Synthesizer Voltage Regulator (635-0656-001)

Rockwell International

instructions

Collins Telecommunications Products Division

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1. DESCRIPTION

Synthesizer Voltage Regulator 635-0656-001, shown in figure 1, is a 2-layer planar card with a 20-pin edge-on connector (2 layers, 10 pins each).

The synthesizer voltage regulator consists of a +20-V dc series regulator, a +5.2-V dc series regulator, and a loss-of-lock summary monitor.

2. PRINCIPLES OF OPERATION

2.1 General

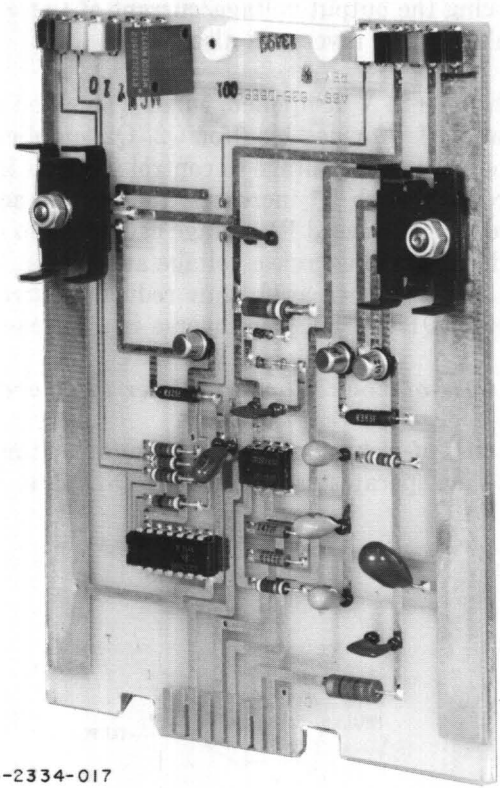
The synthesizer voltage regulator receives +24- and +8-V dc inputs and supplies regulated outputs of +20 and +5.2 V dc.

The synthesizer voltage regulator receives seven monitor inputs and provides one monitor summary output.

2.2 +5.2-V DC Series Regulator (Refer to figure 3.)

The +5.2-V dc series regulator consists of a current/voltage regulator (Q3-Q4), a current control (Q5), a voltage control (U1B), and a reference regulator (VR1).

With +8 and +24 V dc applied, voltage control U1B is enabled. The +24 V dc is applied through R2 to reference regulator VR1. Reference regulator VR1 voltage is applied through R7 to noninverting (reference) input of U1B, and the +5.2-V dc output is applied directly to the inverting input of U1B. Note that R7 is adjusted for an optimum 5.2-V dc regulated output. As the +5.2-V dc output increases, a lower voltage output of U1B is applied to regulator Q3-Q4 base, reducing the output voltage/current of the +5.2-V dc regulator. The inverse is also true.



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Synthesizer Voltage Regulator
Figure 1

With +8 V dc applied, current through Q3-Q4 and R6 provides bias for Q5. Q5 supplies an inverted dc output voltage to control Q3-Q4; that is, as the current through R6 increases, the voltage across R6 increases.

NOTICE: This section replaces first edition dated 1 June 1977.

Increased R6 voltage causes Q5 to increase conduction and decrease voltage at Q8-Q4 base. Conduction of Q3-Q4 is decreased, thus reducing current flow through Q1 and R1. The inverse is also true.

2.3 +20-V DC Series Regulator (Refer to figure 3.)

The +20-V dc series regulator consists of current/voltage regulator Q1, current control Q2, and voltage control U1A.

With +24-V dc input applied, and +5.2-V dc regulated output supplied, voltage control U1A is enabled. The +5.2-V dc output is applied to the non-inverting (reference) input of U1A, and the +20-V dc output is supplied through voltage divider R2 and R4 and applied to the inverting input of U1A. As the voltage at the junction of R3-R4 increases, a lower voltage output of U1A is applied to regulator Q1 base, reducing the output voltage/current of the +20-V dc regulator. The inverse is also true.

With the +24 V dc applied, current supplied through Q1 and R1 provides bias for Q2. Q2 supplies an inverted dc output voltage to control Q1; that is, as the current through R1 increases, the voltage across R1 increases. Increased R1 voltage causes Q2 to increase conduction and decrease voltage at Q1 base. Conduction of Q1 is decreased, thus reducing current flow through Q1 and R1. The inverse is also true.

2.4 Loss-of-Lock Monitor (Refer to figure 3.)

The loss-of-lock monitor is a monitor summary circuit that operates as a normal NAND gate. With all loss-of-lock signals in the normal state (all lock signals present), all logic 1 signals are applied to NAND gate U2 providing a logic 0 output from U2. If any lock signal is lost, a logic 0 is applied by the associated decade to the loss-of-lock monitor and a logic 1 loss-of-lock output is supplied. Note that any (or all) logic 0 inputs to U2 provide a logic 1 output from U2.

2.5 Dual Operational Amplifier MC1458P1 (Refer to figure 2.)

The MC1458G consists of two operational amplifiers in one package designed for use as summing amplifiers, integrators, or amplifiers with operating characteristics as a function of the external feedback components.

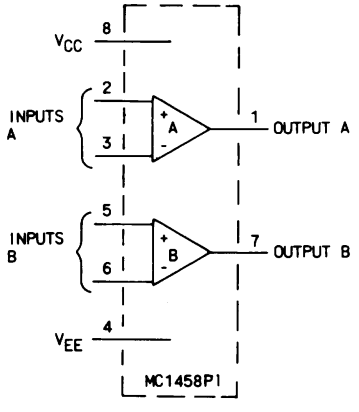
3. TESTING/TROUBLESHOOTING PROCEDURES

3.1 Test Equipment and Power Requirements

Test equipment and power sources required to test, troubleshoot, and repair the synthesizer voltage regulator are listed in the maintenance section of this instruction book.

3.2 Testing

The test procedures in table 1 check total performance of the synthesizer voltage regulator. These test procedures permit isolation of a fault to a specific component or circuit when the results are used with the schematic to circuit trace the fault.



CHARACTERISTICS
SUPPLY VOLTAGE: V_{CC} +18 V DC MAX
V_{EE} -18 V DC MAX
INPUT DIFF VOLTAGE: ±30 V MAX
INPUT COMMON MODE VOLTAGE:
±15 V MAX ⟨1⟩
OUTPUT SHORT CIRCUIT DURATION:
CONTINUOUS ⟨2⟩
INPUT RESISTANCE: 300 kΩ MIN, 2.0 MΩ MAX
OUTPUT RESISTANCE: 75Ω TYPICAL
VOLTAGE GAIN: 15 MIN

NOTES:
⟨1⟩ FOR SUPPLY VOLTAGE LESS THAN ±15.0 V, MAX INPUT VOLTAGE EQUAL TO SUPPLY VOLTAGE.
⟨2⟩ SUPPLY VOLTAGE EQUAL TO OR LESS THAN 15 V.

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Dual Operational Amplifier MC1458P1
Figure 2

Table 1. Synthesizer Voltage Regulator, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	a. Remove top cover of the unit containing the synthesizer voltage regulator to be tested.		
	b. Remove cover from synthesizer section of unit.		
	c. Remove synthesizer voltage regulator, install it on an extender card, and place it in the unit.		
	d. Set unit LINE SELECTOR switch to 115 V.		
	e. Connect unit to 115-V ac power source and set power on.		
	f. Measure dc voltage from TP10 to TP13 (ground).	+24.0 ±0.5 V dc.	Check unit power supply.
	g. Measure dc voltage from TP11 to TP13 (ground).	+8.0 ±0.04 V dc.	Check unit power supply.
2. +5.2 V dc	a. Measure dc voltage from TP9 to TP13 (ground).	+5.2 ±0.05 V dc.	Adjust R7 for +5.2 ±0.05 V dc. If R7 adjustment does not correct the problem, check U1B, Q3, Q4, Q5, and associated circuit.
3. +20-V dc regulator	a. Measure dc voltage from TP12 to TP13 (ground).	NLT +19.7 V dc, NMT +20.6 V dc.	Check U1A, Q1, Q2, and associated circuit.
4. Loss-of-lock monitor	a. Measure voltage from TP8 to TP13 (ground).	NMT 0.5 V dc.	Check dc voltages at TP1 thru TP7. If all voltages are NLT +3.5 V dc, check U2 and associated circuit. If any voltages are less than +3.5 V dc, check unit synthesizer card associated with the input.
	b. Monitor voltage from TP8 to TP13 for steps c thru j.		
	c. Apply a ground signal to TP1.	NLT +3.5 V dc.	Check U2.
	d. Remove ground from TP1 and apply it to TP2.	NLT +3.5 V dc.	Check U2.
	e. Remove ground from TP2 and apply it to TP3.	NLT +3.5 V dc.	Check U2.
	f. Remove ground from TP3 and apply it to TP4.	NLT +3.5 V dc.	Check U2.
(Cont)	g. Remove ground from TP4 and apply it to TP5.	NLT +3.5 V dc.	Check U2.

Table 1. Synthesizer Voltage Regulator, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	h. Remove ground from TP4 and apply it to TP6.	NLT +3.5 V dc.	Check U2.
	i. Remove ground from TP6 and apply it to TP7.	NLT +3.5 V dc.	Check U2.
	j. Remove ground from TP7.		
5. Shutdown	a. Set power off.		
	b. Remove synthesizer voltage regulator from card extender and reinstall it in the unit.		
	c. Replace cover on synthesizer section of unit.		
	d. Replace top cover of unit.		

4. ALIGNMENT/ADJUSTMENT

Refer to table 1, test 2 for adjustment of R7 (+5.2-V dc regulator).

5. REPAIR

Repair of the synthesizer voltage regulator is accomplished using the standard planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

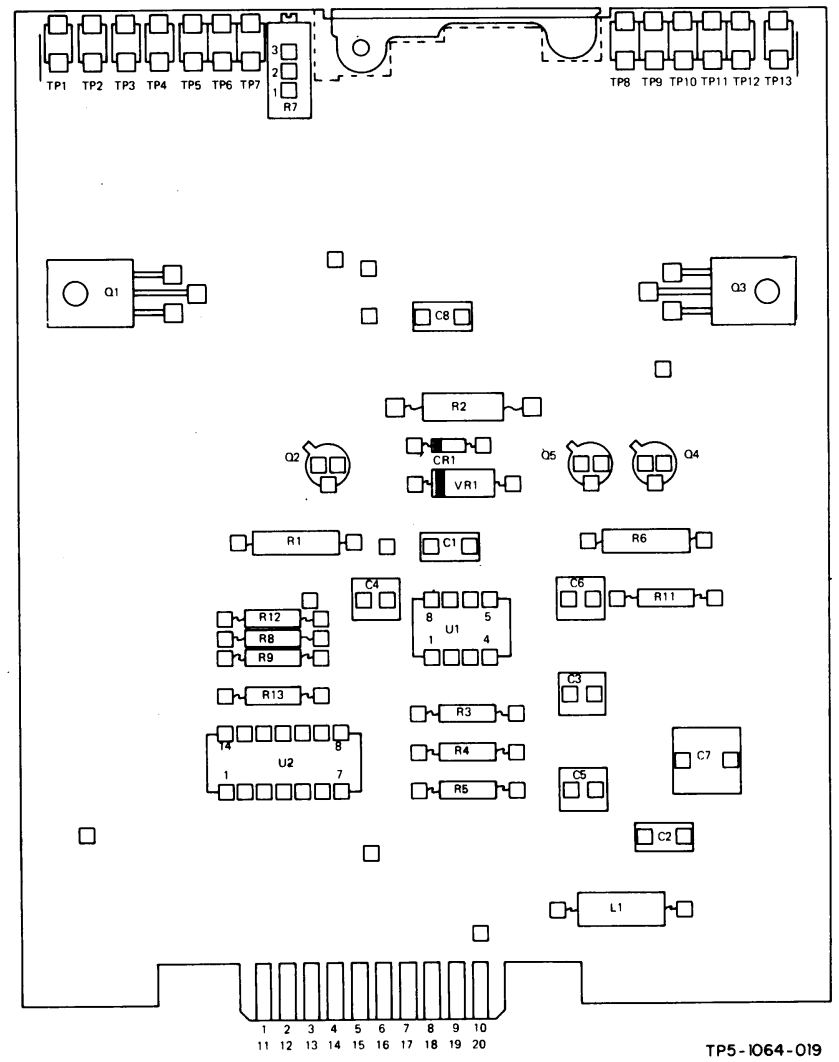
This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram, figure 3. The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Synthesizer voltage regulator	635-0656-001	REV C



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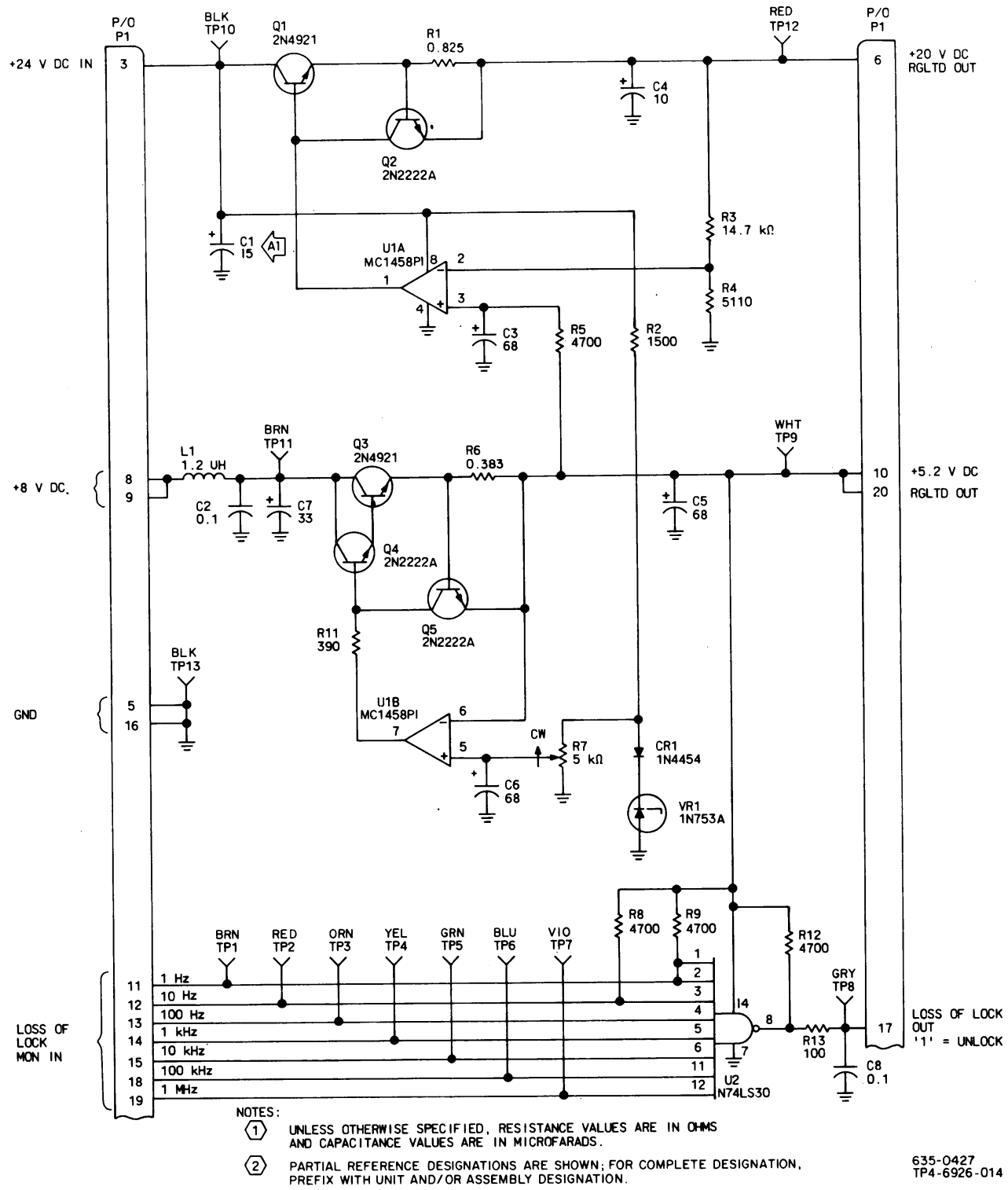

Synthesizer Voltage Regulator, Schematic Diagram
Figure 3 (Sheet 1 of 2)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NO	USABLE ON CODE
	SYNTH VOLTAGE REGULATOR 635-0656-001		
CR1	SEMICOND DEVICE, 1N4454	353-3644-010	
C1	CAPACITOR, FXD, CER DIEL, 0.1μF, 20%, 50V (A1)	913-3279-200	
C1	CAPACITOR, FXD, ELCTLT, 15μF, 20%, 35V	184-9102-420	
C2	CAPACITOR, FXD, CER DIEL, 0.1μF, 20%, 50V	913-3279-200	
C3	CAPACITOR, FXD, ELCTLT, 68μF, 20%, 6V	184-9102-040	
C4	CAPACITOR, FXD, ELCTLT, 10μF, 20%, 25V	184-9102-240	
C5, C6	CAPACITOR, FXD, ELCTLT, 68μF, 20%, 6V	184-9102-040	
C7	CAPACITOR, FXD, ELCTLT, 33μF, 20%, 25V	184-9102-260	
C8	CAPACITOR, FXD, CER DIEL, 0.1μF, 20%, 50V	913-3279-200	
L1	COIL, RF, 1.20μH	240-2715-140	
Q1	TRANSISTOR, 2N4921	352-0782-010	
Q2	TRANSISTOR, 2N2222A	352-0661-020	
Q3	TRANSISTOR, 2N4921	352-0782-010	
Q4, Q5	TRANSISTOR, 2N2222A	352-0661-020	
R1	RESISTOR, FXD, WW, 0.825Ω, 1%, 1W	747-1499-340	
R2	RESISTOR, FXD, CMPSN, 1.5kΩ, 10%, 1/2W	745-1359-000	
R3	RESISTOR, FXD, FILM, 14.7kΩ, 1%, 1/8W	705-1052-000	
R4	RESISTOR, FXD, FILM, 5.11kΩ, 1%, 1/8W	705-1030-000	
R5	RESISTOR, FXD, CMPSN, 4.7kΩ, 10%, 1/4W	745-0773-000	
R6	RESISTOR, FXD, WW, 0.383Ω, 1%, 1W	747-1499-270	
R7	RESISTOR, VAR, WW, 5kΩ, 5%, 3/4W	381-1721-390	
R8, R9	RESISTOR, FXD, CMPSN, 4.7kΩ, 10%, 1/4W	745-0773-000	
R10	NOT USED		
R11	RESISTOR, FXD, CMPSN, 390Ω, 10%, 1/4W	745-0734-000	
R12	RESISTOR, FXD, CMPSN, 4.7kΩ, 10%, 1/4W	745-0773-000	
R13	RESISTOR, FXD, CMPSN, 100Ω, 10%, 1/4W	745-0713-000	
TP1	JACK, TIP, BRN	360-0484-070	
TP2	JACK, TIP, RED	360-0484-020	
TP3	JACK, TIP, ORN	360-0484-050	
TP4	JACK, TIP, YEL	360-0484-060	
TP5	JACK, TIP, GRN	360-0484-040	
TP6	JACK, TIP, BLU	360-0484-080	
TP7	JACK, TIP, VIO	360-0484-090	
TP8	JACK, TIP, GRA	360-0484-100	
TP9	JACK, TIP, WHT	360-0484-010	
TP10	JACK, TIP, BLK	360-0484-030	
TP11	JACK, TIP, BRN	360-0484-070	
TP12	JACK, TIP, RED	360-0484-020	
TP13	JACK, TIP, BLK	360-0484-030	
U1	INTEGRATED CKT, MC1458P1	351-1071-070	
U2	INTEGRATED CKT, N74LS30N	351-1523-140	
VR1	SEMICOND DEVICE, 1N753A	353-2714-000	

MODIFICATION HISTORY

REVISION IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	EFFECTIVITY
A1	Changed C1 from 0.1μF to 15μF.	REV C and above

Synthesizer Voltage Regulator, Schematic Diagram
Figure 3 (Sheet 2)