C-Band Klystron Transmitter VPC3534

CPI Electron Device Business - Klystron Transmitter

The CPI EDB 250 kW, C-band, klystron transmitter components for weather radar are available for constructing a complete microwave transmitter. This microwave transmitter uses a CPI EDB klystron amplifier (VKC8387) as the final RF output device. CPI EDB is able to furnish a compact, user-friendly, cost-effective microwave power source with excellent pulsed Doppler capability.

The typical assemblies that CPI EDB provides to weather radar integrators are: high voltage power supply, Solenoid power supply, Solenoid for the klystron, 250 kW C-band klystron, solid state switch and the high voltage oil tank assembly which includes the pulse transformer, energy storage high voltage capacitor, filament power supply. The weather radar integrators will install these components into their transmitter / receiver cabinet and supply the receiver, system controller, RF synthesizer and pre-amplifier and cooling.

The CPI EDB subsystem components are a high voltage power supply that provides 5 kW of energy at 2 kV DC to the solid state switch assembly. The solid state switch assembly must be located close to the high voltage oil tank assembly so that there is minimal inductance in the buss-line that is carrying the current to the step-up transformer. In addition to the step-up transformer in the high voltage oil tank assembly there is the energy storage capacitor and the filament supply.

FEATURES:

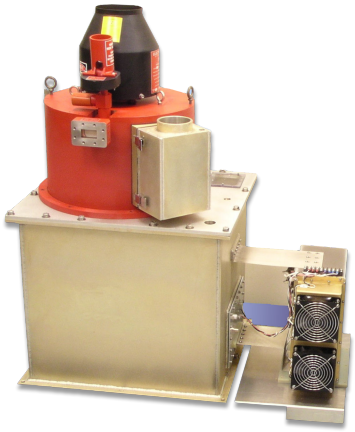
- 250 kW peak power RF output
- Modular design for ease of customization
- Air cooled

BENEFITS:

- CPI EDB Klystrons and modulators ensure compatible performance
- Easy to use and user friendly
- Built in diagnostics and BIT for local or remote troubleshooting.

APPLICATIONS:

- Weather radars
- Instrumentation radars



The high voltage power supply is a 19 inch rack mount unit, 8 inches high by 21.5 inches deep. It is completely self-protected with over current and input under/over voltage circuits.

The high voltage power supply converts input AC into DC then switches it at a 50 kHz rate utilizing a short-circuit proof series resonant inverter. Auxiliary power supplies needed to operate the klystron are contained in this unit, including a filament power source, ion pump source, and low voltage bias supplies. All external interface and control is done in this supply. Cooling is accomplished by internal fans.

The solenoid power supply is contained in a separate 19 inch rack power supply that is 5.25 inches high by 21.5 inches deep. It has a similar approach as the high voltage power supply, AC is converted to DC then a high frequency inverter converts the power to the direct current that the solenoid requires. The solenoid power supply is current controlled as the voltage to the coil will change as the temperature of the solenoid coil changes.

Beam switching is done by a completely solid-state array of IGBT switch boards that is driven by the control interface board in the high voltage power supply. This switch inherently limits current and pulse by design; no external circuitry is required for these functions. The IGBT switch is also a current controlled switch, set by a bias voltage from the high voltage power supply control interface board. The voltage across the switch will change automatically as the voltage across klystron changes due to frequency and temperature changes. This switch is also will inherently limit arc current in the event of a klystron HV arc. The limit is less than twice the normal operating current in the event of a complete short circuit. The size of this switch assembly is 12 inches high by 10 inches deep by 6 inches wide and has integral fans to cool the switches.

All high voltage is contained in an oil tank which is 18 inches high by 23 inches wide and 20 deep. The pulse transformer that steps up the 2 kV high voltage power supply output to the 50 kV that the klystron requires, storage capacitor bank to supply the energy during the pulse, and the klystron filament DC filter are all contained in this oil tank. The Solenoid and the klystron are mounted on the top of the oil tank with the bushing of the klystron going through the top of the oil tank and is immersed in the oil. External fans are required to cool the klystron and the solenoid. The fans should be interlocked as the klystron and Solenoid can be damaged if sufficient cooling is not supplied.

Instrumentation and control

The system controller must provide 4 signals to the high voltage power supply to operate the klystron transmitter. They are a +15 V power-on signal that closes the main power contactor, +15 V that commands high voltage to be supplied to the IGBT switch, a +15 V gate that determines the duration that the IGBT switch is on (which determines the duration of the klystron beam pulse) and a contact closure-to-ground for a latched fault reset. These are all the signals necessary to operate the klystron transmitter.

BITE, status information and operating parameters are also available to the Radar operator for remote monitoring of the equipment. Locally at the front panel of the high voltage power supply, filament voltage adjustment, peak beam current adjustment and beam current test point are available.

The table at the end of this specification gives the specific detailed information for the Instrumentation and control.

Cabinetry

Each block is designed to fit into standard cabinets, the high voltage tank and IGBT switch must be located next to each other due to the necessity of minimizing inductance between the two assemblies.

The high voltage power supply and Solenoid power supply can be located remotely from the switch and high voltage tank although for EMI reasons it makes sense to co-locate them in the same basic enclosure. The high power nature of these assemblies along with the high voltages and currents require care to be used to minimize radiated and conducted energy.

The cabinet must be able to exchange cooling air to remove 4 kW of power and keep the internal temperature under 40° C. The air should be filtered so debris will not be delivered to the switch or clog up the air filters on the individual assemblies.

CPI EDB can provide either subassemblies for OEMs to mount into their tranceiver cabinet or CPI can provide a completed transmitter in the cabinet if desired.

SPECIFICATION	DESCRIPTION	COMMENTS
Modulator Type	Solid state, cathode pulsed	IGBT switch modulator, current controlled
Dimensions	Standard rack mount compatible	Multiple boxes, outline of each box available
Input voltage	208vac 3phase, 50/60hz, +/-5%	0.85 power factor minimum
RF Output power	250 kW peak	This is adjustable via beam drive knob on high voltage power supply front panel
Frequency	5.6-5.65 GHz	Fixed bandwidth
Gain	60dB	Nominal
Coherency	55dB	Dependent on coherency of RF drive, equal to an RMS phase error of approximately 0.1°rms
Power Output stability	<+/- 0.5 dB (pulse-pulse)	Over all PRF and Pulse Width
	<+/- 0.1 dB (pulse-pulse)	At a fixed PRF and Pulse Width
Pulse widths	In response to input gate - Adjustable from 0.5 to 5.0us	The PW is continuously variable based on input gate.
PRF	Minimum: 250 Hz	
	Maximum: 2126 Hz	
Duty cycle	0.0022	RF duty, (Beam duty 0.0033)

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Fault Protection

Monitor and shut off triggers for:

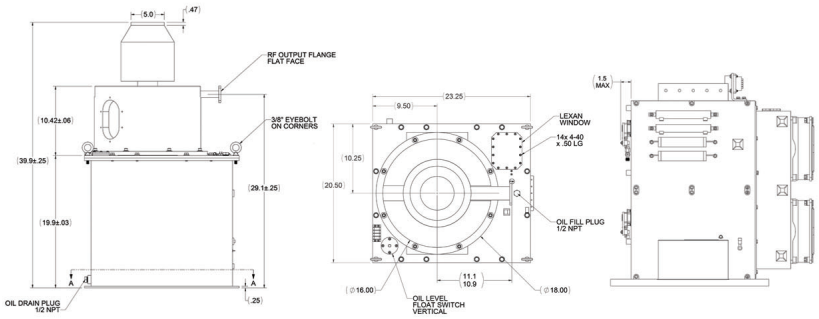
- Peak and average cathode current
- Filament power supply regulation and current
- Excessive duty cycle from gate signal
- Solenoid current fault
- Ion power supply current
- High voltage under voltage and over current
- Low voltage power supply under voltage
- High voltage power supply and Modulator
- Tank oil level window

Front Panel Monitoring

- Peak current adjust - knob with locking dial
- Filament adjust - knob with locking dial
- Reset - momentary push button switch

With a history of producing high quality products, we can help you with your magnetron transmitter.

Contact us at ElectronDevices@cpi-edb.com or call us at +1 978-922-6000.



ETHERNET CONTROL SIGNALS	DESCRIPTION	COMMENTS
Transmit	Transmit + Transmit -	TTL differential signal - RS422
Receive	Receive + Receive -	TTL differential signal - RS422
Control Inputs	Power on Radiate Input Gate Reset	Power on: +15v, powers relay (local only) Radiate: +15v enables trig/HVPS +15V into 100±, variable width (local only) Reset: ground reset faults
Status Outputs	Power on-low Standby-low Radiate-low Ion power supply current fault-low Solenoid current fault-low Low voltage power supply fault-low High voltage power supply fault-low Fil power supply fault-low Klystron Over current-low Over duty-low	Normal operation – no faults, x 5 internal reset LVPS < 80% nominal HVPS < 80% nominal Out of regulation Avg. current > 100ma, peak current > 100a Duty over .001 Excess temperature Open interlock
Analog Outputs	Pulse peak current Pulse avg. current High voltage power supply V Mod avg. current Ion power supply current Solenoid power supply current Filament voltage Filament current	Pulse peak I, 0.1v/a BNC –HVPS (local only) 0-5V remote signals

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