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Vega RA-230

DC-Remote Station Adapter

Instruction Manual

Model RA-230 DC-Remote Station Adapter

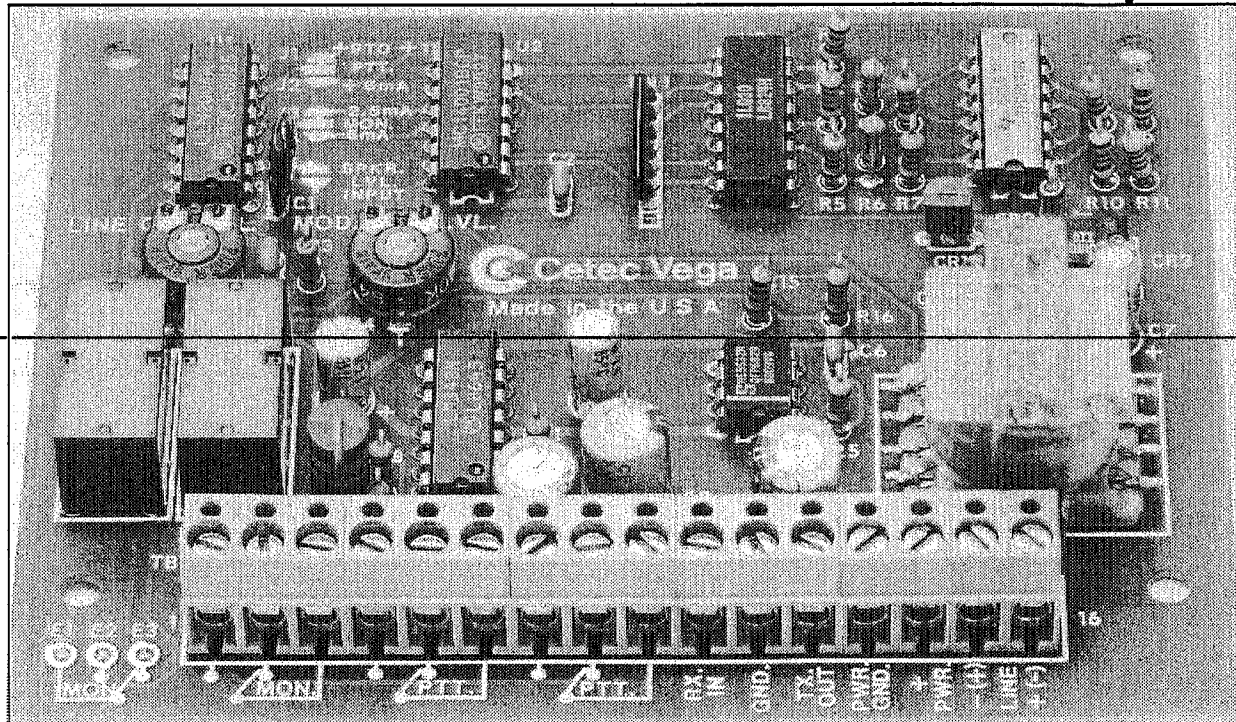


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General

The Vega Model RA-230 DC remote control adapter is a reliable means of remotely controlling a two-way radio base station. The adapter can be used in conjunction with the Vega Model C-530 DC console or most other DC consoles.

The RA-230 is a PC-board assembly which may be mounted in any convenient location at the base station. It provides PTT and monitor relay contact outputs by the precise sensing of amplitude and polarity of the DC currents generated by the distant DC control console. The DC control voltages are transformer and optocoupler isolated from all other circuits. Amplification and adjustment is provided for line transmit and line receive. Transient protection is provided at all inputs and outputs. The line connecting the RA-230 to the control console(s) may be from as little as a few feet to as much as 25 miles long. This line may be a 600-ohm twisted pair of wires or a leased telephone-company metallic line.

Typical Operation

The operator at a DC control console lifts the handset "off hook", causing a negative current to flow through the line to the RA-230. The RA-230 senses this current and closes the monitor relay, which disables the CTCSS circuit in the radio. The operator hears any radio traffic on the channel (this is an FCC requirement for shared-channel users). If the channel is clear, the console operator presses the PTT switch, which causes a reversal of the line current from a negative to a positive polarity. The RA-230 senses this current change and closes the PTT relay, which switches the radio from receive to transmit.

Installation

The RA-230 inputs are diode-protected from line transients up to certain limitations. Lightning-induced high voltages and currents have not been provided for. Vega will not provide repairs under warranty for damage obviously caused by high voltages.

If the DC line is a leased telephone-company metallic pair, lightning protection is usually provided. However, it may be some distance from the point of connection to the RA-230. Therefore, it is recommended that gas-discharge-tube lightning protectors such as a North Supply part # S-561034 or equal be installed near the line input terminals to the RA-230. Gas-discharge tubes such as a North Supply S-568015 or MOV devices such as a GE # V100ZA15 may be connected directly to the line input terminals; however, they offer a lesser degree of protection.

Programming and Connections

The RA-230 has been factory-programmed to respond to a positive 8 mA or higher PTT current, and a negative 2 mA or higher monitor current. Normally no change in programming is required. If other programming is desired, refer to the notes included on the schematic. Open solder bridges with an "Exacto knife" or equivalent tool, and close solder bridges with an appropriate wattage soldering iron.

Close J-5 if the RA-230 is to be driven from speaker-level audio output. Note that this level is controlled by the radio volume control.

Before connecting the DC line to the RA-230, connect a 1-k-ohm, 10-watt resistor directly across the line and have the console operator operate the PTT and monitor controls. The console operator should adjust the current and voltage controls until the resistor voltage is +10 to +15 V for PTT and -10 to -15 V for monitor.

Remove the 1-k-ohm resistor and connect the DC line to TB1-15 and 16. With a current meter in series with one side of the line, have the console operator adjust the PTT and monitor controls for the desired currents. Note: The current meter could be connected at the console end for adjustment if that is more convenient. Usually, the PTT current is adjusted for +9 to +15 mA and monitor current is adjusted for -2.5 to -6 mA. Observe that TB1-16 is a positive polarity for PTT currents.

Connect TB1-10 to the audio line from the radio and TB1-12 to the audio input to the radio. Connect TB1-11 to ground. If a mobile radio is used as a base station, connect TB1-10 to the speaker output (HI), connect the other side to ground, and close J-5. Connect TB1-12 to the radio mic input using shielded cable. If the mic input is low-level dynamic, install a 20-dB attenuator (680 ohms series, 75 ohms shunt) or replace R18 (39 k ohms) with a 6.8-k-ohm, 1/4-W, 5% resistor.

Connect +11 to +16 V_{dc} power to TB1-14 and power-supply common to TB1-13.

Connect PTT and monitor relay outputs to the radio to effect PTT and monitor operations. Refer to the schematic for the proper terminal-block connections.

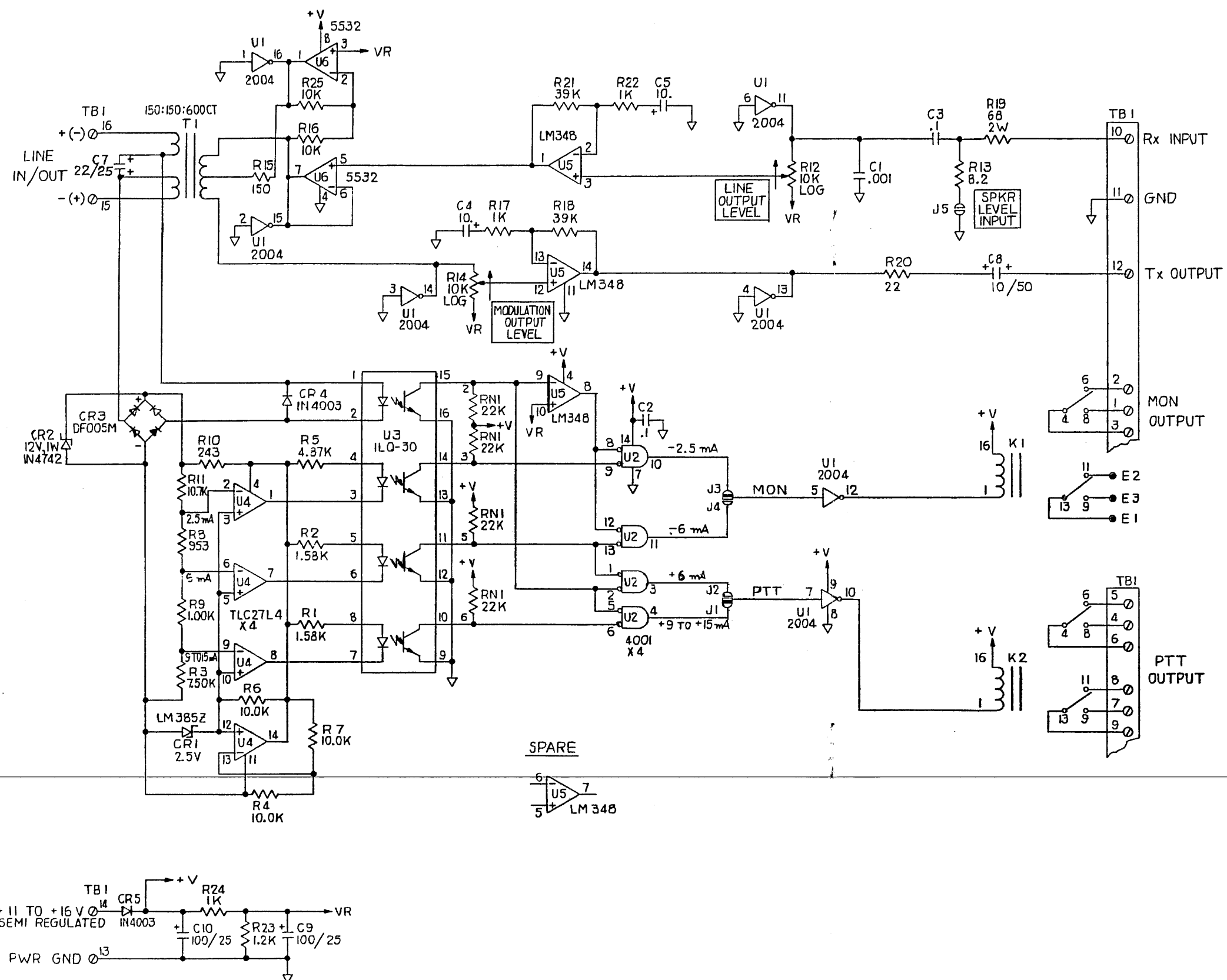
On some radios, it may be necessary to route the radio output signal through the extra set of PTT relay contacts to the RA-230 RX input.

Level Adjustments

Level adjustments are normally required only at the time of installation.

Unsquench the receiver so that noise is present continuously. Connect an AC volt meter (use the meter output terminals) to TB1-16 and 15. Adjust

REVISIONS			
REV	CHG. ON	DESCRIPTION	DATE APP
A	88-101	RELEASE FOR PRODUCTION	3-2-88 MR
B	88-271	DELETED C6	12-17-88 MR
C	93-113	CHANGE C7 TO 22/25	5/25/93 MR



- NOTES:
1. CLOSE J5 WHEN RX INPUT IS AT SPEAKER LEVEL.
 2. CLOSE J1, OPEN J2 FOR PTT FROM POSITIVE 8 mA OR HIGHER CURRENT.
OPEN J1, CLOSE J2 FOR PTT FROM POSITIVE 5 mA OR HIGHER CURRENT.
DO NOT CLOSE BOTH J1 AND J2.
 - CLOSE J3, OPEN J4 FOR MONITOR FROM NEGATIVE 2 mA OR HIGHER CURRENT.
OPEN J3, CLOSE J4 FOR MONITOR FROM NEGATIVE 5 mA OR HIGHER CURRENT.
DO NOT CLOSE BOTH J3 AND J4.
OPEN J3 AND J4 FOR PTT ONLY OPERATION.

ASSY. 011-0064
PCB. 065-0398

LAST USED	NOT USED	DRAWN	RAUSMAN 3-1-88	Cetec Vega	
C10	C6	CHECK		SCH. RA-230 DC REMOTE CONTROL ADAPTOR	
CR3		ENGR	J. B. and 3-2-88		
R25		APP	RA-230 01-0064		
K2		MODEL			
U6		NEXT ASSY		D 071-0510	
				SCALE	SHEET 1 OF 1

the line input level control (R12) for 0 dBm or 0.8 V_{rms} . If the line length is longer than 10 miles, and the line is not a leased telephone-company pair, adjust R12 for +10 dBm or 2.5 V_{rms} . Note that if a speaker output is used to drive the RA-230, the radio volume control will affect the line drive level.

With voice or 1-kHz tone present from the console, adjust the modulation output level control (R14) for proper deviation.

Theory of Operation

Referring to the schematic, a direct current from the DC control line flows through the split primary of transformer T1, through part of opto-coupler U3, through the diode bridge to the junction of R10 and R11. This junction will always develop a positive voltage in respect to the detector-circuit common, regardless of line polarity, this due to the diode bridge.

A small part of the line current flows through the voltage divider R11, R8, R9, and R3. Most, however, flows through R10. This current flow develops 5 volts at U4-4 from a very low current flow due to the CMOS opamp U-4. When line current rises above this small "house keeping" current, U4-12, 13, and 14 start to conduct and maintain 5 volts at U4-4 due to the precision 2.5-V zener CR1 and the voltage divider R7 and R4.

When line current rises to about 2 mA, the voltage at U4-2 is slightly above 2.5 V at U4-3, developed by zener CR1. U4-1 goes low, causing current flow through R5 and the LED in the quad optocoupler, U3. This causes U3-14 to go low, and the 2.5-mA detection has taken place.

As the line current rises above 2 mA, U4-14 conducts the excess current until the line current reaches about 4.5 mA, at which time U4-6 is slightly higher than the 2.5 volts at U4-5. This causes U4-7 to go low, sinking current through R2, R3, R5, and R6. This causes the 6-mA detector output at U3-11.

In the same manner as before, when line current reaches about 7.5 mA, U4-8 goes low, causing the 9-to-15-mA detection output at U3-10.

As line current rises above 7.5 mA, U4-14 sinks the excess current. Line current should not exceed 20 mA for proper operation. The optocoupler may be damaged by continuous line current above 50 mA.

Opto inputs U3-1 and 2 are outside the bridge and cause output at U3-15 with all positive line currents, and no output at all with negative line currents.

At positive line currents above about 7.5 mA, all four opto outputs are low.

U2 logic decodes the opto outputs into 2 mA or higher negative current, 5 mA or higher negative currents, 5 mA or higher positive currents, and 8 mA or higher positive currents. Solder bridges select one of two negative currents to operate relay K1 through relay driver U1, 5, and 12. Solder bridges also select one of two positive currents to operate the PTT relay K2 through relay driver U1-7 and 10.

Audio Circuits

Line-driver signals are induced into the secondary of T1. The level is adjusted by modulation output control R14, amplified by U5-12, 13, and 14, and applied to the TX output terminal TB1-12 through R20 and C8. U1-3 and 14 and U1-4 and 13 protect this circuit from externally applied transients, because U1 has internal protective diodes with relatively high current capability.

RX input applied to TB1-10 is applied to line output level control R12 through R19 and C3. If J5 is closed, this signal is attenuated by about 20 dB. Signal level is adjusted by R12, amplified by U5-3, 2, and 1, and applied to U6. U6 is in a bridge configuration driving the center tap of T1 at 0 degrees phase angle through R15 and the top end of T1 at 180 degrees phase angle. This allows double the maximum signal current to flow through the transformer winding as would occur with a single-ended line driver. A maximum line output of at least +12 dBm without distortion is therefore achieved.

Technical Assistance

Vega products are engineered to meet your requirements of performance, reliability, and compatibility. Technical assistance is offered by correspondence or telephone, should it be required, to assure your satisfaction.

Warranty

Vega signaling products are guaranteed to be free from defects in material and workmanship for a period of three years from the date of shipment. Warranty is for factory repair or replacement only.

Model RA-230 Parts List

Part No.	Description	Ckt Sym
011-0064	TOP ASSY RA-230	
012-0029	KIT HRDWR 230/231 MTG	
065-0398	PCB RA-230	
105-1001	CAP MYLAR .001MF 10% 100V	C1
110-1340	CAP CER .1MF SMALL	C2
		C3
112-1606	CAP ELEC 10MF 25V	C4
		C5
112-1609	CAP ELEC 100MF 20% 25V	C9
		C10
112-1717	CAP ELEC 22UF 25V VP	C7
112-1696	CAP ELEC 10UF 50V NP	C8
130-0724	RES VAR 10K LOG V-ADJ	R12
		R14
131-1853	RES WW 68 5% 2W	R19
134-0212	RES RN55D 10.0K 1% 1/4W	R4
		R6
		R7
		R16
		R25
134-2850	RES RN55D 4.87K 1% 1/4W	R5
134-2867	RES RN55D 7.50K 1% 1/4W	R3
134-2903	RES RN55D 1.00K 1% 1/4W	R9
		R17
		R22
		R24
134-2940	RES RN55D 10.7K 1% 1/4W	R11
134-2946	RES RN55D 953. 1% 1/4W	R8
134-3049	RES RN55D 1.58K 1% 1/4W	R1
		R2
134-3051	RES RN55D 243. 1% 1/4W	R10
136-0003	RES COMP 8.2 5% 1/4W	R13
136-0012	RES COMP 22 5% 1/4W	R20
136-0022	RES COMP 150 5% 1/4W	R15
136-0033	RES COMP 1.2K 5% 1/4W	R23
136-0051	RES COMP 39K 5% 1/4W	R18
		R21
138-0032	RNET CMN 5X22K SIP	RN1
161-0366	DIODE 1N4003	CR4
		CR5
161-0602	DIODE REF LM385Z-2.5	CR1
161-0603	DIODE ZEN 1N4742 12V 1W	CR2
163-0001	DIODE BRDG FULL WAVE 1A	CR3
180-0329	RELAY PCB 12V DPDT MDX12	K1
		K2
286-1862	TERM STRIP 16 PIN MINI	TB1
318-0256	XFORMER 600SPLIT-600	T1
425-0157	IC CMOS 4001 QUAD 2NOR	U2
425-0202	IC OPAMP 5532 DUAL RL600	U6
425-0210	IC OPAMP LM348 QUAD	U5
425-0215	INT CKT ULN2004A	U1
425-0420	OPTO CPLR QUAD ILQ-30	U3
425-0464	IC OPAMP TLC27L4C	U4

Model RA-230 Specifications

Operating Temperature Range: -20 to +55°C

Power Requirements: +11 to +16 V_{dc}, 16 mA idle, 65 mA maximum (at +12 V_{dc})

Relay-Contact Ratings: 2 A, 24 V_{dc}, maximum

Line to TX Output Gain: 0 to 30 dB into 600 Ω, adjustable

TX Output Level: -30 to +6 dBm into 600 Ω, adjustable

TX Output Impedance: 27 to 55 Ω

RX Input Level: 100 mV_{rms} to 13 V_{rms} in two ranges, adjustable

Line Output Level: -30 to +14 dBm, adjustable

Line Input/Output Impedance: 600 Ω, nominal

Line Control Current

TX F1: Solder-jumper adjustable to accept +6 or +9 and +15 mA nominal currents (+5 mA and greater or +8 mA and greater)

RX F1: 0 mA (0 to 1.3 mA)

MON: -2.5 or -6 mA nominal currents, solder-jumper settable (-2 mA and greater or -5 mA and greater)

Dimensions: 0.9 in (2.3 cm) H X 3.5 in (8.9 cm) W X 4.5 in (11.4 cm) D