

CPS-1001/S13.56MHz
FP0213RK

CPS 1001/S/13.56MHz
RF POWER SUPPLY
Operator's Manual



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Table of Contents

I. Safety Information.....	2
II. Description / Specifications	5
A. Electrical Specifications	
B. Protection Features	
C. Generator I/O Requirements	
D. Mechanical Specifications	
E. Environmental Specifications	
F. Testing Specifications	
G. Packaging and Shipping Specifications	
III. Unpacking and Inspection.....	9
IV. Maintenance	9
V. Preparation For Use.....	9
A. Power Requirements	
B. Cooling Requirements	
C. Installation Procedures	
VI. Operating Instructions	10
A. Local Operation	
B. Remote Operation	
C. Test Equipment List	
VII. Theory of Operation.....	11
A. DC Power Supply	
B. Oscillator Control Board	
C. Driver	
D. PA1000 Power Amplifier	
E. Directional Coupler	
F. CPS Meter Board	
VIII. Adjustments and Calibration.....	13
A. Over Voltage / Over Current Adjustment	
B. VSWR Adjustment	
C. Output Power and Forward Monitor Calibration	
D. Reflected Monitor Calibration	
IX. Figures	
FP0213RX	CPS 1001 / 13.56 MHz Block Diagram
FP0213RX.drg	CPS 1001 Control Drawing
FA0105RX	13.56, 1 KW Standard Directional Coupler
FA0207RX	1 KW / 13.56 MHz “S” Driver
FA0401RX	Oscillator Control Bard 13.56 MHz Standard
FA0603RX	Integrated Meter Assembly, Standard

NOTE: Before installing equipment, carefully read and familiarize yourself with the entire operations manual. Observe and obey all WARNING and CAUTION notes provided.

I. Safety Information

Warning Label and Safety Marking Explanations:

The following symbols and terms may be found on an instrument or used in this manual.



The CE mark indicates compliance with all currently applicable directives and standards.



This label indicates a general warning or caution condition.



This symbol indicates the presence of high voltages in or around the unit.



This symbol indicates that the component or circuit is short circuit protected.



This symbol indicates the presence of RF energy in or around the unit.



This symbol indicates a protective earth ground connecting point.



This label indicates a presence of high voltage in or around the equipment, which may cause severe injury or death. All appropriate precautions should be observed when installing, operating or servicing this equipment.



This label indicates the presence of Radio Frequency energy in and around the equipment, which may cause burns or other injuries. All appropriate precautions should be followed when installing, operating or servicing this equipment.

The **WARNING** heading used in this manual explains dangers that might result in personal injury or death. **Always read the associated information** very carefully before performing the indicated procedure.

The **CAUTION** heading used in this manual explains hazards that could damage the unit. Such damage may invalidate the warranty.

MUST – This word is understood to indicate a mandatory condition.

HIGH VOLTAGE – Voltages greater than 50 volts DC or 25volts AC and known to cause death or serious injury if contacted.

SERVICE – Any operation of maintenance, repair, calibration or similar activity other than the normal operation of the unit.

QUALIFIED SERVICE TECHNICIAN, QUALIFIED ELECTRICIAN, QUALIFIED PERSONELL These terms indicate persons specifically trained to install, service or other wise handle electronic equipment of the character and hazard potential of this unit.

End User Labeling

The system installer should obtain and apply all appropriate safety and warning labels required by the end user's local fire department jurisdiction and Occupational Health and Safety Administration over and above those supplied by the generator manufacturer.

Read And Understand This Section Fully Before Installing or Operating This Equipment.

WARNING: This equipment must be installed, operated and serviced only by trained, qualified persons.

General Safety Requirements



- **WARNING:** Hazardous Voltages and RF voltages are present inside this unit, which may cause injury or death. To prevent electrical shock and or RF burns, never operate this equipment with the covers removed. Never operate without an appropriate cable connected between the RF output connector on the rear panel and the load.
- **CAUTION: There are no user or operator serviceable parts inside this equipment. Refer all service to a qualified service technician.**
- This equipment must be bonded to Protective Earth (safety ground) prior to operating the unit. Safety ground connection must be made at the unit's rear panel designated 1/4" - 20 threaded ground stud. The ground wire should be a #14 awg or equivalent (minimum) green/yellow lead.
- Replace fuses only with identical type and rating parts. Installation and connection of this equipment must only be performed by a qualified electrician.
- **HEAVY OBJECT CAUTION:** A heavy object caution exists for equipment weighing more that 51 lbs or 23 kg. Use lifting aids to install unit, such as chain lifts or hooks and straps, attached to the four handles at the sides and front of unit. Guide unit into final location using care to keep hands and body parts clear of unit.



CE Mark Specific Safety Requirements

- This equipment meets all applicable safety directives (as specified in prEN50178) required to qualify for the application of the CE marking.
- This equipment must be installed in accordance with the applicable requirements, or prEN50178 and EN60204-1 / IEC-204-1.
- This equipment is qualified to operate at Pollution Degree II and Insulation Category II.
- The installation of this equipment must assure that the AC power input connector (UL/CSA) is not accessible to the user/operator. Access may be gained only by a qualified service technician. AC Mains connector installation must be in accordance with local requirements.
- This unit provides appropriate separation between all interface, mains and output circuits in accordance with 5.2.18 of prEN50178.

Interlock System

- The low voltage (24 V) safety interlock circuit is designed to disable the unit in the event of an interlock fault condition. At a minimum, interlock protection is located at the removable top cover, bottom cover and RF output connector safety cover.
- End user's system should provide indication to the operator of the interlock fault condition.
- Low voltage power for the interlock circuit is supplied by a step down transformer located inside the unit. This transformer is designed to provide safe low voltage operation and provide isolation from the main AC line.

Lockout/Tagout

Prior to performing system maintenance, repair or other service operations the generator must be locked out and tagged out to prevent accidentally energizing the system.

The following steps should be performed only by a qualified service technician:

- Disconnect AC input power to the generator.
- Mount a suitable "Clamshell" type lockout device to the AC input plug such as a Hubbell # HLD2 or equivalent. Follow all manufacturers' directions for the lockout device.
- Secure the lockout device with an appropriate padlock or safety lock.
- Apply a lockout warning tag to the lock out device.

The Lockout / Tagout device should not be removed until system service is completed and it has been determined appropriate to reconnect and operate the generator.

II. Description / Specification

The CPS-1001/S/13.56MHZ is a RF Generator operating with a center frequency of 13.56 MHz. The power source produces maximum transfer of power into a 50 ohm resistive load, yet it is designed to withstand large deviations in load impedance without failure.

The primary features of the CPS-1001 series are its solid-state design, small physical size and reliability.

The CPS-1001 series amplifier is constructed with two main sections. The DC power section includes all of the filter capacitors, rectifiers and regulators, as well as the three-phase 208 VAC power transformer. Transformers to accommodate other line voltages are available through special order. The rectifiers and bleeder resistors are mounted on a water-cooled copper heatsink. These components are operated at about half of their rated outputs to insure the high reliability of this section. The RF section consists of the oscillator control board (OCB), driver, PA 1000 power amplifier, combiner and directional coupler assembly. The driver and power amplifier modules are mounted on water-cooled heatsinks. All components are used well below their dissipation ratings for long life and low maintenance operation.

The CPS-1001 is enclosed in a standard 19" rack mounted chassis. The chassis is 5.25" high and 16.125" deep (See the Control Drawing for further mechanical detail).

NOTE: This product is subject to a "Copy Exact" agreement that requires written notification to the contract specialist prior to implementing any PART or PROCESS Changes.

A. Electrical Specifications

1. A/C Input Voltage: 180-229 VAC, 49-61Hz, three phase, NO NEUTRAL
2. Line Current Protection: 10 Amp, 3 pole circuit breaker.
3. Output Power: (within specified range of line voltage)
 - 3.1 0 to 1.0 KW continuous forward power into a 50 ohm load, 0 degrees nominal phase.
 - 3.2 0 to 1.0 KW continuous forward power into a plasma load of complex impedance with appropriate matching network.
 - 3.3 Forward power out to track command setpoint for reflected power less than 200 watts.
4. Generator frequency: 13.56 MHz
5. Frequency stability: +/- .005%
6. Load Mismatch: Continuous operation into any load mismatch. Automatic forward power limiting above 200 watts reflected power.
7. Harmonic distortion: All harmonics minimum 30 db below fundamental at full power
8. Accuracy / Linearity / Regulation/ Stability:
 - Setpoint Zero Offset: - 2% of full scale max
 - Input to Output Linearity: +/- 3% of setpoint from 10-100%
 - Input to Output Accuracy: +/- 3% of setpoint from 10-100%
 - A/C Line Regulation: 2% max output change over rated voltage
 - Forward Power Regulation: +/- 5% of setpoint max for load variations from 1:1 to

1.5:1 VSWR within foldback limits
Short Term stability: +/-1%/hr
Long term stability: +/-5% over three years continuous output
Zero Setpoint: less than 5 watts actual output power and less than 5 watts readback power when setpoint signal is at zero or at a negative voltage.

NOTE: Use RF enable switch (Pins 4-9) 15 Pin D to ensure zero output power.

B. Protection Features

1. Mismatch Protection: Continuous operation into any impedance mismatch condition without damage or malfunction; forward power foldback shall occur within 500us if reflected power exceeds 150 Watts.
2. Output power connection interlock: Hard-wired interlock that disables the input AC power contactor upon removal of the output cable.
3. Safety interlock: Disables the input AC power contactor via the connector. MAX external loop resistance of 5.0 ohms .
4. Over Temp Fault: Output disabled on high internal temperature
5. Short Circuit Fault: Output limiting protection under short and open circuit conditions.
6. Overdrive Limit: Internally limited at 1100 watts.
7. Control signal protection: Unit not to be damaged if a short circuit or up to 30 volts AC or DC is placed between any input signal, return signal, and ground.

C. Generator I/O Requirements

1. Signal input impedance: 10K ohms, min.
2. Signal input isolation: 1000 VAC MIN to the A/C supply line.
3. Line connections: Linecord to be 14AWG 4 conductor (three phase & ground); linecord jacket material to be type "STO" gray; linecord to be crimped to NEMA L15-20P style plug; linecord length to be 4.5 ft. +/-6.0 inches as measured from the rear panel exterior to the strain relief end of plug. Reference MARINCO part number 2015P-AM1.

MARINCO: One Digital Dr.
Novato, CA 94949
(415) 883-3347

4. RF Output power Connector: One type "N" female coaxial connector
5. Control connector: 15 pin subminiature "D" type, (female).
6. Control signals and pinout:

Pin 5: Power setpoint 0 to +10 VDC = 0 to 1.0 KW linear

Pin 3: Forward power out 0 to +10 VDC = 0 to 1.0 KW linear

Pin 2: Reflected power out 0 to +10 VDC = 0 to 1.0 KW linear

Pin 4: Power enable	Enables the output oscillator with an external contact closure between pins 4 and 9 (24 VOLTS, 0.5 AMPS MAX SWITCHING)
Pin 9: Power enable	Common for Pin 4
Pin 11: Safety interlock	Enables the input A/C power contactor with an external contact closure to Pin 12. (24 VOLTS, 0.5 AMPS MAX SWITCHING).
Pin 12: Safety interlock common.	
Pin 6: Signal common	
Pin 7: Power on indicator	+5 VDC source when RF Power is on
Pin 8: Power on common	Common for Pin 7

D. Mechanical Specifications

1. Size: 17" W x 5.25" H x 16.125" D max.
2. Mounting: Standard 19" rack.
3. Cooling: 1.5 G.P.M. MIN, 35 degrees C MAX 25% glycol mix MAX
4. Water connections: 1/4 NPT female, inlet and outlet.
5. Front panel indicators:
 - 5.1 Power meters: Dual meters to indicate forward and reverse power.
 - 5.2 Power on indicators: Visible green LED to indicate A/C power on.
 - 5.3 Fault indication: Visible red LED to indicate temp fault.
6. Handles: Two handles (left and right) to be mounted on the front panel exterior, evenly spaced on center, dimensioned
7. Color: Front panel to be black with contrasting white alpha/numeric designators.
8. Warning Labels:
 - 8.1 Safety Labels for hazardous voltages, Heavy Object, and Caution for lifting by water fittings are to be provided on operator visible areas of the generator. IEC standard symbols in user visible areas for start, stop, enable and cautionary conditions, PE ground, high temperatures and RF energy present.
 - 8.2 Special marking available at customers specifications

E. Environmental Specifications

1. Operating Temperature & Humidity
 - 1.1 Operating ambient temperature/humidity/air pressure: 10 to 40° C, 5 - 85% humidity (non-condensing, no formation of ice), 86-106 kPa. Class 3k3 per prEN50178.

- 1.2 Inlet Water Cooling Requirements: 1.5 GPM @ 690 kPa (100 psi) max, 35° C Max.
- 1.3 Coolant type: Water
2. Storage and Transportation
 - 2.1 Storage temperature/humidity/air pressure: -25 to +70° C (class 1k4 per prEN50178), 5 - 95% humidity (non-condensing, no formation of ice, class 1k3), 70-106 kPa (class 1k4).
 - 2.2 Transport temperature/humidity/air pressure: -25 to +70° C, 5 - 95% humidity, 70-106 kPa (class 2k3).
3. This equipment has been designed to be compliant with FCC Part 18 emission standards for EMI/RFI radiation. Radiated emissions shall also not exceed maximum levels permitted by ANSI C95.1-1982 standards on safety levels with respect to human exposure to RF and electromagnetic fields from 300KHz to 100GHz.

F. Testing Specifications

1. Production Acceptance Test: Each unit will be required to "pass" production acceptance testing and a "Final Test Report" will be generated to document results.
 - 1.1 Production Acceptance Testing process shall include as a minimum: Complete Parametric/Functional Tests covering: line regulation, calibration, linearity, burn-in, over-temp test, open circuit test, MAX power test, harmonic distortion, AC ripple, and remote interface tests. Data sheet for each generator to be shipped with unit.

G. Packaging & Shipping Specifications

1. Accessories Supplied
 - 1.1 Final test results
 - 1.2 Operating manual
2. Shipping

NOTE: If there is a conflict between this document and customer Purchase Order then the latter supersedes.

NOTE FOR REPAIRS: Unless repairs have accessories included with them and have them listed on the Return Material Authorization (RMA) Tag, returned materials will not have to fulfill procedural requirements for accessories.

III. Unpacking and Inspection

1. Carefully unpack the unit and inspect for any obvious signs of physical damage that might have occurred during shipment. Notify the shipping agent of any damage immediately.
2. Check the outside of the unit for missing or loose mounting screws or broken parts.
3. If there is shipping damage or the unit fails to operate properly upon receipt, report damage to the carrier and Comdel immediately.

CAUTION: Breaking the seal or removing the warranty decal from this unit will void the warranty. If internal damage is suspected, contact factory for assistance.

IV. Maintenance

The CPS-1001 is designed to run unattended for long periods of time. Should service be required, the system is modularly designed for quick repair. The whole RF section could be replaced in less than thirty minutes.

After a time, scale may build up on the inside of the cooling tubes. This could greatly reduce the cooling capacity of the system. It is recommended that the system be flushed with a descaling agent. A cleaning agent that does not damage copper, brass, stainless steel and nylon tubing should be chosen.

V. Preparation for Use

A. Power Requirements

The CPS-1001 is designed to operate from a 208 VAC three phase line. The system will function within specifications when line voltage fluctuates between 185 and 230 volts. However, voltages over the recommended 208 VAC reduce the safety margins designed into the system and should be avoided. Lower voltages impact power output and regulation. The system draws a maximum of 8 amps per phase (at 208Vac line) when used to drive a load of 50 ohms. Under conditions of mismatch, the amplifier could draw slightly more current.

Nominal Input: 208 VAC, 3 Phase
50/60 Hz
8 Amps

This system utilizes 3 wire plus ground (no neutral) wiring.

B. Cooling Requirements

The CPS 1001 requires 6 liters/minute (1.5 gallons per minute) to cool sufficiently. The inlet water pressure should not exceed 60PSI. Water temperature should not exceed 35° C, and should not fall below a temperature where excess condensation could develop within the unit. The ambient air temperature of the generator should not exceed 35° C. There should be enough room over the top of the amplifier and along the sides to permit unobstructed airflow through and around the unit.

C. Installation Procedures

1. This equipment must be installed in accordance with the directives of PREN50178 and EN60208-1 / IEC-208-1.
2. This equipment is qualified to operate at pollution degree II and installation category II.
3. This equipment is intended to be powered from a 208VAC, 3 Phase source. For use at other voltages, a safety isolation transformer must be used to power this equipment in accordance with the directives of EN60742 / IEC-742.
4. The installation of this equipment must assure that the AC power connector (UL/CSA) is not accessible to the user/operator. Access may be gained only by a qualified service technician.
5. Customer supplied AC mains connector installation to be in accordance with local requirements

CAUTION: There are no user serviceable parts inside this equipment. Refer all service to a qualified service technician.

VI. Operating Instructions

Operating and monitoring the CPS-1001 generator is accomplished either locally at the front panel or remotely. A front panel toggle switch selects either local or remote control. The remote monitoring and control interface is handled through the rear panel mounted 15-pin female “D” type connector, called J1.

A. Local Operation

1. Install 50 ohm coaxial load to output terminal of generator. Attach interlock sleeve on output cable to capture output cable interlock. The generator is normally supplied with Type N coaxial connectors. RG-8/u cable is sufficient to carry the output power from generator to load. Load should have at least 1500W dissipation rating.
2. Pin 11 or rear panel connector J1 must be grounded to enable the main power contactor (Pin 12 is ground). Pin 4 of rear panel connector J1 must be connected to Pin 9 (RF enable).
3. With the front panel circuit breaker in the “OFF” position, attach the primary supply line to the appropriate supply mains.

NOTE: Units are shipped wired for 208V, 3 phase, 50/60 Hz unless specified by customer.

4. Place local/remote switch in “LOCAL” position.
5. Rotate power control knob fully counter-clockwise.
6. Check that cooling water is on.
7. Check to confirm that all cover and cable interlocks are satisfied.
8. Turn on the front panel circuit power breaker.
9. Turn power control knob clockwise until full power is indicated on front panel power meter. (Reflected power will not indicate.)

B. Remote Control Operation

1. To control power remotely, a positive DC voltage must be applied to Pin 5 of J1 (Pin 6 is the return.) Control voltage of 0 to 10V yields an output of 0 to 1000 watts. Voltages put on this pin exceeding 10 volts will produce higher power up to a point. However, warranty of the unit cannot be maintained if the unit exceeds its design rating of 1000 watts.
2. Forward and reflected power can be monitored remotely through Pins 3 and 2 respectively (Pin 6 is the return). Forward power is related linearly to 0 to 5 VDC corresponding to 0 to 1000 watts. Reflected power relates 0 to 5 VDC linearly to 0 to 1000 watts. (Optional 0 to 10 VDC may be chosen for full scale power monitoring.)

C. Test Equipment List

Instrument Type and Cables	Min. Req. Spec	Recommended Instruments and Accessories
50 ohm Coaxial Resistor	1500W dissipation	Bird Electronics Thermaline coaxial Resistor #8860
Water Chiller	25-30 degrees C. 1.5 GPM min	Neslab Cool Flow Refrigerator Recirculator Model CFT-33XW

VII. Theory of Operation

The CPS-1001/S/13.56MHZ is a high frequency RF generator. The power source consists of three DC Power Supplies, oscillator control board, driver, power amplifier, directional coupler and integrated meter assembly. Schematic diagram dwg# FP0213RI is a complete system drawing down to the module level.

A. DC Power Supply (schem dwg# FP0213RI)

The DC supply consists of a three-phase transformer, a three phase full-wave, bridge rectifier, and low-pass filter for the high current DC power supply. This supply is used primarily by the driver and power amplifier (PA). There are two regulated low current power supplies. Both are on the integrated meter assembly printed circuit board (+/- 15VDC). The +/- 15VDC supplies are used in the oscillator control board (OCB) and on the integrated meter board.

The outputs of this stage are:

1	50 VDC max.	Unloaded
	41 VDC	Loaded (1000 watts RF output)
1	+15 VDC	Regulated 250 mA max.
1	-15 VDC	Regulated 150 mA max.

B. Oscillator Control Board (schem dwg# FA0401RE)

The oscillator is a hermetically sealed crystal circuit clock oscillator with a frequency stability of .01%. The signal from the oscillator is buffered and amplified by two stages of gain. This signal is now fed into the OCB output stage. The output is a class "C" amplifier stage. Output power of this stage varies from 0 to 1.0 watts by changing VCC. The VCC is changed via the ALC (automatic level control) circuit. There are no trimming or adjustments required in the RF part of the circuit due to its broadband and low "Q" matching networks.

The automatic level control (ALC) circuitry smoothes output power control and stabilizes output power against line and load variations. Control is achieved through the MC34082

operational amplifier, U5A. This op-amp compares the forward power signal (from the directional coupler board) to that of the DC reference signal applied to the non-inverting input. The reference level is set either from the front panel potentiometer or from Pin 5 of the J1 connector.

When the reference is applied to the U5A, it drives the gain control transistor Q4, until the squared forward power signal from the directional coupler is equal to the inverting input to the op-amp provided by the reference. When the inverting signal equals the reference voltage on the non-inverting input, the drive level holds constant.

The non-inverting input is the connection point for the protection circuits. The OCMA pulls this point down when the load conditions force the amplifiers near their over-voltage, or over-current limits. This limits the drive to the amplifiers until the match between the generator and the load is corrected.

The reflected power limiter performs in the same way. When the signal from the reflected power detector in the directional coupler reaches a pre-set limit, the U5B amplifier pulls -down the reference line until the VSWR conditions are within safe limits.

The oscillator control board also includes linearizing circuitry, allowing both forward and reflected analog power level signals to appear at connector J1 as linear representations of the forward and reflected RF output power. Two squaring ICs (U2 and U4) are used to condition the square law signals from the directional coupler.

Typical Specifications (OCB)

Output load impedance	50 ohms
Output RF power level	1 watt (max)
Input power Pin 10	+15 VDC at 170 mA max
Pin 8	-15 VDC at 24 mA max
Remote power control input impedance	
Pin 5 on J1	2 K ohm typical
Reflected power limit	Internally set to 200W reflected

C. Driver (schem dwg# FA0207R2)

The CPS-1001 driver consists of a two transistor “Class C” power amplifier stage. The output stage of the driver feeds a splitter. The split signals are then used to feed the final power amplifiers. With an input of 1.8 watts, a typical output would be 25 watts x2.

Typical Specifications (Driver)

Gain	50 ohms
Input power	1.5 watts (max)
Output RF power	25 watts
Driver Voltage*	42 VDC
Driver Current*	3.5 A
AC input	208 V

* 1000 watts into 50 ohm resistive load

D. PA 1000/S Power Amplifier

The PA 1000 uses eight power bipolar transistors arranged in four pairs of push-pull class “C” amplifiers. The input power from the driver is matched with a wideband transformer, T11 and T13. The driver inputs are then split into two signals with T12 and T14 and fed into four push-pull transformers T7-T8. Each of these four transformers drives the bases of two power transistors. The transistors are operated common source with feedback.

The collector signals are coupled by a push-pull hybrid combiner T15, T18, T20, T23. The outputs of these combiners are once again added together two two-way hybrid combiners. There are no adjustments on the PA 1000/S.

Typical Specifications (PA1000)

Gain	18 dB
Input power	15 watts (typical)
Output power	1100 watts (min)
Input impedance	50 ohms
Output load impedance	50 ohms
Collector voltage *	42 VDC
Current draw *	46 ADC

* At 1000 watt system output into 50 ohm resistive load

E. Directional Coupler (schem dwg# FA0105RC)

The directional coupler has two detectors that monitor forward and reflected power. The directional coupler produces voltages, which are proportional to the square of both forward and reflected power. The signals from the two detectors are produced from inductive (current) and capacitive (voltage) taps off the output line. The forward power and reflected power signals are fed into the OCB where they are linearized. They are then used to drive the front panel meters and for remote output monitoring. The reflected power signal is only present when the generator is driving a load that is not purely resistive, or not 50 ohms. This signal is also used to drive the VSWR shutdown circuitry.

F. CPS Meter Board (schem dwg # FA0603RE)

The CPS meter board is the major connection and routing point in the CPS generators. It is also the location for the +/- 15vdc and +12vdc power supplies, interlock transformer, over voltage (OV) and over current (OC) foldback circuits, enable circuit and over temp circuit.

VIII. Adjustments and Calibration

The only adjustments required on the CPS-1001/S are made to the monitoring and transistor protection circuitry. All of these adjustments have been performed at the factory and generally will never have to be readjusted.

CAUTION: Unauthorized resetting of any adjustments will **void the warranty**.

A. Over Voltage / Over Current Adjustment

The OV OC potentiometer adjustments are located on the CPS meter board (R22 and R21). These adjustments should be altered only when the generator is operating into a 50 ohm real load. The procedure for adjustment is as follows:

1. Install 50 ohm coaxial cable from the output of the generator to the input of a RF wattmeter, and from the meter to a 50 ohm coaxial load. The generator is normally supplied with Type N coaxial connectors. RG-8/u cable is sufficient to carry the output power from generator to load. Load and RF wattmeter should have at least 1500W dissipation rating.
2. Pin 11 of rear panel connector J1 must be grounded to enable the main power contactor (Pin 12 is ground). Pin 4 of rear panel connector J1 must be connected to Pin 9 (RF enable).
3. With the front panel circuit breaker in the "OFF" position, attach primary supply line to appropriate supply mains.

NOTE: Units are shipped wired for 208V, 3 phase, 50/60 Hz, unless specified by customer.

4. Place local/remote switch in "LOCAL" position.
5. Rotate power control knob fully counter-clockwise.
6. Check that cooling water is on.
7. Turn on front panel main power breaker.
8. Turn power control knob clockwise until full power is indicated on front panel power meter. Reflected power will not indicate.
9. Turn R21 and R22 adjustments to their maximum counter-clockwise limit. Maximum power should now be at least 1400W.
10. Start turning OC R21 adjustment clockwise until output power drops; then back off adjustment $\frac{1}{4}$ of a turn.
11. Turn the OV R22 adjustment clockwise until output power drops to 1350W.

B. VSWR Adjustment

The VSWR set is located in the oscillator control board (OCB) and is adjusted by R1 (10 K pot). Under high VSWR conditions Q6 is biased on and pulls the control voltage low. When this circuitry is activated, the unit will limit output power until the high VSWR condition is eliminated. The oscillator module is set to go into protected operation when there is 200W reflected. The procedure for adjustment is as follows:

1. Install 50 ohm coaxial cable from the output of the generator to the input of a RF wattmeter. Leave the other end of the wattmeter open circuited.
2. Pin 11 of rear panel connector J1 must be grounded to enable the main power contactor (Pin 12 is ground). Pin 4 of rear panel connector J1 must be connected to Pin 9 (RF enable).
3. With the front panel circuit breaker in the "OFF" position, attach the primary supply line to the appropriate supply mains.

NOTE: Units are shipped wired for 208V, 3 phase, 50/60 Hz unless specified by customer.

4. Place local/remote switch in "LOCAL" position.

5. Rotate power control knob fully counter-clockwise.
6. Check that cooling water is on.
7. Turn on front panel main power breaker.
8. Turn power control knob clockwise until 200 W is indicated on the RF wattmeter.
9. Turn adjustment until the reflected power indication on the wattmeter just starts to drop.
10. Slowly turn power control knob clockwise if the reflected power indicated on the wattmeter starts to rise, then go to step 9. Repeat this loop until the power control has reached its maximum setting.

C. Output Power and Forward Power Monitor Calibration

The CPS-1001/S has a DC voltage output proportional to forward power. This voltage is factory adjusted for 5 VDC on J1 Pin 3 when the generator is running at 1000W forward into a 50 ohm load. (The forward power calibration can be optionally set at other levels.)

1. Install 50 ohm coaxial cable from the output of the generator to the input of a RF wattmeter and from the meter to a 50 ohm coaxial load. The generator is normally supplied with Type N coaxial connectors. RG8/u cable is sufficient to carry the output power from generator to load. Load and RF wattmeter should have at least a 1500W dissipation rating.
2. Pin 11 of rear panel connector J1 must be grounded to enable the main power contactor (Pin 12 is ground). Pin 4 of rear panel connector J1 must be connected to Pin 9 (RF enable).
3. With front panel circuit breaker in the "OFF" position, attach primary supply line to appropriate supply mains.

NOTE: Units are shipped wired for 208V, 3 phase, 50/60 Hz unless specified by customer.

4. Place local/remote switch in "LOCAL" position.
5. Rotate power control knob fully counter-clockwise.
6. Check that cooling water is on.
7. Turn on front panel main power breaker.
8. Turn power control knob clockwise until there is 10.00 VDC on the SETPT (set point) test point in the oscillator control module (OCB).
9. Adjust the FWD OUT pot (R34) until there is 5 VDC at the R40 FO test point.
10. Set the CAL pot (R44) until there is 1000W displayed on the RF wattmeter.
11. Turn power control knob until there is 1.00 VDC on the SETPT (set point) test point.
12. Adjust the CAL ZERO pot (R56) until there is 100W displayed on the RF wattmeter.
13. Go to step 8. Repeat this loop until the generator outputs the correct power at the 1.00 and 10.00 VDC setpoints.

14. Set R2 on the meter board so that at the 10.00 VDC setpoint the FORWARD POWER meter reads 1000W.

D. Reflected Monitor Calibration

The CPS-1001/S has a DC voltage output proportional to reflected power. This is set by the following procedure:

1. Install 50 ohm coaxial cable from the output of the generator to the input of a RF wattmeter. Leave the other end of the wattmeter open circuited.
2. Pin 11 of rear panel connector J1 must be grounded to enable the main power contactor (Pin 12 is ground). Pin 4 of rear panel connector J1 must be connected to Pin 9 (RF enable).
3. With the front panel circuit breaker in the "OFF" position, attach primary supply line to appropriate supply mains. NOTE: Units are shipped wired for 208V, 3 phase, 50/60 Hz unless specified by customer.
4. Place local/remote switch in "LOCAL" position.
5. Rotate power control knob fully counter-clockwise.
6. Check that cooling water is on.
7. Turn on front panel main power breaker.
8. Turn power control knob clockwise until 200 W is indicated on the RF wattmeter.
9. Adjust RFL OUT pot (R32) until the voltage at R28 RO is equal to the voltage at R40 FO.
10. Adjust R1 on the meter board until the REFLECTED POWER meter equals the setting on the forward meter.

