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IRT Eurocard

Type DDA-3020
155 Mb/s G.703 (STM-1) Data Distribution Amplifier
&
ZDA-3021RH
Handshake Changeover Assembly

Designed and manufactured in Australia

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

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Instruction Book

Table of Contents

This instruction book applies to units later than S/N 0402001.

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
Types DDA-3020
155 Mb/s G.703 (STM-1) Data Distribution Amplifier
&
ZDA-3021RH
Handshake changeover assembly

General Description

The DDA-3020 data distribution amplifier is intended for use with STM-1 data signals conforming to the ITU Rec. G.703. The DDA-3020 is primarily intended for use in pairs with a double width rear assembly (ZDA-3021RH) for automatic path protection applications, although it is supplied as standard with its own rear assembly for stand-alone applications.

Four outputs are provided at the rear of the module with an additional output for monitoring purposes on the front panel. One output (O/P 3) is controlled by relays to provide a bypass signal from the input in the event of a power failure.

Indicators are provided on the front panel for:
- Data loss
- AIS detect (Alarm Indication Signal)
- Module in service
- Module in standby.

External alarm signals are also available on the rear of the module.

Changeover inhibit and changeover request switches are provided on the front panel for use where modules are linked in pairs for redundancy. For this configuration the ZDA-3021RH double width rear assembly is needed to link the logic sections of two modules.

When used as a line equaliser or distribution amplifier the DDA may be housed in any of IRT's standard Eurocard frames. When used in pairs for handshake operation only 3 RU chassis types may be used so that the double width rear assembly may be used.

The DDA-3020 is also equipped with Simple Network Management Protocol (SNMP) monitoring so that status and alarms can be remotely monitored and controlled via an Ethernet connection. This function is only available when the unit is housed in an IRT 4000 series frame fitted with the SNMP agent module, CDM-4000.

Details of frame types are available separately.

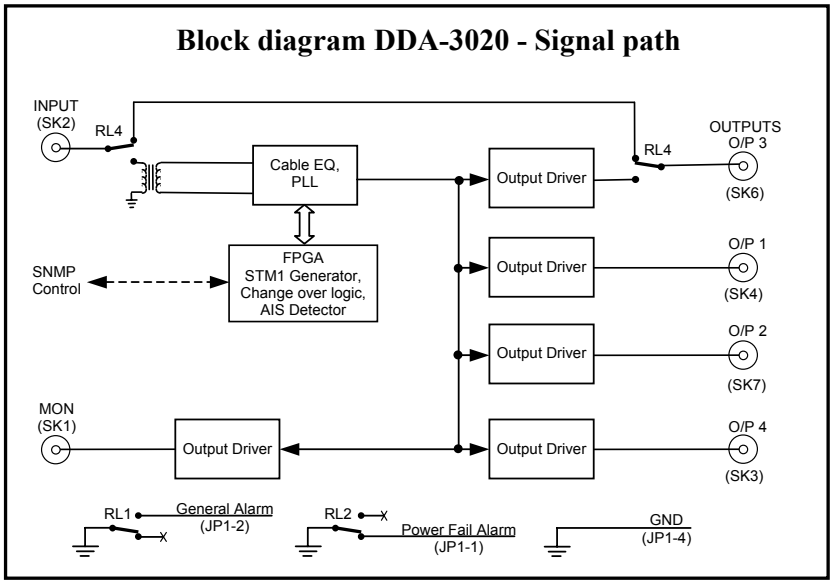
Applications:

- Stand alone cable equaliser or distribution amplifier
- Paired for redundant path protection switching

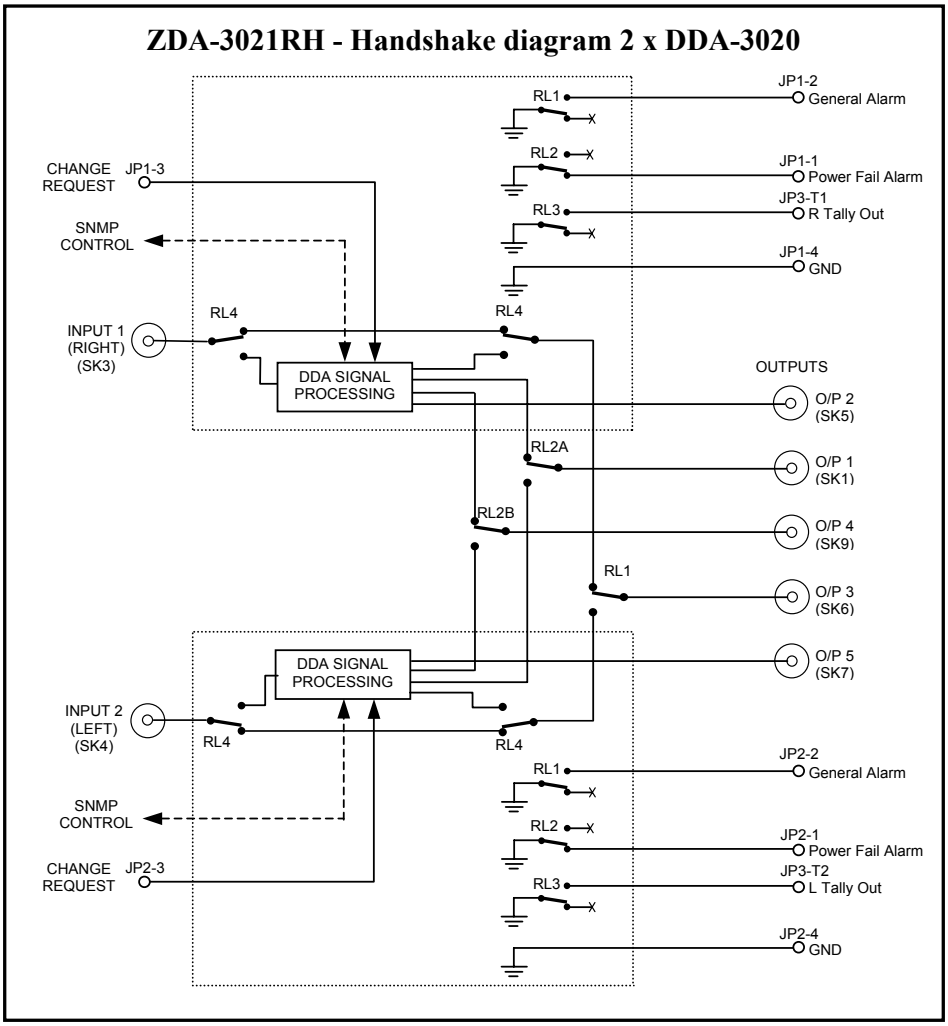
Standard features:

- Adaptive cable input equalisation
- Data regeneration & re-clocking
- Monitor facility
- Power fail bypass facility
- External alarms and bypass
- Redundancy handshake facility
- Simple Network Management Protocol (SNMP) monitoring
- IRT Eurocard construction compatible with other IRT Eurocard modules and frames
- Dual power supply operation

Block diagram DDA-3020 - Signal path



ZDA-3021RH - Handshake diagram 2 x DDA-3020



Technical Specifications

IRT Eurocard module
Type DDA-3020

In accord with ITU-T Rec. G.703 155,520 kb/s – see *Electrical characteristics of G.703 signals***.**

Input:

Type	Transformer coupled.
Impedance	75 Ω terminated.
Equalisation	Automatic for up to 200 m of Belden 8281 equivalent.

Outputs:

Number	1 switched, 3 non-switched, regenerated, reclocked unshaped outputs located on rear connection assembly and 1 located on front panel.
Impedance	75 Ω source terminated.

Electrical Characteristics:

Cable Type	Coaxial
Impedance	75 Ω
Signal level	1.0 V
Pulse Shape	Unshaped, fig. 22&23/G.703
Nominal pulse width	9.64 ns
Code conversion	Code Mark Inversion (CMI)
Return loss at input ports	$\geq$ 15dB over frequency range 8 MHz to 240 MHz

Controls & alarms:

Input:

External changeover request	A ground applied to this input will emulate the operation of the front panel switch "Change Request".

Outputs:

Power Failure	Contact closure to ground if power has failed.
General alarm	Contact closure to ground if a. Data Loss is detected OR b. AIS is detected AND the AIS disable link (LK 3) is not installed. AIS detection is defined as a series of all "1"s in the payload of a frame. Data Loss is defined as less than 120 data "1"s in 512 G.703 data rate clock periods.

Connectors:

Data:	BNC
Alarm:	Krone LSA plus

Indicators:

DC power.
Data loss.
AIS detect.
Module in service.
Module in standby.

Power requirements	28 Vac CT (14-0-14) or ± 16 Vdc.
Power consumption	< 4 VA
Temperature range	0 - 50° C ambient
Mechanical	Suitable for mounting in IRT 19" rack chassis types with input output and power connections on the rear panel.
Finish: Front panel:	Grey, silk-screened 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
Standard accessories	Rear connector assembly.
Optional accessories	ZDA-3021RH double width rear assembly.

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

Controls & alarms:

Input:

External changeover request — A ground applied to this input will emulate the operation of the front panel switch "Change Request".

Outputs:

Bypass — Contact closure to ground if power has failed.

General Alarm — Contact closure to ground if
a. Data Loss is detected OR
b. AIS is detected AND the AIS disable link (LK 3) is not installed.

AIS detection is defined as at least 2048 consecutive data "1"s.
Data Loss is defined as less than 120 data "1"s in 512 G.703 data rate clock periods.

In Service (Main) Path Indication: Transistor switch to ground if card is *Main*.

Connectors:

Data: BNC.
Alarm: Krone LSA plus.
In Service (Main) Path: Krone LSA plus.

Changeover logic:

A changeover to the companion module will occur under any of the following conditions:

Loss of input signal
AIS detection alarm (provided AIS is not disabled by link LK 3)
Loss of power

In all of the above cases switching will only occur if

companion module is able to provide an output free of the same defects and
changeover inhibit switch is not activated on either module.

Priority logic:

The priority switching in normal mode follows non-reverting logic, which dictates:

In the event of failure of main then standby DDA will assume control and become *Main* causing the failed path DDA to become *Standby*.

This implies that when the failed path is restored that it will remain as *Standby* and not become *Main* unless either a failure of *Main* occurs or a manual changeover is requested.

Power on reset.

When power is applied to the pair, the *power on reset* signal will set the module which was last enabled as *Main* as *Main* and the other module will be forced to act as *Standby*.

When power is applied to a pair for the first time it may be necessary to force the desired module to become main by pressing the *Change Request* button on the front panel of the desired module. The *Main* module will be indicated by the *In Service* LED lighting on the front panel.

Characteristics of signal types

Definition of CMI

CMI is a 2-level non-return-to-zero code in which binary 0 is coded so that both amplitude levels, A_1 and A_2, are attained consecutively, each for half a unit time interval (T/2).

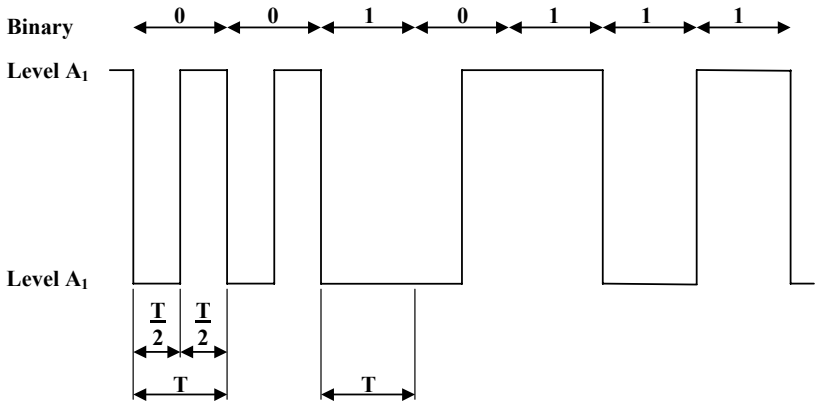
Binary 1 is coded by either of the amplitude levels A_1 or A_2, for one full unit time interval (T), in such a way that the level alternates for successive binary 1s.

An example is given in Figure A.1.

NOTE 1 – For binary 0, there is always a positive transition at the midpoint of the binary unit time interval.

NOTE 2 – For binary 1:

a) there is a positive transition at the start of the binary unit time interval if in the preceding time interval the level was A_1;
b) there is a negative transition at the start of the binary unit time interval if the last binary 1 was encoded by level A_2.



Example of CMI coded binary signal

Description of operation

See block diagrams commencing on page 4 of this manual.

Input:

The 155 Mb/s G.703 (STM-1) input signal is connected to the input circuit of the amplifier.

If no power is present then the signal will be directed to the output connector via a relay, RL4. When power is applied the relay operates and switches the signal via the amplifier to the second RL4 relay contact and the output connectors.

In this power fail mode, the connection from input to output is passive and so only one output can be connected.

Active path:

Input switching & equaliser:
The signal from the RL4 relay connects to the input transformer and automatic line equalisation circuit. The purpose of this equaliser is to restore both the signal level and the leading and trailing edges of the digital signal so that signal jitter is not introduced when the clock signal is derived in the subsequent stage.

Logic processing, reclocking and AIS detection:
The main logic processing, reclocking, error detection and operational interfacing are all performed by logic circuits within a custom-programmed large-scale logic array (FPGA). The internal logic and functions of this IC are too complex to describe in detail and the following is intended as a guide to function only.

Data loss detection:
Valid data is deemed to be present at the module input when 120 or more data pulses have been received in 512 nominal clock periods. In order for the data pulse to be counted, more than 60% of the minimum anticipated data pulse must be present.

If less than 120 data pulses are counted over a period of 512 clock pulses then the data signal is deemed to be invalid and the data loss flag is set.

If the area of a given pulse is less than 60% of the minimum anticipated (or acceptable) data pulse, after line equalisation and shaping, then that pulse is not considered as a valid input to the count.

In any of these cases the *Data Loss* LED on the front panel of the module will light and the general alarm relay output will be activated connecting the general alarm output contact to ground.

AIS detection:
The data processor will detect an incoming AIS (Alarm Indication Signal) (a series of all 1's in the payload of a frame) and will set the AIS flag and the general alarm relay output will be activated connecting the general alarm output contact to ground.

The AIS alarm system may be disabled by a link on the main board, LK 3. This prevents the AIS detection from operating the automatic changeover function when used in handshake configuration and prevents AIS from setting the general alarm output. The AIS detection circuit will, however, still provide AIS indication, on the front panel LED, if AIS is detected.

The AIS disable link does not affect the general alarm being activated by data or signal loss as described above.

Power on reset:
When power is applied to the unit, a *power on reset* signal is generated. This signal causes the processing circuit to examine its current status and connections and restore operation to its state prior to power failure.

If the DDA is connected for stand-alone operation all alarms will be reset and normal operation will resume. If an AIS signal is present on the data input or data is outside the prescribed limits outlined above then the general alarm will be activated after the normal detection period has elapsed from the P.O.R. signal being initiated.

Data signal output drivers.
Four separate output drivers drive the outputs, one of which goes via relay RL4 to O/P 3. In the event of a power failure the input is passively switched to O/P 3.

Note that the *Mon. Output* on the front panel of the module is obtained in the same manner as the outputs on the rear of the module.

Handshake operation:

Purpose:
Handshake interconnection is required when two circuits are to be operated in 1:1 protection switching mode to provide a continuous signal output in the event of failure of the primary signal path.

Priority logic:
For this mode to be employed it is necessary to provide two programme feeds which are designated as the *Main* and *Standby* paths.
The priority switching in normal mode follows non-reverting logic, which dictates:

In the event of failure of main then standby DDA will assume control and become *Main* causing the failed path DDA to become *Standby*.

This implies that when the failed path is restored that it will remain as *Standby* and not become *Main* unless either a failure of *Main* occurs or a manual changeover is requested.

Changeover logic:
A changeover to the companion module will occur under any of the following conditions:

Loss of input signal
AIS detection alarm (provided AIS is not disabled by link LK 3)
Loss of power

In all of the above cases switching will only occur if:

the companion module is able to provide an output free of the same defects AND
the changeover inhibit switch is not activated on either module.

Connections:
Handshake interconnection should only be made using either the ZDA-3021RH handshake double rear assembly. This rear assembly makes all the necessary connections for both logic and data signals when two DDA-3020's are inserted side by side in a 3 RU frame. Individual alarm outputs are provided for each module.

Logic connections:
All required logic connections are made by tracks on the double width PCB. Automatic operation is immediately initiated when two modules are plugged into this type of rear assembly.

No external connections are required, but external alarm connections are available from each module for use if desired. Additionally, each module has a connection for an external *Make Main* control for remote DA selection.

Handshake mode detection:
Two data lines are present on the handshake connector to indicate to each module that it is to operate in handshake mode.

Power on reset.
When power is applied to the pair the *power on reset* signal will attempt to reset both modules. However, as only one module can be *Main*, the logic processor checks for handshake operation and if detected then the module, which was last enabled as *Main* will take control as *Main* and the other module will be forced to act as *Reserve*.

This memory capability is due to the latching nature of the RL1 relay, which will cause the *Main* and *Reserve* paths to be maintained even in the absence of power.

The only exception to this rule is when power is applied to a pair for the first time that they are coupled in handshake mode. In this special case both modules will initially have their K 3 relays in the active path condition and so both will attempt to become *Main*. As the P.O.R. signal for each module will be slightly different for any two modules, one will reach its operating mode first and will force the other module to immediately change to become *Reserve.*

As the selection of which module becomes *Main* is cannot be determined before installation it may be necessary to force the desired module to become main by pressing the *Change Request* button on the front panel of the desired module. The *Main* module will be indicated by the *In Service* LED, on the front panel, lighting.

Automatic changeover:
An automatic changeover is initiated whenever the power fails on *Main* and not on *Reserve* or when a general alarm is initiated on *Main* (indicating either loss of input signal or AIS indication if the AIS is enabled) and the *Change Inhibit* switch is not active on either module.

Manual changeover:
A manual changeover is initiated by pressing the *Change Request* button on the front of the module that is required to become *Main*.
The mechanism of the change is similar to the automatic changeover described above except that it is initiated by the module requesting that it become *Main*.

Alarm and external changeover connections:

Two Krone type connectors (JP1 & JP2) are provided on the rear panel providing the following for each of the modules:

Pin	1	Loss of power - connection to ground indicates module is in bypass mode.
	2	General Alarm - connection to ground indicates a loss of input or AIS detection.
	3	External changeover request - connection to ground will make this module *Main* in handshake mode.
	4	Ground.

A third Krone type connector (JP3) provides remote status of which unit is *In Service (Main)*:

Pin	T1	Connection to ground indicates that module 1 is the *In Service (Main)* module.
	T2	Connection to ground indicates that module 2 is the *In Service (Main)* module.
	T3	Not Connected.
	T4	Ground.

Configuration

Link settings

LK1 IN Output disabled.
OUT Output enabled.

LK2 IN Transmit an Alarm Indication Signal (AIS) on loss of input signal.
OUT Do not transmit an Alarm Indication Signal (AIS) on loss of input signal.

LK3 IN Disable switching to Standby on detection of an Alarm Indication Signal (AIS).
OUT Enable switching to Standby on detection of an Alarm Indication Signal (AIS).

Switch settings

Sw1 Front panel push button. Change request to switch to *In Service (Main)* when used with ZDA-3021RH rear assembly.

Sw2 Front panel slide switch. Inhibit/Allow request to switch to *In Service (Main)*, by either Sw1 or loss of signal, when used with ZDA-3021RH rear assembly.

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.

Signal Connections:

G.703 data connections - stand alone operation:

Connect the input and as many output connections as required.

Only good quality 75 Ohm connectors and cable should be used. The use of 50 Ohm BNC connectors may cause serious reflection problems with G.703 signals, causing data errors.

In general cable runs should be kept as short as possible and should not exceed 200 metres for reliable error free operation.

G.703 data connections - handshake operation:

See separate section on handshake operation.

Alarm and external changeover connections:

A Krone type connector is provided on the rear panel of the module providing the following:

Pin 1 Loss of power - connection to ground indicates module is in bypass mode.
2 General Alarm - connection to ground indicates a loss of input or AIS detection.
3 External changeover request - connection to ground will make this module *Main* in handshake mode.
4 Ground.

SNMP:

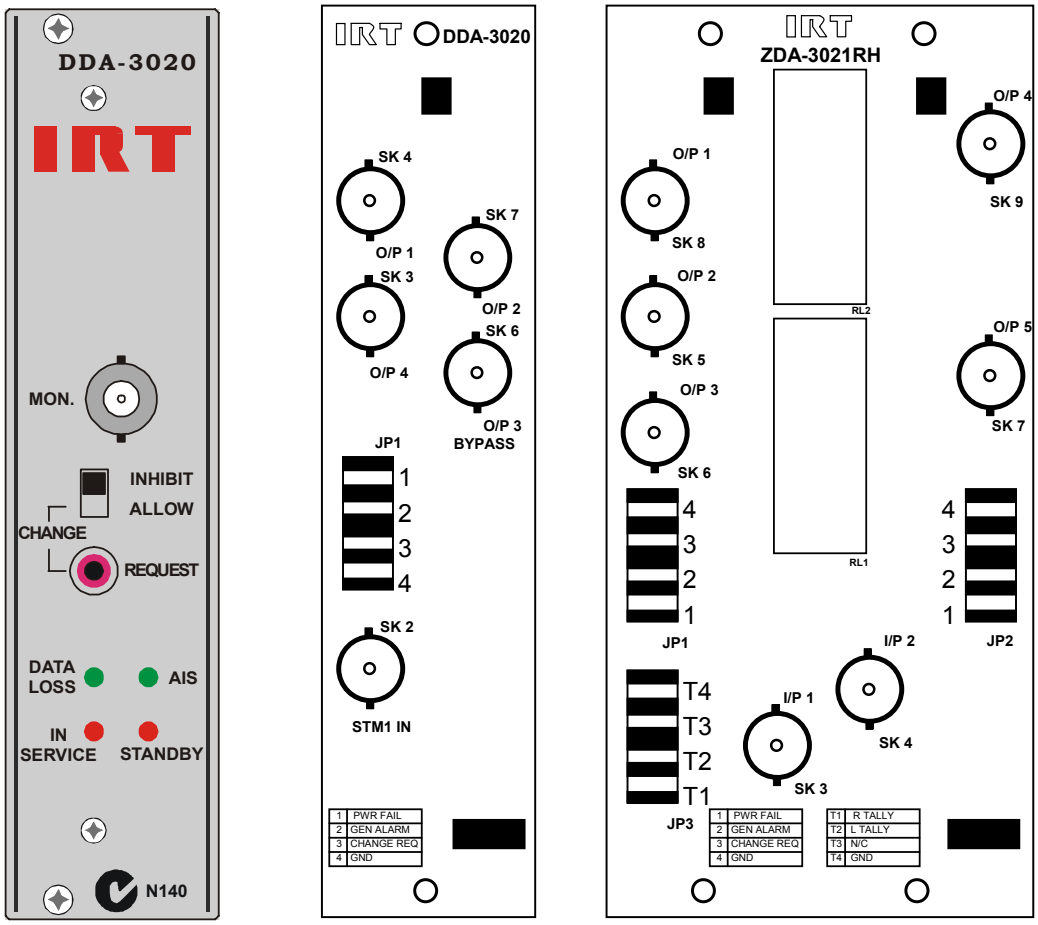
When used in an IRT FRU400 Frame with a CDM400 SNMP Module fitted, the DDA-3020 can be interrogated by an SNMP Network Management System and certain functions can also be remotely controlled.

The MIB (management information base) associated with these devices has the following OIDs (Object Identities):

Alarms
In Service or Standby mode
State of Change-over enable switch
State of link that allows or disallows a change to Standby Status on detection of incoming AIS
State of link that allows or disallows the transmission of AIS when 'Input Loss' is detected
Receive PLL locked (input signal present)

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.



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.

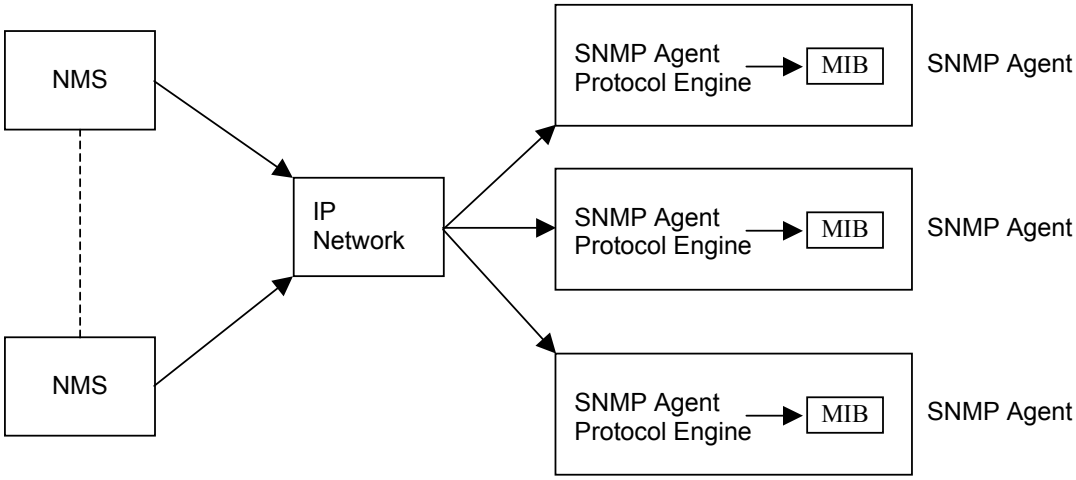
An *NMS* polls, or communicates with, an *agent*. An *agent* is a network management software module that resides in a *managed device*. An *agent* has local knowledge of management information and translates that information into a form compatible with SNMP. The *agent*, therefore, acts as an interface 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

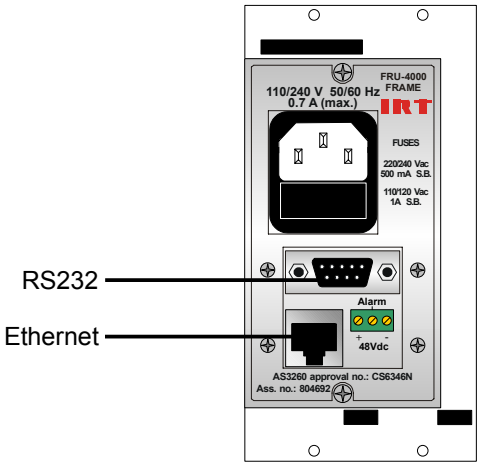
IRT Electronics currently employs SNMPv1 with its 4000 series frame. The frame acts as an *agent* when fitted with a CDM-4000 module. This module has its own designated slot next to the power supply so as to not affect the number of modules that the frame will take. Communication between the *NMS*, the frame and its loaded modules are via this CDM-4000 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.

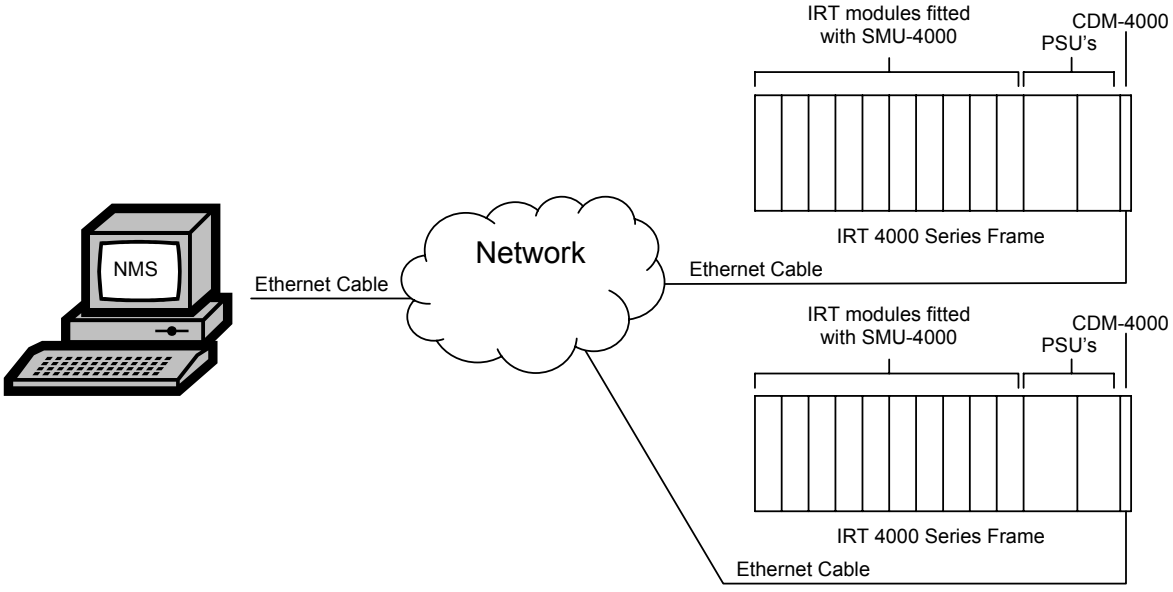
Frame parameters, such as Name, Address and Location, are set via an RS232 interface, a D9 connector on the rear of the frame below the mains inlet. A software terminal emulator, such as Tera Term or HyperTerminal, is used for setting and reading the parameters of the frame.

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-4000 *agent* via a data bus on the rear of the frame. Thus the CDM-4000 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-4000 *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 4000 Series SNMP Setup

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