on the RTR50 unit, whereby the receiver will relock to any higher signal within twice tracking bandwidth. (*currently disabled*)

6.1.5 DC Offset for Analogue Output

The 'DC Offset Analogue Log Output 'makes it possible to offset or zero the output voltage at the 'DC out' connector to a specific input power. To change the Log Offset voltage uses the 'pull down' on the web page menu. Press "submit" key to invoke the change.

Value between 0..99

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6.2 Configure Screen - Down Converter Settings

6.2.1 Frequency

The 'Frequency' manual keyboard entry box on the 'Configure' screen (See Figure 8) enables the user to change the expected Beacon Receive Frequency. Keyboard entry is used (Unit will accept either 'MHz' or 'GHz') down to a 1kHz resolution.

Press "submit" key to invoke the change.

6.2.2 Input Attenuator

The 'Input Attenuator' manual keyboard entry box on the 'Configure' screen (See Figure 8) enables the user to change the Input Attenuation at L-band . Keyboard entry is used, attenuation range 0 to 30 dB in 0.5 steps. This value is automatically compensated for with respect to the 'Rx Level' indicator on the Status Page (See Figure 9).

Press "submit" key to invoke the change.

6.2.3 1st IF Attenuator

The 'Gain' manual keyboard entry box on the 'Configure' screen (See Figure 8) enables the user to change effective 'Gain' of the receiver at 1st IF level . Keyboard entry is used, Gain range 0 to 30 dB in 0.5 steps. This value is automatically compensated for with respect to the 'Rx Level' indicator on the Status Page (See Figure 9).

Press "submit" key to invoke the change.

6.2.4 DC Feed (option)

The 'DC Feed' check box, when activated invokes the 16v (Imax < 500mA) DC Feed (option) onto the 'RF Input' N-type connector. Intended to power external LNB/BDC equipment.

!! Caution when connecting to equipment that may be DC intolerant **!!**

6.2.5 SHF Function *(option)*

SHF stands for SUPER HIGH FREQUENCY and in this context refers the SHF stage which is following this L-Band unit.

This feature does not change any controls inside the unit but is a convenience to mathematically add the effect of the following converter on the downlink chain.

For a block down converter or an LNB the local oscillator frequency should be determined. This is the number which is added in this menu. To apply this value the SHF has to be switched ON

With Peak Communications equipment the following Local Oscillators apply

PBD725, IBD725	X Band Downconverter	6.30GHz
L510	C-Band Downconverter	5.15GHz (inverts spectrum)
L520	Ku Band Downconverter	10.0GHz
L521	Ku Band Downconverter	10.75GHz
L522	Ku Band Downconverter	11.30GHz

Use of this feature allows the user to manipulate the unit to show the overall SYSTEM frequency. This is achieved by selecting both the Local Oscillator frequencies of the external SHF Block downconverter. The SHF LO frequency and Gain/Loss are added or subtracted to the L Band output frequency (not if SHF is OFF) and power to obtain the SYSTEM output frequency and power level.

Example: If a RTR50 down converter L-Band unit is connected to a PBD725 the RTR display can be set to show the actual output frequency at Ku Band. The Block converter calculation in this case is simply the addition of the BDC Local Oscillator value to the L-Band frequency. If the input is set to 1200MHz (1.2GHz) and the LO is 6.30GHz the output is 1.2 + 6.3 = 7.50GHz. IF the 6.30 value is entered as an SHF LO and the feature switched on with SHF ON/OFF you will see that any frequency shown on the unit is at X Band which also means you would have to input any new frequency at X Band.

6.3 RS232/RS485 Remote

(←) 🤣 http://192.168 ♀ - 🗟 ♂ × 🎑 Peak Communications 🛛 ×	↑★ 幕			
Peak Communications Ltd. Kirklees House, 22, West Park Street, Brighouse. W.Yorks. HD6 1DU. England Tel: S (+44) 1484 714200				
Website: www.peakcom.	<u>co.uk</u>			
Status	Configure			
2000				
Unit Serial Communications SNMP TCP/IP Ether	net			
RS232/RS485 RS485 -				
Address 32				
Baudrate 9600 -				
Submit Reset				
Peak Communications Ltd. 2013				
	🖲 100% 🔻 🔐			

Figure 10 : Serial Communications Screen

Normal text

6.4 SNMP

A CONTRACTOR OF THE OWNER OWNER OF THE OWNER					
← 😔 🥖 http://192.168 ♀ - 🗟 ♂ × 🥖 Peak Communications ×					
Peak Communications Ltd. Kirklees House, 22, West Park Street, Brighouse. W.Yorks. HD6 1DU. England Tel: () (+44) 1484 714200 Website: www.peakcom.co.uk					
<u>Status</u> <u>Configu</u>	re				
	I				
Unit Serial Communications SNMP TCP/IP Ethernet					
SNMP					
Trap Address 192.168.000.032					
Submit Reset					
	€ 100% ▼				

Figure 11 : SNMP Screen

The units can be controlled via SNMP, the MIBS necessary for this are available from the Peak Communications website. Please refer to the Peak-Agents.MIB file, as this shows which of the MIBS supplied is used for the unit in question.

6.5 TCP/IP

()	- □ - × · · · · · · · · · · · · · · · · · ·						
COM	Peak Communications Ltd. Kirklees House, 22, West Park Street, Brighouse. W.Yorks. HD6 1DU. England Tel: (S) (+44) 1484 714200 Website: www.peakcom.co.uk						
		<u>Status</u>			<u>Cc</u>	onfigure	
	Unit	Serial Communications	SNMP	TCP/IP	Ethernet		
Port Number4000Socket Timeout (s)30							
Submit Reset							
Peak COI	Peak Communications Ltd. 2013						

Figure 12 : TCP/IP Screen

The units can be controlled via TCP, this involves sending the normal RS232/485 commands to the unit through a TCP port. The TCP port to be used is set by the user via one of the remote control interfaces.

7. RS232/485 REMOTE CONTROL PROTOCOL

The unit transmits and receives data serially in an asynchronous format using the standard ASCII character set. The serial data consists of message frames composed of the following message characters: STX, BYTE COUNT, DEVICE ADDRESS, INSTRUCTION, BODY, CHECKSUM, ETX. All characters are compulsory except for the message body. The presence of a message body is determined by the message type (INSTRUCTION). The total number of message characters in a message frame may range from a minimum of 6 to a maximum of 255.

The remote control follows the following protocol: (in byte form)

[STX] start of message character #02.

- [B] char defining how many characters are in the message including the STX & ETX parts.
- [A] Address of unit. Address ranges from ASCII character 001 to 255.
- [I] Instruction number. See List below

[MESSAGE]

Numerous characters from length 0 upwards.

[CHKSUM]

The checksum is used to verify the accuracy of the message frame. The checksum is defined as the summation of all the bytes in the message, **beginning** with the 3rd byte (DEVICE ADDRESS) and extending through the body of the message, **ending** with the last byte before the checksum. The total of the bytes is then ANDed with 255 so that the checksum is truncated to a single byte.

[ETX] End of transmission character #03

All message to and from the unit follow the above protocol with a character format of 8 data bits, one stop bit, no parity, baud rate 19200, 9600, 4800, 2400, 1200 or 300. Note that all numeric values are shown as decimal.

Instruction Number List: (in decimal)

To P7XXX unit	From P7XXX unit	Description
20		Requests Tracking Status
	21	Responds with Tracking Status
22		Requests Tracking setting
		changes
40		Asks for the main Unit settings
	41	Replies with the Unit Settings
50		Unit reset

Instruction 20 (Tracking Status Request):

Message	Set Value /	Length	Description
Byte No.	(example)	(bytes)	-
1	02	1	STX
2	7	1	No of bytes in message
3	?	1	Address
4	20	1	Message instruction
5	('K')	1	Device we are asking the information on: 'K' = Tracking Receiver
6	?	1	Checksum
7	03	1	ETX

Instruction 21 (Tracking Status Request Reply):

Message	Set Value /	Length	Description
Byte No.	(example)	(bytes)	
1	02	1	STX
2	?	1	No of bytes in message
3	?	1	Address
4	21	1	Message instruction
5	('k')	1	Device we are asking the information on:
			'k' = Remote Tracking
6	('1')	1	Sweep Rate
			Index 0 – 7
			0 = "2.5 kHz/s"
			1 = "5 kHz/s",
			2 = "10 kHz/s",
			3 = "20 kHz/s",
			4 = "40 kHz/s",
			5 = "80 kHz/s",
			6 = "120 KHz/s",
			7 = "240 KHz/s"
7	('1')	1	Sweep Width
			Index 0 – 4
			0 = "+/- 20 kHz"
			1 = "+/- 50 kHz"
			2 = "+/- 100 kHz"
			3 = "+/- 200 kHz"
			4 = "+/- 500 kHz"
8	('1')	1	Log dB/Volt
			Index 0 – 4
			0 = 0.5 dB/Volt
			1 = 1 dB/Volt
			2 = 2 dB/Volt
			3 = 5 dB/Volt
			4 = 10 dB/Volt
9	('080')	3	Log Offset 000 – 100.
12	('0')	1	ASB ON/OFF
			'0' = OFF '1' = ON
13	('+0467')	5	DC Output.
			Divide by 100 to get the actual voltage.
18	('+0467')	5	Rx Level in 0.1dB steps
23	('10123456789' = 10.123456789	11	Frequency in Hz
	GHz)		The Lband Frequency of the unit.
34	(' +0125' = 12.5 dB)	5	Attenuation in 0.5dB steps
39	(' +0125' = 12.5 dB)	5	1 st IF attenuation in 0.5dB steps
44	('X')	1	Not used
45	('1')	1	DC Feed ON/OFF
-	. ,		'0' = OFF '1' = ON
46	('1')	1	SHF LO ON/OFF
	(-)	-	'0' = OFF '1' = ON
47	('20123456789' = 20,123456789	11	SHE Frequency in Hz
	Ghz)		
58	('1')	1	SHE Spectrum Invert ON/OEE
00	\ ' /	· · -	

			'0' = OFF '1' = ON
59	('0')	1	Tracking Out of Lock
			'0' = OK '1' = FAULT
60	('0')	1	1st LO Fault
			'0' = OK '1' = FAULT
61	('0')	1	2nd LO Fault
			'0' = OK '1' = FAULT
62	('XXX')	3	Unused
65	('OK')	17	Indicates if there's a fault
			'OK' = no faults exist
			'NOT OK' = faults exist
82	?	1	Checksum
83	03	1	ETX

Instruction 22 (Tracking Reconfiguration Request):

The message body for this message is a truncated form of the Tracking Status Request Reply (instruction 21)

Not all parameters have to be set, if the user doesn't wish to change a particular parameter then a number of 'x's can be sent in the parameters place. Sending such data will make the unit ignore that particular parameter.

'x's should also be sent in place of parameters that are not used by that particular unit type.

Message	Set Value /	Length	Description
Byte No.	(example)	(bytes)	
1	02	1	STX
2	?	1	No of bytes in message
3	?	1	Address
4	22	1	Message instruction
5	('k')	1	Device we are asking the
U		•	information on:
			'k' = Remote Tracking
6	('1')	1	Sween Rate
0	(1)		Index $0 - 7$
			0 = "2.5 kHz/s"
			1 = 5 kHz/s
			1 = 3 KH 2/3, 2 = "10 kH 2/3"
			2 = 10 kHz/s, 3 = "20 kHz/s"
			3 = 20 kHz/s, 4 = "40 kHz/s"
			4 = 40 kHz/s
			5 = 60 KHz/s
			0 = 120 KH 2/5, 7 = 2/0 KH 2/6
7	('1')	1	7 - 240 KHZ/S
'	(1)	I	Sweep Width
			11000 - 4
			0 = +/-20 Kmz
			1 = +/- 50 km2 2 - "+/- 100 kHz"
			2 = +/-100 KHZ
			3 = +/-200 KHz
0	/{//	4	4 = +/-500 KHZ
8	(1)		Log dB/volt
			Index $U = 4$
			0 = 0.5 dB/Volt
			I = I dB/volt
			2 = 2 dB/Volt
			3 = 5 dB/Volt
0	(10001)		4 = 10 uB/Volt
9	(080)	3	
12	('0')	1	ASB ON/OFF
	<i>"</i>		0' = OFF 1' = ON
13	(`XXXXX)	5	Not used
18	('XXXXX')	5	Not used
23	('10123456789' = 10.123456789	11	Frequency in Hz
	GHz)		The Lband Frequency of the unit.
34	(' +0125' = 12.5 dB)	5	Attenuation in 0.5dB steps
39	(' +0125' = 12.5 dB)	5	1 st IF attenuation in 0.5dB steps
44	('X')	1	Unused
45	('1')	1	DC Feed ON/OFF
			'0' = OFF '1' = ON
46	('1')	1	SHF LO ON/OFF
	. ,		'0' = OFF '1' = ON
47	('20123456789' = 20.123456789	11	SHF Frequency in Hz
	Ghz)		- 1
58	('1')	1	SHF Spectrum Invert ON/OFF
			'0' = OFF '1' = ON

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59	?	1	Checksum
60	03	1	ETX

Instruction 40 (Unit Status Request):

Message	Set Value /	Length	Description
Byte No.	(example)	(bytes)	
1	02	1	STX
2	06	1	No of bytes in message
3	?	1	Address
4	40	1	Message instruction
5	?	1	Checksum
6	03	1	ETX

Instruction 41 (Unit Status Request Reply):

Message	Set Value /	Length	Description
Byte No.	(example)	(bytes)	
1	02	1	STX
2	68	1	No of bytes in message
3	?	1	Address
4	41	1	Message instruction
5	('RTR50 ')	27	Type of unit this is: PTR, P7001 etc
32	('01234' = Serial No 01234)	5	Serial Number
37	('01.1234')	7	Software Version Number
44	'0483' = 48.3	4	Unit temperature in deg C (multiplied by 10)
48	('0' = OK)	1	Summary Alarm OK/FAULT
			'0' = OK '1' = FAULT
49	('0')	1	Temperature out of range fault
			'0' = OK '1' = FAULT
50	('NOT OK')	17	Indicates if there's a fault ('OK' or 'NOT OK')
67	?	1	Checksum
68	03	1	ETX

Instruction 50 (Unit Reset Request):

Message	Set Value /	Length	Description
Byte No.	(example)	(bytes)	
1	02	1	STX
2	06	1	No of bytes in message
3	?	1	Address
4	50	1	Message instruction
5	?	1	Checksum
6	03	1	ETX

8. APPENDIX 1 Terms and conditions of sale

Peak Communications Ltd

Terms and Conditions of Sale

1 Application of Terms and Conditions

The following terms and conditions shall constitute the entire agreement between Peak Communications Limited ("the Seller") and the purchaser of any goods or services ("the Customer) from the Seller. No contract shall be formed between the Seller and the Customer until the dispatch by the Seller to the Customer of the Seller's written acknowledgment of order. Unless otherwise expressly agreed in writing by the Seller, these conditions shall apply to all quotations and invoices given, orders received and accepted and contracts undertaken by the Seller. All prices quoted by the Seller are based upon these Conditions of Sale and reflect the limitations upon the Seller's liability which they contain. No modifications of these terms and conditions shall have effect unless agreed in writing by the Seller and shall not be affected by any documentation or communication from the Customer purporting to give effect to different terms and/or conditions.

2 Invoicing and Payment Terms

a) Unless otherwise expressly agreed in writing between the Customer and the Seller, the Seller shall be entitled to invoice the Customer for the price of goods on delivery of the goods, unless the goods are to be collected by the Customer (or their agent) or the Customer wrongfully fails to take delivery of the goods, in which event the Seller shall be entitled to invoice the Customer for the price at any time after the Seller has notified the Customer that the goods are ready for collection or (as the case may be) the Seller has tendered delivery of the goods.

b) Charges for services will be invoiced on completion of the services.

c) Where credit terms are allowed by the Seller to the Customer, the terms of payment of all invoices issued by the Seller to the Customer are, unless otherwise decreed in writing, to be paid net at the Seller's registered office within 30 days from the date of the invoice unless otherwise stated on the invoice and subject to condition (d) below. Where credit terms are not given by the Seller, a pro-forma invoice will be issued by the Seller and goods will be dispatched on payment.

d) Notwithstanding condition ©, the Seller shall without prejudice to its other rights, have the right by notice in writing to the Customer to demand immediate payment of all monies due from the Customer to the Seller for goods delivered at whatever time. The Seller also reserves the right to ask for a payment of a deposit before acceptance of an order.

e) The Seller reserves the right to charge interest on all or any sums not paid within 30 days from the date of invoice at the rate of 2% of the total invoiced amount for every period of 30 days (and pro rata for any part of a period of 30 days whether before or after judgment) from the due date of payment until the date of actual receipt of payment in full by the Seller.

f) The Customer shall indemnify the Seller against any loss or expense sustained or incurred by the Seller as a result of any change in currency exchange rates or in exchange control or other governmental regulations by reason of or in connection with any failure on the part of the Customer to pay any sum payable hereunder within 30 days of the date of the invoice, g) The Seller shall have the right to invoice the Customer for part delivery or provision of goods or services to the Customer notwithstanding the fact that other goods or services are to be delivered or provided to the Customer under the contract.

h) The Seller's rights under this paragraph (2) shall be exercisable in addition to all and any other rights the Seller may have under these Terms and Conditions of Sale.

i) All sums owing to the Seller to the Customer shall be paid in full without any objection, set off or counterclaim, save in respect of mutual debts and set off which cannot be excluded by reason of statute

3 Prices

a) The price of goods shall be the price ruling at the date of delivery unless otherwise stated on the quotation invoice, or previously agreed in writing by the seller. The prices are based on the costs of packing, documentation, insurance and any other costs incurred by the Seller, prior to dispatch from the Sellers works, but excludes all customs duties levies and freight charges.

b) All prices quoted in writing or by fax by the Seller to the Customer shall have a validity of 30 days unless otherwise expressly stated on the specific quotation. Thereafter the price must be revalidated in writing or by fax by the Seller to the Customer at the Customer's request.

c) The Seller reserves the right to alter its prices, its published terms of trade and its catalogue and other published material at any time and without prior notice.

d) The Seller reserves the right to alter its quoted prices during the course of a contract for the supply of goods or services in that contract to reflect changes in;
(i) VAT, Duty and other levies brought about by changes in governmental legislation.
(ii) Costs brought about by exchange rate fluctuations or changes in manufacturers' list price.

4 Specification

a) Goods are manufactured to the specifications as published within the Sellers documentation. Particular specifications not mentioned in the documentation will be quoted prior to order acceptance at the request of the Customer. Any specifications not agreed at acceptance of order will not form part of any contract or warranty claim.

b) If the goods are to be manufactured or any process is to be applied to the goods by the Seller in accordance with a specification submitted by the Customer, the Customer shall indemnify the Seller against all loss, damages, costs and expenses arising out of or in connection with or paid or agreed to be paid by the Seller in settlement of any claim or infringement of any patent, copyright, design, trade mark or other industrial or intellectual property rights of any other person which results from the Seller's use of the Customer's specification.

c) The Customer shall be responsible for stipulating the specifications of goods to be supplied by the Seller and the Seller accepts no responsibility where the Customer has incorrectly stipulated required specifications, where the specification stipulated is not suitable for the Customer's actual requirements. The Seller will however on request provide advice in relation to the suitability of different specifications of goods for the purposes identified by the Customer, although any such advice is provided for guidance only and the Customer accepts ultimate responsibility for the suitability for the Customer's actual requirements on the specification of the goods stipulated by the Customer. The Customer shall also have responsibility for ensuring that the capacity and performance of the goods are specified in its order and are sufficient and suitable for its purpose

d)The Seller reserves the right to make any changes in the specification of the
goods which are required to conform with any applicable statutory or EC regulatory
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requirements or, where the goods are to be supplied to the Seller's specification, which do not materially affect their quality or performance.

e) The Seller reserves the right, if extra expense or nay increase in costs or overheads are incurred by the Seller as a result of modifications made at the Customer's request, the Customer's special requirements or instructions, or the failure of the Customer to supply drawings, plans, specifications or any other information whatsoever to enable to the Seller to proceed with the Contract, to increase the price by giving notice in writing of the amount of such increase to the Customer

f) Goods are manufactured and dispatched to comply with Customer's Order as interpreted by the Seller. Any costs for changes arising, due to interpretation of the order, are at the Customers expense.

g) At the time of acceptance of the specification submitted by the Customer the Seller will give an estimate of the risk involved in achieving the Customer Specification. If any deviation from the customers Specification is found during development and manufacture, the Customer will be informed within 7 days.

5 Title and Risk

a) Risk in the goods shall pass to the Customer when delivery is made to the customer or its agents, subcontractors or carriers except that, where the goods are to be delivered at the Seller's premises, risk in the goods shall pass at the time when the Seller notifies the Customer that the goods are ready for collection.

b) All the goods shall remain the sole and absolute property of the Seller until such a time as the Customer shall have paid to the Seller the agreed price together with the full price of any other goods the subject of any other contract with the Seller.

c) The Customer acknowledges that the Customer is in possession of goods solely as bailee for the Seller until such time as the full price thereof is paid to the Seller together with the full price of any other goods the subject of any other contract with the Seller.

d) The Customer's right to possession of the goods shall cease if-.

(i) The Seller serves notice requiring that the goods be returned; or

(ii) In the case of an individual, he commits an available act of bankruptcy or proposes to enter into a voluntary arrangement with his creditors; or

(iii) In the case of a company:-

It is unable to pay its debtors for the purposes of S 123 of the Insolvency Act 1986; or a Receiver or Administrative Receiver is appointed; or a Petition for an Administration Order is presented or an Administrator appointed; or

The Customer proposes an informal arrangement with its creditors or a formal corporate voluntary arrangement; or

The Customer takes any step to enter into a voluntary liquidation, or if a Liquidator is appointed, or if a Petition for the winding up of the Customer is presented; or In the event that the Customer is not a company incorporated in England, any event analogous to those specified above shall occur in relation to the Customer. Until such time as the Customer becomes the owner of the goods, the Customer will store them on his premises separately from the Customer's own goods or those of any other person and in a manner which makes them readily identifiable as the goods of the Seller.

e) If any of the events listed at d(ii) and (iii) above occur in relation to the Customer (or any parent of the Customer), or in the event that the Customer is not a company incorporated in England, any events analogous to those specified in d(ii) or (iii) occur, and then and in any such events or such events or sums due or becoming due by the Customer to the Seller shall forthwith and without notice immediately become due and Issue 1.08 RTR50 Tracking Receiver Page 39

payable in full. In addition, the Seller shall have the right at its discretion to decline to perform any contract in whole or in part then not performed by the Seller in whole or in part without prejudice to all and any of the rights it may have under the terms and conditions of sale.

6 Cancellation of Order

a) If the Customer shall fail to pay to the Seller on the due date any sum payable hereunder or shall exceed its credit limit or breach the terms upon which such credit has been offered or shall suffer any of the events listed in Condition 5d)(ii) (being an individual) or 5d)(iii) (being a company) the Seller may, without prejudice to its other rights, and without prejudice to the generality of Condition 2(d) demand immediate payment by the Customer of all unpaid accounts and, in addition, and suspend or cancel further deliveries and cancel this and any other contract between the Seller and the Customer without any liability attaching to the Seller in respect of such suspension or cancellation and debit the Customer with any loss sustained thereby.

b) The Seller will only accept a cancellation or postponement of any order by or on behalf of the Customer or any refusal to accept delivery if the Customer pays the amount specified by the Seller as representing its losses incurred thereby. Without prejudice to the generality of the foregoing the Seller will not accept cancellations of, and the Customer will be obliged at all times to purchase, materials which have already been manufactured or which have been modified or specifically purchased to meet the Customer's requirements. Any amount owing by the Seller to the Customer as a result of any properly cancelled order will be satisfied by the Seller issuing credit notes to the Customer to a value equal to the amount owing.

7 Insurance of Goods in Transit

a) The Seller will insure the goods for a total invoice price to the Customer if transport is agreement to be effected by the Seller or its agent. Where the Seller insures goods the liability of the Seller shall be absolutely limited to the amount if any received by the Seller under such insurance from its insurers from which a reasonable deduction may be made for administrative expenses.

b) If the Customer arranges transport either directly or indirectly through its agents the Customer must insure the goods against loss or damage on any account whatsoever.

c) The Seller shall not in any event be liable for any loss or damage to the goods whilst in transit or where the goods are transported by an outside freight carrier.
 8 Delivery

a) Any time or date for the dispatch or delivery of goods for the completion of work whether specified in the Seller's quotation or otherwise given by the Seller shall be taken as an estimate made by the Seller in good faith but shall not be binding upon the Seller either as a term of the contract or otherwise. In no circumstances shall the Seller be liable for any loss or damage sustained by the Customer in consequence of failure to deliver within such time or by such date or in consequence of any other delay in delivery however caused.

b) Unless otherwise agreed in writing delivery shall be made in the case of sales within the United Kingdom at the premises specified by the Customer and, in the case of export sales, at the United Kingdom port of shipment specified by the Customer. Subject to Condition e) below the risk in the goods shall pass to the Customer upon delivery or, in the case of export sales, upon the goods leaving the Seller's premises.

c) The Seller may deliver the goods in instalments and invoice the Customer as if each instalment comprised a separate contract upon the terms of these Conditions of Sale.

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d) The Seller does not accept any responsibility for failure to deliver or a delay in delivery where such failure or delay is caused by other suppliers or contractors upon whom the Seller is reliant to ensure a timely delivery.

e) If delivery of the goods is delayed or prevented by any act or omission of the Customer, the Seller may put the goods into storage at the Customer's risk and expense. Any redeliveries will be at an extra cost as specified by the Seller, and the Customer will indemnify the Seller in relation to any losses, claims, expenses or liabilities which the Seller suffers or incurs as a result of such delay or prevention (including in particular but without limitation liabilities to any third party suppliers). 9 Acceptance

a) Acceptance of delivery of the equipment by the Customer or its agent shall be conclusive evidence that the equipment was delivered in good operating condition and in all respects in accordance with the contract under which it was supplied and that it was fit for any purpose for which it may be required by the Customer.

b) Shortage claims or claims that goods are defective or otherwise not in accordance with the contract, will only be considered if the Seller receives written notification thereof within seven days of delivery failing which no liability will be accepted.

10 Warranty

a) Subject to the conditions set out below the Seller warrants that the goods will correspond with their specification at the time of delivery and will be free from defects in material and workmanship:

b) The Seller shall be under no liability in respect of any defect in the goods arising from any drawing, design or specification supplied by the Customer.

c) The Seller shall be under no liability in respect of any defect arising from fair wear and tear, willful damage, negligence, abnormal working conditions, failure to follow the Seller's instructions (whether oral or in writing), misuse or alteration or repair of the goods without the Seller's approval,

d) Notwithstanding the terms of sub-clauses (a) and (b) above, the Seller's liability in respect of all goods supplied by it but manufactured by third parties shall be limited to such warranty as shall be provided by the manufacturer to the Seller and the Seller shall have no further or larger responsibility whatsoever.

e) Where goods are returned by the Customer to the Seller or the Seller's agent for warranty or other repair or calibration the Customer shall be responsible for all costs (including freight, duties and insurance) of delivering the goods to the Seller or the Seller's agent and/or at the Seller's option the manufacturer and the return of the goods thereafter to the Customer.

f) All goods returned must have full documentation as to the reason for the return. The Seller reserves the right to charge for time checking equipment which has no faults.

g) All other warranties or representations in respect of the goods expressed or implied by or under statute or custom or trade usage are hereby expressly excluded.

h) The Seller's entire liability in respect of any claim for loss or damage arising from the supply of goods or services (including the proper use of goods by the Customer) shall be limited to sum's recovered under the Seller's liability insurance. Without prejudice to the foregoing, the Seller shall not be liable for any consequential loss or damage (including, without limitation, loss of profits and goodwill).
 11 Provision of Services

a) Where the Seller provides personnel to the Customer, the Customer shall not, without the prior written consent of the Seller use such personnel to undertake any work which, in the Seller's opinion, is inappropriate to their qualifications and

experience, or which is not directly connected with the services If services are to be provided for an indeterminate period, then they will continue until terminated by either party giving to the other (thirty days') prior written notice.

b) The Customer shall be deemed to have been granted a licence to use any program or material supplied by the Seller in performing services for the period during which the services are performed only. This licence shall not entitle the Customer to grant any sub-licence or to provide these programs or materials for use or copying by any third party.

c) The Seller warrants that all services will be performed with reasonable skill and care. The Seller will not be liable for breach of this warranty unless the Customer reports the breach to the Seller within 1 month of completion of the services.

d) The Customer agrees that during a period of 6 months after completion or termination of any service provided by the Seller, it will not solicit the employment or services of any employee of the Seller who has been working in connection with the provision of services to the Customer

12 Lien

The Seller shall have a general lien in respect of all sums due from the Customer upon all goods to be supplied to such Customer or upon which work has been done on the Customer's behalf and, upon 14 days' written notice to the Customer, may sell such goods and apply the proceeds towards the satisfaction of the sums due to the Seller. 13 Force Majeure

The Seller shall not be liable for any delay or failure in the performance of any of its obligation hereunder if the delay or failure is due to causes outside its reasonable control and the Seller shall have the right at its option (a) to suspend further performance of the Contract until such time as the cause of the delay shall be no longer present; or (b) to be discharged from further performance of liability under the Contract and if the Seller exercises such right, the Customer shall thereupon pay the Contract Price less a reasonable allowance for what has not been performed by the Seller.

14 Descriptive Leaflets, Catalogues and Illustrations

All descriptive leaflets, catalogues, illustrations, specifications, drawings and other particulars issued by the Seller are approximate only and shall not form part of any contract between the Seller and the Customer unless specifically stated in writing by the Seller.

15 Representation by Seller's Employees

The Seller's employees or agents are not authorised to make any representations concerning the goods or services provided under the contract unless confirmed by the Seller in writing. In entering into the contract the Customer acknowledges that it does not rely on any such representations which are not so confirmed.

16 Copyright

Copyright in all drawings, specifications, designs, descriptions and documents issued by the Seller to the Customer or other third parties shall be and remain the property of the Seller and no copies shall be taken without the prior written consent of the Seller. 17 Licence Grant

The Seller hereby grants to the Customer a non-exclusive, non-transferable licence to use any programs supplied by the Seller for internal purposes only for the duration of the services provided by the Seller and on the equipment identified by the Seller. Any other use is prohibited. Such programs may not be used to provide a service to a third party without the prior written agreement of the Seller and subject to such extended use charges as the Seller may require.

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18 Severance

a) While the restrictions and exclusions of the Customer's rights whether express or implied by common law, statute, custom of the trade, course of dealing or otherwise, are considered to be fair and reasonable having regard to the circumstances known to and in the contemplation of the parties at the date hereof, it is recognised that certain of the restrictions and exclusions may become unfair and unreasonable due to unforeseen circumstances and accordingly it is hereby agreed that if any of such restrictions and exclusions shall be adjudged to be void but would be valid if part of the wording thereof were deleted the said restriction or exclusion shall apply with such modifications as may be necessary to make it valid and effective.

b) If any condition herein shall be deemed void for any reason whatsoever, but would be valid if part of the wording thereof were deleted the said condition shall apply with such modifications as may be necessary to make it valid and effective.
 19 General

a) Any notice required or permitted to be given by either party to the other under these Terms and Conditions of Sale shall be in writing addressed to that other party at its registered office or principal place of business or such other address as may at the relevant time have been notified pursuant to this provision to the party giving the notice.

b) No waiver by the Seller of any breach of the contract by the Customer shall be considered as a waiver of any subsequent breach of the same or any other provision.

c) If any of the provisions of these Terms and Conditions of Sale is held by any competent authority to be invalid or unenforceable in whole or in part the validity of the other provisions of these Terms and Conditions of Sale and the remainder of the provision in question shall not be affected.

d) These Terms and Conditions of Sale shall be governed and construed in all respects in accordance with the Laws of England. The Customer hereby submits to the non-exclusive jurisdiction of the English Courts in relation to these Terms and Conditions of Sale and all matters falling to be determined hereunder or in connection herewith.