10
VHF and UHF Duplexers Type 2824

10.1 Introduction

The Duplexer contains two sections, a high pass notch and a low pass notch.

Connection to the Duplexer of the receiver and transmitter is dependant on their relative operating frequencies. The unit operating at the highest frequency is connected to the high pass port labelled "H".

The lower frequency unit is connected to the low pass port labelled "L". Antenna connection is made to the extended "N" connector at the rear of the Duplexer.

The following method of tuning the Duplexer involves the use of the receiver in conjunction with the control module as a signal level monitor. The control module is set to align mode and the monitor is switched to Rx position 0 (signal level).

Alternatively the duplexer may be tuned with a Condor receiver on the appropriate frequencies, with these units operating from the Exicom Transmitter/Receiver Test Unit type 2501.

The Condor receiver is synthesised and UHF equipment can be quickly switched between transmit and receive frequencies for this alignment. VHF receivers may not cover both channel frequencies without re-tuning their VCO so use of both receivers may be required.

10.2 Specifications

The duplex filter type 2824 specification characterises this unit for all bands.

Type	Bandstop - bandstop, 4 cavity resonator

Terminations

Antenna	Type N female
RF Modules	Highpass (HP) and lowpass (LP) connections, BNC male on flying leads
Bands Covered (MHz)	68-78, 72-82, 78-88, 148-162, 159-174, 403-423, 410-430, 430-450, 450-470, 470-500, 490-512
Max Input Power	50 Watts
Temperature Range	-30°C to +60°C
Humidity Range	0 - 95% non condensing.

Insertion Loss	1.5dB Max HP port to antenna or LP port to antenna (dependent on Tx - Rx separation)
Tx Noise Suppression at Rx Frequency	60dB minimum
Rx isolation at Tx Frequency	60dB minimum.
Antenna Port Return Loss	10dB minimum (dependent on Tx - Rx separation)
HP, LP Port Return Loss	10dB minimum (dependent on Tx - Rx separation)
Tx - Rx Separation **68 - 88MHz sub-bands** **148 - 174MHz sub-bands** **403 - 512MHz sub-bands**	 4.0 to 6.0MHz 4.5 to 10.0MHz 5.0 to 10MHz

10.3 Alignment Procedures

10.3.1 Instruments Required

> Condor with transmitter and receiver set to required frequencies.

> Signal generator (eg. HP8640B).

> Power meter (eg. Bird 43 and 50Ω / 20 watt load).

10.3.2 Tuning Instructions

Tuning slugs are numbered from left to right. The left hand slug is adjacent to the Transmitter module.

1. With control module in align mode (see 2737 Controller Module) and monitor set to Rx position 0, (or use the transmitter and receiver Test Unit Type 2501 which provides the monitor function). This allows measurement of receive signal level.

   Set up the equipment as follows:

2 Use the receiver which is tuned to the "low" link frequency

   Connect it to the antenna port.

   Connect the signal generator to the "H" port and set its frequency to the receive frequency.

   Connect a 50Ω load to the "L" port.

3. Adjust generator level to read 7 on the monitor, loosen the slug locking nut and turn slug 1 for a dip in the meter reading. Increase the generator level to read 7 on the monitor as necessary. Tighten the lock nut when this adjustment is complete.
4. To adjust slug 2 repeat step 3 above.
5. Remove the original receiver and then select the receiver which is tuned to the "High" link frequency.

   Connect it to the antenna port.

6. Connect the signal generator to the "L" port and set its frequency to the "High" receiver frequency.

   Connect a 50Ω load to the "H" port.

7. Adjust generator level to read 7 on the monitor, loosen the locking nut and turn slug 3 for a dip in the meter reading. Increase the generator level to read 7 on the monitor as necessary. Again tighten the locking nut on completion.
8. To adjust slug 4 repeat step 7 above.

Set up the system for normal operation (ie. with Tx and Rx connected to their respective "H" or "L" ports) and a 50Ω power meter with load connected to the "N" (antenna) port of the duplexer.

With the control module monitor set to Tx position 1 key the transmitter and check that the monitor just reads zero, and that the power output on the meter is not less than 70% of the power directly out of the Tx module.

The duplexer is now tuned.

Note: If only one Condor terminal is available, note the synthesiser switch settings for transmitter and receiver and use the available receiver on both high and low frequencies for Duplexer adjustment. It is necessary to interrupt the receiver power supply in order to load new synthesiser switch settings. Return receiver to its original switch settings on completion of alignment.

12
Mains Power Supply Type 2828

12.1 Introduction

This module is a switchmode power supply operating in flyback mode. This section provides a detailed circuit description, test procedure and some suggestions for fault finding.

12.2 Circuit Description

12.2.1 Input Circuit

AC input is filtered by C1-C6 and L1 and taken to the bridge rectifier D2 to D5. This rectifier may be configured as a bridge for 230V AC operation or as a voltage doubler for 110V AC operation, depending on the position of the voltage selector plug. The rectified DC (about 300V) is then taken to the transformer T1 and switching MOSFET Q1.

Q1 is a MOSFET switch operating at about 180kHz and controlled using pulse width modulation (PWM). It is protected by a catcher winding connected by diodes D10 and D11. This limits peak voltages on Q1 to approximately 750V at full load.

C14 and C17 provide additional protection with fast transients.

12.2.2 Output Circuit

The output of T1 is rectified by D104 and filtered by C110-C114 and L110-L113. R112 provides a small minimum load to ensure correct operation at zero load.

12.2.3 Start-up Circuit

When input power is connected to the unit, relay RLY1 is not energised. The input AC is rectified by D1 and taken through R3 and R4 to the series regulator Q2 which limits the DC voltage to the control circuitry to approximately 15V.

The output of Q2 powers the control circuitry (via the series switch Q4) and the low/high voltage input comparator IC1.

IC1 is an open collector comparator. Three outputs are connected in parallel, so that if the input is too high or too low, or the temperature is too high, the common output is pulled low by one of the comparators.

Start up occurs when the voltage at IC1/C pin 11 reaches the 5.6V reference (D30). When this occurs IC1/C output switches high. IC1/D and IC1/B outputs are already off. R42 and C21 provide a delay of about one second before the inverting output of IC1/A goes high. IC1/A output then pulls low. This turns the series switch Q4 on and provides power to the main control circuit.

IC1/B monitors the input voltage through R12 and R20/21. If this voltage is too high (above 275 V on 230V AC supply), IC1/B turns on and shuts down the supply.

Similarly, IC1/D monitors the temperature sensor thermistor R23 (near to the pillar holding MOSFET Q1). If the temperature rises above about 100°C, IC1/D turns on and shuts down the unit.

12.2.4 Pulse Width Modulation (PWM) Control Circuit

IC2/C is a comparator connected as a sawtooth generator operating at about 180kHz. It produces an asymmetrical sawtooth wave, with peak voltage at about 11V and the trough at about 1 to 2V.

The sawtooth waveform is taken to the inverting inputs of the pair of parallel-comparators IC2/A and IC2/B. The other inputs of IC2/A and IC2/B are taken to a feedback voltage. At full load the feedback voltage is about 5V, and the output duty cycle from the comparators is about 50%. At low loads, the output feedback voltage decreases and thus the comparator duty cycle reduces.

Q5 and Q6 provide buffering for the output from the comparators to the MOSFET Q1.

12.2.5 Current Limiting

The current through MOSFET Q1 is monitored by the source resistor R17. This voltage is taken to the inverting input of IC2/D. The non-inverting input of IC2/D is divided down from Q2 output, plus a small proportion of the MOSFET gate drive signal (through R64).

When the peak current through Q2 reaches the pre-set current limit point, IC2/D output pulls low and turns off IC2/A and IC2/B, turning off the MOSFET.

This is a peak primary current limit , which gives MOSFET protection and an approximate input power limiting effect. Total power, rather than output current is controlled. This means that output current into a short circuit will be considerably greater than the rated output current at 13.8V output.

12.2.6 Voltage Feedback

The voltage at the output is taken to IC104 via an adjustable voltage divider. IC104 acts as a controlled zener. When the reference input for the controlled divider is lower than 2.5V, no current flows through the cathode. As the reference voltage increases, corresponding to high output, increasing current will flow through the cathode.

Cathode current is taken through the optocoupler IC3 and pulls the main PWM comparator inputs low and reduces the duty cycle.

Similarly a low output voltage will decrease cathode current and allow the feedback input to the comparators to increase.

12.2.7 Over-voltage Protection

The output voltage is also taken via a divider to IC106. When the output reaches the pre-set over-voltage shutdown point, IC106 will turn on and turn on Q100. This puts current through optocoupler IC4 and pulls the input to IC1/C low. This causes IC1/C output to go low and switches off the power supply.

The power supply will try to switch on again after the input turn on delay of about 1 second. If the output fault is still present the unit will switch off again.

12.3 Power Supply Installation

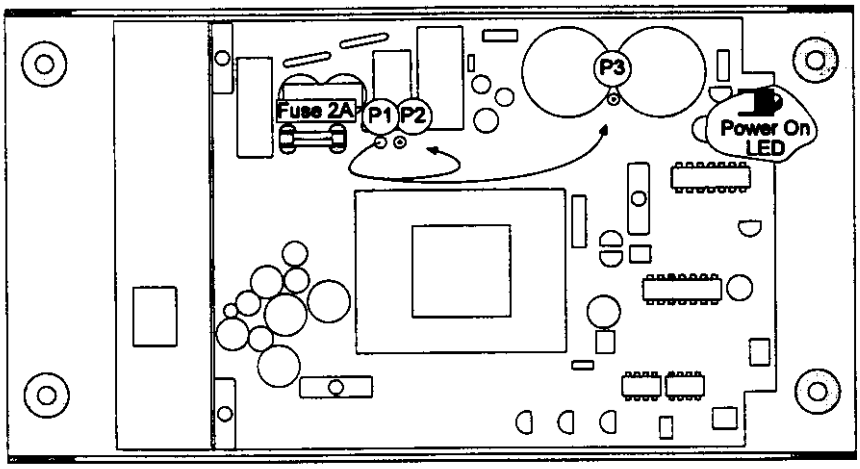
Note: Ensure that the power supply is set up for the correct mains voltage by checking the linking on the PCB. P1 is bridged to P2 to select mains voltages in the range 184 to 276V AC (230V nominal), or bridged to P3 to select mains voltages in the range 88 to 132V AC (110V nominal). Refer to Figure 12.1 to locate P1,2,3.

Rack Mount Condor

The power supply for this option is mounted on the inside right of the Condor rack mount shelf.

Wall Mount Condor

The power supply is normally mounted on the wall adjacent to the Condor. If the wall mount Condor is mounted on the optional rack mount tray the power supply mounts on the right hand side of the rack mount tray in the holes provided.



Drwg. No. 50-4-0519-0

Figure 12.1 2828 Power Supply

12.4 Fault Finding

Note: Because of the high voltages present always exercise extreme care when servicing. An isolation transformer is necessary for all work with the cover removed.

Ensure that the drain voltage on Q1 is always kept to less than 1000V. When testing the unit after major repairs, always check the drain voltage using a 1k ohm resistor soldered onto the drain pad under the PCB, with the scope probe clipped onto this. Refer to Figure 12.2 below.

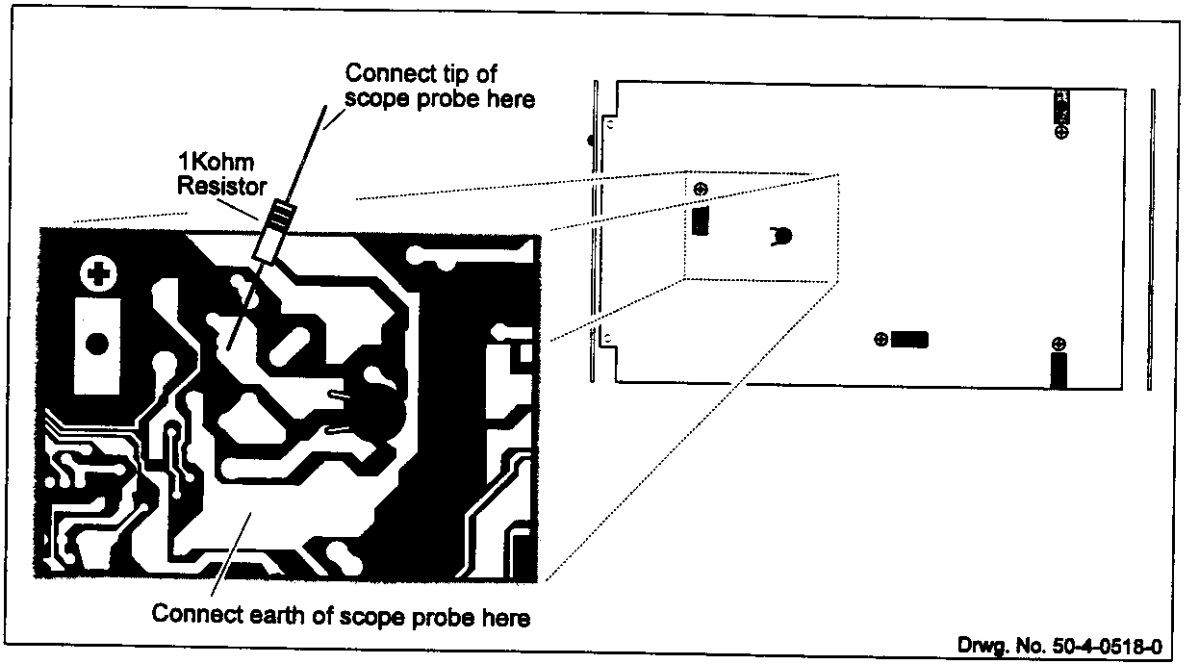


Figure 12.2 Connection Points to Measure the Drain Voltage of Q1

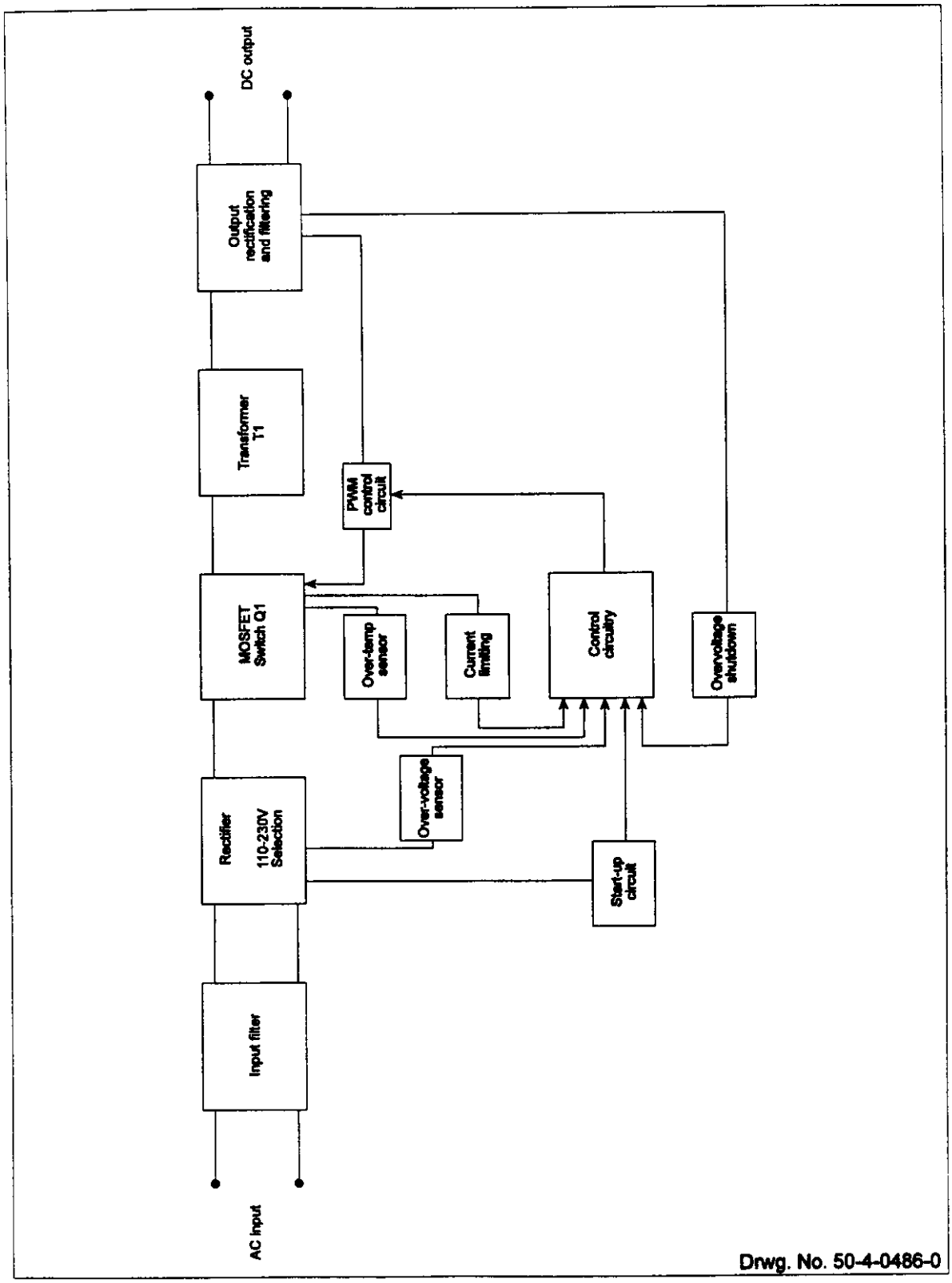


Figure 12.3 Mains Power Supply Type 2828 Block Diagram

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13
DC-DC Converter Type 2461

13.1 Specifications

Input	22 to 70VDC either polarity earthed
Output	13.5V at 4A DC load
Output Ripple	Less than 0.5mV psophometrically weighted
Input Protection	Polarity reversal, undervoltage, overvoltage
Input Fuse	5A 20mm or 30mm (internal)
Isolation	Input, output and frame DC isolated
Output Protection	Short circuit proof. Overvoltage protected
Indicators	Front panel LED, power on digital monitoring

13.2 Circuit Description

The power supply is designed to power a nominal 13.5V to the Condor link terminal from a nominal 24V or 48V supply. The basic configuration is a switched mode converter with input and output DC isolated. Regulation is achieved by optically coupled feedback controlling pulse width.

The input from a nominal 24V or 48V supply is via fuse FS1. 20mm or 30mm fuses can be fitted by modifying the position of the input terminal of the fuseholder. Polarity protection is provided by D2. Overvoltage input shutdown above 60V is provided by D1, D5 and TR1. Pulse width modulator IC2 drives power FETs TR6 and TR7 with a 100kHz square wave via complementary symmetry driver TR3, TR4. During the off period D11 conducts due to the collapsing magnetic field in T1 returning this energy to the supply capacitors. During the "on" period current from T1 secondary feeds via one of the D14 diodes into L7 the switchmode inductor. In the "off" period the other D14 flywheel diode conducts to transfer the L7 stored energy to the output capacitors.

Output voltage is sensed by D16 and optically coupled via IC1 to control the duty cycle of IC2.

Power FET current is sensed at source resistors R19, R31 and R32. Average current is sensed at IC2 pin 4 and peak current at pin 10 to provide protective shutdown of IC2 output. A soft start power supply turn on characteristic is provided by C13 to limit inrush currents. Output overvoltage protection for inductive load transients is provided by 16V VDR R30. Extensive onboard RFI suppression and input/output filtering ensure a low level of conducted and radiated emissions.

13.3 Servicing

No setting up adjustments are provided. Link J1 is provided in the drain connection of power FETs TR6 and TR7. During servicing of faulty units disconnecting this link will enable the supply to be tested up to the FET gates where a 10V peak to peak square wave 100kHz wave-form with less than 50% duty cycle should be observed on a CRO. The 1k ohm 5W resistor across J1 enables the power FETs to be checked without risk of damage to them.

A 100kHz sawtooth waveform of less than 50% duty cycle will be present on the FET drains. Peak to peak amplitude is half supply voltage. ie. 12V p-p for a 24V power supply, or 24V p-p for a 48V power supply.

Operation of the overvoltage shutdown can be checked at this time.

Do not close J1 until these conditions have been met. Operate the supply from a 0-65V supply current limited to 3A. It should start up at 19V input and shut down at 72V.

Full load input current is 2.25A at 23V input and 1A at 56V.

With a short circuited output, input current is limited to less than 1.5A.

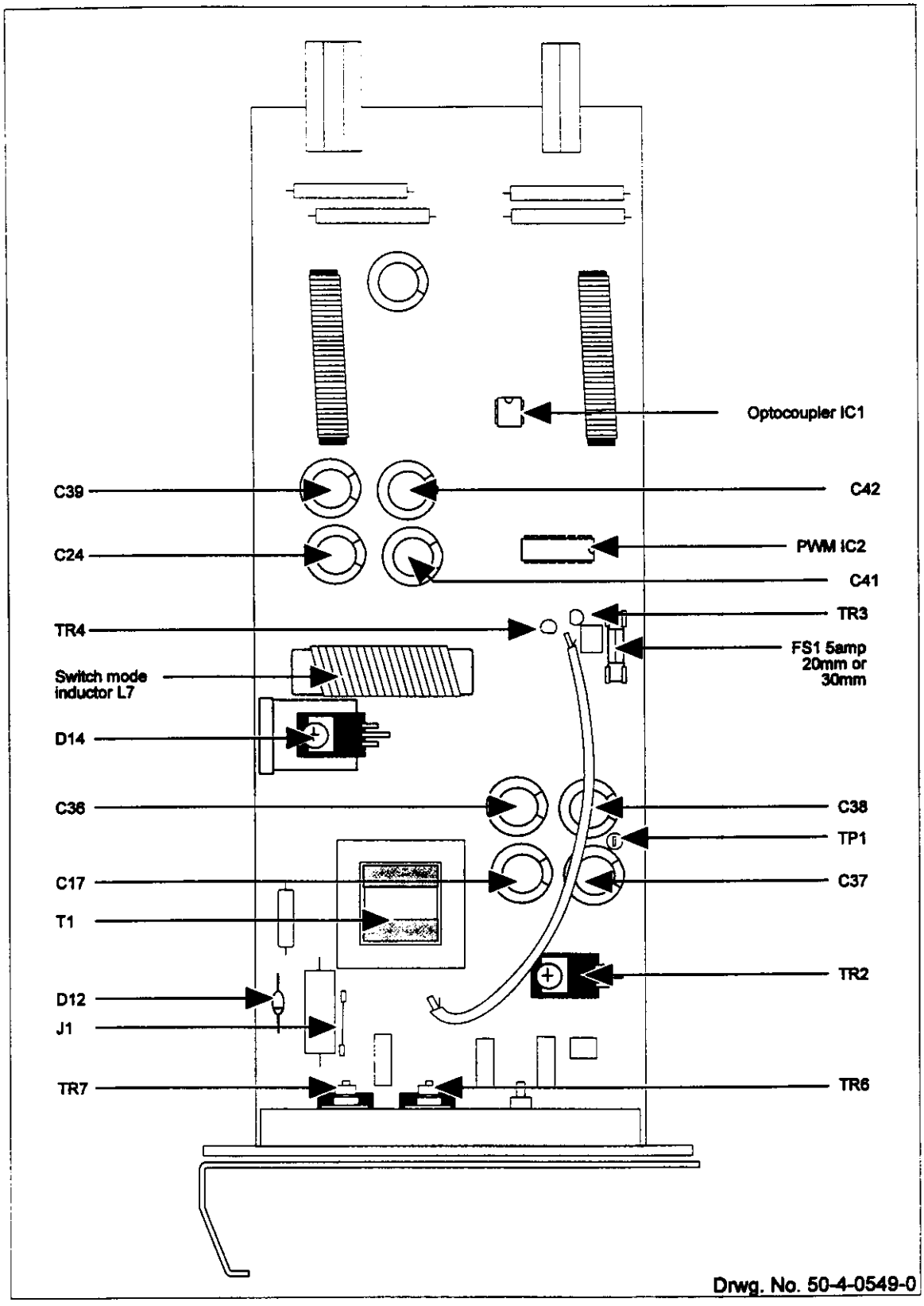

Figure 13.1 DC-DC Converter Type 2461

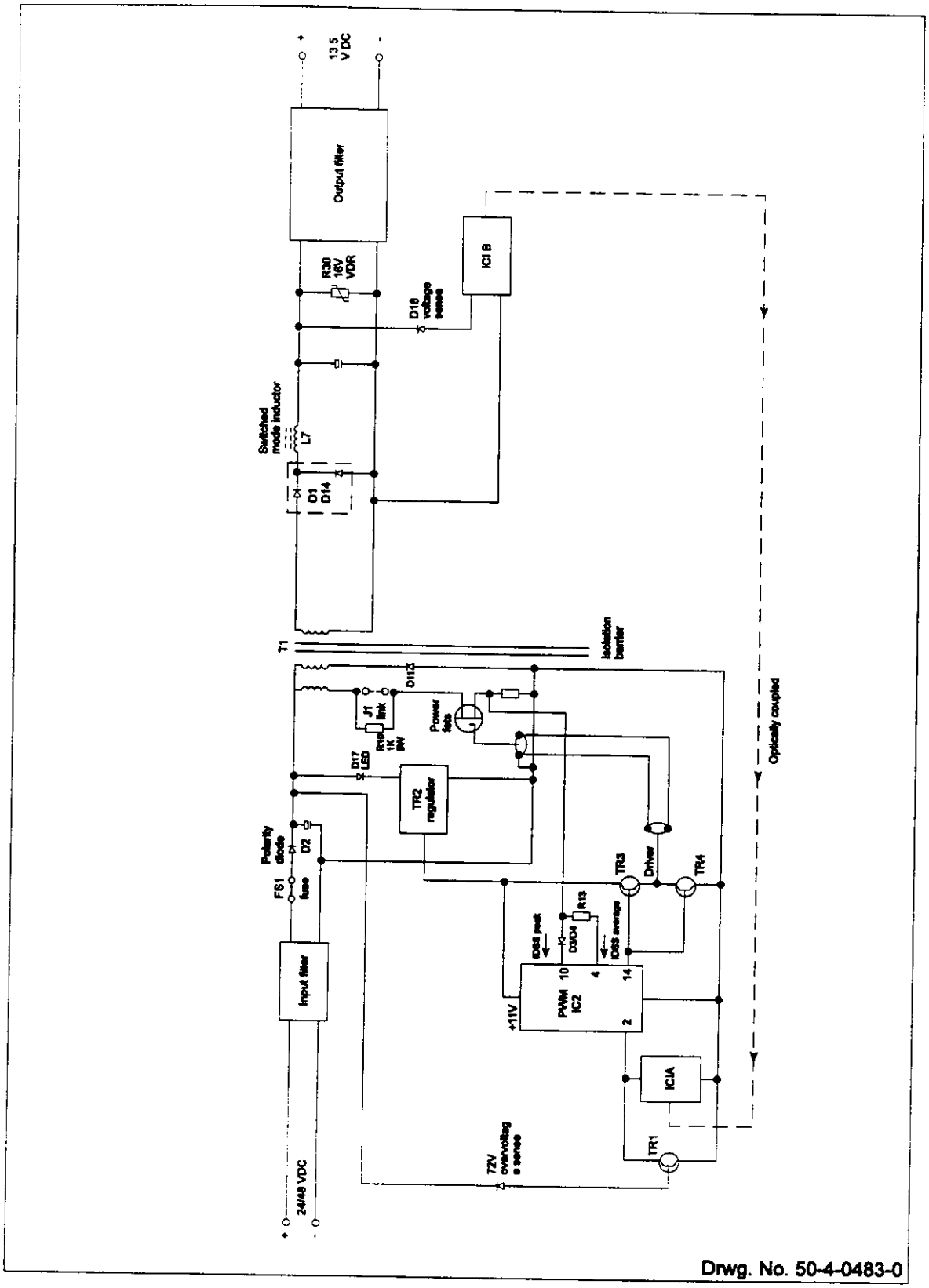

Figure 13.2 DC-DC Converter Type 2461 Block Diagram *Drg. no. 26-2-0381-2*

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EXICOM TECHNOLOGIES (1996) LTD.

TRANSMITTERS: MODELS 2950-3, -4, -5

LIST OF DOCUMENTATION SUBMITTED WITH APPLICATIONS

1. NOTICE FOR INTERMEDIATE MANUAL: (old 2802) New 2950
2. LIST OF ACTIVE DEVICES : 2950
3. CIRCUIT DIAGRAMS: 3 of 3

TECHNICAL MANUAL
CONDOR 2737

1. PART ONE: CONDOR STANDARD CONFIGURATION
2. PART 2 : SPECIFICATIONS NOT APPLICABLE
3. PART 3: SYSTEM OPERATION
4. PART 4: SYSTEM SETUP
5. PART 6: CONTROLLER TYPE 2737 (includes Circuit Descriptions, Schematics and, Block Diagram etc.)
6. PART 9: INTRODUCTION UHF Type 2950 (Includes Alignment & Block Diagram)
7. PART 10: VHF Duplexer descriptions
8. PART 12: MAIN POWER SUPPLY (includes Schematic)
9. PART 13: DC-DC Converter Type 2461 (includes Schematics)
10. PART 17: SYSTEM SETUP

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Important Note

Exicom Technologies has recently designed new transmitter and receiver modules for its Condor radio link product. Specifically, the new 2950 transmitter module replaces the old 2802 module and the new 2940 receiver module replaces the old 2801 module.

The Condor Technical Manual is currently in the process of being updated by Exicom Technologies to include references to these new modules.

This version of the manual is an 'intermediate step' – it contains sections on the new 2950 and 2940 modules (appended to the front of the manual), but the main body still contains many references to the old 2802 and 2801 module. Therefore, wherever you read 2802 or 2801 in this manual, please make the following replacements:

	Old	*New*
Transmitter	2802	2950
Receiver	2801	2940

Thank you,

Exicom Technologies (1996) Ltd

Active Devices for UHF Transmitter Type 2950

Identifier	Manufacturer's Part Number	Description
D151, D152, D301, D401, D402	BAV70	General purpose diodes
D153, D651	BZX84C2V7	Voltage offset in 10V power supply shift regulators
D200	BB515	UHF varicap for VCO tuning
D201	BB515	UHF varicap audio modulation in VCO
D300, D505, D710	BAV99	General purpose diodes
D501, D502, D503, D652, D700, D703	BAV70	General purpose diodes
D602, D603	LED Red	Front panel indicators
D604, D606	5082-2800	SWR bridge RF detectors
Q151, Q402, Q601, Q602	BC847B	General purpose transistors
Q200	BFR93A	UHF oscillator in VCO tuning
Q301	DTA 144	Digital transistor
Q302	DTC144EC-A	Digital transistor
Q401	BC857B	General purpose transistors
Q501	BF994S	Gain control device in power block driver
Q502	2SK2973	Output stage of powerblock driver
Q651, Q701, Q702, Q703, Q704	BC847B	General purpose transistors
Q652, Q152	BD136	Series pass transistors for +10ps regulators
TCXO	TCXO	Temperature stable crystal oscillator reference
U101	TL074CD	Audio stage amplifiers
U151, U651	MC78L08ACD	8V regulators used as reference voltages
U152, U652	CA3140M	10V power supply regulator amplifier
U153	HA17805	5v regulator for uprocessor end phase lock loop IC
U302	AT89C2051-24SI	Microprocessor
U303,U304, U305	MM74HC165M	Shift registers for loading user settable parameters
U307	UMA1014T	Phase lock loop synthesizer
U308	TL071CD	Phase lock loop amplifier
U401	LT1054CS8	Voltage inverter for VCO negative supply
U601	M57704H	Output power block
U653	LM35DZ	Temperature monitor for power block protection
U701	MC14051BD	Analog Multiplexer for monitoring circuit
U702, U703	LM358M	Power control and SWR protection circuit amplifiers