OPERATING AND TECHNICAL MANUAL

BARRETT 922 POWER SUPPLY

BCM92200/1

Table of contents

1.0 Introduction

The BARRETT 922 Power Supply is designed to provide power for one 500 or 900 series transceiver plus one accessory such as a modem. The 922 also has a battery standby system comprising a charging circuit with a true automatic no-break changeover, in case of mains power supply failure. This feature eliminates the problems of data modems resetting during mains failures and requiring reinitialisation.

2.0 Specification

Output current	24 amps.
Output voltage	14.1V DC.
Input voltage	110 120 / 220240 VAC @ 50/60 Hz. (Switch selectable)
Input connector	IEC type with voltage selector, integral fuse and spare fuse.
Regulation	Less than 2.0% change at full load.
Ripple and noise	Less than 10 mV RMS at full load.
Charger output	13.9 VDC, 3 amp maximum.
Dimensions	Standard Barrett 900 series chassis H.75mm W.245mm D.297mm Weight 6.4Kg
Mounting	Standard bench mounting or optional 19" rack mounting kit

3.0 Operation

The Barrett 922 power supply will operate on input voltages of 110-120VAC on the 110VAC setting or 220-240VAC on the 220VAC setting. These settings are switchable on the IEC connector on the rear of the power supply. **Note:- When changing voltage settings it is necessary to change the fuse. A 3 amp slow blow fuse is used on the 220VAC setting and a 6 amp slow blow fuse is used on the 110VAC setting.** A fuse and a spare fuse for setting the power supply is delivered in the IEC connector (the spare fuse is contained in the plastic fitting holding the operational fuse). Two fuses for the other voltage selection are packed with the power supply in the warranty form envelope.

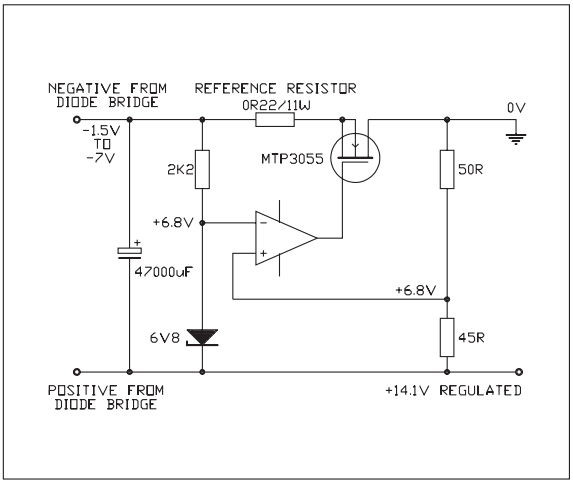
An optional fan unit Barrett P/N BCA90007 should be fitted when the power supply is to be used in a continuous duty cycle mode such as data transmission. An optional 19 inch rack mounting system Barrett P/N 90010 is also available should it be required.

The Barrett 922 Power Supply is controlled by a microprocessor whose function is to monitor the operation of the device. If short circuit or overcurrent load conditions occurs the microprocessor protects the power supply by putting it into a tripped state. During this state the microprocessor deactivates the power regulators and changes the green power indicator to a flashing red state. To leave the tripped state, the regulator is periodically activated to sense if the trip condition has been removed then returning itself to normal operation.

If battery backup is required connect the third power connector (male two pin connector) to a suitable battery, using cable P/N BCA92200. Connect the red lead to the positive battery terminal and the black to the negative. This facility provides an automatically controlled charge of up to 3 amps to the battery when the mains power is available. Change over from normal to battery power when mains power fails is true no-break.

4.0 Overview

Through the use of a novel output series pass topology the Barrett 922 power supply achieves relative simplicity of mechanical design whilst maintaining high output current capability and reliability. As this topology is fundamentally different from that conventionally employed. A simplified explanation follows:-



The circuit to the left is a simplified schematic of the master regulator and differs from standard series pass circuits in three ways.

1. The series pass element is in the negative arm of the power feed between rectifier and ground where as in conventional arrangements the series pass element is in the positive arm.

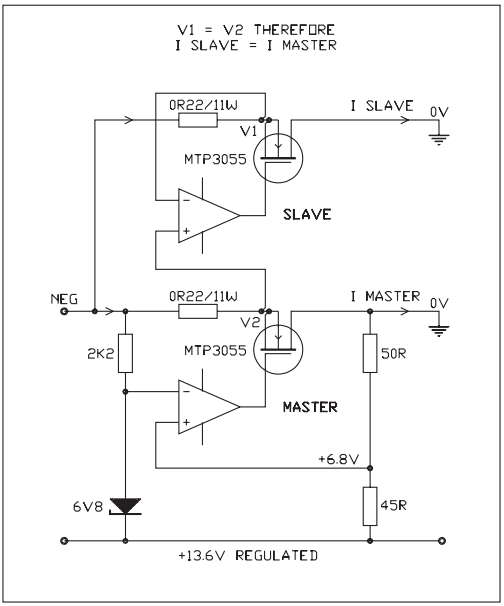
2. A MOSFET is used as the series pass element.

3. The MOSFET is driven directly by the controlling op amp.

Otherwise the circuit functions normally as a feedback control system which maintains the output voltage at + 13.8V with respect to ground.

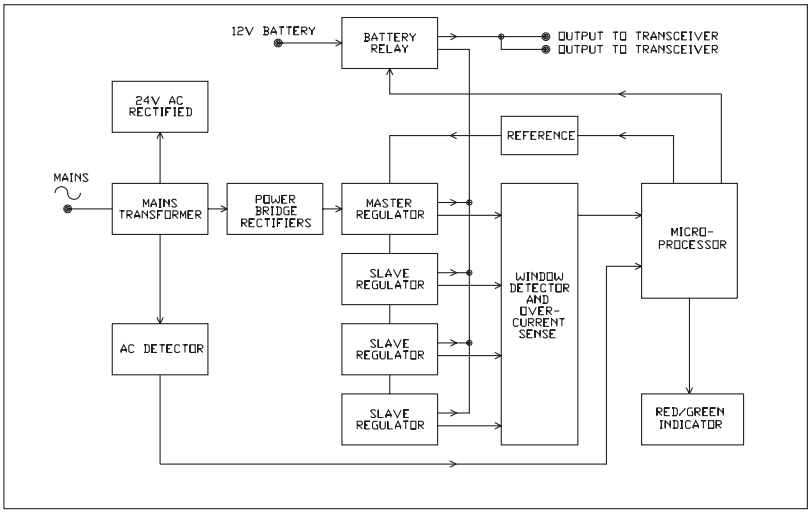
For heavy loads the MOSFET is conducting strongly and the gate voltage is high. It should be noted that the negative output of the rectifier bridge is the most negative point in the circuit and varies from about -7V on light loads to about -1.5V on full load.

The basic circuit can deliver 6 amps and so three slave circuits are used which track the master in current handling. This is achieved by comparing the voltage dropped across the reference 0.22R resistor in the slave. The comparison is done using an op amp and the error voltage controls the MOSFET which equalises the current.



5.0 Technical description

Power Supply Block Diagram



As described previously, the heart of the power supply is the master regulator. This is accompanied by three current tracking slave regulators which provide up to 6 amps each. There is also a fault (over-current and control loss) protection circuit utilising a microprocessor to monitor and control operation. If maximum DC load current-limits are exceeded or if the AC input voltage is too low to maintain regulation, the microprocessor switches the regulator MOSFETS off. In this tripped state the green power indicator changes to flashing red. During this period the regulators are periodically re-activated to determine if the cause of the initial trip still exists, if the initial cause is cleared the power supply resumes normal operation.

Detailed circuit description

Mains power is applied to the power supply via a fused IEC connector with integral 110-120/220-240 VAC voltage selector. Varistor TB1 protects against input transients. The mains transformer provides two 16V AC feeds for the main supply plus as 18V auxiliary winding.

The main supply is rectified by a pair of bridges B1, B2 and smoothed by filter capacitors C1, C2, C24 and C25. The master regulator comprises MOSFET Q2, op amp U5:B, zener diode Z1 plus associated components R2, R4, R5, R6, R7, L2, C9 and reference resistor R10.

This is accompanied by three slave regulators with MOSFETS Q3, Q4, Q5, opamps U5:A, U1:A, U1:B and resistors R12, R16 and R17.

Comparators U2:C and U2:D in conjunction with the 8 diode network D19-D26 form a window detector which senses the gate voltage of the regulating MOSFETS. If any of the four MOSFETS has a gate voltage which is below 2.0V and above 10.7V, which represents a fault or short circuit condition, the output of the window detector goes low.

Comparator U2:A provides overcurrent protection by sensing the voltage drop across the master resistor R10. If this voltage exceeds 1.3V, indicating the power supply is delivering more than 24 amps the comparator goes low to indicate a trip to the microprocessor.

The microprocessor, U4, senses the trip line and de-activates the reference (via Q12) turning the power supply off. The microprocessor also drives the green and red LED, D11, indicating the state of the power supply. After 10 seconds the regulator is reactivated for approximately 15ms to see if the trip condition has cleared.

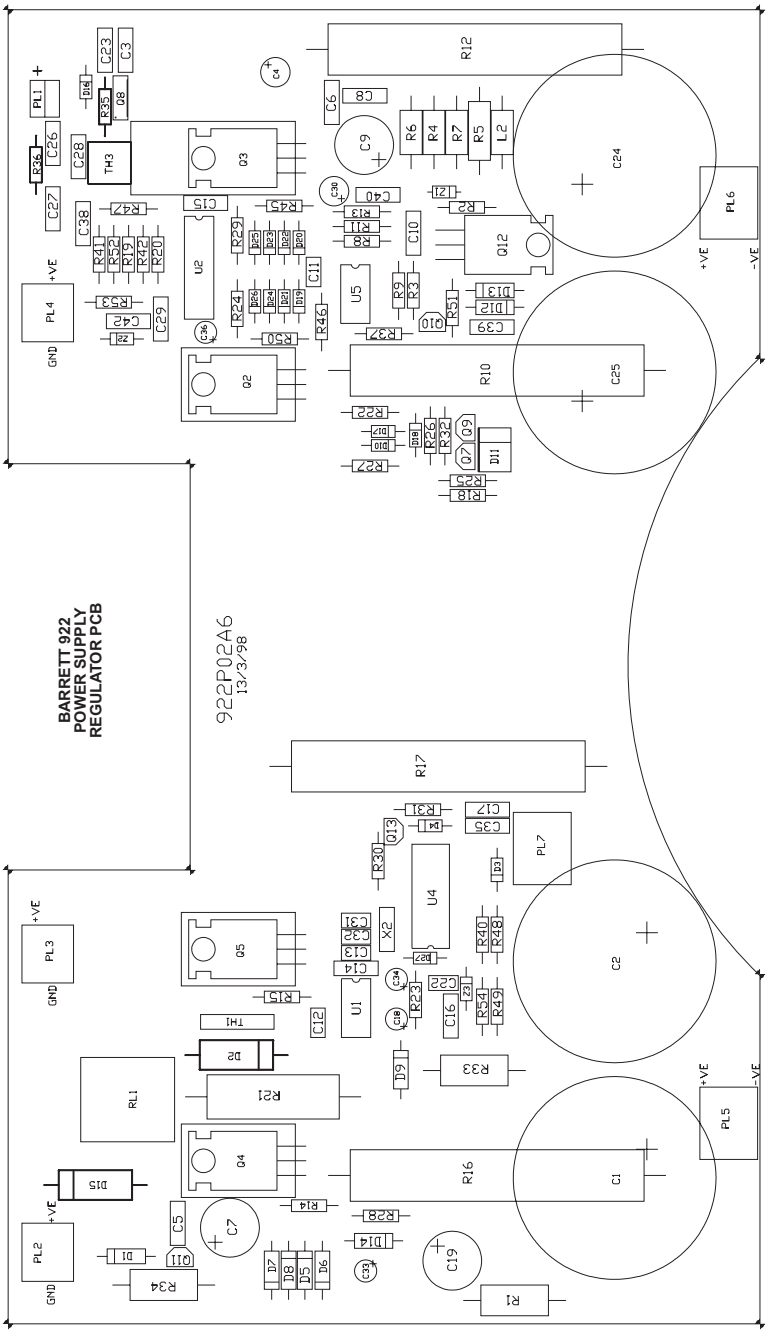
To provide the no-break change over function when the mains power fails, 50Hz TTL pulses, generated from the control voltage winding of the mains transformer, via switching transistor Q13 are fed to the microprocessor. When mains power fails the micro detects the absence of these pulses and switches the load relay, RL1, over to battery via Q11. During this condition, the bicolour LED is switched to orange, indicating that the supply is running from the battery. Power re-establishment is sensed by the microprocessor when the 50Hz pulses re-appear. The microprocessor then delays for 500ms until all voltage levels within the regulation circuit are back to their normal values before switching the load back to the regulated supply.

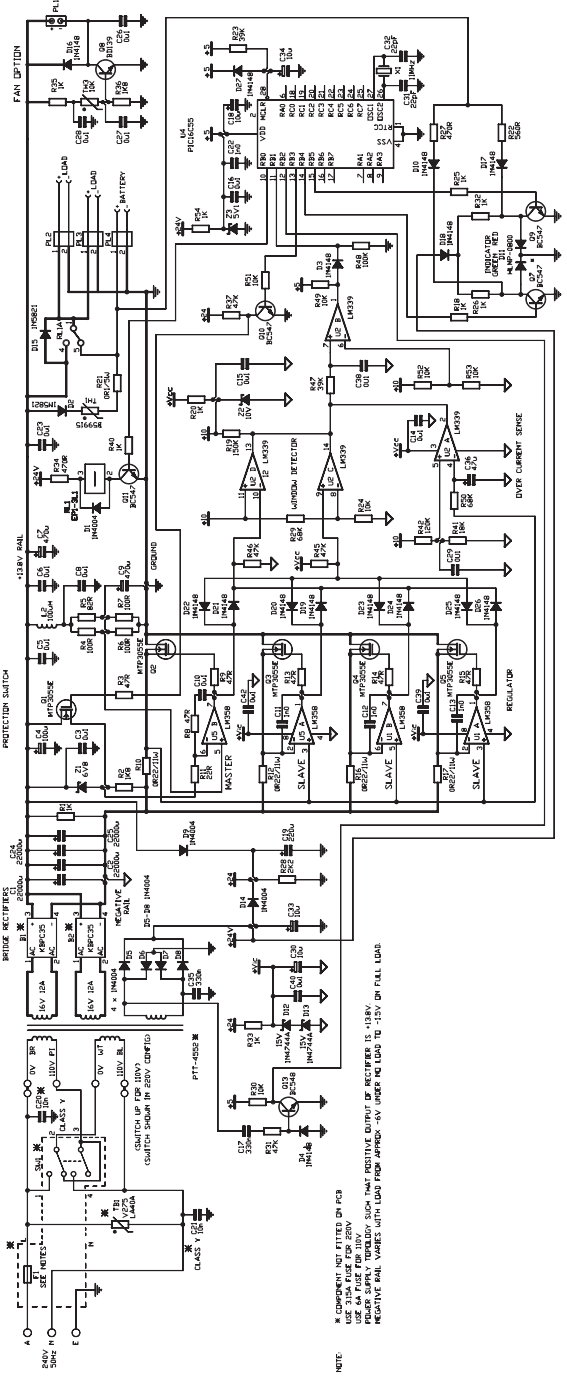
6.0 Input voltage selection

The Barrett 922 power supply will operate on input voltages of 110-120VAC on the 110VAC setting or 220-240VAC on the 220VAC setting. These settings are switchable on the IEC connector on the rear of the power supply. Note:- When changing voltage settings it is necessary to change the fuse.

A 3 amp slow blow fuse is used on the 220VAC setting and a 6amp slow blow fuse is used on the 110VAC setting. A fuse and a spare fuse for the voltage setting that the power supply is set to when delivered is fitted in the IEC connector (the spare fuse is contained in the plastic fitting that holds in the operational fuse). Two fuses for the other voltage selection are packed with the power supply in the warranty form envelope.

7.0 Circuit diagram and overlay





BARRETT 922
POWER SUPPLY
SCHEMATIC

8.0 Parts list

922 Power Supply PCB Assembly No 9051.1 Issue1 Sheet 1 of 3

Component Designator	Description	Barrett P/N
C1	CAP 22000uF 25V	1910
C2	CAP 22000uF 25V	1910
C3	CAP 0.1uF 0.1LS	1015
C4	CAP 100uF 25V ELECT	1637
C5	CAP 0.1uF 0.1LS	1015
C6	CAP 0.1uF 0.1LS	1015
C7	CAP 470uF 16V ELECT	1755
C8	CAP 0.1uF 0.1LS	1015
C9	CAP 470uF 16V ELECT	1755
C10	CAP 0.1uF 0.1LS	1015
C11	CAP 1nF 0.1LS CERAMIC	1329
C12	CAP 1nF 0.1LS CERAMIC	1329
C13	CAP 1nF 0.1LS CERAMIC	1329
C14	CAP 0.1uF 0.1LS	1015
C15	CAP 0.1uF 0.1LS	1015
C16	CAP 0.1uF 0.1LS	1015
C17	CAP 0.33UF 0.2LS MONO	1011
C18	CAP 10uF 0.1LS TANT	1650
C19	CAP 220uF 35V ELECT	1793
C22	CAP 1N0 0.1LS CERAMIC	1329
C23	CAP 0.1uF 0.1LS	1015
C24	CAP 22000uF 25V	1910
C25	CAP 22000uF 25V	1910
C26	CAP 0.1uF 0.1LS	1015
C27	CAP 0.1uF 0.1LS	1015
C28	CAP 0.1uF 0.1LS	1015
C29	CAP 0.1uF 0.1LS	1015
C30	CAP 10uF 0.1LS ELECTRO	1747
C31	CAP 22pF 0.1LS 63V CERAMIC	1414
C32	CAP 22pF 0.1LS 63V CERAMIC	1414
C33	CAP 10uF TANT 0.1LS	1650
C34	CAP 10uF TANT 0.1LS	1650
C35	CAP 0.33UF 0.2LS MONO	1011
C36	CAP 47uF 0.2LS	1655A
C38	CAP 0.1uF 0.1LS	1015
C39	CAP 0.1uF 0.1LS	1015
C40	CAP 0.1uF 0.1LS	1015
C42	CAP 0.1uF 0.1LS	1015
D1	DIODE 1N4004	3303
D2	DIODE1N5821	3322
D3	DIODE 1N4148	3302
D4	DIODE 1N4148	3302
D5	DIODE 1N4004	3303
D6	DIODE 1N4004	3303
D7	DIODE 1N4004	3303
D8	DIODE 1N4004	3303
D9	DIODE 1N4004	3303
D10	DIODE 1N4148	3302

922 Power Supply PCB **Assembly P/N 9051.1** **Issue1** **Sheet 2 of 3**

Component Designator	Description	Barrett P/N
D11	PLUG 3 PIN POLARISED	4102A
D12	DIODE 15V ZENER BZX85	3320
D13	DIODE 15V ZENER 1N4744A	3320
D14	DIODE 1N4004	3303
D15	DIODE 1N5404	3313
D16	DIODE 1N4148	3302
D17	DIODE 1N4148	3302
D18	DIODE 1N4148	3302
D19	DIODE 1N4148	3302
D20	DIODE 1N4148	3302
D21	DIODE 1N4148	3302
D22	DIODE 1N4148	3302
D23	DIODE 1N4148	3302
D24	DIODE 1N4148	3302
D25	DIODE 1N4148	3302
D26	DIODE 1N4148	3302
L2	CHOKE 100uH	3605
PL1	PLUG 2 PIN POLARISED	4101A
PL2	TERMINAL 2 PIN POWER CONN	3730
PL3	TERMINAL 2 PIN POWER CONN	3730
PL4	TERMINAL 2 PIN POWER CONN	3730
PL5	TERMINAL 2 PIN POWER CONN	3730
PL6	TERMINAL 2 PIN POWER CONN	3730
PL7	TERMINAL 2 PIN POWER CONN	3730
Q2	MOSFET MTP3055E	2266
Q3	MOSFET MTP3055E	2266
Q4	MOSFET MTP3055E	2266
Q5	MOSFET MTP3055E	2266
Q7	TRANS BC547	2201
Q8	TRANS BD139	2205
Q9	TRANS BC547	2201
Q10	TRANS BC547	2201
Q11	TRANS BC547	2201
Q12	MOSFET MTP3055E	2266
Q13	TRANS BC548	2204
R1	RES 1K 5% 1W	0439
R2	RES 2K2 5% 1/4W	0125
R3	RES 47R 5% 1/4W	0233
R4	RES 100R 5% 1/2W	0437
R5	RES 82R 5% 1/2W	0433
R6	RES 100R 5% 1/2W	0437
R7	RES 100R 5% 1/2W	0437
R8	RES 47R 5% 1/4W	0233
R9	RES 47R 5% 1/4W	0233
R10	RES 0R22 5% 11W	0420
R11	RES 22R 5% 1/4W	0229
R12	RES 0R22 5% 11W	0420
R13	RES 47R 5% 1/4W	0233
R14	RES 47R 5% 1/4W	0233
R15	RES 47R 5% 1/4W	0233
R16	RES 0R22 5% 11W	0420

922 Power Supply PCB **Assembly P/N 9051.1** **Issue1** **Sheet 3 of 3**

Component Designator	Description	Barrett P/N
R17	RES 0R22 5% 11W	0420
R18	RES 1K 5% 1/4W	0249
R19	RES 10K 5% 1/4W	0261
R20	RES 1K 5% 1/4W	0249
R21	RES 0R1 5% 5W	0751
R22	RES 2K2 5% 1/4W	0253
R23	RES 39K 5% 1/4W	0268
R24	RES 10K 5% 1/4W	0261
R25	RES 1K 5% 1/4W	0249
R26	RES 5K6 5% 1/4W	0258
R27	RES 2K2 5% 1/4W	0253
R28	RES 2K2 5% 1/4W	0253
R29	RES 68K 5% 1/4W	0271
R30	RES 10K 5% 1/4W	0261
R31	RES 47K 5% 1/4W	0269
R32	RES 5K6 5% 1/4W	0258
R33	RES 1K 5% 1W	0439
R34	RES 470R 5% 1W	0440
R35	RES 1K 5% 1/4W	0249
R36	RES 1K8 5% 1/4W	0252
R37	RES 47K 5% 1/4W	0269
R40	RES 1K 5% 1/4W	0249
R41	RES 18K 5% 1/4W	0262
R42	RES 120K 5% 1/4W	0274
R45	RES 68K 5% 1/4W	0271
R46	RES 68K 5% 1/4W	0271
R47	RES 68K 5% 1/4W	0271
R48	RES 100K 5% 1/4W	0273
R49	RES 10K 5% 1/4W	0261
R50	RES 68K 5% 1/4W	0271
R51	RES 10K 5% 1/4W	0261
R52	RES 10K 5% 1/4W	0261
R53	RES 10K 5% 1/4W	0261
R54	RES 1K 5% 1/4W	0249
RL1	RELAY NEC EP1-3L1S	5052
TH1	POLY SWITCH PROTECTOR	2534
TH3	FAN OPTION THERMAL SWITCH	2552
U1	I/C LM358 DUAL OP-AMP	2333
U2	I/C LM339N QUAD COMPARATOR	2339
U4	PIC 16C55	2745
U5	I/C LM358 DUAL OP-AMP	2333
X1	11 MHz Crystal	7620
Z1	DIODE ZENNER 6V8	3321
Z2	DIODE ZENNER 10V	3308
Z3	DIODE ZENNER 5V1	3301

Quality System
Certified to
ISO 9002
Registration No. 16526

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