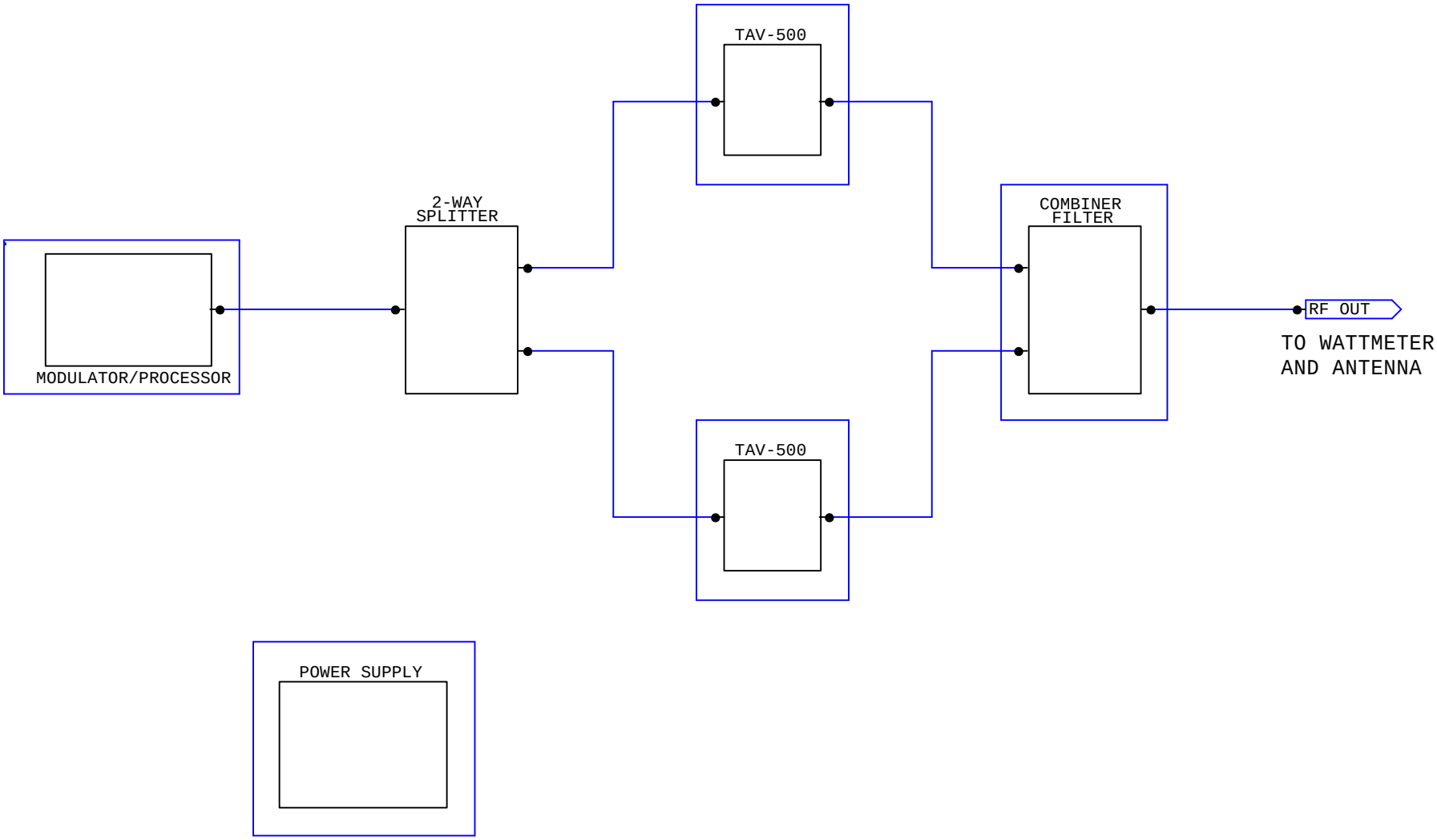
Principle of Operation

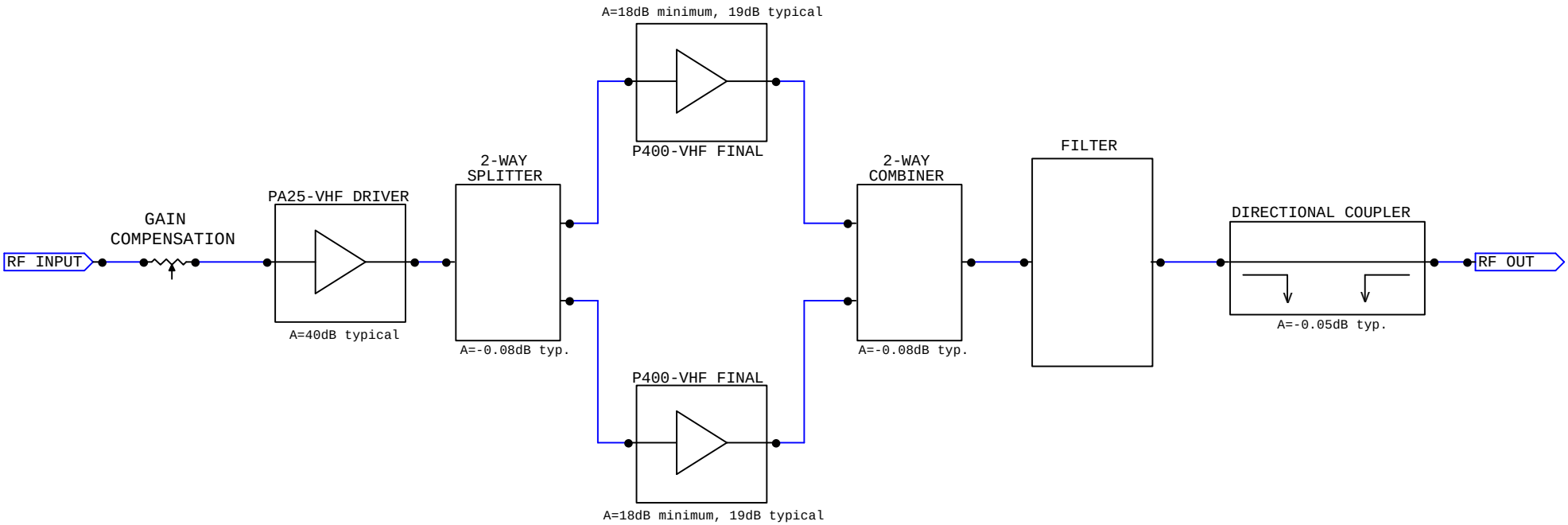
The TAV-1000 power amplifier supplies a 1000-watt peak video signal with 10% aural power on any of the VHF television channels 2 through 13. Please note that channel selection must be made at time of order, as the transmitter or translator is calibrated and tested to the channel requested and is not field tuneable. The TAV-1000 power amplifier is a modular solid-state 1000-watt broadcast amplifier utilizing readily available RF components wherever possible, thus enhancing the serviceability of the equipment. The TAV-1000 features ultra linear amplification and individual channel RF output bandpass filtering. The amplifier modules are stable for high reliability and long service life.

The amplification of the TAV-1000 is comprised of (2) TAV-500 500-watt power amplifiers. Firstly, the output of the modulator or processor gets split into (2) RF signals of equal amplitude. Each output of the 2-way power divider is then fed into a TAV-500 Power Amplifier. Finally, the outputs of each TAV-500 are combined to generate 1000-watts of peak visual power in addition to an aural carrier, as seen in the TAV-1000 block diagram.



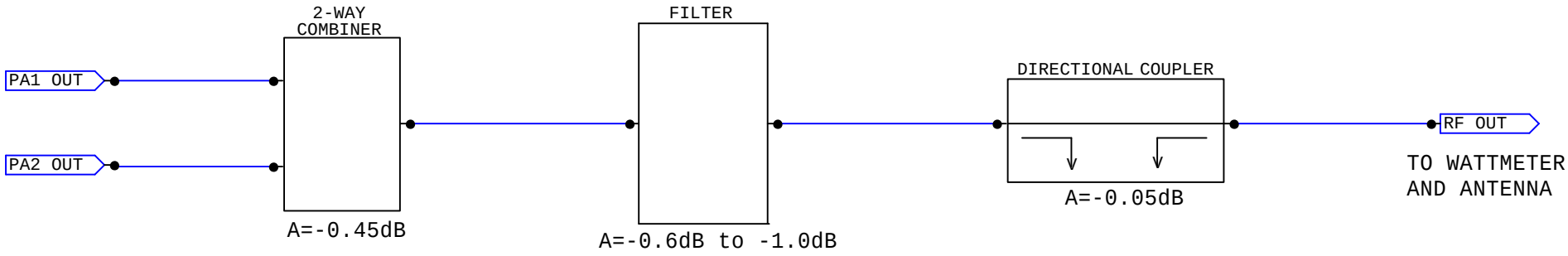
TAV-1000 Overall Block Diagram	
Rev	ID
Date: May 25, 2005	Page: 1 of 1

Inside each 500-watt power amplifier, the RF signal enters through the RF Input connector on the power amplifier enclosure from the modulator or processor. It then passes through an RF attenuator to limit the output power level of the power amplifier and to help buffer any transients that may come into the power amplifier. After attenuation, the signal gets preamplified by a driver pallet before the signal gets split into (2) signals for final amplification. The output of the (2) final amplifier pallets are combined. Finally, the signal gets filtered with a Bandpass filter and monitored with a dual directional coupler before heading out to an antenna for broadcast.



TAV-500 Block Diagram	
Rev	ID
Date: May 24, 2005	Page: 1 of 1

After amplification, the signal exits the power amplifier enclosure and goes into the combiner/filter enclosure, where the signals from each 500-watt amplifier are combined. After combining, the amplified signals are filtered with a bandpass filter and monitored again with another directional coupler before heading out to an antenna for broadcast, as depicted in the following combiner block diagram.



TAV-1000 Combiner Enclosure Block Diagram		
Rev	ID	
Date: May 25, 2005		Page: 1 of 1

Specifications

The following specifications were taken with a Technalogix modulator/processor. Should a different modulator or processor be used, specifications could vary. For this reason, we recommend that any different modulator/processor be shipped to Technalogix so the system can be matched and set up optimally. In addition, the audio/video ratio the input to the power amplifier needs to be –10 dB in order for the software and LCD readout to be accurate. All specifications below were taken with the audio/video ratio set -10dB.

RF Characteristics

Frequency range	any specified VHF Channel 2 to 13
Frequency Response (one channel)	±0.5 dB
Frequency Stability	±250 Hz
Selectivity	60 dB (adjacent channel)
Minimum Input Level	0 dBmV
Rated Visual Output Power	1000 Watts
Rated Aural Output Power	10% of peak visual power
IF Output Level	-12 dBm nominal
Input Impedance	75 Ohms
Output Impedance	50 Ohms
Harmonics	> 60 dB below rated power
Predominant Intermodulation Distortion	dBc = decibels below visual carrier
+ 920 kHz	> -53 dBc
- 920 kHz	> -53 dBc
+ 2.66 MHz	> -53 dBc
- 2.66 MHz	> -53 dBc
+ 5.42 MHz	> -53 dBc
+ 7.16 MHz	> -53 dBc
3rd Order Intermodulation Distortion	
- 4.5 MHz	> -60 dBc
+ 9.0 MHz	> -60 dBc
All others	> -60 dBc
Spurious Emissions	> -60 dBc

NTSC Video Characteristics

Input Level to modulator (for 87.5% modulation)	1.0 V_{PP} (100IRE + 40IRE sync)
Differential Phase (at 87.5% modulation)	±2 Degrees
Differential Gain (at 87.5% modulation)	2%
Group Delay	< ±40 nS
Video Group Delay Pre-emphasis	Conforms to IC/FCC specifications
K-Factor	1.9% for 2T Pulse
Hum and Noise	> 60 dB below rated power

Aural Characteristics

Input Level for 25 kHz Deviation	0.3 V_{PP}
Frequency Response (Standard Pre-emphasis)	±1 dB
Harmonic Distortion (25 kHz Deviation)	< 1% 50 Hz to 15 kHz
Amplitude Modulation Noise	> 50 dB
Frequency Modulation Noise	> 60 dB
Intercarrier Stability	±250 Hz

Physical Characteristics

Power Requirements	
Power Supply	230 V_{AC}, 30 A_{AC}
Combiner / Filter	115 V_{AC}, 2 A_{AC}
Operating Temperature Range	0°C to 50°C
Dimensions	
TAV-500 Power Amplifier (each)	W-19" flange (17” encl.) , D-25", H-8 3/4” (5U)
Combiner / Filter	W-19" flange (17” encl.) , D-25", H-8 3/4” (5U)
Power Supply	W-19” flange (17” encl.) , D-25”, H-7” (4U)

Section IV – RF Components

Amplifier Pallets

The PA25-VHF pallet is a two stage ultra linear class-A linear pallet. The PA25-VHF-L has a typical gain of 40dB and the PA25-VHF-H has a typical gain of 34dB. These pallets draw no more than 3.0Adc total drain current (the exact bias and drain currents of your system are found in the spec sheet supplied with each manual). The quiescent and drain currents can be measured on the PA25-VHF pallet by measuring the voltage drop across the current sense resistor found directly at the DC power supply lead input to the pallet. This resistance is 0.01-ohms, providing a 10mV per ampere ratio.

The final amplifier stages are comprised of (2) P400-VHF-L or P400-VHF-H amplifier pallets and are each characterized with minimum gains of 18 dB (low band) or 15 dB (high band) and maximum drain currents of 28 A (low-band) or 20 A (high-band).

All currents on the driver and final stages can be measured across the on-board shunt resistor (0.01-ohm) found at the DC supply inputs. With this resistance, a 1mV reading across this resistor indicates a current draw of 1.0A.

Power Divider/Combiner (internal to each TAV-500 enclosure)

A Wilkinson power divider and combiner (identical printed circuit boards) are used to split the RF signal into, and combine the amplified RF signal out of the (2) P400-VHF final amplifier pallets. Flanged power resistors help ensure that any differences between the inputs or outputs is balanced.

The Wilkinson design takes advantage of the fact that an impedance transformation can take place across a quarter-wavelength transmission line if the line has a different impedance than the source or load impedances being matched. In this case, quarter-wavelengths of 75-ohm coaxial are used to maintain 50-ohm impedances at the input and output of the Wilkinson divider/combiner. Due to its electrical and mechanical symmetry, the Wilkinson design's performance over moderate bandwidths is superior to other types. This design maintains phase and amplitude equality, in addition to providing isolation and matched outputs.

Final Combiner (internal to combiner enclosure)

The RF outputs from the (2) TAV-500 amplifier modules then pass into a final enclosure where the signals are combined, then filtered and monitored once again. The combiner is a 2-way, 1000-watt isolated power combiner with a maximum phase imbalance of +/-1 degree. Minimum isolation is -18 dB and maximum insertion loss is -0.45 dB from 170 to 280 MHz. Minimum return loss from ports 1 to 2 (input to input) is -25 dB and -20 dB on port 3 (output).

Directional Coupler (internal to TAV-500 and combiner enclosures)

The Technalogix dual directional couplers provide DC voltages proportional to forward and reflected RF power monitoring. These analog voltages are converted for processing using a 10-bit analog-to-digital converter and provide the control system with valuable data for monitoring purposes. The directional couplers installed in the power amplifier and filter enclosures have ***peak*** detection circuits on the forward RF power side of the coupler and ***average*** detection circuits on the reflected RF power side of the coupler. This is to allow the end user to set power in a manner that is more independent of modulation and closer to a true tip-of-sync meter. Hence, the readings on the displays in the power amplifier system are peak for forward and average for reflected. Output power should be set by the following procedure:

THE POWER OUTPUT SHOULD NEVER BE ADJUSTED EXCEPT UNDER THE TEST CONDITIONS OF NO AURAL CARRIER, WITH THE VISUAL CARRIER MODULATED WITH SYNC AND BLANKING.

The directional coupler has a typical insertion loss of 0.05dB and its Type N connectors can handle 1,500 watts peak. The coupler requires 8 to 8.5Vdc to power the internal electronics of the coupler and is supplied from the control printed circuit board at the front of each enclosure.

Filter

The passive bandpass filter rejects spurious and harmonic output products and passes the VHF channel RF output. The cavity resonator uses aperture coupling and is a linear resonator design. Typical insertion loss is 0.6 dB to 1.0 dB depending on channel frequency. Average roll off is –33 dBc at a point 4.5 MHz below the peak visual carrier frequency and –30 dBc 9.0 MHz above the peak visual carrier frequency. The filter is DC grounded on both the input and output for additional lightning protection.

Section V – Power Supply

Switching AC-DC power supplies are used to power the amplifier pallets, the control circuits, and all of the fans. There are (2) power supplies paralleled in the power supply enclosure to generate the necessary current for the amplifier pallets. These (2) supplies are paralleled at 31.0 Vdc nominally and fed to the power amplifier enclosure via 4-AWG multi-stranded conductors and high current connectors. There are no power supplies internal to the power amplifier enclosure, with the exception of those found on the Series IIG control PCB. All fans run off this same supply, though they pass through a series dropping resistor to lower the supply voltage, as the fans are 24Vdc.

A 24Vdc nominal power supply is located in the combiner enclosure. It simply supplies power to the control PCB and the cooling fan.

The power supplies in the power supply enclosure are Mean Well PSP-1500. The power supply found in the filter enclosure is a Mean Well S60-24. The switching power supplies are fully protected against short circuit and output overload. Short circuit protection is a cycling type power limit. The internal AC fuse is designed to blow only on a catastrophic failure in the unit – the fuse does not blow on overload or short circuit. The thermal shutdown automatically recovers when the power supply chassis cools down.

AC (220Vac) is fed into the power supply enclosure via a terminal block and then through a resettable circuit breaker. The AC for the combiner enclosure (110Vac) is fed through a filtered EMI AC entry. The current in the power supply is then current limited with a resettable circuit breaker before passing through a rocker switch. This switch turns the AC on and off to the switching power supply.

MEAN WELL

1500W Single Output with PFC Function

PSP-1500 series

■ Features :

- AC input active surge current limiting
- Built-in active PFC function, PF>0.95
- Protections:Short circuit/Over load/Over voltage/Over temperature
- Built-in constant current limiting circuit
- Built-in remote ON-OFF control
- Built-in remote sense function
- 3 years warranty

SPECIFICATION

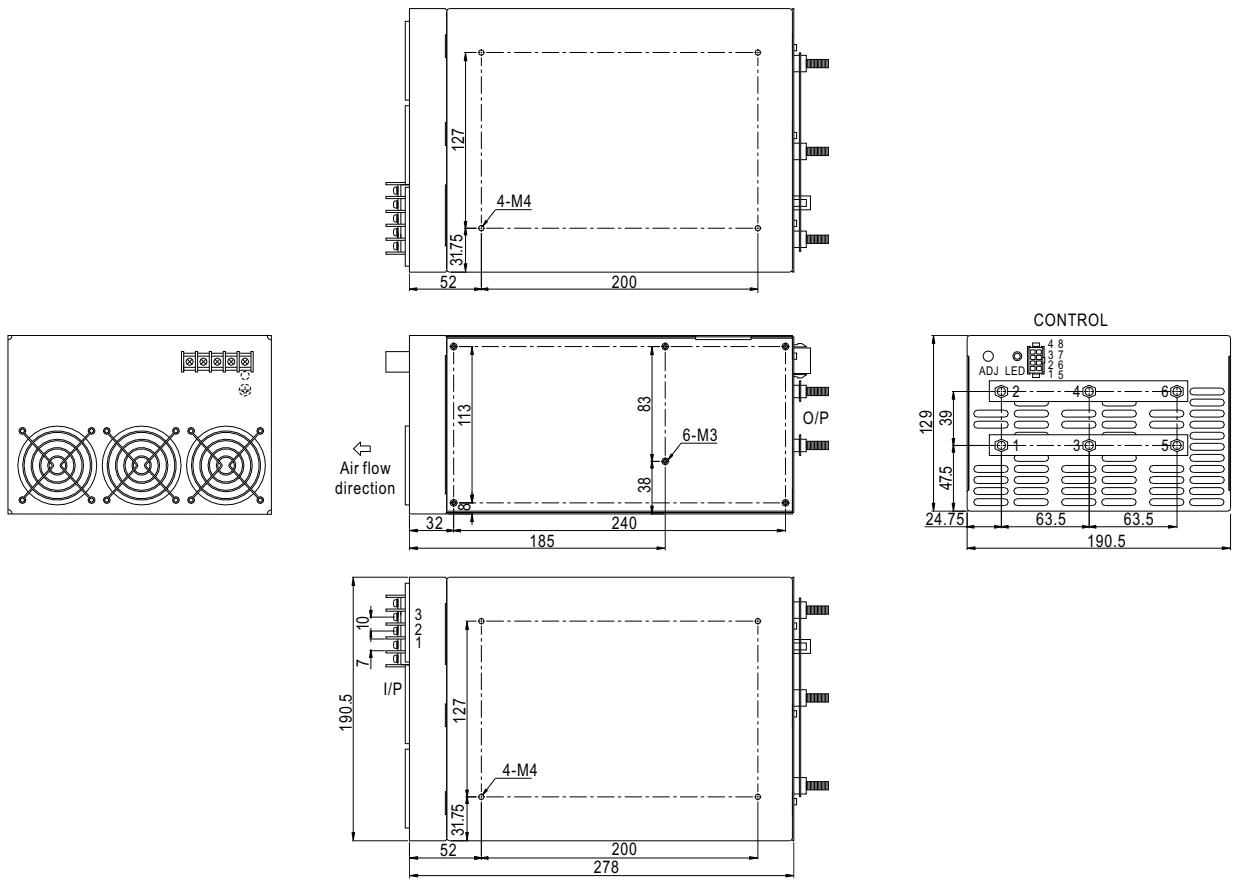
MODEL		PSP-1500-5	PSP-1500-12	PSP-1500-13.5	PSP-1500-15	PSP-1500-24	PSP-1500-27	PSP-1500-48
OUTPUT	DC VOLTAGE	5V	12V	13.5V	15V	24V	27V	48V
	RATED CURRENT	217.5A	112.5A	100.5A	90A	56.4A	50.4A	28.5A
	CURRENT RANGE	0 ~ 217.5A	0 ~ 112.5A	0 ~ 100.5A	0 ~ 90A	0 ~ 56.4A	0 ~ 50.4A	0 ~ 28.5A
	RATED POWER	1087.5W	1350W	1356.75W	1350W	1353.6W	1360.8W	1368W
	PEAK LOAD Note.4	1200W	1500W	1500W	1500W	1500W	1500W	1500W
	RIPPLE & NOISE (max.) Note.2	100mVp-p	150mVp-p	150mVp-p	150mVp-p	150mVp-p	150mVp-p	200mVp-p
	VOLTAGE ADJ. RANGE	4.75 ~ 5.5V	10 ~ 13.2V	12 ~ 15V	13.5 ~ 18V	20 ~ 26.4V	24 ~ 30V	41 ~ 56V
	VOLTAGE TOLERANCE Note.3	±6.0%	±3.0%	±2.0%	±2.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.3%	±0.3%	±0.3%	±0.2%	±0.2%	±0.2%
	LOAD REGULATION	±2.0%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	SETUP, RISE, HOLD TIME	1.5s, 50ms, 15ms/230VAC at full load						
INPUT	VOLTAGE RANGE	176 ~ 264VAC 248 ~ 370VDC						
	FREQUENCY RANGE	47 ~ 63Hz						
	POWER FACTOR	PF>0.95/230VAC at full load						
	EFFICIENCY (Typ.)	77%	84%	84%	84%	85%	85%	86%
	AC CURRENT	10.5A/230VAC						
	INRUSH CURRENT (max.)	100A/230VAC						
	LEAKAGE CURRENT	<3.5mA / 240VAC						
PROTECTION	OVER LOAD	115 ~ 140% rated output power						
		Protection type : Constant current limiting, recovers automatically after fault condition is removed						
	OVER VOLTAGE	5.75 ~ 6.75V	13.8 ~ 16.2V	15.5 ~ 18.2V	18 ~ 21V	27.6 ~ 32.4V	31 ~ 36.5V	57.6 ~ 67.2V
		Protection type : Shut down o/p voltage, re-power on to recover						
	OVER TEMPERATURE	95℃(TSW1) Detect on the heatsink of PFC MOSFET 90℃(TSW2) Detect the winding of output choke						
		Protection type : Shut down o/p voltage, recovers automatically after temperature goes down						
FUNCTION	REMOTE CONTROL	RC+/RC-: 0 ~ 0.8V=power on ; 4 ~ 10V=power off sink current <30mA						
ENVIRONMENT	WORKING TEMP.	-10 ~ +65℃ (Refer to output load derating curve)						
	WORKING HUMIDITY	20 ~ 90% RH non-condensing						
	STORAGE TEMP., HUMIDITY	-20 ~ +85℃, 10 ~ 95% RH						
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)						
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes						
SAFETY & EMC (Note 5)	SAFETY STANDARDS	UL1950, TUV EN60950 Approved						
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC						
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms/500VDC						
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B						
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3						
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN55024, Light industry level, criteria A						
OTHERS	MTBF	43.4K hrs min. MIL-HDBK-217F (25℃)						
	DIMENSION	278*129*190.5mm (L*W*H)						
	PACKING	6.9Kg; 2pcs/13.8Kg/1.14CUFT						

NOTE

1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.
3. Tolerance : includes set up tolerance, line regulation and load regulation.
4. 10% Duty cycle maximum within every 30 seconds(max.). Average output power should not exceed the rated power.
5. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives.

■ Mechanical Specification

Case No. 925 Unit:mm



AC Input Terminal Pin. No Assignment

Pin No.	Assignment
1	AC/L
2	AC/N
3	FG ⏚

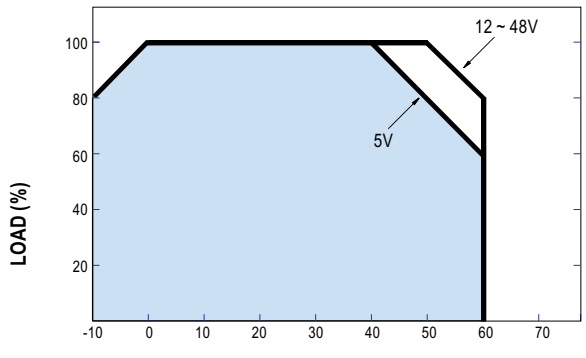
DC Output Terminal Pin. No Assignment

Pin No.	Assignment
1,3,5	DC OUTPUT +V
2,4,6	DC OUTPUT -V

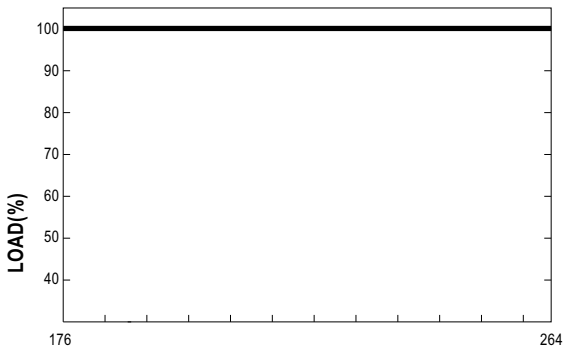
Control Pin. No Assignment : MOLEX 5559-NP uses 5558male crimp terminal

Pin No.	Assignment	Pin No.	Assignment	Mating connector	Terminal
1	NC	5	NC	MOLEX 5557-NR	MOLEX 5556 Female crimp Terminal receptacle
2	-S	6	NC		
3	G	7	+S		
4	RC-	8	RC+		

■ Derating Curve



■ Output Derating VS Input Voltage



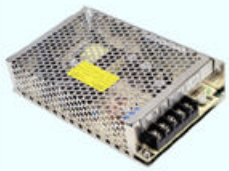
MEAN WELL

SWITCHING POWER SUPPLY

ISO-9001 CERTIFIED MANUFACTURER

S-60 SERIES

.LOW COST, HIGH RELIABILITY .COMPACT SIZE, LIGHT WEIGHT
.105°C OUTPUT CAPACITOR .100% FULL LOAD BURN-IN TEST
.INTERNATIONAL AC INPUT RANGE .BUILT IN EMI FILTER, LOW RIPPLE NOISE
.HIGH EFFICIENCY, LOW WORKING TEMPERATURE
.SOFT-START CIRCUIT, LIMITING AC SURGE CURRENT
.SHORT CIRCUIT, OVERLOAD, OVER VOLTAGE PROTECTED



MODEL / SPECIFICATION	S-60-5	S-60-12	S-60-15	S-60-24
DC OUTPUT VOLTAGE	5V	12V	15V	24V
OUTPUT V. TOLERANCE	±2%	±1%	±1%	±1%
OUTPUT RATED CURRENT	12A	5A	4A	2.5A
OUTPUT CURRENT RANGE	0-12A	0-5A	0-4A	0-2.5A
RIPPLE & NOISE	120mVp-p	120mVp-p	150mVp-p	150mVp-p
LINE REGULATION	±0.5%	±0.5%	±0.5%	±0.5%
LOAD REGULATION	±1%	±0.5%	±0.5%	±0.5%
DC OUTPUT POWER	60W	60W	60W	60W
EFFICIENCY	73%	76%	77%	79%
DC VOLTAGE ADJ.	+10,-5%	±10%	±10%	±10%
INPUT VOLTAGE RANGE	85~264VAC 47~63Hz; 120~370VDC			
AC CURRENT	2A/115V 1A/230V			
INRUSH CURRENT	COLD START 30A/115V 60A/230V			
LEAKAGE CURRENT	<3.5mA/240VAC			
OVERLOAD PROTECTION	105%~150% TYPE:PULSING HICCUP SHUTDOWN RESET:AUTO RECOVERY			
OVER VOLTAGE PROTECTION	115%~135%			
OVER TEMP. PROTECTION	----------			
TEMP. COEFFICIENT	±0.03% / °C (0~50°C)			
SETUP, RISE, HOLD UP TIME	800ms, 50ms, 10ms / 115VAC 300ms, 50ms, 80ms / 230VAC			
VIBRATION	10~500Hz, 2G 10min./1cycle, PERIOD FOR 60min. EACH AXES			
WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC			
ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:500VDC / 100M Ohms			
WORKING TEMP., HUMIDITY	-10°C~+60°C(REFER TO OUTPUT DERATING CURVE), 20%~90% RH			
STORAGE TEMP., HUMIDITY	-20°C~+85°C, 10%~95% RH			
DIMENSION	159*97*38mm CASE:901			
WEIGHT	0.55Kgs			
SAFETY STANDARDS	UL1012, TUV EN60950, IEC950, UL1950 APPROVED			
EMC STANDARDS	CISPR22 (EN55022), IEC801-2,3,4, IEC555-2 VERIFICATION			

NOTE :
1.ALL PARAMETERS ARE SPECIFIED AT 230VAC INPUT, RATED LOAD, 25°C 70% RH. AMBIENT.
2.TOLERANCE GINCLUDE SET UP TOLERANCE, LINE REGULATION, LOAD REGULATION.
3.RIPPLE & NOISE ARE MEASURED AT 20MHz BY USING A 12" TWISTED PAIR TERMINATED WITH A 0.1uF & 47uF CAPACITOR.
4.LINE REGULATION IS MEASURED FROM LOW LINE TO HIGH LINE AT RATED LOAD.
5.LOAD REGULATION IS MEASURED FROM 0% TO 100% RATED LOAD.
6.C2,3,6 MUST BE REMOVED.

2000-10-03

Section VI – Monitor and Control System

Control Board Overview (Series II-rev I)

The control printed circuit boards (PCB) are located at the front of each enclosure connected directly to the back of the liquid crystal displays (LCD) and are identified as Series II – rev I PCBs. The main purpose of the Series II - rev I PCB is to monitor the RF power and the DC supply voltages in the power amplifier and filter enclosures and to monitor just the DC supply voltages in the power supply enclosure. In all cases, a DC voltage proportional to the parameter being sampled is conditioned, protected, buffered, and then run into an analog-to-digital converter (ADC) where software processes the signal. The software processing determines if the parameters are within the predetermined safe operating levels and displays the parameters on the LCD for monitoring purposes. The Series II - rev I PCB can be broken apart into (5) main component areas: the power supply, interface, signal processing, display, and microcontroller. Schematics are found later in this section.

Power Supply Components

There are (4) power supply voltages generated on the Series II – rev I PCB:

1. +5Vdc for all logic and general purpose PCB supply voltage.
2. +4Vdc for the LED backlighting on the LCD
3. -4Vdc for the contrast voltage required by the LCD
4. +5Vdc for the directional coupler supply

The +5Vdc is generated from a small switching power supply comprised of C101, C102, D102, L101, and U101. This power supply accepts DC input voltages up to 40Vdc (unless U101 is an HV option, then the maximum input voltage is 60Vdc) and outputs +5Vdc at up to 1Adc. This voltage is always on, as the ON/OFF pin on U101 is hard-wired to the on configuration. C103, L102, and C104 form a noise choke to help filter and switching noise or RF noise that may radiate onto the control circuit board.

The +4Vdc is generated from a small switching power supply comprised of components C105, C106, D103, L103, and U102. This power supply accepts DC input voltages up to 40Vdc (unless U102 is an HV option, then the maximum input voltage is 60Vdc) and outputs +5Vdc at up to 1Adc. The voltage then gets dropped down to +4Vdc through R101. This backlight voltage can be turned on and off via the ON/OFF pin on U102. The PCB is setup in a manner that allows this voltage to be hard-wired on all the time or controlled from the microcontroller through latch U111. This selection is made with jumper J102.

The -4Vdc is generated using a switched capacitor voltage converter design, using components C109, C110, R102, R103, U104, and VR101. U4 accepts +5Vdc from the general purpose +5Vdc supply and generates -5Vdc. This voltage then gets dropped across the voltage divider (R102, R103) to generate the contrast voltage specific to the LCD that is installed in the system.

The voltage required by the directional coupler is generated with a standard linear voltage regulator, U103. C107 and C108 helps clean up any ripple or noise that might be on the output voltage. In the standard configuration, where the directional coupler requires 5Vdc, the 5Vdc is simply taken from the U101 filtered power supply output.

Interface Components

The interface section of the Series II – rev I PCB includes the front panel switch interfacing in addition to the buzzer and carrier disable output circuits.

The (4) membrane switches found on the front panels of each enclosure are tied to the microcontroller through an isolation stage to avoid any static discharge or noise on the switch wiring from reaching the microcontroller. Optoisolators U105 and U106, in addition to components R104…R115 create the necessary isolation to the sensitive microcontroller. By depressing any membrane switch, a ground (0V) is applied to the input of the optoisolators. The optoisolators will, in turn, output a ground (0V) to the microcontroller.

The membrane switches found on the front panels of the enclosures operate in the following manner with a depress:

POWER – When unit is plugged in, AC is supplied to the fan and switching power supply input, but the amplifiers are still turned off. In order to turn the amplifiers on, wait ten seconds after plugging the PA in and push in the "POWER" tactile button. The LCD will read "Soft Start Warm Up, Please Wait". After ten seconds the bias voltages will be turned on and you may then plug in the RF drive. Depress for (1) second to turn on and (3) seconds to turn system off. In the case of multiple enclosures, all POWER switches are tied together in each enclosure, so only one needs to be depressed.

NAVIGATE – Turns on backlight to LCD and displays forward and reflected RF power and DC supply voltage parameters. When power amplifier is first turned on, the LCD comes on automatically and this information is displayed. Information is displayed for approximately 2 minutes before the backlight turns off and the display is cleared. This is set up so as not to burn any pixels into the LCD from extended on time. In the case of multiple enclosures, the NAVIGATE switches are individual to each enclosure.

SELECT – Turns on backlight to LCD and displays forward and reflected RF power and DC supply voltage parameters. When power amplifier is first turned on, the LCD comes on automatically and this information is displayed. Information is displayed for several minutes before the backlight turns off and the display is cleared. This is set up so as not to burn any pixels into the LCD from extended on time. In the case of multiple enclosures, the SELECT switches are individual to each enclosure.

RESET – Tactile switch resets the monitor and control system. The amplifier gets shut down for under 0.5 seconds and comes back on with each depress of the reset button. At the same time, all fault counters in the microcontroller software are reset and the LCD is reset in the same manner as it is with a depress of the NAVIGATE button. Reset switches are individual to each enclosure but may be tied together externally through the remote port, as explained later in this section.

The buzzer control comes from pin 7 on microcontroller U114. The control signal turns on the base of transistor Q101, which allows current to flow through the single tone magnetic buzzer. Jumper J105 simply turns off the buzzer.

The carrier disable circuit simply applies a shutdown voltage to the driver pallet in the system. The U114 generates the signal out of pin 21 and controls transistor Q102 through R117. When Q102 is turned off, the shutdown voltage to the driver is floating and the carrier is on. During a fault condition, when Q102 is turned on, the shutdown voltage is applied to the carrier disable on the driver. Relay K101, which outputs the carrier disable, is protected from transient spikes by D104.

Signal Conditioning Components

The signal processing section of the Series II – rev I PCBs is used to buffer potentially noisy or damaging signals from the ADC. Power supply samples and forward and reflected power from a directional coupler are then digitized.

Firstly, all analog signals are protected with a resettable fuse and transient voltage suppressor (TVS) combination. These components ensure that voltages above the Vbr breakdown voltage of the TVS get clamped and do not pass farther down the circuit. After this protection stage, the analog voltages get dropped with voltage dividers to safe levels for the buffers and ADC. For example, a 30Vdc power supply sample gets dropped to a level below the +2.5Vdc voltage reference of the ADC. After the voltage dividers, the analog signals get buffered with U107 and U108, configured as unity gain voltage followers. Finally, after some further decoupling capacitors and filters, the analog signals get digitized by the 8-channel, 10-bit ADC (U10) and sent to the microcontroller through a serial interface.

In the power amplifier and filter enclosures, there are (3) analog voltages that get conditioned and processed: DC power supply sample, forward RF power, and reflected RF power. Specifically, the components for the power amplifier and filter enclosure conditioning are as follows:

DC power supply – J108 (pin 1 floating and direct connection), F107, C120, L108, C121, R129, R130, VR105, U8, C122, C123, L109, C124 and U10.
Forward RF power – J108 (pin 2), F106, D109, C117, C118, L107, C119, R127, VR104, R128, U108, C108, C125, L110, C126, C127, and U110.
Reflected RF power – J108 (pin 3), F105, D108, C114, C115, L106, C116, R125, VR103, R126, U108, C130, L112, C131, C132, and U110.

Display Components

The display section of the Series II – rev I PCB is comprised of the LCD and the components that make up the data bus to send the data from the microcontroller to the LCD.

Specifically, the LCD is an alphanumeric 20X4 display that uses the industry standard 44780 controller and a parallel interface for data communications. Firstly, the microcontroller sends out the data to be displayed via a serial bus where the signals are latched with U111 and U112 and converted to a parallel data stream. The parallel data then transfers directly to the LCD through connector J109. J109 also carriers the power supply for the LCD.

Microcontroller Components

The heart of the monitor and control system found in Series II - rev I PCBs is microcontroller U114. This microcontroller analyzes all RF power levels and voltages to ensure that all operating parameters are within their predetermined safe operating levels. If a fault is found, appropriate action is taken to help protect the system from damage, which may include turning the RF carriers off. A full description of all faults and their respective actions is found later in this section.

The power supply for the microcontroller is monitored closely via supervisor U113. Should the +5Vdc supply drop below +4.5Vdc, a microcontroller reset is generated to ensure there are no brown out conditions that may latch the microcontroller up to an unknown state. The front panel Reset momentary switch is also tied to this line after optoisolation. The microcontroller is run off of a 4.000MHz clock source, generated by ceramic resonator CR101. If the software is running, LED D110 will be lit. Finally, U115 stores all characters for the LCD to minimize the overhead required for the microcontroller, and also stores the current state of the power ON/OFF of the system. This is to ensure that, in the event of a power outage, the system returns to the exact state is was before power was interrupted.

Fault Shutdowns

On the LCD (Liquid Crystal Display) the following messages may appear:

If you see this message, the system will:

- shut amp down for 1 minute
- automatically turn amp on after 1 minute and check again for overdriven amplifier
- come back to the same power level that it was set

If you see this message, the system will:

- shut amp down for 5 minutes
- automatically turn amp on after 5 minutes and check again for high VSWR
- come back to the same power level that it was set

Remote Port

The remote port allows external control of the transmission system via the DB25 connector on each enclosure. All functions on the remote port are simply hard-wired or paralleled to existing wiring to provide a secondary method of control to the user, and are activated as follows:

pin 1: ground to reset microcontroller, float otherwise
pin 2: ground for 2 seconds to toggle carrier on/off, float otherwise
pin 3: common ground
pin 4: DC power supply sample