IRT Eurocard

Types DDA-3280
2 Mb/s G.703 Data Distribution Amplifier
&
ZDA-3280RH
Handshake changeover assembly

Designed and manufactured in Australia

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

IRT Eurocard

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Instruction Book

Table of Contents

This instruction book applies to units later than S/N 0201001.

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General Description

The DDA-3280 data distribution amplifier is intended for use with data signals conforming to the ITU Rec. G.703 at the 2.048 Mb/s rate.

The DDA-3280 is primarily intended for use in pairs with a double width rear assembly (ZDA-3280RH) for automatic path protection applications.

Three outputs are provided at the rear of the module with an additional output for monitoring purposes on the front panel. The primary output 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-3280RH dual rear assembly must be used.

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 two modules are side by side. The double width rear assembly is designed specifically for this purpose and provides the best return loss characteristics.
Details of frame types are available separately.

Applications:

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

Standard features:

- Input cable loss to –6dB @ 1024 kHz
- Data regeneration & re-clocking
- Monitor facility
- Power fail bypass facility
- External alarms and bypass
- Redundancy handshake facility
- IRT Eurocard construction compatible with other IRT Eurocard modules and frames
- Dual power supply operation

Equipment provided:

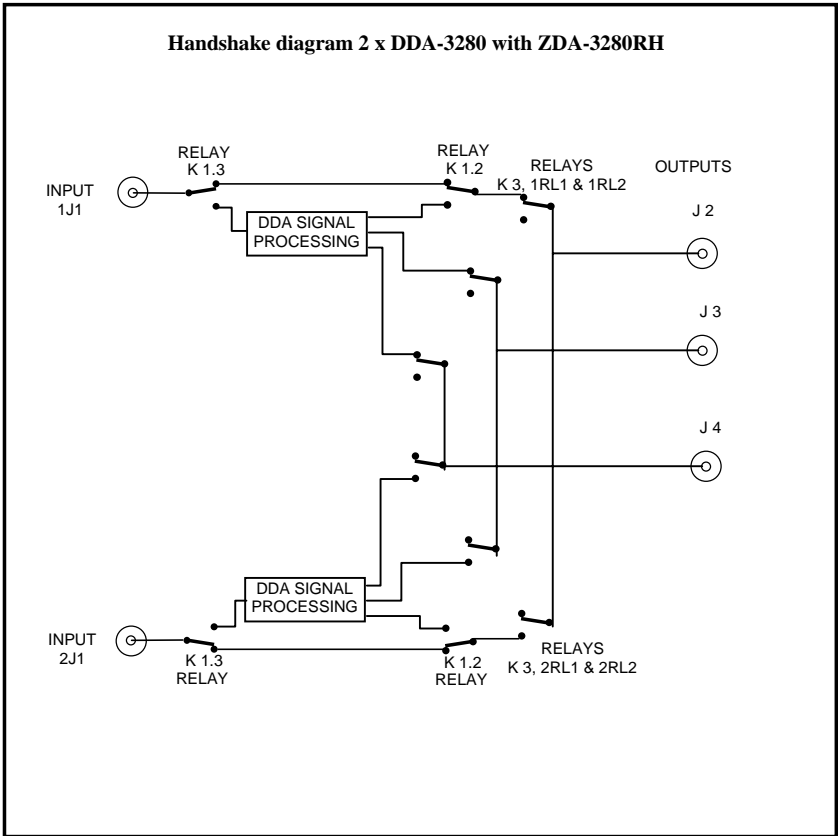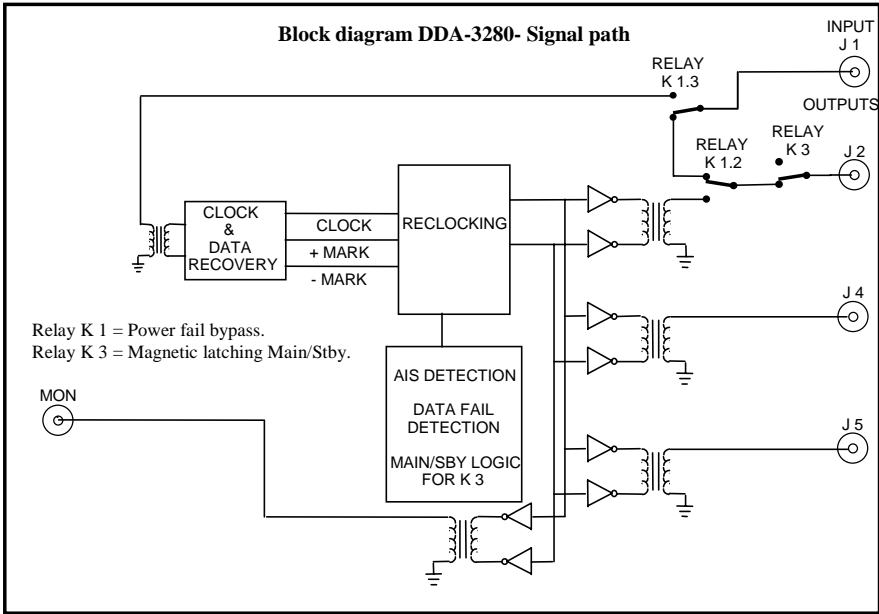**Standard:**   DDA-3280 Data distribution amplifier module.
ZDA-3280 Rear assembly for stand alone DDA-3280.

Accessories available:

ZDA-3280RH Double rear assembly
for handshake: Connects two adjacent DDA-3280's for automatic changeover of all three outputs in the event of a fault being detected.

Functional Diagrams

Block diagram DDA-3280- Signal path

INPUT
J 1

RELAY
K 1.3

OUTPUTS

RELAY
K 1.2

RELAY
K 3

J 2

CLOCK
&
DATA
RECOVERY

CLOCK

RECLOCKING

+ MARK

- MARK

J 4

Relay K 1 = Power fail bypass.
Relay K 3 = Magnetic latching Main/Stby.

AIS DETECTION

DATA FAIL
DETECTION

MAIN/SBY LOGIC
FOR K 3

J 5

MON

Handshake diagram 2 x DDA-3280 with ZDA-3280RH

RELAY
K 1.3

RELAY
K 1.2

RELAYS
K 3, 1RL1 & 1RL2

OUTPUTS

INPUT
1J1

DDA SIGNAL
PROCESSING

J 2

J 3

J 4

DDA SIGNAL
PROCESSING

INPUT
2J1

K 1.3
RELAY

K 1.2
RELAY

RELAYS
K 3, 2RL1 & 2RL2

Technical Specifications

DDA-3280:

2048 kb/s signal data:

Conforms to electrical characteristics CCITT G.703 2048 kHz synchronisation interface – see below.

Input:

Type	Transformer coupled.
Impedance	75 Ω terminated.
Cable Loss	6 dB @ 1024 kHz (650m of Belden 8281).

Outputs:

Type	Transformer coupled.
Number	3 switched, regenerated, reclocked outputs located on rear connection assembly and one located on front panel.
Impedance	75 Ω source terminated.

Controls & alarms:

DC power
Data loss
Module in service
Module in standby
Bypass
General alarm
Changeover 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 1) 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

Connectors:

	Data:	BNC
	Alarm:	Krone LSA plus

Indicators:

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

Other:

Power requirements		28 Vac CT (14-0-14) or ± 16 Vdc
Power consumption		170 mA. (5.5 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 enamel, 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		Instruction manual.

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

Electrical characteristics CCITT G.703 2048 kb/s:

Pair each direction	One coaxial pair.
Test load impedance	75 Ω resistive.
Signal level	2.37 Vp.
Nominal pulse width	244 ns.
Code conversion	HDB3.
Pulse shape	Fig. 15/G.703.
Jitter at input port	§ 3 of recommendation G.823.
Jitter at output port	§ 2 of recommendation G.823.
Return loss at input ports:	
51 kHz to 102 kHz	12 dB.
102 kHz to 2048 kHz	18 dB.
2048 kHz to 3072 kHz	14 dB.

ZDA-3280RH Technical Specifications

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 1) 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.

Connectors:

	Data:	BNC.
	Alarm:	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 1)
  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 *Reserve*.

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

Coding characteristics - G.703:

The **HDB3** (High Density Bi-polar of order 3) code as defined in G.703 for 2048 kb/s is as follows:

Binary 1 bits are represented by alternate positive and negative pulses and binary 0 bits by spaces. Exceptions are made when strings of successive 0 bits occur in the binary signal.

Each block of 4 successive zeros is replaced by 000V or B00V where B is an inserted pulse of the correct polarity and V is an inserted pulse violating the polarity rule. The choice of 000V or B00V is made so that the number of B pulses between consecutive V pulses is odd so that successive V pulses are of alternate polarity and so no DC component is introduced.

G.703 Data Signal Format.

The following waveforms are intended to give some idea of the type of signal at various points in the DDA when in operation. They are not intended as accurate portrayals of either voltage levels or timing.

It can be seen that the original signal has both positive and negative going pulses. This format is used so that the signal does not rely on DC levels. To preserve the AC nature of the signal a coding system is used to ensure that a succession of either '1's or '0's in the original data does not produce a DC output. The coding system varies according to the type of G.703 signal, HDB3 or B3ZS. 2048 kb/s signals are coded as HDB3 (See specification characteristics above).

It can be seen that the cable effected signal bears little resemblance to the original signal and due to the high frequency attenuation looks more like a noisy analogue signal than a digital signal.

The signal is separated into +ve and -ve mark signals as shown. The relative timing of these signals must be closely maintained or the final re-clocked output signal will not be accurate.

The re-clocking circuit acts on each of the +ve and -ve mark signals by detecting the data rate with a ringing circuit, which has a sufficiently ring time to maintain the clock frequency in the presence of the maximum length '0' data signal.

The re-clocked +ve and -ve mark signals are fed to separate output drivers for each output where they are recombined in the output transformers resulting in an output signal as shown which is the same as the original signal.

Original signal

Cable effected signal

Positive mark signal

Negative mark signal
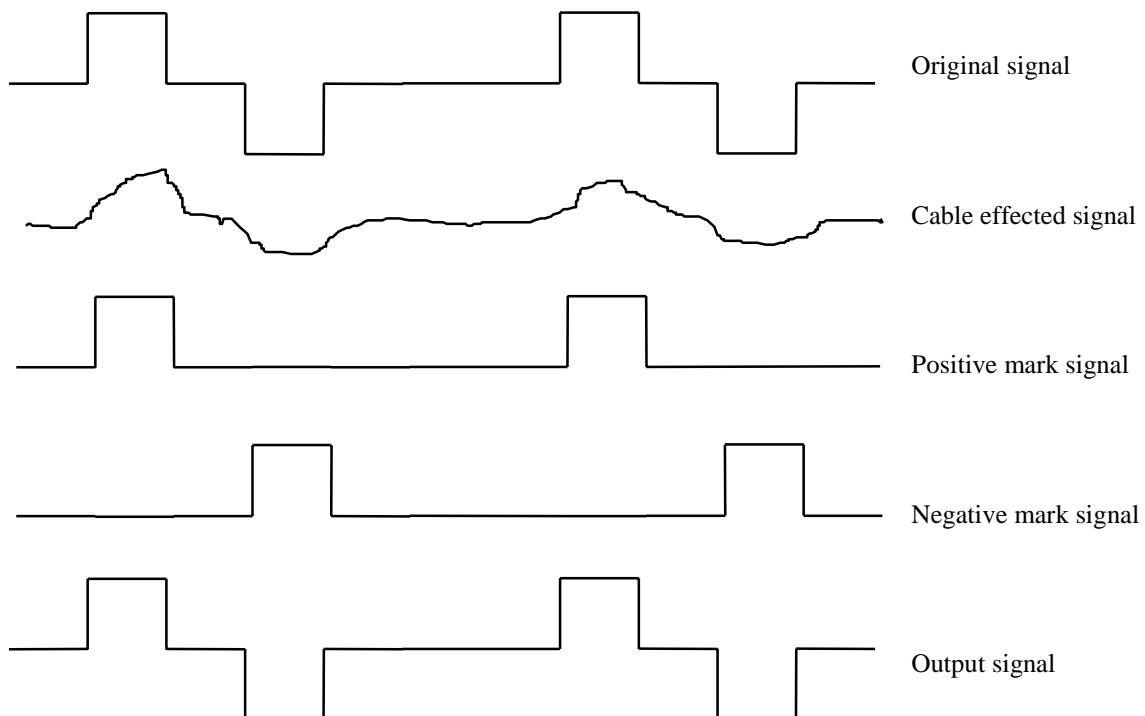
Output signal

Description of Operation

See block diagrams commencing on page 4 and schematic diagrams at rear of this manual.

Input:

The G.703 input signal is connected to the input circuit of the amplifier.

If no power is present, and the amplifier was active before the power was removed, then the signal will be directed to the output connector via K 1 and K 3. When power is applied the K 1 relays operate and switch the signal via the amplifier to the K 3 relay and thence the output connectors.
In this power fail mode, the connection from input to output is passive and so only one output can be connected.

The K 3 relay is of the bi-stable magnetic latching type and so will only change state when an imbalance of drive occurs between the *set* and *reset* coils. The K 3 relay is operated under the control of the logic processor *main select* via transistor driver Q 8 to the *set* coil and released by any external signal present via pin 15a of the rear connector to the *reset* coil.

When power is applied to the DDA, the logic circuit will cause the K 3 relay to be *set*. If two DDA's are connected in handshake configuration, one of the two will take control first and become the *main* amplifier causing the other to become the *standby*.

Either module can be made *main* by pressing the change request button on the front panel of the required module provided that no alarms are present. An external changeover request may also be made via pin 3 of SK 2 alarm/control connector on the rear panel provided that the changeover inhibit switch on the front panel is not in the inhibit position.

When the K 3 relay is in the *reset* position the input path from the input connector and the K 1 relay is terminated in 75 Ω to preserve the loading on the input.

Active path:

Input switching & equaliser:

The signal from the K 1a relay connects to the input transformer,T2, and data/clock recovery IC, U1, which generates +ve and –ve mark signals and the received clock.

Logic processing, reclocking and AIS detection:

The main logic processing, reclocking, error detection and operational interfacing are all performed by logic circuits within U 4, which is a custom-programmed large scale logic array. 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 at the G.703 data bit rate specified for the DDA. 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 >2048 1's) and will set the AIS flag and the general alarm relay output will be activated connecting the general alarm output contact to ground.

Note however that when data errors or no data is detected that the DDA-3280 does not generate an outgoing AIS data stream to the data outputs.

The AIS alarm system may be disabled by a link on the main board LK 1. 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 effect the general alarm being activated by data or signal loss as described above.

Power on reset:

When power is applied to the unit, U 6 generates a *power on reset* signal. 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.

For operation in handshake mode see *Handshake* operation description.

ARA in & urgent alarm out.

These facilities are not enabled at this time.

Data signal output drivers.

The reclocked +ve and -ve mark signals are bussed to output drivers U 7 to 10.
Each output driver consists of three inverters operating in parallel in order to obtain a high current output capability for driving the output transformer without stressing any individual amplifier.

Diodes are connected across the transformer primary to ground and the inverter output to +5V to prevent any back EMF from causing damage to the drivers. The resistors between the output drivers and the output transformer set the correct output operating pulse amplitude to ±2.37 V measured at the output connectors.

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 1)
>
> 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 the handshake double rear assembly ZDA-3280RH.

This rear assembly makes all the necessary connections for both logic and data signals when two DDA's are inserted side by side in a 3 RU frame.

Individual alarm outputs are provided for each module.

Detailed operational description:
Connections for handshake (paired) operation of two DDA-3280's are shown in the following diagram.

ZDA-3280RH handshake connections
(Three switched outputs)
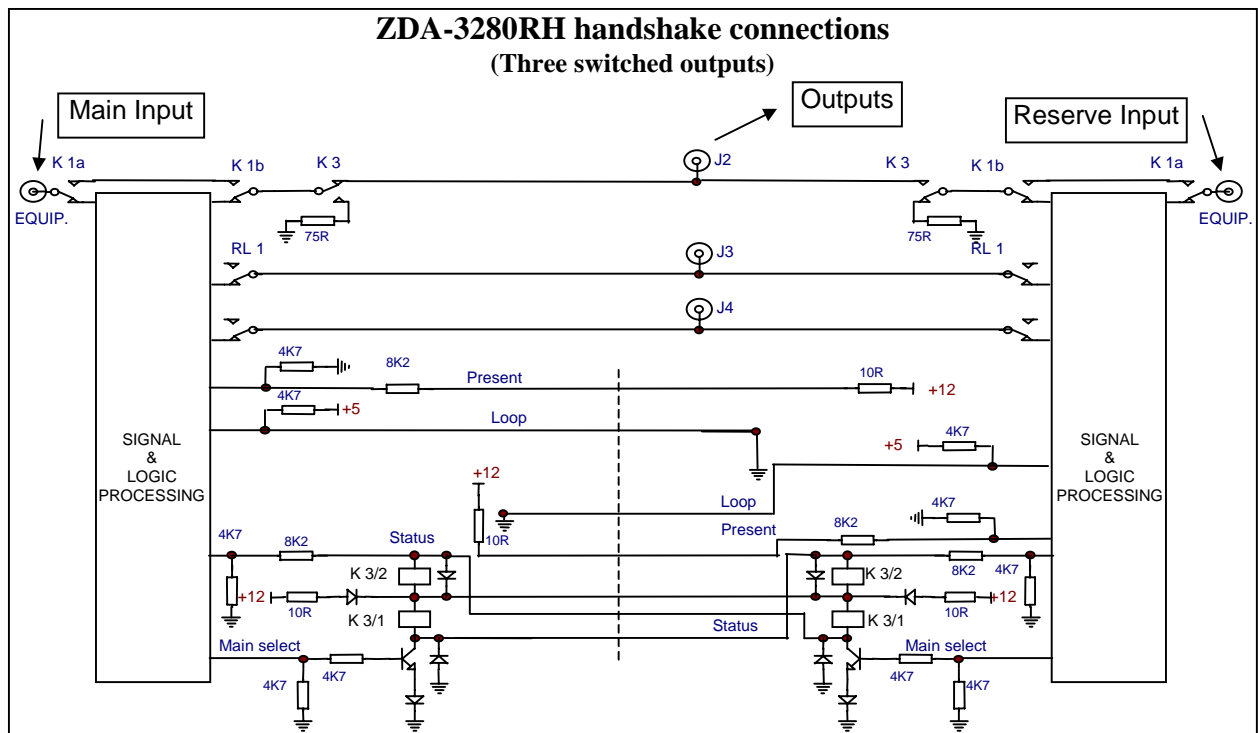
Inputs & outputs:
The two modules are supplied with signals from separate paths to their input connectors on the rear of the module. For the purposes of description these are designated as the main and reserve inputs although they may be of equal standing.

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.

Operation:

Handshake mode detection:

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

The *Loop* signal on pin 16a is connected to ground when another module is connected and the *Present* signal on pin 16b detects the presence of power on the alternate module.

If the *Loop* signal is not connected to ground then all handshake operations are inhibited.

If the loop signal is at ground indicating the presence of an alternate module and if power is present on both modules then normal handshake operation is permitted. If the *Present* signal indicates that power is lost on the alternate module then the module with power will take control and become *Main*.

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 K 3 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.

In either case, the *Main Status* line will go from LO to HI. The companion module, on detecting this change, will switch its *Main Select* line to HI. The K 3/1 relay driver then activates the relay (hence becoming *Main*) and sends the *Status* line to the first module LO confirming the change and preventing that module from attempting to become *Main* again.

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*. This forces the *Status* line to the other module to LO and it immediately responds to become *Reserve*.

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.

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.

Internal Adjustments

The only internal adjustment that may be made by the user is link LK 1, which may be set to disable AIS detection if required.

This module uses a programmable logic device as the main processing circuit. This device must be correctly programmed is only obtainable through IRT. No attempt should be made to substitute other devices or to programme a similar device as this could cause extensive damage to the module.

Installation

Installation in frame or chassis:

See details in separate manual for selected frame type.

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 600 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	K 1 relay status - connection to ground indicates module is in bypass mode.
		2	K 2 relay status - connection to ground indicates module is *Main* in handshake mode.
		3	External changeover request - connection to ground will make this module *Main* in handshake mode.
		4	Ground.

Front & rear panel diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show relative positions of connectors, indicators and controls only.
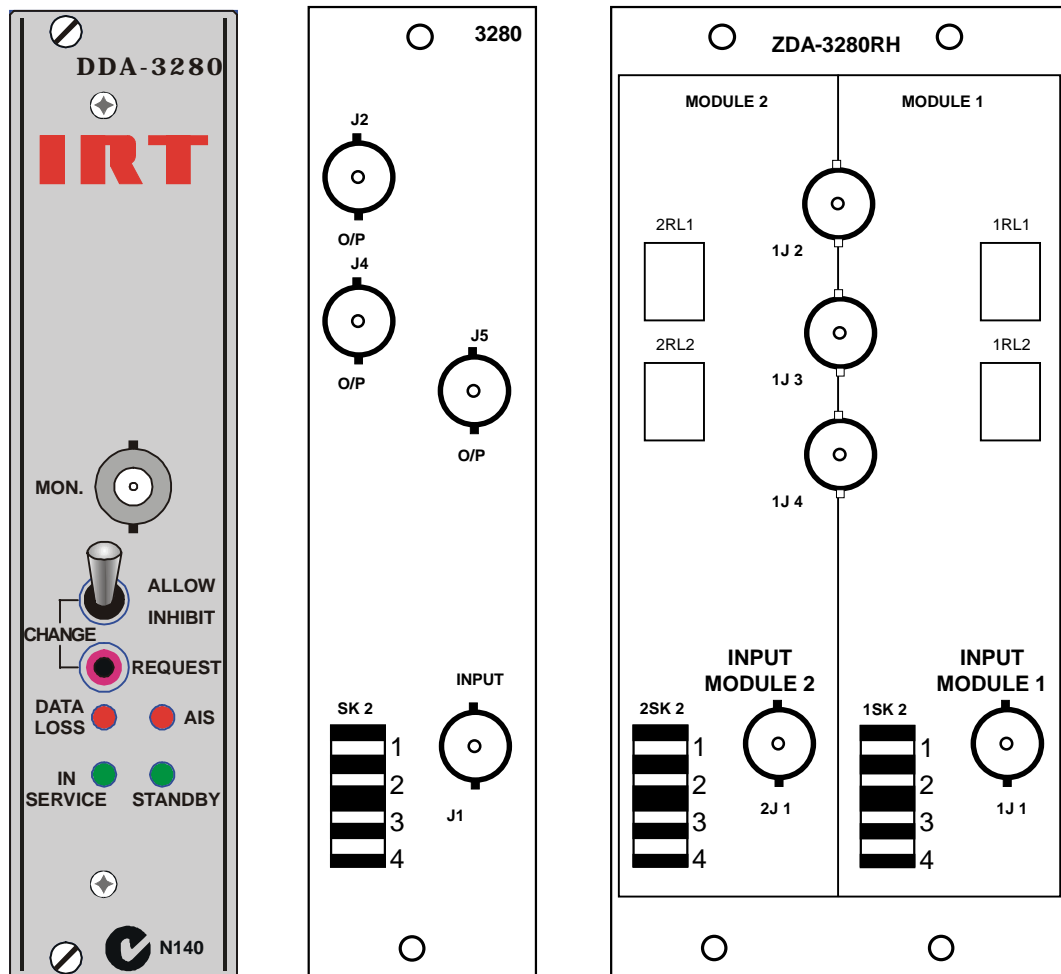
Warranty & service

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 $A100.00 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 $A100.00 will apply, whether the equipment is within the warranty period or not.

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
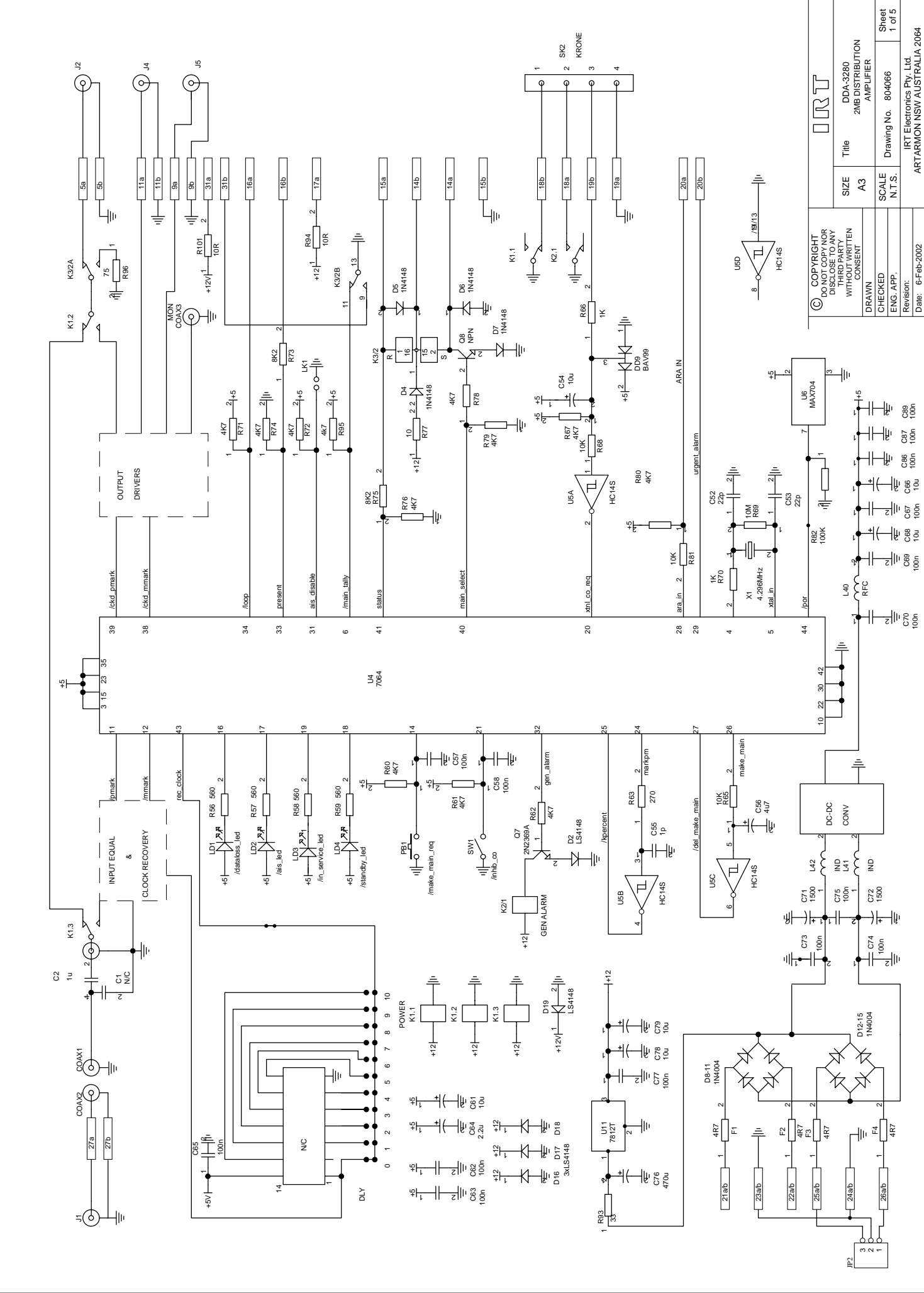26 Hotham Parade
ARTARMON
N.S.W. 2064
AUSTRALIA

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

Drawing index

IRT

SIZE A3	Title	DDA-3280 2MB DISTRIBUTION AMPLIFIER
SCALE N.T.S.	Drawing No. 804066	Sheet 2 of 5

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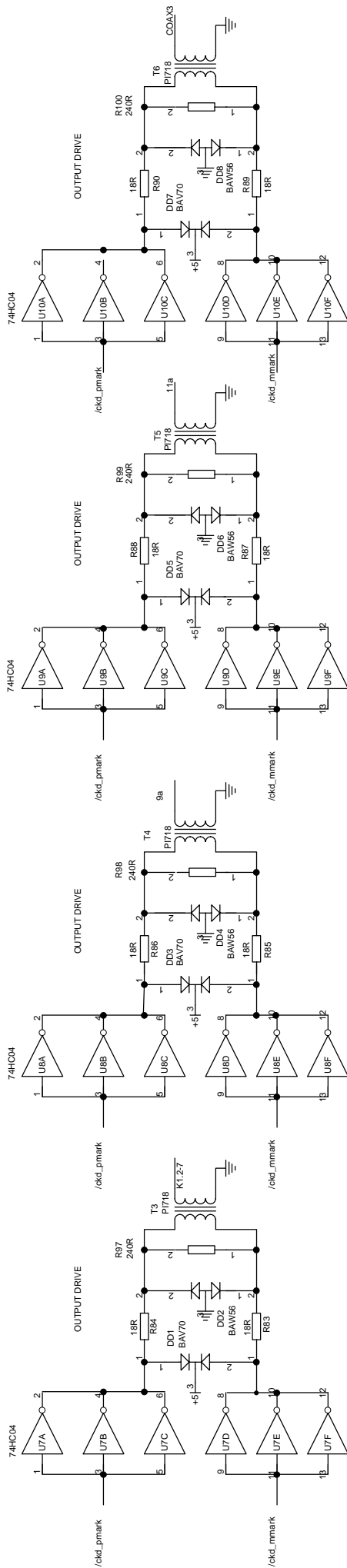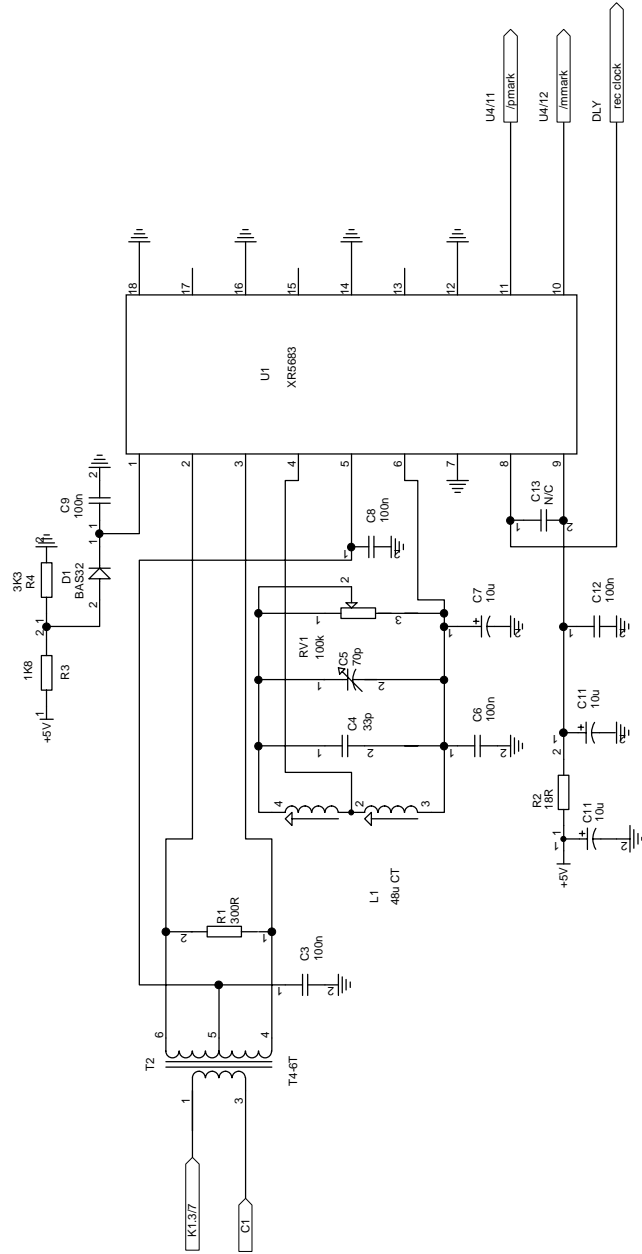ENG. APP.
Revision:
Date: 6-Feb-2002

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+5V = PIN 14 U5,U7,U8,U9,U10

GND = PIN 7 U1,U5,U7,U8,U9,U10

BLOCK DIAGRAM DDA-3280 SIGNAL PATH

INPUT
J1

OUTPUT
J2
75R

RELAY
K3

RELAY
K1b

OUTPUT
J4

OUTPUT
J5

AIS DETECTION
DATA FAIL DETECTION
MAIN/SBY LOGIC FOR K3

CLOCK
+MARK
-MARK

CLOCK AND DATA
RECOVERY

RELAY
K1a

MON.

IRT

SIZE
A3

Title   DDA-3280
2MB DATA DISTRIBUTION
AMPLIFIER

Sheet
3 of 5

SCALE
N.T.S.

Drawing No.   804066

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BLOCK DIAGRAM DDA-3280 EXTERNAL LOGIC

LOOP OUTPUT
J2

OUTPUT
J4

OUTPUT
J5

MON.

RELAY
K3
75R

RELAY
K1b

RELAY
K1a

INPUT

K1
+12V

SIGNAL
&
LOGIC
PROCESSING

Data loss LED   +5V
AIS LED   +5V
In service LED   +5V
Standby LED   +5V

Make main   +5V   4K7
Inhibit   +5V   4K7

Gen.alarm
K2
+12V   4K7

SK2 KRONE
Power Fail
Gen. alarm
Ext C/O Req.
Grnd

K1c
K2
1K
+5V   4K7
+5V
+5V
+6V
10K

IRT

SIZE A3

SCALE N.T.S.

Title   DDA-3280
2MB DATA DISTRIBUTION
AMPLIFIER

Drawing No. 804066

Sheet 4 of 5

DRAWN
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ENG. APP.
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SK2
1 : POWER FAIL
2 : GENERAL ALARM
3 : REQUEST CHANGE OVER
4 : GROUND

1 10/01/99