I R T Electronics Pty Ltd A.B.N. 35 000 832 575
26 Hotham Parade, ARTARMON N.S.W. 2064 AUSTRALIA
National: Phone: (02) 9439 3744   Fax: (02) 9439 7439
International: +61 2 9439 3744   +61 2 9439 7439
Email: sales@irtelectronics.com
Web: www.irtelectronics.com

IRT Eurocard

Type MEM-4760

4 x ASI to Ethernet
Network Interface Adapter

Designed and manufactured in Australia

IRT can be found on the Internet at:
http://www.irtelectronics.com

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Revision History

Revision	Date	By	Change Description	Applicable to:
0	24/09/2010	AL	Original Issue.	Firmware version MEM4760v1.0
1	20/04/2011	AL	Equalisation specification updated to >250m.	Firmware version MEM4760v1.0

IRT Eurocard

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4 x ASI to Ethernet
Network Interface Adapter

Instruction Book

Table of Contents

This instruction book applies to units fitted with firmware version MEM4760v1.0.

Operational Safety:

WARNING

Operation of electronic equipment involves the use of voltages and currents that may be dangerous to human life. Note that under certain conditions dangerous potentials may exist in some circuits when power controls are in the **OFF** position. Maintenance personnel should observe all safety regulations.

Do not make any adjustments inside equipment with power **ON** unless proper precautions are observed. All internal adjustments should only be made by suitably qualified personnel. All operational adjustments are available externally without the need for removing covers or use of extender cards.

IRT Eurocard

Type MEM-4760

4 x ASI to Ethernet
Network Interface Adapter

General Description
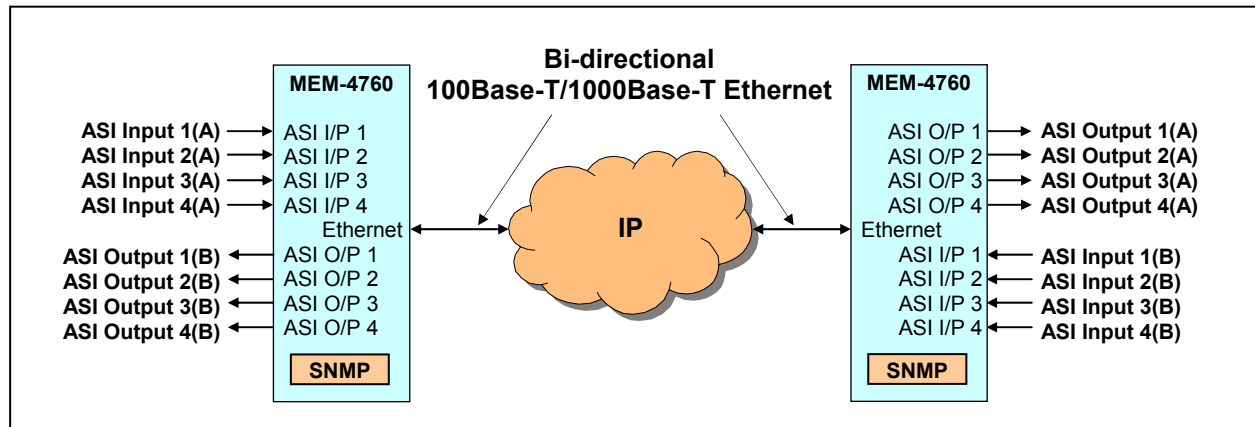
The MEM-4760 acts as a gateway between an ASI and an Ethernet network environment. Up to four ASI signals can be inputted for transport via an Ethernet connection.

The MEM-4760 is designed to operate as a pair with one unit at each end of the link. The unit can be set up to act as a transmitter or receiver for uni-directional operation, or as a transceiver (transmitter and receiver) for bi-directional operation of up to 4 ASI signals both ways.

It is also possible to use multiple units at multiple locations to receive from a single transmitting unit.

All parameters are set and read via a Simple Network Management Protocol (SNMP) system. As such the MEM-4760 must be operated, or at least set up, in one of IRT's frames fitted with SNMP capability.

The Ethernet port has automatic MDI/MDI-X detection and operates automatically at Fast Ethernet (100Mb/s) or Gigabit Ethernet (1000Mb/s) rates. This detects whether the Ethernet interconnect cable is a straight through or cross over type and automatically switches itself to accommodate.

The MEM-4760 is designed to fit IRT's current Eurocard 1RU and 3RU 4000 series frames fitted with SNMP control.

Standard features:

- 4 x ASI to Ethernet to 4 x ASI conversion
- Set up as either transmitter, receiver or both (transceiver)
- Supports enabling of Forward Error Correction (FEC)
- IP de-jittering
- RTP encapsulation, packet re-ordering
- SNMP setup and control

Technical Specifications

IRT Eurocard module
Type MEM-4760

Input

Type	4 x ASI, BNC connector.
Payload Data Rate	Combined ASI ≤ 180 Mb/s[1].
Impedance	75 Ohm.
Return Loss	>15 dB 5 MHz to 270 MHz.
Equalisation	>250 metres at 270 Mb/s for Belden 8281 or equivalent cable.

Ethernet

Type	Standard IEEE 802.3
Data Rate	100 Mb/s or 1 Gb/s, automatic.
Connector	RJ-45.

Output

Type	4 x ASI, BNC connector.
Signal level	800 mV ± 10%.
Impedance	75 Ohm.
Return loss	>15 dB 5 MHz to 270 MHz.

Alarm

General Alarm	Short to ground circuit on loss of Input (on transmitter), loss of RTP (on receiver), or link loss.

Front Panel Indicators

Link	Unit connected to an Ethernet link - Green.
ACT	LAN Activity – Green.
ERR	General alarm present – Red.
ASI 1	ASI signal present on ASI 1 Input/Output[2] – Green.
ASI 2	ASI signal present on ASI 2 Input/Output[2] – Green.
ASI 3	ASI signal present on ASI 3 Input/Output[2] – Green.
ASI 4	ASI signal present on ASI 4 Input/Output[2] – Green.

Power Requirements   28 Vac CT (14-0-14) or ±16 Vdc.
Power consumption   <5 VA.

Other

Temperature range		0 - 50° C ambient.
Mechanical		Suitable for mounting in IRT 19" rack chassis with input, output and power connections on the rear panel.
Finish	Front panel	Grey background, black lettering & red IRT logo.
	Rear assembly	Detachable silk-screened PCB with direct mount connectors to Eurocard and external signals.
Dimensions		6 HP x 3 U x 220 mm IRT Eurocard.

NOTE:	1	ASI data rate through end to end is subject to the network environment in between, and also to the use of FEC.
	2	Input/Output indication dependent on position of front panel switch.

Due to our policy of continuing development, these specifications are subject to change without notice.

Configuration

Setup is via Simple Network Management Protocol (SNMP).

MEM-4760 is required to be mounted in either IRT's current 1RU or 3RU 4000 series frame fitted with SNMP capability. A Network Management System (NMS) software is also required to interface and set the MEM-4760 parameters. Some user knowledge of Internet Protocol (IP) addressing is assumed.

SNMP Configuration Settings:

Local IP Configuration:

irt4760localMac — Set local MAC address. This setting should already be pre-set and match that of sticker on the main board. The MAC address is a unique number given to this card and should **not** be changed so as to avoid possible conflicts with other existing MAC addresses.

irt4760localIp — Set the IP address of this card. User settable.

irt4760subnetMask — Set the Subnet Mask that this cards IP address will belong to. Default setting 255.255.255.000

irt4760gatewayIp — Set the Gateway IP address of the network that this card's local IP address will be able to communicate through.

Transmitter IP Configuration:

irt4760ipTx   enable (1) - Enables MEM-4760 to act in transmitter mode.
     off (2) - MEM-4760 acts as a receiver unit only.

irt4760ipTxFec   off (1) - No Forward Error Correction (FEC) added to transmitted signal.
     colOnly (2) - Column FEC packets added to transmitted signal.
     colRow (3) - Column and Row FEC packets added to transmitted signal.

irt4760ipTxFecD — Set the FEC depth added to the transmitted signal.

irt4760ipTxFecL — Set the FEC length added to the transmitted signal.

irt4760txMac — Set the transmitter MAC address. If sending to multiple locations a broadcast MAC address needs to be set (e.g. ff:ff:ff:ff:ff).

irt4760txIp — Set the transmitter IP address. This address must be the same as the receiver IP address (irt4760rxIpAddr) of the remote MEM-4760. If sending to multiple locations a broadcast IP address needs to be set (e.g. 255.255.255.255).

irt4760txUdpPort — Set transmit UDP port number. UDP port number should be the same on both local transmit and remote receive MEM-4760 cards.

globalBandwidthCapping — Enable or disable global bandwidth capping. Global bandwidth capping allows the ASI inputs to be limited to settable maximum input rate limits.

outputRate — Set the desired output rate. Maximum output rate must not exceed 189Mb, on 1000Base-T Ethernet link (< 100Mb on 100Base-T Ethernet link, maximum value affected by FEC settings). When re-read, output rate actually reads to nearest higher multiple rate based on a 90kHz clock rate (exact formula not described).

inChannelEnabled — Input ASI channels can individually be either enabled or disabled. If disabled ASI input will not be transmitted.

inChannelDataRateLimit — If global bandwidth capping is enabled, set the individual ASI channels' maximum data rate limit here.

inChannelAlias — Individual input ASI channels can be assigned a 15 byte maximum alias (name).

Receiver IP Configuration:

irt4760ipRx   enable (1)   - Enables RTP Rx loss alarm on loss of RTP Rx input. Use this setting when operating unit in transceiver (both transmitter and receiver) or receiver only modes.

                    noAlarms (2) - Disables RTP Rx loss alarm on loss of RTP Rx input. Use this setting when operating unit in transmitter only mode, else an alarm condition will be generated. Note that unit can still operate in receiver mode regardless of this setting.

irt4760rxIpAddr   - Set the receiver IP address of the current (local) MEM-4760.

irt4760rxUdpPort   - Set receive UDP port number. UDP port number should be the same on both local receive and remote transmit MEM-4760 cards.

irt4760rxBufferWatermark   - Set and read the receiver buffer size. Both this MEM-4760 and the second (remote) MEM-4760 should be set the same.

outChannelEnabled   - Output ASI channels can individually be either enabled or disabled. If disabled ASI signal will not appear at output.

outChannelAlias   - Individual output ASI channels can be assigned a 15 byte maximum alias (name).

Other Configuration:

irt4760Trap   - If using a Trap receiver, enable or disable Traps to be sent when an alarm (Input Tx Alarm, Input Rx Alarm, or Net Alarm) occurs and when it clears.

Transmitter only set-up:	Receiver only set-up:	Transceiver set-up:
irt4760ipRx noAlarms (2);	irt4760ipRx enable (1);	irt4760ipRx enable (1);
irt4760ipTx enable (1).	irt4760ipTx off (2).	irt4760ipTx enable (1).

NOTE: Besides these two settings (irt4760ipRx and irt4760ipTx), all other SNMP configuration settings also need to be set.

Installation

Pre-installation:

Handling:

This equipment may contain or be connected to static sensitive devices and proper static free handling precautions should be observed.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Power:

AC mains supply: Ensure that operating voltage of unit and local supply voltage match and that correct rating fuse is installed for local supply.

DC supply: Ensure that the correct polarity is observed and that DC supply voltage is maintained within the operating range specified.

Earthing:

The earth path is dependent on the type of frame selected. In every case particular care should be taken to ensure that the frame is connected to earth for safety reasons. See frame manual for details.

Signal earth: For safety reasons a connection is made between signal earth and chassis earth. No attempt should be made to break this connection.

Installation in frame or chassis:

See details in separate manual for selected frame type.

Ethernet Connection:

The Ethernet port on the rear assembly is for a standard non-crossover Ethernet cable fitted with an RJ-45 connector. This port connects directly to an Ethernet link, or via an Ethernet router or Ethernet switch.
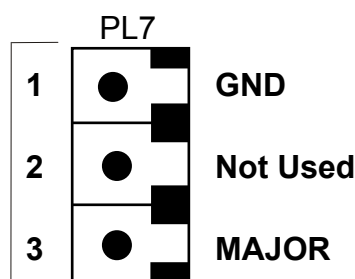
ASI Connections:

All four ASI inputs and four ASI outputs are 75 Ω BNC type for connection with high quality 75 Ω coaxial cable.

Alarm Output Connections:

An opto-coupled alarm output via a 3 pole Phoenix style screw terminal block (PL7) on the rear connector assembly switches to open circuit on alarm condition.

Pin1 is ground, pin 2 is not used, pin 3 is Major Alarm that switches from ground to open circuit when an alarm status has been raised. At time of writing this manual, this rear alarm is yet to be implemented.

PL7

1	●	GND
2	●	Not Used
3	●	MAJOR

Front & rear panel connector diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show connection order and approximate layout only.
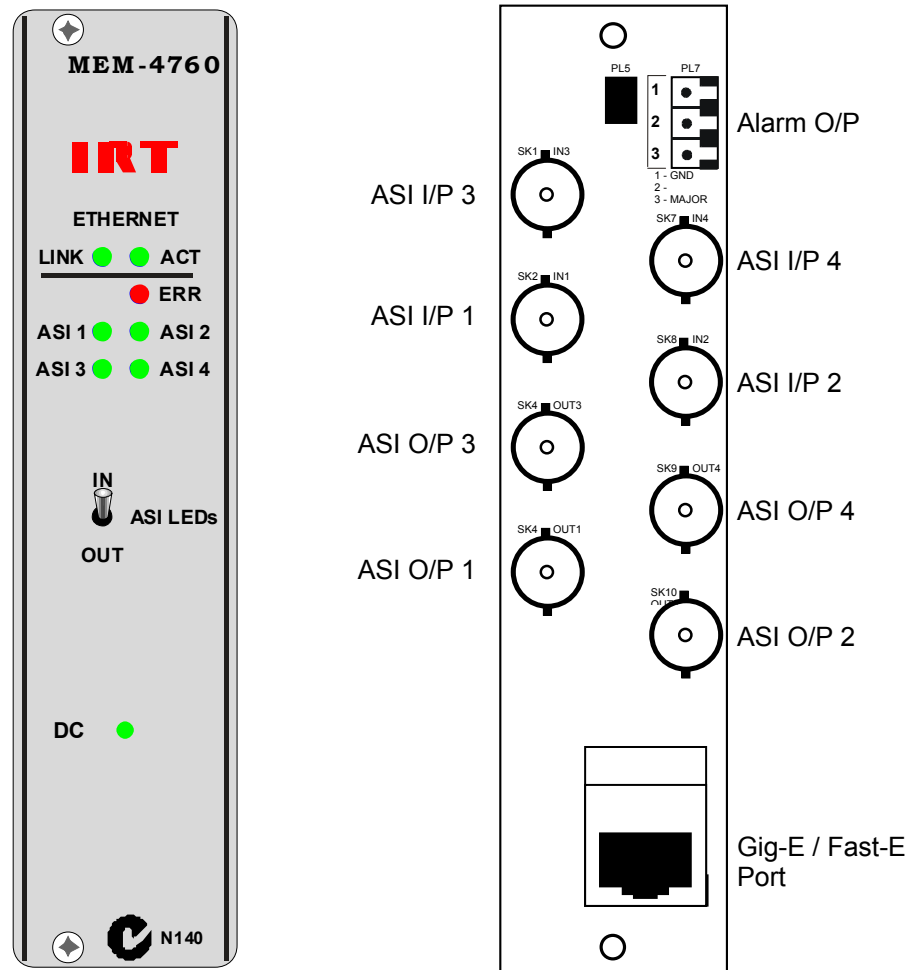
Operation

The MEM-4760 is designed to operate as a pair with a second MEM-4760. Each unit does the 4 x ASI to Ethernet conversion and the reciprocal Ethernet to 4 x ASI conversion.

Setup is done via SNMP as described in the *Configuration* and *SNMP* sections of this manual.

Once the units have been set up correctly and connected to an-Ethernet connection, up to 4 ASI signals are inputted at one MEM-4760 and outputted at the other. Each MEM-4760 is able to act concurrently as an encoder and decoder allowing ASI signals to flow both ways.

Units can be set up to operate uni-directionally, that is as an encoder (transmitter) on one end and a decoder (receiver) at the other, or bi-directionally as both an encoder and decoder (transceiver) at both ends of the link.

Front Panel LEDs give an indication of Ethernet and ASI settings, as described below:
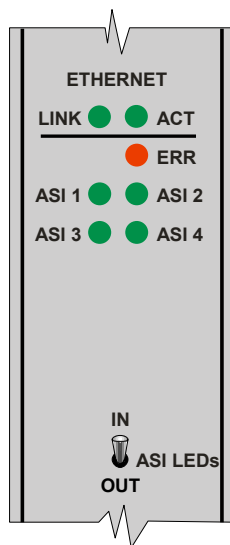
| LINK | Ethernet link established – Green. |
| ACT | LAN Activity – Green. |

ERR	Error – Red (Input Error or Output Error depending on position of front panel switch).
ASI 1	ASI signal present on Input/Output 1 connector – Green (Input/Output indication dependent on position of front panel switch).
ASI 2	ASI signal present on Input/Output 2 connector – Green (Input/Output indication dependent on position of front panel switch).
ASI 3	ASI signal present on Input/Output 3 connector – Green (Input/Output indication dependent on position of front panel switch).
ASI 4	ASI signal present on Input/Output 4 connector – Green (Input/Output indication dependent on position of front panel switch).

Front panel 'ASI LEDs' switch position determines whether the 'ERR', 'ASI 1', 'ASI 2', 'ASI 3' and 'ASI 4' LEDs indicate Input (IN) or Output (OUT) status.

SNMP

What Is It?

SNMP stands for Simple Network Management Protocol. It is an application layer protocol for managing IP (Internet Protocol) based systems. SNMP enables system administrators to manage system performance, and to find and solve system problems. SNMP runs over UDP (User Datagram Protocol), which in turn runs over IP.

Three types of SNMP exist: SNMP version 1 (SNMPv1), SNMP version 2 (SNMPv2) and SNMP version 3 (SNMPv3). It is not the intention here to discuss the differences between various versions, only to bring attention to the fact that IRT Electronics modules, fitted with SNMP capability, use SNMPv1.

An SNMP managed network consists of three key components: Network Management Systems (*NMS*), *agents*, and *managed devices*.

An *NMS* is the console through which the network administrator performs network management functions, such as monitoring status (e.g. alarm states) and remote controlling, of a set of managed devices. One or more *NMS*s must exist on any managed network. Generally the *NMS* is a computer running third party SNMP control software. There are a number of third party SNMP software applications currently available on the market.

An *NMS* polls, or communicates with, an *agent*. An *agent* is a network management software module that resides in a *managed device*. An *agent* has local knowledge of management information and translates that information into a form compatible with SNMP. The *agent*, therefore, acts as an interface between the *NMS* and the managed devices. The *NMS* sends a request message, and control commands for the managed devices, to the *agent*, which in turn sends a response message, containing information about the *managed devices*, back to the *NMS*.

A *managed device* contains an SNMP *agent* and resides on a managed network. *Managed devices* collect and store management information and make this information available to *NMS*s using SNMP.

Managed device agent variables are organised in a tree structure known as a Management Information Base (*MIB*). Within the *MIB* are parameters pertaining to the *managed device*. An Object Identifier (OID) number within the *MIB* defines the managed device type. This is a unique number specific to the model of *managed device*. Other information relating to the device is also stored, information such as alarm states, controllable settings, etc. The *MIB* tree is organised in such a way that there will be no two *MIB* files with conflicting placements.

Normally an *NMS* polls an *agent* for information relating to the *MIB* in a managed device to be sent back to the *NMS*. When certain conditions are met within the *MIB*, such as major alarm conditions, for example, the *agent* automatically sends what is known as a *trap* to the *NMS* without any prompting from the *NMS*. This allows automatic notification of a predetermined event.

SNMP Block Diagram
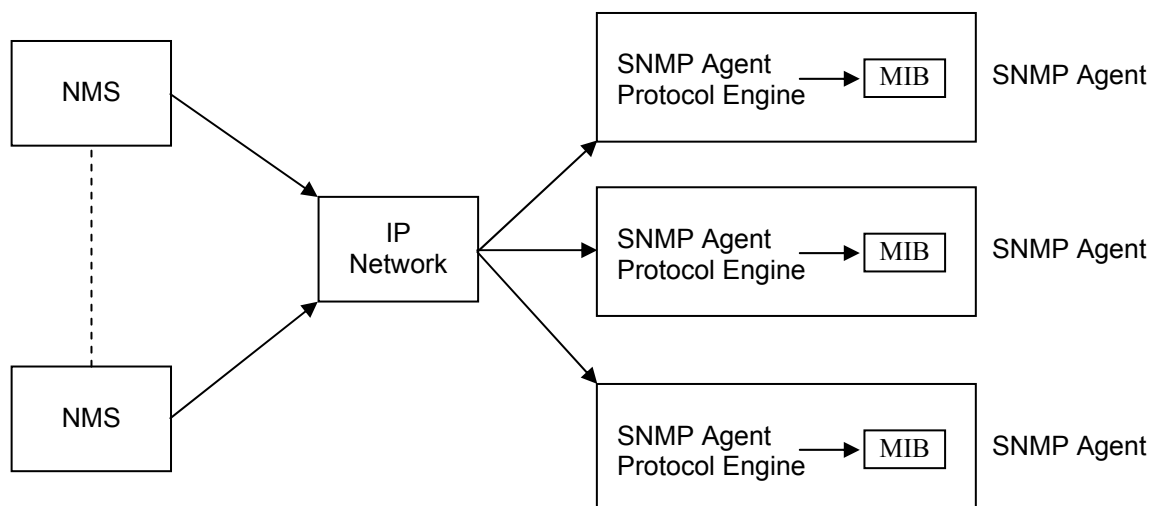
SNMP with IRT Products:

IRT Electronics currently employs SNMPv1 with its SNMP capable frames. The frame acts as an *agent* when fitted with a CDM-xxxx module. This module has its own designated slot next to the power supply so as to not affect the number of modules that the frame will take. Communication between the *NMS*, the frame and its loaded modules are via this CDM-xxxx module. Note that the *NMS* software is third party and not supplied by IRT Electronics.

Ethernet connection for SNMP operation is via an RJ45 connector on the rear of the frame, below the mains inlet. Ethernet rate runs at either 10 baseT or 100 baseT.

Frame parameters, such as Name, Address and Location, are set via an RS232 interface, a D9 connector on the rear of the frame below the mains inlet. A software terminal emulator, such as Tera Term or HyperTerminal, is used for setting and reading the parameters of the frame.

IRT modules that are SNMP compatible need a plug-in SMU-4000 module with a program relevant to the module that it is plugged into. Depending on the module, besides the module identification, parameters such as alarm states, inputs and controls etc. are communicated to the CDM-xxxx *agent* via a data bus on the rear of the frame. Thus the CDM-xxxx collects information on what is loaded within the frame, what positions they occupy, and their current status for communication to the *NMS* when the *NMS* sends a request for information.

In the event of a major alarm from any of the SNMP compatible modules, or power supplies, a *trap* is automatically sent by the CDM-xxxx *agent* to the *NMS* without any prompting by the *NMS*. This alerts the operator to any fault conditions that may exist that need immediate attention.
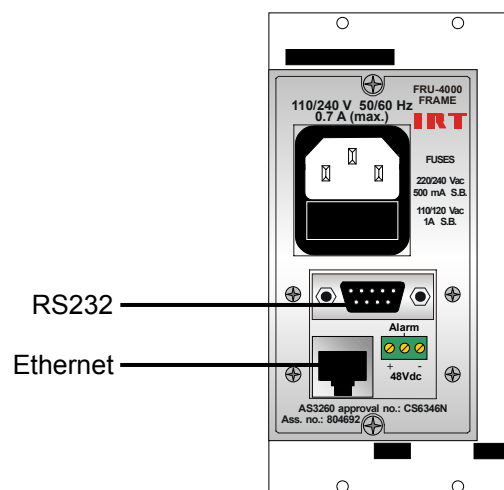
IRT SNMP Connections
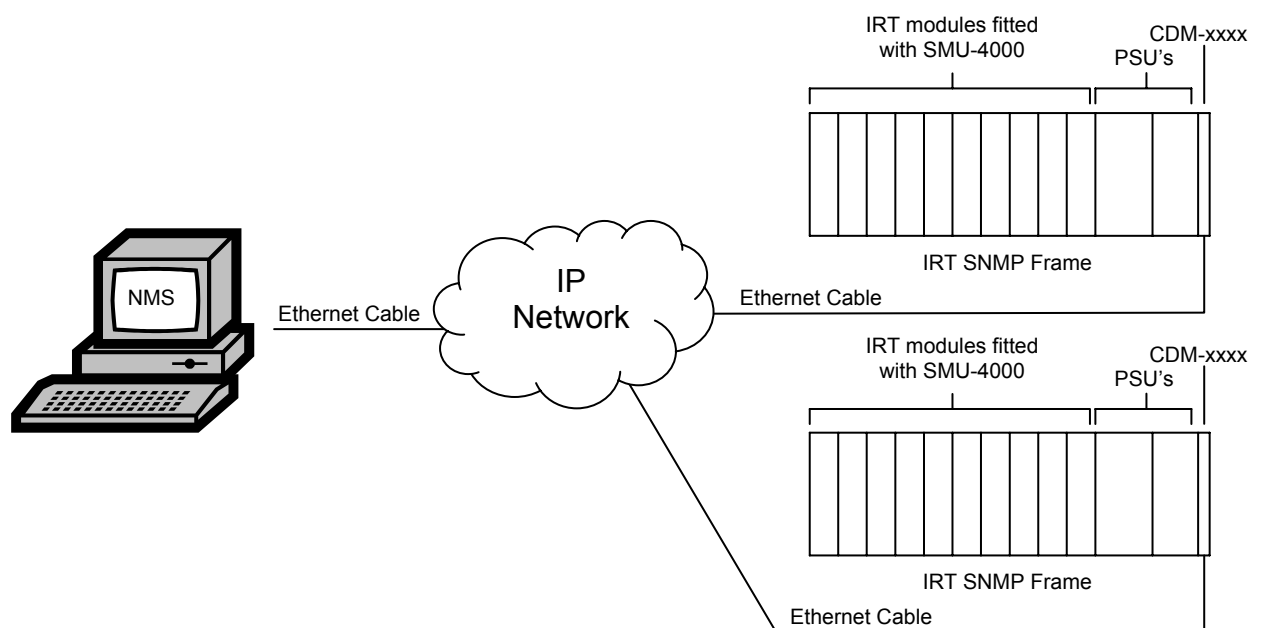
IRT SNMP Setup

MEM-4760 SNMP Functions:

With the MEM-4760 installed in an IRT 4000 series frame with SNMP capability, the MEM-4760 can be configured and interrogated by an SNMP Network Management System (NMS).

The following SNMP functions are capable of being configured and monitored by an NMS:

Alarm States (irt4760Alarms):

irt4760inChannelAlarm   - An indication of the current state of the input alarm.
        (1) noAlarm;
        (2) rateError: Sum of inputs exceeds output rate, or channel rate exceeds set bandwidth capping;
        (3) channelLoss: no ASI inputs present (only possible if 'irt4760ipTx' enabled);

irt4760ipRxAlarm   - An indication of the current state of the receiver (Rx) input alarm.
        (1) noAlarm;
        (2) rtpRxLoss: Loss of RTP information on receiver side;

irt4760enetAlarm   - An indication of the current state of the Ethernet alarm.
        (1) noAlarm;
        (2) linkLoss: Loss of Ethernet connection;

Transmitter operation (irt4670MMM):

globalBandwidthCapping   - Enables or disables channel capping of ASI inputs so as to limit sum of ASI input rates exceeding set output rate.
        (1) disabled;
        (2) enabled;

outputRate   - Set the desired output rate. Maximum output rate must not exceed 189Mb, on 1000Base-T Ethernet link (< 100Mb on 100Base-T Ethernet link, maximum value affected by FEC settings). When re-read, output rate actually reads to nearest higher multiple rate based on a 90kHz clock rate (exact formula not described).

Input Channel Information Table (inChannelInfoTable):

inChannelNumber   - An indication of the channel number of the ASI input (1, 2, 3 & 4).

inChannelPresent   - An indication whether the input channel ASI signal is present or not.
        (1) notPresent;
        (2) present;

inChannelEnabled   - An indication and control of whether the input channel is enabled or not.
        (1) notEnabled: ASI input on channel will not be transmitted;
        (2) enabled: ASI input on channel can be transmitted (if 'irt4760ipTx' enabled);

inChannelPacketSize   - An indication of the input channel ASI signal packet size.
        (1) bytes188;
        (2) bytes204;

inChannelDataRate   - An indication of the approximate data rate of the input channel ASI signal.

inChannelDataRateLimit   - An indication and control of the maximum allowed channel data rate (dependent on the 'globalBandwidthCapping' setting being enabled).

inChannelRateAlarm   - An indication of whether the data rate is too high for the 'inChannelDataRateLimit' setting (dependent on the 'globalBandwidthCapping' setting being enabled).
        (1) noAlarm: Data rate lower than enabled data rate limit, or global bandwidth capping not enabled;
        (2) Alarm: Data rate higher than enabled data rate limit;

inChannelAlias   - An indication and control of a 15 byte maximum alias for the chosen channel.

Receiver operation (irt4670MMX):

inputSignalPresent   - An indication whether an ASI signal is present within the received Ethernet input or not.
                    (1) notPresent;
                    (2) present;

inputDataRate   - An indication of the approximate data rate of the ASI signal within the received Ethernet.

Output Channel Information Table (outChannelInfoTable):

outChannelNumber   - An indication of the channel number of the ASI output (1, 2, 3 & 4).

outChannelPresent   - An indication whether the output channel ASI signal is present or not.
                    (1) notPresent;
                    (2) present;

outChannelEnabled   - An indication and control of whether the output channel is enabled or not.
                    (1) notEnabled: ASI output on channel will not be outputted on rear assembly;
                    (2) enabled: ASI output on channel will be outputted on rear assembly;

outChannelPacketSize - An indication of the input channel ASI signal packet size.
                    (1) bytes188;
                    (2) bytes204;

outChannelDataRate   - An indication of the approximate data rate of the output channel ASI signal.

outChannelAlias   - An indication and control of a 15 byte maximum alias for the chosen channel.

IP Configurations (irt4670IP):

IP Status (ipStatus):

irt4760EthernetLink   - An indication that an Ethernet link has been established on the Ethernet port.
                    (1) inactive: no Ethernet link detected;
                    (2) mb100: 100 Base-T link (Fast-E);
                    (3) gigabit: 1000 Base-T link (Gig-E);

irt4760rtpRx   - An indication that RTP packets have been received.
                    (1) notPresent;
                    (2) present;

irt4760fecRx   - An indication that Forward Error Correction (FEC) packets have been received.
                    (1) notPresent;
                    (2) colOnly: Column FEC packets only received;
                    (3) colRow: Column and Row FEC packets received;

irt4760fecRxD   - An indication of FEC depth received.

irt4760fecRxL   - An indication of FEC length received.

Local IP Configuration (ipLocalConfig):

irt4760pingSink[3]   - Set and read whether MEM-4760 is set up with Ping Sink setting enabled.
                    (1) enable;
                    (2) off;

irt4760localMac   - Set and read the local MAC address of the local MEM-4760. This address has already been preset and matches that of a sticker on the card.

irt4760localIp   - Set and read the local IP address of the local MEM-4760.

irt4760subnetMask   - Set and read the sub-net mask address.

irt4760gatewayIp   - Set and read the gateway IP address.

Transmitter IP Configuration (ipTxConfig):

irt4760ipTx   - Set and read whether MEM-4760 is set up in transmitter mode.
                    (1) enable;
                    (2) off;

irt4760ipTxFec   - Set and read whether FEC is enabled for use when in transmitter mode.
                    (1) off: no FEC (forward error correction) added;
                    (2) colOnly: Column FEC packets only transmitted;
                    (3) colRow: Column and Row FEC packets transmitted;

irt4760ipTxFecD[4]   - Set and read the FEC depth transmitted.

irt4760ipTxFecL[4]   - Set and read the FEC length transmitted.

irt4760txMac   - Set the transmitter MAC address. If sending to multiple locations a broadcast MAC address needs to be set (e.g. ff:ff:ff:ff:ff).

irt4760txIp   - Set the transmitter IP address. This address must be the same as the receiver IP address (irt4760rxIpAddr) of the remote MEM-4760. If sending to multiple locations a broadcast IP address needs to be set (e.g. 255.255.255.255).

irt4760txUdpPort   - Set and read the transmitter UDP port number. Both this MEM-4760 and the second (remote) MEM-4760 receiver UDP port number should be set the same.

Receiver IP Configuration (ipRxConfig):

irt4760ipRx[5]   - Set and read whether MEM-4760 can issue a RTP Rx loss alarm on loss of RTP input.
                              (1) enable;
                              (2) noAlarm;

irt4760rxIpAddr   - Set and read the IP address of the current (local) MEM-4760.

irt4760rxUdpPort   - Set and read the receiver UDP port number. Both this MEM-4760 and the second (remote) MEM-4760 transmitter UDP port number should be set the same.

irt4760rxBufferWatermark   - Set and read the receiver buffer size. Both this MEM-4760 and the second (remote) MEM-4760 should be set the same.

Other:

irt4760FpgaVersion   - The software version of the main FPGA in the format 'x.y', where x is the major rev. no. and y the minor.

irt4760SoftwareVersion   - The software version of the main FPGA in the format 'x.y', where x is the major rev. no. and y the minor.

irt4760Reset   - Unit reset control. A set with a value of 2 sent to this OID will cause a system reset to occur. When queried returns 1.
                              (1) inactive;
                              (2) reset;

irt4760Trap   - Trap automatically sent, if enabled, when an alarm (irt4760inChannelAlarm, irt4760ipRxAlarm, or irt4760enetAlarm) occurs and when it clears
                              (1) enabled;
                              (2) disabled;

NOTE: 3 Ping Sink planned for future release.
           4 Limit maximum Forward Error Correction (FEC) settings irt4760ipTxFecD to 20, and irt4760ipTxFecL to 20. Typical setting could be irt4760ipTxFecD 5, and irt4760ipTxFecL 4.
           5 If using as a transmitter only, set this setting to noAlarm (2) so that RTP Rx alarm is disabled. Enabling this setting allows alarm to operate on loss of RTP received detection.

Maintenance & Storage

Maintenance:
No regular maintenance is required.

Care however should be taken to ensure that all connectors are kept clean and free from contamination of any kind. This is especially important in fibre optic equipment where cleanliness of optical connections is critical to performance.

Storage:
If the equipment is not to be used for an extended period, it is recommended the whole unit be placed in a sealed plastic bag to prevent dust contamination. In areas of high humidity a suitably sized bag of silica gel should be included to deter corrosion.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Warranty & Service

Equipment is covered by a limited warranty period of three years from date of first delivery unless contrary conditions apply under a particular contract of supply. For situations when "No **Fault Found"** for repairs, a minimum charge of 1 hour's labour, at IRT's current labour charge rate, will apply, whether the equipment is within the warranty period or not.

Equipment warranty is limited to faults attributable to defects in original design or manufacture. Warranty on components shall be extended by IRT only to the extent obtainable from the component supplier.

Equipment return:
Before arranging service, ensure that the fault is in the unit to be serviced and not in associated equipment. If possible, confirm this by substitution.

Before returning equipment contact should be made with IRT or your local agent to determine whether the equipment can be serviced in the field or should be returned for repair.

The equipment should be properly packed for return observing antistatic procedures.

The following information should accompany the unit to be returned:

1. A fault report should be included indicating the nature of the fault
2. The operating conditions under which the fault initially occurred.
3. Any additional information, which may be of assistance in fault location and remedy.
4. A contact name and telephone and fax numbers.
5. Details of payment method for items not covered by warranty.
6. Full return address.
7. For situations when "No **Fault Found"** for repairs, a minimum charge of 1 hour's labour will apply, whether the equipment is within the warranty period or not. Contact IRT for current hourly rate.

Please note that all freight charges are the responsibility of the customer.

The equipment should be returned **to the agent who originally supplied the equipment** or, where this is not possible, to IRT direct as follows.

Equipment Service
IRT Electronics Pty Ltd
26 Hotham Parade
ARTARMON
N.S.W. 2064
AUSTRALIA

Phone: 61 2 9439 3744   Fax: 61 2 9439 7439
Email: service@irtelectronics.com