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IRT Eurocard

Type RWA-2310

Reverse Path Amplifier

Telstra serial items:
347/99 RWA-2310
347/105 Manual for RWA-2310
347/106 FRU-2300
347/108 PSU-2300

Designed and manufactured in Australia

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

IRT Eurocard

Type RWA-2310

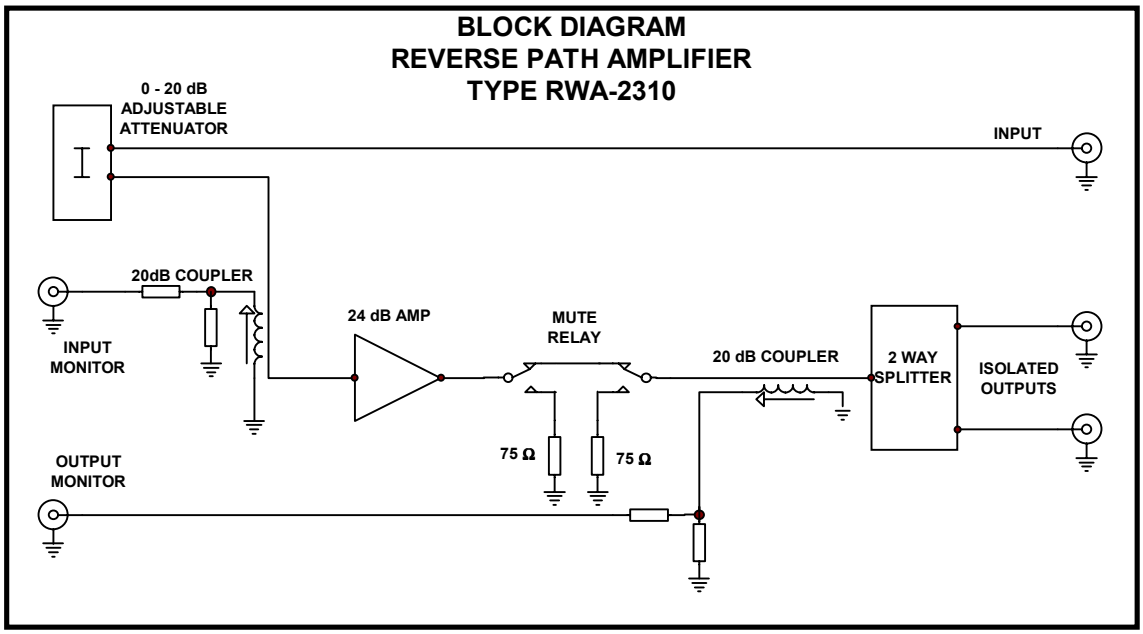
Reverse Path Amplifier

Instruction Book

Table of Contents

This instruction book applies to units later than S/N 9612000.

General Description



The RWA-2310 has been designed to provide amplification of signals in the reverse path of cable TV distribution systems.

An input attenuator with a 20 dB range provides gain control to optimise signal levels at the output.

The frequency response of the amplifier is tailored to give optimum low noise amplification to the reverse path signals which normally lie between 5 and 100 MHz.

In addition the RWA-2310 is constructed with a high level of RF shielding which eliminates both ingress and egress of unwanted RF signals.

Two types of frame are available for the RWA-2310 to suit different types of application:

The FRU-2300 allows 10 RWA-2310's to be mounted in one 3 RU frame together with two PSU's which may be either 240 Vac or -48 Vdc.

The FRU-2310 allows 2 RWA-2310's to be mounted in one 1 RU frame together with an inbuilt single 240 Vac PSU.

Standard features:

- 2 - 200 MHz frequency response specially contoured for use in reverse path of cable TV distribution.
- Very low noise.
- 0 - 20 dB variable input gain control.
- Local or remote muting.
- Input and output monitoring on front panel.
- Power loss alarm output.

Technical Specifications
IRT Eurocard module
Type RWA-2310

RF:

Input:

Type	DC coupled.
Number	1.
Impedance	75 Ω.
Return loss	> 16 dB (2 - 200 MHz).
Maximum input level	> +50 dBmV.

Outputs:

Type	DC coupled.
Number	2.
Impedance	75 Ω.
Return Loss	> 18 dB (2 - 200 MHz).
Isolation between outputs	> 20 dB (2 - 200 MHz).
Maximum output level	>+50 dBmV at 200 MHz.

Monitoring outputs:

Input monitor:		AC coupled.
	Impedance	75 Ω.
	Level	-20 dB
Output monitor:		AC coupled.
	Impedance	75 Ω.
	Level	-20 dB

Performance:

Gain		0 to +20 dB. Adjustable from front panel.
Frequency Response		2 to 200 MHz (-0.5 dB points). -3dB frequency is typically 340MHz.
Noise	Noise (f = 200 MHz)	6 dB at maximum gain
	CTB (22 channels V_o = 47 dBmV)	-67 dB
	CSO (22 channels V_o = 47 dBmV)	-67 dB
Connectors		BNC
Power requirements		28 Vac or +28 Vdc.
Power consumption		<300 mA

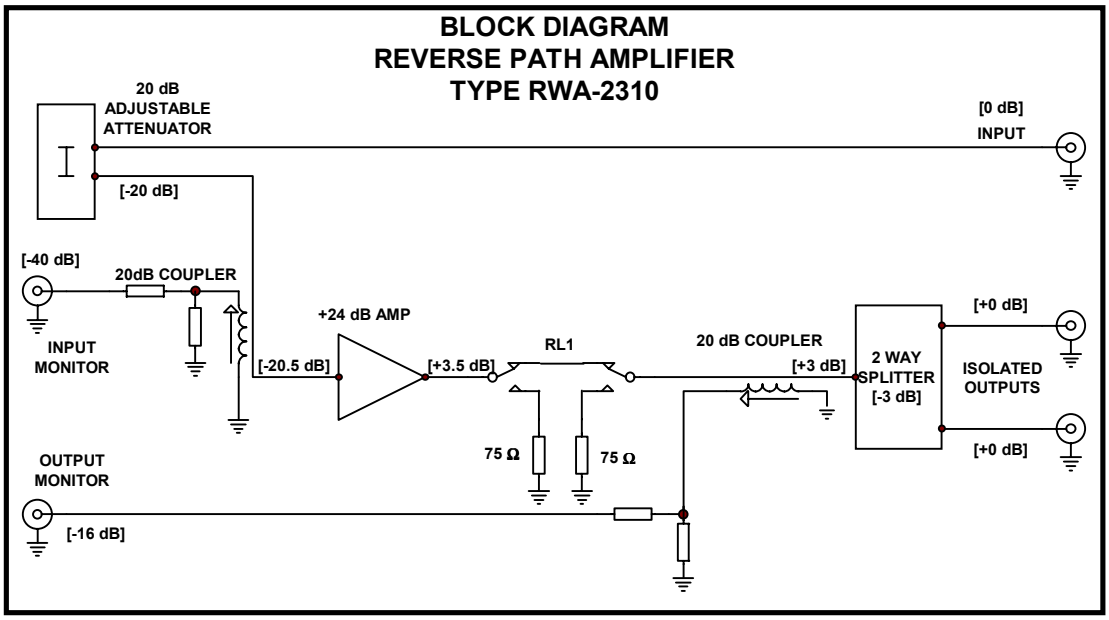
Other:

Temperature range		0 - 45° C ambient
Mechanical		Mounts in IRT 19" rack chassis types FRU-2300 (10 modules in 3 RU*) or FRU-2310 (2 modules in 1 RU). * Maximum number dependent on air circulation - See installation section of manual.
Finish:	Front panel	Grey enamel, silk screened black lettering & red IRT logo
	Rear	Bright steel.
	Case	Alodine finished aluminium.
Dimensions		30 mm x 3 U x 231 mm IRT Eurocard
Optional accessories		Instruction manual

Technical Description

(For detail see diagram 803947)

Signal Path:



The block diagram for the signal path shows the basic layout of the amplifier and its inputs and outputs. The figures in square brackets indicate the approximate signal levels at various points in the circuit when the amplifier is set to unity gain.

The input signal is taken directly to a variable attenuator (maximum 20 dB) whose control is accessible through the front panel of the module.
The attenuator output is connected to the 24 dB gain amplifier via a coupler, which provides a monitoring BNC connector on the front panel with a signal of approximately -20 dB relative to the amplifier input.
This signal may be used to ensure that the signal at the input of the amplifier is sufficiently low as to avoid overloading. The best level will depend on the number of carriers present in the signal and the desired operating level for the system as a whole.

The amplifier output is connected to the output splitter via a muting relay operated switch, which terminates the amplifier output and splitter input in 75 Ohms. This allows the output of the amplifier to be muted if a signal with excessive noise is present which may cause problems for other equipment downstream.

The output of the amplifier is monitored immediately prior to the passive output splitter so as to not introduce a variation in loading between outputs. When measuring output levels using this monitoring point it should be remembered that the actual output level of the amplifier will be 3 dB lower at each output connector in addition to the 20 dB loss in the coupler.

Due to the output splitter being of a passive type it is also essential that both outputs always be terminated in 75 Ohm loads. If one output is not used a termination plug should be fitted to that output.

Amplifier gain. Each coupler itself introduces approximately 0.5 dB of loss in the signal and the output splitter introduces a further 3 dB loss so that with the overall losses exclusive of the attenuator total 4 dB. The amplifier gain is therefore chosen to be 24 dB so that the gain range overall is 0 to 20 dB.

Alarms and controls:

General alarm. This alarm is generated whenever the output of the amplifier is not active due to either loss of power or muting.
When no power is present the normal position for relay contacts RL 2 is with a connection to ground indicating the alarm condition.
When power is applied and no muting signal is present the low impedance of relay coil RL 1 allows the muting control line between diodes D 9 & 10 to rise to nearly the full 24 Vdc power rail. This signal is used to turn on transistor Q 1 which operates relay RL 2 and releases the grounding contact on the alarm output.
When a muting control signal is applied the muting control line falls to near ground and transistor Q 1 turns off resulting in the RL 2 relay contacts closing to ground.

Muting. The muting relay RL 1 may be operated either by the front panel switch or by remote contact closure to ground. In its un-energised state the relay provides a connection between the amplifier and splitter and when energised mutes the output.
The grounding control inputs from the switch and external connector are isolated by diodes D 9 & 10 which provide an OR function. This means that whilst the amplifier may be muted by either means it is not possible to return the amplifier to its normal operating mode unless both the front panel switch and the remote input are in the normal setting.

Pre-Installation

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.

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

Installation in frame or chassis:

See details in separate manual for selected frame type.

Maximum limits:

The enclosed construction of the RWA-2310 gives excellent immunity to electromagnetic interference, but reduces the ability of the electronics inside the casing to dissipate heat.

Adequate air flow should be ensured when modules are placed together in the 3 RU frame to prevent overheating and premature failure of the modules.

Thermal budget:

A fully equipped FRU-2300 frame of RWA-2310's with two PSU's fitted will produce approximately 110 W of heat output.

As a result the following rules should be observed:

1. Frame ventilation should not be obstructed by any equipment mounted immediately above or below the FRU-2300. If possible a 1 RU blank panel should be mounted above and below the frame to ensure that adequate air flow can occur.
2. No more than 8 RWA-2310's should be mounted in an FRU-2300 when free air (unassisted) circulation is the only cooling available or where the ambient temperature exceeds 30°C.

The RWA-2310's should be mounted in the positions shown in the following diagram with front blank panels type FB-700 fitted to the unused positions.

1	2	3	4	5	6	7	8	9	10		
RWA-2310	RWA-2310	RWA-2310	FB-700 BLANK	RWA-2310	RWA-2310	FB-700 BLANK	RWA-2310	RWA-2310	RWA-2310	PSU 1 PT-701 or PSU-2300	PSU 2 PT-701 or PSU-2300

3. All 10 positions in the FRU-2300 may be used when fan forced cooling is available in the rack and the ambient temperature is controlled to less than 30°C.
4. The RWA-2310 should not be mounted in a frame above other equipment which has a high heat output which will increase the effective ambient temperature to above 30°C.

Power Supplies:

When fitted to an FRU-2300 frame the RWA-2310 may be powered by either the PSU-3001 240 Vac PSU or the PSU-2300 -48 Vdc PSU.
In either case it is recommended that two PSU's be fitted at all times so that the power load is shared between the two supplies. In the event of failure of one supply the amplifiers should function within specification whilst operating on the remaining supply as long as the correct input voltage is held to within the specifications for that supply.
However it is not recommended that a full frame of amplifiers be operated on a single supply for an extended period.

Connections:

RF input: This is a single connector with a 75 Ohm input impedance and should be fed from a suitably impedance matched source.

RF outputs: Two outputs are provided which are obtained by a passive output splitter.

It is recommended that the two outputs be loaded in 75 Ohm terminations at all times.

If one output is not to be connected to external equipment it should be fitted with a 75 Ohm termination plug. Failure to observe this may result in a noticeable drop in performance in the output being used.

Mute input: The external mute input presents an open circuit voltage of approximately +24 Vdc and may be operated by either a contact closure to ground or by an open collector transistor driver. The connection to this input must be capable of sinking a current of at least 15 mA.
The mute input is connected from the 9 pin 'D' connector at the rear of the module via the frame motherboard to a Krone IDC connector mounted on the rear of the frame for each module. Connection details are marked on the frame.

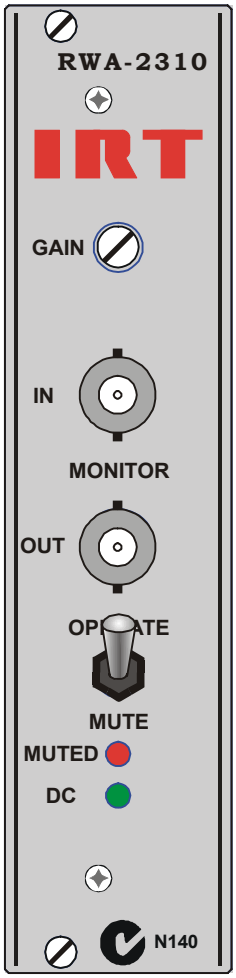
Alarm output: The alarm output makes contact to ground in the alarm condition and is open circuit in the normal condition. The maximum rating on the relay contacts is 30 V (AC or DC) @ 500 mA.
The alarm output is connected from the 9 pin 'D' connector at the rear of the module via the frame motherboard to a Krone IDC connector mounted on the rear of the frame for each module. Connection details are marked on the frame.

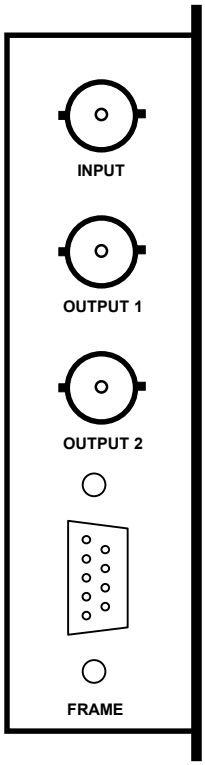
9 pin 'D' connector:
The 9 pin 'D' connector provides connection to the selected frame for power supply inputs for either one or two power supplies and for the alarm output and mute input signals.
This connector mates with a matching connector on the selected frame type and the necessary external connections for the alarm and mute signals are made to the frame and not the module.
The following pin connection details for the 9 pin connector are therefore given for service and general information purposes only.

Pin	Connection
1	Gnd
2	AC 1 or DC +ve
3	AC 1 or DC -ve
4	No connection
5	Mute
6	AC 2 or DC +ve
7	AC 2 or DC -ve
8	Gnd
9	General alarm

Front & rear panel connector 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.





IRT Eurocard Frame

Type FRU-2300

General Description

The purpose of the FRU-2300 is to provide an economical and compact mechanical framing system for IRT 2300 series Eurocard RF shielded modules.

In addition the frame provides a power supply bus to reticulate power from one or two common low voltage power supply units to all modules in the frame.

A total of ten 2300 series IRT Euro-modules and two power supply units can be accommodated in one FRU-2300 3 Rack Unit Frame.

A choice of power supply units is available to provide power from either AC or DC supplies. Each supply is capable of supporting a full frame of cards on its own and AC and DC fed supplies may be mixed in the same frame.

IRT 2000 series Eurocard RF shielded modules are fully enclosed boxes designed to prevent the ingress or egress of electromagnetic interference. The module is complete with front fascia panel and rear signal and power connectors which provides the necessary connections to the frame PSU's other equipment.

The module can be inserted or removed from the frame from the front. When inserted one connector on the rear mates with a motherboard connector which carries the data and power supply connections.

Although the module may be inserted or removed from the front of the frame, care must be taken when doing so to ensure that the connections to the rear of the module have sufficient slack cable for this to be accomplished. If this is not the case all cables should be disconnected before attempting to remove the module from the frame.

Technical Specifications
IRT Eurocard frame
Type FRU-2300

Power:

Input power:	AC	AC mains input (240 Vac ±10%)
		and / or
	DC	-48 Vdc ±25%.
Input power fuses	AC	SLO-BLO 500 mA.
	DC	Fused in PSU-2300 PSU module.
Output power to module bus:	AC	28 Vac from PT-701
		and / or
	DC	+28 Vdc from PSU-2300

Connectors:

Modules		DB female 9 pin RF filtered.
Power module to frame		H15FP4 H15 female 4 mm PCB mounting.
Power input to frame	AC	IEC 320 with integral fuse holder.
	DC	Klippon MK 1/3 3 pin termination block 2616.
Alarm / control		Krone IDC (1 per module).

Other:

Temperature range	0 - 50° C ambient.
Mechanical	3 RU (482 mm x 132 mm) standard 19” rack frame. Suitable for mounting in standard 19" racks.
Finish	Natural anodised aluminium frame with bright passivated steel side panels & rear power connection box with black silk screened lettering.
Dimensions	482 x 132 x 285 mm (Frame empty.) Clearance width 445 mm.
Optional accessories	PT-701 single power supply module 240 Vac input. PSU-2300 single power supply module -48 Vdc input.

Circuit Description

The FRU-2300 provides a circuit path to the modules for two complementary supplies and a ground earth reference making a total of five busses. One supply buss pair is obtained from each of the two PSU module locations. Each supply buss may be either AC or DC according to the type of power supply module selected.

The outputs of the two types of supply are floating with respect to ground.
In the case of the AC type supply this will result in a symmetrical output for the two AC busses due to the action of the bridge rectifiers in the connected modules.
In the case of the DC type supply the negative side will rise to approximately +0.7 Vdc due to the action of the conducting diodes in the negative side of the bridge rectifiers in the connected modules.

The ground supply buss is connected directly to the chassis, safety earth of the 240 Vac IEC input connectors and the +ve side of the -48 Vdc input connector.

The power supply modules connect to the mother board via special H15FP4 connectors. This allows the modules to be inserted or removed safely whilst power is applied to the frame inputs.

An alarm circuit is provided which connects to the two PSU's. When operating normally the alarm is open circuit. When supply is lost the alarm line is grounded.

When both PSU's are installed a failure of either PSU will enable the alarm.

Connection to modules is made via 9 pin D connectors as described in the *General Description*.

Connector pin designations are as follows:

9 pin D Eurocard module connector:

Pins	Designation		
1	Gnd.		
2	AC/1 +	or	+32 Vdc/1.
3	AC/2 +	or	+32 Vdc/2.
4	No connection.		
5	Mute.		
6	AC/1 -	or	0 Vdc/1.
7	AC/2 -	or	0 Vdc/2.
8	Gnd.		
9	Tally.		

Special note: Whilst this frame appears at first sight to be similar to the FR-748A Eurocard frame for 700 & 3000 series Eurocards, there are major differences which make the two quite incompatible.
Please note especially that whilst the PT-701 PSU is able to be used in both the FR-748A & FRU-2300 that the PT-748A PSU is incompatible and to safeguard against accidental insertion the power supply contacts for the PT-748A PSU make no connection in the FRU-2300.

Installation

Operational Safety

WARNING

Operation of electronic equipment involves the use of voltages and currents which may be dangerous to human life. Maintenance personnel should observe all safety regulations. Do not change components or make adjustments inside the equipment with power **ON** unless proper precautions are observed. Note that under certain conditions dangerous potentials may exist in some circuits even though power controls are in the **OFF** position.

Modules & PSU's

FRU-2300 Frame:

Eurocard Module
Slide the module into its appropriate position and tighten the two retaining screws. If the module does not seem to be fully inserted check that the module is not being fouled by any cables at the rear.

Rear Connections
Signal connections. These are made directly to the rear of the module. If it is desired to be able to remove the module without accessing the rear of the frame to disconnect the cables it will be necessary to ensure that approximately 300 mm of additional cable is provided, on each connection, which can readily be withdrawn through the frame to a sufficient distance to disconnect at the front of the frame.

Data connections: These are made to a three way Krone IDC connector above each module. The three connections are designated to suit the RWA-2300 reverse path RF amplifier module as follows:

Pin	Connection
1	Mute - connected to pin 5 of the DB 9 module connector.
2	Tally - connected to pin 9 of the DB 9 module connector.
3	Ground - connected directly to chassis / PSU ground reference.

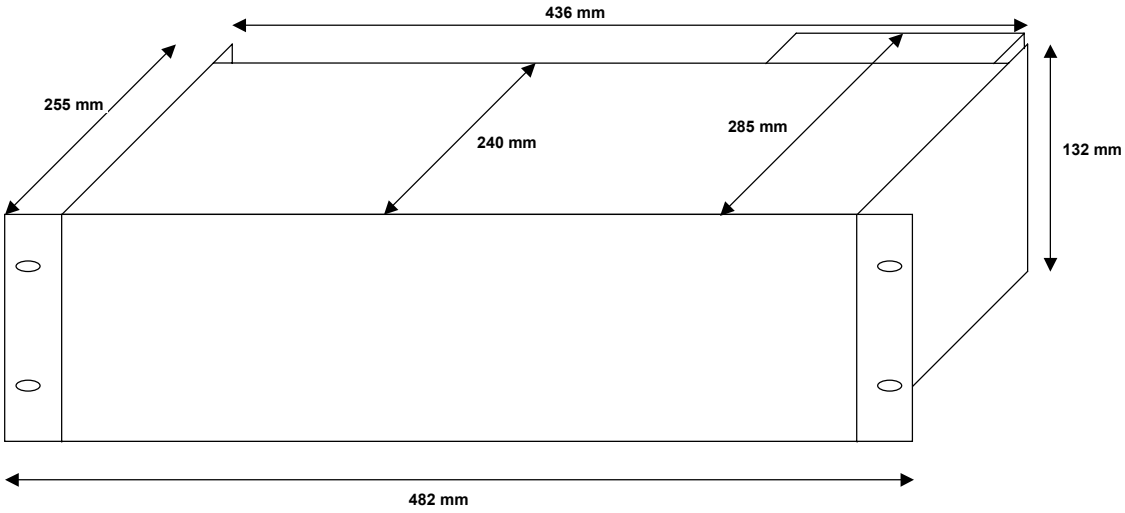
Power Supply
The frame will operate with either one or two power supply modules installed.
The power supply module should be slid into either slot 11 or 12 at the right hand end of the frame. The four retaining screws on the front should be tightened.

Connect power input to rear of frame. For DC input; observe the polarity markings next to each connector.

Due to its weight if the frame is to be freighted for any purpose the power supply should be removed and packed separately before shipment.

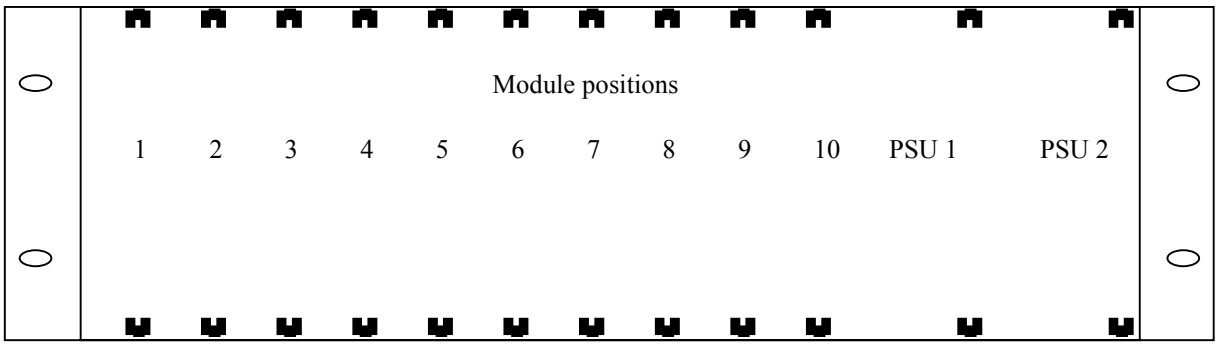
FRU-2300 Dimensional diagram

Note: Dimensions on this diagram are approximate only and do not take into account any connections at the front or rear. Dimensions indicated are intended as a guide for cable installation purposes only.

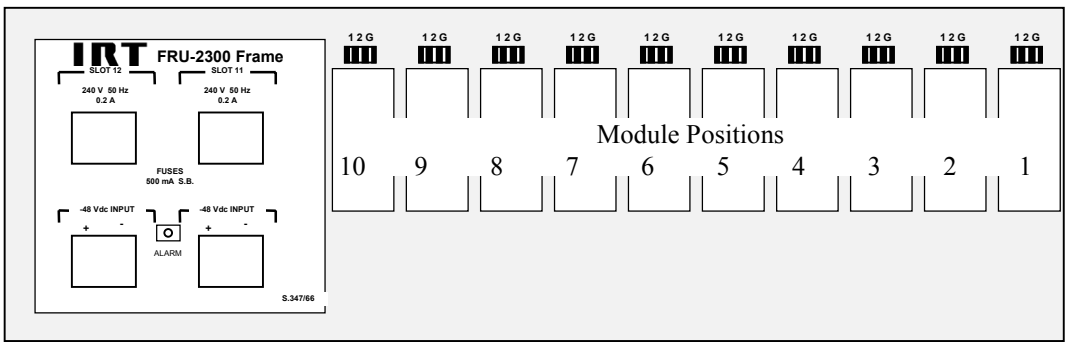


The following diagrams are not to scale and are intended only to show relative locations.

FRU-2300 Front View



FRU-2300 Rear View



IRT Power Supply for Eurocard
-48 Vdc to +29 Vdc
Type PSU-2300

GENERAL DESCRIPTION

The PSU-2300 is designed to provide complementary low voltage DC power supplies required for operation of up to 10 IRT RWA-2310 Eurocard modules.

The IRT PSU-2300 DC-DC converter converts a nominal 48V input voltage to +29V with respect to ground.

Two PSU-2300s can be operated redundantly when using an FRU-2300 Frame. The redundant power supply facility of the PSU-2300 is enabled in each IRT RWA-2310 by having the power supply circuit of each module made up of two bridge rectifier circuits with the outputs connected in parallel. This allows the +29 volts to be sourced from either PSU-2300.

A front panel LED indicator provides visual confirmation of the presence of the low voltage output.

An alarm relay is also included which will activate the alarm if the output fails.

The PSU-2300 is available in -48 Vdc only and is not configurable by the user.

TECHNICAL SPECIFICATIONS

IRT Eurocard Dual Power Supply Module
Type PSU-2300

Power Requirements:

Voltage	48 Vdc ± 25% Positive ground.
Power	1.5 A maximum.
Fusing	2 A

Output voltage:

+29V @ 2.8A

Connectors:

DC power input / output		H15MFAV32 male, Faston

Other:

Temperature range		0 - 50° C ambient
Mechanical		Suitable for mounting in FRU-2300 rack frame
Finish:	Front panel	Grey enamel, silk screened black lettering & red IRT logo
	Body	Passivated steel with silk screened black lettering.
Dimensions		6 HP x 3 U x 230 mm

CIRCUIT DESCRIPTION

The PSU-2300 consists of a DC-DC converter circuit which provides a 29 Vdc output..

The DC input circuitry consists of a safety fuse followed by a low value series resistance and over-voltage protection zener diode and a number of RF suppression components.

The front panel LED power indicator and alarm relay are powered from the output rail by way of a series zener diode so that if the rail voltage falls there is insufficient voltage to operate the relay and the LED dims sufficiently to indicate the fault condition.

The alarm is shown in the unenergised position. When operating normally the alarm is open circuit. When supply is lost the alarm line is grounded.

INSTALLATION & SERVICING

FRU-2300 Frame:

The PSU-2300 should be slid firmly into either of the two double width slots (11 & 12) at the right of the frame. The four retaining screws on the front should then be tightened.

Power to the PSU-2300 is supplied from a connector located on the rear of the FRU-2300 immediately to the rear of the module. Care should be taken to observe the correct polarity as marked when connecting DC to this connector.

The alarm output connector is located on the rear of the FRU-2300 frame and is common to both supply units when installed. The alarms for both units are in parallel such that when a fault develops in either PSU the alarm output will be grounded.

WARNING - Each PSU-2300 dissipates up to 10 Watts and a full frame of ten RWA-2310s and two PSU-2300's dissipates nearly 100 Watts. Ensure that adequate ventilation is available to keep down the operating temperature. If possible at least 44.5mm (1RU) should be left clear above each frame.

Internal adjustments:

The PSU-2300 is factory set for the correct output voltage and should not require re-adjustment unless one of the DC - DC converters is replaced.

Adjust RV 2 for +29 Vdc

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 $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.

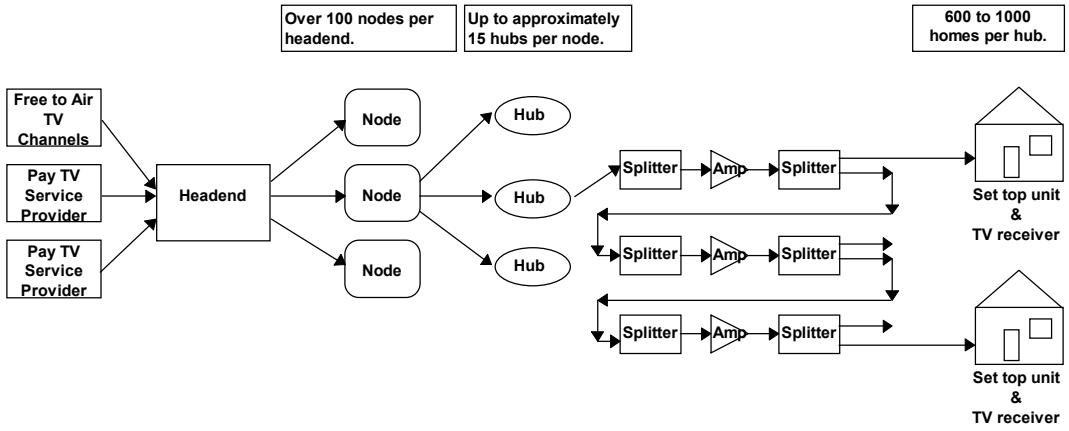
The equipment should be returned **to the agent who originally supplied the equipment or, where this is not possible**, to IRT direct as follows.

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

HFC Cable TV Network Overview

Typical Hybrid Fibre - Coaxial Pay TV Distribution System



The Forward path:
In a Hybrid Fibre Co-axial cable (HFC) network the forward path has a broadband RF capacity bandwidth from approximately 85 MHz to 750 MHz. This wide bandwidth is due to the large requirements of the pay TV application.
Signals from various program providers are concentrated at *HeadEnds* for distribution through the system on a single cable or fibre connection. The input signals to the HeadEnds may be provided over baseband coaxial cable or fibre optic links or in the case of free to air broadcast channels may be demodulated from a locally available signal off air. These signals are modulated and combined to provide a single wideband multichannel signal for distribution.

From the Headend the signals are amplified and converted into optical signals for transport down dedicated fibres to a *node*. Each node is strategically located to cater for approximately 10,000 customers.
From each node the signals are distributed to a *hub* which may service between 500 and 1000 customer sites. At the hub the signal is converted form optical to electrical and amplified before travelling down a coaxial cable for final distribution.

Currently the final distribution to the customer uses amplitude modulation (AM) for ease of interfacing with current set top decoders.

In the final distribution via coaxial cable a combination of splitters and amplifiers is employed and in any particular connection a total of three amplifiers may be present.

This forward path topology ensures that the highest quality of signal is maintained with very low noise by the use of optical fibre transport technology until the final stage of distribution. From this point the high signal level allows the signal to noise ratio to be maintained at high levels as far as the subscriber connection.

The Reverse path:
Whilst the forward path provides an adequate system for distribution of programme material to subscribers it is unidirectional due to the amplifiers and other active hardware in the system. Yet the fibre optic and coaxial cables themselves are able to carry traffic in either direction and so the opportunity is presented to make a bidirectional system which makes provides a better return on the investment in cable and fibre installation.

Provided the bandwidth is sufficient and the signal to noise ratio is kept high the reverse path can be used to provide a wide variety of services which may or may not be related to the primary signals carried in the forward path.

Examples of such services are telephony, high speed data for computer access to the Internet, ISDN services, impulse pay per view (IPPV) registration, movies on demand, home shopping and status monitoring and control (SM&C). Each of these services requires a link back to the service provider.

Whilst IPPV and SM&C services contain only small amounts of information and are suitable for a polled service occupying a minimal bandwidth of less than 1 MHz, telephony, Internet and ISDN require both a larger bandwidth and are typically connected for quite long durations. In addition, Internet, ISDN and data modem services in general require a low noise path in order to minimise date errors.

In order to provide such a reverse path it is necessary to overcome the losses introduced by the passive splitters in the forward path and at each point of amplification provide a reverse path around the forward amplifier. In addition it should be noted that whilst the forward path is a divergent system, and noise levels are relatively easy to control, that the reverse path is convergent and so the noise from every source adds to that of every other across the whole available bandwidth.

It is therefore important that the amplifiers in the reverse path have a controlled bandwidth response to exclude signals in the forward path and that the intrinsic noise of each amplifier be minimal both in band and out of band. In addition to low noise, high speed data services require a minimal group delay through the system and this must therefore be taken into account at every point in the system.

Different types of reverse path amplifier are required at different points in the reverse path.
In the cables leading from the hubs; small reverse path amplifiers with directional couplers are required to be located in the same housing as the forward path amplifiers.
At the hub the reverse path signal is separated from the forward path signal so that it may be converted to an optical signal and sent back to each node on a separate fibre to the forward path. At this point the reverse path signal occupies a bandwidth from 5 MHz to 65 MHz.

Due to the noise ingress into the hubs from the coaxial customer network it is not possible to sum all of the reverse path signals from the hubs together at the node. So at each node the signals are first converted back from optical to electrical form so that they may be combined by Frequency Division Multiplexing (FDM).
This method together with the associated out of band filtering results in minimum noise increase in the combined reverse path signals.

Before combining the signals it is important that the levels be adjusted to compensate for varying path losses from the different hubs and so variable gain reverse path amplifiers with monitoring points are required in each node input.
In addition it is desirable to be able to mute the signal from any path where a failure has occurred causing the noise level to rise to a level where it may cause interference with other signals and thus corruption of services being provided to customers on other hubs.

At each node the reverse path signal is converted back to an optical form for transmission back to the Headend on a separate fibre to the forward path.
At the Headend (or at a node if heavy usage is indicated) the reverse path signal is converted back to electrical form and delivered to decoding equipment for analysis and routing of individual signals. Not all signals will be required to be passed further than the Headend and others will be required to be routed into the public telephony network or to individual service providers.

Application of the RWA-2310 in the reverse path:

The RWA-2310 amplifier is a wideband low noise amplifier optimised for use with RF signals between 2 MHz and 200 MHz. The term reverse path amplifier arises out of its suitability for use in the reverse path of a cable TV network although its use is not limited to reverse path applications.

Nodes:
The RWA-2310 is designed to be used in the reverse path immediately after the optical signal receivers where it is required to boost the level of the signal to enable the various signals situated in the reverse path band to be split into each piece of receiving equipment at the correct level.

In addition it provides signal monitoring at this point for identifying problems in particular node or hub feeds and a muting facility to disable the output in the event of the line becoming to noisy to use.

HeadEnds:
At HeadEnds the received optical signals are once again converted from optical format to an electrical signal. The RWA-2310 may once again be used to perform the same functions as at the nodes.
The reverse path signal at this point is processed by a computer controlled system which interprets the addressing of the incoming signals and routes them to the appropriate destination, whether it be a pay TV provider, ISDN service or Internet access provider.
The router for these signals requires that the signals from various sources be adjusted to the same level so that the router output for a particular destination is held within the prescribed limits of the equipment which converts the signal into the appropriate form for that provider.

General:
As the number of users of the reverse path grows, so does the number of amplifiers needed. The RWA-2310 provides an ideal solution to this expansion due to its modular nature. Additional amplifiers may be plugged in as required into pre-wired rack frames.
It is also vital that in the event of any failure that maintenance is able to be carried out as quickly as possible. The monitoring points on the RWA-2310 provide a ready access to the signals for locating faults and its modular nature allows rapid replacement of a module should its performance be in doubt.
Dual power supplies with a choice of AC or DC options and external alarms enhance the reliability of the RWA-2310 and the local and remote muting functions may be used to quickly isolate any source of noise in a given path before it is combined with other signals to their detriment.

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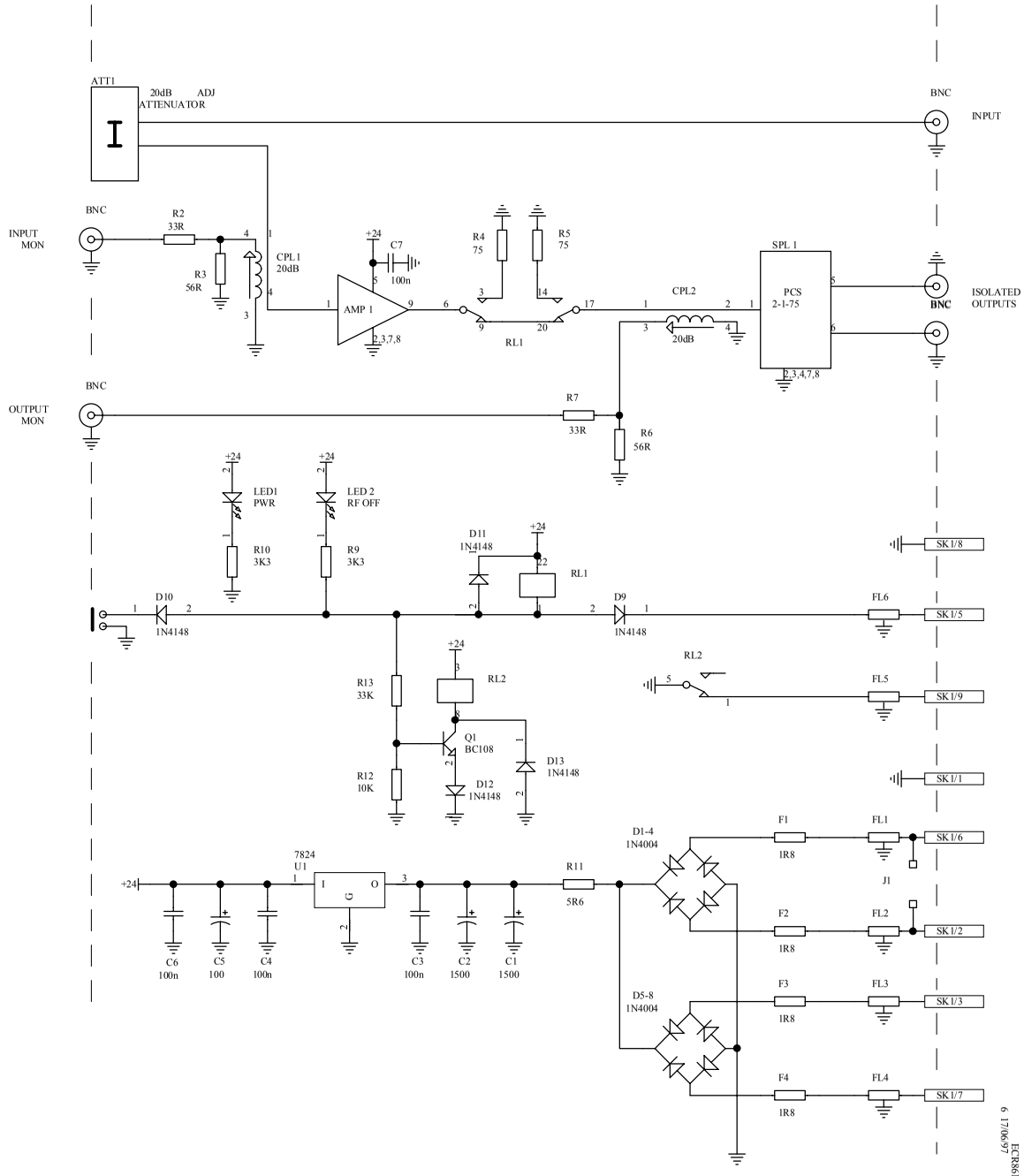
803980		FRU-2300 Eurocard frame schematic.
804039	1	PSU-2300 schematic diagram



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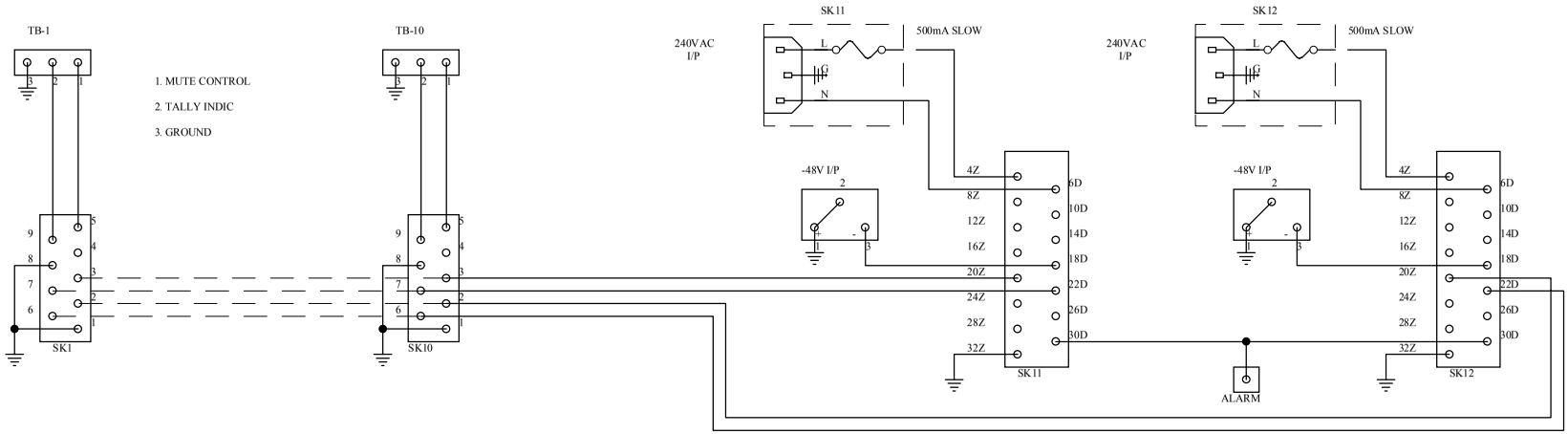

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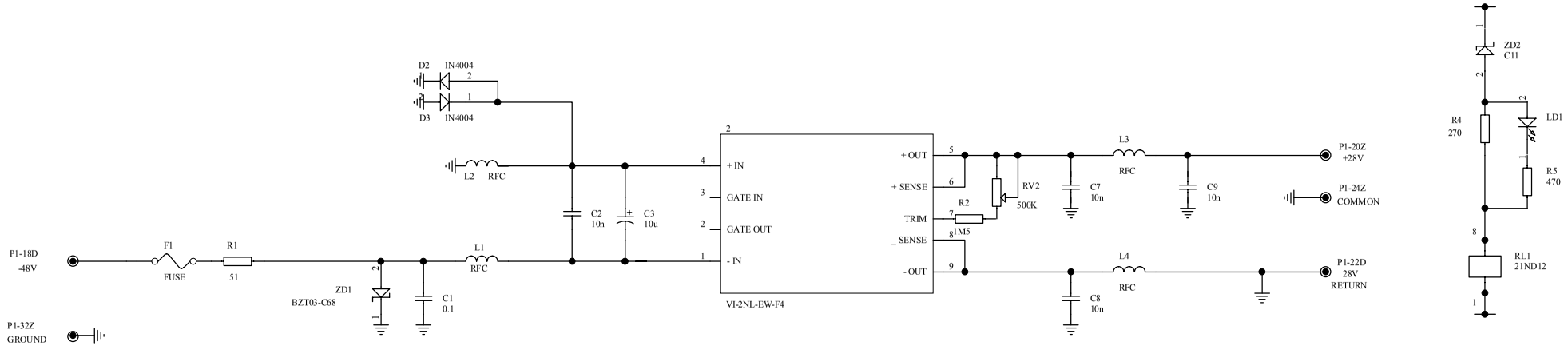

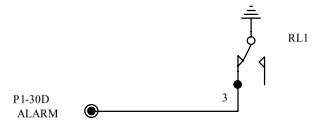

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