

Installation and Operating handbook

IF Series Frequency Converters.

Includes the IF70, IF140 products.

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1999

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**

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CUSTOMER CARE

Contact the Peak Communications sales department for:

- ✚ Product 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
Kirklees House
22 West Park Street
Brighouse
West Yorkshire
HD6 1DU
England
Tel. +44 (0) 1484 714200
Fax +44 (0) 1484 723666
E-mail Sales@peakcom.co.uk

You can also contact us via our website at www.peakcom.co.uk

To return a Peak Communications product for repair:

1. Contact the Peak Communications sales department and request a Return Material Authorisation (RMA) number.
2. You will be required to provide to our sales 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.

PRODUCT COMPLIANCE

Safety

To ensure safety of operator the IF series of converters have 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.

EMC

The IF Series of converters 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.

Damage to the keyboard membrane or mechanical damage to the chassis will also invalidate compliance; please contact the factory under these circumstances for advice on continued operation.

Interfaces to the IF Series of converters must be made with suitably screened connectors and double screened coaxial cable. Data cables must be double screened.

All 'D' type connectors must have grounding fingers on the plug shell to guarantee continuous shielding. The back-shells must comply to the requirements of VDE 0871 and FCC 20708, providing at least 40 dB of attenuation from 30 MHz to 1 GHz.

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

INTRODUCTION

The IF series of converters are 19 inch 1U rack mounted 70 to 140MHz & 140 to 70MHz IF frequency converters. The IF series of converters provide a low-cost solution for matching the IF's of modems, converters and other units. Incorporated is a high stability ovenised crystal oscillator to ensure excellent stability and phase noise. Full alarm monitoring ensures that these units are fully compatible with the Peak RCU100 and RCU200 1+1 and 2+1 redundancy controller units.

The IF series of converters are available as the IF70 70 to 140MHz UpConverter & the IF140 140 to 70MHz DownConverter.

IF series units are designed to meet the phase noise, spurious, level and frequency stability requirements of Intelsat IBS/Eutelsat SMS specifications and are compliant with IESS 308/309 and IESS 306. The group delay response makes the product suitable for both high and low rate data and both digital and analogue TV signals.

SPECIFICATION

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

Input frequency range	70MHz \pm 20MHz (IF70) 140MHz \pm 20MHz (IF140)
Output frequency range	140MHz \pm 20MHz (IF70) 70MHz \pm 20MHz (IF140)
Input connector	BNC female 50 Ω , (75 Ω options available)
Output connector	BNC female 50 Ω , (75 Ω options available)
Conversion gain	0dB nominal
Gain stability	\pm 1dB from 0 to 40 $^{\circ}$ C \pm 0.1dB per week, const. temp
Gain flatness	\pm 0.5dB, across 40 MHz band
Output 1 dB comp. point	+0dBm
Output harmonics	Better than -25dBc at 0dBm
Output spurious	\leq -55dBm (in band non-carrier related) \leq -55dBc (in band carrier related) \leq -45dBc (always out of band)
Output phase noise	-80dBc/Hz @ 100Hz -85dBc/Hz @ 1kHz -87dBc/Hz @ 10kHz -90dBc/Hz @ 100kHz
Frequency stability	\pm 1x10 $^{-7}$ from 0 to 50 $^{\circ}$ C
Internal Ref. Ageing	better than \pm 1x10 $^{-7}$ per year
External Reference Option	5/10MHz (factory selectable), 50Ohm BNC (f), 0dBm \pm 3dB
Summary Alarm	LO lock fail, Power supply fail
Fail Relay	Summary fail, Form C dry contact closure.
Mechanical	1U chassis - 420mm deep, 4.0 kgs (8.8 lbs) weight
Front Panel Display	STATUS
Environmental	Operating temperature range -10 to +50 $^{\circ}$ C
EMC	Compliant to EN55022 part B and EN50082-1
Safety	Compliant to EN60950 safety requirements
Power Supply	115/230VAC \pm 10% (switch selectable), 50/60Hz, 50W max.

INSTALLATION

The equipment is classified in EN60950 as a pluggable equipment class A for connection to the mains supply, as such it is provided with a mains inlet cord suitable for use in the country of operation. In normal circumstances this will be of an adequate length for installation in the rack. If the mains cord proves to be too short then any replacement must have a similar type fuse (if fitted) and be manufactured to similar specification: check for HAR, BASEC or HOXXX-X ratings on the cable. The connector ends should be marked with one of the following : BS1636A (UK free plug 13 amp); BSI, VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, SETI, IMQ, SEV and KEMA-KEUR for the IEC 6 amp free socket. Schuko and North American free plugs must have similar markings.

The installation of the equipment and the connection to the mains supply must be made in compliance to local or national wiring regulations for a category II impulse over voltage installation. The positioning of the equipment must be such that the mains supply socket outlet for the equipment should be near the equipment and easily accessible or that there should be another suitable means of disconnection from the mains supply.

The equipment is designed to operate from a TN type power supply system as specified in EN 60950. This is a system that has separate earth, line and neutral conductors. The equipment is not designed to operate with an IT power system which has no direct connection to earth.

UNIT DESCRIPTION

Front Panel Indicators

A single front panel indicator light is provided, as follows;

STATUS Normally lit GREEN, RED indicates an internal failure causing an alarm.

An Internal alarm is caused by power supply failure or LO's 'out of lock'.

Rear Panel Connections

INPUT Input at 70 or 140MHz (type dependent). Maximum input should ideally not exceed 0dBm.

OUTPUT Output at 70 or 140MHz (type dependent).

EXT. INTERFACE Digital interface with the following signals

Ground	1	9	PSU OK - N/Closed
PSU Common	2	10	LO's OK - N/Closed
LO's Common	3	11	Not used
Not used	4	12	Unit select input
Not used	5	13	Not used
Not used	6	14	Not used
Not used	7	15	Not used
Not used	8		

OPERATION

- Ensure the voltage selector on the rear of the panel is set to the correct setting. The unit is factory set at 230 Volts.
- On switching ON the unit, the STATUS indicator on the front of the unit should be GREEN if all is OK. If the indicator illuminates in the RED alarm condition, check alarm conditions on the rear panel.
- Connect the signal to the INPUT BNC (f) connector, taking note of the power of the signal being supplied. Ensure a good quality connector is used to avoid poor connection.
- The OUTPUT from the unit should be available.

REMOTE CONTROL

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 IBUH unit	From IBUH unit	Description
20		Requests Attenuator Status
	21	Responds with Attenuator Status
22		Requests setting changes
24		Set Remote/Local Mode request
40		Asks for the main Unit settings
	41	Replies with the Unit Settings

Instruction 20 (Attenuator Status Request):

Message Byte No.	Set Value / (example)	Length (bytes)	Description
1	02	1	STX
2	?	1	No of bytes in message
3	?	1	Address
4	20	1	Message instruction
5	('I')	1	IF Converter
6	?	1	Checksum
7	03	1	ETX

Instruction 21 (Attenuator Status Request Reply):

Message Byte No.	Set Value / (example)	Length (bytes)	Rx	Tx	Description
1	02	1	✓	✓	STX
2	?	1	✓	✓	No of bytes in message
3	?	1	✓	✓	Address
4	21	1	✓	✓	Message instruction
5	('I')	1	✓	✓	IF Converter
6	(' +120' = 12.0 dB)	4	✓	✓	Attenuation in 0.5dB steps
10	?	1	✓	✓	Checksum
11	03	1	✓	✓	ETX

Instruction 22 (Rx/Tx Reconfiguration Request):

The message body for this message is of the same format as the Attenuator Status Request Reply (instruction 21)

The unit MUST be in remote mode to allow reconfiguration of parameters via the remote control. Setting the unit in Remote mode can be done either by the front panel or remotely using the following command:

Instruction 24 (Set Remote/Local Mode):

Message Byte No.	Set Value / (example)	Length (bytes)	Description
1	02	1	STX
2	?	1	No of bytes in message
3	?	1	Address
4	24	1	Message instruction
5	('R')	1	'R' = Remote Mode 'L' = Local Mode
6	?	1	Checksum
7	03	1	ETX

Instruction 40 (Unit Status Request):

Message Byte No.	Set Value / (example)	Length (bytes)	Description
1	02	1	STX
2	?	1	No of bytes in message
3	?	1	Address
4	40	1	Message instruction
5	?	1	Checksum
7	03	1	ETX

Instruction 41 (Unit Status Request Reply):

Message Byte No.	Set Value / (example)	Length (bytes)	Description
1	02	1	STX
2	?	1	No of bytes in message
3	?	1	Address
4	41	1	Message instruction
5	('IF70SA')	27	Type of unit this is: IF70SA etc
32	('01234' = Serial No 01234)	5	Serial Number
37	('01.1234')	7	Software Version Number
38	('0')	1	Summary Alarm OK/FAULT '0' = OK '1' = FAULT
39	('0')	1	+5 Volt Fault '0' = OK '1' = FAULT
40	('0')	1	-15 Volt Fault '0' = OK '1' = FAULT
41	('0')	1	Temperature Fault '0' = OK '1' = FAULT
42	('0')	1	External Fault 1 '0' = OK '1' = FAULT
43	('0')	1	External Fault 2 '0' = OK '1' = FAULT
44	('0')	1	LO 1 Fault '0' = OK '1' = FAULT
45	('0')	1	LO 2 Fault '0' = OK '1' = FAULT
46	('0')	1	Not Used '0' = OK '1' = FAULT
47	('0')	1	Not Used '0' = OK '1' = FAULT
48	('23/12/02 12:34:56')	17	OK Since time/date string, if there is a fault with this down/up part of the converter then the string is blank.
65	('0')	1	1:1 Status '0' = Offline '1' = Online
66	('0')	1	Remote mode '0' = Local '1' = Remote
67	('0')	1	External Reference '0' = Off '1' = On
68	?	1	Checksum
69	03	1	ETX

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 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 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.

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.

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.