4 ELECTRONIC SWITCHING SYSTEMS NO. 101 RINGING GENERATOR CIRCUIT FOR SWITCH UNIT

CHANGES

D. Description of Changes

D.1 This circuit was reissued to change the rating to Mfr Disc.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 3224-RJD-RVL

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ELECTRONIC SWITCHING SYSTEMS
NO. 10
RINGING GENERATOR CIRCUIT
FOR SWITCH UNIT

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The ringing generator circuit supplies 20-cps power at the proper dc level to the Line Circuit, Long Line Circuit, and Telephone Dictation Circuit for the purpose of ringing subscriber subsets.

1.02 The ringing generator also supplies a low-level signal, derived from the ac line, to the ac power failure detectors in the Transfer and Alarms Circuit.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The 20-cycle source of power in the ringing generator circuit is provided by a static frequency converter which changes the 60-cps input power to 20 cps. The 20-cycle power is then multipled through isolating capacitors to the line positions in the switch unit matrix. The output of the frequency converter is monitored by a detector circuit (CPS 288) which causes a message to be sent to the control unit if the ringing generator fails or if its output falls below a usable level. This detector also monitors the ring-sync pulses produced by the Tone Generator Circuit and will cause the same message to be sent to the control unit in the event of a failure or degradation of the ring-sync signal.

2.02 The signal delivered to the ac power failure detectors in the Transfer and Alarms Circuit is developed from the ac line by a network consisting of a step-down transformer followed by a voltage-doubling full-wave rectifier circuit. The filter capacitors in the recitfier circuit are selected to only partially filter the dc voltage produced and thus supply a signal to the power failure detectors which contain a 120-cycle ripple component. This ripple component allows the detectors to sense a power failure within 1/4-cycle of the ac line frequency. Potentiometers are used to adjust the level of the signal delivered to the Transfer and Alarms Circuit. Since a loss of the ac power failure signal will result in the inhibiting of the entire switch unit by the transfer and alarms, the step-down transformer and rectifier circuit are duplicated to provide reliability.

SECTION II - DETAILED DESCRIPTION

1. RINGING GENERATOR AND POWER DISTRIBUTION

1.01 The frequency generator employed (G1), is a standard KS-5585, L6 static machine with the ringback producing components removed. Its output is a 20-cps nearly sinusoidal waveform of approximately 96 volts rms. Starting relay K1 is used to excite the circuit into its 20-cycle mode when power is applied. During normal operation, relay K1 is energized and its contacts are open.

1.02 The 20-cycle power from G1 is multiped to the negative terminals of isloating capacitors C1 through C9. These capacitors are triple section units of 15 uf each with a common negative terminal. Each capacitor feeds eight station line positions in the switch unit matrix: four positions in bay 3, and four positions in bay 4. These capacitors serve as isolating devices which limit the current that can be drawn from the generator by any station. Therefore, a short circuit or a low-impedance path present on one of the output leads from C1 through C9 (leads RNGVA through RNGVZ) will not inhibit ringing of station lines supplied by the other 24 leads.

1.03 Capacitor C10 and diodes CR3A, CR3B, CR4A, and CR4B form a dc restorer which clamps to ground the upper excursion of the generator output. During the positive half-cycle of the generator output, the diodes become forward-biased and C10 charges to a negative potential equal to the peak value of the generator voltage (approximately 125 volts). The voltage fed to the isolating capacitors is therefore never more positive than ground potential ensuring that, even under abnormal conditions (ground or low impedance on an RNGV- lead), the polarity of the voltage across the isolating capacitors will always be correct.

1.04 Capacitors C1 through C9 and diodes CR1 and CR15 of each Line Circuit form dc restorers which clamp the lower excursion of the output voltage to ground. This produces a voltage which has a positive dc level equal to the peak voltage of the 20-cycle signal. This is the voltage required by the Line Circuit for proper operation.

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2. DEVELOPMENT OF AC POWER FAILURE SIGNAL

2.01 To eliminate the hazard of running 117 volts ac through the switch unit local cabling,the line voltage is first stepped down by transformers T1 and T2 to approximately 10 volts. The output from the transformers is then rectified producing a dc voltage which is proportional to the voltage level of the ac line. Thus a decrease in voltage from the rectifier is interpreted by the Transfer and Alarms Circuit as a drop in the line voltage.

2.02 The step-down transformer output is connected across a voltage divider consisting of potentiometer R4 and resistor R3. The potentiometer is used to adjust the level of the voltage delivered to the rectifier. The rectifier circuit is a full-wave, voltage-doubling type. When the voltage at terminal B goes negative with respect to terminal H, diode CR2 conducts causing capacitor C2 to charge to the peak positive value of the ac voltage. The charging path for C2 is through CR2, R4, and the transformer secondary winding. On the next alternation of the ac line, terminal B goes positive with respect to terminal H and diode CR1 conducts charging capacitor C1. However, the negative terminal of C1 is connected to the positive terminal of C2; thus the voltage at the positive terminal of C1 is equal to the voltage across C1 plus the voltage across C2 or twice the peak of the supply voltage. The output of the rectifier is connected across a voltage divider consisting of resistors R1 and R2 and potentiometer R5. R5 is used to adjust the output level of the signal.

2.03 Capacitors C1 and C2 are selected to be relatively small compared to the 60-cycle ac they must filter with the result that the signal supplied to the power failure detectors contains an ac ripple of 4 volts peak-to-peak. The positive and negative peaks of the ripple are the portions of the signal used by the power failure detectors and are precisely set by means of potentiometers R4 and R5 at +10.5 and +6.5 volts, respectively. Field adjustment of these potentiometers should not be attempted.

3. RINGING VOLTAGE AND RING-SYNC MONITOR

3.01 The output of the generator is fed to RGM (CPS 288) where it is dc restored to a positive level and filtered by capacitor C1. The rectified voltage is connected across voltage divider R2 and R3 where it is heavily filtered by capacitor C5 to remove any remaining ac ripple. When the ringing generator is operating normally and its output is above 70 volts rms, the dc potential across R3 is sufficient to overcome the threshold set by diode CR2 and transistor Q1 is held on (provided that the RNGSC signal is present which keeps Q2 off). With Q1 on, diodes CR7 and CR8 are reverse-biased by +12volts appearing on the LNBUS leads from the scanners. When the interrogation pulses from the scanners appear at capacitors C3 and C4, they are prevented from returning to the scanners since they are of insufficient amplitude to overcome the bias on the diodes.

3.02 In the event of a failure of generator G1 or if the ring voltage amplitute falls to an unusable level, Q1 will turn off and capacitor C2 will change to +12 volts through resistors R4, R5, and R6. Diodes CR7 and CR8 will thus have zero net bias; and when the interrogation pulses next appear, they will be returned to the scanners on the LNBUS leads causing a 268-off-hook message to by sent to the control unit signifying a ringing circuit failure. The parallel combinations of CR6 and R5 provide a slow-charge and fast-discharge path for C2 to prevent the sending of a failure alarm in the event of momentary loss of ac power to the generator. Resistor R6 limits the dischare current of C2 through Q1 when Q1 is turned on.

3.03 The ring-sync signal developed by the Tone Generator Circuit is monitored by circuit RGM since a failure of this signal would also prevent ringing of a station set. The 12.5-kc ring-sync signal is fed through dropping resistor R10 to dc restorers C6 and CR4 where its upper excursion is clamped at ground producing a negative voltage. This voltage is rectified by diode CR3 and charges capacitor C6 to a negative value. When the ring-sync signal is present, the current supplied through R11 cannot overcome the negative charge on C6 and transistor Q2 Is held off. In the event of failure or degradation of the ring-sync signal (below 6 volts), the negative charge on C6 will not be maintained, and current supplied through R11 will cause Q2 to turn on, grounding the base of Q1. Q1 will thus turn off causing the interrogation pulses to return to the scanner as described above.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 The supply voltages shall be within the limits of +10.8 to +13.2 volts dc and 105 to 125 volts ac, 60 cycles.

2. FUNCTIONAL DESIGNATIONS

2.01 Circuits

Designation	Meaning
RGM	Ringing Generator Monitor
RVD	Rectifier Voltage-Doubler

2.02 Leads

Designation	Meaning
ACPF3, ACPF4 RNGSC	AC power failure ring-sync from Tone Generator Circuit
RNGV, RNGVA through RNGVZ	Distribution leads for the 20-cycle ringing voltage
LNBUS	Line scanning bus which returns change of state information to the scanner
268	Leads on which interrogation pulses are received from the scanners

3. FUNCTIONS

3.01 To supply a source of 20-cps power to the Line Circuit, Long Line Circuit, and Telephone Dictation Circuit for the purpose of ringing subscriber sets.

3.02 To notify the control unit (via the scanner and data transmitter) of the inability to provide ringing due to loss of 20-cps power or loss of the ring-sync pulses.

3.03 The ringing generator must be able to ring subscriber sets connected to any of the remaining distribution leads (RNGVA through RNGVZ) when one of the leads is grounded.

4. CONNECTING CIRCUITS

(a) Line Circuit - SD-1H006-01.

(b) Long Line Circuit - SD-1H025-01.

(c) Telephone Dictation Circuit - SD-1H067-01.

(d) Scanner Circuit - SD-1H011-01.

(e) Tone Generator Circuit - SD-1H020-01.

(f) Transfer and Alarms Circuit - SD-1H017-01.

5. ALARM INFORMATION

5.01 Failure of the circuit to provide ringing voltage will cause an alarm to be sent to the central office. Loss of the ring-sync signal will send the same alarm.

6. MANUFACTURING TESTING REQUIREMENTS

6.01 The ringing generator circuit shall be capable of performing all the service functions ecified in the CD. The requirements for this circuit are found in specifications X-77208 and X-77156, Section CPS 288.

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 No provisions are made for taking the ringing generator out of service. Removal of the generator chassis from the switch unit will cause complete loss of service due to interruption of the ac power failure signals to the Transfer and Alarms Circuit.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 Effective this issue the circuit rating is changed to A&M Only.

BELL TELEPHONE LABORATORIES, INCORPORATED

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