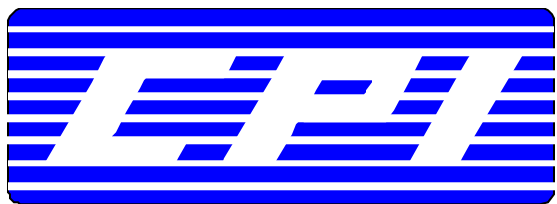

Instruction Manual

DR Series DC Remote Controls
1/2013



CPI Communications 941 Hensley Lane Wylie, Texas 75098
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SPECIFICATIONS Subject to change without notice.

Power Requirements	120 VAC, 60 Hz for wall pack (provided) operation 12 VDC to 16 VDC @ 600 mA maximum. Fused on circuit board.
Dimensions	9" x 4" x 7" inches
Weight	DR10 - 5 lbs, DR20 - 5 lbs, DR30 - 5 lbs, DR40 - 5 lbs.
Audio Output to Speaker	2 Watts at 3% THD into 8 ohms, using supplied wall pack or 12 VDC.
Handset Earpiece Level	Adjustable via internal potentiometer.
Frequency Response	+/- 3dB from 300 to 3000 Hz. 1000 Hz reference.
Hum and Noise	50 dB below operating levels
Compression	Less than 3 dB increase in output with 30 dB increase in input beyond threshold. Threshold is adjustable from -20 dBm to +10 dBm.
Line Impedance	600 ohms or 5000 ohms, dip switch selectable.
Line Output Level	Factory set at 0 dBm. Adjustable to +15 dBm maximum.
Control Currents	Dip switch selection of eight possible control current configurations composed of the following current levels: -15mA, -6mA, -2.5mA, +2.5mA, +6mA and +15mA.
Operating Modes	Standard: Two wire simplex. Two wire duplex. (Trunking mode, jumper selectable.) Optional: -4W Four wire simplex. Audio on one pair and control currents on the other. -FD Full duplex on four wires. TX audio and control currents on one pair, RX audio on the second pair.
Available Factory Options	-M Push button monitor. -2F F1 / F2 push button. Current format is dip switch selectable. -I Push button intercom between remotes.

Please note: Some options are standard on some models. Some options not available on all models or in combinations with other options. **No options are field installable.**

General Description

The DR series DC remotes are designed to provide remote control of a conventional or trunked two way radio base station or repeater via a leased wire line or in-house twisted pair.

The DR series is available in four different housing configurations. They are: the DR10 telephone style unit with handset, the DR20 desktop console with desk microphone, the DR30 desktop console with built in electret condenser microphone and the DR40 desktop console with goose neck microphone.

Standard features on all DR models include front panel PTT switch, line operated transmit indicator, off-hook monitor function(DR10), RX and TX audio compression, two watt amplified speaker with volume control, line continuity sensor and parallel cross mute capability.

The DR10, 20, 30 and 40 may be wall mounted by ordering the -WM option. When wall mounting the DR20 please note, no provisions are made for mounting the desk microphone.

Pre-Installation Considerations

The DR series DC remotes are designed with protection against both power and telephone line surges. This protection circuitry requires the use of a properly grounded AC outlet. If the remote is to be powered directly from DC the wall plug-in transformer is not used

Phone lines

The DR series is designed to work with a good quality leased metallic pair (phone line) or in house twisted pair wiring. The maximum dc loop resistance, including the termination panel, cannot be greater than 10,000 ohms.

Parallel operation

When several remote control units are connected in parallel the total system impedance will decrease to a point where operation is degraded.

To compensate for this effect, DR series remotes provide a dip-switch selectable 600 or 5000 ohm termination impedance.

In parallel remote installations using the same phone line, dip switch 7 should be in the OFF position (5000 ohms), in all remotes except the last one in the chain. For multi-point installations using more than one phone line the above procedure applies to each phone line.

Up to ten DR series DC remotes may be connected in parallel. The maximum loss between any remote and the termination panel must not exceed 20dB.

Installation

Connections

Phone line connections are made using the supplied modular line cord. Power consist of plugging the wall pack in to the nearest properly grounded AC outlet. If the remote is to be powered directly from a DC source, disconnect the wall plug-in transformer from TB1 and connect a well grounded 12 to 16 volt DC supply. The positive lead should connect to TB1 pin 1. The negative lead should connect to TB1 pin 2.

Control Current Settings - Table 1 shows the eight possible control current combinations available in the DR series remote. Switches 1, 2 and 3 of the dip switch are used to select the desired control current format. They are accessible on the underside of the remote.

Table 1

PTT (F1)	PTT (F2)	Mon (F1)	Mon (F2)	Switch 1	Switch 2	Switch 3
+15mA				OFF	OFF	OFF
+6mA				ON	OFF	OFF
+15mA		+6mA		OFF	ON	OFF
+15mA		-6mA		ON	ON	OFF
+6mA		+2.5mA		OFF	OFF	ON
+6mA		-2.5mA		ON	OFF	ON
+6mA	+15mA	-2.5mA	-2.5mA	OFF	ON	ON
+15mA	-15mA	+6mA	-6mA	ON	ON	ON

Field Selectable Configuration Settings

The DR series remotes are designed to be as user / technician friendly as possible and provide a wide range of field selectable options. These dip switch selectable and jumper selectable options give the DR series great flexibility in the field.

Table 2 illustrates the field configuration settings that are dip switch selectable.

Table 2

Switch #	ON	OFF
4	Phone line polarity is reversed.	Phone line polarity normal.
5	Speaker volume can be turned all the way down.	Speaker volume can not be turned all the way down.
6	Speaker active on-hook.	Speaker active all the time.
7	600 ohm termination.	5000 ohm termination.
8	DR10	DR20

Jumper Settings

The DR series DC remotes have 21 solder dot jumpers on the PCB. Jumpers are considered to be "in" when solder has been applied to form a short from one side to the other. Jumpers are considered to be "out" when no solder has been applied and the circuit is open from one side to the other. Remove the four housing screws and open housing to access jumpers.

The following describes field selectable jumper functions.

JU19 - Off-hook monitor function.

Generates monitor current when handset is off-hook.
IN = disabled, OUT = enabled.
Must be IN for DR20, DR30 and DR40.

JU20 - Parallel Transmit Indication (PTI).

Energizes PTT indicator when a parallel remote keys, locks out TX audio and disables control current generation from this remote.
IN = disabled, OUT = enabled.
See "Setup Adjustments" for adjustment procedure.

JU16 - Cross Mute.

Mutes speaker when a parallel remote keys.
IN = enabled, OUT = disabled.
Requires PTI enabled and adjusted.

JU14 - Trunking option for 2 wire system.

Allows trunking status tones to be heard in earpiece while remote is keyed.
IN = disabled, OUT = enabled.
Can not be used for DR20, DR30 or DR40 in 2 wire system.

JU17 & JU18 - High Loop Resistance.

Allows use of PTI on DC loops with 6K to 10K resistance.
IN = Loop resistance is 6K to 10K.
OUT = Loop resistance is less than 6K.
Ignore if PTI not enabled.

A description of all jumper functions appears on the schematic next to the jumper.

Line Continuity Sense

This feature will tell you, via the PTT LED, if your DC loop continuity has been lost.

If the unit is keyed and there is no DC loop continuity, the PTT LED will not illuminate. When the unit is unkeyed, the PTT LED will flash once.

There are no adjustments for this feature.

Setup Adjustments

The following adjustments assume that the termination panel has been properly installed.

Receive Line Input Adjustment

The receive line input, R92, adjusts the audio level to the input of the compression amplifier circuitry. This allows the threshold of compression be adjusted from -20 dBm to +10 dBm.

While applying an RF signal modulated with a 1000 Hz tone at 60% system deviation to base station receiver, adjust the termination panel line output control for 0 dBm to the phone line. Adjust each remote as follows:

- a. Connect a scope or analog AC volt meter to ground and pin 14 of U8.
- b. With R92 fully counter clockwise, adjust in a clockwise direction until the AC voltage level on scope or meter just stops increasing. This point is the threshold of compression.
- c. Remove the RF Signal from the base station.

Transmit Line Out Adjustment

This level is preset at the factory for 0 dBm out to the phone line and should not require readjustment at installation. If needed, the procedure is as follows:

1. With the handset off-hook (if applicable) depress the PTT switch and adjust the mod out pot (R63), while speaking in a normal voice, until 0 dBm is measured across the phone line at the termination panel.

Microphone Sensitivity

R64 controls the microphone audio level into the transmit compression circuit and therefore acts as a sensitivity control. This potentiometer has been factory set to provide adequate compression for normal voice audio with a relatively quiet background noise level.

PTI (Parallel Transmit Indication) Adjustment

If you do not need the PTT indicator to be line operated and you are not using the cross mute feature you may skip the following procedure.

Before making the following adjustments, please verify that: The chosen control current format matches the requirements of the termination panel being used at the radio base station or repeater site. See Table 1 for dip switch settings.

The remote must be connected to the termination panel via your in house wiring or leased wire line.

- 1) Remove the four housing screws that secure the top half of the housing. Set the unsecured top half of the housing to the right of the remote. Do not unplug the ribbon cable from the bottom unit.
- 2) With the remote powered up, depress and hold the PTT switch. The red PTI LED (DS5) on the base board, PCB in lower half of housing, should illuminate. If it is illuminated go to step 3. If it is not illuminated adjust R176 counter-clockwise until the PTI LED illuminates.
- 3) Release the PTT switch. The PTI LED (DS5) should no longer be illuminated. If it is still illuminated, proceed to step 4. If it is not illuminated, verify once more that the PTI LED comes on when the PTT switch is depressed and goes out when it is released. If this is true then proceed to step 6.
- 4) Since the PTI LED (DS5) is still on you must adjust R176 clockwise until it just goes out. If you reach the end of adjustment of R176, it clicks as you turn it, and the PTI LED (DS5) is still on, proceed to step 5. If PTI LED (DS5) goes out, verify once more that the PTI LED comes on when the PTT switch is depressed and goes out when it is released. If this is true then proceed to step 6.
- 5) Power down the remote. Install solder dot jumpers JU17 and JU18. Return to step 2.
- 6) Remove solder dot jumper JU20. Adjustment complete.

Circuit Analysis

Receive Audio Path

Receive audio from the phone line enters through transformer T3. The control for Receive line input, R92, adjusts the signal level passed to the compression amplifier formed by U8. The compression amplifier operates by sampling the output of U8-C through R107 and C57 and then rectifying it with D21 and D20. The rectified dc voltage, which varies as the receive audio level varies, controls the impedance of Q4. The varying impedance of Q4 controls the signal level input to U8-A. C40 and R77 control the compressor attack and decay time. U8-D and it's associated circuitry form a high pass audio filter which reduces 60 Hz components by as much as 40 dB.

The compressor output is passed on through the front panel volume control to speaker drivers U3 and U4. The compressor output is also fed through R94 to the earpiece amplifier circuitry.

Transmit Audio Path

Mic level audio is fed to preamp U7-A or U7-D, depending on which mic is used. Preamplified transmit audio

is routed through audio gate U10-A or U10-C, depending on which mic is used, to the mic level adjustment R64. R64 sets the signal level passed to the compression amplifier formed by U2. The compression amplifier operates by sampling the output of U2-A through R33 and C27 and then rectifying it with D5 and D6. The rectified dc voltage, which varies as the transmit audio level varies, controls the impedance of Q3. The varying impedance of Q3 controls the signal level input to U2-C. C30 and R35 control the compressor attack and decay time. U2-B and it's associated circuitry form a high pass audio filter which reduces 60 Hz components by as much as 40 dB.

The compressor output is gated through U6-C and fed to the phone line driver circuit of U5-A and U5-C. U5-A and U5-C form a push-pull amplifier to drive transformer T3.

Control Current Generation

Activation of the PTT, Monitor or Hook-Switch off-hook will cause U12 pin 10, labeled High Voltage Start, to go low. This pulls pin 4 of U1 to .77Vdc causing it to output a »15Vdc square wave at » 50kHz on pins 9 and 10. This output is pulse width modulated by U1 to provide the appropriate voltage at HIGH VOLTAGE+ and HIGH VOLTAGE-. U7-B is configured to limit high voltage output to 190Vdc. The voltage at HIGH VOLTAGE+ and HIGH VOLTAGE- is continuously adjusted by U1 to maintain a constant current level which is regulated by U7-C. The current level is determined by the control format chosen via dip switches 1, 2 and 3 (See table 1) and the control function, PTT or Monitor, selected at the time.

Parts List

DR Series main PCB #700-DRBB-200 Rev. B

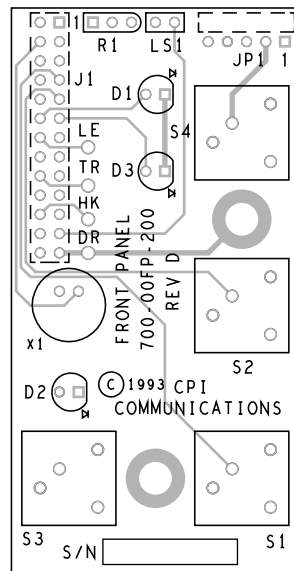
Reference	Description	CPI Part #
CAPACITORS		
C1,2,17,18,26,46,47,52,53,66,67,71,72	.01uF Mono Cer Dip	208-0092-103
C3	.0033uF Met Mylar	208-0211-332
C4	390pF Mono Cer Dip 200V	208-0071-391
C5,7,8,16,20,22,31,33,37,49,50,59,61,69	.1uF Mono Cer Dip	208-0092-104
C6	22uF Elec Rad	208-2022-226
C9,73	2.2uF Elec Rad	208-4052-225
C10,28,58,70	100uF Elec Rad	208-2021-107
C11,12,13,54,55,56	.033uF Met Mylar	208-0212-333
C14,36	470pF Mono Cer Dip	208-0071-471
C15,19	4.7uF Elec Rad	208-4042-475
C21,60	1000uF Elec Rad	208-2031-108
C23	.01uF Cer Disc 1KV	208-0023-103
C24	22uF Elec Rad	208-2000-002
C25	180pF Mono Cer Dip	208-0071-181
C27,30,40,57	1uF Elec Rad	208-4052-105
C29,38	.47uF Elec Rad	208-4052-474
C32,35,62,63	220uF Elec Rad	208-2021-227
C34	47pF Mono Cer Dip	208-0071-470
C39	220uF Elec Rad NP	208-2031-227
C43,44	4.7uF Elec Rad	208-2062-475
C64,65	20pF Cer Disc	208-0001-200
C68	10uF Elec Rad	208-4022-106
C74	.22uF Mono Cer Dip	208-0092-224
DIODES		
D1,7,8	1N4937 600V Fast Recovery Rect	212-0102-012
D2	1N5271B 100V Zener 5% 1/2W	212-0110-012
D5,6,20,21,28,29,30,31,32,37,38,39,40	1N4148 Small Signal Switching	212-0001-001
D9,18,22	1N4735A 6.2V Zener 5% 1W	212-0100-008
D10,11,12,13,14,15,16,17,23,24,25,26,33,34,35,36	1N4004 400V 1A Gen Purpose Rect	212-0002-004
D27	1N4746A 18V Zener 5% 1W	212-0100-019

Reference	Description	CPI Part #
TRANSISTORS		
Q2	Mosfet N-Chan	240-2210-003
Q3,4,9,10,14,15,19,21,24,25,27,28	2N2222 NPN	240-2222-000
Q5,8,16,17	MPSA42 NPN 300V	240-0042-000
Q6,7	MPSA92 PNP 300V	240-0092-000
Q11,12,13,22,23,26	2N2907 PNP	240-2907-000
Q18	MJE521 NPN	212-0001-002
RESISTORS		
R1,13,21,23,25,28,31,37,49,52,75,76,80, 82,116,126,145,148,149,159,164,165,179,181	10K 1/4W 5%	242-0001-103
R2	4.7M 1/4W 5%	242-0001-475
R3	10.0K 1/4W 1%	242-0014-100
R4,72	1.82K 1/4W 1%	242-0013-182
R5,32,105	6.8K 1/4W 5%	242-0001-682
R6	1ohm 1/2W 5%	242-0002-001
R7,29,33,34,42,51,78,107,122,128,130,171	1K 1/4W 5%	242-0001-102
R8	22 1/4W 5%	242-0001-220
R9,53	3.9K 1/4W 5%	242-0001-392
R10	5.1K 1/4W 5%	242-0001-512
R11,24	100 1/4W 5%	242-0001-101
R12,15,16,17,18,47,50,74,90,106,112,113, 114,115,118,119,123,124,158,172	100K 1/4W 5%	242-0001-104
R14,104,160	220K 1/4W 5%	242-0001-224
R19,173	22K 1/4W 5%	242-0001-223
R20,87,88,117,120,146,157,162,163,178	4.7K 1/4W 5%	242-0001-472
R22,67,170	1M 1/4W 5%	242-0001-105
R26,79,81,109,111,140	150K 1/4W 5%	242-0001-154
R27,44,54	27K 1/4W 5%	242-0001-273
R30,46,143,144,145	470 1/4W 5%	242-0001-471
R35,77	1.8M 1/4W 5%	242-0001-185
R36,103	1.2K 1/4W 5%	242-0001-122
R38,39,40,96,97,161	2.7 1/4W 5%	242-0001-027
R41,43,65,93	18K 1/4W 5%	242-0001-183
R55	560K 1/4W 5%	242-0001-564
R56	390K 1/4W 5%	242-0001-394
R59,60	47 1/4W 5%	242-0001-470
R66,85,108,110,142	68K 1/4W 5%	242-0001-683
R68,70,100,101,134,137 106	10.0M 1/4W 1%	242-0016-
R69,71	68.1K 1/4W 1%	242-0014-681
R73	6.81K 1/4W 1%	242-0013-681
R89,121	180 1/4W 5%	242-0001-181
R95	620 1/4W 5%	242-0001-621
R98,102	100.0K 1/4W 1%	242-0015-100
R99	1K 1/4W 1%	242-0013-100
R125,135,138	1.0M 1/4W 1%	242-0016-100
R127,129	10 1/4W 5%	242-0001-100
R131	52.3K 1/4W 1%	242-0014-523
R132	220.0 1/4W 1%	242-0012-220
R133,151	47K 1/4W 5%	242-0001-473
R136,139	182.0K 1/4W 1%	242-0015-182
R141	270K 1/4W 5%	242-0001-274
R147	220 1/4W 5%	242-0001-221
R150,152,155,156,177	390 1/4W 5%	242-0001-391

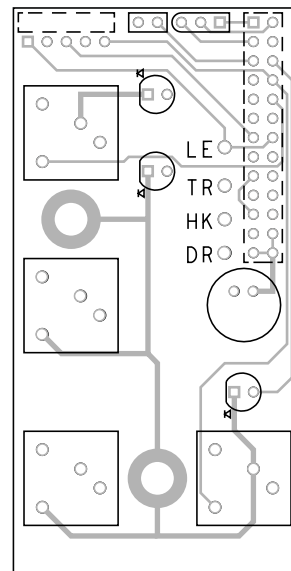
Reference	Description	CPI Part #
R154	39K 1/4W 5%	242-0001-393
R166	470K 1/4W 1%	242-0015-470
R167	3.60K 1/4W 1%	242-0013-360
R168	30.0K 1/4W 1%	242-0014-300
R169	8.20K 1/4W 1%	242-0013-820
R174	120K 1/4W 5%	242-0001-124
R175	1.5K 1/4W 5%	242-0001-152
R180	4.12K 1/4W 1%	242-0013-412
RN1	Resistor Network 100K x 9	242-0117-104
POTENTIOMETERS		
R63	250K Single turn Vert Adj	242-0101-254
R64	5K Single turn Vert Adj	242-0101-502
R83,92,94	25K Single turn Vert Adj	242-0101-253
R91	1K Single turn Vert Adj	242-0101-102
R176	1K Multi-turn Vert Adj	242-0104-102
INTEGRATED CIRCUITS		
U1	PWM Control	420-0494-000
U2,5,7,8	Quad Bi-FET Op Amp	420-L347-000
U3,4	Audio Power Amp	420-0380-000
U6,10	Quad Bilateral Switch	412-4066-000
U9	Opto-Isolator	419-0035-000
U11	Quad Low Power Op Amp	420-0324-000
U12	Micro-Controller	425-1655-000
U15	Under Voltage Sensor	425-7757-000
MISC.		
DS1	LED T1 Yellow Diffused	214-0002-003
DS2, DS5	LED T1 Red Diffused	214-0002-001
DS3	LED T1 Orange Diffused	214-0002-002
DS4	LED T1 Green Diffused	214-0002-004
J2 (DR10)	Handset Jack	228-0041-010
J2 (DR20)	Desk Mic Jack	228-0041-186
J3	Mod Jack Bottom Entry	228-0041-026
J4	Header Shrouded 26 Position	228-0101-001
L2, L3	150uH Choke	232-0000-150
V1, V4	MOV Z5L241 200V	242-0119-241
S1 (DR10)	Hook Switch	244-0100-009
S2	8 Position Dip Switch	244-0002-008
T1	Transformer Flyback 16978	246-0001-008
T2,T3	Transformer Audio 600:600	246-0100-003
Y1	Crystal 4Mhz	258-0002-002
Desk Microphone	CPI Desk Mic Mod Ash	234-0003-004
Handset	CPI Handset K-Style Mod Ash	234-0005-013
Coil Cord	CPI Modular Coil Cord 6ft. Ash	600-0013-007
-4W Option		
C45, 48	.01 Mono Cer Dip	208-0092-103
L1, 2	150uH Choke	232-0000-150
V2, 3	MOV Z5L241 200V	242-0119-241
R58, 61	47 1/4W 5%	242-0001-470
-FD Option (This option consists of the following parts plus the -4W Option)		
C41, 42	4.7uF Elec Rad	208-2062-475

Reference	Description	CPI Part #
C51	.1uF Mono Cer Dip	208-0092-104
D3, 4	1N4735A 6.2V Zener 1W	212-0100-008
D19	1N4148 Small Signal Switching	212-0001-001
Q9	2N2222 NPN	240-2222-000
R45	220K 1/4W 5%	242-0001-224
R48, 86	100K 1/4W 5%	242-0001-104
R57	470 1/4W 5%	242-0001-471
R62	10K 1/4W 5%	242-0001-103
R84	27K 1/4W 5%	242-0001-273
T2	Transformer Audio 600/600	246-0100-003
DR series Top PCB #700-00FP-200 revision C		
D1,D3	LED T1 Green Diffused	214-0002-004
D2	LED T1 Red Diffused	214-0002-001
R1	10K Volume Pot	242-0115-103
LS1	8 Ohm Oval	234-0001-004
S1,S2,S4	Push Button Switch, Black	244-0030-000
S3	Push Button Switch, Red	244-0030-002
X1 (DR10 & DR30)	Electret Microphone	234-0002-004
X1 (DR40)	Gooseneck Microphone	234-0003-003
	26 position cable assembly	600-OTSR-025

PCB Views for Contro Pne P/N 700-00FP-200 rev. D

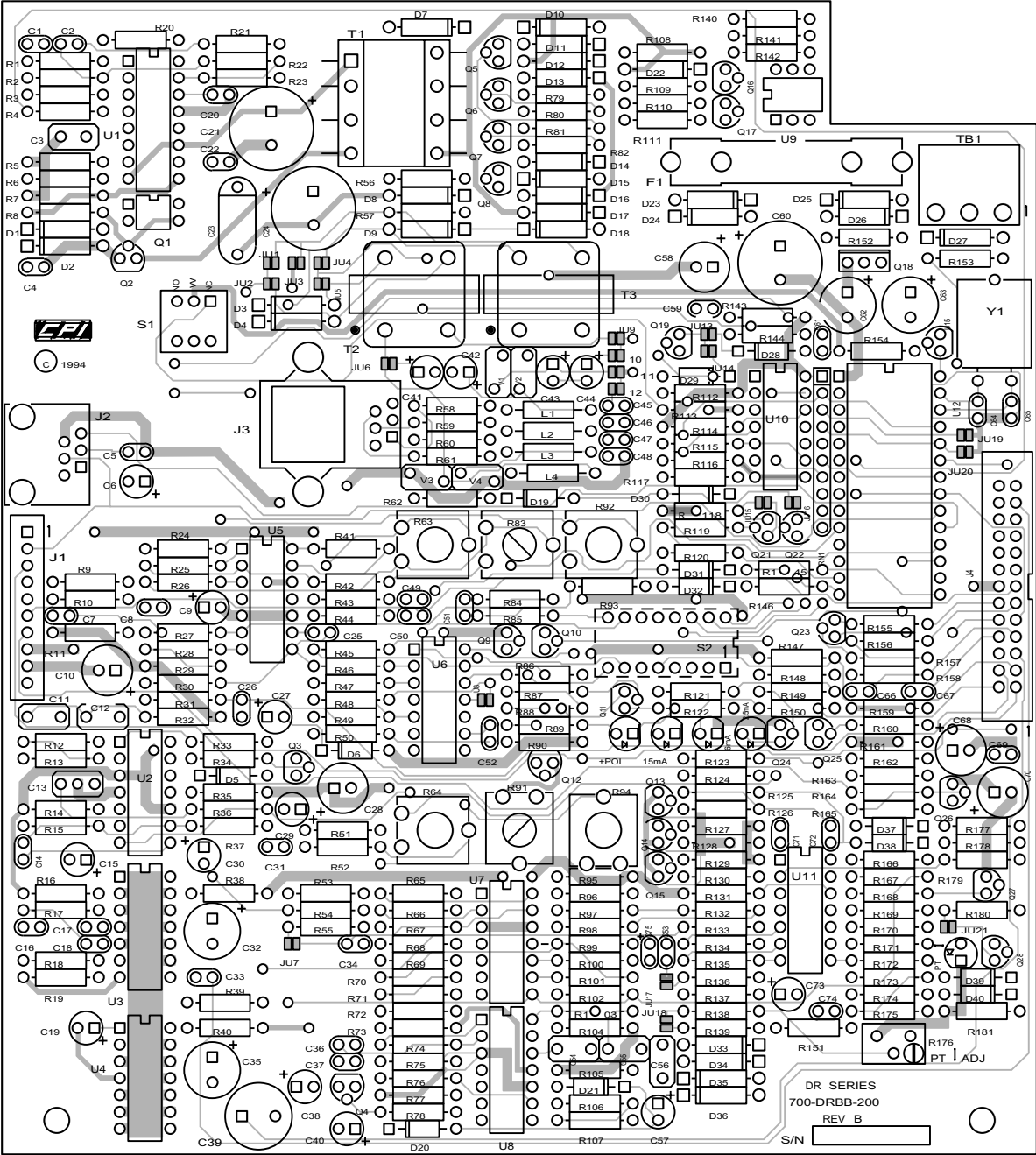


Component Side



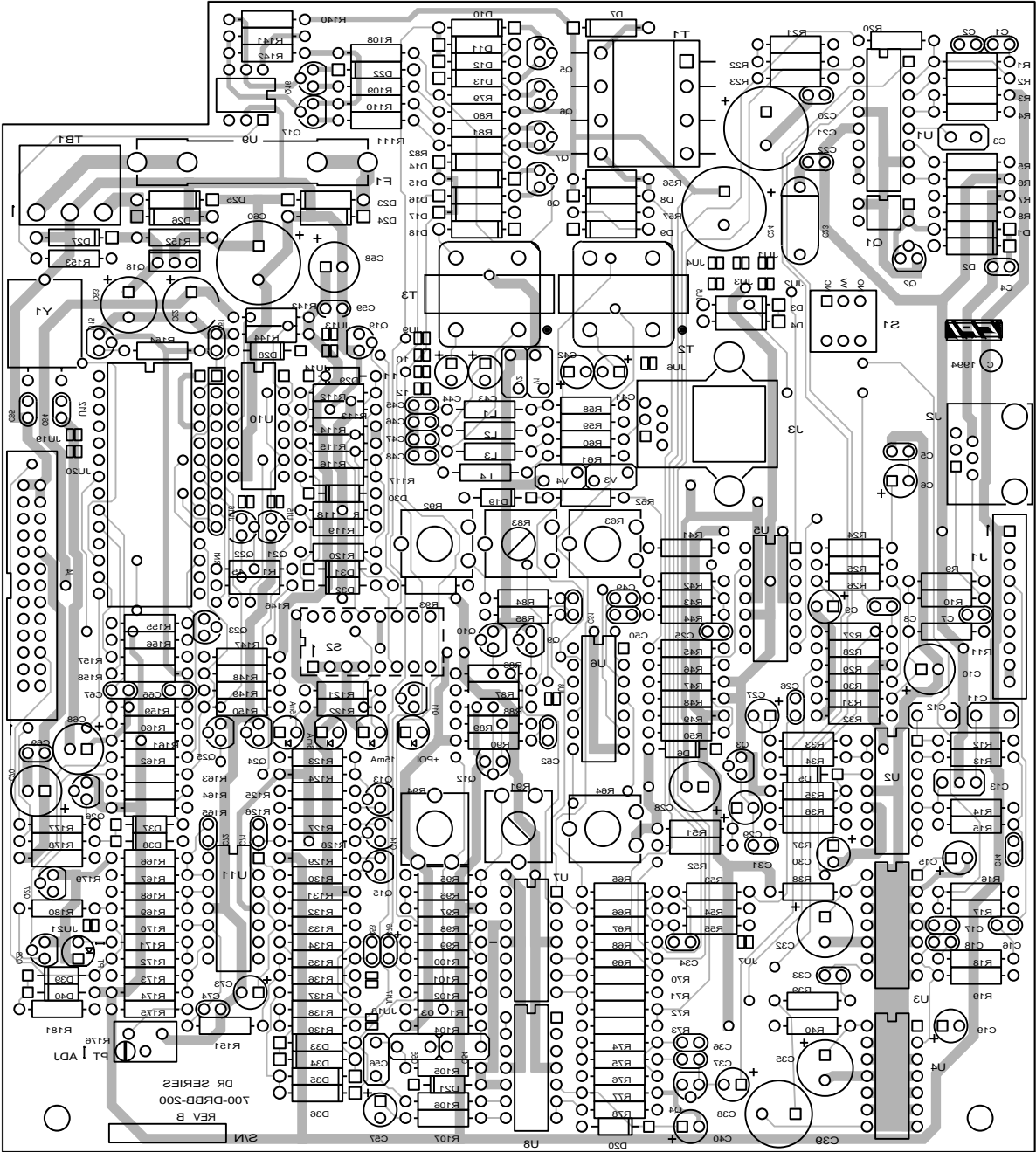
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PCB Views for P/N 700-DRBB-200, Rev. B

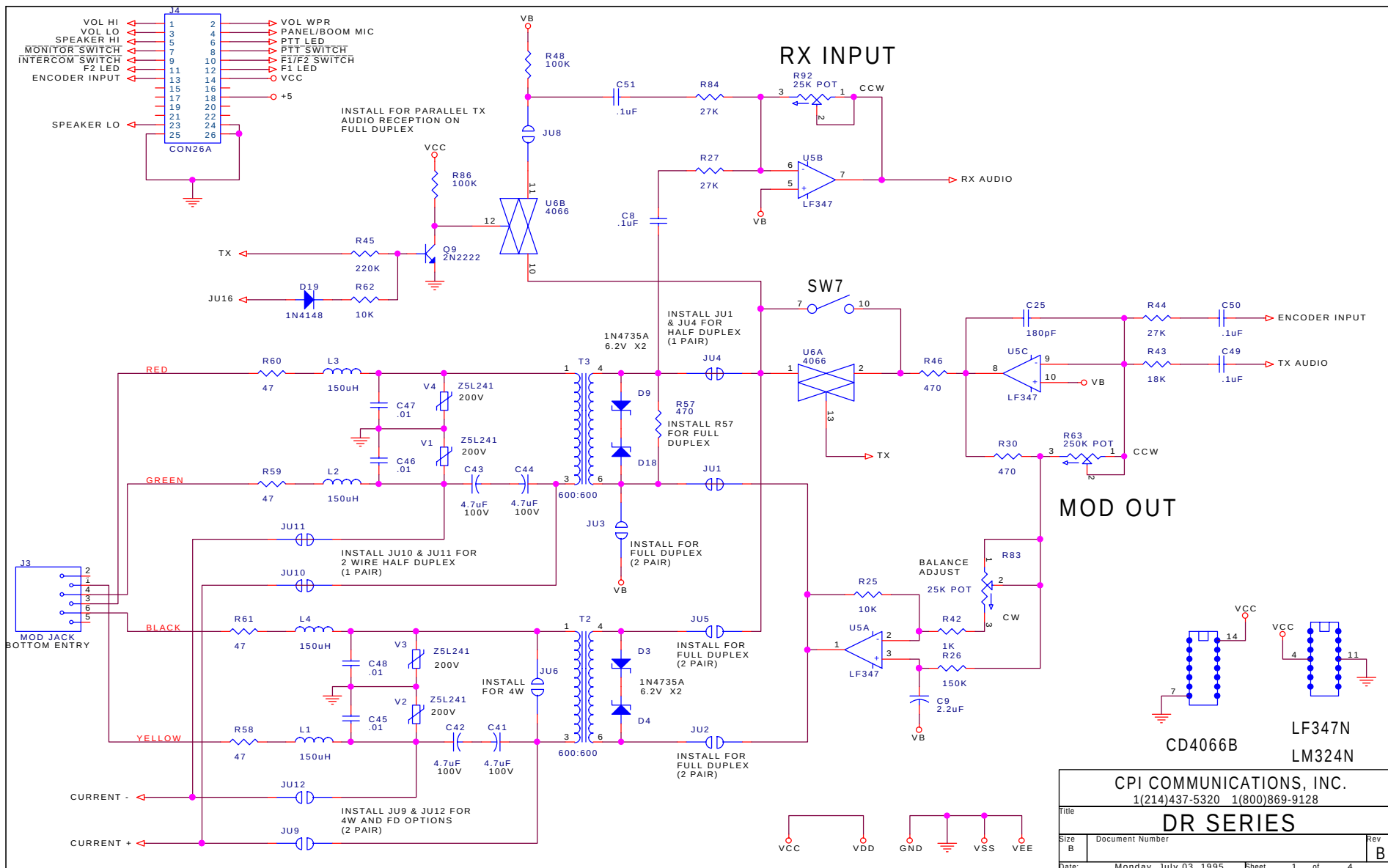


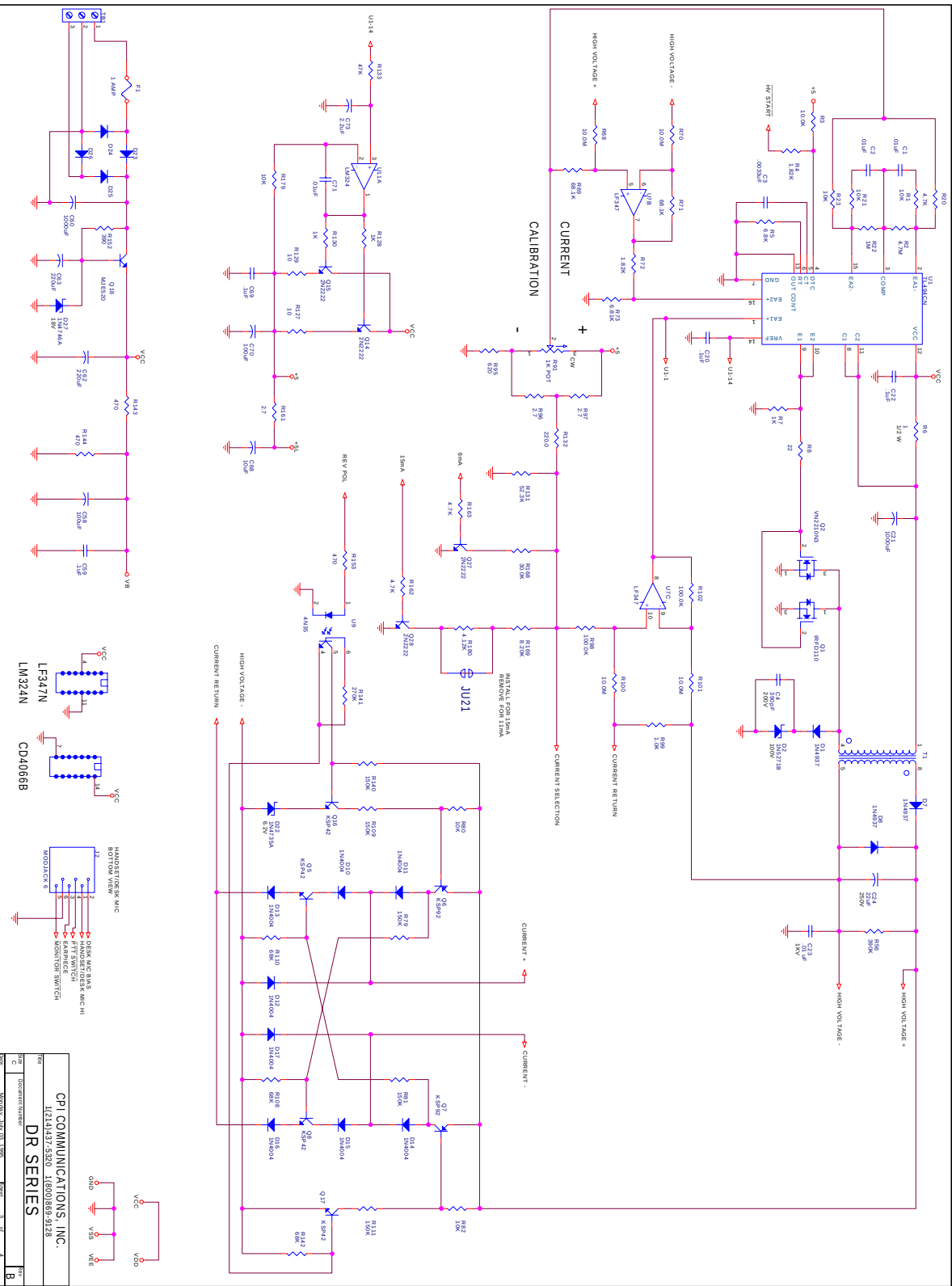
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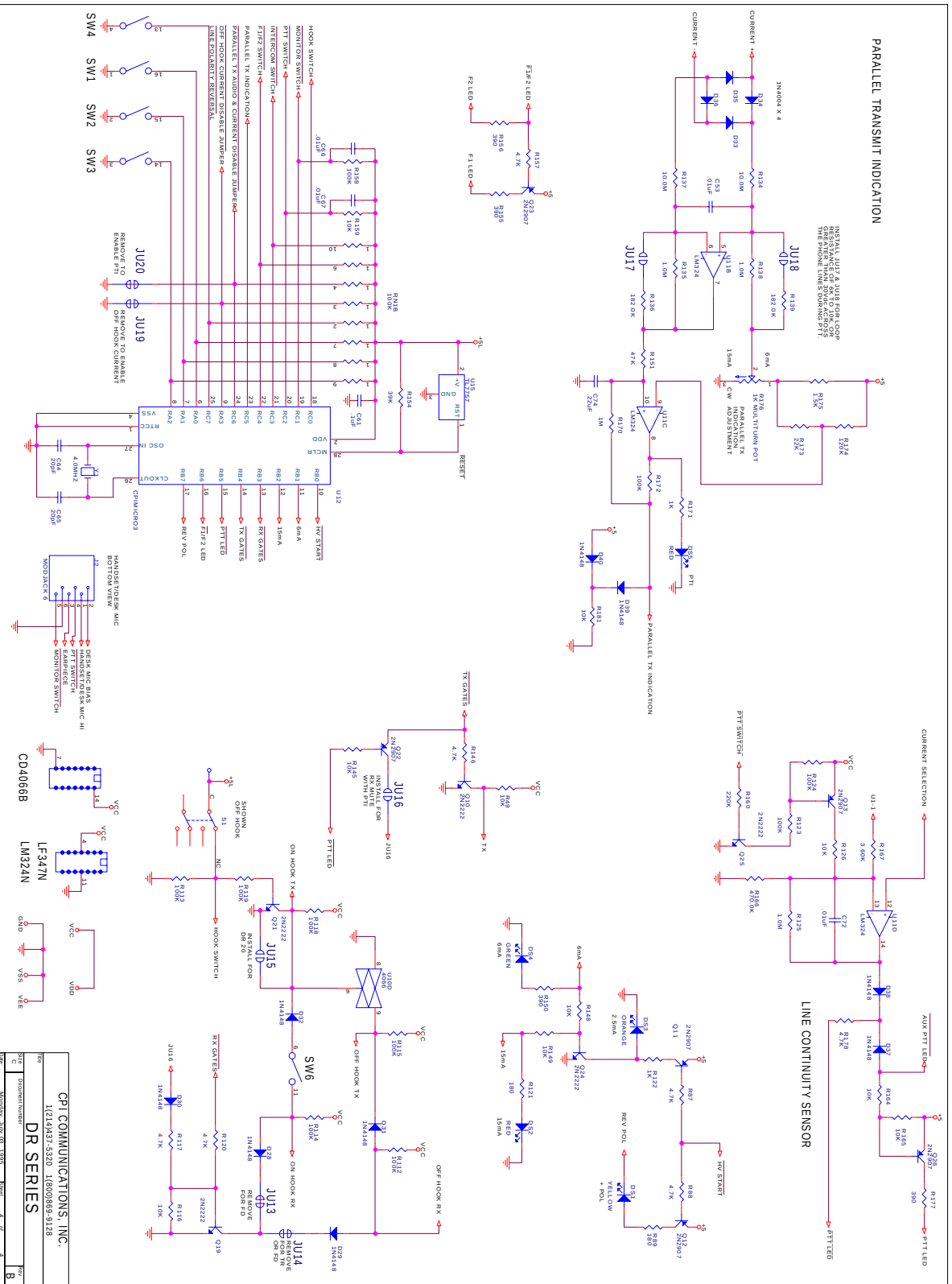
PCB Views for P/N 700-DRBB-200, Rev. B



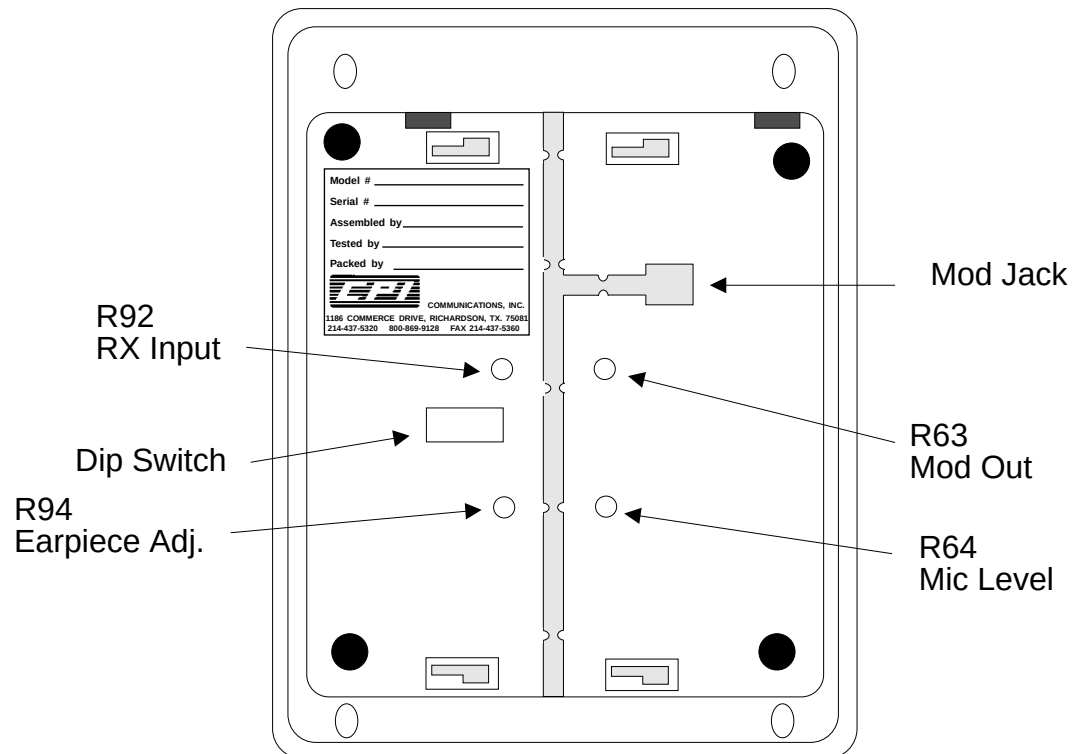
Soder Side







Location of externally adjustable controls.



Warranty

CPI Communications warrants each product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defects or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation use or service discloses such defects, provided the unit is delivered by the customer to our authorized service center intact, with all transportation charges pre paid within two years from date of shipment to the original purchaser. Exceptions are semiconductors which carry only the manufacturer's standard warranty and lamp indicators and fuses which are warranted to be operational when shipped from the factory. No credit will be given for unauthorized repair.

This warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us nor extended to units which have been repaired or altered outside of our factory or authorized service center, nor to cases where the serial number thereof has been removed, defaced, or changed, nor to accessories used therewith not of our own manufacture, nor to finish or appearance items.

This warranty is in lieu of all other warranties expressed or implied and no person is authorized to assume for us any other liability in connection with the sale of our products.

Please Note: CPI products are not authorized for use in applications where nonperformance may be life threatening, or where substantial risk to life and property may be present, without express written consent of the president of CPI Communications. CPI Communications shall never be liable for consequential or indirect damages.

Notes: _____
